1.6L 4-CYL - VIN [A] & 1.8L 4-CYL - VIN [A]

1993 Toyota Celica

1993 TOYOTA ENGINES
1.6L & 1.8L 4-Cylinder

Celica, Corolla

* PLEASE READ THIS FIRST *

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

ENGINE IDENTIFICATION

Vehicle Identification Number (VIN) is located on top of dash panel, near lower left corner of windshield. Engine may be identified by the eighth character of VIN.

Engine identification serial number may be required when ordering replacement parts. Serial number is located on exhaust side cylinder block, near flywheel.

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code	VIN Code
Celica & Corolla		
1.6L 4-Cylinder PFI	4A-FE	A
1.8L 4-Cylinder PFI	7A-FE	A

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine cold.

1) Disconnect negative battery cable. Disconnect all necessary control cables, hoses and electrical connections. Remove valve cover and gasket.

2) Rotate crankshaft so cylinder No. 1 is at TDC of compression stroke. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover.

3) Using feeler gauge, check clearance between camshaft lobe and adjusting shim for the following: all valves on cylinder No. 1, intake valves on cylinder No. 2 and exhaust valves on cylinder No. 3. Record all readings.

4) Rotate crankshaft 360 degrees. Check clearance between camshaft lobe and adjusting shim for the following: all valves on cylinder No. 4, intake valves on cylinder No. 3 and exhaust valves on cylinder No. 2. If clearance is not within specification, adjust by replacing adjusting shim. See VALVE CLEARANCE SPECIFICATIONS table.

VALVE CLEARANCE SPECIFICATIONS TABLE

Application	Clearance In. (mm)
Exhaust	(1) .010-.014 (.25-.35)
Intake	(1) .006-.010 (.15-.25)

(1) - Adjust valve clearance with engine cold.

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5) To adjust exhaust valves, rotate engine until camshaft lobe faces away from valve to be adjusted. Insert Valve Spring Depressor (09248-05011) between camshaft and adjusting shim. See Fig. 1.

6) Install Valve Lash Spring Spacer (09248-05021) between camshaft and valve lifter. Ensure bottom edge of valve lash spring spacer contacts valve lifter, NOT adjusting shim. Remove valve spring depressor. Using small screwdriver and magnet, remove adjusting shim from valve lifter.

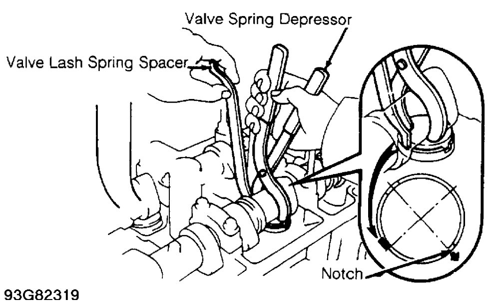

Fig. 1: Adjusting Valve Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

7) To adjust intake valves, manufacturer recommends removal of intake camshaft. See CAMSHAFTS under REMOVAL & INSTALLATION. Remove old adjusting shim and replace with shim of correct thickness.

8) To determine correct adjusting shim thickness for shim replacement, measure and record thickness of removed shim. Locate measured values of removed shim and valve clearance on appropriate adjusting shim selection chart to determine correct shim thickness. See Figs. 2 and 3.

9) Install correct shim thickness to obtain proper clearance. See VALVE CLEARANCE SPECIFICATIONS table. Repeat procedure as necessary. Before installing valve cover, apply Sealant (08826-00080) at valve cover-to-camshaft bearing cap and cylinder head surfaces. To complete installation, reverse removal procedure.

Installed Shim Thickness mm (In.) / Measured Clearance mm (In.)	2.500 (0.0984)	2.520 (0.0992)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.580 (0.1016)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.650 (0.1043)	2.660 (0.1047)	2.670 (0.1051)	2.680 (0.1055)	2.690 (0.1059)	2.700 (0.1063)	2.710 (0.1067)	2.720 (0.1071)	2.730 (0.1075)	2.740 (0.1079)	2.750 (0.1083)	2.760 (0.1087)	2.770 (0.1091)	2.780 (0.1094)	2.790 (0.1098)	2.800 (0.1102)	2.810 (0.1106)	2.820 (0.1110)	2.830 (0.1114)	2.840 (0.1118)	2.850 (0.1122)	2.860 (0.1126)	2.870 (0.1130)
0.000 - 0.020 (0.0000 - 0.0008)																							1	1	1	1	1	1	1	1	1	2
0.021 - 0.040 (0.0008 - 0.0016)																					1	1	1	1	1	1	1	1	1	2	2	2
0.041 - 0.060 (0.0016 - 0.0024)																			1	1	1	1	1	1	1	1	1	2	2	2	2	2
0.061 - 0.080 (0.0024 - 0.0031)																	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3
0.081 - 0.100 (0.0032 - 0.0039)															1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3
0.101 - 0.120 (0.0040 - 0.0047)													1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4
0.121 - 0.140 (0.0048 - 0.0055)											1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4
0.141 - 0.160 (0.0056 - 0.0063)									1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4
0.161 - 0.180 (0.0063 - 0.0071)								1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5
0.181 - 0.200 (0.0071 - 0.0079)							1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5
0.201 - 0.220 (0.0079 - 0.0087)						1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6
0.221 - 0.240 (0.0087 - 0.0094)					1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6
0.241 - 0.249 (0.0095 - 0.0098)					1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6
0.250 - 0.350 (0.0098 - 0.0138)																																
0.351 - 0.360 (0.0139 - 0.0142)	1	2	2	2	2	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9
0.361 - 0.380 (0.0142 - 0.0150)	1	2	2	2	3	3	3	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9
0.381 - 0.400 (0.0150 - 0.0157)	2	2	3	3	3	3	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9
0.401 - 0.420 (0.0158 - 0.0165)	2	3	3	3	3	4	4	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10
0.421 - 0.440 (0.0166 - 0.0173)	3	3	3	4	4	4	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10
0.441 - 0.460 (0.0174 - 0.0181)	3	3	4	4	4	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10
0.461 - 0.480 (0.0181 - 0.0189)	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11
0.481 - 0.500 (0.0189 - 0.0197)	4	4	5	5	5	5	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11
0.501 - 0.520 (0.0197 - 0.0205)	4	5	5	5	5	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12
0.521 - 0.540 (0.0205 - 0.0213)	5	5	5	6	6	6	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12
0.541 - 0.560 (0.0213 - 0.0220)	5	5	6	6	6	7	7	7	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12
0.561 - 0.580 (0.0221 - 0.0228)	5	6	6	6	7	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13
0.581 - 0.600 (0.0229 - 0.0236)	6	6	7	7	7	7	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13
0.601 - 0.620 (0.0237 - 0.0244)	6	7	7	7	7	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14
0.621 - 0.640 (0.0244 - 0.0252)	7	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14
0.641 - 0.660 (0.0252 - 0.0260)	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14
0.661 - 0.680 (0.0260 - 0.0268)	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15
0.681 - 0.700 (0.0268 - 0.0276)	8	8	9	9	9	9	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15
0.701 - 0.720 (0.0276 - 0.0283)	8	9	9	9	9	10	10	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16
0.721 - 0.740 (0.0284 - 0.0291)	9	9	9	10	10	10	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16
0.741 - 0.760 (0.0292 - 0.0299)	9	9	10	10	10	11	11	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16
0.761 - 0.780 (0.0300 - 0.0307)	9	10	10	10	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16
0.781 - 0.800 (0.0307 - 0.0315)	10	10	11	11	11	11	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16	
0.801 - 0.820 (0.0315 - 0.0323)	10	11	11	11	11	12	12	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16			
0.821 - 0.840 (0.0323 - 0.0331)	11	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16					
0.841 - 0.860 (0.0331 - 0.0339)	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16							
0.861 - 0.880 (0.0339 - 0.0346)	11	12	12	12	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16									
0.881 - 0.900 (0.0347 - 0.0354)	12	12	13	13	13	13	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16											
0.901 - 0.920 (0.0355 - 0.0362)	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	16	16	16	16													
0.921 - 0.940 (0.0363 - 0.0370)	13	13	13	14	14	14	15	15	15	15	16	16	16	16	16	16	16															
0.941 - 0.960 (0.0370 - 0.0378)	13	13	14	14	14	15	15	15	16	16	16	16	16	16	16																	
0.961 - 0.980 (0.0378 - 0.0386)	13	14	14	14	15	15	15	16	16	16	16	16	16																			
0.981 - 1.000 (0.0386 - 0.0394)	14	14	15	15	15	15	16	16	16	16	16																					
1.001 - 1.020 (0.0394 - 0.0402)	14	15	15	15	15	16	16	16	16																							
1.021 - 1.040 (0.0402 - 0.0409)	15	15	15	16	16	16	16	16																								
1.041 - 1.060 (0.0410 - 0.0417)	15	15	16	16	16	16	16																									
1.061 - 1.080 (0.0418 - 0.0425)	15	16	16	16	16	16																										
1.081 - 1.100 (0.0426 - 0.0433)	16	16	16	16	16																											
1.101 - 1.120 (0.0433 - 0.0441)	16	16	16																													
1.121 - 1.140 (0.0441 - 0.0449)	16	16																														
1.141 - 1.150 (0.0449 - 0.0453)	16																															

Installed Shim Thickness mm (In.) / Measured Clearance mm (In.)	2.880 (0.1134)	2.890 (0.1138)	2.900 (0.1142)	2.910 (0.1146)	2.920 (0.1150)	2.930 (0.1154)	2.940 (0.1157)	2.950 (0.1161)	2.960 (0.1165)	2.970 (0.1169)	2.980 (0.1173)	2.990 (0.1177)	3.000 (0.1181)	3.010 (0.1185)	3.020 (0.1189)	3.030 (0.1193)	3.040 (0.1197)	3.050 (0.1201)	3.060 (0.1205)	3.080 (0.1213)	3.100 (0.1220)	3.120 (0.1228)	3.140 (0.1236)	3.150 (0.1240)	3.160 (0.1244)	3.180 (0.1252)	3.200 (0.1260)	3.220 (0.1268)	3.240 (0.1276)	3.250 (0.1280)	3.260 (0.1283)	3.280 (0.1291)	3.300 (0.1299)
0.000 - 0.020 (0.0000 - 0.0008)	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	7	7	7	7	8	8	9	9	9	9	10	10
0.021 - 0.040 (0.0008 - 0.0016)	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11
0.041 - 0.060 (0.0016 - 0.0024)	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11
0.061 - 0.080 (0.0024 - 0.0031)	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11
0.081 - 0.100 (0.0032 - 0.0039)	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12
0.101 - 0.120 (0.0040 - 0.0047)	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12	12
0.121 - 0.140 (0.0048 - 0.0055)	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.141 - 0.160 (0.0056 - 0.0063)	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13
0.161 - 0.180 (0.0063 - 0.0071)	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13
0.181 - 0.200 (0.0071 - 0.0079)	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14
0.201 - 0.220 (0.0079 - 0.0087)	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.221 - 0.240 (0.0087 - 0.0094)	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.241 - 0.249 (0.0095 - 0.0098)	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.250 - 0.350 (0.0098 - 0.0138)																																	
0.351 - 0.360 (0.0139 - 0.0142)	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	14	14	14	14	15	15	16	16	16	16	16	
0.361 - 0.380 (0.0142 - 0.0150)	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	16	
0.381 - 0.400 (0.0150 - 0.0157)	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	14	14	15	15	15	15	16	16	16	16	16		
0.401 - 0.420 (0.0158 - 0.0165)	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	15	15	15	15	16	16	16	16				
0.421 - 0.440 (0.0166 - 0.0173)	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	15	15	15	16	16	16	16	16					
0.441 - 0.460 (0.0174 - 0.0181)	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	15	15	15	16	16	16	16	16						
0.461 - 0.480 (0.0181 - 0.0189)	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	16	16	16	16	16							
0.481 - 0.500 (0.0189 - 0.0197)	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	16	16	16	16	16								
0.501 - 0.520 (0.0197 - 0.0205)	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16										
0.521 - 0.540 (0.0205 - 0.0213)	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16											
0.541 - 0.560 (0.0213 - 0.0220)	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16												
0.561 - 0.580 (0.0221 - 0.0228)	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16													
0.581 - 0.600 (0.0229 - 0.0236)	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16														
0.601 - 0.620 (0.0237 - 0.0244)	14	14	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																
0.621 - 0.640 (0.0244 - 0.0252)	14	14	15	15	15	15	15	16	16	16	16	16	16	16	16																		
0.641 - 0.660 (0.0252 - 0.0260)	15	15	15	15	15	16	16	16	16	16	16	16	16																				
0.661 - 0.680 (0.0260 - 0.0268)	15	15	15	16	16	16	16	16	16	16	16																						
0.681 - 0.700 (0.0268 - 0.0276)	15	16	16	16	16	16	16	16	16																								
0.701 - 0.720 (0.0276 - 0.0283)	16	16	16	16	16	16	16																										
0.721 - 0.740 (0.0284 - 0.0291)	16	16	16	16	16																												
0.741 - 0.760 (0.0292 - 0.0299)	16	16	16																														
0.761 - 0.780 (0.0300 - 0.0307)	16																																
0.781 - 0.800 (0.0307 - 0.0315)																																	
0.801 - 0.820 (0.0315 - 0.0323)																																	
0.821 - 0.840 (0.0323 - 0.0331)																																	
0.841 - 0.860 (0.0331 - 0.0339)																																	
0.861 - 0.880 (0.0339 - 0.0346)																																	
0.881 - 0.900 (0.0347 - 0.0354)																																	
0.901 - 0.920 (0.0355 - 0.0362)																																	
0.921 - 0.940 (0.0363 - 0.0370)																																	
0.941 - 0.960 (0.0370 - 0.0378)																																	
0.961 - 0.980 (0.0378 - 0.0386)																																	
0.981 - 1.000 (0.0386 - 0.0394)																																	
1.001 - 1.020 (0.0394 - 0.0402)																																	
1.021 - 1.040 (0.0402 - 0.0409)																																	
1.041 - 1.060 (0.0410 - 0.0417)																																	
1.061 - 1.080 (0.0418 - 0.0425)																																	
1.081 - 1.100 (0.0426 - 0.0433)																																	
1.101 - 1.120 (0.0433 - 0.0441)																																	
1.121 - 1.140 (0.0441 - 0.0449)																																	
1.141 - 1.150 (0.0449 - 0.0453)																																	

Exhaust Valve Clearance (Cold)
0.010-0.014" (0.25-0.35 mm)

EXAMPLE: The 0.1102" (2.800 mm) shim is installed, and the measured clearance is 0.0177" (0.450 mm). Replace the 0.1102" (2.800 mm) shim with a new No. 9 shim.

NEW SHIM THICKNESS

mm (in.)

SHIM NO.	THICKNESS	SHIM NO.	THICKNESS
1	2.55 (0.1004)	9	2.95 (0.1161)
2	2.60 (0.1024)	10	3.00 (0.1181)
3	2.65 (0.1043)	11	3.05 (0.1201)
4	2.70 (0.1063)	12	3.10 (0.1220)
5	2.75 (0.1083)	13	3.15 (0.1240)
6	2.80 (0.1102)	14	3.20 (0.1260)
7	2.85 (0.1122)	15	3.25 (0.1280)
8	2.90 (0.1142)	16	3.30 (0.1299)

HINT: New shims have the thickness in millimeters imprinted on the face.

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Fig. 2: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

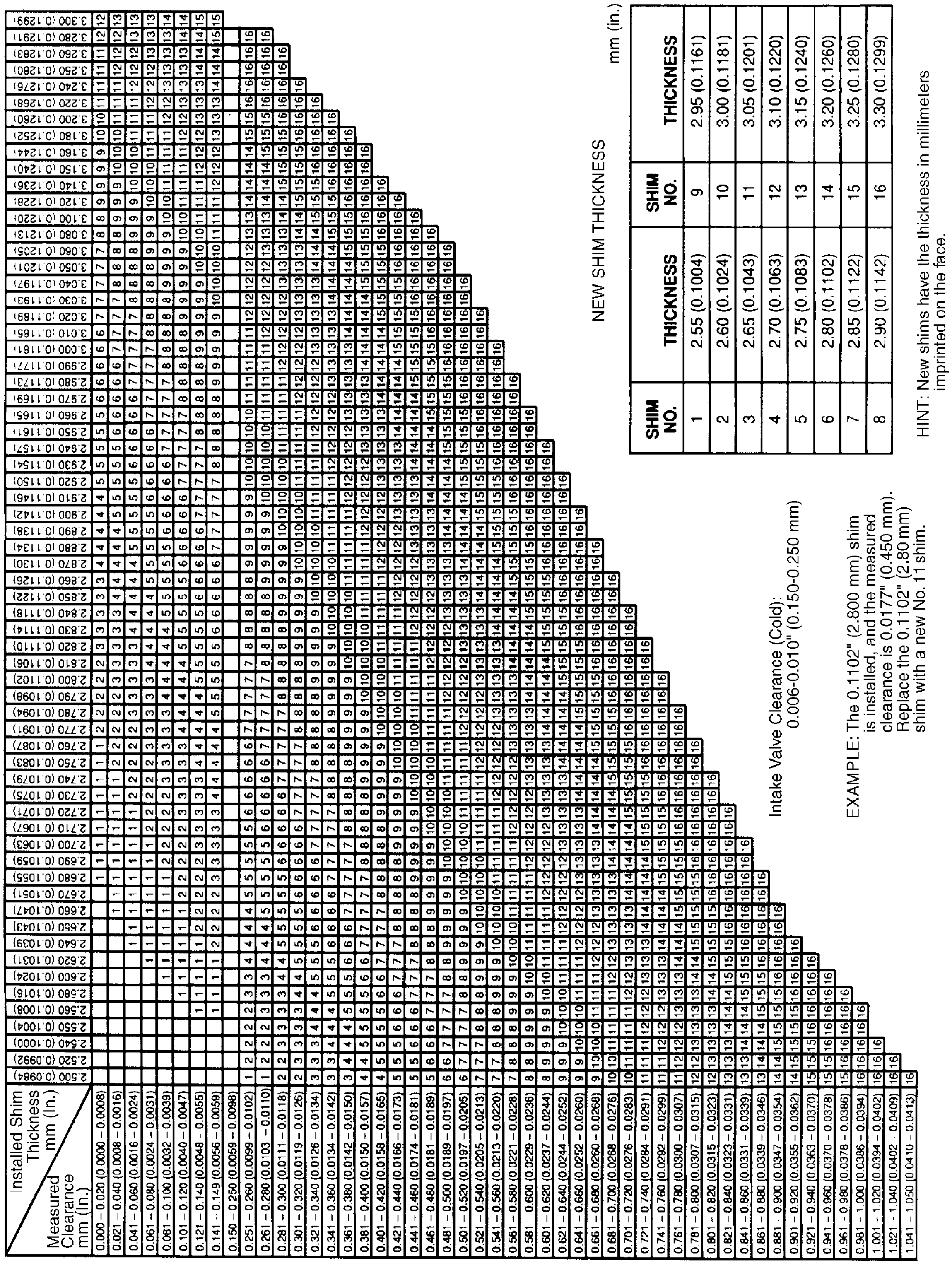


Fig. 3: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

NOTE: For installation reference, label all electrical connectors, vacuum hoses and fuel lines before removing. Also place mating marks on engine hood and other major assemblies before removing.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

FUEL PRESSURE RELEASE

Loosen fuel tank cap to release fuel tank pressure. Unplug circuit opening relay, located behind radio. Crank engine or start engine and allow to stall. Wrap fuel component or fitting with shop towel during removal. Disconnect component.

ENGINE

NOTE: Engine and transaxle are removed as an assembly.

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect battery cables, and remove battery. Remove hood.

2) Drain engine oil and cooling system. Disconnect necessary coolant hoses and fuel lines. Remove air intake duct and control cables from throttle body. Remove air cleaner.

3) Disconnect necessary vacuum hoses. Disconnect the following electrical connections: A/C SV valve, MAP sensor, data link connector, A/C triple switch and engine ground wires. Remove mounting bolts from engine relay box. Remove cruise control actuator (if equipped). On A/T models, disconnect shift cable and oil cooler lines from transaxle. On M/T models, disconnect clutch and shift control cables.

4) On all models, disconnect speedometer cable at transaxle. Remove coolant recovery bottle and bracket. Remove radiator and cooling fan. Remove power steering pump and A/C compressor (if equipped) with hoses attached and set aside.

5) Remove knee bolster, glove box and center console from vehicle. Remove radio. Remove one bolt and set aside left-side carpet bracket. Remove cruise control module mounting bolts and set aside. Disconnect PCM. From engine compartment side, pull wiring harness and grommet through firewall.

6) Raise and support vehicle. Remove lower engine covers. Drain transaxle fluid. Disconnect exhaust pipe at exhaust manifold. Disconnect oxygen sensor connector. Remove front wheels.

7) Remove tie rod nuts from left and right steering knuckle. Separate tie rods from steering knuckles. Remove lower ball joints from steering knuckles. Separate lower control arms from steering knuckles.

8) Using a pry bar or large screwdriver, pry axle shafts from transaxle case. Support engine with hoist. Remove bolt from engine mount near timing belt cover. Remove transaxle mount bolts. If necessary, remove crossmember located below transaxle. Remove engine and transaxle. Separate engine from transaxle.

Installation

1) To install, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS.

2) Adjust all control cables. Adjust fluid levels. On A/T models, fill transaxle with Dexron-II. On M/T models, fill transaxle

with SAE 75W-90 GL-5 gear lubricant.

INTAKE MANIFOLD

Removal

1) Disconnect negative battery cable. Remove air intake ducting. Disconnect vacuum hoses from fuel pressure regulator, brake booster and A/C idle actuator.

2) Remove intake manifold brace. Disconnect fuel hose from fuel pressure regulator. Remove metal vacuum lines from intake manifold. Remove EGR valve and vacuum modulator.

3) Disconnect vacuum and electrical connections from throttle body. Remove throttle body from upper intake chamber. Remove fuel inlet hose. Remove upper intake chamber cover.

CAUTION: Do not drop fuel injectors when removing fuel rail. Damage to injectors may result.

4) Remove electrical connections from fuel injectors. Remove fuel rail mounting bolts and remove fuel rail with injectors. Remove 4 insulators and 2 spacers from intake manifold. Remove intake manifold mounting nuts and ground strap. Remove intake manifold from cylinder head.

Inspection

Check intake manifold surface for warpage. Replace intake manifold if warpage exceeds .008" (.20 mm).

Installation

1) Install new intake manifold gasket. Install new injector insulators in intake manifold. Install fuel rail with injectors, ensure injectors rotate freely. If injectors do not rotate freely "O" rings may not be properly installed.

2) To complete installation, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.

EXHAUST MANIFOLD

Removal

1) Disconnect negative battery cable. Remove heat shield from exhaust manifold. If necessary, disconnect oxygen sensor wiring connector. Remove exhaust manifold brace.

2) Remove warm up catalyst (California models). Disconnect exhaust pipe from exhaust manifold. Remove exhaust manifold bolts/nuts, exhaust manifold and gasket.

Inspection

Check exhaust manifold for cracks and warpage. Replace exhaust manifold if warpage exceeds .011" (.28 mm).

Installation

To install, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

CYLINDER HEAD

Removal

1) Remove intake and exhaust manifolds. See INTAKE MANIFOLD and EXHAUST MANIFOLD under REMOVAL & INSTALLATION.

2) Disconnect necessary coolant hoses and vacuum lines. Remove coolant inlet and outlet housings. Remove EGR valve and lines.

3) Disconnect electrical connections at distributor. Remove

distributor cap. Mark rotor-to-distributor housing position and housing-to-cylinder head position. Remove retaining bolt, and remove distributor assembly.

4) Remove timing belt and camshafts. See TIMING BELT and CAMSHAFTS under REMOVAL & INSTALLATION.

5) Loosen cylinder head bolts in reverse of tightening sequence. See Fig. 4. Remove bolts, note location and length of cylinder head bolts for installation reference. Remove cylinder head and gasket.

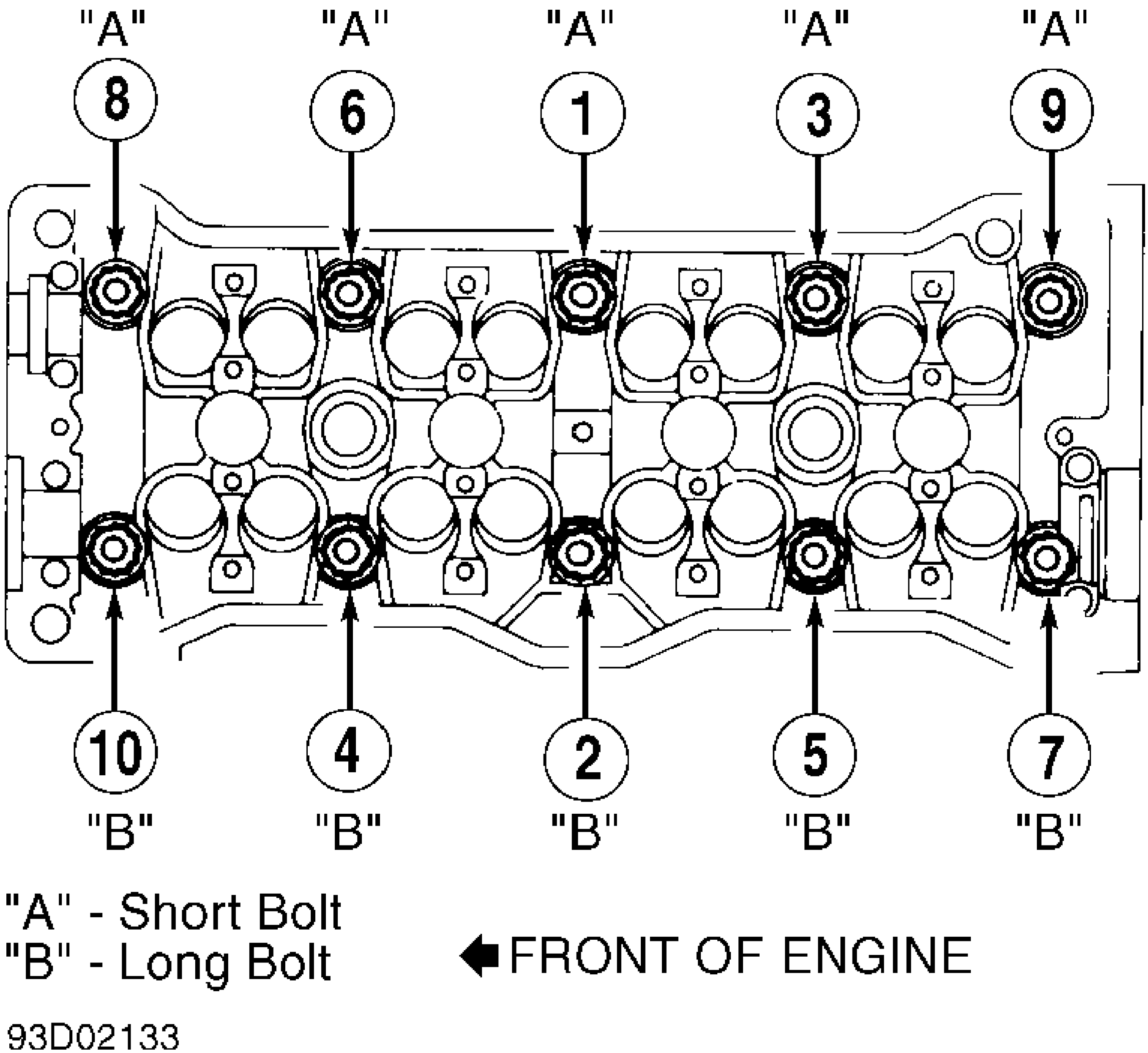


Fig. 4: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of General Motors Corp.

Inspection

Inspect cylinder head surface and manifold sealing areas (if manifolds are removed) for cracks and warpage. Replace cylinder head if warpage exceeds specification. Inspect cylinder block deck warpage.

Replace cylinder block if warpage exceeds specification. See CYLINDER HEAD and CYLINDER BLOCK tables under ENGINE SPECIFICATIONS at end of article.

Installation

1) If spark plug tubes were removed or NEW cylinder head is installed, spark plug tubes must be installed before head is installed on engine block. Use Adhesive (08833-00070) Three-Bond (1324) to coat bore of cylinder head for spark plug tube. Using Press, install each spark plug tube into bore until tube protrudes 1.843-1.874" (46.8-47.6 mm) from top horizontal surface of cylinder head. See Fig. 5.

2) Before installing cylinder head bolts, apply light coat of engine oil to threads. Tighten cylinder head bolts in sequence. See Fig. 4. Tighten bolts in several steps to specification. See TORQUE SPECIFICATIONS.

3) If cylinder head components were serviced, check valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

4) Ensure reference mark is aligned on distributor. If fuel injectors were removed from fuel rail, install NEW grommet and "O" ring on each fuel injector and insulators in intake manifold. Lubricate "O" ring with gasoline before installing fuel injector on fuel rail.

CAUTION: Ensure fuel injector rotates smoothly on fuel rail and intake manifold after installation. If fuel injector does not rotate smoothly, check for improper seal of fuel injector on fuel rail and intake manifold.

5) Before installing valve cover, apply Sealant (08826-00080) at valve cover-to-camshaft bearing cap surfaces on front and rear camshaft bearing caps. Fill cooling system.

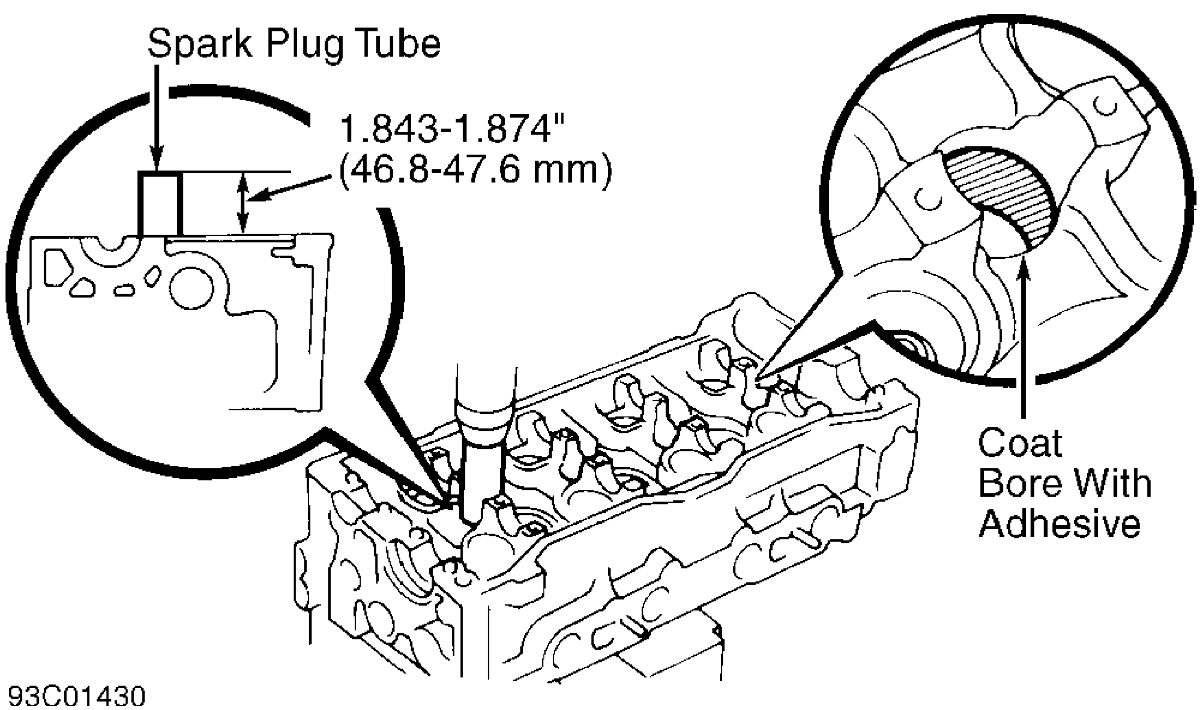


Fig. 5: Installing Spark Plug Tubes
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CRANKSHAFT FRONT SEAL

NOTE: Crankshaft front seal is mounted in oil pump housing.

Removal & Installation

1) Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Pry seal from oil pump housing. DO NOT damage sealing surfaces.

2) Using Seal Installer (09309-37010), install seal in oil pump housing. To install remaining components, reverse removal procedure.

TIMING BELT

CAUTION: Do not turn crankshaft or camshaft independently when timing belt is removed. Binding or damage to engine components could result.

Removal

1) Disconnect negative battery cable. Align crankshaft to cylinder No. 1 TDC. Raise and support vehicle. Remove right front wheel and engine undercover. Loosen water pump pulley bolts. Remove accessory drive belts.

2) Remove cruise control actuator. Remove windshield washer reservoir. Remove valve cover. Disconnect engine ground wire from right fender apron. Support engine with floor jack.

3) Remove through bolt at engine mount, located near timing belt cover. Raise engine slightly. Remove water pump pulley. Remove crankshaft pulley. If necessary, remove A/C compressor with hoses attached. Lower engine. Remove timing belt covers.

4) Remove timing belt guide. See Fig. 6. Loosen belt tensioner bolt. Move belt tensioner pulley away from timing belt, and temporarily tighten belt tensioner pulley bolt. Remove timing belt.

CAUTION: If timing belt is to be reused, mark direction of timing belt rotation, and place reference marks on timing belt and sprockets for installation reference.

5) Remove camshaft sprocket (if necessary) by removing retaining bolt while holding camshaft at hexagonal section with wrench. If crankshaft sprocket is to be removed, gently pry off sprocket using 2 flat-bladed screwdrivers.

Inspection

1) Inspect timing belt for cracks or damaged teeth. Ensure timing belt is not contaminated with oil. Check belt tensioner pulley for smooth rotation. Replace damaged components.

2) Check free length of belt tensioner spring. Free length is measured from inside end to inside end of spring (not coil area). Replace spring if free length is not 1.390" (35.3 mm) on 1.6L engine or 1.252 (31.8) on 1.8L engine.

Installation

1) Install crankshaft and camshaft sprockets (if removed). Tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.

2) Ensure all timing marks are aligned. See Fig. 7. Install timing belt. If reusing old timing belt, ensure belt is installed in original rotating direction. Ensure marks on belt align with camshaft and crankshaft sprockets.

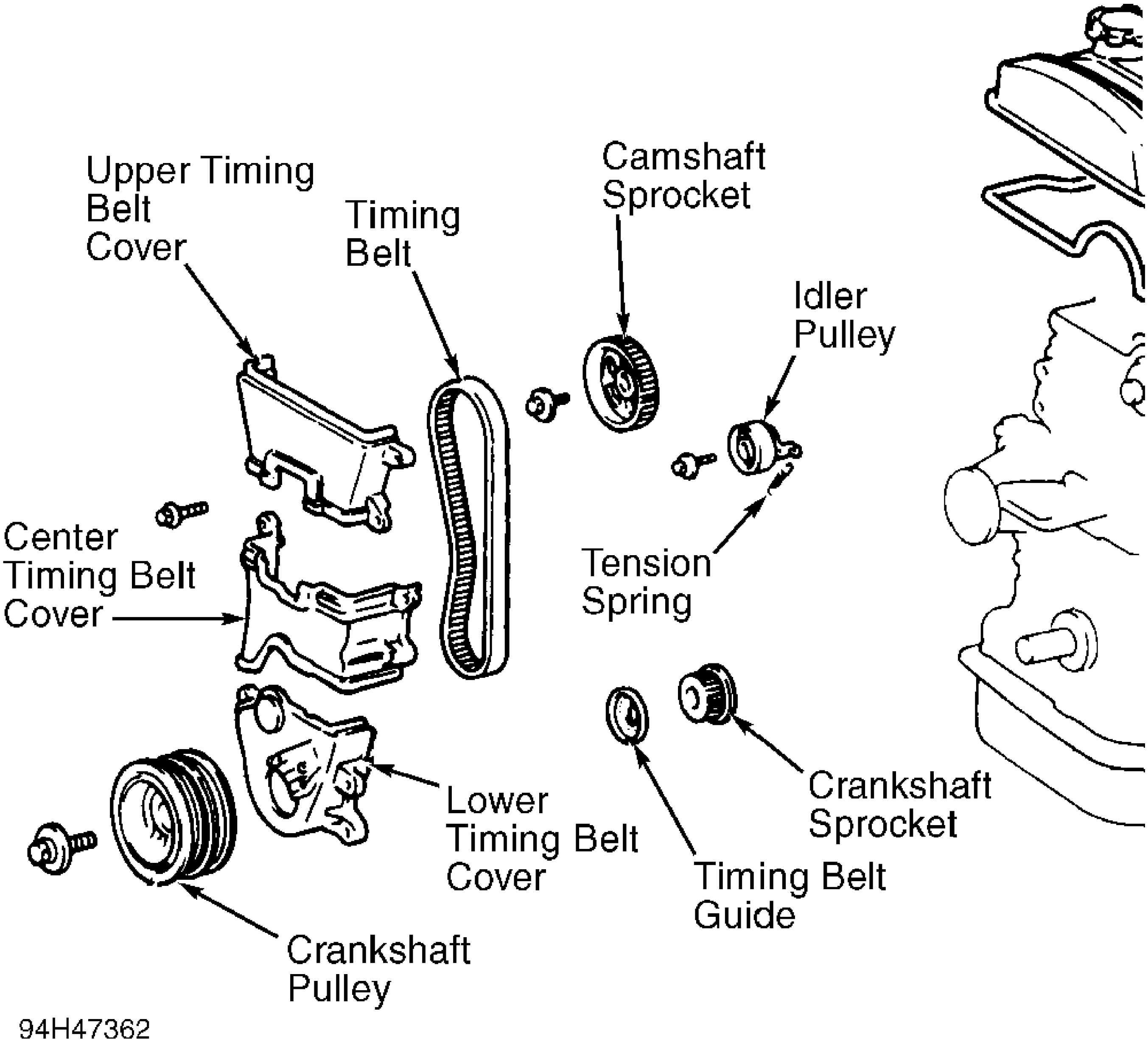


Fig. 6: Exploded View Of Timing Belt & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

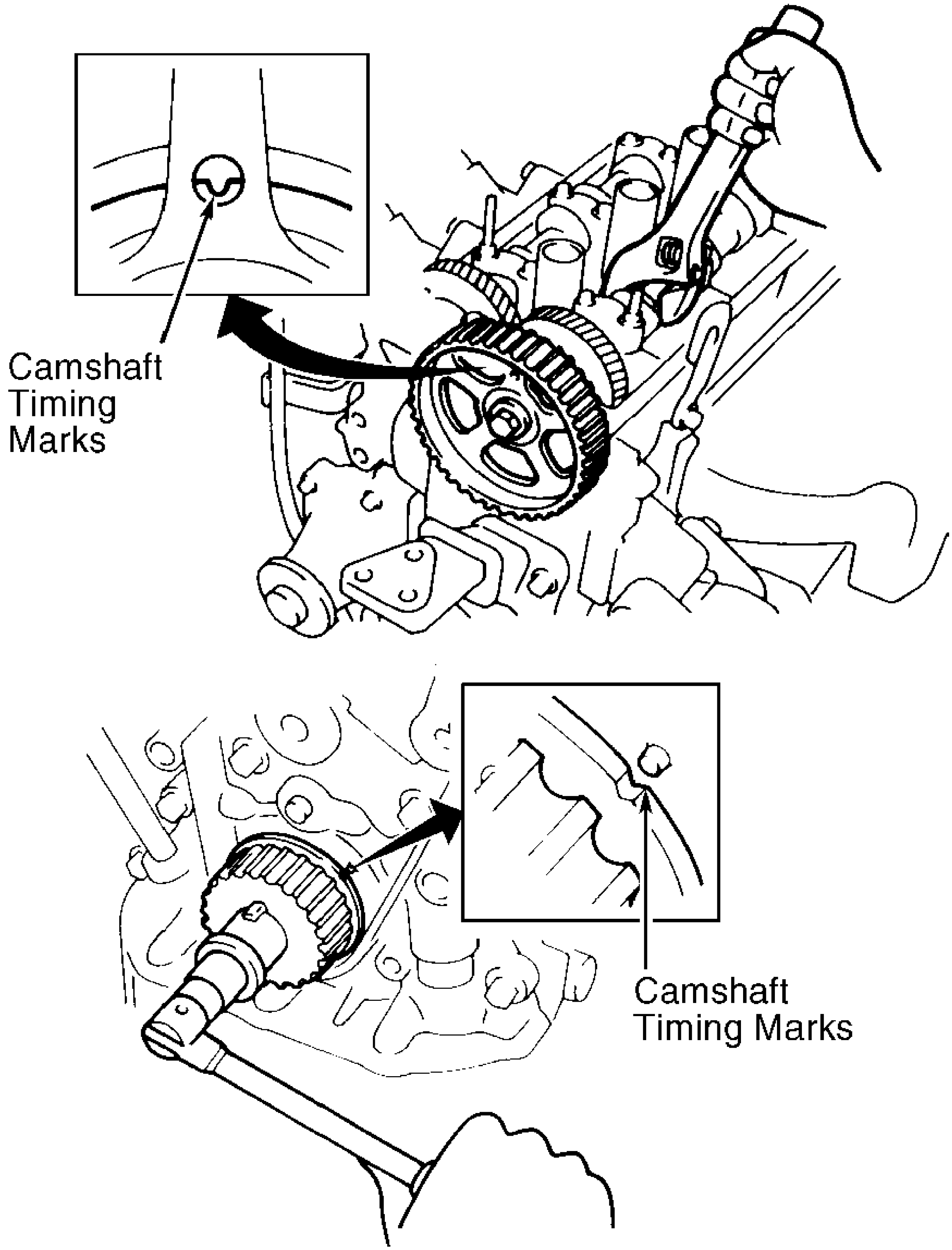


Fig. 7: Aligning Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Loosen belt tensioner bolt to allow tension to be applied on timing belt. Rotate crankshaft clockwise 2 revolutions. Ensure all

timing marks are aligned. Tighten timing belt idler pulley bolts to specification. See TORQUE SPECIFICATIONS.

4) Measure timing belt deflection halfway between camshaft and crankshaft sprockets. With 4.5 lbs. (2.0 kg) applied on timing belt, deflection should be .20-.24" (5-6 mm). If belt deflection is not within specification, repeat steps 3) and 4).

CAUTION: Ensure all timing marks are aligned once timing belt is adjusted.

5) To install remaining components, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Before installing valve cover, apply Sealant (1052942) at valve cover-to-cylinder head surfaces.

CAMSHAFTS

Removal

1) Remove timing belt, valve cover and camshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Using dial indicator, check camshaft end play before removing camshaft.

2) If end play is greater than specification, replace camshaft or cylinder head. See CAMSHAFT table under ENGINE SPECIFICATIONS at end of article.

NOTE: Camshaft bearing caps are marked either with an "I" for intake camshaft or an "E" for exhaust camshaft. Camshaft bearing caps are numbered starting with No. 1 at timing belt end of cylinder head. Ensure arrow on bearing cap points toward timing belt end of engine.

3) To remove intake camshaft, rotate camshafts so knock pin on exhaust camshaft is at 10 o'clock position and service bolt hole on intake camshaft is at 12 o'clock position. See Fig. 8. Remove No. 1 camshaft bearing cap bolts on exhaust and intake camshaft. Remove No. 1 bearing cap on intake camshaft. Install a 6.0 x 1.0 x 18-mm both in service bolt hole in intake camshaft gear. See Fig. 9.
4) Loosen remaining intake camshaft bearing caps evenly in sequence. See Fig. 10. Remove camshaft bearing caps and remove intake camshaft. Ensure camshaft remains level and parallel to cylinder head during removal.

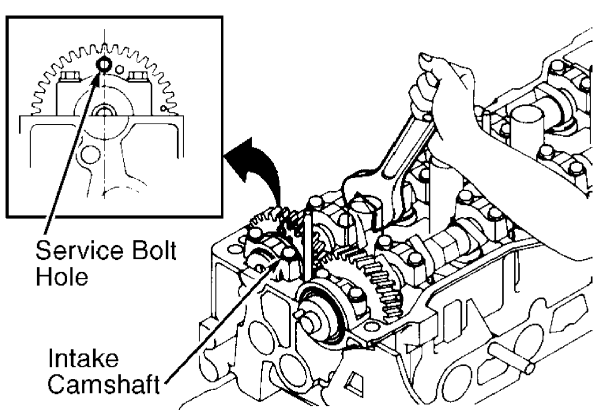


Fig. 8: Positioning Intake Camshaft For Removal
Courtesy of Toyota Motor Sales, U.S.A., Inc.

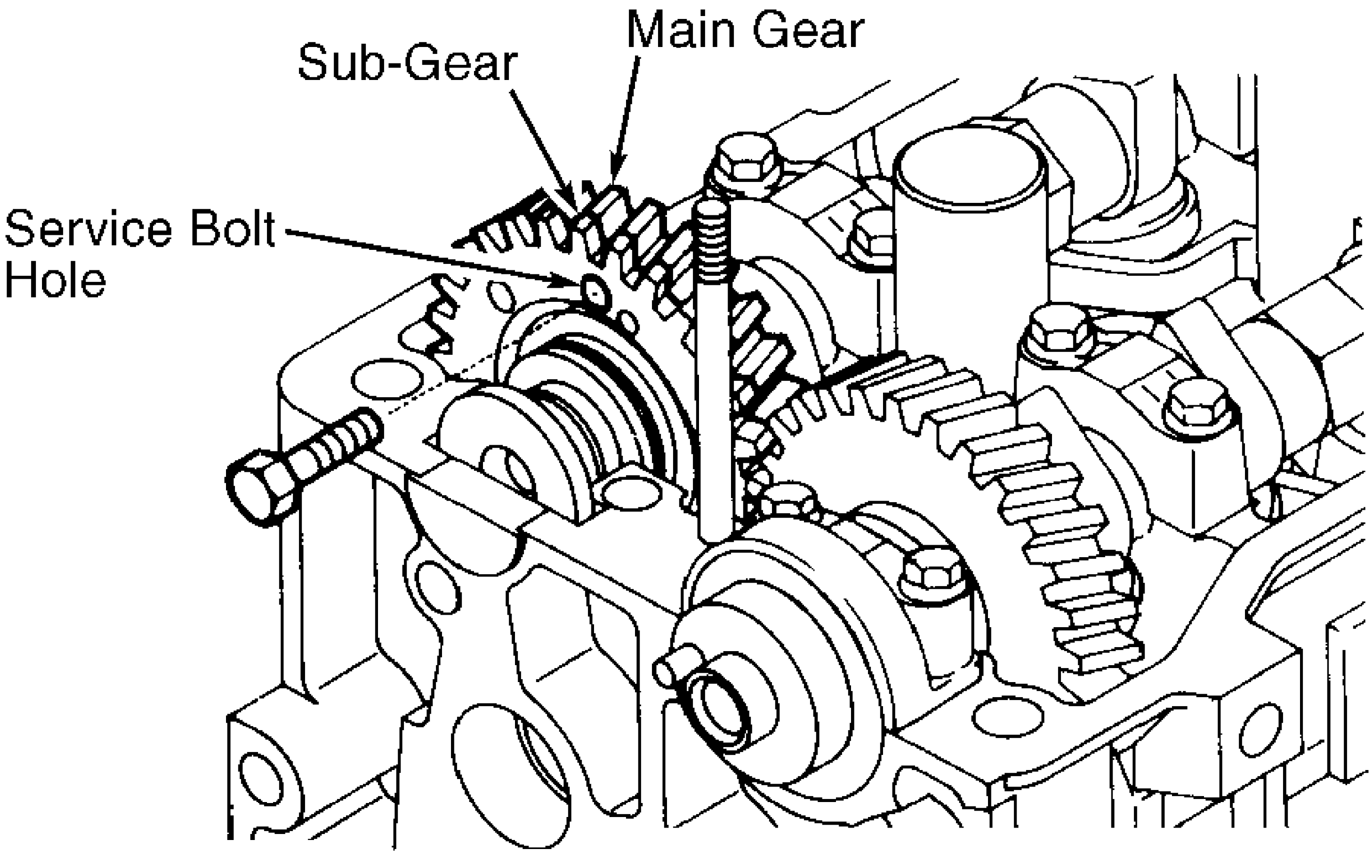


Fig. 9: Installing Service Bolt
Courtesy of Toyota Motor Sales, U.S.A., Inc.

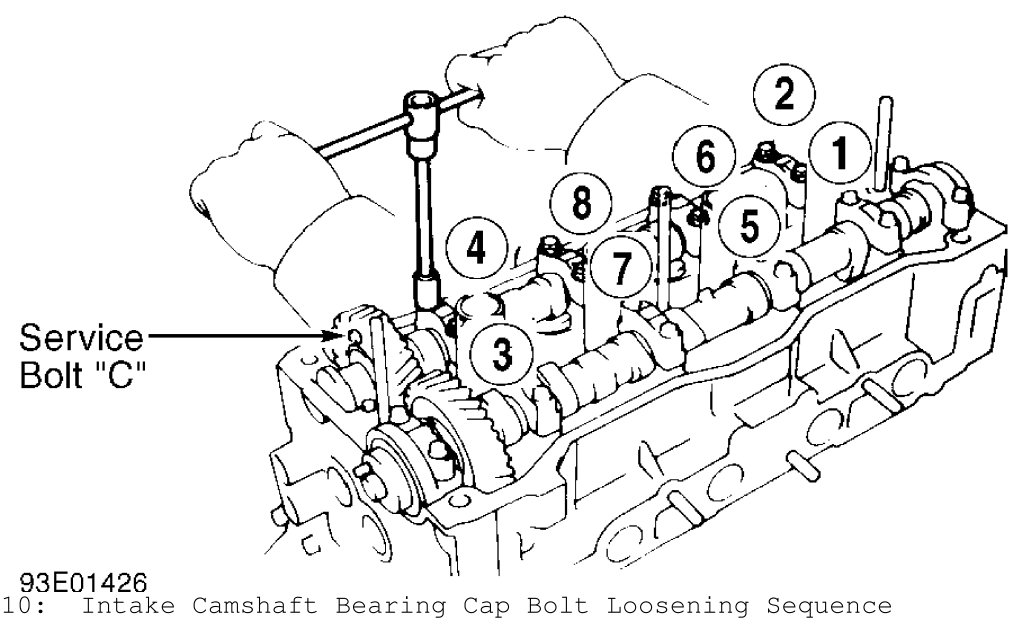


Fig. 10: Intake Camshaft Bearing Cap Bolt Loosening Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

5) To remove exhaust camshaft, rotate camshaft so knock pin is positioned in 5 o'clock position. See Fig. 11. Note location and

direction of camshaft bearing caps.
6) Loosen exhaust camshaft bearing caps evenly in sequence. See Fig. 12. Remove camshaft bearing caps, camshaft and oil seal. If camshaft binds during removal procedure DO NOT force camshaft from cylinder head, retighten No. 3 camshaft bearing cap. Loosen bolts evenly while lifting camshaft. See Fig. 13.

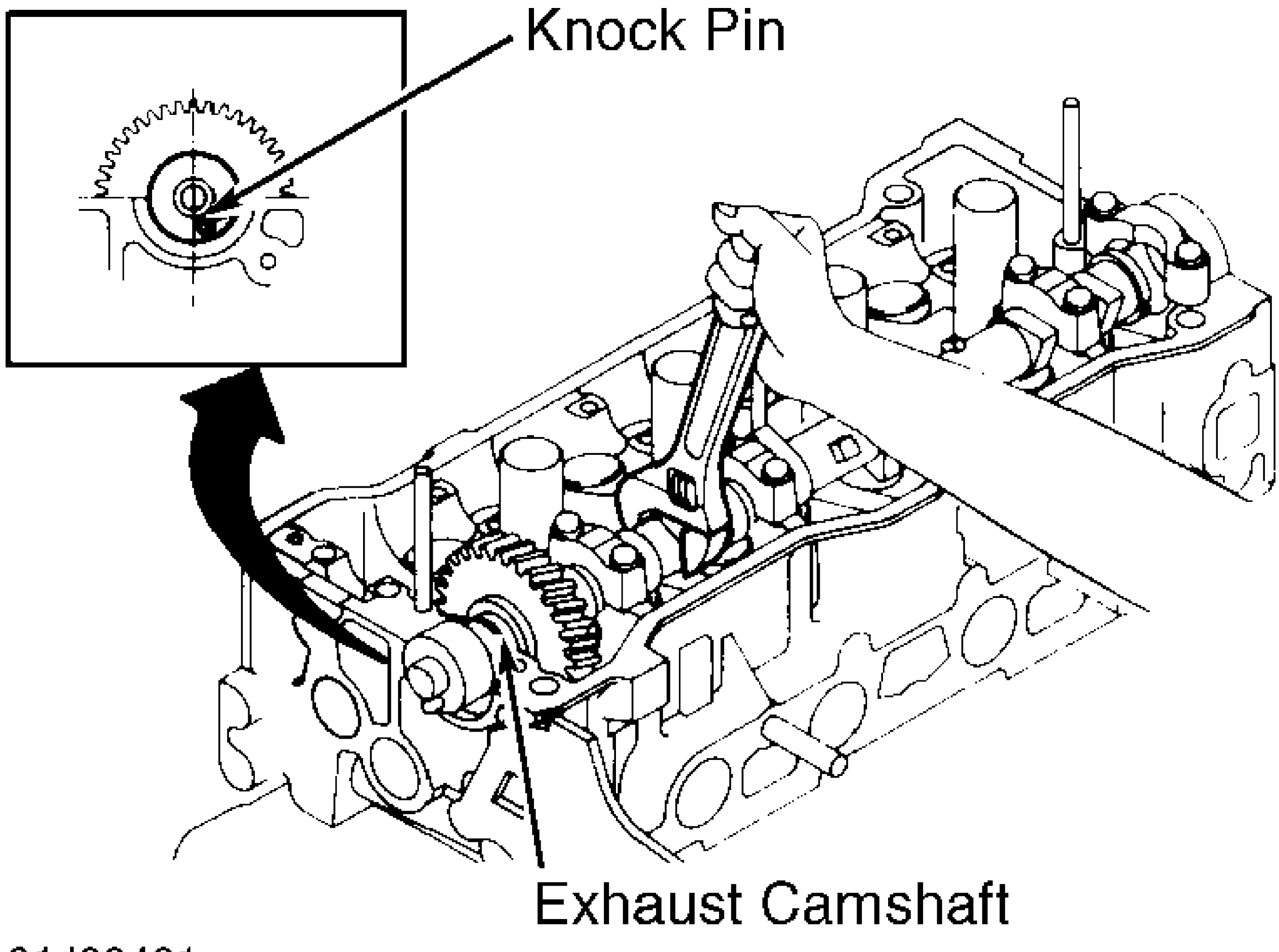


Fig. 11: Positioning Exhaust Camshaft For Removal
Courtesy of Toyota Motor Sales, U.S.A., Inc.

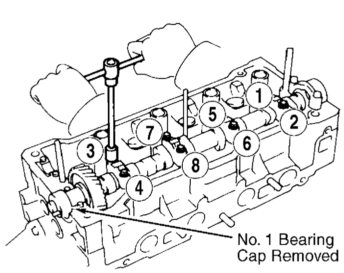


Fig. 12: Exhaust Camshaft Bearing Cap Bolt Loosening Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

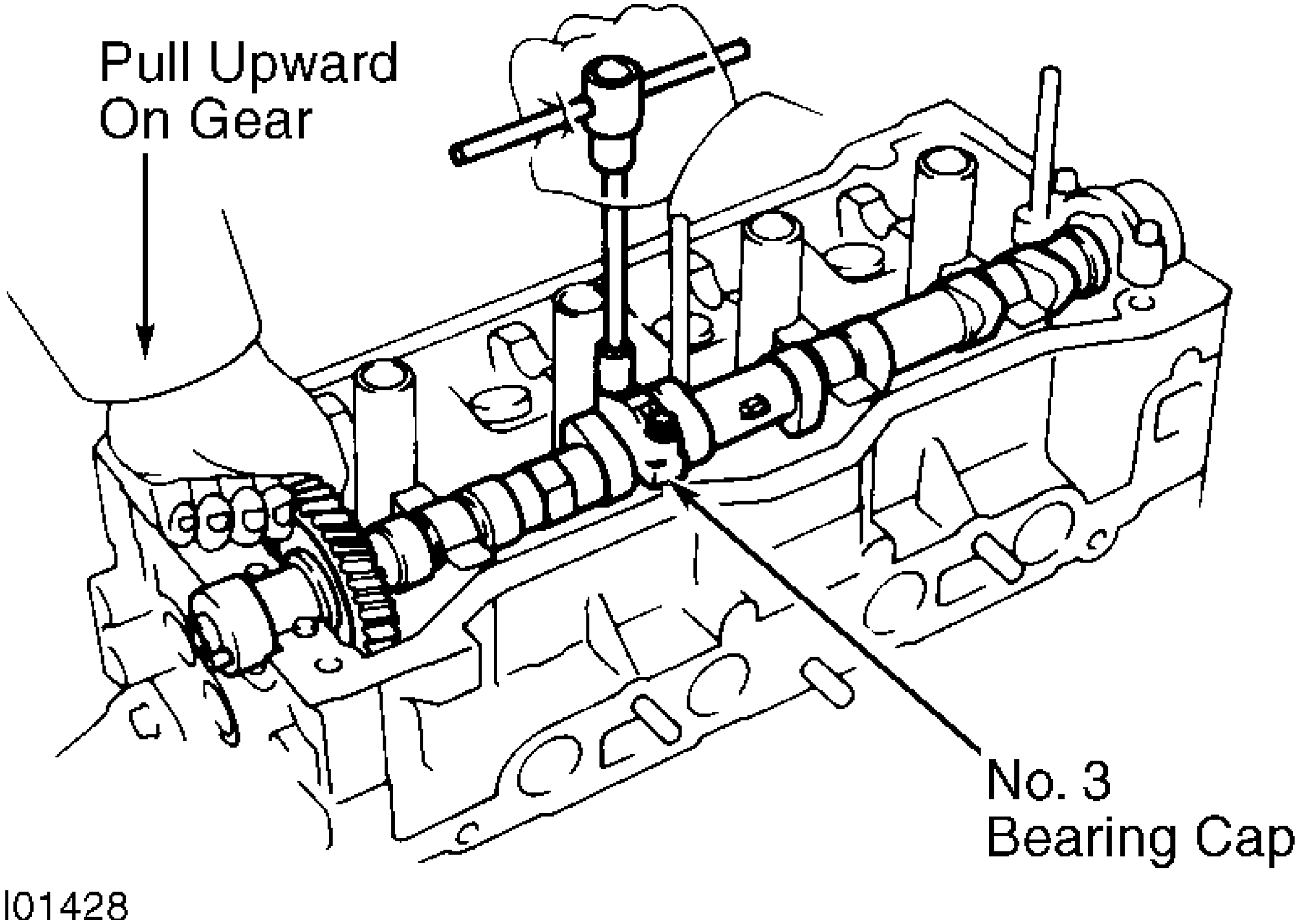


Fig. 13: Removing Stuck Camshaft
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Disassembly & Inspection

1) To disassemble intake camshaft, mount camshaft in vise. Insert pins "A" and "B" in sub-gear holes. See Fig. 14. Using screwdriver, rotate sub-gear clockwise and remove service bolt. Remove pins. Remove snap ring, wave washer, sub-gear and gear spring. See Fig. 15.

2) Inspect components for damage. Measure camshaft journal diameter, lobe height and journal runout. Replace camshaft if measurements are not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS at end of article.

3) Install camshaft in cylinder head without sub-gear. Using Plastigage, check camshaft oil clearance. Tighten camshaft bearing cap bolts to specification when checking oil clearance. See TORQUE SPECIFICATIONS. Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table.

4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if end play is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS at end of article.

5) Use a dial indicator to check gear backlash between camshaft gears. Replace both camshafts if backlash exceeds specification. See CAMSHAFT table.

6) Measure distance between ends of gear spring. Replace gear spring if distance is not .669-.693" (17.0-17.6 mm).

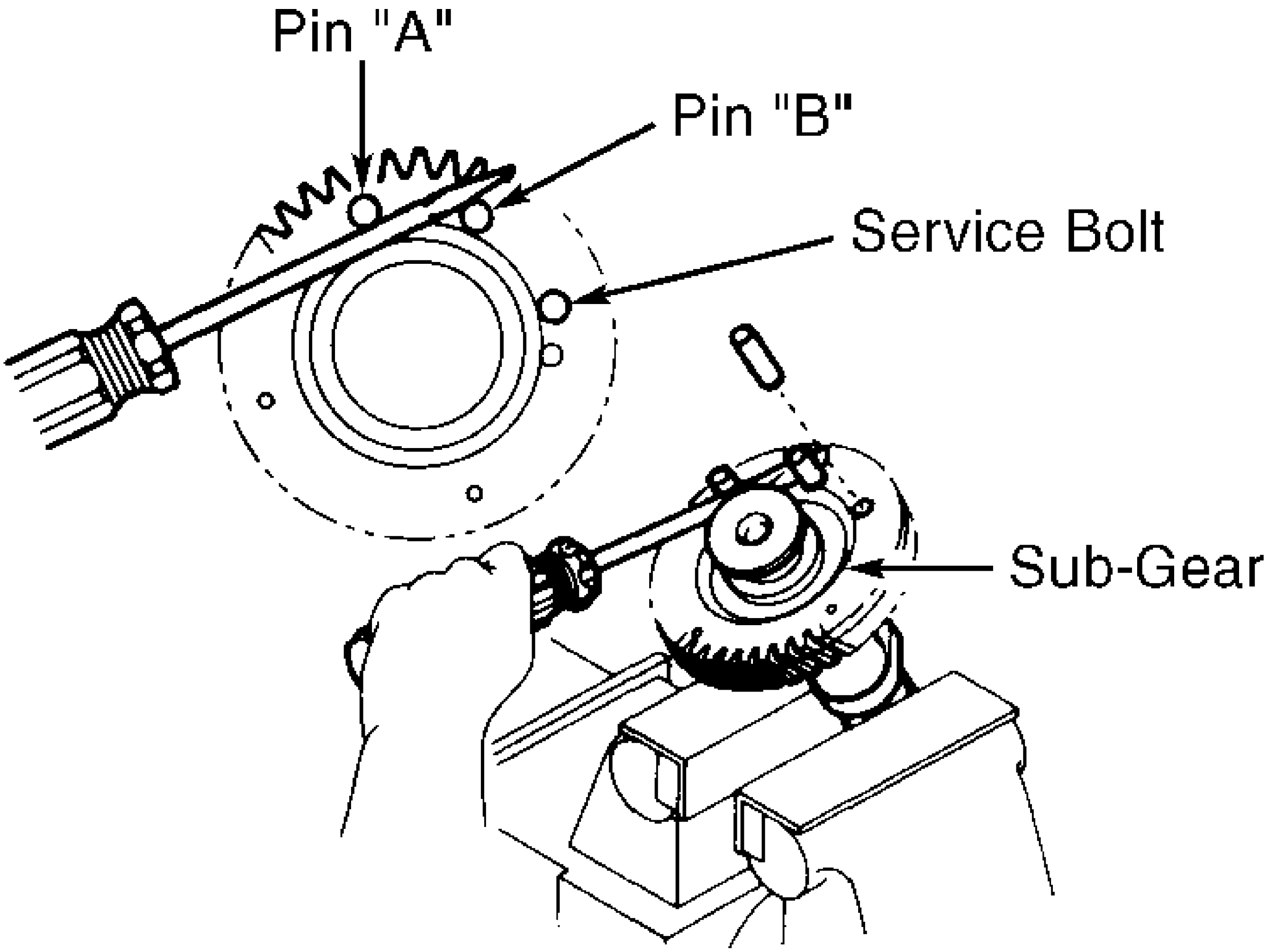


Fig. 14: Removing & Installing Sub-Gear
Courtesy of Toyota Motor Sales, U.S.A., Inc.

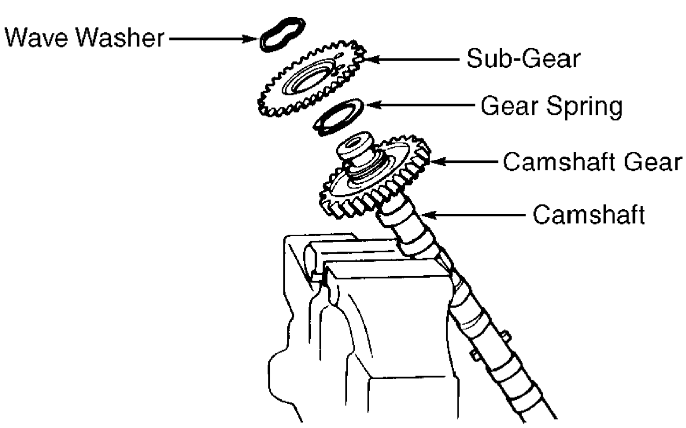


Fig. 15: Exploded View Of Intake Camshaft & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Reassembly & Installation

1) Install gear spring, sub-gear and wave washer. See

Fig. 15. Align pin on gear with gear spring ends. Install snap ring. Install pins "A" and "B" in sub-gear. See Fig. 14. Using screwdriver, rotate sub-gear clockwise and install service bolt and remove pins.

CAUTION: Keep camshaft level during installation, or camshaft binding and breakage may occur.

2) To install exhaust camshaft, lubricate thrust area of camshaft with multipurpose grease. Install exhaust camshaft so knock pin is in 5 o'clock position. This angle allows cylinders No. 1 and 3 cam lobes push on valve lifters evenly. Apply Sealer (08826-00080) to No 1 bearing cap. See Fig. 16. Install exhaust camshaft bearing caps on cylinder head.

CAUTION: Ensure arrow on camshaft bearing cap points toward timing belt end of engine. Install caps so numbers are in order.

3) Tighten bolts on exhaust camshaft bearing caps evenly in sequence. See Fig. 17. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

4) Apply multipurpose grease on camshaft oil seal. Using Seal Installer (09223-46011), install seal on exhaust camshaft.

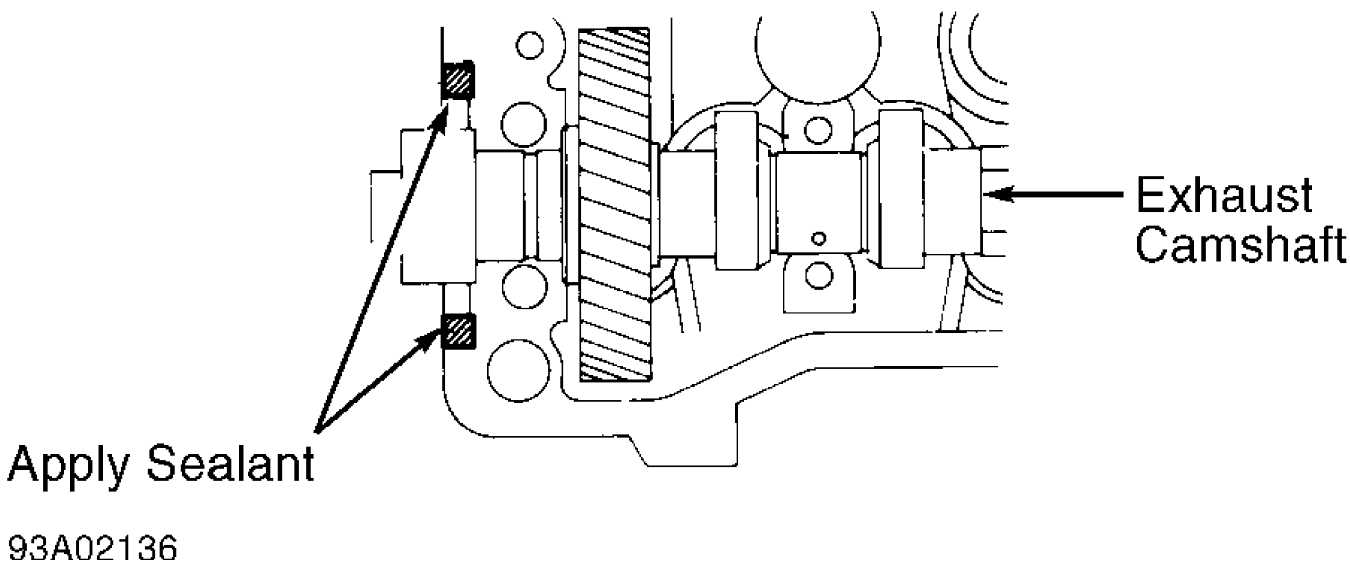


Fig. 16: Applying Sealant To No. 1 Bearing Cap
Courtesy of Toyota Motor Sales, U.S.A., Inc.

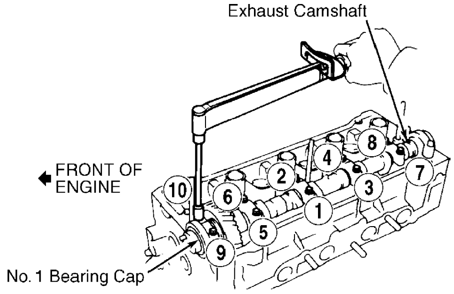


Fig. 17: Camshaft Bearing Cap Bolt Tightening Sequence
(Exhaust Camshaft Shown, Intake Camshaft Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAUTION: DO NOT confuse TDC marks with camshaft aligning marks.

During camshaft installation, ensure installing marks, not TDC marks, are aligned.

5) To install intake camshaft, rotate exhaust camshaft so knock pin is at approximately 10 o'clock position. See Fig. 18. Lubricate thrust area of camshaft with multipurpose grease. Install intake camshaft so installing marks on camshaft gears are aligned.

6) Install all camshaft bearing caps, except No. 1, on cylinder head. Tighten both bolts on each camshaft bearing cap in sequence. See Figs. 16 & 17. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

CAUTION: Ensure arrow on camshaft bearing caps point toward timing belt end of engine. Install bearing caps so numbers are in order.

7) Remove bolt from service bolt hole. Install No. 1 bearing cap. If No. 1 camshaft bearing cap does not fit properly, push camshaft gear backward while installing camshaft bearing cap. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Rotate exhaust camshaft clockwise so knock pin is at 12 o'clock position.

8) Ensure TDC marks are together and at cylinder head surface. See Fig. 18. The installing marks should be at 12 o'clock position.

CAUTION: Check valve clearance if cylinder head or camshaft components were serviced or changed. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

9) To install remaining components, reverse removal procedure. Before installing valve cover, apply Sealant (08825-00080) at valve cover-to-camshaft bearing cap surfaces.

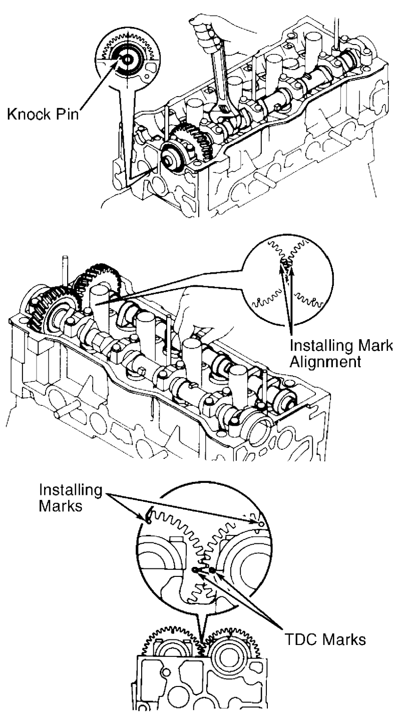


Fig. 18: Installing Intake Camshaft
Courtesy of Toyota Motor Sales, U.S.A., Inc.

VALVE LIFTER

Removal

Remove camshaft. See CAMSHAFTS under REMOVAL & INSTALLATION. Note location of adjusting shims and valve lifter for installation reference. Remove adjusting shim and valve lifter from cylinder head.

Inspection

Inspect valve lifter and bore for damage. Measure O.D. of valve lifter. Replace valve lifter if damaged, or O.D. is not within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS at end of article.

Installation

To install, reverse removal procedure. Ensure components are installed in original location. If camshaft, adjusting shims or valve lifter is replaced, check valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

CRANKSHAFT REAR OIL SEAL

Removal

1) Remove transaxle. Place reference mark on crankshaft and flywheel/drive plate. Remove flywheel/drive plate.

2) Remove rear plate from cylinder block. Pry seal from seal retainer using care not to damage seal retainer.

Installation

1) Ensure all sealing surfaces are clean. Using Seal Installer (09223-41020), install seal flush with edge of seal retainer. Lubricate seal lip with grease.

2) Tighten bolts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Ensure reference mark on flywheel/drive plate aligns with mark on crankshaft.

WATER PUMP

Removal

1) Disconnect negative battery cable. Drain cooling system. Loosen bolts on water pump pulley and remove drive belts. Raise and support vehicle.

2) Support engine with floor jack. Remove right engine mount. Remove upper and center timing belt covers.

3) If equipped with power steering, Remove front transaxle mount, upper radiator hose and electric cooling fan. On all models, remove engine harness mounting bolt.

4) Remove coolant inlet pipe. Remove oil dipstick tube, and plug hole in oil pump housing (if necessary). Remove water pump retaining bolts, water pump and "O" ring from cylinder block.

Installation

Install NEW "O" ring on cylinder block and dipstick tube. Tighten bolts to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure. Adjust drive belt tension, and fill cooling system.

OIL PAN

Removal & Installation

1) Drain engine oil. Raise and support vehicle. Remove lower engine covers. Disconnect oxygen sensor (if necessary) and remove exhaust pipe. Remove engine reinforcement bracket (if equipped).

Remove oil pan bolts and oil pan.

2) On 1.8L, remove oil pan baffle plate. Remove upper oil pan by removing 3 upper oil pan-to-transaxle bolts. Remove remaining upper oil pan bolts.

3) On all models, to install, reverse removal procedure. Apply Sealant (08826-00080) to oil pan gasket(s) before installing. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Inspect cylinder head for cracks and warpage. Using a straightedge and feeler gauge check cylinder head at manifold and cylinder block surfaces for warpage. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS at end of article.

Valve Springs

Using a valve spring tester, measure tension of valve springs at specified length. Ensure valve spring free length and out-of-square are within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS at end of article.

Valve Stem Oil Seals

Install oil seal using Seal Installer (09201-41020).

NOTE: Intake valve stem oil seal is Gray and exhaust valve oil seal is Black.

Valve Guides

1) To determine valve stem-to-guide clearance, measure and record valve stem diameter. Measure valve guide inside diameter and record. Subtract valve stem diameter from valve guide inside diameter. Ensure valve stem and guide are within specification and replace as necessary. See VALVES & VALVE SPRINGS table and CYLINDER HEAD table under ENGINE SPECIFICATIONS at end of article.

2) To remove valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (09201-70010), drive valve guide from cylinder head.

3) Measure cylinder head valve guide bore I.D. If cylinder head valve guide bore I.D. is greater than .4341" (11.026 mm), use a reamer to machine cylinder head bore to .4350-.4361" (11.049-11.077 mm) for oversized valve guide. If valve guide bore I.D. is greater than .4361" (11.077 mm), replace cylinder head.

4) To install valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (09201-70010), drive valve guide into cylinder head.

CAUTION: Install valve guide so installed height above cylinder head surface is .500-.516" (12.70-13.11 mm).

5) Using a sharp 6-mm reamer, ream valve guide to obtain correct valve stem oil clearance. See CYLINDER HEAD table.

Valve Seat

Information is not available from manufacturer.

Valves

Ensure valve stem diameter and valve margin are within specification. Check valve contact pattern and overall length. See

VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS at end of article.

Seat Correction Angles

To lower valve seat surface on valve, cut seat at 30 degrees and 45 degrees. To raise valve seat surface on valve, cut seat at 60 degrees and 45 degrees.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Note direction of connecting rod installation on piston before removing. Check rods for bend and twist. Replace rods if bend or twist exceeds specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS at end of article.

2) Measure connecting rod bolts for stretch. On 1.6L, measure rod bolt .59" (15 mm) from rod. See Fig. 19. Minimum diameter is .3386" (8.60 mm). On 1.8L, measure rod bolt .787" (20 mm) from head of bolt. See Fig. 19. Minimum diameter is .276" (7 mm). On all engines replace rod bolt and nut if less than minimum diameter.

3) Note mark at center of connecting rod, which must be aligned with front mark on top of piston. See Figs. 19 & 20. Install connecting rod in original direction. Install piston with front mark on piston top toward timing belt end of engine.

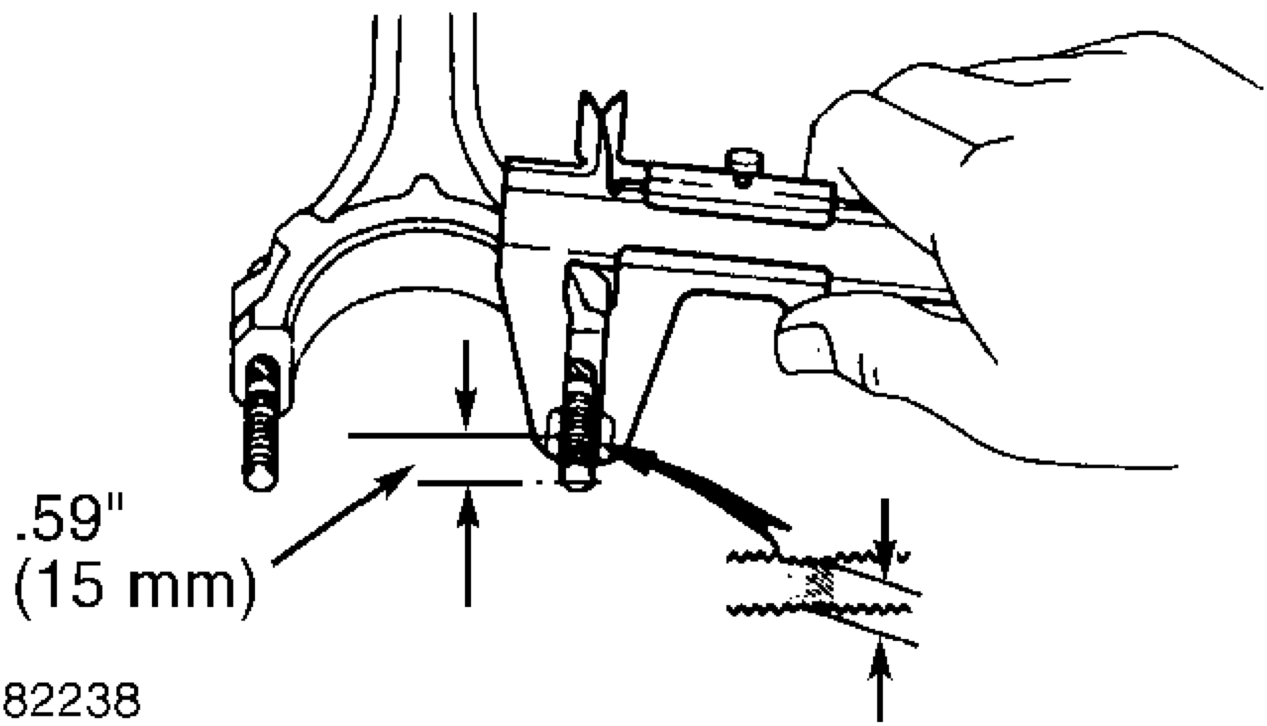
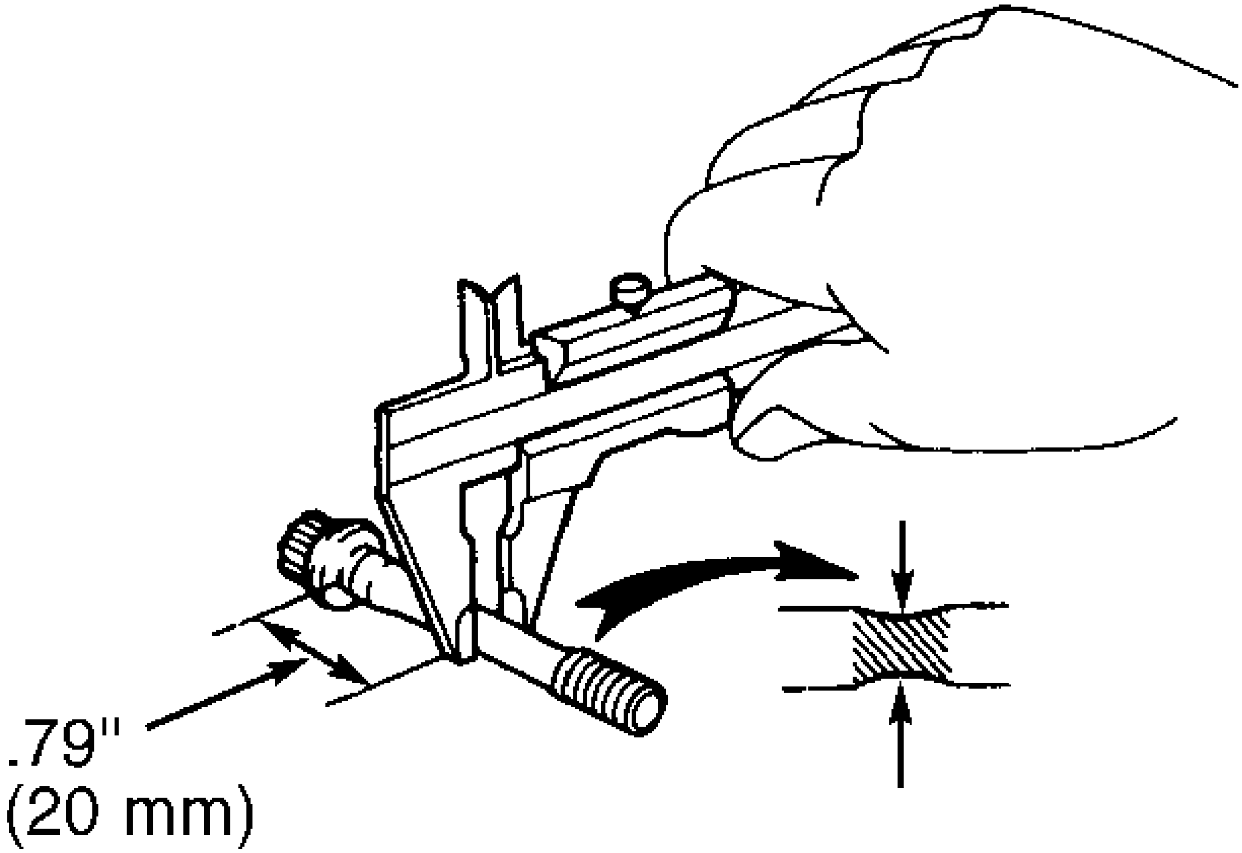
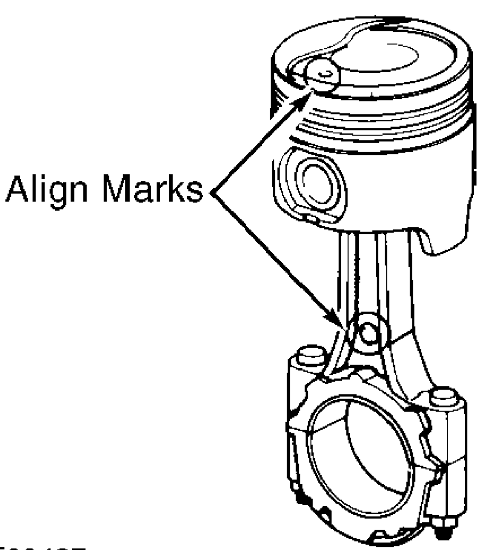


Fig. 19: Measuring Connecting Rod Bolts For Stretch (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93F82227
Fig. 20: Measuring Connecting Rod Bolts For Stretch (1.8L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



91F00427
Fig. 21: Aligning Piston & Connecting Rod (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Three different standard sizes of piston and cylinder bore
         are used. Piston and cylinder bore sizes are identified by a

numerical size mark, "1", "2" or "3". Piston size is stamped on piston top and cylinder bore size is stamped on cylinder block deck surface. See Figs. 22 and 23.

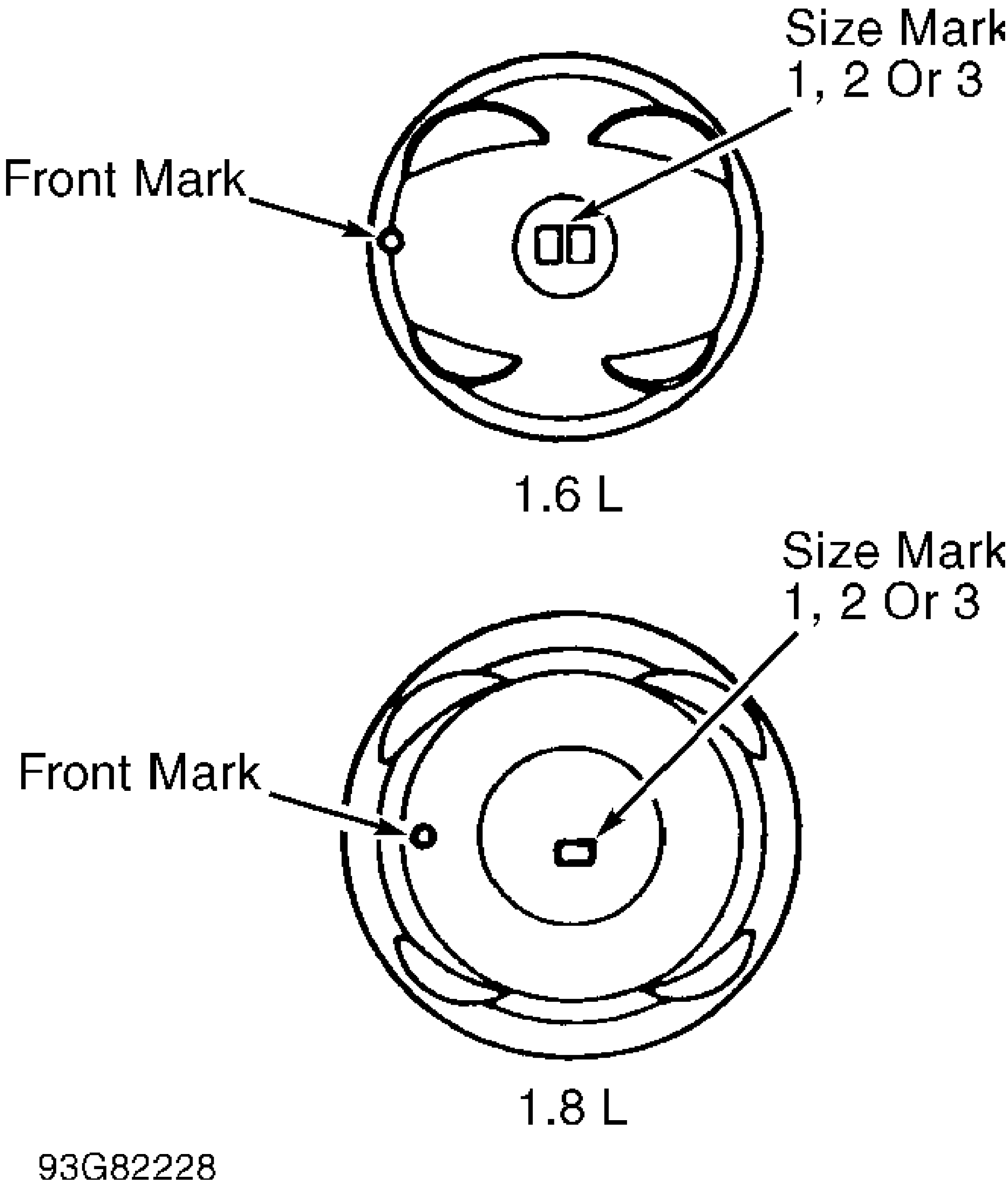


Fig. 22: Identifying Piston Front Mark & Size Mark
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fitting Pistons

1) To determine if piston-to-cylinder clearance is within

specification, measure piston skirt diameter at 90-degree angle to piston pin, .956" (24.5 mm) from top of piston.

2) Three standard piston sizes are used. Piston size is identified by a numerical size mark, "1", "2" or "3", stamped on top of piston. See Fig. 22. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS at end of article. Ensure piston diameter is within specification.

3) Three standard cylinder bore sizes are used. Cylinder bore size is identified by a numerical size mark, "1", "2" or "3", stamped on deck surface. See Fig. 23. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS at end of article. Cylinder bore diameter is measured .39" (10 mm) from top and bottom of bore, and at middle of bore. Make 2 measurements (front-to-rear and side-to-side) at top, middle and bottom of each cylinder to find taper and out-of-round.

4) To determine piston clearance, subtract piston diameter from cylinder bore diameter. If clearance exceeds specification, replace piston with standard piston if cylinder taper and out-of-round are within specification. If any cylinder measurement exceeds specification, bore all cylinders to uniform diameter and replace all pistons with oversize pistons to maintain balance. See PISTONS, PINS & RINGS table.

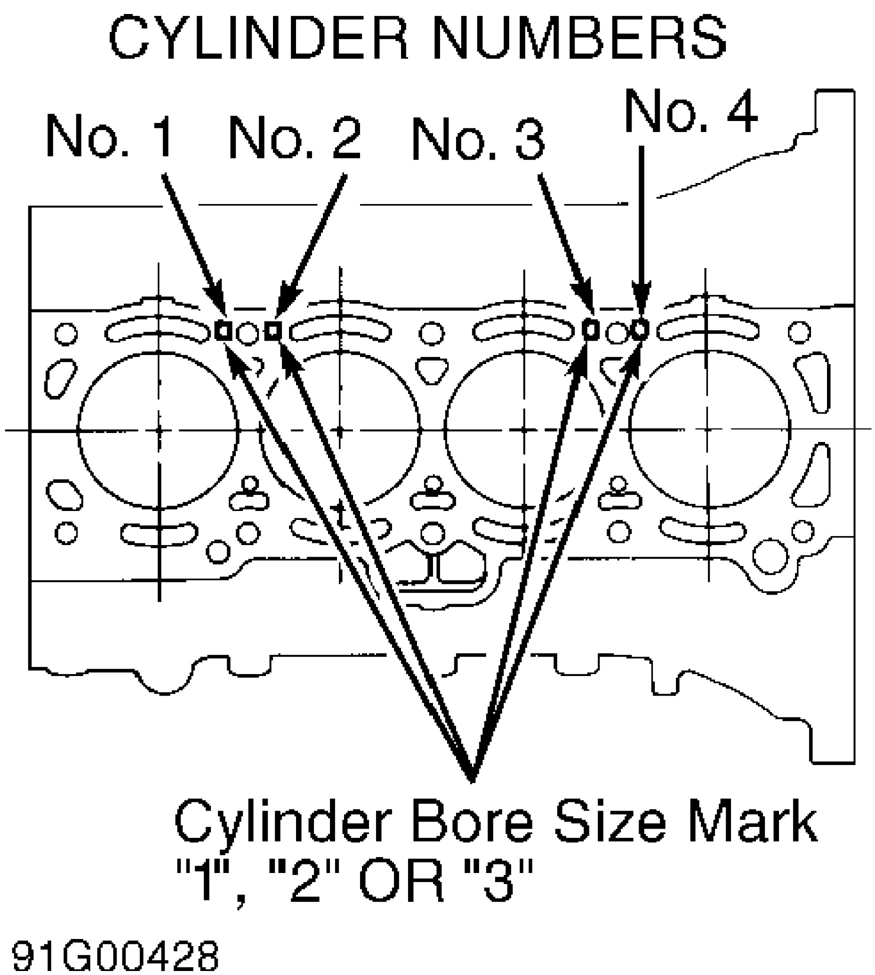


Fig. 23: Locating Cylinder Bore Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Piston Rings

Ensure ring end gap and side clearance are within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS at end of article. Position piston ring gaps 90 degrees apart. Ensure ring end gaps are not aligned, and ensure ring gaps do not align with piston pin.

Rod Bearings

1) Note direction of connecting rod and cap before removal for reassembly reference. If bearings are to be reused, measure bearing oil clearance using Plastigage before removing pistons. Check connecting rod side play. See CONNECTING RODS and CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS tables under ENGINE SPECIFICATIONS at end of article.

2) Rod bearings are available in 3 standard sizes. Rod bearing size is indicated by a numerical identification mark, "1", "2" or "3", stamped on back side bearing shell and on connecting rod cap . Identification mark is used to determine bearing thickness. See CONNECTING ROD BEARING SPECIFICATIONS table.

3) Install piston and rod assembly. Check rod bearing clearance using Plastigage method. Tighten rod bolts in 2 steps to specification, then turn nut additional 90 degrees. If rod bearing clearance is excessive, measure crankpin journal diameter. If crankpin journal diameter is within specification, replace bearing with a standard bearing. If crankpin journal is less than minimum specification, a .0098" (.25 mm) undersize bearing is available. Regrind crankshaft to fit undersize bearing if necessary.

CONNECTING ROD BEARING SPECIFICATIONS TABLE

Bearing Identification Mark	Bearing Thickness In. (mm)
"1"	.0585-.0587 (1.486-1.490)
"2"	.0587-.0588 (1.490-1.494)
"3"	.0588-.0590 (1.494-1.498)

Crankshaft & Main Bearings

1) Ensure main bearing caps are numbered for location, and arrow on caps point toward timing belt end of crankshaft. Remove main bearing cap bolts in proper sequence. See Fig. 24.

2) Cylinder block main bearing bore size is indicated by a size mark number, "1", "2" or "3", stamped on cylinder block. See Fig. 25. Main bearing journal size is indicated by a size mark number, "0", "1" or "2", located near crankshaft counterweight.

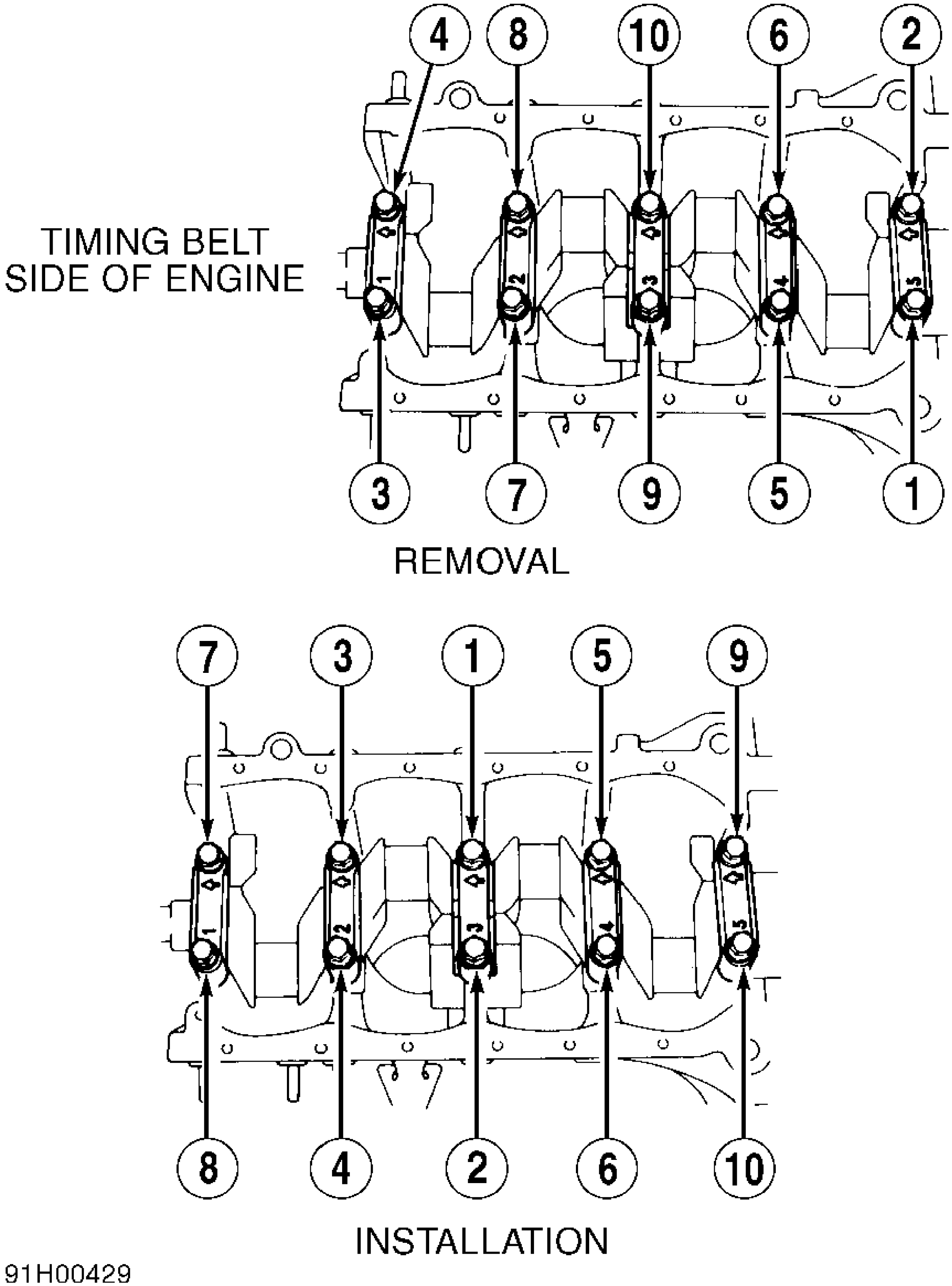


Fig. 24: Main Bearing Cap Bolt Removal & Installation Sequence
Courtesy of General Motors Corp.

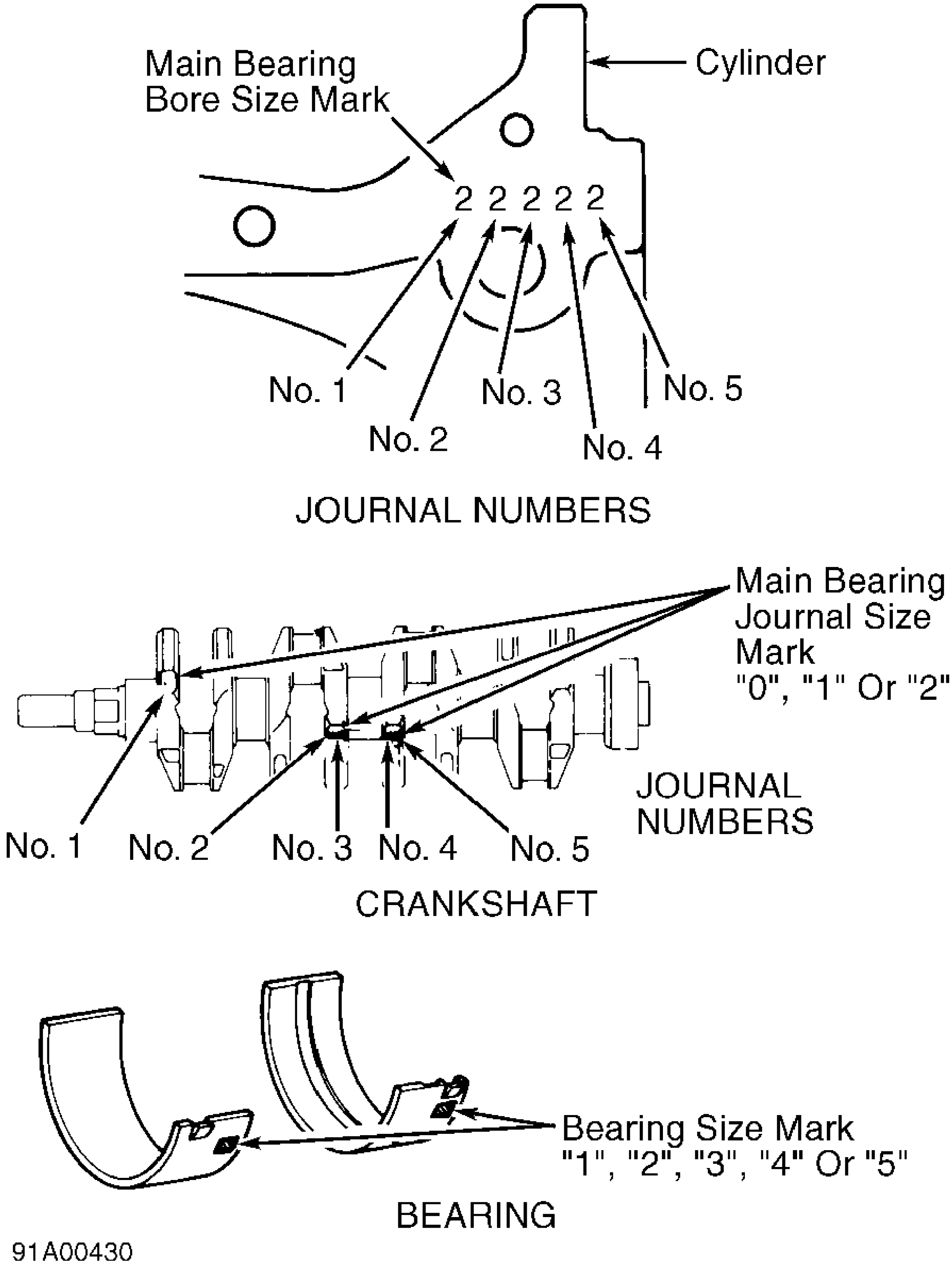


Fig. 25: Locating Main Bearing Bore, Main Bearing Journal & Bearing Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Measure main bearing clearance using Plastigage method.

Main bearing clearance should be .0006-.0013" (.015-.033 mm). Maximum wear tolerance is .004" (.10 mm). If bearing clearance is excessive, measure crankshaft main bearing journals. Measure journals at each end of journal and 90 degrees from first readings. Grind crankshaft to .0098" (.25 mm) undersize or replace crankshaft if journal minimum diameter, taper or out-of-round are not within specification.

4) When replacing worn bearings on a crankshaft that is within original specification, use size markings on bearings to identify replacement bearing. If bearing size mark on original bearing cannot be obtained, use number on cylinder block (main bearing bore size mark) and number on crankshaft (main bearing journal size mark) to determine bearing number. See MAIN BEARING SELECTION table.

MAIN BEARING SELECTION TABLE

Main Bearing Bore Size Mark	Main Bearing Journal Size Mark	Bearing Size Mark
"1"	"0"	"1"
"1"	"1"	"2"
"1"	"2"	"3"
"2"	"0"	"2"
"2"	"1"	"3"
"2"	"2"	"4"
"3"	"0"	"3"
"3"	"1"	"4"
"3"	"2"	"5"

5) When installing main bearing caps, ensure arrow on caps point toward timing belt end of crankshaft. Tighten bolts in sequence. See Fig. 24.

6) Tighten bolts to specification. See TORQUE SPECIFICATIONS. Ensure crankshaft end play is within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS at end of article.

Thrust Bearing

Install thrust bearing on main bearing, with grooves toward crankshaft, away from cylinder block. Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS at end of article.

Cylinder Block

1) Using feeler gauge and straightedge, check cylinder block deck surface in 6 places for warpage. If warpage exceeds specification, replace cylinder block. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS at end of article.

2) Check cylinder bore wear and taper in 3 places. Cylinder block bore diameter is measured .39" (10 mm) from top and bottom of bore, and at middle of bore.

3) Various cylinder bore sizes are used. Cylinder bore size is identified by a numerical size mark, "1", "2" or "3", stamped on deck surface. See Fig. 23. Bore cylinder block if taper exceeds specification. See CYLINDER BLOCK table.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

The crankshaft-driven oil pump provides lubrication to the main gallery. See Fig. 26.

Crankcase Capacity

Crankcase capacity with oil filter change is 3.5 qts. (3.3L) for 1.6L and 3.9 qts. (3.7L) for 1.8L.

Oil Pressure

With engine at normal operating temperature, oil pressure should be greater than 4.3 psi (.3 kg/cm²) at idle and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

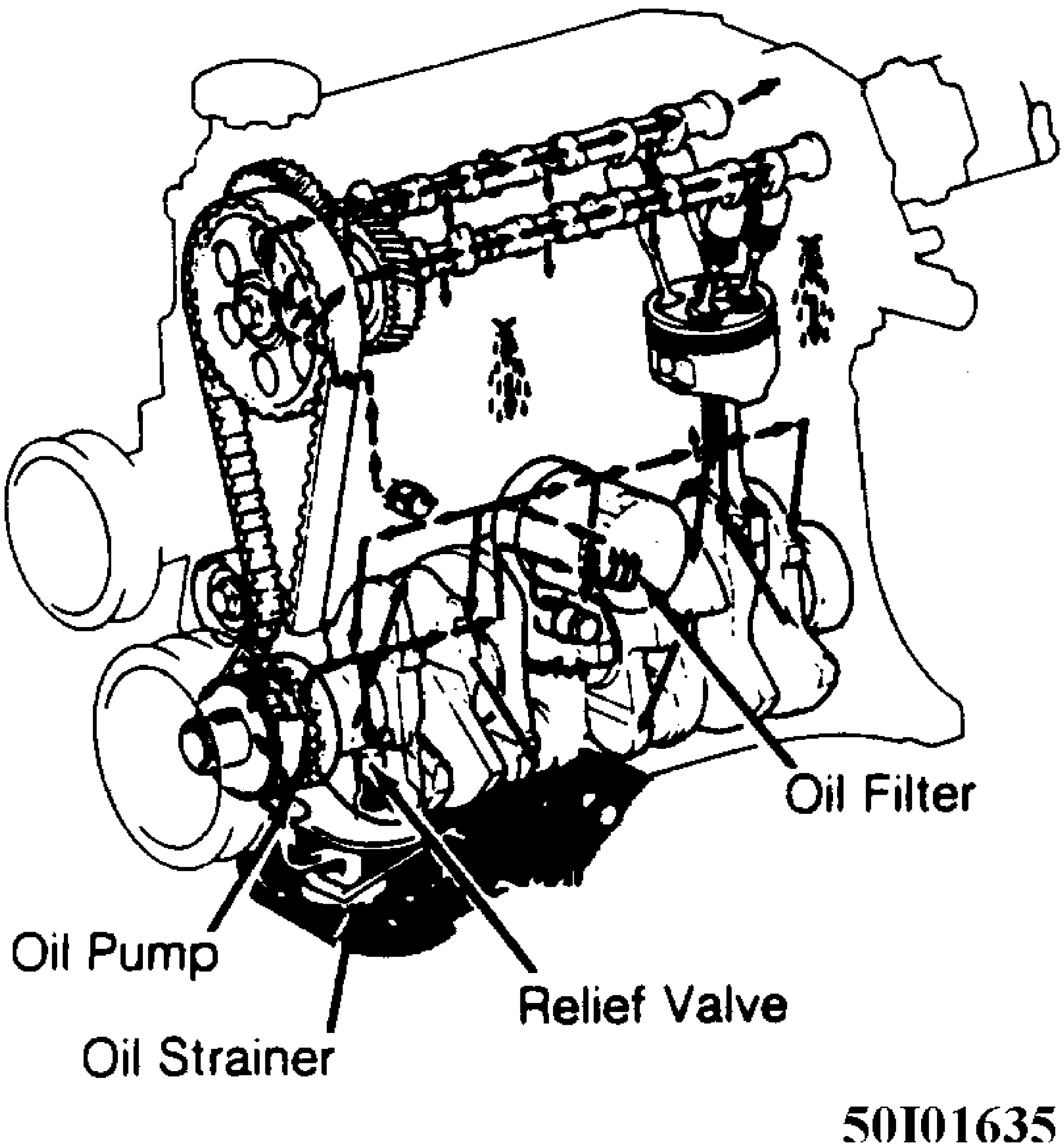


Fig. 26: Cross-Sectional View Of Engine Oil System
Courtesy of General Motors Corp.

OIL PUMP

Removal & Disassembly

1) Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove front exhaust pipe. Remove engine stiffener bracket (if equipped) and oil pan. See OIL PAN under REMOVAL & INSTALLATION.

2) Remove oil pump pickup. Remove dipstick from oil pump housing. Remove oil pump retaining bolts, and remove oil pump. Remove oil pump cover from rear of oil pump. Remove oil seal from oil pump housing. Remove snap ring, spring and relief valve from oil pump housing.

Inspection

1) Inspect components for damage. Ensure relief valve slides freely in bore. Using feeler gauge, measure clearance between driven gear (outer gear) and oil pump housing. Replace pump assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

2) Measure tip clearance between driven gear (outer gear) and drive gear (inner gear). Replace gear set if clearance exceeds specification.

3) With all gears in oil pump housing, place straightedge across oil pump housing. Measure gear end clearance between both gears and straightedge. Replace oil pump assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Rotor Side Clearance	.0010-.0033 (.025-.085)
Rotor Tip Clearance	.0010-.0033 (.025-.085)
Maximum allowable	.014 (.35)
Rotor Clearance	.0031-.0071 (.080-.180)

Reassembly & Installation

1) To reassemble, reverse disassembly procedure. Install oil seal using seal installer. Coat seal lip with grease. Tighten oil pump cover bolts to specification. See TORQUE SPECIFICATIONS table.

2) To install, reverse removal procedure. Use new oil pump gaskets. Tighten all bolts to specification. See TORQUE SPECIFICATIONS table.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	18 (24)
Camshaft Sprocket Bolt	43 (58)
Center Transaxle Mount-To-Crossmember Nut	47 (64)
Connecting Rod Nut	
Step 1	21 (29)
Step 2	Turn Additional 90 Degrees
Crankshaft Pulley Bolt	87 (118)
Cylinder Head Bolt	
Step 1	(1) 22 (30)
Step 2	(1) Turn Additional 90 Degrees
Step 3	(1) Turn Additional 90 Degrees
Exhaust Manifold Bolt/Nut	25 (34)
Flywheel/Drive Plate Bolt	
A/T	47 (64)

```
 M/T  ..............................................  58 (79)
Fuel Rail Bolt  ....................................  11 (15)
Intake Manifold Bolt/Nut  ..........................  14 (19)
Lower Ball Joint-To-Steering Knuckle Nut  ........  94 (127)
Main Bearing Cap Bolt  ........................  (2) 44 (60)
Oil Pump Bolt  .....................................  16 (22)
Power Steering Pump Bolt  ..........................  29 (39)
Rear Transaxle Mount Through Bolt  ................  64 (87)
Right Engine Mount (Timing Belt Side) Engine Mount
 Bracket Mounting Bolt  ...........................  35 (47)
 Through Bolt  .....................................  64 (87)
Spark Plugs  .......................................  13 (18)
Tie Rod End-To-Steering Knuckle Nut  ..............  36 (49)
Timing Belt Idler Pulley Bolt  ....................  27 (37)
Upper Oil Pan-To-transaxle Bolt  ..................  17 (23)
Upper Oil Pan-To-Engine (1.8L)
 Torx Bolt  ........................................  11 (15)
 Hex Bolts (1.8L)  .................................  12 (16)
Water Pump Bolt  ...................................  11 (15)
Water Pump Pulley Bolt  ............................  17 (23)
Wheel Lug Nut  ....................................  76 (103)

                                                 INCH Lbs. (N.m)

Camshaft Bearing Cap Bolt  ...................  (3) 115 (13)
Oil Pan Bolt  ........................................  44 (5)
Oil Pump Cover Bolt  ...............................  89 (10)
Oil Pump Pick-Up Tube Bolt  .......................  84 (9.5)
Rear Seal Retainer Bolt  ............................  79 (9)
Timing Belt Cover Bolt  .............................  62 (7)
Valve Cover Bolt  ...................................  53 (6)

(1) - Tighten bolts to specification in sequence.
      See Fig. 4.
(2) - Tighten bolts to specification in sequence.
      See Fig. 24.
(3) - Tighten bolt to specification in sequence.
      See Fig. 17 & 18.
```

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

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GENERAL SPECIFICATIONS TABLE

Application                                         Specification

1.6L
 Displacement  ..........................  97 Cu. In. (1.6L)
 Bore  ......................................  3.19" (81 mm)
 Stroke  ....................................  3.03" (77 mm)
 Compression Ratio  ..................................  9.5:1
 Fuel System  ..........................................  PFI
 Horsepower @ RPM  .........................  (1) 105 @ 5800
 Torque Ft. Lbs. @ RPM  ........................  100 @ 4800
1.8L
 Displacement  ........................  108 Cu. In. (1.8L)
 Bore  ......................................  3.19" (81 mm)
 Stroke  ..................................  3.37" (85.5 mm)
 Compression Ratio  ..................................  9.5:1
 Fuel System  ..........................................  PFI
```

Horsepower @ RPM	(2) 115 @ 5600
Torque Ft. Lbs. @ RPM	115 @ 2800

(1) - Horsepower for California models is 100 @ 5800.
(2) - Horsepower For California Model Is 110 @ 5600.

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS TABLE

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.221)
Wear Limit	.0118 (.300)
Maximum Runout	.0002 (.005)
Main Bearings	
Journal Diameter	
Size Mark "0"	1.8895-1.8898 (47.994-48.000)
Size Mark "1"	1.8893-1.8895 (47.988-47.994)
Size Mark "2"	1.8891-1.8893 (47.982-47.988)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0002 (.005)
Oil Clearance	.0006-.0013 (.015-.033)
Connecting Rod Bearings	
Journal Diameter	
1.6L	1.5742-1.5748 (39.985-39.999)
1.8L	1.8892-1.8898 (47.985-48.000)
Journal Out-Of-Round	.0002 (.005)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	.0008-.0020 (.020-.051)
Wear Limit	.0031 (.078)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS TABLE

Application	In. (mm)
Minimum Bolt Diameter	
(1.6L)	.3386 (8.60)
(1.8L)	.2760 (7.00)
Maximum Bend	.002 Per 3.94 (.050 Per 100.1)
Maximum Twist	.002 Per 3.94 (.050 Per 100.1)
Side Play	
Standard	.006-.010 (.015-.250)
Wear Limit	.0118 (.300)

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS TABLE

Application	In. (mm)
Pistons	
Oil Clearance	
Standard	.0033-.0041 (.085-.105)

Maximum	.0051 (.13)
Diameter (1)	
Size Mark "1"	3.1852-3.1856 (80.905-80.915)
Size Mark "2"	3.1856-3.1860 (80.915-80.925)
Size Mark "3"	3.1860-3.1864 (80.925-80.935)
Pins	
Diameter	Information Is Not Available
Rod Fit	Information Is Not Available
Rings	
No. 1	
End Gap	
Standard	.010-.018 (.25-.45)
Wear Limit	.042 (1.07)
Side Clearance	.0018-.0035 (.045-.090)
No. 2	
End Gap	
Standard	.014-.020 (.35-.50)
Wear Limit	.0472 (1.20)
Side Clearance	.0012-.0028 (.030-.071)
No. 3 (Oil)	
End Gap	
Standard	.006-.018 (.15-.45)
Wear Limit	.041 (1.05)

(1) - Piston diameter is determined by numerical size mark on top of piston. See Fig. 22.

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK TABLE

Application	In. (mm)
Cylinder Bore	
Standard Diameter (1)	
Size Mark "1"	3.1890-3.1894 (81.001-81.010)
Size Mark "2"	3.1894-3.1898 (81.010-81.020)
Size Mark "3"	3.1898-3.1902 (81.020-81.030)
Cylinder Bore Limit	3.2177 (81.73)
Maximum Taper & Out-Of-Round	.004 (.101)
Maximum Deck Warpage	.002 (.05)

(1) - Cylinder bore diameter is determined by numerical size mark on deck surface. See Fig. 23.

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS TABLE

Application	Specification
Exhaust Valves	
Face Angle	45°
Minimum Margin	.020" (.50 mm)
Overall Length (Min)	3.4390 (87.35)
Stem Diameter	.2348-.2354" (5.96-5.98 mm)
Intake Valves	
Face Angle	45°
Minimum Margin	.020" (.50 mm)
Overall Length (Min)	3.4232 (86.95)
Stem Diameter	.2350-.2356" (5.969-5.985 mm)

Application	Specification
Valve Springs	
Free Length	1.518" (38.57 mm)
Out-Of-Square	.079" (2.0 mm)
	Lbs. @ In. (kg @ mm)
Pressure	
Valve Closed	37.3 @ 1.25 (16.9 @ 31.7)
Valve Open	Information Is Not Available

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD TABLE

Application	Specification
Maximum Warpage	
Cylinder Head Surface	.002" (.05 mm)
Manifold Surfaces	.004" (.10 mm)
Intake & Exhaust	
Cylinder Head Valve Guide Bore (Max)	(1) .4341" (11.026 mm)
Valve Seats	
Seat Angle	45°
Seat Contact Width	.039-.055" (1.0-1.4 mm)
Valve Guide I.D.	.2366-.2374" (6.010-6.029 mm)
Valve Guide Protrusion	.500-.516" (12.70-13.11 mm)
Intake	
Valve Stem-To-Guide Oil Clearance	
Standard	.0010-.0024" (.025-.061 mm)
Wear Limit	.003" (.08 mm)
Exhaust	
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.066 mm)
Wear Limit	.004" (.10 mm)

(1) - If diameter exceeds specification, cylinder head must be machined for oversized valve guide.

CAMSHAFT SPECIFICATIONS

CAMSHAFT TABLE

Application	In. (mm)
Gear Backlash (Max.)	.0188 (.30)
Exhaust Camshaft	
End Play	
Standard	.0014-.0035 (.035-.090)
Wear Limit	.004 (.10)
Journal Diameter	
No. 1	.9822-.9829 (24.949-24.965)
Others	.9035-.9041 (22.949-22.965)
Journal Oil Clearance	
Standard	.0014-.0028 (.035-.072)
Wear Limit	.004 (.10)
Lobe Height	
Standard	1.6520-1.6560 (41.960-41.060)
Minimum	1.6358 (41.55)
Intake Camshaft	
End Play	
Standard	.0012-.0033 (.030-.084)

Wear Limit	.004 (.10)
Journal Diameter	
All	.9035-.9041 (22.949-22.965)
Journal Oil Clearance	
Standard	.0014-.0028 (.035-.072)
Wear Limit	.004 (.10)
Lobe Height	
Standard	1.6450-1.6539 (41.910-42.010)
Minimum	1.6338 (41.50)

VALVE LIFTERS SPECIFICATIONS

VALVE LIFTERS TABLE

Application	In. (mm)
Bore Diameter	1.2205-1.2215 (31.000-31.025)
Lifter Diameter	1.2191-1.2195 (30.966-30.976)
Oil Clearance	
Standard	.0009-.0023 (.024-.059)
Maximum	.003 (.07)

2.0L 4-CYL TURBO - VIN [S]

1993 Toyota Celica

1993 TOYOTA ENGINES
2.0L Turbo 4-Cylinder

Celica All-Trac, MR2

* PLEASE READ THIS FIRST *

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

ENGINE IDENTIFICATION

Engine serial number is stamped on flywheel end of cylinder block, below cylinder head surface.

ENGINE IDENTIFICATION CODE

Application	Engine Code	VIN Code
Celica All-Trac & MR2		
2.0L Turbo 4-Cylinder	3S-GTE	S

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

CAUTION: To prevent air bag deployment, disconnect negative battery cable at least 20 seconds before working on vehicle.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

NOTE: Adjust valve clearance with engine cold.

1) Disconnect negative battery cable. On MR2, remove No. 1 air intake connector from throttle body. See Fig. 30.

2) On Celica All-Trac, remove intercooler. See INTERCOOLER under REMOVAL & INSTALLATION.

3) On all models, disconnect spark plug wires from spark plugs. Drain cooling system. Remove EGR vacuum modulator and Vacuum Switching Valve (VSV) assembly. Remove EGR valve and pipe. Remove intake air connector and intake air connector brace from throttle body. See Fig. 16.

4) Disconnect electrical connections, control cables, vacuum hoses and coolant hoses from throttle body. Remove throttle body and gasket. Remove retaining bolts, seal washers, valve cover and gaskets.

5) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover.

6) Ensure valve lifters are loose on cylinder No. 1 and tight on cylinder No. 4. If conditions are not as described, rotate crankshaft one complete revolution (360 degrees).

7) With cylinder No. 1 at TDC, check valve clearance on specified valves. See VALVE CLEARANCE ADJUSTMENT SEQUENCE table. Using

feeler gauge, measure and record clearance between valve lifter and camshaft.

VALVE CLEARANCE ADJUSTMENT SEQUENCE TABLE

Cylinder No. At TDC	Adjust Intake Valves	Adjust Exhaust Valves
1	1 & 2	1 & 3
4	3 & 4	2 & 4

8) To check remaining valves, rotate crankshaft 360 degrees (one revolution) until cylinder No. 4 is at TDC on compression stroke. Measure and record valve clearance on specified valves. See VALVE CLEARANCE ADJUSTMENT SEQUENCE table. Ensure valve clearance is within specification. See VALVE CLEARANCE SPECIFICATIONS table.

VALVE CLEARANCE SPECIFICATIONS (1) TABLE

Application	In. (mm)
Exhaust Valve	.011-.015 (.28-.38)
Intake Valve	.006-.010 (.15-.25)

(1) - Adjust valve clearance with engine cold.

9) If valve clearance requires adjustment, rotate camshaft so lobe on valve to be adjusted is facing upward, away from valve lifter.

10) Rotate valve lifter so notch on valve lifter is toward spark plug. See Fig. 1. DO NOT align notch with camshaft.

11) Use Valve Clearance Adjuster (SST 09248-55020) to remove adjusting shim. Using SST "A" of valve clearance adjuster, push downward on valve lifter. Place SST "B" between camshaft and valve lifter with side marked with No. 7 at designated position. See Fig. 1. Remove SST "A".

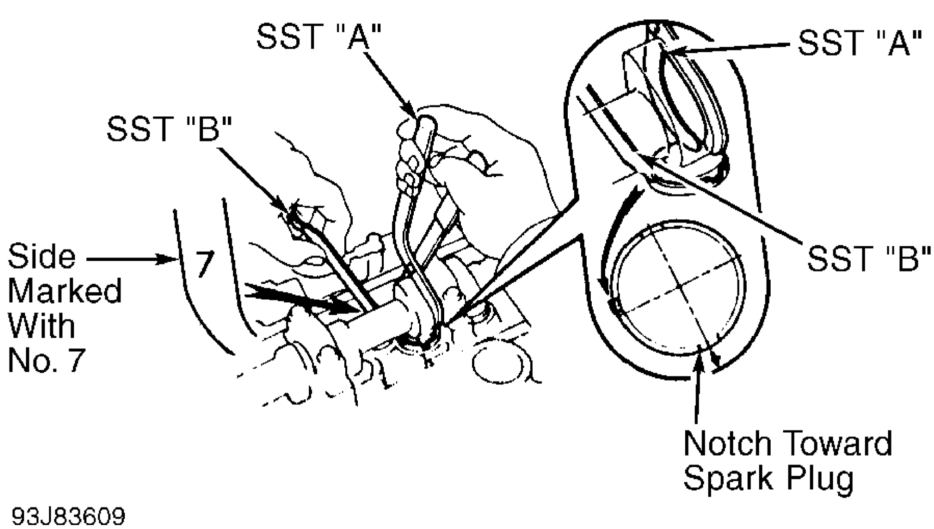

Fig. 1: Adjusting Valve Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

12) Using small screwdriver and magnet, remove adjusting shim. Measure and record thickness of removed adjusting shim. Using

measured clearance and adjusting shim thickness, select proper replacement adjusting shim. See Figs. 3, 4, 5 & 6.

13) Install replacement adjusting shim. Recheck valve clearance. Before installing valve cover and gasket, apply sealant at front and rear areas of cylinder head. See Fig. 2.

14) Using NEW gasket, install valve cover. Install seal washers. Install and tighten retaining bolts to specification. See TORQUE SPECIFICATIONS.

15) To install remaining components, reverse removal procedure. Tighten all bolts to specification. See TORQUE SPECIFICATIONS.

16) Install NEW throttle body gasket with protruding area on gasket toward top of throttle body (opposite coolant line connections). Note that the 2 longer throttle body bolts are used in lower throttle body mounting holes. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS. Fill cooling system. On MR2 cooling system must be bled. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CAUTION: On MR2, ensure cooling system is bled to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

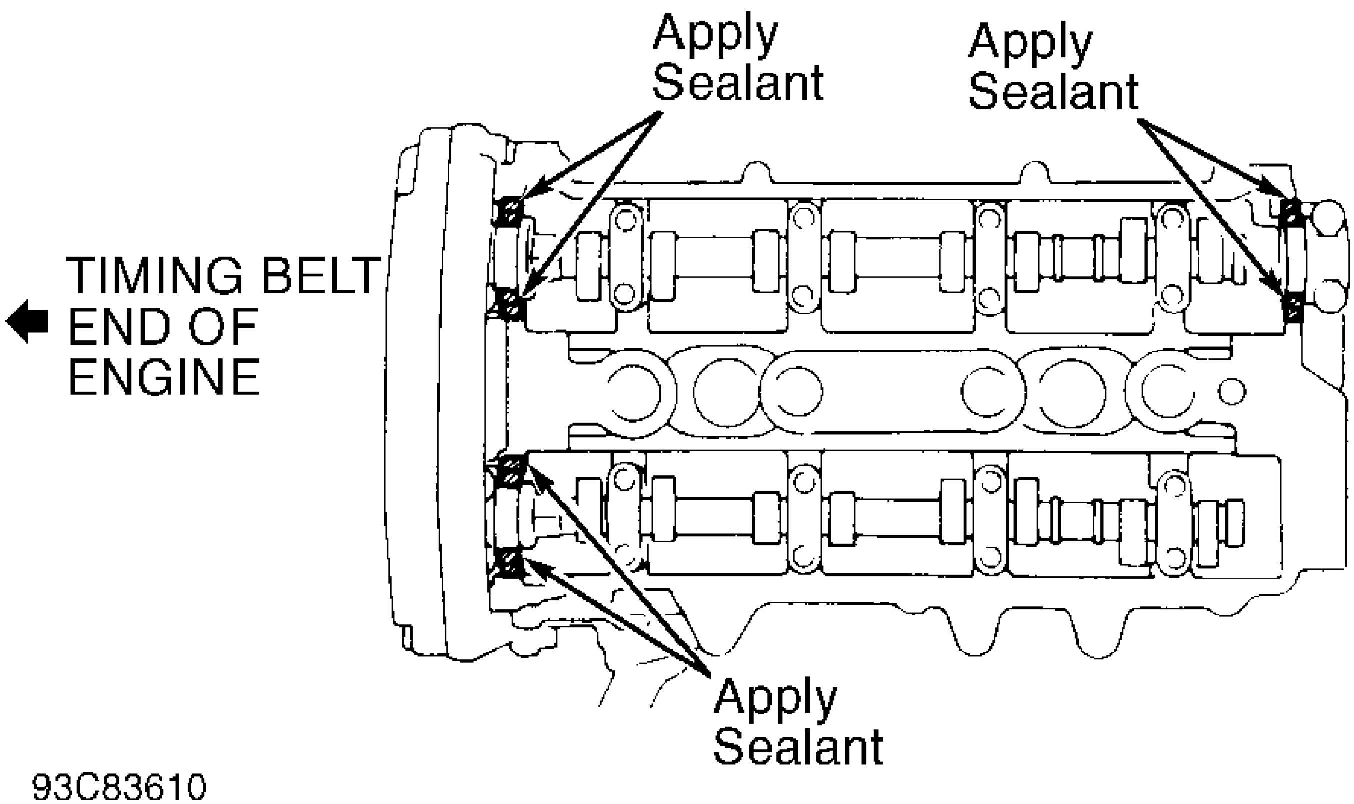

Fig. 2: Applying Valve Cover Sealant
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Measured clearance mm (in.) / Installed shim thickness mm (in.)	2.000 (0.0787)	2.025 (0.0797)	2.050 (0.0807)	2.075 (0.0817)	2.100 (0.0827)	2.125 (0.0837)	2.150 (0.0846)	2.175 (0.0856)	2.200 (0.0866)	2.225 (0.0876)	2.250 (0.0886)	2.275 (0.0896)	2.300 (0.0905)	2.325 (0.0915)	2.350 (0.0925)	2.375 (0.0935)	2.400 (0.0945)	2.425 (0.0955)	2.450 (0.0965)	2.475 (0.0974)	2.500 (0.0984)	2.525 (0.0994)	2.550 (0.1004)	2.575 (0.1014)	2.600 (0.1024)	2.625 (0.1033)	2.650 (0.1043)	2.675 (0.1053)	2.700 (0.1063)	2.725 (0.1073)	2.750 (0.1083)	2.775 (0.1093)	2.800 (0.1102)	2.825 (0.1112)	2.850 (0.1122)	2.875 (0.1132)	2.900 (0.1142)	2.925 (0.1152)	2.950 (0.1161)	2.975 (0.1171)	3.000 (0.1181)	3.025 (0.1191)	3.050 (0.1201)	3.075 (0.1211)	3.100 (0.1220)	3.125 (0.1230)	3.150 (0.1240)	3.175 (0.1250)	3.200 (0.1260)	3.225 (0.1270)	3.250 (0.1280)	3.275 (0.1289)	3.300 (0.1299)
0.000 – 0.020 (0.0000 – 0.0008)																																1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11
0.021 – 0.040 (0.0008 – 0.0016)																															1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11
0.041 – 0.060 (0.0016 – 0.0024)																														1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11
0.061 – 0.080 (0.0024 – 0.0031)																													1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12
0.081 – 0.100 (0.0032 – 0.0039)																													1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12
0.101 – 0.120 (0.0040 – 0.0047)																												1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13
0.121 – 0.140 (0.0048 – 0.0055)																											1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13
0.141 – 0.160 (0.0056 – 0.0063)																										1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13
0.161 – 0.180 (0.0063 – 0.0071)																									1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14
0.181 – 0.200 (0.0071 – 0.0079)																									1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14
0.201 – 0.220 (0.0079 – 0.0087)																								1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15
0.221 – 0.240 (0.0087 – 0.0094)																							1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15
0.241 – 0.260 (0.0095 – 0.0102)																						1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15
0.261 – 0.279 (0.0103 – 0.0110)																						1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16
0.280 – 0.380 (0.0110 – 0.0150)																																																					
0.381 – 0.400 (0.0150 – 0.0157)																	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	
0.401 – 0.420 (0.0158 – 0.0165)																1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17	
0.421 – 0.440 (0.0166 – 0.0173)															1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17		
0.441 – 0.460 (0.0174 – 0.0181)														1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17			
0.461 – 0.480 (0.0181 – 0.0189)													1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17				
0.481 – 0.500 (0.0189 – 0.0197)													1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17					
0.501 – 0.520 (0.0197 – 0.0205)												1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17					
0.521 – 0.540 (0.0205 – 0.0213)											1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17						
0.541 – 0.560 (0.0213 – 0.0220)										1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17							
0.561 – 0.580 (0.0221 – 0.0228)									1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17								
0.581 – 0.600 (0.0229 – 0.0236)									1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17									
0.601 – 0.620 (0.0237 – 0.0244)								1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17									
0.621 – 0.640 (0.0244 – 0.0252)							1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17										
0.641 – 0.660 (0.0252 – 0.0260)						1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17											
0.661 – 0.680 (0.0260 – 0.0268)					1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17												
0.681 – 0.700 (0.0268 – 0.0276)					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17													
0.701 – 0.720 (0.0276 – 0.0283)				1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17													
0.721 – 0.740 (0.0284 – 0.0291)			1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17														
0.741 – 0.760 (0.0292 – 0.0299)		1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17															
0.761 – 0.780 (0.0300 – 0.0307)	1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																
0.781 – 0.800 (0.0307 – 0.0315)	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																	
0.801 – 0.820 (0.0315 – 0.0322)	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																	
0.821 – 0.840 (0.0323 – 0.0331)	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																		
0.841 – 0.860 (0.0331 – 0.0339)	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																			
0.861 – 0.880 (0.0339 – 0.0346)	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																				
0.881 – 0.900 (0.0347 – 0.0354)	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																					
0.901 – 0.920 (0.0355 – 0.0362)	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																					
0.921 – 0.940 (0.0363 – 0.0370)	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																						
0.941 – 0.960 (0.0370 – 0.0378)	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																							
0.961 – 0.980 (0.0378 – 0.0386)	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
0.981 – 1.000 (0.0386 – 0.0394)	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																									
1.001 – 1.020 (0.0394 – 0.0402)	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																									
1.021 – 1.040 (0.0402 – 0.0409)	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																										
1.041 – 1.060 (0.0410 – 0.0417)	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																											
1.061 – 1.080 (0.0418 – 0.0425)	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																												
1.081 – 1.100 (0.0426 – 0.0433)	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																													
1.101 – 1.120 (0.0433 – 0.0441)	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																													
1.121 – 1.140 (0.0441 – 0.0449)	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																														
1.141 – 1.160 (0.0449 – 0.0457)	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																															
1.161 – 1.180 (0.0457 – 0.0465)	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																
1.181 – 1.200 (0.0465 – 0.0472)	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																	
1.201 – 1.220 (0.0473 – 0.0480)	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																	
1.221 – 1.240 (0.0481 – 0.0488)	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																		
1.241 – 1.260 (0.0489 – 0.0496)	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																			
1.261 – 1.280 (0.0496 – 0.0504)	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																				
1.281 – 1.300 (0.0504 – 0.0512)	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																					
1.301 – 1.320 (0.0512 – 0.0520)	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																					
1.321 – 1.340 (0.0520 – 0.0528)	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																						
1.341 – 1.360 (0.0528 – 0.0535)	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																							
1.361 – 1.380 (0.0536 – 0.0543)	12	12	13	13	14	14	15	15	16	16	17	17	17																																								
1.381 – 1.400 (0.0544 – 0.0551)	12	13	13	14	14	15	15	16	16	17	17	17																																									
1.401 – 1.420 (0.0552 – 0.0559)	13	13	14	14	15	15	16	16	17	17	17	17																																									
1.421 – 1.440 (0.0559 – 0.0567)	13	14	14	15	15	16	16	17	17	17	17																																										
1.441 – 1.460 (0.0567 – 0.0575)	13	14	14	15	15	16	16	17	17	17																																											
1.461 – 1.480 (0.0575 – 0.0583)	14	14	15	15	16	16	17	17	17																																												
1.481 – 1.500 (0.0583 – 0.0591)	14	15	15	16	16	17	17	17																																													
1.501 – 1.520 (0.0591 – 0.0598)	15	15	16	16	17	17	17	17																																													
1.521 – 1.540 (0.0599 – 0.0606)	15	16	16	17	17	17	17																																														
1.541 – 1.560 (0.0607 – 0.0614)	15	16	16	17	17	17																																															
1.561 – 1.580 (0.0615 – 0.0622)	16	16	17	17	17																																																
1.581 – 1.600 (0.0622 – 0.0630)	16	17	17	17																																																	
1.601 – 1.620 (0.0630 – 0.0638)	17	17	17	17																																																	
1.621 – 1.640 (0.0638 – 0.0646)	17	17	17																																																		
1.641 – 1.660 (0.0646 – 0.0654)	17	17																																																			
1.661 – 1.680 (0.0654 – 0.0661)	17																																																				

93D83611

Fig. 3: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EXHAUST VALVES

NEW SHIM THICKNESS

Shim No.	Thickness mm (In.)	Shim No.	Thickness mm (In.)
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

EXAMPLE: A 0.1102" (2.800 mm) shim is installed and measured clearance is 0.0177" (0.450 mm). Replace 0.1102" (2.800 mm) shim with a No. 9 shim.
Note: New shims are marked in millimeters.

93E83612

Fig. 4: Exhaust Valve New Shim Thickness Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Measured clearance mm (in.) / Installed shim thickness mm (in.)	2.000 (0.0787)	2.025 (0.0797)	2.050 (0.0807)	2.075 (0.0817)	2.100 (0.0827)	2.125 (0.0837)	2.150 (0.0846)	2.175 (0.0856)	2.200 (0.0866)	2.225 (0.0876)	2.250 (0.0886)	2.275 (0.0896)	2.300 (0.0905)	2.325 (0.0915)	2.350 (0.0925)	2.375 (0.0935)	2.400 (0.0945)	2.425 (0.0955)	2.450 (0.0965)	2.475 (0.0974)	2.500 (0.0984)	2.525 (0.0994)	2.550 (0.1004)	2.575 (0.1014)	2.600 (0.1024)	2.625 (0.1033)	2.650 (0.1043)	2.675 (0.1053)	2.700 (0.1063)	2.725 (0.1073)	2.750 (0.1083)	2.775 (0.1093)	2.800 (0.1102)	2.825 (0.1112)	2.850 (0.1122)	2.875 (0.1132)	2.900 (0.1142)	2.925 (0.1152)	2.950 (0.1161)	2.975 (0.1171)	3.000 (0.1181)	3.025 (0.1191)	3.050 (0.1201)	3.075 (0.1211)	3.100 (0.1220)	3.125 (0.1230)	3.150 (0.1240)	3.175 (0.1250)	3.200 (0.1260)	3.225 (0.1270)	3.250 (0.1280)	3.275 (0.1289)	3.300 (0.1299)
0.000 – 0.020 (0.0000 – 0.0008)																											1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13
0.021 – 0.040 (0.0008 – 0.0016)																										1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14
0.041 – 0.060 (0.0016 – 0.0024)																									1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14
0.061 – 0.080 (0.0024 – 0.0031)																								1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14
0.081 – 0.100 (0.0032 – 0.0039)																							1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15
0.101 – 0.120 (0.0040 – 0.0047)																							1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15
0.121 – 0.140 (0.0048 – 0.0055)																						1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16
0.141 – 0.149 (0.0056 – 0.0059)																						1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16
0.150 – 0.250 (0.0059 – 0.0098)																																																					
0.251 – 0.260 (0.0099 – 0.0102)																	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	
0.261 – 0.280 (0.0103 – 0.0110)																1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	
0.281 – 0.300 (0.0111 – 0.0118)															1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17		
0.301 – 0.320 (0.0119 – 0.0126)															1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17			
0.321 – 0.340 (0.0126 – 0.0134)														1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17			
0.341 – 0.360 (0.0134 – 0.0142)													1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17				
0.361 – 0.380 (0.0142 – 0.0150)												1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17					
0.381 – 0.400 (0.0150 – 0.0157)											1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17						
0.401 – 0.420 (0.0158 – 0.0165)											1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17							
0.421 – 0.440 (0.0166 – 0.0173)										1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17							
0.441 – 0.460 (0.0174 – 0.0181)									1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17								
0.461 – 0.480 (0.0181 – 0.0189)								1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17									
0.481 – 0.500 (0.0189 – 0.0197)							1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17										
0.501 – 0.520 (0.0197 – 0.0205)							1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17											
0.521 – 0.540 (0.0205 – 0.0213)						1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17											
0.541 – 0.560 (0.0213 – 0.0220)					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17												
0.561 – 0.580 (0.0221 – 0.0228)				1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17													
0.581 – 0.600 (0.0229 – 0.0236)			1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17														
0.601 – 0.620 (0.0237 – 0.0244)			1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17															
0.621 – 0.640 (0.0244 – 0.0252)		1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17															
0.641 – 0.660 (0.0252 – 0.0260)	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																
0.661 – 0.680 (0.0260 – 0.0268)	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																	
0.681 – 0.700 (0.0268 – 0.0276)	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																		
0.701 – 0.720 (0.0276 – 0.0283)	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																			
0.721 – 0.740 (0.0284 – 0.0291)	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																			
0.741 – 0.760 (0.0292 – 0.0299)	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																				
0.761 – 0.780 (0.0300 – 0.0307)	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																					
0.781 – 0.800 (0.0307 – 0.0315)	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																						
0.801 – 0.820 (0.0315 – 0.0322)	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																							
0.821 – 0.840 (0.0323 – 0.0331)	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																							
0.841 – 0.860 (0.0331 – 0.0339)	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																								
0.861 – 0.880 (0.0339 – 0.0346)	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																									
0.881 – 0.900 (0.0347 – 0.0354)	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																										
0.901 – 0.920 (0.0355 – 0.0362)	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																											
0.921 – 0.940 (0.0363 – 0.0370)	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																											
0.941 – 0.960 (0.0370 – 0.0378)	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																												
0.961 – 0.980 (0.0378 – 0.0386)	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																													
0.981 – 1.000 (0.0386 – 0.0394)	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																														
1.001 – 1.020 (0.0394 – 0.0402)	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																															
1.021 – 1.040 (0.0402 – 0.0409)	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																															
1.041 – 1.060 (0.0410 – 0.0417)	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																
1.061 – 1.080 (0.0418 – 0.0425)	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																	
1.081 – 1.100 (0.0426 – 0.0433)	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																		
1.101 – 1.120 (0.0433 – 0.0441)	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																			
1.121 – 1.140 (0.0441 – 0.0449)	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																			
1.141 – 1.160 (0.0449 – 0.0457)	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																				
1.161 – 1.180 (0.0457 – 0.0465)	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																					
1.181 – 1.200 (0.0465 – 0.0472)	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																						
1.201 – 1.220 (0.0473 – 0.0480)	11	12	12	13	13	14	14	15	15	16	16	17	17	17																																							
1.221 – 1.240 (0.0481 – 0.0488)	12	12	13	13	14	14	15	15	16	16	17	17	17	17																																							
1.241 – 1.260 (0.0489 – 0.0496)	12	13	13	14	14	15	15	16	16	17	17	17	17																																								
1.261 – 1.280 (0.0496 – 0.0504)	12	13	13	14	14	15	15	16	16	17	17	17																																									
1.281 – 1.300 (0.0504 – 0.0512)	13	13	14	14	15	15	16	16	17	17	17																																										
1.301 – 1.320 (0.0512 – 0.0520)	13	14	14	15	15	16	16	17	17	17																																											
1.321 – 1.340 (0.0520 – 0.0528)	14	14	15	15	16	16	17	17	17	17																																											
1.341 – 1.360 (0.0528 – 0.0535)	14	15	15	16	16	17	17	17	17																																												
1.361 – 1.380 (0.0536 – 0.0543)	14	15	15	16	16	17	17	17																																													
1.381 – 1.400 (0.0544 – 0.0551)	15	15	16	16	17	17	17																																														
1.401 – 1.420 (0.0552 – 0.0559)	15	16	16	17	17	17																																															
1.421 – 1.440 (0.0559 – 0.0567)	16	16	17	17	17	17																																															
1.441 – 1.460 (0.0567 – 0.0575)	16	17	17	17	17																																																
1.461 – 1.480 (0.0575 – 0.0583)	16	17	17	17																																																	
1.481 – 1.500 (0.0583 – 0.0591)	17	17	17																																																		
1.501 – 1.520 (0.0591 – 0.0598)	17	17																																																			
1.521 – 1.540 (0.0599 – 0.0606)	17	17																																																			
1.541 – 1.550 (0.0607 – 0.0610)	17																																																				

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Fig. 5: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

INTAKE VALVES

NEW SHIM THICKNESS

Shim No.	Thickness mm (In.)	Shim No.	Thickness mm (In.)
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

EXAMPLE: A 0.1102" (2.800 mm) shim is installed and measured clearance is 0.0177" (0.450 mm). Replace 0.1102" (2.800 mm) shim with a No. 12 shim.
Note: New shims are marked in millimeters.

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Fig. 6: Intake Valve New Shim Thickness Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

CAUTION: To prevent air bag deployment, disconnect negative battery cable at least 20 seconds before working on vehicle.

FUEL PRESSURE RELEASE

With ignition off, disconnect negative battery cable. Place suitable container under fuel line. Cover fuel line connection with shop towel. Slowly loosen fuel line connection and release fuel pressure. Once fuel pressure is released, fuel system components can be removed.

COOLING SYSTEM BLEEDING

Celica All-Trac
No special cooling system bleeding procedure is required.

MR2

1) Remove spare tire, front luggage compartment trim and upper radiator support seal. Connect air bleed hoses to heater and radiator air drain plugs. See Fig. 7. Attach and support opposite end of air bleed hoses to hood or hood support. Ensure air bleed hoses are not pinched.

2) Place heater control lever to the warmest position. Open heater and radiator air drain plugs at least 3 turns.

3) Slowly add coolant through coolant filler. See Fig. 7. Air will bleed from air bleed hoses on heater and radiator air drain plugs. Ensure coolant level in air bleed hoses and coolant filler are at the same level. See Fig. 7.

4) If coolant level in air bleed hoses is lower, air still exists in cooling system. Check for pinched or restriction in air

bleed hoses and repeat step 3). When proper coolant level is obtained in air bleed hoses, close heater and radiator air drain plugs. Remove air bleed hoses.

5) Install radiator cap on coolant filler to the first stop point. DO NOT fully tighten radiator cap to the second stop point. Start engine and allow to idle for 3 minutes. Shut engine off. Recheck coolant level in coolant filler.

6) Add coolant if necessary and repeat step 5). Recheck coolant level. If proper coolant level exists, install radiator cap and fully tighten to the second stop point. Fill coolant reservoir tank to the FULL line. Reinstall upper radiator support seal.

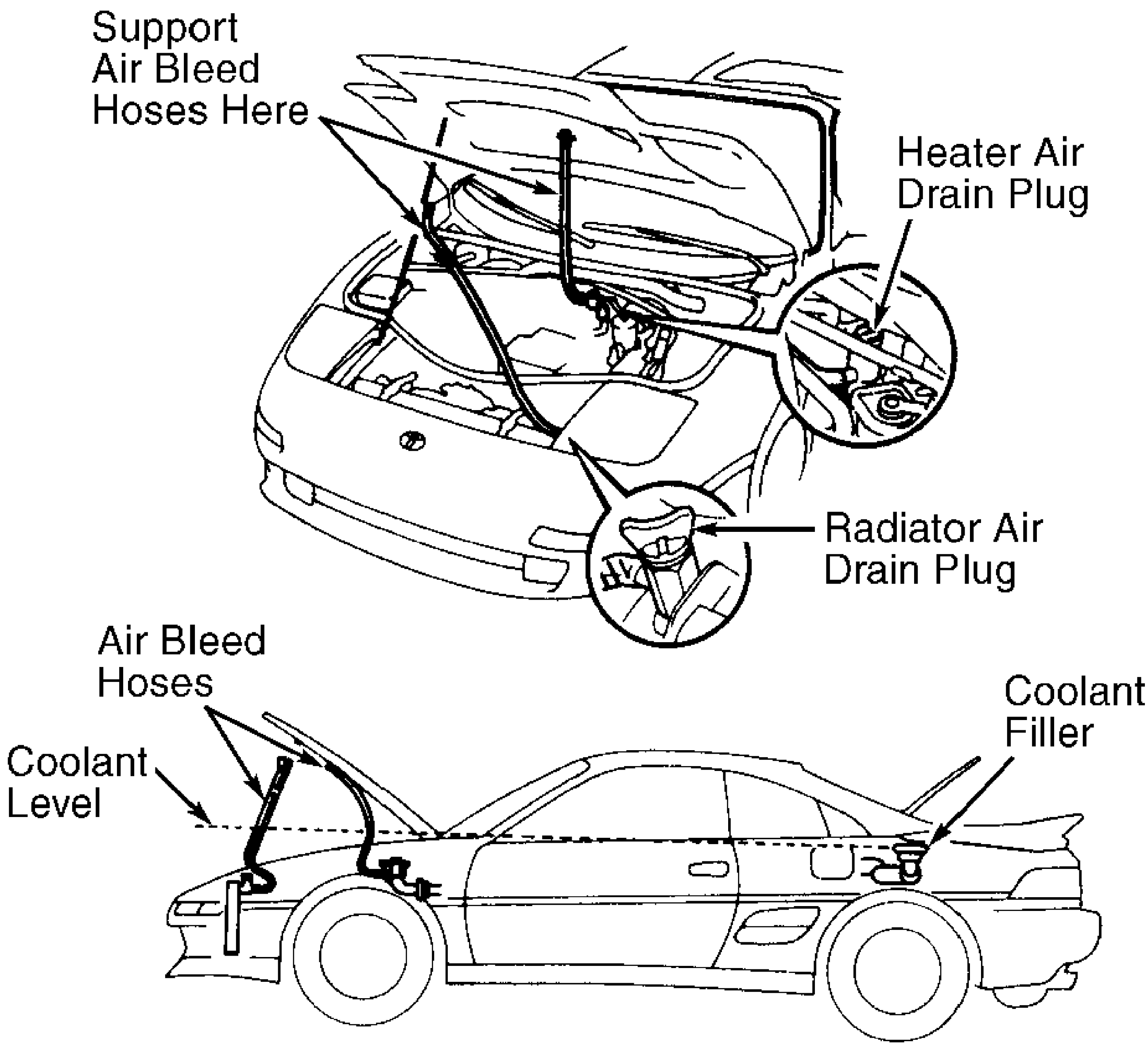

Fig. 7: Bleeding Cooling System & Identifying Coolant Filler (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ENGINE

NOTE: Remove engine and transaxle as an assembly.

Removal (Celica All-Trac)

1) Disconnect negative battery cable. Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION.

2) Drain cooling system, engine oil and transaxle oil. Remove hood and lower engine covers. Remove air intake duct, airflow meter and air cleaner cap as an assembly. Remove air cleaner case. Disconnect control cables from throttle body.

3) Disconnect relay box from battery. Remove lower cover from relay box. Disconnect fusible link assembly and engine wiring connectors from relay box. Remove A/C relay box from bracket, located near passenger's side corner of radiator.

4) Remove battery. Remove injector solenoid resistor and fuel pump resistor located in front of battery, left of radiator. Remove radiator cooling fans, radiator and coolant reservoir tank.

5) Remove cruise control actuator, located near brake master cylinder. Remove ignition coil. Remove strut tower-to-firewall braces. Disconnect necessary coolant hoses, fuel lines, vacuum hoses and electrical connections. Remove charcoal canister.

6) Raise and support vehicle. Remove starter. Disconnect speedometer cable, oil cooler hoses, electrical connections and control cables at transaxle. Remove clutch release cylinder with hose attached and secure aside.

7) Disconnect wiring and remove turbocharger pressure sensor and A/C vacuum switching valve from firewall. Disconnect electrical connectors from Engine Control Module (ECM) located left of glove box, behind center console. See Fig. 8. Disconnect electrical connector at A/C amplifier near glove box. See Fig. 8.

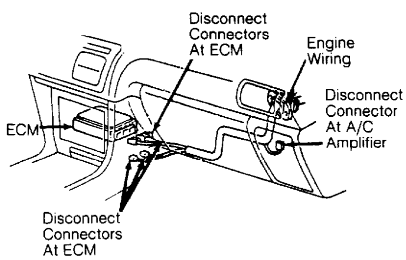

Fig. 8: Identifying ECM & Engine Wiring (Celica All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Remove retaining nuts and pull engine wiring through firewall. Remove suspension crossmember bolted to both lower suspension arms. Disconnect exhaust pipe at catalytic converter (located at bottom of turbocharger) and center pipe. Remove exhaust pipe.

9) Remove front wheels. Remove cotter pin and retainer from end of axle shaft. Loosen axle shaft nut while applying the brakes. Remove axle shaft nut. Remove nut and separate tie rod from steering knuckle.

10) Remove ball joint-to-steering knuckle bolts/nuts. Wrap threads on end of axle shaft with tape. Cover axle shaft boot with shop towel. Using puller attached to hub assembly, press axle shaft from hub assembly.

11) Pull steering knuckle outward and separate axle shaft from hub assembly. To remove left (driver's side) axle shaft, pry between transaxle case and axle shaft until axle shaft disengages from transaxle.

12) To remove right (passenger's side) axle shaft, remove bolts and transaxle case protector, located just above axle shaft at

the transaxle case. Using brass drift and hammer, drive right axle shaft from transaxle. See Fig. 9.

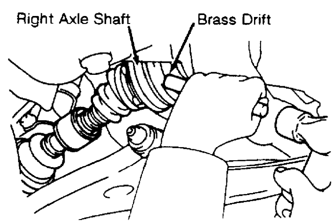

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Fig. 9: Removing Right Axle Shaft (Celica All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

13) Place reference marks on front and rear drive shaft flanges at center bearing. Remove drive shaft flange bolts. Remove drive shaft from transfer case. Remove seal deflector from rear of transfer case. Remove dynamic damper from transfer case. See Fig. 10.

14) Remove accessory drive belt, alternator and idler pulley bracket. Remove A/C compressor and power steering pump with hoses attached and secure aside.

15) Support engine with hoist. Remove engine mount crossmember located below engine. Remove catalytic converter braces, catalytic converter, cushion, retainer and gasket. See Fig. 16.

16) Disconnect engine mounts. Note direction of mount installation for reassembly reference. Mounts must be installed in original direction. Lift engine and transaxle from vehicle.

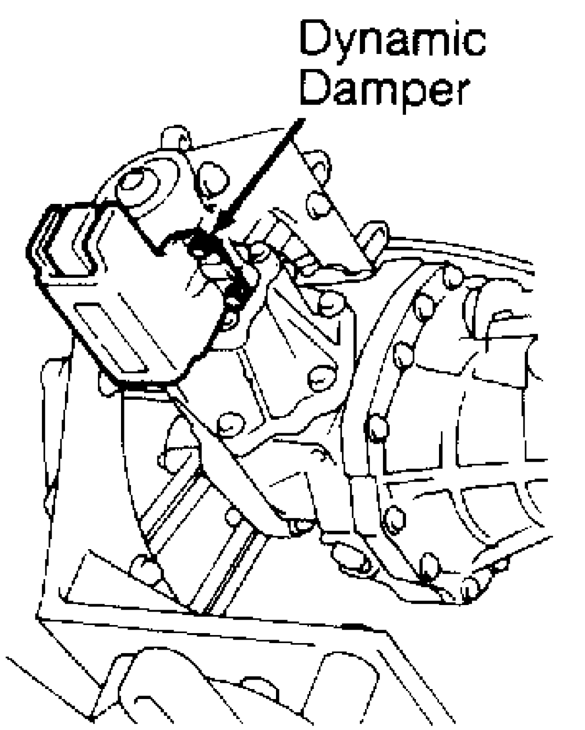


Fig. 10: Identifying Dynamic Damper (Celica All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) To install, reverse removal procedure. Tighten all

fasteners to specification. See TORQUE SPECIFICATIONS. When installing engine mounts, install all bolts and nuts before tightening to specification.

2) Use NEW gasket when installing catalytic converter. Before installing axle shaft, install NEW snap ring on end of axle shaft. Ensure opening of snap ring faces downward. Ensure axle shaft fully engages in transaxle.

3) Ensure reference marks are aligned on drive shaft flanges. Adjust all control cables and fluid levels.

NOTE: Remove engine and transaxle as an assembly from bottom of engine compartment.

Removal (MR2)

1) Disconnect negative battery cable. Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION.

2) Drain cooling system, engine oil and transaxle oil. Remove hood, hood side panels and lower engine covers. Remove strut tower-to-firewall braces. Remove air cleaner cap and airflow meter as an assembly. Remove air cleaner case.

3) Remove No. 1 and 2 air intake connectors to intercooler. See Fig. 30. Remove cruise control actuator. Disconnect necessary control cables, coolant hoses, fuel lines, vacuum hoses and electrical connections.

4) Remove Manifold Absolute Pressure (MAP) sensor from the body. See Fig. 11. Remove data link connector, located near MAP sensor, from the body. Disconnect electrical connectors and remove solenoid resistor, fuel pump relay and fuel pump resistor assembly. See Fig. 11.

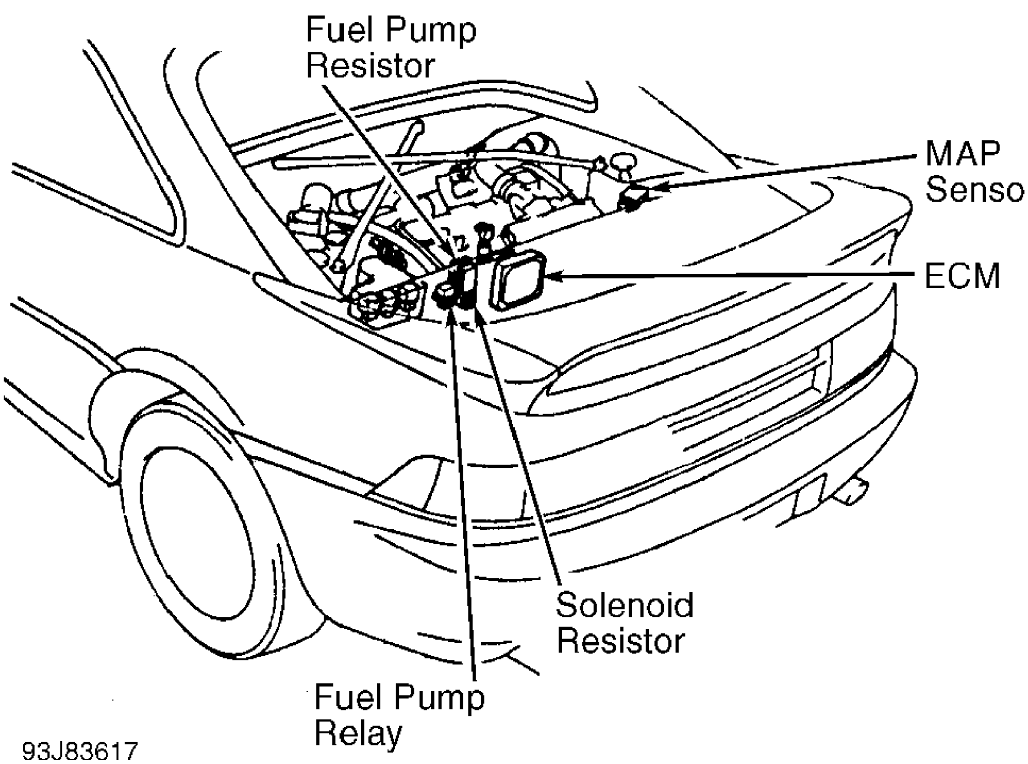


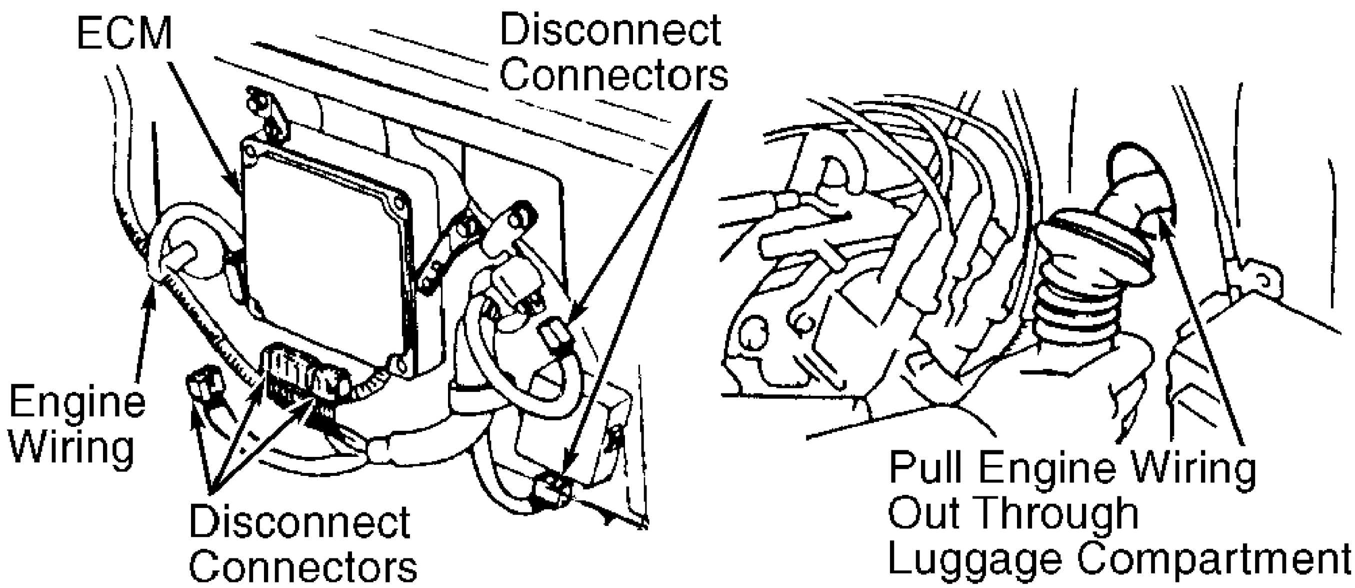
Fig. 11: Identifying Electrical Components (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

5) Remove coolant filler and hose. See Fig. 7. Remove charcoal canister. Remove retaining bolts from relay box located near

strut tower. Disconnect luggage compartment cable near relay box. Remove upper and lower covers from relay box.

6) Disconnect positive cable and electrical connections from relay box. Disconnect electrical connections from igniter and coil wire from ignition coil. Disconnect electrical connectors from Engine Control Module (ECM) located near luggage compartment. See Fig. 12.

7) Disconnect remaining electrical connectors near ECM for removal of engine wiring. See Fig. 12. Pull engine wiring out through opening in luggage compartment.



93A83618
Fig. 12: Identifying ECM & Removing Engine Wiring (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Raise and support vehicle. Disconnect control cables and electrical connections at transaxle. Remove tailpipe and muffler assembly.

9) Disconnect exhaust pipe and gasket from catalytic converter. Remove exhaust by rotating exhaust pipe between rear suspension crossmember and the body. Remove engine compartment cooling fan assembly, located in passenger's side of engine compartment, near the intercooler.

10) Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove intercooler. See INTERCOOLER under REMOVAL & INSTALLATION. Remove rear (intake manifold side) engine mount.

11) Remove rear wheels. Remove cotter pin and retainer from end of axle shaft. Apply parking brake. Remove axle shaft nut. Release parking brake.

12) Remove brake caliper with hose attached and secure aside. Place reference marks on hub assembly and brake rotor for reassembly reference. Remove brake rotor.

13) Remove retaining nut and disconnect stabilizer link from strut assembly. On models with Anti-Lock Brake System (ABS), remove retaining bolt and pull ABS speed sensor from axle carrier.

14) On all models, remove ball joint-to-axle carrier bolts. Separate ball joint with lower control arm from axle carrier. Remove suspension rod-to-axle carrier bolt/nut. Suspension rod is attached to rear of axle carrier. Separate suspension rod from axle carrier.

15) Both lower control arms must be removed. Remove strut rod-to-lower control arm retaining nut, retainers and insulators.

Remove lower control arm-to-body bolts/nuts. Remove lower control arms.

16) Wrap threads on end of axle shaft with tape. Cover axle shaft boot with shop towel. Using puller attached to hub assembly, press axle shaft from hub assembly.

17) To remove left (driver's side) axle shaft, use hammer and brass drift to drive axle shaft from transaxle. See Fig. 13. To remove right (passenger's side) axle shaft, remove snap ring and bearing retaining bolt from bearing bracket. See Fig. 14.

18) Remove right axle shaft assembly. Remove retaining bolts and bearing bracket (if necessary).

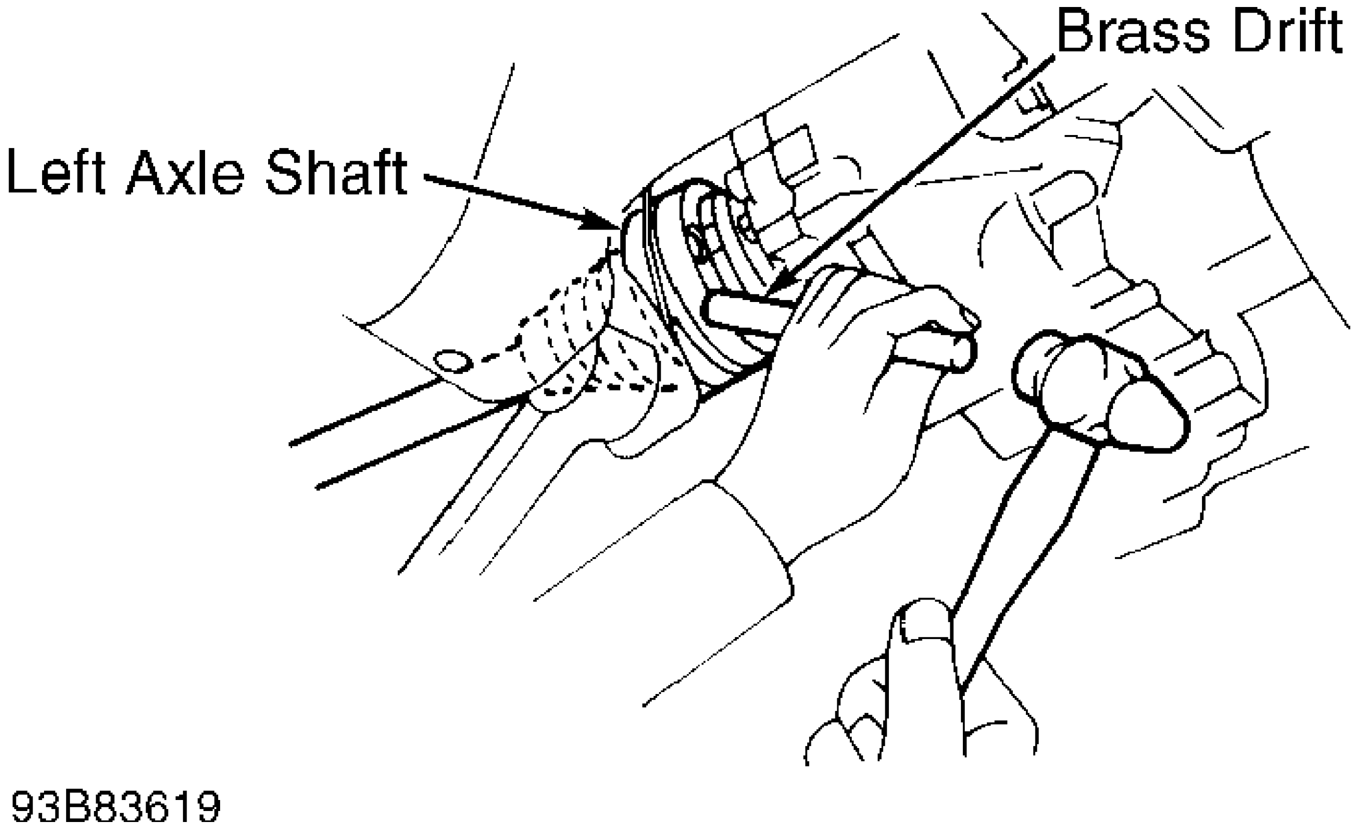


Fig. 13: Removing Left Axle Shaft (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

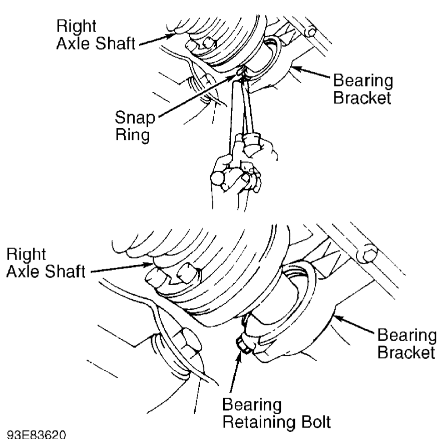


Fig. 14: Removing Right Axle Shaft (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

19) Support rear suspension crossmember with floor jack. Disconnect ABS sensor wiring from rear suspension crossmember. Remove retaining bolts and rear suspension crossmember.

20) Remove through-bolt and retaining bolts from front (exhaust manifold side) engine mount. Remove clutch release cylinder from transaxle with hose attached and secure aside.

21) Support engine with hoist. Remove remaining engine mounts, support rods and through-bolts. Lower engine and transaxle through bottom of engine compartment.

Installation

1) Raise engine into position. Install right (timing belt side) engine mount to body with through-bolt loosely installed. Secure right (timing belt side) engine mount insulator to mounting bracket with nuts loosely installed.

2) Install left (transaxle side) engine mount to body with through-bolt loosely installed. Install left (transaxle side) engine mount insulator to mounting bracket and tighten bolts to specification. See Fig. 15.

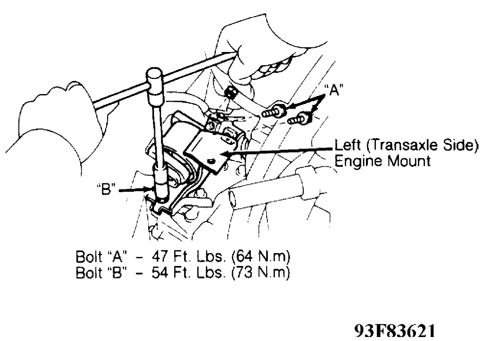


Fig. 15: Installing Left (Transaxle Side) Engine Mount Bolts (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Tighten through-bolt on left (transaxle side) engine mount to specification. See TORQUE SPECIFICATIONS. Tighten right (timing belt side) engine mount insulator to mounting bracket nuts and then the through-bolt to specification. See TORQUE SPECIFICATIONS.

4) Install support brace on top of right (timing belt side) engine mount. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS. Install support rod and support brace and on top of left (transaxle side) engine mount. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS.

5) Install clutch release cylinder and front (exhaust manifold side) engine mount-to body bolts. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Loosely install front (exhaust manifold side) engine mount through-bolt.

6) Install rear suspension crossmember. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Install bearing bracket for right axle shaft (if removed). Install and tighten bearing bracket and support bracket bolts/nuts to specification. See TORQUE SPECIFICATIONS.

7) Coat lip of axle shaft oil seal with grease. Position snap ring on end of axle shaft, with opening facing downward. Install left axle shaft by lightly tapping axle shaft into transaxle. Ensure axle shaft fully engages transaxle.

8) Install right axle shaft. Install and tighten bearing retaining bolt to specification. See TORQUE SPECIFICATIONS. Install NEW snap ring in the bearing bracket.

9) Install lower control arms and strut rods. Install NEW nut on strut rod. DO NOT tighten lower control arm-to-body bolts/nuts and

strut rod nut at this time. Install and tighten ball joint-to-axle carrier bolts to specification. See TORQUE SPECIFICATIONS. Install suspension rod on axle carrier. DO NOT tighten bolt at this time.

10) Once all suspension components are installed, install and tighten rear (intake manifold side) engine mount bolts to specification. See TORQUE SPECIFICATIONS. Install and tighten front (exhaust manifold side) engine mount through-bolt to specification. See TORQUE SPECIFICATIONS.

11) Install stabilizer link on strut assembly. Tighten nut to specification. Install ABS speed sensor in axle carrier. Install and tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.

12) Install brake rotor. Ensure reference mark is aligned with mark on hub assembly. Install brake caliper. Apply parking brake. Install and tighten axle shaft nut to specification. See TORQUE SPECIFICATIONS.

13) Install retainer and NEW cotter pin on axle shaft. Install rear wheels. Tighten lug nuts to specification. See TORQUE SPECIFICATIONS.

14) To install remaining components, reverse removal procedure. Lower vehicle and bounce it several times to stabilize suspension components. Tighten lower control arm-to-body bolts/nuts, strut rod-to-lower control arm nut and suspension rod bolt/nut to specification. See TORQUE SPECIFICATIONS.

15) Adjust all control cables and fluid levels. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION. Check rear wheel alignment.

CYLINDER HEAD & MANIFOLDS

Removal (Celica All-Trac)

1) Disconnect negative battery cable. Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Drain cooling system.

2) Disconnect accelerator cable at throttle body. Remove air intake duct, airflow meter and air cleaner cap as an assembly. Remove intercooler. See INTERCOOLER under REMOVAL & INSTALLATION.

3) Remove alternator. Raise and support vehicle. Remove lower engine cover. Remove suspension crossmember bolted to both lower suspension arms. Disconnect exhaust pipe at catalytic converter (located at bottom of turbocharger) and center pipe. Remove exhaust pipe.

4) Remove alternator mounting bracket and right engine hanger from cylinder head. Remove catalytic converter braces, catalytic converter, cushion, retainer and gasket. See Fig. 16.

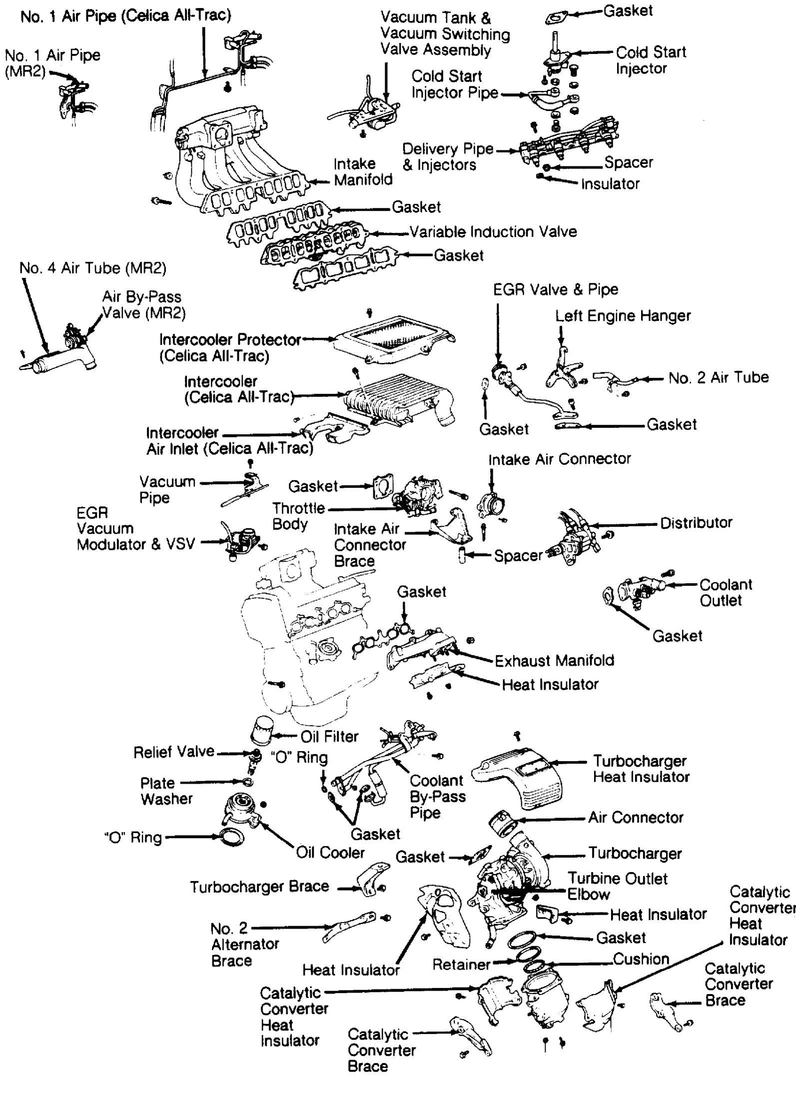


Fig. 16: Exploded View Of Intake & Exhaust Manifolds & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

5) Remove turbocharger. See TURBOCHARGER under REMOVAL & INSTALLATION. Remove intake air connector and intake air connector brace from throttle body. See Fig. 16.

6) Disconnect electrical connectors and hoses from throttle body. Remove accelerator cable bracket. Remove throttle body retaining bolts.

7) Disconnect remaining hoses from throttle body. Remove throttle body. Note position of throttle body gasket for reassembly reference. Remove throttle body gasket.

8) Remove cold start injector pipe, cold start injector and gasket from bottom of intake manifold. See Fig. 16. Remove exhaust manifold and gasket.

9) Remove distributor and spark plug wires. Disconnect hoses from intake manifold and No. 1 air pipe. See Fig. 16. Remove No. 2 air tube, left engine hanger, EGR vacuum modulator and Vacuum Switching Valve (VSV). Remove EGR valve and pipe.

10) Remove vacuum pipe, coolant outlet and gasket. See Fig. 16. Remove oil cooler. See OIL COOLER under ENGINE OILING. Remove

coolant by-pass pipe and "O" ring from rear of water pump cover. See Fig. 16. Remove intake manifold braces, located between intake manifold and cylinder block.

11) Remove No. 1 air pipe, vacuum tank and vacuum switching valve assembly. See Fig. 16. Disconnect necessary hoses and electrical connections for access to intake manifold.

12) Remove retaining bolts/nuts, intake manifold, variable induction valve and gaskets. See Fig. 16. Remove charcoal canister.

13) Disconnect electrical connectors at injectors. Disconnect engine wiring harness from No. 2 (upper timing belt cover). Disconnect fuel inlet line at fuel filter. Disconnect vacuum hose and fuel return line at pressure regulator on delivery pipe.

14) Remove retaining bolts, delivery pipe and injectors, spacers and insulators. See Fig. 16. Remove retaining bolts, seal washers, valve cover and gaskets.

15) Remove timing belt, camshaft sprockets and No. 1 idler pulley. See TIMING BELT under REMOVAL & INSTALLATION. Remove No. 3 timing belt cover from front of cylinder head. See Fig. 21. Remove camshafts. See CAMSHAFT under REMOVAL & INSTALLATION.

CAUTION: Cylinder head bolts must be loosened in proper sequence to prevent cylinder head warpage or cracking.

16) Using Cylinder Head Bolt Wrench (SST 09043-38100), loosen cylinder head bolts in proper sequence using several steps. See Fig. 17. Remove cylinder head bolts, washers, cylinder head and cylinder head gasket.

17) Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

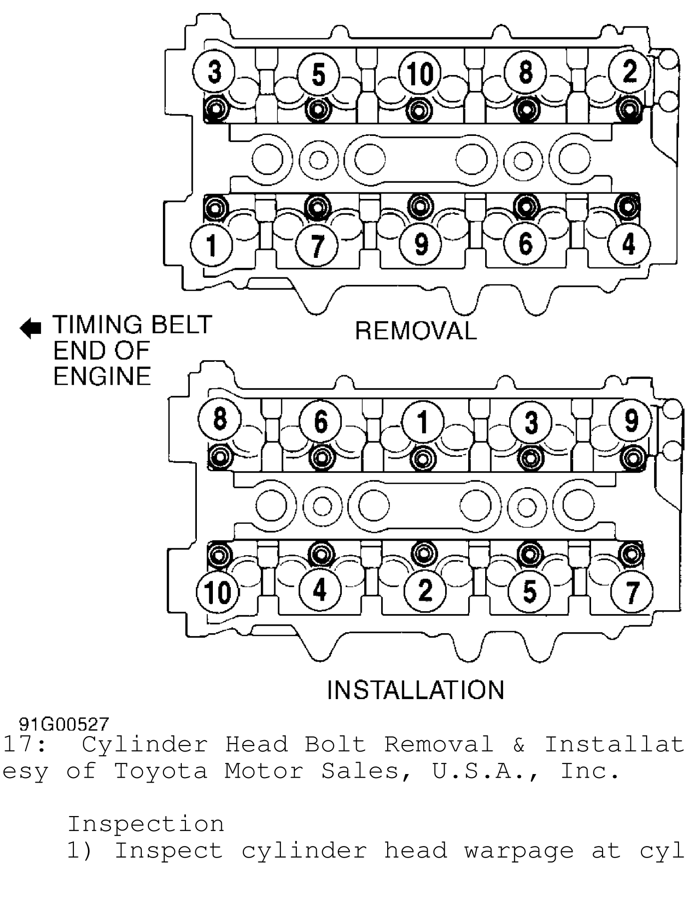


Fig. 17: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect cylinder head warpage at cylinder block, exhaust

manifold and variable induction valve surfaces. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Inspect cylinder block deck for warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

3) Inspect intake manifold, exhaust manifold and variable induction valve machined surfaces for warpage. Replace component if warpage exceeds .0079" (.200 mm).

4) Apply 15.75 in. Hg of vacuum to variable induction control valve, located at center of variable induction valve. Ensure valves fully close. Release vacuum. Ensure valves fully open quickly. Replace variable induction valve assembly if it does not function as described.

5) Inspect camshaft and components. See CAMSHAFT under REMOVAL & INSTALLATION. Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if not within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Installation

1) Install adjusting shims and valve lifters in original location on cylinder head (if removed). Install NEW cylinder head gasket on cylinder block. Ensure all holes in cylinder head gasket align with holes in cylinder block.

2) Install cylinder head. Apply engine oil on cylinder head bolt threads and cylinder head bolt-to-cylinder head contact surfaces. Install and tighten cylinder head bolts to specification in sequence. See Fig. 17. See TORQUE SPECIFICATIONS. Install camshafts using proper procedure. See CAMSHAFT under REMOVAL & INSTALLATION.

3) Install No. 3 timing belt cover. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS.

4) To install remaining components, reverse removal procedure using NEW gaskets, "O" rings and insulators. If camshaft or cylinder head components are serviced, adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

5) Before installing valve cover and gasket, apply sealant at front and rear areas of cylinder head. See Fig. 2.

6) Install gasket, valve cover and seal washers. Install and tighten retaining bolts to specification. See TORQUE SPECIFICATIONS.

7) If installing injector in delivery pipe, replace "O" rings and insulator on injector. Coat "O" rings with gasoline. Install "O" rings on and insulator on bottom of injector.

8) Install injectors in delivery pipe so electrical connectors are facing pressure regulator side of delivery pipe. Install insulator on top of injector. Install injector cover on delivery pipe. Install and tighten injector cover bolts to specification. See TORQUE SPECIFICATIONS.

9) Use insulator on bottom of injector when installing injectors and delivery pipe. Install throttle body gasket with protruding area toward top of throttle body (opposite coolant line connections). Install throttle body with 2 longer bolts in lower throttle body mount holes.

10) Coat coolant by-pass pipe "O" ring with soapy water before installing. Coat distributor "O" ring with engine oil. When installing distributor, rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

11) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure slot area of intake camshaft is positioned vertically.

12) Position cutout on coupling with alignment mark on distributor housing. See Fig. 18. Install distributor so center of

flange is aligned with bolt hole on cylinder head. Install distributor hold-down bolts.

13) Use NEW gasket when installing catalytic converter. To install remaining components, reverse removal procedure. Tighten all fasteners to specification. Adjust control cables and ignition timing. Fill cooling system.

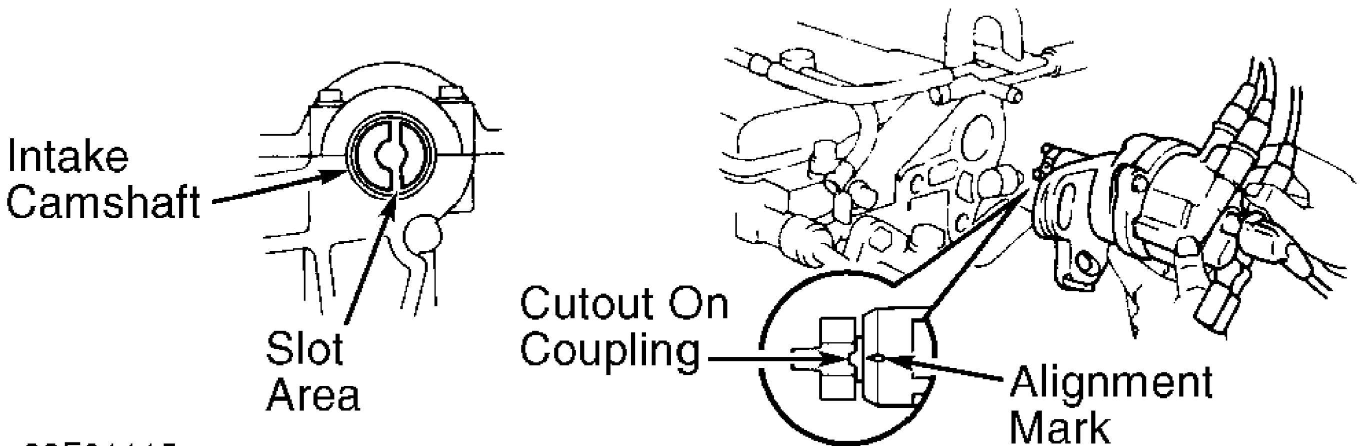


Fig. 18: Installing Distributor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Removal (MR2)

1) Disconnect negative battery cable. Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Drain cooling system.

2) Remove hood, hood side panels and lower engine covers. Remove strut tower-to-firewall braces. Remove air cleaner cap and airflow meter as an assembly. Remove air cleaner case.

3) Remove No. 1 and 2 air intake connectors to intercooler. See Fig. 30. Remove cruise control actuator. Disconnect accelerator cable at throttle body. Remove right engine hanger from front of cylinder head. Remove engine compartment cooling fan assembly, located in passenger's side of engine compartment, near the intercooler.

4) Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove intercooler. See INTERCOOLER under REMOVAL & INSTALLATION.

5) Raise and support vehicle. Remove tailpipe and muffler assembly. Disconnect exhaust pipe and gasket from catalytic converter. Remove exhaust by rotating exhaust pipe between rear suspension crossmember and the body.

6) Remove through-bolt and retaining bolts from front (exhaust manifold side) engine mount. Remove clutch release cylinder from transaxle with hose attached and secure aside.

7) Remove catalytic converter braces, catalytic converter, cushion, retainer and gasket. See Fig. 16. Remove turbocharger. See TURBOCHARGER under REMOVAL & INSTALLATION.

8) Remove intake air connector and intake air connector brace from throttle body. See Fig. 16. Disconnect electrical connectors and vacuum hoses from throttle body. Remove throttle body retaining bolts.

9) Disconnect remaining hoses from throttle body. Remove throttle body. Note position of throttle body gasket for reassembly reference. Remove throttle body gasket.

10) Remove cold start injector pipe, cold start injector and gasket from bottom of intake manifold. See Fig. 16. Remove exhaust manifold and gasket.

11) Remove distributor and spark plug wires. Remove No. 2 air tube, left engine hanger, EGR vacuum modulator and Vacuum Switching

Valve (VSV). Remove EGR valve and pipe.

12) Remove vacuum pipe, coolant outlet and gasket. See Fig. 16. Remove oil cooler. See OIL COOLER under ENGINE OILING. Remove coolant by-pass pipe and "O" ring from rear of water pump cover. See Fig. 16. Remove intake manifold braces, located between intake manifold and cylinder block.

13) Remove No. 1 air pipe, vacuum tank and vacuum switching valve assembly. See Fig. 16. Disconnect necessary hoses and electrical connections for access to intake manifold.

14) Remove retaining bolts/nuts , intake manifold, variable induction valve and gaskets. See Fig. 16. Disconnect electrical connectors at injectors. Disconnect engine wiring harness from No. 2 (upper timing belt cover).

15) Disconnect vacuum hoses and fuel lines at delivery pipe. Remove retaining bolts, delivery pipe and injectors, spacers and insulators. See Fig. 16. Remove retaining bolts, seal washers, valve cover and gaskets.

16) Remove timing belt, camshaft sprockets and No. 1 idler pulley. See TIMING BELT under REMOVAL & INSTALLATION. Remove No. 3 timing belt cover from front of cylinder head. See Fig. 21. Remove camshafts. See CAMSHAFT under REMOVAL & INSTALLATION.

CAUTION: Cylinder head bolts must be loosened in proper sequence to prevent cylinder head warpage or cracking.

17) Using Cylinder Head Bolt Wrench (SST 09043-38100), loosen cylinder head bolts in proper sequence using several steps. See Fig. 17. Remove cylinder head bolts, washers, cylinder head and cylinder head gasket.

18) Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

Inspection

1) Inspect cylinder head warpage at cylinder block, exhaust manifold and variable induction valve areas. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Inspect cylinder block deck for warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

3) Inspect intake manifold, exhaust manifold and variable induction valve machined surfaces for warpage. Replace component if warpage exceeds .0079" (.200 mm).

4) Apply 15.75 in. Hg of vacuum to variable induction control valve, located at center of variable induction valve. Ensure valves fully close. Release vacuum. Ensure valves fully open quickly. Replace variable induction valve assembly if it does not function as described.

5) Inspect camshaft and components. See CAMSHAFT under REMOVAL & INSTALLATION. Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if not within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Installation

1) Install adjusting shims and valve lifters in original location on cylinder head (if removed). Install NEW cylinder head gasket on cylinder block. Ensure all holes in cylinder head gasket align with holes in cylinder block.

2) Install cylinder head. Apply engine oil on cylinder head bolt threads and cylinder head bolt-to-cylinder head contact surfaces. Install and tighten cylinder head bolts to specification in sequence.

See Fig. 17. See TORQUE SPECIFICATIONS.

3) Install camshafts using proper procedure. See CAMSHAFT under REMOVAL & INSTALLATION. Install No. 3 timing belt cover. Install and tighten bolt to specification. See TORQUE SPECIFICATIONS.

4) To install remaining components, reverse removal procedure using NEW gaskets and "O" rings. If camshaft or cylinder head components are serviced, adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

5) Before installing valve cover and gasket, apply sealant at front and rear areas of cylinder head. See Fig. 2.

6) Install gasket, valve cover and seal washers. Install and tighten retaining bolts to specification. See TORQUE SPECIFICATIONS.

7) If installing injector in delivery pipe, replace "O" rings and insulator on injector. Coat "O" rings with gasoline. Install "O" rings on and insulator on bottom of injector.

8) Install injectors in delivery pipe so electrical connectors are facing pressure regulator side of delivery pipe. Install insulator on top of injector. Install injector cover on delivery pipe. Install and tighten injector cover bolts to specification. See TORQUE SPECIFICATIONS.

9) Use NEW insulator on bottom of injector when installing injectors and delivery pipe. Install NEW throttle body gasket with protruding area toward top of throttle body (opposite coolant line connections). Install throttle body with 2 longer bolts in lower throttle body mount holes.

10) Coat coolant by-pass pipe "O" ring with soapy water before installing. Coat distributor "O" ring with engine oil. When installing distributor, rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

11) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure slot area of intake camshaft is positioned vertically.

12) Position cutout on coupling with alignment mark on distributor housing. See Fig. 18. Install distributor so center of flange is aligned with bolt hole on cylinder head. Install distributor hold-down bolts.

13) Use NEW gasket when installing catalytic converter. To install remaining components, reverse removal procedure. Tighten all fasteners to specification. Adjust control cables and ignition timing. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

TURBOCHARGER

Removal (Celica All-Trac)

1) Disconnect negative battery cable. Drain cooling system. Remove air intake duct, airflow meter and air cleaner cap as an assembly.

2) Raise and support vehicle. Remove lower engine covers. Remove suspension crossmember bolted to both lower suspension arms. Disconnect exhaust pipe at catalytic converter (located at bottom of turbocharger) and center pipe. Remove exhaust pipe.

3) Support engine with hoist. Remove engine mount crossmember located below engine. Remove front (radiator side) engine mount and bracket. Remove clutch release cylinder with hose attached and secure aside.

4) Remove accessory drive belt, alternator and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove catalytic converter braces, catalytic converter, cushion, retainer and gasket. See Fig. 16.

5) Remove intercooler. See INTERCOOLER under REMOVAL & INSTALLATION. Remove turbocharger heat insulator. See Fig. 16.

Disconnect electrical connector at oxygen sensor located on turbine outlet elbow on turbocharger.

6) Remove retaining nuts, oxygen sensor and gasket from turbine outlet elbow on turbocharger. Remove heat insulators from turbine outlet elbow on turbocharger. See Fig. 16.

7) Disconnect necessary coolant and vacuum hoses from turbocharger. Disconnect oil hose for turbocharger from oil pan. Remove turbocharger brace. See Fig. 16.

8) Remove turbocharger oil pipe-to-cylinder block union bolt and gaskets. Remove turbocharger oil pipe support bracket-to-cylinder bolt. Remove retaining nuts, turbocharger and gasket.

9) Remove turbocharger oil pipe, turbocharger coolant pipe, turbocharger bearing side plate, turbine outlet elbow and gaskets from turbocharger (if necessary).

Inspection

1) Ensure impeller wheel and shaft rotates smoothly. Replace turbocharger if impeller wheel and shaft fail to rotate smoothly. Using dial indicator, check shaft end play. See Fig. 19. Replace turbocharger if shaft end play exceeds .0051" (.130 mm).

2) Place tip of dial indicator through oil return hole. Tip of dial indicator must be positioned through opening in bearing and on the shaft.

3) Move shaft toward turbocharger mounting flange and then toward outside of turbocharger, noting the shaft radial clearance. See Fig. 19. Replace turbocharger if shaft radial clearance exceeds .0071" (.180 mm).

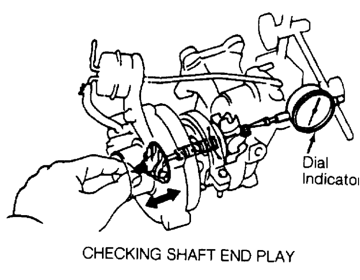


Fig. 19: Checking Turbocharger Shaft End Play
Courtesy of Toyota Motor Sales, U.S.A., Inc.

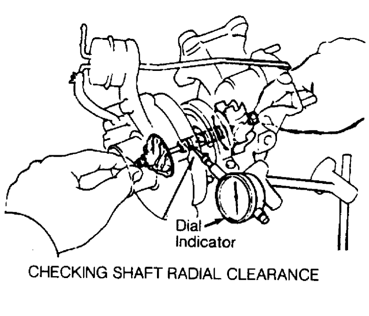


Fig. 20: Checking Turbocharger Radial Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAUTION: When installing turbocharger, pour about 20 cc of engine oil in turbocharger oil supply pipe opening while rotating impeller wheel and shaft.

Installation

1) Using NEW gaskets, install turbocharger oil pipe, turbocharger coolant pipe, turbocharger bearing side plate and turbine outlet elbow (if removed). Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

2) Pour about 20 cc of engine oil in turbocharger oil supply pipe opening while rotating impeller wheel and shaft. Using NEW gasket, install turbocharger, oil pipe and turbocharger brace with all fasteners loosely installed. Tighten all turbocharger fasteners using the following sequence.

3) Tighten turbocharger-to-exhaust manifold nuts to specification. See TORQUE SPECIFICATIONS. Tighten turbocharger oil pipe-to-turbocharger nuts to specification. See TORQUE SPECIFICATIONS.

4) Tighten turbocharger oil pipe-to-cylinder block union bolt to specification. Tighten turbocharger oil pipe support bracket-to-cylinder block bolt to specification. See TORQUE SPECIFICATIONS.

5) Tighten turbocharger brace bolts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Use NEW gasket when installing catalytic converter. Fill cooling system.

Removal (MR2)

1) Disconnect negative battery cable. Drain cooling system. Remove hood, hood side panels and lower engine covers. Remove strut tower-to-firewall braces. Remove No. 1 and 2 air intake connectors to intercooler. See Fig. 30.

2) Remove cruise control accelerator linkage (if equipped). Remove engine compartment cooling fan assembly, located in passenger's side of engine compartment, near the intercooler.

3) Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Raise and support vehicle. Remove tailpipe and muffler assembly.

4) Disconnect exhaust pipe and gasket from catalytic converter. Remove exhaust by rotating exhaust pipe between rear suspension crossmember and the body. Remove air intake hose between air cleaner and mass airflow sensor.

5) Remove through-bolt and retaining bolts from front (exhaust manifold side) engine mount. Remove clutch release cylinder from transaxle with hose attached and secure aside.

6) Remove catalytic converter braces, catalytic converter, cushion, retainer and gasket. See Fig. 16. Remove air by-pass valve and "O" ring from No. 4 air tube. See Fig. 16.

7) Remove No. 4 air tube. See Fig. 16. Remove right engine hanger from front of cylinder head. Remove turbocharger heat insulator. See Fig. 16.

8) Disconnect electrical connector at oxygen sensor located on turbine outlet elbow on turbocharger. Remove retaining nuts, oxygen sensor and gasket from turbine outlet elbow on turbocharger. Remove heat insulators from turbine outlet elbow on turbocharger. See Fig. 16.

9) Disconnect necessary coolant and vacuum hoses from turbocharger. Disconnect oil hose for turbocharger from oil pan. Remove turbocharger brace. See Fig. 16.

10) Remove turbocharger oil pipe-to-cylinder block union bolt and gaskets. Remove turbocharger oil pipe support bracket-to-cylinder bolt. Remove retaining nuts, turbocharger and gasket.

11) Remove turbocharger oil pipe, turbocharger coolant pipe, turbocharger bearing side plate, turbine outlet elbow and gaskets from turbocharger (if necessary).

Inspection

1) Ensure impeller wheel and shaft rotates smoothly. Replace turbocharger if impeller wheel and shaft fail to rotate smoothly.

Using dial indicator, check shaft end play. See Fig. 19. Replace turbocharger if shaft end play exceeds .0051" (.130 mm).

2) Place tip of dial indicator through oil return hole. Tip of dial indicator must be positioned through opening in bearing and on the shaft.

3) Move shaft toward turbocharger mounting flange and then toward outside of turbocharger, noting the shaft radial clearance. See Fig. 19. Replace turbocharger if shaft radial clearance exceeds .0071" (.180 mm).

CAUTION: When installing turbocharger, pour about 20 cc of engine oil in turbocharger oil supply pipe opening while rotating impeller wheel and shaft.

Installation

1) Using NEW gaskets, install turbocharger oil pipe, turbocharger coolant pipe, turbocharger bearing side plate and turbine outlet elbow (if removed). Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

2) Pour about 20 cc of engine oil in turbocharger oil supply pipe opening while rotating impeller wheel and shaft. Using NEW gasket, install turbocharger, oil pipe and turbocharger brace with all fasteners loosely installed. Tighten all turbocharger fasteners using the following sequence.

3) Tighten turbocharger-to-exhaust manifold nuts to specification. See TORQUE SPECIFICATIONS. Tighten turbocharger oil pipe-to-turbocharger nuts to specification. See TORQUE SPECIFICATIONS.

4) Tighten turbocharger oil pipe-to-cylinder block union bolt to specification. Tighten turbocharger oil pipe support bracket-to-cylinder block bolt to specification. See TORQUE SPECIFICATIONS.

5) Tighten turbocharger brace bolts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

6) Install NEW "O" ring on air by-pass valve. Coat "O" ring with soapy water solution before installing air by-pass valve. Use NEW gasket when installing catalytic converter. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CRANKSHAFT FRONT SEAL

Removal & Installation (Oil Pump Installed)

1) Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Using a knife, cut off lip of seal. Pry seal from oil pump housing. Use care not to damage sealing surfaces.

2) To install, apply grease to lip of NEW seal. Using hammer and Seal Installer (SST 09226-10010), install seal until seal outer surface is even with oil pump housing. To install remaining components, reverse removal procedure.

Removal & Installation (Oil Pump Removed)

Using hammer and drift, remove seal from oil pump housing. To install, use hammer and Seal Installer (09226-10010) to install NEW seal. Install seal until seal surface is even with oil pump housing. Apply grease lip of seal.

TIMING BELT

Removal

1) Disconnect negative battery cable. Drain cooling system. Raise and support vehicle. On Celica All-Trac, remove right front wheel, right lower engine cover and alternator.

2) On MR2, remove right rear wheel, right hood side panel and lower engine covers. Remove strut tower-to-firewall braces. Remove cruise control actuator and linkages. Remove engine compartment cooling fan assembly, located in passenger's side of engine compartment, near the intercooler.

3) On all models, remove intercooler. See INTERCOOLER under REMOVAL & INSTALLATION. Remove EGR valve modulator and Vacuum Switching Valve (VSV). Remove EGR valve and pipe. See Fig. 16.

4) Disconnect control cables, electrical connections, vacuum hoses and coolant hoses from throttle body. Remove intake air connector and intake air connector brace from throttle body. See Fig. 16. Remove accelerator cable bracket (if necessary).

5) Remove throttle body and gasket. Remove retaining bolts, seal washers, valve cover and gaskets. Remove spark plugs. Remove accessory drive belts. Slightly raise engine to remove engine weight from right (timing belt side) engine mount.

6) Remove right (timing belt side) engine mount support brace. Remove right (timing belt side) engine mount. Remove right (timing belt side) engine mount bracket from front of engine.

7) Remove retaining bolts, No. 2 timing belt cover and gasket. See Fig. 21. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

8) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure timing marks on camshaft sprockets align with timing marks on No. 3 timing belt cover. See Fig. 22. If timing marks are not aligned, rotate crankshaft one complete revolution (360 degrees).

9) If reusing timing belt, mark direction of timing belt rotation and location on camshaft sprockets for reassembly reference. Also place reference mark on timing belt at upper edge of No. 1 timing belt cover.

10) Remove retaining bolts and timing belt tensioner. See Fig. 21. Remove timing belt from camshaft sprockets. Using Pulley Holder (SST 09213-54015) and Handle (SST 09330-00021), hold crankshaft pulley. Remove crankshaft pulley retaining bolt.

11) If reusing timing belt, ensure reference mark placed on timing belt aligns with upper edge of No. 1 timing belt cover when timing mark on crankshaft pulley is aligned with "0" mark on No. 1 timing belt cover.

12) Using puller, remove crankshaft pulley. Remove No. 1 timing belt cover and gasket. See Fig. 21. Note direction of timing belt guide installation for reassembly reference. See Fig. 21. Remove timing belt guide.

13) If reusing timing belt, mark direction of timing belt rotation and place reference marks on timing belt and crankshaft sprocket for reassembly reference. Remove timing belt.

14) Remove No. 1 and 2 idler pulleys (if necessary). If removing camshaft sprocket, hold hexagonal area at front of camshaft with wrench. Remove retaining bolt and camshaft sprocket.

15) If removing crankshaft sprocket, place shop towels against oil pump housing. Using 2 screwdrivers, pry crankshaft sprocket from crankshaft.

16) If removing oil pump sprocket, hold oil pump sprocket by installing Sprocket Holder (SST 09616-30011) in holes on front of oil pump sprocket. Remove oil pump sprocket retaining nut. Remove sprocket holder and oil pump sprocket.

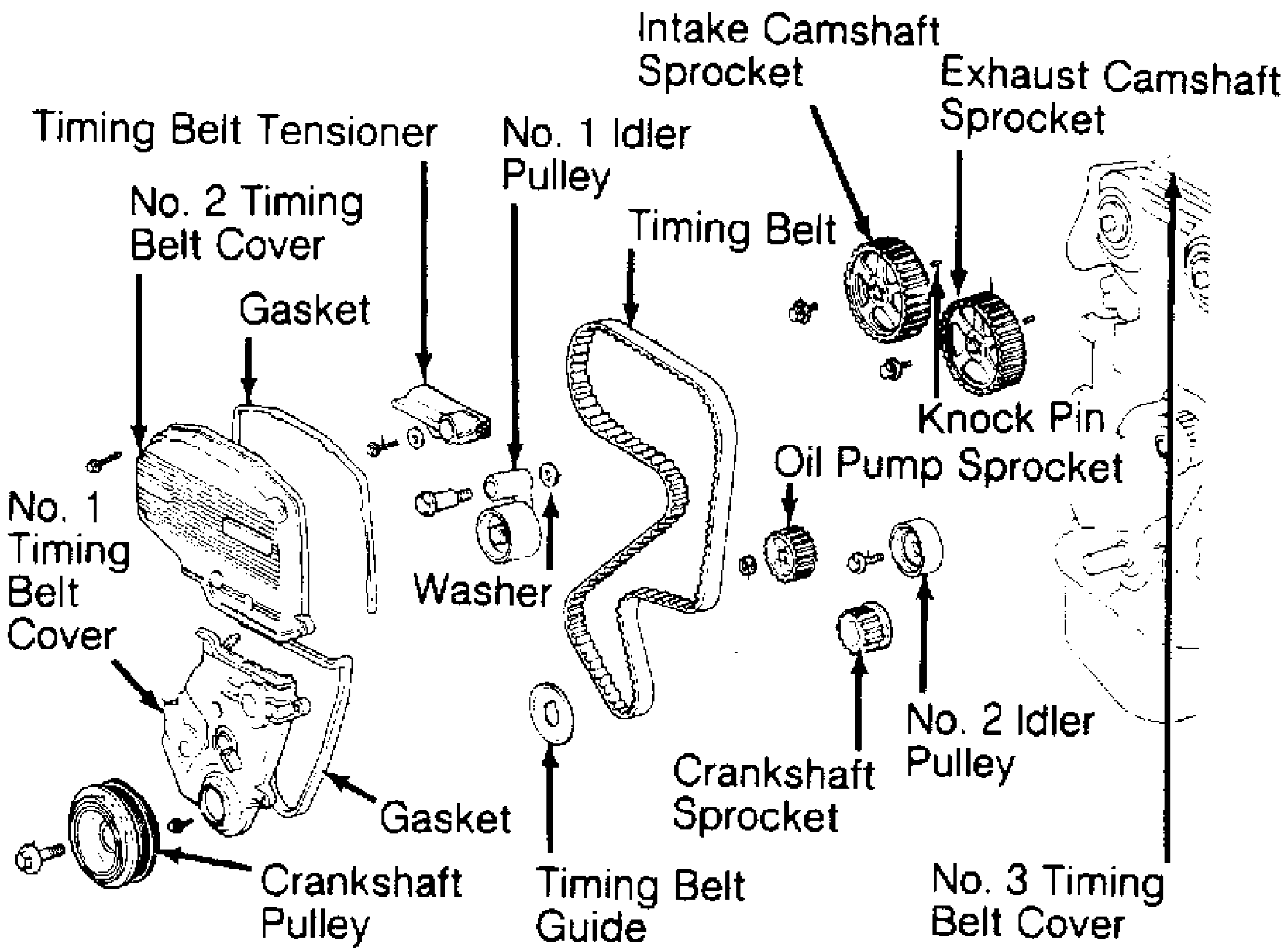


Fig. 21: Exploded View Of Timing Belt & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

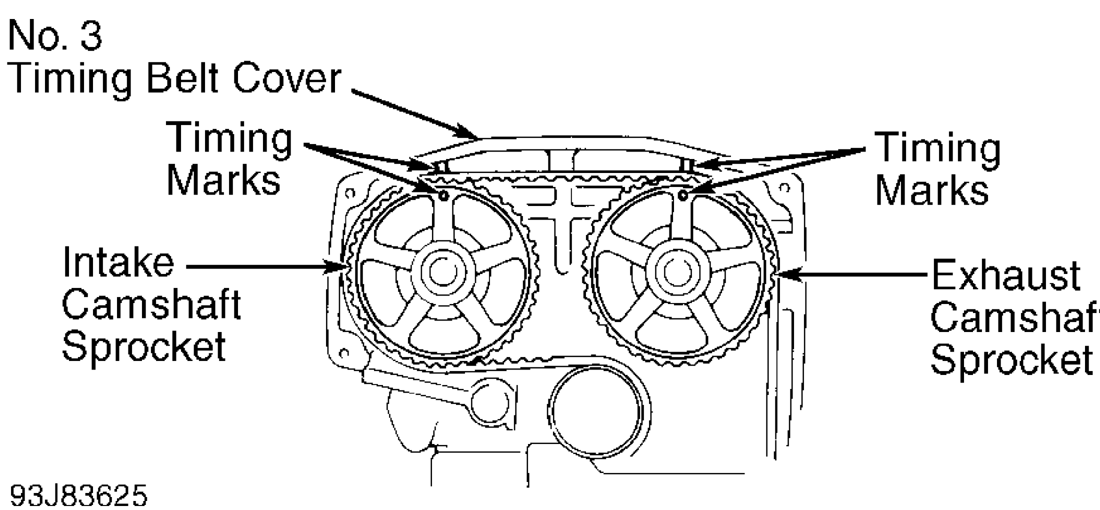


Fig. 22: Aligning Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect timing belt for damaged teeth, cracks or oil

contamination. Ensure idler pulleys rotate freely. Replace damaged components.

2) Inspect timing belt tensioner for signs of oil leakage. Replace timing belt tensioner if oil leakage exists. Hold timing belt tensioner body. Press rod against solid surface. Replace timing belt tensioner if rod moves.

3) Measure timing belt tensioner rod protrusion from end of rod to edge of housing on timing belt tensioner. See Fig. 23. Replace timing belt tensioner if distance is not .335-.374" (8.50-9.50 mm).

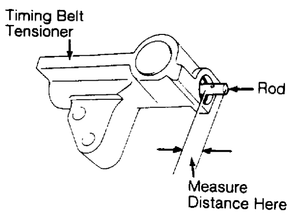


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Fig. 23: Measuring Timing Belt Tensioner Rod Protrusion
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) If installing oil pump sprocket, align cutouts of oil pump sprocket and shaft on drive rotor of oil pump. Install oil pump sprocket. Install and tighten retaining nut to specification. See TORQUE SPECIFICATIONS.

2) If installing crankshaft sprocket, align crankshaft sprocket with key in crankshaft. Install crankshaft sprocket with flange toward the cylinder block.

3) Install No. 2 idler pulley (if removed). Install and tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.

4) Install No. 1 idler pulley and washer (if removed). Apply Loctite to No. 1 idler pulley bolt. Install and tighten retaining bolt to specification. See TORQUE SPECIFICATIONS. Ensure No. 1 and 2 idler pulleys are clean and rotate smoothly.

5) Rotate crankshaft so keyway of crankshaft is at 12 o'clock position. Install timing belt on crankshaft sprocket, oil pump sprocket, No. 2 idler pulley, water pump sprocket and then No. 1 idler pulley.

CAUTION: If reusing timing belt, ensure reference marks are aligned on crankshaft sprocket and timing belt is installed in original direction of rotation.

6) Install timing belt guide with cupped side away from crankshaft sprocket (flat side against timing belt). Install No. 1 timing belt cover and gasket.

7) Align crankshaft pulley groove with key in crankshaft. Install crankshaft pulley. Install and tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.

8) Rotate camshafts so camshaft grooves align with drilled mark on No. 1 camshaft bearing cap. See Fig. 24. If installing camshaft sprockets, install camshaft sprockets on camshafts with "S" mark facing outward, away from top of cylinder head.

NOTE: The "S" mark is located on camshaft sprocket, near center hub of camshaft sprocket.

9) Align knock pin holes. Install knock pin. See Fig. 21. Install and tighten camshaft sprocket retaining bolt to specification. See TORQUE SPECIFICATIONS.

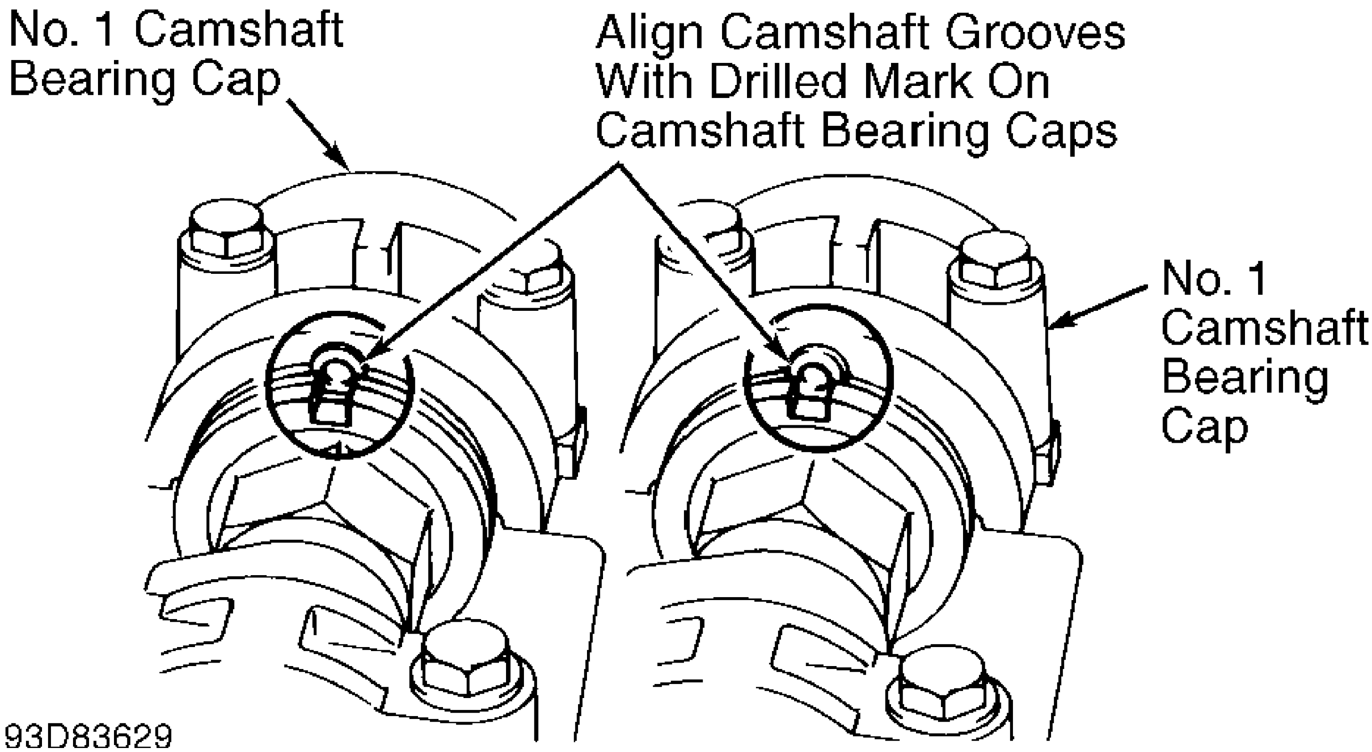

Fig. 24: Aligning Camshafts
Courtesy of Toyota Motor Sales, U.S.A., Inc.

10) Rotate crankshaft pulley so timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover. Rotate camshafts so timing mark on camshaft sprocket is aligned with timing mark on No. 3 timing belt cover. See Fig. 22.

11) Install timing belt on camshaft sprockets. If reusing timing belt, ensure reference marks are aligned on camshaft sprockets and upper edge of No. 1 timing belt cover.

12) Using press, press rod back into timing belt tensioner housing until hole in rod aligns with holes of timing belt tensioner housing. Install a .050" (1.27 mm) Allen wrench through holes of timing belt tensioner housing and rod. Remove timing belt tensioner from press.

13) Place torque wrench on bolt located at center of No. 1 idler pulley. DO NOT use No. 1 idler pulley-to-cylinder block bolt. Torque wrench must be installed on bolt located at center of No. 1 idler pulley with handle near camshaft sprocket to obtain correct torque reading.

14) Rotate bolt and No. 1 idler pulley counterclockwise (viewed from front of engine) to obtain torque reading of 13 ft. lbs. (18 N.m). Install timing belt tensioner with retaining bolts temporarily tightened.

15) Rotate crankshaft clockwise 5 to 6 revolutions and align crankshaft pulley timing mark with 60-degree ATDC timing mark on No. 1 timing belt cover. See Fig. 25. DO NOT rotate crankshaft counterclockwise.

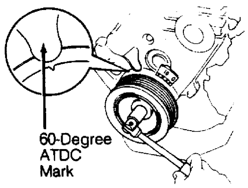

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Fig. 25: Aligning 60-Degree ATDC Timing Mark
Courtesy of Toyota Motor Sales, U.S.A., Inc.

16) Install a .075" (1.90 mm) feeler gauge between timing belt tensioner and No. 1 idler pulley stopper. See Fig. 26. Place torque wrench on bolt located at center of No. 1 idler pulley. DO NOT use No. 1 idler pulley-to-cylinder block bolt.

17) Rotate bolt and No. 1 idler pulley counterclockwise again to obtain torque reading of 13 ft. lbs. (18 N.m). Push timing belt tensioner inward, toward timing belt. Tighten timing belt tensioner retaining bolts to specification. See TORQUE SPECIFICATIONS.

18) Remove .050" (1.27 mm) Allen wrench from timing belt tensioner. Rotate crankshaft clockwise one complete revolution (360 degrees) so timing mark aligns with 60-degree ATDC mark.

19) Using feeler gauge, recheck clearance between the No. 1 idler puller stopper and timing belt tensioner. If clearance is not .071-.087" (1.80-2.20 mm), remove timing belt tensioner and reinstall.

20) Rotate crankshaft clockwise so No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover.

21) Ensure timing marks on camshaft sprockets align with timing marks on No. 3 timing belt cover. See Fig. 22. If timing marks are not aligned, remove timing belt and reinstall.

22) To install remaining components, reverse removal procedure. Before installing valve cover and gasket, apply sealant at front and rear areas of cylinder head. See Fig. 2.

23) Using NEW gasket, install valve cover. Install seal washers. Install and tighten retaining bolts to specification. See TORQUE SPECIFICATIONS.

24) Install NEW throttle body gasket with protruding area on gasket toward top of throttle body (opposite coolant line connections). Note that the 2 longer throttle body bolts are used in lower throttle body mounting holes. Fill cooling system. On MR2 cooling system must be bled. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CAUTION: On MR2, ensure cooling system is bled to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

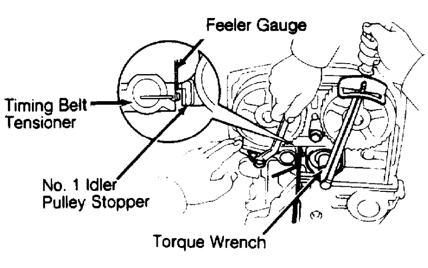

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Fig. 26: Determining Timing Belt Tensioner Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

VALVE LIFTER

Removal

Remove camshaft. See CAMSHAFT under REMOVAL & INSTALLATION. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head.

Inspection

Inspect components for damage. Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if not within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Installation

To install, reverse removal procedure. Ensure components are installed in original locations. If camshaft, adjusting shims or valve lifters are replaced, check valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

CAMSHAFT

Removal

1) Remove timing belt and camshaft sprockets. See TIMING BELT under REMOVAL & INSTALLATION. Remove No. 3 timing belt cover. See Fig. 21. If removing intake camshaft, remove distributor.

NOTE: Camshaft bearing caps are numbered for location with No. 1 at timing belt end and No. 5 at flywheel end of engine. Top of camshaft bearing cap is marked with "I" for intake camshaft or "E" for exhaust camshaft . Arrow on camshaft bearing cap must point toward timing belt end of engine. See Fig. 27.

2) Loosen camshaft bearing cap bolts in sequence using several steps. See Fig. 28. Remove camshaft bearing caps, camshafts and oil camshaft seals. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

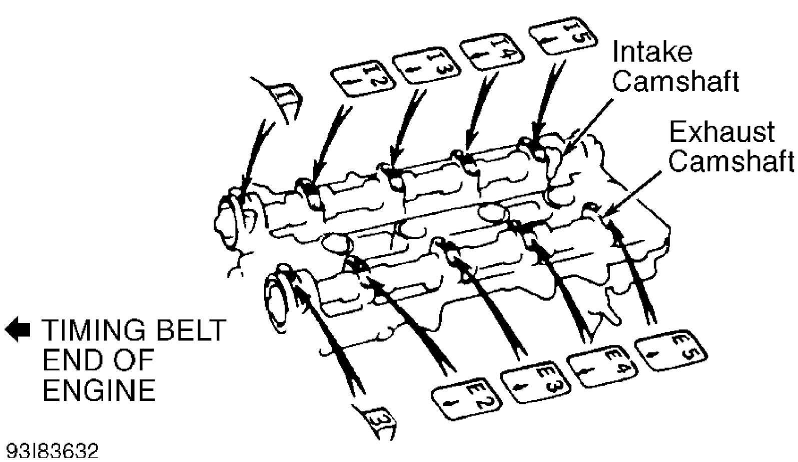

Fig. 27: Identifying Camshaft Bearing Cap Locations
Courtesy of Toyota Motor Sales, U.S.A., Inc.

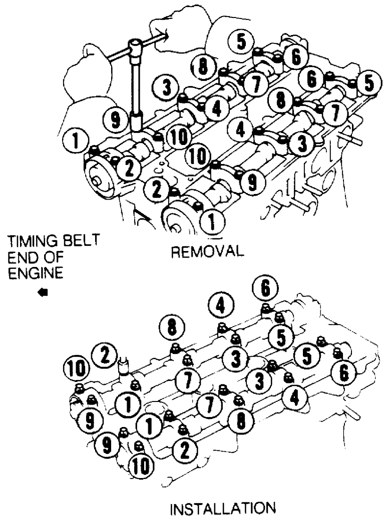

Fig. 28: Camshaft Bearing Cap Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect components for damage. Check camshaft journal diameter, lobe height and runout. Replace camshaft if not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS article.

2) Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See Fig. 28. See TORQUE SPECIFICATIONS.

3) Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

Installation

1) Install camshafts with lobes for the front cylinder pointing toward outside of cylinder head. Apply sealant on outer edge of each No. 1 camshaft bearing cap-to-cylinder head surface. See Fig. 29.

2) Install camshaft bearing caps in original location with arrow pointing toward timing belt end of engine. See Fig. 27.

CAUTION: Ensure arrow on camshaft bearing cap points toward timing belt end of engine and caps are in proper location. See Fig. 27.

3) Apply engine oil to bolt threads and bolt head-to-camshaft bearing cap area. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 28. See TORQUE SPECIFICATIONS.

4) Apply grease to seal lip of NEW camshaft oil seal. Install camshaft oil seal on camshaft. Using hammer and Oil Seal Installer (SST 09223-50010), install camshaft oil seal.

5) If cylinder head or camshaft is serviced or replaced, valve clearance must be adjusted. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS. To install remaining components, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

6) Before installing valve cover and gasket, apply sealant at front and rear areas of cylinder head. See Fig. 2. Using NEW gasket, install valve cover.

7) When installing distributor, coat NEW distributor "O" ring with engine oil. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

8) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure slot area of intake camshaft is positioned vertically.

9) Position cutout on coupling with alignment mark on distributor housing. See Fig. 18. Install distributor so center of flange is aligned with bolt hole on cylinder head. Install distributor hold-down bolts. Adjust ignition timing.

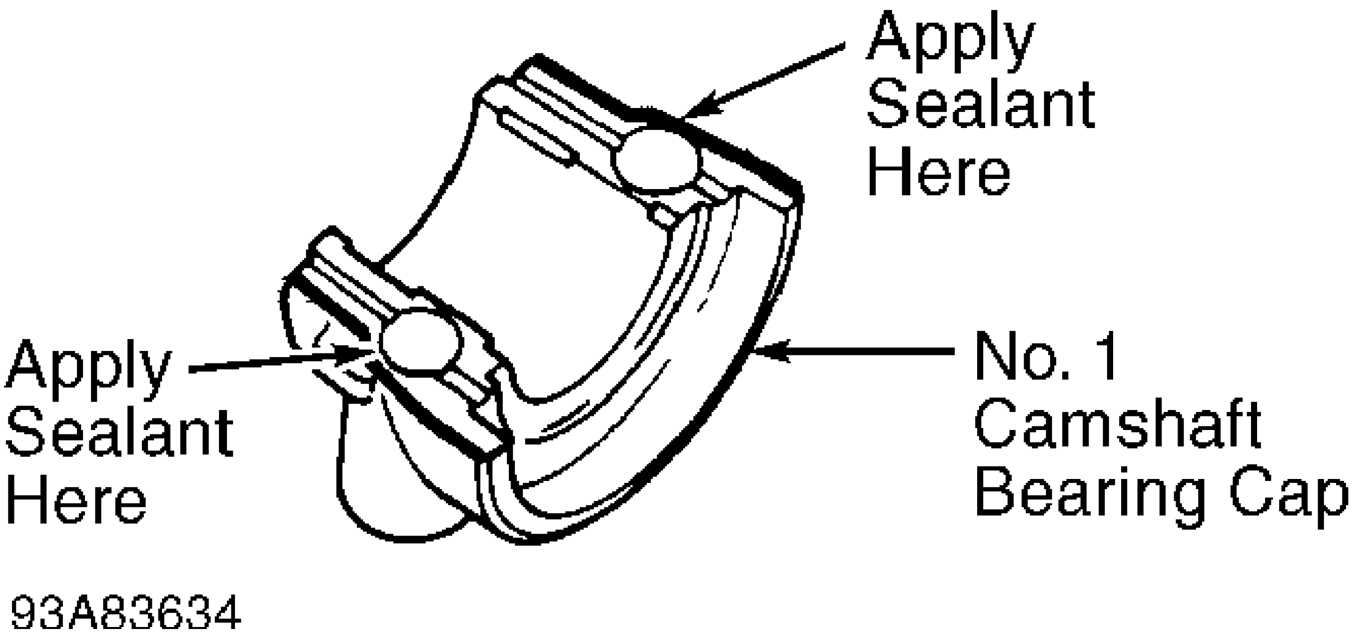

Fig. 29: Applying Sealant On No. 1 Camshaft Bearing Cap
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transaxle, clutch assembly (if equipped) and flywheel. Using a knife, cut off oil seal lip. Pry oil seal from rear seal housing. Use care not to damage sealing surfaces.

Installation

1) Ensure all sealing surfaces are clean. Apply grease to seal lip of NEW oil seal. Using Oil Seal Installer (SST 09223-63010), install oil seal in rear seal housing until oil seal surface is even with rear seal housing surface.

2) Install flywheel. Apply Loctite to flywheel bolts. Install and tighten flywheel bolts to specification in a crisscross pattern. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

INTERCOOLER

Removal & Installation (Celica All-Trac)

1) Disconnect negative battery cable. Remove retaining clips

and intercooler air inlet. See Fig. 16. Remove intercooler protector. See Fig. 16.

2) Remove intercooler retaining bolts. Loosen hose clamps at intercooler. Disconnect intercooler from turbocharger air connector. Remove intercooler. To install, reverse removal procedure.

Removal (MR2)

1) Disconnect negative battery cable. Raise and support vehicle. Remove right hood side panel and lower engine covers. Remove No. 1 and 2 air intake connectors to intercooler. See Fig. 30. Remove cruise control actuator and accelerator linkage.

2) Remove engine compartment cooling fan assembly, located in passenger's side of engine compartment, near the intercooler. Remove suspension brace. See Fig. 30. Remove accessory drive belt and idler pulley bracket.

3) Remove A/C compressor with hoses attached and secure aside. Remove retaining bolts and intercooler. To install, reverse removal procedure.

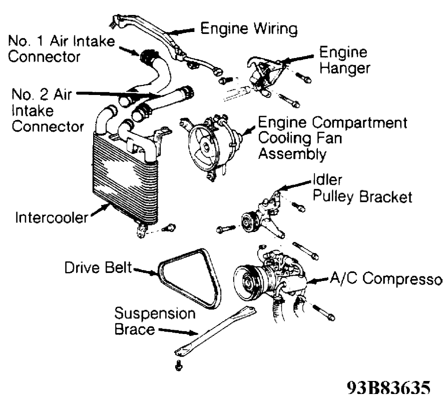

Fig. 30: Exploded View Of Intercooler & Components (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WATER PUMP

Removal

1) Disconnect negative battery cable. Drain cooling system. Remove timing belt and No. 2 idler pulley. See TIMING BELT under REMOVAL & INSTALLATION.

2) Remove drive belt idler pulley bracket (if equipped). Disconnect necessary coolant hoses. Remove coolant by-pass pipe-to-water pump cover retaining nuts. See Fig. 31.

3) Remove bracket bolt (large bolt) from water pump if not previously removed. See Fig. 32. Remove remaining small water pump bolts in sequence. See Fig. 32. Remove water pump, water pump cover and "O" rings as an assembly. Remove retaining bolts and separate water pump with gasket from water pump cover. See Fig. 31.

Installation

1) To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Apply soapy water solution to coolant by-pass pipe "O" ring before installing water pump. DO NOT tighten coolant by-pass pipe-to-water pump cover retaining nuts until water pump bolts are tightened to specification.

2) Tighten water pump bolts to specification in sequence. See Fig. 32. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Fill cooling system. On MR2 cooling system must be bled. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CAUTION: On MR2, ensure cooling system is bled to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

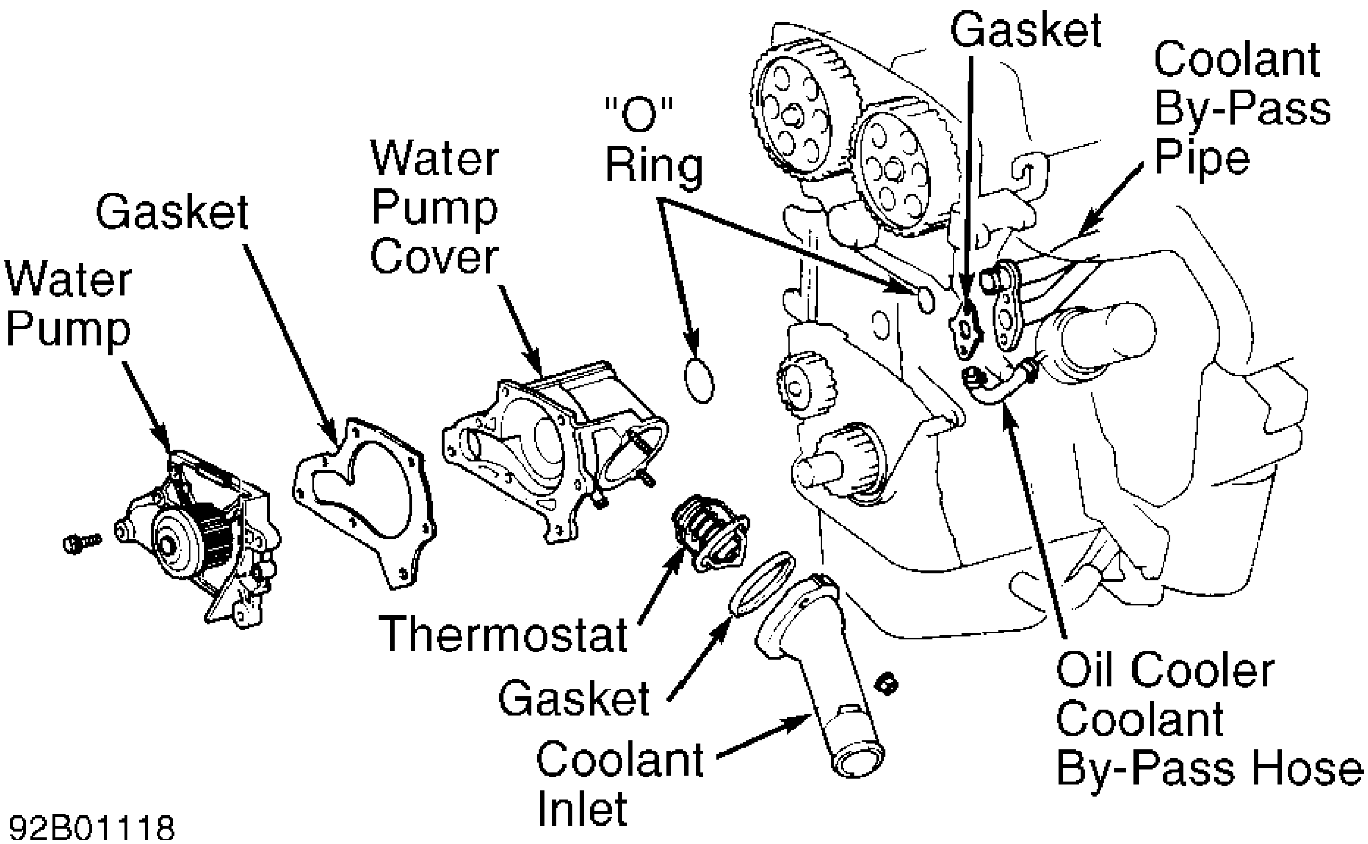

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Fig. 31: Exploded View Of Water Pump & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

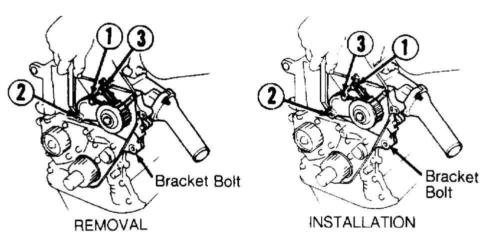

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Fig. 32: Water Pump Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OIL PAN

Removal

1) Disconnect negative battery cable. Raise and support vehicle. Remove lower engine cover. Drain engine oil.

2) On Celica All-Trac models, disconnect exhaust pipe at catalytic converter (located at bottom of turbocharger) and center pipe. Remove exhaust pipe.

3) On MR2, remove tailpipe and muffler assembly. Disconnect exhaust pipe and gasket from catalytic converter. Remove exhaust by rotating exhaust pipe between rear suspension crossmember and the

body.

4) On all models, remove necessary crossmembers for access to oil pan. Remove catalytic converter braces, catalytic converter, cushion, retainer and gasket if necessary for access to oil pan. See Fig. 16.

5) Remove stiffener support brace near rear of oil pan. Remove dipstick. Disconnect turbocharger oil return hose at oil pan. Remove retaining bolts/nuts and oil pan.

Installation

1) Ensure sealing surfaces are clean. Apply bead of sealant at center of oil pan sealing surface, between bolt/nut holes and on inside of bolt/nut holes.

2) Install oil pan. Install and tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Use NEW gasket when installing catalytic converter (if removed). Fill crankcase with oil.

OVERHAUL

CYLINDER HEAD

Cylinder Head

1) Inspect cylinder head warpage at cylinder block, exhaust manifold and variable induction valve areas. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See Fig. 28. See TORQUE SPECIFICATIONS.

3) Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

5) Ensure valve lifter bore diameter in cylinder head is within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Valve Springs

Ensure valve spring free length, pressure and out-of-square are within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Install valve springs with White painted area away from cylinder head surface.

CAUTION: Ensure valve springs are installed with White painted area away from cylinder head surface.

Valve Stem Oil Seals

Intake valve stem oil seal is Brown and exhaust valve stem oil seal is Green. Ensure proper valve stem oil seal is installed. Lubricate valve stem oil seal with engine oil. Install valve stem oil seal using Oil Seal Installer (SST 09201-41020).

Valve Guides

1) Ensure valve guide inside diameter is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.

2) To replace valve guide, wrap tape around stem of an old valve, about .51" (13.0 mm) from end of valve stem. From top of

cylinder head, insert old valve into valve guide until tape area rests on valve guide.

3) Using hammer, hit old valve to break off top of old valve guide. Remove snap ring from valve guide. Heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (SST 09201-70010), drive valve guide from camshaft side of cylinder head.

4) Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4326-.4333" (10.988-11.006 mm), use standard valve guide. If bore inside diameter is .4346-.4353" (11.038-11.056 mm), use oversize valve guide.

5) If bore inside diameter exceeds .4333" (11.006 mm), machine valve guide bore to .4346-.4353" (11.038-11.056 mm) for oversize valve guide. If bore inside diameter exceeds .4353" (11.056 mm), replace cylinder head.

6) To install valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head until snap ring on valve guide contacts the cylinder head.

7) Using .236" (6.00 mm) reamer, ream valve guide to obtain correct valve stem-to-guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Seat

Ensure valve seat angle and seat width are within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Valve seat replacement information is not available from manufacturer.

Valves

Ensure minimum refinish length, stem diameter and valve margin are within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

Valve Seat Correction Angles

Use 30-degree and 45-degree stones to lower valve seat contact area. Use 45-degree and 75-degree stones to raise valve seat contact area.

VALVE TRAIN

Valve Lifters

Ensure valve lifter diameter, bore diameter and oil clearance are within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Ensure connecting rod and connecting rod cap are marked with matching cylinder numbers for reassembly reference. Before disassembling piston and connecting rod, try to move piston back and forth on piston pin. Replace piston and piston pin if any movement is felt.

2) When removing piston from connecting rod, remove snap rings from piston. Heat piston to 176-194°F (80-90°C) in water. Remove piston pin. Separate piston from connecting rod.

3) Ensure piston pin diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Ensure connecting rod bend, twist and piston pin bushing bore diameter are within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

4) Bushing in connecting rod can be replaced if bore diameter is not within specification. Ensure bushing oil hole aligns with connecting rod oil hole. Bushing must be honed to obtain correct

piston pin-to-rod clearance.

NOTE: With piston at 140°F (60°C), piston pin should be able to be pressed into piston using thumb pressure.

5) To reassemble, position piston and connecting rod so front mark (cavity) on top of piston aligns with front mark (protrusion) on connecting rod. See Fig. 33.

6) Install one NEW snap ring in piston. Heat piston to 176-194°F (80-90°C) in water. Coat piston pin with engine oil. Install piston pin into piston and connecting rod using thumb pressure. Install remaining NEW snap ring.

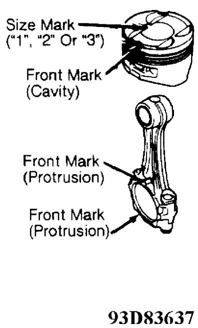

Fig. 33: Identifying Piston Size Mark & Aligning Piston With Connecting Rod
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fitting Pistons

1) To determine piston-to-cylinder clearance, measure piston skirt diameter 1.185" (30.10 mm) from top of piston at 90-degree angle from piston pin.

2) Different piston sizes are used. Piston size can be identified by size mark ("1", "2" or "3") stamped on top of piston. See Fig. 33. Ensure piston diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

3) Measure cylinder bore diameter at .39" (9.9 mm) from top and bottom of cylinder bore and at middle of cylinder bore. Different cylinder bore sizes are used. Cylinder bore diameter can be identified by size mark ("1", "2" or "3") stamped on the cylinder block deck surface. See Fig. 34.

4) Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Determine piston clearance.

5) Replace piston or cylinder block if clearance is not within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. If replacing piston, ensure replacement piston contains same size mark as cylinder block size mark.

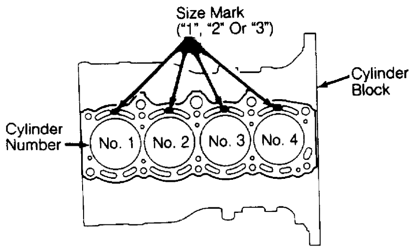

Fig. 34: Identifying Cylinder Bore Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Piston Rings

Ensure piston ring end gap and side clearance are within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Position piston ring with ring end gaps in proper areas with identification mark on piston ring toward top of piston. See Fig. 35.

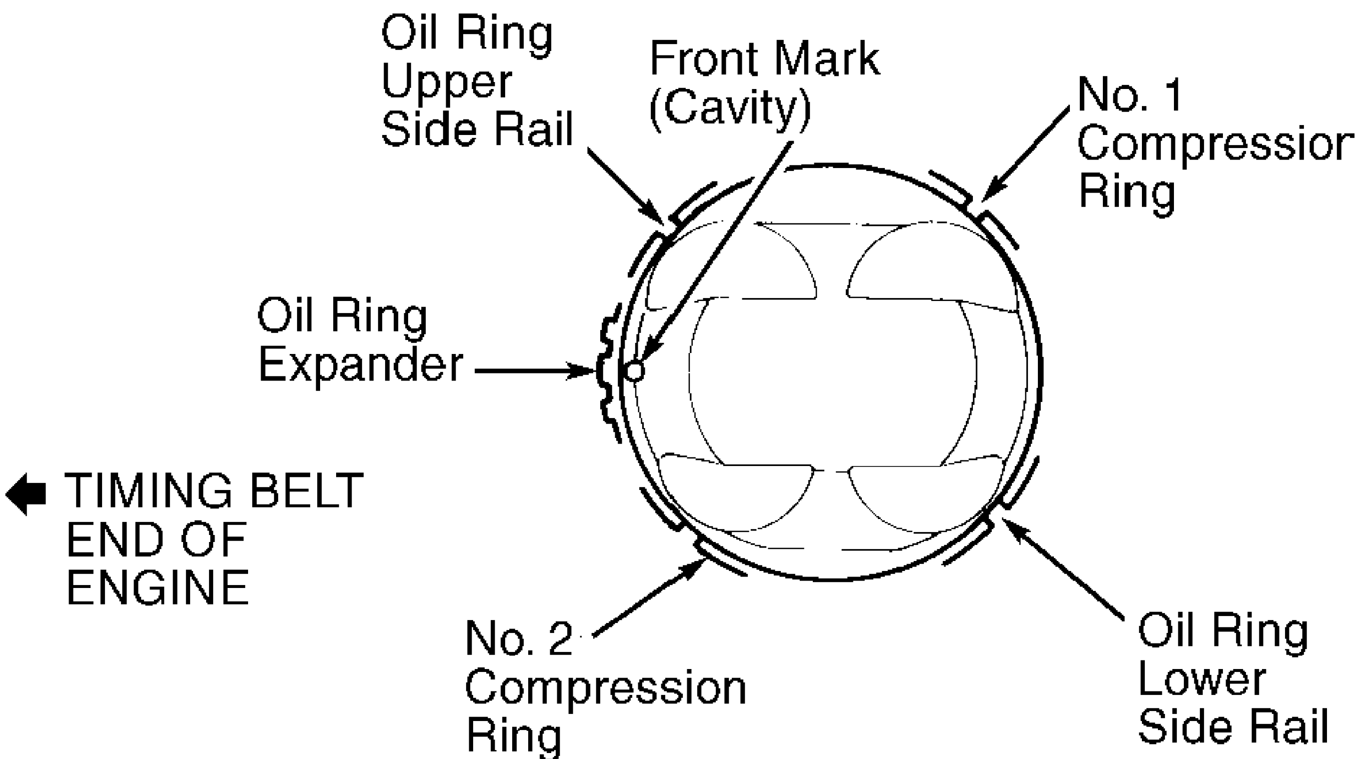

Fig. 35: Positioning Piston Rings
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Rod Bearings

1) Mark connecting rod cap and connecting rod with cylinder number before disassembly. Connecting rod must be installed in original location with front mark (protrusion) at center of connecting rod toward timing belt end of engine. Front mark (protrusion) on connecting rod cap must face toward timing belt end of engine. See Fig. 33.

2) Connecting rod cap and rod bearing are stamped with size mark ("1", "2" or "3"). See Fig. 36. Ensure size marks on connecting

rod cap and rod bearing are same.

NOTE: If replacing rod bearing, ensure size mark on replacement rod bearing is same as size mark on original rod bearing.

3) Rod bearing thickness is determined by the size mark. See ROD BEARING SPECIFICATIONS table. Install connecting rod cap with front mark (protrusion) toward timing belt end of engine. See Fig. 33.

4) Coat threads of connecting rod bolts and nut-to-connecting rod cap surface with engine oil before tightening nuts to specification. See TORQUE SPECIFICATIONS.

5) Ensure bearing oil clearance and connecting rod side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS and CONNECTING RODS tables under ENGINE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS TABLE

Bearing Size Mark	Bearing Thickness In. (mm)
"1"	.0584-.0586 (1.484-1.488)
"2"	.0586-.0587 (1.488-1.492)
"3"	.0587-.0589 (1.492-1.496)

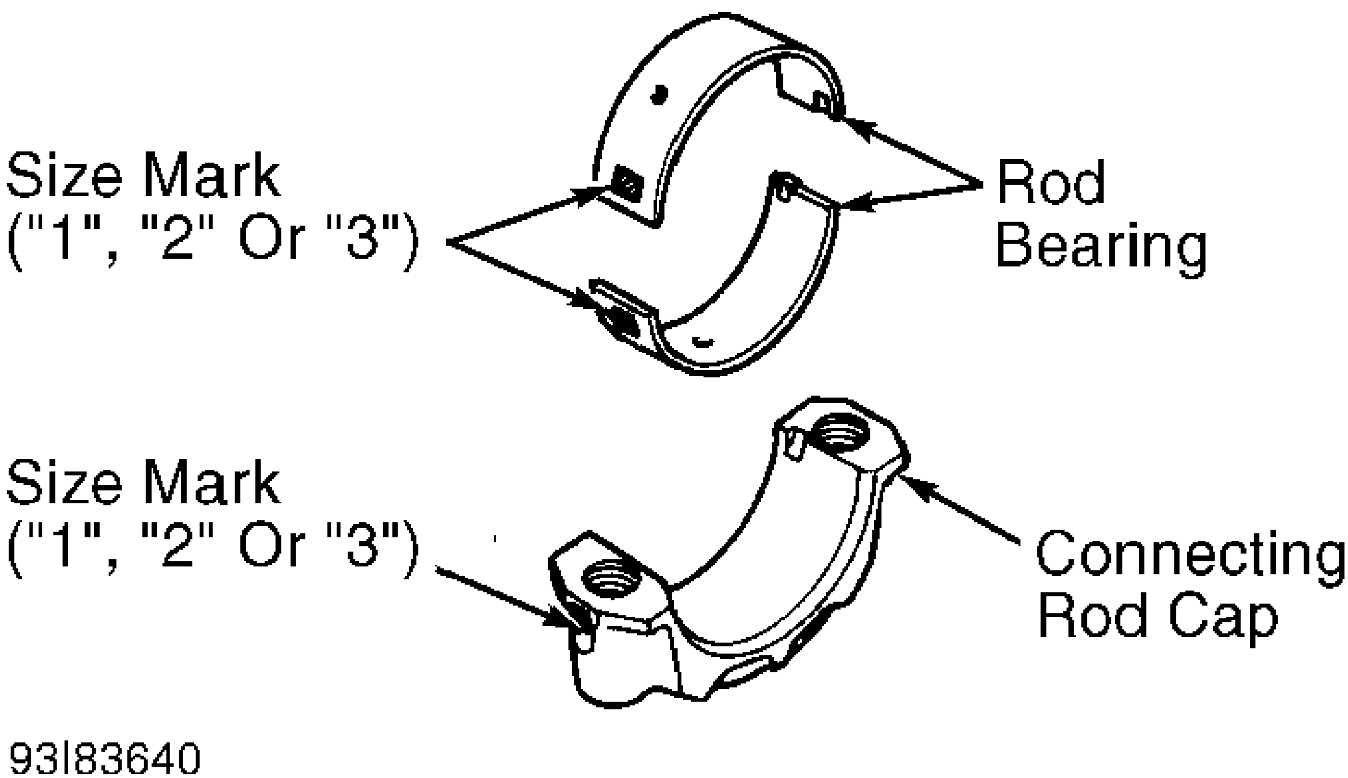

Fig. 36: Identifying Connecting Rod Cap & Rod Bearing Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Crankshaft & Main Bearings

1) Main bearing caps are numbered on top of cap for location reference. No. 1 main bearing cap is at timing belt end of engine and No. 5 is at flywheel end. Arrow on top of main bearing cap must point toward timing belt end of engine.

2) Remove main bearing cap bolts in sequence. See Fig. 37.

Remove main bearing caps, crankshaft, thrust bearing and main bearings.

3) Cylinder block main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 38. Front size mark indicates No. 1 main bearing bore and rear size mark indicates No. 5 main bearing bore.

4) Crankshaft main bearing journal diameter is identified by main bearing journal size mark ("0", "1" or "2") located on crankshaft counterweight. See Fig. 38.

5) Ensure main bearing journal diameter, taper and out-of-round are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

6) Main bearing size mark ("1", "2", "3", "4" or "5") is located on side of main bearing. See Fig. 38. If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.

7) If main bearing size mark cannot be obtained, add size marks on cylinder block and crankshaft to determine size mark of main bearing to be used. For example, if size mark on cylinder block is "2" and size mark on crankshaft is "1", use main bearing with size mark "3".

8) Main bearing thickness is determined by size mark. See MAIN BEARING SPECIFICATIONS table. Install main bearings, thrust bearing, crankshaft and main bearing caps.

9) Ensure main bearings caps are properly installed in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.

10) Coat main bearing cap bolt threads and seat area of bolt with engine oil before installing. Install and tighten main bearing cap bolts to specification in sequence. See Fig. 37. See TORQUE SPECIFICATIONS.

11) Ensure crankshaft main bearing oil clearance and crankshaft end play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Replace thrust bearing if crankshaft end play is not within specification.

MAIN BEARING SPECIFICATIONS TABLE

Bearing Size Mark	Bearing Thickness In. (mm)
No. 3 Main Bearing	
"1"	.0784-.0785 (1.992-1.995)
"2"	.0785-.0787 (1.995-1.998)
"3"	.0787-.0788 (1.998-2.001)
"4"	.0788-.0789 (2.001-2.004)
"5"	.0789-.0790 (2.004-2.007)
All Others	
"1"	.0786-.0787 (1.997-2.000)
"2"	.0787-.0789 (2.000-2.003)
"3"	.0789-.0790 (2.003-2.006)
"4"	.0790-.0791 (2.006-2.009)
"5"	.0791-.0792 (2.009-2.012)

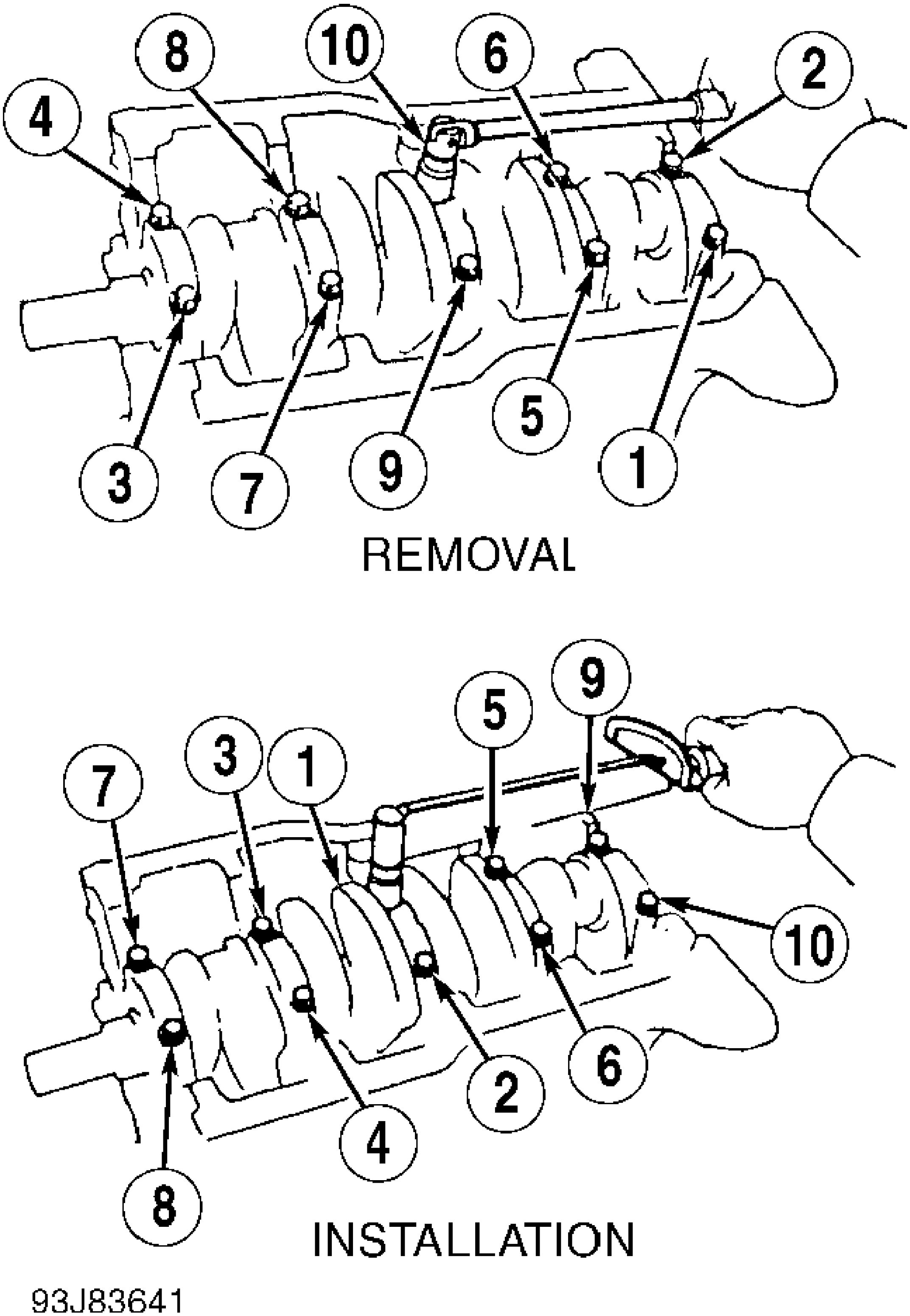

Fig. 37: Main Bearing Cap Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

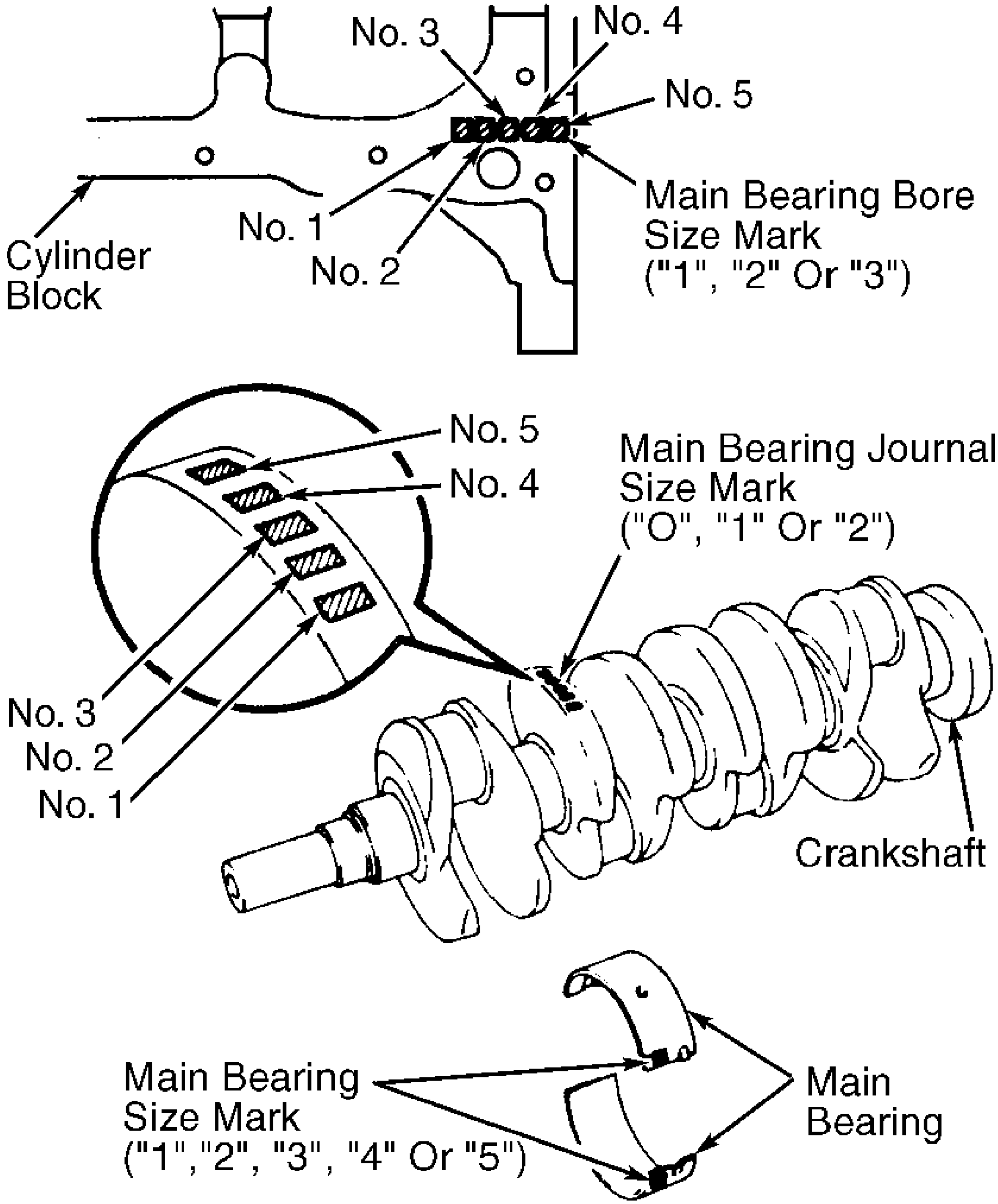

Fig. 38: Identifying Cylinder Block, Crankshaft & Main Bearing Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Thrust Bearing

Install thrust bearing on No. 3 main bearing with grooves facing toward crankshaft away from cylinder block and main bearing cap. Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

1) Inspect cylinder block deck surface warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

2) Different cylinder bore sizes are used and are identified by size mark ("1", "2" or "3") on cylinder block deck surface. See Fig. 34. Measure cylinder bore diameter at .39" (9.9 mm) from top and bottom of cylinder bore and at middle of cylinder bore.

3) Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Replace cylinder block if cylinder bore exceeds specification.

4) Install main bearing caps in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.

5) Install and tighten main bearing cap bolts to specification in sequence. See Fig. 37. See TORQUE SPECIFICATIONS. Ensure main bearing bore inside diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

NOTE: Main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 38.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

The crankshaft-driven oil pump provides pressurized lubrication. See Fig. 39. Oil nozzles are mounted inside cylinder block directly above crankshaft. Oil nozzles spray oil on bottom and inside of piston to aid in cooling and lubrication.

Crankcase Capacity

Crankcase capacity with oil filter is 4.1 qts. (3.9L).

Oil Pressure

With engine at normal operating temperature, oil pressure should be at least 4.3 psi (0.3 kg/cm^2) at idle and 36-71 psi (2.5-5.0 kg/cm^2) at 3000 RPM.

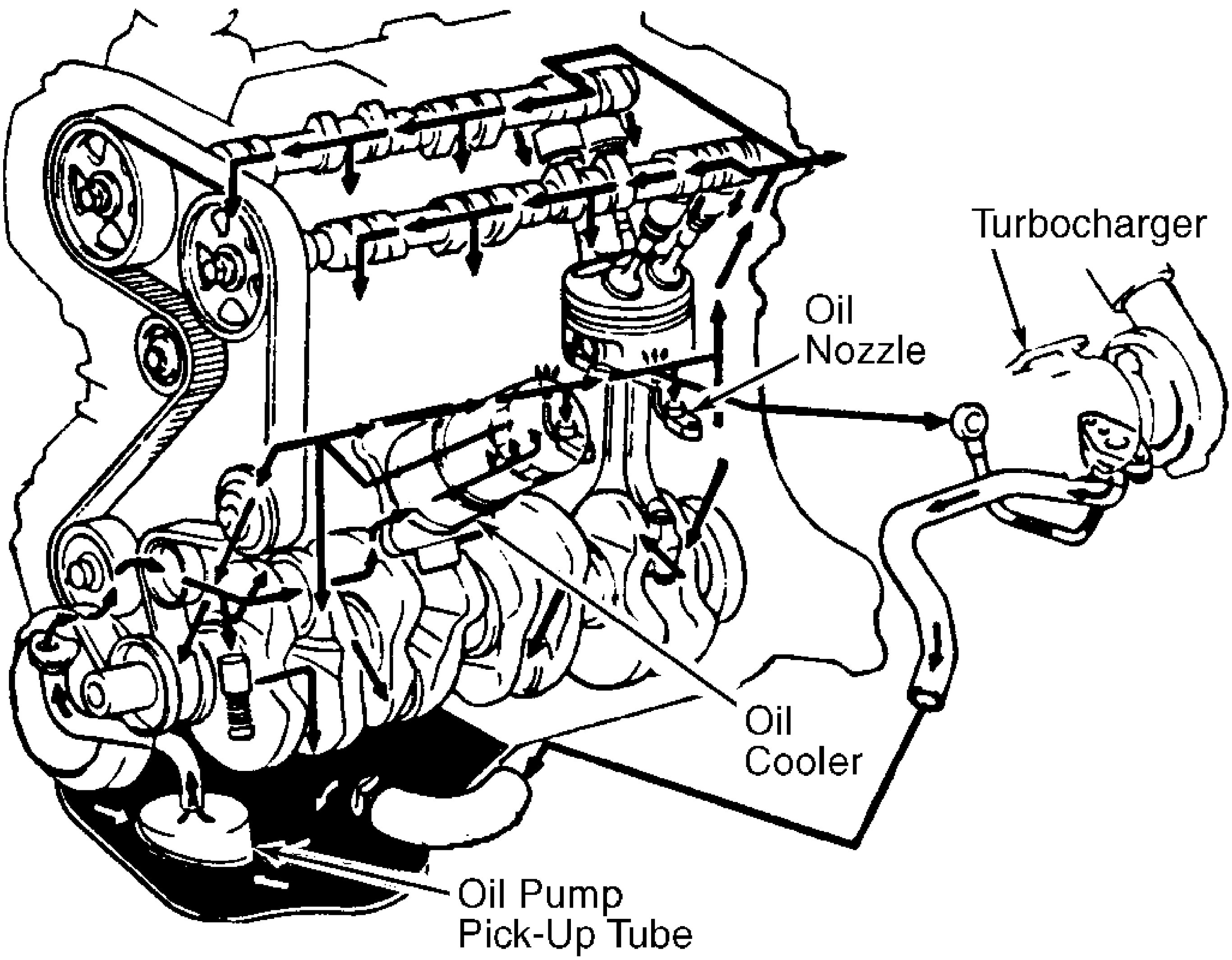

Fig. 39: Cross-Sectional View Of Engine Oil Circuit
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OIL PUMP

Removal & Disassembly

1) Remove timing belt, crankshaft sprocket, oil pump sprocket and No. 2 idler pulley. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION.

2) Remove oil pump pick-up tube. Remove oil pump housing-to-cylinder block retaining bolts. Using soft-faced hammer, tap oil pump housing from cylinder block.

3) To disassemble, remove oil pump body cover retaining bolts, oil pump body cover and "O" ring. Disassemble oil pump components. See Fig. 40. Remove oil pump seal and crankshaft front seal from oil pump housing (if necessary).

Inspection

1) Inspect components for damage. Ensure relief valve slides freely in bore of oil pump housing. Install rotors in oil pump housing.

2) Using feeler gauge, measure driven rotor-to-oil pump

housing clearance. Replace rotor assembly or oil pump housing if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

3) Measure rotor tip clearance between tip of both rotors. Replace rotor assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Driven Rotor-To-Oil Pump Housing Clearance	
Standard	.0039-.0063 (.099-.160)
Wear Limit	.0079 (.200)
Rotor Tip Clearance	
Standard	.0016-.0063 (.040-.160)
Wear Limit	.0079 (.200)

Reassembly & Installation

1) To reassemble, reverse disassembly procedure. Ensure reference marks (dot area) on rotors face toward outside of oil pump body (away from cylinder block surface).

2) Using Seal Installer (SST 09226-10010), install NEW crankshaft front seal (if removed) until seal surface is even with oil pump housing. Coat seal lip with grease.

3) Using Seal Installer (SST 09627-30010) and Handle (SST 09631-00020), install NEW oil pump seal (if removed) until seal surface is even with oil pump body cover. Coat seal lip with grease.

4) Using NEW "O" ring, install oil pump body cover. Install and tighten oil pump body cover bolts to specification. See TORQUE SPECIFICATIONS.

5) Using NEW gasket, install oil pump on cylinder block. Install oil pump housing-to-cylinder block bolts. Ensure the 2 longest bolts are located in the lowest outside holes nearest to oil pan flange. Tighten bolts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

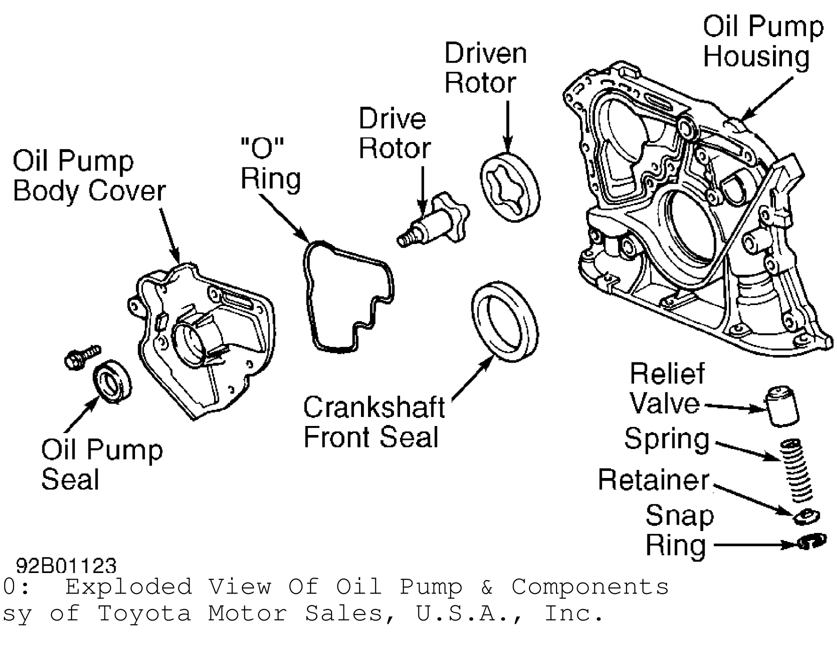

Fig. 40: Exploded View Of Oil Pump & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OIL COOLER

Removal (Celica All-Trac)

1) Disconnect negative battery cable. Oil cooler is mounted between oil filter and cylinder block. See Fig. 39.

2) Remove alternator and oil filter. Drain cooling system. Disconnect coolant hose from oil cooler. Remove relief valve and plate washer from center of oil cooler. See Fig. 16.

3) Remove retaining nuts, oil cooler and "O" ring. If removing oil cooler bracket from cylinder block, remove bolt and disconnect coolant by-pass pipe bracket from oil cooler bracket. Remove retaining bolts, oil cooler bracket and "O" rings.

Inspection

1) Inspect oil cooler for damage or restriction. Replace oil cooler if damage or restricted.

2) Using wooden stick push inward on check valve located in center of relief valve. Push inward from threaded end (opposite oil filter threads) of relief valve. Replace relief valve if check valve fails to move.

Installation

1) To install, reverse removal procedure using NEW "O" rings. Coat all "O" rings with engine oil. Coat relief valve threads and area below head of relief valve with engine oil.

2) Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Add engine oil (as required). Fill cooling system. Add engine oil as required.

Removal (MR2)

1) Disconnect negative battery cable. Oil cooler is mounted between oil filter and cylinder block. See Fig. 39.

2) Drain cooling system. Remove lower engine covers and right hood side panel. Remove No. 1 and 2 air intake connectors. See Fig. 30.

3) Disconnect cruise control actuator linkage. Remove engine compartment cooling fan assembly, located in passenger's side of engine compartment, near the intercooler.

4) Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove oil filter. Remove dipstick guide from coolant inlet.

5) Disconnect coolant hose from oil cooler. Remove relief valve and plate washer from center of oil cooler. See Fig. 16.

6) Remove retaining nuts, oil cooler and "O" ring. If removing oil cooler bracket from cylinder block, remove bolt and disconnect coolant by-pass pipe bracket from oil cooler bracket. Remove retaining bolts, oil cooler bracket and "O" rings.

Inspection

1) Inspect oil cooler for damage or restriction. Replace oil cooler if damage or restricted.

2) Using wooden stick push inward on check valve located in center of relief valve. Push inward from threaded end (opposite oil filter threads) of relief valve. Replace relief valve if check valve fails to move.

Installation

1) To install, reverse removal procedure using NEW "O" rings. Coat all "O" rings with engine oil. Coat relief valve threads and area below head of relief valve with engine oil.

2) Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Add engine oil as required. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

OIL NOZZLES

NOTE: Cylinder block contains 4 oil nozzles, one for each piston. A relief valve check ball is located in each oil nozzle.

Removal

Remove crankshaft. See CYLINDER BLOCK under CYLINDER BLOCK ASSEMBLY under OVERHAUL. Remove oil nozzle retaining bolt that secures the oil nozzle to the cylinder block. Remove oil nozzle.

Inspection

Inspect oil nozzle for damage or restriction. Using small wooden object, ensure relief valve check ball in oil nozzle moves when pressure is applied against relief valve check ball. See Fig. 41. Replace oil nozzle if relief valve check ball fails to move.

Installation

Install oil nozzle in cylinder block. Install and tighten oil nozzle bolt to specification. See TORQUE SPECIFICATIONS. Install crankshaft using proper procedure. See CYLINDER BLOCK under CYLINDER BLOCK ASSEMBLY under OVERHAUL.

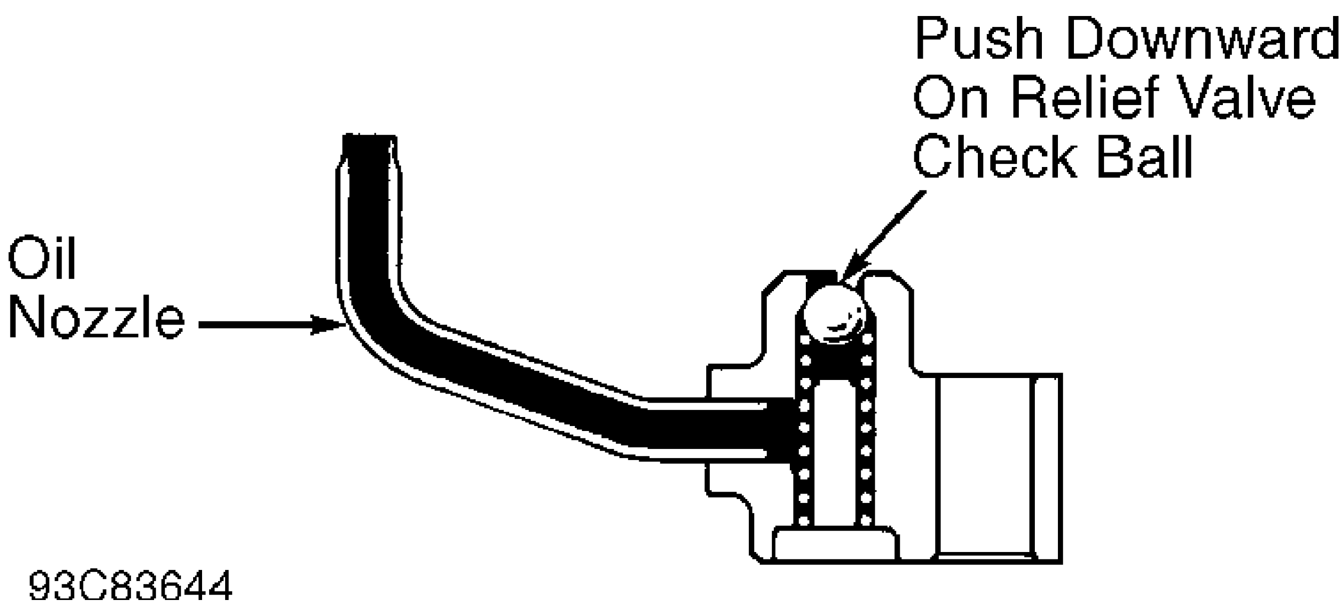

Fig. 41: Checking Oil Nozzle Relief Valve Check Ball Operation
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS - CELICA ALL-TRAC

TORQUE SPECIFICATIONS TABLE - CELICA ALL-TRAC

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	20 (27)
Alternator Bracket & Right Engine Hanger Bolt	29 (39)
Axle Shaft Nut	166 (226)
Ball Joint-To-Steering Knuckle Bolt/Nut	94 (127)
Camshaft Bearing Cap Bolt (1)	14 (19)
Camshaft Sprocket Bolt	43 (58)
Catalytic Converter Brace Bolt	43 (58)
Catalytic Converter-To-Turbocharger Bolt/Nut	21 (29)

Connecting Rod Nut	49 (66)
Coolant Outlet Bolt	29 (39)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (2)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
Delivery Pipe Bolt	14 (19)
Distributor Hold-Down Bolt	29 (39)
Drive Shaft Flange Bolt	54 (73)
Dynamic Damper Bolt	19 (26)
EGR Valve & Pipe Bolt	
At Cylinder Head	18 (24)
At Intake Manifold	14 (19)
Engine Mount Bolt/Nut	
Engine Mount-To-Engine Mount Crossmember Bolt	54 (73)
Front (Radiator Side) Engine Mount Through-Bolt	64 (87)
Left (Transaxle Side) Engine Mount-To-Bracket Bolt	46 (62)
Left (Transaxle Side) Engine Mount Through-Bolt	64 (87)
Left (Transaxle Side) Engine Mount Support Brace Bolt/Nut	15 (20)
Rear (Firewall Side) Engine Mount Through-Bolt	64 (87)
Right (Timing Belt Side) Engine Mount Bracket Bolt	38 (52)
Right (Timing Belt Side) Engine Mount Nut	38 (52)
Right (Timing Belt Side) Engine Mount Support Brace Bolt/Nut	54 (73)
Right (Timing Belt Side) Engine Mount Through-Bolt	64 (87)
Engine Mount Crossmember-To-Body Bolt	38 (52)
Exhaust Manifold Nut	38 (52)
Exhaust Pipe-To-Catalytic Converter Nut	46 (62)
Flywheel Bolt	80 (109)
Fuel Inlet Line-To-Delivery Pipe Union Bolt	22 (30)
Fuel Inlet Line-To-Fuel Line Union Bolt	22 (30)
Intake Air Connector Brace Bolt/Nut	
Bolt	14 (19)
Nut	(3)
Intake Air Connector-To-Throttle Body Bolt	14 (19)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	19 (26)
Knock Sensor	32 (43)
Left Engine Hanger Bolt	
12-mm Bolt	14 (19)
14-mm Bolt	29 (39)
Main Bearing Cap Bolt (4)	43 (58)
No. 1 Idler Pulley Bolt	38 (52)
No. 2 Idler Pulley Bolt	32 (43)
Oil Cooler Relief Valve	58 (79)
Oil Pump Sprocket Nut	26 (35)
Oxygen Sensor Nut	32 (43)
Power Steering Pump Bolt	
Adjusting Bolt	29 (39)
All Others	32 (43)
Spark Plug	13 (18)
Stiffener Support Brace Bolt	27 (37)
Strut Tower-To-Firewall Brace	
Bolt	15 (20)
Nut	47 (64)
Suspension Crossmember Bolt/Nut	112 (152)
Throttle Body Bolt	14 (19)
Tie Rod Nut	36 (49)
Timing Belt Tensioner Bolt	15 (20)

Transaxle Case Protector Bolt	13 (18)
Turbine Outlet Elbow-To-Turbocharger Nut	47 (64)
Turbocharger Brace Bolt	
Cylinder Block Side	43 (58)
Turbocharger Side	51 (69)
Turbocharger Oil Pipe Support Bracket-To-Cylinder Block Bolt	32 (43)
Turbocharger Oil Pipe-To-Cylinder Block Union Bolt	38 (52)
Turbocharger Oil Pipe-To-Turbocharger Nut	13 (18)
Turbocharger-To-Exhaust Manifold Nut	47 (64)
Wheel Lug Nut	76 (103)

	INCH Lbs. (N.m)
Coolant By-Pass Pipe-To-Water Pump Cover Nut	69 (7.8)
Cold Start Injector Bolt	52 (5.9)
Cold Start Injector Pipe Union Bolt	106 (12.0)
No. 3 Timing Belt Cover Bolt	78 (8.8)
Injector Cover Bolt	69 (7.8)
Oil Cooler Bracket-To-Cylinder Block Bolt	69 (7.8)
Oil Cooler Retaining Nut	78 (8.8)
Oil Cooler-To-Coolant By-Pass Pipe Bracket Nut	106 (12.0)
Oil Nozzle Bolt	81 (9.1)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Housing-To-Cylinder Block Bolt	69 (7.8)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Turbocharger Bearing Side Plate Nut	97 (11.0)
Turbocharger Coolant Pipe Bolt/Nut	97 (11.0)
Valve Cover Bolt	22 (2.5)
Water Pump Bolt	
Small Bolt (5)	69 (7.8)
Large Bracket Bolt	(6)
Water Pump-To-Water Pump Cover Bolt	82 (9.3)

(1) - Tighten bolts to specification in sequence. See Fig. 28.
(2) - Tighten bolts to specification in sequence. See Fig. 17.
(3) - Tighten bolt to 69 INCH lbs. (7.8 N.m).
(4) - Tighten bolts to specification in sequence. See Fig. 37.
(5) - Tighten bolts to specification in sequence. See Fig. 32.
(6) - Tighten large bracket bolt to 14 ft. lbs. (19 N.m).

TORQUE SPECIFICATIONS - MR2

TORQUE SPECIFICATIONS TABLE - MR2

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	18 (24)
Air By-Pass Valve Bolt	14 (19)
Axle Shaft Nut	217 (294)
Ball Joint-To-Axle Carrier Bolt	83 (113)
Bearing Bracket Support Brace Bolt/Nut	55 (75)
Bearing Bracket-To-Cylinder Block Bolt	47 (64)
Bearing Retaining Bolt	24 (33)
Brake Caliper Bolt	43 (58)

Camshaft Bearing Cap Bolt (1)	14 (19)
Camshaft Sprocket Bolt	43 (58)
Catalytic Converter Brace Bolt	43 (58)
Catalytic Converter-To-Turbocharger Bolt/Nut	21 (29)
Connecting Rod Nut	49 (66)
Coolant Outlet Bolt	29 (39)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (2)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
Delivery Pipe Bolt	14 (19)
Distributor Hold-Down Bolt	29 (39)
EGR Valve & Pipe Bolt	
At Cylinder Head	18 (24)
At Intake Manifold	14 (19)
Engine Mounts & Brackets	
Front (Exhaust Manifold Side) Engine Mount Through-Bolt	71 (96)
Front (Exhaust Manifold Side) Engine Mount-To-Body Bolt	54 (73)
Left (Transaxle Side) Engine Mount Bolt	(3)
Left (Transaxle Side) Engine Mount Support Brace Bolt	
Mount Side	54 (73)
Transaxle Side	18 (24)
Left (Transaxle Side) Engine Mount Through-Bolt	58 (79)
Rear (Intake Manifold Side) Engine Mount-To-Crossmember Bolt	47 (64)
Rear (Intake Manifold Side) Engine Mount Through-Bolt	64 (87)
Right (Timing Belt Side) Engine Mount Bracket Bolt	45 (61)
Right (Timing Belt Side) Engine Mount Insulator Nut	38 (52)
Right (Timing Belt Side) Engine Mount Support Brace Bolt	54 (73)
Right (Timing Belt Side) Engine Mount Through-Bolt	58 (79)
Exhaust Manifold Nut	38 (52)
Flywheel Bolt	80 (109)
Fuel Inlet Line-To-Delivery Pipe Union Bolt	22 (30)
Fuel Inlet Line-To-Fuel Filter Union Bolt	22 (30)
Intake Air Connector Brace Bolt	
10-mm	(4)
12-mm Bolt	14 (19)
Intake Air Connector-To-Throttle Body Bolt/Nut	14 (19)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	19 (26)
Knock Sensor	27 (37)
Left Engine Hanger Bolt	
12-mm Bolt	(5)
14-mm Bolt	29 (39)
Lower Control Arm-To-Body Bolt/Nut	97 (132)
Main Bearing Cap Bolt (6)	43 (58)
No. 1 Idler Pulley Bolt	38 (52)
No. 2 Idler Pulley Bolt	32 (43)
No. 4 Air Tube Brace Bolt	14 (19)
Oil Cooler Relief Valve	58 (79)
Oil Pump Sprocket Nut	26 (35)
Oxygen Sensor Nut	33 (45)
Rear Suspension Crossmember Bolt	83 (113)
Spark Plug	13 (18)
Stabilizer Link-To-Strut Nut	36 (49)
Stiffener Support Brace Bolt	27 (37)

Strut Rod-To-Lower Control Arm Nut	87 (118)
Strut Tower-To-Firewall Brace	
Bolt	54 (73)
Nut	47 (64)
Suspension Rod-To-Axle Carrier Bolt/Nut	76 (103)
Throttle Body Bolt	14 (19)
Timing Belt Tensioner Bolt	15 (20)
Turbine Outlet Elbow-To-Turbocharger Nut	47 (64)
Turbocharger Brace Bolt	
Cylinder Block Side	43 (58)
Turbocharger Side	51 (69)
Turbocharger Oil Pipe Support Bracket-To-Cylinder Block Bolt	32 (43)
Turbocharger Oil Pipe-To-Cylinder Block Union Bolt	38 (52)
Turbocharger Oil Pipe-To-Turbocharger Nut	13 (18)
Turbocharger-To-Exhaust Manifold Nut	47 (64)
Wheel Lug Nut	76 (103)

	INCH Lbs. (N.m)
ABS Speed Sensor Bolt	65 (7.4)
Coolant By-Pass Pipe-To-Water Pump Cover Bolt/Nut	69 (7.8)
Cold Start Injector Bolt	52 (5.9)
Cold Start Injector Pipe Union Bolt	106 (12.0)
Injector Cover Bolt	69 (7.8)
No. 3 Timing Belt Cover Bolt	78 (8.8)
Oil Cooler Bracket-To-Cylinder Block Bolt	69 (7.8)
Oil Cooler Retaining Nut	78 (8.8)
Oil Cooler-To-Coolant By-Pass Pipe Bracket Nut	106 (12.0)
Oil Nozzle Bolt	81 (9.1)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Housing-To-Cylinder Block Bolt	69 (7.8)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Turbocharger Bearing Side Plate Nut	97 (11.0)
Turbocharger Coolant Pipe Bolt/Nut	97 (11.0)
Valve Cover Bolt	22 (2.5)
Water Pump Bolt	
Small Bolt (7)	69 (7.8)
Large Bracket Bolt	(8)
Water Pump-To-Water Pump Cover Bolt	82 (9.3)

(1) - Tighten bolts to specification in sequence. See Fig. 28.
(2) - Tighten bolts to specification in sequence. See Fig. 17.
(3) - Tighten bolts to specification. See Fig. 15.
(4) - Tighten bolt to 69 INCH lbs. (7.8 N.m).
(5) - Tighten bolt to 115 INCH lbs. (13.0 N.m).
(6) - Tighten bolts to specification in sequence. See Fig. 37.
(7) - Tighten bolts to specification in sequence. See Fig. 32.
(8) - Tighten large bracket bolt to 20 ft. lbs. (27 N.m).

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS TABLE

Application	Specification
Displacement	122 Cu. In. (2.0L)
Bore	3.39" (86.1 mm)
Stroke	3.39" (86.1 mm)
Compression Ratio	8.8:1
Fuel System	PFI
Horsepower @ RPM	200 @ 6000
Torque Ft. Lbs. @ RPM	200 @ 3200

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING
ROD BEARINGS SPECIFICATIONS TABLE

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.0118 (.300)
Maximum Runout	.0024 (.060)
Main Bearings	
Journal Diameter (1)	
Size Mark "0"	2.1653-2.1655 (54.998-55.003)
Size Mark "1"	2.1651-2.1653 (54.993-54.998)
Size Mark "2"	2.1649-2.1651 (54.988-54.993)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft Journal	
No. 3 Journal	
Standard	.0010-.0017 (.025-.044)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0006-.0013 (.015-.034)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft Journal	
No. 3 Journal	
Standard	.0008-.0024 (.021-.061)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0011-.0027 (.029-.069)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	1.8892-1.8898 (47.985-48.000)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft Journal	
Standard	.0009-.0022 (.024-.055)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft Journal	
Standard	.0009-.0027 (.023-.069)
Wear Limit	.0031 (.080)

(1) - Main journal diameter is determined by main bearing journal size mark on crankshaft. See Fig. 38.

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	
Pin Bushing	.8663-.8668 (22.005-22.017)
Maximum Bend	.0020 Per 3.94 (.051 Per 100.1)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	.0063-.0123 (.160-.312)
Wear Limit	.0138 (.350)

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

Application	In. (mm)
Pistons	
Clearance	
Standard	.0028-.0035 (.070-.090)
Wear Limit	.0043 (.110)
Diameter (1)	
Size Mark "1"	3.3827-3.3831 (85.920-85.930)
Size Mark "2"	3.3831-3.3835 (85.930-85.940)
Size Mark "3"	3.3835-3.3839 (85.940-85.950)
Pins	
Diameter	.8660-.8665 (21.997-22.009)
Piston Fit	(2)
Rod Fit	
Standard	.0002-.0004 (.005-.011)
Wear Limit	.0020 (.050)
Rings	
No. 1	
End Gap	
Standard	.0130-.0217 (.330-.550)
Wear Limit	.0335 (.850)
Side Clearance	.0016-.0031 (.041-.080)
No. 2	
End Gap	
Standard	.0177-.0264 (.450-.670)
Wear Limit	.0382 (.970)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0236 (.200-.600)
Wear Limit	.0354 (.900)

(1) - Piston diameter is determined by size mark stamped on top of piston. See Fig. 33.
(2) - With piston heated to 140°F (60°C), piston pin should slide onto piston using thumb pressure.

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATIONS TABLE

Application	In. (mm)

Cylinder Bore	
Standard Diameter (1)	
Size Mark "1"	3.3858-3.3862 (86.000-86.010)
Size Mark "2"	3.3862-3.3866 (86.010-86.020)
Size Mark "3"	3.3866-3.3870 (86.020-86.030)
Maximum Deck Warpage	.002 (.05)
Main Bearing Bore I.D. (2)	
Size Mark "1"	2.3236-2.3239 (59.020-59.026)
Size Mark "2"	2.3239-2.3241 (59.026-59.032)
Size Mark "3"	2.3241-2.3243 (59.032-59.038)

(1) - Cylinder bore diameter is determined by cylinder bore size mark on cylinder block deck surface. See Fig. 34. Maximum bore diameter is 3.3949" (86.230 mm).
(2) - Main bearing bore I.D. is determined by size mark on cylinder block. See Fig. 38.

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS SPECIFICATIONS TABLE

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)
Minimum Refinish Length	
Celica	3.9291" (99.800 mm)
MR2	4.1260" (104.800 mm)
Stem Diameter	.2346-.2352" (5.960-5.975 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)
Minimum Refinish Length	3.8917" (98.849 mm)
Stem Diameter	.2344-.2350" (5.955-5.970 mm)
Valve Springs	
Free Length	1.749" (44.43 mm)
Out-Of-Square	.079" (2.00 mm)
	Lbs. @ In. (kg @ mm)
Pressure	45-53 @ 1.354 (20-24 @ 34.40)

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD SPECIFICATIONS TABLE

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.0079" (.200 mm)
Exhaust Manifold Surface	.0118" (.300 mm)
Variable Induction Valve Surface	.0079" (.200 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.039-055" (.99-1.40 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.039-055" (.99-1.40 mm)

Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.4326-.4333" (10.988-11.006 mm)
Oversize Valve Guide	.4346-.4353" (11.038-11.056 mm)
Valve Guide I.D.	.2362-.2369" (6.000-6.018 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0010-.0023" (.025-.058 mm)
Wear Limit	.0031" (.080 mm)
Exhaust Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.4326-.4333" (10.988-11.006 mm)
Oversize Valve Guide	.4346-.4353" (11.038-11.056 mm)
Valve Guide I.D.	.2362-.2369" (6.000-6.018 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0025" (.030-.063 mm)
Wear Limit	.0039" (.099 mm)

CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

Application	In. (mm)
End Play	
Standard	.0047-.0094 (.120-.240)
Wear Limit	.0118 (.300)
Journal Diameter	1.0614-1.0620 (26.959-26.975)
Journal Runout	.0024 (.060)
Lobe Height	
Exhaust Valve	
Celica	
Standard	1.6177-1.6217 (41.090-41.190)
Wear Limit	1.5740 (39.980)
MR2	
Standard	1.6146-1.6185 (41.010-41.110)
Wear Limit	1.5709 (39.991)
Intake Valve	
Celica & MR2	
Standard	1.6146-1.6185 (41.010-41.110)
Wear Limit	1.5709 (39.991)
Oil Clearance	
Standard	.0010-.0024 (.025-.062)
Wear Limit	.0031 (.080)

VALVE LIFTERS SPECIFICATIONS

VALVE LIFTERS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	
Celica	1.2205-1.2213 (31.000-31.021)
MR2	1.1024-1.1032 (28.000-28.021)
Lifter Diameter	
Celica	1.2195-1.2199 (30.975-30.985)
MR2	1.1014-1.1018 (27.975-27.985)
Oil Clearance	
Standard	.0006-.0018 (.015-.046)
Wear Limit	.0028 (.070)

1993 TOYOTA ENGINES
2.2L 4-Cylinder

Camry, Celica, MR2

* PLEASE READ THIS FIRST *

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

NOTE: On Camry applications only, 2 balance shafts are located in balance shaft assembly at bottom of cylinder block, below crankshaft. The No. 1 balance shaft is driven by a drive gear on No. 3 crankshaft counterweight. Balance shaft assembly is used to reduce engine vibration.

ENGINE IDENTIFICATION

Engine serial number is stamped on flywheel/drive plate end of cylinder block, below cylinder head surface.

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code	VIN Code
Camry, Celica & MR2		
2.2L 4-Cylinder	5S-FE	S

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine cold.

1) Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

2) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure valve lifters are loose on cylinder No. 1 and tight on cylinder No. 4. If conditions are not as described, rotate crankshaft one complete revolution (360 degrees).

3) With cylinder No. 1 at TDC on compression stroke, check valve clearance on specified valves. Perform STEP 1. See Fig. 1. Using feeler gauge, measure and record valve clearance between valve lifter and camshaft.

4) To check remaining valves, rotate crankshaft clockwise 360 degrees (one revolution) until cylinder No. 4 cylinder is at TDC on compression stroke. Measure and record valve clearance on specified valves. Perform STEP 2. See Fig. 1.

5) Ensure valve clearance is within specification. See VALVE CLEARANCE SPECIFICATIONS table.

VALVE CLEARANCE SPECIFICATIONS (1) TABLE

Application	In. (mm)

Exhaust Valve	....	.011-.015 (.28-.38)
Intake Valve	....	.007-.011 (.19-.28)

(1) - Adjust valve clearance with engine cold.

6) If valve clearance requires adjustment, rotate camshaft so lobe on valve to be adjusted is facing upward, away from valve lifter. Rotate valve lifter so notch on valve lifter is toward spark plug.

7) Use Valve Clearance Adjuster (SST 09248-55020) to remove adjusting shim. Using SST "A" of valve clearance adjuster, push downward on valve lifter. Place SST "B" between camshaft and valve lifter with side marked with No. 9 at designated position. See Fig. 2. Remove SST "A".

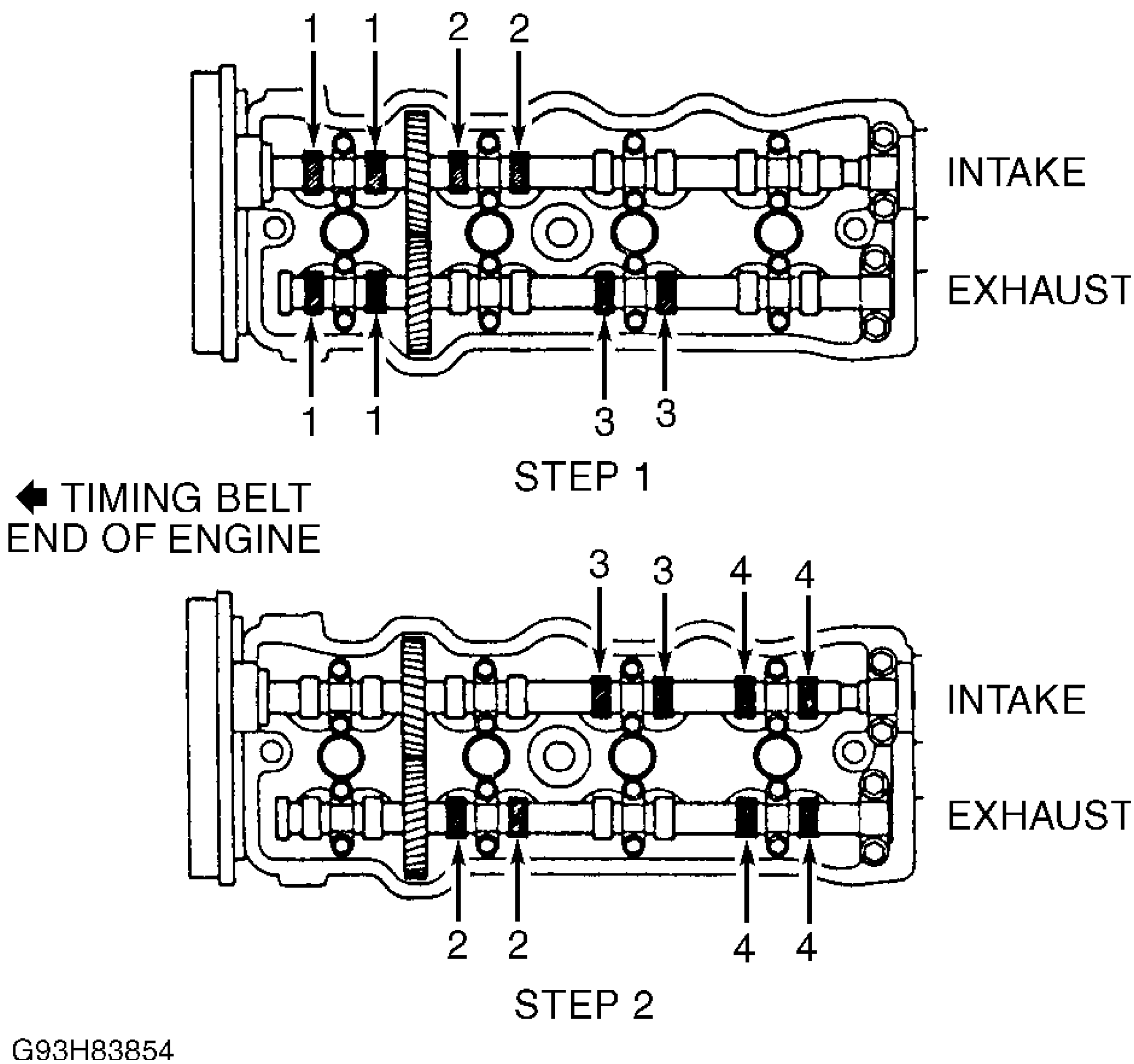

Fig. 1: Checking Valve Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

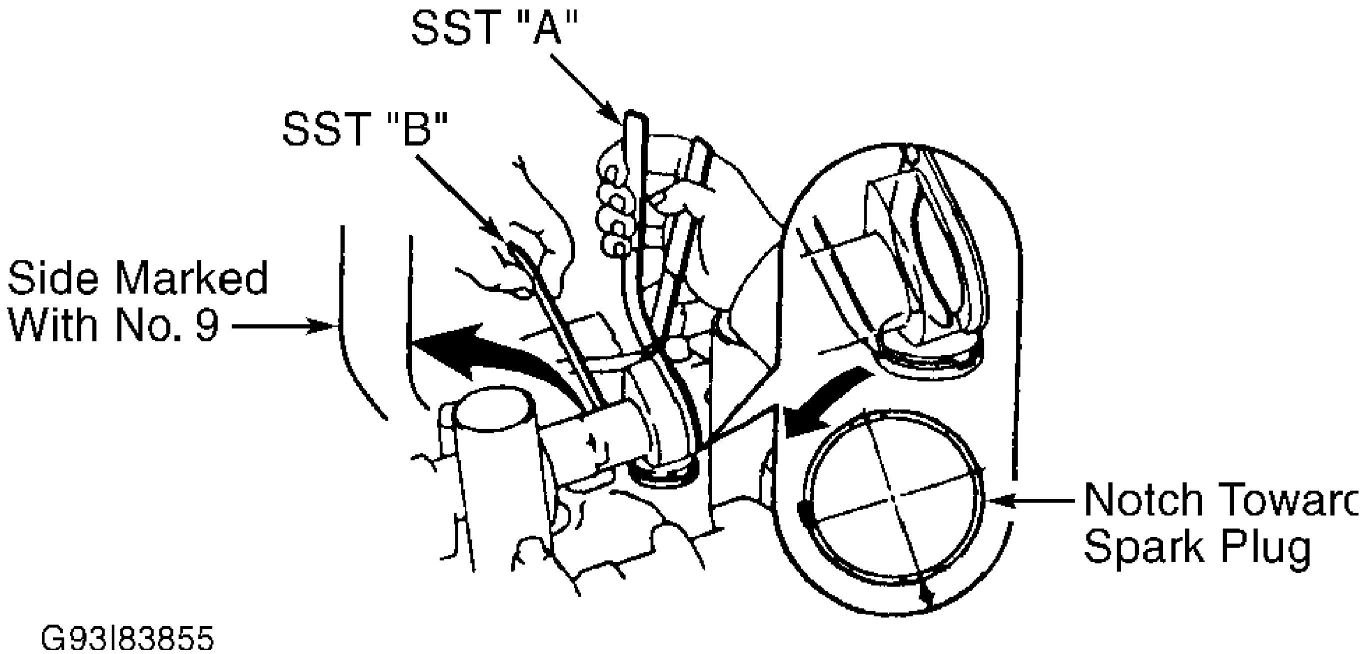

Fig. 2: Adjusting Valve Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Using small screwdriver and magnet, remove adjusting shim. Measure and record thickness of adjusting shim removed. Using measured valve clearance and adjusting shim thickness, select proper replacement adjusting shim. See Figs. 5, 6, 7, 8, 9 and 10.

9) Install replacement adjusting shim. Recheck valve clearance. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See Fig. 3. Using NEW gasket, install valve cover.

10) Install grommets in original location with marking on grommet in aligned in designated area. See Fig. 4. Install and tighten valve cover nuts to specification. See TORQUE SPECIFICATIONS.

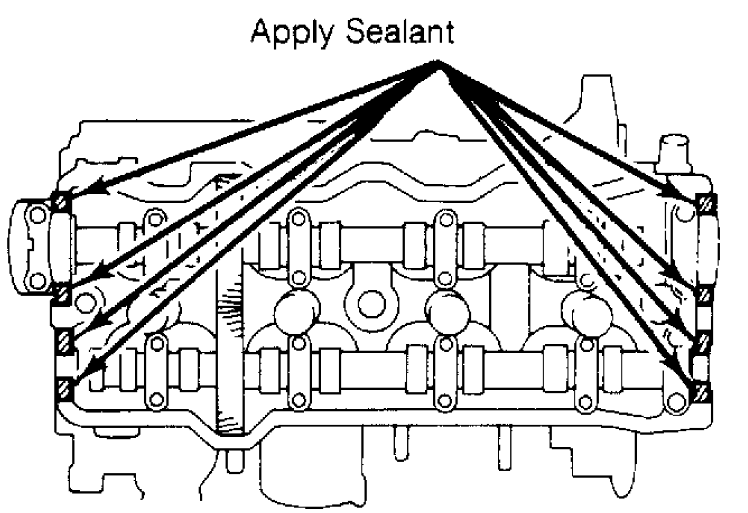

Fig. 3: Applying Sealant On Cylinder Head
Courtesy of Toyota Motor Sales, U.S.A., Inc.

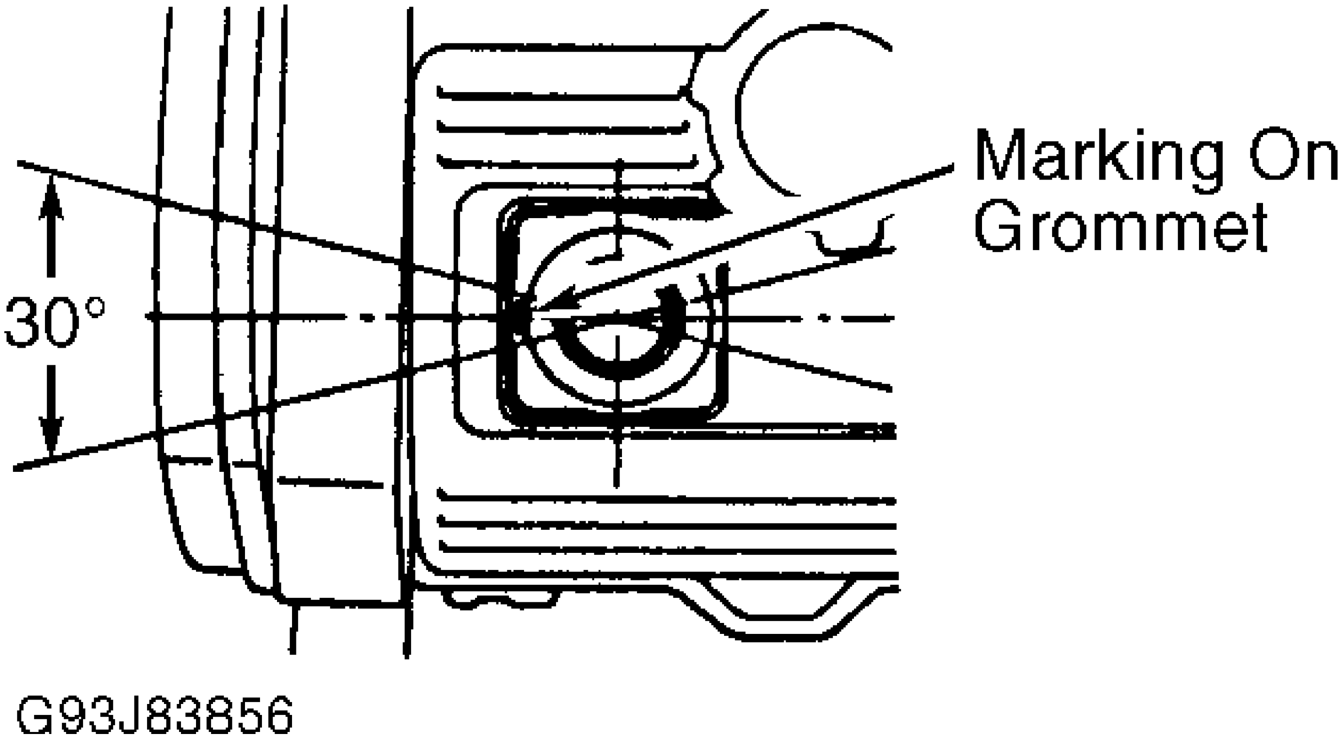

Fig. 4: Aligning Valve Cover Grommets
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Measured clearance mm (in.) \ Installed shim thickness mm (in.)	2.50 (0.0984)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)	2.58 (0.1016)	2.60 (0.1024)	2.62 (0.1031)	2.64 (0.1039)	2.65 (0.1043)	2.66 (0.1047)	2.67 (0.1051)	2.68 (0.1055)	2.69 (0.1059)	2.70 (0.1063)	2.71 (0.1067)	2.72 (0.1071)	2.73 (0.1075)	2.74 (0.1079)	2.75 (0.1083)	2.76 (0.1087)	2.77 (0.1091)	2.78 (0.1094)	2.79 (0.1098)	2.80 (0.1102)	2.81 (0.1106)	2.82 (0.1110)	2.83 (0.1114)	2.84 (0.1118)	2.85 (0.1122)	2.86 (0.1126)	2.87 (0.1130)	2.88 (0.1134)	2.89 (0.1138)	2.90 (0.1142)	2.91 (0.1146)	2.92 (0.1150)	2.93 (0.1154)	2.94 (0.1157)	2.95 (0.1161)	2.96 (0.1165)	2.97 (0.1169)	2.98 (0.1173)	2.99 (0.1177)	3.00 (0.1181)	3.01 (0.1185)
0.000 - 0.020 (0.0000 - 0.0008)													1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7
0.021 - 0.040 (0.0008 - 0.0016)											1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7
0.041 - 0.060 (0.0016 - 0.0024)									1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7
0.061 - 0.080 (0.0024 - 0.0031)								1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8
0.081 - 0.100 (0.0032 - 0.0039)							1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8
0.101 - 0.120 (0.0040 - 0.0047)						1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9
0.121 - 0.140 (0.0048 - 0.0055)					1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9
0.141 - 0.160 (0.0056 - 0.0063)				1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9
0.161 - 0.180 (0.0063 - 0.0071)			1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10
0.181 - 0.189 (0.0071 - 0.0074)		1	1	1	1	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10
0.190 - 0.290 (0.0075 - 0.0114)																																													
0.291 - 0.300 (0.0115 - 0.0118)	2	3	3	3	4	4	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12
0.301 - 0.320 (0.0119 - 0.0126)	2	3	3	4	4	4	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13
0.321 - 0.340 (0.0126 - 0.0134)	3	3	4	4	4	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13
0.341 - 0.360 (0.0134 - 0.0142)	3	4	4	4	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13
0.361 - 0.380 (0.0142 - 0.0150)	4	4	4	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14
0.381 - 0.400 (0.0150 - 0.0157)	4	4	5	5	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14
0.401 - 0.420 (0.0158 - 0.0165)	4	5	5	6	6	6	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15
0.421 - 0.440 (0.0166 - 0.0173)	5	5	6	6	6	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15
0.441 - 0.460 (0.0174 - 0.0181)	5	6	6	6	7	7	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15
0.461 - 0.480 (0.0181 - 0.0189)	6	6	6	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16
0.481 - 0.500 (0.0189 - 0.0197)	6	6	7	7	8	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16
0.501 - 0.520 (0.0197 - 0.0205)	6	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17
0.521 - 0.540 (0.0205 - 0.0213)	7	7	8	8	8	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17
0.541 - 0.560 (0.0213 - 0.0220)	7	8	8	8	9	9	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17
0.561 - 0.580 (0.0221 - 0.0228)	8	8	8	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17
0.581 - 0.600 (0.0229 - 0.0236)	8	8	9	9	10	10	10	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17		
0.601 - 0.620 (0.0237 - 0.0244)	8	9	9	10	10	10	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17				
0.621 - 0.640 (0.0244 - 0.0252)	9	9	10	10	10	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17						
0.641 - 0.660 (0.0252 - 0.0260)	9	10	10	10	11	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17								
0.661 - 0.680 (0.0260 - 0.0268)	10	10	10	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17										
0.681 - 0.700 (0.0268 - 0.0276)	10	10	11	11	12	12	12	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17												
0.701 - 0.720 (0.0276 - 0.0283)	10	11	11	12	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17														
0.721 - 0.740 (0.0284 - 0.0291)	11	11	12	12	12	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																
0.741 - 0.760 (0.0292 - 0.0299)	11	12	12	12	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																		
0.761 - 0.780 (0.0300 - 0.0307)	12	12	12	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																				
0.781 - 0.800 (0.0307 - 0.0315)	12	12	13	13	14	14	14	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																						
0.801 - 0.820 (0.0315 - 0.0323)	12	13	13	14	14	14	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																								
0.821 - 0.840 (0.0323 - 0.0331)	13	13	14	14	14	15	15	16	16	16	16	16	17	17	17	17	17	17	17																										
0.841 - 0.860 (0.0331 - 0.0339)	13	14	14	14	15	15	16	16	16	16	17	17	17	17	17	17	17																												
0.861 - 0.880 (0.0339 - 0.0346)	14	14	14	15	15	16	16	16	17	17	17	17	17	17	17																														
0.881 - 0.900 (0.0347 - 0.0354)	14	14	15	15	16	16	16	17	17	17	17	17	17																																
0.901 - 0.920 (0.0355 - 0.0362)	14	15	15	16	16	16	17	17	17	17	17																																		
0.921 - 0.940 (0.0363 - 0.0370)	15	15	16	16	16	17	17	17	17																																				
0.941 - 0.960 (0.0370 - 0.0378)	15	16	16	16	17	17	17																																						
0.961 - 0.980 (0.0378 - 0.0386)	16	16	16	17	17	17																																							
0.981 - 1.000 (0.0386 - 0.0394)	16	16	17	17	17																																								
1.001 - 1.020 (0.0394 - 0.0402)	16	17	17	17																																									
1.021 - 1.040 (0.0402 - 0.0409)	17	17	17																																										
1.041 - 1.060 (0.0410 - 0.0417)	17	17																																											
1.061 - 1.080 (0.0418 - 0.0425)	17																																												
1.081 - 1.090 (0.0426 - 0.0429)	17																																												

92I24776

Fig. 5: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.50 (0.0984)	10	2.95 (0.1161)
2	2.55 (0.1004)	11	3.00 (0.1181)
3	2.60 (0.1024)	12	3.05 (0.1201)
4	2.65 (0.1043)	13	3.10 (0.1220)
5	2.70 (0.1063)	14	3.15 (0.1240)
6	2.75 (0.1083)	15	3.20 (0.1260)
7	2.80 (0.1102)	16	3.25 (0.1280)
8	2.85 (0.1122)	17	3.30 (0.1299)
9	2.90 (0.1142)		

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EXAMPLE: A 0.1102" (2.800 mm) shim is installed and measured clearance is 0.0177" (0.450 mm). Replace 0.1102" (2.800 mm) shim with a No. 11 shim.

Fig. 6: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

INTAKE VALVES

Measured clearance mm (in.) \ Installed shim thickness mm (in.)	3.02 (0.1189)	3.03 (0.1193)	3.04 (0.1197)	3.05 (0.1201)	3.06 (0.1205)	3.08 (0.1213)	3.10 (0.1220)	3.12 (0.1228)	3.14 (0.1236)	3.15 (0.1240)	3.16 (0.1244)	3.18 (0.1252)	3.20 (0.1260)	3.22 (0.1268)	3.24 (0.1276)	3.25 (0.1280)	3.26 (0.1283)	3.28 (0.1291)	3.30 (0.1299)
0.000 0.020 (0.0000 - 0.0008)	7	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12
0.021 - 0.040 (0.0008 - 0.0016)	7	7	8	8	8	8	9	9	10	10	10	10	11	11	12	12	12	12	13
0.041 - 0.060 (0.0016 - 0.0024)	8	8	8	8	8	9	9	10	10	10	10	11	11	12	12	12	12	13	13
0.061 - 0.080 (0.0024 - 0.0031)	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14
0.081 - 0.100 (0.0032 - 0.0039)	8	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14
0.101 - 0.120 (0.0040 - 0.0047)	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14
0.121 - 0.140 (0.0048 - 0.0055)	9	9	10	10	10	10	11	11	12	12	12	12	13	13	14	14	14	14	15
0.141 - 0.160 (0.0056 - 0.0063)	10	10	10	10	10	11	11	12	12	12	12	13	13	14	14	14	14	15	15
0.161 - 0.180 (0.0063 - 0.0071)	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16
0.181 - 0.189 (0.0071 - 0.0074)	10	10	11	11	11	11	12	12	13	13	13	13	14	14	15	15	15	15	16
0.190 - 0.290 (0.0075 - 0.0114)																			
0.291 - 0.300 (0.0115 - 0.0118)	13	13	13	13	13	14	14	15	15	15	15	16	16	17	17	17	17	17	
0.301 - 0.320 (0.0119 - 0.0126)	13	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17		
0.321 - 0.340 (0.0126 - 0.0134)	13	13	14	14	14	14	15	15	16	16	16	16	17	17	17	17			
0.341 - 0.360 (0.0134 - 0.0142)	14	14	14	14	14	15	15	16	16	16	16	17	17	17					
0.361 - 0.380 (0.0142 - 0.0150)	14	14	14	15	15	15	16	16	16	17	17	17	17						
0.381 - 0.400 (0.0150 - 0.0157)	14	15	15	15	15	16	16	16	17	17	17	17							
0.401 - 0.420 (0.0158 - 0.0165)	15	15	15	15	16	16	16	17	17	17	17								
0.421 - 0.440 (0.0166 - 0.0173)	15	15	16	16	16	16	17	17	17	17									
0.441 - 0.460 (0.0174 - 0.0181)	16	16	16	16	16	17	17	17											
0.461 - 0.480 (0.0181 - 0.0189)	16	16	16	17	17	17	17												
0.481 - 0.500 (0.0189 - 0.0197)	16	17	17	17	17	17													
0.501 - 0.520 (0.0197 - 0.0205)	17	17	17	17	17														
0.521 - 0.540 (0.0205 - 0.0213)	17	17	17	17															
0.541 - 0.560 (0.0213 - 0.0220)	17	17																	

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Fig. 7: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Measured clearance mm (in.) \ Installed shim thickness mm (in.)	2.50 (0.0984)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)	2.58 (0.1016)	2.60 (0.1024)	2.62 (0.1031)	2.64 (0.1039)	2.65 (0.1043)	2.66 (0.1047)	2.67 (0.1051)	2.68 (0.1055)	2.69 (0.1059)	2.70 (0.1063)	2.71 (0.1067)	2.72 (0.1071)	2.73 (0.1075)	2.74 (0.1079)	2.75 (0.1083)	2.76 (0.1087)	2.77 (0.1091)	2.78 (0.1094)	2.79 (0.1098)	2.80 (0.1102)	2.81 (0.1106)	2.82 (0.1110)	2.83 (0.1114)	2.84 (0.1118)	2.85 (0.1122)	2.86 (0.1126)	2.87 (0.1130)	2.88 (0.1134)	2.89 (0.1138)	2.90 (0.1142)	2.91 (0.1146)	2.92 (0.1150)	2.93 (0.1154)	2.94 (0.1157)	2.95 (0.1161)	2.96 (0.1165)	2.97 (0.1169)
0.000 - 0.020 (0.0000 - 0.0008)																								1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4
0.021 - 0.040 (0.0008 - 0.0016)																				1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4
0.041 - 0.060 (0.0016 - 0.0024)																		1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5
0.061 - 0.080 (0.0024 - 0.0031)																1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5
0.081 - 0.100 (0.0032 - 0.0039)														1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6
0.101 - 0.120 (0.0040 - 0.0047)												1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6
0.121 - 0.140 (0.0048 - 0.0055)										1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6
0.141 - 0.160 (0.0056 - 0.0063)								1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7
0.161 - 0.180 (0.0063 - 0.0071)							1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7
0.181 - 0.200 (0.0071 - 0.0079)						1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8
0.201 - 0.220 (0.0079 - 0.0087)					1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8
0.221 - 0.240 (0.0087 - 0.0094)				1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8
0.241 - 0.260 (0.0095 - 0.0102)			1	1	1	1	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9
0.261 - 0.279 (0.0103 - 0.0110)		1	1	1	1	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9
0.280 - 0.380 (0.0110 - 0.0150)																																									
0.381 - 0.400 (0.0150 - 0.0157)	2	3	3	3	4	4	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12
0.401 - 0.420 (0.0158 - 0.0165)	3	3	3	4	4	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12
0.421 - 0.440 (0.0166 - 0.0173)	3	3	4	4	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12
0.441 - 0.460 (0.0174 - 0.0181)	3	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13
0.461 - 0.480 (0.0181 - 0.0189)	4	4	5	5	5	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13
0.481 - 0.500 (0.0189 - 0.0197)	4	5	5	5	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14
0.501 - 0.520 (0.0197 - 0.0205)	5	5	5	6	6	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14
0.521 - 0.540 (0.0205 - 0.0213)	5	5	6	6	7	7	7	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14
0.541 - 0.560 (0.0213 - 0.0220)	5	6	6	7	7	7	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15
0.561 - 0.580 (0.0221 - 0.0228)	6	6	7	7	7	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15
0.581 - 0.600 (0.0229 - 0.0236)	6	7	7	7	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16
0.601 - 0.620 (0.0237 - 0.0244)	7	7	7	8	8	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16
0.621 - 0.640 (0.0244 - 0.0252)	7	7	8	8	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16
0.641 - 0.660 (0.0252 - 0.0260)	7	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17
0.661 - 0.680 (0.0260 - 0.0268)	8	8	9	9	9	10	10	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17
0.681 - 0.700 (0.0268 - 0.0276)	8	9	9	9	10	10	11	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17
0.701 - 0.720 (0.0276 - 0.0283)	9	9	9	10	10	11	11	11	12	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17	
0.721 - 0.740 (0.0284 - 0.0291)	9	9	10	10	11	11	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17			
0.741 - 0.760 (0.0292 - 0.0299)	9	10	10	11	11	11	12	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17					
0.761 - 0.780 (0.0300 - 0.0307)	10	10	11	11	11	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17							
0.781 - 0.800 (0.0307 - 0.0315)	10	11	11	11	12	12	13	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17									
0.801 - 0.820 (0.0315 - 0.0323)	11	11	11	12	12	13	13	13	14	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17											
0.821 - 0.840 (0.0323 - 0.0331)	11	11	12	12	13	13	13	14	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17													
0.841 - 0.860 (0.0331 - 0.0339)	11	12	12	13	13	13	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17															
0.861 - 0.880 (0.0339 - 0.0346)	12	12	13	13	13	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																	
0.881 - 0.900 (0.0347 - 0.0354)	12	13	13	13	14	14	15	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																			
0.901 - 0.920 (0.0355 - 0.0362)	13	13	13	14	14	15	15	15	16	16	16	16	16	17	17	17	17	17	17	17																					
0.921 - 0.940 (0.0363 - 0.0370)	13	13	14	14	15	15	15	16	16	16	16	17	17	17	17	17	17	17																							
0.941 - 0.960 (0.0370 - 0.0378)	13	14	14	15	15	15	16	16	16	17	17	17	17	17	17	17																									
0.961 - 0.980 (0.0378 - 0.0386)	14	14	15	15	15	16	16	17	17	17	17	17	17	17																											
0.981 - 1.000 (0.0386 - 0.0394)	14	15	15	15	16	16	17	17	17	17	17	17																													
1.001 - 1.020 (0.0394 - 0.0402)	15	15	15	16	16	17	17	17	17	17																															
1.021 - 1.040 (0.0402 - 0.0409)	15	15	16	16	17	17	17	17																																	
1.041 - 1.060 (0.0410 - 0.0417)	15	16	16	17	17	17	17																																		
1.061 - 1.080 (0.0418 - 0.0425)	16	16	17	17	17	17																																			
1.081 - 1.100 (0.0426 - 0.0433)	16	17	17	17	17																																				
1.101 - 1.120 (0.0433 - 0.0441)	17	17	17	17																																					
1.121 - 1.140 (0.0441 - 0.0449)	17	17	17																																						
1.141 - 1.160 (0.0449 - 0.0457)	17	17																																							
1.161 - 1.180 (0.0457 - 0.0465)	17																																								

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Fig. 8: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.50 (0.0984)	10	2.95 (0.1161)
2	2.55 (0.1004)	11	3.00 (0.1181)
3	2.60 (0.1024)	12	3.05 (0.1201)
4	2.65 (0.1043)	13	3.10 (0.1220)
5	2.70 (0.1063)	14	3.15 (0.1240)
6	2.75 (0.1083)	15	3.20 (0.1260)
7	2.80 (0.1102)	16	3.25 (0.1280)
8	2.85 (0.1122)	17	3.30 (0.1299)
9	2.90 (0.1142)		

92E24780

EXAMPLE: A 0.1102" (2.800 mm) shim is installed and measured clearance is 0.0177" (0.450 mm). Replace 0.1102" (2.800 mm) shim with a No. 9 shim.

Fig. 9: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EXHAUST VALVES

Measured clearance mm (in.) \ Installed shim thickness mm (in.)	2.98 (0.1173)	2.99 (0.1177)	3.00 (0.1181)	3.01 (0.1185)	3.02 (0.1189)	3.03 (0.1193)	3.04 (0.1197)	3.05 (0.1201)	3.06 (0.1205)	3.08 (0.1213)	3.10 (0.1220)	3.12 (0.1228)	3.14 (0.1236)	3.15 (0.1240)	3.16 (0.1244)	3.18 (0.1252)	3.20 (0.1260)	3.22 (0.1268)	3.24 (0.1276)	3.25 (0.1280)	3.26 (0.1283)	3.28 (0.1291)	3.30 (0.1299)
0.000 - 0.020 (0.0000 - 0.0008)	4	4	5	5	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11
0.021 - 0.040 (0.0008 - 0.0016)	5	5	5	5	5	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11
0.041 - 0.060 (0.0016 - 0.0024)	5	5	5	6	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11
0.061 - 0.080 (0.0024 - 0.0031)	5	6	6	6	6	6	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12
0.081 - 0.100 (0.0032 - 0.0039)	6	6	6	6	7	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12	12
0.101 - 0.120 (0.0040 - 0.0047)	6	6	7	7	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.121 - 0.140 (0.0048 - 0.0055)	7	7	7	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13
0.141 - 0.160 (0.0056 - 0.0063)	7	7	7	8	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13
0.161 - 0.180 (0.0063 - 0.0071)	7	8	8	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14
0.181 - 0.200 (0.0071 - 0.0079)	8	8	8	8	9	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.201 - 0.220 (0.0079 - 0.0087)	8	8	9	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.221 - 0.240 (0.0087 - 0.0094)	9	9	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.241 - 0.260 (0.0095 - 0.0102)	9	9	9	10	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15
0.261 - 0.279 (0.0103 - 0.0110)	9	10	10	10	10	10	11	11	11	11	12	12	13	13	13	13	14	14	15	15	15	15	16
0.280 - 0.380 (0.0110 - 0.0150)																							
0.381 - 0.400 (0.0150 - 0.0157)	12	12	12	12	13	13	13	13	13	14	14	15	15	15	15	16	16	17	17	17	17	17	
0.401 - 0.420 (0.0158 - 0.0165)	12	12	13	13	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17		
0.421 - 0.440 (0.0166 - 0.0173)	13	13	13	13	13	14	14	14	14	15	15	15	16	16	16	17	17	17	17				
0.441 - 0.460 (0.0174 - 0.0181)	13	13	13	14	14	14	14	14	15	15	15	16	16	16	17	17	17	17					
0.461 - 0.480 (0.0181 - 0.0189)	3	14	14	14	14	14	15	15	15	15	16	16	17	17	17	17	17						
0.481 - 0.500 (0.0189 - 0.0197)	4	14	14	14	15	15	15	15	15	16	16	17	17	17	17	17							
0.501 - 0.520 (0.0197 - 0.0205)	4	14	15	15	15	15	15	16	16	16	17	17	17	17	17								
0.521 - 0.540 (0.0205 - 0.0213)	5	15	15	15	15	16	16	16	16	17	17	17	17										
0.541 - 0.560 (0.0213 - 0.0220)	5	15	15	16	16	16	16	16	17	17	17	17											
0.561 - 0.580 (0.0221 - 0.0228)	5	16	16	16	16	16	17	17	17	17	17												
0.581 - 0.600 (0.0229 - 0.0236)	6	16	16	16	17	17	17	17	17	17													
0.601 - 0.620 (0.0237 - 0.0244)	6	16	17	17	17	17	17	17	17														
0.621 - 0.640 (0.0244 - 0.0252)	7	17	17	17	17	17	17																
0.641 - 0.660 (0.0252 - 0.0260)	7	17	17	17	17																		
0.661 - 0.680 (0.0260 - 0.0268)	7	17	17																				
0.681 - 0.700 (0.0268 - 0.0276)	7																						

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Fig. 10: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

CAUTION: To prevent air bag deployment, disconnect negative battery cable at least 30 seconds before working on vehicle.

FUEL PRESSURE RELEASE

With ignition off, disconnect negative battery cable. Place suitable container under fuel line connection. Cover fuel line connection with shop towel. Slowly loosen fuel line connection, allowing fuel pressure to be released. Once fuel pressure is released, fuel system components can be removed.

COOLING SYSTEM BLEEDING

Camry & Celica
No special cooling system bleeding procedure is required.

MR2

1) Remove spare tire, front luggage compartment trim and upper radiator support seal. Connect air bleed hoses to heater and radiator air drain plugs. See Fig. 11. Attach and support opposite end of air bleed hoses to hood or hood support. Ensure air bleed hoses are not pinched.

2) Place heater control lever to the warmest position. Open heater and radiator air drain plugs at least 3 turns.

3) Slowly add coolant through coolant filler. See Fig. 11. Air will bleed from air bleed hoses on heater and radiator air drain plugs. Ensure coolant level in air bleed hoses and coolant filler are at the same level. See Fig. 11.

4) If coolant level in air bleed hoses is lower, air still exists in cooling system. Check for pinched or restriction in air bleed hoses and repeat step 3). When proper coolant level is obtained in air bleed hoses, close heater and radiator air drain plugs. Remove air bleed hoses.

5) Install radiator cap on coolant filler to the first stop point. DO NOT fully tighten radiator cap to the second stop point. Start engine and allow to idle for 3 minutes. Shut engine off. Recheck coolant level in coolant filler.

6) Add coolant if necessary and repeat step 5). Recheck coolant level. If proper coolant level exists, install radiator cap and fully tighten to the second stop point. Fill coolant reservoir tank to the FULL line. Reinstall upper radiator support seal.

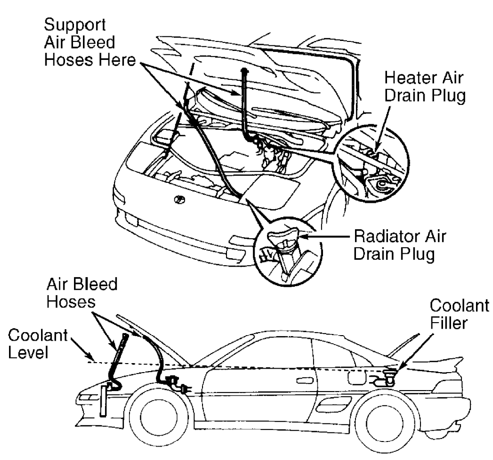

Fig. 11: Installing Air Bleed Hoses & Identifying Coolant Filler (MR2)

Courtesy of Toyota Motor Sales, U.S.A., Inc.

ENGINE

NOTE: Remove engine and transaxle as an assembly.

Removal (Camry)

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Remove hood, battery and battery tray. Drain cooling system and engine oil.

2) Disconnect control cables at throttle body. Remove air intake duct with air cleaner assembly and air cleaner case. Remove cruise control actuator (if equipped). Remove radiator and coolant reservoir tank.

3) Remove windshield washer fluid reservoir tank. Disconnect electrical connections at relay box, located near driver's side front corner of engine compartment. Disconnect electrical connections at ignitor and noise filter on driver's side front fender.

4) Disconnect necessary electrical connections, coolant hose, vacuum hoses and fuel lines. Remove A/C compressor (if equipped) and power steering pump with hoses attached and secure aside.

5) Remove lower instrument panel cover and glove box. Disconnect connectors at Engine Control Module (ECM) and remaining engine wiring connectors. See Fig. 12. Remove nuts from firewall and pull engine wiring out through firewall.

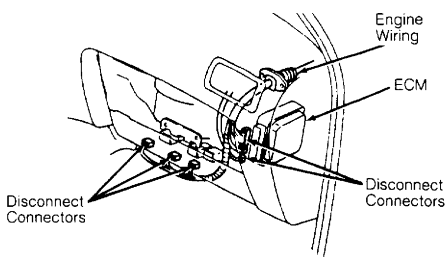

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Fig. 12: Identifying ECM & Engine Wiring Connectors (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Raise and support vehicle. Remove lower engine covers. On M/T models, remove clutch release cylinder with hose attached and secure aside. Remove starter. On A/T models, disconnect oil cooler lines at transaxle.

7) On all models, disconnect control cables and electrical connections at transaxle. Disconnect front exhaust pipe from front catalytic converter or exhaust manifold.

NOTE: Front catalytic converter is bolted to exhaust manifold on California models only.

8) Remove front wheels. Remove cotter pin and retainer from end of axle shaft. Loosen axle shaft nut while applying the brakes. Remove axle shaft nut.

9) Remove inner fenderwell aprons for access to axle shaft. Drain transaxle fluid. Remove nut and separate tie rod from steering knuckle.

10) Disconnect stabilizer bar link from lower control arm. Remove ball joint-to-lower control arm bolts/nuts. Cover axle shaft boots with shop towel.

11) Using soft-faced hammer, tap axle shaft from hub assembly. Pull steering knuckle outward and separate axle shaft from hub assembly.

12) To remove left (driver's side) axle shaft, pry between transaxle case and axle shaft until axle shaft disengages from transaxle. See Figs. 13 & 14.

13) To remove right (passenger's side) axle shaft, remove axle shaft bearing bolt. See Figs. 13 & 14. Remove snap ring from axle shaft bearing retainer. See Fig. 13 & 14. Pull right axle shaft from transaxle.

14) Support engine with hoist. Disconnect engine and transaxle mounts. Lift engine and transaxle from vehicle.

Fig. 13: Removing Left Axle Shafts (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

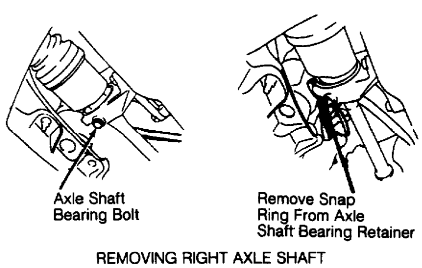


Fig. 14: Removing Right Axle Shaft (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) To install, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

2) When installing control rod and bracket on strut tower and right (timing belt side) engine mount, tighten bolts to specification in sequence. See Figs. 15.

3) Before installing axle shafts, install NEW snap ring on end of left axle shaft. Coat axle shaft seals in transaxle with grease. Coat axle shaft splines and sliding surfaces with gear oil. Position snap ring on end of left axle shaft with opening facing downward.

4) Install left axle shaft by lightly tapping axle shaft into transaxle. Ensure left axle shaft will move inward and outward approximately .079-.120" (2.00-3.00 mm) and cannot be pulled from transaxle.

5) When installing right axle shaft, install NEW snap ring and NEW axle shaft bearing bolt. Tighten axle shaft bearing bolt to specification. See TORQUE SPECIFICATIONS.

6) To install remaining components, reverse removal procedure. Use NEW gasket when installing front exhaust pipe on catalytic converter. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Adjust fluid levels and control cables.

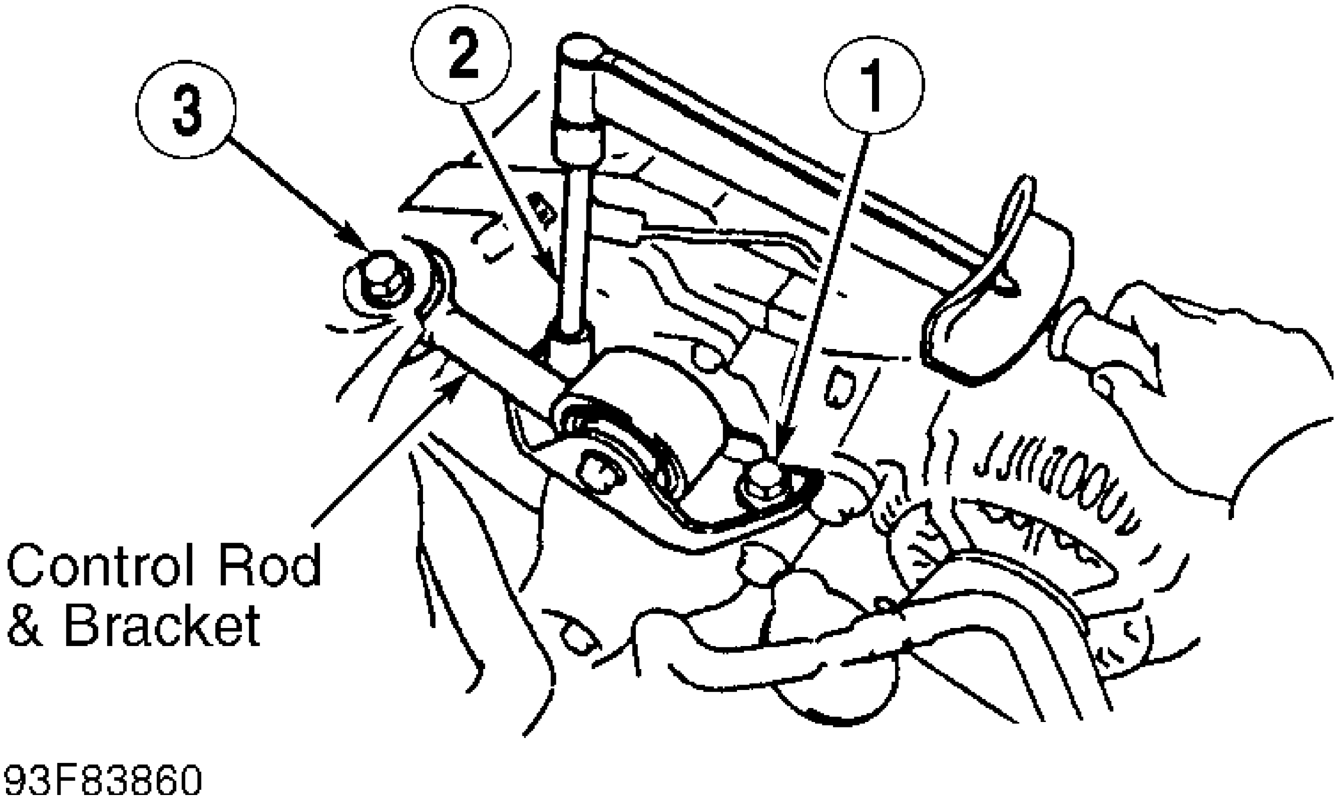


Fig. 15: Control Rod & Bracket Bolt Installation Sequence (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Remove engine and transaxle as an assembly.

Removal (Celica)

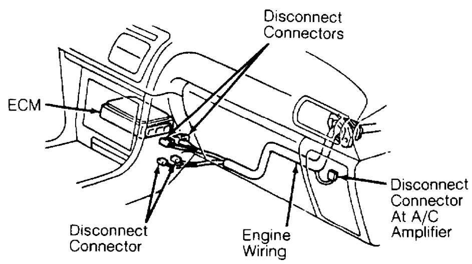
1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Remove hood and battery. Drain cooling system and engine oil.

2) Remove air intake duct with air cleaner assembly and air cleaner case. Remove relay box from bracket, located near battery. Remove lower cover from relay box. Disconnect fusible link assembly and other electrical connectors from relay box.

3) Remove A/C relay box from bracket, located near passenger's side front corner of engine compartment. Remove cruise control actuator and bracket (if equipped).

4) Remove radiator and coolant reservoir tank. Remove strut tower-to-firewall braces. Disconnect necessary control cables, electrical connections, fuel lines, coolant hoses and vacuum hoses.

5) Remove charcoal canister. Remove A/C compressor (if equipped) and power steering pump with hoses attached and secure aside. Disconnect connectors at Engine Control Module (ECM) and remaining engine wiring connectors. See Fig. 16. Remove nuts from firewall and pull engine wiring out through firewall.



93G83861
Fig. 16: Identifying ECM & Engine Wiring Connectors (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Raise and support vehicle. Remove lower engine covers. On M/T models, remove clutch release cylinder with hose attached and secure aside. Remove starter.

7) On A/T models, disconnect oil cooler lines at transaxle. On all models, disconnect control cables and electrical connections at transaxle.

8) Remove suspension crossmember bolted to both lower suspension arms. Remove front exhaust pipe, located between catalytic converter on exhaust manifold are center exhaust pipe.

9) Remove front wheels. Remove cotter pin and retainer from end of axle shaft. Loosen axle shaft nut while applying the brakes. Remove axle shaft nut.

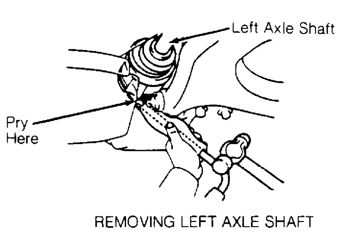
10) Drain transaxle fluid. Remove brake caliper. Place reference mark on brake rotor and hub assembly for reassembly reference. Remove brake rotor. Remove nut and separate tie rod from steering knuckle.

11) Remove ball joint-to-lower control arm bolts/nuts. Cover axle shaft boots with shop towel. Using puller attached to hub assembly, press axle shaft from hub assembly.

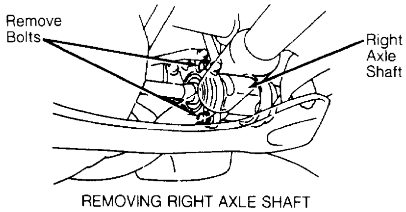
12) Pull steering knuckle outward and separate axle shaft from hub assembly. To remove left (driver's side) axle shaft, pry between transaxle case and axle shaft until axle shaft disengages from transaxle. See Fig. 17 & 18.

13) To remove right (passenger's side) axle shaft, remove the 2 right axle shaft bearing retainer bracket bolts. See Fig. 17 & 18. Remove right axle shaft assembly.

14) Support engine with hoist. Remove engine mount crossmember located below engine. Mark direction of installation on all engine mounts for reassembly reference. Disconnect engine and transaxle mounts. Lift engine and transaxle from vehicle.



93H83862
Fig. 17: Removing Left Axle Shafts (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93I83863
Fig. 18: Removing Right Axle Shafts (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) To install, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Install all bolts/nuts in engine and transaxle mounts before tightening to specification.

2) Before installing axle shafts, install NEW snap ring on end of left axle shaft. Coat axle shaft seals in transaxle with grease. Coat axle shaft splines and sliding surfaces with gear oil. Position snap ring on end of left axle shaft with opening facing downward.

3) Install left axle shaft by lightly tapping axle shaft into transaxle. Ensure axle shaft cannot be pulled from transaxle.

4) When installing right axle shaft, ensure pin on bearing aligns with hole on right axle shaft bearing retainer bracket. Install and tighten right axle shaft bearing retainer bracket bolts to specification. See TORQUE SPECIFICATIONS.

5) To install remaining components, reverse removal procedure. Ensure reference marks on brake rotor and hub assembly are aligned. Use NEW gasket when installing front exhaust pipe on catalytic converter. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Adjust fluid levels and control cables.

NOTE: Remove engine and transaxle as an assembly.

Removal (MR2)

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Drain cooling system, engine oil and transaxle oil.

2) Remove hood, hood side panels and lower engine covers. Disconnect throttle linkage at throttle body. Remove air intake duct with air cleaner assembly and air cleaner case. Remove cruise control actuator (if equipped).

3) Remove Manifold Absolute Pressure (MAP) sensor from the body. See Fig. 19. Remove data link connector, located near MAP sensor, from the body.

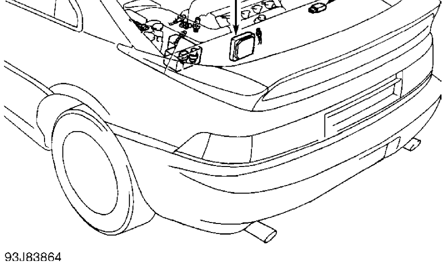


Fig. 19: Identifying ECM & MAP Sensor (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Disconnect necessary coolant hoses, fuel lines, vacuum hoses and electrical connections at engine. Remove A/C vacuum switching valve assembly, located near throttle body and mounted on side of the vehicle body.

5) Remove radiator cap and coolant filler. See Fig. 11. Remove charcoal canister. Remove bolts from relay box located near strut tower. Disconnect luggage compartment cable near relay box. Remove upper and lower covers from relay box.

6) Disconnect positive cable and electrical connections from relay box. Disconnect electrical connections from igniter, noise filter and coil wire from ignition coil.

7) Disconnect electrical connectors from Engine Control Module (ECM) located near luggage compartment. See Fig. 19. Disconnect remaining electrical connectors near ECM for removal of engine wiring. See Fig. 20. Pull engine wiring out through opening in luggage compartment.

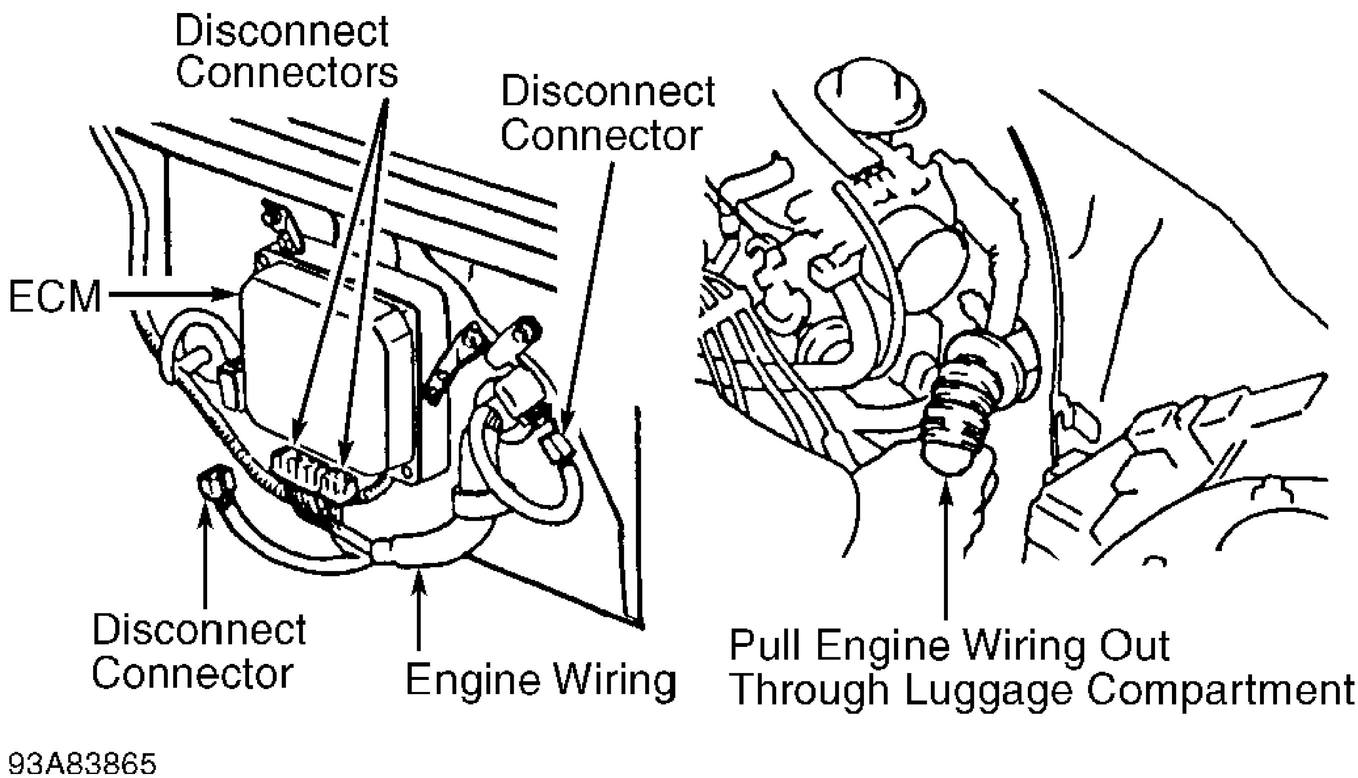


Fig. 20: Identifying Engine Wiring (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Raise and support vehicle. Disconnect control cables and electrical connections at transaxle. On A/T models, disconnect oil cooler hoses at transaxle. On all models, remove front exhaust pipe, located between muffler and catalytic converter on exhaust manifold.

9) Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove rear wheels. Remove cotter pin and retainer from end of axle shaft. Apply parking brake. Remove axle shaft nut. Release parking brake.

10) Remove brake caliper with hose attached and secure aside. Place reference marks on hub assembly and brake rotor for reassembly reference. Remove brake rotor.

11) Remove nut and disconnect stabilizer link from strut assembly. On models with Anti-Lock Brake System (ABS), remove bolt and pull ABS speed sensor from axle carrier.

12) Remove ball joint-to-axle carrier bolts. Separate ball joint with lower control arm from axle carrier. Remove suspension rod-to-axle carrier bolt/nut. Separate suspension rod from axle carrier. Suspension rod is located at rear of axle carrier.

13) Cover axle shaft boot with shop towel. Using puller attached to hub assembly, press axle shaft from hub assembly. To remove left (driver's side) axle shaft, pry axle shaft from transaxle. See Figs. 21 & 22.

14) To remove right (passenger's side) axle shaft, use hammer and brass drift to tap axle shaft from transaxle. See Figs. 21 & 22. Support engine with hoist.

15) Remove engine mount through-bolt and bolts from front (exhaust manifold side) and rear (intake manifold side) engine mounts. Remove transaxle control cable bracket (A/T) or clutch release cylinder (M/T) with hose attached and secure aside.

16) Remove remaining engine mounts, support brackets and through-bolts. Lift engine and transaxle from vehicle.

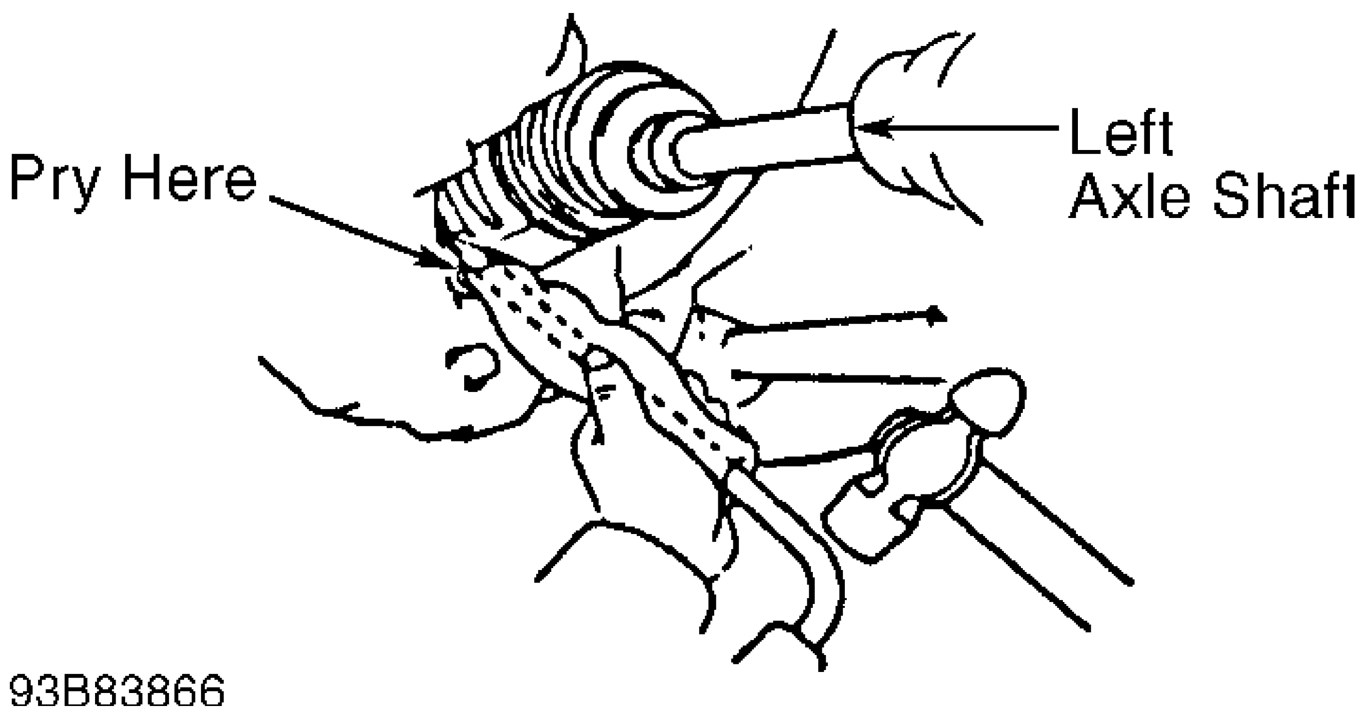


Fig. 21: Removing Left Axle Shafts (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

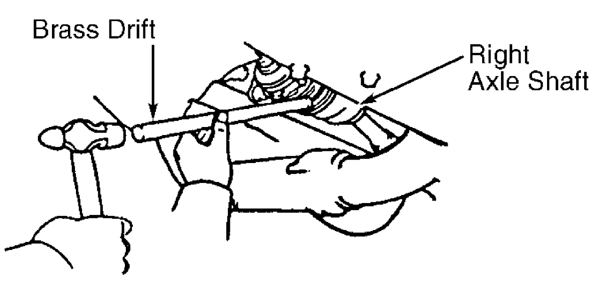


Fig. 22: Removing Right Axle Shafts (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) Install engine and transaxle in engine compartment. Engine

mounts must be installed and bolts/nuts tightened using the following procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

2) Install right (timing belt side) engine mount-to-body with through-bolt loosely installed. Secure right (timing belt side) engine mount-to-mounting bracket with nuts loosely installed.

3) Install left (flywheel side) engine mount-to-body mount with through-bolt loosely installed. Install left (flywheel side) engine mount-to-bracket bolts and tighten to specification. See Fig. 23. Tighten left (flywheel side) engine mount through-bolt to specification.

4) Tighten right (timing belt side) engine mount-to-mounting bracket nuts and then the through-bolt to specification. Install support bracket on top of right (timing belt side) engine mount. Tighten support bracket bolt/nut to specification.

5) Install control rod and bracket on top of left (flywheel side) engine mount and at the body. On M/T models, install control rod support on top of control rod and bracket. On all models, install all bolts in control rod and bracket before tightening to specification.

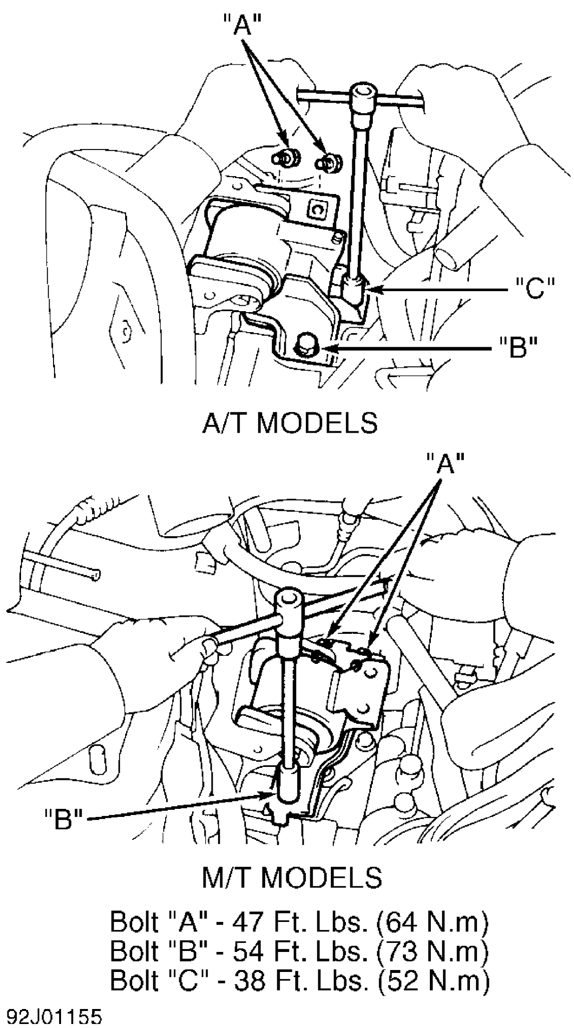


Fig. 23: Installing Left (Flywheel Side) Engine Mount Bolts (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Install transaxle control cable bracket (A/T models) or clutch release cylinder (M/T models). Install front (exhaust manifold

side) engine mount-to-body bolts. Tighten bolts to specification. Loosely install through-bolt in front (exhaust manifold side) engine mount.

7) Install rear (intake manifold side) engine mount bracket-to-body bolts. Tighten bolts to specification. Install rear (intake manifold side) engine mount-to-body bolts. Loosely install through-bolt.

8) Tighten rear (intake manifold side) engine mount-to-body bolts and then the through-bolt to specification. Tighten front (exhaust manifold side) engine mount through-bolt to specification.

9) To install remaining components, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

10) Before installing axle shaft, install NEW snap ring on end of axle shaft. Coat axle shaft seals in transaxle with grease. Coat axle shaft splines and sliding surfaces with gear oil. Position snap ring on end of axle shaft with opening facing downward.

11) Install axle shaft by lightly tapping axle shaft into transaxle. Ensure axle shaft will move inward and outward approximately .079-.120" (2.00-3.00 mm) and cannot be pulled from transaxle.

12) Ensure reference marks on brake rotor and hub assembly are aligned. Tighten suspension rod-to-axle carrier bolt/nut to specification after vehicle is lowered to ground and bounced several times to stabilize suspension components.

13) Use NEW gasket when installing front exhaust pipe. Adjust control cables and fluid levels. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CYLINDER HEAD & MANIFOLDS

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Drain cooling system. Raise and support vehicle. Remove lower engine covers.

2) Disconnect control cables or linkages at throttle body. Remove air intake duct with air cleaner assembly. Remove cruise control actuator (if equipped). Remove alternator (if necessary). Remove distributor.

3) On MR2, remove hood side panels. Remove front exhaust pipe, located between muffler and catalytic converter on exhaust manifold. Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside.

4) On Celica, remove suspension crossmember bolted to both lower suspension arms. On Celica and Camry, remove front exhaust pipe, located between catalytic converter on exhaust manifold and center exhaust pipe.

NOTE: On Camry Calif. models, catalytic converter is bolted to exhaust manifold. Federal and Canada models do not use this catalytic converter on exhaust manifold.

5) On Camry Federal and Canada models, remove heat insulator and exhaust manifold. On all other models, remove heat insulator from top of exhaust manifold and catalytic converter braces. See Fig. 24. Remove nuts, exhaust manifold with catalytic converter and exhaust manifold gasket.

6) Remove catalytic converter, cushion, retainer and gasket from exhaust manifold (if necessary). See Fig. 24. Disconnect necessary electrical connections, coolant hoses and vacuum hoses from throttle body, cylinder head and intake manifold.

7) Remove coolant outlet, coolant by-pass pipe and gaskets. See Fig. 24. Remove throttle body and gasket. Remove EGR valve and

vacuum modulator, and EGR Vacuum Switching Valve (VSV). See Fig. 24.

8) On MR2, remove fuel pressure Vacuum Switching Valve (VSV) assembly from side of intake manifold. On Camry and Celica, remove air pipe. See Fig. 24.

9) On all models, remove intake manifold braces, intake manifold and gasket. Disconnect electrical connections from fuel injectors. Disconnect fuel lines from fuel delivery pipe.

10) Remove bolts and fuel delivery pipe. DO NOT allow fuel injectors to fall from fuel delivery pipe during removal. Remove insulators and spacers for fuel delivery pipe from cylinder head.

NOTE: After removing timing belt from camshaft sprocket, manufacturer recommends keeping tension on timing belt so belt does not come off crankshaft sprocket. If timing belt comes off crankshaft sprocket, timing belt must be completely removed and reinstalled.

11) Remove timing belt from camshaft sprocket. Remove camshaft sprocket, No. 1 idler pulley and tension spring. See TIMING BELT under REMOVAL & INSTALLATION.

12) Remove No. 3 timing belt cover from cylinder head. See Fig. 24. Remove camshafts. See CAMSHAFT under REMOVAL & INSTALLATION.

CAUTION: Cylinder head bolts must be loosened in proper sequence to prevent cylinder head warpage.

13) Loosen cylinder head bolts in proper sequence using several steps. See Fig. 25. Remove cylinder head bolts, washers, cylinder head and cylinder head gasket. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

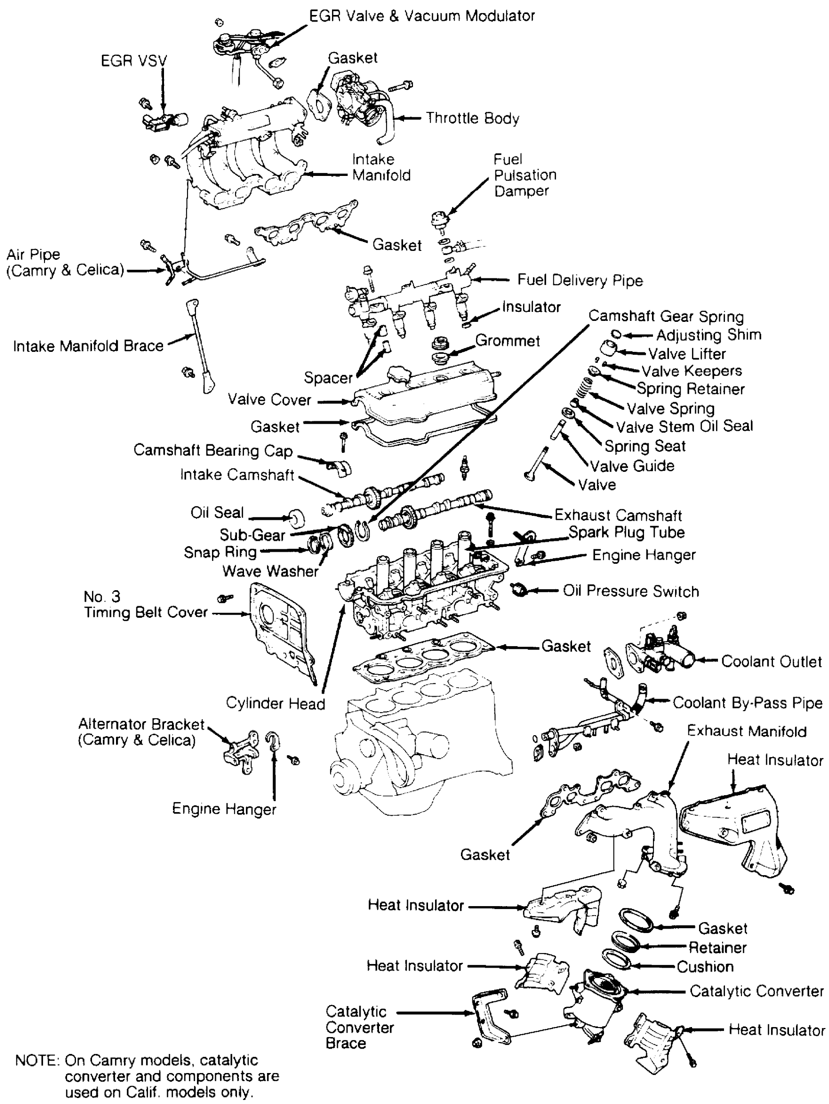


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Fig. 24: Exploded View Of Typical Cylinder Head & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

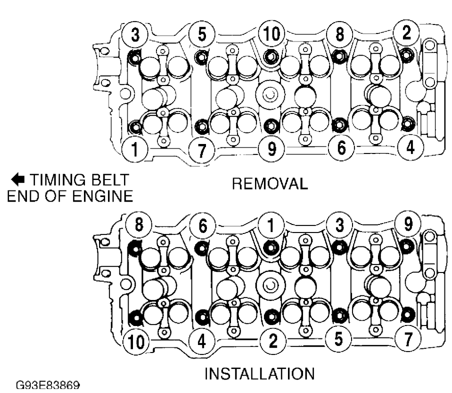

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Fig. 25: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect cylinder head warpage at cylinder block, exhaust manifold and intake manifold surfaces. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Inspect cylinder block deck for warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

3) Inspect intake and exhaust manifold machined surfaces for warpage. Replace component if warpage exceeds .0118" (.300 mm). Inspect camshaft and components. See CAMSHAFT under REMOVAL & INSTALLATION.

4) Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if not within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Installation

1) Install adjusting shims and valve lifters in original location on cylinder head (if removed). Install NEW cylinder head gasket on cylinder block. Ensure all holes in cylinder head gasket align with holes in cylinder block.

2) Install cylinder head. Apply engine oil on cylinder head bolt threads and cylinder head bolt-to-cylinder head contact surfaces. Install and tighten cylinder head bolts to specification in sequence. See Fig. 25. See TORQUE SPECIFICATIONS.

3) Install camshafts using proper procedure. See CAMSHAFT under REMOVAL & INSTALLATION. Install No. 3 timing belt cover. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS.

4) To install remaining components, reverse removal procedure. If camshaft or cylinder head components are serviced, adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

5) Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See Fig. 3. Using NEW gasket, install valve cover.

6) Install grommets in original location with marking on grommet in aligned in designated area. See Fig. 4. Install and tighten valve cover nuts to specification. See TORQUE SPECIFICATIONS.

7) If installing fuel injector in fuel delivery pipe, replace "O" ring and grommet on fuel injector. Coat NEW "O" ring with gasoline. Using twisting motion, install fuel injector into fuel delivery pipe.

8) When installing fuel delivery pipe, install NEW insulators on cylinder head. Install spacers and fuel delivery pipe with fuel injectors on cylinder head. Position electrical connector on fuel injector facing toward top of engine.

9) Install and slightly tighten fuel delivery pipe bolts. Ensure all fuel injectors rotates smoothly. If fuel injector fails to rotate smoothly, check for damaged "O" rings. Tighten fuel delivery pipe bolts to specification. See TORQUE SPECIFICATIONS.

10) Install NEW throttle body gasket with protruding area on gasket facing toward bottom of throttle body. Ensure longer throttle body bolts are installed in the 2 lower bolt holes.

11) Install NEW "O" ring on coolant by-pass pipe. Apply soapy water solution on "O" ring before installing coolant by-pass pipe. Use NEW gasket when installing catalytic converter on exhaust manifold.

12) Install NEW "O" ring on distributor. Coat "O" ring with engine oil. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

13) Ensure slot area on intake camshaft is vertically positioned. Rotate cutout on coupling so it is aligned with alignment mark on distributor housing. See Fig. 26.

14) Install distributor so center of flange on distributor is aligned with bolt hole on cylinder head. Install distributor hold-down bolts.

15) To install remaining components, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS. Adjust control cables and ignition timing. Fill cooling system. On MR2, cooling system must be bled to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CAUTION: On MR2, ensure air is bled from cooling system to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

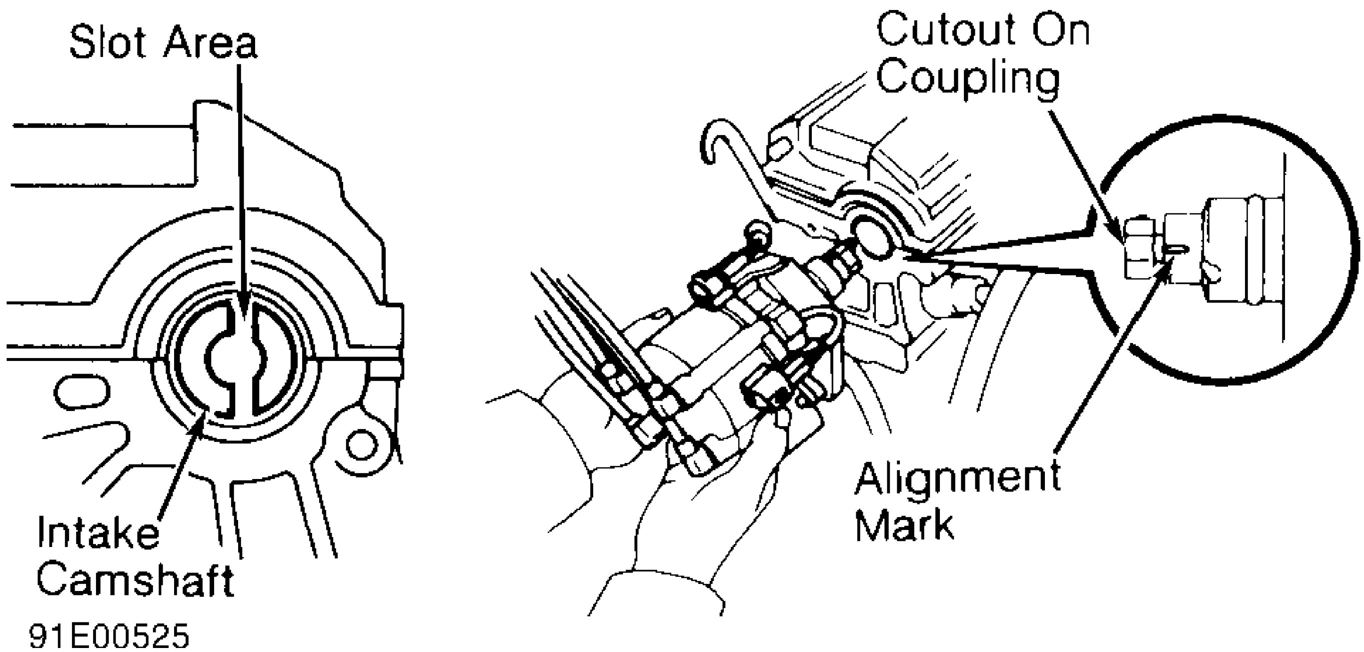

Fig. 26: Installing Distributor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CRANKSHAFT FRONT SEAL

Removal & Installation (Oil Pump Installed)

1) Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Using a knife, cut off oil seal lip. Pry seal from oil pump housing. Use care not to damage sealing surfaces.

2) To install, apply grease to lip of NEW seal. Using hammer and Seal Installer (SST 09226-10010), install seal until seal surface is even with oil pump housing. To install remaining components, reverse removal procedure.

Removal & Installation (Oil Pump Removed)

Using hammer and drift, remove seal from oil pump housing. To install, use hammer and Seal Installer (SST 09226-10010). Install seal until seal surface is even with oil pump housing. Apply grease to lip of NEW oil seal.

TIMING BELT

Removal

1) Disconnect negative battery cable. Raise and support vehicle. Remove lower engine covers.

2) On MR2, remove right hood side panel. Remove right rear wheel. On Celica and Camry, remove right front wheel and alternator. On Camry, remove coolant reservoir tank and windshield washer fluid reservoir.

3) On all models, remove cruise control actuator and bracket (if equipped). Remove accessory drive belts. Using floor jack, slightly raise engine to remove weight from right (timing belt side) engine mount at timing belt cover.

4) Remove right (timing belt side) engine mount and bracket from front of engine. Remove spark plugs. Remove No. 2 timing belt cover and gaskets. See Fig. 27.

5) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

6) Ensure timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover. Ensure hole in camshaft sprocket aligns with alignment mark on camshaft bearing cap. See Fig. 28. If hole in camshaft sprocket is not aligned with alignment mark, rotate crankshaft one full revolution.

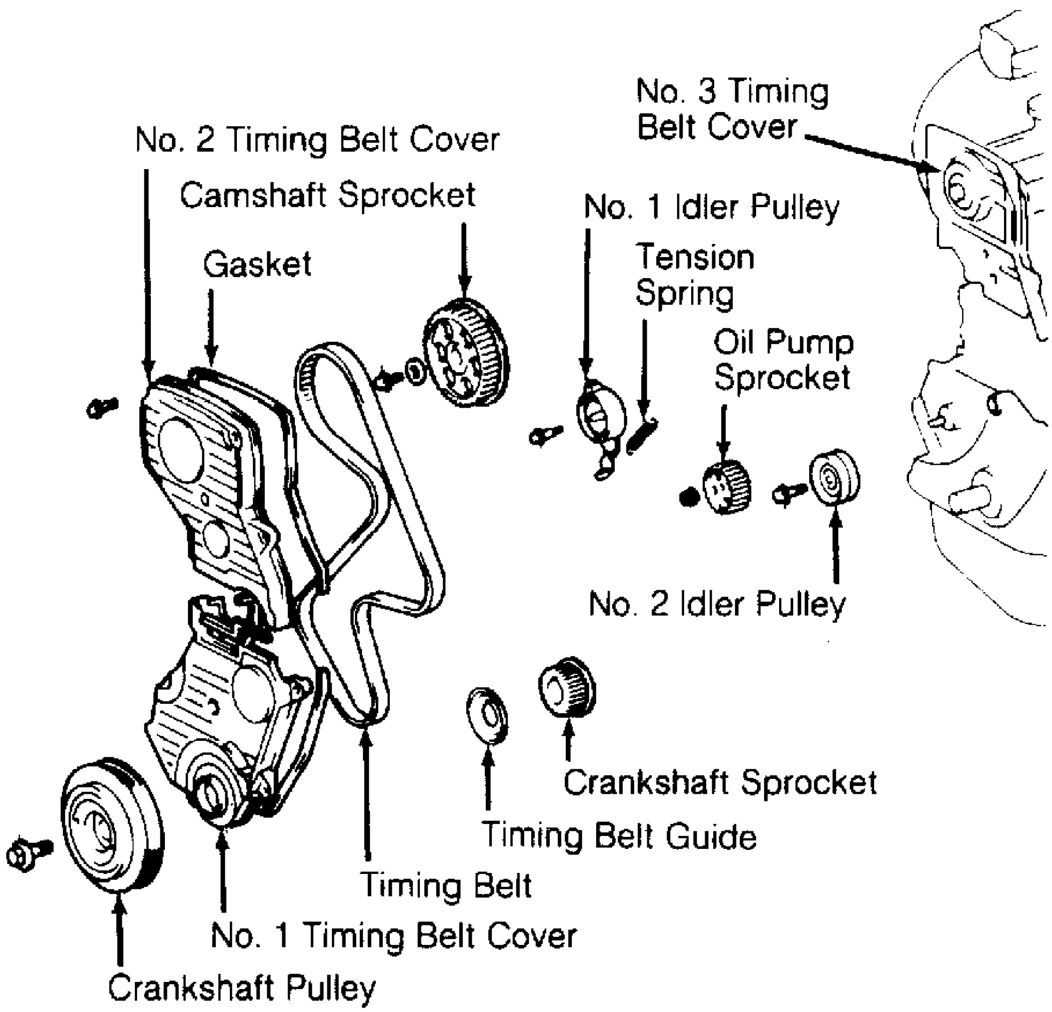

Fig. 27: Exploded View Of Timing Belt & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

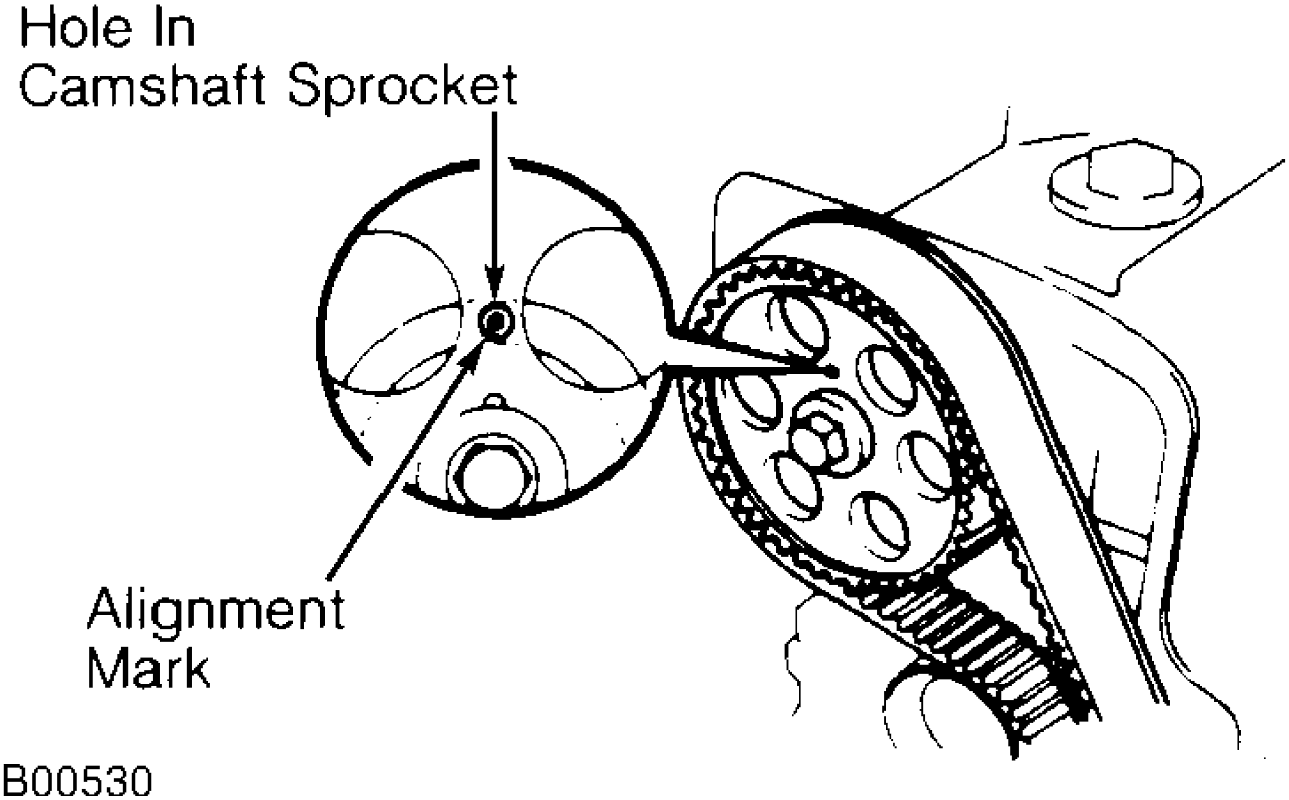

Fig. 28: Aligning Camshaft Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAUTION: If reusing timing belt, mark direction of timing belt rotation and place reference mark on timing belt at camshaft sprocket for reassembly reference. Also place reference mark on timing belt at upper edge of No. 1 timing belt cover.

7) Loosen No. 1 idler pulley bolt. See Fig. 27. Move No. 1 idler pulley outward away from timing belt as far as possible. Temporarily retighten No. 1 idler pulley bolt. Remove timing belt from camshaft sprocket.

8) Using Pulley Holder (SST 09213-54015), hold crankshaft pulley. Remove crankshaft pulley bolt.

9) If reusing timing belt, ensure reference mark placed on timing belt aligns with upper edge of No. 1 timing belt cover when timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover. If reference mark is aligned, proceed to step 14).

10) If reference mark is below surface of No. 1 timing belt cover, pull upward on water pump side of timing belt while rotating crankshaft pulley counterclockwise. Align reference mark with surface of No. 1 timing belt cover.

11) Hold upward on water pump side of timing belt. Rotate crankshaft pulley clockwise so timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover.

12) If reference mark is below above surface of No. 1 timing belt cover, pull upward on No. 1 idler pulley side of timing belt while rotating crankshaft pulley clockwise. Align reference mark with surface of No. 1 timing belt cover.

13) Hold upward on No. 1 idler pulley side of timing belt. Rotate crankshaft pulley counterclockwise so timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover.

14) Using puller, remove crankshaft pulley. Remove No. 1 timing belt cover and gasket. If reusing timing belt, mark direction of timing belt rotation and place reference marks on timing belt and crankshaft sprocket for reassembly reference.

15) Note direction of timing belt guide installation. See Fig. 27. Remove timing belt guide. Remove timing belt from crankshaft sprocket. Remove idler pulleys (if necessary).

16) If removing camshaft sprocket, use Sprocket Holder (SST 09278-54012) to hold camshaft sprocket. Remove bolt and camshaft sprocket.

17) If removing crankshaft sprocket, place shop towels against oil pump housing. Using 2 screwdrivers, carefully pry sprocket from crankshaft. Use care not to damage oil pump housing.

18) If removing oil pump sprocket, hold oil pump sprocket by installing Sprocket Holder (SST 09616-30011) in holes on front of oil pump sprocket. Remove oil pump sprocket retaining nut. Remove sprocket holder and oil pump sprocket.

Inspection

1) Inspect timing belt for damaged teeth, cracking or oil contamination. Ensure idler pulleys rotate freely. Replace components if damaged or worn.

2) Ensure free length of tension spring is within specification. See TENSION SPRING SPECIFICATIONS table. Measure tension required to extend tension spring to specified installed length. Replace tension spring if tension is not within specification. See TENSION SPRING SPECIFICATIONS table.

TENSION SPRING SPECIFICATIONS TABLE

Application	Specification
Free Length	1.811" (46.00 mm)
Tension At Spring Installed Length	
Celica & MR2	7.2-8.3 lbs. (3.25-3.75 kg) @ 1.988" (50.50 mm)
Camry	
Green Spring	7.2-8.3 lbs. (3.25-3.75 kg) @ 1.988" (50.50 mm)
Silver Spring	10.5-11.6 lbs. (4.75-5.25 kg) @ 1.988" (50.50 mm)

Installation

1) If installing oil pump sprocket, align flat area on oil pump sprocket with flat area on oil pump shaft. Install oil pump sprocket. Install and tighten nut to specification while holding oil pump sprocket with sprocket holder. See TORQUE SPECIFICATIONS.

2) If installing crankshaft sprocket, align crankshaft sprocket with key in crankshaft. Install crankshaft sprocket with flange toward cylinder block.

3) Install No. 2 idler pulley (if removed). Install and tighten bolt to specification. See TORQUE SPECIFICATIONS. Ensure idler pulley is clean and rotates smoothly.

4) Install No. 1 idler pulley and tension spring (if removed). Pry No. 1 idler pulley away from timing belt area as far as possible. Temporarily tighten No. 1 idler pulley bolt. Ensure idler pulley is clean and rotates smoothly.

5) If installing camshaft sprocket, align pin groove in camshaft sprocket with pin in camshaft. Install camshaft sprocket. Install washer and camshaft sprocket bolt. Tighten camshaft sprocket bolt to specification. See TORQUE SPECIFICATIONS.

6) Using crankshaft pulley bolt, rotate crankshaft so timing

mark on crankshaft sprocket aligns with timing mark on oil pump housing. See Fig. 29.

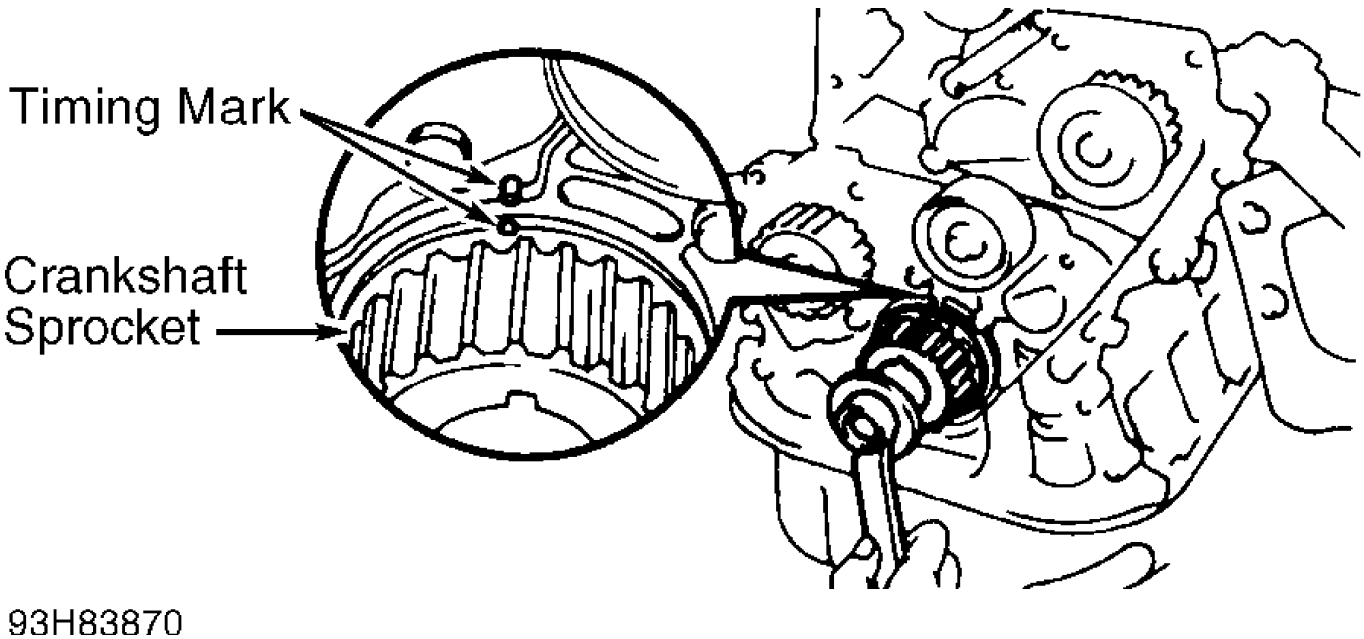

Fig. 29: Aligning Crankshaft Sprocket Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAUTION: If reusing timing belt, ensure reference mark on timing belt aligns with reference mark placed on crankshaft sprocket and timing belt is installed in original direction of rotation.

7) Ensure all sprockets and idler pulleys are clean. Install timing belt on crankshaft sprocket, oil pump sprocket, No. 1 idler pulley and then No. 2 idler pulley in sequence.

8) Install timing belt guide with cupped side away from crankshaft sprocket (flat side toward timing belt). Install No. 1 timing belt cover and gasket.

9) Align crankshaft pulley key groove with key in crankshaft. Install crankshaft pulley. Install and tighten crankshaft pulley bolt to specification while holding crankshaft pulley with pulley holder. See TORQUE SPECIFICATIONS.

10) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Ensure timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover.

11) If reusing timing belt, ensure reference mark on timing belt aligns with upper edge of No. 1 timing belt cover. If reference mark is not aligned, perform procedure in steps 10) through 13) under removal procedure.

12) Rotate camshaft and align hole in camshaft sprocket with alignment mark on camshaft bearing cap. See Fig. 28.

13) Install timing belt on camshaft sprocket. If reusing timing belt, ensure reference mark on timing belt is aligned with reference mark placed on camshaft sprocket. Ensure tension exists on timing belt between crankshaft and camshaft sprockets.

CAUTION: DO NOT rotate crankshaft counterclockwise.

14) Loosen No. 1 idler pulley bolt 1/2 turn. Rotate crankshaft clockwise pulley 2 full revolutions clockwise from TDC to TDC.

15) Ensure timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover and hole in camshaft sprocket aligns with alignment mark on camshaft bearing cap. See Fig. 28. If timing marks are not aligned, remove timing belt and reinstall.

16) Rotate crankshaft clockwise 1 and 7/8 revolutions and align crankshaft pulley "0" mark with 45-degree Before Top Dead Center (BTDC) mark on No. 1 timing belt cover. See Fig. 30.

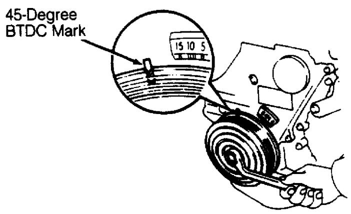

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Fig. 30: Aligning Crankshaft Pulley With 45-Degree BTDC Mark
Courtesy of Toyota Motor Sales, U.S.A., Inc.

17) Tighten No. 1 idler pulley bolt to specification. See TORQUE SPECIFICATIONS. Install No. 2 timing belt cover and gaskets. Install and tighten spark plugs to specification. See TORQUE SPECIFICATIONS.

18) To install remaining components, reverse removal procedure. Install all bolts/nuts on right (timing belt side) engine mount before tightening to specification.

19) On Camry, when installing control rod and bracket on strut tower and right (timing belt side) engine mount, tighten bolts to specification in sequence. See Fig. 15.

VALVE LIFTER

Removal

Remove camshaft. See CAMSHAFT under REMOVAL & INSTALLATION. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head.

Inspection

Inspect components for damage. Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if not within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Installation

To install, reverse removal procedure. Ensure components are installed in original locations. If camshaft, adjusting shims or valve lifters are replaced, check valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

CAMSHAFT

Removal

1) Remove timing belt and camshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove No. 3 timing belt cover. See Fig. 24. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly.

CAUTION: Camshafts must be properly positioned to lift camshaft straight from cylinder head to prevent damage to cylinder head and camshaft. DO NOT pry or force camshafts from cylinder head or component damage will result.

2) For servicing of exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See Figs. 31 & 32. This aids in exhaust camshaft removal by using camshaft lobes of cylinders No. 2 and 4 to push on valve lifters.

3) Secure sub-gear to the main gear on exhaust camshaft with a 6 x 1.0 x 18 mm service bolt "B". See Fig. 33. Before removing camshaft bearing cap bolts, ensure torsional spring force of sub-gear is secured by service bolt "B".

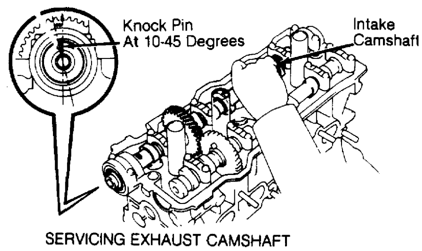

Fig. 31: Servicing Exhaust Camshafts
Courtesy of Toyota Motor Sales, U.S.A., Inc.

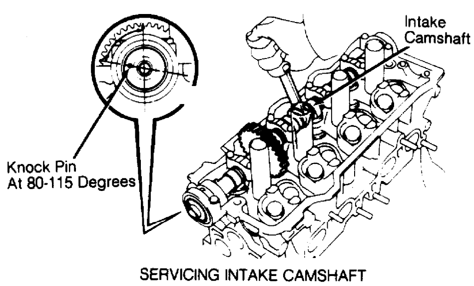

Fig. 32: Servicing Intake Camshafts
Courtesy of Toyota Motor Sales, U.S.A., Inc.

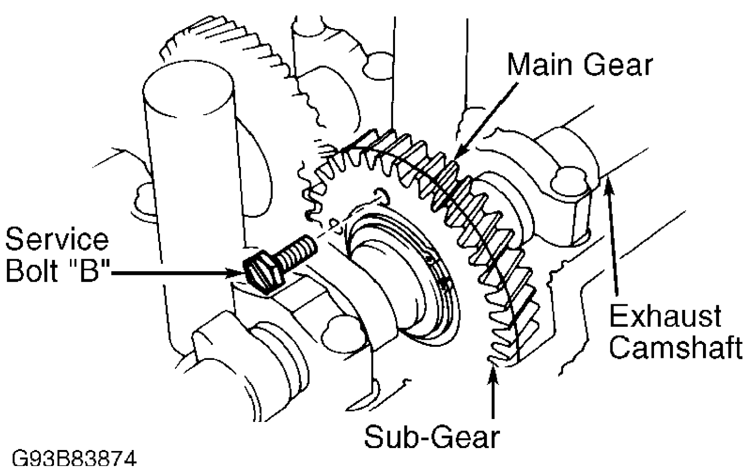

Fig. 33: Securing Sub-Gear-To-Main Gear
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Camshaft bearing caps are numbered for location with arrow on top of the cap. Front camshaft bearing cap on intake camshaft and rear camshaft bearing cap on exhaust camshaft are not numbered. All other camshaft bearing caps are numbered starting with No. 1 at timing belt end of engine. Arrow on top of camshaft bearing cap must point toward timing belt end of engine. See Fig. 34.

4) Remove bolts and rear camshaft bearing cap from exhaust camshaft. Remove bolts from No. 1, 2 and 4 camshaft bearing caps on exhaust camshaft in proper sequence. See Fig. 35. DO NOT remove bolts from No. 3 camshaft bearing cap at this time. Remove No. 1, 2 and 4 camshaft bearing caps from exhaust camshaft.

5) Alternately loosen bolts on No. 3 camshaft bearing cap on exhaust camshaft. Ensure exhaust camshaft is lifted upward as No. 3 camshaft bearing cap bolts are loosened.

6) If exhaust camshaft is not lifted upward, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 10-45 degrees from vertical position. See Fig. 32. Repeat steps 4) and 5). Remove No. 3 camshaft bearing cap and exhaust camshaft.

7) For servicing of intake camshaft, remove distributor. Rotate intake camshaft so knock pin is 80-115 degrees from vertical position. See Fig. 31. This aids in intake camshaft removal by using camshaft lobes of cylinders No. 1 and 3 to push on valve lifters.

8) Remove bolts, front camshaft bearing cap and oil seal from intake camshaft. Remove bolts from No. 1, 3 and 4 camshaft bearing caps on intake camshaft in proper sequence. See Fig. 36. DO NOT remove bolts from No. 2 camshaft bearing cap at this time. Remove No. 1, 3 and 4 camshaft bearing caps from intake camshaft.

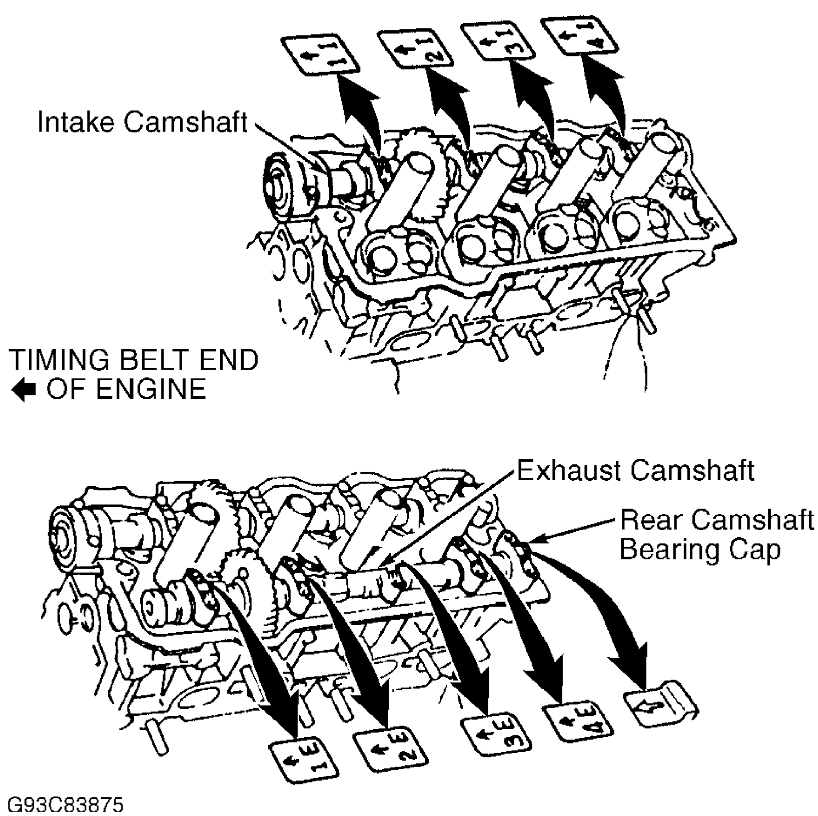

Fig. 34: Identifying Camshaft Bearing Caps
Courtesy of Toyota Motor Sales, U.S.A., Inc.

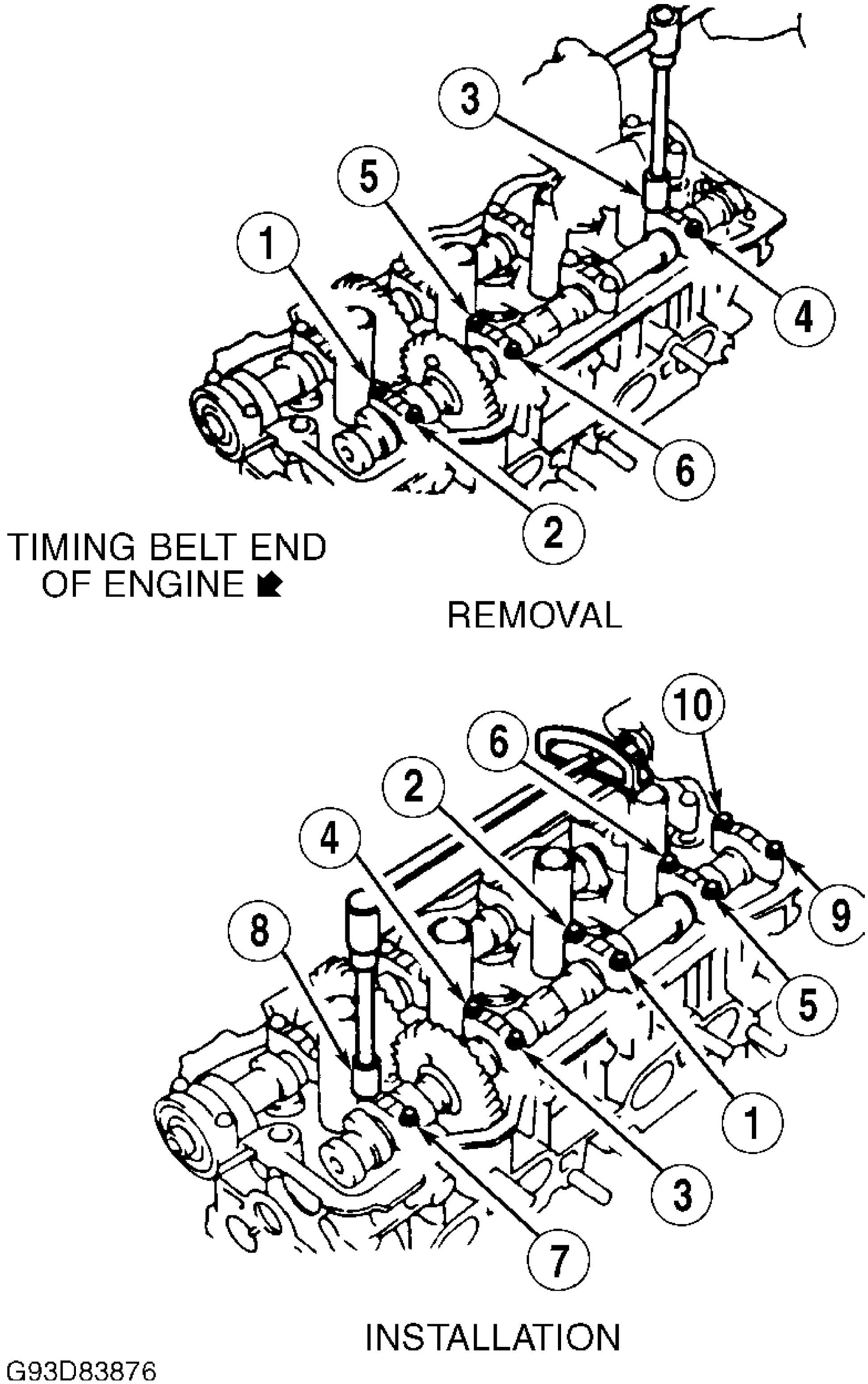

Fig. 35: Exhaust Camshaft Bearing Cap Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

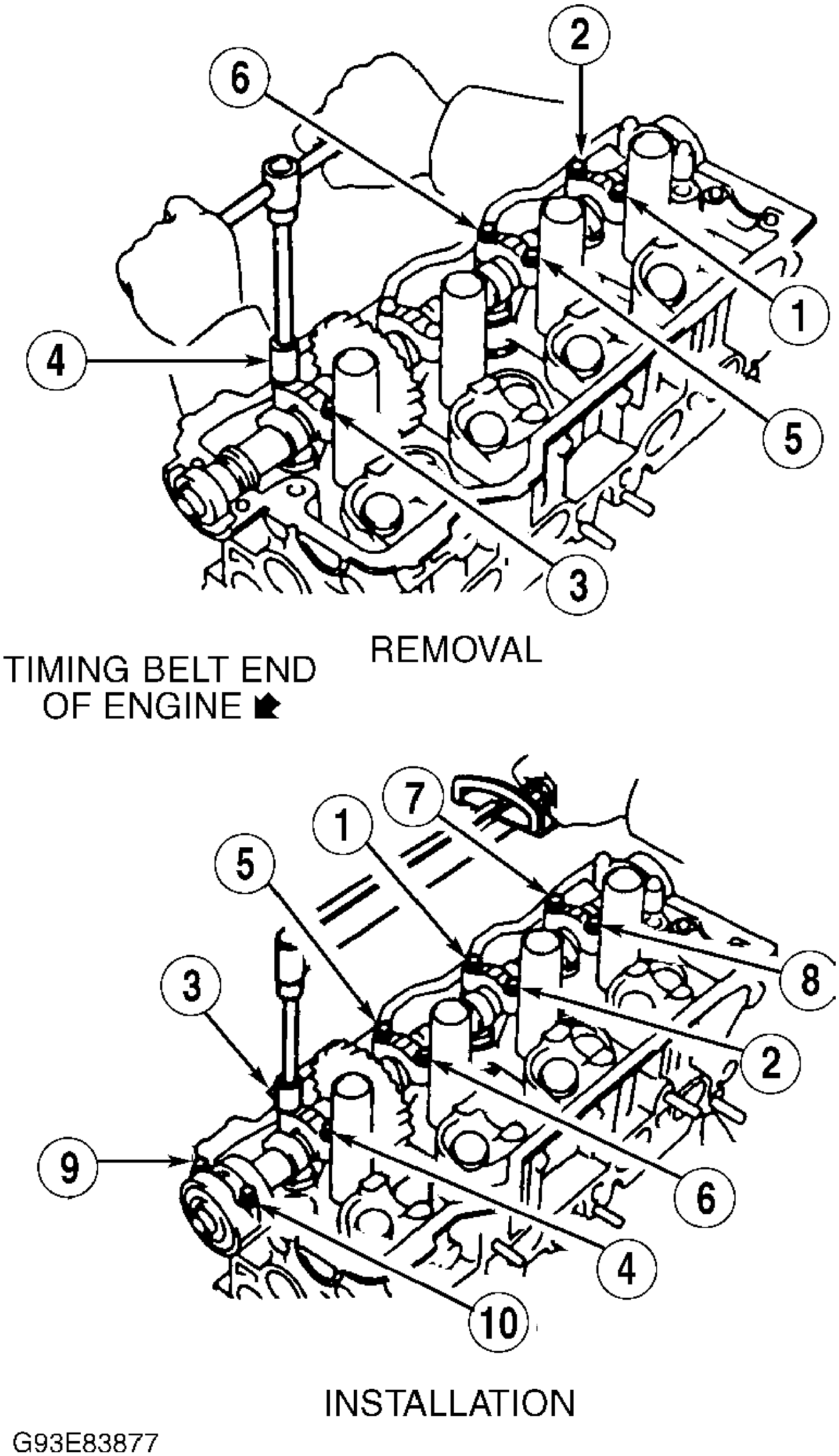

Fig. 36: Intake Camshaft Bearing Cap Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

9) Alternately loosen bolts on No. 2 camshaft bearing cap on

intake camshaft. Ensure intake camshaft is lifted upward as No. 2 camshaft bearing cap bolts are loosened.

10) If intake camshaft is not lifted upward, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 80-115 degrees from vertical position. See Fig. 32. Repeat steps 8) and 9). Remove No. 2 camshaft bearing cap and intake camshaft.

11) If removing sub-gear from exhaust camshaft, mount camshaft in soft-jawed vise on hexagonal area of camshaft. Install service bolts "A" and "B" in camshaft. See Fig. 37.

12) Using screwdriver, rotate sub-gear clockwise. Remove service bolt "B". Remove snap ring, wave washer, sub-gear and camshaft gear spring. See Fig. 24.

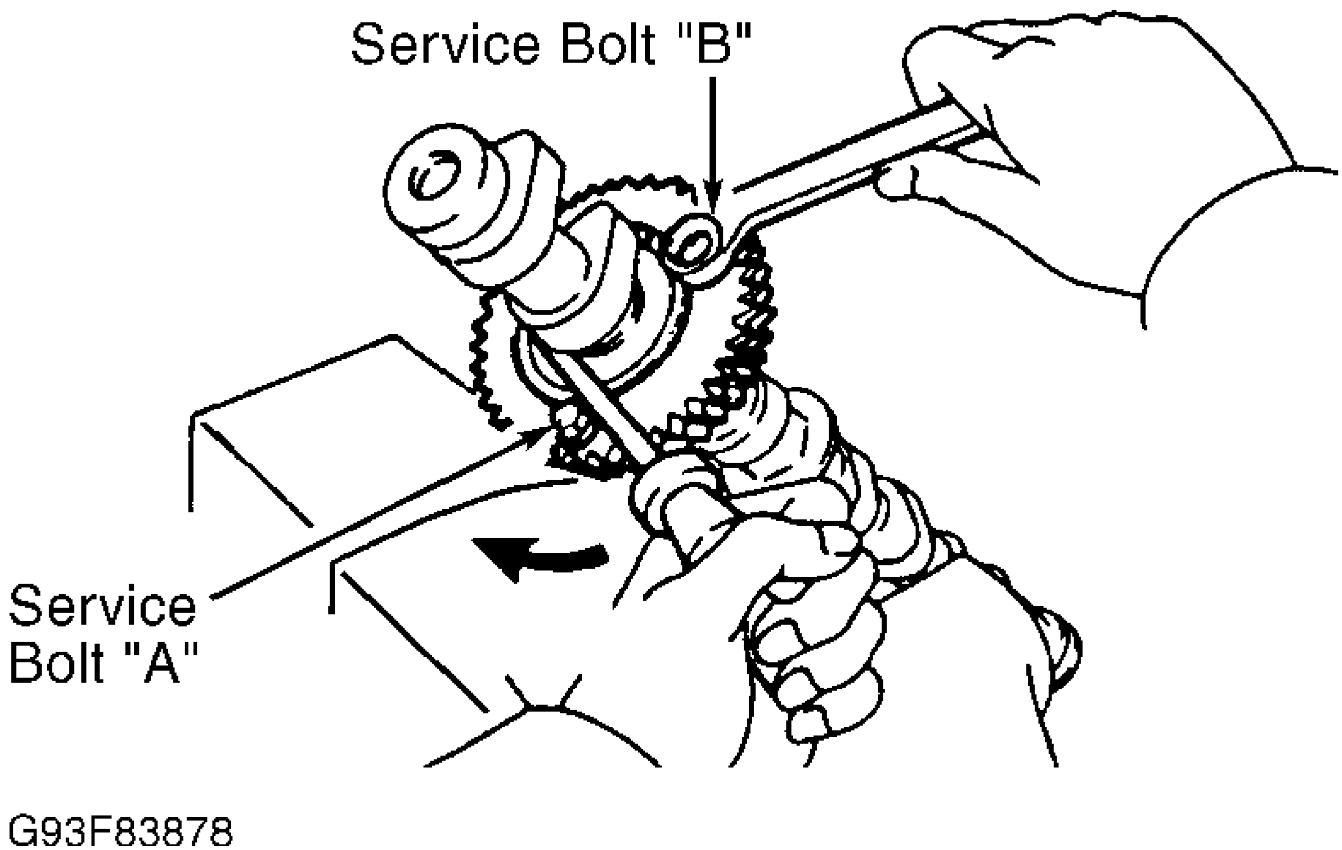

Fig. 37: Disassembling Sub-Gear From Main Gear
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect components for damage. Check camshaft journal diameter, lobe height and journal runout. Replace camshaft if not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

2) Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See Figs. 35 and 36. See TORQUE SPECIFICATIONS.

3) Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

5) Install both camshafts in cylinder head without sub-gear

installed on exhaust camshaft. Install and tighten camshaft bearing cap bolts to specification in sequence. See Figs. 35 and 36. See TORQUE SPECIFICATIONS.

6) Using dial indicator, check gear backlash between gears on camshafts. Replace camshafts if gear backlash exceeds specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

7) Measure distance between ends of camshaft gear spring. Replace camshaft gear spring if distance is not .886-.902" (22.50-22. 90 mm).

Installation

1) If reassembling sub-gear on exhaust camshaft, install camshaft gear spring so ends engage with pins on main gear on exhaust camshaft. Install sub-gear, wave washer and snap ring on exhaust camshaft.

2) Install service bolt "A" on sub-gear. See Fig. 37. Using screwdriver, rotate sub-gear clockwise and align holes in sub-gear with hole on main gear. Install service bolt "B". Remove service bolt "A".

3) Coat thrust surfaces of camshafts with multipurpose grease. To install intake camshaft, rotate camshaft so knock pin is at 80-115 degrees from vertical position and install in cylinder head. See Fig. 32. Apply sealant on front camshaft bearing cap for intake camshaft. See Fig. 38.

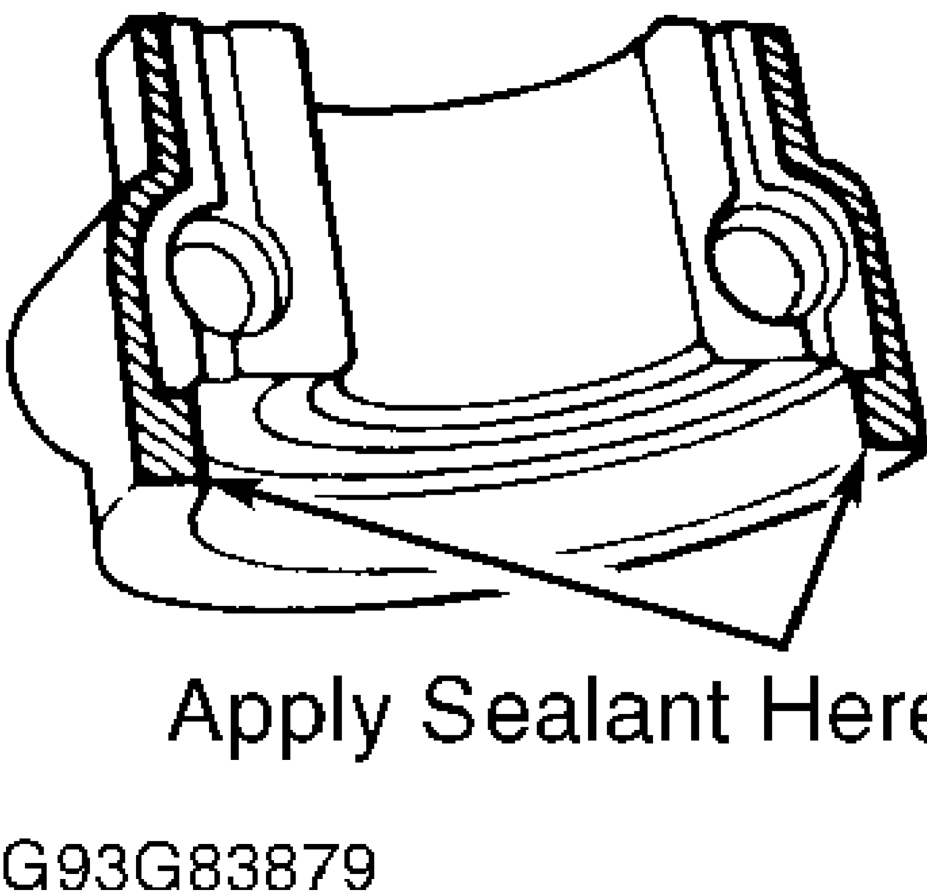

Fig. 38: Applying Sealant On Front Camshaft Bearing Cap
Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Install front camshaft bearing cap for intake camshaft on cylinder head. Install remaining camshaft bearing caps for intake

camshaft on cylinder head in numerical sequence with arrow pointing toward timing belt end of engine. See Fig. 34.

5) Apply engine oil to camshaft bearing cap bolt threads and below bolt head. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 36. See TORQUE SPECIFICATIONS.

6) Coat seal lip of NEW oil seal for intake camshaft with grease. Using Oil Seal Installer (SST 09223-46011), install oil seal into cylinder head.

7) To install exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See Fig. 32. Install exhaust camshaft so timing mark aligns with intake camshaft timing mark. DO NOT use assembly reference marks. See Fig. 39.

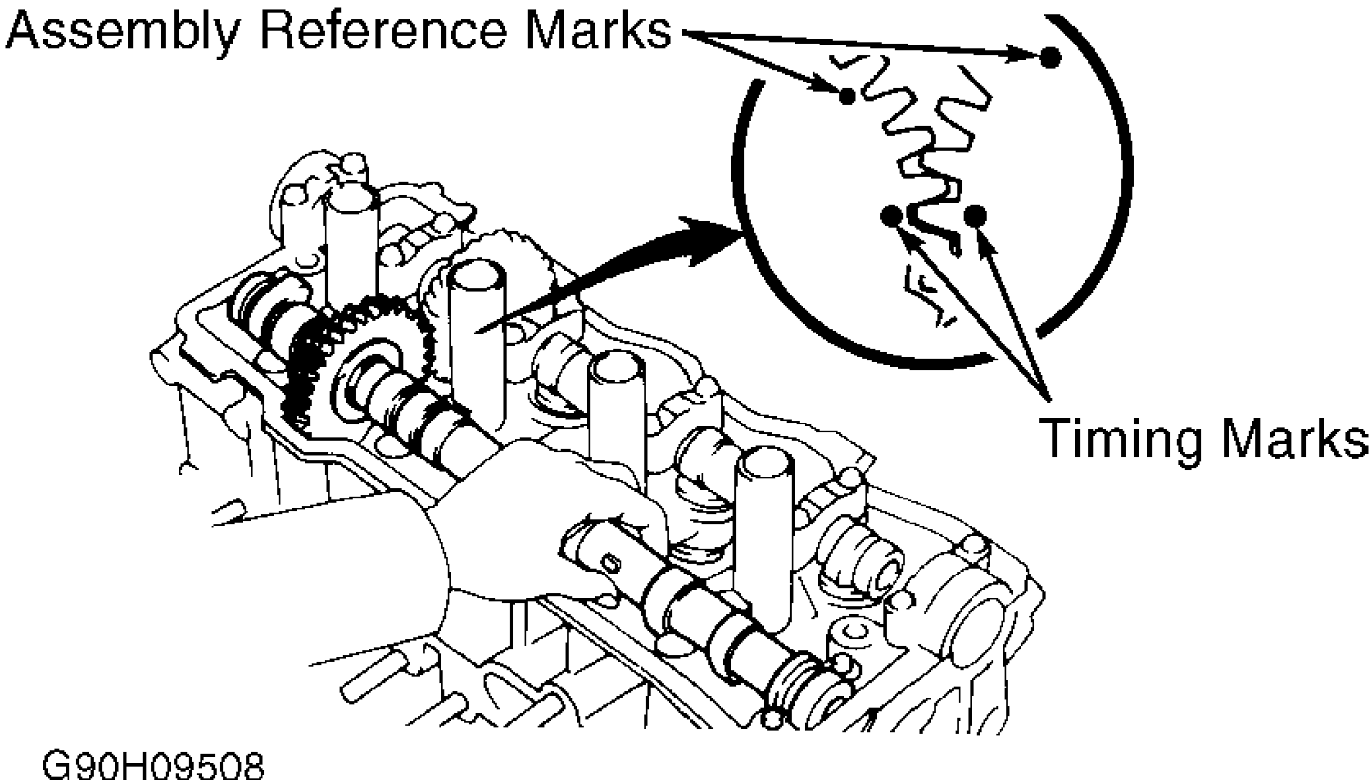

Fig. 39: Aligning Camshaft Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Install camshaft bearing caps for exhaust camshaft on cylinder head in numerical sequence with arrow pointing toward timing belt end of engine. See Fig. 34.

9) Apply engine oil to camshaft bearing cap bolt threads and below bolt head. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 35. See TORQUE SPECIFICATIONS.

10) Remove service bolt "B" from camshaft gear. See Fig. 33. Install No. 3 timing belt cover. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS. Install timing belt using proper procedure. See TIMING BELT under REMOVAL & INSTALLATION.

CAUTION: If cylinder head or camshaft were serviced or replaced, valve clearance must be checked. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

11) Apply sealant on semi-circular plugs and install in each

end of cylinder head, located on exhaust camshaft side of cylinder head. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See Fig. 3.

12) Using NEW gasket, install valve cover. Install grommets in original location with marking on grommet in aligned in designated area. See Fig. 4. Install and tighten valve cover nuts to specification. See TORQUE SPECIFICATIONS.

13) If installing distributor, install NEW "O" ring on distributor. Coat "O" ring with engine oil. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

14) Ensure slot area on intake camshaft is vertically positioned. Rotate cutout on coupling so it is aligned with alignment mark on distributor housing. See Fig. 26.

15) Install distributor so center of flange on distributor is aligned with bolt hole on cylinder head. Install distributor hold-down bolts. Adjust ignition timing.

BALANCE SHAFTS (CAMRY)

NOTE: Following procedure must be used when servicing balance shaft assembly with engine in the vehicle. Perform preliminary inspection before removing balance shaft assembly to ensure proper gear backlash exists. If balance shaft assembly is being serviced with engine removed from vehicle and cylinder block inverted (oil pan area facing upward) special procedure must be used. See BALANCE SHAFTS (CAMRY) under OVERHAUL.

Preliminary Inspection

1) Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION. Gear backlash between crankshaft gear and No. 1 balance shaft must be checked. Gear backlash varies with rotation of No. 1 balance shaft gear and crankshaft gear. Gear backlash must be checked with crankshaft gear and No. 1 balance shaft gear at 4 different points.

2) Rotate crankshaft 3 full revolutions to ensure proper seating of all gears. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

3) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. Perform STEP 1. See Fig. 40.

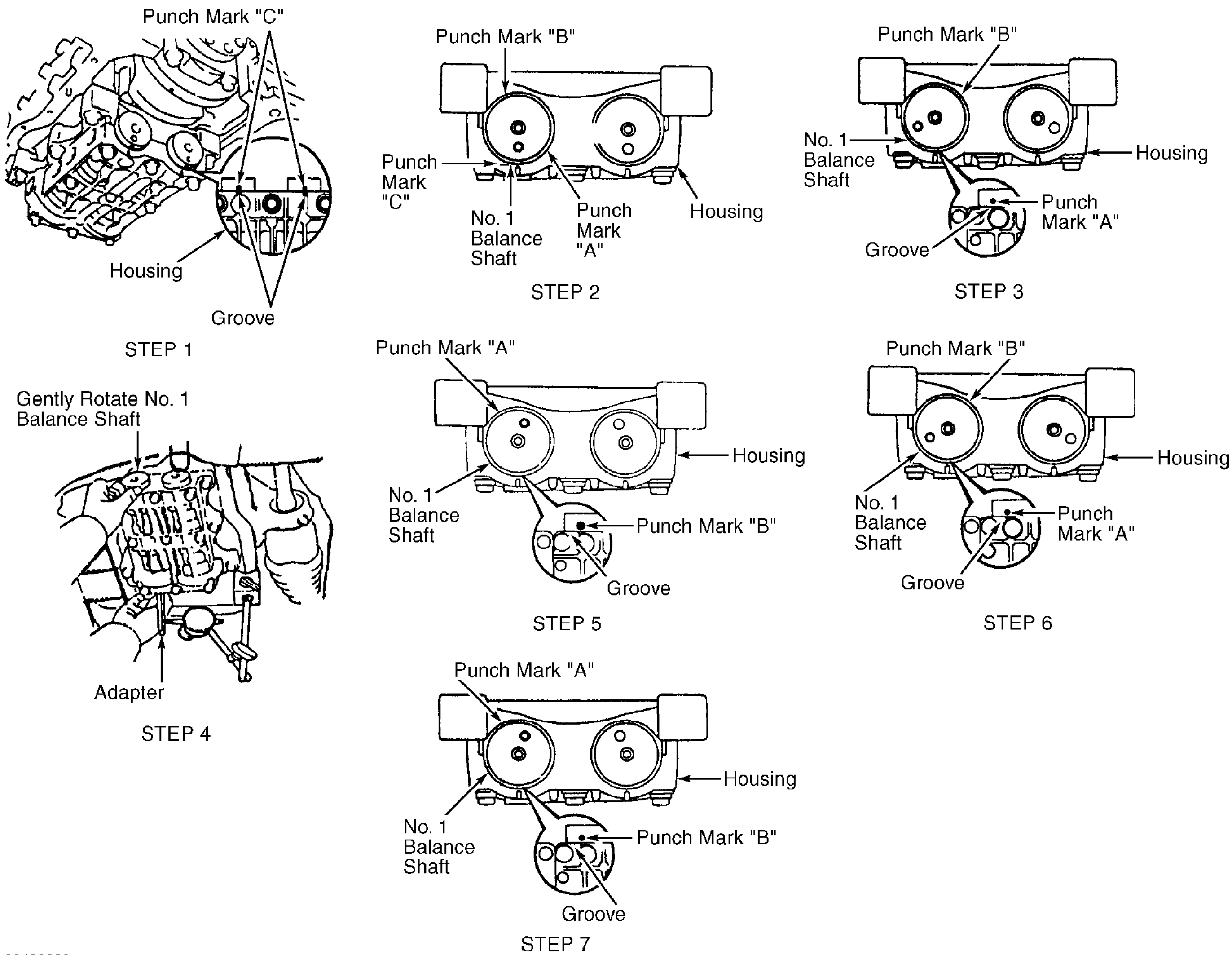

Fig. 40: Checking Crankshaft Gear & No. 1 Balance Shaft Gear Backlash With Engine Installed
Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Ensure punch marks "A" and "B" on No. 1 balance shaft are at designated position. Perform STEP 2. See Fig. 40. Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 3. See Fig. 40.

5) Install dial indicator and Adapter (SST 09224-74010) on cylinder block and balance shaft assembly. See Fig. 41. Ensure dial indicator is perpendicular to adapter and dial indicator stem is in middle of third indentation on adapter. See Fig. 41.

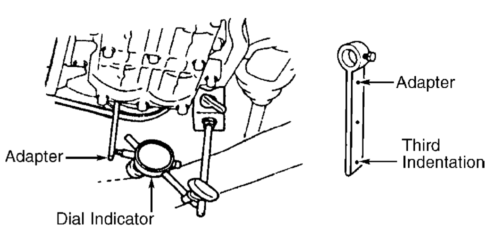

Fig. 41: Installing Dial Indicator & Adapter
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Gently rotate No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt and note gear backlash on dial indicator. Perform STEP 4. See Fig. 40. DO NOT use excessive force when rotating No. 1 balance shaft. It may be necessary to rotate No. 1 balance shaft several times to obtain a steady gear backlash reading. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

7) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 5. See Fig. 40.

8) Reinstall dial indicator. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

9) Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 6. See Fig. 40.

10) Reinstall dial indicator. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

11) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 7. See Fig. 40.

12) Reinstall dial indicator. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

13) If gear backlash in not within specification when performing all measurements, different thickness adjusting spacer must be installed between balance shaft assembly and cylinder block.

14) Remove balance shaft assembly and adjusting spacers from cylinder block using proper removal procedure. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.

15) Using gear backlash measured clearance and number stamped on installed adjusting spacer, determine replacement adjusting spacer. See Fig. 42. If gear backlash exceeds specification, use thinner adjusting spacer. If gear backlash is less than specified, use thicker adjusting spacer. Changing adjusting spacer thickness by .0008" (.020 mm) will change gear backlash about .0017" (.042 mm).

16) Use same thickness adjusting spacers on each side of balance shaft assembly. Reinstall adjusting shims and balance shaft assembly using proper procedure. Recheck gear backlash.

Measured clearance mm (in.) \ Installed spacer No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0.000 – 0.017 (0.0000 – 0.0007)	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31
0.018 – 0.038 (0.0008 – 0.0015)	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31
0.039 – 0.059 (0.0016 – 0.0023)	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29
0.060 – 0.100 (0.0024 – 0.0039)																												
0.101 – 0.121 (0.0040 – 0.0047)		01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27
0.122 – 0.142 (0.0048 – 0.0056)			01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25
0.143 – 0.163 (0.0057 – 0.0064)				01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25
0.164 – 0.184 (0.0065 – 0.0072)					01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23
0.185 – 0.205 (0.0073 – 0.0081)						01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23
0.206 – 0.226 (0.0082 – 0.0089)							01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21
0.227 – 0.247 (0.0090 – 0.0097)								01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21
0.248 – 0.268 (0.0098 – 0.0105)									01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19
0.269 – 0.289 (0.0106 – 0.0114)										01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19
0.290 – 0.310 (0.0115 – 0.0122)											01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17
0.311 – 0.331 (0.0123 – 0.0130)												01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17
0.332 – 0.352 (0.0131 – 0.0138)													01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15
0.353 – 0.373 (0.0139 – 0.0147)														01	01	03	03	05	05	07	07	09	09	11	11	13	13	15
0.374 – 0.394 (0.0148 – 0.0155)															01	01	03	03	05	05	07	07	09	09	11	11	13	13
0.395 – 0.415 (0.0156 – 0.0163)																01	01	03	03	05	05	07	07	09	09	11	11	13
0.416 – 0.436 (0.0164 – 0.0172)																	01	01	03	03	05	05	07	07	09	09	11	11
0.437 – 0.457 (0.0173 – 0.0180)																		01	01	03	03	05	05	07	07	09	09	11
0.458 – 0.478 (0.0181 – 0.0188)																			01	01	03	03	05	05	07	07	09	09
0.479 – 0.499 (0.0189 – 0.0196)																				01	01	03	03	05	05	07	07	09
0.500 – 0.520 (0.0197 – 0.0205)																					01	01	03	03	05	05	07	07
0.521 – 0.541 (0.0206 – 0.0213)																						01	01	03	03	05	05	07
0.542 – 0.562 (0.0214 – 0.0221)																							01	01	03	03	05	05
0.563 – 0.583 (0.0222 – 0.0230)																								01	01	03	03	05
0.584 – 0.604 (0.0231 – 0.0238)																									01	01	03	03
0.605 – 0.625 (0.0239 – 0.0246)																										01	01	03
0.626 – 0.646 (0.0247 – 0.0254)																											01	01
0.647 – 0.667 (0.0255 – 0.0263)																												01
0.668 – 0.688 (0.0264 – 0.0271)																												
0.689 – 0.709 (0.0272 – 0.0279)																												
0.710 – 0.730 (0.0280 – 0.0287)																												
0.731 – 0.751 (0.0288 – 0.0296)																												
0.752 – 0.772 (0.0297 – 0.0304)																												
0.773 – 0.793 (0.0305 – 0.0312)																												
0.794 – 0.814 (0.0313 – 0.0320)																												
0.815 – 0.835 (0.0321 – 0.0329)																												
0.836 – 0.856 (0.0330 – 0.0337)																												
0.857 – 0.877 (0.0338 – 0.0345)																												
0.878 – 0.898 (0.0346 – 0.0354)																												
0.899 – 0.919 (0.0355 – 0.0362)																												

NEW SPACER THICKNESS mm (In.)

No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
01	1.74 (0.0685)	11	1.84 (0.0724)	21	1.94 (0.0764)	31	2.04 (0.0803)
03	1.76 (0.0693)	13	1.86 (0.0732)	23	1.96 (0.0772)	33	2.06 (0.0811)
05	1.78 (0.0701)	15	1.88 (0.0740)	25	1.98 (0.0780)	35	2.08 (0.0819)
07	1.80 (0.0709)	17	1.90 (0.0748)	27	2.00 (0.0787)	37	2.10 (0.0827)
09	1.82 (0.0717)	19	1.92 (0.0756)	29	2.02 (0.0795)	39	2.12 (0.0835)

EXAMPLE: No. 25 adjusting spacers are installed and measured clearance is .0135" (.342 mm). Replace No. 25 adjusting spacers with No. 13 adjusting spacers.

Measured clearance mm (in.) \ Installed spacer No.	29	30	31	32	33	34	35	36	37	38	39	40
0.000 – 0.017 (0.0000 – 0.0007)	33	33	35	35	37	37	39	39				
0.018 – 0.038 (0.0008 – 0.0015)	31	33	33	35	35	37	37	39	39			
0.039 – 0.059 (0.0016 – 0.0023)	31	31	33	33	35	35	37	37	39	39		
0.060 – 0.100 (0.0024 – 0.0039)												
0.101 – 0.121 (0.0040 – 0.0047)	27	29	29	31	31	33	33	35	35	37	37	39
0.122 – 0.142 (0.0048 – 0.0056)	27	27	29	29	31	31	33	33	35	35	37	37
0.143 – 0.163 (0.0057 – 0.0064)	25	27	27	29	29	31	31	33	33	35	35	37
0.164 – 0.184 (0.0065 – 0.0072)	25	25	27	27	29	29	31	31	33	33	35	35
0.185 – 0.205 (0.0073 – 0.0081)	23	25	25	27	27	29	29	31	31	33	33	35
0.206 – 0.226 (0.0082 – 0.0089)	23	23	25	25	27	27	29	29	31	31	33	33
0.227 – 0.247 (0.0090 – 0.0097)	21	23	23	25	25	27	27	29	29	31	31	33
0.248 – 0.268 (0.0098 – 0.0105)	21	21	23	23	25	25	27	27	29	29	31	31
0.269 – 0.289 (0.0106 – 0.0114)	19	21	21	23	23	25	25	27	27	29	29	31
0.290 – 0.310 (0.0115 – 0.0122)	19	19	21	21	23	23	25	25	27	27	29	29
0.311 – 0.331 (0.0123 – 0.0130)	17	19	19	21	21	23	23	25	25	27	27	29
0.332 – 0.352 (0.0131 – 0.0138)	17	17	19	19	21	21	23	23	25	25	27	27
0.353 – 0.373 (0.0139 – 0.0147)	15	17	17	19	19	21	21	23	23	25	25	27
0.374 – 0.394 (0.0148 – 0.0155)	15	15	17	17	19	19	21	21	23	23	25	25
0.395 – 0.415 (0.0156 – 0.0163)	13	15	15	17	17	19	19	21	21	23	23	25
0.416 – 0.436 (0.0164 – 0.0172)	13	13	15	15	17	17	19	19	21	21	23	23
0.437 – 0.457 (0.0173 – 0.0180)	11	13	13	15	15	17	17	19	19	21	21	23
0.458 – 0.478 (0.0181 – 0.0188)	11	11	13	13	15	15	17	17	19	19	21	21
0.479 – 0.499 (0.0189 – 0.0196)	09	11	11	13	13	15	15	17	17	19	19	21
0.500 – 0.520 (0.0197 – 0.0205)	09	09	11	11	13	13	15	15	17	17	19	19
0.521 – 0.541 (0.0206 – 0.0213)	07	09	09	11	11	13	13	15	15	17	17	19
0.542 – 0.562 (0.0214 – 0.0221)	07	07	09	09	11	11	13	13	15	15	17	17
0.563 – 0.583 (0.0222 – 0.0230)	05	07	07	09	09	11	11	13	13	15	15	17
0.584 – 0.604 (0.0231 – 0.0238)	05	05	07	07	09	09	11	11	13	13	15	15
0.605 – 0.625 (0.0239 – 0.0246)	03	05	05	07	07	09	09	11	11	13	13	15
0.626 – 0.646 (0.0247 – 0.0254)	03	03	05	05	07	07	09	09	11	11	13	13
0.647 – 0.667 (0.0255 – 0.0263)	01	03	03	05	05	07	07	09	09	11	11	13
0.668 – 0.688 (0.0264 – 0.0271)	01	01	03	03	05	05	07	07	09	09	11	11
0.689 – 0.709 (0.0272 – 0.0279)		01	01	03	03	05	05	07	07	09	09	11
0.710 – 0.730 (0.0280 – 0.0287)			01	01	03	03	05	05	07	07	09	09
0.731 – 0.751 (0.0288 – 0.0296)				01	01	03	03	05	05	07	07	09
0.752 – 0.772 (0.0297 – 0.0304)					01	01	03	03	05	05	07	07
0.773 – 0.793 (0.0305 – 0.0312)						01	01	03	03	05	05	07
0.794 – 0.814 (0.0313 – 0.0320)							01	01	03	03	05	05
0.815 – 0.835 (0.0321 – 0.0329)								01	01	03	03	05
0.836 – 0.856 (0.0330 – 0.0337)									01	01	03	03
0.857 – 0.877 (0.0338 – 0.0345)										01	01	03
0.878 – 0.898 (0.0346 – 0.0354)											01	01
0.899 – 0.919 (0.0355 – 0.0362)												01

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Fig. 42: Adjusting Shim Selection Chart With Engine Installed
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Removal

1) Before removing balance shaft assembly, perform

preliminary inspection procedure to ensure proper thickness adjusting spacers are installed. See PRELIMINARY INSPECTION procedure under BALANCE SHAFTS (CAMRY).

2) Uniformly loosen and remove 6 outside bolts on balance shaft assembly in proper sequence. See Fig. 43. Remove balance shaft assembly and adjusting spacers. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.

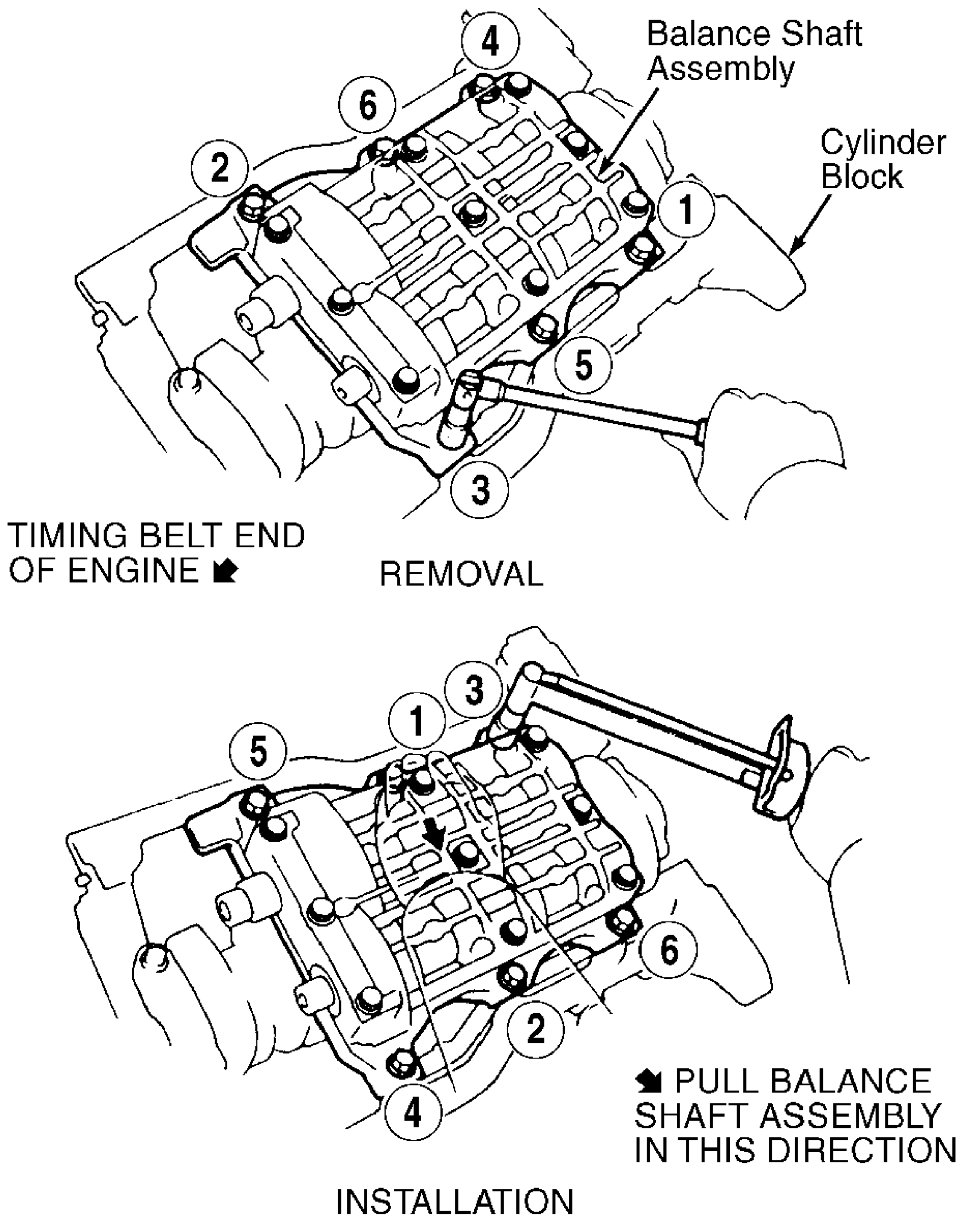

Fig. 43: Balance Shaft Assembly Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on

compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

2) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. Perform STEP 1. See Fig. 44.

3) Ensure surfaces on cylinder block and adjusting spacers are clean. Install adjusting spacers on cylinder block. Perform STEP 2. See Fig. 44. Install balance shaft assembly on cylinder block with bolts loosely installed.

4) Ensure punch mark "C" on both balance shafts are still aligned with grooves on the housing of balance shaft assembly. Pull balance shaft assembly in proper direction and tighten bolts to specification in sequence. See Fig. 43. Recheck gear backlash. See PRELIMINARY INSPECTION procedure under BALANCE SHAFTS (CAMRY).

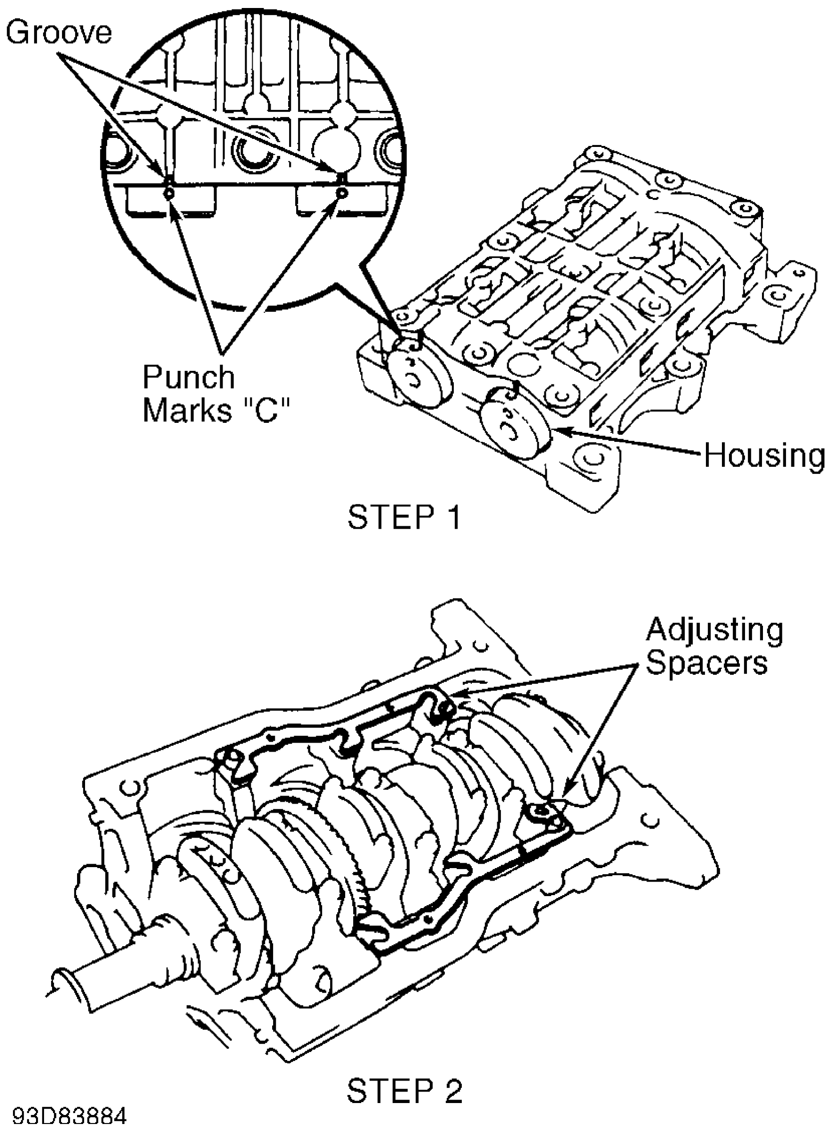

Fig. 44: Aligning Balance Shaft Punch Marks & Installing Adjusting Spacers
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transaxle, clutch assembly (if equipped) and flywheel/drive plate. Using a knife, cut off oil seal lip. Pry oil seal from rear seal housing. Use care not to damage sealing surfaces.

Installation

1) Ensure all sealing surfaces are clean. Apply grease to seal lip of NEW oil seal. Use Oil Seal Installer (SST 09223-63010) for oil seal installation.

2) Install oil seal in rear seal housing until oil seal is even with surface of rear seal housing. Apply Loctite to flywheel/drive plate bolts. Install flywheel/drive plate. Install and tighten bolts to specification in a crisscross pattern. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

WATER PUMP

Removal (Camry & Celica)

1) Disconnect negative battery cable. Drain cooling system. Remove timing belt and idler pulleys. See TIMING BELT under REMOVAL & INSTALLATION.

2) Disconnect lower radiator hose from thermostat housing. Remove alternator adjusting bracket. Remove coolant by-pass pipe nuts. See Fig. 45.

3) Remove water pump bolts in sequence. See Fig. 46. Remove water pump, water pump cover and "O" rings. See Fig. 45. Remove water pump-to-water pump cover bolts. Remove water pump and gasket from water pump cover.

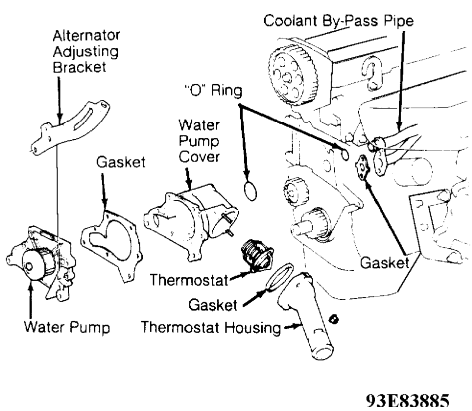

Fig. 45: Exploded View Of Water Pump & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

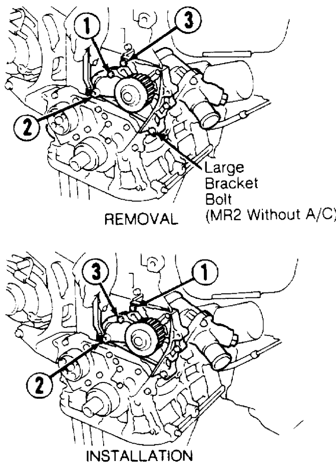

Fig. 46: Water Pump Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Apply soapy water solution on coolant by-pass pipe "O" ring before installing water pump. DO NOT tighten coolant by-pass pipe-to-water pump nuts until water pump bolts are tightened.

2) Tighten water pump bolts to specification in sequence. See Fig. 46. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Fill cooling system.

Removal (MR2)

1) Drain cooling system. Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove timing belt and No. 2 idler pulley. See TIMING BELT under REMOVAL & INSTALLATION.

2) Disconnect radiator hose at water pump. Remove the coolant by-pass pipe-to-water pump nuts. See Fig. 46. On models without A/C, remove large bracket bolt from lower right corner of water pump. See Fig. 46.

3) On all models, remove water pump bolts in sequence. See Fig. 46. Remove water pump, water pump cover and "O" rings. See Fig. 45. Remove water pump-to-water pump cover bolts. Remove water pump and gasket from water pump cover.

Installation

1) To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Apply soapy water solution on coolant by-pass pipe "O" ring before installing water pump. DO NOT tighten coolant by-pass pipe-to-water pump nuts until water pump bolts are tightened.

2) Tighten water pump bolts to specification in sequence. See Fig. 46. See TORQUE SPECIFICATIONS. On models without A/C, install large bracket bolt and tighten to specification. See TORQUE SPECIFICATIONS.

3) To install remaining components, reverse removal procedure. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CAUTION: On MR2, cooling system must be bled to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

OIL PAN

Removal

1) Disconnect negative battery cable. Raise and support vehicle. Remove lower engine covers. Drain engine oil. On all models, remove front exhaust pipe located below oil pan.

2) On Celica, remove suspension crossmember bolted to both lower suspension arm shafts. Support engine with hoist. Remove engine mount crossmember located below engine.

3) On MR2, remove catalytic converter braces, catalytic converter, cushion, retainer and gasket to access oil pan (if necessary). See Fig. 24.

4) Remove stiffener bracket at rear of oil pan. Remove dipstick. Remove bolts/nuts and oil pan.

Installation

1) Ensure sealing surfaces are clean. Apply bead of sealant at center of oil pan sealing surface, between bolt/nut holes and on inside of bolt/nut holes.

2) Install oil pan. Install and tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

3) Use NEW nuts when installing exhaust pipe on catalytic converter. Use NEW gasket when installing catalytic converter (if removed). Fill crankcase with oil.

OVERHAUL

BALANCE SHAFTS (CAMRY)

NOTE: Following procedure must be used when servicing balance shaft assembly with engine removed from vehicle and cylinder block inverted (oil pan area facing upward). Perform inspection procedure to ensure proper thrust clearance and gear backlash exists before removing or after installation of balance shaft assembly. If balance shaft assembly is being serviced with engine in the vehicle, special procedure must be used. See BALANCE SHAFTS (CAMRY) under REMOVAL & INSTALLATION. Manufacture does not provide disassembly procedure for balance shaft assembly.

Inspection

1) Position cylinder block with oil pan area facing upward. To check thrust clearance, mount use dial indicator on cylinder block with stem against balance shaft. See Fig. 47.

2) Measure thrust clearance while manually moving balance shaft back and forth. See Fig. 47. Standard thrust clearance is .0026-.0043" (.065-.110 mm) with maximum thrust clearance of .0043" (.110 mm). Replace balance shaft assembly if thrust clearance exceeds specification.

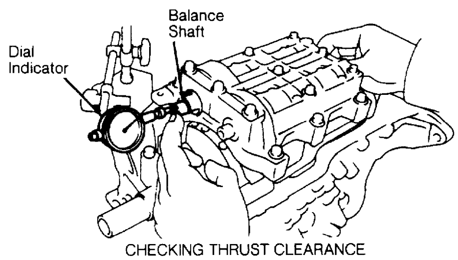

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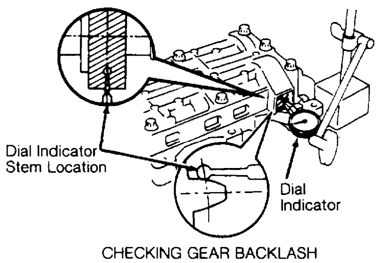
Fig. 47: Checking Thrust Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93H83888
Fig. 48: Checking Gear Backlash
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Gear backlash between crankshaft gear and No. 1 varies with rotation of No. 1 balance shaft gear and crankshaft gear. Gear backlash must be checked with crankshaft gear and No. 1 balance shaft gear at 4 different points.

4) Rotate crankshaft 3 full revolutions to ensure proper seating of all gears. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

5) Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. Perform STEP 1. See Fig. 49.

6) Ensure punch marks "A" and "B" on No. 1 balance shaft are at designated position. Perform STEP 2. See Fig. 49. Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 3. See Fig. 49.

7) Install lever-type dial indicator on cylinder block and balance shaft assembly so dial indicator is parallel to No. 1 balance shaft. See Fig. 48. Ensure dial indicator stem is located in center of tooth. See Fig. 48.

8) Gently rotate No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt and note gear backlash on dial indicator. Perform STEP 4. See Fig. 49. DO NOT use excessive force when rotating No. 1 balance shaft. It may be necessary to rotate No. 1 balance shaft several times to obtain a steady gear backlash reading. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

9) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 5. See Fig. 49.

10) Reinstall dial indicator. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance

shaft. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

11) Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 6. See Fig. 49.

12) Reinstall dial indicator. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

13) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 7. See Fig. 49.

14) Reinstall dial indicator. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

15) If gear backlash in not within specification when performing all measurements, different thickness adjusting spacer must be installed between balance shaft assembly and cylinder block.

16) Remove balance shaft assembly and adjusting spacers from cylinder block. See BALANCE SHAFTS (CAMRY) under REMOVAL & INSTALLATION. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.

17) Using gear backlash measured clearance and number stamped on installed adjusting spacer, determine replacement adjusting spacer. See Fig. 50.

18) If gear backlash exceeds specification, use thinner adjusting spacer. If gear backlash is less than specified, use thicker adjusting spacer. Changing adjusting spacer thickness by .0008" (.020 mm) will change gear backlash about .0006" (.014 mm). Use same thickness adjusting spacers on each side of balance shaft assembly.

19) Reinstall adjusting shims and balance shaft assembly using proper procedure. See BALANCE SHAFTS (CAMRY) under REMOVAL & INSTALLATION. Recheck gear backlash.

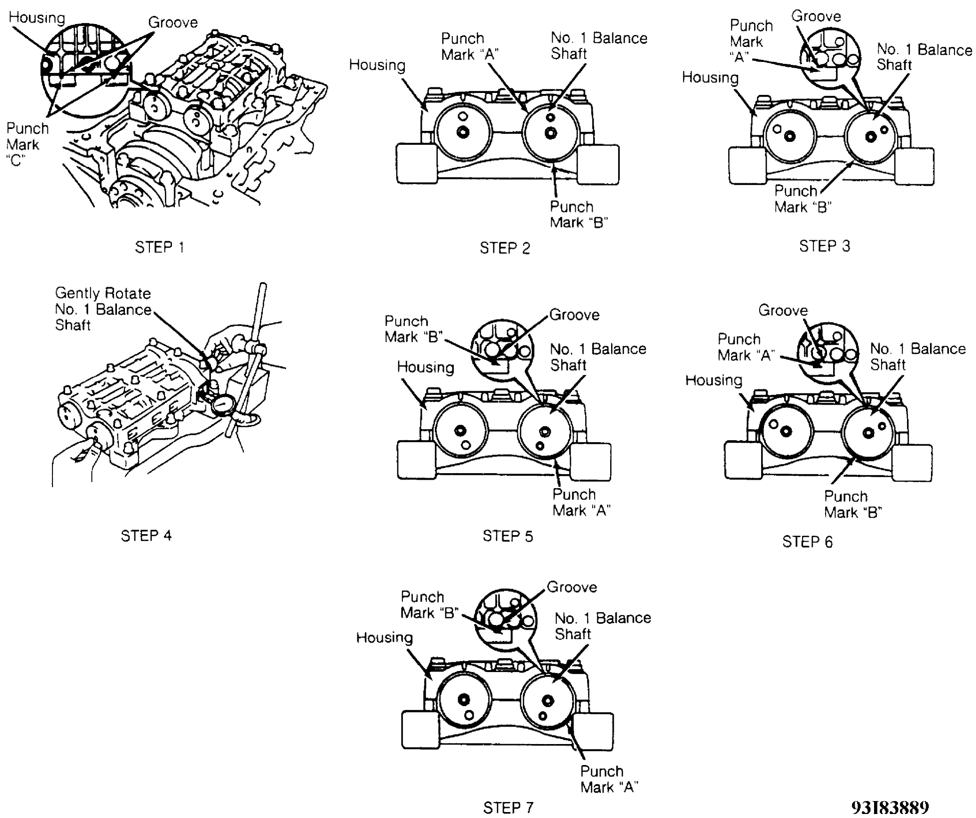


Fig. 49: Checking Crankshaft Gear & No. 1 Balance Shaft Gear Backlash With Engine Removed
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Measured clearance mm (in.) / Installed spacer No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0.000 - 0.060 (0.0000 - 0.0022)																												
0.061 - 0.067 (0.0023 - 0.0025)		01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23
0.068 - 0.074 (0.0025 - 0.0027)			01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23
0.075 - 0.081 (0.0028 - 0.0030)				01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21
0.082 - 0.088 (0.0030 - 0.0033)					01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21
0.089 - 0.095 (0.0033 - 0.0035)						01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19
0.096 - 0.102 (0.0035 - 0.0038)							01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19
0.103 - 0.109 (0.0038 - 0.0040)								01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17
0.110 - 0.116 (0.0040 - 0.0043)									01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17
0.117 - 0.123 (0.0043 - 0.0045)										01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15
0.124 - 0.130 (0.0046 - 0.0048)											01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15
0.131 - 0.137 (0.0048 - 0.0051)												01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13
0.138 - 0.144 (0.0051 - 0.0053)													01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13
0.145 - 0.151 (0.0054 - 0.0056)														01	01	01	01	01	03	03	05	05	07	07	09	09	11	11
0.152 - 0.158 (0.0056 - 0.0058)															01	01	01	01	01	03	03	05	05	07	07	09	09	11
0.159 - 0.165 (0.0059 - 0.0061)																01	01	01	01	01	03	03	05	05	07	07	09	09
0.166 - 0.172 (0.0061 - 0.0064)																	01	01	01	01	01	03	03	05	05	07	07	09
0.173 - 0.179 (0.0064 - 0.0066)																		01	01	01	01	01	03	03	05	05	07	07
0.180 - 0.186 (0.0067 - 0.0069)																			01	01	01	01	01	03	03	05	05	07
0.187 - 0.193 (0.0069 - 0.0071)																				01	01	01	01	01	03	03	05	05
0.194 - 0.200 (0.0072 - 0.0074)																					01	01	01	01	01	03	03	05
0.201 - 0.207 (0.0074 - 0.0077)																						01	01	01	01	01	03	03
0.208 - 0.214 (0.0077 - 0.0079)																							01	01	01	01	01	03
0.215 - 0.221 (0.0079 - 0.0082)																								01	01	01	01	01
0.222 - 0.228 (0.0082 - 0.0084)																									01	01	01	01
0.229 - 0.235 (0.0085 - 0.0087)																										01	01	01
0.234 - 0.242 (0.0087 - 0.0089)																											01	01
0.243 - 0.249 (0.0090 - 0.0092)																												01
0.250 - 0.256 (0.0092 - 0.0095)																												
0.257 - 0.263 (0.0095 - 0.0097)																												
0.264 - 0.270 (0.0098 - 0.0100)																												
0.271 - 0.277 (0.0100 - 0.0102)																												
0.278 - 0.284 (0.0103 - 0.0105)																												
0.285 - 0.291 (0.0105 - 0.0108)																												
0.292 - 0.298 (0.0108 - 0.0110)																												
0.299 - 0.305 (0.0110 - 0.0113)																												
0.306 - 0.312 (0.0113 - 0.0115)																												
0.313 - 0.319 (0.0116 - 0.0118)																												
0.320 - 0.326 (0.0118 - 0.0120)																												
0.327 - 0.333 (0.0120 - 0.0123)																												

EXAMPLE: No. 25 adjusting spacers are installed and measured clearance is .0055" (.140 mm). Replace No. 25 adjusting spacers with No. 9 adjusting spacers.

93B83890

Fig. 50: Adjusting Shim Selection Chart With Engine Removed (Installed Spacer No. 01 Through 28)

Courtesy of Toyota Motor Sales, U.S.A., Inc.

Measured clearance mm (in.) \ Installed spacer No.	29	30	31	32	33	34	35	36	37	38	39	40
0.000 - 0.080 (0.0000 - 0.0022)												
0.061 - 0.067 (0.0023 - 0.0025)	25	25	27	27	29	29	31	31	33	33	35	35
0.068 - 0.074 (0.0025 - 0.0027)	23	25	25	27	27	29	29	31	31	33	33	35
0.075 - 0.081 (0.0028 - 0.0030)	23	23	25	25	27	27	29	29	31	31	33	33
0.082 - 0.088 (0.0030 - 0.0033)	21	23	23	25	25	27	27	29	29	31	31	33
0.089 - 0.095 (0.0033 - 0.0035)	21	21	23	23	25	25	27	27	29	29	31	31
0.096 - 0.102 (0.0035 - 0.0038)	19	21	21	23	23	25	25	27	27	29	29	31
0.103 - 0.109 (0.0038 - 0.0040)	19	19	21	21	23	23	25	25	27	27	29	29
0.110 - 0.116 (0.0040 - 0.0043)	17	19	19	21	21	23	23	25	25	27	27	29
0.117 - 0.123 (0.0043 - 0.0045)	17	17	19	19	21	21	23	23	25	25	27	27
0.124 - 0.130 (0.0046 - 0.0048)	15	17	17	19	19	21	21	23	23	25	25	27
0.131 - 0.137 (0.0048 - 0.0051)	15	15	17	17	19	19	21	21	23	23	25	25
0.138 - 0.144 (0.0051 - 0.0053)	13	15	15	17	17	19	19	21	21	23	23	25
0.145 - 0.151 (0.0054 - 0.0056)	13	13	15	15	17	17	19	19	21	21	23	23
0.152 - 0.158 (0.0056 - 0.0058)	11	13	13	15	15	17	17	19	19	21	21	23
0.159 - 0.165 (0.0059 - 0.0061)	11	11	13	13	15	15	17	17	19	19	21	21
0.166 - 0.172 (0.0061 - 0.0064)	09	11	11	13	13	15	15	17	17	19	19	21
0.173 - 0.179 (0.0064 - 0.0066)	09	09	11	11	13	13	15	15	17	17	19	19
0.180 - 0.186 (0.0067 - 0.0069)	07	09	09	11	11	13	13	15	15	17	17	19
0.187 - 0.193 (0.0069 - 0.0071)	07	07	09	09	11	11	13	13	15	15	17	17
0.194 - 0.200 (0.0072 - 0.0074)	06	07	07	09	09	11	11	13	13	15	15	17
0.201 - 0.207 (0.0074 - 0.0077)	05	06	07	07	09	09	11	11	13	13	15	15
0.208 - 0.214 (0.0077 - 0.0079)	03	06	06	07	07	09	09	11	11	13	13	15
0.215 - 0.221 (0.0079 - 0.0082)	03	03	05	05	07	07	09	09	11	11	13	13
0.222 - 0.228 (0.0082 - 0.0084)	01	03	03	05	06	07	07	09	09	11	11	13
0.229 - 0.235 (0.0085 - 0.0087)	01	01	03	03	05	06	07	07	09	09	11	11
0.234 - 0.242 (0.0087 - 0.0089)	01	01	01	03	03	06	05	07	07	09	09	11
0.243 - 0.249 (0.0090 - 0.0092)	01	01	01	01	03	03	05	05	07	07	09	09
0.250 - 0.256 (0.0092 - 0.0095)	01	01	01	01	01	03	03	05	05	07	07	09
0.257 - 0.263 (0.0095 - 0.0097)		01	01	01	01	01	03	03	05	05	07	07
0.264 - 0.270 (0.0098 - 0.0100)			01	01	01	01	01	03	03	05	05	07
0.271 - 0.277 (0.0100 - 0.0102)				01	01	01	01	01	03	03	05	05
0.278 - 0.284 (0.0103 - 0.0105)					01	01	01	01	01	03	03	05
0.285 - 0.291 (0.0105 - 0.0108)						01	01	01	01	01	03	03
0.292 - 0.298 (0.0108 - 0.0110)							01	01	01	01	01	03
0.299 - 0.305 (0.0110 - 0.0113)								01	01	01	01	01
0.306 - 0.312 (0.0113 - 0.0115)									01	01	01	01
0.313 - 0.319 (0.0116 - 0.0118)										01	01	01
0.320 - 0.326 (0.0118 - 0.0120)											01	01
0.327 - 0.333 (0.0120 - 0.0123)												01

EXAMPLE: No. 25 adjusting spacers are installed
and measured clearance is .0055" (.140 mm).
Replace No. 25 adjusting spacers with No. 9 adjusting spacers.
93C83891

Fig. 51: Adjusting Shim Selection Chart With Engine Removed
(Installed Spacer No. 29 Through 40)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NEW SPACER THICKNESS mm (In.)

No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
01	1.74 (0.0685)	11	1.84 (0.0724)	21	1.94 (0.0764)	31	2.04 (0.0803)
03	1.76 (0.0693)	13	1.86 (0.0732)	23	1.96 (0.0772)	33	2.06 (0.0811)
05	1.78 (0.0701)	15	1.88 (0.0740)	25	1.98 (0.0780)	35	2.08 (0.0819)
07	1.80 (0.0709)	17	1.90 (0.0748)	27	2.00 (0.0787)	37	2.10 (0.0827)
09	1.82 (0.0717)	19	1.92 (0.0756)	29	2.02 (0.0795)	39	2.12 (0.0835)

EXAMPLE: No. 25 adjusting spacers are installed
and measured clearance is .0055" (.140 mm).
Replace No. 25 adjusting spacers with No. 9 adjusting spacers.
93D83892

Fig. 52: Adjusting Shim Selection Chart With Engine Removed
(New Spacer Thickness)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CYLINDER HEAD

Cylinder Head

1) Inspect cylinder head warpage at cylinder block, exhaust manifold and intake manifold areas. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See Figs. 35 and 36. See TORQUE SPECIFICATIONS.

3) Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table

under ENGINE SPECIFICATIONS.

5) Ensure valve lifter bore diameter in cylinder head is within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Valve Springs

Ensure valve spring free length, pressure and out-of-square are within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seals

Intake valve stem oil seal is Brown or Gray and exhaust valve stem oil seal is Green. Ensure proper valve stem oil seal is installed. Lubricate valve stem oil seal with engine oil. Install valve stem oil seal using Oil Seal Installer (SST 09201-41020).

Valve Guides (Camry)

1) Ensure valve guide inside diameter is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.

2) To replace valve guide, wrap tape around an old valve stem. Tape must be approximately .31" (8.0 mm) from small end of valve stem. From top of cylinder head, install old valve in valve guide until tape area rests on valve guide.

3) Using hammer, hit old valve to break off top of old valve guide. Remove snap ring from valve guide. Heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (SST 09201-70010), drive valve guide from camshaft side of cylinder head.

4) Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4331-.4342" (11.000-11.027 mm), use standard valve guide. If bore inside diameter is .4350-.4361" (11.050-11.077 mm), use oversize valve guide.

5) If bore inside diameter exceeds .4342" (11.027 mm), machine valve guide bore to .4350-.4361" (11.050-11.077 mm) for oversize valve guide. If bore inside diameter exceeds .4361" (11.077 mm), replace cylinder head.

6) To install valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head until snap ring on valve guide contacts the cylinder head.

7) Using .236" (6.00 mm) reamer, ream valve guide to obtain correct valve stem-to-guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Guides (Celica & MR2)

1) Ensure valve guide inside diameter is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.

2) To replace valve guide, wrap tape around an old valve stem. Tape must be approximately .31" (8.0 mm) from small end of valve stem. From top of cylinder head, install old valve in valve guide until tape area rests on valve guide.

3) Using hammer, hit old valve to break off top of old valve guide. Remove snap ring from valve guide (if equipped). Heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (SST 09201-70010), drive valve guide from camshaft side of cylinder head.

4) Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4325-.4335" (10.985-11.012 mm), use standard valve guide. If bore inside diameter is .4344-.4355" (11.035-11.062 mm), use oversize valve guide.

5) If bore inside diameter exceeds .4335" (11.012 mm), machine valve guide bore to .4344-.4355" (11.035-11.062 mm) for

oversize valve guide. If bore inside diameter exceeds .4355" (11.062 mm), replace cylinder head.

6) Intake valve guide is 1.516" (38.50 mm) long and exhaust valve guide is 1.594" (40.50 mm) long. Ensure proper valve guide is installed.

7) To install valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head.

8) On exhaust valve guides, install valve guide until snap ring contacts cylinder head. On intake valve guide, install valve guide until distance from top of intake valve guide to the cylinder head surface is .315-.346" (8.00-8.80 mm).

9) On all valve guides, use .236" (6.00 mm) reamer to ream valve guide to obtain correct valve stem-to-guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Seat

Ensure valve seat angle and seat width are within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Valve seat replacement information is not available from manufacturer.

Valves

Ensure minimum refinish length, stem diameter and valve margin are within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

Valve Seat Correction Angles

Use 30-degree and 45-degree stones to lower valve seat contact area. Use 45-degree and 75-degree stones to raise valve seat contact area.

VALVE TRAIN

Valve Lifters

Ensure valve lifter diameter, bore diameter and oil clearance are within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Note that piston must be installed with front mark (cavity) on top of piston aligned with front mark (protrusion) on connecting rod. See Fig. 53.

2) Before disassembling piston and connecting rod, try to move piston back and forth on piston pin. Replace piston and piston pin if any movement is felt.

3) When removing piston from connecting rod, remove snap rings from piston. Heat piston to 176-194°F (80-90°C) in water. Remove piston pin. Separate piston from connecting rod.

4) Ensure piston pin diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Ensure connecting rod bend, twist and piston pin bushing bore diameter are within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

5) Bushing in connecting rod can be replaced if bore diameter is not within specification. Ensure bushing oil hole aligns with connecting rod oil hole. Bushing must be honed to obtain correct piston pin-to-rod clearance. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

NOTE: With piston at 140°F (60°C), piston pin should be able to be pressed into piston using thumb pressure.

6) Check that nut easily rotates on bolt of connecting rod. If nut fails to rotate easily, use caliper to measure connecting rod bolt outside diameter at .59" (15.0 mm) from end of bolt, just above threads. Replace connecting rod bolt and nut if outside diameter is less than .2992" (7.600 mm).

7) To reassemble, position piston and connecting rod so front mark (cavity) on top of piston aligns with front mark (protrusion) on connecting rod. See Fig. 53.

8) Install one NEW snap ring in piston. Heat piston to 176-194°F (80-90°C) in water. Coat piston pin with engine oil. Install piston pin into piston and connecting rod using thumb pressure. Install remaining NEW snap ring.

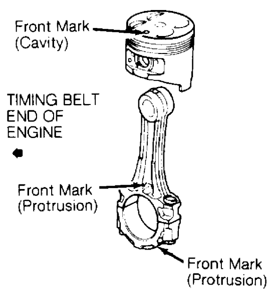


Fig. 53: Aligning Piston With Connecting Rod
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fitting Pistons

1) To determine piston-to-cylinder clearance, measure piston skirt diameter .925" (23.50 mm) from top of piston at 90-degree angle to piston pin.

2) Different piston sizes are used. Piston size can be identified by size mark ("1", "2" or "3") stamped on top of piston. See Fig. 54. Ensure piston diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

3) Measure cylinder bore diameter at .39" (9.9 mm) from top and bottom of cylinder bore and at middle of cylinder bore. Different cylinder bore sizes are used. Cylinder bore diameter can be identified by size mark ("1", "2" or "3") stamped on cylinder block deck surface. See Fig. 55.

4) Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Determine piston clearance.

5) Replace piston or bore cylinder block for oversize pistons if clearance is not within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Pistons are available in .20" (.50 mm) oversize. If replacing piston, ensure replacement piston contains same size mark as size mark on cylinder block.

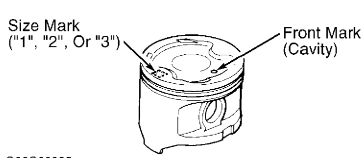


Fig. 54: Identifying Piston Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

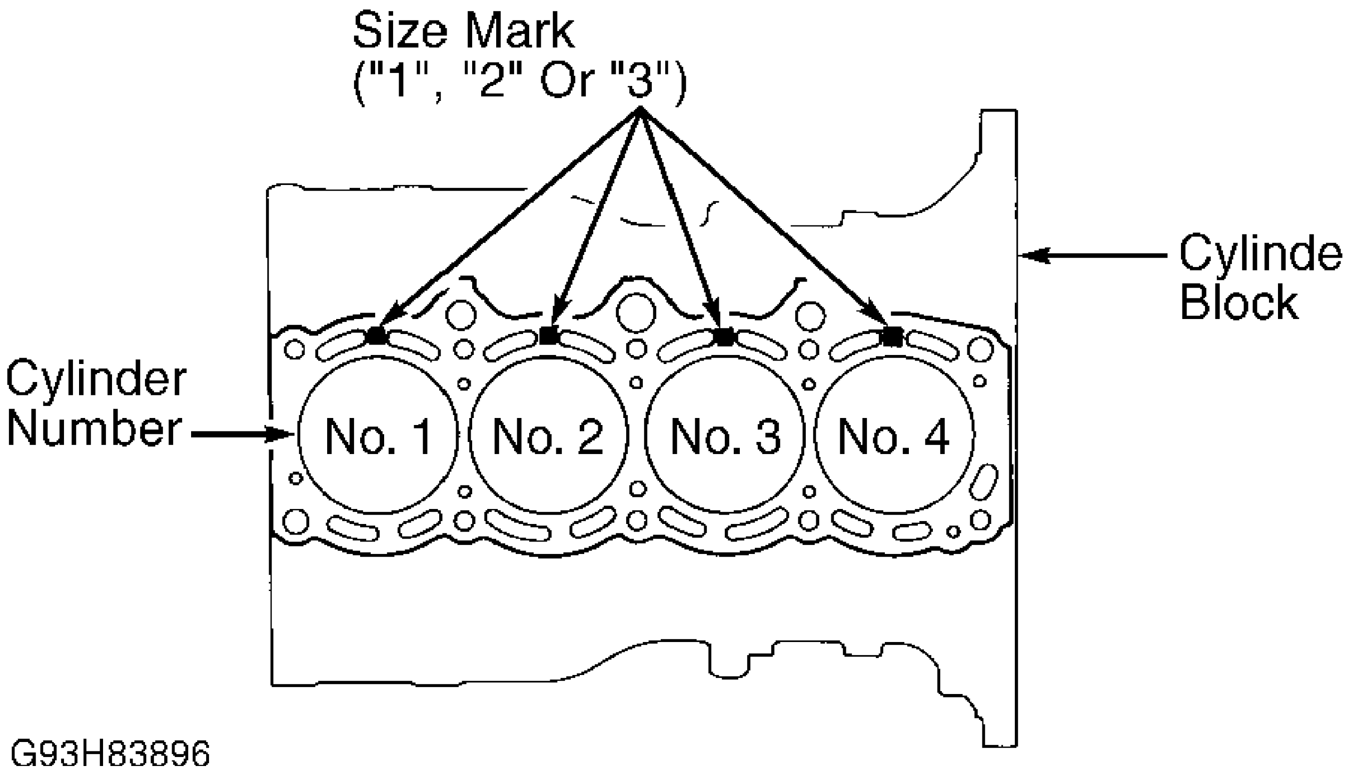


Fig. 55: Identifying Cylinder Bore Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Piston Rings

Ensure piston ring end gap and side clearance are within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Position piston ring with ring end gaps in proper areas with identification mark on piston ring toward top of piston. See Fig. 56.

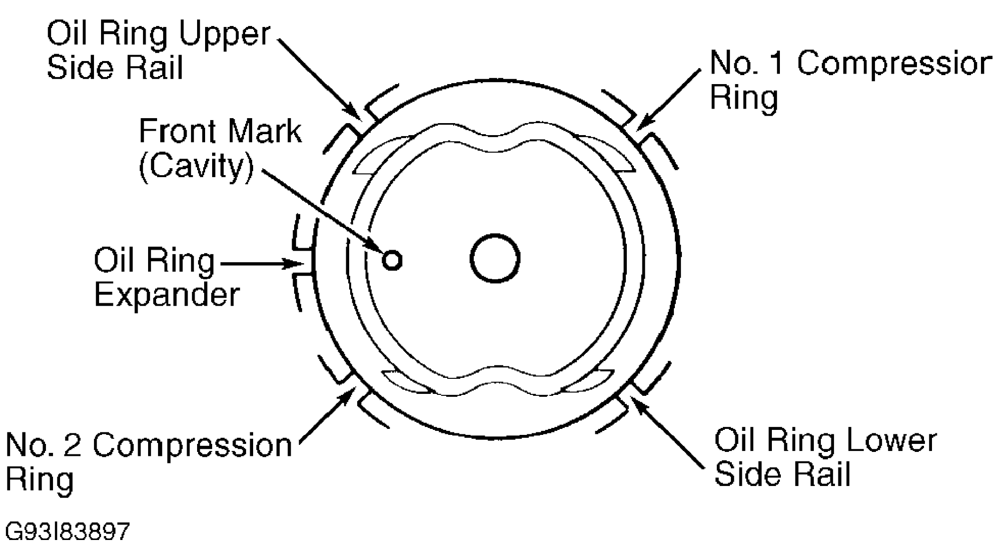


Fig. 56: Positioning Piston Rings
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Rod Bearings

1) Mark direction of connecting rod cap and cylinder number

before disassembly. Connecting rod must be installed so front mark (protrusion) at center of connecting rod is toward timing belt end of engine. Front mark (protrusion) on connecting rod cap must face toward timing belt end of engine. See Fig. 53.

2) Connecting rod cap and rod bearing are stamped with size mark ("1", "2" or "3"). See Fig. 57. Ensure size marks on connecting rod cap and rod bearing are same.

NOTE: If replacing rod bearing, ensure size mark on replacement rod bearing is same as size mark on original rod bearing.

3) Rod bearing thickness is determined by the size mark. See ROD BEARING SPECIFICATIONS table.

4) Check that nut easily rotates on bolt of connecting rod. If nut fails to rotate easily, use caliper to measure connecting rod bolt outside diameter at .59" (15.0 mm) from end of bolt, just above threads. Replace connecting rod bolt and nut if outside diameter is less than .2992" (7.600 mm).

5) Install connecting rod cap with front mark (protrusion) toward timing belt end of engine. See Fig. 53. Coat threads of connecting rod bolts and nut-to-connecting rod cap surface with engine oil before tightening nuts to specification. See TORQUE SPECIFICATIONS.

6) Ensure bearing oil clearance and connecting rod side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS and CONNECTING RODS tables under ENGINE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS TABLE

Bearing Size Mark	Bearing Thickness In. (mm)
"1"	.0584-.0586 (1.484-1.488)
"2"	.0586-.0587 (1.488-1.492)
"3"	.0587-.0589 (1.492-1.496)

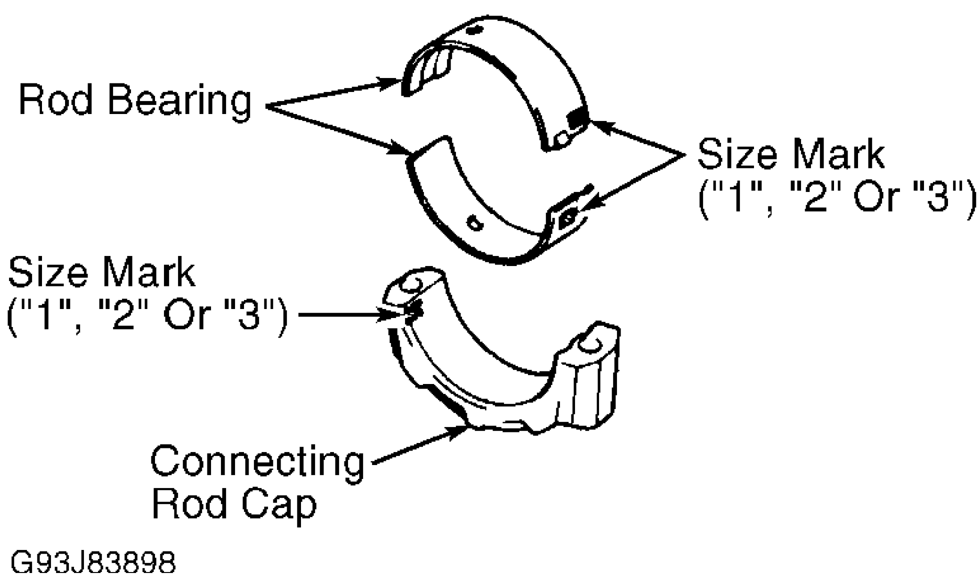


Fig. 57: Identifying Connecting Rod Cap & Rod Bearing Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Crankshaft & Main Bearings

1) Main bearing caps are numbered on top of cap for location

reference. No. 1 main bearing cap is at timing belt end of engine and No. 5 is at flywheel/drive plate end. Arrow on top of main bearing cap must point toward timing belt end of engine.

2) Remove main bearing cap bolts in sequence. See Fig. 58. Remove main bearing caps, crankshaft, thrust bearing and main bearings.

3) Cylinder block main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 59. Front size mark indicates No. 1 main bearing bore and rear size mark indicates No. 5 main bearing bore.

4) Crankshaft main bearing journal diameter is identified by main bearing journal size mark ("0", "1" or "2") located on crankshaft counterweight. See Fig. 59.

5) Ensure main bearing journal diameter, taper and out-of-round are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

6) Main bearing size mark ("1", "2", "3", "4" or "5") is located on side of main bearing. See Fig. 59. If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.

7) If main bearing size mark cannot be obtained, add size marks on cylinder block and crankshaft to determine size mark of main bearing to be used. For example, if size mark on cylinder block is "2" and size mark on crankshaft is "1", use main bearing with size mark "3".

8) Main bearing thickness is determined by size mark. See MAIN BEARING SPECIFICATIONS table. Install main bearings, thrust bearing, crankshaft and main bearing caps.

9) Ensure main bearings caps are properly installed in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel/drive plate end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.

10) Coat main bearing cap bolt threads and seat area of bolt with engine oil before installing. Install and tighten main bearing cap bolts to specification in sequence. See Fig. 58. See TORQUE SPECIFICATIONS.

11) Ensure crankshaft main bearing oil clearance and crankshaft end play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Replace thrust bearing if crankshaft end play is not within specification.

MAIN BEARING SPECIFICATIONS TABLE

Bearing Size Mark	Bearing Thickness In. (mm)
No. 3 Main Bearing	
"1"	.07842-.07854 (1.9920-1.9950)
"2"	.07854-.07866 (1.9950-1.9980)
"3"	.07866-.07877 (1.9980-2.0010)
"4"	.07877-.07889 (2.0010-2.0040)
"5"	.07889-.07901 (2.0040-2.0070)
All Others	
"1"	.07862-.07874 (1.9970-2.0000)
"2"	.07874-.07885 (2.0000-2.0030)
"3"	.07885-.07897 (2.0030-2.0060)
"4"	.07897-.07909 (2.0060-2.0090)
"5"	.07909-.07921 (2.0090-2.0120)

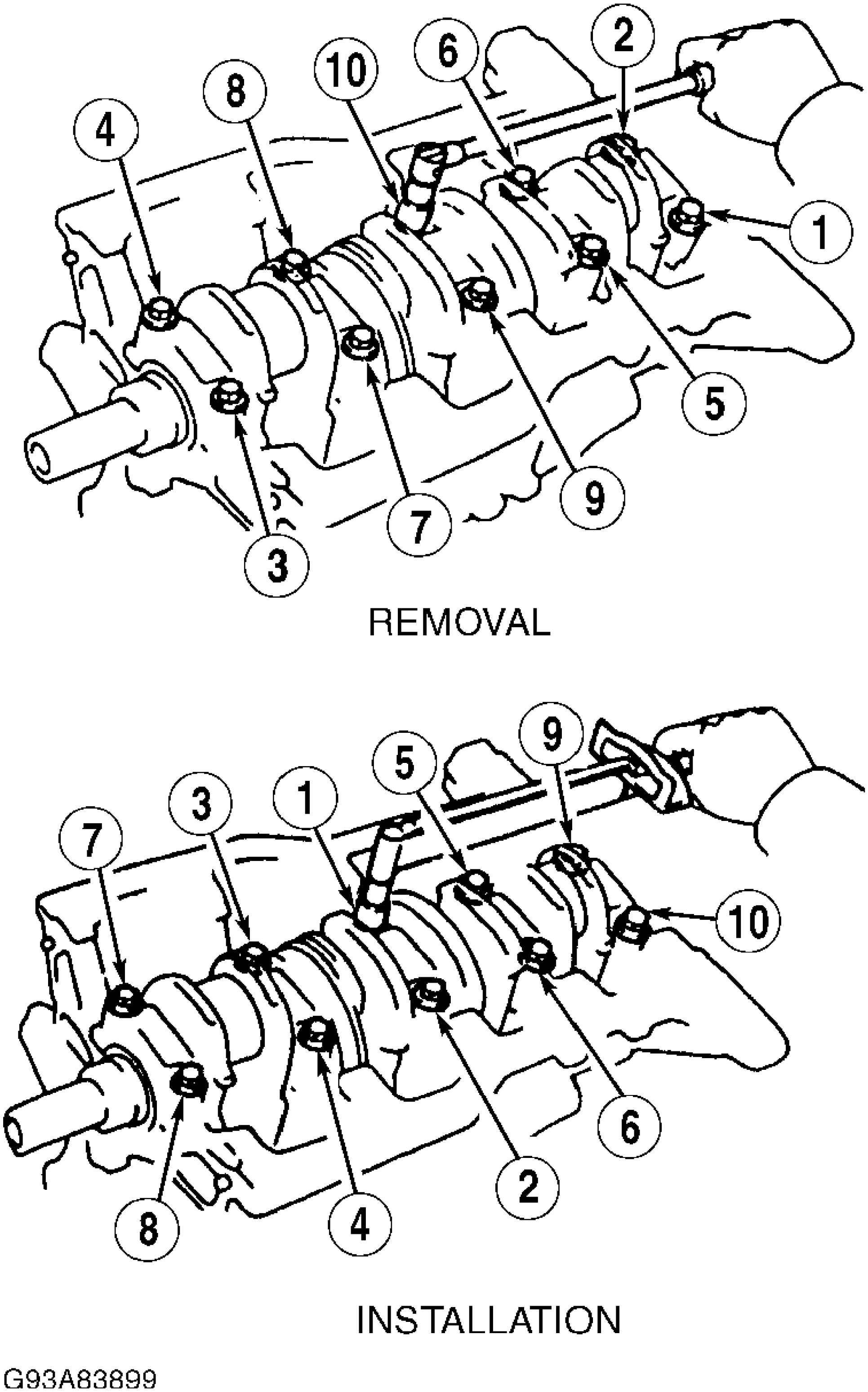


Fig. 58: Main Bearing Cap Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

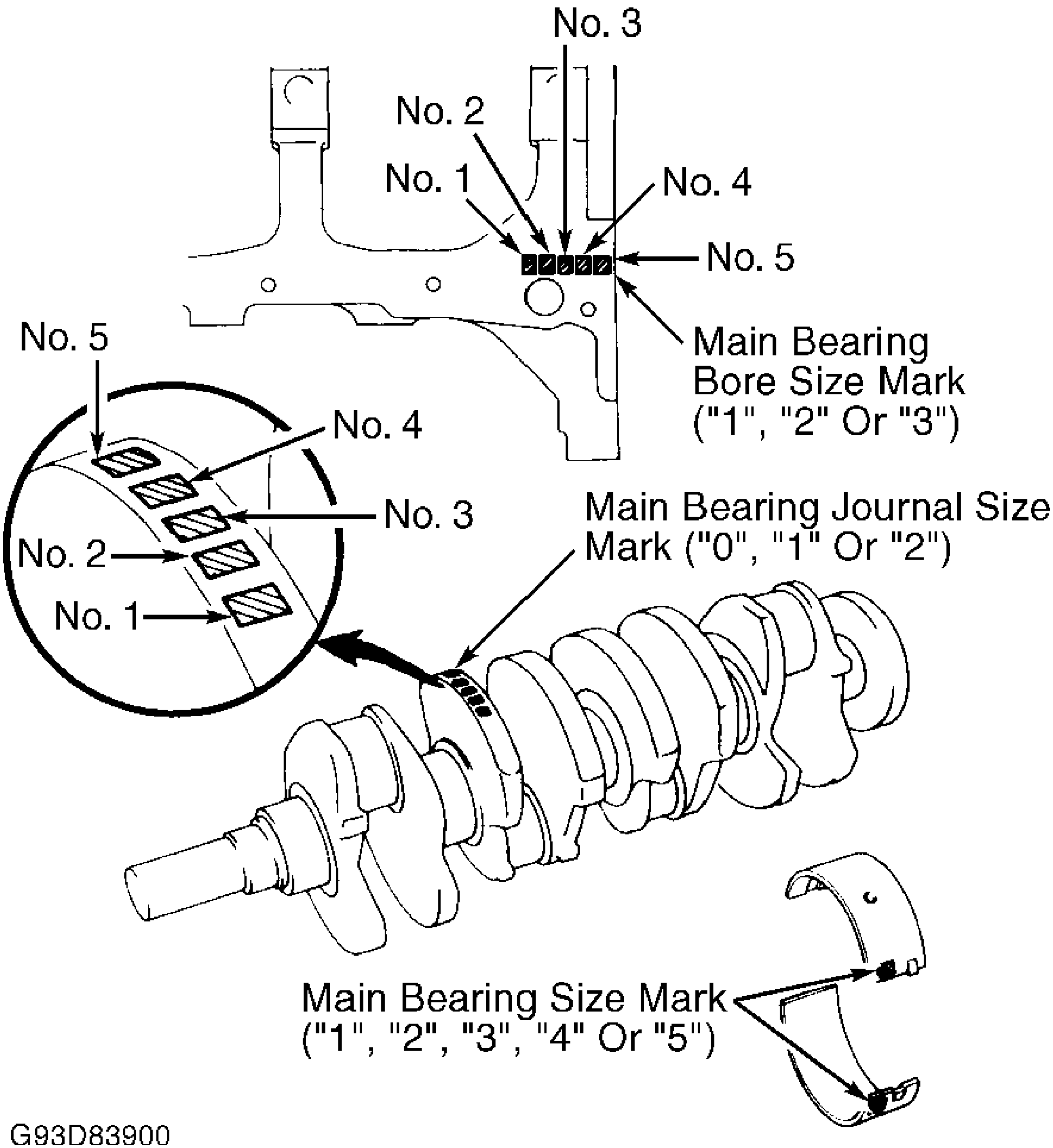


Fig. 59: Identifying Cylinder Block, Crankshaft & Main Bearing Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Thrust Bearing

Install thrust bearing on No. 3 main bearing with grooves facing toward crankshaft away from cylinder block and main bearing cap. Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

1) Inspect cylinder block deck surface warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

2) Different cylinder bore sizes are used and are identified by size mark ("1", "2" or "3") on cylinder block deck surface. See Fig. 55. Measure cylinder bore diameter at .39" (9.9 mm) from top and bottom of cylinder bore and at middle of cylinder bore.

3) Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Bore cylinder block for oversize pistons if clearance is not within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Pistons are available in .20" (.50 mm) oversize.

4) Install main bearing caps in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel/drive plate end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.

5) Install and tighten main bearing cap bolts to specification in sequence. See Fig. 58. See TORQUE SPECIFICATIONS.

6) Ensure main bearing bore inside diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

NOTE: Main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 59.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

The crankshaft-driven oil pump provides lubrication. See Fig. 60. Oil cooler may be installed between oil filter and cylinder block.

NOTE: Oil cooler is used on all Camry and MR2 models and may be optional on Celica models.

Crankcase Capacity

See CRANKCASE CAPACITIES table.

CRANKCASE CAPACITIES (1) TABLE

Application	Qts. (L)
Camry	3.8 (3.6)
Celica	
With Oil Cooler	4.4 (4.2)
Without Oil Cooler	4.3 (4.1)
MR2	4.4 (4.2)

(1) - Capacity listed is with oil filter.

Oil Pressure

With engine at normal operating temperature, oil pressure should be at least 4.3 psi (0.3 kg/cm²) at idle and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

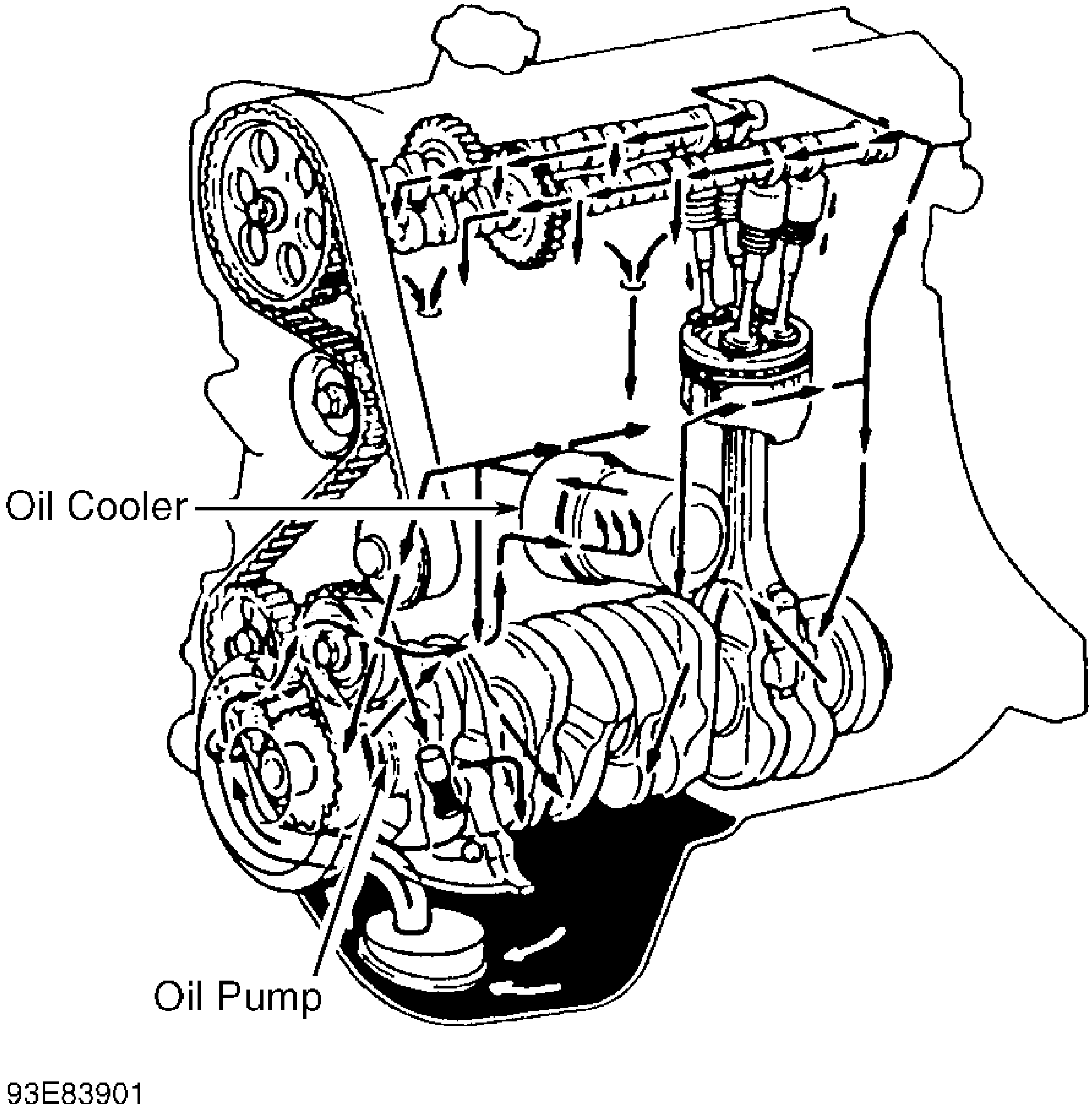


Fig. 60: Cross-Sectional View Of Engine Oil Circuit
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OIL PUMP

Removal & Disassembly

1) Remove timing belt, No. 2 idler pulley, crankshaft sprocket and oil pump sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION.

2) Remove oil pump pick-up tube and gasket. Remove oil pump bolts. Using soft-faced hammer, tap oil pump housing from cylinder

block.

3) To disassemble, remove oil pump body cover bolts, oil pump body cover and "O" ring. Disassemble oil pump components. See Fig. 61. Remove oil pump oil seal and crankshaft front seal from oil pump housing (if necessary).

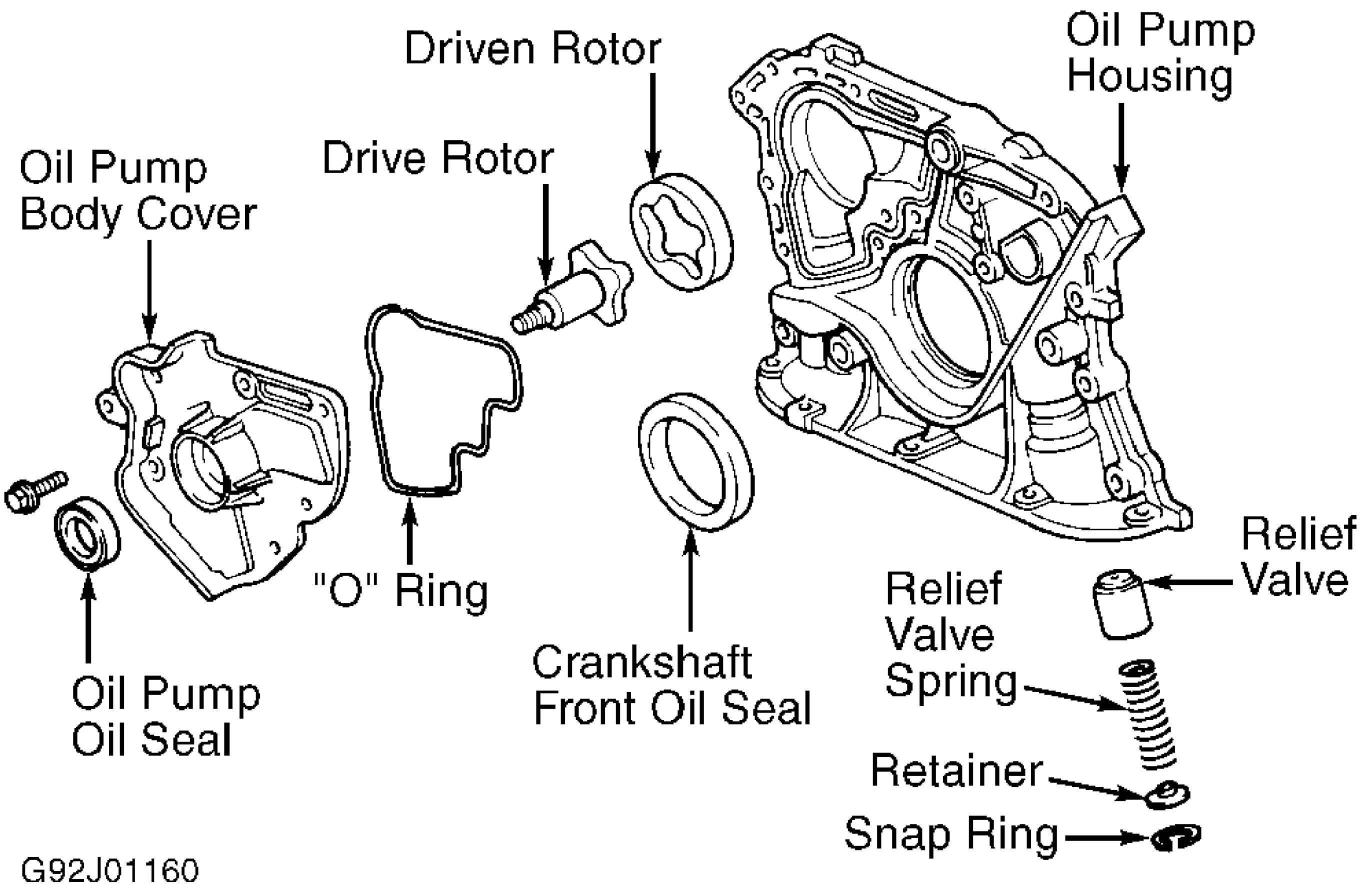


Fig. 61: Exploded View Of Oil Pump
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect components for damage. Ensure relief valve slides freely in bore of oil pump housing. Install rotors in oil pump housing.

2) Using feeler gauge, measure driven rotor-to-oil pump housing clearance. Replace rotor assembly or oil pump housing if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

3) Measure rotor tip clearance between tip of both rotors. Replace rotor assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Driven Rotor-To-Oil Pump Housing Clearance	
Standard	.0039-.0063 (.099-.160)
Wear Limit	.0079 (.200)
Rotor Tip Clearance	
Standard	.0016-.0063 (.040-.160)
Wear Limit	.0079 (.200)

Reassembly & Installation

1) To reassemble, reverse disassembly procedure. Ensure reference marks (dot area) on rotors face toward outside of oil pump body (away from cylinder block surface).

2) Using Seal Installer (SST 09226-10010), install NEW crankshaft front seal (if removed) until seal surface is even with oil pump housing. Coat seal lip with grease.

3) Using Oil Seal Installer (SST 09627-30010) and Handle (SST 09631-00020), install NEW oil pump oil seal (if removed) until seal surface is even with oil pump body cover. Coat seal lip with grease.

4) Install oil pump body cover using NEW "O" ring. Install and tighten oil pump body cover bolts to specification. See TORQUE SPECIFICATIONS.

5) Install oil pump on cylinder block using NEW gasket. Ensure the 2 longest bolts are located in the lowest outside holes nearest to oil pan flange. Tighten bolts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

OIL COOLER

Removal

1) Oil cooler is mounted between oil filter and cylinder block. See Fig. 60. Disconnect negative battery cable. Drain cooling system.

2) Remove lower engine cover. It may be necessary to remove alternator. Remove front exhaust pipe. Remove exhaust manifold with catalytic converter for access to oil cooler (if necessary).

3) Remove oil filter. Disconnect coolant hoses from oil cooler. Remove relief valve and plate washer from center of oil cooler housing. Remove oil cooler-to-cylinder block nut. Remove oil cooler and "O" rings.

Inspection

1) Inspect oil cooler for damage or restriction. Replace oil cooler if damage or restricted.

2) Using wooden stick push inward on check valve located in center of relief valve. Push inward from threaded end (opposite oil filter threads) of relief valve. Replace relief valve if check valve fails to move.

Installation

1) To install, reverse removal procedure using NEW "O" rings. Coat "O" rings with engine oil. Coat threads and area below head of relief valve with engine oil.

2) Install oil cooler with oil cooler-to-cylinder block nut and relief valve loosely installed. Tighten relief valve and then the nut to specification. See TORQUE SPECIFICATIONS.

3) Use NEW gasket when installing exhaust manifold and front exhaust pipe at catalytic converter (if removed). Add engine oil as needed. Fill cooling system.

CAUTION: On MR2, air must be bled from cooling system to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS - CAMRY

TORQUE SPECIFICATIONS TABLE - CAMRY

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	20 (27)
Alternator Bracket Bolt	31 (42)
Axle Shaft Bearing Bolt	24 (33)
Axle Shaft Nut	217 (294)
Balance Shaft Assembly-To-Cylinder Block Bolt (1)	36 (49)
Ball Joint-To-Lower Control Arm Bolt/Nut	94 (127)
Camshaft Bearing Cap Bolt (2)	14 (19)
Camshaft Sprocket Bolt	40 (54)
Catalytic Converter Brace Bolt/Nut	31 (42)
Catalytic Converter-To-Exhaust Manifold Bolt/Nut	21 (29)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Bolt	11 (15)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (3)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Control Rod Bracket-To-Right (Timing Belt Side) Engine Mount Bracket Bolt (4)	47 (64)
Control Rod-To-Strut Tower Bolt	47 (64)
Front (Exhaust Manifold Side) Engine Mount-To-Cylinder Block Bolt	57 (77)
Front (Exhaust Manifold Side) Engine Mount-To-Frame Bolt	59 (80)
Rear (Intake Manifold Side) Engine Mount-To-Cylinder Block Bolt	57 (77)
Rear (Intake Manifold Side) Engine Mount Insulator-To-Frame Nut	49 (66)
Right (Timing Belt Side) Engine Mount Bracket-To-Cylinder Block Bolt	38 (52)
Transaxle Mount-To-Transaxle Bolt	47 (64)
EGR Valve	
Bolt	(5)
Union Nut	43 (58)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Fuel Line-To-Fuel Filter Union Bolt	21 (29)
Fuel Pulsation Damper	25 (34)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	
12-mm Bolt	16 (22)
14-mm Bolt	31 (42)
Knock Sensor	27 (37)
Main Bearing Cap Bolt (6)	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Relief Valve-To-Cylinder Block	58 (79)
Oil Pump Sprocket Nut	21 (29)
Power Steering Pump Bracket Bolt	32 (43)
Power Steering Pump-To-Bracket Bolt	32 (43)
Spark Plug	13 (18)
Stabilizer Bar Link-To-Lower Control Arm Nut	47 (64)
Stiffener Bracket Bolt	27 (37)
Throttle Body Bolt	14 (19)

Tie Rod Nut	36 (49)
Valve Cover Nut	17 (23)
Wheel Lug Nut	76 (103)

	INCH Lbs. (N.m)
Coolant By-Pass Pipe-To-Water Pump Nut	78 (8.8)
Fuel Delivery Pipe Bolt	115 (13.0)
No. 3 Timing Belt Cover Bolt	69 (7.8)
Oil Cooler-To-Cylinder Block Nut	69 (7.8)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	82 (9.3)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Water Pump-To-Cylinder Block Bolt (7)	82 (9.3)
Water Pump-To-Water Pump Cover Bolt	82 (9.3)

(1) - Tighten bolts to specification in sequence. See Fig. 43.
(2) - Tighten bolts to specification in sequence. See Figs. 35 and 36.
(3) - Tighten bolts to specification in sequence. See Fig. 25.
(4) - Tighten bolts to specification in sequence. See Fig. 15.
(5) - Tighten bolt 115 INCH lbs. (13.0 N.m).
(6) - Tighten bolts to specification in sequence. See Fig. 58.
(7) - Tighten bolts to specification in sequence. See Fig. 46.

TORQUE SPECIFICATIONS - CELICA

TORQUE SPECIFICATIONS TABLE - CELICA

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	20 (27)
Alternator Bracket Bolt	31 (42)
Axle Shaft Nut	166 (226)
Ball Joint-To-Lower Control Arm Bolt/Nut	94 (127)
Brake Caliper Bolt	79 (107)
Camshaft Bearing Cap Bolt (1)	14 (19)
Camshaft Sprocket Bolt	40 (54)
Catalytic Converter Brace Bolt/Nut	31 (42)
Catalytic Converter-To-Exhaust Manifold Bolt/Nut	21 (29)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Bolt	11 (15)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (2)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Front (Exhaust Manifold Side) Engine Mount Bracket-To-Cylinder Block Bolt	57 (77)
Front (Exhaust Manifold Side) Engine Mount Through-Bolt	64 (87)

Left (Transaxle Side) Engine Mount Bracket-To-Transaxle Bolt	38 (52)
Left (Transaxle Side) Engine Mount Support Brace Bolt/Nut	15 (20)
Left (Transaxle Side) Engine Mount-To-Bracket Bolt	47 (64)
Left (Transaxle Side) Engine Mount Through-Bolt	64 (87)
Rear (Intake Manifold Side) Engine Mount Bracket-To-Cylinder Block Bolt	57 (77)
Rear (Intake Manifold Side) Engine Mount Through-Bolt	64 (87)
Right (Timing Belt Side) Engine Mount Bracket-To-Cylinder Block Bolt	38 (52)
Right (Timing Belt Side) Engine Mount Support Brace Bolt/Nut	54 (73)
Right (Timing Belt Side) Engine Mount-To-Body Nut	38 (52)
Right (Timing Belt Side) Engine Mount Through-Bolt	64 (87)
Engine Mount Crossmember-To-Body Bolt	38 (52)
Engine Mount-To-Engine Crossmember Bolt	54 (73)
EGR Valve	
Bolt	(3)
Union Nut	43 (58)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Fuel Line-To-Fuel Filter Union Bolt	21 (29)
Fuel Pulsation Damper	25 (34)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	
12-mm Bolt	16 (22)
14-mm Bolt	31 (42)
Knock Sensor	27 (37)
Main Bearing Cap Bolt (4)	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Relief Valve-To-Cylinder Block	58 (79)
Oil Pump Sprocket Nut	21 (29)
Power Steering Pump Bracket Bolt	32 (43)
Power Steering Pump-To-Bracket Bolt	
Adjusting Bolt	29 (39)
All Others	32 (43)
Right Axle Shaft Bearing Retainer Bracket Bolt	47 (64)
Spark Plug	13 (18)
Stiffener Bracket Bolt	27 (37)
Strut Tower-To-Firewall Brace Bolt/Nut	
Bolt	15 (20)
Nut	47 (64)
Suspension Crossmember Bolt	112 (152)
Throttle Body Bolt	14 (19)
Tie Rod Nut	36 (49)
Valve Cover Nut	17 (23)
Wheel Lug Nut	76 (103)

	INCH Lbs. (N.m)
Coolant By-Pass Pipe-To-Water Pump Nut	82 (9.3)
Fuel Delivery Pipe Bolt	115 (13.0)
No. 3 Timing Belt Cover Bolt	69 (7.8)
Oil Cooler-To-Cylinder Block Nut	69 (7.8)

Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Pick-Up Tube Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	78 (8.8)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Water Pump-To-Cylinder Block Bolt (5)	78 (8.8)
Water Pump-To-Water Pump Cover Bolt	78 (8.8)

(1) - Tighten bolts to specification in sequence. See Figs. 35 and 36.
(2) - Tighten bolts to specification in sequence. See Fig. 25.
(3) - Tighten bolt 115 INCH lbs. (13.0 N.m).
(4) - Tighten bolts to specification in sequence. See Fig. 58.
(5) - Tighten bolts to specification in sequence. See Fig. 46.

TORQUE SPECIFICATIONS - MR2

TORQUE SPECIFICATIONS TABLE - MR2

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	18 (24)
Axle Shaft Nut	166 (226)
Ball Joint-To-Axle Carrier Bolt	83 (113)
Brake Caliper Bolt	43 (58)
Camshaft Bearing Cap Bolt (1)	14 (19)
Camshaft Sprocket Bolt	40 (54)
Catalytic Converter Brace Bolt/Nut	31 (42)
Catalytic Converter-To-Exhaust Manifold Bolt/Nut	21 (29)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Bolt	11 (15)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (2)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
EGR Valve	
Nut	(3)
Union Nut	43 (58)
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Control Rod & Bracket-To-Body Bolt	26 (35)
Control Rod & Bracket-To-Engine Mount Bolt	27 (37)
Control Rod Support Bolt	
Engine Mount Side	54 (73)
Transaxle Side	18 (24)
Engine Mount Bracket-To-Transaxle Case Bolt	38 (52)
Front (Exhaust Manifold Side) Engine Mount-To-Body Bolt	54 (73)
Front (Exhaust Manifold Side) Engine Mount Through-Bolt	64 (87)
Left (Flywheel Side) Engine Mount Through-Bolt	58 (79)
Left (Flywheel Side) Engine Mount-To-Bracket Bolt	(4)
Rear (Intake Manifold Side) Engine Mount Bracket-To-Body Bolt	57 (77)
Rear (Intake Manifold Side) Engine Mount-To-Body Bolt	47 (64)

Rear (Intake Manifold Side)	
Engine Mount Through-Bolt	64 (87)
Right (Timing Belt Side) Engine Mount Support	
Bracket Bolt/Nut	54 (73)
Right (Timing Belt Side) Engine Mount	
Bracket-To-Cylinder Block Bolt	45 (61)
Right (Timing Belt Side) Engine Mount-To-Mounting	
Bracket Nut	38 (52)
Right (Timing Belt Side) Engine Mount	
Through-Bolt	58 (79)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Idler Pulley Bracket-To-Cylinder Block Bolt	
12-mm Head	20 (27)
14-mm Head	27 (37)
Fuel Pulsation Damper	25 (34)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	
12-mm Bolt	16 (22)
14-mm Bolt	31 (42)
Knock Sensor	27 (37)
Main Bearing Cap Bolt (5)	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Relief Valve-To-Cylinder Block	58 (79)
Oil Pump Sprocket Nut	21 (29)
Spark Plug	13 (18)
Stabilizer Link Nut	36 (49)
Stiffener Bracket Bolt	27 (37)
Throttle Body Bolt	14 (19)
Suspension Rod-To-Axle Carrier Bolt/Nut	76 (103)
Transaxle Control Cable Bracket Bolt	57 (77)
Valve Cover Nut	17 (23)
Wheel Lug Nut	76 (103)

	INCH Lbs. (N.m)
ABS Speed Sensor Bolt	65 (7.4)
Clutch Release Cylinder-To-Transaxle Bolt	106 (12.0)
Coolant By-Pass Pipe-To-Water Pump Nut	82 (9.3)
Fuel Delivery Pipe Bolt	115 (13.0)
No. 3 Timing Belt Cover Bolt	69 (7.8)
Oil Cooler-To-Cylinder Block Nut	69 (7.8)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	78 (8.8)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Water Pump-To-Cylinder Block Bolt	(6)
Water Pump-To-Water Pump Cover Bolt	78 (8.8)

(1) - Tighten bolts to specification in sequence. See Figs. 35 and 36.
(2) - Tighten bolts to specification in sequence. See Fig. 25.
(3) - Tighten nut 115 INCH lbs. (13.0 N.m).
(4) - Tighten bolts to specification. See Fig. 23.
(5) - Tighten bolts to specification in sequence. See Fig. 58.
(6) - Tighten bolts to 78 (8.8) INCH lbs. in sequence.

See Fig. 46.
On models without A/C, tighten the large bracket bolt to 20 ft. lbs. (27 N.m).

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS TABLE

Application	Specification
Displacement	134 Cu. In. (2.2L)
Bore	3.43" (87.1 mm)
Stroke	3.58" (90.9 mm)
Compression Ratio	9.5:1
Fuel System	PFI
Horsepower @ RPM	135 @ 5400
Torque Ft. Lbs. @ RPM	145 @ 4400

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.0118 (.300)
Maximum Runout	.0024 (.060)
Main Bearings	
Journal Diameter (1)	
Size Mark "0"	2.1653-2.1655 (54.998-55.003)
Size Mark "1"	2.1651-2.1653 (54.993-54.998)
Size Mark "2"	2.1649-2.1651 (54.988-54.993)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft	
No. 3 Journal	
Standard	.0010-.0017 (.025-.044)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0006-.0013 (.015-.034)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft	
No. 3 Journal	
Standard	.0011-.0026 (.027-.067)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0007-.0023 (.019-.059)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	2.0466-2.0472 (51.985-52.000)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft	
Standard	.0009-.0022 (.024-.055)

Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft	
Standard	.0009-.0027 (.023-.069)
Wear Limit	.0031 (.080)

(1) - Main bearing journal diameter is determined by size mark stamped on crankshaft. See Fig. 59.

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	
Pin Bore	.8663-.8668 (22.005-22.017)
Maximum Bend	.002 Per 3.94 (.05 Per 100.1)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	.0063-.0123 (.160-.312)
Wear Limit	.0138 (.350)

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

Application	In. (mm)
Pistons	
Clearance	
Standard	.0055-.0063 (.140-.160)
Wear Limit	.0071 (.180)
Diameter (1)	
Size Mark "1"	3.4193-3.4197 (86.850-86.860)
Size Mark "2"	3.4197-3.4201 (86.860-86.870)
Size Mark "3"	3.4201-3.4205 (86.870-86.880)
Pins	
Diameter	.8660-.8665 (21.997-22.009)
Piston Fit	(2)
Rod Fit	
Standard	.0002-.0004 (.005-.011)
Wear Limit	.0020 (.050)
Rings	
No. 1	
End Gap	
Standard	.0106-.0197 (.270-.500)
Wear Limit	.0433 (1.100)
Side Clearance	.0016-.0031 (.040-.080)
No. 2	
End Gap	
Standard	.0138-.0236 (.350-.600)
Wear Limit	.0472 (1.200)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0217 (.200-.550)
Wear Limit	.0453 (1.150)

(1) - Piston diameter is determined by size mark stamped on top of piston. See Fig. 54.
(2) - With piston temperature at 140°F (60°C), piston pin

should slide through piston with thumb pressure.

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATIONS TABLE

Application	In. (mm)
Cylinder Bore (1)	
Size Mark "1"	3.4252-3.4256 (87.000-87.010)
Size Mark "2"	3.4256-3.4260 (87.010-87.020)
Size Mark "3"	3.4260-3.4264 (87.020-87.030)
Maximum Deck Warpage	.002 (.05)
Main Bearing Bore I.D. (2)	
Size Mark "1"	2.3326-2.3239 (59.020-59.026)
Size Mark "2"	2.3239-2.3241 (59.026-59.032)
Size Mark "3"	2.3241-2.3243 (59.032-59.038)

(1) - Cylinder bore diameter is determined by size mark on cylinder block deck surface. See Fig. 55. Maximum bore diameter is 3.4342" (87.230 mm).
(2) - Main bearing bore I.D. is determined by main bearing bore size mark on cylinder block. See Fig. 59.

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS SPECIFICATIONS TABLE

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)
Minimum Refinish Length	3.823" (97.10 mm)
Stem Diameter	.2350-.2356" (5.970-5.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)
Minimum Refinish Length	3.858" (98.00 mm)
Stem Diameter	.2348-.2354" (5.965-5.980 mm)
Valve Springs	
Free Length	1.6520-1.6531" (41.96-41.99 mm)
Out-Of-Square Limit	.079" (2.00 mm)
	Lbs. @ In. (kg @ mm)
Pressure	37-43 @ 1.366 (16.7-19.5 @ 34.70)

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD SPECIFICATIONS TABLE

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.002" (.05 mm)
Intake & Exhaust Manifold Surface	.003" (.08 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.039-.055" (.99-1.40 mm)

Exhaust Valve	
Seat Angle	45°
Seat Width	.039-.055" (.99-1.40 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Camry	
Standard Valve Guide	.4331-.4342 (11.000-11.027)
Oversize Valve Guide	.4350-.4361 (11.050-11.077)
Celica & MR2	
Standard Valve Guide	.4325-.4335 (10.985-11.012)
Oversize Valve Guide	.4344-.4355 (11.035-11.062)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0010-.0024" (.025-.060 mm)
Wear Limit	.0031" (.080 mm)
Exhaust Valve	
Valve Guide Cylinder Head Bore I.D.	
Camry	
Standard Valve Guide	.4331-.4342 (11.000-11.027)
Oversize Valve Guide	.4350-.4361 (11.050-11.077)
Celica & MR2	
Standard Valve Guide	.4325-.4335 (10.985-11.012)
Oversize Valve Guide	.4344-.4355 (11.035-11.062)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Wear Limit	.0039" (.099 mm)

CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

Application	In. (mm)
End Play	
Intake Camshaft	
Standard	.0018-.0039 (.046-.099)
Wear Limit	.0047 (.120)
Exhaust Camshaft	
Standard	.0012-.0033 (.030-.085)
Wear Limit	.0039 (.099)
Gear Backlash	
Standard	.0008-.0079 (.020-.200)
Wear Limit	.0118 (.300)
Journal Diameter	1.0614-1.0620 (26.959-26.975)
Journal Runout	.0016 (.040)
Lobe Height	
Intake Camshaft	
Standard	1.6539-1.6579 (42.010-42.110)
Wear Limit	1.6496 (41.900)
Exhaust Camshaft	
Standard	1.5772-1.5811 (40.060-40.160)
Wear Limit	1.5728 (39.950)
Oil Clearance	
Standard	.0010-.0024 (.025-.062)
Wear Limit	.0039 (.099)

VALVE LIFTERS SPECIFICATIONS

VALVE LIFTERS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	1.2205-1.2213 (31.000-31.018)
Lifter Diameter	1.2191-1.2195 (30.966-30.976)
Oil Clearance	
Standard	.0009-.0020 (.024-.052)
Wear Limit	.0028 (.070)

ABBREVIATIONS

1993 Toyota Celica

GENERAL INFORMATION

COMMONLY USED ABBREVIATION

"A" ABBREVIATION TABLE

"A" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
A	Amperes
A/C	Air Conditioning
A/T	Automatic Transmission/Transaxle
AAP	Auxiliary Accelerator Pump
AB	Air Bleed
ABCV	Air Bleed Control Valve
ABDC	After Bottom Dead Center
ABRS	Air Bag Restraint System
ABS	Anti-Lock Brake System
AC	Alternating Current
ACC	A/C Clutch Compressor
ACCS	A/C Cycling Switch
ACCUM	Accumulator
ACCY	Accessory
ACT	Air Charge Temperature Sensor
ACV	Thermactor Air Control Valve
ADJ	Adjust or Adjustable
ADV	Advance
AFS	Airflow Sensor
AI	Air Injection
AIR or A.I.R.	Air Injection Reactor
AIS	Air Injection System
ALCL	Assembly Line Communications Link
ALDL	Assembly Line Diagnostic Link
ARC	Automatic Ride Control
ASCD	Automatic Speed Control Device
ASCS	Air Suction Control Solenoid
ASD	Auto Shutdown
ASDM	Air Bag System Diagnostic Module
ASV	Air Suction Valve
ATC	Automatic Temperature Control
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATS	Air Temperature Sensor
AXOD	Automatic Transaxle Overdrive
Abs.	Absolute
Accy.	Accessory
Alt.	Alternator or Altitude
Amp.	Ampere
Assy.	Assembly
Auto.	Automatic
Aux.	Auxiliary
Avg.	Average

"B" ABBREVIATION TABLE

"B" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
B/P	Backpressure
BAC	By-Pass Air Control
BAP	Barometric Absolute Pressure Sensor
BARO	Barometric
BBDC	Before Bottom Dead Center
BCM	Body Control Module
BDC	Bottom Dead Center
BHP	Brake Horsepower
BLK	Black
BLU	Blue
BMAP	Barometric & Manifold Absolute Pressure Sensor
BOO	Brake On-Off Switch
BP	Barometric Pressure sensor
BPS	Barometric Pressure Sensor
BPT	Backpressure Transducer
BRN	Brown
BTDC	Before Top Dead Center
BTU	British Thermal Unit
BVSV	Bimetallic Vacuum Switching Valve
Baro.	Barometric
Batt.	Battery
Bbl.	Barrel (Example: 4-Bbl.)
Blst.	Ballast
Blwr.	Blower
Brkr.	Breaker

"C" ABBREVIATION TABLE

"C" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
° C	Celsius (Degrees)
C(3) I	Computer Controlled Coil Ignition
C(4)	Computer Controlled Catalytic Converter
CANP	Canister Purge solenoid
CARB	California Air Resources Board
CAT	Catalytic Converter
CB	Circuit Breaker
CBD	Closed Bowl Distributor
CBVV	Carburetor Bowl Vent Valve
cc	Cubic Centimeter
CCC	Computer Command Control
CCD	Computer Controlled Dwell
CCM	Central Control Module
CCO	Converter Clutch Override
CCOT	Cycling Clutch Orifice Tube
CCW	Counterclockwise
CDI	Capacitor Discharge Ignition
CEC	Computerized Engine Control
CFI	Central Fuel Injection
CID	Cubic Inch Displacement
CID	Cylinder Identification sensor
CIS	Continuous Injection System
CIS-E	Continuous Injection System-Electronic
CKT	Circuit
CLR	Clear
CNG	Compressed Natural Gas

CO	Carbon Monoxide
CO2	Carbon Dioxide
CONV	Convertible
CP	Canister Purge
CPA	Connector Position Assurance
CPS	Crank Position Sensor
CTS	Coolant Temperature Sensor
CV	Check Valve or Constant Velocity
CVC	Constant Vacuum Control
CW	Clockwise
CYL or Cyl.	Cylinder
Calif.	California
Carb.	Carburetor
Chrg.	Charging
Circ.	Circuit
Cntrl.	Control
Comp.	Compressor or Compartment
Conn.	Connector
Cont.	Continued
Conv.	Convertible or Converter
Cu. In.	Cubic Inch
Cyl.	Cylinder

"D" ABBREVIATION TABLE

"D" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
"D"	Drive
DBC	Dual Bed Catalyst
DC	Direct Current or Discharge
DDD	Dual Diaphragm Distributor
DERM	Diagnostic Energy Reserve Module
DFI	Digital Fuel Injection
DIC	Driver Information Center
DIS	Direct Ignition System
DIS	Distributorless Ignition System
DIST	Distribution
DISTR	Distributor
DK BLU	Dark Blue
DK GRN	Dark Green
DME	Digital Motor Electronics (Motronic System)
DOHC	Double Overhead Cam
DOT	Department of Transportation
DP	Dashpot
DRB-II	Diagnostic Readout Box
DVOM	Digital Volt/Ohm Meter (see VOM)
Def.	Defogger or Defroster
Def.	Defrost
Defog.	Defogger
Diag.	Diagnostic
Dist.	Distributor or Distribution
Dr.	Door

"E" ABBREVIATION TABLE

"E" ABBREVIATION TABLE

ABBREVIATION	DEFINITION

EAC	Electric Assist Choke
EACV	Electric Air Control Valve
EBCM	Electronic Brake Control Module
ECA	Electronic Control Assembly
ECAT	Electronically Controlled Automatic Transaxle
ECM	Electronic Control Module
ECT	Engine Coolant Temperature Sensor
ECU	Electronic Control Unit or Engine Control Unit
EDF	Electric Drive Fan relay assembly
EDIS	Electronic Distributorless Ignition System
EEC	Electronic Engine Control
EECS	Evaporative Emission Control System
EEPROM	Electronically Erasable PROM
EFE	Early Fuel Evaporation
EFI	Electronic Fuel Injection
EGO	Exhaust Gas Oxygen sensor (see HEGO)
EGR	Exhaust Gas Recirculation system
EGRC	EGR Control solenoid or system
EGRV	EGR Vent solenoid or system
EMR	Emission Maintenance Reminder Module
ESA	Electronic Spark Advance
ESC	Electronic Spark Control
EST	Electronic Spark Timing
ETR	Emergency Tensioning Retractor
EVAP	Fuel Evaporative System
EVIC	Electronic Vehicle Information Center
EVO	Electronic Variable Orifice
EVP	EGR Valve Position Sensor
EVR	EGR Valve Regulator
EVRV	Electronic Vacuum Regulator Valve
Elect.	Electronic
Eng.	Engine
Evap.	Evaporative
Exc.	Except

"F" ABBREVIATION TABLE

"F" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
° F	Fahrenheit (Degrees)
F/B	Fuse Block
FBC	Feedback Carburetor
FI	Fuel Injector or Fuel Injection
FICD	Fast Idle Control Device
FIPL	Fuel Injector Pump Lever
FP	Fuel Pump
FPM	Fuel Pump Monitor
FPR-VSV	Fuel Pressure Regulator Vacuum Switching Valve
FWD	Front Wheel Drive
Fed.	Federal
Ft. Lbs.	Foot Pounds

"G" ABBREVIATION TABLE

"G" ABBREVIATION TABLE

ABBREVIATION	DEFINITION

g	grams
GND or GRND	Ground
GRN	Green
GRY	Gray
Ga.	Gauge
Gals.	gallons
Gov.	Governor

"H" ABBREVIATION TABLE

"H" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
H/D	Heavy Duty
HAC	High Altitude Compensation
HC	Hydrocarbons
HEDF	High Speed Electro Drive Fan relay or circuit
HEGO	Heated Exhaust Gas Oxygen Sensor
HEGOG	HEGO Ground circuit
HEI	High Energy Ignition
HLDT	Headlight
HO	High Output
HP	High Performance
HSC	High Swirl Combustion
HSO	High Specific Output
HTR	Heater
HVAC	Heating
Headlt.	Headlight
Hg	Mercury
Hgt.	Height
Htr.	Heater
Hz	Hertz (Cycles Per Second)

"I" ABBREVIATION TABLE

"I" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
I.D.	Inside Diameter
IAC	Idle Air Control
IACV	Idle Air Control Valve
IC	Integrated Circuit
ID	Identification
IDM	Ignition Diagnostic Monitor
IGN	Ignition system or circuit
ILC	Idle Load Compensator
In. Hg	Inches of Mercury
INCH Lbs.	Inch Pounds
INFL REST	Inflatable Restraint
INJ	Injector or Injection
IP	Instrument Panel
IPC	Instrument Panel Cluster
ISA	Idle Speed Actuator
ISC	Idle Speed Control
ISS	Idle Stop Solenoid
ITS	Idle Tracking Switch
IVSV	Idle Vacuum Switching Valve

Ign.	Ignition
In.	Inches
Inj.	Injector

"J" ABBREVIATION TABLE

"J" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
J/B	Junction Block

"K" ABBREVIATION TABLE

"K" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
k/ohms	1000 ohms (kilo as in k/ohms)
kg	Kilograms (weight)
kg/cm^2	Kilograms Per Square Centimeter
KAM	Keep Alive Memory
KAPWR	Keep Alive Power
KM/H	Kilometers Per Hour
KOEO	Key On Engine Off
KOER	Key On Engine Running
KS	Knock Sensor

"L" ABBREVIATION TABLE

"L" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
L	Liter(s)
L/D	Light Duty
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left Hand
LOS	Limited Operation Strategy
LT BLU	Light Blue
LT GRN	Light Green
LUS	Lock-Up Solenoid
Lbs.	Pounds
Lt(s).	Light(s)
Lugg.	Luggage

"M" ABBREVIATION TABLE

"M" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
mA	Milliamps
mV	Millivolts
mfd.	Microfarads

mm	Millimeters
M/T	Manual Transaxle or Transmission
MA PFI	Mass Air Sequential Port Fuel Injection system
MA or MAF	Mass Airflow
MAF	Mass Air Flow sensor
MAFS	Mass Airflow Sensor
MAP	Manifold Absolute Pressure sensor
MAT	Manifold Air Temperature
MCU	Microprocessor Control Unit
MCV	Mixture Control Valve
MEM-CAL	Memory Calibration Chip
MFI	Multiport Fuel Injection
MIL	Malfunction Indicator Light
MLP	Manual Lever Position
MPFI	Multi Point Fuel Injection
MPH	Miles Per Hour
MPI	Multi-Point (Fuel) Injection
Man.	Manual
Mech.	Mechanical
Mem.	Memory
Mtr.	Motor

"N" ABBREVIATION TABLE

"N" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
N.m	Newton-Meter
NA	Not Available
NDS	Neutral Drive Switch
NGS	Neutral Gear Switch
NOx	Oxides of Nitrogen
NPS	Neutral Pressure Switch
No.	Number
Nos.	Numbers

"O" ABBREVIATION TABLE

"O" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
O	Oxygen
O.D.	Outside Diameter
O/S	Oversize
O2	Oxygen
OC	Oxidation Catalyst
OCC	Output Circuit Check
OD	Overdrive
ODO	Odometer
OHC	Overhead Camshaft
ORG	Orange
OSC	Output State Check
Opt.	Option or Optional
oz.	Ounce
ozs.	Ounces

"P" ABBREVIATION TABLE

"P" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
"P"	Park
P/C	Printed Circuit
P/N	Park/Neutral
P/S	Power Steering
PAV	Pulse Air Valve
PC-SOL	Purge Control Solenoid
PCM	Powertrain Control Module
PCS	Purge Control Solenoid
PCSDM	Passenger Compartment Sensor/Diagnostic Module
PCV	Positive Crankcase Ventilation
PFE	Pressure Feedback EGR sensor or circuit
PFI	Port Fuel Injection (see MA SEFI)
PGM-CARB	Programmed Carburetor
PGM-FI	Programmed Fuel Injection
PIP	Profile Ignition Pickup
PNK	Pink
PPL	Purple
PRNDL	Park Reverse Neutral Drive Low
PROM	Programmable Read-Only Memory
psi	Pounds Per Square Inch
PSPS	Power Steering Pressure Switch
PTC	Positive Temperature Coefficient
PTO	Power Take-Off
PWR GND	Power Ground circuit
Pkg.	Package
Press.	Pressure
Prog.	Programmed or Programmable
Pts.	Pints
Pwr.	Power

"Q" ABBREVIATION TABLE

"Q" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
Qts.	Quarts

"R" ABBREVIATION TABLE

"R" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
RABS	Rear Anti-Lock Brake System
RAC	Remote Accessory Control
RAM	Random Access Memory
RAP	Retained Accessory Power
RECIRC	Recirculation
RED	Red
RH	Right Hand
ROM	Read Only Memory
RPM	Revolutions Per Minute

RVB	Rear Vacuum Break
RWAL	Rear Wheel Anti-Lock Brake
RWD	Rear Wheel Drive
Recirc.	Recirculate or Recirculation
Reg.	Regulator
Rly.	Relay

"S" ABBREVIATION TABLE

"S" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
SAW	Spark Angle Word
SBC	Single Bed Converter
SBEC	Single Board Engine Controller
SC	Super Charged
SCC	Spark Control Computer
SCS	Air Suction Control Solenoid
SDM	Supplemental Restraint System Diagnostic Module
SDU	SRS Diagnostic Unit
SEN	Sensor
SES	Service Engine Soon
SFI	Sequential (Port) Fuel Injection
SIG RTN	Signal Return circuit
SIL	Shift Indicator Light
SIR	Supplemental Inflatable Restraint
SMEC	Single Module Engine Controller
SOHC	Single Overhead Cam
SOL or Sol.	Solenoid
SPFI	Sequential Port Fuel Injection
SPK	Spark Control
SPOUT	Spark Output Signal
SRS	Supplemental Restraint System (Air Bag)
SS 3/4-4/3	Shift Solenoid circuit
SSI	Solid State Ignition
STAR	Self-Test Automatic Readout
STI	Self Test Input circuit
STO	Self-Test Output
SUB-O2	Sub Oxygen Sensor
Sen. or Sens.	Sensor
Sol.	Solenoid
Sprchg.	Supercharger
Strg.	Steering
Susp.	Suspension
Sw.	Switch
Sys.	System

"T" ABBREVIATION TABLE

"T" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
T.V.	Throttle Valve
TAB	Thermactor Air By-Pass
TAC	Thermostatic Air Cleaner
TAD	Thermactor Air Diverter
TAN	Tan
TBI	Throttle Body Injection

TCC	Torque Converter Clutch
TCCS	Toyota Computer Control System
TDC	Top Dead Center
TDCL	Total Diagnostic Communication Link
TFI	Thick Film Ignition system
TGS	Top Gear Switch (cancels SIL in top gear)
THERMAC	Thermostatic Air Cleaner
THS	Transmission Hydraulic Switch
TP/TPS	Throttle Position Sensor
TPI	Tuned Port Injection
TPS	Throttle Position Sensor/Switch
TS	Temperature Sensor
TSB	Technical Service Bulletin
TTS	Transmission Temperature Switch
TV	Thermovalve
TWC	Three-Way Catalyst
Temp.	Temperature
Trans.	Transaxle/Transmission

"V" ABBREVIATION TABLE

"V" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
V	Valve
VAF	Vane Air Flow sensor or circuit
VAPS	Variable Assist Power Steering
VAT	Vane Air Temperature
VATS	Vehicle Anti-Theft System
VBATT	Vehicle Battery Voltage
VCC	Viscous Converter Clutch
VIN	Vehicle Identification Number
VIO	Violet
VLR	Volt Loop Reserve
VM	Vacuum Modulator
VM	Vane Meter
VOM	Volt-Ohmmeter (Analog)
VPWR	Vehicle Power supply voltage (10-14 volts)
VREF	Voltage Reference (ECA supplied reference voltage
VRV	Vacuum Regulator Valve
VSC	Vehicle Speed Control sensor or signal
VSS	Vehicle Speed Sensor or signal
VSV	Vacuum Switching Valve
Vac.	Vacuum
Volt.	Voltage

"W" ABBREVIATION TABLE

"W" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
W/	With
W/O	Without
WAC	WOT A/C Cut-off switch or circuit
WAC	Wide Open Throttle A/C Switch
WHT	White
WOT	Wide Open Throttle
YEL	Yellow

A/C COMPRESSOR SERVICING

1993 Toyota Celica

1993 AIR CONDITIONING & HEAT
Compressor Servicing

READ THIS FIRST

NOTE: The purpose of this article is to provide GENERAL servicing overview. For more specific information, refer to the AUTO A/C-HEAT SYSTEM, MANUAL A/C-HEAT SYSTEM, or HEATER SYSTEM articles in this section.

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

ATSUGI ROTARY VANE CLUTCH COIL R & I

Removal

When replacing compressor clutch, be careful not to scratch shaft or bend pulley. When removing center bolt, hold clutch disc with Clutch Holder (KV99231010). Using Hub Puller (KV998VR001), remove clutch disc. When removing pulley, remove lock nut with Hub Socket (KV99235160).

Installation

1) Tighten center bolt to 81-104 INCH lbs. (9.1-11.8 N.m). Tighten lock nut to 21-29 ft. lbs. (29-39 N.m). Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm).

2) If clearance is not correct, replace adjustment shim(s). See Fig. 1. Break-in clutch by engaging and disengaging clutch about 30 times.

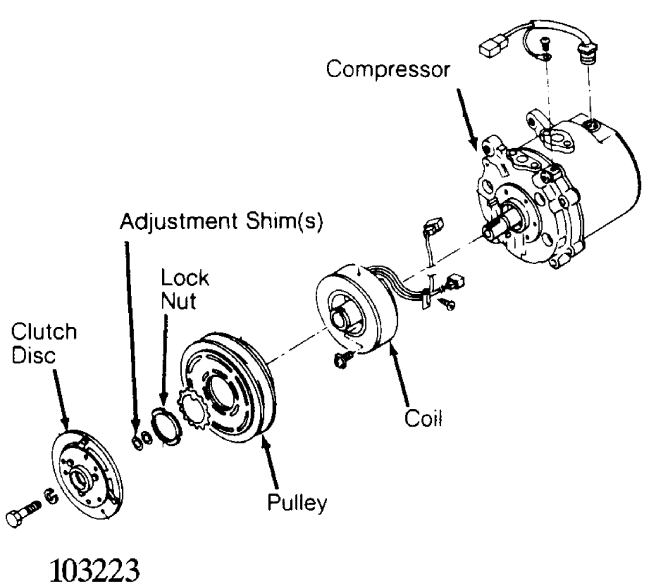


Fig. 1: Exploded View Of Compressor (Atsugi Rotary Vane)
Courtesy of Nissan Motor Co., U.S.A.

BOSCH 6-CYLINDER CLUTCH COIL R & I

Removal

1) Hold clutch plate and remove shaft nut. Using Clutch Plate Remover (64 5 00), remove clutch plate. Using snap ring pliers, remove circlip and remove pulley assembly.

2) If pulley bearing is being replaced, remove circlip at rear of pulley. Press bearing and spacer from pulley. Press in new bearing with spacer and replace circlip.

Installation

1) Clean all surfaces. Install pulley assembly on compressor and install circlip. Ensure clutch plate shim is in place on shaft. Install clutch plate and nut. Tighten nut to 13-15 ft. lbs. (18-20 N. m).

2) Using a feeler gauge, check clutch plate-to-pulley clearance. Clearance should be .028-.051" (.7-1.3 mm). If clearance is not correct, remove clutch plate and replace clutch plate shim. See Fig. 2.

BOSCH 6-CYLINDER SHAFT SEAL R & I

Removal

Remove clutch plate. Remove shaft key and circlip. Using Seal Seat Remover/Installer (64 5 030), remove seal seat. Using Seal Remover/Installer (64 5 040), turn seal slightly clockwise to disengage tangs and pull out shaft seal. Remove "O" ring seal.

Installation

1) Coat new "O" ring seal with refrigerant oil and install. Coat new shaft seal with refrigerant oil and install seal on Seal Remover/Installer(64 5 040). Ensure shaft seal and shaft machine surfaces align. Insert shaft seal and turn slightly counterclockwise to secure on shaft.

2) Using sleeve from Seal Seat Remover/Installer (64 5 030), push seal seat into compressor and install circlip. Install shaft key and clutch plate. Check compressor oil level before charging system.

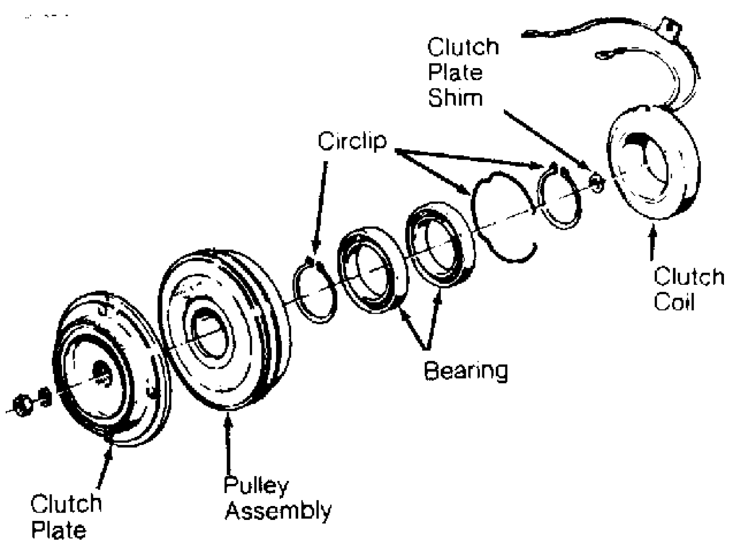


Fig. 2: Exploded View Of Compressor Clutch (Bosch 6-Cylinder)
Courtesy of BMW of North America, Inc.

NOTE: Calsonic V6 compressor servicing procedure is not available from manufacturer.

Removal

1) Remove shaft nut while holding clutch plate with Clutch Disc Wrench (J-39072). Install clutch disc Puller Set (J-39073-4, J-33013-1, J-33013-3) and remove clutch plate.

2) Remove snap ring. Use a universal gear puller to remove clutch pulley. See Fig. 3. Remove screw from clutch coil lead. Use puller to remove clutch coil.

Installation

1) To install clutch coil, reverse removal procedure. Ensure coil lead is installed in original position. Using puller set and Coil Jig (J-39073-1), carefully press clutch coil into place.

2) Install a new clutch pulley snap ring, being careful not to damage shaft seal. Press clutch plate into place. Install shaft nut and torque to 89-106 INCH lbs. (10-12 N.m).

3) Use a feeler gauge to check clutch plate-to-pulley clearance. Clearance should be .012-.024" (.30-.60 mm). If clearance is too large, remove shaft nut and again press in clutch plate. If clearance is too small, increase gap by pulling up clutch plate. DO NOT remove shaft nut.

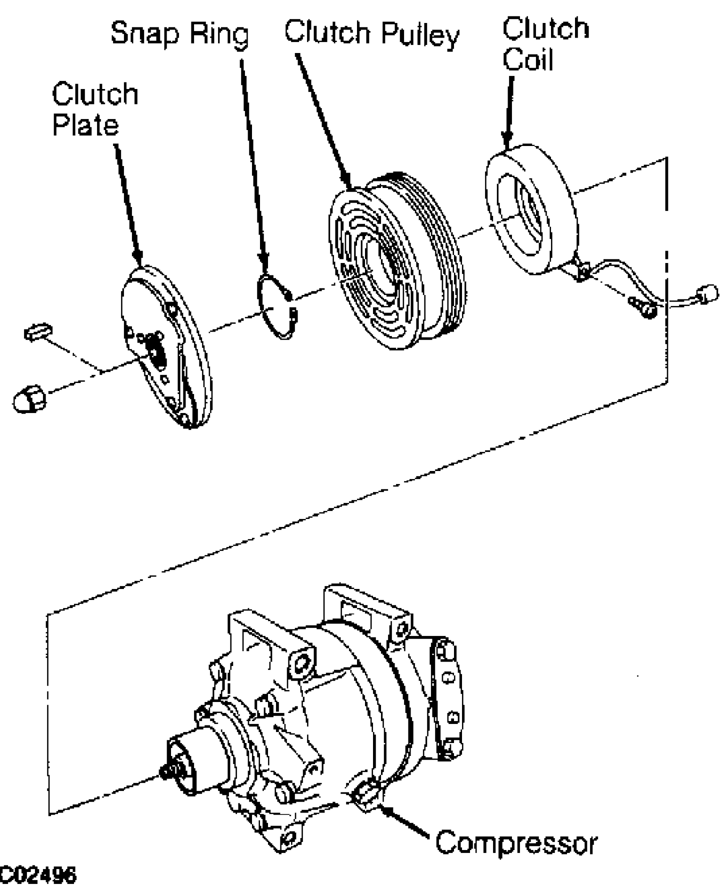


Fig. 3: Exploded View Of Compressor Clutch (Calsonic V5)
Courtesy of Nissan Motor Co., U.S.A.

Removal

1) Hold clutch disc using Clutch Holder (J-33939) and remove center bolt. Using Puller (J-33944-A) and Forcing Bolt (J-33944-4), remove clutch disc. Remove adjustment shim(s) and snap ring.

2) Remove pulley using Pilot (J-38424) and universal puller. Remove coil lead screw, clutch coil screws and coil. Remove snap ring and bearing if necessary.

Installation

1) Ensure coil lead is installed in original position. Install and tighten coil screws to 35-53 INCH lbs. (4-6 N.m). Press pulley onto compressor using Pulley Installer (J-33940). Install snap ring and adjustment shim(s).

2) Install clutch disc and tighten center bolt to 106-133 INCH lbs. (12-15 N.m). Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary. Break-in clutch by engaging and disengaging clutch 30 times.

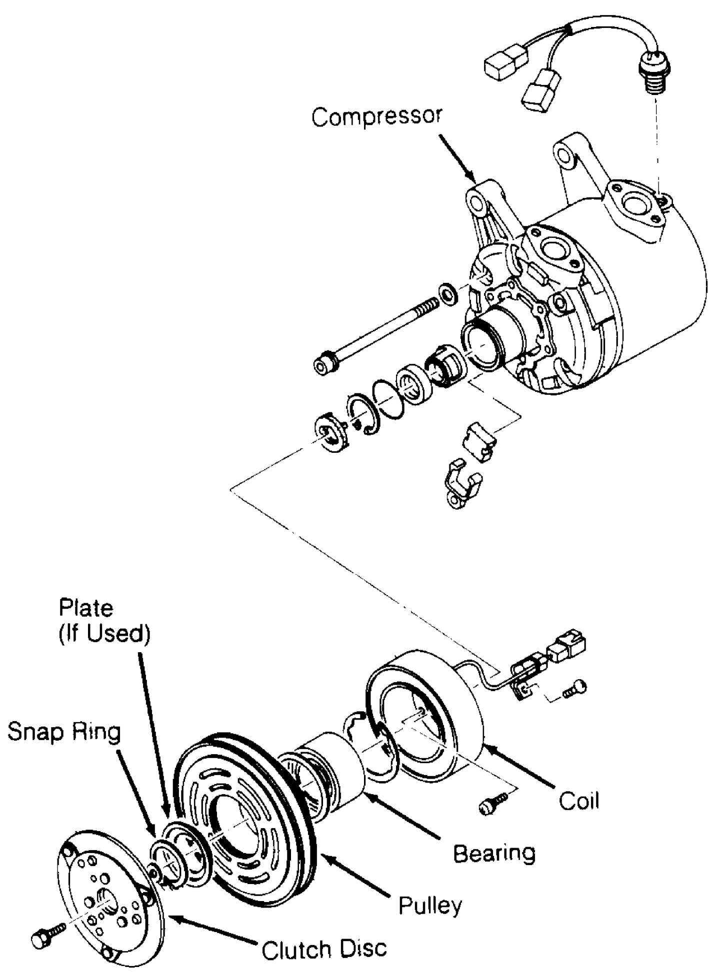


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Fig. 4: Exploded View Of Compressor (Diesel Kiki Rotary Vane)
Courtesy of Nissan Motor Co., U.S.A.

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal & Installation

1) Using Clutch Holder (J-33939) to prevent clutch disc from rotating, remove shaft bolt. Using Clutch Disc Puller (J-33944-A) and Forcing Bolt (J-33944-4), remove clutch disc. Remove shim(s) from compressor drive shaft or clutch disc. See Fig. 5.

2) Remove snap ring, cover and pulley. With Puller Guide (J-33943-A) in center of pulley, attach Crossbar (J-8433) to outside diameter of pulley. Tighten crossbar bolt against puller guide to remove pulley. Remove coil lead, screws, and coil.

3) To install, reverse removal procedure. Install cover snap ring with beveled side facing out. Install clutch disc and tighten center bolt to 133 INCH lbs. (15 N.m).

4) Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.

DIESEL KIKI SHAFT SEAL R & I

Removal & Installation

1) Remove clutch coil. Remove and discard felt. Using Shaft Seal Cover Remover/Installer (J-33942), push down and turn remover clockwise to engage tangs to cover. Slowly remove seal cover from bore.

2) Remove shaft seal snap ring. Use Shaft Seal Remover (J-33942-B) to remove seal. Remove compressor through bolts, front head and "O" ring. If necessary, replace front and rear valve plates, reed valves, and "O" rings.

3) To install, reverse removal procedure. Coat "O" ring, shaft seal and seal seat with refrigerant oil. Place Shaft Seal Guide (J-34614) over end of compressor shaft. Ensure chamfered portion of shaft seal retainer aligns with chamfered portion on compressor shaft.

4) Install front head and tighten compressor through bolts, in a crisscross pattern, to 16 ft. lbs. (22 N.m). Install shaft seal cover and felt. See Fig. 5. Rotate compressor drive shaft 2-3 times to ensure compressor operates smoothly.

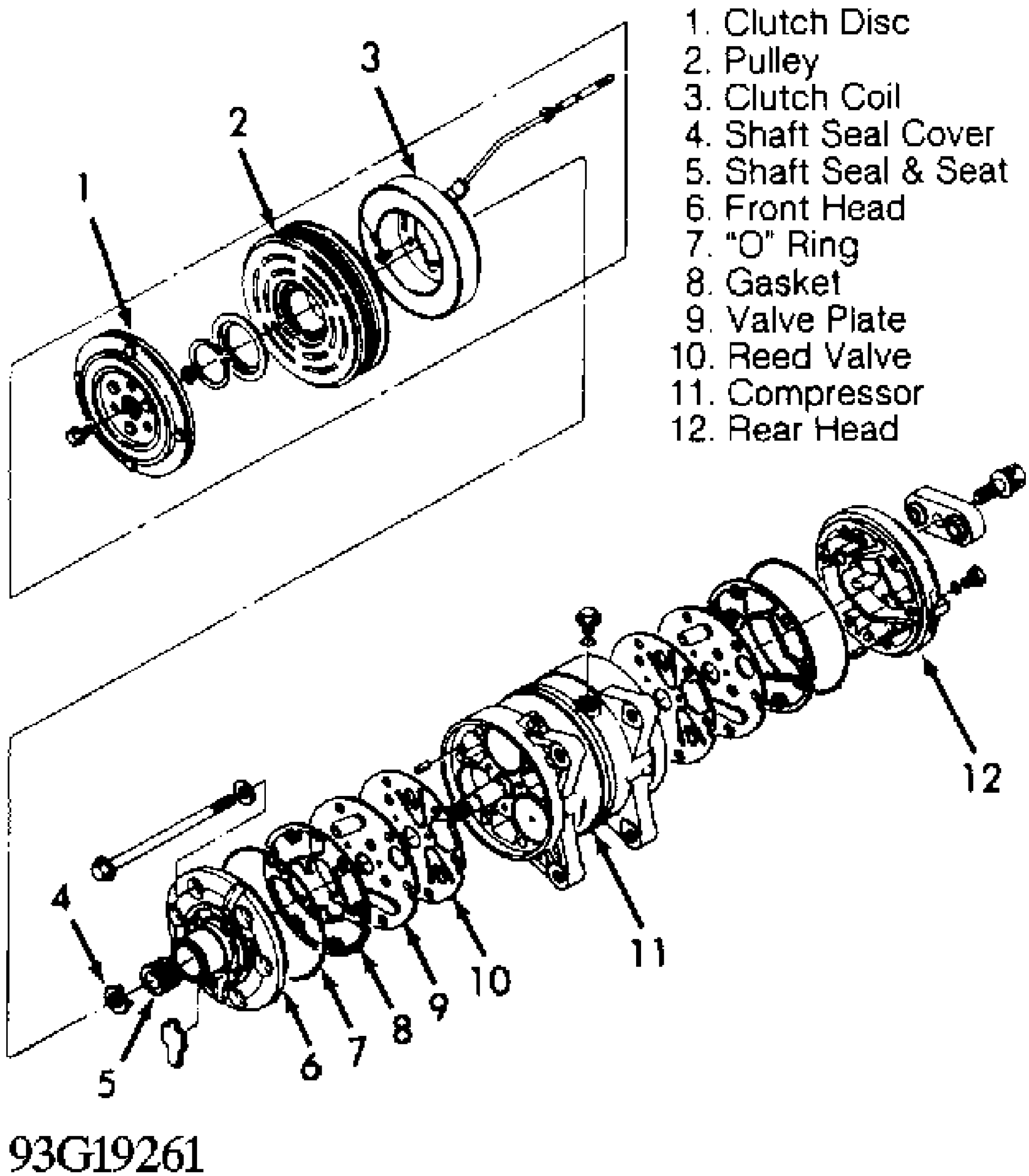


Fig. 5: Exploded View Of Compressor (Diesel Kiki 6-Cylinder)
Courtesy of Isuzu Motor Co.

FORD FX-15 CLUTCH COIL R & I

Removal

1) Using Clutch Holder (000 41 0812 05), remove clutch plate bolt. Using an 8-mm bolt threaded into clutch plate, remove clutch plate and shim(s). See Fig. 6.

2) Remove snap ring and pulley assembly. Install Shaft Protector (49 UN01 047) over shaft seal opening. Use a 2-jaw puller to remove clutch coil from compressor.

Installation

1) Ensure clutch coil mounting surface is clean. Use Coil Installer (49 UN01 046) and 2-jaw puller engaged to rear side of compressor front mounts to press coil into place.

2) Install pulley assembly. Install pulley assembly snap ring with bevel side of snap ring facing out. Install shim(s) and clutch plate. Install a new clutch plate bolt and tighten to 97-115 INCH lbs. (11-13 N.m).

3) Use a feeler gauge to check clearance between clutch plate and pulley assembly. Clearance should be .018-.033" (.46-.84 mm). If clearance is incorrect, add or remove shims as necessary.

FORD FX-15 SHAFT SEAL R & I

Removal

1) Using Clutch Holder (000 41 0812 05), remove clutch plate bolt. Using an 8-mm bolt threaded into clutch plate, remove clutch plate and shim(s). See Fig. 6.

2) Remove shaft felt seal. Thoroughly clean seal area of compressor. Remove shaft seal snap ring. Position Shaft Seal Remover (49 UN01 044) over compressor shaft.

3) Push shaft seal remover downward against seal. Ensure end of shaft seal remover is engaged with inside of seal. Rotate shaft seal remover clockwise to expand remover tip inside seal. Pull shaft seal from compressor.

Installation

1) Lubricate shaft seal protector and shaft seal with refrigerant oil. Install shaft seal on shaft seal protector so lip seal is toward compressor (large end of shaft seal protector).

2) Install shaft seal protector on compressor shaft. Using Shaft Seal Installer (49 UN01 043), push shaft seal down seal protector until seal is seated.

3) Remove shaft seal installer and protector. Install a new shaft seal retaining snap ring and shaft seal felt. Install shim(s) and clutch plate. Install a new clutch plate retaining bolt and tighten to 97-115 INCH lbs. (11-13 N.m).

4) Use a feeler gauge to check clearance between clutch plate and pulley assembly. Clearance should be .018-.033" (.46-.84 mm). If clearance is incorrect, add or remove shims as necessary.

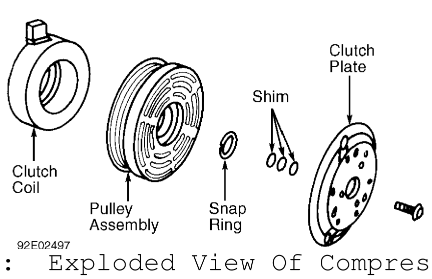


Fig. 6: Exploded View Of Compressor Clutch (Ford FX-15)
Courtesy of Mazda Motors Corp.

HADSYS 7-CYLINDER CLUTCH COIL R & I

Removal

Using Clutch Holder (J-37872), hold pressure plate and remove shaft bolt. Remove pressure plate and adjustment shim(s). See Fig. 7. Remove snap ring. Using universal puller, remove compressor pulley. Remove clutch coil.

Installation

Install clutch coil in reverse order of removal. Ensure snap ring is properly seated. Apply locking compound to shaft bolt and tighten it to 62 INCH lbs. (7 N.m). Ensure clearance between pressure plate and pulley is 0.012-0.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.

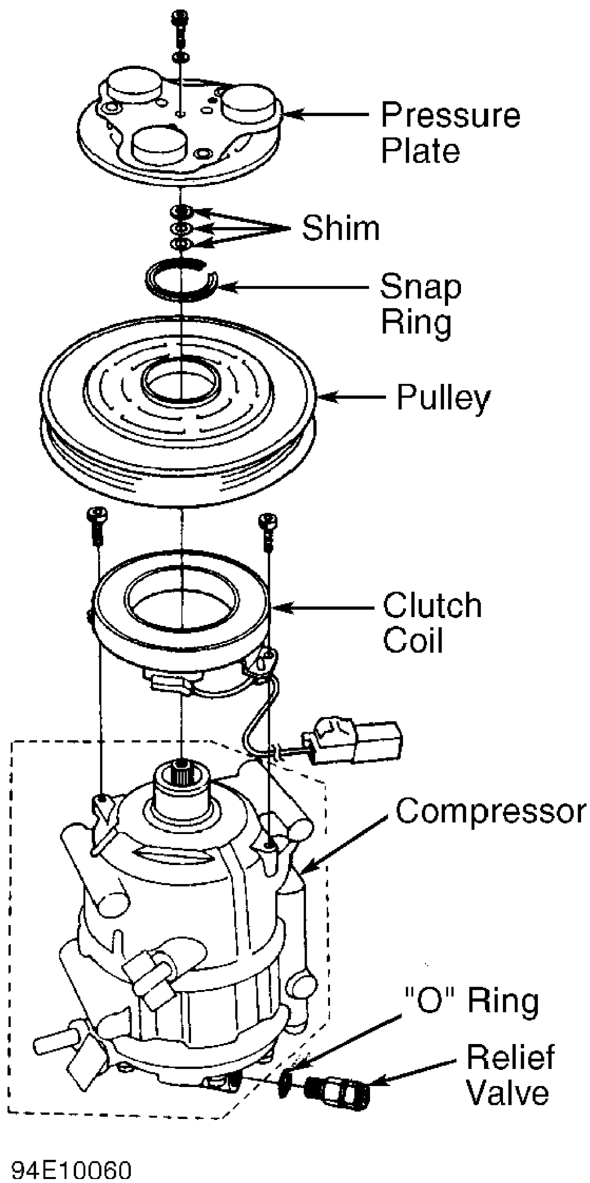


Fig. 7: Exploded View Of Compressor (Hadsys 7-Cylinder)
Courtesy of American Honda Motor Co., Inc.

HARRISON R4 4-CYLINDER CLUTCH COIL AND BEARING R & I

Removal

1) Clamp Holding Fixture (J-25008-A) in vise. Attach compressor to holding fixture. Use Clutch Hub Holder (J-33027) to hold clutch and remove shaft nut.

2) Thread Hub and Drive Plate Assembly Remover/Installer (J-37707) into hub. Hold body of remover with wrench and turn center bolt into remover body to remove clutch plate and hub assembly. Remove shaft key and save for installation.

3) Remove snap ring. Place Puller Guide (J-25031-1) in center of pulley housing. Engage universal puller to outer diameter of pulley (clutch rotor). See Fig. 8. Hold puller and tighten screw to remove pulley.

4) Invert pulley and place on work bench. Press out rotor bearing using handle and Bearing Remover (J-9398-A). Attach universal puller to outside diameter of clutch coil. Tighten bolt against puller guide to remove clutch coil.

CAUTION: DO NOT drive or pound on clutch hub or shaft.

Installation

1) Ensure clutch coil is installed in original position. Press pulley onto compressor using Installer (J-9481-A) and handle. Install shaft key into hub key groove. Allow key to project approximately 3/16" (4.8 mm) out of keyway.

2) Ensure frictional surface of clutch plate and clutch rotor are clean before installing clutch plate and hub assembly. Align shaft key with shaft keyway and place clutch plate and hub assembly onto compressor shaft.

3) Hold hub and drive plate remover/installer with wrench and tighten nut to press hub into shaft until there is a .020-.040" (.5-1.0 mm) air gap between plate and clutch rotor. Install a new shaft nut and tighten to 10 ft. lbs. (14 N.m). Ensure rotor is not rubbing on clutch plate.

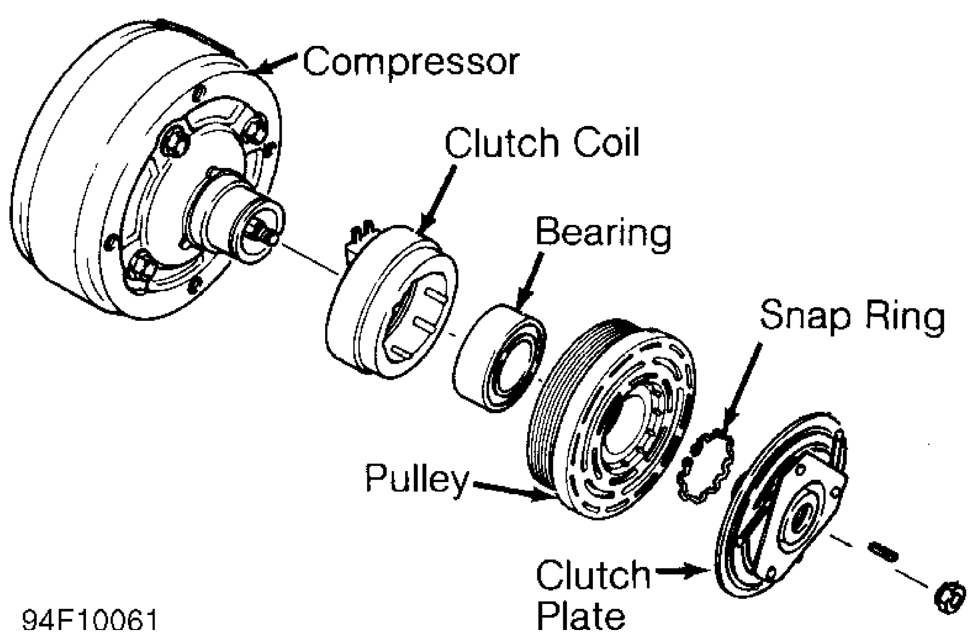


Fig. 8: Exploded View Of Compressor (Harrison R4 4-Cylinder)
Courtesy of Isuzu Motor Co.

HARRISON V5 5-CYLINDER CLUTCH COIL AND BEARING R & I

Removal

1) Clamp Holding Fixture (J-34992) in vise. Attach compressor to holding fixture. Use Clutch Hub Holder (J-33027-A) to hold clutch. Remove shaft nut using Socket (J-33022). See Fig. 9.

2) Thread Clutch Plate and Hub Assembly Remover (J-33013-B) into hub. Hold body of remover with wrench and turn center bolt to remove clutch plate and hub assembly. Remove snap ring. Remove shaft key and save for installation.

3) Place Puller Guide (J-33023-A) in center of pulley housing. Engage Rotor/Bearing Puller (J-33020) to inner circle of slots in pulley (rotor). Hold rotor/bearing puller in place and tighten screw to remove pulley.

4) Remove screw from rotor/bearing puller. Invert assembly and place on work bench with rotor/bearing puller still engaged. Remove hub bearing using handle and Bearing Remover (J-9398-A).

5) With puller guide in place, attach Crossbar (J-8433-1) and Puller (J-33025) to outside diameter of clutch coil. Tighten crossbar Bolt (J-8433-3) against puller guide to remove clutch coil.

Installation

1) Ensure clutch coil is installed in original position. Press coil into position using crossbar, clutch Coil Installer (J-33024) and Through Bolts (J-34992-2). Stake compressor housing 120 degrees apart to secure coil.

2) Position Rotor/Bearing Installer (J-33017) and puller guide over inner race of bearing. Using through bolts, assemble crossbar over puller pilot and tighten through bolts onto holding fixture. Tighten crossbar bolt to press pulley/bearing assembly onto compressor.

3) Install shaft key into hub key groove. Allow key to project approximately 1/8" (3.2 mm) out of keyway. Align shaft key with shaft keyway and place clutch plate and hub assembly onto compressor shaft.

CAUTION: Do not drive or pound on clutch hub or compressor shaft, as compressor could be damaged internally.

4) Hold hex portion of Hub Installer (J-33013) with a wrench. Tighten center screw to press hub into shaft until there is .020-.030" (.50-.76 mm) air gap between frictional plate and clutch rotor.

5) Install new shaft nut with small diameter boss of nut against crankshaft shoulder. Use Socket (J-33022) and Clutch Hub Holder (J-33027-A). Tighten shaft nut to 12 ft. lbs. (16 N.m). Ensure pulley does not rub on clutch plate. See Fig. 9.

HARRISON V5 5-CYLINDER SHAFT SEAL R & I

Removal

Remove clutch plate and hub assembly. Remove shaft seal snap ring. Thoroughly clean inside of compressor neck area around shaft and seal. Engage tangs of Seal Remover/Installer (J-23128-A) into recessed portion of seal and remove seal. Remove and discard "O" ring from compressor neck. Thoroughly clean inside of compressor neck and "O" ring groove.

Installation

1) Coat new "O" ring with refrigerant oil and install on "O" Ring Installer (J-33011). Install "O" ring into groove in compressor neck. Attach new seal to seal remover/installer. Dip shaft seal in clean refrigerant oil.

2) Place Seal Protector (J-34614) over compressor shaft. Push

new seal over shaft protector. Install new seal snap ring with flat side against seal. Install clutch plate assembly.

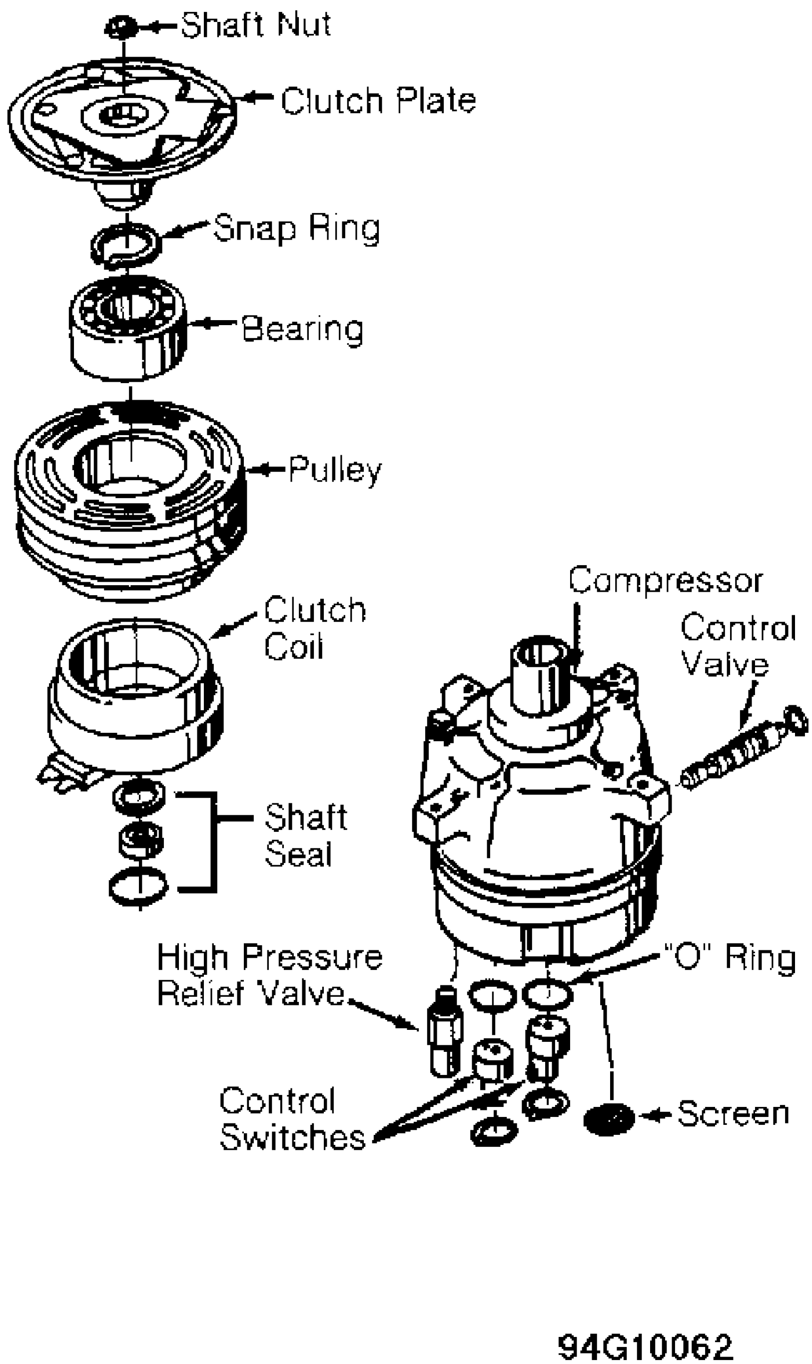


Fig. 9: Exploded View Of Compressor (Harrison V5 5-Cylinder)
Courtesy of General Motors Corp.

HITACHI 6-CYLINDER CLUTCH COIL AND SEAL R & I

Removal

1) Hold clutch hub with Clutch Tightener (925770000). Remove shaft nut from shaft. Using Clutch Hub Remover (926130000), remove clutch hub. Use snap ring pliers to remove inner snap ring.

2) Remove pulley and bearing assembly. Remove screws securing clutch coil lead. Remove inner snap ring from clutch coil. Remove clutch coil from front cover.

3) Remove shaft key. Use snap ring pliers to remove shaft seal snap ring. Wrap a rag around compressor shaft. Using Injector Needle (92619000) and refrigerant can, slowly pressurize compressor at low pressure (suction) service port. See Fig. 10. Catch shaft seal seat in rag.

4) Insert Shaft Seal Remover/Installer (926120000) through open end of front cover. Slowly pull out remover/installer to remove shaft seal.

Installation

1) Ensure shaft seal contact surface is free of dirt. Lubricate with refrigerant oil. Using shaft seal remover/installer, insert shaft seal.

2) To install clutch coil and hub, reverse removal procedure. Tighten shaft nut to 14-15 ft. lbs. (19-21 N.m). Ensure clearance between pressure plate and pulley is 0.020-0.031" (.50-.80 mm).

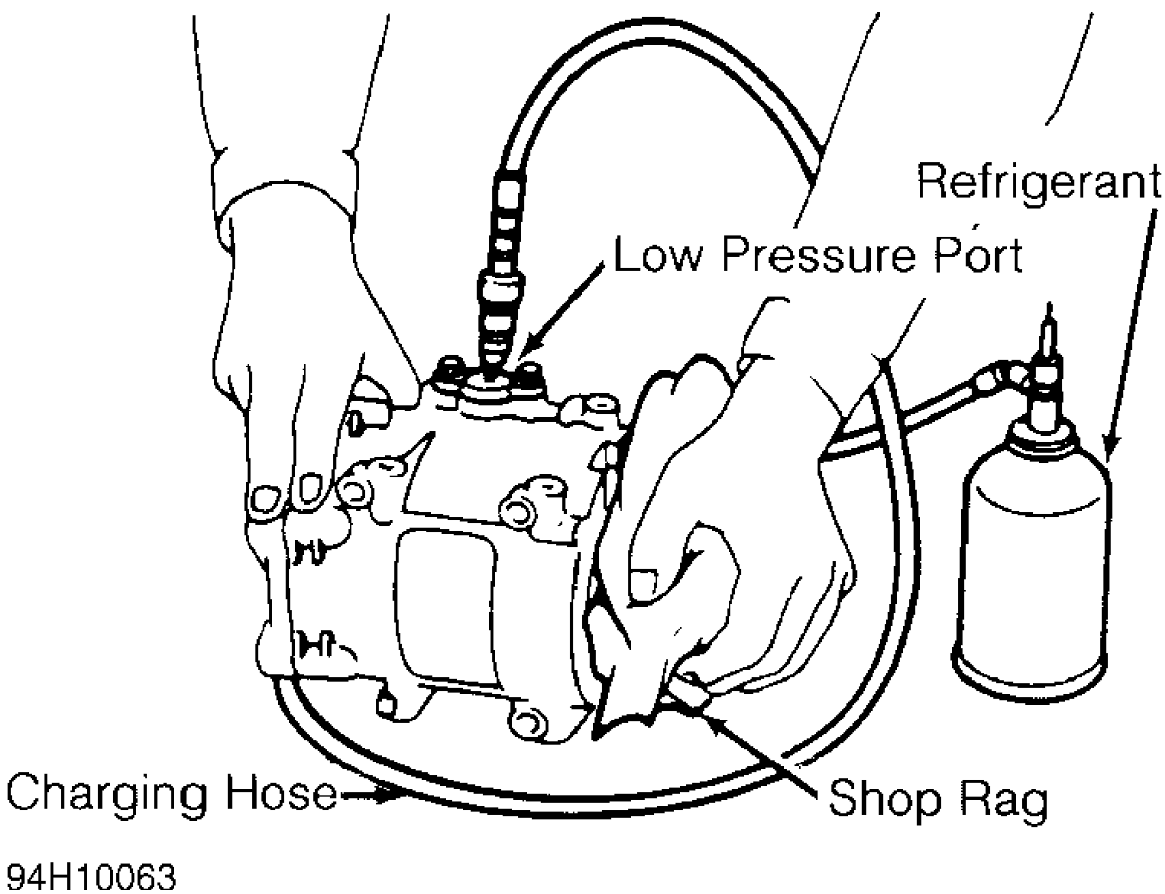


Fig. 10: Removing Compressor Shaft Seal Seat (Hitachi 6-Cylinder)
Courtesy of Subaru of America, Inc.

MATSUSHITA ROTARY VANE CLUTCH COIL R & I

Removal & Installation

1) Using Pressure Plate Holder (J-7624) and socket, remove center bolt. Thread Puller (J-34878) onto pressure plate. Hold pressure plate with pressure plate holder and tighten puller to remove pressure plate.

2) Remove shim(s) from shaft. Remove snap ring and, using a plastic hammer, tap pulley off. Remove screw for clutch coil lead. Remove snap ring and clutch coil. See Fig. 11.

3) To install, reverse removal procedure. Tighten shaft bolt to 10 ft. lbs (14 N.m). Using feeler gauge, ensure clearance between pressure plate and pulley is .014-.026" (.35-.65 mm). If clearance is incorrect, add or remove shim(s) as necessary.

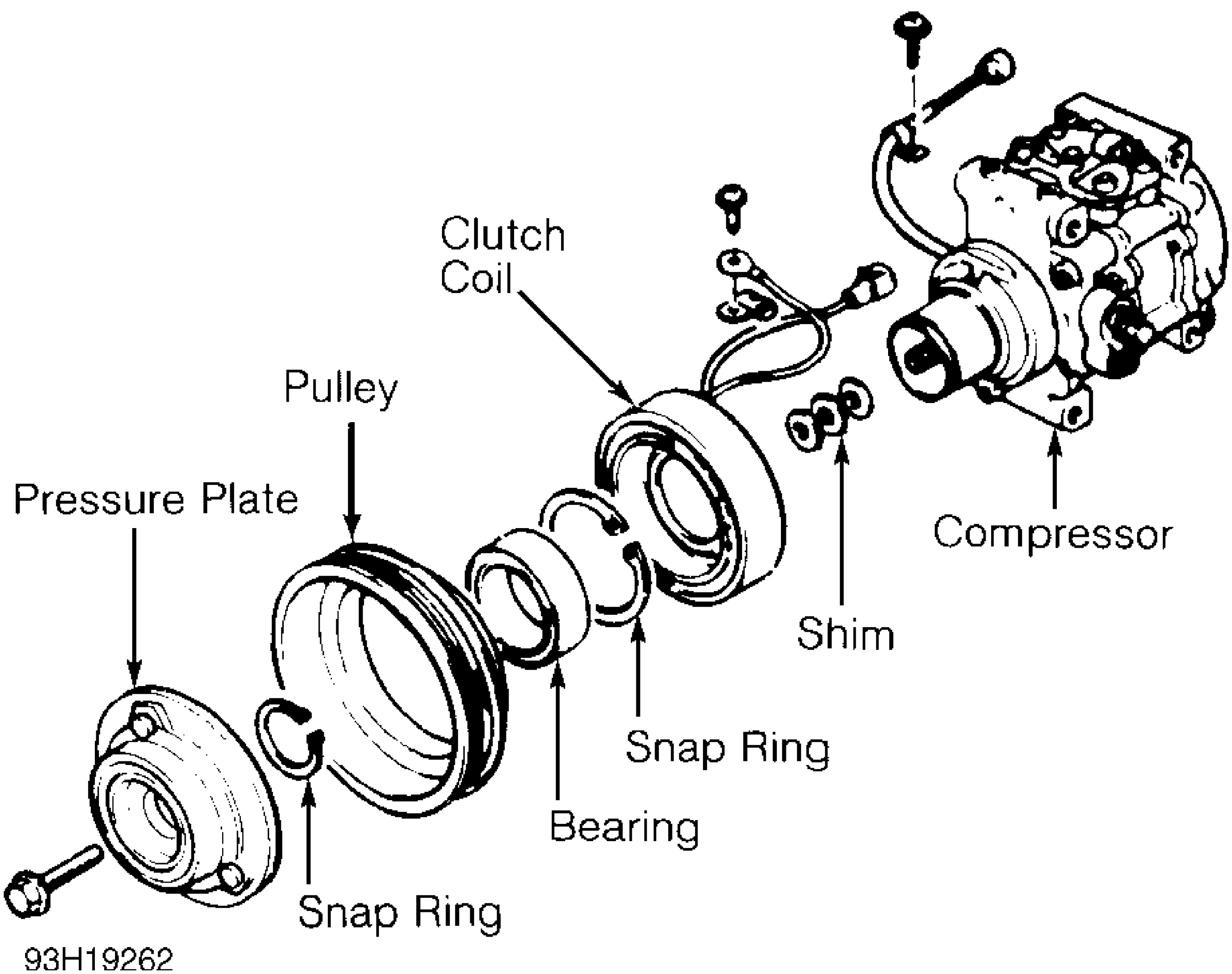


Fig. 11: Exploded View Of Compressor (Matsushita Rotary Vane)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NIPPONDENSO TV12 ROTARY VANE CLUTCH COIL R & I

Removal

1) Hold clutch disc with Clutch Holder (00007-10331) and remove shaft nut. Install Clutch Disc Remover (4992-02-020) and remove clutch disc and shims. See Fig. 12.

2) Remove pulley snap ring and tap pulley (with bearing) off of compressor with plastic hammer. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

Installation

To install, reverse removal procedure. Ensure pulley-to-clutch disc clearance is .016-.024" (.40-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.

NIPPONDENSO TV12 DISCHARGE VALVE & SHAFT SEAL R & I

Removal

1) Drain and measure compressor oil in compressor. Remove discharge valve body through bolts. Remove discharge valve body bolts and body. Remove discharge valve plate and discharge valve.

2) Remove compressor through bolts and front and rear housing (oil separator case). Remove pins and gaskets. Remove shaft seal from shaft. Press shaft seal plate off of front housing (head cover).

Installation

To install components, reverse removal procedure. Tighten compressor through bolts to 19 ft. lbs. (26 N.m). Tighten discharge valve bolts to 41 INCH lbs. (4.6 N.m). Tighten discharge valve body and body through bolts to 96 INCH lbs. (10.8 N.m).

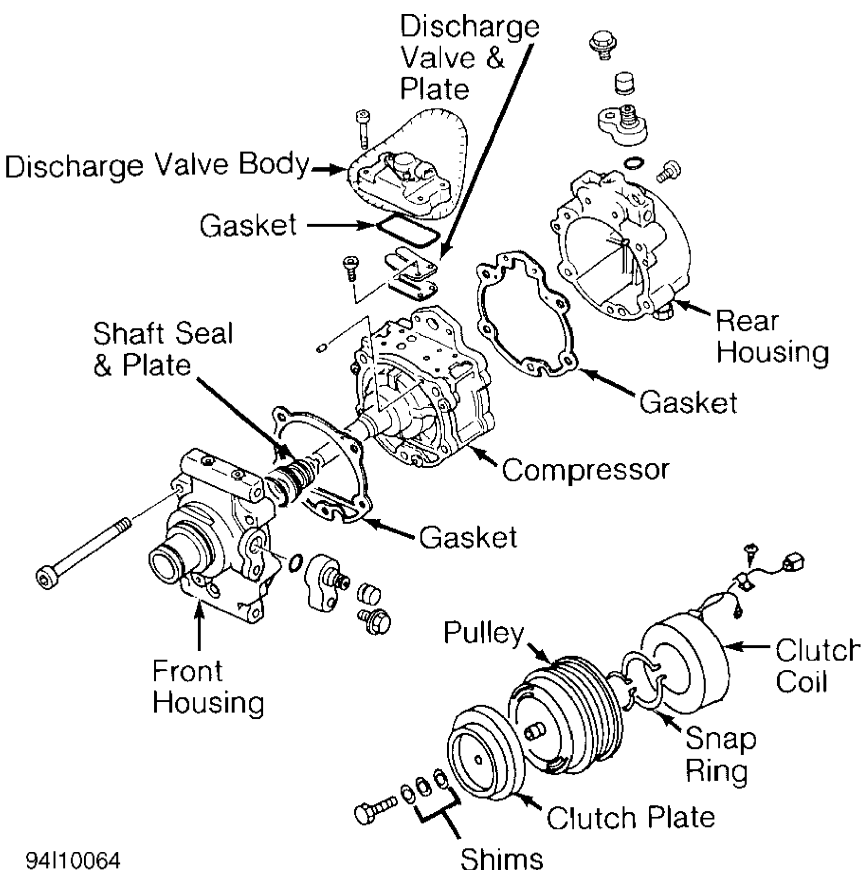


Fig. 12: Exploded View Of Compressor (Nippondenso TV12 Rotary Vane)
Courtesy of Mazda Motors Corp.

NIPPONDENSO 6 & 10-CYLINDER CLUTCH COIL AND BEARING R & I

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal

1) Hold clutch plate stationary and remove shaft bolt (or nut). Remove clutch plate using puller. Remove shim(s) from shaft and snap ring. Tap pulley off shaft with plastic hammer. If pulley cannot be removed by hand, use commercially available puller.

2) Remove snap ring, bearing, and seal (if equipped) from pulley. See Fig. 13. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

Installation

To install, reverse removal procedure. Ensure snap rings are installed with beveled side facing out. Tighten shaft bolt (or nut) to 13-14 ft. lbs. (17-19 N.m) on Fox, MR2 and Scoupe; 10-13 ft. lbs. (14-17 N.m) on all others. Ensure air gap between clutch plate and pulley is .024-.040" (.60-1.00 mm) on Fox and MR2; .014-.026" (.36-.66 mm) on all others. If air gap is incorrect, add or remove shim(s) as necessary.

NOTE: To check air gap, place a dial indicator on clutch plate. Apply voltage to clutch coil. Check air gap between clutch plate and drive pulley. Ensure air gap is as specified.

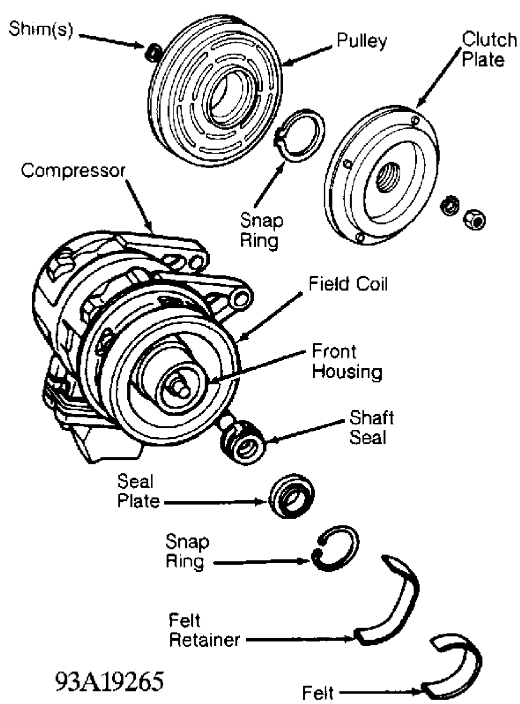


Fig. 13: Exploded View Of Compressor (Nippondenso 10-Cylinder)
Courtesy of Ford Motor Co.

NIPPONDENSO 6 & 10-CYLINDER SHAFT SEAL R & I

NOTE: On Chrysler and Mitsubishi, remove compressor through bolts and front housing to remove shaft seal. See Fig. 14. Alternately tighten through bolts to 18-21 ft. lbs. (24-28 N.m).

Removal

1) Remove clutch plate and pulley. Remove shim(s) from shaft. Remove clutch coil if necessary. Remove felt and felt retainer (if equipped). Place shaft key remover on shaft and turn to remove key.

2) Remove seal plate snap ring. Engage plate remover on seal plate and pull up to remove seal plate. Engage shaft seal remover/installer to shaft seal and pull up to remove shaft seal from front housing.

Installation

1) Apply clean refrigerant oil to compressor housing bore. Lubricate shaft seal with refrigerant oil and install in front housing. Lubricate seal plate and install in front housing.

2) Install shaft key, snap ring, felt retainer and felt. With clutch plate installed, ensure air gap between clutch plate and pulley is .024-.040" (.60-1.00 mm) on Fox and MR2; .014-.026" (.36-.66 mm) on all others. If air gap is incorrect, add or remove shim(s) as necessary.

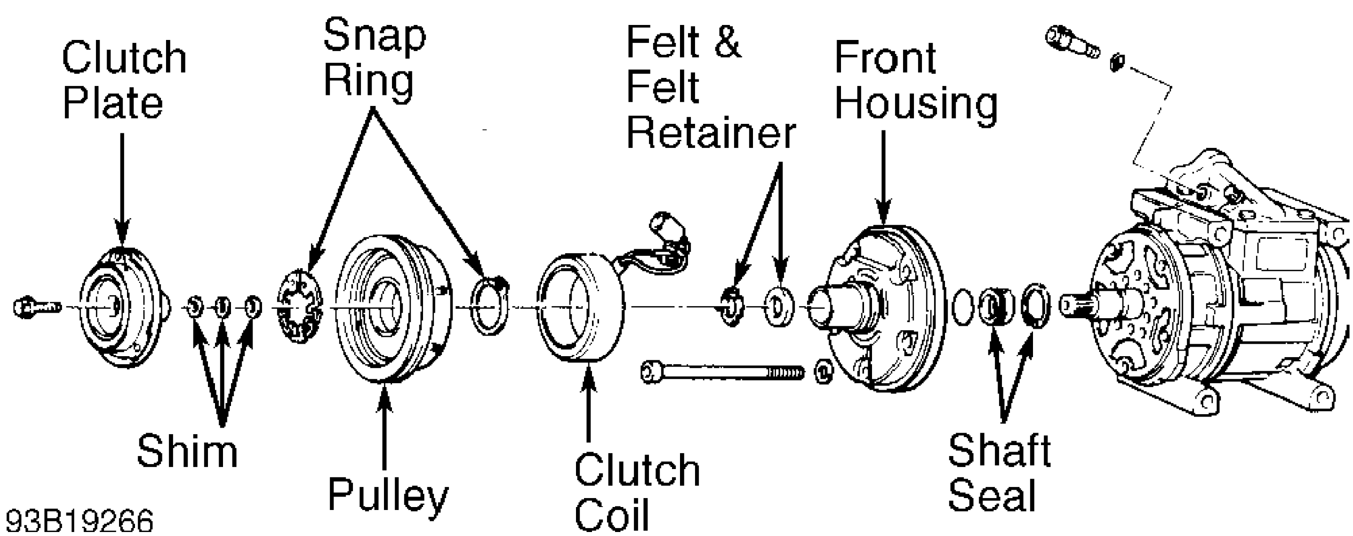


Fig. 14: Exploded View Of Compressor (Nippondenso 10PA15 10-Cylinder)
Courtesy of Chrysler Corp.

PANASONIC ROTARY VANE CLUTCH COIL R & I

Removal

Hold clutch disc stationary and remove shaft bolt. Remove clutch disc and shim(s) from shaft. Remove snap ring. Using a puller, remove pulley. Remove screw from clutch coil lead. Remove screws and field coil.

Installation

To install, reverse removal procedure. Tighten field coil screws to 30-57 INCH lbs. (3.4-6.4 N.m). Ensure pulley-to-armature gap is .016-.020" (.40-.50 mm). If air gap is incorrect, add or remove shim(s) as necessary. Tighten shaft bolt to 97-115 INCH lbs. (11-13 N.m).

PANASONIC ROTARY VANE DISCHARGE VALVE R & I

Removal & Installation

Remove compressor head cover. Remove discharge valve stopper and discharge valve. See Fig. 15. Install replacement discharge valve and stopper, reversing removal procedure. Tighten discharge valve bolts to 27-34 INCH lbs. (3.0-3.8 N.m). Tighten compressor head cover bolts to 89 INCH lbs. (10 N.m).

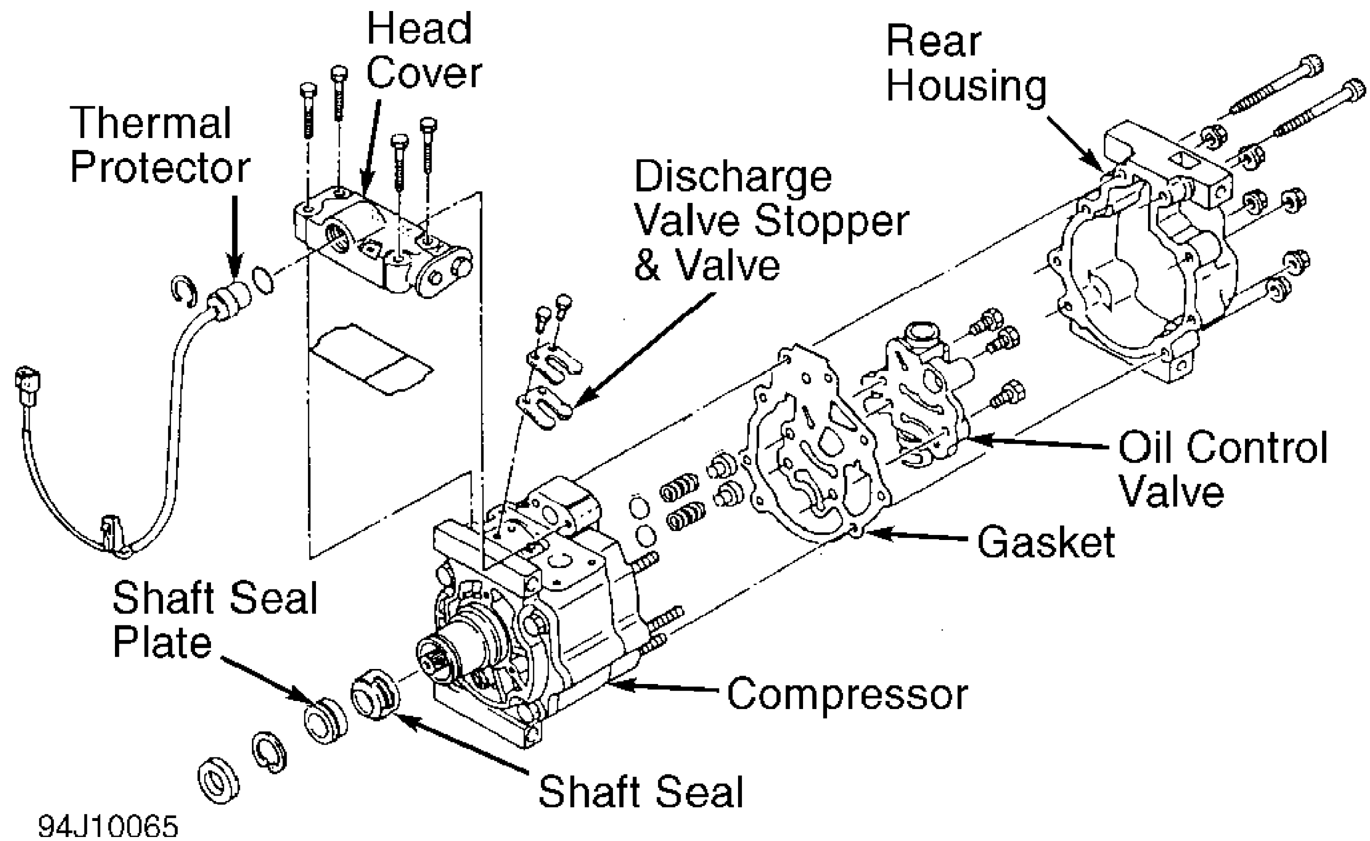


Fig. 15: Exploded View Of Compressor (Panasonic Rotary Vane)
Courtesy of Mazda Motors Corp.

PANASONIC ROTARY VANE OIL CONTROL VALVE R & I

Removal & Installation

Remove compressor rear cover. Remove oil control valve. Remove springs, valve, and rear cover seal. To install components, reverse removal procedure. Tighten oil control valve bolts to 89 INCH lbs. (10 N.m). Tighten rear cover nuts to 21 ft. lbs. (29 N.m) and bolts to 89 INCH lbs. (10 N.m).

PANASONIC ROTARY VANE SHAFT SEAL R & I

Removal & Installation

Remove clutch disc and shim(s). Remove felt seal and snap ring. Using Seal Plate Remover (49 B061 005), engage and remove shaft seal plate. Remove shaft seal with Seal Remover/Installer (49 B061 006). To install, reverse removal procedure. Coat new seal plate and seal with clean refrigerant oil. DO NOT touch seal surfaces with fingers.

SANDEN SCROLL CLUTCH COIL AND SHAFT SEAL R & I

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal (Chrysler & Mitsubishi Except Galant & Mirage)

1) Remove drive belt pulley (if equipped). Hold clutch plate using Pliers (MB991367) and Bolts (MB991386). Use a ratchet and socket to remove clutch hub nut.

2) Remove clutch plate. Remove snap ring with internal snap ring pliers. Remove clutch hub (rotor). Remove snap ring and clutch coil.

3) Using an awl, remove bearing cover and retainer. Using Bearing Remover (MB991456), engage bearing grooves. Place base of bearing remover over remover arms and tighten nut.

4) Tighten bearing remover bolt to withdraw bearing from compressor. Engage grooves of Shaft Seal Remover/Installer (MB991458) and pull straight up on shaft seal.

Installation (Chrysler & Mitsubishi Except Galant & Mirage)

1) To install shaft seal, ensure front housing is free of foreign objects. Lubricate Shaft Seal Protector (MB991459) and place over compressor shaft. Lubricate shaft seal and install using shaft seal remover/installer. Remove shaft seal protector.

2) Using a 21 mm socket or Drift (MB991301), carefully press bearing onto compressor shaft. Install clutch coil so that alignment pin is engaged. Install clutch coil snap ring with tapered side facing out.

3) Align armature plate with crankshaft spline. Tighten shaft nut to 12 ft. lbs (16 N.m). Using feeler gauge, ensure clearance between pressure plate and pulley is .016-.024" (.40-0.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.

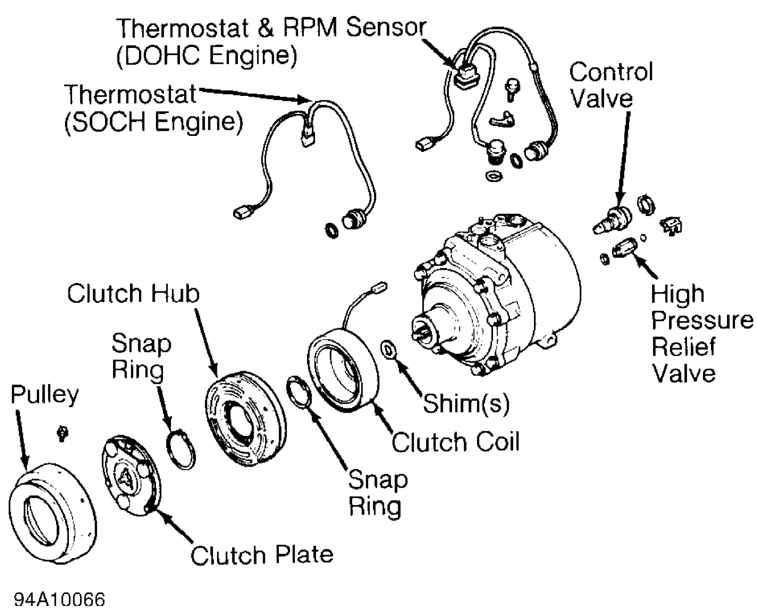


Fig. 16: Exploded View Of Compressor (Sanden Scroll)
Courtesy of Chrysler Corp.

Removal (Chrysler & Mitsubishi Galant & Mirage)

1) Hold clutch plate by securing 2 box-end wrenches with two

6-mm bolts, 1" (25 mm) or longer. Holding bow-end wrenches, use a ratchet and socket to remove clutch hub nut.

2) Remove clutch plate. See Fig. 17. Remove snap ring with internal snap ring pliers. Remove clutch hub. Remove snap ring and clutch coil.

3) Remove front housing bolts. Remove front housing and "O" ring from compressor. Remove shaft seal from shaft. Remove snap ring from back side of front housing. Remove seal plate. Use brass drift and hammer to lightly tap shaft bearing from front housing. Remove felt seal.

NOTE: DO NOT touch sealing surfaces of shaft seal carbon ring and shaft seal plate.

Installation (Chrysler & Mitsubishi Galant & Mirage)

1) Lubricate shaft seal with compressor oil. Align notches on shaft seal with notches on shaft. Install shaft seal plate on front housing. Install front seal housing to compressor.

2) Use Drift (MB991301) to install felt into front housing. Ensure metal ring on felt faces up. Use drift to press bearing into front housing.

3) Align and install clutch coil. Install snap ring so tapered surface faces outward. Install clutch hub. Install snap ring. Align clutch plate mark with shaft; where there are no splines on shaft.

4) Tighten clutch hub nut to 12 ft. lbs. (16 N.m). Using feeler gauge, measure clutch plate-to-clutch hub gap. If gap is not .012-.024" (.30-.60 mm), remove clutch assembly and add or remove shim(s).

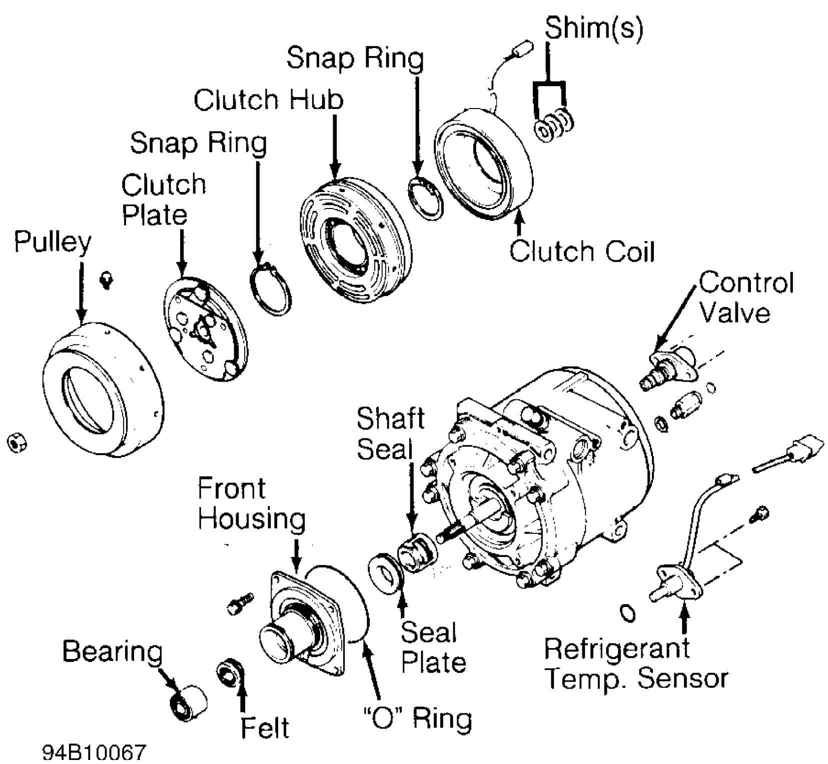


Fig. 17: Exploded View Of Compressor (Sanden FX105V Scroll)
Courtesy of Chrysler Corp.

Removal & Installation (Honda & Hyundai)

1) Remove shaft nut while holding clutch plate with Armature

Holder (J-37872). Using Puller (07935-8050003), remove pressure plate and shim(s). See Fig. 16. Remove snap ring.

2) Place Seal Driver (07945-4150200) in center of pulley. Engage universal puller to outer diameter of pulley. DO NOT engage puller on belt area. Hold puller in place and tighten screw to remove pulley. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

3) To install clutch coil, reverse removal procedure. Align lug on clutch coil with hole in compressor. Install snap rings with chamfered side facing out. Tighten shaft nut to 12-14 ft. lbs. (16-19 N.m). Using feeler gauge, ensure clearance between pressure plate and pulley is .014-.026" (.35-.65 mm). If clearance is incorrect, add or remove shim(s) as necessary.

NOTE: Shaft seal removal and installation procedures not available from Honda or Hyundai.

SANDEN 5-CYLINDER CLUTCH COIL R & I

Removal

1) Hold clutch plate, using Holder (0000-41-0809-01), and remove shaft nut. Remove clutch plate using Puller (0000-41-0809-02). Remove shaft key and shim(s). Remove external front housing snap ring and internal bearing snap ring (if used).

2) Install Clutch Pilot (0000-41-0810-77), Pulley/Clutch Remover (0000-41-0810-76), and Puller (0000-41-0804-51/57) to remove pulley assembly. Remove snap ring and drive bearing out of pulley. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

Installation

1) Install new bearing, ensuring Bearing Installer (000-41-0804-43) contacts outer race of bearing. Install snap ring and ensure bearing turns freely.

2) Install clutch coil, ensuring lug on coil aligns with hole in front housing. Support compressor on rear mounting ears. Align rotor on front housing hub. Use bearing installer and Driver (0000-41-0810-59) to install pulley. With pulley seated, install snap ring(s). Install shim(s) and shaft key.

3) Place clutch plate over shaft and, using Shaft Protector (0000-41-0809-10), tap clutch plate into place. Install and tighten shaft nut to 25-32 ft. lbs. (34-44 N.m). Using feeler gauge, ensure clearance between clutch plate and pulley is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

SANDEN 5-CYLINDER CYLINDER HEAD & VALVE PLATE R & I

Removal & Installation

Remove compressor cylinder head (rear cover) bolts. Carefully pry cylinder head of compressor. Remove reed valve plate and gasket. To install components, reverse removal procedure. Tighten compressor cylinder head bolts, in a crisscross pattern, to 21-29 ft. lbs. (29-39 N.m).

SANDEN 5-CYLINDER SHAFT SEAL R & I

Removal

Remove shaft nut and clutch plate. Remove shaft key and shim(s). Carefully remove felt ring. Remove shaft seal seat snap ring. Using Seal Seat Remover/Installer (0000-41-0810-73), carefully remove seal seat. Using Shaft Seal Remover/Installer (0000-41-0812-11), carefully remove shaft seal.

Installation

1) Install Seal Protector (0000-41-0812-13) over shaft. Place new seal on remover/installer. DO NOT touch carbon sealing surface with fingers. Dip seal in refrigerant oil and install. Remove seal installer by turning counterclockwise.

2) Coat seal seat with refrigerant oil. Install seal seat using remover/installer. Install seal seat snap ring (with flat side down). Install shim(s), felt ring and shaft key. Install shaft nut and clutch plate. Ensure clearance between clutch plate and pulley is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

SANDEN 7-CYLINDER CLUTCH COIL AND BEARING R & I

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal

1) Install two 6-mm bolts, 1" (25 mm) or longer, in clutch plate holes. Using 2 box-end wrenches to hold bolts and to prevent clutch plate from turning, remove shaft nut.

2) Remove clutch plate using Clutch Plate Puller (09977-21100). Remove clutch shim(s) and bearing dust cover. Remove external front housing snap ring. See Fig. 18.

3) Remove pulley using universal puller. Detach clutch coil lead from compressor housing. Remove clutch coil snap ring and clutch coil. If necessary, remove snap ring and bearing.

Installation

1) Align clutch coil lug with hole in compressor housing, and install clutch coil. Install clutch coil snap ring. Install drive pulley using Drive Pulley Installer (09977-21811).

2) Install external bearing snap ring. Using Seal Installer (09977-21800), install bearing dust cover. After dust cover installation, ensure there is no contact between cover and front housing.

3) Install clutch shim(s) and clutch plate. Tighten shaft nut to 13-14 ft. lbs. (17-19 N.m). Using a dial indicator, check air gap between clutch plate and drive pulley. Apply voltage to clutch coil. Ensure air gap is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

NOTE: If compressor valve plate is serviced, tighten compressor cylinder head bolts to 25-26 ft. lbs. (34-35 N.m).

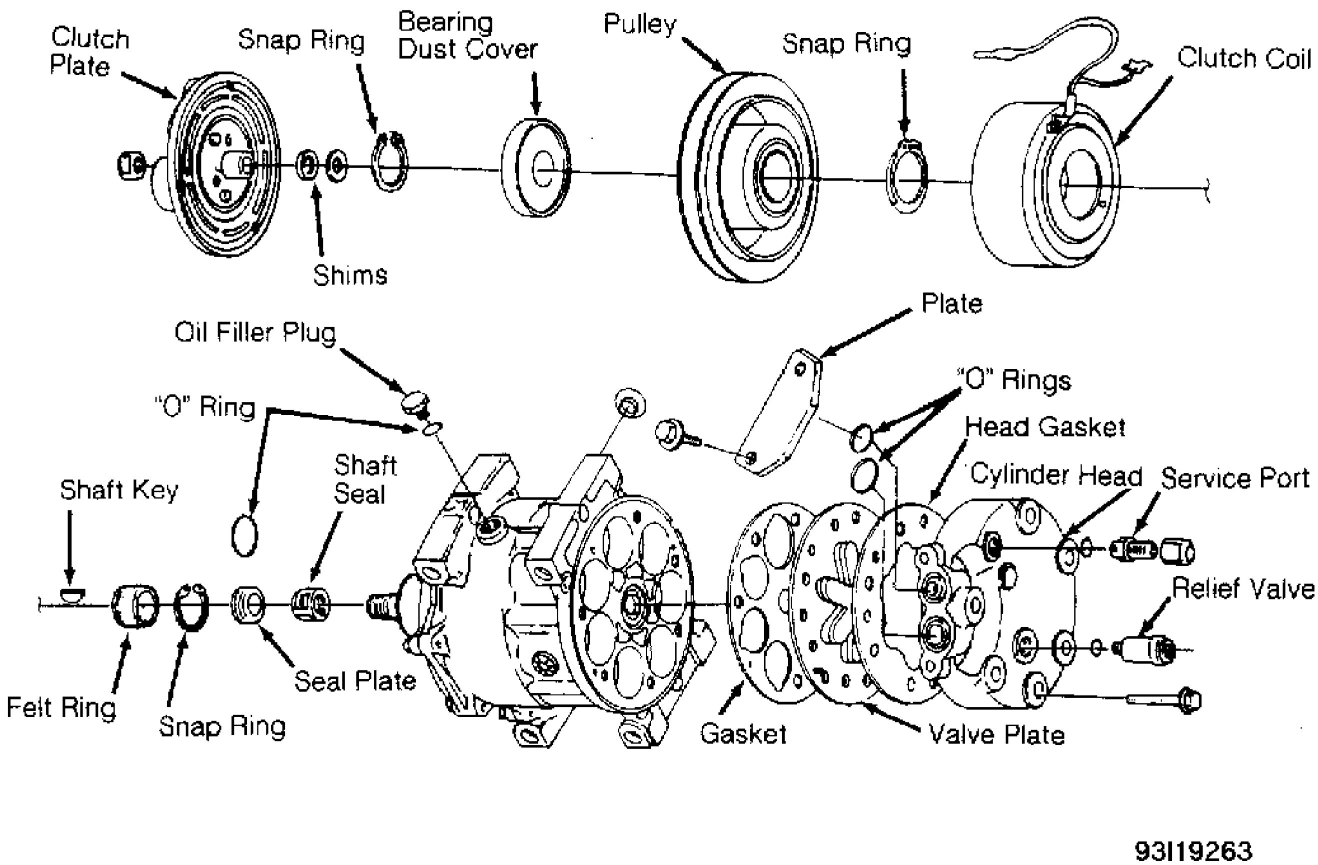


Fig. 18: Exploded View Of Compressor (Sanden 7-Cylinder)
Courtesy of Hyundai Motor Co.

SANDEN 7-CYLINDER SHAFT SEAL R & I

NOTE: Check compressor refrigerant oil level when replacing seals. See COMPRESSOR OIL CHECKING article in GENERAL SERVICING.

Removal

1) Remove clutch plate, shim(s) and bearing dust cover. Tap shaft key out of slot in compressor shaft. Remove seal retainer felt ring.

2) Remove shaft seal seat snap ring. Insert Seal Seat Remover/Installer (09977-21400) into front housing and turn to engage tangs on seat. Lift seal seat out.

3) Insert Seal Remover/Installer (09977-21510) into front housing and turn to engage tangs on seal. Carefully lift shaft seal out without scratching compressor shaft.

Installation

1) Install Shaft Seal Guide Sleeve (09977-21700) over compressor shaft. Dip seal in refrigerant oil and install seal on sleeve. Using seal remover/installer, rotate seal clockwise until seal is engaged. Remove seal remover/installer by turning it counterclockwise.

2) Coat seal seat with refrigerant oil and install seal with seal seat remover/installer. Remove shaft seal guide sleeve. Install snap ring with beveled edge facing out. Install seal retainer felt

ring using seal seat remover/installer.

3) Install shaft key and clutch plate. Tighten shaft nut to 13-14 ft. lbs. (17-19 N.m). Using a dial indicator, check air gap between clutch plate and drive pulley. Apply voltage to clutch coil. Ensure air gap is .016-.032" (.40-.80 mm). If clearance is incorrect, add or remove shim(s) as necessary.

SEIKO-SEIKI ROTARY VANE

NOTE: Volvo Seiko-Seiki compressor servicing procedure is not available from manufacturer.

ZEXEL ROTARY VANE CLUTCH COIL AND BEARING R & I

Removal

1) Hold clutch disc using Clutch Disc Wrench (KV99231260) and remove center bolt. Using Clutch Disc Puller (KV99232340), remove drive plate and adjustment shim(s).

2) Remove snap ring. Remove pulley using Pilot (J-39023) and universal puller. Remove clutch coil. If necessary, remove snap ring and bearing. See Fig. 19.

Installation

1) Ensure coil lead is installed in original position. Install and tighten coil screws. Press pulley onto compressor using Pulley Installer (J-33940). Install snap ring and adjustment shim(s).

2) Install clutch disc and tighten center bolt to 11-13 ft. lbs. (15-18 N.m). Using feeler gauge, ensure clearance between clutch disc and pulley is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary. Break-in clutch by engaging and disengaging clutch 30 times.

NOTE: Shaft seal assembly servicing procedure is not available from manufacturer. Use exploded view as a guide. See Fig. 19. Tighten thermal protector, if removed, to 11-13 ft.lbs. (15-18 N.m).

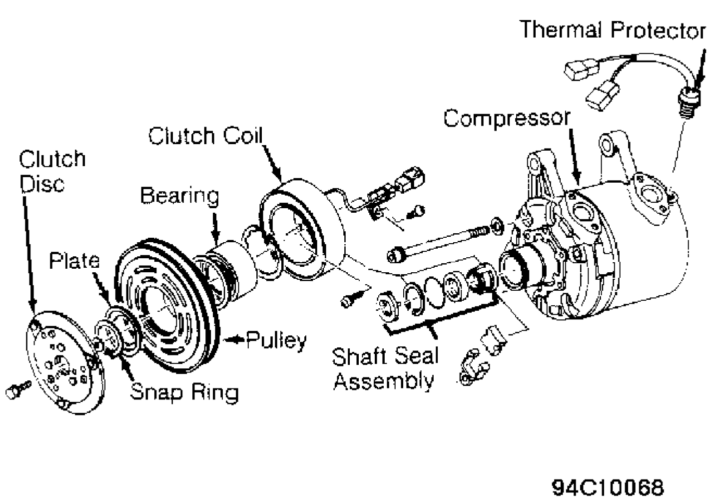


Fig. 19: Exploded View Of Compressor (Zexel Rotary Vane)
Courtesy of Nissan Motor Co., U.S.A.

ZEXEL 6-CYLINDER CLUTCH COIL AND BEARING R & I

NOTE: Volvo Zexel compressor servicing procedure is not available from manufacturer.

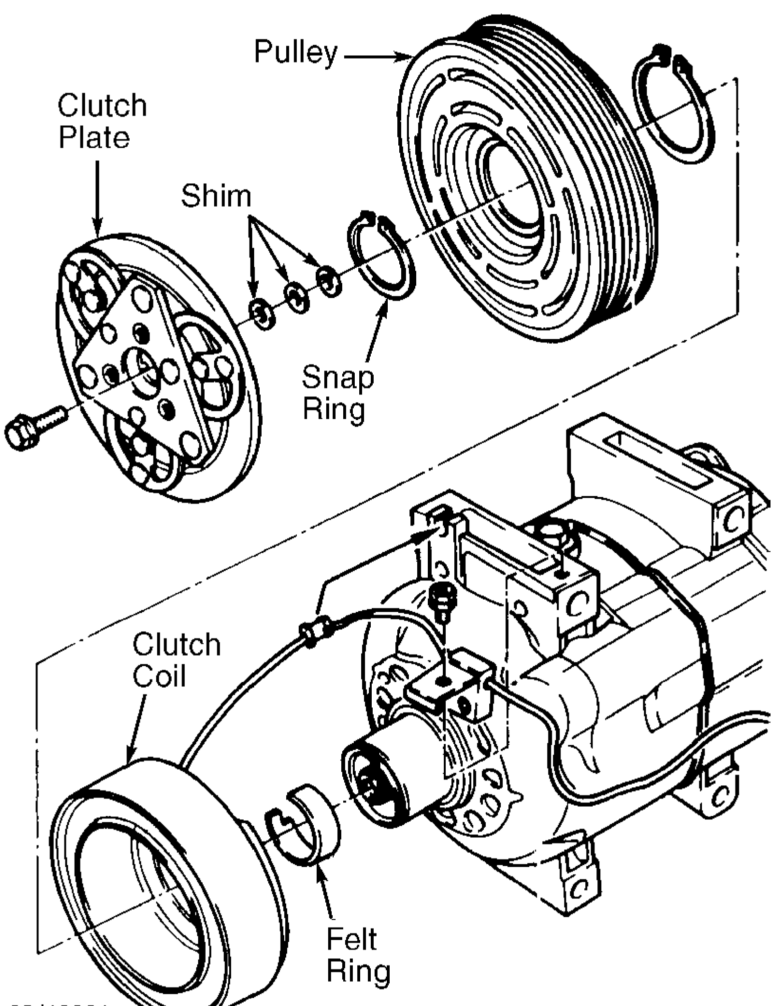
Removal (Audi)

1) Using Spanner Wrench (44-4), hold clutch hub stationary and remove shaft bolt. Remove clutch plate and shim(s) using Puller (VAG 1719) and Spanner Wrench (3212). See Fig. 20. Remove snap ring.

2) Place Spacer (VAG 1719/1) in center of pulley cavity. Attach Puller (US 1078) to outer diameter of pulley and remove pulley. Remove snap ring, bearing, and clutch coil as necessary.

Installation (Audi)

Ensure clutch coil lug fits into hole on compressor housing. Using Installer (VAG 1719/2), press on pulley and install snap ring. Install shim(s) and clutch plate. Tighten shaft bolt to 11 ft. lbs. (15 N.m). Using feeler gauge, ensure air gap between pulley and clutch disc is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary.



93J19264

Fig. 20: Exploded View Of Compressor (Zexel 6-Cylinder)
Courtesy of Audi of America, Inc.

Removal (Nissan)

1) Using Clutch Disc Wrench (J-37877), hold clutch hub

stationary and remove shaft nut. Remove adjustment shim(s) and clutch disc using Clutch Disc Puller (J-26571-A).

2) Bend lock washer away from lock nut. See Fig. 21. Remove lock nut with Wrench (J-37882). Remove pulley by hand or, if difficult to remove, use Pilot (J-26720-A) and universal puller. Remove snap ring, bearing, and clutch coil as necessary.

Installation (Nissan)

1) Ensure key is installed in compressor shaft keyway. Install pulley, lock washer and pulley. Tighten lock nut to 25-29 ft. lbs. (34-39 N.m). Bend lock washer against lock nut.

2) Install clutch disc and tighten shaft nut to 10-12 ft. lbs (14-16 N.m). Using feeler gauge, ensure air gap between pulley and clutch disc is .012-.024" (.30-.60 mm). If clearance is incorrect, add or remove shim(s) as necessary. Break-in compressor clutch assembly by engaging and disengaging clutch 30 times.

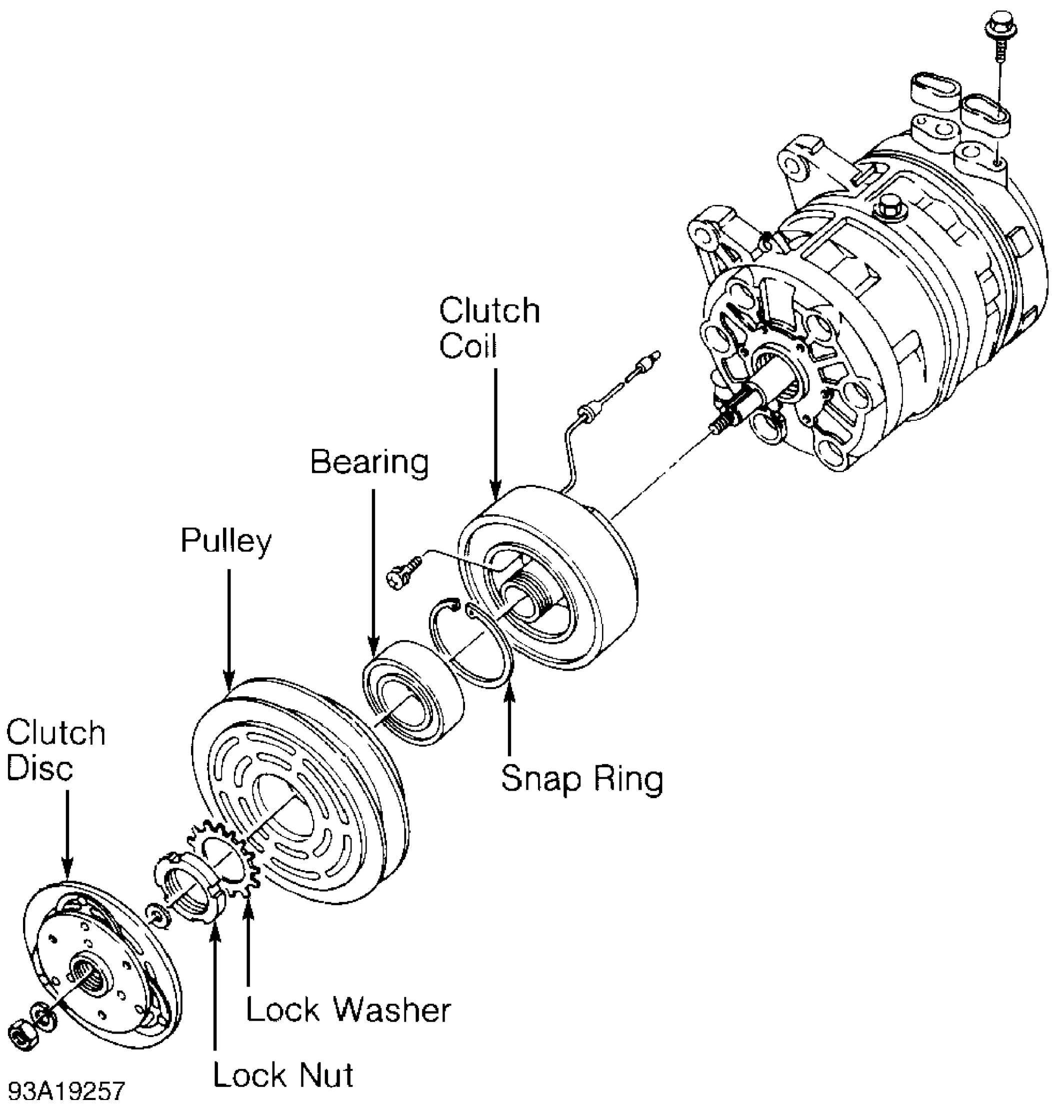


Fig. 21: Exploded View Of Compressor (Zexel DKS-16H 6-Cylinder)
Courtesy of Nissan Motor Co., U.S.A.

A/C COMPRESSOR OIL CHECKING

1993 Toyota Celica

1993 GENERAL SERVICING
Compressor Refrigerant Oil Checking

* PLEASE READ THIS FIRST *

NOTE: For compressor applications, see COMPRESSOR APPLICATIONS TABLE below. DO NOT exceed A/C system refrigerant oil capacity, when servicing system. See REFRIGERANT OIL & REFRIGERANT SPECIFICATIONS TABLE.

COMPRESSOR APPLICATION

NOTE: Due to late changes, always refer to underhood A/C specification label in engine compartment or A/C compressor label while servicing A/C system. If A/C Specification label and specifications in this article differ, always use label specifications.

COMPRESSOR APPLICATION TABLE

Application	Compressor
Acura	Nippondenso 10-Cyl.
Audi	
90	Zexel 6-Cyl.
100	Zexel 6-Cyl.
BMW	Nippondenso Or Seiko-Seiki
Chrysler Motors/Eagle	
Colt & Summit	Sanden FX105V Scroll
Colt Vista & Summit Wagon	Nippondenso 10PA15 10-Cyl.
Stealth	Sanden FX105VS Scroll
Ram-50	Sanden FX80 Scroll
Ford Motor Co.	
Capri	Nippondenso 10-Cyl.
Festiva	Nippondenso 6-Cyl.
General Motors & Geo	
LeMans	Harrison V5 5-Cyl.
Metro & Tracker	Nippondenso 10-Cyl.
Prizm	Nippondenso 10PA15 10-Cyl.
Storm	Diesel Kiki KC-50 Rotary Vane
Honda	
Accord	Nippondenso 10-Cyl. Or Hadsys RC-17S 7-Cyl.
Civic	Sanden Scroll
Civic Del Sol	Sanden Scroll
Prelude	Sanden Scroll
Hyundai	
Elantra	Sanden TRF-090 Scroll
Excel	Sanden SD-709 7-Cyl.
Scoupe	Nippondenso 10PA15C 10-Cyl.
Sonata	Ford FX-15 10-Cyl.
Infiniti	
G20	Atsugi NVR 140S Rotary Vane
J30	Calsonic V6 6-Cyl.
Q45	Calsonic V5 5-Cyl.
Isuzu (R-12)	
Amigo	Diesel Kiki DKS-13CH 6-Cyl.
Pickup	

4-Cylinder .... Diesel Kiki DKS-13CH 6-Cyl.
V6 .... Harrison R4 4-Cyl. Radial
Stylus .... Diesel Kiki DKV-14D Rotary Vane
Rodeo
4-Cylinder .... Diesel Kiki DKS-17CH 6-Cyl.
V6 .... Diesel Kiki DKV-14D Rotary Vane
Trooper .... Diesel Kiki DKV-14D Rotary Vane
Isuzu (R-134a Option) (1)
Amigo, Pickup, Rodeo & Trooper
2.3L & 2.6L Engine .... Zexel R-134a 6-Cyl.
3.1L Engine .... Harrison R-134a R-4 4-Cyl. Radial
3.2L Engine .... Zexel R-134a Rotary Vane
Jaguar
XJS .... Sanden SD-709 7-Cyl.
XJ6 .... Sanden SD-7H15 7-Cyl.
Lexus .... Nippondenso 10PA20 10-Cyl.
Mazda
B2200 & B2600i .... Sanden 5-Cyl.
Miata .... Nippondenso TV12 Rotary Vane
MPV .... Nippondenso 10-Cyl.
MX-6 & 626 .... Panasonic Rotary Vane
Navajo .... Ford FX-15 10-Cyl.
MX-3, Protege & 323 .... Panasonic Rotary Vane
929 .... Panasonic Rotary Vane
RX7 .... Nippondenso TV12 Rotary Vane
Mercedes-Benz
190E .... Nippondenso 10PA15 10-Cyl.
300D/E, 400E & 500E .... Nippondenso 10PA17 10-Cyl.
300SE/SD, 400SE & 500SEL .... Nippondenso 10PA20 10-Cyl.
Mitsubishi
Diamante
R-12 .... Sanden FX105VS Scroll
R-134a .... Sanden MSC105
Diamante Wagon .... Nippondenso 10PA17C 10-Cyl.
Galant & Mirage .... Sanden FX105V Scroll
Eclipse .... Nippondenso 10PA17 10-Cyl.
Expo/Expo LRV .... Nippondenso 10PA17C 10-Cyl.
Pickup .... Sanden FX80 Scroll
Montero .... Nippondenso 10PA15 10-Cyl.
Precis .... Sanden SD-709 7-Cyl.
3000GT
R-12 .... Sanden FX105VS Scroll
R-134a .... Sanden MSC105
Nissan
Altima .... Zexel DKV-14C Rotary Vane
Maxima & 300ZX .... Zexel DKS-16H 6-Cyl.
Quest .... Ford FX-15 10-Cyl.
Pathfinder & Pickup .... Zexel DKV-14C Rotary Vane
Sentra & NX .... Zexel DKV-14D Rotary Vane
240SX .... Calsonic V5 5-Cyl.
Porsche
911 America Roadster,
RS America & Carrera 2/4 .... Nippondenso 10-Cyl.
Saab
900 .... Sanden 5-Cyl.
9000 .... Seiko-Seiki SS121 DN1 Rotary Vane
Subaru
Impreza .... Zexel Rotary Vane
Legacy .... Zexel DKS-15CH 5-Cyl.
Calsonic V5-15C 5-Cyl.
Loyale .... Hitachi MJS170-5DP 6-Cyl.
SVX .... Calsonic V5 5-Cyl.
Suzuki .... Nippondenso 10-Cyl.

Toyota	
Camry	Nippondenso 10PA17C 10-Cyl.
Celica	
4A-FE Engine	Nippondenso 10PA15C 10-Cyl.
3S-GTE & 5S-FE Engine	Nippondenso 10PA17C/VC 10-Cyl.
Corolla	Nippondenso 10PA15 10-Cyl.
Land Cruiser	Nippondenso 10PA17 10-Cyl.
MR2	Nippondenso 10P13C 10-Cyl.
Paseo	Matsushita Rotary Vane
Pickup & 4Runner	Nippondenso 10-Cyl.
Previa	Nippondenso 10PA17E 10-Cyl.
Supra	Nippondenso 10-Cyl.
Tercel	Matsushita TV10B Rotary Vane
T100	Nippondenso 10PA15 10-Cyl.
Volkswagen	
Cabriolet	Sanden SD-508 5-Cyl. Or SD-709 7-Cyl.
Corrado SLC	Sanden SD-709 7-Cyl.
EuroVan	Sanden SD7H15 7-Cyl.
Golf, GTI & Jetta	Sanden SD7-V16/SD7-V16L 7-Cyl.
Fox	Nippondenso 6-Cyl.
Passat	Sanden SD7-V16/SD7-V16L 7-Cyl.
Volvo	
240	Seiko-Seiki SS-121DS5
850	Zexel DKS-15CH 6-Cyl.
940 & 960	Sanden SD-510 5-Cyl., Sanden SD-709 7-Cyl. Or Seiko-Seiki SS-121DS5

(1) - Standard equipment on some models built after 5/1/93.

REFRIGERANT OIL & REFRIGERANT CAPACITY

REFRIGERANT OIL & REFRIGERANT CAPACITY (ACURA THROUGH INFINITI)

Application	(1) Oil Ounces	Refrigerant Ounces
Acura		
Integra	(2) 2.0-3.4	32-34
Legend		
Sedan	(2) (3) 4.7	(4) 24.7-26.5
Coupe	(3) 4.7	24.7-26.5
Vigor	(2) 4.7-4.9	26.5-28.0
Audi		
90	7.8-9.2	(5) 23.0-24.8
100	7.8-9.2	(5) 21.0-22.8
BMW		
318 & 325 Series	3.4-4.8	(6) 35-36
525i & 535i	4.7-6.1	(6) 53.0-55.5
740i & 740iL	4.7-6.1	(6) 53.0-55.5
Chrysler Motors/Eagle		
Colt & Summit	(2) 4.4-5.1	26-30
Colt Vista & Summit Wagon	(2) 2.0-3.4	30
Ram-50	(2) 4.4-5.1	30
Stealth	(2) 4.6-6.0	29
Ford Motor Co.		
Capri	2.4-3.0	23-27
Festiva	10	25
General Motors & Geo		

LeMans	8.0	35
Metro	2.7	18
Prizm & Prizm LSi	6.0	25
Storm	5.1	21
Tracker	2.7	21
Honda		
Accord		
Nippondenso	3.0-4.1	28-30
Hadsys	4.1-4.3	28-30
Civic	4.0-4.7	21-23
Civic Del Sol	4.0-4.7	21-23
Prelude	(7) 4.3-5.0	21-23
Hyundai		
Excel	8.1	30-32
Scoupe	2-3	28-32
Elantra	4.0	32
Sonata	6.9-7.7	30-32
Infiniti		
G20	6.8	24-29
J30	8.5	(8) 24-26
Q45	9.7	38-42

(1) - Total system capacity, unless otherwise noted.
(2) - Compressor refrigerant oil capacity.
(3) - Capacity revised by manufacturer in Acura Service News bulletin number ASN 0793-02.
(4) - Use R-134a refrigerant and ND-Oil 8 (Part No. 38899-PR7-003).
(5) - Use R-134a refrigerant and Polyalkylene Glycol (PAG) oil.
(6) - Use R-134a and Poyalkylene Glycol Oil (Part No. 81-22-9-407-724).
(7) - Use R-134a refrigerant and PAG Refrigerant Oil (Part No. 38899-P13-003).
(8) - Use R-134a refrigerant and Type "S" Oil (Part No. KLH00-PAGS0).

REFRIGERANT OIL & REFRIGERANT CAPACITY (ISUZU THROUGH MERCEDES)

Application	(1) Oil Ounces	Refrigerant Ounces
Isuzu (R-12)		
Amigo	5.0	26
Pickup		
2.3L & 2.6L Engine	5.0	26
3.1L Engine	6.0	26
Rodeo		
2.6L Engine	5.0	26
3.2L Engine	5.0	26
Stylus	5.0	21
Trooper	5.0	30
Isuzu (R-134a Option) (3)		
Amigo & Pickup		
2.3L & 2.6L Engine	5.0	23
3.1L Engine	7.5-8.5	23
Rodeo	5.0	23
Trooper	5.0	26
Jaguar		
XJS	(2) 4.6	40
XJ6	(2) 4.5	(4) 40
Lexus		
ES300	(2) 3.5	32-35

GS300	(2) 4.0	(5) 28-32
LS400	(2) 2.8-3.5	(5) 32
SC300 & SC400	(2) 4.0	32-35
Mazda		
B2200 & B2600i	(2) 4.5	28
Miata	(2) 2.7-3.3	28
MPV		
Dual Unit	(2) 2.7-3.3	51
Single Unit	(2) 2.7-3.3	37
MX-3	(2) 5.0	28
MX-6 & 626	(2) 4.3	26
Protege & 323	(2) 3.9-4.6	28
Navajo	7.0	28-29
929	3.6	28
RX7	3.4-4.7	21
Mercedes-Benz		
190E	(2) 4.0	36
300D/E, 400E & 500E	(2) 5.4	(6) 36
300SE/SD, 400SE & 500SEL	(2) 5.4	(7) 43

(1) - Total system capacity, unless otherwise noted.
(2) - Compressor refrigerant oil capacity.
(3) - Standard equipment on some models built after 5/1/93. Use R-134a Swash Plate Compressor Oil (Part No. 2-90188-300-0)on 2.3L and 2.6L engine. Use R-134a R-4 Compressor Oil (Part No. 2-90222-320-0) on 3.1L engine. Use R-134a Rotary Vane Compressor Oil (Part No. 2-90188-301-0) on 3.2L engine.
(4) - Use R-134a refrigerant and PAG SP20 refrigerant oil.
(5) - Use R-134a refrigerant and ND-Oil 8 (Part No. 38899-PR7-003).
(6) - Use R-134a refrigerant and Densooil 8 (Part No. A 001 989 08 03).
(7) - Use R-134a refrigerant and Densooil 8 (Part No. A 001 989 08 03).Use 50 ounces if equipped with rear passenger compartment A/C-heater system.

REFRIGERANT OIL & REFRIGERANT CAPACITY (MITSUBISHI THRU SUBARU)

Application	(1) Oil Ounces	Refrigerant Ounces
Mitsubishi		
Diamante		
R-12	5.4-6.0	34-38
R-134a	(3) 5.7-6.4	26-28
Diamante Wagon	5.4	28
Eclipse	(2) 2.0-3.4	33
Expo/Expo LRV		
1.8L	(2) 3.4-4.0	30
2.4L	(2) 2.0-3.4	30
Galant	(2) 5.0-5.7	33
Mirage	(2) 4.4-5.1	26-30
Pickup	(2) 4.4-5.1	30
Montero	(2) 2.0-3.4	28
Precis	8.1	30-32
3000GT		
R-12	4.7-6.0	29
R-134a	(3) 4.7-6.0	26-28
Nissan		
Altima	(4) 6.8	25-28

Maxima	(5) 6.8	30-33
Pathfinder & Pickup	(4) 6.8	26-30
Quest		
Front A/C	7.0	36
Front & Rear A/C	10	56
Sentra & NX	6.8	23-26
240SX	8.0	29-32
300ZX	6.8	26-30
Porsche		
911 America Roadster, RS America & Carrera 2/4	4.6	(6) 29.5
Saab		
900	5.9	34-36
9000	6.6	(3) 33-34
Subaru		
Impreza	6.1	23-26
Legacy		
Zexel	(2) 2.4	29-32
Calsonic	(2) 3.2	29-32
Loyale	(2) 2.4	26-28
SVX	(2) 2.4	(7) 22-23

(1) - Total system capacity, unless otherwise noted.
(2) - Compressor refrigerant oil capacity.
(3) - Use SUN PAG 56 refrigerant oil.
(4) - Use R-134a refrigerant and Type "R" Oil (Part No. KLH00-PAGR0).
(5) - Use R-134a refrigerant and Type "S" Oil (Part No. KLH00-PAGS0).
(6) - Use R-134a refrigerant and Nippondenso ND8 refrigerant oil.
(7) - Use R-134a refrigerant and ZXL100 PG (DH-PS) Type "S"Oil (Part No. K0010PS000).

REFRIGERANT OIL & REFRIGERANT CAPACITY (SUZUKI THROUGH VOLVO)

Application	(1) Oil Ounces	Refrigerant Ounces
Suzuki		
Samurai	2.0-3.4	18
Sidekick	2.0-3.4	21-23
Swift	2.0-3.4	18
Toyota		
Camry	(2) 3.5	32-35
Celica	3.4-4.1	24-27
Corolla	3.4-4.1	25-28
Land Cruiser	3.4-4.1	30-34
MR2	3.4-4.1	28-32
Paseo	3.4-4.1	25-28
Pickup	3.4-4.1	24-29
Previa		
Without Rear A/C	3.4-4.7	32-35
With Rear A/C	3.4-4.7	41-44
Supra	(2) 4.1	(3) 23-27
Tercel	3.4-4.1	25-28
T100	3.4-4.1	(3) 21-25
4Runner	3.4-4.1	27-30
Volkswagen		
Cabriolet	4.6	30.0-31.8
Corrado SLC	3.9-4.4	35.0-36.8
EuroVan		
Without Rear A/C	4.6	(4) 34-35

With Rear A/C	8.2	(4) 48-49
Fox	5.7	41-42
Golf, GTI & Jetta	3.9	(4) 28-30
Passat	3.9-4.4	(4) 41.0-42.8
Volvo		
240	7.4	(5) 26
850		
Cold Climates	7.0	(5) 29
Hot Climates	7.0	(5) 26
940 & 960		
Sanden SD-510	4.8	(6) 32-34
Sanden SD-709	8.5	(6) 32-34
Seiko-Seiki	7.8	(6) 32-34

(1) - Total system capacity, unless otherwise noted.
(2) - Compressor refrigerant oil capacity.
(3) - Use R-134a refrigerant and ND-Oil 8 (Part No. 38899-PR7-003).
(4) - Use R-134a refrigerant and SP-10 PAG Oil (Part No. G 052 154 A2).
(5) - Use R-134a refrigerant and ZXL 100 PG Oil (Part No. 8708581-7).
(6) - Use R-134a refrigerant and PAG Oil (Part No. 8708581-9).

REFRIGERANT OIL

Only NEW, moisture-free refrigerant oil should be used in the air conditioning system. This oil is highly refined and dehydrated so moisture content is less than 10 parts per million. The oil container must be tightly closed at all times when not in use, or moisture from the air will be absorbed into the refrigerant oil.

SERVICING PRECAUTIONS

DISCHARGING SYSTEM

Discharge A/C system using approved refrigerant recovery/recycling equipment. Always follow recovery/recycling equipment manufacturer's instructions. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

DISCONNECTING LINES & FITTINGS

After system is discharged, carefully clean area around all fittings to be opened. Always use 2 wrenches when tightening or loosening fittings. Some refrigerant lines are connected with a coupling. Special tools may be required to disconnect lines. Cap or plug all openings as soon as lines are removed. DO NOT remove caps until connections of lines and fittings are completed.

CONNECTING LINES & FITTINGS

NOTE: All R-134a based systems use 1/2-16 ACME threaded fittings. Ensure all replacement parts match the connections of the system being worked on.

Always use a new gasket or "O" ring when connecting lines or fittings. Coat "O" ring with refrigerant oil and ensure it is not twisted during installation. Always use 2 wrenches to prevent damage to lines and fittings.

PLACING SYSTEM IN OPERATION

After component service or replacement has been completed and all connections have been made, evacuate system thoroughly with a vacuum pump. Charge system with proper amount of refrigerant and perform leak test. See REFRIGERANT OIL & REFRIGERANT SPECIFICATIONS article in GENERAL SERVICING for system capacities. Check all fittings that have been opened. After system has been leak tested, check system performance.

NOTE: Most compressors are pre-charged with a fixed amount of refrigerant (shipping) oil. Drain compressor oil from new compressor and add refrigerant oil to new compressor according to amount removed from old compressor. Always refer to underhood A/C specification label or A/C compressor label while servicing A/C system.

ATSUGI

ROTARY VANE

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain compressor oil through compressor discharge port and measure oil amount.

3) If amount drained is less than 3 ounces, conduct leak tests at system connections. Repair or replace faulty parts as necessary. Check purity of oil and adjust oil level as follows.

4) If amount drained is 3 ounces or more, oil level is okay. Fill with same amount drained, using new oil. If amount drained is less than 3 ounces, pour in 3 ounces of new refrigerant oil.

COMPONENT REFRIGERANT OIL CAPACITIES (ATSUGI ROTARY VANE)

Component	Ounces
Condenser	1.0-1.7
Evaporator	1.5-2.5
Receiver-Drier	0.5-0.8
Refrigerant Lines (1)	1.0-1.7

(1) - Add only if a refrigerant oil leak is indicated.

BOSCH

6-CYLINDER

1) Before checking and adjusting oil level, operate compressor at engine idle speed, and set controls at maximum cooling and high blower motor speed for 20-30 minutes to return oil to compressor.

2) Stop engine and discharge refrigerant. See SERVICING PRECAUTIONS. Remove refrigerant oil level inspection plug on side of compressor. Oil should be at lower lip of threaded hole. If oil level is low, add new refrigerant oil as necessary. Replace inspection plug and tighten to 10-12 ft. lbs. (14-16 N.m).

CALSONIC

V5 5-CYLINDER & V6 6-CYLINDER

Infiniti & Nissan

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Measure the amount of oil drained/discharged into refrigerant recovery/recycling equipment.

3) Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add this amount to amount drained in step 2), to obtain total amount drained.

4) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See appropriate COMPONENT REFRIGERANT OIL CAPACITIES table for specified amount.

COMPONENT REFRIGERANT OIL CAPACITIES (CALSONIC V5)

Component	Ounces
Condenser	1.0-1.7
Evaporator	1.5-2.5
Receiver-Drier	0.5-0.8
Refrigerant Lines (1)	1.0-1.7

(1) - Add only if a refrigerant oil leak is indicated.

COMPONENT REFRIGERANT OIL CAPACITIES (CALSONIC V6)

Component	Ounces
Condenser	2.5
Evaporator	2.5
Receiver-Drier	0.2
Refrigerant Lines (1)	1.0

(1) - Add only if a refrigerant oil leak is indicated.

Subaru

1) Before checking and adjusting oil level, operate engine at 1000-1500 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain compressor oil from compressor drain plug and measure oil amount.

3) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See appropriate SUBARU COMPONENT REFRIGERANT OIL CAPACITIES table for specified amount.

SUBARU COMPONENT REFRIGERANT OIL CAPACITIES (LEGACY)

Component	Ounces
Compressor	2.4
Condenser	1.7

Evaporator	2.4
Refrigerant Lines (1)	1.7

(1) - Add only if a refrigerant oil leak is indicated.

SUBARU COMPONENT REFRIGERANT OIL CAPACITIES (SVX)

Component	Ounces
Compressor	2.4
Condenser	1.7
Evaporator	2.4
Refrigerant Lines (1)	1.7

(1) - Add only if a refrigerant oil leak is indicated.

DIESEL KIKI

ROTARY VANE

1) Before checking and adjusting oil level, operate engine at 800-1000 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and measure amount of oil drained.

3) If amount drained is less than 3 ounces (1.7 ounces on Geo Storm), conduct leak tests at system connections. Repair or replace faulty parts as necessary.

4) If amount drained is more 3 ounces (1.7 ounces on Geo Storm), oil level is okay. Fill compressor with same amount drained, using new oil. If amount drained is less than 3 ounces (1.7 ounces on Geo Storm), pour in 3 (1.7) ounces of new refrigerant oil.

5) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI ROTARY VANE) table.

COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI ROTARY VANE)

Component	Ounces
Condenser	1.7
Evaporator	1.0
Receiver-Drier	1.0
Refrigerant Lines	0.3

5 & 6-CYLINDER

1) Before checking and adjusting oil level, operate engine at 800-1000 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and measure amount of oil drained.

3) If amount drained is less than 3 ounces, conduct leak tests at system connections. Repair or replace faulty parts as necessary.

4) If amount drained is more 3 ounces, oil level is okay. Fill compressor with same amount drained, using new oil.

5) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI 5 & 6-CYLINDER) table.

COMPONENT REFRIGERANT OIL CAPACITIES (DIESEL KIKI 5 & 6-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	1.7
Receiver-Drier	1.0
Refrigerant Lines	0.3

FORD

FX-15 10-CYLINDER

1) Slowly discharge system. See SERVICING PRECAUTIONS. Remove A/C compressor. Drain compressor oil from suction and discharge ports. Measure amount drained and discard oil.

2) If amount drained from removed (old) compressor is between 3 and 5 ounces, add drained amount of new refrigerant oil into the NEW compressor through suction port.

3) If amount drained is less than 3 ounces, add 3 ounces to the NEW compressor. If amount drained is more than 5 ounces, add 5 ounces. Use new "O" rings on refrigerant lines. Install A/C compressor. Evacuate and recharge system. Perform leak test.

4) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (FX-15 10-CYLINDER) table.

COMPONENT REFRIGERANT OIL CAPACITIES (FX-15 10-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	3.0
Receiver-Drier	(1) 2.0
Refrigerant Lines	(2) 1.0

(1) - On Hyundai Sonata and Mazda Navajo, drain oil from old receiver-drier. Add amount drained to amount specified.
(2) - Add only if a large oil leak is indicated.

HADSYS

7-CYLINDER

Honda (Accord)

1) Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain all oil from NEW compressor and fill compressor with 4 ounces of clean refrigerant oil.

2) Add one ounce of refrigerant oil when replacing evaporator. Add1/2 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

HARRISON

R4 4-CYLINDER

1) Before checking and adjusting oil level, operate engine at 800-1000 RPM. Set controls at maximum cooling and high blower motor speed for 20 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and measure amount of oil drained.

3) If amount drained is less than one ounce, conduct leak tests at system connections. Repair or replace faulty parts as necessary. Fill compressor with 2 ounces, using new refrigerant oil.

4) If amount drained is more one ounce, oil level is okay. Fill compressor with same amount drained, using new oil.

5) When replacing other A/C system components, add the following amount(s) of refrigerant oil. See COMPONENT REFRIGERANT OIL CAPACITIES (HARRISON R4 4-CYLINDER) table.

COMPONENT REFRIGERANT OIL CAPACITIES (HARRISON R4 4-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	1.7
Receiver-Drier	1.0
Refrigerant Lines	0.3

V5 5-CYLINDER

1) If system is operable, run A/C system for several minutes to stabilize system. Turn off engine. Discharge system and remove compressor. See SERVICING PRECAUTIONS. Remove drain plug and measure oil.

2) If one ounce or more is drained, add same amount. If less than one ounce is drained, add 2 ounces of new refrigerant oil to compressor.

3) If condenser is replaced, add one ounce. Add 3.5 ounces if accumulator is replaced. If evaporator is replaced or if a large refrigerant leak occurred, add 3 ounces of new refrigerant oil.

HITACHI

6-CYLINDER

1) Before checking and adjusting oil level, operate compressor at 1000-1500 engine RPM, and set controls at maximum cooling and high blower motor speed for about 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain oil from compressor through suction port. Measure amount of oil drained.

3) If amount drained is 2.4 ounces or more, fill with same amount using new oil. If amount drained is less than 2.4 ounces, fill with 2.4 ounces. Install compressor and recharge.

4) If A/C components are replaced, add refrigerant oil to system. Add 1.7 ounces if condenser is replaced. Add 2.4 ounces if evaporator is replaced. Oil does not need to be added if receiver-drier is replaced. Add 1.7 ounces of refrigerant oil only if a refrigerant oil leak is indicated.

MATSUSHITA

ROTARY VANE

Geo (Prizm)

1) If system is operable, run A/C system for several minutes to stabilize system. Turn off engine. Discharge system and remove compressor. See SERVICING PRECAUTIONS. Remove drain plug and measure oil.

2) If one ounce or more is drained, add same amount. If less than one ounce is drained, add 2 ounces of new refrigerant oil to compressor.

3) If condenser is replaced, add one ounce. Add 3.5 ounces if receiver-drier is replaced. If evaporator is replaced or if a large refrigerant leak occurred, add 3 ounces of new refrigerant oil.

Toyota

Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain oil from compressor through inlet and outlet ports. Fill compressor with 3.4-4.1 ounces of oil through suction port. Add 0.7 ounces if receiver-drier was replaced. When replacing condenser or evaporator, add 1.4-1.7 ounces of refrigerant oil.

NIPPONDENSO

ROTARY VANE

1) Before checking and adjusting oil level, operate compressor at engine idle speed, and set controls at maximum cooling and high blower motor speed for 20-30 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Drain compressor oil through compressor intake and discharge ports. Measure amount drained.

3) Fill compressor with same amount as drained, plus one ounce. When replacing condenser, add one ounce. When replacing evaporator, add 1 1/2 ounces. When replacing receiver-drier, add 1/3 ounce of new refrigerant oil.

6 & 10-CYLINDER

NOTE: Porsche and Suzuki compressor oil checking procedures are not available from manufacturer.

Acura & Honda

1) Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain all oil from NEW compressor and fill compressor with 3-4 ounces of clean refrigerant oil.

2) On Accord, add 5/6 ounce of refrigerant oil when replacing evaporator. Add 1/3 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

3) On Legend, add 2 ounces of refrigerant oil when replacing evaporator. Add one ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

4) On Integra, add one ounce of refrigerant oil when replacing evaporator. When replacing condenser, receiver-drier or hoses, add 1/3 ounce per component replaced.

5) On Vigor, add 1/2 ounce of refrigerant oil when replacing evaporator. Add 2/3 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Chrysler Corp. (Colt Vista/Summit Wagon)

Add 2 ounces of refrigerant oil when replacing evaporator. Add one ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Ford Motor Co.

On Capri, add 2-3 ounces when replacing compressor. Add one ounce of refrigerant oil when replacing condenser or evaporator. When replacing receiver-drier, add 1/2 ounce. On Festiva, drain and measure oil from receiver-drier. Add the amount drained plus one ounce. Add one ounce when replacing condenser. Add 3 ounces of refrigerant oil when replacing evaporator.

Geo, Hyundai & Mazda

Add one ounce of refrigerant oil when replacing condenser. Add 1-1 1/2 ounce when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Lexus & Toyota

The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system. Add 1 1/2 ounces of refrigerant oil when replacing condenser. Add 1 1/2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add1/2 ounce per component replaced.

Mercedes-Benz

Add 2/3 ounce of refrigerant oil when replacing condenser. Add 1 1/3 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced. If A/C system line has broken (sudden discharge), add1 1/3 ounces of refrigerant oil.

NOTE: On Mercedes-Benz vehicles with rear A/C, add 2/3 ounce of refrigerant oil when replacing rear condenser. When replacing rear A/C lines, add 1/3 ounce per line replaced.

Mitsubishi

1) On Eclipse, add 2/3 ounce of refrigerant oil when replacing condenser. Add one ounce when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

2) On Expo/Expo LRV and Montero, add one ounce of refrigerant oil when replacing condenser. Add 2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

Volkswagen (Fox)

1) The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

2) Add 1 1/2 ounce of refrigerant oil when replacing evaporator. When replacing condenser, add 1 1/3 ounce of refrigerant oil. Add one ounce of refrigerant oil when replacing receiver-drier (1 1/2 ounces if relief valve on receiver-drier has burst).

PANASONIC

ROTARY VANE

Mazda

Add 1 1/3 ounce of refrigerant oil when replacing condenser (1/2 ounce on MX-6 and 626). Add 2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce of refrigerant oil.

SANDEN

SCROLL

Chrysler/Mitsubishi

1) On Colt, Galant, Mirage, Pickup, Ram-50 and Summit, add 1/2 ounce of refrigerant oil when replacing condenser. Add 1 1/2 ounces when replacing evaporator. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

2) On Stealth and 3000GT, add 1/2 ounce of refrigerant oil when replacing condenser. Add 2 ounces when replacing evaporator. When replacing receiver-drier or low-pressure hose, add 1/3 ounce per component replaced.

Honda

1) Discharge system. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain all oil from NEW compressor and fill compressor with 4 ounces of clean refrigerant oil.

2) On Civic and Civic Del Sol, add 1 1/2 ounce of refrigerant oil when replacing evaporator. Add 2/3 ounce when replacing condenser. When replacing receiver-drier or hoses, add 1/3 ounce per component replaced.

3) On Prelude, add one ounce of refrigerant oil when replacing evaporator. When replacing other A/C components, add 1/3 ounce per component replaced (including hoses).

Hyundai

Add 1 1/2 ounces of refrigerant oil when replacing evaporator. Add one ounce when replacing condenser. When replacing receiver-drier, add 1/3 ounce of refrigerant oil.

5-CYLINDER

Mazda

Add one ounce of refrigerant oil when replacing condenser. Add 1 2/3 ounce when replacing evaporator. When replacing receiver-drier, add 1/2 ounce of refrigerant oil.

NOTE: Saab and Volvo (Sanden 5 or 7-cylinder) compressor oil checking procedures are not available from manufacturer.

7-CYLINDER

Hyundai & Mitsubishi (Excel & Precis)

1) Before checking and adjusting oil level, operate compressor at engine idle speed, and set controls at maximum cooling and high blower motor speed for 20-30 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant and remove compressor from vehicle. See SERVICING PRECAUTIONS. Remove oil drain plug and drain oil. Measure amount of oil drained. Install drain plug with new "O" ring.

3) If amount drained is 2.3 ounces or more, fill compressor with same amount using new oil. If amount drained is less than 2.3 ounces, fill with 2.3 ounces. Install filler plug. Install compressor and recharge system.

COMPONENT REFRIGERANT OIL CAPACITIES (SANDEN 7-CYLINDER)

Component	Ounces
Condenser	1.0
Evaporator	3
Receiver-Drier	1

Jaguar (XJS)

1) Operate engine at idle speed for 10 minutes, to return refrigerant oil to compressor. Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Clean area around compressor filler plug and remove plug slowly.

2) Determine angle at which compressor is mounted. Insert compressor dipstick diagonally until stop on dipstick contacts filler plug surface. See Fig. 1. Remove dipstick and note oil fill level. Each increment on dipstick represents one ounce of oil.

3) Determine amount of oil needed according to mounting angle. See COMPRESSOR OIL CAPACITIES (JAGUAR XJS) table for specified amount.

4) If necessary, correct compressor oil level. Install compressor oil plug, and tighten it to 72-108 INCH lbs. (8-12 N.m). Evacuate and recharge A/C system. Perform leak test.

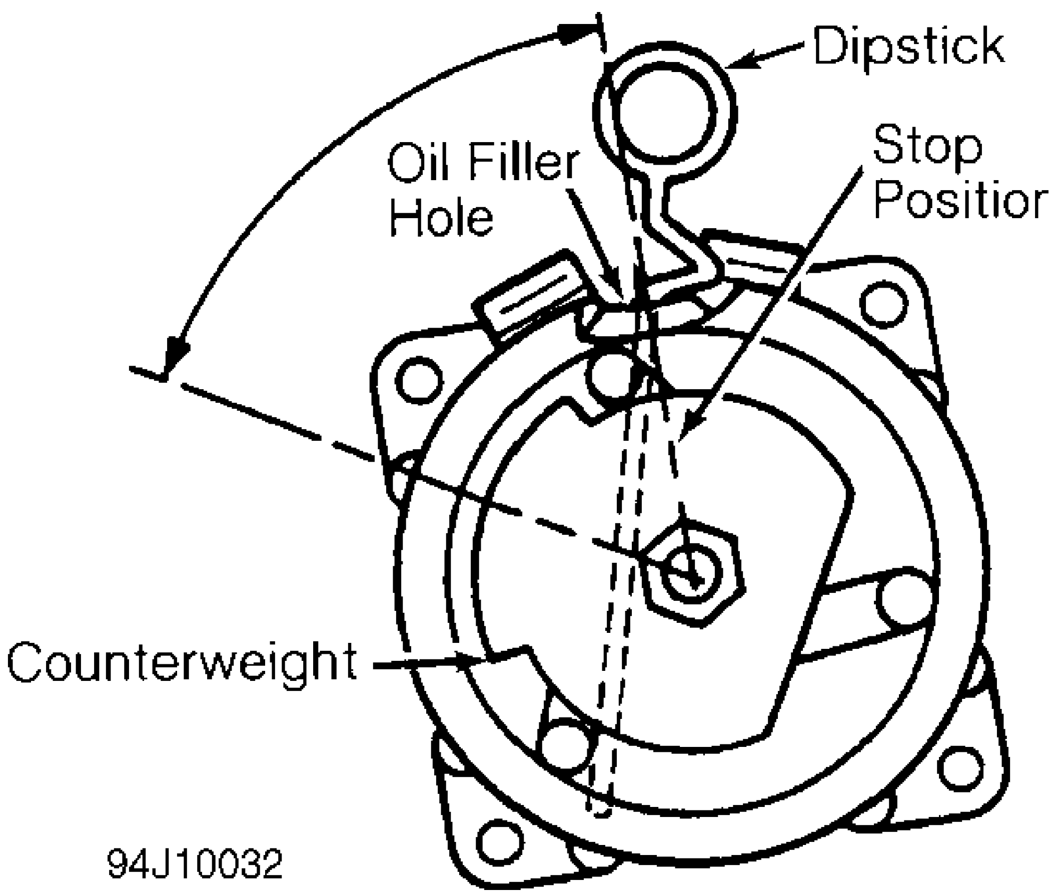


Fig. 1: Checking Jaguar XJS Compressor Oil Level (Sanden 7-Cylinder)
Courtesy of Jaguar Cars, Inc.

COMPRESSOR OIL CAPACITIES (JAGUAR XJS)

Mounting Angle (In Degrees)	Oil Level In Increments
0	3-5
10	4-6
20	5-7
30	6-8
40	7-9
50	8-10
60	9-11
90	10-12

Volkswagen

1) The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

2) On Cabriolet, add 2/3 ounce of refrigerant oil when replacing evaporator. When replacing condenser or receiver-drier, add 1/3 ounce of refrigerant oil per component replaced.

3) On Corrado SLC, Golf, GTI, Jetta and Passat, add 2/3 ounce of refrigerant oil when replacing evaporator. When replacing condenser or receiver-drier, add 1/3 ounce of refrigerant oil per component replaced.

4) On EuroVan, add one ounce of refrigerant oil when replacing evaporator. Add 1/2 ounce when replacing condenser (2/3 ounce on vehicles with rear A/C). When replacing receiver-drier, add 1/3 ounce (2/3 ounce on vehicles with rear A/C).

SEIKO-SEIKI

ROTARY VANE

Saab (9000)

The A/C system is filled with 6.6 ounces of compressor oil. The compressor must be topped off with the specified amount. See COMPONENT REFRIGERANT OIL CAPACITIES (SEIKO-SEIKI ROTARY VANE) table. Topping off should be carried out on the high pressure side of the compressor.

COMPONENT REFRIGERANT OIL CAPACITIES (SEIKO-SEIKI ROTARY VANE)

Component	Ounces
Compressor	(1) 2.3
Condenser	1.3
Expansion Valve	0.6
Evaporator	1.3
Receiver-Drier	1.3
Refrigerant Lines	0.6

(1) - To avoid an excessive amount of oil in the A/C system, oil must be drained from the compressor before it is installed.

ZEXEL

NOTE: Isuzu and Subaru compressor oil checking procedures are not available from manufacturer.

ROTARY VANE

Nissan

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Measure the amount of oil drained/discharged into refrigerant recovery/recycling equipment.

3) Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add this amount to amount drained in step 2), to obtain total amount drained.

4) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See COMPONENT REFRIGERANT OIL CAPACITIES (ZEXEL ROTARY VANE & 6-CYLINDER) table for specified amount.

COMPONENT REFRIGERANT OIL CAPACITIES (ZEXEL ROTARY VANE & 6-CYLINDER)

Component	Ounces
Condenser	
Altima & Maxima	2.5
NX, Pickup, Sentra & 300ZX	1.0-1.7
Evaporator	
Altima & Maxima	2.5
NX, Pickup, Sentra & 300ZX	1.5-2.5
Receiver-Drier	
Altima & Maxima	0.2
NX, Pickup, Sentra & 300ZX	0.5-0.8
Refrigerant Lines (1)	1.0

(1) - Add only if a refrigerant oil leak is indicated.

6-CYLINDER

Audi

1) The use of refrigerant recovery/recycling is recommended by manufacturer. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

2) Add one ounce of refrigerant oil when replacing accumulator. When replacing condenser, add amount drained from condenser plus 1/3 ounce of refrigerant oil. When replacing evaporator, add amount drained from evaporator plus 2/3 ounce of refrigerant oil.

Nissan

1) Before checking and adjusting oil level, operate engine at 1200 RPM. Set controls at maximum cooling and high blower motor speed for 10 minutes to return oil to compressor.

2) Stop engine. Discharge refrigerant. See SERVICING PRECAUTIONS. Measure the amount of oil drained/discharged into refrigerant recovery/recycling equipment.

3) Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add this amount to amount drained in step 2), to obtain total amount drained.

4) Fill compressor with total amount drained, using new oil. If any major components of the system were also replaced, determine the amount of additional oil needed. See COMPONENT REFRIGERANT OIL CAPACITIES (ZEXEL ROTARY VANE & 6-CYLINDER) table for specified amount.

Volvo (850)

1) Discharge refrigerant. See SERVICING PRECAUTIONS. Remove compressor from vehicle. Drain compressor oil from compressor drain plug and measure oil amount. Add the same amount of oil as was drained from the old compressor.

2) Add 1 2/3 ounce of refrigerant oil when replacing evaporator. When replacing condenser or hoses, add 2/3 ounce of refrigerant oil per component replaced. Add 3 ounce of refrigerant oil when replacing receiver-drier.

1993 Manual A/C-Heater Systems

Celica

A/C SYSTEM SPECIFICATIONS

SPECIFICATIONS TABLE

Application	Specification
Compressor Type	
4A-FE Engine	Nippondenso 10PA15C 10-Cyl.
3S-GTE & 5S-FE Engine	Nippondenso 10PA17C/VC 10-Cyl.
Compressor Belt Tension (1)	
1.6L Engine	
New	135-185 lbs. (61.2-83.9 kg)
Used	80-120 lbs. (36.2-54.4 kg)
2.0L Engine	
New	155-175 lbs. (70.3-79.4 kg)
Used	69-99 lbs. (31.3-44.9 kg)
2.2L Engine	
New	155-175 lbs. (70.3-79.4 kg)
Used	100-120 lbs. (45.4-54.4 kg)
System Oil Capacity	3.4-4.7 ozs.
Refrigerant (R-12) Capacity	24-27 ozs.
System Operating Pressures	
High Side	206-213 psi (14.5-15 kg/cm^2)
Low Side	21-28 psi (1.5-2.0 kg/cm^2)

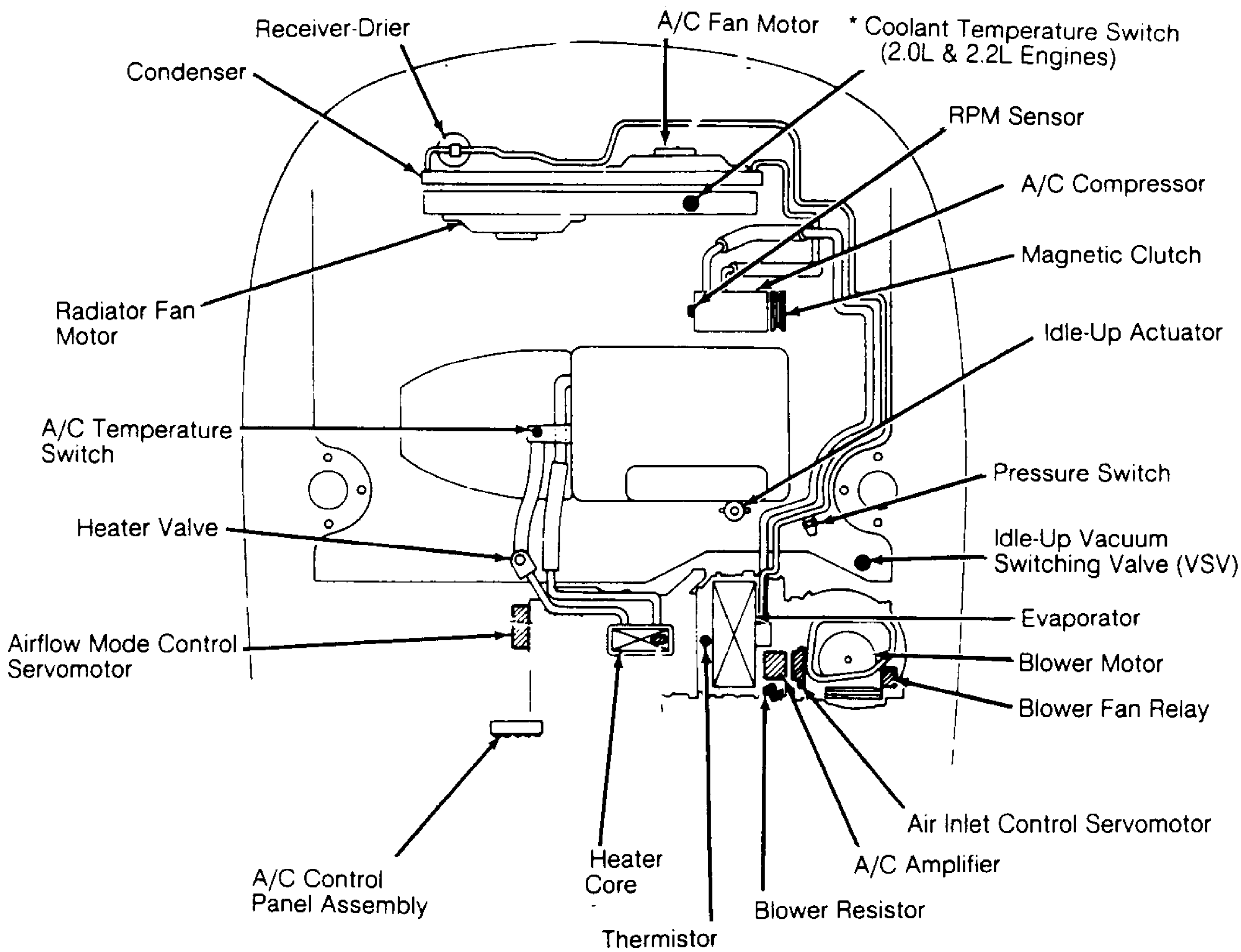
(1) - Using belt tension gauge, measure at longest run of belt.

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES & ELECTRICAL section.

DESCRIPTION

The 2.0L and 2.2L A/T equipped models use a Nippondenso 10-cylinder variable displacement compressor. All other models use a Nippondenso 10-cylinder fixed displacement compressor. An electric condenser fan operates at 2 speeds, depending on coolant temperature and A/C switch position.

System components include A/C amplifier, evaporator, thermistor, triple-pressure switch, engine coolant temperature switch, A/C compressor, condenser, receiver-drier and pipes and hoses. See Fig. 1. Air door operation is controlled through cables or servomotors. A/C compressor operation and A/C modes are electrically controlled.



NOTE: Coolant Temperature Switch (for cooling fan control) on 1.6L engine is located on thermostat housing.

93I19610

Fig. 1: Identifying Manual A/C-Heater System Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OPERATION

SYSTEM CONTROLS

A/C modes are controlled by push buttons and an A/C on-off switch. A dial type switch is used to control fan speed functions. See Fig. 2.A/C controls operate air supply selection (fresh or recirculating air), mode, temperature selection and blower speeds.

Temperature control knob operates the blend-air door in the A/C-heater unit. This mixes cooled and heated air so the selected air temperature can be obtained. The system will provide cooled air when A/C switch is on and blower motor is in any position other than OFF. The temperature control knob should be rotated counterclockwise (maximum cooling) when maximum A/C operation is desired.

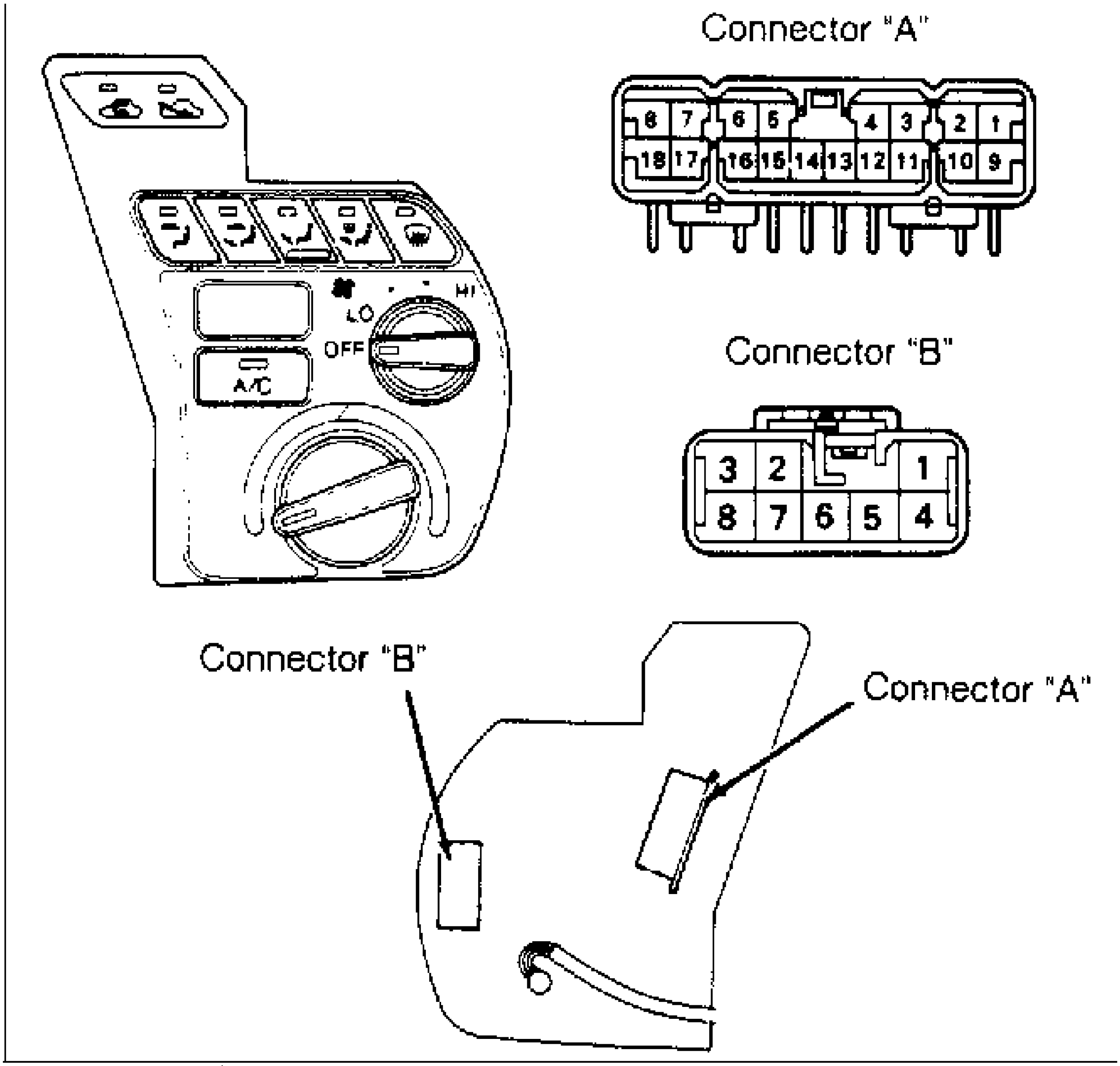


Fig. 2: Identifying A/C-Heater Control Panel Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SYSTEM COMPONENTS

A/C Switch

When A/C switch is pushed, A/C will operate if the blower motor control is in any position other than off. When activated, the A/C switch allows the compressor (magnetic) clutch to engage and operate the compressor. When activated, a light will illuminate on the A/C push button.

Triple-Pressure Switch

The triple-pressure switch is located on the liquid line, and is wired in series with the compressor (magnetic) clutch and the electric fan motor. The compressor clutch control portion of the switch cuts off electrical power to the clutch when refrigerant pressures have gone above or below the control point of the switch. When pressures have returned to normal operating ranges, compressor clutch receives power to resume operation.

The fan control portion of the switch cuts off electrical power to the condenser fan motor when refrigerant pressures have gone above the control point of the switch. When pressures have returned to normal operating ranges, condenser fan receives power to resume operation.

Thermistor

The thermistor is a thermocouple, mounted in front of the evaporator (air outlet side) to sense airflow temperature. The thermistor is electronically wired in series with the compressor clutch. The evaporator thermistor is used to prevent the evaporator from freezing up. The amplifier uses value received from thermistor to send appropriate electrical signal to compressor clutch for proper on-off cycling.

Vacuum Switching Valve (VSV)

A solenoid valve is used to assist in smooth engine operation during compressor on cycle. The VSV holds the throttle at slightly above idle (spring loaded to this position) when A/C system is operating. When system is off, vacuum is directed to VSV diaphragm, allowing throttle to return to normal idle position.

ADJUSTMENTS

AIR MIX DAMPER

With control cable of air mix damper removed, set air mix damper and temperature control switch to cool position. See Fig. 3. Install control cable and clamp.

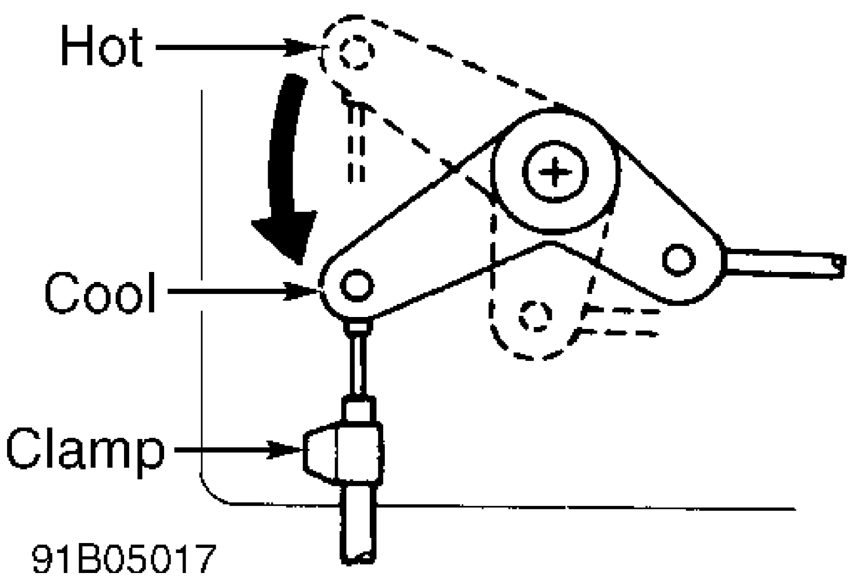


Fig. 3: Adjusting Air Mix Damper
Courtesy of Toyota Motor Sales, U.S.A., Inc.

HEATER VALVE

On servomotor type temperature control switch, turn ignition on, set temperature control switch to cool position, and turn blower motor on. Set heater valve and temperature control switch to cool position. See Fig. 4. Install control cable and clamp.

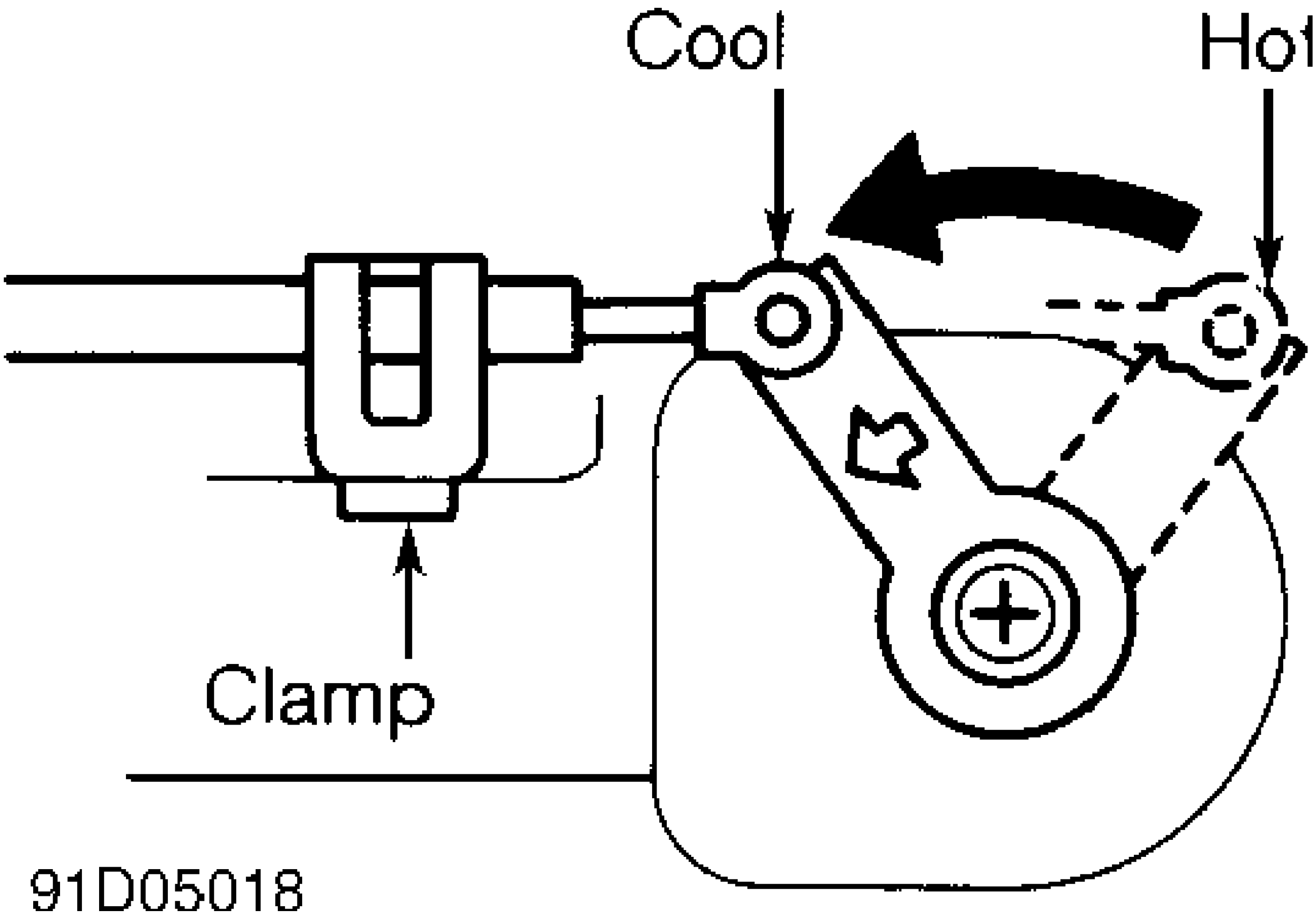


Fig. 4: Adjusting Heater Valve Control Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TROUBLE SHOOTING

NO BLOWER OPERATION

Problem may be due to blown fuses, faulty heater relay, or faulty blower motor or resistor. Also check for faulty blower fan relay or blower switch, faulty A/C-heater control panel, faulty wiring or bad ground.

NO COOL AIR

Problem may be due to blown fuses, incorrect refrigerant charge, incorrect A/C compressor belt tension, faulty compressor (magnetic) clutch relay, or faulty pressure switch or A/C compressor. Check for plugged receiver-drier, condenser, expansion valve or evaporator. Also check for faulty A/C-heater control panel, faulty thermistor or A/C amplifier, faulty wiring or bad ground.

INTERMITTENT COOL AIR

Problem may be caused by incorrect A/C compressor belt tension, incorrect refrigerant charge or faulty compressor clutch. Check for plugged expansion valve.

COOL AIR ONLY AT HIGH SPEED

Problem may be caused by incorrect A/C compressor belt tension, incorrect refrigerant charge or faulty A/C compressor. Check for plugged condenser, faulty A/C fan motor or faulty fan relay.

INSUFFICIENT COOLING

Problem may be caused by incorrect A/C compressor belt tension, incorrect refrigerant charge or A/C control cable out of adjustment. Check for clogged condenser, faulty A/C compressor, or faulty A/C fan or relay. Also check for faulty expansion valve, faulty A/C-heater control panel, faulty air mix servomotor or faulty wiring.

INSUFFICIENT COOL AIR VELOCITY

Problem may be caused by faulty blower motor, blocked air inlet, clogged/frosted evaporator, or air leakage from evaporator case or air duct.

TESTING

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES & ELECTRICAL section.

A/C SYSTEM PERFORMANCE

Connect manifold gauge set. Operate engine at 2000 RPM. Place blower fan on high speed. Place temperature control switch on maximum cooling. Set A/C-heater control panel in recirculated air mode. Ensure air inlet temperature is between 86-95°F (30-35°C). Ensure system operating pressures are within specification. See SPECIFICATIONS table at beginning of article.

A/C SWITCH

Disconnect negative battery cable. Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Check continuity between terminals No. 14 and 16. There should be continuity when switch is on and no continuity when switch is off. If continuity is not as specified, replace A/C-heater control panel.

A/C AMPLIFIER

Disconnect A/C amplifier connector. See Fig. 1. Test wiring harness side of connector. See Fig. 5. Ensure circuit tests as specified in A/C AMPLIFIER CIRCUIT TEST table. If circuit is not as specified, repair as necessary.

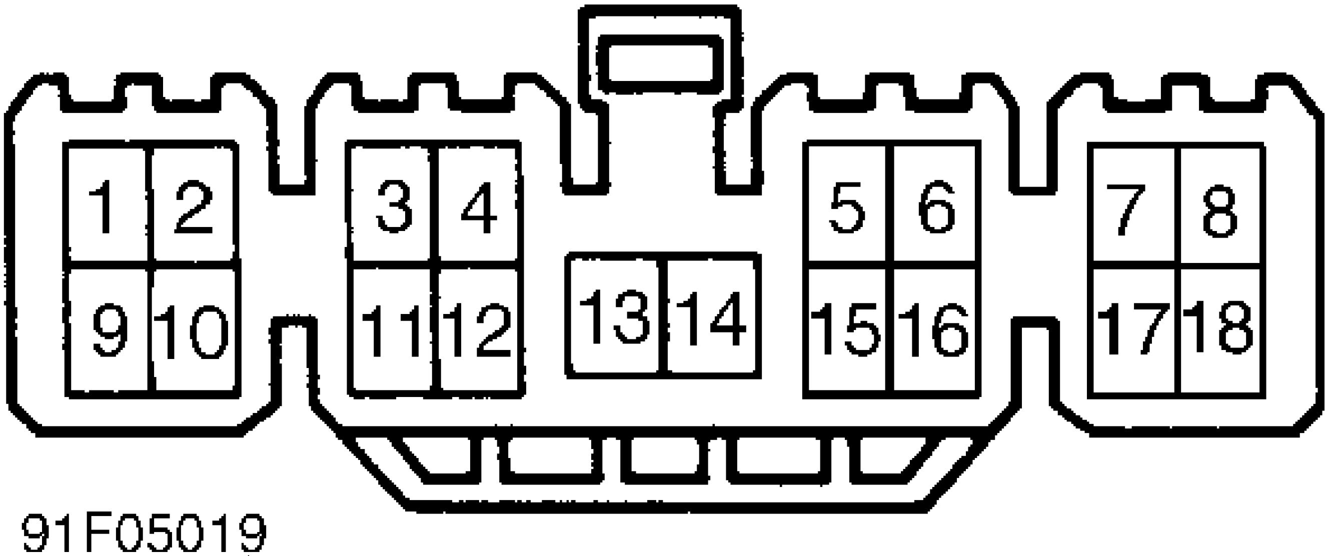


Fig. 5: Identifying A/C Amplifier Harness Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

A/C AMPLIFIER CIRCUIT TEST TABLE

Terminal No. & Test Condition (1)	Specification
2 & Ground (2)	
Coolant Temp. Less Than 203°F (95°C)	Continuity
Coolant Temp. Greater Than 212°F (100°C)	No Continuity
15 & Ground	Continuity
10 & Ground	
3S-GTE (2.0L)	No Continuity
5S-FE (2.2L)	Continuity
5 & Ground (2)	Approx. 12 Ohms
9 & 14	Approx. 115 Ohms
16 & 14	
Air Temp. @ 77°F (25°C)	Approx. 15,000 Ohms
1 & Ground	
A/C Switch On	Voltage
A/C Switch Off	No Voltage
3 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
6 & Ground	Battery Voltage
8 & Ground	Battery Voltage
13 & Ground	Battery Voltage
18 & Ground	
Start Engine	Approx. 10-14 Volts
Stop Engine	No Voltage

(1) - Basic test condition: ignition on, temperature control in max. cool position and blower switch on HI position.
(2) - Models with variable displacement compressor only.

BLOWER MOTOR

Disconnect wiring harness connector. Apply battery voltage to motor connector. See Fig. 6. Motor should operate smoothly. If motor does not operate smoothly, replace motor.

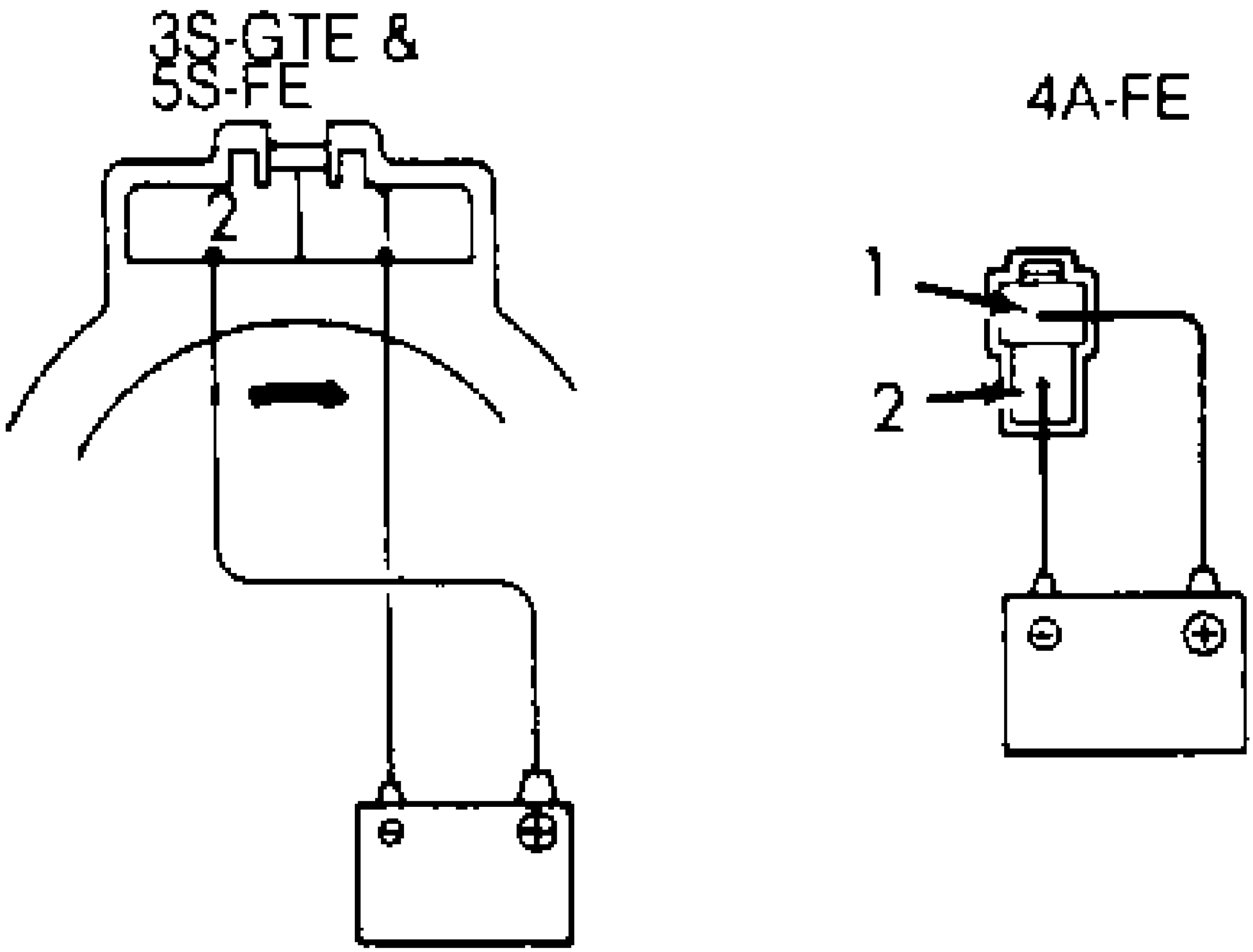


Fig. 6: Identifying Blower Motor Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

COOLANT TEMPERATURE SWITCH

When coolant temperature reaches 212°F (100°C), switch opens and breaks continuity. When coolant temperature drops to approximately 203°F (95°C), switch closes and restores continuity. If switch does not function as specified, replace switch.

CONDENSER FAN MOTOR

Disconnect fan motor 2-pin connector. Apply battery voltage to fan motor connector. Fan motor should rotate smoothly and current draw should be 6.0-7.4 amps. If operation is not as specified, replace condenser fan motor.

INDICATOR & ILLUMINATION LIGHTS

A/C Indicator

Disconnect harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground terminal No. 15. Depress A/C switch and ensure indicator light comes on. If indicator light does not come on, replace A/C-heater control panel.

Air Inlet Indicator

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground terminal No. 2. Ensure recirculated and fresh air indicator lights come on each time air inlet control switch is pressed. If operation is not as specified, replace A/C-heater control panel.

Illumination Light Operation

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 18, and ground terminal No. 17. Illumination light should come on. If illumination light does not come on, remove and check bulb.

Indicator Light Dimming Operation

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground terminal No. 2. Apply battery voltage to terminal No. 3. Indicator lights should dim. If operation is not as specified, replace A/C-heater control panel.

Mode Indicator

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Apply battery voltage to terminal No. 1, and ground terminal No. 2. Press each mode button and ensure proper indicator light comes on. If any light fails to come on, replace A/C-heater control panel.

MAGNETIC CLUTCH

1) Inspect pressure plate and rotor for oil contamination. Check clutch bearing for noisy operation and grease leakage. Using an ohmmeter, measure resistance of stator coil between compressor connector terminal No. 1 and ground. See Fig. 7.

2) Resistance should be 3.4-3.8 ohms at 68°F (20°C). If reading is not as specified, replace stator coil. Apply 12 volts to coil side of A/C compressor connector. If clutch does not energize, replace stator coil.

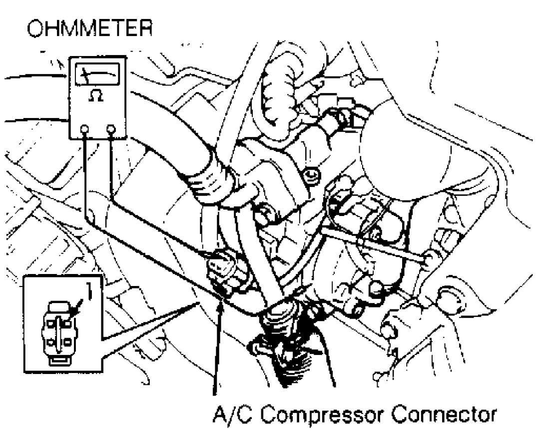


Fig. 7: Identifying A/C Compressor Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

RELAYS

Magnetic Clutch Relay

Remove relay. Using an ohmmeter, ensure continuity exists between terminals No. 1 and 2. See Fig. 8. Apply battery voltage to terminals No. 1 and 2. Continuity should exist between terminals No. 3 and 4. If continuity is not as specified, replace relay.

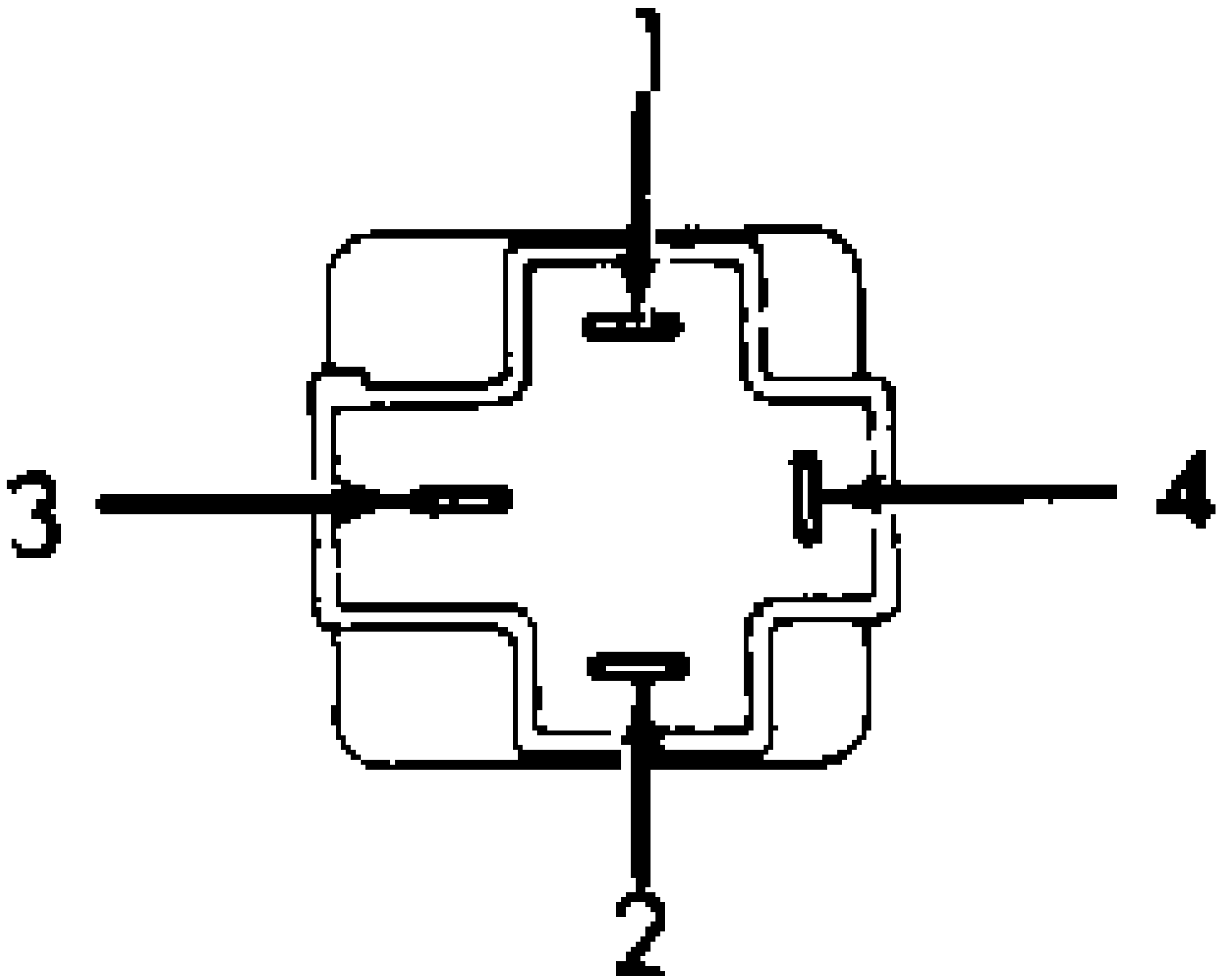


Fig. 8: Identifying Magnetic Clutch Relay Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fan Relay No. 1

Remove relay. Using ohmmeter, ensure continuity exists between terminals No. 1 and 2 and terminals No. 3 and 4. See Fig. 9. Apply battery voltage between terminals No. 1 and 2. Continuity should not exist between terminals No. 3 and 4. If continuity is not as specified, replace relay.

Fan Relay No. 2

Remove relay. Using ohmmeter, check continuity between terminals No. 1 and 2 and terminals No. 3 and 4. See Fig. 9. If continuity does not exist, replace relay. Apply battery voltage between terminals No. 1 and 2. Check continuity between terminals No. 3 and 5. If continuity does not exist, replace relay.

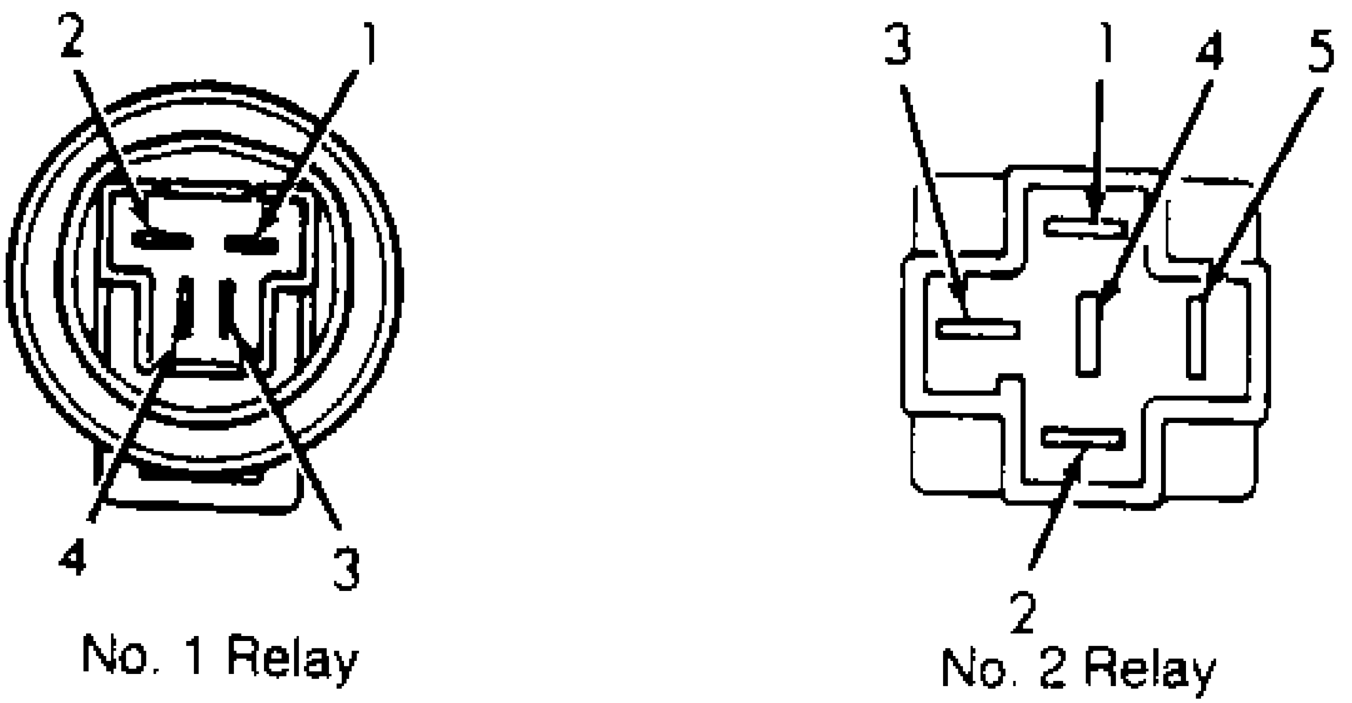


Fig. 9: Identifying A/C Fan Relay Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Blower Fan Relay

Disconnect blower fan relay wiring harness connector. Test relay as specified in TESTING BLOWER FAN RELAY table. See Fig. 10. If relay fails any test, replace relay.

TESTING BLOWER FAN RELAY TABLE

Terminal No. & Test Condition	Specification
5 & 6, 5 & 7, 5 & 8	Constant Continuity
5 & 6 (1)	Continuity Between Terminal No. 1 & 3
5 & 7 (1)	Continuity Between Terminal No. 3 & 4
5 & 8 (1)	Continuity Between Terminal No. 2 & 3

(1) - Apply battery voltage between terminals specified.

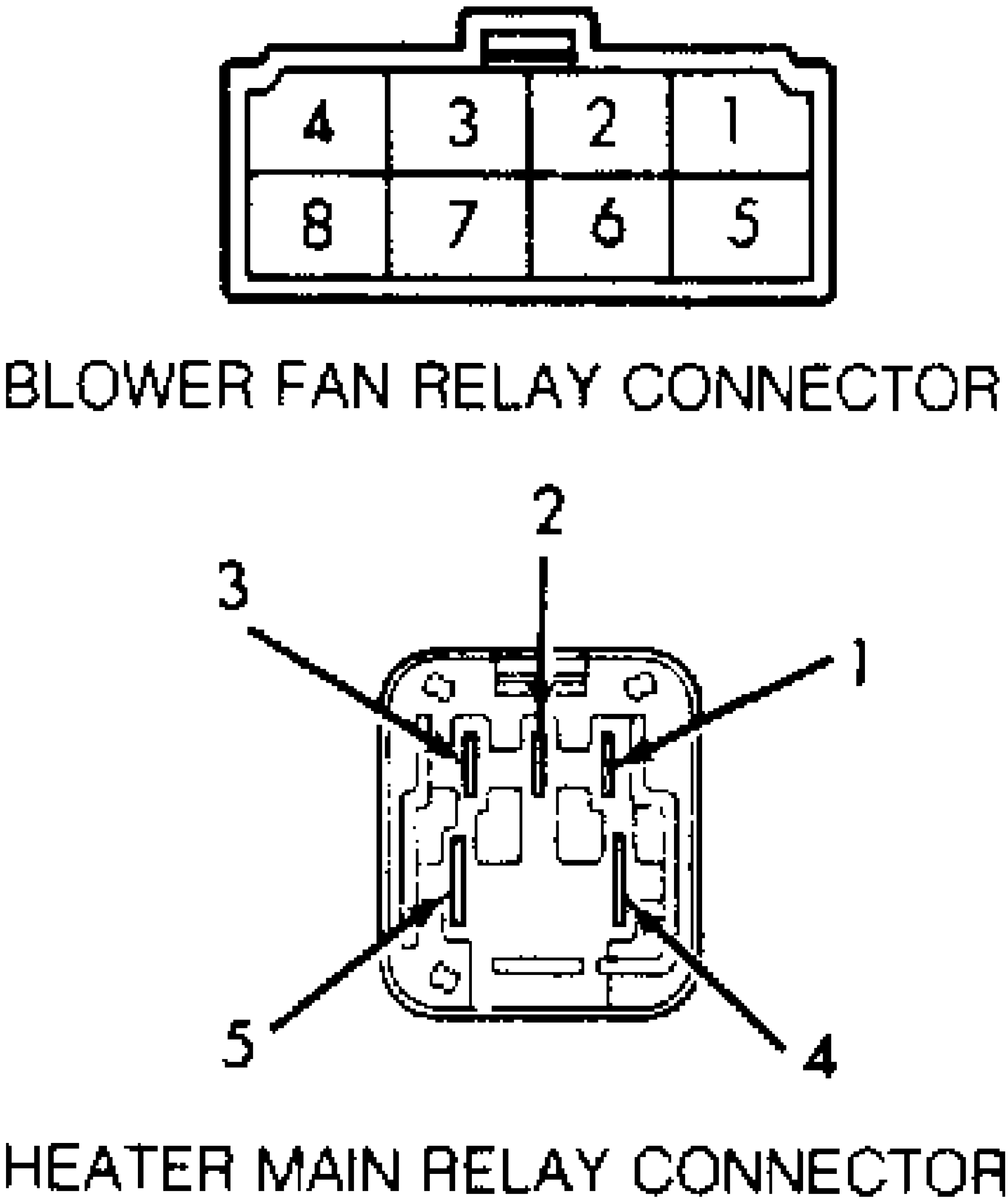


Fig. 10: A/C Blower Fan & Heater Main Relay Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Heater Main Relay
Disconnect heater main relay wiring harness connector. Test

relay as specified in TESTING HEATER MAIN RELAY table. See Fig. 10. If relay fails any test, replace relay.

TESTING HEATER MAIN RELAY TABLE

Terminal No. & Test Condition	Specification
1 & 3, 2 & 4	Constant Continuity
1 & 3 (1)	Continuity Between Terminal No. 4 & 5

(1) - Apply battery voltage between terminals specified.

RPM SENSOR

Disconnect wiring harness connector from A/C compressor. Using an ohmmeter, measure resistance between RPM sensor terminals No. 2 and 3. See Fig. 11. Resistance should be 100-130 ohms at 68°F (20°C). If resistance is not within specification, replace RPM sensor.

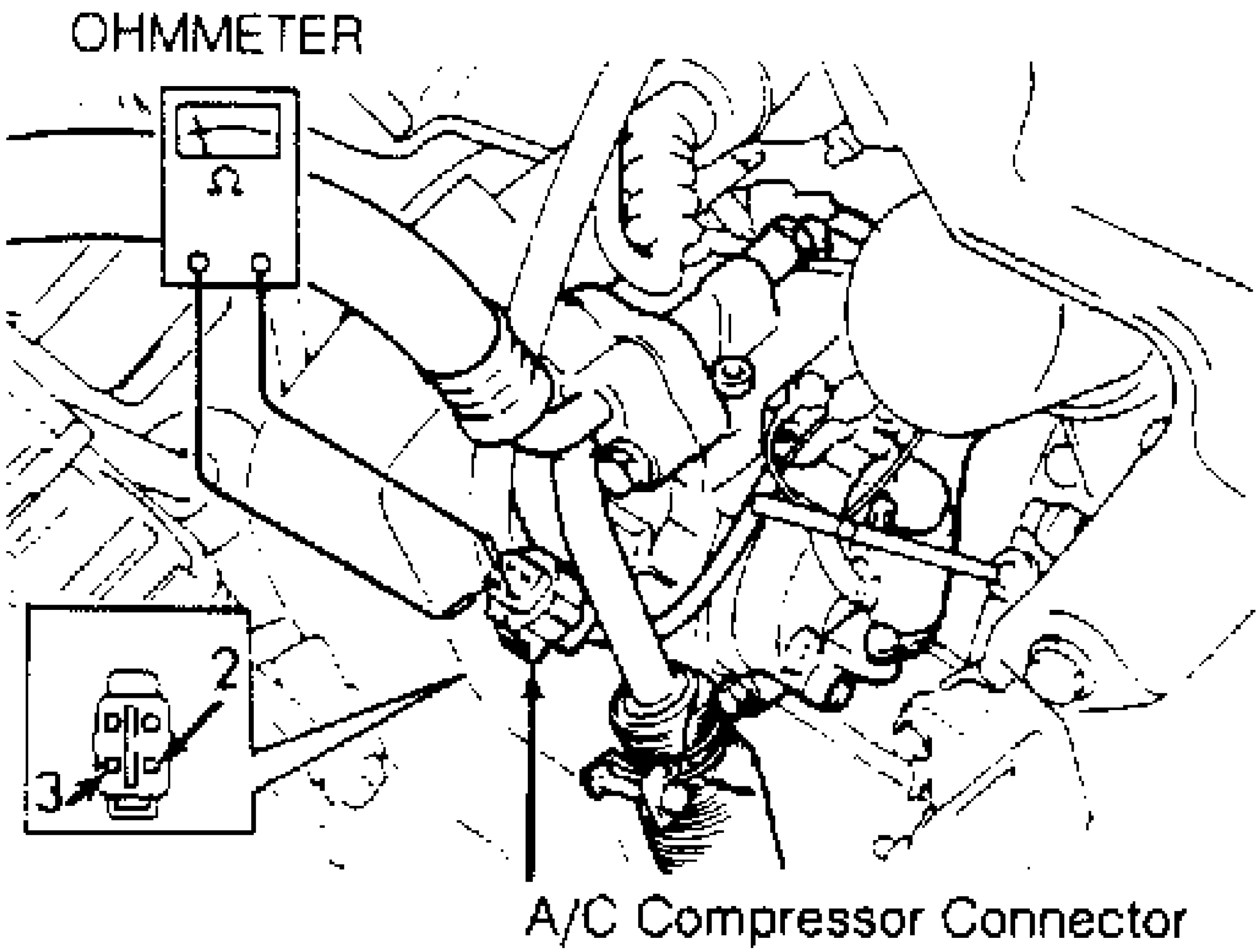


Fig. 11: Identifying RPM Sensor Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SERVOMOTORS

Air Inlet Control Servomotor

1) Disconnect servomotor connector. See Fig. 1. Apply battery voltage to terminal No. 1, and ground terminal No. 3. See Fig. 12. Ensure arm rotates smoothly to fresh air side.

2) Apply battery voltage to terminal No. 1, and ground terminal No. 2. See Fig. 12. Ensure arm rotates smoothly to recirculated air side. If operation is not as specified, replace servomotor.

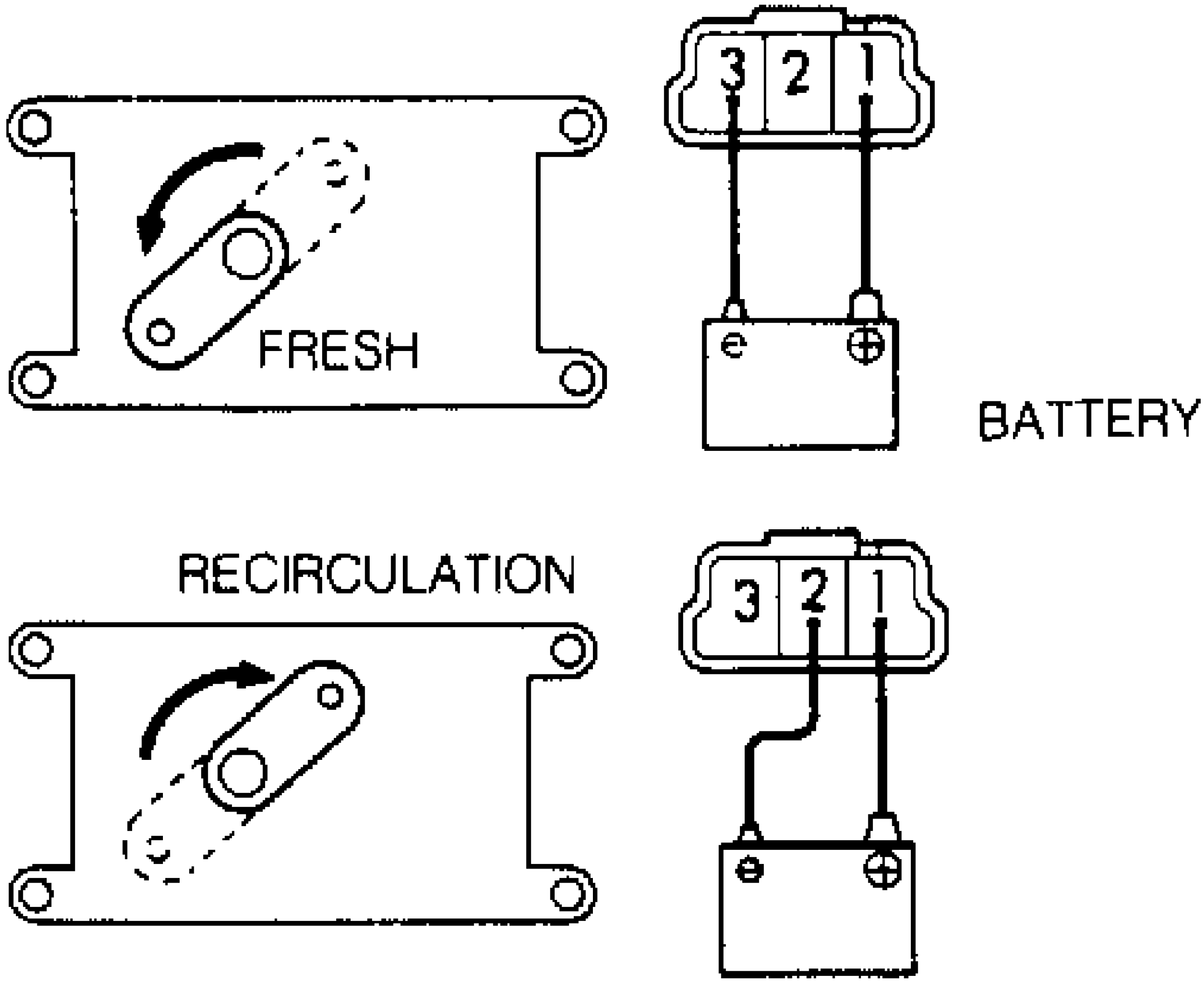


Fig. 12: Testing Air Inlet Control Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Airflow Mode Control Servomotor

Disconnect servomotor connector. See Fig. 1. Apply battery voltage to terminal No. 5, and ground terminal No. 6. See Fig. 13. Ground each specified terminal and ensure arm rotates smoothly to correct position. See TESTING AIRFLOW CONTROL SERVOMOTOR table.

TESTING AIRFLOW CONTROL SERVOMOTOR TABLE

Ground Terminal No.	Arm Position
1	Vent
2	Bi-Level

3	Foot 2
4	Foot/Defrost
7	Defrost
8	Foot 1

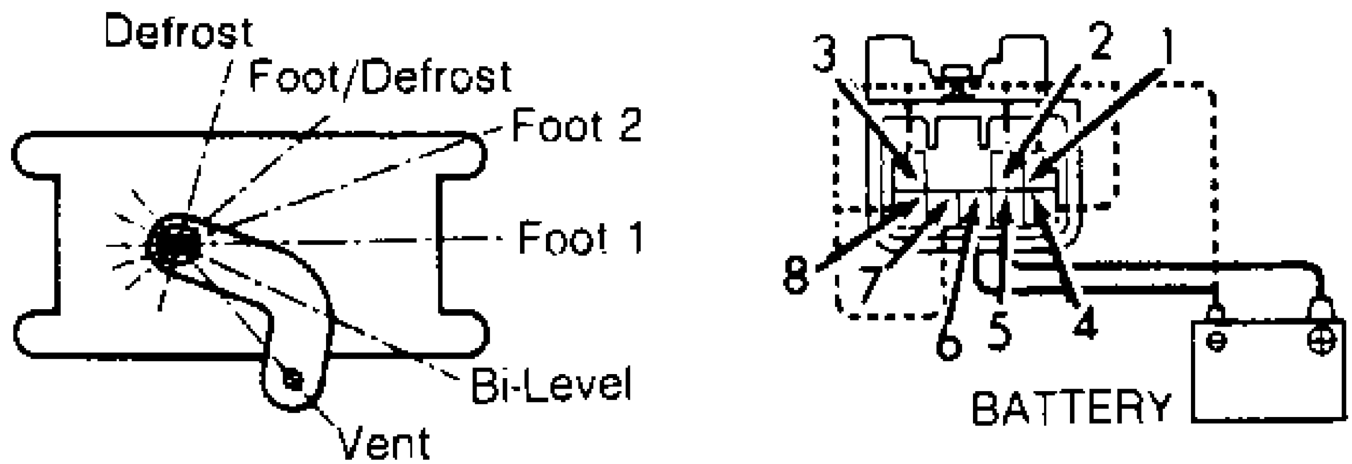


Fig. 13: Testing Airflow Mode Control Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SWITCHES

Air Inlet Control Switch

1) Disconnect wire harness connector "A" of A/C-heater control panel. See Fig. 2. With recirculated air button depressed, continuity should exist between terminals No. 2 and 7.

2) With fresh air button depressed, continuity should exist between terminals No. 2 and 8. Switch contains diodes. Check continuity in both directions before assuming switch is faulty. Continuity should exist in one direction only. If continuity does not exist or exists in both directions, replace A/C-heater control panel.

Blower Speed Control Switch

Disconnect wire harness connector "B" of A/C-heater control panel. See Fig. 2. Check continuity at specified terminals. See TESTING BLOWER SPEED CONTROL SWITCH table. If continuity is not as specified, replace A/C-heater control panel.

TESTING BLOWER SPEED CONTROL SWITCH TABLE

Switch Position	Continuity Between Terminals
OFF	No Continuity
LO	1, 3 & 7
(f) (1)	2, 3 & 6
(f) (2)	2, 3 & 4
HI	2, 3 & 5

(1) - Square (f) closest to LO switch position.
(2) - Square (f) closest to HI switch position.

Mode Control Switch

Disconnect wiring harness connector "A" of A/C-heater control panel. See Fig. 2. Check continuity at specified terminals. See

TESTING MODE CONTROL SWITCH table. If continuity is not as specified, replace A/C-heater control panel.

TESTING MODE CONTROL SWITCH TABLE

Switch Position	Continuity Between Terminals
Face	2 & 9
Bi-Level	2 & 10
Foot	2 & 11
Foot/Defrost	2 & 12
Defrost	2 & 13

THERMISTOR

1) Disconnect negative battery cable. Remove lower trim panel and glove box. Check thermistor installed operation. Using an ohmmeter, measure resistance of thermistor. Resistance should be 1500 ohms at 77°F (25°C). If resistance is not as specified, go to next step.

2) Remove evaporator case. See EVAPORATOR ASSEMBLY under REMOVAL & INSTALLATION. Disassemble evaporator case, and remove thermistor. Check thermistor operation. Place thermistor at least 3. 94" (100 mm) deep in cold water.

3) Measure resistance at connector while measuring temperature of water using thermometer. See Fig. 14. Compare readings with THERMISTOR RESISTANCE VALUES table. Use ice or hot water to change temperature of water. If readings are not within specification, replace thermistor.

THERMISTOR RESISTANCE VALUES TABLE

Temperature °F (°C)	Ohms
41 (5)	3500-4100
39 (4)	3800-4300
37 (3)	3900-4500
36 (2)	4100-4800
34 (1)	4300-4900
32 (0)	4500-5200
30 (-1)	4700-5400

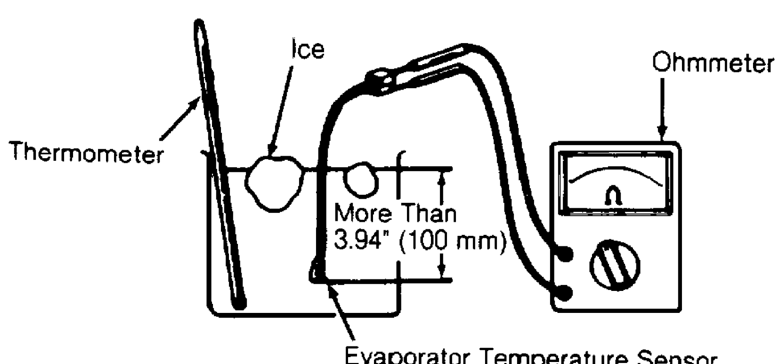


Fig. 14: Testing Thermistor Resistance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TRIPLE-PRESSURE SWITCH

Magnetic Clutch Control

1) Install A/C manifold gauges. Start engine, turn A/C on and observe gauge readings. If low side pressure is less than 30 psi (2.1 kg/cm^2), system pressure is too low and pressure switch (terminals No. 3 and 4) should be open and clutch disengaged.

2) If low side pressure is greater than 33 psi (2.4 kg/cm^2), switch should be closed and clutch engaged. If pressure drops below 33 psi (2.4 kg/cm^2), switch will open and disengage clutch.

3) During system operation, switch opens and disengages clutch if high side pressure becomes greater than 384 psi (27 kg/cm^2). Switch remains open until high side pressure drops to less than 299 psi(21 kg/cm^2). If switch does not operate as specified, replace switch. If switch is okay, proceed to ELECTRIC FAN CONTROL.

Electric Fan Control

If high side pressure becomes greater than 220 psi (15.5 kg/cm^2), switch closes and condenser fan operates at high speed. When pressure drops to approximately 178 psi(12.5 kg/cm^2), switch opens (terminals No. 1 and 2) and condenser fan returns to low speed operation. If switch does not function as specified, replace switch.

VACUUM SWITCHING VALVE (VSV)

1) Remove vacuum connections from fittings "A" and "B" on VSV. See Fig. 15. Connect VSV terminal connector to battery. Blow air through fitting "A". Air should pass from fitting "A" out through fitting "B". Air should not be felt at "C" (atmospheric port).

2) Disconnect battery from VSV terminal connector. Blow air through fitting "A". Air should pass from fitting "A" out through "C" (atmospheric port). Air should not come out of fitting "B".

3) Use ohmmeter to check for short between each terminal and VSV body. Also check resistance between terminals. Reading should be 38-43 ohms at 68°F (20°C).

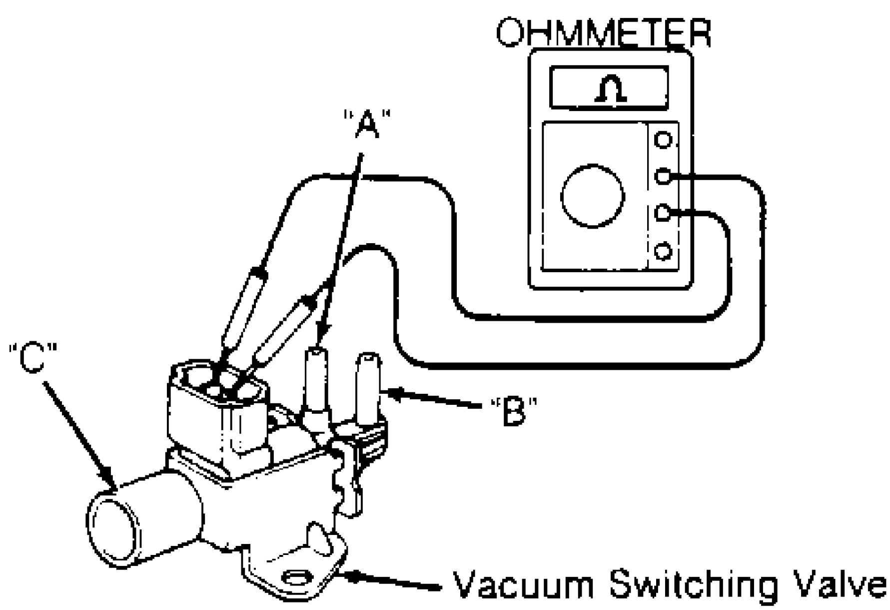


Fig. 15: Testing Vacuum Switching Valve
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES & ELECTRICAL section.

COMPRESSOR

Removal

1) If possible, run system longer than 10 minutes before starting removal procedure. Disconnect battery cables and remove battery. Disconnect A/C wiring harness connectors. Discharge A/C system using approved refrigerant recovery/recycling equipment.

2) Disconnect hoses from service valves. Plug all openings. Loosen and remove compressor belt from pulley. Remove bolts and compressor.

Installation

To install, reverse removal procedure. Evacuate, recharge and leak test system.

EVAPORATOR ASSEMBLY

Removal

Disconnect negative battery cable. Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect inlet and outlet lines and grommets from evaporator. Plug openings. Disconnect electrical leads from evaporator. Remove glove box and reinforcement. Remove nuts, bolts and evaporator assembly.

Disassembly

Release spring clips holding covers together. See Fig. 16. Remove any screws at case joints. Separate upper and lower cases from evaporator core. Remove thermistor with holder. Remove heat insulator from outlet tube. Remove high side (inlet) line from expansion valve, and remove expansion valve.

Reassembly & Installation

To reassemble and install evaporator assembly, reverse disassembly and removal procedures. If installing new evaporator core, add 1.4-1.7 ounces of refrigerant oil to core before installing. Evacuate, recharge and leak test system.

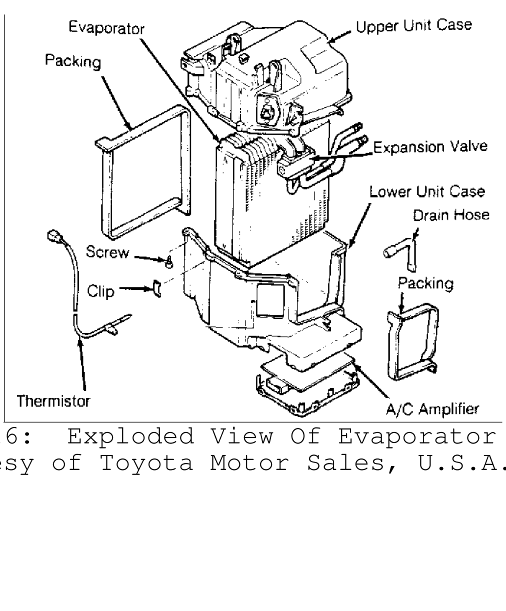


Fig. 16: Exploded View Of Evaporator Assembly
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CONDENSER

Removal

Discharge A/C system using approved refrigerant recovery/ recycling equipment. Remove lower engine cover. Remove grille and hood lock brace. Remove horns. Detach lines from condenser. Plug all openings. Remove bolts and condenser.

Installation

To install, reverse removal procedure. If installing new condenser, add 1.4-1.7 ounces of refrigeration oil before installing. Evacuate, recharge and leak test system.

RECEIVER-DRIER

Removal

Discharge A/C system using approved refrigerant recovery/ recycling equipment. Remove lines from receiver-drier. Plug all openings. Remove bolts and receiver-drier.

Installation

To install, reverse removal procedure. Add 0.7 ounce of refrigerant oil. Evacuate, recharge and leak test system.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
A/C Compressor	18 (25)
A/C Compressor Bracket (1.6L)	35 (47)
Condenser	
Discharge Hose	17 (23)
Liquid Tube	10 (14)
Evaporator Suction Tube	24 (32)
	INCH Lbs. (N.m)
Evaporator Liquid Tube	115 (13)
Expansion Valve Allen Bolt	48 (5.4)
Receiver-Drier	115 (13)

WIRING DIAGRAMS

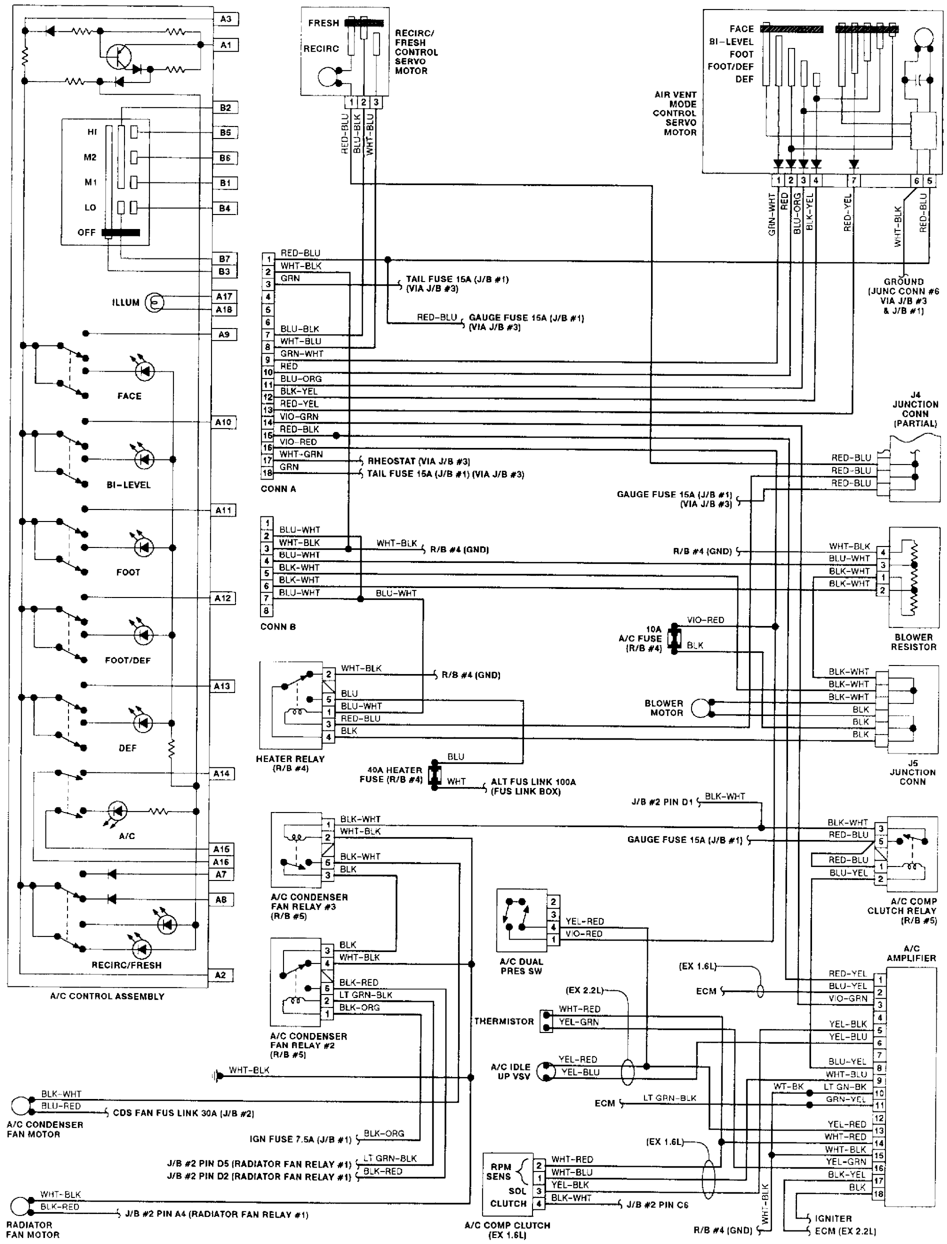


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Fig. 17: Manual A/C-Heater System Wiring Diagram (1 Of 2)

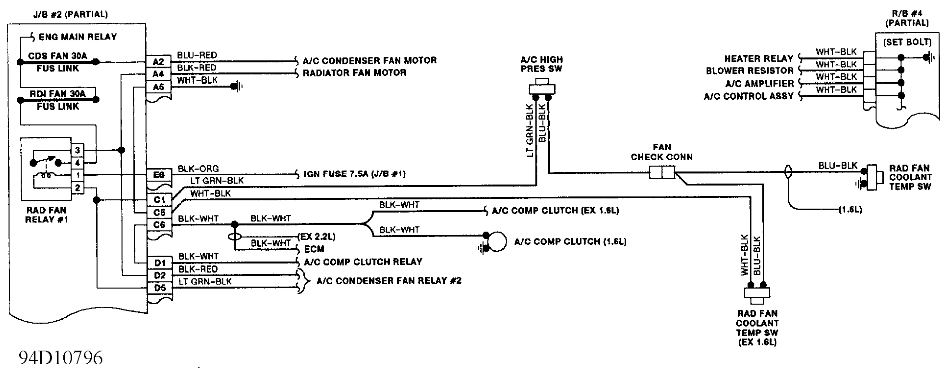

Fig. 18: Manual A/C-Heater System Wiring Diagram (2 Of 2)

* A/C-HEATER SYSTEM UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
A/C-Heater System Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

Motorist Assurance Program (MAP)

OVERVIEW
OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

Heating, Ventilation and Air Conditioning

ACCUMULATORS
ACTUATORS (ELECTRICAL)
ACTUATORS (VACUUM)
AIR CONDITIONING FITTINGS
AIR CONDITIONING HOSES
AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES
AIR CONTROL DOORS
AIR DAMS (EXTERNAL)
AIR DISTRIBUTION SYSTEM
BELTS
BLEND DOORS
BLOWER FANS (BLOWER WHEEL OR SQUIRREL CAGE)
BLOWER MOTORS
BLOWER RESISTORS
BLOWER SWITCHES
CABIN AIR FILTERS
CIRCUIT BREAKERS
COMPRESSOR CLUTCH ASSEMBLIES
COMPRESSORS
CONDENSER AIR SEALS
CONDENSER FAN MOTORS
CONDENSERS
CONNECTORS
CONTROL CABLES
CONTROL HEADS (FUNCTION SELECTORS)
CONTROL LINKAGES
CONTROL MODULES
COOLANT
COOLING FAN BLADES
COOLING FAN CLUTCHES
COOLING FAN MOTORS
EVAPORATOR DRAIN TUBES
EVAPORATOR PRESSURE REGULATORS (EPRS)
EVAPORATORS
EXPANSION VALVES
FUNCTION SELECTORS
FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS
FUSIBLE LINKS
GASKETS
HEATER CASES
HEATER CONTROL VALVES
HEATER CORES

HEATER HOSES
HIGH PRESSURE RELIEF VALVES (HPRV)
IDLERS
IN-LINE FILTERS
METAL FITTINGS
METAL LINES
MIX AND AIR CONTROL DOORS (BLEND DOORS)
O-RINGS
ORIFICE TUBES
PILOT-OPERATED ABSOLUTES (POAS)
PLENUMS
PRESSURE CONTROL VALVES
PRESSURE SENSORS
PULLEYS
RADIATORS
RECEIVER-DRIERS
REFRIGERANT
REFRIGERANT OIL
RELAYS
SEALS
SERVICE PORTS
SPRING LOCK COUPLINGS
SUCTION THROTTLING VALVES (STVS)
SWITCHES (ELECTRICAL)
TENSIONERS
THERMISTORS AND PRESSURE SENSORS
THERMOSTATS AND HOUSINGS
VACUUM HOSES AND TUBES
VACUUM RESERVOIRS
VACUUM TUBES
VALVES IN RECEIVER (VIRS)
WATER PUMPS (ELECTRIC AUXILIARY)
WIRING HARNESSES AND CONNECTORS

MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually republished. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

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MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

HEATING, VENTILATION, AND AIR CONDITIONING

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

CAUTION: Before working on any air conditioning system, be sure to review current local, state, federal, and EPA regulations regarding charging, recycling, and disposal of refrigerant.

ACCUMULATORS

ACCUMULATOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Beyond vehicle manufacturer's service interval	3	Suggest replacement.
Dessicant at the end of its useful life (saturated with moisture)	1	Suggest repair or replacement.
Dessicant bag deteriorated	A	(1) Require replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.

ACTUATORS (ELECTRICAL)

ACTUATOR (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

ACTUATORS (VACUUM)

ACTUATOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

		hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking (vacuum)	A	Require repair or replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR CONDITIONING FITTINGS

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES .

AIR CONDITIONING HOSES

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES .

AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES

AIR CONDITIONING METAL LINE, HOSE AND FITTING ASSEMBLY INSPECTION

Condition	Code	Procedure

Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity	..	No service suggested or required.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Clamp corroded, not reusable	1	Suggest replacement.
Connected incorrectly	A	Require repair.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity	..	No service suggested or required.
Cracked	A	Require repair or replacement.
Fitting type incorrect (such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	C	Require replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Routed incorrectly	2	Require repair.
Swollen	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

AIR CONTROL DOORS

See PLENUMS.

AIR DAMS (EXTERNAL)

AIR DAM (EXTERNAL) INSPECTION

Condition	Code	Procedure

Application incorrect, affecting air conditioning system performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, affecting air conditioning system performance	A	Require repair or replacement.
Blocked, affecting air conditioning system performance	A	Require repair or replacement.
Broken, affecting air conditioning system performance	A	Require repair or replacement.
Cracked, affecting air conditioning system performance	A	Require repair or replacement.
Loose, affecting air conditioning system performance	A	Require repair.
Loose, not affecting air conditioning system performance	2	Suggest repair.
Missing, affecting air conditioning system performance	C	Require replacement.

AIR DISTRIBUTION SYSTEM

See PLENUMS.

BELTS

BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Serpentine belt routed incorrectly	B	Require repair.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.

Condition	Code	Procedure
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

BLEND DOORS

See PLENUMS.

BLOWER FANS (BLOWER WHEEL OR SQUIRREL CAGE)

BLOWER FAN (BLOWER WHEEL OR SQUIRREL CAGE) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Application incorrect	B	Require repair or replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement
Distorted	A	Require replacement.
Fins missing	C	Require replacement.
Hub separated	A	Require replacement.
Inoperative	A	(1) Require replacement.
Mounting loose	A	Require repair or replacement.
Noisy	2	Suggest replacement.
Out of balance	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BLOWER MOTORS

BLOWER MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not		

affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Current draw out of specification	B	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Motor speed insufficient	2	Suggest repair or replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

BLOWER RESISTORS

BLOWER RESISTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Conductor exposed	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	1	(1) Suggest repair or replacement.

Condition	Code	Procedure
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Insulation overheated	A	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

BLOWER SWITCHES

See SWITCHES.

CABIN AIR FILTERS

CABIN AIR FILTER INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require cleaning or replacement.
Maintenance intervals	3	Suggest replacement.
Missing	C	Require replacement.

CIRCUIT BREAKERS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

COMPRESSOR CLUTCH ASSEMBLIES

COMPRESSOR CLUTCH ASSEMBLY INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	Require repair or replacement.
Bearing seized	A	Require replacement of bearing or assembly.
Bearing worn, affecting performance	A	Require replacement of bearing or assembly.
Coil shows signs of overheating	1	Suggest replacement of coil.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted,		

affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Hub broken	A	Require replacement.
Hub cracked	B	Require replacement.
Hub loose on shaft	A	Require replacement.
Hub scored, affecting performance	A	Require replacement.
Hub warped, affecting performance	A	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Slips	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Will not disengage	A	Require repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

COMPRESSORS

COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.

Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Housing broken, affecting performance	A	Require repair or replacement.
Housing broken, not affecting performance	..	No service suggested or required.
Housing cracked, affecting performance	A	Require repair or replacement.
Housing cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	(2) Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Compressor noise can also be caused by low oil level, state of charge, air contamination, or type of refrigerant.

CONDENSER AIR SEALS

CONDENSER AIR SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

CONDENSER FAN MOTORS

See COOLING FAN MOTORS.

CONDENSERS

CONDENSER INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity ...	A	.. Require repair or replacement.
Abrasion damage, not affecting structural integrity	..	.... No service suggested or required.
Air flow obstruction, affecting performance ..	A	.. Require repair or replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Bent, affecting performance	A	.. Require repair or replacement.
Bent, not affecting performance	..	.... No service suggested or required.
Bracket bent, affecting performance	A	.. Require repair or replacement.
Bracket bent, not affecting performance ..	..	.... No service suggested or required.
Bracket broken, affecting performance	A	.... Require replacement.
Bracket broken, not affecting performance ..	..	.... No service suggested or required.
Bracket corroded, affecting performance ..	A	.. Require repair or replacement.
Bracket corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Bracket cracked, affecting performance	A	.. Require repair or replacement.
Bracket cracked, not affecting performance ..	1	.. Suggest repair or replacement.
Bracket holes elongated, affecting performance ..	A	.. Require repair or replacement.
Bracket holes elongated, not affecting performance	..	.... No service suggested or required.
Bracket loose, affecting performance	A	.. Require repair or replacement.
Bracket loose, not affecting performance ..	1	.. Suggest repair or replacement.
Bracket missing	C	.... Require replacement.
Corroded, affecting structural integrity ...	A	.... Require replacement.
Corroded, not affecting structural integrity ...	..	.... No service suggested or

		required.
Fitting type incorrect (such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted internally	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

CONTROL CABLES

CONTROL CABLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require repair or replacement.
Cracked	2	Suggest repair or replacement.

Disconnected	A	Require repair or replacement.
Kinked	2	Suggest repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	(2) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CONTROL HEADS (FUNCTION SELECTORS)

CONTROL HEAD (FUNCTION SELECTOR) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Contaminated	2	Suggest require replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	..	No service suggested or required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.

Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

CONTROL LINKAGES

CONTROL LINKAGE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.

Condition	Code	Procedure
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(1) Require repair or replacement.
Seized	A	Require repair or replacement.

(1) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CONTROL MODULES

NOTE: Includes, but not limited to: IRCM, Coolant Fan Control Module (CFCM), AC Controller, Amplifier, Programmers, Control Heads, Power Modules, etc.

CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector melted, affecting performance	A	(2) Require repair or replacement.
Connector melted, not affecting performance	2	(2) Suggest repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement. Check for accepted cleaning procedure.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable.

COOLANT

COOLANT INSPECTION

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement.
Contaminated	B	(1) Require replacement or recycling. Further inspection required.
Level incorrect	B	(2) Require filling to proper level.
Maintenance intervals	3	(3) Suggest replacement.
Mixture incorrect	B	Require correction or replacement.
Type incorrect	B	Require replacement.

(1) - Determine source of contamination and require correction prior to coolant replacement.
(2) - Determine source of incorrect level and suggest repair.
(3) - The system should be drained and/or flushed and refilled with correct coolant according to OEM recommended service interval and procedures.

COOLING FAN BLADES

COOLING FAN BLADE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.

Bent	A	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

COOLING FAN CLUTCHES

NOTE: Some lateral movement, measured at the fan blade tip, may be normal.

COOLING FAN CLUTCH INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Fastener loose	A	Require repair or replacement of fastener.
Inoperative	A	(1) Require replacement.
Leaking	1	Suggest replacement.
Seized	A	Require replacement.
Slips (insufficient fan speed)	A	Require replacement.
Thermal control incorrect	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.

Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Hydraulic fan motor leaking	A	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

EVAPORATOR DRAIN TUBES

EVAPORATOR DRAIN TUBE INSPECTION

Condition	Code	Procedure
Disconnected	A	Require repair.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require repair.

EVAPORATOR PRESSURE REGULATORS (EPRS)

EVAPORATOR PRESSURE REGULATOR (EPR) INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

EVAPORATORS

EVAPORATOR INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity	..	No service suggested or required.
Air flow obstruction, affecting performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity	..	No service suggested or required.
Evaporator foam seal leaking	A	Require replacement.
Evaporator foam seal missing	C	Require replacement.
Fitting type incorrect		

(such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted internally	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

EXPANSION VALVES

EXPANSION VALVE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corroded internally	1	Suggest replacement.
Filter screen torn	A	Require replacement of screen.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Expansion valve operation may be affected by capillary tube location, corrosion, and insulation tape. Inoperative includes intermittent operation.

FUNCTION SELECTORS

See CONTROL HEADS (FUNCTION SELECTORS).

FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS

FUSE, FUSIBLE LINK AND CIRCUIT BREAKER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Blown	A	(1) Require replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require replacement.
Insulation damaged,		

conductors exposed	A	.. Require repair or replacement.
Insulation damaged, conductors not exposed .	1	.. Suggest repair or replacement.
Missing	C	.... Require replacement.
Routed incorrectly	B	.... Require repair.
Secured incorrectly	B	.... Require repair.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Inoperative includes intermittent operation.

FUSIBLE LINKS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

GASKETS

GASKET INSPECTION

Condition	Code	Procedure
Leaking	A	.... (1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

HEATER CASES

See PLENUMS.

HEATER CONTROL VALVES

HEATER CONTROL VALVE INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	.... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement

		of hardware.
Binding	2	Suggest repair or replacement.
Coolant leak	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Malfunctioning	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Seized	A	Require repair or replacement.
Vacuum leak	A	Require repair or replacement.

(1) - Includes inoperative, intermittent operation, or failure to perform all functions.

HEATER CORES

HEATER CORE INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Disconnected	A	Require repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	..	No service suggested or required.
Internal restrictions, affecting performance	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

HEATER HOSES

HEATER HOSE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require repair or replacement.
Hard (brittle)	1	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Maintenance intervals	3	Suggest replacement.

Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged	1	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	2	Suggest replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair.
Safety clip missing	C	Require replacement.
Spongy	1	Suggest repair or replacement.
Stripped	A	Require replacement.
Surface cracks (dry-rotted)	1	Suggest repair or replacement.
Swollen	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

HIGH PRESSURE RELIEF VALVES (HPRV)

HIGH PRESSURE RELIEF VALVE (HPRV) INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

IDLERS

See TENSIONERS.

IN-LINE FILTERS

IN-LINE FILTER INSPECTION

Condition	Code	Procedure
Connection leaking	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

METAL FITTINGS

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

METAL LINES

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

MIX AND AIR CONTROL DOORS (BLEND DOORS)

See PLENUMS.

O-RINGS

O-RING INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

ORIFICE TUBES

ORIFICE TUBE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Bypassing internally	A	Require repair or replacement.
Filter screen torn	A	Require replacement.
Installation incorrect	B	Require repair.
Restricted	A	Require repair or replacement.

PILOT-OPERATED ABSOLUTES (POAS)

PILOT-OPERATED ABSOLUTE (POA) INSPECTION

Condition	Code	Procedure
Connection damaged	B	Require repair or replacement.
Fitting damaged	B	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

PLENUMS

PLENUM INSPECTION

Condition	Code	Procedure
Air control door binding	A	Require repair or replacement
Air control door broken	A	Require repair or replacement.
Air control door leaking	A	Require repair or replacement.
Air control door seized	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	2	Suggest repair or replacement.
Drain hole restricted	A	Require repair.
Drain plugged	A	Require repair.
Duct disconnected	A	Require repair or replacement.
Duct leaking	A	Require repair or replacement.
Duct missing	C	Require replacement.
Duct restricted	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest cleaning or repair.
Odor	2	Suggest cleaning or repair.
Restricted	A	Require cleaning, repair, or replacement.

PRESSURE CONTROL VALVES

See:

* EVAPORATOR PRESSURE REGULATORS (EPRS)
* HIGH PRESSURE RELIEF VALVES (HPRV)
* PILOT-OPERATED ABSOLUTES (POAS)
* SUCTION THROTTLING VALVES (STVS)
* VALVES IN RECEIVER (VIRS)

PRESSURE SENSORS

See THERMISTORS AND PRESSURE SENSORS.

PULLEYS

PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not		

functioning	A	... Require repair or replacement of hardware.
Bearing noisy	2	.... Suggest replacement.
Bearing seized	A	.. Require repair or replacement.
Bearing worn	1	.... Suggest replacement.
Cracked	A	.... Require replacement.
Loose	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Pulley damaged, affecting belt life	A	.... Require replacement.

RADIATORS

RADIATOR INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	.... Require repair.
Application incorrect ...	B	.... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	.. Require repair or replacement of hardware.
Connection leaking	A	.. Require repair or replacement.
Corroded	1	.. Suggest repair or replacement.
Drain inoperative	A	.. Require repair or replacement.
Fins damaged, affecting performance	A	.. Require repair or replacement.
Fins damaged, not affecting performance ..	..	.... No service suggested or required.
Internal oil cooler leaking	A	.. Require repair or replacement.
Internal restrictions ...	B	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.. Require repair or replacement.
Tubes damaged, affecting performance	A	.. Require repair or replacement.
Tubes damaged, not affecting performance ..	..	.... No service suggested or required.

RECEIVER-DRIERS

NOTE: For VIRs, see VALVES IN RECEIVER (VIRS).

RECEIVER-DRIER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware		

Condition	Code	Procedure
missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Contaminated, affecting performance	A	Require replacement.
Dessicant bag deteriorated	A	(1) Require replacement. Further inspection required.
Dessicant at the end of its useful life (saturated with moisture)	1	Suggest repair or replacement.
Fusible plug leaking	A	Require replacement of plug.
Leaking	A	Require replacement.
Pressure relief device leaking	A	Require replacement of pressure relief device.
Restricted	A	Require repair or replacement.
Sight glass no longer transparent	2	Suggest replacement of drier.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.

REFRIGERANT

NOTE: Refrigerants include any SNAP (Significant New Alternative Policy)-approved blends.

REFRIGERANT INSPECTION

Condition	Code	Procedure
Contaminated (other than refrigerant blends)	B	Require service to remove contamination.
Different types of refrigerants in the same system (other than refrigerant blends)	B	Require repair.
Overcharged	B	Require repair.
Refrigerant type does not match fittings and label	B	Require repair.
Undercharged	B	Require repair.

REFRIGERANT OIL

REFRIGERANT OIL INSPECTION

Condition	Code	Procedure
Contaminated	1	Require repair or replacement.
Overfilled	B	Require repair.

Underfilled	B	Require repair.

RELAYS

RELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Housing broken	A	Require replacement.
Housing cracked	2	Suggest replacement.
Inoperative	A	(1) Require replacement.
Melted, affecting performance	A	(2) Require repair or replacement.
Melted, not affecting performance	2	(2) Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SERVICE PORTS

SERVICE PORT INSPECTION

Condition	Code	Procedure
Application does not match refrigerant type	B	.... Require replacement.
Leaking	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Valve cap leaking	A	... Require repair or replacement of cap.
Valve cap missing	C	.... Require replacement of valve cap.
Valve core sticking	B	.. Require repair or replacement.

SPRING LOCK COUPLINGS

SPRING LOCK COUPLING INSPECTION

Condition	Code	Procedure
Leaking	A	.... (1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SUCTION THROTTLING VALVES (STVS)

SUCTION THROTTLING VALVE (STV) INSPECTION

Condition	Code	Procedure
Connection damaged	B	.. Require repair or replacement.
Fitting damaged	B	.. Require repair or replacement.
Inoperative	A	.... (1) Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

SWITCHES (ELECTRICAL)

SWITCH (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.

Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	(3) Require replacement.
Out of adjustment	B	Require repair or replacement.
Pressure switch leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Won't return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Missing includes high pressure cut-off switches not installed during a retrofit from R12 to R134a.

TENSIONERS

TENSIONER INSPECTION

Condition	Code	Procedure

Alignment incorrect	B	Require repair or replacement.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing worn	1	Suggest replacement.
Belt tension incorrect	B	Require adjustment or repair.
Bracket cracked	A	Require repair or replacement.
Housing cracked	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Seized	A	Require repair or replacement.

THERMISTORS AND PRESSURE SENSORS

NOTE: Includes, but not limited to, In-Car Temperature, Ambient Air Temperature, Sun Load Sensor, etc.

THERMISTOR AND PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Calibration incorrect	B	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.

Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

THERMOSTATS AND HOUSINGS

THERMOSTAT AND HOUSING INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	A	Require replacement.
Housing corroded	1	Suggest replacement of housing.
Inoperative	A	(1) Require replacement.
Installation incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Thermostat missing	C	Require replacement of thermostat.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

VACUUM HOSES AND TUBES

VACUUM HOSE AND TUBE INSPECTION

Condition	Code	Procedure
Disconnected	A	Require repair.
Leaking	A	Require repair or replacement.
Melted	A	Require repair replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Restricted	A	Require repair or replacement.

Routing incorrect	B	Require repair.
Surface cracks (dry-rotted)	1	Suggest replacement.

VACUUM RESERVOIRS

VACUUM RESERVOIR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Check valve leaking internally	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.

VACUUM TUBES

See VACUUM HOSES AND TUBES.

VALVES IN RECEIVER (VIRS)

VALVE IN RECEIVER (VIR) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.

Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Connection damaged	B	Require repair or replacement.
Contaminated, affecting performance	A	Require replacement.
Corroded internally	1	Suggest replacement.
Dessicant bag deteriorated	A	(1) Require replacement. Further inspection required.
Dessicant at the end of its useful life (saturated with moisture)	1	Suggest repair or replacement.
Filter screen torn	A	Require replacement of screen.
Fitting damaged	B	Require repair or replacement.
Fusible plug leaking	A	Require replacement of plug.
Inoperative	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Pressure relief device leaking	A	Require replacement of pressure relief device.
Restricted	A	Require repair or replacement.
Sight glass no longer transparent	2	Suggest replacement of drier.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.
(2) - Inoperative includes intermittent operation or out of OEM specification.

WATER PUMPS (ELECTRIC AUXILIARY)

WATER PUMP (ELECTRIC AUXILIARY) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Circuit open	A	Require repair or replacement.
Circuit resistance (voltage drop) out of		

specification	A	Require repair or replacement.
Circuit shorted	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Diode open	A	Require repair or replacement.
Diode shorted	A	Require repair or replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Protective shield (conduit) melted	B	(1) Require replacement.
Protective shield (conduit) missing	C	Require replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

A/C-HEATER SYSTEM - AUTOMATIC

1993 Toyota Celica

1993 Automatic A/C-Heater Systems

Celica

SPECIFICATIONS

SPECIFICATIONS TABLE

Application	Specification
Compressor Type	
1.6L	Nippondenso 10PA15C 10-Cyl.
2.0L & 2.2L	Nippondenso 10PA17C/VC 10-Cyl.
Compressor Belt Tension (1)	
1.6L	
New	135-185 Lbs. (61.2-83.9 kg)
Used	80-120 Lbs. (36.3-54.4 kg)
2.0L	
New	155-175 Lbs. (70.3-79.4 kg)
Used	69-99 Lbs. (31.3-44.9 kg)
2.2L	
New	155-175 Lbs. (70.3-79.4 kg)
Used	100-120 Lbs. (45.4-54.4 kg)
System Oil Capacity	3.4-4.1 ozs.
Refrigerant (R-12) Capacity	24-27 ozs.
System Operating Pressures (2)	
High Side	206-213 psi (14.5-15.0 kg/cm²)
Low Side	21-28 psi (1.5-2.0 kg/cm²)

(1) - Using a belt tension gauge, measure at longest run of belt.
(2) - Specification is with ambient temperature at 86-95°F (30-35°C) and engine speed at 2000 RPM.

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIPMENT section.

CAUTION: When battery is disconnected, radio will go into anti-theft protection mode. Obtain radio anti-theft protection code from owner prior to servicing vehicle.

DESCRIPTION

Automatic temperature control system is a cycling clutch type with an expansion valve. See Fig. 1.

OPERATION

AMPLIFIERS & SENSORS

Amplifiers monitor system conditions through sensors. Based on signals from sensors, amplifiers control operation of compressor clutch and air control servomotors.

Ambient temperature sensor monitors outside air temperature.

Coolant temperature sensor monitors engine coolant temperature. Room (in-car) temperature sensor monitors passenger compartment air temperature. Solar (sunload) sensor monitors sunlight load. Thermistor monitors evaporator temperature. RPM sensor monitors compressor speed.

ENGINE IDLE-UP CONTROL

When A/C compressor clutch is engaged, Vacuum Switching Valve (VSV) solenoid is energized, allowing vacuum to idle-up actuator. See Fig. 1. Idle-up actuator rod opens throttle slightly, increasing engine speed.

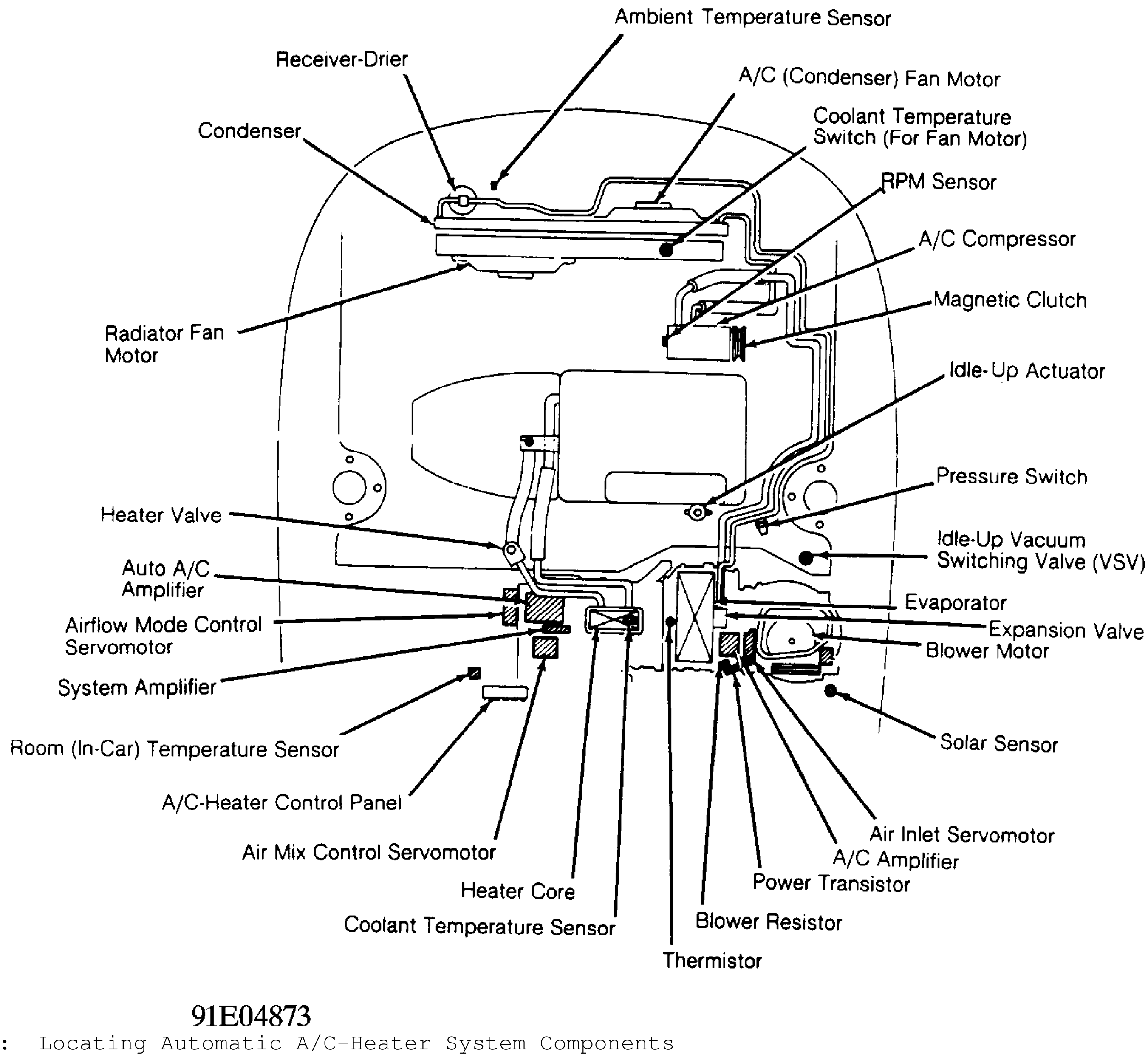


Fig. 1: Locating Automatic A/C-Heater System Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TESTING

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIPMENT section.

NOTE: For testing of components not listed in this article, see A/C-HEATER SYSTEM - MANUAL article in the AIR CONDITIONING & HEAT section.

A/C SYSTEM PERFORMANCE

Start engine and allow it to idle at 2000 RPM. Turn A/C on. Select recirculated air. Ensure temperature of inlet air is 86-95°F (30-35°C). Turn blower to highest speed. Select maximum cool temperature setting. Allow several minutes for system to stabilize. Ensure high side and low side pressures are within specification. See SPECIFICATIONS table at beginning of article.

A/C COMPRESSOR CLUTCH TEST

1) Ensure compressor clutch pressure plate, rotor and bearings are okay, and air gap is .002-.006" (.05-.15 mm). Disconnect compressor connector. Check resistance between Black/White wire terminal of compressor connector and compressor body (ground).

2) If resistance is not 3.4-3.8 ohms at 68°F (20°C), replace clutch coil. If resistance is as specified, connect positive battery lead to Black/White wire terminal, and negative lead to compressor body (ground). Clutch is okay if it engages. Replace clutch if it does not engage.

A/C-HEATER CONTROL PANEL ILLUMINATION

Disconnect negative battery cable. Disconnect A/C-heater control panel connector "A". See Fig. 2. Connect positive battery lead to terminal No. 18, and negative lead to terminal No. 17 of connector "A". If illumination lights DO NOT come on, check bulbs. If bulbs are okay, replace A/C-heater control panel.

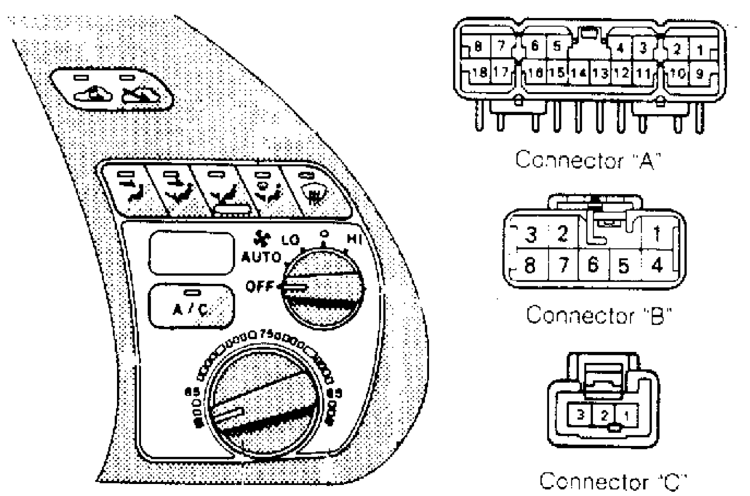


Fig. 2: Identifying A/C-Heater Control Panel Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

A/C-HEATER CONTROL PANEL INDICATORS

Air Inlet & Airflow Mode Indicators Test

Disconnect negative battery cable. Disconnect A/C-heater control panel connector "A". See Fig. 2. Connect positive battery lead to terminal No. 1, and negative lead to terminal No. 2 of connector "A". If indicator lights on air inlet (fresh and recirculated) buttons and airflow mode buttons DO NOT come on when respective button is pressed, replace A/C-heater control panel.

A/C Switch Indicator Test

Disconnect negative battery cable. Disconnect A/C-heater control panel connector "A". See Fig. 2. Connect positive battery lead to terminal No. 1, and negative lead to terminal No. 15 of connector "A". Turn A/C switch on. If A/C switch indicator light does not come on, replace A/C-heater control panel.

Indicator Light Dimming Test

Disconnect negative battery cable. Disconnect connector "A" from A/C-heater control panel. See Fig. 2. Connect positive battery lead to terminal No. 1, and negative lead to terminal No. 2 of connector "A". Connect another positive battery lead to terminal No. 3. If indicator lights DO NOT dim, replace A/C-heater control panel.

A/C SWITCH TEST

Disconnect negative battery cable. Disconnect connector "A" from A/C-heater control panel. See Fig. 2. Check continuity between terminals No. 14 and 16 of connector "A". With A/C switch turned off, there should be no continuity. With A/C switch turned on, there should be continuity. If continuity is not as specified, replace A/C-heater control panel.

AIR INLET SWITCHES TEST

NOTE: Air inlet switches contain diodes. Check continuity in both directions (polarity) before assuming switch is faulty.

Disconnect connector "A" from A/C-heater control panel. See Fig. 2. With recirculated air button pressed, continuity should exist between terminals No. 2 and 7 of connector "A". With fresh air button pressed, continuity should exist between terminals No. 2 and 8. If continuity is not as specified, replace A/C-heater control panel.

AIRFLOW MODE CONTROL SWITCHES TEST

Disconnect connector "A" from A/C-heater control panel. See Fig. 2. Check continuity between specified terminals of connector "A". See AIRFLOW MODE CONTROL SWITCHES CONTINUITY TEST table. If continuity is not as specified, replace A/C-heater control panel.

AIRFLOW MODE CONTROL SWITCHES CONTINUITY TEST TABLE

Switch Position	Continuity Between Terminals
Face	2 & 9
Bi-Level	2 & 10
Foot	2 & 11
Foot/Defrost	2 & 12
Defrost	2 & 13

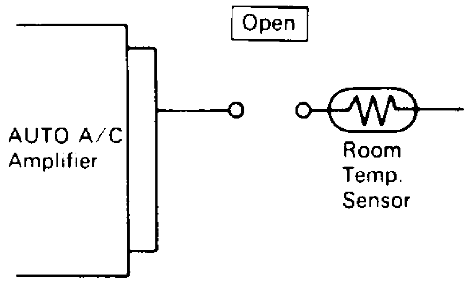
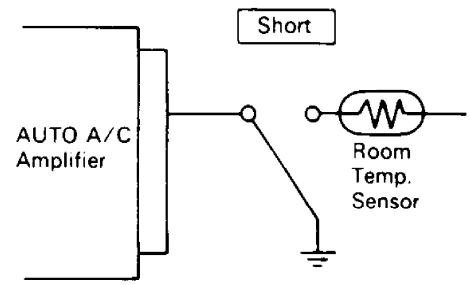
A/C AMPLIFIER CIRCUIT TEST

Disconnect A/C amplifier connector. Turn ignition on. Turn temperature control dial to maximum cool position. Turn blower switch to HI position. At harness side of A/C amplifier connector, check continuity, resistance and voltage at specified terminals. See A/C AMPLIFIER CIRCUIT TEST table. See Fig. 4. If continuity, resistance or voltage is not as specified, repair appropriate circuit.

A/C AMPLIFIER CIRCUIT TEST TABLE

Terminals & Test Condition	Specification
2 & Ground (1)	
Coolant Temp. Less Than 203°F (95°C)	Continuity
Coolant Temp. Greater Than 212°F (100°C)	No Continuity
15 & Ground	Continuity
10 & Ground	
1.6L	No Continuity
2.2L	Continuity
5 & Ground (1)	Approx. 12 Ohms
9 & 14	Approx. 115 Ohms
16 & 14	
Air Temp. @ 77°F (25°C)	Approx. 15,000 Ohms
1 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
3 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
6 & Ground	
A/C Switch On	No Voltage
A/C Switch Off	Battery Voltage
8 & Ground	Battery Voltage
13 & Ground	
A/C Switch On	Battery Voltage
A/C Switch Off	No Voltage
18 & Ground	
Engine Running	Approx. 10-14 Volts
Engine Off	No Voltage

(1) - Vehicles with variable displacement compressor only.

False Signal	A	B
Condition	Interior room temperature is very low.  	Interior room temperature is very high. 
Your Work	Disconnect room temperature sensor connector.	Disconnect room temperature sensor connector. Ground appropriate terminal of room temperature sensor female connector.

System Main Parts	False Signal	Motion			
Air Mix Control Servomotor	A	Air mix control servo motor shaft moves towards max-hot side.			
	B	Air mix control servo motor shaft moves towards max-cool side.			
Airflow Mode Control Servomotor		Airflow Mode Door Position			
		VENT	BI-LEVEL	HEAT	DEF
	A	Close	Close	Open	Close
	B	Open	Close	Close	Close

System Main Parts	False Signal	Motion
Blower Motor	A	Blower motor rotates at high speed.
	B	
Heater Water Valve	A	OPEN
	B	CLOSE
Air Inlet Control Servomotor	FRE Switch ON	Fresh air is ventilated.
	REC Switch ON	Recirculated air is ventilated.

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Fig. 3: Testing Auto A/C Amplifier
Courtesy of Toyota Motor Sales, U.S.A., Inc.

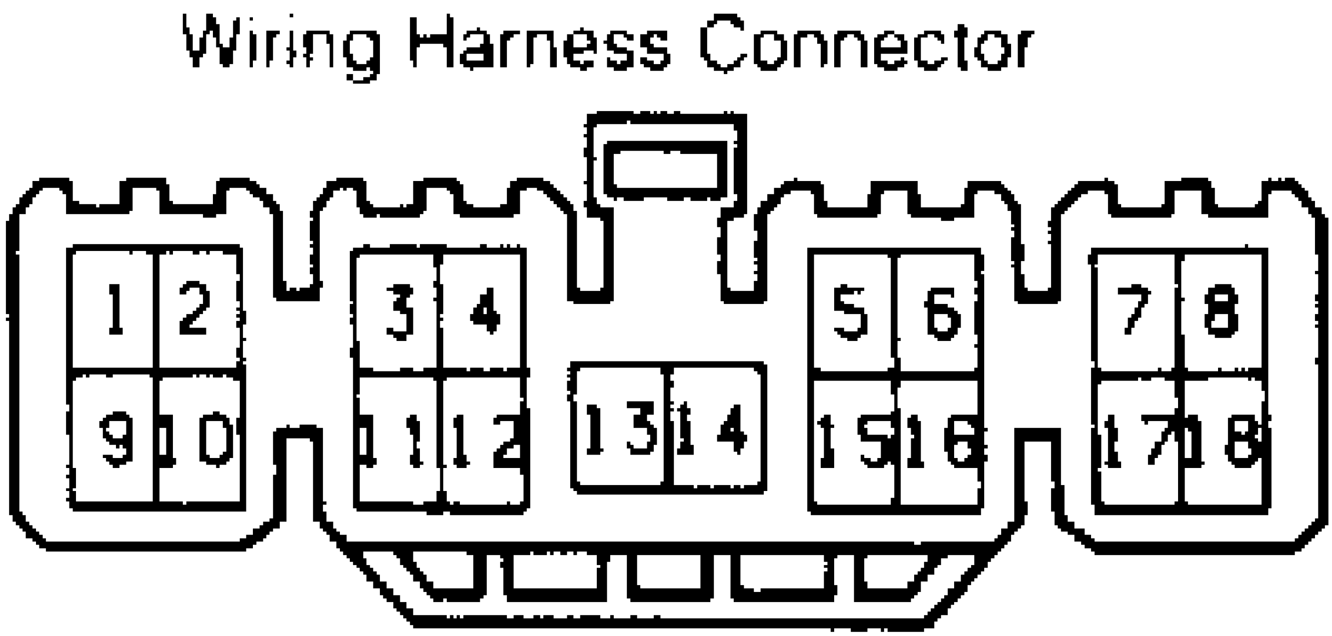

Fig. 4: Identifying A/C Amplifier Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AIR MIX CONTROL SERVOMOTOR

Servomotor

1) Disconnect air mix control servomotor wiring harness connector. Apply battery voltage to terminal No. 2, and ground terminal No. 6. See Fig. 5. Ensure arm rotates smoothly from hot to cool position.

2) Apply battery voltage to terminal No. 6, and ground terminal No. 2. Ensure arm rotates smoothly from cool to hot position. If operation is not as specified, replace servomotor.

Position Sensor

Measure resistance between terminals No. 1 and 3. See Fig. 5. Reading should be about 6000 ohms. Set arm to cool position. While rotating arm to hot position, measure resistance between terminals No. 1 and 4. Resistance should decrease from about 4800 ohms to 1200 ohms. If readings are not as specified, replace air mix control servomotor.

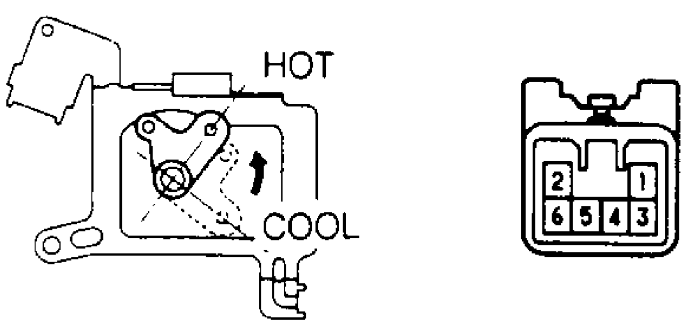

Fig. 5: Testing Air Mix Control Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AUTO A/C AMPLIFIER TEST

1) Set temperature control dial to 77°F (25°C). Disconnect room temperature sensor connector. This simulates very low room temperature (FALSE SIGNAL "A"). See Fig. 3. System should operate at maximum heating, and components indicated in chart should operate as specified.

2) Ground appropriate terminal of room temperature sensor connector. This simulates very high room temperature (FALSE SIGNAL "B"). System should operate at maximum cooling, and components indicated in chart should operate as specified.

3) If system and components operate as specified, replace room temperature sensor. If system and components DO NOT operate as specified, replace auto A/C amplifier.

BLOWER SPEED CONTROL SWITCH TEST

Disconnect connector "B" from A/C-heater control panel. See Fig. 2. Check continuity between specified terminals of connector "B". See BLOWER SPEED CONTROL SWITCH CONTINUITY TEST table. If continuity is not as specified, replace A/C-heater control panel.

BLOWER SPEED CONTROL SWITCH CONTINUITY TEST TABLE

Switch Position	Continuity Between Terminals
OFF	None
AUTO	1, 3 & 7
LO	2, 3 & 6
f	2, 3 & 4
HI	2, 3 & 5

TEMPERATURE CONTROL DIAL TEST

1) Disconnect connector "C" from A/C-heater control panel. See Fig. 2. Measure resistance between terminals No. 2 and 3 of connector "C". Resistance should be approximately 3000 ohms.

2) Measure resistance between terminals No. 1 and 3 while rotating temperature control dial from cool position to hot position. If resistance does not vary from zero to about 3000 ohms, replace A/C-heater control panel.

AMBIENT TEMPERATURE SENSOR TEST

Disconnect electrical connector from ambient temperature sensor, located at front grille, near horns. Check resistance across ambient temperature sensor terminals. If resistance is not as specified, replace sensor. See AMBIENT TEMPERATURE SENSOR RESISTANCE TEST table.

AMBIENT TEMPERATURE SENSOR RESISTANCE TEST TABLE

Temperature °F (°C)	Ohms
77 (25)	1700
122 (50)	620

COOLANT TEMPERATURE SENSOR TEST

Remove coolant temperature sensor. Submerge sensing portion of sensor in container of water. Monitor water temperature with thermometer, and measure resistance between sensor terminals. See

COOLANT TEMPERATURE SENSOR RESISTANCE TEST table. Use ice or hot water to change temperature of water. Replace sensor if resistance is not as specified.

COOLANT TEMPERATURE SENSOR RESISTANCE TEST TABLE

Temperature °F (°C)	Ohms
34 (1)	15,000-19,000
104 (40)	2500-2700
158 (70)	800-1000

ROOM (IN-CAR) TEMPERATURE SENSOR TEST

NOTE: If room temperature sensor circuit is open, system will operate at maximum heating. If circuit is shorted, system will operate at maximum cooling.

Disconnect electrical connector from room temperature sensor, located under driver knee bolster. Measure resistance across sensor terminals. If resistance is not as specified, replace the sensor. See ROOM TEMPERATURE SENSOR RESISTANCE TEST table.

ROOM TEMPERATURE SENSOR RESISTANCE TEST TABLE

Temperature °F (°C)	Ohms
77 (25)	1700
122 (50)	620

RPM SENSOR TEST

Disconnect compressor connector. Measure resistance between White/Blue wire and White/Red wire terminals of compressor connector. If resistance is not 100-130 ohms at 68°F (20°C), replace RPM sensor.

POWER TRANSISTOR TEST

Disconnect power transistor connector. Connect battery, 120-ohm resistor and 3.4-watt light bulb to terminals as shown. See Fig. 5. If light bulb does not come on, replace power transistor.

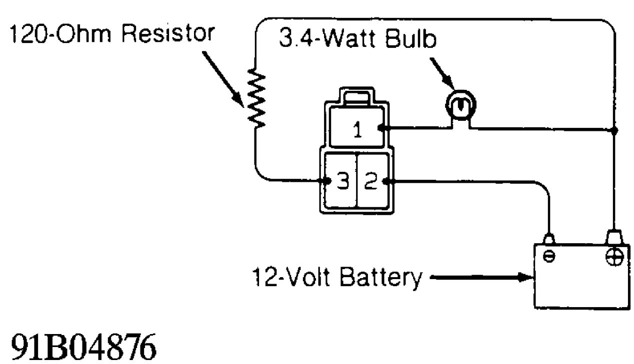

Fig. 6: Testing Power Transistor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SOLAR (SUNLOAD) SENSOR TEST

Disconnect solar sensor connector. Check continuity across solar sensor terminals. If there is no continuity, replace solar sensor.

SYSTEM AMPLIFIER TEST

1) Disconnect system amplifier connector. Turn ignition on. Turn temperature control dial to maximum cool position. At system amplifier connector, check continuity and voltage at specified terminals. See SYSTEM AMPLIFIER TEST (PART 1 OF 2) table. See Fig. 7.

SYSTEM AMPLIFIER TEST (PART 1 OF 2) TABLE

Terminal No.	Specified Value
1 & 6	Continuity
9 & Ground	Continuity
7 & Ground	Battery Voltage

2) If continuity and voltage are not as specified, repair appropriate circuit. If continuity and voltage are as specified, turn off ignition. Reconnect system amplifier connector. Start engine. Turn A/C on. Turn blower switch to HI position.

3) Set temperature dial in appropriate position, and check voltage at specified terminals of system amplifier connector (backprobe terminals). See SYSTEM AMPLIFIER TEST (PART 2 OF 2) table. If voltage is as specified, system amplifier is okay. If voltage is not as specified, replace system amplifier.

SYSTEM AMPLIFIER TEST (PART 2 OF 2) TABLE

Terminals & Test Condition	Specification
3 & Ground	
Maximum Hot	Approximately Zero Volts
Maximum Cool	(1) Approximately 5 Volts
4 & Ground	
Maximum Hot	(1) Approximately 5 Volts
Maximum Cool	Approximately Zero Volts

(1) - When temperature control dial is turned, reading may drop to zero volts and then slowly return to 5 volts.

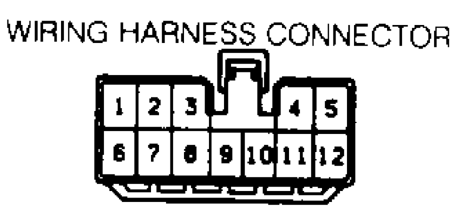

Fig. 7: Identifying System Amplifier Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIPMENT section.

NOTE: For testing of components not listed in this article, see A/C-HEATER SYSTEM - MANUAL article in the AIR CONDITIONING & HEAT section.

COMPRESSOR

Removal

Run engine with A/C on for at least 10 minutes (if possible). Turn engine off. Remove battery. Disconnect A/C wire harness connector. Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect A/C hoses from service valves. Plug all openings. Remove compressor drive belt. Remove compressor bolts and compressor.

Installation

To install, reverse removal procedure. Evacuate and charge A/C system.

EVAPORATOR, EXPANSION VALVE & THERMISTOR

Removal

1) Disconnect negative battery cable. Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect inlet and outlet lines and grommets from evaporator at engine compartment firewall. Plug openings.

2) Disconnect electrical connectors from evaporator case as necessary. Remove glove box and reinforcement. In passenger compartment, remove 3 nuts and 4 bolts securing evaporator case to firewall. Remove evaporator case.

Disassembly

Remove evaporator case clips and screws. See Fig. 8. Separate evaporator case halves. Remove thermistor, evaporator and expansion valve.

Reassembly & Installation

To reassemble and install evaporator assembly, reverse disassembly and removal procedures. If installing new evaporator core, add 1.4-1.7 ounces of refrigerant oil to system. Evacuate and charge A/C system.

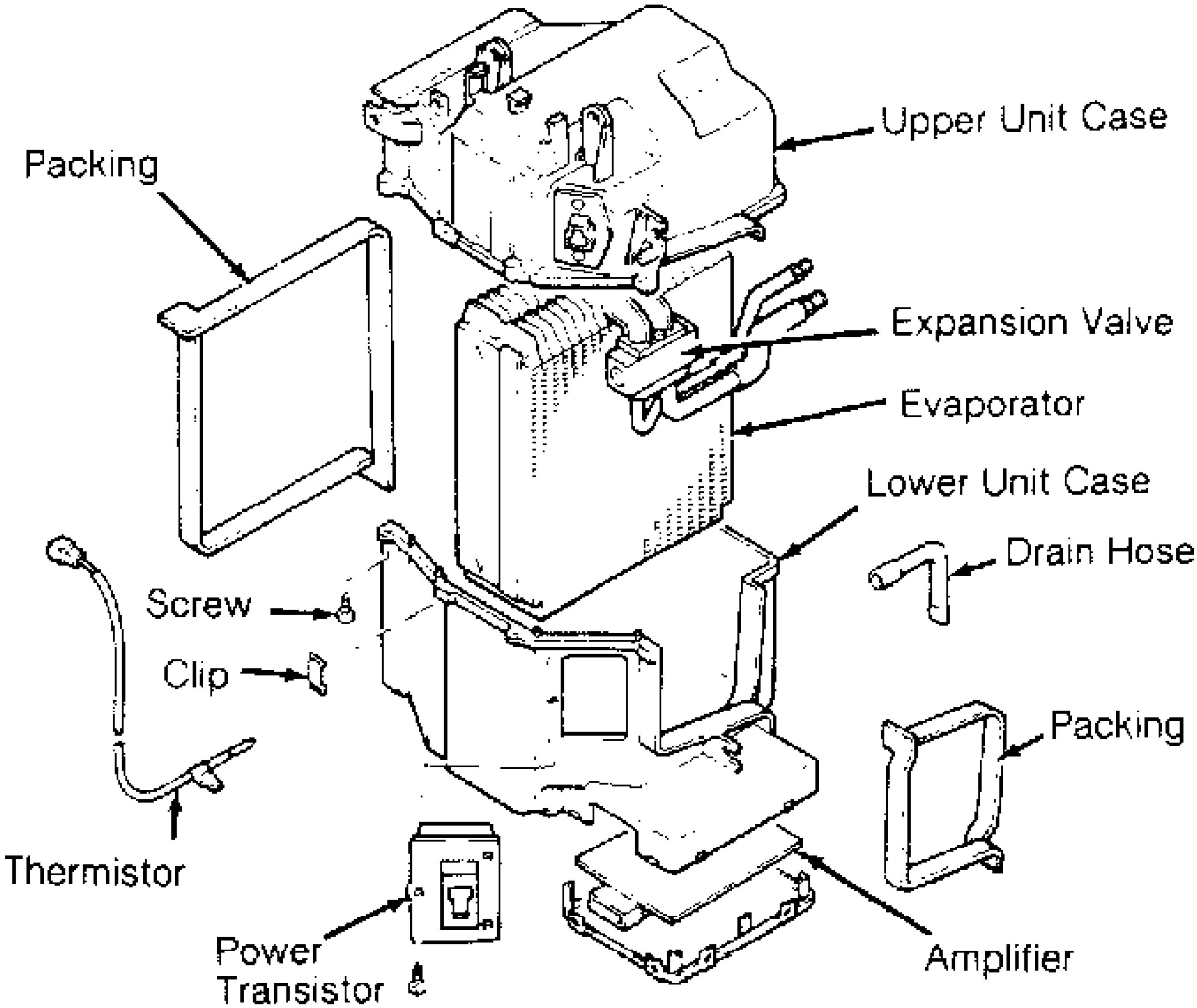

Fig. 8: Exploded View Of Evaporator Case
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CONDENSER

Removal

Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove lower engine cover. Remove grille and hood lock brace. Remove horns. Disconnect A/C lines from condenser. Plug all openings. Remove mounting bolts and condenser.

Installation

To install, reverse removal procedure. If installing new condenser, add 1.4-1.7 ounces of refrigeration oil to system. Evacuate and charge A/C system.

RECEIVER-DRIER

Removal

Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect A/C hoses from receiver-drier. Plug all openings. Remove receiver-drier bolts and receiver-drier.

Installation

To install, reverse removal procedure. Add 0.7 ounce of refrigerant oil to system. Evacuate and charge A/C system.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Compressor Bolts	
1.6L	18 (24)
2.0L & 2.2L	25 (34)
Refrigerant Hose Fitting	
At Compressor	18 (24)
At Condenser	
Liquid Line	10 (14)
Discharge Line	17 (23)
At Evaporator	
Liquid Line	10 (14)
Suction Line	24 (32)
At Receiver-Drier	10 (14)

WIRING DIAGRAMS

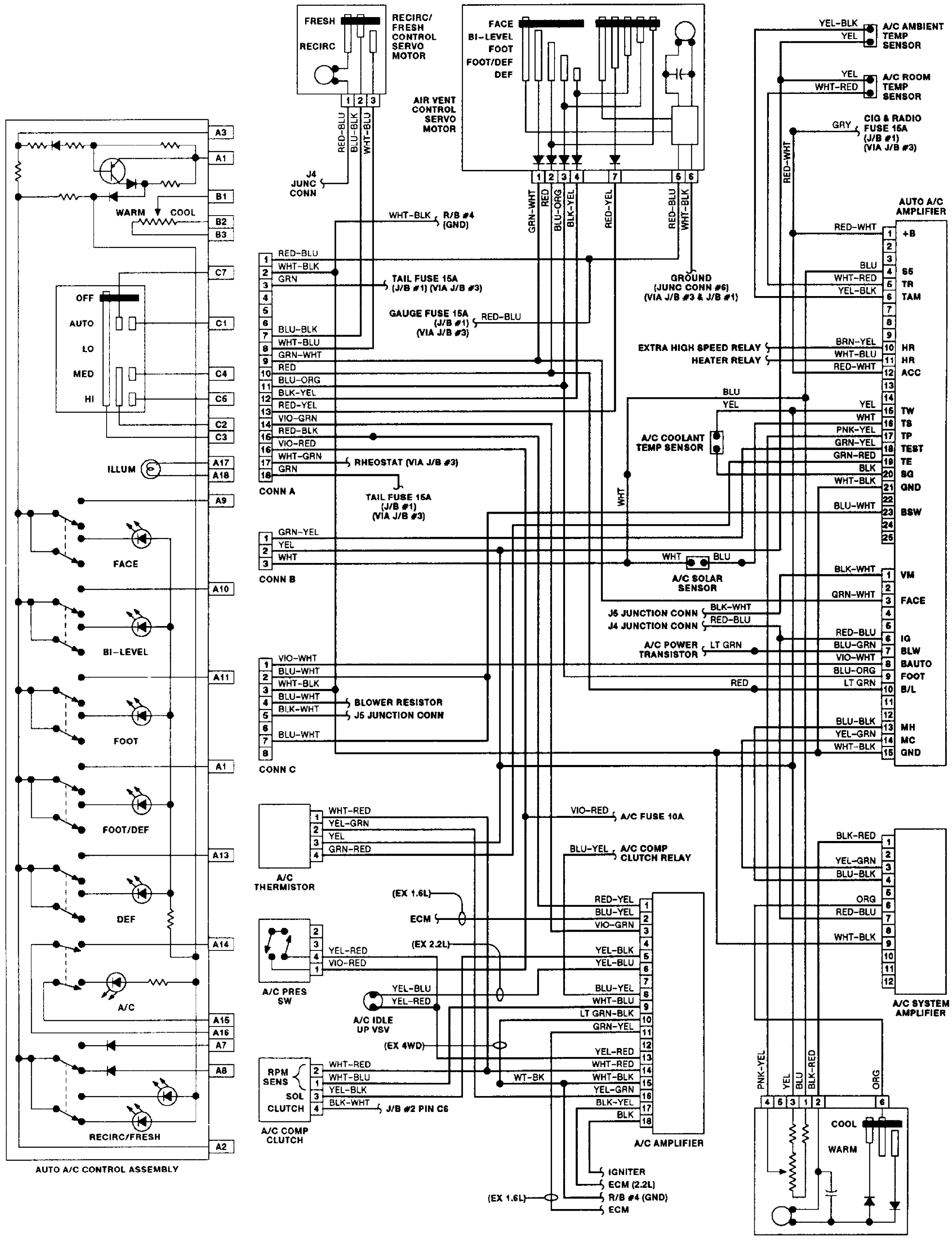

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Fig. 9: Automatic A/C-Heater System Wiring Diagram (1 Of 2)

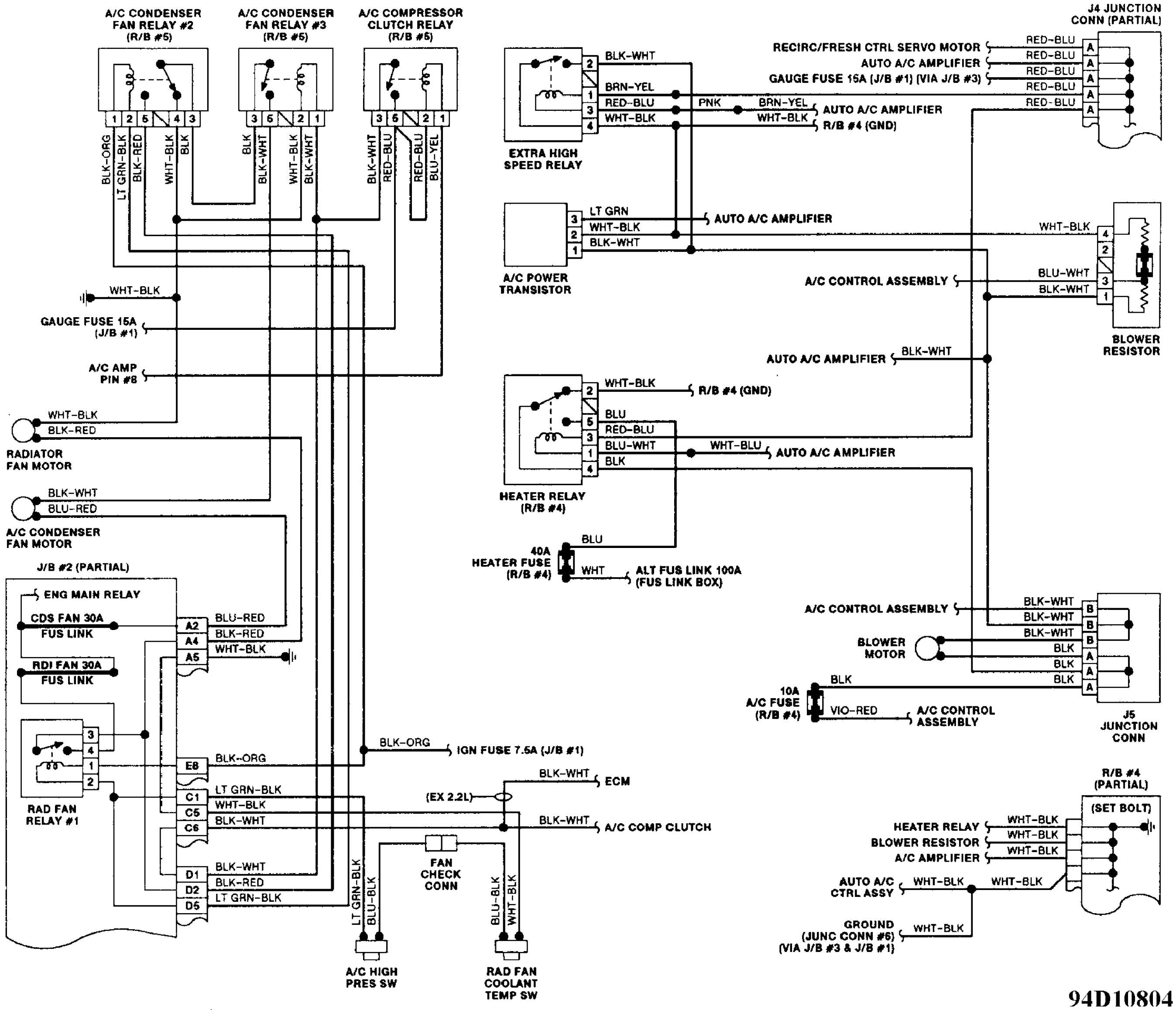


Fig. 10: Automatic A/C-Heater System Wiring Diagram (2 Of 2)

A/C SYSTEM GENERAL SERVICING

1993 Toyota Celica

1993 GENERAL SERVICING
General Servicing Procedures

USING R-12 & R-134a REFRIGERANT

HANDLING/SAFETY PRECAUTIONS

1) Always work in a well-ventilated, clean area. Refrigerant R-134a is colorless and is invisible as a gas. Refrigerant (R-12 or R-134a) is heavier than oxygen and will displace oxygen in a confined area. Avoid breathing refrigerant vapors. Exposure may irritate eyes, nose and throat.

2) The system's high pressure can cause severe injury to eyes and skin if a hose were to burst. Always wear eye protection when working around A/C system and refrigerant. If necessary, wear rubber gloves or other protective clothing.

3) Refrigerant evaporates quickly when exposed to atmosphere, freezing anything it contacts. If liquid refrigerant contacts eyes or skin, DO NOT rub eyes or skin. Immediately flush affected area with cool water for 15 minutes and consult a doctor or hospital.

4) Never use R-134a in combination with compressed air for leak testing. Pressurized R-134a in the presence of oxygen (air concentrations greater than 60% by volume) may form a combustible mixture. DO NOT introduce compressed air into R-134a containers (full or empty), A/C system components or service equipment.

5) DO NOT expose A/C system components to high temperatures, steam cleaning for example, as excessive heat will cause refrigerant/system pressure to increase. Never expose refrigerant directly to open flame. If refrigerant needs to be warmed, place bottom of refrigerant tank in warm water. Water temperature MUST NOT exceed 125°F (52°C).

6) Use care when handling refrigerant containers. DO NOT drop, strike, puncture or incinerate containers. Use Department Of Transportation (DOT) approved, DOT 4BW or DOT 4BA, refrigerant containers.

7) Never overfill refrigerant containers. The safe filling level of a refrigerant container MUST NOT exceed 60% of the container's gross weight rating. Store refrigerant containers at temperature less than 125°F (52°C).

8) R-12 refrigerant (Freon) will be sold and stored in White containers, while R-134a refrigerant will be sold and stored in 30 or 50-pound Light Blue containers.

9) R-12 and R-134a refrigerants must never be mixed, as their desiccants and lubricants are not compatible. If the refrigerants are mixed, system cross-contamination or A/C system component failure may occur. Always use separate servicing and refrigerant recovery/recycling equipment.

10) Follow equipment manufacturer instructions of all service equipment to be used. The Material Safety Data Sheet (MSDS), provided by refrigerant manufacturer/suppliers, contains valuable information regarding the safe handling of R-12 or R-134a refrigerants.

IDENTIFYING R-134a SYSTEMS & COMPONENTS

To prevent refrigerant cross-contamination, use following methods to identify R-134a based systems and components.

Fittings & "O" Rings

All R-134a based A/C systems use 1/2" - 16" ACME threaded fittings (identifiable by square threads) and quick-connect service couplings. See Fig. 1. Besides the use of these fittings, most manufacturers will use Green colored "O" rings in R-134a systems.

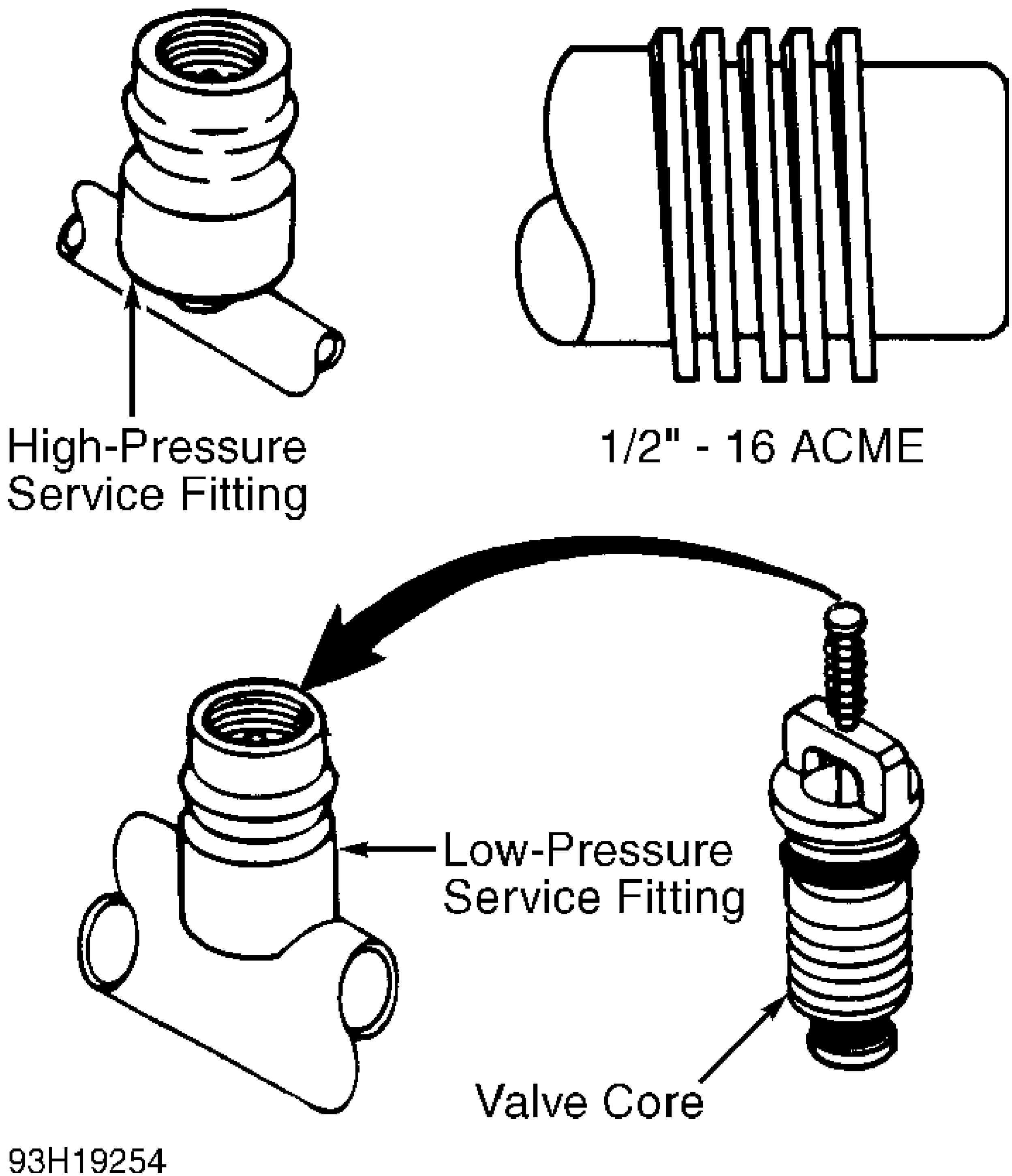


Fig. 1: R-134a Fittings & Quick Connect Service Couplings ID
Courtesy of Audi of America, Inc.

Underhood A/C Specification Labels

Most R-134a based systems will be identified through the use of Green or Light Blue underhood labels, or with R-134a refrigerant clearly printed on labels. See Fig. 2. Some manufacturers will identify R-12 based systems with White, Red, Silver or Gold underhood labels. Before servicing an A/C system, always determine which refrigerant is being used.

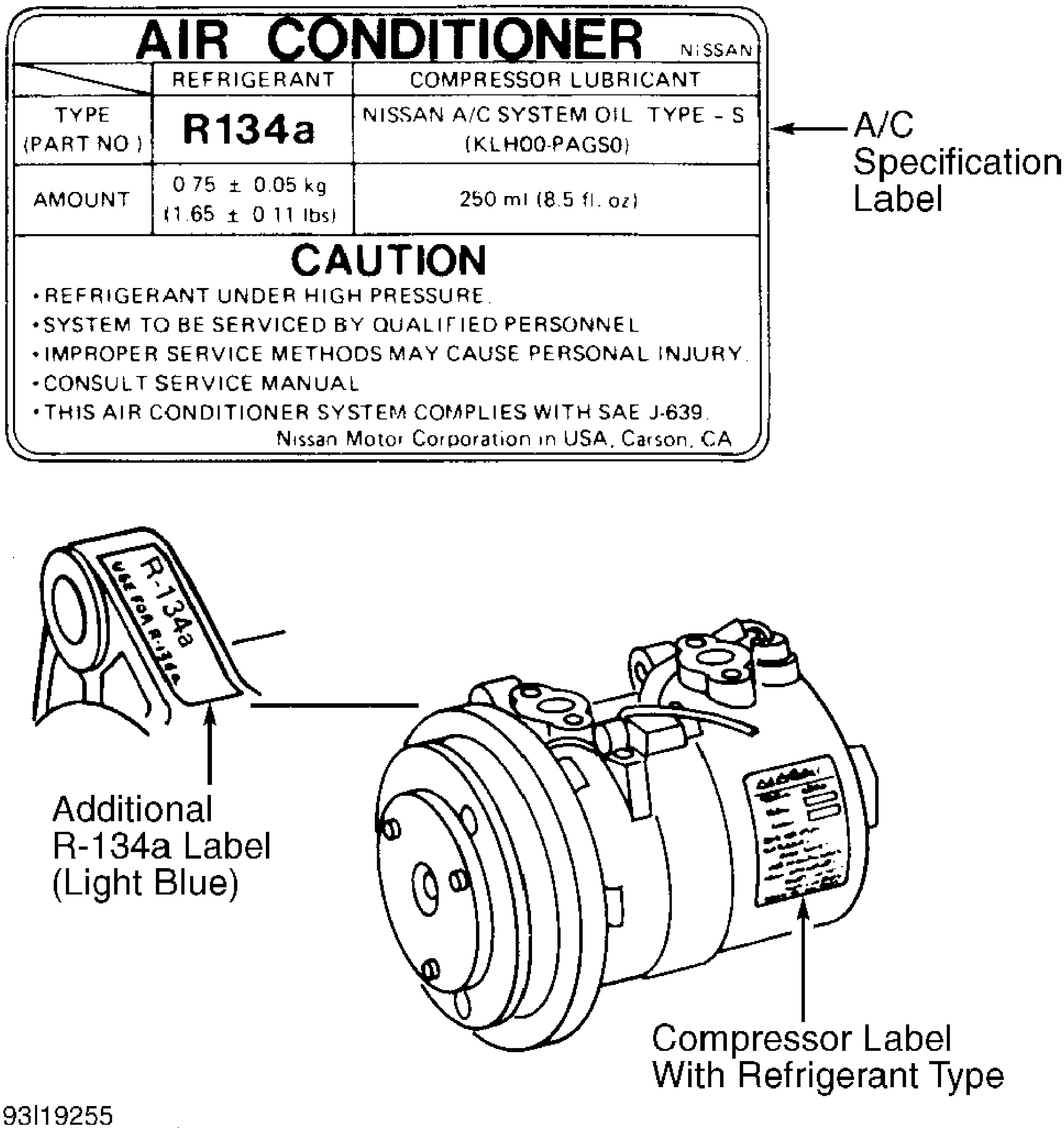


Fig. 2: Underhood A/C Specification Labels (Typical)
Courtesy of Nissan Motor Co., U.S.A.

Other Means Of Identification

Refrigerant R-134a, when viewed through a sight glass, may have a "milky" appearance due to the mixture of refrigerant and lubricating oil. As the refrigerant and oil DO NOT exhibit a "clear" sight glass on a properly charged A/C system, R-134a systems have no sight glass.

Audi, Mercedes-Benz and Volkswagen use Green bands/labels on condenser, refrigerant lines, receiver-drier and expansion valve. Lexus A/C system hoses and line connectors have a groove, a White line and "R-134a" marked on them. See Fig. 3.

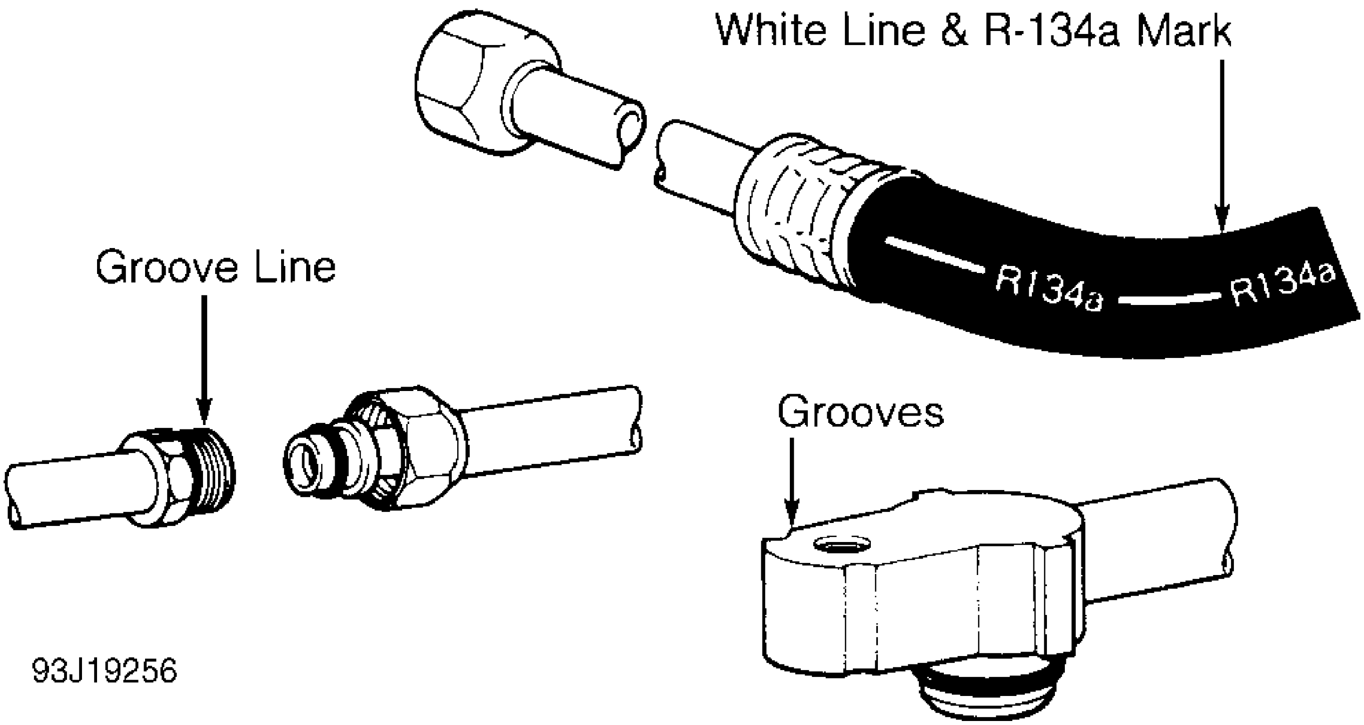


Fig. 3: Identifying R-134a Hose & Line Connectors (Lexus)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REFRIGERANT OILS

Refrigerant R-12 based systems use mineral oil, while R-134a systems use synthetic/Polyalkylene Glycol (PAG) oils. Using a mineral oil based lubricant with R-134a will result in A/C compressor failure due to lack of proper lubrication.

Use ONLY specified oil for the appropriate system and A/C compressor. Always check the underhood A/C specification label or A/C compressor label before adding refrigerant oil to A/C compressor/system. See Fig. 2. The following R-134a refrigerant oils are currently available.

Lexus
PAG Refrigerant Oil (ND-OIL 8) with 10P/10PA swashplate (piston) compressor. Synthetic Refrigerant Oil (ND-OIL 9) with through-vane (rotary vane) compressor.

Mercedes-Benz
PAG Refrigerant Oil (001 989 08 03).

Nissan
PAG Refrigerant Oil (KLH00-PAGR0) with rotary vane compressor. PAG Refrigerant Oil (KLH00-PAGS0) with piston (swashplate) compressor.

Saab
PAG Refrigerant Oil (40 74 787).

NOTE: Synthetic/PAG oils absorb moisture very rapidly, 2.3-5.6% by weight, as compared to a mineral oil absorption rate of .005% by weight.

SERVICE EQUIPMENT

Because R-134a is not interchangeable with R-12, separate sets of hoses, manifold gauge set and recovery/recycling equipment are required to service vehicles. This is necessary to avoid cross-contaminating and damaging system.

All equipment used to service systems using R-134a must meet SAE standard J1991. The service hoses on the manifold gauge set must have manual (turn wheel) or automatic back-flow valves at the service port connector ends. This will prevent refrigerant from being released into the atmosphere.

For identification purposes, R-134a service hoses must have a Black stripe along its length and be clearly labeled SAE J2196/R-134a. The low pressure test hose is Blue with a Black stripe. The high pressure test hose is Red with a Black stripe, and the center test hose is Yellow with a Black stripe.

NOTE: Refrigerant R-12 service hoses will ONLY be labeled SAE J2196.

R-134a manifold gauge sets can be identified by one or all of the following:

* Labeled FOR USE WITH R-134a on set
* Labeled HFC-134 or R-134a on gauge face
* Light Blue color on gauge face

In addition, pressure/temperature scales on R-134a gauge sets are different from R-12 manifold gauge sets.

SYSTEM SERVICE VALVES

SCHRADER-TYPE VALVES

NOTE: Although similar in construction and operation to a tire valve, NEVER replace a Schrader-type valve with a tire valve.

Schrader valve is similar in construction and operation to a tire valve. When a test gauge hose with built-in valve core depressor is attached, Schrader stem is pushed inward to the open position and allows system pressure to reach gauge.

If test hose does not have a built-in core depressor, an adapter must be used. Never attach hose or adapter to Schrader valve unless it is first connected to manifold gauge set.

Refrigerant R-12 Schrader-type valve cores have TV5 thread size. Refrigerant R-134a Schrader-type valve cores use M6 (Metric) threads. R-134a valve cores can be easily identified by use of "O" rings and external spring. See Fig. 1.

SERVICE VALVE LOCATIONS

SERVICE VALVE LOCATIONS TABLE

Vehicle	High	Low

Audi	(12)	(13)
Acura	(2)	(3)
BMW	(4)	(5)
Chrysler, Eagle & Mitsubishi		
Colt, Mirage & Summit	(10)	(5)
Colt Vista & Summit Wagon	(10)	(11)
Diamante	(4)	(5)
Eclipse & Expo	(10)	(11)
Galant	(10)	(11)
Montero	(11)	(11)
Pickup & Ram-50	(10)	(11)
Precis	(10)	(10)
Stealth & 3000GT		
R-12	(1)	(1)
R-134a	(1)	(5)
Ford Motor Co.	(4)	(5)
General Motors	(12)	(12)
Geo	(4)	(5)
Honda	(4)	(5)
Hyundai		
Elantra & Scoupe	(4)	(5)
Excel & Sonata	(10)	(10)
Infiniti	(4)	(5)
Isuzu	(4)	(5)
Jaguar	(4)	(5)
Lexus	(4)	(5)
Mazda		
B2200 & B2600i	(8)	(8)
Miata, MPV Protege & 323	(4)	(5)
Navajo	(6)	(7)
All Others	(1)	(1)
Mercedes-Benz	(4)	(5)
Nissan	(4)	(5)
Porsche	(8)	(8)
Saab	(8)	(8)
Subaru		
Impreza	(1)	(1)
Legacy & Loyale	(4)	(5)
SVX	(9)	(9)
Suzuki	(4)	(5)
Toyota		
Pickup & 4Runner	(11)	(11)
All Others	(4)	(5)
Volkswagen	(4)	(5)
Volvo		
240	(4)	(5)
850	(1)	(5)
940 & 960	(14)	(14)

(1) - Information is not available from manufacturer.
(2) - On high pressure line (near top of condenser on Integra; near receiver-drier on Legend; on receiver-drier on Vigor). Use High-Side Adapter (J-25498).
(3) - On low pressure line (near battery on Integra; near right rear of engine on Legend; near compressor on Vigor).
(4) - On high pressure (discharge) hose/line.
(5) - On low pressure (suction) hose/line.
(6) - On high pressure line, between compressor and condenser.
(7) - On suction accumulator/drier.
(8) - On low and high pressure hoses, behind compressor.
(9) - On receiver/drier and low pressure hose (near

compressor).
(10) - On compressor discharge hose and accumulator.
(11) - On compressor discharge and suction ports.
(12) - Front of condenser on right side.
(13) - Towards rear of compressor.
(14) - Single service valve on suction accumulator/drier.

REFRIGERANT RECOVERY/RECYCLING

Refrigerant recovery/recycling equipment is used to remove refrigerant from vehicle's A/C system without polluting atmosphere. To remove and recycle refrigerant, connect the recovery/recycling system and follow instructions provided with the system.

The removed refrigerant is filtered, dried and stored in a tank within the recovery/recycling system until it is ready to be pumped back into the vehicle's A/C system. With refrigerant stored in the recovery/recycling system, A/C system can be opened without polluting atmosphere.

NOTE: Separate sets of hoses, gauges and refrigerant recovery/recycling equipment MUST be used for R-12 and R-134a based systems. DO NOT mix R-12 and R-134a refrigerants, as their refrigerant oils and desiccants are not compatible. On systems with R-134a refrigerant, use Polyalkylene Glycol (PAG) wax-free refrigerant oil.

A/C SYSTEM GENERAL DIAGNOSTIC PROCEDURES

1993 Toyota Celica

1993 AIR CONDITIONING & HEAT
A/C General Diagnostic Procedures

Diagnosis is an important first step in A/C system servicing. To save time and effort, systems should be carefully checked to identify the causes of poor performance. By using the following diagnostic charts, defective components or system problems can be quickly located. To identify problems that are specific to one system, refer to the repair section of this manual. The charts in this section apply to all systems.

PREPARATION FOR TESTING

1) Attach Low and High pressure gauges.
2) Start engine and allow to warm up.
3) Set system to COOL and blower to HIGH.
4) Open car doors and hood.
5) Run engine at fast idle for 2-3 minutes.

AIR CONDITIONING SYSTEM PERFORMANCE CHECK

AIR CONDITIONING SYSTEM PERFORMANCE CHECK TABLE

PERFORM TESTS:	SHOULD BE:	IF:
Temperature Check		Temperature Check Is:
* Switch to LOW blower. * Close doors. * Check outlet temperature.	35-45° F	Too warm - Check control lever operation, heater water valve, cooling system and gauge readings.

PERFORM TESTS:	SHOULD BE:	IF:
Visual Check		Visual Check Shows:
* Compressor	Quiet with no leaks	Noisy - Check belts, oil level, seals, gaskets, reed valves.
* Condenser	Free of obstructions	Blocked - Clean off. Plugged - Flush or replace.
* Receiver-Drier	Dry and warm to touch	Frosty - Check for restriction, replace desiccant.
* Sight Glass	Clear or few bubbles	Bubbly, foamy or streaks - Check gauge readings.
* High Side Lines	Dry and warm to touch	Frosty or very hot - Check for restriction or overcharge.

* Low Side Lines	Dry and cool to touch	Frosty or warm - Check for restriction, low charge or bad valve.
* Expansion Valve	Dry	Frosty - Check for moisture or restriction. Check sensing bulb.
* STV	Dry and cool to touch	Frosty or warm - Check gauge readings for valve malfunction.
* Evaporator	Dry and cold to touch	Freezing or warm - Check expansion valve, STV or thermoswitch.

PERFORM TESTS:	SHOULD BE:	IF:
Gauge Readings		Gauge Readings are:
* High Side Gauge	See Pressure Chart	Above or below normal - See A/C Diagnosis.
* Low Side Gauge	See Pressure Chart	Above or below normal

AMBIENT TEMPERATURE/PRESSURE

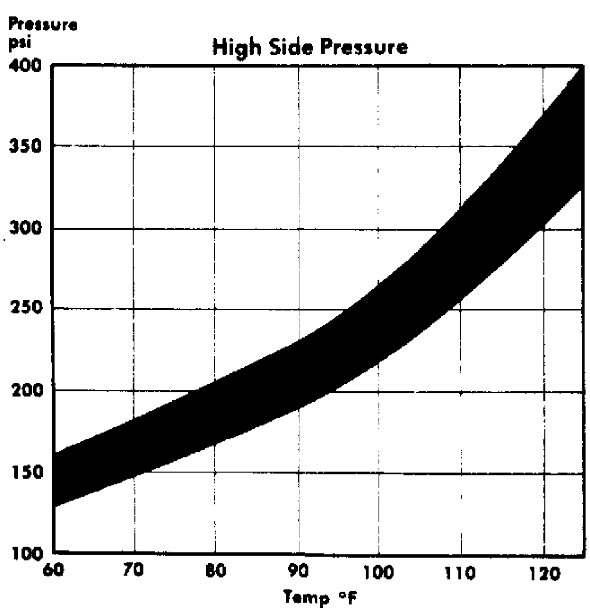


Fig. 1: Ambient Temperature/Pressure (R-12)

EVAPORATOR TEMPERATURE/PRESSURE

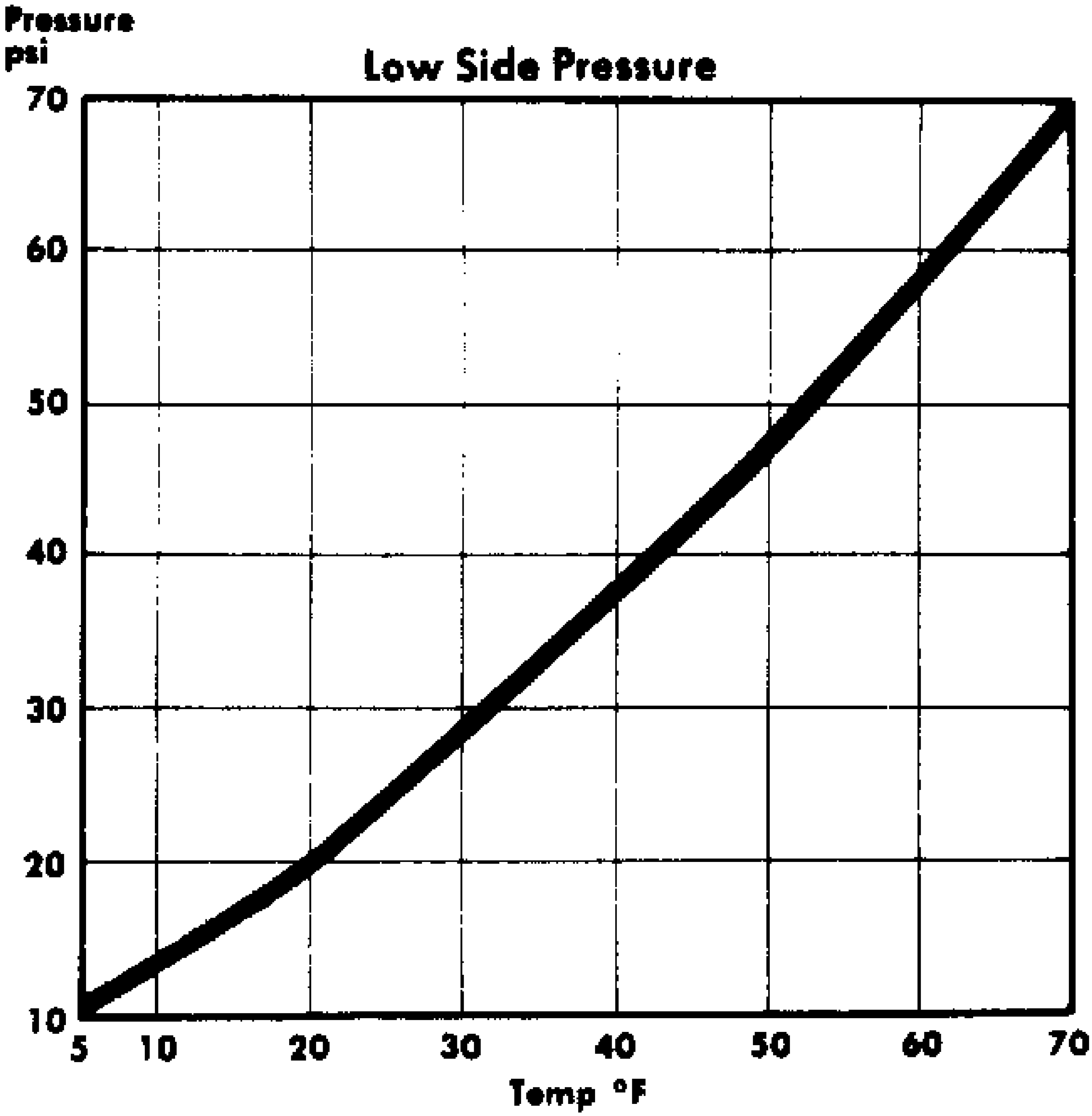


Fig. 2: Evaporator Temperature/Pressure (R-12)

A/C DIAGNOSIS W/GAUGES FOR SYS. W/INSUFFICIENT OR NO COOLING

A/C DIAGNOSIS W/GAUGES FOR SYS. W/INSUFFICIENT OR NO COOLING TABLE

Low Side Gauge	High Side Gauge	Other Symptoms (1)	Diagnosis

NORMAL	NORMAL	No or few bubbles in sight glass. High side gauge may go high. Low side gauge does not fluctuate with compressor on/off cycle.	Some Air & Moisture in System
NORMAL	NORMAL	Cools okay in morning but not during hot part of day. Bubbles in sight glass. Discharge air warm when low side gauge drops into vacuum.	Excessive Moisture in System
NORMAL	NORMAL	Thermostatic sw. sys. only- compressor cycles off & on too rapidly.	Defective Thermostatic Sw.
NORMAL to HIGH	NORMAL	Cycling clutch sys only - compressor doesn't turn on soon enough. Discharge air becomes warm as low side pressure rises.	Misadjusted Thermostatic Sw. or Defective Pressure Sensing Switch
LOW	LOW	Bubbles in sight glass. Outlet air slightly cool.	Low R-12 Charge
LOW	LOW	Sight glass clear. Outlet air very warm.	Excessively Low R-12 Charge
LOW	LOW	Outlet air slightly cool. Sweating or frost at expansion valve.	Expansion Valve Stuck Closed Screen Plugged or Sensing Bulb Malfunction
LOW	LOW	Outlet air slightly cool. High side line cool to touch. Sweating or frost on high side.	Restriction on High Side
LOW	HIGH	Evaporator outlet pipe cold. Low side goes into vacuum when blower is disconnected.	STV Stuck Open
HIGH	LOW	Evaporator outlet pipe warm. Outlet air warm.	STV Stuck Closed
HIGH	LOW	Noise from compressor.	Compressor Malfunction
HIGH	HIGH	Outlet air warm. Liquid line very hot. Bubbles in sight glass.	Compressor Malfunction or R-12 Overcharge
HIGH	HIGH	Outlet air slightly cool. Bubbles in sight glass.	Large Amount of Air of Air & Moisture in System
HIGH	HIGH	Outlet air warm. Evaporator outlet sweating and frost.	Expansion Valve Stuck Open

(1) - If equipped with a low refrigerant charge protection system, compressor operation may have stopped.

AIR CONDITIONING GENERAL TROUBLE SHOOTING

CONDITION & POSSIBLE CAUSE

Compressor Not Working

* Compressor clutch circuit open.
* Compressor clutch coil inoperative.
* Poor clutch ground connection.
* Fan belts loose.
* Thermostatic switch inoperative.
* Thermostatic switch not adjusted.
* Ambient temperature switch open.
* Superheat fuse blown.

Excessive Noise or Vibration

* Missing or loose mounting bolts.
* Bad idler pulley bearings.
* Fan belts not tightened correctly.
* Compressor clutch contacting body.
* Excessive system pressure.
* Compressor oil level low.
* Damaged clutch bearings.
* Damaged reed valves.
* Damaged compressor.

Insufficient or No Cooling; Compressor Working

* Expansion valve inoperative.
* Heater control valve stuck open.
* Low system pressure.
* Blocked condenser fins.
* Blocked evaporator fins.
* Vacuum system leak.
* Vacuum motors inoperative.
* Control cables improperly adjusted.
* Restricted air inlet.
* Mode doors binding.
* Blower motor inoperative.
* Temperature above system capacity.

HEATING GENERAL TROUBLE SHOOTING

CONDITION & POSSIBLE CAUSE

Insufficient, Erratic, or No Heat

* Low coolant level.
* Incorrect thermostat.
* Restricted coolant flow through heater core.
* Heater hoses plugged.
* Misadjusted control cable.
* Sticking heater control valve.
* Vacuum hose leaking.
* Vacuum hose blocked.
* Vacuum motors inoperative.
* Blocked air inlet.
* Inoperative heater blower motor.
* Oil residue on heater core fins.
* Dirt on heater core fins.

Too Much Heat

* Improperly adjusted cables.
* Sticking heater control valve.
* No vacuum to heater control valve.
* Temperature door stuck open.

Airflow Changes During Acceleration

* Vacuum system leak.
* Bad check valve or reservoir.

Air From Defroster At All Times

* Vacuum system leak.
* Improperly adjusted control cables.
* Inoperative vacuum motor.

Blower Does Not Operate Correctly

* Blown fuse.
* Blower motor windings open.
* Resistors burned out.
* Motor ground connection loose.
* Wiring harness connections loose.
* Blower motor switch inoperative.
* Blower relay inoperative.
* Fan binding or foreign object in housing.
* Fan blades broken or bent.

1993 ENGINE PERFORMANCE
Toyota 4-Cylinder On-Vehicle Adjustments

Celica

ENGINE MECHANICAL

Before performing any on-vehicle adjustments to fuel or ignition systems, ensure engine mechanical condition is okay.

VALVE CLEARANCE

NOTE: Adjust valve clearance with engine cold.

NOTE: If valve cover uses grommets below retaining nuts or bolts, keep grommets in order so they are installed in original locations during reassembly.

1) Remove valve cover(s) and gasket(s). Rotate crankshaft so timing mark on crankshaft pulley aligns with "0" mark on front cover and cylinder No. 1 (front cylinder) is at TDC of compression stroke.

2) Ensure valves on cylinder No. 1 are closed. With cylinder No. 1 at TDC, check clearance on specified valves. See VALVE CLEARANCE ADJUSTMENT SEQUENCE table. See Fig. 1.

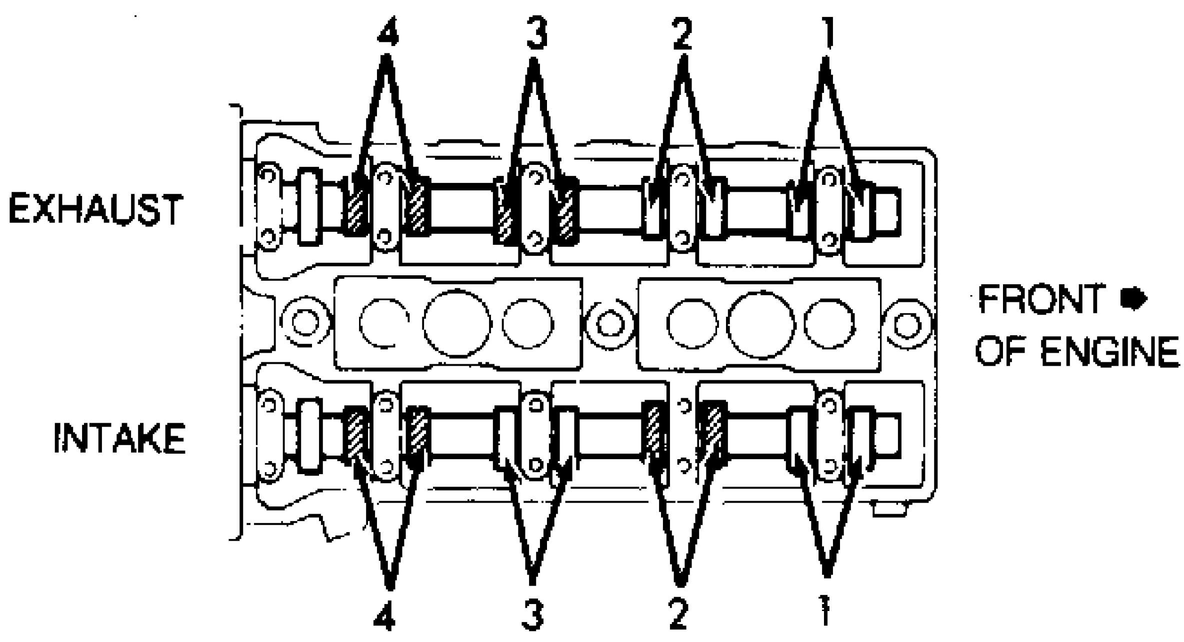


Fig. 1: Valve Arrangement ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Using feeler gauge, measure and record clearance between valve lifter and camshaft. Ensure valve clearance is within

specification. See VALVE CLEARANCE SPECIFICATIONS table.

4) To check remaining valves, rotate crankshaft 360 degrees (one full revolution) until cylinder No. 4 is at TDC of compression stroke. Measure valve clearance on specified valves. See VALVE CLEARANCE ADJUSTMENT SEQUENCE table.

5) If valve clearance requires adjustment, rotate crankshaft so camshaft lobe on valve to be adjusted is facing upward, away from valve lifter. Rotate valve lifter so notch on valve lifter is toward spark plug.

6) Press valve lifter downward using Valve Clearance Adjuster (SST 09248-55020) and SST (A). See Fig. 2. Install SST (B) between camshaft and valve lifter. Remove SST (A).

7) Using small screwdriver and magnet, remove adjusting shim. Measure thickness of adjusting shim removed. Using measured clearance and adjusting shim thickness, determine correct thickness of adjusting shim to be used. Shim thickness can be determined by using the following formula: N = T + A.

* N = Thickness of adjuster shim required.
* T = Thickness of adjuster shim removed.
* A = Measured clearance minus valve clearance specification.

See appropriate SHIM THICKNESS table for proper shim required.

NOTE: Before installing valve cover gasket, apply sealant at camshaft bearing caps-to-cylinder head surfaces where valve cover gasket seals.

8) Install valve cover and gasket. Reverse removal procedure to install remaining components.

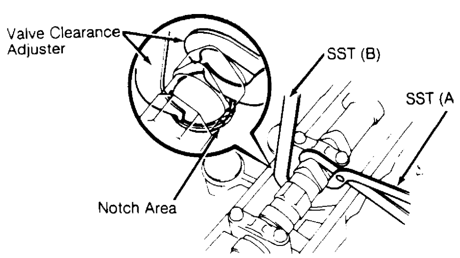


Fig. 2: Removing Valve Clearance Adjusting Shim
Courtesy of Toyota Motor Sales, U.S.A., Inc.

VALVE CLEARANCE ADJUSTMENT SEQUENCE TABLE

Piston No. On TDC	Adjust Intake Valves	Adjust Exhaust Valves
1	1 & 2	1 & 3
4	3 & 4	2 & 4

VALVE CLEARANCE SPECIFICATIONS TABLE

Application	In. (mm)
1.6L (4A-FE)	
Exhaust	.008-.012 (.20-.30)
Intake	.006-.010 (.15-.25)
2.0L Turbo (3S-GTE)	
Exhaust	.011-.015 (.28-.38)

Intake	.006-.010 (.15-.25)
2.2L (5S-FE)	
Exhaust	.011-.015 (.28-.38)
Intake	.007-.011 (.18-.28)

SHIM THICKNESS TABLE (1.6L)

Thickness mm (in.)	Shim No.
2.50 (0.0984)	02
2.55 (0.1004)	04
2.60 (0.1024)	06
2.65 (0.1043)	08
2.70 (0.1063)	10
2.75 (0.1083)	12
2.80 (0.1102)	14
2.85 (0.1122)	16
2.90 (0.1142)	18
2.95 (0.1161)	20
3.00 (0.1181)	22
3.05 (0.1201)	24
3.10 (0.1220)	26
3.15 (0.1240)	28
3.20 (0.1260)	30
3.25 (0.1280)	32
3.30 (0.1299)	34

SHIM THICKNESS TABLE (2.0L TURBO)

Thickness mm (in.)	Shim No.
2.50 (0.0984)	1
2.55 (0.1004)	2
2.60 (0.1024)	3
2.65 (0.1043)	4
2.70 (0.1063)	5
2.75 (0.1083)	6
2.80 (0.1102)	7
2.85 (0.1122)	8
2.90 (0.1142)	9
2.95 (0.1161)	10
3.00 (0.1181)	11
3.05 (0.1201)	12
3.10 (0.1220)	13
3.15 (0.1240)	14
3.20 (0.1260)	15
3.25 (0.1280)	16
3.30 (0.1299)	17

SHIM THICKNESS TABLE (2.2L)

Thickness mm (in.)	Shim No.
2.50 (0.0984)	1
2.55 (0.1004)	2
2.60 (0.1024)	3
2.65 (0.1043)	4
2.70 (0.1063)	5
2.75 (0.1083)	6
2.80 (0.1102)	7

2.85 (0.1122)	8
2.90 (0.1142)	9
2.95 (0.1161)	10
3.00 (0.1181)	11
3.05 (0.1201)	12
3.10 (0.1220)	13
3.15 (0.1240)	14
3.20 (0.1260)	15
3.25 (0.1280)	16
3.30 (0.1299)	17

IGNITION TIMING

CAUTION: Some tachometers may not be compatible with ignition system. Consult tachometer manufacturer before connecting tachometer to system. To avoid possible damage to ignitor and/or coil, DO NOT allow tachometer terminal to become grounded.

1) Warm engine to normal operating temperature. Shut engine off. Connect timing light. Connect tachometer to proper terminals of data link connector. See Fig. 3.

2) Install Jumper Wire (SST 09843-18020) between terminals TE1 and E1 of data link connector located in engine compartment. See Fig. 4. Start engine. Ensure idle speed is within specification.

3) Ensure base timing is within specification with engine at specified RPM. See IGNITION TIMING table.

NOTE: Timing marks are located on front cover.

4) Adjust ignition timing by rotating distributor. Tighten distributor hold-down bolt. Remove jumper wire from data link connector and ensure advance timing is within specification. See IGNITION TIMING table.

IGNITION TIMING TABLE (Degrees BTDC @ RPM)

Application (1)	(2) Base Timing	(3) Advance Timing
1.6L (4A-FE)	10 @ 800	0-20 @ 800
2.0L Turbo (3S-GTE)	10 @ 800	12-21 @ 800
2.2L (5S-FE)	10 @ 700	13-22 @ 700

(1) - With transmission/transaxle in Neutral and parking brake applied.
(2) - Check with jumper wire installed between data link connector terminals TE1 and E1.
(3) - Check with jumper wire removed from data link connector.

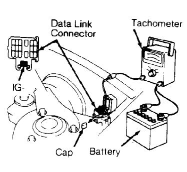


Fig. 3: Connecting Tachometer
Courtesy of Toyota Motor Sales, U.S.A., Inc.

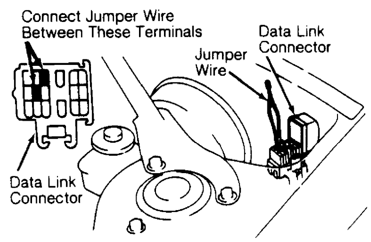


Fig. 4: Installing Jumper Wire Data Link Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

IDLE SPEED & MIXTURE

NOTE: Mixture adjustment is not possible on any model.

IDLE SPEED

CAUTION: Some tachometers may not be compatible with ignition system. Consult tachometer manufacturer before connecting tachometer to system. To avoid possible damage to ignitor and/or coil, DO NOT allow tachometer terminal to become grounded.

NOTE: Check and adjust idle speed with air cleaner installed, all air intake system hoses and vacuum lines connected, electronic fuel injection system wiring connectors tight, transmission/transaxle in Neutral, all accessories and cooling fan off (if equipped), and engine at normal operating temperature.

1.6L

1) Install tachometer on proper terminals of data link connector. See Fig. 3. Start engine. Operate at 2500 RPM for about 2 minutes. Allow engine to idle.

2) Install Jumper Wire (SST 09843-18020) between terminals TE1 and E1 of data link connector. See Fig. 4.

3) Ensure idle speed is within specification. See IDLE SPEED SPECIFICATIONS table. If idle speed requires adjustment, remove rubber boot (if equipped) from throttle body. See Fig. 5. Adjust idle speed adjusting screw to obtain correct idle speed. Install rubber boot. Remove jumper wire and tachometer.

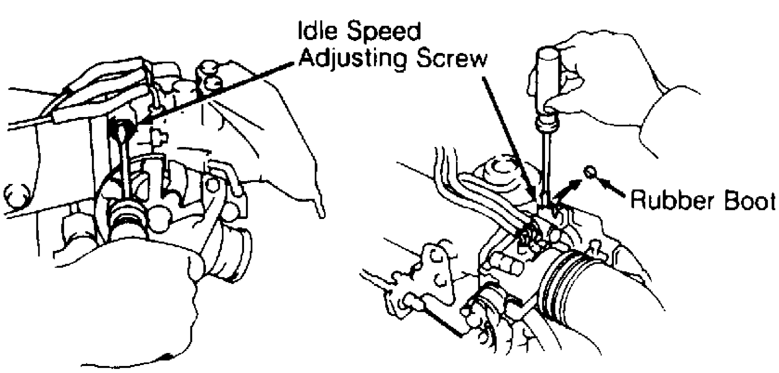


Fig. 5: Idle Speed Adjusting Screw Location ID
Courtesy of Toyota Motor Sales, U S.A., Inc.

2.0L Turbo & 2.2L

1) Install tachometer on proper terminals of data link

connector. See Fig. 3. Start engine. Operate it at 2500 RPM for about 90 seconds.

2) Allow engine to idle and note if idle speed is within specification. See IDLE SPEED SPECIFICATIONS table. If idle speed is not within specification, check Idle Air Control (IAC) valve, wiring and Electronic Control Module (ECM). See IDLE CONTROL SYSTEM in I - SYS/COMP TESTS article in the ENGINE PERFORMANCE section. Remove tachometer.

IDLE SPEED SPECIFICATIONS TABLE

Application (1)	RPM
1.6L (4A-FE) (2)	800
2.0L Turbo (3S-GTE)	800
2.2L (5S-FE)	700

(1) - With transmission/transaxle in Neutral and parking brake applied.
(2) - Check with jumper wire installed between data link connector terminals TE1 and E1.

THROTTLE POSITION SENSOR

1) Disconnect electrical connector from Throttle Position Sensor (TPS). Loosen TPS mounting screws. Connect ohmmeter between terminals IDL and E2. See Fig. 6.

2) Apply vacuum to throttle opener (if equipped). To set initial clearance, insert proper thickness feeler gauge between throttle stop screw and throttle lever. See THROTTLE POSITION SENSOR ADJUSTMENT table.

3) With ohmmeter showing no continuity, rotate TPS clockwise until continuity exists. Tighten TPS mounting screws. Using specified feeler gauge, recheck adjusted clearance. Disconnect ohmmeter. Install electrical connector on TPS.

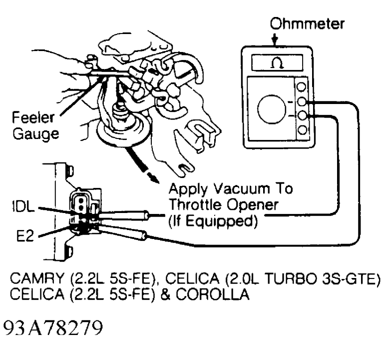


Fig. 6: Adjusting Throttle Position Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

THROTTLE POSITION SENSOR ADJUSTMENT TABLE

Application	Initial Clearance In. (mm)	Adjusted Clearance In. (mm)	Ohmmeter Reading
1.6L	.028 (.71)	.024 (.61)	Continuity
		.031 (.79)	No Continuity
2.0L Turbo & 2.2L (1)	.024 (.61)	.020 (.51)	Continuity

	.028 (.71)	No Continuity

(1) - Apply vacuum to throttle opener before checking TPS adjustment.
(2) - On California models, apply vacuum to throttle opener before checking TPS adjustment.
(3) - On A/T and California models, apply vacuum to throttle opener before checking TPS adjustment.

DASHPOT & THROTTLE VALVE OPENER CONTROL SYSTEM

For testing and adjustment procedures, see THROTTLE CONTROLS in I - SYS/COMP TESTS article in the ENGINE PERFORMANCE section.

AIR BAG RESTRAINT SYSTEM

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Air Bags

Celica

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all WARNINGS and SERVICE PRECAUTIONS.

DESCRIPTION & OPERATION

The Supplement Restraint System (SRS) consists of an AIR BAG/SRS warning light in the instrument cluster, left and right front impact sensors, steering wheel pad, spiral cable and center air bag sensor. Steering wheel pad contains inflator and bag assembly. Center air bag sensor assembly contains the back-up power source circuit, safety circuit, safing sensor, memory circuit, diagnostic circuit, ignition control and drive circuits. See Fig. 1.

The SRS is designed to deploy when the front-to-rear shock is greater than a specified value. The ignition control and drive circuits calculate signals from the center air bag sensor, deploying air bag.

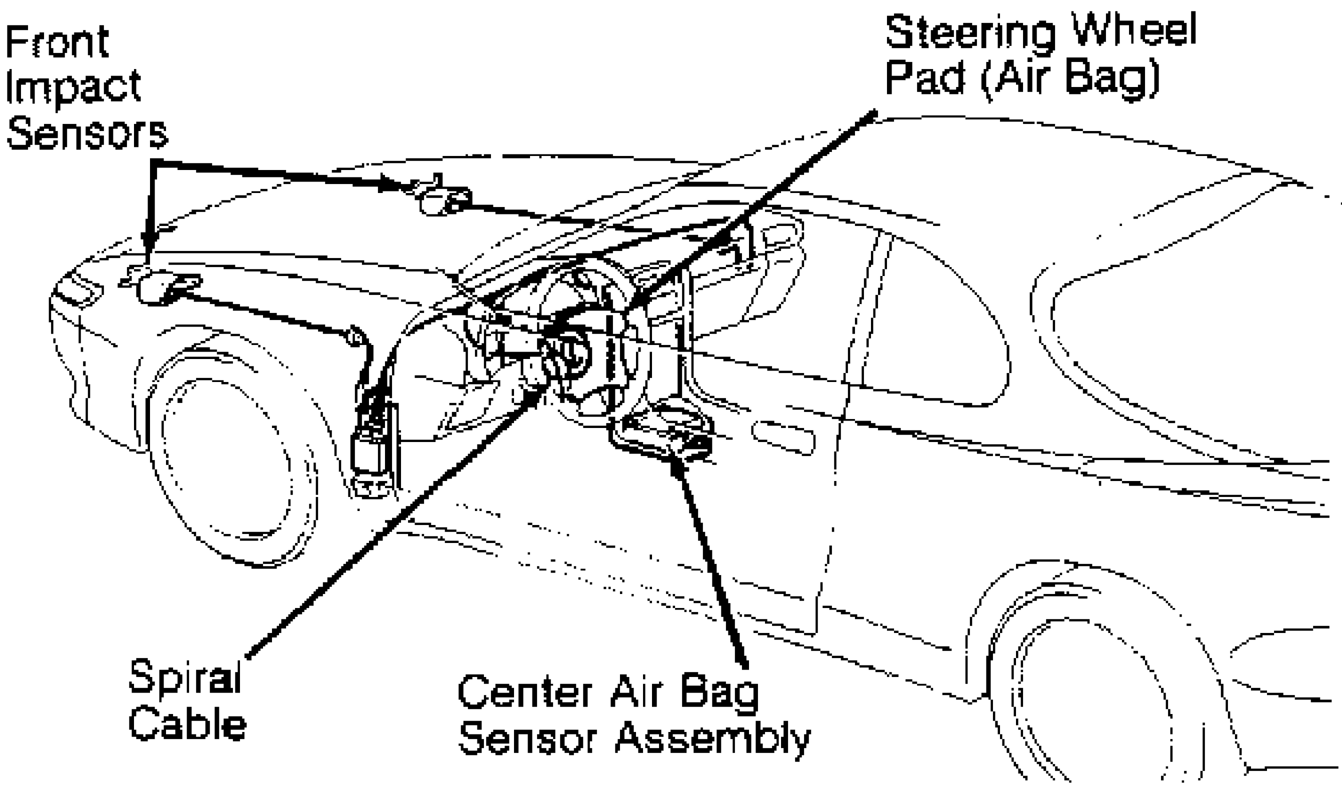


Fig. 1: SRS Component Location
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SYSTEM OPERATION CHECK

Turn ignition switch to ACC or ON position. AIR BAG/SRS warning light in instrument cluster should glow and go out after about 6 seconds. If AIR BAG/SRS warning light glows for more than 6 seconds with ignition switch in ACC or ON position, SRS system is malfunctioning and needs repair. If AIR BAG/SRS warning light glows with ignition off, a short circuit is likely in AIR BAG/SRS warning light circuit. See DIAGNOSIS & TESTING.

SERVICE PRECAUTIONS

Observe following precautions when working with air bag systems:

* Disable SRS before servicing any SRS or steering column component. Failure to do this could result in accidental air bag deployment and possible personal injury. See DISABLING & ACTIVATING AIR BAG SYSTEM.
* When trouble shooting SRS, always check for diagnostic codes before disconnecting battery.
* After turning ignition switch to LOCK position and disconnecting negative battery cable, wait at least 90 seconds before working on SRS. SRS is equipped with a back-up power source that may allow air bag to deploy up to 90 seconds after negative battery cable is disconnected.
* In a minor collision in which air bag does not deploy, front air bag sensors and steering wheel pad should be inspected.
* NEVER use air bag parts from another vehicle. Replace air bag parts using new parts.
* Remove air bag sensors if shocks are likely to be applied to sensors during repairs.
* Center air bag sensor assembly contains mercury. After replacement, DO NOT destroy old part. When scrapping vehicle or replacing center air bag sensor assembly, remove center air bag sensor assembly and dispose of as toxic waste.
* Never disassemble and repair front air bag sensors, center air bag sensor assembly or steering wheel pad.
* If front air bag sensors, center air bag sensor assembly or steering wheel pad is dropped or if cracks, dents or other defects exist in case, bracket or connector, replace parts using new ones.
* DO NOT expose front air bag sensors, center air bag sensor assembly or steering wheel pad directly to hot air or flame.
* Use a volt-ohmmeter with high impedance (10 k/ohm minimum) for trouble shooting electrical circuit.
* Information labels are attached to air bag components. Follow all notices on labels.
* After work on SRS is completed, check AIR BAG/SRS warning light to ensure system is functioning properly. See SYSTEM OPERATION CHECK.
* Always wear safety glasses when servicing or handling an air bag.
* When placing a live air bag on a bench or other surface, always face air bag and trim cover up, away from surface. This will reduce motion of module if it is accidentally deployed.
* After deployment, air bag surface may contain deposits of sodium hydroxide, which irritates skin, from gas generant combustion. Always wear safety glasses, rubber gloves and long-sleeved shirt during clean-up, and wash hands using mild soap and water.
* When carrying a live air bag module, trim cover should be pointed away from your body to minimize injury in case of

accidental deployment.

* If SRS is not fully functional for any reason, vehicle should not be driven until system is repaired and again becomes operational. DO NOT remove bulbs, modules, sensors or other components or in any way disable system from operating normally. If SRS is not functional, park vehicle until it is repaired and functions properly.

DISABLING & ACTIVATING AIR BAG SYSTEM

WARNING: Back-up power supply maintains SRS voltage for about 90 seconds after battery is disconnected. After disabling SRS, wait at least 90 seconds before servicing SRS to prevent accidental air bag deployment and possible personal injury.

To disable SRS, turn ignition switch to LOCK position and disconnect negative battery cable. Wait at least 90 seconds before servicing SRS. To activate SRS, reconnect negative battery cable. Perform SYSTEM OPERATION CHECK.

DISPOSAL PROCEDURES

DEPLOYED AIR BAG

Deployed air bag modules can be disposed of as would any other part. Handle air bag module wearing gloves and safety glasses.

SCRAPPED VEHICLE

NOTE: Some vehicles to be scrapped may have an undeployed air bag. When scrapping vehicles equipped with SRS, deploy air bag module.

1) Before proceeding, follow service precautions. See SERVICE PRECAUTIONS. Disable SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM. Ensure steering wheel and steering wheel pad are not loose. If steering wheel and steering wheel pad are loose, air bag cannot be deployed using this procedure. Follow procedure listed under UNDEPLOYED AIR BAG.

2) Remove instrument panel lower finish panel. Disconnect spiral cable air bag connector, located on lower steering column. Connect Deployment Tool (09082-00700) connector to spiral cable air bag connector. Position deployment tool at least 33 feet from front of vehicle.

3) Close all doors and windows of vehicle. Connect deployment tool Red clip to positive battery terminal and Black clip to negative battery terminal. Ensuring no one is inside or within 33 feet of vehicle, press activation switch to deploy air bag. Because of heat, DO NOT touch air bag for at least 30 minutes after deployment.

UNDEPLOYED AIR BAG

1) Never dispose of a steering wheel pad with an undeployed air bag. Never deploy an air bag inside a vehicle, unless vehicle is to be scrapped.

2) Before proceeding, see SERVICE PRECAUTIONS. Disable SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM. Remove steering wheel pad from vehicle. See STEERING WHEEL PAD & SPIRAL CABLE under REMOVAL & INSTALLATION.

3) To deploy a loose steering wheel pad, manufacturer recommends installing pad to a scrap vehicle wheel rim and tire

assembly. To do so, install 4 bolts in holes provided in rear of steering wheel pad. Tighten bolts by hand until they become difficult to turn. DO NOT overtighten bolts.

4) Wrap strong wire at least twice around bolts on left and right sides of steering wheel pad. See Fig. 2. Ensure no slack is present in wire. If slack is present, or wire is not strong enough, steering wheel pad may become loose due to shock when air bag is deployed.

5) Position steering wheel pad on wheel rim and tire assembly with pad side facing upward. Ensuring wire is tight, separately tie left and right sides of steering wheel pad to wheel rim through lug nut holes. See Fig. 3.

6) Connect Deployment Tool (09082-00700) to steering wheel pad connector. Position deployment tool at least 33 feet from steering wheel pad. Place a large cardboard box (weighted at sides) or 3 scrap tires on top of steering wheel pad. Ensure no one is within 33 feet of steering wheel pad. Press activation switch to deploy air bag.

7) Because of heat, wait 30 minutes before handling air bag. Use Gloves and safety glasses when handling a steering wheel pad with deployed air bag.

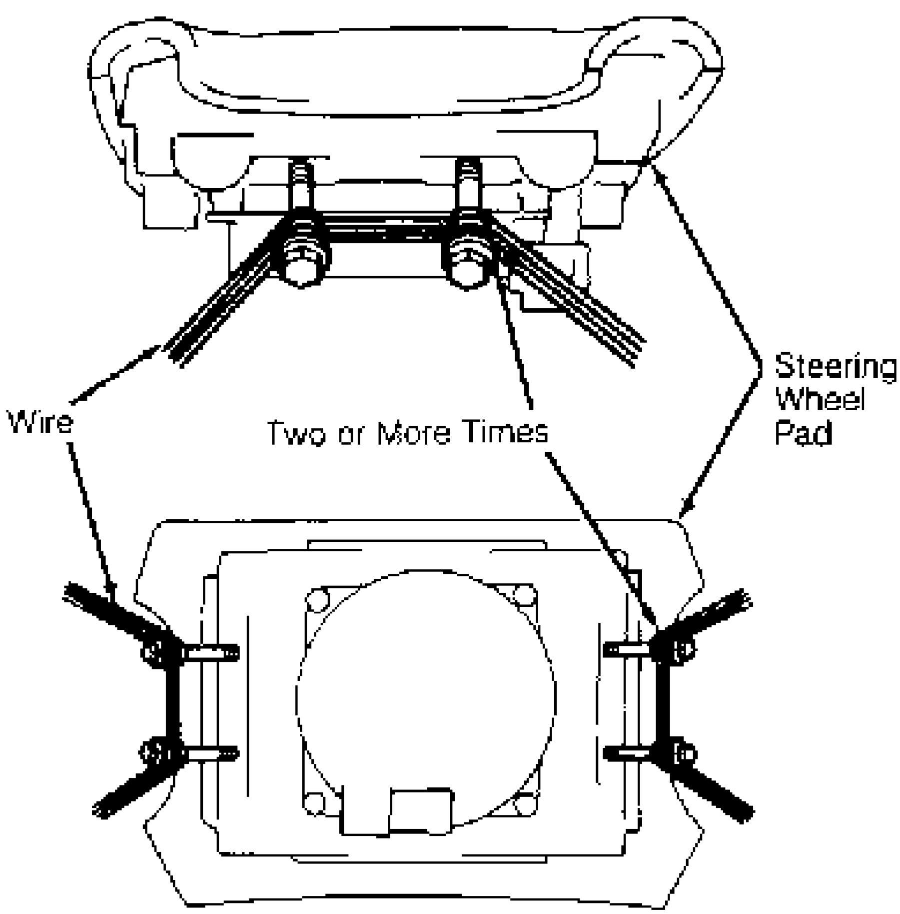


Fig. 2: Installing Wire On Steering Wheel Pad
Courtesy of Toyota Motor Sales, U.S.A., Inc.

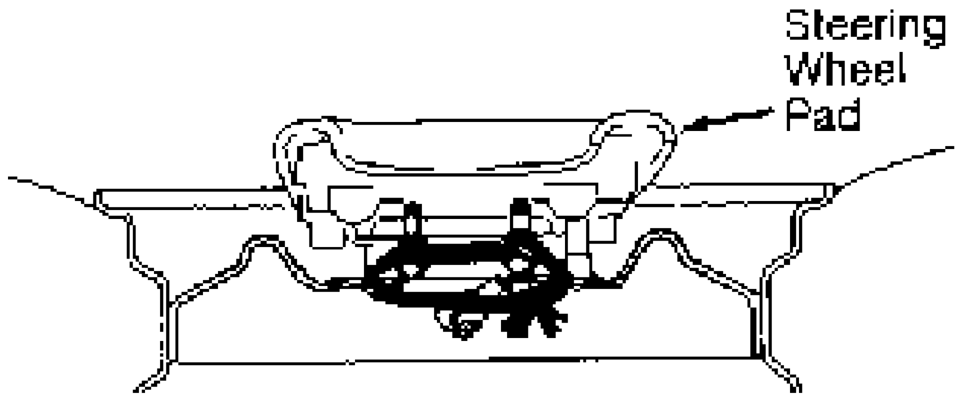


Fig. 3: Installing Steering Wheel Pad On Wheel Assembly
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POST-COLLISION INSPECTION

Check diagnostic system. See SELF-DIAGNOSTIC SYSTEM under DIAGNOSIS & TESTING. Replace center air bag sensor if air bag deployed. Remove steering wheel pad and air bag assembly. Check for following conditions and replace components as necessary:

* Cut, cracked or markedly discolored steering wheel pad top surface and steering wheel pad grooved portion.
* Cut, cracked or chipped connectors or wire harnesses.
* Deformity of horn button contact plate and front air bag sensor bracket.
* Peeling off of label or damage to series number on front air bag sensor.

WARNING: If horn button contact plate is deformed, never repair it. Instead, replace entire steering wheel assembly. Ensure steering wheel pad does not contact steering wheel. Clearance must be uniform all the way around steering wheel pad.

REMOVAL & INSTALLATION

WARNING: Failure to follow air bag service precautions may result in air bag deployment and personal injury. See SERVICE PRECAUTIONS. After component replacement, perform a system operational check to ensure proper system operation. See SYSTEM OPERATION CHECK.

CENTER AIR BAG SENSOR

Removal & Installation

1) Before proceeding, follow air bag service precautions. See SERVICE PRECAUTIONS. Disable SRS. See DISABLING & ACTIVATING AIR BAG

SYSTEM.

2) Center air bag sensor is located underneath console. Remove center console trim panel. See Fig. 4. Remove 4 screw covers from sides of center console box. Remove 4 center console screws and 2 bolts. Remove center console box.

3) Remove scuff plates. Remove 4 screws, glove box and passenger-side lower trim panel. Remove engine hood release lever. Remove screw covers, 6 screws and instrument cluster lower trim panel.

NOTE: Disconnect center air bag sensor electrical connector before removing sensor attaching screws.

4) Remove 2 screws and radio trim panel. Remove 4 screws and radio. Remove screw covers and 4 screws from center console. Remove instrument panel brace. See Fig. 4. Disconnect center air bag sensor assembly electrical connector. Remove 4 screws and center air bag sensor assembly.

5) To install, reverse removal procedure. Tighten center air bag sensor screws to specification. See TORQUE SPECIFICATIONS. Reactivate SRS. Ensure system is functioning properly. See SYSTEM OPERATION CHECK.

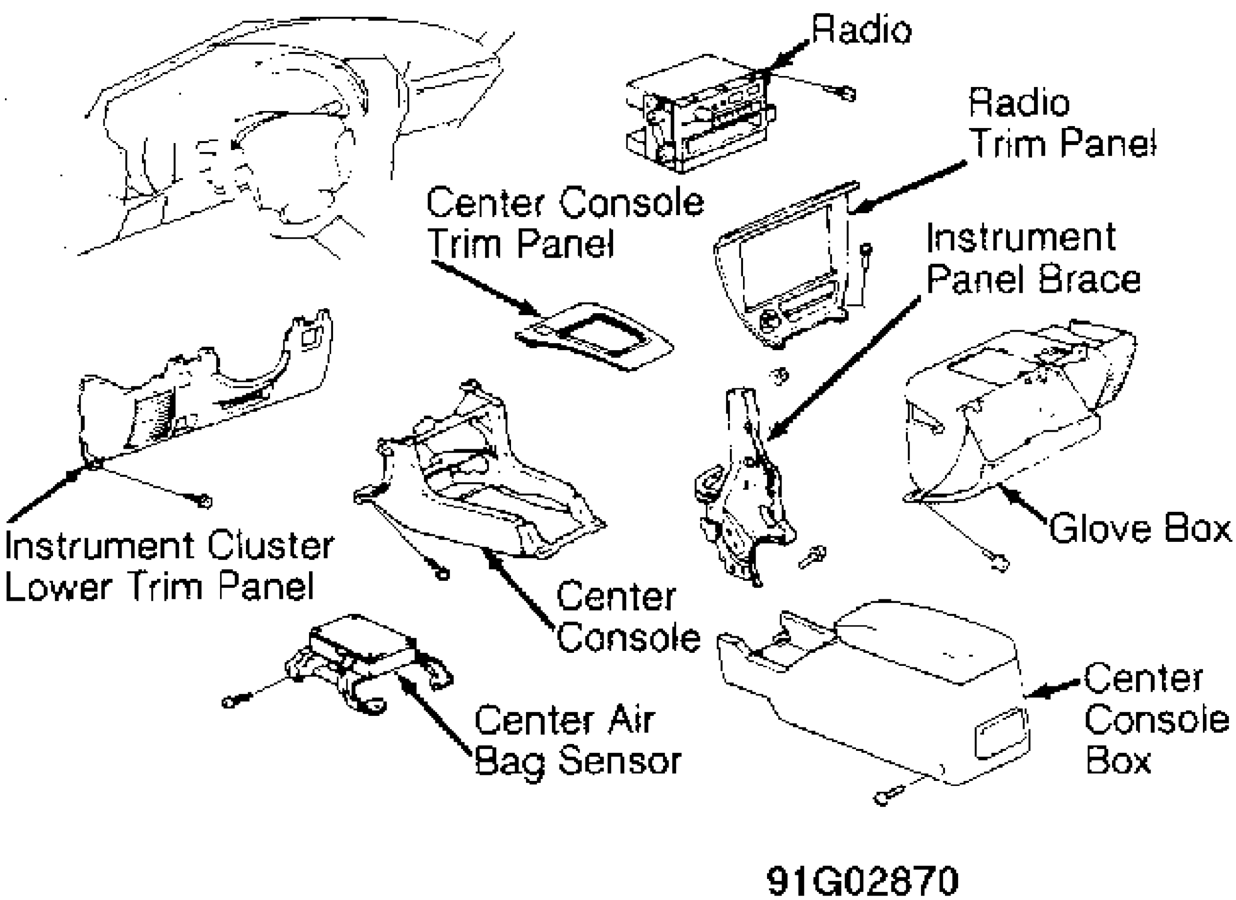


Fig. 4: Removing Center Air Bag Sensor Assembly
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FRONT AIR BAG SENSORS

Removal & Installation

1) Before proceeding, follow air bag service precautions. See SERVICE PRECAUTIONS. Disable SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Front air bag sensors are located in left and right fender areas. Remove screws and clips attaching inner fender shield to vehicle.

3) Remove hood lock protector plate or inner fender shield. Disconnect front air bag sensor electrical connector. Remove 2 bolts attaching sensor to fender. Remove front air bag sensor.

4) To install, reverse removal procedure. Ensure arrow marks on sensors face front of vehicle. Tighten front air bag sensor bolts to specification. See TORQUE SPECIFICATIONS. Reactivate SRS. Check AIR BAG warning light to ensure system is functioning properly. See SYSTEM OPERATION CHECK.

STEERING WHEEL PAD & SPIRAL CABLE

Removal & Installation

1) Ensure front wheels are in straight-ahead position. Before proceeding, see SERVICE PRECAUTIONS. Disable SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM. Remove driver-side scuff plate.

2) Remove engine hood release lever. Remove screw covers, 6 screws and lower instrument cluster trim panel(s). Loosen 4 steering wheel pad Torx screws until groove along screw circumference catches on screw case. See Figs. 5 and 6.

3) Pull steering wheel pad from steering wheel and disconnect steering wheel pad (squib) connector. Remove steering wheel pad assembly. Place steering wheel pad assembly on a flat surface with pad cover facing up.

4) Place a mark on steering wheel and main shaft for installation reference. Using steering wheel puller, remove steering wheel. Remove 4 screws from upper and lower steering column covers.

5) Remove screws attaching spiral cable to combination (headlight/turn signal/wiper) switch. Disconnect spiral cable and remove from vehicle.

6) To install, reverse removal procedure. Before installing spiral cable, ensure spiral cable is properly aligned. See SPIRAL CABLE under ADJUSTMENTS. Tighten steering wheel nut and steering wheel pad screws to specification. See TORQUE SPECIFICATIONS.

7) After spiral cable and steering wheel pad are installed, reactivate SRS. Ensure proper SRS operation. See SYSTEM OPERATION CHECK.

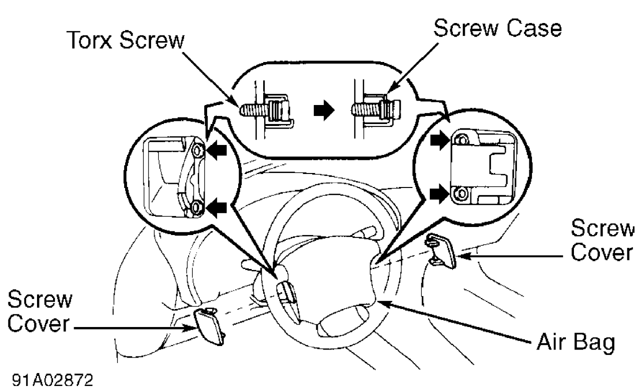


Fig. 5: Removing Steering Wheel Pad
Courtesy of Toyota Motor Sales, U.S.A., Inc.

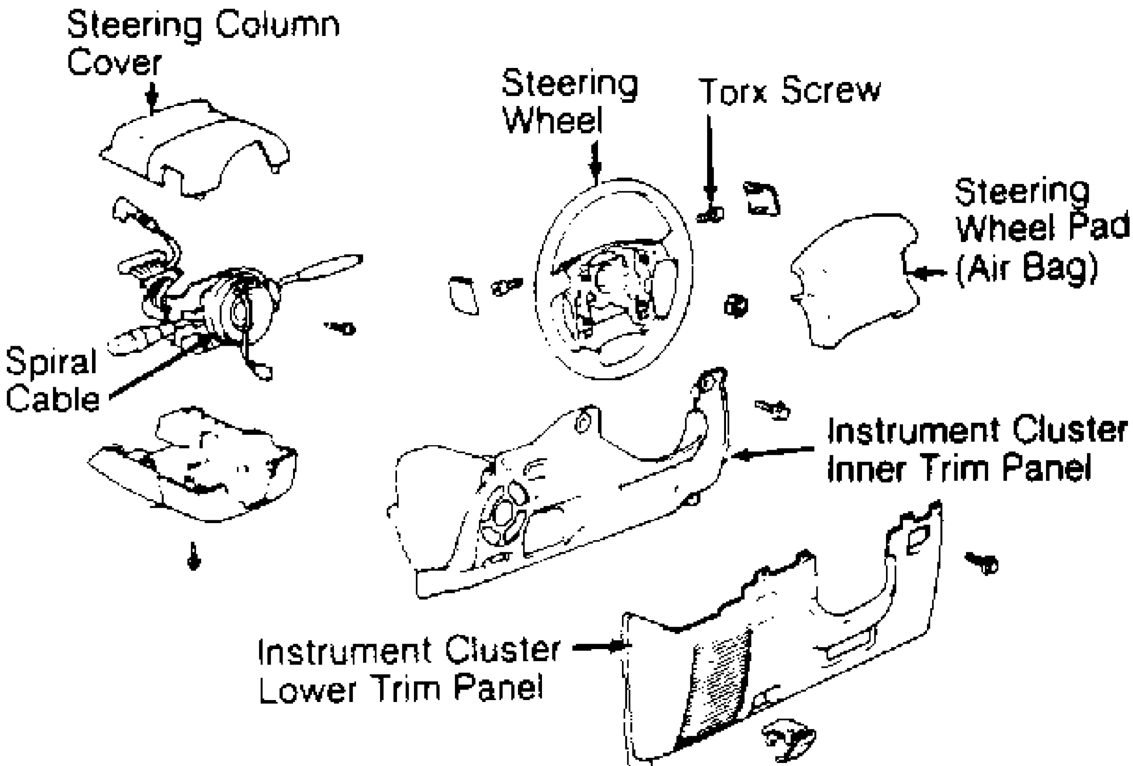


Fig. 6: Exploded View Of Steering Wheel Pad
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ADJUSTMENTS

SPIRAL CABLE

Ensure front wheels are in straight-ahead position. Turn spiral cable counterclockwise until it stops. Turn spiral cable clockwise 2.5 turns. Mating marks should align with Red mark. See Fig. 7. Ensure mating marks are aligned and install steering wheel.

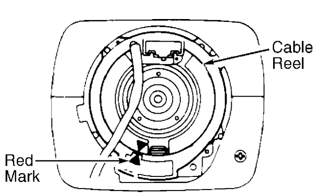


Fig. 7: Aligning Spiral Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRE REPAIR

CAUTION: If air bag wiring harness is damaged, replace complete wiring harness assembly. Following WIRE REPAIR procedure is to be used only to repair connector to front air bag sensors.

1) Repair wire using 2 Pressure-Contact Sleeves (82988-50010); sleeves are available for repairing air bag connector problems. To repair, uncover front air bag sensor connector to be repaired. Leaving wires as long as possible, cut wiring harness behind connector. Carefully strip .31-.43" insulation from each wire to be repaired. DO NOT damage wire during this operation. If any damage exists, perform stripping operation again.

2) Overlap 2 stripped wire ends inside pressure-contact sleeve. Using Crimper (169060-2), place sleeve in correct color-keyed section of tool. With center of sleeve between crimping jaws, squeeze tool until either end comes in contact at section of tool marked CLOSE HERE.

3) Pull joined wires on both ends to ensure a secure crimp. Crimp both ends of sleeve using crimper at INS position. See Fig. 8. Thoroughly wrap silicon tape around joint for protection.

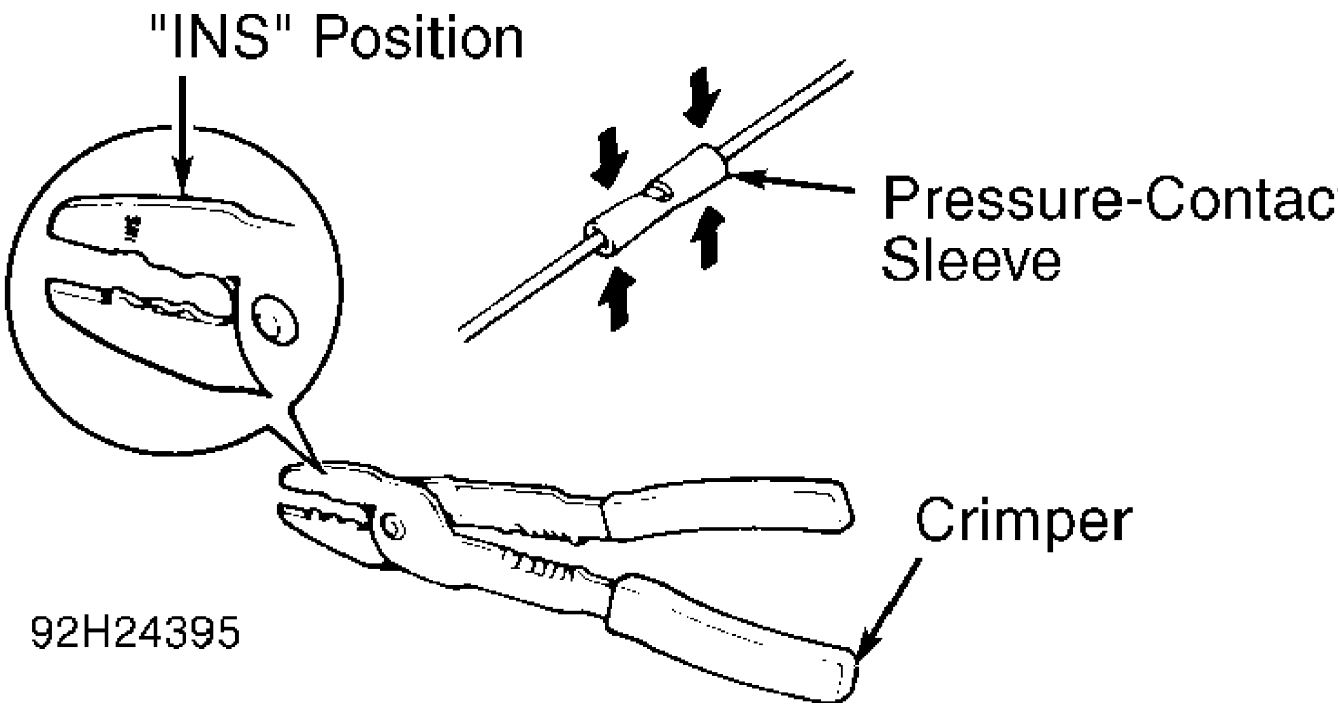


Fig. 8: Crimping Pressure-Contact Sleeve
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Front Air Bag (Impact) Sensor Bolts	19 (26)
Steering Wheel Nut	26 (35)
	INCH Lbs. (N.m)

Center Air Bag Sensor Screws	108 (12)
Steering Wheel Pad Torx Screws	65 (7)

DIAGNOSIS & TESTING

WARNING: Failure to follow air bag service precautions may result in air bag deployment and personal injury. See SERVICE PRECAUTIONS. After component replacement, ensure proper system operation. See SYSTEM OPERATION CHECK.

SELF-DIAGNOSTIC SYSTEM

AIR BAG/SRS Warning Light Check

1) Turn ignition switch to ACC or ON position. Ensure AIR BAG/SRS warning light glows, and then goes out after approximately 6 seconds.

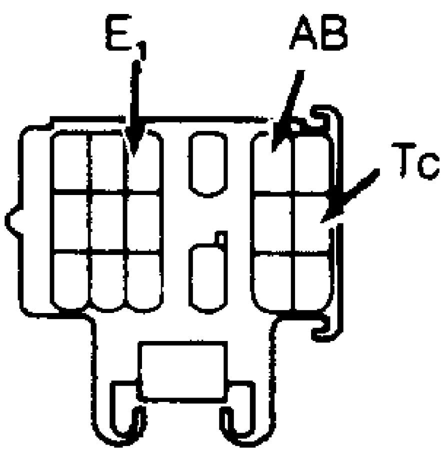
2) When ignition switch is in ACC or ON position and AIR BAG/SRS warning light remains on, center air bag sensor assembly has detected a malfunction code. To identify malfunction code, see DIAGNOSTIC CODE CHECK.

3) If after approximately 6 seconds, air bag warning light sometimes glows or glows even when ignition switch is in OFF position, a short in AIR BAG/SRS warning light circuit is present. See TROUBLE SHOOTING.

NOTE: Celica is equipped with one Data Link Connector (DLC), located in engine compartment.

Diagnostic Code Check

1) Jump DLC terminals Tc and E1 using Diagnosis Check Wiring (09843-18020) jumper harness. See Fig. 9.



93B75508

Fig. 9: Data Link Connector (DLC) Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Read diagnostic codes by noting number of AIR BAG/SRS warning light flashes. See Fig. 10. Normal code indication will flash

light twice per second. If a malfunction code is present, first number of code number will equal first digit of a 2-digit diagnostic code. After a 1.5-second pause, second number of code number will equal second digit.

3) If 2 or more codes are present, a 2.5-second pause will occur between codes. After all codes are displayed, a 4-second pause will occur and codes will be repeated. After code has been identified, see appropriate diagnostic code and perform tests as specified.

4) If more than one malfunction code is present, codes will flash from smallest numbered code to largest. If malfunction code is not displayed or is continuously displayed, see TROUBLE SHOOTING. If AIR BAG/SRS warning light remains illuminated and diagnostic code is normal code, a source voltage drop is present. This malfunction is not stored in memory. If power source voltage returns to normal after approximately 10 seconds, AIR BAG/SRS warning light will automatically go out. See DIAGNOSTIC CODE NORMAL, SOURCE VOLTAGE DROP under TROUBLE SHOOTING.

5) Code 22 is recorded when a malfunction is present in air bag warning light system. If an open circuit is present in air bag warning light circuit, AIR BAG/SRS warning light will not glow. Diagnostic codes (including Code 22) cannot be confirmed until warning light circuit is repaired.

6) When a malfunction is present in SRS, malfunction Codes 11 through 31 are displayed. Codes 11 through 31 are cleared from memory after repair of malfunction, but Code 41 will remain until cleared.

Code No.	Blink Pattern	Diagnosis	Trouble Area
(Normal)		• System normal	–
		• Source voltage drop	• Battery • Center airbag sensor assembly
11		• Short in squib circuit or front airbag sensor circuit (to ground)	• Steering wheel pad (squib) • Front airbag sensor • Spiral cable • Center airbag sensor assembly • Wire harness
12		• Short in squib circuit or front airbag sensor circuit (to +B)	• Steering wheel pad (squib) • Front airbag sensor • Spiral cable • Center airbag sensor assembly • Wire harness
13		• Short in squib circuit (between D^+ wire harness and D^- wire harness)	• Steering wheel pad (squib) • Spiral cable • Center airbag sensor assembly • Wire harness
14		• Open in squib circuit	• Steering wheel pad (squib) • Spiral cable • Center airbag sensor assembly • Wire harness
15		• Open in front airbag sensor circuit	• Front airbag sensor • Center airbag sensor assembly • Wire harness
22		• Airbag warning light system malfunction	• Airbag warning light • Center airbag sensor assembly • Wire harness
31		• Center airbag sensor assembly malfunction	• Center airbag sensor assembly
*41		• Malfunction stored in memory	• (Center airbag sensor assembly)

* Not used on Corolla, Paseo, Previa or Tercel.

93F75510

Fig. 10: Diagnostic Code ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Clearing Malfunction Codes

1) Connect wire probes to DLC terminals Tc and AB. See

Fig. 9. Turn ignition switch to ACC or ON position, and wait about 6 seconds. Starting with Tc terminal, apply body ground alternately to terminal Tc and terminal AB twice each, in cycles of .5-1.5 seconds.

2) When alternating probes between body ground, simultaneously release one probe from body ground while applying ground to other terminal. If time interval is too long, code will not clear. After several seconds, when AIR BAG/SRS warning light starts to blink a regular cycle, code cancellation is complete.

GJ

TROUBLE SHOOTING

AIR BAG/SRS WARNING LIGHT REMAINS ILLUMINATED

Turn ignition switch to LOCK position. Disconnect negative battery cable. Disconnect center air bag sensor assembly connector. Reconnect negative battery cable. If warning light remains illuminated, replace center air bag sensor assembly. If warning light goes out, check warning light circuit or Data Link Connector (DLC) terminal AB for an open circuit. See Fig. 9.

AIR BAG/SRS WARNING LIGHT INTERMITTENT

Intermittent malfunctions can make AIR BAG/SRS warning light glow erratically. To diagnose intermittent problems, apply vibration, heat (as with a hair dryer), or humidity (to entire vehicle, not directly to electrical components) to check whether malfunction reoccurs.

DIAGNOSTIC CODE NOT DISPLAYED

1) If code is not displayed after performing diagnostic code check, turn ignition switch to ACC or ON position. Measure voltage between Data Link Connector (DLC) terminals Tc and E1. If battery voltage is not present, go to next step. If battery voltage is present, go to step 3).

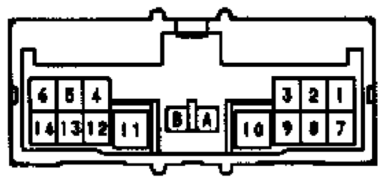
2) Measure voltage between DLC terminal Tc and ground. If battery voltage is present, check harness between terminal E1 of DLC and body ground. If battery voltage is not present, go to next step.

3) Using diagnosis check wiring, jump center air bag sensor assembly connector terminal Tc to ground. If warning light glows, check harness between center air bag sensor assembly and DLC. If warning light does not glow, replace center air bag sensor assembly.

DIAGNOSTIC CODE CONTINUOUSLY DISPLAYED

1) If code is displayed continuously after performing diagnostic code check, turn ignition switch to LOCK position. Disconnect center air bag sensor assembly connector.

2) Check resistance between center air bag sensor assembly connector terminal Tc and ground. See Fig. 11. If resistance is infinite ohms, replace center air bag sensor assembly. If resistance is not infinite ohms, repair or replace harness or connector.



No.	Symbol	Terminal Name	No.	Symbol	Terminal Name
1	IG_1	Power Source (ECU-IG Fuse)	8	E_2	Ground
2	−SR	RH Front Airbag Sensor ⊖	9	LA	Airbag Warning Light
3	+SR	RH Front Airbag Sensor ⊕	10	D^-	Squib ⊖
4	+SL	LH Front Airbag Sensor ⊕	11	D^+	Squib ⊕
5	−SL	LH Front Airbag Sensor ⊖	12	Tc	Diagnosis
6	+B	Battery (ECU-B Fuse)	13	E_1	Ground
7	IG_2	Power Source (IGN Fuse)	14	Acc	Power Source (CIG Fuse)
A	−	Electrical Connection Check Mechanism	B	−	Electrical Connection Check Mechanism

Fig. 11: Center Air Bag Assembly Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DIAGNOSTIC CODE NORMAL, SOURCE VOLTAGE DROP

Circuit Description

1) SRS is equipped with a voltage increase circuit in center air bag sensor assembly. This circuit increases voltage of SRS to normal voltage if source voltage drops.

2) Diagnostic system malfunction display for this circuit is different than other circuits. When AIR BAG/SRS warning light remains lit and diagnostic code is a normal code, source voltage drop is indicated. A malfunction in this circuit is not recorded in center air bag sensor assembly. About 10 seconds after source voltage returns to normal, air bag warning light goes off.

Diagnosis

1) Turn ignition switch to LOCK position. Disconnect center air bag sensor connector. Turn ignition switch to ON position (engine off). Measure voltage between ground and terminals IG, and ACC on connector side of center air bag sensor assembly. See Fig. 11. Operate electrical components (defogger, wiper, headlight, heater blower, etc.).

2) Approximately 6.0-11.5 volts should be present at terminals. Turn all electrical components off. Turn ignition switch to LOCK position. Remove voltmeter, and reconnect connector.

3) Turn ignition switch to ON position. Turn on electrical accessories. If air bag warning light goes out after approximately 10 seconds, check battery and charging system. If light does not go out, check diagnostic code. If a malfunction code is present, perform appropriate trouble shooting. If a normal code is present, replace center air bag sensor assembly.

CODE 11, SHORT IN SQUIB CKT, FRONT AIR BAG SENS CKT (TO

GROUND)

Circuit Description

Squib circuit consists of center air bag assembly, spiral cable and steering wheel pad (squib). Squib causes air bag to deploy when deployment conditions have been met. Front air bag sensors detect deceleration force in frontal collision and are located in front left and right sides of vehicle. Code 11 is recorded when a ground short is detected in squib circuit or front air bag sensor circuit.

Diagnosis

1) Disconnect negative battery cable and wait at least 90 seconds. Remove steering wheel pad. See STEERING WHEEL PAD & SPIRAL CABLE under REMOVAL & INSTALLATION.

2) Disconnect the center air bag sensor assembly connector. Measure resistance between terminals +SR and -SR and terminals +SL and -SL of harness side connector of center air bag sensor assembly. See Fig. 11. If resistance is not 755-885 ohms, go to step 9).

3) If resistance is 755-885 ohms, measure resistance between terminals +SR and +SL of harness side connector of center air bag sensor assembly and body ground. If infinite resistance is present, go to next step. If infinite resistance is not present, repair or replace harness or connector between center air bag sensor assembly and front air bag sensor.

4) Measure resistance between terminals D+ and D- on spiral cable side of connector between spiral cable and steering wheel pad and body ground. See Fig. 12. If resistance is infinite, go to next step. If resistance is not infinite, go to step 10).

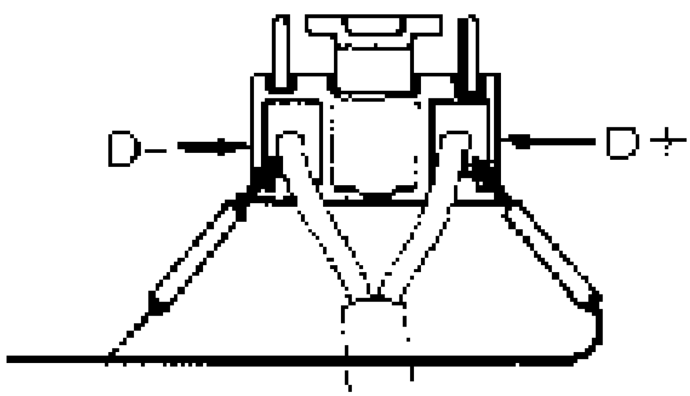


Fig. 12: Spiral Cable-To-Steering Wheel Pad Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

5) Reconnect center air bag sensor assembly. Using a jumper wire, jump terminals D+ and D- on spiral cable side of connector

between spiral cable and steering wheel pad. Connect negative battery cable to battery, and wait at least 2 seconds.

6) Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using Diagnosis Check Wiring (09843-18020), jump DLC terminals Tc and E1. See Fig. 9. Check diagnostic code. If Code 11 is not displayed, go to next step. If Code 11 is displayed, replace center air bag sensor assembly.

7) Turn ignition switch to LOCK position. Disconnect negative battery cable and wait at least 90 seconds. Reconnect steering wheel pad (squib) connector. Reconnect negative battery cable and wait 2 seconds.

8) Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using diagnosis check wiring, jump DLC terminals Tc and E1. See Fig. 9. If Code 11 is not displayed, go to next step. If Code 11 is displayed, replace steering wheel pad assembly.

9) Disconnect front air bag sensor connector. Measure resistance between terminals +S and +A (755-885 ohms), +S and -S (infinite ohms), and -S and -A (less than one ohm). See Fig. 13. If resistance is not to specification, replace front air bag sensor. If resistance is okay, repair or replace harness or connector between center air bag sensor assembly and front air bag sensor.

10) Disconnect connector between center air bag sensor assembly and spiral cable. Measure resistance between terminals D+ and D- on spiral cable side of connector between spiral cable and steering wheel pad and body ground. See Fig. 12. If resistance is infinite, repair or replace harness or connector between center air bag sensor assembly and spiral cable. If resistance is not infinite, repair or replace spiral cable.

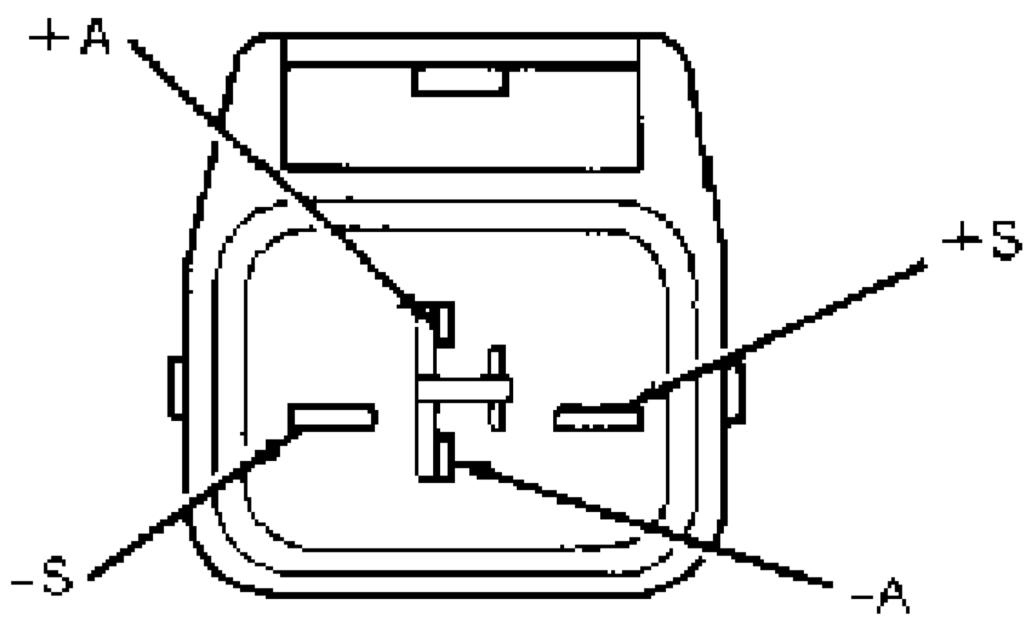


Fig. 13: Front Air Bag Sensor Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CODE 12, SHORT IN SQUIB CKT, FRONT AIR BAG SENS CKT (TO VOLTAGE)

Circuit Description

Squib circuit consists of center air bag sensor assembly, spiral cable and steering wheel pad (squib). Squib causes air bag to deploy when deployment conditions have been satisfied. Front air bag sensors (located on left and right sides of vehicle) detect deceleration force in a frontal collision.

Diagnosis

1) Disconnect negative battery cable and wait at least 90 seconds. Remove steering wheel pad. See STEERING WHEEL PAD & SPIRAL CABLE under REMOVAL & INSTALLATION.

2) Disconnect center air bag sensor assembly connector. Measure resistance between center air bag sensor harness connector terminals +SR and -SR and terminals +SL and -SL. See Fig. 11. If resistance is not 755-885 ohms, go to DIAGNOSTIC CODE 15, OPEN IN FRONT AIR BAG SENSOR CIRCUIT.

3) If resistance is 755-885 ohms, reconnect negative battery cable. Turn ignition switch to ON position. Measure voltage between ground and terminal +SR or +SL of harness side connector of center air bag sensor assembly. If any voltage is present, repair or replace harness or connector between center air bag sensor assembly and front air bag sensor.

4) If no voltage is present, measure voltage at terminal D+ on spiral cable side of connector between spiral cable and steering wheel pad. See Fig. 12. If no voltage is present, go to step 5). If voltage is present, turn ignition switch to LOCK position. Disconnect connector between center air bag sensor assembly and spiral cable. Turn ignition switch to ON position. Measure voltage at terminal D+ on spiral cable side of connector between spiral cable and steering wheel pad. If no voltage is present, repair or replace harness or connector between center air bag sensor assembly and spiral cable. If voltage is present, repair or replace spiral cable.

5) Turn ignition switch to LOCK position. Disconnect negative battery cable. Reconnect center air bag sensor connector. Using Diagnosis Check Wiring (09843-18020), jump terminals D+ and D- on spiral cable side of connector between spiral cable and steering wheel pad. See Fig. 12. Reconnect negative battery cable.

6) Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using diagnosis check wiring, jump DLC terminals Tc and E1. See Fig. 9. If Code 12 is displayed, replace center air bag sensor assembly.

7) If Code 12 is not displayed, turn ignition switch to LOCK position. Disconnect negative battery cable, and wait at least 90 seconds. Reconnect steering wheel pad (squib) connector. Reconnect negative battery cable and wait at least 2 seconds.

8) Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using diagnosis check wiring, jump DLC terminals Tc and E1. See Fig. 9. If Code 12 is displayed, replace steering wheel pad. If Code 12 is not displayed, system is okay.

CODE 13, SHORT IN SQUIB CKT (BETWEEN D+ HARNESS & D- HARNESS)

Circuit Description

Squib circuit consists of center air bag sensor assembly, spiral cable and steering wheel pad (squib). Squib causes air bag to deploy when air bag deployment conditions are satisfied. Code 13 is recorded when a short is detected in D+ wire harness and D- wire harness of squib circuit. See Fig. 12.

Diagnosis

1) Disconnect negative battery cable and wait at least 90 seconds. Remove steering wheel pad. See STEERING WHEEL PAD & SPIRAL

CABLE under REMOVAL & INSTALLATION.

2) Measure resistance between D+ and D- on spiral cable side of connector between spiral cable and steering wheel pad. See Fig. 12. If resistance is 1000 ohms or more, go to next step. If resistance is not 1000 ohms or more, go to step 6).

3) Reconnect negative battery cable. Clear diagnostic code stored in memory. See CLEARING MALFUNCTION CODES under SELF-DIAGNOSTIC SYSTEM under DIAGNOSIS & TESTING. Turn ignition switch to LOCK position, and wait at least 2 seconds. Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using Diagnosis Check Wiring (09843-18020), jump DLC terminals Tc and E1. See Fig. 9. If Code 13 is present, replace center air bag sensor assembly. If Code 13 is not present, go to next step.

4) Turn ignition switch to LOCK position. Disconnect negative battery cable and wait at least 90 seconds. Reconnect steering wheel pad (squib) connector. Reconnect negative battery cable. Clear diagnostic code.

5) Turn ignition switch to LOCK position and wait at least 2 seconds. Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using diagnosis check wiring, jump DLC terminals Tc and E1. See Fig. 9. If Code 13 is present, replace steering wheel pad. If Code 13 is not present, system is okay.

6) Disconnect connector between center air bag sensor assembly and spiral cable. Release air bag activation prevention mechanism on center air bag sensor assembly side of spiral cable connector. Measure resistance between terminals D+ and D- on spiral cable side of connector, between spiral cable and steering wheel pad. See Fig. 12. If infinite resistance is present, go to next step. If infinite resistance is not present, repair or replace spiral cable.

7) Disconnect center air bag sensor assembly connector. Release air bag activation prevention mechanism on center air bag sensor assembly connector. Measure resistance between terminals D+ and D- on center air bag sensor assembly side of connector between center air bag sensor assembly and spiral cable. See Fig. 12. If resistance is infinite, go to next step. If resistance is not infinite, repair or replace harness or connector between center air bag sensor assembly and spiral cable.

8) Reconnect center air bag sensor assembly connector. Measure resistance between terminals D+ and D- on center air bag sensor assembly side of connector between center air bag sensor assembly and spiral cable. See Fig. 12. If resistance is 1000 ohms or more, system is okay. If resistance is not 1000 ohms or more, replace center air bag sensor assembly.

DIAGNOSTIC CODE 14, OPEN IN SQUIB CIRCUIT

Circuit Description

Squib circuit consists of center air bag sensor assembly, spiral cable and steering wheel pad (squib). Squib causes air bag to deploy when deployment conditions are satisfied. Code 14 is recorded when an open is detected in squib circuit.

Diagnosis

1) Disconnect negative battery cable and wait at least 90 seconds. Remove steering wheel pad. See STEERING WHEEL PAD & SPIRAL CABLE under REMOVAL & INSTALLATION.

2) Disconnect center air bag sensor assembly connector. Measure resistance between terminals D+ and D- on spiral cable side of connector between spiral cable and steering wheel pad. See Fig. 12. If resistance is more than one ohm, go to next step. If resistance is less than one ohm, go to step 5).

3) Disconnect connector between center air bag sensor assembly and spiral cable. Measure resistance between terminals D+ and

D- on spiral cable side of connector between spiral cable and steering wheel pad. If resistance is less than one ohm, go to next step. If resistance is more than one ohm, repair or replace spiral cable.

4) Measure resistance between terminals D+ and D- on center air bag sensor assembly side of connector between center air bag sensor assembly and spiral cable. If resistance is less than one ohm, go to next step. If resistance is more than one ohm, repair or replace harness or connector between center air bag sensor assembly and spiral cable.

5) Reconnect connector to center air bag sensor assembly. Connect connector between center air bag sensor assembly and spiral cable. Using Diagnosis Check Wiring (09843-18020), jump terminals D+ and D- on spiral cable side of connector between spiral cable and steering wheel pad. Connect negative battery cable and wait at least 2 seconds.

6) Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using diagnosis check wiring, jump DLC terminals Tc and E1. See Fig. 9. If Code 14 is displayed, replace center air bag sensor assembly. If Code 14 is not displayed, go to next step.

7) Turn ignition switch to LOCK position. Disconnect negative battery cable, and wait at least 90 seconds. Reconnect steering wheel pad (squib) connector. Connect negative battery cable, and wait at least 2 seconds.

8) Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using diagnosis check wiring, jump DLC terminals Tc and E1. See Fig. 9. If Code 14 is displayed, replace steering wheel pad. If Code 14 is not displayed, system is okay.

DIAGNOSTIC CODE 15, OPEN IN FRONT AIR BAG SENSOR CIRCUIT

Circuit Description

Front air bag sensors (located on left and right side of vehicle) detect deceleration force in a frontal collision. Code 15 is recorded when an open circuit is detected in front air bag sensor circuit.

Diagnosis

1) Disconnect negative battery cable and wait at least 90 seconds. Remove steering wheel pad. See STEERING WHEEL PAD & SPIRAL CABLE under REMOVAL & INSTALLATION.

2) Disconnect center air bag sensor assembly connector. Measure resistance between harness side of center air bag sensor assembly connector terminals +SR and -SR and terminals +SL and -SL. See Fig. 11. If resistance is 755-885 ohms, go to next step. If resistance is not 755-885 ohms, go to step 5).

3) Reconnect center air bag sensor connector. Using Diagnosis Check Wiring (09843-18020), jump terminals D+ and D- on spiral cable side of connector between spiral cable and steering wheel pad. See Fig. 12. Connect negative battery cable, and wait at least 2 seconds.

4) Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using diagnosis check wiring, jump DLC terminals Tc and E1. See Fig. 9. If Code 15 is not present, go to next step. If code is present, replace center air bag sensor assembly.

5) Disconnect front air bag sensor connector. Measure resistance between front air bag sensor terminals +S and +A (755-885 ohms), terminals +S and -S (infinite ohms) and terminals -S and -A (less than one ohm). See Fig. 13. If resistances are not to specification, replace front air bag sensor. If resistances are okay, go to next step.

6) Disconnect center air bag sensor assembly connector. Using diagnosis check wiring, jump center air bag sensor assembly connector terminals +SR and -SR and terminals +SL and -SL. See Fig. 11. Measure resistance between terminals +SR and -SR and terminals +SL and -SL of

harness side connector of front air bag sensor. If resistance is less than one ohm, replace front air bag sensor connector. If resistance is more than one ohm, repair or replace harness or connector between center air bag sensor assembly and front air bag sensor.

DIAGNOSTIC CODE 22, AIR BAG/SRS WARNING LIGHT SYS MALFUNCTION

Circuit Description

AIR BAG/SRS warning light is located in instrument cluster. When SRS is normal, air bag warning light glows for approximately 6 seconds after ignition switch is turned from LOCK to ACC or ON position. Warning light will glow if a malfunction exists in SRS. Code 22 is code for AIR BAG/SRS warning light system malfunction. Code 22 usually cannot be accessed through AIR BAG/SRS warning light because warning light circuit is defective.

Diagnosis (Warning Light Does Not Glow)

1) Remove ECU "B" fuse. Replace fuse as necessary. If fuse is bad, check harness between ECU "B" fuse and AIR BAG/SRS warning light, and between ECU "B" fuse and center air bag sensor assembly. If fuse is okay, check center air bag sensor assembly connector and repair as necessary.

2) If connector is okay, disconnect negative battery cable and wait at least 90 seconds. Remove steering wheel pad. See STEERING WHEEL PAD & SPIRAL CABLE under REMOVAL & INSTALLATION.

3) Disconnect center air bag sensor assembly connector. Reconnect negative battery cable. Measure voltage between center air bag sensor harness side connector terminal LA and ground. See Fig. 11. If battery voltage is present, go to next step. If battery voltage is not present, repair air bag warning light circuit.

4) Disconnect negative battery cable. Reconnect center air bag sensor connector. Reconnect negative battery cable. Turn ignition switch to ACC or ON position, and check operation of AIR BAG/SRS warning light. If AIR BAG/SRS warning light glows, it is okay. If warning light does not glow, check terminal LA of center air bag sensor assembly and electrical connector check mechanism. See Fig. 11. If terminal and connector check mechanism are okay, replace center air bag sensor assembly.

Diagnosis (Warning Light On)

Clear malfunction code stored in memory. Turn ignition switch to LOCK position, and wait at least 2 seconds. Turn ignition switch to ACC or ON position, and wait at least 20 seconds. Using Diagnosis Check Wiring (09843-18020), jump DLC terminals Tc and E1. See Fig. 9. If Code 22 is still present, replace center air bag sensor assembly. If no code is present, see AIR BAG/SRS WARNING LIGHT INTERMITTENT.

DIAGNOSTIC CODE 31, CENTER AIR BAG SENS ASSEMBLY MALFUNCTION

Circuit Description

Center air bag sensor assembly consists of a center air bag sensor, safing sensors, ignition control, drive circuit and diagnosis circuit. It receives signals from air bag sensors and determines whether air bag must be activated. Code 31 is recorded when a malfunction in center air bag sensor assembly is detected.

Diagnosis

1) If a malfunction code other than Code 31 is displayed at same time as Code 31, repair the malfunction indicated by code other than Code 31.

2) If Code 31 is displayed again, clear malfunction Code 41 stored in memory. Turn ignition switch to LOCK position, and wait at least 20 seconds. Turn ignition switch to ACC or ON position, and wait

at least 20 seconds. Repeat this operation at least 5 times. Using Diagnosis Check Wiring (09843-18020), jump DLC terminals Tc and E1. If Code 31 is present, replace center air bag sensor assembly. If Code 31 is not present, see AIR BAG/SRS WARNING LIGHT INTERMITTENT.

DIAGNOSTIC CODE 41, MALFUNCTION STORED IN MEMORY

Circuit Description

If a malfunction occurs in SRS, malfunction Codes 11 to 31 may be displayed. When battery is disconnected after malfunction is repaired, malfunction Codes 11 to 31 will be cleared, but Code 41 will be displayed.

Diagnosis

1) Clear malfunction Code 41 stored in memory. See CLEARING MALFUNCTION CODES under SELF-DIAGNOSTIC SYSTEM under DIAGNOSIS & TESTING. Turn ignition switch to LOCK position, and wait at least 2 seconds. Turn ignition switch to ACC or ON position, and wait at least 20 seconds. If AIR BAG warning light turns off, system is okay.

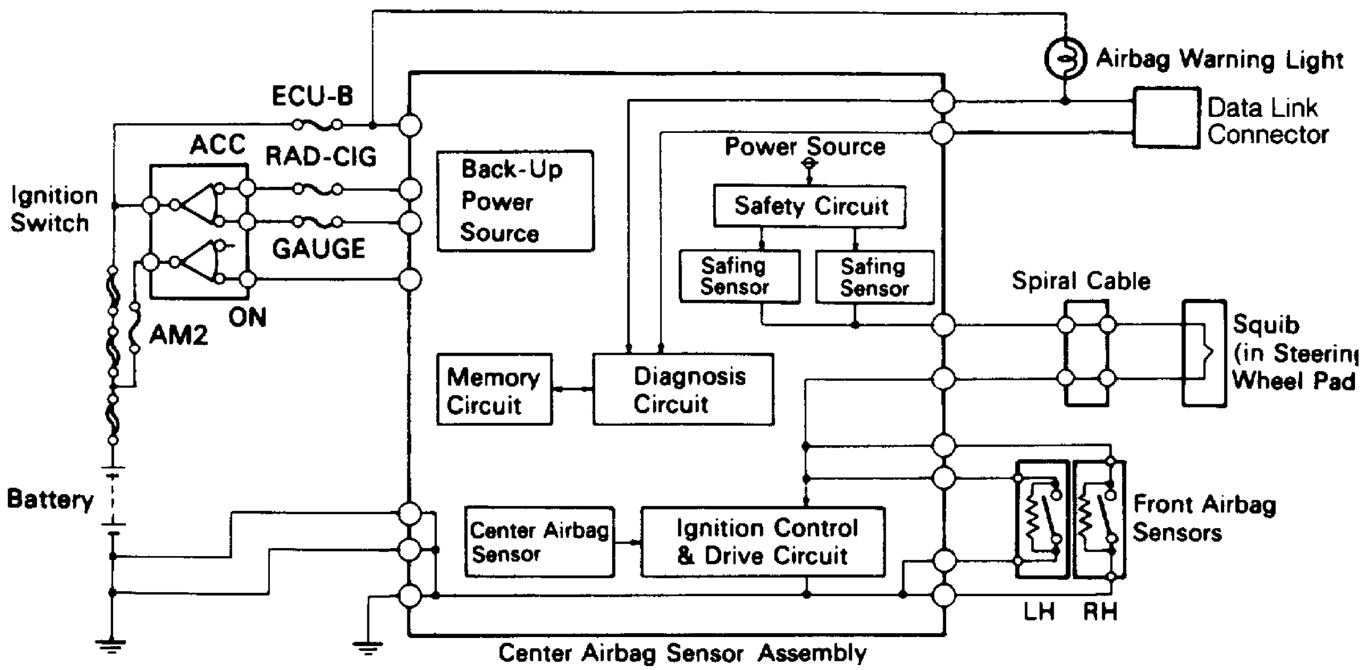
2) If warning light does not go off, turn ignition switch to ACC or ON position and wait at least 20 seconds. Using Diagnosis Check Wiring (09843-18020), jump DLC terminals Tc and E1. See Fig. 9 If Code 41 is present, check harness between ECU "B" fuse and center air bag sensor assembly. If harness is okay, replace center air bag sensor assembly. If Code 41 is not present, perform trouble shooting according to malfunction code displayed.

POST-COLLISION AIR BAG SAFETY INSPECTION

POST-COLLISION AIR BAG SAFETY INSPECTION TABLE

Replace After Deployment	* Air Bag Module * Center Air Bag Sensor Assembly * Front Air Bag Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer’s instructions.

WIRING DIAGRAMS



93H75512
Fig. 14: SRS Wiring Diagram
Courtesy of Toyota Motor Sales, U.S.A., Inc.

1993 ELECTRICAL
Toyota Alternators & Regulators

Celica

WARNING: Before performing service procedures on vehicle, disconnect negative battery cable. Wait at least one minute after disconnecting negative battery cable to avoid accidental air bag deployment on models so equipped.

DESCRIPTION

The alternator is a small, high RPM, high performance type with an internal Integrated Circuit (IC) voltage regulator which controls charging system voltage. A transistor inside IC regulator controls alternator voltage output to maintain a constant voltage. Charging system voltage is maintained within an operating range of 13.2-15.0 volts. See ALTERNATOR REGULATED OUTPUT SPECIFICATIONS table for specific model.

When ignition is turned on, battery voltage flows from alternator terminal "L" through IC regulator to terminal "E" and to ground, causing discharge warning light to come on. When engine starts, alternator RPM increases, which increases alternator voltage output. When alternator output voltage is greater than battery voltage, voltage to recharge battery flows from terminal "B". At the same time voltage at terminal "L" increases and the potential difference between battery and terminal "L" ceases, causing discharge warning light to go off.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION section.

Check all fuses, fusible links, ignition switch, and appropriate relays (if equipped). Check alternator output test. See NO-LOAD TEST under ON-VEHICLE TESTING.

ADJUSTMENTS

NOTE: New Belt refers to a belt which has been used 5 minutes or less on a running engine. Used Belt refers to a belt which has been used more than 5 minutes on a running engine. After installing new belt(s), run engine for at least 5 minutes and recheck tension.

BELT TENSION

BELT TENSION SPECIFICATIONS TABLE (1)

Application	New Belt Lbs. (kg)	Used Belt Lbs. (kg)
1.6L 4A-FE		
Alternator	(2) 160 (73)	(2) 130 (59)
A/C	(2) 160 (73)	(2) 100 (45)
Power Steering	(3) 125 (57)	(2) 80 (36)
2.0L 3S-GTE		
Alternator With A/C	(4) 165 (75)	(2) 115 (52)

Alternator Without A/C ...	(2) 150 (68)	(3) 130 (59)
Power Steering	(3) 125 (57)	(2) 80 (36)
2.2L 5S-FE		
Alternator With A/C	(4) 165 (75)	(4) 110 (50)
Alternator Without A/C ...	(3) 125 (57)	(2) 95 (43)
Power Steering	(3) 125 (57)	(2) 80 (36)

(1) - Measure belt tension with Burroughs (BT-33-73F) tension gauge.
(2) - Plus or minus 20 lbs. (9 kg).
(3) - Plus or minus 25 lbs. (11 kg).
(4) - Plus or minus 10 lbs. (5 kg).

ON-VEHICLE TESTING

NO-LOAD TEST

1) Disconnect battery-to-alternator terminal "B" wire. See Fig. 1. Using an ammeter and voltmeter, connect negative ammeter lead to disconnected alternator terminal "B" wire end, and connect positive ammeter lead to alternator terminal "B".

2) Connect voltmeter positive lead to alternator terminal "B" and negative lead to ground. See Fig. 1.

3) Start engine and increase engine speed to 2000 RPM. Both meters should read within specification. See ALTERNATOR REGULATED OUTPUT SPECIFICATIONS table.

4) If voltage is more than specified, replace IC regulator. If voltage is less than specified, ground "F" (full field) terminal. See Fig. 2. If voltage is more than specified range, replace IC regulator. If voltage is less than specified range, repair or replace alternator.

ALTERNATOR REGULATED OUTPUT SPECIFICATIONS (1)

Application	Amps	(2) Volts
Celica	10 Or Less	(2) 14.0-15.0
Celica	10 Or Less	(3) 13.5-14.3

(1) - Specification given is with engine speed at 2000 RPM.
(2) - Correct reading with temperature at 77°F (25°C).
(3) - Correct reading with temperature at 239°F (115°C).

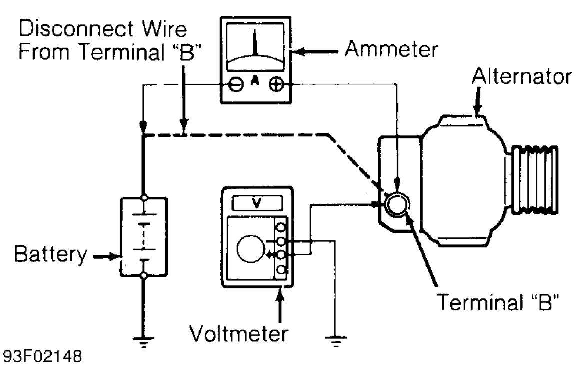


Fig. 1: Testing Charging Circuit
Courtesy of Toyota Motor Sales, U.S.A., Inc.

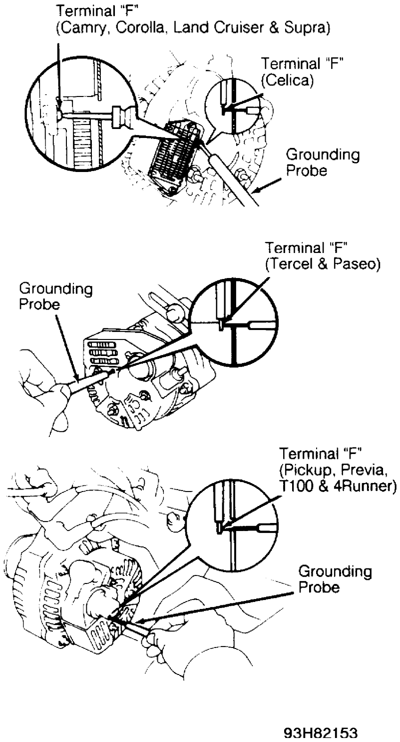


Fig. 2: Testing Alternator Full Field Output
Courtesy of Toyota Motor Sales, U.S.A., Inc.

LOAD TEST

NOTE: If battery is fully charged, disable ignition system. Crank engine for about 15 seconds to partially discharge battery.

1) Connect an ammeter as described in NO-LOAD TEST, step 1). See Fig. 1. Start engine. Turn on high beam headlights and place heater control on HI. Increase engine speed to 2000 RPM.

2) Check ammeter reading. Ammeter should read 30 amps or more. If amperage is less than specified, repair or replace alternator.

ALTERNATOR RATED AMPERE OUTPUT SPECIFICATIONS

Application	(1) Amperes
With A/C	80
Without A/C	70

(1) - Rated output is measured with 12 volts supplied to alternator.

BENCH TESTING

BRUSHES

Brushes should slide smoothly in holders. Replace brushes if damaged or worn. New brush exposed length should be .413" (10.5 mm). Minimum exposed length should be more than .059" (1.5 mm). There are 2 different brush holders used, one has replaceable brushes, the other brush holder is replaced as an assembly. If exposed brush length is less than minimum replace brushes or brush holder assembly. Install new brush springs when replacing brushes.

ROTOR

1) Check rotor for open field windings by using an ohmmeter across slip rings. Rotor resistance should be 2.8-3.0 ohms.

2) Check rotor for shorts to ground by connecting ohmmeter between slip ring and rotor shaft. Ohmmeter should indicate no continuity. Check slip rings for wear or pitting. Standard slip ring diameter is .559"-.567" (14.2-14.4 mm) Turn slip rings on lathe if necessary. Minimum slip ring diameter is .504" (12.8 mm).

STATOR

Connect ohmmeter between 2 stator leads. Continuity should exist between all stator leads. Connect ohmmeter between each stator lead and metal core. Continuity should not exist. If stator does not test as indicated, replace stator.

DIODES

1) With diode/rectifier assembly removed and on bench, contact positive diode plate terminal with one ohmmeter probe. Using other ohmmeter probe, contact each of 3 diode leads in same plate. Note ohmmeter reading. Reverse ohmmeter probes, and repeat tests for all diodes.

2) All diodes should show continuity in one direction and no continuity in opposite direction. If any diode is defective, replace diode/rectifier assembly.

OVERHAUL

DISASSEMBLY

1) Remove dust cover (if equipped). Remove brush holder and IC regulator. Remove diode assembly. Remove rubber insulators or seal plate (if equipped). Use Alternator Pulley Set Nut Wrench Set (SST 09820-63010) to remove alternator pulley.

2) To remove pulley, install SST "A" and "B" to rotor shaft and tighten SST "B" clockwise to 29 ft. lbs. (39 N.m). Place SST "C" securely into a vise. Verify that SST "A" is secured to rotor shaft and install SST "A" and "B" and alternator into SST "C". See Fig. 3. Turn SST "A" in direction shown in Fig. 3 to loosen pulley nut. To prevent damage to rotor shaft, Do Not loosen pulley nut more than 1/2 turn. Remove SST "A" and "B", and alternator from SST "C". Remove SST "A" and "B" from rotor shaft and remove pulley nut and pulley.

3) Remove rectifier and frame using appropriate pulley. Remove alternator washer (if equipped). Remove rotor from drive end frame (stator).

REASSEMBLY

To assembly reverse disassembly procedures. Use Alternator Pulley Set Nut Wrench Set (SST 09820-63010) to install alternator pulley. Place SST "C" securely into a vise. Install SST "A" and "B" and alternator into SST "C". See Fig. 3. Tighten pulley nut to 81 ft. lbs. (110 N.m) in the opposite direction shown in Fig. 3. After completing assembly, verify rotor turns smoothly

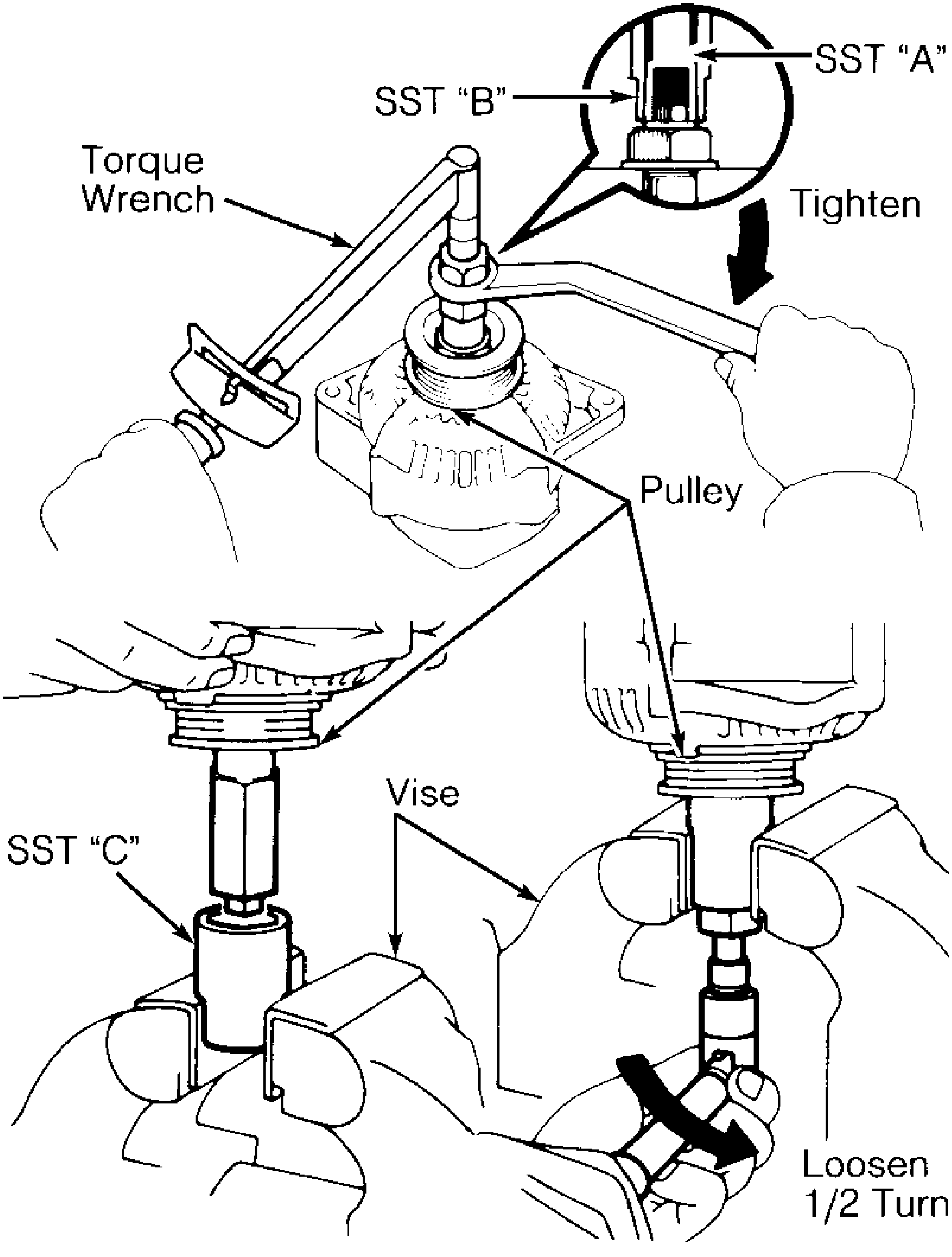


Fig. 3: Removing Alternator Pulley
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: See Figs. 4-7 for exploded views of alternators which are similar.

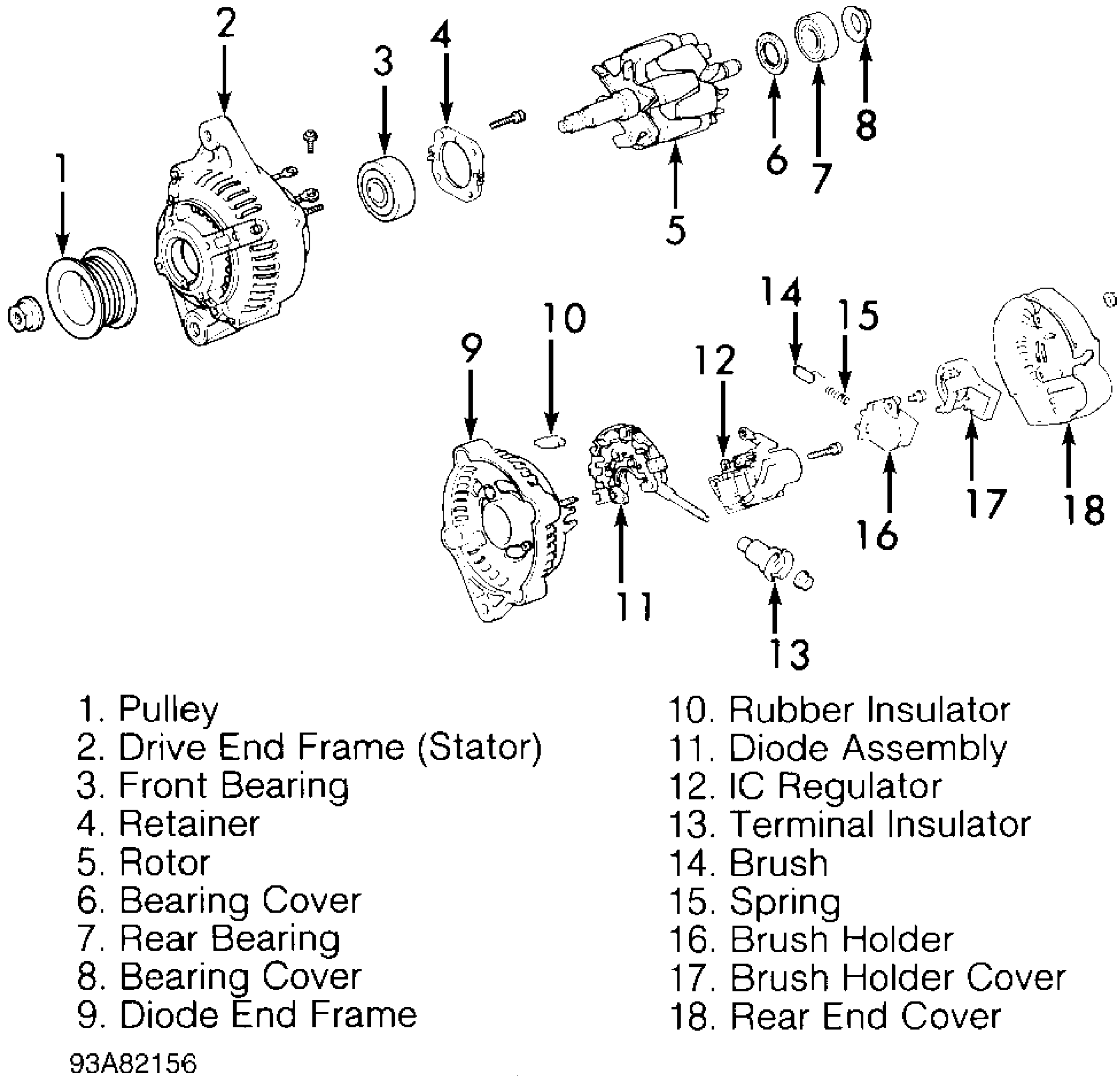
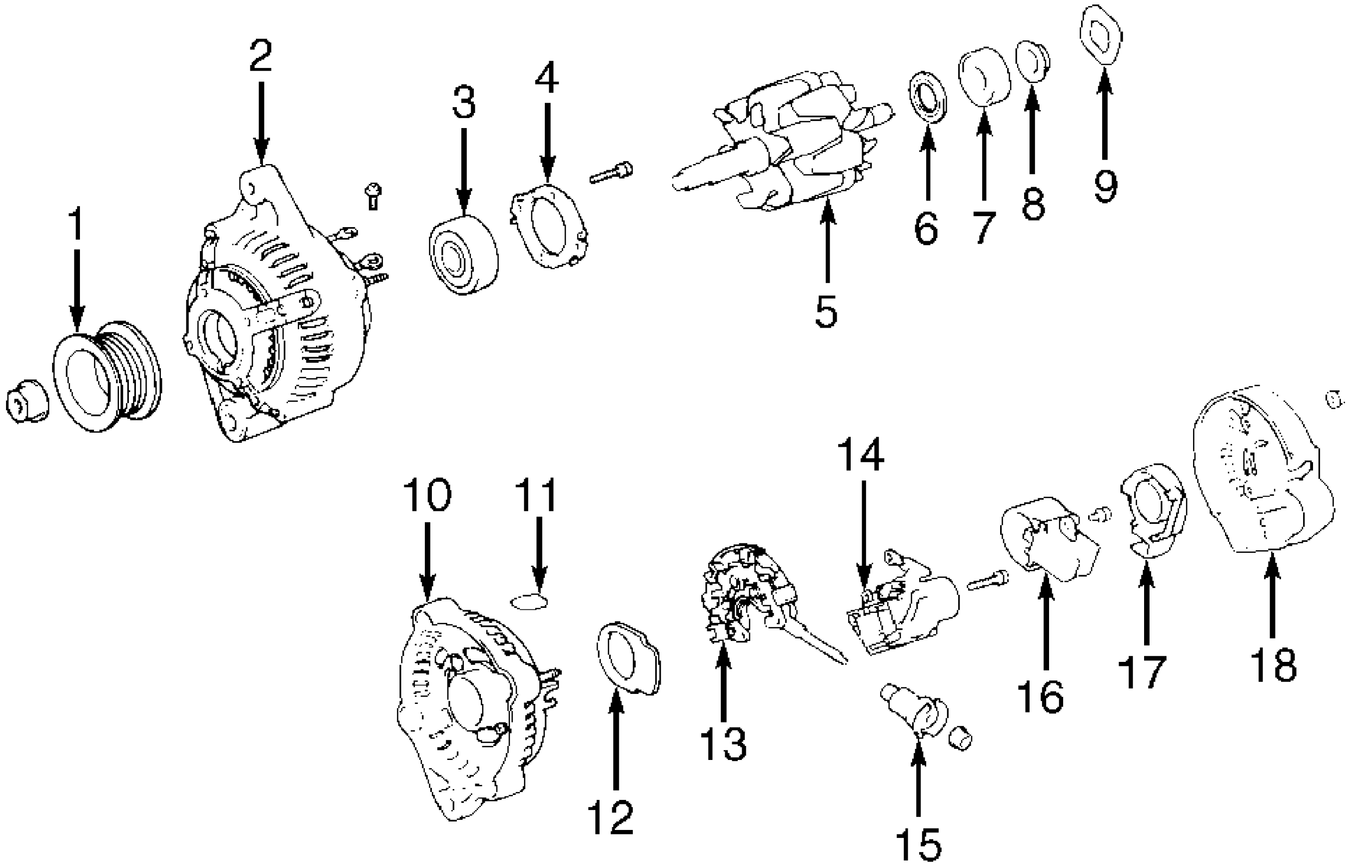


Fig. 4: Exploded View Of Alternator (4A-FE M/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



1. Pulley
2. Drive End Frame (Stator)
3. Front Bearing
4. Retainer
5. Rotor
6. Bearing Cover
7. Rear Bearing
8. Bearing Cover
9. Thrust Washer
10. Diode End Frame
11. Rubber Insulator
12. Seal Plate
13. Diode Assembly
14. IC Regulator
15. Terminal Insulator
16. Brush Holder & Brushes
17. Brush Holder Cover
18. Rear End Cover

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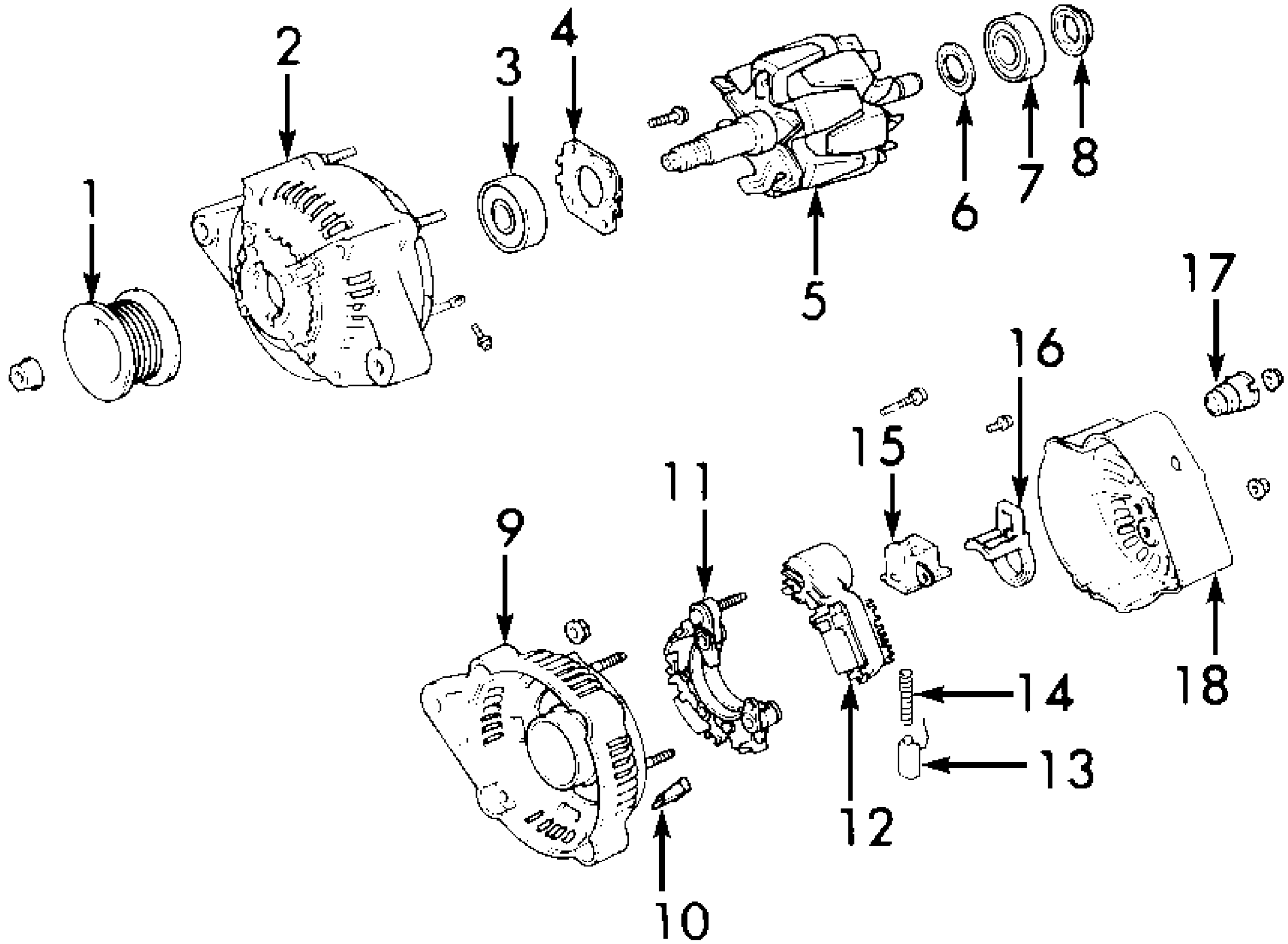
Fig. 5: Exploded View Of Alternator (4A-FE A/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



1. Pulley
2. Drive End Frame (Stator)
3. Front Bearing
4. Retainer
5. Rotor
6. Bearing Cover
7. Rear Bearing
8. Bearing Cover
9. Diode End Frame
10. Rubber Insulator
11. Diode Assembly
12. IC Regulator
13. Brush
14. Spring
15. Brush Holder
16. Brush Holder Cover
17. Terminal Insulator
18. Rear End Frame

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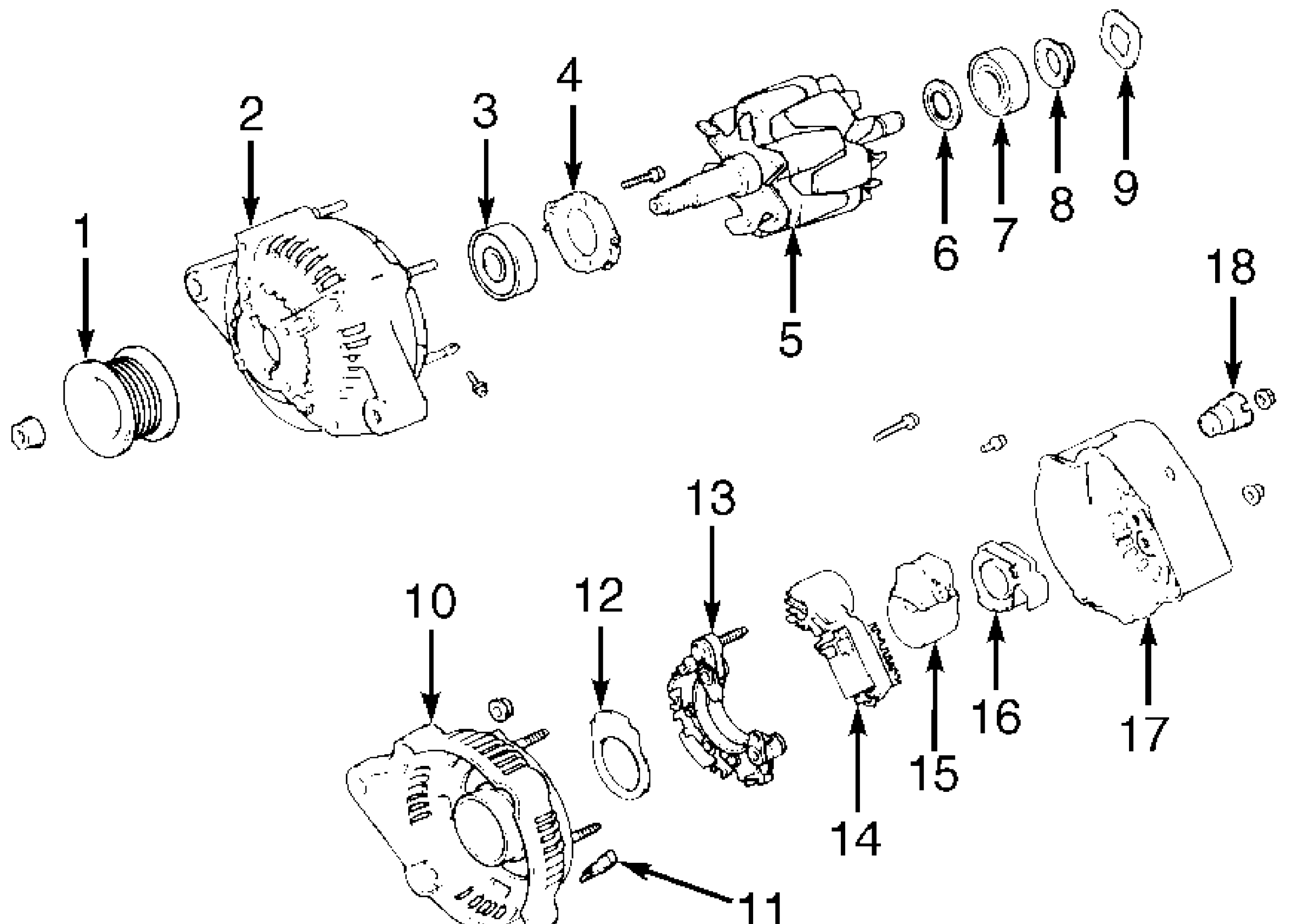
Fig. 6: Exploded View Of Alternator (5S-FE M/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



1. Pulley
2. Drive End Frame (Stator)
3. Front Bearing
4. Retainer
5. Rotor
6. Bearing Cover
7. Rear Bearing
8. Bearing Cover
9. Thrust Washer
10. Diode End Frame
11. Rubber Insulator
12. Seal Plate
13. Diode Assembly
14. IC Regulator
15. Brush Holder & Brushes
16. Brush Holder Cover
17. Rear End Cover
18. Terminal Insulator

93D82159

Fig. 7: Exploded View Of Alternator (3S-GTE & 5S-FE A/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAMS

See appropriate chassis WIRING DIAGRAMS article in WIRING DIAGRAMS section.

ANTI-LOCK BRAKE SYSTEM

1993 Toyota Celica

1993 BRAKES
Toyota Anti-Lock

Celica

DESCRIPTION

The Anti-Lock Brake System (ABS) consists of an ABS Electronic Control Unit (ECU), control relay, actuator, deceleration sensor (All-Trac), and 4 speed sensors. See Fig. 1.

An ABS indicator light is located on the instrument panel. This light comes on for 3 seconds as a bulb test when ignition is first turned on. A primary check is performed after each engine start, and initial vehicle speed exceeds 4 MPH. If brake pedal is pressed before vehicle exceeds 4 MPH, primary check will not occur until brake pedal is released.

NOTE: For more information on brake system, see BRAKE SYSTEM article in this section.

OPERATION

Under normal driving conditions, the ABS functions as a standard brake system. With detection of wheel lock-up, short pedal pulsations occurring in rapid succession will be felt in brake pedal. Pedal pulsation will continue until there is no longer a need for ABS function.

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS in this article.

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

* NEVER open a bleeder valve or loosen a hydraulic line while ABS is pressurized
* NEVER disconnect or reconnect any electrical connectors while ignition is on. Damage to ABS control unit may result.
* DO NOT attempt to bleed hydraulic system without first referring to the appropriate article.
* Only use specially designed brake hoses/lines on ABS-equipped vehicles.
* DO NOT tap on speed sensor components (sensor, sensor rings). Speed rings must be pressed, NOT hammered into hubs. Striking these components can cause demagnetization or a loss of polarization, affecting the accuracy of the speed signal returning to the ABS control unit.
* DO NOT mix tire sizes. Increasing the width, as long as tires remain close to the original diameter, is acceptable. Rolling diameter must be identical for all 4 tires. Some manufacturers recommend tires of the same brand, style and type. Failure to follow this precaution may cause inaccurate wheel speed readings.
* DO NOT contaminate speed sensor components with grease. Only use recommended anti-corrosion coating.
* When speed sensor components have been removed, ALWAYS check sensor-to-ring air gaps when applicable. These specifications can be found in each appropriate article.
* ONLY use recommended brake fluids. DO NOT use silicone brake fluids in an ABS-equipped vehicle.

* When installing transmitting devices (CB's, telephones, etc.) on ABS-equipped vehicles, DO NOT locate the antenna near the ABS control unit (or any control unit).
* Disconnect all on-board computers, when using electric welding equipment.
* DO NOT expose the ABS control unit to prolonged periods of high heat (185°F/85°C for 2 hours is generally considered a maximum limit).

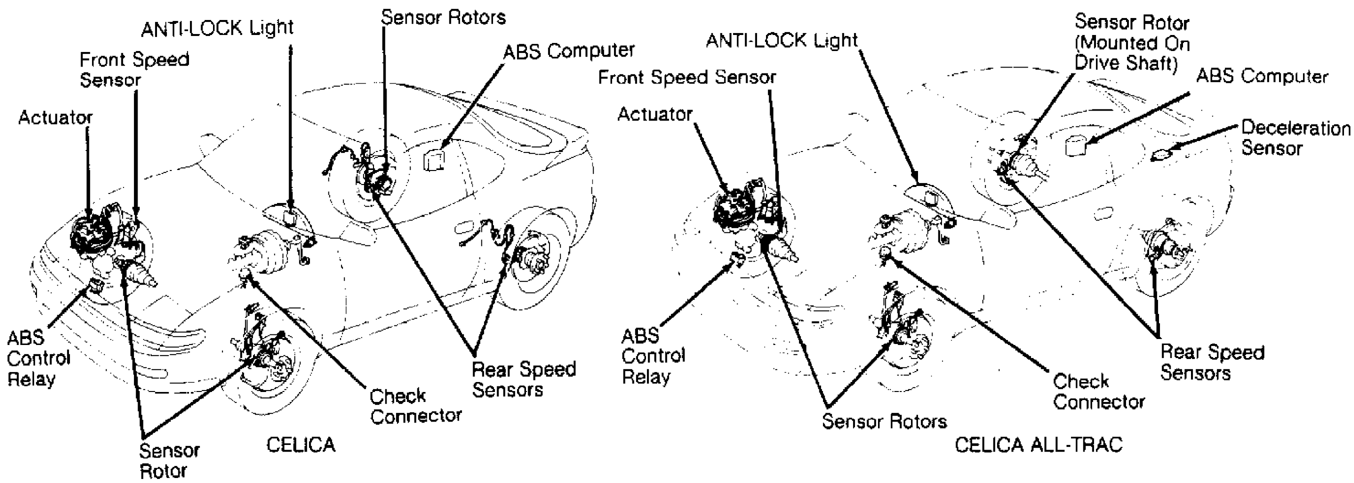


Fig. 1: Locating ABS Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BLEEDING BRAKE SYSTEM

CAUTION: Brake fluid will damage painted surfaces. If brake fluid gets on a painted surface, wipe off immediately and clean with alcohol. Use only DOT 3 brake fluid from a sealed container. Do not mix brake fluid with any other type.

Brake bleeding procedure is same procedure used to bleed non-ABS systems. If master cylinder was rebuilt or reservoir ran empty, bleed master cylinder first. Bleed remaining wheels, starting with brake having longest hydraulic line, working to brake with shortest hydraulic line.

ADJUSTMENTS

MASTER CYLINDER PUSH ROD

1) Install Adjusting Gauge (09737-00010) onto master cylinder, with master cylinder gasket in place. Lower gauge pin until it just touches master cylinder piston. See Fig. 2 (STEP 1). Invert gauge, then install onto power brake unit (STEP 2).

2) Measure clearance between brake unit push rod and head of adjusting gauge. Clearance should be zero. If clearance is not zero, adjust brake unit push rod length until push rod just touches head of gauge pin.

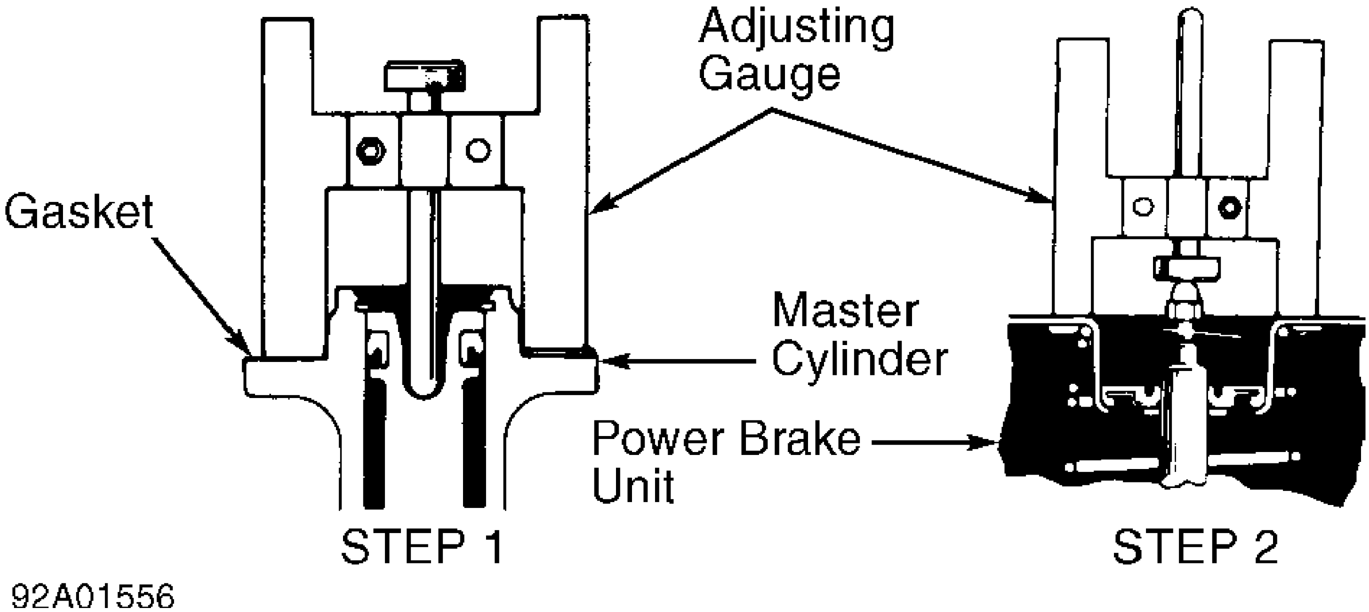


Fig. 2: Adjusting Master Cylinder Push Rod
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BRAKE PEDAL HEIGHT

1) Measure brake pedal height from face of brake pedal pad to rib of floor panel. See Fig. 3. Brake pedal height should be 6.7-7.0" (169-178 mm). To adjust brake pedal height, loosen stoplight switch and lock nut on brake pedal push rod.

2) Adjust pedal height by rotating push rod. After adjusting brake pedal height, tighten lock nut. Adjust stoplight switch. See STOPLIGHT SWITCH. Check and adjust brake pedal free play. See BRAKE PEDAL FREE PLAY.

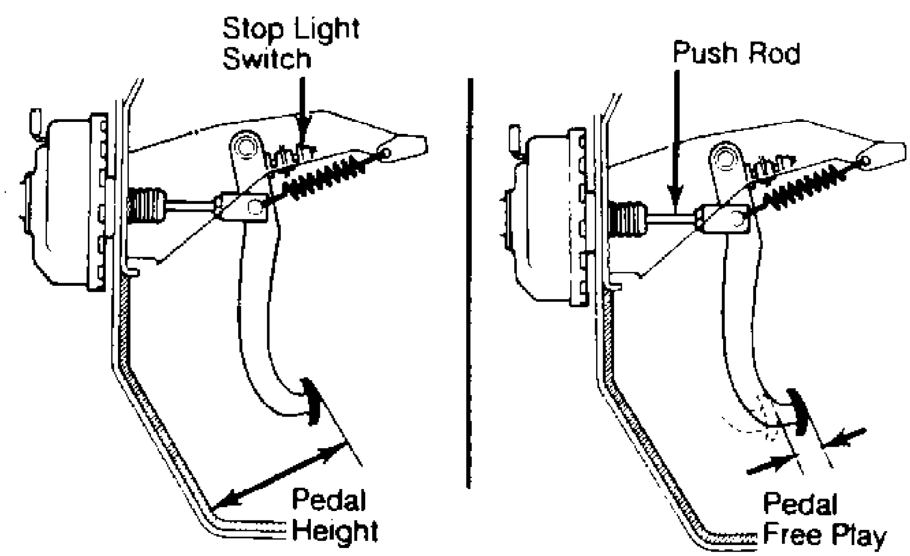


Fig. 3: Measuring Brake Pedal Height & Free Play
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BRAKE PEDAL FREE PLAY

1) Brake pedal free play is distance brake pedal travels (with engine stopped) before encountering resistance. To measure brake pedal free play, press brake pedal several times to exhaust vacuum from power brake unit. Press brake pedal and measure travel until initial resistance occurs.

2) Brake pedal free play should be 0.04-0.24" (1.0-6.0 mm). If free play is not within specification, adjust by rotating push rod. See Fig. 3. After adjusting brake pedal free play, check brake pedal height. See BRAKE PEDAL HEIGHT.

BRAKE PEDAL RESERVE

Measure brake pedal reserve from face of brake pedal pad to asphalt sheet under carpet, with engine running and force of 110 lbs. (50 kg) applied to brake pedal. Minimum brake pedal reserve should be 3.54" (90.0 mm). If distance is less than specified, inspect brake system.

STOPLIGHT SWITCH

Stoplight switch is located above brake pedal. See Fig. 3. To adjust stoplight switch, loosen stoplight switch lock nuts and rotate stoplight switch until clearance between pedal stop and threaded end of switch is 0.02-0.09" (0.5-2.4 mm). Tighten lock nut. Check stoplight operation.

PARKING BRAKE SHOES

Raise and support vehicle. Remove wheels. Temporarily install lug nuts to hold brake rotor in place. Remove hole plug to gain access to adjuster. Turn adjuster to expand shoes until brake rotor locks. Back off adjuster 8 notches. Install hole plug.

PARKING BRAKE

NOTE: Service brake on rear drum brakes and parking brake shoe clearance on rear disc brakes must be adjusted before adjusting parking brake cable.

Parking brake lever stroke should be 4-7 notches (clicks) with a pull force of 44 lbs. (20 kg). To adjust stroke, remove console box. Loosen parking brake cable lock nut. Rotate adjuster nut until parking brake lever travel is as specified. Tighten lock nut. Install console box.

TROUBLE SHOOTING

ANTI-LOCK WARNING LIGHT

ABS Light Comes On

1) Unplug service connector. See Fig. 4. Connect jumper wire between Data Link Connector (DLC) terminals Tc and E1. See Fig. 5. Turn ignition on. If ABS light flashes codes, see DIAGNOSTIC CODES under DIAGNOSIS & TESTING. If ABS light stays on constantly or flashes 4 times per second, go to next step.

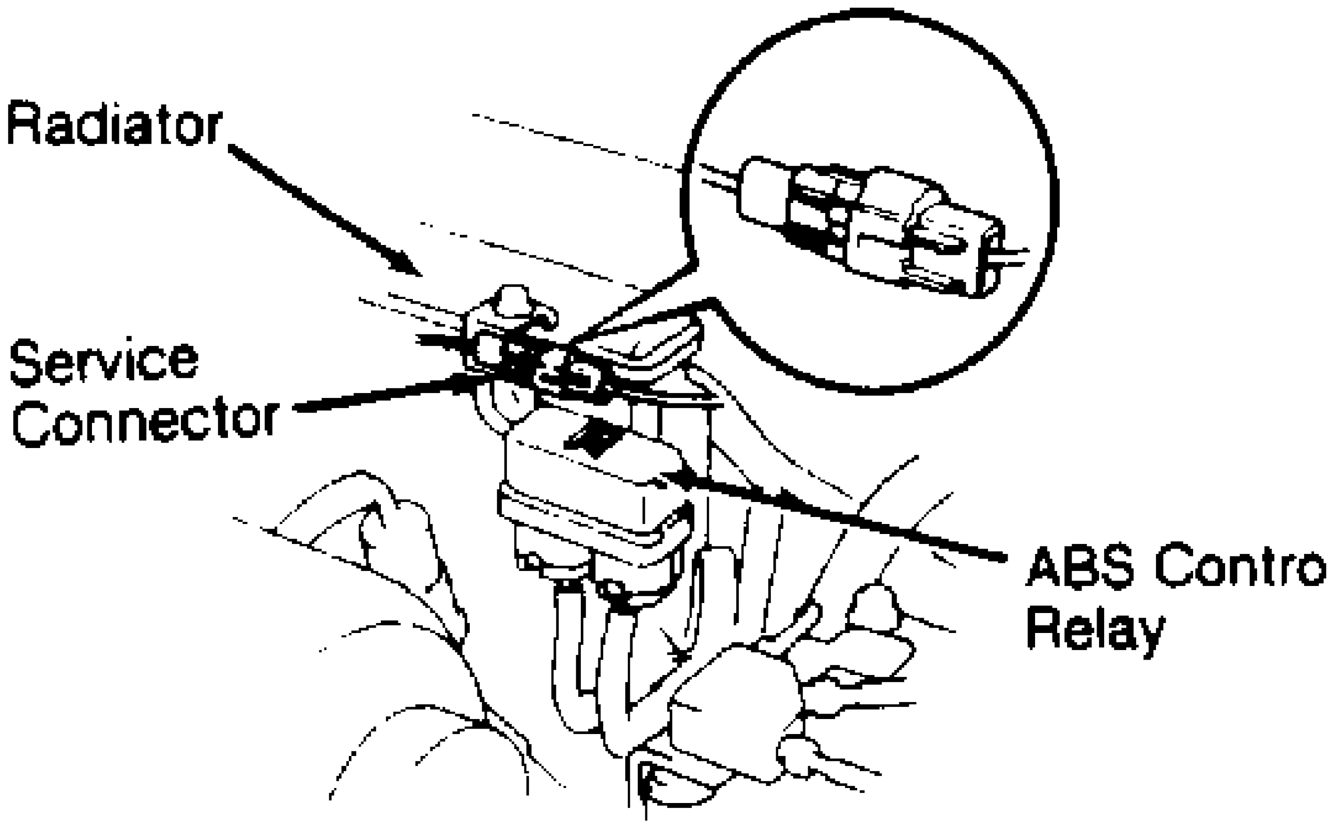


Fig. 4: Locating Service Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

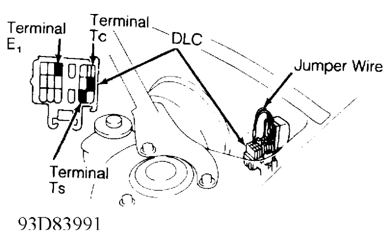


Fig. 5: Locating Data Link Connector DLC
Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Inspect ABS ECU connector for secure attachment and undamaged terminals. Repair connector as necessary. Turn ignition on. Check for battery voltage between ABS ECU connector terminal IG1 (Black/Red wire) and ground. See Fig. 6 or 7. If battery voltage exists, go to next step. If battery voltage does not exist, repair faulty Black/Red wire.

3) Turn ignition off. Unplug ABS ECU connector. Turn ignition on. If ABS light comes on, repair short circuit between 6-pin ABS control relay connector terminal No. 4 (Green wire) and ABS ECU connector terminal "W" (Gray wire). If ABS light does not come on, temporarily substitute known good ABS ECU. Retest system.

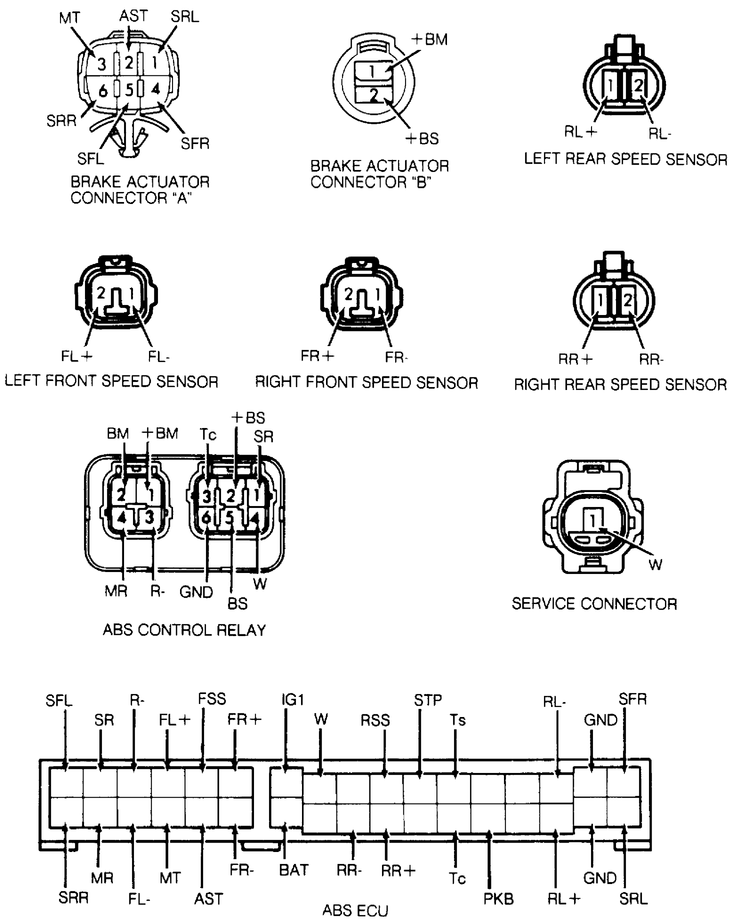


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Fig. 6: Identifying ABS System Connector Terminals (FWD)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

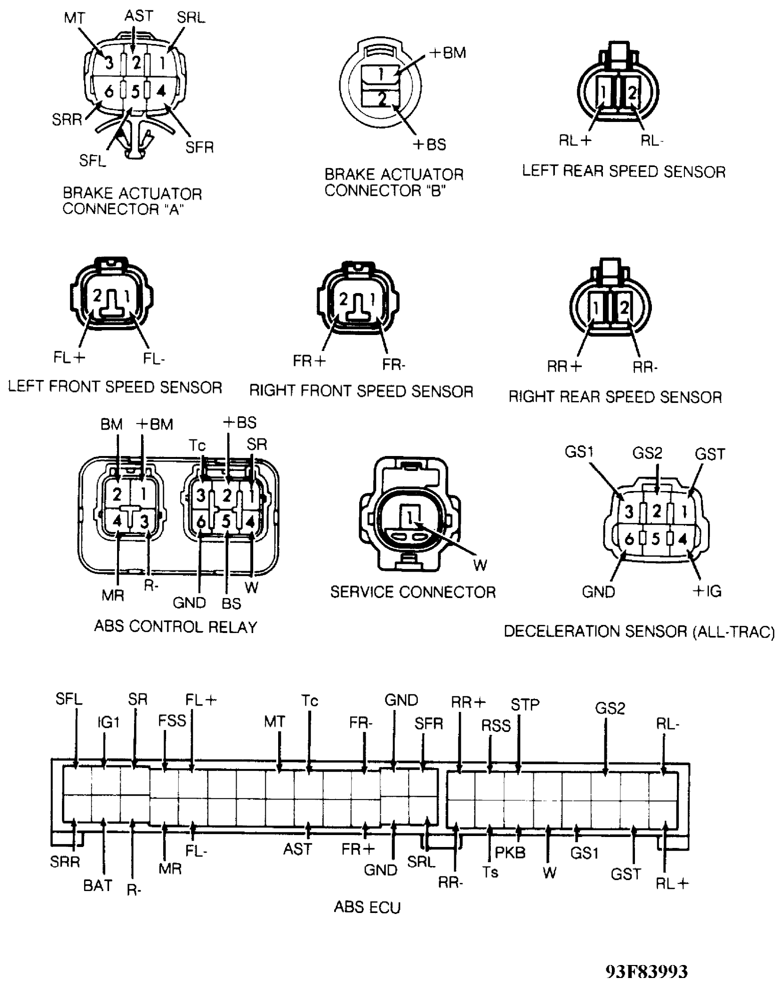


Fig. 7: Identifying ABS System Connector Terminals (All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ABS Light Does Not Come On For 3 Seconds After Ignition Is Turned On

1) Unplug service connector. See Fig. 4. Connect service connector terminal "W" on harness (female) side to ground. Turn ignition on. If ABS light comes on, go to next step. If ABS light does not come on, replace ABS bulb, or repair open circuit between ABS light and service connector terminal "W". See Fig. 6 or 7.

2) Turn ignition off. Unplug ABS ECU connector and ABS control relay connectors. Connect ABS ECU connector terminal "W" (Gray wire) on wire harness side to ground. Turn ignition on. If ABS light comes on, go to next step. If ABS light does not come on, repair open circuit between ABS ECU connector terminal "W" (Gray wire) and ABS light.

3) Turn ignition off. Unplug ABS control relay connector. Check for continuity between 6-pin ABS control relay connector terminals No. 4 and 5. Transpose ohmmeter leads. Again check for continuity.

4) If continuity exists with ohmmeter connected only one way, temporarily substitute known good ABS ECU, then retest system. If continuity exists with ohmmeter connected both ways, or continuity does not exist at all, see ABS CONTROL RELAY under COMPONENT TESTING.

5) If short in ABS control relay diode exists, a malfunction at ABS ECU terminal "W" (Gray wire) will occur. When inspecting terminal, reconnect ABS wiring. Unplug control relay connectors and

DLC. Turn ignition on. If ABS light comes on, ABS ECU terminal "W" (Gray wire) is okay.

ABS Light Comes On Intermittently

Inspect for a short in wiring harness between DLC terminals Tc and E1 or between terminals Ts and E1. See Fig. 5.

SYMPTOM DIAGNOSIS

Symptoms:

* Brakes Pull
* Braking Inefficient
* ABS Operates During Normal Braking
* ABS Operates Just Before Stopping During Normal Braking
* Brake Pedal Pulsates Abnormally With ABS Functioning

Diagnosis

1) Unplug service connector. See Fig. 4. Connect jumper wire between DLC terminals Tc and E1. See Fig. 5. Turn ignition on. If ABS light flashes 2 times per second, go to next step. If ABS light does not flash 2 times per second, refer to DIAGNOSTIC CODES under DIAGNOSIS & TESTING.

2) On FWD vehicles, go to next step. On All-Trac vehicles, enter deceleration sensor diagnostics. See DECELERATION SENSOR DIAGNOSTICS (ALL-TRAC) under DIAGNOSIS & TESTING. If deceleration sensor operation is okay, go to next step. If deceleration sensor operation is not as specified, inspect sensor for proper installation. If sensor is installed properly, replace sensor.

3) Check actuator operation. See ACTUATOR CHECK under DIAGNOSIS & TESTING. If actuator operation is okay, temporarily substitute known good ECU. Retest system. See ABS ECU under REMOVAL & INSTALLATION. If actuator operation is not as specified, replace faulty actuator.

4) Enter speed sensor diagnostics. See SPEED SENSOR DIAGNOSTICS under DIAGNOSIS & TESTING. If speed sensor signal level is okay, go to next step. If speed sensor signal level is not okay, inspect sensor and sensor rotor. Replace as necessary.

5) Inspect all speed sensors for proper installation, and repair as necessary. Clean all foreign material and metal chips from speed sensor tip.

6) Turn ignition off. Unplug ABS ECU connector. Ensure continuity exists between each speed sensor connector and ABS ECU connector. If continuity readings change when wiring harness is twisted or moved, repair faulty wiring harness between speed sensor and ABS ECU connector.

Symptom:

* ABS Works Inefficiently

Diagnosis

1) Unplug service connector. See Fig. 4. Connect jumper wire between DLC terminals Tc and E1. See Fig. 5. Turn ignition on. If ABS light flashes 2 times per second, go to next step. If ABS light does not flash 2 times per second, refer to DIAGNOSTIC CODES under DIAGNOSIS & TESTING.

2) Check for battery voltage between ABS ECU connector terminal STP (Green/White wire) and ground when brake pedal is pressed. If battery voltage does not exist, repair open circuit in stoplight switch or wiring harness. Check actuator operation. See ACTUATOR CHECK under DIAGNOSIS & TESTING.

DIAGNOSIS & TESTING

NOTE: DO NOT start engine when retrieving diagnostic codes.

RETRIEVING CODES

1) Ensure battery voltage is about 12 volts. Turn ignition on. ABS light should come on, then go out after 3 seconds. If warning light does not come on, check fuse, bulb, and wiring harness.

2) With ignition on, unplug DLC. See Fig. 4. Connect jumper wire between DLC terminals Tc and E1. See Fig. 5. If a malfunction is detected, 4 seconds will elapse, then ABS light will begin to flash a 2-digit code. First series of flashes indicates first digit of code. After a 1.5-second pause, second series of flashes indicates second digit of code.

3) If 2 or more codes are stored, there will be a 2.5-second pause between each code. After all codes are displayed, a 4-second pause will occur, then all codes will repeat. If ABS system is functioning properly, ABS light will flash 2 times every second. For code interpretation, see DIAGNOSTIC CODES.

4) After replacing or repairing malfunctioning components, clear diagnostic codes. If a battery cable was disconnected during repairs, all codes will be erased. If battery cable was not disconnected during repairs, see CLEARING CODES.

DIAGNOSTIC CODES

Check suspect components in order given. Checks consist mainly of a visual inspection and continuity tests.

Code 11

Open in solenoid relay circuit. Check actuator wiring harness, ABS control relay (solenoid relay), solenoid relay wiring harness, and solenoid relay connector. See ABS CONTROL RELAY under COMPONENT TESTING.

Code 12

Short in solenoid relay circuit. Check actuator wiring harness, ABS control relay (solenoid relay), solenoid relay wiring harness, and solenoid relay connector. See ABS CONTROL RELAY under COMPONENT TESTING.

Code 13

Open in pump motor relay circuit. Check actuator wiring harness, ABS control relay (pump motor relay), pump motor relay wiring harness, and pump motor relay connector. See ABS CONTROL RELAY under COMPONENT TESTING.

Code 14

Short in pump motor relay circuit. Check actuator wiring harness, ABS control relay (pump motor relay), pump motor relay wiring harness, and pump motor relay connector. See ABS CONTROL RELAY under COMPONENT TESTING.

Code 21

Open or short circuit in solenoid for right front wheel. Check actuator solenoid, wiring harness, and connector. See ACTUATOR CHECK under DIAGNOSIS & TESTING.

Code 22

Open or short circuit in solenoid for left front wheel. Check actuator solenoid, wiring harness, and connector. See ACTUATOR CHECK under DIAGNOSIS & TESTING.

Code 23
Open or short circuit in solenoid for right rear wheel. Check actuator solenoid, wiring harness, and connector. See ACTUATOR CHECK under DIAGNOSIS & TESTING.

Code 24
Open or short circuit in solenoid for left rear wheel. Check actuator solenoid, wiring harness, and connector. See ACTUATOR CHECK under DIAGNOSIS & TESTING.

Code 31
Malfunction of right front wheel speed sensor signal. Check speed sensor, sensor rotor, wiring harness, and connector. See SPEED SENSOR DIAGNOSTICS under DIAGNOSIS & TESTING.

Code 32
Malfunction of left front wheel speed sensor signal. Check speed sensor, sensor rotor, wiring harness, and connector. See SPEED SENSOR DIAGNOSTICS under DIAGNOSIS & TESTING.

Code 33
Malfunction of right rear wheel speed sensor signal. Check speed sensor, sensor rotor, wiring harness, and connector. See SPEED SENSOR DIAGNOSTICS under DIAGNOSIS & TESTING.

Code 34
Malfunction of left rear wheel speed sensor signal. Check speed sensor, sensor rotor, wiring harness, and connector. See SPEED SENSOR DIAGNOSTICS under DIAGNOSIS & TESTING.

Code 35
Open in left front or right rear wheel speed sensor circuit. Check speed sensor, sensor rotor, wiring harness, and connector. See SPEED SENSOR DIAGNOSTICS under DIAGNOSIS & TESTING.

Code 36
Open in right front or left rear wheel speed sensor circuit. Check speed sensor, sensor rotor, wiring harness, and connector. See SPEED SENSOR DIAGNOSTICS under DIAGNOSIS & TESTING.

Code 37 (FWD)
Wrong rear axle hubs on both sides. Check rear sensor rotors.

Code 41
Battery voltage is less than 9.5 volts or more than 16.2 volts. Check battery and voltage regulator.

Code 43 (All-Trac)
Deceleration sensor malfunction. Check deceleration sensor, deceleration sensor installation, wiring harness, and connector. See DECELERATION SENSOR DIAGNOSTICS (ALL-TRAC) under DIAGNOSIS & TESTING.

Code 44 (All-Trac)
Open or short circuit in deceleration sensor. Check deceleration sensor, deceleration sensor installation, wiring harness, and connector. See DECELERATION SENSOR DIAGNOSTICS (ALL-TRAC) under DIAGNOSIS & TESTING.

Code 51
Actuator pump motor is locked or pump motor circuit open. Check pump motor, ABS control relay (pump motor relay), vehicle

battery, actuator wiring harness, connectors, actuator pump motor circuit, and actuator ground bolt. See ACTUATOR CHECK under DIAGNOSIS & TESTING. See ABS CONTROL RELAY under COMPONENT TESTING.

ABS Light Always On

Malfunction of ABS ECU. Inspect ABS ECU connector for proper installation and undamaged terminals. Repair as necessary. If connector is okay, temporarily substitute known good ABS ECU. Retest system.

CLEARING CODES

Turn ignition on. Connect jumper wire between DLC terminals Tc and E1. See Fig. 5. With vehicle stopped, press brake pedal 8 or more times within 3 seconds. Codes will be erased. Turn ignition on. Verify ABS light goes out after 3 seconds. Verify ABS light flashes a normal code. See RETRIEVING CODES under DIAGNOSIS & TESTING.

ACTUATOR CHECK

1) Turn ignition off. Unplug actuator and control relay electrical connectors. See Fig. 6 or 7. Connect Test Harness (09990-00200) and Actuator Checker (09990-00150) to vehicle according to manufacturer's instructions.

2) Place Sheet "A" (09990-00163) onto actuator checker. Start and idle engine. Set SELECTOR switch to FRONT RH position. Press and hold MOTOR switch for a few seconds. Press and hold brake pedal.

NOTE: DO NOT press POWER switch for longer than 10 seconds.

3) Press POWER switch. When POWER switch is pressed, brake pedal should not go down. Release POWER switch. Brake pedal should go down. Press and hold MOTOR switch for a few seconds. Brake pedal should return. Release MOTOR switch. Release brake pedal.

4) Press and hold MOTOR switch for a few seconds. Release MOTOR switch. Press and hold brake pedal for about 15 seconds. As brake pedal is held, press MOTOR switch for a few seconds. Brake pedal should not pulsate.

5) Repeat steps 2) through 4) for FRONT LH, REAR RH, and REAR LH by setting SELECTOR switch to appropriate positions. When checking REAR LH position, press REAR LH switch instead of POWER switch.

6) After checking remaining wheels, press and hold MOTOR switch for a few seconds. Remove test harnesses and actuator checker.

7) If any actuator solenoid does not operate as specified, measure actuator solenoid resistance. Measure resistance of each actuator solenoid between 6-pin connector terminal No. 4 (White wire) and appropriate actuator solenoid connector. Resistance should be 1.2 ohms.

8) Replace actuator if resistance of any actuator solenoid is not as specified. Reconnect wiring harnesses to actuator and control relay. Clear diagnostic codes. See CLEARING CODES.

SPEED SENSOR DIAGNOSTICS

NOTE: While diagnosing speed sensors, brake system functions as a conventional system.

1) Ensure battery voltage is about 12 volts. Turn ignition on. ABS light should come on, then go out after about 3 seconds. If ABS light does not come on, check fuse, bulb, and wiring harness.

2) Turn ignition off. DO NOT remove short pin from DLC. Connect DLC terminals Ts and E1. See Fig. 5. Engage parking brake. Start engine. Verify ABS light flashes 4 times per second.

3) Drive vehicle straight ahead at speed greater than 50 MPH. Verify ABS light flashes while vehicle is traveling at less than 28 MPH. ABS light will stop flashing at more than 28 MPH, and will then flash once at 50 MPH. If ABS light flashes as described, check is complete. If ABS light does not flash as indicated, stop vehicle.

4) Connect jumper between DLC terminals Tc and E1. See Fig. 5. If a malfunction is detected, 4 seconds will elapse, then ABS light will begin to flash a 2-digit code. First series of flashes indicates first digit of code. After a 1.5 second pause, second series of flashes indicates second digit of code.

5) If 2 or more codes are stored, there will be a 2.5-second pause between each code. After all codes are flashed, there will be a 4-second pause, then all codes will repeat.

6) Record diagnostic codes. Turn ignition off. Repair as necessary. See SPEED SENSOR DIAGNOSTIC CODES. Remove jumper wire from DLC. Clear diagnostic codes. See CLEARING CODES.

SPEED SENSOR DIAGNOSTIC CODES

Code 71

Low voltage of right front speed sensor signal. Check right front speed sensor and sensor installation.

Code 72

Low voltage of left front speed sensor signal. Check left front speed sensor and sensor installation.

Code 73

Low voltage of right rear speed sensor signal. Check right rear speed sensor and sensor installation.

Code 74

Low voltage of left rear speed sensor signal. Check left rear speed sensor and sensor installation.

Code 75

Abnormal signal from right front speed sensor. Check right front sensor rotor.

Code 76

Abnormal signal from left front speed sensor. Check right front sensor rotor.

Code 77

Abnormal signal from right rear speed sensor. Check right rear sensor rotor.

Code 78

Abnormal signal from left rear speed sensor. Check left rear sensor rotor.

ABS Light Blinks 4 Times A Second

All speed sensors and sensor rotors are normal.

DECELERATION SENSOR DIAGNOSTICS (ALL-TRAC)

NOTE: While diagnosing deceleration sensor, brake system functions as a conventional system.

System Inspection

1) Ensure battery voltage is about 12 volts. Turn ignition on. ABS light should come on, then go out after 3 seconds. If ABS light does not come on, check fuse, bulb, and wiring harness.

2) Turn ignition off. Connect jumper wire between DLC terminals E1 and Ts. See Fig. 5. Engage parking brake. Start engine. DO NOT press brake pedal.

3) If ABS flashes 4 times per second, inspect sensor detection point and sensor operation. If ABS light does not flash, inspect parking brake switch, stoplight switch, DLC Ts terminal, deceleration sensor installation, and ABS ECU.

Sensor Detection Point

1) Raise rear of vehicle 26-28", measured from bottom of rear bumper to ground. Verify ABS light is off. Completely lower rear of vehicle. As vehicle is lowered, ABS light will start flashing. Raise front of vehicle 21-24", measured from lower body or spoiler edge of vehicle to ground.

2) Verify ABS light is off. As vehicle is lowered, ABS light will start flashing. If ABS light stays on steadily, inspect deceleration sensor installation. If sensor installation is okay, replace deceleration sensor.

Sensor Operation

1) Drive vehicle straight ahead at speed greater than 50 MPH. Verify ABS light flashes while vehicle is traveling at less than 28 MPH. ABS light will stop flashing at more than 28 MPH, and then will flash once at 50 MPH. If ABS light flashes as described, check is complete. If ABS light does not flash as indicated, stop vehicle.

2) Connect jumper between DLC terminals Tc and E1 (do not disconnect Ts and E1) of DLC. See Fig. 5. If a malfunction is detected, 4 seconds will elapse, then ABS light will begin to flash a 2-digit code. First series of flashes indicates first digit of code. After a 1.5-second pause, second series of flashes indicates second digit of code.

3) If 2 or more codes are stored, there will be a 2.5-second pause between each code. After all codes are flashed, there will be a 4-second pause, then all codes will repeat.

4) Record diagnostic codes. Turn ignition off. Repair as necessary. See DIAGNOSTIC CODES. Remove jumper wires from DLC. Clear diagnostic codes. See CLEARING CODES.

COMPONENT TESTING

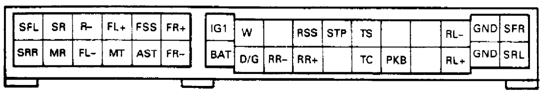
ABS ECU Wiring Harness

1) Remove ABS ECU, leaving connectors attached. See ABS ECU under REMOVAL & INSTALLATION. Backprobe each terminal to measure voltage or resistance at each terminal, as specified in table. See STEP 1

See Fig. 8 or 9 and 10. If circuit values are not as specified, check and repair or replace indicated component.

2) Unplug ABS ECU connectors. Measure resistance on wire harness side of ABS ECU connector terminals, as specified in table. See STEP 2

See Fig. 8 or 10. If circuit values are not as specified, check and repair or replace indicated component.



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Tester Connection	Check Item	Condition	Specified Value	Trouble Part
SFR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
RL-	Continuity	IG switch off	Continuity	ABS ECU
TS	Voltage	IG switch on and check connector Ts-E, not connected	Battery voltage	
		IG switch on and check connector Ts-E, connected	About 0V	
STP	Voltage	IG switch off and brake pedal depressed	Battery voltage	Stoplight switch Stoplight
	Continuity	IG switch off and brake pedal returned	Continuity	
RSS	Continuity	IG switch off	Continuity	ABS ECU
W	Voltage	IG switch on and "ABS" warning light goes on	About 0V	ABS ECU "ABS" warning light
		IG switch on and "ABS" warning light goes off	Battery voltage	
IG1	Voltage	IG switch on	Battery voltage	ECU-IG Fuse
SRL	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
GND	Continuity	IG switch off	Continuity	Wiring harness
PKB	Voltage	IG switch on and PKB lever pulled	About 0V	Parking brake switch Level warning switch
		IG switch on and PKB lever returned	Battery voltage	
TC	Voltage	IG switch on and check connector Tc-E, not connected	Battery voltage	ABS ECU
		IG switch on and check connector Tc-E, connected	About 0V	
RR-	Continuity	IG switch off	Continuity	
D/G	Voltage	IG switch on and check connector Ts-E, not connected	About 0V	
BAT	Voltage	IG switch off	Battery voltage	DOME Fuse
FSS	Continuity	IG switch off	Continuity	ABS ECU
R-	Continuity	IG switch off	Continuity	
SR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	ABS ECU
		IG switch on and "ABS" warning light goes off	Battery voltage	
SFL	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
FR-	Continuity	IG switch off	Continuity	ABS ECU
AST	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
FL-	Continuity	IG switch off	Continuity	ABS ECU
SRR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	

STEP 1 - VOLTAGE & CONTINUITY CHECKS WITH CONNECTORS ATTACHED

Tester Connection	Check Item	Specified Value	Trouble Part	Tester Connection	Check Item	Specified Value	Trouble Part
SFR ↔ AST	Resistance	About 6 Ω	Actuator	SR ↔ R-	Resistance	60 ~ 100 Ω	Control relay
SRL ↔ AST	Resistance	About 6 Ω	Actuator	SFL ↔ AST	Resistance	About 6 Ω	Actuator
RL+ ↔ RL-	Resistance	1.1 ~ 1.7 kΩ	Rear LH speed sensor	AST ↔ Body ground	Resistance	About 5 Ω	Actuator
RR+ ↔ RR-	Resistance	1.1 ~ 1.7 kΩ	Rear RH speed sensor	MT ↔ Body ground	Continuity	Continuity	Actuator
FR+ ↔ FR-	Resistance	0.8 ~ 1.3 kΩ	Front RH speed sensor	MR ↔ R-	Resistance	50 ~ 80 Ω	Control relay
FL+ ↔ FL-	Resistance	0.8 ~ 1.3 kΩ	Front LH speed sensor	SRR ↔ AST	Resistance	About 6 Ω	Actuator

STEP 2 - RESISTANCE CHECKS WITH CONNECTORS UNPLUGGED

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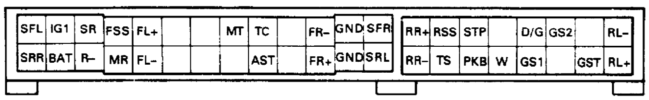
Fig. 8: Testing Specifications Table For ABS ECU Wiring Harness - FWD
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Tester Connection	Check Item	Condition	Specified Value	Trouble Part
RL-	Continuity	IG switch off	Continuity	ABS ECU
GS2	Voltage	IG switch on	4 ~ 6 V	Deceleration Sensor
D/G	Voltage	IG switch on and check connector Ts-E₁ not connected	About 0V	ABS ECU
STP	Voltage	IG switch off and brake pedal depressed	Battery voltage	Stoplight switch Stoplight
	Continuity	IG switch off and brake pedal returned	Continuity	
RSS	Continuity	IG switch off	Continuity	ABS ECU
GS1	Voltage	IG switch on	4 ~ 6 V	Deceleration Sensor
W	Voltage	IG switch on and "ABS" warning light goes on	About 0V	ABS ECU "ABS" warning light
		IG switch on and "ABS" warning light goes off	Battery voltage	
PKB	Voltage	IG switch on and PKB lever pulled	About 0V	Parking brake switch Level warning switch
		IG switch on and PKB lever returned	Battery voltage	
TS	Voltage	IG switch on and check connector Ts-E₁ not connected	Battery voltage	ABS ECU
		IG switch on and check connector Ts-E₁ connected	About 0V	
RR-	Continuity	IG switch off	Continuity	
SFR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
GND	Continuity	IG switch off	Continuity	Wiring harness
FR-	Continuity	IG switch off	Continuity	ABS ECU
TC	Voltage	IG switch on and check connector Tc-E₁ not connected	Battery voltage	
		IG switch on and check connector Tc-E₁ connected	About 0V	
FSS	Continuity	IG switch off	Continuity	
SR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	
		IG switch on and "ABS" warning light goes off	Battery voltage	
IG1	Voltage	IG switch on	Battery voltage	ECU-IG Fuse

STEP 1 - VOLTAGE & CONTINUITY CHECKS WITH CONNECTORS ATTACHED

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Fig. 9: Testing Specs Table For ABS ECU Wir Harness All-Trac (1 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Tester Connection	Check Item	Condition	Specified Value	Trouble Part
SFL	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	
SRL	Voltage	IG switch on and "ABS" warning light goes on	About 0V	
		IG switch on and "ABS" warning light goes off	Battery voltage	
AST	Voltage	IG switch on and "ABS" warning light goes on	About 0V	
		IG switch on and "ABS" warning light goes off	Battery voltage	
FL-	Continuity	IG switch off	Continuity	ABS ECU
R-	Continuity	IG switch off	Continuity	
BAT	Voltage	IG switch off	Battery voltage	DOME Fuse
SRR	Voltage	IG switch on and "ABS" warning light goes on	About 0V	Actuator
		IG switch on and "ABS" warning light goes off	Battery voltage	

STEP 1 - VOLTAGE & CONTINUITY CHECKS WITH CONNECTORS ATTACHED (Cont.)

Tester Connection	Check Item	Specified Value	Trouble Part	Tester Connection	Check Item	Specified Value	Trouble Part
RR+ ↔ RR-	Resistance	1.1 ~ 1.7 kΩ	Rear RH speed sensor	SFL ↔ AST	Resistance	About 6 Ω	Actuator
RL+ ↔ RL-	Resistance	1.1 ~ 1.7 kΩ	Rear LH speed sensor	SRL ↔ AST	Resistance	About 6 Ω	Actuator
SFR ↔ AST	Resistance	About 6 Ω	Actuator	FR+ ↔ FR-	Resistance	0.8 ~ 1.3 kΩ	Front RH speed sensor
MT ↔ Body ground	Continuity	Continuity	Actuator	AST ↔ Body ground	Resistance	About 5 Ω	Actuator
FL+ ↔ FL-	Resistance	0.8 ~ 1.3 kΩ	Front LH speed sensor	MR ↔ R-	Resistance	50 ~ 80 Ω	Control relay
SR ↔ R-	Resistance	60 ~ 100 Ω	Control relay	SRR ↔ AST	Resistance	About 6 Ω	Actuator

STEP 2 - RESISTANCE CHECKS WITH CONNECTORS UNPLUGGED

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Fig. 10: Testing Specs Table For ABS ECU Wir Harness All-Trac(2 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ABS Control Relay

1) Remove ABS control relay. See Fig. 1. Using ohmmeter capable of testing diodes, check for continuity between ABS control relay connector terminals A3 and A4. See Fig. 11. Transpose ohmmeter leads. Repeat measurement.

2) If continuity exists or circuit is open for both measurements, actuator diode is defective. Repair or replace relay, then go to next step. If continuity exists for only one measurement, temporarily substitute known good ABS ECU. Retest system.

3) Continuity should exist between terminals A3 and A6, between terminals A3 and A5, and between terminals A5 and A6.

4) Continuity should not exist between terminals A2 and A3, or between terminals B1 and B2.

5) Using fused jumper wire, connect positive battery terminal to terminal B3. Connect negative battery terminal to terminal B4. Continuity should not exist between terminals B1 and B2.

6) Using fused jumper wire, connect positive battery terminal to terminal B3. Connect negative battery terminal to terminal A1. Continuity should exist between terminals A2 and A5. Continuity should not exist between terminals A3 and A5. Replace relay if operation is not as specified.

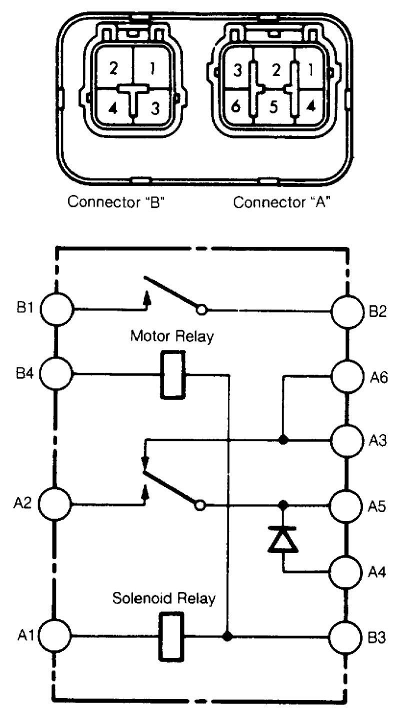

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Fig. 11: Identifying ABS Control Relay Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Front Speed Sensors

1) Remove harness connector clamp. Unplug connector from front wheel speed sensor. Measure resistance between speed sensor terminals. Resistance should be 800-1300 ohms.

2) Measure insulation resistance between each sensor terminal and sensor body. Continuity should not exist. If resistance and continuity are not as specified, replace speed sensor.

Rear Speed Sensors

1) Remove rear seat cushion. Unplug wheel speed sensor

connector. Measure resistance between speed sensor terminals. On All-Trac models, resistance should be 800-1500 ohms. On FWD models, resistance should be 1100-1700 ohms.

2) Measure insulation resistance between each sensor terminal and sensor body. Continuity should not exist. If resistance and continuity are not as specified, replace speed sensor.

Sensor Rotors

Visually inspect sensor rotor serrations for scratches, cracks, missing teeth, or warping. Replace front drive shaft or rear hub as necessary if rotor is damaged.

REMOVAL & INSTALLATION

WARNING: Hydraulic system may be under high pressure. Use caution when opening hydraulic system.

ABS ECU

Removal & Installation

1) Turn ignition off. Disconnect negative battery cable. ABS ECU is located on right side of luggage compartment (left side on convertible models). Remove screws attaching ABS ECU to vehicle.

2) Remove wire harness from ECU bracket clamp. Unplug ABS ECU connector. Remove ABS ECU from vehicle. To install, reverse removal procedure.

ABS CONTROL RELAY

Removal & Installation

Remove connector from wire harness clamp. Remove relay bolt. Remove relay from vehicle. See Fig. 1. To install, reverse removal procedure.

ACTUATOR

Removal & Installation

Turn ignition off. Remove actuator cover. Unplug electrical connectors. Remove cover bracket and bolt. Disconnect brake lines. Remove actuator from bracket. To install, reverse removal procedure. Bleed brake system. See BLEEDING BRAKE SYSTEM.

FRONT SENSOR ROTOR

Front speed sensor rotor is an integral part of outboard CV joint. See appropriate DRIVE AXLES article in the POWERTRAIN section.

FRONT WHEEL SPEED SENSORS

See Fig. 12.

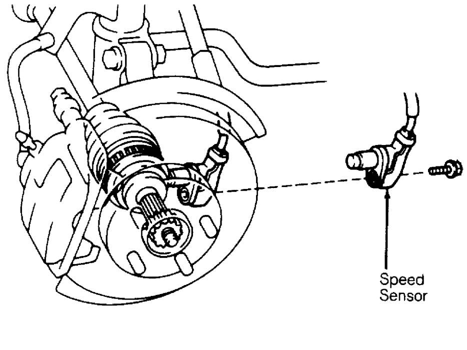

Fig. 12: Removing & Installing Front Speed Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REAR SENSOR ROTOR (ALL TRAC)

Rear speed sensor rotor is an integral part of outboard CV joint. See appropriate DRIVE AXLES article in the POWERTRAIN section.

REAR SENSOR ROTOR (FWD)

Removal & Installation

Rear speed sensor rotor is an integral part of rear hub. Remove rear hub. See SUSPENSION - REAR article in the SUSPENSION section.

REAR WHEEL SPEED SENSORS

See Fig. 13.

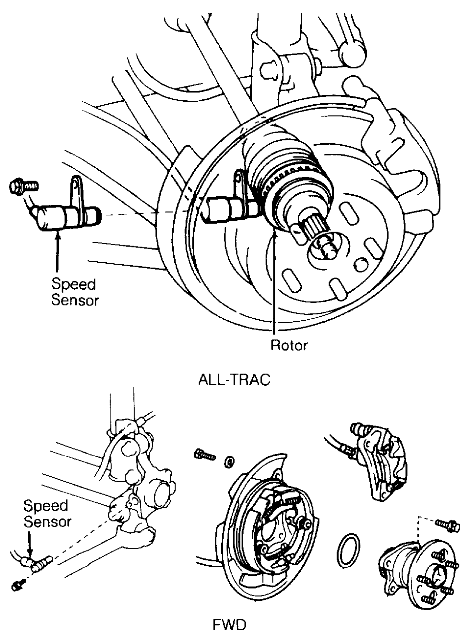

Fig. 13: Removing & Installing Rear Speed Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OVERHAUL

DO NOT attempt to overhaul or disassemble actuator assembly. If actuator is defective, replace entire assembly.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Brakeline Nuts	11 (15)
Power Steering Reservoir Tank Mounting Bolts	14 (19)
Wheel Lug Nuts	76 (103)
3-Way Union Bolt	12 (16)
	INCH Lbs. (N.m)
ABS ECU Mounting Screws	27 (3)
Actuator Mounting Nuts	44 (5)
Deceleration Sensor Mounting Bolts	27 (3)
Proportioning Valve Bolts	80 (9)
Wheel Speed Sensor Mounting Bolt	71 (8)

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

1993 Toyota Celica

GENERAL INFORMATION
Anti-Lock Brake Safety Precautions

* PLEASE READ THIS FIRST *

This article is intended for general information purposes only. This information may not apply to all makes and models. If vehicle is equipped with Anti-Lock Brake System (ABS), refer to appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES section for description, operation, depressurizing, testing, system bleeding, trouble shooting and servicing of specific system.

WARNING: Failure to depressurize ABS could lead to physical injury.

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

WARNING: Failure to depressurize ABS could lead to physical injury.

* NEVER open a bleeder valve or loosen a hydraulic line while ABS is pressurized.
* NEVER disconnect or reconnect any electrical connectors while ignition is on. Damage to ABS control unit may result.
* DO NOT attempt to bleed hyudarulic system without first referring to the appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES section.
* Only use specially designed brake hoses/lines on ABS equipped vehicles.
* DO NOT tap on speed sensor components (sensor, sensor rings). Sensor rings must be pressed into hubs, NOT hammered into hubs. Striking these components can cause demagnetization or a loss of polarization, affecting the accuracy of the speed signal returning to the ABS control unit.
* DO NOT mix tire sizes. Increasing the width, as long as tires remain close to the original diameter, is acceptable. Rolling diameter must be identical for all 4 tires. Some manufacturers recommend tires of the same brand, style and type. Failure to follow this precaution may cause inaccurate wheel speed readings.
* DO NOT contaminate speed sensor components with grease. Only use recommended coating, when system calls for an anti-corrosion coating.
* When speed sensor components have been removed, ALWAYS check sensor-to-ring air gaps when applicable. These specifications can be found in each appropriate article.
* ONLY use rocommended brake fluids. DO NOT use silicone brake fluids in an ABS equipped vehicle.
* When instlling transmittion devices (CB's, telephones, etc.) on ABS equipped vehicles, DO NOT locate the antenna near the ABS control unit (or any control unit).
* Disconnect all on-board computers, when using electric welding equipment.
* DO NOT expose the ABS control unit to prolonged periods of high heat (185 °F/85°C for 2 hours is generally considered a maximum limit).

AUTO TRANS DIAGNOSIS - A-240E

1993 Toyota Celica

AUTOMATIC TRANSMISSIONS
Toyota A-240 "E" Series Electronic Controls

APPLICATION

APPLICATION

Vehicle	Transmission Model
Geo	
Prizm (LSi)	A-245E
Toyota	
Celica 1.8L (1994)	A-246E
Celica 2.2L (1993)	A-241E
Corolla 1.8L	A-245E
MR2	A-241E
Paseo	A-244E

CAUTION: All models are equipped with a Supplemental Restraint System (SRS). When servicing vehicle, use care to avoid accidental air bag deployment. All SRS electrical connections and wiring harness are covered by Yellow insulation. SRS-related components are located in steering column, center console, instrument panel and lower panel on instrument panel. DO NOT use electrical test equipment on these circuits. If necessary, deactivate SRS before servicing components. See AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIP section.

DESCRIPTION

The A-240 "E" series automatic transmission is electronically controlled. Transmission shifting and torque converter lock-up are controlled by an Electronic Controlled Transmission (ECT) Electronic Control Unit (ECU). Control unit is referred to as the ECT ECU.

NOTE: ECT ECU is combined with the engine ECU into one unit. This control unit is referred to as the engine and ECT ECU. See Figs. 1-8. In this article, control unit will be referred to as the ECT ECU on all models.

The ECT ECU receives information from various input devices and uses this information to control No. 1 and No. 2 solenoids for transmission shifting and lock-up solenoid for torque converter lock-up.

A pattern select switch is located on center console (1993 Celica 2.2L). Pattern select switch contains a POWER (depressed) and a NORMAL (released) operating position. When pattern select switch is depressed, transmission upshifts and downshifts will occur at a higher vehicle speed than with switch released. An indicator light will indicate the pattern select switch position.

An Overdrive (OD) switch is mounted on the shift lever. See Figs. 1-8. When OD switch is depressed to ON position, transmission will shift into 4th gear when shift lever is in "D" position, and OD OFF light on instrument panel will go off. When OD switch is released to OFF position, transmission will shift into 3rd gear, and OD OFF light on instrument panel will illuminate.

Transmission is equipped with a shift lock and key lock system. Shift lock system prevents shift lever from being moved from Park unless brake pedal is depressed. In case of a malfunction, shift lever can be released by depressing shift lock override button, located near shift lever. Key lock system prevents ignition key from being moved from ACC to LOCK position on ignition switch unless shift lever is in Park. For more information on shift lock and key lock system, see the SHIFT LOCK SYSTEM article.

OPERATION

ELECTRONIC CONTROLLED TRANSMISSION ELECTRONIC CONTROL UNIT (ECT ECU)

1) The ECT ECU receives information from various input devices and uses this information to control No. 1, No. 2 and lock-up solenoids. The ECT ECU contains a self-diagnostic system, which will store code if failure or problem exists in the electronic control system.

2) Code can be retrieved to determine transmission problem area. See SELF-DIAGNOSTIC SYSTEM. On Corolla, Celica, Paseo and Prizm ECU is located near front of center console. See Figs. 1-6. On MR2 models, ECT ECU is located near left rear corner of engine compartment. See Figs. 7-8.

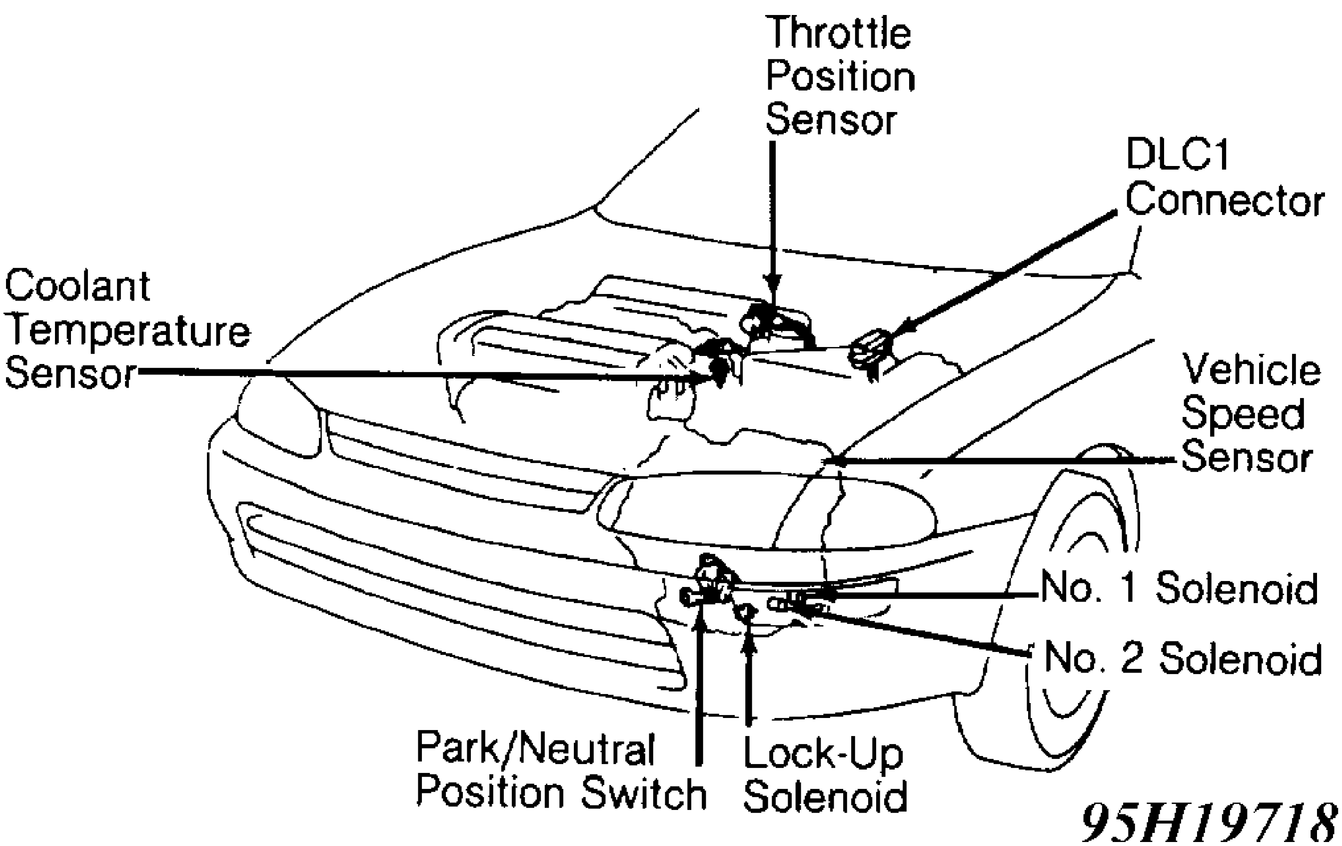

Fig. 1: Input & Output Devices (Corolla Shown, Prizm Is Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

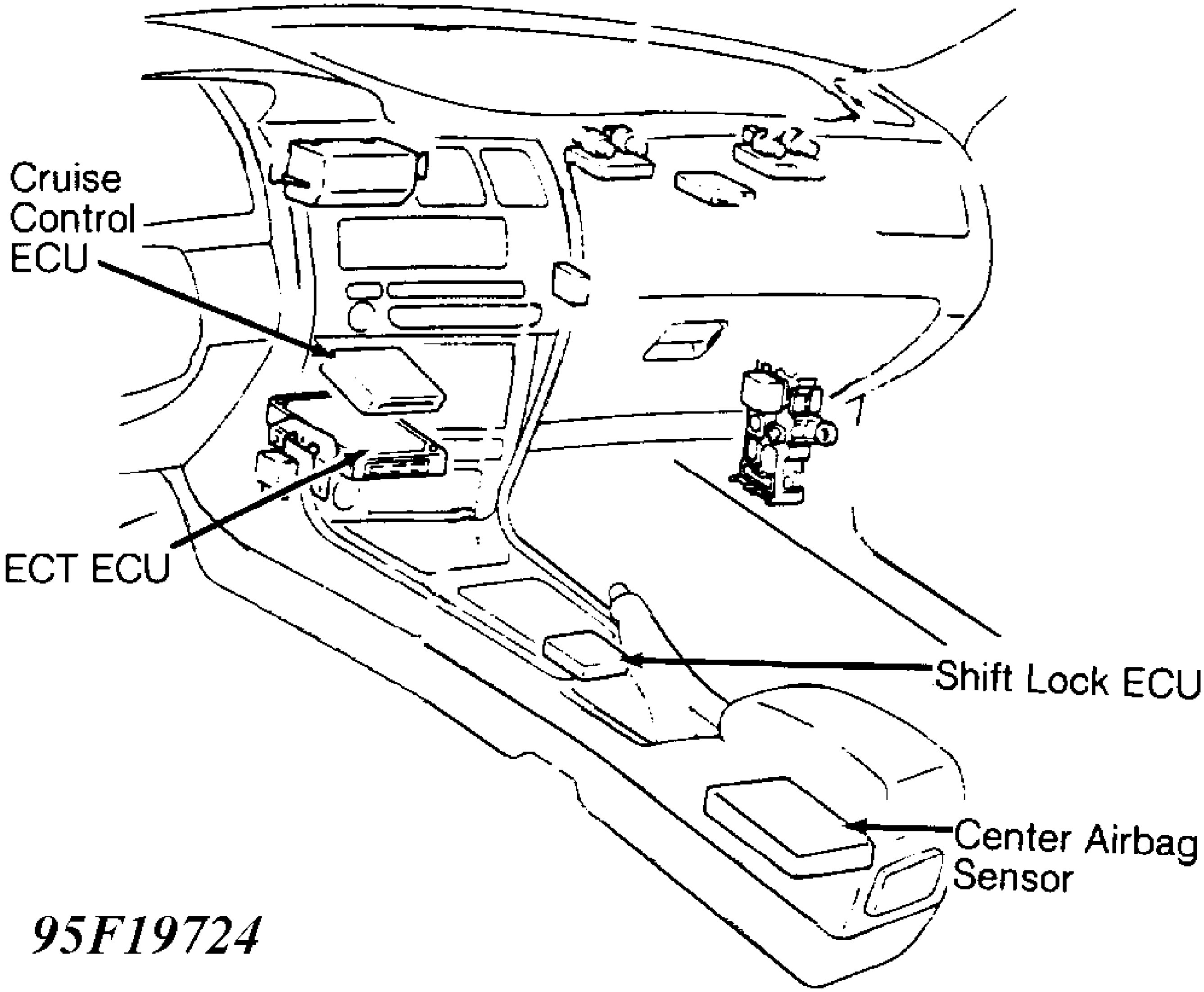

Fig. 2: Input & Output Devices (Corolla Shown, Prizm Is Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

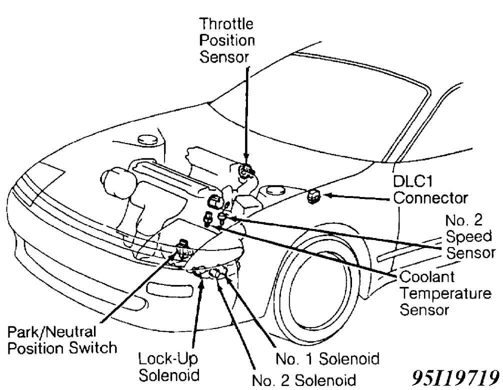

Fig. 3: Input & Output Devices (1993 Celica Shown, 1994 Celica Is Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

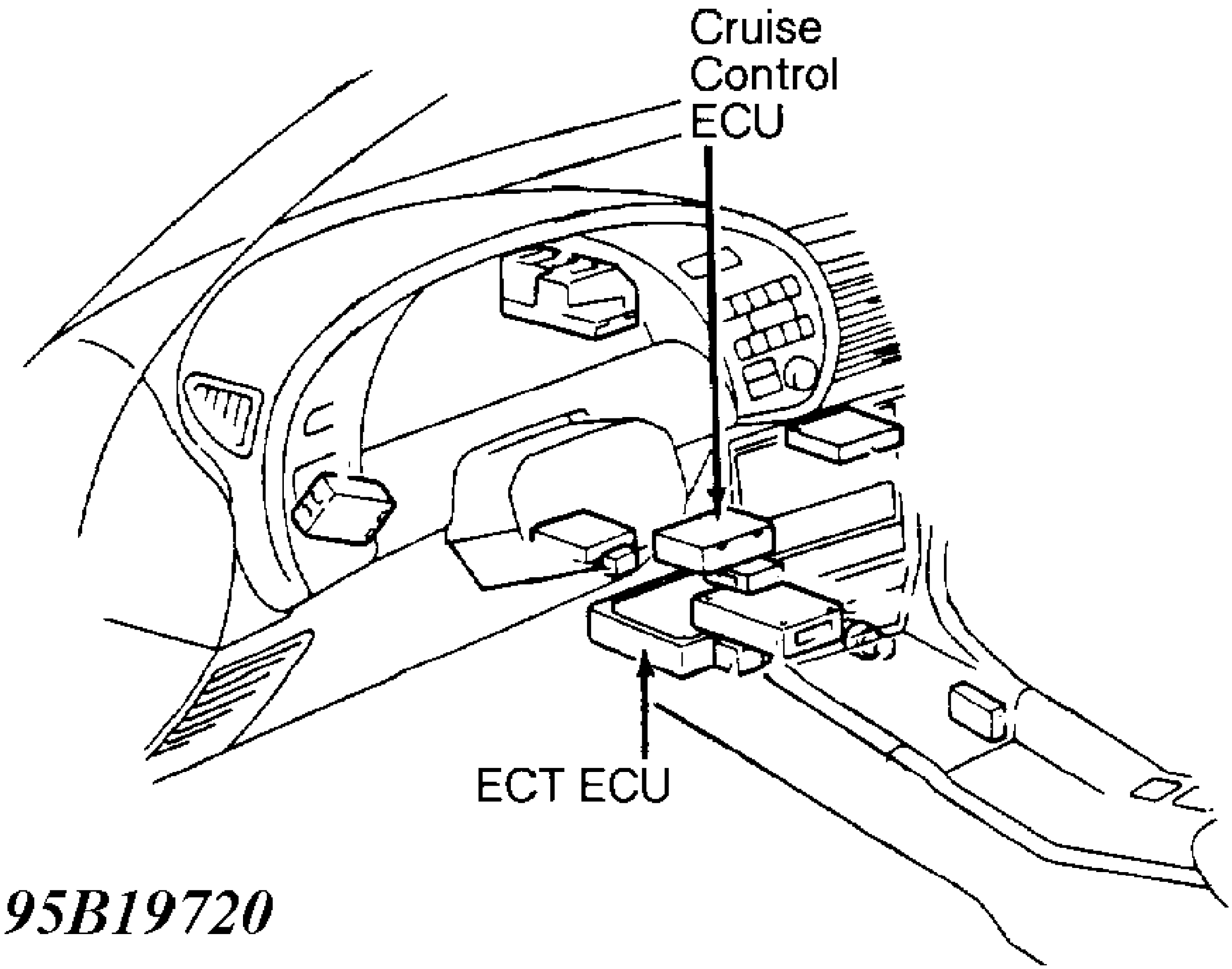

Fig. 4: Input & Output Devices (1993 Celica Shown, 1994 Celica Is Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

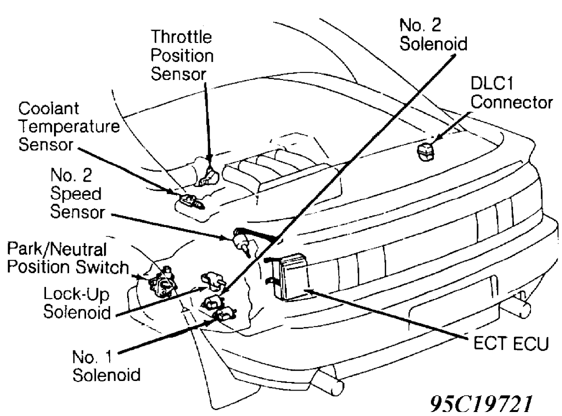

Fig. 5: Input & Output Devices (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

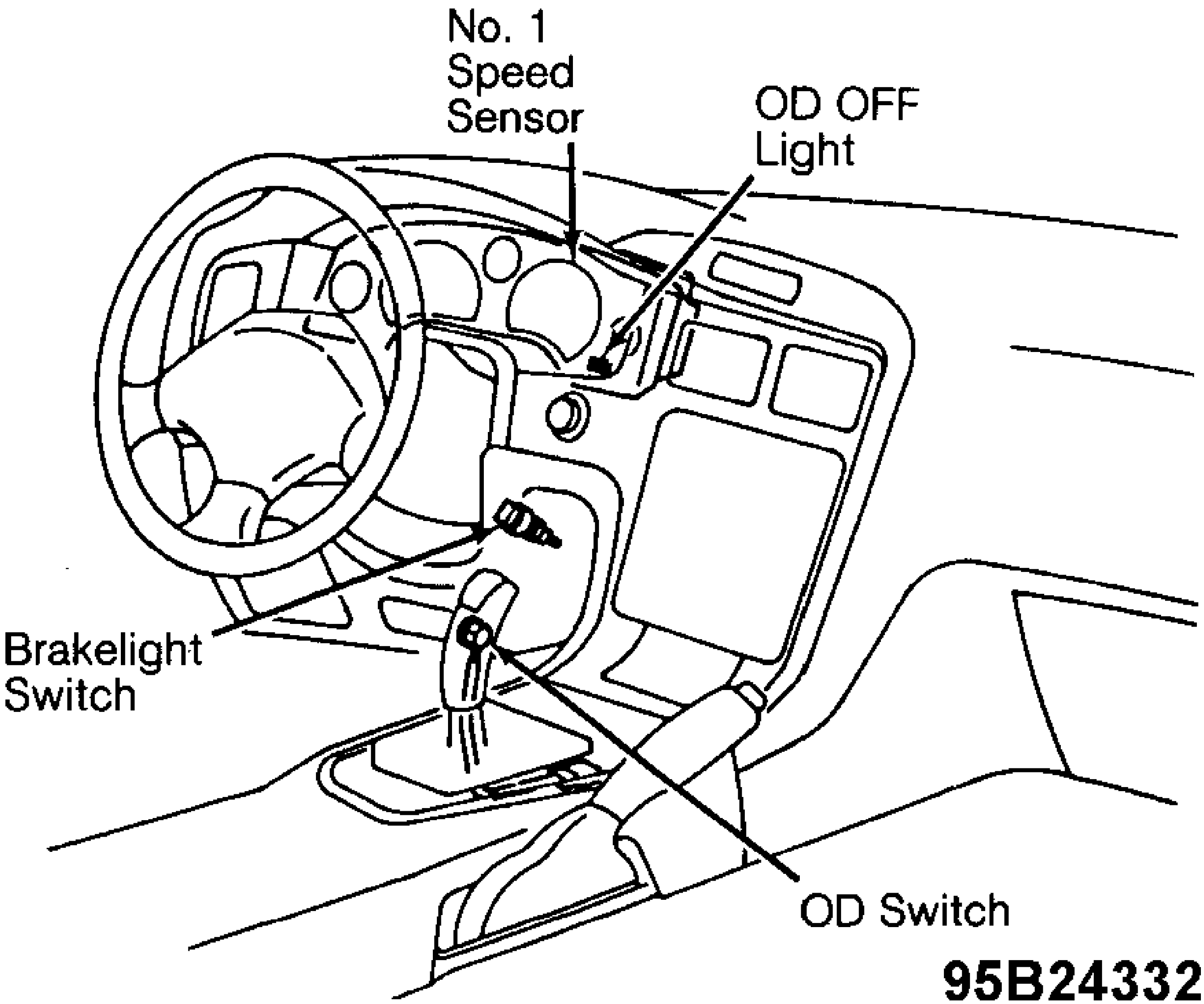

Fig. 6: Input & Output Devices (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

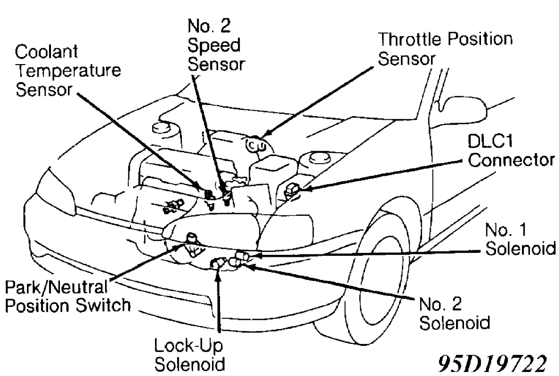

Fig. 7: Input & Output Devices (Paseo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

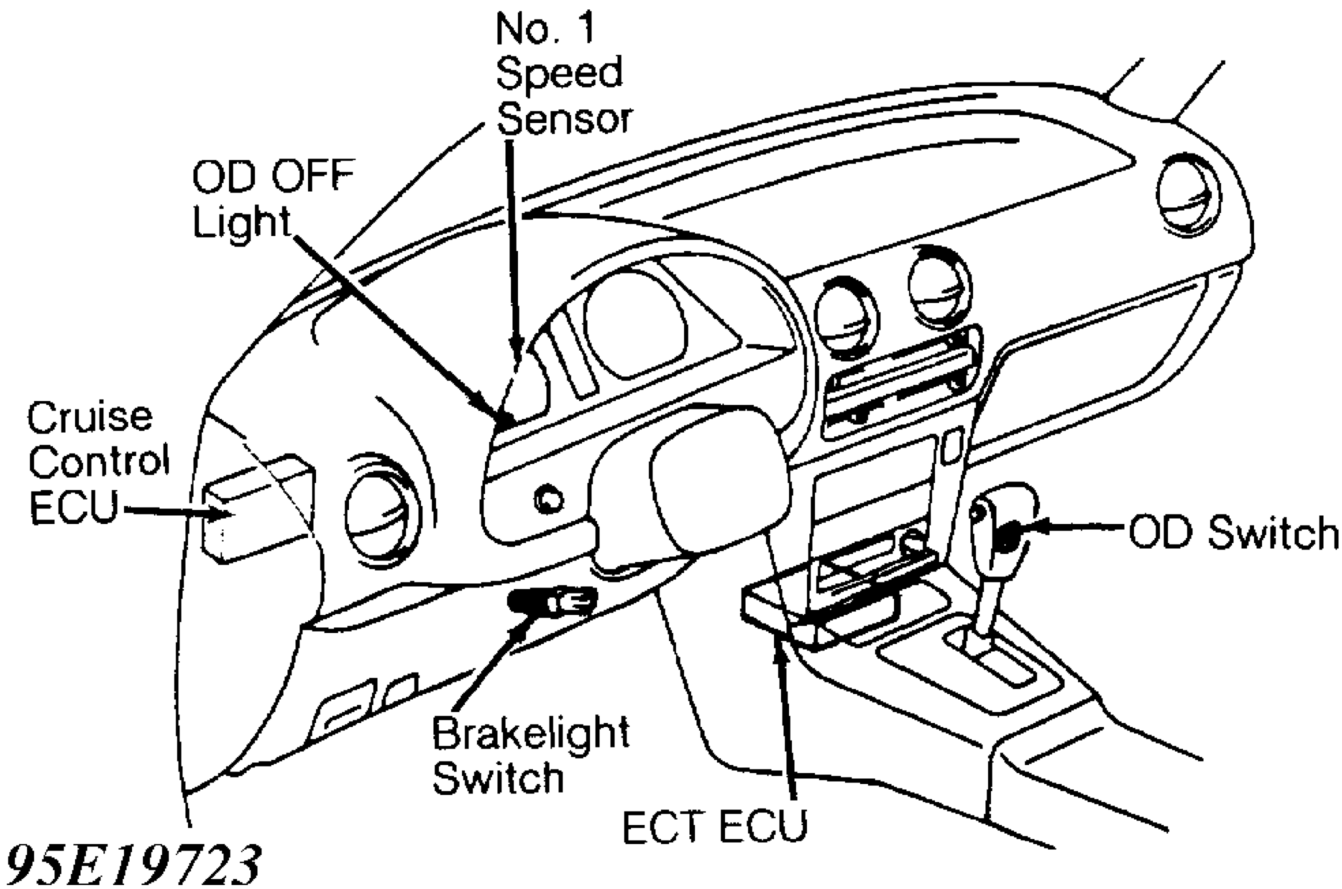

Fig. 8: Input & Output Devices (Paseo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ECT ECU INPUT DEVICES

Pattern Select Switch

Pattern select switch delivers an input signal to ECT ECU to indicate transmission shift points selected by the operator. Pattern select switch is located near shift lever (1993 Celica models).

Park/Neutral Position Switch

Park/Neutral position switch delivers an input signal to ECT ECU to indicate shift lever position. Park/Neutral position switch is located on side of transmission. See Figs. 1-8.

Throttle Position Sensor

Throttle position sensor delivers an input signal to ECT ECU indicating throttle position. Throttle position sensor is located on side of throttle body.

Vehicle Speed Sensor

Vehicle speed signal is delivered to ECT ECU by speed sensors. Speed sensors are located on transmission and in combination meter on some models.

Brakelight Switch

Brakelight switch delivers input signal to ECT ECU, indicating vehicle braking. Brakelight switch is located on brake pedal support.

OD Switch

The OD switch provides an input signal to ECT ECU to indicate when overdrive is selected by the operator. When OD switch is depressed to ON position, transmission will shift into 4th gear when shift lever is in "D" position, and OD OFF light on instrument panel will go off. See Figs. 1-8. When OD switch is released to OFF position, transmission will shift into 3rd gear, and OD OFF light on instrument panel will come on. The OD switch is mounted on the shift lever.

Coolant Temperature Sensor

Coolant temperature sensor delivers input signal to ECT ECU, indicating engine coolant temperature. Coolant temperature sensor is located in thermostat housing or radiator

Cruise Control Electronic Control Unit (ECU)

Cruise control ECU delivers an input signal to control overdrive operation in accordance with vehicle speed when cruise control is operating. When in overdrive with cruise control on, if vehicle speed drops 3 MPH less than the set speed, overdrive is released to prevent reduction in vehicle speed. Once vehicle speed is more than the set speed, the overdrive is resumed. Cruise control ECU is located behind instrument panel on passenger's side. See Figs. 1-8.

NOTE: Cruise control ECU may be referred to as cruise control computer.

ECT ECU OUTPUT DEVICES

No. 1 & No. 2 Solenoids

The ECU controls transmission shifting by delivering an output signal to operate proper solenoid. Solenoids are operated in accordance with shift lever range. See Fig. 9. If a solenoid malfunctions, designated gear may result. See Fig. 9. Solenoids are located on transmission. See Figs. 1-8.

Lock-Up Solenoid

ECU controls torque converter lock-up on all "E" series models by delivering an output signal to lock-up solenoid. Lock-up solenoid is activated when shift lever is in "D" position and vehicle is at specified speed. Lock-up solenoid is located on transmission. See Figs. 1-8.

Range	NORMAL			NO. 1 SOLENOID MALFUNCTIONING			NO. 2 SOLENOID MALFUNCTIONING			BOTH SOLENOID MALFUNCTIONING		
	Solenoid valve No. 1	Solenoid valve No. 2	Gear Position	Solenoid valve No. 1	Solenoid valve No. 2	Gear Position	Solenoid valve No. 1	Solenoid valve No. 2	Gear Position	Solenoid valve No. 1	Solenoid valve No. 2	Gear Position
D range	ON	OFF	1st	x	ON (OFF)	3rd (O/D)	ON	x	1st	x	x	O/D
	ON	ON	2nd	x	ON	3rd	OFF (ON)	x	O/D (1st)	x	x	O/D
	OFF	ON	3rd	x	ON	3rd	OFF	x	O/D	x	x	O/D
	OFF	OFF	O/D	x	OFF	O/D	OFF	x	O/D	x	x	O/D
2 range	ON	OFF	1st	x	ON (OFF)	3rd (O/D)	ON	x	1st	x	x	3rd
	ON	ON	2nd	x	ON	3rd	OFF (ON)	x	3rd (1st)	x	x	3rd
	OFF	ON	3rd	x	ON	3rd	OFF	x	3rd	x	x	3rd
L range	ON	OFF	1st	x	OFF	1st	ON	x	1st	x	x	1st
	ON	ON	2nd	x	ON	2nd	ON	x	1st	x	x	1st

( ): No fail safe function x: Malfunctions

93C24135

Fig. 9: Determining No. 1 & No. 2 Solenoid Operation
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SELF-DIAGNOSTIC SYSTEM

SYSTEM DIAGNOSIS

NOTE: Before testing transmission, ensure fluid level is correct and throttle and shift cables are properly adjusted. Ensure engine starts with shift lever in Park and Neutral to ensure proper adjustment of neutral start switch. Transmission must first be tested by checking for stored codes. Refer to RETRIEVING CODES.

ECT ECU monitors transmission operation and contains a self-diagnostic system which stores code if transmission electronic control system failure or problem exists. If a problem exists in No. 1 or No. 2 solenoids or speed sensors and code is set, ECT ECU blinks OD OFF light on instrument panel to warn driver.

OD OFF light on instrument panel will not blink to warn driver if a problem exists or code is stored for lock-up solenoid, or problem exists with brakelight switch signal or throttle position sensor signal.

RETRIEVING CODES

NOTE: Before retrieving codes, ensure proper battery voltage exists for proper self-diagnosis system operation. Perform diagnostic circuit check before retrieving codes to ensure proper operation of OD OFF light. See DIAGNOSTIC CIRCUIT CHECK heading below.

Diagnostic Circuit Check

1) Turn ignition on. Release OD switch on shift lever to OFF position. Ensure OD OFF light on instrument panel turns on. If OD OFF light does not illuminate, check OD switch and wiring circuit.

2) Depress OD switch to ON position. Ensure OD OFF light on instrument panel goes off. If OD OFF light remains on, check OD switch and wiring circuit. If OD OFF light is blinking, check for stored codes. See ECT ECU CODES heading below.

ECT ECU Codes

1) Turn ignition on. DO NOT start engine. Depress OD switch on shift lever to ON position.

NOTE: Codes can only be retrieved with OD switch on. If OD switch is off, OD OFF light will be on continuously and will not blink the code.

2) Install jumper wire between terminals TE1 and E1 of DLC1 connector. See Figs. 10-11.

3) Note number of flashes from OD OFF light on instrument panel. If normal system operation exists, OD OFF light will flash once every .25 second. See Fig. 12-13.

4) If system is operating correctly and no code exists, turn ignition off and remove jumper wire. Perform MANUAL SHIFTING TEST under TRANSMISSION SHIFT TESTING to determine if problem is a electrical or mechanical transmission problem. Check system by the symptom. See appropriate symptom under SYMPTOM TROUBLE SHOOTING.

5) If code exists, OD OFF light will blink once every .5 second. Number of blinks equals first digit of code. After a pause of 1.5 seconds, second digit will be displayed. See Figs. 12-13.

6) If more than one code exists, next code will be displayed after pause of 2.5 seconds. See Figs. 12-13. Smallest number code will display first and system will progress to largest code. Codes will be repeated.

7) Once code is obtained, determine probable cause and

symptom. See CODE IDENTIFICATION table. For diagnosis and repair of codes, see DIAGNOSTIC TESTING. Turn ignition off and remove jumper wire.

NOTE: Once repairs have been performed, codes must be cleared from ECT ECU memory. See CLEARING FAULT CODES.

CODE IDENTIFICATION

Fault Code	(1) Probable Cause
42	(2) Defective No. 1 Speed Sensor
61	(2) Defective No. 2 Speed Sensor
62	Defective No. 1 Solenoid
63	Defective No. 2 Solenoid
64	Defective Lock-Up Solenoid

(1) - Check listed component for probable cause. Also check wiring and connections of specified component.
(2) - If both No. 1 and No. 2 speed sensors fail simultaneously, fault code will not exist, but transmission will not upshift from 1st gear with shift lever in "D" position.

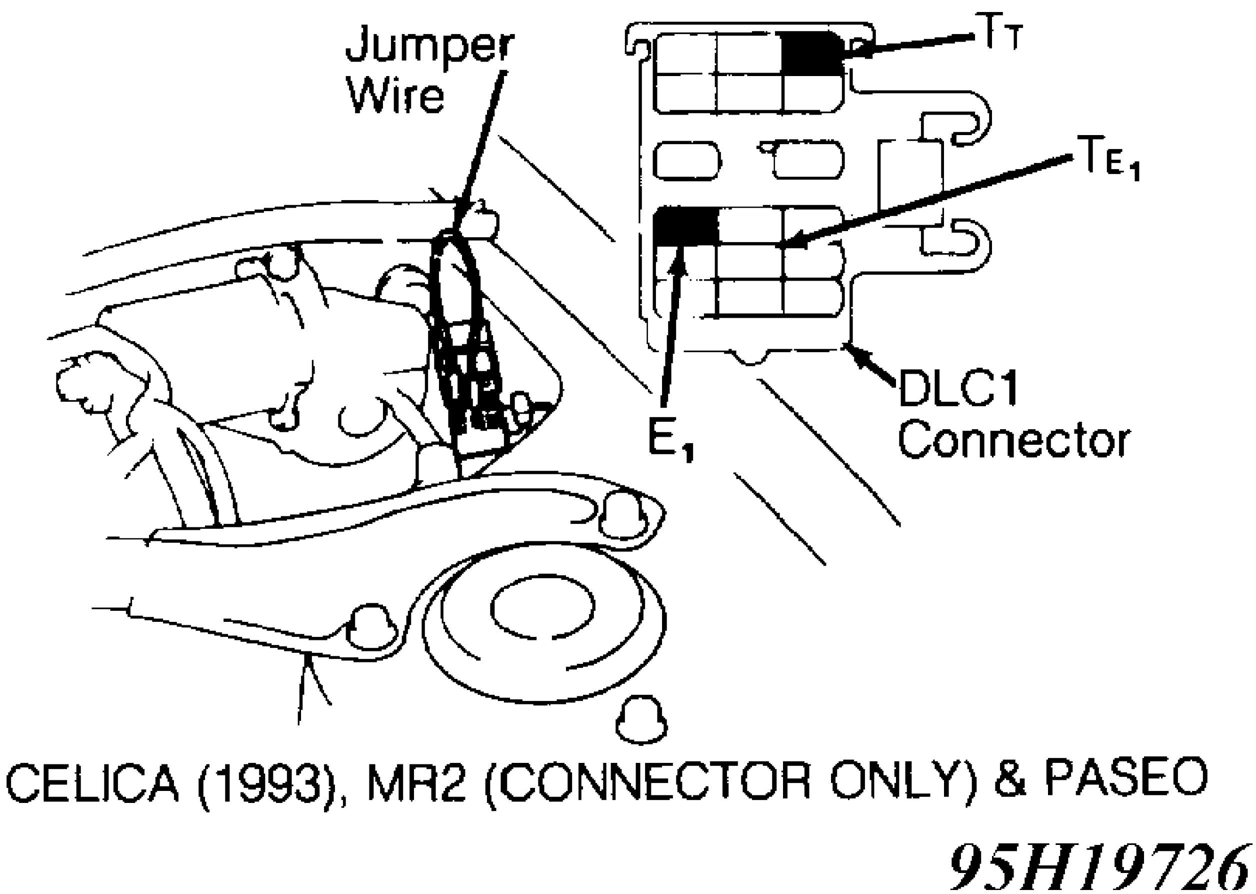

Fig. 10: DLC1 Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

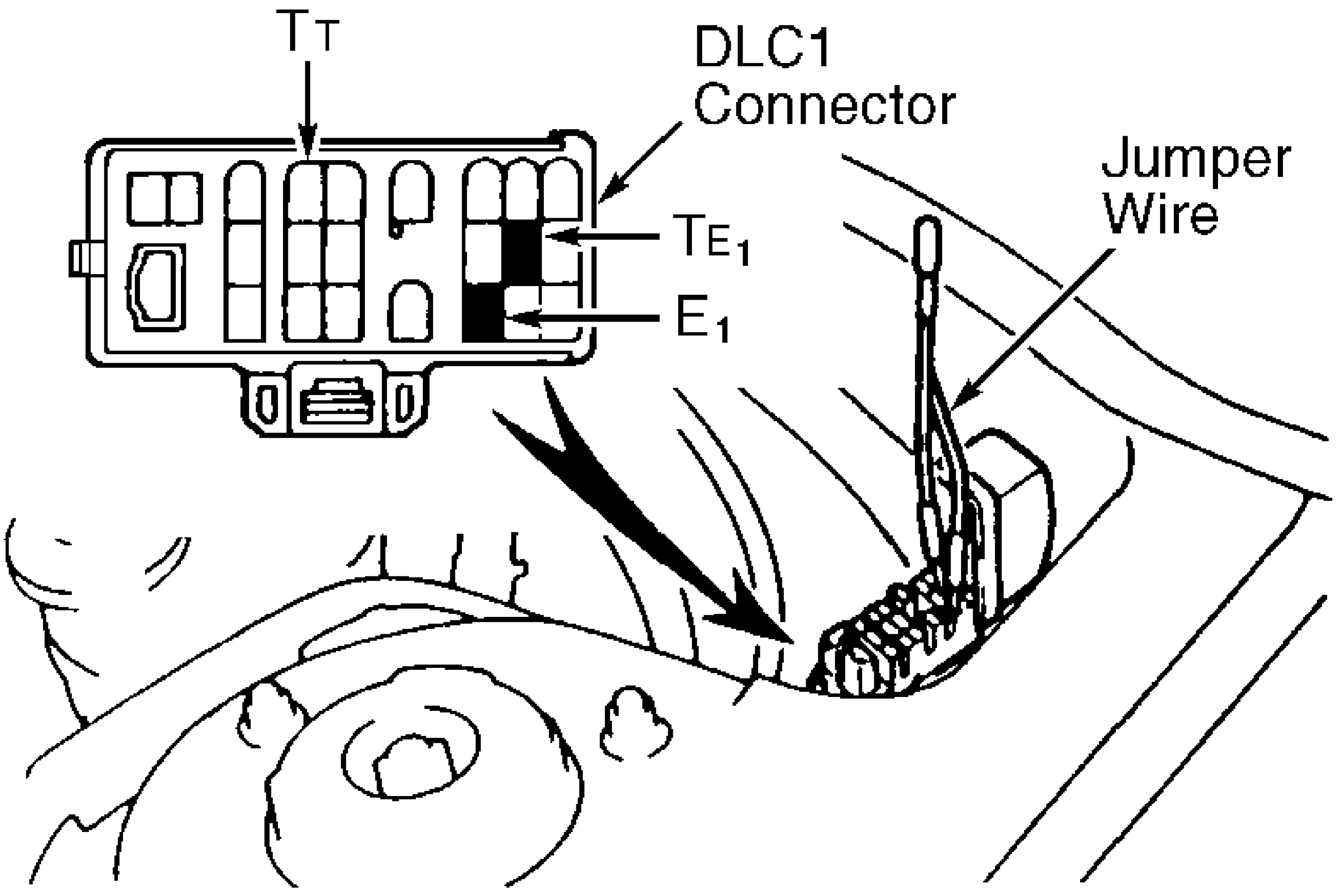

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Fig. 11: DLC1 Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

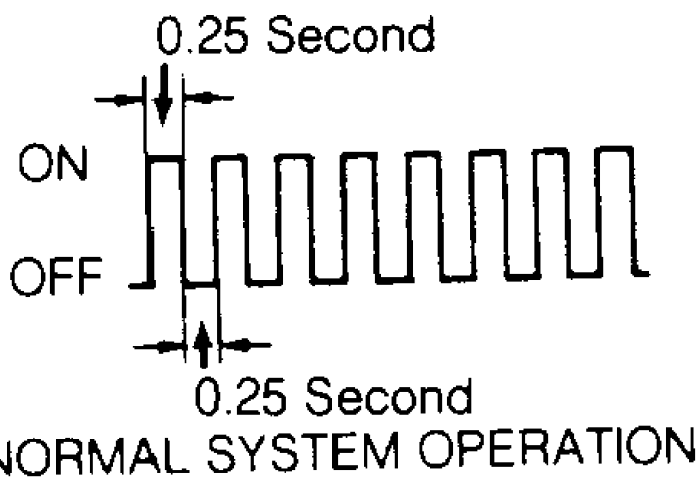

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Fig. 12: Fault Code Displays
Courtesy of Toyota Motor Sales, U.S.A., Inc.

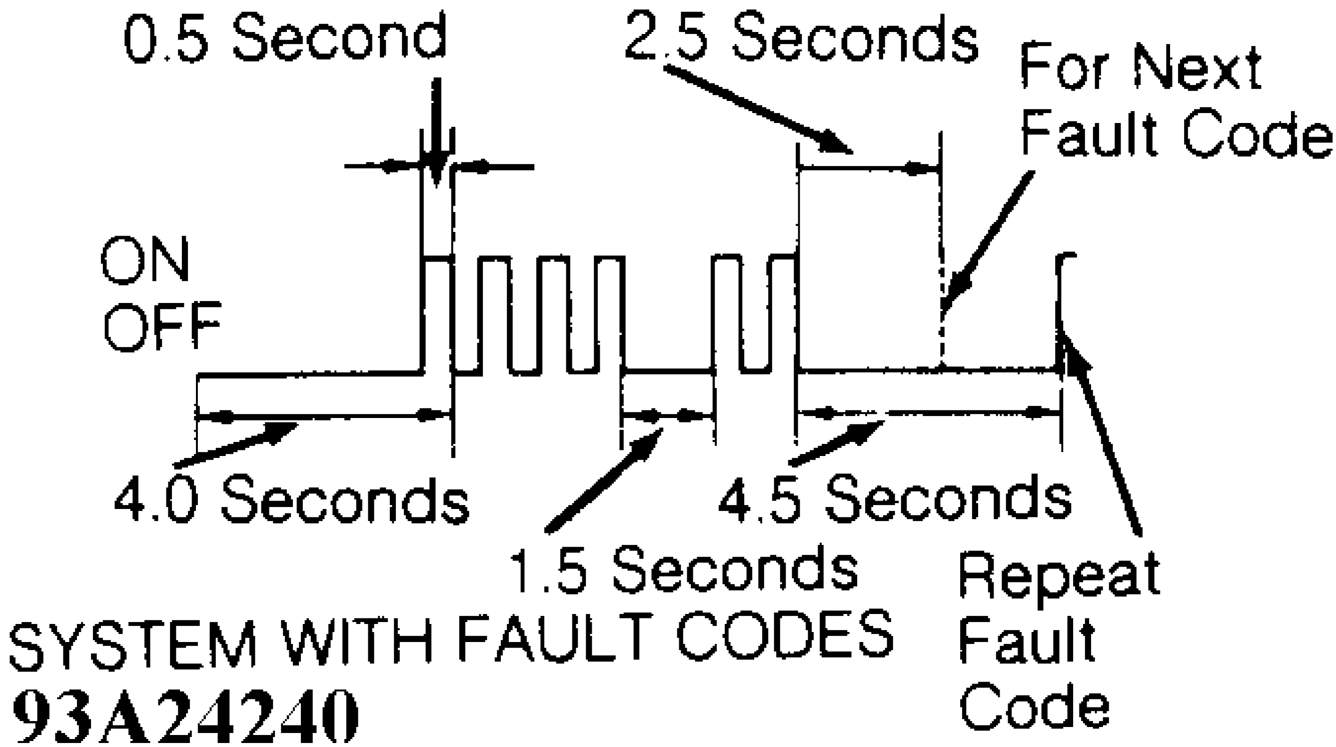


Fig. 13: Fault Code Displays
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CLEARING FAULT CODES

1) Once repairs have been performed, fault codes must be cleared from ECU memory. Remove EFI fuse (15-amp) from engine compartment fuse box for 10 seconds to clear memory in ECU.

2) On MR2, engine compartment fuse box is located on driver's side of engine compartment. On Celica, Corolla and Paseo, engine compartment fuse box is located near the battery in engine compartment.

3) Fuse may need to be removed for more than 10 seconds in cold ambient temperatures. Reinstall fuse.

NOTE: Fault codes may also be cleared by disconnecting negative battery cable, but memory for electronic components will be also be canceled.

DIAGNOSTIC TESTING

When trouble shooting transmission, first check for stored codes and repair as necessary. If no codes exist, perform manual shifting test to determine if problem area is in electrical circuits or a mechanical transmission problem. See MANUAL SHIFTING TEST under TRANSMISSION SHIFT TESTING.

CODE NO. 42 (NO. 1 VEHICLE SPEED SENSOR (VSS)

Celica (1993) & Paseo

1) Determine if speedometer is operating properly. Inspect and repair speedometer drive gear, cable and combination meter as needed.

2) Turn ignition off. Access ECT ECU harness connector. See

Figs. 3-4 and 8-9. Lift and support front wheels of vehicle. Backprobing ECT ECU harness connector with DVOM. Check voltage between SPD terminal and vehicle ground while turning front wheel.

3) If voltage pulses as wheel is turned, replace ECT ECU and retest. If pulse is not present, turn ignition off. Remove combination meter. Connect ohmmeter to test terminals and rotate meter shaft. See Figs. 14-15. If ohmmeter pulses, inspect and repair circuits between combination meter and ECT ECU. See appropriate wiring diagram in WIRING DIAGRAMS. If ohmmeter does not pulse, replace combination meter and retest.

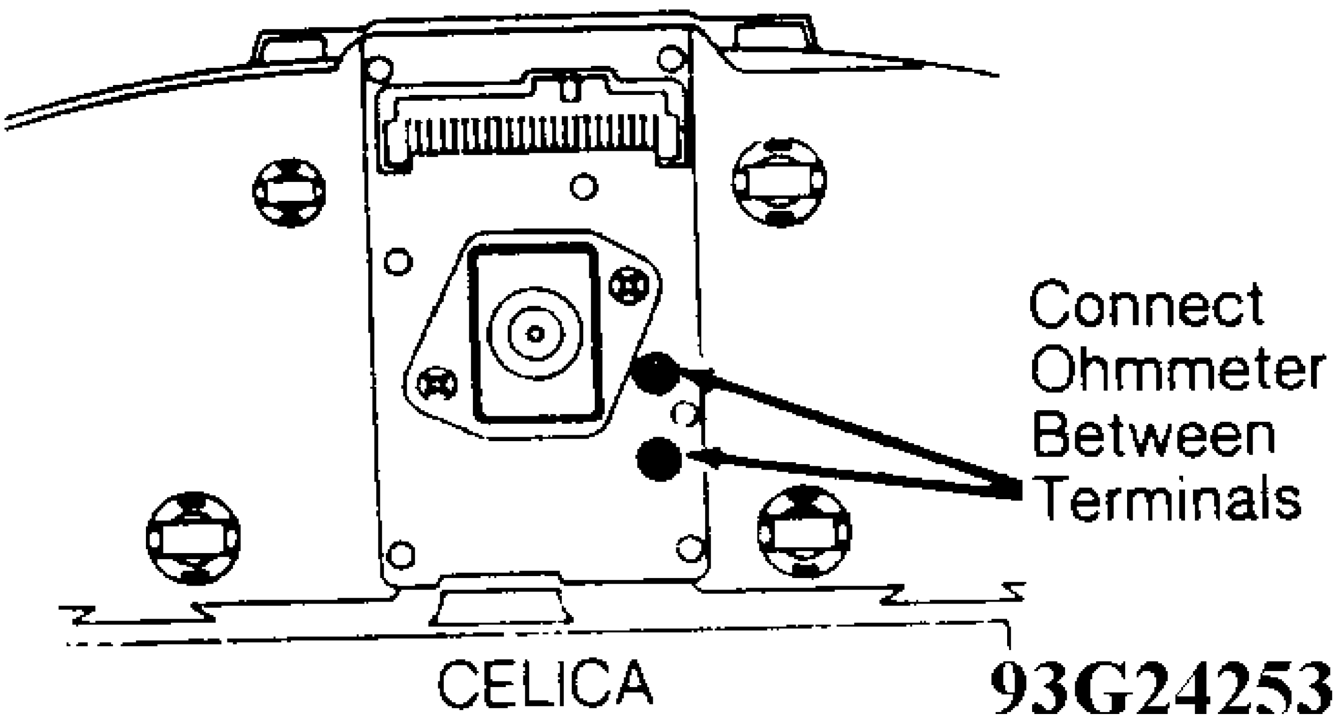


Fig. 14: Checking No. 1 Speed Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

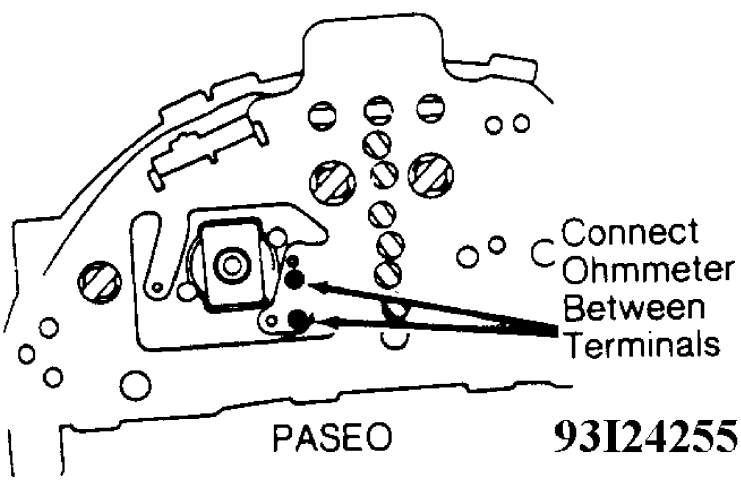


Fig. 15: Checking No. 1 Speed Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Celica (1994), Corolla, MR2 & Prizm

1) Lift and support vehicle. Disconnect cruise control ECU.

See Figs. 1-8. Remove combination meter. Turn ignition on. Using DVOM, measure voltage between SPD terminal of combination meter connector and ground. Refer to the SPD CIRCUIT IDENTIFICATION table. Also, see Figs. 16-20. Rotate front wheel.

SPD CIRCUIT IDENTIFICATION

Application	Terminal No.
Corolla	9
Celica	3
MR2	10
Prizm	12

2) If voltage pulses 0-5 volts, check continuity between ECT ECU harness connector E1 terminal and ground. If continuity does not exist, inspect and repair circuit as needed. If continuity does exist, replace ECT ECU and retest. If no voltage is present, go to next step. If voltage is 4-6 volts and remains unchanged, go to step 5).

3) Turn ignition off. Disconnect ECT ECU harness connector. See Figs. 1-8. Using ohmmeter, check continuity between combination meter harness connector SPD terminal and ECU SPD terminal. Refer to the Fig. 21. If continuity exists, go to next step. If continuity does not exist, inspect and repair circuit as needed.

4) Check continuity of 2 circuits between combination meter and VSS. See appropriate wiring diagram in WIRING DIAGRAMS. If continuity does not exist, inspect and repair circuit(s) as needed. If continuity exists, inspect VSS. See NO. 1 VEHICLE SPEED SENSOR under COMPONENT TESTING. Replace as needed.

5) Disconnect VSS harness connector. Turn ignition on. Measure voltage between VSS harness connector terminal No. 1 (Red/Blue wire) and ground. If battery voltage is not present, inspect and repair circuit as needed. If battery voltage is present, replace combination meter and retest.

6) Turn ignition off. Disconnect ECT ECU harness connector. Refer to the Fig. 1-8. Using ohmmeter, check continuity between combination meter harness connector SPD terminal and ECT ECU SPD terminal. See Fig. 21. If continuity exists, replace combination meter and retest. If continuity does not exist, inspect and repair circuit as needed.

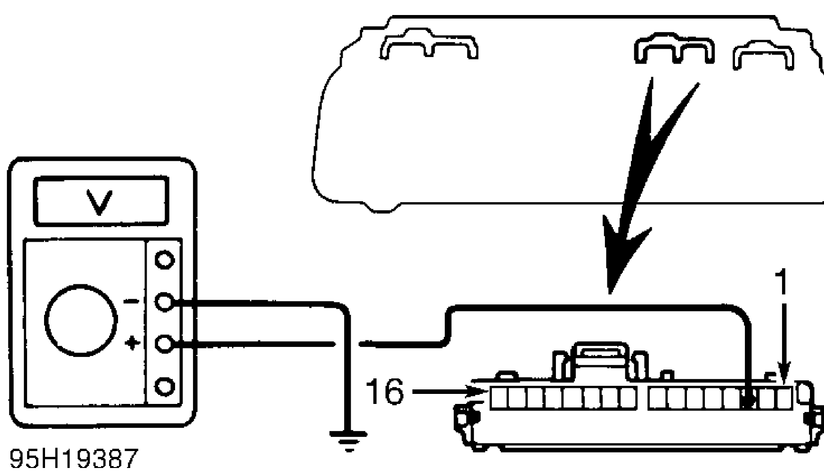


Fig. 16: Combination Meter Harness Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

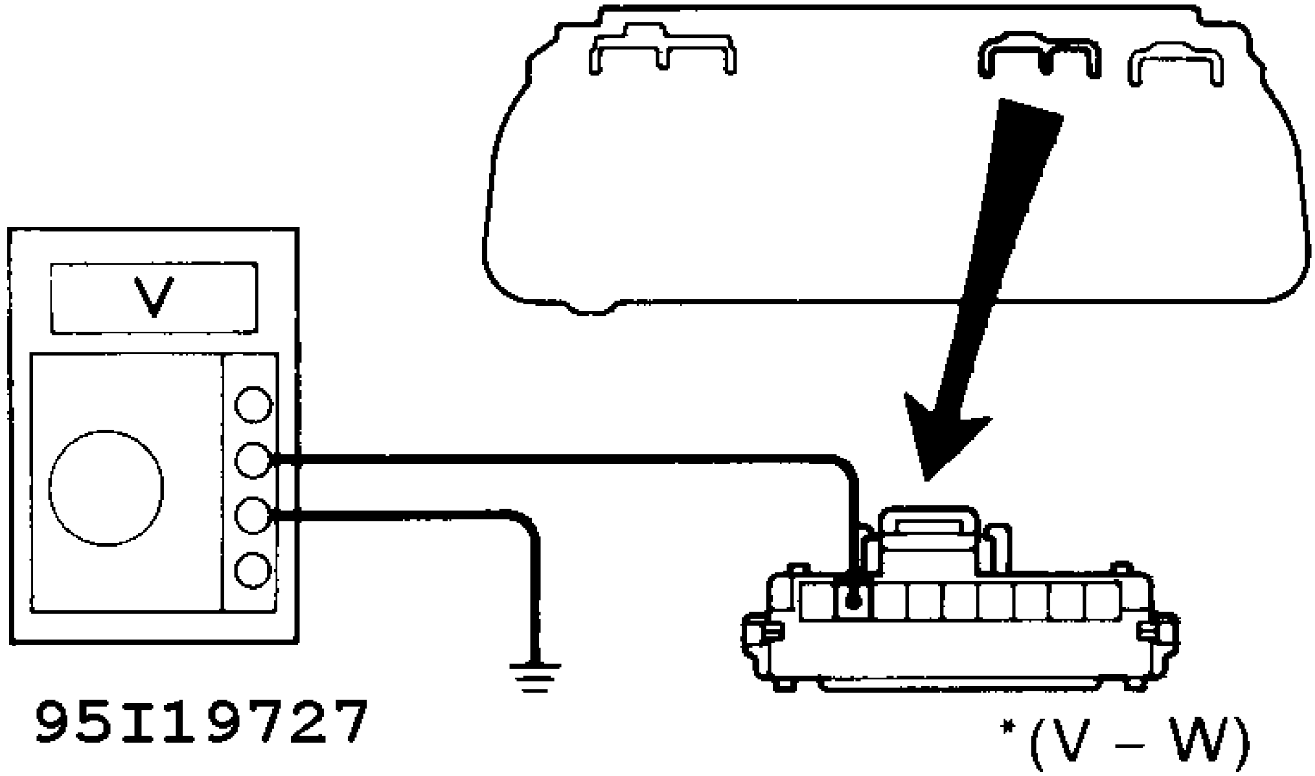


Fig. 17: Combination Meter Harness Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

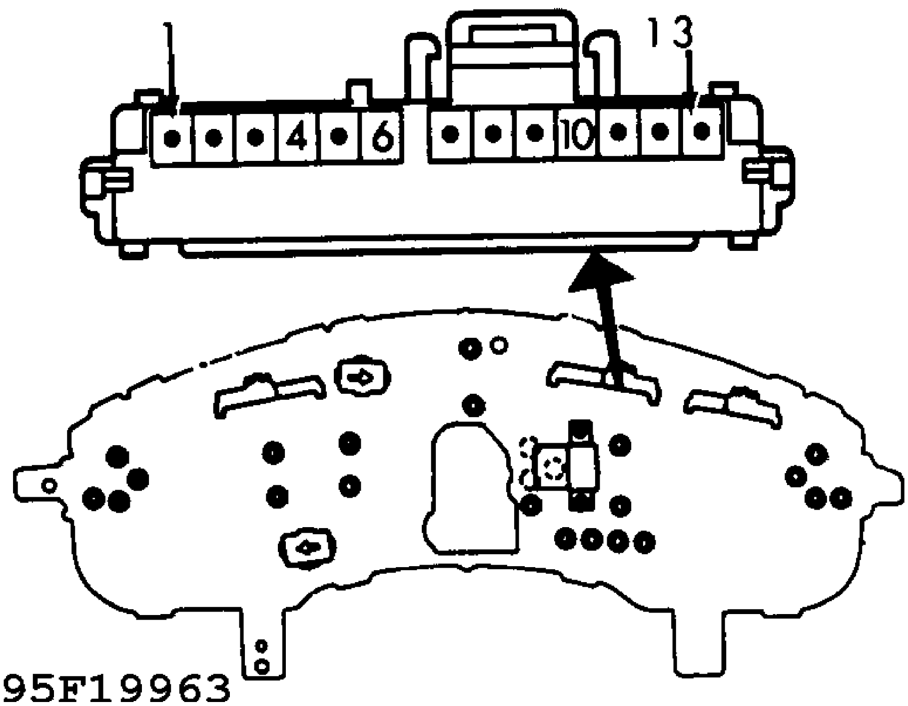


Fig. 18: Combination Meter Harness Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

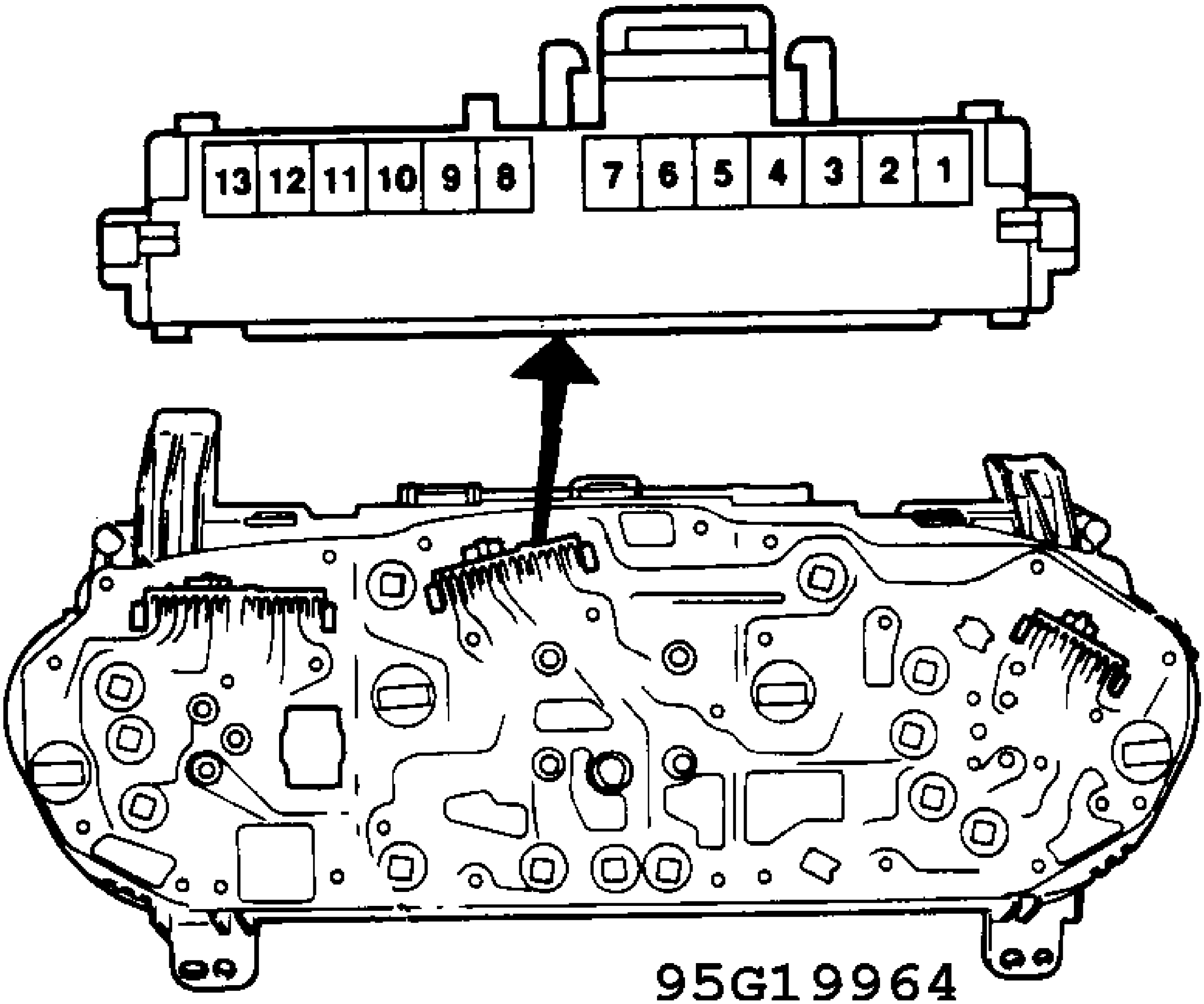


Fig. 19: Combination Meter Harness Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

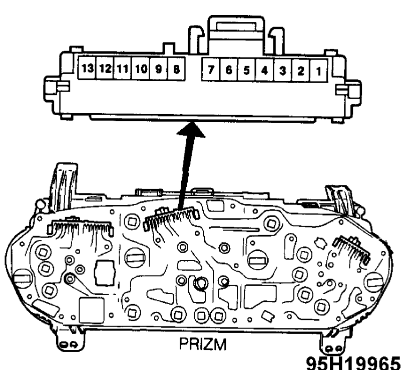
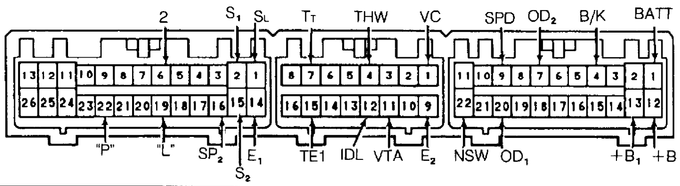


Fig. 20: Combination Meter Harness Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.



Wire Color	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
[1]	S_1 [2]	No. 1 Shift Solenoid	10-14 Volts With KOEO [3]
[1]	S_2 [2]	No. 2 Solenoid	1 Volt Or Less With KOEO [3]
[1]	S_L [2]	Lock-Up Solenoid	1 Volt Or Less With KOEO [3]
Blue/Red	P [4]	Pattern Select Switch Signal	10-14 Volts In PWR Position
Green/White	B/K	Brakelight Switch Signal	10-14 Volts With Pedal Depressed
[1]	THW	Coolant Temperature Sensor Signal	.2-1.0 Volts @ 176°F (80°C)
[1]	IDL	Closed Throttle Sensor Signal	0-3 Volts With Throttle Closed, KOEO [3]
[1]	VTA	Throttle Position Sensor Output Signal	3.2-4.9 Volts With Throttle Fully Open
[1]	OD_1	OD Output To Cruise Control ECU	10-14 Volts With KOEO [3]
[1]	OD_2	Overdrive Switch Signal	10-14 Volts With Switch On
[1]	SPD	Vehicle Speed Sensor Signal	1 Volt Or Less With ECU Unplugged [5] (Car Parked)
[1]	NSW	Ignition Switch (ST1) Signal	10-14 Volts In "P" Or "N", KOEO [3]
[1]	2	Park/Neutral Position Switch "2" Signal	10-14 Volts In "2", KOEO [3]
[1]	L	Park/Neutral Position Switch "L" Signal	10-14 Volts In "L", KOEO [1]
[1]	R	Park/Neutral Position Switch "R" Signal	10-14 Volts With KOEO [1]
[1]	+B	EFI Main Relay Power Supply	10-14 Volts With KOEO [1]
[1]	BATT	Power Supply Voltage	10-14 Volts (Constant)
Brown	E_1	Ground	Not Applicable
Brown	E_2	Ground	Not Applicable

[1] – For wire color identification, see PIN VOLTAGE CHART WIRE COLOR IDENTIFICATION chart.
[2] – S_1 – SOL1, S_2 – SOL2 and S^3 – SOL3.
[3] – Key On, Engine Off.
[4] – 1993 Celica only.
[5] – Disconnect cruise control ECU harness connector, see Figs. 1-4.

95119966

Fig. 21: ECT ECU Harness Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CODE NO. 61 (NO. 2 VEHICLE SPEED SENSOR (VSS)

Celica (1993), MR2 & Paseo

1) Obtain access to ECT ECU, located near glove box. See Figs. 1-8. Using ohmmeter, check for continuity between terminal SP2 of ECT ECU connector and body ground. See Fig. 21.

2) If continuity exists, replace ECT ECU. If continuity does not exist, check No. 2 speed sensor. See NO. 2 SPEED SENSOR under COMPONENT TESTING.

3) Replace No. 2 speed sensor if defective. If No. 2 speed sensor is okay, check wiring between ECT ECU and No. 2 speed sensor. See appropriate wiring diagram in WIRING DIAGRAMS.

CODE NO. 62 (NO. 1 SOLENOID)

1) Access ECT ECU. See Figs. 1-8. Using ohmmeter, check resistance between terminal S1 and body ground with connector removed from ECT ECU. See Fig. 21.

2) Resistance should be 11-15 ohms. If resistance is okay, replace ECT ECU. If resistance is not within specification, remove oil pan. Disconnect electrical connector (Pink wire on Paseo, White wire on all others) at No. 1 solenoid.

3) Check resistance between electrical terminal on No. 1 solenoid and body ground. Replace No. 1 solenoid if resistance is not 11-15 ohms. If resistance is 11-15 ohms, inspect and repair wiring

between No. 1 solenoid and ECT ECU.

CODE NO. 63 (NO. 2 SOLENOID)

1) Access ECT ECU. See Figs. 1-8. Using ohmmeter, check resistance between terminal S2 and body ground with connector removed from ECT ECU. See Fig. 21.

2) Resistance should be 11-15 ohms. If resistance is okay, replace ECT ECU. If resistance is not within specification, remove oil pan. Disconnect electrical connector (Pink/Green wire on Paseo, Black wire on all others) at No. 1 solenoid.

3) Check resistance between electrical terminal on No. 1 solenoid and body ground. Replace No. 1 solenoid if resistance is not 11-15 ohms. If resistance is 11-15 ohms, inspect and repair wiring between No. 1 solenoid and ECT ECU.

CODE NO. 64 (LOCK-UP SOLENOID)

NOTE: Lock-up solenoid terminal SL, may also be known as solenoid No. 3 (SOL 3) terminal.

1) Access ECT ECU. See Figs. 1-8. Using ohmmeter, check resistance between terminal SL and body ground with connector removed from ECT ECU. See Figs. 27-29.

2) Resistance should be 11-15 ohms. If resistance is okay, replace ECT ECU. If resistance is not within specification, disconnect electrical connector at lock-up solenoid.

3) Check resistance between electrical terminal on lock-up solenoid and body ground. Replace lock-up solenoid if resistance is not 11-15 ohms. If resistance is 11-15 ohms, inspect and repair wiring between lock-up solenoid and ECT ECU.

TRANSMISSION SHIFT TESTING

MANUAL SHIFTING TEST

NOTE: Perform manual shifting test if no fault codes exist. Manual shifting test determines if problem area is in electrical circuits or a mechanical transmission problem.

1) With ignition off, disconnect electrical connector from solenoids on transmission. Electrical connector is located near neutral start switch on transmission.

2) Road test vehicle and ensure transmission gear changes corresponds with shift lever position. See GEAR APPLICATION table. If abnormality exists, a mechanical transmission problem exists.

3) If all gears are correct, perform trouble shooting in accordance with the symptom. See SYMPTOM TROUBLE SHOOTING. Turn ignition off.

4) Reconnect electrical connector. Clear fault codes from ECU memory. See CLEARING FAULT CODES.

GEAR APPLICATION

Shift Lever Position	Transmission Gear
D	Overdrive
2	3rd Gear
L	1st Gear
R	Reverse
P	Park

TORQUE CONVERTER LOCK-UP

NOTE: Refer to appropriate SHIFT SPEED SPECIFICATION table in the appropriate AUTO TRANS OVERHAUL article for lock-up shift speed. Refer to the following:

* For A-241E, A-241H, A241L & A-243E transaxles, see: AUTO TRANS OVERHAUL - A-241E/H/L & A-243E

* For A-240E, A-240L, A244L & A-245E transaxles, see: AUTO TRANS OVERHAUL - A-240E/L, A-244L & A-245E

Road test vehicle. Increase vehicle speed until lock-up should occur. To confirm lock-up operation, very lightly depress brake pedal with left foot and release while maintaining constant speed. Monitor vehicle tachometer. Torque converter should release and then return to lock-up once brake pedal is released.

SYMPTOM TROUBLE SHOOTING

NOTE: If problem area is not listed under symptom trouble shooting, check throttle position sensor signal, brake signal, gear signal and ECT ECU voltages.

TRANSMISSION WILL NOT SHIFT

1) Warm engine to normal operating temperature. Connect voltmeter between terminals TT and E1 of DLC1 connector. Refer to the Figs. 10-11. Turn ignition on. Note that voltage changes as throttle pedal is depressed.

2) If voltage changes with throttle opening, go to step 6). If voltage does not change with throttle opening, go to next step. Access ECT ECU. See Figs. 1-8.

3) Connect voltmeter between terminals B/K and E1 on ECT ECU connector. See Figs. 21. No voltage should exist with brake pedal released. Approximately 10-14 volts should exist with brake pedal depressed.

4) If voltage is not as specified, check for defective brakelight switch. If brakelight switch is okay, inspect and repair circuit between brakelight switch and ECT ECU. See appropriate wiring diagram in WIRING DIAGRAMS.

5) If voltage is as specified, check for defective ECT ECU power source or ground connections. Check for short or open circuit in wire to TT terminal of DLC connector. Check for defective throttle position sensor or wiring. See THROTTLE POSITION SENSOR under COMPONENT TESTING.

6) Perform MANUAL SHIFTING TEST under TRANSMISSION SHIFT TESTING. If transmission does not perform correctly, disassemble and inspect transmission. If transmission operates correctly, road test vehicle and ensure voltage at terminal TT increases from zero to 7 volts. See GEAR SIGNAL under INPUT & OUTPUT SIGNAL TESTING.

7) If no voltage exists, go to step 9). If voltage increases from zero to 7 volts, transmission or solenoids are faulty. If voltage increases from zero to 4 volts, perform NO UPSHIFT TO OVERDRIVE under SYMPTOM TROUBLE SHOOTING.

8) If voltage increases from zero to 2 volts, check for 10-14 volts between terminals 2 and E1 on ECT ECU with connector connected and shift lever in "D" position. See Fig. 21. If 10-14 volts exist, check for defective park/neutral position switch. If switch is okay, inspect and repair circuit(s) between switch and ECT ECU. See appropriate wiring diagram in WIRING DIAGRAMS. If 10-14 volts does not

exist, replace ECT ECU.

9) Check for 10-14 volts between terminals "L" and E1 on the ECT ECU with the connector connected and shift lever in "D" position. See Fig. 21. If 10-14 volts exist, check for defective park/neutral position switch. If switch is okay, inspect and repair circuit(s) between switch and ECT ECU. Refer to the appropriate wiring diagram in WIRING DIAGRAMS. If 10-14 volts do not exist, replace ECT ECU.

SHIFT POINTS TOO HIGH OR LOW

1) Warm engine to normal operating temperature. Connect voltmeter between terminals TT and E1 of DLC1 connector. Refer to the Figs. 10-11.

2) Turn ignition on. Depress and release throttle pedal. Note if voltage changes with throttle opening. If voltage changes with throttle opening, go to step 6). If voltage does not change with throttle opening, go to next step.

3) Access ECT ECU. See Figs. 1-8. Connect voltmeter between terminals B/K and E1 on ECT ECU with connector connected. See Fig. 21.

4) No voltage should exist with brake pedal released. Approximately 10-14 volts should exist with brake pedal depressed. If voltage is not as specified, check for defective brakelight switch or wiring circuit.

5) If voltage is as specified, check for defective ECT ECU power source or ground connections. See appropriate wiring diagram in WIRING DIAGRAMS. Check for short or open circuit in wire to TT terminal of DLC connector. See THROTTLE POSITION SENSOR SIGNAL under INPUT & OUTPUT SIGNAL TESTING and the appropriate wiring diagram under WIRING DIAGRAMS. Check for defective throttle position sensor or wiring.

6) On 1993 Celica, connect voltmeter between terminals P and E1 on ECT ECU with connector connected. See Figs. 21. Check voltage with pattern select switch in POWER (depressed) and NORMAL (released) operating positions (if applicable).

7) Voltage should be 10-14 volts with switch in POWER position and one volt with switch in NORMAL position. If voltage is as specified, ECT ECU or transmission is defective. If voltage is not as specified, check for defective pattern select switch or wiring circuit. See PATTERN SELECT SWITCH under COMPONENT TESTING.

NO UPSHIFT TO OVERDRIVE

1) Warm engine to normal operating temperature. With ignition off, disconnect solenoid harness connector from transmission. Electrical connectors are located near park/neutral position switch on transmission.

2) Road test vehicle and note if transmission upshifts to overdrive. Reconnect harness connector. Clear codes from ECU memory, as disconnecting electrical connectors may set codes. Refer to CLEARING FAULT CODES. If no overdrive upshift exists, disassemble and inspect transmission. If overdrive upshift exists, go to next step.

3) Connect voltmeter between terminals TT and E1 of DLC connector. See Figs. 10-11. Road test vehicle and ensure voltage at terminal TT increases from zero to 7 volts. See GEAR SIGNAL under INPUT & OUTPUT SIGNAL TESTING.

4) If no voltage exists, check for 10-14 volts between terminals L and E1 on ECT ECU with the connector connected, the shift lever in the "D" position and with ignition on. See Fig. 21. If 10-14 volts exist, check for defective park/neutral position switch. Refer to PARK/NEUTRAL POSITION (PNP) SWITCH under COMPONENT TESTING.

5) If switch is okay, inspect and repair circuit(s) between switch and ECT ECU. See appropriate wiring diagram in WIRING DIAGRAMS. If 10-14 volts does not exist, replace ECT ECU.

6) If voltage increases from zero to 2 volts, check for 10-14 volts between terminals 2 and E1 on ECT ECU with connector connected, shift lever in "D" position and ignition on.

7) If 10-14 volts exist, check for defective park/neutral position switch. If switch is okay, inspect and repair circuit(s) between switch and ECT ECU. See appropriate wiring diagram in WIRING DIAGRAMS. If 10-14 volts does not exist, replace ECT ECU.

8) If voltage increases from zero to 7 volts between terminals L and E1, solenoids may be faulty. See SOLENOIDS under COMPONENT TESTING. If solenoids are okay, disassemble and inspect transmission. If voltage increases from zero to 4 volts between terminals L and E1, connect voltmeter between terminals OD2 and E1 on ECT ECU with connector connected. See Fig. 21.

9) Turn ignition on. Check voltage with OD switch on the shift lever released (OFF position) and depressed (ON position). No voltage should exist with switch released and 10-14 volts should exist with switch depressed.

10) If voltage is correct, go to next step. If voltage is not as specified, check for defective OD switch or wiring circuit.

11) Check voltage between terminals OD1 and E1 on ECT ECU with connector connected and ignition on. Voltage should be approximately 5 volts. If voltage is correct, replace ECT ECU. If voltage is not correct, go to next step.

12) Disconnect electrical connector from cruise control ECU. See Figs. 1-8. Check voltage between terminals OD1 and E1 on ECT ECU with connector connected and with ignition on. If voltage is approximately 5 volts, replace cruise control ECU. If voltage is not within specification 5 volts, inspect and repair circuit(s) between cruise control ECU and ECT ECU. See appropriate wiring diagram in WIRING DIAGRAMS. If wiring is okay, replace ECT ECU.

NO LOCK-UP

1) Warm engine to normal operating temperature. Connect voltmeter between terminals TT and E1 of DLC connector. Refer to the Figs. 10-11.

2) Road test vehicle and ensure voltage at terminal TT is 7 volts in lock-up range. See GEAR SIGNAL under INPUT & OUTPUT SIGNAL TESTING. If voltage is correct, lock-up solenoid, torque converter or transmission is defective.

3) If voltage is not as specified, access ECT ECU. Refer to the Figs. 1-8. Connect voltmeter between terminals B/K and E1 on ECT ECU with connector connected. See Fig. 21.

4) No voltage should exist with brake pedal released. Approximately 10-14 volts should exist with brake pedal depressed. If voltage is not as specified, check for defective brakelight switch or wiring circuit.

5) If voltage is as specified, check for defective ECT ECU power source or ground connections. See appropriate wiring diagram in WIRING DIAGRAMS. Check for short or open circuit in wire to TT terminal of check connector. Check for defective throttle position sensor or wiring. Refer to THROTTLE POSITION SENSOR (TPS) under COMPONENT TESTING.

INPUT & OUTPUT SIGNAL TESTING

NOTE: All voltage checks are made with ignition switch in ON position unless otherwise stated.

THROTTLE POSITION SENSOR SIGNAL

1) Locate DLC1 connector in engine compartment. Refer to the

Figs. 10-11. Connect voltmeter between terminals TT and E1 of DLC connector. See Figs. 10-11.

2) Turn ignition on. Note that voltage gradually increases as accelerator is depressed. Voltage should gradually increase to about 6 volts with throttle fully open.

3) If voltage does not change with throttle opening, check throttle position sensor. See THROTTLE POSITION SENSOR (TPS) under COMPONENT TESTING. If throttle position sensor is okay, check wiring circuit for throttle position sensor.

BRAKE SIGNAL

1) Locate check connector in engine compartment. Refer to the Figs. 1-2. Connect voltmeter between terminals TT and E1 of check connector. See Figs. 7-8.

2) Depress accelerator pedal until 6 volts exists. Depress brake pedal and note that voltage decreases to no voltage. Release brake pedal and note that voltage increases to 6 volts.

3) If voltage is not as specified, check brakelight switch. See BRAKELIGHT SWITCH under COMPONENT TESTING. If brakelight switch is okay, check wiring circuit for brakelight switch.

GEAR SIGNAL

1) Warm engine to normal operating temperature. On Celica models, place pattern select switch in NORMAL (released position). Pattern select switch is located near shift lever.

2) On all models, depress OD switch, mounted on shift lever, to the ON position. Locate check connector in engine compartment. See Figs. 1-2. Connect voltmeter between terminals TT and E1 of check connector. See Figs. 10-11.

3) Road test the vehicle with the shift lever in the "D" position and with vehicle speed greater than 6 MPH. Voltage should increase as specified in accordance with transmission gear position. See the GEAR SIGNAL VOLTAGES table.

4) If voltages are as specified, electronic control system is operating correctly. If voltages are not as specified, system must be checked.

GEAR SIGNAL VOLTAGES

Gear Position	Voltage (Approximate)
1st Gear	0
2nd Gear	2
3rd Gear	4
Overdrive	6
Overdrive With Lock-Up	7

OVERDRIVE CANCEL SIGNAL

1) Access ECT ECU. See Figs. 1-8. Turn ignition on. Measure voltage (backprobe) between terminal OD1 of ECT ECU harness connector and ground. If battery voltage is present, substitute known good ECU and retest. If battery voltage is not present, go to next step.

2) Turn ignition off. Disconnect cruise control ECU harness connector. See Figs. 1-8. Turn ignition on. Measure voltage between terminal OD and ground. See Fig. 22. If battery voltage is present, replace cruise control ECU and retest. If battery voltage is not present, inspect and repair circuit between cruise control ECU and ECT ECU.

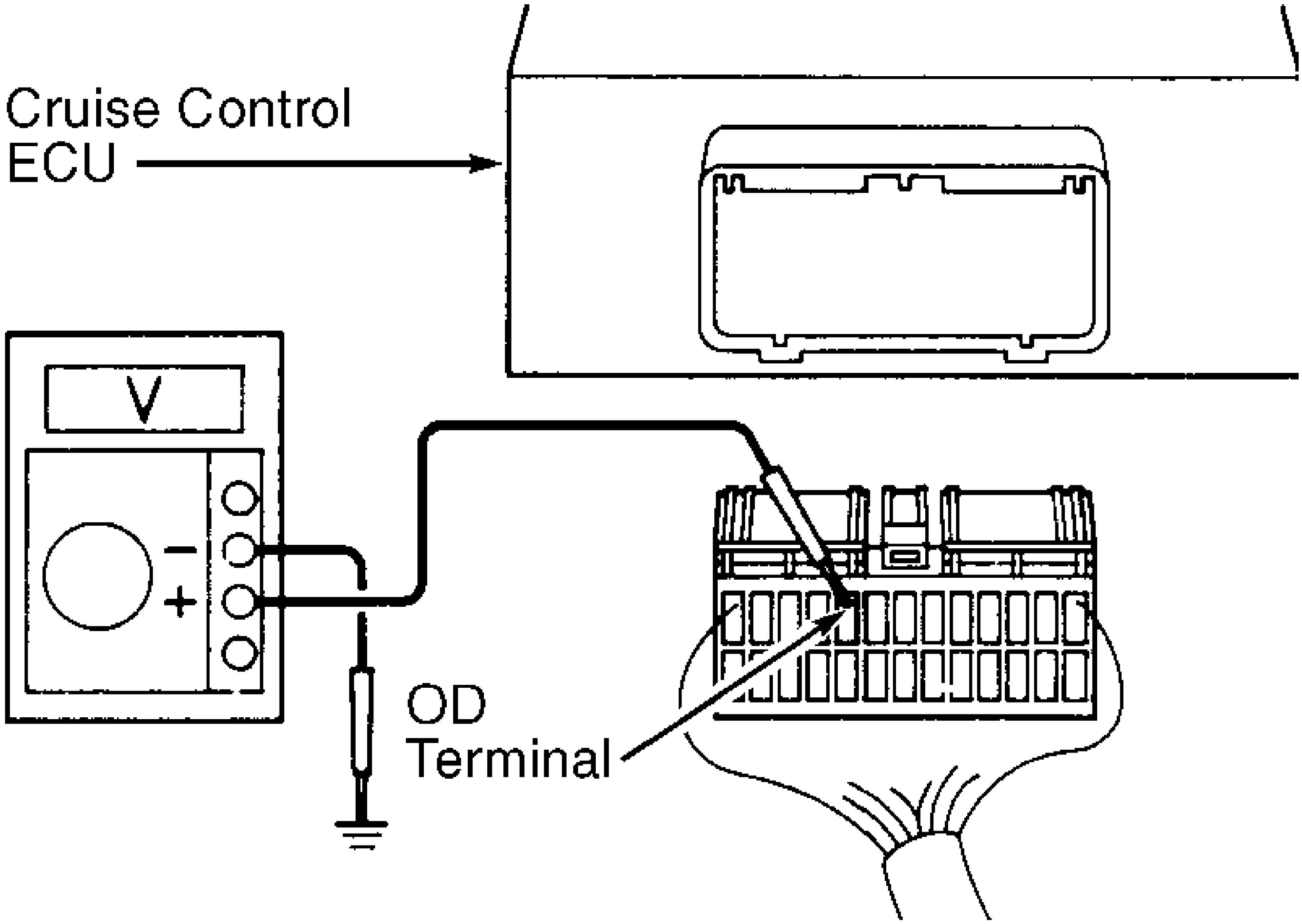


Fig. 22: Cruise Control ECU Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ECT ECU VOLTAGES

Access ECT ECU. See Figs. 1-8. Turn ignition on. Using voltmeter, backprobe ECT ECU harness connector. Check voltage between selected terminal and E1 or E2 terminal. Voltage should be as specified. See Fig. 21.

COMPONENT TESTING

SOLENOIDS COMPONENT TEST

NOTE: Lock-up solenoid terminal SL, may also be referred to as solenoid No. 3 (SOL 3) terminal.

1) Access ECT ECU. See Figs. 1-8. Ensure ignition is off. Disconnect ECT ECU harness connector. Using ohmmeter, measure resistance between SL, S1 and S2 terminal and ground for appropriate proper solenoid. See Fig. 21.

2) Replace solenoid if resistance is not 11-15 ohms. To check solenoid operation, apply battery voltage to SL, S1 or S2 terminal of ECT ECU connector for appropriate solenoid. Ensure operating sound can

be heard when battery voltage is connected. Replace solenoid if operating sound cannot be heard.

3) To check solenoid seals, remove suspect solenoid. Connect battery voltage to solenoid. Apply 71 psi (5 kg/cm²) to solenoid with battery voltage connected. See Fig. 23.

4) With battery voltage applied, air should pass through solenoid No. 1 and 2 solenoids. Disconnect voltage to solenoid. Ensure air does not pass through solenoid. Replace solenoid if defective.

5) With battery voltage applied, air should not pass through lock-up solenoid. Disconnect voltage to solenoid. Ensure air passes through solenoid. Replace solenoid if defective.

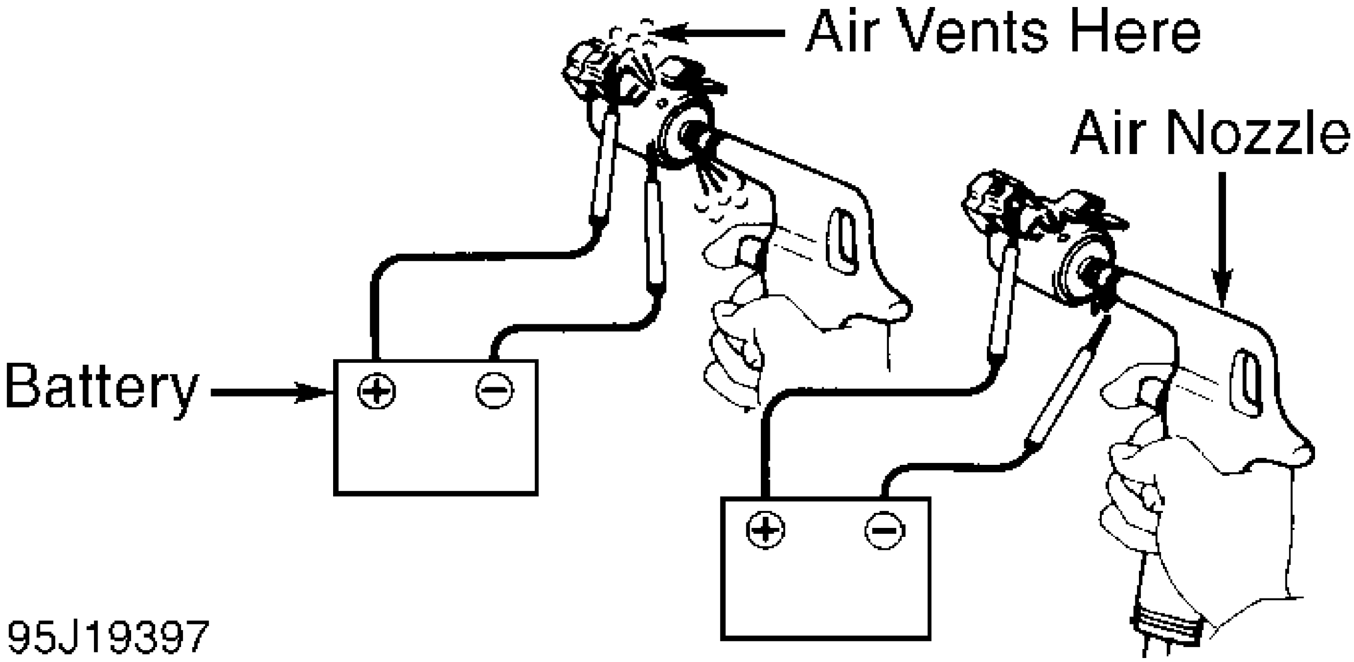
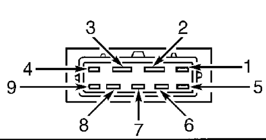


Fig. 23: Checking Solenoids
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PARK/NEUTRAL POSITION (PNP) SWITCH COMPONENT TEST

Disconnect harness connector at park/neutral position switch. Switch is located on side of transmission. Using ohmmeter, check for continuity between specified terminals in accordance with shift lever position. See Figs. 24-26. Replace PNP switch if defective.



Position \ Terminal	2	3	6	1	5	7	8	9	4
P	O	O	O	O					
R			O		O				
N	O	O	O			O			
D			O				O		
2			O					O	
L			O						O

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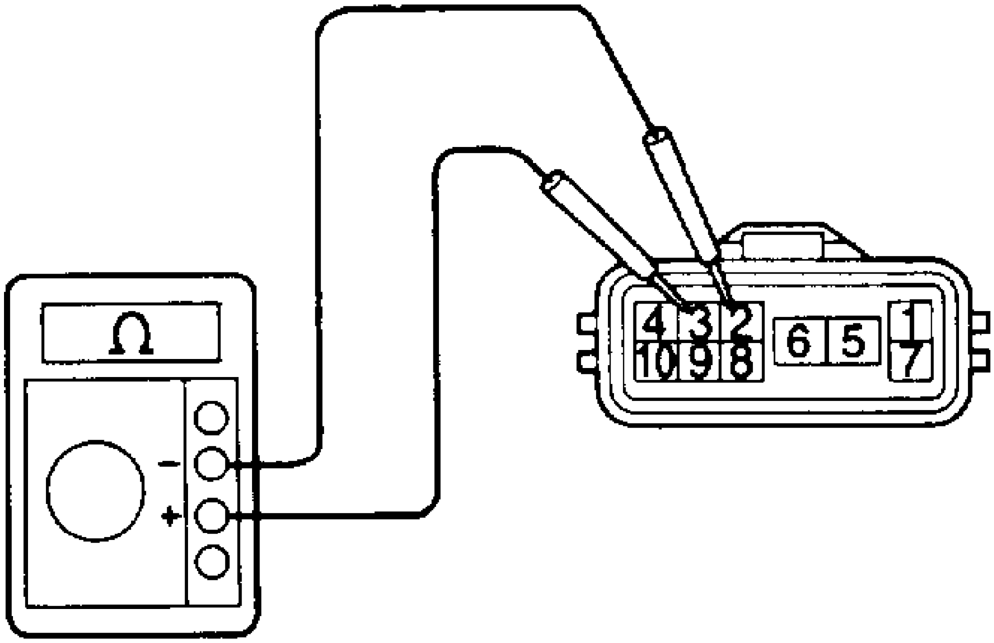
Fig. 24: Testing Park/Neutral Position Switch
(1993 Celica, MR2 & Paseo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

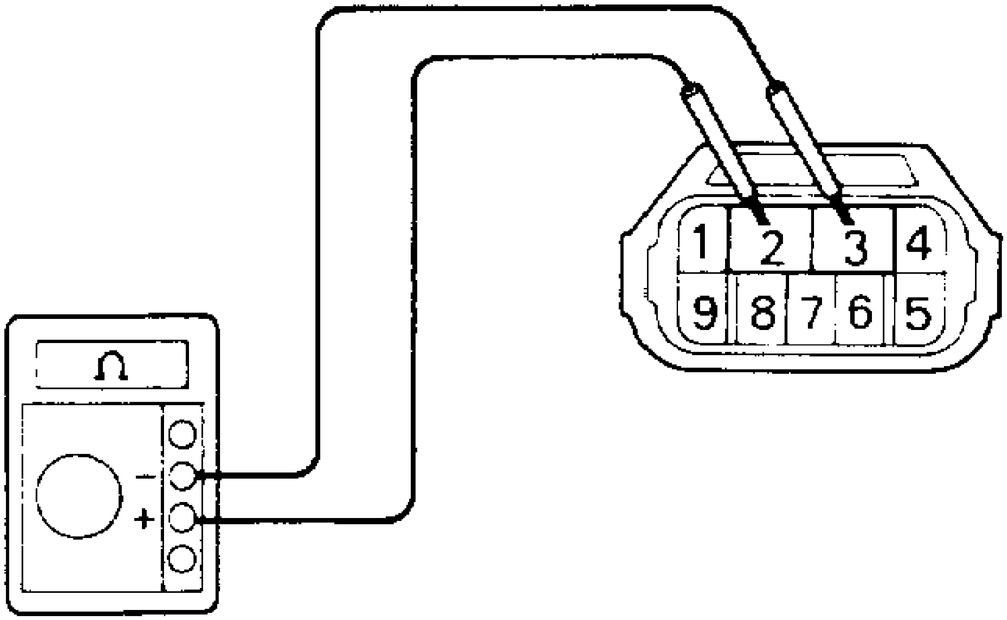


○—○ Continuity

Shift Position \ Terminal	6	5	4	7	8	10	9	2	3
P	○	○	○	○					
R			○	—	○				
N	○	○	○	—	—	○			
D			○	—	—	—	○		
2			○	—	—	—	—	○	
L			○	—	—	—	—	—	○

95G19394

Fig. 25: Testing Park/Neutral Position Switch
(1994 Celica & Prizm)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



○——○ Continuity

Shift Position \ Terminal	3	2	9	1	4	6	5	7	8
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
L			○						○

50A12856

Fig. 26: Testing Park/Neutral Position Switch (Corolla)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

THROTTLE POSITION SENSOR (TPS) COMPONENT TEST

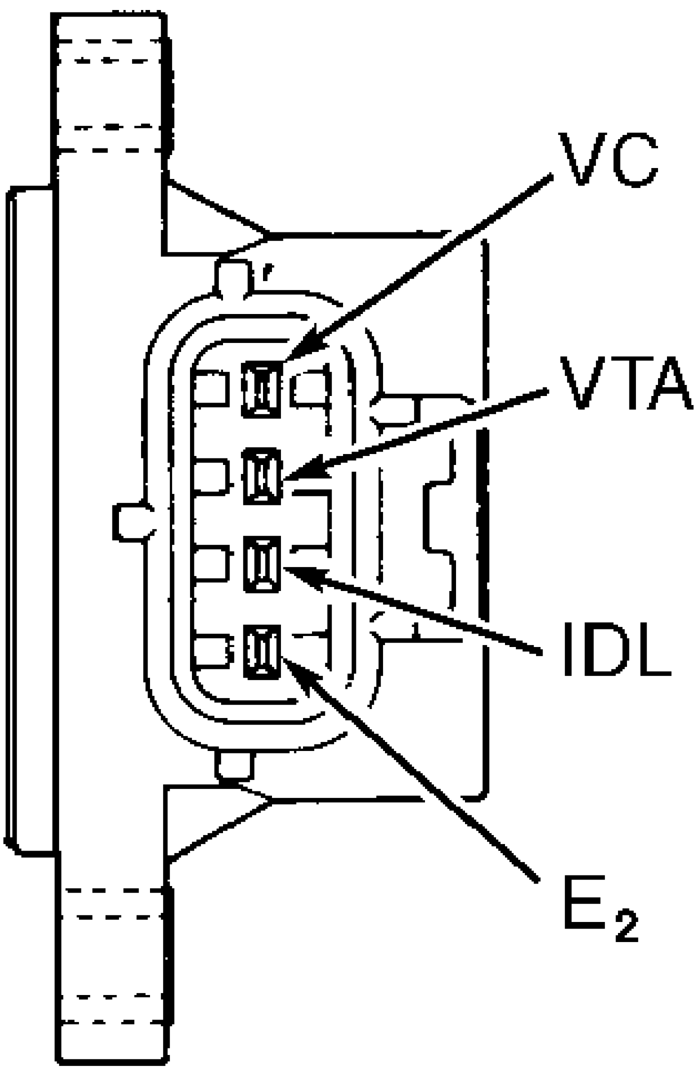
1) Disconnect electrical connector at TPS, located on side of throttle body. Note TPS terminal identification. See Fig. 27.

2) Using an ohmmeter, check resistance between specified terminals in relation to specific throttle position(s). Refer to the TPS RESISTANCE SPECIFICATIONS table. Replace TPS if resistance is not

as specified.

TPS RESISTANCE SPECIFICATIONS

Terminals	Ohms
IDL & E2	
Throttle Fully Closed	0-100
Throttle Fully Open	Infinity
VC & E2	3000-7000
VTA & E2	
Throttle Fully Closed	200-800
Throttle Fully Open	3200-10,000



93C24150

Fig. 27: Throttle Position Sensor (TPS) Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NO. 1 SPEED SENSOR COMPONENT TEST

1993 Celica & Paseo

1) Remove instrument panel. Connect ohmmeter between terminals on rear of instrument panel. See Figs. 14-15.

2) Rotate speedometer cable shaft on instrument panel. Note that ohmmeter needle fluctuates from continuity to no continuity. If reading does not fluctuate correctly, replace speedometer or speed sensor as necessary.

1994 Celica, Corolla, MR2 & Prizm

1) Disconnect electrical connector from No. 1 VSS, located on top of transmission. See Figs. 1-8. Connect positive battery lead to terminal No. 1 and negative lead to terminal No. 2. Connect positive lead of voltmeter to terminal No. 3 and negative lead to terminal No. 2. See Fig. 28.

2) Rotate speedometer cable shaft on speed sensor. Ensure voltage changes from zero to 11 volts. Voltage should change 4 times per each revolution of speedometer cable shaft. Replace speed sensor if voltage dose not change as specified.

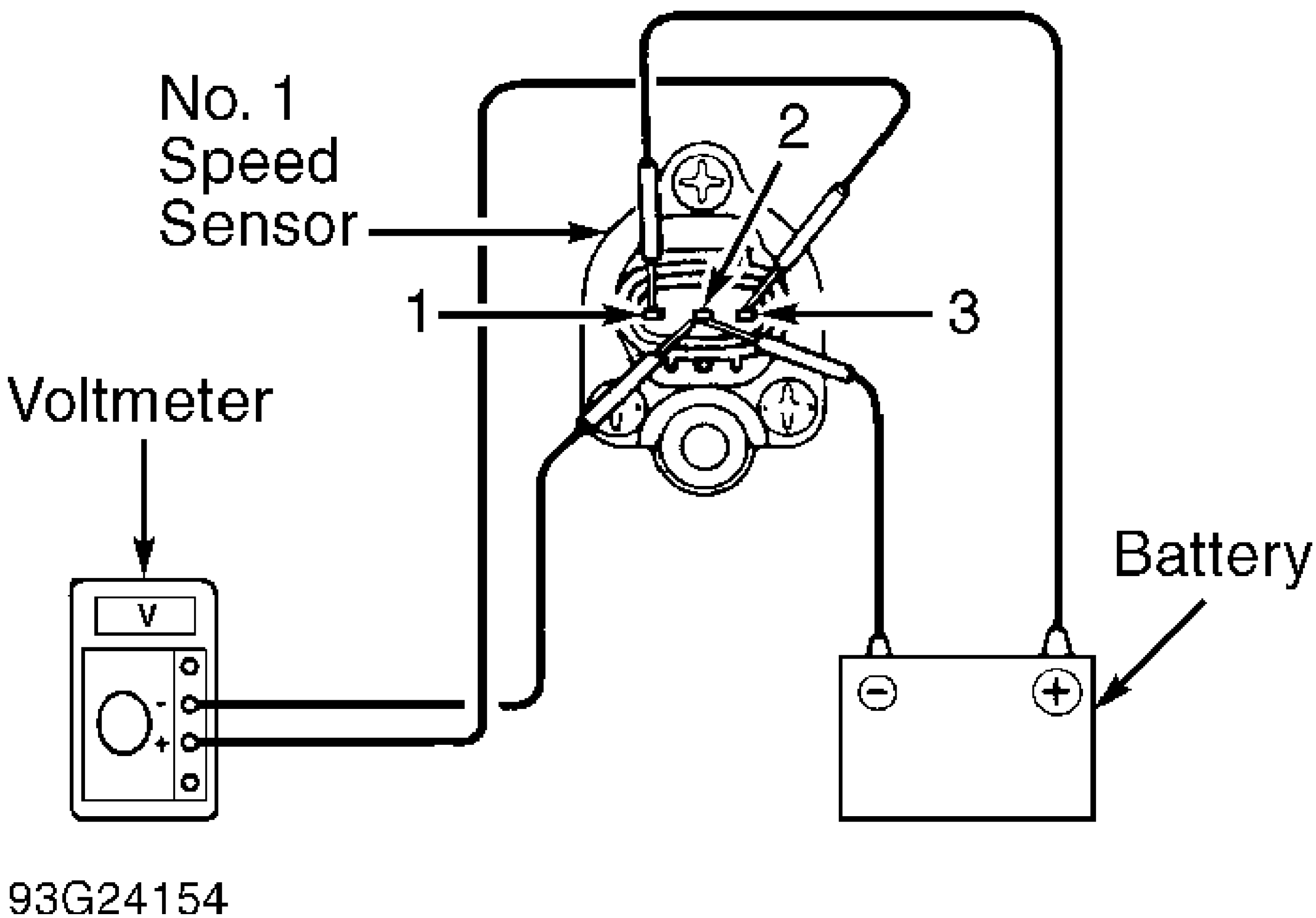


Fig. 28: Checking No. 1 Vehicle Speed Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NO. 2 SPEED SENSOR COMPONENT TEST

1) Disconnect electrical connector from No. 2 speed sensor, located on transmission. Raise and support vehicle so front wheels can rotate. Connect ohmmeter between terminals of No. 2 speed sensor.

2) Rotate front wheel. Note that ohmmeter needle fluctuates

from continuity to no continuity. If reading does not fluctuate correctly, remove No. 2 speed sensor from transmission.

3) Connect ohmmeter between terminals of No. 2 speed sensor. Note that ohmmeter needle fluctuates from continuity to no continuity when shaft is rotated.

4) Replace speed sensor if reading does not fluctuate. If reading fluctuates correctly, components in transmission for speed sensor must be replaced.

PATTERN SELECT SWITCH (1993 CELICA ONLY) COMPONENT TEST

1) Disconnect electrical connector from pattern select switch, located near shift lever. See Figs. 1-2. Note terminal identification on pattern select switch. See Fig. 29.

2) Using ohmmeter, ensure continuity exists between terminals No. 2 and 3 with switch in POWER (depressed) position, and no continuity exists with switch in NORMAL (released) position. Replace switch if defective.

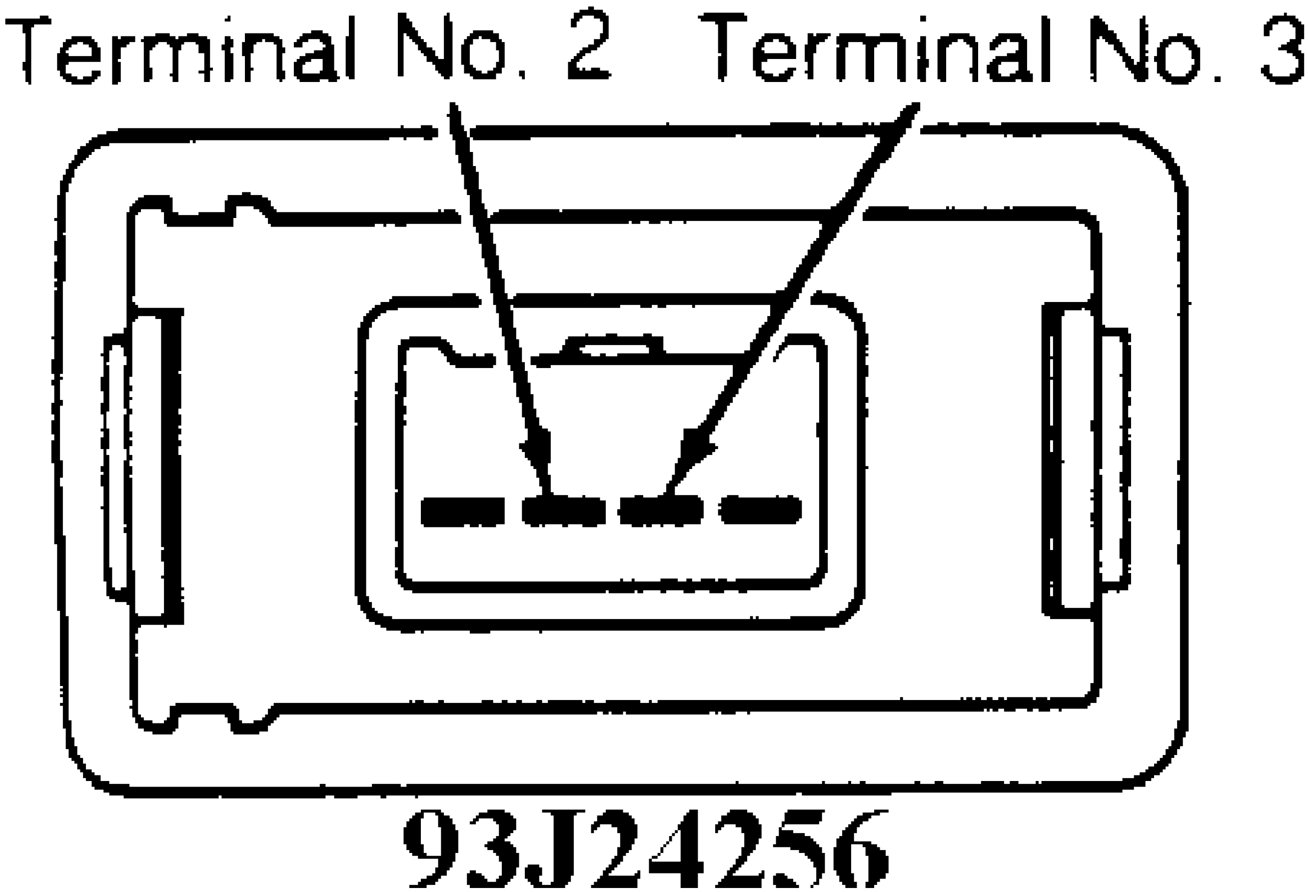


Fig. 29: Pattern Select Switch Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OVERDRIVE (OD) SWITCH COMPONENT TEST

1) Disconnect electrical connector from OD switch, located on shift lever. Note terminal identification on OD switch. See Fig. 30.

2) Using ohmmeter, ensure continuity exists between terminals No. 1 and 3 with switch released (OFF position).

3) Ensure no continuity exists between terminals No. 1 and 3 with switch depressed (ON position). Replace switch if defective.

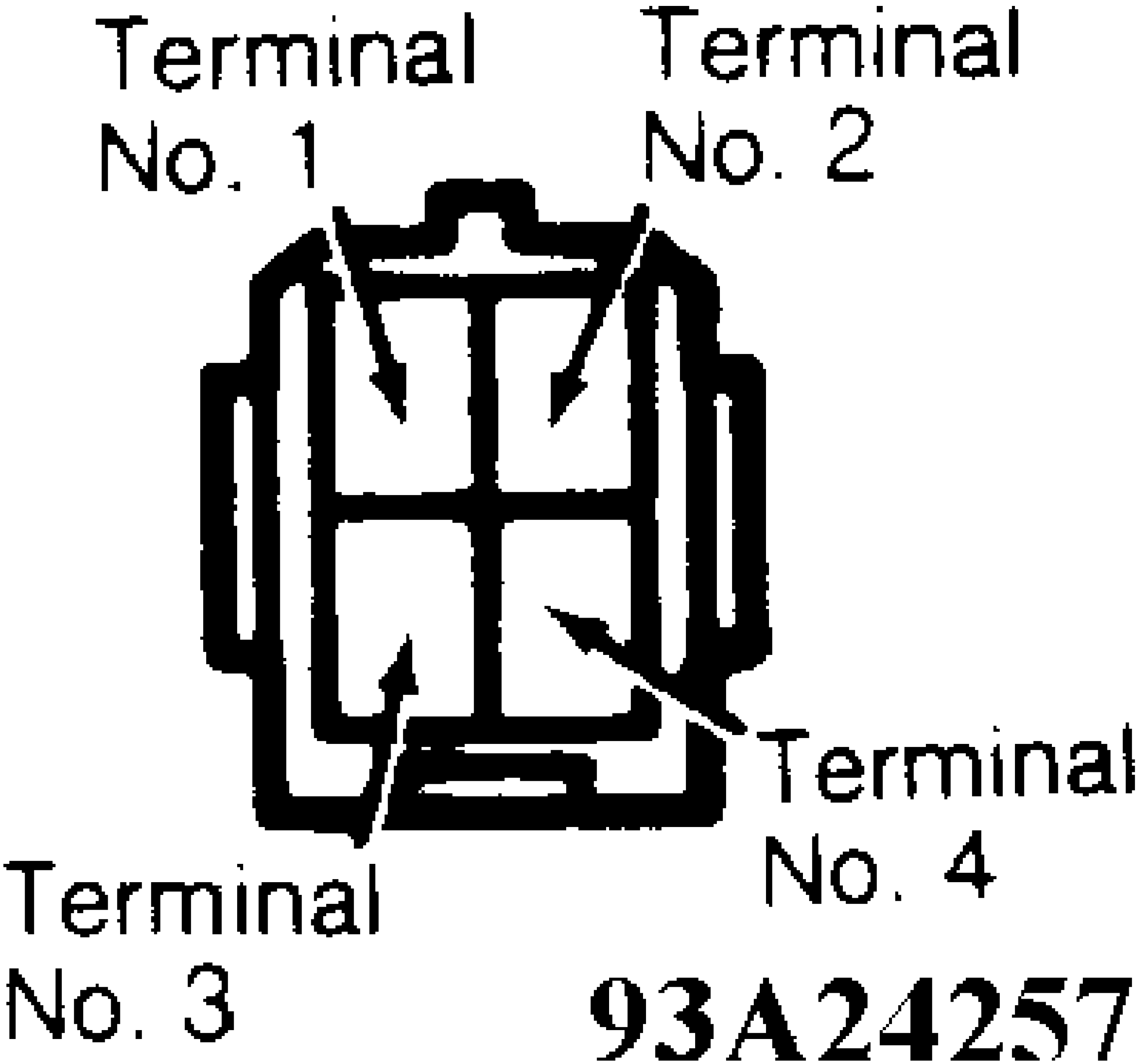


Fig. 30: Overdrive (OD) Switch Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

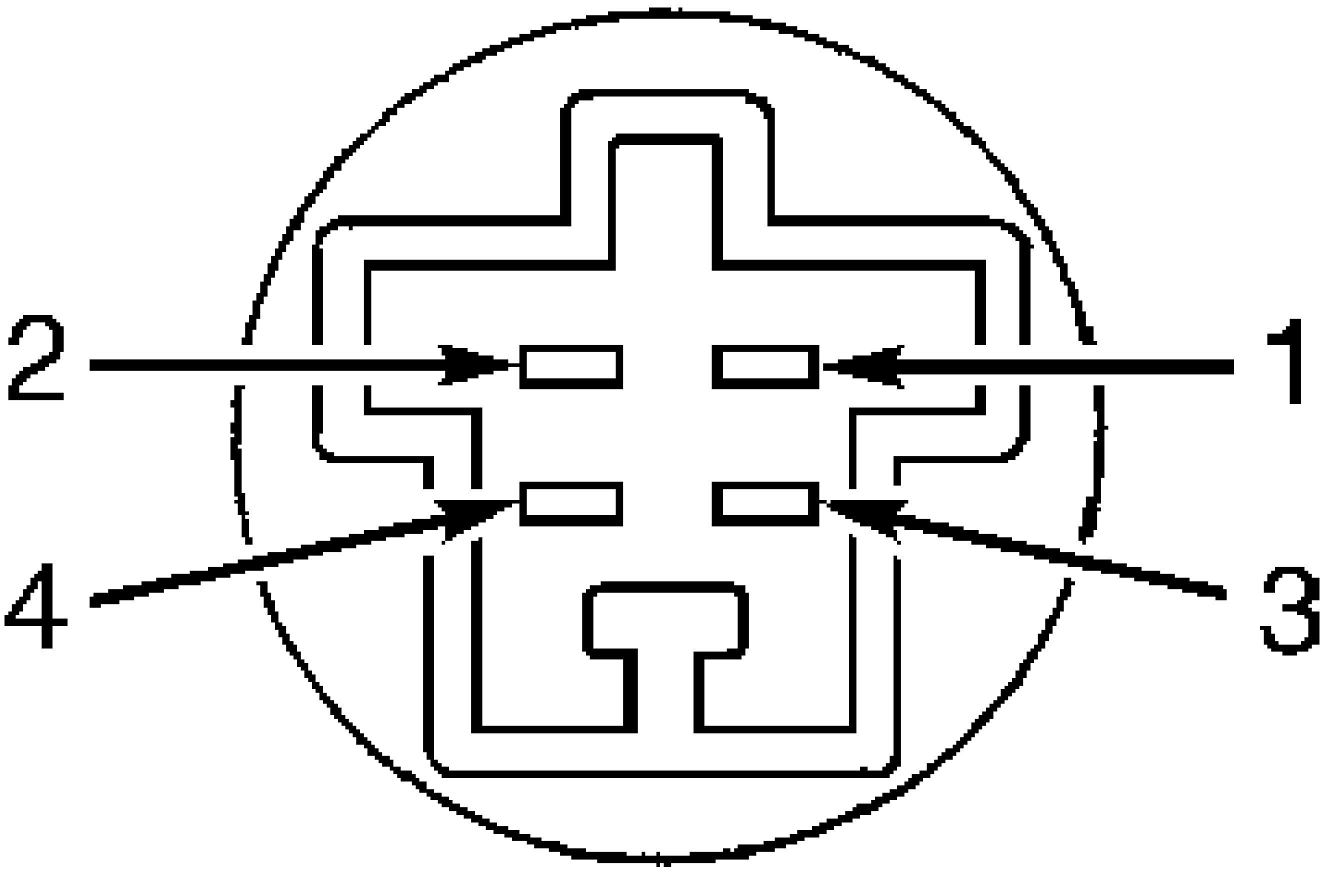
BRAKELIGHT SWITCH COMPONENT TEST

1) Disconnect electrical connector from brakelight switch, located near brake pedal. Note brakelight switch terminal identification. See Fig. 31.

2) Using ohmmeter, ensure no continuity exists between terminals No. 1 and 3 with brake pedal released. Replace brakelight switch if continuity exists.

3) Using ohmmeter, ensure continuity exists between terminals No. 1 and 3 with brake pedal depressed. If continuity does not exist, ensure brake pedal is properly adjusted so brakelight switch has proper travel for switch operation. If proper brakelight switch travel

exists, replace brakelight switch.



93E24160

Fig. 31: Brakelight Switch Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

COOLANT TEMPERATURE SENSOR (CTS) COMPONENT TEST

Disconnect electrical connector from CTS. See CTS LOCATION table. Using ohmmeter, check resistance between terminals of coolant temperature sensor. Resistance should as specified in accordance with coolant temperature. See Fig. 32. Replace sensor if resistance is not within specification.

CTS LOCATION

Application	Location
Celica	
1993	Radiator
1994	Thermostat Housing
Corolla	Thermostat Housing
MR2	Radiator
Paseo	N/A
Prizm	Thermostat Housing

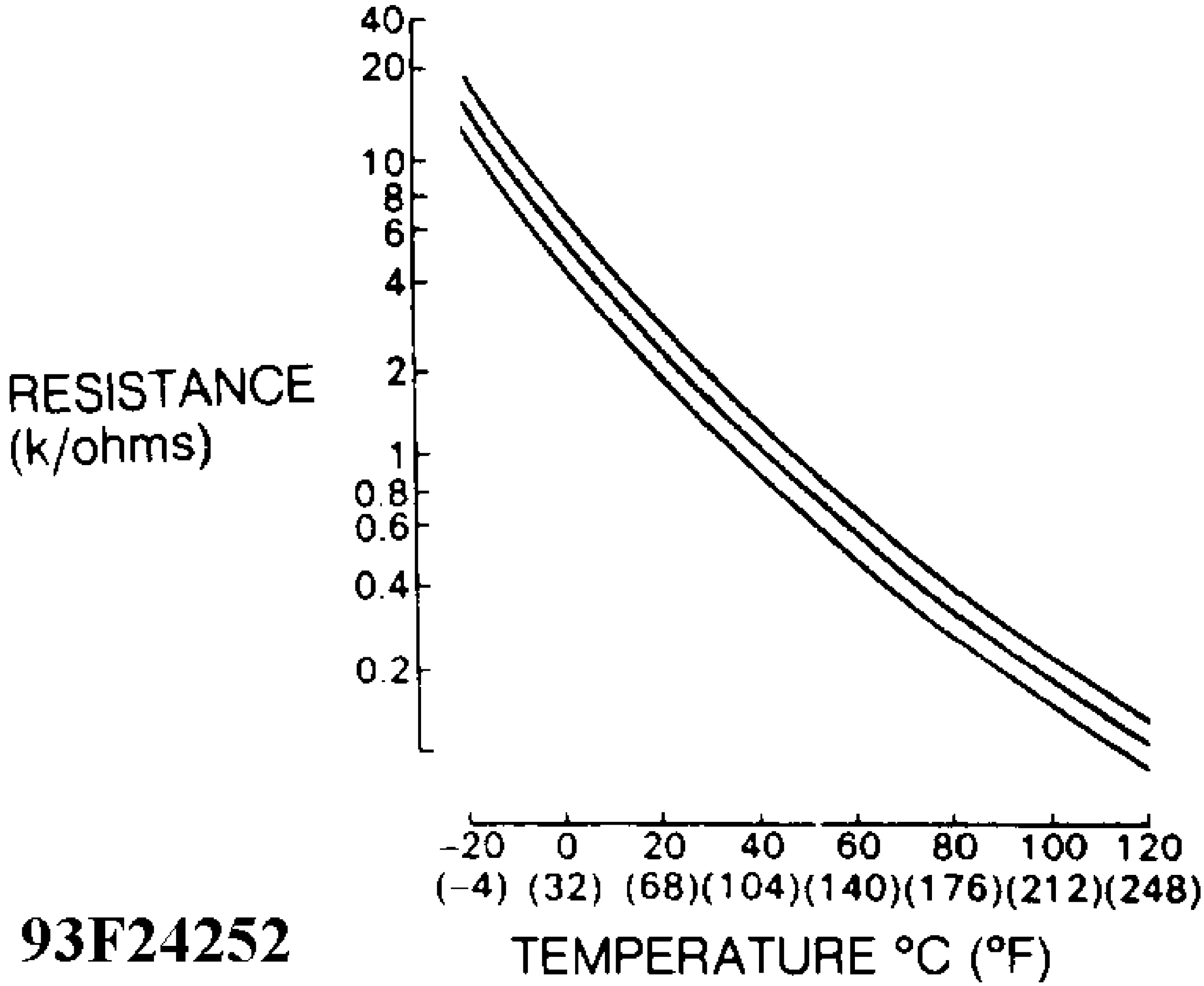


Fig. 32: Checking Coolant Temperature Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

BRAKELIGHT SWITCH R & I

Removal & Installation

1) Disconnect electrical connector. Remove lock nut, and unscrew brakelight switch. To install, screw brakelight switch inward until brakelight plunger contacts brake pedal.

2) Install and tighten lock nut on brakelight switch. Install electrical connector. Ensure brakelights and cruise control (if equipped) operate properly.

COOLANT TEMPERATURE SENSOR (MR2) R & I

Removal

Coolant temperature sensor is located in radiator. Drain cooling system. Remove coolant temperature sensor.

Installation

1) To install, reverse removal procedure. Proper cooling system bleeding procedure must be followed.

2) Remove spare tire, front luggage compartment trim and upper radiator support seal. Connect air bleed hoses to heater and radiator air drain plugs. Attach and support opposite end of hoses to hood or hood support. See Fig. 33. Ensure hoses are not pinched.

3) Place heater control lever on instrument panel to warmest position. Open heater and radiator air drain plugs at least 3 turns.

4) Slowly add coolant through coolant filler. Air will bleed from hoses on heater and radiator air drain plugs. Ensure coolant in air bleed hoses and coolant filler are at the same lever.

5) If coolant level in air bleed hoses is lower than lever in coolant filler, air still exists in cooling system. Check for pinched or restriction in air bleed hoses. If necessary, repeat step 4). When proper coolant level is obtained in air bleed hoses, close air drain plugs. Remove air bleed hoses.

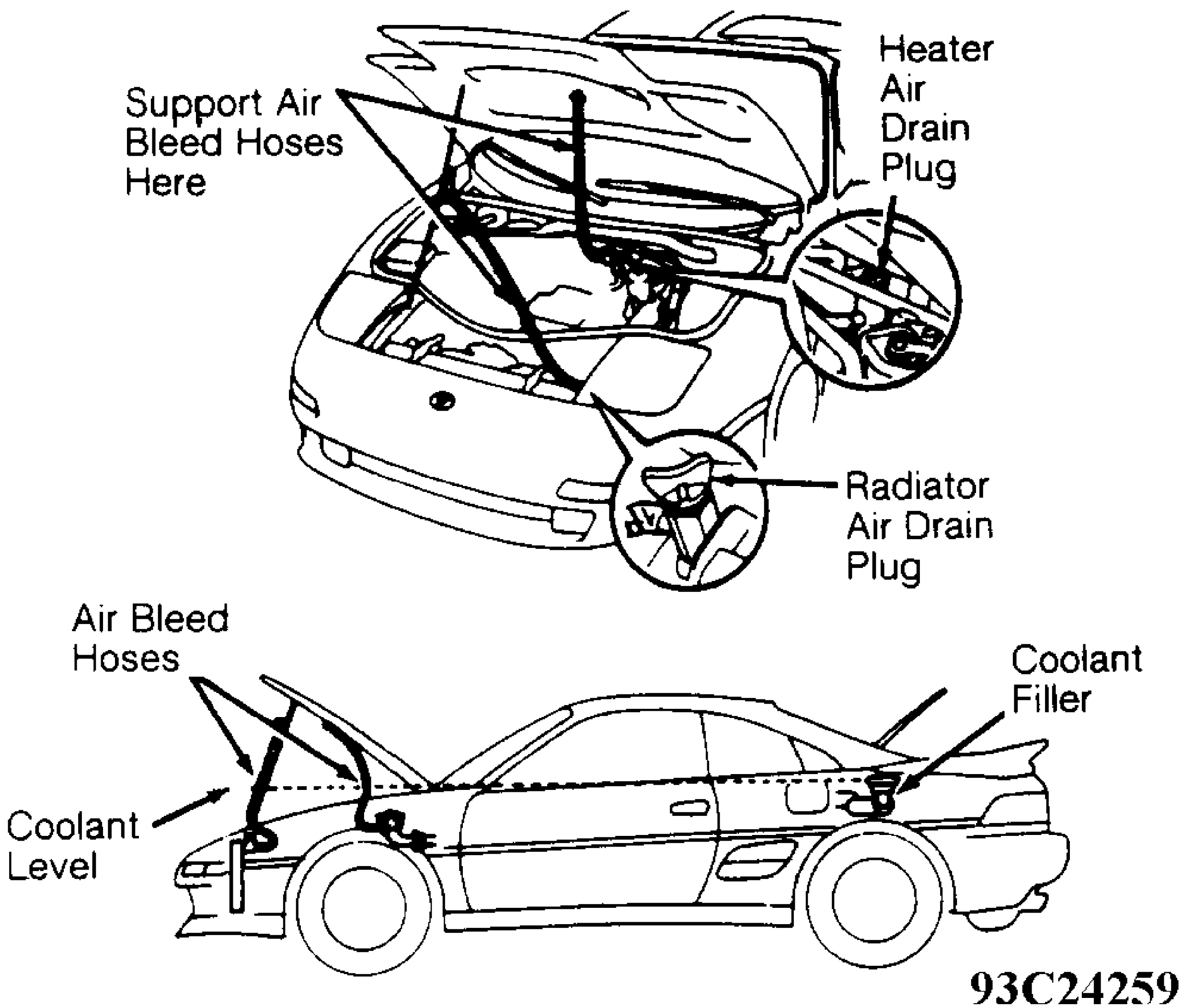


Fig. 33: Installing Air Bleed Hoses (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SHIFT SOLENOIDS R & I

Removal & Installation

Solenoids are located on the valve body. Remove bolt, solenoid and "O" ring from valve body. To install, reverse removal procedure using NEW "O" ring.

PARK/NEUTRAL POSITION (PNP) SWITCH R & I

Removal

1) Neutral start switch is located on side of transmission. Remove lock nut, washer and manual lever from control shaft. Refer to the Figs. 34-35

2) Bend up tabs on lock washer. Remove lock nut, lock washer and seal from control shaft. Remove retaining bolts and neutral start switch.

Installation

1) Install switch on control shaft. Loosely install neutral start switch retaining bolts. Install seal and lock washer. Install lock nut and tighten to specification. See TORQUE SPECIFICATIONS. Bend tabs on lock washer over against lock nut.

2) Ensure parking brake is applied. Temporarily install manual lever on control shaft. Place shift lever in Neutral. Remove manual lever. Rotate switch and align reference mark on PNP switch with groove.See Figs. 34-35

3) Hold neutral switch in this position. Tighten retaining bolts to specification. To install remaining components, reverse removal procedure.

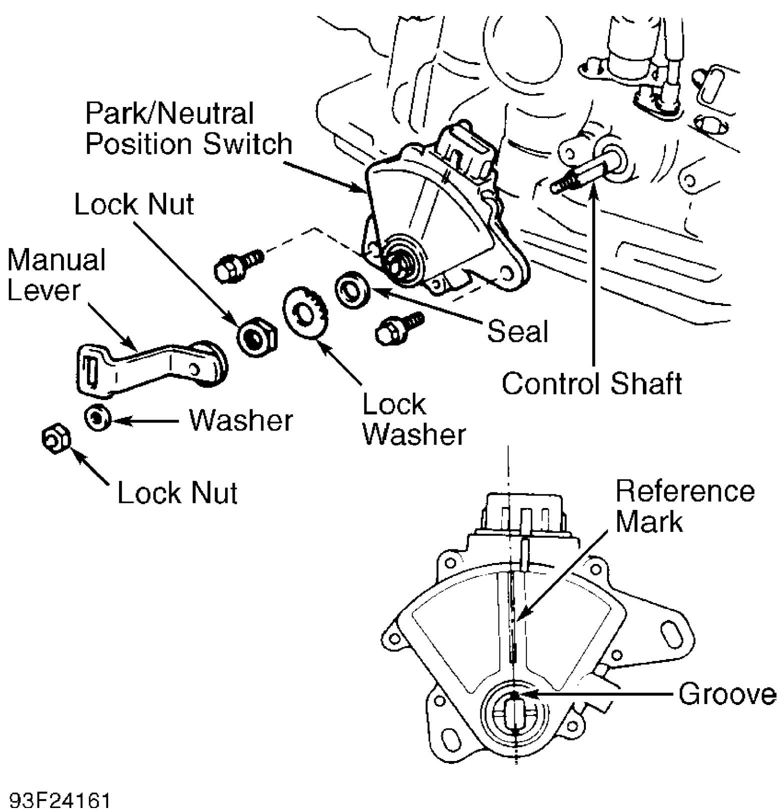


Fig. 34: Removing & Installing PNP Switch
Courtesy of Toyota Motor Sales, U.S.A., Inc.

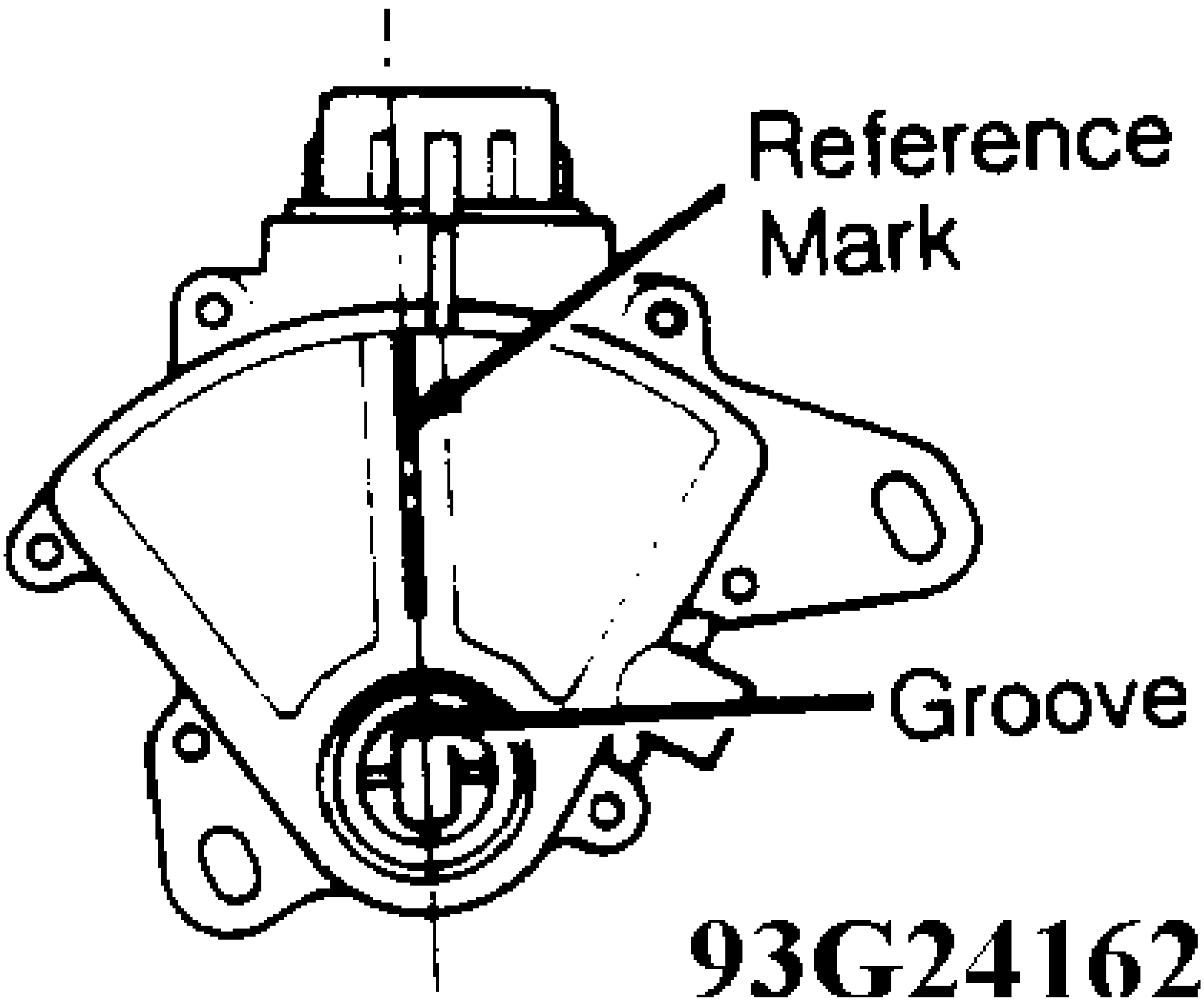


Fig. 35: Removing & Installing PNP Switch
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OVERDRIVE (OD) SWITCH R & I

Overdrive (OD) switch is mounted on the shift lever. Replacement information not available from manufacturer.

PATTERN SELECT SWITCH R & I

Pattern select switch is located on center console. Replacement information not available from manufacturer.

THROTTLE POSITION SENSOR (TPS) R & I

Removal

Ensure ignition is off. Disconnect electrical connector from TPS. TPS is located on throttle body. Remove screws and TPS.

Installation

1) Install TPS on throttle body with screws loosely installed. TPS must be adjusted. Connect ohmmeter leads to IDL and E2

terminals of TPS. See Fig. 16.

2) Apply vacuum to throttle opener on valve body. Insert a .024" (.60 mm) feeler gauge between throttle stop screw and stop lever. Gradually rotate TPS until ohmmeter deflects, and tighten retaining screws.

3) Remove feeler gauge. Insert a .020" (.50 mm) feeler gauge between throttle stop screw and stop lever. Ensure continuity now exists between IDL and E2 terminals. Remove feeler gauge.

4) Insert a .028" (.70 mm) feeler gauge between throttle stop screw and stop lever. Ensure no continuity now exists between IDL and E2 terminals. Remove feeler gauge.

NO. 1 SPEED SENSOR R & I

The No. 1 speed sensor is mounted on rear of instrument panel. See Fig. 1. Replacement information not available from manufacturer.

NO. 2 SPEED SENSOR R & I

Removal

Disconnect electrical connector from No. 2 speed sensor, located on transmission. See Fig. 1. Remove bolt, retaining plate and No. 2 speed sensor. Remove "O" ring from No. 2 speed sensor.

Installation

To install, reverse removal procedure using NEW "O" ring. Coat "O" ring with ATF before installing No. 2 speed sensor. Tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.

WIRING DIAGRAMS

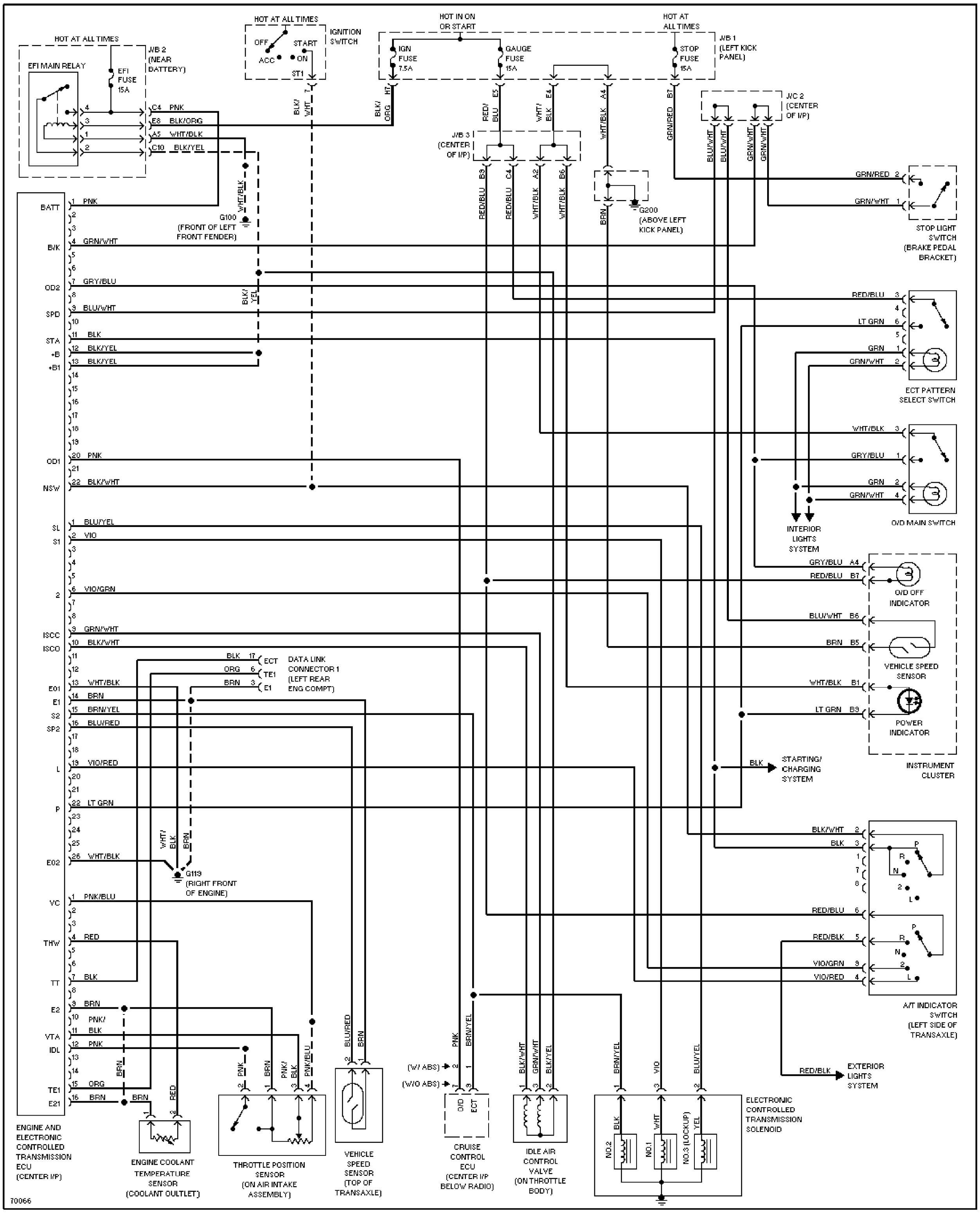


Fig. 36: Transmission Wiring Diagram (1993 Celica 2.2L)

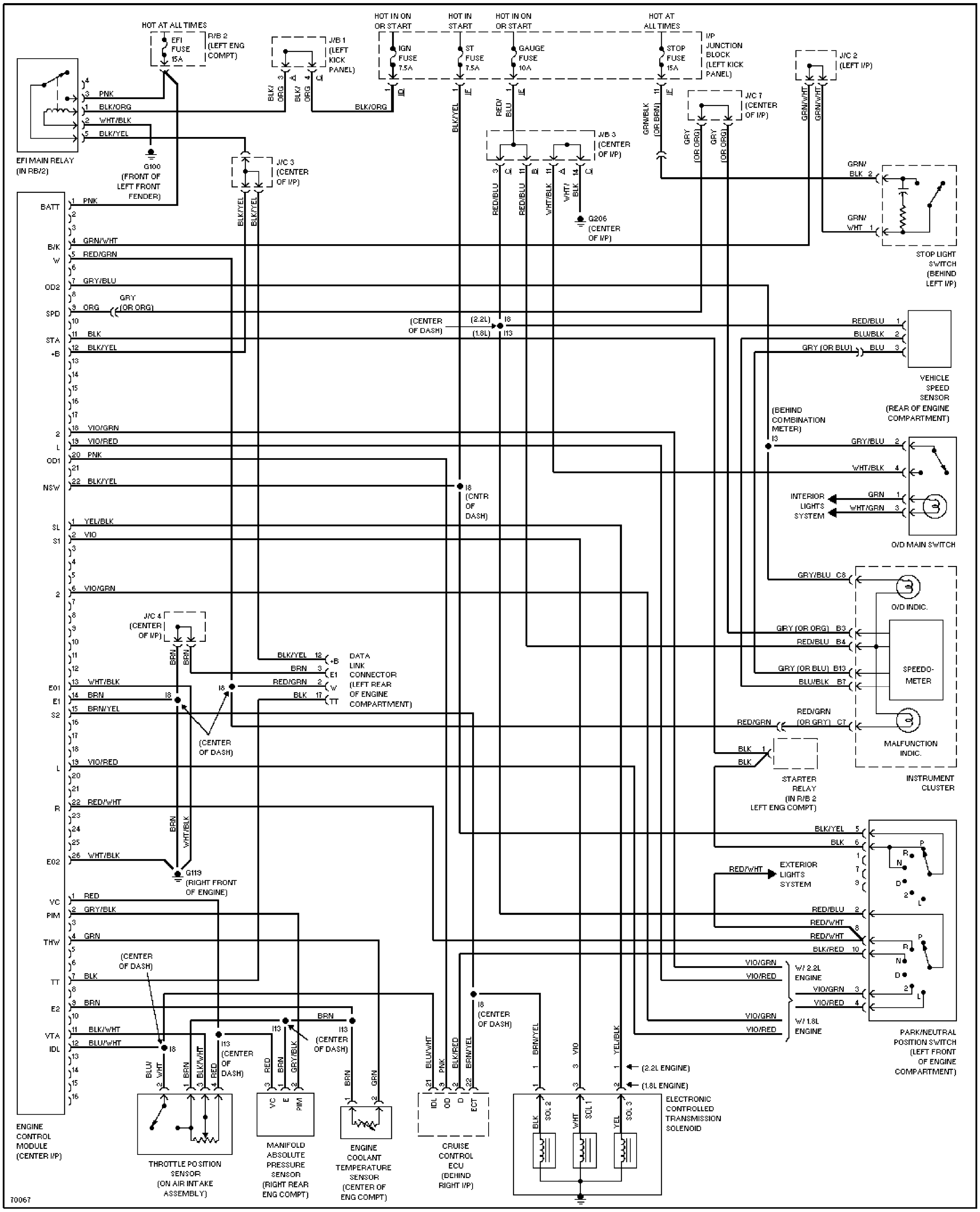


Fig. 37: Transmission Wiring Diagram (1994 Celica 1.8L)

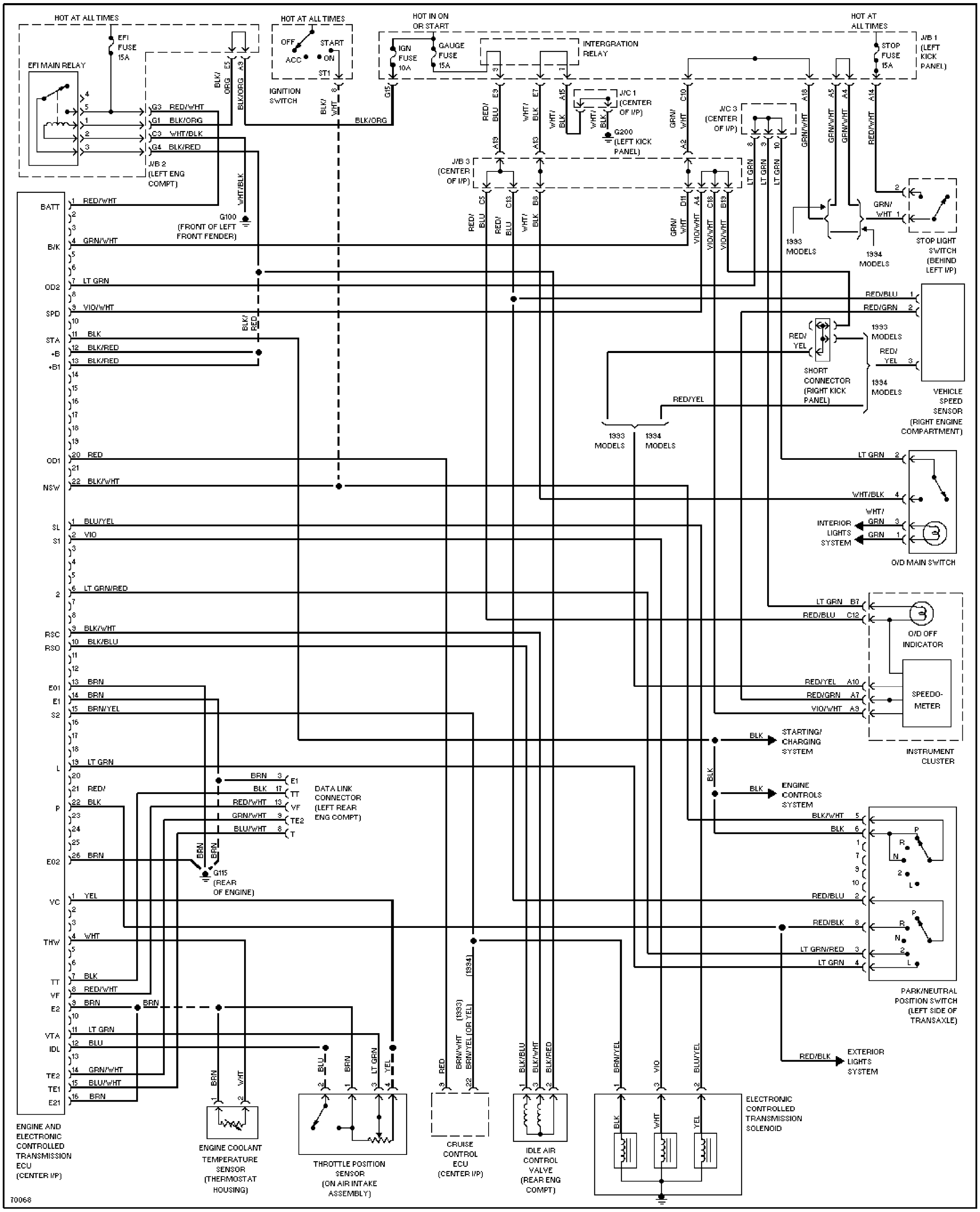


Fig. 38: Transmission Wiring Diagram (1993-94 Corolla)

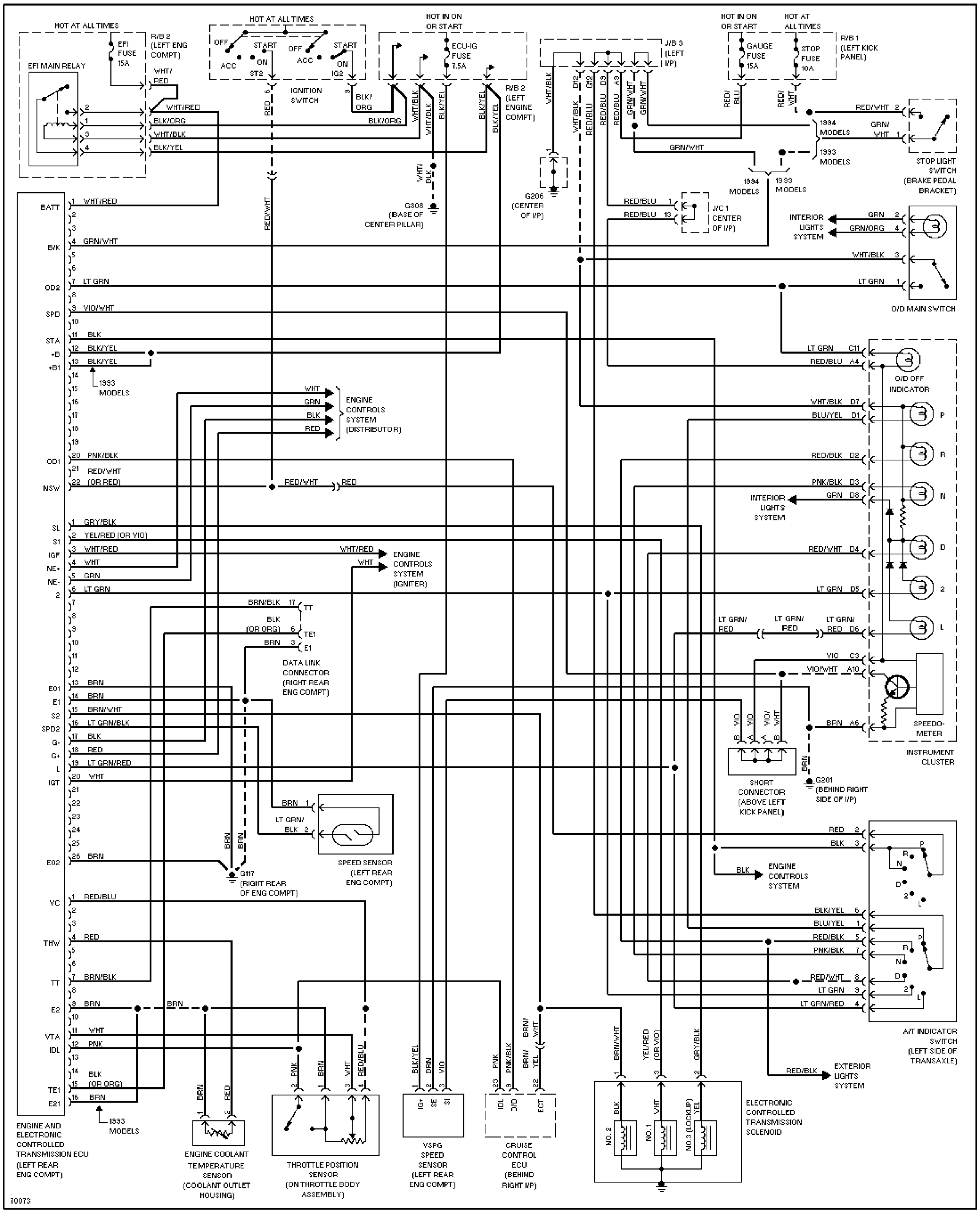


Fig. 39: Transmission Wiring Diagram (1993-94 MR2)

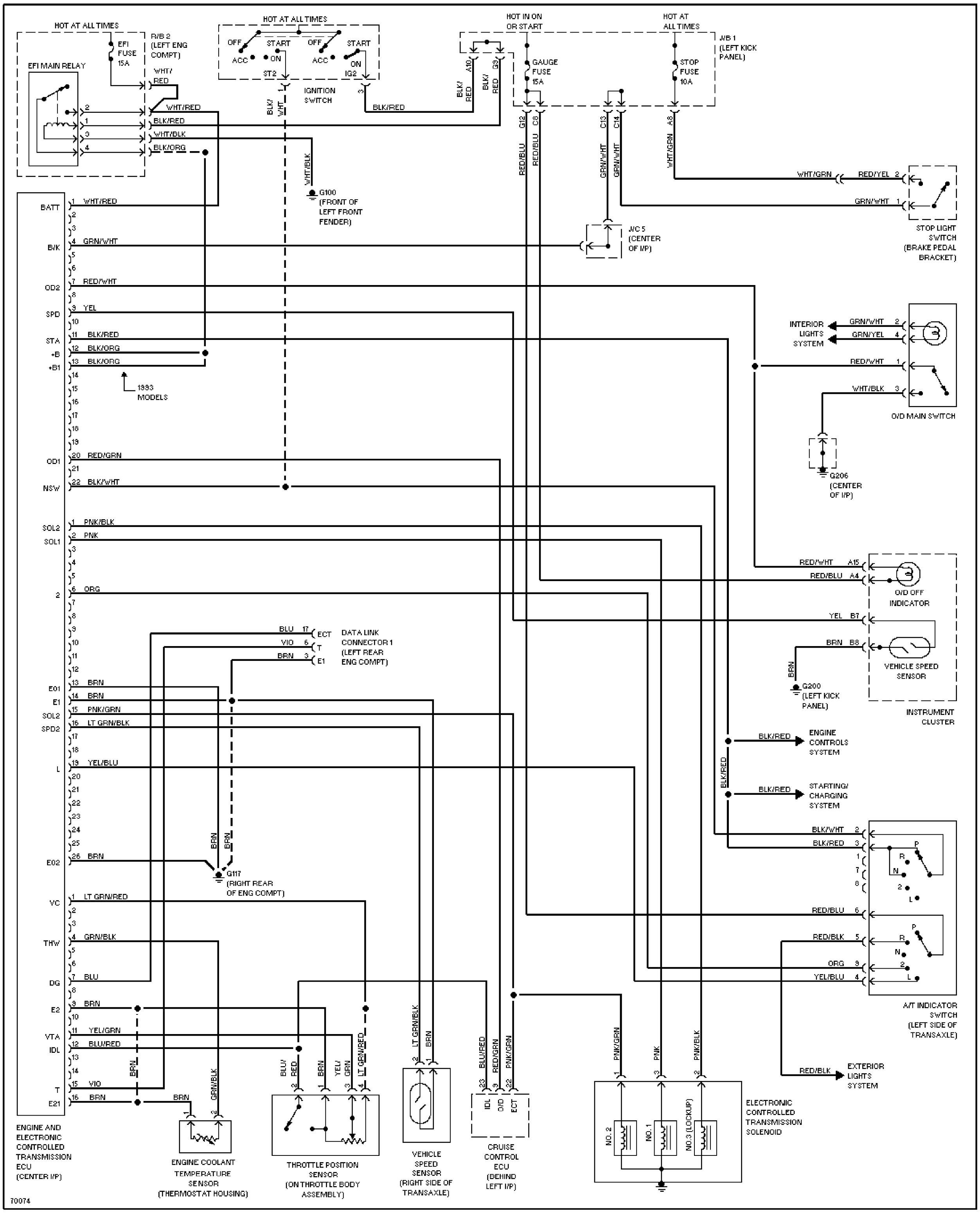


Fig. 40: Transmission Wiring Diagram (1993-94 Paseo)

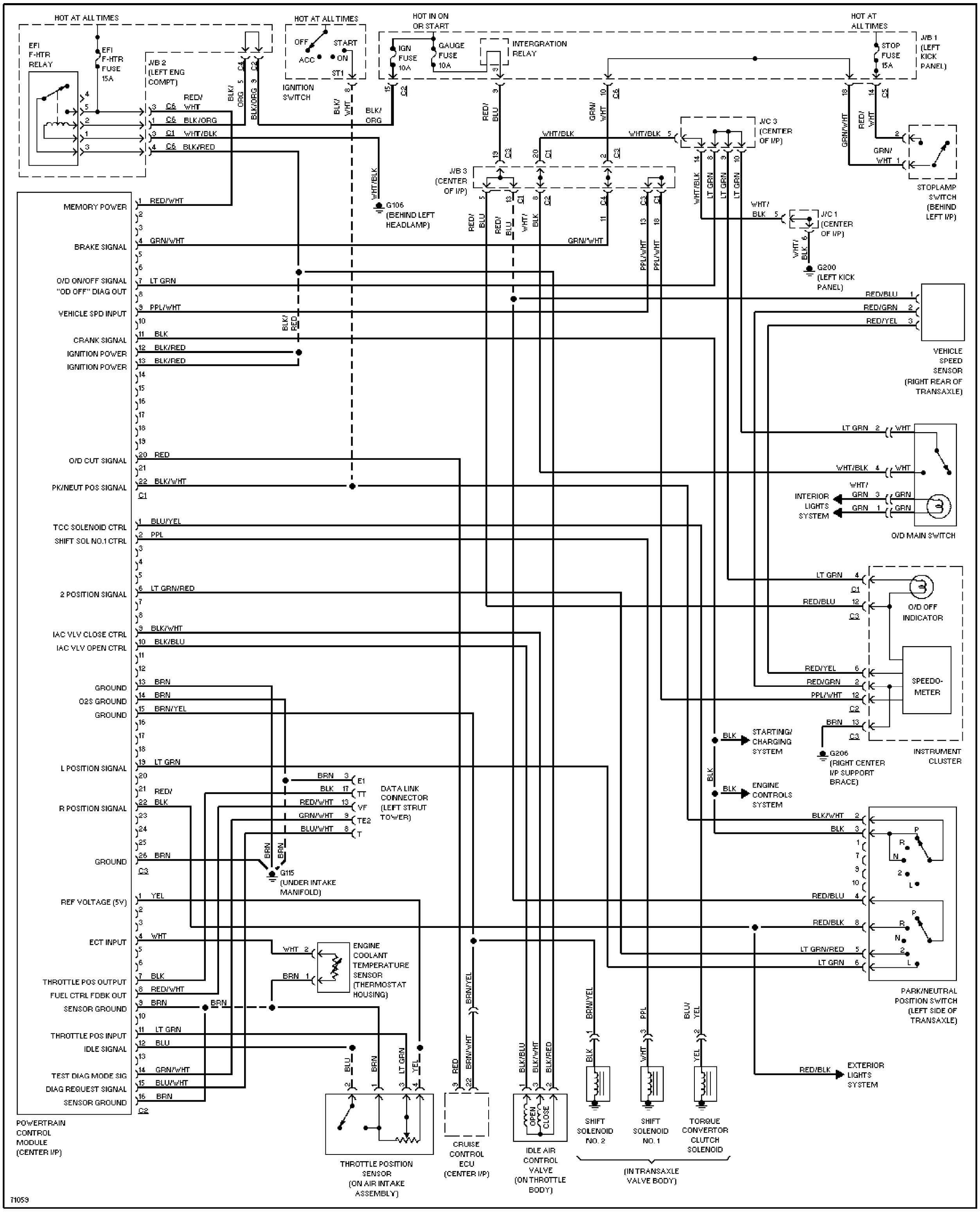


Fig. 41: Transmission Wiring Diagram (1993-94 Prizm LSi)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Park/Neutral Position Switch Bolt	48 (5)
Park/Neutral Position Switch Lock Nut	62 (7)
Speed Sensor Bolt	89 (10)

AXLE SHAFTS - FRONT

1993 Toyota Celica

1993 DRIVE AXLES
Toyota FWD Axle Shafts

Toyota; Celica

DESCRIPTION

Axle shafts transfer power from transaxle to driving wheels. All axle shafts consist of a shaft and flexible Constant Velocity (CV) joint at each end. Inner CV joint is splined or bolted to transaxle. Outer CV joint is splined to hub assembly and secured by axle shaft nut.

The inner CV joint is a plunging tripod joint. The plunging action allows for axle shaft length change as suspension moves up and down.

The inner and outer CV joints are enclosed by a CV joint boot. The boot maintains lubrication in the joint and prevents contamination of CV lubricant. Boots must be replaced when signs of leakage or cracks are present. The inner CV joint can be repaired without replacing assembly. The outer CV joint must be replaced as an assembly.

REMOVAL, DISASSEMBLY, REASSEMBLY & INSTALLATION

NOTE: Manufacturer recommends removing right axle shaft and intermediate shaft as an assembly

Removal

1) Raise and support vehicle. Remove cotter pin, lock nut cap and lock nut. Apply brake and remove lock nut from wheel bearing. Remove engine undercover. Drain transaxle fluid. Remove cotter pin and nut from tie rod end.

2) Using Tie Rod Remover (09628-62011), disconnect tie rod end from steering knuckle.

3) Paint mating marks on axle shaft flange and side gear shaft flange. DO NOT use punch to make mating marks. Apply brakes and loosen, but DO NOT remove, 6 retaining nuts on each inboard axle shaft flange.

4) Push front axle hub toward outside of vehicle. Use a plastic hammer to separate axle from steering knuckle if necessary. Remove axle shaft from axle hub.

5) Use a pry bar to separate left axle shaft from transaxle. On Celica All-Trac, use a brass drift and hammer to separate right axle shaft from transaxle.

6) To remove side gear shaft, use a slide hammer to pull side gear shaft out of transaxle. Inspect side gear and side gear shaft seal for damage. Replace as necessary.

Disassembly

Ensure no play exists in outboard joint. Inboard joint must slide smoothly in thrust direction and be free from excessive play in radial direction. Remove CV joint boot clamps, and slide boots away from joint. Paint alignment marks on CV joint housings, tripod and shaft(s) for reassembly reference. Disassemble axle shafts using exploded view for guide. See Fig. 1.

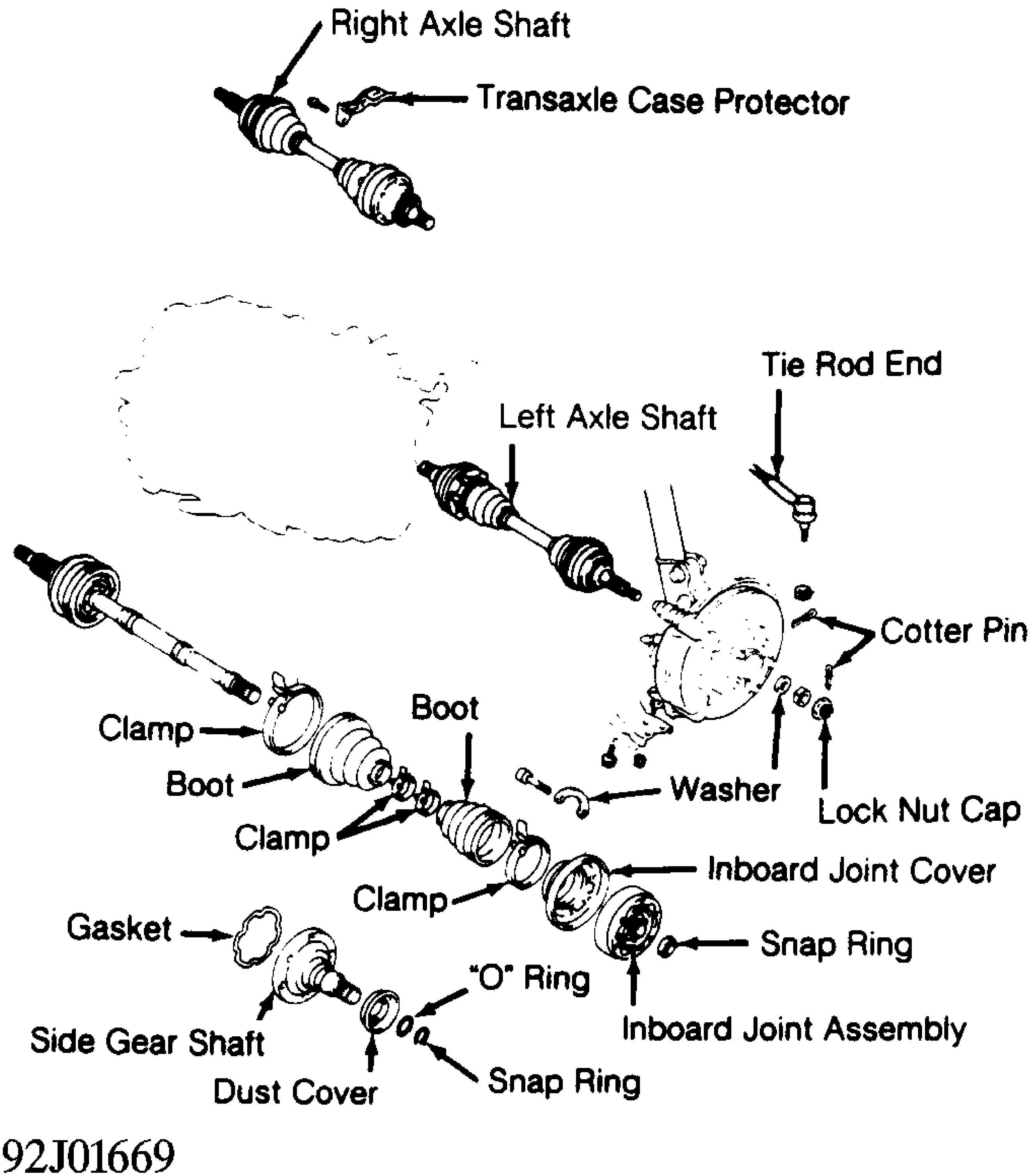


Fig. 1: Exploded View Of Front Axle Shafts (Celica All-Trac)
Courtesy of Toyota Motor Co., U.S.A., Inc.

Reassembly

1) To reassemble axle shafts, reverse disassembly procedure. Tighten inboard CV joint cover bolts as shown. See Fig. 2.

2) Ensure dust boots are not collapsed or stretched. Pack boots with grease supplied in overhaul kit. Set axle shaft to standard length. See AXLE SHAFT LENGTH SPECIFICATIONS table. Install and tighten boot clamps.

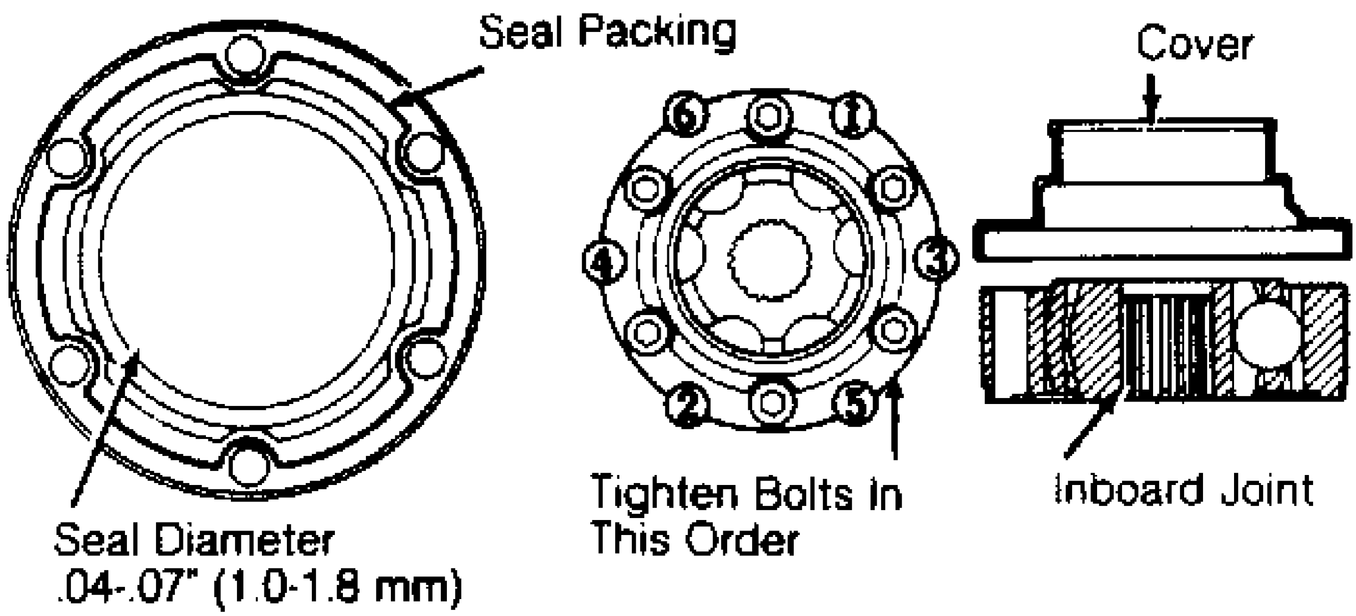


Fig. 2: Tightening Inboard CV Joint Cover Bolts (Celica All-Trac)
Courtesy of Toyota Motor Co., U.S.A., Inc.

Installation

To install, reverse removal procedure. Ensure there is no free play in inboard and outboard joint. To ensure proper engagement of snap ring, attempt to pull axle shaft out of differential by hand. Install axle shafts into wheel hub. Align suspension marks made at removal and tighten nuts.

Removal (Celica FWD)

1) Raise and support vehicle. Remove front wheels. Remove cotter pin and lock nut cap. Apply brakes and remove axle shaft/bearing lock nut. Remove lower engine undercover.

2) Drain transaxle fluid. Remove brake caliper with hydraulic line attached, and wire aside. Mark front brake disc-to-axle hub position for reassembly reference. Remove brake disc.

3) Remove nut and disconnect tie rod end from steering knuckle. Disconnect lower control arm from steering knuckle. Using universal puller, separate axle shaft from steering knuckle. Using a pry bar, remove left axle shaft from transaxle case.

4) On 5S-FE engine, remove 2 bolts from center bearing bracket. Remove right axle shaft and intermediate shaft as an assembly. On 4A-FE engine, using a hammer and brass punch, remove right axle shaft from transaxle case.

Disassembly

Ensure no play exists in inboard and outboard joints. Inboard joint must slide smoothly in thrust direction and be free from excessive play in radial direction. Remove CV joint boot clamps, and slide boots away from joint. Paint alignment marks on CV joint housings, tripod and shaft(s) for reassembly reference. Disassemble axle shafts using exploded view for guide. See Fig. 3.

Reassembly

1) To reassemble, reverse disassembly procedure. On 5S-FE engine, right axle shaft dust cover must be located 3.39-3.43" (86-87 mm) from end of shaft (splined end).

2) Clearance between dust cover and bearing should be .04-.08" (1-2 mm). On 4A-FE, locate damper on right axle shaft. See Fig. 4. On A/T models, distance should be 15.15" (384.7 mm). On M/T models, distance should be 16.99" (431.6 mm).

3) Ensure dust boots are not collapsed or stretched. Set axle shaft to standard length. See AXLE SHAFT LENGTH SPECIFICATIONS table. Install and tighten boot clamps.

Installation

To install, reverse removal procedure.

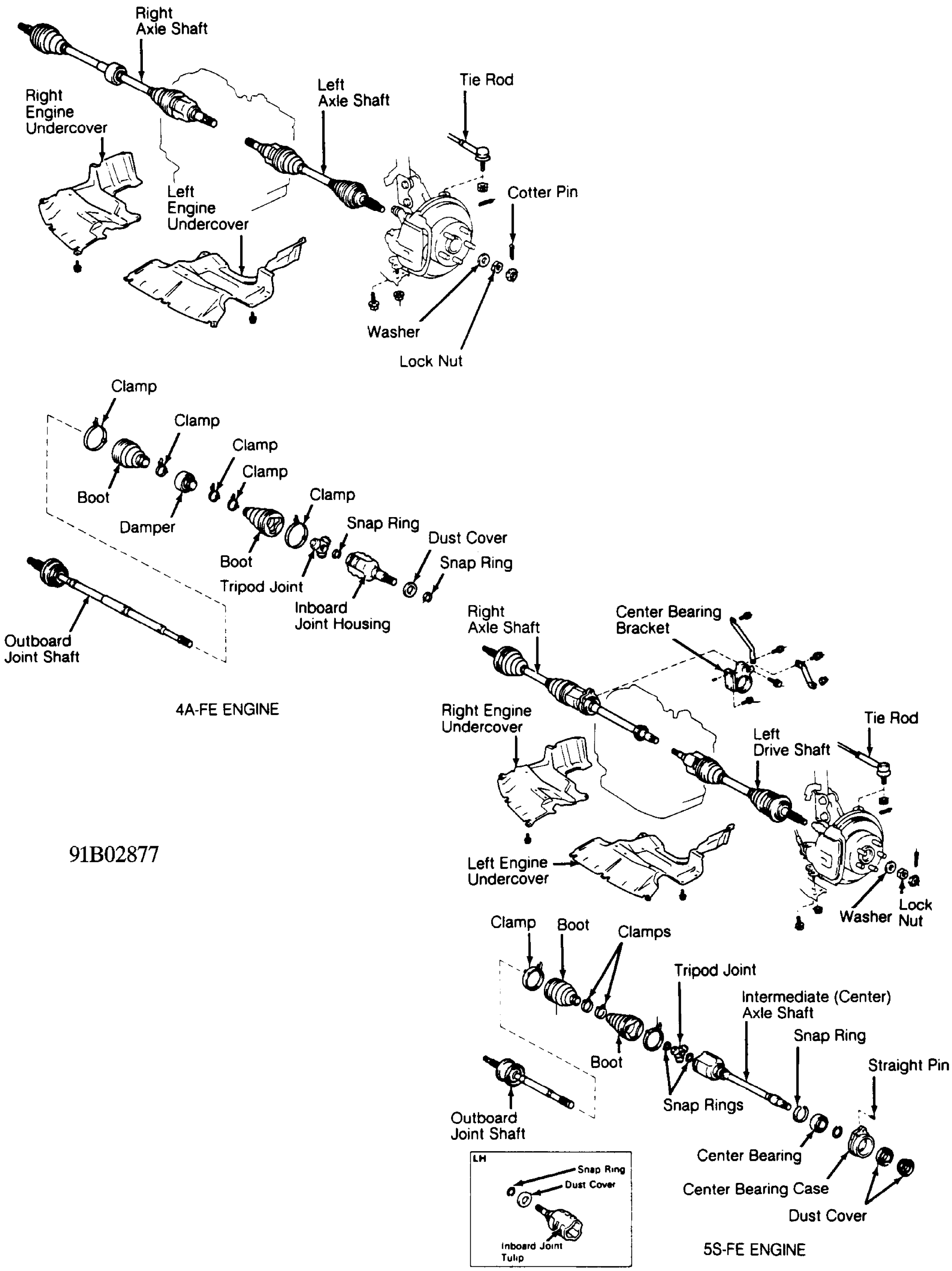


Fig. 3: Exploded View Of Front Axle Shafts (Celica FWD)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

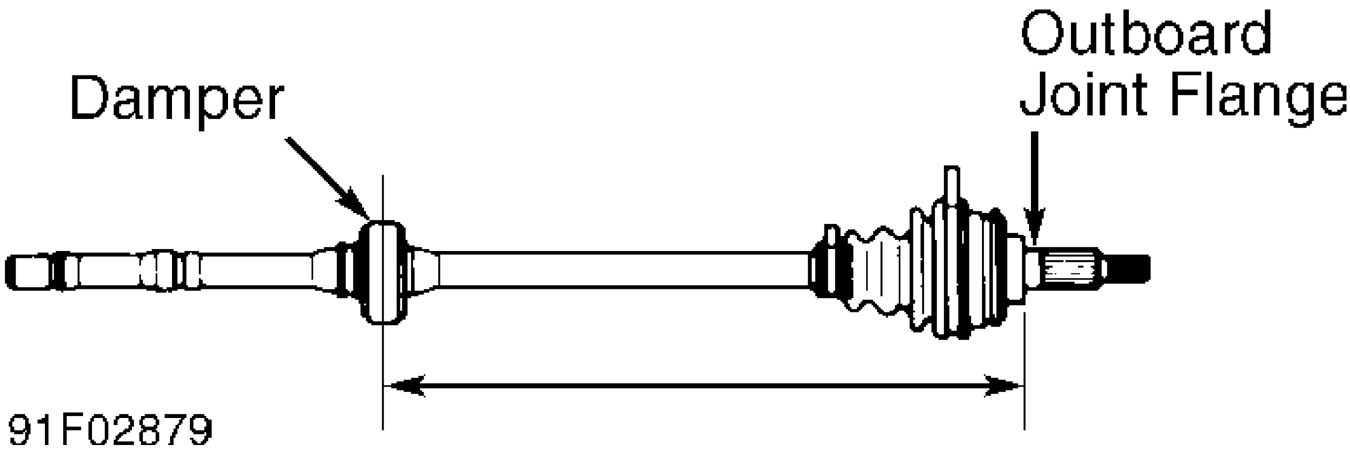


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Fig. 4: Locating Axle Shaft Damper
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AXLE SHAFT LENGTH SPECIFICATIONS TABLE

Application	Length - In. (mm)
Celica All-Trac (2)	
Right & Left Sides	15.96 (405.4)
Celica FWD (1)	
4A-FE Engine	
A/T	
Left Side	21.05-21.45 (534.7-544.8)
Right Side	33.50-33.89 (850.8-860.8)
M/T	
Left Side	21.10-21.50 (536.0-546.0)
Right Side	33.77-34.17 (857.8-867.8)
5S-FE Engine	
Left Side	21.80-22.19 (553.7-563.7)
Right Side	33.08-33.47 (840.2-850.1)

(1) - See Fig. 5.
(2) - See Fig. 6.

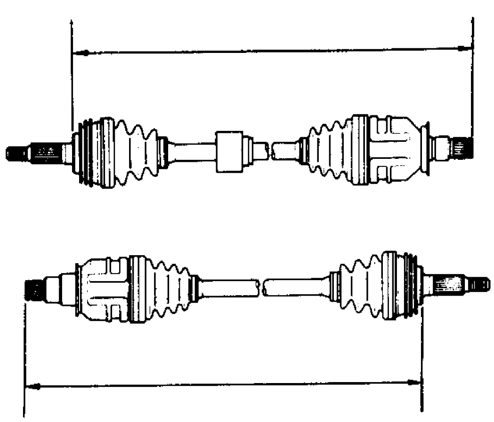

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Fig. 5: Measuring Axle Shaft Standard Length (Celica FWD)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

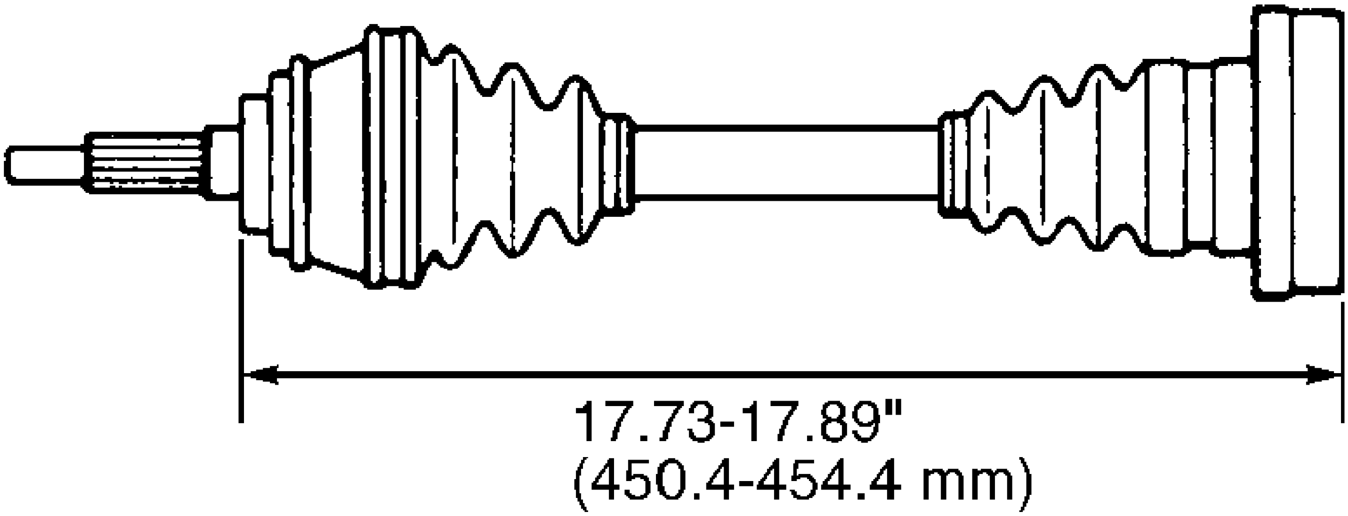

Fig. 6: Measuring Axle Shaft Standard Length (Celica All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Celica	
Axle Shaft/Bearing Lock Nut	166 (226)
Axle Shaft Inboard Joint Flange Bolts (All-Trac)	48 (65)
Bearing Bracket Bolts (5S-FE Engine)	47 (64)
Brake Caliper Bolts	79 (107)
Lower Control Arm-To-Steering Knuckle Bolts/Nuts	94 (127)
Tie Rod Nuts	36 (49)
Wheel Lug Nuts	76 (103)

1993 ENGINE PERFORMANCE
Basic Diagnostic Procedures

Celica

INTRODUCTION

The following diagnostic steps will help prevent overlooking a simple problem. This is also where to begin diagnosis for a no-start condition. The first step in diagnosing any driveability problem is verifying the customer's complaint with a test drive under the conditions problem reportedly occurred.

Before entering self-diagnostics, perform a careful and complete visual inspection. Most engine control problems result from mechanical breakdowns, poor electrical connections or damaged/ misrouted vacuum hoses. Before condemning the computerized system, perform each test listed in this article.

NOTE: Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure.

PRELIMINARY INSPECTION & ADJUSTMENTS

VISUAL INSPECTION

Visually inspect all electrical wiring, looking for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and are not pinched or cut. See the M - VACUUM DIAGRAMS article to verify routing and connections (if necessary). Inspect air induction system for possible vacuum leaks.

MECHANICAL INSPECTION

Compression

Check engine mechanical condition with a compression gauge, vacuum gauge, or engine analyzer. See engine analyzer manual for specific instructions.

WARNING: DO NOT use ignition switch during compression tests. Use a remote starter to crank engine. Fuel injectors on many models are triggered by ignition switch during cranking mode, which can create a fire hazard or contaminate the engine's oiling system.

4-CYLINDER COMPRESSION SPECIFICATIONS

Application	psi (kg/cm^2)
Normal Compression Pressure	
1.6L (4A-FE)	191 (13.4)
2.0L Turbo (3S-GTE)	164 (11.5)
2.2L Non-Turbo (5S-FE)	178 (12.5)
Minimum Compression Pressure	142 (10.0)
Maximum Variation Between Cylinders	14 (1.0)

Exhaust System Backpressure

The exhaust system can be checked with a vacuum or pressure gauge. If using a pressure gauge, remove O2 sensor or air injection check valve (if equipped). Connect a 0-5 psi pressure gauge and run engine at 2500 RPM. If exhaust system backpressure is greater than 1 3/4 - 2 psi, exhaust system or catalytic converter is plugged.

If using a vacuum gauge, connect vacuum gauge hose to intake manifold vacuum port and start engine. Observe vacuum gauge. Open throttle part way and hold steady. If vacuum gauge reading slowly drops after stabilizing, check exhaust system for restriction.

FUEL SYSTEM

Basic diagnosis of fuel system should begin by checking fuel pump operation and fuel pressure.

WARNING: ALWAYS relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL PUMP OPERATION

1) Install Jumper Wire (SST-09843-18020) between +B and FP terminals of data link connector. See Fig. 1. The data link connector is located in engine compartment.

2) Turn ignition on. Listen for fuel pump operating sound and feel for pressure in fuel line near fuel filter. Turn ignition off. Remove jumper wire. If fuel pump operates, check fuel pressure. See FUEL PRESSURE.

3) If fuel pump does not operate, connect a jumper wire from battery source to FP terminal of data link connector. If fuel pump operates, EFI main relay, EFI No. 2 relay, circuit opening relay or fuel pump relay may be defective. For explanation of relay operation, see FUEL PUMP CONTROL CIRCUIT.

4) If relays are okay, check wiring circuit and fuses. If fuel pump does not operate, check for defective fuel pump, open circuit between data link connector and fuel pump, or defective fuel pump ground or fuses. See appropriate wiring diagram in the L - WIRING DIAGRAMS article.

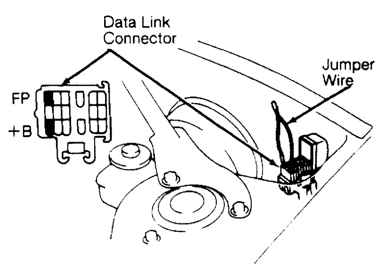

Fig. 1: Installing Jumper Wire In DLC (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc

FUEL PRESSURE

NOTE: All models use in-tank fuel pump. Fuel pump contains internal relief valve and check valve.

1) Ensure battery is fully charged and ignition is off. Disconnect negative battery cable. Disconnect electrical connector from cold start injector (if equipped).

2) Note location of fuel pressure gauge installation. See

Figs. 2, 3, or 4. Place container under cold start injector pipe, deliver pipe or fuel filter. Cover union bolt with shop towel, and slowly loosen union bolt to relieve fuel pressure.

3) Remove union bolt and gaskets. Install Fuel Pressure Gauge (SST 09268-45012) using NEW gaskets. See Fig. 2, 3 or 4. Tighten union bolt. Reconnect negative battery cable.

4) Install jumper wire between +B and FP terminals of data link connector. See Fig. 1. The data link connector is located in engine compartment.

5) Turn ignition on and note fuel pressure. Fuel pressure should be within specification. See FUEL PUMP PERFORMANCE table.

6) If fuel pressure exceeds specification, replace fuel pressure regulator. If fuel pressure is less than specified, check for defective fuel lines, connections, fuel pump, fuel filter or fuel pressure regulator.

7) Remove jumper wire from data link connector. Start engine and allow to idle. Disconnect and plug vacuum line at fuel pressure regulator. Note fuel pressure.

8) Reconnect vacuum hose on fuel pressure regulator, and note fuel pressure. Fuel pressure should be within specification. See FUEL PRESSURE SPECIFICATIONS table.

9) If fuel pressure is not within specification, check for defective vacuum hose or fuel pressure regulator. Shut engine off and note fuel pressure.

10) Fuel pressure should hold at least 21 psi (1.5 kg/cm^2) for a minimum of 5 minutes. If fuel pressure does not hold as specified, check for defective fuel pump, fuel injector or fuel pressure regulator.

11) Disconnect negative battery cable. Remove fuel pressure gauge. Reinstall union bolt using NEW gaskets. Tighten union bolt. Install cold start injector electrical connector (if equipped). Install negative battery cable.

NOTE: For more information on checking fuel injectors and other fuel sub-systems, see the I - SYSTEM/COMPONENT TESTS article.

FUEL PUMP PERFORMANCE

Application	(1) psi (kg/cm^2)
1.6L (4A-FE)	38-44 (2.7-3.1)
2.0L Turbo	33-38 (2.3-2.7)
2.2L (5S-FE)	38-44 (2.7-3.1)

(1) - Check fuel pressure with jumper wire installed between data link connector +B and FP terminals, ignition on and engine off.

FUEL PRESSURE SPECIFICATIONS

Application	At Idle W/ Vacuum psi (kg/cm^2)	At Idle W/O Vacuum psi (kg/cm^2)
1.6L (4A-FE)	31-37 (2.2-2.6)	38-44 (2.7-3.1)
2.0L Turbo	27-31 (1.9-2.2)	33-38 (2.3-2.7)
2.2L (5S-FE)	31-37 (2.2-2.6)	38-44 (2.7-3.1)

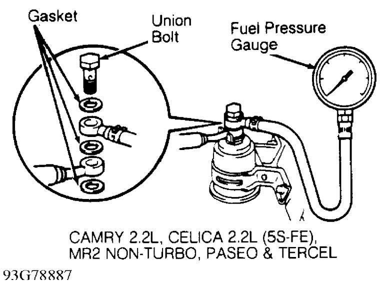

Fig. 2: Installing Fuel Pressure Gauge (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc

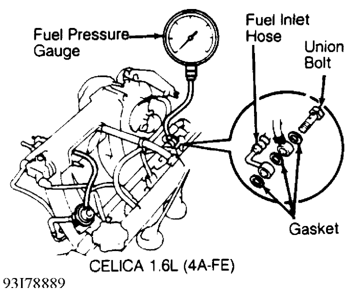

Fig. 3: Installing Fuel Pressure Gauge (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc

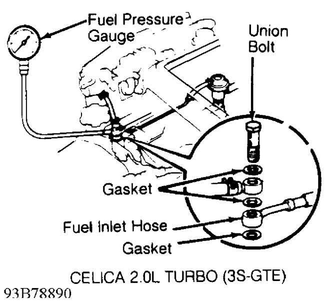

Fig. 4: Installing Fuel Pressure Gauge (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc

FUEL PUMP CONTROL CIRCUIT

NOTE: For information on testing relays and fuel system components, see the I - SYSTEM/COMPONENT TESTS article. Relays may be identified by appropriate illustration in the E - THEORY/OPERATION article.

EFI Main Relay

The EFI fuse supplies constant battery voltage to EFI main relay. The EFI main relay provides battery voltage to +B terminal of circuit opening relay (some models) and data link connector. Depending on model, EFI main relay may either be turned on directly by ignition switch or by M-REL terminal of Engine Control Module (ECM). The EFI main relay may also provide battery voltage to +B and +B1 terminals of ECM when ignition is turned on. The EFI main relay is located in engine compartment relay box.

NOTE: Circuit opening relay is used on all models.

Circuit Opening Relay

Circuit opening relay controls fuel pump circuit. The Engine Control Module (ECM) receives an input signal at STA terminal when engine is cranking. Starter signal is also applied to STA terminal of circuit opening relay.

Starter signal energizes circuit opening relay during cranking. Circuit opening relay then provides voltage to fuel pump or fuel pump relay. Fuel pump relay is used on Celica Turbo only.

On Celica, the circuit opening relay is grounded by ECM through FC terminal.

Fuel Pump Relay & Fuel Pump Resistor (Celica Turbo)

Fuel pump relay receives voltage from circuit opening relay and operates fuel pump. Fuel pump operating speed may be varied by Engine Control Module (ECM). When ECM grounds fuel pump relay, relay contacts close, and voltage is supplied through fuel pump resistor, to fuel pump. This changes fuel pump operating speed.

IGNITION CHECKS

SPARK TEST

NOTE: Before performing spark test, ensure ignitor is properly grounded.

1) On Celica 1.6L (4A-FE), disconnect spark plug wires. Remove spark plugs. Install spark plug on each spark plug wire. Ground spark plug against cylinder block.

2) On all other models, disconnect high tension coil wire from distributor. Hold coil wire approximately 1/2" away from cylinder block.

CAUTION: To prevent gasoline from being injected, DO NOT crank engine for longer than 2 seconds.

3) On all models, crank engine and check for spark. If spark does not occur, check ignition coil, ignitor and distributor electrical connections.

4) If electrical connections are okay, using ohmmeter, check resistance of high tension wires. Replace high tension wires if resistance is not within specification. See HIGH TENSION WIRE RESISTANCE table. If resistance is within specification, proceed to step 5).

HIGH TENSION WIRE RESISTANCE

Application	Maximum Ohms
All Models	25,000 Per Wire

5) Check voltage at ignition coil and ignitor. Turn ignition on. Ensure voltage exists at ignition coil positive terminal. If voltage exists, proceed to step 6). If voltage does not exist, check wiring between ignition switch, ignition coil and ignitor. Refer to the L - WIRING DIAGRAMS article for wiring circuit.

6) Check ignition coil resistance. See IGNITION COIL RESISTANCE under IGNITION CHECKS. Replace ignition coil if resistance is not within specification. If ignition coil resistance is within specification, proceed to step 7).

7) Check pick-up coil resistance. See PICK-UP COIL RESISTANCE under IGNITION CHECKS. Replace pick-up coil or distributor assembly if pick-up coil resistance is not within specification. If pick-up coil resistance is within specification, proceed to step 8).

8) Check pick-up coil air gap. See PICK-UP COIL AIR GAP under IGNITION CHECKS. If pick-up coil air gap is incorrect, replace

distributor assembly. If air gap is correct, proceed to step 9).

9) Check ignition IGT signal from ECU. See appropriate DIAGNOSTIC TROUBLE CODE 14 chart in the G - TESTS W/CODES article. If IGT signal is okay, replace ignitor.

IGNITION COIL RESISTANCE

1) Disconnect wiring from ignition coil so ignition coil is isolated from system. Using ohmmeter, check primary resistance between ignition coil positive (+) and negative (-) terminals. See Figs. 5, 6 or 7.

2) Check secondary resistance between ignition coil positive (+) terminal and high tension wire terminal (coil wire tower). See Figs. 8, 9 or 10. Replace ignition coil if resistance is not within specification. See appropriate IGNITION COIL RESISTANCE table.

IGNITION COIL RESISTANCE (4-CYLINDER) - Ohms @ 68°F (20°C)

Application	Primary	Secondary
1.6L (4A-FE)	1.1-1.7	9000-15,000
2.0L Turbo (3S-GTE)	.30-.60	9000-15,000
2.2L (5S-FE)	.30-.60	9000-15,000

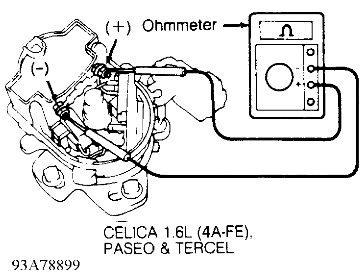

Fig. 5: Checking Ignition Coil Primary Resistance (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

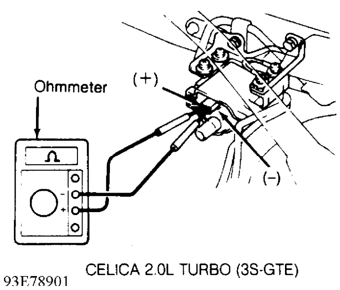

Fig. 6: Checking Ignition Coil Primary Resistance (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

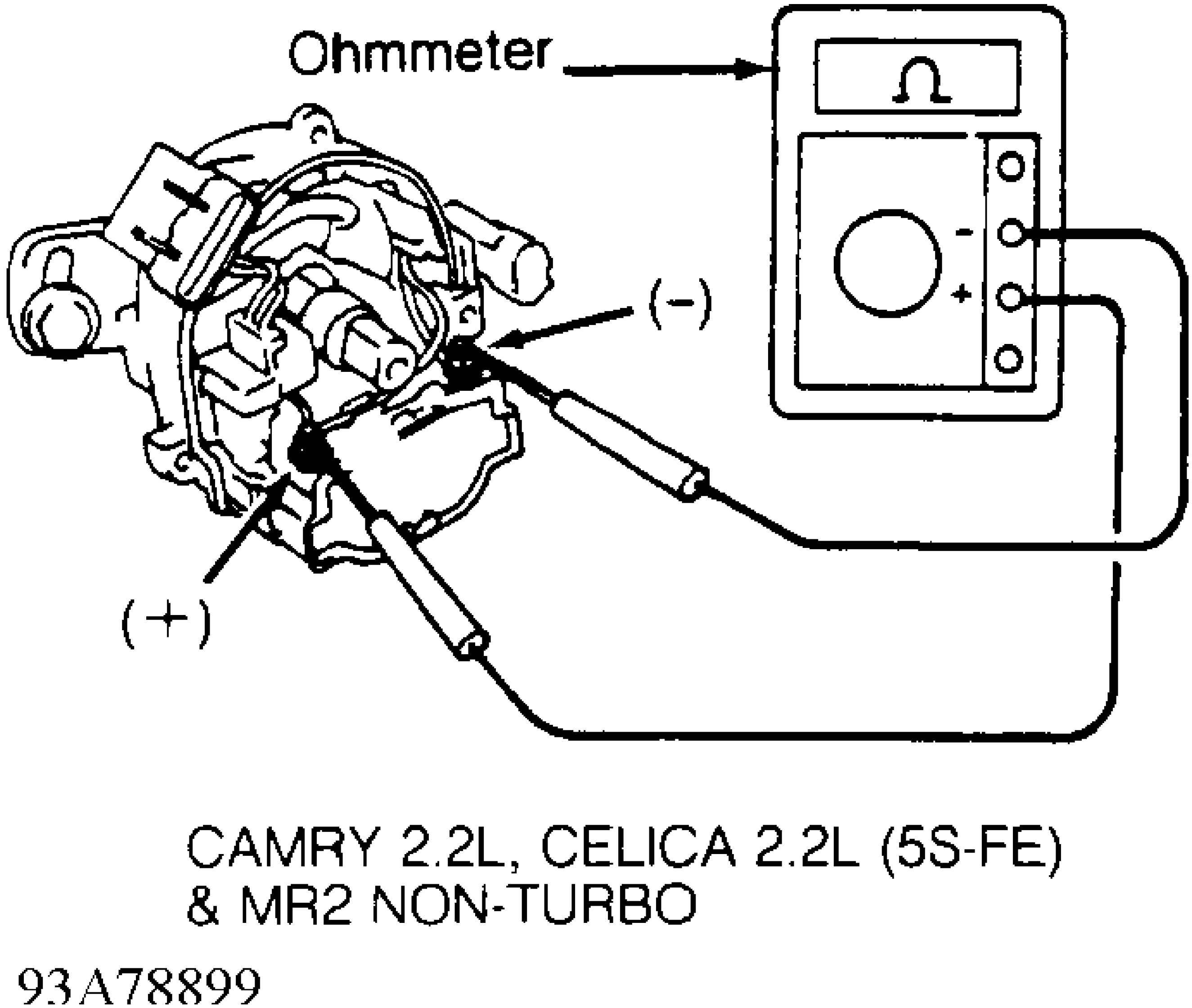

Fig. 7: Checking Ignition Coil Primary Resistance (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

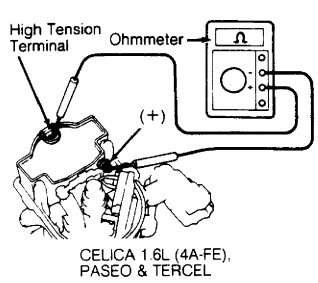

Fig. 8: Checking Ignition Coil Secondary Resistance (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

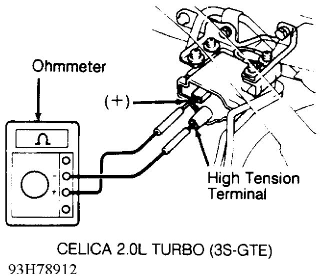

Fig. 9: Checking Ignition Coil Secondary Resistance (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

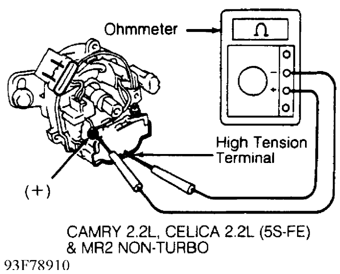

Fig. 10: Checking Ignition Coil Secondary Resistance (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PICK-UP COIL RESISTANCE

1) Note pick-up coil terminal identification on the distributor. See Fig. 11, 12, or 13. Using ohmmeter, measure resistance between specified terminals. See PICK-UP COIL RESISTANCE SPECIFICATIONS table.

2) Replace distributor assembly if pick-up coil resistance is not within specification.

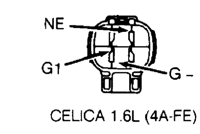

Fig. 11: Pick-Up Coil Terminal I.D. (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

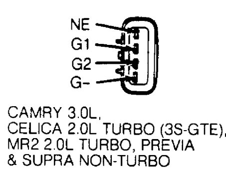

Fig. 12: Pick-Up Coil Terminal I.D. (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

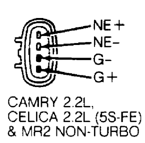

Fig. 13: Pick-Up Coil Terminal I.D. (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PICK-UP COIL RESISTANCE SPECIFICATIONS

Application	Pick-Up Coil Terminals	(1) Ohms
1.6L (4A-FE)	G1 & G-	185-265
1.6L (4A-FE)	NE+ & G-	185-265
2.0L Turbo (3S-GTE)	G1 & G-	125-190
2.0L Turbo (3S-GTE)	G2 & G-	125-190
2.0L Turbo (3S-GTE)	NE & G-	155-240
2.2L (5S-FE)	G+ & G-	185-265
2.2L (5S-FE)	NE+ & NE-	370-530

(1) - With pick-up coil temperature at 14-104°F (-10-40°C).

PICK-UP COIL AIR GAP

1) Using a flat, non-magnetic feeler gauge, check air gap between signal rotor and pick-up coil projection. See Figs. 14, 15, or 16 for air gap measuring procedures.

2) Replace distributor assembly if pick-up coil air gap is not within specification. See PICK-UP COIL AIR GAP SPECIFICATIONS table.

PICK-UP COIL AIR GAP SPECIFICATIONS

Application	In. (mm)
All Engines	.008-.016 (.20-.40)

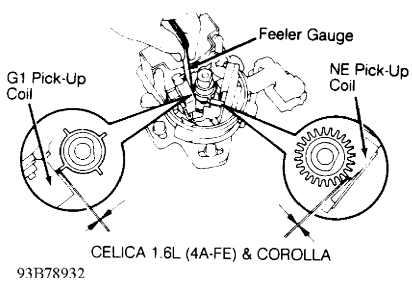

Fig. 14: Checking Pick-Up Coil Air Gap (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

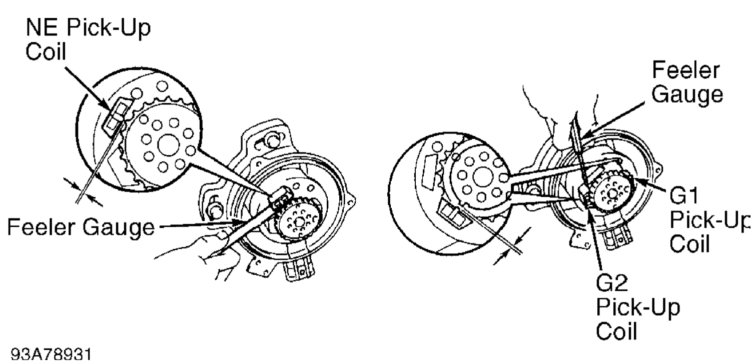

Fig. 15: Checking Pick-Up Coil Air Gap (2.0L Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

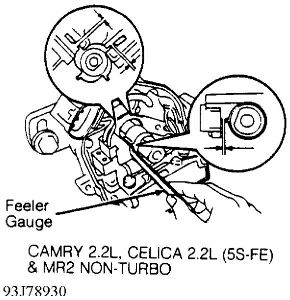

Fig. 16: Checking Pick-Up Coil Air Gap (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

IDLE SPEED & IGNITION TIMING

Ensure idle speed and ignition timing are set to specification. For adjustment procedures, refer to the appropriate D - ADJUSTMENTS - 4-CYL article in this section.

SUMMARY

If no faults were found while performing the test procedures in this article, proceed to G - TESTS W/CODES article. If no hard diagnostic trouble codes are found while performing self-diagnostics, go to the H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

BRAKE SYSTEM

1993 Toyota Celica

1993 BRAKES
Toyota Disc & Drum - FWD Cars

Celica

WARNING: For warnings and procedures regarding vehicles equipped with Anti-Lock Brake Systems (ABS), see ANTI-LOCK BRAKE SYSTEM article in the BRAKES section.

DESCRIPTION & OPERATION

The hydraulic brake system uses a tandem master cylinder with vacuum power assist servo. All models are equipped with standard front disc and rear drum brakes. Rear disc brakes are available on Celica.

A proportioning valve is used to regulate brake pressure between front and rear brakes. Rear brakes on all models are self-adjusting.

Parking brake lever mechanically activates rear brakes. On models with rear drum brakes, a cable applies rear shoes. On Celica with rear disc brakes, parking brake is a duo servo mechanical drum brake design built into bell of rear rotor assemblies.

BLEEDING BRAKE SYSTEM

BLEEDING PROCEDURES

CAUTION: DO NOT allow reservoir to run dry during brake bleeding procedure. Use only clean brake fluid. Ensure no dirt or other foreign matter contaminates brake fluid. DO NOT mix different brands of brake fluid, as they may not be compatible. DO NOT spill brake fluid on vehicle, as it may damage paint. If brake fluid contacts paint, immediately wash with water.

1) If master cylinder is rebuilt or reservoir is empty, bleed master cylinder first. Bleed wheels in sequence. Start on wheel with longest hydraulic line, and work toward wheel with shortest hydraulic line.

2) Raise and support vehicle. Ensure brake fluid reservoir is at least half full during bleeding procedure. Connect one end of transparent vinyl tube to bleeder plug. Submerge other end of tube in a container half filled with clean brake fluid.

3) Have an assistant depress brake pedal several times and hold in depressed position. Loosen bleeder plug, and drain fluid into container. Tighten bleeder plug.

NOTE: Ensure brake pedal remains depressed until bleeder plug is tightened.

4) Refill brake fluid reservoir as necessary. Repeat step 3) until air is no longer discharged. Tighten bleeder plug to 74 INCH lbs. (8 N.m). Ensure fluid leakage is not present. Add fluid to reservoir. Repeat procedure for remaining wheels.

ADJUSTMENTS

BRAKE PEDAL HEIGHT

1) Measure brake pedal height from face of pedal pad to asphalt sheet under carpet. See Fig. 1. If pedal height adjustment is necessary, loosen stoplight switch and lock nut on brake push rod. Turn push rod to adjust height. See BRAKE PEDAL HEIGHT SPECIFICATIONS table.

2) After setting pedal height, tighten lock nut on push rod. See TORQUE SPECIFICATIONS table at the end of this article. Adjust stoplight switch, and tighten switch lock nut. See STOPLIGHT SWITCH under ADJUSTMENTS.

BRAKE PEDAL HEIGHT SPECIFICATIONS TABLE

Application	In. (mm)
Celica	6.6-7.0 (168-178)

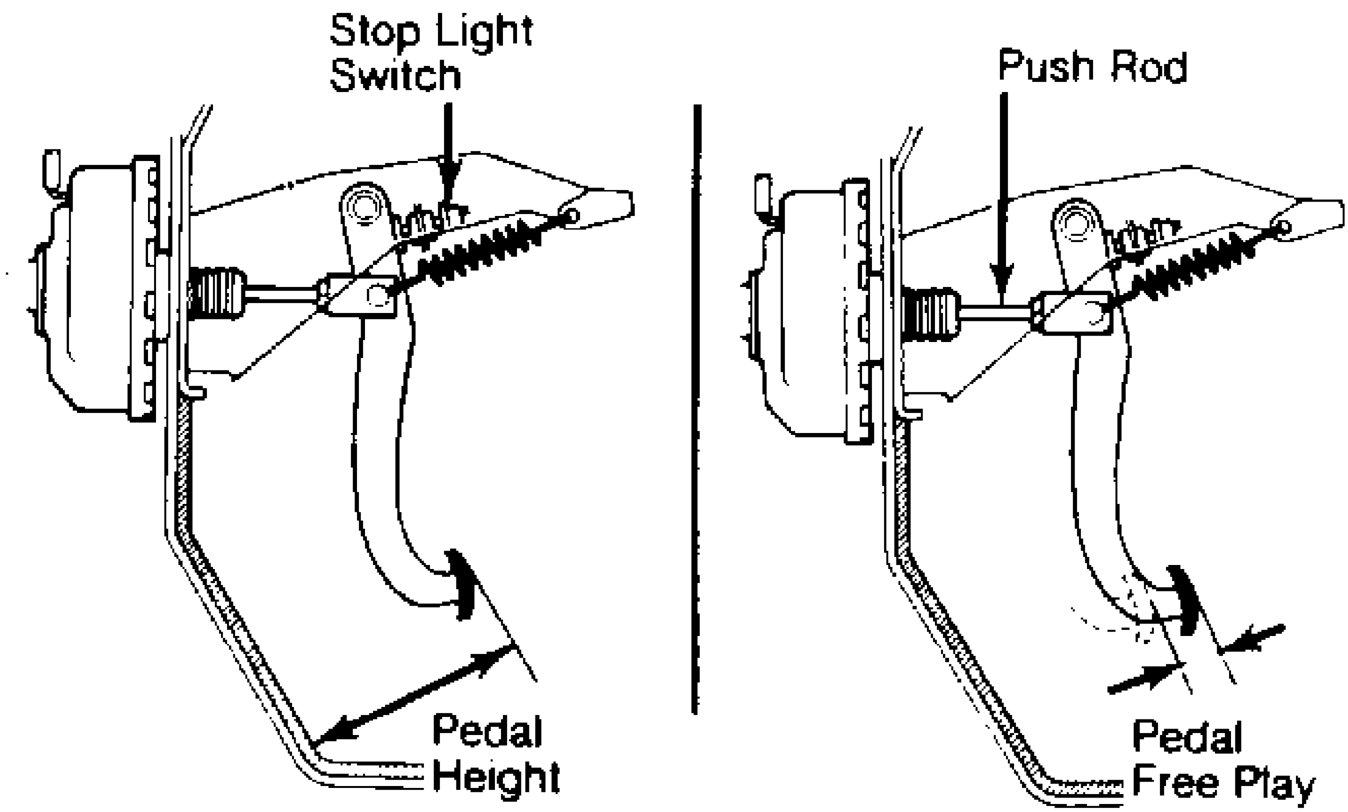

Fig. 1: Measuring Pedal Height & Free Play
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BRAKE PEDAL FREE PLAY

1) Brake pedal free play is distance brake pedal travels with engine off before resistance is felt. See Fig. 1. To check pedal free play, depress brake pedal several times to exhaust vacuum from power brake unit.

2) Depress pedal until initial resistance is felt, and measure distance traveled. On all models brake pedal free play should be .04-.24" (1-6 mm). If free play is not as specified, adjust by turning push rod. Check brake pedal height. See BRAKE PEDAL HEIGHT under ADJUSTMENTS.

BRAKE PEDAL DEPRESSED HEIGHT

1) Measure pedal depressed height with engine running and weight of 110 lbs. (50 kg) applied against pedal. Measure pedal depressed height from face of pedal pad to asphalt sheet under carpet.

2) If measured depressed height is less than specification, inspect brake system. See BRAKE PEDAL MINIMUM DEPRESSED HEIGHT table.

BRAKE PEDAL MINIMUM DEPRESSED HEIGHT TABLE

Application	In. (mm)
With ABS	3.54 (90)
Without ABS	3.35 (85)

PARKING BRAKE (LEVER TYPE)

NOTE: Adjust rear brake shoe clearance before adjusting parking brake. See REAR BRAKE SHOES under ADJUSTMENTS.

Inspection

To check parking brake adjustment, pull parking brake lever with force of 44 lbs. (20 kg). Count number of notches (clicks). Adjust parking brake if lever stroke (number of notches) is not as specified. See PARKING BRAKE LEVER STROKE SPECIFICATIONS table.

Adjustment

Remove center console or parking brake lever boot to uncover base of lever. Loosen lock nut. Turn adjusting nut on cable until lever stroke is correct. Tighten lock nut. Install console or boot.

PARKING BRAKE LEVER STROKE SPECIFICATIONS TABLE

Application	Notches
Celica	4-7

REAR BRAKE SHOES

NOTE: All rear drum brakes have a self-adjuster, which is activated when brake pedal is applied as vehicle travels in Reverse.

Disc Brakes

Raise and support rear of vehicle. Remove rear wheel. Release parking brake. Remove adjustment hole plug from rear rotor. Turn adjuster until parking brake shoes lock rotor. Back off adjuster 8 notches.

Drum Brakes

Raise and support rear of vehicle. Remove rear wheel. Release parking brake. Measure drum inner diameter and brake shoe diameter. Difference between drum and shoe diameters is clearance. Measured clearance should be .024" (.6 mm).

POWER BRAKE UNIT PUSH ROD

Check and adjust clearance between power brake unit push rod and master cylinder piston if either unit is replaced or overhauled. See Fig. 2. If clearance is not zero, adjust male portion of push rod using open-end wrench while holding female portion of push rod with pliers.

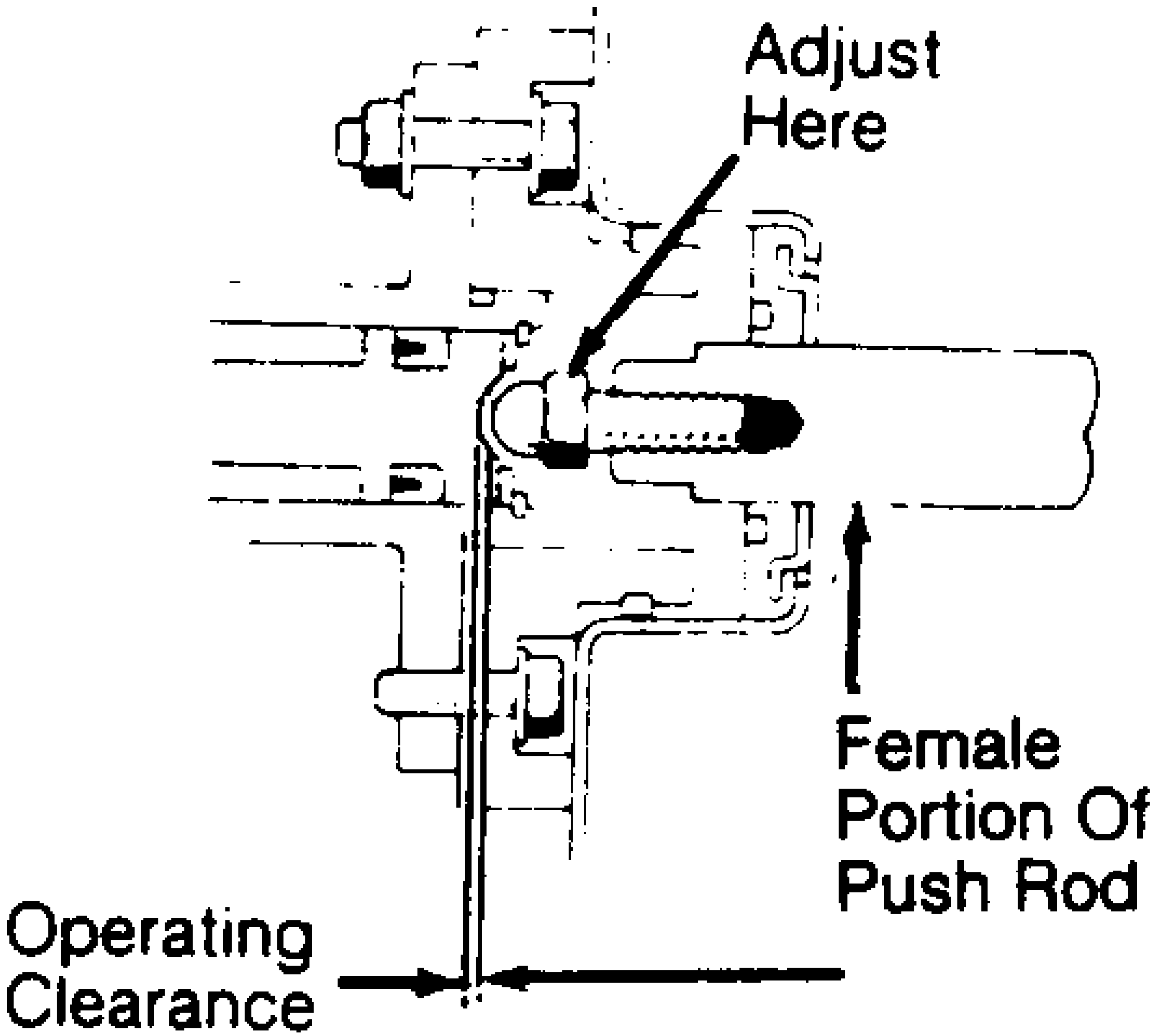

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Fig. 2: Measuring Clearance Between Master Cylinder Piston & Power Brake Unit Push Rod
Courtesy of Toyota Motor Sales, U.S.A., Inc.

STOPLIGHT SWITCH

Remove lower instrument panel and air duct (if necessary).

Loosen lock nut. Turn switch until clearance between switch and pedal stop is .02-.09" (.5-2.3 mm). See Fig. 1. Check brake pedal height. See BRAKE PEDAL HEIGHT under ADJUSTMENTS. Check brakelight operation.

TESTING

POWER BRAKE UNIT

Functional Test

1) Start engine. Turn ignition off. Depress brake pedal several times. Depress pedal firmly and hold for 15 seconds. If pedal sinks, master cylinder, brakeline or caliper piston is faulty.

2) Start engine with pedal depressed. If pedal sinks slightly, vacuum unit is working properly. If pedal height does not vary, power brake unit or check valve is faulty. Replace as necessary.

Leak Test

1) Depress brake pedal with engine running. Hold brake pedal in depressed position, and turn ignition off. If pedal height does not vary within 30 seconds, vacuum booster is okay. If pedal height changes, check for air leaks.

2) With engine stopped, depress brake pedal several times using normal pressure. Pedal height should be low when first depressed. On consecutive applications, pedal height should gradually increase. If pedal height does not increase, check for air leaks.

PROPORTIONING VALVE ("P" VALVE) (NON-LOAD-SENSING TYPE)

1) Install pressure gauges to "P" Valve. See Fig. 3. Bleed air from system. See BLEEDING BRAKE SYSTEM. Increase master cylinder (front) pressure to indicated value, and read rear wheel pressure gauges. See PROPORTIONING VALVE PRESSURE SPECIFICATIONS table.

2) Rear pressure increase should be less than front pressure increase. If rear wheel cylinder pressure as specified, replace valve assembly.

PROPORTIONING VALVE PRESSURE SPECIFICATIONS TABLE

Application	Front Pressure psi (kg/cm^2)	Rear Pressure psi (kg/cm^2)
3S-GTE	569 (40)	569 (40)
	1280 (90)	832 (58.5)
4A-FE	427 (30)	427 (30)
	1138 (80)	604.5 (42.5)
5S-FE		
Coupe & Liftback	427 (30)	427 (30)
	1138 (80)	690 (48.5)
Convertible	356 (25)	356 (25)
	1138 (80)	646 (45.4)
4WD	569 (40)	569 (40)
	1280 (90)	832 (58.5)

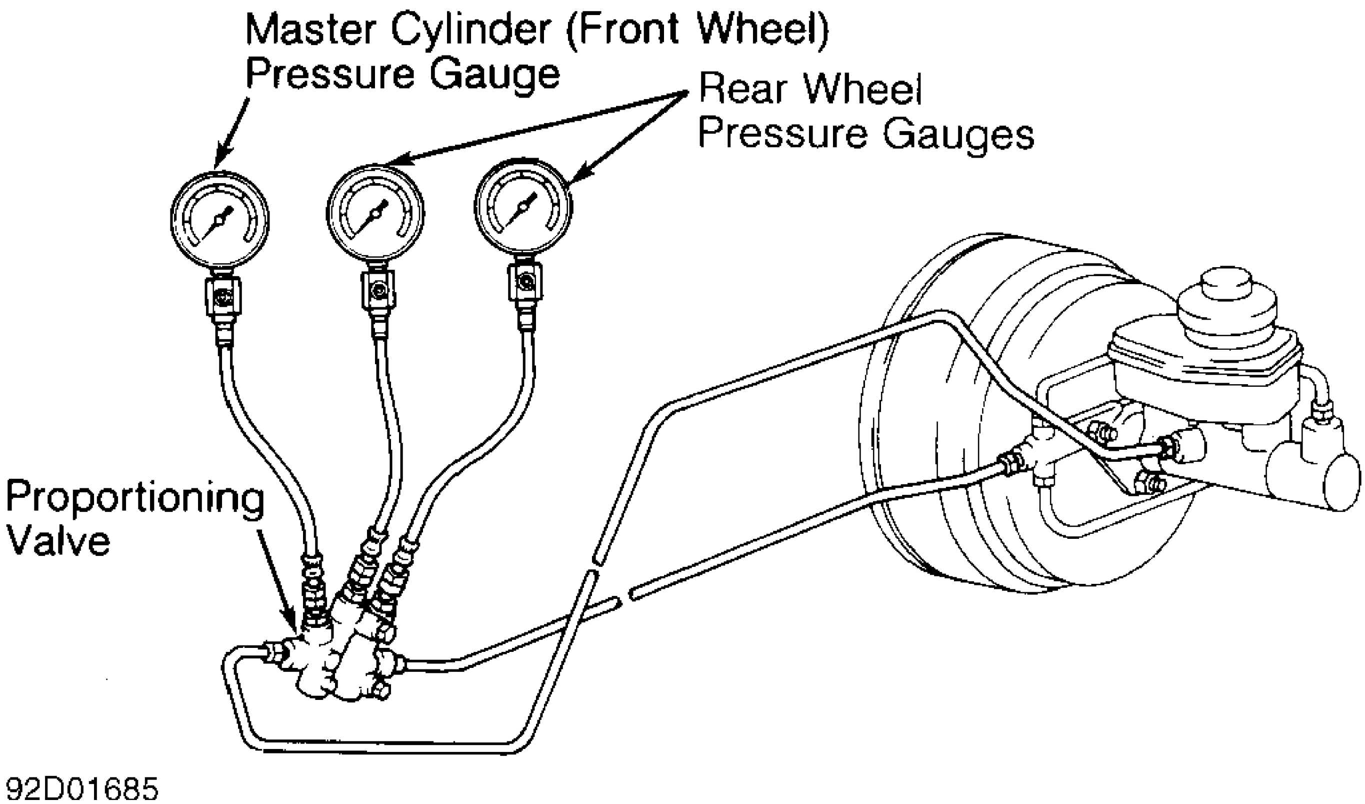

Fig. 3: Testing Proportioning Valve
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

FRONT DISC BRAKE PADS

NOTE: Location and number of anti-rattle springs, anti-squeal shims and pad support plates vary by model. Note component locations during removal for installation reference.

Removal

1) Raise and support vehicle. Remove wheel and tire assembly. Temporarily install wheel lug nuts to retain rotor position. Remove brake caliper from torque plate and wire aside; leave brakeline connected. See Fig. 4.

2) Remove anti-rattle springs (if equipped), anti-squeal shims and pads. Remove pad support plates and pad wear indicators. Check rotor thickness and runout. Measure brake pads and replace if necessary. See appropriate DISC & DRUM BRAKE SPECIFICATIONS table at end of article.

NOTE: Some models have one or more sets of anti-squeal shims. If one set of shims is vented, place it between pad and outer anti-squeal shim.

Installation

1) Install pad support plates and NEW pads. Install pad wear indicators, anti-squeal shims and anti-rattle springs (if equipped). Apply disc brake grease to inner anti-squeal shims. DO NOT allow grease to contact rubbing face of pads. Wear indicator must be on top side of pad.

NOTE: Pushing piston into caliper bore forces fluid back into master cylinder reservoir. Remove reservoir cap when compressing piston.

2) Press piston into caliper bore. DO NOT let piston dust boot wedge against edge of pads. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check reservoir fluid level.

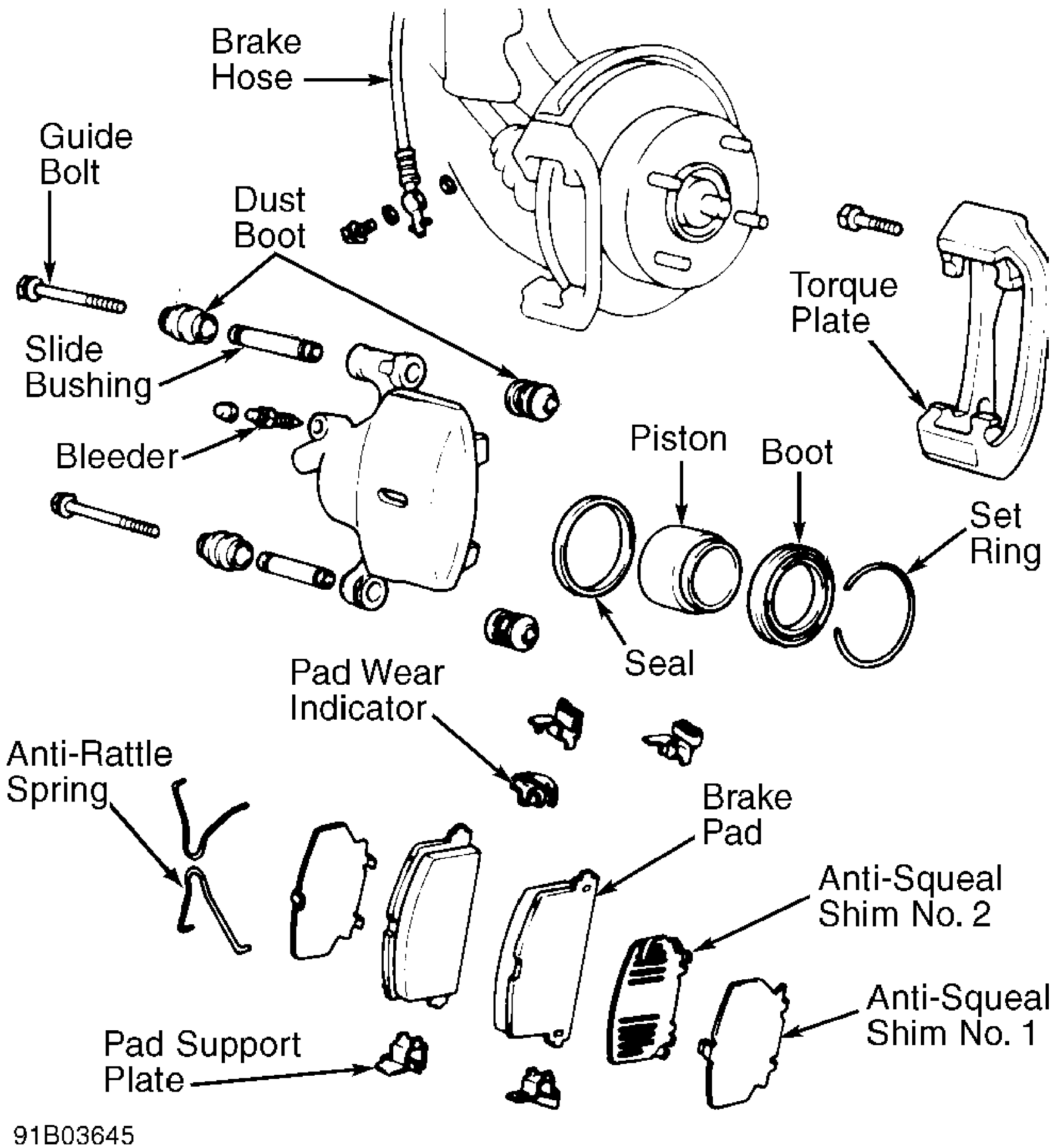

Fig. 4: Exploded View Of Front Brake Caliper Assembly (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FRONT BRAKE CALIPER

Removal

Raise and support vehicle. Remove wheel and tire assembly. Disconnect brakeline from caliper. Plug brakeline to prevent fluid spillage. Remove caliper mounting bolts or slide pins if necessary. Remove caliper from torque plate.

NOTE: Pushing piston into caliper bore forces fluid back into master cylinder reservoir. Remove reservoir cap when compressing piston.

Installation

Push piston into caliper bore, if necessary. DO NOT let piston dust boot wedge against edge of pads. To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check reservoir fluid level.

FRONT BRAKE ROTOR

Removal & Installation

1) Remove caliper assembly with brakeline connected, and wire aside. See FRONT BRAKE CALIPER under REMOVAL & INSTALLATION. Remove torque plate from knuckle.

2) Mark rotor and hub for installation reference. Slide rotor off hub assembly. To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article.

REAR DISC BRAKE PADS

NOTE: Location and number of anti-rattle springs, anti-squeal shims and pad support plates vary by model. Note component locations during removal for installation reference.

Removal

1) Raise and support vehicle. Remove wheel and tire assembly. Temporarily install wheel lug nuts to retain rotor position. Remove brake caliper from torque plate and wire aside; leave brakeline connected.

2) Remove anti-squeal shims and pads. See Fig. 5. Remove pad support plates and pad wear indicators. Check rotor thickness and runout. Measure brake pads and replace if necessary. See appropriate DISC & DRUM BRAKE SPECIFICATIONS table at end of article.

NOTE: Some models have one or more sets of anti-squeal shims. If one set of shims is vented, place it between pad and outer anti-squeal shim.

Installation

1) Install pad support plates and NEW pads. Install pad wear indicators and anti-squeal shims. Apply disc brake grease to inner anti-squeal shims. DO NOT allow grease to contact rubbing face of pads. Wear indicator must be on bottom side of pad on Celica.

NOTE: Pushing piston into caliper bore forces fluid back into master cylinder reservoir. Remove reservoir cap when compressing piston.

2) Press piston into caliper bore. DO NOT let piston dust boot wedge against edge of pads. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check reservoir fluid level.

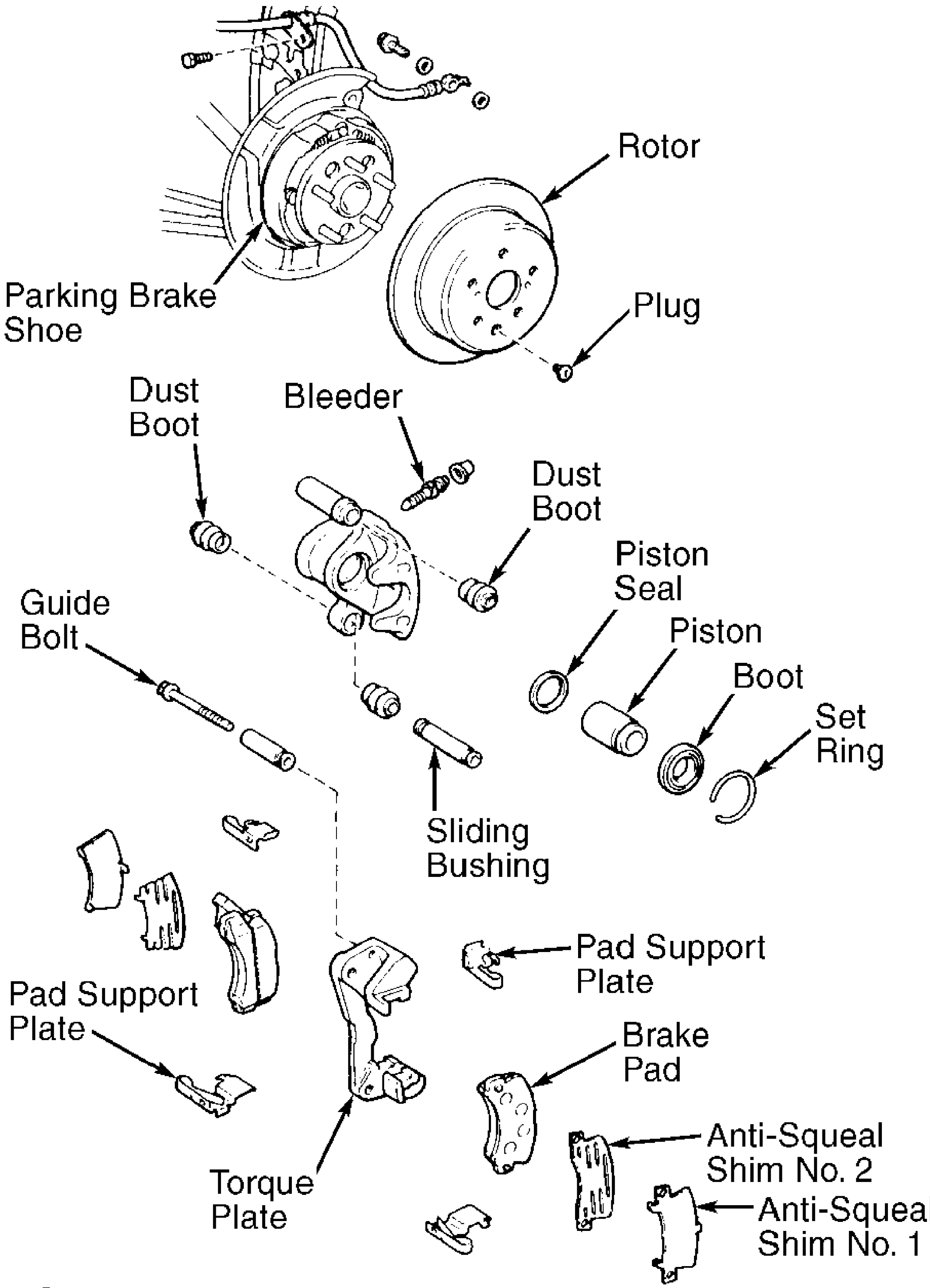

Fig. 5: Exploded View Of Rear Brake Caliper W/ Internal Shoe Parking Brake
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REAR BRAKE CALIPER

Removal

Raise and support vehicle. Remove wheel and tire assembly. Disconnect brakeline from caliper. Plug brakeline to prevent fluid spillage. Remove caliper mounting bolts or slide pins if necessary. Remove caliper from torque plate.

NOTE: Pushing piston into caliper bore forces fluid back into master cylinder reservoir. Remove reservoir cap when compressing piston.

Installation

Push piston into caliper bore, if necessary. DO NOT let piston dust boot wedge against edge of pads. To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check reservoir fluid level.

REAR BRAKE ROTOR

Removal & Installation

1) Remove caliper assembly with brakeline connected, and wire aside. See REAR BRAKE CALIPER under REMOVAL & INSTALLATION. Remove torque plate from backing plate.

2) Mark rotor and hub for installation reference. Slide rotor off hub assembly. To remove rotor, turn parking brake shoe adjuster to release shoes from rotor (if necessary). To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article.

REAR BRAKE DRUM

Removal & Installation

Raise and support vehicle. Remove wheel and tire assembly. Remove set screws from brake drum (if equipped). Pull drum off hub assembly. To remove drum, turn parking brake shoe adjuster to release shoes from drum (if necessary). To install, reverse removal procedure. Check and adjust rear brake shoe clearance. See REAR BRAKE SHOES under ADJUSTMENTS.

REAR DRUM BRAKE SHOES

Removal

1) Raise and support vehicle. Remove wheel and tire assembly. Remove brake drum. See REAR BRAKE DRUM under REMOVAL & INSTALLATION. Disconnect return spring from front shoe. See Fig. 6. Remove front shoe hold-down spring, cup and pin. Remove anchor spring from front shoe, and remove front shoe.

2) Remove anchor spring from rear shoe. Remove rear shoe hold-down spring, cup and pin. Disconnect parking brake cable from lever. Remove rear shoe, adjuster and levers as an assembly.

3) Remove adjusting lever spring. Remove adjuster and return spring from rear shoe. Remove "C" washers, adjusting lever and parking brake lever from rear shoe.

Installation

1) Install adjusting lever and parking brake lever to rear shoe with NEW "C" washers. Measure clearance between lever and rear shoe. Measured clearance must be .0138" (.350 mm) or less. If clearance is more than .0138" (.350 mm), replace shim under parking brake lever. See Fig. 6. Shims range from .008-.024" (.2-.6 mm), in . 004" (.1 mm) increments; shims are also available in .035" (.9 mm) size. Install and stake "C" washers.

2) To complete installation, reverse removal procedure. Apply non-melting grease to sliding surfaces of shoes and adjuster threads. Check and adjust rear brake shoe clearance. See REAR BRAKE SHOES under ADJUSTMENTS.

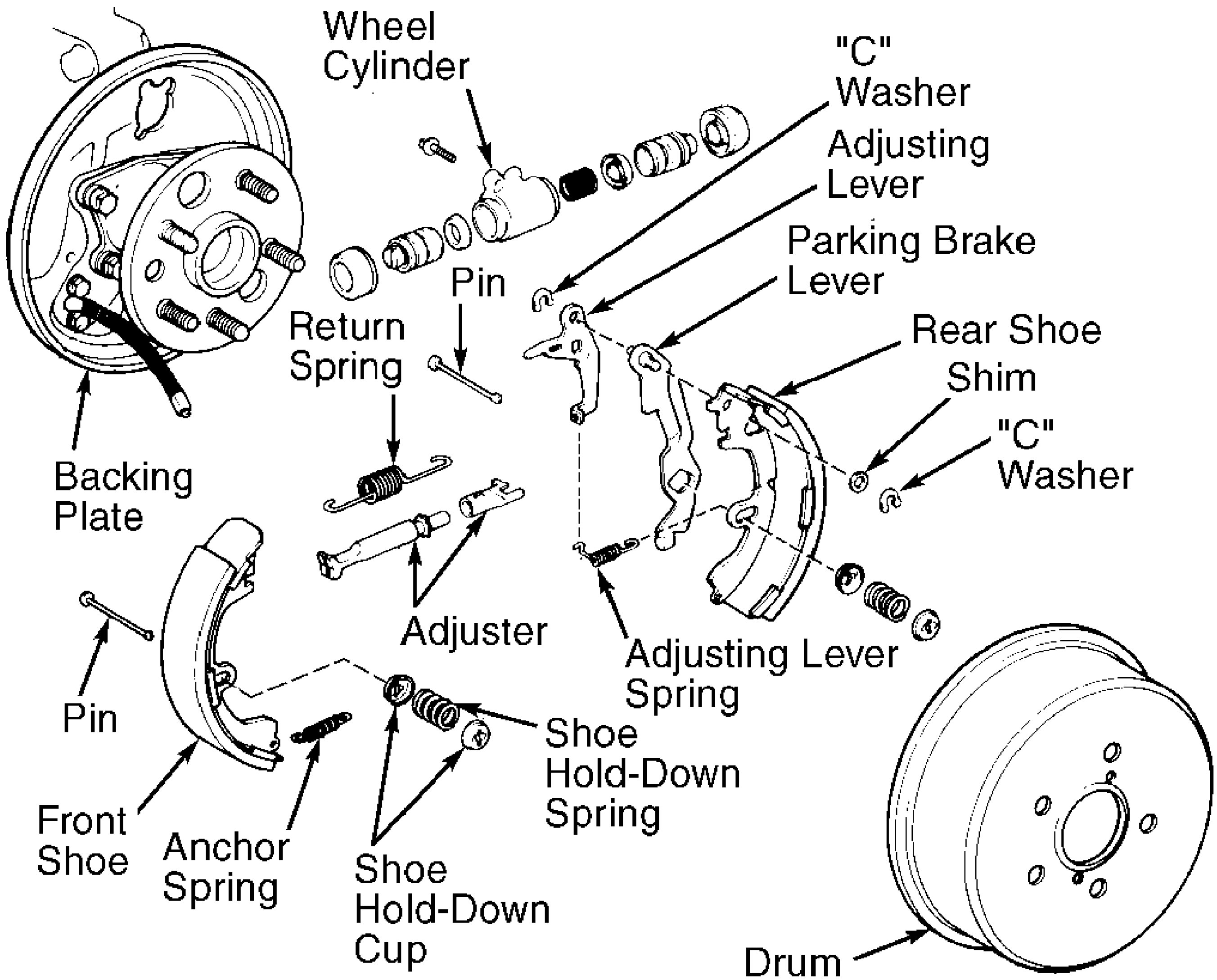

Fig. 6: Exploded View Of Rear Drum Brakes
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REAR WHEEL CYLINDER

Removal & Installation

With brake drum and shoes removed, disconnect brakeline from wheel cylinder. Remove mounting bolts and remove wheel cylinder. To install, reverse removal procedure. Check and adjust rear brake shoe clearance. See REAR BRAKE SHOES under ADJUSTMENTS. Bleed brake system. See BLEEDING BRAKE SYSTEM.

REAR PARKING BRAKE (INTERNAL SHOE)

Removal (With Rear Disc Brake)

1) Remove rotor. See REAR BRAKE ROTOR under REMOVAL &

INSTALLATION. Remove shoe return springs and shoe strut with spring attached. See Fig. 7.

2) Pull out on front shoe, and remove adjuster. Remove tension spring from front shoe. Remove front shoe hold-down spring, cup and pin. Remove front shoe. Remove tension spring from rear shoe. Remove rear shoe hold-down spring, cup and pin. Disconnect parking brake cable from lever, and remove rear shoe.

Inspection (With Rear Disc Brake)

Clearance between parking brake shoe and lever must be .0138" (.350 mm) or less. If clearance is more than .0138" (.350 mm), replace shim under parking brake lever. See Fig. 7. Shims are available from .012-.036" (.3-.9 mm), in .012" (.3 mm) increments. Use NEW "C" washer when installing lever.

Installation (With Rear Disc Brake)

To install, reverse removal procedure. Apply non-melting grease to sliding surfaces of shoes and adjuster threads. Align rotor to hub marks made during rear brake rotor removal procedure. Adjust parking brake shoe clearance. See REAR BRAKE SHOES under ADJUSTMENTS. To complete installation, reverse removal procedure.

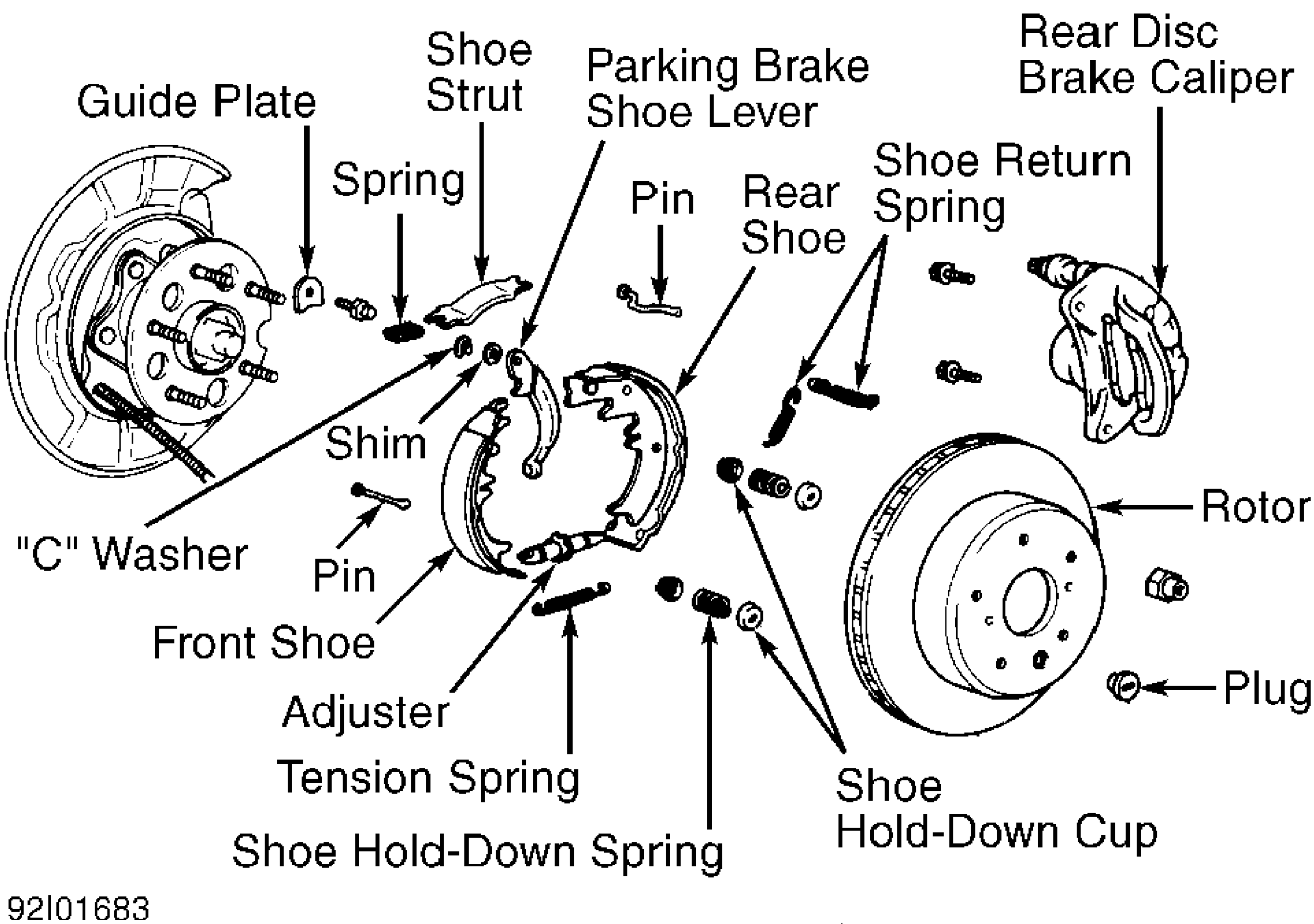

Fig. 7: Exploded View Of Internal Parking Brake Assembly (W/ Rear Disc Brake)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

MASTER CYLINDER

Removal

Remove air cleaner assembly. Disconnect level warning switch connector. Drain brake fluid from reservoir. Disconnect and plug brakelines. Remove master cylinder-to-power brake unit nuts. Remove master cylinder.

Installation

To install, reverse removal procedure. Tighten nuts to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check and adjust power brake unit push rod. See POWER BRAKE UNIT PUSH ROD under ADJUSTMENTS. Bleed brake system. See BLEEDING BRAKE SYSTEM.

POWER BRAKE UNIT

Removal & Installation

1) Remove wiper arms. Remove outside lower windshield molding. Remove upper suspension brace. Temporarily secure shock absorber with nuts. Remove left wheel. Remove master cylinder. See MASTER CYLINDER under REMOVAL & INSTALLATION.

2) Remove charcoal canister, vacuum hose and lower pad. Disconnect push rod at brake pedal. Remove ignition coil, bracket and ignitor. Disconnect brakeline from flexible hose at left front brake. Remove brakeline grommet.

3) On ABS-equipped vehicles, remove 3 brakelines from clamp on firewall. On all models, remove power brake unit. To install, reverse removal procedure. Tighten nuts to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check and adjust push rod. See POWER BRAKE UNIT PUSH ROD under ADJUSTMENTS. Bleed brake system. See BLEEDING BRAKE SYSTEM.

OVERHAUL

NOTE: When overhauling caliper, if cylinder bores are pitted or scored beyond repair by light honing, replace entire assembly.

FRONT BRAKE CALIPER

NOTE: For exploded view of front brake caliper assembly, see Fig. 4.

REAR BRAKE CALIPER

NOTE: For exploded view of rear brake caliper assembly, see Fig. 5.

REAR WHEEL CYLINDER

NOTE: For exploded view of rear wheel cylinder assembly, see Fig. 6.

MASTER CYLINDER

NOTE: For exploded view of master cylinder assembly, see Fig. 8.

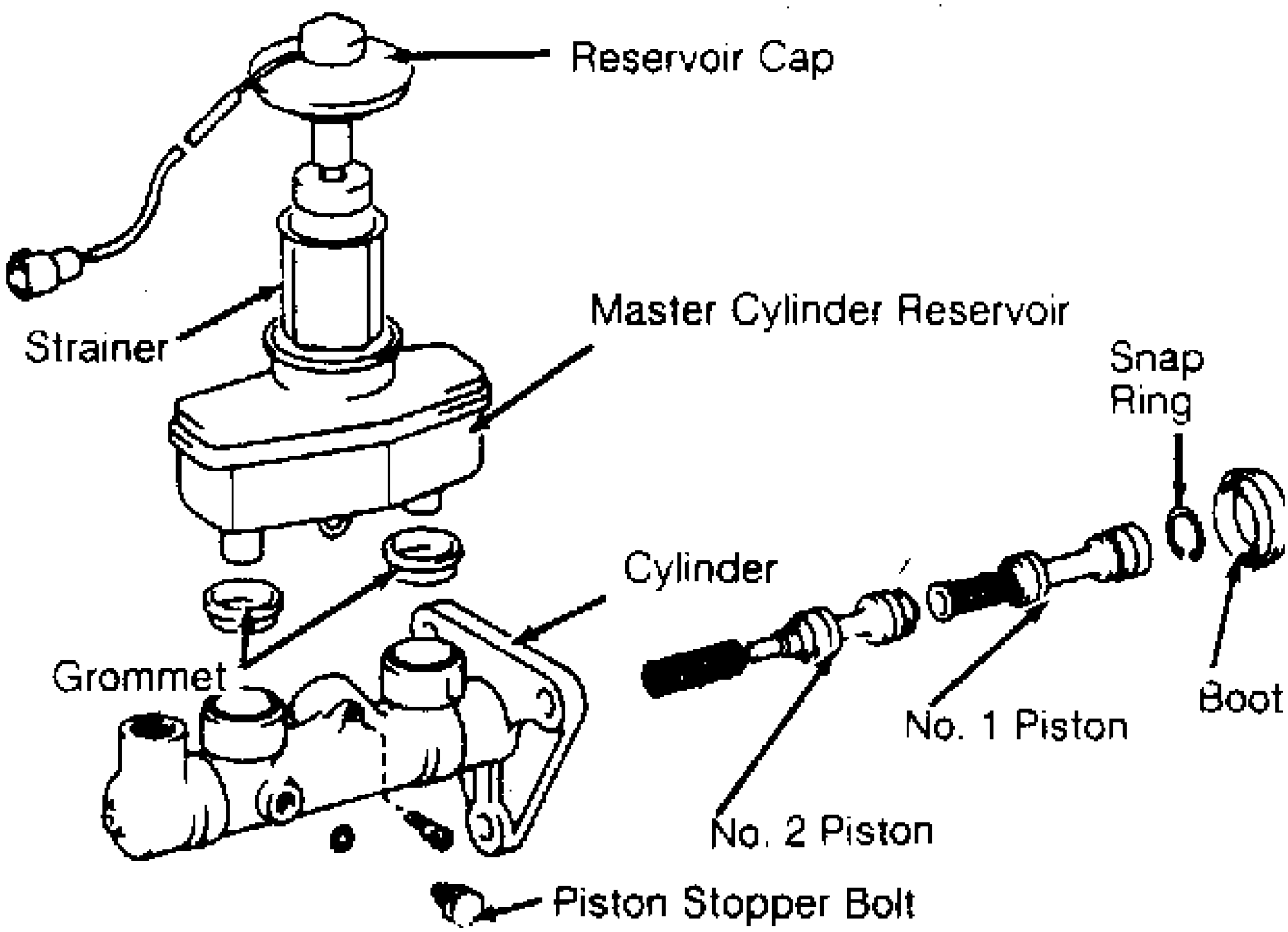

Fig. 8: Exploded View Of Master Cylinder Assembly (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Axle Carrier Upper Bolt	166 (225)
Brake Hose-To-Caliper Fitting	22 (30)
Brakeline Fittings	11 (15)
Brake Pedal Push Rod Lock Nut	19 (26)
Caliper Guide Bolts	
Front	29 (39)
Rear	14 (19)
Caliper Torque Plate Bolts	
Front	79 (107)
Rear	34 (46)
Upper Suspension Brace	
Bolt	15 (20)
Nut	27 (37)
Wheel Lug Nuts	76 (103)

INCH Lbs. (N.m)

Bleeder Plug	74 (8)
Master Cylinder Mounting Nuts	115 (13)
Parking Brake Lever Adjustment Lock Nut	48 (5.4)
Power Brake Unit Mounting Nuts	115 (13)
Wheel Cylinder Mounting Bolts	89 (10)

DISC & DRUM BRAKE SPECIFICATIONS

DISC & DRUM BRAKE SPECIFICATIONS TABLE

Application	In. (mm)
Front Disc	
Standard Disc Thickness	.984 (25.0)
Minimum Refinish Disc Thickness	.906 (23.0)
Maximum Disc Runout	.0028 (.070)
Standard Pad Thickness	.394 (10.0)
Minimum Pad Thickness	.039 (1.00)
Rear Disc	
Standard Disc Thickness	.394 (10.0)
Minimum Refinish Disc Thickness	.354 (9.00)
Maximum Disc Runout	.0059 (.150)
Standard Pad Thickness	.394 (10.0)
Minimum Pad Thickness	.039 (1.00)
Rear Parking Brake Drum (Integral W/ Rear Disc)	
Standard Disc Diameter	6.69 (170.0)
Maximum Refinish Disc Diameter	6.73 (171.0)
Standard Pad Thickness	.079 (2.00)
Minimum Pad Thickness	.039 (1.00)
Brake Shoe-To-Lever Side Clearance (Maximum)	.0138 (.350)
Rear Brake Drum	
Standard Drum Diameter	7.874 (200.0)
Maximum Refinish Drum Diameter	7.913 (201.0)
Standard Pad Thickness	.157 (4.00)
Minimum Pad Thickness	.039 (1.00)
Brake Shoe-To-Drum Clearance	.024 (.600)
Brake Shoe-To-Lever Side Clearance (Maximum)	.0138 (.350)

* BRAKE SYSTEM UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
Brake Systems - Motorist Assurance Program
Standards For Automotive Repair

All Makes & Models

CONTENTS

OVERVIEW OF MOTORIST ASSURANCE PROGRAM
OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS
ACCELEROMETERS (G SENSOR OR LATERAL)
ACCUMULATORS
ANCHOR PINS
ANTI-LOCK BRAKE SYSTEMS
BACKING PLATES
BRAKE FLUID
BRAKE FRICTION MATERIAL
BRAKE PADS
BRAKE PEDALS
BRAKE SHOES
BRAKE SHOE HARDWARE
BRAKE STOPLIGHT SWITCHES
BULB SOCKETS
BULBS AND LEDS
CALIPER HARDWARE
CALIPERS
CONTROLLERS
DIGITAL RATIO AXLE CONTROLLERS AND BUFFERS (DRAC AND DRAB)
DISABLE SWITCHES
DRUMS
ELECTRICAL PUMPS AND MOTORS
ELECTRONIC CONTROLLERS
FLUID
FLUID LEVEL SENSOR SWITCHES
FOUR WHEEL DRIVE SWITCHES
FRICTION MATERIAL
G SENSORS
HOSES
HYDRAULIC MODULATORS
HYDRO-BOOSTERS
HYDRO-ELECTRIC BOOSTERS (POWERMASTER)
IGNITION DISABLE SWITCHES
LATERAL ACCELERATION SWITCHES
LEDS
LENSES
MASTER CYLINDERS
MODULATORS
MOTORS
PARKING BRAKE SWITCHES
PARKING BRAKE SYSTEMS
PADS
PEDAL TRAVEL SWITCHES
PEDALS
POWERMASTER
PUMPS
PRESSURE DIFFERENTIAL SWITCHES
PRESSURE SWITCHES
RELAYS
ROTORS
SELF-ADJUSTING SYSTEMS

SHOE HARDWARE
SHOES
SOCKETS
SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)
STEEL BRAKE LINES
STOPLIGHT SWITCHES
SWITCHES
TIRES
TOOTHED RINGS (TONE WHEEL)
VACUUM BOOSTERS
VACUUM HOSES
VALVES
WHEEL ATTACHING HARDWARE
WHEEL BEARINGS, RACES AND SEALS
WHEEL CYLINDERS
WIRING HARNESSES

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt:

1) a Pledge of Assurance to their Customers and
2) the Motorist Assurance Program Standards of Service.

All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

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Washington, DC 20005
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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications.

Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement
A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement
1 – Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 – To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 – To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 – Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

BRAKES

SERVICE PROCEDURES REQUIRED & SUGGESTED FOR PROPER VEHICLE OPERATION

Some states may have specifications that differ from OEM. Check your local/state regulations. Where state or local laws are stricter, they take precedence over these guidelines.

ACCELEROMETERS (G SENSOR OR LATERAL)

ACCELEROMETER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Loose	B	Require repair or replacement.
Missing	C	Require replacement.
Out of position	B	Require re-positioning to vehicle manufacturer’s specifications.
Output signal incorrect	B	Require replacement.

ACCUMULATORS

ACCUMULATOR INSPECTION

Condition	Code	Procedure
Leaking	B	Require replacement.
Missing	C	Require replacement.
Pre-charge incorrect	B	Require replacement.

ANCHOR PINS

See BACKING PLATES.

ANTI-LOCK BRAKE SYSTEMS

NOTE: Anti-lock brakes are an integral part of the brake system. It is essential that the anti-lock brakes function properly when brake service is performed.

Anti-lock brake systems are commonly referred to as "ABS" and will be referred to as "ABS" throughout these guidelines. Some ABS components also function as part of a traction control system (TCS).

WARNING: When diagnosing and servicing high pressure components, observe safety procedures and equipment requirements established by the vehicle manufacturer to reduce the possibility of serious personal injury.

NOTE: Intermittent electrical conditions are often caused by a loss of ground, poor connection, or water intrusion into the wiring harness.

NOTE: Electro-magnetic interference (EMI) may be caused by incorrect installation of accessories or components. EMI can result in improper system operation.

BACKING PLATES

BACKING PLATE INSPECTION

Condition	Code	Procedure
Anchor pin bent	B	Require repair or replacement.
Anchor pin broken	A	Require replacement.
Anchor pin worn, affecting structural integrity	B	Require replacement.
Backing plate bent	B	Require repair or replacement.
Backing plate broken	A	Require replacement.
Backing plate cracked	B	Require repair or replacement.
Corroded, affecting structural integrity	A	Require replacement.
Loose	B	Require repair or replacement.
Missing	C	Require replacement.
Shoe lands worn	A	Require repair or replacement.

BRAKE FLUID

CAUTION: Most manufacturers prohibit the use of DOT 5 brake fluid in a system equipped with ABS.

DOT 3, DOT 4, and DOT 5.1 brake fluids are clear or light amber in color. DOT 5 brake fluid is violet in color. Correct fluid required for the brake system is stamped on the master cylinder cover.

BRAKE FLUID INSPECTION

Condition	Code	Procedure
Beyond service interval	3	Suggest flushing and refilling with correct fluid.
Brake fluid type incorrect	B	Require flushing and refilling with correct fluid.
Contaminated, for example, fluid other than brake fluid present	A or B	(1) Require service.
Hydraulic component overhaul or replacement	3	Suggest flushing and refilling with correct fluid.
Rubber master cylinder cover gasket distorted and gummy	A	(2) Require replacement of gasket.

(1) - If a fluid other than brake fluid is present in the brake system which DOES affect the rubber parts, the required service is to:

* Remove all components having rubber parts from the system.
* Flush lines with denatured alcohol or brake cleaner
* Repair or replace all components having rubber parts
* Flush and fill with correct brake fluid. (Code A)

If a fluid other than brake fluid is present in the brake system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct brake fluid. (Code B)

(2) - This condition may indicate contaminated brake fluid.

BRAKE FRICTION MATERIAL

See FRICTION MATERIAL.

BRAKE PADS

See FRICTION MATERIAL.

BRAKE PEDALS

BRAKE PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Pedal pad missing	C	Require replacement of pedal pad.
Pedal pad worn	1	Suggest replacement.
Pivot bushings worn, affecting performance	A	Require replacement of pivot bushings.

BRAKE SHOES

See FRICTION MATERIAL.

BRAKE SHOE HARDWARE

See also SELF-ADJUSTING SYSTEMS.

BRAKE SHOE HARDWARE INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Distorted	A	Require replacement.
Missing	C	Require replacement.
Surfaces rust-pitted	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

BRAKE STOPLIGHT SWITCHES

BRAKE STOPLIGHT INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require adjustment or replacement.
Output signal incorrect	B	Require replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Determine cause and correct prior to repair or replacement of part.

BULB SOCKETS

BULB SOCKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Bulb seized in socket	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector missing	C	Require replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Melted	A	(2) Require replacement.

Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of socket.
(2) - Determine cause and correct prior to repair or replacement of part.

BULBS AND LEDS

NOTE: Copied from Electrical UIGs and modified. Does not include soldered-in components.

BULB AND LED INSPECTION

Condition	Code	Procedure
Application incorrect	B	(1) Require replacement.
Base burned, affecting performance	A	(2) Require repair or replacement.
Base burned, not affecting performance	2	(2) Suggest repair or replacement.
Base corroded, affecting performance	A	Require repair or replacement.
Base corroded, not affecting performance	2	Suggest repair or replacement.
Base loose, affecting performance	B	Require repair or replacement.
Base loose, not affecting performance	1	Suggest repair or replacement.
Burned out	A	Require replacement.
Intermittent	A	Require replacement.
Missing	C	Require replacement.
Seized in socket	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	(2) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.

Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Application incorrect includes wrong bulb coating or color.
(2) - Determine cause and correct prior to repair or replacement of part.

CALIPER HARDWARE

CALIPER HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Corroded, affecting performance	A	Require repair or replacement.
Dust boots on slider pin (bolt) missing	C	Require replacement of boots.
Dust boots on slider pin (bolt) torn	A	Require replacement of boots.
Missing	C	Require replacement.
Shim bent	A	(1) Require removal or replacement.
Shim (OE standard) missing	C	(2) Require replacement.
Shim out of position	B	(1) Require removal or replacement.
Shim worn	A	(1) Require removal or replacement.
Slider pin (bolt) bent	B	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) rust-pitted	A	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) worn	A	Require replacement of slider pin or bolt and lubricants.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

(1) - Removal is acceptable if shim is not OE.
(2) - Aftermarket shims may be suggested to reduce noise.

CALIPERS

You are not required to replace or rebuild calipers in axle sets. However, when replacing or rebuilding a caliper due to the conditions that follow, you may suggest servicing, rebuilding, or replacement of the other caliper (on the same axle) for improved performance and preventive maintenance (for example, the part is close to the end of its useful life, replacing the caliper may extend pad life, or contribute to more balanced braking).

CAUTION: When installing loaded calipers, it is required that friction material be matched in axle sets for consistent braking characteristics.

CALIPER INSPECTION

Condition	Code	Procedure
Bleeder port damaged	A	Require repair or replacement of caliper.
Bleeder screw broken off in caliper	A	(1) Require repair or replacement of caliper.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement of caliper.
Casting corroded, affecting structural integrity	A	Require replacement.
Casting damaged, affecting structural integrity	A	Require replacement.
Dust boot around caliper torn	A	Require replacement of dust boot.
Leaking	A	Require repair or replacement.
Mounting pin threads damaged	A	Require repair or replacement of component with damaged threads.
Mounting pin threads stripped in caliper bracket (threads missing)	A	Require repair or replacement of caliper bracket.
Mounting pin threads stripped in steering knuckle (threads missing)	A	Require repair or replacement of steering knuckle.
Mounting pin threads stripped (threads missing)	A	Require repair or replacement of component with stripped threads.
Parking brake cable support, lever, or return spring bent	A	Require replacement of parts.
Parking brake cable support, lever, or return spring broken	A	Require replacement of parts.
Parking brake mechanism in caliper inoperative	A	Require repair or replacement.
Piston corroded (pitted or peeling chrome plating)	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, affecting performance	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, not affecting performance	..	No service suggested or required.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement

		of caliper.
Piston sticking	A	Require rebuilding or replacement of caliper.
Slide mechanism sticking	A	Require repair or replacement of slide mechanism.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

CONTROLLERS

See ELECTRONIC CONTROLLERS.

DIGITAL RATIO AXLE CONTROLLERS AND BUFFERS (DRAC AND DRAB)

DIGITAL RATIO AXLE CONTROLLER AND BUFFER INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	B	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Determine cause and correct prior to repair or replacement of part.

DISABLE SWITCHES

See SWITCHES.

DRUMS

Determine the need to recondition based upon individual drum conditions that follow. Friction material replacement does not require drum reconditioning unless other justifications exist. DO NOT recondition new drums unless they are being pressed or bolted onto an existing hub. It is not necessary to replace drums in axle sets. However, when replacing or reconditioning a drum due to the conditions that follow, you may suggest reconditioning of the other drum on the same axle to eliminate uneven braking behavior. Always wash drums after servicing or before installing.

DRUM INSPECTION

Condition	Code	Procedure
Balance weight missing	..	No service suggested or required.
Bell-mouthed, affecting performance	A	Require reconditioning or replacement.
Cooling fin broken	..	No service suggested or required.
Cracked	B	Require replacement.
Drum diameter is greater than OEM "machine to" specifications but less than "discard at" specifications, and the drum does not require reconditioning	1	(1) Suggest replacement.
Drum diameter will exceed OEM "machine to" specifications after required reconditioning	B	(2) Require replacement.
Hard-spotted	2	Suggest reconditioning or replacement.
Measured diameter is greater than OEM discard specifications	B	Require replacement.
Out-of-round (runout), affecting performance	A	Require reconditioning or replacement.
Out-of-round (runout), exceeding manufacturer's specifications	B	Require reconditioning or replacement.
Scored	B	Require reconditioning or replacement.
Surface threaded due to improper machining	B	Require reconditioning or replacement.
Tapered, affecting performance	A	Require reconditioning or replacement.

(1) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the drum may be worn to discard specifications.
(2) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.

ELECTRICAL PUMPS AND MOTORS

Copied fuel pump conditions from engine UIGs & deleted pulsator from leaking conditions.

ELECTRICAL PUMP AND MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Contaminated	A	.... (2) Require replacement.
Inoperative	A	.... (3) Require repair or replacement.
Leaking externally	A	.. Require repair or replacement.
Leaking internally	A	.. Require repair or replacement.
Noisy	2	.. Suggest repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specifications.

ELECTRONIC CONTROLLERS

ELECTRONIC CONTROLLER INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	.... Require replacement.
Attaching hardware missing	C	.... Require replacement of

		hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	Require repair or replacement.
Inoperative	B	Require repair or replacement. (3) Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable. Check for accepted cleaning procedure.

FLUID

See BRAKE FLUID.

FLUID LEVEL SENSOR SWITCHES

See SWITCHES.

FOUR WHEEL DRIVE SWITCHES

See SWITCHES.

FRICTION MATERIAL

NOTE: Original Equipment Manufacturer (OEM) specifications designate replacement at different thicknesses.

CAUTION: It is required that friction material be matched in axle sets for consistent braking characteristics.

FRICTION MATERIAL INSPECTION

Condition	Code	Procedure
Contaminated, for example, fluid that leaked from caliper, wheel cylinder, or axle seal	A	(1) Require replacement.
Cracked through	B	Require replacement.
Flaking or chunking	B	Require replacement.
Glazed (shiny)	..	No service suggested or required.
Grooves or ridges	..	(2) No service suggested or required.
Permanently attached hardware bent	A	Require replacement.
Permanently attached hardware broken	A	Require replacement.
Permanently attached hardware loose	A	Require replacement.
Permanently attached hardware missing	C	Require replacement.
Permanently attached hardware seized	A	Require repair or replacement.
Rivets loose	B	Require replacement.
Separating from backing	B	Require replacement.
Shoe table or web bent	B	Require replacement.
Shoe table or web cracked	A	Require replacement.
Shoe table or web worn, affecting performance	A	Require replacement.
Surface cracking	..	No service suggested or required. Further inspection may be necessary to determine cause.
Tapered wear	B	(3) Suggest replacement.
Thickness of one pad is greater than opposite pad in the same caliper (uneven wear)	..	(4) Replacement of friction material not suggested or required. Further inspection required. See CALIPERS and CALIPER HARDWARE.
Wear indicator device (electronic) contacts rotor	B	(5) Require replacement of appropriate parts.
Wear indicator device (mechanical) bent	..	(6) Further inspection required.
Wear indicator device (mechanical) broken	..	(6) Further inspection required.

Wear indicator device (mechanical) contacts rotor		(6) Further inspection required.
Worn close to minimum specifications	1	(7) Suggest replacement.
Worn to, or below minimum specifications	B	Require replacement.

(1) - Identify and repair cause of contamination prior to replacing friction material.
(2) - When reconditioning or replacing drums or rotors, replacement of friction material may be suggested depending on the severity of the grooves or ridges.
(3) - Some vehicles use pads that are tapered by design. Refer to specific vehicle application. If not normal, require replacement of pads and correction of cause.
(4) - Uneven pad thickness is normal on some vehicles. Refer to specific vehicle applications.
(5) - The pad wear indicator light may come on due to other electrical problems.
(6) - Explain to the customer that the purpose of the wear indicator is to alert him or her to check for friction wear. Wear indicators may be bent or broken. Therefore, the friction material must be measured. The need for friction material replacement is determined based upon the conditions stated in this section. Periodic inspection is suggested.
(7) - When the part appears to be close to the end of its useful life, replacement may be suggested.

G SENSORS

See ACCELEROMETERS.

HOSES

HOSE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Blistered	B	Require replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Incorrectly secured	B	Require repair.
Inner fabric (webbing) cut	B	Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that inner fabric of hose		

is visible	B	.... Require replacement.
Restricted	A	.... Require replacement.
Routed incorrectly	B	.... Require repair.

HYDRAULIC MODULATORS

NOTE: Many modulators can only be replaced as complete assemblies. Whenever possible, replace the failed component part. If replacement of the failed part is not possible, then replace the modulator assembly.

HYDRAULIC MODULATOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require replacement.
Connector missing	C	.... Require replacement.
Disabled	A	.. Require repair or replacement.
Electrical failure	A	.. Require repair or replacement.
External leak	A	.. Require repair or replacement.
Housing cracked	B	.. Require repair or replacement.
Inoperative (2)	A	.. Require repair or replacement.
Internal leak	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Valve stuck	A	.. Require repair or replacement.
Wire lead burned	A	.. Require repair or replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

HYDRO-BOOSTERS

NOTE: Hydro-boosters and hydro-electric boosters are combined.

HYDRO-BOOSTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Does not apply assist, or inadequate assist	A	Require repair or replacement.
Leaking	B	Require repair or replacement.
Leaks fluid at fitting	B	Require tightening or replacement.
Leaks fluid at unit	B	Require repair or replacement.
Leaks fluid from pressure hose(s)	B	Require replacement of hose(s).
Leaks fluid into passenger compartment	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to replacement of part.

HYDRO-ELECTRIC BOOSTERS (POWERMASTER)

See HYDRO-BOOSTERS.

IGNITION DISABLE SWITCHES

See SWITCHES.

LATERAL ACCELERATION SWITCHES

See ACCELEROMETERS.

LEDS

See BULBS AND LEDS.

LENSES

LENSE INSPECTION

Condition	Code	Procedure
Application incorrect	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Cracked	A	Require replacement.
Discolored	A	Require replacement.
Leaking	A	Require repair or replacement.
Melted, affecting performance	A	Require replacement.
Melted, not affecting performance	2	Suggest replacement.
Missing	C	Require replacement.

MASTER CYLINDERS

MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Brake fluid leaking from rear of master cylinder bore	B	Require repair or replacement.
Brake pedal drops intermittently	A	(1) Require repair or replacement.
Fluid level low	..	(2) Further inspection required.
Internal valve failure	A	Require repair or replacement.
Master cylinder leaking brake fluid internally	A	Require repair or replacement.
Piston does not return	A	Require repair or replacement.
Ports plugged	A	Require repair or replacement.
Rubber master cylinder cover gasket distorted and gummy	A	(3) Require replacement of the gasket.

(1) - This condition may be normal on some vehicles equipped with anti-lock brakes.
(2) - Refer to OEM procedures for adjusting low fluid level. Inspect for brake hydraulic system leaks and friction material wear.
(3) - This condition may indicate contaminated brake fluid. See BRAKE FLUID.

MODULATORS

See HYDRAULIC MODULATORS.

MOTORS

See ELECTRICAL PUMPS AND MOTORS.

PARKING BRAKE SWITCHES

See SWITCHES.

PARKING BRAKE SYSTEMS

NOTE: The parking brake is an integral part of the brake system. It is important that the parking brake function properly when brake service is performed.

PARKING BRAKE SYSTEM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cable improperly adjusted	B	Require cable adjustment.
Cable or individual wires in the cable are broken	A	Require replacement of cable assembly.
Cable sticking	A	Require cable lubrication.
Cable stuck inside conduit and cannot be lubricated so that parking brake functions properly	A	Require replacement of cable assembly.
Inoperative (1)	A	Require replacement of inoperative parts.
Parking brake parts bent	B	Require repair or replacement of bent parts.
Parking brake parts broken	A	Require replacement of broken parts.
Parking brake parts		

missing	C	.. Require replacement of missing parts.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

(1) - Inoperative includes intermittent operation.

PADS

See FRICTION MATERIAL.

PEDAL TRAVEL SWITCHES

See SWITCHES.

PEDALS

See BRAKE PEDALS.

POWERMASTER

See HYDRO-BOOSTERS.

PUMPS

See ELECTRICAL PUMPS AND MOTORS.

PRESSURE DIFFERENTIAL SWITCHES

See SWITCHES.

PRESSURE SWITCHES

See SWITCHES.

RELAYS

NOTE: Copied from Electrical UIGs

RELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Housing broken	A	.... Require replacement.
Housing cracked	2	.... Suggest replacement.
Inoperative (1)	A	.... Require replacement.
Missing	C	.... Require replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance ..	A	.... (2) Require repair or replacement.

Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

ROTORS

Determine the need to recondition based upon individual rotor conditions that follow. Friction material replacement does not require rotor reconditioning unless other justifications exist. DO NOT recondition new rotors unless they are being pressed or bolted onto an existing hub. It is not necessary to replace rotors in axle sets. However, when replacing or reconditioning a rotor due to the conditions that follow, you may suggest reconditioning of the other rotor on the same axle to eliminate uneven braking behavior.

Determine the need to replace based upon the individual rotor conditions that follow. Reconditioning is defined as machining and block sanding, or block sanding only. Block sanding is defined as using 120-150 grit sandpaper with moderate to heavy force for 60 seconds per side. Always wash rotors after servicing or before installing.

ROTOR INSPECTION

Condition	Code	Procedure
Corrosion affecting structural integrity	A	(1) Require replacement.
Cracked	B	Require replacement.
Hard spots	2	Suggest reconditioning or replacement of rotor according to OEM specifications.
Lateral runout (wobble) exceeds OEM specifications	B	Require re-indexing, reconditioning, or replacement according to specifications.
Measured thickness is less than OEM discard specifications	B	Require replacement.
Rotor thickness is less than OEM "machine to" specifications but thicker than "discard at" specifications, and the rotor does not require reconditioning	1	(2) Suggest replacement.
Rotor thickness will be less than OEM "machine to" specifications after required		

reconditioning	B	(3) Require replacement.
Surface is rust-pitted	B	Require reconditioning or replacement of rotor according to OEM specifications.
Surface is scored	B	(4) Require reconditioning or replacement of rotor according to OEM specifications.
Thickness variation (parallelism) exceeds OEM specifications	B	Require reconditioning or replacement of rotor according to OEM specifications.

(1) - Examples of severe corrosion are: composite plate separated from friction surfaces and cooling fins cracked or missing.
(2) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the rotor may be worn to discard specifications.
(3) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.
(4) - Scoring is defined as grooves or ridges in the friction contact surface. Some vehicle manufacturers require machining when scoring exceeds their allowable specifications.

SELF-ADJUSTING SYSTEMS

SELF-ADJUSTING SYSTEM INSPECTION

Condition	Code	Procedure
Bent	A	Require repair or replacement of bent part.
Broken	A	Require repair or replacement of broken part.
Inoperative	A	(1) Require repair or replacement of inoperative parts.
Missing	C	Require replacement of missing part.
Star wheel does not turn freely	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

SHOE HARDWARE

See BRAKE SHOE HARDWARE.

SHOES

See FRICTION MATERIAL.

SOCKETS

See BULB SOCKETS.

SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)

NOTE: Copied Vehicle Speed Sensors from Engine UIGs & added Air Gap incorrect, loose, and wire lead misrouted. For "contaminated" removed coolant & fuel examples from note.

SPEED SENSOR INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Leaking	A	Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Sensor housing cracked	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead misrouted	B	Require re-routing according to vehicle manufacturer's

		specifications.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as metal particles or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

STEEL BRAKE LINES

STEEL BRAKE LINE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corroded, affecting structural integrity	A	Require replacement.
Fitting incorrect (for example, compression fitting)	B	Require replacement.
Flare type incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Line material incorrect (copper, etc.)	B	Require replacement.
Restricted	A	Require replacement.
Routed incorrectly	B	Require routing correction.
Rust-pitted	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

STOPLIGHT SWITCHES

See BRAKE STOPLIGHT SWITCHES.

SWITCHES

NOTE: Copied from Electrical UIGs & added "float saturated" from old fluid level sensor switches.

STEEL BRAKE LINE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Float saturated	A	Require replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won't return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TIRES

Consult the vehicle owner's manual or vehicle placard for correct size, speed ratings, and inflation pressure of the original tires.

TIRE INSPECTION

Condition	Code	Procedure
Tire diameter incorrect, affecting ABS or TCS	A	Require replacement.
Tire pressure incorrect, affecting ABS or TCS	A	Require repair or replacement.
Tire size incorrect, affecting ABS or TCS	A	Require replacement.

TOOTHED RINGS (TONE WHEEL)

NOTE: Copied from Drivetrain UIGs.

If the toothed ring requires replacement and cannot be replaced as a separate component, replace the assembly of which the ring is a part.

TOOTHED RING INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Bent	B	Require replacement.
Contaminated, affecting performance	A	Require repair. Identify and correct cause.
Cracked	B	Require replacement.
Loose	A	Require replacement of worn parts.
Missing	C	Require replacement.
Number of teeth incorrect	B	Require replacement.
Teeth broken	A	Require replacement.
Teeth damaged, affecting performance	A	Require replacement.

VACUUM BOOSTERS

VACUUM BOOSTER INSPECTION

Condition	Code	Procedure
Applies too much assist (oversensitive)	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Auxiliary vacuum pump inoperative	A	(1) Require repair or replacement.
Check valve grommet deteriorated, affecting performance	A	Require replacement of grommet.

Check valve grommet deteriorated, not affecting performance	1	Suggest replacement of grommet.
Check valve inoperative	A	(2) Require repair or replacement.
Check valve leaking	A	Require replacement of check valve.
Check valve missing	C	Require replacement of check valve.
Check valve noisy	2	Suggest replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(3) Require replacement.
Connector missing	C	Require replacement.
Leaking	A	Require replacement.
Terminal burned, affecting performance	A	(3) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Vacuum hose filter leaking	A	Require replacement of filter.
Vacuum hose filter restricted	A	Require replacement of filter.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Inoperative includes intermittent operation.
(3) - Determine cause and correct prior to replacement of part.

VACUUM HOSES

See HOSES.

VALVES

VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

		hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	B	Require repair or replacement.
Linkage bent (rear load valves)	A	Require repair or replacement of linkage.
Linkage broken (rear load valves)	A	Require repair or replacement of linkage.
Linkage disconnected (rear load valves)	C	Require repair or replacement of linkage.
Pressure out of specification	B	Require adjustment. If not possible, require replacement.
Seized	A	Require replacement.
Sticking	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

WHEEL ATTACHING HARDWARE

For conditions noted below, also check condition of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow manufacturer's torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHING HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	(1) Require replacement.
Loose	B	Require repair or replacement of affected component.

Lug nut flats rounded ...	A	..... Require replacement of nut.
Lug nut installed backward	B	.... Require repair.
Lug nut mating surface dished	A	..... Require replacement of nut.
Lug nut mating type incorrect	B	..... Require replacement of nut.
Lug nut seized	A	...... Require replacement of nut and/or stud.
Stud incorrect	B	.... Require replacement of stud.
Threads damaged	A	... Require repair or replacement of component with damaged threads.
Threads stripped (threads missing)	A	.... Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on any wheel if two or more studs or nuts on the same wheel are broken or missing.

WHEEL BEARINGS, RACES AND SEALS

NOTE: Grease seal replacement is required if seal is removed. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARINGS, RACES AND SEALS INSPECTION

Condition	Code	Procedure
Axle seal on drive axle leaking	A	. Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Bearing end-play exceeds specifications	B	.. Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or feel rough when rotated as an assembly	B	.. Require replacement of bearing assembly.
Seal leaking	A	...... (1) Require replacement of seal and inspection of bearings.
Spindle worn	B	.. Require replacement of spindle and bearings.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged vent may force fluid past the seal.

WHEEL CYLINDERS

You are not required to replace or rebuild wheel cylinders in axle sets. However, when rebuilding or replacing a wheel cylinder due to the conditions that follow, you may suggest rebuilding or replacement of the other wheel cylinder (on the same axle) for preventive maintenance, for example, the part is close to the end of its useful life.

Determine the need to rebuild or replace based upon the individual wheel cylinder conditions that follow.

WHEEL CYLINDER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require replacement of bent parts.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded parts.
Attaching hardware loose	A	Require repair or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bleeder port damaged (if non-repairable)	A	Require replacement.
Bleeder screw broken off in wheel cylinder (if non-repairable)	A	(1) Require replacement.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement.
Bore corroded (pitted)	B	Require replacement.
Bore grooved	A	Require replacement.
Bore oversized	B	Require replacement.
Dust boot missing	C	Require replacement of dust boot.
Dust boot torn	A	(3) Require replacement of dust boot.
Leaking	A	(4) Require rebuilding or replacement.
Piston corroded, affecting performance	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston stuck in bore	A	Require replacement of wheel cylinder.
Loose	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

(3) - Inspect for conditions related to wheel cylinder.
(4) - Leaking is defined as a drop or more. Dampness is normal.

WIRING HARNESSES

NOTE: Copied from Electrical UIGs.

WIRING HARNESS INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

1993 Clutch

Celica

DESCRIPTION

The single, dry disc type clutch uses a hydraulically operated master cylinder and a release cylinder mounted on clutch housing. Clutch release cylinder is not adjustable. Clearance is automatically compensated for by internal design of cylinder. Camry models also use an accumulator.

ADJUSTMENTS

CLUTCH PEDAL HEIGHT

Pedal height is measured from highest point of pedal pad to area of floor contacted when pedal is fully depressed. Loosen pedal stop bolt at top of pedal assembly to adjust pedal height from floor. See Fig. 1. See CLUTCH PEDAL HEIGHT SPECIFICATIONS table.

CLUTCH PEDAL HEIGHT SPECIFICATIONS TABLE

Application	In. (mm)
Camry	
4-Cylinder	6.33-6.72 (160.8-170.7)
V6	6.48-6.88 (164.6-174.8)
Celica	6.41-6.80 (162.8-172.7)
Corolla	5.61-6.00 (142.5-152.5)
Paseo	5.51-5.91 (140.0-150.1)
Tercel	
4-Speed	5.69-6.08 (144.5-154.4)
5-Speed	5.51-5.91 (140.0-150.1)

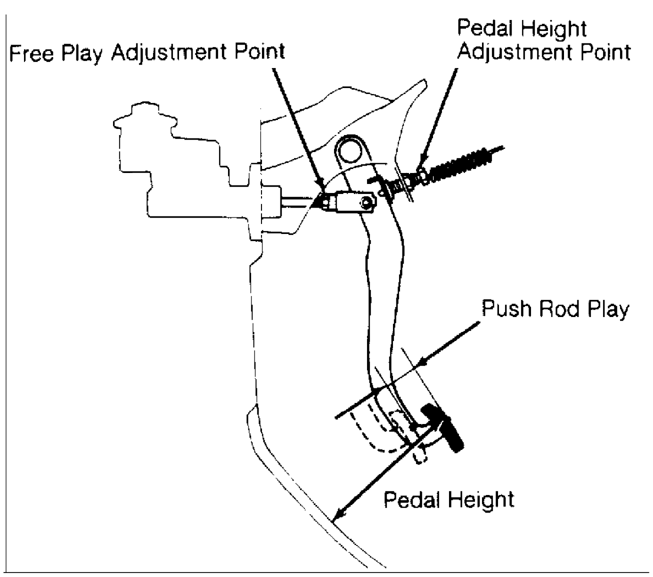


Fig. 1: Adjusting Clutch Pedal Height & Free Play
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CLUTCH PEDAL FREE PLAY

Push in on clutch pedal until beginning of clutch resistance is felt. Clutch pedal free play should be .20-.59" (5.0-15.0 mm). See Fig. 2. To adjust free play, loosen lock nut on master cylinder push rod and turn push rod to obtain correct pedal free play. See Fig. 1. Tighten lock nut, and recheck pedal height.

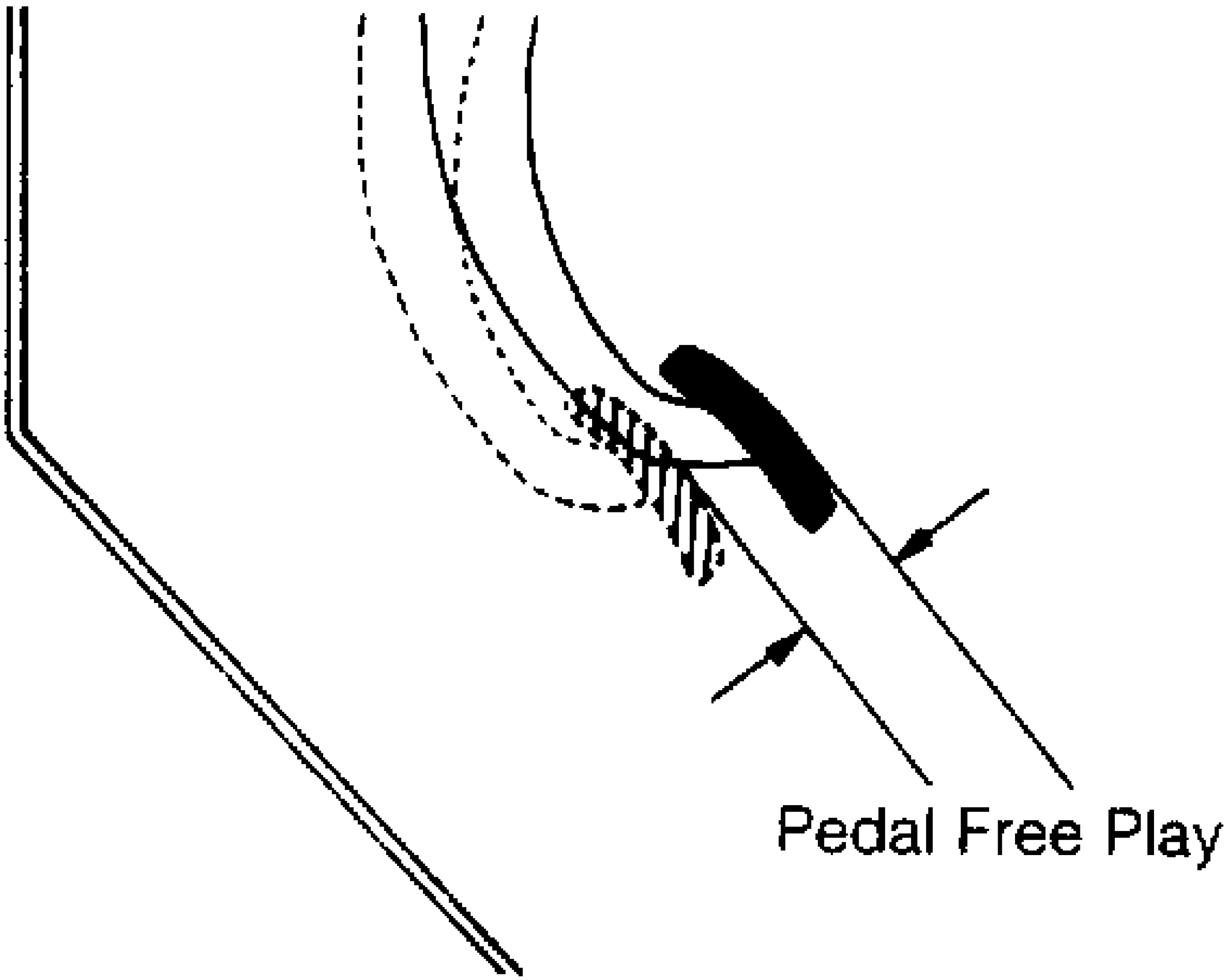


Fig. 2: Measuring Clutch Pedal Free Play
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CLUTCH START SYSTEM

Switch Adjustment

1) Ensure engine does not start when clutch pedal is released. Ensure engine starts when clutch pedal is fully depressed.

2) On all models, if system is not operating correctly, check clutch start switch. With switch in ON (pushed) position, continuity should exist. With switch in OFF (free) position, continuity should not exist. See CLUTCH SWITCH PLUNGER CONTINUITY SPECIFICATIONS table. See Fig. 3. Replace or adjust switch as necessary.

CLUTCH SWITCH PLUNGER CONTINUITY SPECIFICATIONS TABLE (1)

Application	In. (mm)
Celica	.176-.216 (4.5-5.5)

(1) - Distance from threaded end of switch where continuity changes. See Fig. 3.

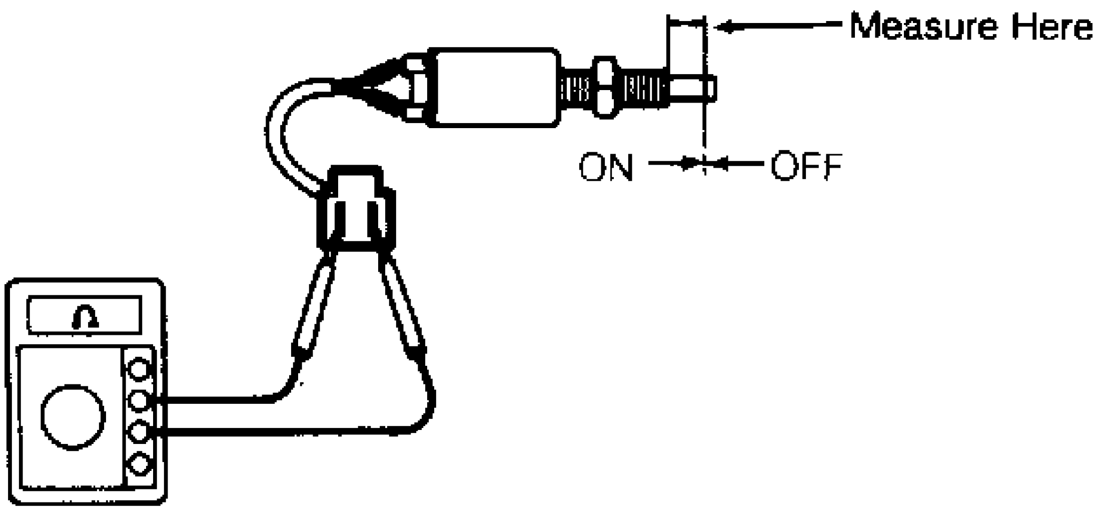


Fig. 3: Testing Clutch Start System Switch
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

CLUTCH ASSEMBLY

WARNING: To prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

Removal (Celica FWD)

1) Disconnect negative battery cable. Remove air cleaner assembly. Remove cruise control assembly. Remove starter, clutch release cylinder and bracket. Remove left engine stay, ground cable and back-up switch connector. Disconnect control cables and speedometer cable.

2) Remove left side engine and transaxle mounting bolts. Remove front wheels. Raise and support vehicle. Remove splash shields. Drain transaxle fluid. Remove drive shaft. See AXLE SHAFTS - FRONT article in DRIVE AXLES. Remove lower crossmember. Remove front exhaust pipe. Remove engine mounting bolts and engine-to-center crossmember bolts.

3) Raise engine and transaxle slightly with a jack, and remove center crossmember. Remove stiffener plate. Remove transaxle mounting bolts, lower engine and remove transaxle.

4) Mark pressure plate and flywheel for reassembly reference.

Loosen pressure plate attaching bolts alternately until pressure plate is released. Remove clutch disc and pressure plate. DO NOT drop clutch disc.

WARNING: To prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

Removal (Celica All-Trac)

1) Engine and transaxle must be removed as an assembly to replace clutch assembly. With ignition off, disconnect negative battery cable. Place suitable container under fuel line. Cover fuel line connection with shop towel. Slowly loosen fuel line connection to release fuel pressure.

2) Drain cooling system, engine oil and transaxle oil. Remove hood and engine undercover. Remove air intake duct, airflow meter and air cleaner cap as an assembly. Remove air cleaner case. Disconnect cables from throttle body.

3) Disconnect relay box from battery. Remove lower cover from relay box. Disconnect fusible link assembly and engine wire connectors from relay box. Remove A/C relay box from bracket, located near right corner of radiator.

4) Remove battery. Remove injector solenoid resistor and fuel pump resistor located in front of battery, left of radiator. Remove radiator cooling fans, radiator and radiator reservoir tank. Remove cruise control actuator and ignition coil. Remove strut tower-to-firewall braces.

5) Label charcoal canister vacuum hoses, and remove canister. Label all necessary vacuum hose locations for reassembly reference. Disconnect necessary control cables, coolant hoses, fuel lines, vacuum hoses and electrical connections.

6) Raise and support vehicle. Disconnect speedometer cable, oil cooler hoses and control cables at transaxle. Remove clutch release cylinder with hose attached, and secure aside. Disconnect wiring, and remove turbo pressure sensor and A/C vacuum switching valve from firewall. Remove starter.

7) Disconnect electrical connectors from engine Electronic Control Unit (ECU) located left of glove box, behind center console. Disconnect remaining electrical connections so engine wiring can be pulled out through access hole in passenger's side of firewall. See Fig. 4. Remove retaining nuts, and pull engine wiring through firewall.

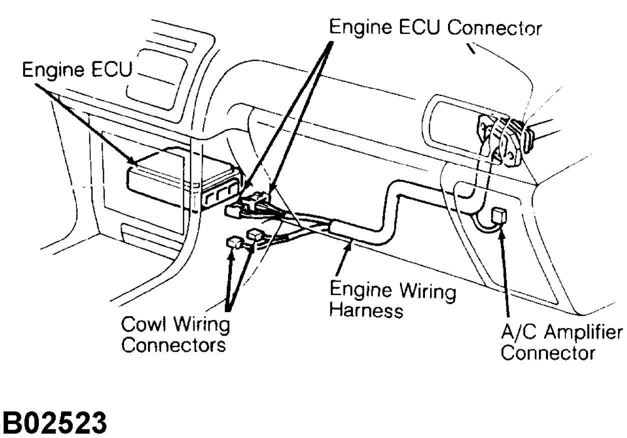


Fig. 4: Identifying Engine Wiring Connectors (Celica All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Remove suspension crossmember bolted to both lower suspension arm shafts. Disconnect exhaust pipe at catalytic converter

(located at bottom of turbo) and center pipe. Remove exhaust pipe. Remove front tires and wheels. Remove axle shafts. See the AXLE SHAFTS - FRONT article in DRIVE AXLES. Remove front drive shaft.

9) Place reference marks on front and rear drive shaft flanges at center bearing. Remove flange bolts. Remove drive shaft from transfer case. Remove seal deflector from rear of transfer case. Remove dynamic damper from transfer case.

10) Remove alternator and idler pulley bracket. Remove A/C compressor and power steering pump with hoses attached, and secure aside. Remove engine mount crossmember located below engine. Remove catalytic converter from turbo.

11) Disconnect engine and transaxle mounts. Note direction of mount installation for reassembly reference. Mounts must be installed in original direction. Lift engine and transaxle from vehicle.

12) Remove bolts attaching engine to transaxle and remove transaxle. Mark pressure plate and flywheel for reassembly reference. Loosen pressure plate attaching bolts alternately until pressure plate is released. Remove clutch disc and pressure plate. DO NOT drop clutch disc.

WARNING: To prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

Inspection

1) Check wear on facings of clutch disc by measuring depth of each rivet head. Minimum depth at any rivet is .012" (.30 mm). Maximum runout of clutch disc facing is .031" (.79 mm). Replace clutch disc if it is not within specifications.

2) Check diaphragm spring and pressure plate for wear and damage. If assembly is excessively worn or damaged, replace pressure plate. Check pilot bearing rotation. If bearing rotates roughly, replace bearing. Check release bearing for rough rotation. Replace bearing and hub as necessary.

3) Inspect flywheel runout. Maximum runout is .004" (.10 mm). If runout is excessive, replace flywheel. Clean flywheel and pressure plate of all oil, grease and metal deposits. Inspect for damage, cracks and warpage. Slight surface scoring can be removed using sandpaper. Replace or repair as necessary.

4) Using calipers, inspect diaphragm spring for depth and width of wear. See Fig. 5. Maximum depth is .024" (.060 mm). Maximum width is .197" (5.0 mm).

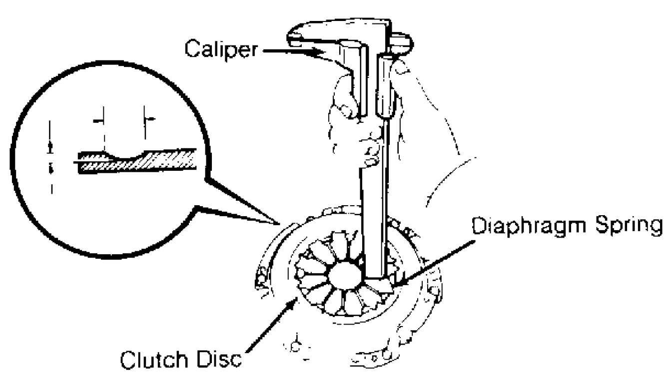


Fig. 5: Checking Diaphragm Spring Depth & Width Wear
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) Align reference marks, and install clutch disc and

pressure plate. Use clutch aligner to center clutch disc on flywheel. Tighten pressure plate bolts alternately and evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS table.

2) Apply molybdenum disulfide grease to release fork contact surfaces, release bearing and hub, and clutch disc splines. Reverse removal procedure to complete installation.

CLUTCH MASTER CYLINDER

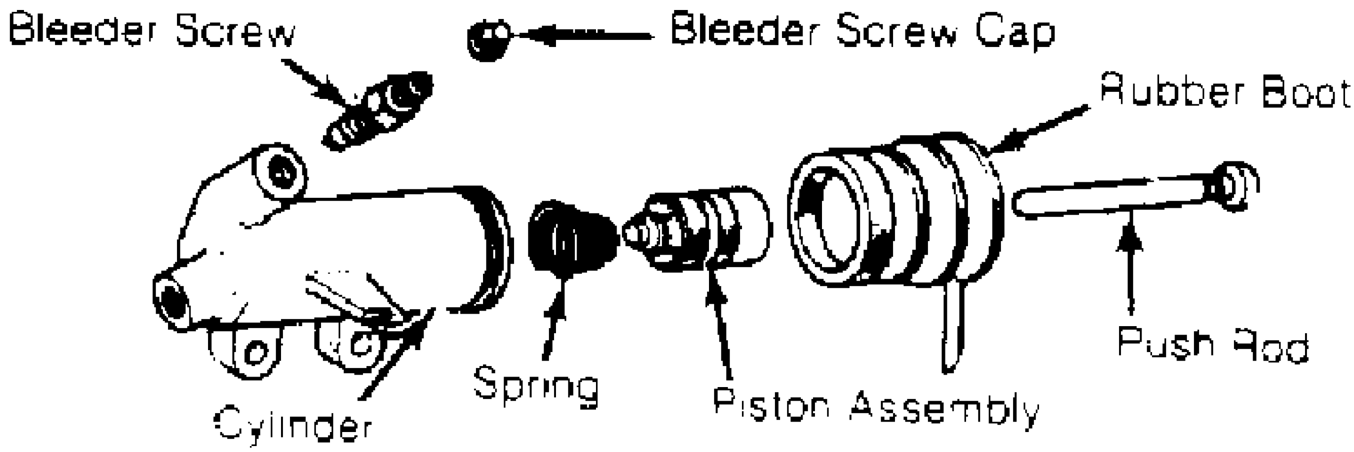
Removal & Installation

1) On Celica Turbo, remove front suspension brace. On Corolla, remove brake booster. On all models, disconnect master cylinder push rod at clutch pedal. Disconnect hydraulic line at cylinder.

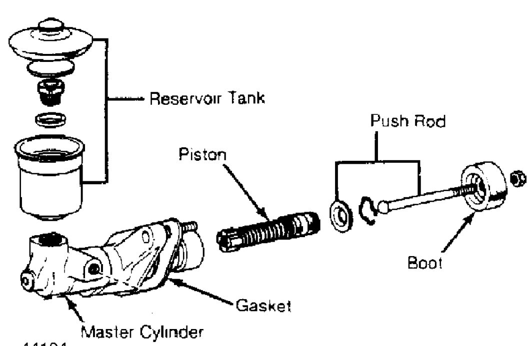
2) Remove clutch master cylinder. To install, reverse removal procedure. Adjust pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS. Bleed hydraulic system.

OVERHAUL

NOTE: For exploded view of release cylinder, see Fig. 6. For exploded view of clutch master cylinder, see Fig. 7.



44005
Fig. 6: Exploded View Of Release Cylinder (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



44104
Fig. 7: Exploded View Of Clutch Master Cylinder (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Celica (FWD)	
Flywheel Bolts	
4A-FE	58 (79)
5S-FE	65 (88)
3S-GTE	80 (108)
Pressure Plate Bolts	14 (19)
Transaxle-To-Engine Bolts	
10-mm Bolts	34 (46)
12-mm Bolts	47 (64)
Wheel Lug Nuts	76 (103)
Celica (All-Trac)	
Dynamic Damper Bolt	19 (26)
Engine Mount Crossmember-To-Underbody Bolt	38 (52)
Engine Mounting Bracket-To-Engine Bolts (Right Front)	38 (52)
Engine Mounting Insulator Through Bolt	64 (87)
Engine Mounting Insulator-To-Bracket Nuts (Right Front)	38 (52)
Engine Mount-To-Crossmember Bolt	54 (73)
Flywheel Bolt	65 (88)
Power Steering Pump Bolt	32 (43)
Pressure Plate Bolts	14 (19)
Stiffener Support Brace Bolt (Engine Block-To-Flywheel Housing)	27 (37)
Strut Tower-To-Firewall Brace	
Bolt	15 (20)
Nut	47 (64)
Suspension Crossmember Bolt	112 (152)
Transaxle-To-Engine Bolts	
10-mm Bolts	34 (46)
12-mm Bolts	47 (64)
Wheel Lug Nuts	76 (103)

COMPUTER RELEARN PROCEDURES

1993 Toyota Celica

GENERAL INFORMATION
Computer Relearn Procedures

All Models

* PLEASE READ THIS FIRST *

The following general procedures are to be used if driveability problems are encountered after power loss or battery has been disconnected. These procedures may provide an aid in eliminating these problems.

To reduce the possibility of complaints, after any service which requires battery power to be disconnected, vehicle should be road tested.

COMPUTER RELEARN PROCEDURES

Vehicles equipped with engine or transmission computers may require a relearn procedure after vehicle battery is disconnected. Many vehicle computers memorize and store vehicle operation patterns for optimum driveability and performance. When vehicle battery is disconnected, this memory is lost. The computer will use default data until new data from each key start is stored. As computer memorizes vehicle operation for each new key start, driveability is restored. Vehicle computers may memorize vehicles operation patterns for 40 of more key starts.

Customers often complain of driveability problems during relearn stage because vehicle acts differently then before being serviced. Depending on type and make of vehicle and how it is equipped, the following complaints (driveability problems) may exist:

* Harsh Or Poor Shift Quality
* Rough Or Unstable Idle
* Hesitation Or Stumble
* Rich Or Lean Running
* Poor Fuel Mileage

These symptoms and complaints should disappear after a number of drive cycles have been memorized. To reduce the possibility of complaints, after any service which requires battery power to be disconnected, vehicle should be road tested. If a specific relearn procedure is not available, the following procedure may be used:

Automatic Transmission

* Set parking brake, start engine in "P" or "N" position. Warm-up vehicle to normal operating temperature or until cooling fan cycles.
* Allow vehicle to idle for one minute in "N" position. Select "D" and allow engine to idle for one minute.
* Accelerate at normal throttle position (20-50%) until vehicle shifts into top gear.
* Cruise at light to medium throttle.
* Decelerate to a stop, allowing vehicle to downshift, and use brakes normally.
* Process may be repeated as necessary.

Manual Transmission

* Place transmission in Neutral position.
* Ensure emergency brake has been set and all accessories are turned off.
* Start engine and bring to normal operating temperature.
* Allow vehicle to idle in Neutral for one minute.
* Initial relearn is complete: process will be completed during normal driving.

Some manufacturers identify a specific relearn procedure which will help establish suitable driveability during relearn stage. These procedures are especially important if vehicle is equipped with and electronically controlled automatic transmission or transaxle. Always complete procedure before returning vehicle to customer.

CRUISE CONTROL SYSTEM

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Cruise Control Systems

Celica

DESCRIPTION

Cruise control system consists of Cruise Control Electronic Control Unit (CC ECU), actuator and associated cables, speed sensor(s), parking brake switch, cruise control switch, stoplight switch, park/neutral switch (A/T), clutch switch (M/T) and related wiring. See Fig. 1. System allows vehicle to cruise at a desired speed greater than 25 MPH.

Speed control will cancel when brake pedal or clutch pedal is depressed, CANCEL switch is activated or automatic transmission shift lever is moved to "N" position. If vehicle speed falls below 25 MPH or drops 10 MPH less than preset speed, will be canceled. If a malfunction is detected in either actuator, speed sensor or speed control switch circuits cruise control function, speed control will also be canceled.

OPERATION

Pressing cruise control CRUISE ON-OFF to ON position, activates system. CRUISE indicator light in instrument cluster comes on to indicate activation of system. To set desired speed, press control SET/COAST switch and release switch. Vehicle speed will now be maintained. To increase speed, depress accelerator pedal enough to exceed set speed. When accelerator pedal is released, speed will return to speed previously set.

To cancel set speed, press cruise control CANCEL switch, depress brake pedal, depress clutch pedal or place shift lever in "N" position. If vehicle speed falls to less than 25 MPH, set speed will automatically cancel. If vehicle speed falls below set speed by 10 MPH, set speed will also automatically cancel.

Pressing cruise control RES/ACC switch, allows vehicle to return to set speed before cancellation. Pressing cruise control RES/ACC position and keeping it there gradually increases vehicle speed. Pressing cruise control SET/COAST position and keeping it there gradually decreases vehicle speed.

ACTUATOR (MOTOR)

Actuator consists of a motor, safety magnetic clutch, control arm and position sensor. When actuator receives a signal from CC ECU, it engages safety magnetic clutch and activates motor. Motor causes control arm to move, opening or closing engine throttle valve.

When motor rotates forward, control arm also rotates via safety magnetic clutch, gears and drive shaft. Control arm pulls a cable connected to engine throttle valve and opens the valve accordingly. When motor rotates in a reverse direction, control arm also rotates in a reverse direction and engine throttle valve closes.

Safety magnetic clutch disengages motor from control arm and shuts throttle valve when vehicle speed approaches 10 MPH or more above set speed during cruise control operation, when motor malfunctions or when a circuit problem occurs. Position sensor detects rotary angle of control arm and constantly sends a signal to CC ECU.

ACTUATOR (VACUUM)

Actuator consists of a vacuum diaphragm, control cable and vacuum control valve. When cruise control is activated, vacuum actuator receives an input signal from CC ECU, to increase vehicle speed. Signal from CC ECU causes vacuum control valve to close atmospheric intake port introducing a vacuum to diaphragm. Control cable is pulled and throttle valve is opened, increasing vehicle speed to preselected speed. To close throttle valve, signal from CC ECU is decreased, causing vacuum control valve to reduce vacuum and increase atmospheric pressure. Control cable is released and throttle valve is closed.

CRUISE CONTROL SWITCH

CRUISE ON-OFF Switch

Cruise control CRUISE ON-OFF switch is power switch for cruise control system. When ignition is turned off, cruise control CRUISE ON-OFF switch is also turned off. Switch remains off even when ignition is turned on again.

SET/COAST Position

With cruise control CRUISE ON-OFF switch turned on and vehicle speed greater than 25 MPH, press cruise control switch in SET/COAST position and then release. CC ECU will store vehicle speed and control that speed constantly.

While in cruise control mode, if cruise control switch is pressed and held in SET/COAST position, actuator motor will be energized. Engine throttle valve will close, and vehicle will decelerate until switch is released. From then on, CC ECU will store new vehicle speed and control that speed constantly.

RES/ACC Position

If cruise control system is canceled by any of various cancellation methods, the previously set speed can be resumed by moving cruise control switch to RES/ACC position and then releasing. Set speed, however, cannot be resumed if vehicle speed drops to less than 25 MPH, as CC ECU memory will be cleared.

While in cruise control mode, if cruise control switch is pressed and held in RES/ACC position, actuator motor will be energized. Engine throttle valve will open, and vehicle will accelerate until switch is released. From then on, CC ECU stores new vehicle speed and controls that speed constantly.

CANCEL Position

When cruise control switch is turned to CANCEL position, a cancellation signal is sent from cruise control switch to CC ECU.

CRUISE CONTROL ELECTRONIC CONTROL UNIT (CC ECU)

CC ECU constantly monitors and compares set speed with actual vehicle speed from input sensors. When vehicle speed is different from set speed, CC ECU activates actuator motor to change engine throttle valve, changing vehicle speed.

CC ECU includes a self-diagnostic function. If cruise control system is canceled by any condition other than driver operation, CC ECU assumes a malfunction has occurred and may set a corresponding fault code.

SPEED SENSOR

Speed sensors are located in combination meter and/or on extension housing of Electronically Controlled Transmission (ECT) or M/T. Speed sensor rotor shaft is driven by a gear on speedometer output shaft. For each shaft rotation, speed sensor sends a 20-pulse signal to instrument cluster. This signal is converted inside instrument cluster to a 4-pulse signal which is sent to CC ECU. CC ECU calculates vehicle speed from this pulse frequency.

SELF-DIAGNOSTIC SYSTEM

When vehicle is in cruise control mode, system will cancel due to a malfunction in either actuator, speed sensor or speed control switch circuit. When cruise control functions are canceled, CRUISE light will blink 5 times, indicating 2-digit trouble code(s) are stored in CC ECU memory. See CC ECU TROUBLE CODE DEFINITION table under SELF-DIAGNOSTICS. Two digit trouble codes(s) will be stored in CC ECU memory until ignition is turned off. See SELF-DIAGNOSTICS.

If a fault or symptom is present, but no trouble codes were set, a circuit function test can be performed. Circuit function test will display a one digit function code if circuit tested is okay. See CRUISE CONTROL CIRCUIT FUNCTION TEST under TROUBLE SHOOTING.

NOTE: Intermittent failures may cause CRUISE indicator light to flicker or come on. Light will go out after fault goes away. Fault may or may not be present at time of testing; however, a corresponding trouble code may be stored in CC ECU memory. See SELF-DIAGNOSTICS.

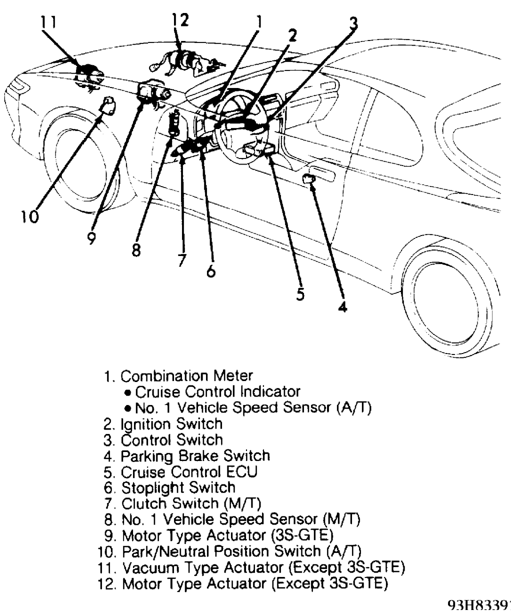


Fig. 1: Locating Cruise Control Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SELF-DIAGNOSTICS

* PLEASE READ THIS FIRST *

CAUTION: Celica is equipped with a Supplemental Restraint System (SRS). SRS wiring harness is routed close to instrument cluster, steering wheel and related components. All SRS wiring harnesses and connectors are Yellow. DO NOT use electrical test equipment on these circuits. Before working on cruise control components, disable air bag system. Refer to AIR BAG RESTRAINT SYSTEM article in ACCESSORIES/SAFETY EQUIPMENT section.

WARNING: Wait at least 90 seconds after disabling SRS. Back-up power circuit, capacitor, maintains system voltage for about 90 seconds after battery is disconnected. Servicing cruise control system before 90 seconds may cause accidental air bag deployment and possible personal injury.

READING TROUBLE CODES

Trouble codes are displayed as flashes of CRUISE indicator light. All trouble codes are 2-digit numbers. CC ECU outputs trouble codes from lowest to highest. These codes indicate current faults in system and should be serviced in order of appearance. Pay careful attention to length of pauses in order to read codes correctly. See Fig. 2.

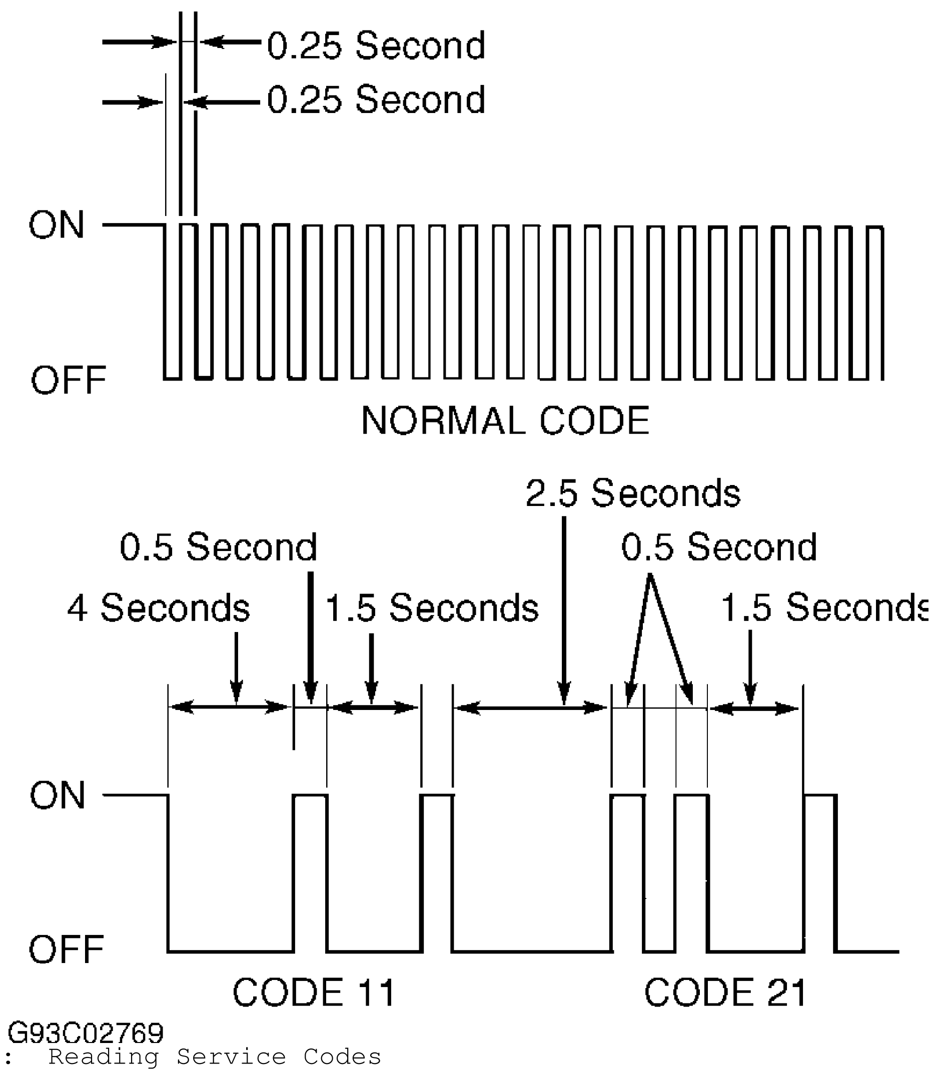


Fig. 2: Reading Service Codes
Courtesy of Toyota Motor Sales, U.S.A., Inc.

RETRIEVING TROUBLE CODES

1) Codes from CC ECU self-diagnostic system are retrieved through self-test diagnostic Data Link Connector (DLC). Test drive vehicle to allow fault codes to set in CC ECU memory. If CRUISE indicator light begins to flash 5 times while driving or cruise control will not set or operate, check for trouble codes. Go to next step.

2) Stop vehicle and leave ignition switch in ON position. If ignition switch is turned to OFF position, any stored trouble codes will be erased from CC ECU memory. Connect jumper wire between DLC self-diagnostic terminals. See CC ECU CODE RETRIEVAL table. See Fig. 3.

3) If any code is present, perform test(s) in order given. See CC ECU FAULT CODE DEFINITION table. If no codes are present and CRUISE indicator light begins flashing on and off every .25 seconds, perform NORMAL code tests in order given. See CC ECU FAULT CODE DEFINITION table. If no codes are present and CRUISE indicator light does not flash on and off every .25 seconds, and cruise control system malfunction still exists, perform CRUISE CONTROL CIRCUIT FUNCTION TEST under TROUBLE SHOOTING.

CC ECU CODE RETRIEVAL TABLE

Application	DLC Self-Test Terminals
Celica	3 & 11

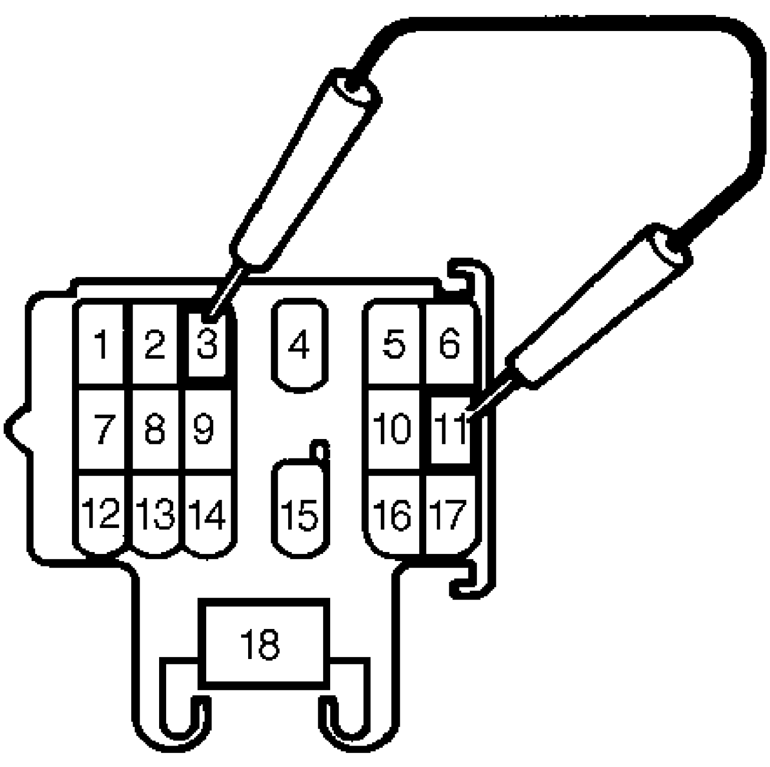


Fig. 3: DLC Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CC ECU FAULT CODE DEFINITION

CC ECU FAULT CODE DEFINITION TABLE

Code No.	Diagnosis Problem	(1) Perform Test No.
Normal	Indicator Light Flashes 5 Times, CC System Can Not Be Set Or Does Not Operate	3, 5, 6, 8, 9, 7, 4, (2), (3)
11	Excessive Voltage To Motor Acceleration Side	4, (2), (3)
11	Over Current/Short In Motor Circuit	4, (2), (3)
12	Open In Magnet Clutch Circuit	4, 6, (2), (3)
12	Overcurrent/Short In Magnet Clutch Circuit	4, 6, (2), (3)
13 (4)	Position Sensor Detects Abnormal Voltage	4, (2)
13 (4)	Open In Actuator Motor Circuit	4, (2)
13 (4)	Position Sensor Signal Value Does Not Change When Motor Operates	4, (2)
21	Speed Sensor Signal Not Sent To CC ECU For 140 Milliseconds Or Longer	5, (2)
23 (5)	Vehicle Speed Decreased 10 MPH Or More Below Speed Set During Cruise Control Operation	(6), 5, 4, 13
31 (4)	RES/ACC Mode Is On At All Times When MAIN Switch Is On	3, (2)
32	Short In Control Switch Circuit	3, (2)
34	Control Does Not Turn Off Before Switching	3, (2)
41	Faulty CC ECU	(2)

(1) - Perform test numbers in order given.
(2) - Replace CC ECU, and retest system.
(3) - Check wire harness and connectors.
(4) - Except with vacuum type actuator.
(5) - If speed set can be maintained when speed control switch is again set to SET/COAST position, there is no malfunction.
(6) - Check speed control cable and control link function.

CLEARING CODES

CAUTION: Do not disconnect vehicle battery to clear codes.

To clear codes from CC ECU memory, turn ignition off. This procedure erases fault codes from CC ECU memory. If problem has not been corrected or fault is still present, code will be reset in CC ECU memory.

TROUBLE SHOOTING

NOTE: Before TROUBLE SHOOTING BY SYMPTOM, perform SELF-DIAGNOSTICS. TROUBLE SHOOTING BY SYMPTOM should only be performed if no self-diagnostic trouble codes are present.

CRUISE CONTROL CIRCUIT FUNCTION TEST

Retrieving 1-Digit Normal Function Code

Turn ignition on. Push cruise control switch to SET/COAST or RES/ACC position and hold. Set CRUISE ON-OFF (MAIN) switch to ON position. Ensure CRUISE indicator light comes on in combination meter and flashes after 3 seconds. Release cruise control switch from SET/COAST or RES/ACC position. Activate each switch circuit in order given. If other than a normal function code is displayed, go to TROUBLE SHOOTING BY SYMPTOM. If normal code is displayed and cruise control is still malfunctioning, go to TROUBLE SHOOTING BY SYMPTOM. Normal function code will be displayed by CRUISE indicator light, as each circuit is activated as follows:

* SET/COAST

Set cruise control switch to SET/COAST position and hold. Indicator light will flash normal Code 2, if circuit function is normal. SET/COAST circuit normal function code will repeat normal Code 2.

* RES/ACC

Set cruise control switch to RES/ACC position and hold. Indicator light will flash normal Code 3, if circuit function is normal. RES/ACC circuit normal function code will repeat normal Code 3.

* CANCEL Switches

Raise vehicle and support drive wheels off ground. Perform CANCEL switch test with engine running. Press CANCEL switch to ON and OFF positions. Depress and release brake pedal. Apply and release parking brake. On A/T models, move shift lever from "D" to "N" position. On M/T models, depress and release clutch pedal. If circuit is normal, indicator light will come on when switch is in OFF position and go off when switch is in ON position.

* Vehicle Speed Sensor

Raise vehicle and support drive wheels off ground. Start engine and slowly depress accelerator pedal until specified speed is reached. Turn CRUISE ON-OFF (MAIN) switch to ON position. If circuit is normal, indicator light will flash on and off every .25 second at vehicle speeds greater than 25 MPH. At vehicle speeds of 25 MPH or less, if circuit is normal, indicator light will come on and stay on. On models with Electrically Controlled Transmission (ECT), drive vehicle at 25 MPH or less. If circuit is normal, indicator light will come on and stay on. If indicator light functions as described, this would be considered a normal code.

NOTE: When 2 or more function codes are sent to CC ECU, only the lowest numbered function code will be displayed.

CLEARING FUNCTION CODES

CAUTION: DO NOT disconnect vehicle battery to clear codes.

Normal function code display will be canceled when CRUISE ON-OFF switch is set to OFF position.

TROUBLE SHOOTING BY SYMPTOM

NOTE: Perform tests No. 1 and No. 2 to ensure power source and indicator light circuits are okay. Perform following tests in order listed.

Vehicle Speed Does Not Decrease When Speed Control Switch Set To SET/COAST

When normal function code is displayed, check speed control cable function and perform TEST 4 and 5. When other than normal function code is displayed, perform TEST 3.

Cruise Control System Can Not Be Set, Does Not Operate Or Indicator Light Flashes 5 Times

When normal function code is displayed, check wire harness, speed control cable function and perform TEST 3, 6, 8, 9, 7, and 4. When other than normal function code is displayed, perform TEST 5.

Vehicle Speed Fluctuates When Speed Control Switch Turned To SET/COAST Position

Check speed control cable function and perform TEST 5 and 4.

Large Speed Drop When Cruise Control Switch Turned To SET/COAST

Check speed control cable function and perform TEST 12 and 4.

Vehicle Speed Does Not Increase When Control Set To RES/ACC - Perform TEST 4, 5, 11, and 10. When other than normal function code is displayed, perform TEST 3.

Set Speed Changes On High Or Low Side

When normal function code is displayed, check speed control cable function and perform TEST 5 and 4. On models with motor type actuator perform TEST 12 only. When other than normal function code is displayed, perform TEST 5.

Acceleration Response Is Sluggish When Control Is Set To RES/ACC

On models with vacuum type actuator, perform TEST 3, 4, 11, and 10. On models with motor type actuator, perform TEST 3, 4, 11, 10, and 12.

Vehicle Does Not Return To Memorized Speed When Control Set To RES/ACC

When normal function code is displayed, check speed control cable function and perform TEST 4 and 5. When other than normal function code is displayed, perform TEST 3.

Set Speed Does Not Cancel When Brake Pedal Depressed

When normal function code is displayed, perform TEST 4 and 6. When other than normal function code is displayed, perform TEST 6.

Set Speed Does Not Cancel When Parking Brake Applied

When normal function code is displayed, perform TEST 4. When other than normal function code is displayed, perform TEST 7.

Speed Does Not Cancel When Shifted to "N" (A/T) Or Clutch Pedal Depressed (M/T)

When normal function code is displayed, perform TEST 4. When other than normal function code is displayed, perform TEST 8 (A/T) or 9 (M/T).

Set Speed Does Not Cancel When Control Set To CANCEL

When normal function code is displayed, perform TEST 4. When other than normal function code is displayed, perform TEST 3.

Set Speed Can Be Set Below Approximately 25 MPH

When normal function code is displayed, perform TEST 4. When other than normal function code is displayed, perform TEST 5.

Set Speed Will Not Disengage At Approximately 25 MPH Or Less

When normal function code is displayed, perform TEST 4. When other than normal function code is displayed, perform TEST 5 and check speed control cable function.

TESTING & DIAGNOSIS

TEST 1: POWER SOURCE CIRCUIT

1) Check CC ECU-IG fuse and replace if faulty. If fuse is okay, go to next step. If fuse failure is continuous, turn ignition off and disconnect Cruise Control Electronic Control Unit (CC ECU) wire harness connector. Install NEW fuse. Turn ignition on and check fuse. If fuse fails, check for short in wire harness between CC ECU-IG fuse and CC ECU. If fuse is okay, replace CC ECU and retest.

2) Turn ignition off and disconnect CC ECU wire harness connector. Ensure continuity exists between CC ECU ground terminal and body ground. See CC ECU CONNECTOR GROUND & POWER TERMINAL IDENTIFICATION table. If continuity is not present, repair open in circuit. If continuity is present, go to next step.

3) Turn ignition on. Measure voltage between power terminal and ground. See CC ECU CONNECTOR GROUND & POWER TERMINAL IDENTIFICATION table. If battery voltage is not present, repair open in circuit. If battery voltage is present, replace CC ECU and retest system.

CC ECU CONNECTOR GROUND & POWER TERMINAL IDENTIFICATION TABLE

Application	Ground Term. (Wire Color)	Power Term. (Wire Color)
Motor Actuator	A9 (BRN)	A1 (BLK/RED)
Vacuum Actuator	15 (BRN)	12 (BLK/RED)

TEST 2: CRUISE CONTROL INDICATOR LIGHT CIRCUIT

1) Turn ignition off. Ensure GAUGE fuse is okay. If fuse is okay, go to next step. If fuse is not okay replace fuse and turn ignition on. If fuse fails, check for short on harness side and repair as necessary.

2) Remove combination meter and disconnect connector(s). Turn ignition on and ensure battery voltage exists between ground and connector terminal on GAUGE fuse side of combination meter. If battery voltage is present, go to next step. If battery voltage is not present, go to step 5).

3) Remove CRUISE indicator light and ensure continuity. Replace if necessary. If bulb is okay install bulb, connect combination meter connector and go to next step.

4) Turn ignition off. Disconnect CC ECU wire harness connector(s). Ensure continuity exists between ground and CC ECU

indicator light terminal. If continuity is not present, go to next step. If continuity is present, repair short in indicator light circuit between CC ECU connector and combination meter or between combination meter circuit plate and indicator light. See appropriate vehicle under step 5) for terminal identification.

5) Turn ignition on. Ensure battery voltage exists between ground and CC ECU indicator light terminal. If battery voltage is present, replace CC ECU and retest system. If battery voltage is not present, repair open in indicator light circuit between CC ECU connector and combination meter or open in combination meter circuit plate between indicator light terminal and indicator bulb or between GAUGE fuse terminal and indicator bulb.

6) Test between GAUGE fuse and combination meter 12-pin connector "B" terminal No. B7 (Red/Blue wire). Test between combination meter Brown 10-pin connector "C" terminal No. C2 and CC ECU connector terminal No. B6 with motor actuator or No. 4 with vacuum actuator, (Light Green wire). Test between combination meter 12-pin connector "B" terminal No. B7 (Red/Blue wire) and indicator light to combination meter Brown 10-pin connector "C" terminal No. C2 (Light Green wire).

TEST 3: CONTROL SWITCH CIRCUIT

NOTE: Ensure main switch and control switch operations are normal. See COMPONENT TESTING.

1) Disconnect control switch connector(s), (6-pin with Supplemental Restraint System (SRS) or 14-pin connector "A" and Black 20-pin connector "B" without SRS). Ensure continuity exists between ground and control switch connector terminal No. 3 or B17 (Brown wire). If continuity is present, go to next step. If continuity is not present, repair faulty ground or open in circuit between ground and control switch terminal No. 3 or B17.

3) Disconnect CC ECU connector. Ensure continuity exists between main switch connector terminal and ground terminal or resistance between control switch connector terminal and ground terminal at specified switch positions. See CRUISE CONTROL SWITCH TERMINALS and CRUISE CONTROL SWITCH TESTING tables. Replace cruise control switch if results are not as specified. If results are as specified, go to step 8).

CRUISE CONTROL SWITCH TERMINALS TABLE

Main Switch Terminal (Wire Color)	Control Switch Terminal (Wire Color)	Ground Terminal (Wire Color)
4 (WHT) (1)	5 (YEL/BLK)	3 (BRN)
B15 (YEL/BLK) (2)	B5 (WHT)	B17 (BRN)

(1) - With Supplemental Restraint System.
(2) - Without Supplemental Restraint System.

CRUISE CONTROL SWITCH TESTING TABLE

Switch Position	Result
Main OFF	No Continuity
Main ON	Continuity
Control OFF	No Continuity
Control RES/ACC	Approximately 68 Ohms

Control SET/COAST	Approximately 198 Ohms
Control CANCEL	Approximately 418 Ohms

SLIP RING TESTING TABLE

5-Pin Slip Ring Terminal No.	6-Pin Slip Ring Terminal No.
2	6
3	4
4	5

4) Turn ignition off and connect control switch connector. Disconnect CC ECU connector(s). Turn CRUISE ON-OFF (MAIN) switch to OFF position and ensure no continuity exists between ground and CC ECU harness side connector terminal. See CC ECU-TO-CRUISE ON-OFF (MAIN) SWITCH HARNESS TESTING table. If continuity is not present, go to next step. If continuity is present, repair short in circuit between CC ECU terminal and control switch terminal.

5) If continuity is not present, turn CRUISE ON-OFF (MAIN) switch to ON position and ensure continuity exists between ground and CC ECU connector terminal. If continuity is not present, repair open in circuit between CC ECU terminal and control switch terminal. See CC ECU-TO-CRUISE ON-OFF (MAIN) SWITCH HARNESS TESTING table. If continuity is present, go to next step.

CC ECU-TO-CRUISE ON-OFF (MAIN) SWITCH HARNESS TESTING TABLE

CC ECU Terminal	Control Switch Terminal
A8 (YEL/BLK) Motor Actuator	5 (W/ SRS), 15 (W/O SRS)
6 (YEL/BLK) Vacuum Actuator	5 (W/ SRS), 15 (W/O SRS)

6) Turn control switch to OFF position and ensure no continuity exists between ground and CC ECU harness side connector terminal. See CC ECU-TO-CRUISE ON-OFF (MAIN) SWITCH HARNESS TESTING table. If continuity is present, repair short in circuit between CC ECU terminal and control switch terminal.

7) Turn control switch to 3 operating positions. Measure resistance between ground and CC ECU terminal at each switch position. See CC ECU-TO-CONTROL SWITCH HARNESS TESTING table. If resistance is not as specified, repair open in harness between CC ECU terminal and control switch terminal. If resistance is as specified, replace cruise control switch.

CC ECU-TO-CONTROL SWITCH HARNESS TESTING TABLE

CC ECU Terminal	Control Switch Terminal
B8 (WHT) Motor Actuator	4 (W/ SRS), B5 (W/O SRS)
19 (WHT) Vacuum Actuator	4 (W/ SRS), B5 (W/O SRS)

TEST 4A: ACTUATOR CKT VAC TYPE ACTUATOR (W/ VAC ACTUATOR)

1) Inspect actuator vacuum hoses and ensure no cracks or other damage is present. Replace vacuum hose as necessary.

2) Disconnect 3-pin connector from vacuum actuator. Ensure

continuity exists between ground and actuator harness side connector terminal No. 3 (White/Black wire). If continuity is present, verify actuator operation. See ACTUATOR OPERATION - WITH VACUUM TYPE ACTUATOR under COMPONENT TESTING. If actuator is okay, go to step 5). Replace actuator if it is faulty and retest system. If continuity is not present, go to next step.

3) Disconnect CC ECU connector and ensure continuity exists between ground and CC ECU harness side connector terminal No. 15 (Brown wire). If continuity is present, go to next step. If continuity is not present, repair faulty ground or open in harness between CC ECU terminal No. 15 and ground.

4) Ensure continuity exists between CC ECU side connector terminals No. 15 (Brown wire) and No. 16 (White/Black wire). If continuity is not present, replace CC ECU and retest. If continuity is present, repair open in harness between CC ECU terminal No. 16 and actuator connector terminal No. 3.

5) Ensure correct installation and operation of stoplight switch. See step 2) under TEST 4B: ACTUATOR CIRCUIT MOTOR TYPE ACTUATOR.

6) Connect actuator connector and disconnect stoplight switch 4-pin connector. Measure resistance between stoplight switch connector terminal No. 4 (Red/Yellow wire) and ground. If approximately 68 ohms are present, go to next step. If approximately 68 ohms are not present, repair open or short in harness between stoplight connector terminal No. 4 and actuator connector terminal No. 1 (Red/Yellow wire).

7) Connect stoplight switch 4-pin connector. Turn ignition off and disconnect CC ECU connector. On harness side measure resistance between CC ECU terminals No. 5 (Red/Green wire) and No. 16 (White/Black wire). If approximately 30 ohms are present, go to next step. If approximately 30 ohms are not present, repair open or short in harness between CC ECU connector terminal No. 5 and actuator connector No. 2 (Red/Green wire).

8) Ensure brake pedal is released. On harness side measure resistance between CC ECU connector terminals No. 3 (Green/Black wire) and No. 16 (White/Black wire). If approximately 68 ohms are present, replace CC ECU and retest system. If approximately 68 ohms are not present, repair open or short in harness between CC ECU connector terminal No. 5 (Red/Green wire) and stoplight connector terminal No. 3 (Green/Black wire).

TEST 4B: ACTUATOR CIRCUIT MOTOR TYPE ACTUATOR

1) Disconnect actuator connector. Ensure continuity exists on harness side between actuator connector No. 4 (White/Black wire) and ground. See Fig. 4. If continuity is present, verify actuator operation. See ACTUATOR OPERATION - MOTOR TYPE under COMPONENT TESTING. Replace actuator if faulty and retest system. If actuator is okay, go to next step. If continuity is not present, repair faulty ground or open in harness between actuator terminal No. 4 and ground.

2) Ensure stoplights come on when brake pedal is depressed. If stoplights come on, go to step 5). If stoplights do not come on, ensure .02-.09" (.5-2.3 mm) clearance between stoplight switch and brake pedal stop. Loosen switch lock nut to adjust clearance. If stoplights do not come on after adjusting switch when brake pedal is depressed, disconnect 4-pin stoplight switch connector and go to next step.

3) Depress brake pedal (stoplight switch pin free). Ensure continuity exists between stoplight switch connector terminals No. 1 (Green/White wire) and No. 2 (Green/Red wire). If continuity is not as specified, replace stoplight switch and retest system. If stoplight switch is okay, go to next step.

4) Release brake pedal (stoplight switch pin pushed in).

Ensure continuity exists between stoplight switch connector terminals No. 3 (Green/Black wire) and No. 4 (Red/Yellow wire). If continuity is not as specified, replace stoplight switch and retest system. If stoplight switch is okay, go to next step.

5) Connect actuator connector and disconnect stoplight switch connector. Measure resistance between ground and stoplight switch terminal No. 4 (Red/Yellow wire). If resistance is approximately 38.5 ohms, go to next step. If resistance is not approximately 38.5 ohms, repair open or short in wire harness between stoplight connector terminal No. 4 and actuator connector terminal No. 5 (Red/Yellow wire.

NOTE: Magnet clutch and motor circuits include a diode. If circuit shows no continuity or incorrect resistance, reverse positive and negative test leads and retest circuit.

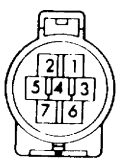


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Fig. 4: Motor Type Actuator Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Connect stoplight switch connector and disconnect CC ECU connector(s). Measure resistance between ground and CC ECU connector terminal. See CC ECU-TO-MOTOR TYPE ACTUATOR HARNESS TESTING table. If resistance is approximately 38.5 ohms, go to next step. If resistance is not approximately 38.5 ohms, repair open or short in harness between CC ECU connector terminal and actuator connector terminal.

7) Ensure no continuity exists between ground and CC ECU connector terminals. If continuity is not present, go to next step. If continuity is present, repair short in harness between CC ECU terminal and actuator terminal.

8) Move actuator arm to a position other than fully open or fully closed. Ensure continuity exists between CC ECU connector terminals. If continuity is present, go to next step. If continuity is not present, repair open in harness between CC ECU connector terminal(s) and actuator terminal(s). See CC ECU-TO-MOTOR TYPE ACTUATOR HARNESS TESTING table.

9) Ensure no continuity exists between ground and CC ECU connector terminal No. A12. If continuity is not present, go to next step. If continuity is present, repair short in harness between CC ECU terminal No. 24 or No. A12 and actuator connector terminal No. 1. See CC ECU-TO-MOTOR TYPE ACTUATOR HARNESS TESTING table.

10) Measure resistance between CC ECU connector terminals No. 24 and No. A10 and No. A12. If approximately 2000 ohms resistance are present, go to next step. If approximately 2000 ohms are not present, repair open in harness between CC ECU connector terminal No. A10 and actuator connector terminal No. 3 or between CC ECU connector terminal No. A12 and actuator connector terminal No. 1. See CC ECU-TO-MOTOR TYPE ACTUATOR HARNESS TESTING table.

11) Move position sensor arm from closed to open position and back again. Ensure resistance change, as arm is moved, between CC ECU connector terminals No. A10 and No. A11. If resistance changes evenly, replace CC ECU and retest system. If resistance does not change evenly, repair open or short in harness between CC ECU terminal No. A11 and actuator terminal No. 2. See CC ECU-TO-MOTOR TYPE ACTUATOR HARNESS TESTING table.

CC ECU-TO-MOTOR TYPE ACTUATOR HARNESS TESTING TABLE

CC ECU Terminal	Actuator Terminal Or To Ground
Magnet Clutch Circuit	
B3 (GRN/BLK)	5 (RED/YEL)
Motor Circuit	
B4 (PNK/BLK)	6 (PNK/BLK)
B10 (RED/GRN)	7 (RED/GRN)
Position Sensor Circuit	
A10 (GRY/BLK)	3 (GRY/BLK)
A11 (GRY/RED)	2 (GRY/RED)
A12 (GRY)	1 (GRY)

TEST 5B: NO. 1 VEHICLE SPEED SENSOR CIRCUIT (A/T)

1) If speedometer fluctuates while driving at a steady speed, replace speedometer cable and retest system. If speedometer does not fluctuate, go to next step.

2) Remove combination meter to gain access to back. Disconnect 12-pin connector "B". Ensure continuity exists between ground and connector "B" terminal No. B5, Brown wire. If continuity is present, verify No. 1 vehicle speed sensor operation. See NO. 1 VEHICLE SPEED SENSOR (A/T) under COMPONENT TESTING. If speed sensor is okay, go to step 3), for models with motor actuator, go to step 4) for models with vacuum actuator see step 5). If continuity is not present, repair faulty ground and/or open in harness between connector "B" terminal No. B5 and ground.

3) On models with motor actuator, connect combination meter connector "B" and disconnect CC ECU 12-pin connector "A". Ensure repeated continuity exists between CC ECU connector terminal No. A7 (Blue/White wire) and ground. If continuity repeats, replace CC ECU and retest system. If continuity does not repeat, repair open or short in harness between CC ECU connector terminal No. A7 and combination meter terminal No. B6, or an open or short in circuit plate between terminal No. B6 and speed sensor, or an open in circuit plate between combination meter terminal No. B5 and speed sensor.

4) On models with vacuum actuator, connect combination meter connector "B" and disconnect CC ECU connector. Ensure repeated continuity exists between CC ECU connector terminal No. 8 (5S-FE, Blue/White wire; except 5S-FE, Blue wire) and ground. If continuity repeats, replace CC ECU and retest system. If continuity does not repeat, repair open or short in harness between CC ECU connector terminal No. 8 and combination meter terminal No. B6, or an open or short in circuit plate between terminal No. B6 and speed sensor, or an open in circuit plate between combination meter terminal No. B5 and speed sensor.

TEST 5C: NO. 1 VEHICLE SPEED SENSOR CIRCUIT (WITH M/T)

1) Locate speed sensor on manual transaxle and disconnect 3-pin connector. Ensure continuity exists between connector terminal No. 3 (Brown wire) and ground. If continuity is not present, repair faulty ground or open in harness between connector terminal No. 3 and ground. If continuity is present, verify No. 1 vehicle speed sensor operation. See NO. 1 VEHICLE SPEED SENSOR (M/T) under COMPONENT TESTING. If speed sensor is okay, go to step 2) for models with motor actuator or step 3) for models with vacuum actuator.

2) Connect combination meter connector "B" and disconnect CC ECU 12-pin connector "A". Ensure repeated continuity exists between CC ECU connector terminal No. A7 (Blue/White wire) and ground as speed sensor is rotated. If continuity repeats, replace CC ECU and retest system. If continuity does not repeat, repair open or short in harness

between CC ECU connector terminal No. A7 and speed sensor terminal No. 2 (Blue wire).

3) Connect combination meter connector "B" and disconnect CC ECU connector. Ensure repeated continuity exists between CC ECU connector terminal No. 8 (Blue wire) and ground as speed sensor is rotated. If continuity repeats, replace CC ECU and retest system. If continuity does not repeat, repair open or short in harness between CC ECU connector terminal No. 8 and speed sensor terminal No. 2 (Blue wire).

TEST 6: STOPLIGHT SWITCH

1) Verify normal operation of stoplight system. If stoplight system operates correctly, go to step 9). If stoplight system does not operate correctly, ensure STOP fuse is okay. If STOP fuse is okay, go to step 4). Replace fuse if needed. If fuse fails again, go to step 2). If fuse does not fail again, go to step 3).

2) If STOP fuse fails after replacement, disconnect CC ECU connector and replace fuse. If fuse fails again repair short in harness between stoplight switch terminal and STOP fuse or between CC ECU terminal and STOP fuse. See STOPLIGHT SWITCH TO STOP FUSE CIRCUIT table.

STOPLIGHT SWITCH TO STOP FUSE CIRCUIT TABLE

Stoplight Switch Terminal	CC ECU Terminal
Motor Actuator 2 (GRN/RED)	A2 (GRN/RED)
Vacuum Actuator 2 (GRN/RED)	18 (GRN/RED)

3) If STOP fuse does not fail after replacement, depress brake pedal and inspect STOP fuse. If fuse does not fail, replace CC ECU and retest system. If fuse fails again, repair short in harness between stoplight terminal and stoplights or between CC ECU terminal and stoplights. See STOPLIGHT SWITCH TO STOPLIGHTS CIRCUIT table.

STOPLIGHT SWITCH TO STOPLIGHTS CIRCUIT TABLE

Stoplight Switch Terminal	CC ECU Terminal
Motor Actuator 1 (GRN/WHT)	A3 (GRN/WHT)
Vacuum Actuator 1 (GRN/WHT)	17 (GRN/WHT)

4) Ensure stoplights come on when brake pedal is depressed. If stoplights do not come on, ensure .02-.09" (.5-2.3 mm) clearance between stoplight switch and brake pedal stop. Loosen switch lock nut to adjust clearance. If stoplights do not come on after adjusting switch when brake pedal is depressed, disconnect 4-pin stoplight switch connector and go to next step.

5) Depress brake pedal (stoplight switch pin free). Ensure continuity exists between stoplight switch connector terminals No. 1 (Green/White wire) and No. 2 (Green/Red wire).

6) Release brake pedal (stoplight switch pin pushed in). Ensure continuity exists between stoplight switch connector terminals No. 3 (Green/Black wire and No. 4 (Red/Yellow wire). If continuity is

not as specified, replace stoplight switch and retest system. If stoplight switch is okay, go to next step.

7) Disconnect stoplight switch connector. Ensure battery voltage between stoplight connector terminal No. 2 (Green/Red wire) and STOP fuse. If battery voltage is present, go to next step. If battery voltage is not present, repair open in harness between stoplight connector terminal No. 2 and STOP fuse.

8) Using a jumper wire, connect stoplight connector terminals No. 1 (Green/White wire) and No. 2 (Green/Red wire). If brake lights come on, go to next step. If brake lights do not come on, repair open in harness between stoplight connector terminal No. 1 and ground.

9) If stoplight system is operating normally, start testing with this step. Connect stoplight connector and disconnect CC ECU connector (12-pin connector "A", models with motor actuator). Ensure battery voltage between ground and CC ECU connector terminal No. A2 (with motor actuator, Green/Red wire) or No. 18 (with vacuum actuator, Green/Red wire). If battery voltage is present, go to next step. If battery voltage is not present, repair open in harness between terminal No. 1 or No. A2 or No. 18 and STOP fuse.

10) Ensure battery voltage, when brake pedal is depressed, between ground and CC ECU terminal No. A3 (with motor actuator) or No. 17 (with vacuum actuator), Green/White wire. If battery voltage is present, replace CC ECU and retest system. If battery voltage is not present, repair open in harness between CC ECU connector terminal No. 16 or No. A3 or No. 17 and stoplight switch terminal No. 1, Green/White wire.

TEST 7: PARKING BRAKE SWITCH

1) Disconnect parking brake switch. Ensure continuity exists between switch terminal and ground with switch in ON position (switch pin released). Ensure no continuity exists between switch terminal and ground with switch in OFF position (switch pin pushed in). If continuity is not as specified replace switch. If continuity is as specified, go to next step.

2) Connect parking brake switch connector and disconnect CC ECU connector (12-pin connector "A", models with motor actuator). Release parking brake and ensure no continuity exists between ground and CC ECU terminal No. A5 (with motor actuator, Red/Green wire) or No. 14 (with vacuum actuator, Red/Green wire). If continuity is present, repair short in harness between parking brake switch and CC ECU terminal No. 3 or No. A5 or No. 14. If continuity is not present, go to next step.

3) Ensure continuity exists, with parking brake set, between ground and CC ECU terminal No. A5 (with motor actuator) or No. 14 (with vacuum actuator). If continuity is not present, repair open in harness between parking brake switch and terminal No. 3 or No. A5 or No. 14. If continuity is present replace CC ECU and retest system.

TEST 8: PARK/NEUTRAL POSITION SWITCH

NOTE: Park/Neutral position switch includes a diode. If circuit shows no continuity, reverse positive and negative test leads and retest circuit.

1) Ensure starting system is operating normally. Disconnect CC ECU connector (12-pin connector "A", models with motor actuator). Set shift lever to "P" or "N" position. Ensure continuity exists between ground and CC ECU connector terminal No. A4 (with motor actuator, Black wire) or No. 13 (with vacuum actuator, Black wire). If continuity is not present, repair open in harness between CC ECU terminal No. 2 or No. A4 or No. 13 and park/neutral position switch connector terminal No. 2 (Black/White wire).

2) Set shift lever to "L", 2, 3, and "R" positions. Ensure no continuity exists between ground and CC ECU connector terminal No. A4 (with motor actuator) or No. 13 (with vacuum actuator). If continuity is not present, replace CC ECU and retest system. If continuity is present, repair short in harness between terminal No. 2 or No. A4 or No. 13 and park/neutral position switch connector terminal No. 2 (Black/White wire).

TEST 9: CLUTCH SWITCH (M/T)

1) Ensure engine does not start when clutch pedal is released. If engine starts, ensure .176-.216" (4.5-5.5 mm) clearance between clutch switch and clutch pedal stop. Adjust clutch switch as necessary.

2) Disconnect 2-pin clutch switch connector. Ensure continuity exists between terminals when clutch pedal is depressed (switch pin free). Ensure no continuity when clutch pedal is released (switch pin pushed in). If continuity is not as specified, replace clutch switch.

3) Disconnect clutch switch connector. Ensure continuity exists between ground and clutch switch terminal No. 1. If continuity is present, go to next step. If continuity is not present, repair faulty ground and/or open in harness between terminal No. 1 or No. 2 and ground.

4) Connect clutch switch connector and disconnect CC ECU connector (12-pin connector "A", with motor actuator). Release clutch pedal and ensure no continuity exists between ground and CC ECU connector terminal A4 (with motor actuator) or No. 13 (with vacuum actuator), Black wire. If continuity is not present, go to next step. If continuity is present, repair short in harness between CC ECU connector terminal No. 2 or No. A4 or No. 13 and clutch switch terminal No. 2 or No. 1.

5) Depress clutch pedal and ensure continuity exists between ground and CC ECU connector terminal No. A4 (with motor actuator), or No. 13, (models with vacuum actuator), Black wire. If continuity is present, replace CC ECU and retest system. If continuity is not present, repair open in harness between CC ECU connector terminal No. 2 or No. A4 or No. 13 and clutch switch terminal No. 2 or No. 1.

NOTE: Ensure Electrical Controlled Transmission (ECT) system is operating normally. Repair system as necessary.

TEST 10A: NO. 2 SOLENOID ELECTRICAL CONTROLLED TRANSMISSION

1) Disconnect CC ECU connector (10-pin connector "B", models with motor actuator). Measure resistance between ground and CC ECU connector terminal No. B1 (with motor actuator, Brown/Yellow wire) or No. 9 (5S-FE A/T with vacuum actuator, Brown/Yellow wire). If approximately 13 ohms are present, replace CC ECU and retest system.

2) If approximately 13 ohms are not present, repair open or short in harness between No. 2 solenoid and CC ECU connector terminal No. B1 (with motor actuator, Brown/Yellow wire) or No. 9 (5S-FE A/T with vacuum actuator, Brown/Yellow wire).

NOTE: Ensure Electrical Controlled Transmission (ECT) system is operating normally. Repair system as necessary.

TEST 11: O/D OFF CIRCUIT (A/T)

NOTE: Ensure overdrive off system is operating normally. Repair system as necessary.

1) Disconnect CC ECU connector (10-pin connector "B" with

motor actuator). Set overdrive main switch to ON position. Ensure continuity exists between ground and CC ECU connector terminal No. B2 (with motor actuator) or No. 7 (with vacuum actuator), (Pink wire). If continuity is present, go to next step. If continuity is not present, repair open in harness between CC ECU connector terminal No. B2 (with motor actuator) or No. 7 (with vacuum actuator), (Pink wire) and overdrive main switch.

2) Set overdrive main switch to OFF position. Ensure no continuity exists between ground and CC ECU connector terminal No. B2 (with motor actuator) or No. 7 (with vacuum actuator), (Pink wire). If continuity is present, replace CC ECU and retest system. If continuity is not present, repair short in harness between CC ECU connector terminal No. B2 (with motor actuator) or No. 7 (with vacuum actuator), (Pink wire) and overdrive main switch.

TEST 12: THROTTLE POSITION SENSOR IDL SIGNAL

NOTE: Ensure throttle position sensor adjustment and operation are normal. See G - TESTS W/CODES article in the ENGINE PERFORMANCE section. Adjust or replace throttle position sensor as necessary.

1) On models with motor actuator, connect Throttle Position Sensor (TPS) connector and disconnect CC ECU connector (10-pin connector "B", models with motor actuator). Release accelerator pedal and ensure continuity exists between ground and CC ECU connector terminal No. B9 (with motor actuator, Pink wire).

2) If continuity is present, go to next step. If continuity is not present, repair open in harness between CC ECU connector terminal No. 23 or No. B9 and terminal No. 2/IDL of 4-pin throttle position sensor connector (Pink wire).

3) Depress accelerator pedal and ensure no continuity exists between ground and CC ECU connector terminal No. B9 (with motor actuator, Pink wire). If continuity is not present, replace CC ECU and retest system. If continuity is present, repair short in harness between CC ECU connector terminal No. 23 or No. B9 and terminal No. 2 of 4-pin throttle position sensor connector.

COMPONENT TESTING

Actuator Operation - With Vacuum Type Actuator

1) Disconnect 3-pin actuator connector. Resistance between actuator harness connector terminals No. 1 (Red/Yellow wire) and No. 3 (White/Black wire) should be approximately 68 ohms. Resistance between actuator terminals No. 2 (Red/Green wire) and No. 3 (White/Black wire) should be 30 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace actuator.

2) Connect positive battery lead to actuator terminals No. 1 and No. 2. Connect negative battery lead to actuator terminal No. 3. Slowly apply vacuum from 0-11.81 in. Hg. Control cable should pull smoothly as vacuum increases approximately 1.57" (40 mm). With vacuum stabilized control cable should not return. Disconnect positive battery from terminals No. 1 and 2. Control cable should return to original position as vacuum returns to zero. If vacuum actuator operation is not as specified, replace actuator and retest system.

NOTE: As vacuum is applied and held, drawn-in diaphragm may return. This does not indicate a malfunction as actuator leakage is allowable.

Actuator Operation - With Motor Type Actuator

1) Disconnect motor actuator linkage and 7-pin actuator

connector. Ensure magnet clutch moves smoothly by moving arm by hand. Connect positive battery lead to actuator terminal No. 5 (Red/Yellow wire) and negative battery lead to actuator terminal No. 4 (White/Black wire). This activates magnet clutch and arm should not move by hand. If operation is not as specified, replace actuator motor. If operation is as specified, go to next step. See Fig. 4.

2) Do not disconnect battery leads from actuator terminals No. 5 and No. 4. With magnet clutch activated, connect positive battery lead to actuator terminal No. 6 (Pink/Black wire). Connect negative battery lead to actuator terminal No. 7 (Red/Green wire). Motor operation should start and arm should move smoothly to open position (acceleration side). When arm reaches open position, motor operation should stop.

3) With magnet clutch activated, reverse positive and negative leads on actuator terminals No. 6 and No. 7. Motor operation should start and arm should move smoothly to closed position (deceleration side). When arm reaches closed position, motor operation should stop. If motor operation is not as specified, replace actuator motor and retest system. If operation is as specified, disconnect battery leads from 7-pin actuator connector.

CRUISE CONTROL SWITCH TESTING TABLE

Switch Position	Result
Control OFF	No Continuity
Control RES/ACC	Approximately 68 Ohms
Control SET/COAST	Approximately 198 Ohms
Control CANCEL	Approximately 418 Ohms

Position Sensor Operation

Measure resistance between actuator terminals No. 1 (Gray wire) and No. 3 (Gray/Black wire). Resistance should be approximately 2000 ohms. Check resistance between actuator connector terminals No. 2 (Gray/Red wire) and No. 3 while moving arm from closed to open position. Resistance should increase from approximately 500 ohms to 1800 ohms. If operation is not as specified, replace actuator motor.

No. 1 Vehicle Speed Sensor (A/T)

Remove combination meter and locate speedometer/speed sensor at back of meter under 12-pin connector in middle of meter. Locate terminals No. "A" and No. "B" on right side of speedometer/speed sensor shaft. Ensure continuity exists between terminals No. "A" and No. "B" 4 times for each revolution of speedometer shaft. Replace speed sensor if operation is not as specified and retest system.

No. 1 Vehicle Speed Sensor (M/T)

Locate speed sensor on manual transaxle and remove. Disconnect 3-pin connector. Connect positive battery lead to connector terminal No. 1 (Black/Red wire) and negative lead to terminal No. 3 (Brown wire). Connect voltmeter positive lead to terminal No. 2 (Blue wire) and negative tester lead to battery negative terminal. Ensure approximately a 0-5 volt, change 4 times per each revolution of speed sensor shaft. Replace speed sensor if operation is not as specified.

CRUISE CONTROL ECU CIRCUIT TESTING CHARTS

NOTE: CC ECU circuit testing charts are provided to pinpoint a malfunctioning circuit. Checking pin voltages at CC ECU connector will help determine if CC ECU is receiving and sending proper voltage signals. Using test charts may also help in determining if there is a short or open in harness or connectors. Test circuit continuity, resistance and voltages by backprobing CC ECU harness connector.

NOTE: Unless stated otherwise in testing procedures, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. Voltage readings may very slightly due to battery condition or charging rate.

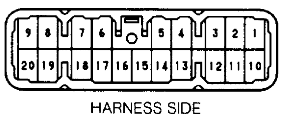

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Fig. 5: CC ECU Harness & Conn. Testing (W/ Vacuum Actuator - 1 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CC ECU HARNESS & CONNECTOR TESTING [2] (Celica W/ Vacuum Actuator)

Test Lead (Red)	Pin No.	Component Description	[1] Specified Value ON	OFF	Pin No.	Common Lead (Black)
WHT/BLU	1	DLC 1 Circuit (Connector Terminals No. 3 & 11 Connected)	$< 1\Omega$	N/A	N/A	GROUND
WHT/BLU	1	DLC 1 Circuit (Connector Terminals Disconnected)	N/A	$\geq 1 M\Omega$	N/A	GROUND
YEL/BLK	6	Main Control Switch (ON - Switch In ON Position)	$< 1\Omega$	$\geq 1 M\Omega$	N/A	GROUND
PNK [3]	7	Engine Coolant Temperature & O/D Switch (Engine Cold)	$< 1\Omega$	N/A	N/A	GROUND
PNK [3]	7	Engine Coolant Temperature & O/D Switch (Engine Hot) (ON - O/D Switch In ON Position)	$< 1\Omega$	$\geq 1 M\Omega$	N/A	GROUND
BLK	13	Park/Neutral Switch A/T (ON - "N" Or "P" Position)	$< 1\Omega$	$\geq 1 M\Omega$	N/A	GROUND
BLK	13	Clutch Switch M/T (ON - Depressed)	$< 1\Omega$	$\geq 1 M\Omega$	N/A	GROUND
RED/GRN	14	Parking Brake Switch (ON - Parking Brake Applied)	$< 1\Omega$	$\geq 1 M\Omega$	N/A	GROUND
BRN	15	Cruise Control ECU Ground	$< 1\Omega$	N/A	N/A	GROUND
GRN/BLK	3	Actuator Release Valve (ON - Brake Pedal Released)	68Ω	$\geq 1 M\Omega$	16	WHT/BLK
RED/GRN	5	Actuator Control Valve	30Ω	N/A	16	WHT/BLK
BRN/YEL	9	Electrical Controlled Transaxle No. 2 Solenoid Valve	13Ω	N/A	N/A	GROUND
WHT	19	Control Switch (ON - Control Switch OFF Position)	$\geq 1 M\Omega$	N/A	N/A	GROUND
WHT	19	Control Switch (ON - Control Switch RES/ACC Position)	68Ω	N/A	N/A	GROUND
WHT	19	Control Switch (ON - Control Switch SET/COAST Position)	198Ω	N/A	N/A	GROUND
WHT	19	Control Switch (ON - Control Switch CANCEL Position)	418Ω	N/A	N/A	GROUND

[1] - Symbol definitions: $<$ means less than; $>$ means greater than; $\leq$ means equal to or less than; $\geq$ means equal to or greater than; B+ means battery voltage; Ω means Ohms; $M\Omega$ means Mega (Million) Ohms.
[2] - Disconnect Cruise Control ECU connector and test on harness side as shown. If results are not as specified, replace CC ECU and retest.
[3] - ECU Terminal No. 7 is Pink wire on 5S-FE A/T with Electronic Controlled Transmission, and Yellow/Black wire on 4A-FE A/T without ECT.

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Fig. 6: CC ECU Harness & Conn. Testing (W/ Vacuum Actuator - 2 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

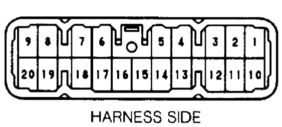

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Fig. 7: CC ECU Harness Voltage Testing (W/ Vacuum Actuator - 1 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CC ECU VOLTAGE TESTING [2] (Celica W/ Vacuum Actuator)

Test Lead (Red)	Pin No.	Component Description	[1] Specified Value ON	[1] Specified Value OFF	Pin No.	Common Lead (Black)
LT GRN	4	Cruise Control Indicator Light (ON - Ignition Switch In ON Position)	B+	Zero	N/A	GROUND
[3]	8	No. 1 Vehicle Speed Sensor Ignition In ON Position, Speedometer Shaft Or No. 1 Speed Sensor Shaft Turned	[4]	N/A	N/A	GROUND
BLK/RED	12	Cruise Control ECU Power Source ECU-IG Fuse (ON - Ignition Switch In ON Position)	B+	Zero	N/A	GROUND
GRN/WHT	17	Stoplight (ON - Brake Pedal Depressed)	B+	Zero	N/A	GROUND
GRN/RED	18	Stoplight Power Source STOP Fuse	B+	Zero	N/A	GROUND

[1] - Symbol definitions: < means less than; > means greater than; ≦ means equal to or less than; ≧ means equal to or greater than; B+ means battery voltage; Ω means Ohms; MΩ means Mega (Million) Ohms.
[2] - Disconnect Cruise Control ECU connector and test on harness side as shown. If results are not as specified, replace CC ECU and retest.
[3] - ECU terminal No. 8 is Blue wire. Except 5S-FE A/T, it is Blue/White wire.
[4] - Voltage will change repeatedly.

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Fig. 8: CC ECU Harness Voltage Testing (W/ Vacuum Actuator - 2 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

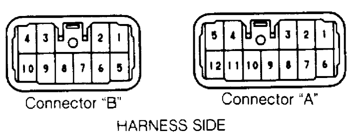

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Fig. 9: CC ECU Harness Voltage Testing (W/ Motor Actuator - 1 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CC ECU VOLTAGE TESTING [2] (Celica W/ Motor Actuator)

Test Lead (Red)	Pin No.	Component Description	[1] Specified Value ON	[1] Specified Value OFF	Pin No.	Common Lead (Black)
BLK/RED	A1	Cruise Control ECU Power Source ECU-IG Fuse (ON - Ignition Switch In ON Position)	B+	Zero	N/A	GROUND
GRN/RED	A2	Stoplight Power Source STOP Fuse	B+	N/A	N/A	GROUND
GRN/WHT	A3	Stoplight (ON - Brake Pedal Depressed)	B+	Zero	N/A	GROUND
[3]	A7	No. 1 Vehicle Speed Sensor Ignition In ON Position, Speedometer Shaft Or No. 1 Speed Sensor Shaft Turned	[4]	N/A	N/A	GROUND

[1] - Symbol definitions: < means less than; > means greater than; ≦ means equal to or less than; ≧ means equal to or greater than; B+ means battery voltage; Ω means Ohms; MΩ means Mega (Million) Ohms.
[2] - Disconnect Cruise Control ECU connector and test on harness side as shown. If results are not as specified, replace CC ECU and retest.
[3] - A/T is Blue/White wire. M/T is Blue wire.
[4] - Voltage will change repeatedly.

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Fig. 10: CC ECU Harness Voltage Testing (W/ Motor Actuator - 2 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

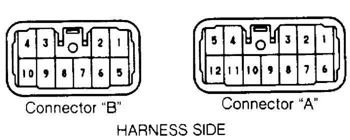

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Fig. 11: CC ECU Harness & Conn. Testing (W/ Motor Actuator - 1 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CC ECU HARNESS & CONNECTOR TESTING [2] (Celica W/ Motor Actuator)

Test Lead (Red)	Pin No.	Component Description	[1] Specified Value ON	[1] Specified Value OFF	Pin No.	Common Lead (Black)
BLK	A4	Park/Neutral Switch A/T (ON - "N" Or "P" Position)	< 1Ω	≧ 1 MΩ	N/A	GROUND
BLK	A4	Clutch Switch M/T (ON - Depressed)	< 1Ω	≧ 1 MΩ	N/A	GROUND
RED/GRN	A5	Parking Brake Switch (ON - Parking Brake Applied)	< 1Ω	≧ 1 MΩ	N/A	GROUND
YEL/BLK	A8	Control Switch (ON - Switch In ON Position)	< 1Ω	≧ 1 MΩ	N/A	GROUND
BRN	A9	Cruise Control ECU Ground	< 1Ω	N/A	N/A	GROUND
GRY/BLK	A10	Actuator Position Sensor	2000Ω	N/A	A12	GRY
GRY/BLK	A10	Actuator Position Sensor (Actuator Arm Turned)	[4]	N/A	A11	GRY/RED
BRN/YEL	B1	Electrical Controlled Transaxle No. 2 Solenoid Valve	13Ω	N/A	N/A	GROUND
PNK	B2	Engine Coolant Temperature & O/D Switch (Engine Cold)	< 1Ω	N/A	N/A	GROUND
PNK	B2	Engine Coolant Temperature & O/D Switch (Engine Hot) (ON - O/D Switch In ON Position)	< 1Ω	≧ 1 MΩ	N/A	GROUND
GRN/BLK	B3	Actuator Magnet Clutch (ON - Brake Pedal Released)	38.5Ω	≧ 1 MΩ	N/A	GROUND
PNK/BLK	B4	Actuator Motor (ON - Actuator Arm MAX. OPEN Position)	< 1Ω	N/A	B10	RED/GRN
RED/GRN	B10	Actuator Motor (ON - Actuator Arm MAX. CLOSE Position)	< 1Ω	N/A	B4	PNK/BLK
PNK/BLK	B4	Actuator Motor (ON - Actuator Arm In Any Position Except OPEN Or CLOSE) [3]	< 1Ω	N/A	B10	RED/GRN
WHT/BLU	B7	DLC 1 Circuit (Connector Terminals No. 3 & 11 Connected)	< 1Ω	N/A	N/A	GROUND
WHT/BLU	B7	DLC 1 Circuit (Connector Terminals Disconnected)	N/A	≧ 1 MΩ	N/A	GROUND
WHT	B8	Control Switch (ON - Control Switch OFF Position)	≧ 1 MΩ	N/A	N/A	GROUND
WHT	B8	Control Switch (ON - Control Switch RES/ACC Position)	68Ω	N/A	N/A	GROUND
WHT	B8	Control Switch (ON - Control Switch SET/COAST Position)	198Ω	N/A	N/A	GROUND
WHT	B8	Control Switch (ON - Control Switch CANCEL Position)	418Ω	N/A	N/A	GROUND
PNK	B9	Throttle Position Sensor IDL (ON - Gas Pedal Released)	< 1Ω	≧ 1 MΩ	N/A	GROUND

[1] - Symbol definitions: < means less than; > means greater than; ≦ means equal to or less than; ≧ means equal to or greater than; B+ means battery voltage; Ω means Ohms; MΩ means Mega (Million) Ohms.
[2] - Disconnect Cruise Control ECU connector and test on harness side as shown. If results are not as specified, replace CC ECU and retest.
[3] - Continuity should be present in either direction.
[4] - As actuator arm is turned resistance will change evenly.

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Fig. 12: CC ECU Harness & Conn. Testing (W/ Motor Actuator - 2 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAMS

Proceed to chassis WIRING DIAGRAMS article in WIRING DIAGRAMS section.

DEFOGGER - REAR WINDOW

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Rear Window Defoggers

Camry, Celica, Corolla, Land Cruiser, MR2, Paseo, Previa, Supra, Tercel, 4Runner

DESCRIPTION & OPERATION

NOTE: Some systems use an integrated or multipurpose relay as defogger relay. Some systems use a timer between switch and heating grid, and some use only a switch and heating grid.

Rear window defogger systems use a heating wire grid bonded to the inside of window. Heat is regulated by a control switch and a relay/timer. Most systems have an indicator light to show system is operating.

Power to the control switch is through a fuse in the fuse block. Timer relay will keep power to the grid for 12-18 minutes, or until the ignition is turned off. On 4Runner, relay ground is through rear power window limit switch. Supra models are also available with an outside rearview mirror heater/defogger.

TROUBLE SHOOTING

DEFOGGER DOES NOT WORK

Blown fuse or poor contact. Defogger switch defective. Poor connections. Broken wire. Relay defective.

INDICATOR LIGHT DOES NOT WORK

Bulb burned out. Open wire or poor connection.

TESTING

SYSTEM TESTING

1) Ensure all in-line fuses or circuit breakers are okay. Turn ignition and control switches to ON position. Glass should feel warm after a few minutes.

2) If glass is not warm, use a test light or voltmeter to check for battery voltage at grid feed wire. If voltage is not correct, check wiring harness, control switch and timer/relay.

SWITCH TEST

Camry

1) Remove defogger switch. Using an ohmmeter, check for continuity between terminals No. 3 and No. 4 of switch. See Fig. 1. Continuity should exist at all times.

2) With defogger switch on, check for continuity between terminals No. 1 and No. 5 of switch. Continuity should exist between terminals. With defogger switch off, no continuity should exist. If switch continuity is not as specified, replace switch.

3) To check switch indicator light operation, connect battery positive lead to terminal No. 3 of switch, and battery negative lead to terminal No. 4. Ensure defogger switch indicator light is on. If

switch indicator light is not on, replace switch.

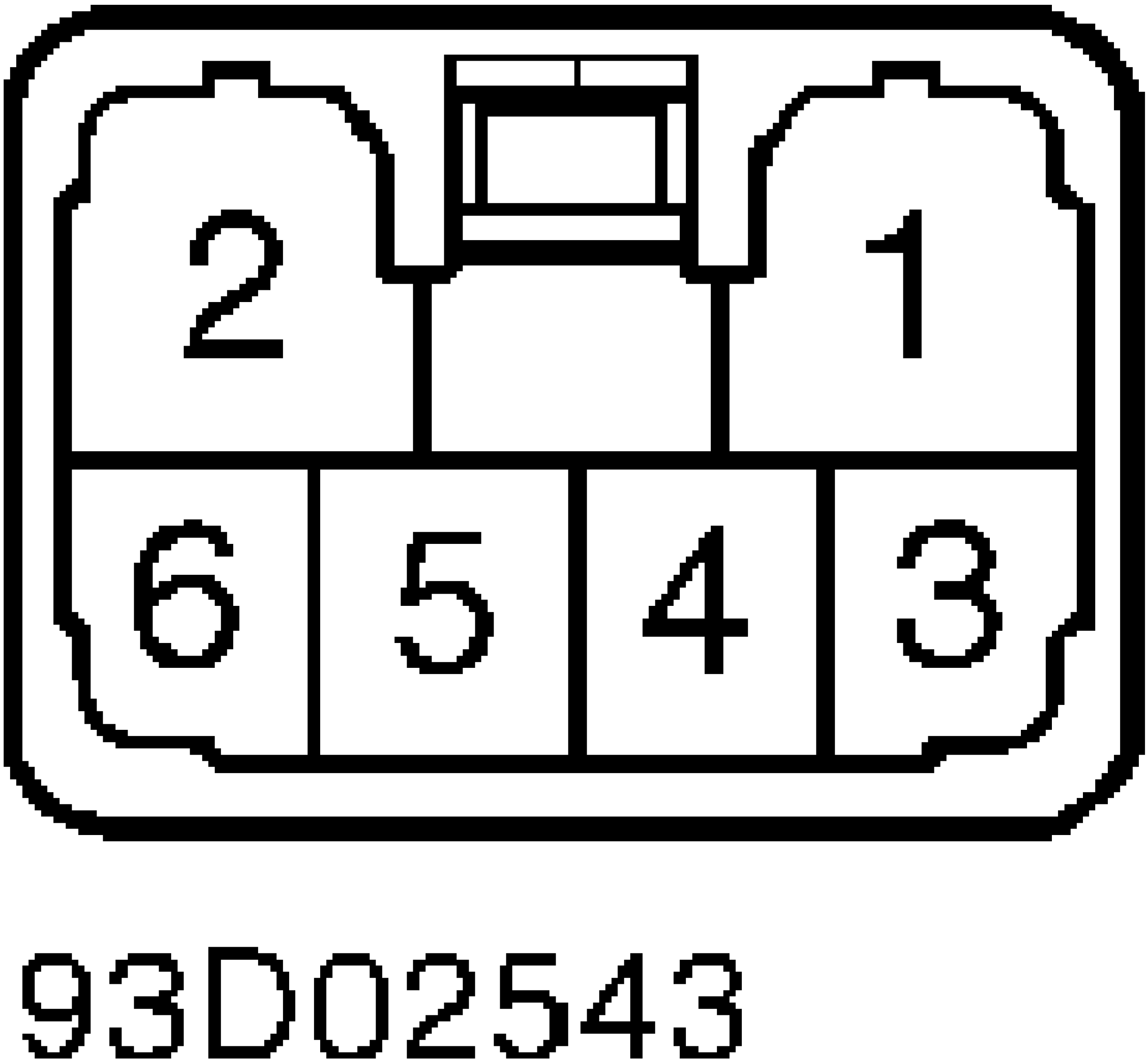


Fig. 1: Defogger Switch Terminal ID (Except MR2 & Supra)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Celica

1) To test defogger switch without timer, ensure continuity exists between terminals No. 2, No. 3, and No. 6 with switch on. See Fig. 1. With switch off, continuity should not exist between terminals No. 2, No. 3, and No. 6. Check for continuity between terminals No. 4 and No. 5 (light bulb). Continuity should exist at all times. If continuity is not as specified, replace switch.

2) To test defogger switch with timer, connect battery positive lead to terminal No. 3, and battery negative lead to terminal No. 2. See Fig. 2. Connect 3.4-watt test light between terminals No. 2 and No. 6. Push defogger switch. Ensure test light lights for 12-18 minutes and then goes out. If switch does not operate as specified, replace switch.

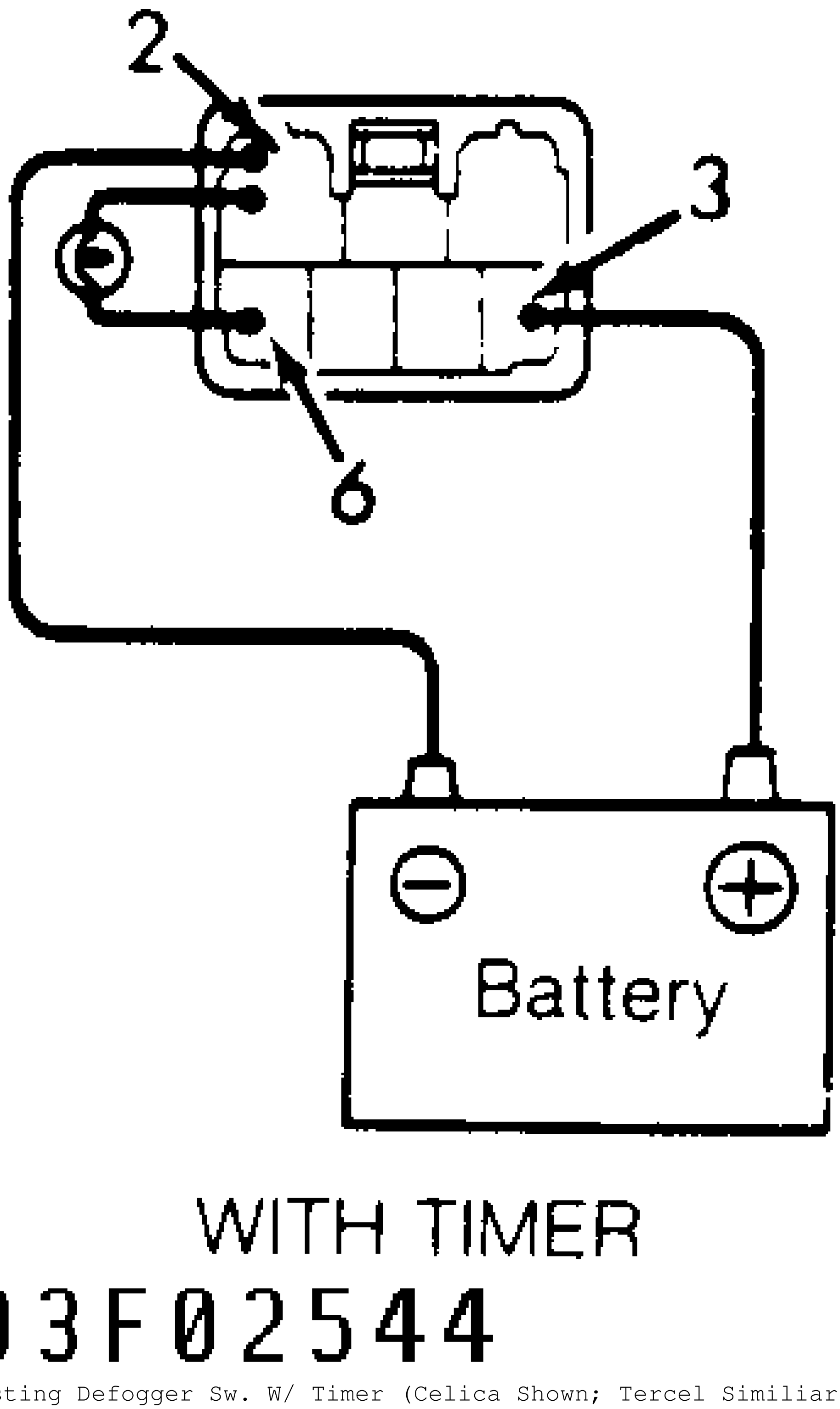


Fig. 2: Testing Defogger Sw. W/ Timer (Celica Shown; Tercel Similiar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Corolla

1) With defogger switch on, ensure continuity exists between

terminals No. 4 (White/Black wire) and No. 6 (Black/Blue wire). See Fig. 1. With switch off, continuity should not exist between terminals No. 4 and No. 6. Check for continuity between terminals No. 1 and No. 3 (light bulb). Continuity should exist at all times. If continuity is not as specified, replace switch.

2) To test defogger switch timer, connect battery positive lead to terminal No. 5 (Red/Blue wire) and battery negative lead to terminal No. 6 (Black/Blue wire). See Fig. 1. Connect 3.4-watt test light between terminals No. 4 (White/Black wire) and battery voltage. Push defogger switch to ON position. Ensure test light and indicator light, lights for 12-18 minutes and then goes out. If switch does not operate as specified, replace switch.

3) To test defogger timer circuit on harness side, disconnect defogger switch 6-pin connector. Ensure continuity between terminal No. 4 (Black/Blue wire) and ground all the time. Measure voltage between terminal No. 5 (Red/Blue wire) and ground and between terminal No. 6 (Black/Blue wire) and ground. Ensure battery voltage with ignition in ON position and zero voltage with ignition in OFF position. Using a jumper wire, connect connector terminals No. 4 and No. 6. With normal operation, defogger will come on. If results are as specified, replace defogger switch and retest system.

Land Cruiser, Previa & 4Runner

1) Remove rear defogger switch. Terminals No. 1 and No. 4 are for bulb illumination. Using an ohmmeter, check for continuity between terminals No. 1 and No. 4 of switch. See Fig. 1. Continuity should exist at all times.

2) With defogger switch on, check for continuity between terminals No. 2, No. 3, and No. 6 of switch. Continuity should exist between terminals. With defogger switch off, continuity should not exist between terminals No. 2, No. 3 and No. 6. If switch continuity is not as specified, replace switch.

DEFOGGER SWITCH WIRE COLORS TABLE

Terminal No.	Wire Color
Land Cruiser	
2	Yellow
3	White/Black
6	Blue/Orange
Previa	
2	Red/Blue
3	White/Black
6	Blue
4Runner	
2	Black/Orange
3	Blue/Black
6	Black/Yellow

MR2

1) On MR2, defogger switch is located in A/C control assembly. With defogger switch on, ensure continuity exists between terminals No. 10 (Red/Blue wire) and No. 11 (Red/Yellow wire) of switch. See Fig. 3. With switch off, continuity should not exist between terminals No. 10 and No. 11.

2) To check switch indicator light operation, connect battery positive lead to terminal No. 10 of switch, and battery negative lead to terminal No. 15 (White/Black wire). See Fig. 3. Ensure defogger switch indicator light is on. If switch indicator light is not on, replace switch.

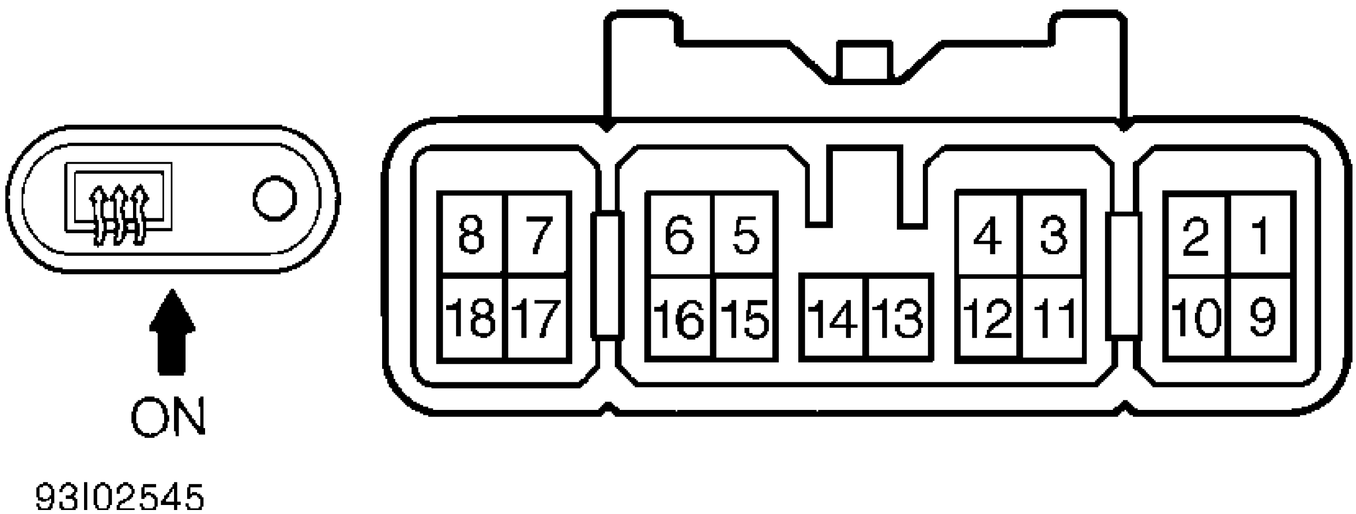


Fig. 3: Defogger Switch Terminal ID (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Paseo

1) To test defogger switch with timer, remove defogger switch. Using an ohmmeter, check for continuity between terminals No. 1 and No. 4. See Fig. 1. If continuity does not exist, replace switch. Connect battery positive lead to terminal No. 2, and battery negative lead to terminal No. 3. See Fig. 4.

2) Connect 3.4-watt test light between terminals No. 2 and No. 6. Turn defogger on. Ensure test light lights for 12-18 minutes and then goes out. If switch does not operate as specified, replace switch.

3) To test defogger switch without timer, remove defogger switch. With switch on, ensure continuity exists between terminals No. 2, No. 4, and No. 6. See Fig. 1. With switch off, continuity should not exist between terminals No. 2, No. 4, and No. 6. Check for continuity between terminals No. 1 and No. 3 (light bulb). Continuity should exist at all times. If continuity is not as specified, replace switch.

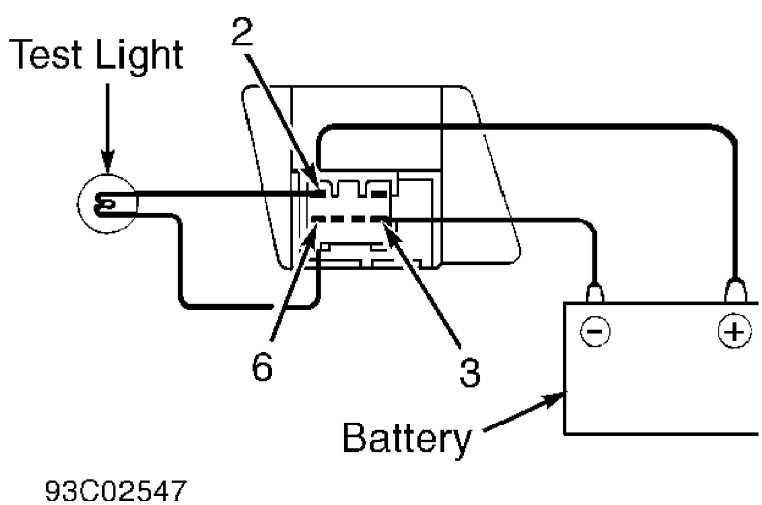


Fig. 4: Testing Defogger Switch (Paseo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Supra

1) Defogger switch is part of heater control switch. Locate

A/C Heater Control switch Orange 14-pin "B" connector and ensure it is connected. See Fig. 5. Using voltmeter positive lead, backprobe connector terminal No. 7 (Pink/Black wire). Using voltmeter negative lead, backprobe "B" connector terminal No. 10 (Red/White wire). Ensure battery voltage with defogger switch in OFF position. Put switch to ON position, ensure indicator light is on and less than one volt between connector terminals No. 7 and No. 10. After 15 minutes, ensure defogger switch is off and battery voltage is again present. If voltage is not as specified, go to next step.

2) Disconnect A/C Heater Control switch Orange 14-pin connector. Put defogger switch to ON position. Ensure continuity between switch terminals No. 7 and No. 10. If continuity is not present, repair or replace A/C Heater Control switch.

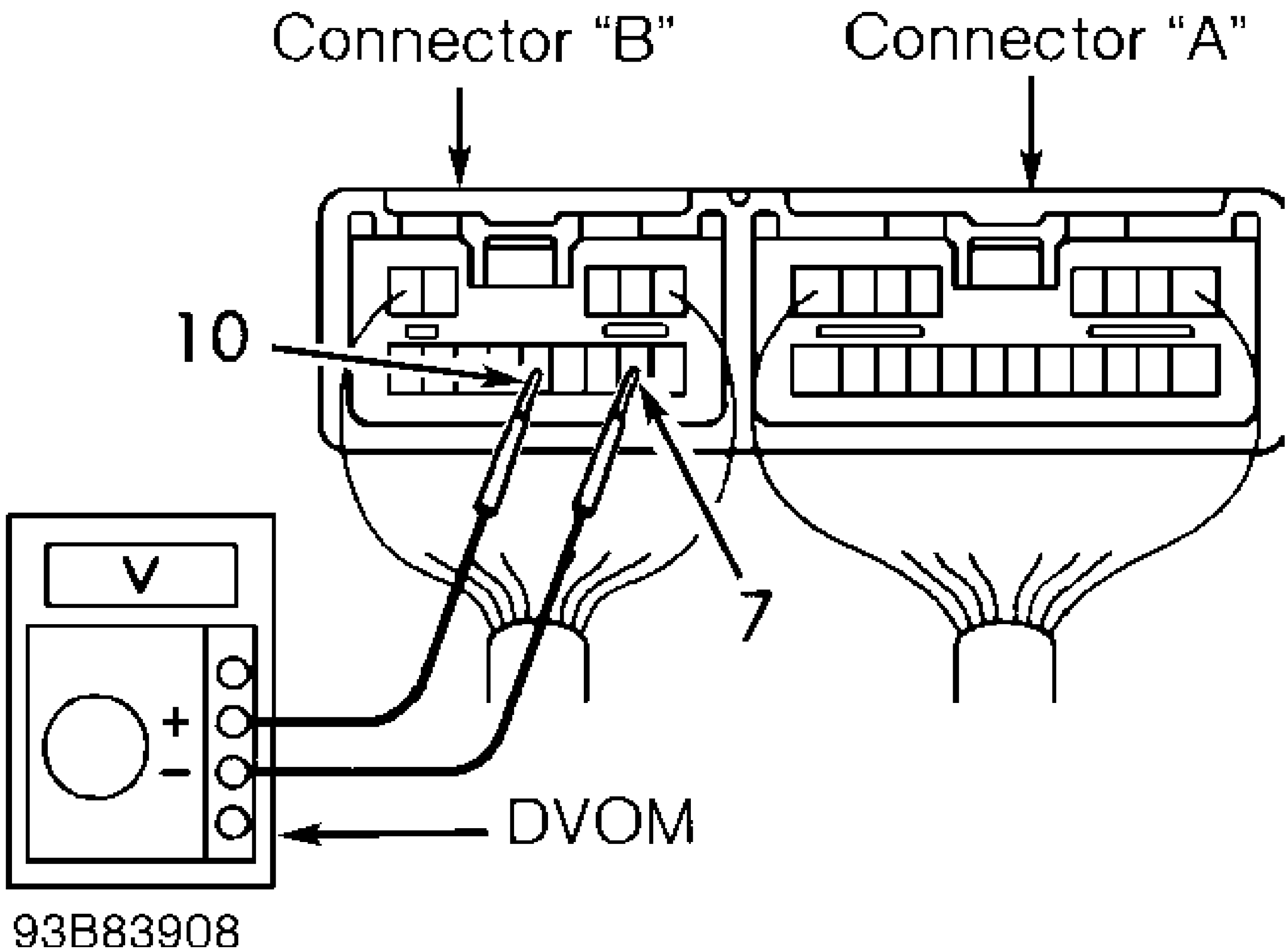


Fig. 5: Testing Defogger Switch (Supra)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Tercel

1) To test defogger switch without timer, remove defogger switch. Ensure continuity exists between switch connector terminals No. 2 (White/Black wire), No. 4 (Blue wire), and No. 6 (Black wire) with switch on. See Fig. 1. Check for continuity between switch connector terminals No. 2 and No. 6 (indicator bulb). Continuity should exist at all times. If continuity is not as specified, check switch indicator bulb and/or replace switch. With switch off, continuity should exist between switch connector terminals No. 1 and

No. 3. If continuity is not present, check illumination bulb.

2) To test defogger switch with timer, remove defogger switch. Ensure continuity between switch connector terminals No. 1 and No. 4. See Fig. 1. If continuity does not exist, replace illumination bulb.

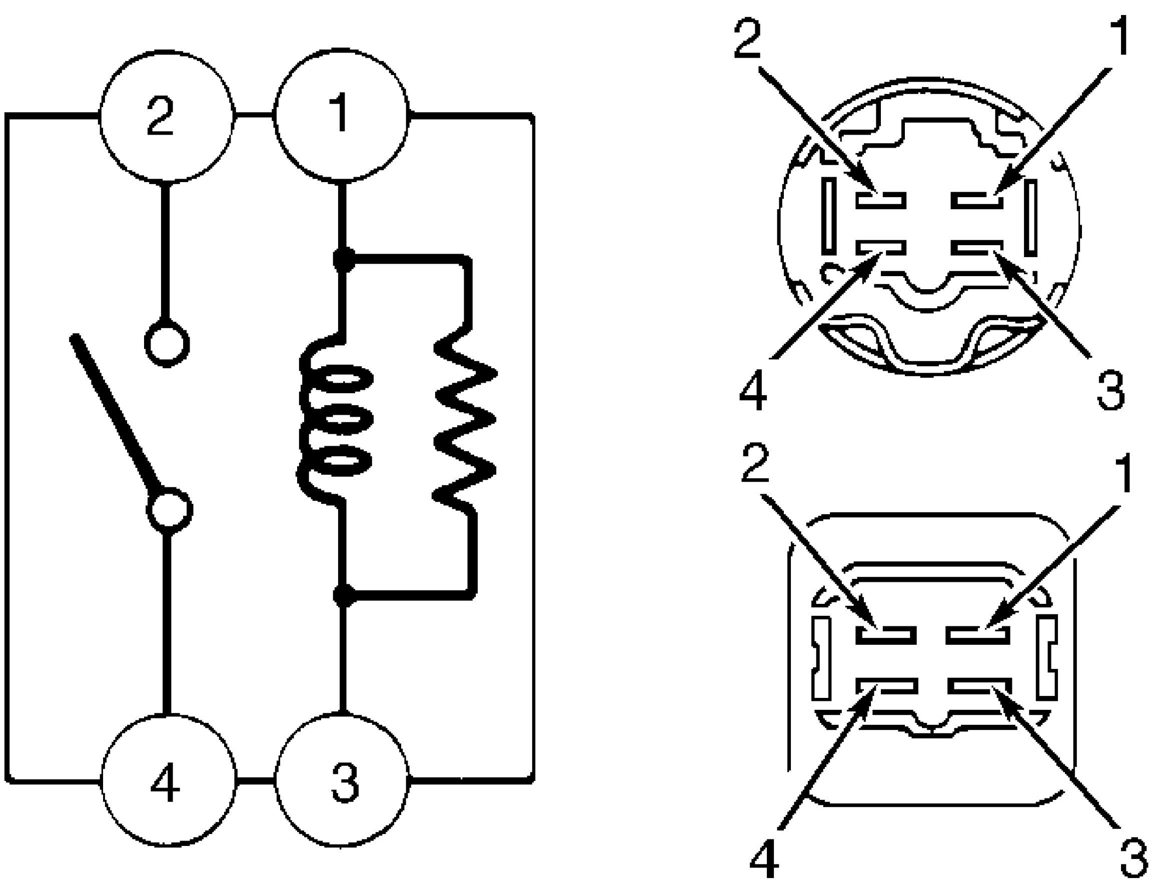
3) Connect battery positive lead to terminal No. 2 (Red/Blue wire), and battery negative lead to terminal No. 3 (White/Black wire). See Fig. 2. Connect 3.4-watt test light between terminals No. 2 and No. 6 (Green/White wire). Turn defogger on. Ensure indicator light and test light comes on for 12-18 minutes and then goes out. If defogger switch with timer, does not operate as specified, replace switch.

RELAY TEST

Except Camry, MR2 & Tercel

1) Using an ohmmeter, ensure continuity exists between terminals No. 1 and No. 3. See Fig. 6. Continuity should not exist between terminals No. 2 and No. 4 and terminals No. 3 and No. 4. If continuity is not as specified, replace relay.

2) Connect battery positive lead to terminal No. 1 and battery negative lead to terminal No. 3. Continuity should exist between terminals No. 2 and No. 4. If operation is not as specified, replace relay.



91D00128

Fig. 6: Testing Defogger Relay (Except Camry, MR2 & Tercel)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Camry, MR2 & Tercel

1) Using an ohmmeter, ensure continuity exists between

terminals No. 1 and No. 2. See Fig. 7. Continuity should not exist between terminals No. 3 and No. 5. If continuity is not as specified, replace relay.

2) Connect battery positive lead to terminal No. 1 and battery negative lead to terminal No. 2. Continuity should exist between terminals No. 3 and No. 5. If operation is not as specified, replace relay.

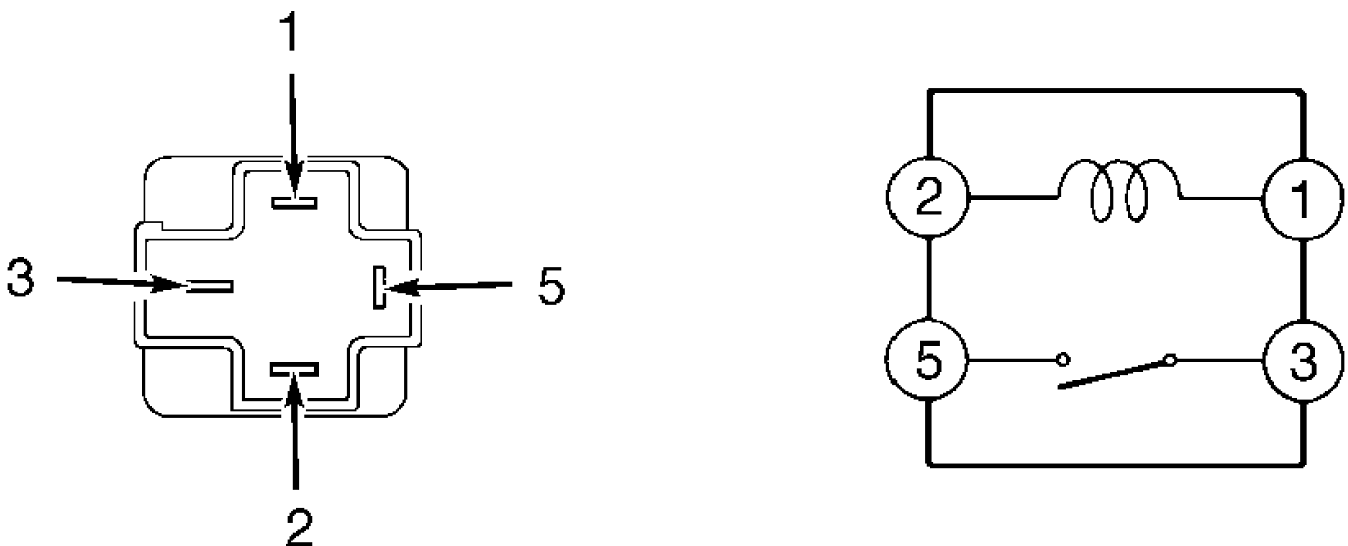


Fig. 7: Testing Defogger Relay (Camry, MR2 & Tercel)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OUTSIDE REARVIEW MIRROR DEFOGGER TEST

Rearview Mirror Defogger Operation (Supra)

Locate and disconnect outside rearview mirror 5-pin connector. Connect battery positive lead to terminal No. 2 (Blue/Red wire), and battery negative lead to terminal No. 1 (White/Black wire). After a short time, ensure mirror becomes warm. If mirror does not become warm, replace mirror assembly.

Rearview Mirror Defogger Circuit (Supra)

1) Locate and disconnect outside rearview mirror 5-pin connector. Ensure continuity between ground and 5-pin harness side connector terminal No. 1 (White/Black wire). If continuity is present, go to next step.

2) Turn ignition on and defogger switch off. Ensure no voltage between ground and 5-pin harness side connector terminal No. 2 (Blue/Red wire). Turn ignition switch on and defogger switch on. Ensure battery voltage between ground and 5-pin harness side connector terminal No. 2 (Blue/Red wire). If harness side circuit is not as specified, inspect other related components and/or harnesses.

POWER WINDOW LIMIT SWITCH

4Runner

Power window limit switch is located behind trim panel and bottom of rear door. Using an ohmmeter, ensure continuity exists between terminals No. 1 (Red/Blue wire) and No. 2 (White/Black wire) when switch is turned to ON position. See Fig. 8. Continuity should not exist between any terminals when switch is pushed to OFF position. If continuity is not as specified, replace relay.

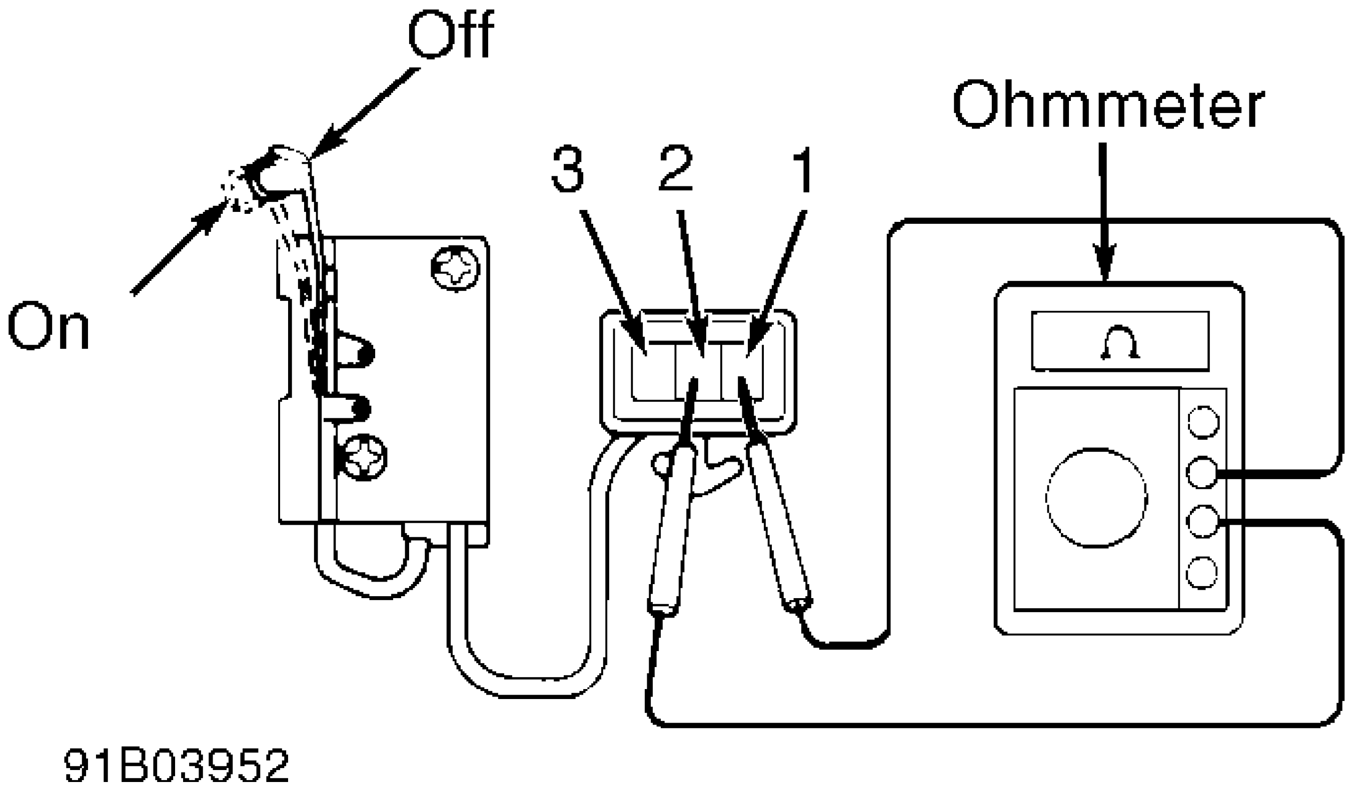


Fig. 8: Testing Power Window Limit Switch (4Runner)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

GRID FILAMENT TESTING

NOTE: When testing grid wires with voltmeter, wrap aluminum foil around end of test probe, then press foil to grid wire. This will prevent probe from damaging grid wire

1) To locate breaks in grid wire filaments, attach a voltmeter to middle portion of each filament. Attach other meter probe to vertical section of window grid. See Fig. 9.

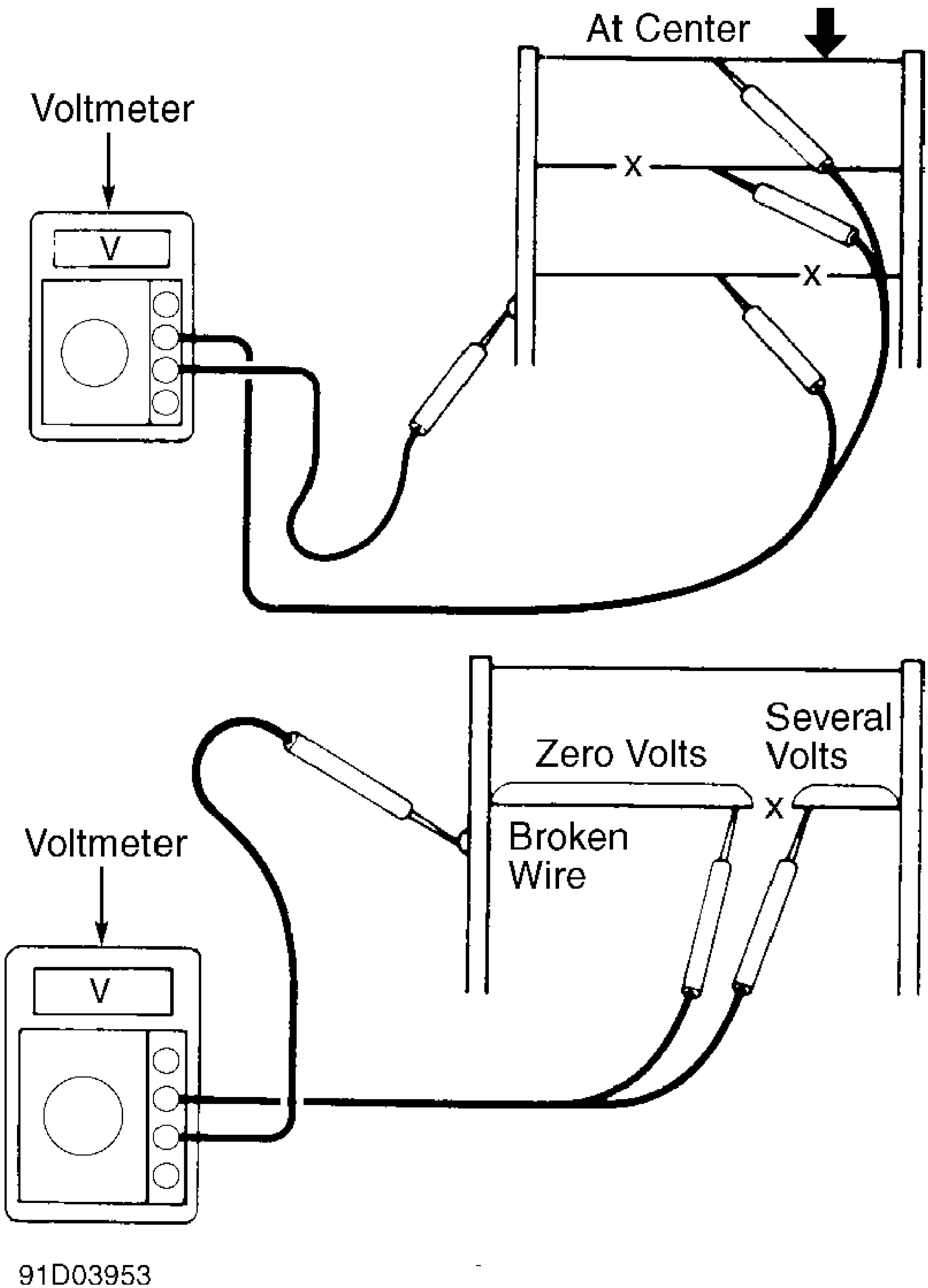


Fig. 9: Testing Grid Filament
Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) If a grid is broken, meter will register zero volts or about 10 volts, depending on if grid is broken between or outside test

leads. If wire is unbroken, meter will register about 5 volts. To locate break, move probe along wire until voltage changes abruptly.

ON-VEHICLE SERVICE

GRID FILAMENT REPAIR

Clean broken wire tips thoroughly. Place masking tape along both sides of broken wire. See Fig. 10. Apply Repair Paste (DuPont 4817) to broken section of grid. Remove masking tape after paste has dried. Wait 24 hours before using defogger.

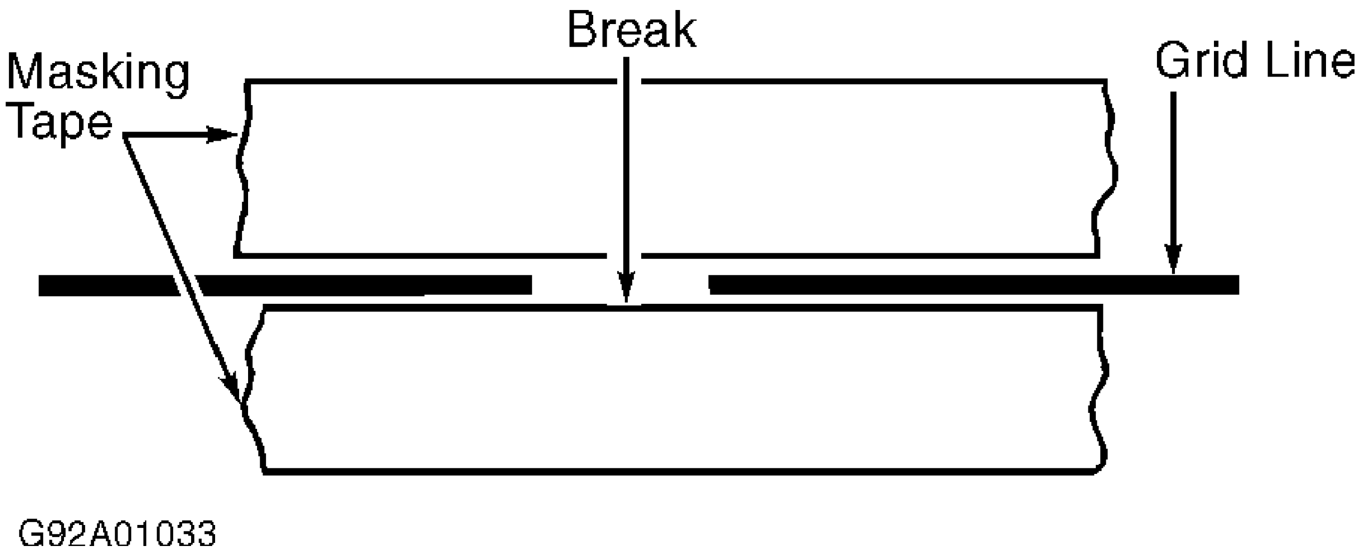


Fig. 10: Repairing Rear Defogger Grid Filament
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAMS

Proceed to appropriate WIRING DIAGRAMS article listed below in WIRING DIAGRAMS section.

* WIRING DIAGRAMS (for Camry).
* WIRING DIAGRAMS (for Celica).
* WIRING DIAGRAMS (for Corolla).
* WIRING DIAGRAMS (for Land Cruiser).
* WIRING DIAGRAMS (for MR2).
* WIRING DIAGRAMS (for Paseo).
* WIRING DIAGRAMS (for Previa).
* WIRING DIAGRAMS (for Supra).
* WIRING DIAGRAMS (for Tercel).
* WIRING DIAGRAMS (for 4Runner).

DOOR LOCKS - POWER

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Power Door Locks

Celica

DESCRIPTION & OPERATION

All doors can be locked or unlocked simultaneously using either front door. Turning driver door lock once will unlock driver door only, twice will unlock all doors. Door locks can be controlled by a switches on driver or passenger doors within vehicle, or by operating each door lock with key or lock knob. Front door(s) can not be manually locked when key is in ignition switch. See Fig. 1.

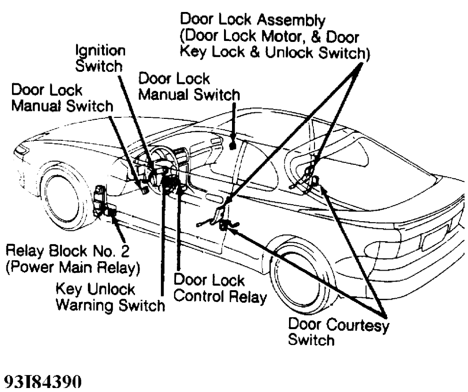


Fig. 1: Locating Power Door Lock Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TROUBLE SHOOTING

NOTE: Malfunctions that are most likely to occur are shown in order of their probability.

Door Lock System Does Not Operate.

* Check Fuse(s).
* Check Door Lock Switch Signal.
* Check Door Lock Motor Operation.
* Check Door Lock Control Relay. See POWER DOOR LOCK CONTROL RELAY CIRCUIT TESTING CHARTS.
* Check Harness & Connectors.

Door Lock System Does Not Operate With Manual Switch.

* Check Door Lock Manual Switch.
* Check Door Lock Control Relay. See POWER DOOR LOCK CONTROL RELAY CIRCUIT TESTING CHARTS.
* Check Door Lock Motor Operation.
* Check Harness & Connectors.

Door Lock System Does Not Operate With Door Key.

* Check Door Key Lock & Unlock Switch.
* Check Door Lock Control Relay. See POWER DOOR LOCK CONTROL RELAY CIRCUIT TESTING CHARTS.
* Check Harness & Connectors.

* Check Door Lock Link Disconnected.

Driver Door 2-Key Turns, Key Unlock Function Does Not Operate.

* Check Door Key Lock & Unlock Switch.
* Check Harness & Connectors.
* Check Door Lock Control Relay. See POWER DOOR LOCK CONTROL RELAY CIRCUIT TESTING CHARTS.

Key In Ignition Switch Warning, Does Not Operate.

* Check Key Unlock Warning Switch.
* Check Door Courtesy Switch.
* Check Door Lock Switch.
* Check Harness & Connectors.
* Check Door Lock Control Relay. See POWER DOOR LOCK CONTROL RELAY CIRCUIT TESTING CHARTS.

Only One Door Lock Does Not Operate.

* Check Door Lock Motor Operation.
* Check Harness & Connectors.

TESTING

COMPONENT TESTING

Door Courtesy Switch

Locate door courtesy switch in each door next to power door lock assembly. Ensure continuity exists between terminal(s) and switch body with switch pin released (switch ON). Ensure no continuity exists between terminal(s) and switch body with switch pin pushed in (switch OFF). If continuity is not as specified, replace switch and retest system.

Door Key Lock & Unlock Switch

Locate door key lock and unlock switch connector behind door panel. Disconnect 7-pin connector. Ensure continuity exists between switch terminals No. 2 and No. 3, with switch in LOCK position. Ensure continuity exists between switch terminals No. 1 and No. 2, with switch in UNLOCK position. If continuity is not as specified, replace switch and retest system.

Door Lock Manual Switch

Locate door lock manual switch in front door. Disconnect 4-pin connector. Ensure continuity exists between switch terminals No. 2 (White/Black wire) and No. 4 (Blue/Black wire), with switch in lock position. Ensure continuity exists between switch terminals No. 2 and No. 3 (Blue wire), with switch in unlock position. Ensure no continuity in OFF position. If continuity is not as specified, replace switch and retest system.

Door Lock Motor Operation

Locate front or rear door lock motor and disconnect door lock motor 7-pin connector. Connect positive battery lead to terminal No. 7 (Blue/White wire) and negative battery lead to terminal No. 5 (Blue/Red wire). Ensure door lock link moves to LOCK position. Reverse battery leads and ensure door lock link moves to UNLOCK position. If door lock motor operation is not as specified, replace door lock assembly and retest system.

Door Unlock Detection Switch

Locate front door lock motor and disconnect door lock motor 7-pin connector. Ensure continuity exists between connector terminals No. 4 (Green wire) and terminal No. 6 (White/Black wire) with door unlock detection switch in UNLOCK position. Ensure no continuity with switch in LOCK position. If continuity is not as specified, replace door lock assembly and retest system.

Key Unlock Warning Switch

Locate ignition switch 10-pin connector. With key removed from switch, ensure continuity exists between connector terminals No. 1 and No. 5. If continuity is not present, replace key unlock warning switch.

Positive Temperature Coefficient (PTC) Thermistor Operation

1) Locate front or rear door lock motor in door. Disconnect door lock motor 7-pin connector. Connect positive battery lead to door lock motor terminal No. 7 (Blue/White wire). Connect ammeter positive lead to door lock motor terminal No. 5 (Blue/Red wire) and ammeter negative lead to battery negative terminal. Ensure current changes from 3.2 amps to less than 0.5 amps within 20-70 seconds. If current changes as specified, go to next step. If current does not change as specified, replace door lock assembly.

2) Disconnect test leads from terminals and wait at least 60 seconds. Connect positive battery lead to door lock motor terminal No. 5 and battery negative lead to terminal No. 7. Ensure door lock link moves to LOCK position. If operation is not as specified, replace door lock assembly and retest system.

DOOR LOCK SWITCH SIGNAL TEST

NOTE: Ensure power door lock harness & connector circuits are okay before testing door lock switch signal. See appropriate POWER DOOR LOCK HARNESS & CONNECTOR CIRCUIT TESTING and POWER DOOR LOCK CIRCUIT VOLTAGE TESTING under POWER DOOR LOCKS CIRCUIT TESTING CHARTS.

Door Lock Switch Signal

Locate power door lock control relay. Ensure control relay 16-pin connector is connected. Using voltmeter positive lead backprobe connector terminal No. 3 (Blue/Red wire). Using voltmeter negative lead backprobe connector terminal No. 4 (Blue/White wire). Ensure voltage increases from zero to battery voltage for approximately 0.2 seconds with door lock manual switch in UNLOCK position. Reverse voltmeter leads and ensure voltage increases from zero to battery voltage for approximately 0.2 seconds with door lock manual switch in LOCK position. If voltage does not change as specified, replace power door lock control relay and retest system.

POWER DOOR LOCK CONTROL RELAY CIRCUIT TESTING CHARTS

NOTE: Power Door Locks ECU or Control Relay Circuit Testing Charts are provided to pinpoint a malfunctioning circuit. Checking pin voltages at power door locks ECU or Control Relay connectors will help determine if power door locks ECU or Control Relay is receiving and sending proper voltage signals. Using test charts may also help in determining if there is a short or open in harness or connectors.

NOTE: Unless stated otherwise in testing procedures, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. Voltage readings may vary slightly due to battery condition or charging rate.

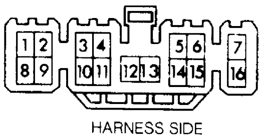


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Fig. 2: Power Door Lock Harness & Connector Circuit Testing
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER DOOR LOCK HARNESS & CONNECTOR CIRCUIT TESTING (CELICA)

NOTE: Turn ignition off and disconnect power door lock relay 16-pin connector. Measure resistance (continuity) between terminal number shown and ground. If resistance is as specified, check door lock switch signal. See DOOR LOCK SWITCH SIGNAL under TESTING.

Test Lead (Red)	Pin No.	Component Description	[1] Specified Value ON	[1] Specified Value OFF	Pin No.	Common Lead (Black)
RED/YEL	2	Driver Door Courtesy Switch (ON – Door Open)	< 1Ω	≧ 1 MΩ	N/A	GROUND
GRN/YEL	5	Pass. Door Unlock Detection Switch (ON – Door Unlocked)	< 1Ω	≧ 1MΩ	N/A	GROUND
GRN	6	Driver Door Unlock Detection Switch (ON – Door Unlocked)	< 1Ω	≧ 1MΩ	N/A	GROUND
YEL	7	Key Unlock Warning Switch (ON – Ignition Key Set)	< 1Ω	≧ 1MΩ	N/A	GROUND
BLU/YEL	9	Driver Door Key Lock & Unlock Switch (ON – Door Key Turned To Unlock Position)	< 1Ω	≧ 1MΩ	N/A	GROUND
BLU/BLK	10	Door Lock Manual Switch Position (ON – Lock Position)	< 1Ω	≧ 1MΩ	N/A	GROUND
BLU	11	Door Lock Manual Switch Position (ON – Unlock Position)	< 1Ω	≧ 1MΩ	N/A	GROUND
BLU	11	Pass. Door Key Lock & Unlock Switch Position (ON – Unlock Position)	< 1Ω	≧ 1MΩ	N/A	GROUND
BLU/ORG	12	Door Key Lock & Unlock Switch Position (ON – Lock Position)	< 1Ω	≧ 1MΩ	N/A	GROUND
RED/GRN	14	Pass. Door Courtesy Switch Position (ON – Door Open)	< 1Ω	≧ 1MΩ	N/A	GROUND
BLU/YEL	15	Power Main Relay Circuit (ON – Ign. Key Off)	70Ω	N/A	N/A	GROUND
WHT/BLK	16	Power Door Lock Control Relay Ground	< 1Ω	N/A	N/A	GROUND

[1] – Symbol definitions: < means less than; > means greater than; ≦ means equal to or less than; ≧ means equal to or greater than; B+ means battery voltage; Ω means Ohms; MΩ means Mega (Million) Ohms.

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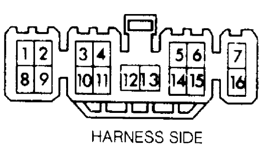
Fig. 3: Power Door Lock Harness & Connector Circuit Testing
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93H84407
Fig. 4: Power Door Lock Circuit Voltage Testing
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER DOOR LOCK CIRCUIT VOLTAGE TESTING (CELICA)

NOTE: Turn ignition off and disconnect power door lock relay 16-pin connector. Measure voltage between terminal number shown and ground with ignition switch off or in specified position. If voltage is as specified, check door lock switch signal. See DOOR LOCK SWITCH SIGNAL under TESTING.

Test Lead (Red)	Pin No.	Component Description	[1] Specified Value ON	[1] Specified Value OFF	Pin No.	Common Lead (Black)
RED/BLU	1	Door Courtesy Switch (ON – Ign. In ON Position)	B+	N/A	N/A	GROUND
BLU/RED	3	Door Lock Control Switch (ON – Unlocked)	B+ [3]	N/A	N/A	GROUND
BLU/RED	3	Door Lock Control Switch (ON – Locked W/ Key In Ignition & Driver Door Open) [2]	B+ [3]	N/A	N/A	GROUND
BLU/RED	3	Door Lock Knob (ON – Locked W/ Key In Ignition & Driver Door Open) [2]	B+ [3]	N/A	N/A	GROUND
BLU/RED	3	Driver/Pass. Door (ON – Unlocking Door Cylinder W/ Key)	B+ [3]	N/A	N/A	GROUND
BLU/WHT	4	Door Lock Control Switch (ON – Switch Locked)	B+ [3]	N/A	N/A	GROUND
BLU/WHT	4	Driver Or Pass. Door (ON – Locking Door Cylinder W/ Key)	B+ [3]	N/A	N/A	GROUND
WHT/BLU	8	Constant Power Supply (30 Amp POWER Fuse)	B+	N/A	N/A	GROUND
BLU/YEL	9	Driver Door Lock Cylinder (ON – Unlocked With Key)	ZERO	N/A	N/A	GROUND
BLU/BLK	10	Door Lock Control Switch (ON – Switch Locked)	ZERO	N/A	N/A	GROUND
BLU	11	ON – Door Lock Control Switch Unlocked Or Pass. Door Lock Cylinder Unlocked W/ Key	ZERO	N/A	N/A	GROUND
BLU/ORG	12	Driver & Pass. Door Lock Cylinder (ON – Locked W/ Key)	ZERO	N/A	N/A	GROUND
BLU/YEL	15	Power Main Relay Circuit (ON – Ign. In ON Position)	B+	N/A	N/A	GROUND

[1] - Symbol definitions: $<$ means less than; $>$ means greater than; $\leq$ means equal to or less than; $\geq$ means equal to or greater than; B+ means battery voltage; Ω means Ohms; $M\Omega$ means Mega (Million) Ohms.
[2] - Key in ignition switch, reminder function.
[3] - Battery voltage present for 0.2 seconds after switch operation.

93E84412

Fig. 5: Power Door Lock Circuit Voltage Testing
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAMS

Proceed to chassis WIRING DIAGRAMS article in WIRING DIAGRAMS section.

DRIVE AXLE - REAR

1993 Toyota Celica

1993 DRIVE AXLES
Toyota RWD Axle Shafts

Toyota; Celica All-Trac

*** PLEASE READ THIS FIRST ***

NOTE: Information in this article only applies to models with independent rear suspension. For other models, see appropriate DRIVE AXLE - INTEGRAL HOUSING article.

DESCRIPTION & OPERATION

Axle shafts transfer power from differential or transaxle to driving wheels. All axle shafts consist of a shaft and flexible Constant Velocity (CV) joint at each end. Inner CV joint is bolted or splined to differential or transaxle. Outer CV joint is splined to hub assembly and secured by axle shaft nut.

Inner CV joint is a plunging tripod joint. The plunging action allows for axle shaft length change as suspension moves up and down.

Inner and outer CV joints are enclosed by a CV joint boot. Boot maintains lubrication in joint and prevents contamination of CV lubricant. Boots must be replaced if leaking or cracked. Inner CV joint can be repaired without replacing assembly; outer CV joint must be replaced as an assembly.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in the GENERAL INFORMATION section.

REMOVAL, DISASSEMBLY, REASSEMBLY & INSTALLATION

REAR AXLE SHAFT

Removal

Raise and support vehicle. Remove rear wheels. From center of disc brake hub, remove cotter pin and lock nut. See Fig. 1. Place match marks on inboard axle shaft flange and differential flange. Remove nuts (4) securing axle shafts to differential flange. Disconnect axle shaft from differential. Slide axle shaft out of wheel hub and remove from vehicle.

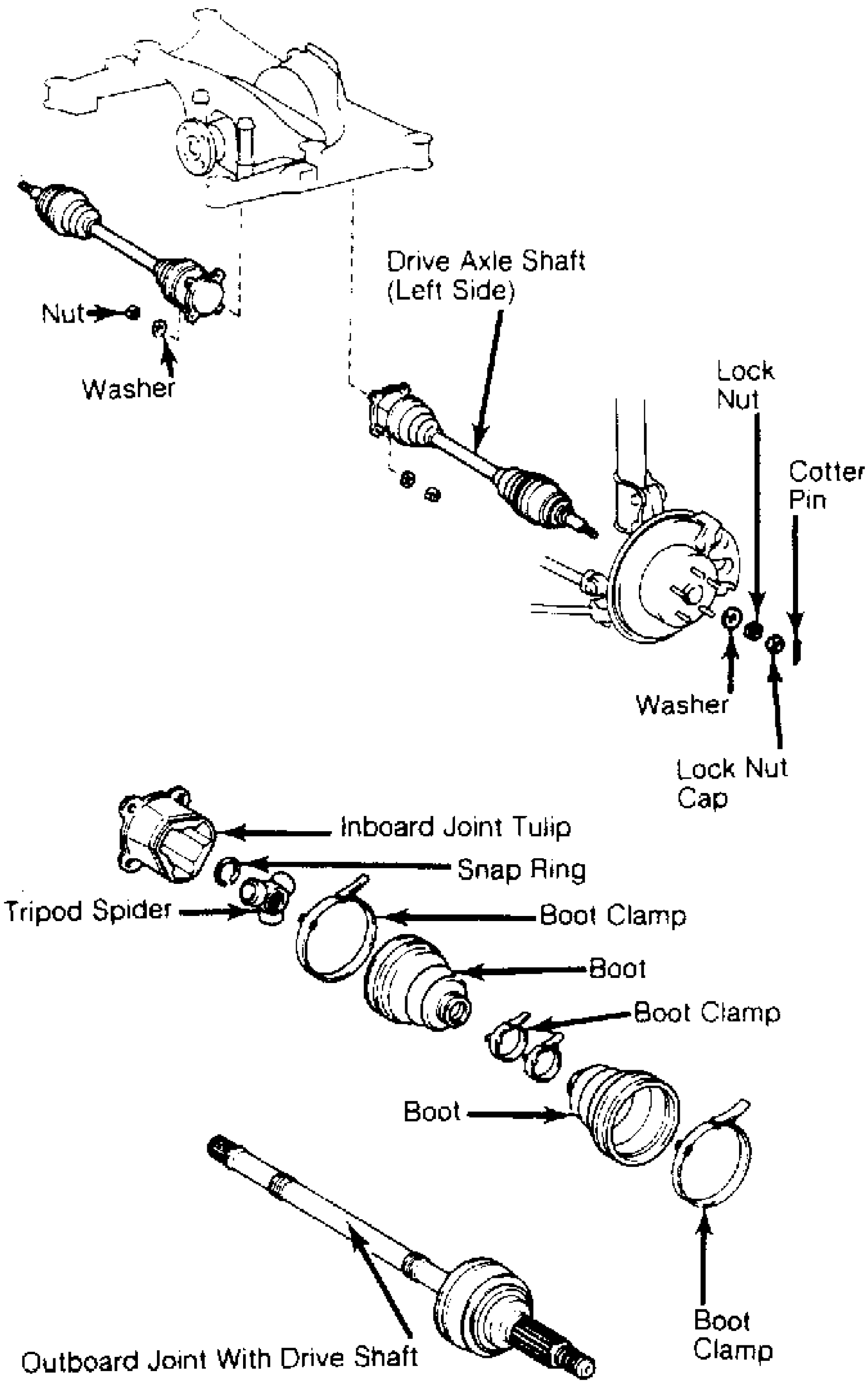


Fig. 1: Identifying Rear Axle Shaft Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

Ensure no play exists in inboard and outboard joints. Inboard joint must slide smoothly in thrust direction and be free from excessive play in radial direction. Check for torn or damaged boots.

Disassembly

1) Remove inboard joint boot clamps and slide boot off of inboard joint tulip. See Fig. 1. Paint match marks on inboard joint tulip and axle shaft. Remove inboard tulip from axle shaft.

CAUTION: When removing tripod joint, DO NOT use brass drift on tripod roller.

2) Remove snap ring from tripod spider. Paint matching marks on tripod spider and axle shaft. Drive tripod spider from axle shaft using hammer and brass drift. Remove inboard boot. Remove outboard boot clamps and slide boot from joint.

NOTE: Toyota does not recommend overhaul of outboard CV joint assembly.

Reassembly

1) Wrap axle shaft splines with vinyl tape. Temporarily install new boots and clamps. Inboard and outboard boots are not the same design. Outboard joint boot and clamp are smaller than inboard boot and clamp. See Fig. 2.

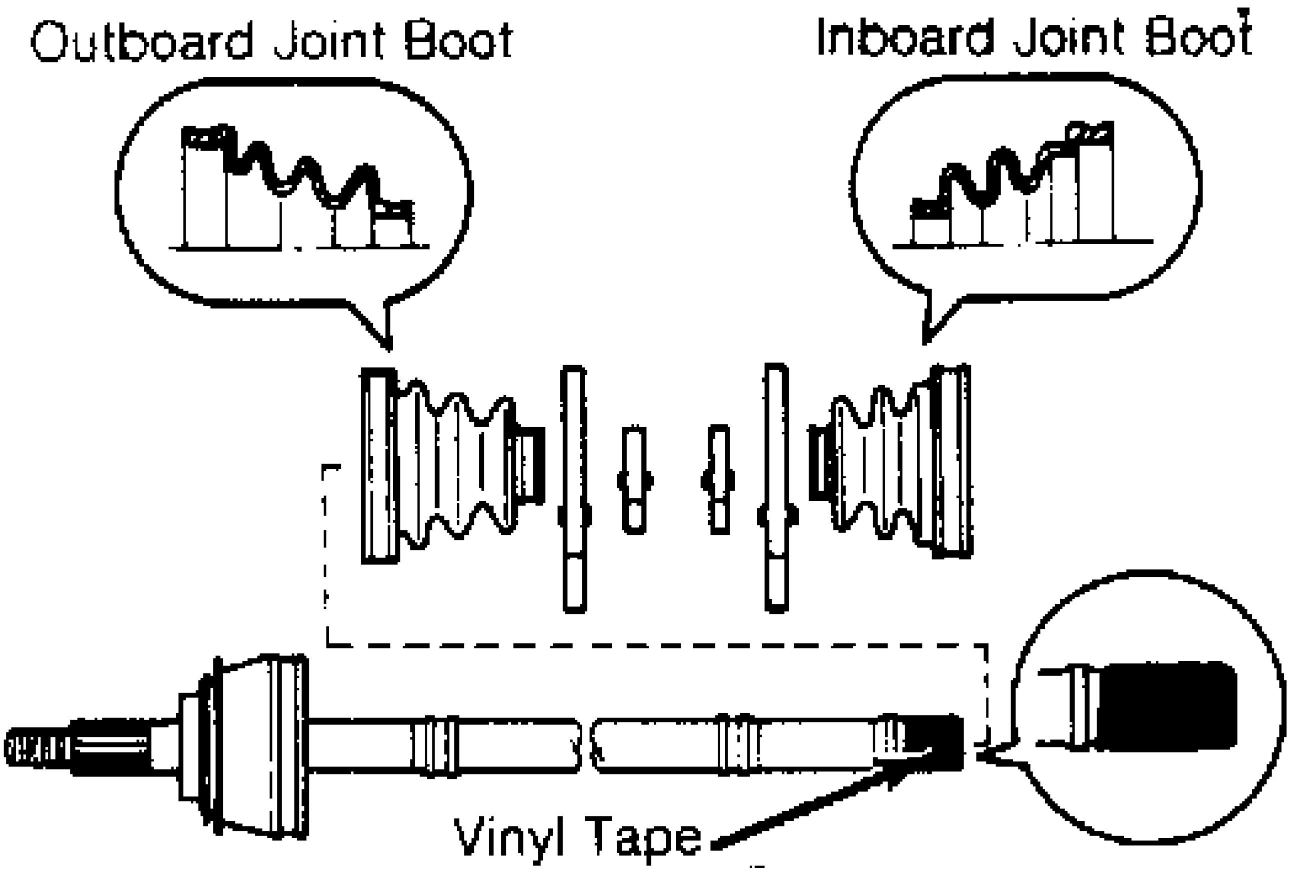


Fig. 2: Identifying CV Joint Boots
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAUTION: When installing tripod joint, DO NOT use brass drift on tripod roller.

2) Aligning matching marks made at disassembly, install tripod spider onto axle shaft. Install snap ring. Pack inboard joint tulip with CV joint grease supplied in overhaul kit. Grease capacity is 6.3 ozs. (180 g). Slide tulip over onto axle shaft. Install inboard boot, but DO NOT tighten clamps at this time.

3) Pack outboard joint with CV joint grease supplied in overhaul kit. Grease capacity is 4.2 ozs. (120 g). Slide boot over joint; DO NOT tighten clamps. Ensure boots are not stretched or compressed with shaft at standard length. Standard length for both axles is 18.07" (459.1 mm). See Fig. 3. Tighten boot clamps.

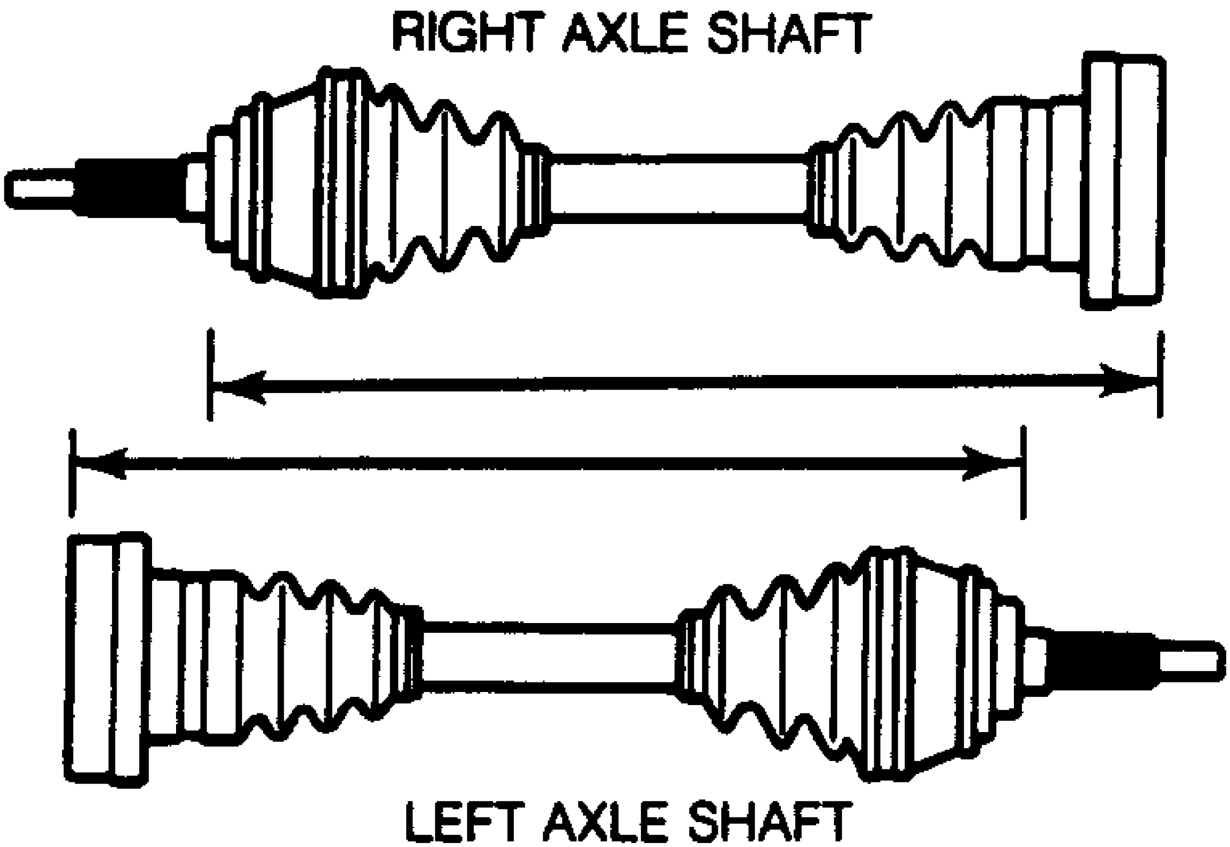


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Fig. 3: Measuring Rear Axle Shaft Standard Length
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

To install rear axle shaft, reverse removal procedure. Tighten fasteners to specification. See TORQUE SPECIFICATIONS.

REAR AXLE HUB & CARRIER

Removal

1) Raise and support vehicle. Remove rear wheel. Remove

cotter pin and lock nut cap. Remove disc brake caliper without disconnecting hydraulic line. Place matching marks on rotor and axle hub. See Fig. 4. Remove rotor.

2) Check hub bearing end play and axle hub runout. See Fig. 5. If bearing end play is greater than .002" (.05 mm), replace bearing. If hub runout is greater than .003" (.07 mm), replace hub. Apply parking brake and remove bearing lock nut. Release parking brake. Remove parking brake assembly and cable. Remove rear speed sensor (if equipped).

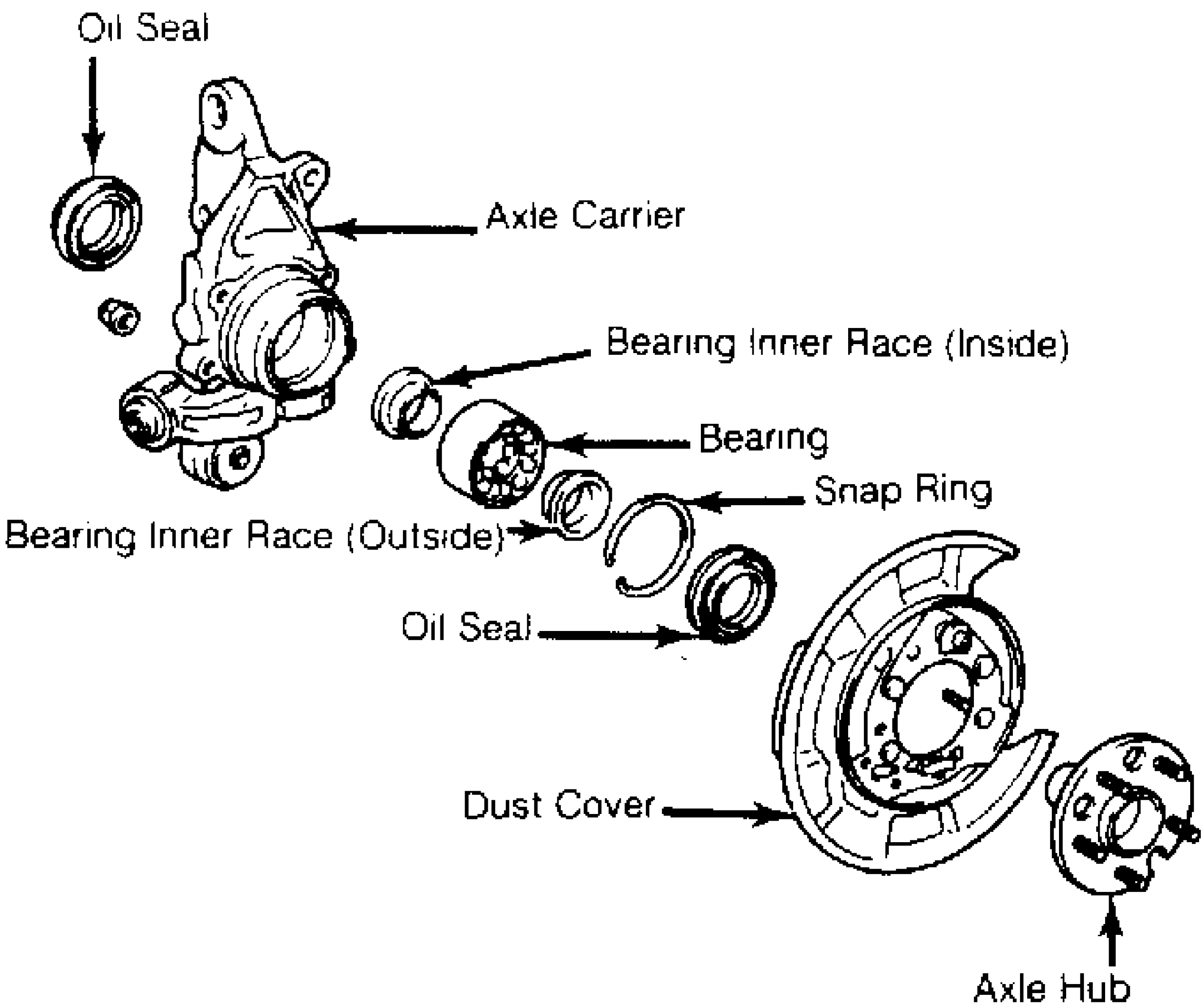

Fig. 4: Identifying Rear Axle Hub & Carrier Components
Courtesy of Toyota Motor Sales U.S.A., Inc.

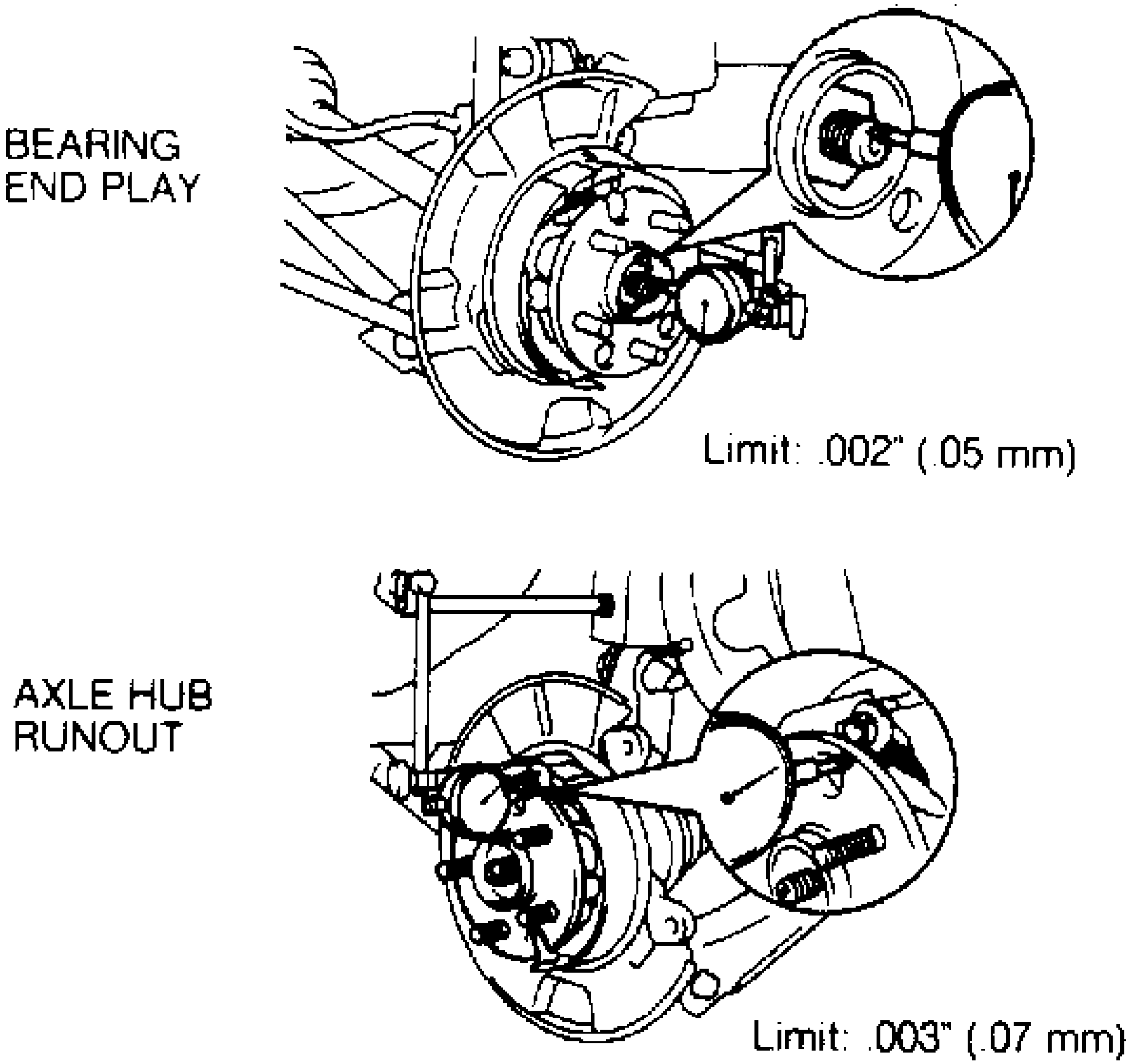

Fig. 5: Checking Axle Hub & Bearings
Courtesy of Toyota Motor Sales U.S.A., Inc.

3) After noting camber setting on adjusting cam, remove 2 bolts securing axle carrier to shock strut. Disconnect strut rod and suspension arms from axle carrier. Tap axle shaft from center of axle hub, and remove axle carrier from vehicle.

Disassembly & Reassembly

Press axle hub from carrier. Press bearing inner race off of axle hub. Remove backing plate from carrier. Remove inner and outer oil seal from carrier. Remove retaining snap ring from carrier. Press bearing from axle carrier. To reassemble axle carrier, reverse disassembly procedure.

Installation

To install axle carrier, reverse removal procedure. Tighten 2 axle carrier-to-strut nuts to 188 ft. lbs. (255 N.m). After attaching suspension strut rod and lower suspension arms, DO NOT final tighten bolts. Reinstall wheels, lower vehicle and bounce several times to settle suspension. Raise vehicle and remove wheels. Place wooden block on jack and jack up axle carrier. Final tighten No. 2 suspension arm, No. 1 suspension arm and strut rod mounting bolts. Reinstall wheels and check rear wheel alignment.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Celica All-Trac	
Axle Carrier-To-Strut Nuts	188 (255)
Disc Brake Caliper Bolts	34 (46)
Drive Axle Shaft Hub Nut	166 (226)
Inboard Axle Shaft Flange Nuts	51 (69)
Rear Speed Sensor Bolt	14 (19)
Strut Rod-To-Lower Suspension Arm Bolt	83 (113)
Wheel Lug Nuts	76 (103)

DRIVE AXLE - INTEGRAL HOUSING

1993 Toyota Celica

1993 DRIVE AXLES
Toyota Differentials & Axle Shafts - Integral Housing

Toyota; Celica All-Trac

DESCRIPTION

Drive axle assembly is a hypoid type with integral carrier housing. Drive pinion preload is adjusted using collapsible spacer. Side bearing preload is adjusted using shims.

INTEGRAL HOUSING DIFFERENTIAL APPLICATION TABLE

Application	Location
Celica All-Trac	Rear

AXLE RATIO & IDENTIFICATION

Integral carrier-type drive axle is identified on inspection cover, on rear of carrier housing. Axle ratio is determined by dividing number of ring gear teeth by number of pinion gear teeth.

AXLE RATIO SPECIFICATIONS TABLE

Application	Ratio
Celica All-Trac	2.928:1

LUBRICATION

FLUID TYPE & CAPACITY

All standard models should use SAE 90 (API GL-5) for temperatures greater than 0°F (-18°C) and SAE 80W-90 (API GL-5) for temperatures less than 0°F (-18°C). Models with Automatic Disconnecting Differential should use SAE 75W-90 (API GL-5). See FLUID CAPACITY SPECIFICATIONS table.

FLUID CAPACITY SPECIFICATIONS TABLE

Application	Pts. (L)
Celica All-Trac	2.4 (1.1)

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in the GENERAL INFORMATION section.

REMOVAL & INSTALLATION

NOTE: During removal and installation procedures, refer to Fig. 1.

AXLE SHAFT & BEARING

NOTE: For Celica All-Trac installation procedure, see appropriate DRIVE AXLE - REAR article in DRIVE AXLES.

DIFFERENTIAL ASSEMBLY

Removal

1) Drain gear oil. Remove rear crossmember.

2) Disconnect vacuum hoses and electrical connector (if equipped). Support differential assembly using jack. Remove differential assembly mounting bolts and nuts. Lower differential assembly from vehicle.

Installation

To install, reverse removal procedure. Ensure reference marks on axle shaft and companion flange align. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS.

PINION FLANGE & OIL SEAL

Removal

1) Drain gear oil. On Celica All-Trac, remove rear crossmember. Mark drive shaft and drive pinion companion flange for installation reference. Remove drive shaft. Reverse staked portion of companion flange nut. Remove flange nut.

2) Remove companion flange. Remove oil seal from housing. Remove oil slinger. Using a puller, remove front bearing from housing. Remove and discard collapsible spacer.

NOTE: Always replace collapsible spacer whenever companion flange nut is loosened or removed.

Installation

1) Install NEW collapsible spacer and front bearing. Install oil slinger with concave side facing front drive pinion bearing. Apply grease to seal lips. Install new oil seal to correct depth. See DRIVE PINION SEAL DEPTH INSTALLATION SPECIFICATIONS table.

DRIVE PINION SEAL DEPTH INSTALLATION SPECIFICATIONS TABLE

Application	In. (mm)
Celica All-Trac	.08 (2.0)

2) Install companion flange. Install companion flange nut. Tighten flange nut to specification, and measure pinion preload. See TORQUE SPECIFICATIONS and AXLE ASSEMBLY SPECIFICATIONS tables at end of article.

3) If preload is greater than specification, replace collapsible spacer, and repeat procedure. If preload is less than specification, tighten nut in increments of 108 INCH lbs. (12 N.m) until preload is correct. If maximum torque is exceeded, replace spacer and repeat procedure.

4) Check pinion nut torque. Check longitudinal and latitudinal runout of companion flange using dial indicator. Replace companion flange if runout is greater than .004" (.10 mm) on all models.

SIDE GEAR SHAFT & OIL SEAL

Removal

1) Drain gear oil. Remove axle shaft. See DRIVE AXLE - REAR in DRIVE AXLES. Remove differential cover.

2) Remove side gear shaft snap ring. Remove side gear shaft. Remove oil seal.

Installation

Install and grease oil seal. Install side gear shaft and tube (if equipped) to differential. Install NEW snap ring on side gear shaft. Ensure side gear shaft cannot be pulled out by hand.

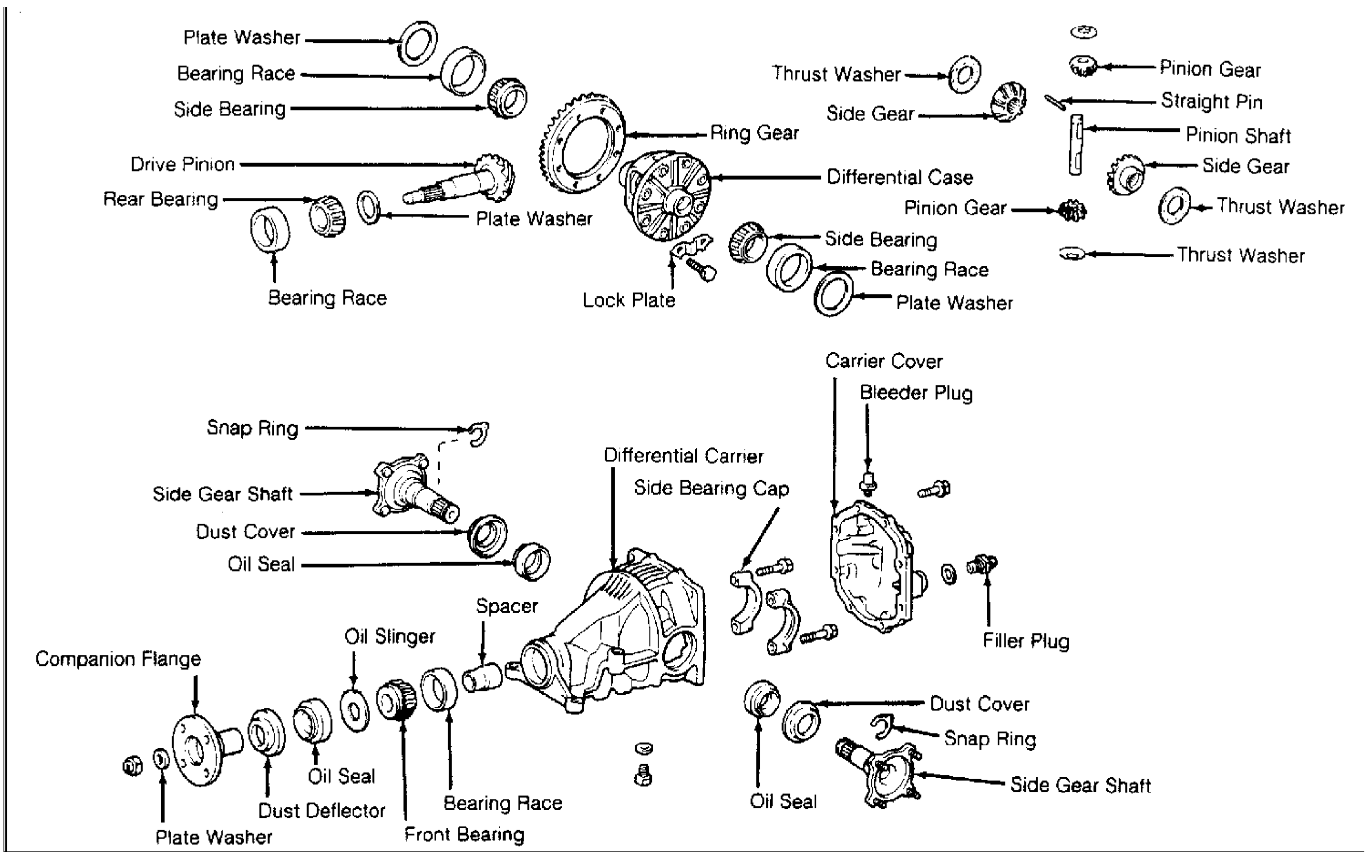

Fig. 1: Exploded View Of Rear Differential Assembly
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OVERHAUL

DIFFERENTIAL ASSEMBLY

NOTE: Refer to Fig. 1 during overhaul procedures.

Disassembly

1) Remove differential carrier cover. Check pinion companion flange lateral and radial runout. If runout exceeds .004" (.10 mm).

2) Using INCH-pound torque wrench, measure drive pinion starting preload and total preload. See AXLE ASSEMBLY SPECIFICATIONS table at end of article.

3) Check ring gear runout and backlash. See AXLE ASSEMBLY SPECIFICATIONS table. Check gear tooth contact pattern. See appropriate GEAR TOOTH CONTACT PATTERNS article in GENERAL

INFORMATION.

4) On 2-pinion conventional differentials, check side gear backlash. See AXLE ASSEMBLY SPECIFICATIONS table.Remove side gear shafts, oil seals and differential tube (if equipped). See SIDE GEAR SHAFT & OIL SEAL under REMOVAL & INSTALLATION.

5) Remove drive pinion flange and oil seal. See PINION FLANGE & OIL SEAL under REMOVAL & INSTALLATION. Paint mating marks on bearing caps, and remove caps. Remove 2 side bearing preload adjusting plate washers. Measure washers, and record thicknesses.

6) Remove differential case and ring gear. Remove differential case side bearing outer races. Index mark bearings, gears and thrust washers. Remove drive pinion shaft from differential carrier. Press rear bearing from pinion shaft.

7) Drive front and rear drive pinion bearing outer races from carrier. Inspect bearings, outer races and pinion shaft for wear and damage. Discard collapsible spacer. Ring gear and drive pinion must be replaced as a set.

8) Remove side bearings from differential case using puller. Keep side bearings together with correct outer races, and mark for reassembly. Place alignment marks on ring gear and differential case.

9) Remove ring gear bolts and locking tabs. Tap ring gear using plastic hammer to remove. Disassemble differential case (except limited slip type). See DIFFERENTIAL CASE under OVERHAUL.

Reassembly

1) Reassemble differential case. See DIFFERENTIAL CASE under OVERHAUL. Clean contact surfaces of differential case. Heat ring gear to 212°F (100°C) in water. DO NOT heat ring gear warmer than 230°F (110°).

2) Install ring gear on differential case while it is still hot. Align index marks on ring gear and case. Temporarily install NEW ring gear bolts with NEW lock plates (if equipped).

3) When ring gear has cooled, tighten ring gear bolts gradually in diagonal sequence to specification. See TORQUE SPECIFICATIONS. Stake lock plates with one tab flush against flat of bolt head. Tab resting on point should be staked on tightening side of point.

4) Press side bearings onto differential case. Install case, with side bearings, into carrier. Install plate washers until no play exists in bearing. Temporarily install bearing caps.

5) Check ring gear runout using dial indicator against back of gear (opposite teeth). See AXLE ASSEMBLY SPECIFICATIONS table at end of article. If runout exceeds specification, rotate ring gear on case, and remeasure. If runout cannot be brought within specified range, case or ring gear must be replaced.

6) Remove bearing caps, plate washers, differential case from carrier. Install front and rear bearing outer races into carrier. Press rear drive pinion bearing, with depth shim under bearing, onto drive pinion. Install drive pinion into carrier. Install front bearing.

NOTE: Drive pinion preload is set in 2 stages. Initial adjustment is made without collapsible spacer, oil slinger or oil seal installed. Final adjustment is made with differential case installed and ring and pinion backlash set.

7) Install companion flange, and lightly grease threads of flange nut. Install flange nut, and adjust drive pinion preload by slowly tightening nut. Measure preload using torque wrench. See AXLE ASSEMBLY SPECIFICATIONS table.

CAUTION: Since spacer is not yet installed, tighten pinion nut slowly until desired preload is obtained. DO NOT exceed torque specification. See TORQUE SPECIFICATIONS.

8) Place bearing outer races on respective bearings, and install differential case into carrier. Install plate washer only on side opposite ring gear teeth. Tap ring gear using plastic hammer to seat washer and bearing.

9) Install dial indicator with plunger on tooth surface of ring gear. Apply downward pressure on side bearing boss. Measure ring gear-to-drive pinion reference backlash. See RING GEAR INITIAL BACKLASH SPECIFICATIONS table.

RING GEAR INITIAL BACKLASH SPECIFICATIONS TABLE

Application	In. (mm)
Celica All-Track	.005 (.13)

10) Using initial backlash as reference, select ring gear (back side) plate washer. Select ring gear side (tooth side) plate washer just thick enough to eliminate clearance between outer race and case. Remove plate washers and differential case from carrier.

11) Install plate washer into lower part of carrier. Place other plate washer on differential case with outer race. Install case assembly into carrier housing. Seat washer and bearing by tapping ring gear using plastic hammer.

12) Measure ring gear backlash using dial indicator. See AXLE ASSEMBLY SPECIFICATIONS table. Adjust backlash by increasing or decreasing washers on both sides by equal amounts. Ensure no clearance exists between plate washer and case. Ensure ring gear backlash exists at all times.

13) After adjustment, remove ring gear (tooth side) plate washer, and measure thickness. Install washer .0024-.0035 (.06-.09 mm) thicker than washer removed.

NOTE: Select washer which can be pressed in 2/3 of way by finger pressure. Backlash will change approximately .0008" (.020 mm) for every .0012" (.030 mm) change in washer thickness.

14) Using a plastic hammer, tap washer in place. Recheck ring gear backlash. See AXLE ASSEMBLY SPECIFICATIONS table. Adjust as necessary. Align index marks on caps and carrier. Install cap bolts, and tighten to specification. See TORQUE SPECIFICATIONS.

15) Measure total drive pinion preload. Ensure total preload equals drive pinion preload plus assembled preload. See AXLE ASSEMBLY SPECIFICATIONS table. Coat 3 or 4 teeth at 3 different positions on ring gear with Red lead.

16) Hold companion flange firmly and rotate ring gear in both directions. Inspect gear tooth contact pattern. Adjust as necessary by changing shims on drive pinion. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION.

17) Remove companion flange and front bearing. See PINION FLANGE & OIL SEAL under REMOVAL & INSTALLATION. Install new bearing collapsible spacer, front bearing, oil slinger and oil seal. Install companion flange, and tighten pinion nut to minimum specification. See TORQUE SPECIFICATIONS.

18) Check total differential preload. Total preload range equals measured drive pinion preload plus assembled preload. See AXLE ASSEMBLY SPECIFICATIONS table.

19) If preload is greater than specification, replace collapsible spacer, and repeat procedure. If preload is less than specification, tighten pinion companion flange nut in increments of 108 INCH lbs. (13 N.m).

NOTE: If maximum pinion flange nut torque is reached before minimum preload is attained, replace collapsible spacer, and repeat procedure. See TORQUE SPECIFICATIONS.

20) Ensure companion flange longitudinal and latitudinal runout do not exceed .004" (.10 mm). Stake drive pinion flange nut. Install side gear oil seals, differential tube (if equipped) and gear shafts. See SIDE GEAR SHAFT & OIL SEAL under REMOVAL & INSTALLATION.

21) Apply sealant to differential cover, and install cover. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

DIFFERENTIAL CASE

Disassembly (Conventional Differential)

1) On 2-pinion differentials, use hammer and punch to drive out pinion shaft-to-case lock pin. On 4-pinion differentials, mark case halves for reassembly reference, and remove bolts retaining case halves.

2) On all differentials, remove pinion shaft, pinion gears, side gears and thrust washers. Thoroughly clean and inspect all parts for wear and damage. Repair or replace parts as necessary.

Reassembly

1) Install side gears and thrust washers in case. See Fig. 1. Thrust washers should be same size for both sides. Install pinion gears with thrust washers. Tap pinion shaft into place. Hold pinion gear toward case. Check side gear backlash.

2) Change thickness of thrust washers until side gear backlash is .002-.008" (.05-.20 mm). On 2-pinion differentials, install lock pin through case and hole in pinion shaft. Stake pin to differential case.

3) On 4-pinion differentials, align marks, and install case halves. Alternately tighten bolts to specification. See TORQUE SPECIFICATIONS.

AXLE ASSEMBLY SPECIFICATIONS

AXLE ASSEMBLY SPECIFICATIONS TABLE

Application	In. (mm)
Pinion Flange Runout	
Latitudinal	.004 (.10)
Longitudinal	.004 (.10)
Ring Gear Backlash	.005-.007 (.13-.18)
Ring Gear Runout	.003 (.07)
Side Gear Backlash	.002—.008 (.05-.20)
	INCH Lbs. (N.m)
Assembled Preload (1)	
Celica All-Trac	2.6-4.3 (.3-.5)
Drive Pinion Preload	
Celica All-Trac	
New Bearings	8.7-13.9 (1.0-1.6)
Used Bearings	4.3-6.9 (.5-.8)

(1) - Add this amount to drive pinion preload to obtain total preload.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
ADD Actuator Bolts	15 (20)
Clutch Case Bolts (With ADD)	58 (78)
Differential Carrier Retainer	16 (22)
Differential Case Bolts	35 (47)
Drain Plug	36 (49)
Differential Mounting Bolt & Nut	
Celica All-Trac	
Front	70 (95)
Rear	108 (146)
Differential Tube Bolts	65 (88)
Drive Shaft Flange Bolts	54 (73)
Filler Plug	29 (39)
Pinion Flange Nut	
Celica All-Trac	(1) 80-174 (108-236)
Rear Cover Bolt	34 (46)
Rear Crossmember Bolt	
Celica All-Trac	53 (72)
Ring Gear Bolts	71 (96)
Side Bearing Cap Bolts	58 (78)

(1) - Minimum and maximum torque for adjustment of drive pinion preload. See DIFFERENTIAL ASSEMBLY under OVERHAUL.

* DRIVETRAIN SYSTEMS UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
Drivetrain/Transmission Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

OVERVIEW OF MOTORIST ASSURANCE PROGRAM
OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

Drive/Power Train Assemblies

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLIES
DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES
MANUAL TRANSMISSION/TRANSAXLE ASSEMBLIES
TRANSFER CASE ASSEMBLIES

Drive/Power Train Components

ACTUATORS (ELECTRICAL)
ACTUATORS (VACUUM)
AXLES
BEARINGS AND RACES
BELL CRANKS
BELL HOUSINGS
BUSHINGS (EXTERNAL)
CABLES (SPEEDOMETER)
CABLES (TV, DETENT AND SHIFT)
CARRIER BEARINGS
CLUTCH CABLES AND CABLE HOUSINGS
CLUTCH DISCS (MANUAL TRANSMISSION)
CLUTCH FORKS
CLUTCH LINKAGES (MECHANICAL)
CLUTCH MASTER CYLINDERS
CLUTCH PEDALS
CLUTCH PIVOTS
CLUTCH PRESSURE PLATES
CLUTCH RELEASE BEARINGS
CLUTCH SLAVE CYLINDERS (CONCENTRIC)
CLUTCH SLAVE CYLINDERS (CONVENTIONAL OR EXTERNAL)
COMPANION FLANGES
CONNECTORS
COOLER BYPASS VALVES
COOLER LINES
COOLERS
CV JOINTS
DIP STICK TUBES
DIP STICKS (FLUID LEVEL INDICATORS)
DOWEL PINS, GUIDES AND PILOT HOLES
DRIVE SHAFT FLANGES
DRIVE SHAFTS AND HALF SHAFTS
DUST BOOTS
ENGINE MOUNTS
EXCITER RINGS
FILLER TUBES
FILTERS AND SCREENS

FLANGES
FLEX PLATES
FLUID LEVEL INDICATORS
FLUIDS AND LUBRICANTS
FLYWHEELS
FORCE MOTORS
GUIDES
HALF SHAFTS
HOSES, LINES AND TUBES
HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY)
INTERMEDIATE SHAFT SUPPORT BEARINGS
KEY INTERLOCK SYSTEMS
LIMITED SLIPS
LINES
LINKAGES (EXTERNAL)
LOCKING HUB ASSEMBLIES
LOCKING HUB CONTROL KNOBS
LUBRICANTS
METAL-CLAD SEALS
METALASTIC JOINTS
MODULATOR PINS
MODULATORS
MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION)
ODOMETER DRIVES (MECHANICAL)
ODOMETER HEADS (MECHANICAL)
OIL PANS
PANS
PILOT HOLES
PRESSURE PLATES
PRESSURE SWITCHES
RACES
RUBBER JOINTS (METALASTIC)
SCREENS
SEALS
SEALS (METAL-CLAD)
SELECTOR INTERLOCK SYSTEMS
SERVOS
SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS)
SENSORS
SIDE COVERS
SLIP YOKES
SOLENOIDS
SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)
SPEEDOMETER-DRIVEN GEAR HOUSINGS
SPEEDOMETER/ODOMETER DRIVES (MECHANICAL)
SPEEDOMETER/ODOMETER HEADS (MECHANICAL)
SPEEDOMETERS AND ODOMETERS (ELECTRONIC)
SWITCHES
TONE WHEELS
TOOTHED RINGS (TONE WHEELS)
TORQUE CONVERTERS
TRANSAXLE MOUNTS
TRANSDUCERS (TRANSMISSION)
TRANSMISSION COOLERS
TRANSMISSION MOUNTS
TRANSMISSION PANS
TRANSMISSION RANGE INDICATORS (PRNDL)
TUBES
UNIVERSAL JOINTS (CARDON OR CROSS TYPE)
VACUUM CONTROLS
VACUUM HOSES
VACUUM MOTORS
VACUUM-OPERATED SWITCHES

VEHICLE SPEED SENSORS
VENTS
VIBRATION DAMPERS
WHEEL ATTACHMENT HARDWARE
WHEEL SPEED SENSORS
WIRING HARNESSES AND CONNECTORS
YOKES AND SLIP YOKES

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection were recently published. Further, revisions to all of these inspection communication standards are continually republished. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

DRIVE/POWER TRAIN ASSEMBLIES

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

NOTE: Whenever transmission or drivetrain service is performed that affects the suspension alignment, for example, removing the engine cradle, it is required that the alignment be checked and corrected if necessary.

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLIES

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	(2) Require repair or replacement of the automatic transmission/transaxle assembly.

(1) - It is Required that the torque converter and all other failure related components be inspected for cause and condition.
(2) - For components not requiring removal of the assembly, refer to the component listing in this document.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES

NOTE: Does not include half shafts.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLIES

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the manual transmission/transaxle assembly.

(1) - For components not requiring removal of the assembly,

refer to the component listing in this document.

TRANSFER CASE ASSEMBLIES

TRANSFER CASE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the transfer case differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

DRIVE TRAIN/COMPONENTS

The conditions listed for the components included in this section assume that the problem has been isolated to the specific component through proper testing.

ACTUATORS (ELECTRICAL)

ACTUATOR (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or

		replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

ACTUATORS (VACUUM)

ACTUATOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking (vacuum)	A	Require repair or replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.

Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AXLES

AXLE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	Require replacement.
End play exceeds specifications	B	Require repair or replacement.
Flange bent	A	Require replacement.
Flange threads stripped	A	Require repair or replacement.
Twisted	A	Require replacement.
Worn, affecting performance	A	Require replacement.

BEARINGS AND RACES

NOTE: When replacing or repacking bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

BEARING AND RACE INSPECTION

Condition	Code	Procedure
Bearing end-play exceeds specifications	B	Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or		

feel rough when rotated as an assembly	B	Require replacement of bearing assembly.

BELL CRANKS

BELL CRANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Missing	C	Require replacement.
Worn, affecting performance	A	Require repair or replacement.

BELL HOUSINGS

See HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY).

BUSHINGS (EXTERNAL)

BUSHING (EXTERNAL) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.

Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	Require repair or replacement.
Contaminated	1	Suggest replacement.
Deteriorated, affecting performance	A	Require repair or replacement.
Distorted, affecting performance	A	Require repair or replacement.
Missing	A	Require replacement.
Noisy	2	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	Require replacement.
Seized	A	Require replacement.
Shifted (out of position)	B	Require repair or replacement.
Split	A	Require replacement.
Surface cracking (weather-checked)	..	No service suggested or required.
Worn, affecting performance	A	Require repair or replacement.
Worn close to the end of its useful life	1	Suggest replacement.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CABLES (SPEEDOMETER)

CABLE (SPEEDOMETER) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or

		required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

CABLES (TV, DETENT AND SHIFT)

CABLE (TV, DETENT AND SHIFT) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.

Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Frayed	A	Require replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(2) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.
Self-adjuster inoperative	A	Require repair or replacement of self-adjuster.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Cable replacement is required if it cannot be adjusted within specifications.

CARRIER BEARINGS

See INTERMEDIATE SHAFT SUPPORT BEARINGS.

CLUTCH CABLES AND CABLE HOUSINGS

CLUTCH CABLE AND CABLE HOUSING INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Cable bent	A	Require replacement.
Cable binding	A	Require repair or replacement.
Cable mounting loose	B	Require repair or replacement.
Cable out of adjustment	B	Require repair or replacement.
Frayed	B	Require replacement.
Housing heat-damaged	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH DISCS (MANUAL TRANSMISSION)

CLUTCH DISC (MANUAL TRANSMISSION) INSPECTION

Condition	Code	Procedure
Backing plate cracked	A	Require replacement.
Broken	A	Require replacement.
Contaminated with oil	A	Require replacement.
Damper cushion broken	A	Require replacement.
Damper cushion collapsed	A	Require replacement.
Damper spring collapsed	A	Require replacement.
Damper spring missing	C	(1) Require replacement.
Friction material cracked through	B	Require replacement.
Friction material flaking or chunking	B	Require replacement.
Friction material surface cracking	B	No service suggested or required.
Grooved	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Ridged	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Splines worn, affecting performance	A	Require replacement.
Warped	A	Require replacement.
Wear exceeds specifications (where applicable)	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

(1) - Not all clutch discs have springs in all spring chambers on the disc.

CLUTCH FORKS

CLUTCH FORK INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require repair or replacement.
Cracked	B	Require repair or replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH LINKAGES (MECHANICAL)

See LINKAGES (EXTERNAL).

CLUTCH MASTER CYLINDERS

CLUTCH MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Cover gasket distorted	A	Require replacement of cover gasket.
Cover gasket gummy	A	Require replacement of cover gasket.
Cylinder leaking fluid from rear of bore	A	Require repair or replacement.
Cylinder leaking fluid internally	A	Require replacement.
Dust boot missing	C	Require replacement of dust boot.
Dust boot punctured	A	Require replacement of dust boot.
Dust boot torn	A	Require replacement of dust boot.
Fluid level incorrect	B	Require fluid level adjustment.
Housing damaged, affecting performance	A	Require repair or replacement.
Master cylinder has residue in reservoir (make parallel w/brakes when they are done)	2	(1) Further inspection required.
Threads damaged	A	Require repair replacement
Threads stripped (threads missing)	A	Require replacement.

(1) - DO NOT replace master cylinder unless it exhibits conditions listed for replacement. You may suggest fluid change according to OEM service intervals.

CLUTCH PEDALS

CLUTCH PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Pedal pad missing	C	Require replacement of pedal pad.
Pivot bushings worn, affecting performance	A	Require replacement of pivot bushings.

CLUTCH PIVOTS

CLUTCH PIVOT INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH PRESSURE PLATES

See PRESSURE PLATES.

CLUTCH RELEASE BEARINGS

CLUTCH RELEASE BEARING INSPECTION

Condition	Code	Procedure
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Rough when rotated as an assembly	B	Require replacement.
Seized	A	Require replacement.
Wear exceeds specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONCENTRIC)

CLUTCH SLAVE CYLINDER (CONCENTRIC) INSPECTION

Condition	Code	Procedure
Bearing rough when rotated as an assembly	B	Require replacement.
Bearing seized	A	Require replacement.
Bleeder pipe leaks	A	Require repair or replacement.
Carrier assembly worn, affecting performance	A	Require replacement.
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Housing leaks	A	Require replacement.
Inoperative	A	Require replacement.
Release binding	A	Require replacement.
Spring broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONVENTIONAL OR EXTERNAL)

CLUTCH SLAVE CYLINDER (CONVENTIONAL OR EXTERNAL) INSPECTION

Condition	Code	Procedure
Binding	A	.. Require repair or replacement.
Bleeder port damaged (not repairable)	A	.... (1) Require replacement.
Bleeder port damaged (repairable)	A	.... (1) Require repair.
Bleeder screw broken off in slave cylinder	A	.... (1) Require replacement.
Bleeder screw seized	A	.... (2) Require replacement.
Bore corroded (pitted) ..	B	.... Require replacement.
Bore grooved	A	.... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing it has been made.

COMPANION FLANGES

See YOKES AND SLIP YOKES.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLER BYPASS VALVES

COOLER BYPASS VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	.... Require replacement.
Installed incorrectly ...	A	.... Require repair.
Leaking	A	.. Require repair or replacement.
Restricted	A	.. Require repair or replacement.

COOLER LINES

COOLER LINE INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity ...	A	.. Require repair or replacement.
Abrasion damage, not affecting structural integrity	..	.... No service suggested or required.
Application incorrect ...	B	.... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Clamp corroded, not reusable	1	Suggest replacement.
Connected incorrectly	A	Require repair.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity	..	No service suggested or required.
Cracked	A	Require repair or replacement.
Fitting type incorrect (such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	C	Require replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Routed incorrectly	2	Require repair.
Swollen	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

COOLERS

See TRANSMISSION COOLERS.

CV JOINTS

CV JOINT INSPECTION

Condition	Code	Procedure
Bearing, bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Boot clamp broken	A	Require repair or replacement of clamp.
Boot clamp loose	A	Require repair or replacement of clamp.
Boot clamp missing	C	Require repair or replacement of clamp.
Boot leaking	A	Require replacement of CV boot.
Boot surface cracked,		

not leaking	2	Suggest replacement of CV boot.
Cage broken	A	Require repair or replacement of CV joint.
Housing damaged to the extent that it no longer performs its intended function	A	(1) Require repair or replacement of CV joint.
Housing worn to the extent that it no longer performs its intended function	A	(1) Require repair or replacement of CV joint.
Holes elongated	A	Require replacement.
Internal parts binding	A	Require repair or replacement.
Internal parts worn	A	Require repair or replacement.
Lubricant missing	C	Require cleaning, inspection, and repacking of CV joint.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Housing assembly may appear blue in color from normal manufacturing process of heat-treating the housing.

DIP STICK TUBES

DIP STICK TUBE INSPECTION

Condition	Code	Procedure
Broken	A	Require repair or replacement.
Checkball missing	C	Suggest repair or replacement.
Cracked	A	Require repair or replacement.
Hold down bracket broken	A	Require repair or replacement.
Hold down bracket missing	C	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

DIP STICKS (FLUID LEVEL INDICATORS)

DIP STICK (FLUID LEVEL INDICATOR) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Broken	A	Require replacement.
Compressed	A	Require repair or replacement.
Missing	C	Require replacement.
Modified	A	Require replacement.
Stretched	A	Require repair or replacement.

DOWEL PINS, GUIDES AND PILOT HOLES

DOWEL PIN, GUIDE AND PILOT HOLE INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	.. Require repair or replacement.
Cracked	A	.. Require repair or replacement.
Distorted	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Positioned incorrectly ..	B	.. Require repair or replacement.
Stepped	A	.. Require repair or replacement.
Worn to the extent that it no longer performs its intended function	A	.. Require repair or replacement.

DRIVE SHAFT FLANGES

See COMPANION FLANGES.

DRIVE SHAFTS AND HALF SHAFTS

DRIVE SHAFT AND HALF SHAFT INSPECTION

Condition	Code	Procedure
Balance weight missing ..	C	.. Require repair or replacement.
Bearing cap bore distorted	A	.. Require repair or replacement.
Bent	A	.... Require replacement.
Bolt holes elongated	A	.. Require repair or replacement.
Bushing or seal surface worn, affecting performance	A	.. Require repair or replacement.
Leaking through soft yoke plug	A	... Require repair or replacement of soft yoke plug.
Out of balance	A	.. Require repair or replacement.
Retainer strap bent	A	.... Require replacement of retainer strap.
Slip yoke broken	A	.... Require replacement.
Splines worn, affecting performance	A	.... Require replacement.
Splines worn close to the end of their useful life	1	.... Suggest replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
U-bolt damaged, affecting performance	A	. Require replacement of U-bolts.
Yoke damaged, affecting performance	A	.. Require repair or replacement.

DUST BOOTS

NOTE: Does not include CV boots.

DUST BOOT INSPECTION

Condition	Code	Procedure
Cracked, not leaking	1	.... Suggest replacement.
Missing	C	.... Require replacement.
Leaking	A	.. Require repair or replacement.

Torn	A	Require replacement.

ENGINE MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

EXCITER RINGS

See TOOTHED RINGS (TONE WHEELS).

FILLER TUBES

See DIP STICK TUBES.

FILTERS AND SCREENS

FILTER AND SCREEN INSPECTION

Condition	Code	Procedure
At service interval	3	Suggest replacement.
Bent	A	Require repair or replacement.
Exceeding service interval	3	Suggest replacement.
Missing	C	Require replacement.
Near service interval	3	Suggest replacement.
Restricted	A	(1) Require repair or replacement.
Torn	A	Require replacement.
Worn, affecting performance (metal or nylon screen type)	A	Require repair or replacement.

(1) - Further inspection may be required to determine the source of restriction or contamination.

FLANGES

See COMPANION FLANGES.

FLEX PLATES

FLEX PLATE INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require replacement.
Bent, not affecting performance	..	No service suggested or required.
Bolt or stud holes elongated	B	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Ring gear worn close to the end of its useful life	1	Suggest replacement.
Ring gear worn to the extent that it no longer		

performs its intended function	A	Require replacement.
Weights missing	A	Require replacement.

FLUID LEVEL INDICATORS

See DIP STICKS (FLUID LEVEL INDICATORS).

FLUIDS AND LUBRICANTS

FLUID AND LUBRICANT INSPECTION

Condition	Code	Procedure
Application incorrect	B	(1) Require replacement.
At service interval	3	Suggest replacement.
Beyond service interval	3	Suggest replacement.
Burned	..	(2) Further inspection required.
Contaminated, for example, fluid other than hydraulic fluid present	A or B	(3)(4) Require service.
Exceeding service interval	3	Suggest replacement.
Hydraulic fluid incorrect	B	(5) Require service.
Level incorrect	B	Require correction of fluid level.
Near service interval	3	Suggest replacement.
Rubber master cylinder cover gasket distorted and gummy	A	(3) Require service.
Varnished	..	(6) Further inspection required.

(1) - Determine and correct cause.
(2) - Fluid that is burned indicates a serious problem. Determine and correct the cause.
(3) - If a fluid other than hydraulic fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines with denatured alcohol or hydraulic cleaner, 3) repair or replace all components having rubber parts, and 4) bleed and flush with correct hydraulic fluid. (Code A)
(4) - If a fluid other than hydraulic fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct hydraulic fluid. (Code B)
(5) - If a fluid other than specification hydraulic fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.
(6) - Fluid that is varnished may indicate a serious problem. Determine and correct the cause.

FLYWHEELS

NOTE: Clutch disc replacement does not necessitate flywheel reconditioning, unless other conditions justify the reason to do so.

FLYWHEEL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked (other than mounting area)	A	(1) Require resurfacing or replacement.
Cracks in mounting area	B	Require replacement.
Hard spots	B	Require repair or replacement.
Ring gear broken	A	Require replacement of ring gear.
Ring gear teeth worn, affecting performance	A	Require replacement of ring gear.
Runout exceeds specifications	B	Require repair or replacement.
Scored	B	Require repair or replacement.
Surface cracks after resurfacing to manufacturer's minimum specifications	B	Require replacement.
Wear exceeds specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Some manufacturers allow slight surface cracking in the friction surface.

FORCE MOTORS

See ACTUATORS (ELECTRICAL).

GUIDES

See DOWEL PINS, GUIDES AND PILOT HOLES.

HALF SHAFTS

See DRIVE SHAFTS AND HALF SHAFTS.

HOSES, LINES AND TUBES

HOSE, LINE AND TUBE INSPECTION

Condition	Code	Procedure

Application incorrect ...	B	.... Require replacement.
Connected incorrectly ...	A	.... Require repair.
Corroded, not reusable ..	1	.... Suggest replacement.
Cracked	A	.... Require replacement.
Dry-rotted	1	.. Suggest repair or replacement.
Hard	1	.. Suggest repair or replacement.
Inner fabric (webbing) damaged	A	.... Require replacement.
Insufficient clamping force, allowing hose to leak	A	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Maintenance intervals ...	3	.... Suggest replacement.
Melted	1	.. Suggest repair or replacement.
Missing	C	.... Require replacement.
Outer covering damaged ..	1	.... Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	.... Require replacement.
Protective sleeves damaged	2	. Suggest replacement of sleeves.
Protective sleeves missing	2	. Suggest replacement of sleeves.
Restricted, affecting performance	A	.. Require repair or replacement.
Restricted, not affecting performance	2	.. Suggest repair or replacement.
Routed incorrectly	2	.... Suggest replacement.
Safety clip missing	C	.... Require replacement.
Spongy	1	.. Suggest repair or replacement.
Stripped	A	.... Require replacement.
Swollen	B	.... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Type incorrect	1	.. Suggest repair or replacement.

HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY)

HOUSING (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY) INSPECTION

Condition	Code	Procedure
Bearing race loose in bore	A	.. Require repair or replacement.
Broken, affecting performance	A	.. Require repair or replacement.
Cracked	A	.. Require repair or replacement.
Dowel pin holes worn, affecting performance ..	A	.... (1) Require repair or replacement.
Machined surfaces damaged, affecting performance ..	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Worn, affecting performance	A	.. Require repair or replacement.

(1) - See DOWEL PINS, GUIDES AND PILOT HOLES.

INTERMEDIATE SHAFT SUPPORT BEARINGS

INTERMEDIATE SHAFT SUPPORT BEARING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing rollers, balls or races are worn, pitted, noisy, or feel rough when rotated as an assembly	A	Require replacement of bearing assembly.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performances)	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Cracked	..	Require replacement.
Rough (brinelling, spalling)	A	Require replacement.
Rubber deteriorated, affecting performance	A	Require replacement.
Seized	A	Require replacement.

KEY INTERLOCK SYSTEMS

See
SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS).

LIMITED SLIPS

See DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES.

LINES

See HOSES, LINES AND TUBES.

LINKAGES (EXTERNAL)

LINKAGE (EXTERNAL) INSPECTION

Condition	Code	Procedure
Components missing	C	Require replacement of missing components.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Worn to the extent that it no longer performs its intended function	A	Require repair or replacement.

LOCKING HUB ASSEMBLIES

LOCKING HUB ASSEMBLY INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Loose	A	Require repair or replacement.
Seized in any position	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

LOCKING HUB CONTROL KNOBS

LOCKING HUB CONTROL KNOB INSPECTION

Condition	Code	Procedure

Damaged, affecting performance	A	Require replacement.
Missing	C	Require replacement.
Worn, affecting performance	A	Require replacement.

LUBRICANTS

See FLUIDS AND LUBRICANTS.

METAL-CLAD SEALS

See SEALS.

METALASTIC JOINTS

See RUBBER JOINTS (METALASTIC).

MODULATOR PINS

MODULATOR PIN INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Missing	C	Require replacement.

MODULATORS

MODULATOR INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require replacement.
Contaminated (water, fuel, etc.)	A	(1) Require replacement.
Housing cracked	A	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking fluid externally	A	Require repair or replacement.
Leaking fluid internally	A	Require replacement.
Leaking vacuum	A	Require replacement.
Nipple broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Further inspection is required to determine the cause of the contamination.
(2) - Inoperative includes intermittent operation or out of OEM specification.

MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION)

MOUNT (ENGINE, TRANSAXLE AND TRANSMISSION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Broken	A	.... Require replacement.
Leaking (hydraulic mount)	A	.... Require replacement.
Mounting hole worn, affecting performance ..	A	.... Require replacement.
Mounting hole worn, not affecting performance ..	..	.... No service suggested or required.
Rubber deteriorated, affecting performance ..	A	.... Require replacement.
Rubber deteriorated, not affecting performance ..	..	.... No service suggested or required.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

ODOMETER DRIVES (MECHANICAL)

See SPEEDOMETER/ODOMETER DRIVES (MECHANICAL).

ODOMETER HEADS (MECHANICAL)

See SPEEDOMETER/ODOMETER HEADS (MECHANICAL).

OIL PANS

See TRANSMISSION PANS.

PANS

See TRANSMISSION PANS.

PILOT HOLES

See DOWEL PINS, GUIDES AND PILOT HOLES.

PRESSURE PLATES

PRESSURE PLATE INSPECTION

Condition	Code	Procedure
Balance weight missing ..	C	.... Require replacement.
Broken	A	.... Require replacement.
Contact surface distorted	B	.... Require replacement.
Cracks	B	.... Require replacement.
Fingers bent	A	.... Require replacement.
Hard spots	B	.... Require replacement.

Scored	B	Require replacement.
Spring rate less than specifications	B	Require replacement.
Worn, affecting performance	A	Require replacement.
Worn beyond specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.

PRESSURE SWITCHES

See SWITCHES.

RACES

See BEARINGS AND RACES.

RUBBER JOINTS (METALASTIC)

These joints may be found on half and/or drive shafts. They are usually found on European vehicles featuring a three-lug drive flange. They may be equipped with a centering ball or pin.

RUBBER JOINT (METALASTIC) INSPECTION

Condition	Code	Procedure
Drive flange bent	A	Require repair or replacement.
Drive flange damaged, affecting performance	A	Require replacement.
Rubber drive joint cracked	2	Suggest replacement.
Rubber drive joint damaged, affecting performance	A	Require replacement.
Rubber drive joint split between mounting holes	A	Require replacement.
Rubber drive joint torn at mounting holes	A	Require replacement.
Rubber drive joint weather-cracked	..	No service suggested or required.

SCREENS

See FILTERS AND SCREENS.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged

vent may force fluid past the seal.

SEALS (METAL-CLAD)

See SEALS.

SELECTOR INTERLOCK SYSTEMS

See SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS).

SERVOS

See ACTUATORS (VACUUM).

SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS)

See:
ACTUATORS (ELECTRICAL)
CABLES
LINKAGES (EXTERNAL)
SWITCHES

SENSORS

SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Leaking (vacuum/fluid/air)	A	Require replacement.
Out of adjustment	B	(3) Further inspection required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting		

performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of specification.
(3) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

SIDE COVERS

See TRANSMISSION PANS.

SLIP YOKES

See YOKES AND SLIP YOKES.

SOLENOIDS

See:
ACTUATORS (ELECTRICAL)
ACTUATORS (VACUUM)

SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)

SPEED SENSOR (ELECTRONIC WHEEL AND VEHICLE) INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of		

specification	B	Require repair or replacement.
Sensor housing cracked	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead misrouted	B	Require re-routing according to vehicle manufacturer's specifications.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as metal particles or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

SPEEDOMETER-DRIVEN GEAR HOUSINGS

See SPEEDOMETER/ODOMETER DRIVES (MECHANICAL).

SPEEDOMETER/ODOMETER DRIVES (MECHANICAL)

SPEEDOMETER/ODOMETER DRIVE (MECHANICAL) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Teeth broken	A	Require repair or replacement.

Condition	Code	Procedure
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

(1) - Inoperative includes intermittent operation.

SPEEDOMETER/ODOMETER HEADS (MECHANICAL)

SPEEDOMETER/ODOMETER HEAD (MECHANICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Lens broken	A	(1) Require repair or replacement.
Lens cloudy	2	(1) Suggest repair or replacement.
Lens missing	C	(1) Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - If lens is available as a separate part, require replacement of lens only.
(2) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

SPEEDOMETERS AND ODOMETERS (ELECTRONIC)

SPEEDOMETER AND ODOMETER (ELECTRONIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack		

type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Leaking	A	Require replacement.
Lens broken	A	(2) Require repair or replacement.
Lens cloudy	2	(2) Suggest repair or replacement.
Lens missing	C	(2) Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Mechanical head noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - If lens is available as a separate part, require replacement of lens only.
(3) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

SWITCHES

SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or

Condition	Code	Procedure
		replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won't return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TONE WHEELS

See TOOTHED RINGS (TONE WHEELS).

TOOTHED RINGS (TONE WHEELS)

If the toothed ring requires replacement and cannot be replaced as a separate component, replace the assembly of which the ring is a part.

TOOTHED RING (TONE WHEEL) INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Bent	B	Require replacement.
Contaminated, affecting performance	A	Require repair. Identify and correct cause.
Cracked	B	Require replacement.
Loose	A	Require replacement of worn parts.
Missing	C	Require replacement.
Number of teeth		

incorrect	B	Require replacement.
Teeth broken	A	Require replacement.
Teeth damaged, affecting performance	A	Require replacement.

TORQUE CONVERTERS

TORQUE CONVERTER INSPECTION

Condition	Code	Procedure
Converter clutch lock-up operation is faulty	A	Require replacement.
Cover shell damaged, affecting performance	A	Require replacement.
Does not meet stall speed specification	B	Require replacement.
End play exceeds specifications	B	Require replacement.
Hub broken	A	Require replacement.
Hub cracked	A	Require replacement.
Internal component failure	A	Require replacement.
Leaking	A	Require repair or replacement.
Pilot broken	A	Require replacement.
Pilot worn, affecting performance	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Weights missing	C	Require replacement.

TRANSAXLE MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

TRANSDUCERS (TRANSMISSION)

See SENSORS.

TRANSMISSION COOLERS

TRANSMISSION COOLER INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connection leaking	A	Require repair or replacement.
Contaminated	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting		

performance	A	.. Require repair or replacement.
Fins damaged, not affecting performance ..	..	.... No service suggested or required.
Internal restrictions ...	B	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.. Require repair or replacement.
Tubes damaged, affecting performance	A	.. Require repair or replacement.
Tubes damaged, not affecting performance ..	..	.... No service suggested or required.

TRANSMISSION MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

TRANSMISSION PANS

TRANSMISSION PAN INSPECTION

Condition	Code	Procedure
Bent, interfering with filter or other internal components	A	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.

TRANSMISSION RANGE INDICATORS (PRNDL)

TRANSMISSION RANGE INDICATOR (PRNDL) INSPECTION

Condition	Code	Procedure
Binding	A	.. Require repair or replacement.
Broken	A	.. Require repair or replacement.
Components missing	C	.. Require replacement of missing components.
Loose, affecting performance	A	.. Require repair or replacement.
Out of adjustment	A	.... Require repair.
Worn, affecting performance	A	.. Require repair or replacement.

TUBES

See HOSES, LINES AND TUBES.

UNIVERSAL JOINTS (CARDON OR CROSS TYPE)

UNIVERSAL JOINT (CARDON OR CROSS TYPE) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing cap distorted	B	Require replacement.
Binding	A	Require replacement.
Cross (trunion) worn, affecting performance	A	Require replacement.
Double cardon centering ball damaged	A	Require replacement.
Double cardon centering ball worn, affecting performance	A	Require replacement.
Double cardon centering spring broken	A	Require replacement.
Double cardon centering spring missing	C	Require replacement.
Double cardon centering spring weak	A	Require replacement.
End cap seal cracked	2	Suggest replacement.
End cap seal missing	C	Require replacement of seal.
Grease fitting broken	A	(1) Require replacement of grease fitting.
Grease fitting missing	C	(2) Require replacement of grease fitting.
Rust-colored powder around end cap seals	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

(1) - A broken grease fitting does not require replacement of the U-Joint.
(2) - A missing grease fitting does not require replacement of the U-Joint.

VACUUM CONTROLS

See ACTUATORS (VACUUM).

VACUUM HOSES

See HOSES, LINES AND TUBES.

VACUUM MOTORS

See ACTUATORS (VACUUM).

VACUUM-OPERATED SWITCHES

See SWITCHES.

VEHICLE SPEED SENSORS

See SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE).

VENTS

VENT INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Plugged	A	(1) Require repair or replacement.

(1) - A plugged vent may force fluid past the seal.

VIBRATION DAMPERS

VIBRATION DAMPER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Out of position	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

WHEEL ATTACHMENT HARDWARE

NOTE: For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	(1) Require replacement.
Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEEL SPEED SENSORS

See SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE).

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Transmission connector leaking	..	See TRANSMISSION ASSEMBLY.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

YOKES AND SLIP YOKES

YOKE AND SLIP YOKE INSPECTION

Condition	Code	Procedure
Bearing cap bore distorted	A	Require repair or replacement.
Bent	A	Require replacement.
Bolt holes elongated	A	Require repair or replacement.
Bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Leaking through soft yoke plug	A	Require repair or replacement of soft yoke plug.
Retainer strap bent	A	Require replacement of retainer strap.
Slip yoke broken	A	Require replacement.
Splines worn, affecting performance	A	Require replacement.
Splines worn close to the end of their useful life	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
U-bolt damaged, affecting performance	A	Require replacement of U-bolts.
Yoke damaged, affecting performance	A	Require repair or replacement.

P - EGR FUNCTION TESTING

1993 Toyota Celica

1989-95 ENGINE PERFORMANCE
Toyota EGR Function Testing

All Models

EGR VALVE

1) Disconnect vacuum hose to EGR valve. Using a hand-held vacuum pump, apply vacuum to EGR valve with engine at idle. Engine should run rough or stall. If engine does not run rough or stall, check EGR valve passages for blockage or faulty EGR valve. Clean passages as necessary. If passages are clear, replace EGR valve.

2) Install vacuum gauge to ported vacuum port to EGR. Raise engine RPM. Vacuum should be present. If vacuum is not present, clear vacuum port of blockage.

* ELECTRICAL SYSTEM UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
Electrical System Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

OVERVIEW OF MOTORIST ASSURANCE PROGRAM
OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS
ACTUATOR MOTORS (SOLENOIDS) (ELECTRIC)
ACTUATOR MOTORS (VACUUM)
AIR BAGS
ALTERNATORS AND GENERATORS
AMPLIFIERS
ANTENNAS
BATTERIES
BATTERY CABLES
BATTERY CABLES
BATTERY HOLD DOWN HARDWARE
BATTERY TRAYS AND HOLD DOWN HARDWARE
BATTERY WIRES
BELTS
BULB SOCKETS
BULBS, SEALED BEAMS AND LEDS
CD PLAYERS
CIGARETTE LIGHTER ASSEMBLIES
CIRCUIT BREAKERS
CLUTCH SWITCHES
CONNECTORS
CONTROL MODULES
CRUISE CONTROL BRAKE SWITCHES
CRUISE CONTROL CABLES
CRUISE CONTROL CLUTCH SWITCHES
CRUISE CONTROL LINKAGES AND CABLES
CRUISE CONTROL RESERVOIRS
CRUISE CONTROL TUBES
CRUISE CONTROL VACUUM DUMP RELEASE VALVES
CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS
CRUISE CONTROL VEHICLE SPEED SENSORS
DEFOGGERS
DEFROSTERS
DELAYS
DIMMERS
ELECTRIC HEATERS
EQUALIZERS
FUSE BLOCKS
FUSE BOXES AND BLOCKS
FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS
FUSIBLE LINKS
GAUGES
GENERATORS
GROUND CABLES AND STRAPS
GROUND STRAPS
HEADLIGHT ADJUSTERS
HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS)
HORNS AND SIRENS

IGNITION SWITCHES
INDICATOR LIGHTS
KEYLESS ENTRY KEYPADS AND TRANSMITTERS
KEYLESS ENTRY TRANSMITTERS
LEDS
LENSES
MICROPHONES
MIRRORS (ELECTROCHROMATIC AND HEATED)
MOTORS
NEUTRAL SAFETY SWITCHES
ODOMETERS
ODOMETERS, SPEEDOMETERS AND TACHOMETERS (CABLE-DRIVEN)
PULLEYS
RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS
RELAY BOXES
RELAYS
SEALED BEAMS
SEAT HEATERS
SECURITY ALARM SENSORS
SIRENS
SOLENOIDS
SPEAKERS AND MICROPHONES
SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES
SPEEDOMETER CABLES
SPEEDOMETERS
STARTERS
SUB-WOOFER VOLUME CONTROLS
SWITCHES
TACHOMETER CABLES
TACHOMETERS
TAPE PLAYERS AND CD PLAYERS
TENSIONERS
TIMERS
TIRE PRESSURE SENSORS
TRANSCEIVERS
TRANSDUCERS
VACUUM ACCUMULATORS (RESERVOIRS)
VACUUM RESERVOIRS
VOLTAGE REGULATORS
WASHER FLUID LEVEL SENDERS
WASHER PUMPS
WIPER ARMS AND BLADES
WIPER BLADES
WIPER HOSES AND NOZZLES
WIPER LINKAGES
WIPER NOZZLES
WIPER PUMP RESERVOIRS
WIRING HARNESSES AND CONNECTORS

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published.

In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646

January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose

B - Part does not meet a design specification (regardless of performance)

C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)

2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)

3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)

4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

ELECTRICAL SYSTEMS

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

NOTE: When working on electrical systems, if a potentially hazardous condition is observed, require repair or replacement of affected components prior to performing further work.

ACTUATOR MOTORS (SOLENOIDS) (ELECTRIC)

ACTUATOR MOTOR (SOLENOIDS) (ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

ACTUATOR MOTORS (VACUUM)

ACTUATOR MOTOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

Condition	Code	Procedure
		hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking (vacuum)	A	Require repair or replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR BAGS

For all air bag components and conditions, refer to vehicle manufacturer's specifications for diagnosis and parts replacement.

ALTERNATORS AND GENERATORS

NOTE: If components have been added that increase vehicle electrical load requirement (for example, sound systems, air conditioning, alarm systems, etc.), charging system output must meet the increased demand.

ALTERNATOR AND GENERATOR INSPECTION

Condition	Code	Procedure
Alternator output meets OEM specification but is insufficient for add-on		

electrical load	2	Suggest upgrade of alternator or removal of excess electrical load.
Alternator's rated output is below OEM specification	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware non-functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Diode inoperative	A	(2) Require repair or replacement.
Housing broken, affecting performance	A	Require repair or replacement.
Housing broken, not affecting performance	..	No service suggested or required.
Housing cracked, affecting performance	A	Require repair or replacement.
Housing cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Pulley incorrect	B	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Terminal resistance (voltage drop) out of specification	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AMPLIFIERS

See RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

ANTENNAS

ANTENNA INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Bent	2	Suggest repair or replacement.
Binding	2	Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Missing	C	Require replacement.
Motor runs continuously	A	Require or replacement.
Power antenna noisy	2	Suggest repair or replacement.
Sticking	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of specification.

BATTERIES

Proper operation of any electrical system or component can be affected by battery condition. The battery(ies) must meet or exceed minimum specification for vehicle as equipped and test to that specific battery's CCA.

Definition of Terms

* Battery Performance Testing
  Testing that determines whether or not a battery meets both vehicle OEM and battery manufacturer's specifications.
* Cold Cranking Amp (CCA) Rating
  The number of amperes a new, fully charged battery at 0° F (-17.8° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).
* Cranking Amps (CA)
  The number of amperes a new, fully charged battery, typically at 32° F (0° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).
* OEM Cranking Amps
  The minimum CCA required by the original vehicle manufacturer for a specific vehicle.

BATTERY INSPECTION

Condition	Code	Procedure
Battery frozen	..	(1) Further inspection required.
Case leaking	A	Require replacement.
Casing swollen	A	(2) Further inspection required.
Circuit open internally	A	Require replacement.
Electrolyte contamination	A	(2) Further inspection required.
Electrolyte discoloration	A	(2) Further inspection required.
Fails to accept and hold charge	A	(3) Require replacement.
Fluid level low	B	(4) Further inspection required.
Out of performance specification for battery	B	(5) Require replacement.
Out of specification for application	B	(5) Require replacement.
Post (top or side) burned, affecting performance	A	(6) Require repair or replacement.
Post (top or side) burned, not affecting performance	2	(6) Suggest repair or replacement.
Post (top or side) corroded, affecting performance	A	Require repair.
Post (top or side) corroded, not affecting performance	2	Suggest repair.

Post (top or side) loose	A	Require replacement.
Post (top or side) melted, affecting performance	A	(6) Require repair or replacement.
Post (top or side) melted, not affecting performance	2	(6) Suggest repair or replacement.
Specific gravity low	B	(7) Further inspection required.
State of charge low	A	(7) Further inspection required.
Top dirty	2	Suggest cleaning battery.
Top wet	A	(8) Require cleaning battery. Further inspection required.
Vent cap loose	A	Require repair or replacement of vent cap.
Vent cap missing	C	Require replacement of vent cap.

(1) - DO NOT attempt to charge a frozen battery. Allow battery to warm thoroughly and then performance-test. If battery fails performance test, require replacement.
(2) - No service suggested or required unless the battery fails performance test, in which case, require replacement.
(3) - This phrase refers to a battery that fails to either accept and/or retain a charge using appropriate times listed in the Battery Charging Guide of the BCI Service Manual, battery charger operating manual, or battery manufacturer's specifications.
(4) - Determine cause of low fluid level. Refill to proper level(s) with water (distilled water preferred). Recharge battery and performance-test. If battery does not meet specifications, require replacement. If battery is sealed type (non-removable filler caps), require replacement.
(5) - The battery may meet battery manufacturer's specifications but test below the minimum specification defined by the vehicle's OEM for that vehicle.
(6) - Determine cause and correct prior to repair or replacement of part.
(7) - Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.
(8) - Check fluid level and adjust to manufacturer's specification. Suggest checking charging system for proper operation.

BATTERY CABLES

See BATTERY CABLES, WIRES AND CONNECTORS.

BATTERY CABLES, WIRES AND CONNECTORS

BATTERY CABLE, WIRE AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	(2) Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Exposed conductor at replacement (aftermarket) terminal end does not require repair or replacement.

BATTERY HOLD DOWN HARDWARE

See BATTERY TRAYS AND HOLD DOWN HARDWARE.

BATTERY TRAYS AND HOLD DOWN HARDWARE

BATTERY TRAY AND HOLD DOWN HARDWARE INSPECTION

Condition	Code	Procedure
Battery improperly secured	2	Suggest repair.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting		

performance	..	No service suggested or required.
Broken, affecting performance	A	Require repair or replacement.
Broken, not affecting performance	..	No service suggested or required.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Water drain clogged	A	Require repair.

BATTERY WIRES

See BATTERY CABLES, WIRES AND CONNECTORS.

BELTS

BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

BULB SOCKETS

BULB SOCKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

hardware.

Condition	Code	Procedure
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bulb seized in socket	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Broken	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector missing	C	Require replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Melted	A	(2) Require replacement.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of socket.
(2) - Determine cause and correct prior to replacement of part.

BULBS, SEALED BEAMS AND LEDS

NOTE: Does not include soldered-in components.

BULB, SEALED BEAM AND LED INSPECTION

Condition	Code	Procedure
Adjustment out of specification	B	Require repair or replacement.
Application incorrect	B	(1) Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not		

functioning	A	Require repair or replacement of hardware.
Base burned, affecting performance	A	(2) Require repair or replacement.
Base burned, not affecting performance	2	(2) Suggest repair or replacement.
Base corroded, affecting performance	A	Require repair or replacement.
Base corroded, not affecting performance	2	Suggest repair or replacement.
Base leaking	A	Require repair or replacement.
Base loose, affecting performance	B	Require repair or replacement.
Base loose, not affecting performance	1	Suggest repair or replacement.
Base melted	A	(2) Require replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Burned out	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	C	Require replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked	A	Require replacement.
Intermittent	A	Require replacement.
Lamp base melted	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Seized in socket	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not		

affecting performance	2	(2) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Application incorrect includes wrong bulb coating or color.
(2) - Determine cause and correct prior to repair or replacement of part.

CD PLAYERS

See TAPE PLAYERS AND CD PLAYERS.

CIGARETTE LIGHTER ASSEMBLIES

CIGARETTE LIGHTER ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	2	Suggest replacement.
Sticking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

CIRCUIT BREAKERS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

CLUTCH SWITCHES

See SWITCHES.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

CONTROL MODULES

CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

CRUISE CONTROL BRAKE SWITCHES

See SWITCHES.

CRUISE CONTROL CABLES

See CRUISE CONTROL LINKAGES AND CABLES.

CRUISE CONTROL CLUTCH SWITCHES

See SWITCHES.

CRUISE CONTROL LINKAGES AND CABLES

CRUISE CONTROL LINKAGE AND CABLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.

Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(2) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CRUISE CONTROL RESERVOIRS

See CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS.

CRUISE CONTROL TUBES

See CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS.

CRUISE CONTROL VACUUM DUMP RELEASE VALVES

CRUISE CONTROL VACUUM DUMP RELEASE VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Inoperative	A	(1) Require replacement.
Leaking	2	Suggest replacement.
Out of adjustment	B	(2) Further inspection required.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS

CRUISE CONTROL VACUUM HOSE, TUBE AND RESERVOIR INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Melted	A	Require replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Restricted	A	Require repair or replacement.
Surface cracks (dry-rotted)	1	Suggest replacement.

CRUISE CONTROL VEHICLE SPEED SENSORS

CRUISE CONTROL VEHICLE SPEED SENSOR INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment to vehicle manufacturer's specifications.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Housing cracked	A	Require replacement.
Internal resistance does not meet specifications	B	(2) Require replacement.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Loose	B	(3) Require adjustment to vehicle manufacturer's specifications.
Missing	C	Require replacement.
Output signal incorrect	B	(2) Require repair or replacement.
Surface contaminated	2	Suggest cleaning; identify and correct source.
Tip bent	B	Require replacement.
Tip broken	B	Require replacement.
Tip missing	B	Require replacement.
Wire lead burned	A	Require replacement.
Wire lead conductors exposed	B	Require replacement.
Wire lead corroded	A	Require replacement.
Wire lead open	A	Require replacement.
Wire lead shorted	A	Require replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Component failure may be caused by water intrusion into the wiring harness. Always check insulation for damage

and wiring for excessive resistance.
(3) - Some integral bearing assemblies with sensors may require replacement.

DEFOGGERS

See
HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

DEFROSTERS

See
HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

DELAYS

DELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not		

affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

DIMMERS

DIMMER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.

Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

ELECTRIC HEATERS

See HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

EQUALIZERS

See RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

FUSE BLOCKS

See FUSE BOXES AND BLOCKS.

FUSE BOXES AND BLOCKS

FUSE BOX AND BLOCK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Cover missing	C	Require replacement of cover.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Melted, affecting performance	A	(1) Require replacement.

Melted, not affecting performance	2	(1) Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS

FUSE, FUSIBLE LINK AND CIRCUIT BREAKER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Blown	A	(1) Require replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Missing	C	Require replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

FUSIBLE LINKS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

GAUGES

NOTE: Includes odometers, speedometers and tachometers (except cable-driven).

GAUGE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Leaking	A	.... Require replacement.
Lens broken	A	.... (2) Require repair or replacement.
Lens cloudy	2	.... (2) Suggest repair or replacement.
Lens missing	C	.... (2) Require repair or replacement.
Malfunctioning	A	.... (3) Require repair or replacement.
Mechanical head noisy ...	2	.. Suggest repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - If lens is available as a separate part, require replacement of lens only.
(3) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

GENERATORS

See ALTERNATORS AND GENERATORS.

GROUND CABLES AND STRAPS

GROUND CABLE AND STRAP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Insulation damaged, exposing conductors	2	Suggest replacement.
Loose	A	Require repair.
Missing	C	Require replacement.
Open	A	Require repair or replacement.
Resistance high	A	Require repair or replacement.
Terminal resistance (voltage drop) is out of specification	B	Require repair or replacement.
Voltage drop out of specification	B	Require repair or replacement.

GROUND STRAPS

See GROUND CABLES AND STRAPS.

HEADLIGHT ADJUSTERS

HEADLIGHT ADJUSTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, preventing adjustment	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Indicator broken	A	Require replacement.
Indicator missing	C	Require replacement.
Missing	C	Require replacement of

		adjusters.
Seized	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS)

HEATING ELEMENT (DEFROSTER, DEFOGGER, ELECTRIC HEATER AND SEAT) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

HORNS AND SIRENS

HORN AND SIREN INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require adjustment.
Sound quality poor	A	Require repair or replacement. Further inspection required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

IGNITION SWITCHES

See SWITCHES.

INDICATOR LIGHTS

INDICATOR LIGHT INSPECTION

Condition	Code	Procedure
Does not come on during bulb check	..	(1) Further inspection required.
Fails to function properly during test mode	..	(1) Further inspection required.
On constantly	..	(1) Further inspection required.

On intermittently		(1) Further inspection required.

(1) - See service manual for further information.

KEYLESS ENTRY KEYPADS AND TRANSMITTERS

KEYLESS ENTRY KEYPAD AND TRANSMITTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Malfunctioning	A	(2) Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.

KEYLESS ENTRY TRANSMITTERS

See KEYLESS ENTRY KEYPADS AND TRANSMITTERS.

LEDS

See BULBS, SEALED BEAMS AND LEDS.

LENSES

LENSE INSPECTION

Condition	Code	Procedure
Adjustment out of specification	B	.... Require repair.
Application incorrect ...	A	.... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Broken, affecting performance	A	.... Require replacement.
Broken, not affecting performance..............	..	.... No service suggested or required.
Cracked	A	.... Require replacement.
Discolored	A	.... Require replacement.
Leaking	A	.. Require repair or replacement.
Melted, affecting performance	A	.... Require replacement.
Melted, not affecting performance	2	.... Suggest replacement.
Missing	C	.... Require replacement.

MICROPHONES

See SPEAKERS AND MICROPHONES.

MIRRORS (ELECTROCHROMATIC AND HEATED)

MIRROR (ELECTROCHROMATIC AND HEATED) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Broken	A	.. Require repair or replacement.
Connector broken	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Cracked	A	.... Require replacement.
Inoperative	A	.... (2) Require replacement.
Missing	C	.... Require replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or

		replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

MOTORS

MOTOR INSPECTION

Condition	Code	Procedure
Amperage draw out of specification	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent	A	Require repair or replacement.
Bracket broken	A	Require repair or replacement.
Bracket cracked	A	Require repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	No service suggested or required.
Bracket missing	C	Require replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Drive mechanism damaged, affecting performance	A	(2) Require repair or replacement.
Drive mechanism damaged, not affecting performance	2	(2) Suggest repair or replacement.
Fails to disengage	A	Require repair or replacement.

Housing broken, affecting performance	2	Suggest repair or replacement.
Housing broken, not affecting performance	..	No service suggested or required.
Housing cracked, affecting performance	A	Require repair or replacement.
Housing cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(3) Require repair or replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	..	No service suggested or required.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(4) Further inspection required.
Resistance out of specification	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Further inspection required to determine cause.
(3) - Inoperative includes intermittent operation.

(4) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

NEUTRAL SAFETY SWITCHES

See SWITCHES.

ODOMETERS

See GAUGES.

ODOMETERS, SPEEDOMETERS AND TACHOMETERS (CABLE-DRIVEN)

ODOMETER, SPEEDOMETER AND TACHOMETER (CABLE-DRIVEN) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Drive cable broken	A	Require replacement.
Drive cable noisy	2	Suggest repair or replacement.
Inoperative	A	(2) Further inspection required.
Leaking	A	Require replacement.
Lens broken	A	(3) Require repair or replacement.
Lens cloudy	2	(3) Suggest repair or replacement.
Lens missing	C	(3) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - If lens is available as a separate part, require

replacement of lens only.
(3) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

PULLEYS

PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.

RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS

RECEIVER, AMPLIFIER, EQUALIZER AND SUB-WOOFER VOLUME CONTROL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Sound quality poor	A	(3) Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.

Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

RELAY BOXES

RELAY BOX INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Cover missing	C	Require replacement of cover.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Melted, affecting performance	A	(1) Require replacement.
Melted, not affecting		

performance	2	(1) Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

RELAYS

RELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Housing broken	A	Require replacement.
Housing cracked	2	Suggest replacement.
Inoperative	A	(1) Require replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

SEALED BEAMS

See BULBS, SEALED BEAMS AND LEDS.

SEAT HEATERS

See
HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

SECURITY ALARM SENSORS

SECURITY ALARM SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

SIRENS

See HORNS AND SIRENS.

SOLENOIDS

See ACTUATOR MOTORS (SOLENOIDS) (ELECTRIC).

NOTE: For starter solenoids that are integral to the starter assembly, see STARTERS.

NOTE: For starter relays, see RELAYS.

SPEAKERS AND MICROPHONES

SPEAKER AND MICROPHONE INSPECTION

Condition	Code	Procedure
Application incorrect	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Membrane torn	A	Require replacement.
Missing	C	Require replacement.
Polarity reversed	A	Require repair.
Sound quality poor	A	(3) Require repair or replacement. Further inspection required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical

interference.

SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES

SPEEDOMETER AND TACHOMETER LINKAGE AND CABLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

SPEEDOMETER CABLES

See SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES.

SPEEDOMETERS

See GAUGES.

STARTERS

NOTE: To prevent misdiagnosis, care should be taken to eliminate the possibilities of mechanical problems or high resistance in power and/or ground circuits.

STARTER INSPECTION

Condition	Code	Procedure
Amperage draw does not meet OEM specifications	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	(1) Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance)	..	No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Drive gear damaged, affecting performance	A	(2) Require repair or replacement.
Drive gear damaged, not affecting performance	2	(2) Suggest repair or replacement.
Fails to disengage	A	Require repair or replacement.
Housing broken, affecting performance	2	Require repair or replacement.
Housing broken, not		

affecting performance	..	No service suggested or required.
Housing cracked, affecting performance	A	Require repair or replacement.
Housing cracked, not affecting performance	2	Suggest repair or replacement.
Inoperative	A	(3) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Shimmed incorrectly	B	Require repair.
Starter shaft bushing missing	C	(4) Require replacement.
Starter shaft bushing worn, affecting performance	A	Require replacement.
Starter shaft bushing worn, not affecting performance	1	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(5) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inspect block or bell housing mounting surface.
(2) - Further inspection required to determine cause. Require inspection of ring gear.
(3) - Inoperative includes intermittent operation.
(4) - Bushing may be in bell housing.
(5) - Determine cause and correct prior to repair or replacement of part.

SUB-WOOFER VOLUME CONTROLS

See
RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

SWITCHES

SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting		

performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won't return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TACHOMETER CABLES

See SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES.

TACHOMETERS

See GAUGES.

TAPE PLAYERS AND CD PLAYERS

TAPE PLAYER AND CD PLAYER INSPECTION

Condition	Code	Procedure
Attaching hardware		

broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Skips	A	Require repair or replacement.
Sound quality poor	A	(3) Require repair or replacement.
Speed incorrect	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

TENSIONERS

TENSIONER INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement

		of hardware.
Bearings worn	1	Suggest replacement.
Belt tension incorrect	B	Require adjustment or repair.
Cracked	2	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Seized	A	Require repair or replacement.

TIMERS

TIMER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

(2) - Inoperative includes intermittent operation or out of OEM specification.

TIRE PRESSURE SENSORS

TIRE PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

TRANSCEIVERS

TRANSCEIVER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Sound quality poor	A	(3) Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting		

performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

TRANSDUCERS

TRANSDUCER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Drive mechanism damaged, affecting performance	A	(2) Require repair or replacement.
Drive mechanism damaged, not affecting performance	2	(2) Suggest repair or replacement.
Inoperative	A	(3) Require repair or replacement.
Leaking (vacuum/fluid/air)	A	Require replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	..	No service suggested or required.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement

Condition	Code	Procedure
		of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Out of adjustment	B	(4) Further inspection required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Further inspection required to determine cause.
(3) - Inoperative includes intermittent operation or out of specification.
(4) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

VACUUM ACCUMULATORS (RESERVOIRS)

VACUUM ACCUMULATOR (RESERVOIR) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.

VACUUM RESERVOIRS

See VACUUM ACCUMULATORS (RESERVOIRS).

VOLTAGE REGULATORS

VOLTAGE REGULATOR INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - NOTE: Inoperative includes intermittent operation or out of OEM specification.

WASHER FLUID LEVEL SENDERS

WASHER FLUID LEVEL SENDER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.

Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

WASHER PUMPS

WASHER PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.

Wire lead corroded	A ..	Require repair or replacement.
Wire lead open	A ..	Require repair or replacement.
Wire lead shorted	A ..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

WIPER ARMS AND BLADES

NOTE: Windshield coatings or waxes can cause blades to not function as intended. Clean surface before making final judgment about blade replacement.

WIPER ARM AND BLADE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Attaching socket stripped	A	Require replacement.
Bent	A ..	Require repair or replacement.
Loose	2 ..	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2 ..	Suggest repair or replacement.
Size incorrect	2	Suggest replacement.
Tension insufficient	B ..	Require repair or replacement.
Torn	A	Require replacement.
Worn, affecting performance	A	Require replacement.
Worn, not affecting performance	1	Suggest replacement.

WIPER BLADES

See WIPER ARMS AND BLADES.

WIPER HOSES AND NOZZLES

WIPER HOSE AND NOZZLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Blocked	A ..	Require repair or replacement.

Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Spray pattern incorrect	2	Suggest repair or replacement.
Surface cracks (dry-rotted)	1	Suggest replacement.

WIPER LINKAGES

WIPER LINKAGE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Attaching stud stripped	A	Require replacement.
Bent	A	Require repair or replacement.
Inoperative	A	(1) Require replacement.
Loose	2	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Tension insufficient	B	Require repair or replacement.
Worn, affecting performance	A	Require replacement.
Worn, not affecting performance	1	Suggest replacement.

(1) - Inoperative includes intermittent operation.

WIPER NOZZLES

See WIPER HOSES AND NOZZLES.

WIPER PUMP RESERVOIRS

WIPER PUMP RESERVOIR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cap missing	C	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

ELECTRICAL COMPONENT LOCATOR

1993 Toyota Celica

1993 ELECTRICAL COMPONENT LOCATION
Toyota Electrical Components

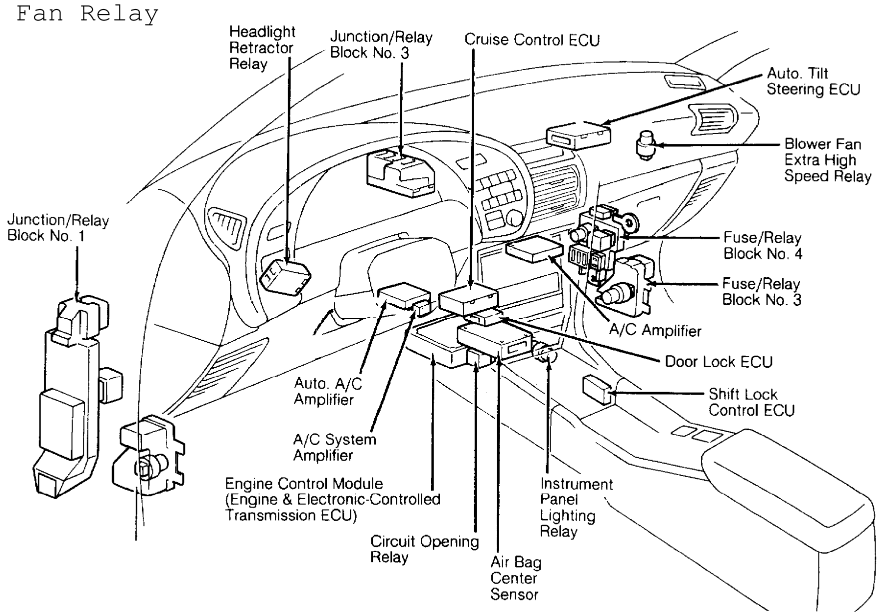
Toyota; Celica

SAFETY PRECAUTION

WARNING: When working on vehicles equipped with Supplemental Restraint System (SRS), never apply electrical voltage to the system. This could cause the SRS (air bag) to be deployed. For complete Air Bag Safety precautions see AIR BAGS article in ACCESSORIES/SAFETY EQUIPMENT Section.

BUZZERS, RELAYS & TIMERS

Component	Component Location
ABS Control Relay	Mounted to top right side of radiator.
A/C Condenser Fan Relays No. 2 & 3	On relay block No. 5, right front of engine compartment.
A/C Magnetic Clutch Relay	On relay block No. 5, right front of engine compartment.
Blower Fan Relay	



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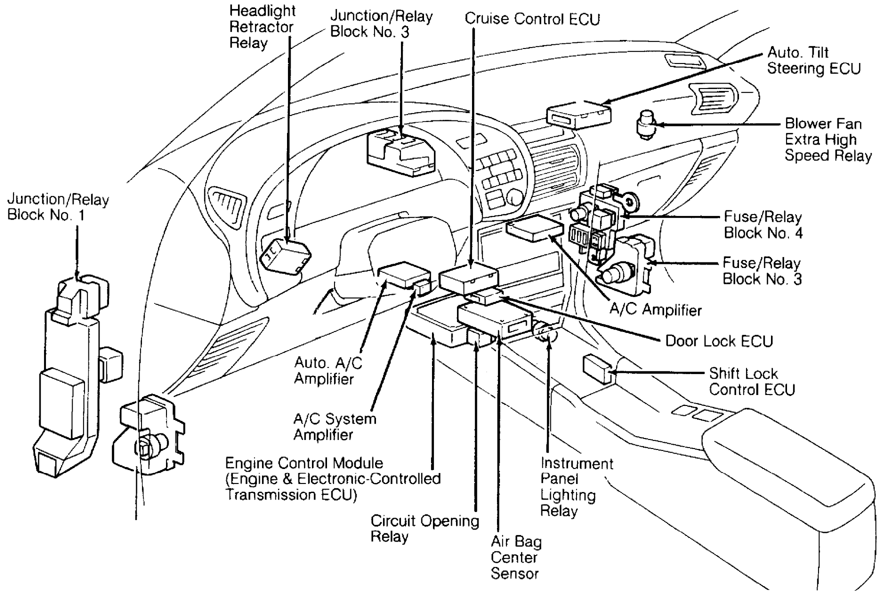
Component Location	Behind right side of dash, above glove box.
Bulb Check Relay	On rear of instrument cluster.



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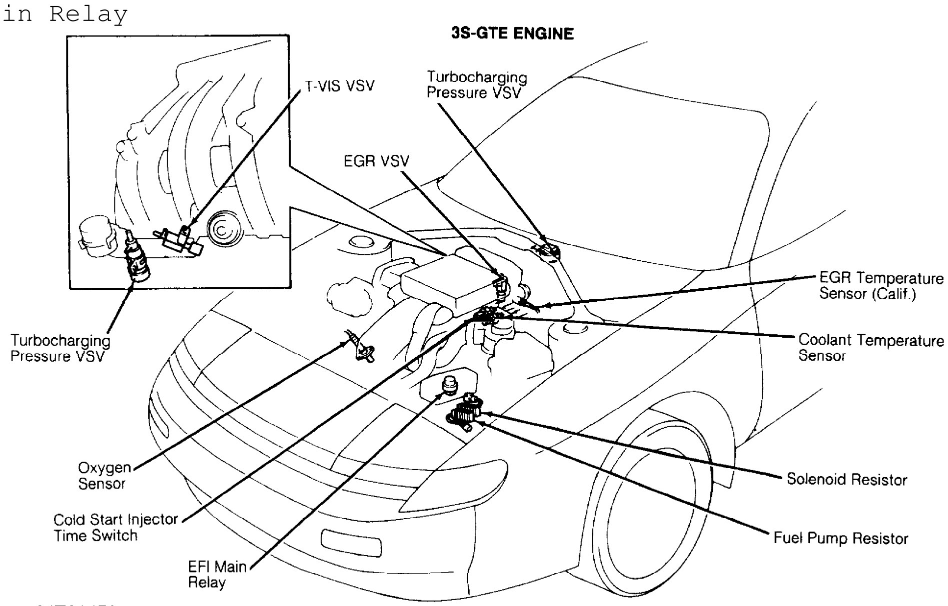
Circuit Opening Relay — Under center of dash, forward of engine control module.

Defogger Relay — On junction/relay block No. 1, behind left kick panel.

Door Lock Relay — Mounted under center console, in front of gear selector.

EFI Main Relay



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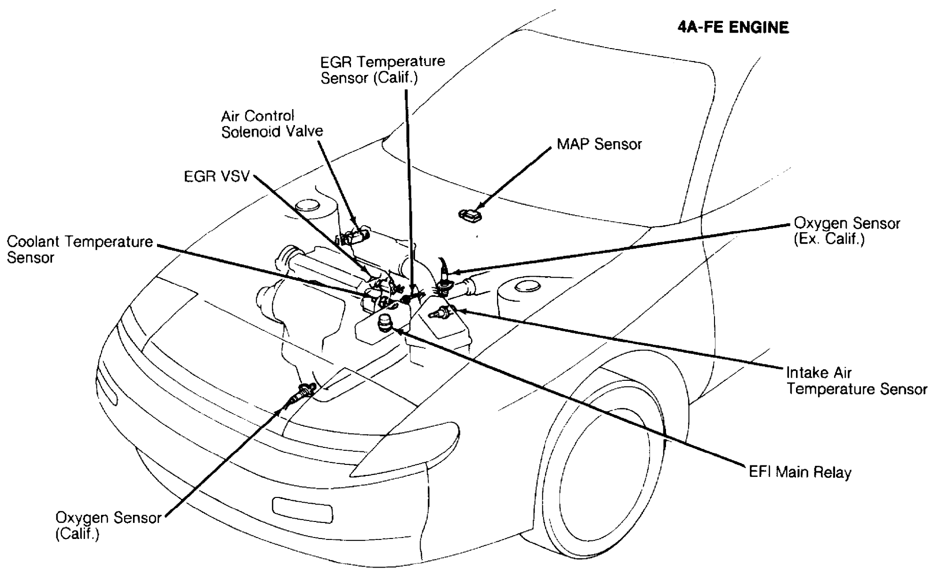
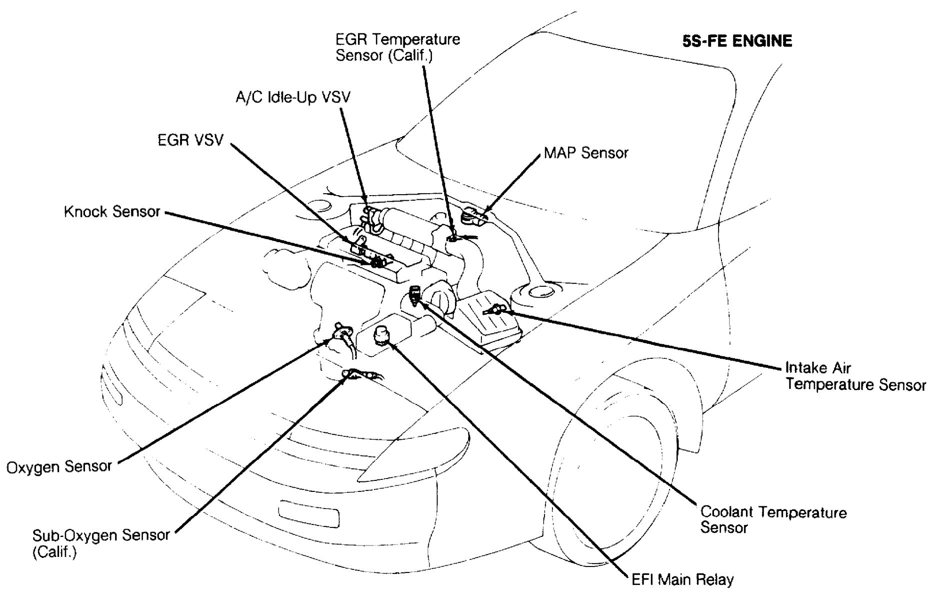
(3S-GTE) — On junction/relay block No. 2, near battery.

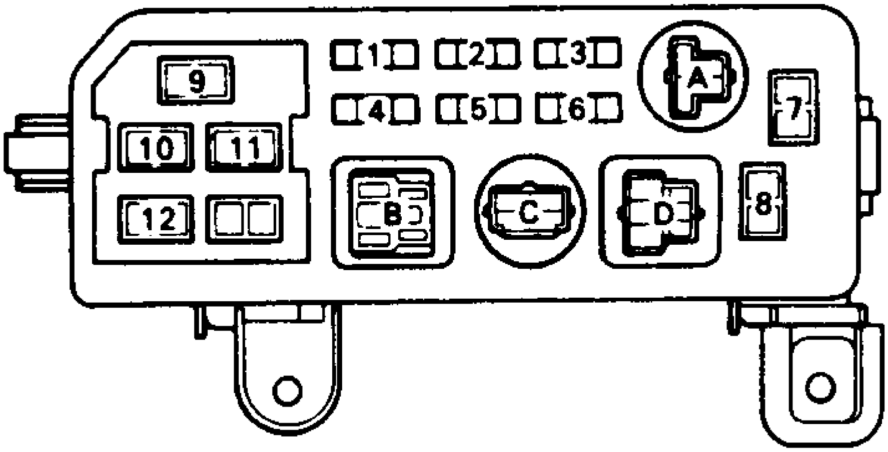


(4S-FE)	On junction/relay block No. 2, near battery.



(5S-FE)	On junction/relay block No. 2, near battery.
Engine Main Relay	On junction/relay block No. 2, near battery.
Foglight Relay	On fuse/relay block No. 3, right side kick panel.
Fuel Pump Relay (All-Track/4WD)	On relay block No. 5, right front of engine compartment.

4A-FE & 5S-FE SHOWN; 3S-GTE SIMILAR



JUNCTION RELAY BLOCK NO. 2

FUSES & FUSIBLE LINKS (FL)
1. Headlight (LH)
2. Headlight Retractor
3. Headlight (RH)
4. EFI
5. Dome
6. Hazard-Horn
7. Radiator Cooling Fan (FL)
8. Condenser Cooling Fan (FL)
9. ALT (FL)
10. AM2 (FL)
11. AM1 (FL)
12. ABS (FL)

RELAYS
A. A/C Fan Relay No. 1
B. Headlight Control Relay
C. EFI Main Relay
D. Engine Main Relay

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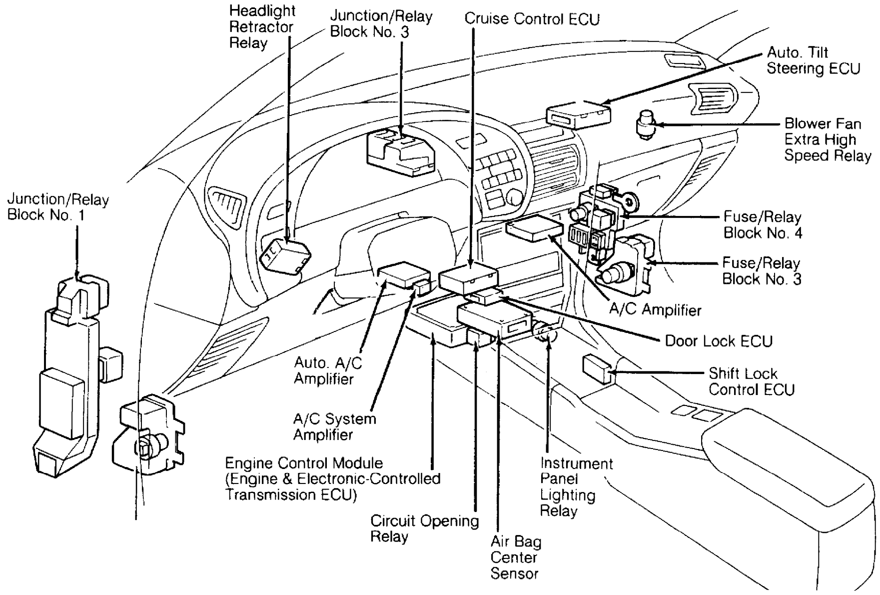
Headlight Control Relay	On junction/relay block No. 2, near battery.



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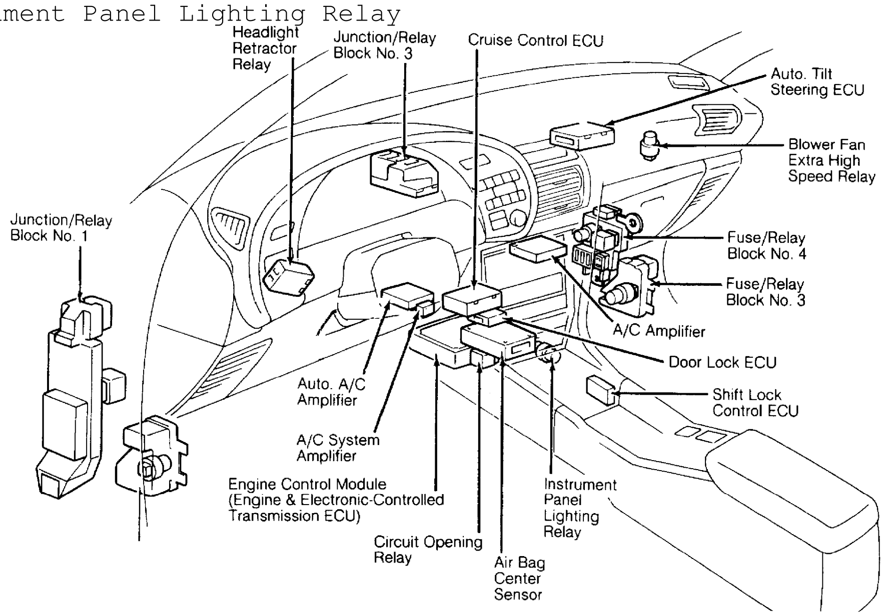
Headlight Retractor Relay	Behind left side of dash.
Heater Relay	On fuse/relay block No. 4, behind right kick panel.
Horn Relay	On relay block No. 5, right front of engine compartment.

Instrument Panel Lighting Relay



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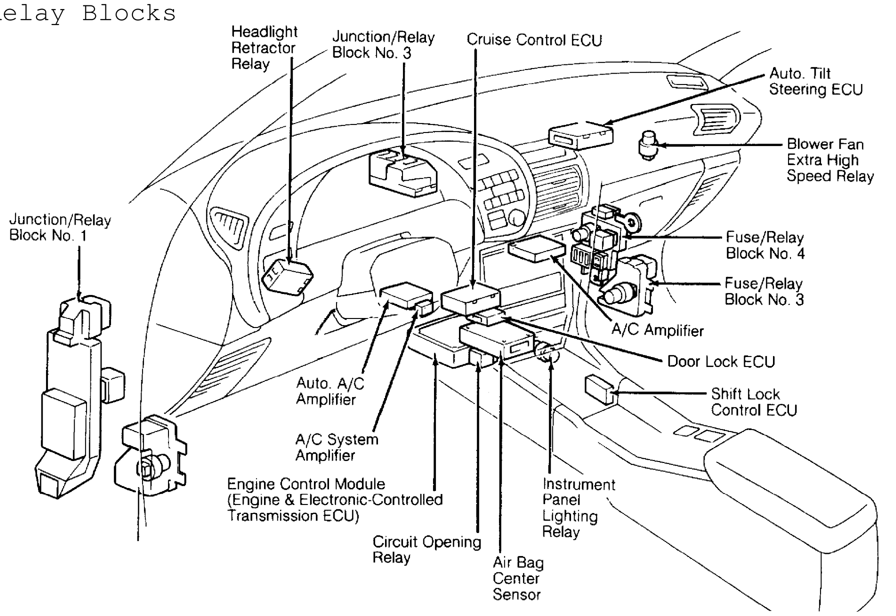
Component Location

	Behind center of dash, mounted near right rear of ashtray bracket.
Integration Relay	On back side of junction/relay block No. 1.
Power Main Relay	On fuse/relay block No. 2,

	behind left kick panel.
Radiator Fan Relay No. 1	On junction block No. 2, near battery.
Rear Wiper Relay	Inside liftgate, on rear window wiper motor.
Starter Relay (M/T)	On fuse/relay block No. 4, behind right side kick panel.
Sun Roof Control Relay	In front of sun roof opening.
Taillight Control Relay	On junction/relay block No. 1, behind left kick panel.
Turn Signal/Hazard Flasher Relay	On junction/relay block No. 1, behind left kick panel.
Turn Signal/Hazard Flasher Relay	On junction/relay block No. 1, behind left kick panel.

CIRCUIT PROTECTION DEVICES

Component	Component Location
Fuse/Relay Blocks	



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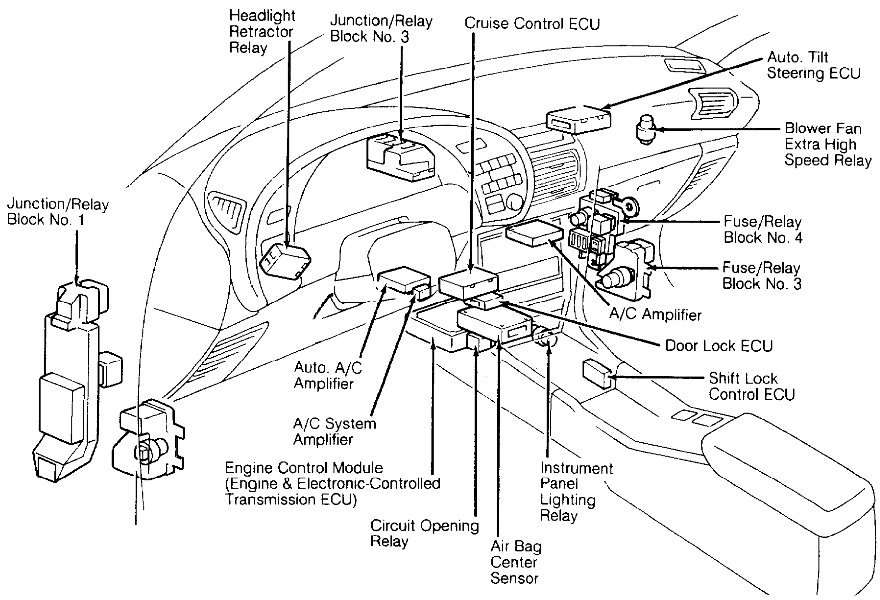
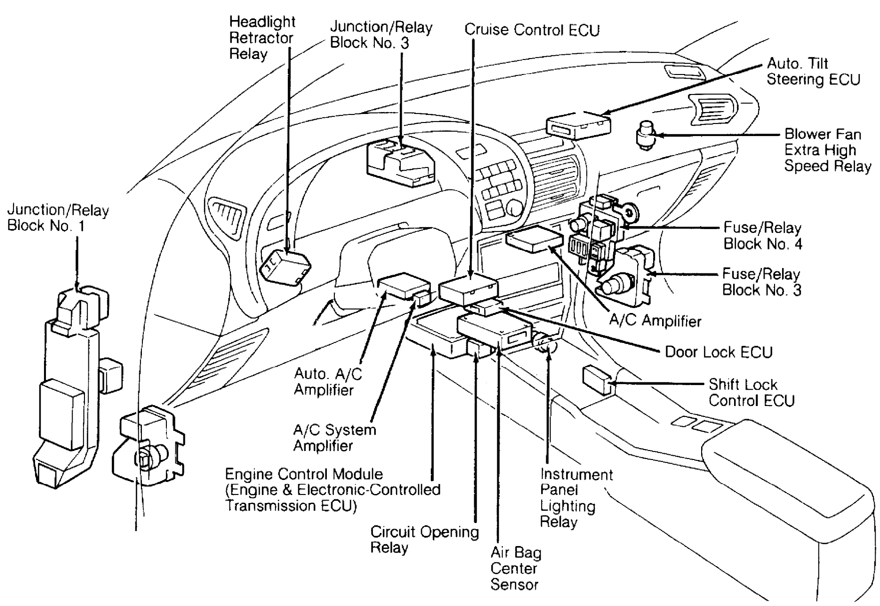
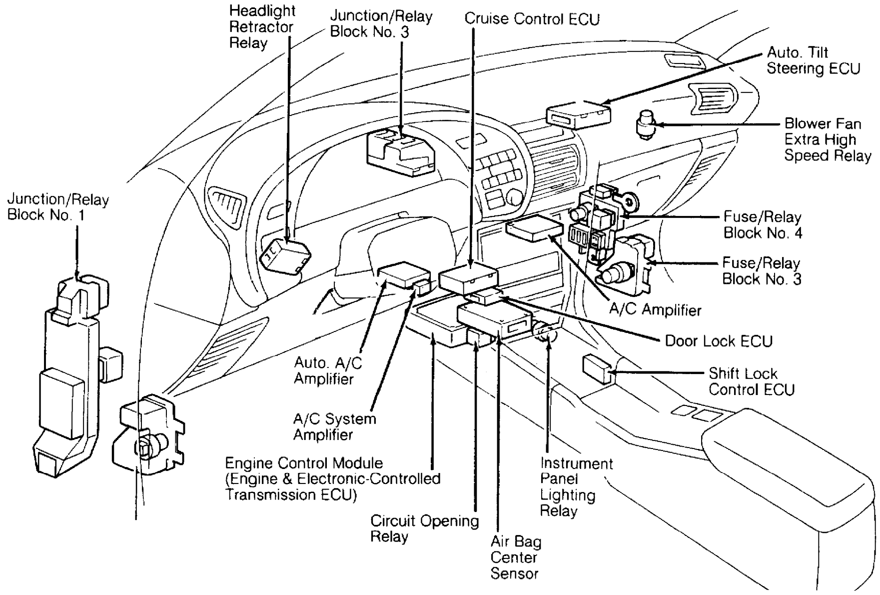
No. 2	Beside junction/relay block No. 1, behind left kick panel.



No. 3 Behind right kick panel.



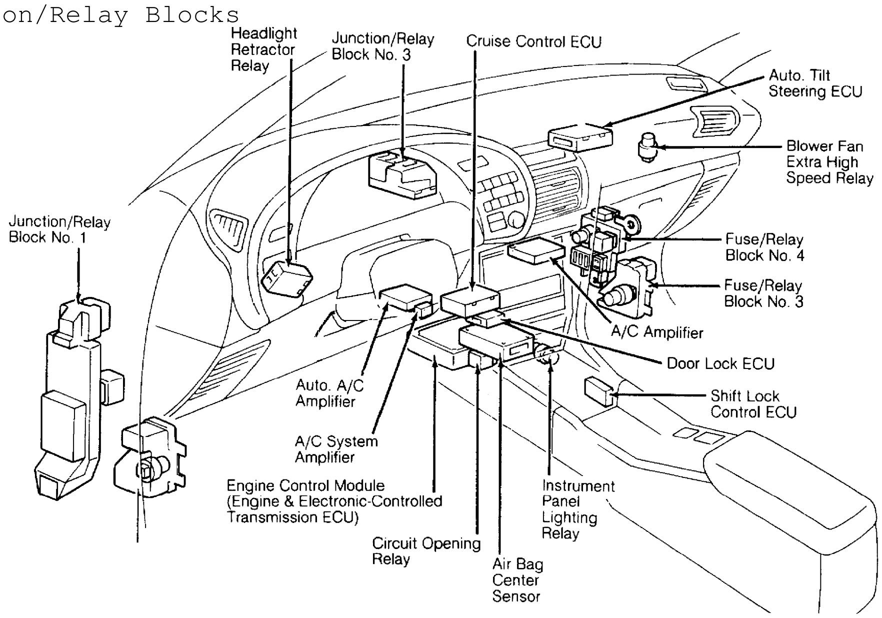
No. 4 Behind right kick panel.



94A31468

No. 5 — Right front corner of engine compartment.

Junction/Relay Blocks



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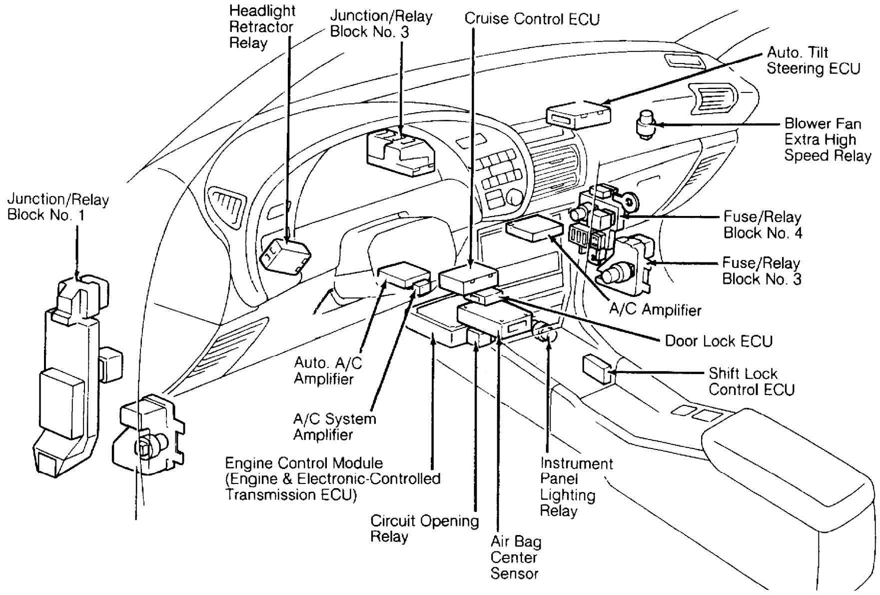
No. 1 — Behind left kick panel.

No. 4 — In engine compartment, near battery.

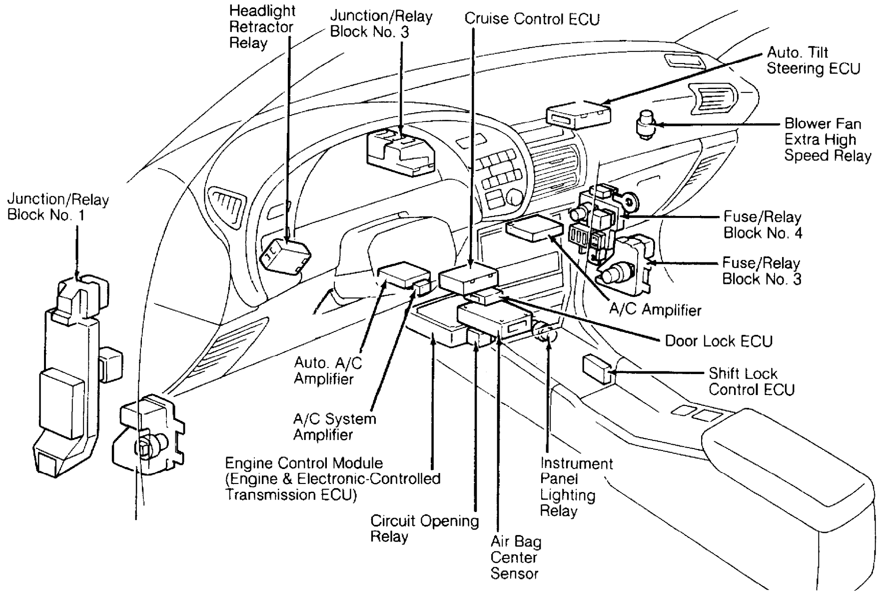


94A31468

No. 3	Behind left side of dash, behind instrument cluster.

CONTROL UNITS

Component	Component Location
ABS ECU (Convertible)	In trunk, behind left rear quarter panel.
ABS ECU (Except Convertible)	In trunk, behind right rear quarter panel.



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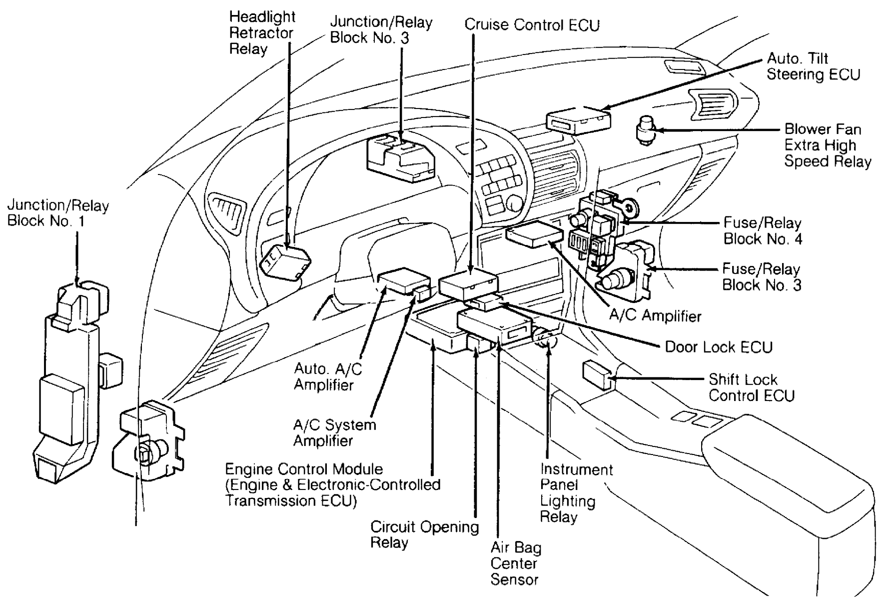
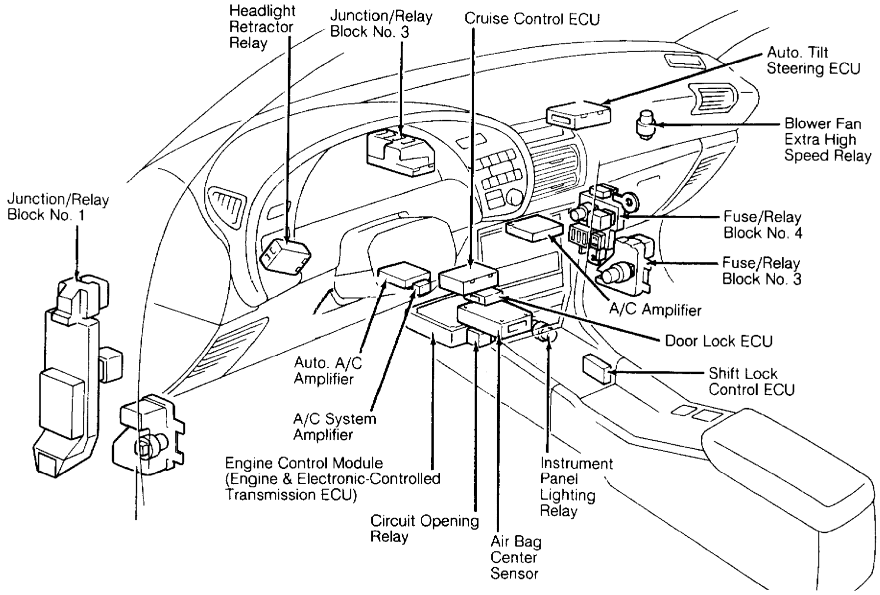
Auto. Tilt Steering ECU	Behind right side of dash, above glove box.



94A31468

Cruise Control ECU	Behind center of dash, below radio.



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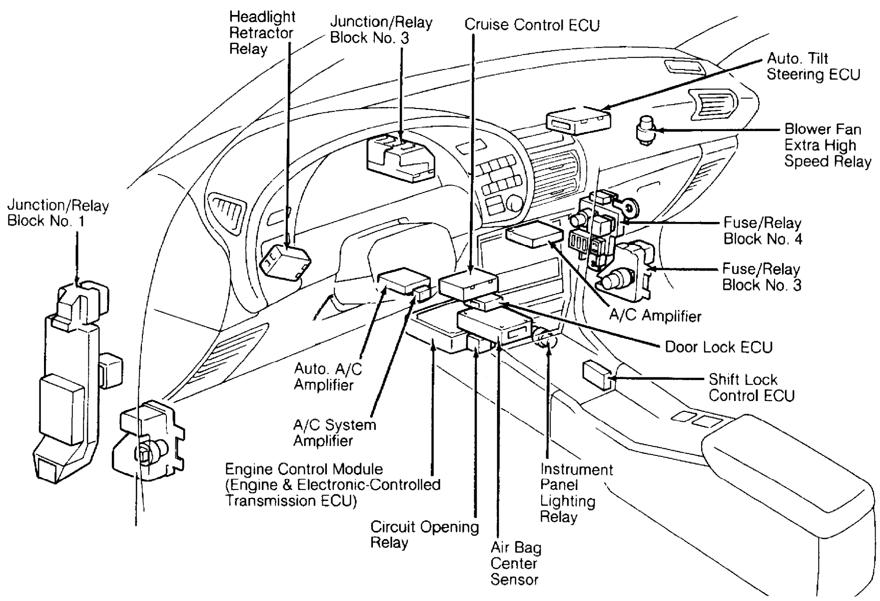
Door Lock ECU

Behind center of dash behind ashtray.

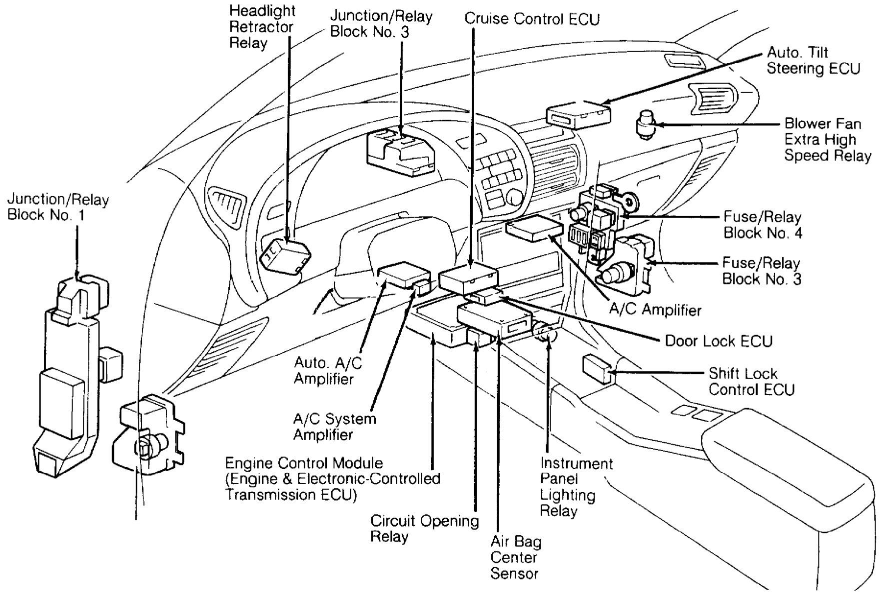


94A31468

Engine Control Module (ECM)

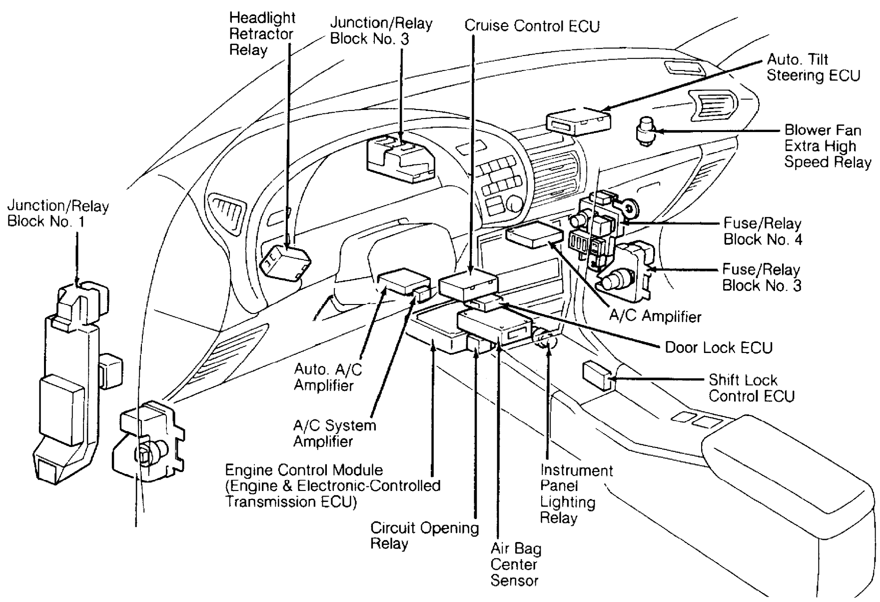
Behind front of center console.

Electronic-Controlled Transmission (ECU)



94A31468

Component Location	Integrated within engine control module.
Engine Oil Level ECU	Behind rear seat, mounted to floor in trunk.



94A31468

Shift Lock ECU	Under center floor console, at base of gear selector.

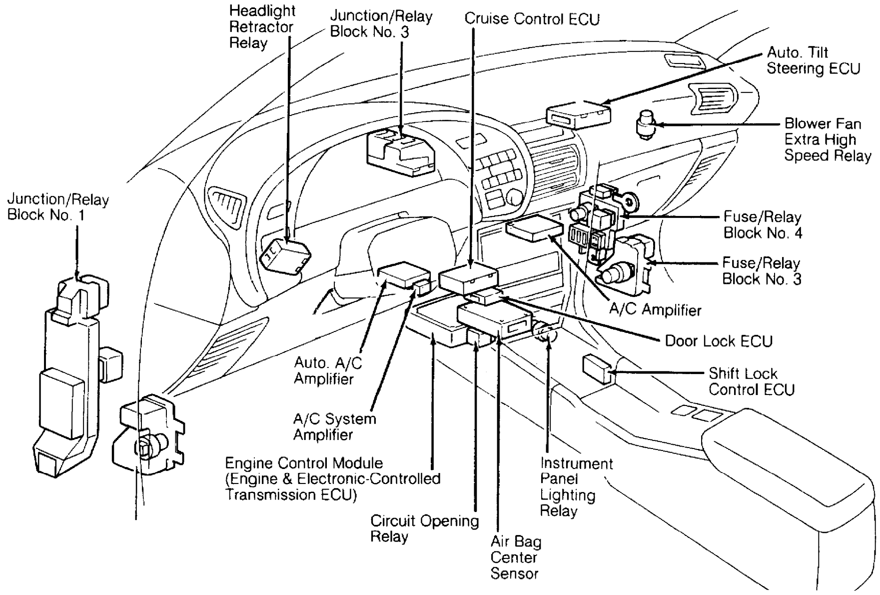
MOTORS

Component	Component Location
ABS Actuator	Right front corner of engine

	compartment.
A/C-Heater System	
Air Inlet Servomotor	Behind glove box, on top left side of blower housing.
Air Mix Control Servomotor	Under center of dash, on front of A/C-heater core housing.
Airflow Mode Control Servomotor	Above accelerator pedal, mounted to A/C-heater housing.
Auto. Tilt Steering Motor	Inside steering column tilt assembly.
Front Wiper Motor	On left rear corner of engine compartment, near brake booster.
Rear Wiper Motor	Inside liftgate.
Sun Roof Motor	In front of sun roof opening, above control switch.
Windshield Washer Motor	On right front corner of engine compartment.

SENDING UNITS & SENSORS

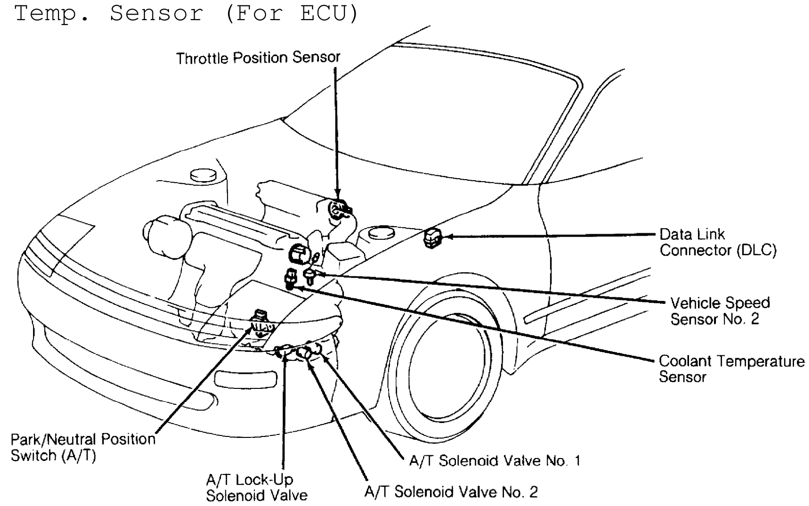
Component	Component Location
ABS Deceleration Sensor (4WD)	Behind rear seat, mounted to floor of trunk.
ABS Speed Sensors	One sensor mounted to each wheel hub.
A/C-Heater System	
Ambient Temp. Sensor	On front grille of vehicle, near receiver-drier.
Coolant Temp. Sensor (Auto. A/C)	On heater core housing.
In-Car Temp. Sensor (Auto. A/C)	Behind A/C control panel.
Revolution Sensor	On rear of A/C compressor.
Solar Sensor (Auto. A/C)	On top right side of dash.
Air Bag	



94A31468

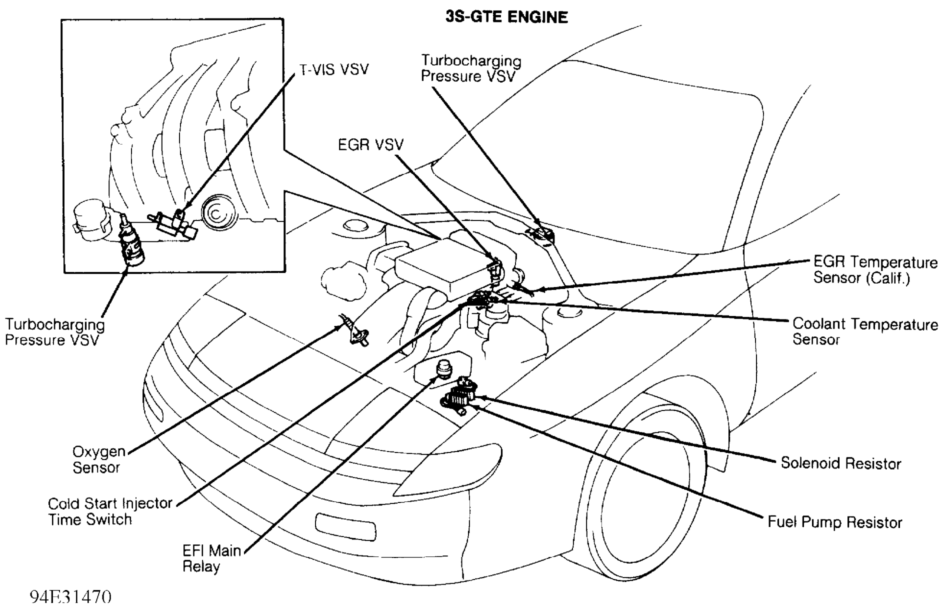
Center Sensor	Mounted under center console, in front of gear selector.
Impact Sensors	On top of left and right inner fender panels.
Coolant Temp. Gauge Sending Unit	
3S-GTE & 5S-FE	Threaded into under side of coolant outlet flange.
4A-FE	Threaded into top of coolant outlet flange.

Coolant Temp. Sensor (For ECU)



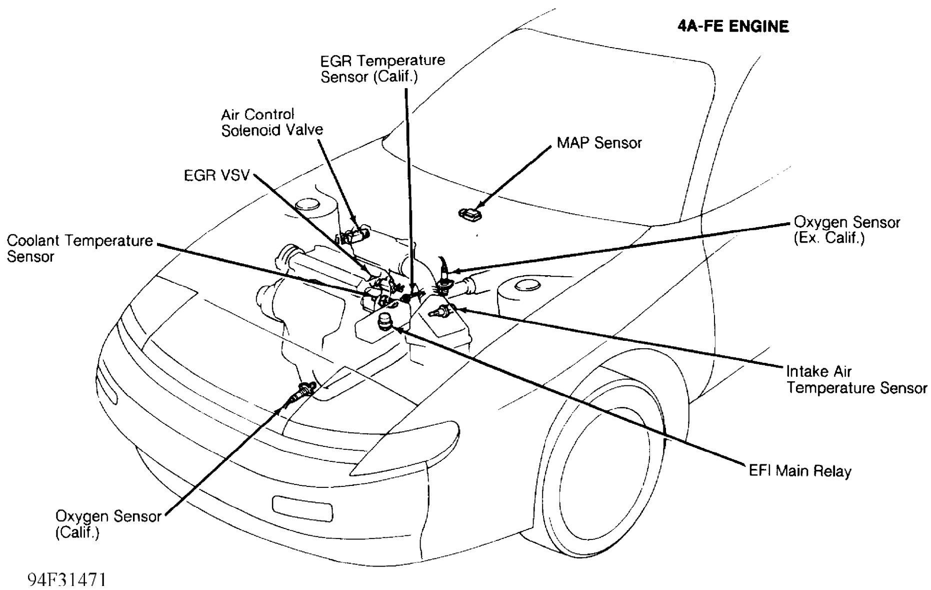
94B31469

(3S-GTE)	Threaded into top of coolant outlet flange nearest cylinder head.



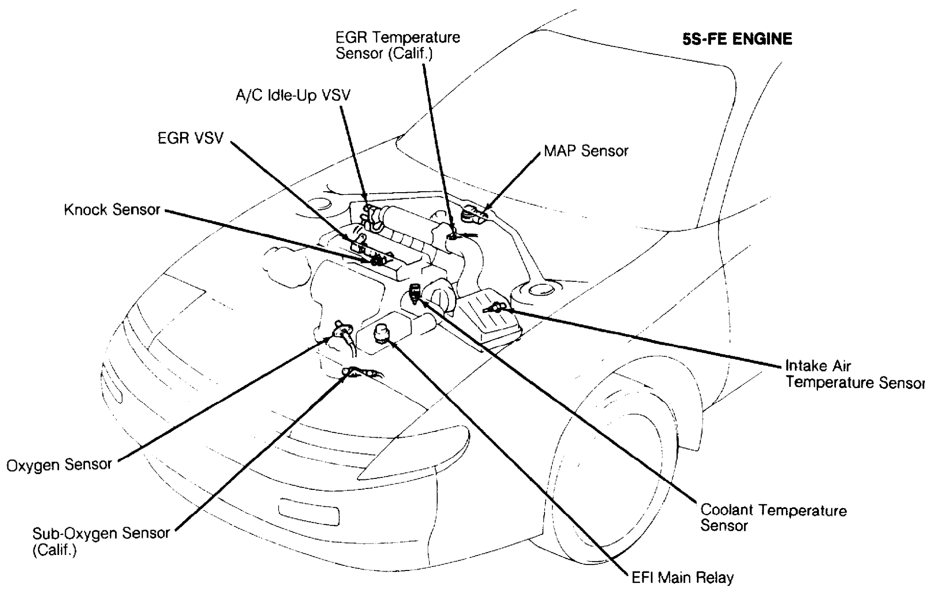
(3S-GTE)

Threaded into top of coolant
outlet flange nearest cylinder
head.



(4A-FE)

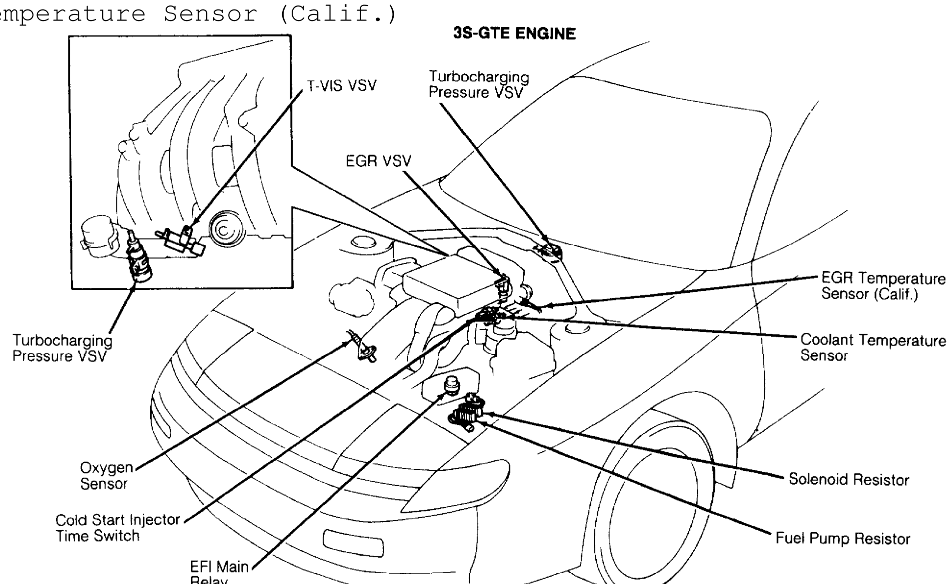
Threaded into top of coolant
outlet flange nearest cylinder
head.



94G31472
(5S-FE)

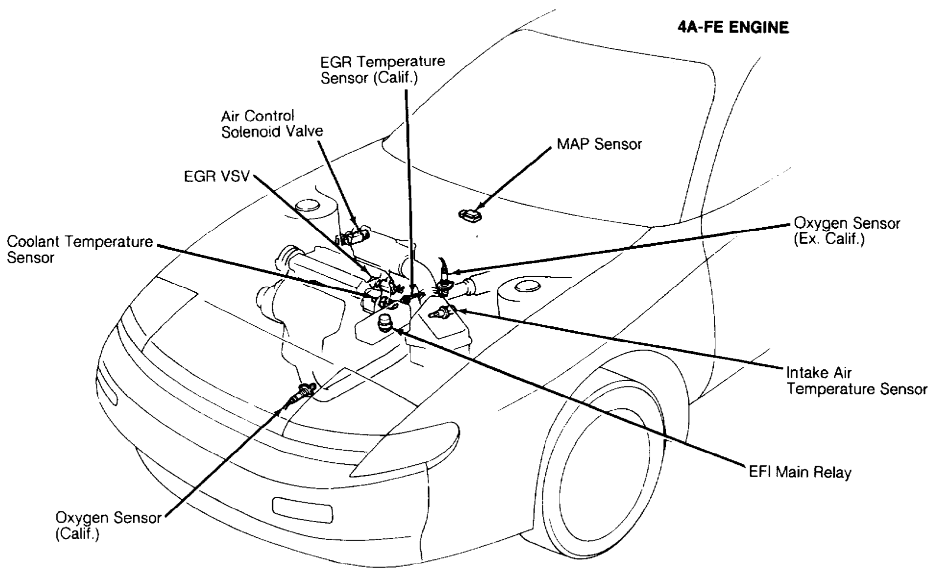
Threaded into top of coolant outlet flange nearest cylinder head.

EGR Temperature Sensor (Calif.)

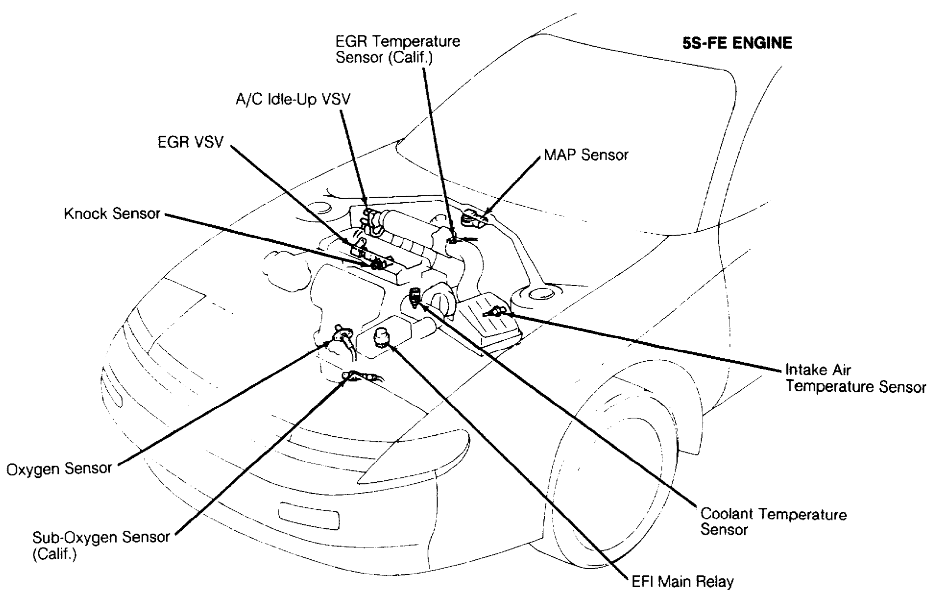


94E31470
(3S-GTE)

Mounted on side of EGR valve.

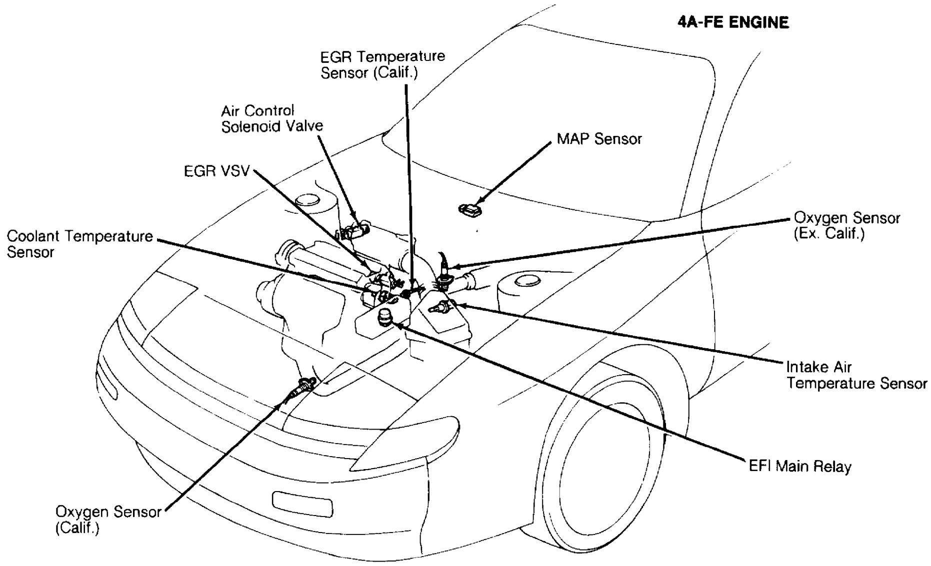


94F31471
(5S-FE) Mounted on side of EGR valve.



94G31472
(5S-FE) Mounted on side of EGR valve.

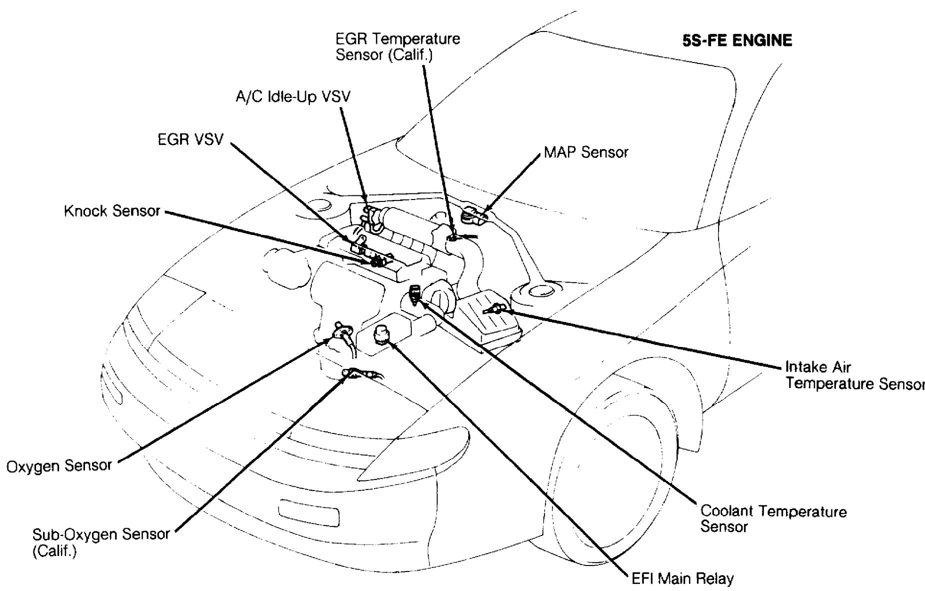
Intake Air Temperature Sensor



94F31471

(4E-FE)

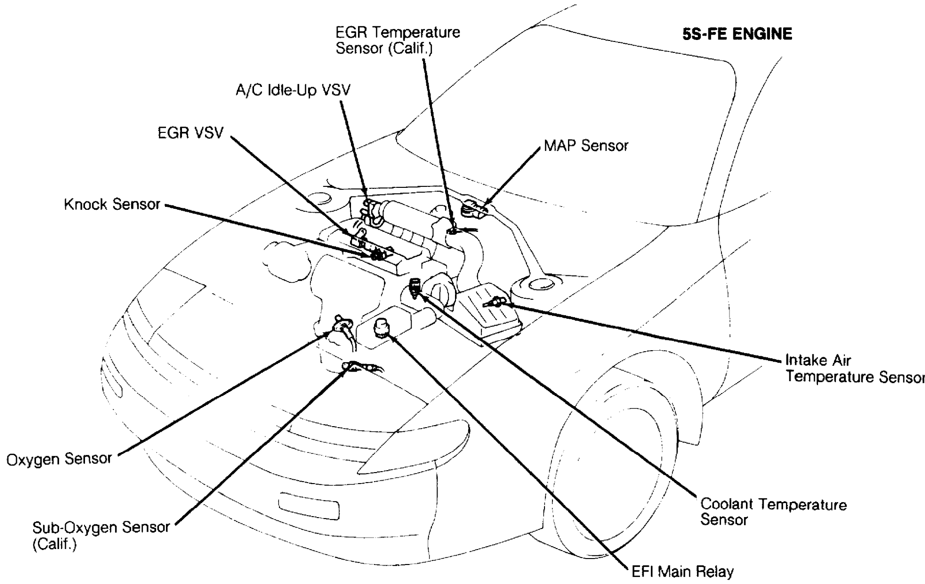
Mounted to air cleaner assembly or in air intake duct.



94G31472

(5E-FE)

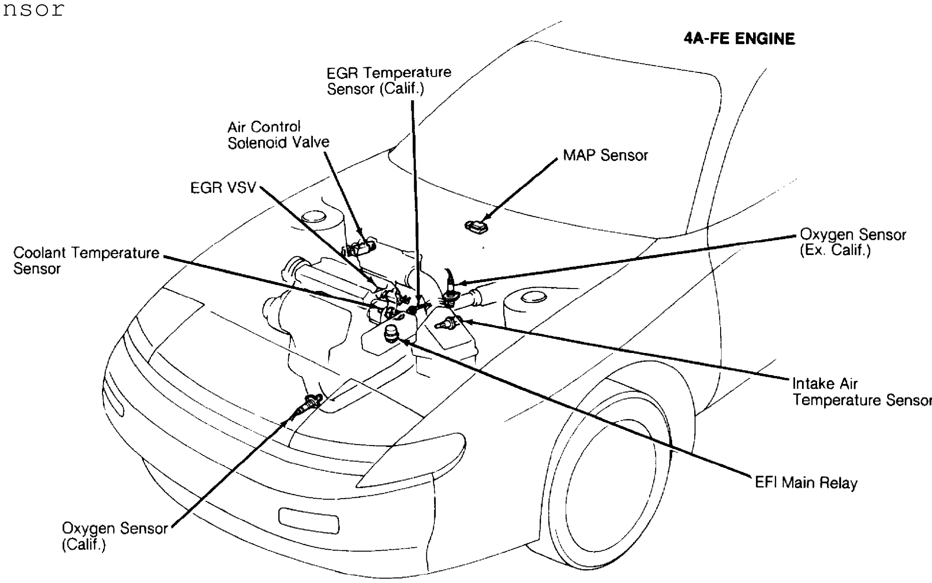
Mounted to air cleaner assembly or in air intake duct.



94G31472

Knock Sensor (3S-GTE & 5S-FE)   On intake side of cylinder block, near No. 1 cylinder.

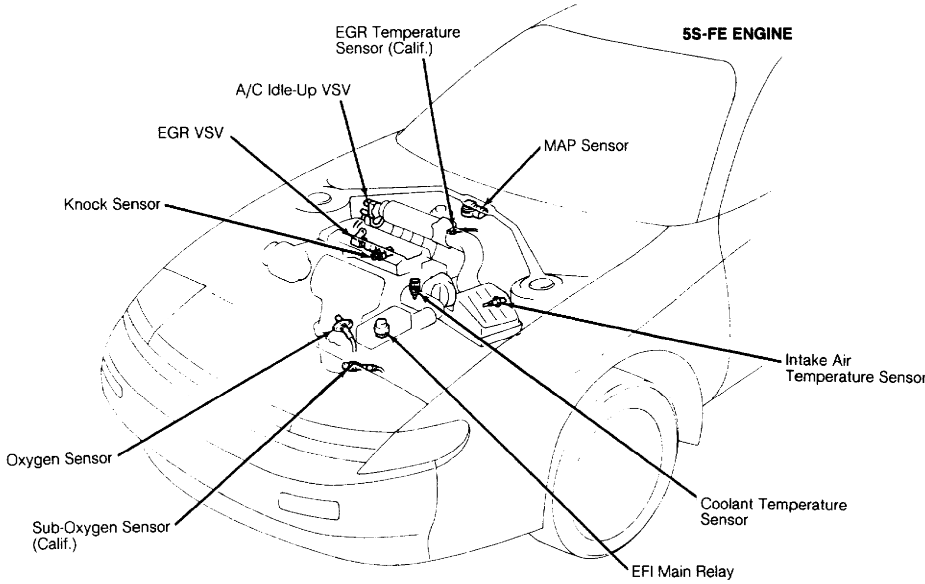
MAP Sensor



94F31471

(4S-FE Shown 4S-FE Similar)   In engine compartment, near center of firewall.

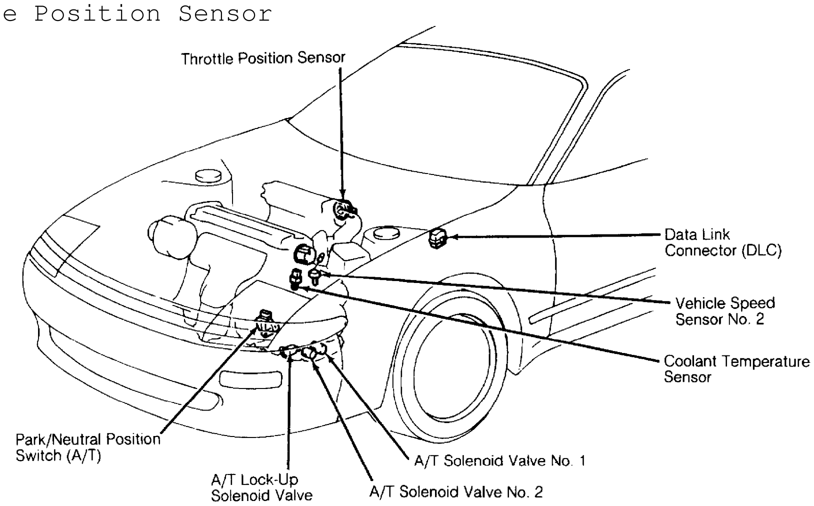
Speed Sensor



(5S-FE

On rear of speedometer assembly.

Throttle Position Sensor



(5S-FE Shown 4S-FE Similar)

On throttle body housing.

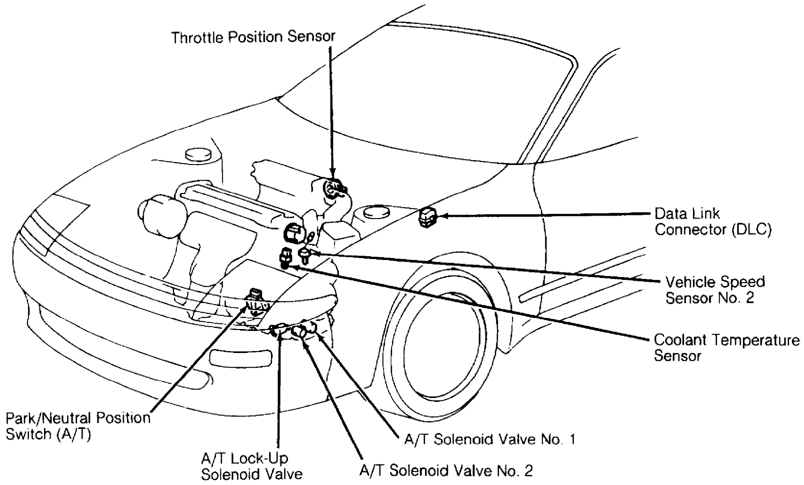
Turbo Pressure Sensor (3S-GTE)

On center of firewall.

Vehicle Speed Sensors

No. 1

On rear of speedometer assembly.



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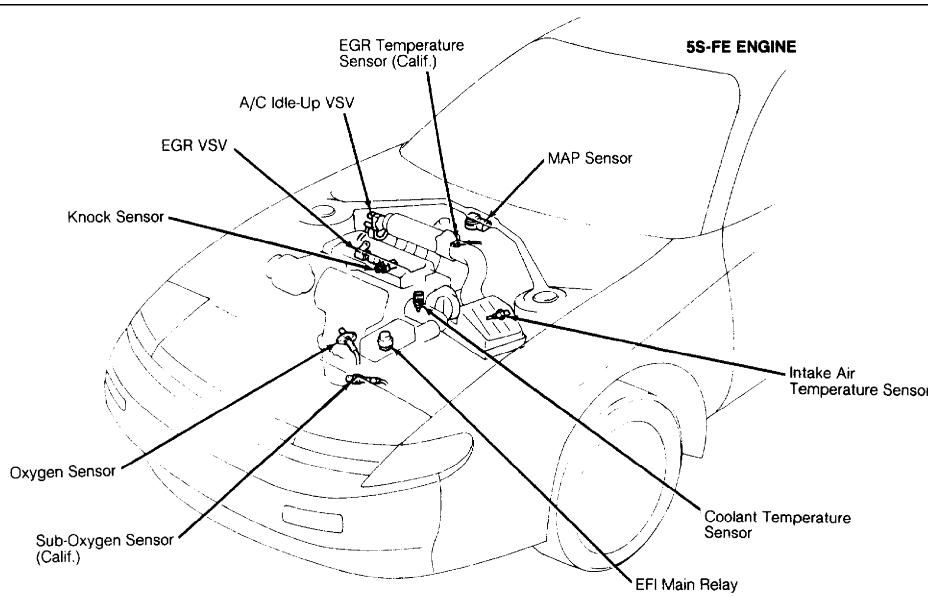
No. 2	Mounted to top of transaxle.

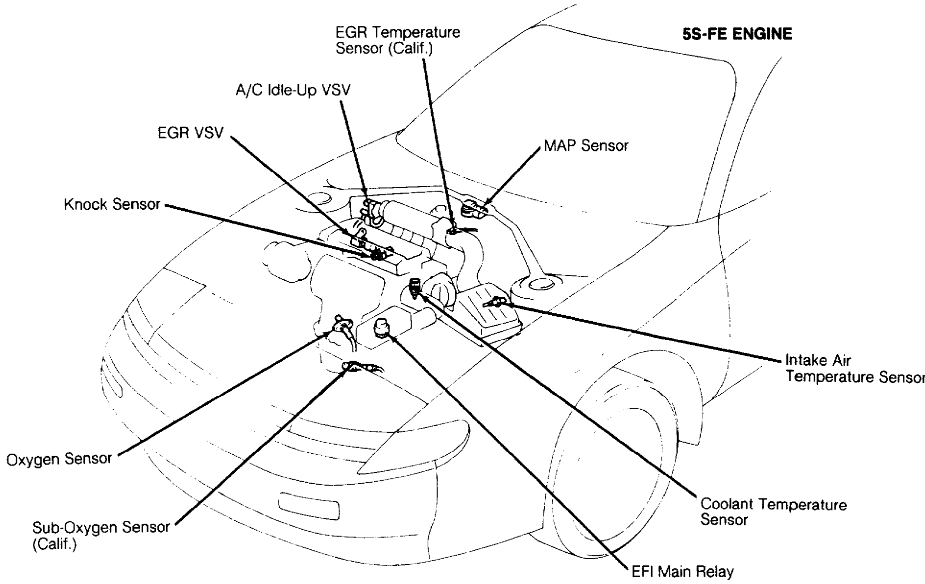
SOLENOIDS & SOLENOID VALVES

Component	Component Location



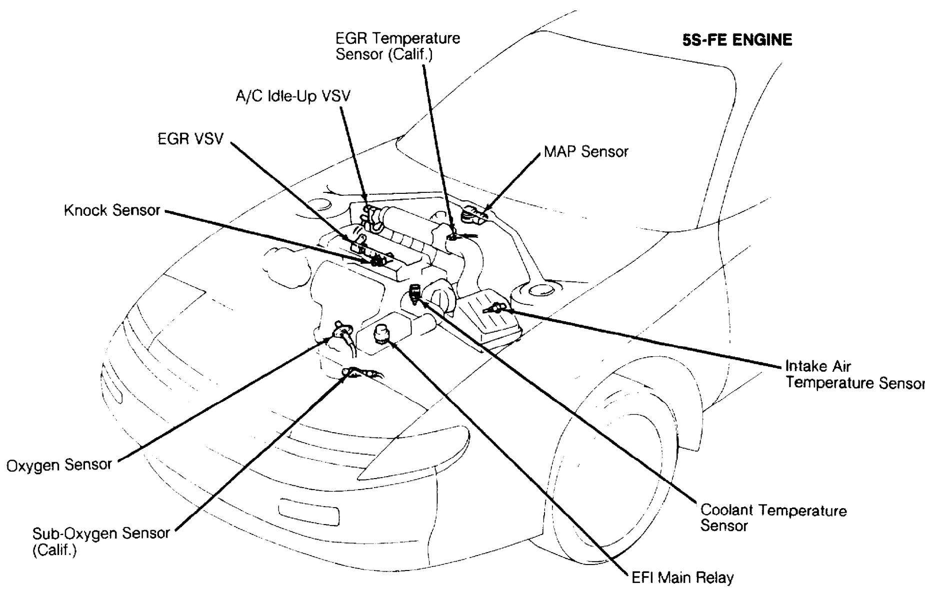
94G31472

A/C Idle-Up Vacuum Switching Valve (VSV)	In engine compartment, on right side of firewall, behind shock tower.



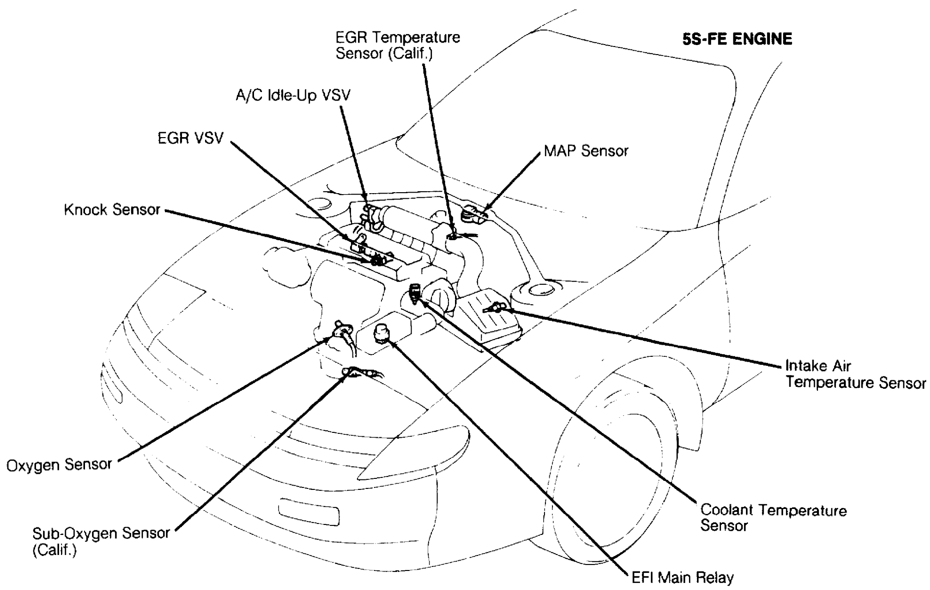
94G31472

Air Control Solenoid Valve	In right rear corner of engine compartment.



94G31472

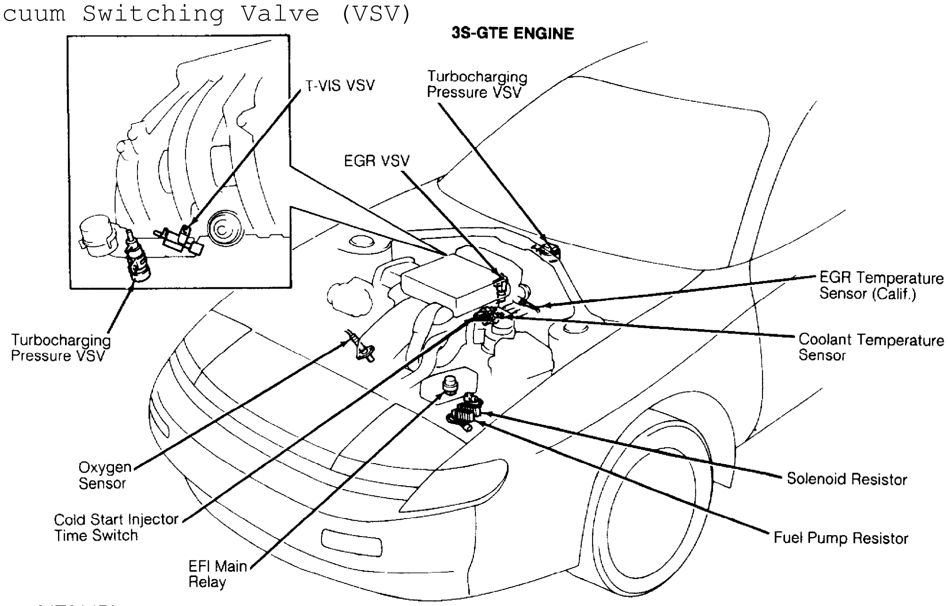
A/T Lock-Up Solenoid	On transaxle valve body.
A/T Overdrive Solenoid	On transaxle valve body.



94G31472

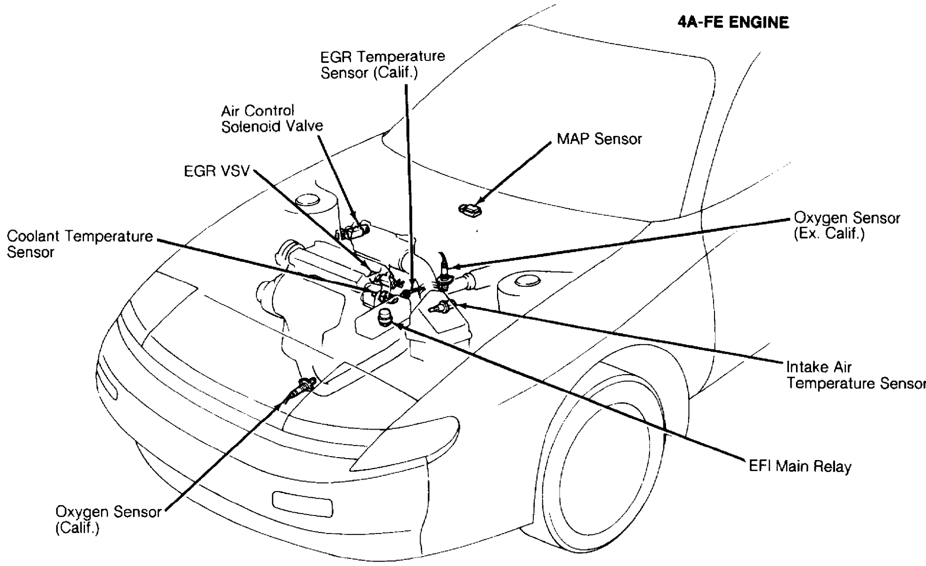
A/T Solenoid Valves No. 1 & 2 On transaxle valve body.

EGR Vacuum Switching Valve (VSV)



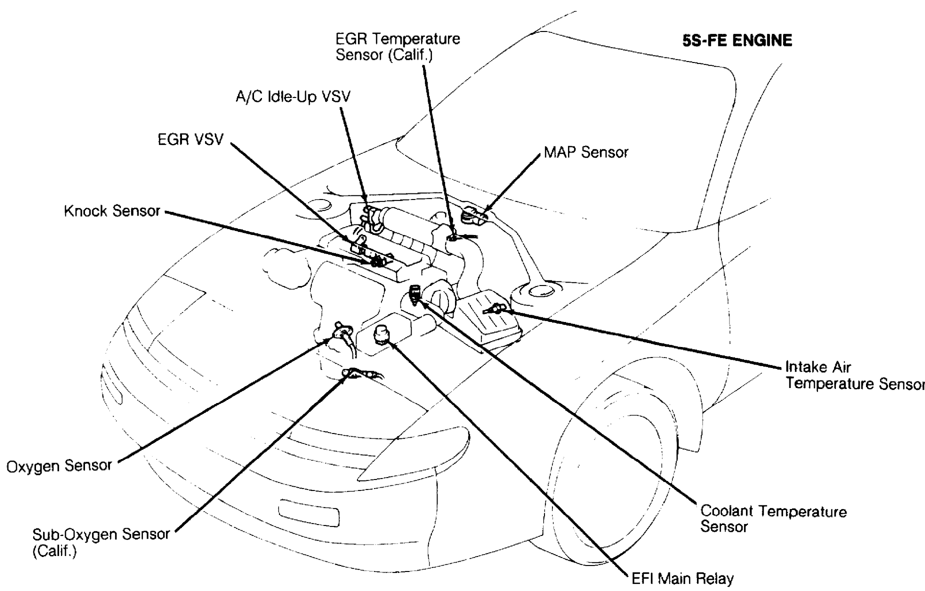
94E31470

3S-GTE Near EGR Valve.



94F31471

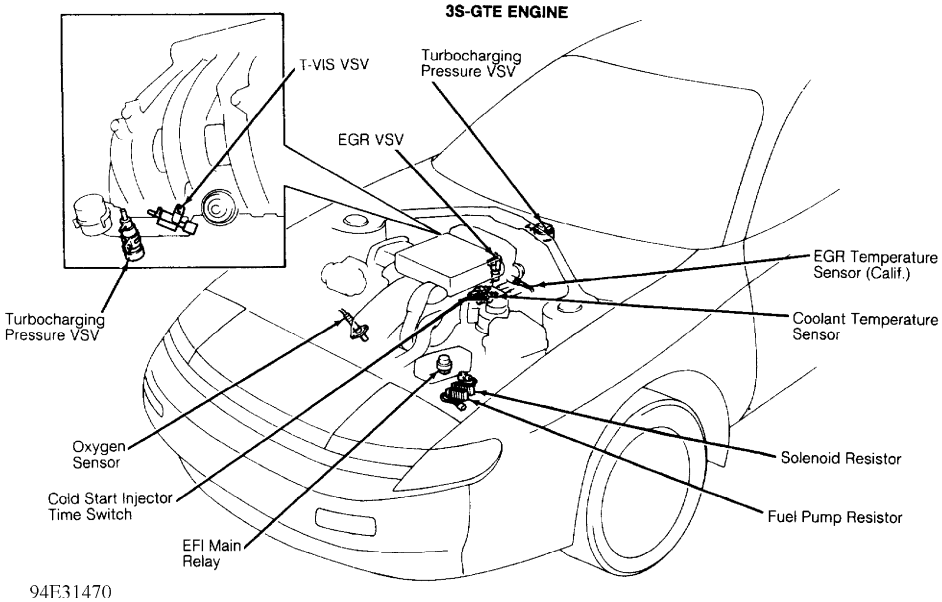
4A-FE Near EGR Valve.



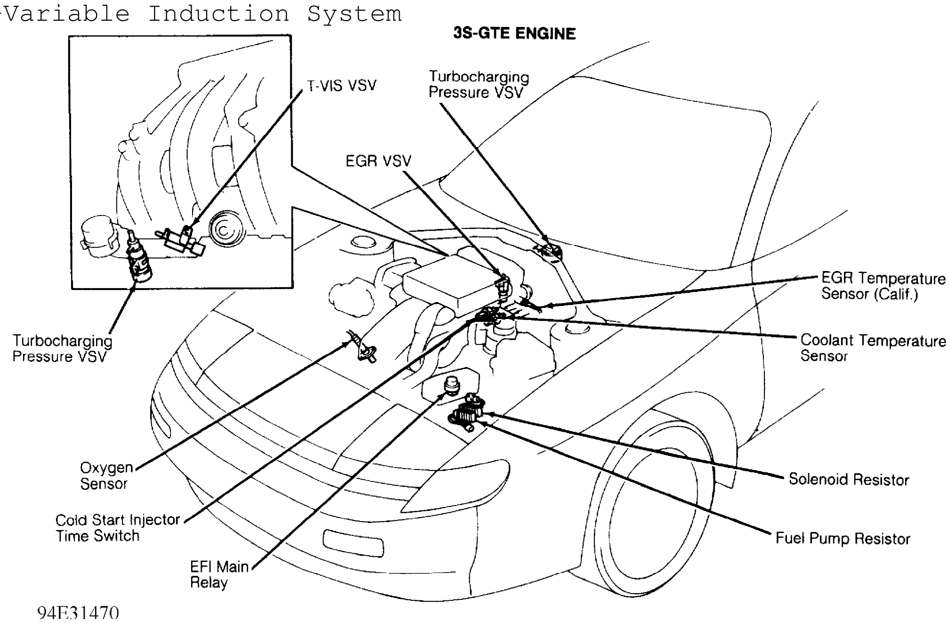
94G31472

5S-FE Near EGR Valve.

Idle Air Control (IAC) Valve (3S-GTE & 5S-FE)	On throttle body.
Key Interlock Solenoid	On steering column, mounted to lock cylinder assembly.
Shift Lock Solenoid (A/T)	Under center floor console at base of gear selector.



Turbocharging Pressure (3S-GTE)	On center of firewall.
Turbo-Variable Induction System	

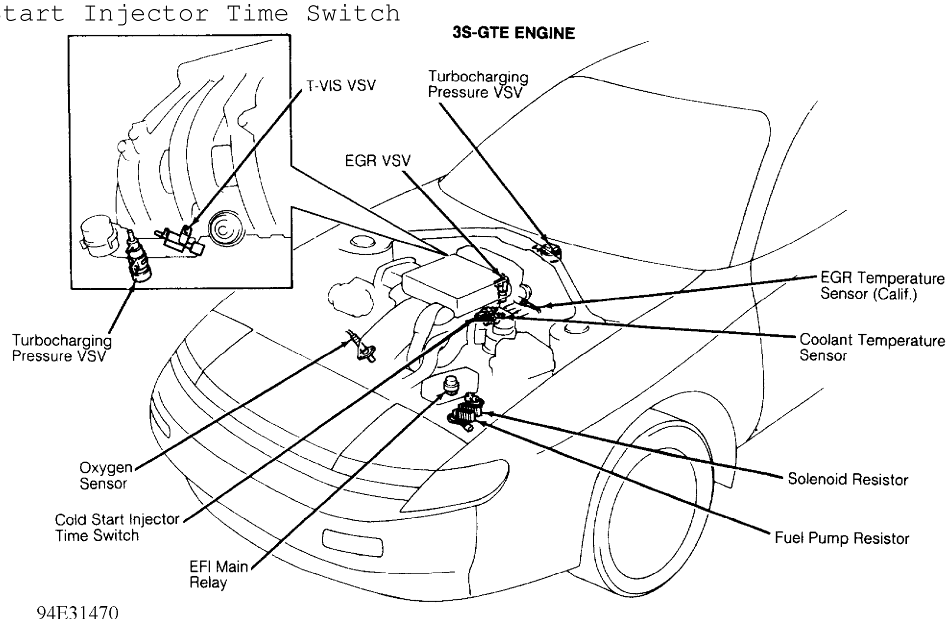


3S-GTE	On intake manifold, near turbocharging pressure VSV.

SWITCHES

Component	Component Location
A/C Cooling Fan Temp. Switch	On top of radiator.
A/C Pressure Switch	On A/C line, in right rear corner of engine compartment.
Back-Up Light Switch (M/T)	On transaxle.

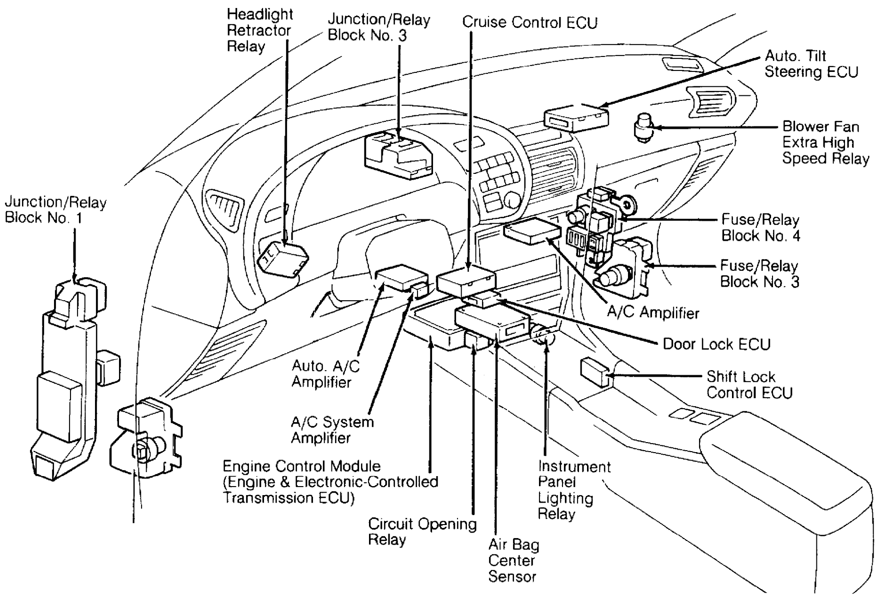
Brake Fluid Warning Switch	On cap of brake fluid reservoir.
Brake/Stoplight Switch	On brake pedal bracket.
Clutch Start Switch	On clutch pedal bracket.
Cold Start Injector Time Switch	



(3S-GTE)	On left side of engine, on coolant outlet.
Coolant Temperature Switch	
3S-GTE & 5S-FE	In radiator.
4A-FE	Threaded into top of coolant outlet flange.
Key Unlock Warning Switch	On steering column, next to ignition switch.
Low Oil Pressure Warning Switch	
3S-GTE	On rear of engine, near distributor.
4A-FE	On left side of engine, near oil filter.
5S-FE	On left rear of cylinder head.
Par/Neutral Position Switch (A/T)	On left side of transaxle.
Parking Brake Switch	At base of parking brake lever
Seat Belt Buckle Switch	At base of seat belt buckle.
Shift Lock Control Switch (A/T)	Under center floor console, at base of gear selector.
Sun Roof Control & Limit Switches	In sun roof front opening rail, near sun roof motor.

MISCELLANEOUS

Component	Component Location



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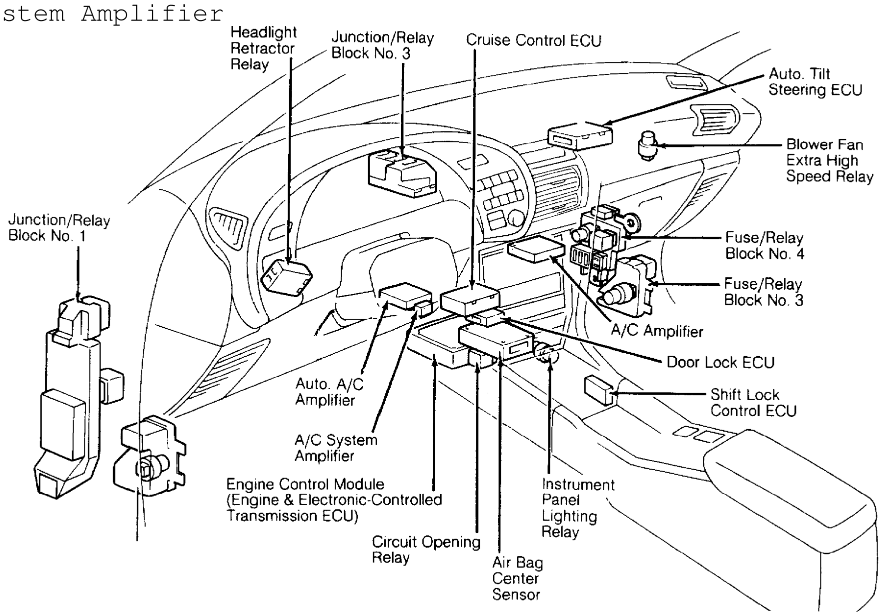
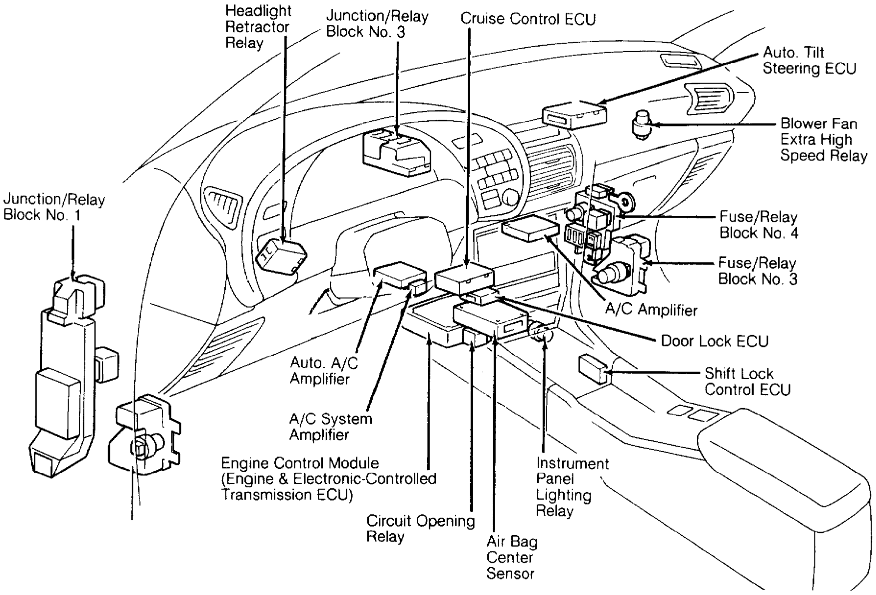
Component	Component Location
A/C Amplifier	Behind glove box, attached to bottom of evaporator housing.

A/C System Amplifier



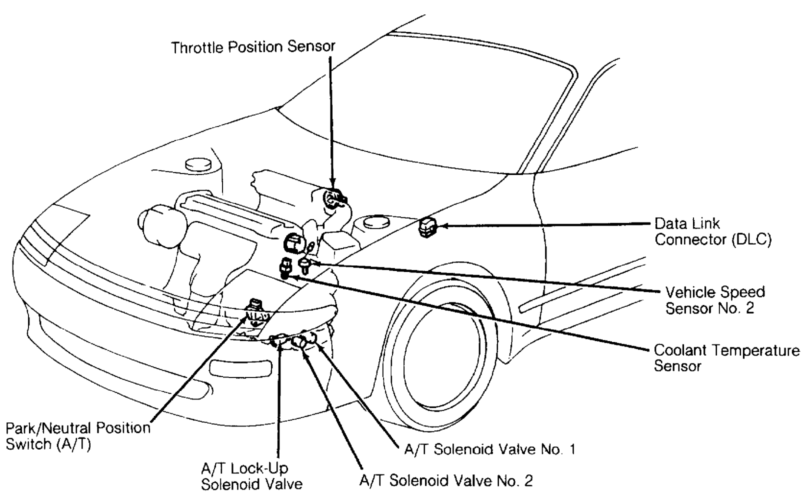
94A31468

Component	Component Location
(Push-Button Control Switch)	Behind center of dash, in front of Auto. A/C Amplifier.



94A31468

Auto. A/C Amplifier	Behind center of dash, on bottom left of heater core housing.
Auto. A/C Power Transistor	Behind glove box, mounted to right rear side of evaporator housing.
Blower Resistor	Behind glove box, mounted to right front side of evaporator housing.



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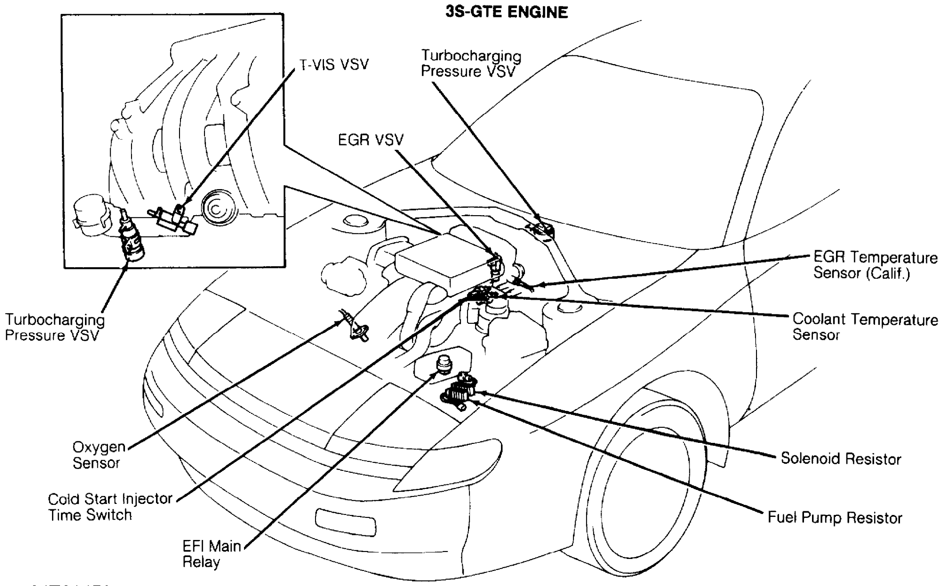
Data Link Connector	In left rear of engine compartment, behind strut tower.
Fuel Pump Resistor	



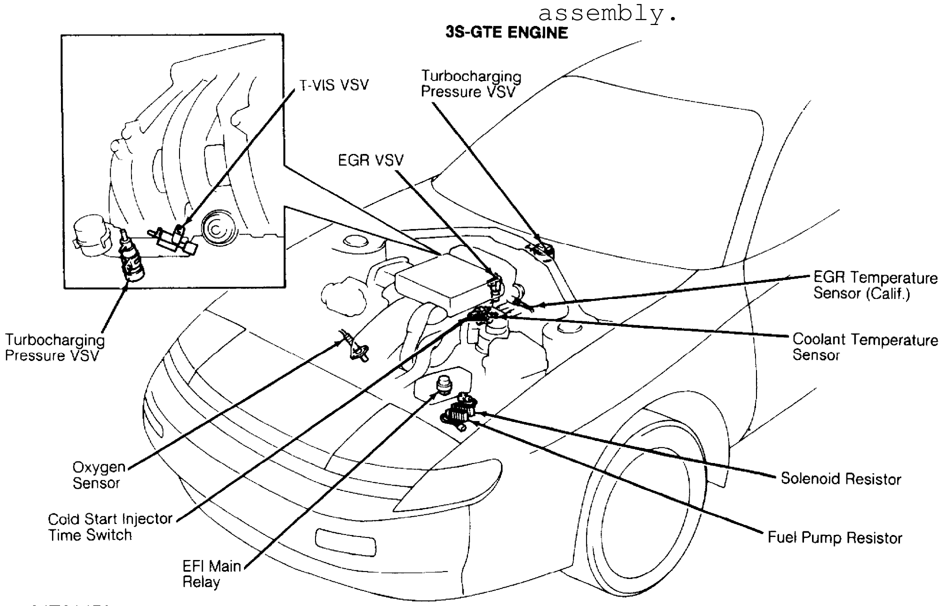
94E31470

(3S-GTE) On left front corner of engine compartment.

Igniter

3S-GTE On left side of firewall.

4A-FE Integrated within distributor assembly.



94E31470

Solenoid Resistor On left front corner of engine compartment.

ELECTROSTATIC DISCHARGE WARNING - BASIC INFORMATION

1993 Toyota Celica

GENERAL INFORMATION
Electrostatic Discharge (ESD) Warning - Basic Information

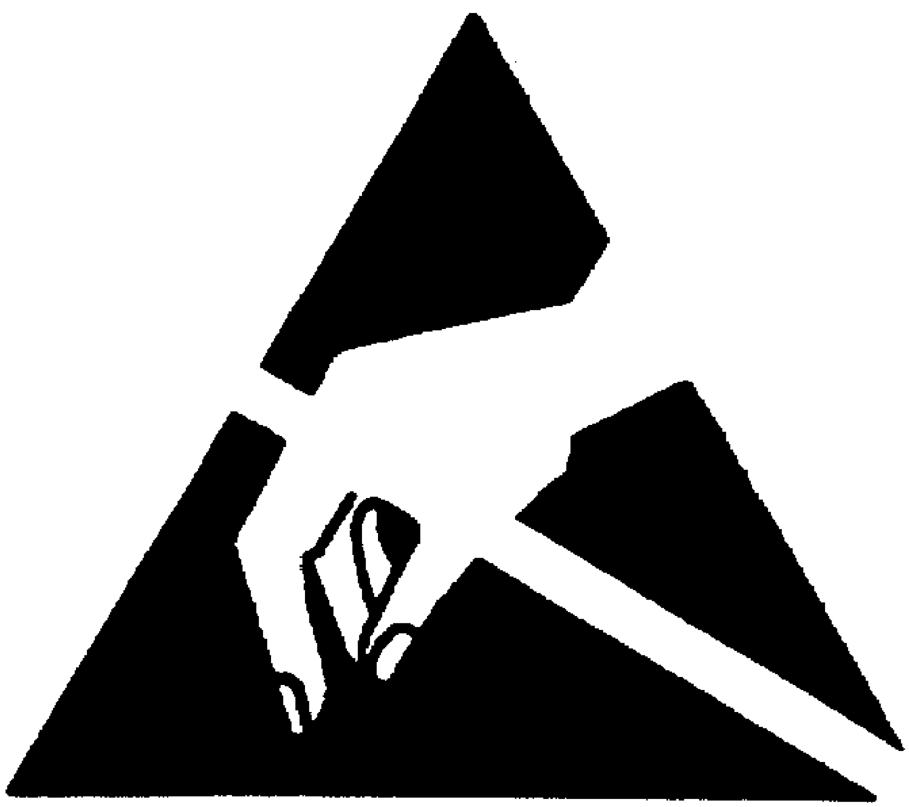
All Makes amd Models

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only.

INTRODUCTION

All Electrostatic Discharge (ESD) sensitive components contain solid state circuits (transistors, diodes, semiconductors) that may become damaged when contacted with an electrostatic charge. The following information applies to all ESD sensitive devices. The ESD symbol shown in Fig. 1 may be used on schematics to indicate which components are ESD sensitive. See Fig. 1. Although different manufactures may display different symbols to represent ESD sensitive devices, the handling and measuring precautions and procedures are the same.



50I12680

Fig. 1: Sample ESD Symbol

HANDLING STATIC-SENSITIVE CIRCUITS/DEVICES

When handling an electronic part that is ESD sensitive, the technician should follow these guidelines to reduce any possible electrostatic charge build-up on the technician's body and the electronic part.

1) Always touch a known good ground source before handling the part. This should be repeated while handling the part and more frequently after sitting down from a standing position, sliding across the seat or walking a distance.
2) Avoid touching electrical terminals of the part, unless instructed by a diagnostic procedure.
3) DO NOT open the package of a new part until it is time to install the part.
4) Before removing the part from its package, ground the package to a known good ground source.

CHECKING STATIC-SENSITIVE CIRCUITS/DEVICES

1) Solid State circuits in electronic devices are shown greatly simplified in schematics. See Fig. 2. Due to the simplification of the electronic devices on the schematic, resistance measurements could be misleading or could lead to an electrostatic discharge. Always follow the recommended diagnostic procedure.

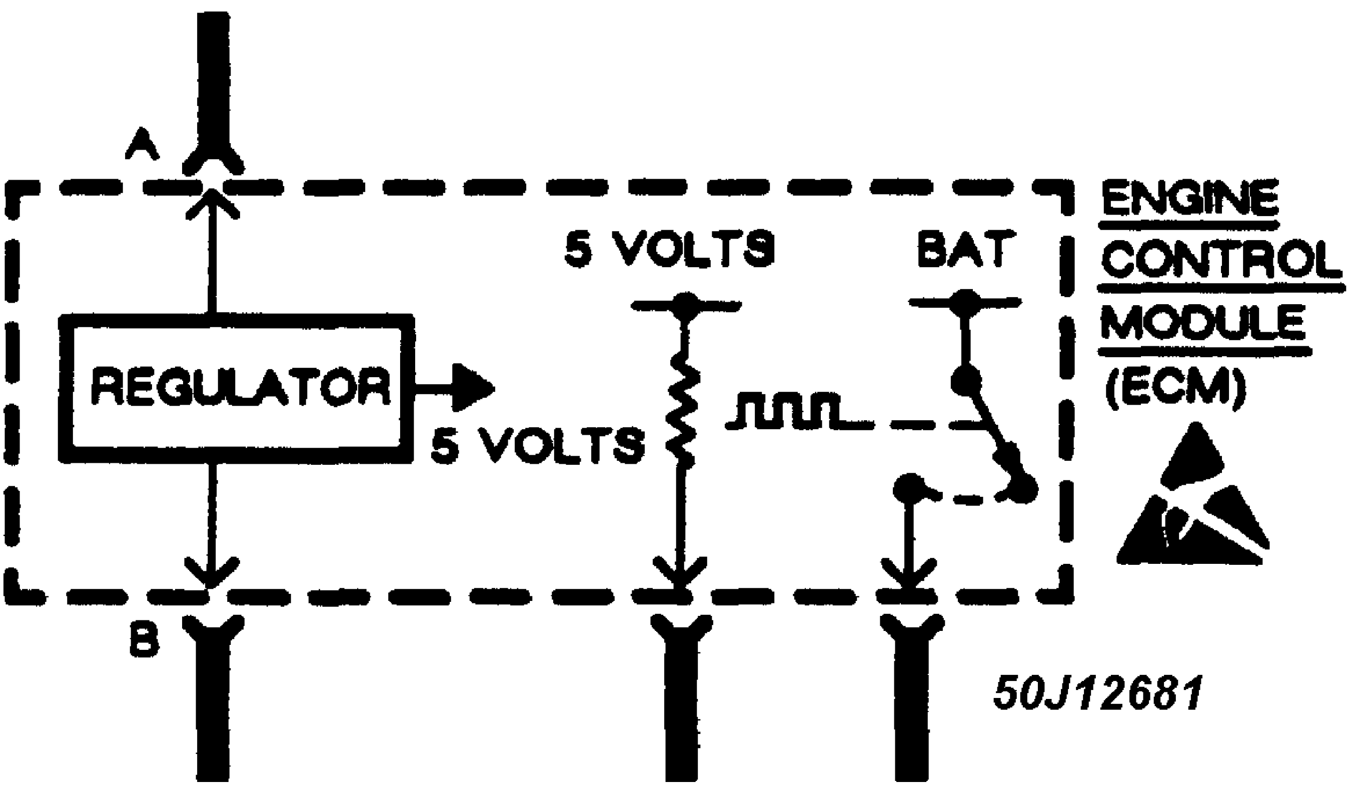


Fig. 2: Sample Schematic Showing Typical ESD Sensitive Device

2) Only measure resistance at the terminals of the devices when instructed by the recommended diagnostic procedure.
3) When using a voltmeter, be sure to connect the ground lead first.

EMISSION CONTROL VISUAL INSPECTION PROCEDURES

1993 Toyota Celica

1983-98 GENERAL INFORMATION
Emission Control Visual Inspection Procedures

All Models

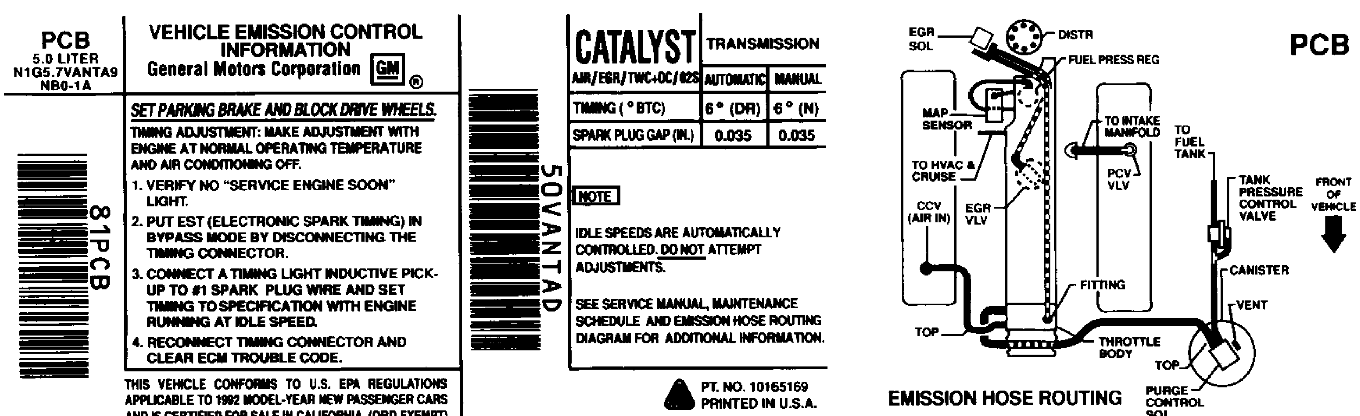
* PLEASE READ THIS FIRST *

This article is provided for general information only. Not all information applies to all makes and models. For more complete information, see appropriate article(s) in the ENGINE PERFORMANCE Section.

EMISSION CONTROL LABELS

The vehicle manufacturer's emission control label, also known as the underhood tune-up label or Vehicle's Underhood Emission Control System (VECI) label, is located in the engine compartment. Information regarding year model of vehicle, engine size, number of cylinders, emission equipment or type, engine tune-up specifications, whether vehicle was manufactured for sale in California or is a Federal vehicle, vacuum hose routing schematic, etc., can be found on this label. See Fig. 1.

In addition to the VECI label, some emission control inspection and maintenance programs may require an additional label to be affixed to the vehicle in special circumstances. For example, in California, a Bureau Of Automotive Repair (BAR) engine label may be affixed to the left door post. A BAR engine label is only used when the vehicle has an engine change, approved modification or is a Specially Constructed (SPCN) or an acceptable Gray market vehicle. Check your state's emission control inspection and maintenance laws to determine if a similar label is used.



93D04127
Fig. 1: Typical Emission Control Label
Courtesy of General Motors Corp.

EMISSION CONTROL VISUAL INSPECTION

* PLEASE READ THIS FIRST *

NOTE: The following emission control visual inspection procedures should be used as a guide only. When performing a visual inspection, always follow your state's recommended inspection procedures.

A visual inspection is made to determine if any required emission control devices are missing, modified or disconnected. Missing, modified or disconnected systems must be made fully operational before a vehicle can be certified.

POSITIVE CRANKCASE VENTILATION (PCV)

PCV controls the flow of crankcase fumes into the intake manifold while preventing gases and flames from traveling in the opposite direction. PCV is either an open or closed system. See Fig. 2 .

Ensure PCV system is installed as required. Verify valve, required hoses, connections, flame arresters, etc., are present, routed properly and in serviceable condition.

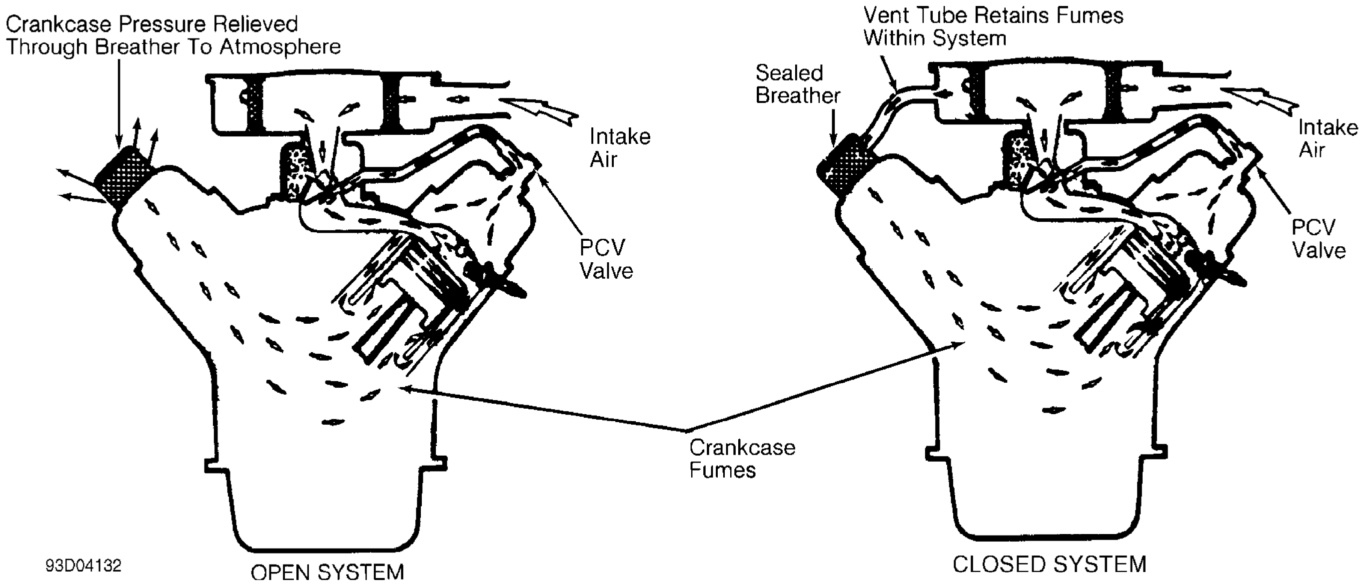


Fig. 2: Typical Open & Closed Type PCV System

THERMOSTATIC AIR CLEANER (TAC)

The TAC supplies warm air to air intake during cold engine operation. This system is active during cold engine warm-up only. Under all other operating conditions, air cleaner function is the same as any non-thermostatic unit.

Ensure required exhaust shroud, hot air duct, vacuum hoses and air cleaner components are present and installed properly. See Fig. 3. Ensure any required thermostatic vacuum switches are in place and vacuum hoses are installed and in serviceable condition. Also ensure air cleaner lid is installed right side up. Check for oversized air filter elements and for additional holes in the air cleaner housing.

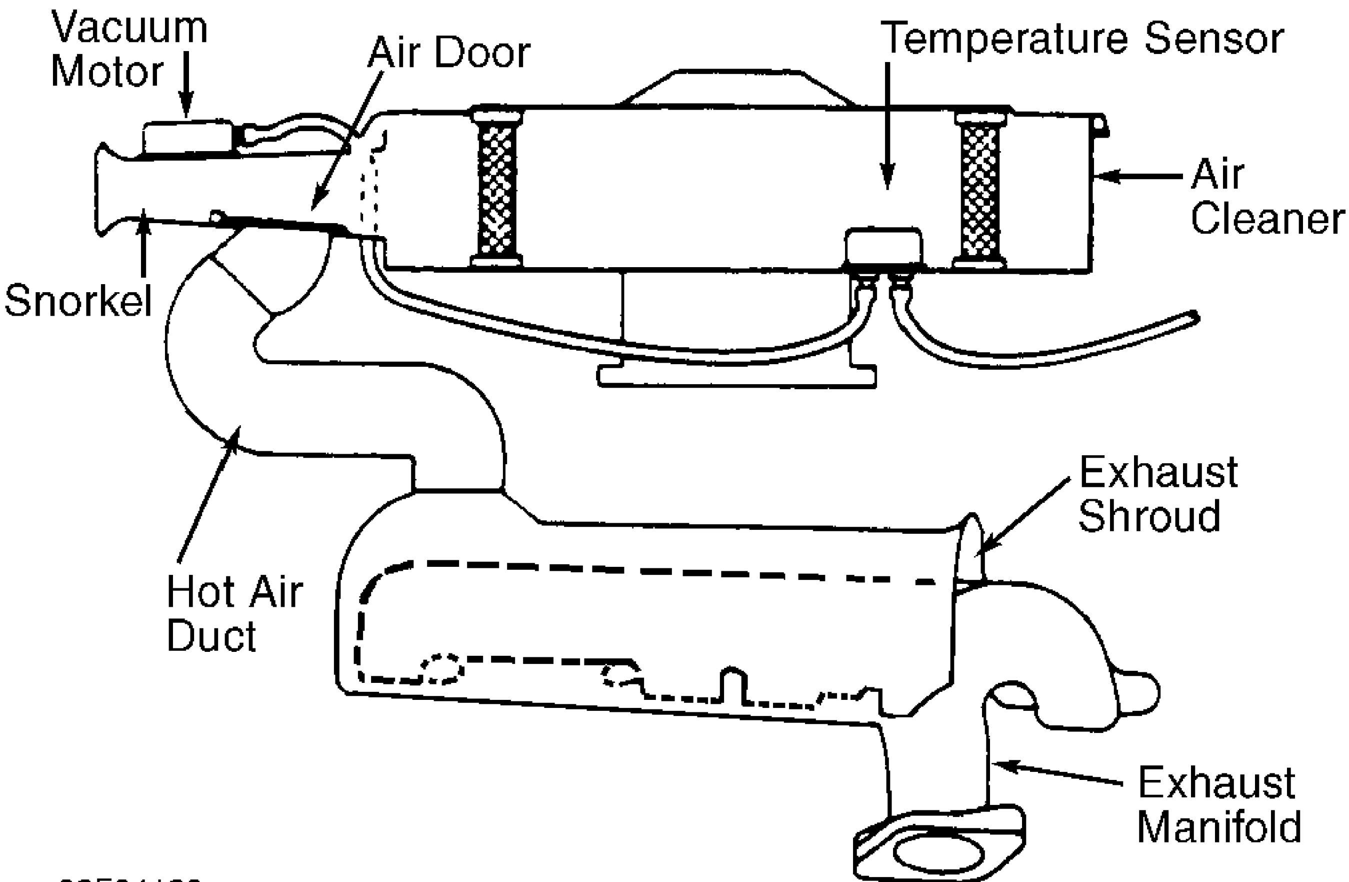


Fig. 3: Typical Thermostatic Air Cleaner System

FUEL EVAPORATIVE SYSTEM (EVAP)

The EVAP system allows for proper fuel system ventilation while preventing fuel vapors from reaching the atmosphere. This means that vapors must be caught and stored while the engine is off, which is when most fuel evaporation occurs. When the engine is started, these fuel vapors can be removed from storage and burned. In most systems, storage is provided by an activated charcoal (or carbon) canister. See Fig. 4. On a few early systems, charcoal canisters are not used. Instead, fuel vapors are vented into the PCV system and stored inside the crankcase.

The main components of a fuel evaporation system are a sealed fuel tank, a liquid-vapor separator and vent lines to a vapor-storing canister filled with activated charcoal. The filler cap is normally not vented to the atmosphere, but is fitted with a valve to allow both pressure and vacuum relief.

Although a few variations do exist between manufacturers, basic operation is the same for all systems. Check for presence of vapor storage canister or crankcase storage connections when required. Ensure required hoses, solenoids, etc., are present and connected properly. Check for proper type fuel tank cap. Check for any non-OEM or auxiliary fuel tanks for compliance and the required number of evaporation canisters.

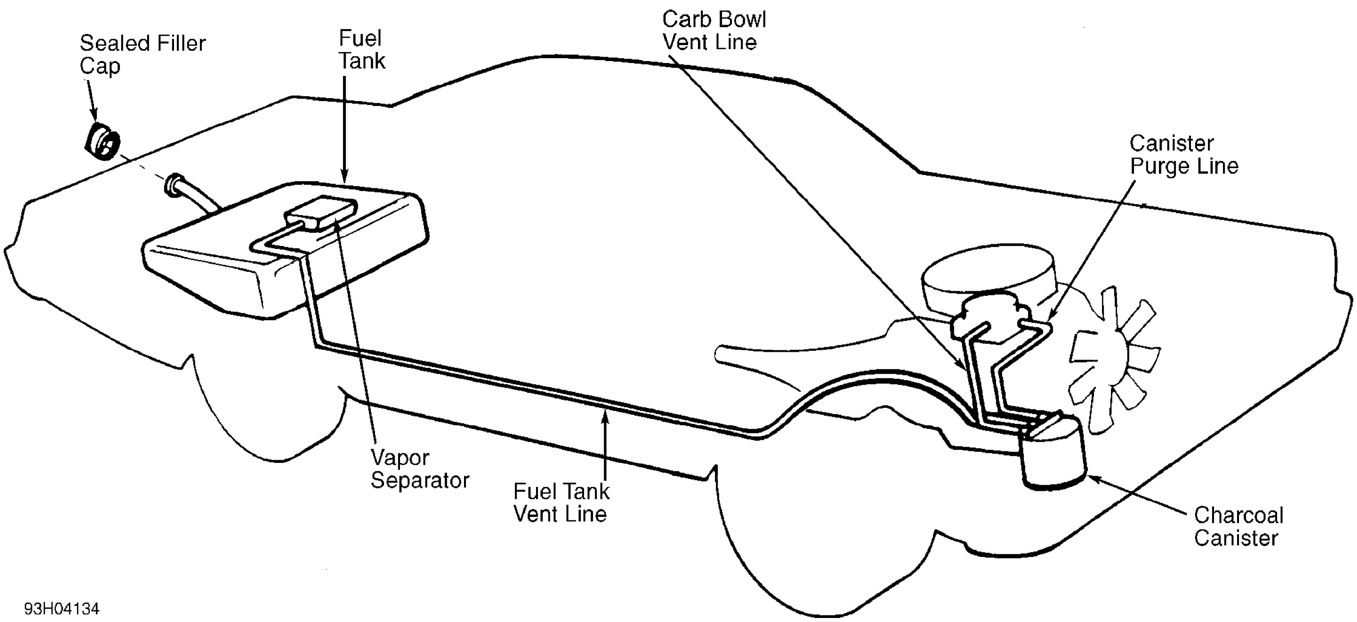


Fig. 4: Typical Fuel Evaporative System

CATALYTIC CONVERTERS

Oxidation Catalyst (OC)

This type of converter is the most common. It may use pellets or monolith medium, depending upon application. See Fig. 5. Platinum and palladium (or platinum alone) are used as catalyst in this type of converter.

Visually check for presence of catalytic converter(s). Check for external damage such as severe dents, removed or damaged heat shields, etc. Also check for pellets or pieces of converter in the tailpipe.

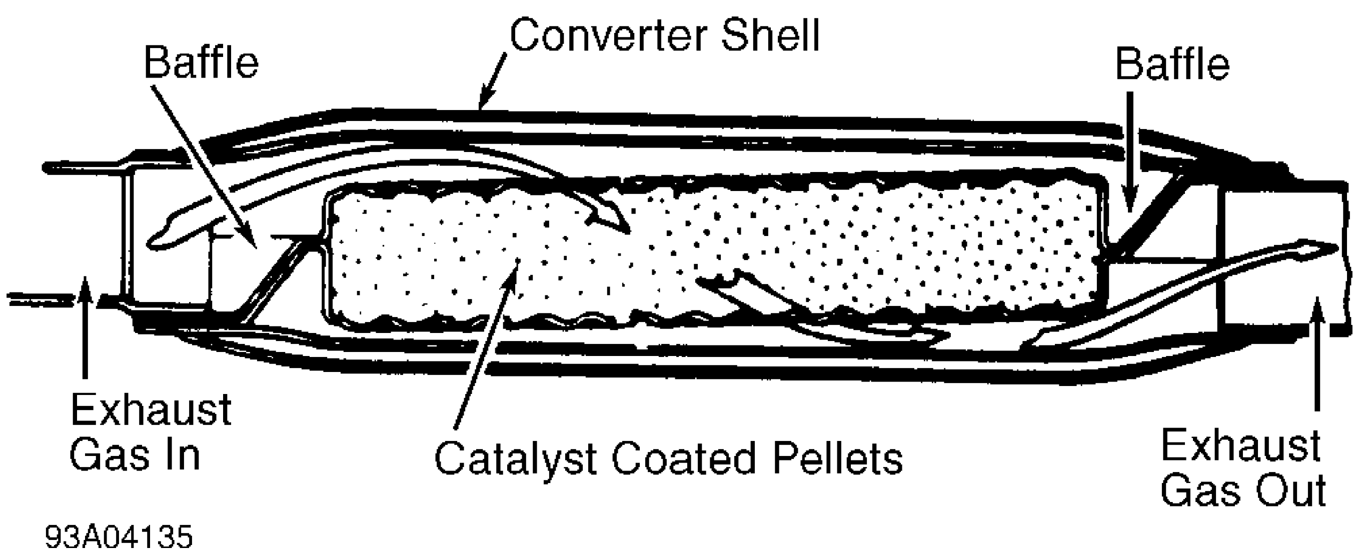


Fig. 5: Typical Oxidation Catalytic Converter (Pellet Type) Shown; Typical Three-Way Catalytic Converter Is Similar
Courtesy of General Motors Corp.

Three-Way Catalyst (TWC)

This type of converter is nearly identical to a conventional converter with the exception of the catalyst. See Fig. 5. The TWC converter uses rhodium, with or without platinum, as its catalyst. Rhodium helps reduce NOx emissions, as well as HC and CO.

Visually check for presence of catalytic converter(s). Also check for presence of any required air supply system for the oxidizing section of the converter. Check for external damage such as severe dents, removed or damaged heat shields, etc. Check for pellets or pieces of converter in the tailpipe.

Three-Way Catalyst + Oxidation Catalyst (TWC + OC)

This system contains a TWC converter and an OC converter in a common housing, separated by a small air space. See Fig. 6. The 2 catalysts are referred to as catalyst beds. Exhaust gases pass through the TWC first. The TWC bed performs the same function as it would as a separate device, reducing all 3 emissions. As exhaust gases leave the bed, they pass through the air space and into the second (OC) converter catalyst bed.

Visually check for presence of catalytic converter(s). Check for external damage such as severe dents, removed or damaged heat shields, etc. Check for pellets or pieces of converter in the tailpipe.

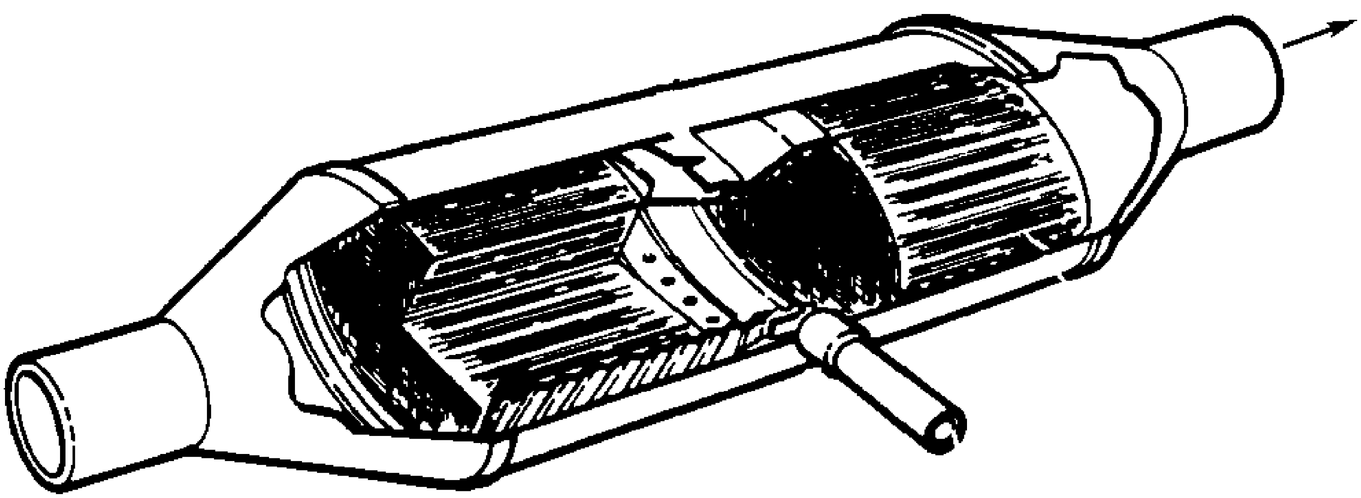


Fig. 6: Typical Three-Way + Oxidation Catalytic Converter
Courtesy of General Motors Corp.

FILL PIPE RESTRICTOR (FR)

A fuel tank fill pipe restrictor is used to prohibit the introduction of leaded fuel into the fuel tank. Unleaded gasoline pump dispensers have a smaller diameter nozzle to fit fuel tank of vehicle requiring the use of unleaded fuel (vehicles equipped with catalytic converter).

Visually inspect fill pipe restrictor(s) for tampering, i.e., restrictor is oversize or the flapper is non-functional. If vehicle is equipped with an auxiliary fuel tank, ensure auxiliary fuel tank is also equipped with a fill pipe restrictor.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

Single Diaphragm EGR Valve

This type uses a single diaphragm connected to the valve by a shaft. Diaphragm is spring-loaded to keep valve closed in the absence of vacuum. As throttle valves open and engine speed increases, vacuum is applied to the EGR vacuum diaphragm, opening the EGR valve. This vacuum signal comes from a ported vacuum source. Variations in the vacuum signal control the amount of exhaust gas that is recirculated. See Fig. 7.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

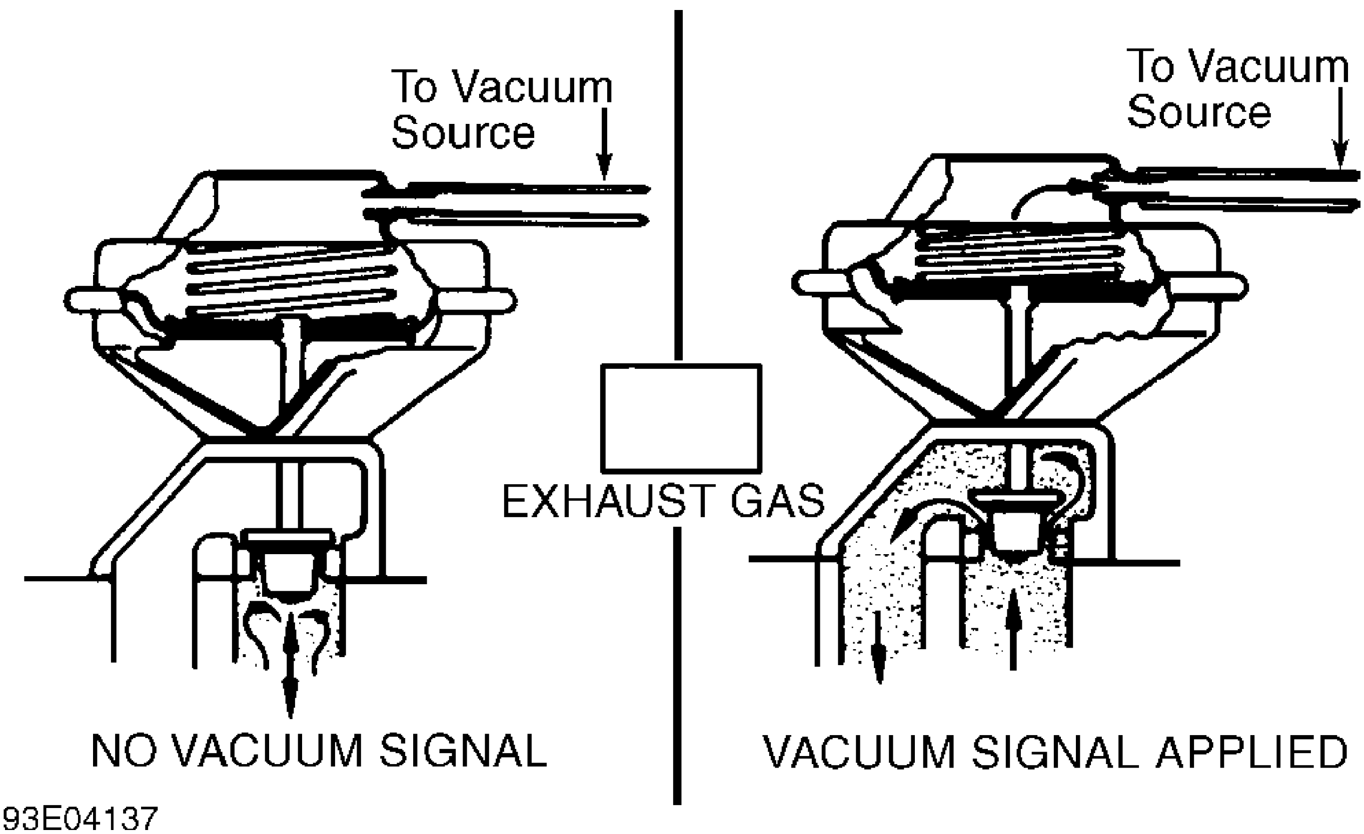


Fig. 7: Typical Single Diaphragm EGR Valve
Courtesy of General Motors Corp.

Dual Diaphragm EGR Valve

This type uses 2 diaphragms with different effective areas and 2 vacuum sources. Although similar to the single diaphragm type, the second diaphragm is added below the upper diaphragm and is rigidly attached to the valve seat. See Fig. 8. These diaphragms form a vacuum chamber which is connected to manifold vacuum.

During highway cruising when manifold vacuum is high in the center chamber, manifold vacuum tends to pull the valve closed. However, the vacuum signal applied to the top side of the upper diaphragm overcomes the downward spring force and the manifold vacuum pull, due to the diaphragm's larger piston. This regulates the amount of EGR.

When manifold vacuum is low during acceleration, the higher vacuum signal opens the valve, permitting more EGR. When manifold vacuum is high during highway cruising, the valve is only partially opened, reducing the amount of EGR.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

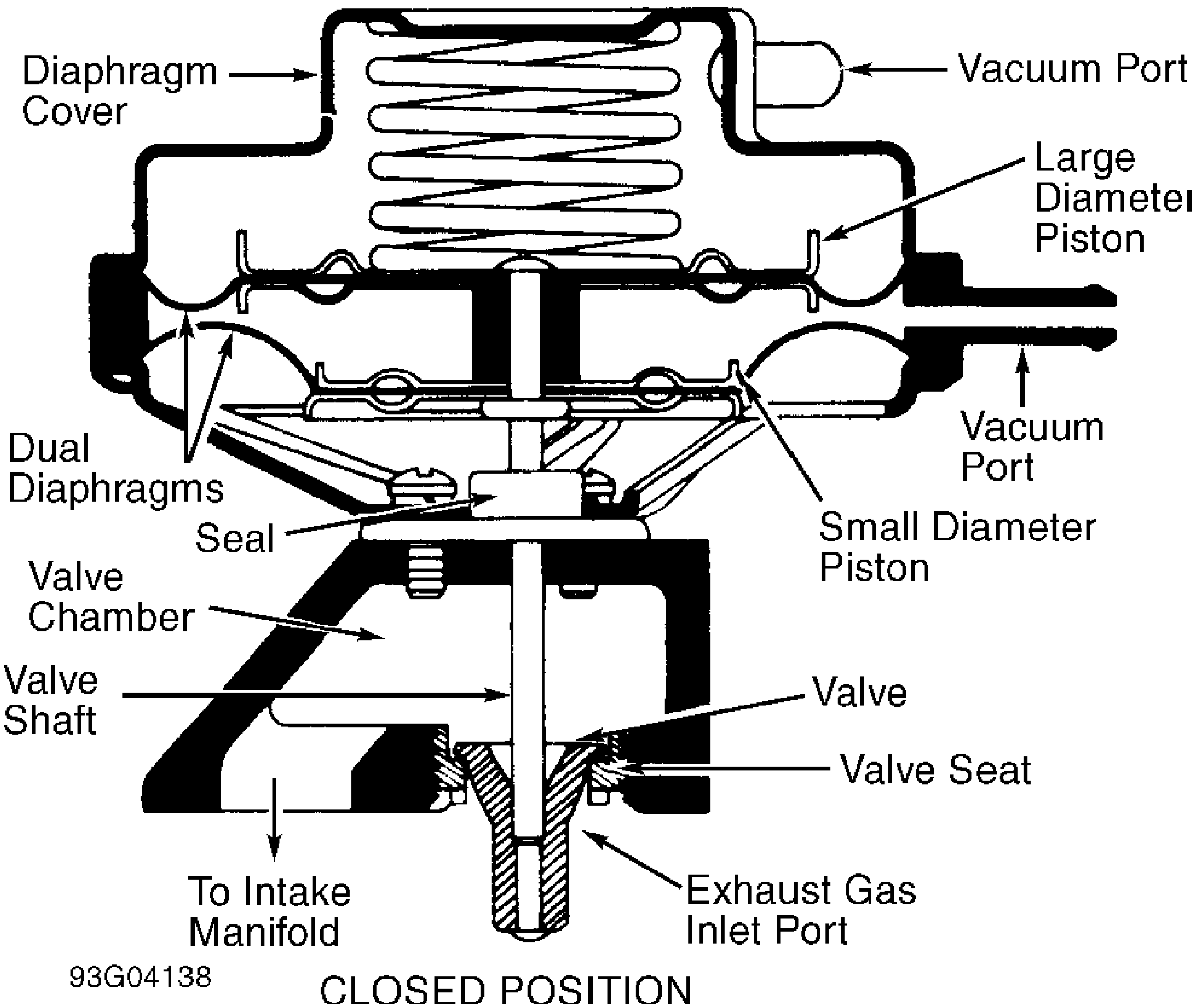


Fig. 8: Typical Dual Diaphragm EGR Valve
Courtesy of General Motors Corp.

Positive Backpressure EGR (BP/EGR) Valve

This type uses both engine vacuum and exhaust backpressure to control the amount of EGR. It provides more recirculation during heavy engine loads than the single diaphragm EGR valve.

A small diaphragm-controlled valve inside EGR valve acts as a pressure regulator. The control valve gets an exhaust backpressure signal through the hollow valve shaft. This exhaust backpressure exerts a force on bottom of control valve diaphragm. The diaphragm plate contains 6 bleed holes to bleed air into the vacuum chamber when backpressure valve is in open position. See Fig. 9.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

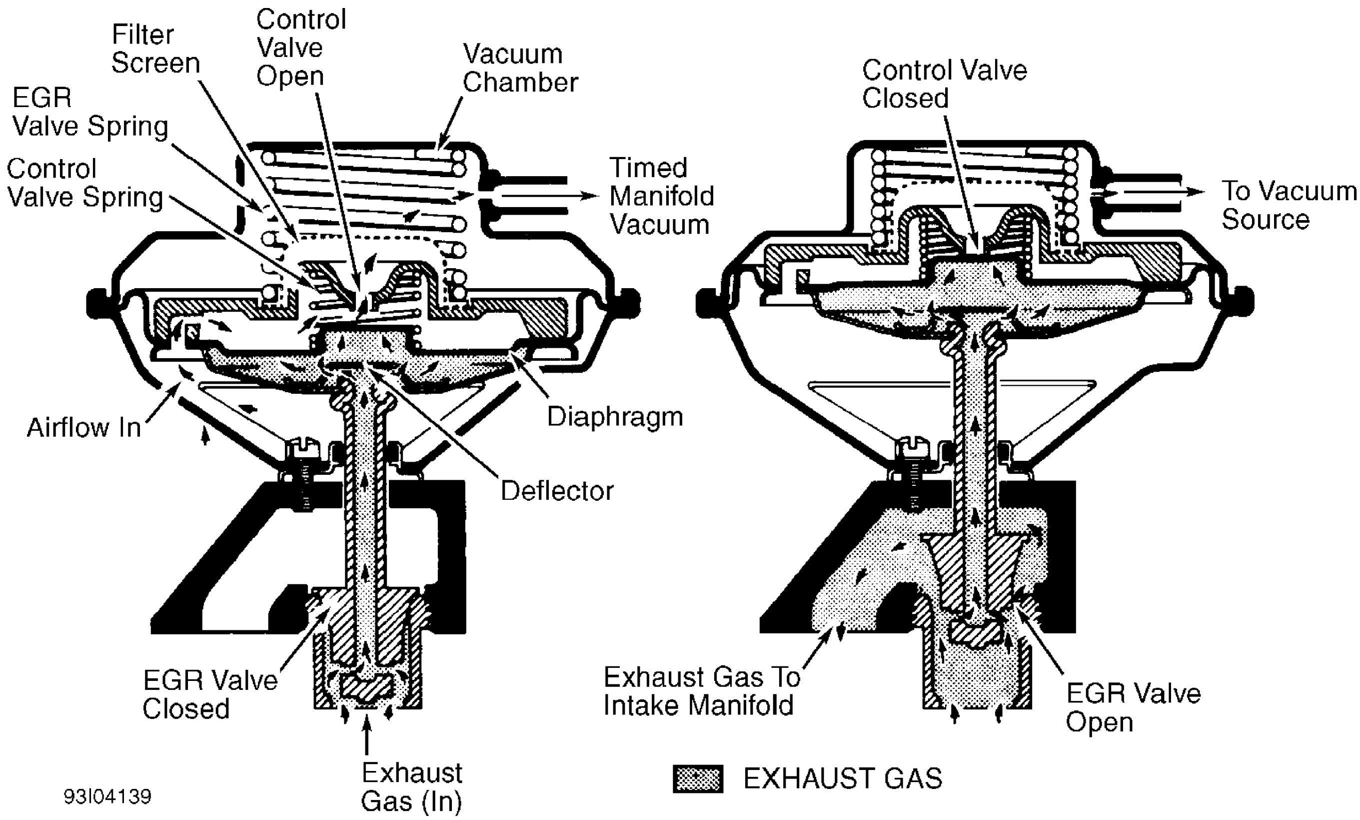


Fig. 9: Typical Positive Backpressure EGR Valve
Courtesy of General Motors Corp.

Negative Backpressure EGR (BP/EGR) Valve

This type has the same function as the positive BP/EGR valve except valve is designed to open with a negative exhaust backpressure. The control valve spring in the transducer is placed on the bottom side of the diaphragm. See Fig. 10.

When ported vacuum is applied to the main vacuum chamber, partially opening the valve, the vacuum signal from the manifold side (reduced by exhaust backpressure) is transmitted to the hollow stem of the valve. See Fig. 10. This enables the signal to act on the diaphragm, providing a specific flow. Thus, the EGR flow is a constant percentage of engine airflow.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged.

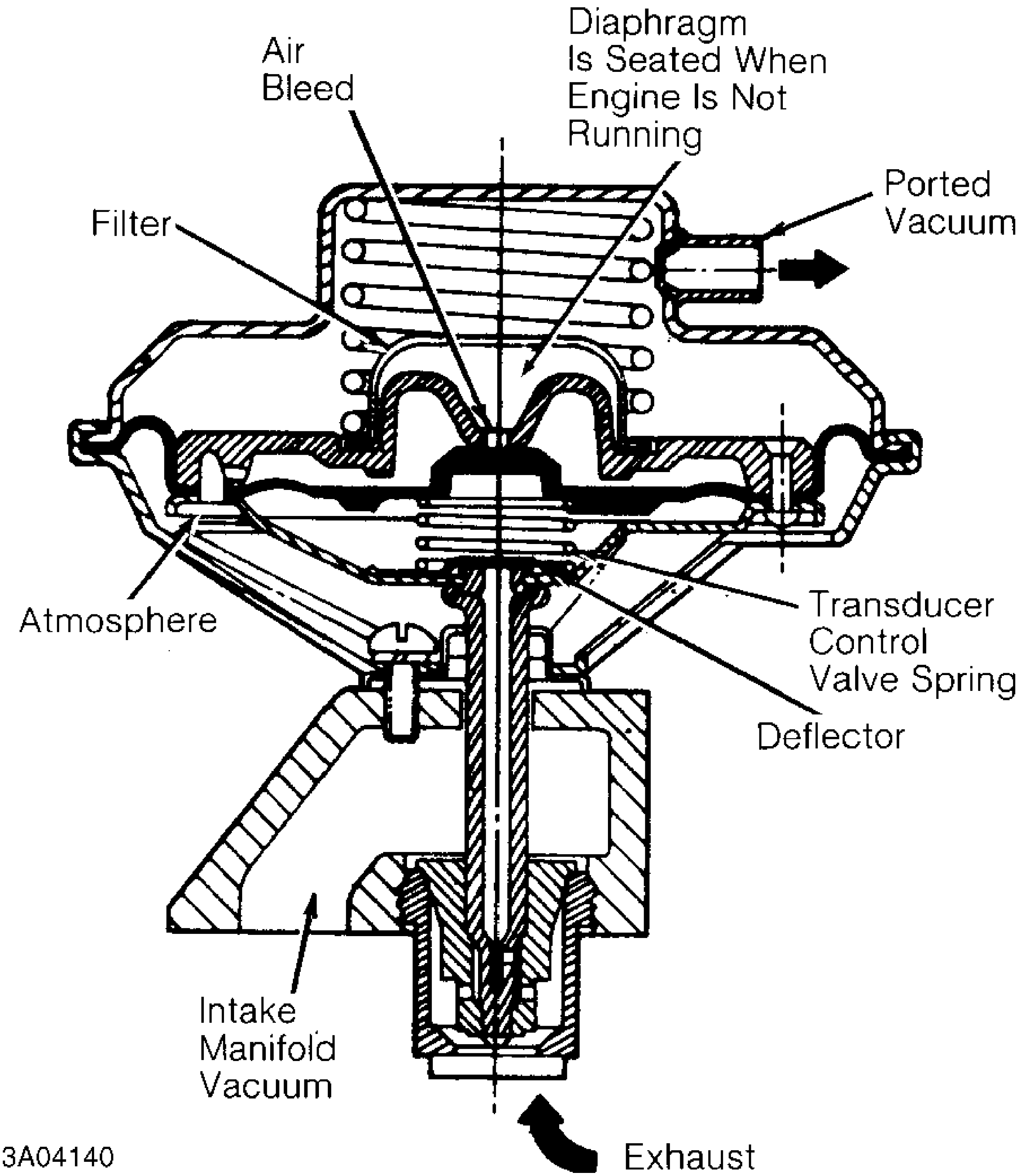


Fig. 10: Typical Negative Backpressure EGR Valve
Courtesy of General Motors Corp.

Digital EGR Valve

The digital EGR valve operates independently of engine manifold vacuum. This valve controls EGR flow through 3 orifices.

These 3 orifices are opened and closed by electric solenoids. The solenoids are, in turn, controlled by the Electronic Control Module (ECM). When a solenoid is energized, the armature with attached shaft and swivel pintle is lifted, opening the orifice. See Fig. 11.

The ECM uses inputs from the Coolant Temperature Sensor (CTS), Throttle Position Sensor (TPS) and Mass Airflow (MAF) sensors to control the EGR orifices to make 7 different combinations for precise EGR flow control. At idle, the EGR valve allows a very small amount of exhaust gas to enter the intake manifold. This EGR valve normally operates above idle speed during warm engine operation.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure vacuum hose(s) to EGR valve is not plugged. Ensure electrical connector to EGR valve is not disconnected.

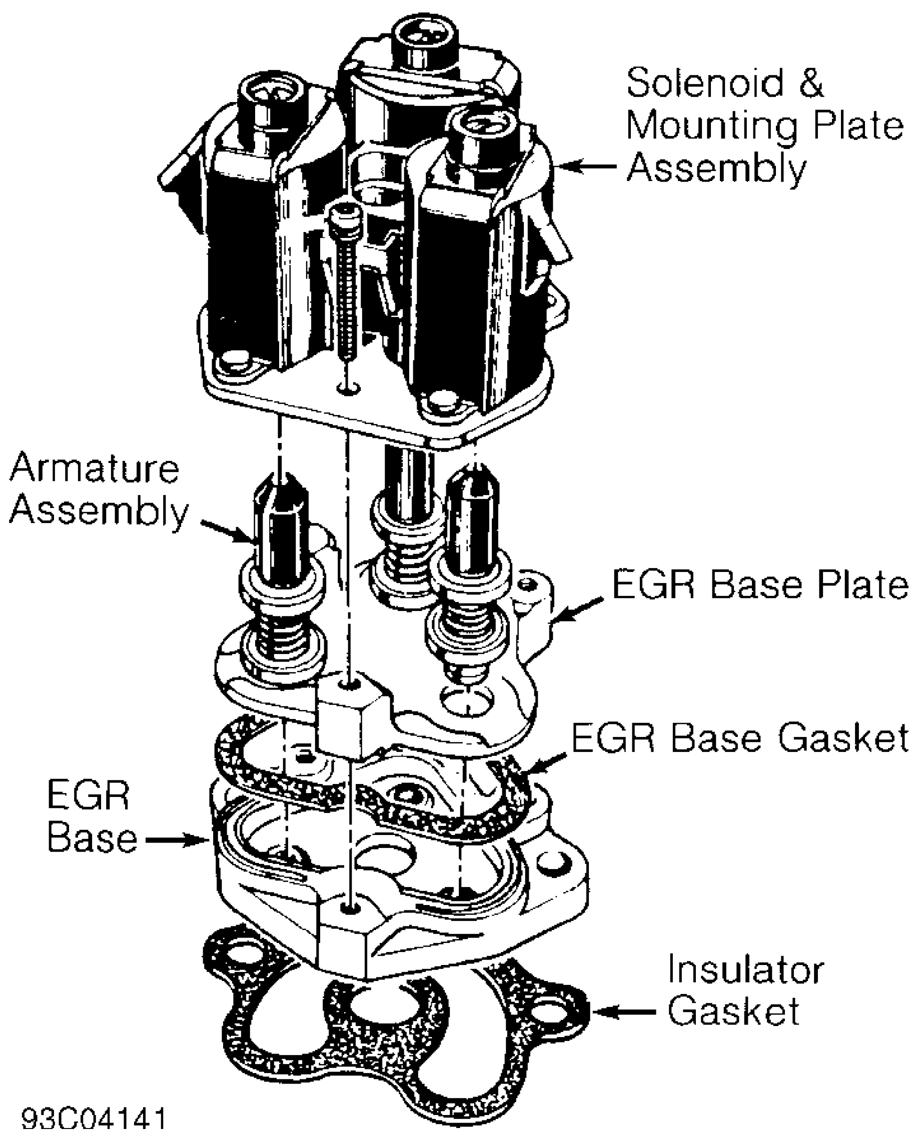


Fig. 11: Typical Digital EGR Valve
Courtesy of General Motors Corp.

Integrated Electronic EGR Valve

This type functions similar to a ported EGR valve with a remote vacuum regulator. The internal solenoid is normally open, which causes the vacuum signal to be vented off to the atmosphere when EGR is not controlled by the Electronic Control Module (ECM). The solenoid valve opens and closes the vacuum signal, controlling the amount of vacuum applied to the diaphragm. See Fig. 12.

The electronic EGR valve contains a voltage regulator, which converts ECM signal and regulates current to the solenoid. The ECM controls EGR flow with a pulse width modulated signal based on airflow, TPS and RPM. This system also contains a pintle position sensor, which works similarly to a TPS sensor. As EGR flow is increased, the sensor output increases.

Verify EGR valve is present and not modified or purposely damaged. Ensure thermal vacuum switches, pressure transducers, speed switches, etc., (if applicable) are not by-passed or modified. Ensure electrical connector to EGR valve is not disconnected.

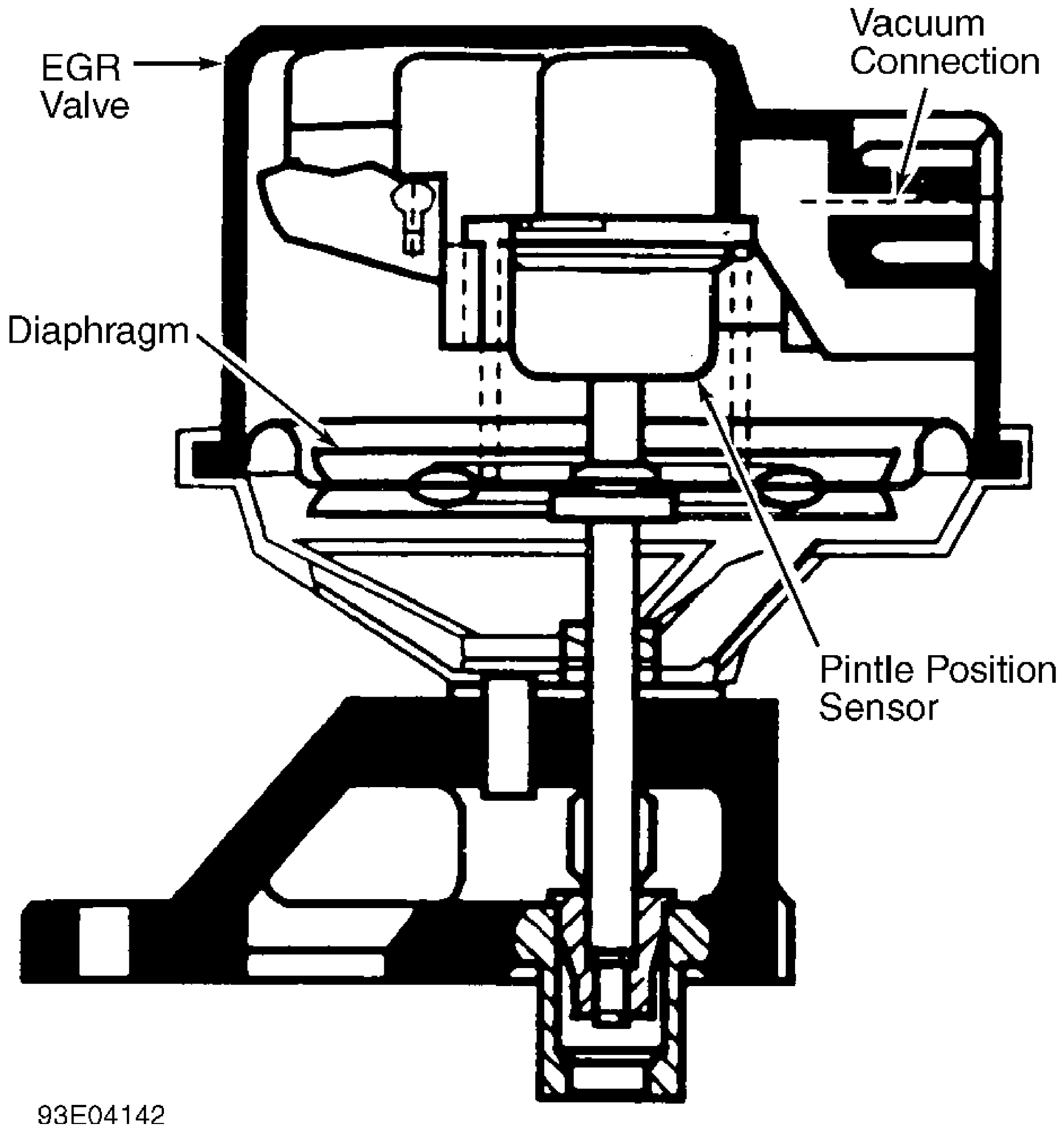


Fig. 12: Cutaway View Of Typical Integrated Electronic EGR Valve
Courtesy of General Motors Corp.

SPARK CONTROLS (SPK)

Spark control systems are designed to ensure the air/fuel mixture is ignited at the best possible moment to provide optimum efficiency and power and cleaner emissions.

Ensure vacuum hoses to the distributor, carburetor, spark delay valves, thermal vacuum switches, etc., are in place and routed properly. On Computerized Engine Controls (CEC), check for presence of required sensors (O2, MAP, CTS, TPS, etc.). Ensure they have not been tampered with or modified.

Check for visible modification or replacement of the feedback carburetor, fuel injection unit or injector(s) with a non-feedback carburetor or fuel injection system. Check for modified emission-related components unacceptable for use on pollution-controlled vehicles.

AIR INJECTION SYSTEM (AIS)

Air Pump Injection System (AP)

The air pump is a belt-driven vane type pump, mounted to engine in combination with other accessories. The air pump itself consists of the pump housing, an inner air cavity, a rotor and a vane assembly. As the vanes turn in the housing, filtered air is drawn in through the intake port and pushed out through the exhaust port. See Fig. 13.

Check for missing or disconnected belt, check valve(s), diverter valve(s), air distribution manifolds, etc. Check air injection system for proper hose routing.

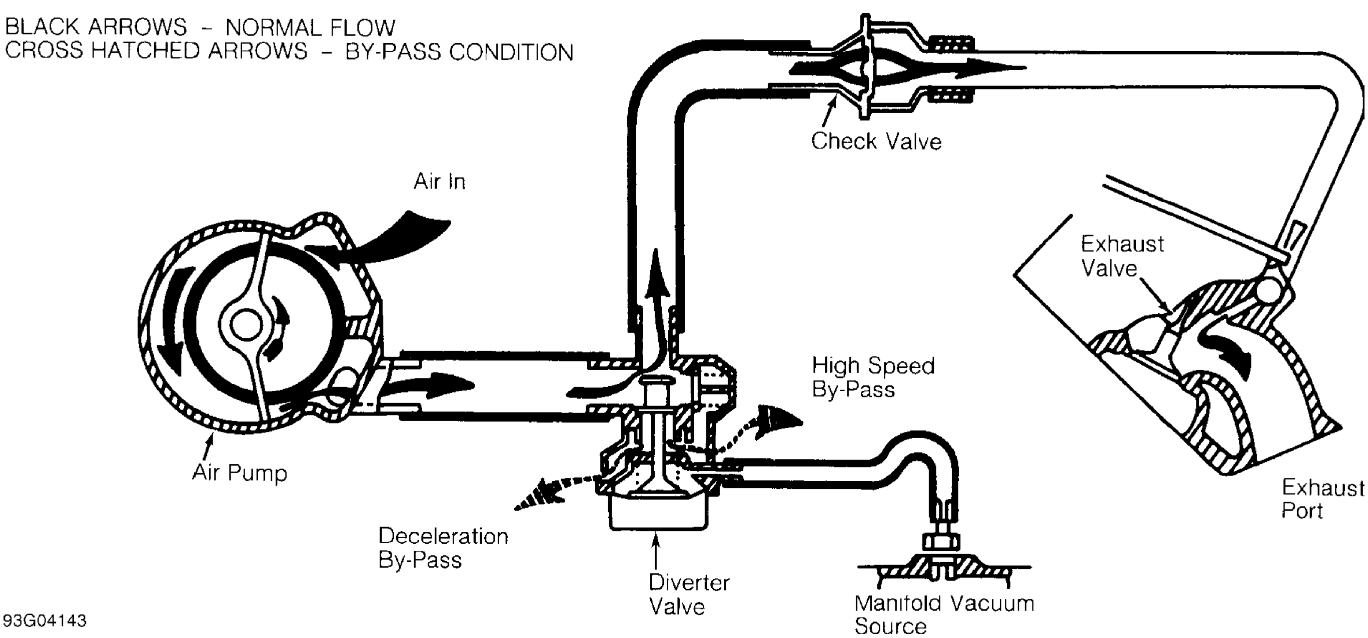


Fig. 13: Typical Air Pump Injection System
Courtesy of General Motors Corp.

Pulsed Secondary Air Injection (PAIR) System

PAIR eliminates the need for an air pump and most of the associated hardware. Most systems consists of air delivery pipe(s), pulse valve(s) and check valve(s). The check valve prevents exhaust gases from entering the air injection system. See Fig. 14.

Ensure required check valve(s), diverter valve(s), air distribution manifolds, etc., are present. Check air injection system for proper hose routing.

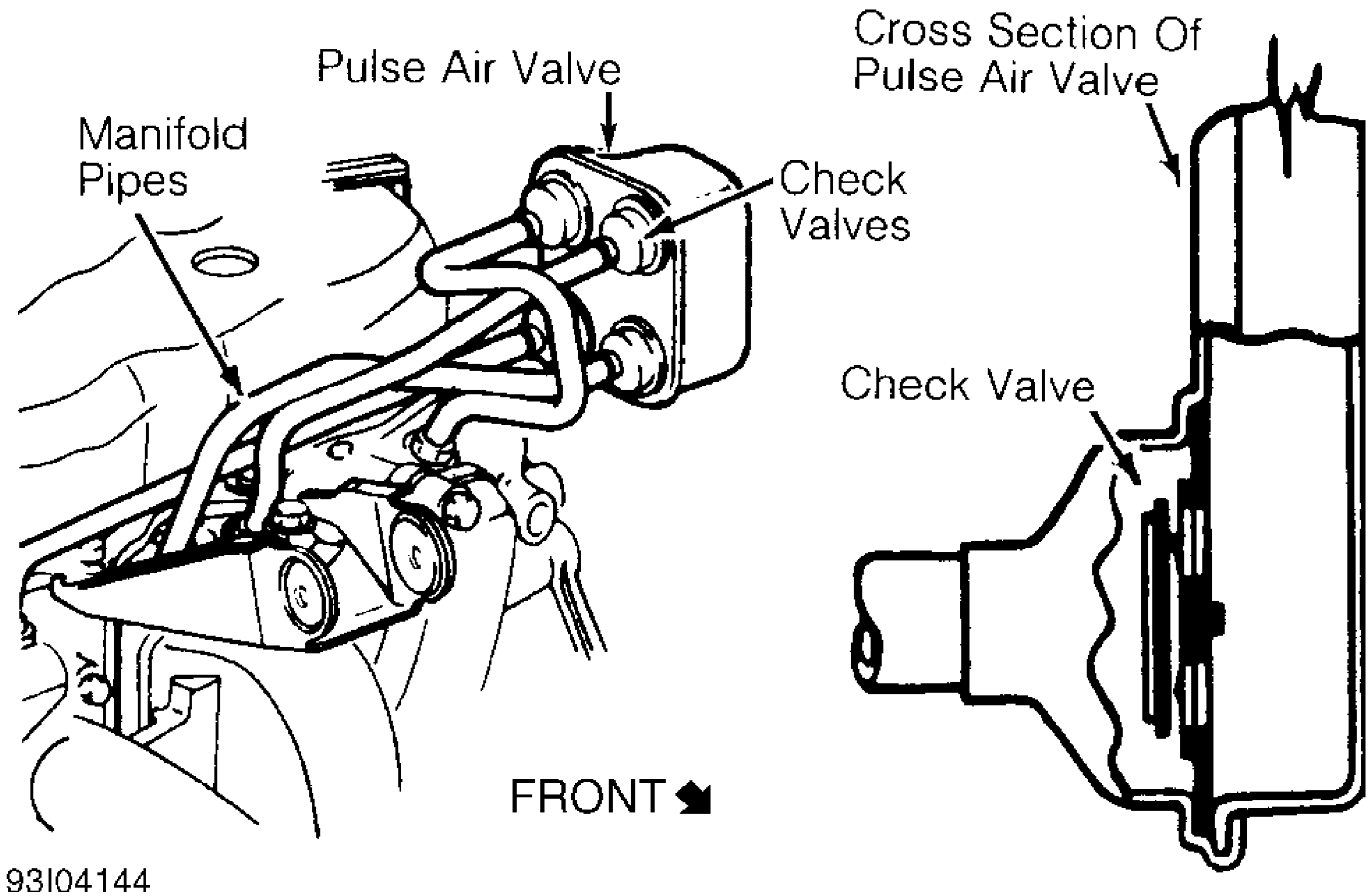


Fig. 14: Typical Pulsed Secondary Air Injection System
Courtesy of General Motors Corp.

OXYGEN SENSOR (O2)

The O2 sensor is mounted in the exhaust system where it monitors oxygen content of exhaust gases. Some vehicles may use 2 O2 sensors. The O2 sensor produces a voltage signal which is proportional to exhaust gas oxygen concentration (0-3%) compared to outside oxygen (20-21%). This voltage signal is low (about .1 volt) when a lean mixture is present and high (1.0 volt) when a rich mixture is present.

As ECM compensates for a lean or rich condition, this voltage signal constantly fluctuates between high and low, crossing a reference voltage supplied by the ECM on the O2 signal line. This is referred to as cross counts. A problem in the O2 sensor circuit should set a related trouble code.

COMPUTERIZED ENGINE CONTROLS (CEC)

The CEC system monitors and controls a variety of engine/vehicle functions. The CEC system is primarily an emission control system designed to maintain a 14.7:1 air/fuel ratio under most operating conditions. When the ideal air/fuel ratio is maintained, the catalytic converter can control oxides of nitrogen (NOx), hydrocarbon (HC) and carbon monoxide (CO) emissions.

The CEC system consists of the following sub-systems: Electronic Control Module (ECM), input devices (sensors and switches) and output signals.

EARLY FUEL EVAPORATION (EFE)

The EFE valve is actuated by either a vacuum actuator or a bimetal spring (heat-riser type). The EFE valve is closed when engine is cold. The closed valve restricts exhaust gas flow from the exhaust manifold. This forces part of the exhaust gas to flow up through a passage below the carburetor. As the exhaust gas quickly warms the intake mixture, distribution is improved. This results in better cold engine driveability, shorter choke periods and lower emissions.

Ensure EFE valve in exhaust manifold is not frozen or rusted in a fixed position. On vacuum-actuated EFE system, check EFE thermal vacuum valve and check valve(s). Also check for proper vacuum hose routing. See Fig. 15.

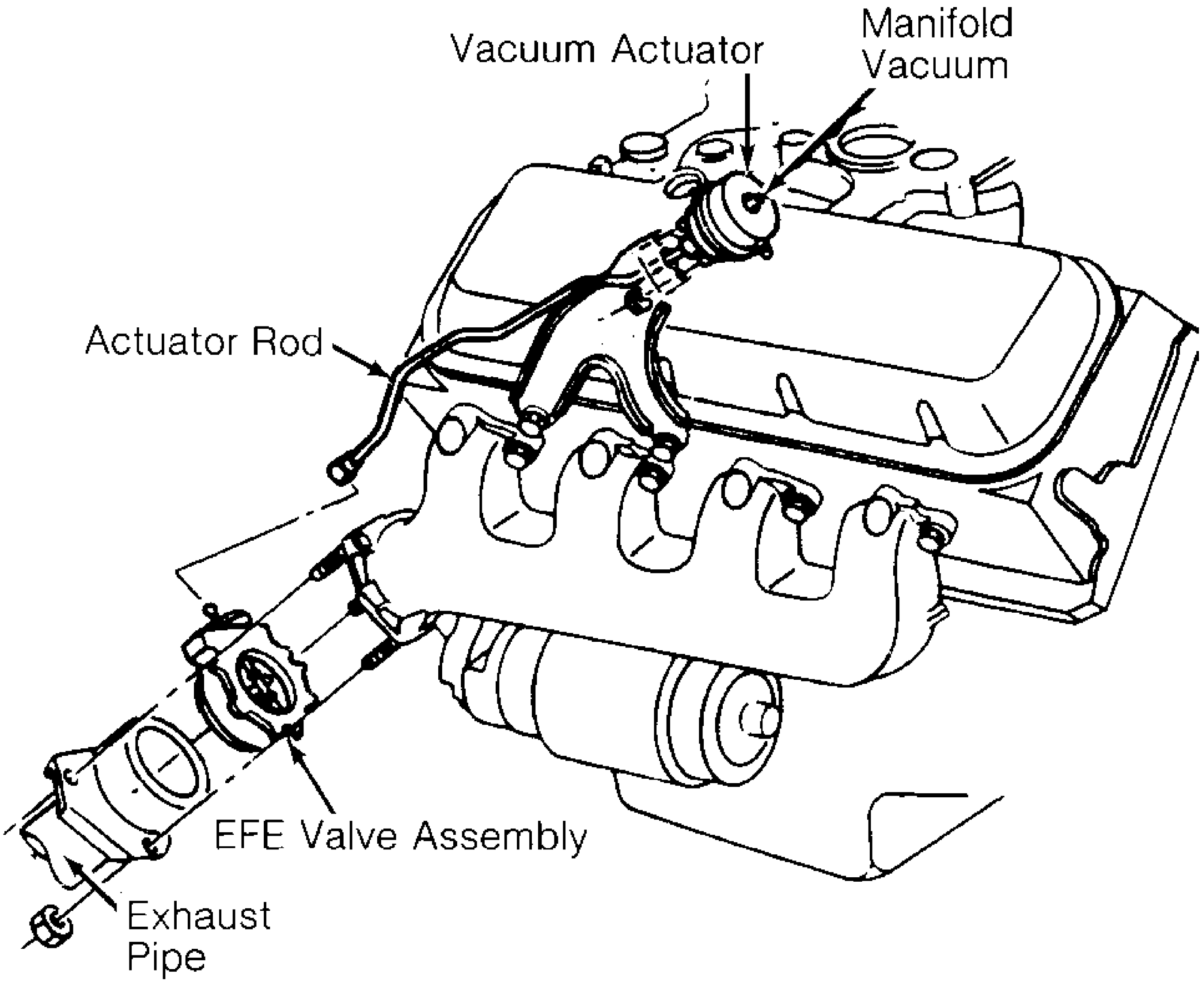


Fig. 15: Typical Vacuum-Actuated EFE System
Courtesy of General Motors Corp.

EMISSION MAINTENANCE REMINDER LIGHT (EMR) (IF EQUIPPED)

If equipped, the EMR light (some models may use a reminder flag) reminds vehicle operator that an emission system maintenance is required. This indicator is activated after a predetermined time/mileage.

When performing a smog check inspection, ensure EMR indicator is not activated. On models using an EMR light, light should glow when ignition switch is turned to ON position and should turn off when engine is running.

If an EMR flag is present or an EMR light stays on with engine running, fail vehicle and service or replace applicable emission-related components. To reset an EMR indicator, refer to appropriate MAINTENANCE REMINDER LIGHTS in the MAINTENANCE section.

MALFUNCTION INDICATOR LIGHT (MIL)

The Malfunction Indicator Light (MIL) is used to alert vehicle operator that the computerized engine control system has detected a malfunction (when it stays on all the time with engine running). On some models, the MIL may also be used to display trouble codes.

As a bulb and system check, malfunction indicator light will glow when ignition switch is turned to ON position and engine is not running. When engine is started, light should go out.

1993 ENGINE PERFORMANCE
Toyota Emission Applications

Camry, Celica, Corolla, Land Cruiser, MR2, Paseo, Pickup, Previa, Supra, Tercel, T100, 4Runner

EMISSION APPLICATIONS

EMISSION APPLICATIONS TABLE

Engine & Fuel System	Emission Control Systems & Devices
Camry	
2.2L 4-Cyl. PFI	
Major Control Systems & Devices	PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, EVAP-CKV, (1) SUB-TWC, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, (1) SUB-O2
3.0L V6 PFI	
Components & Other Related Devices	PCV, EVAP, TWC, FR, EGR, SPK, (3) O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, EVAP-CKV, (1) EGR-TS, EGR-VM, EGR-BVSV, SPK-CC, (1) SUB-O2
Celica	
1.6L 4 Cyl. (4A-FE) PFI	
Major Control Systems & Devices	PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, EVAP-CKV, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC
2.0L 4-Cyl. Turbo (3S-GTE) PFI	
Components & Other Related Devices	PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, EVAP-CKV, SUB-TWC, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC
2.2L 4-Cyl. (5S-FE) PFI	
Major Control Systems & Devices	PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, EVAP-CKV, (1) SUB-TWC, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, (1) SUB-O2
Corolla	
1.6L 4-Cyl. (4A-FE) PFI & 1.8L 4-Cyl. (7A-FE) PFI	
Major Control Systems & Devices	PCV, EVAP, TWC, FR, (1) EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, (1) EGR-TS, (1) EGR-VM,

(1) (2) EGR-VSV,
SPK-CC, (1) SUB-O2

Land Cruiser
4.5L 6-Cyl. PFI
Major Control Systems & Devices .... PCV, EVAP, (3) TWC, FR, EGR, SPK, PAIR, (3) O2, CEC, MIL
Components & Other Related Devices ..... EVAP-BVSV, (2) EVAP-VSV, EVAP-VC, EVAP-CKV, EVAP-VCTV, (1) EGR-TS, EGR-VM, (2) EGR-VSV, PAIR-CKV, PAIR-RES, (2) PAIR-VSV, PAIR-RV, SPK-CC

MR2
2.0L 4-Cyl. (3S-GTE) Turbo PFI
Major Control Systems & Devices .... PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices .... EVAP-BVSV, EVAP-VC, EVAP-CKV, SUB-TWC, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC

2.2L 4-Cyl. (5S-FE) PFI
Major Control Systems & Devices .... PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices .... EVAP-BVSV, EVAP-VC, (1) SUB-TWC, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, (1) SUB-O2

Paseo
1.5L 4-Cyl. PFI
Major Control Systems & Devices .... PCV, EVAP, TWC, FR, (4) EGR, SPK, O2, CEC, MIL
Components & Other Related Devices .... EVAP-BVSV, EVAP-VC, (1) EGR-TS, (4) EGR-VM, (2)(4) EGR-VSV, SPK-CC

Pickup
2.4L 4-Cyl. PFI
Major Control Systems & Devices .... PCV, EVAP, TWC, FR, EGR, SPK, PAIR, O2, CEC, MIL
Components & Other Related Devices .... EVAP-VC, (5) EGR-BVSV, (1) EGR-TS, EGR-VM, (1)(2) EGR-VSV, SPK-CC, PAIR-RV, PAIR-RES, (2) PAIR-VSV, PAIR-CKV, (1) SUB-O2

3.0L V6 PFI
Major Control Systems & Devices .... PCV, EVAP, TWC, FR, EGR, SPK, PAIR, O2, CEC, MIL
Components & Other Related Devices .... EVAP-BVSV, EVAP-VC, (6) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, PAIR-RV, PAIR-RES, (2) PAIR-VSV, PAIR-CKV

Previa
2.4L 4-Cyl. PFI
Major Control Systems & Devices .... PCV, EVAP, TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices .... EVAP-VC, EGR-BVSV, (1) EGR-TS, EGR-VM, SPK-CC, SUB-O2

Supra

3.0L 6-Cyl. Non-Turbo (2JZ-GE) PFI

Major Control Systems & Devices	PCV, EVAP, (3) TWC, FR, EGR, SPK, (3) O2, CEC, MIL
Components & Other Related Devices	(2) EVAP-VSV, EVAP-VC, EVAP-CKV, EGR-CLR, EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, (1) SUB-O2

3.0L 6-Cyl. Turbo (2JZ-GTE) PFI

Major Control Systems & Devices	PCV, EVAP, (3) TWC, FR, EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	(2) EVAP-VSV, EVAP-VC, EVAP-CKV, EGR-CLR, EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, SUB-O2

Tercel

1.5L 4-Cyl. PFI

Major Control Systems & Devices	PCV, EVAP, TWC, FR, (1) EGR, SPK, O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, (1) EGR-TS, (1) EGR-VM, (2)(1) EGR-VSV, SPK-CC

T100

3.0L V6 PFI

Major Control Systems & Devices	PCV, EVAP, TWC, FR, EGR, SPK, PAIR, O2, CEC, MIL
Components & Other Related Devices	(2) EVAP-VSV, EVAP-VC, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, PAIR-RV, PAIR-RES, (2) PAIR-VSV, PAIR-CKV, (7) SUB-O2

4Runner

2.4L 4-Cyl. PFI

Major Control Systems & Devices	PCV, EVAP, TWC, FR, EGR, SPK, PAIR, O2, CEC, MIL
Components & Other Related Devices	EVAP-VC, (5) EGR-BVSV, (1) EGR-TS, EGR-VM, (2)(1) EGR-VSV, SPK-CC, PAIR-RV, PAIR-RES, (2) PAIR-VSV, PAIR-CKV, (1) SUB-O2

3.0L V6 PFI

Major Control Systems & Devices	PCV, EVAP, TWC, FR, EGR, SPK, PAIR, O2, CEC, MIL
Components & Other Related Devices	EVAP-BVSV, EVAP-VC, (1) EGR-TS, EGR-VM, (2) EGR-VSV, SPK-CC, PAIR-RV, PAIR-RES, (2) PAIR-VSV, PAIR-CKV

(1) - Calif. only.
(2) - Controlled by ECM.
(3) - Two required.
(4) - Federal A/T and all Calif.
(5) - Federal and Canada only.
(6) - Calif. and all cab and chassis models.
(7) - Calif. 2WD models only.

ABBREVIATION DEFINITIONS

ABBREVIATION DEFINITION TABLE

Abbreviation	Definition
A/T	Automatic Transmission
CEC	Computerized Engine Controls
EGR	Exhaust Gas Recirculation
EGR-BVSV	EGR Bimetallic Vacuum Switching Valve
EGR-CLR	EGR Cooler
EGR-TS	EGR Temperature Sensor
EGR-VM	EGR Vacuum Modulator
EGR-VSV	EGR Vacuum Switching Valve
EVAP	Fuel Evaporative System
EVAP-BVSV	EVAP Bimetallic Vacuum Switching Valve
EVAP-CKV	EVAP Check Valve
EVAP-VC	EVAP Vapor Canister
EVAP-VCTV	EVAP Vacuum Control Valve
EVAP-VSV	EVAP Vacuum Switching Valve
FR	Fill Pipe Restrictor
O2	Oxygen Sensor
MIL	Malfunction Indicator Light
PAIR	Pulsed Secondary Air Injection
PAIR-CKV	PAIR Check Valve
PAIR-RES	PAIR Resonator
PAIR-RV	PAIR Reed Valve
PAIR-VSV	PAIR Vacuum Switching Valve
PCV	Positive Crankcase Ventilation
PFI	Port Fuel Injection
SPK	Spark Controls
SPK-CC	SPK Computer Controlled
SUB-O2	Sub-Oxygen Sensor
SUB-TWC	Sub Three-Way Catalyst
TWC	Three-Way Catalyst

ENGINE COOLING FAN

1993 Toyota Celica

1993 ENGINE COOLING
Toyota Specifications & Electric Cooling Fans

Toyota; Celica

SPECIFICATIONS

BELT ADJUSTMENT

Ensure belt tension is within specification. See appropriate BELT ADJUSTMENT table.

4-CYLINDER BELT ADJUSTMENT TABLE
Tension In Lbs. (kg) Using Burroughs Tension Gauge

Application	New Belt	(1) Used Belt
Celica		
1.6L (4A-FE)		
A/C	160 (73)	100 (45)
Alternator	160 (73)	130 (59)
Power Steering	125 (57)	80 (36)
2.0L Turbo (3S-GTE)		
A/C	165 (75)	84 (38)
Alternator		
With A/C	175 (79)	115 (52)
Without A/C	150 (68)	130 (59)
Power Steering	125 (57)	80 (36)
2.2L (5S-FE)		
A/C	165 (75)	110 (50)
Alternator		
With A/C	175 (79)	130 (59)
Without A/C	125 (57)	95 (43)
Power Steering	125 (57)	80 (36)

(1) - Used belt is a belt in operation at least 5 minutes.

COOLING SYSTEM SPECIFICATIONS

4-CYLINDER COOLING SYSTEM SPECIFICATIONS TABLE

Application	Specification
Coolant Replacement Interval	
First Service Interval (1)	45,000 Miles Or 36 Months
Coolant Capacity	
Celica	
1.6L (4A-FE)	
A/T	5.9 Qts. (5.6L)
M/T	5.5 Qts. (5.2L)
2.0L Turbo (3S-GTE)	6.3 Qts. (6.0L)
2.2L (5S-FE)	
A/T	7.0 Qts. (6.6L)
M/T	6.9 Qts. (6.5L)

(1) - After first service interval, replace coolant every 30,000 miles or 24 months.

COOLING SYSTEM BLEEDING

No special cooling system bleeding procedure is required.

ELECTRIC COOLING FAN

NOTE: Electric cooling fan may be used for the radiator or condenser. To verify electric cooling location and application, see ELECTRIC COOLING FAN IDENTIFICATION table. For condenser cooling fan testing, see appropriate A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

ELECTRIC COOLING FAN IDENTIFICATION TABLE

Application	Cooling Fan Identification
Celica	
Condenser Cooling Fan	Passenger's Side Front Of Radiator
Radiator Cooling Fan	Driver's Side Rear Of Radiator

RADIATOR COOLING FAN SYSTEM TEST

NOTE: On A/C equipped models, a A/C high-pressure switch which may be used in conjunction with cooling fan relays for controlling of radiator cooling fan. See appropriate A/C-HEATER SYSTEM article in the AIR CONDITIONING & HEAT section.

1) Ensure engine coolant temperature is less than specified STEP 1 temperature. See RADIATOR COOLING FAN SYSTEM TESTING TEMPERATURE SPECIFICATIONS table. Turn ignition on. Ensure radiator cooling fan stops.

2) If radiator cooling fan stops, proceed to step 5). If radiator cooling fan operates, check cooling fan relay No. 1 and Engine Coolant Temperature (ECT) switch. See COOLING FAN RELAY NO. 1 and ENGINE COOLANT TEMPERATURE (ECT) SWITCH under COMPONENT TESTING.

3) If cooling fan relay No. 1 and ECT switch are okay, check for open circuit in wire between ECT switch and cooling fan relay No. 1. Consult appropriate wiring diagram if necessary. See WIRING DIAGRAMS.

4) Cooling fan relay No. 1 is located in fuse/relay box. See Fig. 1. For ECT switch locations, see ECT SWITCH LOCATIONS table.

5) With ignition on, disconnect electrical connector at Engine Coolant Temperature (ECT) switch. For ECT switch locations, see ECT SWITCH LOCATIONS table. Ensure radiator cooling fan operates.

6) If radiator cooling fan operates, proceed to step 9). If radiator cooling fan does not operate, check cooling fan relay No. 1, radiator cooling fan, engine or fan main relay and necessary fuses.

NOTE: Engine main relay is used on this model.

7) Consult appropriate wiring diagram for proper fuse applications. See WIRING DIAGRAMS. See COOLING FAN RELAY NO. 1, RADIATOR COOLING FAN, FAN MAIN RELAY and ENGINE MAIN RELAY under COMPONENT TESTING.

8) If all components are okay, check for short circuit in wire between cooling fan relay No. 1 and ECT switch. Consult appropriate wiring diagram if necessary. See WIRING DIAGRAMS.

9) Install electrical connector on ECT switch. Start engine.

Warm engine until coolant temperature is greater than specified STEP 2 temperature. See RADIATOR COOLING FAN SYSTEM TESTING TEMPERATURE SPECIFICATIONS table.

10) Ensure radiator cooling fan operates. Replace ECT switch if radiator cooling fan fails to operate and recheck operation.

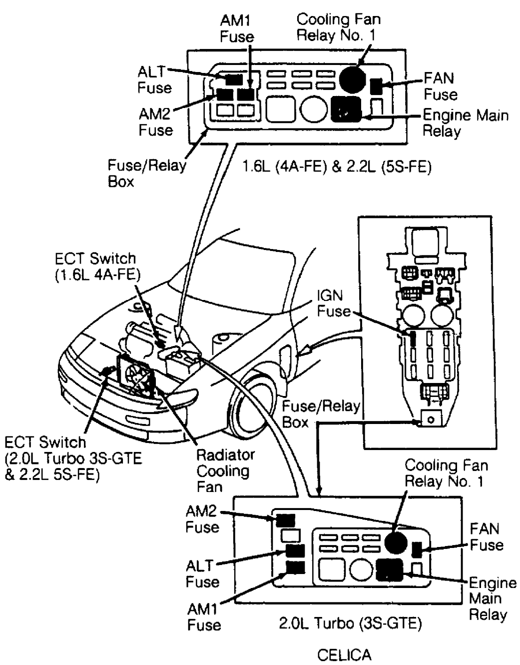
RADIATOR COOLING FAN SYSTEM TESTING TEMPERATURE SPECIFICATIONS TABLE

Application	Step 1 Temp. °F (°C)	Step 2 Temp. °F (°C)
Celica Without A/C	181 (83)	199 (93)

ECT SWITCH LOCATIONS TABLE

Application	(1) Switch Location
Celica	
1.6L (4A-FE)	(2)
2.0L Turbo (3S-GTE) & 2.2L (5S-FE)	Bottom Of Radiator

(1) - For additional information on ECT switch locations, see Fig. 1.
(2) - ECT switch is located in coolant housing below distributor and contains a single-pin connector with a Blue/Black wire.



93D84015

Fig. 1: Identifying Radiator Cooling Fan & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

COMPONENT TESTING

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

A/C AMPLIFIER CIRCUIT TEST TABLE

Wiring Harness Terminals	Condition	Specification
No. 3 & Ground	....	Continuity
No. 4 & Ground	Ignition On	Battery Voltage
No. 9 & 15	185°F (85°C) (1)	1350 Ohms
No. 9 & 15	194°F (90°C) (1)	1190 Ohms
No. 9 & 15	203°F (95°C) (1)	1050 Ohms
No. 10 & Ground	Ignition On	Battery Voltage
No. 13 & Ground	....	Continuity

(1) - This is the coolant temperature.

Cooling Fan Relay No. 1

1) Disconnect negative battery cable. Remove cooling fan relay No. 1 relay from fuse/relay box. See Fig. 1. Using ohmmeter, ensure continuity exists between specified terminals. See Fig. 2.

2) To check relay operation, connect battery to specified terminals of cooling fan relay No. 1. See Fig. 2. Using ohmmeter, ensure no continuity exists between specified terminals. See Fig. 2. Replace cooling fan relay No. 1 if defective.

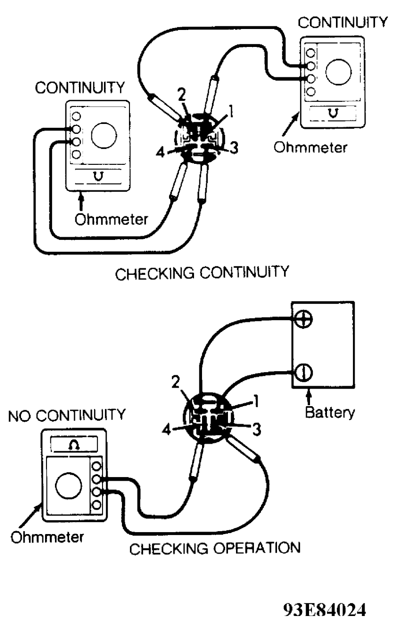


Fig. 2: Testing Cooling Fan Relay No. 1 & Engine Compartment Cooling Fan Relay
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Engine Coolant Temperature (ECT) Switch (Celica 2.0L 5S-FE)

1) Disconnect negative battery cable. Drain cooling system. Disconnect electrical connector and remove ECT switch. See ECT SWITCH LOCATIONS table. Place probe end of ECT switch in container of water.

2) Using ohmmeter, check for continuity and then no continuity between electrical terminals on ECT switch while heating water to specified temperatures. See ECT SWITCH CONTINUITY SPECIFICATIONS table.

3) Replace ECT switch if not as specified. Reinstall ECT switch using NEW "O" ring (if equipped). Fill cooling system. On MR2, air must be bled from cooling system. See COOLING SYSTEM BLEEDING.

Engine Coolant Temperature (ECT) Switch (Celica 1.6L 4A-FE)

1) Disconnect negative battery cable. Drain cooling system.

Disconnect electrical connector and remove ECT switch. See ECT SWITCH LOCATIONS table. Place probe end of ECT switch in container of water.

2) Using ohmmeter, check for continuity and then no continuity between electrical terminal on ECT switch and switch body while heating water to specified temperatures. See ECT SWITCH CONTINUITY SPECIFICATIONS table. Replace ECT switch if not as specified. Reinstall and fill cooling system.

ECT SWITCH LOCATIONS TABLE

Application	(1) Switch Location
Celica	
1.6L (4A-FE)	(2)
2.0L Turbo (3S-GTE) & 2.2L (5S-FE)	Bottom Of Radiator

(1) - For additional information on ECT switch locations, see Figs. 1 and 5.
(2) - ECT switch is located in coolant housing below distributor and contains a single-pin connector with a Blue/Black wire.

ECT SWITCH CONTINUITY SPECIFICATIONS TABLE

Application	Temperature
Celica	
Continuity	Less Than 181°F (83°C)
No Continuity	Greater Than 199°F (93°C)

Engine Main Relay

1) Disconnect negative battery cable. Remove engine main relay from fuse/relay box. See Fig. 1. Using ohmmeter, ensure continuity and no continuity exists between specified terminals. See Fig. 3.

2) To check relay operation, connect battery to specified terminals of engine main relay. See Fig. 3. Using ohmmeter, ensure continuity and no continuity exists between specified terminals. See Fig. 3. Replace engine main relay if defective.

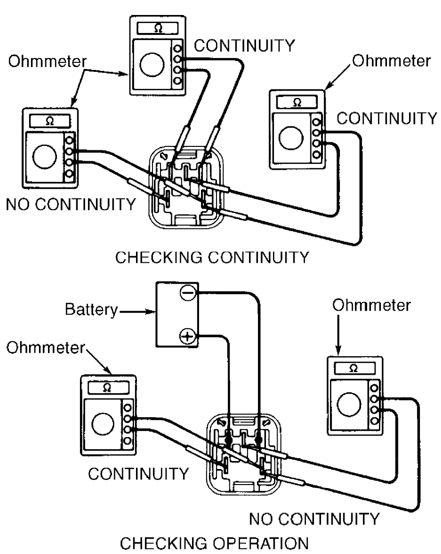


Fig. 3: Testing Engine Main Relay
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Radiator Cooling Fan

1) Disconnect electrical connector from radiator cooling fan. Connect battery and ammeter to electrical connector on radiator cooling fan.

2) Radiator cooling fan should operate smoothly and amperage draw should be within specification. See RADIATOR COOLING FAN AMPERAGE DRAW SPECIFICATIONS table.

3) Replace radiator cooling fan if it fails to rotate smoothly or amperage draw is not within specification. Reinstall electrical connector.

RADIATOR COOLING FAN AMPERAGE DRAW SPECIFICATIONS TABLE

Application	Amps
Celica	
1.6L 4A-FE & 2.2L 5S-FE	5.8-7.4
2.0L Turbo (3S-GTE)	8.8-10.8

WIRING DIAGRAMS

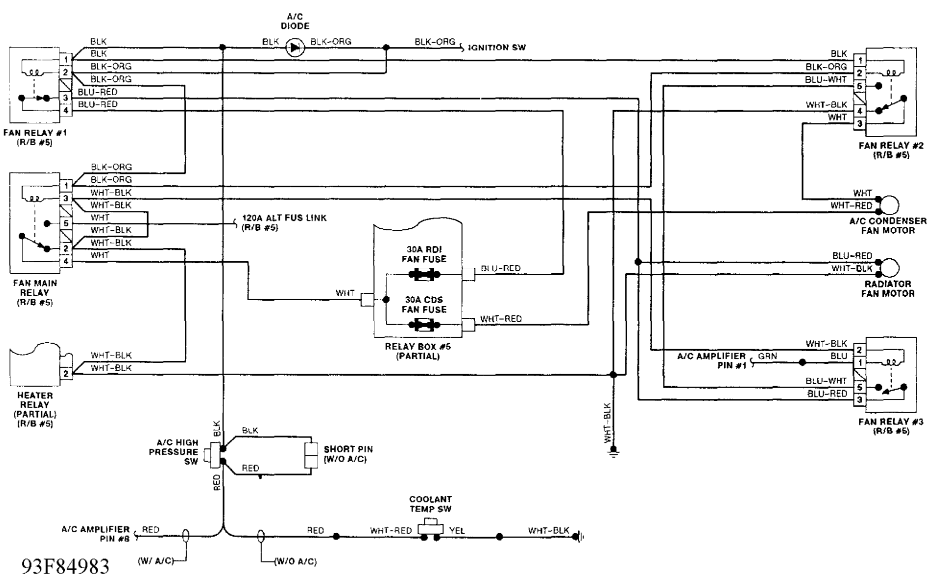


Fig. 4: Electric Cooling Fan Wiring Diagram

ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION

1993 Toyota Celica

Engine Overhaul Procedures - General Information
ALL PISTON ENGINES

* PLEASE READ THIS FIRST *

Examples used in this article are general in nature and do not necessarily relate to a specific engine or system. Illustrations and procedures have been chosen to guide mechanic through engine overhaul process. Descriptions of processes of cleaning, inspection, assembly and machine shop practice are included.

Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ENGINE IDENTIFICATION

The engine may be identified from its Vehicle Identification Number (VIN) stamped on a metal tab. Metal tab may be located in different locations depending on manufacturer. Engine identification number or serial number is located on cylinder block. Location varies with manufacturer.

INSPECTION PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

Engine components must be inspected to meet manufacturer's specifications and tolerances during overhaul. Proper dimensions and tolerances must be met to obtain proper performance and maximum engine life.

Micrometers, depth gauges and dial indicator are used for checking tolerances during engine overhaul. Magnaflux, Magnaglo, dye-check, ultrasonic and x-ray inspection procedures are used for parts inspection.

MAGNETIC PARTICLE INSPECTION

Magnaflux & Magnaglo

Magnaflux is an inspection technique used to locate material flaws and stress cracks. The part in question is subjected to a strong magnetic field. The entire part, or a localized area, can be magnetized. The part is coated with either a wet or dry material that contains fine magnetic particles.

Cracks which are outlined by the particles cause an interruption in the magnetic field. The dry powder method of Magnaflux can be used in normal light. A crack will appear as an obvious bright line.

Fluorescent liquid is used in conjunction with a blacklight in a second Magnaflux system called Magnaglo. This type of inspection demands a darkened room. The crack will appear as a glowing line in this process. Both systems require complete demagnetizing upon completion of the inspection. Magnetic particle inspection applies to ferrous materials only.

PENETRANT INSPECTION

Zyglo

The Zyglo process coats the material with a fluorescent dye penetrant. The part is often warmed to expand cracks that will be penetrated by the dye. When the coated part is subjected to inspection with a blacklight, a crack will glow brightly. Developing solution is often used to enhance results. Parts made of any material, such as aluminum cylinder heads or plastics, may be tested using this process.

Dye Check

Penetrating dye is sprayed on the previously cleaned component. Dye is left on component for 5-45 minutes, depending upon material density. Component is then wiped clean and sprayed with a developing solution. Surface cracks will show up as a bright line.

ULTRASONIC INSPECTION

If an expensive part is suspected of internal cracking, Ultrasonic testing is used. Sound waves are used for component inspection.

X-RAY INSPECTION

This form of inspection is used on highly stressed components. X-ray inspection maybe used to detect internal and external flaws in any material.

PRESSURE TESTING

Cylinder heads can be tested for cracks using a pressure tester. Pressure testing is performed by plugging all but one of the holes in the head and injecting air or water into the open passage. Leaks are indicated by the appearance of wet or damp areas when using water. When air is used, it is necessary to spray the head surface with a soap solution. Bubbles will indicate a leak. Cylinder head may also be submerged in water heated to specified temperature to check for cracks created during heat expansion.

CLEANING PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

All components of an engine do not have the same cleaning requirements. Physical methods include bead blasting and manual removal. Chemical methods include solvent blast, solvent tank, hot tank, cold tank and steam cleaning of components.

BEAD BLASTING

Manual removal of deposits may be required prior to bead blasting, followed by some other cleaning method. Carbon, paint and rust may be removed using bead blasting method. Components must be free of oil and grease prior to bead blasting. Beads will stick to grease or oil soaked areas causing area not to be cleaned.

Use air pressure to remove all trapped residual beads from components after cleaning. After cleaning internal engine parts made of aluminum, wash thoroughly with hot soapy water. Component must be thoroughly cleaned as glass beads will enter engine oil resulting in bearing damage.

CHEMICAL CLEANING

Solvent tank is used for cleaning oily residue from components. Solvent blasting sprays solvent through a siphon gun using compressed air.

The hot tank, using heated caustic solvents, is used for cleaning ferrous materials only. DO NOT clean aluminum parts such as cylinder heads, bearings or other soft metals using the hot tank. After cleaning, flush parts with hot water.

A non-ferrous part will be ruined and caustic solution will be diluted if placed in the hot tank. Always use eye protection and gloves when using the hot tank.

Use of a cold tank is for cleaning of aluminum cylinder heads, carburetors and other soft metals. A less caustic and unheated solution is used. Parts may be lift in the tank for several hours without damage. After cleaning, flush parts with hot water.

Steam cleaning, with boiling hot water sprayed at high pressure, is recommended as the final cleaning process when using either hot or cold tank cleaning.

COMPONENT CLEANING

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

SHEET METAL PARTS

Examples of sheet metal parts are the rocker covers, front and side covers, oil pan and bellhousing dust cover. Glass bead blasting or hot tank may be used for cleaning.

Ensure all mating surfaces are flat. Deformed surfaces should be straightened. Check all sheet metal parts for cracks and dents.

INTAKE & EXHAUST MANIFOLDS

Using solvent cleaning or bead blasting, clean manifolds for inspection. If the intake manifold has an exhaust crossover, all carbon deposits must be removed. Inspect manifolds for cracks, burned or eroded areas, corrosion and damage to fasteners.

Exhaust heat and products of combustion cause threads of fasteners to corrode. Replace studs and bolts as necessary. On "V" type intake manifolds, the sheet metal oil shield must be removed for proper cleaning and inspection. Ensure that all manifold parting surfaces are flat and free of burrs.

CYLINDER HEAD REPLACEMENT

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

REMOVAL

Remove intake and exhaust manifolds and valve cover. Cylinder head and camshaft carrier bolts (if equipped), should be removed only when the engine is cold. On many aluminum cylinder heads, removal while hot will cause cylinder head warpage. Mark rocker arm or overhead cam components for location.

Remove rocker arm components or overhead cam components. Components must be installed in original location. Individual design rocker arms may utilize shafts, ball-type pedestal mounts or no rocker arms. For all design types, wire components together and identify according to the corresponding valve. Remove cylinder head bolts. Note length and location. Some applications require cylinder head bolts be removed in proper sequence to prevent cylinder head damage. See Fig. 1. Remove cylinder head.

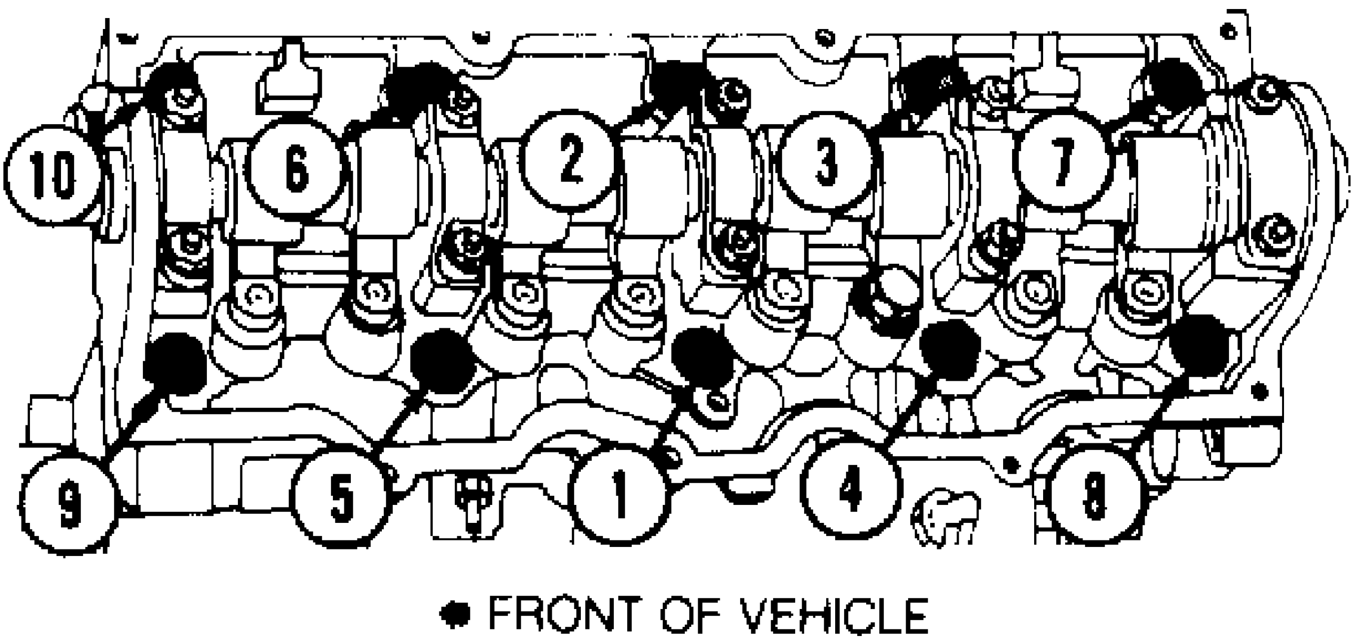


Fig. 1: Typical Cylinder Head Tightening or Loosening Sequence
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INSTALLATION

Ensure all surfaces and head bolts are clean. Check that head bolt holes of cylinder block are clean and dry to prevent block damage when bolts are tightened. Clean threads with tap to ensure accurate bolt torque.

Install head gasket on cylinder block. Some manufacturer's may recommend sealant be applied to head gasket prior to installation. Note that all holes are aligned. Some gasket applications may be marked so certain area faces upward. Install cylinder head using care not to damage head gasket. Ensure cylinder head is fully seated on cylinder block.

Some applications require head bolts be coated with sealant prior to installation. This is done if head bolts are exposed to water passages. Some applications require head bolts be coated with light coat of engine oil.

Install head bolts. Head bolts should be tightened in proper steps and sequence to specification. See Fig. 1. Install remaining components. Tighten all bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

NOTE: Some manufacturers require that head bolts be retightened after specified amount of operation. This must be done to prevent head gasket failure.

VALVE ADJUSTMENT

Engine specifications will indicate valve train clearance and temperature at which adjustment is to be made on most models. In most cases, adjustment will be made with a cold engine. In some cases, both a cold and a hot clearance will be given for maintenance convenience.

On some models, adjustment is not required. Rocker arms are tightened to specification and valve lash is automatically set. On some models with push rod actuated valve train, adjustment is made at push rod end of rocker arm while other models do not require adjustment.

Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer’s specifications.

Some models require hydraulic lifter to be bled down and clearance measured. Different length push rods can be used to obtain proper clearance. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge.

On overhead cam engines designed without rocker arms actuate valves directly on a cam follower. A hardened, removable disc is installed between the cam lobe and lifter. Clearance will be checked between cam heel and adjusting disc in proper sequence using a feeler gauge. Engine will be rotated to obtain all valve adjustments.

On overhead cam engines designed with rocker arms, adjustment is made at push rod end of rocker arm. Ensure that the valve to be adjusted is riding on the heel of the cam on all engines. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer’s specifications.

CYLINDER HEAD OVERHAUL

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

DISASSEMBLY

Mark valves for location. Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator, valve spring, spring seat and valve. See Fig. 2.

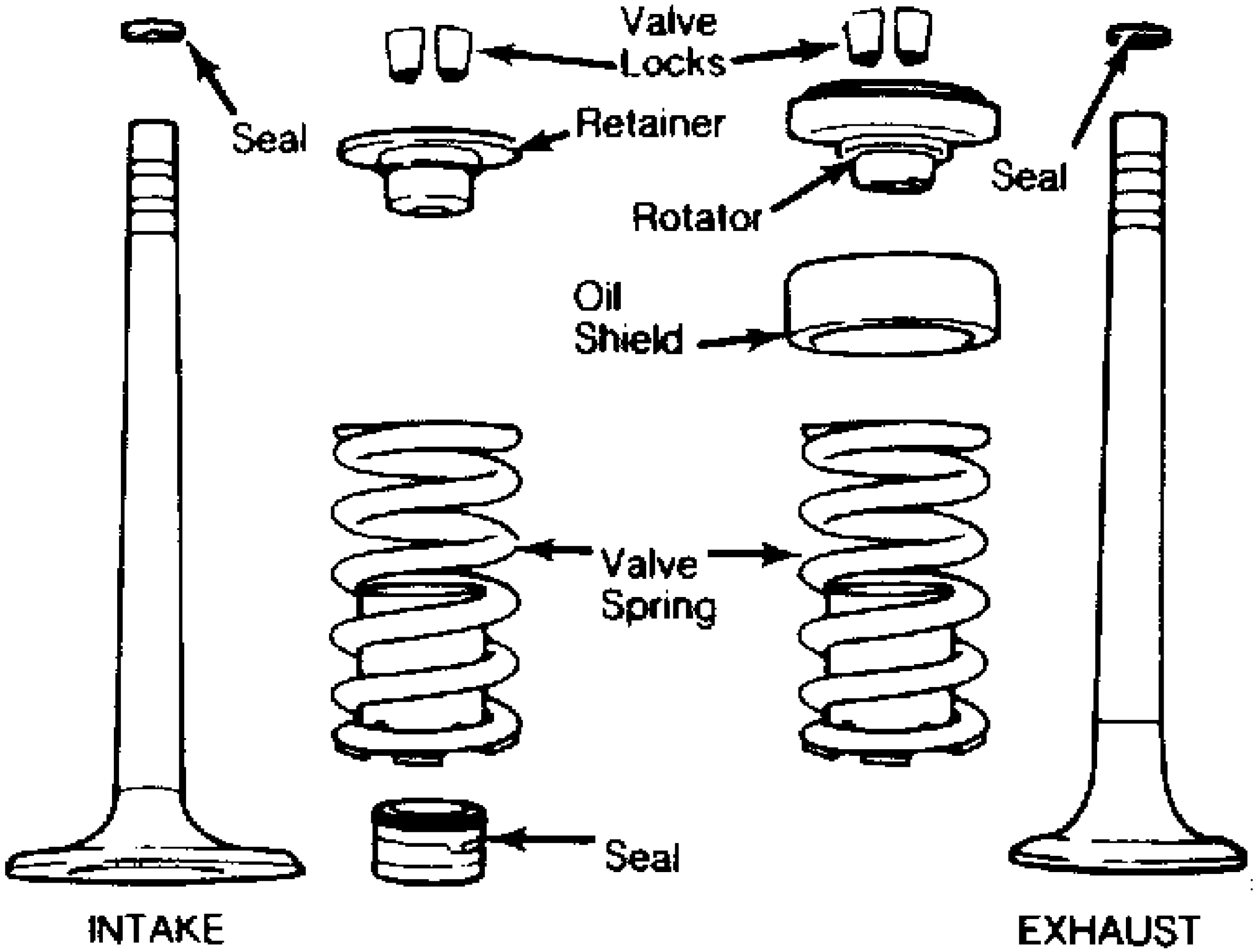

Fig. 2: Exploded View of Intake & Exhaust Valve Assemblies - Typical
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CLEANING & INSPECTION

Clean cylinder head and valve components using approved cleaning methods. Inspect cylinder head for cracks, damage or warped gasket surface. Place straightedge across gasket surface. Determine clearance at center of straightedge. Measure across both diagonals, longitudinal centerline and across the head at several points. See Fig. 3.

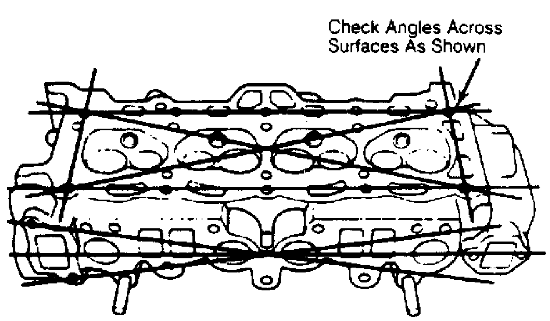

Fig. 3: Checking Cylinder Head for Warpage - Typical
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On cast cylinder heads, if warpage exceeds .003" (.08 mm) in a 6" span, or .006" (.15 mm) over total length, cylinder head must be resurfaced. On most aluminum cylinder heads, if warpage exceeds .002" (.05 mm) in any area, cylinder head must be resurfaced. Warpage specification may vary with manufacturer.

Cylinder head thickness should be measured to determine amount of material which can be removed before replacement is required. Cylinder head thickness must not be less than manufacturer's specifications.

If cylinder head required resurfacing, it may not align properly with intake manifold. On "V" type engines, misalignment is corrected by machining intake manifold surface that contacts cylinder head. Cylinder head may be machined on surface that contacts intake manifold.

Using oil stone, remove burrs or scratches from all sealing surfaces.

VALVE SPRINGS

Inspect valve springs for corroded or pitted valve spring surfaces which may lead to breakage. Polished spring ends caused by a rotating spring, indicates that spring surge has occurred. Replace springs showing evidence of these conditions.

Inspect valve springs for squareness using a 90 degree straightedge. See Fig. 4. Replace valve spring if out-of-square exceeds manufacturer's specification.

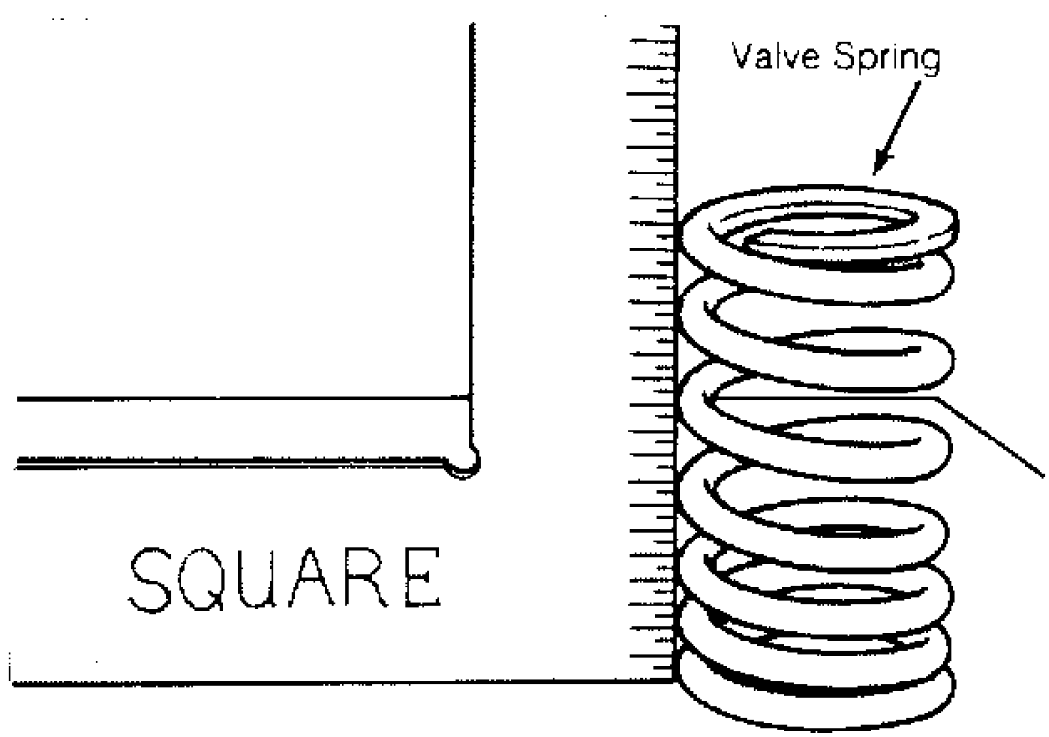

Fig. 4: Checking Valve Spring Squareness - Typical
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Using vernier caliper, measure free length of all valve springs. Replace springs if not within specification. Using valve spring tester, test valve spring pressure at installed and compressed heights. See Fig. 5.

Usually compressed height is installed height minus valve lift. Replace valve spring if not within specification. It is recommended to replace all valve springs when overhauling cylinder head.

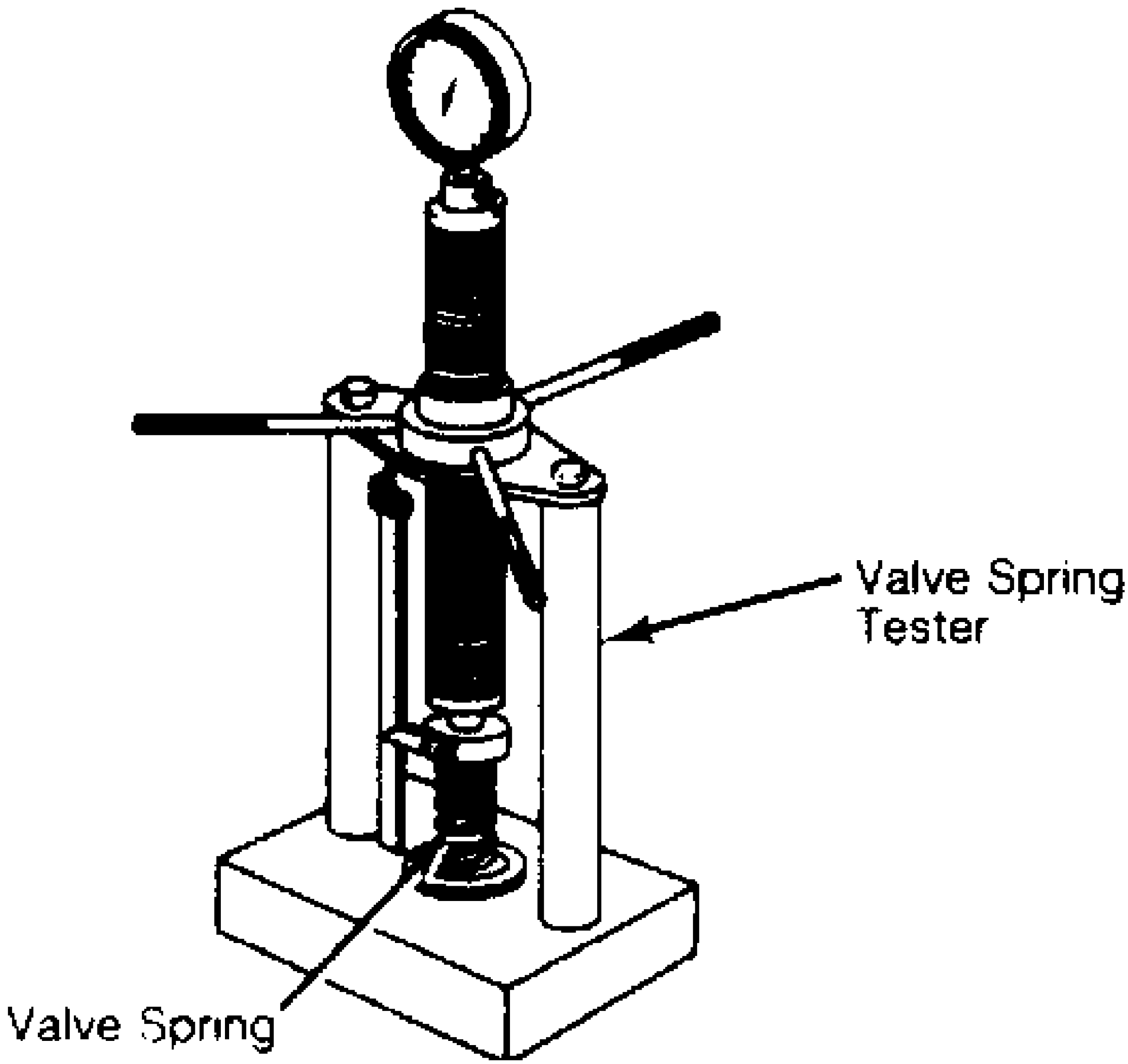

Fig. 5: Checking Valve Spring Pressure - Typical
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VALVE GUIDE

Measuring Valve Guide Clearance

Check valve stem-to-guide clearance. Ensure valve stem diameter is within specifications. Install valve in valve guide. Install dial indicator assembly on cylinder head with tip resting against valve stem just above valve guide. See Fig. 6.

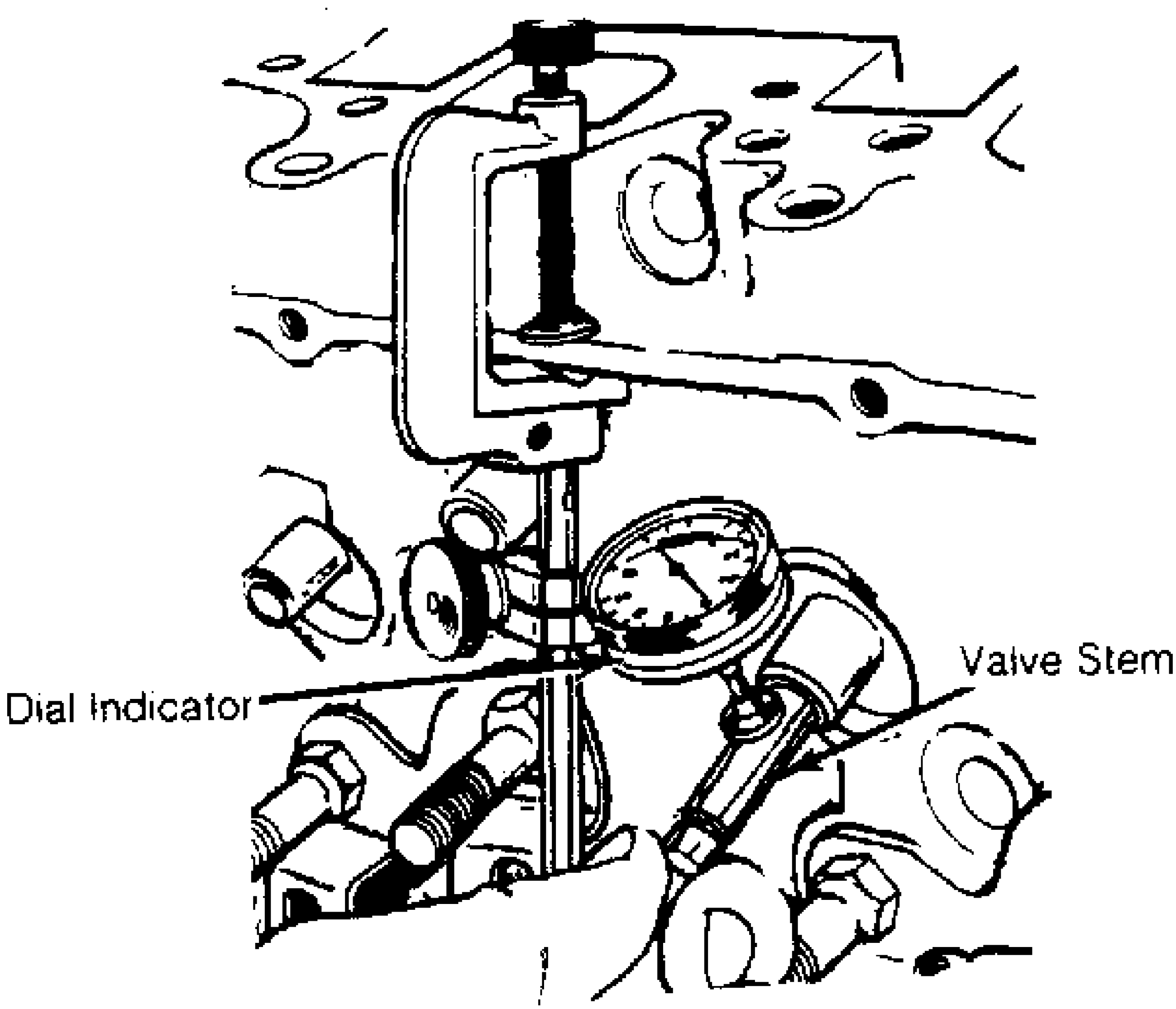

Fig. 6: Measuring Valve Stem-to-Guide Clearance - Typical
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Lower valve approximately 1/16" below valve seat. Push valve stem against valve guide as far as possible. Adjust dial indicator to zero. Push valve stem in opposite direction and note reading. Clearance must be within specification.

If valve guide clearance exceeds specification, valves with oversize stems may be used or valve guide must be replaced. On some applications, a false guide is installed, then reamed to proper specification. Valve guide reamer set is used to ream valve guide to obtain proper clearance for new valve.

Reaming Valve Guide

Select proper reamer for valve stem. Reamer must be of proper length to provide clean cut through entire length of valve guide. Install reamer in valve guide and rotate to cut valve guide. See Fig. 7.

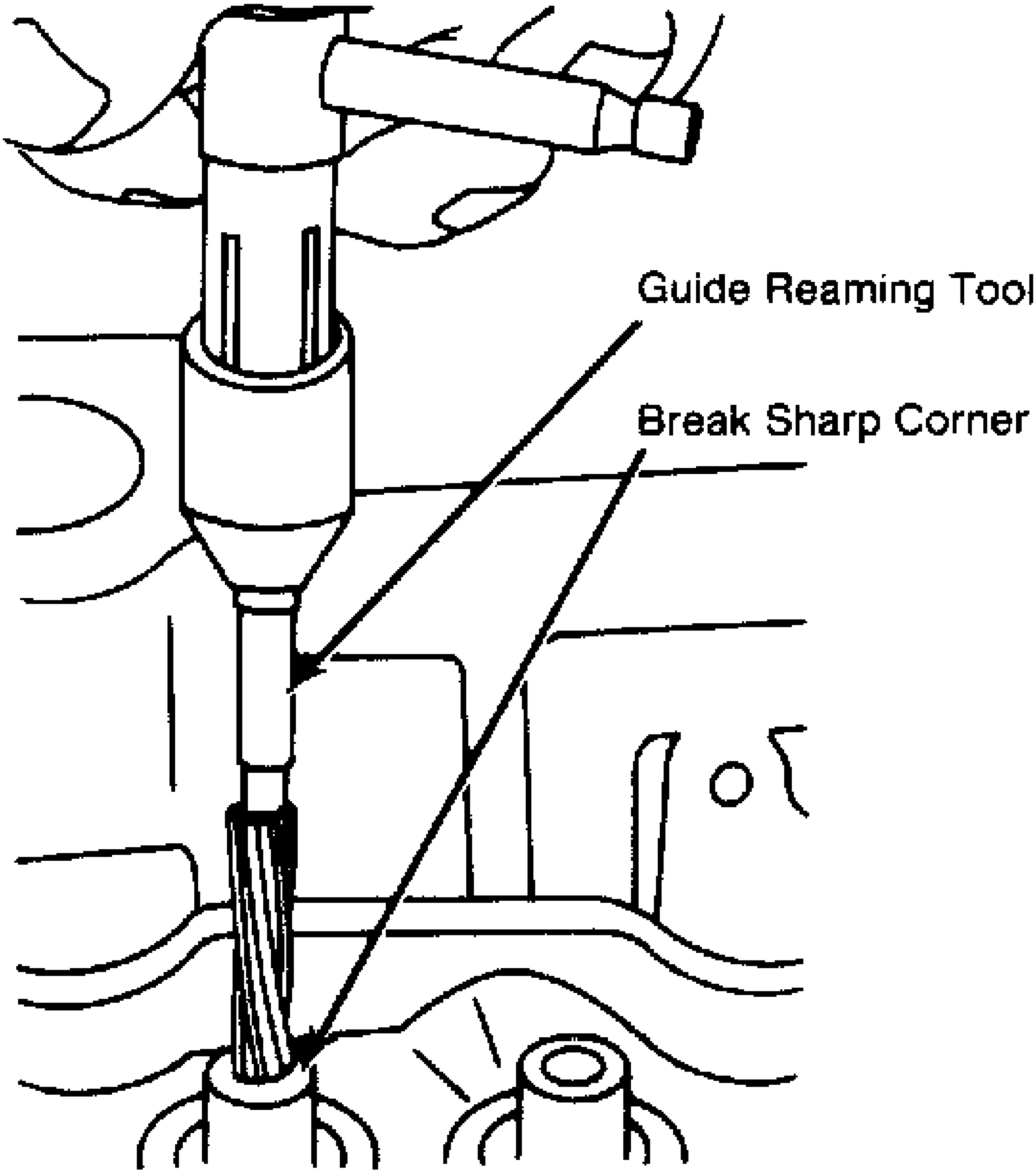

Fig. 7: Reaming Valve Guides - Typical
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Replacing Valve Guide

Replace valve guide if clearance exceeds specification. Valve guides are either pressed, hammered or shrunk in place, depending upon cylinder head design and type of metal used.

Remove valve guide from cylinder head by pressing or tapping on a stepped drift. See Fig. 8. Once valve guide is installed, distance from cylinder head to top of valve guide must be checked. This distance must be within specification.

Aluminum heads are often heated before installing valve guide. Guide is sometimes chilled in dry ice before installation. Combination of a heated head and chilled guide insures a tight guide fit upon assembly. The new guide must be reamed to specification.

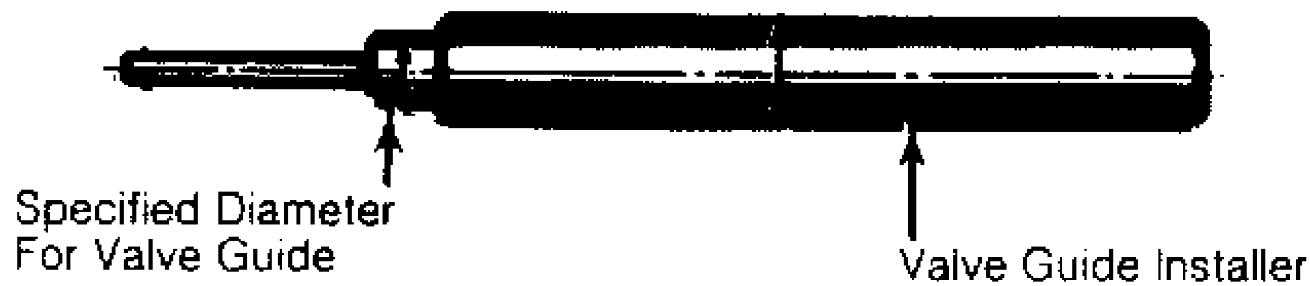

Fig. 8: Typical Valve Guide Remover & Installer
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VALVES & VALVE SEATS

Valve Grinding

Valve stem O.D. should be measured in several areas to indicate amount of wear. Replace valve if not within specification. Valve margin area should be measured to ensure that valve can be grounded. See Fig. 9.

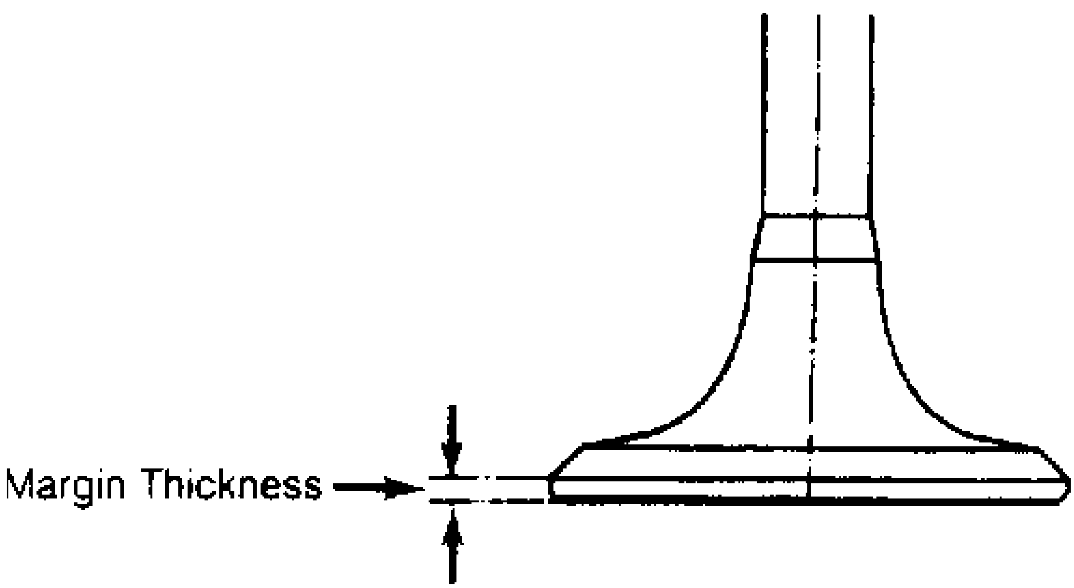

Fig. 9: Measuring Valve Head Margin - Typical
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If valve margin is less than specification, this will burn the valves. Valve must be replaced. Due to minimum margin dimensions during manufacture, some new type valves cannot be reground.

Resurface valve on proper angle specification using valve grinding machine. Follow manufacturer's instructions for valve grinding machine. Specifications may indicate a different valve face angle than seat angle.

Measure valve margin after grinding. Replace valve if not within specification. Valve stem tip can be refinished using valve grinding machine.

Valve Lapping

During valve lapping of recent designed valves, be sure to follow manufacturers recommendations. Surface hardening and materials used with some valves do not permit lapping. Lapping process will remove excessive amounts of the hardened surface.

Valve lapping is done to ensure adequate sealing between valve face and seat. Use either a hand drill or lapping stick with suction cup attached.

Moisten and attach suction cup to valve. Lubricate valve stem and guide. Apply a thin coat of fine valve grinding compound between valve and seat. Rotate lapping tool between the palms or with hand drill.

Lift valve upward off the seat and change position often. This is done to prevent grooving of valve seat. Lap valve until a smooth polished seat is obtained. Thoroughly clean grinding compound from components. Valve to valve seat concentricity should be checked. See VALVE SEAT CONCENTRICITY.

CAUTION: Valve guides must be in good condition and free of carbon deposits prior to valve seat grinding. Some engines contain an induction hardened valve seat. Excessive material removal will damage valve seats.

Valve Seat Grinding

Select coarse stone of correct size and angle for seat to be ground. Ensure stone is true and has a smooth surface. Select correct size pilot for valve guide dimension. Install pilot in valve guide. Lightly lubricate pilot shaft. Install stone on pilot. Move stone off and on the seat approximately 2 times per second during grinding operation.

Select a fine stone to finish grinding operation. Grinding stones with 30 and 60 degree angles are used to center and narrow the valve seat as required. See Fig. 10.

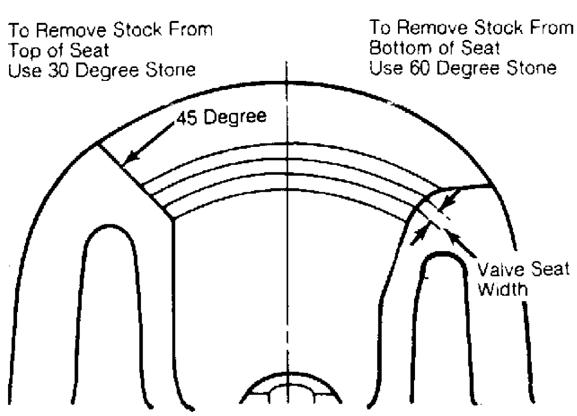

Fig. 10: Adjusting Valve Seat Width - Typical
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Valve Seat Replacement

Replacement of valve seat inserts is done by cutting out the old insert and machining an oversize insert bore. Replacement oversize insert is usually chilled and the cylinder head is sometimes warmed. Valve seat is pressed into the head. This operation requires specialized machine shop equipment.

Valve Seat Concentricity

Using dial gauge, install gauge pilot in valve guide. Position gauge arm on the valve seat. Adjust dial indicator to zero. Rotate arm 360 degrees and note reading. Runout should not exceed specification.

To check valve-to-valve seat concentricity, coat valve face lightly with Prussian Blue dye. Install valve and rotate it on valve seat. If pattern is even and entire seat is coated at valve contact point, valve is concentric with the seat.

REASSEMBLY

Valve Stem Installed Height

Valve stem installed height must be checked when new valves are installed or when valves or valve seats have been ground. Install valve in valve guide. Measure distance from tip of valve stem to spring seat. See Fig. 11. Distance must be within specifications.

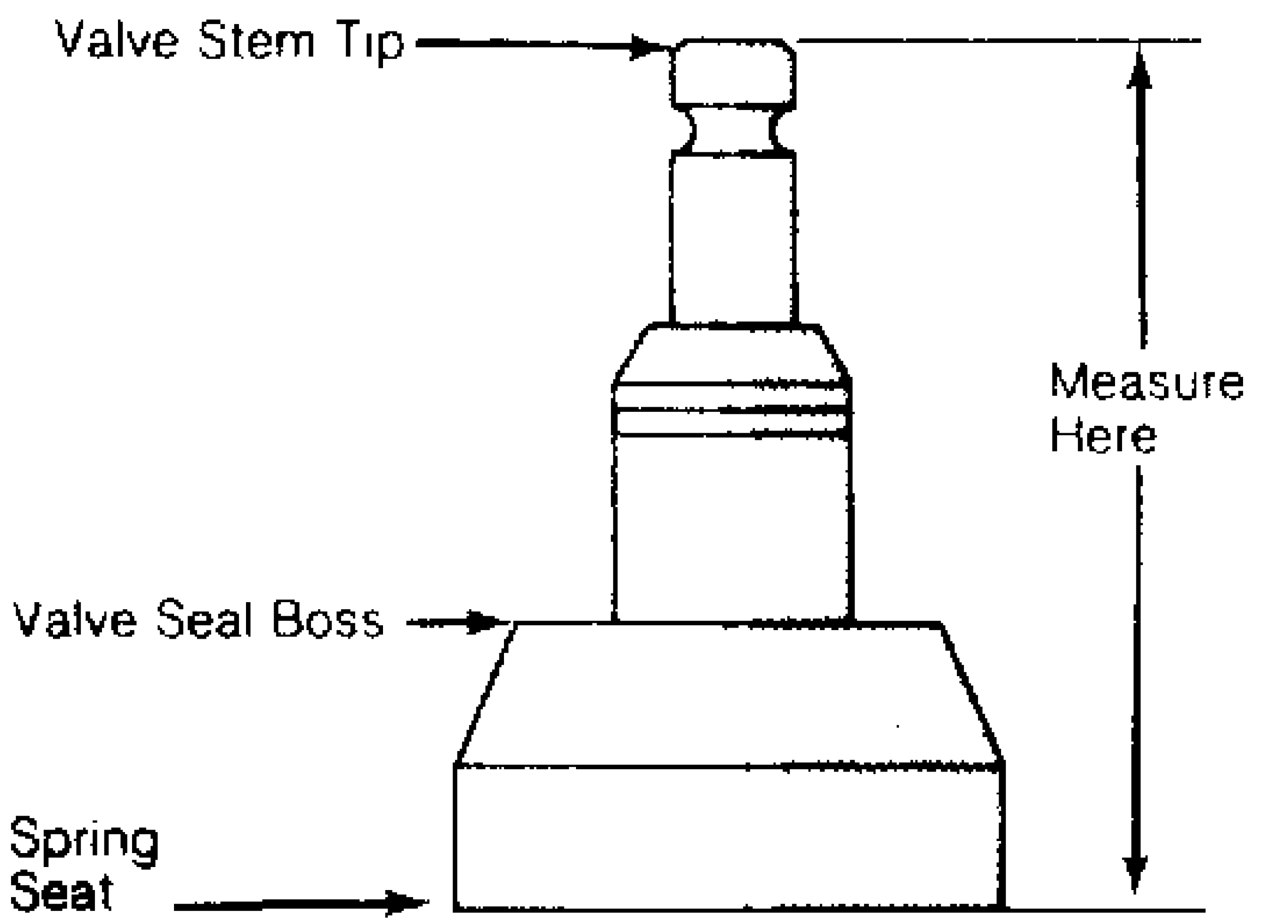

Fig. 11: Measuring Valve Stem Installed Height - Typical
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Remove valve and grind valve stem tip if height exceeds specification. Valve tips are surface hardened. DO NOT remove more than .010" (.25 mm) from tip. Chamfer sharp edge of reground valve tip. Recheck valve stem installed height.

VALVE STEM OIL SEALS

Valve stem oil seals must be installed on valve stem. See Fig. 2. Seals are needed due to pressure differential at the ends of valve guides. Atmospheric pressure above intake guide, combined with manifold vacuum below guide, causes oil to be drawn into the cylinder.

Exhaust guides also have pressure differential created by exhaust gas flowing past the guide, creating a low pressure area. This low pressure area draws oil into the exhaust system.

Replacement (On Vehicle)

Mark rocker arm or overhead cam components for location. Remove rocker arm components or overhead cam components. Components must be installed in original location. Remove spark plugs. Valve stem oil seals may be replaced by holding valves against seats using air pressure.

Air pressure must be installed in cylinder using an adapter for spark plug hole. An adapter can be constructed by welding air hose connection to spark plug body with porcelain removed.

Install adapter in spark plug hole. Apply a minimum of 140 psi (9.8 kg/cm^2) to adapter. Air pressure should hold valve closed. If air pressure does not hold valve closed, check for damaged or bent valve. Cylinder head must be removed for service.

Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator and valve spring. Remove valve stem oil seal.

If oversized valves have been installed, oversized oil seals must be used. Coat valve stem with engine oil. Install protective sleeve over end of valve stem. Install new oil seal over valve stem and seat on valve guide. Remove protective sleeve. Install spring seat, valve spring and retainer or rotator. Compress spring and install valve locks. Remove spring compressor. Ensure valve locks are fully seated.

Install rocker arms or overhead cam components. Tighten all bolts to specification. Adjust valves if required. Remove adapter. Install spark plugs, valve cover and gasket.

VALVE SPRING INSTALLED HEIGHT

Valve spring installed height should be checked during reassembly. Measure height from lower edge of valve spring to the upper edge. DO NOT include valve spring seat or retainer. Distance must be within specifications. If valves and/or seats have been ground, a valve spring shim may be required to correct spring height. See Fig. 12.

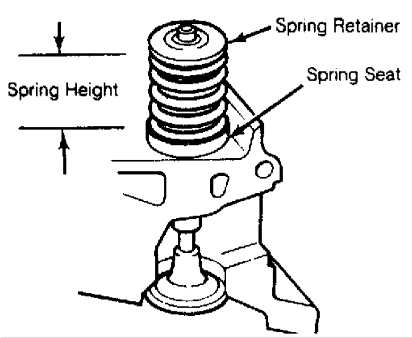

Fig. 12: Measuring Valve Spring Installed Height - Typical
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ROCKER ARMS & ASSEMBLIES

Rocker Studs

Rocker studs are either threaded or pressed in place. Threaded studs are removed by locking 2 nuts on the stud. Unscrew the stud by turning the jam nut. Coat the stud threads with Loctite and install. Tighten to specification.

Pressed in stud can be removed using a stud puller. Ream the stud bore to proper specification and press in a new oversize stud. Pressed in studs are often replaced by cutting threads in the stud bore to accept a threaded stud.

Rocker Arms & Shafts

Mark rocker arms for location. Remove rocker arm retaining bolts. Remove rocker arms. Inspect rocker arms, shafts, bushings and pivot balls (if equipped) for excessive wear. Inspect rocker arms for wear in valve stem contact area. Measure rocker arm bushing I.D. Replace bushings if excessively worn.

The rocker arm valve stem contact point can be reground, using special fixture for valve grinding machine. Remove minimum amount of material as possible. Ensure all oil passages are clear. Install rocker arms in original locations. Ensure rocker arm is properly seated in push rod. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

Pushrods

Remove rocker arms. Mark push rods for location. Remove push rods. Push rods can be steel or aluminum, solid or hollow. Hollow pushrods must be internally cleaned to ensure oil passage to the rocker arms is cleaned. Check the pushrod for damage, such as loose ends on steel tipped aluminum types.

Check push rod for straightness. Roll push rod on a flat surface. Using feeler gauge, check clearance at center. Replace push rod if bent. The push rod can also be supported at each end and rotated. A dial indicator is used to detect bends in the push rod.

Lubricate ends of push rod and install push rod in original location. Ensure push rod is properly seated in lifter. Install rocker arm. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

LIFTERS

Hydraulic Lifters

Before replacing a hydraulic lifter for noisy operation, ensure noise is not caused by worn rocker arms or valve tips. Hydraulic lifter assemblies must be installed in original locations. Remove the rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold, or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use a hydraulic lifter remover or magnet. Different type lifters are used. See Fig. 13.

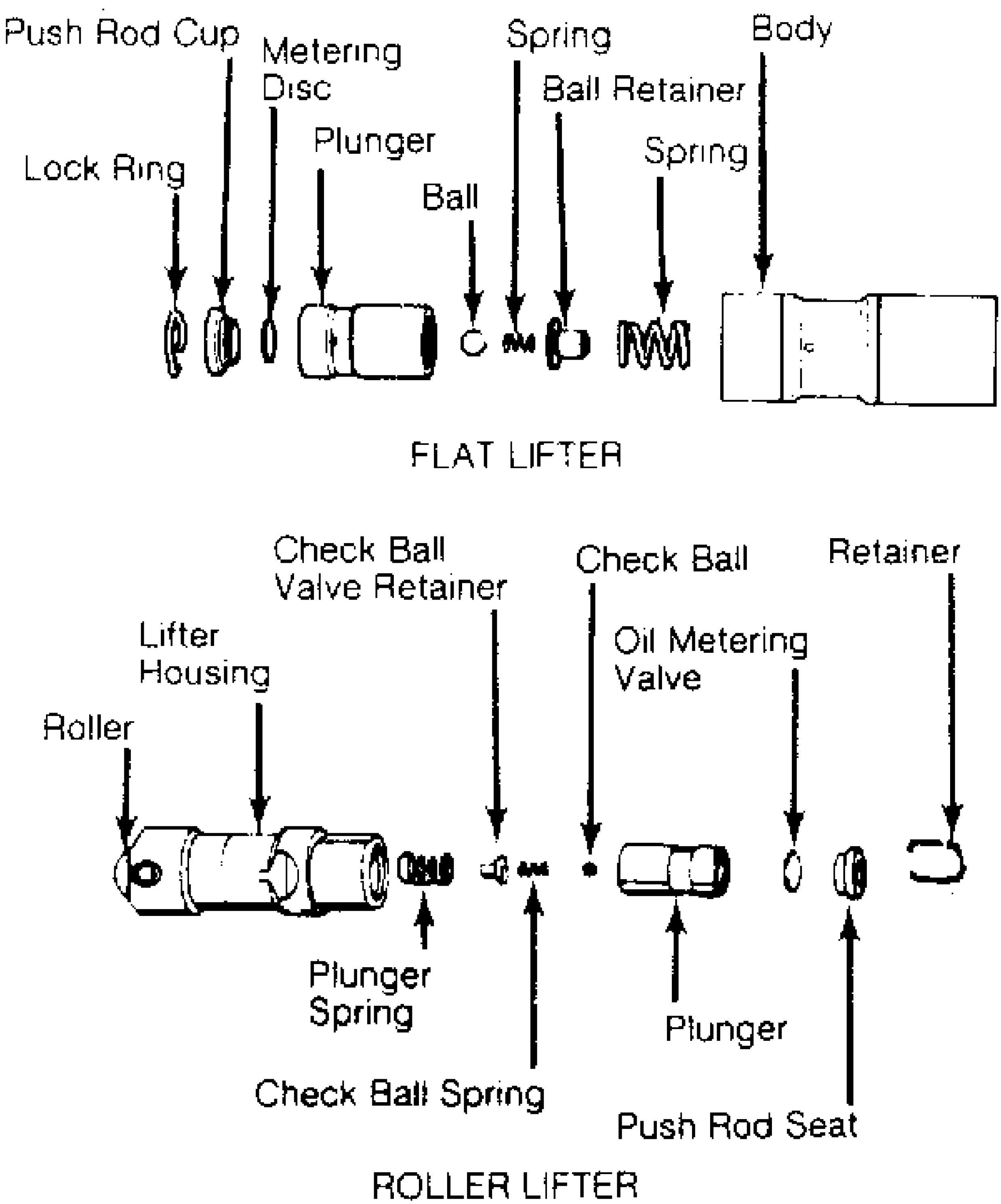

Fig. 13: Typical Hydraulic Valve Lifter Assemblies - Typical This Graphic For General Information Only

On sticking lifters, disassemble and clean lifter. DO NOT mix lifter components or positions. Parts are select-fitted and are not interchangeable. Inspect all components for wear. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. On roller type lifters, inspect roller for flaking, pitting, loss of needle bearings and roughness during rotation.

Measure lifter body O.D. in several areas. Measure lifter bore I.D. of cylinder block. Some models offer oversized lifters. Replace lifter if damaged.

If lifter check valve is not operating, obstructions may be preventing it from closing or valve spring may be broken. Clean or replace components as necessary.

Check plunger operation. Plunger should drop to bottom of the body by its own weight when assembled dry. If plunger is not free, soak lifter in solvent to dissolve deposits.

Lifter leak-down test can be performed on lifter. Lifter must be filled with special test oil. New lifters contain special test oil. Using lifter leak-down tester, perform leak-down test following manufacturer’s instructions. If leak-down time is not within specifications, replace lifter assembly.

Lifters should be soaked in clean engine oil several hours prior to installation. Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. See Fig. 13. Install lifter in original location. Install remaining components. Valve lash adjustment is not required on most hydraulic lifters. Preload of hydraulic lifter is automatic. Some models may require adjustment.

Mechanical Lifters

Lifter assemblies must be installed in original locations. Remove rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use lifter remover or magnet.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. Install lifter in original location. Install remaining components. Tighten bolts to specification. Adjust valves. See VALVE ADJUSTMENT in this article.

PISTONS, CONNECTING RODS & BEARINGS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

RIDGE REMOVAL

Ridge in cylinder wall must be removed prior to piston removal. Failure to remove ridge prior to removing pistons will cause piston damage in piston ring locations.

With the piston at bottom dead center, place a rag in the bore to trap metal chips. Install ridge reamer in cylinder bore. Adjust ridge reamer using manufacturer’s instructions. Remove ridge using ridge reamer. DO NOT remove an excessive amount of material. Ensure ridge is completely removed.

PISTON & CONNECTING ROD REMOVAL

Note top of piston. Some pistons may contain a notch, arrow or be marked "FRONT". Piston must be installed in proper direction to prevent damage with valve operation.

Check that connecting rod and cap are numbered for cylinder location and which side of cylinder block the number faces. Proper cap and connecting rod must be installed together. Connecting rod cap must be installed on connecting rod in proper direction to ensure bearing lock procedure. Mark connecting rod and cap if necessary. Pistons must be installed in original location.

Remove cap retaining nuts or bolts. Remove bearing cap. Install stud protectors on connecting rod bolts. This protects cylinder walls from scoring during removal. Ensure proper removal of ridge. Push piston and connecting rod from cylinder. Connecting rod boss can be tapped with a wooden dowel or hammer handle to aid in removal.

PISTON & CONNECTING ROD

Disassembly

Using ring expander, remove piston rings. Remove piston pin retaining rings (if equipped). On pressed type piston pins, special fixtures and procedures according to manufacturer must be used to remove piston pins. Follow manufacturer's recommendations to avoid piston distortion or breakage.

Cleaning

Remove all carbon and varnish from piston. Pistons and connecting rods may be cleaned in cold type chemical tank. Using ring groove cleaner, clean all deposits from ring grooves. Ensure all deposits are cleaned from ring grooves to prevent ring breakage or sticking. DO NOT attempt to clean pistons using wire brush.

Inspection

Inspect pistons for nicks, scoring, cracks or damage in ring areas. Connecting rod should be checked for cracks using Magnaflux procedure. Piston diameter must be measured in manufacturers specified area.

Using telescopic gauge and micrometer, measure piston pin bore of piston in 2 areas, 90 degrees apart. This is done to check diameter and out-of-round.

Install proper bearing cap on connecting rod. Ensure bearing cap is installed in proper location. Tighten bolts or nuts to specification. Using inside micrometer, measure inside diameter in 2 areas, 90 degrees apart.

Connecting rod I.D. and out-of-round must be within specification. Measure piston pin bore I.D. and piston pin O.D. All components must be within specification. Subtract piston pin diameter from piston pin bore in piston and connecting rod to determine proper fit.

Connecting rod length must be measured from center of crankshaft journal inside diameter to center of piston pin bushing using proper caliper. Connecting rods must be the same length. Connecting rods should be checked on an alignment fixture for bent or twisted condition. Replace all components which are damaged or not within specification.

PISTON & CYLINDER BORE FIT

Ensure cylinder is checked for taper, out-of-round and properly honed prior to checking piston and cylinder bore fit. See CYLINDER BLOCK in this article. Using dial bore gauge, measure cylinder bore. Measure piston at right angle to piston pin in center of piston skirt area. Subtract piston diameter from cylinder bore diameter. The difference is piston-to-cylinder clearance. Clearance must be within specification. Mark piston for proper cylinder location.

ASSEMBLING PISTON & CONNECTING ROD

Install proper fitted piston on connecting rod for proper cylinder. Ensure piston marking on top of piston marked is in correspondence with connecting rod and cap number. See Fig. 14.

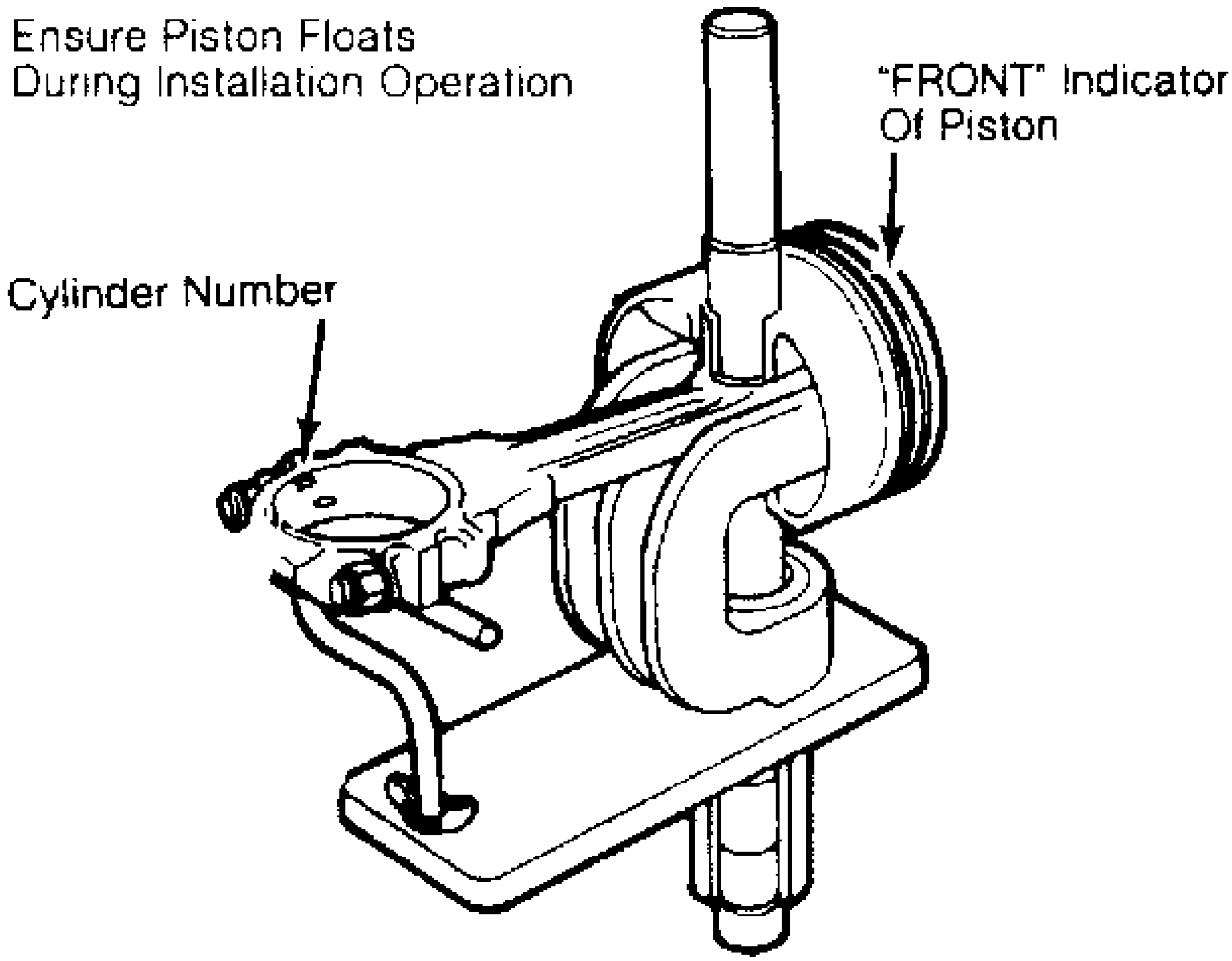

Fig. 14: Piston Pin Installation - Typical
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Lubricate piston pin and install in connecting rod. Ensure piston pin retainers are fully seated (if equipped). On pressed type piston pins, follow manufacturer's recommended procedure to avoid distortion or breakage.

CHECKING PISTON RING CLEARANCES

Piston rings must be checked for side clearance and end gap. To check end gap, install piston ring in cylinder which it is to be installed. Using an inverted piston, push ring to bottom of cylinder in smallest cylinder diameter.

Using feeler gauge, check ring end gap. See Fig. 15. Piston ring end gap must be within specification. Ring breakage will occur with insufficient ring end gap.

On some manufacturers, insufficient ring end gap may be corrected by using a fine file while other manufacturers recommend using another ring set. Mark rings for proper cylinder installation after checking end gap.

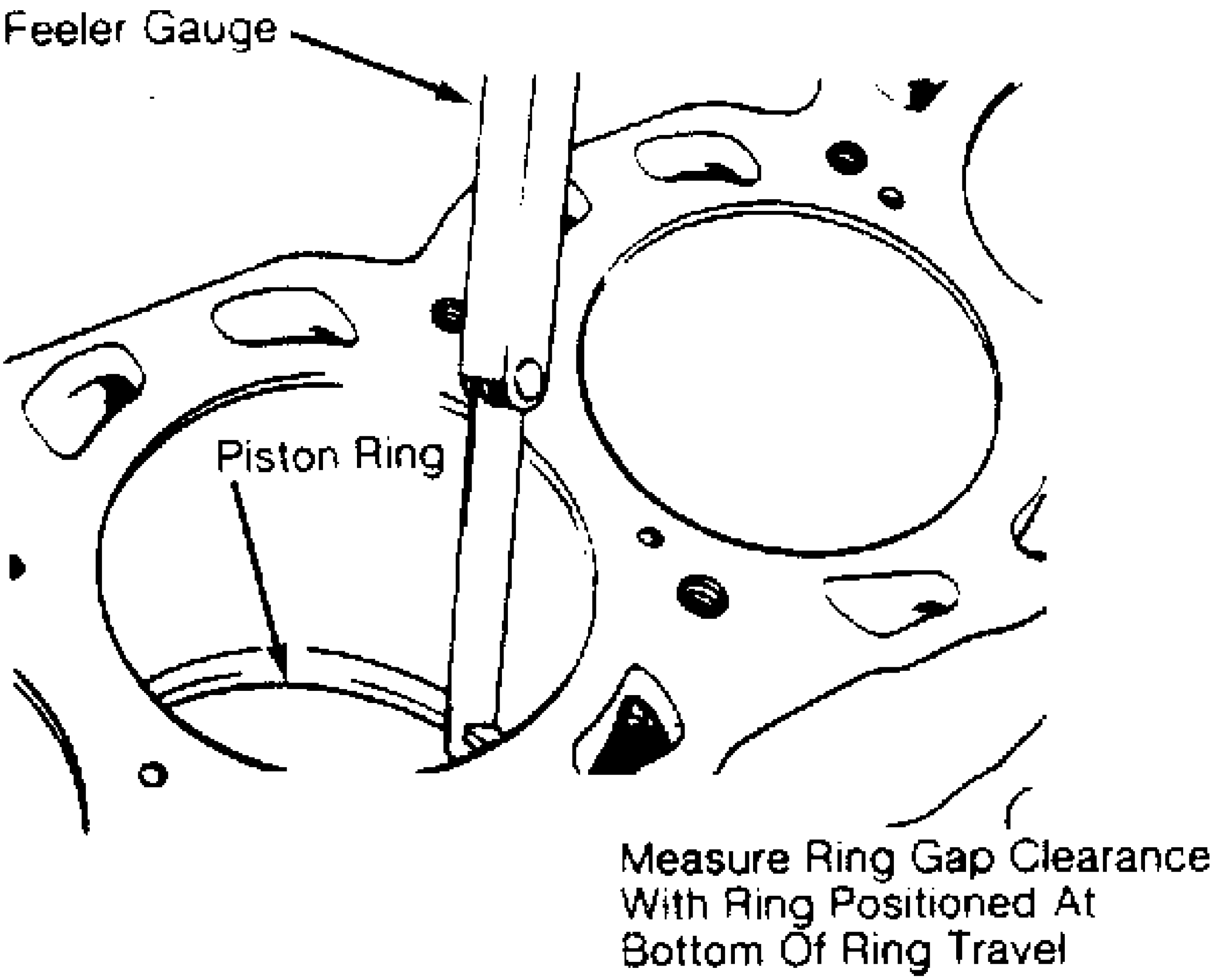

Fig. 15: Checking Piston Ring End Gap - Typical
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For checking side clearance, install rings on piston. Using feeler gauge, measure clearance between piston ring and piston ring land. Check side clearance in several areas around piston. Side clearance must be within specification.

If side clearance is excessive, piston ring grooves can be machined to accept oversized piston rings (if available). Normal practice is to replace piston.

PISTON & CONNECTING ROD INSTALLATION

Cylinders must be honed prior to piston installation. See CYLINDER HONING under CYLINDER BLOCK in this article.

Install upper connecting rod bearings. Lubricate upper bearings with engine oil. Install lower bearings in rod caps. Ensure bearing tabs are properly seated. Position piston ring gaps according to manufacturers recommendations. See Fig. 16. Lubricate pistons, rings and cylinder walls.

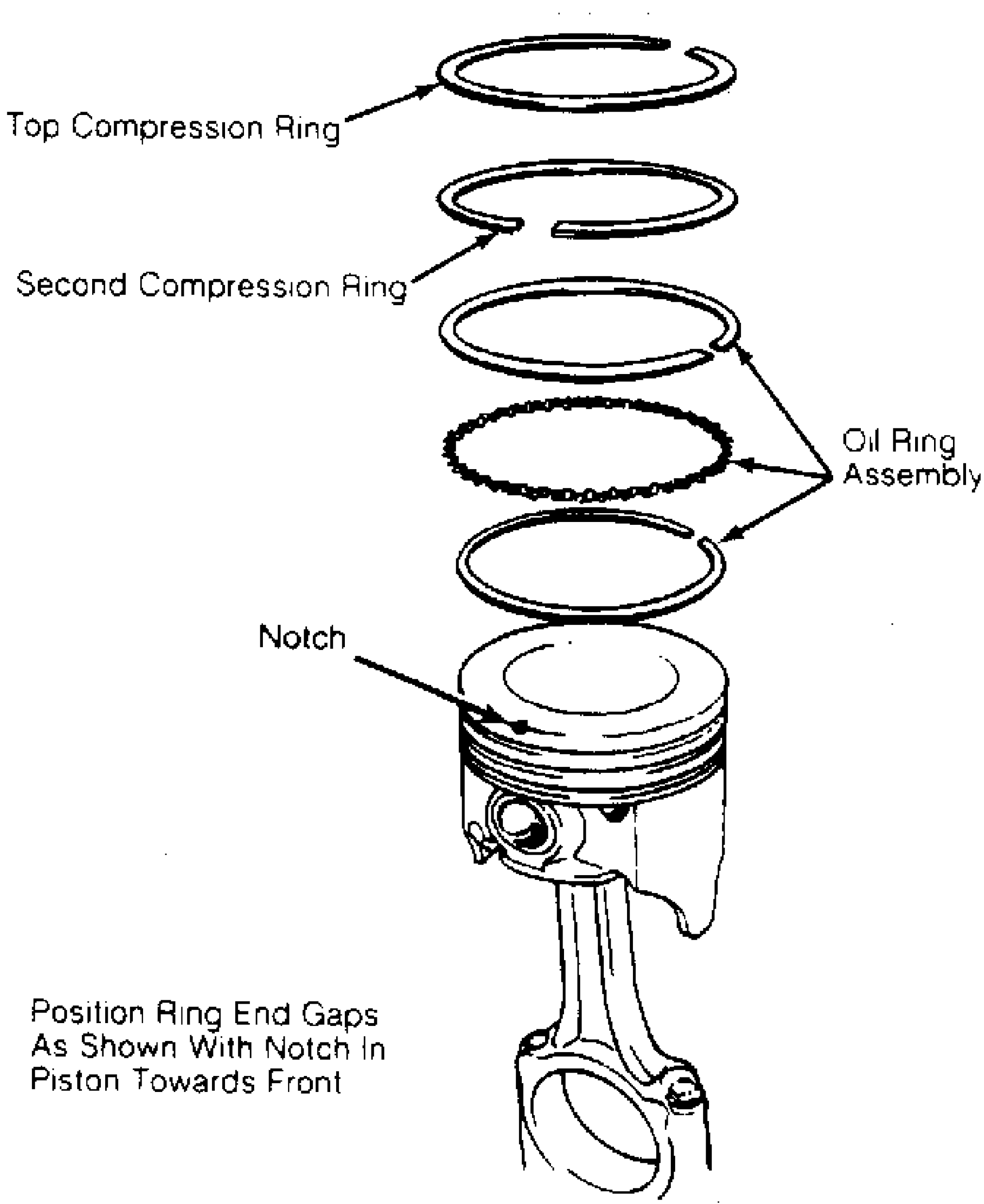

Fig. 16: Typical Piston Ring End Gap Positioning - Typical
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Install ring compressor. Use care not to rotate piston rings. Compress rings with ring compressor. Install plastic tubing protectors over connecting rod bolts. Install piston and connecting rod assembly. Ensure piston notch, arrow or "FRONT" mark is toward front of engine. See Fig. 17.

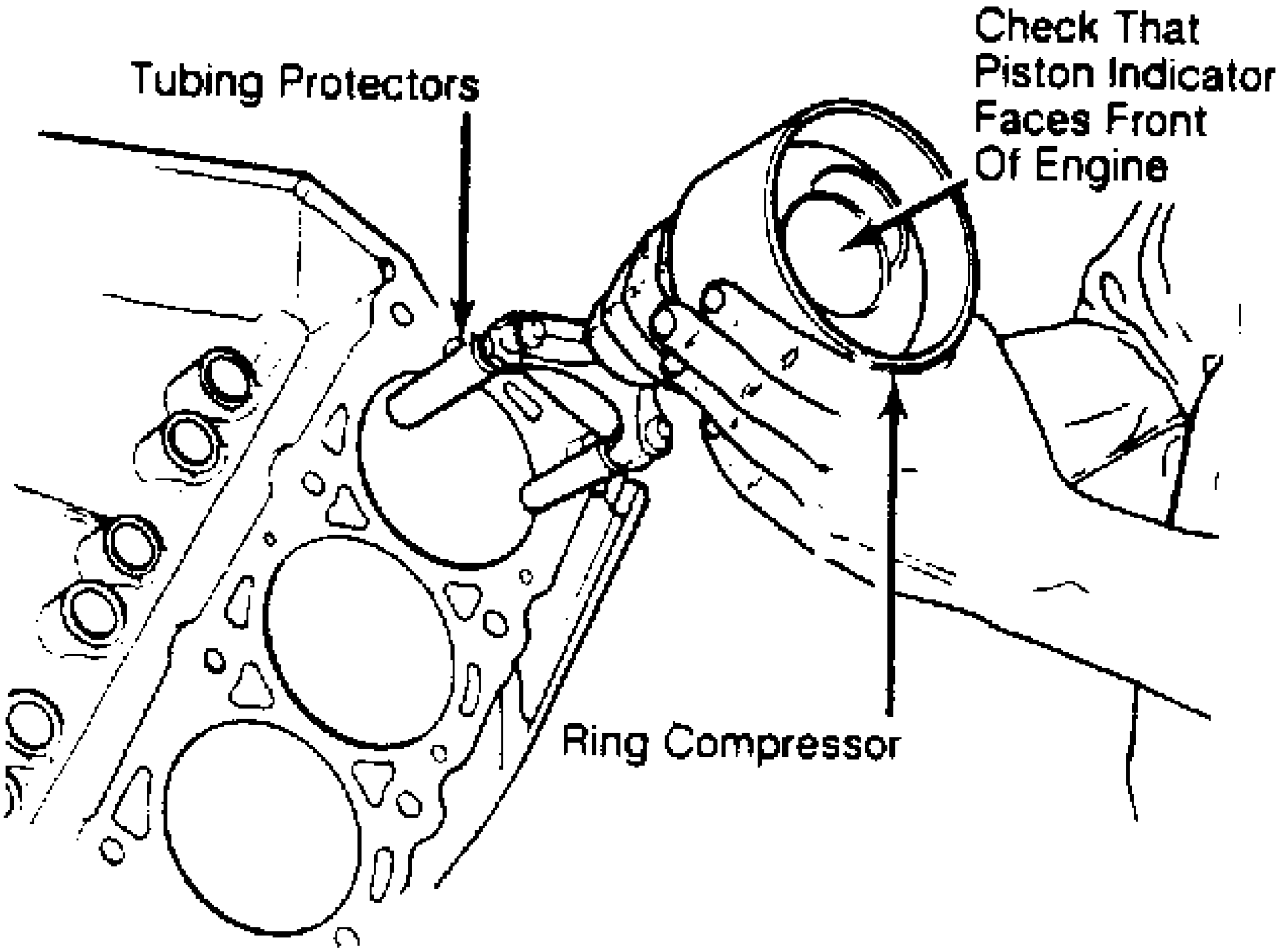

Fig. 17: Installing Piston & Connecting Rod Assembly - Typical
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Carefully tap piston into cylinder until rod bearing is seated on crankshaft journal. Remove protectors. Install rod cap and bearing. Lightly tighten connecting rod bolts. Repeat procedure for remaining cylinders. Check bearing clearance. See MAIN & CONNECTING ROD BEARING CLEARANCE in this article.

Once clearance is checked, lubricate journals and bearings. Install bearing caps. Ensure marks are aligned on connecting rod and cap. Tighten rod nuts or bolts to specification. Ensure rod moves freely on crankshaft. Check connecting rod side clearance. See CONNECTING ROD SIDE CLEARANCE in this article.

CONNECTING ROD SIDE CLEARANCE

Position connecting rod toward one side of crankshaft as far as possible. Using feeler gauge, measure clearance between side of connecting rod and crankshaft. See Fig. 18. Clearance must be within specifications.

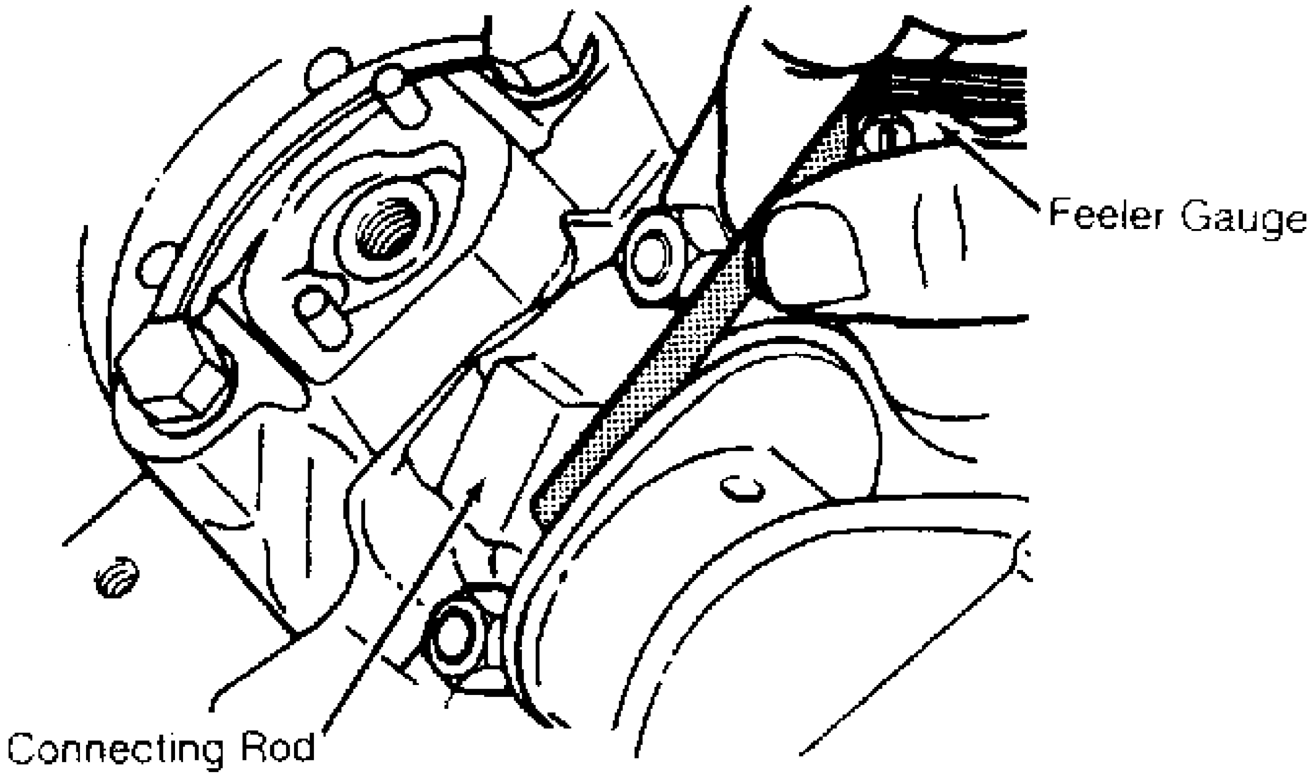

Fig. 18: Measuring Connecting Rod Side Clearance - Typical
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Check for improper bearing installation, wrong bearing cap or insufficient bearing clearance if side clearance is insufficient. Connecting rod may require machining to obtain proper clearance. Excessive clearance usually indicates excessive wear at crankshaft. Crankshaft must be repaired or replaced.

MAIN & CONNECTING ROD BEARING CLEARANCE

Plastigage Method

Plastigage method may be used to determine bearing clearance. Plastigage can be used with an engine in service or during reassembly. Plastigage material is oil soluble.

Ensure journals and bearings are free of oil or solvent. Oil or solvent will dissolve material and false reading will be obtained. Install small piece of Plastigage along full length of bearing journal. Install bearing cap in original location. Tighten bolts to specification.

CAUTION: DO NOT rotate crankshaft while Plastigage is installed. Bearing clearance will not be obtained if crankshaft is rotated.

Remove bearing cap. Compare Plastigage width with scale on Plastigage container to determine bearing clearance. See Fig. 19. Rotate crankshaft 90 degrees. Repeat procedure. this is done to check journal eccentricity. This procedure can be used to check oil clearance on both connecting rod and main bearings.

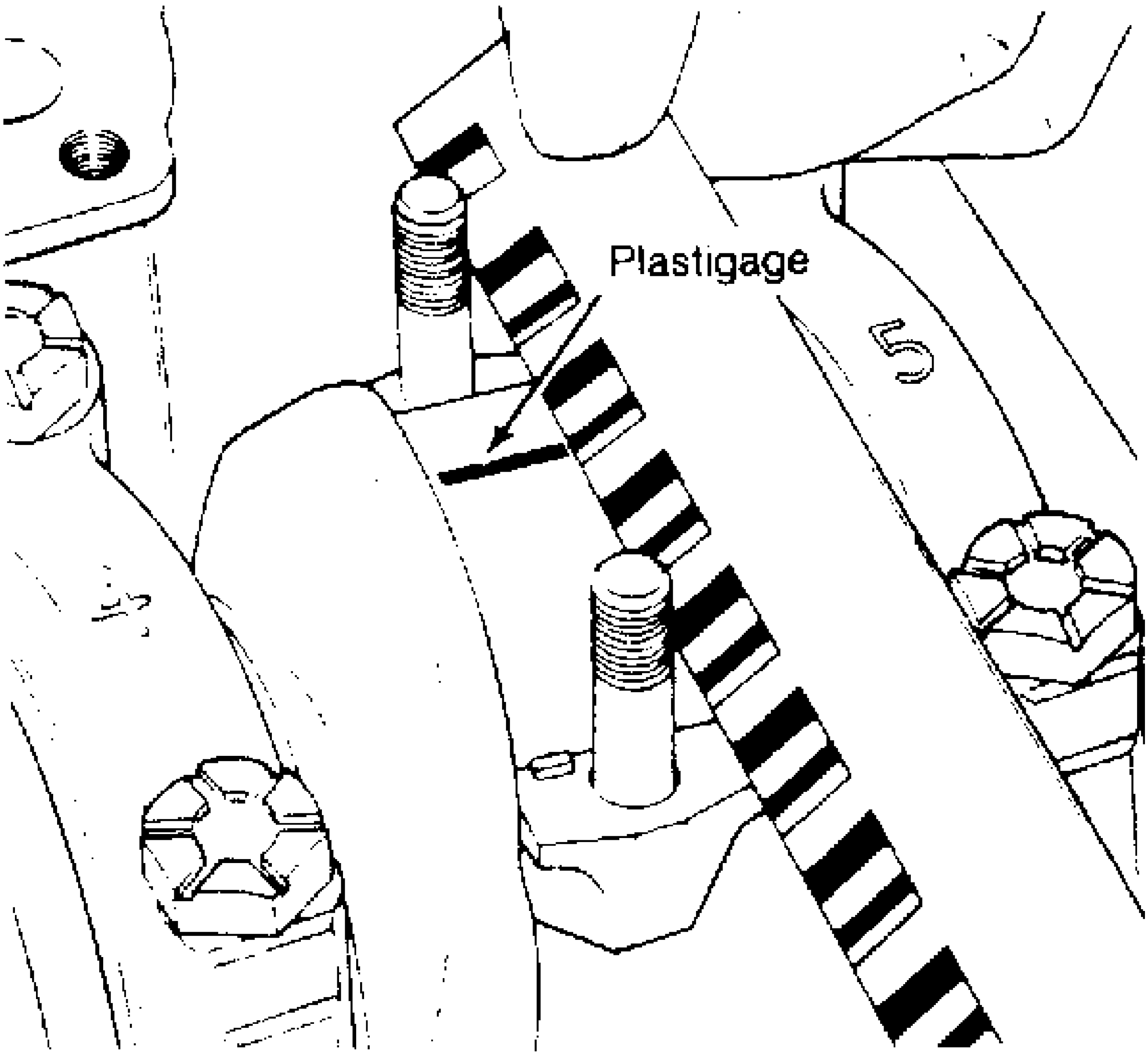

Fig. 19: Measuring Bearing Clearance - Typical
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Micrometer & Telescopic Gauge Method

A micrometer is used to determine journal diameter, taper and out-of-round dimensions of the crankshaft. See CLEANING & INSPECTION under CRANKSHAFT & MAIN BEARINGS in this article.

With crankshaft removed, install bearings and caps in original location on cylinder block. Tighten bolts to specification. On connecting rods, install bearings and caps on connecting rods. Install proper connecting rod cap on corresponding rod. Ensure bearing cap is installed in original location. Tighten bolts to specification.

Using a telescopic gauge and micrometer or inside micrometer measure inside diameter of connecting rod and main bearings bores. Subtract each crankshaft journal diameter from the corresponding inside bore diameter. This is the bearing clearance.

CRANKSHAFT & MAIN BEARINGS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

REMOVAL

Ensure all main bearing caps are marked for location on cylinder block. Some main bearing caps have an arrow stamped on it which must face front of engine. Remove main bearing cap bolts. Remove main bearing caps. Carefully remove crankshaft. Use care not to bind crankshaft in cylinder block during removal.

CLEANING & INSPECTION

Thoroughly clean crankshaft using solvent. Dry with compressed air. Ensure all oil passages are clear and free of sludge, rust, dirt, and metal chips.

Inspect crankshaft for scoring and nicks. Inspect crankshaft for cracks using Magnaflux procedure. Inspect rear seal area for grooving or damage. Inspect bolt hole threads for damage. If pilot bearing or bushing is used, check pilot bearing or bushing fit in crankshaft. Inspect crankshaft gear for damaged or cracked teeth. Replace gear if damaged. Check that oil passage plugs are tight (if equipped).

Using micrometer, measure all journals in 4 areas to determine journal taper, out-of-round and undersize. See Fig. 20. Some crankshafts can be reground to the next largest undersize, depending on the amount of wear or damage. Crankshafts with rolled fillet cannot be reground and must be replaced.

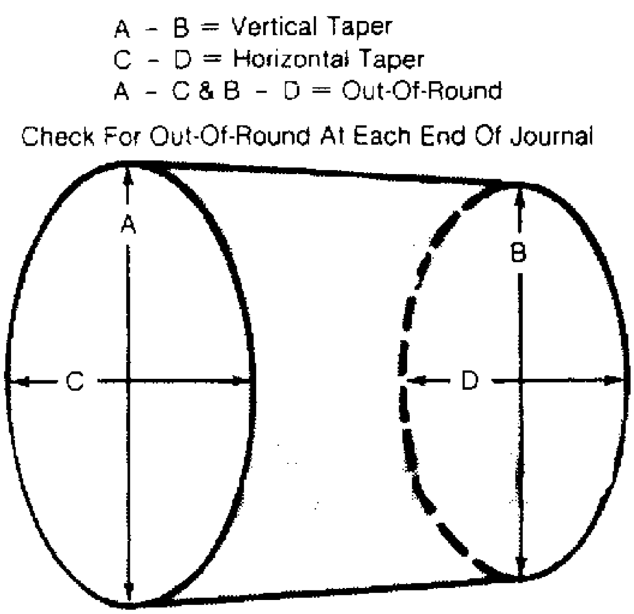

Fig. 20: Measuring Crankshaft Journal - Typical
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Crankshaft journal runout should be checked. Install crankshaft in "V" blocks or bench center. Position dial indicator with tip resting on the main bearing journal area. See Fig. 21. Rotate crankshaft and note reading. Journal runout must not exceed specification. Repeat procedure on all main bearing journals. Crankshaft must be replaced if runout exceeds specification.

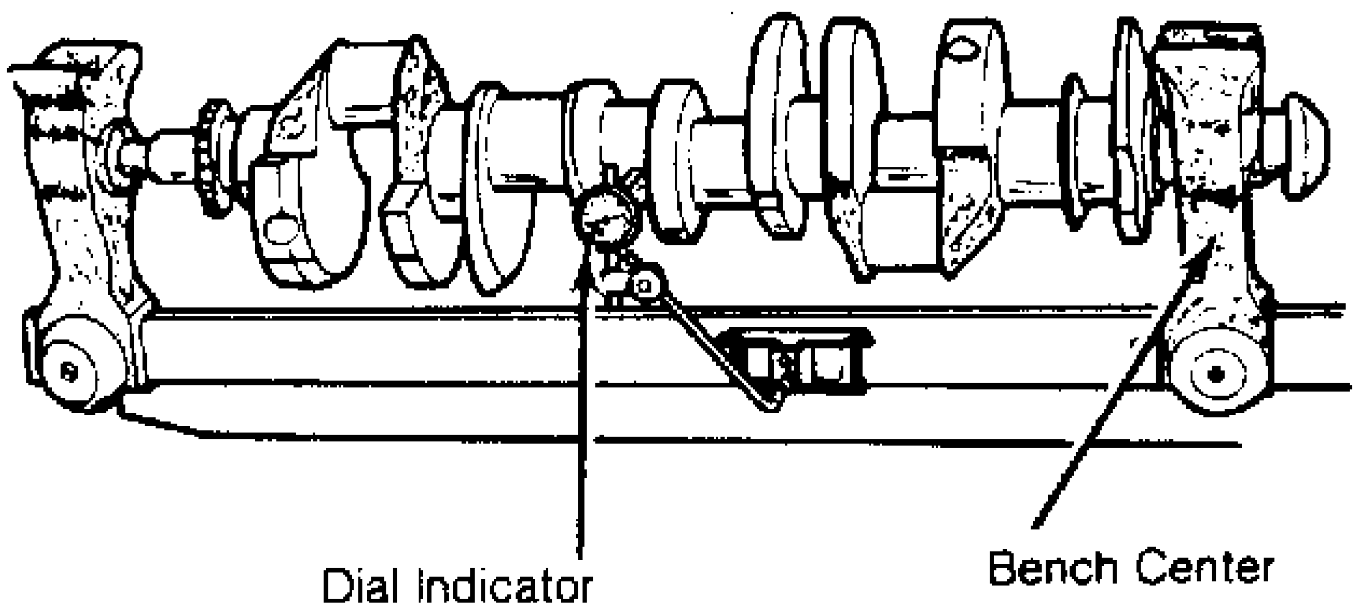

Fig. 21: Measuring Crankshaft Main Bearing Journal Runout - Typical
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INSTALLATION

Install upper main bearing in cylinder block. Ensure lock tab is properly located in cylinder block. Install bearings in main bearing caps. Ensure all oil passages are aligned. Install rear seal (if removed).

Ensure crankshaft journals are clean. Lubricate upper main bearings with clean engine oil. Carefully install crankshaft. Check each main bearing clearance using Plastigage method. See MAIN & CONNECTING ROD BEARING CLEARANCE in this article.

Once clearance is checked, lubricate lower main bearing and journals. Install main bearing caps in original location. Install rear seal in rear main bearing cap (if removed). Some rear main bearing caps require sealant to be applied in corners to prevent oil leakage.

Install and tighten all bolts except thrust bearing cap to specification. Tighten thrust bearing cap bolts finger tight only. Thrust bearing must be aligned. On most applications, crankshaft must be moved rearward then forward. Procedure may vary with manufacturer. Thrust bearing cap is then tighten to specification. Ensure crankshaft rotates freely. Crankshaft end play should be checked. See CRANKSHAFT END PLAY in this article.

CRANKSHAFT END PLAY

Dial Indicator Method

Crankshaft end play can be checked using dial indicator. Mount dial indicator on rear of cylinder block. Position dial indicator tip against rear of crankshaft. Ensure tip is resting against flat surface.

Pry crankshaft rearward. Adjust dial indicator to zero.

Pry crankshaft forward and note reading. Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

Feeler Gauge Method

Crankshaft end play can be checked using feeler gauge. Pry crankshaft rearward. Pry crankshaft forward. Using feeler gauge, measure clearance between crankshaft and thrust bearing surface. See Fig. 22.

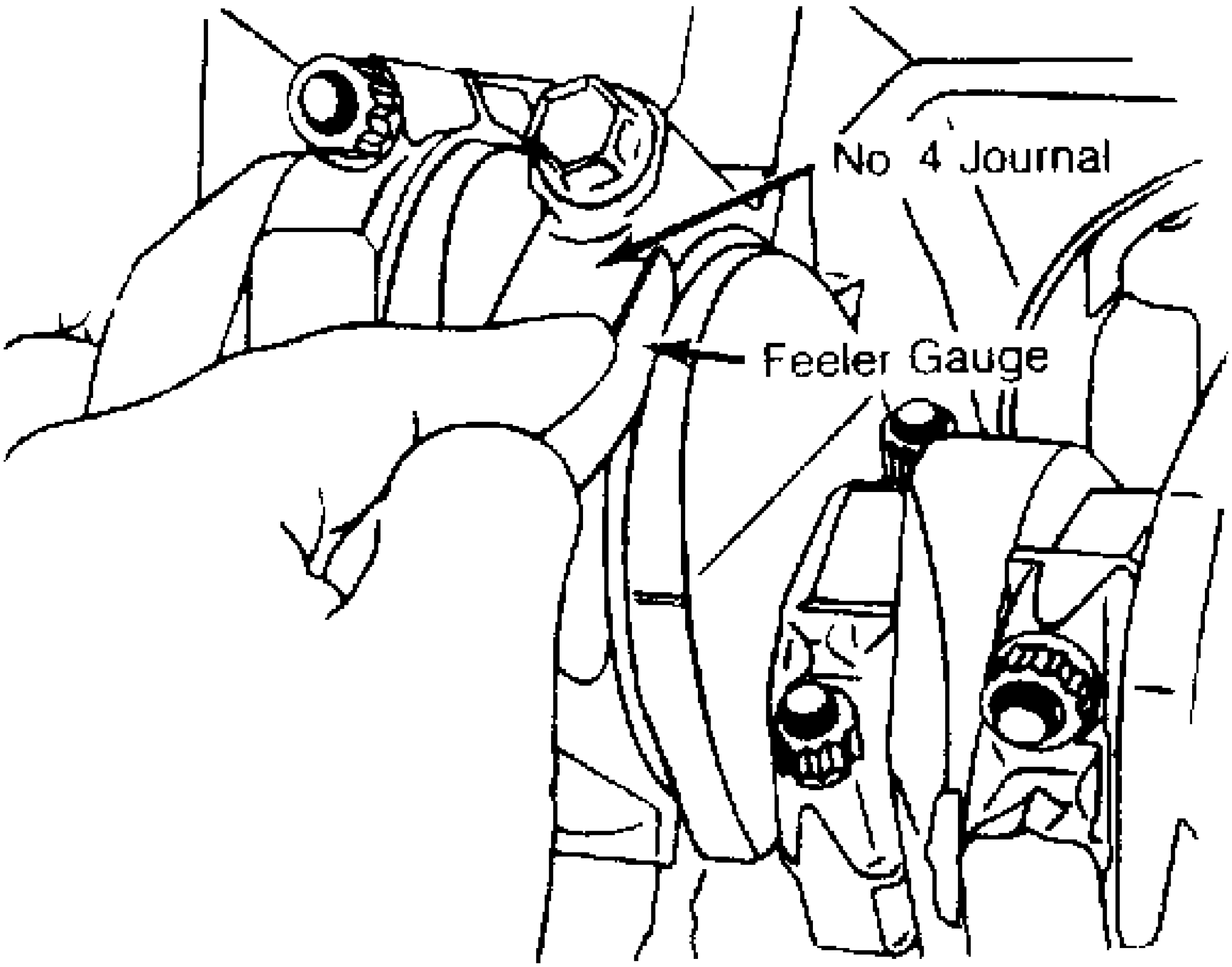

Fig. 22: Checking Crankshaft End Play - Typical
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Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

CYLINDER BLOCK

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

BLOCK CLEANING

Only cast cylinder blocks should be hot tank cleaned. Aluminum cylinder blocks should be cleaned using cold tank method. Cylinder block is cleaned in order to remove carbon deposits, gasket residue and water jacket scale. Remove oil galley plugs, freeze plugs and cam bearings prior to block cleaning.

BLOCK INSPECTION

Visually inspect the block. Check suspected areas for cracks using the Dye Penetrant inspection method. Block may be checked for cracks using the Magnaflux method.

Cracks are most commonly found at the bottom of the cylinders, the main bearing saddles, near expansion plugs and between the cylinders and water jackets. Inspect lifter bores for damage. Inspect all head bolt holes for damaged threads. Threads should be cleaned using tap to ensure proper head bolt torque. Consult machine shop concerning possible welding and machining (if required).

CYLINDER BORE INSPECTION

Inspect the bore for scuffing or roughness. Cylinder bore is dimensionally checked for out-of-round and taper using dial bore gauge. For determining out-of-round, measure cylinder parallel and perpendicular to the block centerline. Difference in the 2 readings is the bore out-of-round. Cylinder bore must be checked at top, middle and bottom of piston travel area.

Bore taper is obtained by measuring bore at the top and bottom. If wear has exceeded allowable limits, block must be honed or bored to next available oversize piston dimension.

CYLINDER HONING

Cylinder must be properly honed to allow new piston rings to properly seat. Cross-hatching at correct angle and depth is critical to lubrication of cylinder walls and pistons.

A flexible drive hone and power drill are commonly used. Drive hone must be lubricated during operation. Mix equal parts of kerosene and SAE 20w engine oil for lubrication.

Apply lubrication to cylinder wall. Operate cylinder hone from top to bottom of cylinder using even strokes to produce 45 degree cross-hatch pattern on the cylinder wall. DO NOT allow cylinder hone to extend below cylinder during operation.

Recheck bore dimension after final honing. Wash cylinder wall with hot soapy water to remove abrasive particles. Blow dry with compressed air. Coat cleaned cylinder walls with lubricating oil.

DECK WARPAGE

Check deck for damage or warped head sealing surface. Place a straightedge across gasket surface of the deck. Using feeler gauge, measure clearance at center of straightedge. Measure across width and

length of cylinder block at several points.
If warpage exceeds specifications, deck must be resurfaced. If warpage exceeds manufacturer’s maximum tolerance for material removal, replace block.

DECK HEIGHT

Distance from the crankshaft centerline to the block deck is termed the deck height. Measure and record front and rear main journals of crankshaft. To compute this distance, install crankshaft and retain with center main bearing and cap only. Measure distance from the crankshaft journal to the block deck, parallel to the cylinder centerline.
Add one half of the main bearing journal diameter to distance from crankshaft journal to block deck. This dimension should be checked at front and rear of cylinder block. Both readings should be the same.
If difference exceeds specifications, cylinder block must be repaired or replaced. Deck height and warpage should be corrected at the same time.

MAIN BEARING BORE & ALIGNMENT

For checking main bearing bore, remove all bearings from cylinder block and main bearing caps. Install main bearing caps in original location. Tighten bolts to specification. Using inside micrometer, measure main bearing bore in 2 areas 90 degrees apart. Determine bore size and out-of-round. If diameter is not within specification, block must be align-bored.
For checking alignment, place a straightedge along centerline of main bearing saddles. Check for clearance between straightedge and main bearing saddles. Block must be align-bored if clearance is present.

EXPANSION PLUG REMOVAL & INSTALLATION

Removal
Drill a hole in the center of expansion plug. Remove with screwdriver or punch. Use care not to damage sealing surface.

Installation
Ensure sealing surface is free of burrs. Coat expansion plug with sealer. Use a wooden dowel or pipe of slightly smaller diameter, install expansion plug. Ensure expansion plug is evenly located.

OIL GALLERY PLUG REMOVAL & INSTALLATION

Removal
Remove threaded oil gallery plugs using the appropriate wrench. Soft, press-in plugs are removed by drilling into plug and installing a sheet metal screw. Remove plug with slide hammer or pliers.

Installation
Ensure threads or sealing surface is clean. Coat threaded oil gallery plugs with sealer and install. Replacement soft press-in plugs are driven in place with a hammer and drift.

CAMSHAFT

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

CLEANING & INSPECTION

Clean camshaft with solvent. Ensure all oil passages are clear. Inspect cam lobes and bearing journals for pitting, flaking or scoring. Using micrometer, measure bearing journal O.D.

Support camshaft at each end with "V" blocks. Position dial indicator with tip resting on center bearing journal. Rotate camshaft and note reading. If reading exceeds specification, replace camshaft.

Check cam lobe lift by measuring base circle of camshaft using micrometer. Measure again at 90 degrees to tip of cam lobe. Cam lift can be determined by subtracting base circle diameter from tip of cam lobe measurement.

Different lift dimensions are given for intake and exhaust cam lobes. Reading must be within specifications. Replace camshaft if cam lobes or bearing journals are not within specifications.

Inspect camshaft gear for chipped, eroded or damaged teeth. Replace gear if damaged. On camshafts using thrust plate, measure distance between thrust plate and camshaft shoulder. Replace thrust plate if not within specification.

CAMSHAFT BEARINGS

Removal & Installation

Remove the camshaft rear plug. The camshaft bearing remover is assembled with its shoulder resting on the bearing to be removed according to manufacturer's instructions. Tighten puller nut until bearing is removed. Remove remaining bearings, leaving front and rear bearings until last. These bearings act as guide for camshaft bearing remover.

To install new bearings, puller is rearranged to pull bearings toward the center of block. Ensure all lubrication passages of bearing are aligned with cylinder block. Coat new camshaft rear plug with sealant. Install camshaft rear plug. Ensure plug is even in cylinder block.

CAMSHAFT INSTALLATION

Lubricate bearing surfaces and cam lobes with ample amount of Molykote or camshaft lubricant. Carefully install camshaft. Use care not to damage bearing journals during installation. Install thrust plate retaining bolts (if equipped). Tighten bolts to specification. On overhead camshafts, install bearing caps in original location. Tighten bolts to specification. Check end play.

CAMSHAFT END PLAY

Using dial indicator, check end play. Position dial indicator on front of engine block. Position indicator tip against camshaft. Push camshaft toward rear of engine and adjust indicator to zero.

Move camshaft forward and note reading. Camshaft end play must be within specification. End play may be adjusted by relocating gear, shimming thrust plate or replacing thrust plate depending on manufacturer.

TIMING CHAINS & BELTS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

TIMING CHAINS

Timing chains will stretch during operation. Limits are placed upon amount of stretch before replacement is required. Timing chain stretch will alter ignition timing and valve timing.

To check timing chain stretch, rotate crankshaft to eliminate slack from one side of timing chain. Mark reference point on cylinder block. Rotate crankshaft in opposite direction to eliminate slack from remaining side of timing chain. Force other side of chain outward and measure distance between reference point and timing chain. See Fig. 23. Replace timing chain and gears if not within specification.

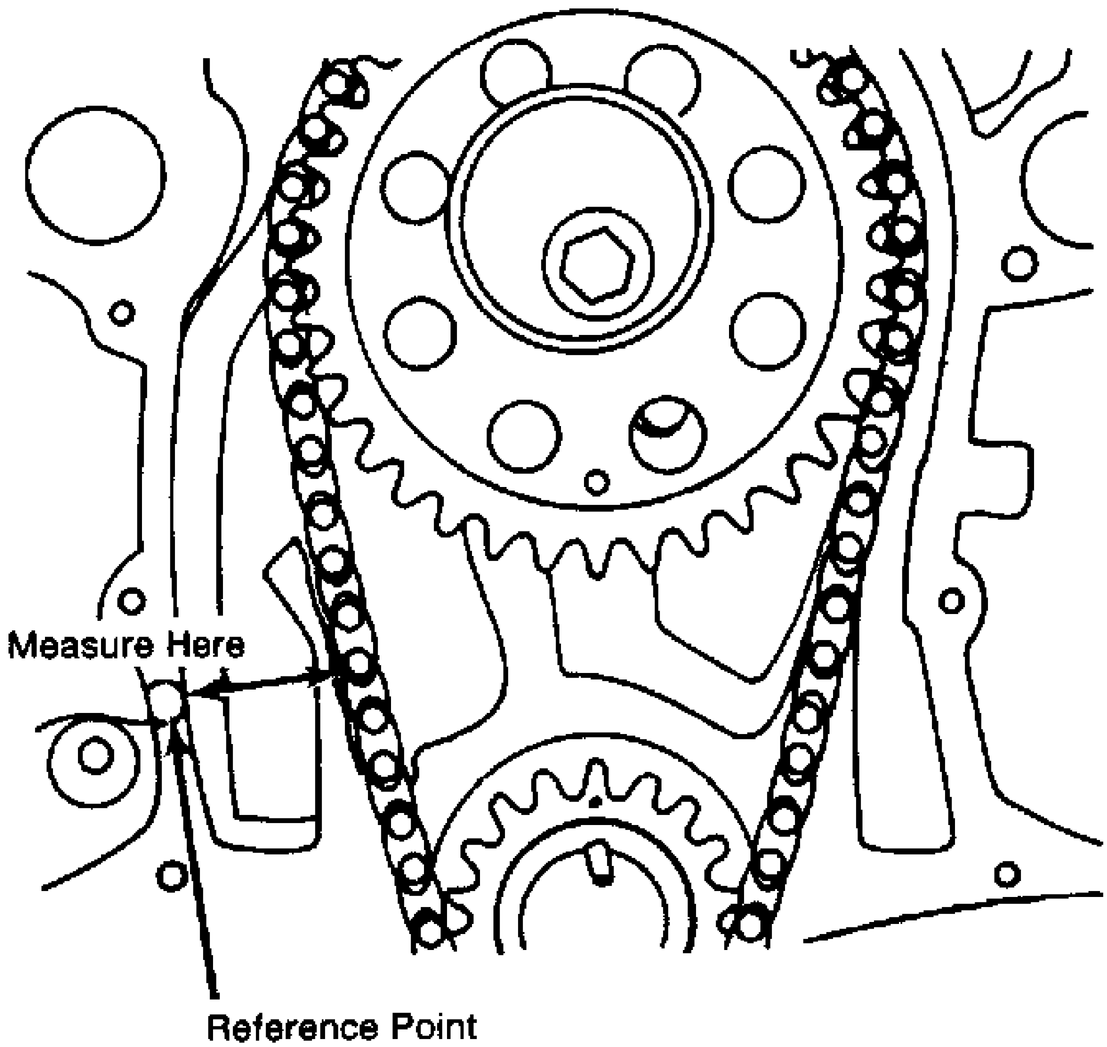

Fig. 23: Measuring Timing Chain Stretch - Typical
This Graphic For General Information Only

Timing chains must be installed so that timing marks on camshaft gear and crankshaft gear are aligned according to manufacturer. See Fig. 24.

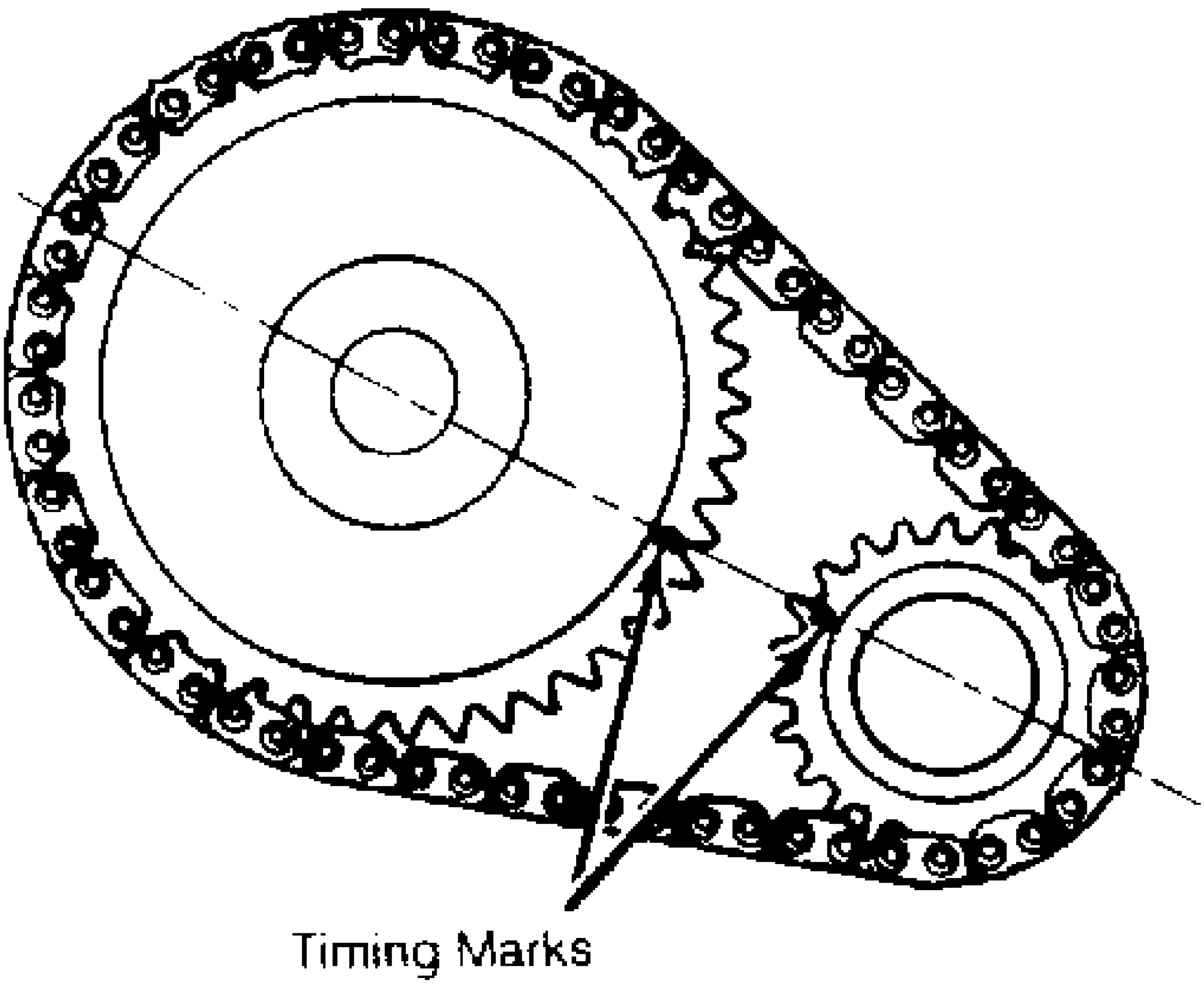

Fig. 24: Timing Gear Mark Alignment - Typical
This Graphic For General Information Only

TIMING BELTS

Cogged tooth belts are commonly used on overhead cam engines. Inspect belt teeth for rounded corners or cracking. Replace belt if cracked, damaged, missing teeth or oil soaked.

Used timing belt must be installed in original direction of rotation. Inspect all sprocket teeth for wear. Replace all worn sprockets. Sprockets are marked for timing purposes. Engine is positioned so that crankshaft sprocket mark will be upward. Camshaft sprocket is aligned with reference mark on cylinder head and timing belt is installed. See Fig. 25.

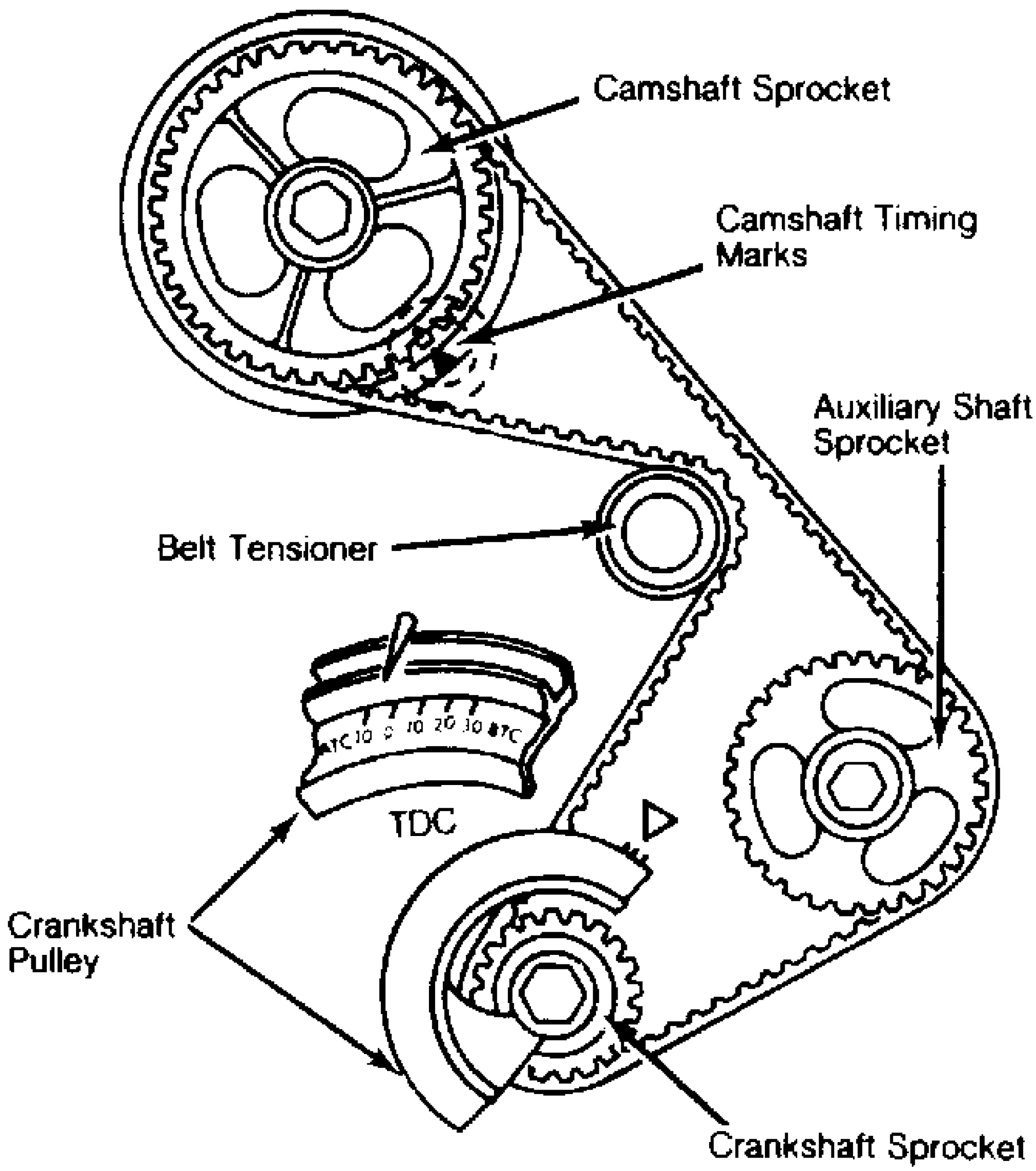

Fig. 25: Timing Belt Sprocket Alignment - Typical
This Graphic For General Information Only

TENSION ADJUSTMENTS

If guide rails are used with spring loaded tensioners, ensure at least half of original rail thickness remains. Spring loaded tensioner should be inspected for damage.

Ensure all timing marks are aligned. Adjust belt tension using manufacturer's recommendations. Belt tension may require checking using tension gauge. See Fig. 26.

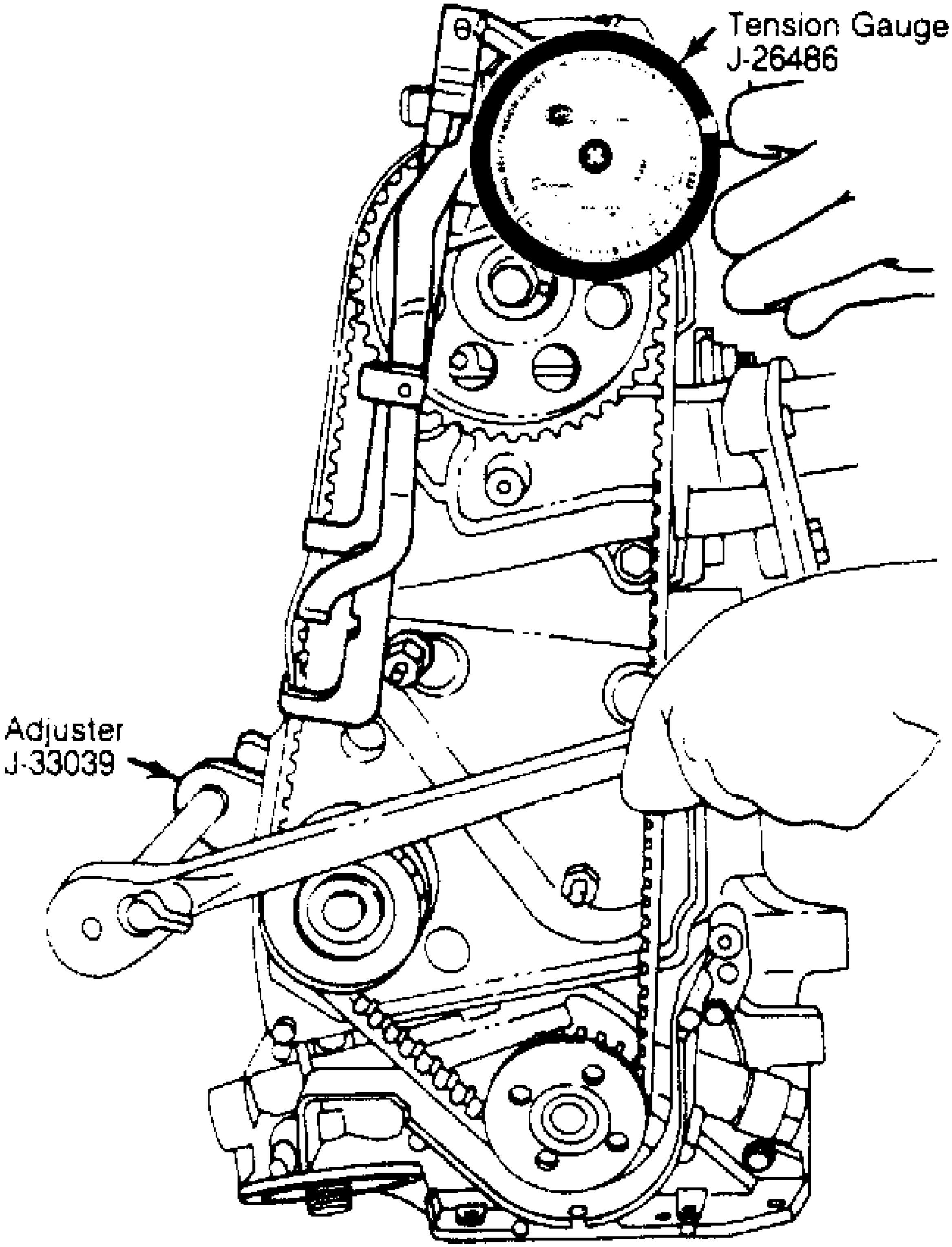

Fig. 26: Timing Belt Tension Adjustment - Typical
This Graphic For General Information Only

TIMING GEARS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

TIMING GEAR BACKLASH & RUNOUT

On engines where camshaft gear operates directly on crankshaft gear, gear backlash and runout must be checked. To check backlash, install dial indicator with tip resting on tooth of camshaft gear. Rotate camshaft gear as far as possible. Adjust indicator to zero. Rotate camshaft gear in opposite direction as far as possible and note reading.

To determine timing gear runout, mount dial indicator with tip resting on face edge of camshaft gear. Adjust indicator to zero. Rotate camshaft gear 360 degrees and note reading. If backlash or runout exceed specifications, replace camshaft and/or crankshaft gear.

REAR MAIN OIL SEAL

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

INSTALLATION

One-Piece Type Seal

For one-piece type oil seal installation, coat block contact surface of seal with sealer if seal is not factory coated. Ensure seal surface is free of burrs. Lubricate seal lip with engine oil and press seal into place using proper oil seal installer. See Fig. 27.

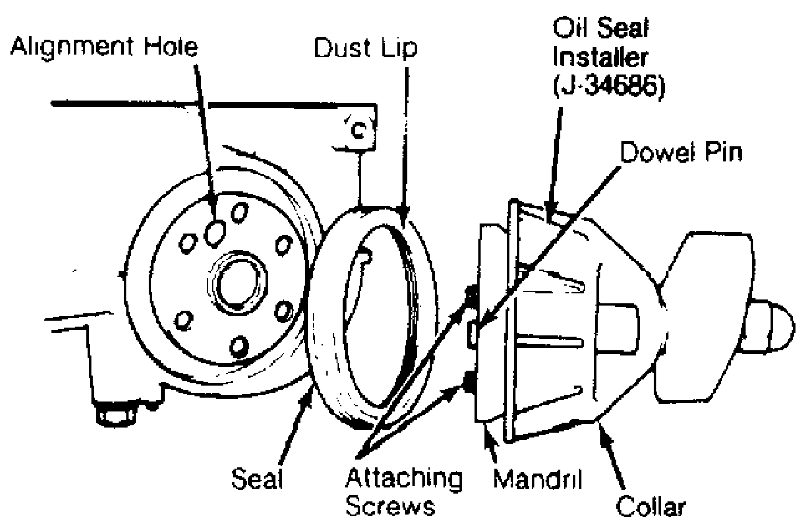

Fig. 27: Installing Typical One-Piece Oil Seal
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Rope Type Seal

For rope type rear main oil seal installation, press seal lightly into its seat. Using seal installer, fully seat seal in bearing cap or cylinder block.

Trim seal ends even with block parting surface. Some applications require sealer to be applied on main bearing cap prior to installation. See Fig. 28.

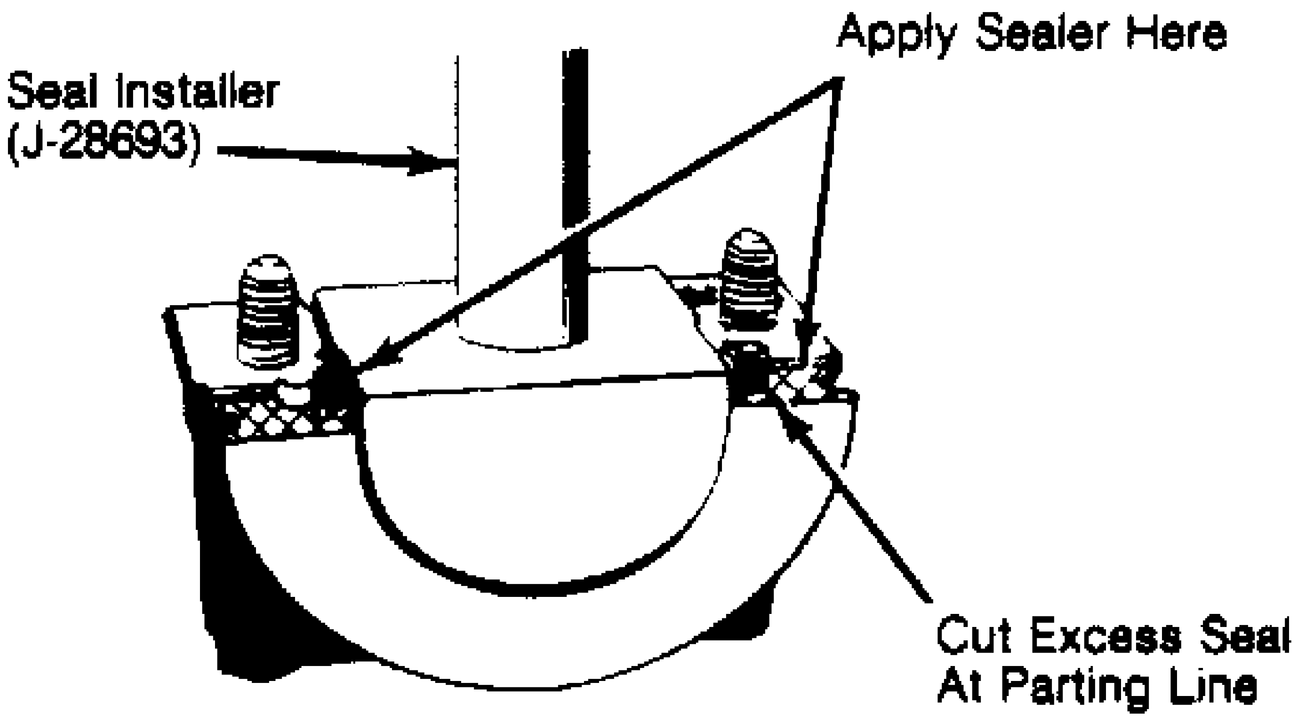

Fig. 28: Typical Rope Seal Installation
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Split-Rubber Type Seal

Follow manufacturers procedures when installing split-rubber type rear main oil seals. Installation procedures vary with engine type. See appropriate ENGINE article in this section. See Fig. 29.

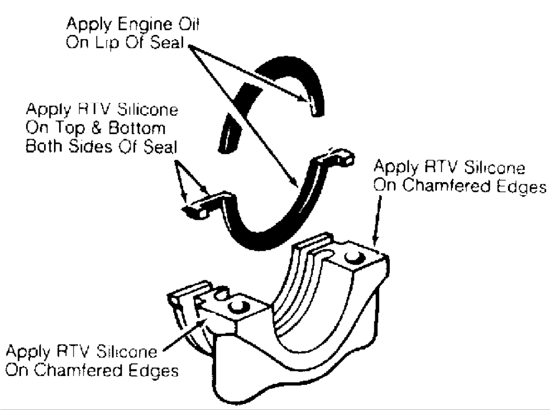

Fig. 29: Typical Split-Rubber Seal Installation
This Graphic For General Information Only

OIL PUMP

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ROTOR-TYPE

Oil pump rotors must be marked for location prior to removal. See Fig. 30. Remove outer rotor and measure thickness and diameter. Measure inner rotor thickness. Inspect shaft for scoring or wear. Inspect rotors for pitting or damage. Inspect cover for grooving or wear. Replace components if worn or damaged.

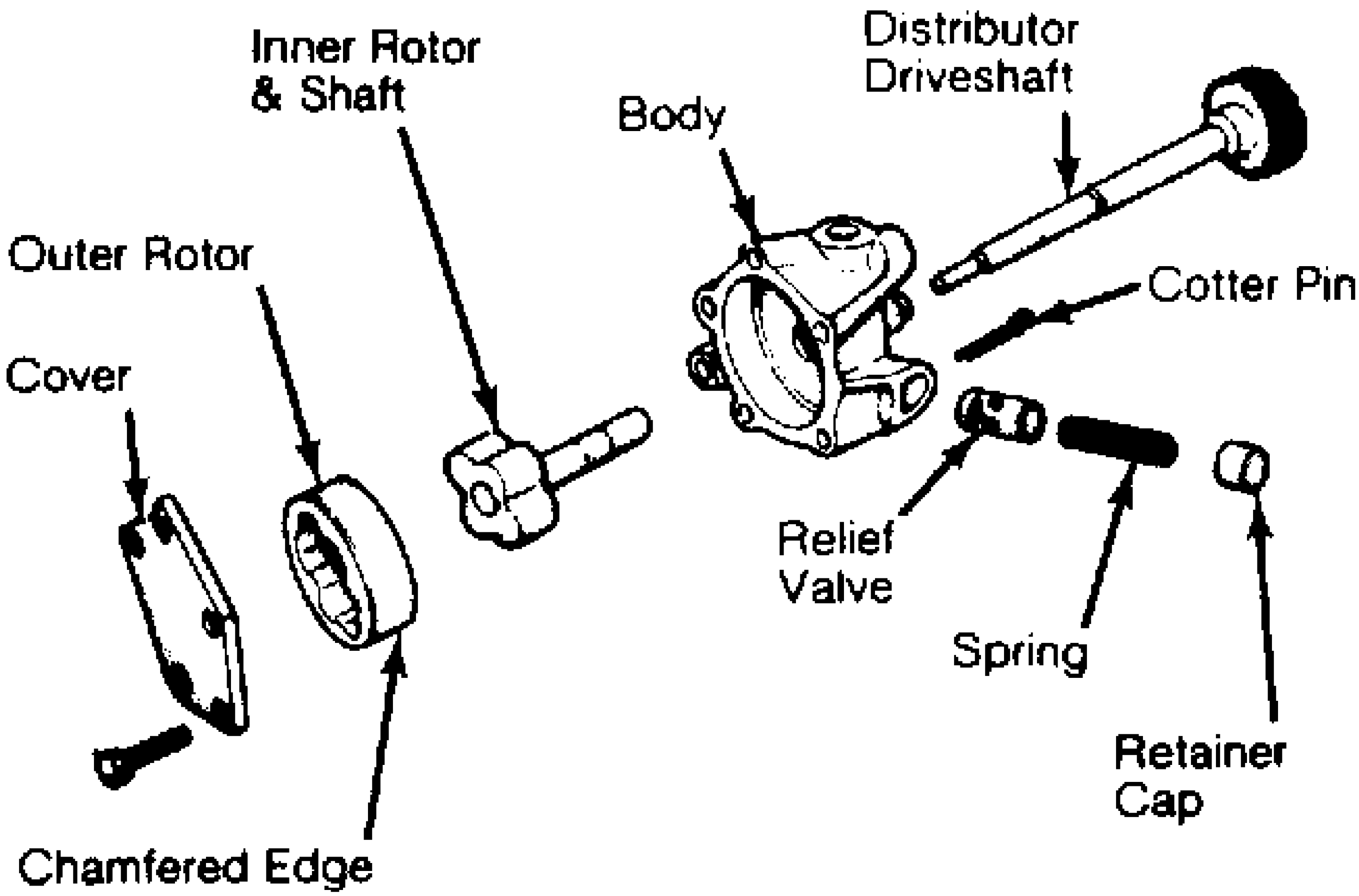

Fig. 30: Typical Rotor Type Oil Pump
This Graphic For General Information Only

Measure outer rotor-to-body clearance. Replace pump assembly if clearance exceeds specification. Measure clearance between rotors. See Fig. 31. Replace shaft and both rotors if clearance exceeds specifications.

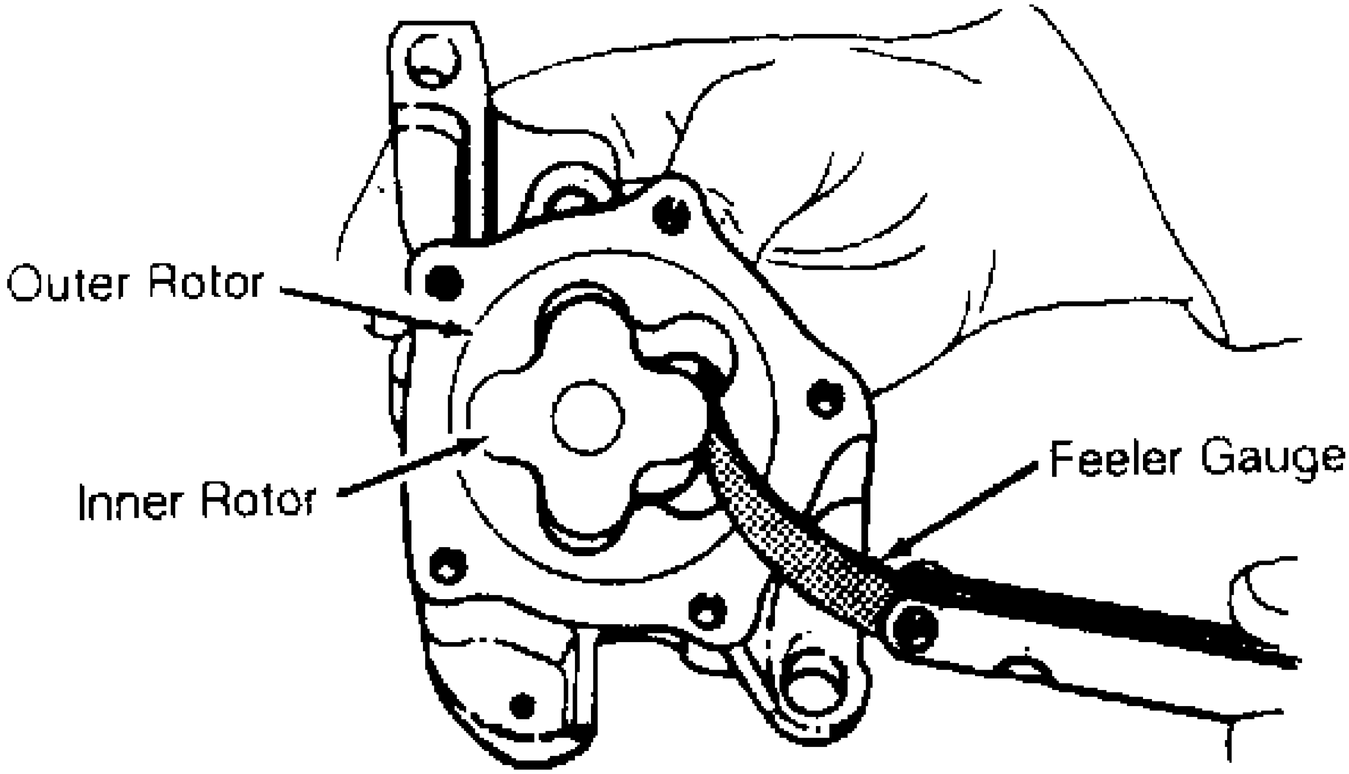

Fig. 31: Measuring Rotor Clearance - Typical
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Install rotors in pump body. Position straightedge across pump body. Using feeler gauge, measure clearance between rotors and straightedge. Pump cover wear is measured using a straightedge and feeler gauge. Replace pump if clearance exceeds specification.

GEAR TYPE

Oil pump gears must be marked for location prior to removal. See Fig. 32. Remove gears from pump body. Inspect gears for pitting or damage. Inspect cover for grooving or wear.

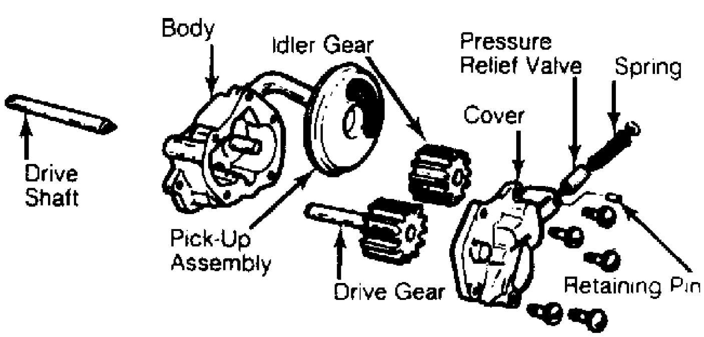

Fig. 32: Typical Gear Type Oil Pump
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Measure gear diameter and length. Measure gear housing cavity depth and diameter. See Fig. 33. Replace components if worn or damaged.

Pump cover wear is measured using a straightedge and feeler gauge. Pump is to be replaced if warpage or wear exceeds specifications or mating surface of pump cover is scratched or grooved.

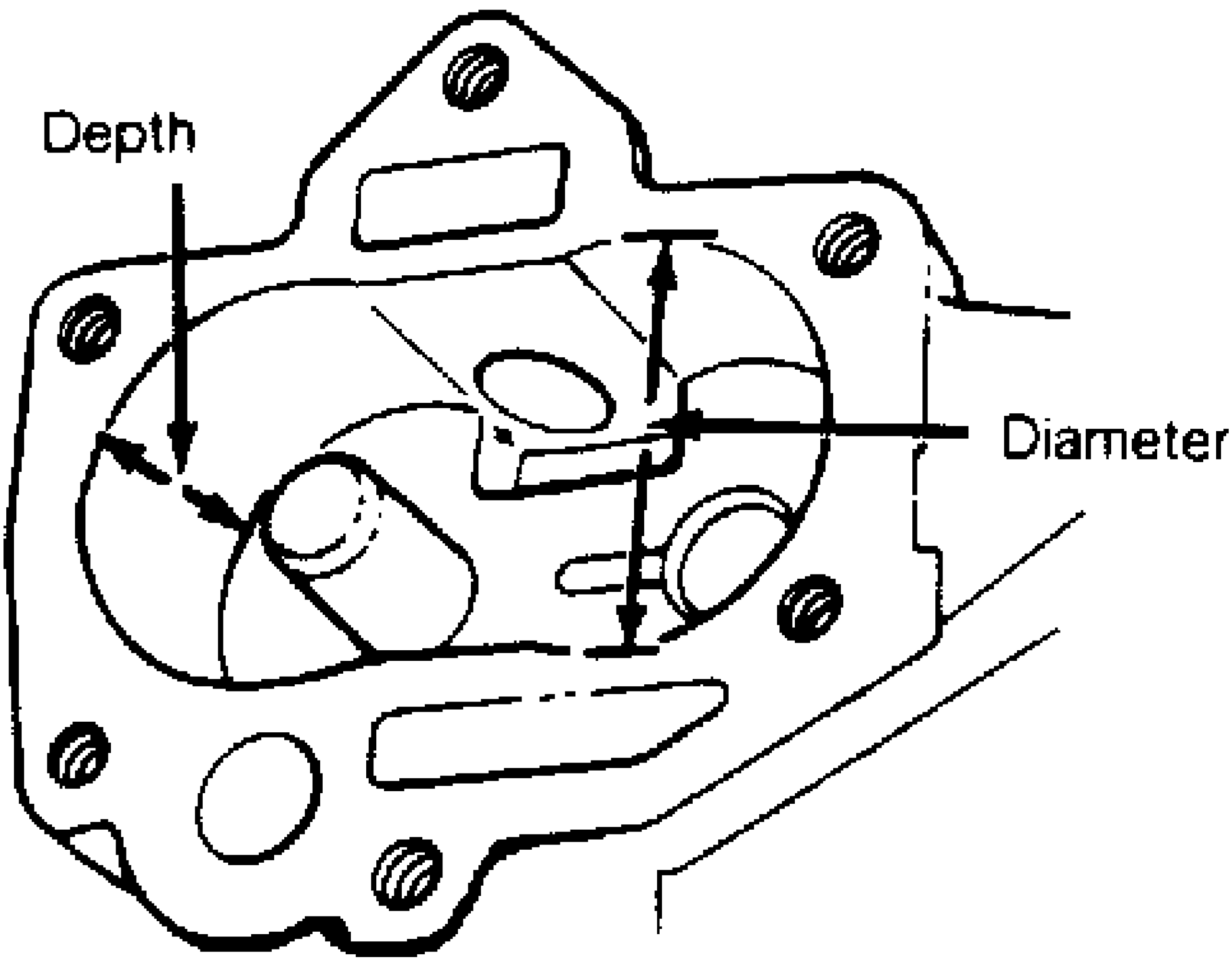

Fig. 33: Measuring Oil Pump Gear Cavity - Typical
This Graphic For General Information Only

BREAK-IN-PROCEDURE

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ENGINE PRE-OILING

Engine pre-oiling should be done prior to operation to prevent engine damage. A lightly oiled pump will cavitate unless oil pump cavities are filled with engine oil or petroleum jelly.

Engine pre-oiling can be done using pressure oiler (if available). Connect pressure oiler to cylinder block oil passage such as oil pressure sending unit. Operate pressure oiler long enough to ensure correct amount of oil has filled crankcase. Check oil level while pre-oiling.

If pressure oiler is not available, disconnect ignition system. Remove oil pressure sending unit and replace with oil pressure test gauge. Using starter motor, rotate engine starter until gauge shows normal oil pressure for several seconds. DO NOT crank engine for more than 30 seconds to avoid starter motor damage.

Ensure oil pressure has reached the most distant point from the oil pump. Reinstall oil pressure sending unit. Reconnect ignition system.

INITIAL START-UP

Start the engine and operate engine at low speed while checking for coolant, fuel and oil leaks. Stop engine. Recheck coolant and oil level. Adjust if necessary.

CAMSHAFT

Break-in procedure is required when a new or reground camshaft has been installed. Operate and maintain engine speed between 1500-2500 RPM for approximately 30 minutes. Procedure may vary due to manufacturers recommendations.

PISTON RINGS

Piston rings require a break-in procedure to ensure seating of rings to cylinder walls. Serious damage may occur to rings if correct procedures are not followed.

Extremely high piston ring temperatures are produced obtained during break-in process. If rings are exposed to excessively high RPM or high cylinder pressures, ring damage can occur. Follow piston ring manufacturer's recommended break-in procedure.

FINAL ADJUSTMENTS

Check or adjust ignition timing and dwell (if applicable). Adjust valves (if necessary). Adjust carburetion or injection idle speed and mixture. Retighten cylinder heads (if required). If cylinder head or block is aluminum, retighten bolts when engine is cold. Follow the engine manufacturer's recommended break-in procedure and maintenance schedule for new engines.

NOTE: Some manufacturer's require that head bolts be retightened after specified amount of operation. This must be done to prevent head gasket failure.

* ENGINE SYSTEMS UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
Engine Performance and Maintenance Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

Motorist Assurance Program (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM
OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

Engine Assemblies

CYLINDER HEAD ASSEMBLIES
LONG BLOCK ASSEMBLIES
SHORT BLOCK ASSEMBLIES

Engine Components

ACCELERATOR PEDAL POSITION SENSORS
ACCESSORY BELTS
ACCESSORY PULLEYS
ACTUATORS
AIR CONDITIONING CYCLING SWITCHES
AIR CONDITIONING PRESSURE SENSORS
AIR DUCTS AND TUBES
AIR FILTER ELEMENTS
AIR FILTER GASKETS
AIR FILTER HOUSINGS AND GASKETS
AIR FUEL RATIO SENSORS
AIR INJECTION CONTROL SOLENOIDS
AIR PLENUMS
AIR PUMP BELTS
AIR PUMPS (ELECTRIC-DRIVEN)
AIR TUBES
ASPIRATOR, CHECK AND DECEL VALVES
BAFFLES
BALLAST PRIMARY SUPPLY RESISTOR WIRES
BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES
BAROMETRIC PRESSURE SENSORS
BATTERIES
BATTERY CABLES, WIRES AND CONNECTORS
BATTERY CONNECTORS
BATTERY TRAYS AND HOLD DOWN HARDWARE
BATTERY WIRES
BELT-DRIVEN AIR PUMPS
BELT IDLER ASSEMBLIES (ACCESSORY AND CAM BELTS)
BELT TENSIONERS (ACCESSORY AND CAM BELTS)
BOOST CONTROL MECHANISMS
CAMSHAFT POSITION SENSORS
CARBURETORS AND CHOKES
CASTING CORE PLUGS AND EXPANSION PLUGS
CHARGE AIR COOLERS "INTERCOOLERS" (CAC)
CHECK VALVES
CHOKES

CLUTCH PEDAL POSITION SWITCHES
COLD START INJECTORS
CONNECTORS
COOLANT
COOLANT RECOVERY TANKS
COOLING FAN MOTOR MODULES
COOLING FAN MOTOR RELAYS AND MODULES
COOLING FAN MOTOR RESISTORS
COOLING FAN MOTOR SENSORS AND SWITCHES
COOLING FAN MOTOR SWITCHES
COOLING FAN MOTORS
CRANKSHAFT POSITION SENSORS
DECEL VALVES
DEFLECTORS
DIP STICKS AND TUBES
DIP STICK TUBES
DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM)
DISTRIBUTOR BOOTS AND SHIELDS
DISTRIBUTOR CAPS
DISTRIBUTOR RETARDERS (MECHANICAL AND VACUUM)
DISTRIBUTOR ROTORS
DISTRIBUTOR SHIELDS
DISTRIBUTORS
EARLY FUEL EVAPORATION VALVES (HEAT RISER ASSEMBLIES)
EGR COOLERS
EGR EXHAUST MANIFOLD PASSAGES
EGR INTAKE AND EXHAUST MANIFOLD PASSAGES
EGR PLATES AND COOLERS
ELECTRONIC SPARK CONTROL MODULES
ELECTRONIC TRANSMISSION CONTROL DEVICES
ELECTRONIC TRANSMISSION FEEDBACK DEVICES
ENGINE COOLANT TEMPERATURE SENSORS
ENGINE COOLING SYSTEMS
ENGINE COVERS (OIL PAN, VALVE COVER, TIMING COVER)
ENGINE OIL
ENGINE OIL CANISTERS
ENGINE OIL COOLERS (EXTERNAL)
ENGINE OIL DRAIN PLUGS AND GASKETS
ENGINE OIL FILTERS AND CANISTERS
ENGINE OIL GASKETS
ENGINE OIL PRESSURE GAUGES (MECHANICAL)
EVAPORATIVE EMISSION (EVAP) CANISTER FILTERS
EVAPORATIVE EMISSION (EVAP) CANISTER PURGE DEVICES
EVAPORATIVE EMISSION (EVAP) CANISTERS
EVAPORATIVE EMISSION (EVAP) FEEDBACK DEVICES
EXHAUST GAS RECIRCULATION DEVICES
EXHAUST GAS RECIRCULATION FEEDBACK DEVICES
EXPANSION PLUGS
FAN CONTROL SENSORS
FUEL
FUEL ACCUMULATORS AND DAMPERS
FUEL AND COLD START INJECTORS
FUEL DAMPERS
FUEL DELIVERY CHECK VALVES
FUEL DISTRIBUTORS (BOSCH CIS)
FUEL FILLER NECKS AND RESTRICTORS
FUEL FILTERS
FUEL INJECTORS
FUEL LEVEL SENDERS7
FUEL PRESSURE REGULATORS
FUEL PUMPS (IN-TANK AND EXTERNAL, ELECTRICAL OR MECHANICAL)
FUEL RAILS
FUEL RESTRICTORS

FUEL TANKS
GAS CAPS
GASKETS
GROMMETS (VALVE COVER)
HARMONIC DAMPERS
HEATER CONTROL VALVES
HEATER CORES
HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS
HOSE CLAMPS
HOSE CONNECTORS
HOSE COUPLERS
HOSES AND TUBES (FUEL LINES, RADIATOR, VACUUM, BY PASS,
  HEATER, RECOVERY TANK AND OIL COOLERS)
HOUSINGS
IDLE AIR CONTROLS
IDLE SPEED CONTROL ACTUATORS
IGNITION BOOTS
IGNITION COIL TOWERS
IGNITION COILS
IGNITION CONTROL MODULES (ICM)
IGNITION SWITCHES
IGNITION TERMINALS
IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY)
IN-TANK FUEL STRAINERS
INERTIA FUEL SHUT-OFF SWITCHES
INTAKE AIR TEMPERATURE SENSORS
INTAKE MANIFOLDS
INTERCOOLERS
KNOCK SENSORS
LIQUID VAPOR SEPARATORS
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSORS
MASS AIR FLOW (MAF) SENSORS
METAL AIR MANIFOLDS AND PIPES
METAL AIR PIPES
MIX CONTROL SOLENOIDS
MOTOR MOUNTS
O-RINGS, GASKETS, SEALS AND SPRING LOCKS
O2 SENSORS
OIL PRESSURE SENDING UNITS
OIL PUMP PICK-UP SCREENS
OIL PUMPS
PARK NEUTRAL POSITION SWITCHES
PCV BREATHER ELEMENTS
PCV ORIFICES
PCV VALVES
PICK-UP ASSEMBLIES (INCLUDES MAGNETIC, HALL EFFECT AND
  OPTICAL)
POWER STEERING PRESSURE SENSORS
POWERTRAIN CONTROL MODULES (PCM) AND PROM
POWERTRAIN CONTROL PROM
PRESSURIZED EXPANSION TANK CAPS
RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS
RADIATOR FAN BLADES
RADIATOR FAN CLUTCHES
RADIATORS
ROLL OVER VALVES
SEALING COMPOUNDS
SEALS
SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICES
SENSORS AND ACTUATORS
SHROUDS, BAFFLES AND DEFLECTORS
SPARK PLUGS
SPRING LOCKS

SUPER CHARGERS
SWITCHES
THERMAL VACUUM VALVES
THERMOSTATIC AIR DOOR ASSEMBLIES
THERMOSTATS AND HOUSINGS
THROTTLE BODIES
THROTTLE CABLES
THROTTLE LINKAGES AND CABLES
THROTTLE POSITION SENSORS
THROTTLE POSITION SWITCHES
TIMING BELT SPROCKETS
TIMING BELTS
TORQUE STRUTS
TRANSMISSION RANGE SWITCHES
TUBE CLAMPS
TUBE CONNECTORS
TUBE COUPLERS
TUBES
TURBO CHARGERS
VACUUM CONNECTIONS
VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)
VACUUM REGULATOR SOLENOIDS
VACUUM TUBES
VEHICLE SPEED SENSORS
VOLUME AIR FLOW SENSORS
WASTE GATE CONTROL SOLENOIDS
WASTE GATES AND BOOST CONTROL MECHANISMS
WATER PUMPS (ELECTRIC)
WATER PUMPS (NON-ELECTRIC)
WIRING HARNESSES AND CONNECTORS

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication

Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

1444 I Street, NW Suite 700
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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer’s best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer’s recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

ENGINE ASSEMBLIES

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

CYLINDER HEAD ASSEMBLIES

NOTE: A Cylinder Head Assembly is a cylinder head fitted with valves, associated springs, retainers, and on overhead camshaft cylinder heads (OHC), camshaft, camshaft bearings, lash adjusters, tappets and rockers.

CYLINDER HEAD ASSEMBLY INSPECTION

Condition	Code	Procedure
Adjustable valve lash is out of specification	B	Require repair.
Internal component failure (any component)	A	(1) Require repair or replacement of cylinder head assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement, such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

LONG BLOCK ASSEMBLIES

NOTE: A Long Block Assembly is a short block assembly together with a cylinder head assembly and all those components fitted within the rocker or cam cover, and timing cover (the whole presented as an assembly). A rebuilt or new oil pump, or kit shall be supplied or fitted as appropriate.

LONG BLOCK ASSEMBLY INSPECTION

Condition	Code	Procedure
Internal component failure (any component)	A	.... (1) Require repair or replacement of the long block assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

SHORT BLOCK ASSEMBLIES

NOTE: A Short Block Assembly is a cylinder block and all those components contained within the limits of the block deck or decks, the pan rail, the block rear face and the timing cover (where fitted), including the crankshaft.

SHORT BLOCK ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure	A	.... (1) Require repair or replacement of the short block assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement, such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

ENGINE COMPONENTS

ACCELERATOR PEDAL POSITION SENSORS

ACCELERATOR PEDAL POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ACCESSORY BELTS

ACCESSORY BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

ACCESSORY PULLEYS

ACCESSORY PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.

ACTUATORS

See SENSORS AND ACTUATORS.

AIR CONDITIONING CYCLING SWITCHES

AIR CONDITIONING CYCLING SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.

Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR CONDITIONING PRESSURE SENSORS

AIR CONDITIONING PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.

Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR DUCTS AND TUBES

AIR DUCT AND TUBE INSPECTION

Condition	Code	Procedure

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

AIR FILTER ELEMENTS

AIR FILTER ELEMENT INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Paper filter element oil-soaked	A	(1) Require replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Melted	A	Required replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Water-contaminated	A	(1) Require replacement.

(1) - Further inspection required to determine cause.

AIR FILTER GASKETS

See AIR FILTER HOUSINGS AND GASKETS.

AIR FILTER HOUSINGS AND GASKETS

AIR FILTER HOUSING AND GASKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

AIR FUEL RATIO SENSORS

AIR FUEL RATIO SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR INJECTION CONTROL SOLENOIDS

AIR INJECTION CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR PLENUMS

AIR PLENUM INSPECTION

Condition	Code	Procedure
Integrated air or fuel control components inoperative	A	(1) Require repair or replacement.
Internal air or fuel components damaged, affecting performance	A	Require repair or replacement of component.
Internal air or fuel components damaged, not affecting performance	..	No service suggested or required.
Internal air or fuel components missing	C	Require replacement of component.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

AIR PUMP BELTS

AIR PUMP BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle OEM recommended service intervals.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

AIR PUMPS (ELECTRIC-DRIVEN)

AIR PUMP (ELECTRIC-DRIVEN) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR TUBES

See AIR DUCTS AND TUBES.

ASPIRATOR, CHECK AND DECEL VALVES

ASPIRATOR, CHECK AND DECEL VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement

		of hardware.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Melted, affecting performance	A	Require replacement.
Melted, not affecting performance	..	No service suggested or required.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BAFFLES

See SHROUDS, BAFFLES AND DEFLECTORS.

BALLAST PRIMARY SUPPLY RESISTOR WIRES

See BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES.

BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES

BALLAST RESISTOR AND PRIMARY SUPPLY RESISTOR WIRE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Conductor exposed	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Insulation overheated	A	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

BAROMETRIC PRESSURE SENSORS

BAROMETRIC PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or

replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

BATTERIES

Proper operation of any electrical system or component can be affected by battery condition. The battery(ies) must meet or exceed minimum specification for vehicle as equipped and test to that specific battery's CCA.

Definition of Terms

* Battery Performance Testing
  Testing that determines whether or not a battery meets both vehicle OEM and battery manufacturer's specifications.

* Cold Cranking Amp (CCA) Rating
  The number of amperes a new, fully charged battery at 0° F (-17.8° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* Cranking Amps (CA)
  The number of amperes a new, fully charged battery, typically at 32° F (0° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* OEM Cranking Amps
  The minimum CCA required by the original vehicle manufacturer for a specific vehicle.

BATTERY INSPECTION

Condition	Code	Procedure
Battery frozen	..	(1) Further inspection required.
Case leaking	A	Require replacement.
Casing swollen	A	(2) Further inspection required.
Circuit open internally	A	Require replacement.
Electrolyte contamination	A	(2) Further inspection required.
Electrolyte discoloration	A	(2) Further inspection required.
Fails to accept and hold charge	A	(3) Require replacement.
Fluid level low	B	(4) Further inspection required.
Out of performance specification for battery	B	(5) Require replacement.
Out of specification for application	B	(5) Require replacement.

Post (top or side) burned, affecting performance	A	(6) Require repair or replacement.
Post (top or side) burned, not affecting performance	2	(6) Suggest repair or replacement.
Post (top or side) corroded, affecting performance	A	Require repair.
Post (top or side) corroded, not affecting performance	2	Suggest repair.
Post (top or side) loose	A	Require replacement.
Post (top or side) melted, affecting performance	A	(6) Require repair or replacement.
Post (top or side) melted, not affecting performance	2	(6) Suggest repair or replacement.
Specific gravity low	B	(7) Further inspection required.
State of charge low	A	(7) Further inspection required.
Top dirty	2	Suggest cleaning battery.
Top wet	A	(8) Require cleaning battery. Further inspection required.
Vent cap loose	A	Require repair or replacement of vent cap.
Vent cap missing	C	Require replacement of vent cap.

(1) - DO NOT attempt to charge a frozen battery. Allow battery to warm thoroughly and then performance-test. If battery fails performance test, require replacement.
(2) - No service suggested or required unless the battery fails performance test, in which case, require replacement.
(3) - This phrase refers to a battery that fails to either accept and/or retain a charge using appropriate times listed in the Battery Charging Guide of the BCI Service Manual, battery charger operating manual, or battery manufacturer's specifications.
(4) - Determine cause of low fluid level. Refill to proper level(s) with water (distilled water preferred). Recharge battery and performance-test.
(5) - The battery may meet battery manufacturer's specifications but test below the minimum specification defined by the vehicle's OEM for that vehicle.
(6) - Determine cause and correct prior to repair or replacement of part.
(7) - Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.
(8) - Check fluid level and adjust to manufacturer's specification. Suggest checking charging system for proper operation.

BATTERY CABLES, WIRES AND CONNECTORS

BATTERY CABLE, WIRE AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	(2) Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Exposed conductor at replacement (aftermarket) terminal end does not require repair or replacement.

BATTERY CONNECTORS

See BATTERY CABLES, WIRES AND CONNECTORS.

BATTERY TRAYS AND HOLD DOWN HARDWARE

BATTERY TRAY AND HOLD DOWN HARDWARE INSPECTION

Condition	Code	Procedure
Battery improperly secured	2	Suggest repair.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance	..	No service suggested or required.
Broken, affecting performance	A	Require repair or replacement.
Broken, not affecting performance	..	No service suggested or required.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Water drain clogged	A	Require repair.

BATTERY WIRES

See BATTERY CABLES, WIRES AND CONNECTORS.

BELT-DRIVEN AIR PUMPS

BELT-DRIVEN AIR PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley alignment incorrect	B	Require repair or replacement.
Pulley bent	A	Require replacement.
Pulley cracked	A	Require replacement.
Pulley loose	A	Require repair or replacement.
Pulley missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads		

missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BELT IDLER ASSEMBLIES (ACCESSORY AND CAM BELTS)

BELT IDLER ASSEMBLY (ACCESSORY AND CAM BELT) INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearings worn	1	Suggest replacement.
Cracked	2	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Seized	A	Require repair or replacement.

BELT TENSIONERS (ACCESSORY AND CAM BELTS)

BELT TENSIONER (ACCESSORY AND CAM BELT) INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearings worn	1	Suggest replacement.
Belt tension incorrect	B	Require adjustment or repair.
Cracked	2	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Seized	A	Require repair or replacement.

BOOST CONTROL MECHANISMS

See WASTE GATES AND BOOST CONTROL MECHANISMS.

CAMSHAFT POSITION SENSORS

CAMSHAFT POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

CARBURETORS AND CHOKES

NOTE: Proper operation of a carburetor includes the ability to control air/fuel mixtures during all phases or driving operation to comply with all federal and local emissions standards. Adjustments are to be considered repairs.

CARBURETOR AND CHOKE INSPECTION

Condition	Code	Procedure
Air/fuel control incorrect	B	Require repair or replacement.
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Components binding	A	Require repair or replacement.
Components damaged, affecting operation or performance	A	Require repair or replacement.
Components missing	C	Require replacement of components.
Contaminated	A	(1) Require repair or replacement. Further inspection required.
Controlling linkages binding	A	Require repair or replacement of linkage.
Leaking	A	Require repair or replacement.
Mechanical operation incorrect	B	Require repair or replacement.
Operating incorrectly	B	Require repair or replacement.

(1) - Some components may be serviceable; check for accepted cleaning procedure. Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.

CASTING CORE PLUGS AND EXPANSION PLUGS

CASTING CORE PLUG AND EXPANSION PLUG INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Material type incorrect	2	Suggest replacement.

CHARGE AIR COOLERS "INTERCOOLERS" (CAC)

CHARGE AIR COOLER "INTERCOOLER" (CAC) INSPECTION

Condition	Code	Procedure
Air-to-air intercooler leaking, affecting boost performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking coolant	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

CHECK VALVES

See ASPIRATOR, CHECK AND DECEL VALVES.

CHOKES

See CARBURETORS AND CHOKES.

CLUTCH PEDAL POSITION SWITCHES

CLUTCH PEDAL POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors		

exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COLD START INJECTORS

See FUEL AND COLD START INJECTORS.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLANT

COOLANT INSPECTION

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement.
Contaminated	B	(1) Require replacement or recycling. Further inspection required.
Level low	B	(2) Require filling to proper level.
Maintenance intervals	3	(3) Suggest replacement.
Mixture incorrect	B	Require correction or replacement.
Type incorrect	B	Require replacement.

(1) - Determine source of contamination and require correction prior to coolant replacement.
(2) - Determine source of incorrect level and suggest repair.
(3) - The system should be drained and/or flushed and refilled with correct coolant according to OEM recommended service interval and procedures.

COOLANT RECOVERY TANKS

COOLANT RECOVERY TANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.

Missing (if original equipment)	C	Require replacement.

COOLING FAN MOTOR MODULES

See COOLING FAN MOTOR RELAYS AND MODULES.

COOLING FAN MOTOR RELAYS AND MODULES

COOLING FAN MOTOR RELAY AND MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Housing cracked	2	Suggest repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

COOLING FAN MOTOR RESISTORS

COOLING FAN MOTOR RESISTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Open	A	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Shorted	A	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

COOLING FAN MOTOR SENSORS AND SWITCHES

COOLING FAN MOTOR SENSOR AND SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or

		replacement.
Inoperative	B	.... (3) Require repair or replacement. Further inspection required.
Leaking	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Resistance out of specification	B	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COOLING FAN MOTOR SWITCHES

See COOLING FAN MOTOR SENSORS AND SWITCHES.

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	.. Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	.. Require repair or replacement of hardware.
Connector broken	A	. Require repair or replacement.
Connector (Weatherpack type) leaking	A	. Require repair or replacement.

Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Hydraulic fan motor leaking	A	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

CRANKSHAFT POSITION SENSORS

CRANKSHAFT POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	Require repair or replacement.
Inoperative	B	Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.

Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

DECEL VALVES

See ASPIRATOR, CHECK AND DECEL VALVES.

DEFLECTORS

See SHROUDS, BAFFLES AND DEFLECTORS.

DIP STICKS AND TUBES

DIP STICK AND TUBE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Bent	2	Suggest repair or replacement.
Broken, affecting performance (for example, fuel mixture)	A	Require repair or replacement.
Broken, not affecting performance	2	Suggest repair or replacement.
Leaking, affecting performance (for example, fuel mixture)	A	Require repair or replacement.
Leaking, not affecting performance	2	Suggest repair or replacement.
Missing	C	Require replacement.

DIP STICK TUBES

See DIP STICKS AND TUBES.

DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM)

DISTRIBUTOR ADVANCE AND RETARDER (MECHANICAL AND VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding	A	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Out of specification	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

DISTRIBUTOR BOOTS AND SHIELDS

DISTRIBUTOR BOOT AND SHIELD INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Deteriorated	A	Require replacement.
Leaking	A	Require replacement.
Missing	A	Require replacement.
Torn	A	Require replacement.

DISTRIBUTOR CAPS

DISTRIBUTOR CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Arcing	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Burned	A	Require replacement.
Carbon button missing	A	Require replacement.
Carbon button worn, affecting performance	A	Require replacement.
Carbon button worn, not affecting performance	1	Suggest replacement.
Carbon-tracked	A	Require replacement.
Cracked	A	Require replacement.
Loose	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal eroded, affecting performance	A	Require repair or replacement.
Terminal eroded, not affecting performance	..	No service suggested or required.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

DISTRIBUTOR RETARDERS (MECHANICAL AND VACUUM)

See DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM) .

DISTRIBUTOR ROTORS

DISTRIBUTOR ROTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Carbon-tracked	A	Require replacement.
Contact burned	A	Require replacement.
Corroded	1	Suggest replacement.

Eroded	1	Suggest replacement.
Loose	A	Require repair or replacement.
Out of specification	B	Require replacement.

DISTRIBUTOR SHIELDS

See DISTRIBUTOR BOOTS AND SHIELDS.

DISTRIBUTORS

DISTRIBUTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bushings worn, affecting performance	A	Require repair or replacement.
Bushings worn, not affecting performance	1	Suggest repair or replacement.
Cam lobes worn, affecting performance	A	Require repair or replacement.
Cam lobes worn, not affecting performance	1	Suggest repair or replacement.
Gear broken	A	Require repair or replacement.
Gear worn, affecting performance	A	Require replacement.
Gear worn, not affecting performance	..	No service suggested or required.
Integrated pickup triggering device loose	A	Require repair or replacement.
Integrated pickup triggering device magnetism incorrect	A	Require repair or replacement.
Leaking oil internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Pickup triggering device (reluctor) broken	A	Require repair or replacement.
Pickup triggering device (reluctor) loose	A	Require repair or replacement.
Pickup triggering device (reluctor) weak	A	Require repair or replacement.
Reluctor (pickup triggering device) broken	A	Require repair or replacement.
Reluctor (pickup triggering device) loose	A	Require repair or replacement.
Reluctor (pickup triggering device) weak	A	Require repair or replacement.
Shaft bent	A	Require replacement.
Thrust washer broken	A	Require repair or replacement.

Thrust washer missing ...	C	.. Require repair or replacement.
Thrust washer worn, affecting performance ..	A	.. Require repair or replacement.
Thrust washer worn, not affecting performance ..	1	.. Suggest repair or replacement.

EARLY FUEL EVAPORATION VALVES (HEAT RISER ASSEMBLIES)

EARLY FUEL EVAPORATION VALVE (HEAT RISER ASSEMBLY) INSPECTION

Condition	Code	Procedure
Broken	A	. Require replacement of affected parts.
Diaphragm inoperative ...	A	.... (1) Further inspection required.
Leaking	A	.. Require repair or replacement.
Noisy	2	.. Suggest repair or replacement.
Seized	A	. Require replacement of affected parts.
Spring broken	B	.... Require replacement of spring(s).
Spring inoperative	A	...... (2) Require replacement of spring(s).

(1) - Inoperative includes intermittent operation or out of OEM specification. If the inoperative diaphragm is separate from the heat riser, then require replacement of the inoperative diaphragm. If the inoperative diaphragm is part of the heat riser, then replace the heat riser.
(2) - Inoperative includes intermittent operation or out of OEM specification.

EGR COOLERS

See EGR PLATES AND COOLERS.

EGR EXHAUST MANIFOLD PASSAGES

See EGR INTAKE AND EXHAUST MANIFOLD PASSAGES.

EGR INTAKE AND EXHAUST MANIFOLD PASSAGES

EGR INTAKE AND EXHAUST MANIFOLD PASSAGE INSPECTION

Condition	Code	Procedure
Leaking	A	.. Require repair or replacement.
Restricted, affecting performance	A	.. Require repair or replacement.

EGR PLATES AND COOLERS

EGR PLATE AND COOLER INSPECTION

Condition	Code	Procedure
Leaking	A	.. Require repair or replacement.

Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

ELECTRONIC SPARK CONTROL MODULES

ELECTRONIC SPARK CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement of source.
(3) - Includes inoperative, intermittent operation, failure to

perform all functions, or out of OEM specification.

ELECTRONIC TRANSMISSION CONTROL DEVICES

ELECTRONIC TRANSMISSION CONTROL DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.

(3) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

ELECTRONIC TRANSMISSION FEEDBACK DEVICES

ELECTRONIC TRANSMISSION FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant,

fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ENGINE COOLANT TEMPERATURE SENSORS

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ENGINE COOLING SYSTEMS

NOTE: Overheating, poor engine performance, and insufficient cabin heat can be affected by, but are not limited to, all of the components in the engine cooling system.

ENGINE COVERS (OIL PAN, VALVE COVER, TIMING COVER)

ENGINE COVER (OIL PAN, VALVE COVER, TIMING COVER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	B	Require replacement.
Attaching hardware loose	A	Require repair or replacement.
Attaching hardware missing	C	Require replacement.
Baffle loose	2	Suggest repair or replacement.
Baffle missing	C	Require replacement.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance	..	No service suggested or required.
Cracked (not leaking)	2	Suggest repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally, causing fluid contamination	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted passage	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.

ENGINE OIL

ENGINE OIL INSPECTION

Condition	Code	Procedure
Contaminated	A	(1) Require replacement of oil and filter.
Level high	B	Determine source of incorrect level and require repair.
Level low	B	Determine source of incorrect level and require repair.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.

(1) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water when changing oil. Require

repair or replacement.

ENGINE OIL CANISTERS

See ENGINE OIL FILTERS AND CANISTERS.

ENGINE OIL COOLERS (EXTERNAL)

ENGINE OIL COOLER (EXTERNAL) INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require repair or replacement.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Fluid flow restrictions	A	Require repair or replacement.
Internal restrictions, affecting performance	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

ENGINE OIL DRAIN PLUGS AND GASKETS

ENGINE OIL DRAIN PLUG AND GASKET INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	(1) Require repair or replacement.

(1) - Some OEMs require replacement of drain plug gasket when removing drain plug. Inspect threads in oil pan for damage.

ENGINE OIL FILTERS AND CANISTERS

ENGINE OIL FILTER AND CANISTER INSPECTION

Condition	Code	Procedure
Bulged	A	(1) Require replacement.

		Further inspection required.
Canister attaching hardware broken	A	Require repair or replacement of hardware.
Canister attaching hardware loose	A	Require repair.
Canister attaching hardware missing	C	Require replacement.
Canister attaching hardware not functioning	A	Require repair or replacement of hardware.
Center tube collapsed	A	(2) Require replacement. Further inspection required.
Contaminated	A	(3) Require replacement of oil and filter.
Dented	2	(4) Suggest replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.

(1) - Inspect pressure relief valve.
(2) - Inspect bypass.
(3) - Determine cause of contamination, such as engine coolant, fuel, metal particles, or water when changing oil. Require repair or replacement.
(4) - Determine cause, such as broken motor mount.

ENGINE OIL GASKETS

See ENGINE OIL DRAIN PLUGS AND GASKETS.

ENGINE OIL PRESSURE GAUGES (MECHANICAL)

ENGINE OIL PRESSURE GAUGE (MECHANICAL) INSPECTION

Condition	Code	Procedure
Indicates out of range	B	(1) Further inspection required.
Inoperative	A	(2) Further inspection required.
Leaking	A	Require repair or replacement.
Reads inaccurately	2	Suggest repair or replacement.

(1) - Gauge may indicate problem with contaminated oil, level, pressure, or temperature, or problem with gauge.
(2) - Gauge may indicate problem with contaminated oil, level, pressure, or temperature, or problem with gauge. Inoperative includes intermittent operation, out of OEM specification, or out of range. Further inspection required to determine cause.

EVAPORATIVE EMISSION (EVAP) CANISTER FILTERS

EVAPORATIVE EMISSION (EVAP) CANISTER FILTER INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Maintenance interval	3	Suggest replacement to comply with OEM recommended service interval.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	A	Require replacement.

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE DEVICES

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.

Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EVAPORATIVE EMISSION (EVAP) CANISTERS

EVAPORATIVE EMISSION (EVAP) CANISTER INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Saturated	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

EVAPORATIVE EMISSION (EVAP) FEEDBACK DEVICES

EVAPORATIVE EMISSION (EVAP) FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.

Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXHAUST GAS RECIRCULATION DEVICES

EXHAUST GAS RECIRCULATION DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.

Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	1	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXHAUST GAS RECIRCULATION FEEDBACK DEVICES

EXHAUST GAS RECIRCULATION FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	1	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXPANSION PLUGS

See CASTING CORE PLUGS AND EXPANSION PLUGS.

FAN CONTROL SENSORS

FAN CONTROL SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

FUEL

FUEL INSPECTION

Condition	Code	Procedure
Contaminated	B	(1) Require repair or replacement.
Fuel incorrect	B	(2) Require flushing of system.

(1) - Determine of source of contamination. Require repair or replacement.
(2) - If a fuel other than specification fuel is present in the system, the required service is to flush and fill with the correct fuel.

FUEL ACCUMULATORS AND DAMPERS

FUEL ACCUMULATOR AND DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connections leaking	A	Require repair or replacement.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

FUEL AND COLD START INJECTORS

NOTE: You are not required to replace injectors in sets. However, you may suggest replacement of all injectors for preventive maintenance.

FUEL AND COLD START INJECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.

Flow restricted	B	Require repair or replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Resistance out of specification	B	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation, out of OEM specification. Some components may be serviceable.

FUEL DAMPERS

See FUEL ACCUMULATORS AND DAMPERS.

FUEL DELIVERY CHECK VALVES

FUEL DELIVERY CHECK VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require replacement.
Leaking externally	A	Require repair or replacement.
Missing	C	Require replacement.
Pressure leaking (bleeds down)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

FUEL DISTRIBUTORS (BOSCH CIS)

FUEL DISTRIBUTOR (BOSCH CIS) INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Out of specification	B	Require repair or replacement.
Restricted, affecting		

performance	A	(2) Require repair or replacement. Further inspection required.

(1) - Inoperative includes intermittent operation.
(2) - Some components may be serviceable; check for accepted cleaning procedure.

FUEL FILLER NECKS AND RESTRICTORS

FUEL FILLER NECK AND RESTRICTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted	2	Suggest repair or replacement.

FUEL FILTERS

FUEL FILTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Maintenance interval	3	Suggest replacement to comply with OEM recommended service interval.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	2	Suggest replacement.

FUEL INJECTORS

FUEL INJECTOR INSPECTION

Condition	Code	Procedure
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

FUEL LEVEL SENDERS

FUEL LEVEL SENDER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

FUEL PRESSURE REGULATORS

FUEL PRESSURE REGULATOR INSPECTION

Condition	Code	Procedure
Contaminated	2	(1) Suggest repair or replacement. Further inspection required.
Inoperative	B	(2) Require repair or replacement.
Leaking (internally or externally)	A	Require repair or replacement.
Pressure out of specification	B	Require repair or replacement.
Vapor bypass restricted	A	Require repair or replacement.

(1) - Some components may be serviceable; check for accepted cleaning procedure. Determine source of contamination. Require repair or replacement.

(2) - Inoperative includes intermittent operation or out of OEM specification.

FUEL PUMPS (IN-TANK AND EXTERNAL, ELECTRICAL OR MECHANICAL)

FUEL PUMP (IN-TANK AND EXTERNAL, ELECTRICAL OR MECHANICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require replacement.
Inoperative	A	(3) Require repair or replacement.
Leaking externally (includes pulsator)	A	Require repair or replacement.
Leaking internally (includes pulsator)	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination. Require repair or replacement.
(3) - Inoperative includes intermittent operation.

FUEL RAILS

FUEL RAIL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Contaminated	A	(1) Require replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Rust-pitted	1	Suggest replacement.

(1) - Determine source of contamination. Require repair or replacement.

FUEL RESTRICTORS

See FUEL FILLER NECKS AND RESTRICTORS.

FUEL TANKS

FUEL TANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Baffles loose	A	Require repair or replacement.
Contaminated	A	(1) Require repair.
Corroded internally	A	Require repair or replacement.
Distorted, affecting performance	B	Require replacement.
Distorted, not affecting performance	..	No service suggested or required.
Leaking	A	Require repair or replacement.

(1) - Determine source of contamination. Require repair or replacement.

GAS CAPS

GAS CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Fails to maintain proper pressure	A	Require replacement.
Gaskets missing	C	Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Plugged (vacuum and pressure relief)	A	Require replacement.
Seals missing	C	Require replacement.

GASKETS

GASKET INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

GROMMETS (VALVE COVER)

GROMMET (VALVE COVER) INSPECTION

Condition	Code	Procedure
Leaking	2	(1) Suggest repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

HARMONIC DAMPERS

HARMONIC DAMPER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	A	Require replacement.
Dented (fluid type only)	A	Require replacement.
Keyway distorted	A	Require repair or replacement.
Leaking (Fluid damper only)	A	Require replacement.
Loose	A	Require replacement.
Noisy	A	Require replacement.

Condition	Code	Procedure
Outer ring slipped out of position	A	Require replacement.
Positioned incorrectly	A	Require repair or replacement.
Rubber damping material deteriorated	1	Suggest replacement.
Seal surface worn, causing a leak	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

HEATER CONTROL VALVES

HEATER CONTROL VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require replacement.
Coolant leak	A	Require repair or replacement.
Malfunctioning	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Vacuum leak	A	Require repair or replacement.

(1) - Includes inoperative, intermittent operation, or failure to perform all functions.

HEATER CORES

HEATER CORE INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require repair or replacement.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Internal restrictions,		

affecting performance	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS

NOTE: When replacing fuel lines and hoses, replace with product that meets or exceeds OEM design specifications.

HOSE AND TUBE COUPLER, CONNECTOR AND CLAMP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Safety clip missing (not leaking)	C	Require replacement of safety clip.
Stripped	A	Require replacement.

HOSE CLAMPS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS .

HOSE CONNECTORS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS .

HOSE COUPLERS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS .

HOSES AND TUBES (FUEL LINES, RADIATOR, VACUUM, BY PASS, HEATER, RECOVERY TANK AND OIL COOLERS)

HOSE AND TUBE (FUEL LINE, RADIATOR, VACUUM, BY PASS, HEATER, RECOVERY TANK AND OIL COOLER) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Dry-rotted	1	Suggest repair or replacement.
Hard	1	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Maintenance intervals	3	Suggest replacement.

Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged	1	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	2	Suggest replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair or replacement.
Safety clip missing	C	Require replacement.
Spongy	1	Suggest repair or replacement.
Stripped	A	Require replacement.
Swollen	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

HOUSINGS

See THERMOSTATS AND HOUSINGS.

IDLE AIR CONTROLS

IDLE AIR CONTROL INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

IDLE SPEED CONTROL ACTUATORS

IDLE SPEED CONTROL ACTUATOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.

Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead corroded	A	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

IGNITION BOOTS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COIL TOWERS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COILS

IGNITION COIL INSPECTION

Condition	Code	Procedure
Arcing	A	.... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or

Condition	Code	Procedure
		replacement.
Connector missing	C	Require replacement.
Corroded, affecting performance	A	Require replacement.
Corroded, not affecting performance	2	Suggest replacement.
Distorted	..	(2) No service suggested or required.
Inoperative	A	(3) Require replacement.
Oil leaking	A	Require replacement.
Out of specification	B	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Distortion may be the result of overheating; coil should be tested.
(3) - Inoperative includes intermittent operation.

IGNITION CONTROL MODULES (ICM)

IGNITION CONTROL MODULE (ICM) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.

Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(4) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Includes inoperative, intermittent operation, or failure to perform all functions.

IGNITION SWITCHES

See SWITCHES.

IGNITION TERMINALS

See
IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY)

NOTE: You are not required to replace ignition wires in sets. However, you may suggest replacement of the entire secondary wire set for preventive maintenance.

IGNITION WIRE, BOOT, COIL TOWER AND TERMINAL (SECONDARY) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Carbon-tracked	A	Require replacement.
Corroded	1	Suggest repair or replacement.
Insulation leaking (shorted)	A	Require repair or replacement.
Metal heat shield bent	2	Suggest repair or replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Resistance incorrect	B	Require replacement.
Routed incorrectly	2	(1) Suggest repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - If improper routing affects the performance of other systems, require repair. Proper routing, hardware, heatshields, etc., are intended to prevent premature failure of secondary ignition components.
(2) - Determine cause and correct prior to repair or replacement of part.

IN-TANK FUEL STRAINERS

IN-TANK FUEL STRAINER INSPECTION

Condition	Code	Procedure
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Torn	A	Require replacement.

INERTIA FUEL SHUT-OFF SWITCHES

INERTIA FUEL SHUT-OFF SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement

		of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require replacement.
Inoperative	A	(3) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification.

INTAKE AIR TEMPERATURE SENSORS

INTAKE AIR TEMPERATURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or

Condition	Code	Procedure
		replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

INTAKE MANIFOLDS

INTAKE MANIFOLD INSPECTION

Condition	Code	Procedure
Corroded, affecting sealability	A	Require repair or replacement.
Integrated air or fuel control components inoperative	A	(1) Require repair or replacement.
Internal air or fuel components damaged, affecting performance	A	Require repair or replacement of component.
Internal air or fuel components damaged, not affecting performance	..	No service suggested or required.
Internal air or fuel components missing	C	Require replacement of

		component.
Leaking	A	Require repair or replacement.
Out of specification	B	Require replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.
Warped	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

INTERCOOLERS

See CHARGE AIR COOLERS "INTERCOOLERS" (CAC).

KNOCK SENSORS

KNOCK SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

LIQUID VAPOR SEPARATORS

LIQUID VAPOR SEPARATOR INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSORS

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

MASS AIR FLOW (MAF) SENSORS

MASS AIR FLOW (MAF) SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.

Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

METAL AIR MANIFOLDS AND PIPES

METAL AIR MANIFOLD AND PIPE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair of injection tube or replacement of manifold.
Corroded, affecting structural integrity	1	Suggest replacement of injection tube or manifold.
Leaking	A	Require repair of injection tube or replacement of manifold.
Loose	A	Require repair.
Missing	C	Require replacement.
Restricted	A	Require replacement of injection tube or manifold.

Threads damaged	A	Require repair.
Threads stripped (threads missing)	A	Require replacement.

METAL AIR PIPES

See METAL AIR MANIFOLDS AND PIPES.

MIX CONTROL SOLENOIDS

MIX CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.

Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

MOTOR MOUNTS

MOTOR MOUNT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Leaking (hydraulic mount)	A	Require replacement.
Mounting hole worn, affecting performance	A	Require replacement.
Mounting hole worn, not affecting performance	..	No service suggested or required.
Rubber deteriorated, affecting performance	A	Require replacement.
Rubber deteriorated, not affecting performance	..	No service suggested or required.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

O-RINGS, GASKETS, SEALS AND SPRING LOCKS

O-RING, GASKET, SEAL AND SPRING LOCK INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

O2 SENSORS

O2 SENSOR INSPECTION

Condition	Code	Procedure

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

OIL PRESSURE SENDING UNITS

OIL PRESSURE SENDING UNIT INSPECTION

Condition	Code	Procedure
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	.... (1) Require repair or replacement.
Connector missing	C	.... Require replacement.
Inoperative	A	.... (2) Require repair or replacement.
Leaking	A	.... Require replacement.
Output signal incorrect .	B	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	.... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

OIL PUMP PICK-UP SCREENS

OIL PUMP PICK-UP SCREEN INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Bypass stuck	A	.. Require repair or replacement.
Cracked	A	.. Require repair or replacement.
Loose	A	.. Require repair or replacement.
Missing	C	.... Require replacement.
Positioned incorrectly ..	A	.. Require repair or replacement.
Restricted	A	.. Require repair or replacement.
Screen torn	A	.... Require replacement.

OIL PUMPS

OIL PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Housing cracked	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Pressure relief valve stuck	A	Require repair or replacement.
Seized	A	Require repair or replacement.
Worn beyond specifications	B	Require repair or replacement.

PARK NEUTRAL POSITION SWITCHES

PARK NEUTRAL POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.

Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

PCV BREATHER ELEMENTS

PCV BREATHER ELEMENT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Melted	A	Required replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	A	Require replacement.

PCV ORIFICES

PCV ORIFICE INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Maintenance interval	3	Suggest repair or replacement to comply with OEM recommended service intervals.

Missing	C	Require replacement.
Restricted	A	Require repair or replacement.

PCV VALVES

PCV VALVE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Grommet broken	A	Require repair or replacement of grommet.
Grommet missing	C	Require replacement of grommet.
Grommet not functioning	A	Require repair or replacement of grommet.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Maintenance interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Missing	C	Require replacement.
Restricted	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

PICK-UP ASSEMBLIES (INCLUDES MAGNETIC, HALL EFFECT AND OPTICAL)

PICK-UP ASSEMBLY (MAGNETIC, HALL EFFECT AND OPTICAL) INSPECTION

Condition	Code	Procedure
Adjustment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require replacement.
Oil-soaked	A	Require replacement.

Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A ..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal loose, affecting performance	B ..	Require repair or replacement.
Terminal loose, not affecting performance ..	1 ..	Suggest repair or replacement.
Wire lead conductors exposed	B ..	Require repair or replacement.
Wire lead corroded	A ..	Require repair or replacement.
Wire lead open	A ..	Require repair or replacement.
Wire lead shorted	A ..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Refer to OEM recommended service' procedures.

POWER STEERING PRESSURE SENSORS

POWER STEERING PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A ...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A ...	Require repair or replacement of hardware.
Connector broken	A ..	Require repair or replacement.
Connector (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A ..	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B ..	Require repair or replacement.
Restricted, affecting performance	A ..	Require repair or replacement.
Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or

		replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

POWERTRAIN CONTROL MODULES (PCM) AND PROM

POWERTRAIN CONTROL MODULE (PCM) AND PROM INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(4) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

POWERTRAIN CONTROL PROM

See POWERTRAIN CONTROL MODULES (PCM) AND PROM.

PRESSURIZED EXPANSION TANK CAPS

See RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS.

RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS

RADIATOR CAP AND PRESSURIZED EXPANSION TANK CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Coolant recovery check valve inoperative	A	(1) Require replacement.
Fails to maintain proper pressure	B	Require replacement.
Gasket missing	C	Require replacement of gasket.
Missing	C	Require replacement.
Seal missing	C	Require replacement of seal.

(1) - Inoperative includes intermittent operation or out of OEM specification.

RADIATOR FAN BLADES

RADIATOR FAN BLADE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

RADIATOR FAN CLUTCHES

NOTE: Some lateral movement, measured at the fan blade tip, may be normal.

RADIATOR FAN CLUTCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Fastener loose	A	Require repair or replacement of fastener.
Inoperative	A	(1) Require replacement.
Leaking	1	Suggest replacement.
Seized	A	Require replacement.
Slips (insufficient fan speed)	A	Require replacement.
Thermal control incorrect	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

RADIATORS

RADIATOR INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair.

Application incorrect ...	B	.... Require replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	.... Require replacement of hardware.
Attaching hardware not functioning	A	.. Require repair or replacement of hardware.
Connection leaking	A	.. Require repair or replacement.
Corroded	1	.. Suggest repair or replacement.
Fins damaged, affecting performance	A	.. Require repair or replacement.
Fins damaged, not affecting performance ..	2	.. Suggest repair or replacement.
Internal oil cooler leaking	A	.. Require repair or replacement.
Internal restrictions, affecting performance ..	B	.. Require repair or replacement.
Internal restrictions, not affecting performance ..	2	.. Suggest repair or replacement.
Leaking	A	.. Require repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.. Require repair or replacement.
Tubes damaged, affecting performance	A	.. Require repair or replacement.
Tubes damaged, not affecting performance ..	..	.... No service suggested or required.

ROLL OVER VALVES

ROLL OVER VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	.... (1) Require replacement.
Leaking	A	.... Require replacement.
Missing	C	.... Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

SEALING COMPOUNDS

SEALING COMPOUND INSPECTION

Condition	Code	Procedure
Leaking	A	.... (1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICES

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

SENSORS AND ACTUATORS

NOTE: Conditions pertaining to the sensors and actuators listed in this section may be found under the name of the sensor or actuator.

SENSOR ABBREVIATION TABLE

Sensor	Abbreviation
Accelerator Pedal Position Sensor	APP
Air Conditioning Cycling Switch	AC
Air Conditioning Pressure Sensor	..
Air Fuel Ratio Sensor	..
Barometric Pressure Sensor	BARO
Camshaft Position Sensor	CMP
Clutch Pedal Position Switch	CPP
Cooling Fan Motor Sensors and Switches	..
Crankshaft Position Sensor	CKP
Electronic Transmission Feedback Devices	..
Engine Coolant Temperature Sensor	ECT
Evaporative Emission feedback devices	..
Exhaust Gas Recirculation feedback devices	..
Fan Control Sensor	FC
Intake Air Temperature Sensor	IAT
Knock Sensor	KS
Manifold Absolute Pressure Sensor	MAP
Mass Air Flow Sensor	MAF
O2 Sensor	O2S
Park Neutral Position Switch	PNP
Power Steering Pressure Sensor	PSP
Thermal Vacuum Valve	TVV
Throttle Position Sensor	TP Sensor
Throttle Position Switch	..
Transmission Range Switch	TR Switch
Vehicle Speed Sensor	VSS
Volume Air Flow Sensor	VAF

ACTUATOR ABBREVIATION TABLE

Actuator	Abbreviation
Air Injection Control Solenoid	..
Electronic Transmission control devices	..
Evaporative Emission Canister	EVAP
Purge Device	..
Exhaust Gas Recirculation Device	EGR
Fuel Injector	..
Idle Air Control	IAC

Idle Speed Control Actuator	ISC
Mix Control Solenoid	MC Solenoid
Secondary Air Injection System Management Device	AIR, PAIR
Vacuum Regulator Solenoid	..
Waste Gate Control Solenoid	..

SHROUDS, BAFFLES AND DEFLECTORS

SHROUD, BAFFLE AND DEFLECTOR INSPECTION

Condition	Code	Procedure
Application incorrect, affecting cooling system performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, affecting cooling system performance	A	Require repair or replacement.
Blocked, affecting cooling system performance	A	Require repair or replacement.
Broken, affecting cooling system performance	A	Require repair or replacement.
Cracked, affecting cooling system performance	A	Require repair or replacement.
Loose, affecting cooling system performance	A	Require repair.
Loose, not affecting cooling system performance	2	Suggest repair.
Missing, affecting cooling system performance	C	Require replacement.

SPARK PLUGS

NOTE: You are not required to replace spark plugs in sets. However, you may suggest replacement of the other plugs for preventive maintenance.

SPARK PLUG INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Electrode eroded	1	Suggest replacement.
Fouled	A	(1) Require repair or replacement.
Gap incorrect	B	Require repair or replacement.
Insulation broken	A	Require replacement
Insulator cracked	A	Require replacement.
Leaking compression	A	Require repair or replacement.
Maintenance interval	3	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads		

missing)	A	Require replacement.

(1) - Determine cause of fouling and suggest repair.

SPRING LOCKS

SPRING LOCK INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SUPER CHARGERS

SUPER CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware damaged, affecting operation or performance	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Boost pressure incorrect	A	(1) Require repair or replacement.
Clearance out of specification	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

SWITCHES

SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement

of hardware.

Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won't return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

THERMAL VACUUM VALVES

THERMAL VACUUM VALVE INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or

		replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THERMOSTATIC AIR DOOR ASSEMBLIES

THERMOSTATIC AIR DOOR ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware damaged, affecting operation or performance	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Binding	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Seized	A	Require repair or replacement.

THERMOSTATS AND HOUSINGS

THERMOSTAT AND HOUSING INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Housing corroded	1	Suggest replacement of housing.
Inoperative	A	(1) Require replacement.
Installation incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Thermostat missing	C	Require replacement of thermostat.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

THROTTLE BODIES

THROTTLE BODY INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	(3) Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.
Throttle shaft binding, affecting performance	A	Require repair or replacement.
Throttle shaft worn, affecting performance	A	Require repair or replacement.
Throttle shaft worn, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE CABLES

See THROTTLE LINKAGES AND CABLES.

THROTTLE LINKAGES AND CABLES

THROTTLE LINKAGE AND CABLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.

Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(1) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

THROTTLE POSITION SENSORS

THROTTLE POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not		

affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE POSITION SWITCHES

THROTTLE POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.

Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

TIMING BELT SPROCKETS

TIMING BELT SPROCKET INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Key damaged	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Sprocket damaged, affecting belt life	A	Require repair or replacement.
Sprocket loose	B	Require repair or replacement.
Sprocket-to-shaft alignment incorrect	B	Require repair or replacement.

TIMING BELTS

TIMING BELT INSPECTION

Condition	Code	Procedure
Adjustment incorrect	2	(1) Suggest adjustment.
Alignment incorrect	B	(2) Further inspection required.
Broken	A	Require replacement.
Cam timing out of specification	B	Require repair.
Cracked	1	Suggest replacement.
Fluid-soaked	1	Suggest replacement. Further inspection required.
Frayed	1	Suggest replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle OEM recommended

Condition	Code	Procedure
		service intervals.
Missing	C	(3) Require replacement.
Noisy	2	(4) Further inspection required. See note below.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Teeth missing	A	Require replacement.

(1) - Inspect belt tensioners, pulleys, and cover.
(2) - Determine cause of incorrect alignment and require repair.
(3) - CAUTION: Internal engine damage may result from timing belt damage/failure.
(4) - Determine cause of noise and suggest repair.

TORQUE STRUTS

TORQUE STRUT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Bushing deteriorated, affecting performance	A	Require replacement.
Bushing deteriorated, not affecting performance	..	No service suggested or required.
Bushings missing	C	Require replacement.
Bushings separated from mounting eye	1	Suggest replacement.
Damping (none)	A	Require replacement.
Leaking oil, enough for fluid to be running down the body	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Require replacement of units where dents restrict strut piston rod movement. If dents don't restrict movement, no service is suggested or required.
(2) - If noise is isolated to shock or strut, suggest replacement.

TRANSMISSION RANGE SWITCHES

TRANSMISSION RANGE SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable;

check for accepted cleaning procedure.

TUBE CLAMPS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE CONNECTORS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE COUPLERS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBES

See HOSES AND TUBES (FUEL LINES, RADIATOR, BY PASS, HEATER, RECOVERY TANK AND OIL COOLERS).

TURBO CHARGERS

TURBO CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Boost pressure incorrect	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Oil seal (internal) leaking	A	Require repair or replacement.
Vibrates	A	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

VACUUM CONNECTIONS

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)

VACUUM HOSE, TUBE AND CONNECTION (NON-METALLIC) INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Melted	A	Require replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.

Condition	Code	Procedure
Restricted	A	Require repair or replacement.
Surface cracks (dry-rotted)	1	Suggest replacement.

VACUUM REGULATOR SOLENOIDS

VACUUM REGULATOR SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VACUUM TUBES

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VEHICLE SPEED SENSORS

VEHICLE SPEED SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VOLUME AIR FLOW SENSORS

VOLUME AIR FLOW SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATE CONTROL SOLENOIDS

WASTE GATE CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATES AND BOOST CONTROL MECHANISMS

WASTE GATE AND BOOST CONTROL MECHANISM INSPECTION

Condition	Code	Procedure
Boost pressure incorrect	A	(1) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.

(1) - Incorrect boost pressure includes intermittent operation or out of OEM specification.

WATER PUMPS (ELECTRIC)

WATER PUMP (ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

WATER PUMPS (NON-ELECTRIC)

WATER PUMP (NON-ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corrosion (internal) is excessive, affecting performance	A	Require replacement.
Corrosion (internal) is excessive, not affecting performance	2	Suggest cooling system service.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Noisy	A	Require replacement.
Rotation incorrect for application	B	Require repair or replacement.
Shaft bent	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

1993 ENGINE PERFORMANCE
Toyota Introduction

1993 MODEL COVERAGE

MODEL COVERAGE TABLE

MODEL	BODY CODE	ENGINE	ENGINE ID (1)	FUEL SYSTEM (2)	IGNITION SYSTEM
Camry	SXV	2.2L 4-Cyl. (5S-FE)	S	PFI	Magnetic
	VCV	3.0L V6 (3VZ-FE)	V	PFI	Magnetic
Celica	AT	1.6L 4-Cyl. (4A-FE)	A	PFI	Magnetic
	ST (4WD)	2.0L 4-Cyl. (3S-GTE)	S	PFI Turbo	Magnetic
	ST	2.2L 4-Cyl. (5S-FE)	S	PFI	Magnetic
Corolla	AE	1.6L 4-Cyl. (4A-FE)	A	PFI	Magnetic
		1.8L 4-Cyl. (7A-FE)	A	PFI	Magnetic
Land Cruiser	FZJ	4.5L 6-Cyl. (1FZ-FE)	D	PFI	Magnetic
MR2	SW	2.0L 4-Cyl. (3S-GTE)	S	PFI Turbo	Magnetic
		2.2L 4-Cyl. (5S-FE)	S	PFI	Magnetic
Paseo	EL	1.5L 4-Cyl. (5E-FE)	E	PFI	Magnetic
Pickup	RN	2.4L 4-Cyl. (22R-E)	R	PFI	Magnetic
	VZN	3.0L V6 (3VZ-E)	V	PFI	Magnetic
Previa	TCR	2.4L 4-Cyl. (2TZ-FE)	A	PFI	Magnetic
Supra	(3)	3.0L 6-Cyl. (2JZ-GE)	(3)	PFI	Magnetic
		3.0L 6-Cyl. (2JZ-GTE)	(3)	PFI Turbo	DIS (4)
Tercel	EL	1.5L 4-Cyl.	E	PFI	Magnetic

		(3E-E)			
T100	VCK	3.0L V6 (3VZ-E)	V	PFI	Magnetic
4Runner	RN	2.4L 4-Cyl. (22R-E)	R	PFI	Magnetic
	VZN	3.0L V6 (3VZ-E)	V	PFI	Magnetic

(1) - Engine may be identified by Vehicle Identification Number (VIN) or number stamped on engine block. See Figs. 1-13. VIN is located on stamped plate on left side of instrument panel.
(2) - A Port Fuel Injection (PFI) fuel system is used.
(3) - Information is not available from manufacturer.
(4) - Application uses a Distributorless Ignition System (DIS).

ENGINE CODE EXPLANATION

Typical Engine Code

```
7  M - G  T  E
1  2   3  4  5
```

1 - Engine Model Code & VIN VDS Code
2 - Engine Generation Code
3-5 - C - U.S. specifications. (Engines without "C" may also meet U.S. specifications
E - Fuel Injection
F - Twin Camshafts
G - Twin Camshafts
L - Transverse Engine
T - Turbocharged

VIN DEFINITION

```
(VIN)    J  T  2  A  E  9  2  E  6  P  3  1  6  5  7  0  9
         1  2  3  4  5  6  7  8  9  10 11 12 13 14 15 16 17
```

1 - Indicates Nation of Origin.
2 - Indicates Manufacturer.
3 - Indicates Vehicle Type.
4 - Indicates Engine Type and Make.
5 - Indicates Vehicle Line.
6 - Indicates Model.
7 - Indicates Series Type.
8 - Indicates Body Type.
9 - Indicates Check Digit.
10 - Indicates Model Year.
11 - Indicates Assembly Plant.
12-17 - Indicates Plant Sequential Number.

MODEL YEAR VIN CODE APPLICATION TABLE

VIN Code	Model Year
1991	M
1992	N
1993	P

VIN LOCATIONS

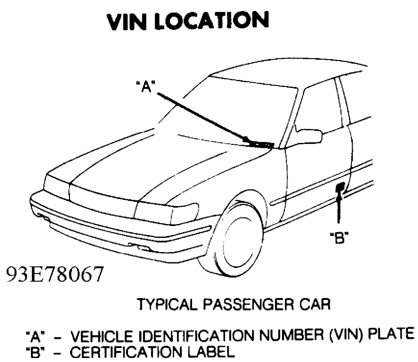


Fig. 1: Locating VIN (Typical Passenger Car)
Courtesy of Toyota Motor Sales, U.S.A.

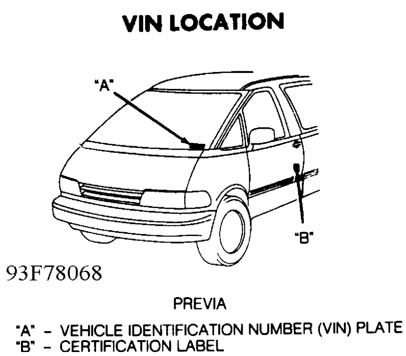


Fig. 2: Locating VIN (Previa)
Courtesy of Toyota Motor Sales, U.S.A.

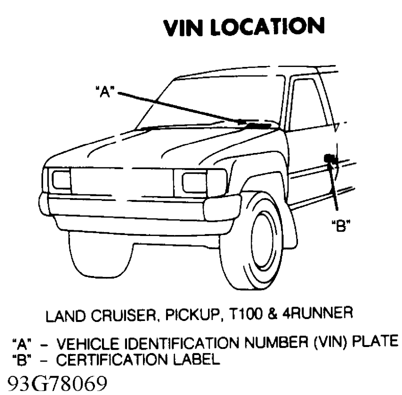
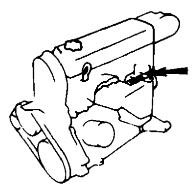


Fig. 3: Locating VIN (Land Cruiser, Pickup, T100 & 4Runner)
Courtesy of Toyota Motor Sales, U.S.A.

ENGINE CODE LOCATION

ENGINE CODE LOCATION

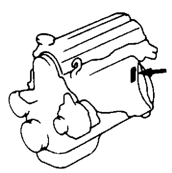


1.5L 4-CYL. (PASEO & TERCEL)

93J78070

Fig. 4: Engine Code Location (1.5L Paseo & Tercel)
Courtesy of Toyota Motor Sales, U.S.A.

ENGINE CODE LOCATION

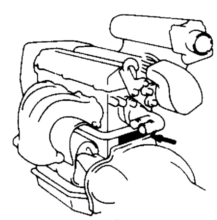


1.6L 4-CYL. (CELICA & COROLLA)
1.8L 4-CYL. (COROLLA)

93A78071

Fig. 5: Engine Code Location (1.6L Celica & Corolla & 1.8L Corolla)
Courtesy of Toyota Motor Sales, U.S.A.

ENGINE CODE LOCATION

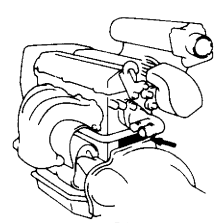


2.0L 4-CYL. (CELICA & MR2)
2.2L 4-CYL. (CAMRY, CELICA & MR2)

93B78072

Fig. 6: Engine Code Location (2.0L Celica & MR2)
Courtesy of Toyota Motor Sales, U.S.A.

ENGINE CODE LOCATION

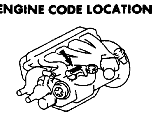


2.0L 4-CYL. (CELICA & MR2)
2.2L 4-CYL. (CAMRY, CELICA & MR2)

93B78072

Fig. 7: Engine Code Location (2.2L Camry, Celica & MR2)
Courtesy of Toyota Motor Sales, U.S.A.

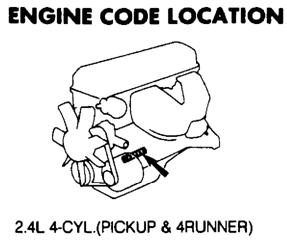
ENGINE CODE LOCATION



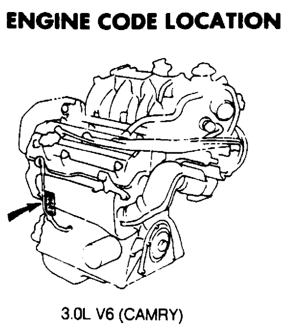
2.4L 4-CYL. (PREVIA)

93C78073

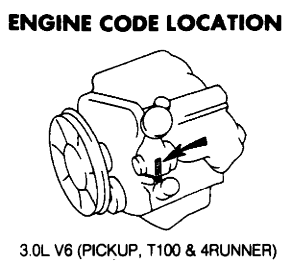
Fig. 8: Engine Code Location (2.4L Previa)
Courtesy of Toyota Motor Sales, U.S.A.



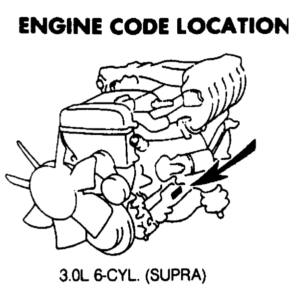
93D78074
Fig. 9: Engine Code Location (2.4L Pickup & 4Runner)
Courtesy of Toyota Motor Sales, U.S.A.



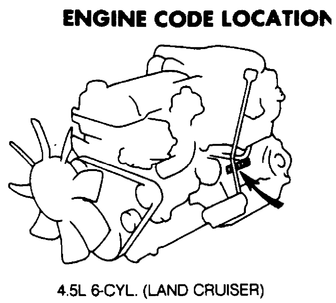
93E78075
Fig. 10: Engine Code Location (3.0L Camry)
Courtesy of Toyota Motor Sales, U.S.A.



93F78076
Fig. 11: Engine Code Location (3.0L Pickup, T100 & 4Runner)
Courtesy of Toyota Motor Sales, U.S.A.



93G78077
Fig. 12: Engine Code Location (3.0L Supra)
Courtesy of Toyota Motor Sales, U.S.A.



93H78078
Fig. 13: Engine Code Location (4.5L Land Cruiser)
Courtesy of Toyota Motor Sales, U.S.A.

* EXHAUST SYSTEM UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
Exhaust Systems Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

Motorist Assurance Program (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM
OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

Exhaust

CATALYTIC CONVERTERS
EXHAUST AND TAIL PIPES
EXHAUST CONNECTIONS
HANGERS
HEAT RISERS (MECHANICAL EFE DEVICES)
HEAT SHIELDS
MANIFOLDS (CAST AND TUBE TYPE)
MECHANICAL EFE DEVICES
MUFFLERS AND RESONATORS

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication

Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement
A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

EXHAUST

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

WARNING: Federal EPA rules prohibit altering an exhaust system in any way that defeats the emission reduction components of a vehicle. Be sure to review and adhere to EPA policy on removing and replacing catalytic converters. Where state or local laws are stricter, they take precedence over these guidelines.

NOTE: Some exhaust systems are of a welded design. It is not required that the entire system be replaced. Determine the need to replace individual components based on conditions of component.

CATALYTIC CONVERTERS

CAUTION: Before working on an exhaust system, review EPA regulations on removing and replacing catalytic converters.

NOTE: Any time a converter has failed, further diagnosis is required to determine the reason(s) for converter failure.

CATALYTIC CONVERTER INSPECTION

Condition	Code	Procedure
Air injection tube broken	A	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube burnt	A	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube leaking	A	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube		

loose	A	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube restricted	A	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube threads damaged	A	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube threads stripped (threads missing)	A	Require repair or replacement of injection tube or replacement of catalytic converter.
Body cracked	B	Require repair or replacement.
Converter empty	A	Require repair or replacement.
Converter fill plug missing	C	Require repair or replacement.
Converter missing	C	Require replacement.
Exhaust gases leaking	A	Require repair or replacement.
Flanges leaking	A	Require repair or replacement of flanges.
Inlet pipes cracked	B	Require repair or replacement.
Internal rattle (except pellet-type)	2	(1) Further inspection required.
Mounting brackets that are part of converter broken	A	Require repair or replacement.
Obvious overheating	..	(2) Require testing of converter.
Outlet pipes cracked	B	Require repair or replacement.
Pieces of catalyst material found downstream	1	Suggest replacement.
Plugged	A	(3) Require replacement.
Testing has determined that existing converter has been lead-poisoned, contaminated, or failed testing	A	Require repair or replacement.

(1) - If the converter is breaking up, suggest converter replacement. If an object has fallen into the converter, remove the object.
(2) - Overheating is caused by something other than the converter. Further diagnosis is required to determine the cause of the overheating.
(3) - Determine cause and correct to ensure that new converter will not become plugged.

EXHAUST AND TAIL PIPES

NOTE: For pipes with resonators, also see MUFFLERS AND RESONATORS.

EXHAUST AND TAIL PIPE INSPECTION

Condition	Code	Procedure
Bracket broken	A	Require repair or replacement.
Pipe bent out of position	B	Require repair or replacement.
Pipe broken	A	Require repair or replacement.
Pipe cracked	B	Require repair or replacement.
Pipe leaking	A	Require replacement.
Pipe missing	C	Require replacement.
Pipe plugged	A	Require replacement.
Pipe weak due to corrosion, but no leaks present	1	Suggest replacement.
Weld broken	A	Require repair or replacement.

EXHAUST CONNECTIONS

EXHAUST CONNECTION INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	B	Require replacement of hardware.
Clamp broken	A	Require replacement.
Clamp loose	A	Require repair or replacement.
Clamp missing	C	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Incorrect type (i.e. flange, ball & socket etc.)	B	Require replacement.
Leaking	A	Require repair.
Loose	A	Require repair.

HANGERS

HANGER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Incorrect type	B	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Out of position	B	Require repair or replacement.
Rubber deteriorated	1	Suggest replacement.

HEAT RISERS (MECHANICAL EFE DEVICES)

HEAT RISER (MECHANICAL EFE DEVICE) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement of affected parts.
Diaphragm inoperative	A	(1) Require replacement.

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement of affected parts.
Seized	A	Require repair or replacement of affected parts.
Spring broken	B	Require replacement of spring(s).
Spring inoperative	A	Require replacement of spring(s).

(1) - If the inoperative diaphragm is separate from the heat riser, then require replacement of the inoperative diaphragm. If the inoperative diaphragm is part of the heat riser, then replace the heat riser.

HEAT SHIELDS

HEAT SHIELD INSPECTION

Condition	Code	Procedure
Bent	B	Require repair or replacement.
Broken	A	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

MANIFOLDS (CAST AND TUBE TYPE)

MANIFOLD (CAST AND TUBE TYPE) INSPECTION

Condition	Code	Procedure
Air injection tube in manifold broken	A	Require repair or replacement of injection tube or replacement of manifold.
Air injection tube in manifold corroded, affecting structural integrity	1	Suggest replacement of injection tube or manifold.
Air injection tube in manifold leaking	A	Require repair or replacement of injection tube or replacement of manifold.
Air injection tube in manifold loose	A	Require repair.
Air injection tube in manifold restricted	A	Require replacement of injection tube or manifold.
Air injection tube in manifold threads damaged	A	Require repair of injection tube or manifold.
Air injection tube in manifold threads stripped (threads missing)	A	Require replacement of injection tube or manifold.
Bolt broken	A	Require replacement of bolts.

Bolt loose	A	Require tightening or replacement of bolts.
Bolt missing	C	Require replacement of bolts.
Corroded, affecting sealability	A	Require repair or replacement.
Cylinder head threads stripped	A	Require repair or replacement of cylinder head.
Gasket leaking	A	Require tightening or replacement of gasket.
Heat stove bent	B	(1) Require repair or replacement of stove.
Heat stove broken	A	(1) Require replacement of stove.
Heat stove corroded, affecting structural integrity	1	(1) Suggest replacement of stove.
Heat stove missing	C	(1) Require replacement of stove.
Manifold broken	A	Require repair or replacement.
Manifold cracked	B	Require repair or replacement.
Manifold warped	A	Require repair or replacement.
Out of specification	B	Require repair or replacement.
Stud broken	A	Require replacement of stud.
Stud missing	C	Require replacement of stud.
Stud threads damaged	A	Require repair or replacement of stud.
Stud threads stripped (threads missing)	A	Require replacement of stud.

(1) - Stove may not be available separately; this may require replacement of manifold.

MECHANICAL EFE DEVICES

See HEAT RISERS (MECHANICAL EFE DEVICES).

MUFFLERS AND RESONATORS

MUFFLER AND RESONATOR INSPECTION

Condition	Code	Procedure
Body shell distorted, affecting performance or structural integrity	A	Require replacement.
Corrosion hole	A	Require replacement.
Missing	C	Require replacement.
Mounting bracket broken	A	Require repair or replacement.
Mounting bracket cracked	B	Require repair or replacement.
Nipple cracked	A	Require repair or replacement.
Nipple loose	B	Require replacement.
Outer wrap peeling (exhaust not leaking)	1	Suggest replacement.
Plugged	A	Require replacement.
Puncture (other than a drain hole)	A	Require replacement.
Rattling or knocking noise from inside muffler	B	Require replacement.
Seam open (exhaust		

leaking)	A	Require replacement.
Sound quality unsatisfactory	2	Suggest replacement to address customer need and/or request.
Split (exhaust leaking)	A	Require replacement.
Weak due to corrosion, but no leaks present	1	Suggest replacement.

FUSES & CIRCUIT BREAKERS
1983-93 Toyota

Celica

IDENTIFICATION

FUSE PANEL LOCATION (1983-85)

There are 3 fuse panels on this vehicle. The driver's side fuse box is located behind the driver's kick panel. The passenger's side fuse box is behind the passenger's side kick panel. The main fuse and relay block is in the engine compartment.

PASSENGER COMPARTMENT FUSE BOX IDENTIFICATION (1983-85)

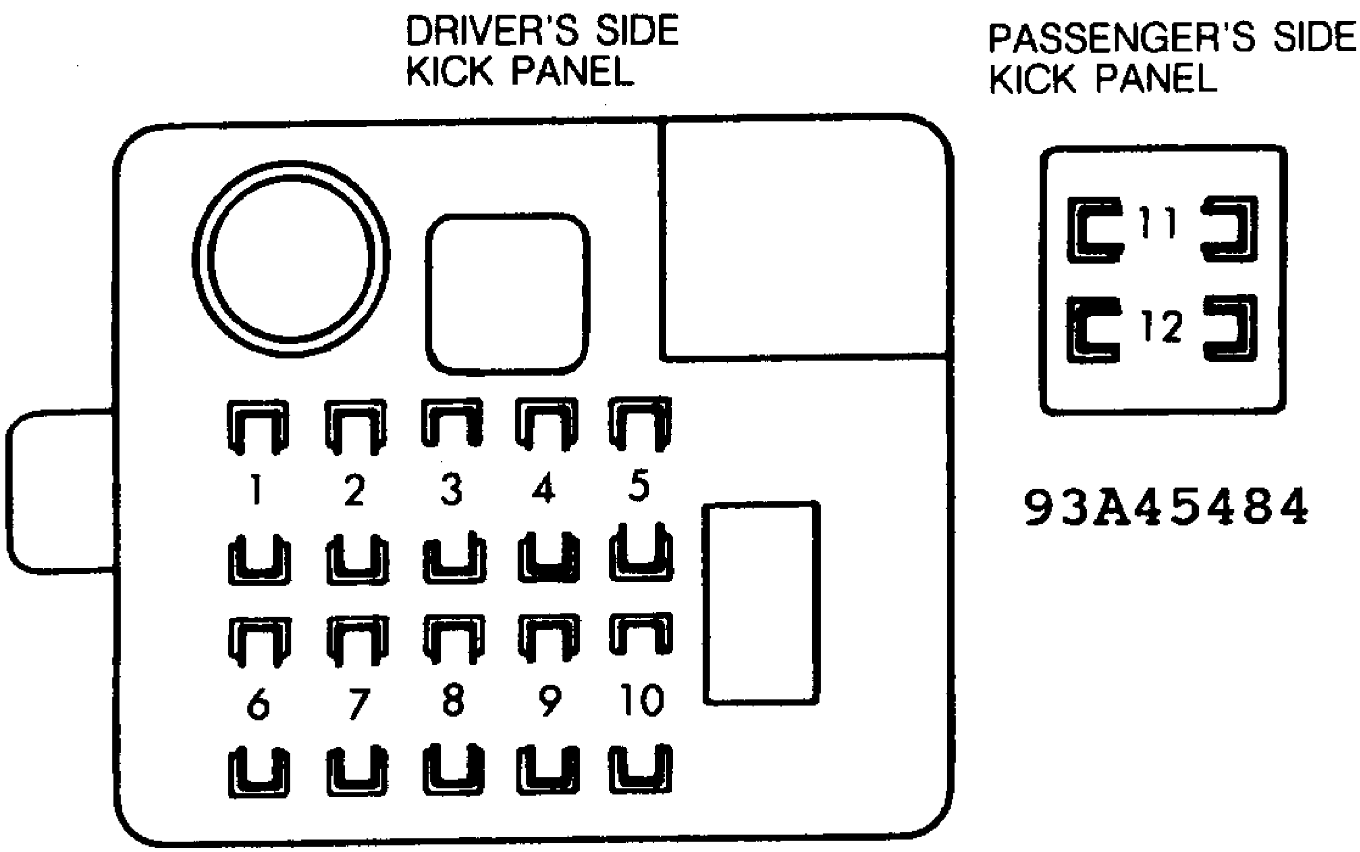


Fig. 1: Passenger Compartment Fuse Boxes Identification
Courtesy of Toyota Motor Sales, U.S.A., Inc.

* 1 - 7.5 Amp
  Gauges & Warning Lights/Indicators, A/T Overdrive System & Back-Up Lights, Main Heater Relay Coil (1983)
* 2 - 7.5 Amp
  Radio & Cassette Player
* 3 - 15 Amp
  Trip Computer (Supra)
* 4 - 7.5 Amp
  Retractable Headlight System (1983-84), Outside Mirror

Defogger (1985 Supra)
* 5 - 7.5 Amp
Discharge Warning Light, Main Ignition Relay Coil, Main EFI Relay (1983 Supra)
* 6 - 7.5 Amp
Interior, Personal & Door Courtesy Lights, Trunk, Ignition Switch & Door Warning Lights, Clock & Power Antenna (1984-85), Vanity Lights (Supra)
* 7 - 15 Amp
Cigarette Lighter & Outside Mirror, Clock (1983), Trip Computer (1983 Supra)
* 8 - 15 Amp
Cruise Control System, Electronically Controlled A/T System (1984-85 Supra)
* 9 - 7.5 Amp
Turn Signal Lights
* 10 - 15 Amp
Foglights (Supra)
* 11 - 10 Amp
Air Conditioner
* 12 - Blank

ENGINE COMPARTMENT MAIN BLOCK IDENTIFICATION (1983-85)

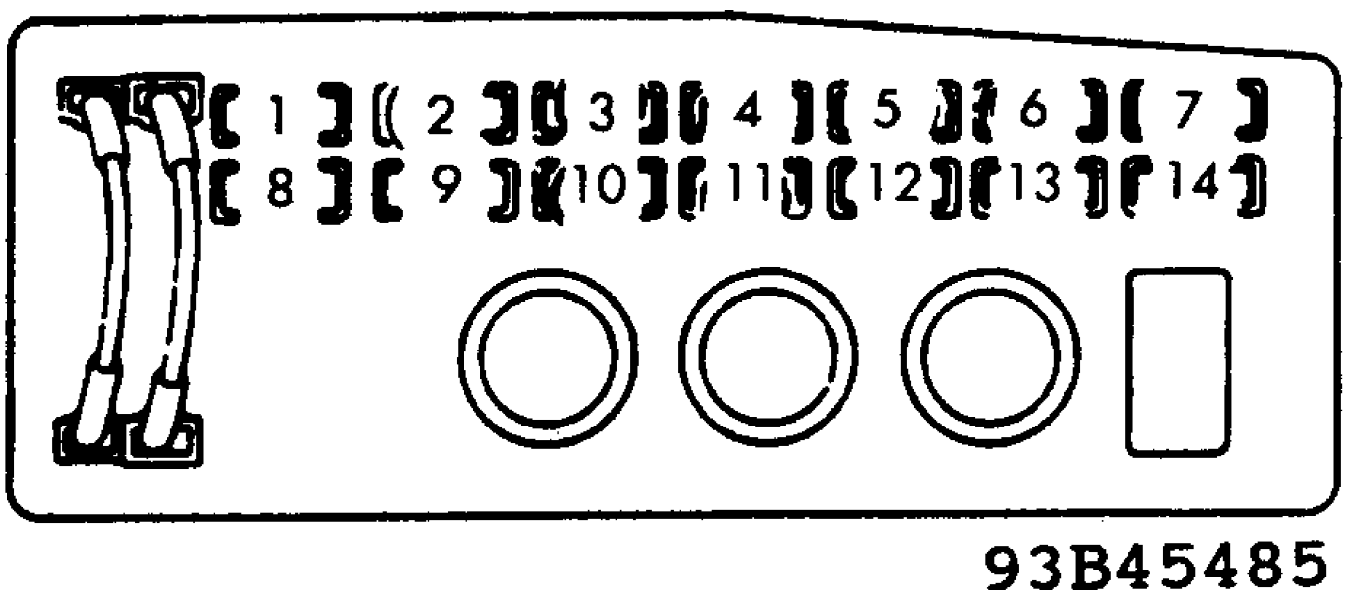


Fig. 2: Engine Compartment Main Fuse & Relay Block Identification
Courtesy of Toyota Motor Sales, U.S.A., Inc.

* 1 - Blank
* 2 - 7.5 Amp
Discharge Warning Light
* 3 - 15 Amp
Alternator With IC Regulator, Emission Control System (1984-85)
* 4 - 15 Amp
Hazard Lights & Horns, Radio (1983), Retractable Headlights (1985)
* 5 - 15 Amp
A/T Shift Position Indicator Light, Clock (Digital), Side Marker & License Lights, Park Lights, Taillights & Glove Box Light, Instrument Panel Lights, Foglight Relay (1983 Supra)
* 6 - 15 Amp

Right Headlight, High Beam Indicator Light (1983)
* 7 - 15 Amp
  Left Headlight
* 8 - Blank
* 9 - 15 Amp
  EFI Control System
* 10 - 20 Amp
  Wipers & Washers, Headlight Cleaner Relay (1984-85 Supra)
* 11 - 15 Amp
  Stoplights, Cruise Control System (1983 Supra)
* 12 - Blank
* 13 - 15 Amp
  Right Low Beam Headlight (1983)
* 14 - 15 Amp
  Left Low Beam Headlight (1983)

FUSE PANEL LOCATION (1986-89)

There are 3 fuse panels on this vehicle. The driver's side fuse box is located behind the driver's kick panel. The passenger's side fuse box is behind the passenger's side kick panel. The main fuse and relay block is in the engine compartment.

PASSENGER COMPARTMENT FUSE BOX IDENTIFICATION (1986-89)

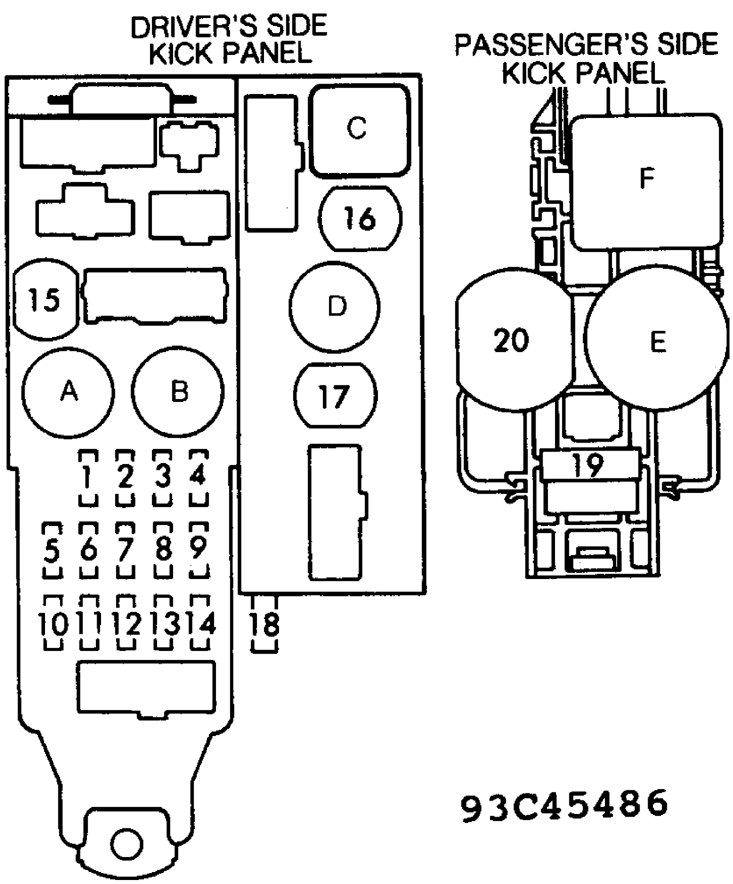


Fig. 3: Passenger Compartment Fuse Boxes Identification
Courtesy of Toyota Motor Sales, U.S.A., Inc.

* 1 - 15 Amp
  Gauges, Warning Lights & Buzzer, Back-Up Lights & A/T

Overdrive System, Rear Window Defogger & Power Antenna

* 2 - 7.5 Amp
  Clock & Open Door Warning Light (1987), Interior, Personal & Door Courtesy Lights (1987), Trunk & Ignition Switch Lights (1987)
* 3 - 15 Amp
  Stoplights & Cruise Control Cancel Device
* 4 - 15 Amp
  Tail, Park, License & Side Marker Lights, Glove Box Light & Instrument Illumination
* 5 - 15 Amp
  Cigarette Lighter & Digital Clock
* 6 - 7.5 Amp
  Radio & Cassette Player
* 7 - 10 Amp
  Turn Signal Lights
* 8 - 10 Amp
  Outside Mirror Defogger
* 9 - Blank
* 10 - 10 Amp
  Charging System
* 11 - 20 Amp
  Wipers & Washers
* 12 - 15 Amp
  Electric Sun Roof
* 13 - Blank
* 14 - 7.5 Amp
  Charging System & Discharge Warning Light, Electronic Fuel Injection & Electric Cooling Fans
* 15 - 30 Amp (Circuit Breaker)
  Defogger
* 16 - 14 Amp (Circuit Breaker 1986)
* 16 - 30 Amp (Circuit Breaker 1987-89)
  Power Door Locks
* 17 - 30 Amp (Circuit Breaker)
  Power Windows
* 18 - 15 Amp
  Anti-Lock Brake System & Foglights (1988-89)
* 19 - 10 Amp
  Air Conditioning System
* 20 - 30 Amp (Circuit Breaker)
  Heater

PASSENGER COMPARTMENT RELAY IDENTIFICATION (1986-89)

* A - Defogger
* B - Taillight Control
* C - Turn Signal Flasher
* D - Clutch Start
* E - Horn
* F - Heater

ENGINE COMPARTMENT BLOCK IDENTIFICATION (1986-89)

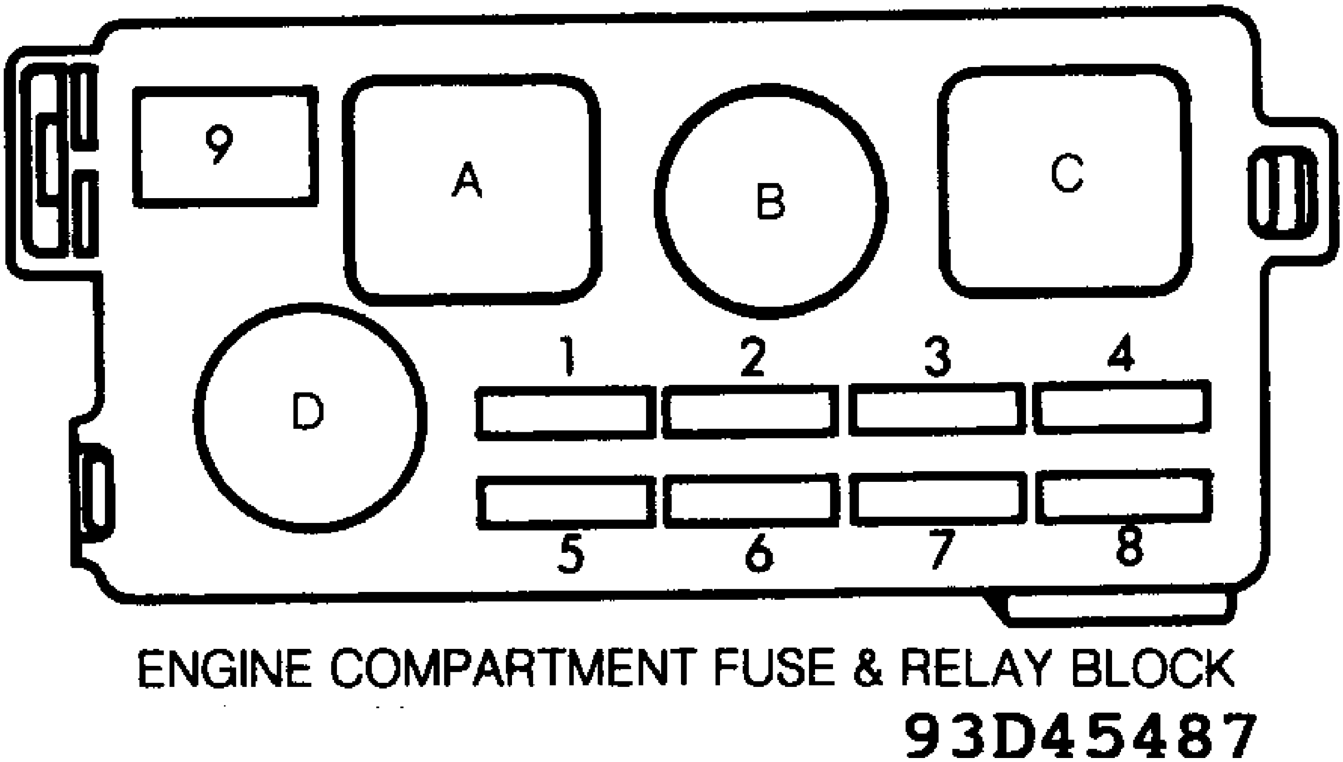


Fig. 4: Engine Compartment Fuse & Relay Block Identification
Courtesy of Toyota Motor Sales, U.S.A., Inc.

* 1 - 15 Amp
  Headlights (Left)
* 2 - 15 Amp
  Emergency Flashers & Horns
* 3 - 15 Amp
  EFI System
* 4 - 7.5 Amp
  Charging System & Discharge Warning Light
* 5 - 15 Amp
  Headlights (Right)
* 6 - 30 Amp
  Retractable Headlight System
* 7 - 15 Amp (1986-87)
* 7 - 20 Amp (1988-89)
  Radio, Cassette Player & Power Antenna, Interior, Trunk, Personal & Courtesy Lights (1988-89), Ignition Switch & Door Warning Lights (1988-89), Clock (1988-89)
* 8 - Blank
* 9 - 30 Amp
  Fan

ENGINE COMPARTMENT RELAY IDENTIFICATION (1986-89)

* A - Engine Main
* B - EFI Main
* C - Headlight Control
* D - Fan No. 1

FUSE PANEL LOCATION (1990-93)

There are 3 fuse panels on this vehicle. The driver's side fuse box is located behind the driver's kick panel. The passenger's side fuse box is behind the passenger's side kick panel. The main fuse and relay block is in the engine compartment.

PASSENGER COMPARTMENT FUSE BOX IDENTIFICATION (1990-93)

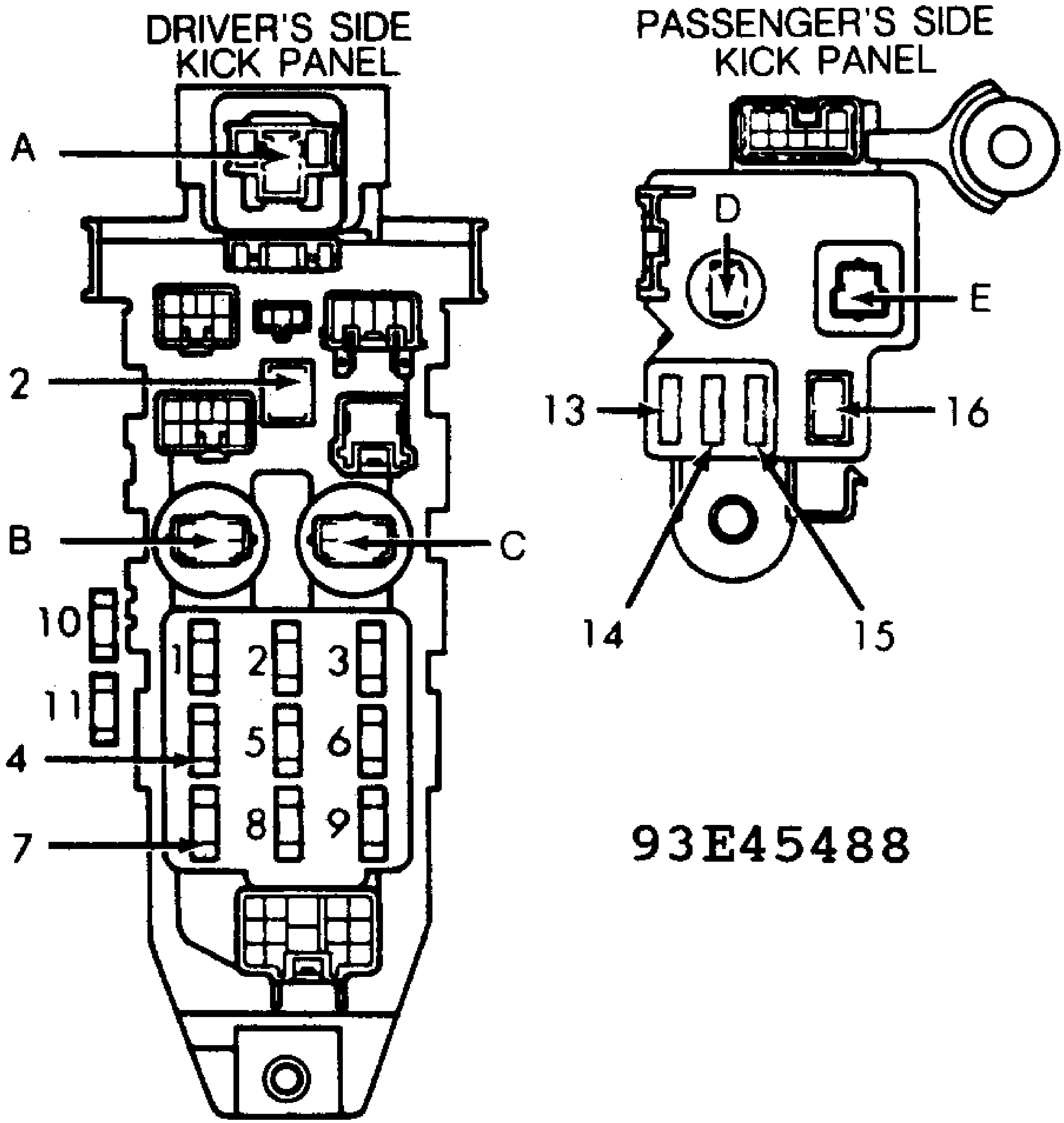


Fig. 5: Driver's Side & Passenger's Side Fuse Boxes Identification
Courtesy of Toyota Motor Sales, U.S.A., Inc.

* 1 - 7.5 Amp
  Charging System & Discharge Warning Light, Electric Cooling

Fans & EFI System

* 2 - 15 Amp
  Cigarette Lighter & Digital Clock, Radio, Cassette Player & Compact Disc Player
* 3 - 15 Amp
  Stoplights & Cruise Control Cancel Device
* 4 - 15 Amp
  Gauges, Warning Lights & Buzzer, Back-Up Lights & A/T Overdrive System, Rear Window Defogger & Power Antenna, Tilt Steering, Convertible Top Control
* 5 - 10 Amp
  Turn Signal Lights
* 6 - 15 Amp
  Electric Sun Roof
* 7 - 20 Amp
  Wipers & Washers
* 8 - 15 Amp
  Anti-Lock Brake System
* 9 - 15 Amp
  Taillights, Parking Lights, Side Marker Lights, License Lights, Instrument Lights, Glove Box Light
* 10 - Blank
* 11 - 10 Amp
  Rear View Mirror
* 12 - 30 Amp (Circuit Breaker)
  Defogger
* 13 - Blank
* 14 - 20 Amp
  Front Foglights
* 15 - 10 Amp
  Air Conditioning
* 16 - 40 Amp (Circuit Breaker)
  Heater, A/C Control System

PASSENGER COMPARTMENT RELAY IDENTIFICATION (1990-93)

* A - Turn Signal Flasher
* B - Defogger
* C - Taillight Control
* D - Starter
* E - Heater Main

ENGINE COMPARTMENT MAIN BLOCK IDENTIFICATION (1990-93)

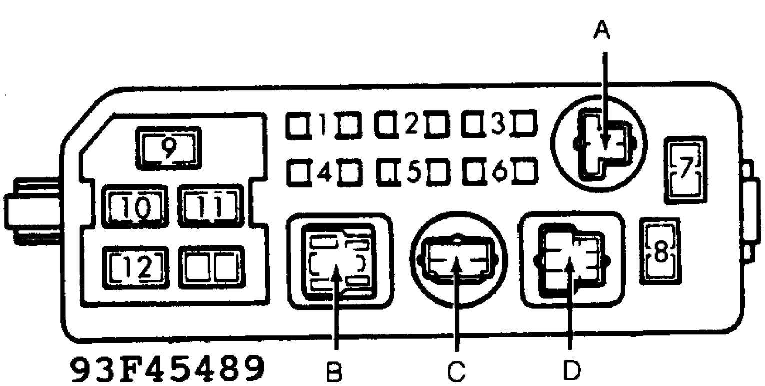


Fig. 6: Engine Compartment Main Fuse & Relay Block ID (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc

* 1 - 15 Amp
  Headlight (Left Side)

* 2 - 30 Amp
  Retractable Headlight System
* 3 - 15 Amp
  Headlight (Right Side)
* 4 - 15 Amp
  EFI System
* 5 - 20 Amp
  Radio, Cassette Player & Compact Disc Player, Power Antenna, Clock, Interior & Personal Lights, Door Courtesy Lights, Luggage Compartment Light, Trunk Light, Ignition Switch, Open Door Warning Lights
* 6 - 15 Amp
  Hazard Flashers & Horns
* 7 - 30 Amp (Circuit Breaker)
  Cooling Fan
* 8 - 30 Amp (Circuit Breaker)
  Condenser Cooling Fan
* 9 - 100 Amp (Circuit Breaker)
  Charging System
* 10 - 40 Amp (Circuit Breaker)
  AM2
* 10 - 30 Amp (1992-93)
  Electronic Fuel Injection, Ignition System
* 11 - 30 Amp (Circuit Breaker)
  AM1
* 11 - 40 Amp (1992-93)
  Charging System, Electric Underhood Cooling Fan
* 12 - 60 Amp (Circuit Breaker)
  Anti-Lock Brake System

ENGINE COMPARTMENT MAIN BLOCK RELAY IDENTIFICATION (1990-93)

* A - Fan No. 1
* B - Headlight Control
* C - EFI System
* D - Engine Main

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG SYSTEM)

NOTE: For information on air bag DIAGNOSIS & TESTING or DISPOSAL PROCEDURES, see AIR BAGS article in the ACCESSORIES/SAFETY EQUIPMENT Section.

When servicing vehicles equipped with Supplemental Restraint Systems (SRS), always allow at least 20 seconds after turning ignition switch to LOCK position and disconnecting the negative terminal cable before beginning work on the SRS. The system has a back-up power supply and may deploy air bag if these precautions are not followed.

RADIATOR FAN & CAP

To avoid injury, stay clear of the radiator fan when the ignition key is in the ON position. The fan is thermostatically controlled and may come on suddenly. DO NOT loosen or remove radiator cap when cooling system is hot.

GEAR TOOTH CONTACT PATTERNS

1993 Toyota Celica

GENERAL INFORMATION
Gear Tooth Contact Patterns

* PLEASE READ THIS FIRST *

The following article is for GENERAL INFORMATION purposes only. Information does not SPECIFICALLY apply to all years, makes and models, but is to be used as a general reference guide.

INSPECTION

PRELIMINARY INSPECTION

Wipe lubricant from internal parts. Rotate gears and inspect for wear or damage. Mount dial indicator to housing, and check backlash at several points around ring gear. Backlash must be within specifications at all points. If no defects are found, check gear tooth contact pattern.

GEAR TOOTH CONTACT PATTERN

NOTE: Drive pattern should be well centered on ring gear teeth. Coast pattern should be centered, but may be slightly toward toe of ring gear teeth.

1) Paint ring gear teeth with marking compound. Wrap cloth or rope around drive pinion flange to act as brake. Rotate ring gear until clear tooth contact pattern is obtained.

2) Contact pattern will indicate whether correct pinion bearing mounting shim has been installed and if drive gear backlash has been set properly. Backlash between drive gear and pinion must be maintained within specified limits, until correct tooth pattern is obtained.

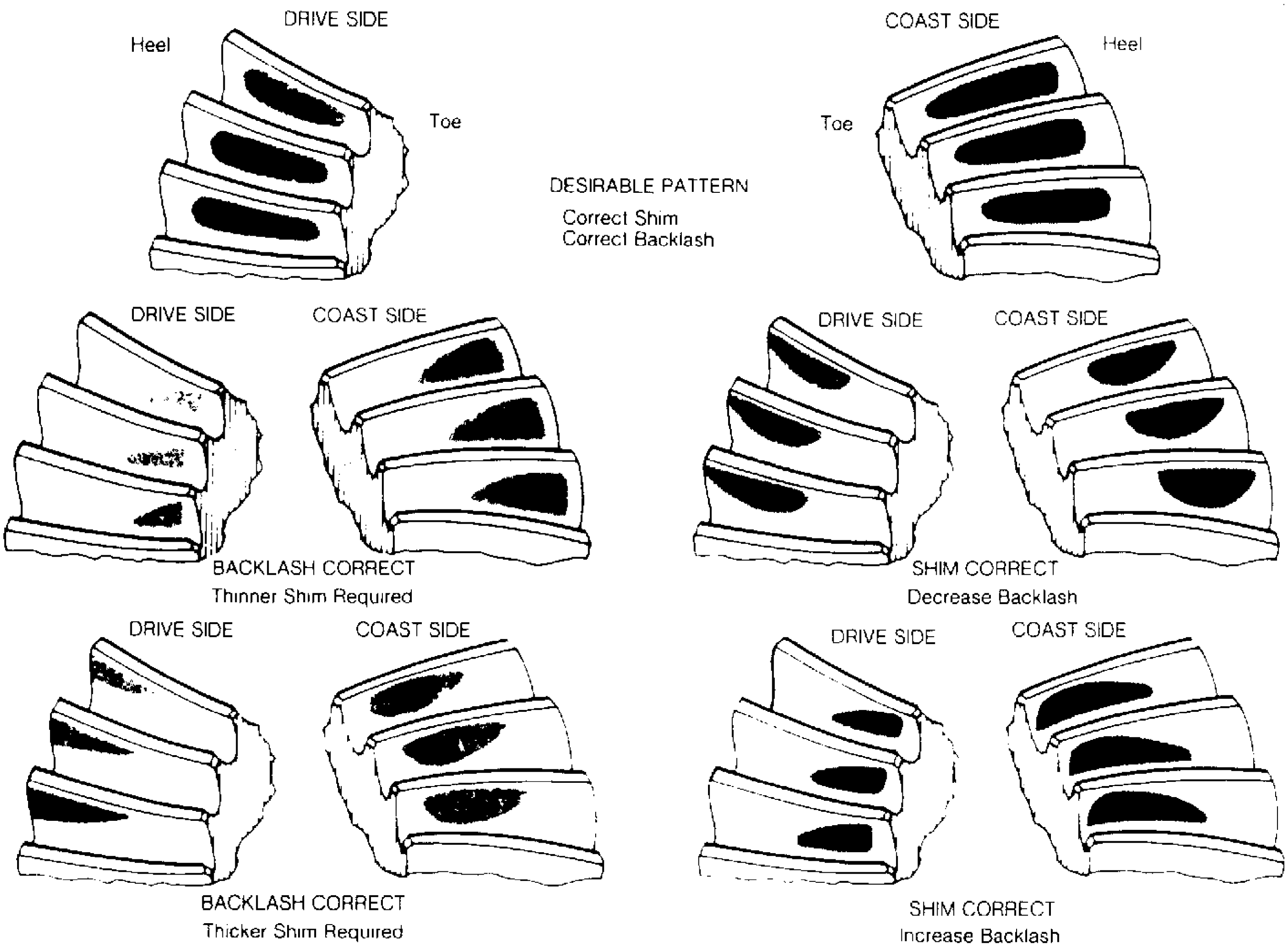


Fig. 1: Drive Axle Gear Tooth Patterns

ADJUSTMENTS

GEAR BACKLASH & PINION SHIM CHANGES

NOTE: Backlash is adjusted by either moving shims from one side of differential case to the other or by turning adjusting nuts on which side bearing races ride. Changing of pinion shims alters the distance from face of pinion of centerline of ring gear.

1) With no change in backlash, moving pinion further from ring gear moves drive pattern toward heel and top of tooth, and moves coast pattern toward toe and top of tooth.

2) With no change in backlash, moving pinion closer to ring gear moves drive pattern toward toe and bottom of tooth, and moves coast pattern toward heel and bottom of tooth.

3) With no change in pinion shim thickness, an increase in backlash moves ring gear further from pinion. Drive pattern moves toward heel and top of tooth, and coast pattern moves toward heel and top of tooth.

4) With no change in pinion shim thickness, decrease in

backlash moves ring gear closer to pinion gear. Drive pattern moves toward toe and bottom of tooth, and coast pattern moves toward toe and bottom of tooth.

GENERAL COOLING SYSTEM SERVICING

1993 Toyota Celica

GENERAL INFORMATION
General Cooling System Servicing

* PLEASE READ THIS FIRST *

The following article is for general information only. Information may not apply to all years, makes and models. See specific article in the ENGINE COOLING section.

DESCRIPTION

The basic liquid cooling system consists of a radiator, water pump, thermostat, electric or belt-driven cooling fan, pressure cap, heater, and various connecting hoses and cooling passages in the block and cylinder head.

MAINTENANCE

DRAINING

Remove radiator cap and open heater control valve to maximum heat position. Open drain cocks or remove plugs in bottom of radiator and engine block. In-line engines usually have one plug or drain cock, while "V" type engines will have 2, one in each bank of cylinders.

CLEANING

A good cleaning compound removes most rust and scale. Follow manufacturer's instructions in the use of cleaner. If considerable rust and scale has to be removed, cooling system should be flushed. Clean radiator air passages with compressed air.

FLUSHING

CAUTION: Some manufacturers use an aluminum and plastic radiator. Flushing solution must be compatible with aluminum.

Back Flushing

Back flushing is an effective means of removing cooling system rust and scale. The radiator, engine and heater core should be flushed separately.

Radiator

To flush radiator, connect flushing gun to water outlet of radiator and disconnect water inlet hose. To prevent flooding engine, use a hose connected to radiator inlet. Use air in short bursts to prevent damage to radiator. Continue flushing until water runs clear.

Engine

To flush engine, remove thermostat and replace housing. Connect flushing gun to water outlet of engine. Flush using short air bursts until water runs clean.

Heater Core

Flush heater core as described for radiator. Ensure heater control valve is set to maximum heat position before flushing heater.

REFILLING

To prevent air from being trapped in engine block, engine should be running when refilling cooling system. After system is full, continue running engine until thermostat is open, then recheck fill level. Do not overfill system.

TESTING

THERMOSTAT

1) Visually inspect thermostat for corrosion and proper sealing of valve and seat. If okay, suspend thermostat and thermometer in a 50/50 mixture of coolant and water. See Fig. 1. Do not allow thermostat or thermometer to touch bottom of container. Heat water until thermostat just begins to open.

2) Read temperature on thermometer. This is the initial opening temperature and should be within specification. Continue heating water until thermostat is fully open and note temperature. This is the fully opened temperature. If either reading is not to specification, replace thermostat.

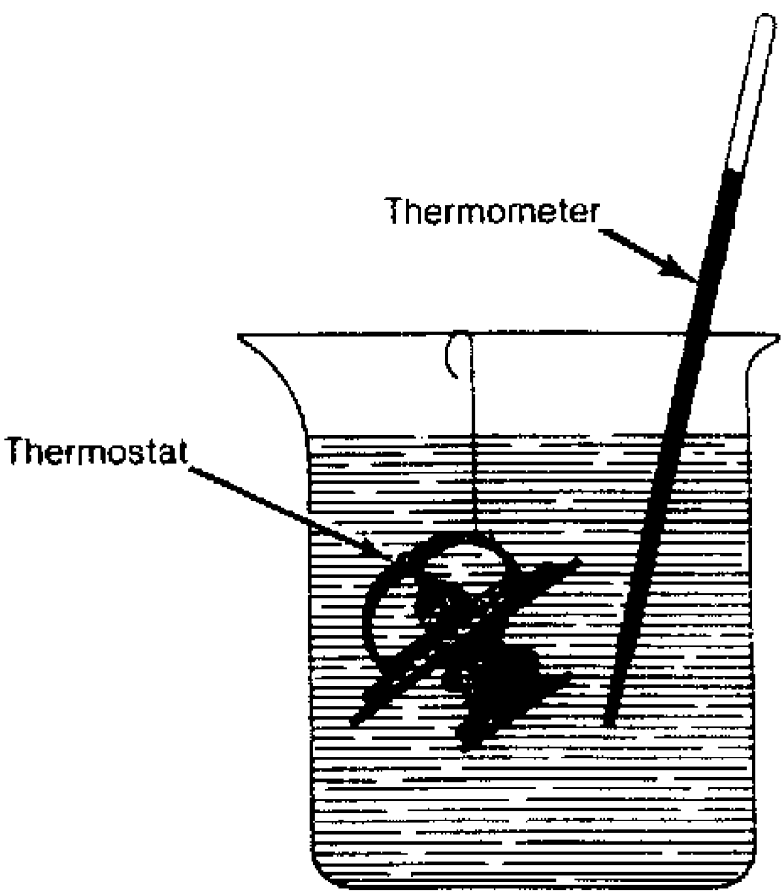


Fig. 1: Testing Thermostat in Anti-Freeze/Water Solution

PRESSURE TESTING

A pressure tester is used to check both radiator cap and complete cooling system. Test components as follows, following tool manufacturer's instructions.

Radiator Cap

Visually inspect radiator cap, then dip cap into water and connect to tester. Pump tester to bring pressure to upper limit of cap specification. If cap fails to hold pressure, replace cap.

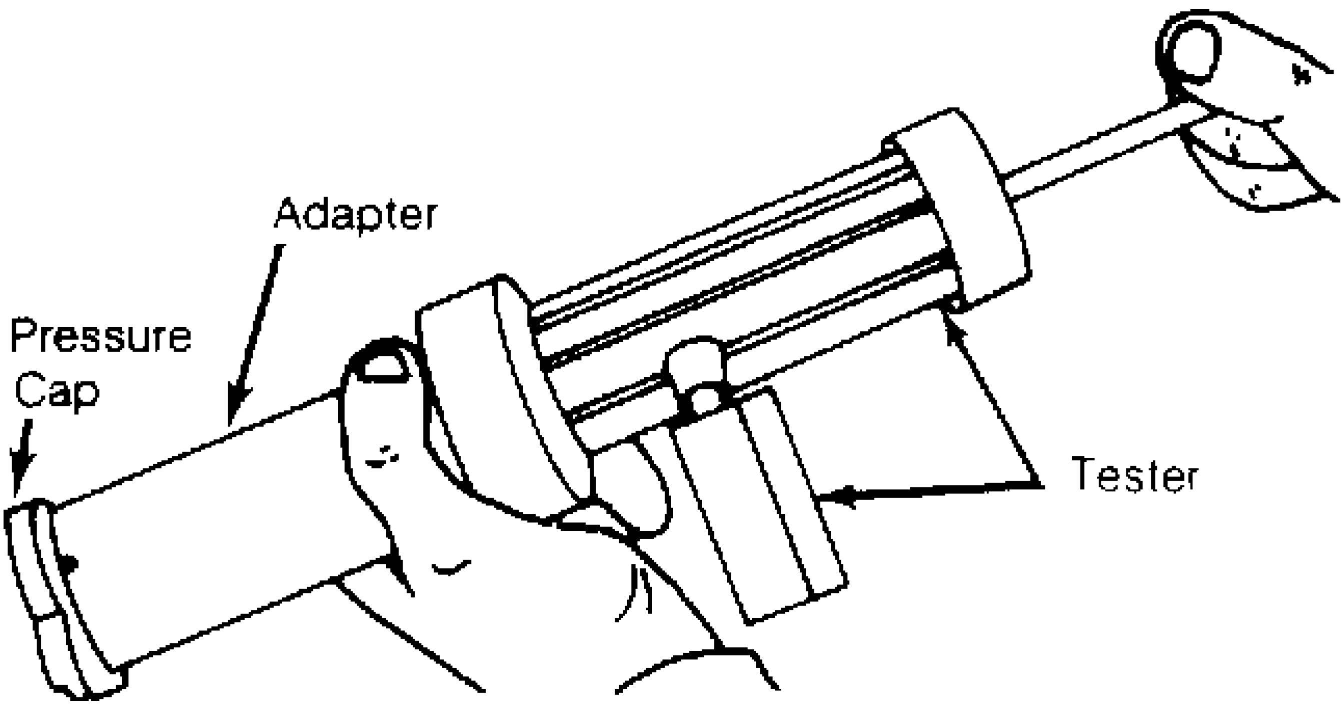


Fig. 2: Testing Radiator Pressure Cap

Cooling System

1) With engine off, wipe radiator filler neck seat clean. Fill radiator to correct level. Attach tester to radiator and pump until pressure is at upper level of radiator rating.

2) If pressure drops, inspect for external leaks. If no leaks are apparent, detach tester and run engine until normal operating temperature is reached. Reattach tester and observe. If pressure builds up immediately, a possible leak exists from a faulty head gasket or crack in head or block.

NOTE: Pressure may build up quickly. Release any excess pressure or cooling system damage may result.

3) If there is no immediate pressure build up, pump tester to within system pressure range (on radiator cap). Vibration of gauge pointer indicates compression or combustion leak into cooling system. Isolate leak by shorting each spark plug wire to cylinder block. Gauge pointer should stop or decrease vibration when leaking cylinder is shorted.

HEATER SYSTEM

1993 Toyota Celica

1993 Heater Systems

Celica

DESCRIPTION

Heater assembly consists of heater core, control panel, blower motor, control cables (electric servomotors on push button-controlled models) and air ducts. All components are located under instrument panel.

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES & ELECTRICAL section.

CAUTION: When battery is disconnected, radio will go into anti-theft protection mode. Obtain radio anti-theft protection code from owner prior to servicing vehicle.

OPERATION

BLOWER SWITCH

Switch controls blower motor speed through blower resistor. Switch is operated by control lever, dial knob or push button.

CONTROL PANEL

Lever-Controlled Models

Temperature and mode levers are cable-connected to heater coolant valve and air doors. All models have a fresh/recirculation lever to provide choice of outside air entry or inside air recirculation.

Push Button-Controlled Models

Air inlet (fresh/recirculation), mode control and air mix are controlled by electric servomotors. Temperature selection is controlled by slide lever or rotating dial knob.

HEATER RELAY

A heater (or main) relay in heater circuit controls current flow through system. See WIRING DIAGRAM. For location of heater relay, see HEATER RELAY LOCATION table.

HEATER RELAY LOCATION TABLE

Models	Location
Celica	Relay/Fuse Block, Behind Right Kick Panel

ADJUSTMENTS

AIR INLET DAMPER CABLE

Lever-Controlled Models

Set air inlet damper and control lever to fresh air position. Remove cable retaining clip, and ensure damper and cable are in full fresh position. Attach control cable using retaining clip, and check operation of air intake damper.

AIR MIX DAMPER CABLE

Lever-Controlled Models

Set air door lever to warm position, and remove cable retaining clip. Ensure cable and damper are in full cool position. Install cable retaining clip. Check air mix damper operation.

AIRFLOW MODE DAMPER CABLE

Lever-Controlled Models

Set control lever to defrost position. Remove cable retaining clip. Ensure airflow mode damper and cable are in full defrost position. Install cable retaining clip.

WATER VALVE CONTROL CABLE

Lever-Controlled Models

Set control lever to warm position. Remove cable retaining clip. Ensure water valve control cable is in full warm position. Install cable retaining clip.

TROUBLE SHOOTING

BLOWER DOES NOT WORK

Check for open circuit breaker (some models), blown heater fuse and faulty heater relay. Also check for heater blower switch, heater blower resistor, heater blower motor, wiring or ground circuit fault.

INCORRECT TEMPERATURE OUTPUT

Check for control cables broken or out of adjustment, heater hoses leaking or clogged and faulty water pump. Also check for broken air dampers, faulty servomotor (some models), clogged air ducts, leaking or clogged heater core and faulty heater control unit.

TESTING

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES & ELECTRICAL section.

AIR INLET CONTROL SERVOMOTOR

1) Disconnect air inlet control servomotor wiring harness connector. Ground terminal No. 3, and apply battery voltage to terminal No. 1. See Fig. 1. Ensure arm rotates smoothly to fresh (full counterclockwise) position.

2) Ground terminal No. 2, and apply battery voltage to terminal No. 1. Ensure arm rotates smoothly to recirculation (full

clockwise) position. If operation is not as specified, replace servomotor.

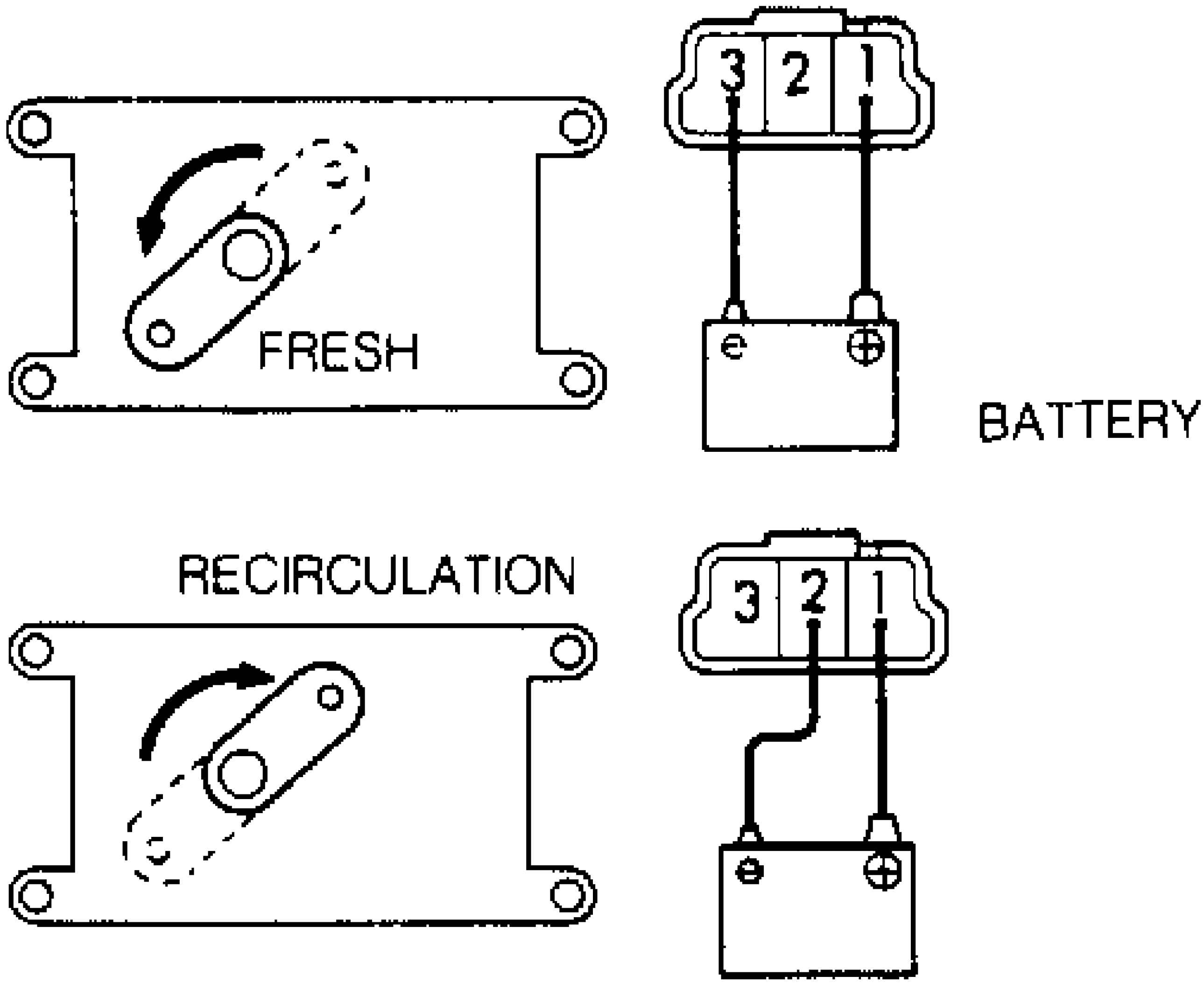


Fig. 1: Testing Air Inlet Control Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AIR INLET CONTROL SWITCH

1) Disconnect wiring harness connector "A" of heater control assembly. See Fig. 2. With recirculation button depressed, continuity should exist between terminals No. 2 and 7.

2) With fresh button depressed, continuity should exist between terminals No. 2 and 8. Switch contains diodes. Before deciding switch is faulty, check for continuity in both directions. If continuity is not as specified, replace heater control assembly.

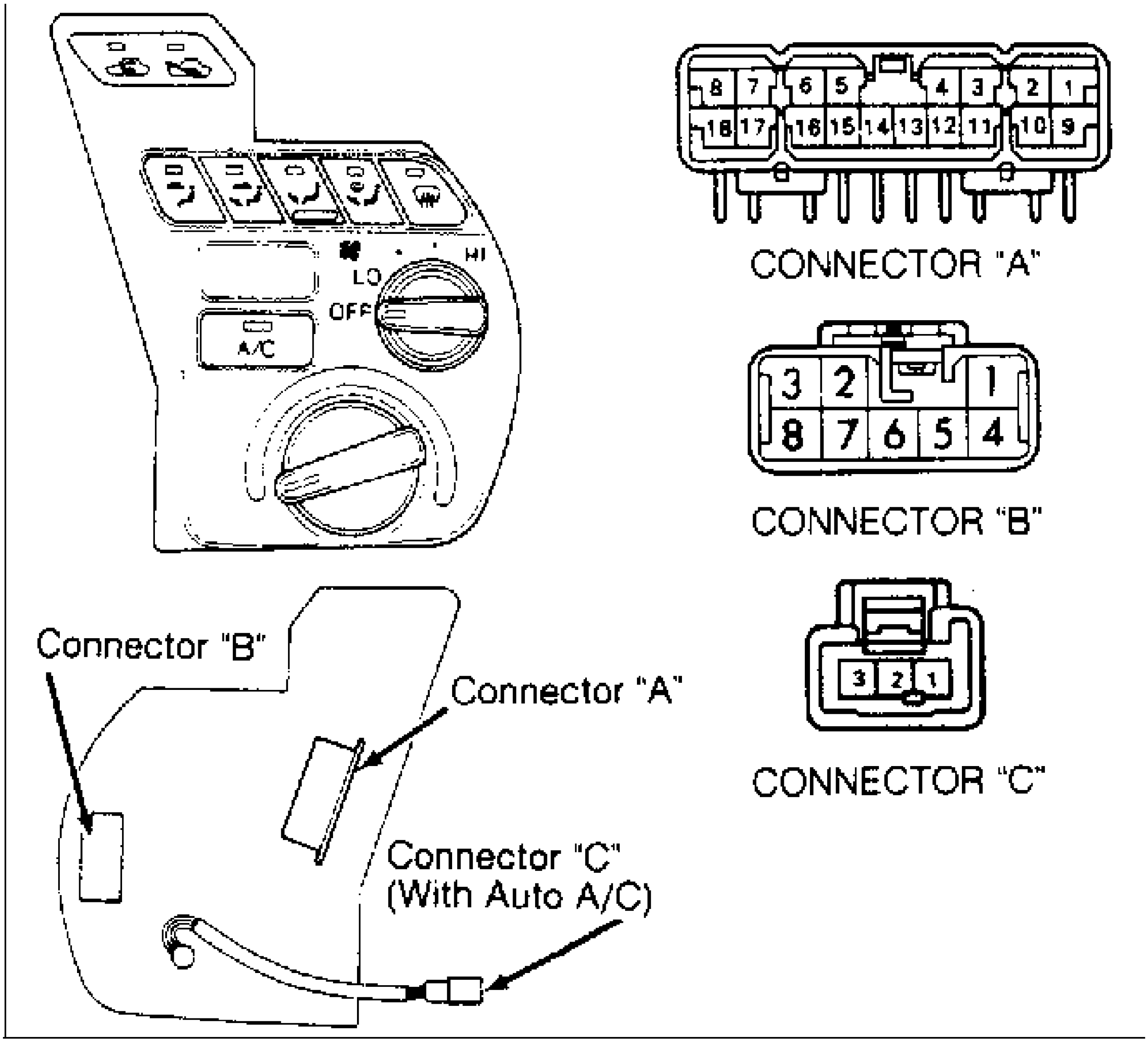


Fig. 2: Identifying Heater Control Assembly Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AIRFLOW MODE CONTROL SWITCH

Disconnect wiring harness connector "A" of heater control assembly. See Fig. 2. Check for continuity at specified terminals. See TESTING AIRFLOW MODE CONTROL SWITCH table. If continuity is not as specified, replace heater control assembly.

TESTING AIRFLOW MODE CONTROL SWITCH TABLE

Switch Position	Continuity Between Terminals
Face	2 & 9
Bi-Level	2 & 10
Foot	2 & 11

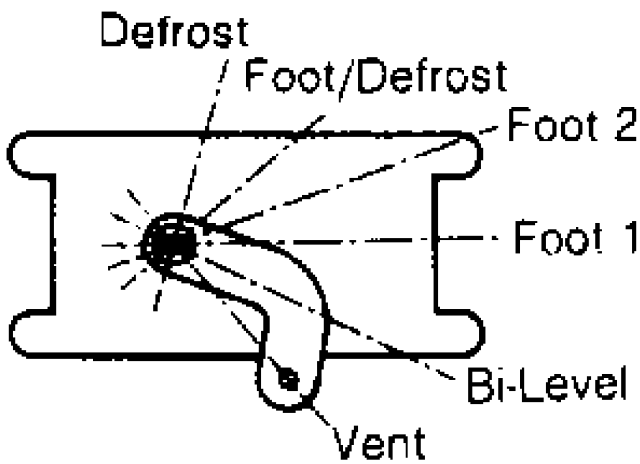
Foot/Defrost	2 & 12
Defrost	2 & 13

AIRFLOW MODE SERVOMOTOR

Disconnect servomotor connector. Ground terminal No. 6, and apply battery voltage to terminal No. 5. See Fig. 3. Ground each specified terminals, and ensure arm rotates smoothly to correct position. See TESTING AIRFLOW MODE SERVOMOTOR table. Replace servomotor if operation is not as specified.

TESTING AIRFLOW MODE SERVOMOTOR TABLE

Ground Terminal No.	Arm Position
1	Vent
2	Bi-Level
3	Foot 2
4	Foot/Defrost
7	Defrost
8	Foot 1



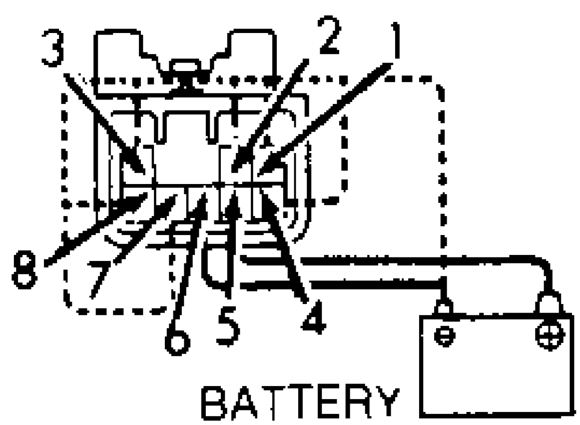


Fig. 3: Testing Airflow Mode Servomotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BLOWER FAN RELAY

Disconnect wiring harness connector. Test blower fan relay as specified. See TESTING BLOWER FAN RELAY table. See Fig. 4. If continuity is not as specified, replace relay.

TESTING BLOWER FAN RELAY TABLE

Apply Battery Voltage Between Terminal No.	(1) Continuity Should Exist Between Terminal No.
5 & 6	1 & 3
5 & 7	3 & 4
5 & 8	2 & 3

(1) - When battery voltage is not applied, constant continuity is present between terminals No. 5 and 6,

5 and 7, and 5 and 8.

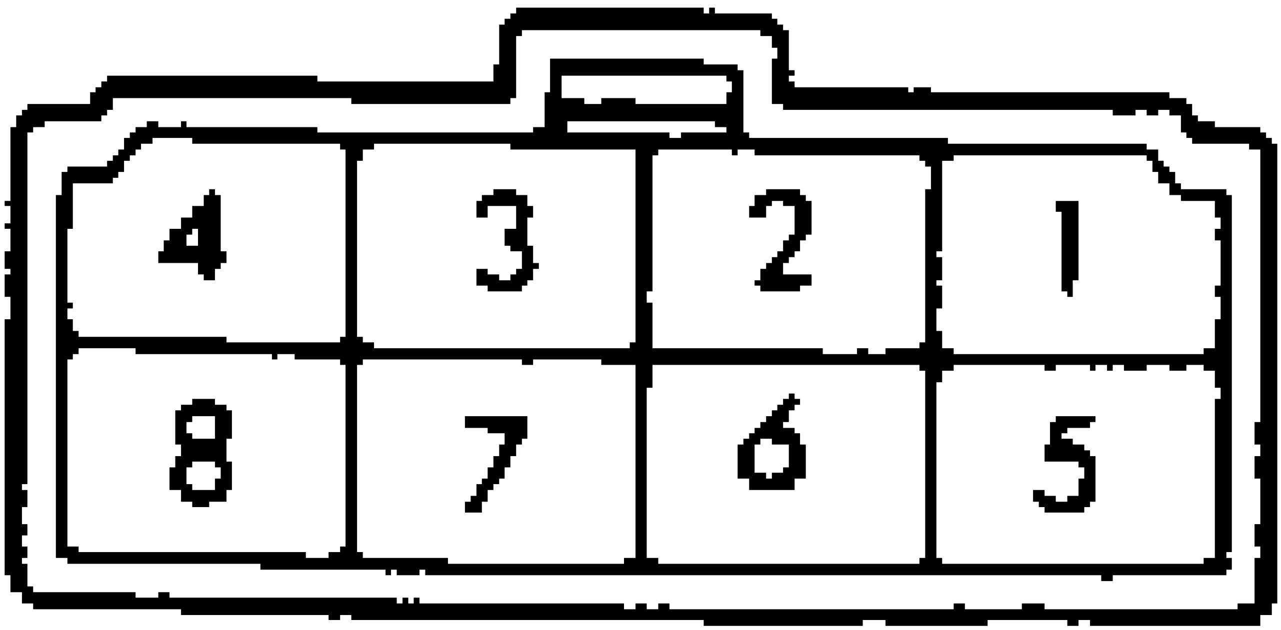


Fig. 4: Identifying Blower Fan Relay Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

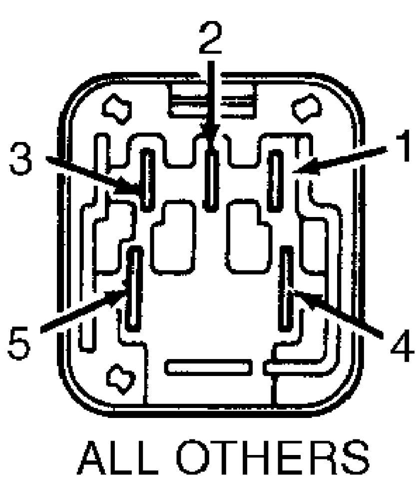


Fig. 5: Identifying Heater Relay Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BLOWER MOTOR

Disconnect blower motor wiring harness connector. Apply battery voltage to motor side of connector. Motor should operate smoothly. If motor operation is not smooth, replace motor.

BLOWER RESISTOR

Remove resistor from vehicle or disconnect resistor wiring. Using an ohmmeter, ensure continuity exists between blower resistor terminals No. 1 and 4. See Fig. 6. If continuity is not as specified, replace resistor.

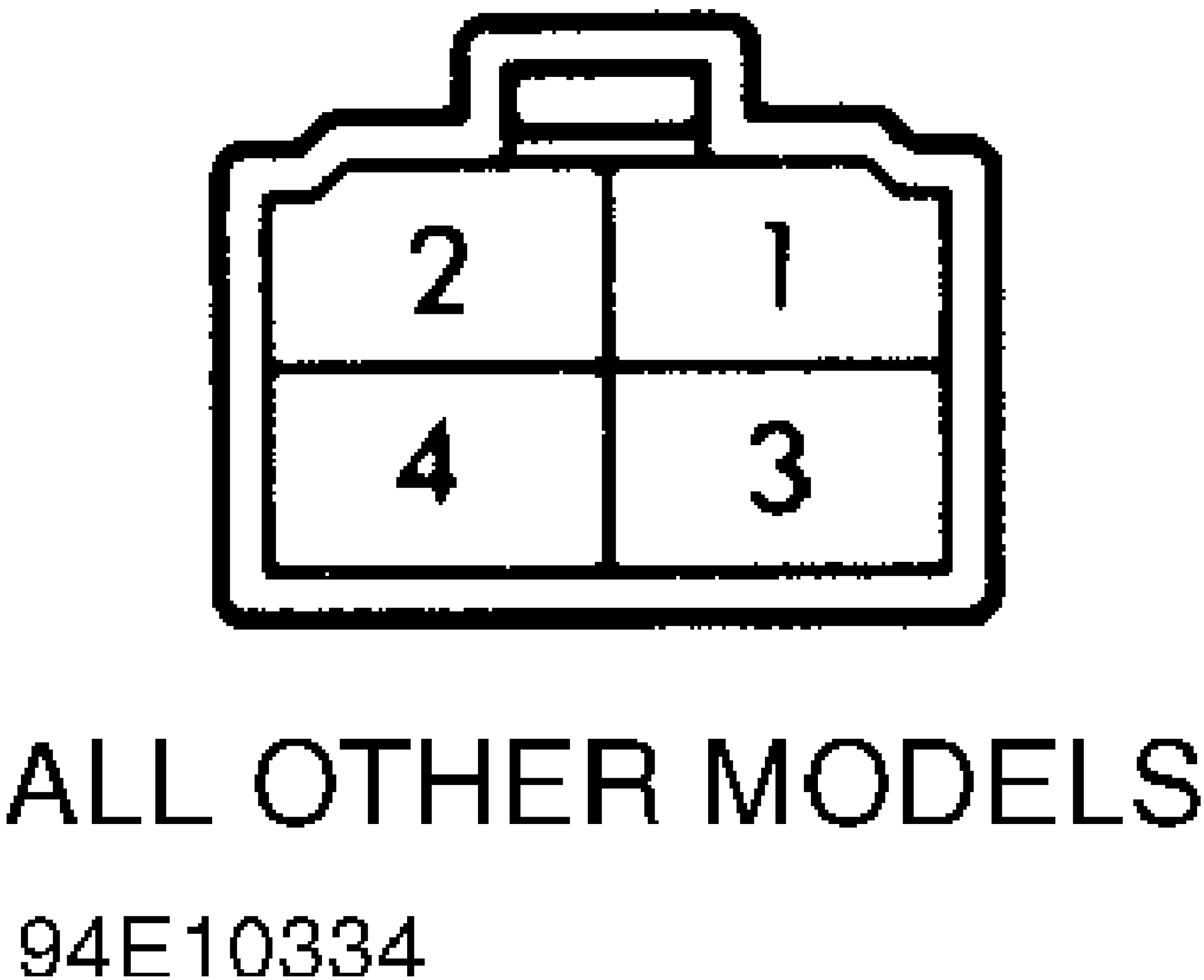


Fig. 6: Identifying Heater Blower Resistor Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BLOWER SPEED CONTROL SWITCH

Disconnect wiring harness connector "B" of heater control panel. Using an ohmmeter, check continuity between specified terminals and switch positions. See Fig. 2. See appropriate TESTING BLOWER SPEED CONTROL SWITCH table. If continuity is not as specified, replace blower switch.

TESTING BLOWER SPEED CONTROL SWITCH TABLE

Switch Position	Continuity Between Terminals
OFF	(1)
LO	1, 3 & 7
(i) (2)	2, 3 & 6
(i) (3)	2, 3 & 4
HI	2, 3 & 5

(1) - No continuity.
(2) - Square (i) closest to LO position.
(3) - Square (i) closest to HI position.

HEATER RELAY

4-Pin Type

1) Disconnect negative battery cable. Remove heater relay. Using an ohmmeter, ensure continuity exists between heater relay terminals No. 1 and 3, and between terminals No. 2 and 4. See Fig. 5. Ensure continuity does not exist between terminals No. 4 and 5. If continuity is not as specified, replace relay.

2) Ground terminal No. 3, and apply battery voltage to terminal No. 1. Ensure continuity exists between terminals No. 4 and 5. If continuity is not as specified, replace relay.

REMOVAL & INSTALLATION

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in appropriate AIR BAG RESTRAINT SYSTEM article in ACCESSORIES & ELECTRICAL section.

BLOWER MOTOR

Removal & Installation

Removal and installation procedures are not available. Exploded views of heater systems are provided. See Fig. 7.

HEATER ASSEMBLY

Removal & Installation

Removal and installation procedures are not available. Exploded views of heater systems are provided. See Fig. 7.

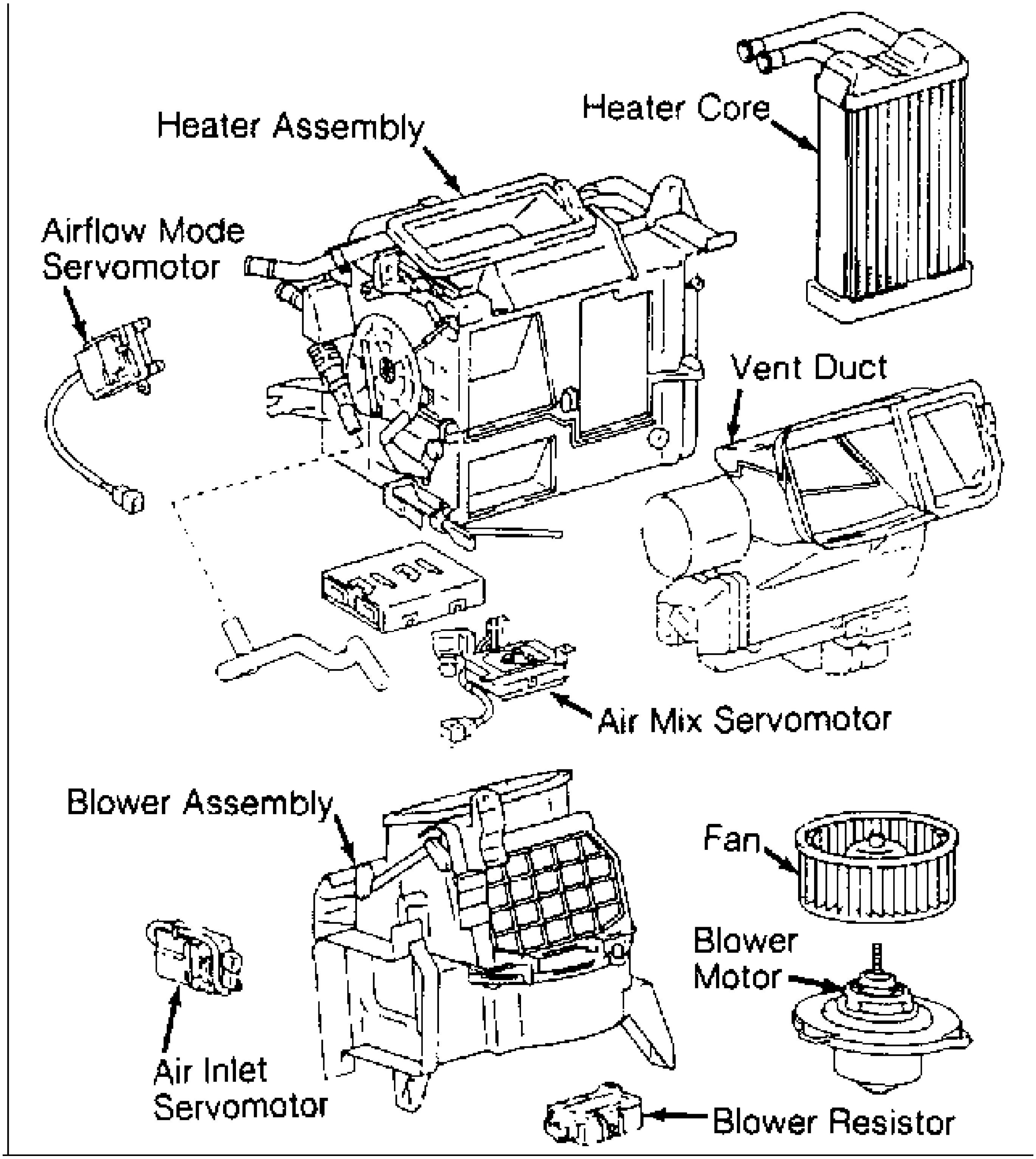


Fig. 7: Exploded View Of Heater Assembly
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAM

NOTE: For additional wiring diagrams, see appropriate A/C-HEATER SYSTEM - MANUAL article in the AIR CONDITIONING & HEAT section.

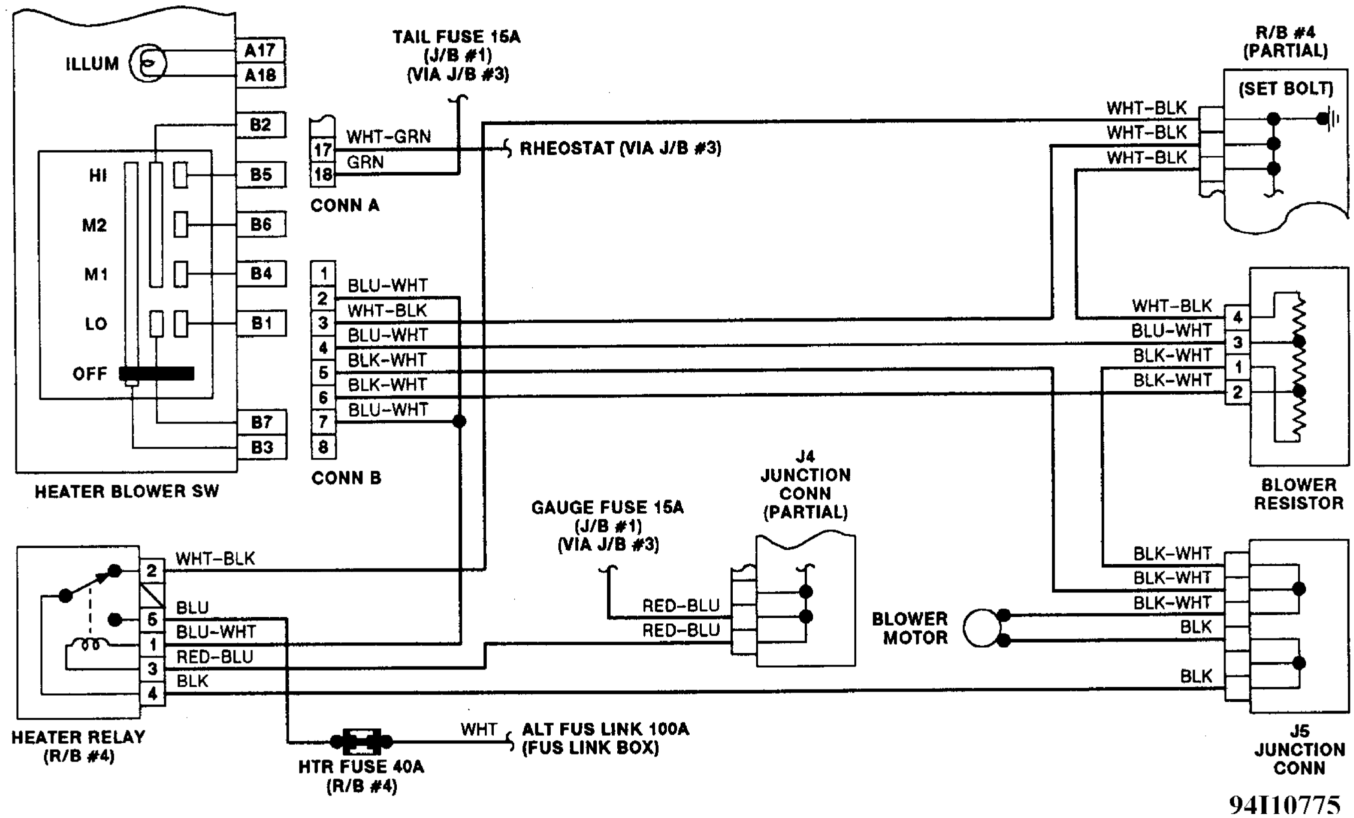


Fig. 8: Heater System Wiring Diagram

HOW TO USE SYSTEM WIRING DIAGRAMS

1993 Toyota Celica

GENERAL INFORMATION
Using Wiring Diagrams

All Models

INTRODUCTION

This CD obtains wiring diagrams and technical service bulletins, containing wiring diagram changes from the domestic and import manufacturers. These are checked for accuracy and are all redrawn into a consistent format for easy use.

In the past, when cars were simpler, diagrams were simpler. All components were connected by wires and diagrams seldom exceeded 4 pages in length. Today, some wiring diagrams require more than 16 pages. It would be impractical to expect a service technician to trace a wire from page 1 across every page to page 16.

Removing some of the wiring maze reduces eyestrain and time wasted searching across several pages. Today the majority of these diagrams follow a much improved format, which permits space for internal switch details.

Wiring diagrams are drawn in a "top-down" format. The diagrams are drawn with the power source at the top of the diagram and the ground point at the bottom of the diagram. Components locations are identified on the wiring diagrams. Any wires that don't connect directly to a component are identified on the diagram to indicate where they go.

COLOR ABBREVIATIONS

COLOR ABBREVIATIONS TABLE

Color	Normal	Optional
Black	BLK	BK
Blue	BLU	BU
Brown	BRN	BN
Clear	CLR	CR
Dark Blue	DK BLU	DK BU
Dark Green	DK GRN	DK GN
Green	GRN	GN
Gray	GRY	GY
Light Blue	LT BLU	LT BU
Light Green	LT GRN	LT GN
Orange	ORG	OG
Pink	PNK	PK
Purple	PPL	PL
Red	RED	RD
Tan	TAN	TN
Violet	VIO	VI
White	WHT	WT
Yellow	YEL	YL

IDENTIFYING WIRING DIAGRAM ABBREVIATIONS

NOTE: Abbreviations used on these diagrams are normally self-explanatory. If necessary see ABBREVIATIONS article in GENERAL INFORMATION.

IDENTIFYING WIRING DIAGRAM SYMBOLS

NOTE: Standard wiring symbol are used in these diagrams. The illustration below will help clarify any symbols that are not easily understood at a glance. Most components are labeled "Motor", "Switch" or "Relay" in addition to being drawn with the standard symbol.

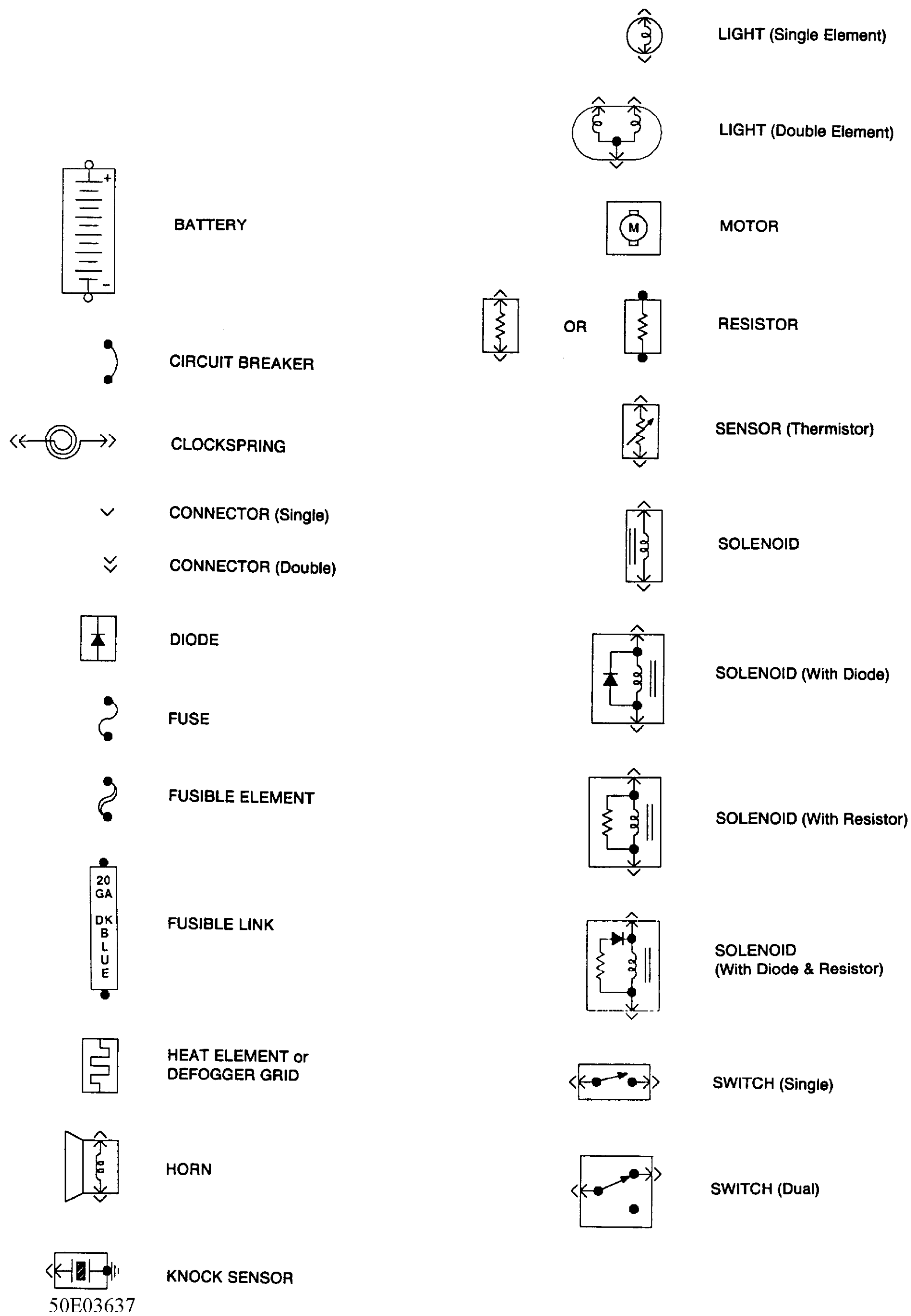


Fig. 1: Identifying Wiring Diagram Symbols

WIRING DIAGRAM COMPONENT LOCATIONS

When trying to locate a component in a wiring diagram and you don't know the specific system where it is located, use this handy component locator to find the system wiring diagram in which the component is located. Then, go to that system and locate the component within the wiring diagram.

For example, if you don't know the specific system in which the ignition switch is located, look up ignition switch in the wiring diagram component location tables and go to the appropriate wiring diagram(s) which contain either full or partial views of the ignition switch. The full view of the ignition switch is located in Power Distribution.

The first listing for the component will be the full or most complete view of the component. Additional listings will be partial views of the component. Not all components are used on all models.

All components will have a partial view in Ground Distribution and Power Distribution. Data Link Connectors show connecting circuits between modules. Alternate names for components may be listed in wiring diagram component locations tables.

WIRING DIAGRAM COMPONENT LOCATIONS TABLE

Component	Wiring Diagram
ABS Electronic Control Unit	Anti-Lock Brakes
	Data Link Connectors
ABS Hydraulic Unit	Anti-Lock Brakes
Acceleration Sensor	Anti-Lock Brakes
Accessory Delay Relay	Power Windows
A/C Compressor Clutch Relay	Engine Performance
A/C Sensor	Engine Performance
A/C Pressure Switch	Engine Performance
Adaptive Lamp Control Module	Exterior Lights
Air Bag(s)	Air Bag Restraint System
Air Bag Module	Air Bag Restraint System
Air Bag Sensor(s)	Air Bag Restraint System
Air Injection Pump Relay	Engine Performance
Air Temperature Sensor	Overhead Console
Alternator (Generator)	Generators & Regulators
Anti-Theft Control Module	Anti-Theft System
	Starters
Autolamp Control Relay	Headlight Systems
	Daytime Running Lights
Automatic Shutdown (ASD) Relay	Engine Performance
	Generators & Regulators
Autostick Switch	Engine Performance
Auxiliary Battery Relay	Generators & Regulators
Back-Up Lights	Back-Up Lights
	Exterior Lights
Barometric (BARO) Pressure Sensor	Engine Performance
Battery	Power Distribution
Battery Temperature Sensor	Engine Performance
Body Control Module	Body Control Computer
	Anti-Theft System
	Daytime Running Lights
	Engine Performance
	Headlight Systems
	Warning Systems
Boost Control Solenoid	Engine Performance
Boost Sensor	Engine Performance
Brake Fluid Level Switch	Analog Instrument Panels

Brake On/Off (BOO) Switch	Cruise Control Systems
	Engine Performance
	Shift Interlock Systems
Buzzer Module	Warning Systems
Camshaft Position (CMP) Sensor	Engine Performance
Central Control Module	Anti-Theft System
Clockspring	Air Bag Restraint System
	Cruise Control Systems
	Steering Column Switches
Clutch Pedal Position Switch	Starters
Clutch Start Switch	Starters
Combination Meter	Analog Instrument Panels
Constant Control Relay Module (CCRM)	Engine Performance
	Electric Cooling Fans
Convenience Center	Power Distribution
	Illumination/Interior Lights
Convertible Top Motor	Power Convertible Top
Convertible Top Switch	Power Convertible Top
Crankshaft Position (CKP) Sensor	Engine Performance
Cruise Control Module	Cruise Control Systems
Cruise Control Switch	Cruise Control Systems
Condenser Fan Relay(s)	Electric Cooling Fans
Data Link Connector (DLC)	Engine Performance
Daytime Running Lights Module	Daytime Running Lights
	Exterior Lights
Defogger Relay	Rear Window Defogger
Diagnostic Energy Reserve Module (DERM)	Air Bag Restraint System
Discriminating Sensor (Air Bag)	Air Bag Restraint System
Distributor	Engine Performance
Door Lock Actuators	Power Door Locks
	Remote Keyless Entry
Door Lock Relay(s)	Power Door Locks
Electrochromic Mirror	Power Mirrors
Electronic Level Control (ELC) Height Sensor	Electronic Suspension
Electronic Level Control (ELC) Module	Electronic Suspension
Engine Coolant Temperature (ECT) Sending Unit	Analog Instrument Panels
Engine Coolant Temperature (ECT) Sensor	Engine Performance
Engine Control Module	Engine Performance
	Generators & Regulators
	Starters
ETACS ECU	Warning Systems
	Power Windows
	Remote Keyless Entry
Evaporative (EVAP) Emissions Canister	Engine Performance
EVAP Canister Purge Solenoid	Engine Performance
EVAP Canister Vent Solenoid	Engine Performance
Exhaust Gas Recirculation (EGR) Valve	Engine Performance
Fuel Tank Vacuum Sensor	Engine Performance
Fog Lights	Headlight Systems
	Daytime Running Lights
Fog Light Relay	Headlight Systems
	Daytime Running Lights
Fuel Door Release Solenoid	Power Fuel Door Release
Fuel Gauge Sending Unit	Analog Instrument Panels
Fuel Injectors	Engine Performance
Fuel Pump	Engine Performance
Fuel Pump Relay	Engine Performance
	Power Distribution
Fuse/Relay Block	Power Distribution
Fusible Links	Power Distribution
	Generators & Regulators

	Starters
Generator	Generators & Regulators
	Engine Performance
	Power Distribution
Generic Electronic Module (GEM)	Body Control Modules
	Electronic Suspension
Glow Plug Relay	Engine Performance
Glow Plugs	Engine Performance
Grounds	Ground Distribution
Headlight Door Module	Headlight Doors
Headlight Relay	Headlight Systems
	Daytime Running Lights
Headlights	Headlight Systems
	Daytime Running Lights
Heated Oxygen Sensor(s) (HO2S)	Engine Performance
Heated Windshield Control Module	Heated Windshields
Height Sensor	Electronic Suspension
Horns	Steering Column Switches
Horn Relay	Steering Column Switches
Idle Air Control (IAC) Motor/Valve	Engine Performance
Ignition Coil(s)	Engine Performance
Ignition Key Lock Cylinder	Anti-Theft System
Ignition Module	Engine Performance
Ignition Switch	Power Distribution
	Engine Performance
	Generators & Regulators
	Starters
Illuminated Entry Module	Illumination/Interior Lights
Illumination Lights	Illumination/Interior Lights
Impact Sensor	Air Bag Restraint System
Inertia Fuel Shutoff Switch	Engine Performance
Inhibit Relay	Starters
Instrument Cluster	Analog Instrument Panels
Intake Air Temperature (IAT) Sensor	Engine Performance
Interior Lights	Illumination/Interior Lights
Interlock Switch	Starters
Junction Block	Power Distribution
Keyless Entry Receiver	Remote Keyless Entry
Key Reminder Switch	Starters
Knock Sensor	Engine Performance
Lamp Control Module	Exterior Lights
License Plate Lamp	Exterior Lights
Lighting Control Module	Lighting Control Modules
	Anti-Theft System
	Daytime Running Lights
	Headlight Systems
Lower Relay	Power Convertible Top
Malfunction Indicator Light (MIL)	Engine Performance
	Instrument Panels
Manifold Absolute Pressure (MAP) Sensor	Engine Performance
Mass Airflow (MAF) Sensor	Engine Performance
Mega Fuse	Generators & Regulators
Memory Seat/Mirror Module	Memory Systems
Mirror Defogger	Rear Window Defogger
Moon Roof Motor	Power Moon Roof
Moon Roof Relay	Power Moon Roof
Multi-Function Control Module	Warning Systems
Neutral Safety Switch	Starters
Oil Level Switch	Engine Performance
Oil Pressure Switch/Sending Unit	Analog Instrument Panels
	Engine Performance
Overhead Console	Overhead Console
Oxygen Sensor(s) (O2S)	Engine Performance

Parking Brake Switch	Analog Instrument Panels
Park Lights	Exterior Lights
Park/Neutral Position Switch	Starters
	Engine Performance
	Anti-Theft System
	Body Control Module
Perimeter Lighting Control Relay	Exterior Lights
Power Amplifier	Power Antennas
Power Antenna Module	Power Antennas
Power Antenna Motor	Power Antennas
Power Distribution Center	Power Distribution
	Generators & Regulators
	Starters
Power Door Lock Motors	Power Door Locks
Power Mirror Motors	Power Mirrors
	Memory Systems
Power Sliding Door Controller	Power Sliding Side Door
Power Seat Motors	Power Seats
	Memory Systems
Power Steering Pressure Switch	Engine Performance
Power Top Motor	Power Convertible Top
Power Top Relay(s)	Power Convertible Top
Powertrain Control Module	Engine Performance
	Analog Instrument Panels
	Cruise Control Systems
	Data Link Connectors
	Generators & Regulators
	Starters
Power Window Motors	Power Windows
Power Window Relay(s)	Power Windows
Radiator Fan Motor(s)	Electric Cooling Fans
Radiator Fan Relay(s)	Engine Performance
	Electric Cooling Fans
Rainsense Module	Wiper/Washer Systems
Raise Relay	Power Convertible Top
Remote Anti-Theft Personality (RAP) Module	Anti-Theft System
	Starters
	Warning Systems
Seat Belt Pretensioners	Air Bag Restraint System
Seat Belt Retractor Solenoid	Passive Restraints
Seat Belt Switch	Air Bag Restraint System
	Passive Restraints
Shift Interlock Solenoid	Shift Interlock Systems
Shift Lock Actuator	Shift Interlock Systems
Side Marker Lights	Exterior Lights
SIR Coil Assembly (Clockspring)	Air Bag Restraint System
Slip Ring (Clockspring)	Air Bag Restraint System
	Steering Column Switches
SRS Control Module	Air Bag Restraint System
Starter Motor	Starters
Starter Interrupt Relay	Starters
Starter Solenoid	Starters
Starter Relay	Starters
Steering Wheel Position Sensor	Anti-Lock Brakes
Stoplights	Exterior Lights
Stoplight Switch	Engine Performance
	Cruise Control Systems
	Anti-Lock Brakes
Sun Roof ECU	Power Sun Roof
Sun Roof Motor	Power Sun Roof
Sun Roof Position Sensor	Power Sun Roof
Taillights	Exterior Lights
Throttle Position (TP) Sensor	Engine Performance

Torque Converter Clutch Solenoid/Switch	Engine Performance
Traction Control Switch	Anti-Lock Brakes
Trailer Tow Connector	Exterior Lights
Trailer Tow Relay	Exterior Lights
Transmission/Transaxle	Engine Performance
Transmission Control Module (TCM)	Engine Performance
	Starters
Transmission Range Sensor	Starters
	Back-Up Lights
	Engine Performance
Transmission Range Switch	Back-Up Lights
	Engine Performance
	Anti-Theft System
Turn Signal Flasher	Exterior Lights
Turn Signal Lights	Exterior Lights
Twilight Sentinel Switch	Headlight Systems
	Daytime Running Lights
Vapor Canister Leak Detection Pump	Engine Performance
Vehicle Control Module (VCM)	Engine Performance
Vehicle Dynamic Module	Electronic Suspension
Vehicle Speed Control Servo	Cruise Control Systems
Vehicle Speed Sensor	Data Link Connectors
	Analog Instrument Panels
	Cruise Control Systems
	Electronic Suspension
Voltage Regulator	Generators & Regulators
Water-In-Fuel Sensor	Engine Performance
	Analog Instrument Panels
Wheel Speed Sensors	Anti-Lock Brakes
Window Timer Module	Power Convertible Top
Windshield Intermittent Wiper Relay	Wiper/Washer Systems
Windshield Washer Motor	Wiper/Washer Systems
Wiper Motor	Wiper/Washer Systems

INSTRUMENT PANEL

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Instrument Panels

Celica

* PLEASE READ THIS FIRST *

WARNING: Celica is equipped with a driver-side air bag; use extreme caution while working around steering column. To disable air bag system, ensure ignition switch is in LOCK position and negative battery terminal is disconnected for at least one minute before attempting any repair. DO NOT apply electrical power to any instrument panel connector without disconnecting air bag control unit. Information labels are attached to air bag components. Follow all notices on labels. Use only DVOM (volt/ohmmeter) with minimum of 10-k/ohm impedance to check ANY circuit.

DESCRIPTION & OPERATION

GAUGES

Standard instrument clusters contain fuel and temperature gauges with tell-tale warning lights. Some optional instrument panels are equipped with a tachometer, oil pressure gauge and voltmeter. Gauge internal operating components use either a 2-terminal bimetallic strip type, or a 3-terminal coil type. The 2-terminal type gauges are generally used on clusters without tachometers.

SWITCHES

Celica contains a hazard warning switch and cruise control main ON/OFF switch on instrument panel. Celica uses a combination switch for headlight, turn signal, wiper/washer, and cruise control switches. Combination switch is mounted on steering column. For testing and/or removal and installation procedures for combination switch components, see STEERING COLUMN SWITCHES article in the ACCESSORIES/SAFETY EQUIPMENT section.

TESTING - GAUGES

FUEL GAUGE & WARNING LIGHT

Fuel Gauge And Wiring Harness Operational Test

1) Unplug fuel tank sending unit connector. Turn ignition on. If fuel gauge indicates EMPTY, go to next step. If fuel gauge does not indicate EMPTY, repair short circuit in wiring harness. See appropriate chassis WIRING DIAGRAMS article in WIRING DIAGRAMS section.

2) Connect a 12-volt, 3.4-watt test light between appropriate terminals of sending unit wiring harness connector. See FUEL GAUGE & HARNESS TEST table. See Fig. 1.

3) With ignition on, test light should flash and gauge needle should move toward FULL. If test light does not flash and gauge needle does not move, check wiring harness for open circuit. Repair or replace as necessary. If wiring harness checks good, replace fuel gauge.

FUEL GAUGE & HARNESS TEST TABLE

Model	Sending Unit Harness Connector Terminals
Celica	3 & 4

Fig. 1: Fuel Sending Unit Harness Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FUEL SENDING UNIT TESTS

Fuel Sending Unit Resistance Test

1) Turn ignition off. Remove fuel sending unit from tank. Connect ohmmeter to appropriate sending unit terminals. See FUEL SENDING UNIT CONNECTOR TERMINALS table. Sending unit connector terminals are located opposite harness connector terminals. See Fig. 1.

2) Move sender arm and ensure resistance is within specifications. See FUEL SENDING UNIT RESISTANCE SPECIFICATIONS table. After a short delay, gauge pointer should move when sender is connected and float arm is moved.

FUEL SENDING UNIT CONNECTOR TERMINALS TABLE

Model	Sending Unit Connector Terminals
Celica	3 & 4

FUEL SENDING UNIT RESISTANCE SPECIFICATIONS TABLE

Float Position	Ohms
Full	3
Empty	110

Low Fuel Warning Light Sensor Operational Test

1) Remove fuel sending unit from gas tank. Prepare a battery to connect voltage to warning light sensor terminals of sending unit connector. See LOW FUEL WARNING LIGHT SENSOR TERMINALS table.

2) Connect a 12-volt, 3.4-watt test light between positive battery terminal and one warning light sensor terminal of sending unit connector. Connect other warning light sensor terminal to negative battery terminal.

3) With sending unit float/sensor dry, test light should come on within about 40 seconds. With sending unit float/sensor submerged in gasoline or water, test light should not come on. If test light does not function as described, reverse wire connections at battery terminals and retest. If test light still does not function as described, replace sensor or complete sending unit.

LOW FUEL WARNING LIGHT SENSOR TERMINALS TABLE

Model	Sending Unit Connector Terminals
3S-GTE	2 & 4
4A-FE & 5S-FE	1 & 4

Fuel Gauge Resistance Test

Remove instrument cluster. Unplug cluster connector(s). Using an ohmmeter, check fuel gauge resistance by measuring across appropriate terminals. See Fig. 2. See FUEL GAUGE RESISTANCE SPECIFICATIONS table. Replace fuel gauge if not within specifications.

FUEL GAUGE RESISTANCE SPECIFICATIONS TABLE

Application & Terminals	Ohms
3S-GTE	
Terminals "A" & "B"	101
Terminals "A" & "C"	252
Terminals "B" & "C"	151
4A-FE & 5S-FE	
Terminals "A" & "B"	86
Terminals "A" & "C"	274
Terminals "B" & "C"	188

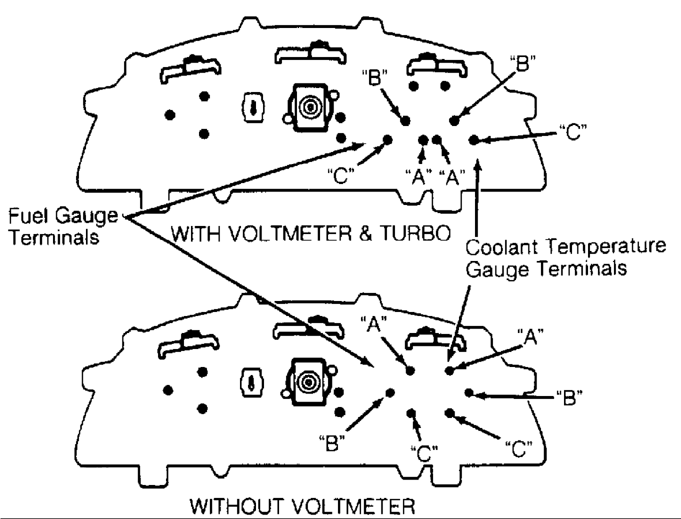


Fig. 2: Gauge Test Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TEMPERATURE GAUGE & SENDER

Wiring Harness Operational Test

1) Unplug connector at coolant temperature sender. Turn ignition on. Temperature gauge should indicate COOL. Turn ignition off. Connect a 12-volt, 3.4-watt test light between coolant temperature sender harness connector terminal and ground.

2) Turn ignition on. Test light should glow and temperature gauge should slowly move to HOT. If gauge functions as described, replace sending unit. If gauge does not function as described, perform TEMPERATURE GAUGE RESISTANCE TEST.

Temperature Gauge Resistance Test

Remove instrument cluster. Using ohmmeter, check gauge resistance across appropriate terminals. See Fig. 2. Ensure ignition is off and harness connector is unplugged from instrument cluster. See TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS table. Replace gauge if not within specification. If gauge is within specification, repair open or short circuit in wiring harness.

TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS TABLE

Application	Ohms
Terminals "A" & "B"	182
Terminals "A" & "C"	131
Terminals "B" & "C"	51

TACHOMETER TEST

Connect a tune-up test tachometer and start engine. Compare vehicle tachometer RPM reading against test tachometer. If vehicle tachometer reading is outside allowable range, replace tachometer. See TACHOMETER TEST table.

TACHOMETER TEST TABLE

Vehicle RPM Reading	Allowable Range
700	610-750
3000	2800-3200
5000	4800-5200
7000	6700-7300

TURBO GAUGE

Turbo Gauge & Harness Operational Test

1) Disconnect turbo pressure sensor harness connector located on right rear of firewall. Turn ignition on. Turbo gauge needle should move to top of gauge.

2) Jump terminal No. 2 of turbo pressure sensor harness connector to ground. See Fig. 4. Turbo gauge needle should move to bottom of gauge. If gauge needle functions as described, test turbo pressure sensor and meter drive circuit. If gauge needle does not function as described, test turbo gauge resistance.

Turbo Gauge Resistance

Remove instrument cluster enough to leave harness connectors connected and still access turbo gauge terminals on rear of cluster. Using ohmmeter, check turbo gauge resistance. See Fig. 3. If resistance is not 72 ohms, replace turbo gauge. If turbo gauge resistance is 72 ohms, test turbo pressure sensor.

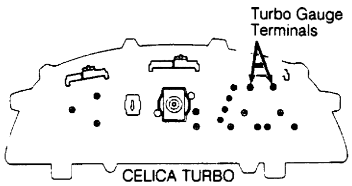


Fig. 3: Turbo Gauge Test Terminal ID (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Turbo Pressure Sensor (Voltage Test)

1) Connect three 1.5-volt dry cell batteries in series. Disconnect turbo pressure sensor connector located on right rear of firewall. Connect positive wire from batteries to terminal No. 3 of pressure sensor connector. See Fig. 4.

2) Connect negative wire of batteries to terminal No. 1 of pressure sensor connector. Using DVOM, check voltage between terminals No. 1 and 2. If voltage is not as specified, replace pressure sensor. See TURBO PRESSURE SENSOR VOLTAGE SPECIFICATIONS table. If voltage is within specification, go to next step.

TURBO PRESSURE SENSOR VOLTAGE SPECIFICATIONS TABLE

Application	Approximate Voltage
Turbo	2.4

3) Apply 8 in. Hg (vacuum) to pressure sender. Check DVOM voltage reading to drop below specification. Using SST 09992-00241, apply 7 psi (.5 kg/cm^2) air pressure to pressure sender. Ensure DVOM voltage reading increases slightly more than specification. See TURBO PRESSURE SENSOR VOLTAGE SPECIFICATIONS table.

4) If voltage readings do not change as described, replace turbo pressure sensor. If turbo pressure sensor tests okay, check wiring harness. Repair as necessary. For more information, see appropriate I - SYSTEM/COMPONENT TESTS article in the ENGINE PERFORMANCE section.

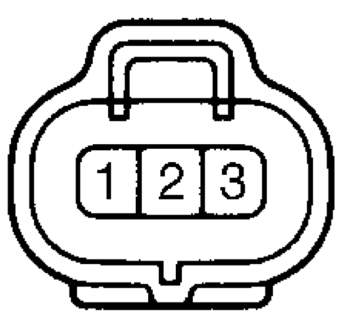


Fig. 4: Turbo Pressure Sensor Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Turbo Meter Drive Circuit

1) Disconnect turbo pressure sensor connector. Remove

instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Inspect cluster wiring harness connectors/terminals for damage or poor connections.

2) Using DVOM, check turbo meter drive circuit terminals for correct values. See Fig. 5. See TURBO METER DRIVE CIRCUIT SPECIFICATIONS table. If values are not as specified, replace turbo meter drive circuit.

TURBO METER DRIVE CIRCUIT SPECIFICATIONS TABLE

Connector-Terminal	Ignition	Specified Value
Resistance Check		
"A" - "B"	Off	Continuity
"C" - 2 (1)	Off	Continuity
"D" - Ground	Off	Continuity
1 (1) - Ground	Off	Continuity
Voltage Check		
"E" - Ground	Off	Zero Volts
"E" - Ground	On	Battery Voltage
3 (1) - Ground	Off	Zero Volts
3 (1) - Ground	On	Battery Voltage

(1) - Terminal number is located on turbo pressure sensor wiring harness connector. See Fig. 4.

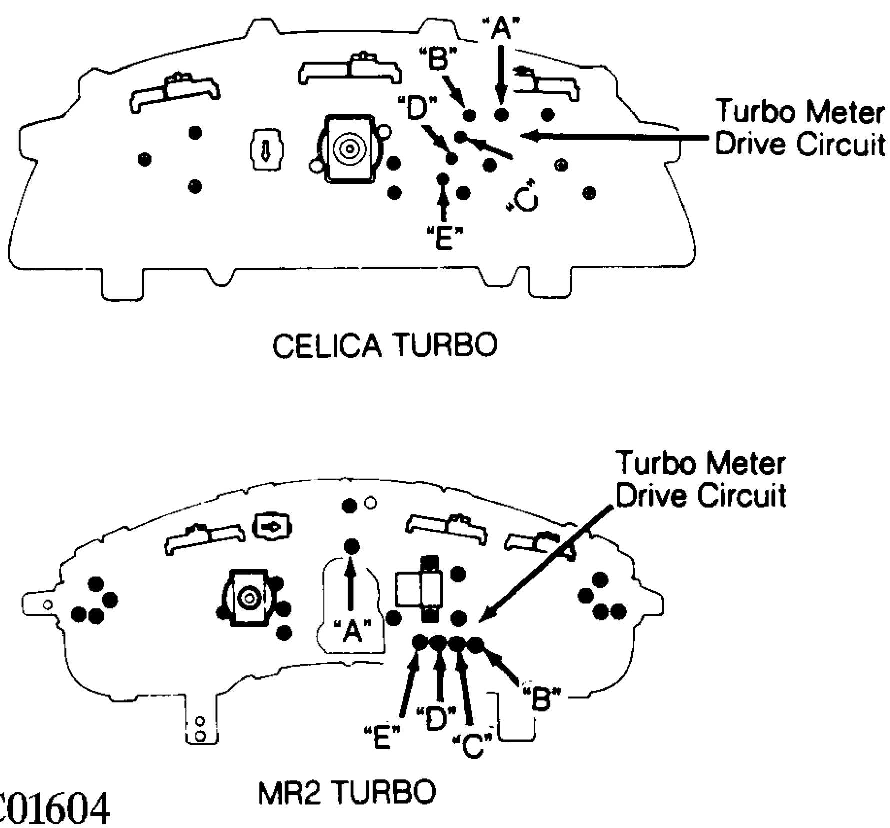


Fig. 5: Turbo Meter Drive Circuit Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TESTING - SWITCHES

HAZARD WARNING SWITCH

1) Ensure HAZARD-HORN and/or TURN fuses are good. Ensure flasher is good. See TURN SIGNAL FLASHER LOCATION table. With hazard warning switch removed from dash, ensure voltage is at switch wiring harness connector terminal No. 8. See Fig. 6. If voltage does not exist, check/repair fuses and wiring circuit. If voltage exists, disconnect switch from connector.

2) Using DVOM, ensure switch continuity exists between terminals listed, with switch in specified position. See HAZARD WARNING SWITCH CONTINUITY TEST table. Replace switch if continuity is not as specified. If switch is good, check wiring circuit. See appropriate chassis wiring diagram in WIRING DIAGRAMS.

TURN SIGNAL FLASHER LOCATION TABLE

Model	Location
Celica	Top Relay In Junction/Relay Block No. 1, Behind Left Kick Panel

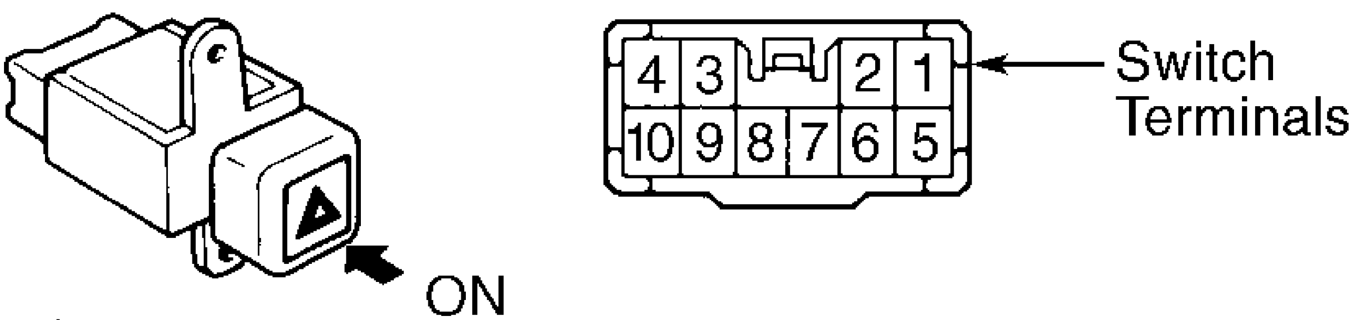


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Fig. 6: Hazard Warning Switch Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

HAZARD WARNING SWITCH CONTINUITY TEST TABLE (1)

Switch Position	Terminal Numbers	Continuity
Off	7 & 10	Yes
On	4, 5, 6 & 9; 7 & 8	Yes

(1) - Terminals No. 2 and 3 are for switch illumination bulb.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Celica is equipped with a driver-side air bag; use extreme caution while servicing steering column. Ensure ignition switch is in LOCK position and negative battery terminal is disconnected for at least one minute before attempting any repair. DO NOT apply electrical power to any instrument panel connector without disconnecting air bag control unit. Information labels are attached to air bag components. Follow all notices on labels. Use only DVOM (volt/ohmmeter) with minimum of 10-k/ohm impedance to check ANY circuit.

HAZARD WARNING SWITCH

Removal & Installation

Hazard warning switch is mounted to center air duct register, to left of clock. See Fig. 7. Using flat-blade screwdriver, pry top of register outward, away from dash opening and disconnect connectors. Remove switch from rear of register. To install, reverse removal procedure.

INSTRUMENT CLUSTER

CAUTION: When removing steering wheel horn/pad, DO NOT pull on air bag wiring harness. When storing steering wheel horn/pad, ensure pad surface faces upward.

Removal (With Air Bag)

1) Turn ignition switch to LOCK position. Disconnect negative battery cable. Wait at least one minute before continuing. Ensure front wheels are in straight-ahead position. Remove steering wheel. See STEERING WHEEL.

2) Remove steering column covers. Remove plastic screw covers from instrument panel lower finish panel and remove 6 retaining screws. See Fig. 7. Remove 5 bolts securing inner pad of lower finish panel and remove inner pad.

3) Pry off lower instrument cluster finish panel from around ignition key bezel and steering column. Remove 5 screws retaining instrument cluster finish panel. Pull cluster finish panel outward from heater controls and instrument cluster.

4) Remove instrument cluster retaining screws. Pull instrument cluster out far enough to disconnect harness connectors and speedometer cable (if equipped). Remove instrument cluster.

Installation

To install, reverse removal procedure. Before installing steering wheel, center spiral cable.

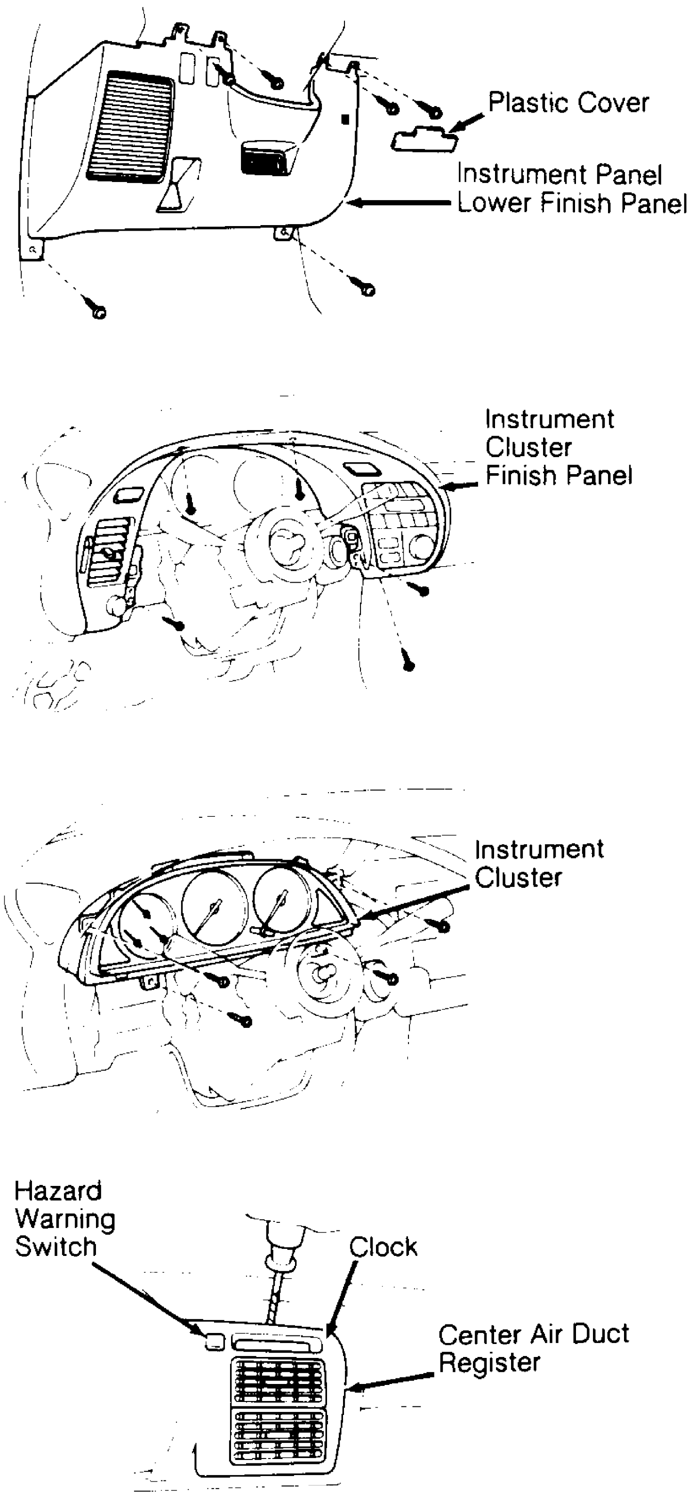

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Fig. 7: Removing Instrument Cluster & Hazard Warning Switch
Courtesy of Toyota Motor Sales, U.S.A., Inc.

STEERING WHEEL

Removal (Without Air Bag)

1) On rear of steering wheel, locate and remove retaining screw securing horn pad. Pull horn pad out enough to disconnect horn electrical connector(s).

2) Remove steering wheel lock nut and washer. Make alignment mark on steering shaft and steering wheel for installation reference. Install suitable steering wheel puller and pull steering wheel from shaft.

Installation

Align reference marks on steering shaft and steering wheel. Tighten steering wheel lock nut to 25 ft. lbs. (34 N.m). Connect horn wiring and install horn pad.

Removal (With Air Bag)

1) Ensure front wheels are in straight-ahead position. Place ignition switch in LOCK position and remove key. Disconnect negative battery cable. Remove 2 screw covers from sides of steering wheel. See Fig. 8. Using Torx Wrench (T30), loosen 4 air bag pad retaining screws until screw head is snug against screw case.

2) Carefully pull air bag pad away from steering wheel enough to unlock and disconnect air bag electrical connector. DO NOT forcefully pull on electrical connector or wiring. Place air bag pad aside with pad facing upward.

3) Remove steering wheel lock nut and washer from steering shaft. Make alignment mark on steering shaft and steering wheel for installation reference. Using appropriate steering wheel puller, pull steering wheel from shaft while guiding spiral cable wire through steering wheel opening.

Installation

1) Ensure front wheels are in straight-ahead position. Connect and install spiral cable to combination switch. Turn spiral cable counterclockwise by hand until it is hard to turn. Turn spiral cable clockwise about 2 1/2 turns and align Red mark at bottom with opening.

2) Guide spiral cable through steering wheel opening while installing steering wheel to shaft. Align reference marks on steering shaft and steering wheel. Tighten steering wheel lock nut to 25 ft. lbs. (34 N.m).

3) Connect air bag electrical connector and snap down connector lock. Ensure air bag pad Torx screws are retracted and snug against screw case. See Fig. 8. Install air bag pad to steering wheel ensuring wiring is not pinched and does not interfere with other moving parts. Tighten 4 Torx screws to 65 INCH lbs. (7.4 N.m). Install screw covers. Connect negative battery cable.

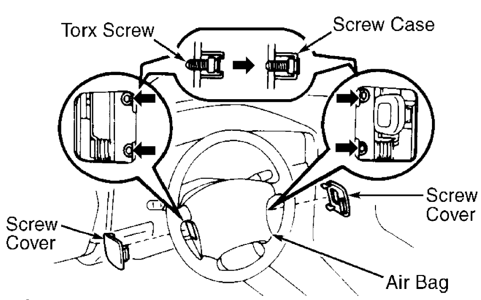


Fig. 8: Removing Air Bag From Steering Wheel
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAMS

Proceed to chassis WIRING DIAGRAMS article in WIRING DIAGRAMS section.

INTERFERENCE VERIFICATION CHECK FOR OHC ENGINE

1993 Toyota Celica

Maintenance & Service Information
1980-96 Toyota - Timing Belt Information

Avalon, Camry, Celica, Celica (ALL-TRAC), Celica Supra, Corolla, Corolla FX, Corolla Tercel, Cressida, GTS, MR2, Paseo, Pickup, RAV4, Supra, Tacoma, Tercel, T100, 4Runner

TIMING BELT INTERFERENCE VERIFICATION INFORMATION

TIMING BELT INTERFERENCE CAUTION

NOTE: CAMSHAFT DRIVE BELTS OR TIMING BELTS - The condition of camshaft drive belts should always be checked on vehicles which have more than 50,000 miles. Although some manufacturers do not recommend replacement at a specified mileage, others require it at 60,000-100,000 miles. A camshaft drive belt failure may cause extensive damage to internal engine components on most engines, although some designs do not allow piston-to-valve contact. These designs are often called "Free Wheeling". Many manufacturers changed their maintenance and warranty schedules in the mid-1980's to reflect timing belt inspection and/or replacement at 50,000-60,000 miles. Most service interval schedules shown in this section reflect these changes. Belts or components should be inspected and replaced if any of the following conditions exist:

* Crack Or Tears In Belt Surface
* Missing, Damaged, Cracked Or Rounded Teeth
* Oil Contamination
* Damaged Or Faulty Tensioners
* Incorrect Tension Adjustment

TIMING BELT INTERFERENCE CHECK MENU

TIMING BELT INTERFERENCE VERIF. TABLE - PASSENGER CARS (1)

Application	Engine	Replacement Interval (Miles)
Avalon		
1995-96	3.0L V6	60,000
Camry		
1983-86	(2) 1.9L 4-Cyl. Diesel	60,000
1983-87	2.0L 4-Cyl.	60,000
1988-91	2.0L 4-Cyl.	60,000
	2.5L V6	60,000
1992-96	2.2L 4-Cyl.	60,000
	3.0L V6	60,000
Celica		
1986-94	2.0L 4-Cyl.	60,000
1990-93	1.6L 4-Cyl.	60,000
1990-96	2.2L 4-Cyl. "5SFE"	60,000
1994-96	1.8L 4-Cyl. "7AFE"	60,000
Celica (ALL-TRAC)		
1993-94	2.0L 4-Cyl. "3SGTE"	60,000
Celica Supra		
1982-85	2.8L 6-Cyl.	60,000
Corolla		

1983-88	1.6L 4-Cyl. (Exc. GTS)	60,000
1983-86	(2) 1.8L 4-Cyl. Diesel	60,000
1985-86	1.6L 4-Cyl. (GTS)	60,000
1988-96	1.6L 4-Cyl. (Exc. FX)	60,000
1993-96	1.8L 4-Cyl.	60,000
Corolla FX		
1988	1.6L 4-Cyl.	60,000
Corolla Tercel		
1980-81	1.5L 4-Cyl.	60,000
Cressida		
1983-88	2.8L 6-Cyl.	60,000
1989-92	3.0L 6-Cyl.	60,000
GTS		
1989-92	1.6L 4-Cyl.	60,000
MR2		
1985-89	1.6L 4-Cyl.	60,000
1991-95	2.0L 4-Cyl.	60,000
	2.2L 4-Cyl.	60,000
Paseo		
1992-96	1.5L 4-Cyl.	60,000
Supra		
1983-85	2.8L 6-Cyl.	60,000
1986-92	3.0L 6-Cyl. "7MGE" & "7MGTE"	60,000
1993-96	3.0L 6-Cyl. "2JZGE" & "2JZGTE"	60,000
Tercel		
1980-86	(2) 1.5L 4-Cyl.	60,000
1987	(2) 1.5L 4-Cyl. "3E" (Exc. Wagon)	60,000
1987-88	1.5L 4-Cyl. "3AC" (Wagon)	60,000
1988-94	(2) 1.5L 4-Cyl. "3E"	60,000
1995-96	1.5L 4-Cyl. "5EFE"	60,000

(1) - Other interference engine applications may exist which are not indicated here.

(2) - Interference engine. Check for possible damage to piston(s) or valve(s) if there has been a timing belt failure.

TIMING BELT INTERFERENCE VERIF. TABLE - LIGHT TRUCKS (1)

Application	Engine	Replacement Interval (Miles)
Pickup		
1981-83	(2) 2.2L 4-Cyl. Diesel	60,000
1984-87	(2) 2.4L 4-Cyl. Diesel	100,000
1988-92	3.0L V6 "3VZE"	60,000
1993-95	3.0L V6 "3VZE"	60,000
RAV4		
1996	2.0L 4-Cyl. "3SFE"	60,000
Tacoma		
1995-96	3.4L V6 "5VZFE"	60,000
T100		
1993-94	3.0L V6 "3VZE"	60,000
1995-96	3.4L V6 "5VZFE"	60,000
4Runner		
1988-95	3.0L V6 "3VZE"	60,000
1996	3.4L V6 "5VZFE"	60,000

(1) - Other interference engine applications may exist which are not indicated here.
(2) - Interference engine. Check for possible damage to piston(s) or valve(s) if there has been a timing belt failure.

JACKING & HOISTING

1993 Toyota Celica

1993 WHEEL ALIGNMENT
Toyota Jacking & Hoisting

Celica

JACKING & HOISTING

FLOOR JACK

To raise vehicle front, place floor jack under center of front longitudinal engine crossmember. For vehicle rear, place floor jack under rear suspension crossmember.

EMERGENCY JACKING

Place emergency jack on reinforced support points of side body panel (between front and rear wheels). Safety stands may also be placed at these points. See Fig. 1.

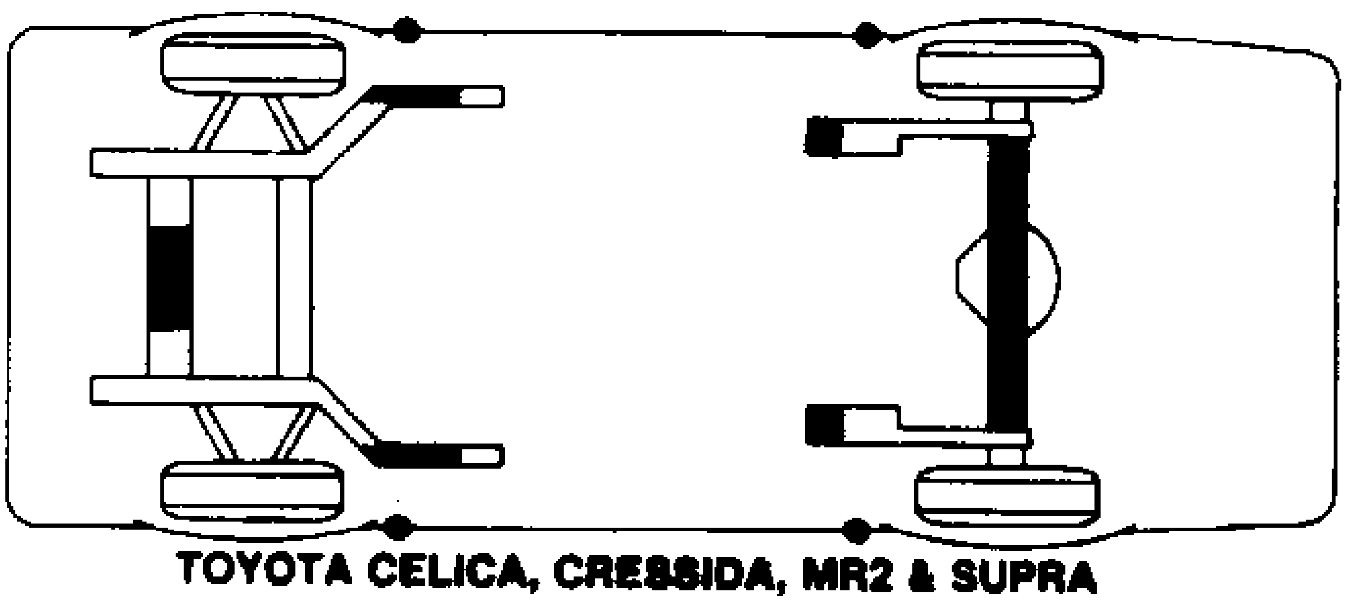


Fig. 1: Identifying Jacking & Hoisting Support Points
Courtesy of Toyota Motor Sales, U.S.A., Inc.

LIFTING VEHICLE WITH HOIST

Place lift blocks on reinforced support points of side body panel (between front and rear wheels). Safety stands may also be placed at these points. See Fig. 1.

MAINTENANCE INFORMATION

1993 Toyota Celica

1990-96 MAINTENANCE
Toyota Maintenance Information

Celica

* PLEASE READ THIS FIRST *

NOTE: For scheduled maintenance intervals and the related fluid capacities, fluid specifications and labor times for major service intervals, see SCHEDULED SERVICES article below:

* SCHEDULED SERVICES - TURBO
* SCHEDULED SERVICES - NON-TURBO

Warranty information and specifications for fluid capacities, lubrication specifications, wheel and tire size, and battery type are covered in this article.

MODEL IDENTIFICATION

VIN LOCATION

The Vehicle Identification Number (VIN) is located on the left side of the dash panel at the base of the windshield. The VIN chart explains the code characters.

VIN CODE ID EXPLANATION

Numbers preceding the explanations in the legend below refer to the sequence of characters as listed on VIN identification label. See VIN example below.

(VIN)	J	T	2	S	T	8	7	N	2	P	1	1	0	0	0	0	1
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

1 - Manufacturing Country
J * Japan

2 - Manufacturer
T * Toyota

3 - Vehicle Type
2 * Passenger Vehicle (Japan)
5 * Incomplete Vehicle (Celica Convertible)

4 - Engine (1990-95)
A * 4A-FE 1.6L EFI
A * 7A-FE 1.8L EFI
S * 3S-GTE 2.0L Turbo EFI
S * 5S-FE 2.2L EFI

4 - Body Type (1996)
C * 2-Door Coupe
D * 3-Door Liftback
F * 2-Door Convertible

5-6 - Line (1990-95)
 T8 * Celica (1990-93)
 T0 * Celica (1994-95)

5 - Engine (1996)
 B * 5S-FE 1.8L 4-Cylinder
 G * 5S-FE 2.2L 4-Cylinder

6 - Series/Grade (1996)
 2 * All Models

7 - Series/Grade (1990-95)
 5 * GT-S
 6 * ST
 7 * GT
 8 * All-Trac/4WD
 0 * ST

7 - Restraint System (1996)
 2 * 2 Air Bags

8 - Body Type & Restraint System (1990-95)
 F * 2-Door Coupe
 K * Incomplete Vehicle (Convertible Conversion)
 N * 3-Door Liftback
 P * 3-Door Liftback 4WD

8 - Line (1996)
 T * Celica

9 - VIN Check Digit
 2 * Manufacturer's Internal Code

10 - Vehicle Model Year
 L * 1990
 M * 1991
 N * 1992
 P * 1993
 R * 1994
 S * 1995
 T * 1996

11 - Assembly Plant
 1 * Toyota, Japan
 2 * Motomachi, Japan
 0-9 * Japan
 C * Canada
 U * Georgetown, United States
 Z * United States
 0 * Japan

12-17 - Serial Number
 * Sequential Production Number

MAINTENANCE SERVICE INFORMATION

SEVERE & NORMAL SERVICE DEFINITIONS

Service is recommended at mileage intervals based on vehicle operation and engine type. Service schedules are based on the following primary operating conditions:

Normal Service

* Driven More Than 10 Miles Daily
* No Operating Conditions From Severe Service Schedule

Severe Service (Unique Driving Conditions)

* Towing A Trailer, Using A Camper Or Car Top Carrier
* Repeated Short Trips Less Than 5 Miles When Temperatures Are Below Freezing
* Extensive Idling Conditions (Taxi Or Delivery Type Service)
* Operating On Dusty, Rough, Muddy Or Salt Spread Roads

CAMSHAFT TIMING BELT

CAUTION: Failure to replace a faulty camshaft timing belt may result in serious engine damage.

The condition of camshaft drive belts should always be checked on vehicles which have more than 50,000 miles. Although some manufacturers do not recommend belt replacement at a specified mileage, others require it at 60,000-100,000 miles. A camshaft drive belt failure may cause extensive damage to internal engine components on most engines, although some designs do not allow piston-to-valve contact. These designs are often called "Free Wheeling".

Many manufacturers changed their maintenance and warranty schedules in the mid-1980's to reflect timing belt inspection and/or replacement at 50,000-60,000 miles. Most service interval schedules in this manual reflect these changes.

Belts or components should be inspected and replaced if any of the following conditions exist:

* Cracks Or Tears In Belt Surface
* Missing, Damaged, Cracked Or Rounded Teeth
* Oil Contamination
* Damaged Or Faulty Tensioners
* Incorrect Tension Adjustment

Replace the camshaft timing belt every 72 months or 60,000 miles if the vehicle is operated under Severe Service conditions such as frequent idling or extensive long distance driving at low speeds (taxi, police or door-to-door delivery).

SERVICE POINT LOCATIONS

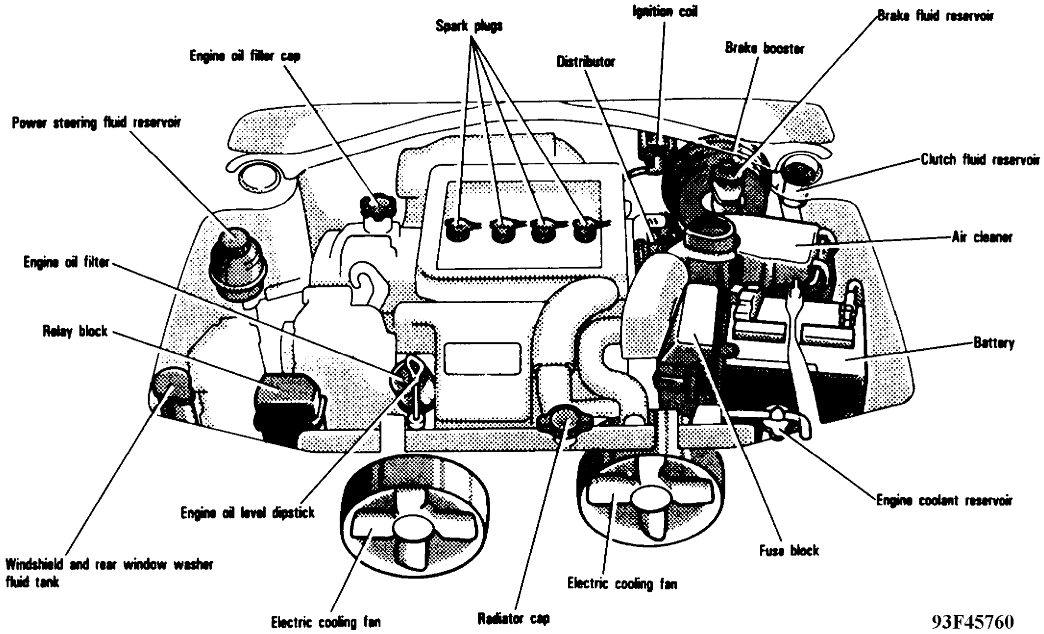


Fig. 1: Service Point Locations (3S-GTE Engine (Turbo))
Courtesy of Toyota Motor Sales, U.S.A., Inc.

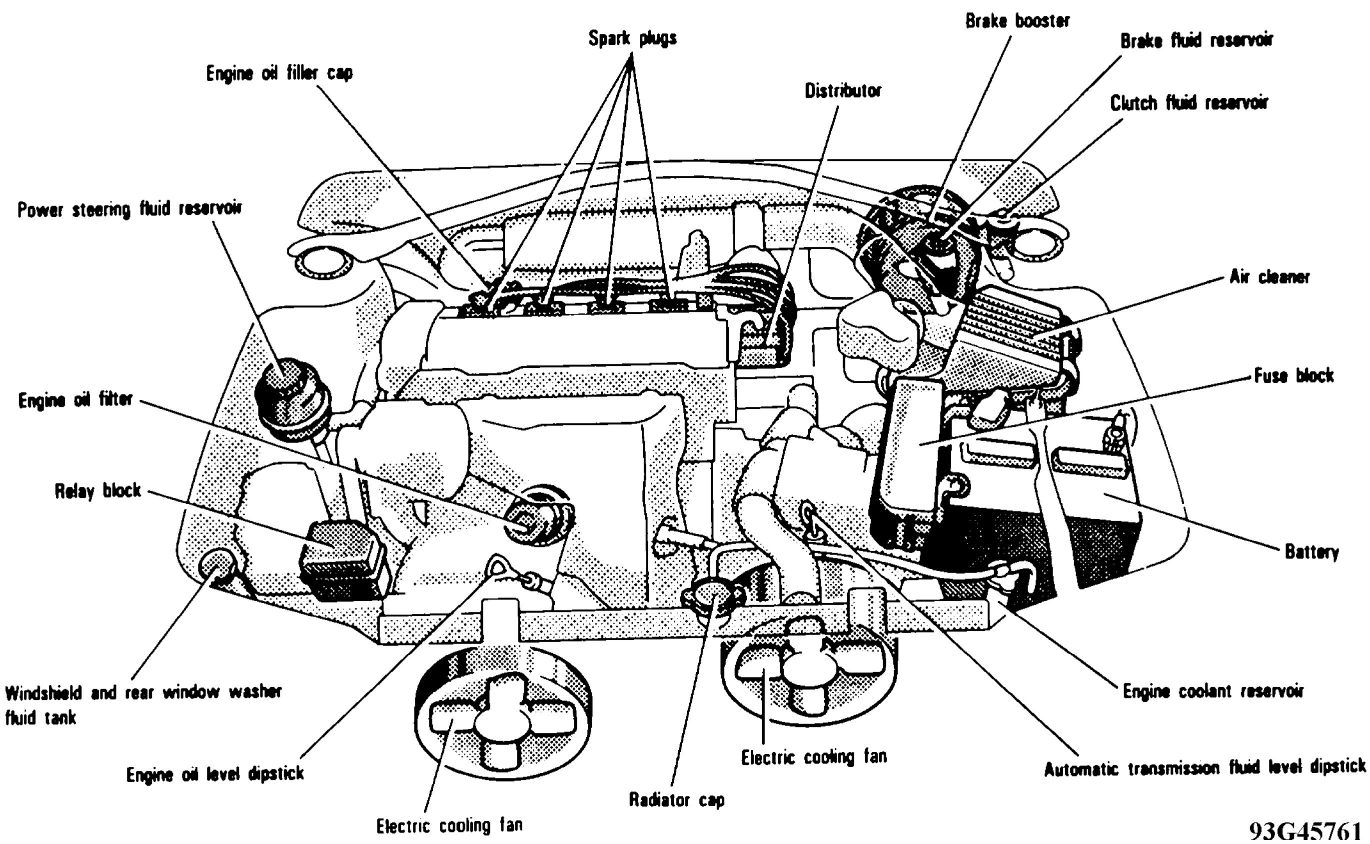


Fig. 2: Service Point Locations (5S-FE Engine)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

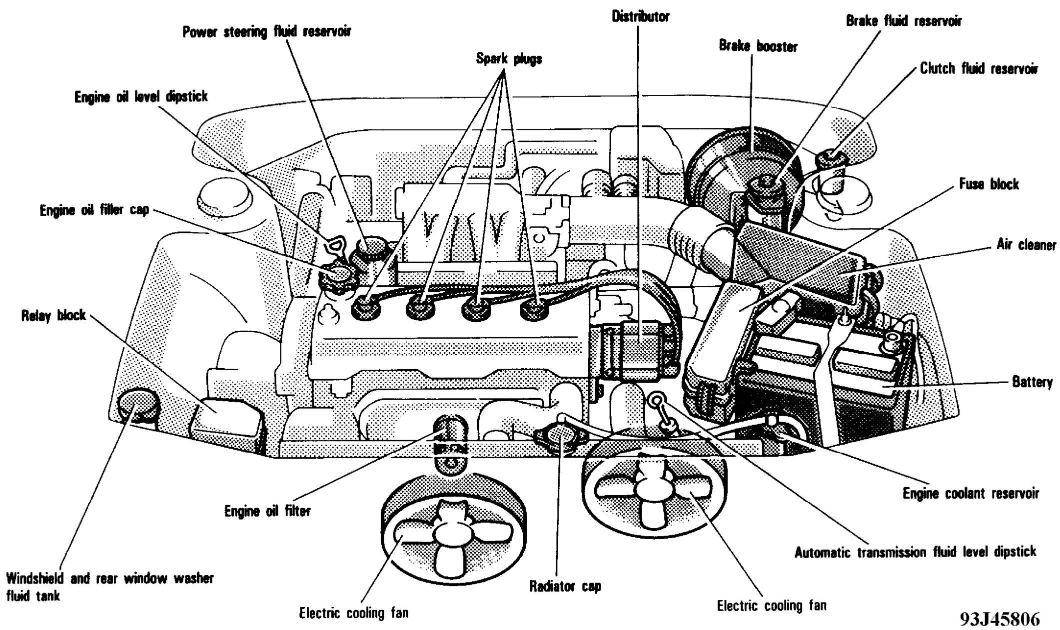


Fig. 3: Service Point Locations (4A-FE Engine)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

INFORMATION LABEL LOCATIONS

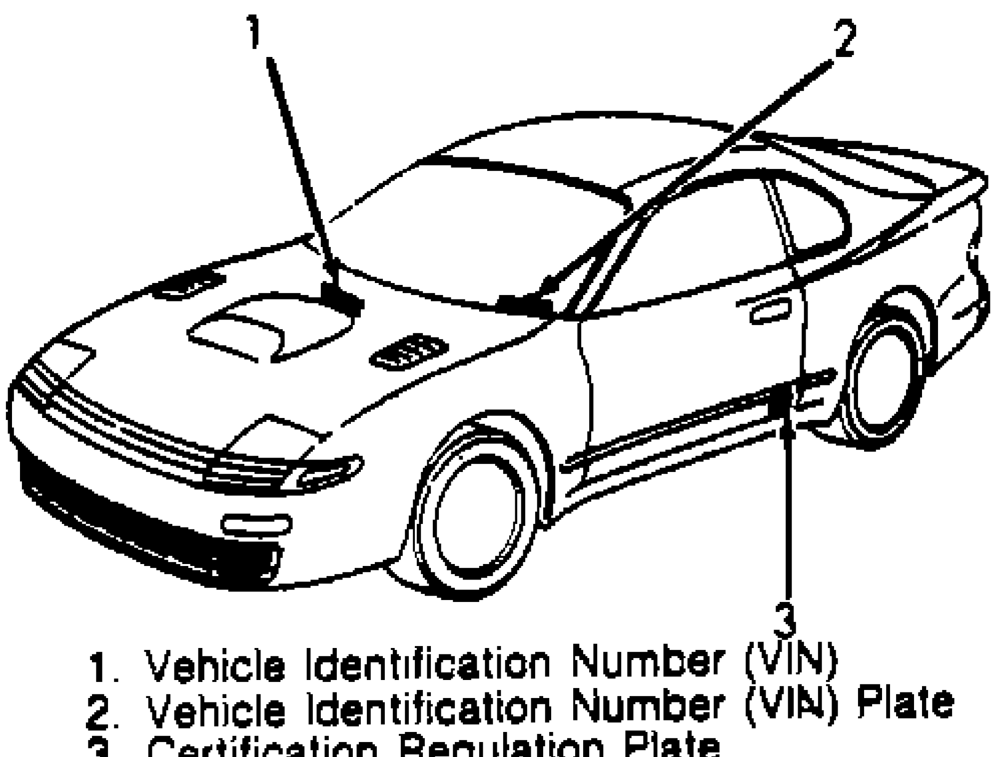


Fig. 4: Information Label Locations
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SERVICE LABOR TIMES

SERVICE LABOR TIMES TABLE (HOURS)

Application	15,000 Mile Service	30,000 (60,000) Mile Service
1.6L 4A-FE		
Automatic Transaxle	1.5	2.0 ((1) 4.5)
Manual Transaxle	1.5	2.0 ((1) 4.5)
2.0L Turbo 3S-GTE		
Manual Transaxle	1.7	2.2 ((2) 5.7)
2.2L 5S-FE EFI		
Automatic Transaxle	1.5	2.0 ((1) 4.5)
Manual Transaxle	1.5	2.0 ((1) 4.5)

(1) - Add 2.3 hours to replace camshaft timing belt.
(2) - Add 3.5 hours to replace camshaft timing belt.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Application	Fluid Specifications
Automatic Transaxle	Dexron-IIE ATF
Brake & Clutch Fluid	SAE J1703 Or FMVSS No. 116 DOT 3 Brake Fluid
Differential (4WD)	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 (1)(2) API GL-3
4WD & Transfer Case	SAE 75W-90 Or 80W-90 API GL-5
Power Steering Fluid	Dexron-IIE ATF

(1) - If API GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10 043 December 1991.

FLUID CAPACITIES

FLUID CAPACITIES TABLE (1)

Application	Quantity
A/C System R-12 Refrigerant	
1990-93	24-28 Ozs.
A/C System R-134a Refrigerant (2)	
1994	21-24.6 Ozs.
Cooling System	
4A-FE 1.6L	5.5-5.9 Qts. (5.2-5.6L)

5S-FE 2.2L	6.9-7.0 Qts. (6.5-6.6L)
3S-GTE 2.0L	6.3 Qts. (6.0L)
7A-FE 1.8L	6.4-7.0 Qts. (6.1-6.6L)
Engine Oil (3)	
4A-FE 1.6L	3.4 Qts. (3.2L)
5S-FE 2.2L (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE 2.2L (W/ Oil Cooler)	4.5 Qts. (4.2L)
3S-GTE 2.0L	3.8-4.1 Qts. (3.6-3.9L)
7A-FE	3.9 Qts. (3.7L)
Fuel Tank	
All-Trac 4WD	18 Gals. (68L)
Except All-Trac	15.9 Gals. (60L)
Transmission	
Automatic	
All Except 5S-FE (1994)	3.5 Qts. (3.3L)
5S-FE (1994)	2.6 Qts. (2.5L)
Manual	
All Except 3S-GTE	2.7 Qts. (2.6L)
3S-GTE	5.5 Qts. (5.2L)
Rear Differential	
4WD only	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Use of R-12 in a R-134a system will result in SEVERE DAMAGE.
(3) - Includes filter change.

WHEEL & TIRE SPECIFICATIONS

WHEEL & TIRE SIZE SPECIFICATIONS TABLE

Wheel Size	Tire Size
13 x 5J"	165SR13
13 x 5.5J"	P185 x 70R
14 x 6JJ"	P185 x 65R
15 x 6JJ"	P205/55R
15 x 6.5JJ"	P195/60R
15 x 6.5JJ"	P215 x 50R
14 x 4T" (Compact Spare)	T125 x 70D
16 x 4T" (Compact Spare)	T135 x 70D

TIRE INFLATION

TIRE INFLATION PRESSURES

Tire Size	Front psi (kg/cm²)	Rear psi (kg/cm²)
165SR13	30 (2.1)	29 (2.0)
185/65R14	29 (2.0)	28 (1.9)
195/60R15	36 (2.5)	36 (2.5)
215/50R15 (Exc. 4WD)	30 (2.1)	28 (1.9)
215/50R15 (4WD)	32 (2.2)	30 (2.1)
P205/55R15	33 (2.3)	32 (2.2)
T135/70D16	60 (4.2)	60 (4.2)

WHEEL TIGHTENING

Tighten all wheel lug nuts to 76 ft. lbs. (103 N.m).

BATTERY SPECIFICATIONS

CAUTION: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section.

If battery is replaced, it should be of the same group number as shown on the original battery’s label. All models use batteries with BCI group number 24F.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) AIR BAG SYSTEM

NOTE: See the AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT Section.

The SRS has no user-servicable parts. Always have servicing done by an authorized dealer.

When performing maintenance on air bag equipped vehicles always observe proper safety precautions.

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all warnings and service precautions. See appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

CAUTION: Disconnect negative battery cable before servicing any air bag system, steering column or passenger side dash component. After any repair, turn ignition key to the ON position from passenger’s side of vehicle in case of accidental air bag inflation

ANTI-LOCK BRAKE SYSTEM (ABS)

CAUTION: Never mix different diameter tires. On loose or uneven surfaces, the ABS system may require longer stopping distances than conventional brake systems. Exercise caution when removing mud or snow from the wheels so as not to damage the ABS wiring or speed sensors.

BATTERY WARNING

WARNING: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See appropriate COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION section below.

REPLACING BLOWN FUSES

Before replacing a blown fuse, remove ignition key, turn off all lights and accessories to avoid damaging the electrical system. Be sure to use fuse with the correct indicated amperage rating. The use of an incorrect amperage rating fuse may result in a dangerous electrical system overload.

BRAKE PAD WEAR INDICATOR

Indicator will cause a squealing or scraping noise, warning that brake pads need replacement.

CATALYTIC CONVERTER

Continued operation of vehicle with a severe malfunction could cause converter to overheat, resulting in possible damage to converter and vehicle.

COOLANT (PROPYLENE-GLYCOL FORMULATIONS)

CAUTION: To avoid possible damage to vehicle use only ethylene-glycol based coolants with a mixture ratio from 44-68% anti-freeze. DO NOT use 100% anti-freeze as it will cause the formation of cooling system deposits. This results in coolant temperatures of over 300° F (149°C) which can melt plastics. 100% anti-freeze has a freeze point of only -8° F (-22°C).

CAUTION: Propylene-Glycol Mixtures has a smaller temperature range than Ethylene-Glycol. The temperature range (freeze-boil) of a 50/50 Anti-Freeze/Water Mix is as follows:

Propylene-Glycol -26° F (-32°C) - 257° F (125°C)
Ethylene-Glycol -35° F (-37°C) - 263° F (128°C)

CAUTION: Propylene-Glycol/Ethylene-Glycol Mixtures can cause the destabilization of various corrosion inhibitors. Also Propylene-Glycol/Ethylene-Glycol has a different specific gravity than Ethylene-Glycol coolant, which will result in inaccurate freeze point calculations.

ELECTROSTATIC DISCHARGE SENSITIVE (ESD) PARTS

WARNING: Many solid state electrical components can be damaged by static electricity (ESD). Some will display a warning label, but many will not. Discharge personal static electricity by touching a metal ground point on the vehicle prior to servicing any ESD sensitive component.

ENGINE OIL

CAUTION: Never use non-detergent or straight mineral oil.

FUEL SYSTEM SERVICE

WARNING: Relieve fuel system pressure prior to servicing any fuel system component (fuel injection models).

HALOGEN BULBS

WARNING: Halogen bulbs contain pressurized gas which may explode if overheated. DO NOT touch glass portion of bulb with bare hands. Eye protection should be worn when handling or working around halogen bulbs.

RADIATOR CAP

CAUTION: Always disconnect the fan motor when working near the radiator fan. The fan is temperature controlled and could start at any time even when the ignition key is in the OFF position. DO NOT loosen or remove radiator cap when cooling system is hot.

RADIATOR FAN

WARNING: Keep hands away from radiator fan. Fan is controlled by a thermostatic switch which may come on or run for up to 15 minutes even after engine is turned off.

CATALYTIC CONVERTER

To prevent catalytic converter overheating and possibly creating a fire hazard, do not allow engine to idle for more than 20 minutes, avoid spark jump test and prolonged engine compression measurement.

WARRANTY INFORMATION

CAUTION: Always refer to customer's copy of warranty information for specific model application and/or coverage limitations.

NEW VEHICLE LIMITED WARRANTY

Covers any repair or replacement of parts which becomes necessary due to defects in materials or workmanship under normal use for 36 months or 36,000 miles from in-service date.

POWERTRAIN WARRANTY

Engine, transmission, front wheel drive, rear wheel drive and restraint systems are warranted against defects in materials or workmanship under normal use for 5 years or 60,000 miles, whichever occurs first. See copy of warranty for specific components covered.

CORROSION PERFORATION WARRANTY

Covers any repair or replacement to body sheet metal which develops corrosion perforation (hole through panel), in normal use, due to defects in material or workmanship for a period of 5 years, regardless of mileage.

BATTERY WARRANTY

Covers replacement of defective original battery for first 12 months or 12,000 miles. After the first 12 months or 12,000 miles, warranty covers a pro-rated amount based on months in service, up to a maximum of 36 months.

AIR CONDITIONER REFRIGERANT CHARGE WARRANTY

Covers the air conditioner refrigerant for the first 12 months, regardless of mileage, unless done as a warranty repair.

ADJUSTMENTS WARRANTY

Service adjustments - minor repairs not usually associated with the replacement of parts - are covered for the first 12 months or 12,500 miles, whichever occurs first.

EMISSION SYSTEM DEFECT WARRANTY (EXCEPT CALIFORNIA)

Warrants to the retail purchaser, and subsequent purchaser that vehicle was designed, built, and equipped so as to conform at the time of sale with applicable emission regulations and that it is free from defects in materials or workmanship which may cause the vehicle to fail to conform with applicable regulations for 5 years or 50,000 miles, whichever occurs first.

EMISSION SYSTEM PERFORMANCE WARRANTY (EXCEPT CALIFORNIA)

Covers all repairs, adjustments, or replacements if vehicle fails to conform to applicable emission standards and such failure results in the vehicle owner having to bear a penalty or other sanction under local, state or federal law for 5 years or 50,000 miles, whichever comes first. If the vehicle has been in use for more than 24 months or 24,000 miles, the manufacturer will make the necessary adjustments, repairs or replacements at no cost to the owner only when noncompliance is caused by failure of components which have been installed in the vehicle for the sole or primary purpose of reducing vehicle emissions. See copy of warranty for specific components covered.

EMISSION SYSTEM PERFORMANCE WARRANTY (CALIFORNIA)

For a period of 3 years or 50,000 miles, manufacturer will make all necessary repairs and adjustments to ensure vehicle passes a required Smog Check inspection.

EMISSION SYSTEM DEFECT WARRANTY (CALIFORNIA)

Warrants vehicle to be free of defects in materials or workmanship, which may cause it to fail to conform with applicable California emission regulations, for a period of 5 years or 50,000 miles, whichever occurs first. Certain emission-related parts are covered for repair or replacement for 7 years or 70,000 miles, whichever occurs first. See copy of warranty for specific components covered.

FUSES & CIRCUIT BREAKERS

FUSE PANEL LOCATION

There are 3 fuse panels on this vehicle. The driver's side fuse box is located behind the driver's kick panel. The passenger's side fuse box is behind the passenger's side kick panel. The main fuse and relay block is in the engine compartment.

PASSENGER COMPARTMENT FUSE BOXES IDENTIFICATION (1990-93)

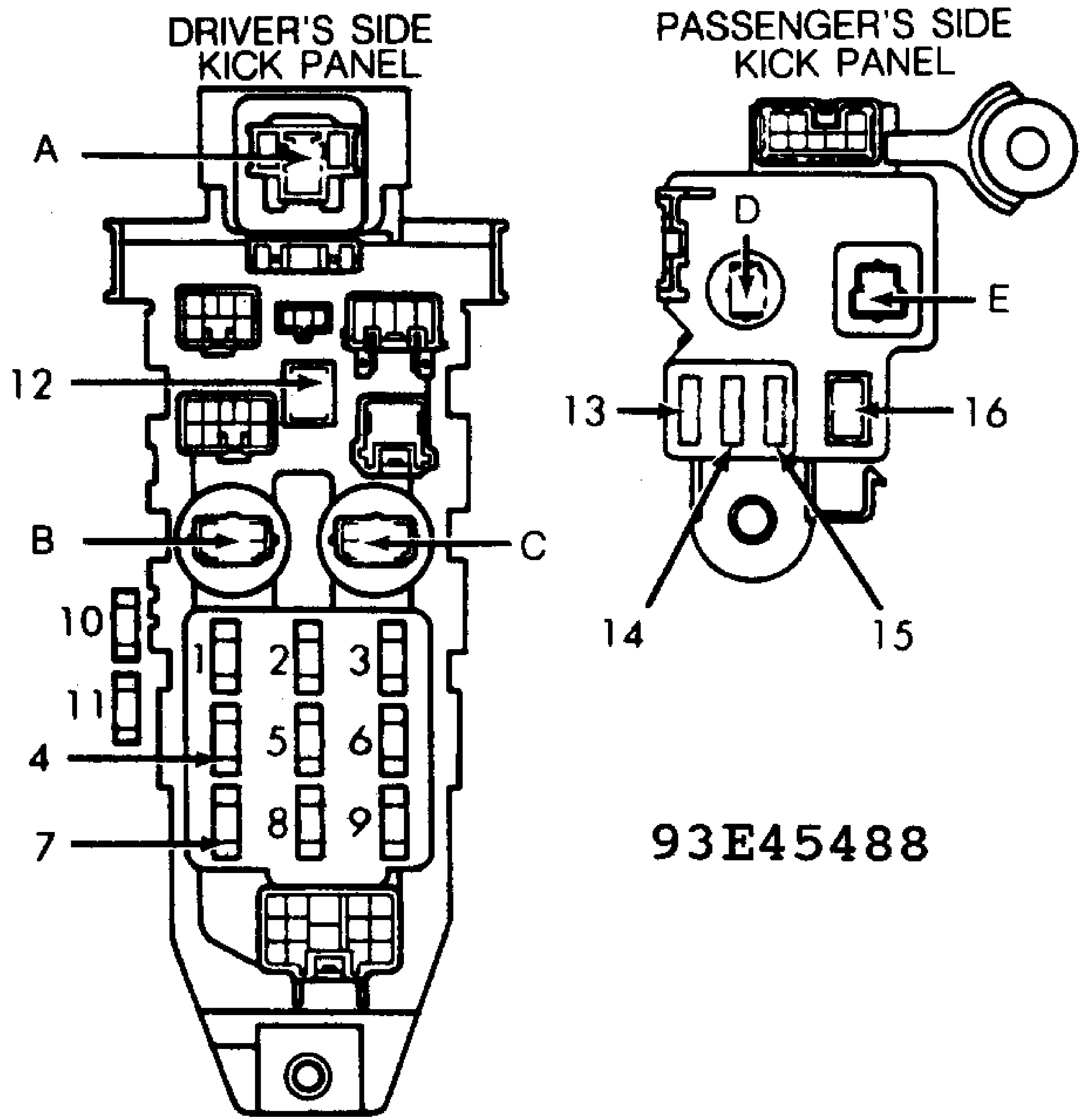


Fig. 5: Passenger Compartment Fuse Identification (1990-93)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fuse & Circuit Breaker Identification

1 - 7.5 Amp
Charging System & Discharge Warning Light, Electric Cooling Fans & EFI System
2 - 15 Amp
Cigarette Lighter & Digital Clock, Radio, Cassette Player &

Compact Disc Player
3 - 15 Amp
Stoplights & Cruise Control Cancel Device
4 - 15 Amp
Gauges, Warning Lights & Buzzer, Back-Up Lights & A/T Overdrive System, Rear Window Defogger & Power Antenna, Tilt Steering, Convertible Top Control
5 - 10 Amp
Turn Signal Lights
6 - 15 Amp
Electric Sun Roof
7 - 20 Amp
Wipers & Washers
8 - 15 Amp
Anti-Lock Brake System
9 - 15 Amp
Taillights, Parking Lights, Side Marker Lights, License Lights, Instrument Lights, Glove Box Light
10 - Blank
11 - 10 Amp
Rear View Mirror
12 - 30 Amp (Circuit Breaker)
Defogger
13 - Blank
14 - 20 Amp
Front Foglights
15 - 10 Amp
Air Conditioning
16 - 40 Amp (Circuit Breaker)
Heater, A/C Control System

Relay Identification

A - Turn Signal Flasher
B - Defogger
C - Taillight Control
D - Starter
E - Heater Main

ENGINE COMPARTMENT MAIN FUSE & RELAY IDENTIFICATION (1990-93)

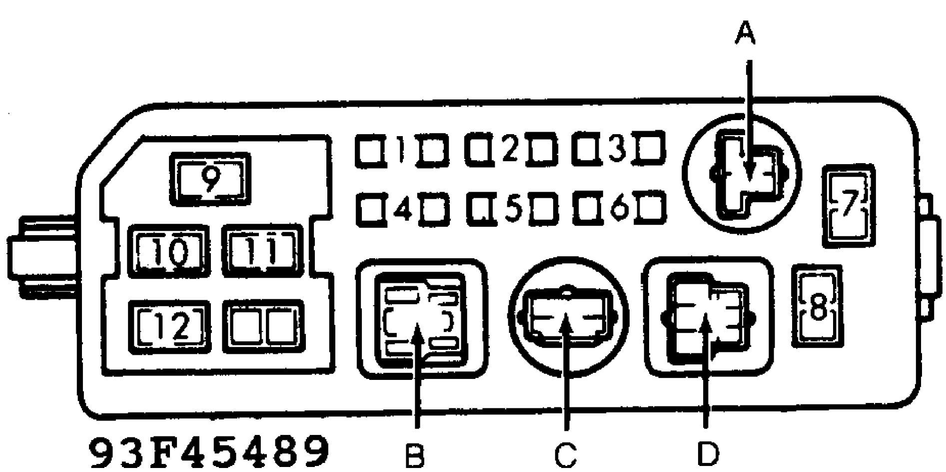


Fig. 6: Engine Compartment Main Fuse & Relay (1990-93)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fuse & Circuit Breaker Identification

1 - 15 Amp
Headlight (Left Side)
2 - 30 Amp
Retractable Headlight System
3 - 15 Amp
Headlight (Right Side)
4 - 15 Amp
EFI System
5 - 20 Amp
Radio, Cassette Player & Compact Disc Player, Power Antenna, Clock, Interior & Personal Lights, Door Courtesy Lights, Luggage Compartment Light, Trunk Light, Ignition Switch, Open Door Warning Lights
6 - 15 Amp
Hazard Flashers & Horns
7 - 30 Amp (Circuit Breaker)
Cooling Fan
8 - 30 Amp (Circuit Breaker)
Condenser Cooling Fan
9 - 100 Amp (Circuit Breaker)
Charging System
10 - 40 Amp (Circuit Breaker)
AM2
30 Amp (1992-93)
Electronic Fuel Injection, Ignition System
11 - 30 Amp (Circuit Breaker)
AM1
40 Amp (1992-93)
Charging System, Electric Underhood Cooling Fan
12 - 60 Amp (Circuit Breaker)
Anti-Lock Brake System

Relay Identification

A - Fan No. 1
B - Headlight Control
C - EFI System
D - Engine Main

FUSE PANEL IDENTIFICATION (1994-96)

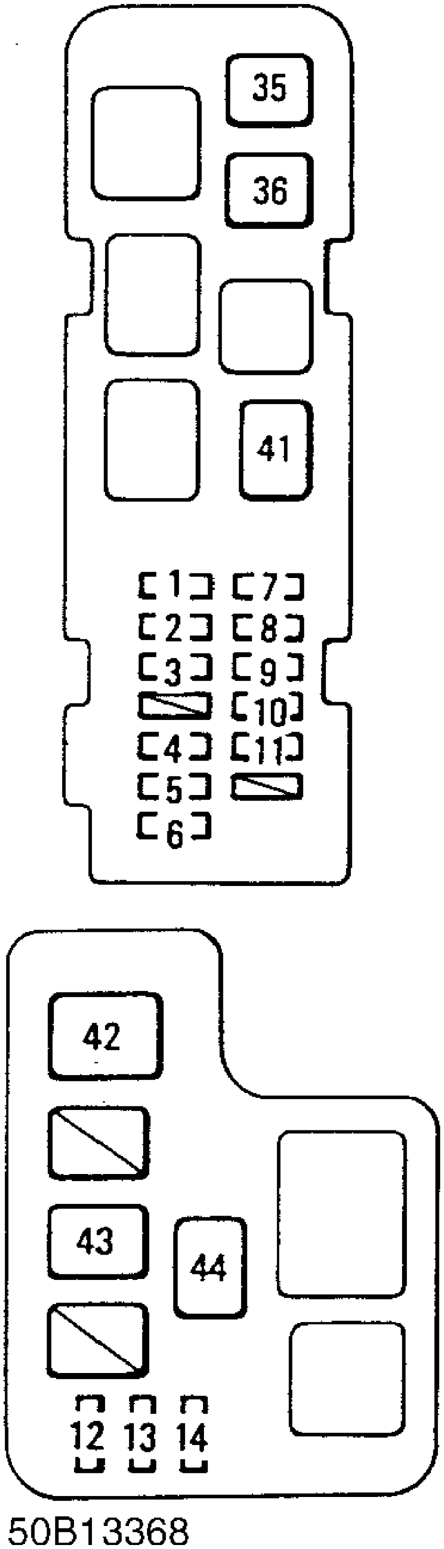
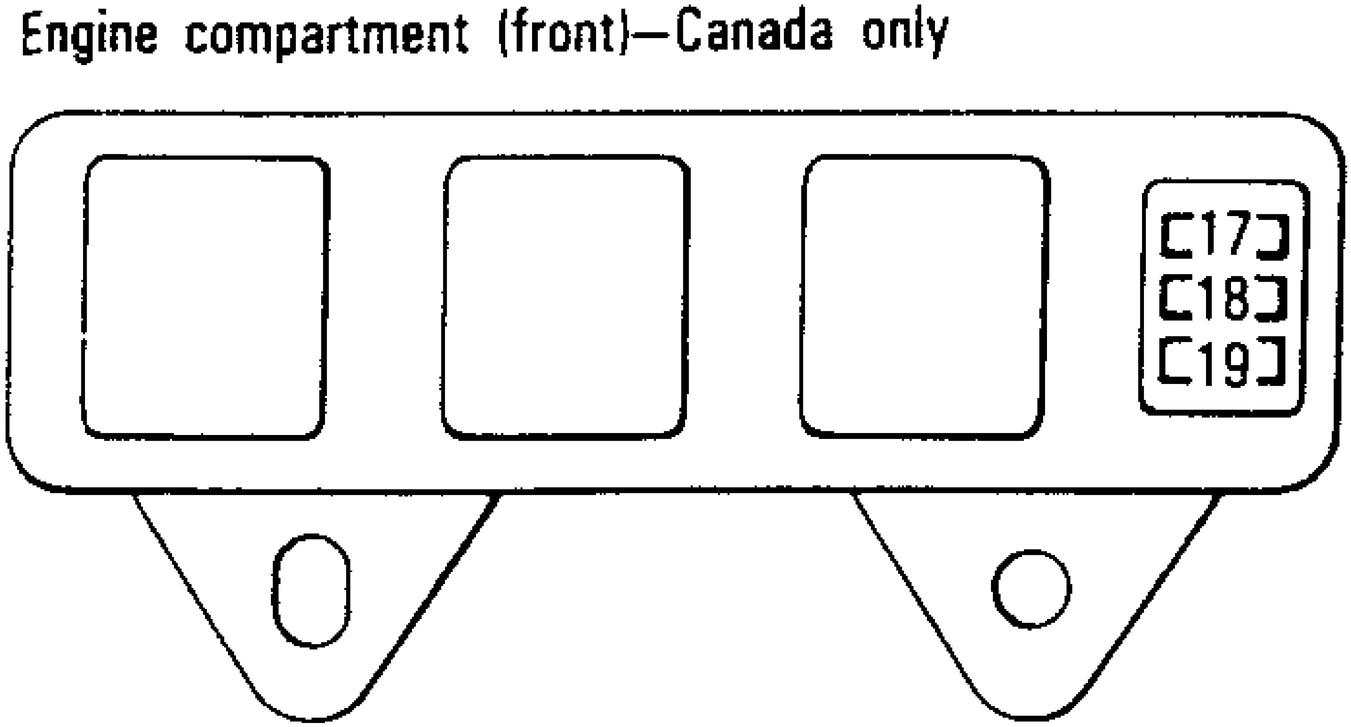
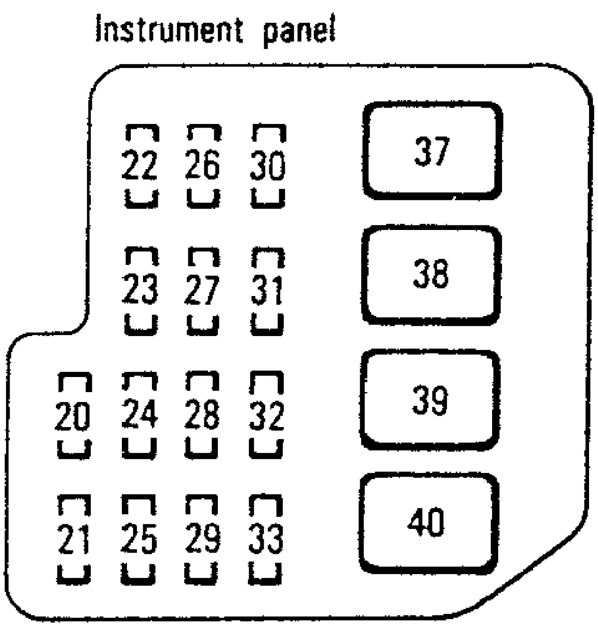


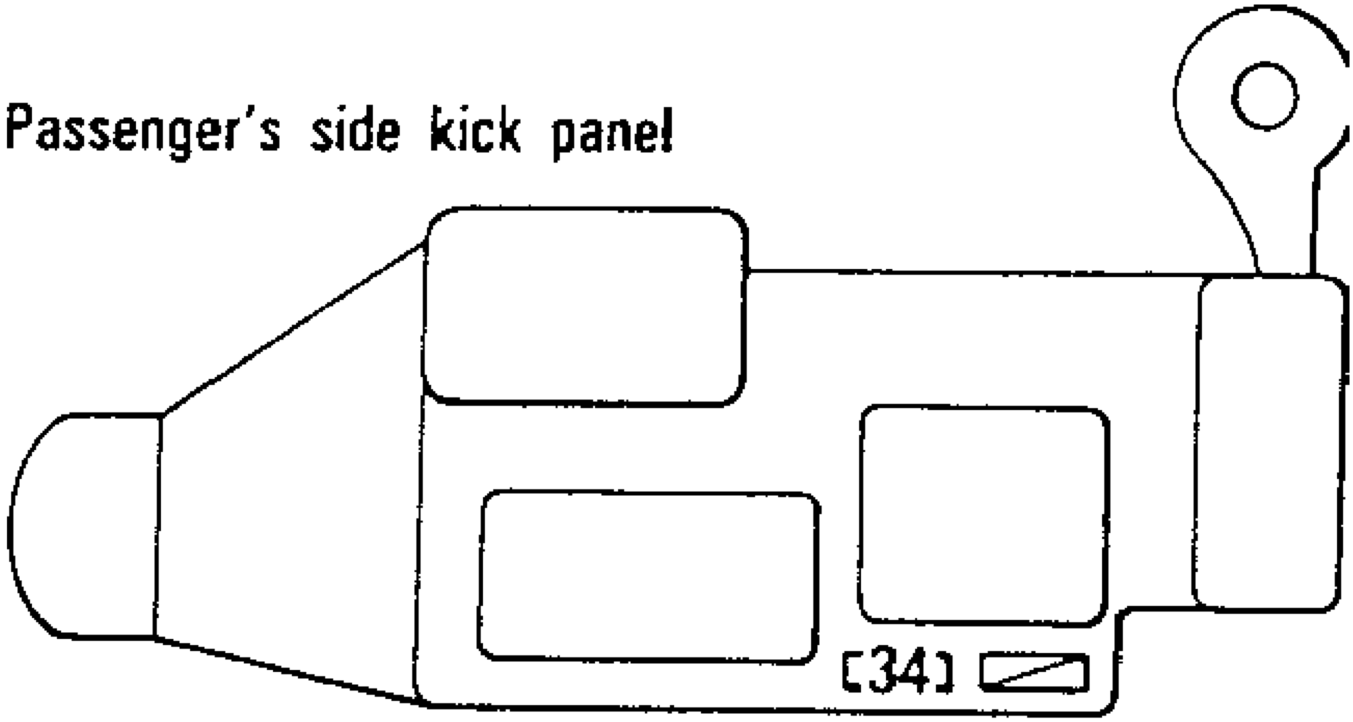
Fig. 7: Engine Compartment Main Fuse Identification (1994-95)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



50C13369
Fig. 8: Engine Compartment (Front) ID (Canada Only) (1994-96)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

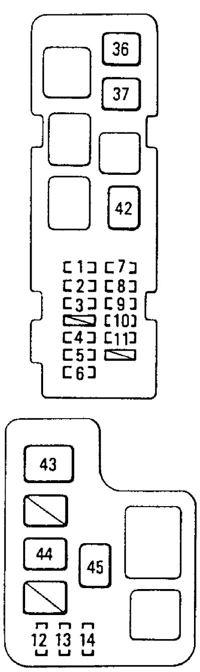


50F13370
Fig. 9: Instrument Panel Identification (1994-95)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



50G13371

Fig. 10: Passenger Side Kick Panel Identification (1994-95)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



50H13372

Fig. 11: Engine Compartment Main Fuse Identification (1996)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

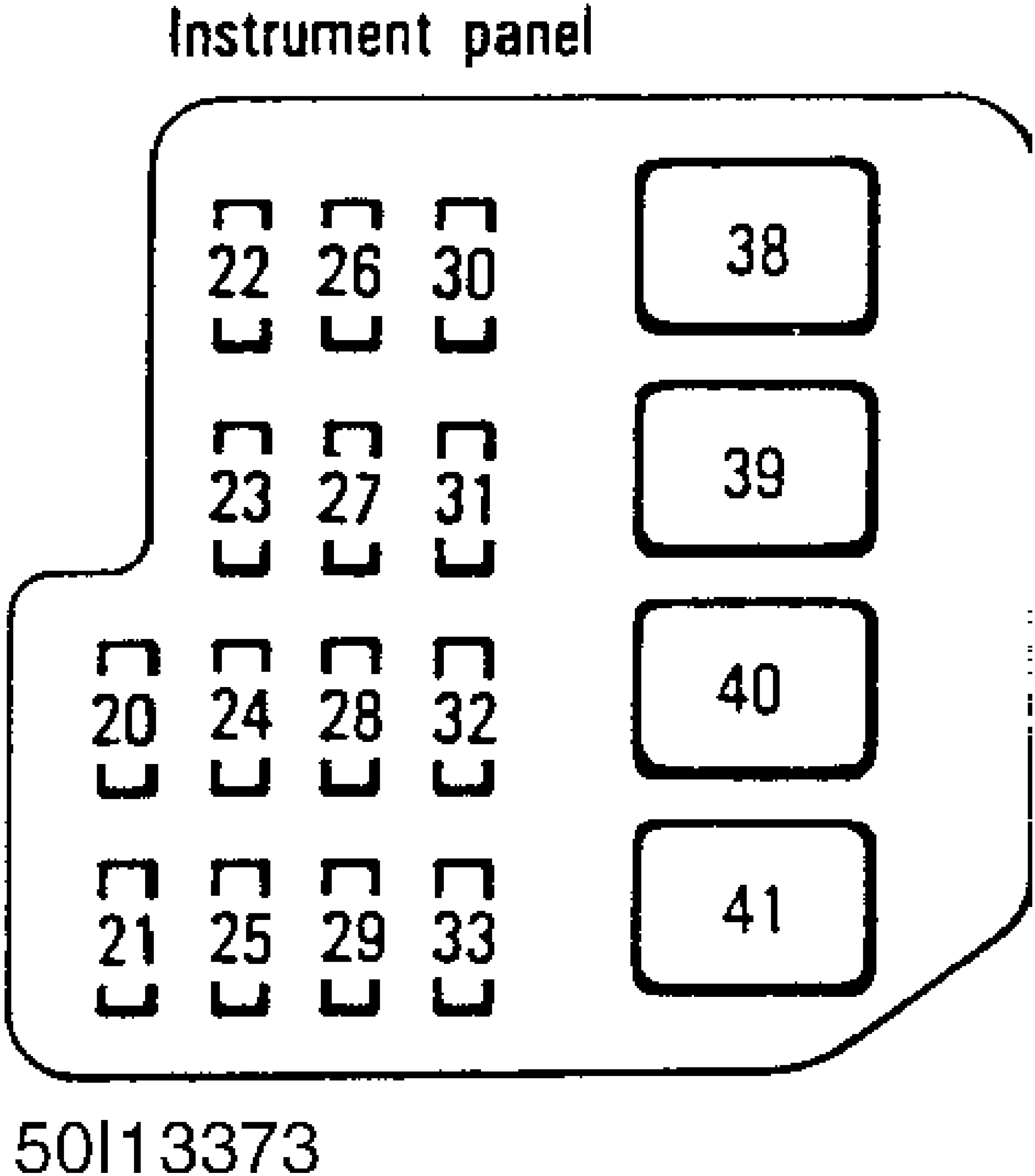


Fig. 12: Instrument Panel Identification (1996)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

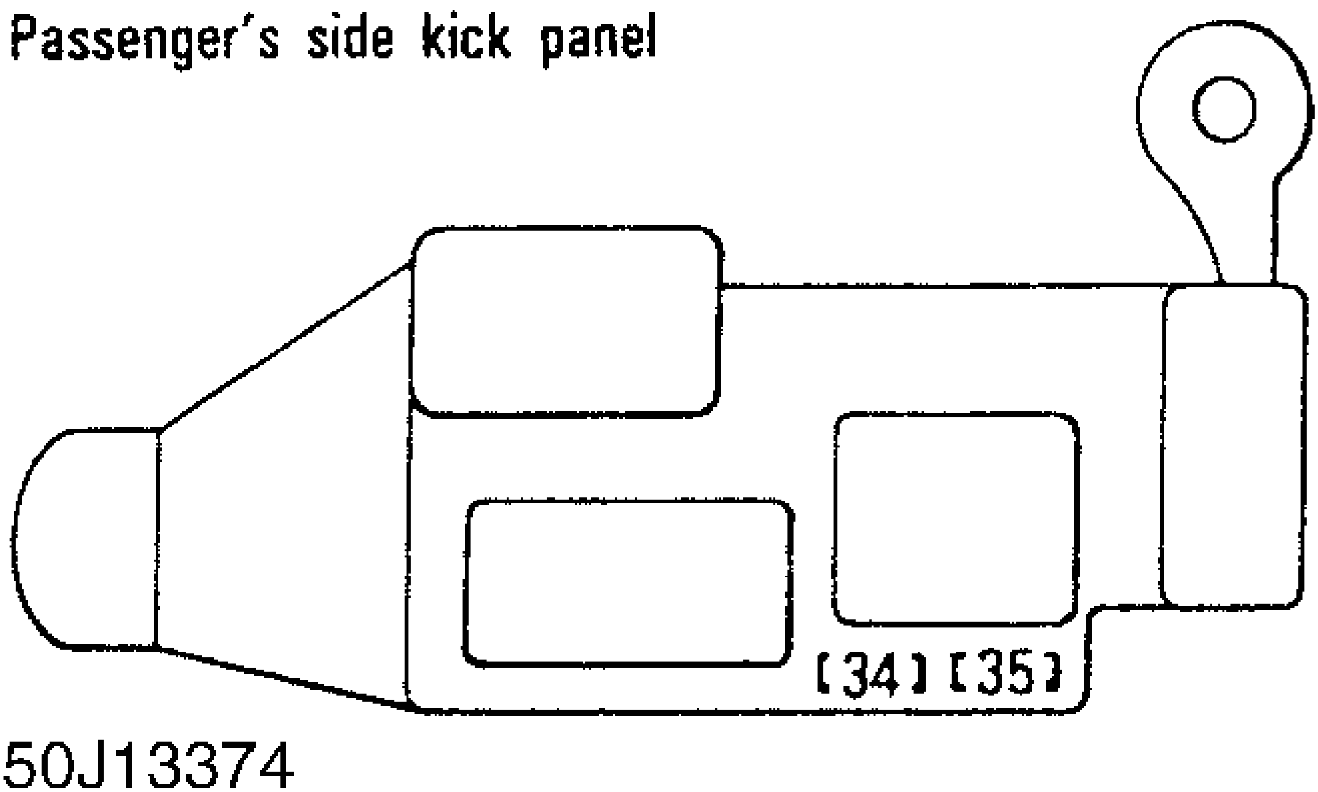


Fig. 13: Passenger Side Kick Panel Identification (1996)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fuse & Circuit Breaker Identification

1 - 30 Amp
Starting System
2 - 10 Amp
Emergency Flashers
3 - 7.5 Amp
Horns
4 - 20 Amp
Car Audio System
5 - 15 Amp
Anti-Lock Brake System, Cruise Control System
6 - 10 Amp
Interior Lights, Personal Lights, Luggage Compartment Light, Trunk Light, Door Courtesy Lights, Clock
7 - 15 Amp
Left Hand Headlight
8 - 15 Amp
Right Hand Headlight
9 - Spare
10 - Spare
11 - Spare
12 - 7.5 Amp
Charging System
13 - 7.5 Amp
SRS Airbag Warning Light
14 - 15 Amp
Multiport Fuel Injection System/Sequential Multiport Fuel Injection System
15 - 15 Amp
Left Hand Headlight (Low Beam)

16 - 15 Amp
Right Hand Headlight (Low Beam)
17 - 15 Amp
Right Hand Headlight (High Beam)
18 - 15 Amp
Left Hand Headlight (High Beam)
19 - 7.5 Amp
Daytime Running Lights
20 - 15 Amp
Electronically Controlled Automatic Transmission System,
Anti-Lock Brake System
21 - 20 Amp
No Circuit
22 - 7.5 Amp
Instrument Panel Lights
23 - 15 Amp
Stop Lights, High Mounted Stop Light, Multiport Fuel
Injection System/Sequential Multiport Fuel Injection System,
Cruise Control System Cancel Device
24 - 20 Amp
Front Fog Lights
25 - 15 Amp
Cigarette Lighter, Digital Clock Display, Car Audio System
26 - 7.5 Amp
Charging System, Discharge Warning Light, Multiport Fuel
Injection System/Sequential Multiport Fuel Injection System,
SRS Airbag System
27 - 20 Amp
Windshield Wipers & Washer, Rear Window Wiper & Washer
28 - 10 Amp
Multiport Fuel Injection System/Sequential Multiport Fuel
Injection System
29 - 10 Amp
Turn Signal Lights, Emergency Flashers
30 - 15 Amp
Tail Lights, Parking Lights, Front Side Marker Lights, Rear
Side Marker Lights, License Plate Lights
31 - 10 Amp
Air Conditioning System, Rear Window Defogger
32 - 10 Amp
Gauges & Meters, Power Door Lock System
33 - 7.5 Amp
Starting System, Multiport Fuel Injection System/Sequential
Multiport Fuel Injection System
34 - 10 Amp
Air Conditioning System
35 - 7.5 Amp
On-Board Diagnosis Sytsem
36 - 30 Amp
Electric Cooling Fan
37 - 30 Amp
Electric Cooling Fan
38 - 40 Amp
Electronic Ignition System/Distributor Ignition System
39 - 30 Amp
Power Door Lock System, Convertible Top Control System
40 - 30 Amp
Rear Window Defogger
41 - 30 Amp
Power Windows, Electric Moonroof
42 - 40 Amp
Air Conditioning System
43 - 100 Amp

Charging System, Tail Lights, Parking Lights, Front Side Marker Lights, Rear Side Marker Lights, License Plate Lights, Power Door Lock System, Convertible Top Control System, Rear Window Defogger, Power Windows, Electric Moonroof

44 - 60 Amp

Starting System, Headlights, Starting System, Horns, Emergency Flashers, Interior Lights, Personal Lights, Luggage Compartment Light, Trunk Light, Door Courtesy Lights, Clock, Car Audio Sytem

45 - 50 Amp

Anti-Lock Brake System

METRIC CONVERSIONS

1993 Toyota Celica

GENERAL INFORMATION

METRIC CONVERSIONS

METRIC CONVERSIONS

Metric conversions are making life more difficult for the mechanic. In addition to doubling the number of tools required, metric-dimensioned nuts and bolts are used alongside English components in many new vehicles. The mechanic has to decide which tool to use, slowing down the job. The tool problem can be solved by trial and error, but some metric conversions aren't so simple. Converting temperature, lengths or volumes requires a calculator and conversion charts, or else a very nimble mind. Conversion charts are only part of the answer though, because they don't help you "think" metric, or "visualize" what you are converting. The following examples are intended to help you "see" metric sizes:

LENGTH

Meters are the standard unit of length in the metric system. The smaller units are 10ths (decimeter), 100ths (centimeter), and 1000ths (millimeter) of a meter. These common examples might help you to visualize the metric units:

* A meter is slightly longer than a yard (about 40 inches).
* An aspirin tablet is about one centimeter across (.4 inches).
* A millimeter is about the thickness of a dime.

VOLUME

Cubic meters and centimeters are used to measure volume, just as we normally think of cubic feet and inches. Liquid volume measurements include the liter and milliliter, like the English quarts or ounces.

* One teaspoon is about 4 cubic centimeters.
* A liter is about one quart.
* A liter is about 61 cubic inches.

WEIGHT

The metric weight system is based on the gram, with the most common unit being the kilogram (1000 grams). Our comparable units are ounces and pounds:

* A kilogram is about 2.2 pounds.
* An ounce is about 28 grams.

TORQUE

Torque is somewhat complicated. The term describes the amount of effort exerted to turn something. A chosen unit of weight or force is applied to a lever of standard length. The resulting leverage is called torque. In our standard system, we use the weight of one pound applied to a lever a foot long, resulting in the unit called a foot-pound. A smaller unit is the inch-pound (the lever is one inch long).

Metric units include the meter kilogram (lever one meter long with a kilogram of weight applied) and the Newton-meter (lever one meter long with force of one Newton applied). Some conversions are:

* A meter kilogram is about 7.2 foot pounds.
* A foot pound is about 1.4 Newton-meters.
* A centimeter kilogram (cmkg) is equal to .9 inch pounds.

PRESSURE

Pressure is another complicated measurement. Pressure is described as a force or weight applied to a given area. Our common unit is pounds per square inch. Metric units can be expressed in several ways. One is the kilogram per square centimeter (kg/cm^2). Another unit of pressure is the Pascal (force of one Newton on an area of one square meter), which equals about 4 ounces on a square yard. Since this is a very small amount of pressure, we usually see the kiloPascal, or kPa (1000 Pascals). Another common automotive term for pressure is the bar (used by German manufacturers), which equals 10 Pascals. Thoroughly confused? Try the examples below:

* Atmospheric pressure at sea level is about 14.7 psi.
* Atmospheric pressure at sea level is about 1 bar.
* Atmospheric pressure at sea level is about 1 kg/cm^2.
* One pound per square inch is about 7 kPa.

CONVERSION FACTORS

CONVERSION FACTORS

TO CONVERT	TO	MULTIPLY BY
LENGTH		
Millimeters (mm)	Inches	.03937
Inches	Millimeters	25.4
Meters (M)	Feet	3.28084
Feet	Meters	.3048
Kilometers(Km)	Miles	.62137
AREA		
Square Centimeters (cm^2)	Square Inches	.155
Square Inches	Square Centimeters	6.45159
VOLUME		
Cubic Centimeters	Cubic Inches	.06103
Cubic Inches	Cubic Centimeters	16.38703
Liters	Cubic Inches	61.025
Cubic Inches	Liters	.01639
Liters	Quarts	1.05672
Quarts	Liters	.94633
Liters	Pints	2.11344
Pints	Liters	.47317
Liters	Ounces	33.81497
Ounces	Liters	.02957
WEIGHT		
Grams	Ounces	.03527
Ounces	Grams	28.34953
Kilograms	Pounds	2.20462
Pounds	Kilograms	.45359
WORK		
Centimeter Kilograms	Inch Pounds	.8676
Pounds/Sq. Inch	Kilograms/Sq.Centimeter	.07031
Bar	Pounds/Sq. Inch	14.504

Pounds/Sq. Inch	Bar	.06895
Atmosphere	Pounds/Sq. Inch	14.696
Pounds/Sq. Inch	Atmosphere	.06805
TEMPERATURE		
Centigrade Degrees	Fahrenheit Degrees	(°Cx(9)/5)+32
Fahrenheit Degrees	Centigrade Degrees	(°F-32)x(5)/9

CONVERSION FACTORS (Cont.)

INCHES	DECIMALS	mm
1/64	.016	.397
1/32	.031	.794
3/64	.047	1.191
1/16	.063	1.588
5/64	.078	1.984
3/32	.094	2.381
7/64	.109	2.778
1/8	.125	3.175
9/64	.141	3.572
5/32	.156	3.969
11/64	.172	4.366
3/16	.188	4.763
13/64	.203	5.159
7/32	.219	5.556
15/64	.234	5.953
1/4	.250	6.350
17/64	.266	6.747
9/32	.281	7.144
19/64	.297	7.541
5/16	.313	7.938
21/64	.328	8.334
11/32	.344	8.731
23/64	.359	9.128
3/8	.375	9.525
25/64	.391	9.992
13/32	.406	10.319
27/64	.422	10.716
7/16	.438	11.113
29/64	.453	11.509
15/32	.469	11.906
31/64	.484	12.303
1/2	.500	12.700
33/64	.516	13.097
17/32	.531	13.494
35/64	.547	13.891
9/16	.563	14.288
37/64	.578	14.684
19/32	.594	15.081
39/64	.609	15.478
5/8	.625	15.875
41/64	.641	16.272
21/32	.656	16.669
43/64	.672	17.066
11/16	.687	17.463
45/64	.703	17.859
23/32	.719	18.256
47/64	.734	18.653
3/4	.750	19.050
49/64	.766	19.447

25/32	.781	19.844
51/64	.797	20.241
13/16	.813	20.638
53/64	.828	21.034
27/32	.844	21.431
55/64	.859	21.828
7/8	.875	22.225
57/64	.891	22.622
29/32	.906	23.019
59/64	.922	23.416
15/16	.938	23.813
61/64	.953	24.209
31/32	.969	24.606
63/64	.984	25.003
1	1.000	25.400

MIRRORS - POWER

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Power Mirrors

Camry, Celica, Corolla, Land Cruiser, MR2, Pickup, Previa, Supra, T100, 4Runner

DESCRIPTION & OPERATION

Power mirrors are controlled by a dual control switch assembly, located on center console or instrument panel. Left/right control switch directs current to desired mirror. Horizontal/vertical control switch directs current to one of 2 motors located in mirror/motor assembly. Mirror and motors must be removed and serviced as an assembly.

TROUBLE SHOOTING

POWER MIRROR

Both Power Mirrors Inoperative
Check RADIO fuse, power mirror switch, power mirror motor(s), wiring and ground. See TESTING.

Left Or Right Power Mirror Inoperative
Check power mirror switch, power mirror motor(s), wiring and ground. See TESTING.

Up/Down Or Left/Right Function Inoperative
Check power mirror motor(s), wiring and ground. See POWER MIRROR MOTOR TEST under TESTING.

TESTING

POWER MIRROR SWITCH TEST

NOTE: Mirror motor connectors may vary in configuration from vehicle to vehicle of the same model.

Remove power mirror switch. See POWER MIRROR SWITCH under REMOVAL & INSTALLATION. Using ohmmeter, check continuity between appropriate mirror switch terminals. See Figs. 1-6. See appropriate POWER MIRROR SWITCH CONTINUITY TEST table. If switch fails any test, replace switch.

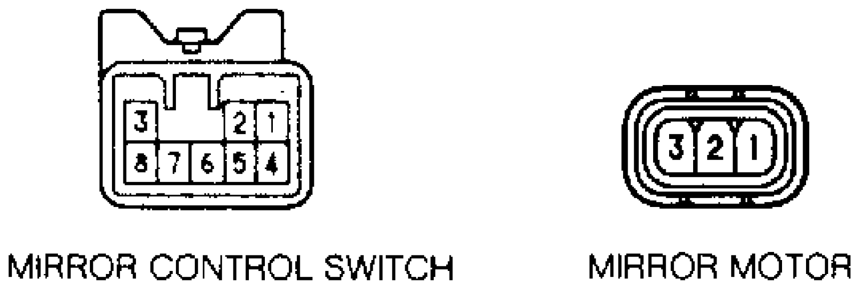


Fig. 1: Power Mirror Switch & Motor Connector Terminal ID (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER MIRROR SWITCH CONTINUITY TEST (CAMRY)

Application	Terminals
Switch In Left Position	
Up	2 & 8; 3 & 5
Down	2 & 5; 3 & 8
Left	2 & 8; 5 & 6
Right	2 & 5; 6 & 8
Switch In Right Position	
Up	2 & 8; 5 & 7
Down	2 & 5; 7 & 8
Left	1 & 5; 2 & 8
Right	1 & 8; 2 & 5

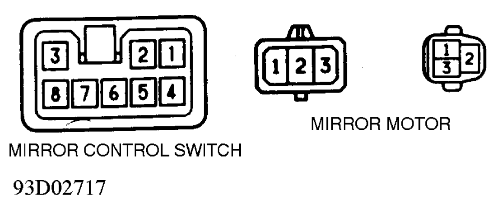


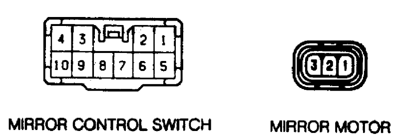
Fig. 2: Pwr. Mir. Sw. & Motor Conn. Term. ID (Celica, Corolla, Previa)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER MIRROR SWITCH CONTINUITY TEST TABLE (CELICA & PREVIA)

Application	Terminals
Switch In Off Position	
Up	2 & 3
Down	1 & 2
Left	2 & 3
Right	1 & 2
Switch In Left Position	
Up	1 & 7; 2 & 3
Down	1 & 2; 3 & 7
Left	1 & 8; 2 & 3
Right	1 & 2; 3 & 8
Switch In Right Position	
Up	1 & 5; 2 & 3
Down	1 & 2; 3 & 5
Left	1 & 6,;2 & 3
Right	1 & 2; 3 & 6

POWER MIRROR SWITCH CONTINUITY TEST TABLE (COROLLA)

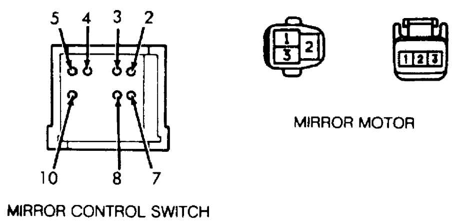
Application	Terminals
Switch In Left Position	
Up	3 & 7; 4 & 8
Down	3 & 4; 7 & 8
Left	1 & 8; 3 & 7
Right	1 & 3; 7 & 8
Switch In Right Position	
Up	3 & 7; 6 & 8
Down	3 & 6; 7 & 8
Left	3 & 7; 5 & 8
Right	3 & 5; 7 & 8



93F02718
Fig. 3: Pwr. Mirror Sw. & Motor Connector Terminal ID (Land Cruiser)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER MIRROR SWITCH CONTINUITY TEST TABLE (LAND CRUISER)

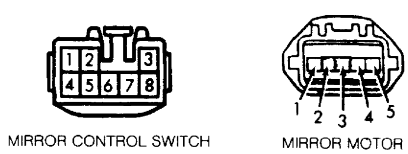
Application	Terminals
Switch In Off Position	
Up	3 & 4
Down	1 & 3
Left	3 & 4
Right	1 & 3
Switch In Left Position	
Up	1 & 10; 3 & 4
Down	1 & 3; 4 & 10
Left	1 & 9; 3 & 4
Right	1 & 3; 4 & 9
Switch In Right Position	
Up	1 & 6; 3 & 4
Down	1 & 3; 4 & 6
Left	1 & 2; 3 & 4
Right	1 & 3; 2 & 4



93H02719
Fig. 4: Pwr. Mirror Sw. & Mtr. Conn. Term. ID (MR2, Pickup & 4Runner)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER MIRROR SWITCH CONTINUITY TEST TABLE (MR2, PICKUP & 4RUNNER)

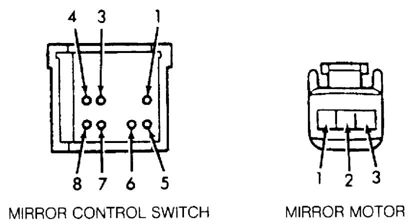
Application	Terminals
Switch In Off Position	
Up	7 & 8
Down	8 & 10
Left	7 & 8
Right	8 & 10
Switch In Left Position	
Up	2 & 10; 7 & 8
Down	2 & 7; 8 & 10
Left	3 & 10; 7 & 8
Right	3 & 7; 8 & 10
Switch In Right Position	
Up	5 & 10; 7 & 8
Down	5 & 7; 8 & 10
Left	4 & 10; 7 & 8
Right	4 & 7; 8 & 10



93F84785
Fig. 5: Power Mirror Switch & Motor Connector Terminal ID (Supra)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER MIRROR SWITCH CONTINUITY TEST TABLE (SUPRA)

Application	Terminals
Switch In Left Position	
Up	2 & 5; 6 & 8
Down	2 & 6; 5 & 8
Left	1 & 8; 2 & 5
Right	1 & 2; 5 & 8
Switch In Right Position	
Up	2 & 5; 3 & 8
Down	2 & 3; 5 & 8
Left	2 & 5; 7 & 8
Right	2 & 7; 5 & 8



93G84786

Fig. 6: Power Mirror Switch & Motor Connector Terminal ID (T100)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER MIRROR SWITCH CONTINUITY TEST TABLE (T100)

Application	Terminals
Switch In Left Position	
Up	1 & 8; 3 & 4
Down	1 & 3; 4 & 8
Left	1 & 7; 3 & 4
Right	1 & 3; 4 & 7
Switch In Right Position	
Up	1 & 5; 3 & 4
Down	1 & 3; 4 & 5
Left	1 & 6; 3 & 4
Right	1 & 3; 4 & 6

POWER MIRROR MOTOR TEST

NOTE: Mirror motor connectors may vary in configuration from vehicle to vehicle of the same model.

Disconnect power mirror motor harness connector. Using 12-volt power source, connect positive and negative leads to specified pins or terminals. See appropriate POWER MIRROR MOTOR TEST table. See Figs. 1-6. If power mirror motor fails any test, replace power mirror assembly.

POWER MIRROR MOTOR TEST TABLE (CAMRY, CELICA & MR2)

Apply 12 Volts To Pin No.	Ground Pin No.	Mirror Operation
3	2	Up
2	3	Down
1	2	Left
2	1	Right

POWER MIRROR MOTOR TEST TABLE (COROLLA)

Apply 12 Volts To Pin No.	Ground Pin No.	Mirror Operation
1	2	Up
2	1	Down
3	2	Left
2	3	Right

POWER MIRROR MOTOR TEST TABLE (LAND CRUISER)

Apply 12 Volts To Pin No.	Ground Pin No.	Mirror Operation
2	3	Up
3	2	Down
1	3	Left
3	1	Right

POWER MIRROR MOTOR TEST TABLE (PICKUP, PREVIA & 4RUNNER)

Apply 12 Volts To Pin No.	Ground Pin No.	Mirror Operation
2	1	Up
1	2	Down
3	1	Left
1	3	Right

POWER MIRROR MOTOR TEST TABLE (SUPRA)

Apply 12 Volts To Pin No.	Ground Pin No.	Mirror Operation
3	4	Up
4	3	Down
5	4	Left
4	5	Right

POWER MIRROR MOTOR TEST TABLE (T100)

Apply 12 Volts To Pin No.	Ground Pin No.	Mirror Operation
3	1	Up
1	3	Down
2	1	Left
1	2	Right

REMOVAL & INSTALLATION

POWER MIRROR SWITCH

Removal & Installation (Celica & Supra)

Remove console box retaining screws and raise console box enough to disconnect mirror switch harness connector. Push on switch's connector end to remove switch from console box. To install, reverse removal procedure.

Removal & Installation (Camry, Corolla, Cressida & Land Cruiser)

Remove instrument panel lower trim cover and inner knee pad (if equipped). Remove retaining screws from bottom of power mirror switch. Using flat-blade screwdriver, carefully pry switch out of instrument panel. Disconnect harness connector. To install, reverse removal procedure.

Removal & Installation (Pickup, Previa, T100 & 4Runner)

Remove arm rest retaining screw caps, retaining screws and arm rest. Disconnect all electrical connectors. Remove power window master switch retaining screws. Remove power window master switch from arm rest. Push on power mirror switch connector end to remove switch from power window master switch. To install, reverse removal procedure.

POWER MIRROR ASSEMBLY

Removal & Installation

Remove mirror inner trim panel on inside of the door. Disconnect power mirror motor harness connector. Support outside mirror assembly while removing 3 mirror retaining screws/bolts on inside of the door. To install, reverse removal procedure.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in WIRING DIAGRAMS section.

PASSIVE RESTRAINT SYSTEM INSPECTION

1993 Toyota Celica

GENERAL INFORMATION
Passive Restraint System Inspection - Asian

* PLEASE READ THIS FIRST *

Follow all manufacturers servicing precautions when working with air bag systems. See SERVICE PRECAUTIONS in the appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

INTRODUCTION

When a vehicle equipped with passive restraint system has been involved in a collision, certain systems and components must be inspected and or replaced regardless of whether or not the air bag has deployed. Follow the manufacturer's guidelines provided in this article.

ACURA (1988-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - ACURA (1988-98)

Model	Year	(1) Location
Integra	1994-98	D/P
Legend	1991-95	D/P
	1988-90	DS
NSX	1993-98	D/P
	1991-92	DS
Vigor	1993-94	D/P
	1992	DS
2.2CL	1997	D/P
2.3CL	1998	D/P
2.5TL	1995-98	D/P
3.0CL	1997-98	D/P
3.2TL	1996-98	D/P
3.5RL	1996-98	D/P
SLX	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - ACURA (1988-98 EXCEPT SLX)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace Component	* Cable Reel * Dash or Impact Sensors (If Equipped) * Seat Belts

(Even If Air Bag Did Not Deploy)	* SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - ACURA (1996-98 SLX)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

HONDA (1991-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - HONDA (1991-98)

Model	Year	(1) Location
Accord	1993-98	D/P
	1991-92	DS
Civic	1994-98	D/P
	1992-93	DS
Civic del Sol	1994-97	D/P
	1993	DS
CR-V	1997-98	D/P
Odyssey	1995-98	D/P
Prelude	1994-98	D/P
SI 4WS	1992-93	D/P
Except SI 4WS	1992-93	DS
Passport	1995 1/2-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - HONDA (1991-98 EXCEPT PASSPORT)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Cable Reel * Dash Sensors (1991-94) * Seat Belts * SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - HONDA (1995 1/2-98 PASSPORT)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

HYUNDAI (1994-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - HYUNDAI (1994-98)

Model	Year	(1) Location
Accent	1995-98	D/P
Elantra	1996-98	D/P
	1994-95	DS
Sonata	1995-98	D/P
Tiburon	1997-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - HYUNDAI (1994-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Module * Steering Column Clockspring
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Any Seat Belt In Use At Time Of Collision * Steering Column * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness.

INFINITI (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - INFINITI (1990-98)

Model	Year	(1) Location	Inspection Table
G20	1993-96	D/P	INFINITI-2
I30	1998	D/P, SI	INFINITI-1
	1997	D/P	INFINITI-1
	1996	D/P	INFINITI-2
J30	1997	D/P	INFINITI-1
	1994-96	D/P	INFINITI-2
	1993	D/P	INFINITI-3
M30	1990-92	DS	INFINITI-3
Q45	1998	D/P, SI	INFINITI-1
	1997	D/P	INFINITI-1
	1994-96	D/P	INFINITI-2
	1990-93	DS	INFINITI-3
QX4	1997-98	D/P	INFINITI-1

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - INFINITI-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Satellite Sensor (1) * Seat Belt Pretensioners (2)

	* Side Air Bag Module (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Pillar Inner (1) * Instrument Panel * Seat (1) * Seat Belt Pretensioners (2) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust. * After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.
(1) - On side of impact. (2) - Except I30 and QX4.	

INSPECTION PROCEDURES TABLE - INFINITI-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Instrument Panel * Seat Belt Pretensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (2) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust. * After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.
(1) - Except I30. (2) - Except 1996 I30, 1995-96 J30 and 1995-96 Q45.	

INSPECTION PROCEDURES TABLE - INFINITI-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Sensors In Affected Collision Area
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust.

	* After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.

ISUZU (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - ISUZU (1990-98)

Model	Year	(1) Location	Inspection Table
Hombre	1996-97	DS	ISUZU-1
Impulse	1990-92	DS	ISUZU-5
Oasis	1996-98	D/P	ISUZU-2
Rodeo	1996-98	D/P	ISUZU-3
	1995 1/2	D/P	ISUZU-3
Stylus	1991-93	DS	ISUZU-5
Trooper	1996-98	D/P	ISUZU-3
	1995	D/P	ISUZU-4

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - ISUZU-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensors In Area Of Accident Damage
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolster * Sensors In Area Of Accident Damage * SRS Coil Assembly
Comments	* Any sensor which the Diagnostic Energy Reserve Module (DERM) indicates as bad must be replaced. * If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - ISUZU-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace	* Cable Reel * Dash Sensors (1991-94)

Component (Even If Air Bag Did Not Deploy)	* Seat Belts * SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - ISUZU-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

INSPECTION PROCEDURES TABLE - ISUZU-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * All Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* SRS Coil Assembly * Instrument Panel Steering Column Reinforcement Panel * Instrument Panel Braces * Knee Bolsters * Seat Belts Mounting Points * Sensors In Area of Accident Damage * Steering Column
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

INSPECTION PROCEDURES TABLE - ISUZU-5

Action	Component or System
Replace After	* Air Bag Module

Deployment	
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Arming Sensor * Coil Assembly * Diagnostic Energy Reserve Module (DERM) * Forward Sensor * Instrument Panel-To-Steering Column Reinforcement * Knee Pad * Passenger Compartment Sensor * Steering Column * Wiring Harness & Brackets
Comments	* If any components are damaged or bent, they must be replaced.

KIA (1995-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - KIA (1995-98)

Model	Year	(1) Location
Sephia	1996-98	D/P
	1995 1/2	D/P
Sportage	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - KIA (1995-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Diagnosis Control Unit * Clockspring * Impact Sensors Sensor Mountings (1) * Steering Column * Steering Wheel * Wiring Harness
Comments	* After repairs a completed, ensure Warning Light is functioning properly.
(1) - 1995 1/2 Sephia only.	

LEXUS (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - LEXUS (1990-98)

Model	Year	(1) Location	Inspection Table
ES250	1990-91	DS	LEXUS-6
ES300	1998	D/P, SI	LEXUS-3
	1997	D/P	LEXUS-1
	1994-96	D/P	LEXUS-4
	1992-93	DS	LEXUS-5
GS300	1998	D/P, SI	LEXUS-3
	1993-97	D/P	LEXUS-4
GS400	1998	D/P, SI	LEXUS-3
LS400	1997-98	D/P, SI	LEXUS-3
	1995-96	D/P	LEXUS-1
	1993-94	D/P	LEXUS-4
	1990-92	DS	LEXUS-6
LX450	1996-97	D/P	LEXUS-1
LX470	1998	D/P	LEXUS-2
SC300	1996-98	D/P	LEXUS-1
	1993-95	D/P	LEXUS-4
	1992	DS	LEXUS-5
SC400	1996-98	D/P	LEXUS-1
	1993-95	D/P	LEXUS-4
	1992	DS	LEXUS-5

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - LEXUS-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Seat Belt Pretensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced.
(1) - 1995 LS400 only. (2) - 1997 ES300, 1996 LS400 and 1996-97 LX450 only.	

INSPECTION PROCEDURES TABLE - LEXUS-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors * Seat Belt Pretensioner
Inspect & If Damaged, Replace Component	* Instrument Panel * Instrument Panel Reinforcement * Seat Belt Pretensioner

(Even If Air Bag Did Not Deploy)	* Spiral Cable Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.

INSPECTION PROCEDURES TABLE - LEXUS-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Seat Belt Pretensioner (1) * Side Air Bag Modules * Side Air Bag Sensor Assembly
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel Instrument Panel Reinforcement * Seat Belt Pretensioner (1) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Except 1997 LS400. (2) - 1997 LS400 only.	

INSPECTION PROCEDURES TABLE - LEXUS-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Front Seat Belt Tensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer’s instructions.
(1) - 1993-95 GS300 and 1993-94 LS400. (2) - Except 1994-95 SC300 and SC400.	

INSPECTION PROCEDURES TABLE - LEXUS-5

Action	Component or System
Replace After Deployment	* Air Bag Module * Center Air Bag Sensor Assembly * Front Air Bag Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - LEXUS-6

Action	Component or System
Replace After Deployment	* Air Bag Module * Front Air Bag Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Air Bag Sensor Assembly * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

MAZDA (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - MAZDA (1990-98)

Model	Year	(1) Location	Inspection Table
Miata	1995-97	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1990-93	DS	MAZDA-2
Millenia	1995-98	D/P	MAZDA-1
MPV	1996-98	D/P	MAZDA-1
	1995	DS	MAZDA-1
	1994	DS	MAZDA-2
MX-3	1994-95	D/P	MAZDA-2
MX-6	1995-98	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1993	DS	MAZDA-2

Pickup	1996-98	D/P	MAZDA-2
	1995-96	DS	MAZDA-2
Protege	1995-98	D/P	MAZDA-1
RX7	1994-95	D/P	MAZDA-2
	1990-93	DS	MAZDA-2
626	1995-98	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1993	DS	MAZDA-2
929	1992-95	D/P	MAZDA-2

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - MAZDA-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Impact Sensors & Sensors Mountings * Steering Column * Steering Wheel * Wiring Harness
Comments	* DO NOT attempt wiring harness repairs. Replace entire wiring harness. * Impact sensors must always be installed with arrow on sensor facing front of vehicle.

INSPECTION PROCEDURES TABLE - MAZDA-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Diagnosis Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Impact Sensors & Sensors Mountings * Steering Column Steering Wheel Wiring Harness
Comments	* DO NOT attempt wiring harness repairs. Replace entire wiring harness. * Impact sensors must always be installed with arrow on sensor facing front of vehicle.

MITSUBISHI (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - MITSUBISHI (1990-98)

Model	Year	(1) Location	Inspection Table
Diamante	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
	1992-93	DS	MITSUBISHI-2
Eclipse	1996-98	D/P	MITSUBISHI-1
	1995	D/P	MITSUBISHI-3
Expo	1994-95	DS	MITSUBISHI-1
Galant	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
Mirage	1997-98	D/P	MITSUBISHI-1
	1995-96	D/P	MITSUBISHI-4
	1994	DS	MITSUBISHI-4
Montero	1996-98	D/P	MITSUBISHI-2
	1994-95	DS	MITSUBISHI-2
Montero Sport	1997-98	D/P	MITSUBISHI-2
Sigma	1990	DS	MITSUBISHI-3
3000GT	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
	1991-93	DS	MITSUBISHI-2

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - MITSUBISHI-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column & Intermediate Joint * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-2

Action	Component or System
Replace After Deployment	* Air BagModule(s) * Front Impact Sensors * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column & Intermediate Joint * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Clockspring * Front Impact Sensors * SRS Control Unit * Steering Column & Intermediate Joint * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

NISSAN (1989-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - NISSAN (1989-98)

Model	Year	(1) Location	Inspection Table
Altima	1998	D/P	NISSAN-3
	1995-97	D/P	NISSAN-4
	1994	D/P	NISSAN-6
	1993	DS	NISSAN-6
Frontier	1998	D/P	NISSAN-1
Maxima	1998	D/P, SI	NISSAN-2
	1997	D/P	NISSAN-3
	1995-96	D/P	NISSAN-4
	1994	D/P	NISSAN-5
	1992-93	DS	NISSAN-6
NX Coupe	1991-93	DS	NISSAN-6
Pathfinder	1996-98	D/P	NISSAN-5

Pickup	1996-97	DS	NISSAN-5
Pulsar NX	1989-90	DS	NISSAN-6
Quest	1997-98	D/P	NISSAN-3
	1996	D/P	NISSAN-4
	1994-95	DS	NISSAN-5
Sentra	1997-98	D/P	NISSAN-3
	1995-96	D/P	NISSAN-4
	1994	DS	NISSAN-5
	1993	DS	NISSAN-6
200SX	1997-98	D/P	NISSAN-3
	1995-96	D/P	NISSAN-4
240SX	1997-98	D/P	NISSAN-3
	1995-96	D/P	NISSAN-4
300ZX	1994-96	D/P	NISSAN-4
	1991-93	DS	NISSAN-6

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - NISSAN-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Crash Zone Sensor (1) * Instrument Panel * Passenger Deactivation Switch * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.
(1) - 4WD only.	

INSPECTION PROCEDURES TABLE - NISSAN-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Side Air Bag Module (1) * Satellite Sensor (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Pillar Inner (1) * Instrument Panel * Seat (1) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced.

	* DO NOT attempt SRS wiring harness repairs.
(1) - On side of impact.	

INSPECTION PROCEDURES TABLE - NISSAN-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.

INSPECTION PROCEDURES TABLE - NISSAN-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (1) * Instrument Panel * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.
(1) - 300ZX Only.	

INSPECTION PROCEDURES TABLE - NISSAN-5

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (1) * Crash Zone Sensor (2) * Instrument Panel (3) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. DO NOT attempt SRS wiring harness repairs.

(1) - Except Pathfinder and Pickup.
(2) - 4WD Pickup only.
(3) - Pathfinder only.

INSPECTION PROCEDURES TABLE - NISSAN-6

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Sensors In Affected Collision Area
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.

SUBARU (1992-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - SUBARU (1992-98)

Model	Year	(1) Location
Forester	1998	D/P
Impreza	1994-98	D/P
	1993	DS
Legacy	1995-98	D/P
	1992-94	DS
SVX	1994-97	D/P
	1992-93	DS

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - SUBARU (1992-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Control Module * Front Impact Sensors (1) * Side Air Bag Sensors (2)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Control Module * Combination Switch & Clockspring * Front Impact Sensors

Comments	* DO NOT attempt SRS wiring repairs. * If any components are damaged or bent, they must be replaced.
(1) - If Equipped. (2) - 1998 Legacy, on side of deployment.	

SUZUKI (1995-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - SUZUKI (1995-98)

Model	Year	(1) Location
Esteem	1995-98	D/P
Sidekick	1996-98	D/P
Swift	1995-98	D/P
X90	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - SUZUKI (1995-98)

Action	Component or System
Replace After Deployment	* Air BagModule(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Warning Light * Combination Switch Assembly * Contact Coil * Forward Discriminating Sensor (1) * Instrument Panel Reinforcement * Knee Bolsters * Seat Belts & Mounting Points * SDM Bracket * Steering Column Bracket * Steering Column & Shaft Joints * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.
(1) - Swift Only	

TOYOTA (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - TOYOTA (1990-98)

Model	Year	(1) Location	Inspection Table
Avalon	1998	D/P, SI	TOYOTA-1
	1996-97	D/P	TOYOTA-3
	1995	D/P	TOYOTA-4
Camry	1998	D/P, SI	TOYOTA-1
	1997	D/P	TOYOTA-3
	1996	D/P	TOYOTA-5
	1994-95	D/P	TOYOTA-6
	1992-93	DS	TOYOTA-9
Celica	1998	D/P	TOYOTA-2
	1996-97	D/P	TOYOTA-5
	1994-95	D/P	TOYOTA-7
	1990-93	DS	TOYOTA-10
Corolla	1998	D/P, SI	TOYOTA-1
	1996-97	D/P	TOYOTA-3
	1994-95	D/P	TOYOTA-6
	1993	DS	TOYOTA-9
Land Cruiser	1998	D/P	TOYOTA-2
	1995-97	D/P	TOYOTA-4
MR2	1994-95	D/P	TOYOTA-5
	1991-93	DS	TOYOTA-10
Paseo	1996-97	D/P	TOYOTA-3
	1993-95	DS	TOYOTA-9
Previa	1996-97	D/P	TOYOTA-3
	1994-95	D/P	TOYOTA-6
	1992-93	DS	TOYOTA-9
RAV4	1996-98	D/P	TOYOTA-3
Sienna	1998	D/P	TOYOTA-1
Supra	1997-98	D/P	TOYOTA-3
	1993-96	D/P	TOYOTA-5
	1990-92	DS	TOYOTA-10
Tercel	1998	D/P	TOYOTA-2
	1996-97	D/P	TOYOTA-3
	1995	D/P	TOYOTA-8
	1993-94	DS	TOYOTA-9
Tacoma	1998	D/P	TOYOTA-3
	1996-97	DS	TOYOTA-3
T100	1994-98	DS	TOYOTA-9
4Runner	1996-98	D/P	TOYOTA-4

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - TOYOTA-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors (1) * Seat Belt Pretensioner (2) * Seatback Assembly (2) (3) * Side Air Bag Modules (If Equipped) (2) * Side Air Bag Sensor Assembly (If equipped) (1)

Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Instrument Panel Reinforcement * Seatback Assembly (2) * Seat Belt Pretensioner (2) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Corolla and Sienna only. Replace both sensors. (2) - On side of impact. (3) - Avalon only.	

INSPECTION PROCEDURES TABLE - TOYOTA-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors * Seat Belt Pretensioner (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Instrument Panel Reinforcement * Seat Belt Pretensioner (1) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Land Cruiser and Tercel only.	

INSPECTION PROCEDURES TABLE - TOYOTA-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensor (1) * Instrument Panel (2) * Instrument Panel Reinforcement (2) * Spiral Cable (3) * Steering Wheel (3)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Spiral Cable (4) * Steering Wheel (4) * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they

	must be replaced.

(1) - 1998 RAV4 only. (2) - Except 1996-97 Tacoma and 1998 Supra. (3) - Except 1998 Tacoma. (4) - 1998 Tacoma.

INSPECTION PROCEDURES TABLE - TOYOTA-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Glove Compartment Door * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - TOYOTA-5

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-6

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly

	* Front Air Bag Sensors * Glove Compartment * Glove Compartment Door * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-7

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Center Console Bracket Support * Front Air Bag Sensors * Instrument Panel * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-8

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Center Console Bracket Support * Instrument Panel Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not	* Wiring Harness & Connectors

Deploy)	
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - TOYOTA-9

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-10

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Front Air Bag Sensors * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Air Bag Sensor Assembly * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

J - PIN VOLTAGE CHARTS

1993 Toyota Celica

1993 ENGINE PERFORMANCE
Toyota Pin Voltage Charts

Celica

INTRODUCTION

Pin voltage charts are supplied to reduce diagnostic time. Checking pin voltages at the ECM determines whether it's receiving and transmitting proper voltage signals. Charts may also help determine if ECM harness is shorted or opened.

NOTE: Unless stated otherwise in testing procedures, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. Voltage readings may vary slightly due to battery condition or charging rate.

ECM LOCATION & IDENTIFICATION

ECM LOCATION TABLE

Model	Location
Celica	Bottom Center Of Dash, Under Radio

ECM PIN CONNECTOR ABBREVIATION IDENTIFICATION TABLE

Abbreviation	Function
ABS	Anti-Lock Brake ECM
ACA, ACT, ATS	A/C Amplifier
AC, AC1, A/C	A/C Compressor Or Magnetic Switch
A/D	Cruise Control Computer
AI	Air Injection Vacuum Switching Valve
AS	Air Suction Vacuum Switching Valve
BATT	Battery
BK	Brake Switch
B, +B, +B1	EFI Main Relay
CHK	Sub-Oxygen Sensor
C1	Distributor
DFG	Defogger Relay
DG	Check Connector
ECT	Electronically Controlled Transmission/Transaxle (ECT)
EGR	EGR Vacuum Switching Valve
ELS	Headlight & Defogger Relay
E1, E2, E01, E02	Engine Or Computer Ground
E11, E2, E21, E22	Sensor Ground
FC	Circuit Opening Relay
FP	Fuel Pump Relay
FPR	Fuel Pump Relay
FPU	Fuel Pressure-Up Vacuum Switching Valve
G, G1, G2	Cam Position Sensor Or Distributor
G-, G+	Cam Position Sensor Or Distributor (Crank Angle)
HT	Oxygen Sensor Heater
HT1	Oxygen Sensor Heater (Main)
HT2	Oxygen Sensor Heater (Sub)

IDL	Throttle Position Sensor
IGDA, IGDB	Ignitor
IGF	Ignitor
IG SW	Ignition Switch
IGT	Ignitor (Primary Trigger)
ISCC, ISCO	Idle Speed Control Valve
ISCV	A/C Idle-Up Vacuum Switching Valve
ISC1, ISC2, ISC3, ISC4	Idle Speed Control Valve Or Motor
KNK, KNK1, KNK2	Knock Sensor
KS	Airflow Meter
L	Neutral Start Switch Or Shift Position Switch
LP	Headlight Relay
L1, L2, L3, L4	(1) ECT
M	Neutral Start Switch Or Shift Position Switch
M-REL	EFI Main Relay
MS	Engine Oil Level Sensor
N	Neutral Start Switch Or Shift Position Switch
N/C	Clutch Switch (M/T)
NE, NE-, NE+	Cam Position Sensor Or Distributor (RPM)
NSW	Neutral/Start Switch (A/T)
No. 1-4	Injector
No. 10, 20 & 30	Injector
OD, ODT	Overdrive Solenoid
OD1	Overdrive Off Switch
OD2	Cruise Control Computer Or Overdrive Main Switch
O/G	Check Connector
OIL	Oil Pressure Switch Or A/T Oil Temperature Warning Light
OLS	Engine Oil Level Sensor
OMR	Engine Oil Feed Motor
OMT	Engine Oil Feed Motor Relay
OSFC	Overspeed Fuel Cut
OW	Engine Oil Warning Light
OX, OX1, OX+	Oxygen Sensor
OX2	Sub-Oxygen Sensor
P	Shift Position Switch Or Pattern Select Switch
PS	Power Steering ECM
PSCT	Power Steering ECM
PSW	Throttle Position Sensor
PIM	Vacuum Sensor Or Turbocharger Pressure Sensor
PSW	Throttle Position Sensor
PWR	Pattern Select Switch
R	Neutral Start Switch Or Shift Position Switch
RSC	Idle Speed Control Valve
RSO	Idle Speed Control Valve
S	Neutral Start Switch Or Shift Position Switch
SL, S1, S2	(1) ECT Solenoid
SPD, SPD1, SPD2	Vehicle Speed Sensor
SP1, SPD1	No. 1 Vehicle Speed Sensor, (1) ECT In Instrument Cluster
SP2, SPD2	No. 2 Vehicle Speed Sensor, (1) ECT In Transaxle or Transmission
STA	Starter Signal
STP	Stoplight Switch
STJ	Cold Start Injector
S1, S2, S3, S4	(1) ECT Solenoid
T, TT	Check Connector Or (2) DLC
THA, THA1	Air Temperature Sensor
THE	Evaporator Temperature Sensor
THG	EGR Gas Temperature Sensor
THO, THO1, THO2	Transmission Oil Temperature Sensor
THW	Coolant Temperature Sensor

TIL .... Turbo Indicator Light
TOV .... Throttle Opener Vacuum Switching Valve
TPC, TPC1 .... Turbocharger Pressure
Vacuum Switching Valve
TVIS .... Variable Induction System Vacuum Switching Valve
TWS .... Coolant Temperature Switch
T2 .... Check Connector
VC .... Airflow Meter, Vacuum Sensor Or
Throttle Position Sensor
VCC .... Throttle Position Sensor Or Vacuum Sensor
VF, VF1, VF2 .... Check Connector
V-ISC .... Auxiliary Control Valve Or
Idle-Up System Vacuum Switching Valve
VS .... Airflow Meter
VSV1 .... Air Control Vacuum Switching Valve
VSV2 .... Fuel Pressure-Up Vacuum Switching Valve
VTA .... Throttle Position Sensor
W .... Malfunction Indicator Light
2 .... Neutral Start Switch Or Shift Position Switch

(1) - Electronically Controlled Transmission/Transaxle (ECT).
(2) - Data Link Connector (DLC).

PIN VOLTAGE CHARTS

ECM PIN VOLTAGE TEST

CAUTION: Perform all voltage measurements with ECM harness connector installed. Use high-impedance digital voltmeter (10,000 ohm minimum). Verify battery voltage is greater than 11 volts.

NOTE: If voltage value is not as specified, proceed to test number indicated. Tests are located in G - TESTS W/CODES article in the ENGINE PERFORMANCE section.

No.	Terminals	Condition		STD voltage (V)	TEST NO.
1	+B +B1 – E1	IG SW ON		10 – 14	2
2	BATT – E1	–		10 – 14	1
3	IDL – E2	IG SW ON	Throttle valve open	4.5 – 5.5	9
	VC – E2		–	4.5 – 5.5	
	VTA – E2		Throttle valve fully closed (Throttle opener must be cancelled first)	0.1 – 1.0	
			Throttle valve fully open	3.2 – 4.2	
4	VC – E2		–	4.5 – 5.5	7
	VS – E2		Measuring plate fully closed	3.7 – 4.3	
			Measuring plate fully open	0.2 – 0.5	
		Idling		1.6 – 4.1	
		3,000 rpm		1.0 – 2.0	
5	No.1 No.2 – E01 No.3 – E02 No.4	IG SW ON		10 – 14	13
6	THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	1 – 3	6
7	THW – E2		Coolant temp. 80°C (176°F)	0.1 – 1.1	5
8	STA – E1	Cranking		6 – 14	10
9	IGT – E1	Cranking or idling		0.8 – 1.2	3
10	RSC RSO – E1	IG SW ON	Engine ECU connectors disconnected	8 – 14	14
11	W – E1	No trouble ("CHECK" engine warning light off) and engine running		10 – 14	15
12	PIM – E2	IG SW ON		2.5 – 4.5	8
	VC – E2			4.5 – 5.5	
13	ACl – E1	IG SW ON	Air conditioning ON	8 – 14	11

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Fig. 1: ECM Pin Voltage Test (3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

No.	Terminals	Condition		STD voltage (V)	TEST NO.
1	+B, +B1 - E1	IG SW ON		10 - 14	2
2	BATT - E1	-		10 - 14	1
3	IDL - E2	IG SW ON	Throttle valve open	10 - 14	9
	PSW - E2		Throttle valve fully closed	10 - 14	
4	PIM - E2	IG SW ON		3.3 - 3.9	7
	VCC - E2			4.5 - 5.5	
5	No.10, No.20 - E01, E02			10 - 14	13
6	THA - E2	IG SW ON	Intake air temp. 20°C (68°F)	1 - 3	6
7	THW - E2		Coolant temp. 80°C (176°F)	2.0 - 2.8	5
8	STA - E1	Cranking		6 - 14	10
9	IGT - E1	Cranking or idling		0.7 - 1.0	3
10	W - E1	No trouble ("CHECK" engine warning light off) and engine running		10 - 14	15
11	A/C - E1	IG SW ON	Air conditioning ON	8 - 14	11

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Fig. 2: ECM Pin Voltage Test (4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

No.	Terminals	Condition		STD voltage (V)	TEST NO.
1	+B / +B1 – E1	IG SW ON		10 – 14	2
2	BATT – E1	—		10 – 14	1
3	IDL – E2	IG SW ON	Throttle valve open	8 – 14	9
	VC – E2		—	4.5 – 5.5	
	VTA – E2		Throttle valve fully closed (Throttle opener must be cancelled first)	0.8 – 1.2	
			Throttle valve fully open	3.2 – 4.2	
4	PIM – E2	IG SW ON		3.3 – 3.9	7
	VC – E2			4.5 – 5.5	
5	No.10 / No.20 – E01 / E02			10 – 14	13
6	THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	1.9 – 2.9	6
7	THW – E2		Coolant temp. 80°C (176°F)	0.1 – 1.1	5
8	STA – E1	Cranking		6 – 14	10
9	IGT – E1	Cranking or idling		0.8 – 1.2	3
10	ISCC / ISCO – E1	IG SW ON	Engine ECU connectors disconnected	8 – 14	14
11	W – E1	No trouble ("CHECK" engine warning light off) and engine running		10 – 14	15

92C25843

Fig. 3: ECM Pin Voltage Test (5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ECM WIRING HARNESS RESISTANCE TEST

CAUTION: When measuring resistance at ECM wiring harness, DO NOT touch ECM terminals with ohmmeter. Turn ignition off and unplug ECM wiring harness connector. Tester probe should be inserted into the wiring connector from the WIRING side.

Terminals	Condition	STD resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	2,300 or less
VTA – E2	Throttle valve fully open	3,100 – 12,100
	Throttle valve fully closed	470 – 6,100
VC – E2	–	3,900 – 9,000
VS – E2	Measuring plate fully closed	200 – 600
	Measuring plate fully open	20 – 1,200
THA – E2	Intake air temp. 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temp. 80°C (176°F)	200 – 400
G1, G2 – G⊖	Cold	125 – 190
NE – G⊖	Cold	155 – 240
RSC – +B, RSO – +B1	–	19.3 – 22.3

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Fig. 4: ECM Wiring Harness Resistance Test (3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Terminals	Condition	STD resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	0
PSW – E2	Throttle valve fully open	0
	Throttle valve fully closed	Infinity
THA – E2	Intake air temperature 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temperature 80°C (176°F)	200 – 400
G1, NE – G⊖	Cold	185 – 265

92B25842

Fig. 5: ECM Wiring Harness Resistance Test (4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Resistance of ECU Wiring Connectors (5S-FE)

Terminals	Condition	STD resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed (Throttle opener must be cancelled first)	2,300 or less
VTA – E2	Throttle valve fully open	2,000 – 10,200
	Throttle valve fully closed (Throttle opener must be cancelled first)	200 – 5,700
VC – E2	—	2,500 – 5,900
THA – E2	Intake air temp. 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temp. 80°C (176°F)	200 – 400
G+ – G–	Cold	185 – 265
NE+ – NE–	Cold	370 – 530
ISCC – +B ISCO – +B1	—	19.3 – 22.3

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Fig. 6: ECM Wiring Harness Resistance Test (5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ECM TERMINAL IDENTIFICATION

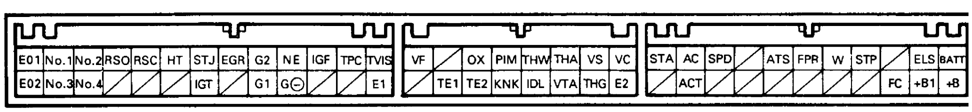

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Fig. 7: ECM Terminal ID (3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

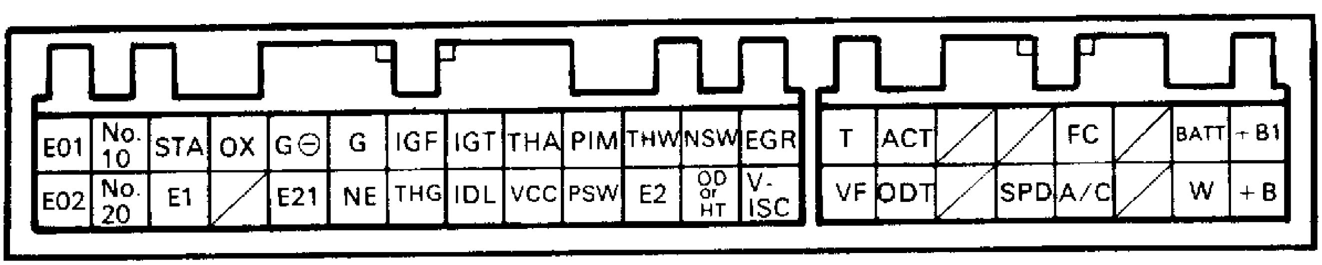

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Fig. 8: ECM Terminal ID (4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

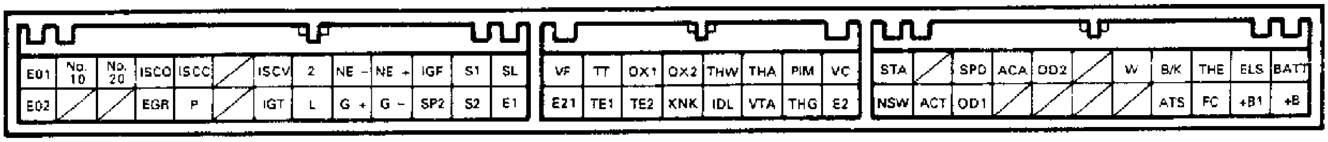

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Fig. 9: ECM Terminal ID (5S-FE Automatic Transaxle)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

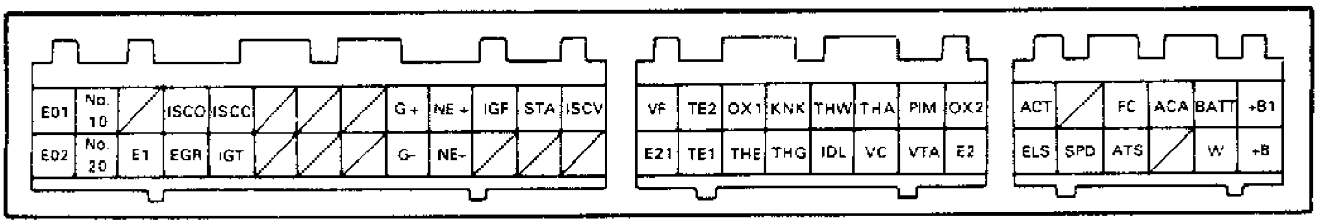

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Fig. 10: ECM Terminal (5S-FE Manual Transaxle)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER WINDOWS

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Power Windows

Celica

DESCRIPTION & OPERATION

System components consist of a power window relay, power window switches and power window motors for each door. With ignition switch in ON position, battery voltage is supplied through power window relay to power window switches. Power window switch supplies power and ground for power window motors.

Driver's side power window switch offers one-touch operation of driver's side window. Driver's side power window switch also includes a lock-out feature to prevent passengers from operating any of the other power window switches.

TROUBLE SHOOTING

ALL WINDOWS INOPERATIVE & LOCK-OUT IS INOPERATIVE

Check for defective fuse (ALT, AM1, DOOR, GAUGE, POWER), ignition switch, door lock control relay, driver's side power window switch and wiring circuits.

ALL WINDOWS INOPERATIVE & LOCK-OUT OPERATES NORMAL

Check for defective fuse (GAUGE, POWER), ignition switch, door lock control relay, driver's side power window switch or power main relay.

LOCK SWITCH INOPERATIVE

Check driver's side power window lock switch.

WINDOW LOCK ILLUMINATION DOES NOT OPERATE

Check driver's side power window switch.

ONE-TOUCH FEATURE IS INOPERATIVE

Check driver's side power window switch.

ONE WINDOW DOES NOT OPERATE

Check driver's side power window switch for appropriate window, power window switch, power window motor and wiring circuits for appropriate window.

NOTE: For door lock control relay testing, see DOOR LOCKS - POWER article in the ACCESSORIES/SAFETY EQUIPMENT section. For ignition switch testing, see STEERING COLUMN SWITCHES article in the ACCESSORIES/SAFETY EQUIPMENT section.

TESTING

POWER WINDOW SWITCH ILLUMINATION TEST (DRIVER'S SIDE SWITCH)

NOTE: Illumination test is for all switches at driver's side power window switch.

1) Using a 12 volt battery, connect jumper wire from positive battery terminal to driver's side power window switch connector terminal No. 6. See Fig. 1. Connect jumper wire from negative battery terminal to connector terminal No. 3. Ensure power window switches illuminate.

2) Put power window lock switch in lock position. Ensure passenger side power window switch does not illuminate. If illumination is not as described, replace driver's side power window switch.

POWER WINDOW SYSTEM CURRENT TEST

1) Disconnect connector from driver's side power window switch. Connect positive lead of ammeter to driver's side power window switch connector (harness side) terminal No. 5.

2) Connect ammeter negative lead to negative terminal of 12 volt battery. Connect jumper wire from positive battery terminal to driver's side power window switch connector terminal No. 1. See Fig. 1.

3) While lowering driver's side window, current should be about 7 amperes. When window operation is stopped, current should increase to about 14.5 amperes or more. If current is as described, replace driver's side power window switch. If current is not as described, check and repair appropriate circuit.

POWER WINDOW SWITCH CONTINUITY TEST (DRIVER'S SIDE SWITCH)

Using an ohmmeter, check continuity between specified terminals with driver's side power window switch in specified position. See POWER WINDOW SWITCH CONTINUITY TEST table. See Fig. 1. If continuity does not exist at specified terminals, replace power window switch.

POWER WINDOW SWITCH CONTINUITY TEST TABLE

Application & Position	(1) Terminal No.
Driver's Side Switch	
Locked & Unlocked	
UP	1, 3, 5 & 6
OFF	1 & 3; 3 & 5
DOWN	1 & 6; 3 & 5
Passenger Side Switch	
Locked	
UP	2 & 6
OFF	2 & 4
DOWN	4 & 6
Unlocked	
UP	2 & 6; 3 & 4
OFF	2 & 3; 3 & 4
DOWN	2 & 3; 4 & 6

(1) - See Fig. 1.

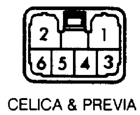

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Fig. 1: Pwr. Win. Sw. Conn. Term. ID (Drvrs' Side Sw. - Harn Side)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER WINDOW SW CONTINUITY TEST (PASSENGER SIDE & REAR SW'S)

Using an ohmmeter, check continuity between specified terminals with power window switch in specified position. See POWER WINDOW SWITCH CONTINUITY TEST (PASSENGER SIDE & REAR) table. See Fig. 2. If continuity does not exist at specified terminals, replace appropriate power window switch.

PWR WINDOW SW CONTINUITY TEST (PASSENGER SIDE & REAR) TABLE

Application & Position	(1) Terminal No.
UP	1 & 2; 4 & 5
OFF	1 & 2; 3 & 4
DOWN	1 & 5; 3 & 4

(1) - See Fig. 2.

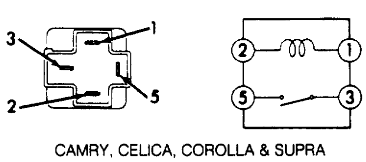
93J84847

Fig. 2: Pwr. Win. Conn. Term. ID (Pass. Side & Rear Sw's Harn. Side)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER WINDOW MAIN RELAY

1) Remove power window main relay, located in junction block No. 2 at left side kick panel.

2) Using an ohmmeter, check continuity between terminals No. 1and 2. Continuity should exist. See Fig. 3. Apply battery voltage to terminal No. 1 and ground terminal No. 2. Continuity should exist at terminals No. 3 and 5. If relay does not test as described, replace power window main relay.



93F84850

Fig. 3: Power Window Main Relay Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER WINDOW MOTOR TEST

Using a 12 volt battery, connect jumper wire from positive battery terminal to terminal No. 2 of power window motor. See Fig. 4. Connect jumper wire from negative battery terminal to terminal No. 1 of power window motor. Motor should operate clockwise. Reverse jumper wire positions. Motor should operate counterclockwise. If motor does not test as described, replace motor.

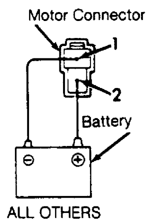


Fig. 4: Power Window Motor Terminal ID
Courtesy of Toyota Motor Sales, U.S.A. Inc.

REMOVAL & INSTALLATION

POWER WINDOW MOTOR

Removal & Installation

Remove door trim panel and waterproof shield. Remove glass retaining bolts and glass. Remove window regulator nuts and remove window regulator. Remove power window motor retaining screws and remove motor from window regulator. To install, reverse removal procedure.

POWER WINDOW SWITCH

Removal & Installation

Disconnect negative battery cable. Pry out power window switch from door panel using flat screwdriver. Disconnect power window switch connectors and remove switch. To install, reverse removal procedure.

WIRING DIAGRAMS

Proceed to chassis WIRING DIAGRAMS article in WIRING DIAGRAMS section.

PRE-ALIGNMENT CHECKS

1993 Toyota Celica

Wheel Alignment
PRE-ALIGNMENT INSPECTION PROCEDURES

PRE-ALIGNMENT CHECKS

Before making wheel alignment adjustment, perform the following checks:

1) Tires should be equal in size and runout must not be excessive. Tires and wheels should be in balance, and inflated to manufacturer's specifications.

2) Wheel bearings must be properly adjusted. Steering linkage and suspension must not have excessive looseness. Check for wear in tie rod ends and ball joints.

3) Steering gear box must not have excessive play. Check and adjust to manufacturer's specifications.

4) Vehicle must be at curb height with full fuel load and spare tire in vehicle. No extra load should be on vehicle.

5) Vehicle must be level with floor and with suspension settled. Jounce front and rear of vehicle several times and allow it to settle to normal curb height.

6) If steering wheel is not centered with front wheels in straight-ahead position, correct by shortening one tie rod adjusting sleeve and lengthening opposite sleeve equal amounts.

7) Ensure wheel lug nuts are tightened to torque specifications.

1993 ENGINE PERFORMANCE
Removal, Overhaul & Installation

Celica

INTRODUCTION

Removal, overhaul and installation procedures are covered in this article. If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be furnished.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. If vehicle is equipped with air bag(s), after disconnecting negative battery cable, wait a minimum of 2 minutes before working on vehicle.

IGNITION SYSTEM

DISTRIBUTOR

NOTE: For timing specifications and procedures, see the appropriate D - ADJUSTMENTS - 4-CYL article in this section.

Removal (Celica)

1) Disconnect negative battery cable. On 2.0L turbo 3S-GTE, remove intercooler. See TURBOCHARGER under AIR INDUCTION SYSTEM.

2) On all models, disconnect spark plug wires from spark plugs (and from ignition coil on 3S-GTE). Disconnect distributor electrical connector. Scribe relationship mark between distributor flange and cylinder head. Remove distributor hold-down bolt(s) or nut(s). Remove distributor. Remove "O" ring from distributor housing and discard.

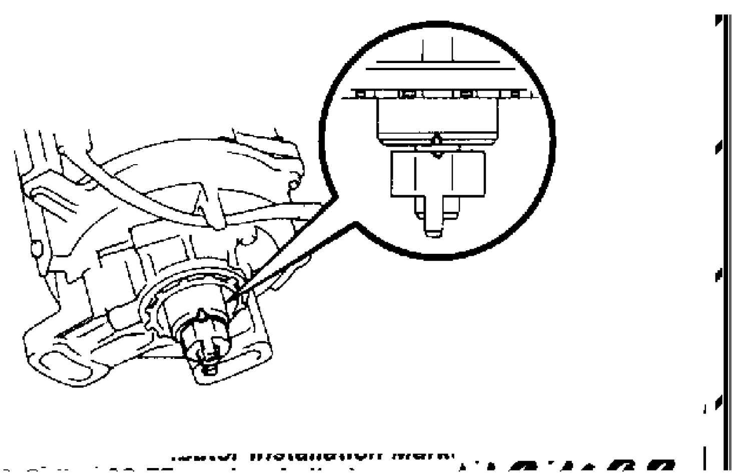


Fig. 1: Aligning Distributor Cut-Out Marks (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Overhaul

Only distributor cap, rotor and coil are serviceable. Pick-up coil and distributor housing assembly are replaced as a unit.

Installation

1) Set cylinder No. 1 to TDC of compression stroke. Coat new "O" ring with oil and install onto distributor housing. Align mark of drive coupling with groove on distributor housing. See Fig. 1.

2) Install distributor to camshaft, aligning distributor mounting flange hole slot with bolt hole on cylinder head. Snug distributor hold-down bolt/nut, but DO NOT tighten. Connect distributor wiring connector. Install spark plug wires.

3) To complete installation, reverse removal procedure. Connect negative battery cable. Start engine and set ignition timing. Tighten distributor hold-down bolt/nut(s). See TORQUE SPECIFICATIONS at the end of this article.

FUEL SYSTEM

FUEL SYSTEM PRESSURE RELEASE

WARNING: High fuel pressure may be present in fuel lines and component parts. Before opening system for testing purposes or component replacement, relieve fuel pressure. DO NOT allow fuel to flow onto engine or electrical parts. Whenever possible, release fuel pressure at fuel filter fitting.

Disconnect negative battery cable. If possible, position container under fuel fitting to be loosened. To prevent fuel spraying, use a rag to cover fuel fitting to be loosened. Slowly loosen fitting, allowing pressurized fuel to spill into container or spray into rag(s). After fuel system pressure is released, disconnect fitting and plug all openings.

CHECKING FOR FUEL LEAKS

NOTE: After replacing fuel system components or performing fuel system maintenance, verify there are no fuel leaks.

Using Diagnosis Check Wire (SST09843-18020), connect Data Link Connector 1 (DLC1) terminals +B and FP. Turn ignition on, with engine off. When fuel return hose is pinched (DO NOT bend hose, as it may cause cracking), fuel pressure within high pressure line will rise to approximately 57 psi (4 kg/cm^2). Pinch fuel return hose and verify there are no fuel system leaks. When inspection is completed, turn ignition off and remove diagnosis check wire from DLC1.

COLD START INJECTOR

Removal & Installation (Celica 2.0L 3S-GTE)

1) Locate cold start injector under throttle body. Disconnect negative battery cable. Remove throttle body. See THROTTLE BODY. Disconnect cold start injector connector. Slowly remove cold start injector pipe 2 union bolts and 4 gaskets, using care not to spill fuel. Remove cold start injector and gasket.

2) Install cold start injector with a NEW gasket. Tighten bolts to 52 INCH lbs. (5.9 N.m). Install injector pipe, 2 union bolts and 4 NEW gaskets. Tighten union bolt to 108 INCH lbs. (12 N.m). Connect cold start injector connector and throttle body. See THROTTLE BODY. Connect negative battery cable. Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

FUEL PUMP

Removal (Celica 2.0L 3S-GTE)

1) Disconnect negative battery cable. Remove gas cap from filler tube to relieve fuel tank pressure. Release fuel pressure at fuel filter. See FUEL SYSTEM PRESSURE RELEASE. In luggage compartment, locate floor service hole cover. Remove wiring protector and disconnect fuel pump and fuel sender electrical connectors at floor service hole cover.

2) Remove service hole cover. Remove screws attaching fuel sender gauge to tank and remove fuel sender gauge. Drain fuel from fuel tank into container. Raise vehicle enough to enable fuel tank removal.

3) Remove left rear wheel. Remove fuel tank plastic protector. Remove fuel tank filler pipe protector. Disconnect filler pipe from fuel tank. Disconnect fuel outlet hose, return hose and fuel evaporation hose from tank tubes. Support fuel tank and remove retaining straps. Lower tank. Remove fuel evaporation bent tube. Remove fuel pump assembly from tank.

4) Pull lower end of fuel pump (with filter) away from bracket. Remove 2 nuts securing fuel pump wires to fuel pump and disconnect wires. Disconnect fuel hose from pump and remove fuel pump. Using small blade screwdriver, remove clip retaining filter to pump.

Installation

1) Use NEW retaining clip to install filter. Use NEW gasket between fuel pump bracket and tank. Tighten fuel pump bracket-to-tank nuts to 26 INCH lbs. (2.9 N.m). Install fuel evaporation bent tube. Tighten fuel evaporation bent tube-to-tank retaining screws to 13 INCH lbs. (1.5 N.m). Tighten fuel evaporation bent tube-to-fuel pump bracket to 26 INCH lbs. (2.9 N.m).

2) Install fuel tank to body. Tighten fuel tank band nuts to 16 ft. lbs. (22 N.m). Install fuel hoses. Tighten outlet hose to 22 ft. lbs. (30 N.m). Install fuel sender gauge with NEW gasket. Tighten fuel sender bracket-to-tank nuts to 13 INCH lbs. (1.5 N.m). To complete installation, reverse removal procedure. Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

Removal & Installation (Celica 1.6L 4A-FE & 2.2L 5S-FE)

1) Disconnect negative battery cable. Remove gas cap from filler tube to relieve fuel tank pressure. Remove rear seat cushion. Remove fuel pump hole cover. Disconnect fuel pump and fuel sender electrical connector. Release fuel pressure at filter. See FUEL SYSTEM PRESSURE RELEASE.

2) Disconnect fuel outlet line and fuel return line from fuel pump bracket assembly. Remove bolts securing fuel pump and bracket assembly to fuel tank. Remove fuel pump and bracket assembly from tank.

3) Remove nuts and washers retaining fuel sending unit wires. Disconnect wires. Remove screws retaining sending unit and separate sending unit from fuel pump and bracket assembly.

4) Pull lower end of fuel pump (with filter) from bracket. Remove 2 nuts securing fuel pump wires to fuel pump. Disconnect wires. Disconnect fuel hose from fuel pump. Remove fuel pump.

5) To install, reverse removal procedure. Use NEW retaining clip to install filter. Use NEW gasket between fuel pump bracket and tank. On Corolla, tighten fuel pump bracket-to-tank nuts to 34 INCH lbs. (3.8 N.m). On other models, tighten fuel pump bracket-to-tank nuts to 26 INCH lbs. (2.9 N.m). On all models, tighten fuel pump outlet line to 22 ft. lbs. (30 N.m). Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

FUEL INJECTORS & FUEL RAILS

NOTE: Install NEW grommets and "O" rings when replacing fuel injectors or reinstalling old injectors. Verify injectors rotate smoothly in injector ports and in fuel rail. If injectors do not rotate smoothly, check "O" rings for proper installation.

Removal (Celica 2.2L 5S-FE)

1) Disconnect negative battery cable. Release fuel pressure at fuel filter. See FUEL SYSTEM PRESSURE RELEASE. Drain engine coolant. Disconnect throttle cable(s) from throttle body. Remove air temperature sensor connector and cruise control cable clamp from air cleaner housing.

2) Loosen duct hose clamp from throttle body. Remove air cleaner cap, resonator and duct hose as an assembly. Disconnect Throttle Position Sensor (TPS) connector and Idle Air Control (IAC) valve connector from throttle body. Mark positions of all vacuum hoses connected to throttle body for reassembly purposes, and remove vacuum hoses from throttle body.

3) Remove 4 throttle body mounting bolts. Remove coolant hoses from throttle body and remove throttle body. Remove power steering vacuum hoses from tubing lines near intake manifold. Mark positions and remove 2 vacuum hoses from EVAP-Thermal Vacuum Valve (TVV) near distributor. Remove EGR temperature sensor harness connector (if equipped).

4) Mark positions and remove 2 vacuum hoses from EGR VSV near bottom of intake manifold. Remove vacuum hose from canister. Remove vacuum hoses tubing retaining clamp near bottom of intake manifold. Disconnect EGR pipe fittings. Remove EGR valve, EGR vacuum modulator and related vacuum hoses.

5) Remove vacuum hoses from intake manifold to brake booster, vacuum sensor, and A/C magnet switch VSV connector. Remove engine ground wire from intake manifold. Disconnect knock sensor and EGR VSV harness connectors. Remove engine harness clamps from brackets on intake manifold. Remove 2 intake manifold support braces. Remove intake manifold.

6) Disconnect fuel injector harness connectors. Disconnect fuel return hose from fuel return pipe. Remove fuel inlet hose by removing pressure pulsation damper and washer gaskets.

7) Remove 2 fuel rail mounting bolts. Gently twist each injector to ease removal. Remove fuel rail with 4 injectors attached, using care not to drop injectors from rail. Replace injector if dropped. Remove 4 injector insulators and 2 rail spacers from intake manifold. Remove fuel injectors from fuel rail by gently pulling. Remove pressure regulator from fuel rail. See Fig. 2.

Installation

1) Install NEW grommets and "O" rings onto injectors. Apply light coat of gasoline to "O" rings and install injectors to fuel rail. See Fig. 5. Install 4 NEW injector insulators and 2 rail spacers in position on cylinder head.

2) Place injectors with attached fuel rail into injector ports on cylinder head. Verify injectors rotate smoothly. If injectors do not rotate smoothly, check "O" rings for binding and for proper installation. Replace "O" ring(s) as required. Verify injector electrical connectors are positioned upward and on cam cover side of fuel rail.

3) Install fuel rail bolts. Install fuel inlet pipe and pulsation damper. To complete installation, reverse removal procedure. Tighten all nuts and bolts to specification. See TORQUE SPECIFICATIONS. Fill engine with coolant. Engine coolant capacity is 6.7 qts. (6.3L). Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

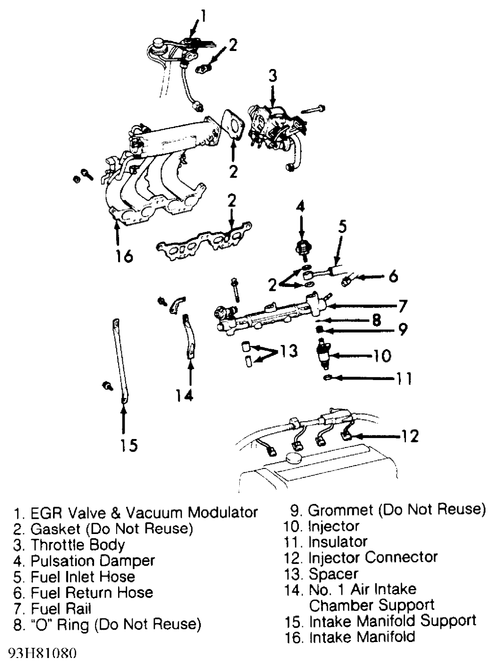


Fig. 2: Locating Fuel Injection Components (Celica - 2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A.

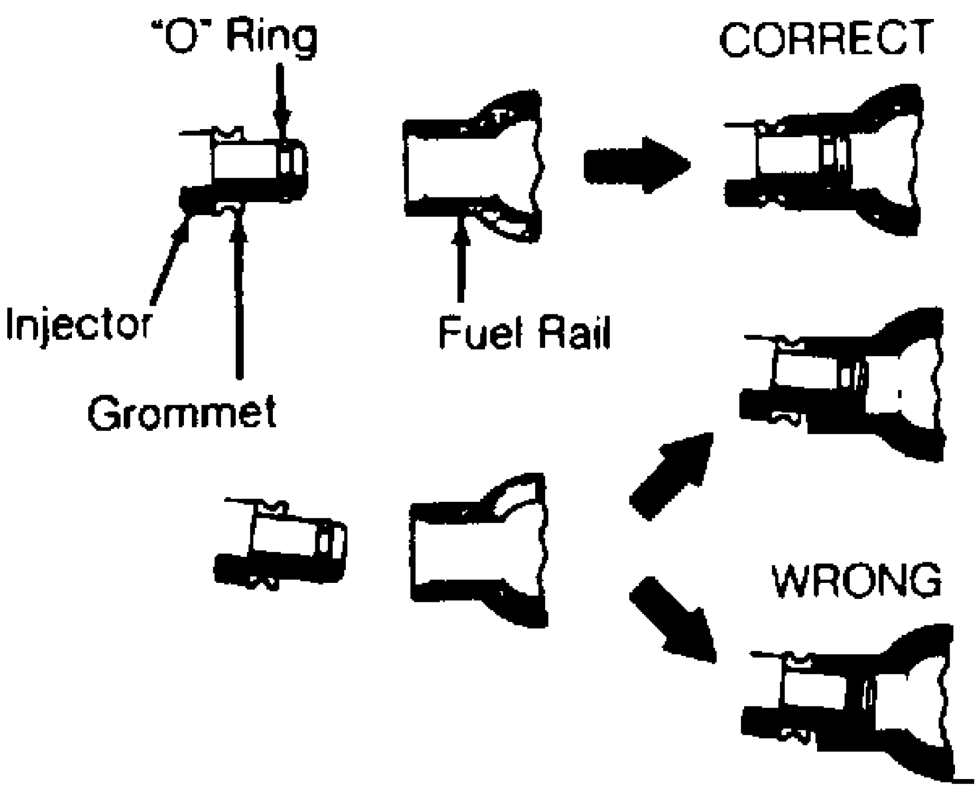


Fig. 3: Proper Injector Installation Into Fuel Rail (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Removal (Celica 1.6L 4A-FE)

1) Disconnect negative battery cable. Disconnect vacuum hose

and fuel return hose from fuel pressure regulator. Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE.

2) Disconnect fuel inlet pipe from fuel rail by removing fuel pipe union bolt and 2 washer gaskets. Disconnect fuel injector harness connectors. Remove 2 fuel rail mounting bolts and carefully lift fuel rail with injectors attached.

3) Remove 4 insulators and 2 fuel rail spacers from cylinder head. Pull injectors from fuel rail. Remove "O" ring and grommet from each fuel injector.

Installation

1) Install NEW grommet to each fuel injector. Apply a light coat of gasoline to NEW "O" ring and install onto injector. Apply a light coat of gasoline to "O" ring on injector to ease installation into fuel rail.

2) Install fuel injectors into fuel rail by turning/twisting fuel injector from left to right in order to bottom injector into fuel rail. See Fig. 3. Place 4 NEW insulators and 2 NEW spacers into position on cylinder head. Insert fuel rail/injector assembly into insulators on cylinder head. Verify fuel injectors rotate smoothly in insulators.

3) Position fuel injector electrical connectors upward. Install fuel rail mounting bolts and tighten to 11 ft. lbs. (15 N.m). Connect fuel inlet hose to fuel rail using 2 NEW washer gaskets. Tighten fuel inlet pipe union bolt to 22 ft. lbs. (30 N.m).

4) Connect fuel injector connectors. Connect fuel return hose and vacuum hose to fuel pressure regulator. Connect negative battery cable. Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

Removal (Celica 2.0L 3S-GTE)

1) Disconnect negative battery cable. Drain coolant from engine. Remove intercooler and throttle body. See THROTTLE BODY. Remove charcoal canister. Remove EGR VSV and vacuum modulator. Remove EGR valve and pipe. Remove cold start injector fuel pipe and cold tart injector. See COLD START INJECTOR.

2) Remove air hose and coolant hoses by-pass pipe. Disconnect injector connectors. Disconnect engine wiring harness from intake manifold. Disconnect fuel pressure regulator vacuum hose. Release fuel pressure at filter, and remove fuel inlet hose. See FUEL SYSTEM PRESSURE RELEASE. Disconnect fuel return hose from pressure regulator.

3) Remove 3 bolts retaining fuel rail to intake manifold. Remove fuel rail with attached fuel injectors. Note position of 3 mounting spacers for reassembly reference. Remove 3 mounting spacers and any remaining injector insulators from intake manifold. Disconnect fuel inlet hose pipe and one mounting bolt from fuel rail.

4) Remove 4 small bolts retaining fuel injector cover to fuel rail. Apply gasoline to both ends of injector to ease removal from fuel rail. Pull injectors from rail. Loosen lock nut, and remove fuel pressure regulator from fuel rail.

Installation

1) Apply light coat of gasoline to NEW "O" rings and install 2 "O" rings to each injector. Install each injector into fuel rail so injector electrical connector is opposite injector cover bolt hole. See Fig. 4.

2) Install fuel pressure regulator to fuel rail using hand pressure to fully bottom unit into rail. Turn regulator counterclockwise until vacuum pipe aligns with rail and fuel return pipe is 180 degrees from fuel rail. Tighten lock nut to 22 ft. lbs. (30 N.m).

3) Install NEW insulator to each injector and install injector cover. Tighten 4 cover bolts to 69 INCH lbs. (7.8 N.m). Connect fuel inlet pipe to fuel rail. Tighten fuel pipe union bolt to

22 ft. lbs. (30 N.m), and fuel line mounting bolt to 69 INCH lbs. (7.8 N.m).

4) Install NEW insulator to each injector bottom. Position 3 fuel rail mounting spacers to intake manifold. Install fuel rail, with attached injectors, into intake manifold injector recesses. Install 3 fuel rail mounting bolts and tighten to 14 ft. lbs. (19 N.m).

5) Connect fuel return hose and vacuum hose to pressure regulator. Install wiring harness to intake manifold and position to mounting bolts on timing belt cover. Connect Gray colored injector connectors to No. 2 and 4 injectors. Connect Brown colored injector connectors to No. 1 and 3 injectors.

6) To complete installation, reverse removal procedure. Tighten all nuts and bolts to specification. See TORQUE SPECIFICATIONS. After installation complete check for fuel leaks. See CHECKING FOR FUEL LEAKS.

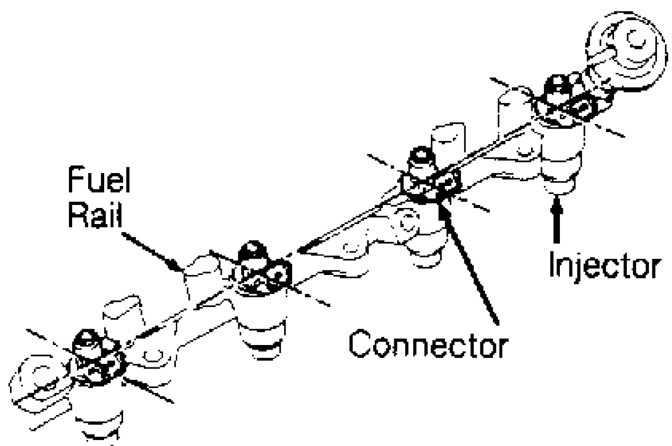


Fig. 4: Positioning Injector Connectors (Celica 3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OXYGEN (O2) & SUB-OXYGEN SENSORS

NOTE: To ease removal of O2 sensor and/or its mounting bolts from exhaust pipe/manifold, it may be necessary to apply penetrating oil to threads. Also to ease O2 sensor removal, run engine a few minutes to heat exhaust system to about 120°F (48°C).

Removal

1) Turn engine off. Disconnect O2 sensor electrical connector. Remove 2 mounting bolts/nuts and remove O2 sensor from manifold/pipe. Some O2 and sub-oxygen sensors screw into exhaust

manifold or header pipe in front of converter.

2) When removing an O2 sensor that will be reused, protect its permanent pigtail from damage by using proper socket wrench (if required). After removal, verify sensor tip is free of contaminants. Replace sensor as required. DO NOT use cleaning solvents on sensor tip.

Installation

Before installing O2 sensor, apply anti-seize compound or silicone to O2 sensor threads or to mounting bolt threads. Screw O2 sensor into exhaust, or install gasket and O2 sensor using mounting bolts.

FUEL PRESSURE REGULATORS

NOTE: If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be furnished. See TORQUE SPECIFICATIONS.

Removal & Installation (Celica 2.2L 5S-FE & 1.6L 4A-FE)

1) Disconnect negative battery cable. To remove pressure regulator from fuel rail, it is not necessary to remove intake manifold. Disconnect vacuum hose from pressure regulator. Release fuel pressure at fuel filter. See FUEL SYSTEM PRESSURE RELEASE.

2) Position cloth under pressure regulator fuel return pipe fitting. On 4A-FE, release hose clamp and remove fuel return hose. On 5S-FE, remove fuel return hose union bolt and 2 washer gaskets. On all models, remove 2 mounting bolts, and remove pressure regulator from fuel rail.

3) To install pressure regulator, apply light coat of gasoline to NEW "O" ring and install onto pressure regulator. Carefully insert pressure regulator into fuel rail, and verify pressure regulator and "O" ring are properly seated to rail. On 4A-FE, install mounting bolts and tighten to 82 INCH lbs. (9.3 N.m). On 5S-FE, install mounting bolts and tighten to 48 INCH lbs. (5.4 N.m).

4) On 4A-FE, install fuel return hose and tighten hose clamp. On 5S-FE, install fuel return hose and union bolt with 2 NEW washer gaskets. Tighten union bolt to 14 ft. lbs. (19 N.m). On all models, connect vacuum hose. Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

Removal & Installation (Celica 2.0L 3S-GTE)

1) To replace pressure regulator, remove fuel injector fuel rail. See FUEL INJECTORS & FUEL RAILS. After removing fuel rail, loosen lock nut and unscrew pressure regulator from fuel rail.

2) To install, fully loosen lock nut on pressure regulator. Apply light coat of gasoline to NEW "O" ring and install onto pressure regulator. Install pressure regulator completely into fuel rail.

3) Turn pressure regulator counterclockwise until its fuel return pipe faces 180 degrees away from fuel rail and vacuum pipe aligns with fuel rail. Tighten lock nut to 22 ft. lbs. (30 N.m). To complete installation, see appropriate installation procedure under FUEL INJECTORS & FUEL RAILS. Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

THROTTLE BODY

Removal & Installation (Celica 1.6L 4A-FE & 2.2L 5S-FE)

1) Disconnect negative battery cable. Drain engine coolant. Disconnect throttle cable (A/T) and accelerator cable from throttle body linkage.

2) Disconnect air intake temperature sensor connector and cruise control cable from air cleaner. Loosen air cleaner hose clamp

at throttle body. Remove air cleaner cap, resonator and air cleaner hose as one assembly.

3) Disconnect TPS connector. On 1.6L 4A-FE, remove accelerator bracket from throttle body. On 2.2L 5S-FE, disconnect ISC valve connectors. On all models, disconnect PCV valve hose from throttle body. Label and disconnect emission control vacuum hoses from throttle body.

4) Remove throttle body mounting bolts. Remove air hose and 2 coolant by-pass hoses from throttle body. Remove throttle body. Note position of throttle body gasket for reassembly reference.

5) To install, reverse removal procedure. Tighten all nuts and bolts to specification. See TORQUE SPECIFICATIONS. Throttle body bolts are 2 different lengths. Install 2 shorter bolts in top holes of throttle body. Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

Removal & Installation (Celica 2.0L 3S-GTE)

1) Disconnect negative battery cable. Drain coolant from engine. Disconnect accelerator cable from throttle linkage. Remove intercooler cool air inlet by removing 7 retaining clips. Remove 3 bolts retaining intercooler top protector. Remove 2 intercooler mounting bolts and 2 air hose clamps. Remove intercooler.

2) Remove 4 bolts retaining throttle body intake air connector. Remove intake air connector support bracket. Disconnect throttle position sensor and Idle Air Control (IAC) valve connectors. Remove accelerator cable bracket. Label and disconnect emission control vacuum hoses and PCV hose from throttle body.

3) Remove 4 throttle body mounting bolts. Lift throttle body enough to disconnect No. 1 air tube hose and 2 coolant by-pass hoses. Remove throttle body. Note position of throttle body gasket for reassembly reference.

4) To install, reverse removal procedure. Tighten all nuts and bolts to specification. See TORQUE SPECIFICATIONS. Check for fuel leakage. See CHECKING FOR FUEL LEAKS.

AIR INDUCTION SYSTEM

VARIABLE INDUCTION SYSTEM

Removal & Installation (Celica 2.0L Turbo 3S-GTE)

1) Disconnect negative battery cable. Disconnect volume airflow meter connector. Disconnect air cleaner hose from volume airflow meter. Remove air cleaner cap and volume airflow meter assembly. Pry off lock plates. Remove bolt, 4 nuts, volume airflow meter and gasket from air cleaner cap.

2) To install, reverse removal procedure using a NEW volume airflow meter gasket. Connect negative battery cable.

TURBOCHARGER

Removal (Celica 2.2L 3S-GTE)

1) Disconnect negative battery cable. Remove engine undercovers. Drain coolant. Remove air cleaner. Remove suspension lower crossmember (connecting lower "A" arms). Remove front exhaust pipe. Support engine, remove front engine lower mount and bracket, and center crossmember.

2) Without disconnecting hydraulic line, remove clutch slave cylinder. Remove alternator and bracket. Remove idler pulley bracket and A/C compressor (without disconnecting lines). Remove 3-way catalytic converter. Remove catalytic converter from turbine outlet elbow. See Fig. 5.

3) Remove intercooler cool air inlet by removing 7 retaining clips. Remove 3 bolts retaining intercooler top protector. Remove 2

intercooler mounting bolts and 2 air hose clamps. Remove intercooler. Remove 3 bolts retaining turbocharger heat insulator.

4) Remove dipstick. Remove oxygen sensor. Remove turbocharger turbine outlet elbow heat insulators. Remove turbocharger vacuum hose and 3 coolant hoses. Remove turbocharger-to-block bracket. Remove turbo top oil pipe nuts and remove return oil pipe hose from turbocharger. Remove 4 nuts retaining turbocharger and remove turbocharger. Remove turbo top oil pipe and turbo coolant pipe from turbo. Remove side bearing housing plate and turbine outlet elbow.

NOTE: Check for oil sludge in oil pipes. Replace pipes if necessary.

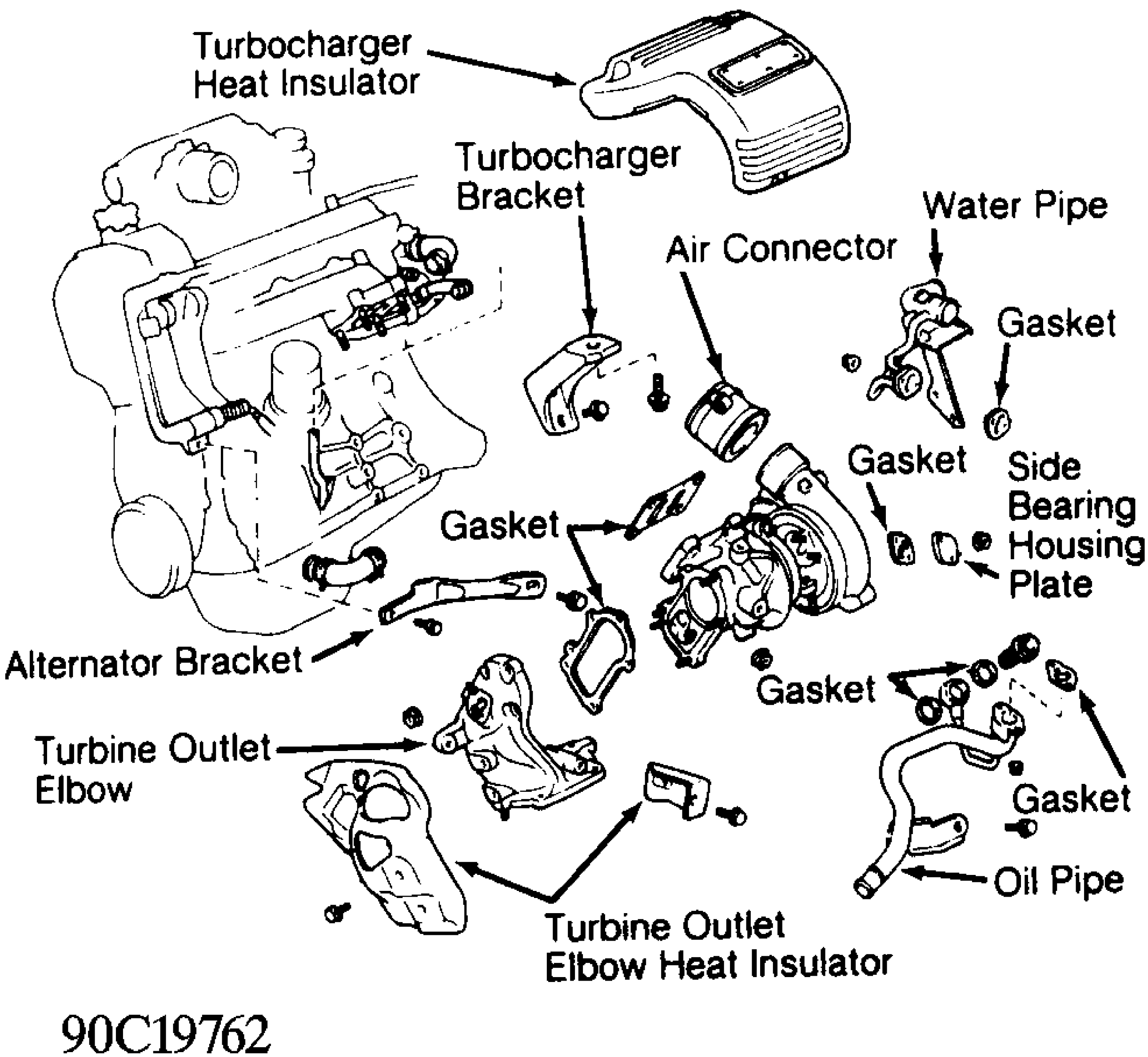


Fig. 5: Exploded View Of Turbocharger (Celica 3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Using finger pressure on impeller shaft, ensure turbine

wheel/shaft assembly turns smoothly. If impeller wheel will not turn or drags when turned, replace turbocharger assembly.

2) To check axial shaft play, insert dial indicator into intake side and place dial indicator needle on shaft end. Axial (forward-and-backward) shaft play should be .0051" (.13 mm) or less. If play is not as specified, replace turbocharger assembly.

3) To check radial shaft play, insert dial indicator needle into turbo oil outlet hole and into hole in spacer bearing to touch impeller shaft. Set dial indicator against center of impeller shaft. Radial (up-and-down) play should be .0071" (.18 mm) or less. If play is not as specified, replace turbocharger assembly.

Installation

1) To install turbocharger, reverse removal procedure. Use NEW gaskets and "O" rings. Tighten all bolts and nuts to specification. See TORQUE SPECIFICATIONS.

2) After installing turbocharger and before installing intercooler air duct, using a funnel, slowly pour one ounce (30 cc) of clean oil into turbo oil inlet. Turn impeller wheel shaft by hand to circulate oil onto bearings. Complete installation procedures and fill cooling system. Check engine oil level. Start engine and check for leaks.

TORQUE SPECIFICATIONS

CAM POSITION SENSOR & DISTRIBUTOR TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Distributor Hold-Down Bolt	
1.6L 4A-FE & 2.2L 5S-FE	14 (19)
2.0L 3S-GTE	29 (39)

FUEL INJECTION TORQUE SPECIFICATIONS (CELICA 1.6L 4A-FE)

Application	Ft. Lbs. (N.m)
Fuel Pressure Regulator Fuel Pipe Bolt	14 (19)
Fuel Pump Outlet Pipe Union Bolt	22 (30)
Fuel Rail Inlet Pipe Union Bolt	22 (30)
Fuel Rail-To-Cylinder Head Bolt	11 (15)
Throttle Body-To-Intake Manifold Bolt	16 (22)
	INCH Lbs. (N.m)
Fuel Pressure Regulator-To-Fuel Rail	82 (9.3)
Fuel Pump Housing Bracket-To-Tank Nuts	26 (2.9)

FUEL INJECTION TORQUE SPECIFICATIONS (CELICA 2.0L 3S-GTE)

Application	Ft. Lbs. (N.m)
Fuel Filter Outlet Hose Pipe Union Bolt	22 (30)
Fuel Inlet Hose Pipe Union Bolt	22 (30)
Fuel Pressure Regulator-To-Fuel Rail Nut	22 (30)
Fuel Rail-To-Cylinder Head Bolts (3)	14 (19)
Fuel Tank Outlet Line Fitting	22 (30)
Fuel Tank Support Straps	16 (22)
Intake Air Connector Support Bracket-To-Throttle Body Bolt	14 (19)

Throttle Body-To-Air Intake Chamber Bolt (1)	14 (19)
	INCH Lbs. (N.m)
Cold Start Injector Fuel Pipe Union Bolt	108 (12)
Cold Start Injector-To-Air Intake Chamber Bolt	52 (5.9)
Fuel Inlet Hose Bracket-To- Fuel Rail Mounting Bolt	69 (7.8)
Fuel Pump Bracket-To-Tank Nuts	26 (2.9)
Fuel Rail Injector Cover Bolts (3)	69 (7.8)
Fuel Sender Bracket-To-Tank Nuts	13 (1.5)
Intake Air Connector Bracket-To-Cylinder Head Nut	69 (7.8)

(1) - Throttle body bolts are 2 different lengths. Install 2 shorter bolts in top holes of throttle body.

FUEL INJECTION TORQUE SPECIFICATIONS (CELICA 2.2L 5S-FE)

Application	Ft. Lbs. (N.m)
Air Intake Chamber	
Cylinder Head Mounting Bolts	14 (19)
Support Bracket Bolts	
12-mm Bolts	16 (22)
14-mm Bolts	31 (42)
EGR Valve Pipe Union Nut	43 (59)
Fuel Pressure Regulator Fuel Pipe Union Bolt	14 (19)
Fuel Pump Outlet Pipe Union Bolt	22 (30)
Fuel Rail Inlet Pipe Pulsation Damper	25 (34)
Throttle Body-To-Intake Manifold	14 (19)
	INCH Lbs. (N.m)
EGR Valve Mounting Nut	115 (13)
Fuel Pressure Regulator-To-Fuel Rail	48 (5.4)
Fuel Pump Housing Bracket-To-Tank Nuts	26 (2.9)
Fuel Rail-To-Cylinder Head Bolts	115 (13)

FUEL PUMP TORQUE SPECIFICATIONS

Application	INCH (N.m)
Fuel Pump Bracket Retaining Screws	35 (3.9)

THROTTLE BODY TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Celica	
1.6L 4A-FE	16 (22)
2.0L 3S-GTE (1) (2)	14 (19)
2.2L 5S-FE	14 (19)

(1) - Throttle body bolts are 2 different lengths. Install 2 shorter bolts in top holes of throttle body.
(2) - For intake air connector support bracket bolts and nuts, tighten bolts to 14 ft. lbs. (19 N.m) and tighten nuts to 69 INCH lbs. (7.8 N.m). For intake air connector bolts, tighten bolts to 14 ft. lbs. (19 N.m).

TURBOCHARGER TORQUE SPECIFICATIONS (CELICA 3S-GTE)

Application	Ft. Lbs. (N.m)
A/C Compressor Bracket Bolts	20 (27)
Alternator Bolts	
12 mm	14 (19)
14 mm	38 (52)
Alternator Support Bracket Bolts	
Lower Alternator Bracket Bolt	29 (39)
Turbine Outlet Elbow Bolt	32 (43)
Bottom Oil Pipe	
Oil Pipe Bracket-To-Block Bolt	32 (43)
Oil Pipe-To-Block Union Bolt	38 (51)
Oil Pipe-To-Turbocharger Nuts	13 (17)
Catalytic Converter Support Bracket (2) Bolts	43 (59)
Catalytic Converter-To-Turbocharger Bolts	22 (30)
Engine Mounting Brackets & Crossmembers	
Engine Mount Through-Bolts	64 (87)
Front Engine Mount-To-Engine Bolts	57 (77)
Lower Crossmember-To-Engine Mount Bolts (4)	54 (73)
Lower Crossmember-To-Frame Bolts	38 (52)
Exhaust Pipe-To-Converter Nuts	46 (62)
Oxygen Sensor Bolts	33 (44)
Turbine Outlet Elbow Nut	47 (64)
Turbocharger Bracket Bolt	
Bracket-To-Block	43 (59)
Bracket-To-Turbo	51 (69)
Turbo-To-Exhaust Manifold Nuts	47 (64)
	INCH Lbs. (N.m)
Air Cleaner Bracket Bolt	108 (12)
Side Bearing Housing Plate	97 (11)
Top Oil Pipe Nuts	108 (12)
Turbocharger Water Pipe Nuts & Bolts	97 (11)

RIDING HEIGHT ADJUSTMENT

1993 Toyota Celica

1993 WHEEL ALIGNMENT
Toyota Riding Height Adjustment

Celica

RIDING HEIGHT ADJUSTMENT

Before adjusting alignment, measure riding height. Riding height must be measured with vehicle on level floor and tires properly inflated. Bounce vehicle several times to allow suspension to settle.

Visually inspect vehicle for signs of abnormal height from front to rear or side to side. Check passenger and luggage compartments for extra heavy items, and remove them if present. If riding height is not within specification, inspect and repair or replace suspension components. See RIDING HEIGHT SPECIFICATIONS table.

RIDING HEIGHT MEASUREMENT POINTS

Celica (FWD)

Measure front riding height from ground to center of lower arm mounting bolt/nut. Measure rear riding height from ground to center of forward strut rod mounting bolt. Strut rod is parallel to side body panel.

Celica (All-Trac)

Measure front riding height from ground to center of lower arm mounting bolt/nut. Measure rear riding height from ground to center of body side No. 2 suspension arm mounting bolt (behind axle).

RIDING HEIGHT SPECIFICATIONS TABLE

Application (1)	Front In. (mm)	Rear In. (mm)
All-Trac	7.38 (187.5)	9.33 (237)
FWD	7.28 (185)	9.90 (251.5)

SCHEDULED SERVICES - TURBO

1993 Toyota Celica

1990-93 MAINTENANCE
Toyota Maintenance & Service Intervals (Turbo)

Celica

* PLEASE READ THIS FIRST *

NOTE: All SERVICE SCHEDULES are listed for normal service vehicles. If vehicle is operated under severe service conditions, see SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES) for items requiring additional maintenance.

NOTE: This article contains scheduled maintenance service information. Fluid types and capacities listed with each service in this article are only those necessary to perform that scheduled service. For specifications pertaining to fluid capacities for the entire vehicle, fuse and circuit breaker identification, wheel and tire size, battery type, warranty information, or model identification refer to the MAINTENANCE INFORMATION article in this section.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG SYSTEM)

NOTE: For information on air bag DIAGNOSIS & TESTING or DISPOSAL PROCEDURES, see AIR BAGS article in the ACCESSORIES/SAFETY EQUIPMENT Section.

When servicing vehicles equipped with Supplemental Restraint Systems (SRS), always allow at least 20 seconds after turning ignition switch to LOCK position and disconnecting the negative terminal cable before beginning work on the SRS. The system has a back-up power supply and may deploy air bag if these precautions are not followed.

RADIATOR FAN & CAP

To avoid injury, stay clear of the radiator fan when the ignition key is in the ON position. The fan is thermostatically controlled and may come on suddenly. DO NOT loosen or remove radiator cap when cooling system is hot.

CATALYTIC CONVERTER

To prevent catalytic converter overheating and possibly creating a fire hazard, do not allow engine to idle for more than 20 minutes, avoid spark jump test and prolonged engine compression measurement.

SERVICE POINT LOCATIONS

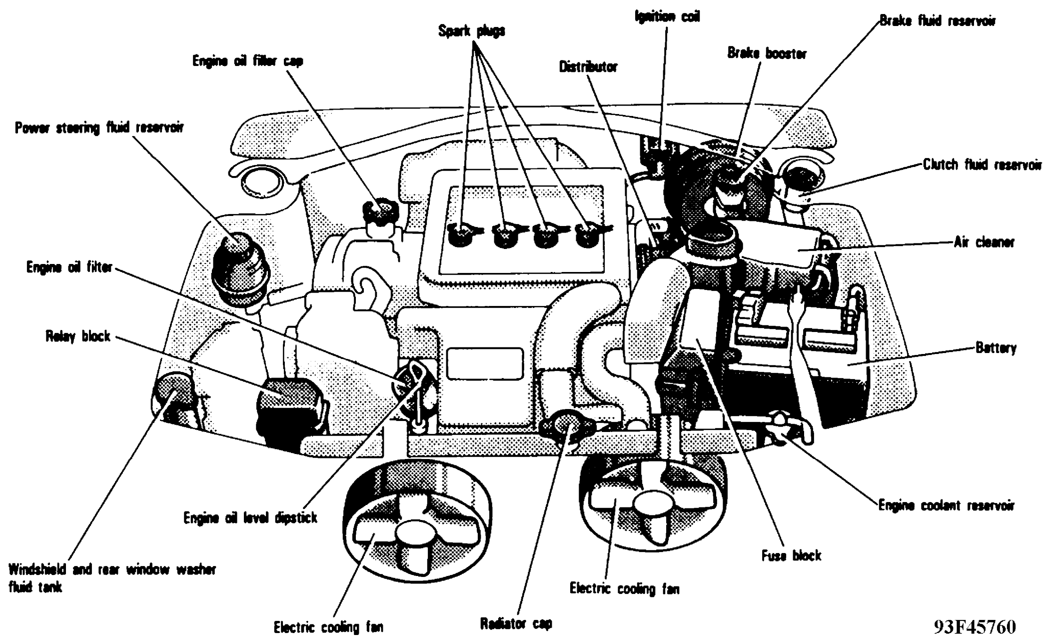


Fig. 1: Service Point Locations (3S-GTE Engine (Turbo))
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAMSHAFT TIMING BELT REPLACEMENT INFORMATION

CAUTION: Failure to replace a faulty camshaft timing belt may result in serious engine damage.

The condition of camshaft drive belts should always be checked on vehicles which have more than 50,000 miles. Although some manufacturers do not recommend belt replacement at a specified mileage, others require it at 60,000-100,000 miles. A camshaft drive belt failure may cause extensive damage to internal engine components on most engines, although some designs do not allow piston-to-valve contact. These designs are often called "Free Wheeling".

Many manufacturers changed their maintenance and warranty schedules in the mid-1980's to reflect timing belt inspection and/or replacement at 50,000-60,000 miles. Most service interval schedules in this manual reflect these changes.

Belts or components should be inspected and replaced if any of the following conditions exist:

* Cracks Or Tears In Belt Surface
* Missing, Damaged, Cracked Or Rounded Teeth
* Oil Contamination
* Damaged Or Faulty Tensioners
* Incorrect Tension Adjustment

Replace the camshaft timing belt every 72 months or 60,000 miles if the vehicle is operated under Severe Service conditions such as frequent idling or extensive long distance driving at low speeds (taxi, police or door-to-door delivery).

SEVERE & NORMAL SERVICE DEFINITIONS

Service is recommended at mileage intervals based on vehicle operation and engine type. Service schedules are based on the following primary operating conditions:

Normal Service

* Driven More Than 10 Miles Daily
* No Operating Conditions From Severe Service Schedule

Severe Service (Unique Driving Conditions)

* Towing A Trailer, Using A Camper Or Car Top Carrier
* Repeated Short Trips Less Than 5 Miles When Temperatures Are Below Freezing
* Extensive Idling Conditions (Taxi Or Delivery Type Service)
* Operating On Dusty, Rough, Muddy Or Salt Spread Roads

SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES)

NOTE: The following services are to be performed on vehicles subjected to severe service. See SEVERE & NORMAL SERVICE DEFINITIONS. This service is to be performed in addition to the normal services listed in the NORMAL MAINTENANCE SERVICE SCHEDULES.

SEVERE SERVICE CONDITIONS/ACTIONS TABLE

Condition	Action	Item	Perform Every (1)
Towing A Trailer, Using A Camper Or Car Top Carrier	Replace	Engine Oil	2,500 Miles or 3 Months
	Replace	Engine Oil Filter	5,000 Miles or 6 Months
	Replace	Transaxle Fluid	15,000 Miles or 24 Months
	Replace	Differential Fluid	15,000 Miles or 24 Months
Repeated Short Trips Less Than 5 Miles When Temperatures Are Below Freezing	Replace	Engine Oil	2,500 Miles or 3 Months
	Replace	Engine Oil Filter	5,000 Miles or 6 Months
	Replace	Transaxle Fluid	15,000 Miles or 24 Months
	Replace	Differential Fluid	15,000 Miles or 24 Months
Extensive Idling Conditions (Taxi Or Delivery Type Service)	Replace	Engine Oil	2,500 Miles or 3 Months
	Replace	Engine Oil Filter	5,000 Miles or 6 Months
	Replace	Transaxle Fluid	15,000 Miles or 24 Months
	Replace	Differential Fluid	15,000 Miles or 24 Months
Operating On Dusty, Rough, Muddy Or	Replace	Engine Oil	2,500 Miles or 3 Months
	Replace	Engine Oil	5,000 Miles or 6 Months

Salt-Spread Roads		Filter	
	Replace	Transaxle Fluid	15,000 Miles or 24 Months
	Replace	Differential Fluid	15,000 Miles or 24 Months

(1) - Perform these services at the mileage or number of months (since the last time), whichever comes first.

NORMAL MAINTENANCE SERVICE SCHEDULES (TURBO)

The following service schedules refer to vehicles driven under normal operating conditions. For vehicles driven under severe conditions, additional services may be necessary. See SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES) above in this article for additional service requirements.

5000 MILE (8000 KM) SERVICE

5000 MILE (8000 KM) SERVICE

	Service Or Inspect
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

10,000 MILE (16,000 KM) SERVICE

10,000 MILE (16,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil

	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

15,000 MILE (24,000 KM) SERVICE

15,000 MILE (24,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Ball Joints & Dust Covers
	Transaxle & Differential Fluid
	Steering Gear Housing

Replace	
	Engine Oil & Filter

Lubrication Specifications	
Application	Specification
Differential	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG

Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times

Application	Hours
2.0L Turbo 3S-GTE	1.7

20,000 MILE (32,000 KM) SERVICE

20,000 MILE (32,000 KM) SERVICE

Service Or Inspect

	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

25,000 MILE (40,000 KM) SERVICE

25,000 MILE (40,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

30,000 MILE (48,000 KM) SERVICE

30,000 MILE (48,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Exhaust Pipes & Mountings
	Fuel Line & Connections
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers
	Transaxle & Differential Fluid
	Steering Gear Housing
Replace	
	Engine Oil & Filter
	Air Filter

	Spark Plugs

Lubrication Specifications	
Application	Specification
Differential	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities	
Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Cooling System	6.3 Qts. (6.0L)
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times	
Application	Hours
2.0L Turbo 3S-GTE	2.2

35,000 MILE (56,000 KM) SERVICE

35,000 MILE (56,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	

Less Than 0°F (-18°C) .... SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

40,000 MILE (64,000 KM) SERVICE

40,000 MILE (64,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

45,000 MILE (72,000 KM) SERVICE

45,000 MILE (72,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage

Ball Joints & Dust Covers
Transaxle & Differential Fluid
Steering Gear Housing
Replace
Engine Oil & Filter

Lubrication Specifications

Application	Specification
Differential	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

50,000 MILE (80,000 KM) SERVICE

50,000 MILE (80,000 KM) SERVICE

Service Or Inspect
Verify Last Major Service Was Performed
Change Engine Oil
Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

55,000 MILE (88,000 KM) SERVICE

55,000 MILE (88,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

60,000 MILE (96,000 KM) SERVICE

60,000 MILE (96,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Valve Clearance
	Drive Belts
	Exhaust Pipes & Mountings
	Idle Speed
	Fuel Line & Connections

	Charcoal Canister
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers
	Transaxle & Differential Fluid
	Steering Gear Housing

Replace

	Engine Oil & Filter
	Air Filter
	Fuel Tank Cap Gasket
	Camshaft Timing Belt (Severe Service)
	Spark Plugs

Lubrication Specifications

Application	Specification
Differential	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times

Application	Hours
2.0L Turbo 3S-GTE	(1) 5.7
(1) - Add 3.5 hours to replace camshaft timing belt.	

65,000 MILE (104,000 KM) SERVICE

65,000 MILE (104,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

70,000 MILE (112,000 KM) SERVICE

70,000 MILE (112,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

75,000 MILE (120,000 KM) SERVICE

75,000 MILE (120,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Ball Joints & Dust Covers
	Transaxle & Differential Fluid
	Steering Gear Housing
	Replace
	Engine Oil & Filter

Lubrication Specifications	
Application	Specification
Differential	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times	
Application	Hours
2.0L Turbo 3S-GTE	1.7

80,000 MILE (128,000 KM) SERVICE

80,000 MILE (128,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.	
(2) - Includes filter change.	

85,000 MILE (136,000 KM) SERVICE

85,000 MILE (136,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	

Minimum Temperature Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

90,000 MILE (144,000 KM) SERVICE

90,000 MILE (144,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Exhaust Pipes & Mountings
	Fuel Line & Connections
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers
	Transaxle & Differential Fluid
	Steering Gear Housing
	Replace
	Engine Oil & Filter
	Air Filter
	Spark Plugs

Lubrication Specifications	
Application	Specification
Differential	
Minimum Temperature Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	

Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities

Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Cooling System	6.3 Qts. (6.0L)
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times

Application	Hours
2.0L Turbo 3S-GTE	2.2

95,000 MILE (152,000 KM) SERVICE

95,000 MILE (152,000 KM) SERVICE

Service Or Inspect

	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

100,000 MILE (160,000 KM) SERVICE

100,000 MILE (160,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

105,000 MILE (168,000 KM) SERVICE

105,000 MILE (168,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Ball Joints & Dust Covers
	Transaxle & Differential Fluid
	Steering Gear Housing
Replace	
	Engine Oil & Filter

Lubrication Specifications	
Application	Specification

Differential	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

110,000 MILE (176,000 KM) SERVICE

110,000 MILE (176,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

115,000 MILE (184,000 KM) SERVICE

115,000 MILE (184,000 KM) SERVICE

Service Or Inspect
Verify Last Major Service Was Performed
Change Engine Oil
Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

120,000 MILE (192,000 KM) SERVICE

120,000 MILE (192,000 KM) SERVICE

Service Or Inspect
Verify Last Major Service Was Performed
Valve Clearance
Drive Belts
Exhaust Pipes & Mountings
Idle Speed
Fuel Line & Connections
Charcoal Canister
Brake Lining & Drums
Brake Pads & Discs
Brake Line Pipes & Hoses
Steering Linkage
Drive Shaft Boots

	Ball Joints & Dust Covers
	Transaxle & Differential Fluid
	Steering Gear Housing
Replace	
	Engine Oil & Filter
	Air Filter
	Fuel Tank Cap Gasket
	Camshaft Timing Belt (Severe Service)
	Spark Plugs

Lubrication Specifications

Application	Specification
Differential	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 Or 80W-90 API GL-5

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times

Application	Hours
2.0L Turbo 3S-GTE	(1) 5.7

(1) - Add 3.5 hours to replace camshaft timing belt.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Application	Fluid Specifications

Automatic Transaxle	Dexron-II ATF
Brake & Clutch Fluid	SAE J1703 Or FMVSS No. 116 DOT 3 Brake Fluid
Differential (4WD)	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-94)	SAE 75W-90 (1)(2) API GL-3
4WD & Transfer Case	SAE 75W-90 Or 80W-90 API GL-5
Power Steering Fluid	Dexron-IIE ATF

(1) - If API GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10 043 December 1991.

FLUID CAPACITIES

FLUID CAPACITIES TABLE (1)

Application	Quantity
A/C System R-12 Refrigerant	24-28 Ozs.
Automatic Transmission	3.5 Qts. (3.3L)
Cooling System	6.3 Qts. (6.0L)
Engine Oil (2)	3.8-4.1 Qts. (3.6-3.9L)
Fuel Tank	
All-Trac 4WD	18 Gals. (68L)
Except All-Trac	15.9 Gals. (60L)
Manual Transmission	5.5 Qts. (5.2L)
Rear Differential	
4WD only	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

SCHEDULED SERVICES - NON-TURBO

1993 Toyota Celica

1990-96 MAINTENANCE
Toyota Maintenance & Service Intervals (Non-Turbo)

Celica

* PLEASE READ THIS FIRST *

NOTE: All SERVICE SCHEDULES are listed for normal service vehicles. If vehicle is operated under severe service conditions, see SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES) for items requiring additional maintenance.

NOTE: This article contains scheduled maintenance service information. Fluid types and capacities listed with each service in this article are only those necessary to perform that scheduled service. For specifications pertaining to fluid capacities for the entire vehicle, fuse and circuit breaker identification, wheel and tire size, battery type, warranty information, or model identification refer to the MAINTENANCE INFORMATION article in this section.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG)

NOTE: See the AIR BAGS article in the ACCESSORIES/SAFETY EQUIPMENT Section.

Modifications or improper maintenance, including incorrect removal and installation of the Supplemental Restraint System (SRS), can adversely affect system performance. DO NOT cover, obstruct or change the steering wheel horn pad in any way, as such action could cause improper function of the system. Use only plain water when cleaning the horn pad. Solvents or cleaners could adversely affect the air bag cover and cause improper deployment of the system.

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all warnings and service precautions. See appropriate AIR BAGS article in ACCESSORIES/SAFETY EQUIPMENT.

CAUTION: Disconnect negative battery cable before servicing any air bag system, steering column or passenger side dash component. After any repair, turn ignition key to the ON position from passenger's side of vehicle in case of accidental air bag inflation

AIR CONDITIONING SERVICING

CAUTION: Avoid breathing R-134a refrigerant and PAG lubricant vapors, exposure may irritate eyes, nose and throat. To remove R-134a from system use R-134a recycling equipment that meets SAE J2210 specifications. If accidental system discharge occurs, ventilate work area before resuming service.

WARNING: R-134a service equipment or vehicle A/C systems SHOULD NOT be pressure tested or leak tested with compressed air. Some mixtures of air/R134a have shown to be combustible at elevated pressures. These mixtures are dangerous and may cause fire and/or explosions. See AIR CONDITIONING SERVICE article in GENERAL INFORMATION section.

ANTI-LOCK BRAKE SYSTEM

The anti-lock brake system contains electronic equipment that can be susceptible to interference caused by improperly installed or high output radio transmitting equipment. Since this interference could cause the possible loss of the anti-lock braking capability, such equipment should be installed by qualified professionals.

On models equipped with anti-lock brake systems, ALWAYS observe the following cautions:

* DO NOT attempt to bleed hydraulic system without first referring to the appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES Section.
* DO NOT mix tire sizes. As long as tires remain close to the original diameter, increasing the width is acceptable. Rolling diameter must be identical for all 4 tires. Some manufacturers recommend tires of the same brand, style and type. Failure to follow this precaution may cause inaccurate wheel speed readings.
* Use ONLY recommended brake fluids. DO NOT use silicone brake fluids in an ABS-equipped vehicle.

BATTERY WARNING

WARNING: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION section.

REPLACING BLOWN FUSES

Before replacing a blown fuse, remove ignition key, turn off all lights and accessories to avoid damaging the electrical system. Be sure to use fuse with the correct indicated amperage rating. The use of an incorrect amperage rating fuse may result in a dangerous electrical system overload.

BRAKE PAD WEAR INDICATOR

Indicator will cause a squealing or scraping noise, warning that brake pads need replacement.

CATALYTIC CONVERTER

Continued operation of vehicle with a severe malfunction could cause converter to overheat, resulting in possible damage to converter and vehicle.

Any modification to the exhaust system on turbo models, which reduces exhaust backpressure, will lead to lean fuel mixtures and excessive spark advance. This could cause serious engine damage.

ELECTROSTATIC DISCHARGE SENSITIVE (ESD) PARTS

WARNING: Many solid state electrical components can be damaged by static electricity (ESD). Some will display a warning label, but many will not. Discharge personal static electricity by touching a metal ground point on the vehicle prior to servicing any ESD sensitive component.

ENGINE OIL

CAUTION: Never use non-detergent or straight mineral oil.

FUEL SYSTEM SERVICE

WARNING: Relieve fuel system pressure prior to servicing any fuel system component (fuel injection models).

HALOGEN BULBS

Halogen bulbs contain pressurized gas which may explode if overheated. DO NOT touch glass portion of bulb with bare hands. Eye protection should be worn when handling or working around halogen bulbs.

RADIATOR CAP

CAUTION: Always disconnect the fan motor when working near the radiator fan. The fan is temperature controlled and could start at any time even when the ignition key is in the OFF position. DO NOT loosen or remove radiator cap when cooling system is hot.

RADIATOR FAN

WARNING: Keep hands away from radiator fan. Fan is controlled by a thermostatic switch which may come on or run for up to 15 minutes even after engine is turned off.

TURBOCHARGED MODELS

CAUTION: Do not race engine immediately after starting. When stopping engine, allow engine to idle for approximately 60 seconds before shutting it off. Failure to do so may cause turbocharger damage due to lack of oil flowing to the turbocharger bearings.

SERVICE POINT LOCATIONS

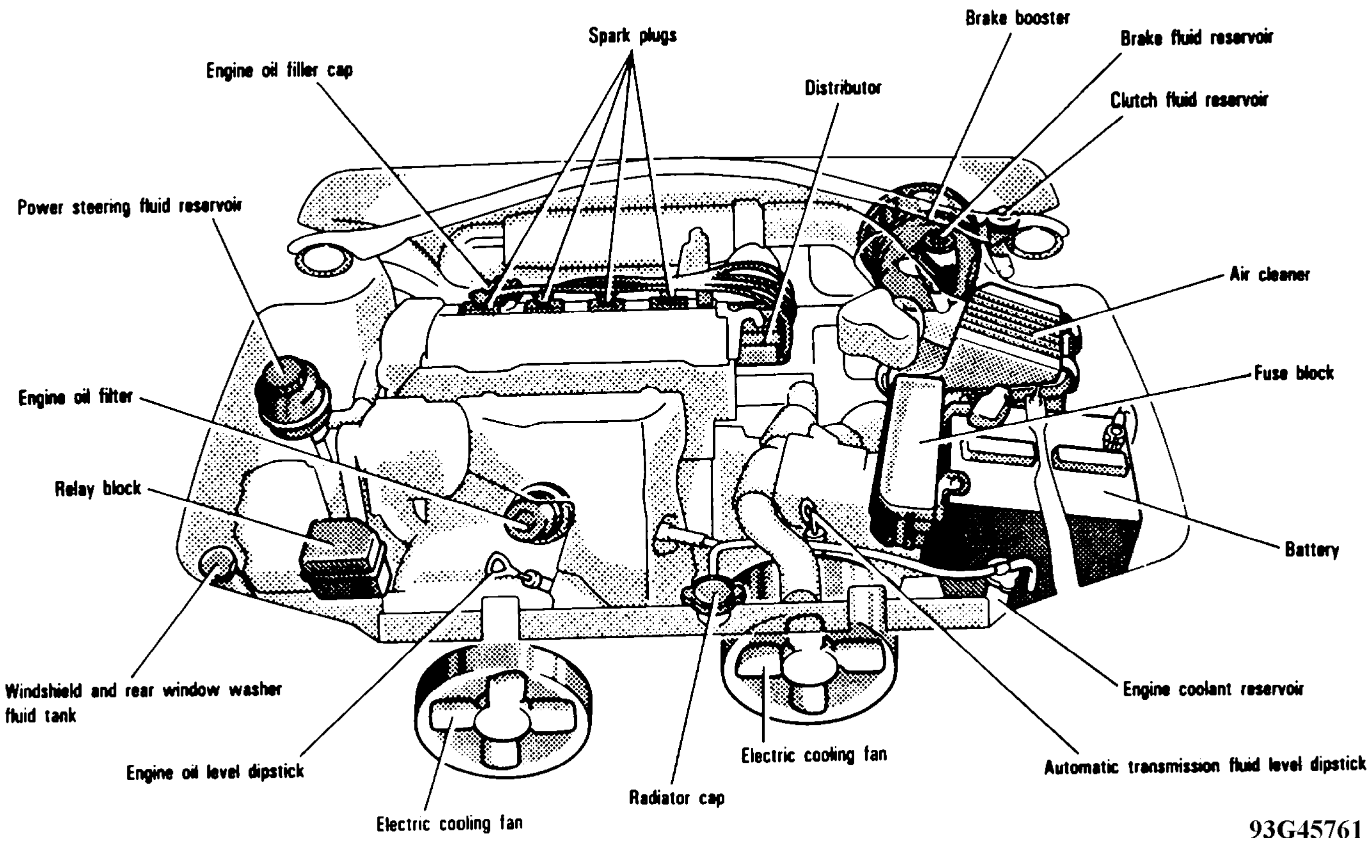


Fig. 1: Service Point Locations (5S-FE Engine)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

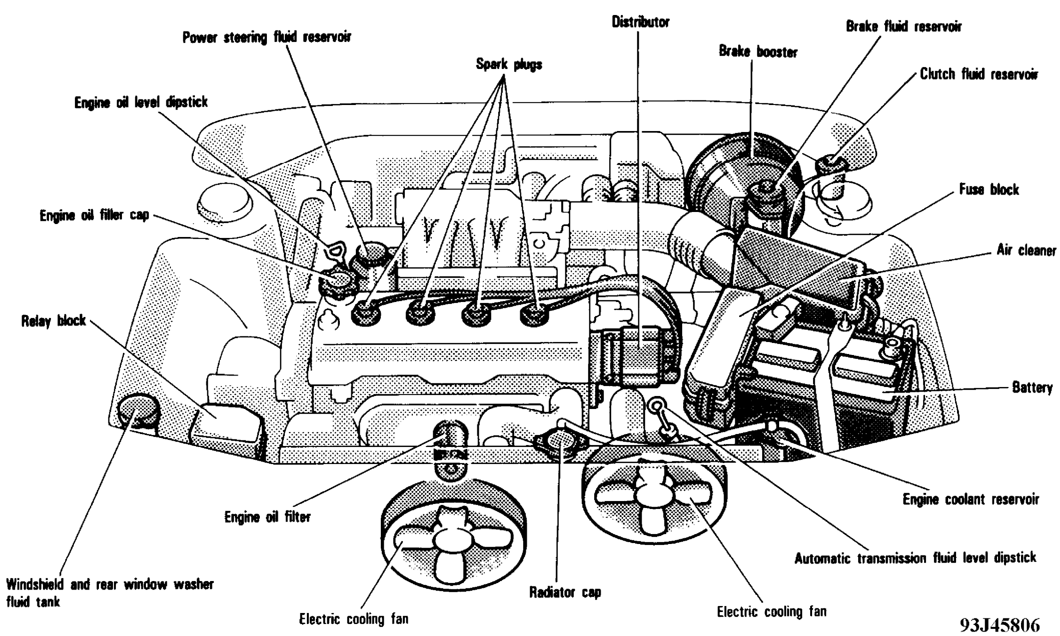


Fig. 2: Service Point Locations (4A-FE Engine)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAMSHAFT TIMING BELT REPLACEMENT INFORMATION

CAUTION: Failure to replace a faulty camshaft timing belt may result in serious engine damage.

The condition of camshaft drive belts should always be checked on vehicles which have more than 50,000 miles. Although some manufacturers do not recommend belt replacement at a specified mileage, others require it at 60,000-100,000 miles. A camshaft drive belt failure may cause extensive damage to internal engine components on most engines, although some designs do not allow piston-to-valve contact. These designs are often called "Free Wheeling".

Many manufacturers changed their maintenance and warranty schedules in the mid-1980's to reflect timing belt inspection and/or replacement at 50,000-60,000 miles. Most service interval schedules in this manual reflect these changes.

Belts or components should be inspected and replaced if any of the following conditions exist:

* Cracks Or Tears In Belt Surface
* Missing, Damaged, Cracked Or Rounded Teeth
* Oil Contamination
* Damaged Or Faulty Tensioners
* Incorrect Tension Adjustment

Replace the camshaft timing belt every 72 months or 60,000 miles if the vehicle is operated under Severe Service conditions such as frequent idling or extensive long distance driving at low speeds (taxi, police or door-to-door delivery).

SEVERE & NORMAL SERVICE DEFINITIONS

NOTE: Use the Severe Service schedule if the vehicle to be serviced is operated under ANY (one or more) of these conditions:

Service is recommended at mileage intervals based on vehicle operation and engine type. Service schedules are based on the following primary operating conditions:

Normal Service

* Driven More Than 10 Miles Daily
* No Operating Conditions From Severe Service Schedule

Severe Service (Unique Driving Conditions)

* Towing A Trailer, Using A Camper Or Car Top Carrier
* Repeated Short Trips Less Than 5 Miles When Temperatures Are Below Freezing
* Extensive Idling Conditions (Taxi Or Delivery Type Service)
* Operating On Dusty, Rough, Muddy Or Salt Spread Roads

SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES)

NOTE: The following services are to be performed on vehicles subjected to severe service. See SEVERE & NORMAL SERVICE DEFINITIONS. This service is to be performed in addition to the normal services listed in the NORMAL MAINTENANCE SERVICE SCHEDULES.

SEVERE SERVICE CONDITIONS/ACTIONS TABLE

Condition	Action	Item	Perform Every (1)

Towing A Trailer, Using A Camper Or Car Top Carrier	Replace	Engine Oil & Filter	5,000 Miles or 6 Months
	Replace	Transmission Fluid	20,000 Miles or 24 Months
	Replace	Differential Fluid	20,000 Miles or 24 Months
Repeated Short Trips Less Than 5 Miles When Temperatures Are Below Freezing	Replace	Engine Oil & Filter	5,000 Miles or 6 Months
	Replace	Transmission Fluid	20,000 Miles or 24 Months
	Replace	Differential Fluid	20,000 Miles or 24 Months
Extensive Idling Conditions (Taxi Or Delivery Type Service)	Replace	Engine Oil & Filter	5,000 Miles or 6 Months
	Replace	Transmission Fluid	20,000 Miles or 24 Months
	Replace	Differential Fluid	20,000 Miles or 24 Months
Operating On Dusty, Rough, Muddy Or Salt Spread Roads	Replace	Engine Oil & Filter	5,000 Miles or 6 Months
	Replace	Transmission Fluid	20,000 Miles or 24 Months
	Replace	Differential Fluid	20,000 Miles or 24 Months
(1) - Perform these services at the mileage or number of months (since the last time), whichever comes first.			

NORMAL MAINTENANCE SERVICE SCHEDULES (NON-TURBO)

The following service schedules refer to vehicles driven under normal operating conditions. For vehicles driven under severe conditions, additional services may be necessary. See SEVERE SERVICE REQUIREMENTS (PERFORM W/SERVICE SCHEDULES) above in this article for additional service requirements.

7500 MILE (12,000 KM) SERVICE

7500 MILE (12,000 KM) SERVICE

Service Or Inspect	
	Change Engine Oil
	Change Oil Filter
Lubrication Specifications	
Application	Specification

Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

15,000 MILE (24,000 KM) SERVICE

15,000 MILE (24,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers
	Transaxle Fluid
	Steering Gear Housing

	Replace
	Engine Oil & Filter

Lubrication Specifications	
Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10, 043 December 1991.

Fluid Capacities

Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times

Application	Hours
1.6L 4A-FE	1.5
2.2L 5S-FE EFI	1.5

22,500 MILE (36,000 KM) SERVICE

22,500 MILE (36,000 KM) SERVICE

Service Or Inspect

- Verify Last Major Service Was Performed

Replace

- Change Engine Oil
- Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

30,000 MILE (48,000 KM) SERVICE

30,000 MILE (48,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
	Exhaust Pipes & Mountings
	Idle Speed (4A-FE Engines)
	Fuel Line & Connections
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers
	Transaxle Fluid
	Steering Gear Housing
Replace	
	Engine Oil & Filter
	Air Filter
	Spark Plugs

Lubrication Specifications

Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10, 043 December 1991.

Fluid Capacities	
Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times	
Application	Hours
1.6L 4A-FE	2.0
2.2L 5S-FE EFI	2.0

37,500 MILE (60,000 KM) SERVICE

37,500 MILE (60,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
Replace	
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

45,000 MILE (72,000 KM) SERVICE

45,000 MILE (72,000 KM) SERVICE

Service Or Inspect
Verify Last Major Service Was Performed
Brake Lining & Drums
Brake Pads & Discs
Brake Line Pipes & Hoses
Steering Linkage
Drive Shaft Boots
Ball Joints & Dust Covers
Transaxle Fluid
Steering Gear Housing

Replace
Engine Oil & Filter

Lubrication Specifications

Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10, 043 December 1991.

Fluid Capacities

Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

52,500 MILE (84,000 KM) SERVICE

52,500 MILE (84,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Replace
	Change Engine Oil
	Change Oil Filter
	Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

60,000 MILE (96,000 KM) SERVICE

60,000 MILE (96,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Valve Clearance
	Drive Belts
	Exhaust Pipes & Mountings
	Idle Speed
	Fuel Line & Connections
	Charcoal Canister
	Brake Lining & Drums
	Brake Pads & Discs

	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers
	Transaxle Fluid
	Steering Gear Housing
Replace	
	Engine Oil & Filter
	Air Filter
	Fuel Tank Cap Gasket
	Camshaft Timing Belt (Severe Service)
	Spark Plugs

Lubrication Specifications

Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10, 043 December 1991.

Fluid Capacities

Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times

Application	(1) Hours
1.6L 4A-FE	4.5

2.2L 5S-FE EFI	4.5
(1) - Add 2.3 hours to replace camshaft timing belt.	

67,500 MILE (108,000 KM) SERVICE

67,500 MILE (108,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Replace
	Change Engine Oil
	Change Oil Filter
	Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

75,000 MILE (120,000 KM) SERVICE

75,000 MILE (120,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers

	Transaxle Fluid
	Steering Gear Housing

Replace

	Engine Oil & Filter

Lubrication Specifications

Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10, 043 December 1991.

Fluid Capacities

Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times

Application	Hours
1.6L 4A-FE	1.5
2.2L 5S-FE EFI	1.5

82,500 MILE (132,000 KM) SERVICE

82,500 MILE (132,000 KM) SERVICE

Service Or Inspect

	Verify Last Major Service Was Performed

Replace

	Change Engine Oil

Change Oil Filter

Lubrication Specifications	
Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

90,000 MILE (144,000 KM) SERVICE

90,000 MILE (144,000 KM) SERVICE

Service Or Inspect
Verify Last Major Service Was Performed
Exhaust Pipes & Mountings
Idle Speed (4A-FE Engines)
Fuel Line & Connections
Brake Lining & Drums
Brake Pads & Discs
Brake Line Pipes & Hoses
Steering Linkage
Drive Shaft Boots
Ball Joints & Dust Covers
Transaxle Fluid
Steering Gear Housing
Replace
Engine Oil & Filter
Air Filter

	Spark Plugs

Lubrication Specifications	
Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10, 043 December 1991.

Fluid Capacities	
Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times	
Application	Hours
1.6L 4A-FE	2.0
2.2L 5S-FE EFI	2.0

97,500 MILE (156,000 KM) SERVICE

97,500 MILE (156,000 KM) SERVICE

Service Or Inspect	
	Verify Last Major Service Was Performed
Replace	
	Change Engine Oil
	Change Oil Filter

Lubrication Specifications	
Application	Specification

Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities	
Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

105,000 MILE (168,000 KM) SERVICE

105,000 MILE (168,000 KM) SERVICE

	Service Or Inspect
	Verify Last Major Service Was Performed
	Brake Lining & Drums
	Brake Pads & Discs
	Brake Line Pipes & Hoses
	Steering Linkage
	Drive Shaft Boots
	Ball Joints & Dust Covers
	Transaxle Fluid
	Steering Gear Housing
	Replace
	Engine Oil & Filter

Lubrication Specifications	
Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10, 043 December 1991.

Fluid Capacities

Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

112,500 MILE (180,000 KM) SERVICE

112,500 MILE (180,000 KM) SERVICE

Service Or Inspect

	Verify Last Major Service Was Performed

Replace

	Change Engine Oil
	Change Oil Filter

Lubrication Specifications

Application	Specification
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG

Fluid Capacities

Application	(1) Quantity
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

120,000 MILE (192,000 KM) SERVICE

120,000 MILE (192,000 KM) SERVICE

Service Or Inspect
Verify Last Major Service Was Performed
Valve Clearance
Drive Belts
Exhaust Pipes & Mountings
Idle Speed
Fuel Line & Connections
Charcoal Canister
Brake Lining & Drums
Brake Pads & Discs
Brake Line Pipes & Hoses
Steering Linkage
Drive Shaft Boots
Ball Joints & Dust Covers
Transaxle Fluid
Steering Gear Housing

Replace
Engine Oil & Filter
Air Filter
Fuel Tank Cap Gasket
Camshaft Timing Belt (Severe Service)
Spark Plugs

Lubrication Specifications

Application	Specification
Automatic Transaxle	Dexron-II ATF
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3

(1) - If API-GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service

Bulletin VOL. 10, 043 December 1991.

Fluid Capacities	
Application	(1) Quantity
Automatic Transmission	3.5 Qts. (3.3L)
Engine Oil (2)	
4A-FE	3.4 Qts. (3.2L)
5S-FE (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE (W/ Oil Cooler)	4.5 Qts. (4.2L)
Manual Transmission	2.7 Qts. (2.6L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Includes filter change.

Service Labor Times	
Application	(1) Hours
1.6L 4A-FE	4.5
2.2L 5S-FE EFI	4.5

(1) - Add 2.3 hours to replace camshaft timing belt.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Application	Fluid Specifications
Automatic Transaxle	Dexron-IIE ATF
Brake & Clutch Fluid	SAE J1703 Or FMVSS No. 116 DOT 3 Brake Fluid
Differential (4WD)	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 90 API GL-5
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 80W Or 80W-90 API GL-5
Engine Oil	
Minimum Temperature	
Greater Than 0°F (-18°C)	SAE 10W-30 API SG
Maximum Temperature	
Less Than 0°F (-18°C)	SAE 5W-30 API SG
Manual Transaxle	
2WD (1990)	Dexron-II
2WD (1991-96)	SAE 75W-90 (1)(2) API GL-3
4WD & Transfer Case	SAE 75W-90 Or 80W-90 API GL-5
Power Steering Fluid	Dexron-IIE ATF

(1) - If API GL-3 is unavailable, API GL-4 or GL-5 may be used.
(2) - If there are questions concerning the correct type of fluid for Celica 2WD Manual Transaxle, see Toyota Tech Service Bulletin VOL. 10 043 December 1991.

FLUID CAPACITIES

FLUID CAPACITIES TABLE (1)

Application	Quantity
A/C System R-12 Refrigerant	
1990-93	24-28 Ozs.
A/C System R-134a Refrigerant (2)	
1994-96	21-24.6 Ozs.
Cooling System	
4A-FE 1.6L	5.5-5.9 Qts. (5.2-5.6L)
5S-FE 2.2L	6.9-7.0 Qts. (6.5-6.6L)
3S-GTE 2.0L	6.3 Qts. (6.0L)
7A-FE 1.8L	6.4-7.0 Qts. (6.1-6.6L)
Engine Oil (3)	
4A-FE 1.6L	3.4 Qts. (3.2L)
5S-FE 2.2L (W/O Oil Cooler)	4.2 Qts. (4.1L)
5S-FE 2.2L (W/ Oil Cooler)	4.5 Qts. (4.2L)
3S-GTE 2.0L	3.8-4.1 Qts. (3.6-3.9L)
7A-FE	3.9 Qts. (3.7L)
Fuel Tank	
All-Trac 4WD	18 Gals. (68L)
Except All-Trac	15.9 Gals. (60L)
Transmission	
Automatic	
All Except 5S-FE (1994-96)	3.5 Qts. (3.3L)
5S-FE (1994-96)	2.6 Qts. (2.5L)
Manual	
All Except 3S-GTE	2.7 Qts. (2.6L)
3S-GTE	5.5 Qts. (5.2L)
Rear Differential	
4WD only	1.2 Qts. (1.1L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.
(2) - Use of R-12 in a R-134a system will result in SEVERE DAMAGE.
(3) - Includes filter change.

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Power Seats

Camry, Celica, Land Cruiser, Supra

DESCRIPTION & OPERATION

CAMRY

Driver's seat cushion moves 6 ways (front up and down, rear up and down and slide forward and backward). See Fig. 1. Seat back reclines forward and backward. Switch controls power and ground circuits of power seat motors. Circuit breaker in power seat motor protects circuit.

CELICA

Driver's seat is equipped with an adjustable lumbar (lower back) support and side supports. See Fig. 2. System receives power through power main relay (near battery, in relay block No. 2). Switch controls power and ground circuits of power seat motors. Circuit breaker in power seat motor protects circuit.

LAND CRUISER

Both front seats move 6 ways (front up and down, rear up and down and slide forward and backward) and seat backs recline forward and backward. Driver's seat is also equipped with an adjustable lumbar (lower back) support. See Fig. 3. Switch controls power and ground circuits of power seat motors. Circuit breaker in power seat motor protects circuit.

SUPRA

Driver's seat slides forward and backward and reclines forward and backward. Switch controls power and ground circuits of power seat motors. See Fig. 4. Circuit breaker in power seat motor protects circuit.

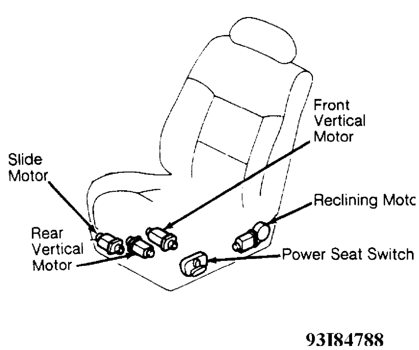


Fig. 1: Locating Power Seat Components (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

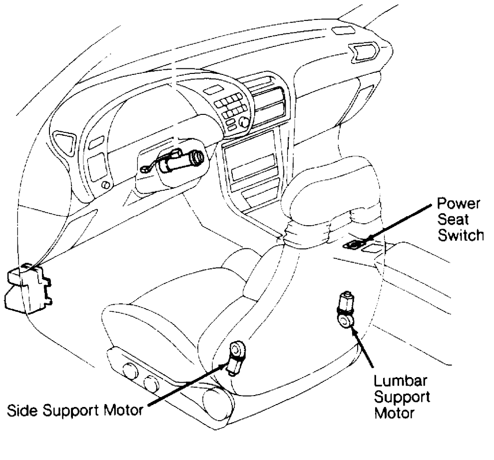


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Fig. 2: Locating Power Seat Components (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

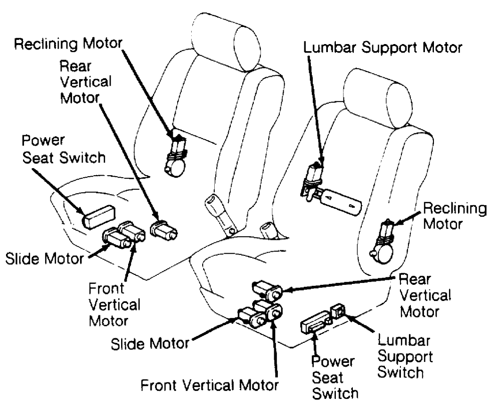

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Fig. 3: Locating Power Seat Components (Land Cruiser)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

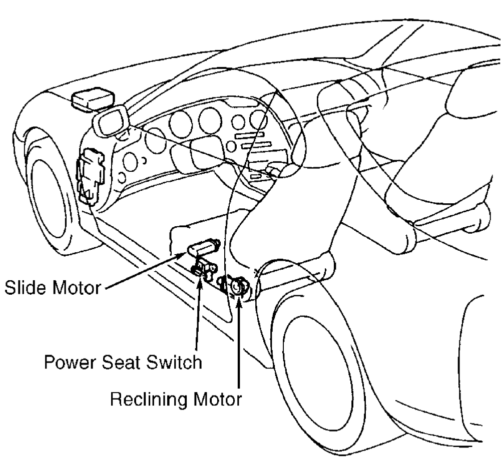

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Fig. 4: Locating Power Seat Components (Supra)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TROUBLE SHOOTING

CAMRY & SUPRA (SEAT DOES NOT MOVE IN ANY DIRECTION)

Check fuse, power seat switch and wiring harness.

CAMRY & SUPRA (SEAT MOVES IN AT LEAST ONE DIRECTION)

Check power seat switch. Check appropriate power seat motor. Check wiring harness.

CELICA (LUMBAR SEAT DOES NOT MOVE IN ANY DIRECTION)

Check fuses and power main relay. Check power seat switch and wiring harness.

CELICA (LUMBAR SEAT MOVES IN AT LEAST ONE DIRECTION)

Check movement of appropriate power seat motor. Check circuit breaker of appropriate power seat motor. Check power seat switch and wiring harness.

LAND CRUISER (LUMBAR SEAT DOES NOT MOVE IN ANY DIRECTION)

Check fuses and power main relay. Check power seat switch and wiring harness.

LAND CRUISER (LUMBAR SEAT MOVES IN AT LEAST ONE DIRECTION)

Check movement of appropriate power seat motor. Check circuit breaker of appropriate power seat motor. Check power seat switch and wiring harness.

TESTING

POWER MAIN RELAY TEST

Celica

Remove power main relay (near battery, in relay block No. 2). Check continuity between terminals No. 3 and 5. See Fig. 5. If there is continuity, replace relay. If there is no continuity, apply battery voltage across terminals No. 1 and 2. Check continuity between terminals No. 3 and 5. If there is no continuity, replace relay. If there is continuity, relay is okay.

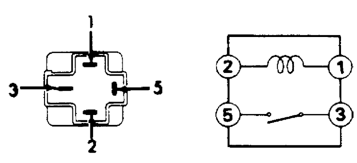

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Fig. 5: Power Main Relay Terminal ID (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

POWER SEAT MOTOR TEST

1) Disconnect power seat motor connector. Apply battery voltage across power seat motor connector terminals. Reverse polarity to move seat in opposite direction. If power seat motor does not operate, replace power seat motor.

2) If power seat motor operates, move seat fully in one direction until it stops. With seat stopped, keep battery voltage applied to terminals until circuit breaker is heard operating (4-60 seconds). If circuit breaker does not operate within 60 seconds, replace power seat motor.

3) If circuit breaker operates within 60 seconds, reverse polarity and wait until seat moves in opposite direction. If seat moves in opposite direction within 60 seconds, power seat motor is okay. If seat does not move in opposite direction within 60 seconds, replace power seat motor.

POWER SEAT SWITCH TEST

Disconnect power seat switch connector. Check continuity between specified terminals of power seat switch connector. See appropriate POWER SEAT SWITCH CONTINUITY TEST table. Replace switch if continuity is not as specified. See Figs. 6-8.

POWER SEAT SWITCH CONTINUITY TEST TABLE (CAMRY)

Switch Position	(1) Terminals
Slide	
Forward	5 & 10; 8 & 9
Off	5 & 9; 8 & 9
Backward	5 & 9; 8 & 10
Front Up/Down	
Up	10 & 12; 4 & 11
Off	4 & 11; 4 & 12
Down	4 & 12; 10 & 11
Rear Up/Down	
Up	2 & 10; 6 & 7
Off	2 & 7; 6 & 7
Down	2 & 7; 6 & 10
Recline	
Forward	4 & 10; 7 & 9
Off	4 & 9; 7 & 9
Backward	4 & 9; 7 & 10

(1) - See Figs. 6-8.

POWER SEAT SWITCH CONTINUITY TEST TABLE (CELICA)

Switch Position	(1) Terminals
Lumbar	
Push (Outward)	2 & 7; 8 & 9
Off	2, 8 & 9
Release (Inward)	2 & 8; 7 & 9
Side Support	
Spread (Outward)	3 & 8; 5 & 7
Off	3, 5 & 8
Close (Inward)	3 & 7; 5 & 8

(1) - See Figs. 6-8.

POWER SEAT SWITCH CONTINUITY TEST TABLE (LAND CRUISER)

Switch Position	(1) Terminals
Slide	

Forward	5 & 10; 8 & 9
Off	5, 8 & 9
Backward	5 & 9; 8 & 10
Front Up/Down	
Up	4 & 11; 10 & 12
Off	4, 11 & 12
Down	4 & 12; 10 & 11
Rear Up/Down	
Up	2 & 10; 6 & 7
Off	2, 6 & 7
Down	2 & 7; 6 & 10
Recline	
Forward	4 & 10; 7 & 9
Off	4, 7 & 9
Backward	4 & 9; 7 & 10
Lumbar	
Forward (Outward)	1 & 9; 3 & 10
Off	1, 3 & 9
Backward (Inward)	1 & 10; 3 & 9

(1) - See Figs. 6-8.

POWER SEAT SWITCH CONTINUITY TEST TABLE (SUPRA)

Switch Position	(1) Terminals
Slide	
Forward	A1 & A3; A2 & A4
Off	A1 & A3; A1 & A4
Backward	A1 & A4; A2 & A3
Recline	
Forward	A1 & B1; A2 & B2
Off	A1 & B1; A1 & B2
Backward	A1 & B2; A2 & B1

(1) - See Figs. 6-8.

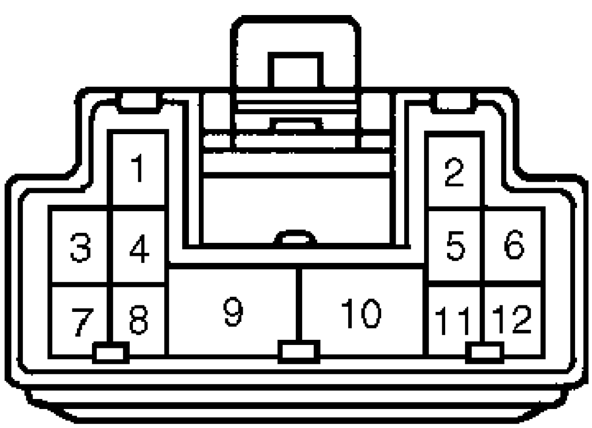

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Fig. 6: Power Seat Switch Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A.

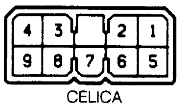

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Fig. 7: Power Seat Switch Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A.

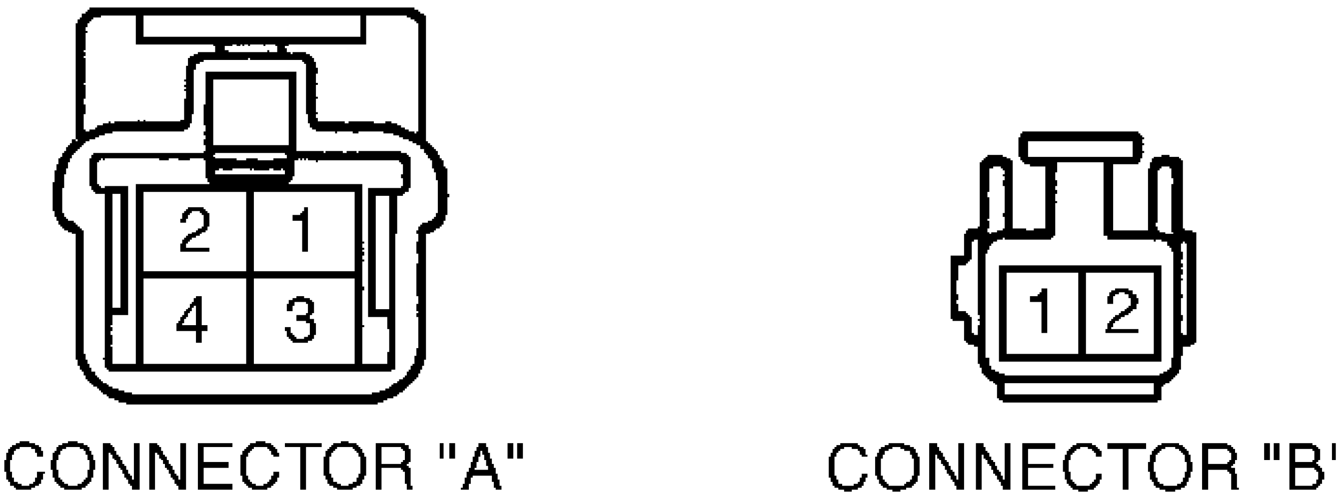

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Fig. 8: Power Seat Switch Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A.

WIRING DIAGRAMS

See appropriate chassis wiring diagram in WIRING DIAGRAMS section.

1993 ENGINE PERFORMANCE
Toyota Sensor Operating Range Charts

Celica

INTRODUCTION

Sensor operating range information can help determine if a sensor is out of calibration. An out-of-calibration sensor may not set a trouble code, but it may cause driveability problems.

NOTE: Unless stated otherwise in testing procedure, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance.

AIRFLOW METER

NOTE: Airflow meter may be referred to as Volume Airflow (VAF) meter or Mass Airflow (MAF) meter.

AIRFLOW METER RESISTANCE SPECIFICATIONS TABLE

Application & Terminals (1)	Ohms
Turbo	
E2-VC	200-400
E2-THA	
-4°F (20°C)	10,000-20,000
32°F (0°C)	4000-7000
68°F (20°C)	2000-3000
104°F (40°C)	900-1300
140°F (60°C)	400-700
E2-VS	
Measuring Plate Fully Closed	200-600
Measuring Plate Fully Opened	20-1200

(1) - For terminal identification and testing, see I - SYS /COMP TESTS article in the ENGINE PERFORMANCE section.

AIR TEMPERATURE SENSOR

NOTE: Air temperature sensor may be referred to as intake air temperature sensor.

1.6L 4A-FE & 2.2L 5S-FE

Air temperature sensor is located in air intake, near air filter. Measure resistance between sensor terminals. For resistance specifications, see Fig. 1.

2.0L Turbo

Air temperature sensor is an integral part of airflow meter. Check resistance at terminals E2 and THA of airflow meter. See AIRFLOW METER RESISTANCE SPECIFICATIONS table.

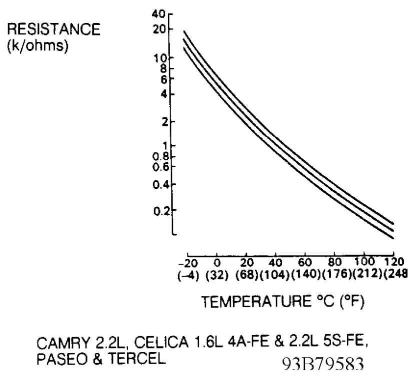


Fig. 1: Checking Air Temperature Sensor (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

COLD START INJECTOR TIME SWITCH

COLD START INJECTOR TIME SWITCH RESISTANCE SPECIFICATIONS TABLE

Application & Terminals (1)	Temperature °F (°C)	Ohms
Turbo		
STA-STJ	Less Than 50 (10)	30-50
	Greater Than 77 (25)	70-90
STA-Ground	.....	30-90

(1) - For terminal identification and testing, see I - SYS/ COMP TESTS article in the ENGINE PERFORMANCE section.

COOLANT TEMPERATURE SENSOR

NOTE: Coolant temperature sensor may also be referred to as Engine Coolant Temperature (ECT) sensor.

Measure coolant temperature sensor resistance between sensor terminals. For resistance specifications, see Fig. 2.

EGR GAS TEMPERATURE SENSOR

EGR GAS TEMPERATURE SENSOR SPECIFICATIONS TABLE (1)

Temperature - °F (°C)	k/Ohms
122 (50)	69-89
212 (100)	11-15
302 (150)	2-4

(1) - For terminal identification and testing, see I - SYS/ COMP TESTS article in the ENGINE PERFORMANCE section.

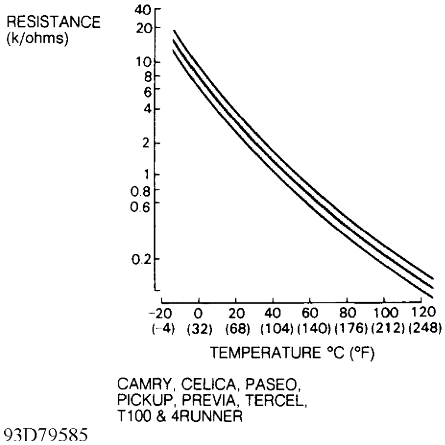


Fig. 2: Checking Coolant Temperature Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

MANIFOLD ABSOLUTE PRESSURE SENSOR

NOTE: See VACUUM SENSOR section in this article.

OXYGEN SENSOR HEATER

OXYGEN SENSOR HEATER RESISTANCE SPECIFICATIONS TABLE (1)

Application	Ohms
Celica	5.1-6.3 @ 68°F (20°C)

(1) - Measure resistance between sensor terminals +B and HT. For terminal identification, see I - SYS/COMP TESTS article in the ENGINE PERFORMANCE section.

THROTTLE POSITION SENSOR

NOTE: For terminal identification and testing procedures, see I - SYS/COMP TESTS article in the ENGINE PERFORMANCE section.

TPS RESISTANCE SPECIFICATIONS TABLE

Application	Clearance In. (mm)	Terminal	Ohmmeter Reading
1.6L 4A-FE	.024 (.61)	IDL & E2	Continuity
		PSW-E2	No Continuity
	.031 (.79)	IDL-E2	No Continuity
		PSW-E2	No Continuity
	Fully Open	IDL-E2	No Continuity
		PSW-E2	Continuity
2.0L Turbo (1)	0 (0)	VTA & E2	470-6100
	.020 (.51)	IDL & E2	2300 Or Less
	.028 (.71)	IDL & E2	No Continuity
	Fully Open	VTA & E2	3100-12,100
		VC & E2	3900-9000
2.2L 5S-FE (1)	0 (0)	VTA & E2	200-5700
	.020 (.51)	IDL & E2	2300 Or Less
	.028 (.71)	IDL & E2	No Continuity
	Fully Open	VTA & E2	2000-10,200
		VC & E2	2500-5900

(1) - Apply vacuum to throttle opener before checking TPS.

TURBOCHARGING PRESSURE SENSOR

TURBOCHARGING PRESSURE SENSOR OUTPUT VOLTAGE SPECIFICATIONS TABLE

Applied Vacuum In. Hg	Output Voltage Drop
3.94	.15-.35
7.87	.40-.60
11.81	.65-.85
15.75	.90-1.10
19.69	1.15-1.35

VACUUM SENSOR

NOTE: Vacuum sensor may also be referred to as Manifold Absolute Pressure (MAP) sensor. Vacuum sensor is used on 1.6L 4A-FE and 2.2L 5S-FE. For testing procedures, see I - SYS/COMP TESTS article in the ENGINE PERFORMANCE section.

VACUUM SENSOR SUPPLY VOLTAGE SPECIFICATIONS TABLE

Application	Voltage
1.6L 4A-FE & 2.2L 5S-FE	4.50-5.50

VACUUM SENSOR OUTPUT VOLTAGE DROP SPECIFICATIONS TABLE

Applied Vacuum In. Hg	Output Voltage Drop
3.94	.3-.5
7.87	.7-.9
11.81	1.1-1.3
15.75	1.5-1.7
19.69	1.9-2.1

SHIFT LOCK SYSTEM

1993 Toyota Celica

AUTOMATIC TRANSMISSIONS
Toyota Shift Lock System

APPLICATION

APPLICATION

Application	Model
Lexus	ES300, GS300, LS400, SC300 & SC400
Toyota	Camry, Celica, Corolla, Land Cruiser, MR2, Paseo, Pickup, Supra, Tercel & 4Runner

DESCRIPTION

Transmission is equipped with a electronically controlled shift lock and key lock system. See Fig. 1. Shift lock system prevents shift lever from being moved from Park unless brake pedal is depressed. In case of a malfunction, shift lever can be released by depressing shift lock override button, located near shift lever. Key lock system prevents ignition key from being moved from ACC to LOCK position on ignition switch unless shift lever is in Park.

The system consists of a brakelight switch, key interlock solenoid, shift lock control switch, shift lock Electronic Control Unit (ECU), shift lock solenoid and shift lock override button. See Fig. 1.

NOTE: Shift lock Electronic Control Unit is referred to as ECU.

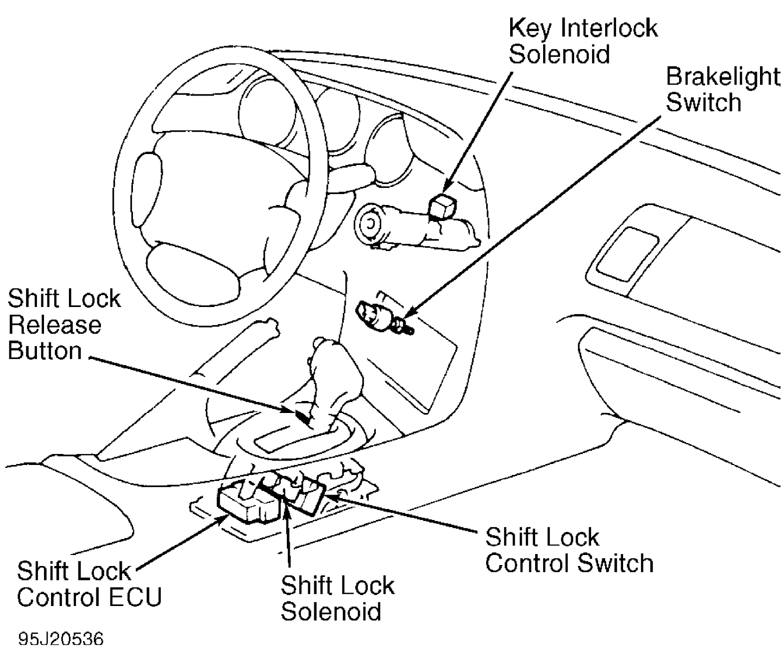


Fig. 1: Shift & Key Lock System (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OPERATION

SHIFT LOCK SYSTEM

With ignition on, when brake pedal is depressed, an input signal is sent from brakelight switch to the ECU. With shift lever in Park, an input signal from shift control switch is input to ECU, indicating shift lever is in Park. The ECU then operates shift lock solenoid, so shift lever can be moved from Park.

KEY LOCK SYSTEM

With ignition in ON or ACC position and shift lever in Park, shift lock control switch opens and voltage from ECU to key interlock solenoid is turned off. When key interlock solenoid is turned off, ignition key can be turned from ACC to LOCK position on ignition switch.

NOTE: If ignition is left in ACC or ON position with shift lever in any gear range except Park for about one hour, ECU then operates to release the lock mechanism.

TESTING

ELECTRONIC CONTROL UNIT (ECU)

Access ECU. See Fig. 1. The ECU is mounted under the center console, in front or back of shifter. Turn ignition on. Backprobing ECU harness connector with DVOM, check voltage between designated terminals. Voltage should be as specified. Refer to the appropriate SHIFT LOCK SYSTEM PIN VOLTAGES table. For circuit identification, see appropriate wiring diagram in WIRING DIAGRAMS.

NOTE: Ground (GND) terminal is also referred to as "E" terminal.

SHIFT LOCK SYSTEM PIN VOLTAGES

SHIFT LOCK SYSTEM PIN VOLTAGES (CAMRY, CELICA, COROLLA, ES300, GS300, LAND CRUISER, PASEO & TERCEL)

Measure Between Terminals:	Description	Voltage
ECU		
ACC-GND	Ignition Switch In ACC Position	10-14
IG-GND	Ignition Switch In ON Position	10-14
STP-GND	Depress Brake Pedal	10-14
KLS-GND	Ignition Switch In ACC, Shifter In "P"	0
	Ignition Switch In ACC, Shifter Except "P"	10-14
	(1) Ignition Switch In ACC, Shifter Except "P"	6-9
Shift Lock Solenoid		
SLS+-SLS-	Ignition Switch In ACC, Shifter In "P"	0
	Depress Brake Pedal	8-13.5
	Depress Brake Pedal (After 20 Seconds)	5.5-9.5
	Ignition Switch In ACC, Shifter Except "P"	0
Shift Lock Control Switch		
P1-P	Ignition Switch In ON Position, Shifter In "P", Depress Brake Pedal	0
	Ignition Switch In ON, Shifter Except "P"	9-13.5
P2-P	Ignition Switch In ACC, Shifter In "P"	9-13.5
	Ignition Switch In ACC, Shifter Except "P"	0

(1) - Voltage measurement after 1 second.

SHIFT LOCK SYSTEM PIN VOLTAGES (LS400, SC300, SC400 & SUPRA)

Measure Between Terminals:	Description	Voltage
ECU		
ACC-GND	Ignition Switch In ACC Position	10-14
IG-GND	Ignition Switch In ON Position	10-14
STP-GND	Depress Brake Pedal	10-14
KLS-GND	Ignition Switch In ACC, Shifter In "P"	0
	Ignition Switch In ACC, Shifter Except "P"	7.5-11
	(1) Ignition Switch In ACC, Shifter Except "P"	6-9.5
Shift Lock Solenoid		
SLS+-SLS-	Ignition Switch In ACC, Shifter In "P"	0
	Depress Brake Pedal	8-13.5
	Depress Brake Pedal (After 20 Seconds)	5.5-9.5
	Ignition Switch In ACC, Shifter Except "P"	0
Shift Lock Control Switch		
P1-P	Ignition Switch In ON Position, Shifter In "P", Depress Brake Pedal	0
	Ignition Switch In ON, Shifter Except "P"	9-13.5
P2-P	Ignition Switch In ACC, Shifter In "P"	9-13.5
	Ignition Switch In ACC, Shifter Except "P"	0

(1) - Voltage measurement after 1 second.

SHIFT LOCK SYSTEM PIN VOLTAGES (MR2)

Measure Between Terminals:	Description	Voltage
ECU		
ACC-GND	Ignition Switch In ACC Position	10-14
IG-GND	Ignition Switch In ON Position	10-14
STP-GND	Depress Brake Pedal	10-14
KLS-GND	Ignition Switch In ACC, Shifter In "P"	0
	Ignition Switch In ACC, Shifter Except "P"	7.5-11
	(1) Ignition Switch In ACC, Shifter Except "P"	6-9
Shift Lock Solenoid		
SLS+-GND	Ignition Switch In ACC, Shifter In "P"	0
	Depress Brake Pedal	8-13.5
	Ignition Switch In ACC, Shifter Except "P"	0
Shift Lock Control Switch		
P1-P	Ignition Switch In ON Position, Shifter In "P", Depress Brake Pedal	0
	Ignition Switch In ON, Shifter Except "P"	9-13.5
P2-P	Ignition Switch In ACC, Shifter In "P"	0-13.5

(1) - Voltage measurement after 1 second.

SHIFT LOCK SYSTEM PIN VOLTAGES (PICKUP & 4RUNNER)

Measure Between

Terminals:	Description	Voltage
ECU		
ACC-GND	Ignition Switch In ACC Position	10-14
IG-GND	Ignition Switch In ON Position	10-14
STP-GND	Depress Brake Pedal	10-14
KLS-GND	Ignition Switch In ACC, Shifter In "P"	0
	Ignition Switch In ACC, Shifter Except "P"	10-14
	(1) Ignition Switch In ACC, Shifter Except "P"	6-9
Shift Lock Solenoid		
SLS+-SLS-	Ignition Switch In ACC, Shifter In "P"	0
	Depress Brake Pedal	10-14
	Ignition Switch In ACC, Shifter Except "P"	0
Shift Lock Control Switch		
P1-P	Ignition Switch In ON Position, Shifter In "P", Depress Brake Pedal	0
	Ignition Switch In ON, Shifter Except "P"	10-14
P2-P	Ignition Switch In ACC, Shifter In "P"	10-14
	Ignition Switch In ACC, Shifter Except "P"	0

(1) - Voltage measurement after 1 second.

SHIFT LOCK SOLENOID

1) Disconnect electrical connector from shift lock solenoid. Using ohmmeter, measure resistance between electrical terminals of shift lock solenoid.

2) Replace shift lock solenoid if resistance is not within specification. See SHIFT LOCK SOLENOID RESISTANCE SPECIFICATIONS table.

3) Apply battery voltage between electrical terminals of shift lock solenoid. Replace shift lock solenoid if operating sound cannot be heard.

SHIFT LOCK SOLENOID RESISTANCE SPECIFICATIONS

Application	Ohms
Camry, Celica, ES300, GS300 & MR2	21-27
Corolla, Paseo & Tercel	30-35
Land Cruiser, LS400, Pickup, SC300, SC400, Supra & 4Runner	20-28
Pickup & 4Runner	29-36

KEY INTERLOCK SOLENOID

1) Disconnect electrical connector from key interlock solenoid. Using ohmmeter, measure resistance between electrical terminals of key interlock solenoid.

2) Replace key interlock solenoid if resistance is not 12-17 ohms. Apply battery voltage between electrical terminals of key interlock solenoid. Replace key interlock solenoid if operating sound cannot be heard.

SHIFT LOCK CONTROL SWITCH

NOTE: Testing for Land Cruiser not available from manufacturer.

Disconnect electrical connector from shift lock control switch. Using ohmmeter, check continuity between specified terminals in relation to shift lever. See SHIFT LOCK CONTROL SWITCH CONTINUITY table. Replace switch if continuity is not as specified.

NOTE: Continuity must be checked in accordance with position of release button on shift lever and shift lever position.

SHIFT LOCK CONTROL SWITCH CONTINUITY

Shift Lever Position & Condition	Terminals
Park & Release Button Not Pushed	P & P1
Any Other Gear Except Park	P & P2

WIRING DIAGRAMS

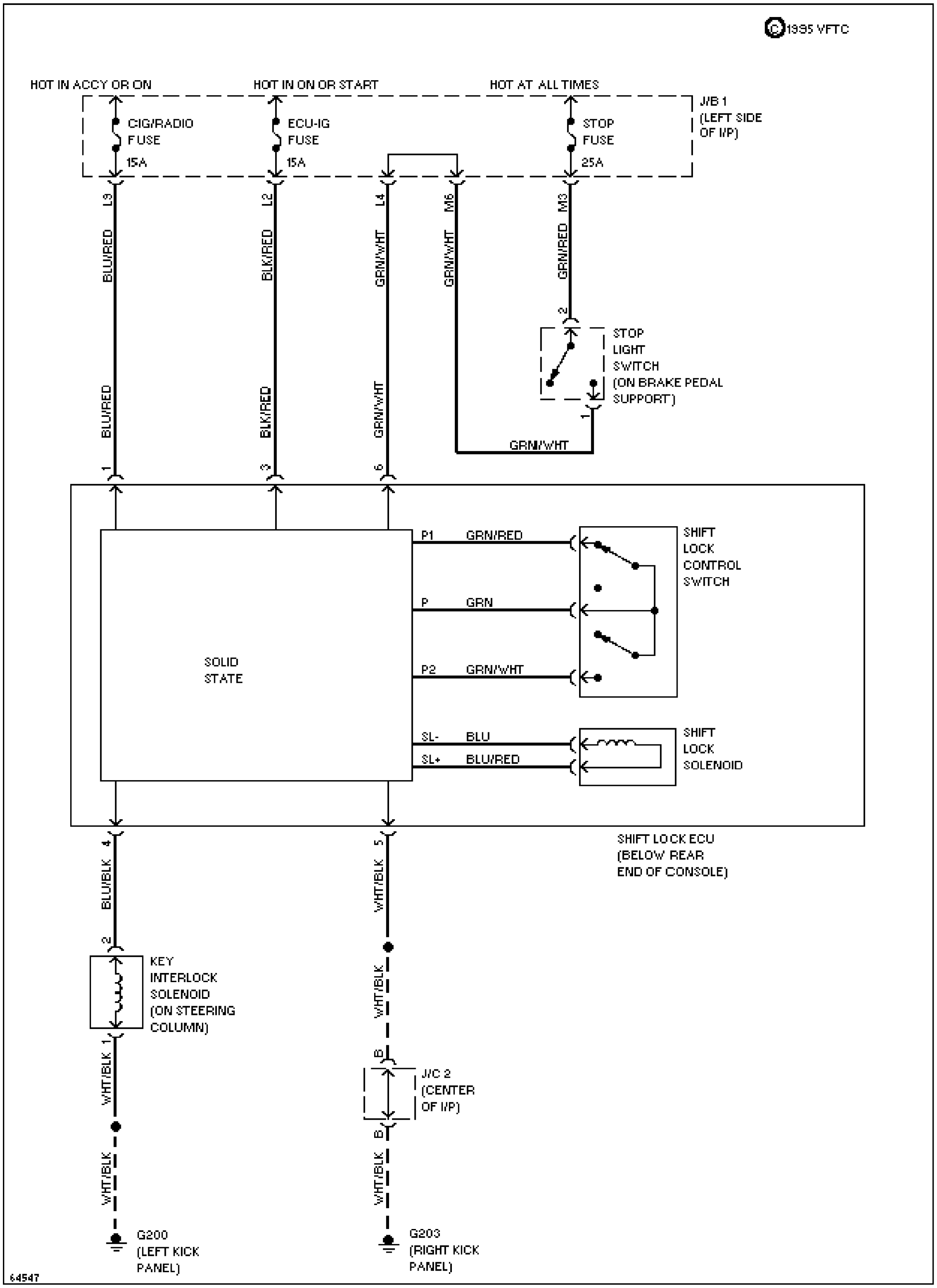


Fig. 2: Shift Interlock System Wiring Diagram (ES300)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

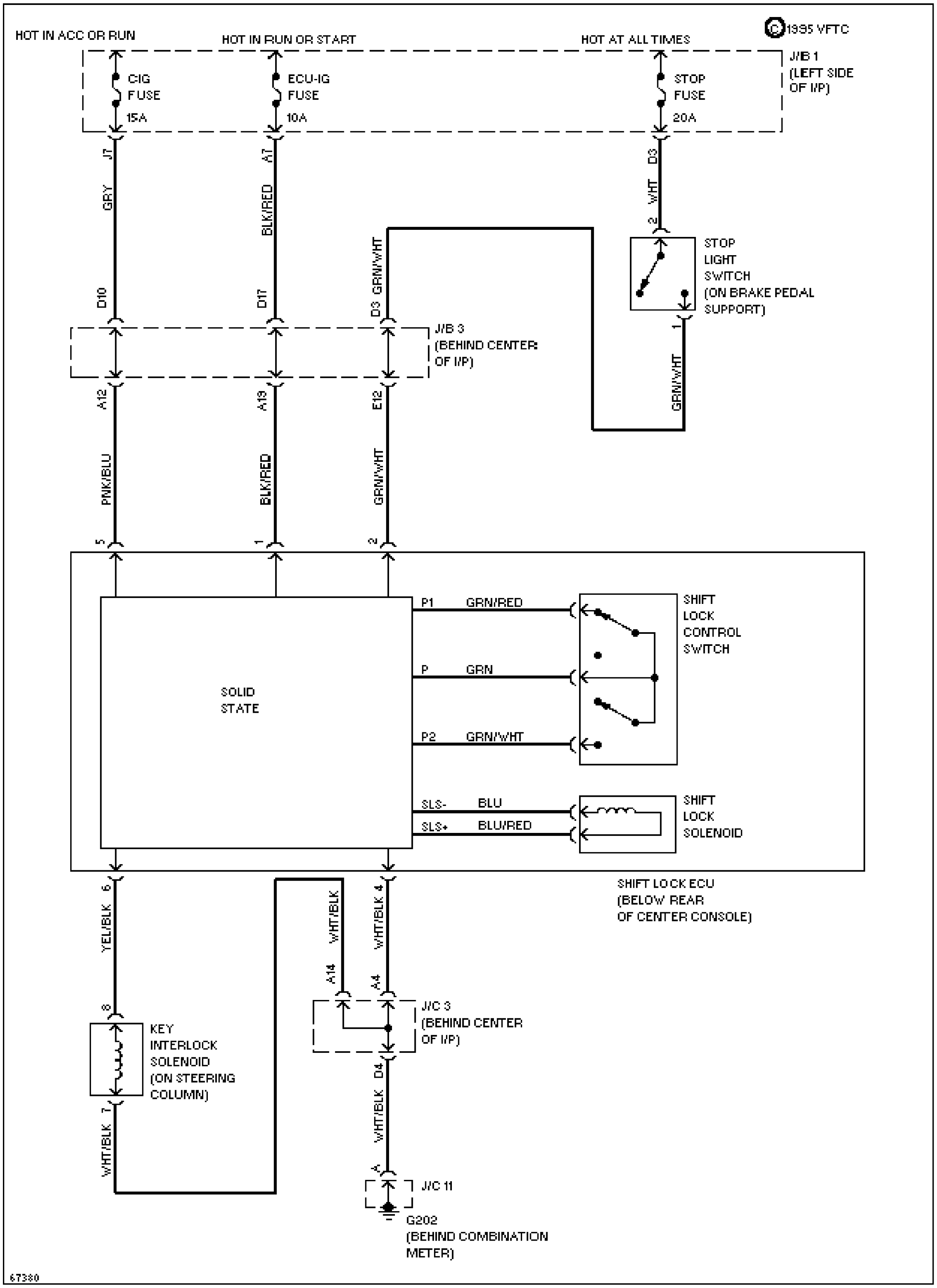


Fig. 3: Shift Interlock System Wiring Diagram (GS300)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

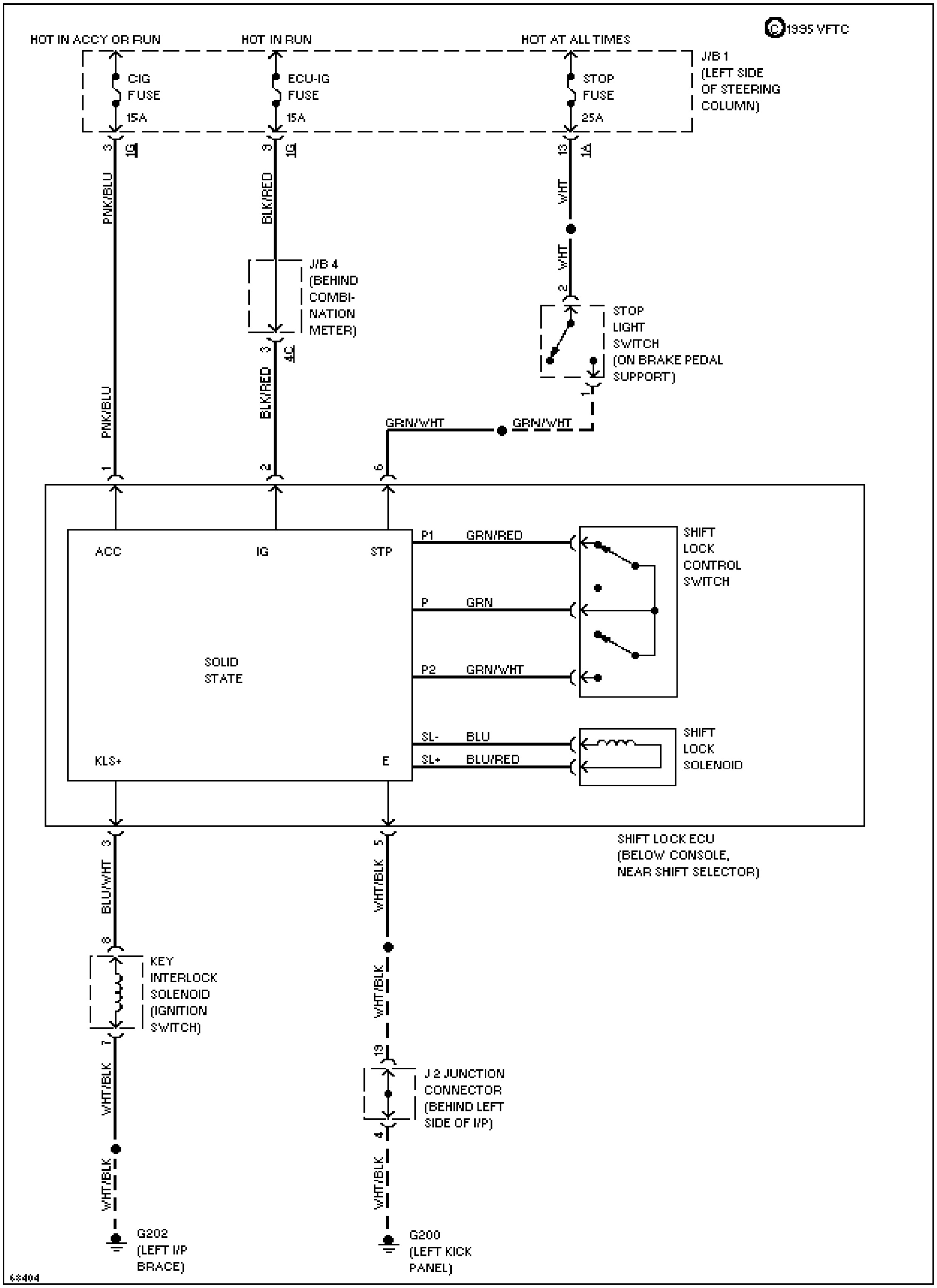


Fig. 4: Shift Interlock System Wiring Diagram (LS300)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

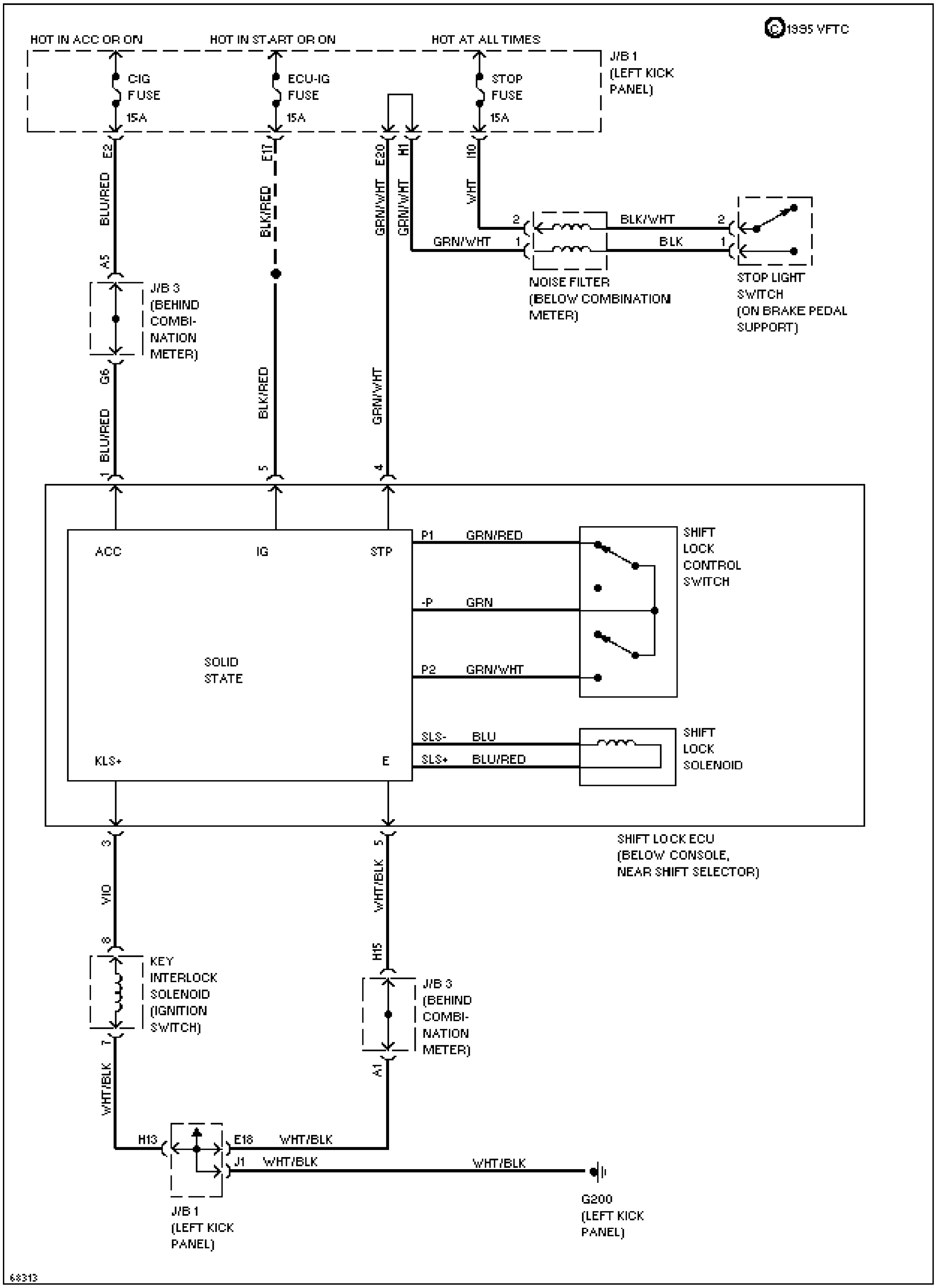


Fig. 5: Shift Interlock System Wiring Diagram (SC300 & SC400)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

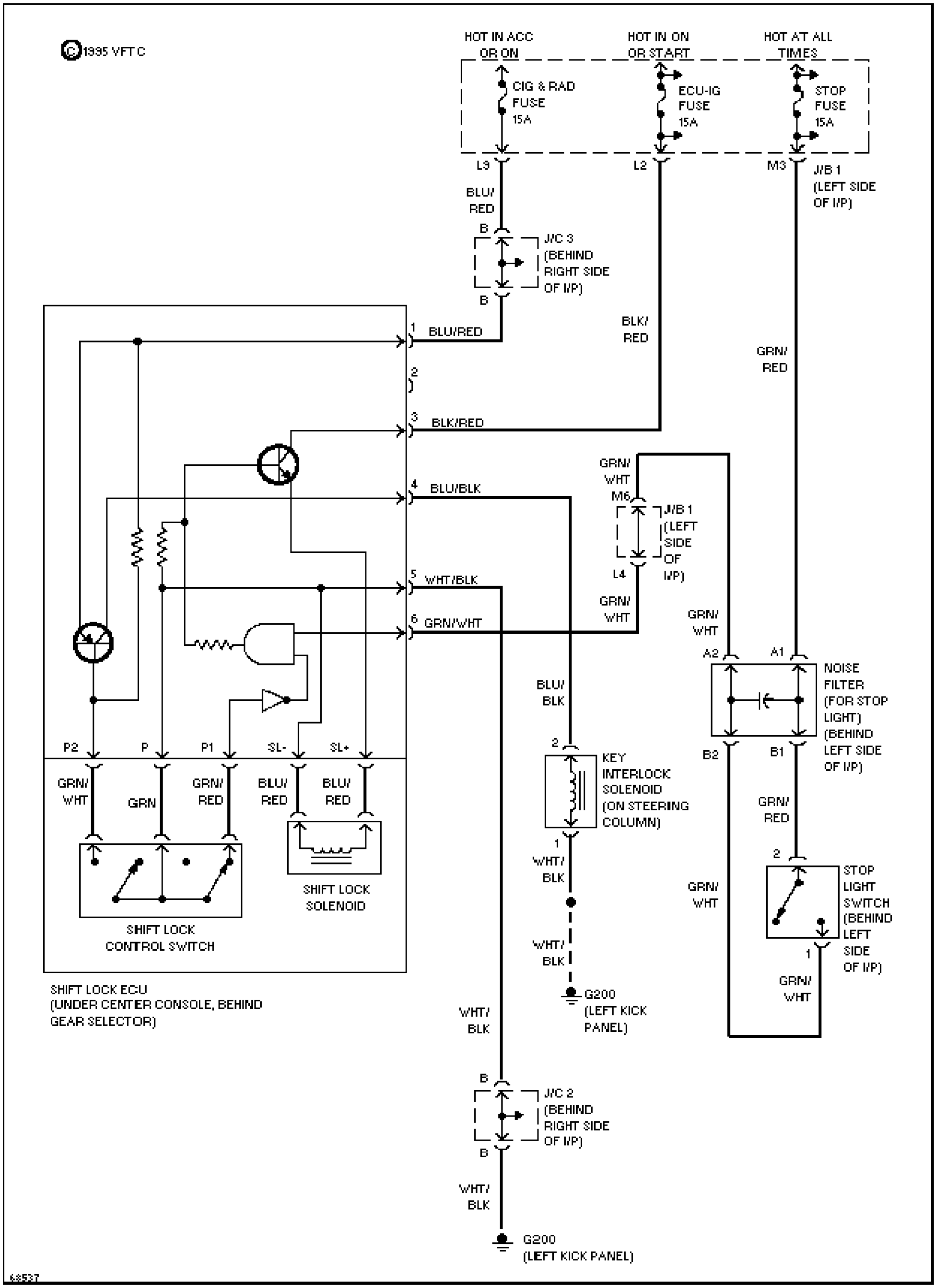


Fig. 6: Shift Interlock System Wiring Diagram (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

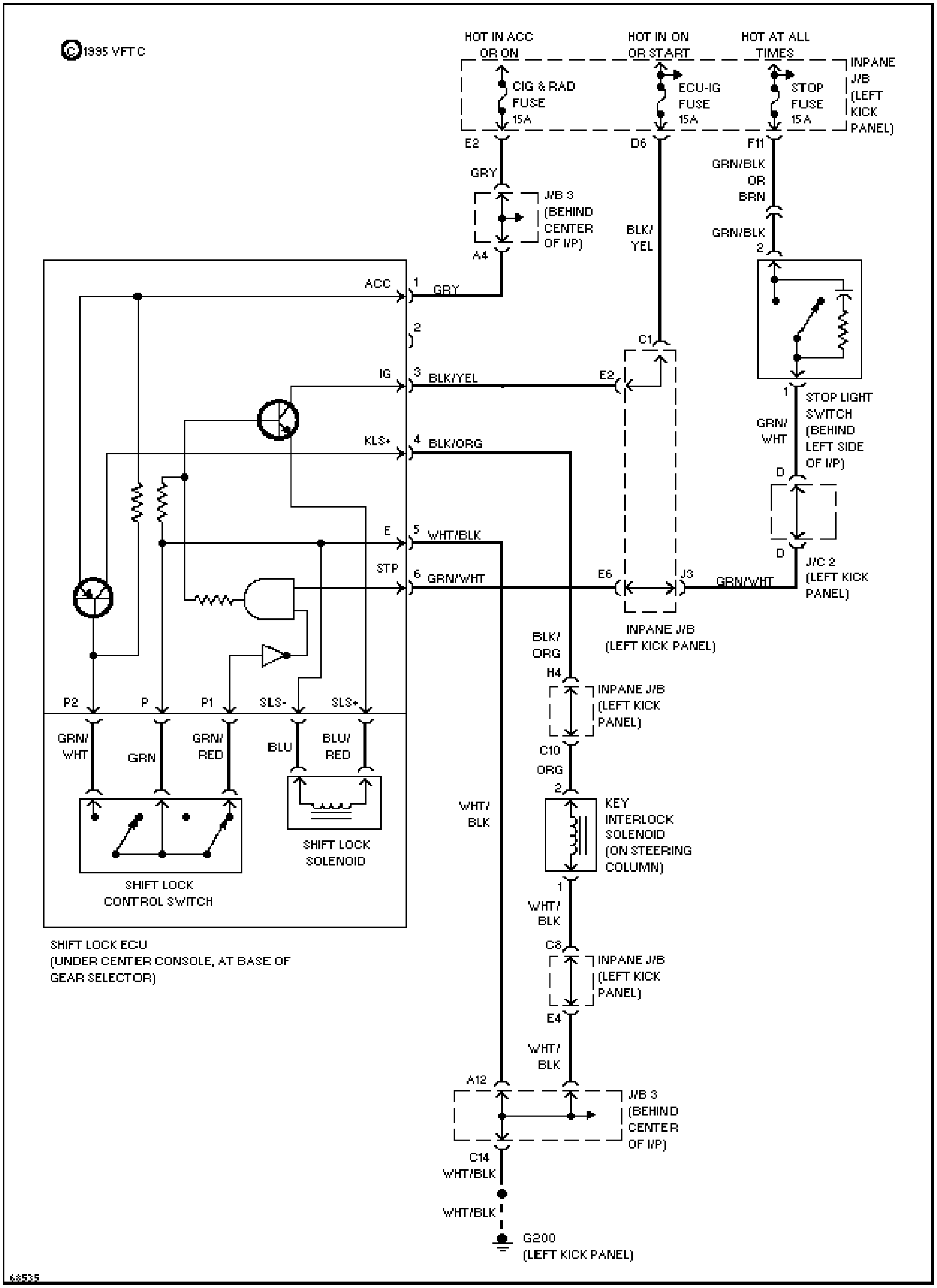


Fig. 7: Shift Interlock System Wiring Diagram (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

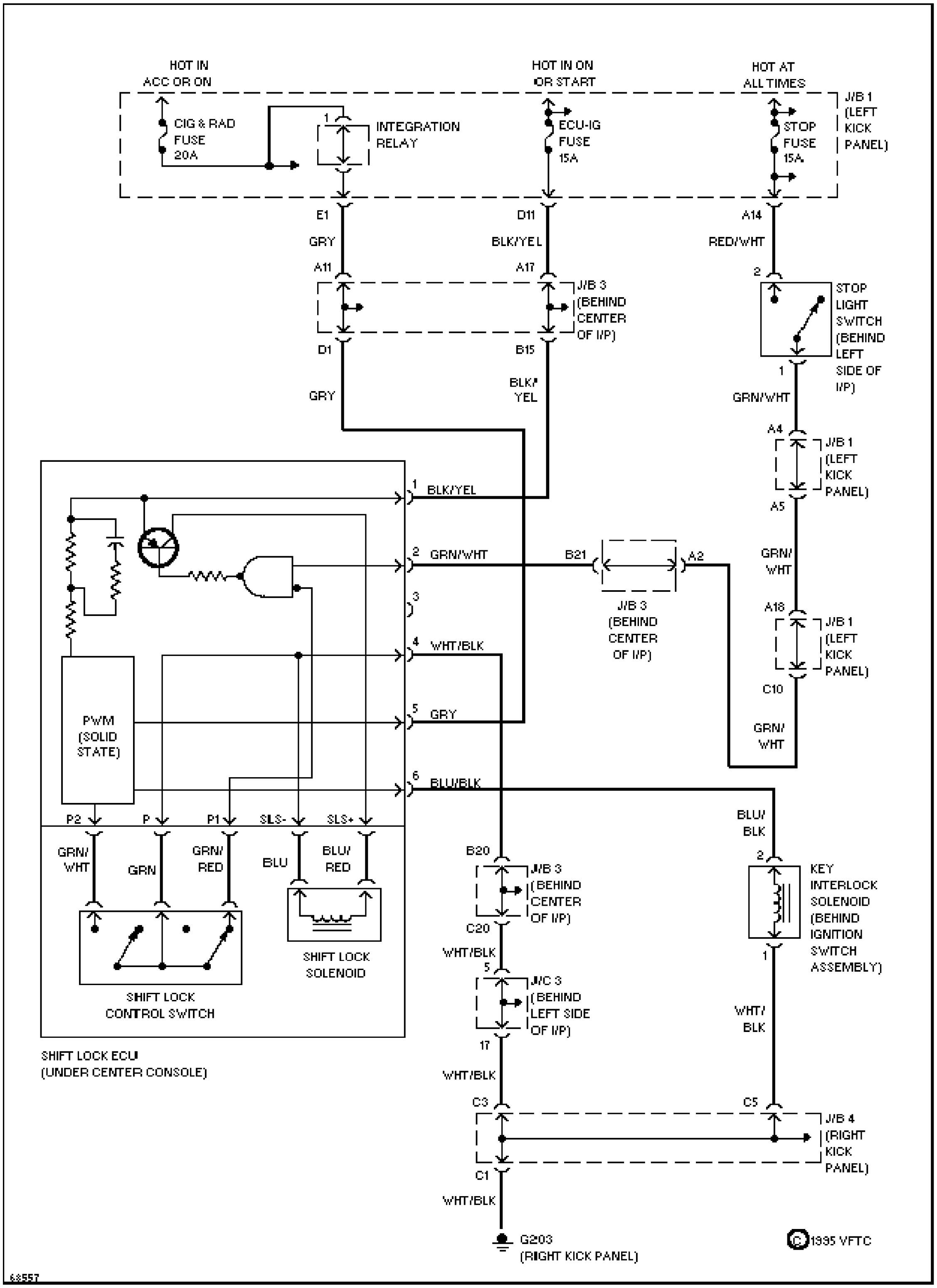


Fig. 8: Shift Interlock System Wiring Diagram (Corolla)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

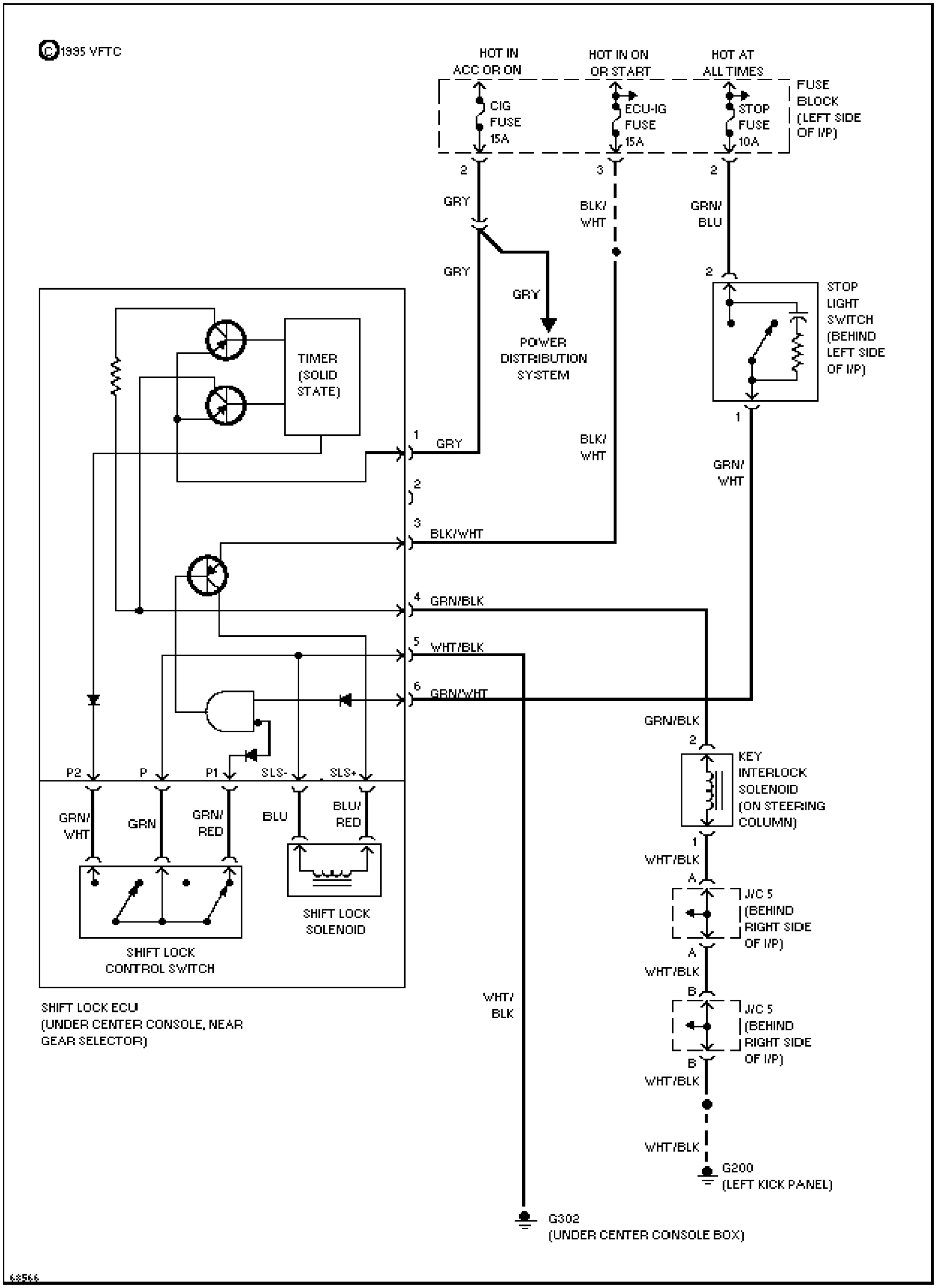


Fig. 9: Shift Interlock System Wiring Diagram (Land Cruiser)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

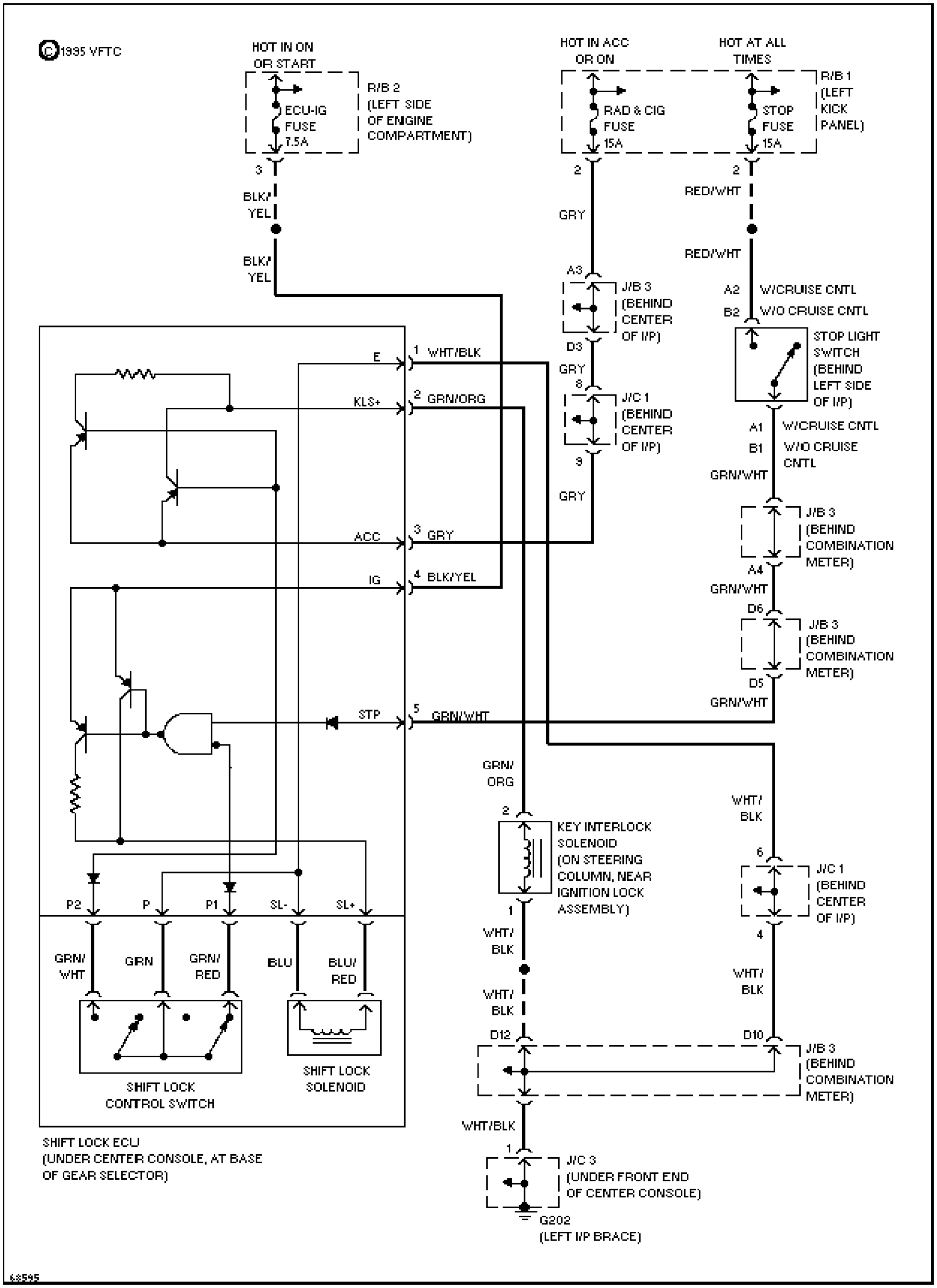


Fig. 10: Shift Interlock System Wiring Diagram (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

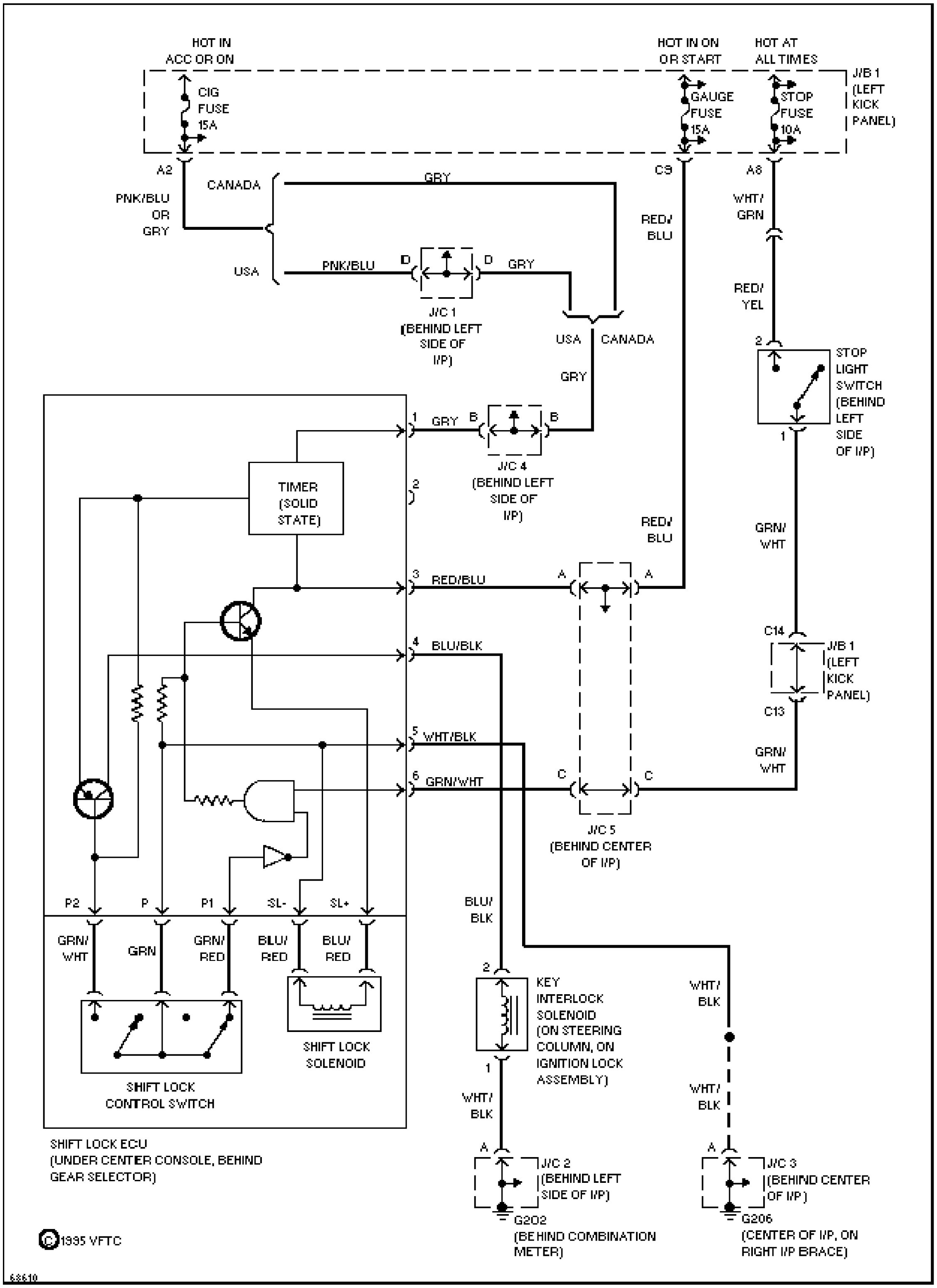


Fig. 11: Shift Interlock System Wiring Diagram (Paseo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

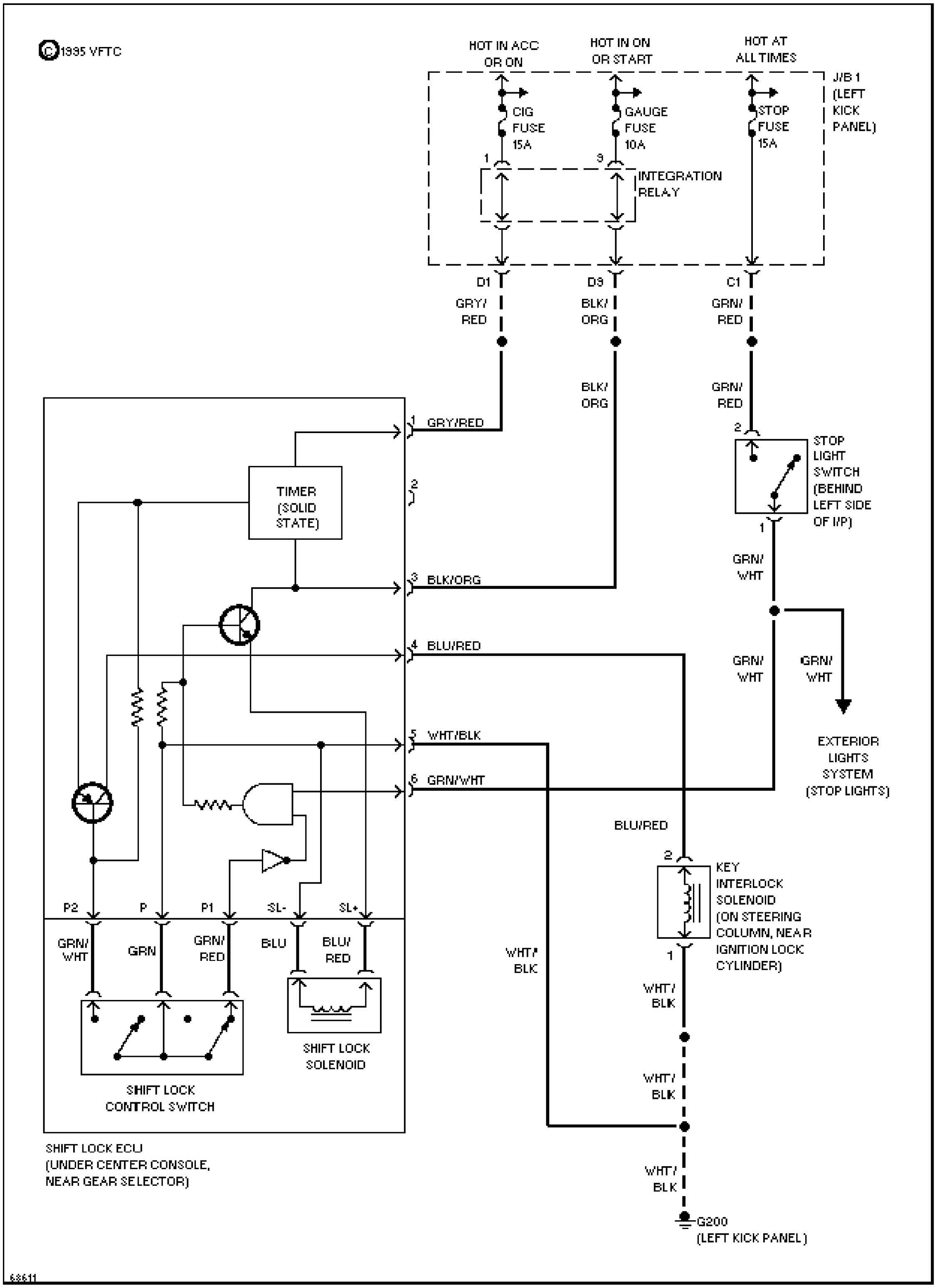


Fig. 12: Shift Interlock System Wiring Diagram (Pickup)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

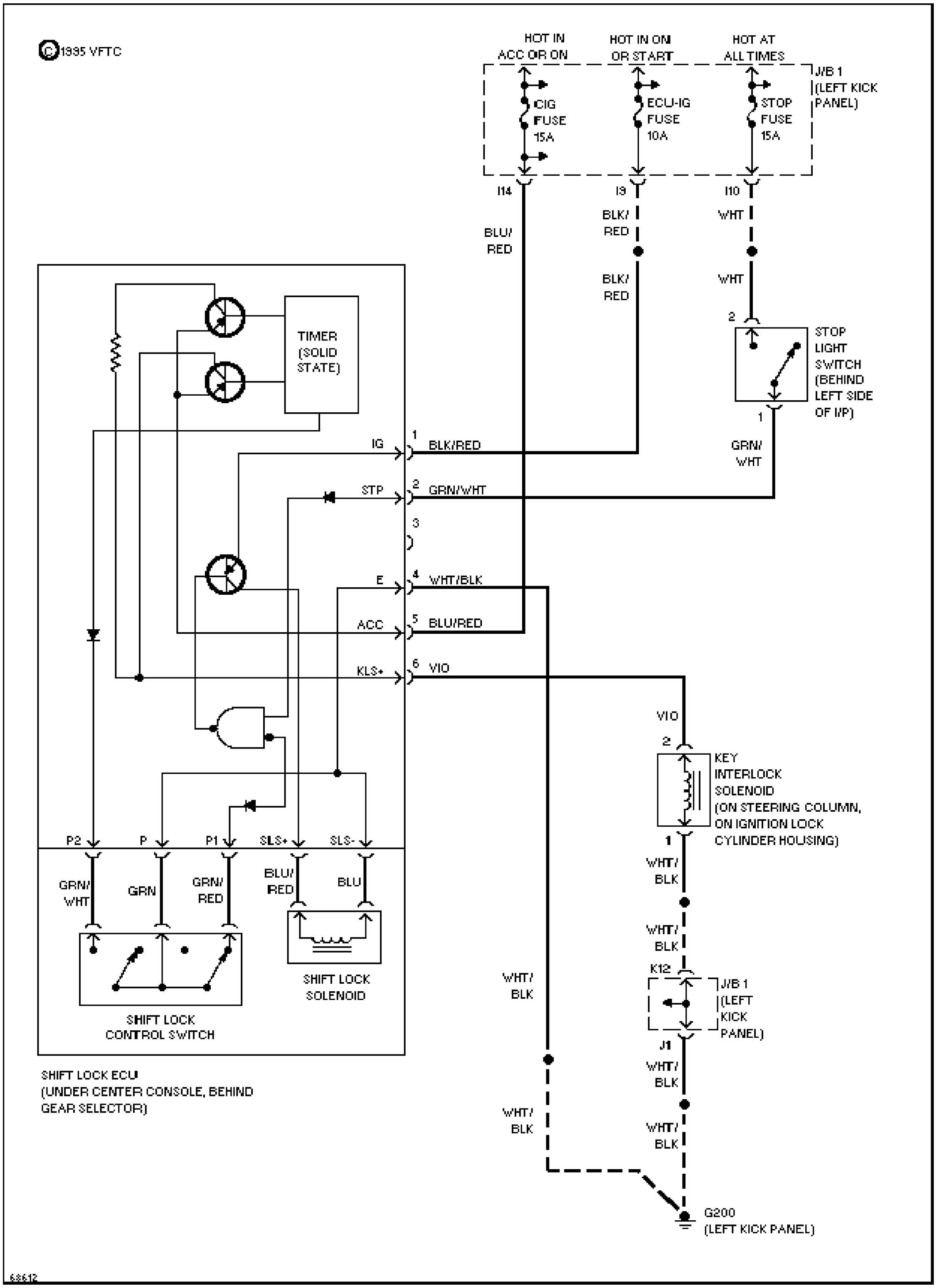


Fig. 13: Shift Interlock System Wiring Diagram (Supra)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

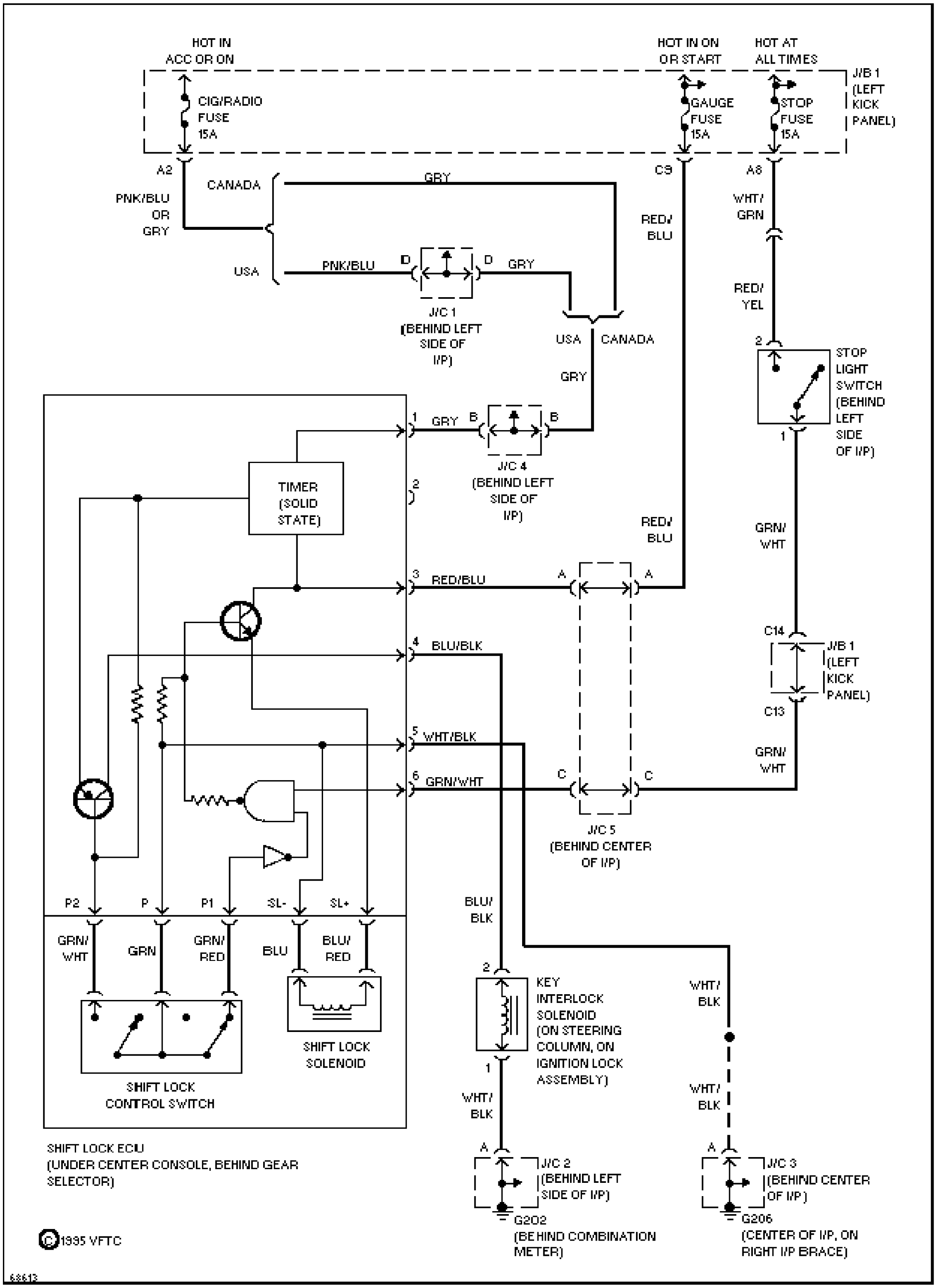


Fig. 14: Shift Interlock System Wiring Diagram (Tercel)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

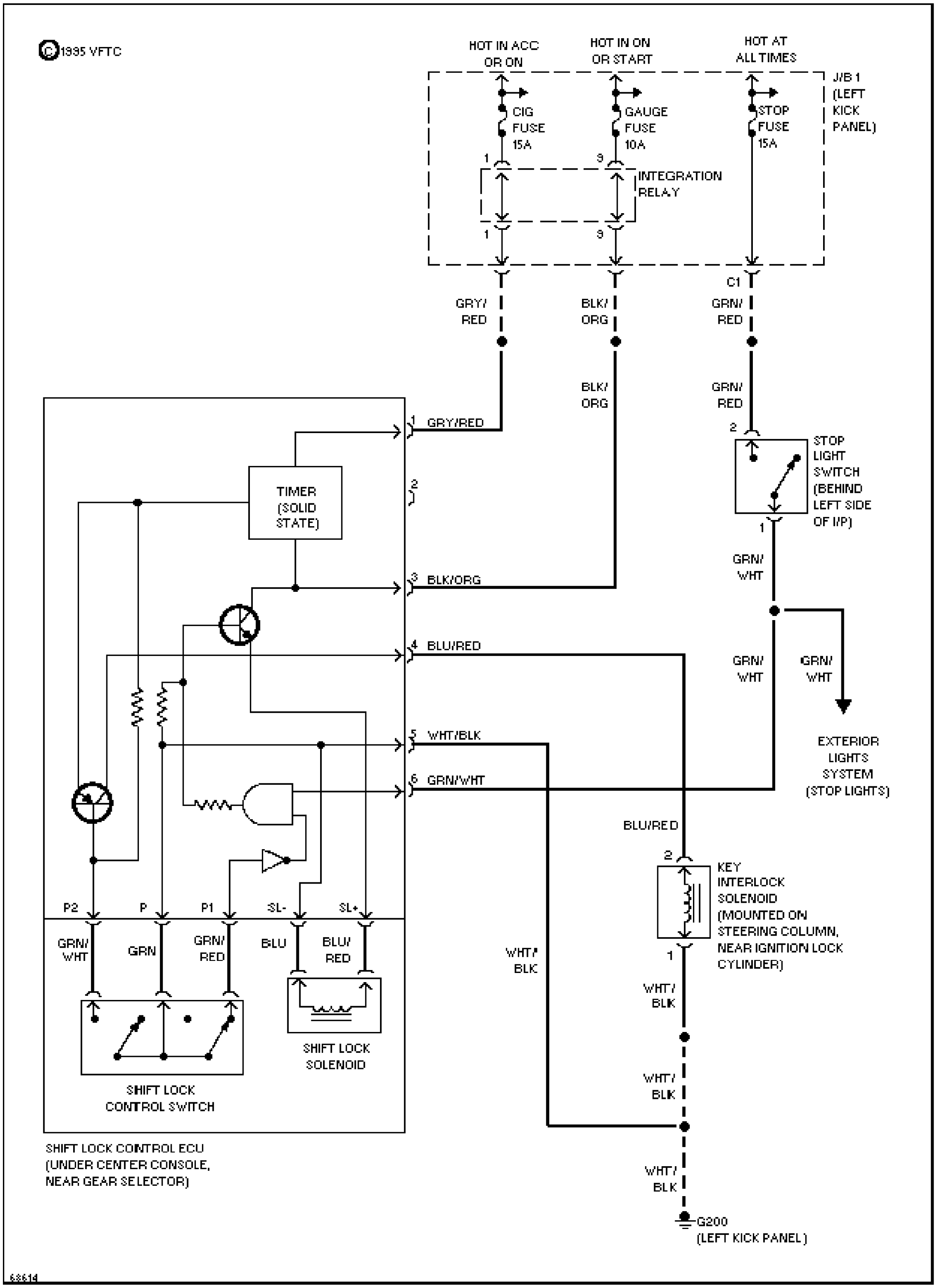


Fig. 15: Shift Interlock System Wiring Diagram (4Runner)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

1993 ENGINE PERFORMANCE
Toyota 4-Cylinder Service & Adjustment Specifications

Celica

INTRODUCTION

Use this article to quickly find specifications related to servicing and on-vehicle adjustments. Use this quick-reference article when you are familiar with an adjustment procedure and only need a specification.

CAPACITIES

BATTERY SPECIFICATIONS TABLE

Application	Amp Hr. Rating
Celica	55

FLUID CAPACITIES TABLE

Application	(1) Quantity
Crankcase (Includes Filter)	
1.6L (4A-FE)	3.4 Qts. (3.2L)
2.0L Turbo (3S-GTE)	4.1 Qts. (3.9L)
2.2L (5S-FE)	
With Oil Cooler	4.4 Qts. (4.2L)
Without Oil Cooler	4.3 Qts. (4.1L)
Cooling System (Includes Heater)	
1.6L (4A-FE)	
A/T	5.9 Qts. (5.6L)
M/T	5.5 Qts. (5.2L)
2.0L Turbo (3S-GTE)	6.3 Qts. (6.0L)
2.2L (5S-FE)	
A/T	7.0 Qts. (6.6L)
M/T	6.9 Qts. (6.5L)
Manual Transaxle (SAE 75W-90/API GL-5)	
1.6L (4A-FE) & 2.2L (5S-FE)	2.7 Qts. (2.6L)
2.0L Turbo (3S-GTE)	5.5 Qts. (5.2L)
Automatic Transaxle (Dexron-II)	
Dry Refill	
1.6L (4A-FE)	8.1 Qts. (7.7L)
2.2L (5S-FE)	8.5 Qts. (8.0L)
Drain & Refill	3.5 Qts. (3.3L)
Differential (SAE 80W-90/API GL-5)	
AWD Rear Axle	1.2 Qts. (1.1L)

(1) - Approximate quantity listed.

QUICK-SERVICE

SERVICE INTERVALS & SPECIFICATIONS

REPLACEMENT INTERVALS TABLE

Component	Months	Miles
Air Filter	36	30,000
Cam Timing Belt	(1)	60,000
Coolant	36	(2) 45,000
Oil & Filter (3)		
1.6L (4A-FE) & 2.2L (5S-FE)		
Normal Service	12	7500
Severe Service	6	3750
2.0L Turbo (3S-GTE)		
Normal Service	6	5000
Severe Service	3	2500
Oxygen Sensor	N/A	80,000
Spark Plugs		
1.6L (4A-FE)	36	30,000
2.0L Turbo (3S-GTE)	72	60,000
2.2L (5S-FE)	72	60,000

(1) - Monthly interval is not available from manufacturer.
(2) - After first change, replace coolant every 30,000 miles or 24 months.
(3) - Different interval is required for normal service and severe service. Severe service is described as trailer towing, police, taxi or local delivery service, or operating in dust conditions.

VALVE CLEARANCE ADJUSTMENT INTERVALS TABLE

Application	Months	Miles
Celica	72	60,000

BELT ADJUSTMENT TABLE (1)

Application	New Belt	(2) Used Belt
1.6L (4A-FE)		
A/C	160 (73)	100 (45)
Alternator	160 (73)	130 (59)
Power Steering	125 (57)	80 (36)
2.0L Turbo (3S-GTE)		
A/C	165 (75)	84 (38)
Alternator		
With A/C	175 (79)	115 (52)
Without A/C	150 (68)	130 (59)
Power Steering	125 (57)	80 (36)
2.2L (5S-FE)		
A/C	165 (75)	110 (50)
Alternator		
With A/C	175 (79)	130 (59)
Without A/C	125 (57)	95 (43)
Power Steering	125 (57)	80 (36)

(1) - Tension In Lbs. (kg) Using Burroughs Tension Gauge.
(2) - Used belt is a belt in operation at least 5 minutes.

MECHANICAL CHECKS

ENGINE COMPRESSION

Check engine compression with engine at normal operating temperature at specified cranking speed with fully charged battery, all spark plugs removed and throttle wide open.

COMPRESSION SPECIFICATIONS TABLE

Application	Specification
Compression Ratio	9.5:1
1.6L (4A-FE) & 2.2L (5S-FE)	9.5:1
2.0L Turbo (3S-GTE)	8.8:1
Compression Pressure	
1.6L (4A-FE)	191 psi (13.4 kg/cm^2)
2.0L Turbo (3S-GTE)	164 psi (11.5 kg/cm^2)
2.2L (5S-FE)	178 psi (12.5 kg/cm^2)
Minimum Compression Pressure	128 psi (9.0 kg/cm^2)
Maximum Variation Between Cylinders	14 psi (1.0 kg/cm^2)

VALVE CLEARANCE

VALVE CLEARANCE SPECIFICATIONS TABLE

Application	In. (mm)
1.6L (4A-FE)	
Exhaust	.008-.012 (.20-.30)
Intake	.006-.010 (.15-.25)
2.0L Turbo (3S-GTE)	
Exhaust	.011-.015 (.28-.38)
Intake	.006-.010 (.15-.25)
2.2L (5S-FE)	
Exhaust	.011-.015 (.28-.38)
Intake	.007-.011 (.18-.28)

IGNITION SYSTEM

IGNITION COIL

IGNITION COIL RESISTANCE TABLE - Ohms @ 68°F (20°C)

Application	Primary	Secondary
1.6L (4A-FE)	1.10-1.70	9000-15,000
2.0L (3S-GTE)	.30-.60	9000-15,000
2.2L (5S-FE)	.30-.60	9000-15,000

DISTRIBUTOR PICK-UP COIL AIR GAP TABLE

Application	In. (mm)
Celica	.008-.016 (.20-.40)

(1) - Cam position sensors are used; air gap is not adjustable.

DISTRIBUTOR PICK-UP COIL RESISTANCE TABLE

Application	(1) Pick-Up Coil Terminals	(2) Ohms
1.6L (4A-FE)	G1 & G-	185-265
"	NE+ & G-	185-265
2.0L Turbo (3S-GTE)	G1 & G-	125-190
"	G2 & G-	125-190
"	NE & G-	155-240
2.2L (5S-FE)	G+ & G-	185-265
"	NE+ & NE-	370-530

(1) - For proper testing and terminal identification, see F - BASIC TESTING article in the ENGINE PERFORMANCE section.
(2) - Specification is with pick-up coil or cam position sensor temperature between 14 and 104°F (-10 and 40°C).

HIGH TENSION WIRE RESISTANCE

HIGH TENSION WIRE RESISTANCE TABLE

Application	Maximum Ohms
Celica	25,000 Per Wire

SPARK PLUGS

SPARK PLUG TYPE TABLE

Application	NGK No.	Nippondenso No.
1.6L (4A-FE)	BCPR5EY	Q16R-U
2.0L Turbo (3S-GTE)	BKR6EP8	PK20R8
2.2L (5S-FE)	BKR6EP11	PK20R11

SPARK PLUG SPECIFICATIONS TABLE

Application	Gap In. (mm)	Torque Ft. Lbs. (N.m)
1.6L (4A-FE)	.031 (0.79)	13 (18)
2.0L Turbo (3S-GTE)	.031 (0.79)	13 (18)
2.2L (5S-FE)	.043 (1.09)	13 (18)

FIRING ORDER

FIRING ORDER TABLE

Application	Firing Order
Celica (1)	1-3-4-2

(1) - No. 1 cylinder is located at timing belt or timing chain end of engine. No. 4 cylinder is located at flywheel end.

IGNITION TIMING

IGNITION TIMING TABLE - Degrees BTDC @ RPM

Application (1)	(2) Base Timing	(3) Advance Timing
1.6L (4A-FE)	10 @ 800	0-20 @ 800
2.0L Turbo (3S-GTE)	10 @ 800	12-21 @ 800
2.2L (5S-FE)	10 @ 700	13-22 @ 700

(1) - Check with transmission/transaxle in Neutral and parking brake applied.
(2) - With jumper wire installed between data link connector terminals TE1 and E1.
(3) - With jumper wire removed from data link connector.

FUEL SYSTEM

FUEL PUMP

NOTE: Fuel pump performance measures fuel pressure, not regulated fuel pressure.

FUEL PUMP PERFORMANCE TABLE

Application	(1) Pressure - psi (kg/cm^2)
1.6L (4A-FE) & 2.2L (5S-FE)	38-44 (2.7-3.1)
2.0L Turbo (3S-GTE)	33-38 (2.3-2.7)

(1) - Check fuel pressure with jumper wire installed between data link connector terminals +B and FP, ignition on and engine off.

REGULATED FUEL PRESSURE TABLE

Application	Specification
1.6L & 2.2L	
At Idle With Vacuum	31-37 psi (2.2-2.6 kg/cm^2)
At Idle Without Vacuum	38-44 psi (2.7-3.1 kg/cm^2)
2.0L Turbo	
At Idle With Vacuum	27-31 psi (1.9-2.2 kg/cm^2)
At Idle Without Vacuum	33-38 psi (2.3-2.7 kg/cm^2)

INJECTOR RESISTANCE

INJECTOR RESISTANCE TABLE

Application	Ohms
1.6L (4A-FE) & 2.2L (5S-FE)	13.8
2.0L Turbo (3S-GTE)	2.0-4.0

IDLE SPEED

IDLE SPEED SPECIFICATIONS TABLE

Application (1)	RPM

1.6L (4A-FE) (2)	800
2.0L Turbo (3S-GTE)	800
2.2L (5S-FE)	700

(1) - Check with transmission/transaxle in Neutral and parking brake applied.
(2) - Check with jumper wire installed between data link connector terminals TE1 and E1.

DASHPOT

DASHPOT SPECIFICATIONS TABLE

Application	RPM
1.6L (4A-FE)	
A/T	2200
M/T	1800

THROTTLE OPENER

THROTTLE OPENER SPECIFICATIONS TABLE

Application	(1) RPM
2.0L Turbo (3S-GTE)	900-1900
2.2L (5S-FE)	1300-1500

(1) - With electric cooling fan turned off (if equipped).

FUEL CUT

FUEL CUT SPECIFICATIONS TABLE

Application	Fuel Cut RPM	Fuel Return RPM
1.6L (4A-FE)	2300	1700
2.0L Turbo (3S-GTE)	(1)	1600
2.2L (5S-FE)	(1)	1500

(1) - Fuel cut specification is not available from manufacturer.

THROTTLE POSITION SENSOR (TPS)

THROTTLE POSITION SENSOR RESISTANCE SPECIFICATIONS

Application	Clearance In. (mm)	Terminal	Ohmmeter Reading
1.6L (4A-FE)	024 (.61)	IDL & E2	Continuity
"	"	PSW & E2	No Continuity
"	031 (.79)	IDL & E2	No Continuity
"	"	PSW & E2	No Continuity

"	Fully Open	IDL & E2	No Continuity
"	"	PSW & E2	Continuity
2.0L Turbo (1)	0 (0)	VTA & E2	470-6100
"	020 (.51)	IDL & E2	2300 Or Less
"	028 (.71)	IDL & E2	No Continuity
"	Fully Open	VTA & E2	3100-12,100
"	"	VC & E2	3900-9000
2.2L (5S-FE) (1)	0 (0)	VTA & E2	200-5700
"	020 (.51)	IDL & E2	2300 Or Less
"	028 (.71)	IDL & E2	No Continuity
"	Fully Open	VTA & E2	2000-10,200
"	"	VC & E2	2500-5900
(1) - Apply vacuum to throttle opener before checking TPS.			

STARTER

1993 Toyota Celica

1993 ELECTRICAL
Toyota Starters

Celica

DESCRIPTION

Celica uses a Nippondenso 4-brush, solenoid-actuated, gear reduction-type starter, equipped with an overrunning clutch. The brush holder assembly retains 4 brushes and springs in the starter housing.

Reduction gear type starters contain an integral solenoid attached to drive housing, a reduction idler gear and bearing installed into starter housing, and a clutch drive assembly. The clutch drive assembly is mounted to starter housing and is driven by the reduction idler gear from armature shaft. The brush holder assembly retains 4 brushes and 4 springs in the end cover of field frame housing.

Manual transmission vehicles use a clutch start switch and automatic transmission vehicles use a park/neutral switch to energize starter relay. On models with theft deterrent system, theft deterrent system ECU provides ground for starter relay.

NOTE: Starter type and kilowatt (kW) rating can be found on a metal label attached to side of starter.

TROUBLE SHOOTING

1) If a no-start condition exists and battery is known to be good, connect test light or voltmeter between starter solenoid terminal No. 50 and ground. See Fig. 8.

2) Turn ignition switch to START position. If test light or voltmeter does not indicate voltage, check main fusible links and large ampere main fuses in engine compartment relay box. If fusible links and fuses are okay, see IGNITION SWITCH CONTINUITY TEST and/or STARTER RELAY TEST under ON-VEHICLE TESTING.

ON-VEHICLE TESTING

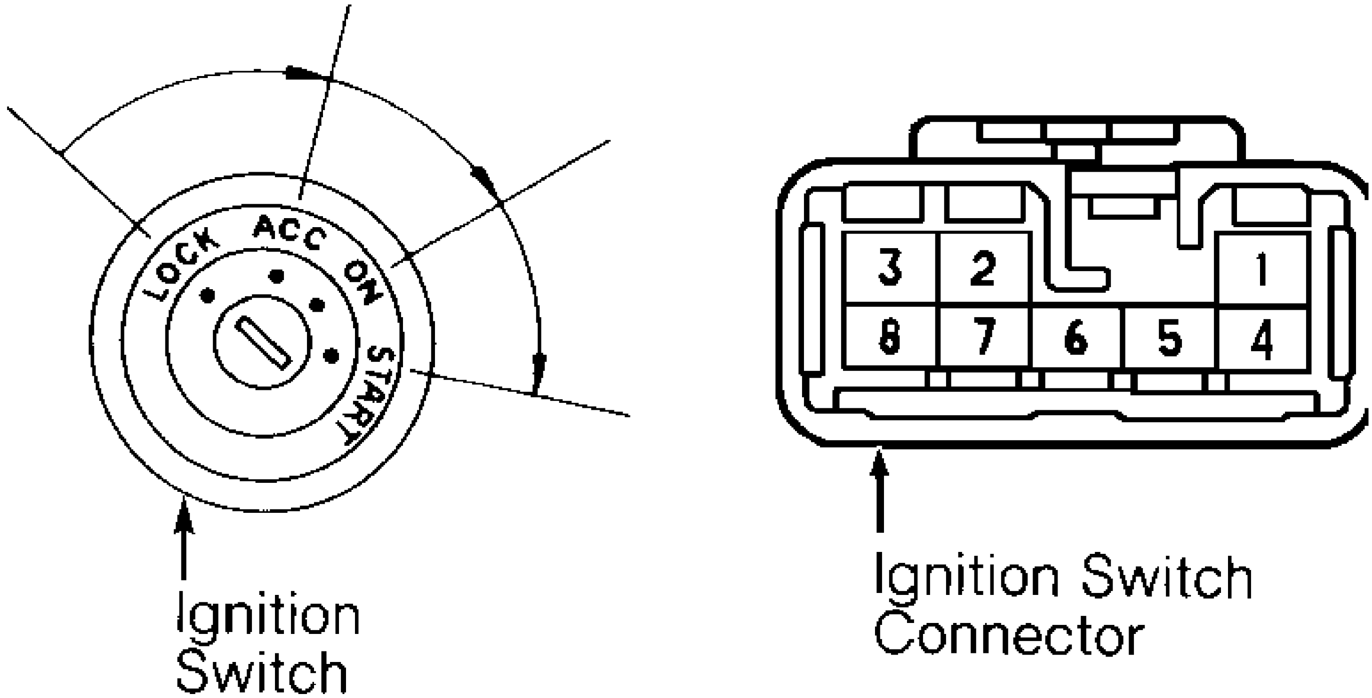
NOTE: Before testing, ensure battery is fully charged, battery cables and terminal ends are tight and clean, and engine grounds are secure.

CLUTCH START SWITCH TEST

1) Switch is located above clutch pedal on bracket. Disconnect wiring harness connector from switch.

2) Connect ohmmeter probes to switch terminals. Depress clutch pedal. If continuity does not exist, adjust or replace clutch start switch. If continuity exists, check circuit to starter relay for open, and check starter relay. See STARTER RELAY TEST.

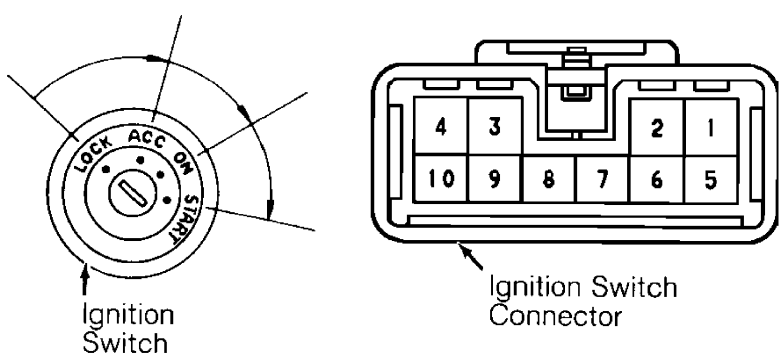
IGNITION SWITCH CONTINUITY TEST



93G82269
Fig. 1: Ignition Switch 8-Pin Connector ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

1) Disconnect negative battery cable. Remove driver's lower instrument panel cover. Remove upper and lower steering column covers if needed. Locate ignition switch wiring harness 10-pin connector. See Fig. 2.

2) With ignition switch in LOCK position, there should be no continuity between any terminals. With ignition switch in ACC position, there should be continuity between terminals No. 3 and 4. With ignition switch in ON position, there should be continuity between terminals No. 2, 3 and 4, and between terminals No. 9 and 10. With ignition switch in START position, there should be continuity between terminals No. 2, 4 and 7, and between terminals No. 6, 9 and 10. If continuity is not as specified, replace switch.



93J82270
Fig. 2: Ignition Switch 10-Pin Connector ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PARK/NEUTRAL SWITCH

NOTE: If vehicle will not start with shift lever in Park/Neutral position, verify correct park/neutral switch adjustment. If park/neutral switch is correctly adjusted, verify switch continuity.

Adjusting Park/Neutral Switch

Locate park/neutral switch at transmission or transaxle. Loosen park/neutral position switch bolt(s) and verify shift selector is in "N" position. Align switch shaft groove with neutral basic line on switch. Hold switch in position and tighten switch bolt(s) to 48 INCH lbs. (5.4 N.m).

Park/Neutral Switch Continuity Check

Disconnect electrical connector from park/neutral switch at transmission or transaxle. Using ohmmeter, check for continuity at specified terminals with gearshift in proper positions. See Figs. 3 and 4. See PARK/NEUTRAL SWITCH CONTINUITY table. Replace switch if defective.

PARK/NEUTRAL SWITCH CONTINUITY

Gearshift Position	Check Between Terminals
2.2L 5S-FE	
Park	2 & 3, 1 & 6
Reverse	5 & 6
Neutral	2 & 3, 6 & 7
Drive	6 & 8
2	6 & 9
Low	4 & 6
1.6L 4A-FE	
Park	"B" & "N"
Reverse	RB & RL
Neutral	"B" & "N"

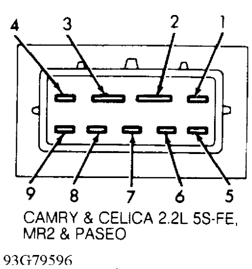


Fig. 3: Park/Neutral Switch Terminal ID (2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

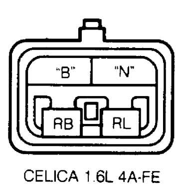


Fig. 4: Park/Neutral Switch Terminal ID (1.6L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

STARTER RELAY TEST

Starter Relay With Terminals No. 1, 2, 3 & 4

1) Locate and remove starter relay. Relay is located behind right kick panel, on relay box No. 4. See Fig. 7. Using ohmmeter,

verify continuity between relay terminals No. 1 and 3. See Fig. 5. Continuity should not exist between terminals No. 2 and 4. If continuity is not as indicated, replace relay.

2) Check relay operation by applying battery voltage through terminals No. 1 and 3. See Fig. 5. Continuity should now exist between terminals No. 2 and 4. If relay does not test as indicated, replace relay.

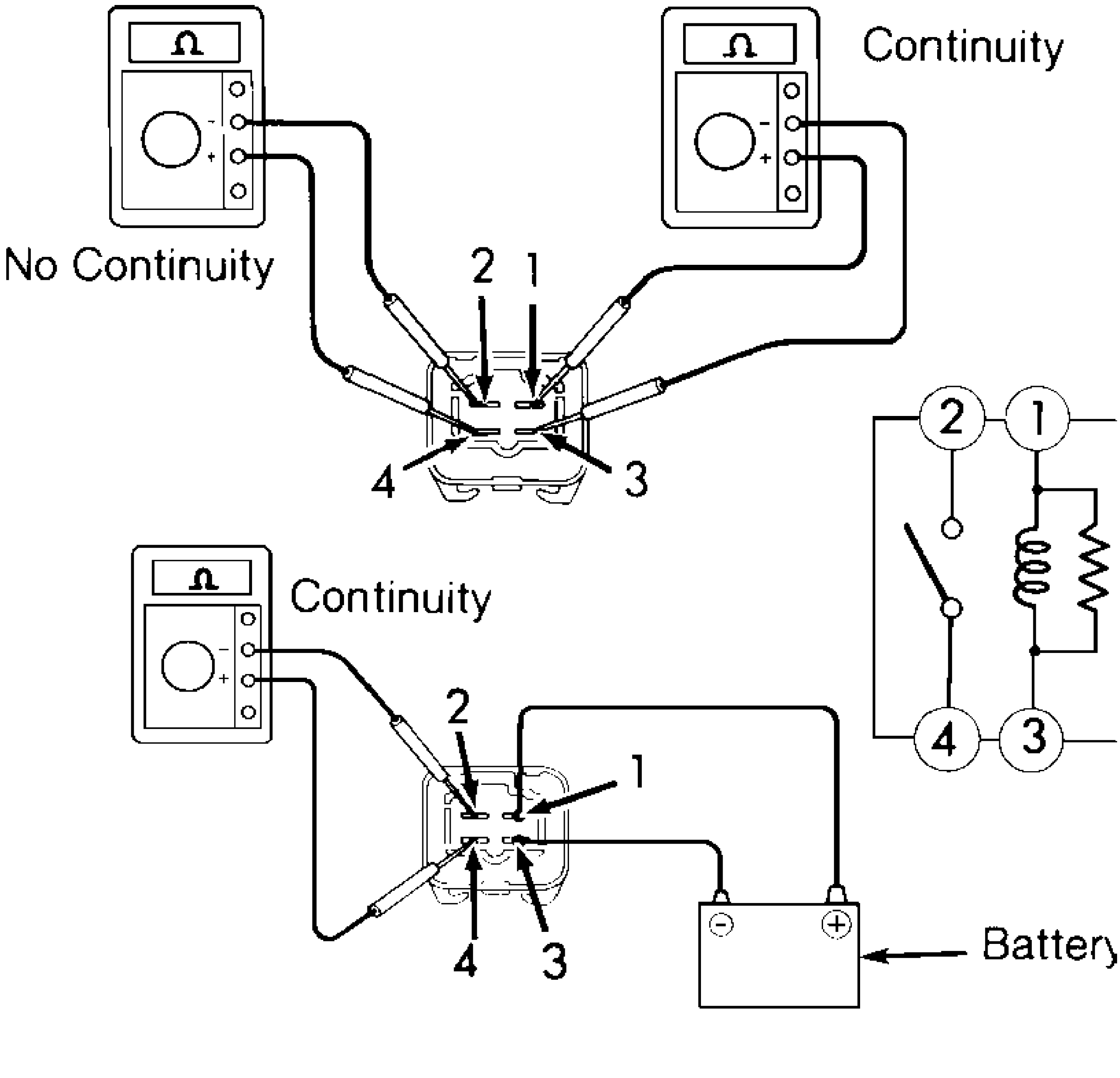


Fig. 5: Testing Starter Relay With Terminals No. 1, 2, 3 & 4
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Starter Relay With Terminals No. 1, 2, 3 & 5

1) Locate and remove starter relay. Relay is located behind

right kick panel, on relay box No. 4. See Fig. 7. Using ohmmeter, verify continuity between relay terminals No. 1 and 2. See Fig. 6. Continuity should not exist between terminals No. 3 and 5. If continuity is not as indicated, replace relay.

2) Check relay operation by applying battery voltage through terminals No. 1 and 2. See Fig. 6. Continuity should now exist between terminals No. 3 and 5. If relay does not test as indicated, replace relay.

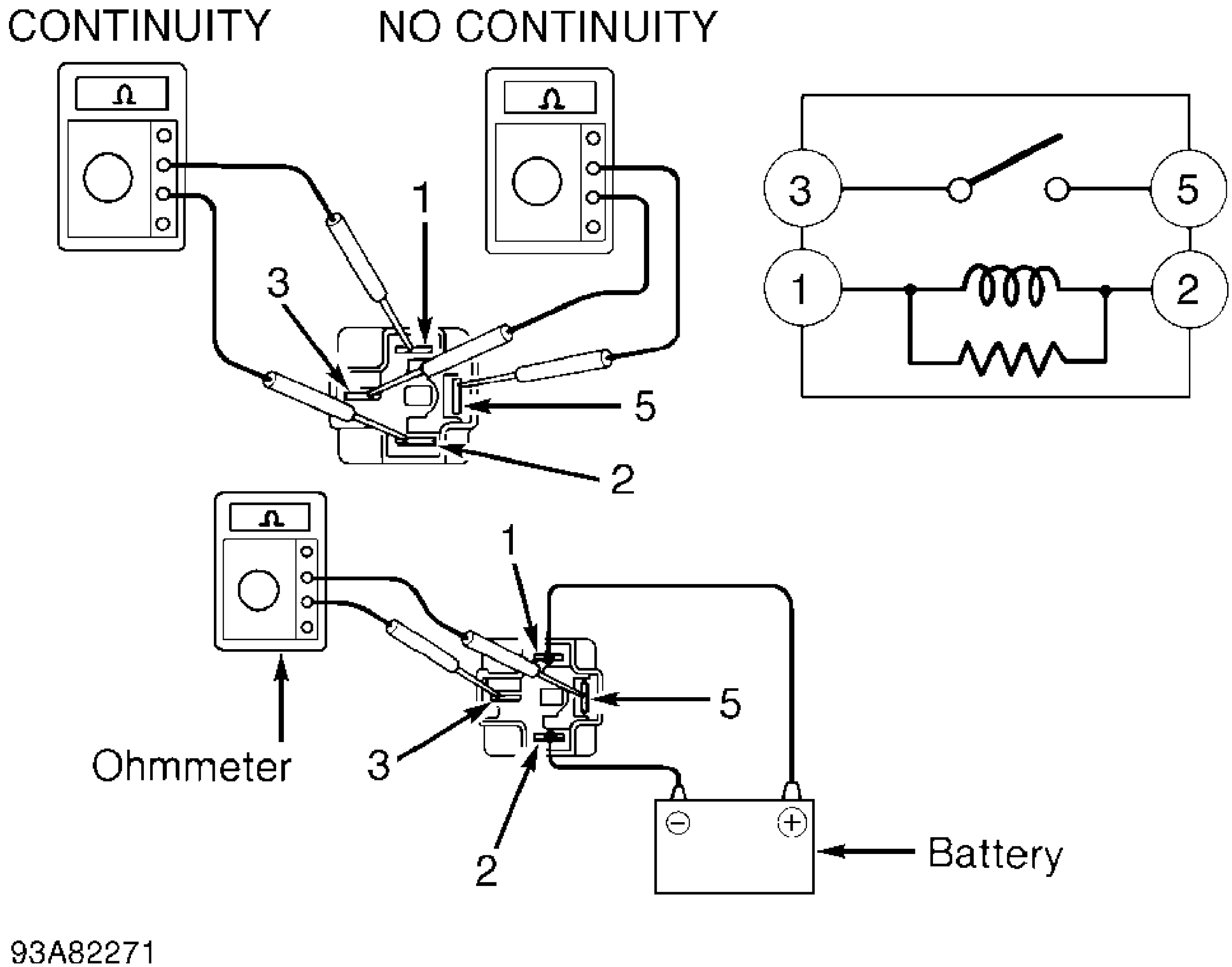


Fig. 6: Testing Starter Relay With Terminals No. 1, 2, 3 & 5
Courtesy of Toyota Motor Sales, U.S.A., Inc.

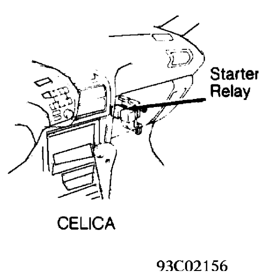


Fig. 7: Locating Starter Relay
Courtesy of Toyota Motor Sales, U.S.A., Inc.

BENCH TESTING

NO-LOAD TEST

CAUTION: DO NOT engage starter solenoid for more than 5 seconds during testing or damage to coil winding will result.

1) Remove starter. Connect ammeter in series between starter motor terminal No. 30 (battery terminal) and a fully charged 12-volt battery. Connect battery negative to starter case ground. See Figs. 8 and 9. Connect voltmeter to battery to observe voltage draw readings.

2) Connect remote starter or jumper wire to terminal No. 30 and to terminal No. 50 to engage starter. Starter drive pinion gear should extend quickly and spin smoothly. Verify starter amperage draw and battery voltage draw to be within specifications. See NO-LOAD TEST SPECIFICATIONS table. Replace starter if not within specification.

NO-LOAD TEST SPECIFICATIONS

Application	Max. Amps @ (Volts)	RPM
(1.0 kW)	90 (11.5)	3000
(1.4 & 1.6 kW)	90 (11.5)	3500

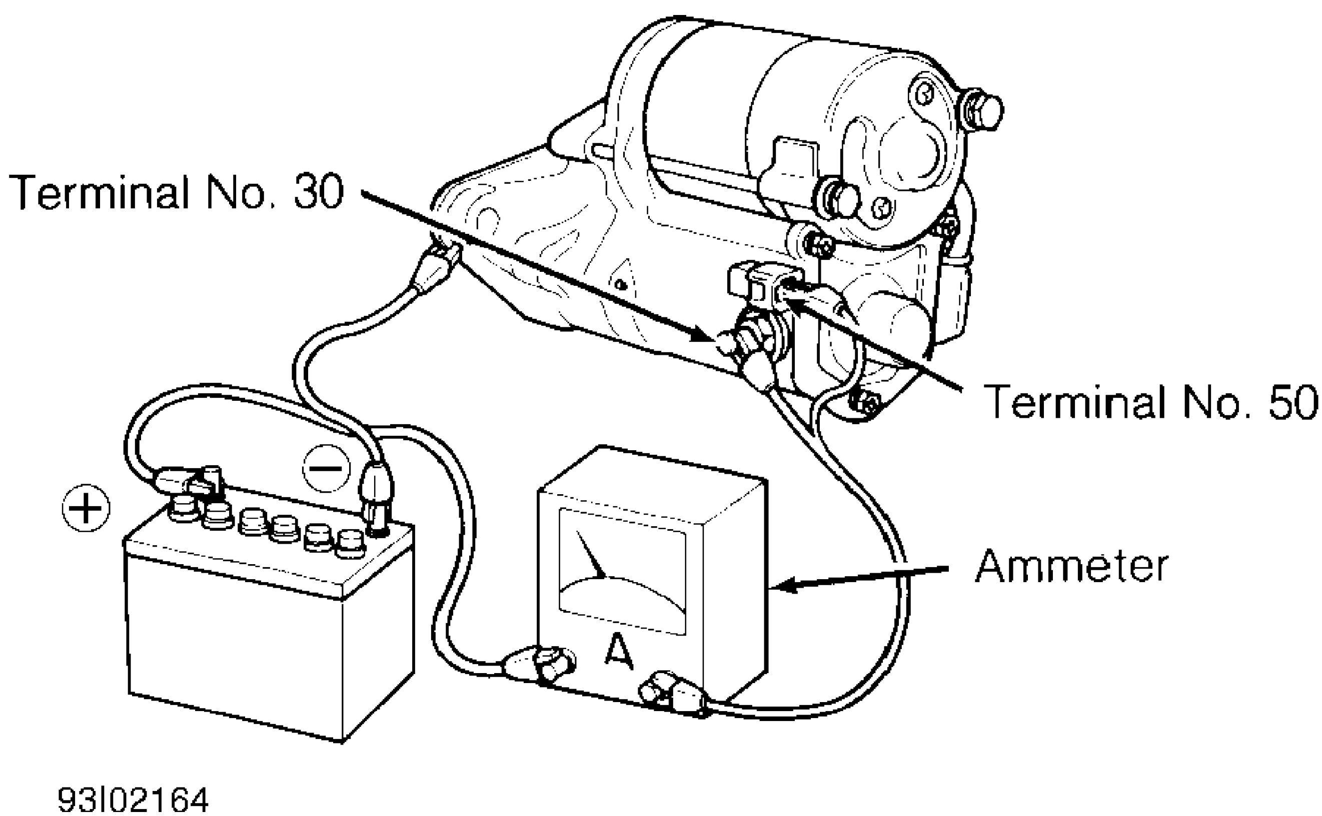


Fig. 8: Testing Starter No-Load (Reduction Gear)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SOLENOID TESTS

CAUTION: DO NOT engage starter solenoid for more than 5 seconds during testing or damage to coil winding will result.

Pull-In Coil Test

Disconnect field coil lead from terminal "C". Connect jumper wires from negative battery terminal to terminal "C" and to starter housing. When wire is connected from positive battery terminal to terminal No. 50, clutch pinion gear should extend fully. See Figs. 9-11. If clutch pinion gear does not move, replace solenoid. If clutch pinion gear does move, go to next test.

Hold-In Coil Test

With battery connected as in previous test and clutch pinion gear still extended, disconnect jumper wire from starter terminal "C". See Figs. 9-11. Clutch pinion gear should remain extended. If clutch pinion gear does not remain extended, replace solenoid. If clutch pinion gear does remain extended, go to next test.

Drive Pinion Return Test

Disconnect jumper wire from negative battery terminal to starter housing. See Figs. 9-11. Pinion gear should now retract. If it does not retract, replace solenoid.

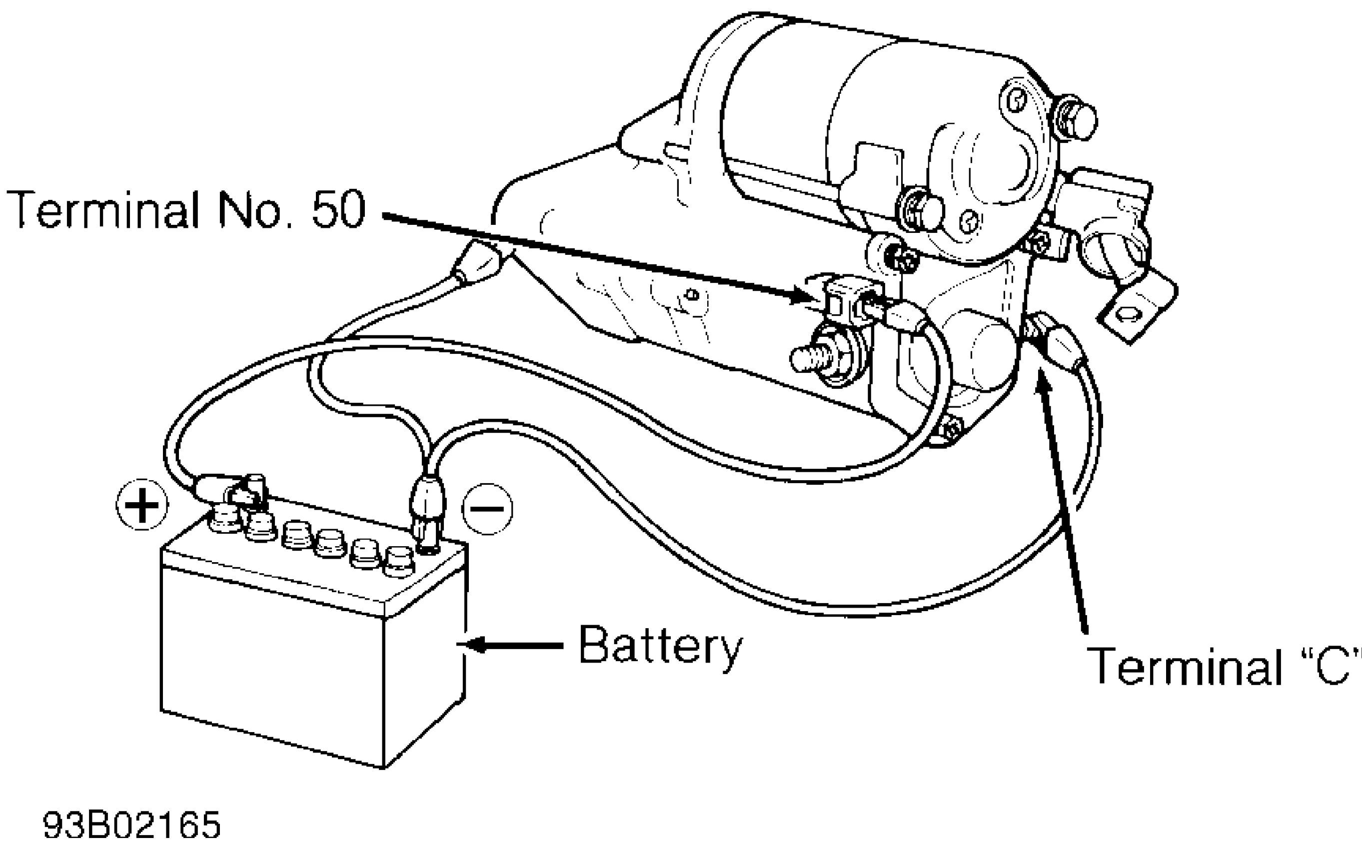


Fig. 9: Testing Solenoid Pull-In Coil
Courtesy of Toyota Motor Sales, U.S.A.Inc.

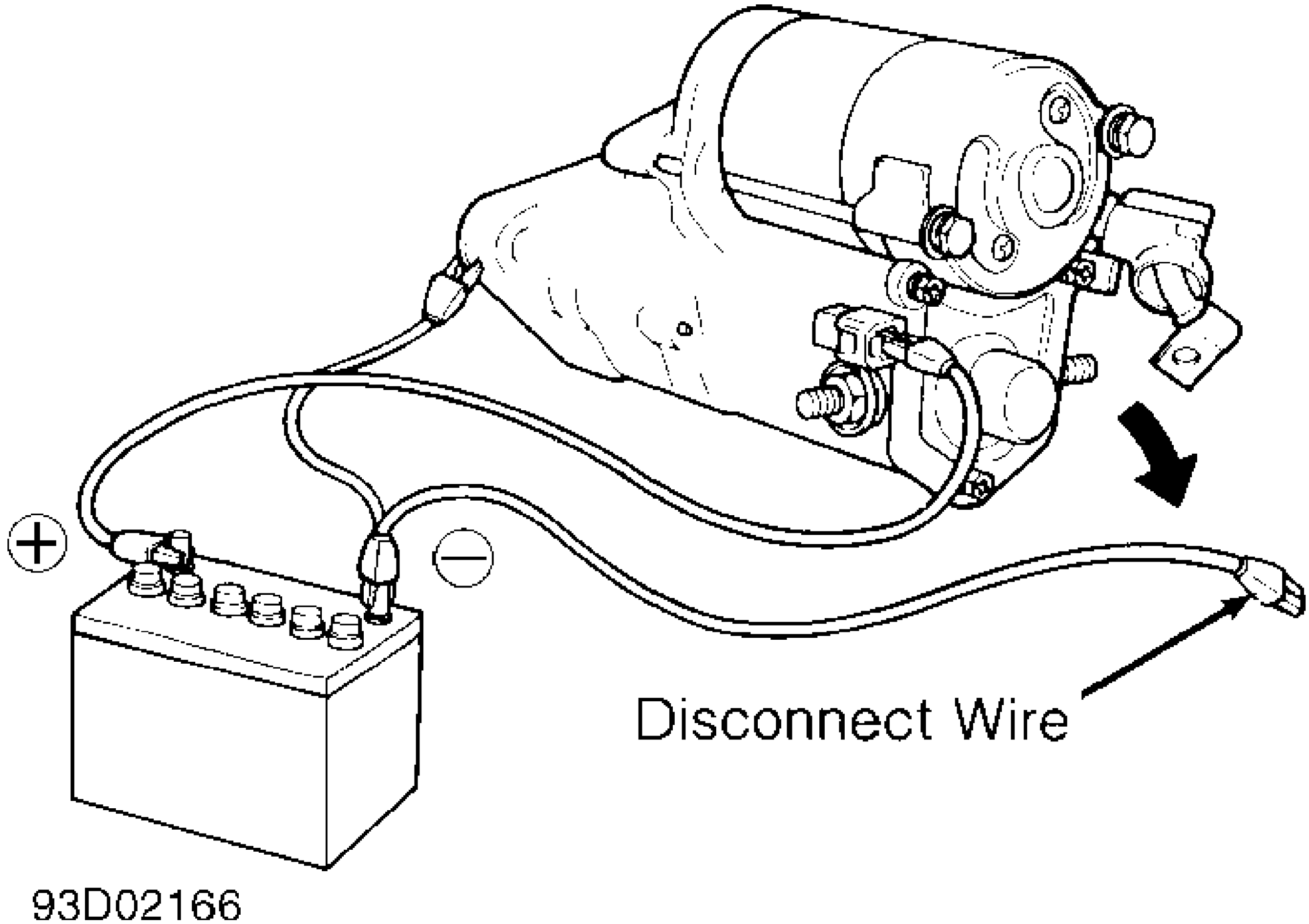


Fig. 10: Testing Solenoid Hold-In Coil
Courtesy of Toyota Motor Sales, U.S.A.Inc.

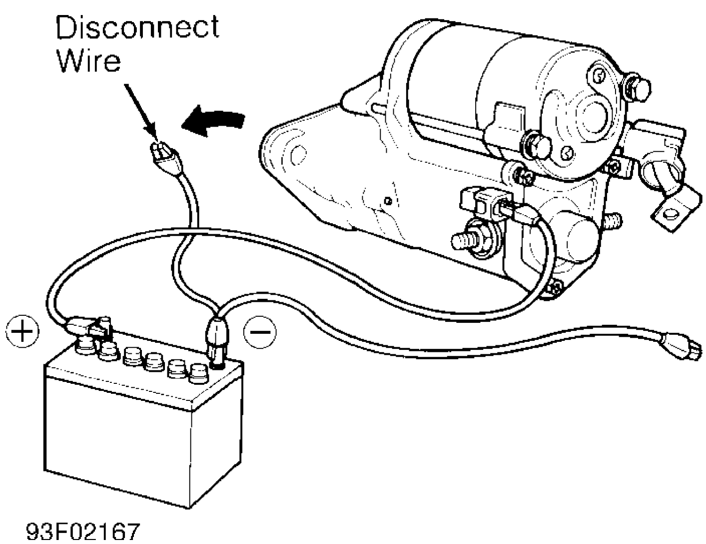


Fig. 11: Testing Solenoid Drive Pinion Return
Courtesy of Toyota Motor Sales, U.S.A.Inc.

STARTER COMPONENT INSPECTION

Armature Coil

1) Using ohmmeter, check for continuity between armature coil core and insulation between commutator segments. If continuity is present, replace armature. Check armature for shorts using a growler. Replace armature as necessary.

2) Check for continuity between segments of commutator. If continuity is not present between any segment, replace armature.

Brushes & Springs

1) Check brush length. If length is less than specification, replace brushes. See NIPPONDENSO STARTER SPECIFICATIONS table under STARTER SPECIFICATIONS.

2) Check brush holders, springs, spring clip and insulation between positive and negative holders. Verify no continuity between positive and negative brush holders. Repair or replace components as needed.

Clutch Assembly & Gears

1) Inspect teeth on pinion gear, idler gear and clutch assembly for wear or damage. If damaged, replace gear or clutch assembly and inspect flywheel ring gear for wear or damage.

2) Inspect clutch pinion gear by rotating pinion gear. Depending on engine, pinion gear will rotate freely in one direction and lock when rotated in opposite direction. On 3S-GTE and 5S-FE, clutch pinion gear will lock when rotated in a clockwise direction. On all other models, lock in a counterclockwise direction. If necessary replace, clutch assembly.

Commutator

1) If commutator surface is dirty or burnt, it can be cleaned with No. 400 grit sandpaper or on a lathe. If commutator runout (out-of-round) is more than .002" (.05 mm), turn commutator on a lathe. Wear or cutting limit of commutator diameter is 1.06" (27 mm) for 0.8 kW starter, 1.14" (29.0 mm) for 1.2, 1.4 and 1.6 kW starter, and 1.34" (34 mm) for 2.2 kW starter. If commutator diameter is less than minimum, replace armature.

2) Ensure undercut depth between commutator segments are clean, free of debris, and that edges are smooth. Minimum undercut depth is .008" (.20 mm). If undercut depth is less than minimum use a hacksaw blade to correct to a depth of .008-.024" (.20-.60 mm).

Field Frame (Field Coil)

Verify continuity between lead wire and field coil brush lead. If continuity is not present, replace field coil. Verify there is no continuity between field coil end and field frame. If continuity exists, replace or repair field frame.

REMOVAL & INSTALLATION

STARTER MOTOR

NOTE: Only starters with specific removal procedures are listed. On models not listed, disconnect negative battery cable and remove starter. To install, reverse removal procedure. See TORQUE SPECIFICATIONS.

Removal & Installation (4A-FE)

Disconnect negative battery cable. Raise vehicle. Remove suspension lower crossmember to access lower starter bolt. Remove air cleaner cap to access upper starter bolt. Remove starter, then remove starter terminal/wire cover and remove starter wires. To install, reverse removal procedure. Tighten starter mounting bolts to 29 ft.

lbs. (39 N.m). Tighten suspension lower crossmember to 112 ft. lbs. (152 N.m).

Removal & Installation (3S-GTE)

1) Disconnect negative battery cable. Disconnect electrical connectors and hoses from air cleaner assembly. Remove air intake tube from throttle body. Remove air intake tube and air cleaner top cap as an assembly. Remove air filter and air cleaner case from engine compartment.

2) Remove engine relay box from battery bracket. Remove battery and tray. Remove starter terminal/wire cover and remove starter wires. Remove starter. To install, reverse removal procedure. Tighten starter mounting bolts to 29 ft. lbs. (39 N.m).

Removal & Installation (5S-FE)

1) Disconnect negative battery cable. Disconnect air intake temperature sensor connector from air cleaner assembly. Remove air intake tube from throttle body. Remove air intake tube and air cleaner from throttle body. Remove air filter and air cleaner case from engine compartment.

2) Remove engine relay box and locate out of way. Remove cruise control actuator on models equipped with ABS brakes. Remove starter terminal/wire cover and remove starter wires. Remove starter. To install, reverse removal procedure. Tighten starter mounting bolts to 29 ft. lbs. (39 N.m).

OVERHAUL

NOTE: Overhaul procedures are not available from manufacturer. For exploded views of starters, see Fig. 12.

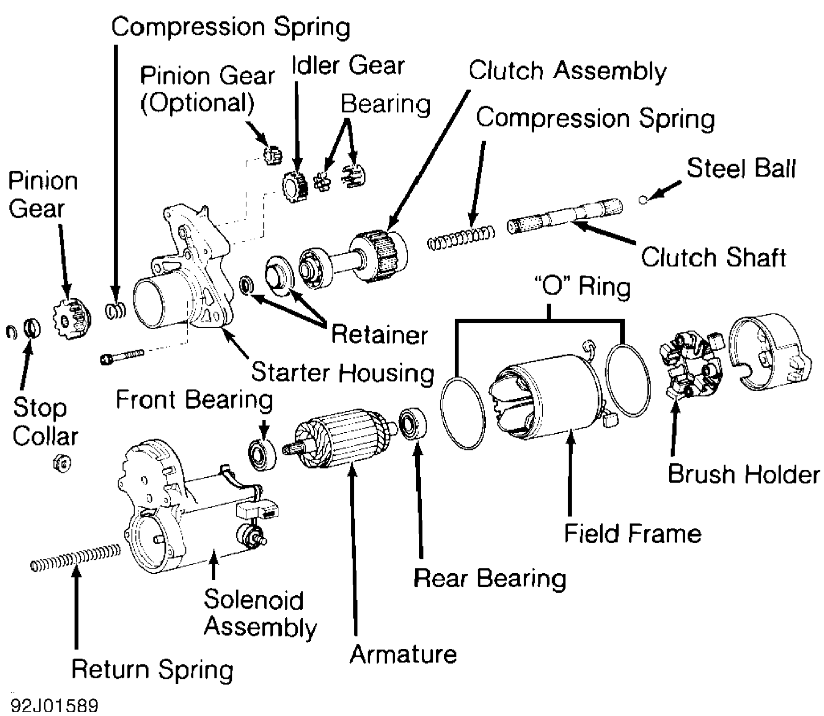


Fig. 12: Exploded View of Gear Reduction Starter (3S-GTE, 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

STARTER SPECIFICATIONS

NIPPONDENSO STARTER SPECIFICATIONS

Application	Specification
Brush Minimum Length	
1.4 & 1.6 kW	.394" (10.0 mm)
1.0 kW (1)	.335" (8.5 mm)
Brush Spring Load	
1.4 & 1.6 kW	3.9-5.3 Lbs. (18-24 N)
Commutator Minimum Diameter	
0.8 kW	1.06" (27 mm)
1.0, 1.2, 1.4, 1.6 kW	1.14" (29.0 mm)
2.2 kW	1.34" (34 mm)
Commutator Minimum Undercut Depth	.008" (.2 mm)
Commutator Runout	.002" (.05 mm)
Armature	
Core Runout	.002" (.05 mm)
End Play	.002" (.05 mm)

(1) Reduction gear.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Lower Crossmember Bolts (4A-FE)	112 (152)
Starter Mounting Bolts (All Others)	29 (39)

STEERING COLUMN SWITCHES

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Steering Column Switches

Celica

DESCRIPTION

* PLEASE READ THIS FIRST *

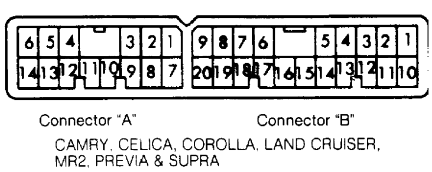
WARNING: Celica is equipped with a driver-side air bag. Before servicing steering column, disable air bag system to prevent air bag deployment. To disable air bag system, turn ignition switch to LOCK position. Disconnect negative battery cable. Wait at least 90 seconds to allow back-up power supply to discharge. For more information, see AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

TESTING

NOTE: This article TABLE contains information on headlight and taillight system relays because they are part of exterior lighting system.

COMBINATION SWITCH

NOTE: Combination switch includes switches for headlights, turn signals and windshield wipers. For testing, see appropriate component procedure.



93J84664

Fig. 1: Combination Switch Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A. Inc.

HEADLIGHT, DIMMER & PASSING SWITCHES

With headlight switch in specified position, check continuity between specified terminals of combination switch connector. See HEADLIGHT SWITCH CONTINUITY TEST table and/or DIMMER & PASSING SWITCHES CONTINUITY TEST table. See Fig. 1. If continuity is not as specified, replace headlight switch or turn signal/dimmer switch as necessary.

HEADLIGHT SWITCH CONTINUITY TEST TABLE

Application & Switch Position	Terminals (1)	Continuity Present
Off	A2, A11, A13 & B20	No
(Next Position)	A11 & B20	Yes
Tail	A2, A11 & B20	Yes
Head	A2, A11 & A13	Yes

(1) - See Fig. 1.

DIMMER & PASSING SWITCHES CONTINUITY TEST TABLE

Application & Switch Position	Terminals (1)	Continuity Present
Celica	(2)	(2)

(1) - See Fig. 1.
(2) - See HEADLIGHT SWITCH CONTINUITY TEST table.

HEADLIGHT CONTROL RELAY

Remove relay. See HEADLIGHT CONTROL RELAY LOCATION table. Apply battery voltage across specified terminals of relay connector. See HEADLIGHT CONTROL RELAY TEST table. See Fig. 2. Check continuity between other specified terminals. If there is no continuity, replace relay.

HEADLIGHT CONTROL RELAY LOCATION TABLE

Application	Location
Celica	Left Side Engine Bay, In Relay Block No. 2

HEADLIGHT CONTROL RELAY TEST TABLE (1)

Application Type	Apply Voltage To These Terminals	Continuity Between These Terminals
Celica	1 & 2	3 & 4

(1) - See Fig. 2.

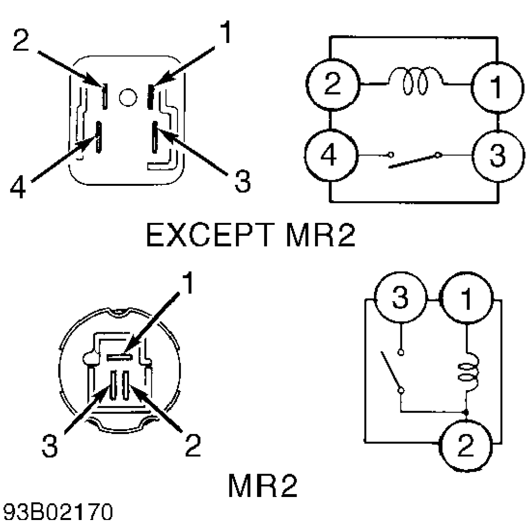


Fig. 2: Headlight Control Relay Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TAILLIGHT CONTROL RELAY

Remove relay. See TAILLIGHT CONTROL RELAY LOCATION table. Apply battery voltage across specified terminals of relay connector. See TAILLIGHT CONTROL RELAY TEST table. See Fig. 3. Check continuity between other specified terminals. If there is no continuity, replace relay.

TAILLIGHT CONTROL RELAY LOCATION TABLE

Application	Location
Celica	Behind Left Side Of Dash In Relay Block No. 1

(1) - Theft Deterrent System.

TAILLIGHT CONTROL RELAY TEST TABLE (1)

Application Type	Apply Voltage To These Terminals	Continuity Between These Terminals
Celica	1 & 3	2 & 4

(1) - See Fig. 3.

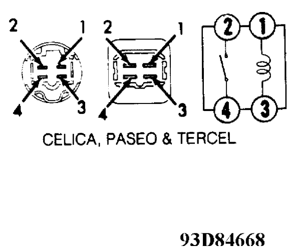


Fig. 3: Taillight Control Relay Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

HORN SWITCH

1) Disconnect combination switch connector. See Fig. 6. With horn pad pressed and held down (horn ON), check continuity between appropriate wire terminal of combination switch connector. See Fig. 1. See appropriate wiring diagram.

2) If there is no continuity, repair wiring or replace components as necessary. Components include horn pad and contact pin, slip ring and spiral cable (with air bag). If there is continuity, check for open in horn circuit, faulty horn or faulty horn relay. See HORN RELAY LOCATION table.

HORN RELAY LOCATION TABLE

Application	Location
Celica	Right Side Engine Bay, In Relay Block No. 5

IGNITION SWITCH

Disconnect ignition switch connector. With ignition switch in specified position, check continuity between specified terminals of ignition switch connector. See IGNITION SWITCH CONTINUITY TEST table. See Fig. 4. If continuity is not as specified, replace ignition switch.

IGNITION SWITCH CONTINUITY TEST TABLE

Application & Switch Position	Terminals (1)	Continuity Present
Lock	2, 3, 4, 6, 7, 9 & 10	No
Accessory	3 & 4	Yes
On	2, 3 & 4; 9 & 10	Yes
Start	2, 4 & 7; 6, 9 & 10	Yes

(1) - See Fig. 4.

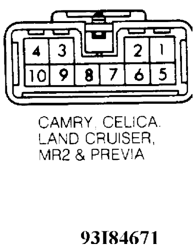


Fig. 4: Ignition Switch Connector Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TURN SIGNAL SWITCH

Disconnect combination switch connector. See Fig. 6. With turn signal switch in specified position, check continuity between specified terminals of combination switch connector. See TURN SIGNAL SWITCH CONTINUITY TEST table. See Fig. 1. If continuity is not as specified, replace turn signal switch.

TURN SIGNAL SWITCH CONTINUITY TEST TABLE

Application & Switch Position	Terminals (1)	Continuity Present
Left	A1 & A5	Yes
Neutral	A1, A5 & A8	No
Right	A1 & A8	Yes

(1) - See Fig. 1.

TURN SIGNAL FLASHER

Remove turn signal flasher. See TURN SIGNAL FLASHER LOCATION table. At turn signal flasher terminals, connect battery positive lead to terminal No. 2. See Fig. 5. Connect battery negative lead to terminal No. 3. Connect 2 turn signal bulbs in parallel between terminal No. 1 and battery negative terminal. Replace turn signal flasher if bulbs do not flash 60-120 times per minute.

TURN SIGNAL FLASHER LOCATION TABLE

Application	Location
Celica	Behind Left Kick Panel, In Relay Block No. 1

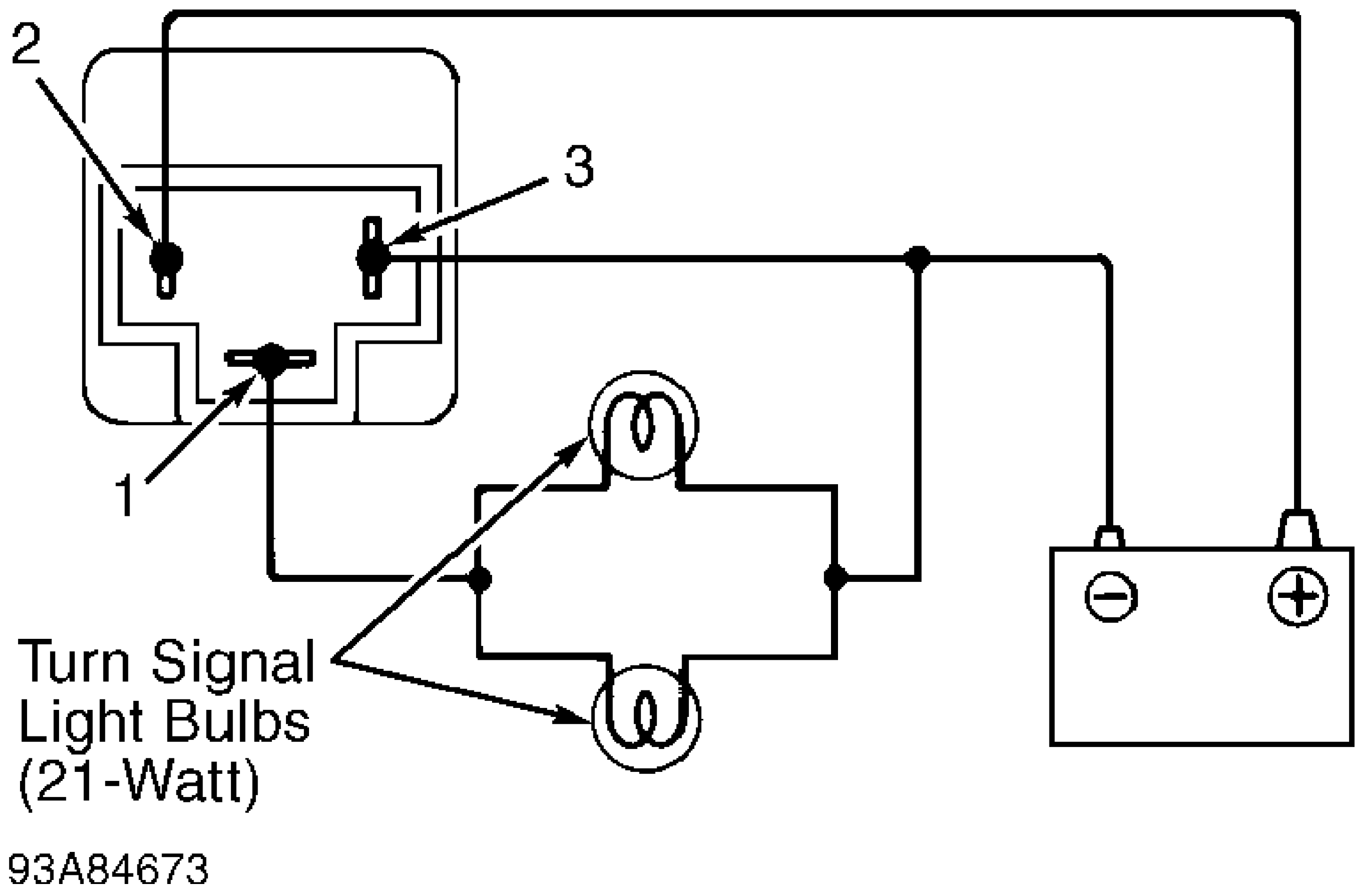


Fig. 5: Testing Turn Signal Flasher
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIPER/WASHER SWITCH

NOTE: See appropriate WIPER/WASHER SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Celica is equipped with a driver-side air bag. Before servicing steering column, disable air bag system to prevent air bag deployment. To disable air bag system, turn ignition switch to LOCK position. Disconnect negative battery cable. Wait at least 90 seconds to allow back-up power supply to discharge. For more information, see AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

COMBINATION SWITCH

1) Remove steering wheel. See STEERING WHEEL. Remove upper and lower steering column covers (it may be necessary to first remove lower finish panel from instrument panel). Disconnect combination switch connector. See Fig. 6.

2) On vehicles with cruise control switches on steering wheel, disconnect cruise control electrical connector(s) from slip ring. Remove slip ring from combination switch.

3) Remove wire ties securing combination switch wiring harness to column. Remove screws securing combination switch to steering column. Remove combination switch. To install, reverse removal procedure.

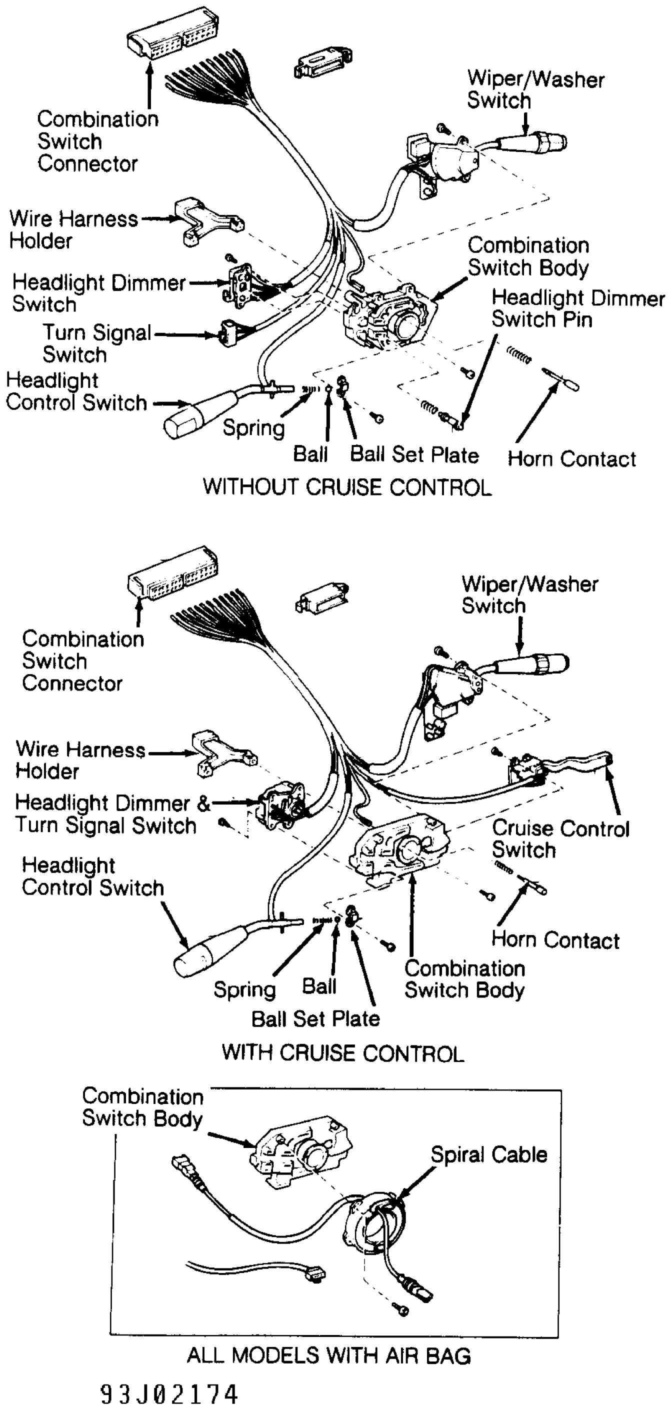


Fig. 6: Exploded View Of Combination Switch
Courtesy of Toyota Motor Sales, U.S.A., Inc.

IGNITION SWITCH

1) Disconnect negative battery cable. Remove upper and lower steering column covers (it may be necessary to first remove lower instrument panel trim panel). Remove outer plastic trim cover from lock cylinder assembly (if equipped).

2) Disconnect ignition switch electrical connector(s). Remove screw(s) retaining ignition switch to lock cylinder. Remove ignition switch from lock cylinder. To install, reverse removal procedure.

STEERING WHEEL

Removal

1) Ensure front wheels are in straight-ahead position. Turn ignition switch to LOCK position. Remove key. Disconnect negative battery cable. Remove 2 screw covers from outer sides of steering wheel. Using Torx Wrench (T30), loosen 4 horn pad screws until screw head is snug against screw case. See Fig. 7.

2) Carefully pull steering wheel pad away from steering wheel enough to unlock and disconnect air bag electrical connector. DO NOT pull on electrical connector or wiring. Store air bag pad aside with pad facing upward.

3) Remove steering wheel lock nut and washer from steering shaft. Make alignment mark on steering shaft and steering wheel for installation reference. Using appropriate steering wheel puller, pull steering wheel from shaft while guiding spiral cable wire through steering wheel opening.

Installation

1) Ensure front wheels are in straight-ahead position. Install spiral cable on combination switch body. Turn spiral cable counterclockwise by hand until it is hard to turn. Turn spiral cable clockwise about 2 1/2 turns, aligning marks on spiral cable.

2) Install steering wheel, guiding spiral cable through opening in steering wheel. Align reference marks on steering shaft and steering wheel. Tighten steering wheel lock nut to specification. See TORQUE SPECIFICATIONS.

3) Connect air bag module electrical connector. Close connector lock. Ensure air bag module Torx screws are retracted and snug against screw case. See Fig. 7.

4) Install air bag module, ensuring wiring is not pinched and does not interfere with other moving parts. Tighten air bag module Torx screws to specification. Install screw covers. Connect negative battery cable.

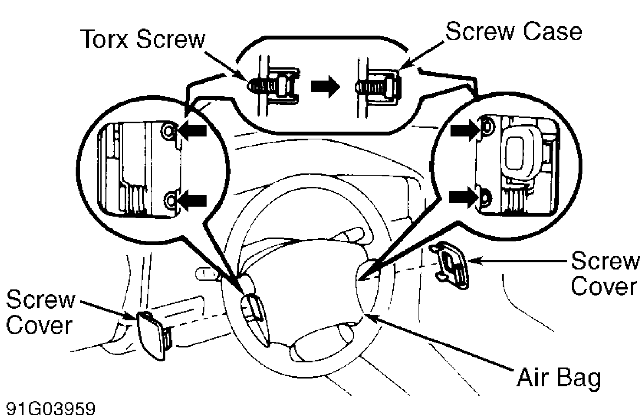


Fig. 7: Removing Air Bag From Steering Wheel
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TURN SIGNAL/DIMMER SWITCH

NOTE: To remove turn signal/dimmer switch, it may be necessary to first remove headlight control switch, spring, ball and ball set plate. See Fig. 6.

Removal

1) Disconnect negative battery cable. Remove steering column covers. At combination switch connector, lift tab locks and remove clamp. See Fig. 8. Identify turn signal/dimmer switch wire terminals in combination switch connector.

2) Using miniature screwdriver, release wire terminal lock inside connector. Pull wires from connector and from harness jacket tubing. Remove turn signal/dimmer switch screws from combination switch body. See Fig. 6. Remove turn signal/dimmer switch.

Installation

To install, reverse removal procedure. To install wire terminals into combination switch connector cavities, push wire terminal into cavity until terminal clicks into place.

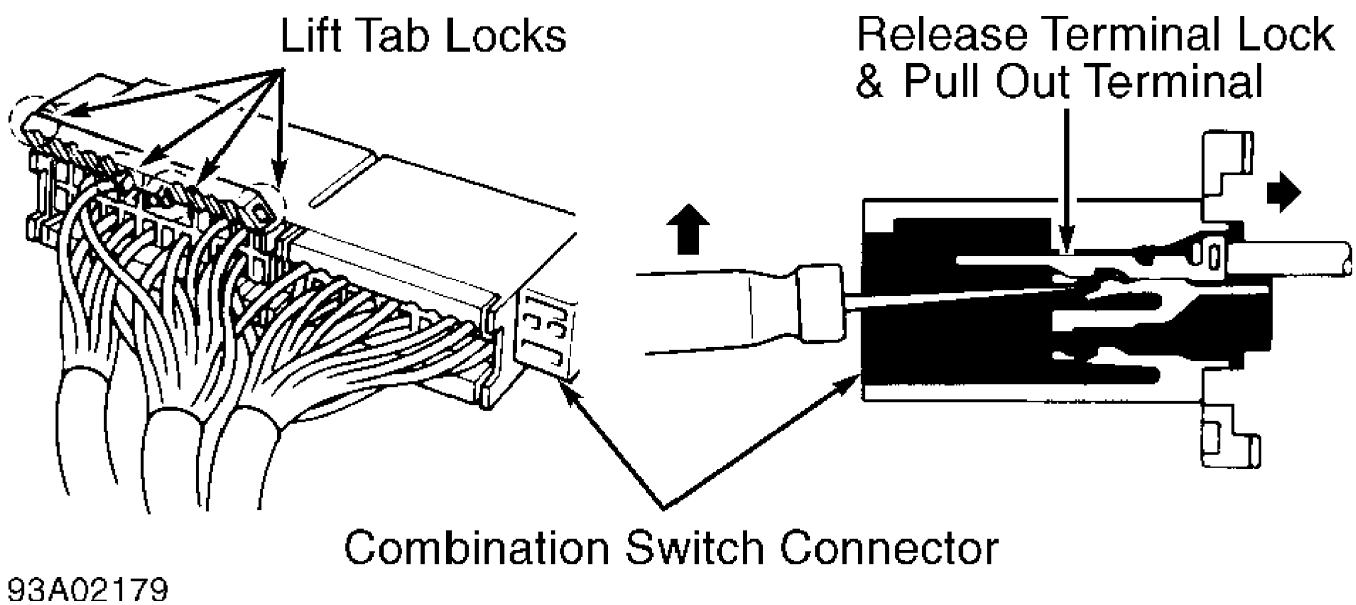


Fig. 8: Releasing Wire Terminals Inside Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Steering Wheel Nut	26 (35)
	INCH Lbs. (N.m)
Air Bag Module Torx Screws	65 (7.3)

STEERING COLUMN - TILT

1993 Toyota Celica

1993 STEERING
Toyota - Steering Columns - Tilt Wheel

Celica

DESCRIPTION & OPERATION

Tilt steering wheels incorporate an upper steering shaft, attached by a "U" joint to an intermediate steering shaft. These shafts are held in place by upper and lower brackets. Brackets are pinned together so upper bracket can move up or down. Upper bracket is locked in place by pawl attached to lever. Steering columns are collapsible.

Celica All-Trac models use an automatic tilt steering column. See STEERING COLUMN - AUTOMATIC TILT WHEEL article in this section for trouble-shooting and diagnosis.

DISABLING & ACTIVATING AIR BAG SYSTEM

WARNING: All models are equipped with a driver-side air bag; use extreme caution while servicing steering column. Air bag system retains enough voltage to deploy air bag for a short time after disconnecting power. Proceeding too quickly may cause accidental deployment and possible personal injury. Always wait at least 90 seconds after disconnecting battery before starting work.

To disable air bag system, ensure ignition switch is in LOCK position and negative battery terminal is disconnected for at least 90 seconds before attempting any repair. DO NOT apply electrical power to any component on steering column without disconnecting air bag control unit. Information labels are attached to air bag components. Follow all notices on labels.

ADJUSTMENTS

SPIRAL CABLE

Make sure front wheels are in a straight-ahead position. Turn spiral cable COUNTERCLOCKWISE by hand until it becomes hard to turn cable. Turn spiral cable CLOCKWISE 2 1/2-3 turns and ensure Red marks align and are visible through inspection hole. See Fig. 1.

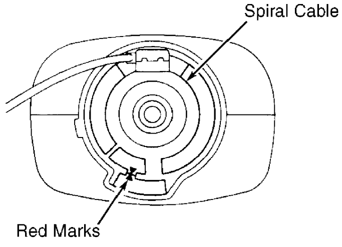


Fig. 1: Adjusting Air Bag Spiral Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

STEERING WHEEL PAD & SPIRAL CABLE

NOTE: See DISABLING & ACTIVATING AIR BAG SYSTEM.

Removal

1) Make sure front wheels are in a straight-ahead position. Turn ignition off. Disconnect negative battery cable.

2) Remove engine hood release lever. Remove screw covers, screws and lower instrument cluster trim panel(s). Loosen steering wheel pad Torx screws until groove along screw circumference catches on screw case. See Fig. 2.

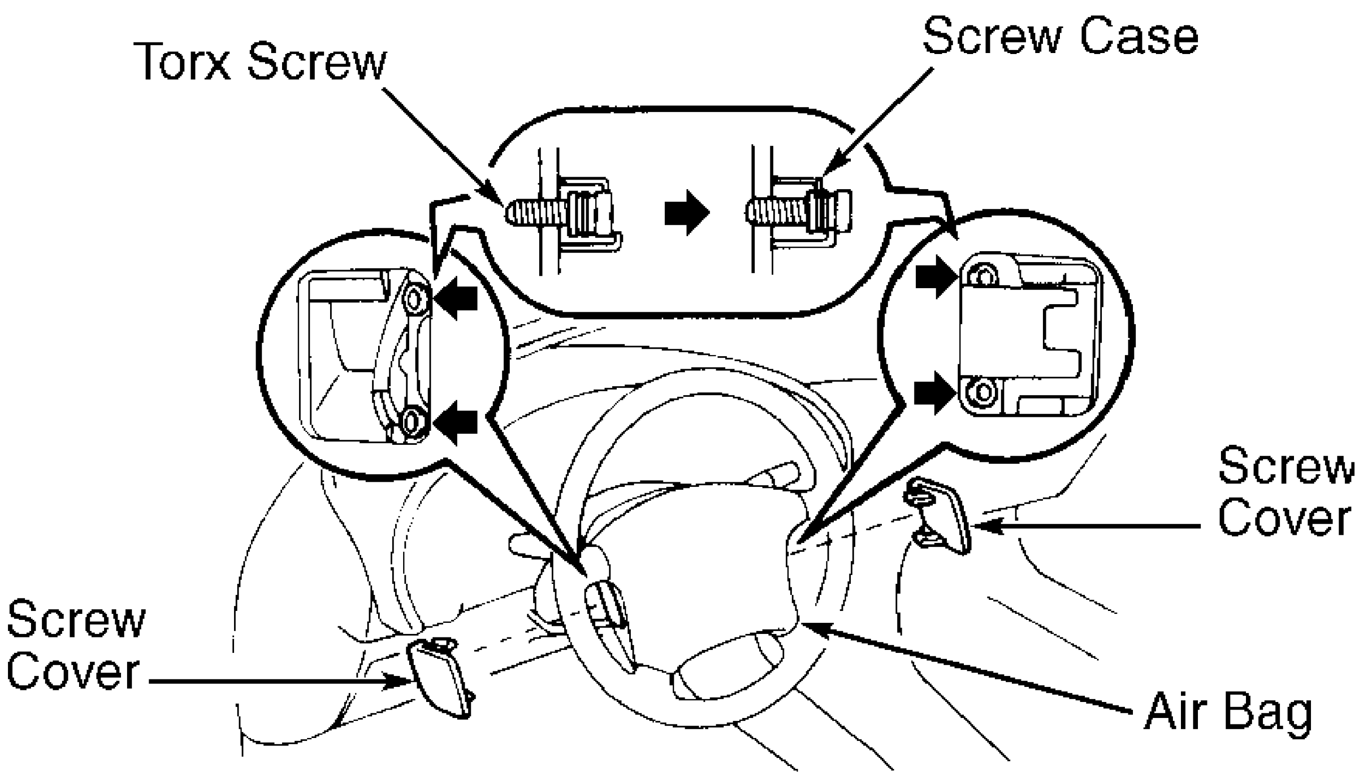


Fig. 2: Removing Steering Wheel Pad
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Pull steering wheel pad from steering wheel and disconnect air bag. Remove steering wheel pad assembly. Place steering wheel pad assembly on a flat surface with pad cover facing upward.

WARNING: Place steering wheel pad assembly on workbench. Pad surface MUST face up. If assembly is stored face down, accidental air bag deployment could propel assembly and cause serious bodily injury.

4) Place a mark on steering wheel and main shaft for installation reference. Using steering wheel puller, remove steering wheel. Remove 4 screws from upper and lower steering column covers. Remove spiral cable-to-combination (headlight/turn signal/wiper) switch screws. Disconnect spiral cable and remove from vehicle.

Installation

1) To install, reverse removal procedure. Before installing

spiral cable, ensure spiral cable is properly aligned. See SPIRAL CABLE under ADJUSTMENTS.

2) After steering wheel pad and spiral cable are installed, ensure proper operation of air bag system by turning ignition switch to ACC or ON position. AIR BAG warning light should come on and go out after about 6 seconds.

3) If AIR BAG warning light stays on for more than 6 seconds, air bag system is malfunctioning and needs repair. If AIR BAG warning light comes on with ignition off, a short circuit may be present in AIR BAG warning light circuit.

COMBINATION SWITCH

Removal & Installation

1) Remove steering wheel. See STEERING WHEEL PAD & SPIRAL CABLE or STEERING WHEEL & HORN PAD under REMOVAL & INSTALLATION. Remove instrument panel lower finish panel. Remove upper and lower steering column covers. Locate and disconnect combination switch electrical connector(s).

2) On models equipped with cruise control switches on steering wheel, disconnect cruise control electrical connector(s) from slip ring. Remove slip ring from combination switch.

3) On all models, remove wire ties securing combination switch wiring harness to column. Remove screws securing combination switch to steering column. Remove combination switch. To install, reverse removal procedure.

IGNITION SWITCH

Removal

1) Remove steering wheel and combination switch (if necessary). See STEERING WHEEL PAD & SPIRAL CABLE and/or COMBINATION SWITCH under REMOVAL & INSTALLATION. Disconnect ignition switch harness connectors. If shear bolt studs are accessible, use a hacksaw to cut a slot into exposed studs.

2) Remove studs using a screwdriver. If shear bolt studs are recessed or hard to reach with a hacksaw, use a center punch on studs. Using drill bit and screw extractor, remove studs. Place key in ACC position and remove steering lock and ignition switch.

Installation

To install, reverse removal procedure. Install new shear bolts. Tighten shear bolts finger tight. Ensure proper operation of steering lock and ignition switch. Tighten shear bolts until heads break off. Install combination switch, upper and lower steering column covers and steering wheel (if removed).

STEERING COLUMN

Removal & Installation

1) Disconnect negative battery cable. Wait for at least 90 seconds before starting work to prevent air bag deployment. Remove steering wheel pad. Mark steering shaft and wheel for installation reference. Remove steering wheel.

2) Remove instrument cluster lower trim panel. Remove air duct from under steering column (if equipped). Remove steering column upper and lower covers. Remove combination (headlight/turn signal/wiper) switch.

3) Mark "U" joint and shaft for installation reference. Remove bolt(s) and disconnect "U" joint from bottom of steering column shaft. Remove steering column bolts and steering column. To install, reverse removal procedure.

OVERHAUL

STEERING COLUMN

NOTE: See DISABLING & ACTIVATING AIR BAG SYSTEM.

Disassembly

1) Drill out shear bolt studs. Using a screw extractor, remove column bracket bolts. Remove upper (key cylinder) bracket. See Figs. 4 and 5. Remove compression spring bolt. Remove compression spring.

2) Remove bushings from compression spring. Remove 3 tension springs. On all models except Celica All-Trac, remove 2 tilt lever "E" rings from tilt lever lock shaft. Remove tilt lever spacer. Remove 2 nuts from tilt steering bolts. Remove 2 tilt lever retainers and 2 pawl stoppers.

3) Remove tilt pawl nut and washers. Pull out tilt pawl bolt. Remove tilt lever assembly installation bolt. Remove 2 tilt pawls. Remove tilt lever, tilt sub lever and tilt lever assembly from tilt lever lock shaft.

4) On Celica All-Trac, remove tilt steering gear with motor. Remove E-ring and collar. Remove nut and 2 washers and remove tilt memory lever, torsion spring and spacer. Remove 3 nuts and 2 washers, and remove spacer, torsion spring, 2 memory plates and 2 collars. Remove 4 nuts and 3 washers and remove tilt release lever and lever retainer.

5) Remove E-rings, bolt, 2 tilt lever retainers and tilt steering stopper. Remove tilt lever and tilt sub lever from retainer. Remove spacer and pawl stoppers. Remove tilt lever bracket and tilt pawls. Remove tilt lever, tilt sub lever and release lever. Pull out tilt lever lock shaft.

6) On all models, install nut (10 mm x 1.25 mm), washer (36-mm outside diameter), and bolt (10 mm x 1.25 mm x 50 mm) to upper column tube tilt steering bolt. Using a slide hammer, remove steering column tube tilt bolts. Remove upper column tube from lower column tube. See Fig. 3. Remove collar from main shaft.

7) Using a press, compress spring on main shaft. Remove snap ring. Remove main shaft from column tube. Remove spring, thrust collar and bearing. On Celica All-Trac, remove nut and collar and using a hex wrench, remove tilt memory bolt and square nut.

Inspection

Ensure lock mechanism operates properly. Check upper bracket for damage and upper bearing for rotating smoothness. Check steering shafts for bending, damaged splines, or damaged "U" joints. Check column tube for bending or other damage. Repair or replace components as necessary.

Reassembly

1) Reassemble in reverse order of disassembly procedure. Apply molybdenum disulfide lithium base grease to tilt lever assembly, lock bolt, main shaft, and steering bolt pivot points. Install steering column tube tilt bolts.

2) If upper column tube mark is "1", install hollow tipped thread bolt. If upper column tube mark is "2", install plain thread bolt. With tilt pawl and ratchet engaged, install 2 pawl stoppers. Ensure alignment marks on tilt pawl and stopper align when stopper is rotated to pawl side. If alignment marks do not align, select a different size pawl stopper. See TILT PAWL STOPPER SIZE table.

TILT PAWL STOPPER SIZE TABLE

Mark Tilt Lever Side	Mark Tilt Sub Lever Side	In. (mm)
Celica FWD & 4WD		
1	A	.4992-.5016 (12.68-12.74)
2	B	.4965-.4988 (12.61-12.67)
3	C	.4937-.4961 (12.54-12.60)
4	D	.4909-.4933 (12.47-12.53)
5	E	.4882-.4906 (12.40-12.46)
6	F	.4854-.4878 (12.33-12.39)
7	G	.4827-.4850 (12.26-12.32)

3) On Celica All-Trac, after installing the tilt memory lever, place the steering column in tilt-away position. Push the upper column tube downward and install a collar between the tilt memory bolt and lever retainer. Select a collar with an outer diameter 1 rank below the collar that fits most tightly. See TILT LEVER RETAINER COLLAR SIZE table. When installing steering gear and motor, tilt release lever pin goes into long hole of steering gear lever.

TILT LEVER RETAINER COLLAR SIZE TABLE (CELICA ALL-TRAC)

Color	Outside Diameter In. (mm)
Blue	.5020-.5059 (12.75-12.85)
Yellow	.4941-.4980 (12.55-12.65)
Pink	.4862-.4902 (12.35-12.45)
None	.4783-.4823 (12.15-12.25)
Black	.4705-.4744 (11.95-12.05)
Red	.4610-.4665 (11.75-11.85)
Green	.4547-.4587 (11.55-11.65)
Red	.4429-.4468 (11.25-11.35)

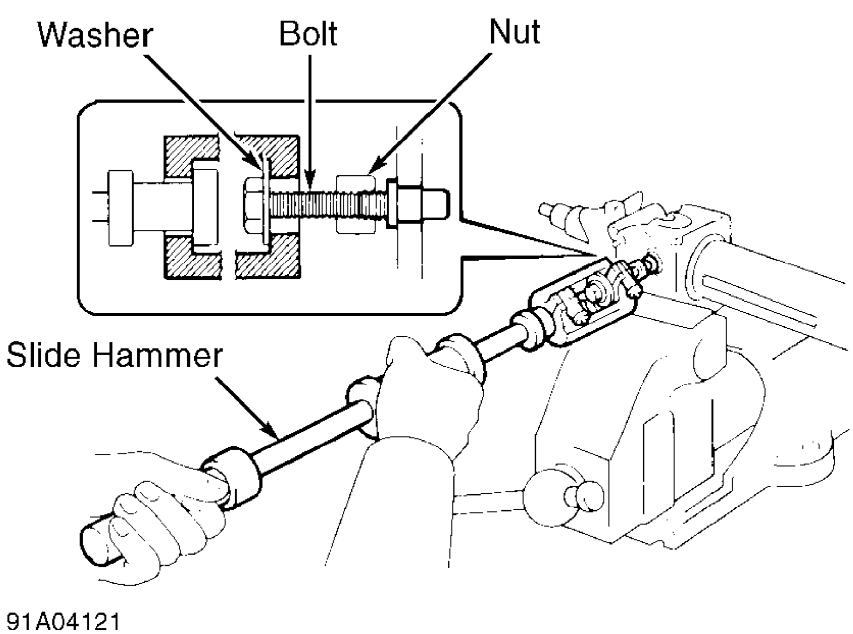


Fig. 3: Removing Upper Column Tube Tilt Steering Bolts
Courtesy of Toyota Motor Sales, U.S.A., Inc.

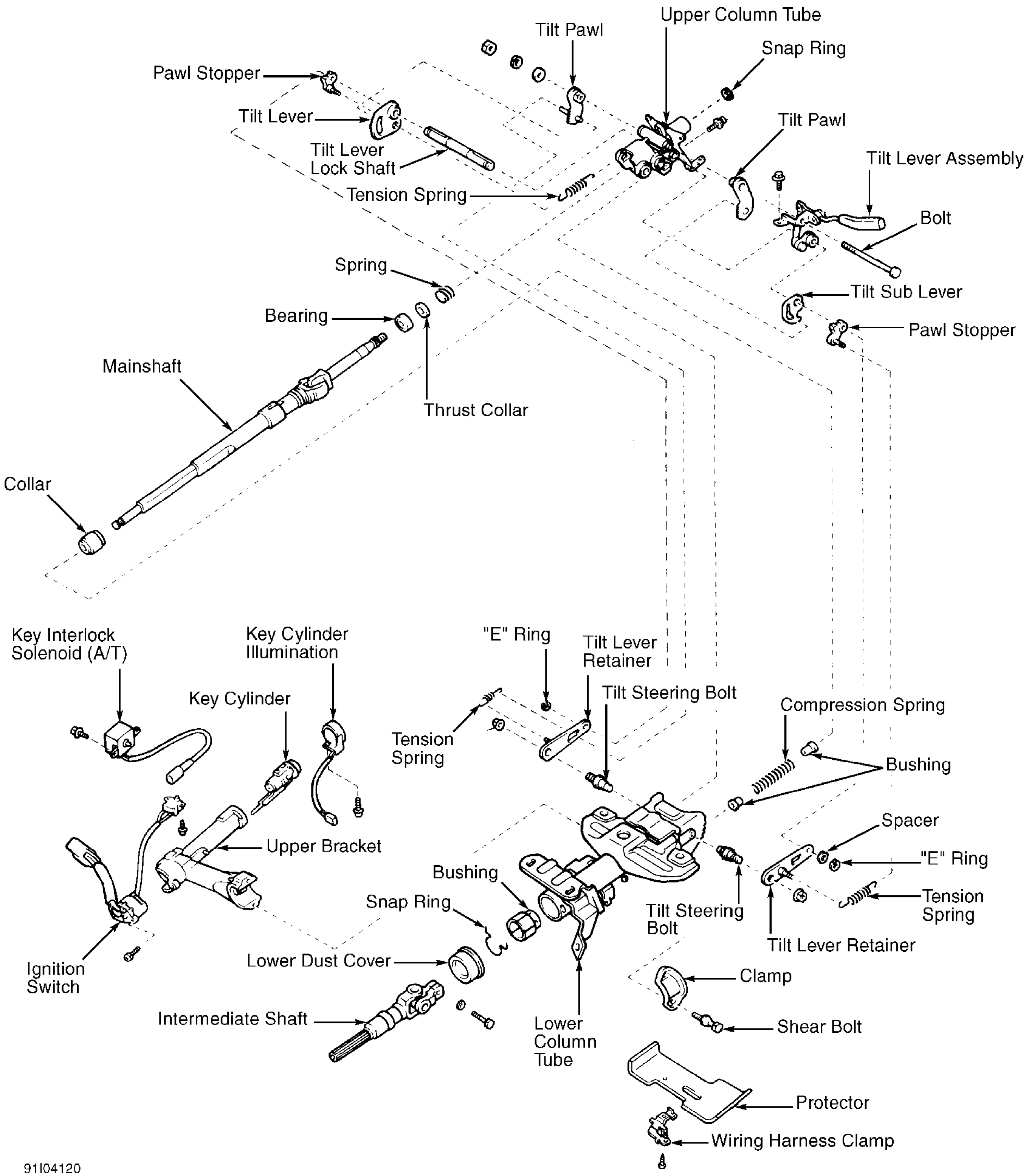


Fig. 4: Exploded View Of Steering Column (FWD)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

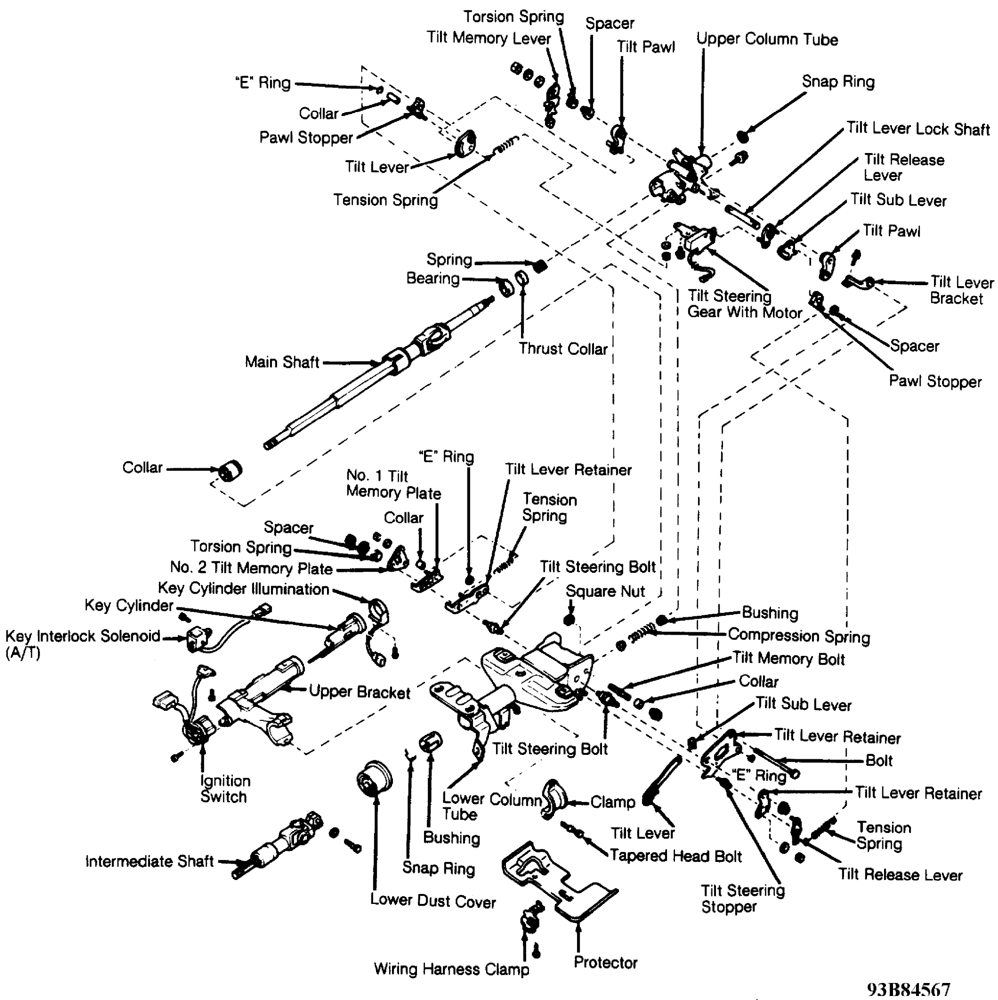


Fig. 5: Exploded View Of Steering Column (All-Trac W/Auto Tilt)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Tilt Lever Retainer Nut	11 (15)
Steering Wheel Nut	26 (35)
Tilt Sub Lever Retainer Nut	11 (15)
"U" Joint Clamp Bolt	26 (35)
	INCH Lbs. (N.m)
Compression Spring Bolt	69 (8)
Steering Wheel Pad Bolts	65 (7.5)
Tilt Lever Nut	52 (6)
Tilt Lever Bracket Bolt (All-Trac)	26 (2.9)
Tilt Memory Bolt (All-Trac)	56 (6.4)

STEERING COLUMN - STANDARD

1993 Toyota Celica

1993 STEERING
Toyota - Steering Columns - Standard

Celica

DESCRIPTION & OPERATION

Steering column is a collapsible 2-piece design. Columns use shear pins to absorb collision impact. Steering shaft is connected directly to steering gear with either a flexible coupling or "U" joint. Car models have an air bag integral with the steering wheel pad.

NOTE: For models with tilt wheel steering columns, see the STEERING COLUMN - TILT article in the STEERING section.

DISABLING & ACTIVATING AIR BAG SYSTEM

WARNING: Before any repairs are performed on air bag equipped models, disconnect and shield negative battery cable. Wait at least 90 seconds after disconnecting battery cable before performing any repairs. Air bag system retains enough voltage to deploy air bag for a short time after disconnecting power. Use caution when working around steering column. Air bag could deploy.

To disable air bag system, ensure ignition switch is in LOCK position and negative battery terminal is disconnected for at least 90 seconds before attempting any repair. DO NOT apply electrical power to any component on steering column without disconnecting air bag control unit. Information labels are attached to air bag components. Follow all notices on labels.

ADJUSTMENTS

SPIRAL CABLE

On vehicles equipped with air bag system, spiral cable MUST be correctly adjusted to ensure proper air bag operation. Ensure front wheels are in straight-ahead position. Turn spiral cable counterclockwise by hand until it becomes harder to turn cable. Turn spiral cable clockwise about 2 1/2-3 turns and ensure Red marks align and are visible through inspection hole. See Fig. 1.

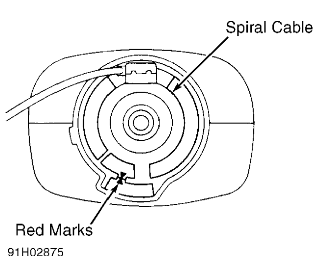


Fig. 1: Adjusting Air Bag Spiral Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

STEERING WHEEL PAD & SPIRAL CABLE (WITH AIR BAG)

NOTE: See DISABLING & ACTIVATING AIR BAG SYSTEM.

Removal

1) Ensure front wheels are in straight-ahead position. Turn ignition switch to LOCK position. Disconnect and shield negative battery cable.

2) Remove screw covers, screws, and lower instrument cluster trim panel(s). Loosen steering wheel pad Torx screws until groove along screw circumference catches on screw case. See Fig. 2.

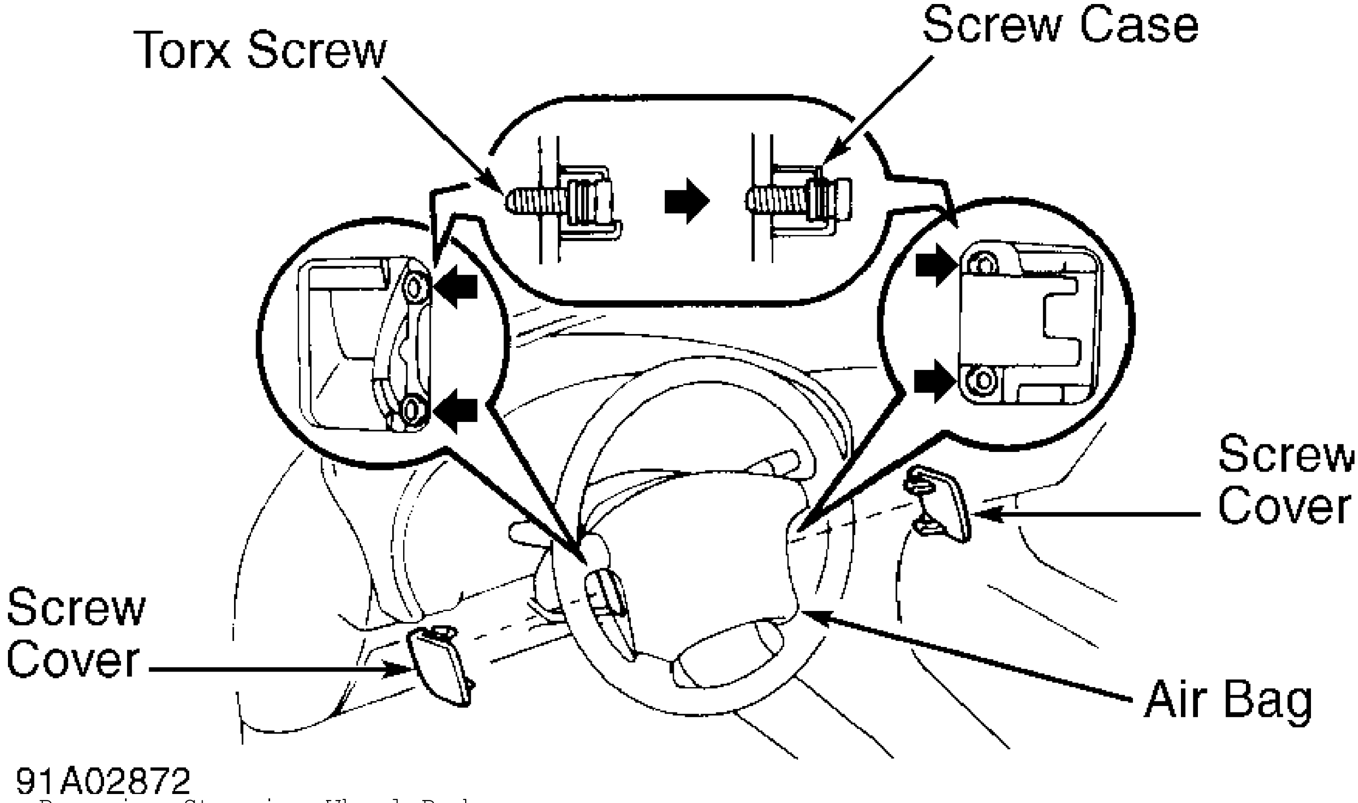


Fig. 2: Removing Steering Wheel Pad
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Pull steering wheel pad from steering wheel and disconnect electrical connector. Remove steering wheel pad. Place steering wheel pad on flat surface with pad cover facing up.

WARNING: Place steering wheel pad assembly on workbench. Pad surface MUST face up. If assembly is stored face down, accidental air bag deployment could propel assembly and cause serious bodily injury.

4) Mark steering wheel and steering shaft for installation reference. Remove steering wheel nut. Use appropriate puller to remove steering wheel. Remove 4 screws from upper and lower steering column covers. Remove screws attaching spiral cable to combination (headlight/turn signal/wiper) switch. Disconnect spiral cable and remove from vehicle.

Installation

1) To install, reverse removal procedure. Before installing spiral cable, ensure spiral cable is properly aligned. See ADJUSTMENTS . Tighten steering wheel nut and Torx screws to specification. See TORQUE SPECIFICATIONS.

2) After spiral cable and steering wheel pad are installed, ensure proper operation of air bag system by turning ignition switch to ACC or ON position. AIR BAG warning light should come on and go out after approximately 6 seconds.

3) If AIR BAG warning light stays on for more than 6 seconds, air bag system is malfunctioning and needs repair. If AIR BAG warning light comes on with ignition on, a short circuit is likely in AIR BAG warning light circuit.

COMBINATION SWITCH

Removal & Installation

1) Disconnect negative battery cable. Remove steering wheel. See STEERING WHEEL PAD & SPIRAL CABLE or STEERING WHEEL & HORN PAD. Remove instrument cluster lower trim panel. Remove upper and lower steering column covers.

2) Disconnect combination switch electrical connector. Remove screws securing combination switch to steering column and remove combination switch. To install, reverse removal procedure. Tighten steering wheel nut to specification. See TORQUE SPECIFICATIONS.

IGNITION SWITCH & LOCK CYLINDER

Removal

1) Disconnect negative battery cable. Remove steering wheel. See STEERING WHEEL PAD & SPIRAL CABLE or STEERING WHEEL & HORN PAD. Remove upper and lower steering column covers. Remove combination switch (if necessary).

2) Disconnect ignition switch harness connectors. If shear bolt studs are accessible, use a hacksaw to cut a slot into exposed studs. Using a screwdriver, remove studs.

3) If shear bolt studs are recessed or hard to reach with a hacksaw, center punch studs. Using a drill bit and a screw extractor, remove studs. Remove ignition switch and lock cylinder.

Installation

1) To install, reverse removal procedure. Install NEW shear bolts. Tighten shear bolts finger tight. Ensure proper operation of ignition switch and lock cylinder.

2) Tighten shear bolts until heads break off. Install combination switch, upper and lower steering column covers and steering wheel. Tighten steering wheel nut to specification. See TORQUE SPECIFICATIONS.

STEERING COLUMN

Removal & Installation

1) Disconnect negative battery cable. Remove steering wheel pad. Mark steering shaft and steering wheel for installation reference. Remove steering wheel. See STEERING WHEEL PAD & SPIRAL CABLE or STEERING WHEEL & HORN PAD.

2) Remove instrument cluster lower trim panel. Remove air duct from under steering column (if equipped). Remove steering column upper and lower covers. Remove combination switch.

3) On passenger cars, mark "U" joint and steering shaft for installation reference. Remove bolt(s) and disconnect "U" joint from bottom of steering column shaft. Remove bolts securing steering

column.

OVERHAUL

NOTE: See DISABLING & ACTIVATING AIR BAG SYSTEM.

Disassembly

1) Drill out tapered head bolts and use screw extractor to remove upper bracket bolts. Remove upper bracket from column tube. Remove upper snap ring. Remove steering column main shaft from column tube. See Fig. 3.

2) Remove lower snap ring. Remove collar from main shaft. Use a screwdriver to remove bushing. Place ignition key lock in ACC position. Push down on stop pin and pull out key cylinder.

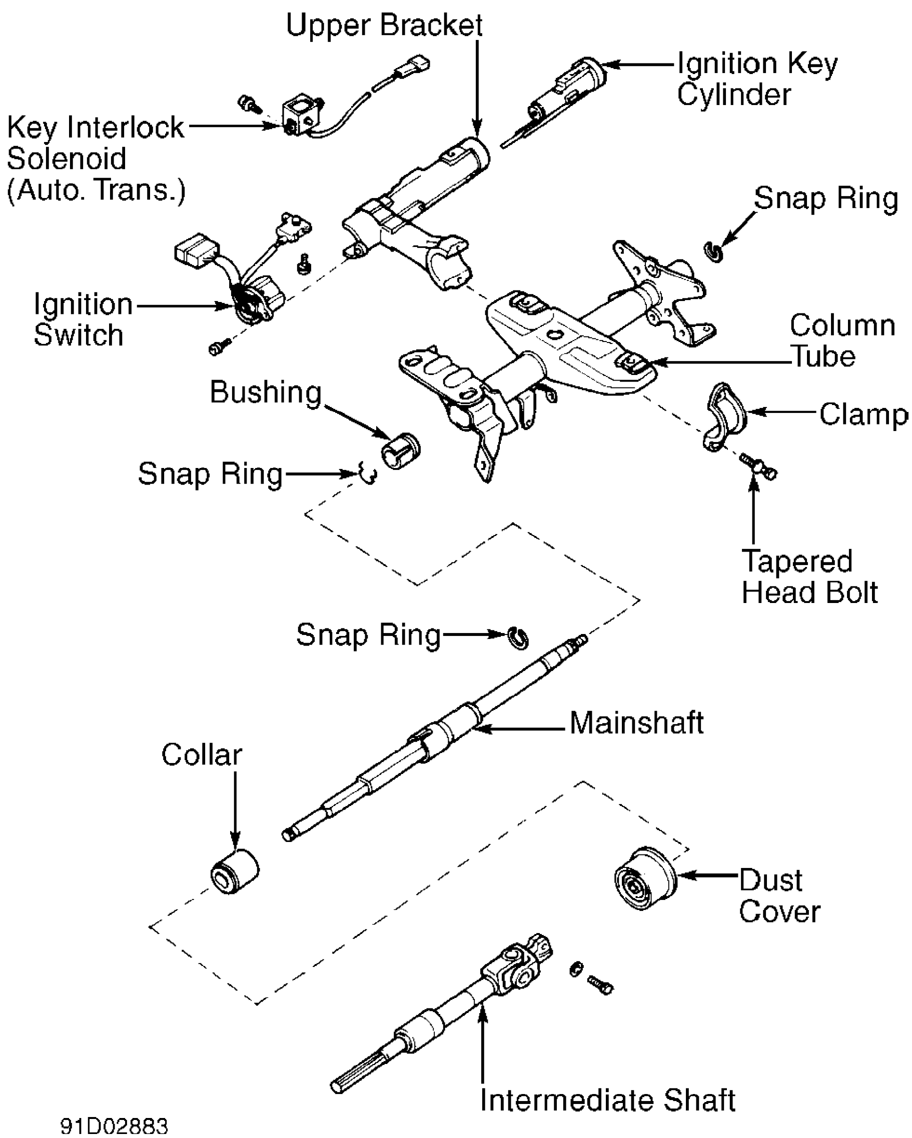


Fig. 3: Exploded View Of Steering Column
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

Ensure lock mechanism operates properly. Check upper bracket for damage and upper bearing for rotating smoothness. Check steering shafts for bending, damaged splines, or damaged "U" joints. Check column tube for bending or other damage. Repair or replace components as necessary.

Reassembly

To reassemble, reverse disassembly procedure. Apply molybdenum disulfide base grease to thrust stopper and upper bushing. Align bushing tabs with holes of column tube. Install upper bracket with tapered head bolts. Tighten bolts until hexagonal heads break off.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Intermediate Shaft-To-Main Shaft Bolt	26 (35)
Lower Tube-To-Upper Tube Bolt	14 (19)
Steering Column Bracket-To-Instrument Panel Bolt/Nut	19 (26)
Steering Wheel Nut	25 (34)
"U" Joint Bolt	26 (35)
	INCH Lbs. (N.m)
Column Hole Cover Bolt	69 (7.8)
Column Hole Dust Seal Bolt	69 (7.8)
Steering Wheel Pad Torx Screw	78 (8.8)

STEERING SYSTEM - POWER RACK & PINION

1993 Toyota Celica

1993 STEERING
Toyota - Power Rack & Pinion

Celica

DESCRIPTION & OPERATION

System consists of a rack and pinion assembly, hydraulic pump, and hoses. On some vehicles, an air control valve increases idle speed when power steering pump is under load.

LUBRICATION

FLUID TYPE

Use Dexron-II fluid.

FLUID LEVEL CHECK

When fluid is at normal operating temperature, fluid level should be between HOT marks on fluid reservoir or dipstick. When fluid is cold, fluid level should be between COLD marks on fluid reservoir or dipstick. Add Dexron-II fluid if necessary.

HYDRAULIC SYSTEM BLEEDING

1) With engine off, check fluid level in power steering pump reservoir. See FLUID LEVEL CHECK. Raise and support vehicle. Turn wheels fully in both directions. Recheck fluid level. Start and run engine at 1000 RPM or less. Rotate steering from lock to lock 2 or 3 times. Lower vehicle.

2) Rotate wheel from lock to lock 2 or 3 times. Center steering wheel. If fluid level does not rise and no foaming of fluid is evident, bleeding is complete. If fluid level rises more than 0.20" (5.0 mm) or foaming is evident, repeat procedure until air is released.

ADJUSTMENTS

POWER STEERING PUMP BELT

Using belt tension gauge, measure belt tension. See BELT TENSION SPECIFICATIONS table.

BELT TENSION SPECIFICATIONS TABLE

Application	Lbs. (kg)
New	100-150 (45-68)
Used (1)	60-100 (27-45)

(1) - Belt is used if it has been in operation longer than 5 minutes.

TESTING

AIR CONTROL VALVE

Start engine. Turn A/C off. Rotate steering wheel right and left. Engine RPM should not decrease more than 50 RPM. Pinch air hose shut. Rotate steering wheel right and left. Engine RPM should decrease about 200 RPM. If system fails any of these tests, check vacuum hoses and air control valve.

HYDRAULIC SYSTEM PRESSURE TEST

Pressure Test

1) Disconnect pressure line at line joint. Connect pressure gauge according to manufacturer's instructions. Bleed air from system. Check fluid level. With engine at idle, close valve for 2-3 seconds. Note fluid pressure. See HYDRAULIC PRESSURE table.

HYDRAULIC PRESSURE TABLE

Application	psi (kg/cm^2)
1.6L	970 (70)
2.0L	1140 (80)
2.2L	1070 (75)

NOTE: DO NOT keep pressure gauge valve closed longer than 10 seconds. Fluid testing temperature should be 176°F (80°C) or warmer.

2) Open valve fully. Note pressure with engine at idle and at 3000 RPM. Pressure difference should be less than 71 psi (5 kg/cm^2). If difference is greater than specified, check flow control valve. If flow control valve is okay, repair or replace pump.

3) With steering wheel at lock position and pressure valve open, again measure pressure. See HYDRAULIC PRESSURE table. If pressure is less than specified, steering gear has an internal leak. Repair or replace steering gear.

STEERING WHEEL TURNING FORCE

1) Attach spring scale to steering wheel, as close to rim as possible. Steering effort should not exceed value specified in table. See STEERING EFFORT SPECIFICATIONS table. Repair or replace power steering unit if turning force exceeds specification.

STEERING EFFORT SPECIFICATIONS TABLE

Application	Lbs. (Kg)
Celica	8.8 (4)

REMOVAL & INSTALLATION

POWER STEERING PUMP

Removal (1.6L)

1) Raise and support front of vehicle. Remove right front wheel. Remove right fender apron. Remove air control valve vacuum hose. Remove drive belt.

2) Remove pressure and return lines. Plug and elevate lines

to prevent fluid loss. Remove pulley nut. Remove pump bolts and pump.

Removal (2.0L & 2.2L)

Raise and support front of vehicle. Remove engine undercover and lower crossmember. Remove and plug pressure and return lines. Remove drive belt. On 4WD models, separate right tie rod end from steering knuckle. Remove drive pulley. On all models, remove pump mounting bolts. Remove pump.

Installation (All Models)

To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. On FWD models, check front end alignment (if necessary). Proceed to appropriate WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

POWER RACK & PINION

CAUTION: On models with air bag, position front wheels straight ahead, then secure steering wheel to prevent it from rotating, before disconnecting steering column "U" joint.

Removal

1) On Celica, remove air cleaner and duct. On all models, raise and support front of vehicle. Remove front wheels. Separate tie rod ends from steering arms. Remove steering column hole cover for access to steering coupler bolts.

2) Mark and disconnect steering coupler "U" joint. Remove and plug pressure and return lines. Remove air control vacuum valve hose (if equipped). On Celica All-Trac, remove exhaust pipe. On Celica, remove rear engine mount bracket. On Celica, remove crossmember.

3) On Celica All-Trac, mark and remove drive shaft. Remove stabilizer bar (if necessary). Remove steering gear mounting brackets. Remove steering gear. Use care not to tear rack boots when removing from chassis.

Installation

To install, reverse removal procedure. Check front end alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

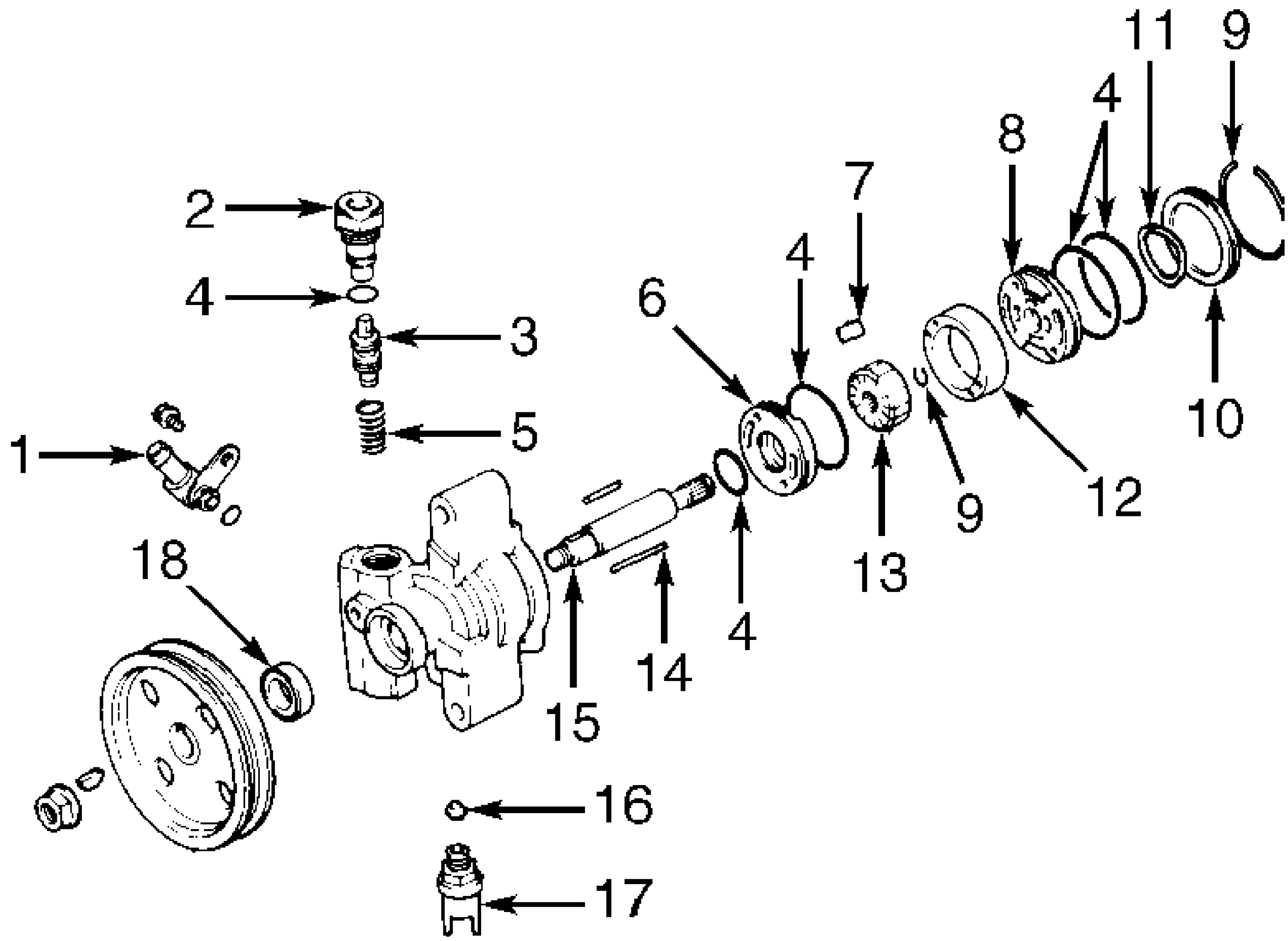
OVERHAUL

POWER STEERING PUMP

Disassembly

1) Remove drive pulley. Place power steering pump in vise. Remove reservoir and bracket. Remove air control valve (if equipped). See Fig. 1 or 2. Remove pressure feed tube, pressure port, flow control valve, and spring. Remove rear housing bolts or snap ring.

2) Using plastic mallet, tap end of shaft to remove rear housing and wave washer. Remove pump shaft, cam ring, and vane plates. Remove rotor and side plate. Drive out straight pins.



1. Suction Port Union
2. Pressure Port Union
3. Flow Control Valve
4. "O" Ring
5. Spring
6. Front Side Plate
7. Vane
8. Rear Side Plate
9. Snap Ring
10. Rear Housing
11. Wave Washer
12. Cam Ring
13. Rotor
14. Straight Pin
15. Pump Shaft
16. Union Seat
17. Air Control Valve
18. Oil Seal

91D03967

Fig. 1: Exploded View Of Power Steering Pump (2.0 & 2.2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

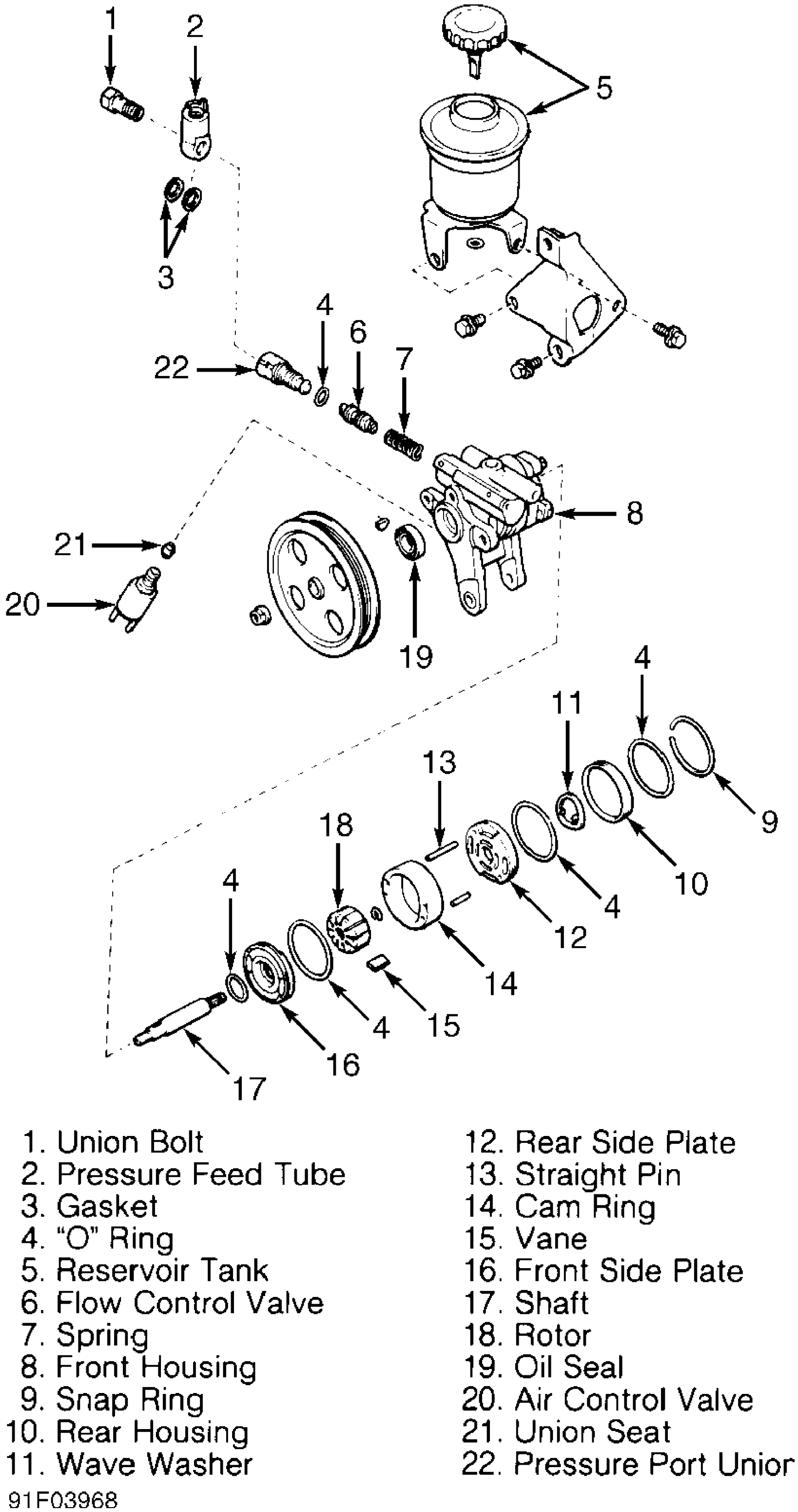


Fig. 2: Exploded View Of Power Steering Pump (Celica 1.6)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Except on models with shaft bearing, measure oil clearance

between pump housing bushing and rotor shaft. See Fig. 3. If clearance exceeds 0.0028" (0.07 mm), replace pump. On all models, discard all "O" rings and oil seals, and replace with new ones.

2) Inspect vane plates for wear or damage. See VANE PLATE SPECIFICATIONS table. Maximum clearance between vane plate and rotor groove is 0.0012" (0.03 mm). If clearance exceeds specification, replace rotor and vane plate as an assembly.

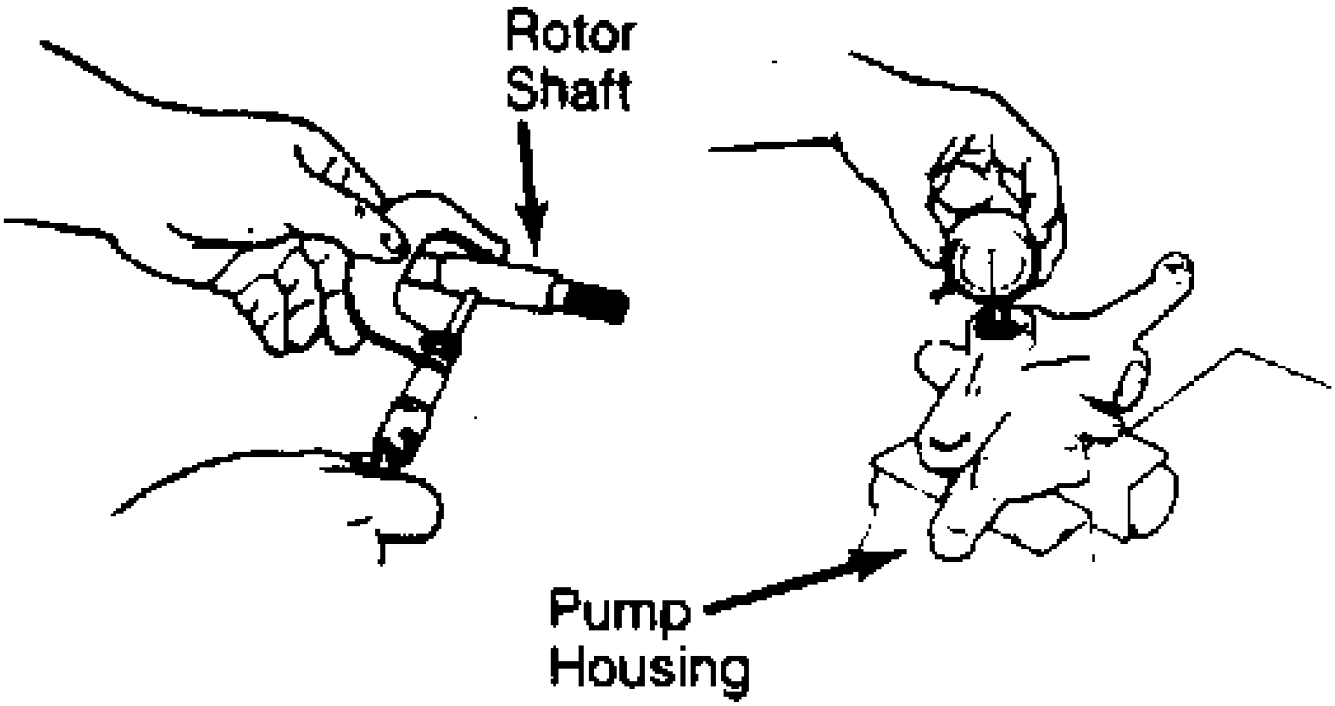


Fig. 3: Measuring Pump Shaft Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

VANE PLATE SPECIFICATIONS TABLE

Application	In. (mm)
Minimum Height	0.315 (8.00)
Minimum Thickness	0.0697 (1.770)
Minimum Length	0.5894 (14.970)

3) Using 57-71 psi (4.0-5.0 kg/cm²) compressed air, check flow control valve for leakage. See Fig. 4. Spring length should be 1.42-1.49" (36-38 mm). Replace spring if length is not as specified.

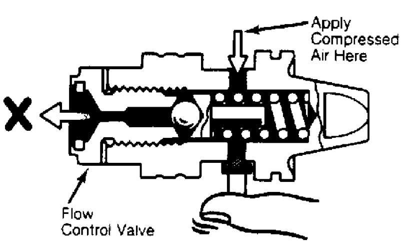


Fig. 4: Checking Flow Control Valve
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Reassembly

1) Coat all sliding surfaces with ATF. Assemble front plate and rotor assembly onto pump shaft. See Fig. 5. Coat shaft seal with grease. Install longer pin into housing. Align pin and hole in front plate.

2) Using a plastic mallet, tap pump shaft into housing. Install cam ring with scribe mark toward rear of pump. Install vane plates with rounded end facing rear of pump. Install rear side plate and "O" ring. Install wave washer, "O" ring, and rear housing.

3) Measure pump shaft rotating preload. Preload should not exceed 2.7 INCH lbs. (0.3 N.m). If preload exceeds specification, disassemble pump and inspect components. To complete reassembly, reverse disassembly procedure.

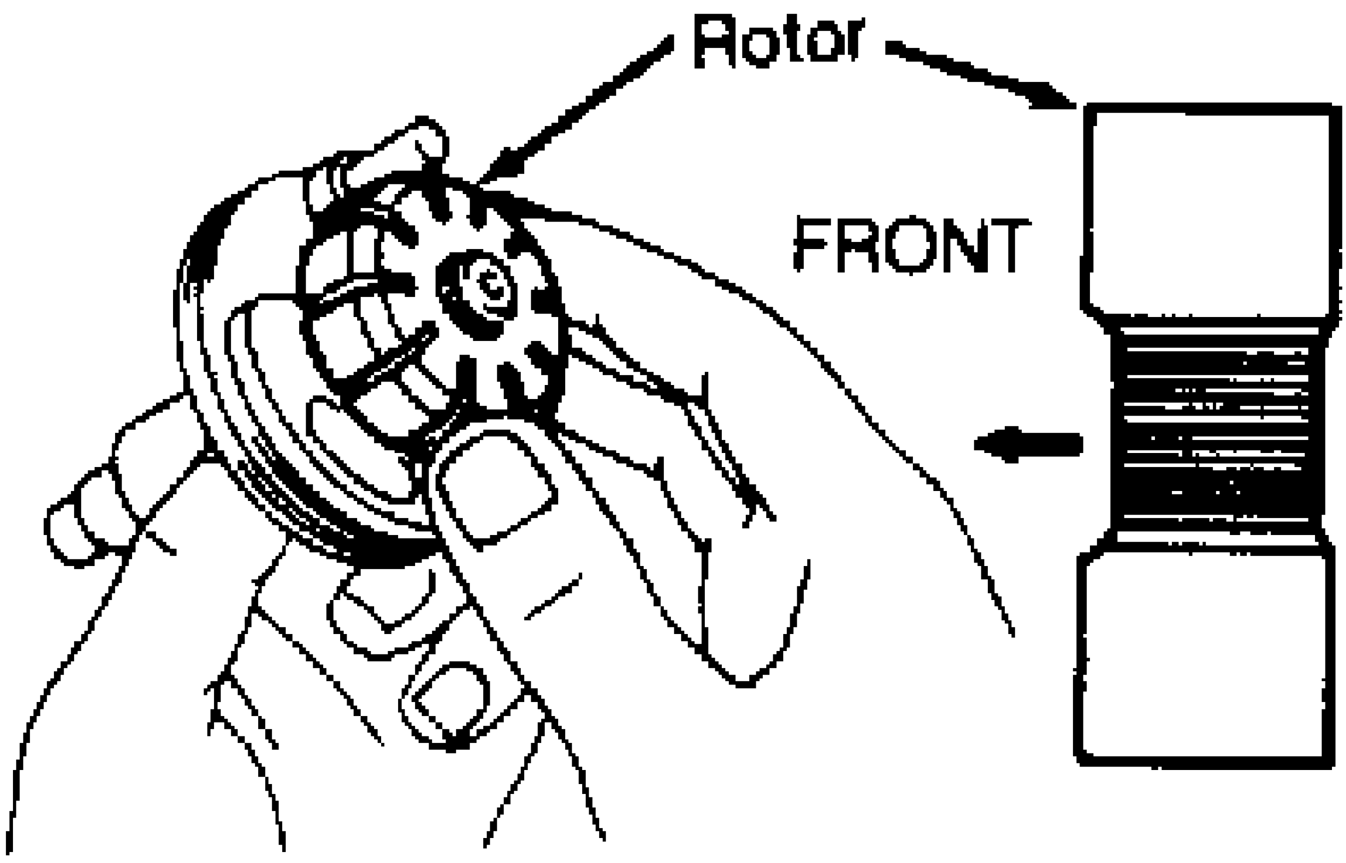


Fig. 5: Installing Power Steering Pump Rotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

STEERING GEAR

NOTE: Lubricate all internal parts of steering gear with power steering fluid before reassembly.

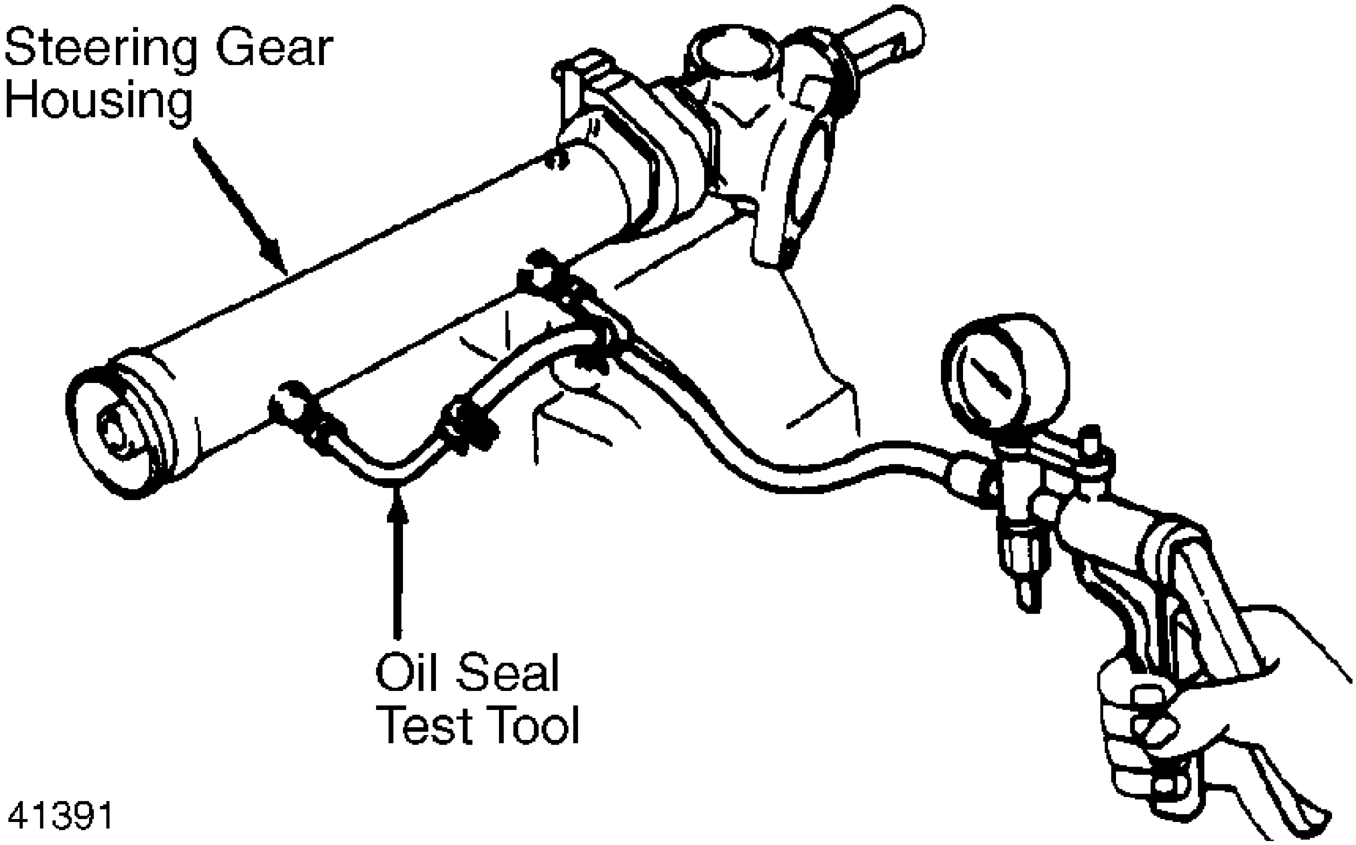


Fig. 6: Testing Rack Seal
Courtesy of Toyota Motor Sales, U.S.A., Inc.

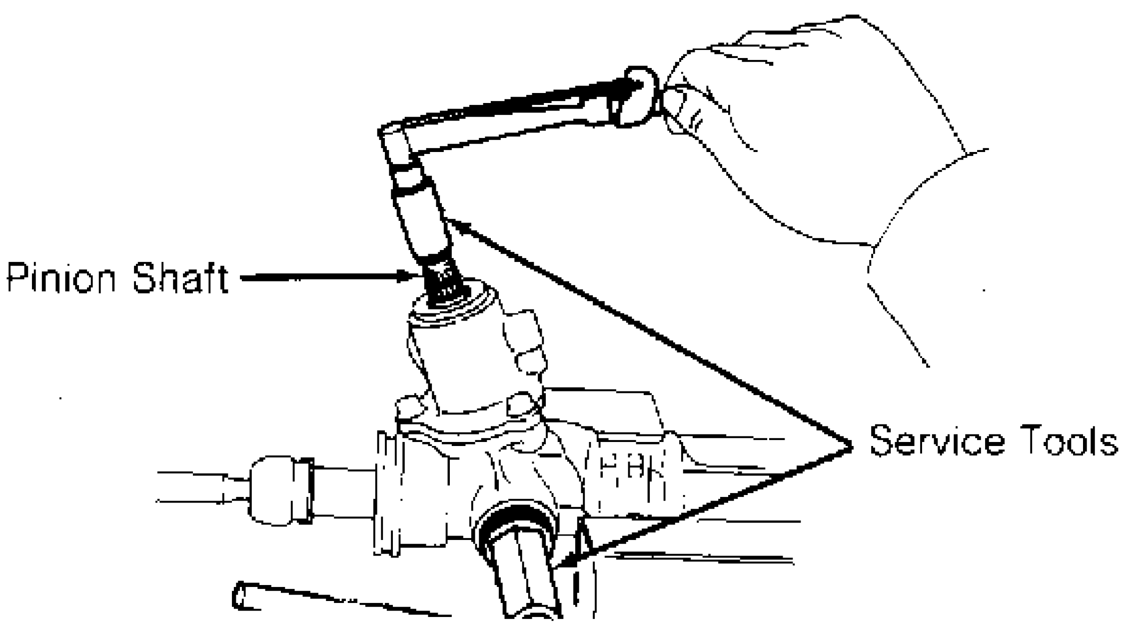


Fig. 7: Setting Rack & Pinion Total Preload
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Disassembly

1) Using Rack Housing Stand (09612-00012), mount steering

gear in vise. Remove left and right turn tubes. Mark and remove tie rod ends. Remove boots. See Fig. 8.

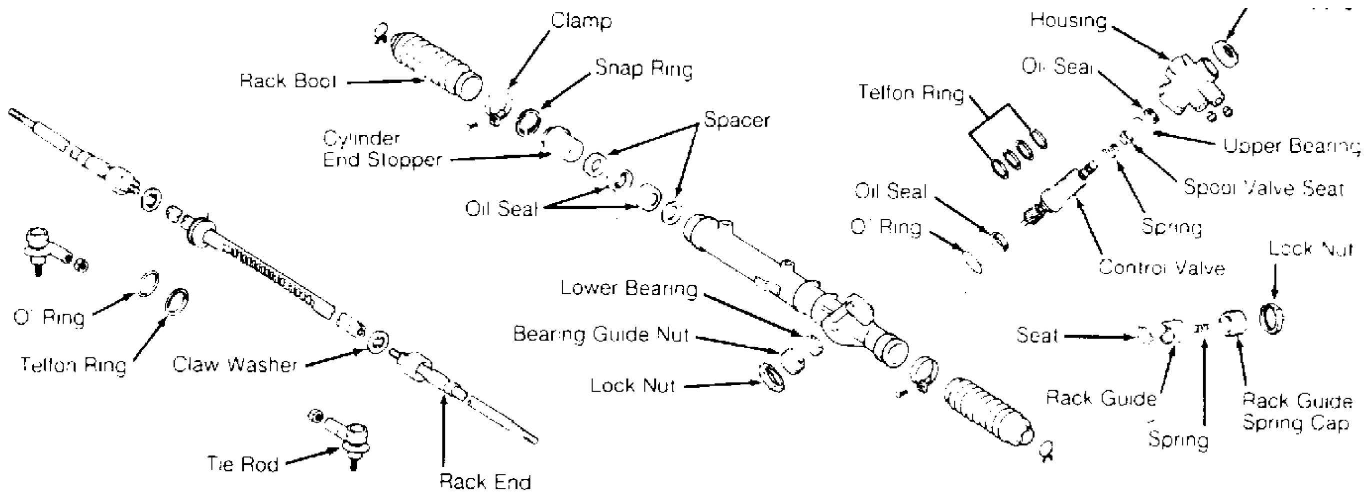


Fig. 8: Exploded View Of Power Rack & Pinion Steer Gear Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Unstake claw washers. Mark left and right rack ends for reassembly reference. Using Wrench (09628-10020), remove rack ends and claw washers. Remove rack guide spring cap lock nut. Remove spring cap. Remove rack guide spring, guide, and seat.

3) Remove bearing guide lock nut and guide nut. Remove dust cover. Mark control valve housing and rack for reassembly reference. Remove control valve housing. Remove control valve and bearing.

4) Remove snap ring from end of housing. Using Bearing Replacer (09612-10061), press cylinder end stopper out until end stopper touches press plate. Pull out rack with cylinder end stopper, spacer, and oil seal. Drive out rack housing oil seal and spacer.

Inspection & Repair

1) Check all parts for damage and deterioration. Place rack on "V" blocks. Measure runout at center of rack. Maximum runout is 0. 012" (0.30 mm). Inspect back surface of rack for wear or damage. Inspect all bearings and seals for damage. Replace as necessary. Replace all "O" rings. Replace rack housing if defective.

2) Using a small screwdriver, remove Teflon ring from rack. Lubricate NEW ring with power steering fluid. Carefully expand ring with Expander (09631-24020). Install ring onto rack, and firmly snug down with finger pressure.

3) Remove Teflon rings from control valve in similar manner. Lubricate Teflon rings with power steering fluid. Slide rings over Installer (09620-24040). Install rings onto control valve. Snug down rings with fingers. Slide chamfered end of Seal Ring Setter (09620-224050) over assembly to seat seal rings.

Reassembly & Adjustments

1) Install rack housing oil seal and spacer. Install Rack Cover (09631-32010) onto rack. Install rack into cylinder. Remove rack cover. Wind vinyl tape around steering rack end. Install oil seal into cylinder. Install spacer. Drive in cylinder end stopper with Bearing Replacer (09612-22011). Install snap ring.

3) Install Oil Seal Tester (09631-12070). Apply 15.8 in. Hg vacuum for 30 seconds. If vacuum drops, recheck seals, "O" rings, and Teflon rings in rack housing. See Fig. 6.

4) Coat control valve Teflon rings with power steering fluid. Insert valve into steering housing. Install "O" ring, spring, and

spring seat. Align reference marks on control valve housing. Install control valve lower bearing.

5) Apply Loctite 242 sealant to 2 or 3 threads of bearing guide nut. Install and tighten bearing guide nut to 11 ft. lbs. (15 N.m). Loosen guide nut until rotating torque is 3.5-5.3 INCH lbs. (0.4-0.6 N.m). See Fig. 7.

6) Apply Loctite 242 sealant to 2 or 3 threads of bearing guide lock nut. Install and tighten lock nut to 41 ft. lbs. (56 N.m). Measure preload, and readjust if necessary.

7) Install rack guide, guide spring, and seat. Apply Loctite 242 sealant to threads of rack guide spring cap. Install and tighten cap to 18 ft. lbs. (25 N.m). Back off spring cap 12 degrees. Rotate control valve shaft left and right twice.

8) Loosen spring cap until preload is eliminated. Tighten spring cap until preload is 8.0-10.6 INCH lbs. (0.9-1.2 N.m). Apply liquid sealer to threads of lock nut, and install lock nut. Tighten lock nut to 41 ft. lbs. (56 N.m). Measure preload, and readjust if necessary. To complete reassembly, reverse disassembly procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Air Control Valve	27 (36)
Control Valve Bearing Guide Lock Nut	41 (56)
Control Valve Housing Bolts	23 (31)
Control Valve Lower Bearing Self-Locking Nut	
FWD	18 (25)
All-Trac	11 (15)
Pressure Port	51 (69)
Pulley Bolt Or Nut	32 (43)
Pump Bracket Bolt	29-33 (39-45)
Rack Guide Spring Cap Lock Nut	51 (69)
Rear Housing Bolt	34 (46)
Stabilizer Bar Bracket Bolt	14 (19)
Steering Gear-To-Chassis	43 (58)
Steering Rack Tie Rod	61 (83)
Tie Rod Lock Nut	41 (56)
Tie Rod-To-Steering Arm Nut	36 (49)
Turn Tubes	14 (19)
"U" Joint Pinch Bolt	24 (32)
Wheel Lug Nuts	76 (103)
	INCH Lbs. (N.m)
Return Port Bolt	106 (12)

* STEERING UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
Steering, Suspension, Wheel Alignment, Wheels and Tires
Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

Motorist Assurance Program (MAP)

OVERVIEW
OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

Steering and Suspension

AIR RIDE SUSPENSION
AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS
AIR RIDE SUSPENSION - AIR SPRING VALVES
AIR RIDE SUSPENSION - AIR SPRINGS
AIR RIDE SUSPENSION - COMPRESSORS
AIR RIDE SUSPENSION - HEIGHT SENSORS
AIR RIDE SUSPENSION - MODULES
AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)
AIR RIDE SUSPENSION - SWITCHES (ON/OFF)
AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)
AIR RIDE SUSPENSION - TUBING
AIR RIDE SUSPENSION - WARNING LAMPS
AIR RIDE SUSPENSION - WIRING HARNESSES
BALL JOINTS
BUSHINGS
CENTER LINKS
CONTROL ARM SHAFTS
CONTROL ARMS
DRAG LINKS
ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS
IDLER ARMS
KING PINS
PITMAN ARMS
POWER STEERING HOSES
POWER STEERING (HYDRAULIC) PUMPS
RADIUS ARMS
RELAY RODS
SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES
SPINDLES
SPRINGS - COIL, LEAF AND TORSION BAR
STEEL POWER STEERING LINES
STEERING ARMS
STEERING DAMPERS
STEERING GEARS (EXCEPT RACK AND PINION)
STEERING GEARS - RACK AND PINION
STEERING KNUCKLES
STRIKE OUT BUMPERS
STRUT RODS
STRUT UPPER BEARING PLATE ASSEMBLIES
SWAY BAR LINKS
SWAY BARS

TIE ROD ENDS (INNER AND OUTER)
TRACK BARS
TRAILING ARMS
WHEEL BEARINGS, RACES AND SEALS

Wheel Alignment

WHEEL ALIGNMENT

Wheels and Tires

TIRES
VALVE STEMS
WHEEL ATTACHMENT HARDWARE
WHEELS (RIMS)

MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt 1) a Pledge of Assurance to their Customers and 2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

STEERING AND SUSPENSION

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

Steering and suspension are complex systems made up of a variety of interdependent components. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed.

Conditions listed assume that the problem has been isolated to the specific component by proper testing procedures.

NOTE: When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

CAUTION: DO NOT use ride height altering or load compensating components, such as variable rate springs and coil over shocks, on vehicles with height or load sensing proportioning valve-equipped braking systems, unless these components are original equipment.

AIR RIDE SUSPENSION

NOTE: Depending on the air suspension design, there are some aftermarket products available to eliminate the air ride suspension on certain vehicles. If the system has been eliminated with one of these products, then no service is suggested or required.

AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS

NOTE: This section covers the air spring portion of the air shock or strut. For damping portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

AIR RIDE SUSPENSION - AIR SHOCK AND AIR STRUT INSPECTION

Condition	Code	Procedure
Inner fabric of air bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.

AIR RIDE SUSPENSION - AIR SPRING VALVES

AIR RIDE SUSPENSION - AIR SPRING VALVE INSPECTION

Condition	Code	Procedure

Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Inoperative	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

AIR RIDE SUSPENSION - AIR SPRINGS

AIR RIDE SUSPENSION - AIR SPRING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Collar cracked	A	Require replacement.
End cap cracked	A	Require replacement.
Inner fabric of bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.
Piston cracked	A	Require replacement.

AIR RIDE SUSPENSION - COMPRESSORS

AIR RIDE SUSPENSION - COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Does not build pressure	A	(1) Further inspection required.
Excessive run time	B	(2) Further inspection required.
Inoperative	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - If failure to build pressure is traced to the compressor, require replacement.
(2) - If excessive run time is traced to the compressor, require replacement.

AIR RIDE SUSPENSION - HEIGHT SENSORS

AIR RIDE SUSPENSION - HEIGHT SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware		

threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Dust boot missing	2	(1) Suggest replacement.
Dust boot split	2	(1) Suggest replacement.
Dust boot torn	2	(1) Suggest replacement.
Housing cracked	A	Require replacement.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Loose	B	Require adjustment to vehicle manufacturer's specifications.
Missing	C	Require replacement.
Output signal incorrect	A	Require repair or replacement.
Wire lead damaged	A	Require repair or replacement.

(1) - This condition can lead to damage of the sliding magnet, which, in turn, causes premature sensor failure.

AIR RIDE SUSPENSION - MODULES

AIR RIDE SUSPENSION - MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Housing cracked	2	Suggest repair or replacement.
Inoperative	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)

AIR RIDE SUSPENSION - RELAY (COMPRESSOR) INSPECTION

Condition	Code	Procedure
Housing cracked	2	(1) Suggest replacement.
Intermittent	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

(1) - If moisture enters the relay, it can reduce life expectancy or impair function.

AIR RIDE SUSPENSION - SWITCHES (ON/OFF)

AIR RIDE SUSPENSION - SWITCH (ON/OFF) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)

AIR RIDE SUSPENSION - TORSION SPRING (COUNTER BALANCING) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - TUBING

AIR RIDE SUSPENSION - TUBING INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Blocked	A	Require repair or replacement.
Fitting incorrect	B	Require replacement.
Leaking	A	Require repair or replacement.
Line type incorrect	B	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require routing correction.

AIR RIDE SUSPENSION - WARNING LAMPS

AIR RIDE SUSPENSION - WARNING LAMP INSPECTION

Condition	Code	Procedure
Bulb burned out	A	Require replacement.
Warning light does not come on during bulb check	..	Further inspection required to determine cause.
Warning light flashes	..	Further inspection required to determine cause.
Warning light is intermittent	..	Further inspection required to determine cause.
Warning light stays on after initial bulb check	..	Further inspection required to determine cause.

AIR RIDE SUSPENSION - WIRING HARNESSES

AIR RIDE SUSPENSION - WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer's specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer's specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	Require repair or replacement

		of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	.. Require repair or replacement.
Deteriorated, affecting performance	A	.. Require repair or replacement.
Distorted, affecting performance	A	.. Require repair or replacement.
Leaking (fluid-filled type)	A	.... Require replacement.
Missing	C	.... Require replacement.
Noisy	2	.... (1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	.... Require replacement.
Seized	A	.... Require replacement.
Shifted (out of position)	B	.. Require repair or replacement.
Split	A	.... Require replacement.
Surface cracking (weather-checked)	..	.... No service suggested or required.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CENTER LINKS

CENTER LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	.... Require replacement of incorrect part, if available; otherwise, replace center link.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace center link.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace center link.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace center link.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if

Condition	Code	Procedure
		available; otherwise, replace center link.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Stud loose in taper hole	A	(7) Require repair or replacement.
Taper hole elongated	A	(8) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

CONTROL ARM SHAFTS

CONTROL ARM SHAFT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken

		part, if available; otherwise, replace shaft.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shaft.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shaft.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shaft.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shaft.
Bent	B	Require replacement.
Shaft bushing surface undersized (worn)	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

CONTROL ARMS

CONTROL ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace control arm.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace control arm.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace control arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace control arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace control arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace control arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace control arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace control arm.
Bent	B	Require replacement.
Bushing hole oversized	B	Require replacement.
Ball joint hole oversized (loose interference or press fit)	B	(1) Further inspection required.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - If oversized ball joint is available, require replacement of ball joint. If oversized ball joint is not available, require replacement of control arm.

DRAG LINKS

DRAG LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace drag link.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace drag link.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace drag link.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace drag link.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace drag link.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.

Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(6) Suggest replacement.
Looseness that is excessive	B	(6)(7) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(8) Require replacement.
Stud broken	A	(8) Require replacement.
Stud loose in taper hole	A	(8) Require repair or replacement.
Taper hole elongated	A	(9) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(8) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter the joint and will accelerate wear.
(6) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(7) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS

NOTE: This section covers the electronic damping control portion of the electronic shock or strut. For dampening portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

ELECTRONIC RIDE CONTROL SHOCK AND STRUT INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Electronic valve control		

inoperative	2	(1) Suggest replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

(1) - It is acceptable to replace with a non-electronically controlled unit, where available.

IDLER ARMS

IDLER ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace idler arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace idler arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace idler arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace idler arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace idler arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace idler arm.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Greaseable joint will not take grease	2	(1) Suggest replacement of grease fitting.
Looseness at frame bracket end	B	(6)(7) Require repair or replacement.

Looseness at link end (perceptible horizontal movement)	1	(8) Suggest replacement.
Looseness at link end that is excessive	B	(8)(9) Require replacement.
Mounted out of position (center link not parallel)	B	Require repositioning.
Nut on stud loose	A	(10) Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(11) Require replacement.
Stud broken	A	(11) Require replacement.
Taper hole elongated	A	(12) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(11) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter joint and will accelerate wear.
(6) - If manufacturer's procedures and specifications exist, use those procedures and specifications; otherwise, use an approved inspection method such as the dry park check.
(7) - Looseness is defined as movement that creates excessive toe change.
(8) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(9) - Excessive looseness is defined as significant enough to affect vehicle handling or structural integrity.
(10) - Check for bent stud or damaged taper hole.
(11) - Check for damaged taper hole.
(12) - Check for damaged stud.

KING PINS

You are not required to replace king pins in axle sets. However, when replacing a king pin due to wear exceeding manufacturer's specifications, you may suggest replacement of the other king pin on the axle if its measurement shows it is close to the end of its useful life.

KING PIN INSPECTION

Condition	Code	Procedure
Bearing balls pitted	A	Require replacement.
Bearing balls worn	A	Require replacement.
Bearing races pitted	A	Require replacement.

Bearing races worn	A	Require replacement.
Bearing rollers pitted	A	Require replacement.
Bearing rollers worn	A	Require replacement.
Bearing seal bent	2	Suggest replacement of seal or bearing.
Bearing seal missing	2	Suggest replacement of seal or bearing.
Bearing seal torn	2	Suggest replacement of seal or bearing.
Binding	A	Require repair or replacement of affected parts.
End caps missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
End play exceeds specifications	B	Require repair.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Locating pins missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
Looseness exceeds manufacturer's specifications	B	Require replacement of worn parts.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Will not take grease	2	(1) Suggest replacement of grease fitting.

(1) - If king pin will not take grease after replacement of grease fitting, suggest replacement of king pin.

PITMAN ARMS

PITMAN ARM INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace pitman arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace pitman arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace pitman arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise,

		replace pitman arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace pitman arm.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement of seal.
Grease seal torn	2	(4) Suggest replacement of seal.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Nut on stud loose	A	(7) Require repair or replacement.
Seized	A	Require replacement.
Splines damaged	A	Require repair or replacement.
Splines stripped (splines missing)	A	Require replacement.
Stud bent	B	(8) Require replacement.
Stud broken	A	(8) Require replacement.
Stud loose in taper hole	A	(8) Require repair or replacement.
Taper hole elongated	A	(9) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(8) Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for bent stud of damaged taper hole.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

POWER STEERING HOSES

POWER STEERING HOSE INSPECTION

Condition	Code	Procedure
Blistered	B	Require replacement.
Blocked	A	Require repair or replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Inner fabric (webbing) cut	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that the inner fabric of hose is visible	B	Require replacement.
Restricted	A	Require repair or replacement.

POWER STEERING (HYDRAULIC) PUMPS

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

POWER STEERING (HYDRAULIC) PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Belt alignment incorrect	B	(1) Further inspection required.
Belt cracked	1	Suggest replacement.
Belt frayed	1	Suggest replacement.
Belt missing	C	Require replacement.
Belt noisy	2	(2) Further inspection required.
Belt plies separated	A	Require replacement.

Belt tension out of specification	B	Require adjustment or replacement.
Belt worn beyond adjustment range	B	Require replacement.
Belt worn so it contacts bottom of pulley	A	Require replacement.
Binding	A	Require repair or replacement.
Fluid at or beyond service interval	3	Suggest fluid change.
Fluid contaminated	B	(3) Require flushing and refilling of the system.
Fluid level incorrect	B	Require adjustment of fluid level.
Inadequate assist	A	(4) Further inspection required.
Leaking	A	Require repair or replacement.
Noise	2	(5) Further inspection required.
Pulley bent	A	Require repair or replacement of pulley.
Pulley missing	C	Require replacement of pulley.
Remote reservoir leaking	A	Require replacement of reservoir,
Reservoir cap broken	A	Require replacement of cap.
Reservoir cap missing	C	Require replacement of cap.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.
(3) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(4) - If pump is source of inadequate assist, require repair or replacement.
(5) - If noise is isolated to pump, suggest repair or replacement.

RADIUS ARMS

RADIUS ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	....	A	.... (7) Require repair or replacement.
Taper hole elongated	....	A	.... (8) Require replacement.
Threads damaged	....	A	.. Require repair or replacement.
Threads stripped (threads missing)	....	A	.... (7) Require replacement.
Wear exceeds manufacturer's specifications	....	B	.... Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	(2) Suggest replacement of boot.
Dust boot (bellows) torn	2	(2) Suggest replacement of boot.
Dust shield broken	2	(2) Suggest replacement.
Dust shield missing	2	(2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool	A	(3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged	A	Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	Require replacement of nut.
Housing dented	A	(1) Further inspection required.
Housing punctured	A	Require replacement.
Jounce bumper missing	C	Require replacement of jounce bumper.
Jounce bumper split	1	Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	(4) Require replacement.
Noise	2	(5) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Piston rod has surface defect	2	Suggest replacement.
Piston rod threads damaged	A	Require repair or replacement.
Piston rod threads stripped (threads missing)	A	Require replacement.
Seized	A	Require replacement.
Shock missing	C	Require replacement.
Strut housing bent	A	Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool	A	(3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged	A	Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	Require replacement of nut.
Strut housing severely corroded, affecting structural integrity	A	Require replacement.
Strut housing threads damaged	A	Require repair or replacement.
Strut housing threads stripped (threads missing)	A	Require replacement.
Tire cupping	A	(6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated - rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	Require adjustment or replacement.

(1) - If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) - Some manufacturers require replacement under these conditions.
(3) - Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) - Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	Require replacement.
Flare type incorrect	B	Required replacement.
Leaking	A	Require tightening or replacement.
Line type incorrect	B	Require replacement.

Condition	Code	Procedure
Restricted	A	Require replacement.
Routed incorrectly	B	Require routing correction.
Rust-pitted	1	Suggest replacement.
Rust pitted, affecting structural integrity	A	Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Taper hole elongated	A	(1) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise,

		replace steering damper.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace steering damper.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace steering damper.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace steering damper.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace steering damper.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace steering damper.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace steering damper.
Binding	A	Require replacement.
Damper body dented	A	(1) Further inspection required.
Damper body punctured	A	Require replacement.
Damping (none)	A	Require replacement.
Dust boot (bellows) missing	2	(2) Suggest replacement of boot.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.
Dust shield broken	2	(2) Suggest replacement.
Dust shield missing	2	(2) Suggest replacement.
Leaking oil, enough for fluid to be running down the body	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Noise	2	(3) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Piston rod has surface defect	2	Suggest replacement.
Piston rod threads stripped (threads missing)	A	Require replacement.
Piston rod threads damaged	A	Require repair or replacement.
Seized	A	Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

		of seal and/or mating part.
Splines damaged	A	... Require repair or replacement of splines.
Splines stripped	A	. Require replacement of splines.
Steering coupler shield cracked	2	.... Suggest replacement.
Steering coupler shield missing	C	.... Require replacement.
Threads damaged	A	... Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
U-joint binding	A	... Require repair or replacement of joint.
U-joint loose	A	... Require repair or replacement of joint.
Unequal power assist	A	.. Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	.... Require replacement of broken part.
Attaching hardware loose	A	.. Require repair or replacement of loose part.
Attaching hardware missing	C	.... Require replacement of missing part.
Attaching hardware threads damaged	A	.. Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.... Require replacement of part with stripped threads.
Balance tube blocked	A	.. Require repair or replacement of balance tube.
Balance tube missing	C	.. Require replacement of balance tube.
Balance tube restricted .	A	... Require repair or replacement of balance tube.
Bellows boot clamp missing	C	... Require replacement of clamp.
Bellows boot cracked		

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 (not through)  .........  2  ..  Suggest replacement of bellows
                                                          boot.
Bellows boot missing  ....  C  ..  Require replacement of bellows
                                                          boot.
Bellows boot
 not sealing  ...........  A  ...  Require repair or replacement
                                               of bellows boot.
Bellows boot torn  .......  A  ..  Require replacement of bellows
                                                          boot.
Bellows boot twisted
 (from toe adjustment)  ..  B  ................  Require repair.
Fitting leaking  .........  A  ..  Require repair or replacement.
Fitting missing  .........  A  .  Require replacement of fitting.
Fitting threads
 damaged  ................  A  ...  Require repair or replacement
                                    of part with damaged threads.
Fitting threads stripped
 (threads missing)  ......  A  .....  Require replacement of part
                                          with stripped threads.
Flex coupler binding  ....  A  ...  Require repair or replacement
                                                     of coupler.
Flex coupler loose  ......  A  ...  Require repair or replacement
                                                     of coupler.
Flex coupler
 missing parts  ..........  A  ...  Require repair or replacement
                                                     of coupler.
Flex coupler
 soft/spongy  ............  A  .  Require replacement of coupler.
Flex coupler torn  .......  A  .  Require replacement of coupler.
Fluid contaminated  ......  B  ........  (1) Require flushing and
                                         refilling of the system.
Gasket leaking  ..........  A  ..  Require repair or replacement.
Hard steering on cold
 start-up  ...............  1  ..........  (2) Suggest repair or
                                                    replacement.
Housing cracked,
 affecting structural
 integrity  ..............  B  ...........  Require replacement.
Housing leaking  .........  A  ...........  Require replacement.
Inadequate power assist  .  A  ..........  (3) Further inspection
                                                       required.
Lash exceeds
 manufacturer's
 specifications  .........  B  ..  Require repair or replacement.
Seal leaking  ............  A  ..  Require repair or replacement.
Splines damaged  .........  A  ..  Require repair or replacement.
Splines stripped
 (splines missing)  ......  A  ...........  Require replacement.
Steel line blocked  ......  A  ...  Require repair or replacement
                                                        of line.
Steel line leaking  ......  A  ...  Require repair or replacement
                                                        of line.
Steel line missing  ......  C  ....  Require replacement of line.
Steel line restricted  ...  A  ...  Require repair or replacement
                                                        of line.
Steering coupler shield
 cracked  ................  2  ...........  Suggest replacement.
Steering coupler shield
 missing  ................  C  ...........  Require replacement.
Steering coupler shield
 torn  ...................  2  ...........  Suggest replacement.
Threads damaged  .........  A  ...  Require repair or replacement
                                    of part with damaged threads.
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Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. Follow OE specifications for fluid type.
(2) - Indicates internal wear.
(3) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING KNUCKLES

STEERING KNUCKLE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Pinch bolt incorrect	B	Require replacement with bolt that meets OE design.
Pinch bolt loose	B	Require repair.
Pinch bolt missing	B	Require replacement.
Pinch bolt tabs deformed (pinched together), .032" or more before clamping	B	(1) Require replacement.
Taper hole elongated	A	(2) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Steering knuckle deformation can cause pinch bolt breakage.
(2) - Check for damaged stud.

STRIKE OUT BUMPERS

STRIKE OUT BUMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Missing	C	Require replacement.
Split	1	Suggest replacement.

STRUT RODS

STRUT ROD INSPECTION

Condition	Code	Procedure
Adjusting nut seized	A	(1) Require repair or replacement.
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace strut rod.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace strut rod.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace strut rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace strut rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace strut rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace strut rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace strut rod.
Attaching (mating) hole oversized	A	Require repair or replacement of frame.
Attaching point on frame corroded, affecting structural integrity	A	Require repair of frame.
Bent	A	Require replacement.
Mating (attaching) hole oversized	A	Require repair or replacement of frame.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if an alignment is being performed.

STRUT UPPER BEARING PLATE ASSEMBLIES

NOTE: When the following guidelines indicate replacement of bearing, only the bearing should be replaced if it is available separately; otherwise, replace the bearing plate assembly.

STRUT UPPER BEARING PLATE ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace bearing plate assembly.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace bearing plate assembly.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace bearing plate assembly.
Bearing axial or radial movement exceeds vehicle manufacturer's		

specifications	B	Require replacement of bearing.
Bearing binding	A	Require replacement of bearing.
Bearing missing	C	Require replacement of bearing.
Bearing seized	A	Require replacement of bearing.
Bent	B	Require replacement.
Holes distorted	A	Require replacement.
Missing	C	Require replacement.
Severely corroded, affecting structural integrity	A	Require replacement.

SWAY BAR LINKS

SWAY BAR LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace link.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace link.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace link.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace link.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace link.
Ball and socket has looseness (perceptible vertical movement)	1	(1) Suggest replacement.
Ball and socket has looseness that is excessive	B	(1)(2) Require replacement.
Bent	B	Require replacement.
Broken	A	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Missing	C	Require replacement.
Nut on stud loose	A	(6) Require repair.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.

Threads stripped (threads missing)	A	(7) Require replacement.

(1) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.

CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.

(2) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.

(3) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.

(4) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.

(5) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.

(6) - Check for bent stud or damaged taper hole.

(7) - Check for damaged taper hole.

SWAY BARS

SWAY BAR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace sway bar.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace sway bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace sway bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace sway bar.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace sway bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace sway bar.
Bent	B	Require replacement.
Broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

TIE ROD ENDS (INNER AND OUTER)

TIE ROD END (INNER AND OUTER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace tie rod end.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace tie rod end.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace tie rod end.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace tie rod end.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace tie rod end.
Adjusting sleeve bent	B	Require replacement of sleeve or tie rod end.
Adjusting sleeve clamps out of position	B	Require repair.
Adjusting sleeve corroded, affecting structural integrity	A	Require replacement of sleeve or tie rod end.
Adjusting sleeve missing	C	Require replacement of sleeve or tie rod end.
Adjusting sleeve seized	A	(1) Require repair or replacement.
Adjusting sleeve threads damaged	A	Require repair or replacement of sleeve or tie rod end.
Adjusting sleeve threads stripped (threads missing)	A	Require replacement of sleeve or tie rod end.
Binding	A	(2) Further inspection required.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(4) Suggest replacement of seal.

Grease seal torn	2	(5) Suggest replacement of seal.
Greaseable tie rod end won't take grease	2	(6) Suggest replacement of grease fitting.
Looseness (perceptible horizontal movement)	1	(7) Suggest replacement.
Looseness exceeds manufacturer's specifications	B	Require replacement.
Looseness that is excessive	B	(7)(8) Require replacement.
Nut on stud loose	A	(9) Require repair or replacement of nut.
Seized	A	Require replacement
Stud bent	B	(10) Require replacement.
Stud broken	A	(10) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(10) Require replacement.

(1) - Only required if toe needs to be adjusted.
(2) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(3) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(6) - If greaseable tie rod end will not take grease after replacing the grease fitting, suggest replacement of tie rod end.
(7) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(8) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(9) - Check for bent stud or damaged taper hole.
(10) - Check for damaged taper hole.

TRACK BARS

TRACK BAR INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace track bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace track bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace track bar.
Attaching hardware		

threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace track bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace track bar.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Grease boot cracked	2	(1) Suggest replacement.
Grease boot missing	2	(2) Suggest replacement.
Grease boot torn	2	(3) Suggest replacement.
Holes distorted	A	Require replacement.
Looseness (perceptible horizontal movement)	1	(4) Suggest replacement.
Looseness that is excessive	B	(4)(5) Require replacement.
Nut on stud loose	A	(6) Require repair or replacement of nut.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(2) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(5) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

TRAILING ARMS

TRAILING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace trailing arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available;

		otherwise, replace trailing arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace trailing arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace trailing arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace trailing arm.
Bent	B	Require replacement.
Bushing hole oversized	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARING, RACE AND SEAL INSPECTION

Condition	Code	Procedure
Rear axle seal on rear-wheel drive leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Seal bent	1	Suggest replacement.
Seal leaking	A	Require replacement of seal and inspection of bearings.
Seal missing	C	Require replacement.
Seal torn	A	Require replacement.
Wheel bearing assembly feels rough when rotated	A	Require replacement of bearing assembly.
Wheel bearing balls are pitted	A	Require replacement of bearing assembly.
Wheel bearing balls are worn	A	Require replacement of bearing assembly.
Wheel bearing end-play exceeds vehicle manufacturer's specifications	B	Require adjustment of bearing,

		if possible. If proper adjustment cannot be obtained, require repair or replacement of worn component.
Wheel bearing race is loose in the hub bore	A	Require replacement of hub assembly and wheel bearings.
Wheel bearing races are pitted	A	Require replacement of bearing assembly.
Wheel bearing races are worn	A	Require replacement of bearing assembly.
Wheel bearing rollers are pitted	A	Require replacement of bearing assembly.
Wheel bearing rollers are worn	A	Require replacement of bearing assembly.

WHEEL ALIGNMENT

WHEEL ALIGNMENT

Wheel alignment is defined as the measurement, analysis, and adjustment of steering and suspension angles to conform to OEM specifications. These angles usually include, but are not limited to: caster, camber, toe, and thrust angle. Where these angles are not adjustable and not in specification, component replacement or correction kits may be required. Errors in set-back and steering axis inclination (SAI) are often attributable to failed or damaged components and must be corrected prior to performing an alignment.

Failure to replace or correct suggested parts or service may prevent a proper alignment.

Before performing an alignment check, inspect and verify the following:

* Tire pressure and size
* Vehicle loading
* Ride height
* Steering and suspension parts

If the inspection reveals that all the above are within published specifications, a wheel alignment check and an alignment, if needed, may be performed.

CAUTION: Under no circumstances should a technician bend or heat any steering or suspension component, unless specified by the vehicle manufacturer, for example, Ford forged twin "I" beam axles. All measurements and specifications must be noted on the inspection report.

WHEEL ALIGNMENT INSPECTION

Condition	Code	Procedure
Dog tracking, shown to be caused by faulty alignment	2	Suggest repair.
Lead, shown to		

be caused by faulty alignment	A	Require alignment.
Part has been changed, affecting alignment	A	Require alignment check.
Pull, shown to be caused by faulty alignment	A	Require alignment.
Steering wheel off-center	2	Suggest alignment.
Tire wear, shown to be caused by faulty alignment	A	Require alignment.
Wander, shown to be caused by faulty alignment	A	Require alignment.

WHEELS AND TIRES

TIRES

These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes.

WARNING: High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death.

WARNING: Only specially trained persons should dismount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death.

WARNING: Consult the vehicle owner’s manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. DO NOT exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association

WARNING: When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. DO NOT mix different speed rating designations on the same axle.

WARNING: DO NOT mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule.

WARNING: DO NOT mix size or type (all season, performance, mud and snow) of tires on the same axle.

TIRE INSPECTION

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement.
Bead leaking, caused by tire	A	Require repair or replacement.
Bead wire/cord exposed	A	Require replacement.
Cord or belt material exposed	A	Require replacement.
Cord ply separations	A	Require replacement.
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning.
Irregular tread wear, affecting performance	2	(1) Suggest replacement.
Load ratings less than OEM specifications	B	Require replacement.
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement.
Number of punctures exceeds manufacturer's limit	B	Require replacement.
Out of balance	B	Require rebalance of tire/wheel assembly.
Ply separation	A	Require replacement.
Pull or lead, caused by tire	A	Require repair or replacement.
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement.
Radials are on the front and not on the rear	B	(2) Require repair or replacement.
Run flat damage	A	Require replacement.
Shoulder cut	A	Require replacement.
Shoulder puncture	A	Require replacement.
Shoulder with plug	A	Require replacement.
Sidewall bulge	A	Require replacement.
Sidewall cut	A	Require replacement.
Sidewall indentation	..	No service required or suggested.
Sidewall puncture	A	Require replacement.
Sidewall with plug	A	Require replacement.
Speed rating designations different on same axle	2	Suggest repair or replacement.
Tire and wheel assembly has excessive run-out	B	(3) Require repair or replacement of appropriate part.
Tires with more than 1/4" diameter difference on a four-wheel drive vehicle	B	Require replacement.
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement.
Tread missing pieces		

Condition	Code	Procedure
(chunking), exposing cord	A	Require replacement.
Tread missing pieces (chunking), not exposing cord	1	Suggest replacement.
Tread separations	A	Require replacement.
Tube in tubeless tire	3	(4) Suggest removal of tube.
Weather-checking	..	No service required or suggested.
Worn to tread wear indicators	B	Require replacement.

(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	Suggest replacement.
Broken	A	Require replacement.
Cut, but not leaking	1	Suggest replacement.
Deteriorated (cracking, dry rot)	1	Suggest replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped	A	Require replacement.
Valve cap missing	C	Require replacement of cap.
Weather-checking	1	Suggest replacement.
Won't take air	A	Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	(1) Require replacement.

Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEELS (RIMS)

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition	Code	Procedure
Bead leaking, caused by wheel	A	(1) Require repair or replacement.
Bent hub mounting surface	A	Require replacement.
Bent rim, causing vibration	2	(1) Suggest replacement.
Broken	A	Require replacement.
Cast wheel porous, causing a leak	A	Require repair or replacement.
Clip-on balance weight is incorrect type for rim flange	2	Suggest replacement.
Corrosion, affecting structural integrity	A	Require replacement.
Corrosion build-up on wheel mounting surface	A	Require repair.
Cracked	A	Require replacement.
Directional/asymmetrical wheels mounted incorrectly	B	Require remounting and/or repositioning.

Load capacity less than OEM specifications	B	Require replacement.
Offset mismatched on same axle	B	Require replacement.
Rivets leaking	A	Require replacement.
Run-out beyond OEM specs	B	Require replacement.
Stud holes elongated	A	(2) Require replacement.
Welded or brazed repair	2	Suggest replacement.
Welds leaking	A	Require replacement.
Wheel centering (pilot) hole incorrect	B	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

STEERING COLUMN - AUTOMATIC TILT WHEEL

1993 Toyota Celica

1993 STEERING
Toyota - Steering Columns - Automatic Tilt Wheel

Celica All-Trac

DESCRIPTION & OPERATION

Automatic tilt steering column uses a standard tilt steering column with a motor located in the column housing. The motor allows the column to automatically swing up when the ignition key is removed for easier exit and entry to the vehicle. When the key is inserted in the ignition and the steering wheel is pulled down, it will automatically return to the pre-set position.

The position of the wheel can be adjusted by pulling the lock release knob, placing the wheel in the desired position and releasing the knob. An unlock warning switch is located in the ignition key cylinder and a tilt steering ECU is located behind the instrument panel above the glove box.

NOTE: For Adjustments and Removal and Installation of steering wheel pad, combination switch, ignition switch and Overhaul of steering column see STEERING COLUMN - TILT article in the STEERING section.

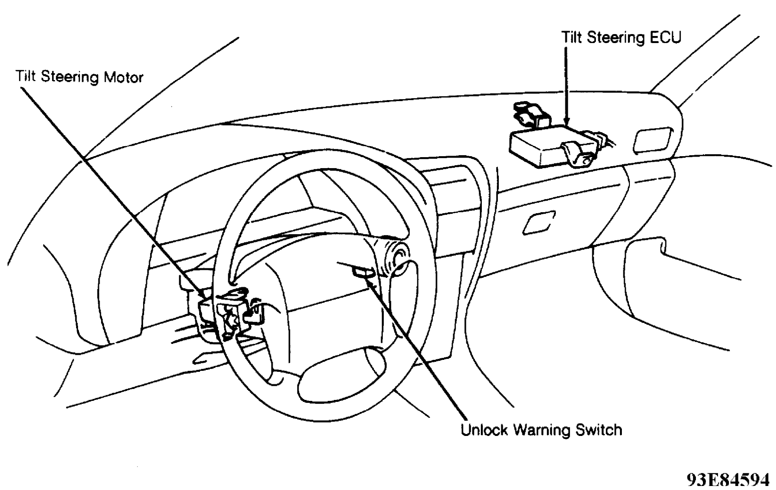

Fig. 1: Locating Celica All-Trac Auto Tilt Wheel Steer Col Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TESTING

COMPONENT TESTING

Tilt Steering Motor

1) Disconnect tilt motor electrical connector. Connect positive lead from battery to connector terminal TiM+ and negative lead to terminal TiM-. Motor arm should move away from housing. Reverse battery leads to terminals. Motor arm should move toward housing. If motor does operate as specified, replace motor. See Fig. 2.

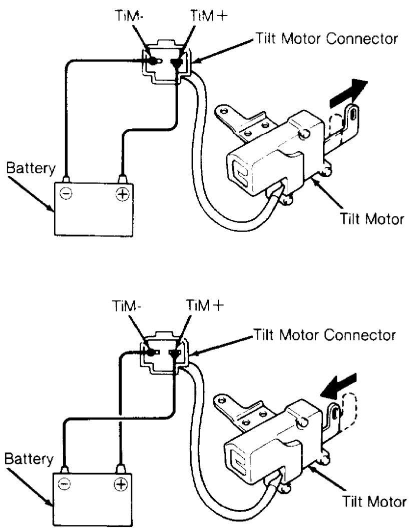

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Fig. 2: Tilt Steering Motor Test
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Tilt Steering ECU

1) Place ignition key in ignition switch. Remove glove box to gain access to ECU. Connect positive voltmeter lead to ECU terminal TiM+ and negative lead to GRD terminal. See Fig. 3. Check that meter needle jumps once to approximately 10 volts when the key is removed from ignition.

2) Connect voltmeter positive lead to ECU terminal TiM- and negative led to GRD terminal. Check that meter needle jumps once to approximately 10 volts when key is inserted in ignition.

3) Connect positive lead from battery to ECU terminal lead IGSW and negative lead to GRD terminal. Check that tilt-away feature does not operate when key is removed from ignition. If ECU operation is not as specified, replace ECU.

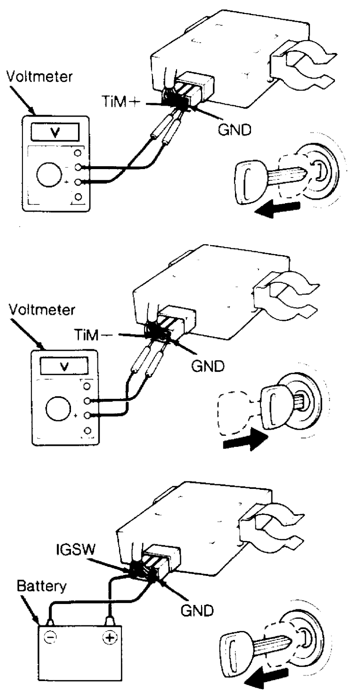


Fig. 3: Tilt Steering ECU Test
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Key Unlock Warning Switch

Using ohmmeter, check for continuity between terminals 1 and 5 of ignition switch. With ignition key removed, there should be no continuity. With ignition key installed there should be continuity. If continuity is not as specified, replace unlock switch.

SYSTEM TESTING

1) Check battery voltage. If less than 8 volts, check battery and charging system. If more than 8 volts, check POWER fuse in fuse block. If fuse is blown, replace fuse and check auto-tilt operation. If system does not operate, check for short circuit in wire harness between fuse and tilt ECU terminal B+. If fuse is okay, but system does not operate, disconnect tilt ECU connector.

2) Using volt-ohmmeter, check for battery voltage between terminal B+ and body ground. See Fig. 4. If voltage is okay, go to next step. If voltage is not okay, check for open circuit between fuse and terminal B+

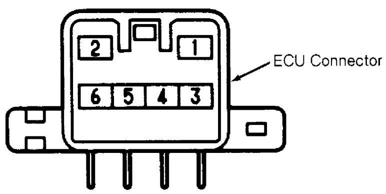
3) Using volt-ohmmeter, check for continuity between terminal GND and body ground. If continuity exists, go to next step. If no continuity, check body ground, or for open circuit between terminal GND and ground.

4) Check for continuity between terminal UWSW and GND. There should be no continuity with ignition key removed, and continuity with key inserted in ignition switch. If continuity is okay, go to next step. If continuity is not as specified, check for open circuit between terminal UWSW and unlock warning switch. If circuit is okay, replace unlock warning switch.

5) Check for voltage between terminals IGSW and GND. With ignition switch on, battery voltage should be present. With switch off, 0 volts should be present. If voltage is okay, go to next step.

If voltage is not as specified, check for open circuit between terminal IGSW and ignition switch.

6) Check for continuity between terminals TiM+ and TiM-. If continuity exists, check ECU. See Tilt Steering ECU under COMPONENT TESTING. If ECU fails test, replace ECU. If continuity does not exist, check for open circuit between terminals TiM+ and TiM-. If circuit is okay, check tilt motor. See Tilt Steering Motor under COMPONENT TESTING. If motor fails test, replace motor.



No.	Symbol	Terminal Name
1	B+	Power Source
2	UWSW	Unlock Warning Switch
3	GND	Ground
4	TiM +	Tilt Away
5	TiM-	Tilt Return
6	IGSW	Ignition Switch

93H84597

Fig. 4: Tilt Steering ECU Connector Terminal Identification
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAMS

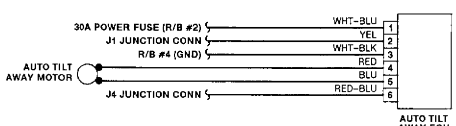


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Fig. 5: Automatic Tilt Wheel Steering Column Wiring Diagram

SUN ROOF - POWER

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Power Sun Roof

Celica

DESCRIPTION & OPERATION

The ignition switch must be in ON position for sun roof to operate. The sun roof has a tilt mode and sliding mode. When closing sun roof in sliding mode, sun roof will stop partway until sun roof switch is pressed a second time.

ADJUSTMENTS

NOTE: Remove sun roof trim plates from top of sun roof opening before making adjustments.

SUN ROOF HEIGHT

Close sun roof fully. Measure sun roof height. Roof panel should be even with glass weatherstrip within 0.04" (1.0 mm). If adjustment is required, install or remove shims between bracket and sun roof. Recheck sun roof height.

SUN ROOF CLEARANCE & ALIGNMENT

Closing Clearance

If sun roof closing clearances are unequal between right and left sides, loosen sun roof slider mount nuts. Move either side forward or backward as required. Tighten sun roof slide mount nuts. Recheck sun roof alignment and operation.

Front-To-Rear Alignment

If front-to-rear position of sun roof is incorrect, loosen sun roof slider mount nuts. Move sun roof to front or rear as necessary. Tighten sun roof slider mount nuts.

Side-To-Side Alignment

If sun roof is mounted to right or left of center line in roof opening, loosen sun roof slider mount nuts. Move sun roof right or left as necessary. Tighten sun roof slider mount nuts.

TROUBLE SHOOTING

NOTE: Ensure all component terminals and ground connections are clean and tight. Check possible faults in order listed. Repair or replace components and circuits as necessary.

Power Sun Roof Operates Abnormally

Defective GAUGE fuse. Defective POWER fuse. Defective power main relay. Defective power sun roof switch. See SUN ROOF SWITCH under TESTING. Defective limit switch. See LIMIT SWITCH under TESTING. Defective motor. See MOTOR under TESTING. Defective sliding roof control relay. See CONTROL RELAY under TESTING. Defective wire harness.

TESTING

CONTROL RELAY

See CONTROL RELAY LOCATION table for relay location. Unplug relay connector. Check for continuity or voltage as indicated at control relay connector terminals with sun roof switch or limit switch in specified positions. See appropriate CONTROL RELAY TEST table. If test results are as specified, replace control relay. If test results are not as specified, repair or replace appropriate switch or wire. See Fig. 1.

CONTROL RELAY LOCATION TABLE

Model	Location
Celica	To Left Of Motor

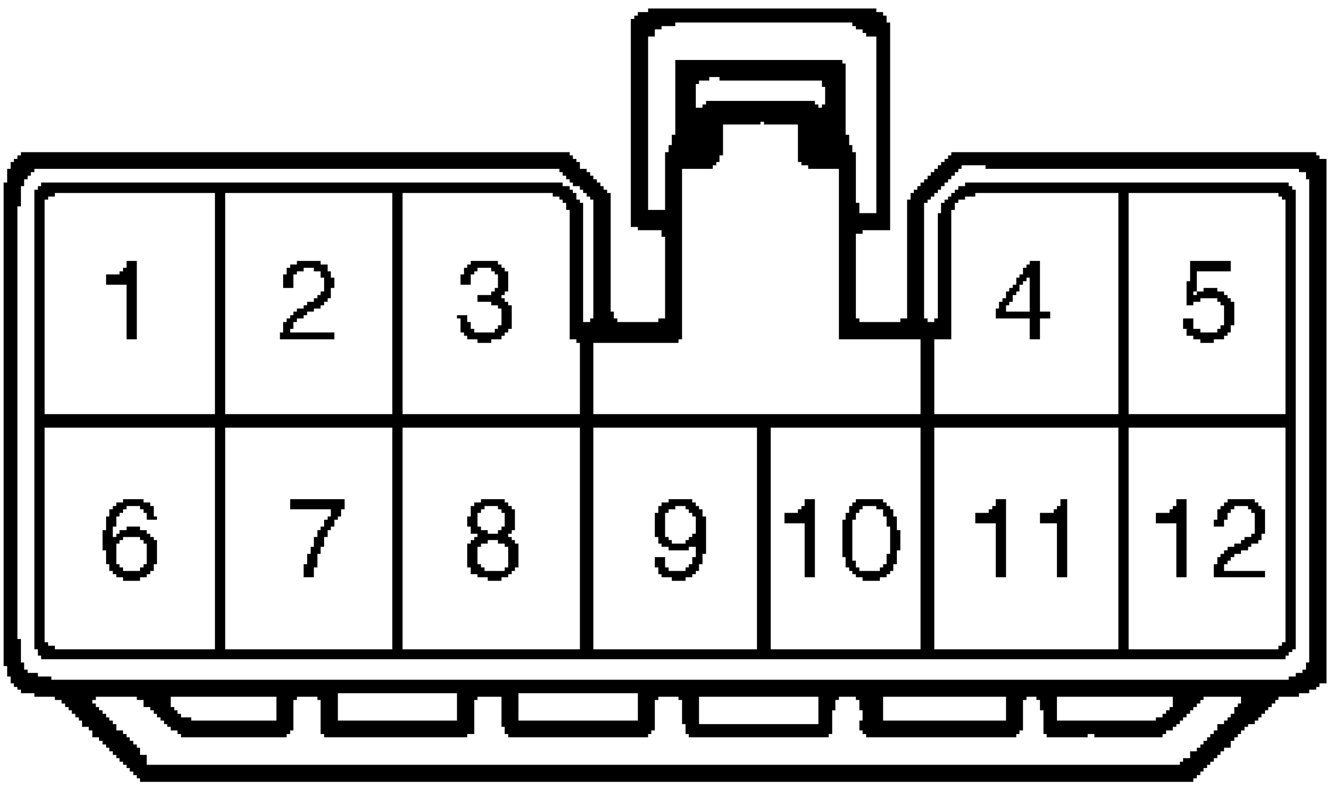

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Fig. 1: Control Relay Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CONTROL RELAY TEST TABLE

Terminal No. & Switch Position	Condition
1 And 5	Continuity
2 (1)	
DOWN, OPEN, Or CLOSE	No Continuity
Up	Continuity

4 (1) OFF (Roof Open)	No Continuity
4 (1) ON (Roof closed)	Continuity
5 (1)	Continuity
6 (1)	
Ignition Switch LOCK or ACC	No Voltage
Ignition Switch ON	Battery Voltage
7 (1)	
UP, DOWN, Or OPEN	No Continuity
CLOSE	Continuity
8 (1)	
UP, DOWN, Or CLOSE	No Continuity
OPEN	Continuity
9 (1)	
UP, OPEN, Or CLOSE	No Continuity
DOWN	Continuity
10 (1)	
OFF	
Roof Tilted Up	No Continuity
Roof Partly Open	No Continuity
ON	
Except As Above	Continuity
12 (1)	Continuity

(1) - Terminal connected to ground.

MOTOR

Unplug sun roof motor connector. Using fused jumper wires, connect motor connector terminals to battery voltage. Motor should rotate smoothly. Transpose jumper wires. Motor should rotate smoothly in opposite direction. Replace motor if operation is not as specified.

LIMIT SWITCH

1) Unplug switch connector. See Fig. 2. For limit switch No. 1, continuity should not exist between terminals No. 1 and 4 with switch pin released. With pin pressed in, continuity should exist between terminals No. 1 and 4.

2) For limit switch No. 2, continuity should not exist between terminals No. 2 and 4 with switch pin released. With pin pressed in, continuity should exist between terminals No. 2 and 4. Replace switch if continuity is not as specified.

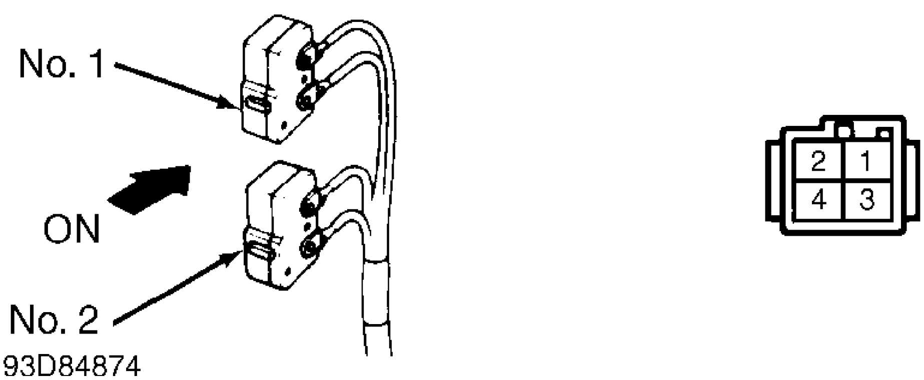

Fig. 2: Limit Switch Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SUN ROOF SWITCH

Remove power sun roof switch. Check for continuity between switch terminals with switch in specified positions. If continuity is not as specified, replace switch. See Fig. 3. See appropriate SUN ROOF SWITCH CONTINUITY TEST table.

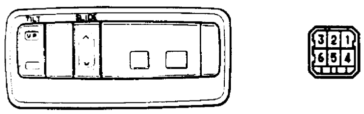

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Fig. 3: Sun Roof Switch Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SUN ROOF SWITCH CONTINUITY TEST TABLE

Position	Terminal Continuity
Slide	
Off	(1)
Open	3 & 4
Close	4 & 6
Tilt	
Off	(1)
Up	4 & 5
Down	2 & 4

(1) - Continuity should not exist.

REMOVAL & INSTALLATION

DRIVE CABLES

Removal & Installation
See SUN ROOF.

DRIVE MOTOR

Removal & Installation
See SUN ROOF.

SUN ROOF SWITCH

NOTE: Tape the end of a flat blade screwdriver to protect switch and trim panels during removal.

Removal & Installation
Disconnect negative battery cable. Pry sun roof switch assembly from roof panel. Remove screws and switch from switch panel. Unplug switch connector. To install, reverse removal procedure.

SUN ROOF

WARNING: Disable air bag (if equipped) before removing sun roof. See appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

NOTE: For installation reference, note number and position of shims when removing sun roof.

Removal & Installation

1) Tilt sun roof upward. Disconnect negative battery cable. Disable air bag. Remove map light. Remove sunvisors, rear view mirror, opening trim panels, and front assist grips. Remove front pillar trim moldings.

2) Unplug and remove drive motor. Remove sun roof mounting nuts and shims. Pull upward on sun roof glass to remove. Remove drip channel. Remove wind deflector. Remove cable guide. To install, reverse removal procedure.

WIND DEFLECTOR

See SUN ROOF.

WIRING DIAGRAMS

Proceed to chassis WIRING DIAGRAMS article in WIRING DIAGRAMS section.

SUSPENSION - REAR

1993 Toyota Celica

1993 SUSPENSION
Toyota Rear

Celica

DESCRIPTION & OPERATION

On Celica FWD, suspension uses MacPherson struts, fastened to rear axle carrier and wheelwell. Wheel bearings are mounted in axle hub, bolted to rear axle carrier. See Fig. 1.

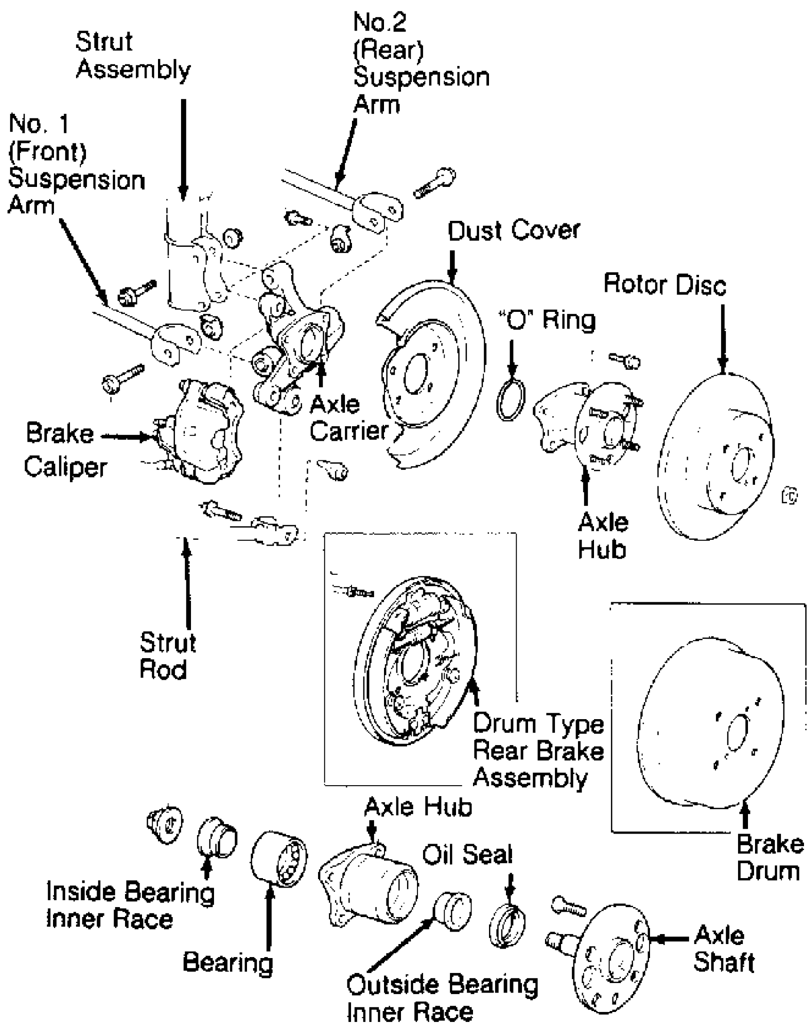


Fig. 1: Exploded View Of Typical FWD Rear Axle Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

On Celica All-Trac models, suspension uses MacPherson struts, fastened to rear axle carrier and wheelwell. Wheel bearings are mounted in axle carrier.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

WHEEL BEARING INSPECTION

Raise and support vehicle. Remove tire assembly. Place dial indicator against axle shaft. Move axle shaft in and out and note axial reading. Replace bearings if axial play exceeds .002" (.05 mm). On Celica, check axle hub runout using a dial indicator. Replace bearings if runout exceeds .0028" (.07 mm).

WHEEL BEARING ADJUSTMENT

Bearings must be replaced if axle shaft nut is tightened to specification and axial play exceeds .002" (.05 mm). No adjustment is available.

NOTE: Ensure no brake drag exists when adjusting wheel bearings.

REMOVAL & INSTALLATION

AXLE HUB, CARRIER & SHAFT

Removal (FWD)

1) Raise and support vehicle. Remove rear wheels. On models with ABS, remove rear speed sensor. On drum brake models, disconnect brake line (tube) at wheel cylinder. Plug line openings. Remove brake drum. See Fig. 1.

2) On disc brake models, remove caliper and hang aside. Remove rotor. On all applications, remove axle hub-to-axle carrier bolts, axle hub and "O" ring.

CAUTION: Be careful not to damage ABS sensor rotor.

3) Remove nuts and bolts holding axle carrier to strut assembly and suspension arms. Note position of nuts on suspension arms and strut rods for installation reference. Remove axle carrier.

Installation (FWD)

To install, reverse removal procedure using new "O" ring. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check rear wheel alignment. Bleed brake system.

NOTE: Tighten axle carrier-to-strut assembly and suspension arms bolts to specification with vehicle at normal operating height. Bounce vehicle several times to stabilize suspension.

Removal (All-Trac)

1) Raise and support vehicle. Remove wheels. Remove cotter pin and lock nut cap. With parking brake applied, remove lock nut from axle shaft.

2) Disconnect parking brake cable. On ABS-equipped models, remove rear speed sensor. Remove brake caliper, and secure aside. Mark axle hub-to-rotor location for reassembly reference. Remove rotor.

Disconnect strut assembly-to-axle carrier bolts. Remove strut assembly from axle carrier. Disconnect suspension arms from axle carrier. Remove axle carrier.

NOTE: Cover axle shaft boot with cloth to protect boot from damage.

Installation (All-Trac)

To install, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS table at the end of this article. Check rear wheel alignment. Proceed to appropriate WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

NOTE: Tighten axle carrier-to-strut assembly and suspension arms bolts to specification with vehicle at normal operating height. Bounce vehicle several times to stabilize suspension.

STRUT ASSEMBLY

Removal

1) Raise and support vehicle. On vehicles with ABS, disconnect speed sensor wire from strut. Remove clip and brake line at strut. On vehicles equipped with disc brakes, remove brake caliper and secure aside.

2) Disconnect stabilizer bar link (if equipped) from strut. Support axle carrier with jack.

NOTE: If disassembling strut assembly, loosen but DO NOT remove strut assembly shaft nut before removing strut assembly.

3) Remove strut assembly-to-axle carrier bolts. Remove strut assembly-to-body retaining nuts. Remove strut assembly.

Inspection

While pushing strut piston rod, ensure pull throughout stroke is even and abnormal resistance and noise do not exist. Push piston rod in fully and release. Ensure piston returns at a constant speed throughout travel. If shock is defective, replace as an assembly.

CAUTION: To prevent personal injury, discharge gas from old shock absorber prior to its disposal. Drill a hole .079-.118" (2-3 mm) in diameter above lower mounting bracket on cylinder.

Installation

To install, reverse removal procedure. Tighten fasteners to specification. See TORQUE SPECIFICATIONS table at the end of this article. Bleed brake system (if necessary).

SUSPENSION ARMS

Removal

Raise and support vehicle. On vehicles with ABS, disconnect speed sensor wire clamp from suspension arms. Remove strut rod. Remove fuel tank protector. Support suspension member. Place match marks on cam plate, No. 2 (rear) suspension arm, and body for reassembly reference. Remove remaining suspension arm retaining bolts. Remove suspension arms.

NOTE: Note direction of suspension arm installation for reassembly reference.

Installation

1) To install, reverse removal procedure. Ensure components

are installed in original location.

2) Temporarily install all bolts, but DO NOT tighten. Install wheels and lower vehicle. Bounce vehicle to stabilize suspension.

3) Ensure reference marks are aligned on cam plate, No. 2 (rear) suspension arm and body. Tighten bolts to specification with vehicle resting on suspension. See TORQUE SPECIFICATIONS table at the end of this article. Check rear wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

STABILIZER BAR

Removal

Raise and support vehicle. Remove wheels. On Celica, use a jack and a wooden block to support fuel tank. Remove tank band bolts from body. Slightly lower fuel tank. Disconnect stabilizer bar from stabilizer bar link. Remove stabilizer bar mount brackets from body. Remove stabilizer bar.

Installation

To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article.

WHEEL BEARINGS

Removal (FWD)

1) Raise and support vehicle. Remove rear wheels. Remove axle hub-to-axle carrier bolts, axle hub and "O" ring.

2) Using hammer and chisel, loosen staked part of axle shaft nut. Remove axle nut. Using Puller (09950-20017), remove axle shaft from axle hub. Remove inner bearing inner race. Using puller, remove outer bearing inner race from axle shaft. Remove oil seal. Press bearing from axle hub.

Installation (FWD)

1) Coat outside of new bearing with grease. Press new bearing into axle hub. Install outer bearing inner race.

2) Coat oil seal lip with grease. Drive oil seal into axle hub. Install inner bearing inner race. Using Adapter (09636-20010), press inner races onto axle shaft. Tighten axle shaft nut to specification. To install remaining components, reverse removal procedure. Tighten all bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article.

NOTE: Stake axle shaft nut after tightening to specification.

Removal (All-Trac)

1) Remove rear axle hub and carrier. See AXLE HUB, CARRIER & SHAFT under REMOVAL & INSTALLATION.

2) Using Puller (09950-20017), press axle hub from axle carrier. Using puller, remove outer bearing inner race from axle hub. Remove dust cover. See Fig. 2.

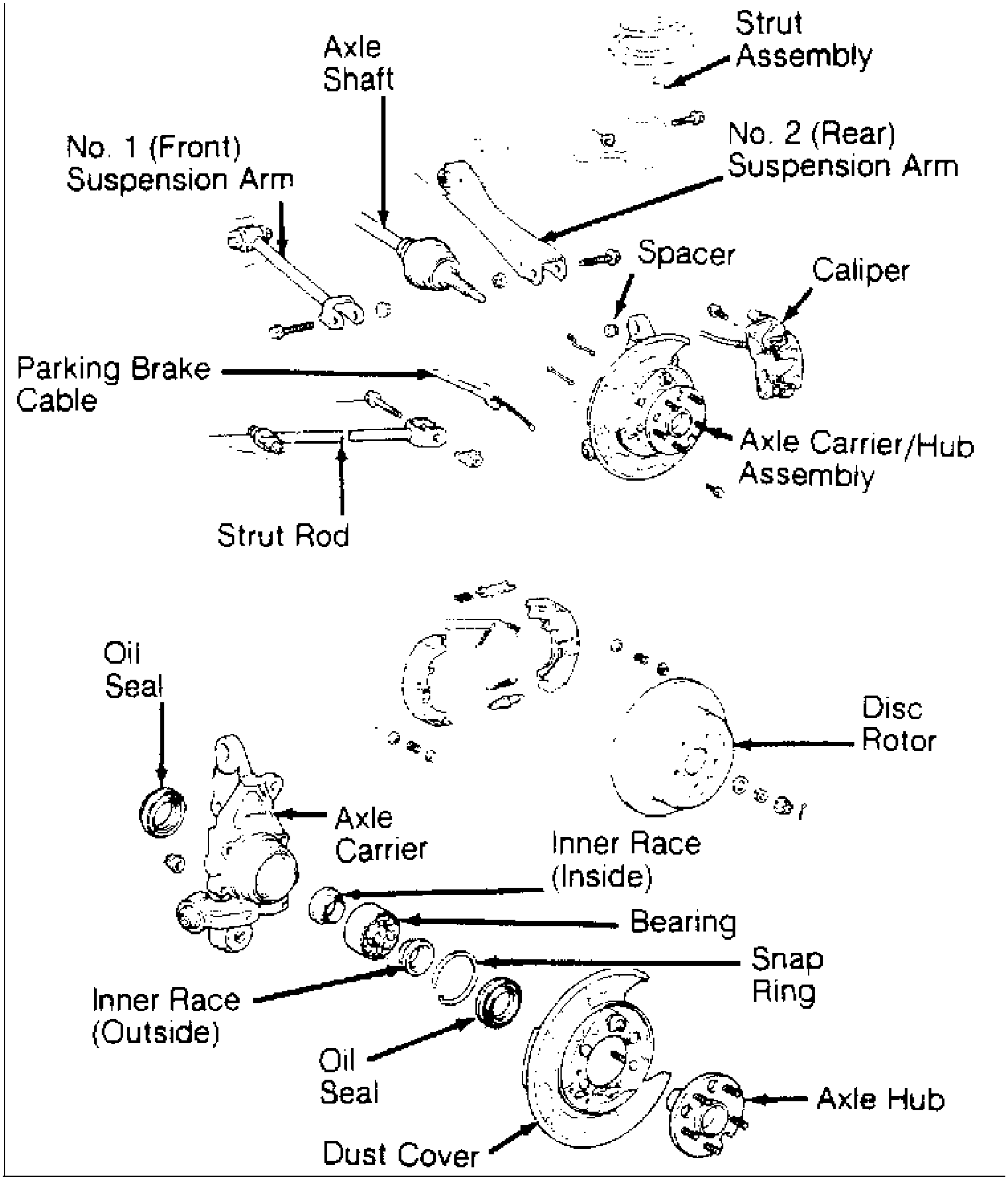


Fig. 2: Exploded View Of Rear Axle Components (All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Using Puller (09308-00010), remove inner and outer oil seals from axle carrier. Remove snap ring from axle carrier. Using

press and Bearing Remover (09636-20010), press bearing from axle carrier.

Installation (All-Trac)

1) Using press and Bearing Installer (09309-36010 and 09608-32010), press bearing into axle carrier. Install snap ring.

2) Coat inner and outer oil seals lip with grease. Using Seal Installer (09608-30012 and 09608-32010), install new outer oil seal. Install dust cover. Using bearing installer, press axle hub into axle carrier. Using seal installer, install new inner oil seal.

3) To install remaining components, reverse removal procedure. Tighten all bolts to specification. See TORQUE SPECIFICATIONS table at the end of this article.

STRUT ROD

Removal & Installation

1) Raise and support vehicle. Remove wheels. Remove nuts and bolts holding strut rod to axle carrier and body. Remove strut rod.

2) To install, connect, but DO NOT tighten, strut rod to body and to axle carrier. Temporarily install all bolts, but DO NOT tighten. Lower vehicle. Bounce vehicle to stabilize suspension. Tighten all bolts to specification with vehicle resting on suspension. See TORQUE SPECIFICATIONS table at the end of this article.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
FWD	
Axle Hub-To-Axle Carrier Bolt	59 (80)
Axle Shaft Nut	90 (122)
Stabilizer Bar Link Nut	47 (64)
Stabilizer Bar Mount Bolt	14 (19)
Strut Rod Bolt	83 (113)
Strut-To-Axle Carrier Bolt	188 (255)
Strut-To-Body Nut	29 (39)
Suspension Arm-To-Axle Carrier Bolt	134 (182)
Suspension Arm-To-Body Bolt	
No. 1 (Front) Arm	83 (113)
No. 2 (Rear) Arm	64 (87)
Suspension Arm-To-Body Nut	
No. 2 (Rear) Arm	166 (226)
Wheel Lug Nut	76 (103)
All-Trac	
Axle Shaft Nut	166 (266)
Speed Sensor Bolt	14 (19)
Strut-to-Axle Carrier Bolt	188 (255)
Strut-to-Body Nut	29 (39)
Suspension Arm-to-Axle Carrier Bolt	90 (122)
Suspension Arm-to-Body Bolt	83 (113)
Wheel Lug Nut	76 (103)
	INCH Lbs. (N.m)
Speed Sensor Bolt (FWD)	69 (7.8)

* SUSPENSION UNIFORM INSPECTION GUIDELINES *

1993 Toyota Celica

GENERAL INFORMATION
Steering, Suspension, Wheel Alignment, Wheels and Tires
Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

CONTENTS

Motorist Assurance Program (MAP)

OVERVIEW
OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

Steering and Suspension

AIR RIDE SUSPENSION
AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS
AIR RIDE SUSPENSION - AIR SPRING VALVES
AIR RIDE SUSPENSION - AIR SPRINGS
AIR RIDE SUSPENSION - COMPRESSORS
AIR RIDE SUSPENSION - HEIGHT SENSORS
AIR RIDE SUSPENSION - MODULES
AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)
AIR RIDE SUSPENSION - SWITCHES (ON/OFF)
AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)
AIR RIDE SUSPENSION - TUBING
AIR RIDE SUSPENSION - WARNING LAMPS
AIR RIDE SUSPENSION - WIRING HARNESSES
BALL JOINTS
BUSHINGS
CENTER LINKS
CONTROL ARM SHAFTS
CONTROL ARMS
DRAG LINKS
ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS
IDLER ARMS
KING PINS
PITMAN ARMS
POWER STEERING HOSES
POWER STEERING (HYDRAULIC) PUMPS
RADIUS ARMS
RELAY RODS
SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES
SPINDLES
SPRINGS - COIL, LEAF AND TORSION BAR
STEEL POWER STEERING LINES
STEERING ARMS
STEERING DAMPERS
STEERING GEARS (EXCEPT RACK AND PINION)
STEERING GEARS - RACK AND PINION
STEERING KNUCKLES
STRIKE OUT BUMPERS
STRUT RODS
STRUT UPPER BEARING PLATE ASSEMBLIES
SWAY BAR LINKS
SWAY BARS

TIE ROD ENDS (INNER AND OUTER)
TRACK BARS
TRAILING ARMS
WHEEL BEARINGS, RACES AND SEALS

Wheel Alignment

WHEEL ALIGNMENT

Wheels and Tires

TIRES
VALVE STEMS
WHEEL ATTACHMENT HARDWARE
WHEELS (RIMS)

MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt 1) a Pledge of Assurance to their Customers and 2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www. motorist.org or contact us at:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer’s best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer’s recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer’s design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer’s discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 – Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 – To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 – To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 – Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

STEERING AND SUSPENSION

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

Steering and suspension are complex systems made up of a variety of interdependent components. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed.

Conditions listed assume that the problem has been isolated to the specific component by proper testing procedures.

NOTE: When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

CAUTION: DO NOT use ride height altering or load compensating components, such as variable rate springs and coil over shocks, on vehicles with height or load sensing proportioning valve-equipped braking systems, unless these components are original equipment.

AIR RIDE SUSPENSION

NOTE: Depending on the air suspension design, there are some aftermarket products available to eliminate the air ride suspension on certain vehicles. If the system has been eliminated with one of these products, then no service is suggested or required.

AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS

NOTE: This section covers the air spring portion of the air shock or strut. For damping portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

AIR RIDE SUSPENSION - AIR SHOCK AND AIR STRUT INSPECTION

Condition	Code	Procedure
Inner fabric of air bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.

AIR RIDE SUSPENSION - AIR SPRING VALVES

AIR RIDE SUSPENSION - AIR SPRING VALVE INSPECTION

Condition	Code	Procedure

Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Inoperative	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

AIR RIDE SUSPENSION - AIR SPRINGS

AIR RIDE SUSPENSION - AIR SPRING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Collar cracked	A	Require replacement.
End cap cracked	A	Require replacement.
Inner fabric of bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.
Piston cracked	A	Require replacement.

AIR RIDE SUSPENSION - COMPRESSORS

AIR RIDE SUSPENSION - COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Does not build pressure	A	(1) Further inspection required.
Excessive run time	B	(2) Further inspection required.
Inoperative	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - If failure to build pressure is traced to the compressor, require replacement.
(2) - If excessive run time is traced to the compressor, require replacement.

AIR RIDE SUSPENSION - HEIGHT SENSORS

AIR RIDE SUSPENSION - HEIGHT SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware		

threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Dust boot missing	2	(1) Suggest replacement.
Dust boot split	2	(1) Suggest replacement.
Dust boot torn	2	(1) Suggest replacement.
Housing cracked	A	Require replacement.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Loose	B	Require adjustment to vehicle manufacturer's specifications.
Missing	C	Require replacement.
Output signal incorrect	A	Require repair or replacement.
Wire lead damaged	A	Require repair or replacement.

(1) - This condition can lead to damage of the sliding magnet, which, in turn, causes premature sensor failure.

AIR RIDE SUSPENSION - MODULES

AIR RIDE SUSPENSION - MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Housing cracked	2	Suggest repair or replacement.
Inoperative	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)

AIR RIDE SUSPENSION - RELAY (COMPRESSOR) INSPECTION

Condition	Code	Procedure
Housing cracked	2	(1) Suggest replacement.
Intermittent	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

(1) - If moisture enters the relay, it can reduce life expectancy or impair function.

AIR RIDE SUSPENSION - SWITCHES (ON/OFF)

AIR RIDE SUSPENSION - SWITCH (ON/OFF) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)

AIR RIDE SUSPENSION - TORSION SPRING (COUNTER BALANCING) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - TUBING

AIR RIDE SUSPENSION - TUBING INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Blocked	A	Require repair or replacement.
Fitting incorrect	B	Require replacement.
Leaking	A	Require repair or replacement.
Line type incorrect	B	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require routing correction.

AIR RIDE SUSPENSION - WARNING LAMPS

AIR RIDE SUSPENSION - WARNING LAMP INSPECTION

Condition	Code	Procedure
Bulb burned out	A	Require replacement.
Warning light does not come on during bulb check	..	Further inspection required to determine cause.
Warning light flashes	..	Further inspection required to determine cause.
Warning light is intermittent	..	Further inspection required to determine cause.
Warning light stays on after initial bulb check	..	Further inspection required to determine cause.

AIR RIDE SUSPENSION - WIRING HARNESSES

AIR RIDE SUSPENSION - WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer's specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer's specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	Require repair or replacement

		of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	Require repair or replacement.
Deteriorated, affecting performance	A	Require repair or replacement.
Distorted, affecting performance	A	Require repair or replacement.
Leaking (fluid-filled type)	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	Require replacement.
Seized	A	Require replacement.
Shifted (out of position)	B	Require repair or replacement.
Split	A	Require replacement.
Surface cracking (weather-checked)	..	No service suggested or required.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CENTER LINKS

CENTER LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace center link.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace center link.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace center link.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace center link.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if

		available; otherwise, replace center link.
Bent	B	.... Require replacement.
Binding	A	.... (1) Further inspection required.
Grease boot cracked	2	.... (2) Suggest replacement.
Grease boot missing	2	.... (3) Suggest replacement.
Grease boot torn	2	.... (4) Suggest replacement.
Grease fitting broken ...	A	... Require replacement of grease fitting.
Grease fitting missing ..	C	... Require replacement of grease fitting.
Grease fitting won't seal	A	... Require replacement of grease fitting.
Grease seal missing	2	.... (3) Suggest replacement.
Grease seal torn	2	.... (4) Suggest replacement.
Looseness (perceptible horizontal movement) ...	1	.... (5) Suggest replacement.
Looseness that is excessive	B	..... (5)(6) Require replacement.
Seized	A	.... Require replacement.
Stud bent	B	.... (7) Require replacement.
Stud broken	A	.... (7) Require replacement.
Stud loose in taper hole	A	.... (7) Require repair or replacement.
Taper hole elongated	A	.... (8) Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... (7) Require replacement.
Wear exceeds manufacturer's specifications	B	.... Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

CONTROL ARM SHAFTS

CONTROL ARM SHAFT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require replacement of broken

Condition	Code	Procedure
		part, if available; otherwise, replace shaft.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shaft.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shaft.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shaft.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shaft.
Bent	B	Require replacement.
Shaft bushing surface undersized (worn)	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

CONTROL ARMS

CONTROL ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace control arm.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace control arm.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace control arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace control arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace control arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace control arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

Condition	Code	Procedure
		if available; otherwise, replace control arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace control arm.
Bent	B	Require replacement.
Bushing hole oversized	B	Require replacement.
Ball joint hole oversized (loose interference or press fit)	B	(1) Further inspection required.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - If oversized ball joint is available, require replacement of ball joint. If oversized ball joint is not available, require replacement of control arm.

DRAG LINKS

DRAG LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace drag link.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace drag link.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace drag link.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace drag link.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace drag link.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.

Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(6) Suggest replacement.
Looseness that is excessive	B	(6)(7) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(8) Require replacement.
Stud broken	A	(8) Require replacement.
Stud loose in taper hole	A	(8) Require repair or replacement.
Taper hole elongated	A	(9) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(8) Require replacement.
Wear exceeds manufacturer’s specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter the joint and will accelerate wear.
(6) - If manufacturer’s procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(7) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS

NOTE: This section covers the electronic damping control portion of the electronic shock or strut. For dampening portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

ELECTRONIC RIDE CONTROL SHOCK AND STRUT INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Electronic valve control		

inoperative	2	(1) Suggest replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

(1) - It is acceptable to replace with a non-electronically controlled unit, where available.

IDLER ARMS

IDLER ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace idler arm.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace idler arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace idler arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace idler arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace idler arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace idler arm.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(5) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Greaseable joint will not take grease	2	(1) Suggest replacement of grease fitting.
Looseness at frame bracket end	B	(6)(7) Require repair or replacement.

Looseness at link end (perceptible horizontal movement)	1	(8) Suggest replacement.
Looseness at link end that is excessive	B	(8)(9) Require replacement.
Mounted out of position (center link not parallel)	B	Require repositioning.
Nut on stud loose	A	(10) Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(11) Require replacement.
Stud broken	A	(11) Require replacement.
Taper hole elongated	A	(12) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(11) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter joint and will accelerate wear.
(6) - If manufacturer's procedures and specifications exist, use those procedures and specifications; otherwise, use an approved inspection method such as the dry park check.
(7) - Looseness is defined as movement that creates excessive toe change.
(8) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(9) - Excessive looseness is defined as significant enough to affect vehicle handling or structural integrity.
(10) - Check for bent stud or damaged taper hole.
(11) - Check for damaged taper hole.
(12) - Check for damaged stud.

KING PINS

You are not required to replace king pins in axle sets. However, when replacing a king pin due to wear exceeding manufacturer's specifications, you may suggest replacement of the other king pin on the axle if its measurement shows it is close to the end of its useful life.

KING PIN INSPECTION

Condition	Code	Procedure
Bearing balls pitted	A	Require replacement.
Bearing balls worn	A	Require replacement.
Bearing races pitted	A	Require replacement.

Condition	Code	Procedure
Bearing races worn	A	Require replacement.
Bearing rollers pitted	A	Require replacement.
Bearing rollers worn	A	Require replacement.
Bearing seal bent	2	Suggest replacement of seal or bearing.
Bearing seal missing	2	Suggest replacement of seal or bearing.
Bearing seal torn	2	Suggest replacement of seal or bearing.
Binding	A	Require repair or replacement of affected parts.
End caps missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
End play exceeds specifications	B	Require repair.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Locating pins missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
Looseness exceeds manufacturer's specifications	B	Require replacement of worn parts.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Will not take grease	2	(1) Suggest replacement of grease fitting.

(1) - If king pin will not take grease after replacement of grease fitting, suggest replacement of king pin.

PITMAN ARMS

PITMAN ARM INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace pitman arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace pitman arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace pitman arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise,

		replace pitman arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace pitman arm.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement of seal.
Grease seal torn	2	(4) Suggest replacement of seal.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Nut on stud loose	A	(7) Require repair or replacement.
Seized	A	Require replacement.
Splines damaged	A	Require repair or replacement.
Splines stripped (splines missing)	A	Require replacement.
Stud bent	B	(8) Require replacement.
Stud broken	A	(8) Require replacement.
Stud loose in taper hole	A	(8) Require repair or replacement.
Taper hole elongated	A	(9) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(8) Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - If manufacturer’s procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for bent stud of damaged taper hole.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

POWER STEERING HOSES

POWER STEERING HOSE INSPECTION

Condition	Code	Procedure
Blistered	B	Require replacement.
Blocked	A	Require repair or replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Inner fabric (webbing) cut	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that the inner fabric of hose is visible	B	Require replacement.
Restricted	A	Require repair or replacement.

POWER STEERING (HYDRAULIC) PUMPS

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

POWER STEERING (HYDRAULIC) PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Belt alignment incorrect	B	(1) Further inspection required.
Belt cracked	1	Suggest replacement.
Belt frayed	1	Suggest replacement.
Belt missing	C	Require replacement.
Belt noisy	2	(2) Further inspection required.
Belt plies separated	A	Require replacement.

Condition	Code	Procedure
Belt tension out of specification	B	Require adjustment or replacement.
Belt worn beyond adjustment range	B	Require replacement.
Belt worn so it contacts bottom of pulley	A	Require replacement.
Binding	A	Require repair or replacement.
Fluid at or beyond service interval	3	Suggest fluid change.
Fluid contaminated	B	(3) Require flushing and refilling of the system.
Fluid level incorrect	B	Require adjustment of fluid level.
Inadequate assist	A	(4) Further inspection required.
Leaking	A	Require repair or replacement.
Noise	2	(5) Further inspection required.
Pulley bent	A	Require repair or replacement of pulley.
Pulley missing	C	Require replacement of pulley.
Remote reservoir leaking	A	Require replacement of reservoir,
Reservoir cap broken	A	Require replacement of cap.
Reservoir cap missing	C	Require replacement of cap.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.
(3) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(4) - If pump is source of inadequate assist, require repair or replacement.
(5) - If noise is isolated to pump, suggest repair or replacement.

RADIUS ARMS

RADIUS ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	A	.... (7) Require repair or replacement.
Taper hole elongated	A	.... (8) Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	.... (7) Require replacement.
Wear exceeds manufacturer's specifications	B	.... Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	.... (2) Suggest replacement of boot.
Dust boot (bellows) torn	2	.... (2) Suggest replacement of boot.
Dust shield broken	2	.... (2) Suggest replacement.
Dust shield missing	2	.... (2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool .	A	.. (3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged ...	A	... Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	..... Require replacement of nut.
Housing dented	A	.... (1) Further inspection required.
Housing punctured	A	.... Require replacement.
Jounce bumper missing ...	C	... Require replacement of jounce bumper.
Jounce bumper split	1	... Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	.... (4) Require replacement.
Noise	2	.... (5) Further inspection required.
Piston rod bent	A	.... Require replacement.
Piston rod broken	A	.... Require replacement.
Piston rod has surface defect	2	.... Suggest replacement.
Piston rod threads damaged	A	.. Require repair or replacement.
Piston rod threads stripped (threads missing)	A	.... Require replacement.
Seized	A	.... Require replacement.
Shock missing	C	.... Require replacement.
Strut housing bent	A	.... Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool .	A	.... (3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged ...	A	... Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	..... Require replacement of nut.
Strut housing severely corroded, affecting structural integrity ...	A	.... Require replacement.
Strut housing threads damaged	A	.. Require repair or replacement.
Strut housing threads stripped (threads missing)	A	.... Require replacement.
Tire cupping	A	.... (6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated - rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	Require adjustment or replacement.

(1) - If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) - Some manufacturers require replacement under these conditions.
(3) - Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) - Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	Require replacement.
Flare type incorrect	B	Required replacement.
Leaking	A	Require tightening or replacement.
Line type incorrect	B	Require replacement.

Restricted	A	Require replacement.
Routed incorrectly	B	Require routing correction.
Rust-pitted	1	Suggest replacement.
Rust pitted, affecting structural integrity	A	Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Taper hole elongated	A	(1) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise,

Condition	Code	Procedure
		replace steering damper.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace steering damper.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace steering damper.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace steering damper.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace steering damper.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace steering damper.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace steering damper.
Binding	A	Require replacement.
Damper body dented	A	(1) Further inspection required.
Damper body punctured	A	Require replacement.
Damping (none)	A	Require replacement.
Dust boot (bellows) missing	2	(2) Suggest replacement of boot.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.
Dust shield broken	2	(2) Suggest replacement.
Dust shield missing	2	(2) Suggest replacement.
Leaking oil, enough for fluid to be running down the body	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Noise	2	(3) Further inspection required.
Piston rod bent	A	Require replacement.
Piston rod broken	A	Require replacement.
Piston rod has surface defect	2	Suggest replacement.
Piston rod threads stripped (threads missing)	A	Require replacement.
Piston rod threads damaged	A	Require repair or replacement.
Seized	A	Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

		of seal and/or mating part.
Splines damaged	A	Require repair or replacement of splines.
Splines stripped	A	Require replacement of splines.
Steering coupler shield cracked	2	Suggest replacement.
Steering coupler shield missing	C	Require replacement.
Threads damaged	A	Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Balance tube blocked	A	Require repair or replacement of balance tube.
Balance tube missing	C	Require replacement of balance tube.
Balance tube restricted	A	Require repair or replacement of balance tube.
Bellows boot clamp missing	C	Require replacement of clamp.
Bellows boot cracked		

(not through)	2	Suggest replacement of bellows boot.
Bellows boot missing	C	Require replacement of bellows boot.
Bellows boot not sealing	A	Require repair or replacement of bellows boot.
Bellows boot torn	A	Require replacement of bellows boot.
Bellows boot twisted (from toe adjustment)	B	Require repair.
Fitting leaking	A	Require repair or replacement.
Fitting missing	A	Require replacement of fitting.
Fitting threads damaged	A	Require repair or replacement of part with damaged threads.
Fitting threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement.
Hard steering on cold start-up	1	(2) Suggest repair or replacement.
Housing cracked, affecting structural integrity	B	Require replacement.
Housing leaking	A	Require replacement.
Inadequate power assist	A	(3) Further inspection required.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement.
Splines damaged	A	Require repair or replacement.
Splines stripped (splines missing)	A	Require replacement.
Steel line blocked	A	Require repair or replacement of line.
Steel line leaking	A	Require repair or replacement of line.
Steel line missing	C	Require replacement of line.
Steel line restricted	A	Require repair or replacement of line.
Steering coupler shield cracked	2	Suggest replacement.
Steering coupler shield missing	C	Require replacement.
Steering coupler shield torn	2	Suggest replacement.
Threads damaged	A	Require repair or replacement of part with damaged threads.

Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. Follow OE specifications for fluid type.
(2) - Indicates internal wear.
(3) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING KNUCKLES

STEERING KNUCKLE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Pinch bolt incorrect	B	Require replacement with bolt that meets OE design.
Pinch bolt loose	B	Require repair.
Pinch bolt missing	B	Require replacement.
Pinch bolt tabs deformed (pinched together), .032" or more before clamping	B	(1) Require replacement.
Taper hole elongated	A	(2) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Steering knuckle deformation can cause pinch bolt breakage.
(2) - Check for damaged stud.

STRIKE OUT BUMPERS

STRIKE OUT BUMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Missing	C	Require replacement.
Split	1	Suggest replacement.

STRUT RODS

STRUT ROD INSPECTION

Condition	Code	Procedure
Adjusting nut seized	A	(1) Require repair or replacement.
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace strut rod.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace strut rod.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace strut rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace strut rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace strut rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace strut rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace strut rod.
Attaching (mating) hole oversized	A	Require repair or replacement of frame.
Attaching point on frame corroded, affecting structural integrity	A	Require repair of frame.
Bent	A	Require replacement.
Mating (attaching) hole oversized	A	Require repair or replacement of frame.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if an alignment is being performed.

STRUT UPPER BEARING PLATE ASSEMBLIES

NOTE: When the following guidelines indicate replacement of bearing, only the bearing should be replaced if it is available separately; otherwise, replace the bearing plate assembly.

STRUT UPPER BEARING PLATE ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace bearing plate assembly.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace bearing plate assembly.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace bearing plate assembly.
Bearing axial or radial movement exceeds vehicle manufacturer's		

specifications	B	Require replacement of bearing.
Bearing binding	A	Require replacement of bearing.
Bearing missing	C	Require replacement of bearing.
Bearing seized	A	Require replacement of bearing.
Bent	B	Require replacement.
Holes distorted	A	Require replacement.
Missing	C	Require replacement.
Severely corroded, affecting structural integrity	A	Require replacement.

SWAY BAR LINKS

SWAY BAR LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace link.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace link.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace link.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace link.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace link.
Ball and socket has looseness (perceptible vertical movement)	1	(1) Suggest replacement.
Ball and socket has looseness that is excessive	B	(1)(2) Require replacement.
Bent	B	Require replacement.
Broken	A	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Missing	C	Require replacement.
Nut on stud loose	A	(6) Require repair.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.

Threads stripped (threads missing)	A	(7) Require replacement.

(1) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(2) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(3) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

SWAY BARS

SWAY BAR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require replacement of broken part, if available; otherwise, replace sway bar.
Attaching hardware corroded, affecting structural integrity ...	A	Require replacement of corroded part, if available; otherwise, replace sway bar.
Attaching hardware loose	A ...	Require repair or replacement of loose part, if available; otherwise, replace sway bar.
Attaching hardware missing	C ..	Require replacement of missing part, if available; otherwise, replace sway bar.
Attaching hardware threads damaged	A ...	Require repair or replacement of part with damaged threads, if available; otherwise, replace sway bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace sway bar.
Bent	B	Require replacement.
Broken	A	Require replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

TIE ROD ENDS (INNER AND OUTER)

TIE ROD END (INNER AND OUTER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace tie rod end.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace tie rod end.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace tie rod end.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace tie rod end.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace tie rod end.
Adjusting sleeve bent	B	Require replacement of sleeve or tie rod end.
Adjusting sleeve clamps out of position	B	Require repair.
Adjusting sleeve corroded, affecting structural integrity	A	Require replacement of sleeve or tie rod end.
Adjusting sleeve missing	C	Require replacement of sleeve or tie rod end.
Adjusting sleeve seized	A	(1) Require repair or replacement.
Adjusting sleeve threads damaged	A	Require repair or replacement of sleeve or tie rod end.
Adjusting sleeve threads stripped (threads missing)	A	Require replacement of sleeve or tie rod end.
Binding	A	(2) Further inspection required.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won’t seal	A	Require replacement of grease fitting.
Grease seal missing	2	(4) Suggest replacement of seal.

Condition	Code	Procedure
Grease seal torn	2	(5) Suggest replacement of seal.
Greaseable tie rod end won't take grease	2	(6) Suggest replacement of grease fitting.
Looseness (perceptible horizontal movement)	1	(7) Suggest replacement.
Looseness exceeds manufacturer's specifications	B	Require replacement.
Looseness that is excessive	B	(7)(8) Require replacement.
Nut on stud loose	A	(9) Require repair or replacement of nut.
Seized	A	Require replacement
Stud bent	B	(10) Require replacement.
Stud broken	A	(10) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(10) Require replacement.

(1) - Only required if toe needs to be adjusted.
(2) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(3) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(6) - If greaseable tie rod end will not take grease after replacing the grease fitting, suggest replacement of tie rod end.
(7) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(8) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(9) - Check for bent stud or damaged taper hole.
(10) - Check for damaged taper hole.

TRACK BARS

TRACK BAR INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace track bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace track bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace track bar.
Attaching hardware		

threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace track bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace track bar.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Grease boot cracked	2	(1) Suggest replacement.
Grease boot missing	2	(2) Suggest replacement.
Grease boot torn	2	(3) Suggest replacement.
Holes distorted	A	Require replacement.
Looseness (perceptible horizontal movement)	1	(4) Suggest replacement.
Looseness that is excessive	B	(4)(5) Require replacement.
Nut on stud loose	A	(6) Require repair or replacement of nut.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(2) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(5) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

TRAILING ARMS

TRAILING ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace trailing arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available;

		otherwise, replace trailing arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace trailing arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace trailing arm.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace trailing arm.
Bent	B	Require replacement.
Bushing hole oversized	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARING, RACE AND SEAL INSPECTION

Condition	Code	Procedure
Rear axle seal on rear-wheel drive leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Seal bent	1	Suggest replacement.
Seal leaking	A	Require replacement of seal and inspection of bearings.
Seal missing	C	Require replacement.
Seal torn	A	Require replacement.
Wheel bearing assembly feels rough when rotated	A	Require replacement of bearing assembly.
Wheel bearing balls are pitted	A	Require replacement of bearing assembly.
Wheel bearing balls are worn	A	Require replacement of bearing assembly.
Wheel bearing end-play exceeds vehicle manufacturer's specifications	B	Require adjustment of bearing,

		if possible. If proper adjustment cannot be obtained, require repair or replacement of worn component.
Wheel bearing race is loose in the hub bore	A	Require replacement of hub assembly and wheel bearings.
Wheel bearing races are pitted	A	Require replacement of bearing assembly.
Wheel bearing races are worn	A	Require replacement of bearing assembly.
Wheel bearing rollers are pitted	A	Require replacement of bearing assembly.
Wheel bearing rollers are worn	A	Require replacement of bearing assembly.

WHEEL ALIGNMENT

WHEEL ALIGNMENT

Wheel alignment is defined as the measurement, analysis, and adjustment of steering and suspension angles to conform to OEM specifications. These angles usually include, but are not limited to: caster, camber, toe, and thrust angle. Where these angles are not adjustable and not in specification, component replacement or correction kits may be required. Errors in set-back and steering axis inclination (SAI) are often attributable to failed or damaged components and must be corrected prior to performing an alignment.

Failure to replace or correct suggested parts or service may prevent a proper alignment.

Before performing an alignment check, inspect and verify the following:

* Tire pressure and size
* Vehicle loading
* Ride height
* Steering and suspension parts

If the inspection reveals that all the above are within published specifications, a wheel alignment check and an alignment, if needed, may be performed.

CAUTION: Under no circumstances should a technician bend or heat any steering or suspension component, unless specified by the vehicle manufacturer, for example, Ford forged twin "I" beam axles. All measurements and specifications must be noted on the inspection report.

WHEEL ALIGNMENT INSPECTION

Condition	Code	Procedure
Dog tracking, shown to be caused by faulty alignment	2	Suggest repair.
Lead, shown to		

be caused by faulty alignment	A	Require alignment.
Part has been changed, affecting alignment	A	Require alignment check.
Pull, shown to be caused by faulty alignment	A	Require alignment.
Steering wheel off-center	2	Suggest alignment.
Tire wear, shown to be caused by faulty alignment	A	Require alignment.
Wander, shown to be caused by faulty alignment	A	Require alignment.

WHEELS AND TIRES

TIRES

These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes.

WARNING: High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death.

WARNING: Only specially trained persons should dismount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death.

WARNING: Consult the vehicle owner's manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. DO NOT exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association

WARNING: When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. DO NOT mix different speed rating designations on the same axle.

WARNING: DO NOT mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule.

WARNING: DO NOT mix size or type (all season, performance, mud and snow) of tires on the same axle.

TIRE INSPECTION

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement.
Bead leaking, caused by tire	A	Require repair or replacement.
Bead wire/cord exposed	A	Require replacement.
Cord or belt material exposed	A	Require replacement.
Cord ply separations	A	Require replacement.
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning.
Irregular tread wear, affecting performance	2	(1) Suggest replacement.
Load ratings less than OEM specifications	B	Require replacement.
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement.
Number of punctures exceeds manufacturer's limit	B	Require replacement.
Out of balance	B	Require rebalance of tire/wheel assembly.
Ply separation	A	Require replacement.
Pull or lead, caused by tire	A	Require repair or replacement.
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement.
Radials are on the front and not on the rear	B	(2) Require repair or replacement.
Run flat damage	A	Require replacement.
Shoulder cut	A	Require replacement.
Shoulder puncture	A	Require replacement.
Shoulder with plug	A	Require replacement.
Sidewall bulge	A	Require replacement.
Sidewall cut	A	Require replacement.
Sidewall indentation	..	No service required or suggested.
Sidewall puncture	A	Require replacement.
Sidewall with plug	A	Require replacement.
Speed rating designations different on same axle	2	Suggest repair or replacement.
Tire and wheel assembly has excessive run-out	B	(3) Require repair or replacement of appropriate part.
Tires with more than 1/4" diameter difference on a four-wheel drive vehicle	B	Require replacement.
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement.
Tread missing pieces		

(chunking), exposing cord	A	Require replacement.
Tread missing pieces (chunking), not exposing cord	1	Suggest replacement.
Tread separations	A	Require replacement.
Tube in tubeless tire	3	(4) Suggest removal of tube.
Weather-checking	..	No service required or suggested.
Worn to tread wear indicators	B	Require replacement.

(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	Suggest replacement.
Broken	A	Require replacement.
Cut, but not leaking	1	Suggest replacement.
Deteriorated (cracking, dry rot)	1	Suggest replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped	A	Require replacement.
Valve cap missing	C	Require replacement of cap.
Weather-checking	1	Suggest replacement.
Won't take air	A	Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	(1) Require replacement.

```
Loose  ..................  B  ...  Require repair or replacement
                                          of affected component.
Lug nut installed
 backward  ..............  B  ..  Require repair or replacement.
Lug nut mating type
 incorrect  .............  B  .....  Require replacement of nut.
Lug nut mating surface
 dished  ................  A  .....  Require replacement of nut.
Lug nut rounded  ........  A  .  (2) Require replacement of nut.
Lug nut seized  .........  A  .  (2) Require replacement of nut.
Stud incorrect  .........  B  ....  Require replacement of stud.
Threads damaged  ........  A  ...  Require repair or replacement
                                       of component with damaged
                                                        threads.
Threads stripped  .......  A  .........  Require replacement of
                                         component with stripped
                                                        threads.

(1) - Some manufacturers require replacement of all studs on
      that wheel if two or more studs or nuts on the same
      wheel are broken or missing.
(2) - Only required if removing wheel.
```

WHEELS (RIMS)

```
WARNING: Mounting a regular tire on a high-pressure compact spare
         wheel is not permitted. Attempting to mount a tire of one
         diameter on a wheel of a different diameter or flange
         type may result in serious injury or death. If the wheel
         identification stamp is not legible, or cannot be found,
         do not use the wheel until the size and type have been
         properly identified. Wheels of different diameter,
         offset, or width cannot be mixed on the same axle. Bead
         seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition                 Code                         Procedure

Bead leaking, caused
 by wheel  ..............  A  ..........  (1) Require repair or
                                                    replacement.
Bent hub mounting
 surface  ...............  A  ...........  Require replacement.
Bent rim, causing
 vibration  .............  2  ........  (1) Suggest replacement.
Broken  .................  A  ...........  Require replacement.
Cast wheel porous,
 causing a leak  ........  A  ..  Require repair or replacement.
Clip-on balance weight is
 incorrect type
 for rim flange  ........  2  ...........  Suggest replacement.
Corrosion, affecting
 structural integrity  ...  A  ...........  Require replacement.
Corrosion build-up on
 wheel mounting
 surface  ...............  A  ................  Require repair.
Cracked  ................  A  ...........  Require replacement.
Directional/asymmetrical
 wheels mounted
 incorrectly  ...........  B  ......  Require remounting and/or
                                                  repositioning.
```

Load capacity less than OEM specifications	B	Require replacement.
Offset mismatched on same axle	B	Require replacement.
Rivets leaking	A	Require replacement.
Run-out beyond OEM specs	B	Require replacement.
Stud holes elongated	A	(2) Require replacement.
Welded or brazed repair	2	Suggest replacement.
Welds leaking	A	Require replacement.
Wheel centering (pilot) hole incorrect	B	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

1993 SUSPENSION
Toyota Front

Celica

DESCRIPTION

Vehicles are equipped with front wheel drive and independent MacPherson strut front suspension. Suspension consists of vertically mounted strut assemblies, control arms and stabilizer bar.

Struts are mounted between inner fender and steering knuckle. Tie rod ends connect rack and pinion steering to steering knuckle. Ball joint connects steering knuckle to lower control arm which attaches to frame crossmember. On Celica, stabilizer bar attaches to lower control arms and 2 points on crossmember.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

WHEEL BEARING

Wheel bearings are not adjustable. Whenever bearings are removed, replace with NEW bearings, races and oil seals.

BALL JOINT CHECKING

1) Raise vehicle, and place a wooden block with a height of 7.09-7.87" (180.0-200.0 mm) under either front tire. Lower floor jack until about half vehicle load is on front struts. Place safety stands under vehicle.

2) Place front wheels in straight-ahead position, and block them. Use a rod to move control arm up and down. Check for vertical ball joint play. If ball joint is damaged or any vertical play is found, replace ball joint. See LOWER CONTROL ARM & BALL JOINT under REMOVAL & INSTALLATION.

REMOVAL & INSTALLATION

WHEEL BEARING

Removal

1) Raise and support vehicle. Remove front wheels. Remove cotter pin, bearing lock nut cap and bearing lock nut (apply brakes when removing lock nut). Remove brake caliper. DO NOT disconnect brakeline. Secure caliper aside.

2) Remove disc brake rotor. Remove ABS speed sensor (if equipped). Loosen, but DO NOT remove, shock absorber lower mounting bolts. Remove cotter pin and castle nut from tie rod end. Using Puller (09628-62011), remove tie rod end from steering knuckle.

3) Remove nuts and bolt attaching lower ball joint to lower control arm. Using Puller (09950-20017), disconnect steering knuckle from axle shaft. See Fig. 1. Remove steering knuckle and axle hub as an assembly. Place steering knuckle in a vise. Remove dust deflector.

4) Using Puller (09628-62011), remove lower ball joint (if necessary) from steering knuckle. Remove inner oil seal and snap ring from steering knuckle. Remove dust cover retaining bolts. Using Puller (09950-20017), remove axle hub. Remove dust cover. Remove hub bearing inner race.

5) Using Puller (09950-20017), remove hub bearing outer race from axle hub. Remove outer oil seal from steering knuckle. Reinstall outer race on hub bearing. Using Driver (09605-60010), press hub bearing from steering knuckle.

NOTE: Always replace bearings and races as an assembly.

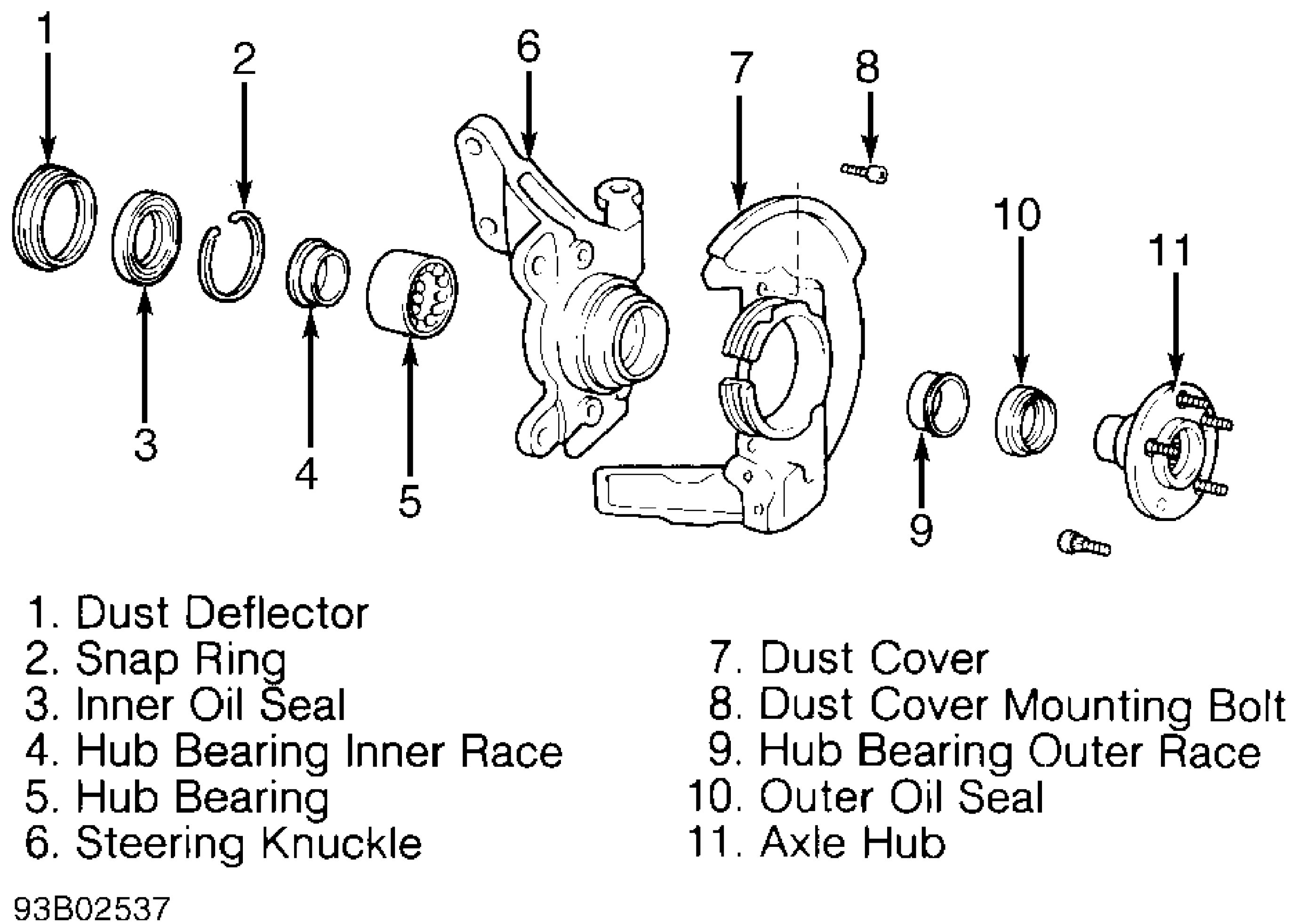


Fig. 1: Identifying Hub Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) Using an arbor press and Seal Driver (09608-32010), press NEW bearing into steering knuckle. Install hub bearing outer race on hub bearing. Using seal driver and Bushing Driver (09710-14012), drive NEW outer oil seal into steering knuckle.

2) Install dust cover. Apply multipurpose grease to oil seal lip and bearing. Install hub bearing inside race on hub bearing. Using Bearing Driver (09310-35010), press hub into steering knuckle. Install snap ring into steering knuckle.

3) Using seal driver and Bushing Driver (09710-14012), install NEW inner oil seal flush with end surface of steering knuckle. Install lower ball joint (if removed). Position NEW dust deflector in

steering knuckle so hole in dust deflector (for ABS speed sensor) is aligned with hole in steering knuckle.

4) Using Seal Driver (09608-35014), install dust deflector. To complete installation, reverse removal procedure. Tighten all nuts and bolts to specification. See TORQUE SPECIFICATIONS. Check front end alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

LOWER CONTROL ARM & BALL JOINT

Removal

1) Raise and support vehicle. Remove front wheels. Disconnect lower control arm from steering knuckle. Disconnect stabilizer link from lower control arm. See Fig. 2. Remove lower control arm front setting nut and washer.

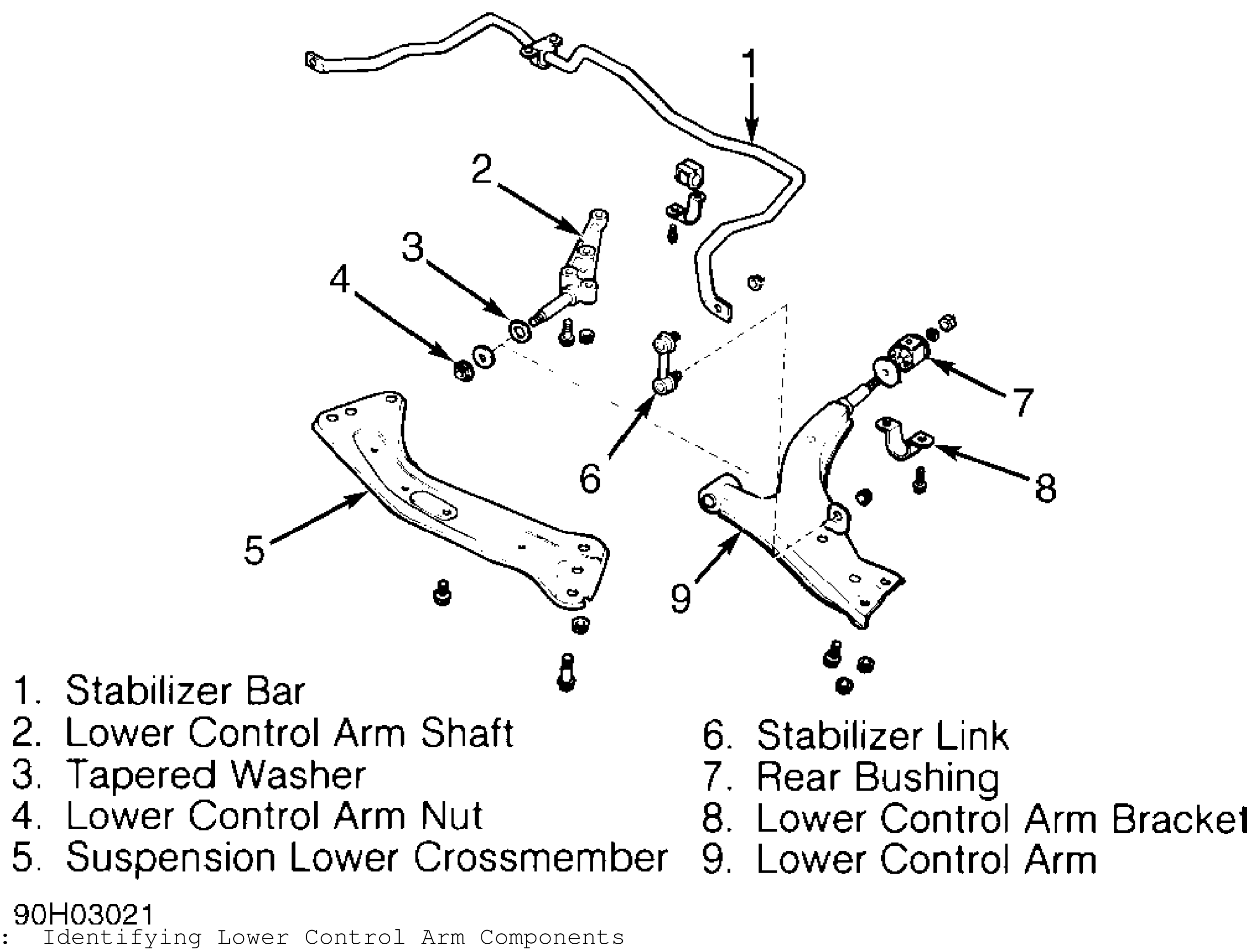


Fig. 2: Identifying Lower Control Arm Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: On A/T models, remove left lower control arm with lower control arm shaft as an assembly. Remove suspension lower crossmember before removing lower control arm and shaft assembly.

2) On M/T models, remove left lower control arm and lower arm

damper plate. Remove lower control arm rear bracket bolts. Remove right lower control arm. Remove suspension lower crossmember and lower control arm shaft (if necessary).

3) On A/T models, remove suspension lower crossmember. Remove lower arm damper plate bolts and damper plate. Remove lower control arm with lower control arm shaft as an assembly.

4) On all models, remove ball joint cotter pin and nut to remove ball joint from steering knuckle. Using Remover (09628-62011), remove ball joint from steering knuckle.

Installation

1) Install ball joint to steering knuckle, and tighten to specification. See TORQUE SPECIFICATIONS. Install NEW cotter pin. To complete installation, reverse removal procedure. Install left lower control arm. Ensure tapered side of lower control arm faces body side.

2) Install, but DO NOT tighten, nut attaching lower control arm to lower control arm shaft and lower control arm bracket bolts. Install lower arm damper plate. Connect lower control arm to steering knuckle. Connect stabilizer link to control arm.

3) Install wheels, and lower vehicle. Bounce vehicle up and down to stabilize suspension. Tighten lower control arm nuts/bolts to specification. Check front end alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

LOWER CONTROL ARM BUSHING

Removal & Installation

Install lower control arm in a vise. Remove nut, washer and bushing from control arm. Install NEW bushing, washer and nut. Install washer with tapered side facing lower control arm. Install nut and tighten to specification. See TORQUE SPECIFICATIONS.

STRUT ASSEMBLY

NOTE: During following procedures, refer to Fig. 3.

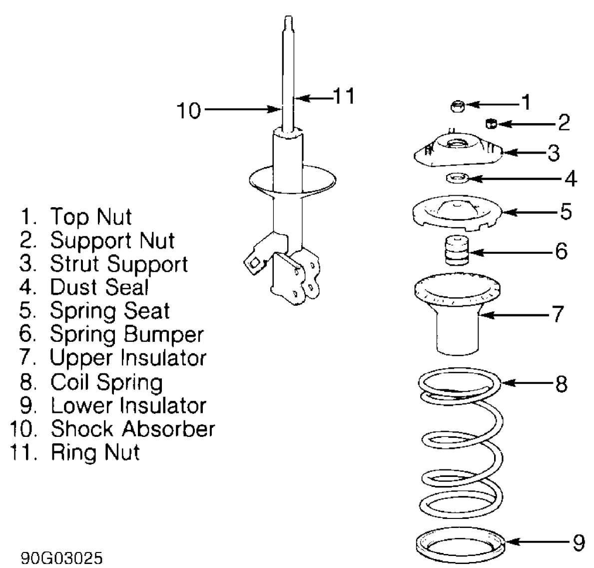


Fig. 3: Identifying Strut Assembly Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Removal

1) On Celica, remove union bolt and washers, and disconnect

brake hose from disc brake caliper. Drain fluid into a container. Remove clip from brake hose, and pull hose from bracket.

CAUTION: When removing strut, cover axle shaft boot using a cloth for protection.

2) Remove nuts and bolts, and separate strut from steering knuckle. Remove dust seal from top of strut. Remove nuts holding top of strut to body. Remove strut from vehicle.

Disassembly

Install a bolt and 2 nuts to strut lower bracket to prevent distortion of strut shell when clamped. Clamp bottom of strut in a vise. Using Compressor (09727-30020), compress coil spring. Hold spring seat using Lever (09729-22031) and remove strut rod top nut. Remove components.

Inspection

Compress and extend shock rod, and ensure no abnormal resistance or noise exists. Push shock absorber piston rod in fully and release. Ensure piston rod returns at a constant speed throughout travel. If shock is defective, replace as an assembly.

CAUTION: To prevent personal injury, discharge gas in shock absorber. On Celica, use Shock Absorber Wrench (09720-00012) to loosen ring nut 2 or 3 turns before discarding.

Reassembly & Installation

1) To install, reverse removal procedure. On Celica, ensure "OUT" mark on spring seat faces toward outside of vehicle. Tighten support nut to specification. See TORQUE SPECIFICATIONS.

2) Install strut to body. Tighten nuts to specification. Install strut to steering knuckle, and tighten bolts. Install dust seal after packing bearing in suspension support with grease. Bleed brakes. On Celica, ensure flexible brake hose pin aligns with caliper hole.

3) Check front end alignment. Proceed to appropriate WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

STABILIZER BAR

Removal & Installation

1) Disconnect stabilizer link from lower control arm and stabilizer bar. See Fig. 2. Disconnect front exhaust pipe from rear exhaust pipe. Disconnect exhaust pipe hanger from body.

2) Remove both stabilizer bar brackets from body. Remove stabilizer bar. Inspect stabilizer link ball joint arms. If movement of arms is not free in all directions, replace stabilizer link. To install, reverse removal procedure. Check wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Axle Nut	166 (226)
Axle Shaft Flange Bolts (All-Trac)	48 (65)
Ball Joint-To-Lower Control Arm Nut	94 (127)

Ball Joint-To-Steering Knuckle Nut	76 (103)
Brake Caliper-To-Knuckle Bolt	79 (107)
Brake Hose-To-Caliper Bolt	22 (30)
Crossmember Bolts/Nuts	112 (152)
Drive Shaft Flange Bolts	54 (74)
Exhaust Pipe Hanger Bolts	14 (19)
Lower Control Arm Bracket-To-Body Bolt	72 (98)
Lower Control Arm Nut	
Front	156 (211)
Rear	101 (137)
Lower Control Arm Shaft-To-Body Bolt	112 (152)
Stabilizer Bar Link Bolt	26 (35)
Stabilizer Bracket-To-Body Bolt	13 (18)
Steering Knuckle-To-Strut Bolt	224 (301)
Strut Assembly-To-Body Nuts	59 (80)
Strut Assembly Top Support Nut	34 (47)
Tie Rod-To-Knuckle Nut	36 (49)
Wheel Lug Nuts	76 (103)

* SYMPTOM CHECK LIST *

1993 Toyota Celica

SYMPTOM CHECK LIST WORKSHEETS

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. It does not apply specifically to one make or model.

PURPOSE

Why Use the Symptom Check List Worksheets?

One of the most difficult and critical lines of communication is between the service customer and the technician. The clearer the technician understands the customer's concerns, the more likely the problem will be "fixed right the first time".

The Symptom Check List Worksheets in this article are designed to improve this communication. When used consistently, they can be helpful in reducing shop comebacks, increasing technician productivity, and producing satisfied customers. They also provide other benefits:

* Reduce "No Trouble Found" problems
* Increase customer involvement
* Customer perceive that "they really care and listen"
* Save time during peak write-up periods
* Reduce recontacting customers for additional information
* Improve night drop information
* Insure all the right questions are asked at write-up

Making the Worksheets a Part of Your Normal Routine

The following information contains ideas that may be helpful in forming habits that promote daily use of the Symptom Check Lists:

* HAVE THE SERVICE ADVISER FILL OUT THE FORM(S) WITH THE CUSTOMER WHENEVER POSSIBLE.
* Place them in your night drop for the customer to fill out, along with an instruction sheet to help them understand what to do.
* Hand out the worksheets to customers while they wait in line during the peak morning rush and ask them to fill it out. It will save time for all concerned and improve the quality of information received from the customer.
* Make sure it is attached to the hard copy when it goes to the technician.
* Place a copy with the final repair papers and review it with the customer at delivery.
* Put a new worksheet in the glovebox of all departing customers.
* Require that you personally see a copy of all worksheets filled out for shop comebacks.
* Hold a shop meeting to get employee buy-in and their ideas on how to make it effective in your shop.

There are many other ways to utilize the concept, but as with every other idea, successful implementation depends on employee involvement and buy-in.

SYMPTOM CHECK LIST WORKSHEETS

CONDENSED VERSION - ALL ON ONE PAGE

NOTE: Have the service adviser fill out this form with the customer whenever possible.

DRIVEABILITY WORKSHEET

(To Be Filled Out By Vehicle Owner)

Name: ____________________ **Date:** __________ **Make:** ______________

Model: ____________ **Year:** ____________ **Engine:** ____________ **Mileage:** __________

FAULT CHARACTERISTICS – SYMPTOMS – DESCRIPTION OF PROBLEM (**Please Check All That Apply In All Categories**)

Starting Problems	☐ Will Not Crank ☐ Cranks, But Won't Start ☐ Starts, But Takes A Long Time
Engine Quits/ Running Problems	**Quits:** ☐ Right After Starting ☐ When Put Into Gear ☐ Right After Vehicle Comes To A Stop ☐ During Steady Speed Driving ☐ While Idling ☐ During Acceleration ☐ When Parking
Poor Idling Conditions	**Idle Speed:** ☐ Is Too Slow At All Times ☐ Is Too Slow With A/C On ☐ Is Too Fast ☐ Is Rough Or Uneven ☐ Fluctuates Up and Down
Poor Running Conditions	☐ Runs Rough ☐ Lacks Power ☐ Hesitates Or Stumbles On Acceleration ☐ Bucks and Jerks ☐ Engine Knocks, Pings, Rattles ☐ Backfires ☐ Poor Fuel Economy ☐ Misfires or Cuts Out ☐ Surges and/or Chuggles ☐ Dieseling or Run-On ☐ Engine Light Always On ☐ Engine Light On Sometimes ☐ Fuel, Gas, or Sulfur Smell
Auto. Transmission Problems	☐ Improper Shifting (early/late) ☐ Changes Gear Randomly On Its Own ☐ Vehicle Does Not Move When In Gear
Poor Handling	☐ Pulls To One Side ☐ Hard Steering ☐ Vehicle Shakes and/or Vibrates While Moving
Noise Problems	**Explain:**
Odor Problems	**Explain:**
Problem Frequency	☐ Always ☐ Often ☐ Occasionally
Usually Occurs	☐ Morning ☐ Afternoon ☐ Anytime
Engine Temp.	☐ Cold ☐ Warm ☐ Hot
Vehicle Speed	☐ Low ☐ Cruising ☐ High
Driving Conditions During Occurrence	☐ Short – Less Than 2 Miles ☐ 2-10 Miles ☐ Long – More Than 10 Miles ☐ Stop & Go ☐ While Turning ☐ While Braking ☐ At Gear Engagement ☐ With A/C Operating ☐ With Headlights On ☐ During Acceleration ☐ During Deceleration ☐ Mostly Downhill ☐ Mostly Uphill ☐ Mostly Level ☐ Mostly Curvy ☐ Rough Road
Driving Habits	☐ Drive Hard Before Engine Is Warmed ☐ Allow Engine To Warm ☐ Mostly City Driving ☐ Highway ☐ Park Vehicle Inside ☐ Outside **Drive Per Day:** ☐ Less Than 10 Miles ☐ 10-50 ☐ More Than 50 **Fuel Octane:** ☐ 87 ☐ 89 ☐ 91 ☐ More Than 91 **Brand:** ______________ ☐ Gasohol ☐ Propane Conversion
Outside Weather	☐ Cold ☐ Warm ☐ Hot ☐ Wet/Rainy ☐ Fog ☐ Snow/Hail ☐ Dust/Dirt ☐ Dry ☐ Humid

Fig. 1: Entire Vehicle - Symptom Check List For Customer

FULL VERSION - ALL ON FOUR PAGES

NOTE: Have the service adviser fill out these forms with the customer whenever possible.

Dear Valued Customer:
Our goal is to fix your problem correctly and get you back on the road as soon as possible in the unlikely event you experience a problem with your vehicle. Help us identify the exact nature of the concern by taking a few moments to complete the appropriate section of this diagnostic worksheet. Thank you.

CUSTOMER NAME: ______ **PHONE NO.:** ______ **REPAIR ORDER NO.:** ______

DIAGNOSTIC WORKSHEET

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)

ENGINE

- ☐ "Service Engine Soon"/"Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Pings, detonates
- ☐ Suphur, rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): ______

(whine, rattle, groan, clunk, etc.)

- ☐ Other: ______

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe): ______

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc.
- ☐ Other: ______

EXPLAIN: ______

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine and/or Transmission)

- ☐ Always ☐ Few seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every ______ to ____ miles ☐ Unknown
- ☐ Other (explain): ______
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0 degrees F ☐ Cold - 0 to 32 degrees F
- ☐ Cool - 32 to 60 degrees F ☐ Warm - 60 to 80 degrees F
- ☐ Hot - Above 80 degrees F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/ice ☐ Wet roads ☐ Other (explain below)

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising steady at ______ MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between ______ MPH and ______ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? **What Brand?** ______

- ☐ Regular UL ☐ Mid range UL ☐ Premium Unleaded
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

- ☐ Park to R or D ☐ Rev/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

50G15061

Fig. 2: Symptom Check List - Page 1

BRAKES - STEERING - SUSPENSION

SYMPTOM

☐ Vehicle pulls right - When ____________	☐ Suspension bottoms out	☐ Sits uneven
☐ Vehicle pulls left - When ____________	☐ Leans or sways in corners	☐ "Dog" tracks
☐ Steering wheel vibrates at ____ MPH	☐ Brake light on	☐ ABS light on
☐ Excessive play in steering	☐ Traction control light on	☐ Soft ride
☐ Erratic steering when braking	☐ Uneven tire wear	
☐ Poor steering wheel return after cornering		

Hard to steer

☐ Effort ☐ Wanders

☐ Steering wheel off center

Shimmy/vibration (check box below for location)

☐ Front	☐ Rear	☐ Don't know
☐ Seat	☐ Floor	☐ Other ________

Brake pedal

☐ Noise ☐ Pulses ☐ Squeaks ☐ Hard ☐ Mushy ☐ Excessive travel

WHEN DOES IT OCCUR?

☐ Cold days	☐ Hot days	☐ Wet/rain	☐ All the time	☐ Intermittent
☐ Parking manuevers	☐ At road speed	☐ Accelerating	☐ Decelerating	

EXPLAIN: ____

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other ____________		

NOISE SOUNDS LIKE

☐ Knocks	☐ Hard metal	☐ Light metal	☐ Roars	☐ Ticking	☐ Whine
☐ Squeaks	☐ Rattles	☐ Scraping	☐ Other ____________		

HOW OFTEN DOES IT OCCUR?

☐ Continuous ☐ Often ☐ Intermittent ☐ Just started ☐ Since new

WHEN DOES IT OCCUR?

☐ All the time	☐ Speed	☐ RPM	☐ Only moving	☐ On turns	☐ Braking
☐ Hard throttle	☐ Light throttle	☐ Decelerate	☐ Steady speed	☐ Idle in gear	☐ Idle out of gear
☐ Hot days	☐ Cold days	☐ Humid or rainy	☐ Temperature ________		
☐ Heavy bumps	☐ Light bumps	☐ Smooth pavement			

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15062

Fig. 3: Symptom Check List - Page 2

AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

☐ Air conditioner ☐ Heater ☐ Defroster ☐ Vent ☐ Bi-Level ☐ Fan/blower
☐ Max A/C ☐ Automatic Temperature Control ☐ Mix/blend ☐ Economy ☐ All

SYMPTOM

☐ Does not work ☐ Blows wrong temperature air ☐ No air comes out of vents ☐ Rapid cycling
☐ Noisy (explain) ☐ Broken ☐ Odor ☐ Air comes from wrong outlets ☐ Blows fuse
☐ Leaks ☐ Insufficient heat or cool ☐ Other (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Intermittent ☐ Right after startup
☐ When change controls only ☐ Other (explain below) ☐ Fan blower speed High / Med / Low

EXPLAIN: ______________________________

____

ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

______________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Just after starting - malfunctions for a while
☐ Intermittent ☐ After runs for ______ minutes ☐ Rough roads or bumps only
☐ Other (explain below)

EXPLAIN: ______________________________

____

CUSTOMER NAME: **PHONE NO.:** **REPEAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50I15063

Fig. 4: Symptom Check List - Page 3

WATER LEAK - WINDNOISE

WATER LEAK
Leak Occurs When?

☐ Setting level ☐ Any time it rains ☐ While driving in the rain ☐ Car wash only
☐ Back lower than front (facing uphill) ☐ Front lower than back (facing downhill)

Location of Leak (where water appears):

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

WINDNOISE:
Location:

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

EXPLAIN: ______________________________

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

☐ Hard to shift ☐ Doesn't shift
☐ Grinds going into_____ gear
☐ Noisy when in _____ gear or neutral _____
☐ Slips/pops out of gear
☐ Noise (describe): ______________________________

☐ Upshift light stays on
☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

☐ All the time ☐ Light load
☐ Heavy load

SYMPTOM - CLUTCH

☐ Hard to push ☐ Fail to release
☐ Noise when pressing pedal down (describe): ______________________________

☐ Slips ☐ Chattering (grabbing)
☐ Odor present ☐ Pedal stays on the floor
☐ Squealing sound

WHEN DOES IT OCCUR?
When Engine Temperature is:

☐ Cold ☐ Hot
☐ Accelerating ☐ Decelerating

EXPLAIN: ______________________________

COMMENTS:

____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15064

Fig. 5: Symptom Check List - Page 4

INDIVIDUAL SYSTEM-BASED CHECK LISTS

NOTE: Have the service adviser fill out these forms with the customer whenever possible.

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)
ENGINE

- ☐ "Service Engine Soon"/Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Ping, detonates
- ☐ Sulphur/rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): ______

(whine, rattle, groan, clunk, etc.)

- ☐ Other: ______

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe): ______

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into next gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc.
- ☐ Other: ______

EXPLAIN: ______

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine &/or Transmission)

- ☐ Always ☐ Few Seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every ______ to ____ miles ☐ Unknown
- ☐ Other (explain): ______
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0°F ☐ Cold - 0 to 32°F
- ☐ Cool - 32 to 60°F ☐ Warm - 60 to 80°F
- ☐ Hot - above 80°F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/Ice ☐ Wet roads
- ☐ Other (explain): ______

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising - steady at MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between ____ MPH and ______ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? **What Brand?**

- ☐ Regular UL ☐ Midrange UL ☐ Premium UL
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

- ☐ Park to R or D ☐ Reverse/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15054

Fig. 6: Engine Driveability & Automatic Transmission

BRAKES - STEERING - SUSPENSION

SYMPTOM

☐ Vehicle pulls right - When ____________
☐ Vehicle pulls left - When ____________
☐ Steering wheel vibrates at ____ MPH
☐ Excessive play in steering
☐ Erratic steering when braking
☐ Poor steering wheel return after cornering
☐ Suspension bottoms out
☐ Leans or sways in corners
☐ Brake light on
☐ Traction control light on
☐ Uneven tire wear
☐ Sits uneven
☐ "Dog" tracks
☐ ABS light on
☐ Soft ride

Hard to steer

☐ Effort ☐ Wanders
☐ Steering wheel off center

Shimmy/vibration (check box below for location)

☐ Front ☐ Rear ☐ Don't know
☐ Seat ☐ Floor ☐ Other ________

Brake pedal

☐ Noise ☐ Pulses ☐ Squeaks ☐ Hard ☐ Mushy ☐ Excessive travel

WHEN DOES IT OCCUR?

☐ Cold days ☐ Hot days ☐ Wet/rain ☐ All the time ☐ Intermittent
☐ Parking manuevers ☐ At road speed ☐ Accelerating ☐ Decelerating

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50C15059

Fig. 7: Brakes, Steering, & Suspension

AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

☐ Air conditioner ☐ Heater ☐ Defroster ☐ Vent ☐ Bi-Level ☐ Fan/blower
☐ Max A/C ☐ Automatic Temperature Control ☐ Mix/blend ☐ Economy ☐ All

SYMPTOM

☐ Does not work ☐ Blows wrong temperature air ☐ No air comes out of vents ☐ Rapid cycling
☐ Noisy (explain) ☐ Broken ☐ Odor ☐ Air comes from wrong outlets ☐ Blows fuse
☐ Leaks ☐ Insufficient heat or cool ☐ Other (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Intermittent ☐ Right after startup
☐ When change controls only ☐ Other (explain below) ☐ Fan blower speed High / Med / Low

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50A15057

Fig. 8: Air Conditioning, Heater & Ventilation

ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

________________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

________________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

________________________ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Just after starting - malfunctions for a while
☐ Intermittent ☐ After runs for ______ minutes ☐ Rough roads or bumps only
☐ Other (explain below)

EXPLAIN: ____

____

____

____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50B15058

Fig. 9: Electrical, Radio & Tape/CD Player

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

- ☐ Hard to shift
- ☐ Doesn't shift
- ☐ Grinds going into_____ gear
- ☐ Noisy when in _______ gear or neutral _____
- ☐ Slips/pops out of gear
- ☐ Noise (describe): ____________________________
- ☐ Upshift light stays on
- ☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Light load
- ☐ Heavy load

SYMPTOM - CLUTCH

- ☐ Hard to push
- ☐ Fail to release
- ☐ Noise when pressing pedal down (describe): ________
- ☐ Slips
- ☐ Chattering (grabbing)
- ☐ Odor present
- ☐ Pedal stays on the floor
- ☐ Squealing sound

WHEN DOES IT OCCUR?

When Engine Temperature is:

- ☐ Cold
- ☐ Hot
- ☐ Accelerating
- ☐ Decelerating

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15056

Fig. 10: Manual Transmission & Clutch

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other ________		

NOISE SOUNDS LIKE

☐ Knocks	☐ Hard metal	☐ Light metal	☐ Roars	☐ Ticking	☐ Whine
☐ Squeaks	☐ Rattles	☐ Scraping	☐ Other ________		

HOW OFTEN DOES IT OCCUR?

☐ Continuous ☐ Often ☐ Intermittent ☐ Just started ☐ Since new

WHEN DOES IT OCCUR?

☐ All the time	☐ Speed	☐ RPM	☐ Only moving	☐ On turns	☐ Braking
☐ Hard throttle	☐ Light throttle	☐ Decelerate	☐ Steady speed	☐ Idle in gear	☐ Idle out of gear
☐ Hot days	☐ Cold days	☐ Humid or rainy	☐ Temperature ________		
☐ Heavy bumps	☐ Light bumps	☐ Smooth pavement			

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50F15060

Fig. 11: Squeak, Rattle, & Noise Conditions

WATER LEAK - WINDNOISE

WATER LEAK
Leak Occurs When?

☐ Setting level ☐ Any time it rains ☐ While driving in the rain ☐ Car wash only
☐ Back lower than front (facing uphill) ☐ Front lower than back (facing downhill)

Location of Leak (where water appears):

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

WINDNOISE:
Location:

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

EXPLAIN: ____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50I15055

Fig. 12: Water Leak & Wind Noise

1993 ENGINE PERFORMANCE
Toyota System & Component Testing

Celica

INTRODUCTION

Before testing separate components or systems, perform procedures in F - BASIC TESTING article. Since many computer-controlled and monitored components set a trouble code if they malfunction, also perform procedures in G - TESTS W/CODES article.

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate wiring harness shorts or opens.

NOTE: When testing some systems, tachometer may be required. Tachometer must be connected to proper terminals. For tachometer connections, see IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

AIR INDUCTION SYSTEMS

TURBOCHARGERS (CELICA & MR2)

Initial Checks

1) Check air intake system for cracks or restrictions. Inspect exhaust system for leaks or restrictions.

2) Check air intake system and exhaust system for signs of oil leaks from turbocharger. Oil leaks can be caused by worn oil seals in turbocharger.

Wastegate Actuator

1) Disconnect hose from wastegate actuator. Using Pressure Gauge/Pump (SST 09992-00241), apply approximately 9.4 psi (.66 kg/cm^2) of pressure to wastegate actuator. See Fig. 1. Ensure wastegate actuator rod moves.

2) Replace turbocharger assembly if wastegate actuator rod does not move. Remove pressure gauge/pump and reconnect hose.

CAUTION: DO NOT apply more than 11.4 psi (.8 kg/cm^2) pressure to wastegate actuator.

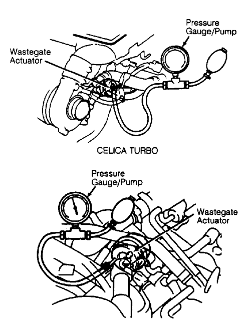


Fig. 1: Checking Wastegate Actuator (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Turbo pressure may be referred to as boost pressure. Tachometer is required when checking turbo pressure. If installing tachometer, ensure it is connected to proper terminals. For tachometer connections, see IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

Turbo Pressure Check

1) Ensure intake air hoses are connected. Install hose, "T" fitting and pressure gauge between intake manifold and turbocharging pressure sensor. See Fig. 2.

2) Drive vehicle with engine at 2800 RPM or more with throttle fully open and transaxle in 2nd gear (Celica) or 3rd gear (MR2), and note turbo pressure. Turbo pressure should be 7.1-11.8 psi (.50-.83kg/cm²).

3) If turbo pressure is less than specified, check intake air and exhaust systems for leaks. If no leaks exist, replace turbocharger. If turbo pressure exceeds specification, check wastegate actuator hose for leaks or cracks. If no leaks or cracks exist, replace turbocharger. Remove test equipment.

NOTE: Ensure turbocharging pressure sensor and vacuum switching valve are okay. For testing procedures, see ENGINE SENSORS & SWITCHES.

Impeller Wheel Rotation

Disconnect air cleaner hose. Rotate impeller wheel in air intake side of turbocharger and verify smooth rotation. Replace turbocharger if impeller wheel binds, drags or does not rotate smoothly.

Turbine Shaft End Play & Radial Play

1) Disconnect intake and exhaust hoses and pipes from turbocharger. Disconnect oil drain tube from turbocharger.

2) Install dial indicator with stem resting against end of shaft on impeller wheel (intake side). Push turbine wheel (exhaust) side of shaft toward dial indicator and zero dial indicator. Push impeller wheel (intake side) away from dial indicator, and note end play reading on dial indicator.

3) Remove dial indicator and reinstall with stem extending into oil drain tube hole and against center of turbine shaft. Pull impeller wheel (intake side) and turbine wheel upward toward dial indicator and zero dial indicator.

4) Push impeller wheel and turbine wheel downward and note radial play reading on dial indicator. Replace turbocharger if end play or radial play exceeds specification. See TURBOCHARGER SPECIFICATIONS table. Reinstall oil drain tube, intake and exhaust hoses, and pipes.

TURBOCHARGER SPECIFICATIONS TABLE

Measurement	In. (mm)
End Play	.0051 (.130)
Radial Play	.0071 (.180)

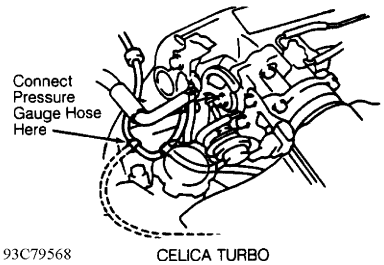


Fig. 2: Checking Turbo Pressure (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

VARIABLE INDUCTION SYSTEMS

NOTE: Tachometer may need to be installed when checking variable induction system. Ensure tachometer is connected to proper terminals. For tachometer connections, see IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

System Operation

1) Warm engine to normal operating temperature. Shut engine off. Using vacuum "T", install vacuum gauge in vacuum line between variable induction Vacuum Switching Valve (VSV) and variable induction vacuum actuator. Variable induction VSV is located below intake manifold, near cylinder block. See Fig. 3.

NOTE: Variable induction VSV may also be referred to as the T-VIS VSV.

2) Start engine. Vacuum gauge should indicate high vacuum at idle. Note that variable induction vacuum actuator rod moves inward so valves on variable induction system close.

3) Increase engine speed to greater than 4200 RPM. No vacuum should be indicated on vacuum gauge. Variable induction vacuum actuator rod should move outward so valves are open. If system operates correctly, all components are okay. If vacuum reading was obtained at idle, but variable induction vacuum actuator does not operate, check variable induction vacuum actuator.

4) If no vacuum reading was obtained at idle, check vacuum supply to vacuum tank. Vacuum tank is located below intake manifold. See Fig. 3.

5) If no vacuum supply exists, check vacuum hoses and circuit. If vacuum supply is okay, check vacuum tank, variable induction VSV and all hoses. If components are okay, check wiring circuit for variable induction VSV. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

6) On Celica Turbo, Engine Control Module (ECM) controls variable induction VSV ground circuit on Blue/Green wire. ECM is located at bottom center of dash, in front of console. Power is supplied to VSV through EFI main relay.

8) If necessary to check EFI main relay, see EFI MAIN RELAY under RELAYS. Repair as necessary and recheck system operation.

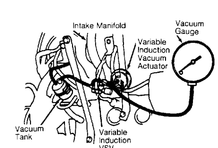


Fig. 3: Component ID & Checking Variable Induction System (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Vacuum Tank

1) Disconnect vacuum hoses from vacuum tank, located below intake manifold. See Fig. 3. Apply air pressure to port "A" on vacuum tank. Ensure air passes out port "B". Perform STEP 1. See Fig. 4. Apply air pressure to port "B". Ensure air does not pass out port "A". Perform STEP 2. See Fig. 4.

2) Using vacuum pump, apply approximately 20 in. Hg of vacuum to port "A". Perform STEP 3. See Fig. 4. Ensure vacuum reading will hold for at least one minute. Replace vacuum tank if defective. Remove vacuum pump. Reconnect vacuum hoses.

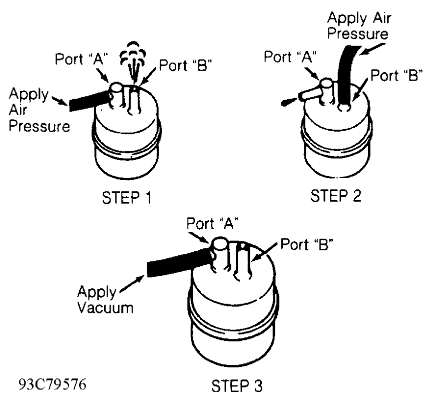


Fig. 4: Checking Vacuum Tank (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Variable induction VSV may also be referred to as T-VIS VSV.

Variable Induction Vacuum Switching Valve (VSV)

1) Disconnect electrical connector variable induction VSV, located below intake manifold, near cylinder block. See Fig. 3.

2) Using ohmmeter, ensure continuity exists between electrical terminals on VSV and resistance is 33-39 ohms. Check that no continuity exists between each electrical terminal and body of VSV.

3) Apply air pressure to port "E" and ensure air passes out filter. See Fig. 5. Connect battery voltage and ground to VSV terminals. Apply air pressure to port "E". Ensure air passes out port "F". See Fig. 5. Replace VSV if defective.

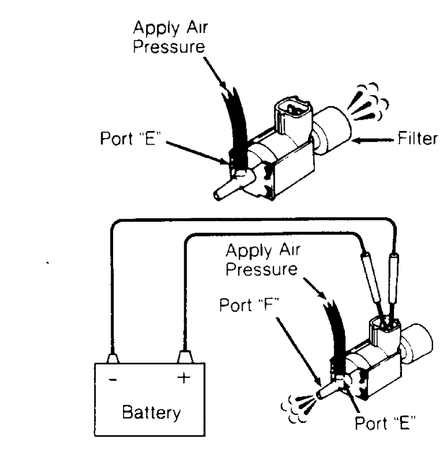


Fig. 5: Checking Variable Induction VSV (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Variable Induction Vacuum Actuator

1) Disconnect vacuum hose at variable induction vacuum

actuator. See Fig. 3. Using vacuum pump, apply about 16 in. Hg of vacuum to variable induction vacuum actuator. Ensure vacuum actuator rod pulls inward and valves move to closed position.

2) Release vacuum and note that variable induction vacuum actuator rod moves quickly outward so valves are open. Replace variable induction vacuum actuator if defective. Remove vacuum pump. Reconnect vacuum hose.

ENGINE SENSORS & SWITCHES

NOTE: Airflow meter may be referred to as Volume Airflow (VAF) meter or Mass Airflow (MAF) meter.

Airflow Meter (Except 1.6L 4A-FE & 2.2L 5S-FE)

1) Turn ignition off. Disconnect electrical connector from airflow meter. Note airflow meter terminal identification. See Fig. 6.

2) Using ohmmeter, measure resistance between specified terminals. See AIRFLOW METER RESISTANCE SPECIFICATIONS table. Replace airflow meter if resistance is not within specification.

3) On Supra Turbo models, check airflow meter operation. Ensure electrical connector is installed on airflow meter.

4) Connect voltmeter leads to proper terminals on airflow meter with electrical connector installed. Apply air into airflow meter and note voltage reading.

5) While air is being applied, voltage reading should fluctuate. Replace airflow meter if voltage reading was not obtained. Remove voltmeter.

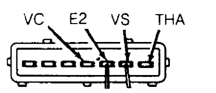


Fig. 6: Identifying Airflow Meter Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AIRFLOW METER RESISTANCE SPECIFICATIONS TABLE

Application & Terminals	Ohms
Turbo	
E2-VC	200-400
E2-THA	
-4°F (20°C)	10,000-20,000
32°F (0°C)	4000-7000
68°F (20°C)	2000-3000
104°F (40°C)	900-1300
140°F (60°C)	400-700
E2-VS	
Measuring Plate Fully Closed	200-600
Measuring Plate Fully Opened	20-1200

NOTE: Air temperature sensor may be referred to as intake air temperature sensor.

Air Temperature Sensor (1.6L 4A-FE & 2.2L 5S-FE)

1) Ensure ignition is off. Disconnect electrical connector from air temperature sensor. Air temperature sensor is located in air intake, near air filter.

2) Remove air temperature sensor. Place threaded end of air temperature sensor and thermometer in container of water. Attach

ohmmeter between air temperature sensor electrical terminals.

3) Heat water and note that resistance is within specification in relation to temperature. See Fig. 7. Replace air temperature sensor if defective.

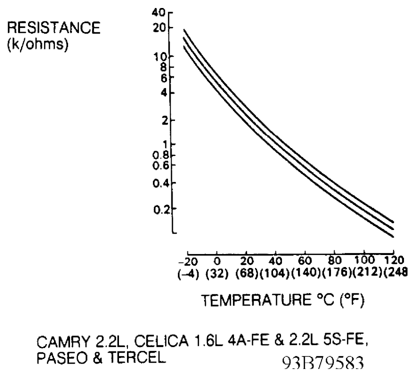


Fig. 7: Testing Air Temperature Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Cold Start Injector Time Switch (Turbo)

1) Ensure ignition is off. Disconnect electrical connector from cold start injector time switch.

2) Cold start injector time switch is located in engine coolant passage near cylinder head or thermostat housing. To verify wire colors for proper identification, see appropriate wiring diagram in L - WIRING DIAGRAMS article.

NOTE: Cold start injector time switch may also be identified using appropriate illustration in E - THEORY/OPERATION article.

3) Note cold start injector time switch terminal identification. See Fig. 8. Using ohmmeter, measure resistance at designated switch terminals at specified temperature. See COLD START INJECTOR TIME SWITCH RESISTANCE SPECIFICATIONS table. Replace cold start injector time switch if resistance is not within specification.

COLD START INJECTOR TIME SWITCH RESISTANCE SPECIFICATIONS TABLE

Application & Terminals	Temperature °F (°C)	Ohms
Turbo		
STA-STJ	Less Than 50 (10)	30-50
	Greater Than 77 (25)	70-90
STA-Ground	.....	30-90

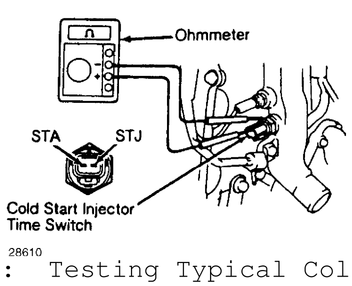


Fig. 8: Testing Typical Cold Start Injector Time Switch
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Coolant temperature sensor may also be referred to as Engine Coolant Temperature (ECT) sensor.

Coolant Temperature Sensor (CTS)

1) Ensure ignition is off. Disconnect electrical connector from CTS. CTS is located in engine coolant passage near cylinder head or thermostat housing. To verify wire colors for proper identification, see appropriate wiring diagram in L - WIRING DIAGRAMS article.

NOTE: The CTS may be also identified using appropriate illustration in E - THEORY/OPERATION article.

2) Using ohmmeter, check resistance between CTS electrical terminals. Resistance should be within specification at designated temperature. See Fig. 9. Replace CTS if resistance is not within specification.

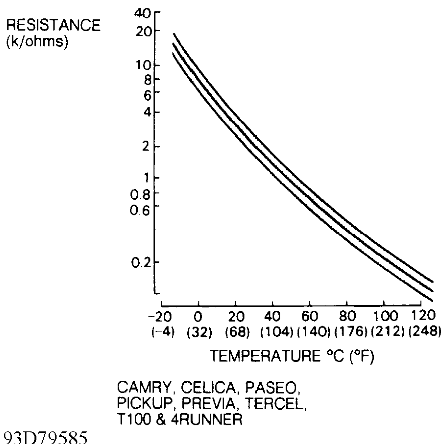


Fig. 9: Checking Coolant Temperature Sensor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EGR Gas Temperature Sensor

1) Remove EGR gas temperature sensor from side of EGR valve. Place threaded end of sensor and thermometer in container of water.

2) Attach ohmmeter to electrical terminals. Heat water and note resistance at specified temperature. See EGR GAS TEMPERATURE SENSOR SPECIFICATIONS table. Replace EGR gas temperature sensor if resistance is not within specification.

EGR GAS TEMPERATURE SENSOR SPECIFICATIONS TABLE

Temperature °F (°C)	k/ohms
122 (50)	69-89
212 (100)	11-15
302 (150)	2-4

Intake Air Temperature Sensor (1.6L 4A-FE & 2.2L 5S-FE)

See AIR TEMPERATURE SENSOR under ENGINE SENSORS & SWITCHES.

Knock Sensor (2.0L Turbo & 2.2L 5S-FE)

Information for testing of knock sensor is not available from manufacturer. Use diagnosis in trouble Code 52 and 53 charts. Some models only have trouble Code 52. For trouble code charts, see G - TESTS W/CODES article.

Manifold Absolute Pressure (MAP) Sensor

See VACUUM SENSOR under ENGINE SENSORS & SWITCHES.

Park/Neutral Switch

Disconnect electrical connector from park/neutral switch at transmission or transaxle. Note terminal identification. See Figs. 10 and 11. Using ohmmeter, check for continuity at specified terminals with gearshift in proper positions. See PARK/NEUTRAL SWITCH SPECIFICATIONS table. Replace switch if defective.

PARK/NEUTRAL SWITCH SPECIFICATIONS TABLE

Application & Gearshift Position	Terminal Continuity
2.2L 5S-FE	
Park	2 & 3, 1 & 6
Reverse	5 & 6
Neutral	2 & 3, 6 & 7
Drive	6 & 8
2	6 & 9
Low	4 & 6
1.6L 4A-FE	
Park	"B" & "N"
Reverse	RB & RL
Neutral	"B" & "N"

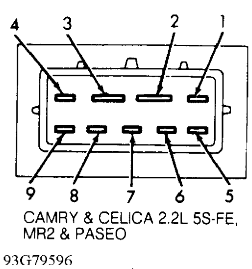


Fig. 10: Park/Neutral Switch Terminal ID (2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

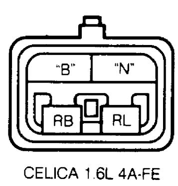


Fig. 11: Park/Neutral Switch Terminal ID (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Oxygen Sensor Feedback Voltage Test

1) Warm engine to normal operating temperature. Connect analog voltmeter to terminals VF1 and E1 of Data Link Connector No. 1 (DLC1). See Fig. 12. Perform test procedures listed. See Figs. 13 & 14.

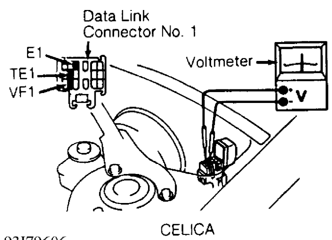
2) Depending on model application, some vehicles may be equipped with a main oxygen sensor, sub-oxygen sensor and a sensor heater. See OXYGEN SENSOR APPLICATION table.

NOTE: Diagnostic trouble Codes 21, 25, 26, 27 and 28 (some models) are oxygen sensor circuit codes. For trouble code charts, see G - TESTS W/CODES article.

OXYGEN SENSOR APPLICATION TABLE

Application	Main Oxygen Sensor	Sub-Oxygen Sensor	Sensor Heater
1.6L 4A-FE	X	.....	(2) X
2.0L Turbo	X	.....	(3) X
2.2L 5S-FE	X	(1) X	.....

(1) - Applies to California models.
(2) - Heater used on all except California models.
(3) - Heater used on main oxygen sensor.



93179606
Fig. 12: Using Voltmeter For Testing Oxygen Sensor Feedback Voltage
Courtesy of Toyota Motor Sales, U.S.A., Inc.

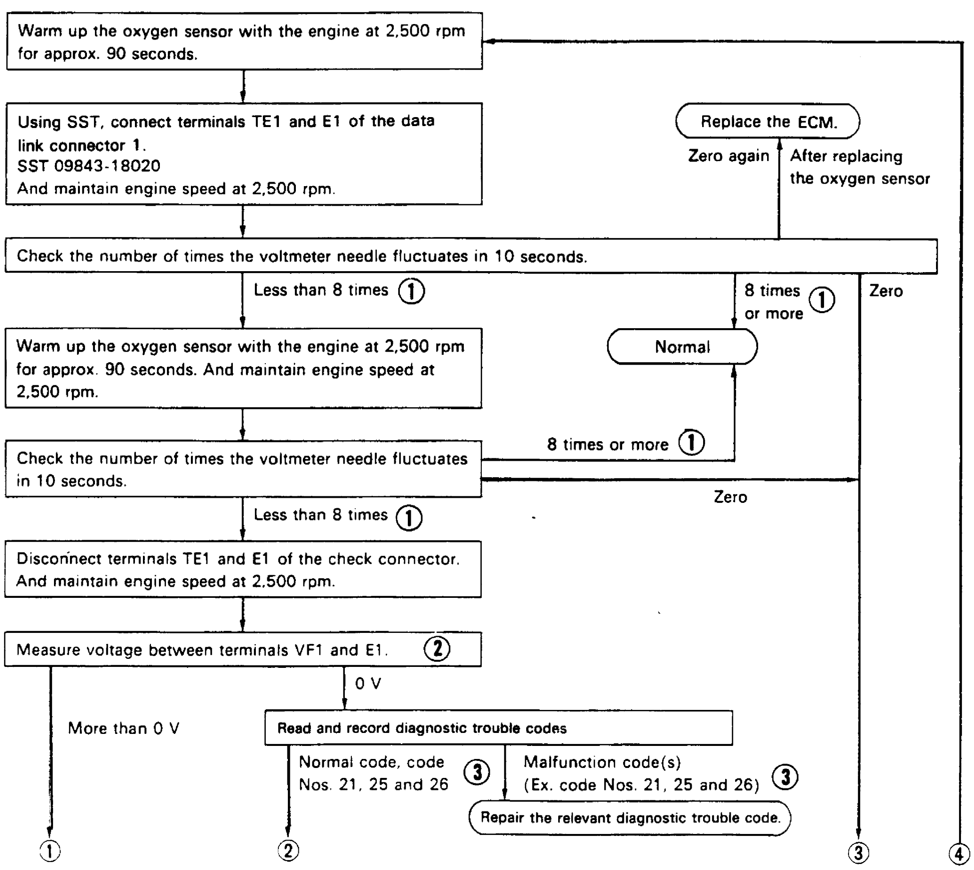


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Fig. 13: Performing Oxygen Sensor Feedback Voltage Test (1 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CONTINUED FROM PREVIOUS GRAPHIC

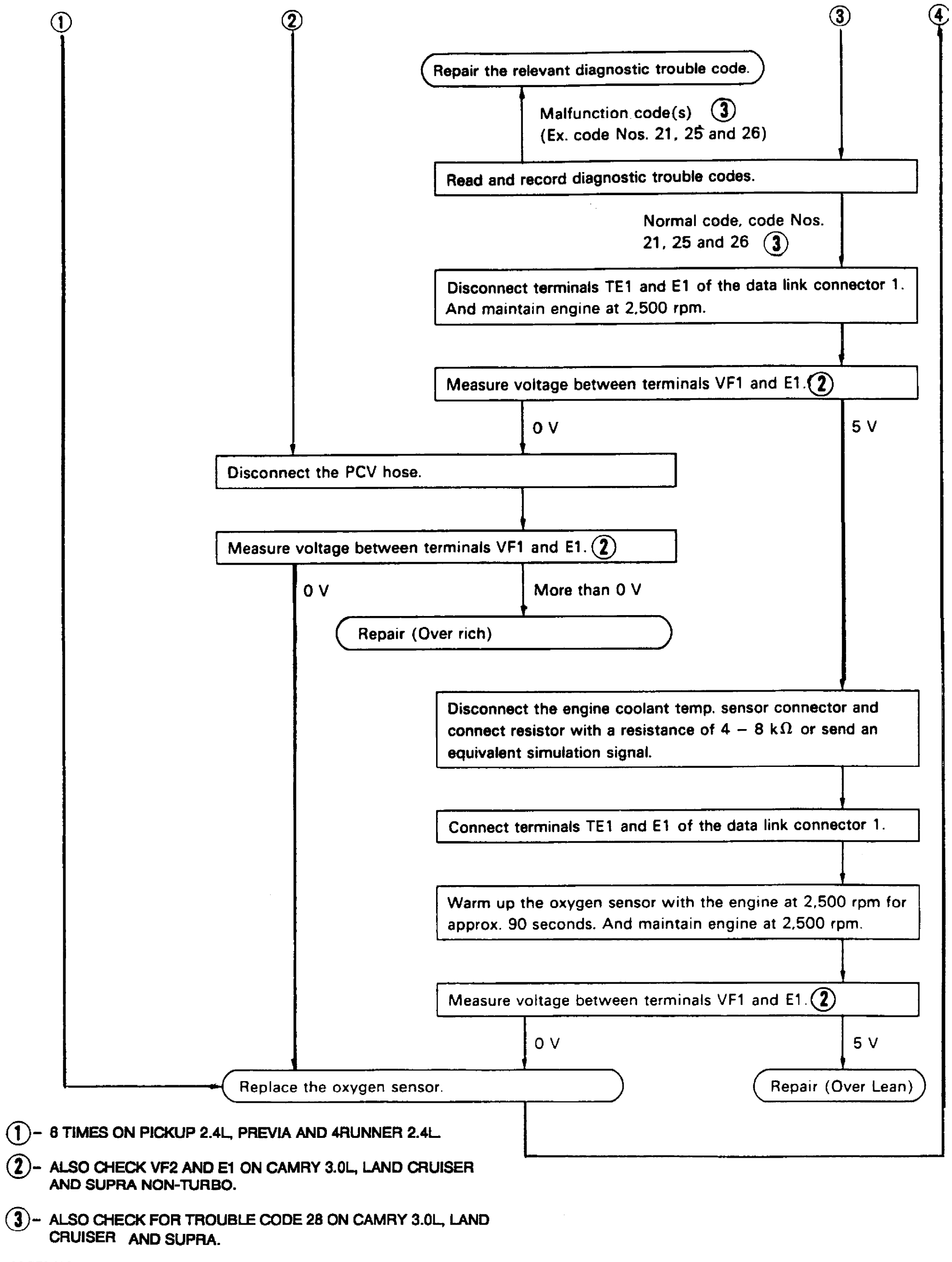

Fig. 14: Performing Oxygen Sensor Feedback Voltage Test (2 Of 2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Sub-oxygen sensor may be used only on California applications on some models. See OXYGEN SENSOR APPLICATION table.

Sub-Oxygen Sensor (2.2L 5S-FE)

1) Warm engine to normal operating temperature. Check Engine Control Module (ECM) for stored diagnostic trouble code(s). See

RETRIEVING TROUBLE CODES in G - TESTS W/CODES article. If sub-oxygen sensor or circuit fails, a trouble Code 27 will set in ECM memory. Clear codes if present. See CLEARING TROUBLE CODES in G - TESTS W/CODES article.

2) Drive vehicle between 50 and 62 MPH for at least 5 minutes in 4th or 5th gear (M/T) or Drive (A/T).

CAUTION: DO NOT drive vehicle at speeds exceeding 62 MPH, or trouble code will be cancelled.

3) On all other models, drive vehicle at speeds less than 50 MPH for at least 5 minutes in 4th or 5th gear (M/T) or Drive (A/T). On all models, fully depress accelerator pedal for at least 2 seconds.

4) Stop engine and turn ignition off. Repeat steps and note if trouble Code 27 exists again. If trouble Code 27 exists again, check sub-oxygen sensor circuit for continuity, shorts or grounds. Replace sub-oxygen sensor if circuit is okay.

NOTE: Oxygen sensor heater may be used only on California applications on some models. See OXYGEN SENSOR APPLICATION table.

Oxygen Sensor Heater (1.6L 4A-FE Except Calif. & Turbo)

1) Disconnect electrical connector from oxygen sensor. Using ohmmeter, measure resistance between sensor terminals +B and HT. See Figs. 15 and 16.

2) Replace oxygen sensor if resistance is not within specification. See OXYGEN SENSOR HEATER RESISTANCE SPECIFICATIONS table.

OXYGEN SENSOR HEATER RESISTANCE SPECIFICATIONS TABLE

Application	Ohms
Celica	5.1-6.3 @ 68°F (20°C)

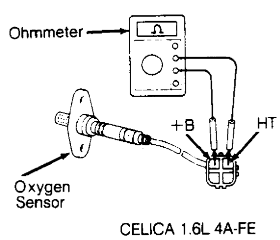

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Fig. 15: Testing Oxygen Sensor Heater (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

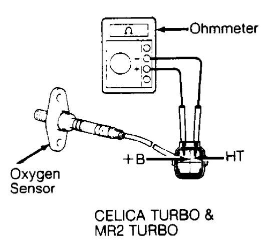

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Fig. 16: Testing Oxygen Sensor Heater (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Pick-Up Coils

See PICK-UP COIL AIR GAP and PICK-UP COIL RESISTANCE under

IGNITION CHECKS in F - BASIC TESTING article.

Throttle Position Sensor (TPS)

1) Turn ignition off. Disconnect electrical connector from TPS on throttle body. Note terminal identification. See Figs. 29 and 30.

2) Insert specified thickness feeler gauge between throttle stop screw and throttle lever and check resistance or continuity. See appropriate TPS RESISTANCE SPECIFICATIONS table. Replace or adjust TPS if not within specification.

NOTE: Some models require that vacuum be applied to throttle opener before checking TPS. See appropriate TPS RESISTANCE SPECIFICATIONS table.

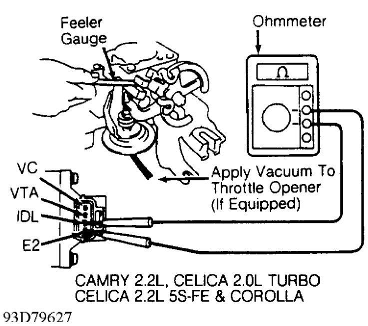

Fig. 17: Checking Throttle Position Sensor (2.0L Turbo & 2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

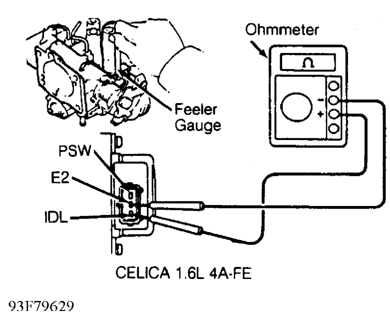

Fig. 18: Checking Throttle Position Sensor (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TPS RESISTANCE SPECIFICATIONS TABLE

Application	Clearance In. (mm)	Terminal	Ohmmeter Reading
1.6L 4A-FE	.024 (.61)	IDL & E2	Continuity
		PSW-E2	No Continuity
	.031 (.79)	IDL-E2	No Continuity
		PSW-E2	No Continuity
	Fully Open	IDL-E2	No Continuity
		PSW-E2	Continuity
2.0L Turbo (1)	0 (0)	VTA & E2	470-6100
	.020 (.51)	IDL & E2	2300 Or Less
	.028 (.71)	IDL & E2	No Continuity
	Fully Open	VTA & E2	3100-12,100
		VC & E2	3900-9000
2.2L 5S-FE (1)	0 (0)	VTA & E2	200-5700
	.020 (.51)	IDL & E2	2300 Or Less
	.028 (.71)	IDL & E2	No Continuity
	Fully Open	VTA & E2	2000-10,200

VC & E2	2500-5900

(1) - Apply vacuum to throttle opener before checking TPS.

Turbocharging Pressure Sensor (Turbo)

1) Ensure ignition is off. To check turbocharging pressure sensor supply voltage, disconnect electrical connector from turbocharging pressure sensor.

2) Sensor is mounted near firewall, close to brake booster.

NOTE: Turbocharging pressure sensor has a vacuum hose connected to it and may be identified by wire colors. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Turbocharging pressure sensor may also be identified using appropriate illustration in E - THEORY/OPERATION article.

3) Turn ignition on. Using voltmeter, measure voltage between terminals VC and E2 of wiring harness side of electrical connector. See Fig. 19. Voltage should be 4.5-5.5 volts.

4) If voltage is not within specification, check wiring circuit. See appropriate wiring diagram in L - WIRING DIAGRAMS article. If voltage is correct, turn ignition off. Reinstall electrical connector on turbocharging pressure sensor.

5) To check turbocharging pressure sensor output voltage, turn ignition on. Disconnect turbocharging pressure sensor vacuum hose from intake manifold. Connect voltmeter to terminals PIM and E2 of Engine Control Module (ECM). See Fig. 20. See ECM LOCATION table.

ECM LOCATION TABLE

Application	Location
Turbo	Bottom Center Of Dash, In Front Of Console

6) Measure and record output voltage under ambient atmospheric pressure. Attach vacuum pump to turbocharging pressure sensor.

7) Apply vacuum in specified increments and measure output voltage drop at each increment. See TURBOCHARGING PRESSURE SENSOR OUTPUT VOLTAGE SPECIFICATIONS table. Replace turbocharging pressure sensor if output voltage drop is not within specification. Reinstall vacuum hose.

TURBOCHARGING PRESSURE SENSOR OUTPUT VOLTAGE SPECIFICATIONS TABLE

Applied Vacuum In. Hg	Output Voltage Drop
3.94	.15-.35
7.87	.40-.60
11.81	.65-.85
15.75	.90-1.10
19.69	1.15-1.35

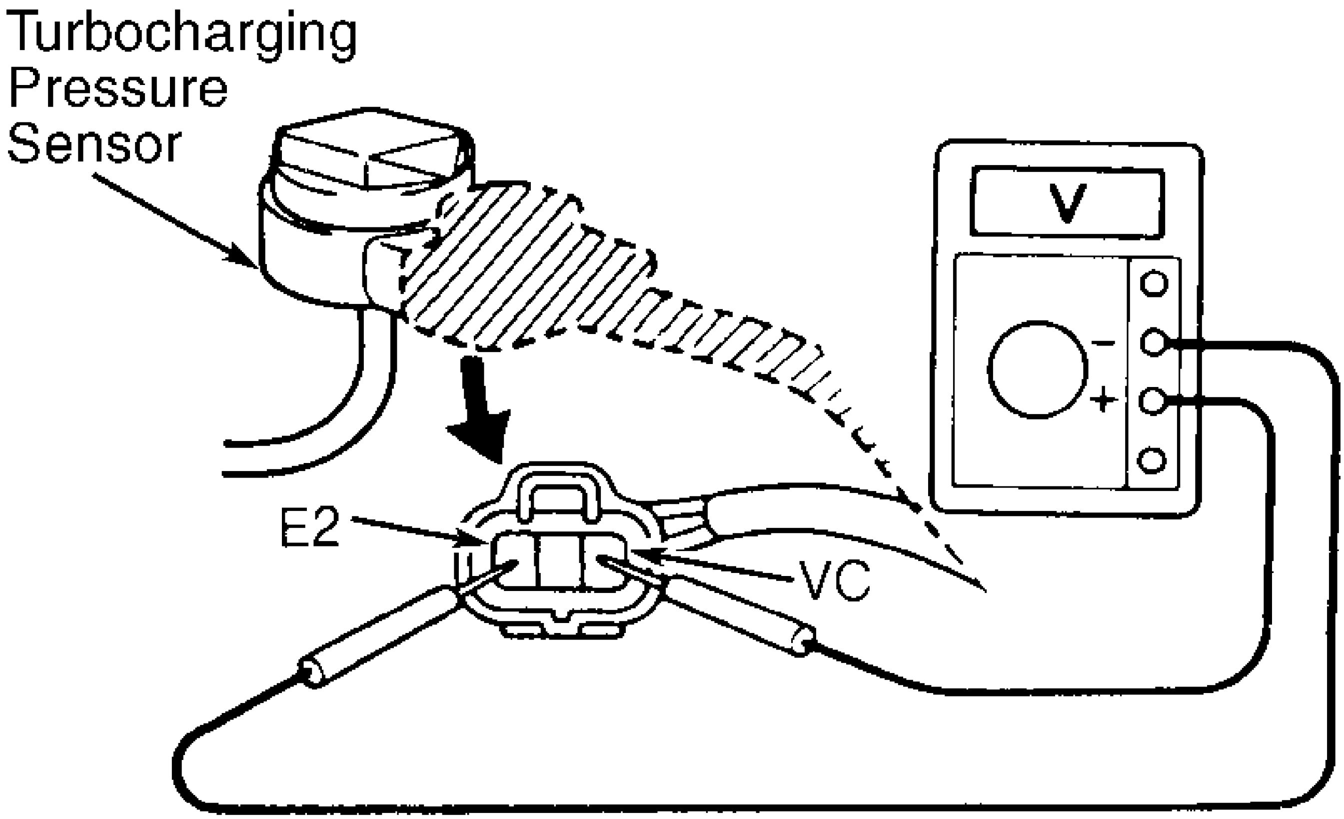

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Fig. 19: Measuring Turbocharging Pressure Sensor Supply Voltage
Courtesy of Toyota Motor Sales, U.S.A., Inc.

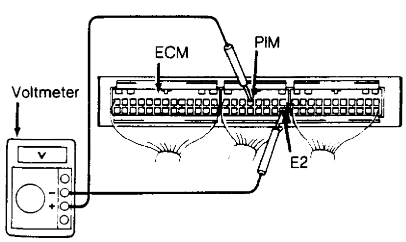

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Fig. 20: Measuring Turbocharging Pressure Sensor Output Voltage
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Turbocharging Pressure Vacuum Switching Valve (Turbo)

1) Disconnect electrical connector and hoses from turbocharging pressure Vacuum Switching Valve (VSV), located on lower area of air intake chamber. See Fig. 21.

2) Using ohmmeter, check resistance between turbocharging VSV electrical terminals. Replace VSV if resistance is not 24-30 ohms.

3) Check that no continuity exists between each electrical terminal and VSV body. Apply air pressure to port "B". Ensure no air passes from port "A". See Fig. 22.

4) Connect battery voltage to VSV terminals. Apply air pressure to port "B". Ensure air passes from port "A". See Fig. 22. Replace VSV if defective.

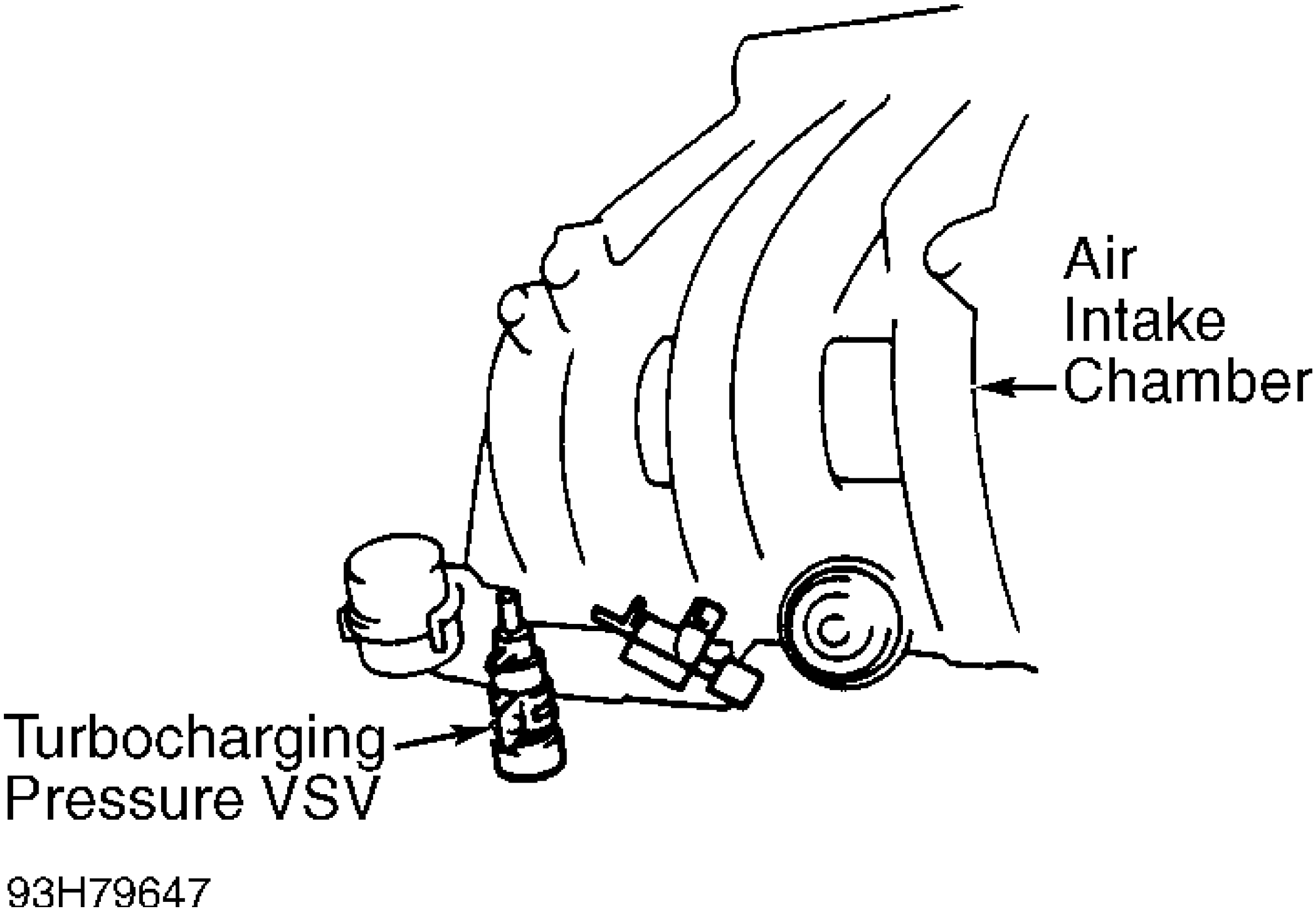

Fig. 21: Identifying Turbocharging Pressure VSV (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

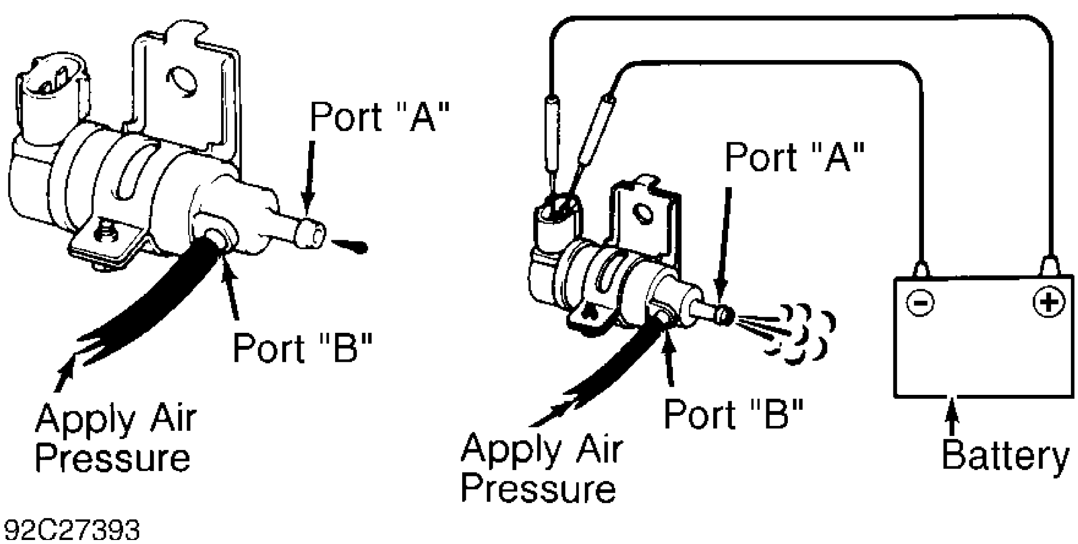

Fig. 22: Checking Turbocharging Pressure VSV (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Vacuum Sensor (1.6L 4A-FE & 2.2L 5S-FE)
1) Ensure ignition is off. To check vacuum sensor supply

voltage, disconnect electrical connector from vacuum sensor. See VACUUM SENSOR LOCATIONS table.

NOTE: Vacuum sensor may also be identified using appropriate illustration in E - THEORY/OPERATION article. Vacuum sensor has a vacuum hose connected to it and may be identified by wire colors. See appropriate wiring diagram in WIRING DIAGRAMS article.

VACUUM SENSOR LOCATIONS TABLE

Application	Location
Celica	Center Of Firewall In Engine Compartment

2) Turn ignition on. Using voltmeter, measure voltage between terminals VCC and E2 of electrical connector on wiring harness. See Fig. 23. The VCC and E2 terminals are the 2 outer terminals on all models. Voltage should be within specification. See VACUUM SENSOR SUPPLY VOLTAGE SPECIFICATIONS table.

VACUUM SENSOR SUPPLY VOLTAGE SPECIFICATIONS TABLE

Application	Voltage
1.6L 4A-FE & 2.2L 5S-FE	4.50-5.50

3) If supply voltage is not within specification, check wiring circuit. See appropriate wiring diagram in L - WIRING DIAGRAMS article. If supply voltage is correct, turn ignition off. Reinstall electrical connector on vacuum sensor.

4) To check vacuum sensor output voltage, turn ignition on. Disconnect vacuum sensor vacuum hose from intake manifold. Connect voltmeter to terminals PIM and E2 of Engine Control Module (ECM). See Figs. 24-26. See ECM LOCATION table.

ECM LOCATION TABLE

Application	Location
Celica	Bottom Center Of Dash, In Front Of Console

5) Measure and record output voltage under ambient atmospheric pressure. Attach vacuum pump to vacuum sensor.

6) Apply vacuum in specified increments and measure output voltage drop at each increment. See VACUUM SENSOR OUTPUT VOLTAGE DROP SPECIFICATIONS table. Replace vacuum sensor if output voltage drop is not within specification.

VACUUM SENSOR OUTPUT VOLTAGE DROP SPECIFICATIONS TABLE

Applied Vacuum In. Hg	Output Voltage Drop
3.94	.3-.5
7.87	.7-.9
11.81	1.1-1.3
15.75	1.5-1.7
19.69	1.9-2.1

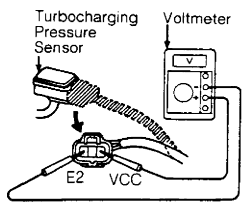

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Fig. 23: Measuring Vacuum Sensor Supply Voltage (Camry 2.2L Shown; Others Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

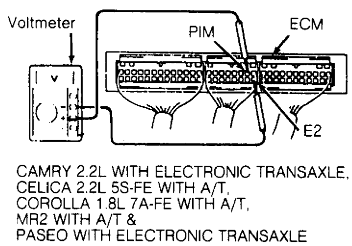

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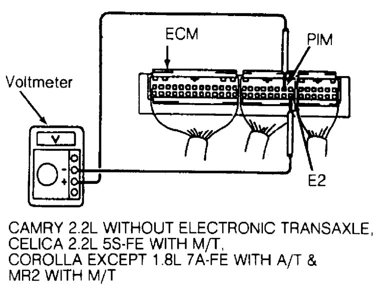
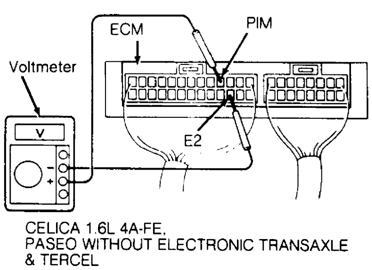
Fig. 24: Measuring Vacuum Sensor Output Voltage (2.2L 5S-FE With A/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93H79894
Fig. 25: Measuring Vacuum Sensor Output Voltage (2.2L 5S-FE With M/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

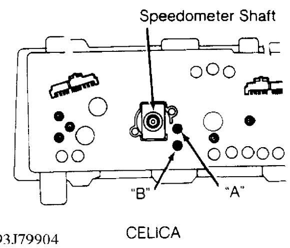


93I79895
Fig. 26: Measuring Vacuum Sensor Output Voltage (1.6L 4A-FE With A/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Vehicle Speed Sensor

1) Vehicle speed sensor is located on rear of combination meter in instrument cluster. Connect ohmmeter between terminals "A" and "B". Terminals are located near vehicle speed sensor. See Fig. 27.

2) Rotate speedometer cable shaft and note reading. Ohmmeter should deflect from continuity to no continuity 4 times per speedometer cable shaft revolution. Replace vehicle speed sensor or speedometer if reading does not deflect as specified.



93J79904
Fig. 27: Identifying Vehicle Speed Sensor Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CONTROL UNITS

FUEL PUMP ELECTRONIC CONTROL UNIT

See FUEL CONTROL under FUEL SYSTEM.

RELAYS

CIRCUIT OPENING RELAY

Circuit Opening Relay

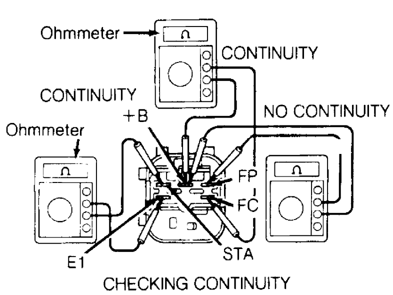
1) Ensure ignition is off. Remove circuit opening relay. See CIRCUIT OPENING RELAY LOCATION table. Using ohmmeter, check continuity between specified terminals. See Figs. 45-49.

2) Check circuit opening relay operation by applying battery voltage and ground and checking continuity between specified terminals. See Figs. 45-49. Replace circuit opening relay if defective.

NOTE: Circuit opening relay may also be identified using appropriate illustration in E - THEORY/OPERATION article or wire color. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

CIRCUIT OPENING RELAY LOCATION TABLE

Application	Location
Celica	Bottom Center Of Dash, In Front Of Console, Attached To ECM



92F27404
Fig. 28: Testing Circuit Opening Relay - Checking Continuity (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

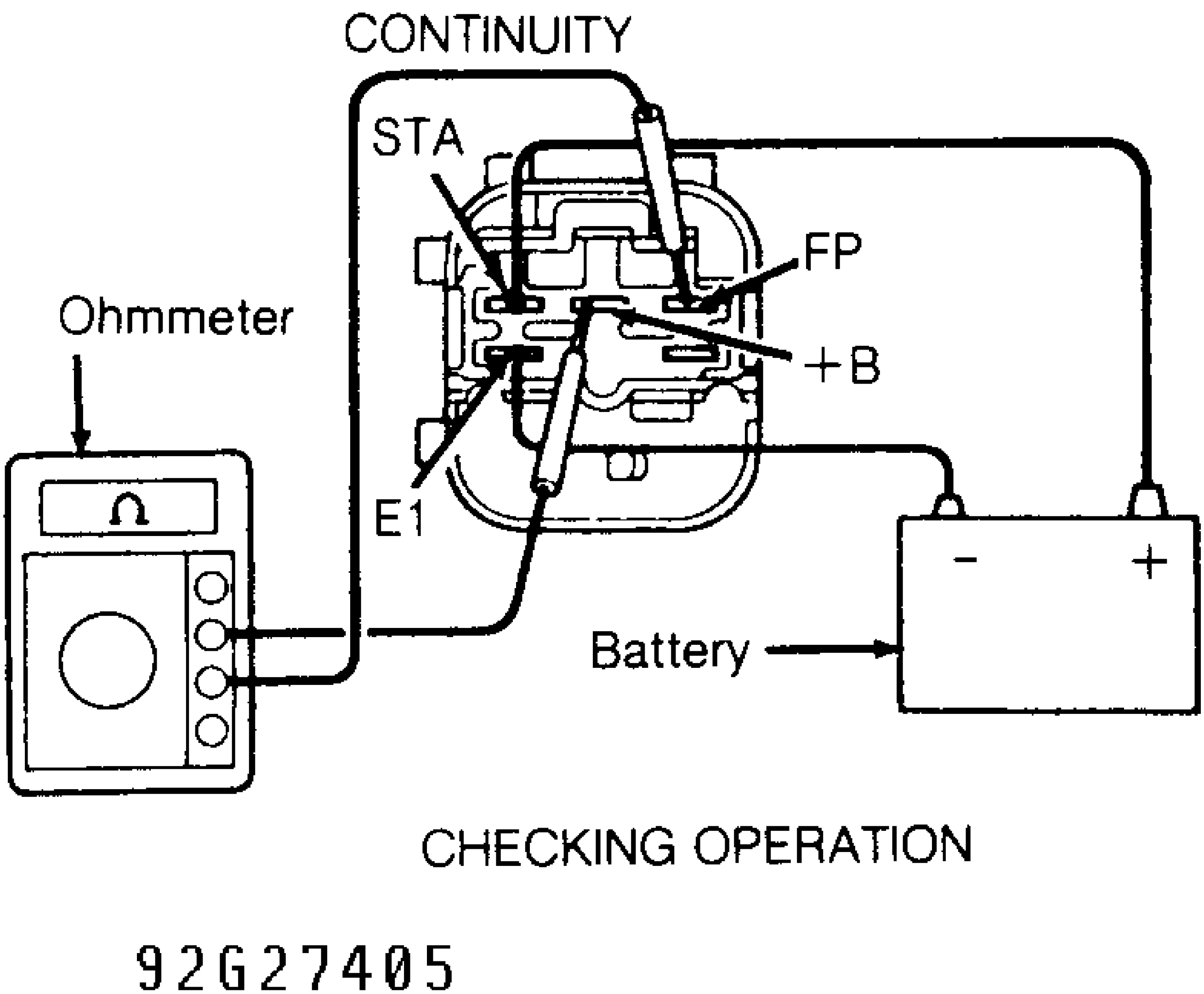


Fig. 29: Testing Circuit Opening Relay - Checking Operation (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

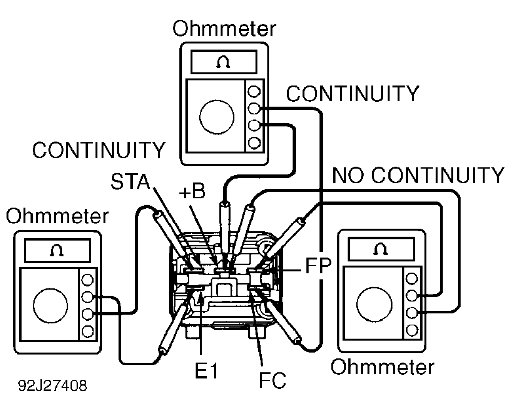


Fig. 30: Testing Circuit Opening Relay - Checking Continuity (1.
6L & 2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

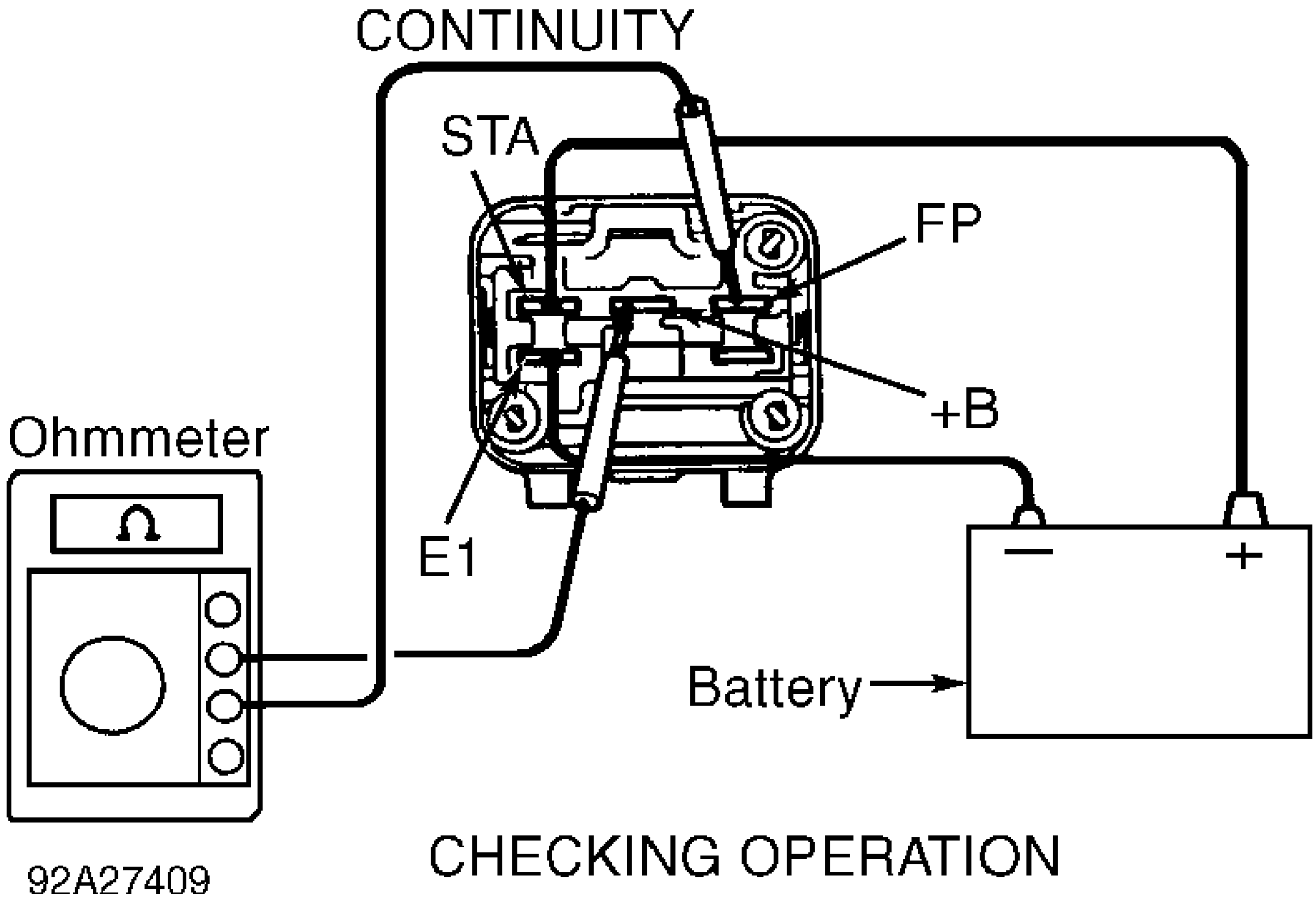


Fig. 31: Testing Circuit Opening Relay - Checking Operation (1.6L & 2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EFI MAIN RELAY

NOTE: The EFI main relay may also be referred to as MFI main relay, SFI main relay or MPI main relay.

1) Ensure ignition is off. Remove EFI main relay. See EFI MAIN RELAY LOCATION table. Using ohmmeter, check continuity between specified terminals. See Figs. 32 and 33.

2) Check EFI main relay operation by applying battery voltage and ground and checking continuity between specified terminals. See Figs. 32 and 33. Replace EFI main relay if defective.

NOTE: The EFI main relay may also be identified using appropriate illustration in E - THEORY/OPERATION article or wire color. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

EFI MAIN RELAY LOCATION TABLE

Application	Location
Celica	Relay Box Near Air Filter In Left Corner Of Engine Compartment

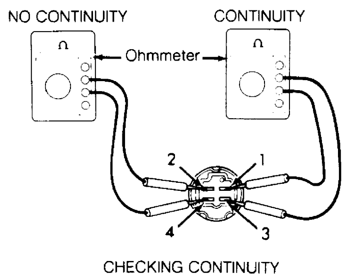


Fig. 32: Testing EFI Main Relay - Checking Continuity
Courtesy of Toyota Motor Sales, U.S.A., Inc.

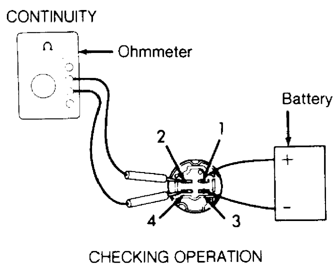


Fig. 33: Testing EFI Main Relay - Checking Operation
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FUEL PUMP RELAY

Fuel Pump Relay (Turbo)

1) Ensure ignition is off. Remove fuel pump relay. See FUEL PUMP RELAY LOCATION table. Using ohmmeter, check continuity between specified terminals. See Figs. 34 and 35.

2) Check fuel pump relay operation by applying battery voltage and ground and checking continuity between specified terminals. See Fig. 34 and 35. Replace fuel pump relay if defective.

NOTE: Fuel pump relay may also be identified using appropriate illustration in E - THEORY/OPERATION article or wire color. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

FUEL PUMP RELAY LOCATION TABLE

Application	Location
Celica Turbo	Relay Box Near Radiator In Passenger's Front Corner Of Engine Compartment

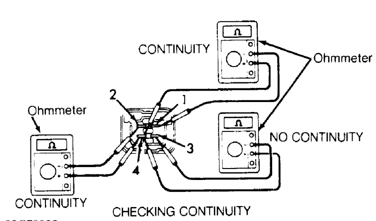


Fig. 34: Testing Fuel Pump Relay - Checking Continuity (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

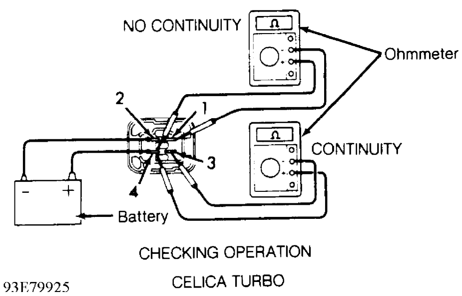


Fig. 35: Testing Fuel Pump Relay - Checking Operation (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

IGNITION MAIN RELAY

See IGNITION MAIN RELAY under IGNITION SYSTEM.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For fuel system pressure testing, see F - BASIC TESTING article.

Circuit Opening Relay
See CIRCUIT OPENING RELAY under RELAYS.

EFI Main Relay
See EFI MAIN RELAY under RELAYS.

Fuel Pump Relay
See FUEL PUMP RELAY under RELAYS.

Fuel Pump Resistor
1) Ensure ignition is off. Disconnect fuel pump resistor electrical connector. See FUEL PUMP RESISTOR LOCATION table.

NOTE: Fuel pump resistor may also be identified using appropriate illustration in E - THEORY/OPERATION article. On Celica Turbo, ensure proper resistor is checked, as fuel injector solenoid resistor is located near fuel pump resistor.

2) Using ohmmeter, measure resistance between fuel pump resistor electrical terminals. See Fig. 36. Replace fuel pump resistor if resistance is not about .73 ohm.

FUEL PUMP RESISTOR LOCATION TABLE

Application	Location
Celica Turbo	Driver's Side Front Corner Of Engine Compartment & Contains 2-Wire Connector

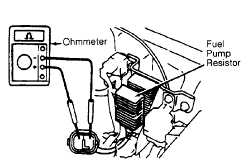


Fig. 36: Testing Fuel Pump Resistor (MR2 Shown; Others Are Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FUEL CONTROL

NOTE: Fuel injector solenoid resistor may also be referred to as EFI resistor, SFI resistor or solenoid resistor.

Fuel Injector Solenoid Resistor (Turbo)

1) Ensure ignition is off. Disconnect fuel injector solenoid resistor electrical connector. See FUEL INJECTOR SOLENOID RESISTOR LOCATION table.

NOTE: Fuel injector solenoid resistor may also be identified using appropriate illustration in E - THEORY/OPERATION article. On Celica Turbo, ensure proper resistor is checked, as fuel pump resistor is located near fuel injector solenoid resistor.

2) Using ohmmeter, measure resistance between terminal +B and other fuel injector solenoid resistor electrical terminals. See Fig. 37. Replace fuel injector solenoid resistor if resistance is not within specification. See FUEL INJECTOR SOLENOID RESISTOR SPECIFICATIONS table.

FUEL INJECTOR SOLENOID RESISTOR LOCATION TABLE

Application	Location
Celica Turbo	Driver's Side Front Corner Of Engine Compartment & Contains 5-Wire Connector

FUEL INJECTOR SOLENOID RESISTOR SPECIFICATIONS TABLE

Application	Ohms
Celica Turbo	4-6

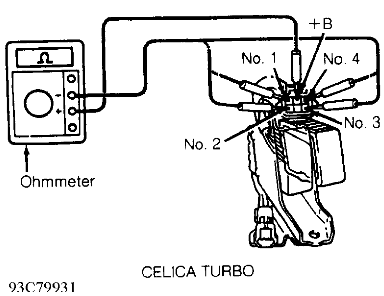


Fig. 37: Testing Fuel Injector Solenoid Resistor (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fuel Injectors

1) Ensure ignition is off. Disconnect electrical connector at fuel injector. Using ohmmeter, measure resistance between fuel injector electrical terminals. Replace fuel injector if resistance is not within specification. See FUEL INJECTOR RESISTANCE SPECIFICATIONS table.

2) To check fuel injector spray pattern and volume, remove fuel injector. See N - REMOVE/INSTALL/OHAUL article. Disconnect fuel hose from fuel filter outlet. Use Delivery Hose (09268-41045) to install fuel injector between fuel filter and fuel pressure regulator. See Figs. 38 and 39.

3) Place fuel injector into a clean graduated container.

Place vinyl tube on end of fuel injector to prevent fuel spillage. Install Jumper Wire (SST 09843-18020) between +B and FP terminals of data link connector No. 1. Turn ignition on, with engine off to pressurize fuel system.

NOTE: For proper location of data link connector No. 1 and terminal identification, see F - BASIC TESTING article. Jumper wire is installed in data link connector No. 1 when checking fuel pump operation and fuel pressure.

4) Connect fuel injector tester to fuel injector for 15 seconds. Use Fuel Injector Tester (09842-30060) for Turbo.

5) Measure fuel injector volume and check spray pattern. Test each fuel injector 2-3 times. Replace fuel injector if volume is not as specified. See FUEL INJECTOR VOLUME SPECIFICATIONS table.

NOTE: Ensure difference between fuel injector volume on all fuel injectors is within specification. See FUEL INJECTOR VOLUME SPECIFICATIONS table.

6) Disconnect fuel injector tester. Ensure fuel leakage from end of fuel injector is one drop or less in specified time. See FUEL INJECTOR LEAKAGE SPECIFICATIONS table. Replace fuel injector if leakage exceeds specified amount. Turn ignition off and remove test equipment.

FUEL INJECTOR RESISTANCE SPECIFICATIONS TABLE

Application	Ohms
1.6L 4A-FE & 2.2L 5S-FE	13.8
2.0L Turbo	2.0-4.0

FUEL INJECTOR VOLUME SPECIFICATIONS TABLE

Application	Cu. In. (cc)
1.6L 4A-FE	2.4-3.1 (40-50)
2.0L Turbo	5.8-7.3 (95-120)
2.2L 5S-FE	3.0-3.6 (49-59)
Maximum Difference Between Each Fuel Injector	
All	.3 (5)

FUEL INJECTOR LEAKAGE SPECIFICATIONS TABLE

Application	Leakage Time
All	1 Minute

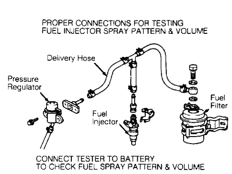


Fig. 38: Testing Fuel Injector Spray Pattern & Volume
Courtesy of Toyota Motor Sales, U.S.A., Inc.

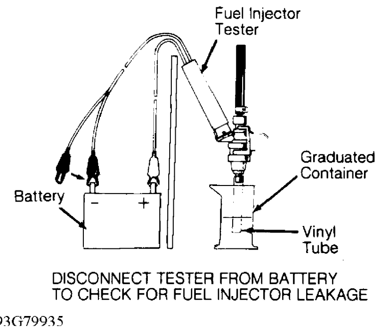


Fig. 39: Testing Fuel Injector For Leakage
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Fuel pressure control system may also be referred to as fuel pressure-up system.

Fuel Cut System (1.6L 4A-FE)

1) Install tachometer. Ensure tachometer is connected to proper terminals. See IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

CAUTION: Some tachometers may not be compatible with ignition system. Consult tachometer manufacturer before connecting tachometer to system. To avoid possible damage to ignitor and/or coil, DO NOT allow tachometer terminal to become grounded.

2) Disconnect electrical connector from throttle position sensor. Install jumper wire between IDL and E2 terminals on wiring harness side. See Fig. 40.

3) Start engine and warm to normal operating temperature. Ensure all accessories are off. Gradually increase engine RPM. Note fluctuation in tachometer reading to indicate fuel cut RPM and fuel return RPM. See Fig. 41.

4) Ensure fuel cut and fuel return RPM are within specification. See FUEL CUT SYSTEM SPECIFICATIONS table. Shut engine off. Disconnect tachometer. Reinstall electrical connector on throttle position sensor.

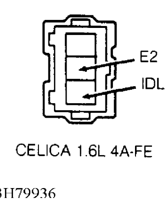


Fig. 40: Throttle Position Sensor Connector Terminal ID (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

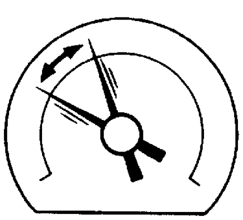


Fig. 41: Needle Fluctuations For Fuel Cut System RPM Test (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fuel Cut System (Except 1.6L 4A-FE)

1) Install tachometer. Tachometer must be connected to proper terminals. See IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

CAUTION: Some tachometers may not be compatible with ignition system. Consult tachometer manufacturer before connecting tachometer to system. To avoid possible damage to ignitor and/or coil, DO NOT allow tachometer terminal to become grounded.

2) Start engine and warm to normal operating temperature. Ensure all accessories are off. Gradually increase engine RPM to maintain at least specified engine speed. See FUEL CUT SYSTEM TESTING SPECIFICATION table.

FUEL CUT SYSTEM TESTING SPECIFICATION TABLE

Application	Engine RPM
Except 1.6L 4A-FE	2500

3) Using stethoscope, check for fuel injector operating sound. Ensure when throttle lever is released, fuel injector stops operating momentarily (fuel cut RPM) and then resumes operating (fuel return RPM).

4) Ensure fuel cut RPM (if available) and fuel return RPM are within specification. See FUEL CUT SYSTEM SPECIFICATIONS table. Shut engine off. Disconnect tachometer.

FUEL CUT SYSTEM SPECIFICATIONS TABLE

Application	Fuel Cut RPM	Fuel Return RPM
1.6L 4A-FE	2300	1700
2.0L Turbo	(1)	1600
2.2L 5S-FE	(1)	1500

(1) - Fuel cut specification is not available from manufacturer.

Cold Start Injector (Turbo)

1) Disconnect negative battery cable. Disconnect cold start injector wiring harness connector.

2) Using ohmmeter, measure resistance between electrical terminals of cold start injector. Replace cold start injector if resistance is not 2-4 ohms. Remove cold start injector. See N - REMOVE/INSTALL/OHAUL article.

3) Install Union Adapters (SST 09268-41045) with NEW gaskets on cold start injector and delivery pipe. Connect delivery hose to union adapters. See Figs. 42 and 43.

4) Reconnect negative battery cable. Connect Jumper Wire (SST 09843-18020) between terminals FP and +B of data link connector No. 1. Turn ignition on, with engine off to pressurize fuel system.

NOTE: For proper location of data link connector No. 1 and terminal identification, see F - BASIC TESTING article. Jumper wire is installed in data link connector No. 1 when checking fuel pump operation and fuel pressure.

5) Place tip of cold start injector in a container. Connect cold start injector tester to cold start injector. Use Cold Start

Injector Tester (SST 09842-30050).

CAUTION: Perform cold start injector test in shortest possible time to check fuel spray pattern.

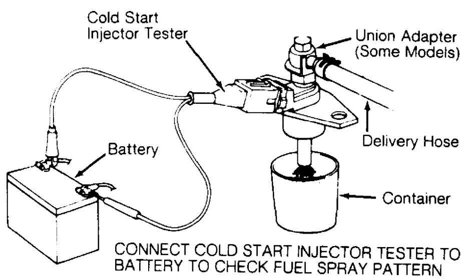
6) Connect cold start injector tester to battery. See Figs. 42 and 43. Ensure fuel spray pattern is an even cone shape. Disconnect cold start injector tester from battery.

7) Check for fuel leakage from cold start injector. Maximum leakage should be one drop per minute with fuel pressure applied. Replace cold start injector if defective. Disconnect negative battery cable and test equipment.

NOTE: Cold start injector is controlled by cold start injector time switch when ignition is turned on.

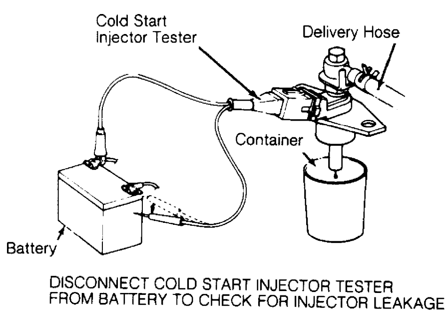
Cold Start Injector Time Switch

For test procedures, see ENGINE SENSORS & SWITCHES.



93I79937

Fig. 42: Testing Cold Start Injector - Fuel Spray Pattern
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93J79938

Fig. 43: Testing Cold Start Injector - For Leakage
Courtesy of Toyota Motor Sales, U.S.A., Inc.

IDLE CONTROL SYSTEM

AIR CONTROL VALVE

1.6L 4A-FE

1) Remove air control valve, located on end of air intake chamber on passenger's side. Air control valve may also be identified using appropriate illustration in E - THEORY/OPERATION article or wire color. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

2) Using ohmmeter, check resistance and for continuity between air control valve electrical terminals. Replace air control valve if resistance is not within specification or continuity does not exist. See AIR CONTROL VALVE RESISTANCE SPECIFICATIONS table.

AIR CONTROL VALVE RESISTANCE SPECIFICATIONS TABLE

Application	Ohms
1.6L 4A-FE	27-33

3) Ensure no continuity exists between each electrical terminal and air control valve body. Test air control valve by applying air pressure to designated area and checking air passage, and then applying battery voltage and ground and retesting. See Fig. 44. Replace air control valve if defective or continuity exists between electrical terminals and air control valve body.

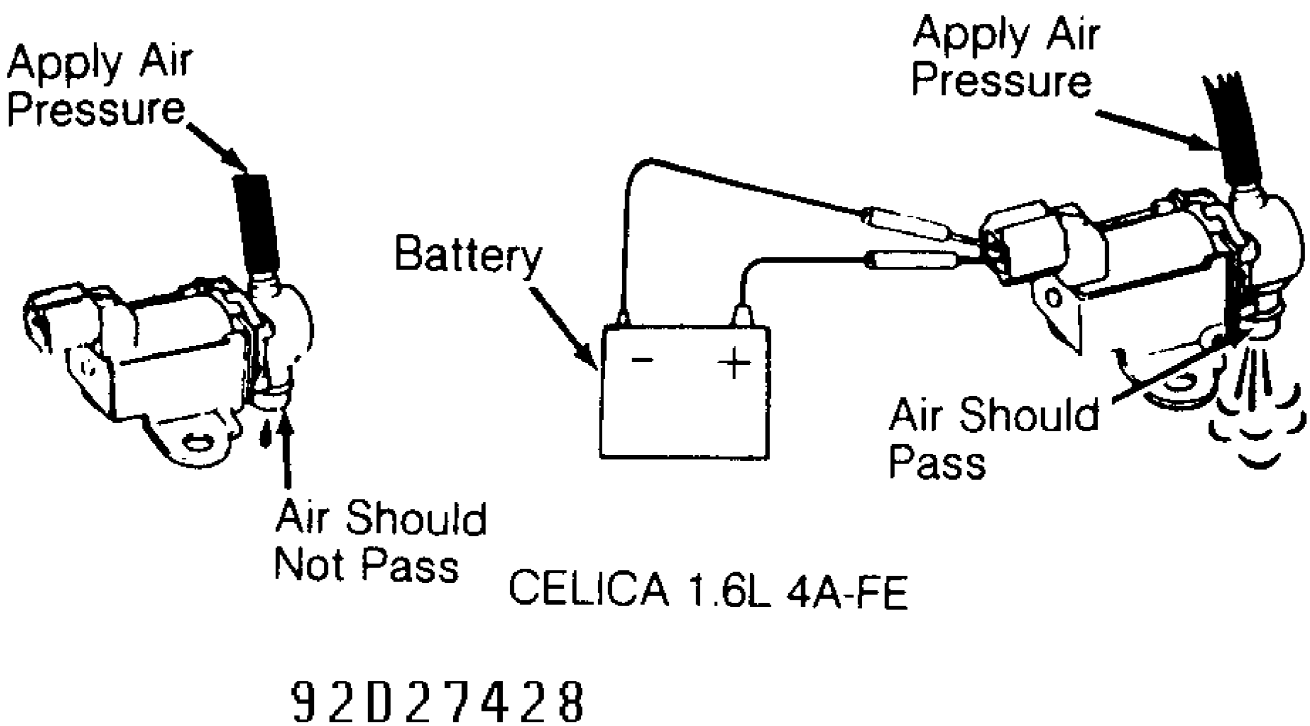


Fig. 44: Testing Air Control Valve (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

AUXILIARY AIR VALVE SYSTEM

NOTE: Install tachometer when checking auxiliary air valve system. Ensure tachometer is connected to proper terminals. See IDLE SPEED & MIXTURE in D - ADJUSTMENTS article for tachometer connections.

CAUTION: Some tachometers may not be compatible with ignition system. Consult tachometer manufacturer before connecting tachometer to system. To avoid possible damage to ignitor and/or coil, DO NOT allow tachometer terminal to become grounded.

1.6L 4A-FE

1) Install tachometer. With engine coolant less than 176°F (80°C), remove air intake hose from throttle body.

2) Start engine. Place finger over air valve port to block airflow. See Fig. 45. Engine speed should decrease noticeably. Remove

finger from air valve port.
3) Allow engine to warm to normal operating temperature. Place finger over air valve port to block airflow. Engine speed should not decrease more than 100 RPM for Tercel or 50 RPM for all others.
4) If engine RPM does not respond as indicated, check for vacuum leaks or restricted chamber in auxiliary air valve circuit. If no defects are found, replace auxiliary air valve.

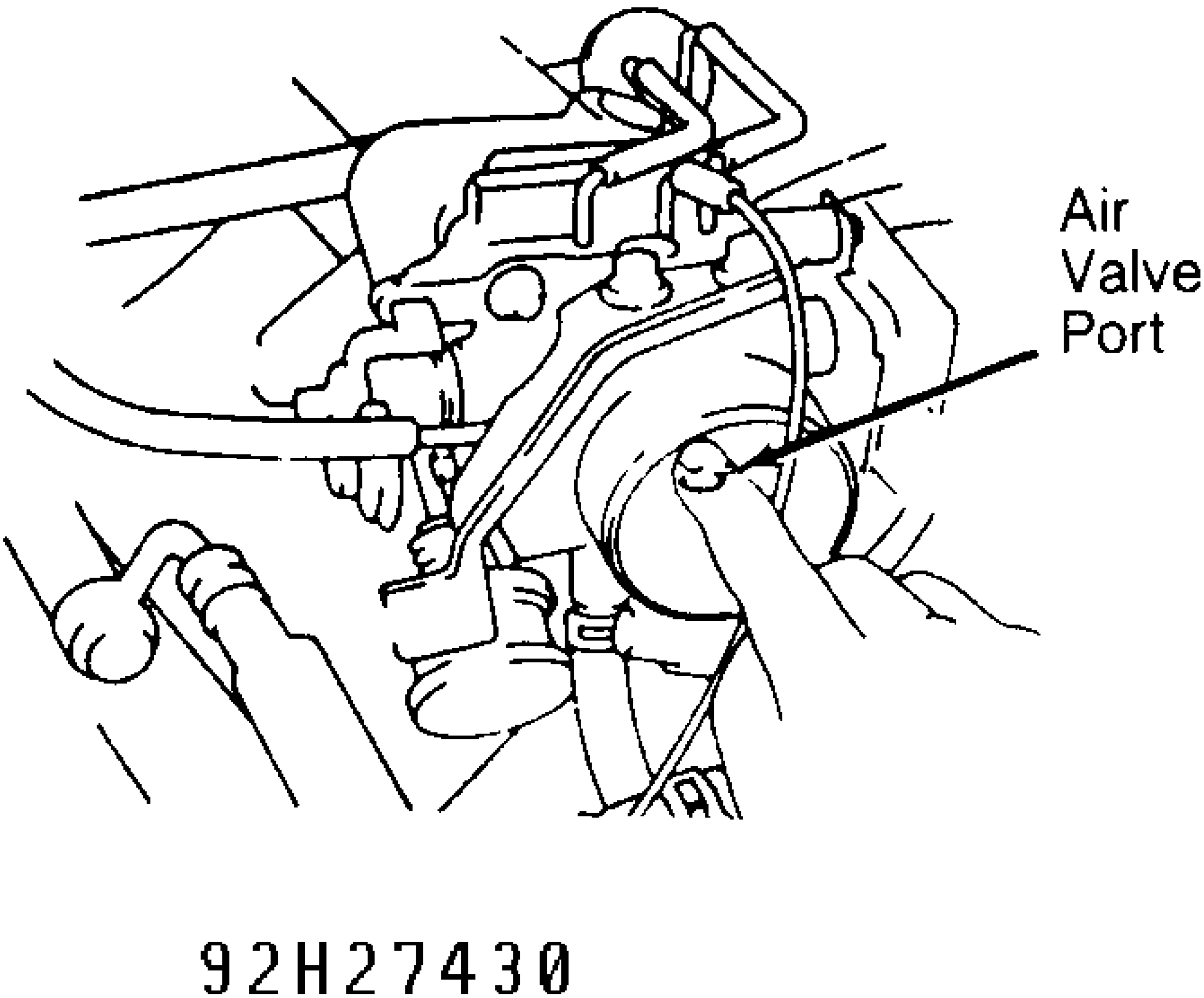


Fig. 45: Checking Auxiliary Air Valve (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

A/C IDLE-UP SYSTEM

2.2L 5S-FE

1) Remove A/C idle-up system Vacuum Switching Valve (VSV). See A/C IDLE-UP VSV LOCATIONS table.

NOTE: The A/C idle-up VSV may also be identified using appropriate illustration in E - THEORY/OPERATION article or wire color. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

A/C IDLE-UP VSV LOCATIONS TABLE

Application	Location
2.2L 5S-FE	End Of Air Intake Chamber, Near Front Of Valve Cover

2) Using ohmmeter, check resistance between A/C idle-up VSV electrical terminals. Replace A/C idle-up VSV if resistance is not 30-34 ohms.

3) Ensure no continuity exists between each electrical terminal and A/C idle-up VSV body. Test A/C idle-up VSV by applying air pressure to designated area and checking air passage, and then applying battery voltage and ground and retesting. See Fig. 46. Replace A/C idle-up VSV if defective.

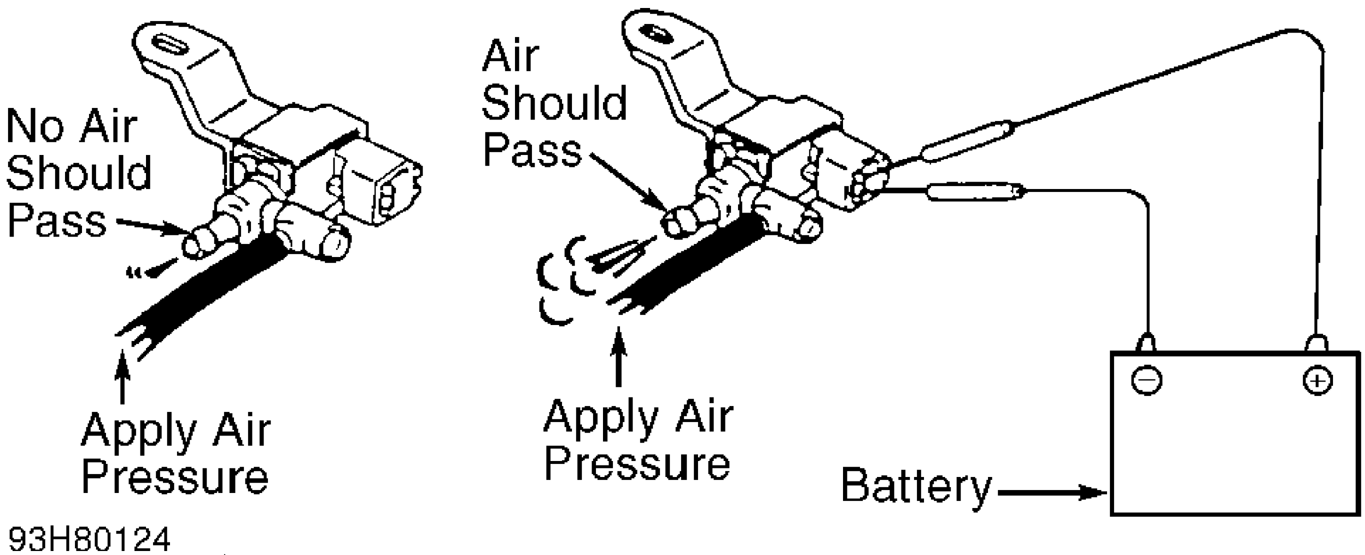


Fig. 46: Testing A/C Idle-Up VSV (2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

IDLE AIR CONTROL (IAC) VALVE

NOTE: IAC valve may also be referred to as Idle Speed Control (ISC) valve.

2.2L 5S-FE

1) Warm engine to normal operating temperature. Ensure idle speed is correct. See D - ADJUSTMENTS article.

2) Apply parking brake and place transmission/transaxle in Neutral. Install Jumper Wire (SST 09843-18020) between terminals TE1 and E1 of data link connector No. 1. See Fig. 47. Start engine and note engine RPM.

NOTE: Data link connector No. 1 is located in engine compartment on all models except Previa. On Previa, data link connector No. 1 is located under below driver's seat.

3) On Previa, engine RPM should increase to specified engine RPM for 5 seconds and then decrease approximately 200 RPM. See IAC VALVE ENGINE SPEED TESTING SPECIFICATIONS table.

4) On all other models, engine RPM should increase to specified engine RPM for 5 seconds, and then return to idle. See IAC VALVE ENGINE SPEED TESTING SPECIFICATIONS table.

IAC VALVE ENGINE SPEED TESTING SPECIFICATIONS TABLE

Application	Engine RPM
All	900-1300

5) If engine RPM is not as specified, check IAC valve resistance and operation. If engine RPM is within specification, remove jumper wire. Turn ignition off.

6) To check IAC valve resistance, ensure ignition is off. Disconnect electrical connector from IAC valve located on lower area of throttle body. Using ohmmeter, measure resistance between terminal B+ and each remaining terminal. See Figs. 48 and 49.

7) Replace IAC valve if resistance is not within specification. See IAC VALVE RESISTANCE SPECIFICATIONS table.

NOTE: Information is not available from manufacturer for checking IAC valve operation for Previa.

8) Remove IAC valve from throttle body. See appropriate N - REMOVE/INSTALL/OHAUL article. Connect battery voltage and ground to proper terminals and ensure valve opens and closes. See Figs. 50 and 51. Replace IAC valve if defective.

9) If IAC valve resistance is correct and operates correctly, check wiring circuit between Engine Control Module (ECM) and IAC valve. See ECM LOCATION table. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

IAC VALVE RESISTANCE SPECIFICATIONS TABLE

Application	Ohms
Turbo & 2.2L 5S-FE	19.3-22.3

ECM LOCATION TABLE

Model	Location
Celica	Bottom Center Of Dash, In Front Of Console

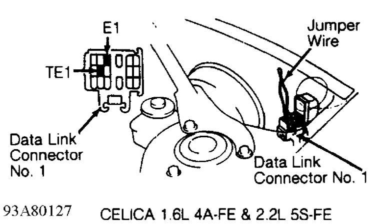


Fig. 47: Using Jumper Wire In Data Link Connector No. 1 (1.6L 4A-FE & 2.2L 5S-FE
Courtesy of Toyota Motor Sales, U.S.A., Inc.

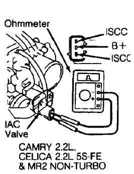
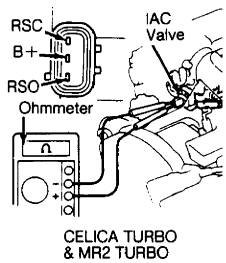
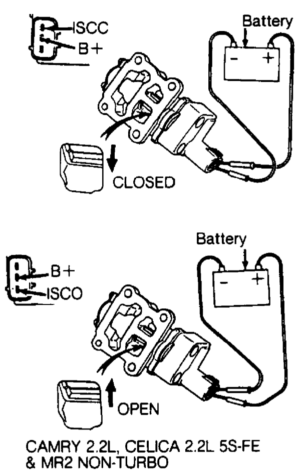


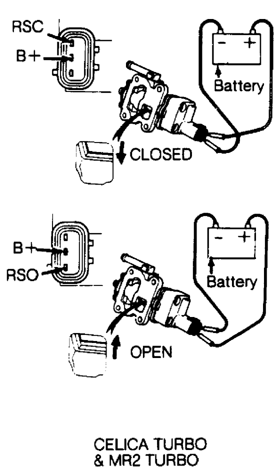
Fig. 48: Checking IAC Valve Resistance (2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93H80132
Fig. 49: Checking IAC Valve Resistance (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93A80135
Fig. 50: Checking IAC Valve Operation (2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93B80136
Fig. 51: Checking IAC Valve Operation (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Turbo

1) Warm engine to normal operating temperature. Ensure idle speed is correct. See D - ADJUSTMENTS article. Apply parking brake and place transaxle in Neutral.

2) With engine idling, disconnect electrical connector from IAC valve located on lower area of throttle body. Engine RPM should increase to at least 1000 RPM. Reinstall electrical connector on IAC

valve.

3) Ensure engine returns to idle speed of 750-850 RPM. If engine does not return to proper idle speed, check IAC valve resistance and operation.

4) To check IAC valve resistance, ensure ignition is off. Disconnect electrical connector from IAC valve. Using ohmmeter, measure resistance between terminal B+ and each remaining terminal. See Figs. 48 and 49.

5) Replace IAC valve if resistance is not within specification. See IAC VALVE RESISTANCE SPECIFICATIONS (EXCEPT CAMRY 3.0L, LAND CRUISER & SUPRA) table.

6) To check IAC valve operation, remove IAC valve from throttle body. See N - REMOVE/INSTALL/OHAUL article. Connect battery voltage and ground to proper terminals and ensure valve opens and closes. See Fig. 50 and 51. Replace IAC valve if defective.

7) If IAC valve resistance is correct and operates correctly, check wiring circuit between Engine Control Module (ECM) and IAC valve. See ECM LOCATION table. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

4) To check IAC valve operation, remove IAC valve. See N - REMOVE/INSTALL/OHAUL article. Note IAC valve terminal identification.

5) Apply battery voltage to terminals B1 and B2. Repeatedly ground terminals in sequence and ensure IAC valve closes and opens. See IAC VALVE GROUNDING SEQUENCE table. Replace IAC valve if defective.

6) If IAC valve resistance is correct and operates correctly, check wiring between Engine Control Module (ECM) and IAC valve. See ECM LOCATION table. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC TESTING article.

TIMING CONTROL SYSTEMS

Knock Sensor

See KNOCK SENSOR under ENGINE SENSORS & SWITCHES.

EMISSION SYSTEMS & SUB-SYSTEMS

EXHAUST GAS RECIRCULATION (EGR)

NOTE: EGR systems contain different components and have different operating parameters depending on application. See Figs. 55-63. When testing EGR system and components, use proper illustration to determine component location.

EGR System Test (2.2L 5S-FE)

1) Ensure EGR vacuum modulator filter is clean and in good condition. Clean filter with compressed air (if necessary).

2) Using "T" connector, install vacuum gauge in vacuum line to EGR valve. Start engine. Ensure engine runs idles smoothly to ensure proper seating of EGR valve.

3) Install Jumper Wire (SST 09843-18020) between terminals TE1 and E1 of data link connector No. 1, located in engine compartment. See Fig. 47.

NOTE: The EGR system components can be checked with engine coolant temperature less than minimum temperature and engine at specified engine RPM.

4) Operate engine with engine coolant temperature less than minimum temperature and at specified RPM. See EGR TESTING SPECIFICATIONS table. No vacuum reading should be obtained.

5) Warm engine to normal operating temperature. Operate engine at specified engine RPM again. See EGR TESTING SPECIFICATIONS table. Ensure a low vacuum reading is now obtained.

6) Disconnect vacuum hose from port "R" of EGR vacuum modulator. See Fig. 52. Using additional hose, connect port "R" of EGR vacuum modulator directly to intake manifold. High vacuum reading should be obtained at specified engine RPM. See EGR TESTING SPECIFICATIONS table.

NOTE: Engine should misfire due to large amounts of exhaust gas being injected into intake manifold.

7) Remove vacuum hose and reconnect original vacuum hose to EGR vacuum modulator. To check EGR valve operation, remove vacuum hose from EGR valve.

8) Using vacuum pump, apply vacuum directly to EGR valve with engine idling. Engine should run rough or stall. If EGR system does not operate as described, each individual component should be tested. Shut engine off. Remove jumper wire from data link connector No. 1.

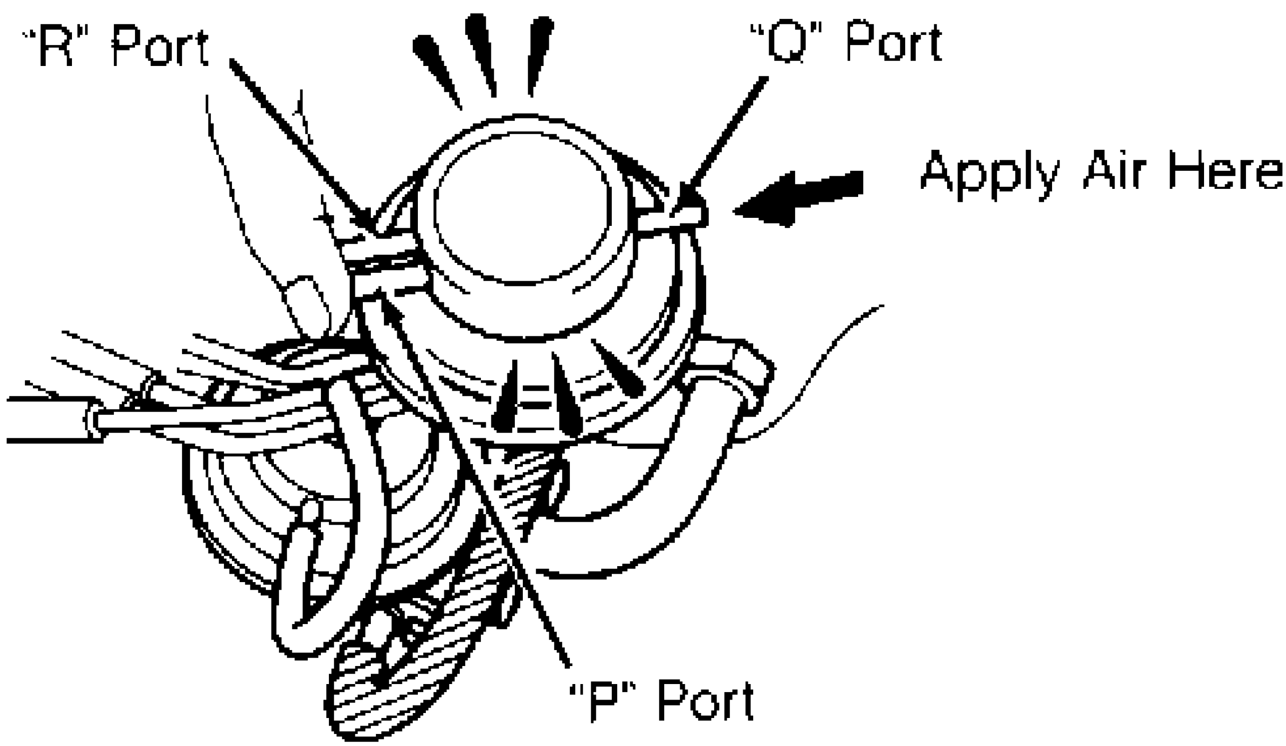


Fig. 52: Identifying Ports & Testing EGR Vacuum Modulator
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EGR System Test (1.6L 4A-FE)

1) Ensure EGR vacuum modulator filter is clean and in good condition. Clean filter with compressed air (if necessary).

2) Using "T" connector, install vacuum gauge in vacuum line to EGR valve. Start engine. Ensure engine runs idles smoothly to ensure proper seating of EGR valve.

3) Install Jumper Wire (SST 09843-18020) between terminals TE1 and E1 of data link connector No. 1, located in engine compartment. See Fig. 47.

NOTE: The EGR system components can be checked with engine coolant temperature less than minimum temperature and engine at specified engine RPM.

4) Operate engine with engine coolant temperature less than minimum temperature and at specified RPM. See EGR TESTING SPECIFICATIONS table. No vacuum reading should be obtained.

5) Warm engine to normal operating temperature. Operate engine at specified engine RPM again. See EGR TESTING SPECIFICATIONS table. Ensure a low vacuum reading is now obtained.

6) To check EGR valve operation, remove vacuum hose from EGR valve. Using vacuum pump, apply vacuum directly to EGR valve with engine idling. Engine should run rough or stall.

7) If EGR system does not operate as described, each individual component should be tested. Shut engine off. Remove jumper wire from data link connector No. 1.

EGR System Test (All Others)

1) Ensure EGR vacuum modulator filter(s) are clean and in good condition. Clean filter(s) with compressed air (if necessary).

2) Using "T" connector, install vacuum gauge in vacuum line to EGR valve. Start engine. Ensure engine runs idles smoothly to ensure proper seating of EGR valve.

NOTE: The EGR system components can be checked with engine coolant temperature less than minimum temperature and engine at specified engine RPM.

3) Operate engine with engine coolant temperature less than minimum temperature and at specified RPM. See EGR TESTING SPECIFICATIONS table. No vacuum reading should be obtained.

4) Warm engine to normal operating temperature. Operate engine at specified engine RPM again. See EGR TESTING SPECIFICATIONS table. Ensure a low vacuum reading is now obtained.

5) On all models except Turbo, disconnect vacuum hose from port "R" of EGR vacuum modulator. See Fig. 52.

6) Using additional hose, connect port "R" of EGR vacuum modulator directly to intake manifold. High vacuum reading should be obtained at specified engine RPM. See EGR TESTING SPECIFICATIONS table.

NOTE: Engine should misfire due to large amounts of exhaust gas being injected into intake manifold.

7) Remove vacuum hose and reconnect original vacuum hose to EGR vacuum modulator.

8) To check EGR valve operation, remove vacuum hose from EGR valve. Using vacuum pump, apply vacuum directly to EGR valve with engine idling. Engine should run rough or stall. If EGR system does not operate as described, each individual component should be tested.

EGR TESTING SPECIFICATIONS TABLE

Application	Minimum Temperature	Engine RPM
1.6L 4A-FE	117°F (47°C)	2500
2.0L Turbo	129°F (54°C)	2500
2.2L 5S-FE	131°F (55°C)	2500

EGR Vacuum Modulator (Turbo)

1) Disconnect vacuum hoses from EGR vacuum modulator. Plug one end of vacuum hose connection on EGR vacuum modulator.

2) Apply air pressure through remaining port. Air should pass freely through air filter side of EGR vacuum modulator.

3) Start and operate engine at specified RPM. See EGR VACUUM MODULATOR TESTING SPECIFICATIONS table. Repeat test procedures in steps 1) and 2). Strong resistance of airflow should be felt. Replace EGR vacuum modulator if resistance is not felt. Reconnect vacuum hoses to proper locations.

EGR Vacuum Modulator (All Others)

1) Disconnect vacuum hoses from EGR vacuum modulator. Block ports "P" and "R" of EGR vacuum modulator. See Fig. 52.

NOTE: Ports "P" and "R" are the double ports on side of EGR vacuum modulator. Port "Q" is the single port on side of EGR vacuum modulator.

2) Apply air pressure to port "Q". See Fig. 52. Air should pass freely through air filter side of EGR vacuum modulator.

3) Start and operate engine at specified RPM. See EGR VACUUM MODULATOR TESTING SPECIFICATIONS table. Repeat test procedures in steps 1) and 2). Strong resistance of airflow should be felt. Replace EGR vacuum modulator if resistance is not felt. Reconnect vacuum hoses to proper locations.

EGR VACUUM MODULATOR TESTING SPECIFICATIONS TABLE

Application	Engine RPM
All	2500

NOTE: Bimetallic Vacuum Switching Valve (BVSV) may be referred to as a Thermal Vacuum Valve (TVV). When testing BVSV, use proper illustration to determine component location. See Figs. 55-63.

EGR Vacuum Switching Valve (VSV) (Turbo & 2.2L 5S-FE)

1) Disconnect electrical connector from EGR VSV. Using ohmmeter, check resistance between EGR VSV electrical terminals.

2) Replace EGR VSV if resistance is not within specification. See EGR VSV RESISTANCE SPECIFICATIONS table. Ensure no continuity exists between each electrical terminal and EGR VSV body. Replace EGR VSV if continuity exists between any electrical terminal and VSV body.

3) Apply air pressure to port "E" (without battery connected). See Figs. 53 and 54. Air pressure should flow from port "G". Connect battery to EGR VSV electrical terminals. See Figs. 53 and 54. Apply air pressure to port "E". Air pressure should flow through the air filter. Replace EGR VSV if defective.

EGR Vacuum Switching Valve (VSV) (1.6L 4A-FE)

1) Disconnect electrical connector from EGR VSV. Using ohmmeter, check resistance between EGR VSV electrical terminals.

2) Replace EGR VSV if resistance is not within specification. See EGR VSV RESISTANCE SPECIFICATIONS table. Ensure no continuity exists between each electrical terminal and EGR VSV body. Replace EGR VSV if continuity exists between any electrical terminal and VSV body.

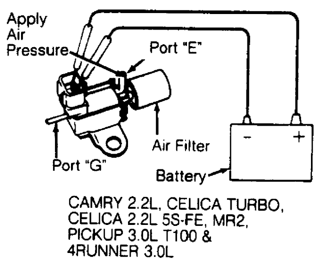
3) Apply air pressure to port "E" (without battery connected). See Figs. 53 and 54. Air pressure should flow through the

air filter. Connect battery to EGR VSV electrical terminals. See Fig. 54. Apply air pressure to port "E". Air pressure should not flow through the air filter. Replace EGR VSV if defective.

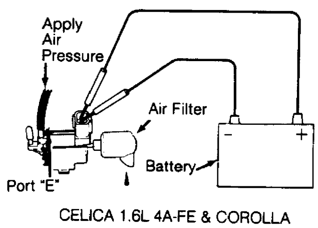
EGR VSV RESISTANCE SPECIFICATIONS TABLE

Application	(1) Ohms
1.6L 4A-FE	37-44
2.0L Turbo & 2.2L 5S-FE	33-39

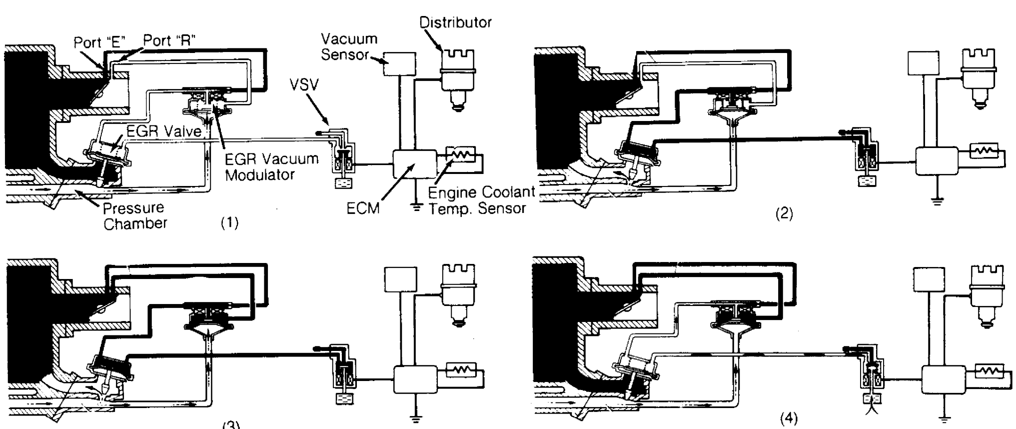
(1) - Specification listed when measured at 68°F (20°C).



93G80149
Fig. 53: Testing EGR VSV Operation (Turbo & 2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93A80150
Fig. 54: Testing EGR VSV Operation (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93J80159
Fig. 55: Identifying EGR System Operation (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Engine Coolant Temp.	ENGINE rpm	VSV	Throttle Valve Opening Angle	Pressure in the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 47°C (117°F)	-	.... OFF	-	-		-	CLOSED	Not recirculated
Above 53°C (127°F)	Above 1,100 rpm (Federal) & Below 4,000 rpm	.... OFF	-	-		-	CLOSED	Not recirculated
		... ON	Positioned below port E	-		-	CLOSED	Not recirculated
			Positioned between port E and and port R	(1) LOW	*Pressure constantly alternating between low and high	OPENS passage to atmosphere	CLOSED	Not recirculated
				(2) HIGH		CLOSES passage to atmosphere	OPEN	Recirculated
			Positioned above port R	(3) HIGH	**	CLOSES passage to atmosphere	OPEN	Recirculated (increase)
	Below 1,000 rpm (Federal) & Above 4,400 rpm	(4) OFF	-	-		-	CLOSED	Not recirculated

Remarks: * Pressure increase → Modulator closes → EGR valve opens → Pressure drops → Modulator opens → EGR valve closes → (Pressure increase)

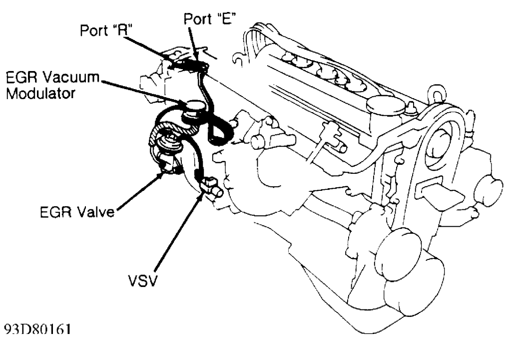
** When the throttle valve is positioned above port R, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the exhaust gas, even if the exhaust pressure is insufficiently low.

*** VSV switched ON when product of engine rpm multiplied by vacuum sensor valve exceeds a specified valve.

**** If terminals TE1 and E1 of data link connector 1 are connected, the VSV switches ON.

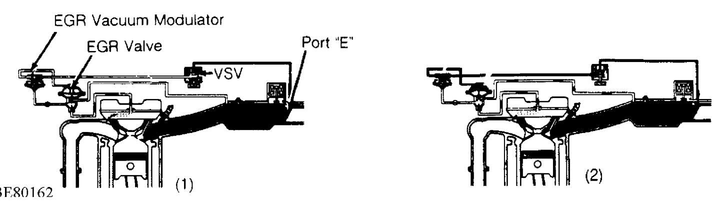
93C80160

Fig. 56: Identifying EGR System Operating Parameters (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93D80161

Fig. 57: Identifying EGR System Components (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93E80162

Fig. 58: Identifying EGR System Operation (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

To reduce NOx emissions, part of the exhaust gases is recirculated through the EGR valve to the intake manifold to lower the maximum combustion temperature.

Coolant temp.	VSV	Throttle Valve Opening Angle	Pressure in the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 54°C (129°F)	CLOSED	-	-		-	CLOSED	Not recirculated
Above 60°C (140°F)	OPEN	Positioned above port E	(1)	-	-	CLOSED	Not recirculated
		Positioned below port E	(2)	*	CLOSED passage to atmosphere	OPEN	Recirculated (increase)

Remarks: * When the throttle valve is positioned above the port E, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the EGR gas, even if the exhaust pressure is insufficiently low.

93G80164

Fig. 59: Identifying EGR System Operating Parameters (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

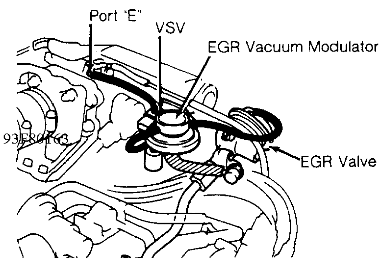


Fig. 60: Identifying EGR System Components (Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

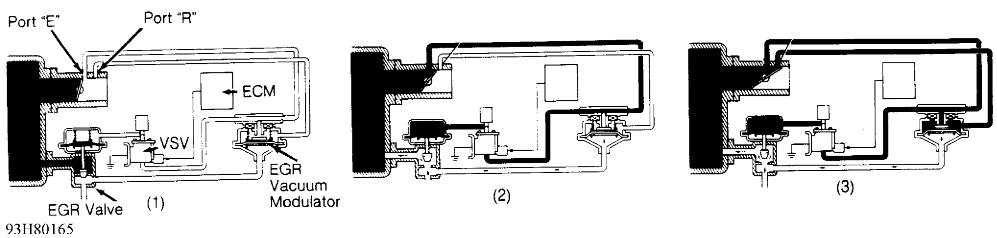


Fig. 61: Identifying EGR System Operation (2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Engine Coolant Temp.	Engine RPM	ECM	VSV	Throttle Valve Opening Angle	Pressure in the EGR Valve Pressure Chamber	EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 55°C (131°F)	-	-	CLOSED	-	-	-	CLOSED	Not recirculated
Above 60°C (140°F)	Below 4,000 rpm	OFF	CLOSED	Positioned below port E	-	-	CLOSED	Not recirculated
		OFF	CLOSED	Positioned below port E	(1) -	-	CLOSED	Not recirculated
		*** ON	OPEN	Positioned between port E and port R	(2) HIGH *	CLOSES passage to atmosphere	OPEN	Recirculated
		*** ON	OPEN	Positioned above port R	(3) HIGH **	CLOSES passage to atmosphere	OPEN	Recirculated (increase)
	Above 4,000 rpm	OFF	CLOSED	-	-	-	CLOSED	Not Recirculated

* Pressure increases → Modulator closes → EGR valve opens → Pressure drops → Modulator opens → EGR valve closes → Pressure increases

** When the throttle valve is positioned above port R, the EGR vacuum modulator will close the atmosphere passage and open the EGR valve to increase the exhaust gas, even if the exhaust pressure is insufficiently low.

*** If terminals TE1 and E1 of data link connector 1 are connected, the VSV switches ON.

93J80167

Fig. 62: Identifying EGR System Operating Parameters (2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

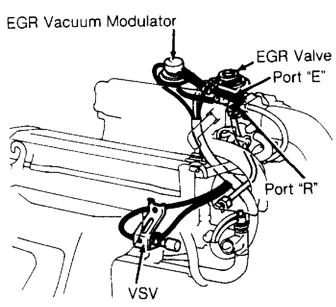
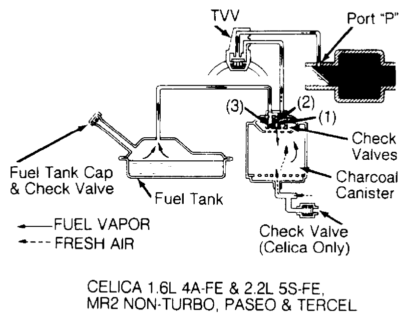


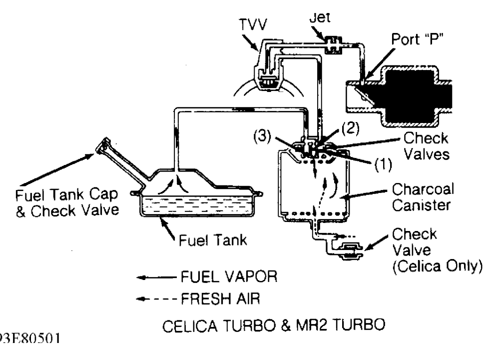
Fig. 63: Identifying EGR System Components (2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FUEL EVAPORATION

NOTE: Fuel evaporation systems contain different components and have different operating parameters depending on application. See Figs. 64-66.



93D80500
Fig. 64: Fuel Evaporation System Operation ID (1.6L 4A-FE & 2.2L 5S-FE)
Courtesy Of Toyota Motor Sales, U.S.A., Inc.



93E80501
Fig. 65: Fuel Evaporation System Operation ID (Turbo)
Courtesy Of Toyota Motor Sales, U.S.A., Inc.

PICKUP 3.0L & 4RUNNER 3.0L

Engine Coolant Temp.	TVV	Throttle Valve Opening	Canister Check Valve			Check Valve in Cap	Evaporated Fuel (HC)
			(1)	(2)	(3)		
Below 35°C (95°F)	CLOSED	-	-	-	-	-	HC from tank is absorbed into the canister
Above 54°C (129°F)	OPEN	Positioned below port P	CLOSED	-	-	-	
		Positioned above port P	OPEN	-	-	-	HC from canister is led into air intake chamber.
High pressure in tank	-	-	-	OPEN	CLOSED	CLOSED	HC from tank is absorbed into the canister.
High vacuum in take	-	-	-	CLOSED	OPEN	OPEN	Air is led into the fuel tank.

93H80504
Fig. 66: Fuel Evaporation System Operating Parameters
Courtesy Of Toyota Motor Sales, U.S.A., Inc.

NOTE: The Bimetallic Vacuum Switching Valve (BVSV) may be referred to as a Thermal Vacuum Valve (TVV).

Bimetallic Vacuum Switching Valve

1) Drain cooling system. Remove Bimetallic Vacuum Switching Valve (BVSV). BVSV is located in coolant passage and contains 2 vacuum hoses which go to the charcoal canister and throttle body.

2) Use cool water to cool threaded end of BVSV to less than 95°F (35°C). Apply air pressure to top port on BVSV. Ensure BVSV is closed and no air will pass through lower port.

3) Heat water to greater than 129°F (54°C). Apply air pressure to top port on BVSV. Ensure BVSV is open and air passes through lower port. Replace BVSV if defective. Apply thread sealant to threads of BVSV and reinstall. Fill cooling system.

Charcoal Canister

1) Disconnect hoses from charcoal canister. Check for clogged

filter and/or stuck check valve by applying low air pressure to port "A". See Fig. 67. Ensure air flows freely from other ports on charcoal canister.

2) Apply low air pressure to port "B". See Fig. 67. Ensure no air flows from any other ports on charcoal canister. Replace charcoal canister if defective.

3) To clean charcoal canister filter, apply 43 psi (3 kg/cm^2) air pressure to port "A" while holding port "B" closed. Ensure no activated carbon comes out of charcoal canister. DO NOT attempt to wash out charcoal canister.

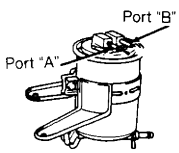


Fig. 67: Identifying Charcoal Canister Ports
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Check Valve

1) Remove check valve from lower hose on charcoal canister. Apply air pressure to Yellow side of check valve. Air should pass through check valve.

2) Apply air pressure to Black side of check valve. Air should not pass through check valve. Replace check valve if defective.

Jet (Turbo)

Remove jet from hose between throttle body and BVSV. Blow air through both sides and ensure no blockage exists. Replace jet if blockage exists in either direction.

POSITIVE CRANKCASE VENTILATION (PCV)

Turbo

Visually inspect hose and connections for cracks, leaks or other damage. Clean deposits from orifice with solvent and blow out with compressed air.

All Others

1) Remove PCV valve. Attach hose to PCV valve. Blow air from cylinder head side of PCV valve. Ensure air passes easily through PCV valve.

2) Blow air from intake manifold side of PCV valve. Ensure air passes through PCV valve with some restriction. Replace PCV valve if valve does not function as described.

THROTTLE CONTROLS

NOTE: When testing throttle control systems, tachometer may be required. Ensure tachometer is connected to proper terminals. For tachometer connections, see IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

Dashpot Control System (1.6L 4A-FE)

1) Warm engine to normal operating temperature. Ensure idle speed is correct. See IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

2) Remove cover, cap, filter and separator from dashpot. See Fig. 68. Install Jumper Wire (SST 09843-18020) between terminals TE1 and E1 of data link connector No. 1. See Fig. 47. Disconnect electrical connector from EGR Vacuum Switching Valve (VSV), located below EGR valve.

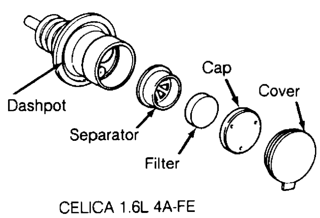
3) Start engine. Maintain engine speed at specified testing RPM. See DASHPOT TESTING SPECIFICATIONS table.

4) Plug Vacuum Transmitting Valve (VTV) hole. See Fig. 69. Release throttle. Dashpot should be extended and dashpot setting RPM should be as specified. See DASHPOT TESTING SPECIFICATIONS table.

5) If dashpot setting RPM is incorrect, rotate dashpot adjusting screw to obtain correct RPM. See Fig. 70. Repeat steps 3) and 4) and ensure proper adjustment is obtained.

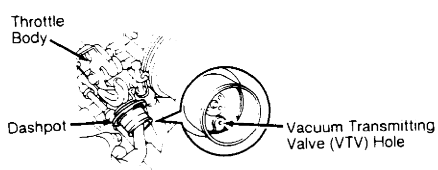
6) Reinstall electrical connector on EGR VSV. Remove jumper wire from data link connector No. 1. Install separator, filter, cap and cover. Install filter with coarse surface facing outward (away from dashpot).

7) To check VTV operation, operate engine at dashpot testing RPM for a few seconds. Release throttle. Ensure engine returns to idle in a few seconds.



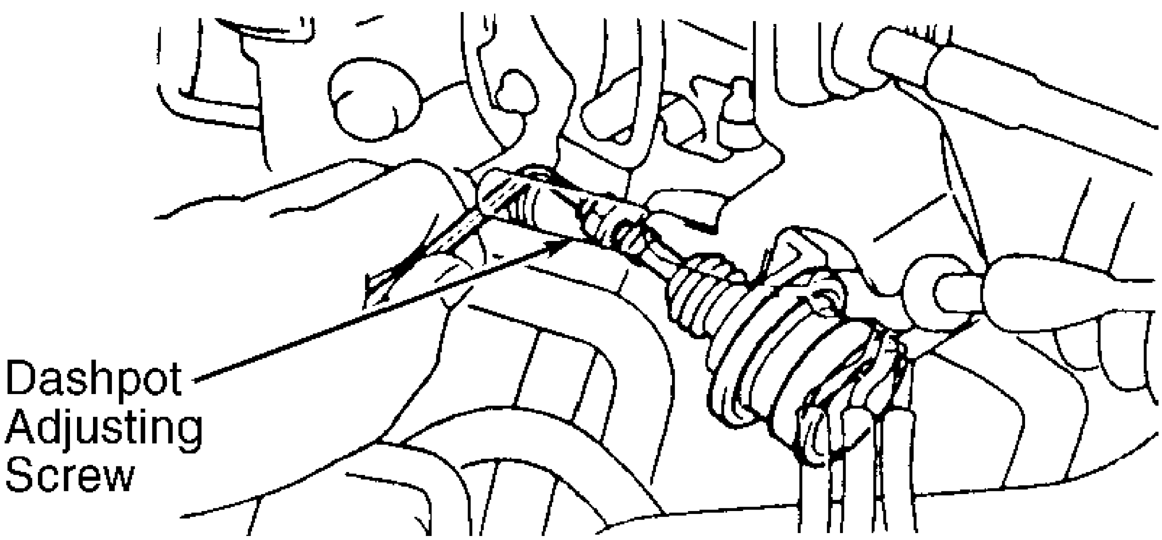
93E80543

Fig. 68: Identifying Dashpot (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93F80544

Fig. 69: Identifying Vacuum Transmitting Valve (1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93G80545

Fig. 70: Adjusting Dashpot
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DASHPOT TESTING SPECIFICATIONS TABLE

Application	Testing RPM	(1) Dashpot Setting RPM
1.6L 4A-FE		
A/T	3000	2200
M/T	3000	1800

(1) - With electric cooling fan off (if equipped).

Throttle Opener (2.2L 5S-FE)

1) Warm engine to normal operating temperature. Ensure idle speed is correct. See IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

2) Disconnect and plug vacuum hose at throttle opener, located on side of throttle body. Start engine. Maintain engine speed at 2500 RPM. Release throttle and note engine speed. Engine speed should be within specification. See THROTTLE OPENER SPECIFICATIONS table.

3) If engine speed is not within specification, rotate throttle opener adjusting screw until correct engine speed is obtained. See Fig. 71. Reinstall vacuum hose on throttle opener.

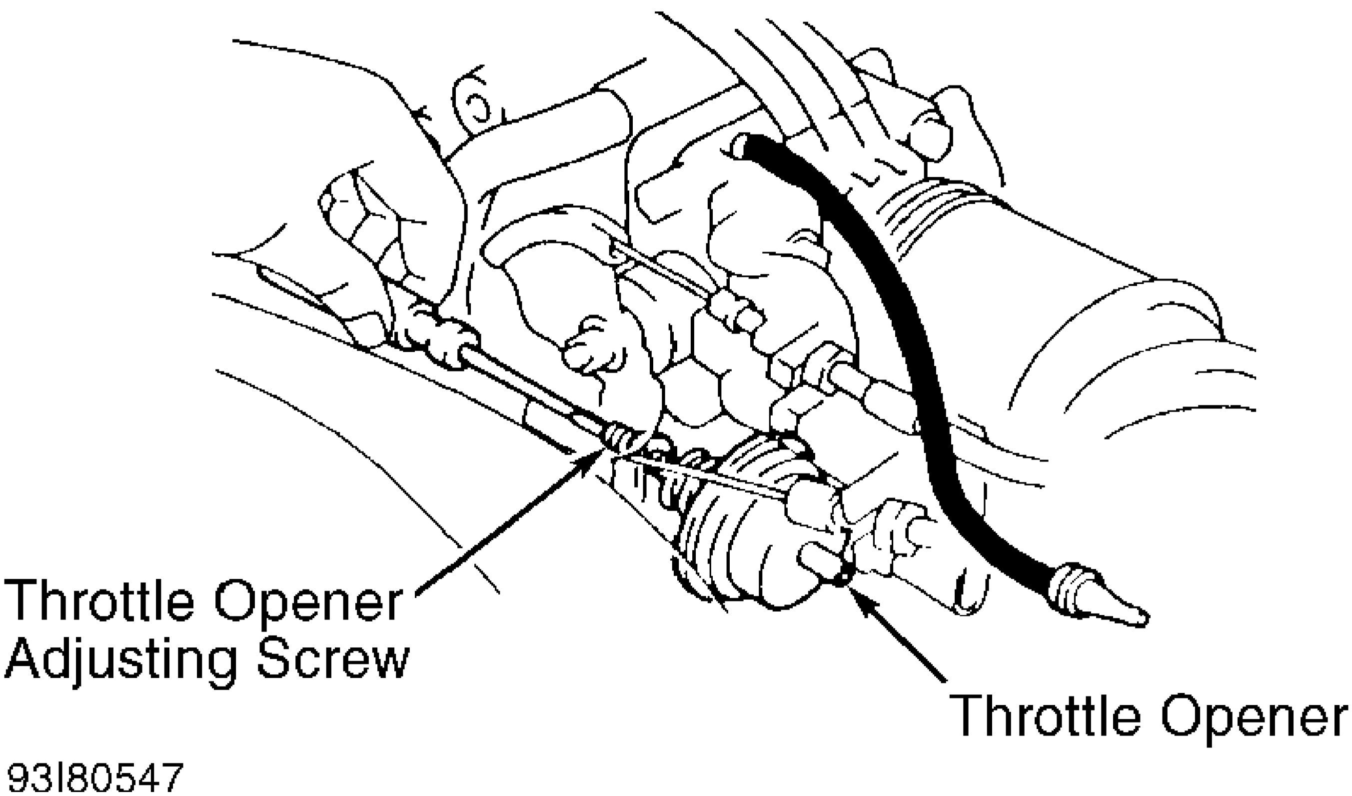


Fig. 71: Adjusting Throttle Opener (Camry 2.2L Shown; Others Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Throttle Opener (Turbo)

1) Warm engine to normal operating temperature. Ensure idle speed is correct. See IDLE SPEED & MIXTURE in D - ADJUSTMENTS article.

2) Disconnect and plug vacuum hose at throttle opener, located on side of throttle body. Start engine and note engine speed. Engine speed should be within specification. See THROTTLE OPENER SPECIFICATIONS table.

3) Replace throttle body if engine speed is not within specification. Shut engine off. Reinstall vacuum hose on throttle opener. Start engine and ensure engine returns to correct idle speed.

THROTTLE OPENER SPECIFICATIONS TABLE

Application	(1) Engine RPM
2.0L Turbo	900-1900
2.2L 5S-FE	1300-1500

(1) - With electric cooling fan turned off (if equipped).

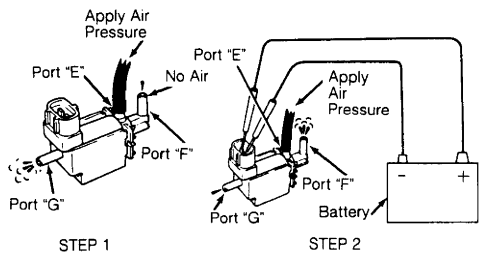


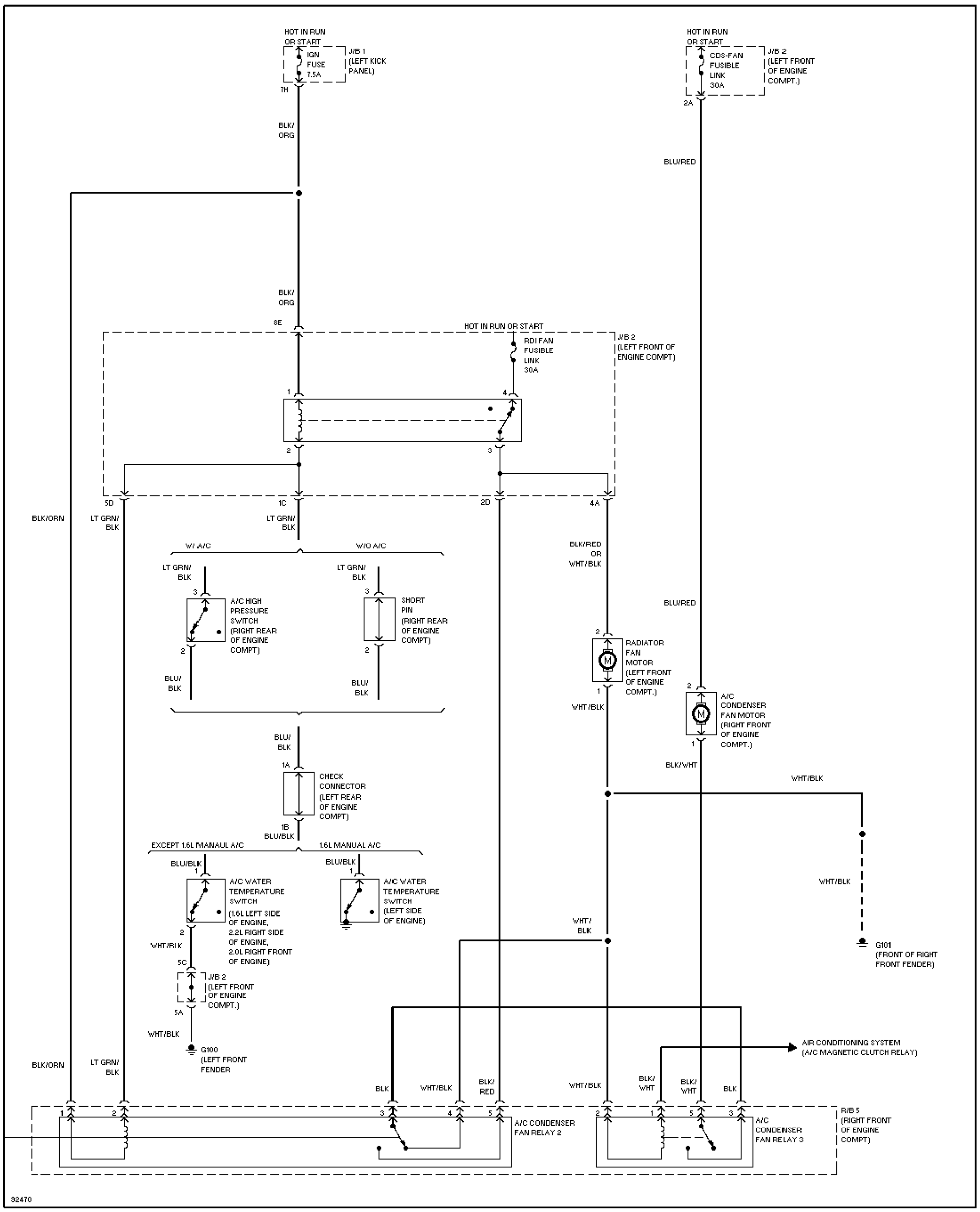
Fig. 72: Checking Throttle Opener Vacuum Switching Valve (VSV)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SYSTEM WIRING DIAGRAMS

1993 Toyota Celica

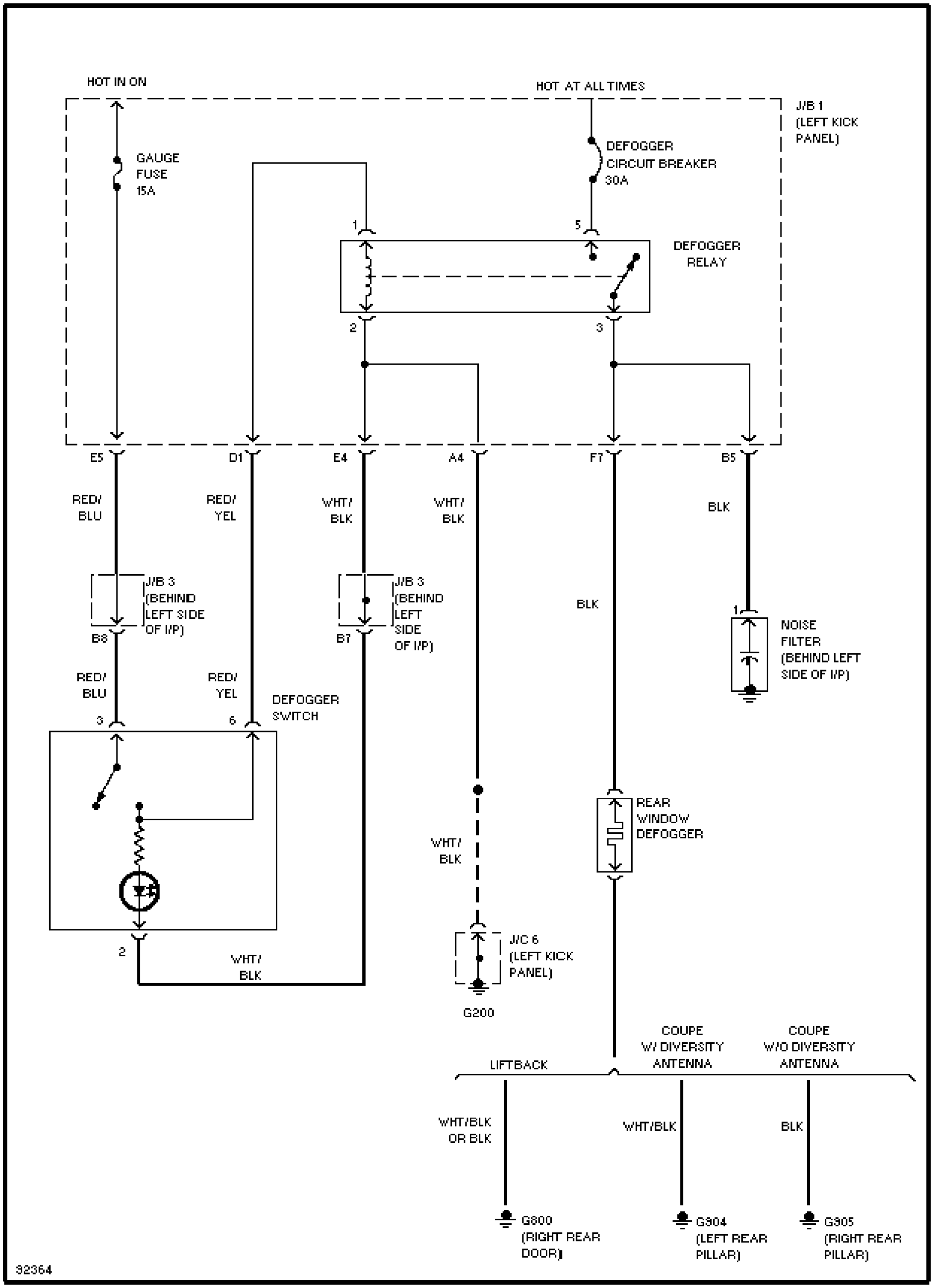
1993 System Wiring Diagrams
Toyota - Celica

COOLING FAN



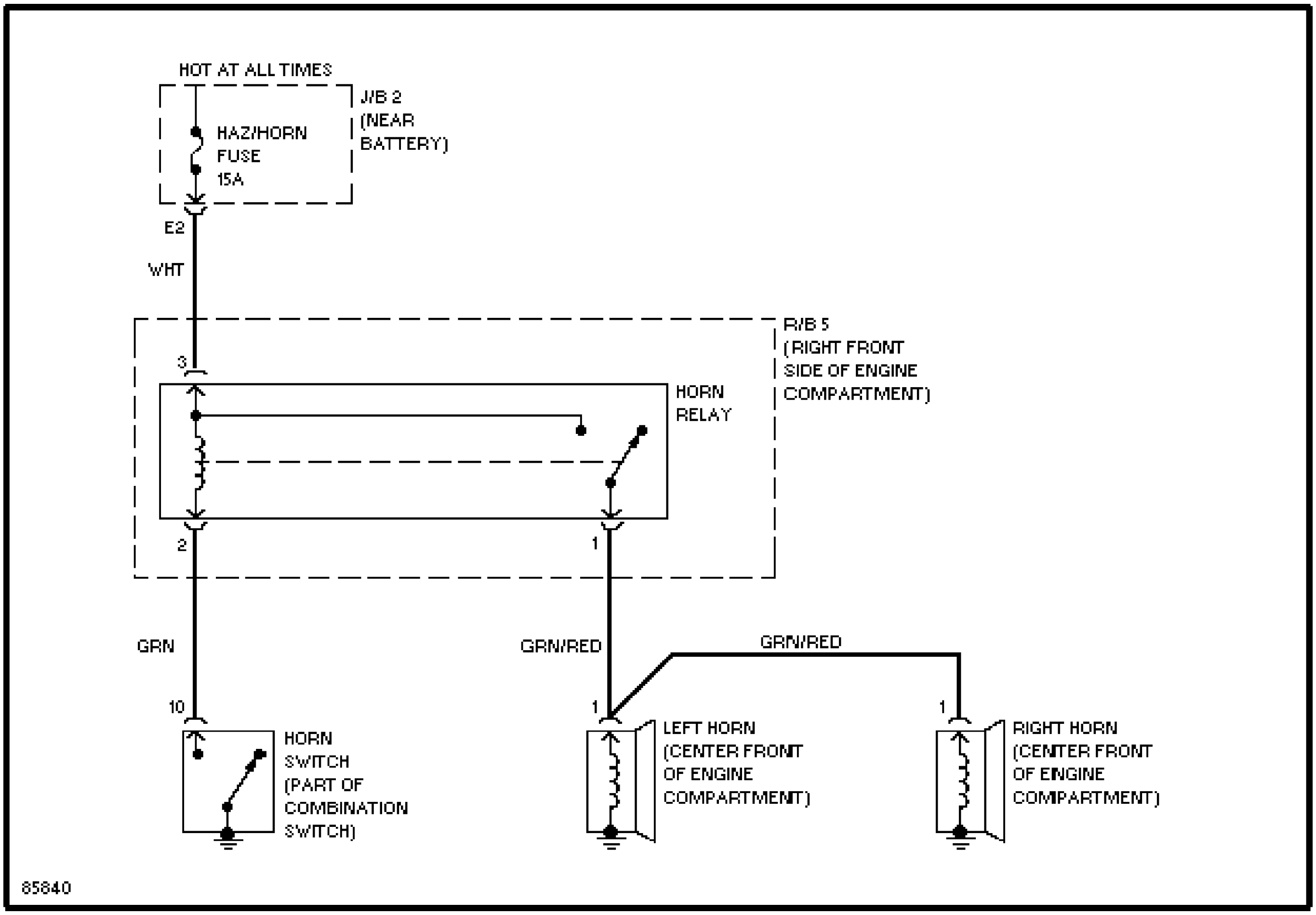
Cooling Fan Circuit

DEFOGGERS



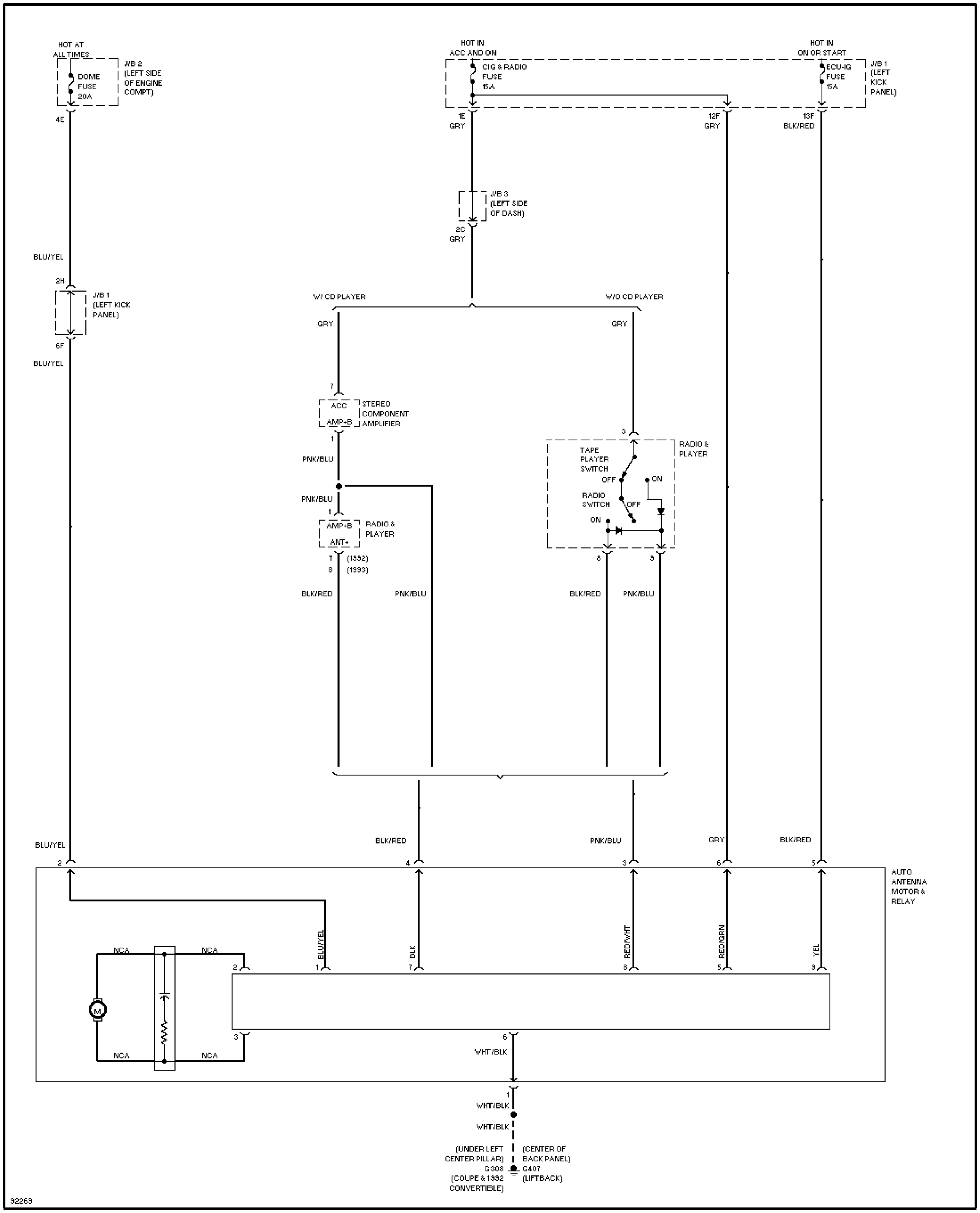
Defogger Circuit

HORN



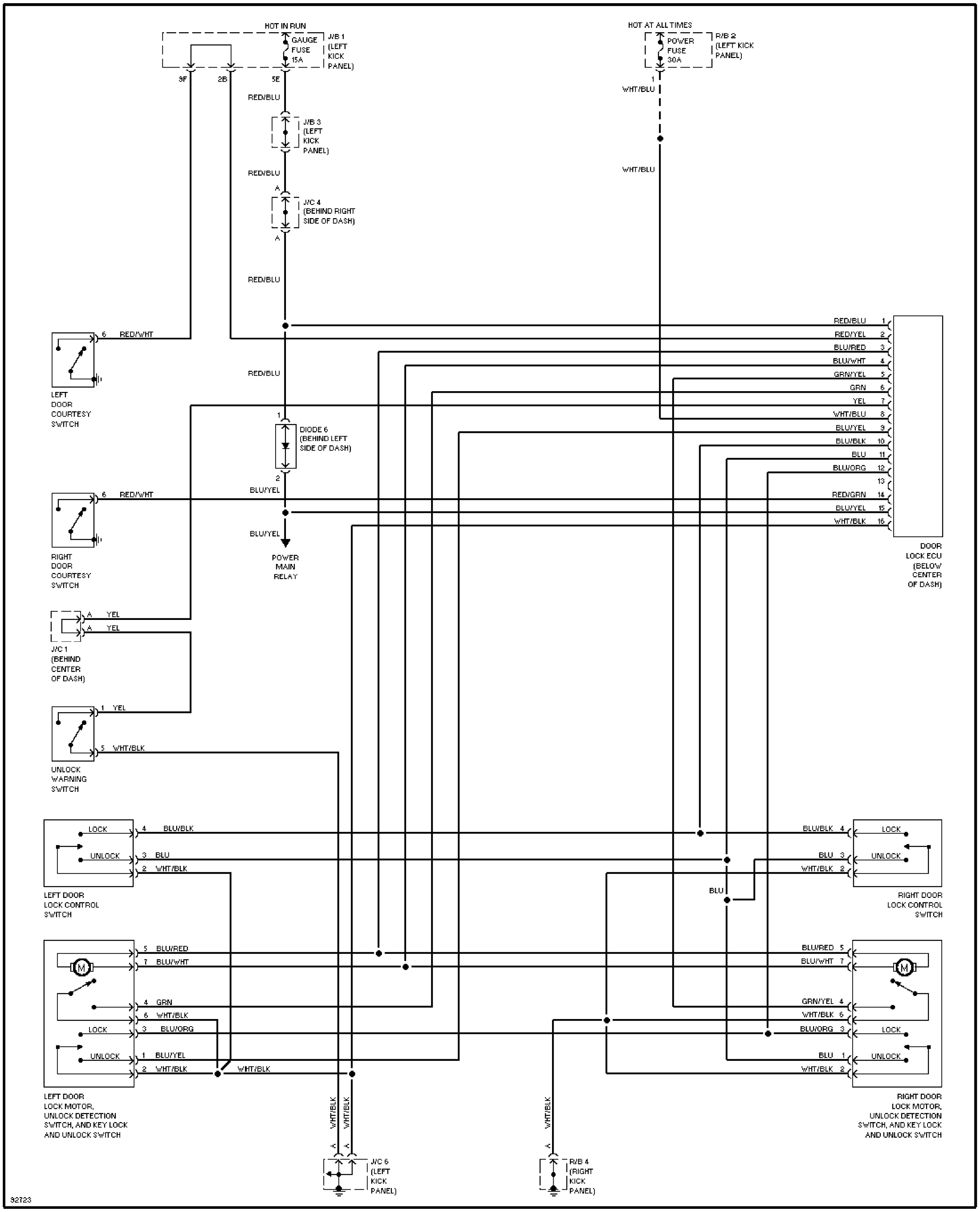
Horn Circuit

POWER ANTENNA



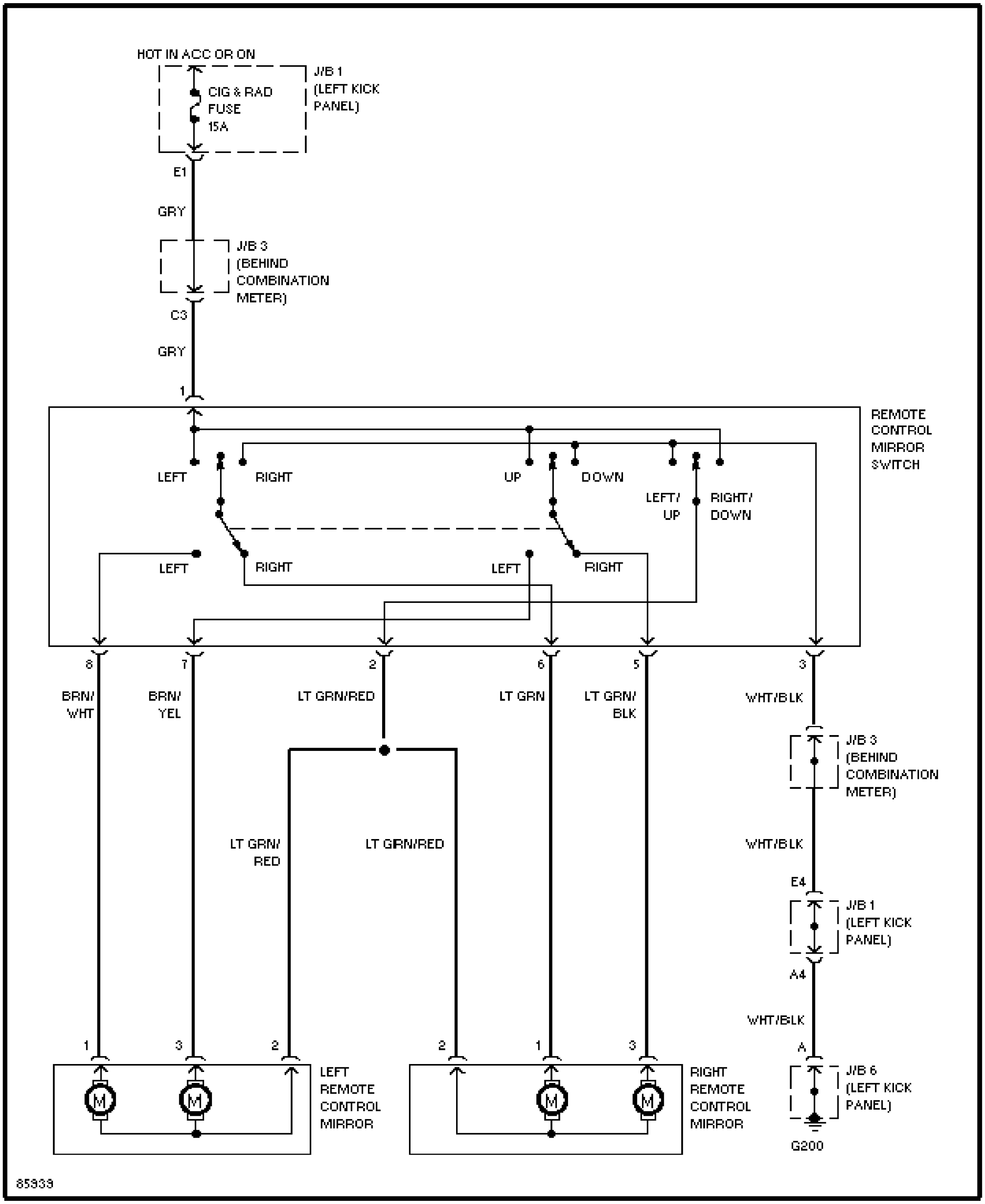
Power Antenna Circuit

POWER DOOR LOCKS



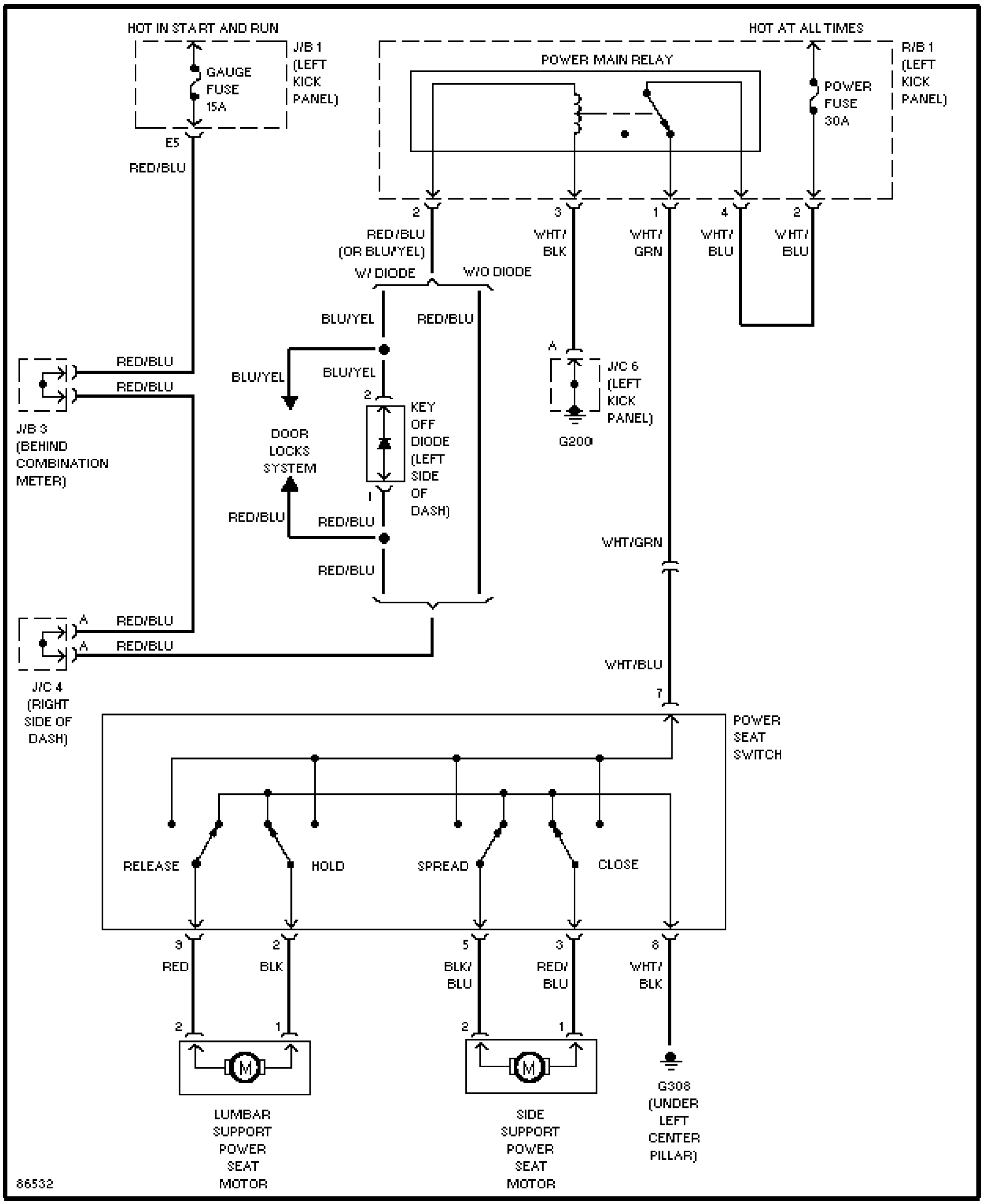
Power Door Lock Circuit

POWER MIRRORS



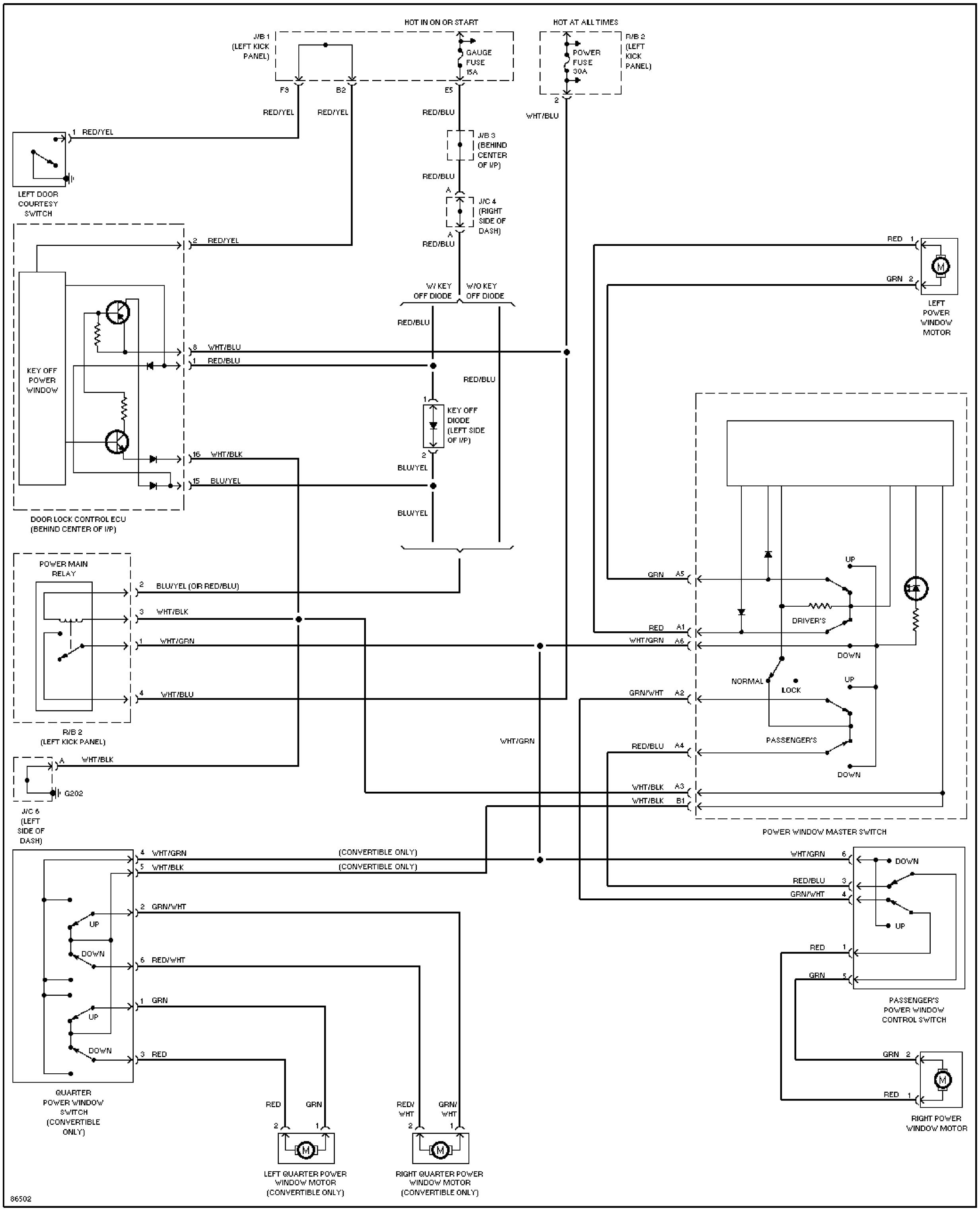
Power Mirror Circuit

POWER SEATS



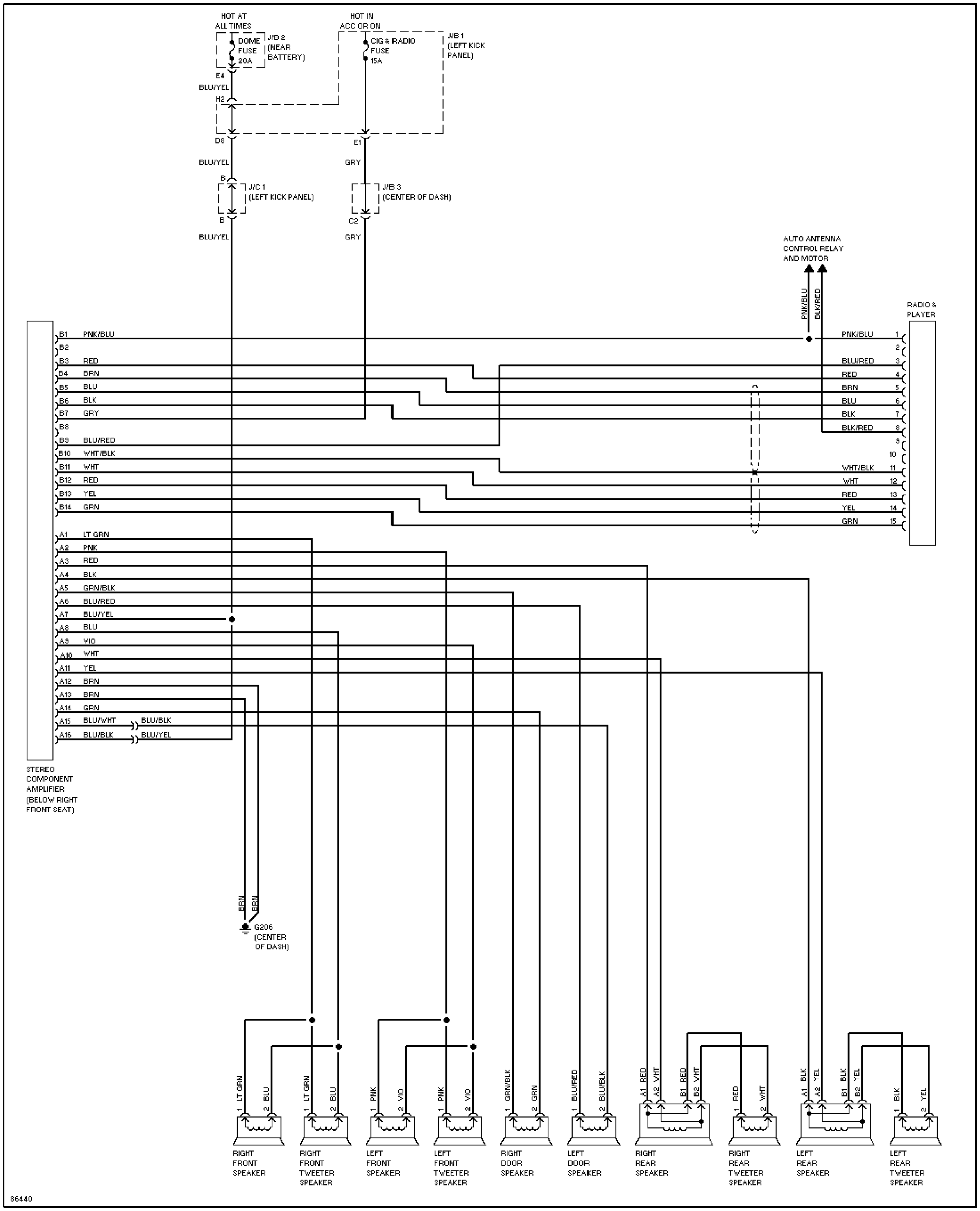
Power Seat Circuits

POWER WINDOWS

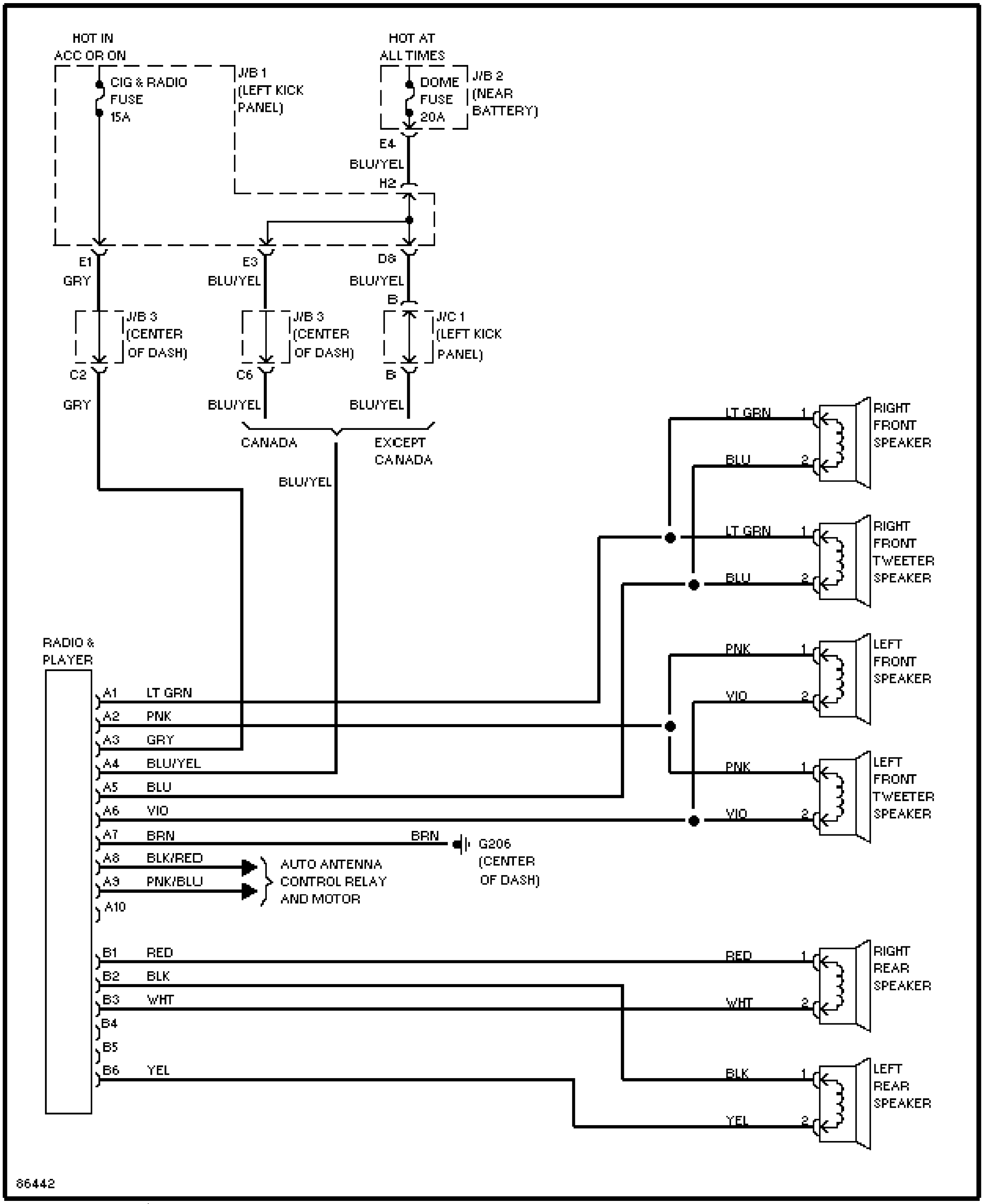


Power Window Circuit

RADIO

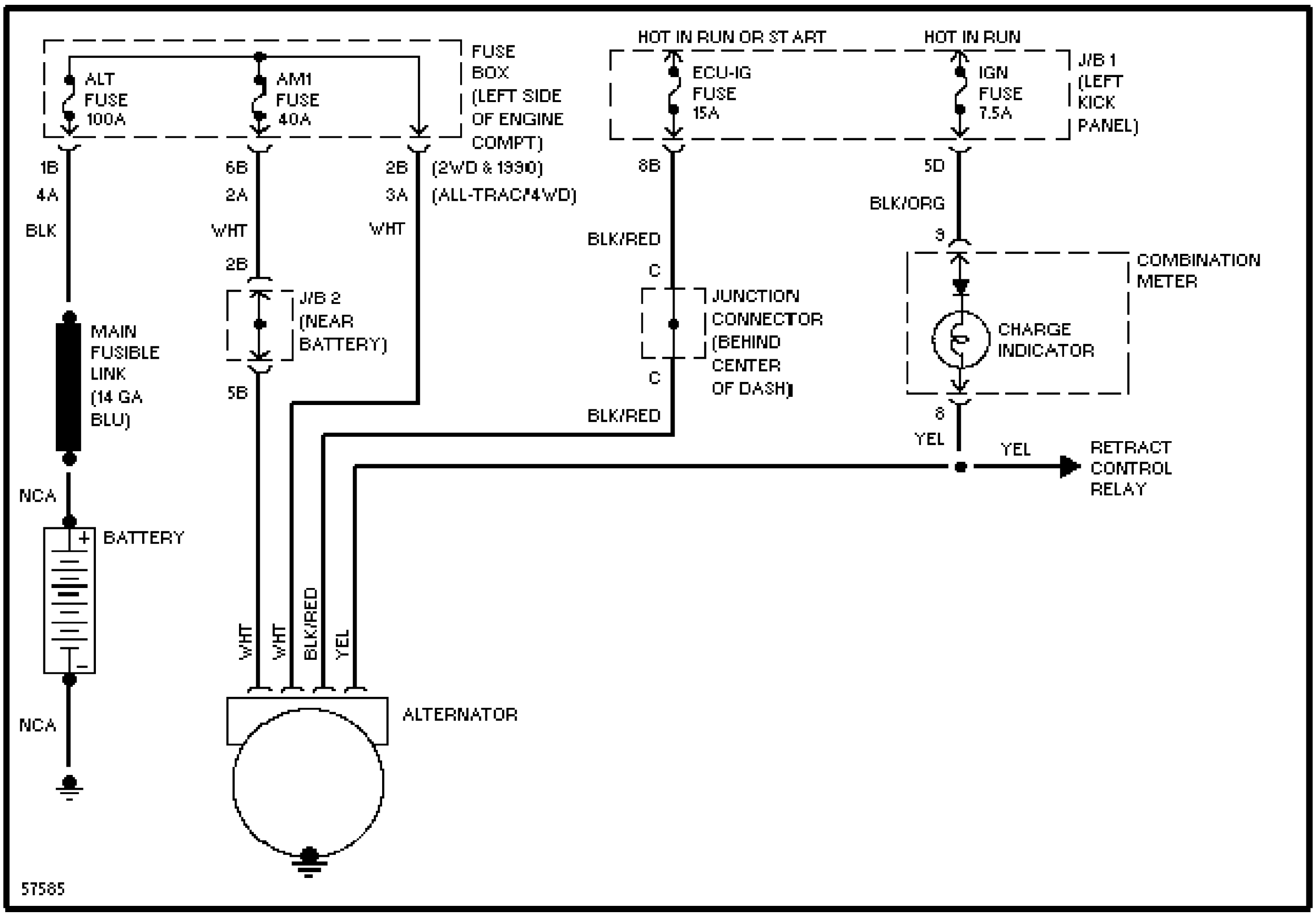


Radio Circuits, W/ CD Player

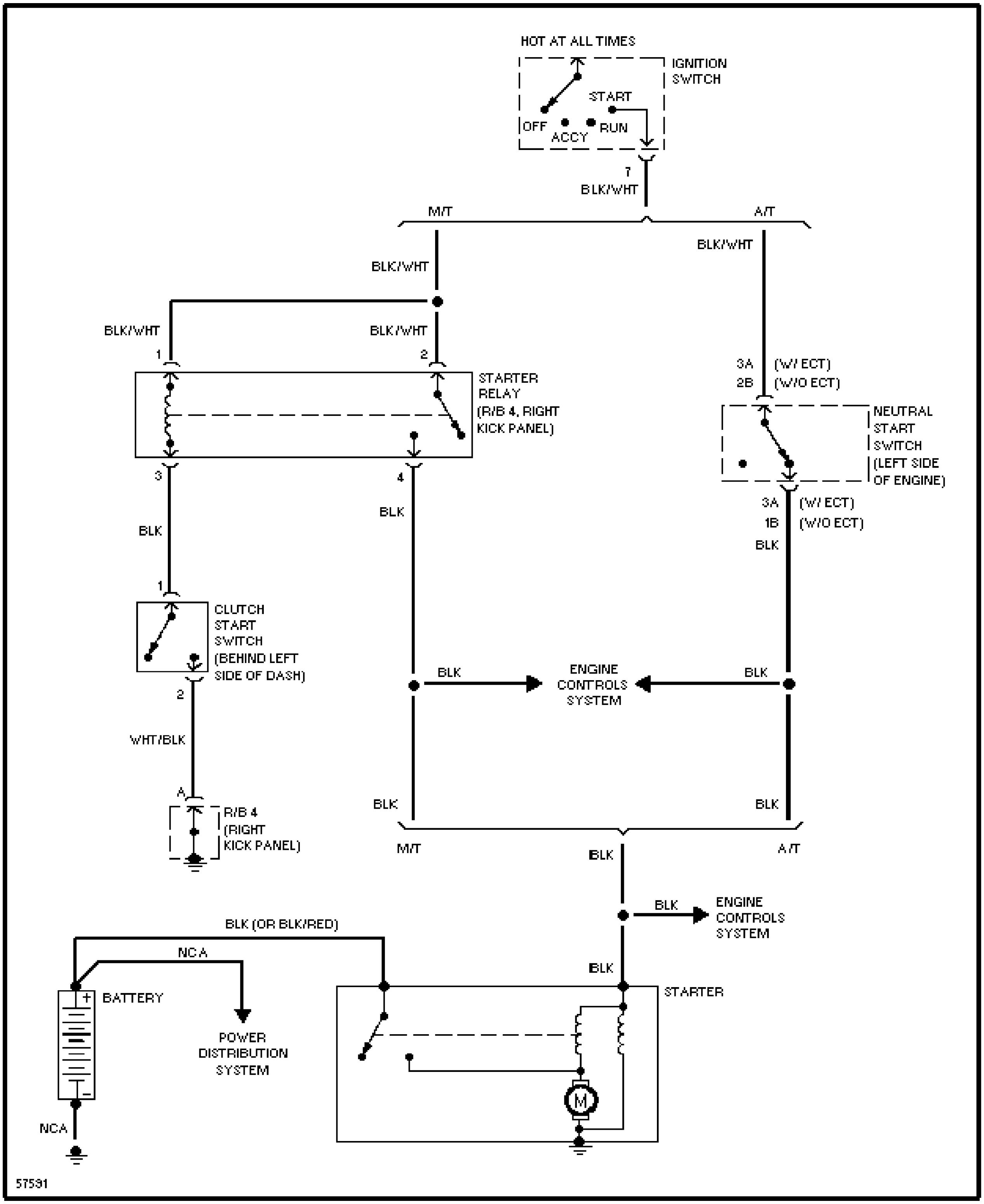


Radio Circuits, W/O CD Player

STARTING/CHARGING



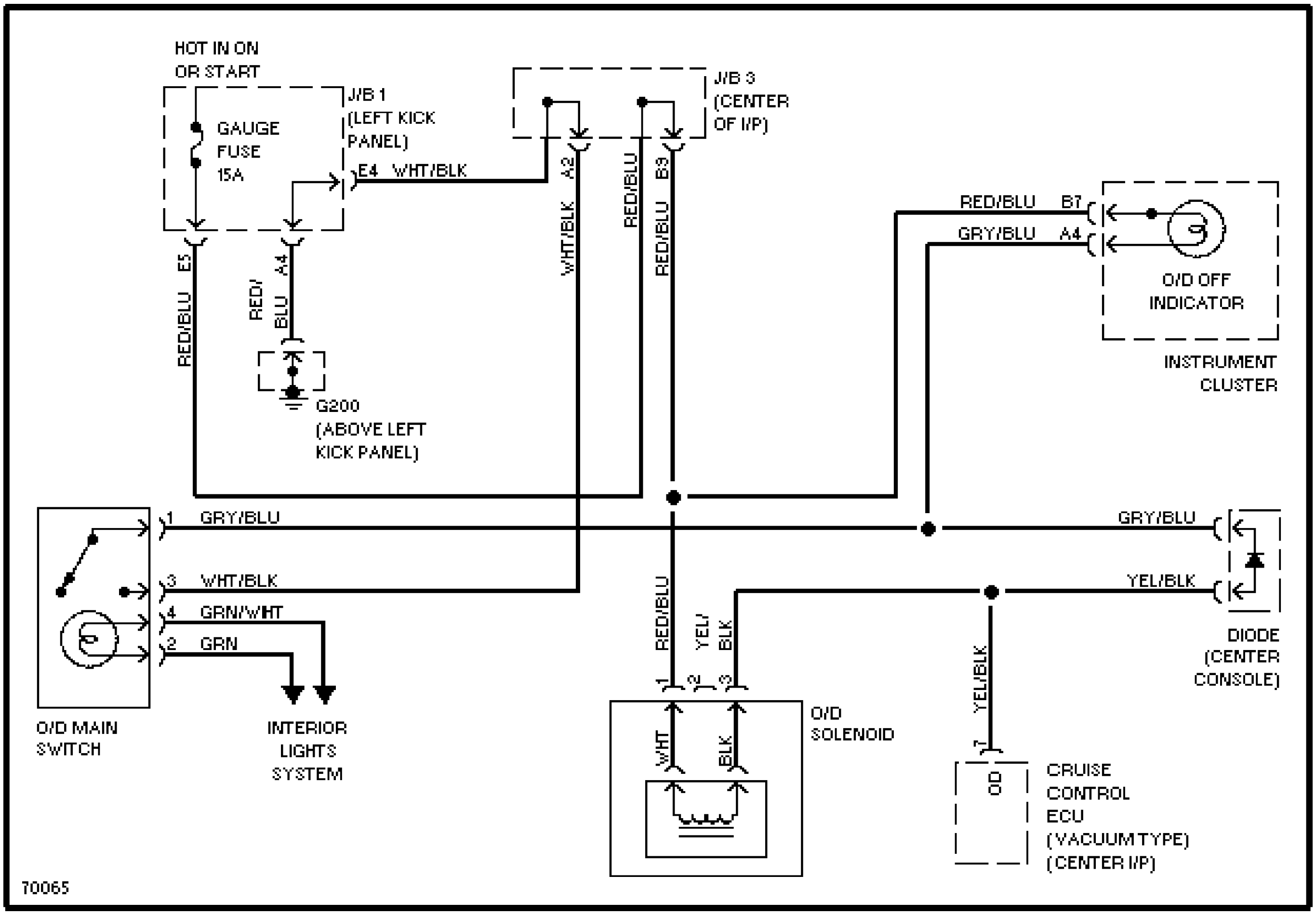
Charging Circuit



Starting Circuit

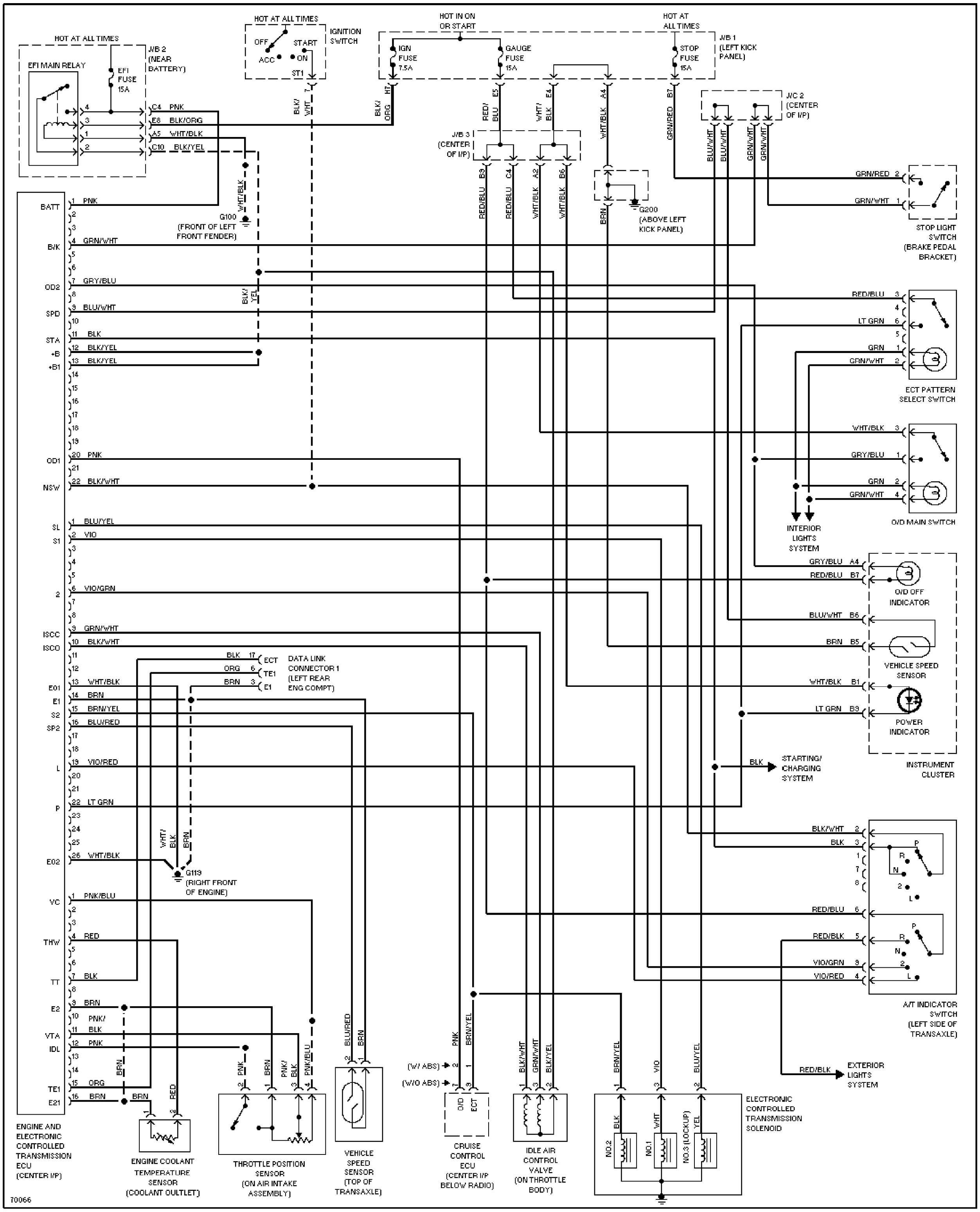
TRANSMISSION

1.6L



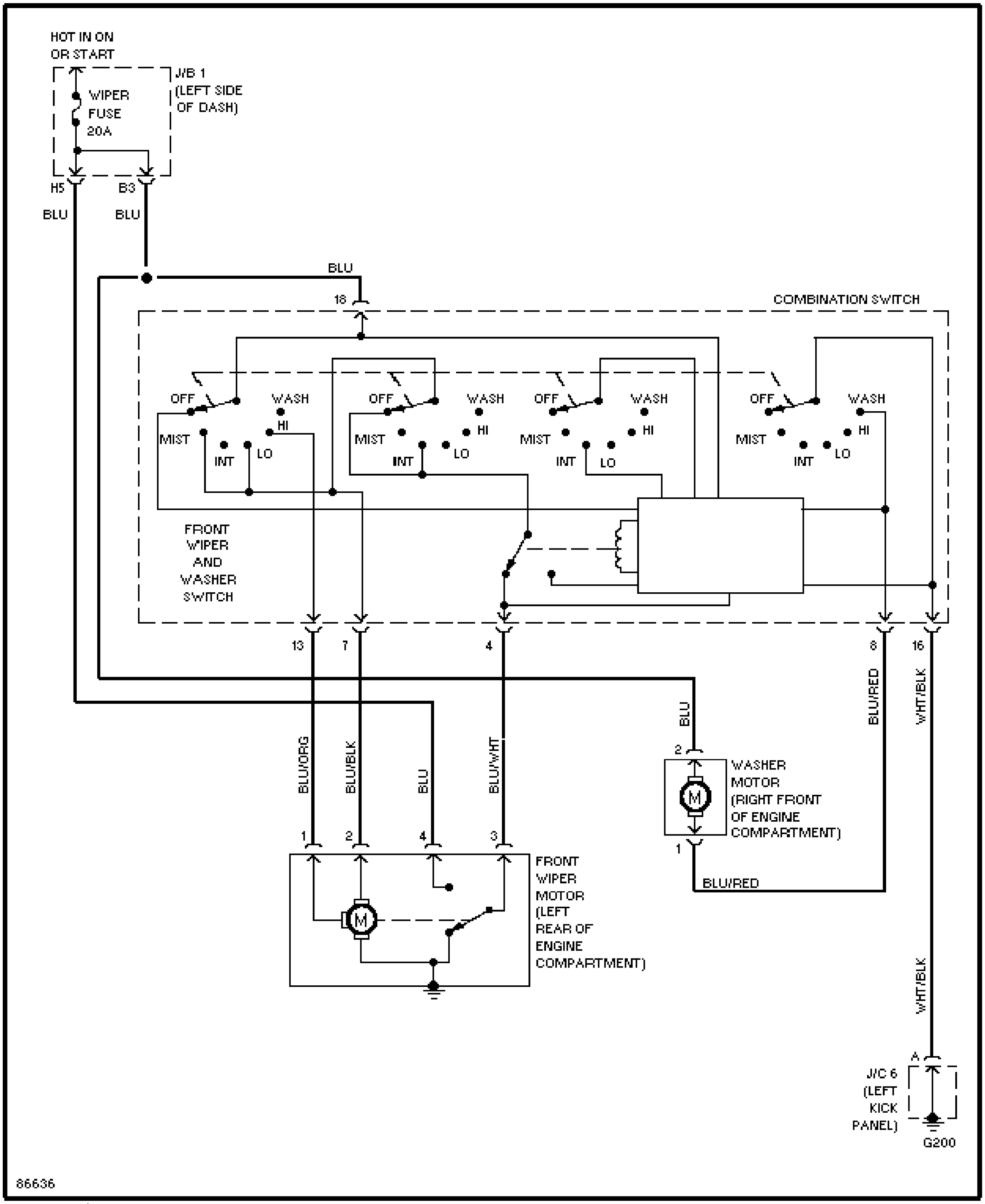
1.6L, Transmission Circuit

2.2L

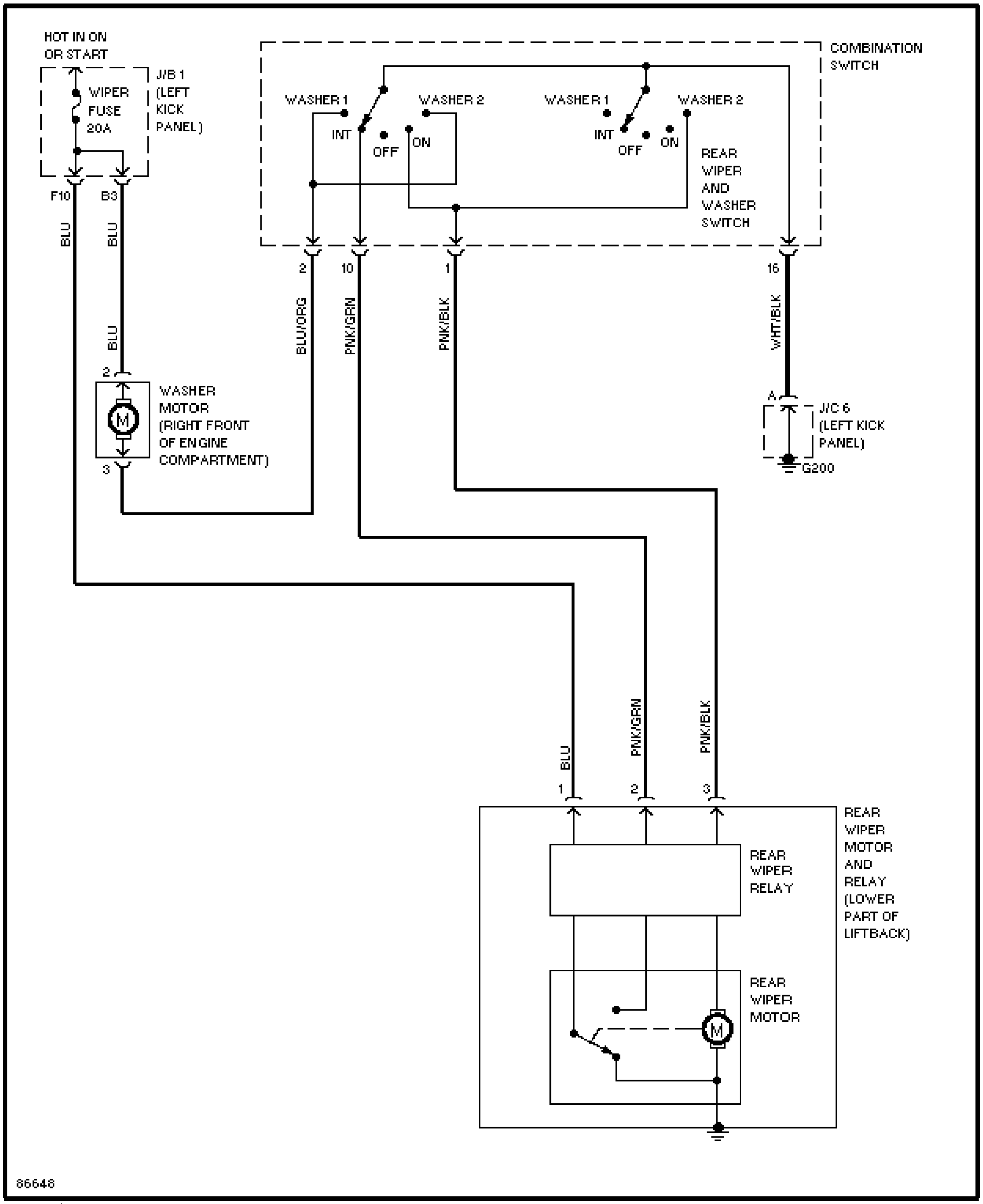


2.2L, Transmission Circuit

WIPER/WASHER



Front Washer/Wiper Circuit



Rear Wiper/Washer Circuit

1993 ENGINE PERFORMANCE
Toyota Trouble Shooting - No Codes

Camry, Celica, Corolla, Land Cruiser, MR2, Paseo, Pickup, Previa, Supra, Tercel, T100 & 4Runner

INTRODUCTION

Before diagnosing symptoms or intermittent faults, perform steps in F - BASIC TESTING and appropriate information in applicable G - TESTS W/ CODES articles. Use this article to diagnose driveability problems existing when a hard fault code is not present or vehicle is not equipped with a self-diagnostic system.

NOTE: Some driveability problems may have been corrected by manufacturer with a revised computer calibration chip or computer control module. Check with manufacturer for latest chip or computer application.

Symptom checks can direct the technician to malfunctioning component(s) for further diagnosis. A symptom should lead to a specific component, system test or adjustment.

Use intermittent test procedures to locate driveability problems that DO NOT occur when the vehicle is being tested. These test procedures should also be used if a soft (intermittent) trouble code was present, but no problem was found during self-diagnostic testing.

NOTE: For specific testing procedures, see I - SYS/COMP TESTS article. For specifications, see D - ADJUSTMENTS or appropriate C - SPECIFICATIONS article.

SYMPTOMS

SYMPTOM DIAGNOSIS

Symptom checks cannot be used properly unless the problem occurs while the vehicle is being tested. To reduce diagnostic time, ensure steps in F - BASIC TESTING and appropriate G - TESTS W/ CODES article were performed before diagnosing a symptom. Symptoms available for diagnosis include:

* Engine Cranking Or Starting Problems
* Engine Idling Problems
* Engine Driveability Problems
* Engine Stalling Problems
* Engine Has Poor Fuel Economy

ENGINE CRANKING OR STARTING PROBLEMS

Engine Fails To Crank

* Check battery, cables, charging system and fusible links.
* Check ignition switch.
* Check starter and wiring connections.
* Check clutch switch (M/T) or park/neutral switch (A/T).
* Check starter relay (if equipped).
* Check theft deterrent system (if equipped).

Engine Cranks But Fails To Start

* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector, fuel pressure regulator).
* Check Engine Control Module (ECM) and wiring.
* Check airflow meter or vacuum sensor and wiring.
* Check idle air control valve (if equipped) and wiring.
* Check circuit opening relay and EFI main relay.
* Check engine compression, valve clearance, valve timing and timing belt (if equipped).

Engine Difficult To Start Under Normal Conditions

* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Check engine compression, valve clearance, valve timing and timing belt (if equipped).
* Check idle air control valve (if equipped) and wiring.
* Check EGR system.
* Check cold start injector system (if equipped).
* Check coolant temperature sensor and wiring.
* Check air temperature sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

Engine Difficult To Start Under Cold Conditions

* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Check coolant temperature sensor and wiring.
* Check STA signal at Engine Control Module (ECM).
* Check idle air control valve (if equipped) and wiring.
* Check cold start injector system (if equipped).
* Check air temperature sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

Engine Difficult To Start Under Hot Conditions

* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Ensure ignition timing is correct.
* Check fuel pressure control vacuum switching valve (if equipped) and wiring.
* Check coolant temperature sensor and wiring.
* Check idle air control valve (if equipped) and wiring.
* Check cold start injector system (if equipped).
* Check air temperature sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

ENGINE IDLING PROBLEMS

Incorrect Idle At Engine Start-up

* Check for defective throttle linkage or cable.
* Check throttle opener or dashpot (if equipped).
* Check idle-up vacuum switching valve (if equipped) and wiring.
* Check idle air control valve (if equipped) and wiring.
* Check coolant temperature sensor and wiring.

* Check Engine Control Module (ECM) and wiring.

Engine Idle Speed Remains High

* Check for defective throttle linkage or cable.
* Check dashpot or throttle opener (if equipped).
* Check idle-up vacuum switching valve (if equipped) and wiring.
* Check idle air control valve (if equipped) and wiring.
* Check coolant temperature sensor and wiring.
* Check air temperature sensor and wiring.
* Check Throttle Position Sensor (TPS) and wiring.
* Check A/C signal circuit to Engine Control Module (ECM).
* Check park/neutral switch signal to Engine Control Module (ECM).
* Check cold start injector system (if equipped).
* Check fuel injectors.
* Check Engine Control Module (ECM) and wiring.

Engine Idle Speed Remains Low

* Check coolant temperature sensor and wiring.
* Check idle air control valve (if equipped) and wiring.
* Check EGR system.
* Check airflow meter or vacuum sensor and wiring.
* Check fuel injectors.
* Check Engine Control Module (ECM) and wiring.

Rough Engine Idle

* Check for vacuum leaks.
* Check EGR system.
* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Check engine compression, valve clearance, valve timing and timing belt (if equipped).
* Check coolant temperature sensor and wiring.
* Check idle air control valve (if equipped) and wiring.
* Check airflow meter or vacuum sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

Engine Misfires

* Check EGR system.
* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Check engine compression, valve clearance, valve timing and timing belt (if equipped).
* Check fuel injectors and cold start injector (if equipped).
* Check airflow meter or vacuum sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

ENGINE DRIVEABILITY PROBLEMS

Hesitation & Poor Acceleration

* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Check EGR system.

* Check engine compression, valve clearance, valve timing and timing belt (if equipped).
* Check Throttle Position Sensor (TPS) and wiring.
* Check airflow meter or vacuum sensor and wiring.
* Check coolant temperature sensor and wiring.
* Check air temperature sensor and wiring.
* Check oxygen sensor and wiring.
* Check cold start injector system (if equipped).
* Check Engine Control Module (ECM) and wiring.

Engine Backfires

* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Check valve timing and timing belt (if equipped).
* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Check EGR system.
* Check Throttle Position Sensor (TPS) and wiring.
* Check airflow meter or vacuum sensor and wiring.
* Check coolant temperature sensor and wiring.
* Check air temperature sensor and wiring.
* Check oxygen sensor and wiring.

Engine Surges

* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Check Engine Control Module (ECM) and wiring.

Engine Knocks

* Ensure ignition timing is correct.
* Check knock sensor (if equipped) and wiring.
* Check EGR system.
* Check valve timing and timing belt (if equipped).
* Check Engine Control Module (ECM) and wiring.

Muffler Explosion

* Ensure ignition timing is correct.
* Check fuel-cut system.
* Check cold start injector system (if equipped).
* Ensure fuel injectors and fuel pressure regulator operate correctly.
* Check coolant temperature sensor and wiring.
* Check airflow meter or vacuum sensor and wiring.
* Check Throttle Position Sensor (TPS) and wiring.
* Check air temperature sensor and wiring.
* Check oxygen sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

ENGINE STALLING PROBLEMS

Engine Stalls Soon After Start-up

* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Ensure proper spark exists from ignition system.
* Check EGR system.
* Check idle air control valve (if equipped) and wiring.

* Check airflow meter or vacuum sensor and wiring.
* Check coolant temperature sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

Engine Stalls After Accelerator Is Depressed

* Ensure fuel system performs properly (fuel pump, fuel filter, fuel injector and fuel pressure regulator).
* Ensure proper spark exists from ignition system.
* Check airflow meter or vacuum sensor and wiring.
* Check EGR system.
* Check Throttle Position Sensor (TPS) and wiring.
* Check Engine Control Module (ECM) and wiring.

Engine Stalls After Accelerator Is Released

* Check idle air control valve (if equipped) and wiring.
* Check EGR system.
* Check airflow meter or vacuum sensor and wiring.
* Check Engine Control Module (ECM) and wiring.

Engine Stalls During A/C Operation

* Check A/C signal circuit to Engine Control Module (ECM).
* Check idle air control valve (if equipped) and wiring.
* Check Engine Control Module (ECM) and wiring.

Engine Stalls When Shifting From Neutral Into Drive (A/T)

* Check idle air control valve (if equipped) and wiring.
* Check park/neutral switch signal to Engine Control Module (ECM).

ENGINE HAS POOR FUEL ECONOMY

Check for vacuum leaks (oil filler cap, oil dipstick, hose connections, PCV hose, PCV valve and EGR system).

* Check air filter.
* Check idle speed.
* Ensure proper spark exists from ignition system.
* Ensure ignition timing is correct.
* Check engine compression, valve clearance, valve timing and timing belt (if equipped).
* Check EGR system.
* Check dashpot or throttle opener (if equipped).
* Check fuel-cut system.
* Check fuel injectors.
* Check cold start injector system (if equipped).
* Check airflow meter or vacuum sensor and wiring.
* Check coolant temperature sensor and wiring.
* Check Throttle Position Sensor (TPS) and wiring.
* Check oxygen sensor and wiring.
* Check air temperature sensor and wiring.

INTERMITTENTS

INTERMITTENT PROBLEM DIAGNOSIS

Intermittent fault testing requires duplicating circuit or component failure to identify the problem. These procedures may lead to the computer setting a fault code, which may help in diagnosis.

If problem vehicle does not produce fault codes, use DVOM to help pinpoint faults. Monitor voltage or resistance values while attempting to reproduce conditions causing intermittent fault. A status change on DVOM indicates area of fault.

When monitoring voltage, ensure ignition switch is in ON position or engine is running. Ensure ignition switch is in OFF position or negative battery cable is disconnected when monitoring circuit resistance.

TEST PROCEDURES

Intermittent Simulation

To reproduce the conditions creating an intermittent fault, use the following methods:

* Lightly vibrate component. See VIBRATION METHOD.
* Heat component. See HEAT METHOD.
* Wiggle or bend wiring harness. See VIBRATION METHOD.
* Spray component with water. See HUMIDITY METHOD.
* Remove/apply vacuum source.

Monitor circuit/component voltage or resistance while simulating intermittent. If engine is running, monitor for self-diagnostic trouble codes. Use test results to identify a faulty component or circuit.

VIBRATION METHOD

Wiring Harness Testing

Using DVOM, monitor suspected circuit or component. Lightly shake wiring harness while noting fluctuation in DVOM reading. Inspect component connector harness for stretched areas. Inspect wiring harness at area where it goes through the body.

Component, Relay & Sensor Testing

Using DVOM, monitor suspected circuit or component. Lightly vibrate suspect component, relay or sensor while noting fluctuation in DVOM reading.

Electrical Connector Testing

Using DVOM, monitor suspected circuit or component. Lightly shake electrical connector while noting fluctuation in DVOM reading. Visually inspect electrical connector for damage.

HEAT METHOD

CAUTION: DO NOT heat any component to temperature greater than 140°F (60°C). DO NOT apply heat directly to any part of the Engine Control Module (ECM).

Using hair dryer or similar device, apply heat to the component. Monitor suspected circuit or component while applying heat.

HUMIDITY METHOD

CAUTION: DO NOT apply water directly to any electrical component.

If humidity or moisture is suspected of causing intermittent failure, lightly spray water on the front of warm radiator to increase humidity in the engine compartment. Check for malfunction by monitoring suspected circuit or component with a DVOM.

If vehicle has interior water leakage, the water may have damaged the Engine Control Module (ECM) or corroded the electrical connections. Carefully inspect ECM terminals and electrical connections for corrosion.

ELECTRICAL LOAD METHOD

To check if intermittent fault occurs under electrical load, turn on all electrical loads (heater blower, headlights, rear window defogger, wipers, etc.). Check for malfunction by monitoring suspected circuit or component with a DVOM.

1993 ENGINE PERFORMANCE
Toyota Self-Diagnostics

Celica

INTRODUCTION

If no faults were found while performing the test procedures in the F - BASIC TESTING - 4-CYL article, proceed with self-diagnostics. If no Diagnostic Trouble Codes (DTC) are present after entering self-diagnostics, proceed to H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.).

NOTE: Diagnostic trouble codes will be referred to as trouble codes in this article.

SELF-DIAGNOSTIC SYSTEM

Hard Failures

Hard failures cause Malfunction Indicator Light (MIL) on instrument panel to illuminate and remain on until problem is repaired. If light comes on and remains on (light may flash) during vehicle operation, corresponding trouble code will be retained in ECM memory on some trouble code applications. Not all trouble codes are retained in ECM memory. The cause of malfunction must be determined using trouble code charts. If a sensor fails, Engine Control Module (ECM) will use a substitute value in its calculations to continue engine operation. In this condition, commonly known as limp-in mode, the vehicle runs but driveability will not be optimum.

NOTE: The MIL may also be referred to as the CHECK ENGINE light. The MIL may not illuminate when certain failures such as faulty starter signal or A/C switch signal exist, or if certain trouble codes are set.

Intermittent Failures

Intermittent failures may cause Malfunction Indicator Light (MIL) to flicker or illuminate and go out after intermittent fault goes away. However, the corresponding trouble code will be retained in ECM memory on some trouble code applications. Not all trouble codes are retained in ECM memory. Intermittent failures may be caused by a sensor, connector or wiring related problem. See INTERMITTENTS in the H - TESTS W/O CODES article.

NOTE: Test Mode (if equipped) and Normal Mode on self-diagnostics system are used for retrieving trouble code from ECM memory for system diagnosis. For information on different mode usage, see RETRIEVING TROUBLE CODES.

RETRIEVING TROUBLE CODES

NOTE: On all models, Normal Mode is used to retrieve trouble code from ECM to determine problem area. On Celica 1.6L (4A-FE), the self-diagnostics system does not have Test Mode. On all other models, Test Mode is used to check for trouble codes when operating vehicle to simulate conditions in which trouble code was set. Test Mode helps determine malfunctions caused by poor electrical connections, which are difficult to determine using Normal Mode. Test Mode also checks for malfunction in starter signal circuit, A/C switch signal and Park/Neutral switch signal.

NOTE: The Malfunction Indicator Light (MIL) on the instrument panel may also be referred to as CHECK ENGINE light.

Normal Mode

1) Before retrieving trouble code(s), verify MIL on instrument panel light comes on with ignition on and engine off. The MIL light should go off when engine is started.

2) If MIL does not come on, see appropriate DIAGNOSTIC CIRCUIT CHECK chart under TROUBLE CODE DIAGNOSTIC CHARTS.

3) If MIL remains on, self-diagnostic system has detected a malfunction or abnormality. Ensure battery voltage is greater than 11 volts and charging system is okay. Warm engine to normal operating temperature.

4) Apply parking brake. Shift transmission/transaxle into Neutral(M/T) or Park (A/T). Turn A/C and all accessories off. Ensure throttle is in idle position.

5) Turn ignition on with engine off. Install Jumper Wire (SST 09843-18020) between terminals TE1 and E1 in Data Link Connector (DLC). See Fig. 1.

NOTE: Data link connector may be referred to as DLC. See Fig. 1.

6) Count number of flashes from MIL on instrument panel. If system is operating properly (with no trouble codes), MIL will flash continuously and evenly. See Fig. 2.

NOTE: If MIL will not flash, check TE1 and E1 wiring circuit. See the DIAGNOSTIC CHART CHECK chart under TROUBLE CODE DIAGNOSTIC CHARTS.

7) If trouble code exists, digits of trouble code will be flashed at approximately 1/2-second intervals. A 1 1/2-second pause separates first and second digits of code. See Fig. 2.

8) If more than one trouble code is stored, a 2 1/2-second pause will occur before next trouble code is flashed. Once all trouble codes are displayed, a 4 1/2-second pause will occur then trouble code(s) will be repeated.

9) Trouble codes are displayed in order of smallest to largest. After trouble codes are retrieved, remove jumper wire to exit Normal Mode. See NOTES ON TROUBLE CODES. For additional information on trouble codes, see TROUBLE CODE DIAGNOSTIC HINTS table under SELF-DIAGNOSTIC SYSTEM and appropriate table under TROUBLE CODE IDENTIFICATION.

NOTE: To repair failure causing trouble code, refer to proper trouble code chart under TROUBLE CODE CHARTS. Once repairs for trouble code are made, trouble code must be cleared from ECM memory. See CLEARING TROUBLE CODES.

NOTE: Test Mode is not available on Celica 1.6L 4A-FE.

Test Mode

1) Before retrieving trouble code(s), verify MIL on instrument panel light comes on with ignition on and engine off. The MIL light should go off when engine is started.

2) If MIL does not come on, see appropriate DIAGNOSTIC CIRCUIT CHECK chart under TROUBLE CODE DIAGNOSTIC CHARTS.

3) Ensure battery voltage is greater than 11 volts and charging system is okay. Apply parking brake. Shift the transmission/transaxle to Neutral (M/T) or Park (A/T). Turn A/C and

all accessories off. Ensure throttle is in idle position and ignition is off.

NOTE: Test Mode will not operate if jumper wire is installed between terminals TE2 and E1 in Data Link Connector (DLC) AFTER ignition is turned on.

4) Install Jumper Wire (SST 09843-18020) between terminals TE2 and E1 in Data Link Connector (DLC) with ignition off. See Fig. 1.

5) Turn ignition on with engine off. Test Mode is operational if MIL on instrument panel flashes. If MIL light fails to flash, check TE2 wiring circuit.

NOTE: See the L - WIRING DIAGRAMS article for TE2 wiring circuit.

6) Drive vehicle at a speed greater than 6 MPH. The ECM will set Trouble Codes 42 and 43 if vehicle is not driven. Try to simulate conditions of driveability complaint described by the customer and note when MIL comes on. This indicates when the problem exists.

7) Stop vehicle, but DO NOT turn engine off. Install jumper wire between terminals TE1 and E1 in data link connector. See Fig. 1. Count number of flashes from MIL on instrument panel. If system is operating properly (with no trouble codes), MIL will flash continuously and evenly. See Fig. 2.

8) If trouble code exists, digits of trouble code will be flashed at approximately 1/2-second intervals. A 1 1/2-second pause separates first and 2second digits of code. See Fig. 2.

9) If more than one trouble code is stored, a 2 1/2-second pause will occur before next trouble code is flashed. Once all trouble codes are displayed, a 4 1/2-second pause will occur, then trouble code(s) will be repeated. Trouble codes are displayed in order of smallest to largest.

NOTE: On all models, Trouble Code 51 will normally be displayed if transmission/transaxle is in any gear except Park or Neutral, A/C is turned on, or accelerator pedal is depressed.

10) After trouble code(s) is retrieved, remove jumper wires to exit Test Mode. See NOTES ON TROUBLE CODES. For additional information on trouble codes, see TROUBLE CODE DIAGNOSTIC HINTS table under SELF-DIAGNOSTIC SYSTEM and appropriate table under TROUBLE CODE IDENTIFICATION.

NOTE: The MIL may not come on if certain trouble code is set when in Test Mode. See TROUBLE CODE IDENTIFICATION CHARTS.

NOTE: To repair failure causing trouble code, refer to proper trouble code chart under TROUBLE CODE CHARTS. Once repairs for trouble code are made, trouble code must be cleared from ECM memory. See CLEARING TROUBLE CODES.

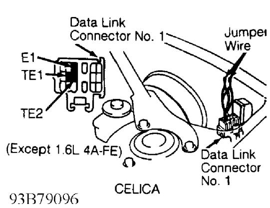


Fig. 1: Installing Jumper Wire In DLC (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

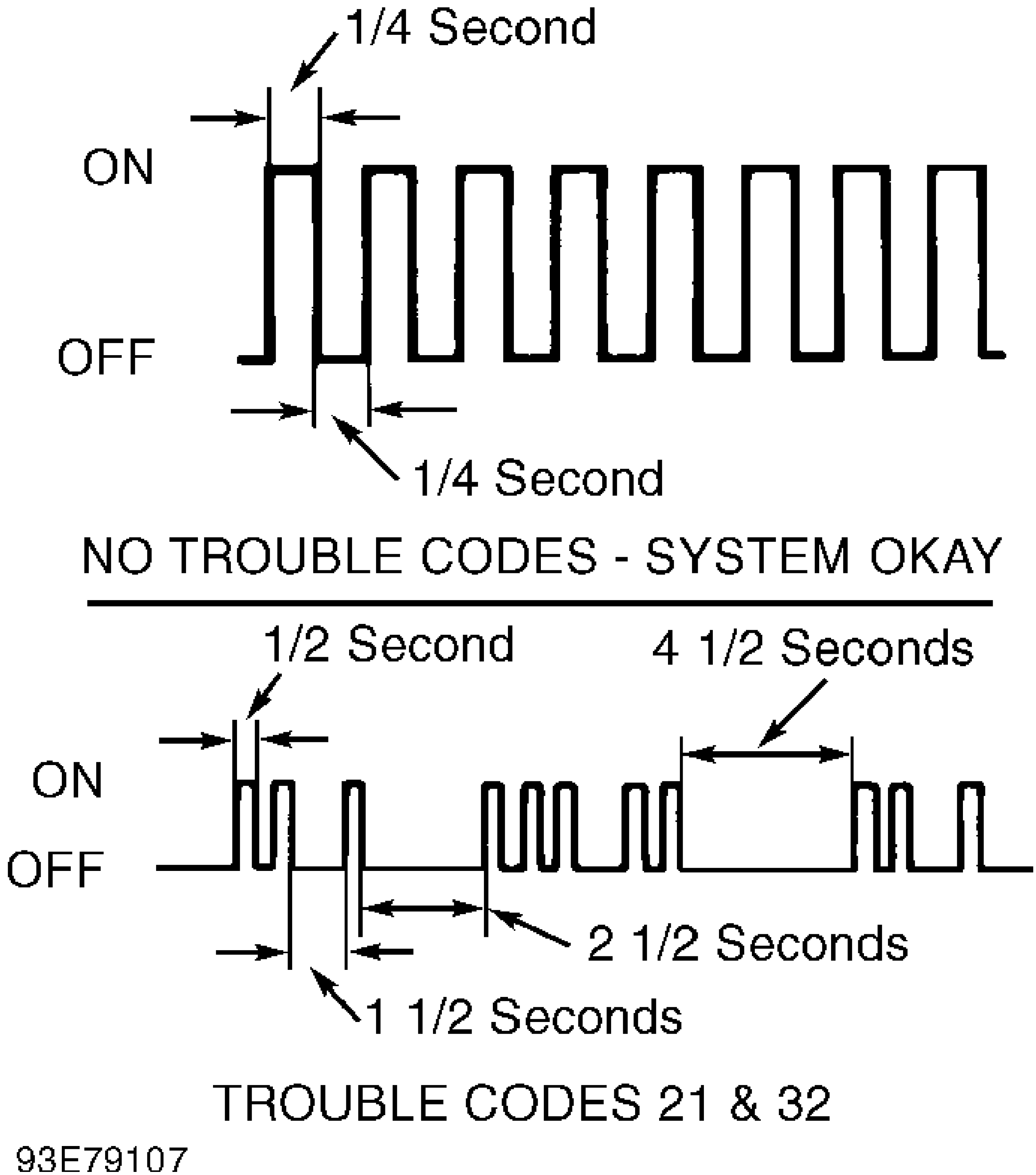


Fig. 2: Normal System Operation & Trouble Code I.D. Using MIL
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTES ON TROUBLE CODES

1) No other trouble code will appear with Trouble Code 11.

2) On various models when certain trouble codes occur, MIL on instrument panel will not come on. For designation of MIL operation on certain trouble codes, see appropriate table under TROUBLE CODE IDENTIFICATION.

3) On various models when certain trouble codes initially occur, they will be temporarily stored in ECM memory, but MIL on instrument panel will not come on.

4) The second time trouble code is detected, MIL on instrument panel will then come on. This is referred to as the 2 trip detection logic and only applies to specified trouble codes. See DETECTION LOGIC TROUBLE CODES table.

DETECTION LOGIC TROUBLE CODES TABLE

Application	Trouble Code
Celica	
1.6L (4A-FE)	21, 25, 26 & 71
2.0L Turbo (3S-GTE)	(1) 21, 25, 26 & 71
2.2L (5S-FE)	25, 26, 27 & 71

(1) - Detection logic is used on trouble code 21 on all except California models.

5) In Normal Mode, MIL on instrument panel will go off after malfunction is repaired, but trouble codes, except ECM non-memory codes, will be retained in ECM memory until cleared. ECM non-memory codes are not stored in ECM memory. See ECM NON-MEMORY TROUBLE CODES table.

NOTE: Test Mode is not used on Celica 1.6L 4A-FE.

6) In Test Mode (if equipped), all codes except ECM non-memory codes are retained in ECM memory, even with ignition off and repairs made, until cleared. ECM non-memory codes are not retained in ECM memory. See ECM NON-MEMORY TROUBLE CODES table.

NOTE: When in Test Mode, if vehicle is not driven at a speed greater than 6 MPH, ECM will set Trouble Codes 42 and 43. For MIL operation in relation to trouble code when in Test Mode, see appropriate table under TROUBLE CODE IDENTIFICATION.

ECM NON-MEMORY TROUBLE CODES TABLE

Application	Trouble Code
Normal Mode	
1.6L (4A-FE)	51
2.0L Turbo (3S-GTE)	43, 51 & 53
2.2L (5S-FE)	43 & 51
Test Mode	
2.0L Turbo (3S-GTE) & 2.2L (5S-FE)	42, 43 & 51

CLEARING TROUBLE CODES

1) After performing repairs, clear ECM memory of all stored trouble codes. To clear memory, turn ignition off. Remove proper fuse from fuse/relay box for approximately 30 seconds or more. See FUSE/RELAY BOX LOCATION table. See FUSE APPLICATION table to remove

proper fuse.

2) Depending on ambient temperature, fuse may need to be removed for more than 30 seconds in colder temperatures. Install fuse. Road test vehicle, and ensure system operates properly. See Fig. 2.

NOTE: Trouble codes may also be cleared by disconnecting negative battery cable. However, other memory functions (clock, radio, alarm, seats, etc.) will be canceled and must be reset.

FUSE/RELAY BOX LOCATION TABLE

Application	Location
Celica	Driver Side, Front Corner Of Engine Compartment

FUSE APPLICATION TABLE

Model	Fuse (Amperage)
Celica	EFI (15)

ECM LOCATION

NOTE: For illustration of ECM location, refer to the appropriate E - THEORY/OPERATION article in this section.

ECM LOCATION

Model	Location
Celica	Bottom Center Of Dash, In Front Of Console

SUMMARY

If no hard trouble codes are present (or only pass trouble codes), driveability symptoms exist or intermittent trouble codes exist, proceed to H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent procedures.

NOTE: To determine a common cause for a trouble code to be set, see TROUBLE CODE DIAGNOSTIC HINTS table below.

TROUBLE CODE DIAGNOSTIC HINTS

TROUBLE CODE DIAGNOSTIC HINTS

Trouble Code	(1) Diagnostic Hints
12	No "G1", "G2" or "NE" Ignition Signal To ECM Within 2 Seconds After Engine Is Cranked, No "G" Ignition Signal To ECM For 3 Seconds With Engine Speed Of 600-4000 RPM
13	No "NE" Ignition Signal To ECM When Engine Speed Is Greater Than Approximately 1000 RPM, No "G" Ignition Signal To ECM When "NE" Signal

Is Input 4 Times With Engine Speed Of 500-4000 RPM

14	No "IG" Or "IGF" Ignition Signal To ECM From Ignitor Several Times In Succession
16	Fault In Transmission/Transaxle ECM Or ECM
21	Defective Main O2 Sensor, Open Or Short Circuit In Main O2 Sensor Signal
22	Open Or Short Circuit In Coolant Temp. Sensor Signal
24	Open Or Short Circuit In Intake Air Temp. Sensor Signal
25	Lean Signal Sent By O2 Sensor For Several Seconds
26	Rich Signal Sent By O2 Sensor For Several Seconds
27	Open Or Short Circuit In Sub-O2 Sensor Signal
28	Defective O2 Sensor, Open Or Short Circuit In O2 Sensor Signal
31	Open Or Short Circuit In Airflow Meter, MAP Sensor Or Vacuum Sensor Signal
32	Open Or Short Circuit Between Airflow Meter Terminals
34	Turbocharger Pressure Is Abnormal
35	Open Or Short Circuit In Turbocharging Pressure Sensor Or BARO Sensor
41	Open Or Short Circuit In Throttle Position Sensor Signal
42	No Signal From Vehicle Speed Sensor For Several Seconds
43	No "STA" Signal To ECM Until Engine Reaches 800 RPM With Engine Cranking
47	Open Or Short Circuit In Sub-Throttle Position Sensor Signal
51	(2) Problem In One Of 3 Circuits Monitored By ECM
52	Open Or Short Circuit In Knock Sensor Signal
53	Knock Control In ECM Is Faulty
55	Open Or Short Circuit In Knock Sensor Signal
71	EGR Gas Temperature Less Than Predetermined Level During EGR Control
78	Open Or Short Circuit In Fuel Pump Control Circuit Or Fuel Pump Electronic Control Unit (ECM)
81	Open In ECT1 Circuit Between ECM & Transmission Control Module (TCM) For At Least 2 Seconds
83	Open In ESA1 Circuit Between ECM & Transmission Control Module (TCM) For 1/2 Second After Engine Idles At Least 1/2 Second
84	Open In ESA2 Circuit Between ECM & Transmission Control Module (TCM) For 1/2 Second After Engine Idles At Least 1/2 Second
85	Open In ESA3 Circuit Between ECM & Transmission Control Module (TCM) For 1/2 Second After Engine Idles At Least 1/2 Second

(1) - Listed are possible areas causing trouble codes. Not all trouble codes are used on all models.
(2) - Throttle position sensor, Park/Neutral switch and A/C Signal circuits are monitored.

TROUBLE CODE IDENTIFICATION

TROUBLE CODE IDENTIFICATION (CELICA) (1) (2) (3)

CODE No.	System Affected	MIL in NORMAL MODE	MIL in TEST MODE	Probable Cause:
12	RPM Signal	ON	N/A	Distributor, Starter or Ckt, ECM

13	RPM Signal	ON	ON	Distributor or Ckt, ECM
14	Ignition Signal	ON	N/A	Ignitor or Ckt to ECM, ECM
16 (2.2L)	Elect. Controlled A/T Signal	ON	N/A	ECM or Ckt
21 (1.6L)	O2 Sensor Signal	ON	N/A	O2 Sensor or Ckt, ECM
21 (2.0L)	O2 Sensor Signal	ON	(4)	O2 Sensor or Ckt, ECM
21 (2.2L)	O2 Sensor Signal	ON	N/A	O2 Sensor or Ckt, ECM
22	Coolant Temp. Sensor Signal	ON	ON	Coolant Temp. Sensor or Ckt, ECM
24	Intake Air Temp. Sensor Signal	ON (5)	ON	Intake Air Temp. Sensor or Ckt, ECM
25	Lean Air/Fuel Mixture	ON	ON	Loose Ground, Injector or Ckt, Fuel Pressure, Ignition System, Coolant Temp. Sensor, Airflow Meter, Vacuum Sensor, O2 Sensor or Ckt, Compression Pressure, ECM
26 (6)	Rich Air/Fuel Mixture	ON	ON	Loose Ground, Injector or Ckt, Fuel Pressure, Ignition System, Coolant Temp. Sensor, Airflow Meter, Vacuum Sensor, O2 Sensor or Ckt, Cold Start Injector or Ckt, Compression Pressure, ECM
27 (2.2L)	Sub-O2 Sensor Signal (7)	ON	ON	Sub-O2 Sensor or Ckt, ECM
31 (1.6L)	Vacuum Sensor Signal	ON	ON	Vacuum Sensor or Ckt, ECM
31 (2.0L)	Airflow Meter	ON	ON	Airflow Meter or Ckt, ECM
31 (2.2L)	Vacuum Sensor Signal	ON	ON	Vacuum Sensor or Ckt, ECM
32 (2.0L)	Airflow Meter	ON	ON	Airflow Meter or Ckt, ECM
34 (2.0L)	Turbocharging Pressure Sensor	ON	N/A	Turbocharging Pressure Sensor or Ckt, ECM
35 (2.0L)	Turbocharging Pressure Sensor	ON	ON	Turbocharging Pressure Sensor or Ckt, ECM
41	TPS Signal	ON (5)	ON	Throttle Position Sensor or Ckt, ECM
42	Vehicle Speed Sensor Signal	OFF	OFF	Vehicle Speed Sensor or Ckt, ECM

43 (1.6L)	Starter Signal	OFF	..	Starter Signal Ckt, Main Relay, Ignition Switch or Ckt, ECM
43 (2.0L) (2.2L)	Starter Signal	N/A	OFF	Starter Signal Ckt, Main Relay, Ignition Switch or Ckt, ECM
51 (1.6L)	Switch Condition Signal	OFF	..	A/C Switch, Park/Neutral Switch or Ckt, TPS or Ckt, ECM
51 (2.0L) (2.2L)	Switch Condition Signal	N/A	OFF	A/C Switch, Park/Neutral Switch or Ckt, TPS or Ckt, ECM
52 (2.0L) (2.2L)	Knock Sensor Signal	ON	N/A	Knock Sensor or Ckt, ECM
53 (2.0L)	Knock Control Signal	ON	N/A	ECM
71 (7)	EGR System Malfunction	ON	ON	EGR System, EGR Temp. Sensor or Ckt, EGR-VSV, ECM

(1) - The 1.6L is the 4A-FE engine, 2.0L is the Turbo 3S-GTE, and 2.2L is the 5S-FE engine.
(2) - Only Normal Mode is used on 1.6L (4A-FE). Both modes are used on all others. Information in Test Mode applies to all models except the 1.6L (4A-FE).
(3) - ON indicates MIL on instrument panel will be illuminated. N/A indicates item is not included in malfunction diagnosis when using this mode. OFF indicates MIL on instrument panel will be not be illuminated even if malfunction is detected.
(4) - The MIL will be illuminated if problem exists in O2 sensor circuit. The MIL will not be illuminated if problem exists in O2 sensor heater or circuit.
(5) - The MIL will be illuminated on California models only.
(6) - Applies to California models on 2.2L, or all models on 1.6L and 2.0L.
(7) - Applies to California models only.

TROUBLE CODE DIAGNOSTIC CHARTS

NOTE: All schematics and diagnostic flow charts are courtesy of Toyota Motor Sales, U.S.A., Inc.

ECM TERMINAL IDENTIFICATION

CAUTION: Perform all voltage measurements with ECM harness connector installed. Use a high-impedance DVOM (10,000-ohm minimum). Verify battery voltage is greater than 11 volts.

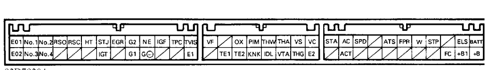
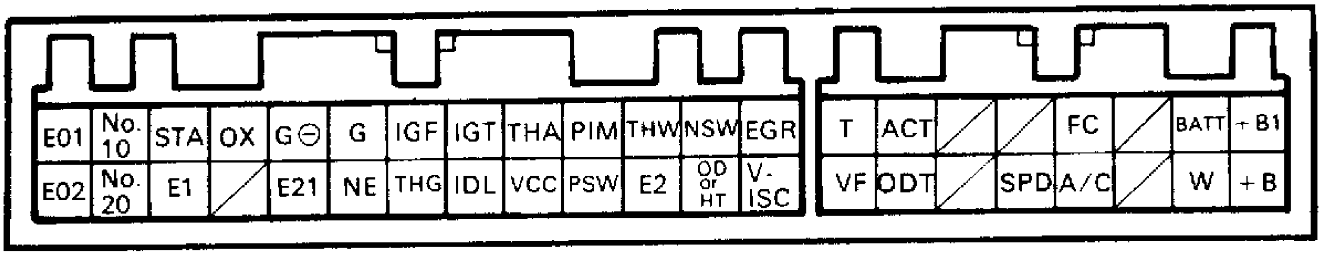
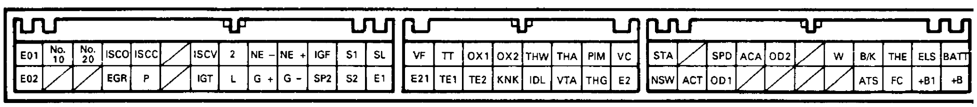


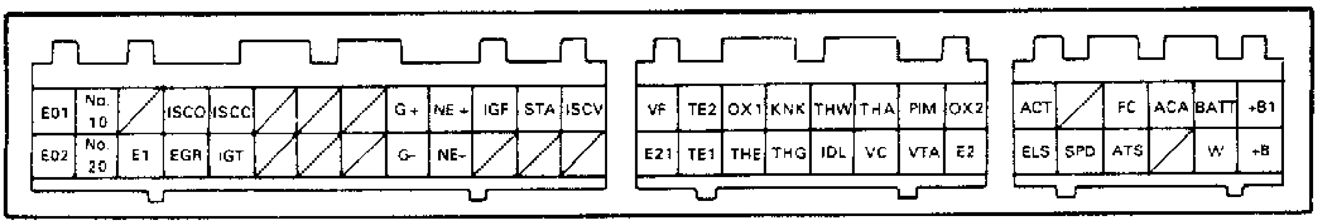
Fig. 3: ECM Terminal ID (3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



92D25810
Fig. 4: ECM Terminal ID (4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93E79305
Fig. 5: ECM Terminal ID (5S-FE W/ECT)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



92F25812
Fig. 6: ECM Terminal ID (5S-FE W/O ECT)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DIAGNOSTIC CIRCUIT CHECK

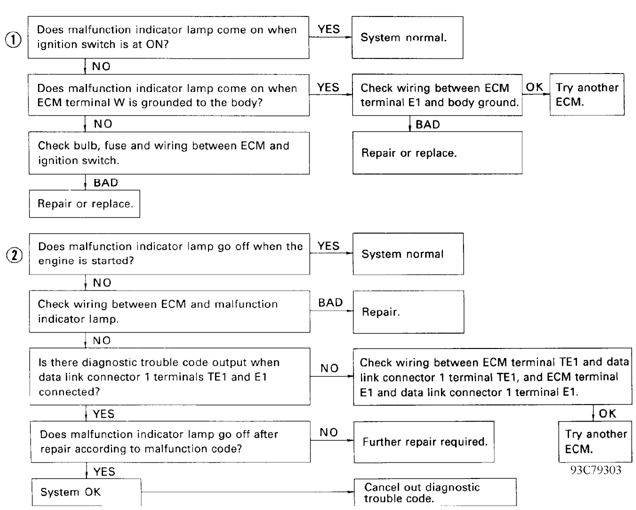


Fig. 7: Diagnostic Circuit Check Flow Chart

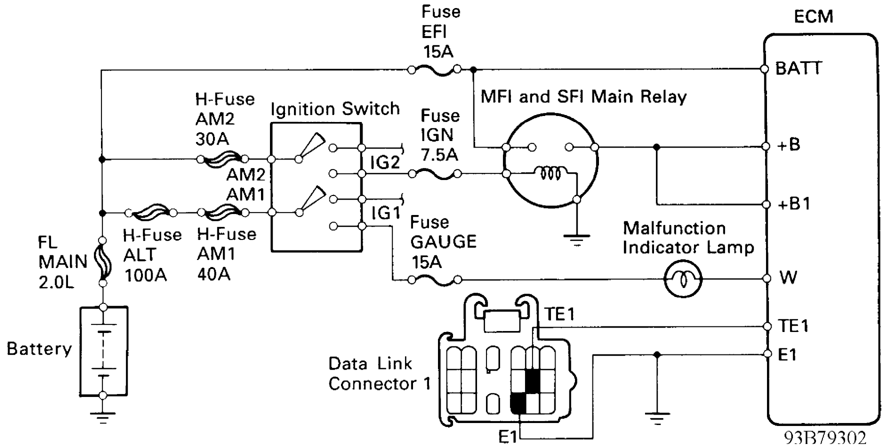


Fig. 8: Diagnostic Circuit Check Schematic

TEST NO. 1 - ECM POWER SOURCE

TEST NO. 1-ECM POWER SOURCE TROUBLE TABLE

Terminals	Trouble	Condition	STD Voltage
BATT - E1	No Voltage	——	10 - 14V

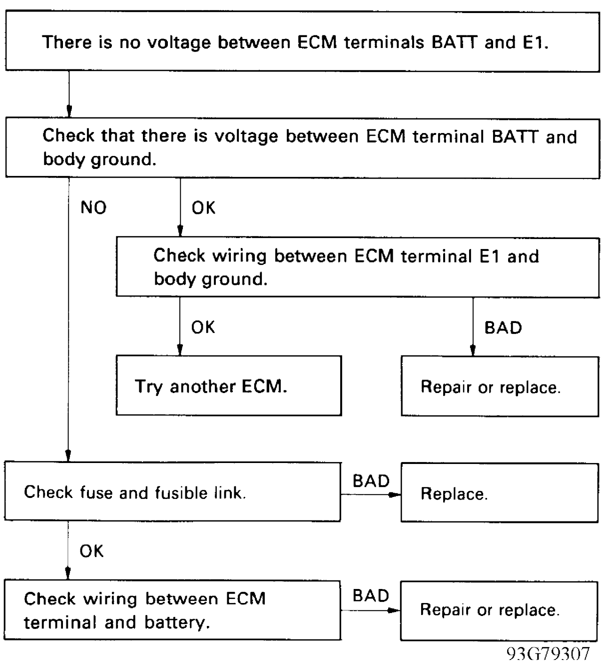


Fig. 9: Test No. 1 Flow Chart - ECM Power Source

Terminals	Trouble	Condition	STD voltage
BATT- E1	**No voltage**	–	**10 – 14 V**

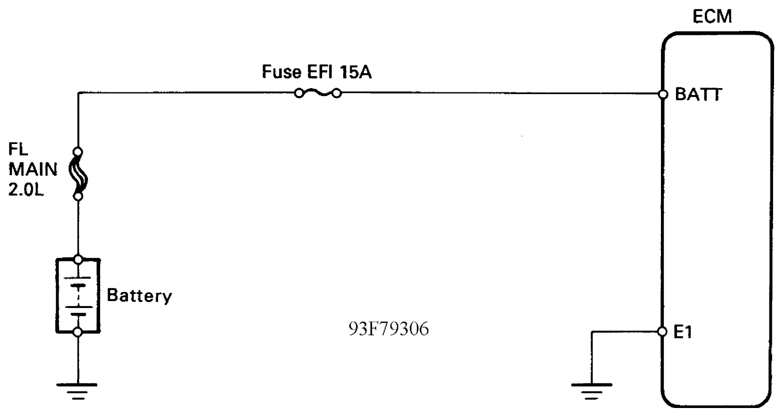


Fig. 10: Test No. 1 Schematic - ECM Power Source

TEST NO. 2 - ECM (+B) CIRCUIT

TEST NO. 2-ECM (+B) CIRCUIT TROUBLE TABLE

Terminals	Trouble	Condition	STD Voltage
+B - E1 +B1 - E1	No Voltage	Ignition Switch ON	10 - 14V

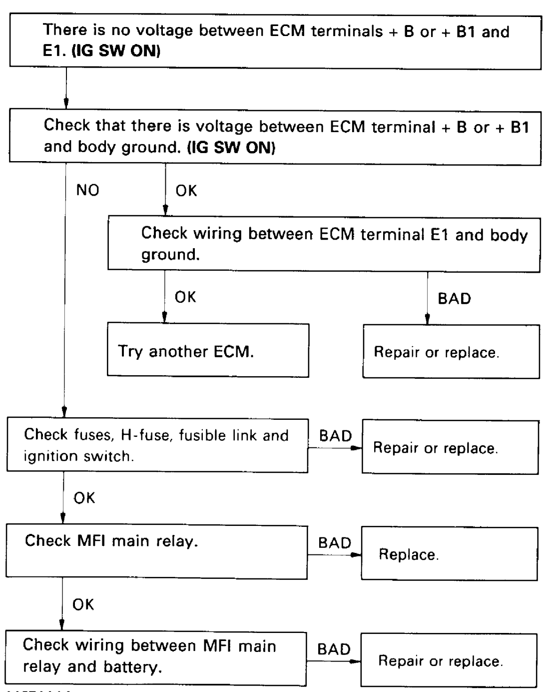


Fig. 11: Test No. 2 Flow Chart - ECM (+B) Circuit

Terminals	Trouble	Condition	STD voltage
+B +B1 – E1	No voltage	IG SW ON	10 – 14 V

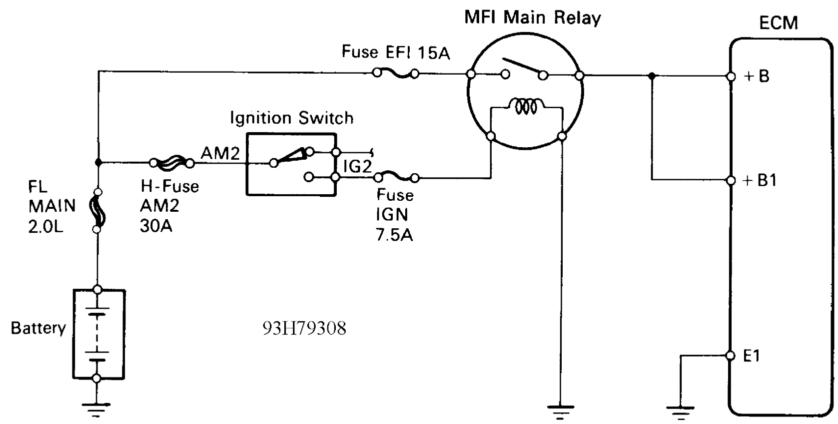


Fig. 12: Test No. 2 Schematic - ECM (+B) Circuit

CODE 12, 13 - RPM SIGNAL

Code 12 is caused by loss of "G2", "G1", or "NE" signal (3S-GTE), or no "G" or "NE" signal (all others), from distributor to ECM for at least 2 seconds after starter signal is received at ECM. Check distributor and ignition system components. See the article I - SYSTEM/COMPONENT TESTS in this section. Ensure starter signal exists at ECM. See CODE 43/TEST NO. 10 - STARTER SIGNAL test procedures in this article.

Code 13 is caused by loss of "NE" signal from distributor to ECM when engine RPM exceeds 1000-1500 RPM. Check for open or short in distributor wiring to ECM. Check distributor and ignition system components. See I - SYSTEM/COMPONENT TESTS article.

Code 12 is caused by loss of signal "G2", "G1", or "NE" (3S-GTE) or "G" or "NE" (all others) from distributor to ECM for at least 2 seconds after starter signal is received at ECM. Ensure starter signal exists at ECM. See CODE 43/TEST NO. 10 - STARTER SIGNAL test procedures in this article.

Code 13 is caused by loss of "NE" signal from distributor to ECM when engine RPM exceeds 1000 RPM.

NOTE: Diagnostic chart not available from manufacturer.

CODE 14/TEST NO. 3 - IGNITION SIGNAL

NOTE: To check ignition system components, see the article I - SYSTEM/COMPONENT TESTS in this section.

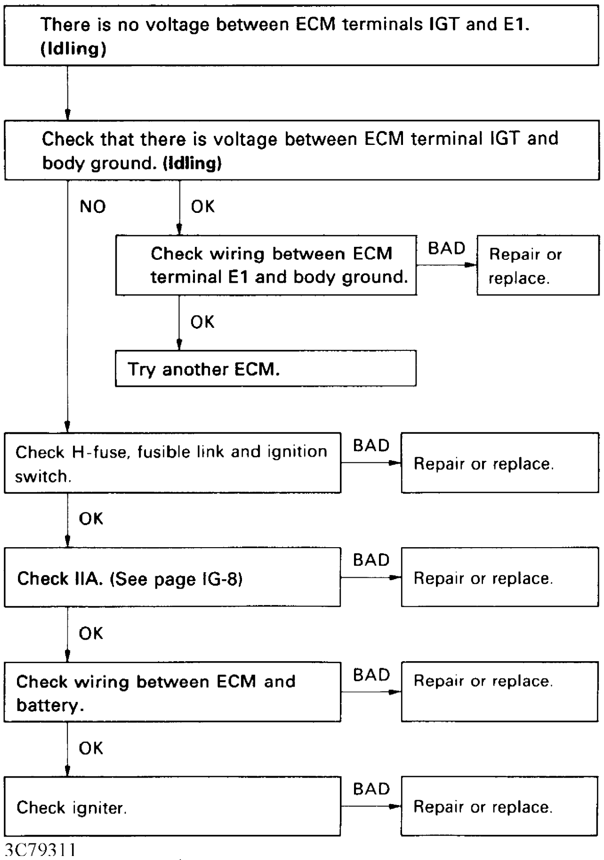


Fig. 13: Code 14/Test No. 3 Flow Chart (All Engines)
Ignition Signal

CODE 14/TEST NO. 3-IGNITION SIGNAL TROUBLE TABLE (4A-FE)

Terminals	Trouble	Condition	STD Voltage
IGT - E1	No Voltage	Idling	0.8 - 1.2V

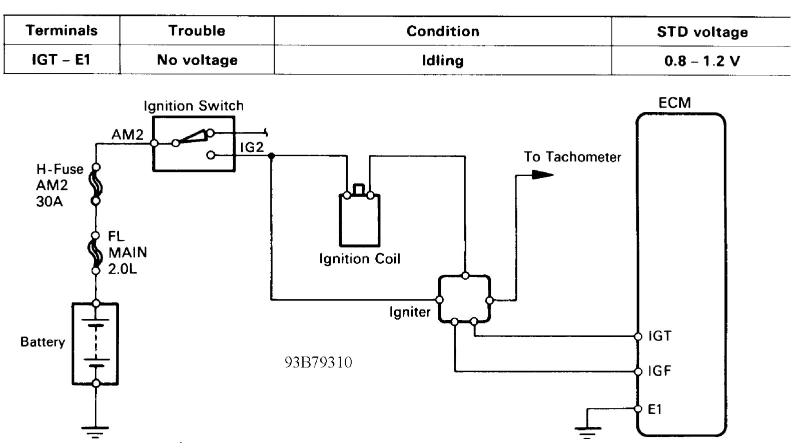


Fig. 14: Code 14/Test No. 3 Schematic (3S-GTE)
Ignition Signal

CODE 14/TEST NO. 3-IGNITION SIGNAL TROUBLE TABLE (3S-GTE)

Terminals	Trouble	Condition	STD Voltage
IGT - E1	No Voltage	Idling	0.7 - 1.0V

Terminals	Trouble	Condition	STD voltage
IGT – E1	No voltage	Idling	0.7 – 1.0 V

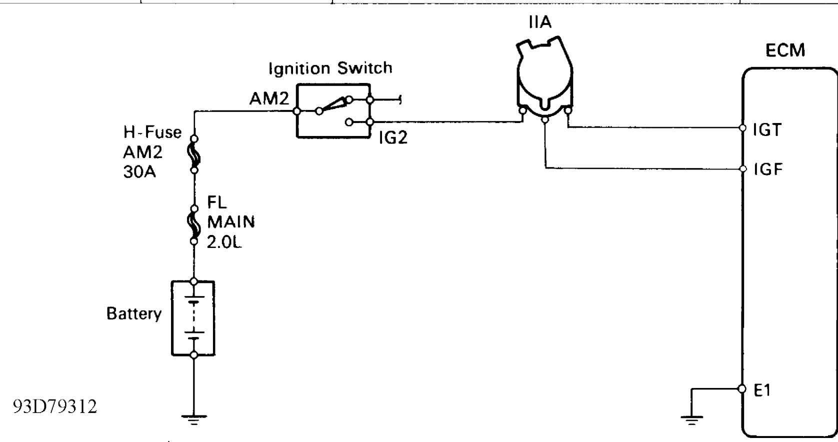


Fig. 15: Code 14/Test No. 3 Schematic (4A-FE)
Ignition Signal

CODE 14/TEST NO. 3-IGNITION SIGNAL TROUBLE TABLE (5S-FE)

NO.	Terminals	Trouble	Condition	STD Voltage
9	IGT - E1	No Voltage	Idling	0.8 - 1.2V

Terminals	Trouble	Condition	STD voltage
IGT – E1	No voltage	Idling	0.8 – 1.2 V

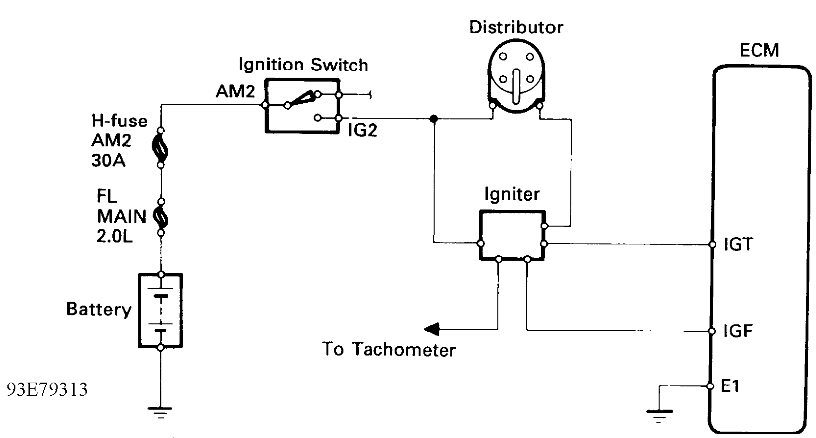


Fig. 16: Code 14/Test No. 3 Schematic (5S-FE)
Ignition Signal

CODE 21, 27/TEST NO. 4 - OXYGEN SENSOR SIGNAL

NOTE: Code 27 applies to 5S-FE only.

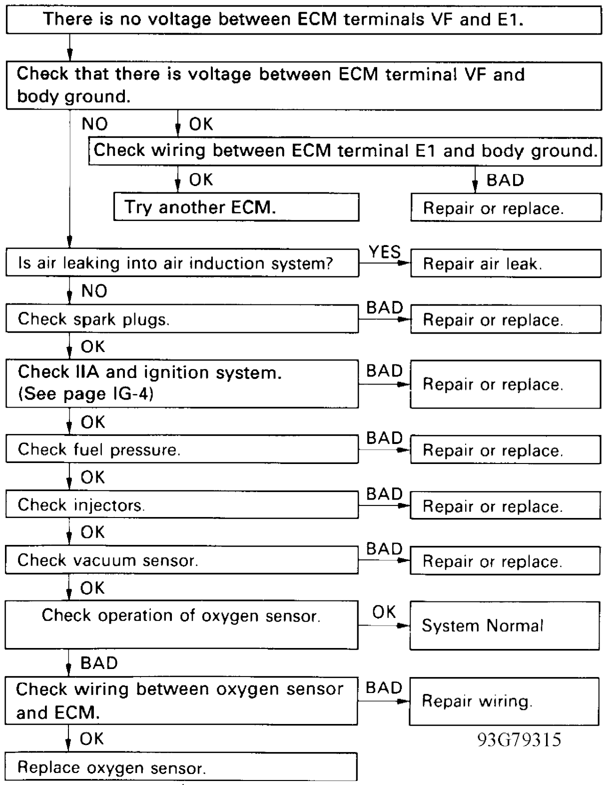


Fig. 17: Code 21/Test No. 4 Flow Chart
Oxygen Sensor Signal

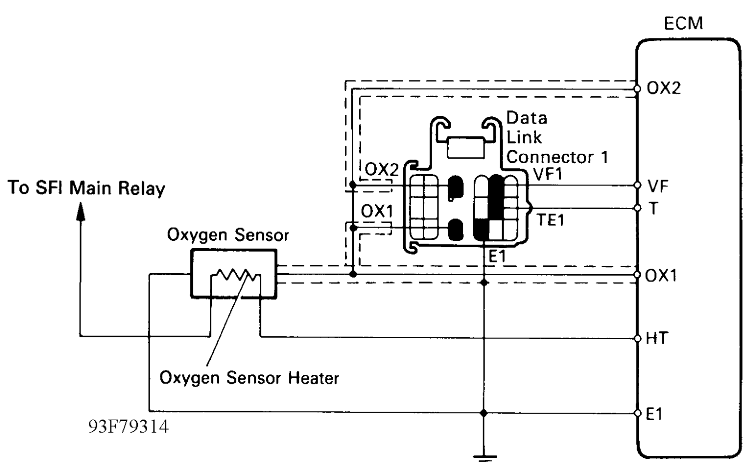


Fig. 18: Code 21/Test No. 4 Schematic (3S-GTE)
Oxygen Sensor Signal

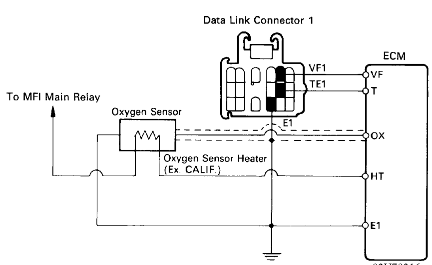


Fig. 19: Code 21/Test No. 4 Schematic (4A-FE)
Oxygen Sensor Signal

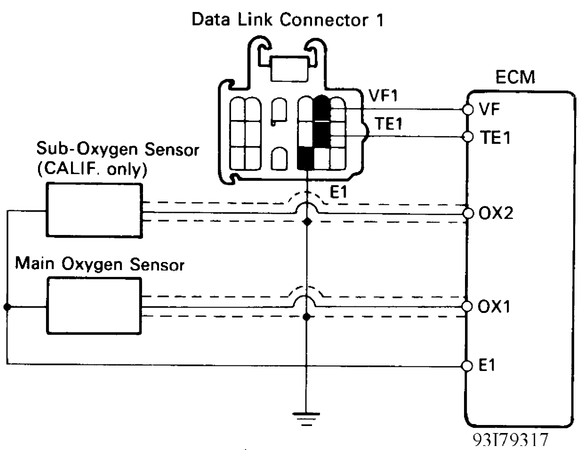


Fig. 20: Code 21, 27/Test No. 4 Schematic (5S-FE)
Oxygen Sensor Signal

CODE 22/TEST NO. 5 - COOLANT TEMPERATURE SENSOR SIGNAL

NOTE: Water temperature sensor is also referred to as coolant temperature sensor.

CODE 22/TEST NO. 5 - CTS SENSOR SIGNAL TROUBLE TABLE

Terminals	Trouble	Condition	STD Voltage
THW - E2	No Voltage	Ignition Switch ON Coolant Temp. 80°C (176°F)	0.1 - 1.1V

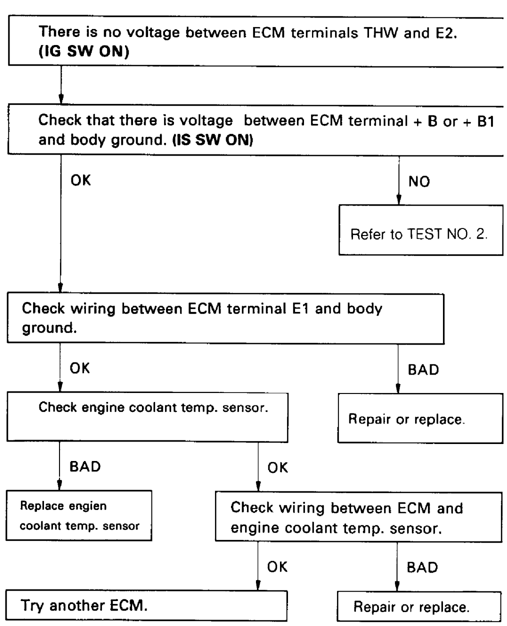


Fig. 21: Code /Test No. 5 Flow Chart
Coolant Temperature Sensor Signal

Terminals	Trouble	Condition		STD voltage
THW– E2	No voltage	IG SW ON	Engine coolant temperature 80°C (176°F)	0.1 – 1.0 V

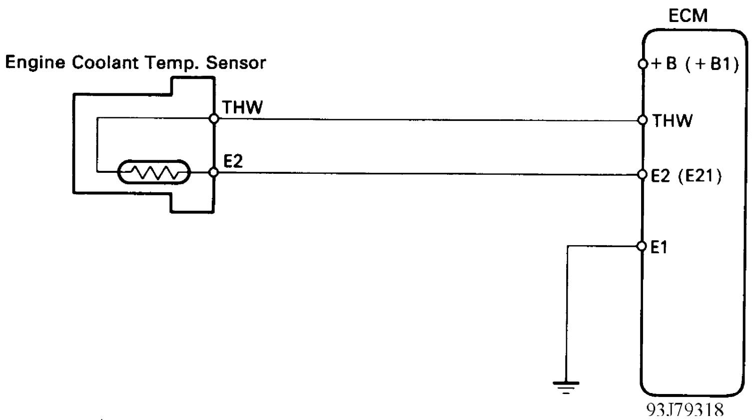


Fig. 22: Code 22/Test No. 5 Schematic
Coolant Temperature Sensor Signal

CODE 24/TEST NO. 6 - INTAKE AIR TEMPERATURE SENSOR SIGNAL

CODE 24/TEST NO. 6 - IAT SENSOR SIGNAL TROUBLE TABLE

Terminals	Trouble	Condition	STD Voltage
3S-GTE			
THA - E2	No Voltage	Ignition Switch ON Int. Air Temp. 20°C (68°F)	1 - 3V
4A-FE			
THA - E2	No Voltage	Ignition Switch ON Int. Air Temp. 20°C (68°F)	1 - 3V
5S-FE			
THA - E2	No Voltage	Ignition Switch ON Int. Air Temp. 20°C (68°F)	1.9 - 2.9V

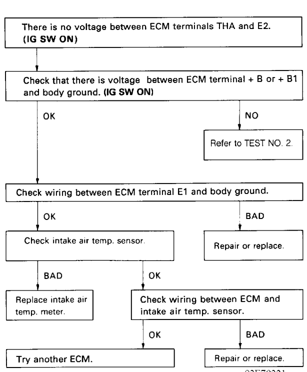


Fig. 23: Code 24/Test No. 6 Flow Chart (All Models)
Intake Air Temperature Sensor Signal

Terminals	Trouble	Condition		STD voltage
THA - E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	1 - 3 V

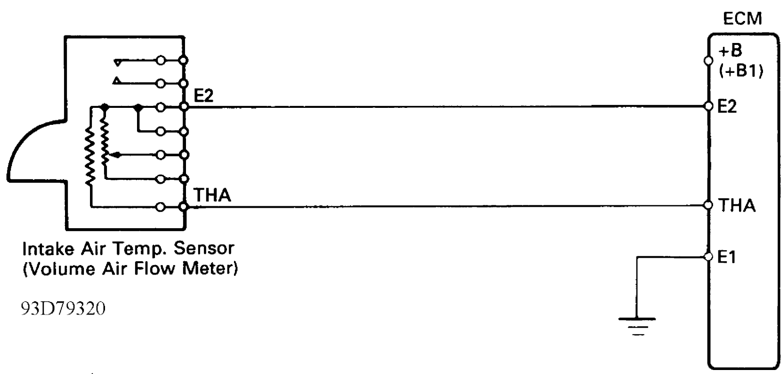


Fig. 24: Code 24/Test No. 6 Schematic (3S-GTE)
Intake Air Temperature Sensor Signal

Terminals	Trouble	Condition		STD voltage
THA- E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	1 - 3 V

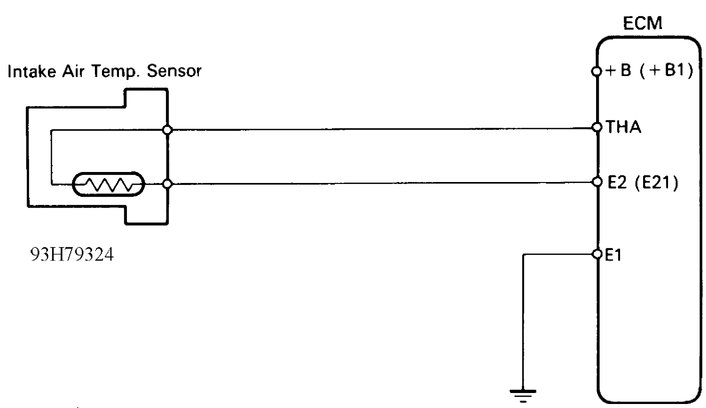


Fig. 25: Code 24/Test No. 6 Schematic (4A-FE & 5S-FE)
Intake Air Temperature Sensor Signal

CODE 25 - LEAN AIR/FUEL MIXTURE

Probable Causes

* Loose Engine Ground
* Open E1 Circuit
* Open Injector Circuit
* Open Or Short In Oxygen Sensor Or Circuit
* Fuel Line Pressure (Blocked Injector)
* Ignition System
* Coolant Temperature Sensor
* Airflow Meter Or Air Intake System (3S-GTE)
* Vacuum Sensor
* ECM

For oxygen (O2) sensor or circuit testing, see Code 21. For injector or circuit testing, see TEST NO. 13 - INJECTOR CIRCUIT.

NOTE: Diagnostic chart not available from manufacturer.

CODE 26 - RICH AIR/FUEL MIXTURE

Probable Causes

* Loose Engine Ground
* Open E1 Circuit
* Short In Injector Circuit Or Injector
* Open Or Short In Oxygen Sensor Or Circuit
* Fuel Line Pressure (Leaking Injector)
* Open Or Short In Cold Start Injector Or Circuit
* Airflow Meter Or Air Intake System (3S-GTE)
* Compression Pressure
* Coolant Temperature Sensor
* Vacuum Sensor Circuit
* ECM

For oxygen sensor or circuit testing, see Code 21. For injector or circuit testing, see CELICA TEST NO. 13.

NOTE: Diagnostic chart is not available from manufacturer.

CODE 31/NO. 7 VACUUM SENSOR SIGNAL (4A-FE & 5S-FE)

CODE 31/TEST NO. 7 - VACUUM SENSOR SIGNAL
TROUBLE TABLE (4A-FE & 5S-FE)

Terminal	Trouble	Condition	STD Voltage
PIM-E2	No Voltage	Ignition Switch ON	3.3-3.9V
VCC-E2	No Voltage	Ignition Switch ON	4.5-5.5V

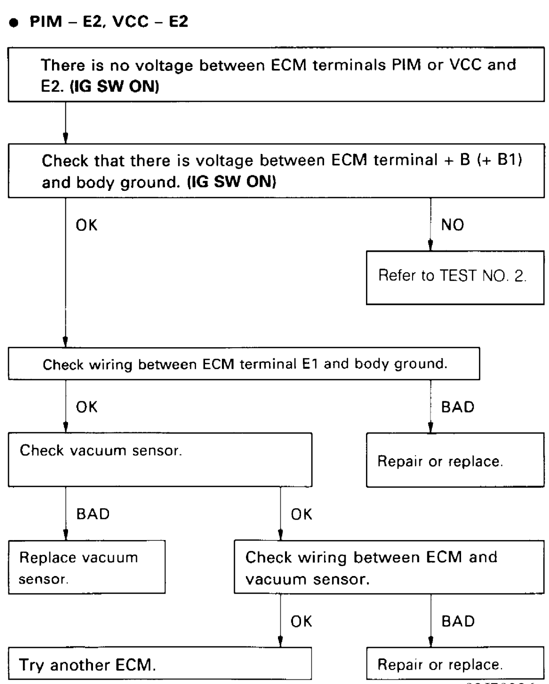


Fig. 26: Code 31/Test No. 7 Flow Chart (4A-FE & 5S-FE)
Vacuum Sensor Signal

Terminals	Trouble	Condition	STD voltage
PIM – E2	No voltage	IG SW ON	3.3 – 3.9 V
VCC – E2			4.5 – 5.5 V

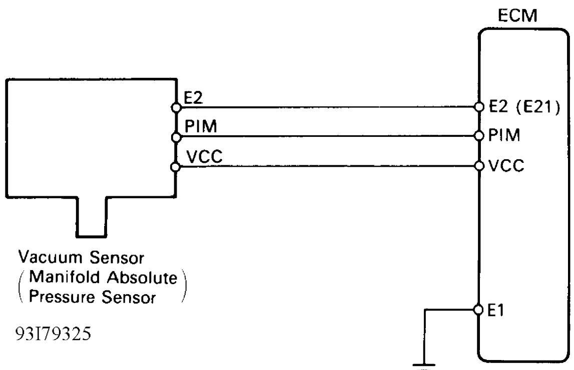


Fig. 27: Code 31/Test No. 7 Schematic (4A-FE & 5S-FE)
Vacuum Sensor Signal

CODE 31, 32/TEST NO. 7 - AIRFLOW METER SIGNAL (3S-GTE)

CODE 31,32/TEST NO. 7-AIRFLOW METER SIGNAL TROUBLE TABLE

Terminals	Trouble	Condition	STD Voltage
VC - E2	No Voltage	----	4.5-5.5V
VS - E2		Ignition Switch ON Measuring Plate CLOSED	3.7-4.3V
VS - E2		Ignition Switch ON Measuring Plate OPEN	0.2-0.5V
VS - E2		Idling	1.6-4.1V
VS - E2		3000 RPM	1.0-2.0V

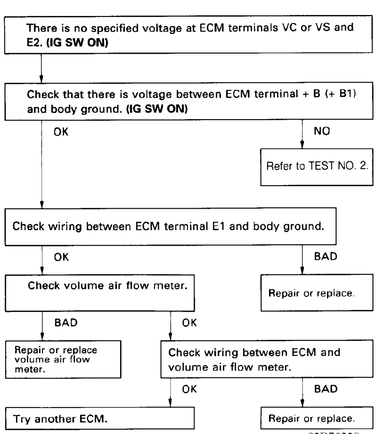


Fig. 28: Code 31, 32/Test No. 7 Flow Chart (3S-GTE)
Airflow Meter Signal

Terminals	Trouble	Condition		STD voltage
VC – E2	No voltage	IG SW ON	–	4.5 – 5.5 V
VS – E2			Measuring plate fully closed	3.7 – 4.3 V
			Measuring plate fully open	0.2 – 0.5 V
		Idle		1.6 – 4.1 V
		3,000 rpm		1.0 – 2.0 V

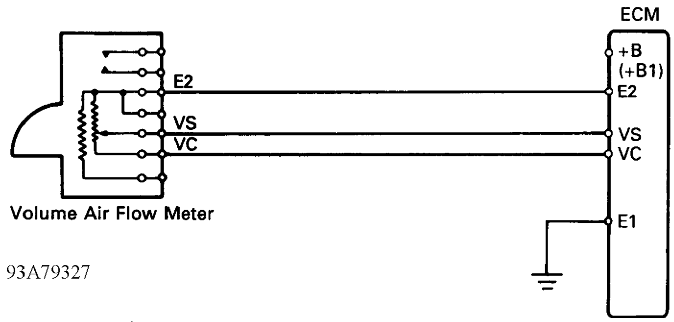


Fig. 29: Code 31, 32/Test No. 7 Schematic (3S-GTE)
Airflow Meter Signal

CODE 34, 35/TEST NO. 8 - TURBOCHARGER PRESSURE (3S-GTE)

CODE 34, 35/TEST NO. 8-TURBOCHARGER PRESSURE TROUBLE TABLE

Terminal	Trouble	Condition	STD Voltage
PIM-E2	No Voltage	Ignition Switch ON	2.5-4.5V
VC-E2	No Voltage	Ignition Switch ON	4.5-5.5V

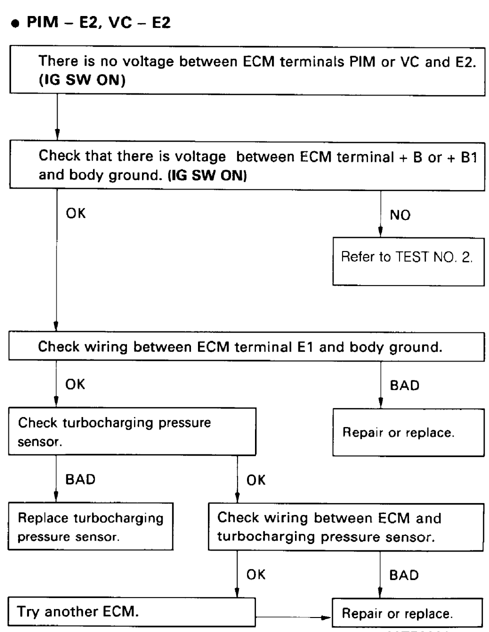


Fig. 30: Code 34, 35/Test No. 8 Flow Chart (3S-GTE)
Turbocharger Pressure

Terminals	Trouble	Condition	STD voltage
PIM – E2	No voltage	IG SW ON	2.5 – 4.5 V
VC – E2			4.5 – 5.5 V

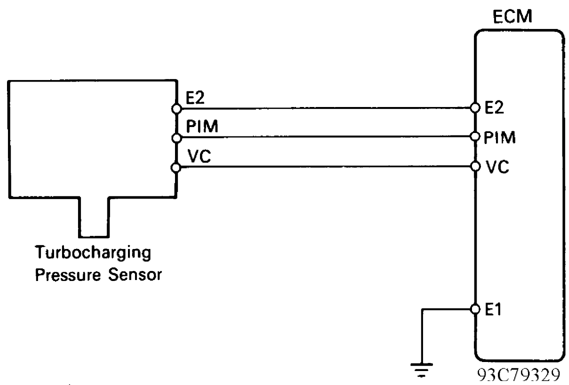


Fig. 31: Code 34, 35/Test No. 8 Schematic (3S-GTE)
Turbocharger Pressure

CODE 41/TEST NO. 9 - THROTTLE POSITION SENSOR SIGNAL (3S-GTE)

CODE 41/TEST NO. 8-TPS SENSOR SIGNAL TROUBLE TABLE (3S-GTE)

Terminals	Trouble	Condition	STD Voltage
IDL - E2	No Voltage	IG SW ON-Throttle valve OPEN	4.5-5.5V
VC - E2		IG SW ON ———	4.5-5.5V
VTA - E2		IG SW ON-Throttle valve SHUT	0.1-1.0V
		IG SW ON-Throttle valve OPEN	3.2-4.2V

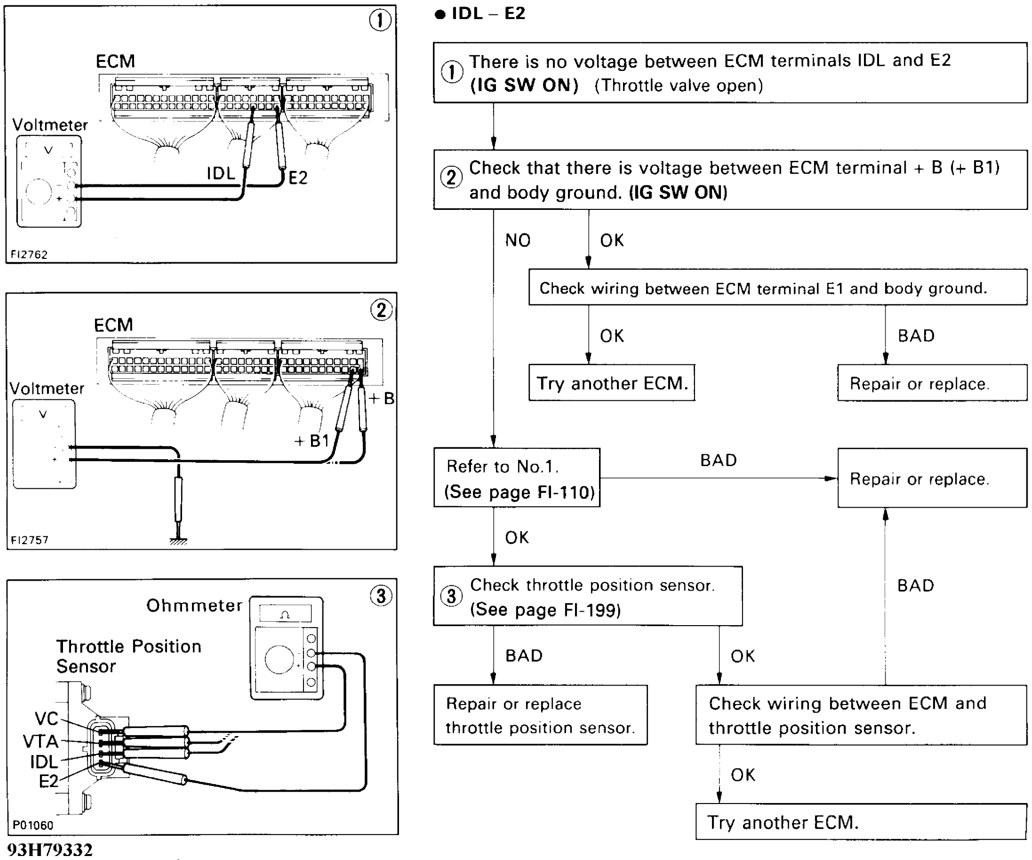


Fig. 32: Code 41/Test No. 9 Flow Chart, Terminals IDL - E2 (3S-GTE) Throttle Position Sensor Signal

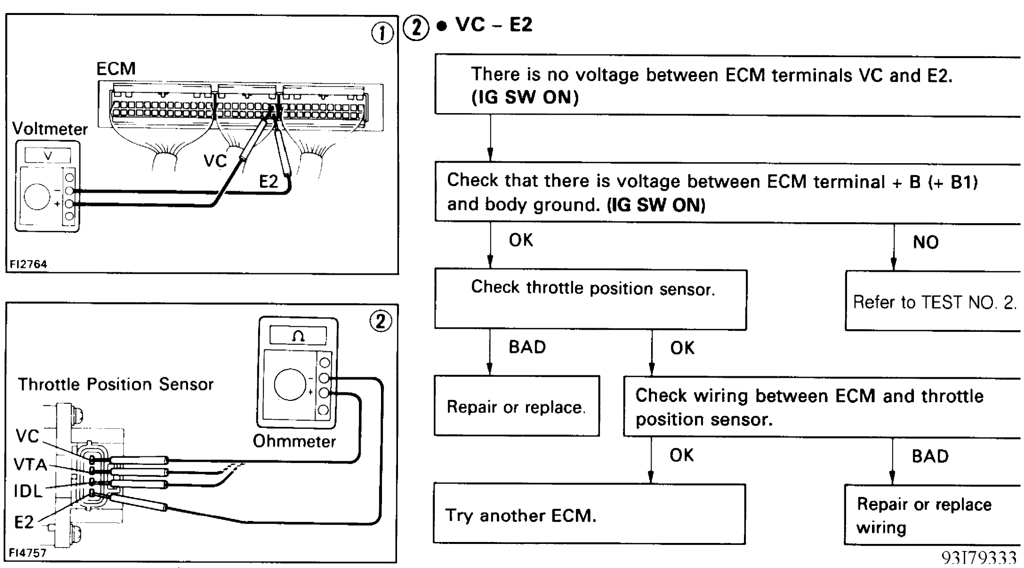


Fig. 33: Code 41/Test No. 9 Flow Chart, Terminals VC - E2 (3S-GTE) Throttle Position Sensor Signal

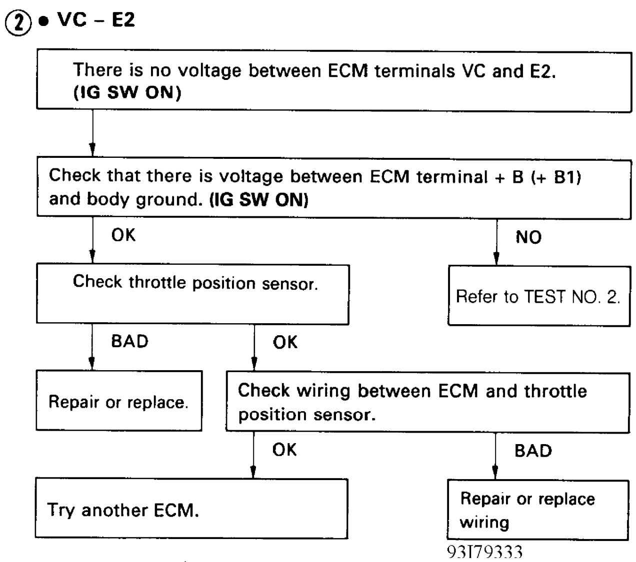


Fig. 34: Code 41/Test No. 9 Flow Chart, Terminals VTA - E2 (3S-GTE) Throttle Position Sensor Signal

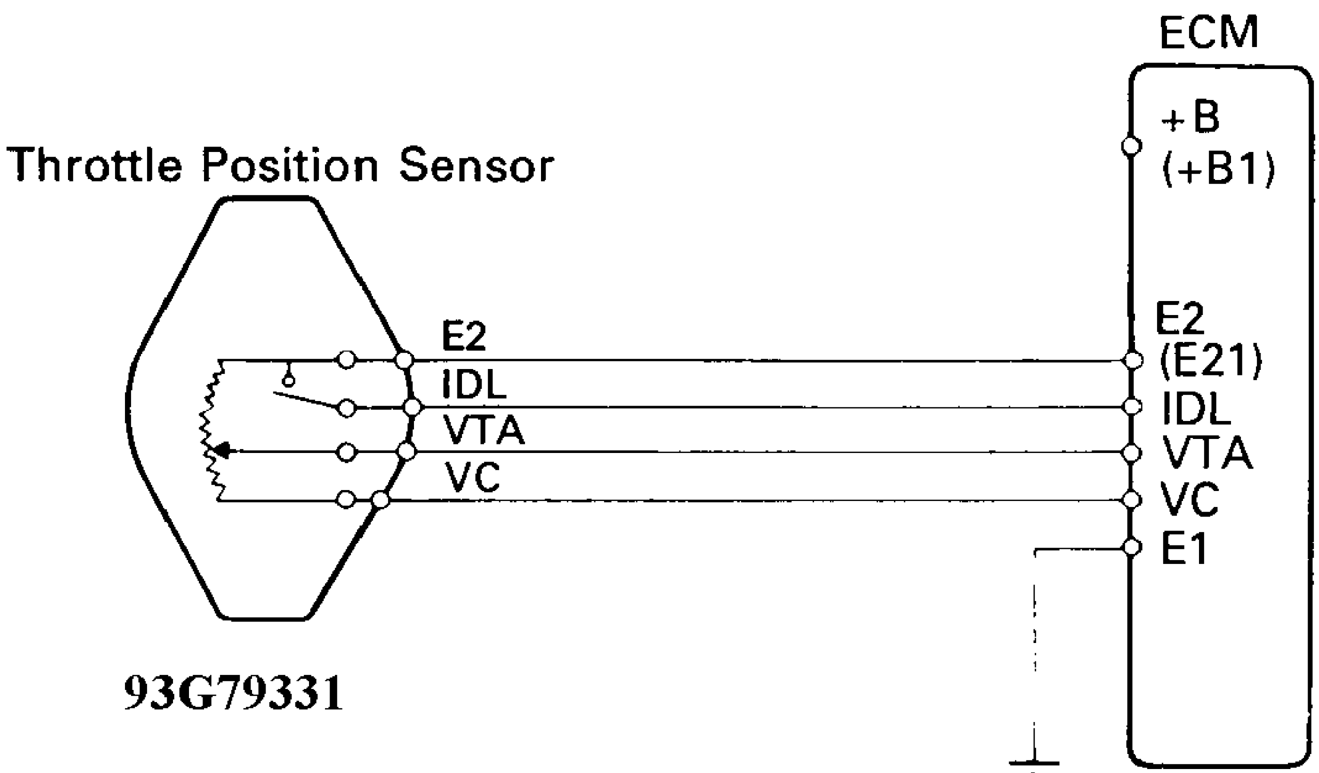


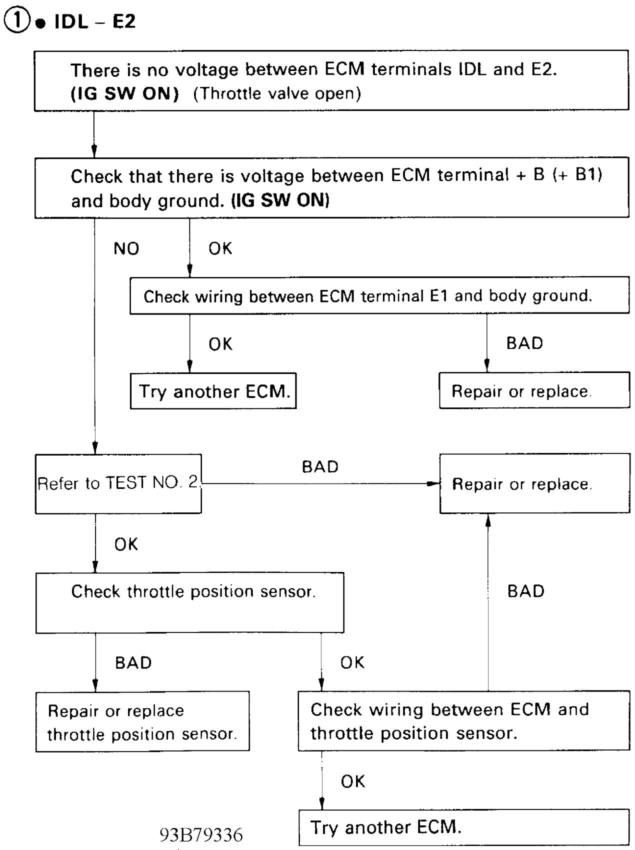
Fig. 35: Code 41/Test No. 9 Schematic (3S-GTE) Throttle Position Sensor Signal

CODE 41/TEST NO. 9 - THROTTLE POSITION SENSOR SIGNAL (4A-FE)

CODE 41/TEST NO. 9-TPS SENSOR SIGNAL TROUBLE TABLE (4A-FE)

Terminal	Trouble	Condition	STD Voltage
IDL-E2		IG SW ON - Throttle Valve OPEN	10-14V

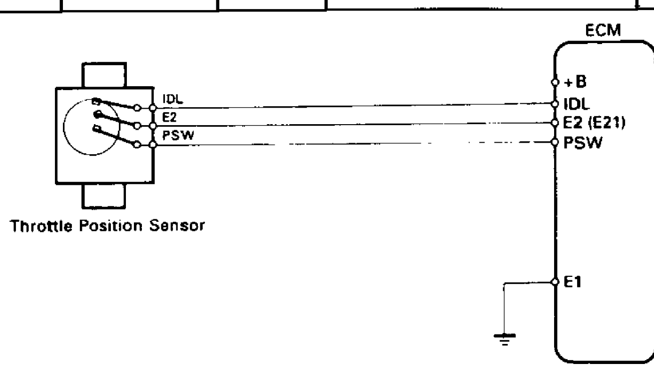
PSW-E2	No Voltage	IG SW ON - Throttle Valve CLOSED	10-14V



93B79336

Fig. 36: Code 41/Test No. 9 Flow Chart (4A-FE) Throttle Position Sensor Signal

Terminals	Trouble		Condition	STD voltage
IDL - E2	No voltage	IG SW ON	Throttle valve open	10 - 14 V
PSW - E2			Throttle valve fully closed	10 - 14 V



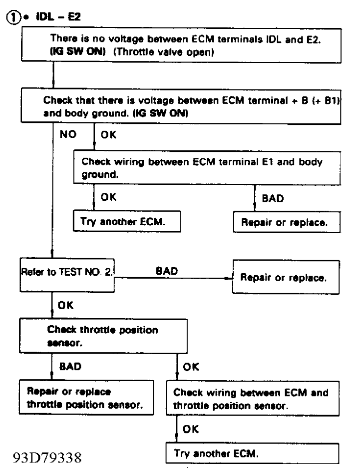
93A79335

Fig. 37: Code 41/Test No. 9 Schematic (4A-FE) Throttle Position Sensor Signal

CODE 41/TEST NO. 9 - THROTTLE POSITION SENSOR SIGNAL (5S-FE)

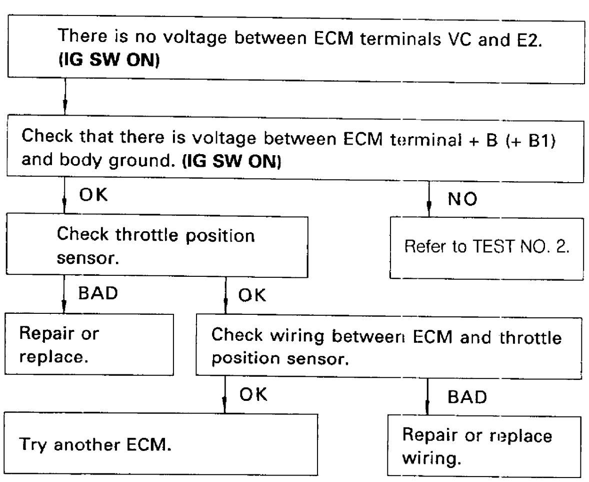
CODE 41/TEST NO. 8-TPS SENSOR SIGNAL TROUBLE TABLE (5S-FE)

Terminals	Trouble	Condition	STD Voltage
IDL - E2	No Voltage	IG SW ON-Throttle valve OPEN	8 - 14V
VC - E2		IG SW ON-	4.5-5.5V
VTA - E2		IG SW ON-Throttle Valve SHUT (Throttle Opener Must Be Canceled First)	0.8 - 1.2V
		IG SW ON-Throttle valve OPEN	3.2 - 4.2V



93D79338

Fig. 38: Code 41/Test No. 9 Flow Chart Terms. IDL - E2 (5S-FE) Throttle Position Sensor Signal



93E79339

Fig. 39: Code 41/Test No. 9 Flow Chart Terms. VC - E2 (5S-FE) Throttle Position Sensor Signal

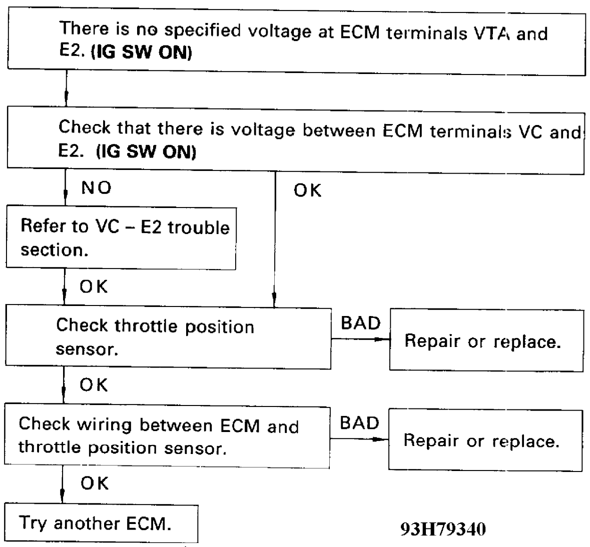


Fig. 40: Code 41/Test No. 9 Flow Chart Terms. VTA - E2 (5S-FE)
Throttle Position Sensor Signal

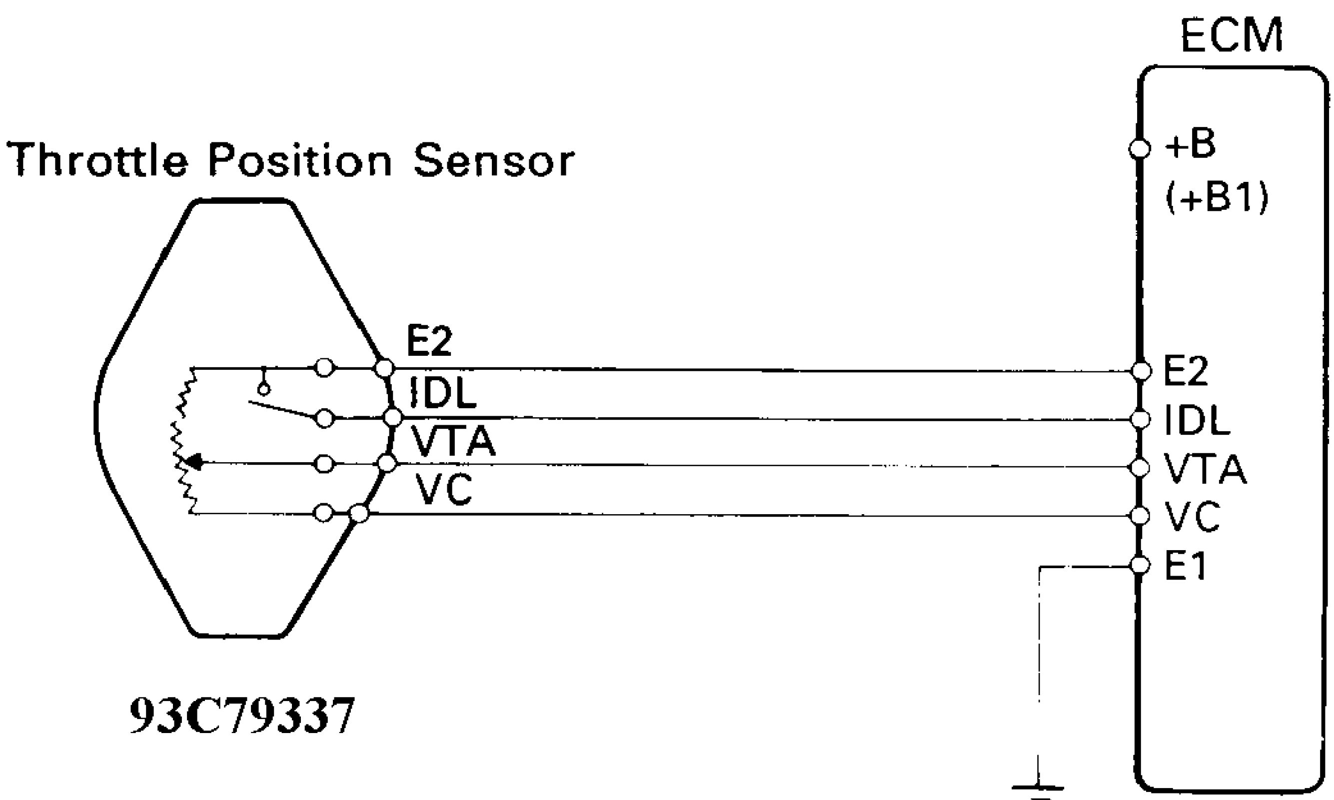


Fig. 41: Code 41/Test No. 9 Schematic (5S-FE)
Throttle Position Sensor Signal

CODE 42 - VEHICLE SPEED SENSOR SIGNAL

Probable Causes:

* Open or Short in Vehicle Speed Sensor or Sensor Circuit
* ECM

NOTE: Diagnostic chart not available from manufacturer.

CODE 43/TEST NO. 10 - STARTER SIGNAL

CODE 43/TEST NO. 10-STARTER SIGNAL TROUBLE TABLE

Terminal	Trouble	Condition	STD Voltage
STA-E1	No Voltage	Cranking	6-14V

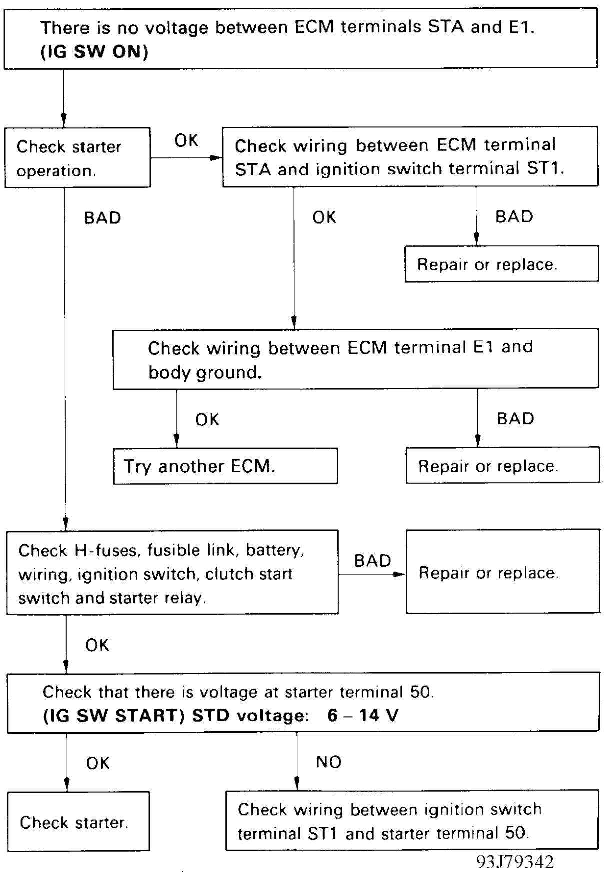


Fig. 42: Code 43/Test No. 10 Flow Chart
Starter Signal

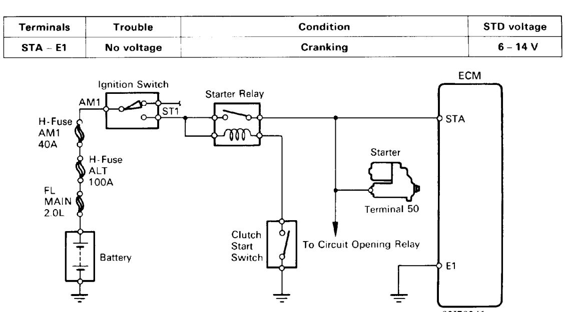
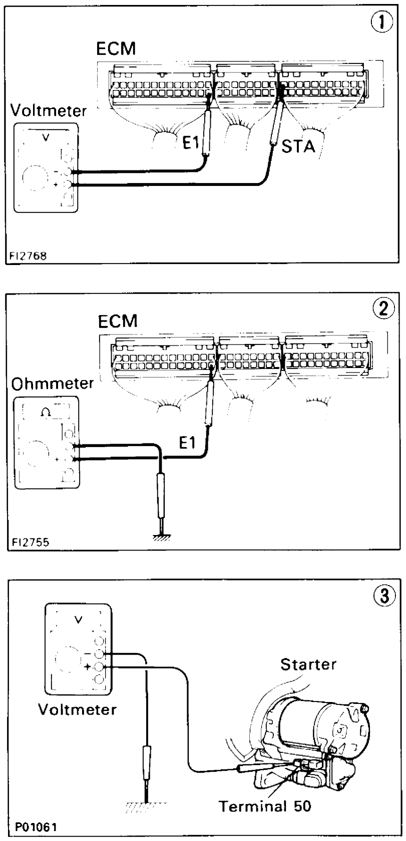


Fig. 43: Code 43/Test No. 10 Schematic
Starter Signal



93A79343
Fig. 44: Code 43/Test No. 10 Component Diagram
Starter Signal

CODE 51/TEST NO. 11 - SWITCH SIGNAL

Probable Causes:

* A/C Switch or Switch Circuit
* Accelerator Pedal or Cable
* Neutral/Start Switch or Switch Circuit
* Throttle Position Sensor IDL Circuit
* ECM

To check throttle position sensor signal, see Code 41.
To check A/C switch signal, use the following procedure.

CODE 51/TEST NO. 11-SWITCH SIGNAL TROUBLE TABLE

Terminal	Trouble	Condition	STD Voltage
A/C-E1	No Voltage	Air Conditioning ON	8-14V

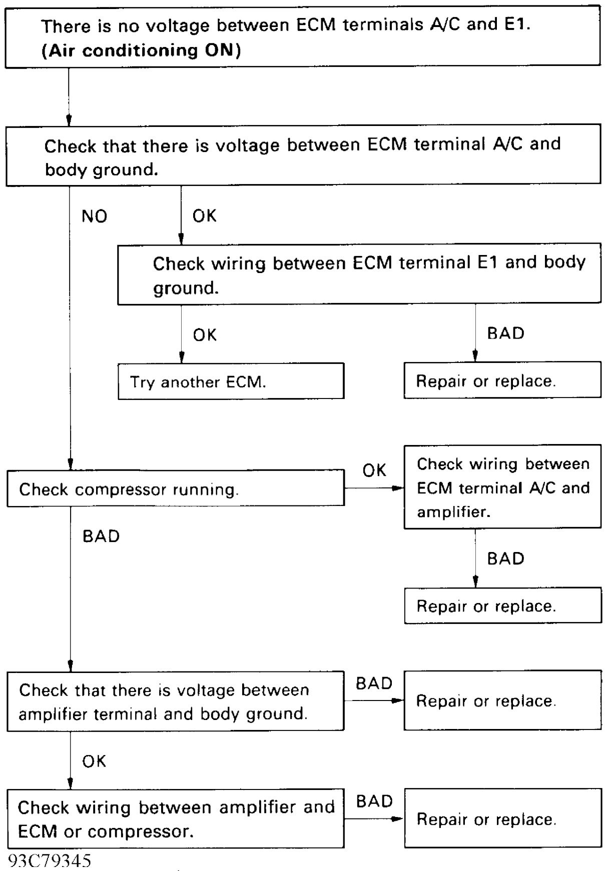


Fig. 45: Code 51/Test No. 11 Flow Chart - Switch Signal

Terminals	Trouble	Condition	STD voltage
A/C - E1	No voltage	Air conditioning ON	8 - 14 V

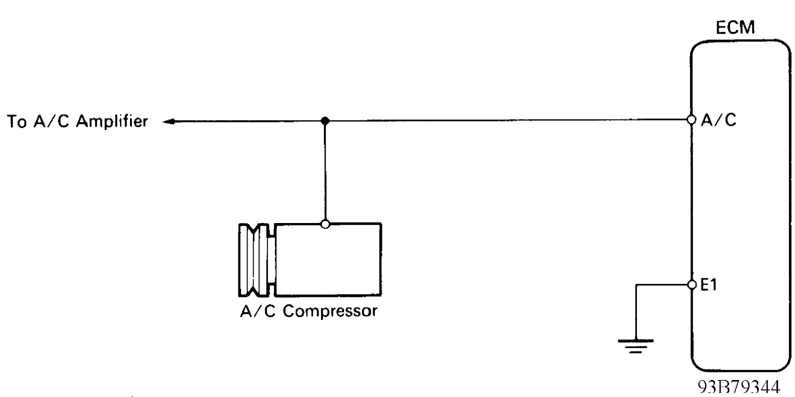


Fig. 46: Code 51/Test No. 11 Schematic - Switch Signal

CODE 52 - KNOCK SENSOR SIGNAL (3S-GTE & 5S-FE)

Probable Causes:

* Open Or Short In Knock Sensor Or Circuit
* ECM Defective

NOTE: Diagnostic chart not available from manufacturer.

CODE 53 - KNOCK SENSOR CONTROL (ECM) (3S-GTE)

Probable Causes:
* ECM Defective

NOTE: Diagnostic chart not available from manufacturer.

CODE 71/TEST NO. 12 - EGR SYSTEM MALFUNCTION

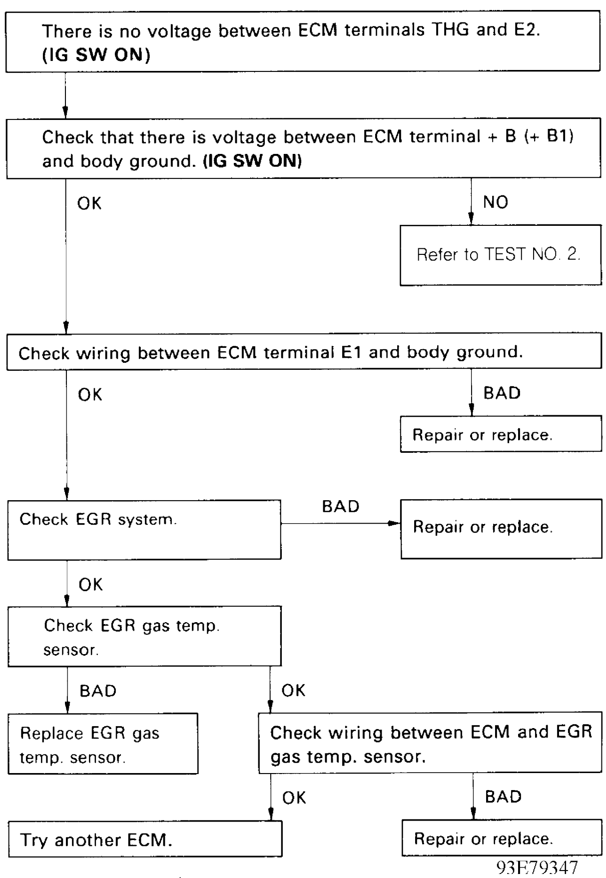


Fig. 47: Code 71/Test No. 12 Flow Chart
EGR System Malfunction

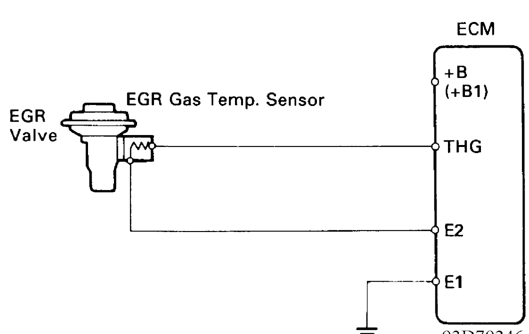


Fig. 48: Code 71/Test No. 12 Schematic
EGR System Malfunction

TEST NO. 13 - INJECTOR CIRCUIT

TEST NO. 13-INJECTOR CIRCUIT TROUBLE TABLE

Terminal	Trouble	Condition	STD Voltage
3S-GTE			
No.1,2,3 & 4 to E01 & E02	No Voltage	Ignition Switch ON	10-14V
4A-FE & 5S-FE			
No.10 & No.20 to E01 & E02	No Voltage	Ignition Switch ON	10-14V

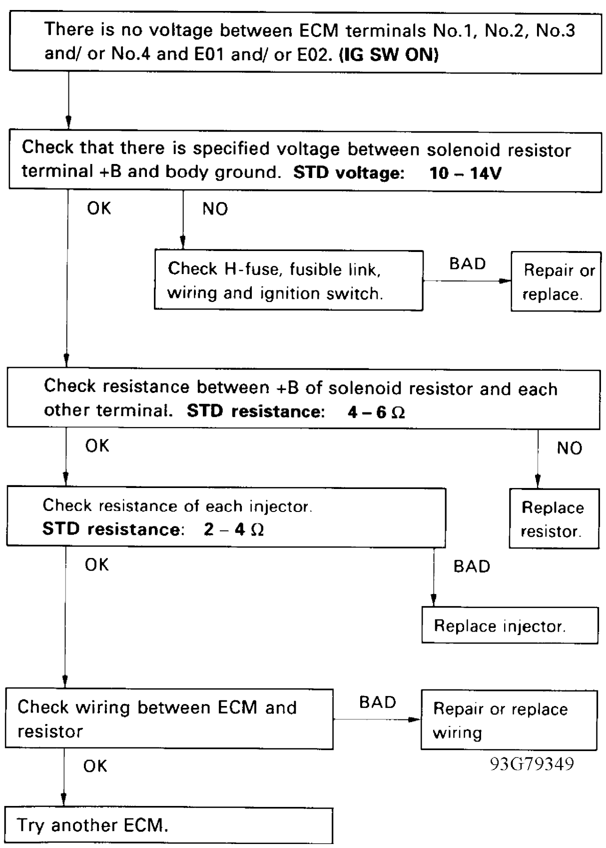


Fig. 49: Test No. 13 Flow Chart (3S-GTE)
Injector Circuit

Terminals	Trouble	Condition	STD voltage
No. 1 No. 2 – E01 No. 3 – E02 No. 4	No voltage	IG SW ON	10 – 14 V

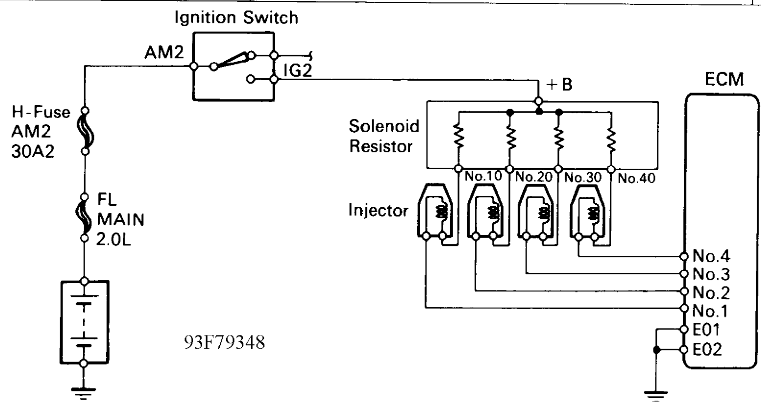
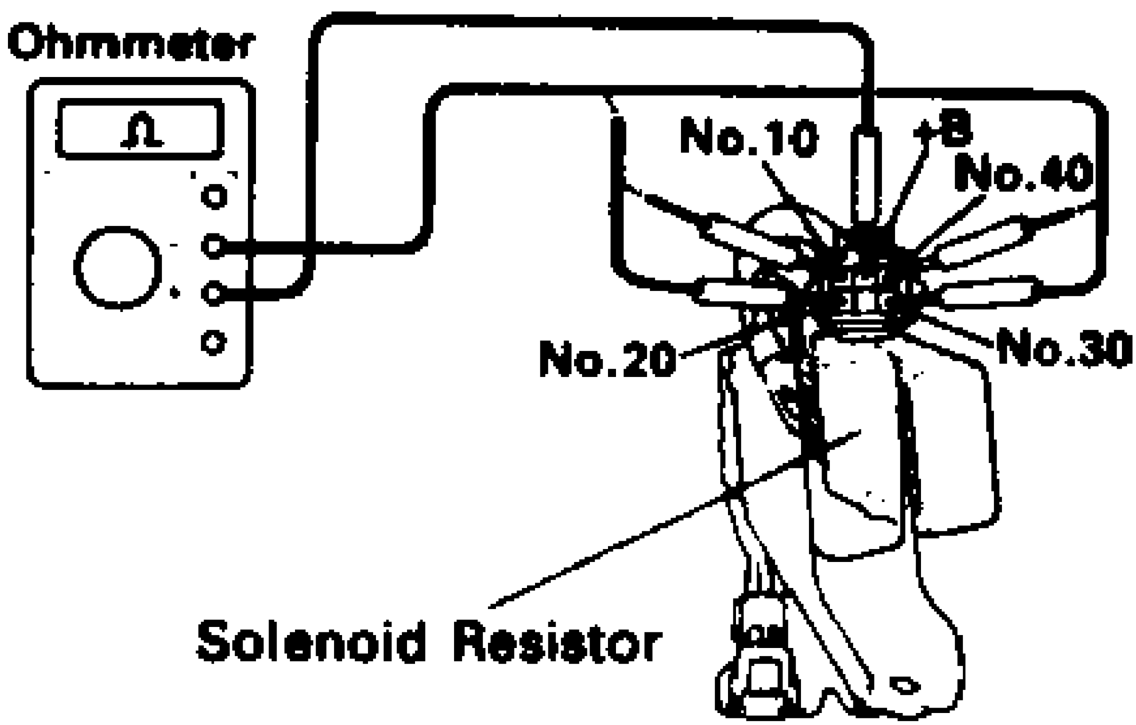
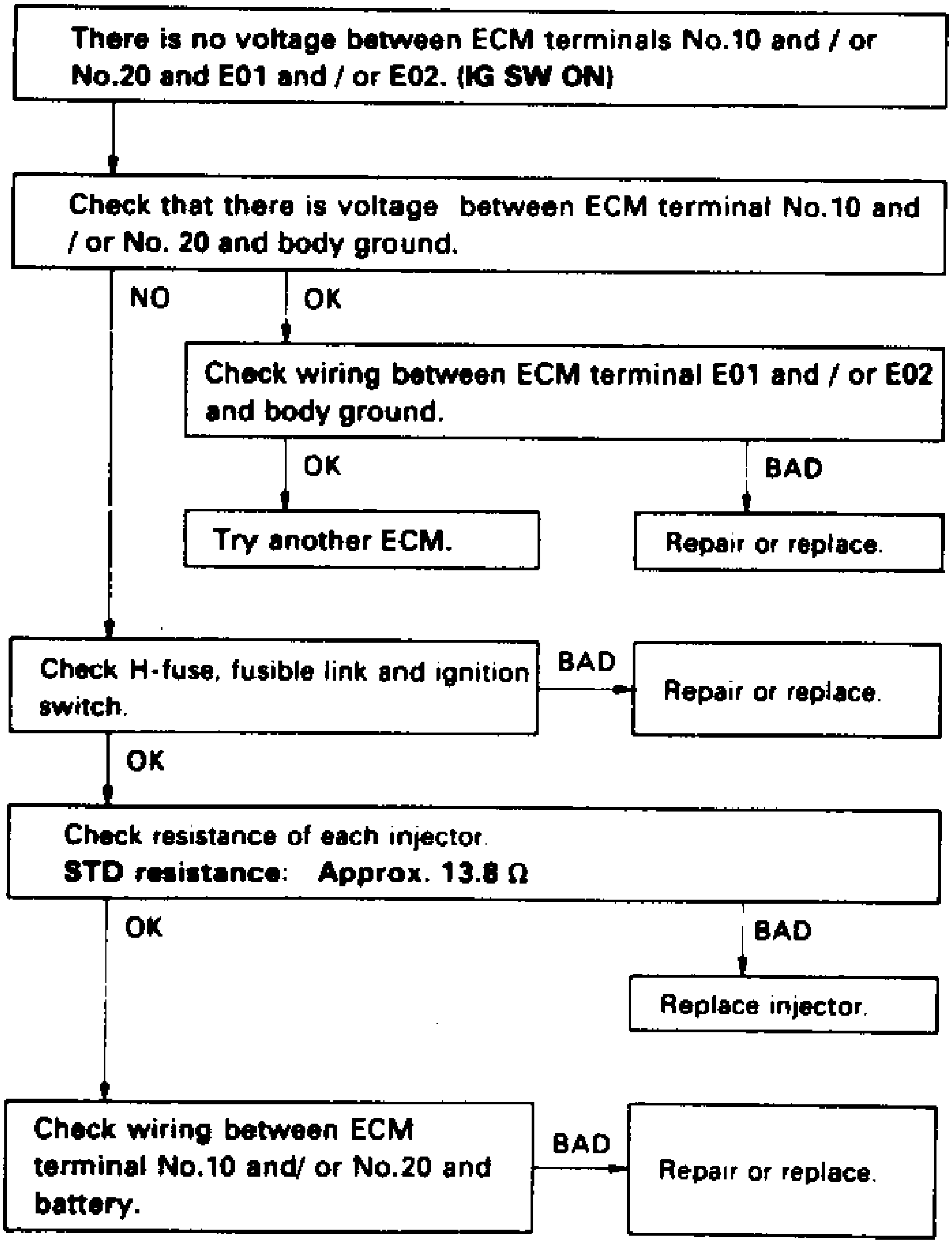


Fig. 50: Test No. 13 Schematic (3S-GTE)
Injector Circuit



93A79350

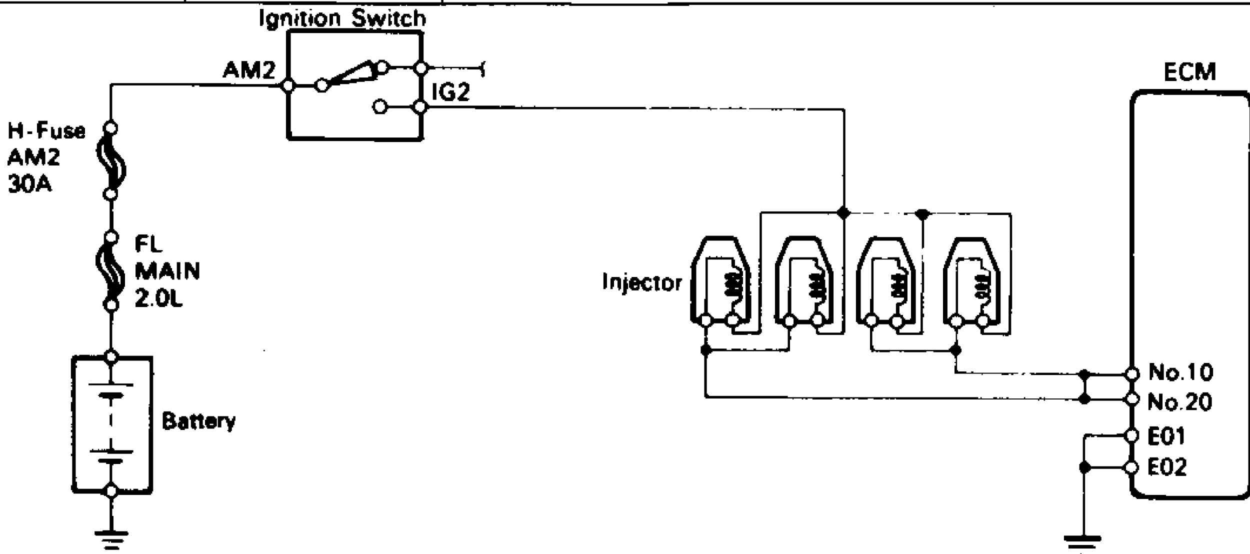
Fig. 51: Test No. 13 Component Diagram (3S-GTE)
Injector Circuit



93C79352

Fig. 52: Test No. 13 Flow Chart (4A-FE & 5S-FE) Injector Circuit

Terminals	Trouble	Condition	STD voltage
No.10 - E01 No.20 - E02	No voltage	IG SW ON	10 - 14 V



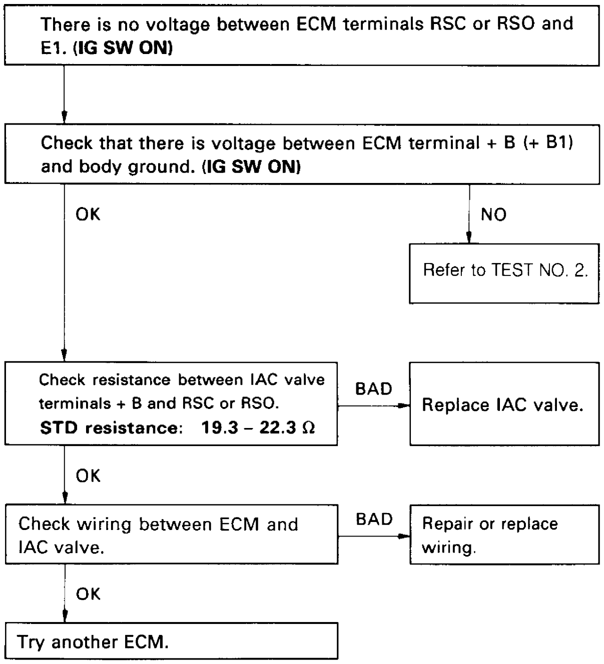
93B79351

Fig. 53: Test No. 13 Schematic (4A-FE & 5S-FE)
Injector Circuit

TEST NO. 14 - IDLE SPEED CONTROL CIRCUIT

TEST NO. 14-IDLE SPEED CONTROL CIRCUIT TROUBLE TABLE

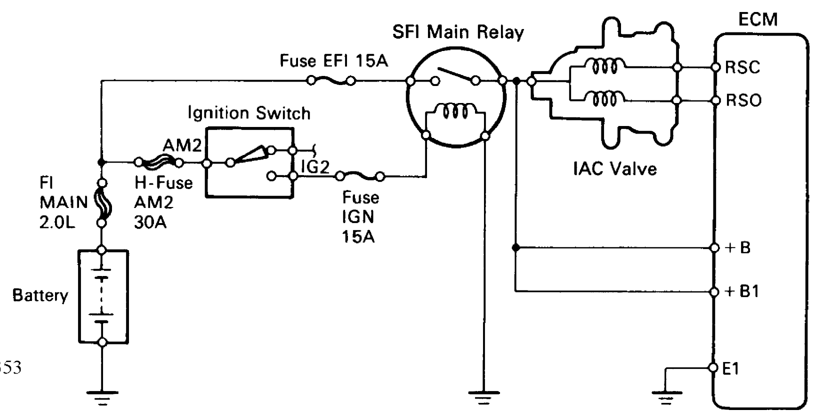
Terminal	Trouble	Condition	STD Voltage
3S-GTE			
RSC-E1 RSO-E1	No Voltage No Voltage	Ignition Switch ON	8-14V
5S-FE			
ISCC-E1 ISCO-E1	No Voltage	Ignition Switch ON	8-14V



93E79354

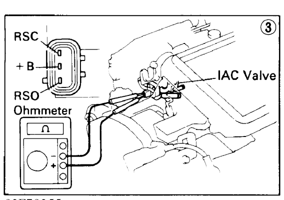
Fig. 54: Test No. 14 Flow Chart (3S-GTE)
Idle Speed Control Circuit

Terminals	Trouble	Condition		STD voltage
RSC – E1 RSO	No voltage	IG SW ON	Engine ECM connectors disconnected	8 – 14 V



93D79353

Fig. 55: Test No. 14 Schematic (3S-GTE)
Idle Speed Control Circuit



93F79355

Fig. 56: Test No. 14 Component Diagram (3S-GTE)
Idle Speed Control Circuit

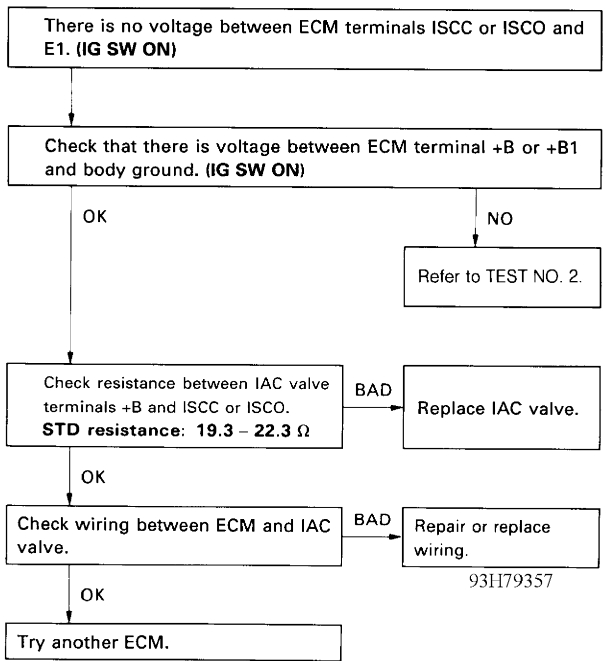


Fig. 57: Test No. 14 Flow Chart (5S-FE)
Idle Speed Control Circuit

Terminals	Trouble	Condition		STD voltage
ISCC – E1 ISCO	No voltage	IG SW ON	ECM connectors disconnected	8 – 14 V

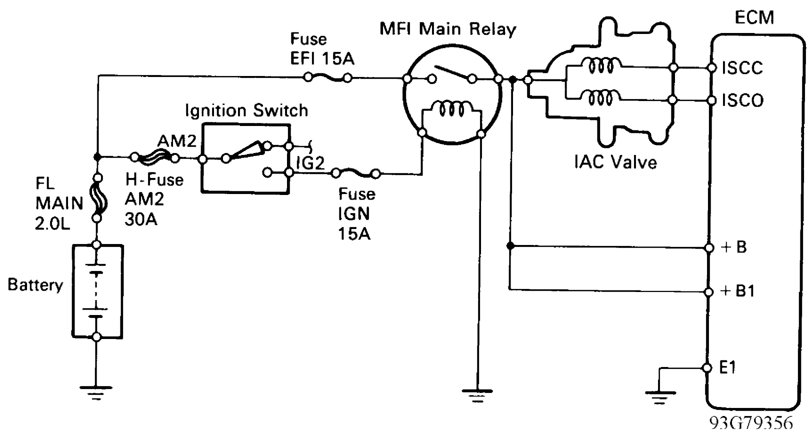
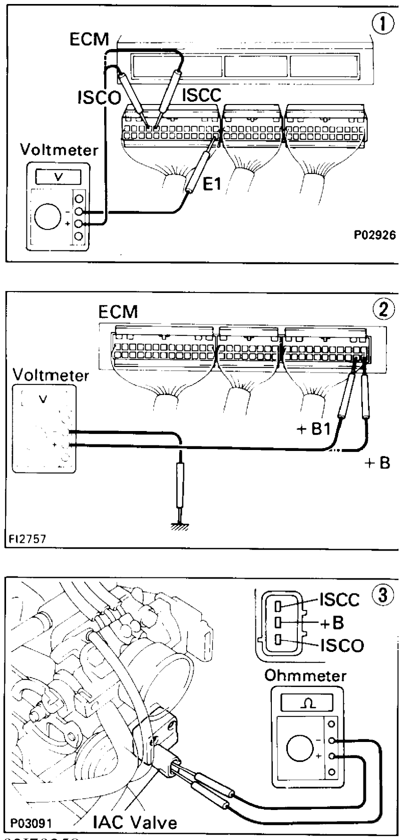


Fig. 58: Test No. 14 Schematic (5S-FE)
Idle Speed Control Circuit

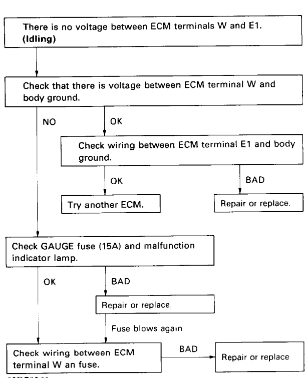


93I79358
Fig. 59: Test No. 14 Component Diagram (5S-FE)
Idle Speed Control Circuit

TEST NO. 15 - CHECK ENGINE LIGHT CIRCUIT

TEST NO. 14-CHECK ENGINE LIGHT CIRCUIT TROUBLE TABLE

Terminal	Trouble	Condition	STD Voltage
W-E1	No Voltage	No Trouble (Check Engine Light OFF) and Engine Running	10-14V



93D79361
Fig. 60: Test No. 15 Flow Chart
Check Engine Light Circuit

Terminals	Trouble	Condition	STD voltage
W - E1	No voltage	No trouble (malfunction indicator lamp off) and engine running	10 - 14 V

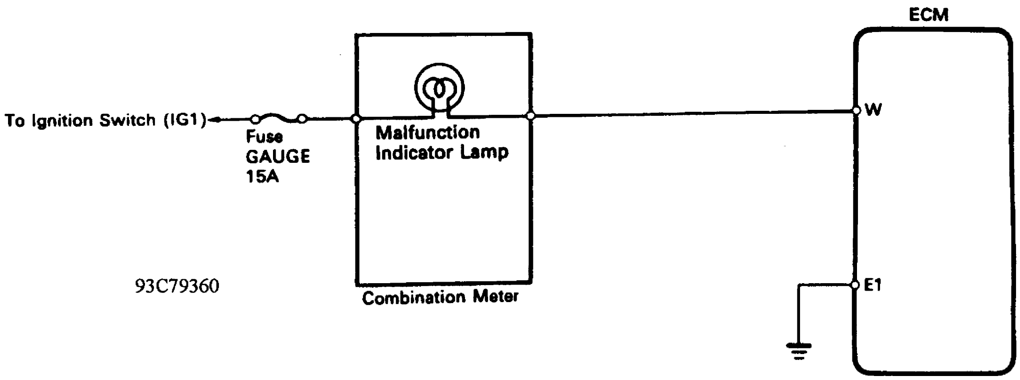


Fig. 61: Test No. 15 Schematic
Check Engine Light Circuit

1993 ENGINE PERFORMANCE
Toyota Theory & Operation

Celica

INTRODUCTION

This article covers basic description and operation of engine performance-related systems and components. Read this article before diagnosing vehicles or systems with which you are not completely familiar.

AIR INDUCTION SYSTEM

INTAKE AIR CONTROL VALVE SYSTEM

NOTE: Intake air control valve system may also be referred to as Acoustic Control Induction System (ACIS).

VARIABLE INDUCTION SYSTEM

Turbo

Each intake manifold cylinder runner is divided into 2 parts. An intake air control valve is installed in one passage on each cylinder runner. Opening and closing of intake air control valve provides best possible airflow to prevent low-speed performance loss and improved fuel economy.

On Engine Control Module (ECM) uses input RPM signal from distributor pick-up coil, throttle position signal and coolant temperature signal for determining intake air control valve operation.

NOTE: The T-VIS Vacuum Switching Valve (VSV) may also be referred to as variable induction system VSV.

ECM controls ground circuit on T-VIS VSV, which provides vacuum to a vacuum chamber for intake air control valve operation.

TURBOCHARGERS

Turbo

All systems are equipped with Charge Air Cooler (CAC) to cool turbocharger intake air, and a wastegate system to control maximum boost pressure. Cooling of turbocharger intake air increases air density, resulting in increased engine output.

Maximum boost pressure is controlled by Engine Control Module (ECM) and wastegate actuator. Turbocharging pressure sensor delivers an input signal to ECM, indicating boost pressure. The ECM controls a turbocharging pressure Vacuum Switching Valve (VSV) which operates wastegate actuator for controlling boost pressure.

COMPUTERIZED ENGINE CONTROLS

TOYOTA COMPUTER CONTROL SYSTEM (TCCS)

The TCCS is a computerized emission, ignition and fuel injection control system. The TCCS lowers exhaust emissions while maintaining good fuel economy and driveability. System consists of various sensors, switches and control units. See Figs. 1-4.

An Engine Control Module (ECM) controls the TCCS based on input signals received from various input devices. The ECM contains preprogrammed data to maintain optimum engine performance under all operating conditions.

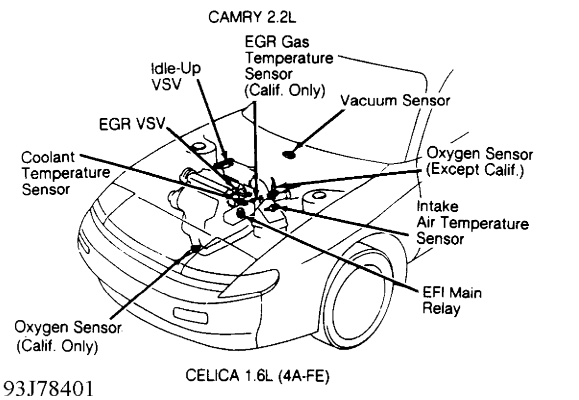


Fig. 1: Locating TCCS Components (1.6L - 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

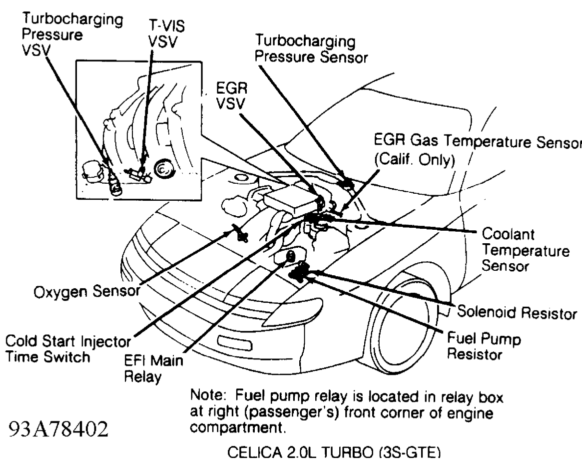


Fig. 2: Locating TCCS Components (2.0L Turbo - 3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

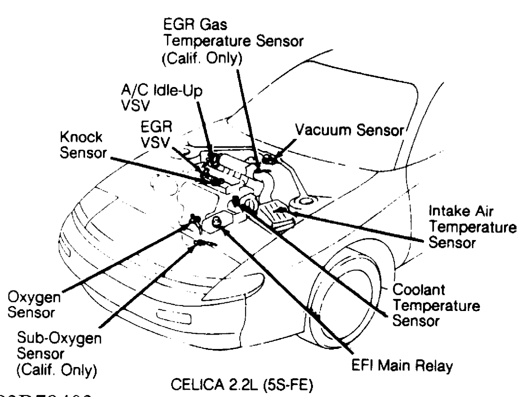


Fig. 3: Locating TCCS Components (2.2L - 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

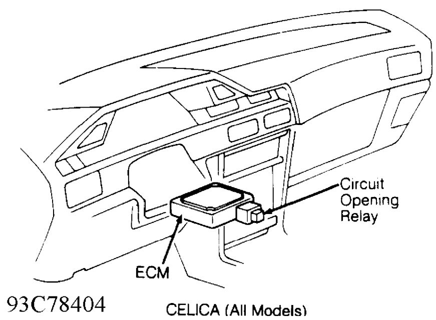


Fig. 4: Locating TCCS Components (All Models)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ENGINE CONTROL MODULE

The Engine Control Module (ECM) microprocessor receives input signals from various sensors, switches, and ignition and starting system components. The ECM uses this information for controlling various functions. See OUTPUT SIGNALS under COMPUTERIZED ENGINE CONTROLS. The ECM has constant battery voltage at BATT terminal. The EFI main relay provides battery voltage to +B and +B1 terminals of ECM when ignition is turned on.

The ECM contains a fail-safe function, used in case of sensor or switch failure. Fail-safe function uses preprogrammed values to provide a limp-in mode for minimal driveability. If a failure exists, ECM will inform the driver by turning on Malfunction Indicator Light (MIL) on the instrument panel.

NOTE: The MIL light may also be referred to as the CHECK ENGINE light.

The ECM is equipped with a self-diagnostic function. Diagnostic trouble codes may be set by the malfunction of various engine sensors, switches or circuits, and stored in the ECM memory. When diagnostic trouble code is stored, Malfunction Indicator Light (MIL) on instrument panel will come on.

ECM LOCATION TABLE

Model	Location
Celica ...	Bottom Center Of Dash, In Front Of Console

NOTE: Components are grouped into 2 categories. First category is INPUT DEVICES, which covers components that control or produce voltage signals monitored by the Engine Control Module (ECM). Second category is OUTPUT SIGNALS, which are components controlled by the ECM.

INPUT DEVICES

Vehicles are equipped with different combinations of input devices. Not all devices are used on all models. To determine input device usage on a specific model, see appropriate wiring diagram in L - WIRING DIAGRAMS article. Available input signals include the following:

A/C Switch

When A/C is turned on, an input signal is delivered to the Engine Control Module (ECM). The ECM uses input signal to control engine idle speed during A/C operation.

Airflow Sensor (Except 1.6L 4A-FE & 2.2L 5S-FE)

Airflow sensor is located in airflow meter and measures intake airflow volume. Airflow meter converts intake air readings into a voltage signal by means of a variable resistor (potentiometer). On all models, input signal is sent to Engine Control Module (ECM) for controlling fuel injection system operation and ignition timing (spark advance).

NOTE: Airflow meter may be referred to as Volume Airflow (VAF) meter or Mass Airflow (MAS) meter.

Battery Signal

Battery voltage is always present at BATT terminal of Engine Control Module (ECM). When ignition is turned on, voltage for ECM operation is applied through EFI main relay to +B and +B1 terminals.

Brakelight Signal (Turbo)

Brakelight switch delivers an input signal to STP terminal of Engine Control Module (ECM) to indicate when brakes are applied.

Coolant Temperature Sensor (CTS)

The CTS contains a built-in thermistor in which resistance varies according to engine coolant temperature. The CTS delivers an input signal to THW terminal of Engine Control Module (ECM). The ECM uses input signal for controlling Pulsed Secondary Air Injection (PAIR) system (if equipped), fuel injection system, overdrive operation on electronically controlled transaxles/transmissions, ignition timing (spark advance), idle speed control system, fuel pressure control system (if equipped), heated oxygen sensor system (if equipped) and EGR system.

NOTE: Coolant temperature sensor may be referred to as Engine Coolant Temperature (ECT) sensor.

Electrical Load Signal (Turbo & 2.2L 5S-FE)

An input signal is delivered to ELS terminal of Engine Control Module (ECM) to indicate when high electrical output is required. This signal is delivered when items such as rear window defroster, headlights, etc. are turned on. The ECM uses input signal to maintain proper idle speed.

Engine Cranking Signal

While engine is cranking, voltage applied to the starter is also delivered to STA terminal of Engine Control Module (ECM).

NOTE: The EGR gas temperature sensor may be referred to as EGR function sensor.

EGR Gas Temperature Sensor

EGR gas temperature sensor monitors EGR gas temperature and delivers an input signal to Engine Control Module (ECM).

Intake Air Temperature Sensor

An intake air temperature sensor is mounted in either airflow meter or air filter housing. Intake air temperature sensor measures incoming intake air temperature and delivers an input signal to THA terminal of Engine Control Module (ECM) to control fuel injection system. Input signal is also used to control fuel pressure control and heated oxygen sensor systems (if equipped).

Knock Sensor (Turbo & 2.2L)

Knock sensor monitors ignition knock conditions and delivers an input signal to KNK or KNK1 and KNK2 terminals of Engine Control Module (ECM). The ECM uses input signal to determine ignition timing (spark advance) and control fuel injection system.

Oxygen (O2) Sensor

O2 sensor monitors exhaust gas oxygen content and delivers an input signal to Engine Control Module (ECM). The ECM uses input signal to determine fuel injection system operation. Some models may be equipped with more than one oxygen sensor and a sub-oxygen sensor. Some models may contain a heater to warm the oxygen sensor.

Park/Neutral Switch (A/T Models)

On some models, neutral/start switch delivers an input signal to NSW terminal of Engine Control Module (ECM), indicating gear position. The ECM uses information to control engine idle and fuel injection system.

RPM Signal

Crankshaft position and engine RPM are detected by pick-up coils in the distributor. The Engine Control Module (ECM) uses input signal for controlling Pulsed Secondary Air Injection (PAIR) system (if equipped), fuel injection system, ignition timing (spark advance), idle speed control system, fuel pressure control system (if equipped), EGR system, A/C-cut control system (if equipped) and heated oxygen sensor system (if equipped).

Crankshaft position input signal is delivered to G, G+ or G1 (and G2 on some models) terminal of ECM, and engine RPM input signal is delivered to NE or NE+ terminal of ECM.

Sub-Oxygen Sensor

Sub-oxygen sensor is used in conjunction with the oxygen sensor. Sub-oxygen sensor monitors exhaust gas oxygen content and delivers an input signal to Engine Control Module (ECM). The ECM uses input signal to determine fuel injection system operation.

Throttle Position Sensor (TPS)

The TPS, mounted on throttle body, delivers an input signal indicating throttle valve position to the Engine Control Module (ECM). The ECM uses input signal for controlling Pulsed Secondary Air Injection (PAIR) system (if equipped), fuel injection system, ignition timing (spark advance), idle speed control system, fuel pressure control system (if equipped), A/C-cut control system (if equipped), EGR system (if equipped) and automatic transmissions/transaxles (some models).

Turbocharging Pressure Sensor (Turbo)

Turbocharging pressure sensor delivers an input signal to Engine Control Module (ECM), indicating boost pressure. The ECM uses this signal to control turbo boost pressure.

Vacuum Sensor (1.6L & 2.2L)

Vacuum sensor may also be referred to as Manifold Absolute Pressure (MAP) sensor. Vacuum sensor monitors intake manifold intake air volume and delivers an input signal to Engine Control Module (ECM). The ECM uses input signal for controlling fuel injection system and ignition timing (spark advance).

Vehicle Speed Sensor

Vehicle speed sensor monitors vehicle speed and delivers an input signal to Engine Control Module (ECM). The ECM uses input signal for controlling fuel injection system and electronic control of automatic transmission/transaxle (some models). Vehicle speed sensor is mounted on instrument cluster.

OUTPUT SIGNALS

NOTE: Vehicles are equipped with various combinations of computer-controlled components. Not all components listed are used on every vehicle. For theory and operation on each output component, refer to system indicated after component.

The Engine Control Module (ECM) receives input from data sensors and switches, depending on model application, to control following components and sub-systems:

A/C-Cut Control System
See IDLE SPEED under FUEL SYSTEM.

A/C Idle-Up System
See IDLE SPEED under FUEL SYSTEM.

Circuit Opening Relay
See FUEL DELIVERY under FUEL SYSTEM.

Electronic Spark Advance
See ELECTRONIC IGNITION SYSTEM under IGNITION SYSTEM.

EGR System Vacuum Switching Valve (VSV)
See EXHAUST GAS RECIRCULATION (EGR) SYSTEM under EMISSION SYSTEMS.

Electronically Controlled Transmission/Transaxle (ECT)
See TRANSMISSION/TRANSAXLE CONTROLS under MISCELLANEOUS CONTROLS.

EVAP Vacuum Switching Valve (VSV)
See EVAPORATIVE EMISSION (EVAP) SYSTEM under EMISSION SYSTEMS.

Exhaust By-Pass Valve Vacuum Switching Valve (VSV)
See TURBOCHARGERS under AIR INDUCTION SYSTEM.

Exhaust Gas Control Valve Vacuum Switching Valve (VSV)
See TURBOCHARGERS under AIR INDUCTION SYSTEM.

Fuel Pressure Control System Vacuum Switching Valve (VSV)
See FUEL DELIVERY under FUEL SYSTEM.

Fuel Pump
See FUEL DELIVERY under FUEL SYSTEM.

Idle Speed Control System
See IDLE SPEED under FUEL SYSTEM.

Idle-Up System
See IDLE SPEED under FUEL SYSTEM.

Intake Air Control Valve System
See INTAKE AIR CONTROL VALVE SYSTEM under AIR INDUCTION SYSTEM.

Oxygen Sensor Heater
See FUEL CONTROL under FUEL SYSTEM.

Pulsed Secondary Air Injection (PAIR) System Vacuum Switching

Valve (VSV)
See PULSED SECONDARY AIR INJECTION (PAIR) SYSTEM under EMISSION SYSTEMS.

Self-Diagnostic System
See SELF-DIAGNOSTIC SYSTEM.

Throttle Opener Vacuum Switching Valve (VSV)
See IDLE SPEED under FUEL SYSTEM.

Turbocharging Vacuum Switching Valve (VSV)
See TURBOCHARGERS under AIR INDUCTION SYSTEM.

Variable Induction System Vacuum Switching Valve (VSV)
See VARIABLE INDUCTION SYSTEM under AIR INDUCTION SYSTEM.

Wastegate Vacuum Switching Valve (VSV)
See TURBOCHARGERS under AIR INDUCTION SYSTEM.

FUEL SYSTEM

FUEL DELIVERY

Vehicles are equipped with different combinations of fuel system electrical components. For complete wiring circuit of electrical components on a specific model, see appropriate wiring diagram in L - WIRING DIAGRAMS article.

NOTE: EFI main relay may be also be referred to as MFI main relay, MPI main relay or SFI main relay.

EFI Main Relay
The EFI fuse supplies constant battery voltage to EFI main relay. EFI main relay provides battery voltage to +B terminal of circuit opening relay (some models) and data link connector. Depending on model, EFI main relay may either be turned on directly by ignition switch or by M-REL terminal of Engine Control Module (ECM). The EFI main relay may also provide battery voltage to +B and +B1 terminals of ECM when ignition is turned on. The EFI main relay is located in engine compartment relay box. See Figs. 1-4.

NOTE: Circuit opening relay is used on all models.

Circuit Opening Relay
Circuit opening relay controls fuel pump circuit. The Engine Control Module (ECM) receives an input signal at STA terminal when engine is cranking. Starter signal is also applied to terminal STA of circuit opening relay.

Starter signal energizes circuit opening relay during cranking. Circuit opening relay then provides voltage to fuel pump or fuel pump relay. Fuel pump relay is used on Turbo only.

Circuit opening relay is grounded by the ECM through the FC terminal. On all other models, fuel pump switch in airflow meter provides ground for circuit opening relay. Circuit opening relay and fuel pump relay are located in different locations. See Figs. 1-4.

Fuel Pump Relay & Fuel Pump Resistor (Turbo)
Fuel pump relay receives voltage from circuit opening relay to operate the fuel pump. Fuel pump operating speed may be varied by the Engine Control Module (ECM). When ECM grounds fuel pump relay, relay contacts close and voltage is supplied through fuel pump resistor to the fuel pump. This changes the fuel pump operating speed.

Fuel pump relay and fuel pump resistor are located in different locations. See Figs. 1-4.

Fuel Pump

Fuel pump is mounted in the fuel tank and contains an internal check valve. Fuel pump can be operated with ignition off by installing jumper wire between +B and FP terminals of data link connector. On Turbo fuel pump operating speed may be varied by use of fuel pump relay and fuel pump resistor.

Fuel Pressure Regulator

Mounted on fuel rail, vacuum-operated fuel pressure regulator maintains constant fuel pressure to fuel injectors. As throttle is depressed and manifold vacuum decreases, fuel pressure regulator increases fuel pressure to maintain a constant fuel flow to fuel injectors.

NOTE: Fuel pressure control system may also be referred to as fuel pressure-up system.

Fuel Pulsation Damper

Some models use a fuel pulsation damper mounted on fuel delivery pipe to eliminate fuel line pressure surges caused by fuel injector operation.

FUEL CONTROL

Cold Start Injector (Turbo)

Cold start injector delivers additional fuel during cold engine starts. Cold start injector receives voltage from ignition switch during engine cranking. Ground circuit for cold start injector is controlled by cold start injector time switch.

Cold Start Injector Time Switch (Turbo)

Cold start injector time switch determines cold start injector on time for cold engine starting. Cold start injector ground circuit is controlled by cold start injector time switch, located in an engine coolant passage. See Figs. 1-4.

Fuel-Cut System

Controlled through input from throttle position sensor, Engine Control Module (ECM) will cut fuel delivery during closed throttle deceleration.

Fuel Injectors

Fuel injectors are ECM-actuated electric solenoids which deliver fuel to individual cylinders. The ECM controls fuel injector duration based on various input signals to determine air/fuel mixture.

NOTE: Solenoid resistor may also be referred to as injector resistor.

Solenoid Resistor (Turbo)

Solenoid resistor reduces current flow to fuel injectors. Solenoid resistor is located in engine compartment. See Figs. 1-4.

Oxygen Sensor Heater (1.6L 4A-FE & Turbo)

Oxygen sensor is equipped with a heating element. The Engine Control Module (ECM) activates oxygen sensor heater when intake air volume and coolant temperature are low, warming the oxygen sensor for improved performance.

IDLE SPEED

A/C-Cut Control System (1.6L & 2.2L)

The A/C-cut control system interrupts A/C compressor operation for a fixed period of time when vehicle accelerates from low engine speed.

On 2.2L Engine Control Module (ECM) uses vehicle speed and throttle valve angle input signals to determine A/C-cut control system operation. On 1.6L, ECM uses vehicle speed, throttle valve angle, vacuum sensor and park/neutral switch input signals to determine A/C-cut control system operation.

A/C Idle-Up System (2.2L 5S-FE)

The A/C idle-up system provides a stable idle speed when A/C is operating. Engine Control Module (ECM) controls A/C idle-up Vacuum Switching Valve (VSV). The A/C idle-up VSV allows extra intake air to by-pass throttle valve for increased idle speed. The A/C idle-up VSV is located in engine compartment. See Figs. 1-4.

NOTE: Auxiliary air valve may also be referred to as the air valve.

Auxiliary Air Valve (1.6L 4A-FE)

Auxiliary air valve provides additional air to intake manifold when engine is cold for increased idle speed. Auxiliary air valve is mounted on throttle body and determines engine temperature by engine coolant being routed around auxiliary air valve.

NOTE: Idle speed control system may also be referred to as idle air control system.

Idle Speed Control System (Turbo & 2.2L 5S-FE)

Engine Control Module (ECM) is programmed with engine idle speed values. Idle air control system provides a stable idle speed when engine is cold and idle speed decreases due to electrical load.

An input signal is delivered to ECM, indicating when high electrical output is required. Input signal is delivered when items such as rear window defroster, headlights, etc. are turned on. The ECM uses input signal along with other various input signals to maintain proper idle speed by controlling Idle Air Control (IAC) valve located on air intake system.

IGNITION SYSTEM

ELECTRONIC IGNITION SYSTEM

NOTE: The electronic ignition system may be referred to as Electronic Spark Advance (ESA).

The electronic ignition system uses the Engine Control Module (ECM) for determining ignition timing (spark advance). The ECM determines ignition timing (spark advance) based on various input signals. Following input signals may be used: coolant temperature sensor, oxygen sensor, engine RPM, vehicle speed sensor, A/C switch, airflow meter, knock sensor, vacuum sensor and cranking (starter) signal. Input signals may vary on model application. Integrated (ignition coil on distributor) and remote ignition coil designs are used depending on model.

Crankshaft position and engine RPM input signals are delivered to the ECM by 2 pick-up coils in the distributor. Crankshaft position input signal is delivered to G, G+ or G1 (and G2 on some models) terminal of ECM, and engine RPM input signal is delivered to NE or NE+ terminal of ECM. See Fig. 5.

On all models, ECM uses pick-up coil input signals to switch primary ignition circuit on and off. Primary circuit is turned off when ECM delivers a signal to ignitor on the IGT wire, causing ignition coil to fire the spark plug. After delivering a command to turn off primary circuit on the IGT wire, the ECM monitors IGF circuit to ensure primary switching occurred. See Fig. 5.

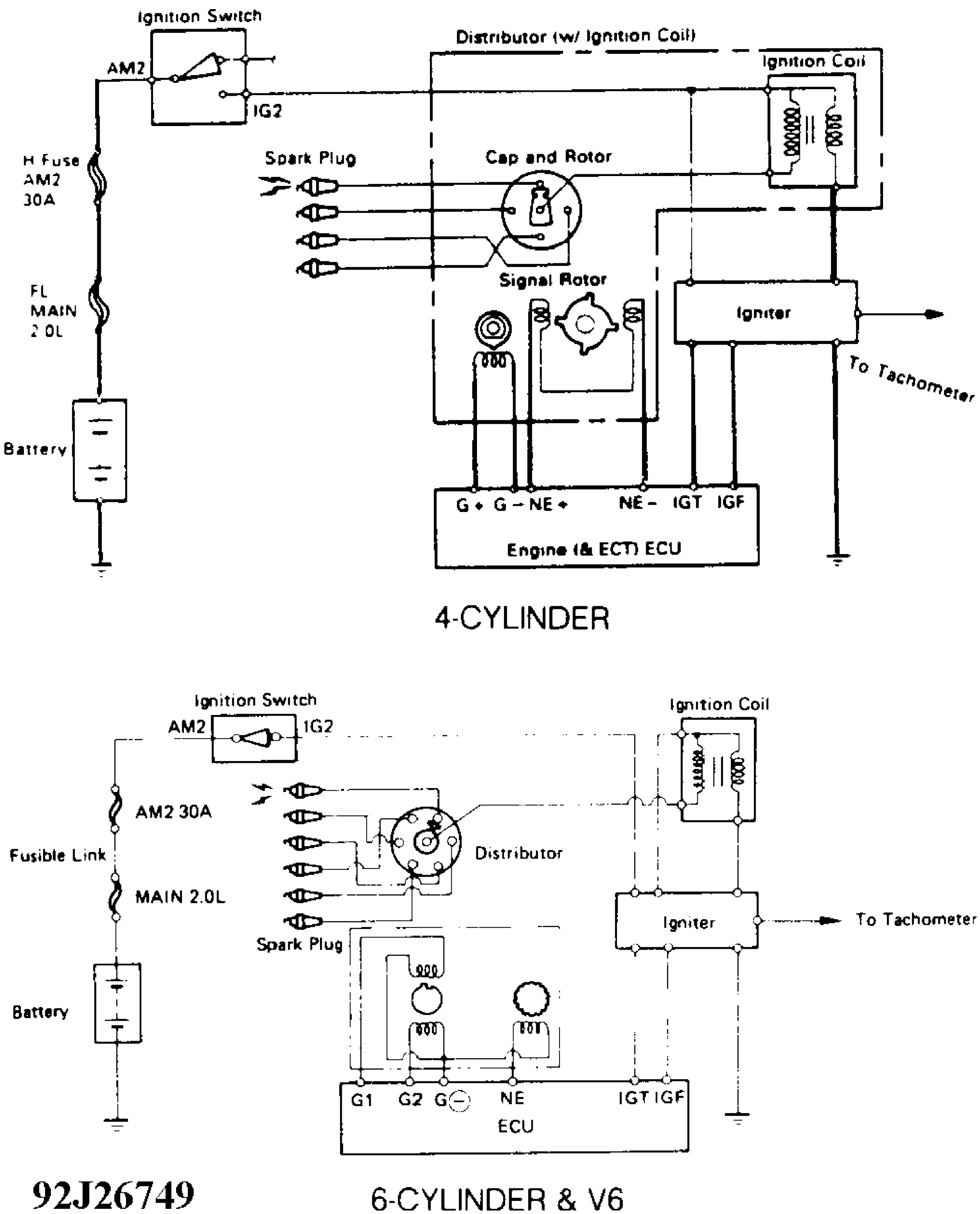
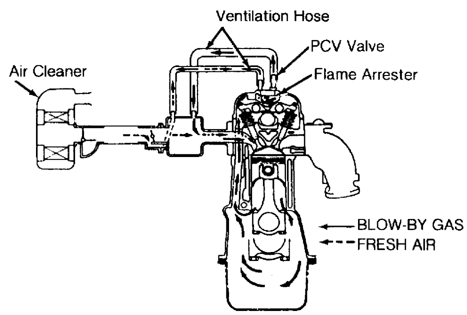


Fig. 5: Typical Electronic Ignition System Schematic
Courtesy of Toyota Motor Sales, U.S.A. Inc.

CRANKCASE VENTILATION

The Positive Crankcase Ventilation (PCV) system prevents crankcase hydrocarbon (HC) vapors from escaping into the atmosphere. Crankcase vapors are routed from crankcase through a vacuum-controlled PCV valve, into the intake manifold. In the intake manifold, crankcase vapors are mixed with air/fuel mixture and delivered into the cylinders. See Fig. 6.

The PCV system provides primary control of crankcase blow-by vapors, according to manifold vacuum. When manifold vacuum is high (at idle), PCV restricts vapor flow to maintain a smooth idle condition.



93A78451
Fig. 6: Identifying PCV System (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

The EGR system reduces oxides of nitrogen (NOx) emissions by lowering combustion temperatures. Combustion temperatures are lowered by recycling metered amount of exhaust gases back into the intake system.

The EGR system contains a vacuum-operated EGR valve and a vacuum modulator. See Fig. 7. A check valve, EGR cooler and EGR Vacuum Switching Valve (VSV) may also be used. Vacuum modulator regulates exhaust backpressure and balances atmospheric pressure and vacuum to allow EGR operation at heavy throttle.

Engine Control Module (ECM) controls the EGR VSV for EGR operation. This system is referred to as EGR-cut control system. The ECM uses input signals such as coolant temperature, engine RPM, throttle position, brakelight switch, intake air volume and vehicle speed for controlling the EGR VSV. Input signals may vary by vehicle application. Various model and engine types will have different EGR system components and operating parameters. For specific EGR operating parameters and testing of system or components on various models, see EXHAUST GAS RECIRCULATION (EGR) under EMISSION SYSTEMS & SUB-SYSTEMS in I - SYSTEM/COMPONENT TESTS article.

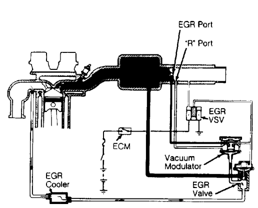


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Fig. 7: Identifying Typical EGR System Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EVAPORATIVE EMISSION (EVAP) SYSTEM

NOTE: The EVAP may also be referred to as fuel evaporation.

The EVAP system prevents fuel tank gasoline vapors from escaping into the atmosphere. Fuel tank gasoline vapors are routed through charcoal canister into intake manifold for combustion in the cylinders. See Fig. 8. All models use a Bimetallic Vacuum Switching (BVSV) to control EVAP system in relation to engine coolant temperature. BVSV is mounted in the engine coolant passage.

NOTE: The BVSV may be referred to as a Thermal Vacuum Valve (TVV).

Various model and engine types will have different evaporative emission system components and operating parameters. For specific EVAP system operating parameters and system and component testing, see FUEL EVAPORATION under EMISSION SYSTEMS & SUB-SYSTEMS in I - SYSTEM/COMPONENT TESTS article.

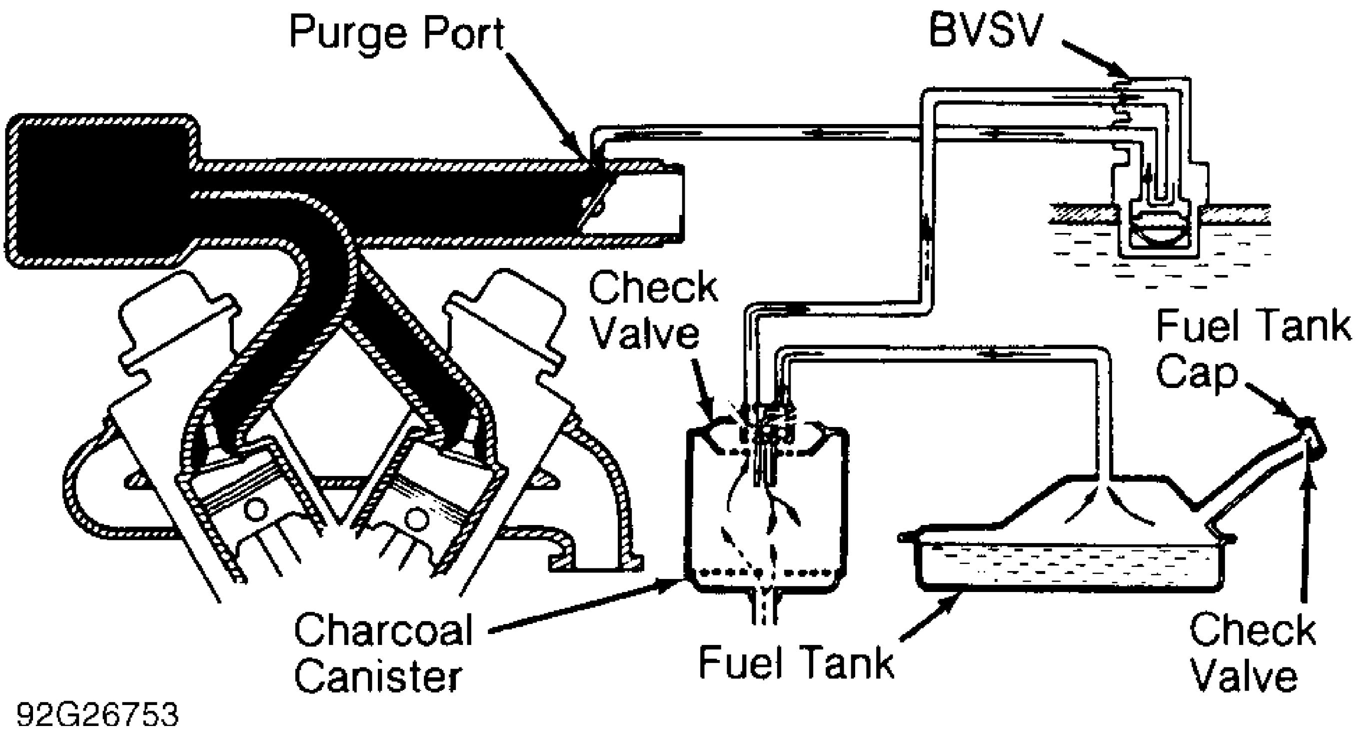

Fig. 8: Identifying Typical EVAP System Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SELF-DIAGNOSTIC SYSTEM

The Engine Control Module (ECM) is equipped with self-diagnostic system. By analyzing various input signals, ECM detects system malfunctions related to various operating parameters. When malfunction occurs, ECM will inform the driver by turning on Malfunction Indicator Light (MIL) on the instrument panel.

NOTE: The MIL may be referred to as the CHECK ENGINE light.

Diagnostic Trouble Codes (DTC) may be set by malfunction of various engine sensors, switches or circuits. DTC is stored in ECM memory. When diagnostic trouble code is stored, MIL on instrument panel will come on. Diagnostic trouble code can be retrieved for system diagnosis. For additional information on self-diagnostic system, see G - TESTS W/CODES article.

MISCELLANEOUS CONTROLS

TRANSMISSION/TRANSAXLE CONTROLS

NOTE: Only electronically controlled transmissions/transaxles are covered. Some models have transmissions and transaxles that are not electronically controlled.

Electronically Controlled Transmission/Transaxle (ECT)

ECM uses input signals for controlling transmission/transaxle operation.

1993 MANUAL TRANSMISSION REMOVAL & INSTALLATION
Toyota

Celica

MANUAL REMOVAL & INSTALLATION

REMOVAL (FWD)

WARNING: To prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

1) Disconnect negative battery cable. Remove air cleaner assembly. Remove cruise control assembly. Remove starter, clutch release cylinder and bracket. Remove left engine stay, ground cable and back-up switch connector. Disconnect control cables and speedometer cable.

2) Remove left side engine and transaxle mounting bolts. Remove front wheels. Raise and support vehicle. Remove splash shields. Drain transaxle fluid. Remove drive shaft. See AXLE SHAFTS - FRONT article in DRIVE AXLES. Remove lower crossmember. Remove front exhaust pipe. Remove engine mounting bolts and engine-to-center crossmember bolts.

3) Raise engine and transaxle slightly with a jack, and remove center crossmember. Remove stiffener plate. Remove transaxle mounting bolts, lower engine and remove transaxle.

4) Mark pressure plate and flywheel for reassembly reference. Loosen pressure plate attaching bolts alternately until pressure plate is released. Remove clutch disc and pressure plate. DO NOT drop clutch disc.

WARNING: To prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

REMOVAL (ALL-TRAC)

1) Engine and transaxle must be removed as an assembly to replace clutch assembly. With ignition off, disconnect negative battery cable. Place suitable container under fuel line. Cover fuel line connection with shop towel. Slowly loosen fuel line connection to release fuel pressure.

2) Drain cooling system, engine oil and transaxle oil. Remove hood and engine undercover. Remove air intake duct, airflow meter and air cleaner cap as an assembly. Remove air cleaner case. Disconnect cables from throttle body.

3) Disconnect relay box from battery. Remove lower cover from relay box. Disconnect fusible link assembly and engine wire connectors from relay box. Remove A/C relay box from bracket, located near right corner of radiator.

4) Remove battery. Remove injector solenoid resistor and fuel pump resistor located in front of battery, left of radiator. Remove radiator cooling fans, radiator and radiator reservoir tank. Remove cruise control actuator and ignition coil. Remove strut tower-to-firewall braces.

5) Label charcoal canister vacuum hoses, and remove canister. Label all necessary vacuum hose locations for reassembly reference. Disconnect necessary control cables, coolant hoses, fuel lines, vacuum hoses and electrical connections.

6) Raise and support vehicle. Disconnect speedometer cable,

oil cooler hoses and control cables at transaxle. Remove clutch release cylinder with hose attached, and secure aside. Disconnect wiring, and remove turbo pressure sensor and A/C vacuum switching valve from firewall. Remove starter.

7) Disconnect electrical connectors from engine Electronic Control Unit (ECU) located left of glove box, behind center console. Disconnect remaining electrical connections so engine wiring can be pulled out through access hole in passenger's side of firewall. See Fig. 1. Remove retaining nuts, and pull engine wiring through firewall.

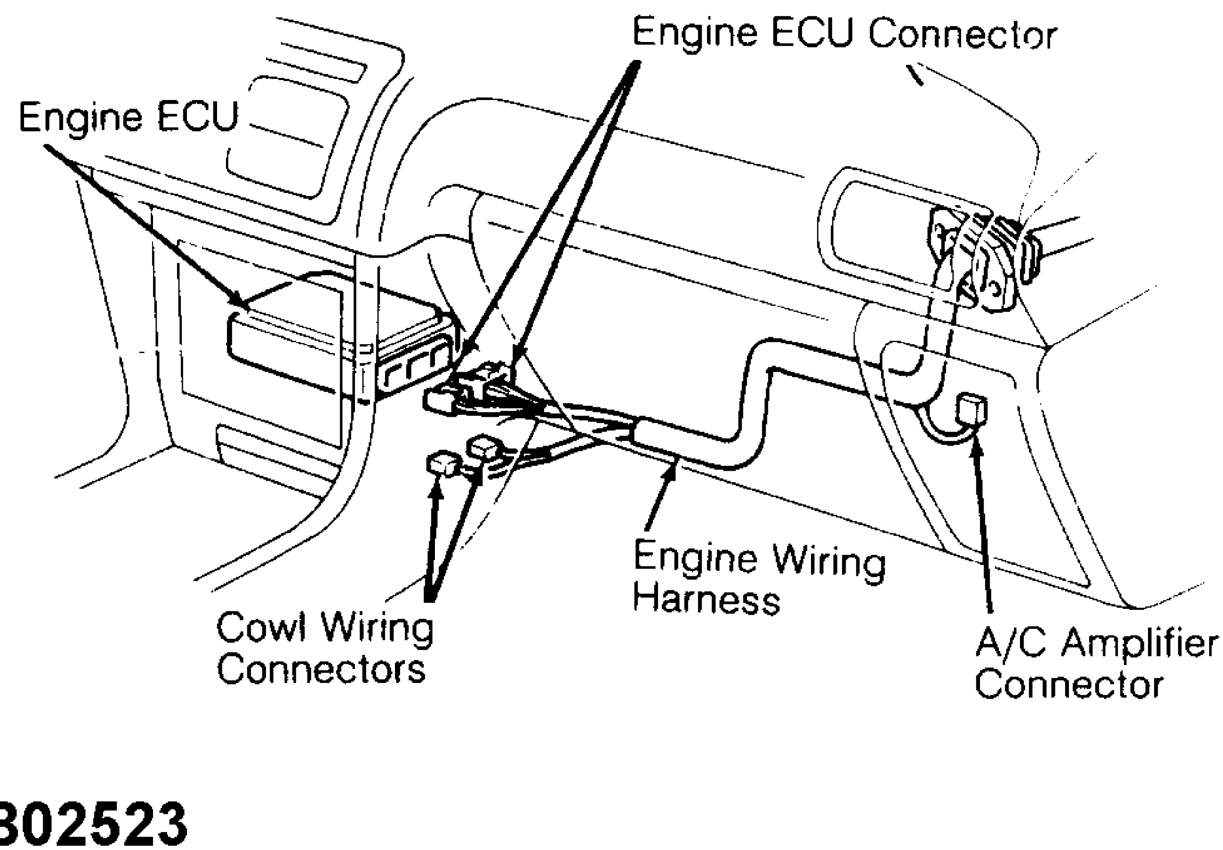

Fig. 1: Identifying Engine Wiring Connectors (Celica All-Trac)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Remove suspension crossmember bolted to both lower suspension arm shafts. Disconnect exhaust pipe at catalytic converter (located at bottom of turbo) and center pipe. Remove exhaust pipe. Remove front tires and wheels. Remove axle shafts. Remove front drive shaft.

9) Place reference marks on front and rear drive shaft flanges at center bearing. Remove flange bolts. Remove drive shaft from transfer case. Remove seal deflector from rear of transfer case. Remove dynamic damper from transfer case.

10) Remove alternator and idler pulley bracket. Remove A/C compressor and power steering pump with hoses attached, and secure aside. Remove engine mount crossmember located below engine. Remove catalytic converter from turbo.

11) Disconnect engine and transaxle mounts. Note direction of mount installation for reassembly reference. Mounts must be installed in original direction. Lift engine and transaxle from vehicle.

12) Remove bolts attaching engine to transaxle and remove

transaxle. Mark pressure plate and flywheel for reassembly reference. Loosen pressure plate attaching bolts alternately until pressure plate is released. Remove clutch disc and pressure plate. DO NOT drop clutch disc.

WARNING: To prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

Installation

1) Align reference marks, and install clutch disc and pressure plate. Use clutch aligner to center clutch disc on flywheel. Tighten pressure plate bolts alternately and evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS.

2) Apply molybdenum disulfide grease to release fork contact surfaces, release bearing and hub, and clutch disc splines. Reverse removal procedure to complete installation.

TORQUE SPECIFICATIONS

CELICA

TORQUE SPECIFICATIONS (CELICA)

Application	Ft. Lbs. (N.m)
Flywheel Bolts	
4A-FE	58 (79)
5S-FE	65 (88)
3S-GTE	80 (108)
Pressure Plate Bolts	14 (19)
Transaxle-To-Engine Bolts	
10-mm Bolts	34 (46)
12-mm Bolts	47 (64)
Wheel Lug Nuts	76 (103)

CELICA ALL-TRAC

TORQUE SPECIFICATIONS (CELICA ALL-TRAC)

Application	Ft. Lbs. (N.m)
Dynamic Damper Bolt	19 (26)
Engine Mount	
Crossmember-To-Underbody Bolt	38 (52)
Bracket-To-Engine Bolts (Right Front)	38 (52)
Insulator Through Bolt	64 (87)
Insulator-To-Bracket Nuts (Right Front)	38 (52)
Mount-To-Crossmember Bolt	54 (73)
Flywheel Bolt	65 (88)
Power Steering Pump Bolt	32 (43)
Pressure Plate Bolts	14 (19)
Stiffener Support Brace Bolt (Engine Block-To-Flywheel Housing)	27 (37)
Strut Tower-To-Firewall Brace	
Bolt	15 (20)
Nut	47 (64)
Suspension Crossmember Bolt	112 (152)
Transaxle-To-Engine Bolts	
10-mm Bolts	34 (46)
12-mm Bolts	47 (64)
Wheel Lug Nuts	76 (103)

TRANSMISSION SERVICING - A/T

1993 Toyota Celica

1993 TRANSMISSION SERVICING
Toyota Automatic Transmission

Toyota; Celica

LUBRICATION

SERVICE INTERVALS

Inspect fluid level every 15,000 miles. Under severe operating conditions, change ATF and filter every 15,000 miles or 24 months.

CHECKING FLUID LEVEL

Transmission

Check fluid with vehicle on level surface and at normal operating temperature. With engine idling, shift each gear from "P" through "L" and back to "P". Fluid level should be in HOT range marked on dipstick. DO NOT overfill.

NOTE: If vehicle has been operated in heavy traffic, pulling a trailer or at high speeds in hot weather, wait 30 minutes before checking fluid level.

Differential

Remove filler plug. Fluid should be level with bottom edge of filler plug hole. If fluid is level with opening, install fill plug. If fluid is low, fill until fluid is level with fill plug opening.

RECOMMENDED FLUID

Use Dexron-II automatic transmission fluid. See TRANSMISSION REFILL CAPACITIES table.

TRANSMISSION REFILL CAPACITIES TABLE

Application (1)	Refill Qts. (L)	Dry-Fill Qts. (L)
Celica		
1.6L (A243L)	3.5 (3.3)	8.1 (7.7)
2.2L (A241E)	3.5 (3.3)	8.5 (8.0)

(1) - Use Dexron-II ATF.

DIFFERENTIAL REFILL CAPACITIES TABLE

Application	Qts. (L)
Celica (1)	1.2 (1.1)

(1) - Use SAE 90 with GL-5 rating.

DRAINING & REFILLING

Transmission

1) Remove engine undercover if necessary. Remove drain plug and drain fluid. If replacing transmission filter, remove oil pan. Thoroughly clean transmission oil pan. Install filter and pan with new gasket.

CAUTION: When removing transmission filter, note different size bolt lengths for reassembly reference.

2) Replace pan drain plug and fill transmission with approximate amount of ATF fluid. See TRANSMISSION REFILL CAPACITIES table. Start engine and shift through all gears. Shift into "P" and check fluid level. Add fluid as necessary. DO NOT overfill.

Differential

Some FWD models have separate drain plugs for transmission and differential. Both transmission and differential plugs must be removed to drain all fluid from both units. Transaxle is filled through dipstick tube, and differential is filled through a separate fill plug. See Fig. 1. Fill differential until fluid is level with fill hole.

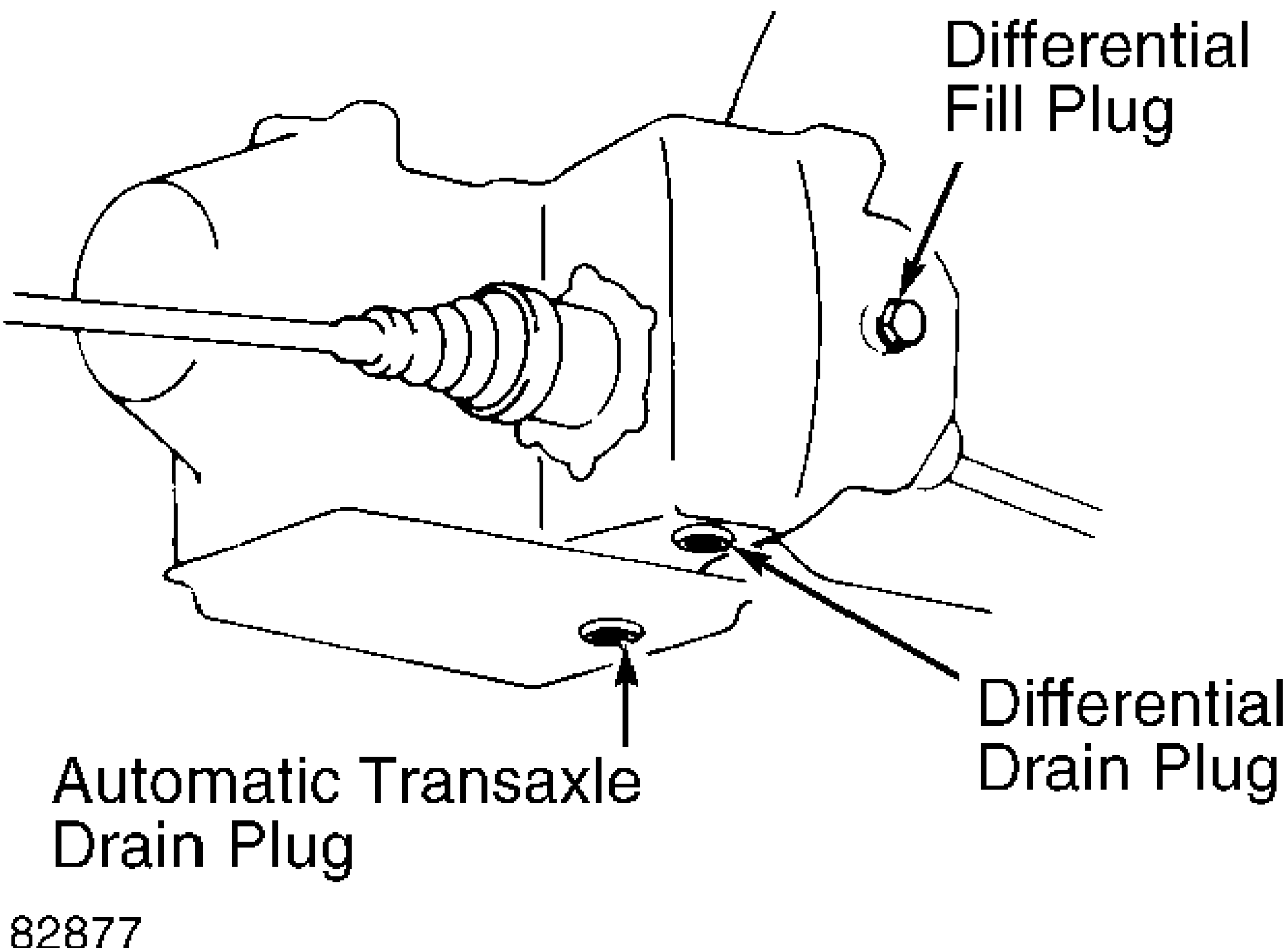

Fig. 1: Servicing Differential On Integral-Type Transaxle
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ADJUSTMENTS

SHIFT CABLE

1) Loosen swivel nut on manual shift lever. Push manual shift lever fully toward right side of vehicle.

2) Return lever 2 notches to Neutral position. Ensure shift lever is in "N". While holding lever lightly toward "R" range side, tighten swivel nut to 61 INCH lbs. (6 N.m). See Fig. 2.

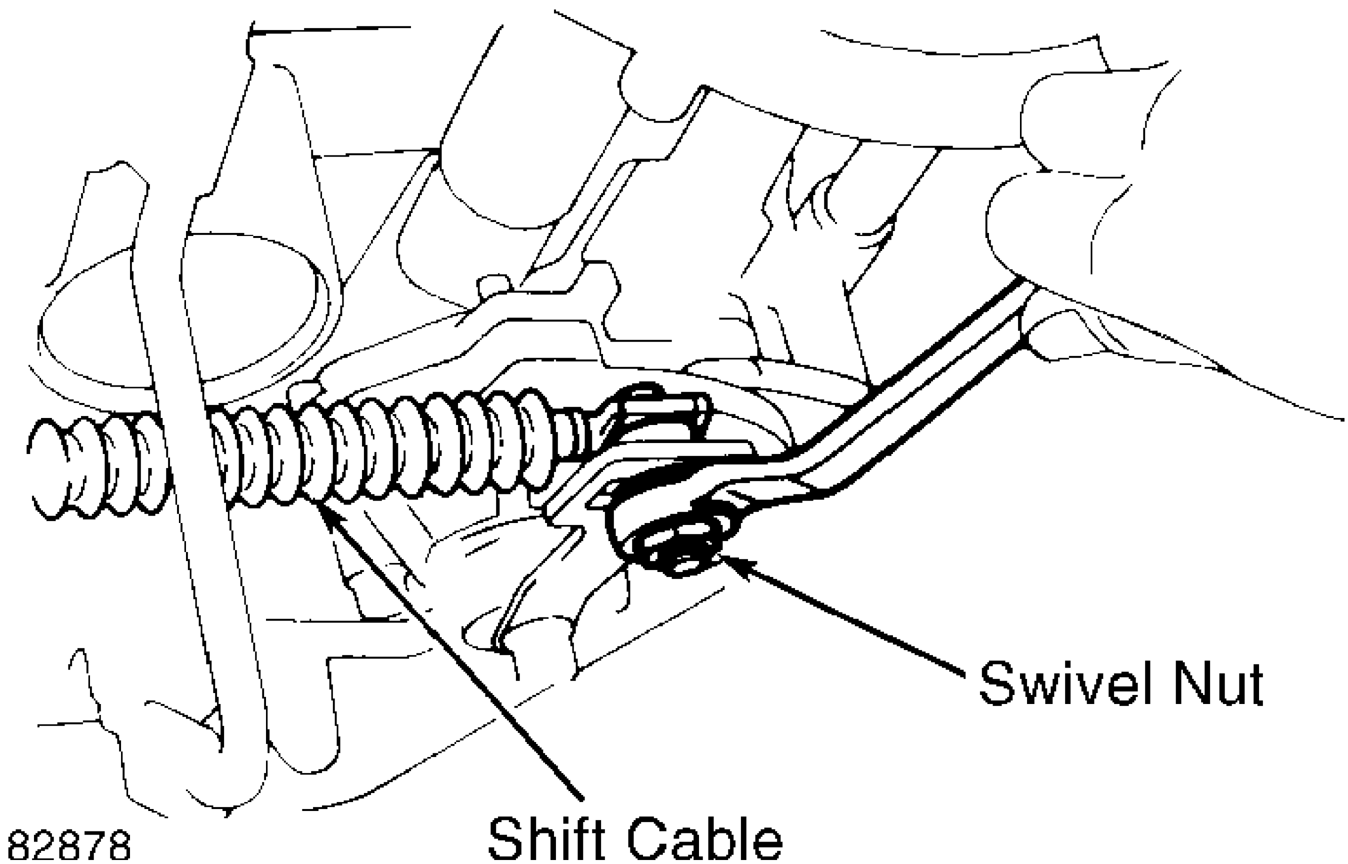

Fig. 2: Adjusting Shift Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

THROTTLE CABLE

1) Remove air cleaner. Check throttle cable bracket and linkage for looseness or bending. Depress accelerator to wide open throttle position.

2) Adjust cable housing so distance between rubber boot end and inner cable stopper or paint mark is .04" (1 mm). See Fig. 3. Tighten lock nut.

3) For new throttle cables, stopper or paint mark will not be in place. With new cable securely installed in transmission, pull inner cable slightly until resistance is felt. See Fig. 4. Stake new stopper or paint a mark as shown.

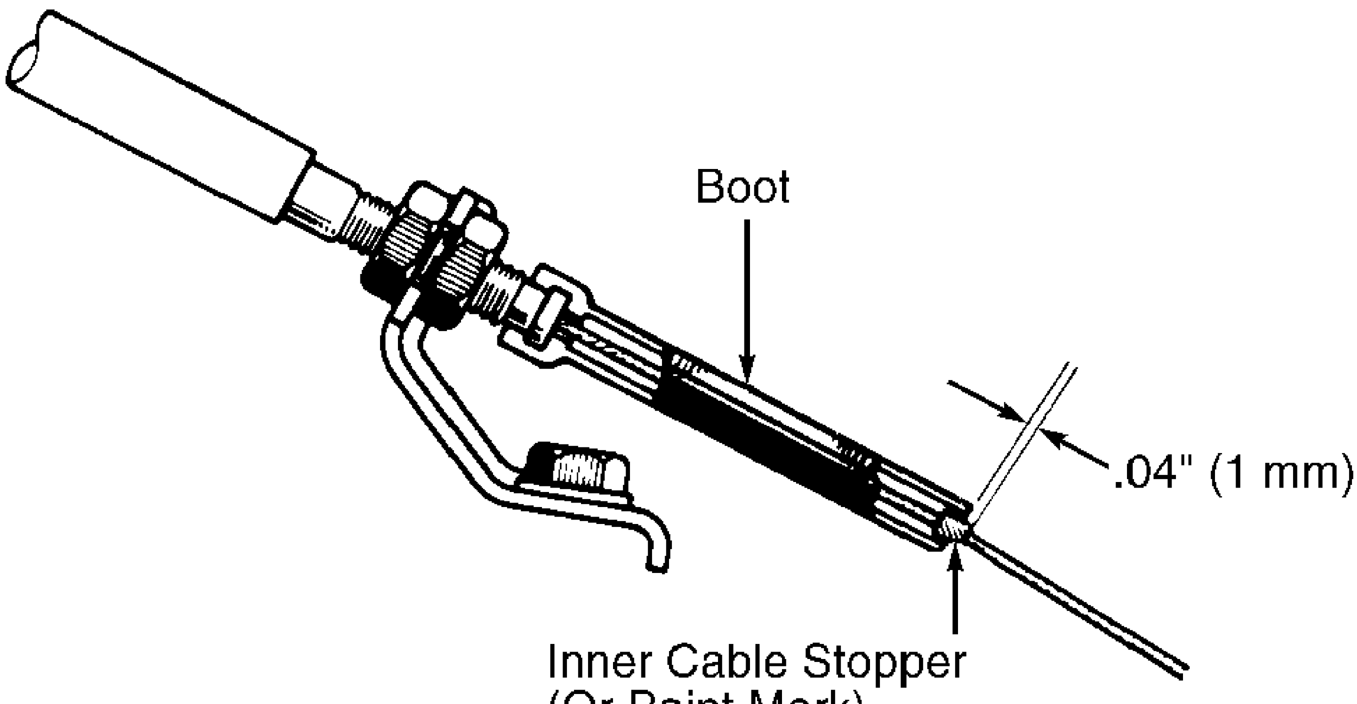

Fig. 3: Adjusting Throttle Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

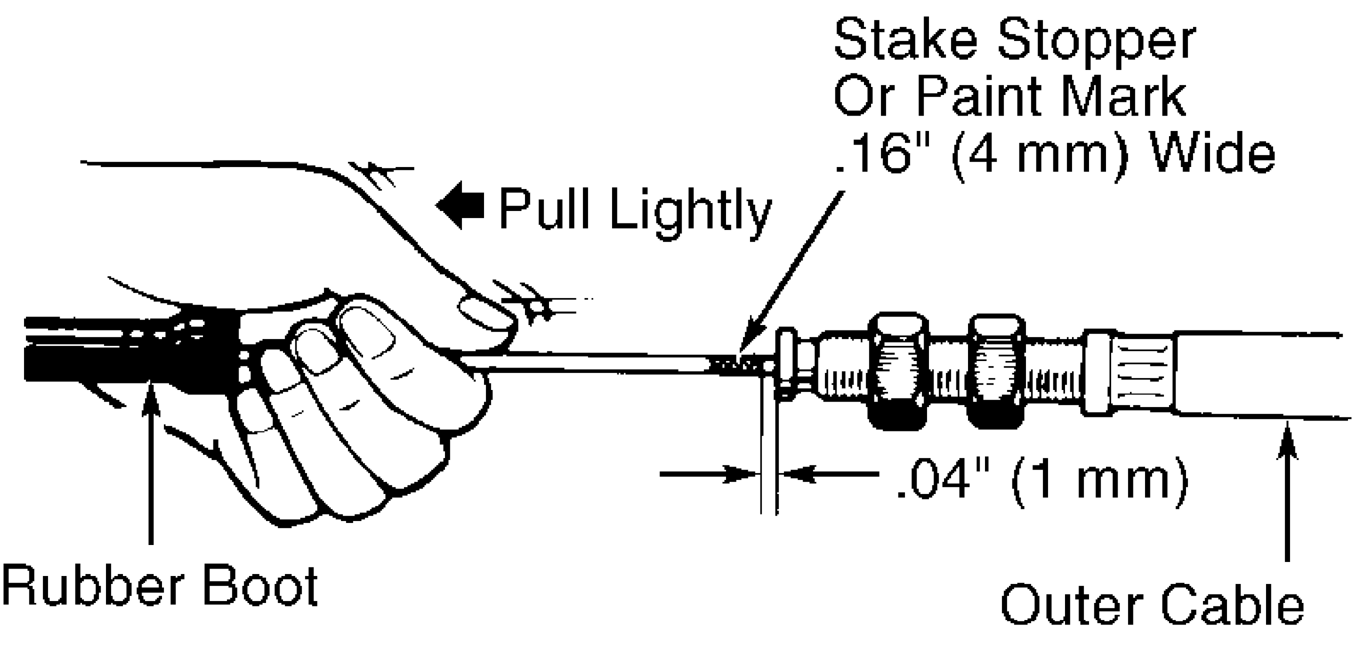

Fig. 4: Marking New Throttle Cable
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NEUTRAL SAFETY SWITCH

Loosen neutral safety switch bolts. Position shift lever in "N". Align switch shaft groove to neutral basic line. See Fig. 5.

Tighten adjusting bolt.

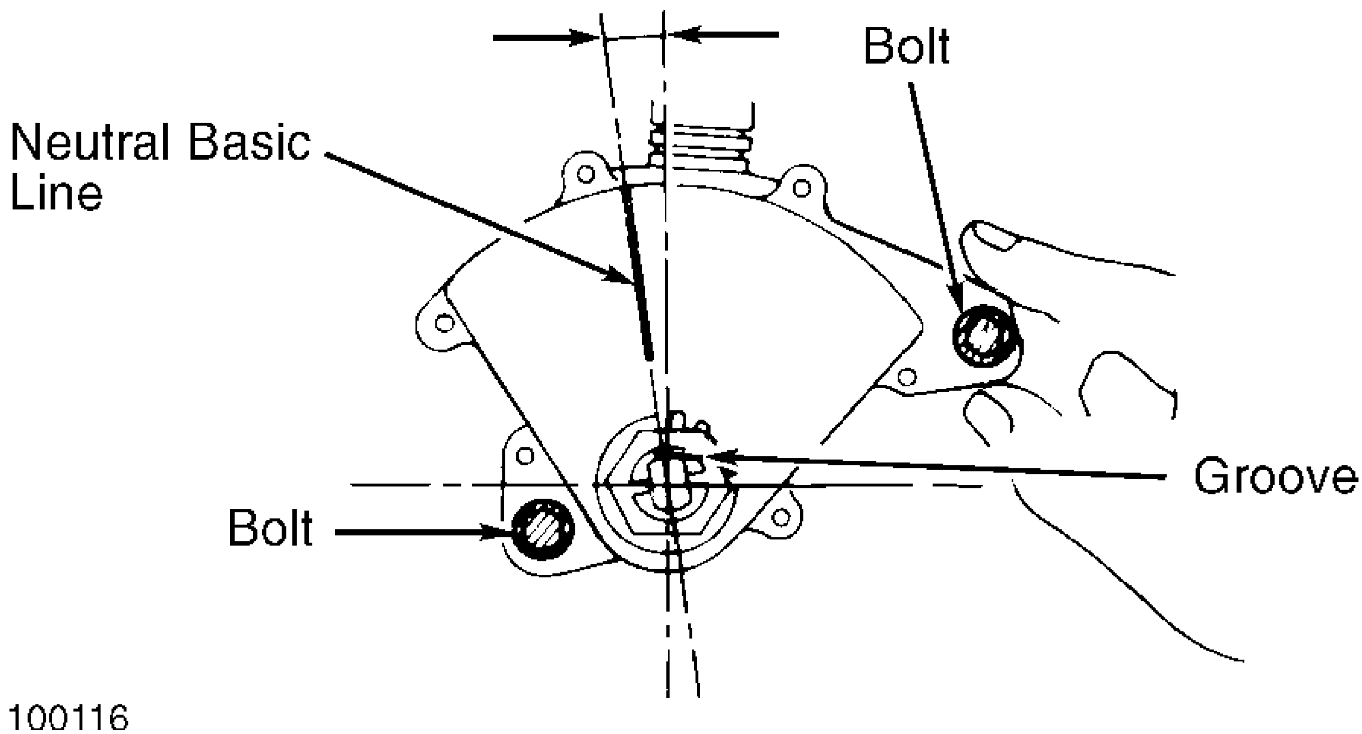

Fig. 5: Adjusting FWD Neutral Safety Switch (RWD Adjustment Is Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

1993 Manual Transmission Servicing

Celica

IDENTIFICATION

MANUAL TRANSMISSION/TRANSAXLE APPLICATIONS TABLE

Model	Transmission/Transaxle
Celica	
FWD	5-Speed - Model S53 Or C52
All-Trac	5-Speed - Model E150F

LUBRICATION

SERVICE INTERVALS

Check lubricant level every 15,000 miles or 24 months. Replace fluid at 15,000 mile intervals if vehicle is operated in severe service conditions. Severe service conditions include trailer towing, repeated short trips in cold weather and operation on dusty or salt spread roads.

CHECKING FLUID LEVEL

Transmission/Transaxle

Remove left engine undercover (if necessary). Check fluid level at fill plug hole. Lubricant should be level with bottom of fill hole.

Transfer Case

Drain and fill plugs on 4WD transfer cases are separate from main transmission/transaxle case. Lubricant should be level with bottom of fill hole.

RECOMMENDED FLUID

All transmission/transaxles except S54 use API GL-4 or GL-5, SAE 75W-90 or 80W-90 gear oil. The S54 transmission uses Dexron-II ATF. The E153 uses E50 transaxle oil. The V160 uses Toyota V160 Gear Oil.

FLUID CAPACITIES

TRANSMISSION/TRANSAXLE REFILL CAPACITIES TABLE

Application	Qts. (L)
Celica (SAE 75W-90)	
FWD	2.7 (2.6)
All-Trac	5.5 (5.2)

ADJUSTMENTS

NOTE: Adjustments are not required during routine servicing and maintenance.

1993 TRANSMISSION SERVICING
Toyota Transmission Removal & Installation

Toyota; Celica

AUTOMATIC

WARNING: On models with air bags, to prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

Removal

1) Disconnect negative battery cable. Wait at least 90 seconds before starting work, to prevent air bag deployment. Remove airflow meter and air cleaner. Disconnect all external electrical connectors to transaxle. Remove ground strap.

2) Disconnect transaxle throttle valve cable at throttle linkage and remove cable from bracket. Remove transaxle case protector and disconnect speedometer cable. Disconnect shift control cable at lever and remove from bracket.

3) Disconnect oil cooler hoses and remove starter motor bolts. Remove 2 upper transaxle-to-engine bolts. Remove insulator bracket set bolt for rear engine mount. Raise and support vehicle. Drain transaxle fluid. Disconnect and plug oil cooler hoses.

4) Remove left front fender apron. Disconnect both axle shafts from transaxle. Remove lower suspension crossmember. Using pliers, remove snap ring on center axle shaft bearing bracket. Remove bearing bracket bolt and pull center axle shaft assembly out.

5) Disconnect control cable clamp and remove crossmember bolts supporting center mounts of engine. Remove crossmember. Remove stabilizer bar and left steering knuckle from lower control arm.

6) Pull steering knuckle outward and remove left axle shaft. Remove bellhousing cover and remove 6 bolts attaching torque converter to drive plate.

7) Support engine with jack stand and secure transaxle jack under transaxle. Lower rear end of transaxle and remove remaining transaxle-to-engine bolts. Separate transaxle from engine and lower transaxle assembly.

Installation

1) Apply multipurpose grease to center hub of torque converter. Install one guide pin in threaded mounting pad of torque converter to align torque converter. Distance from torque converter drive lug to engine mating surface of transaxle should be at least .51" (13 mm). See Fig. 1.

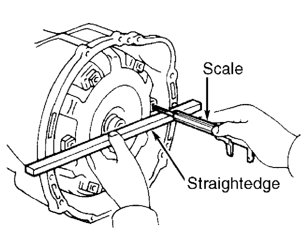

Fig. 1: Measuring Torque Converter Depth
Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Reverse removal procedure to complete installation of transaxle. Torque converter bolts are color coded. Install Gray bolt

first, then the remaining 5 bolts. Tighten torque converter bolts to specification. See TORQUE SPECIFICATIONS.

3) Fill transaxle to proper capacity. Check and adjust throttle cable and control cable.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Celica	
Drain Plug	25 (34)
Drive Shaft Bolts	
Center Bearing Support	36 (49)
Transaxle Side	41 (56)
Differential Side	58 (79)
Exhaust Pipe Nut	43 (58)
Oil Cooler Tubes	25 (34)
Rear Center Crossmember	10 (14)
Starter Bolt	29 (39)
Torque Converter Clutch Bolts	25 (33)
Transaxle-To-Engine Bolts	
14-mm	27 (37)
17-mm	53 (72)

TROUBLE SHOOTING - BASIC PROCEDURES

1993 Toyota Celica

GENERAL TROUBLE SHOOTING

* PLEASE READ THIS FIRST *

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ACCESSORIES & ELECTRICAL

CHARGING SYSTEM TROUBLE SHOOTING

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BASIC CHARGING SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Vehicle Will Not Start	Dead battery	Check battery cells, alternator belt tension and alternator output
	Loose or corroded battery connections	Check all charging system connections
	Ignition circuit or switch malfunction	Check and replace as necessary
Alternator Light Stays On With Engine Running	Loose or worn alternator drive belt	Check alternator drive tension and condition, See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Loose alternator wiring connections	Check all charging system connections
	Short in alternator light wiring	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
	Defective alternator stator or diodes	See Bench Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in

		ALTERNATOR article
Alternator Light Stays Off With Ignition Switch ON	Blown fuse	See WIRING DIAGRAMS
	Defective alternator	See Testing in ALTERNATOR article
	Defective indicator light bulb or socket	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Alternator Light Stays OFF With Ignition Switch ON	Short in alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective rectifier bridge	See Bench Tests in ALTERNATOR article
Lights or Fuses Burn Out Frequently	Defective alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in ALTERNATOR article
	Defective battery	Check and replace as necessary
Ammeter Gauge Shows Discharge	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Defective wiring	Check all wires and wire connections
	Defective alternator or regulator	See Bench Tests and On-Vehicle Tests in ALTERNATOR article
	Defective ammeter, or improper ammeter wiring connection	See Testing in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Noisy Alternator	Loose drive pulley	Tighten drive pulley attaching nut
	Loose mounting bolts	Tighten all alternator mounting bolts
	Worn or dirty bearings	See Bearing Replacement ALTERNATOR article

	Defective diodes or stator	See Bench Test in ALTERNATOR article
Battery Does Stay Charged	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in appropriate TUNE-UP article in the TUNE-UP section
	Loose or corroded battery connections	Check all charging system connections
	Loose alternator connections	Check all charging system connections
	Defective alternator or battery	See On-Vehicle Tests and Bench Tests in ALTERNATOR article
	Add-on electrical accessories exceeding alternator capacity	Install larger alternator
Battery Overcharged- Uses Too Much Water	Defective battery	Check alternator output and repair as necessary
	Defective alternator	See On-Vehicle Test and Bench Tests in ALTERNATOR article
	Excessive alternator voltage	Check alternator output and repair as necessary

IGNITION SYSTEM TROUBLE SHOOTING

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Ignition Secondary Trouble Shooting Chart

START: Visually inspect Spark Plug Wires, Coil Wires, Plug Wire Boots, Rotor, and Distributor Cap for signs of damage.

OK

* To test secondary ignition system, modify a Spark Plug by attaching a ground wire to the body of the plug and

NOT OK

* Repair or replace damaged components as necessary

widening the gap to 1/4-3/8". Disconnect spark plug wire and insert test plug. Ground plug, crank engine, and check for spark.

GOOD SPARK

* If plug sparks, driveability problem is most likely NOT in the ignition system.

NO SPARK

* Remove coil wire from the distributor and attach the modified spark plug. Ground the plug and crank engine while checking for spark.

GOOD SPARK

* If plug has a good spark, the problem is in the plug wires, distributor cap, or rotor. Replace components as necessary.

NO SPARK

* Proceed to the IGNITION PRIMARY TROUBLE SHOOTING CHECK CHART below in this article.

Ignition Primary Trouble Shooting Chart

START: Visually inspect primary ignition wires for broken, frayed, split, or cut wires. Also check for loose, corroded, or disconnected connectors.

OK

* Check that battery voltage is at least 11.5 volts.

NOT OK

* Repair or replace damaged components as necessary.

NOT OK

* Replace or recharge the battery.

OK

* Check for battery voltage at the positive terminal of the coil.

OK

* Check air Gap of the Pick-Up coil in the distributor.

NOT OK

* Check resistance of ballast resistor (if used) for the correct resistance value.

OK

* Check Pick-Up coil for correct resistance value.

NOT OK

* Adjust or replace as necessary.

NOT OK

* Replace Pick-Up coil if not to specification.

OK

* Check control module for good ground connections.

OK

* If vehicle fails to run at this point, go to the appropriate article in the ENGINE PERFORMANCE section.

OK

* Check wires from the battery/ ignition switch to the coil. Also check the coil primary and secondary resistance.

NOT OK

* Replace ballast resistor if the measured resistance value is not within specification.

STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article

	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary

	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay Does Not Close	Dead battery	Charge or replace battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay

Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary
High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine	Distance too small between starter pinion and flywheel	

Fires With Key released. Engine Fires and Cranks Normally	Flywheel runout contributes to the intermittent nature

AIR CONDITIONING & HEAT

AIR CONDITIONING TROUBLE SHOOTING

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BASIC AIR CONDITIONING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Compressor Not Working	• Compressor clutch circuit open. • Compressor clutch coil inoperative. • Poor clutch ground connection. • Fan belts loose. • Thermostatic switch inoperative. • Thermostatic switch not adjusted. • Ambient temperature switch open. • Superheat fuse blown.
Excessive Noise or Vibration	• Missing or loose mounting bolts. • Bad idler pulley bearings. • Fan belts not tightened correctly. • Compressor clutch contacting body. • Excessive system pressure. • Compressor oil level low. • Damaged clutch bearings. • Damaged reed valves. • Damaged compressor.
Insufficient or No Cooling; Compressor Working	• Expansion valve inoperative. • Heater control valve stuck open. • Low system pressure. • Blocked condenser fins. • Blocked evaporator fins. • Vacuum system leak. • Vacuum motors inoperative. • Control cables improperly adjusted. • Restricted air inlet. • Mode doors binding. • Blower motor inoperative. • Temperature above system capacity.

HEATER SYSTEM TROUBLE SHOOTING

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BASIC HEATER SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Insufficient, Erratic, or No Heat	• Low Coolant Level • Incorrect thermostat. • Restricted coolant flow through heater core. • Heater hoses plugged. • Misadjusted control cable. • Sticking heater control valve. • Vacuum hose leaking. • Vacuum hose blocked. • Vacuum motors inoperative. • Blocked air inlet. • Inoperative heater blower motor. • Oil residue on heater core fins. • Dirt on heater core fins.
Too Much Heat	• Improperly adjusted cables. • Sticking heater control valve. • No vacuum to heater control valve. • Temperature door stuck open.
Air Flow Changes During Acceleration	• Vacuum system leak. • Bad check valve or reservoir.
Air From Defroster At All Times	• Vacuum system leak. • Improperly adjusted control cables. • Inoperative vacuum motor.
Blower Does Not Operate Correctly	• Blown fuse. • Blower motor windings open. • Resistors burned out. • Motor ground connection loose. • Wiring harness connections loose. • Blower motor switch inoperative. • Blower relay inoperative. • Fan binding or foreign object in housing. • Fan blades broken or bent.

BRAKES

BRAKE SYSTEM TROUBLE SHOOTING

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BRAKE SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Brakes Pull Left or Right	Incorrect tire pressure	Inflate tires to proper pressure
	Front end out of alignment	See WHEEL ALIGNMENT
	Mismatched tires	Check tires sizes
	Restricted brake lines or hoses	Check hose routing
	Loose or malfunctioning caliper	See DISC BRAKES or BRAKE SYSTEM
	Bent shoe or oily linings	See DRUM BRAKES or BRAKE SYSTEM
	Malfunctioning rear brakes	See DRUM, DISC BRAKES or BRAKE SYSTEM
	Loose suspension parts	See SUSPENSION
Noises Without Brakes Applied	Front linings worn out	Replace linings
	Dust or oil on drums or rotors	See DRUM, DISC BRAKES or BRAKE SYSTEM
Noises With Brakes Applied	Insulator on outboard shoe damaged	See DISC BRAKES or BRAKE SYSTEM
	Incorrect pads or linings	Replace pads or linings
Brake Rough, Chatters or Pulsates	Excessive lateral runout	Check rotor runout
	Parallelism not to specifications	Reface or replace rotor
	Wheel bearings not adjusted	See SUSPENSION
	Rear drums out-of-round	Reface or replace drums
	Disc pad reversed, steel against rotor	Remove and reinstall pad
Excessive Pedal Effort	Malfunctioning power unit	See POWER BRAKES or BRAKE SYSTEM
	Partial system failure	Check fluid and pipes
	Worn disc pad or lining	Replace pad or lining
	Caliper piston stuck or	

	sluggish	See DISC BRAKES or BRAKE SYSTEM
	Master cylinder piston stuck	See MASTER CYLINDERS or BRAKE SYSTEM
	Brake fade due to incorrect pads for linings	Replace pads or linings
	Linings or pads glazed	Replace pads or linings
	Worn drums	Reface or replace drums
Excessive Pedal Travel	Partial brake system failure	Check fluid and pipes
	Insufficient fluid in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Air trapped in system	See BRAKE BLEEDING or BRAKE SYSTEM
	Rear brakes not adjusted	See Adjustments in DRUM BRAKES or BRAKE SYSTEM
	Bent shoe or lining	See DRUM BRAKES or BRAKE SYSTEM
	Plugged master cylinder cap	See MASTER CYLINDERS or BRAKE SYSTEM
	Improper brake fluid	Replace brake fluid
Pedal Travel Decreasing	Compensating port plugged	See MASTER CYLINDERS or BRAKE SYSTEM
	Swollen cup in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Master cylinder piston not returning	See MASTER CYLINDERS or BRAKE SYSTEM
	Weak shoe retracting springs	See DRUM BRAKES BRAKE SYSTEM
	Wheel cylinder piston sticking	See DRUM BRAKES or BRAKE SYSTEM
Dragging Brakes	Master cylinder pistons not returning	See MASTER CYLINDERS BRAKE SYSTEM
	Restricted brake lines or hoses	Check line routing
	Incorrect parking brake adjustment	See DRUM BRAKES BRAKE SYSTEM

	Parking Brake cables frozen	See DRUM BRAKES BRAKE SYSTEM
	Incorrect installation of inboard disc pad	Remove and replace correctly
	Power booster output rod too long	See POWER BRAKE UNITS BRAKE SYSTEM
	Brake pedal not returning freely	See DISC, DRUM BRAKES BRAKE SYSTEM
Brakes Grab or Uneven Braking Action	Malfunction of combination valve	See CONTROL VALVE or BRAKE SYSTEM
	Malfunction of power brake unit	See POWER BRAKE UNITS or BRAKE SYSTEM
	Binding brake pedal	See DISC, DRUM BRAKES or BRAKE SYSTEM
Pulsation or Roughness	Uneven pad wear caused by caliper	See DISC BRAKES or BRAKE SYSTEM
	Uneven rotor wear	See DISC BRAKES or BRAKE SYSTEM
	Drums out-of-round	Reface or replace drums

ENGINE MECHANICAL

COOLING SYSTEM TROUBLE SHOOTING

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COOLING SYSTEM TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION
Overheating	Coolant Leak	Fill/Pressure Test System
	A/C Condenser Fins Clogged	Remove/Clean Condenser
	Radiator Fins Clogged	Remove/Clean Radiator
	Thermostat Stuck Closed	Replace Thermostat
	Clogged Cooling System Passages	Clean/Flush Cooling System

	Water Pump Malfunction	Replace Water Pump
	Fan Clutch Malfunction	Replace Fan Clutch
	Retarded Ignition Timing	Reset Ignition Timing
	Cooling Fan Malfunction	Test Cooling Fan/ Circuit
	Cooling Fan Motor Malfunction	Test Fan Motor
	Cooling Fan Relay Malfunction	Test Fan Relay
	Faulty Radiator Cap	Replace Radiator Cap
	Broken/Slipping Fan Belt	Replace Fan Belt
	Restricted Exhaust	Repair Exhaust System
Corrosion	Impurities In Coolant	Clean/Flush System
Coolant Leakage	Damaged hose	Replace Hose
	Leaky Water Pump	Replace Water Pump
	Damaged Radiator Seam	Replace/Repair Radiator
	Leaky Thermostat Cover	Replace Thermostat Cover
	Cylinder Head Problem	Check Head/Head Gasket
	Leaky Freeze Plugs	Replace Freeze Plugs
Recovery System Inoperative		
	Loose and/or Defective Radiator Cap	Replace Radiator Cap
	Overflow Tube Clogged and/or Leaking	Repair Tube
	Recovery Bottle Vent Restricted	Clean Vent
No Heater Core Flow		
	Collapsed Heater Hose	Replace Heater Hose
	Plugged Heater Core	Clean/Replace Heater Core
	Faulty Heater Valve	Replace Heater Valve

GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING

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BASIC GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Lopes At Idle	Intake manifold-to-head leaks	Replace manifold gasket, See ENGINES
	Blown head gasket	Replace head gasket, See ENGINES
	Worn timing gears, chain or sprocket	Replace gears, chain or sprocket
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Overheated engine	Check cooling system, See COOLING
	Blocked crankcase vent valve	Remove restriction
	Leaking EGR valve	Repair leak and/or replace valve
	Faulty fuel pump	Replace fuel pump
Engine Has Low Power	Leaking fuel pump	Repair leak and/or replace fuel pump
	Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
	Sticking valves or weak valve springs	Check valve train components, See ENGINES
	Incorrect valve timing	Reset valve timing, See ENGINES
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Blown head gasket	Replace head gasket. See ENGINES.
	Clutch slipping	Adjust pedal and/or replace components, See ENGINES
	Engine overheating	Check cooling system, See COOLING
	Auto. Trans. pressure regulator valve faulty	Replace pressure regulator valve
	Auto. Trans. fluid level too low	Add fluid as necessary
	Improper vacuum diverter valve operation	Replace vacuum diverter valve
	Vacuum leaks	Inspect vacuum system and repair as required
	Leaking piston rings	Replace piston rings, See ENGINES
Faulty High Speed Operation	Low fuel pump volume	Replace fuel pump
	Leaking valves or worn	Replace valves and/or springs, See ENGINES
	Incorrect valve timing	Reset valve timing,See ENGINES
	Intake manifold restricted	Remove restriction
	Worn distributor shaft	Replace distributor
Faulty Acceleration	Improper fuel pump stroke	Remove pump and reset pump stroke

	Incorrect ignition timing	Reset ignition timing, See TUNE-UP
	Leaking valves	Replace valves, See ENGINES
	Worn fuel pump diaphragm or piston	Replace diaphragm or piston
Intake Backfire	Improper ignition timing	Reset ignition timing, See TUNE-UP
	Faulty accelerator pump discharge	Replace accelerator pump
	Improper choke operation	Check choke and adjust as required
	Defective EGR valve	Replace EGR valve
	Fuel mixture too lean	Reset air/fuel mixture, See TUNE-UP
	Choke valve initial clearance too large	Reset choke valve initial clearance
Exhaust Backfire	Vacuum leak	Inspect and repair vacuum system
	Faulty vacuum diverter valve	Replace vacuum diverter valve
	Faulty choke operation	Check choke and adjust as required
	Exhaust system leak	repair exhaust system leak
Engine Detonation	Ignition timing too far advanced	Reset ignition timing, See TUNE-UP
	Faulty ignition system	Check ignition timing, See TUNE-UP
	Spark plugs loose or faulty	Retighten or replace plugs
	Fuel delivery system clogged	Inspect lines, pump and filter for clog
	EGR valve inoperative	Replace EGR valve
	PCV system inoperative	Inspect and/or replace hoses or valve
	Vacuum leaks	Check vacuum system and repair leaks
	Excessive combustion chamber deposits	Remove built-up deposits
	Leaking, sticking or broken valves	Inspect and/or replace valves
External Oil Leakage	Fuel pump improperly seated or worn gasket	Remove pump, replace gasket and seat properly
	Oil pan gasket broken or pan bent	Straighten pan and replace gasket
	Timing chain cover gasket broken	Replace timing chain cover gasket
	Rear main oil seal worn	Replace rear main oil seal
	Oil pan drain plug not seated properly	Remove and reinstall drain plug
	Camshaft bearing drain hole blocked	Remove restriction
	Oil pressure sending switch leaking	Remove and reinstall sending switch

Excessive Oil Consumption	Worn valve stems or guides	Replace stems or guides, See ENGINES
	Valve "O" ring seals damaged	Replace "O" ring seals, See ENGINES
	Plugged oil drain back holes	Remove restrictions
	Improper PCV valve operation	Replace PCV valve
	Engine oil level too high	Remove excess oil
	Engine oil too thin	Replace thicker oil
	Valve stem oil deflectors damaged	Replace oil deflectors
	Incorrect piston rings	Replace piston rings, See ENGINES
	Piston ring gaps not staggered	Reinstall piston rings, See ENGINES
	Insufficient piston ring tension	Replace rings, See ENGINES
	Piston ring grooves or oil return slots clogged	Replace piston rings, See ENGINES
	Piston rings sticking in grooves	Replace piston rings, See ENGINES
	Piston ring grooves excessively worn	Replace piston and rings, See ENGINES
	Compression rings installed upside down	Replace compression rings correctly, See ENGINES
	Worn or scored cylinder walls	Rebore cylinders or replace block
	Mismatched oil ring expander and rail	Replace oil ring expander and rail, See ENGINES
	Intake gasket dowels too long	Replace intake gasket dowels
	Excessive main or connecting rod bearing clearance	Replace main or connecting rod bearings, See ENGINES
No Oil Pressure	Low oil level	Add oil to proper level
	Oil pressure sender or gauge broken	Replace sender or gauge
	Oil pump malfunction	Remove and overhaul oil pump, See ENGINES
	Oil pressure relief valve sticking	Remove and reinstall valve
	Oil pump passages blocked	Overhaul oil pump, See ENGINES
	Oil pickup screen or tube blocked	remove restriction
	Loose oil inlet tube	Tighten oil inlet tube
	Loose camshaft bearings	Replace camshaft bearings, See ENGINES
	Internal leakage at oil passages	Replace block or cylinder head
Low Oil Pressure	Low engine oil level	Add oil to proper level
	Engine oil too thin	Remove and replace with thicker oil
	Excessive oil pump clearance	Reduce oil pump clearance, See ENGINES
	Oil pickup tube or screen blocked	Remove restrictions
	Main, rod or cam bearing clearance excessive	Replace bearing to reduce clearance, See

ENGINES

High Oil Pressure	Improper grade of oil	Replace with proper oil
	Oil pressure relief valve stuck closed	Eliminate binding
	Oil pressure sender or gauge faulty	Replace sender or gauge
Noisy Main Bearings	Inadequate oil supply	Check oil delivery to main bearings
	Excessive main bearing clearance	Replace main bearings, See ENGINES
	Excessive crankshaft end play	Replace crankshaft, See ENGINES
	Loose flywheel or torque converter	Tighten attaching bolts
	Loose or damaged vibration damper	Tighten or replace vibration damper
	Crankshaft journals out-of-round	Re-grind crankshaft journals
	Excessive belt tension	Loosen belt tension
Noisy Connecting Rods	Excessive bearing clearance or missing bearing	Replace bearing, See ENGINES
	Crankshaft rod journal out-of-round	Re-grind crankshaft journal
	Misaligned connecting rod or cap	Remove rod or cap and realign
	Incorrectly tightened rod bolts	Remove and re-tighten rod bolts
Noisy Pistons and Rings	Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
	Bore tapered or out-of-round	Rebore block
	Piston ring broken	Replace piston rings, See ENGINES
	Piston pin loose or seized	Replace piston pin, See ENGINES
	Connecting rods misaligned	Realign connecting rods
	Ring side clearance too loose or tight	Replace with larger or smaller rings
	Carbon build-up on piston	Remove carbon
Noisy Valve Train	Worn or bent push rods	Replace push rods, See ENGINES
	Worn rocker arms or bridged pivots	Replace push rods, See ENGINES
	Dirt or chips in valve lifters	Remove lifters and remove dirt/chips
	Excessive valve lifter leak-down	Replace valve lifters, See ENGINES
	Valve lifter face worn	Replace valve lifters, See ENGINES
	Broken or cocked valve springs	replace or reposition springs
	Too much valve stem-to-guide clearance	Replace valve guides, See ENGINES
	Valve bent	Replace valve, See ENGINES
	Loose rocker arms	Retighten rocker arms, See ENGINES
	Excessive valve seat run-out	Reface valve seats, See ENGINES

	Missing valve lock	Install new valve lock
	Excessively worn camshaft lobes	Replace camshaft, See ENGINES
	Plugged valve lifter oil holes	Eliminate restriction or replace lifter
	Faulty valve lifter check ball	Replace lifter check ball, See ENGINES
	Rocker arm nut installed upside down	Remove and reinstall correctly
	Valve lifter incorrect for engine	Remove and replace valve lifters
	Faulty push rod seat or lifter plunger	Replace plunger or push rod
Noisy Valves	Improper valve lash	Re-adjust valve lash, See ENGINES
	Worn or dirty valve lifters	Clean and/or replace lifters
	Worn valve guides	Replace valve guides, See ENGINES
	Excessive valve seat or face run-out	Reface seats or valve face
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Loose rocker arm studs	Re-tighten rocker arm studs, See ENGINES
	Bent push rods	Replace push rods, See ENGINES
	Broken valve springs	Replace valve springs, See ENGINES
Burned,Sticking or Broken Valves	Weak valve springs or warped valves	Replace valves and/or springs, See ENGINES
	Improper lifter clearance	Re-adjust clearance or replace lifters
	Worn guides or improper guide clearance	Replace valve guides, See ENGINES
	Out-of-round valve seats or improper seat width	Re-grind valve seats
	Gum deposits on valve stems, seats or guides	Remove deposits
	Improper spark timing	Re-adjust spark timing
Broken Pistons/Rings	Undersize pistons	Replace with larger pistons, See ENGINES
	Wrong piston rings	Replace with correct rings, See ENGINES
	Out-of-round cylinder bore	Re-bore cylinder bore
	Improper connecting rod alignment	Remove and realign connecting rods
	Excessively worn ring grooves	Replace pistons, See ENGINES
	Improperly assembled piston pins	Re-assemble pin-to -piston, See ENGINES
	Insufficient ring gap clearance	Install new rings, See ENGINES
	Engine overheating	Check cooling system
	Incorrect ignition timing	Re-adjust ignition timing, See TUNE-UP
Excessive Exhaust Noise	Leaks at manifold to head, or to pipe	Replace manifold or pipe gasket
	Exhaust manifold	Replace exhaust

	cracked or broken	manifold, See ENGINES

ENGINE PERFORMANCE

CARBURETOR TROUBLE SHOOTING:

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BASIC COLD START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Choke not closing	Check choke operation, see FUEL SYSTEMS
	Choke linkage bent	Check linkage, see FUEL SYSTEM
Engine Starts, Then Dies	Choke vacuum kick setting too wide	Check setting and adjust see, FUEL SYSTEMS
	Fast idle RPM too low	Reset RPM to specif- ication, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEMS
	Vacuum leak	Inspect vacuum system for leaks
	Low fuel pump outlet	Repair or replace pump, see FUEL SYSTEMS
	Low carburetor fuel level	Check float setting see FUEL SYSTEM
Engine Quits Under Load	Choke vacuum kick setting incorrect	Reset vacuum kick setting,see FUEL SYSTEMS
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEM
	Incorrect hot fast idle speed RPM	Reset fast idle RPM, see TUNE-UP
Engine Starts, Runs Up,Then Idles, Slowly With Black Smoke	Choke vacuum kick set too narrow	Reset vacuum kick, see FUEL SYSTEMS
	Fast idle cam index	Reset fast idle cam

	incorrect	index, see FUEL SYSTEMS
	Hot fast idle RPM too low	Reset fast idle RPM, see TUNE-UP

BASIC HOT START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Engine flooded	Allow fuel to evaporate

BASIC COLD ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Stalls in Gear	Choke vacuum kick setting incorrect	Reset choke vacuum kick, see FUEL SYSTEMS
	Fast idle RPM incorrect	Reset fast idle RPM, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam see FUEL SYSTEMS
Acceleration Sag or Stall	Defective choke control switch	Replace choke control switch
	Choke vacuum kick setting incorrect	Reset choke vacuum kick see, FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, FUEL SYSTEMS
	Accelerator pump defective	Repair or replace pump see FUEL SYSTEMS
	Secondary throttles not closed	Inspect lockout adjustment,see FUEL SYSTEMS
Sag or Stall After Warmup	Defective choke control switch	Replace choke control switch, see FUEL SYSTEMS
	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, see FUEL SYSTEMS
Backfiring & Black Smoke	Plugged heat crossover system	Remove restriction

BASIC WARM ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Hesitation With Small Amount of Gas Pedal Movement	Vacuum leak	Inspect vacuum lines
	Accelerator pump weak or inoperable	Replace pump, see FUEL SYSTEMS
	Float level setting too low	Reset float level, see,FUEL SYSTEMS
	Metering rods sticking or binding	Inspect and/or replace rods, see FUEL SYSTEMS
	Carburetor idle or transfer system plugged	Inspect system and remove restriction
	Frozen or binding heated air inlet	Inspect heated air door for binding
Hesitation With Heavy Gas Pedal Movement	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Metering rod carrier sticking or binding	Remove restriction
	Large vacuum leak	Inspect vacuum system and repair leak
	Float level setting too low	Reset float level, see FUEL SYSTEMS
	Defective fuel pump, lines or filter	Inspect pump, lines and filter
	Air door setting incorrect	Adjust air door setting, see FUEL

DIESEL ENGINE TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

BASIC DIESEL ENGINE TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Crank	Bad battery connections or dead batteries	Check connections and/or replace

		batteries
	Bad starter connections or bad starter	Check connections and/or replace batteries
Engine Cranks Slowly, Won't Start	Bad battery connections or dead batteries	Check connections and/or replace batteries
	Engine oil too heavy	Replace engine oil
Engine Cranks Normally, But Will Not Start	Glow plugs not functioning	Check glow plug system, see FUEL SYSTEMS
	Glow plug control not functioning	Check controller, see FUEL SYSTEMS
	Fuel not injected into cylinders	Check fuel injectors, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Fuel filter blocked	Replace fuel filter
	Fuel tank filter blocked	Replace fuel tank filter
	Fuel pump not operating	Check pump operation and/or replace pump
	Fuel return system blocked	Inspect system and remove restriction
	No voltage to fuel solenoid	Check solenoid and connections
	Incorrect or contaminated fuel	Replace fuel
	Incorrect injection pump timing	Re-adjust pump timing, see FUEL SYSTEMS
	Low compression	Check valves, pistons, rings, see ENGINES
	Injection pump malfunction	Inspect and/or replace injection pump
Engine Starts, Won't Idle	Incorrect slow idle adjustment	Reset idle adjustment, see TUNE-UP
	Fast idle solenoid malfunctioning	Check solenoid and connections
	Fuel return system blocked	Check system and remove restrictions
	Glow plugs go off too soon	See glow plug diagnosis in FUEL SYSTEMS
	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Incorrect or contaminated fuel	Replace fuel
	Low compression	Check valves, piston, rings, see ENGINES
	Injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
	Fuel solenoid closes in RUN position	Check solenoid and connections
Engines Starts/ Idles Rough W/out Smoke or Noise	Incorrect slow idle adjustment	Reset slow idle, see TUNE-UP
	Injection line fuel leaks	Check lines and connections
	Fuel return system blocked	Check lines and connections

	Air in fuel system Incorrect or contaminated fuel Injector nozzle malfunction	Bleed air from system Replace fuel Check nozzles, see FUEL SYSTEMS
Engines Starts and Idles Rough W/out Smoke or Noise, But Clears After Warm-Up	Injection pump timing incorrect Engine not fully broken in Air in system Injector nozzle malfunction	Reset pump timing, see FUEL SYSTEMS Put more miles on engine Bleed air from system Check nozzles, see FUEL SYSTEMS
Engine Idles Correctly, Misfires Above Idle	Blocked fuel filter Injection pump timing incorrect Incorrect or contaminated fuel	Replace fuel filter Reset pump timing, see FUEL SYSTEMS Replace fuel
Engine Won't Return To Idle	Fast idle adjustment incorrect Internal injection pump malfunction External linkage binding	Reset fast idle, see TUNE-UP Replace injection pump, see FUEL SYSTEMS Check linkage and remove binding
Fuel Leaks On Ground	Loose or broken fuel line Internal injection pump seal leak	Check lines and connections Replace injection pump, see FUEL SYSTEMS
Cylinder Knocking Noise	Injector nozzles sticking open Very low nozzle opening pressure	Test injectors, see FUEL SYSTEMS Test injectors and/or replace
Loss of Engine Power	Restricted air intake EGR valve malfunction Blocked or damaged exhaust system Blocked fuel tank filter Restricted fuel filter Block vent in gas cap Tank-to-injection pump fuel supply blocked Blocked fuel return system Incorrect or contaminated fuel Blocked injector nozzles Low compression	Remove restriction Replace EGR valve Remove restriction and/or replace components Replace filter Remove restriction and/or replace filter Remove restriction and/or replace cap Check fuel lines and connections Remove restriction Replace fuel Check nozzle for blockage, see FUEL SYSTEMS Check valves, rings, pistons, see ENGINES
Loud Engine Noise With Black Smoke	Basic timing incorrect EGR valve malfunction Internal injection pump malfunction	Reset timing, see FUEL SYSTEMS Replace EGR valve Replace injection pump, see FUEL SYSTEMS

	Incorrect injector pump housing pressure	Check pressure, see FUEL SYSTEMS
Engine Overheating	Cooling system leaks	Check cooling system and repair leaks
	Belt slipping or damaged	Check tension and/or replace belt
	Thermostat stuck closed	Remove and replace thermostat, see ENGINE COOLING
	Head gasket leaking	Replace head gasket
Oil Light on at Idle	Low oil pump pressure	Check oil pump operation, see ENGINES
	Oil cooler or line restricted	Remove restriction and/or replace cooler
Engine Won't Shut Off	Injector pump fuel solenoid does not return fuel valve to OFF position	Remove and check solenoid and replace if needed
	VACUUM PUMP DIAGNOSIS	
Excessive Noise	Loose pump-to-drive assembly screws	Tighten screws
	Loose tube on pump assembly	Tighten tube
	Valves not functioning properly	Replace valves
Oil Leakage	Loose end plug	Tighten end plug
	Bad seal crimp	Remove and re-crimp seal

FUEL INJECTION TROUBLE SHOOTING

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BASIC FUEL INJECTION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start (Cranks Normally)	Cold start valve inoperative	Test valve and circuit
	Poor connection;vacuum or wiring	Check vacuum and electrical connections
	Contaminated fuel	Test fuel for water or alcohol
	Defective fuel pump relay or circuit	Test relay and wiring
	Battery too low	Charge and test battery

	Low fuel pressure	Test pressure regulator and fuel pump, check for restricted lines and filters
	No distributor reference pulses	Repair ignition system as necessary
	Open coolant temperature sensor circuit	Test sensor and wiring
	Shorted W.O.T. switch in T.P.S.	Disconnect W.O.T. switch, engine should start
	Defective ECM	Replace ECM
	Fuel tank residual pressure valve leaks	Test for fuel pressure drop after shut down
Hard Starting	Disconnected hot air tube to air cleaner	Reconnect tube and test control valve
	Defective Idle Air Control (IAC) valve	Test valve operation and circuit
	Shorted, open or misadjusted T.P.S.	Test and adjust or replace T.P.S.
	EGR valve open	Test EGR valve and control circuit
	Poor Oxygen sensor signal	Test for shorted or circuit
	Incorrect mixture from PCV system	Test PCV for flow, check sealing of oil filter cap
Poor High Speed Operation	Low fuel pump volume	Faulty pump or restricted fuel lines or filters
	Poor MAP sensor signal	Test MAP sensor, vacuum hose and wiring
	Poor Oxygen sensor signal	Test for shorted or open sensor or circuit
	Open coolant temperature sensor circuit	Test sensor and wiring
	Faulty ignition operation	Check wires for cracks or poor connections, test secondary voltage with oscilloscope
	Contaminated fuel	Test fuel for water

		or alcohol
	Intermittent ECM ground	Test ECM ground connection for resistance
	Restricted air cleaner	Replace air cleaner
	Restricted exhaust system	Test for exhaust manifold back pressure
	Poor MAF sensor signal	Check leakage between sensor and manifold
	Poor VSS signal	If tester for ALCL hook-up is available check that VSS reading matches speedometer
Ping or Knock on Acceleration	Poor Knock sensor signal	Test for shorted or open sensor or circuit
	Poor Baro sensor signal	Test for shorted or open sensor or circuit
	Improper ignition timing	See VEHICLE EMISSION CONTROL LABEL (where applicable)
	Check for engine overheating problems	Low coolant, loose belts or electric cooling fan inoperative

NOTE: For additional electronic fuel injection trouble shooting information, see the appropriate article in the ENGINE PERFORMANCE section (not all vehicles have Computer Engine Control articles). Information is provided there for diagnosing fuel system problems on vehicles with electronic fuel injection.

IGNITION SYSTEM TROUBLE SHOOTING

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Ignition Secondary Trouble Shooting Chart

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┌─────────────────────────────────────────────────────────┐
│ START: Visually inspect Spark Plug Wires, Coil Wires,   │
│        Plug Wire Boots, Rotor, and Distributor Cap for  │
│        signs of damage.                                 │
```

OK

* To test secondary ignition system, modify a Spark Plug by attaching a ground wire to the body of the plug and widening the gap to 1/4-3/8". Disconnect spark plug wire and insert test plug. Ground plug, crank engine, and check for spark.

  GOOD SPARK

  * If plug sparks, driveability problem is most likely NOT in the ignition system.

  NO SPARK

  * Remove coil wire from the distributor and attach the modified spark plug. Ground the plug and crank engine while checking for spark.

    GOOD SPARK

    * If plug has a good spark, the problem is in the plug wires, distributor cap, or rotor. Replace components as necessary.

    NO SPARK

    * Proceed to the IGNITION PRIMARY TROUBLE SHOOTING CHECK CHART below in this article.

NOT OK

* Repair or replace damaged components as necessary

Ignition Primary Trouble Shooting Chart

START: Visually inspect primary ignition wires for broken, frayed, split, or cut wires. Also check for loose, corroded, or disconnected connectors.

OK

* Check that battery voltage is at least 11.5 volts.

  NOT OK

  * Replace or recharge the battery.

  OK

  * Check for battery voltage at the positive terminal of the coil.

NOT OK

* Repair or replace damaged components as necessary.

OK

* Check air Gap of the Pick-Up coil in the distributor.

OK

* Check Pick-Up coil for correct resistance value.

NOT OK

* Replace Pick-Up coil if not to specification.

OK

* Check control module for good ground connections.

OK

* If vehicle fails to run at this point, go to the appropriate article in the ENGINE PERFORMANCE section.

NOT OK

* Adjust or replace as necessary.

NOT OK

* Check resistance of ballast resistor (if used) for the correct resistance value.

OK

* Check wires from the battery/ ignition switch to the coil. Also check the coil primary and secondary resistance.

NOT OK

* Replace ballast resistor if the measured resistance value is not within specification.

STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter

	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article
	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground

		connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary
	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay	Dead battery	Charge or replace

Does Not Close		battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay
Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary

High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine Fires With Key released. Engine Fires and Cranks Normally	Distance too small between starter pinion and flywheel Flywheel runout contributes to the intermittent nature	

TUNE-UP TROUBLE SHOOTING - GAS ENGINE VEHICLES

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BASIC SPARK PLUG TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Normal Spark Plug Condition	Light Tan or Gray deposits	No Action
	Electrode not burned or fouled	No Action
	Gap tolerance not changed	No Action
Cold Fouling or Carbon Deposits	Overrich air/fuel mixture	Adjust air/fuel mixture, see ENGINE PERFORMANCE section
	Faulty choke	Replace choke assembly, see ENGINE PERFORMANCE section
	Clogged air filter	Clean and/or replace air filter
	Incorrect idle speed or dirty carburetor	Reset idle speed and/ or clean carburetor
	Faulty ignition wires	Replace ignition wiring
	Prolonged operation at idle	Shut engine off during long idle
	Sticking valves or worn valve guide seals	Check valve train
Wet Fouling or Oil Deposits	Worn rings and pistons	Install new rings and pistons

	Excessive cylinder wear	Rebore or replace block
	Excessive valve guide clearance	Worn or loose bearing
Gap Bridged	Deposits in combustion chamber becoming fused to electrode	Clean combustion chamber of deposits
Blistered Electrode	Engine overheating	Check cooling system
	Wrong type of fuel	Replace with correct fuel
	Loose spark plugs	Retighten spark plugs
	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Pre-Ignition or Melted Electrodes	Incorrect type of fuel	Replace with correct fuel
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Burned valves	Replace valves
	Engine Overheating	Check cooling system
	Wrong type of spark plug, too hot	Replace with correct spark plug, see ENGINE PERFORMANCE
Chipped Insulators	Severe detonation	Check for over-advanced timing or combustion
	Improper gapping procedure	Re-gap spark plugs
Rust Colored Deposits	Additives in unleaded fuel	Try different fuel brand
Water In Combustion Chamber	Blown head gasket or cracked head	Repair or replace head or head gasket

NOTE: Before diagnosing an electronic ignition system, ensure that all wiring is connected properly between distributor, wiring connector and spark plugs. Ignition problem will show up either as: Engine Will Not Start or Engine Runs Rough.

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Open circuit between distributor and bulkhead connector	Repair circuit
	Open circuit between bulkhead connector and	Repair circuit

	ignition switch	
	Open circuit between ignition switch and starter solenoid	Repair circuit
Engine Runs Rough	Fuel lines leaking or clogged	Tighten fitting, remove restriction
	Initial timing incorrect	Reset ignition timing see ENGINE PERFORMANCE
	Centrifugal advance malfunction	Repair distributor advance
	Defective spark plugs or wiring	Replace plugs or plug wiring
Component Failure	Spark arc-over on cap, rotor or coil	Replace cap, rotor or or coil
	Defective pick-up coil	Replace pick-up coil
	Defective ignition coil	Replace ignition coil
	Defective vacuum unit	Replace vacuum unit
	Defective control module	Replace control module

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS - USING OSCILLOSCOPE PATTERNS

CONDITION	POSSIBLE CAUSE	CORRECTION
Firing Voltage Lines are the Same, but Abnormally High	Retarded ignition timing	Reset ignition timing, see ENGINE PERFORMANCE section
	Fuel mixture too lean	Readjust carburetor, see ENGINE PERFORMANCE
	High resistance in coil wire	Replace coil wire
	Corrosion in coil tower terminal	Clean and/or replace coil
	Corrosion in distributor coil terminal	Clean and/or replace distributor cap
Firing Voltage Lines are the Same but Abnormally Low	Fuel mixture too rich	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in coil wire causing arcing	Replace coil wire
	Cracked coil tower causing arcing	Replace coil
	Low coil output	Replace coil
	Low engine compression	Determine cause and

		repair
One or More, But Not All Firing Voltage Lines are Higher Than Others	Carburetor idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	EGR valve stuck open	Clean and/or replace valve
	High resistance in spark plug wires	Replace spark plug wires
	Cracked or broken spark plug insulator	Replace spark plugs
	Intake vacuum leak	Repair leak
	Defective spark plugs	Replace spark plugs
	Corroded spark plug terminals	Replace spark plugs
One or More, But Not All Firing Voltage Lines Are Lower Than Others	Curb idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in plug wires causing arcing	Replace plug wires
	Cracked coil tower causing arcing	Replace coil
	Low compression	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Corroded spark plugs	Replace spark plugs
Cylinders Not Firing	Cracked distributor cap terminals	Replace distributor cap
	Shorted spark plug wire	Determine cause and repair
	Mechanical problem in engine	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Spark plugs fouled	Replace spark plugs

BASIC DRIVEABILITY PROBLEMS TROUBLE SHOOTING TABLE

CONDITION	POSSIBLE CAUSE	CORRECTION
Hard Starting	Binding carburetor linkage	Eliminate binding
	Binding choke linkage	Eliminate binding
	Binding choke piston	Eliminate binding
	Restricted choke vacuum	Check vacuum lines for blockage

	Worn or dirty needle valve and seat	Clean carburetor, see ENGINE PERFORMANCE
	Float sticking	Readjust or replace float see the ENGINE PERFORMANCE section
	Incorrect choke adjustment	Reset choke adjustment see ENGINE PERFORMANCE
	Defective coil	Replace coil
	Improper spark plug gap	Regap spark plugs
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Detonation	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective spark plugs	Replace spark plugs
	Fuel lines clogged	Clean fuel lines
	EGR system malfunction	Check and repair EGR system
	PCV system malfunction	Repair PCV system
	Vacuum leaks	Check and repair vacuum system
	Loose fan belts	Tighten or replace fan belts, see ENGINE PERFORMANCE
	Restricted airflow	Remove restriction
	Vacuum advance malfunction	Check distributor operation
Dieseling	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate blinding
	Binding choke linkage or fast idle cam	Eliminate binding
	Defective idle solenoid	Replace idle solenoid see ENGINE PERFORMANCE
	Improper base idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Incorrect idle mixture setting	Reset idle mixture, see ENGINE PERFORMANCE
Faulty Acceleration	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE

	Engine cold and choke too lean	Adjust choke and allow engine to warm-up
	Defective spark plugs	Replace spark plugs
	Defective coil	Replace coil
Faulty Low Speed Operation	Clogged idle transfer slots	Clean idle transfer slots, see FUEL
	Restricted idle air bleeds and passages	Disassemble and clean carburetor, see FUEL
	Clogged air cleaner	Replace air filter
	Defective spark plugs	Replace spark plugs
	Defective ignition wires	Replace ignition wire see ENGINE PERFORMANCE
	Defective distributor cap	Replace distributor cap
Faulty High Speed Operation	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective distributor centrifugal advance	Replace advance mechanism
	Defective distributor vacuum advance	Replace advance unit
	Incorrect spark plugs or plug gap	Check gap and/or replace spark plugs
	Faulty choke operation	Check choke and repair as required
	Clogged vacuum passages	Remove restrictions
	Improper size or clogged main jet	Check jet size and clean, see FUEL
	Restricted air cleaner	Check filter and replace as necessary
	Defective distributor cap, rotor or coil	Replace cap, rotor or coil
Misfire at All Speeds	Defective spark plugs	Replace spark plugs
	Defective spark plug wires	Replace spark plug wires
	Defective distributor cap, rotor, or coil	Replace cap, rotor, or coil
	Cracked or broken vacuum hoses	Replace vacuum hoses

	Vacuum leaks	Repair vacuum leaks
	Fuel lines clogged	Remove restriction
Hesitation	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair Vacuum leaks
	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate binding
	Binding choke linkage or fast idle cam	Eliminate binding
	Improper float setting	Readjust float setting, see FUEL
	Cracked or broken ignition wires	Replace ignition wires
Rough idle, Missing or Stalling	Incorrect curb idle or fast idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect basic timing	Reset ignition timing see ENGINE PERFORMANCE
	Improper idle mixture adjustment	Reset idle mixture, see ENGINE PERFORMANCE
	Improper feedback system operation	Check feedback system see ENGINE PERFORMANCE
	Incorrect spark plug gap	Reset spark plug gap, see ENGINE PERFORMANCE
	Moisture in ignition components	Dry components
	Loose or broken ignition wires	Replace ignition wires
	Damaged distributor cap or or rotor	Replace distributor cap or rotor
	Faulty ignition coil	Replace ignition coil
	Fuel filter clogged or worn	Replace fuel filter
	Damaged idle mixture screw	Replace idle mixture screw, see FUEL
	Improper fast idle cam adjustment	Reset fast idle cam adjustment, see TUNE- see ENGINE PERFORMANCE
	Improper EGR valve operation	Replace EGR valve
	Faulty PCV valve air flow	Replace PCV valve
	Choke binding or improper choke setting	Reset choke or eliminate binding

	Vacuum leak	Repair vacuum leak
	Improper float bowl fuel level	Reset float adjustment, see FUEL
	Clogged air bleed or idle passages	Clean carburetor passages, see FUEL
	Clogged or worn air cleaner filter	Replace air filter
	Faulty choke vacuum diaphragm	Replace diaphragm, see ENGINE PERFORMANCE
	Exhaust manifold heat valve inoperative	Replace heat valve
	Improper distributor spark advance	Check distributor operation
	Leaking valves or valve components	Check and repair valvetrain
	Improper carburetor mounting	Remove and remount carburetor
	Excessive play in distributor shaft	Replace distributor
	Loose or corroded wiring connections	Repair or replace as required
Engine Surges	Improper PCV valve airflow	Replace PCV valve
	Vacuum leaks	Repair vacuum leaks
	Clogged air bleeds	Remove restriction
	EGR valve malfunction	Replace EGR valve
	Restricted air cleaner filter	Replace air filter
	Cracked or broken vacuum hoses	Replace vacuum hoses
	Cracked or broken ignition wires	Replace ignition wires
	Vacuum advance malfunction	Check unit and replace as necessary
	Defective or fouled spark plugs	Replace spark plugs
Ping or Spark Knock	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Distributor centrifugal or vacuum advance malfunction	Check operation and replace as necessary
	Carburetor setting too lean	Readjust mixture

		setting, see ENGINE PERFORMANCE
	Vacuum leak	Eliminate vacuum leak
	EGR valve malfunction	Replace EGR valve
Poor Gasoline Mileage	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair vacuum leaks
	Defective ignition wires	Replace wires
	Incorrect choke setting	Readjust setting, see ENGINE PERFORMANCE
	Defective vacuum advance	Replace vacuum advance
	Defective spark plugs	Replace spark plugs
	Binding carburetor power piston	Eliminate binding
	Dirt in carburetor jets	Clean and/or replace jets
	Incorrect float adjustment	Readjust float setting, see FUEL
	Defective power valve	Replace power valve, see ENGINE PERFORMANCE
	Incorrect idle speed	Readjust idle speed
Engine Stalls	Improper float level	Readjust float level
	Leaking needle valve and seat	Replace needle valve and seat
	Vacuum leaks	Eliminate vacuum leaks

VACUUM PUMP - DIESEL TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

VACUUM PUMP (DIESEL) TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION

Excessive Noise	Loose pump-to-drive assembly screws Loose tube on pump assembly Valves not functioning properly	Tighten screws Tighten tube Replace valves
Oil Leakage	Loose end plug Bad seal crimp	Tighten end plug Remove and re-crimp seal

MANUAL TRANSMISSION

MANUAL TRANSMISSION TROUBLE SHOOTING

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MANUAL TRANSMISSION/TRANSAXLE TROUBLE SHOOTING

Condition	Possible Cause
Noisy In Forward Gears	.Low gear oil level, .Loose bell housing bolts, .Worn bearings or gears
Clunk On Deceleration (FWD Only)	.Loose engine mounts, .Worn inboard CV joints, .Worn differential pinion shaft, .Side gear hub counterbore in case worn oversize
Gear Clash When Shifting Forward Gears	.Clutch Out Of Adjustment, .Shift linkage damaged or out of adjustment, .Gears or synchronizers damaged, .Low gear oil level
Transmission Noisy When Moving (RWD Only) Quiet In Neutral With Clutch Engaged	.Worn rear outputshaft bearing
Gear Rattle	.Worn bearings, .Wrong gear oil, .Low gear oil, .Worn gears
Steady Ticking At Idle (Increases With RPM)	.Broken tooth on gear
Gear Clash When Shifting Forward Gears	.Worn or broken synchronizers
Loud Whine In Reverse	.Normal condition (1)

Noise When Stepping On Clutch	.Bad release bearing, .Worn pilot bearing
Ticking Or Screeching As Clutch Is Engaged	.Faulty release bearing, .Uneven pressure plate fingers
Click Or Snap When Clutch Is Engaged	.Worn clutch fork, .Worn or broken front bearing retainer
Transmission Shifts Hard	.Clutch not releasing, .Shift mechanism binding, .Clutch installed backwards
Will Not Shift Into One Gear, Shifts Into All Others	.Bent shift fork, .Worn detent balls
Locked Into Gear, Cannot Shift	.Clutch adjustment, .Worn detent balls
Transmission Jumps Out Of Gear	.Pilot bearing worn, .Bent shift fork, .Worn gear teeth or face .Excessive gear train end play .Worn synchronizers .Missing detent ball spring .Shift mechanism worn or out of adjustment .Engine or transmission mount bolts loose or out of adjustment .Transmission not aligned
Shift Lever Rattle	.Worn shift lever or detents .Worn shift forks .Worn synchronizers sleeve
Shift Lever Hops Under Acceleration	.Worn engine or transmission mounts

(1) - Most units use spur cut gears in reverse and are noisy

POWERTRAIN

CLUTCH TROUBLE SHOOTING

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BASIC CLUTCH TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Chattering or Grabbing	Incorrect clutch adjustment	Adjust clutch
	Oil, grease or glaze on facings	Disassemble and clean or replace
	Loose "U" joint flange	See DRIVE AXLES article
	Worn input shaft spline	Replace input shaft
	Binding pressure plate	Replace pressure plate
	Binding release lever	See CLUTCH article
	Binding clutch disc hub	Replace clutch disc
	Unequal pressure plate contact	Replace worn/misaligned components
	Loose/bent clutch disc	Replace clutch disc
	Incorrect transmission alignment	Realign transmission
	Worn pressure plate, disc or flywheel	Replace damaged components
	Broken or weak pressure springs	Replace pressure plate
	Sticking clutch pedal	Lubricate clutch pedal & linkage
	Incorrect clutch disc facing	Replace clutch disc
	Engine loose in chassis	Tighten all mounting bolts
Failure to Release	Oil or grease on clutch facings	Clean or replace clutch clutch disc
	Incorrect release lever or pedal adjustment	See CLUTCH article
	Worn or broken clutch facings	Replace clutch disc
	Bent clutch disc or pressure plate	Replace damaged components
	Clutch disc hub binding on input shaft	Clean or replace clutch disc and/or input shaft
	Binding pilot bearing	Replace pilot bearing
	Sticking release bearing sleeve	Replace release bearing and/or sleeve
	Binding clutch cable	See CLUTCH article

	Defective clutch master	Replace master cylinder
	Defective clutch slave	Replace slave cylinder
	Air in hydraulic system	Bleed hydraulic system
Rattling	Weak or broken release lever spring	Replace spring and check alignment
	Damaged pressure plate	Replace pressure plate
	Broken clutch return spring	Replace return spring
	Worn splines on clutch disc or input shaft	Replace clutch disc and/or input shaft
	Worn clutch release bearing	Replace release bearing
	Dry or worn pilot bearing	Lubricate or replace pilot bearing
	Unequal release lever contact	Align or replace release lever
	Incorrect pedal free play	Adjust free play
	Warped or damaged clutch disc	Replace damaged components
Slipping	Pressure springs worn or	Release pressure plate
	Oily, greasy or worn facings	Clean or replace clutch disc
	Incorrect clutch alignment	Realign clutch assembly
	Warped clutch disc or pressure plate	Replace damaged components
	Binding release levers or clutch pedal	Lubricate and/or replace release components
Squeaking	Worn or damaged release	Replace release bearing
	Dry or worn pilot or release bearing	Lubricate or replace assembly
	Pilot bearing turning in crankshaft	Replace pilot bearing and/or crankshaft
	Worn input shaft bearing	Replace bearing and seal
	Incorrect transmission alignment	Realign transmission
	Dry release fork between pivot	Lubricate release fork and pivot
Heavy and/or Stiff Pedal	Sticking release bearing sleeve	Replace release bearing and/or sleeve

	Dry or binding clutch pedal hub	Lubricate and align components
	Floor mat interference with pedal	Lay mat flat in proper area
	Dry or binding ball/fork pivots	Lubricate and align components
	Faulty clutch cable	Replace clutch cable
Noisy Clutch Pedal	Faulty interlock switch	Replace interlock switch
	Self-adjuster ratchet noise	Lubricate or replace self-adjuster
	Speed control interlock switch	Lubricate or replace interlock switch
Clutch Pedal Sticks Down	Binding clutch cable	See CLUTCH article
	Springs weak in pressure plate	Replace pressure plate
	Binding in clutch linkage	Lubricate and free linkage
Noisy	Dry release bearing	Lubricate or replace release bearing
	Dry or worn pilot bearing	Lubricate or replace bearing
	Worn input shaft bearing	Replace bearing
Transmission Click	Weak springs in pressure plate	Replace pressure plate
	Release fork loose on ball stud	Replace release fork and/or ball stud
	Oil on clutch disc damper	Replace clutch disc
	Broken spring in slave cylinder	Replace slave cylinder

DRIVE AXLE - NOISE DIAGNOSIS

Unrelated Noises

Some driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. Ensure cause of trouble actually is in the drive axle before adjusting, repairing, or replacing any of its parts.

Non-Drive Axle Noises

A few conditions can sound just like drive axle noise and have to be considered in pre-diagnosis. The 4 most common noises are exhaust, tires, CV/universal joints and wheel trim rings.

In certain conditions, the pitch of the exhaust gases may sound like gear whine. At other times, it may be mistaken for a wheel bearing rumble.

Tires, especially radial and snow, can have a high-pitched tread whine or roar, similar to gear noise. Also, some non-standard tires with an unusual tread construction may emit a roar or whine.

Defective CV/universal joints may cause clicking noises or excessive driveline play that can be improperly diagnosed as drive axle problems.

Trim and moldings also can cause a whistling or whining noise. Ensure none of these components are causing the noise before disassembling the drive axle.

Gear Noise

A "howling" or "whining" noise from the ring and pinion gear can be caused by an improper gear pattern, gear damage, or improper bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.

Before disassembling axle to diagnose and correct gear noise, make sure that tires, exhaust, and vehicle trim have been checked as possible causes.

Chuckle

This is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 40 MPH and usually can be heard until vehicle comes to a complete stop. The frequency varies with the speed of the vehicle.

A chuckle that occurs on the driving phase is usually caused by excessive clearance due to differential gear wear, or by a damaged tooth on the coast side of the pinion or ring gear. Even a very small tooth nick or a ridge on the edge of a gear tooth is enough the cause the noise.

This condition can be corrected simply by cleaning the gear tooth nick or ridge with a small grinding wheel. If either gear is damaged or scored badly, the gear set must be replaced. If metal has broken loose, the carrier and housing must be cleaned to remove particles that could cause damage.

Knock

This is very similar to a chuckle, though it may be louder, and occur on acceleration or deceleration. Knock can be caused by a gear tooth that is damaged on the drive side of the ring and pinion gears. Ring gear bolts that are hitting the carrier casting can cause knock. Knock can also be due to excessive end play in the axle shafts.

Clunk

Clunk is a metallic noise heard when an automatic transmission is engaged in Reverse or Drive, or when throttle is applied or released. It is caused by backlash somewhere in the driveline, but not necessarily in the axle. To determine whether driveline clunk is caused by the axle, check the total axle backlash as follows:

1) Raise vehicle on a frame or twinpost hoist so that drive wheels are free. Clamp a bar between axle companion flange and a part of the frame or body so that flange cannot move.

2) On conventional drive axles, lock the left wheel to keep it from turning. On all models, turn the right wheel slowly until it is felt to be in Drive condition. Hold a chalk marker on side of tire about 12" from center of wheel. Turn wheel in the opposite direction until it is again felt to be in Drive condition.

3) Measure the length of the chalk mark, which is the total

axle backlash. If backlash is one inch or less, drive axle is not the source of clunk noise.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by malfunctioning pinion bearings. Pinion bearings operate at drive shaft speed. Roller wheel bearings may whine in a similar manner if they run completely dry of lubricant. Bearing noise will occur at all driving speeds. This distinguishes it from gear whine, which usually comes and goes as speed changes.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. It is usually caused by a malfunctioning wheel bearing. The lower pitch is because the wheel bearing turns at only about 1/3 of drive shaft speed.

Chatter On Turns

This is a condition where the entire front or rear of vehicle vibrates when vehicle is moving. The vibration is plainly felt as well as heard. Extra differential thrust washers installed during axle repair can cause a condition of partial lock-up that creates this chatter.

Axle Shaft Noise

Axle shaft noise is similar to gear noise and pinion bearing whine. Axle shaft bearing noise will normally distinguish itself from gear noise by occurring in all driving modes (Drive, cruise, coast and float), and will persist with transmission in Neutral while vehicle is moving at problem speed.

If vehicle displays this noise condition, remove suspect axle shafts, replace wheel seals and install a new set of bearings. Re-evaluate vehicle for noise before removing any internal components.

Vibration

Vibration is a high-frequency trembling, shaking or grinding condition (felt or heard) that may be constant or variable in level and can occur during the total operating speed range of the vehicle.

The types of vibrations that can be felt in the vehicle can be divided into 3 main groups:

* Vibrations of various unbalanced rotating parts of the vehicle.
* Resonance vibrations of the body and frame structures caused by rotating of unbalanced parts.
* Tip-in moans of resonance vibrations from stressed engine or exhaust system mounts or driveline flexing modes.

DRIVE AXLE - RWD TROUBLE SHOOTING

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DRIVE AXLE (RWD) TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION

Knocking or Clunking		
	Differential Side Gear Clearance	Check Clearance
	Worn Pinion Shaft	Replace Pinion Shaft
	Axle Shaft End Play	Check End Play
	Missing Gear Teeth	Check Differential/ Replace Gear
	Wrong Axle Backlash	Check Backlash
	Misaligned Driveline	Realign Driveline
Clinking During Engagement		
	Side Gear Clearance	Check Clearance
	Ring and Pinion Backlash	Check Backlash
	Worn/Loose Pinion Shaft	Replace Shaft/Bearing
	Bad "U" Joint	Replace "U" Joint
	Sticking Slip Yoke	Lube Slip Yoke
	Broken Rear Axle Mount	Replace Mount
	Loose Drive Shaft Flange	Check Flange
Click/Chatter On Turns		
	Differential Side Gear Clearance	Check Clearance
	Wrong Turn On Plates (1)	Replace Clutch Plates
	Wrong Differential Lubricant (1)	Change Lubricant
Knock Or Click	Flat Spot on Rear Wheel Bearing	Replace Wheel Bearing
Low Vibration At All Speeds		
	Faulty Wheel Bearing	Replace Wheel Bearing
	Faulty "U" Joint	Replace "U" Joint
	Faulty Drive Shaft	Balance Drive Shaft
	Faulty Companion Flange	Replace Flange
	Faulty Slip Yoke Flange	Replace Flange

(1) - Limited slip differential only.

FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING

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BASIC FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Grease Leaks	CV boot torn or cracked
Clicking Noise on Cornering	Damaged outer CV
Clunk Noise on Acceleration	Damaged inner CV
Vibration or Shudder on Acceleration	Sticking, damaged or worn CV Misalignment or spring height

STEERING & SUSPENSION

MANUAL STEERING GEAR TROUBLE SHOOTING

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BASIC MANUAL STEERING GEAR TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise in Rack and Pinion	Rack and pinion mounting bracket loose	Tighten all mounting bolts
	Lack of/or incorrect lubricant	Correct as necessary
	Steering gear mounting bolts loose	Tighten all mounting bolts
Excessive Play	Front wheel bearing improperly adjusted	See FRONT SUSPENSION article
	Loose or worn steering linkage	See STEERING LINKAGE article
	Loose or worn steering gear shift	See MANUAL STEERING GEAR article
	Steering arm loose on gear shaft	See MANUAL STEERING GEAR article
	Steering gear housing bolts loose	Tighten all mounting bolts
	Steering gear adjustment too loose	See MANUAL STEERING GEAR article
	Steering arms loose on	Tighten and check

	knuckles	steering linkage
	Rack and pinion mounting loose	Tighten all mounting bolts
	Rack and pinion out of adjustment	See adjustment in STEERING article
	Tie rod end loose	Tighten and check steering linkage
	Excessive Pitman shaft-to-ball nut lash	Repair as necessary
Poor Returnability	Lack of lubricant in ball joint or linkage	Lubricate and service systems
	Binding in linkage or ball joints	See STEERING LINKAGE and SUSPENSION article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Improper tire pressure	Inflate to proper pressure
	Tie rod binding	Inflate to proper pressure
	Shaft seal rubbing shaft	See STEERING COLUMN article
Excessive Vertical Motion	Improper tire pressure	Inflate to proper pressure
	Tires, wheels or rotors out of balance	Balance tires then check wheels and rotors
	Worn or faulty shock absorbers	Check and replace if necessary
	Loose tie rod ends or steering	Tighten or replace if necessary
	Loose or worn wheel bearings	See SUSPENSION article
Steering Pulls to One Side	Improper tire pressure	Inflate to proper pressure
	Front tires are different sizes	Rotate or replace if necessary
	Wheel bearings not adjusted properly	See FRONT SUSPENSION article
	Bent or broken suspension components	See FRONT SUSPENSION article
	Improper wheel alignment	See WHEEL ALIGNMENT article

	Brakes dragging	See BRAKES article
Instability	Low or uneven tire pressure	Inflate to proper pressure
	Loose or worn wheel bearings	See FRONT SUSPENSION article
	Loose or worn idler arm bushing	See FRONT SUSPENSION article
	Loose or worn strut bushings	See FRONT SUSPENSION article
	Incorrect front wheel alignment	See WHEEL ALIGNMENT article
	Steering gear not centered	See MANUAL STEERING GEARS article
	Springs or shock	Check and replace if necessary
	Improper cross shaft	See MANUAL STEERING GEARS article

POWER STEERING TROUBLE SHOOTING

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BASIC POWER STEERING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise	Pressure hoses touching engine parts	Adjust to proper clearance
	Loose Pitman shaft	Adjust or replace if necessary
	Tie rods ends or Pitman arm loose	Tighten and check system
	Rack and pinion mounts loose	Tighten all mounting bolts
	Free play in worm and	See POWER STEERING GEAR article
	Loose sector shaft or thrust bearing adjustment	See POWER STEERING GEAR
	Free play in pot coupling	See STEERING COLUMN article

	Worn shaft serrations	See STEERING COLUMN article
Growl in Steering Pump	Excessive pressure in hoses	Restricted hoses, see POWER STEERING GEAR article
	Scored pressure plates	See POWER STEERING GEAR article
	Scored thrust plates or rotor	See POWER STEERING GEAR article
	Extreme wear of cam ring	See POWER STEERING GEAR article
Rattle in Steering Pump	Vanes not installed	See POWER STEERING PUMP article
	Vanes sticking in rotor	See POWER STEERING PUMP article
Swish noise in Pump	Defective flow control valve	See POWER STEERING PUMP article
Groan in Steering Pump	Air in fluid	See POWER STEERING PUMP article
	Poor pressure hose connection	Tighten and check, replace if necessary
Squawk When Turning	Damper "O" ring on valve spool cut	See POWER STEERING PUMP article
Moan or Whine in Pump	Pump shaft bearing scored	Replace bearing and fluid
	Air in fluid or fluid level low	See POWER STEERING PUMP article
	Hose or column grounded	Check and replace if necessary
	Cover "O" ring missing or damaged	See POWER STEERING PUMP article
	Valve cover baffle missing or damaged	See POWER STEERING PUMP article
	Interference of components in pump	See POWER STEERING PUMP article
	Loose or poor bracket alignment	Correct or replace if necessary
Hissing When Parking	Internal leakage in steering gear	Check valved assembly first
Chirp in Steering Pump	Loose or worn power steering belt	Adjust or replace if necessary
Buzzing When Not Steering	Noisy pump	See POWER STEERING PUMP article

	Free play in steering shaft bearing	See STEERING COLUMN article
	Bearing loose on shaft serrations	See STEERING COLUMN article
Clicking Noise in Pump	Pump slippers too long	See POWER STEERING PUMP article
	Broken slipper springs	See POWER STEERING PUMP article
	Excessive wear or nicked rotors	See POWER STEERING PUMP article
	Damaged cam contour	See POWER STEERING PUMP article
Poor Return of Wheel	Wheel rubbing against turn signal	See STEERING COLUMN SWITCHES article
	Flange rubbing steering gear adjuster	See STEERING COLUMN article
	Tight or frozen steering shaft bearing	See STEERING COLUMN article
	Steering gear out of adjustment	See POWER STEERING GEAR article
	Sticking or plugged spool valve	See POWER STEERING PUMP article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Wheel bearings worn or loose	See FRONT SUSPENSION article
	Ties rods or ball joints binding	Check and replace if necessary
	Intermediate shaft joints binding	See STEERING COLUMN article
	Kinked pressure hoses	Correct or replace if necessary
	Loose housing head spanner nut	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Sector shaft adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Worm thrust bearing adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Reaction ring sticking in cylinder	See POWER STEERING GEAR article

	Reaction ring sticking in housing head	See POWER STEERING GEAR article
	Steering pump internal leakage	See POWER STEERING PUMP article
	Steering gear-to-column misalignment	See STEERING COLUMN article
	Lack of lubrication in linkage	Service front suspension
	Lack of lubrication in ball joints	Service front suspension
Increased Effort When Turning Wheel Fast Foaming, Milky Power Steering Fluid, Low Fluid Level or Low Pressure	High internal pump leakage	See POWER STEERING PUMP article
	Power steering pump belt slipping	Adjust or replace if necessary
	Low fluid level	Check and fill to proper level
	Engine idle speed to low	Adjust to correct setting
	Air in pump fluid system	See POWER STEERING PUMP article
	Pump output low	See POWER STEERING PUMP article
	Steering gear malfunctioning	See POWER STEERING GEAR article
Wheel Surges or Jerks	Low fluid level	Check and fill to proper level
	Loose fan belt	Adjust or replace if necessary
	Insufficient pump pressure	See POWER STEERING PUMP article
	Sticky flow control valve	See POWER STEERING PUMP article
	Linkage hitting oil pan at full turn	Replace bent components
Kick Back or Free Play	Air in pump fluid system	See POWER STEERING PUMP article
	Worn poppet valve in steering gear	See POWER STEERING PUMP article
	Excessive over center lash	See POWER STEERING GEAR article
	Thrust bearing out of adjustment	See POWER STEERING GEAR article

	Free play in pot coupling	See POWER STEERING PUMP article
	Steering gear coupling loose on shaft	See POWER STEERING PUMP article
	Steering disc mounting bolts loose	Tighten or replace if necessary
	Coupling loose on worm shaft	Tighten or replace if necessary
	Improper sector shaft adjustment	See POWER STEERING GEAR article
	Excessive worm piston side play	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Universal joint loose	Tighten or replace if necessary
	Defective rotary valve	See POWER STEERING GEAR article
No Power When Parking	Sticking flow control valve	See POWER STEERING PUMP article
	Insufficient pump pressure output	See POWER STEERING PUMP article
	Excessive internal pump leakage	See POWER STEERING PUMP article
	Excessive internal gear leakage	See POWER STEERING PUMP article
	Flange rubs against gear adjust plug	See STEERING COLUMN article
	Loose pump belt	Adjust or replace if necessary
	Low fluid level	Check and add proper amount of fluid
	Engine idle too low	Adjust to correct setting
	Steering gear-to-column misaligned	See STEERING COLUMN article
No Power, Left Turn	Left turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Left turn reaction seal damaged/missing	See POWER STEERING GEAR article
	Cylinder head "O" ring damaged	See POWER STEERING PUMP article

No Power, Right Turns	Column pot coupling bottomed	See STEERING COLUMN article
	Right turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Right turn reaction seal damaged	See POWER STEERING GEAR article
	Internal leakage through piston end plug	See POWER STEERING GEAR article
	Internal leakage through side plugs	See POWER STEERING GEAR article
Lack of Effort in Turning	Left and/or right reaction seal sticking in cylinder head	Replace, see POWER STEERING GEAR article
Wanders to One Side	Front end alignment incorrect	See WHEEL ALIGNMENT article
	Unbalanced steering gear valve	See POWER STEERING GEAR article
Low Pressure Due to Steering Pump	Flow control valve stuck or inoperative	See POWER STEERING PUMP article
	Pressure plate not flat against cam ring	See POWER STEERING PUMP article
	Extreme wear of cam ring	Replace and check adjustments
	Scored plate, thrust plate or rotor	See POWER STEERING PUMP article
	Vanes not installed properly	See POWER STEERING PUMP article
	Vanes sticking in rotor slots	See POWER STEERING PUMP article
	Cracked/broken thrust or pressure plate	See POWER STEERING PUMP article

STEERING COLUMN TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC STEERING COLUMN TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Noise in Steering	Coupling pulled apart	See STEERING COLUMNS article

	Column not correctly aligned	See STEERING COLUMNS article
	Broken lower joint	Replace joint
	Horn contact ring not	See STEERING COLUMN article
	Bearing not lubricated	See STEERING COLUMN article
	Shaft snap ring not properly seated	Reseat or replace snap ring
	Plastic spherical joint not lubricated	See STEERING COLUMN article
	Shroud or housing loose	Tighten holding screws
	Lock plate retaining ring not seated	See STEERING COLUMN article
	Loose sight shield	Tighten holding screws
High Steering Shaft Effort	Column assembly misaligned	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Tight steering universal joint	See STEERING COLUMN article
High Shift Effort	Column is out of alignment	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Seals or bearings not lubricated	See STEERING COLUMNS article
	Mounting bracket screws too long	Replace with new shorter screws
	Burrs on shift tube	Remove burrs or replace tube
	Lower bowl bearing assembled wrong	See STEERING COLUMN article
	Shift tube bent or broken	Replace as necessary
	Improper adjustment of shift levers	See STEERING COLUMN article
Improper Trans. Shifting	Sheared shift tube joint	Replace as necessary
	Sheared lower shaft lever	Replace as necessary
	Improper shift lever adjustment	See STEERING COLUMN article

	Improper gate plate adjustment	See STEERING COLUMN article
Excess Play in Column	Instrument panel bracket bolts loose	Tighten bolts and check bracket
	Broken weld nut on jacket	See STEERING COLUMN article
	Instrument bracket capsule sheared	See STEERING COLUMN article
	Column bracket/jacket bolts loose	Tighten bolts and check bracket
Steering Locks in Gear	Release lever mechanism	See STEERING COLUMN article

SUSPENSION TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC SUSPENSION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Front End Noise	Loose or worn wheel	See Wheel Bearing Adjustment in SUSPENSION
	Worn shocks or shock mountings	Replace struts or strut mountings
	Worn struts or strut mountings	Replace struts or strut mountings
	Loose or worn lower control arm	See SUSPENSION
	Loose steering gear-to-frame bolts	See STEERING
	Worn control arm bushings	See SUSPENSION
	Ball joints not lubricated	Lubricate ball joints & see Ball Joint Checking in SUSPENSION
Front Wheel Shake, Shimmy, or Vibration	Tires or wheels out of balance	Check tire balance
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Drive shaft unbalanced	Check drive shaft balance

	Loose or worn wheel bearings	See WHEEL ALIGNMENT
	Loose or worn tie rod ends	See SUSPENSION
	Worn upper ball joints	See Ball Joint Checking in SUSPENSION
	Worn shock absorbers	Replace shock absorbers
	Worn strut bushings	Replace strut bushings
Car Pulls to One Side	Mismatched or uneven tires	Check tire condition
	Broken or sagging springs	See SUSPENSION
	Loose or worn strut bushings	See SUSPENSION
	Improper wheel alignment	See WHEEL ALIGNMENT
	Improper rear axle alignment	Check rear axle alignment
	Power steering gear unbalanced	See STEERING
	Front brakes dragging	See BRAKES
Abnormal Tire Wear	Unbalanced tires	Check tire balance & rotation
	Sagging or broken springs	See SUSPENSION
	Incorrect front end alignment	See WHEEL ALIGNMENT
	Faulty shock absorbers	Replace chock absorbers
Scuffed Tires	Toe-In incorrect	See WHEEL ALIGNMENT
	Suspension arm bent or twisted	See appropriate SUSPENSION article
Springs Bottom or Sag	Bent or broken springs	See SUSPENSION
	Leaking or worn shock absorbers	Replace shock absorbers
	Frame misalignment	Check frame for damage
Spring Noises	Loose "U" Bolts	See SUSPENSION
	Loose or worn bushings	See SUSPENSION
	Worn or missing interliners	See SUSPENSION
Shock Absorber Noise	Loose shock mountings	Check & tighten mountings
	Worn bushings	Replace bushings

	Air in system	Bleed air from system
	Undercoating on shocks	Remove undercoating
Car Leans or Sways on Corners	Loose stabilizer bar	See SUSPENSION
	Faulty shocks or mountings	Replace shocks or mountings
	Broken or sagging springs	See SUSPENSION
Shock Absorbers Leaking	Worn seals or reservoir tube crimped	See SUSPENSION
Broken Springs	Loose "U" bolts	See SUSPENSION
	Inoperative shock absorbers	Replace shock absorbers

WHEEL ALIGNMENT TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC WHEEL ALIGNMENT TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Premature Tire Wear	Improper tire inflation	Check tire pressure
	Front alignment out of tolerance	See ALIGNMENT SPECS in WHEEL ALIGNMENT section
	Suspension components worn	See SUSPENSION section
	Steering system components worn	See STEERING section
	Improper standing height	See WHEEL ALIGNMENT
	Uneven or sagging springs	See SUSPENSION section
	Bent wheel	See WHEEL ALIGNMENT
	Improper torsion bar adjustment	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARING ADJ. in SUSPENSION section
	Worn or defective shock	Replace shock absorbers
	Tires out of balance	Check tire balance
Pulls to One Side	Improper tire inflation	Check tire pressure
	Brake dragging	See BRAKE section

	Mismatched tires	See WHEEL ALIGNMENT
	Broken or sagging spring	See SUSPENSION section
	Broken torsion bar	See SUSPENSION section
	Power steering valve not centered	See STEERING section
	Front alignment out of tolerance	See WHEEL ALIGNMENT section
	Defective wheel bearing	See WHEEL BEARINGS in SUSPENSION section
	Uneven sway bar links	See SUSPENSION section
	Frame bent	Check for frame damage
	Steering system bushing worn	See STEERING section
Hard Steering	Idler arm bushing too tight	See STEERING LINKAGE in STEERING section
	Ball joint tight or seized	See SUSPENSION section
	Steering linkage too tight	See STEERING LINKAGE in STEERING section
	Power steering fluid low	Add proper amount of fluid
	Power steering drive belt loose	See STEERING section
	Power steering pump defective	See STEERING section
	Steering gear out of adjustment	See STEERING section
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Damaged steering gear	See STEERING section
	Damaged suspension	See SUSPENSION section
	Bent steering knuckle or supports	See SUSPENSION section
Vehicle "Wanders"	Strut rod or control arm bushing worn	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARINGS in SUSPENSION section
	Improper tire inflation	Check tire pressure
	Stabilizer bar missing or defective	See SUSPENSION section

	Wheel alignment out of tolerance	See Adjustment in WHEEL ALIGNMENT section
	Broken spring	See SUSPENSION section
	Defective shock absorbers	Replace shock absorbers
	Worn steering & suspension components	See SUSPENSION section
Front End Shimmy	Tire out of balance/round	Check tire balance
	Excessive wheel runout	See WHEEL ALIGNMENT
	Insufficient or improper caster	See WHEEL ALIGNMENT section
	Worn suspension or steering components	See SUSPENSION section
	Defective shock absorbers	Replace shock absorber
	Wheel bearings worn or loose	See WHEEL BEARING ADJ. in SUSPENSION section
	Power steering reaction Bracket loose	See STEERING section
	Steering gear box (rack) mounting loose	See STEERING section
	Steering gear adjustment loose	See STEERING section
	Worn spherical joints	See SUSPENSION section
Toe-In Not Adjustable	Lower control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
Camber Not Adjustable	Control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
	Hub & bearing not seated properly	See SUSPENSION section

1993 ENGINE PERFORMANCE
Vacuum Diagrams

Camry, Celica, Corolla, Land Cruiser, MR2, Paseo,
Pickup, Previa, Supra, Tercel, T100, 4Runner

INTRODUCTION

This article contains underhood views or schematics of vacuum hose routing. Use these vacuum diagrams during the visual inspection in the appropriate F - BASIC TESTING article. This will assist in identifying improperly routed vacuum hoses which cause driveability and/or computer-indicated malfunctions.

VACUUM DIAGRAMS

CAMRY

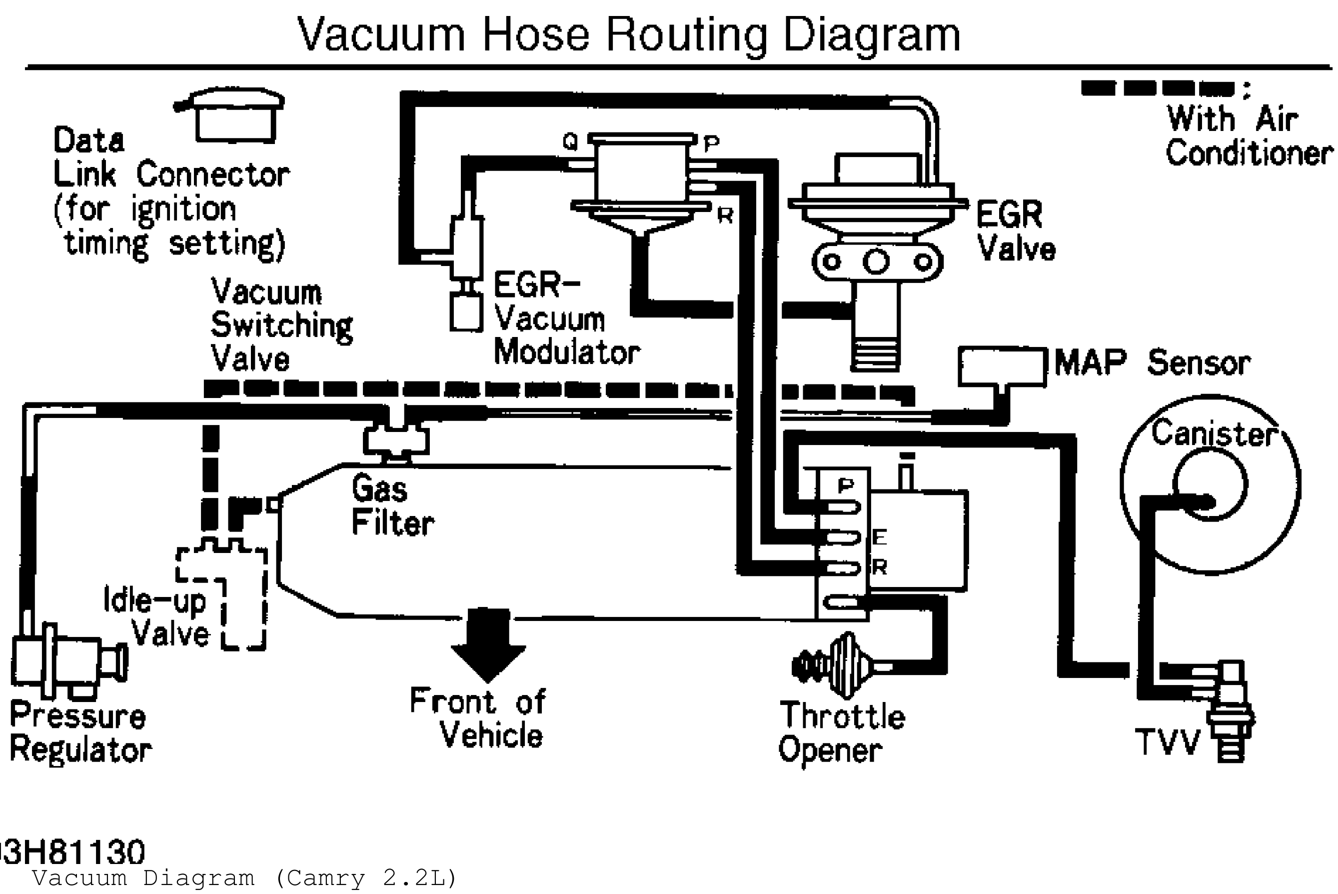
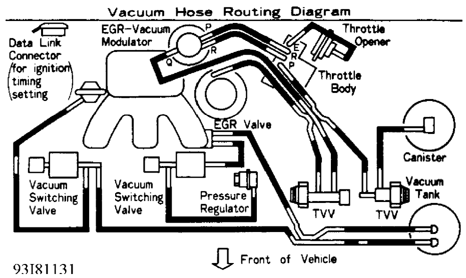
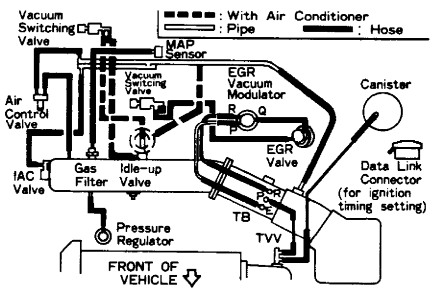


Fig. 1: Vacuum Diagram (Camry 2.2L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

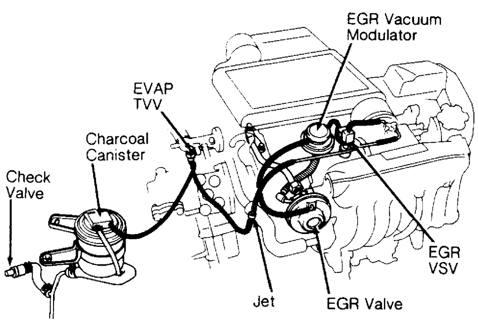


93I81131
Fig. 2: Vacuum Diagram (Camry 3.0L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

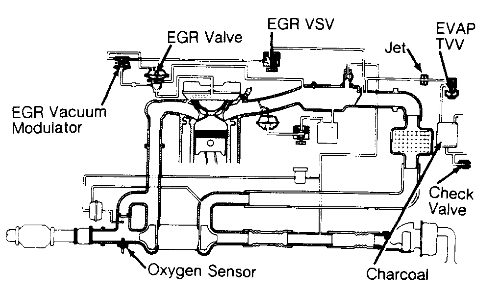
CELICA



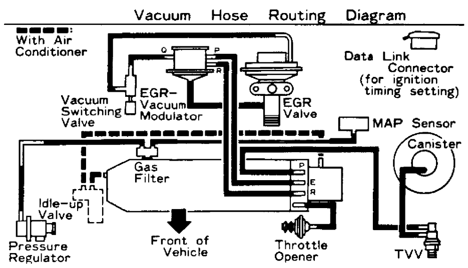
93J81132
Fig. 3: Vacuum Diagram (Celica 1.6L 4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93A81133
Fig. 4: Vacuum Diagram (Celica 2.0L Turbo 3S-GTE - Routing)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

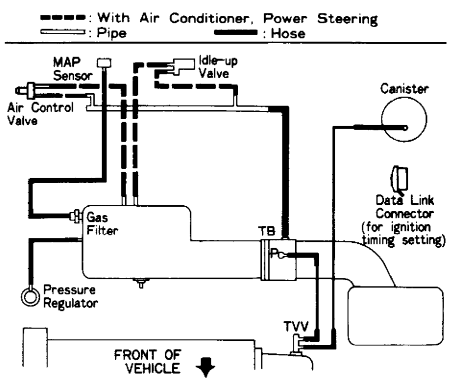


93B81134
Fig. 5: Vacuum Diagram (Celica 2.0L Turbo 3S-GTE - Schematic)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

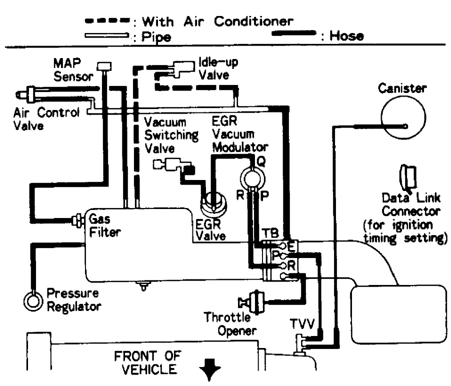


93C81135
Fig. 6: Vacuum Diagram (Celica 2.2L 5S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

COROLLA



93D81136
Fig. 7: Vacuum Diagram (Corolla - Federal Models)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93E81137
Fig. 8: Vacuum Diagram (Corolla - Calif. Models W/ Power Steering)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

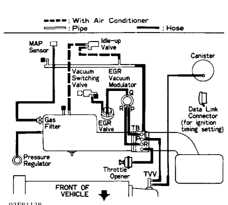
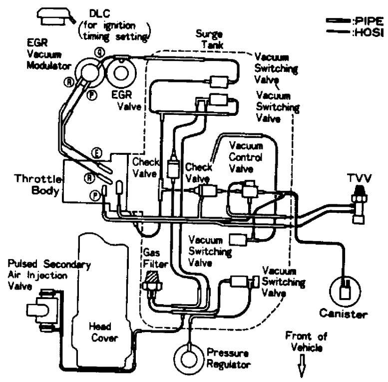


Fig. 9: Vacuum Diagram (Corolla - Calif. Models W/O Power Steering)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

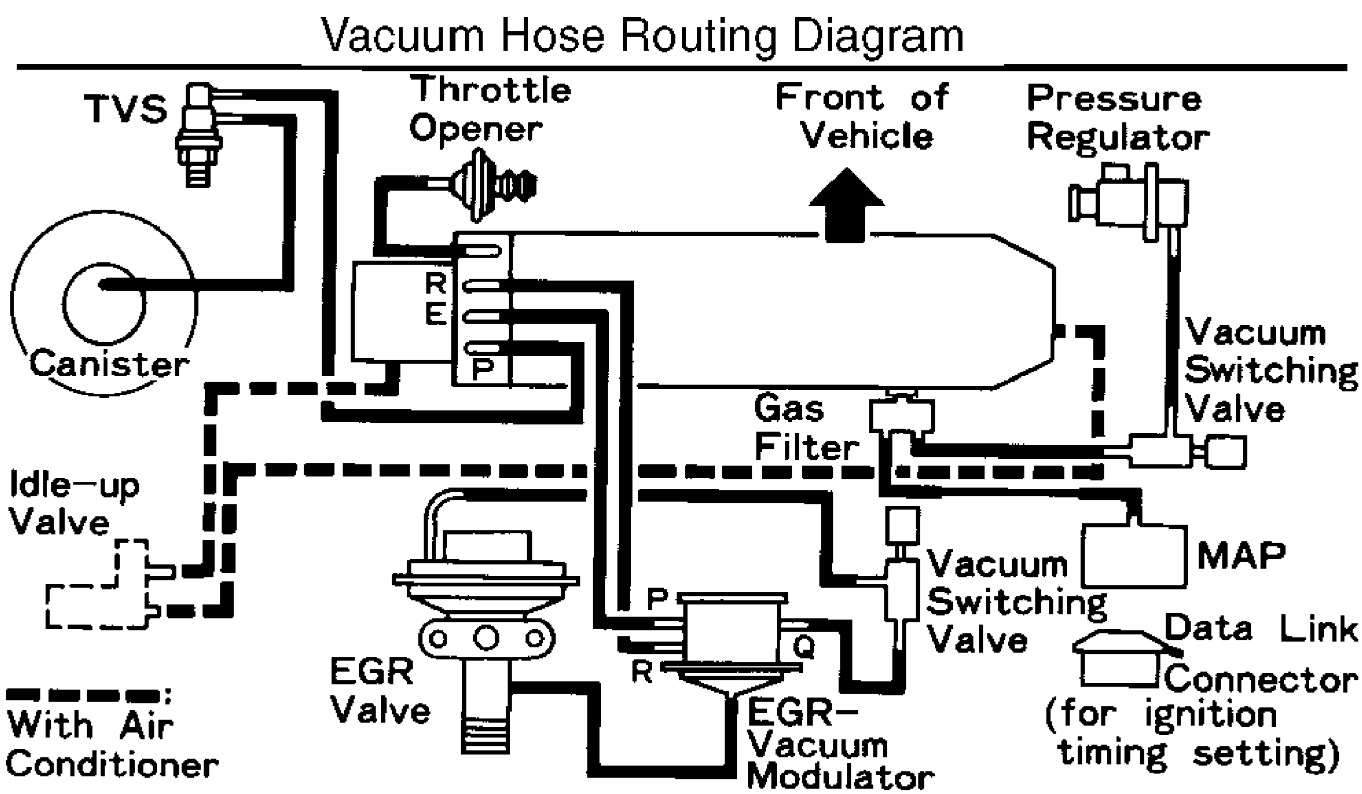
LAND CRUISER



93G81139

Fig. 10: Vacuum Diagram (Land Cruiser)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

MR2



93J81140

Fig. 11: Vacuum Diagram (MR2 Non-Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

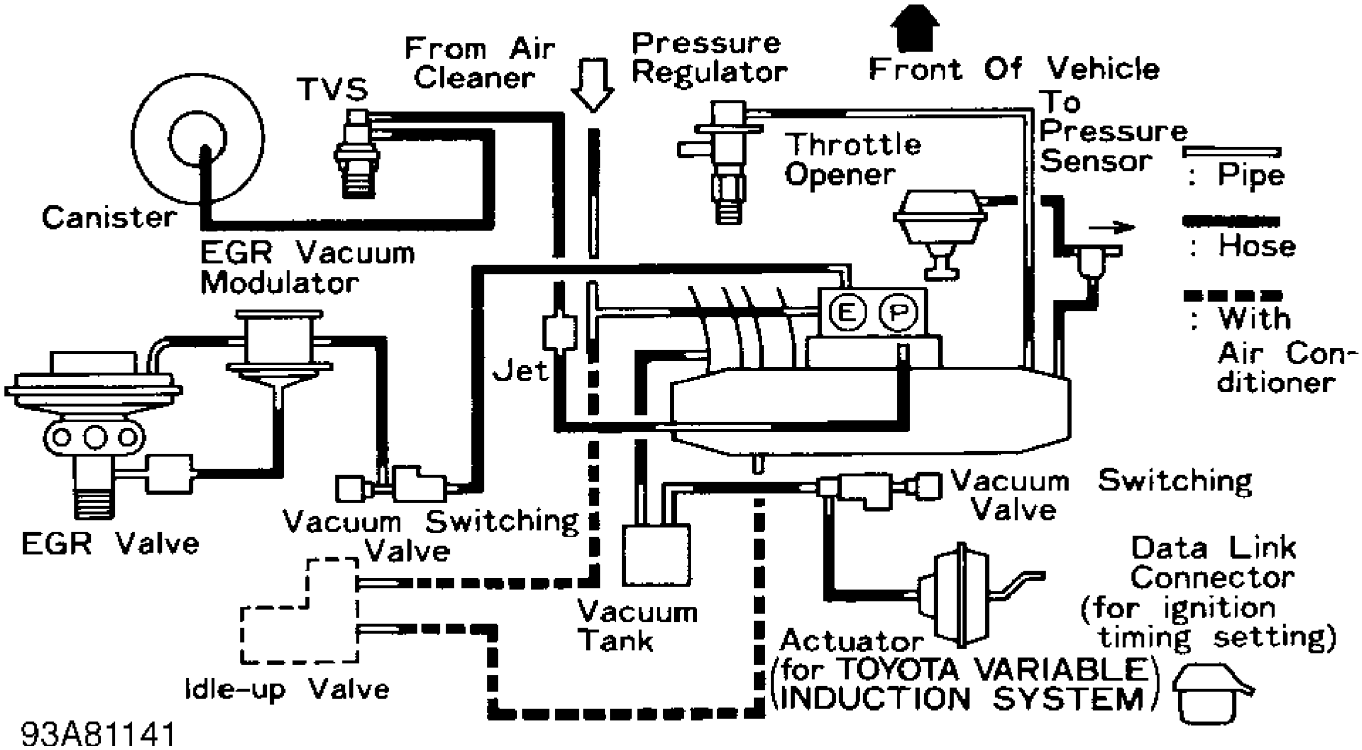


Fig. 12: Vacuum Diagram (MR2 Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PASEO

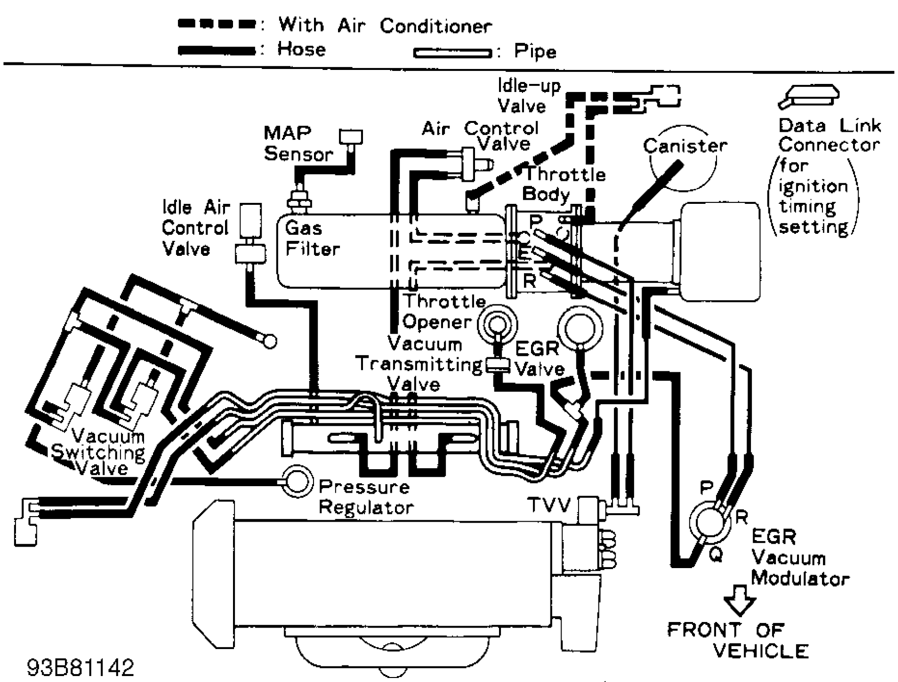
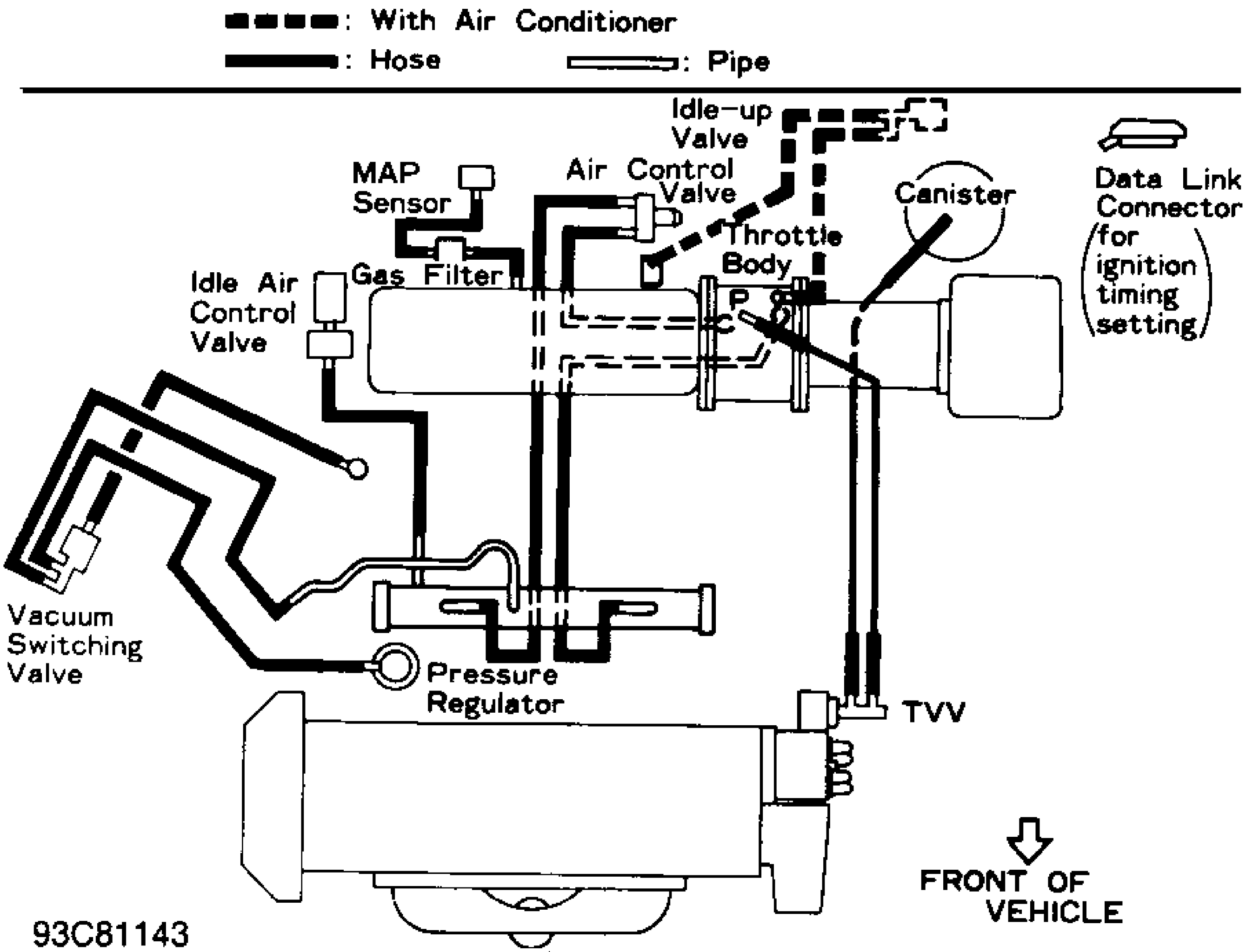
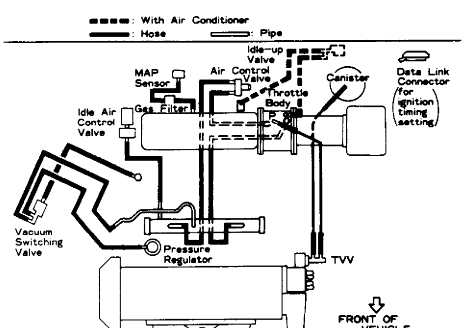


Fig. 13: Vacuum Diagram (Paseo - Federal A/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93C81143

Fig. 14: Vacuum Diagram (Paseo - Federal M/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93D81144

Fig. 15: Vacuum Diagram (Paseo - California Models)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PICKUP & 4RUNNER

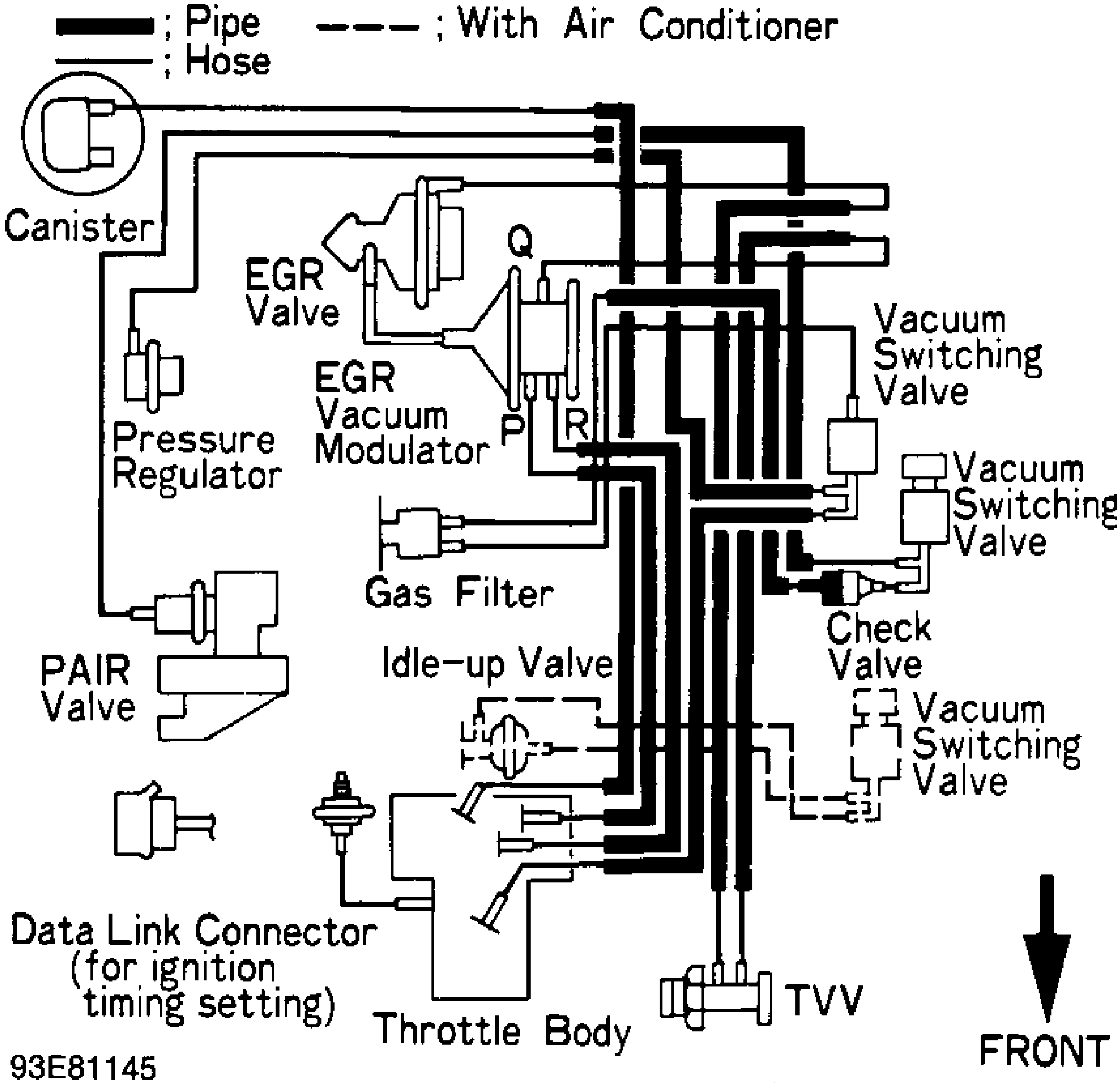


Fig. 16: Vacuum Diagram (Pickup 2.4L & 4Runner 2.4L - Federal A/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

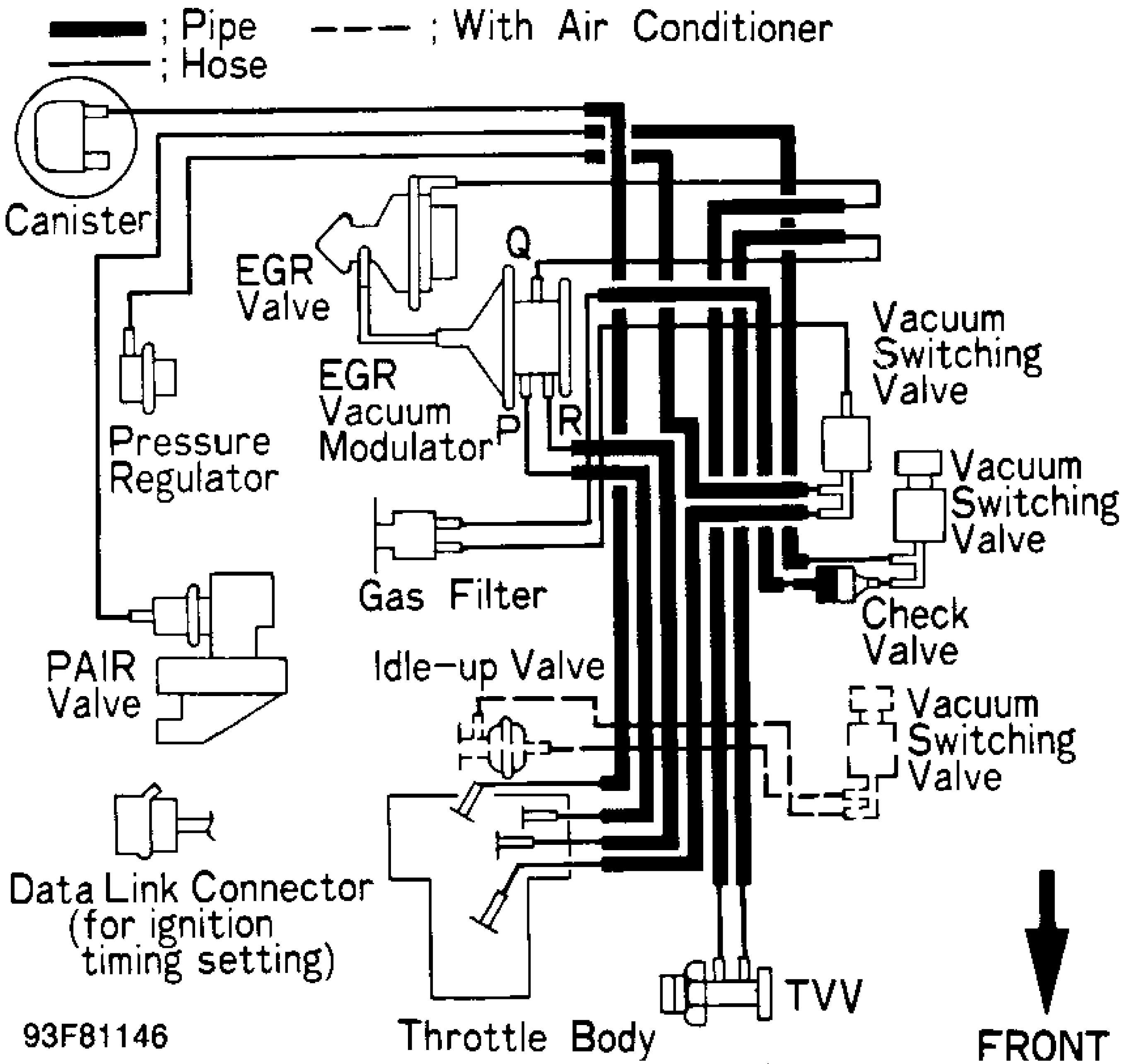


Fig. 17: Vacuum Diagram (Pickup 2.4L & 4Runner 2.4L - Federal M/T)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

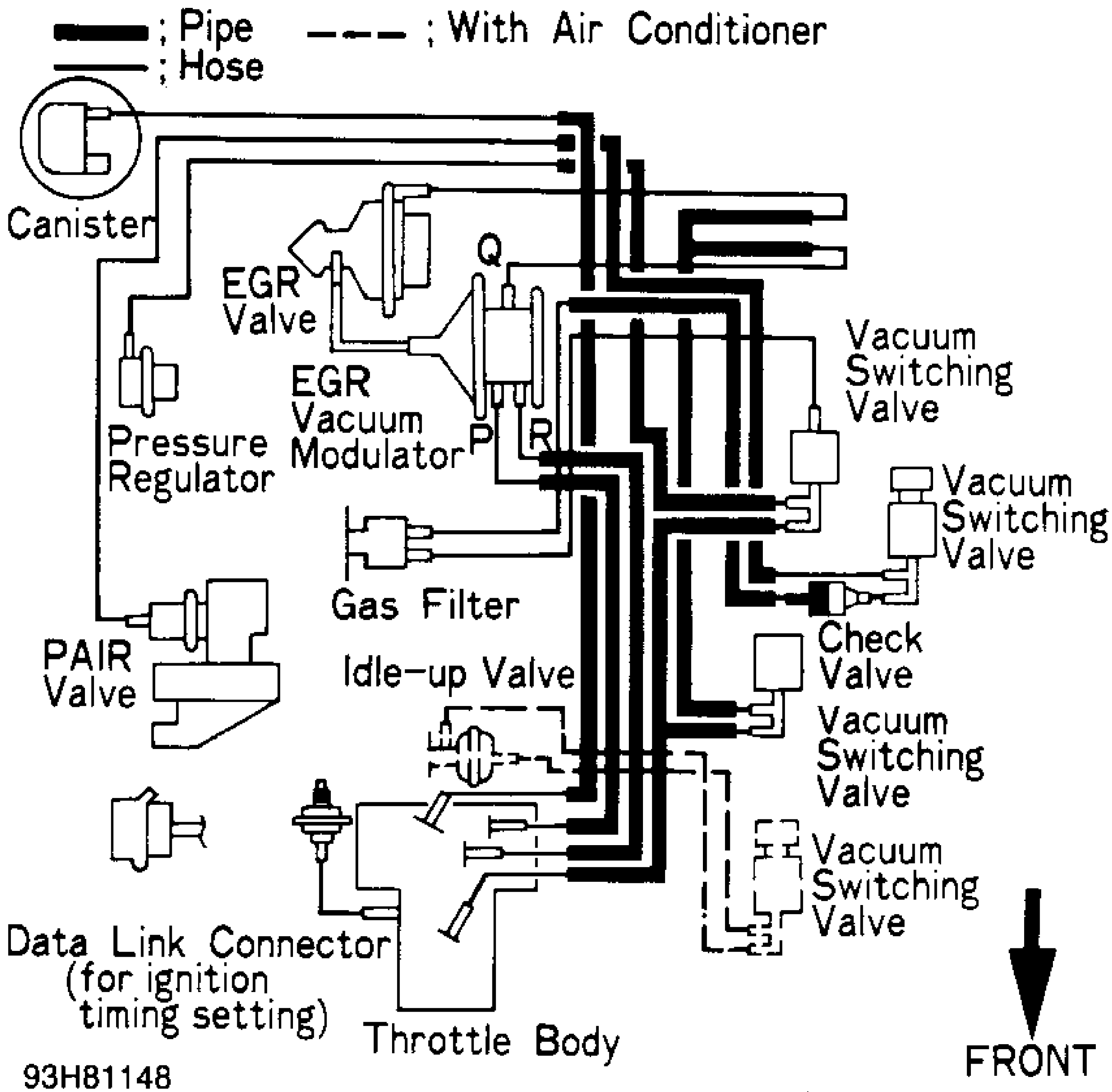


Fig. 18: Vacuum Diagram (Pickup 2.4L & 4Runner 2.4L - California A/T)

Courtesy of Toyota Motor Sales, U.S.A., Inc.

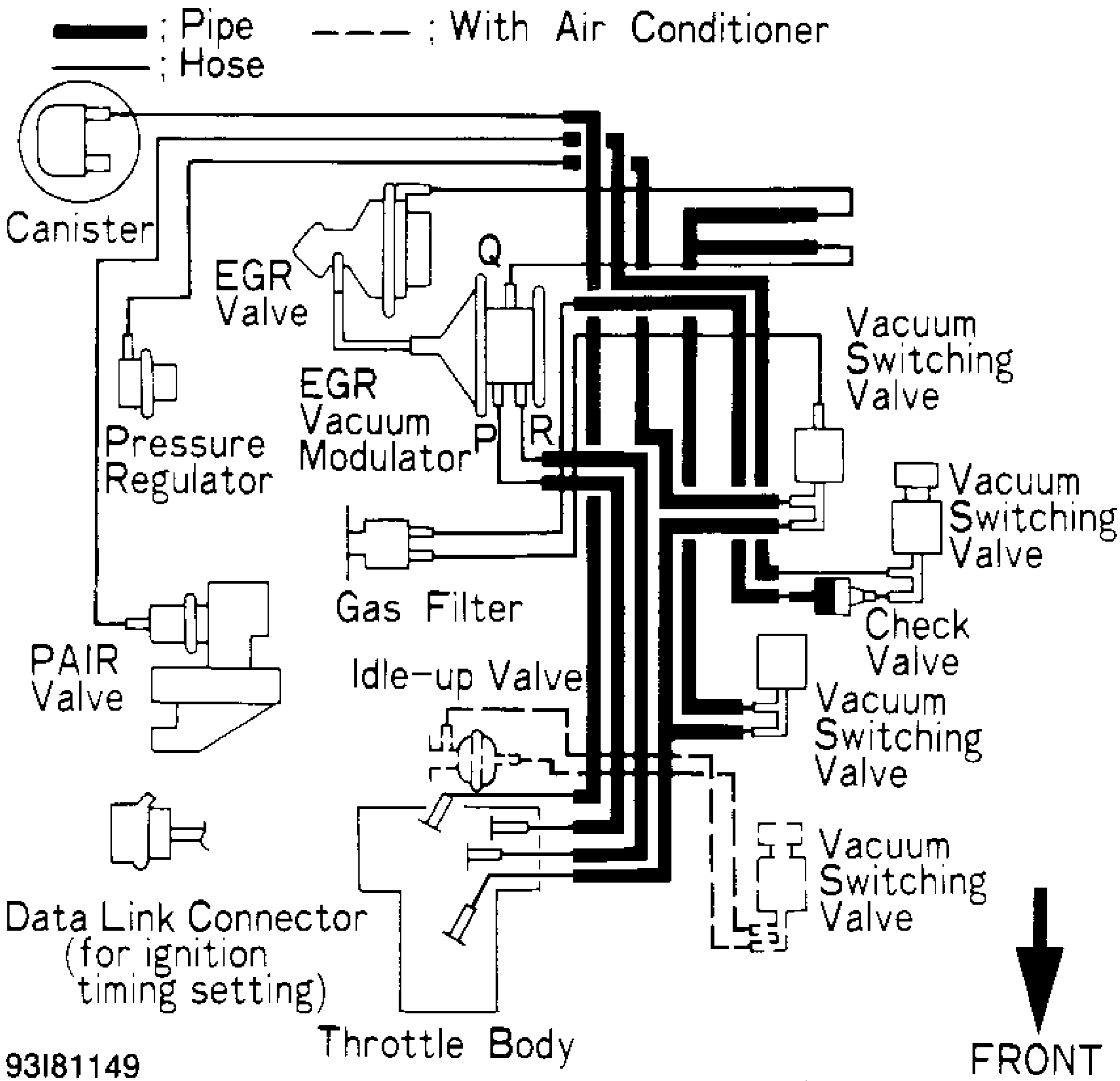


Fig. 19: Vacuum Diagram (Pickup 2.4L & 4Runner 2.4L - California M/T)

Courtesy of Toyota Motor Sales, U.S.A., Inc.

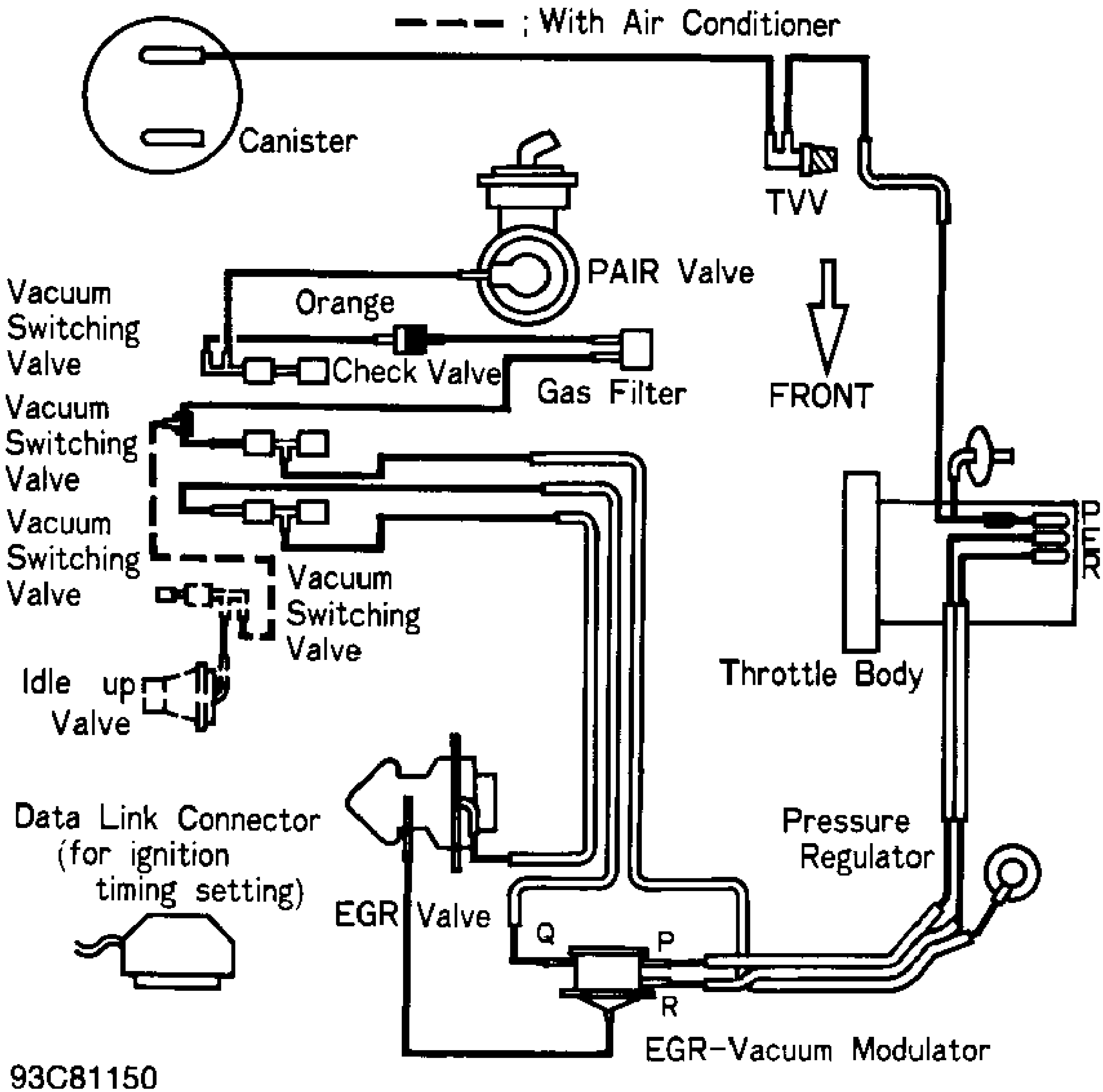


Fig. 20: Vacuum Diagram (Pickup 3.0L & 4Runner 3.0L)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

PREVIA

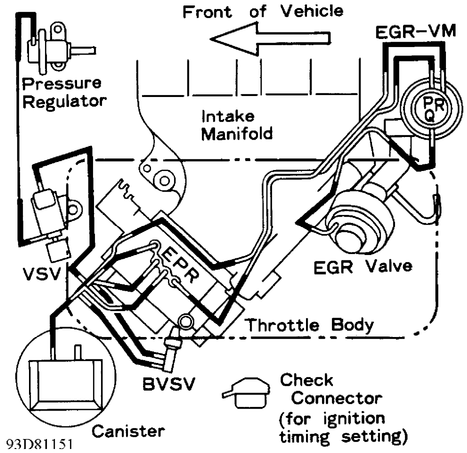


Fig. 21: Vacuum Diagram (Previa)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

SUPRA

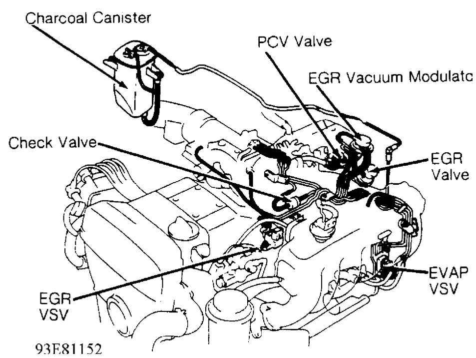


Fig. 22: Vacuum Diagram (Supra Non-Turbo - Routing)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

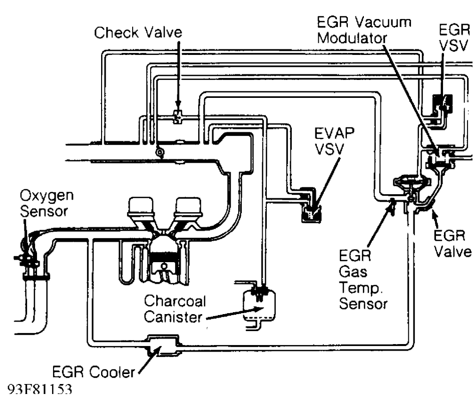


Fig. 23: Vacuum Diagram (Supra Non-Turbo - Schematic)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

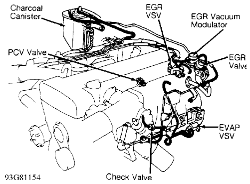


Fig. 24: Vacuum Diagram (Supra Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

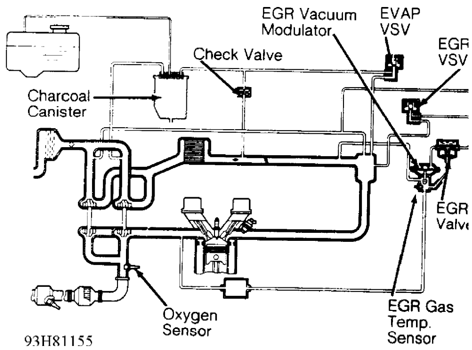


Fig. 25: Vacuum Diagram (Supra Turbo)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TERCEL

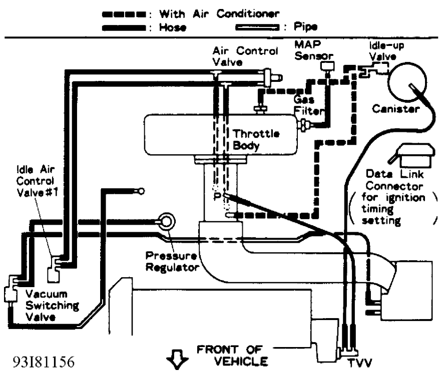


Fig. 26: Vacuum Diagram (Tercel - Federal Models W/ Power Steering)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

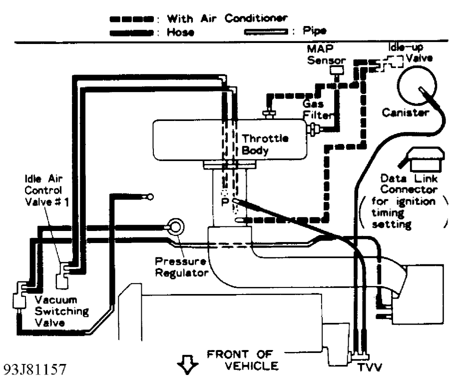


Fig. 27: Vacuum Diagram (Tercel - Federal Models W/O Power Steering)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

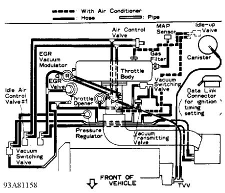


Fig. 28: Vacuum Diagram (Tercel - Calif. Models W/ Power Steering)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

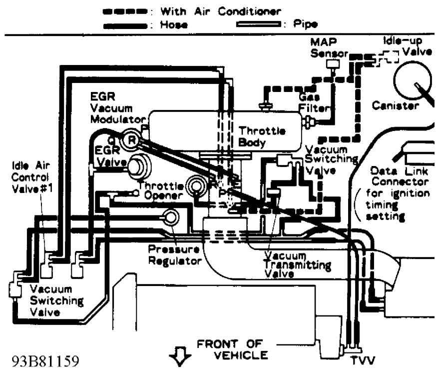


Fig. 29: Vacuum Diagram (Tercel - Calif. Models W/O Power Steering)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

T100

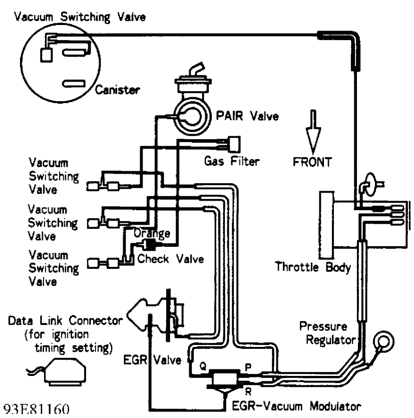


Fig. 30: Vacuum Diagram (T100)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

W - WAVEFORM (INJECTOR) - 1.6L 4A-FE MFI VIN [A]

1993 Toyota Celica

1987-1996 TOYOTA FUEL INJECTOR WAVEFORM
1.6L "4A-FE" DOHC 16-Valve In-Line 4 MFI VIN [A]

1988.5-1989
Toyota: Corolla

1990-1993
Toyota: Celica, Corolla

1994-1996
Toyota: Corolla

NOTES

NOTES

* For a tutorial on how to interpret injector waveforms, see WAVEFORMS - INJECTOR PATTERN TUTORIAL found in the GENERAL/GENERAL INFORMATION area.
* To see a list of the other year/make/models these waveform(s) apply to, go to the top of the article.

SOURCE OF WAVEFORM

The Source Vehicle Information Table describes the vehicle the waveform came from. It is not needed for interpretation and is included for reference only.

The waveform contains a note that links it to its related source table.

SOURCE VEHICLE INFORMATION TABLE

Application	Specification
Year	1990
Make	Toyota
Model	Corolla
Engine	1.6L DOHC 16-Valve In-Line 4 4A-FE VIN [A]
Ignition Type	Distributor w/Magnetic Pickup
Trans Type	Manual Transaxle
Mileage	14,916
VIN Code	- - - A E - - A - L - - - - - - -

VOLTAGE WAVEFORM

Quick Hyperlinks

* See Fig. 1 for the waveform.
* See the WAVEFORM DATA TABLE for supporting data.

Introduction

The Waveform Data Table is listed first. This table contains supporting information about the waveform illustration and should be used in conjunction with it.

The waveform illustration follows after the table.

NOTE: See the SOURCE VEHICLE INFORMATION TABLE in this article for a description of the vehicle the waveform came from.

WAVEFORM DATA TABLE

Application	Specification
Pattern Type	Voltage
Voltage Base	20 Volts
Time Base	2 Milliseconds
Oscilloscope Used	Tektronix 222A
Pattern Represents	Bank Of Injectors
Injector Driver Type	Voltage Controlled
Side of Circuit That Driver Switches	Ground
Injector On-Time Shown	2.2 mS
Conditions	Unknown
Cursors On-Screen	No
Cursors Are Measuring	N/A
Status	Known Good Pattern

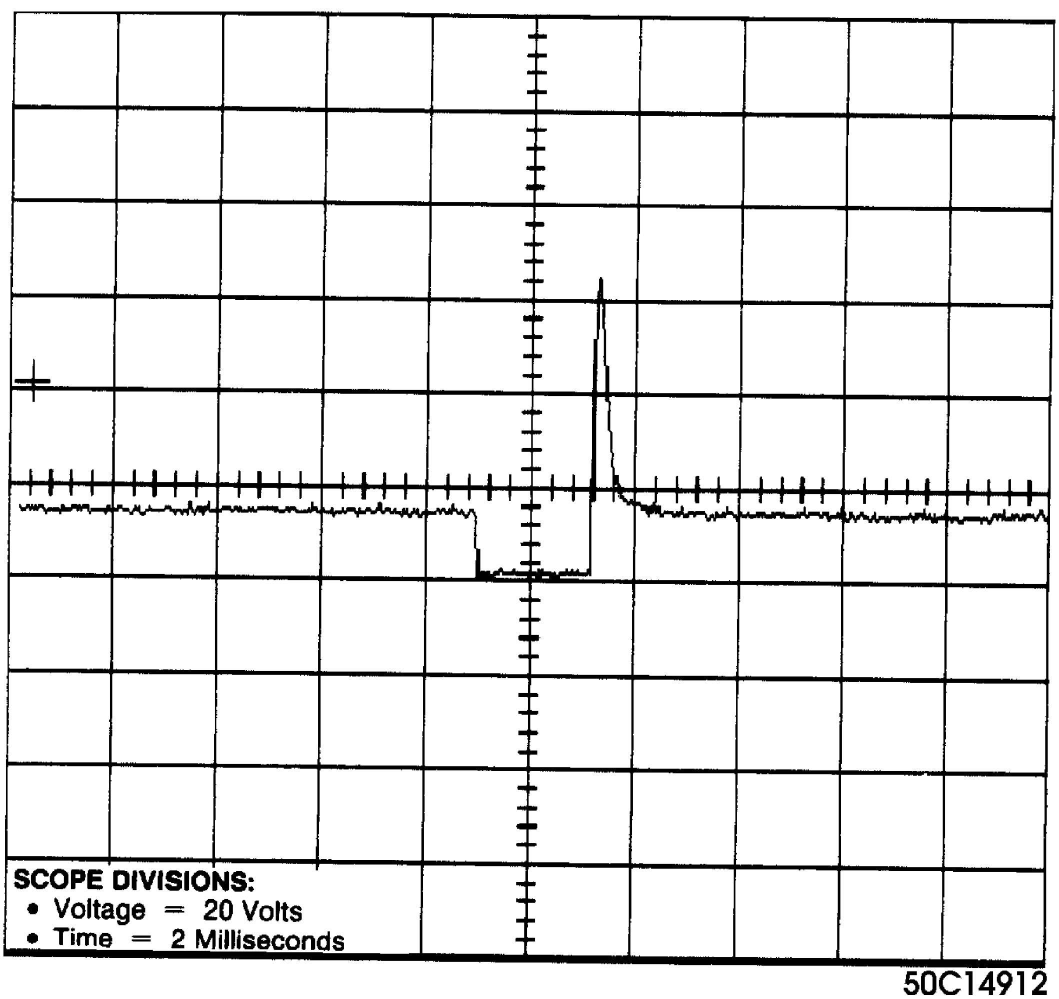


Fig. 1: Injector Waveform (Voltage) - Known Good

WAVEFORMS - INJECTOR PATTERN TUTORIAL

1993 Toyota Celica

GENERAL INFORMATION
Waveforms - Injector Pattern Tutorial

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PURPOSE OF THIS ARTICLE

Learning how to interpret injector drive patterns from a Lab Scope can be like learning ignition patterns all over again. This article exists to ease you into becoming a skilled injector pattern interpreter.

You will learn:

* How a DVOM and noid light fall short of a lab scope.
* The two types of injector driver circuits, voltage controlled & current controlled.
* The two ways injector circuits can be wired, constant ground/switched power & constant power/switched ground.
* The two different pattern types you can use to diagnose with, voltage & current.
* All the valuable details injector patterns can reveal.

SCOPE OF THIS ARTICLE

This is NOT a manufacturer specific article. All different types of systems are covered here, regardless of the specific year/make/model/engine.

The reason for such broad coverage is because there are only a few basic ways to operate a solenoid-type injector. By understanding the fundamental principles, you will understand all the major points of injector patterns you encounter. Of course there are minor differences in each specific system, but that is where a waveform library helps out.

If this is confusing, consider a secondary ignition pattern. Even though there are many different implementations, each still has a primary voltage turn-on, firing line, spark line, etc.

If specific waveforms are available in On Demand for the engine and vehicle you are working on, you will find them in the Engine Performance section under the Engine Performance category.

IS A LAB SCOPE NECESSARY?

INTRODUCTION

You probably have several tools at your disposal to diagnose injector circuits. But you might have questioned "Is a lab scope necessary to do a thorough job, or will a set of noid lights and a multifunction DVOM do just as well?"

In the following text, we are going to look at what noid lights and DVOMs do best, do not do very well, and when they can mislead you. As you might suspect, the lab scope, with its ability to look inside an active circuit, comes to the rescue by answering for the deficiencies of these other tools.

OVERVIEW OF NOID LIGHT

The noid light is an excellent "quick and dirty" tool. It can usually be hooked to a fuel injector harness fast and the flashing light is easy to understand. It is a dependable way to identify a no-pulse situation.

However, a noid light can be very deceptive in two cases:

* If the wrong one is used for the circuit being tested. Beware: Just because a connector on a noid light fits the harness does not mean it is the right one.
* If an injector driver is weak or a minor voltage drop is present.

Use the Right Noid Light

In the following text we will look at what can happen if the wrong noid light is used, why there are different types of noid lights (besides differences with connectors), how to identify the types of noid lights, and how to know the right type to use.

First, let's discuss what can happen if the incorrect type of noid light is used. You might see:

* A dimly flashing light when it should be normal.
* A normal flashing light when it should be dim.

A noid light will flash dim if used on a lower voltage circuit than it was designed for. A normally operating circuit would appear underpowered, which could be misinterpreted as the cause of a fuel starvation problem.

Here are the two circuit types that could cause this problem:

* Circuits with external injector resistors. Used predominately on some Asian & European systems, they are used to reduce the available voltage to an injector in order to limit the current flow. This lower voltage can cause a dim flash on a noid light designed for full voltage.
* Circuits with current controlled injector drivers (e.g. "Peak and Hold"). Basically, this type of driver allows a quick burst of voltage/current to flow and then throttles it back significantly for the remainder of the pulse width duration. If a noid light was designed for the other type of driver (voltage controlled, e.g. "Saturated"), it will appear dim because it is expecting full voltage/current to flow for the entire duration of the pulse width.

Let's move to the other situation where a noid light flashes normally when it should be dim. This could occur if a more sensitive noid light is used on a higher voltage/amperage circuit that was weakened enough to cause problems (but not outright broken). A circuit with an actual problem would thus appear normal.

Let's look at why. A noid light does not come close to consuming as much amperage as an injector solenoid. If there is a partial driver failure or a minor voltage drop in the injector circuit, there can be adequate amperage to fully operate the noid light BUT NOT ENOUGH TO OPERATE THE INJECTOR.

If this is not clear, picture a battery with a lot of corrosion on the terminals. Say there is enough corrosion that the starter motor will not operate; it only clicks. Now imagine turning on the headlights (with the ignition in the RUN position). You find they light normally and are fully bright. This is the same idea as noid light: There is a problem, but enough amp flow exists to operate the headlights ("noid light"), but not the starter motor ("injector").

How do you identify and avoid all these situations? By using the correct type of noid light. This requires that you understanding the types of injector circuits that your noid lights are designed for. There are three. They are:

* Systems with a voltage controlled injector driver. Another way to say it: The noid light is designed for a circuit with a "high" resistance injector (generally 12 ohms or above).
* Systems with a current controlled injector driver. Another way to say it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) without an external injector resistor.
* Systems with a voltage controlled injector driver and an external injector resistor. Another way of saying it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) and an external injector resistor.

NOTE: Some noid lights can meet both the second and third categories simultaneously.

If you are not sure which type of circuit your noid light is designed for, plug it into a known good car and check out the results. If it flashes normally during cranking, determine the circuit type by finding out injector resistance and if an external injector resistor is used. You now know enough to identify the type of injector circuit. Label the noid light appropriately.

Next time you need to use a noid light for diagnosis, determine what type of injector circuit you are dealing with and select the appropriate noid light.

Of course, if you suspect a no-pulse condition you could plug in any one whose connector fit without fear of misdiagnosis. This is because it is unimportant if the flashing light is dim or bright. It is only important that it flashes.

In any cases of doubt regarding the use of a noid light, a lab scope will overcome all inherent weaknesses.

OVERVIEW OF DVOM

A DVOM is typically used to check injector resistance and available voltage at the injector. Some techs also use it check injector on-time either with a built-in feature or by using the dwell/duty function.

There are situations where the DVOM performs these checks dependably, and other situations where it can deceive you. It is important to be aware of these strengths and weaknesses. We will cover the topics above in the following text.

Checking Injector Resistance

If a short in an injector coil winding is constant, an ohmmeter will accurately identify the lower resistance. The same is true with an open winding. Unfortunately, an intermittent short is an exception. A faulty injector with an intermittent short will show "good" if the ohmmeter cannot force the short to occur during testing.

Alcohol in fuel typically causes an intermittent short, happening only when the injector coil is hot and loaded by a current high enough to jump the air gap between two bare windings or to break down any oxides that may have formed between them.

When you measure resistance with an ohmmeter, you are only applying a small current of a few milliamps. This is nowhere near enough to load the coil sufficiently to detect most problems. As a result, most resistance checks identify intermittently shorted injectors as being normal.

There are two methods to get around this limitation. The first is to purchase an tool that checks injector coil windings under full load. The Kent-Moore J-39021 is such a tool, though there are others. The Kent-Moore costs around $240 at the time of this writing and works on many different manufacturer's systems.

The second method is to use a lab scope. Remember, a lab scope allows you to see the regular operation of a circuit in real time. If an injector is having an short or intermittent short, the lab scope will show it.

Checking Available Voltage At the Injector

Verifying a fuel injector has the proper voltage to operate correctly is good diagnostic technique. Finding an open circuit on the feed circuit like a broken wire or connector is an accurate check with a DVOM. Unfortunately, finding an intermittent or excessive resistance problem with a DVOM is unreliable.

Let's explore this drawback. Remember that a voltage drop due to excessive resistance will only occur when a circuit is operating? Since the injector circuit is only operating for a few milliseconds at a time, a DVOM will only see a potential fault for a few milliseconds. The remaining 90+% of the time the unloaded injector circuit will show normal battery voltage.

Since DVOMs update their display roughly two to five times a second, all measurements in between are averaged. Because a potential voltage drop is visible for such a small amount of time, it gets "averaged out", causing you to miss it.

Only a DVOM that has a "min-max" function that checks EVERY MILLISECOND will catch this fault consistently (if used in that mode). The Fluke 87 among others has this capability.

A "min-max" DVOM with a lower frequency of checking (100 millisecond) can miss the fault because it will probably check when the injector is not on. This is especially true with current controlled driver circuits. The Fluke 88, among others fall into this category.

Outside of using a Fluke 87 (or equivalent) in the 1 mS "min-max" mode, the only way to catch a voltage drop fault is with a lab scope. You will be able to see a voltage drop as it happens.

One final note. It is important to be aware that an injector circuit with a solenoid resistor will always show a voltage drop when the circuit is energized. This is somewhat obvious and normal; it is a designed-in voltage drop. What can be unexpected is what we already covered--a voltage drop disappears when the circuit is unloaded. The unloaded injector circuit will show normal battery voltage at the injector. Remember this and do not get confused.

Checking Injector On-Time With Built-In Function

Several DVOMs have a feature that allows them to measure injector on-time (mS pulse width). While they are accurate and fast to hookup, they have three limitations you should be aware of:

* They only work on voltage controlled injector drivers (e.g "Saturated Switch"), NOT on current controlled injector drivers (e.g. "Peak & Hold").
* A few unusual conditions can cause inaccurate readings.
* Varying engine speeds can result in inaccurate readings.

Regarding the first limitation, DVOMs need a well-defined injector pulse in order to determine when the injector turns ON and OFF. Voltage controlled drivers provide this because of their simple switch-like operation. They completely close the circuit for the entire duration of the pulse. This is easy for the DVOM to interpret.

The other type of driver, the current controlled type, start off well by completely closing the circuit (until the injector pintle opens), but then they throttle back the voltage/current for the duration of the pulse. The DVOM understands the beginning of the pulse but it cannot figure out the throttling action. In other words, it cannot distinguish the throttling from an open circuit (de-energized) condition.

Yet current controlled injectors will still yield a millisecond on-time reading on these DVOMs. You will find it is also always the same, regardless of the operating conditions. This is because it is only measuring the initial completely-closed circuit on-time, which always takes the same amount of time (to lift the injector pintle off its seat). So even though you get a reading, it is useless.

The second limitation is that a few erratic conditions can cause inaccurate readings. This is because of a DVOM's slow display rate; roughly two to five times a second. As we covered earlier, measurements in between display updates get averaged. So conditions like skipped injector pulses or intermittent long/short injector pulses tend to get "averaged out", which will cause you to miss important details.

The last limitation is that varying engine speeds can result in inaccurate readings. This is caused by the quickly shifting injector on-time as the engine load varies, or the RPM moves from a state of acceleration to stabilization, or similar situations. It too is caused by the averaging of all measurements in between DVOM display periods. You can avoid this by checking on-time when there are no RPM or load changes.

A lab scope allows you to overcome each one of these limitations.

Checking Injector On-Time With Dwell Or Duty

If no tool is available to directly measure injector millisecond on-time measurement, some techs use a simple DVOM dwell or duty cycle functions as a replacement.

While this is an approach of last resort, it does provide benefits. We will discuss the strengths and weaknesses in a moment, but first we will look at how a duty cycle meter and dwell meter work.

How A Duty Cycle Meter and Dwell Meter Work

All readings are obtained by comparing how long something has been OFF to how long it has been ON in a fixed time period. A dwell meter and duty cycle meter actually come up with the same answers using different scales. You can convert freely between them. See RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE.

The DVOM display updates roughly one time a second, although some DVOMs can be a little faster or slower. All measurements during this update period are tallied inside the DVOM as ON time or OFF time, and then the total ratio is displayed as either a percentage (duty cycle) or degrees (dwell meter).

For example, let's say a DVOM had an update rate of exactly 1 second (1000 milliseconds). Let's also say that it has been measuring/tallying an injector circuit that had been ON a total of 250 mS out of the 1000 mS. That is a ratio of one-quarter, which would be displayed as 25% duty cycle or 15° dwell (six-cylinder scale). Note that most duty cycle meters can reverse the readings by selecting the positive or negative slope to trigger on. If this reading were reversed, a duty cycle meter would display 75%.

Strengths of Dwell/Duty Meter

The obvious strength of a dwell/duty meter is that you can compare injector on-time against a known-good reading. This is the only practical way to use a dwell/duty meter, but requires you to have known-good values to compare against.

Another strength is that you can roughly convert injector mS on-time into dwell reading with some computations.

A final strength is that because the meter averages everything together it does not miss anything (though this is also a severe weakness that we will look at later). If an injector has a fault where it occasionally skips a pulse, the meter registers it and the reading changes accordingly.

Let's go back to figuring out dwell/duty readings by using injector on-time specification. This is not generally practical, but we will cover it for completeness. You NEED to know three things:

* Injector mS on-time specification.
* Engine RPM when specification is valid.
* How many times the injectors fire per crankshaft revolution.

The first two are self-explanatory. The last one may require some research into whether it is a bank-fire type that injects every 360° of crankshaft rotation, a bank-fire that injects every 720°, or an SFI that injects every 720°. Many manufacturers do not release this data so you may have to figure it out yourself with a frequency meter.

Here are the four complete steps to convert millisecond on-time:

1) Determine the injector pulse width and RPM it was obtained at. Let's say the specification is for one millisecond of on-time at a hot idle of 600 RPM.

2) Determine injector firing method for the complete 4 stroke cycle. Let's say this is a 360° bank-fired, meaning an injector fires each and every crankshaft revolution.

3) Determine how many times the injector will fire at the specified engine speed (600 RPM) in a fixed time period. We will use 100 milliseconds because it is easy to use.

Six hundred crankshaft Revolutions Per Minute (RPM) divided by 60 seconds equals 10 revolutions per second.

Multiplying 10 times .100 yields one; the crankshaft turns one time in 100 milliseconds. With exactly one crankshaft rotation in 100 milliseconds, we know that the injector fires exactly one time.

4) Determine the ratio of injector on-time vs. off-time in the fixed time period, then figure duty cycle and/or dwell. The injector fires one time for a total of one millisecond in any given 100 millisecond period.

One hundred minus one equals 99. We have a 99% duty cycle. If we wanted to know the dwell (on 6 cylinder scale), multiple 99% times .6; this equals 59.4° dwell.

Weaknesses of Dwell/Duty Meter

The weaknesses are significant. First, there is no one-to-one correspondence to actual mS on-time. No manufacturer releases dwell/duty data, and it is time-consuming to convert the mS on-time readings. Besides, there can be a large degree of error because the conversion forces you to assume that the injector(s) are always firing at the same rate for the same period of time. This can be a dangerous assumption.

Second, all level of detail is lost in the averaging process. This is the primary weakness. You cannot see the details you need to make a confident diagnosis.

Here is one example. Imagine a vehicle that has a faulty injector driver that occasionally skips an injector pulse. Every skipped pulse means that that cylinder does not fire, thus unburned O2 gets pushed into the exhaust and passes the O2 sensor. The O2 sensor indicates lean, so the computer fattens up the mixture to compensate for the supposed "lean" condition.

A connected dwell/duty meter would see the fattened pulse width but would also see the skipped pulses. It would tally both and likely come back with a reading that indicated the "pulse width" was within specification because the rich mixture and missing pulses offset each other.

This situation is not a far-fetched scenario. Some early GM

3800 engines were suffering from exactly this. The point is that a lack of detail could cause misdiagnosis.

As you might have guessed, a lab scope would not miss this.

RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE (1)

Dwell Meter (2)	Duty Cycle Meter
1°	1%
15°	25%
30°	50%
45°	75%
60°	100%

(1) - These are just some examples for your understanding. It is okay to fill in the gaps.
(2) - Dwell meter on the six-cylinder scale.

THE TWO TYPES OF INJECTOR DRIVERS

OVERVIEW

There are two types of transistor driver circuits used to operate electric fuel injectors: voltage controlled and current controlled. The voltage controlled type is sometimes called a "saturated switch" driver, while the current controlled type is sometimes known as a "peak and hold" driver.

The basic difference between the two is the total resistance of the injector circuit. Roughly speaking, if a particular leg in an injector circuit has total resistance of 12 or more ohms, a voltage control driver is used. If less than 12 ohms, a current control driver is used.

It is a question of what is going to do the job of limiting the current flow in the injector circuit; the inherent "high" resistance in the injector circuit, or the transistor driver. Without some form of control, the current flow through the injector would cause the solenoid coil to overheat and result in a damaged injector.

VOLTAGE CONTROLLED CIRCUIT ("SATURATED SWITCH")

The voltage controlled driver inside the computer operates much like a simple switch because it does not need to worry about limiting current flow. Recall, this driver typically requires injector circuits with a total leg resistance of 12 or more ohms.

The driver is either ON, closing/completing the circuit (eliminating the voltage-drop), or OFF, opening the circuit (causing a total voltage drop).

Some manufacturers call it a "saturated switch" driver. This is because when switched ON, the driver allows the magnetic field in the injector to build to saturation. This is the same "saturation" property that you are familiar with for an ignition coil.

There are two ways "high" resistance can be built into an injector circuit to limit current flow. One method uses an external solenoid resistor and a low resistance injector, while the other uses a high resistance injector without the solenoid resistor. See the left side of Fig. 1.

In terms of injection opening time, the external resistor voltage controlled circuit is somewhat faster than the voltage controlled high resistance injector circuit. The trend, however, seems to be moving toward use of this latter type of circuit due to its lower cost and reliability. The ECU can compensate for slower opening times by increasing injector pulse width accordingly.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

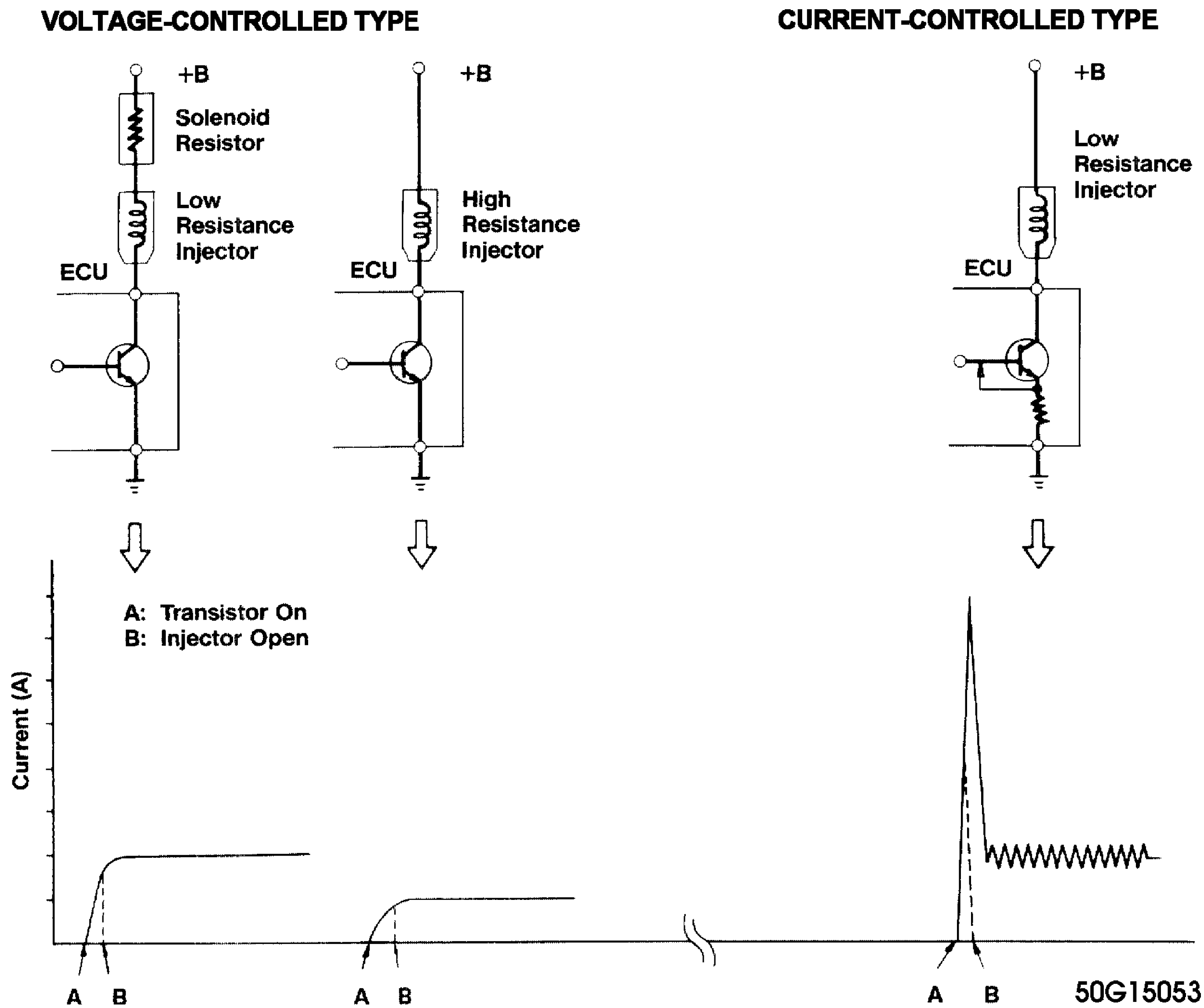


Fig. 1: Injector Driver Types - Current and Voltage

CURRENT CONTROLLED CIRCUIT ("PEAK & HOLD")

The current controlled driver inside the computer is more complex than a voltage controlled driver because as the name implies, it has to limit current flow in addition to its ON-OFF switching function. Recall, this driver typically requires injector circuits with a total leg resistance of less than 12 ohms.

Once the driver is turned ON, it will not limit current flow until enough time has passed for the injector pintle to open. This period is preset by the particular manufacturer/system based on the amount of current flow needed to open their injector. This is typically between two and six amps. Some manufacturers refer to this as the "peak" time, referring to the fact that current flow is allowed to "peak" (to open the injector).

Once the injector pintle is open, the amp flow is considerably reduced for the rest of the pulse duration to protect the injector from overheating. This is okay because very little amperage is needed to hold the injector open, typically in the area of one amp or less. Some manufacturers refer to this as the "hold" time, meaning that just enough current is allowed through the circuit to "hold" the already-open injector open.

There are a couple methods of reducing the current. The most common trims back the available voltage for the circuit, similar to turning down a light at home with a dimmer.

The other method involves repeatedly cycling the circuit ON-OFF. It does this so fast that the magnetic field never collapses and the pintle stays open, but the current is still significantly reduced. See the right side of Fig. 1 for an illustration.

The advantage to the current controlled driver circuit is the short time period from when the driver transistor goes ON to when the injector actually opens. This is a function of the speed with which current flow reaches its peak due to the low circuit resistance. Also, the injector closes faster when the driver turns OFF because of the lower holding current.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

THE TWO WAYS INJECTOR CIRCUITS ARE WIRED

Like other circuits, injector circuits can be wired in one of two fundamental directions. The first method is to steadily power the injectors and have the computer driver switch the ground side of the circuit. Conversely, the injectors can be steadily grounded while the driver switches the power side of the circuit.

There is no performance benefit to either method. Voltage controlled and current controlled drivers have been successfully implemented both ways.

However, 95% percent of the systems are wired so the driver controls the ground side of the circuit. Only a handful of systems use the drivers on the power side of the circuit. Some examples of the latter are the 1970's Cadillac EFI system, early Jeep 4.0 EFI (Renix system), and Chrysler 1984-87 TBI.

INTERPRETING INJECTOR WAVEFORMS

INTERPRETING A VOLTAGE CONTROLLED PATTERN

NOTE: Voltage controlled drivers are also known as "Saturated Switch" drivers. They typically require injector circuits with a total leg resistance of 12 ohms or more.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 2 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This can occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Note that circuits with external injector resistors will not be any different because the resistor does not affect open circuit voltage.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

The points between "B" and "D" represent the time in milliseconds that the injector is being energized or held open. This line at Point "C" should remain flat. Any distortion or upward bend indicates a ground problem, short problem, or a weak driver. Alert readers will catch that this is exactly opposite of the current controlled type drivers (explained in the next section), because they bend upwards at this point.

How come the difference? Because of the total circuit resistance. Voltage controlled driver circuits have a high resistance of 12+ ohms that slows the building of the magnetic field in the injector. Hence, no counter voltage is built up and the line remains flat.

On the other hand, the current controlled driver circuit has low resistance which allows for a rapid magnetic field build-up. This causes a slight inductive rise (created by the effects of counter voltage) and hence, the upward bend. You should not see that here with voltage controlled circuits.

Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts at the top of Point "D".

If you do see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning the injector has a weak winding.

If a zener diode is not used in the computer, the spike from a good injector will be 60 or more volts.

Point "E" brings us to a very interesting section. As you can see, the voltage dissipates back to supply value after the peak of the inductive kick. Notice the slight hump? This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking because of a faulty injector

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

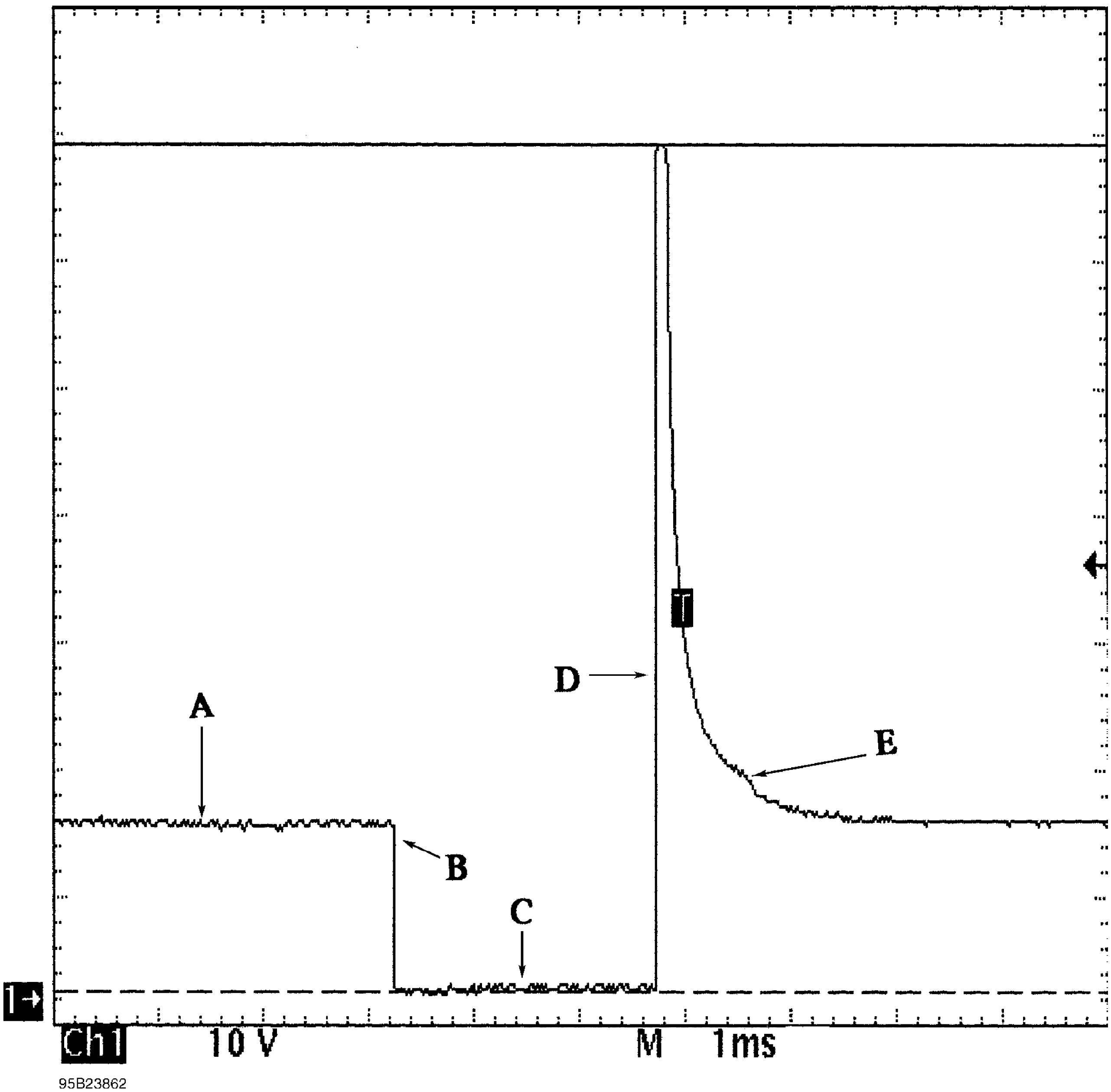


Fig. 2: Identifying Voltage Controlled Type Injector Pattern

INTERPRETING A CURRENT CONTROLLED PATTERN

NOTE: Current controlled drivers are also known as "Peak and Hold" drivers. They typically require injector circuits with a total leg resistance with less than 12 ohm.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 3 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This could occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

Right after Point "C", something interesting happens. Notice the trace starts a normal upward bend. This slight inductive rise is created by the effects of counter voltage and is normal. This is because the low circuit resistance allowed a fast build-up of the magnetic field, which in turn created the counter voltage.

Point "D" is the start of the current limiting, also known as the "Hold" time. Before this point, the driver had allowed the current to free-flow ("Peak") just to get the injector pintle open. By the time point "D" occurs, the injector pintle has already opened and the computer has just significantly throttled the current back. It does this by only allowing a few volts through to maintain the minimum current required to keep the pintle open.

The height of the voltage spike seen at the top of Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts.

If you see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning there is a problem with a weak injector winding.

If a zener diode is not used in the computer, the spike from a good injector will be 60 or more volts.

At Point "E", notice that the trace is now just a few volts below system voltage and the injector is in the current limiting, or the "Hold" part of the pattern. This line will either remain flat and stable as shown here, or will cycle up and down rapidly. Both are normal methods to limit current flow. Any distortion may indicate shorted windings.

Point "F" is the actual turn-off point of the driver (and injector). To measure the millisecond on-time of the injector, measure between points "C" and "F". Note that we used cursors to do it for us; they are measuring a 2.56 mS on-time.

The top of Point "F" (second inductive kick) is created by the collapsing magnetic field caused by the final turn-off of the driver. This spike should be like the spike on top of point "D".

Point "G" shows a slight hump. This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking. Some older Nissan TBI systems suffered from this.

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

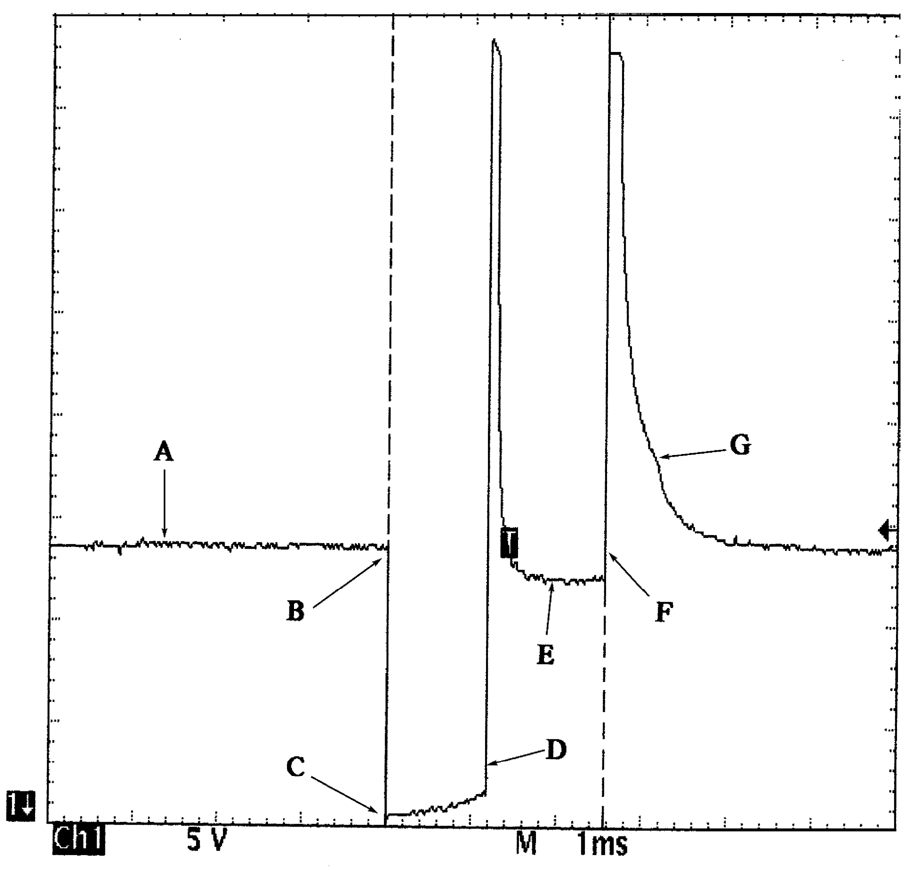


Fig. 3: Identifying Current Controlled Type Injector Pattern

CURRENT WAVEFORM SAMPLES

EXAMPLE #1 - VOLTAGE CONTROLLED DRIVER

The waveform pattern shown in Fig. 4 indicate a normal current waveform from a Ford 3.0L V6 VIN [U] engine. This voltage controlled type circuit pulses the injectors in groups of three injectors. Injectors No. 1, 3, and 5 are pulsed together and cylinders 2, 4, and 6 are pulsed together. The specification for an acceptable bank resistance is 4.4 ohms. Using Ohm's Law and assuming a hot run voltage of 14 volts, we determine that the bank would draw a current of 3.2 amps.

However this is not the case because as the injector windings become saturated, counter voltage is created which impedes the current flow. This, coupled with the inherent resistance of the driver's transistor, impedes the current flow even more. So, what is a known good value for a dynamic current draw on a voltage controlled bank of injectors? The waveform pattern shown below indicates a good parallel injector current flow of 2 amps. See Fig. 4.

Note that if just one injector has a resistance problem and partially shorts, the entire parallel bank that it belongs to will draw more current. This can damage the injector driver.

The waveform pattern in Fig. 5 indicates this type of problem with too much current flow. This is on other bank of injectors of the same vehicle; the even side. Notice the Lab Scope is set on a one amp per division scale. As you can see, the current is at an unacceptable 2.5 amps.

It is easy to find out which individual injector is at fault. All you need to do is inductively clamp onto each individual injector and compare them. To obtain a known-good value to compare against, we used the good bank to capture the waveform in Fig. 6. Notice that it limits current flow to 750 milliamps.

The waveform shown in Fig. 7 illustrates the problem injector we found. This waveform indicates an unacceptable current draw of just over one amp as compared to the 750 milliamp draw of the known-good injector. A subsequent check with a DVOM found 8.2 ohms, which is under the 12 ohm specification.

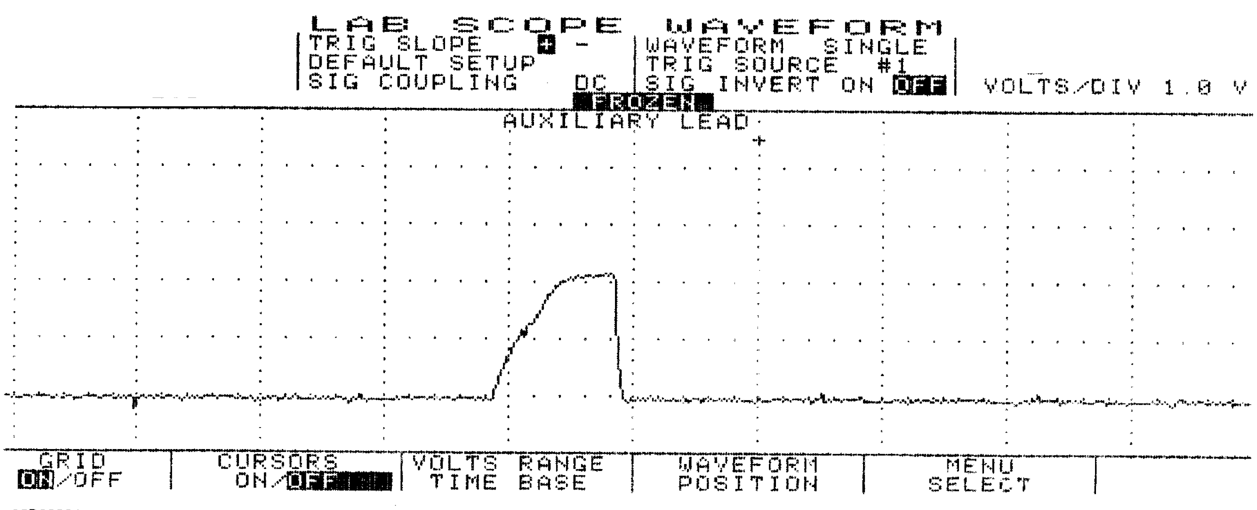


Fig. 4: Injector Bank w/Normal Current Flow - Current Pattern

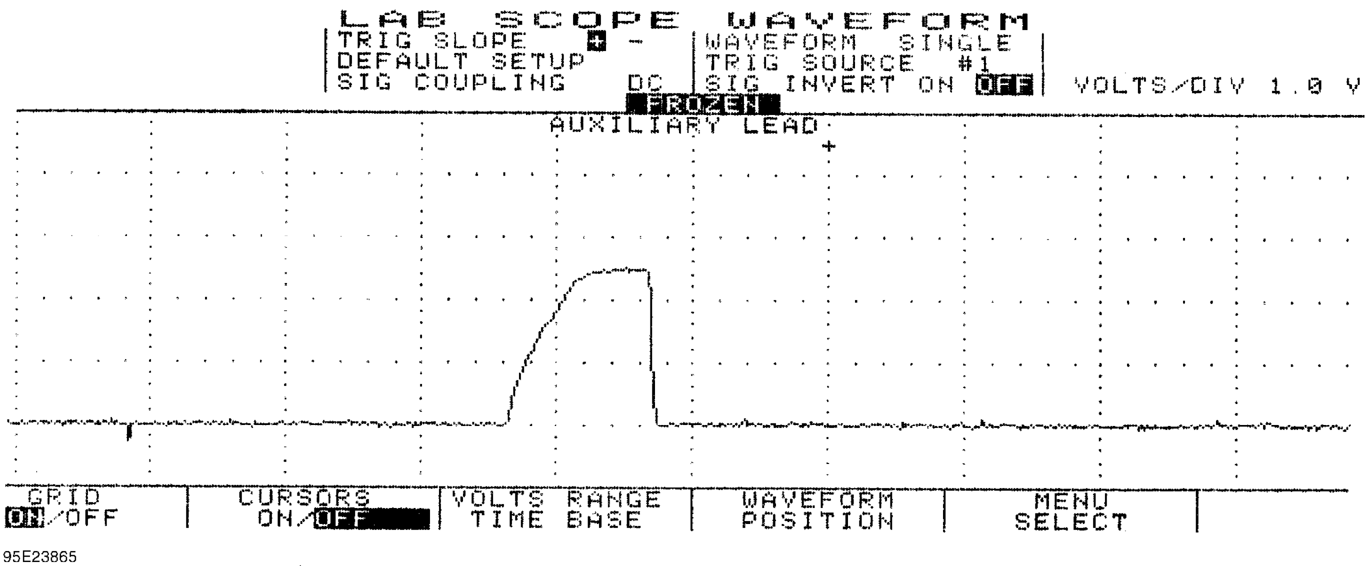


Fig. 5: Injector Bank w/Excessive Current Flow - Current Pattern

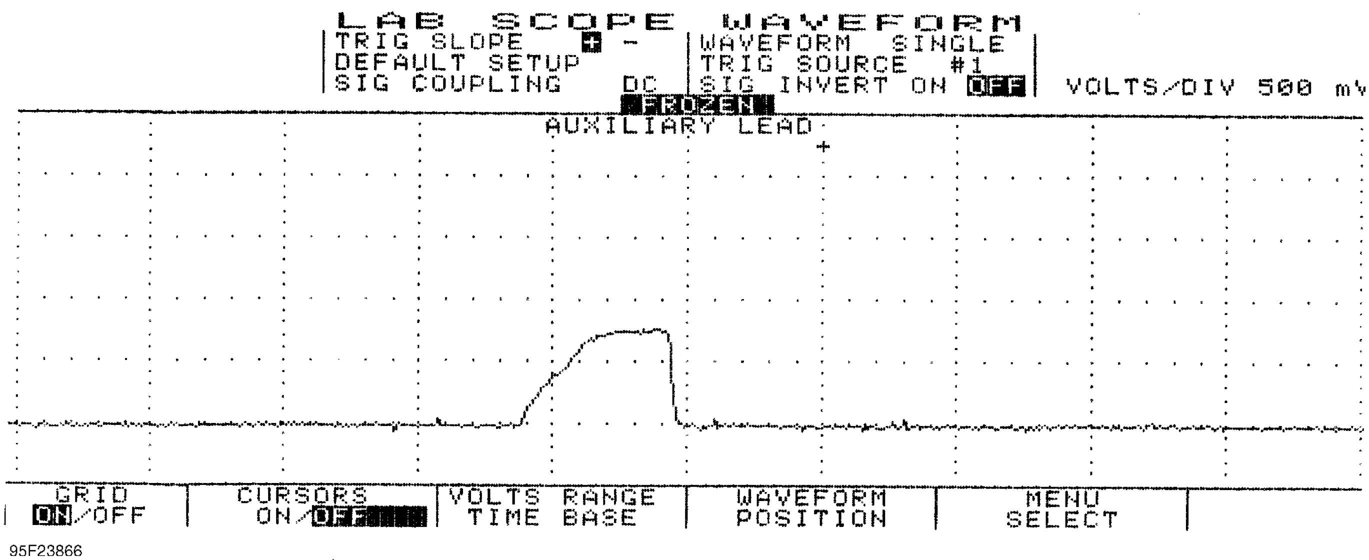


Fig. 6: Single Injector w/Normal Current Flow - Current Pattern

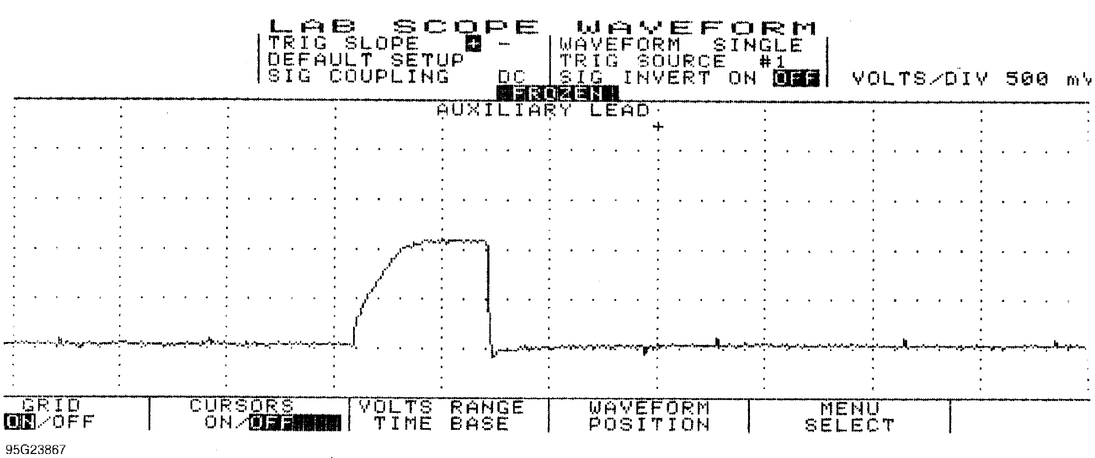


Fig. 7: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

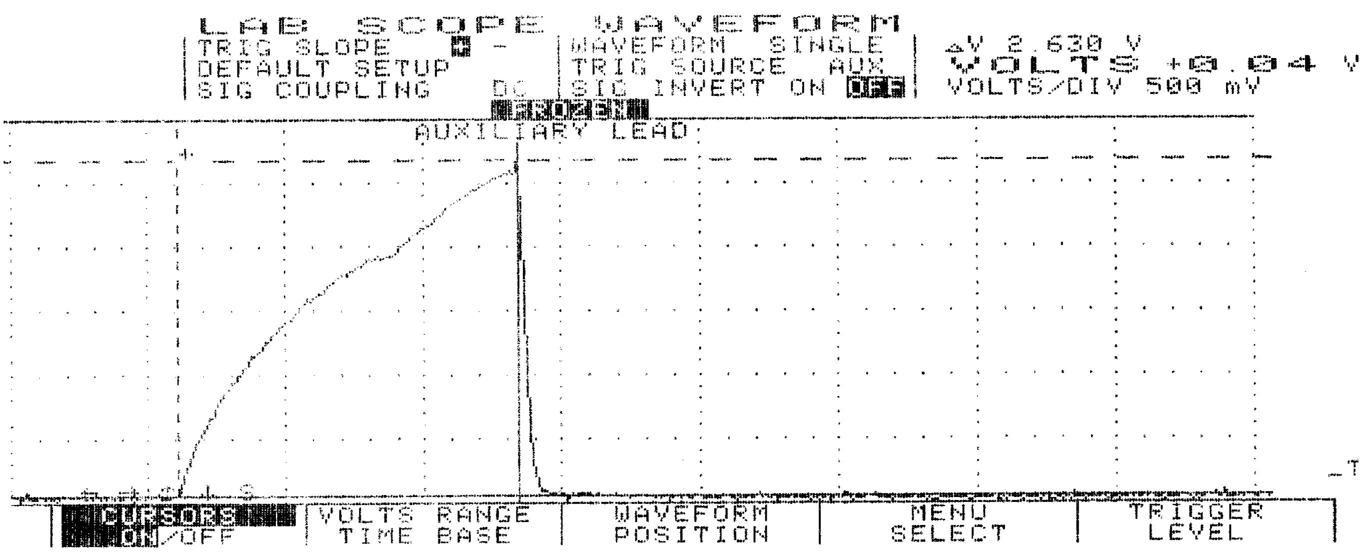
This time we will look at a GM 3.1L V6 VIN [T]. Fig. 8 shows the 1, 3, 5 (odd) injector bank with the current waveform indicating about a 2.6 amp draw at idle. This pattern, taken from a known good vehicle, correctly stays at or below the maximum 2.6 amps current range. Ideally, the current for each bank should be very close in comparison.

Notice the small dimple on the current flow's rising edge. This is the actual injector opening or what engineers refer to as the "set point." For good idle quality, the set point should be uniform between the banks.

When discussing Ohm's Law as it pertains to this parallel circuit, consider that each injector has specified resistance of 12.2 ohms. Since all three injectors are in parallel the total resistance of this parallel circuit drops to 4.1 ohms. Fourteen volts divided by four ohms would pull a maximum of 3.4 amps on this bank of injectors. However, as we discussed in EXAMPLE #1 above, other factors knock this value down to roughly the 2.6 amp neighborhood.

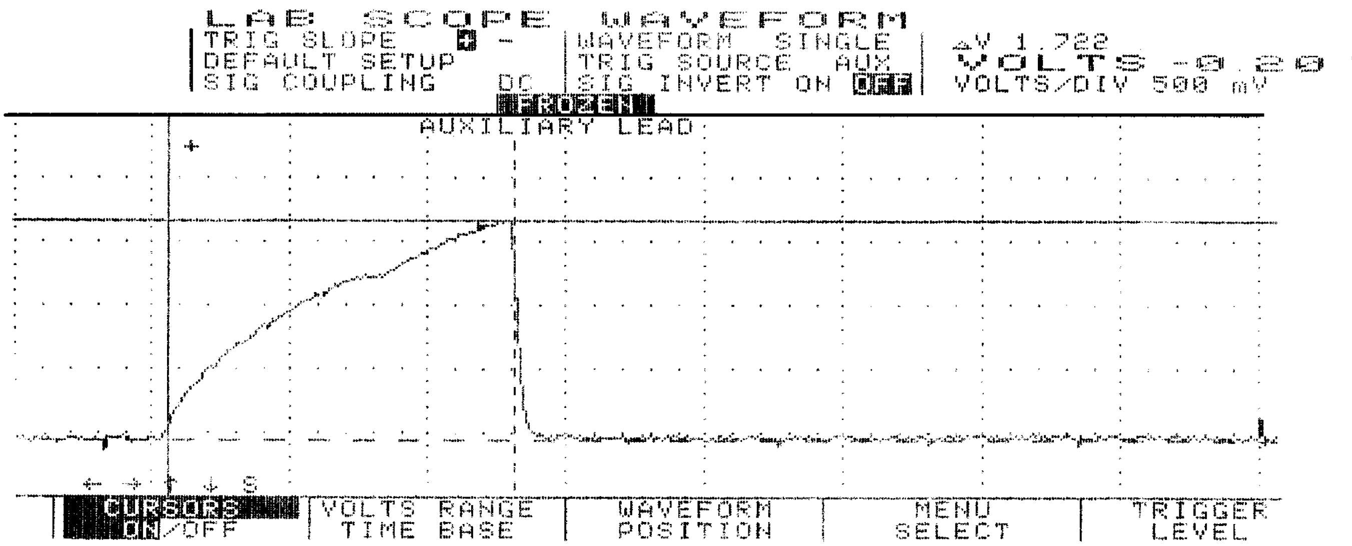
Now we are going to take a look at the even bank of injectors; injectors 2, 4, and 6. See Fig. 9. Notice this bank peaked at 1.7 amps at idle as compared to the 2.6 amps peak of the odd bank (Fig. 8). Current flow between even and odd injectors banks is not uniform, yet it is not causing a driveability problem. That is because it is still under the maximum amperage we figured out earlier. But be aware this vehicle could develop a problem if the amperage flow increases any more.

Checking the resistance of this even injector group with a DVOM yielded 6.2 ohms, while the odd injector group in the previous example read 4.1 ohms.



95E23873

Fig. 8: Injector Odd Bank w/Normal Current Flow - Current Pattern



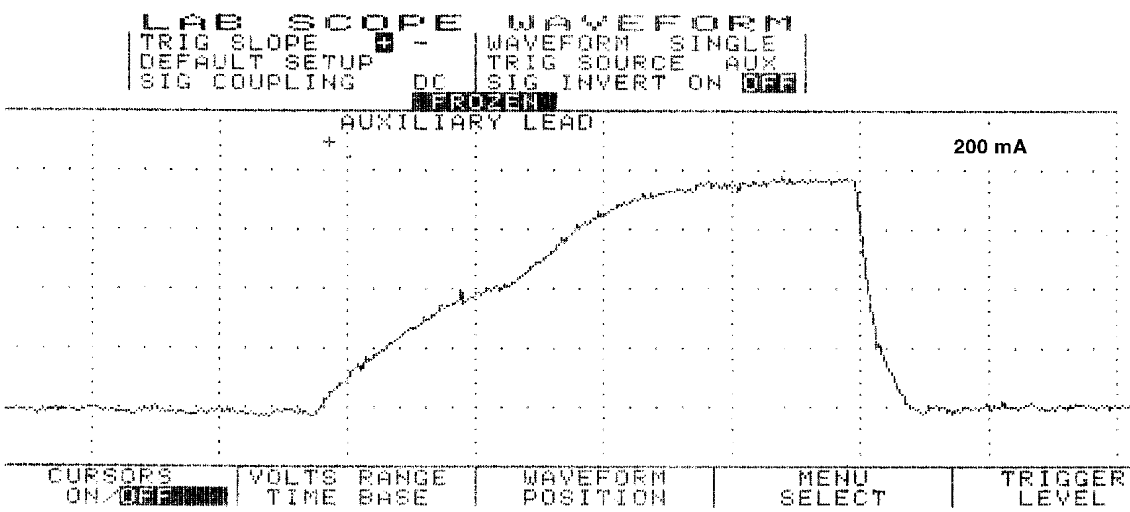
95F23874
Fig. 9: Injector Even Bank w/Normal Current Flow - Current Pattern

EXAMPLE #3 - VOLTAGE CONTROLLED DRIVER

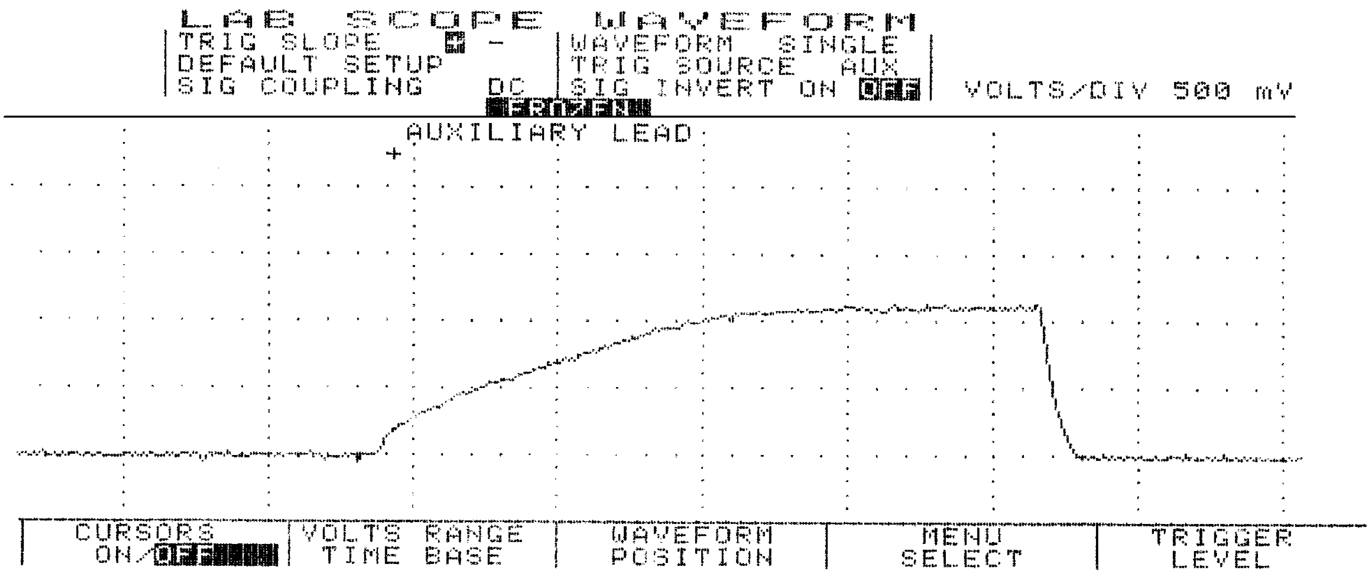
Example #3 is of a Ford 5.0L V8 SEFI. Fig. 10 shows a waveform of an individual injector at idle with the Lab Scope set on 200 milliamps per division. Notice the dimple in the rising edge. This dimple indicates the actual opening of the injector (set point) occurred at 400 milliamps and current peaked at 750 milliamps. This is a good specification for this engine.

The next waveform pattern in Fig. 11 shows an abnormality with another injector. With the Lab Scope set on 500 milliamps per division, you can see that the current waveform indicates a 1200 milliamp draw. This is a faulty injector.

Abnormally low resistance injectors create excessive current draw, causing rough idle, and possible computer driver damage.



95G23875
Fig. 10: Single Injector w/Normal Current Flow - Current Pattern

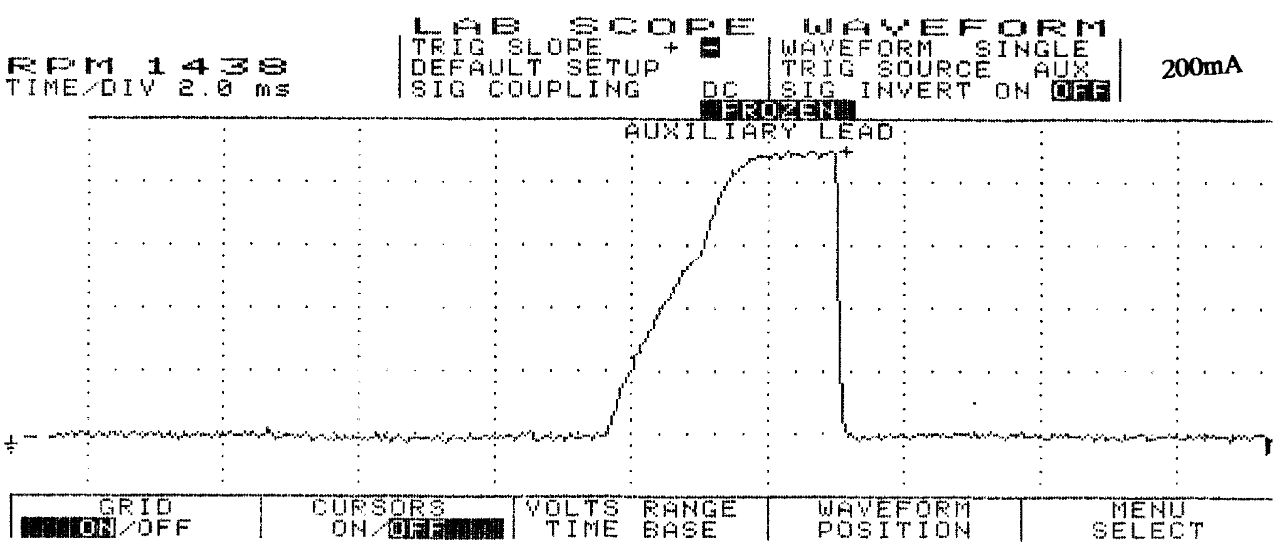


95H23876
Fig. 11: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #4 - CURRENT CONTROLLED DRIVER

Example #4 is of a Ford 4.6L SEFI VIN [W]. See Fig. 12 for the known-good waveform pattern. This Ford system is different from the one above in EXAMPLE #3 as it peaks at 900 milliamps and the actual opening of the injector (set point) is just below 600 milliamps.

This is offered as a comparison against the Ford pattern listed above, as they are both Ford SEFI injectors but with different operating ranges. The point is that you should not make any broad assumptions for any manufacturer.

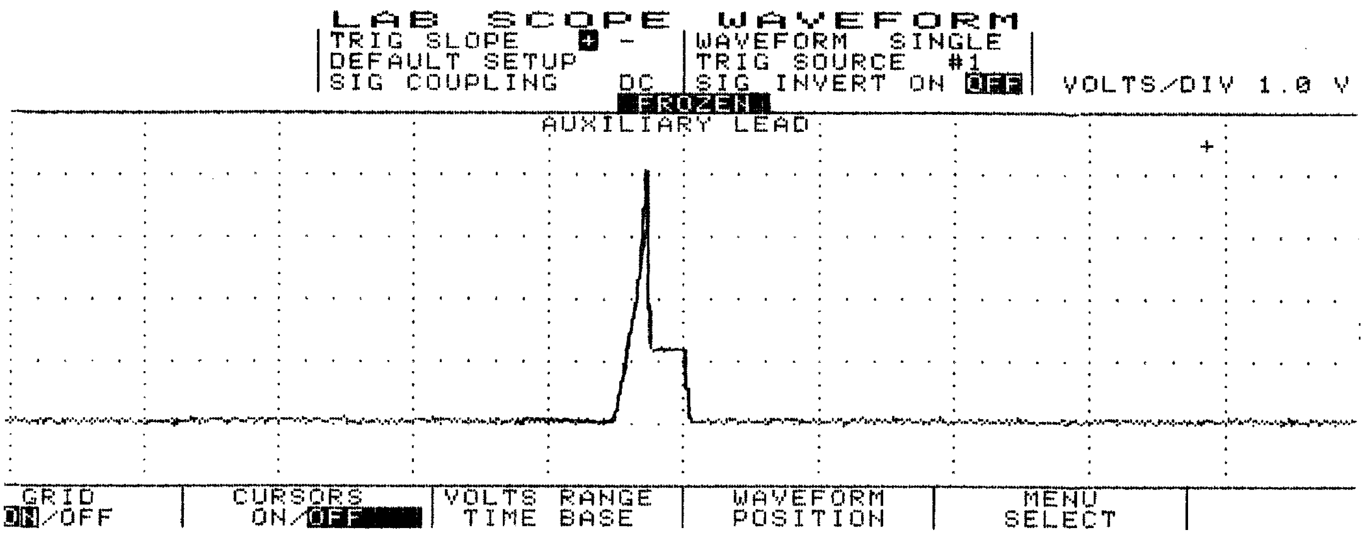


95D23872
Fig. 12: Single Injector w/Normal Current Flow - Current Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

The known-good waveform in Fig. 13 is from a Chrysler 3.0L V6

PFI VIN [3]. It is a perfect example of the peak and hold theory. The waveform shows a 1-amp per division current flow, ramping to 4 amps and then decreasing to 1-amp to hold the injector open.

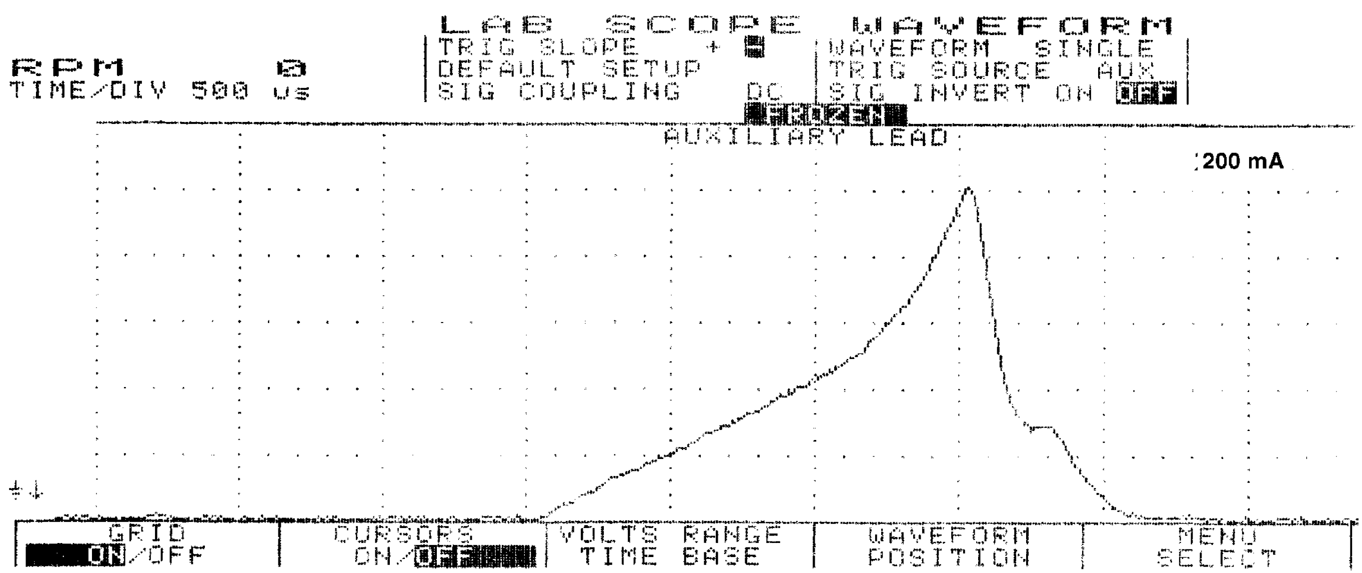


95H23868

Fig. 13: Injector Bank w/Normal Current Flow - Current Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

This next known-good waveform is from a Ford 5.0L V8 CFI VIN [F]. See Fig. 14. The pattern, which is set on a 250 milliamps scale, indicates a 1.25 amp peak draw and a hold at 350 milliamps.



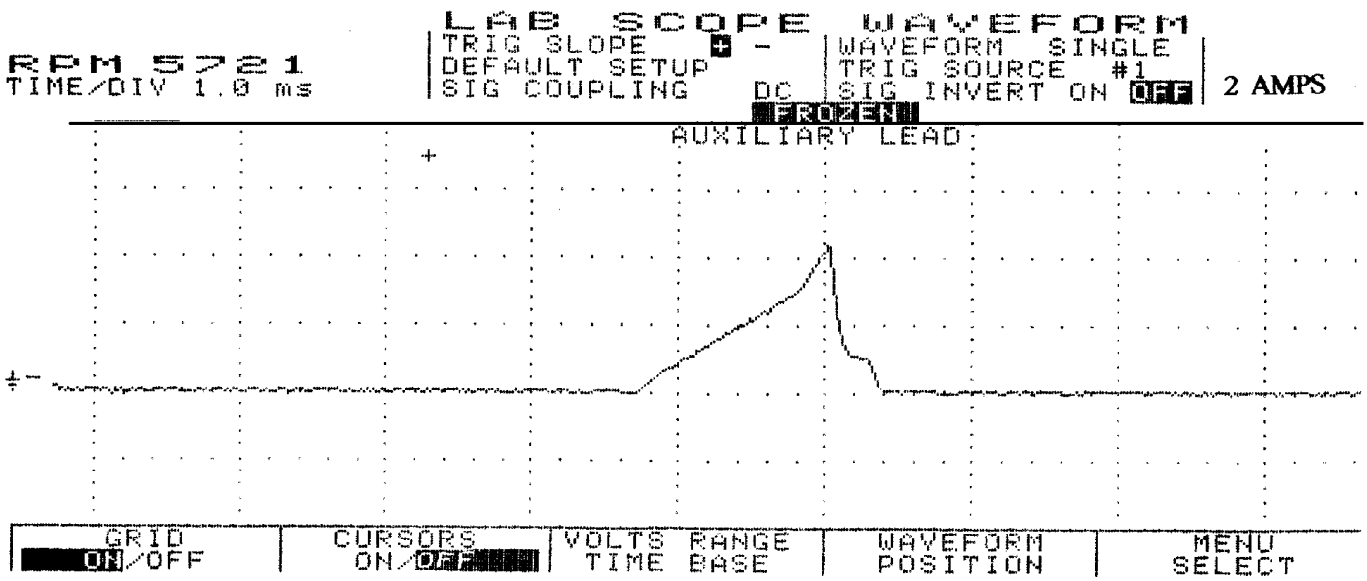
95I23869

Fig. 14: Single Injector w/Normal Current Flow - Current Pattern

EXAMPLE #7 - CURRENT CONTROLLED DRIVER

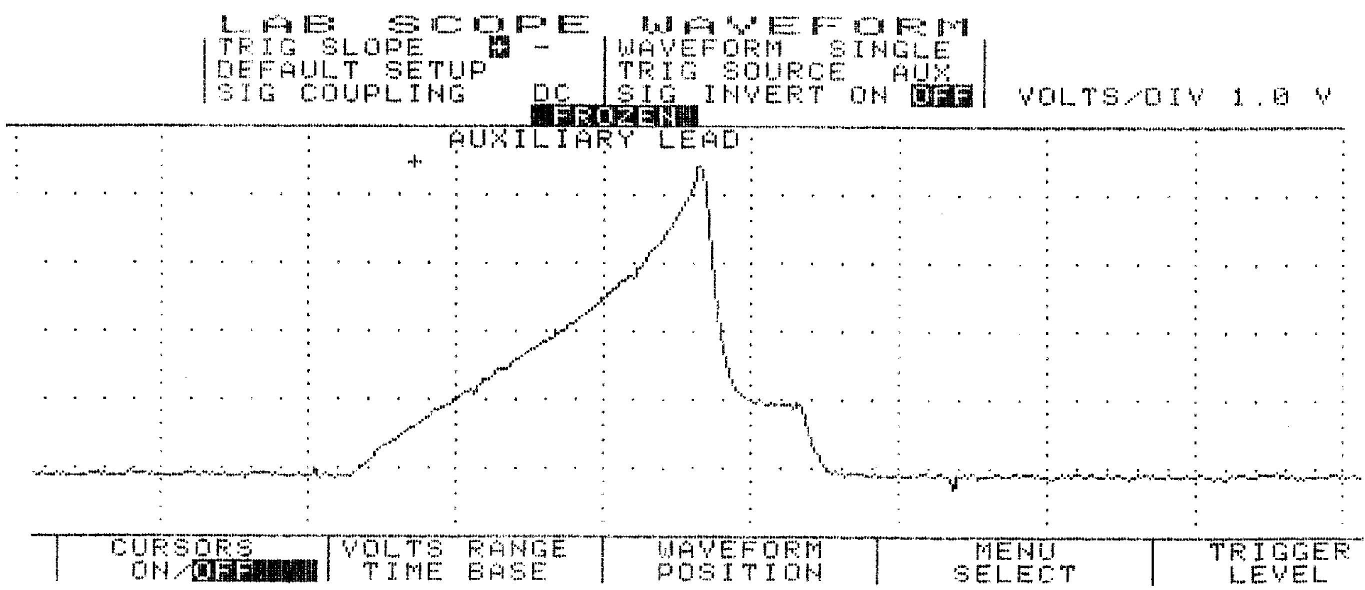
The known-good current controlled type waveform in Fig. 15 is from a GM 2.0L TBI VIN [1]. With the lab scope set at 2 amps per division, notice that this system peaks at 4 amps and holds at 1 amp.

The next waveform is from the same type of engine, except that it shows a faulty injector. See Fig. 16. Notice that the current went to almost 5 amps and stayed at 1 amp during the hold pattern. Excessive amounts of current flow from bad injectors are a common source of intermittent computer shutdown. Using a current waveform pattern is the most accurate method of pinpointing this problem.



95C23871

Fig. 15: Single Injector w/Normal Current Flow - Current Pattern



95I23877

Fig. 16: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #8 - CURRENT CONTROLLED DRIVER

This known-good CPI system waveform from a GM 4.3L V6 CPI VIN [W] peaks at 4 amps and holds at 1-amp. See Fig. 17 for waveform.

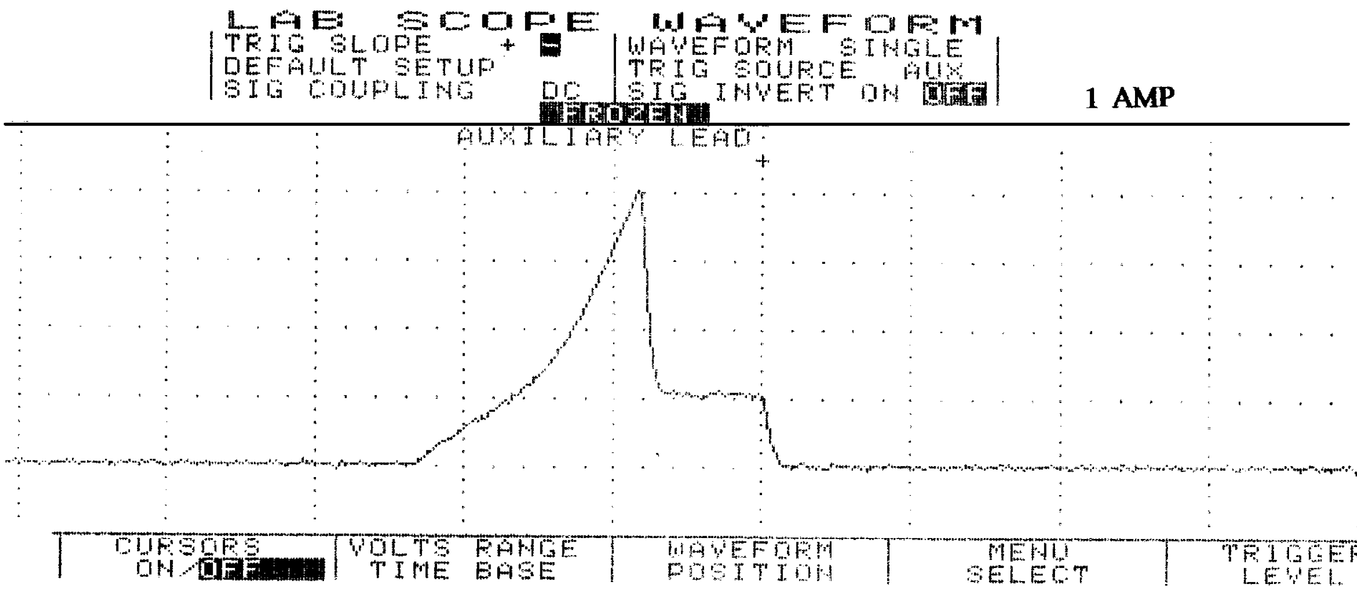
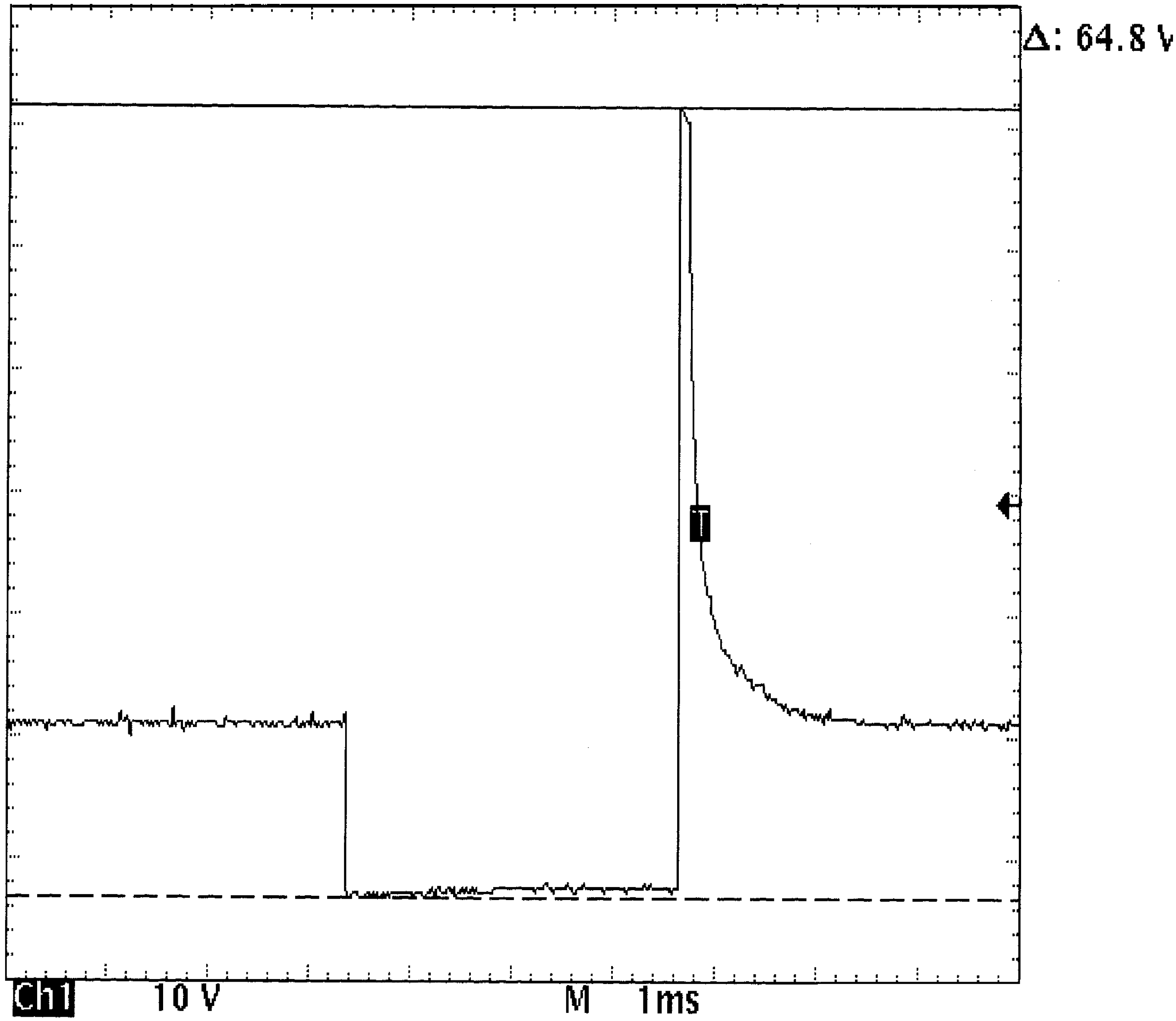


Fig. 17: Single Injector w/Normal Current Flow - Current Pattern

VOLTAGE WAVEFORM SAMPLES

EXAMPLE #1 - VOLTAGE CONTROLLED DRIVER

These two known-good waveform patterns are from a Ford 4.6L V8 VIN [W]. Fig. 18 illustrates the 64 volt inductive kick on this engine, indicating no clamping is occurring. The second pattern, Fig. 19, was taken during hot idle, closed loop, and no load.



95E23857

Fig. 18: Injector Bank - Known Good - Voltage Pattern

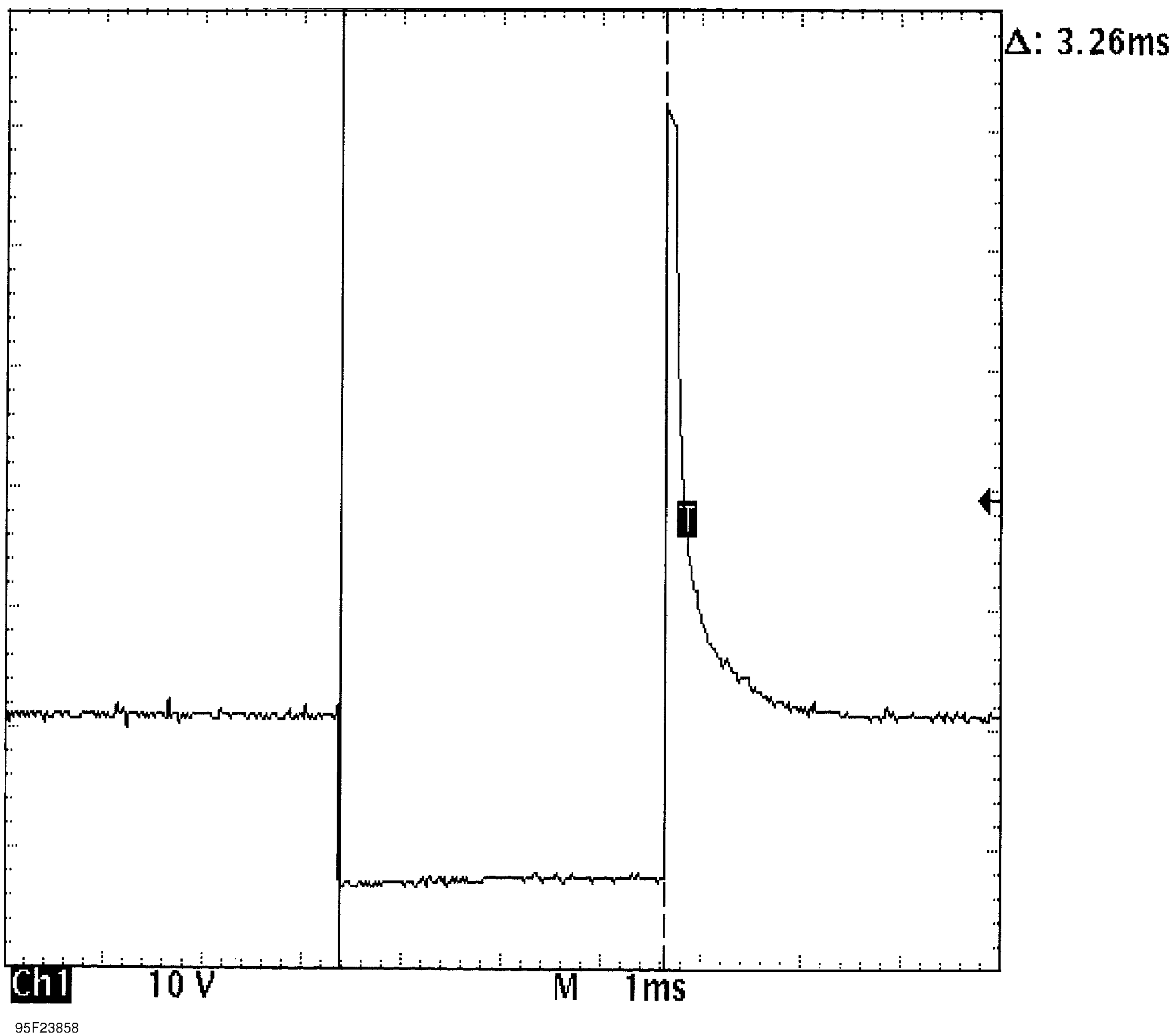


Fig. 19: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

The known-good waveform pattern in Fig. 20 is from a GM 3.8L V6 PFI VIN [3]. It was taken during hot idle, closed loop and no load.

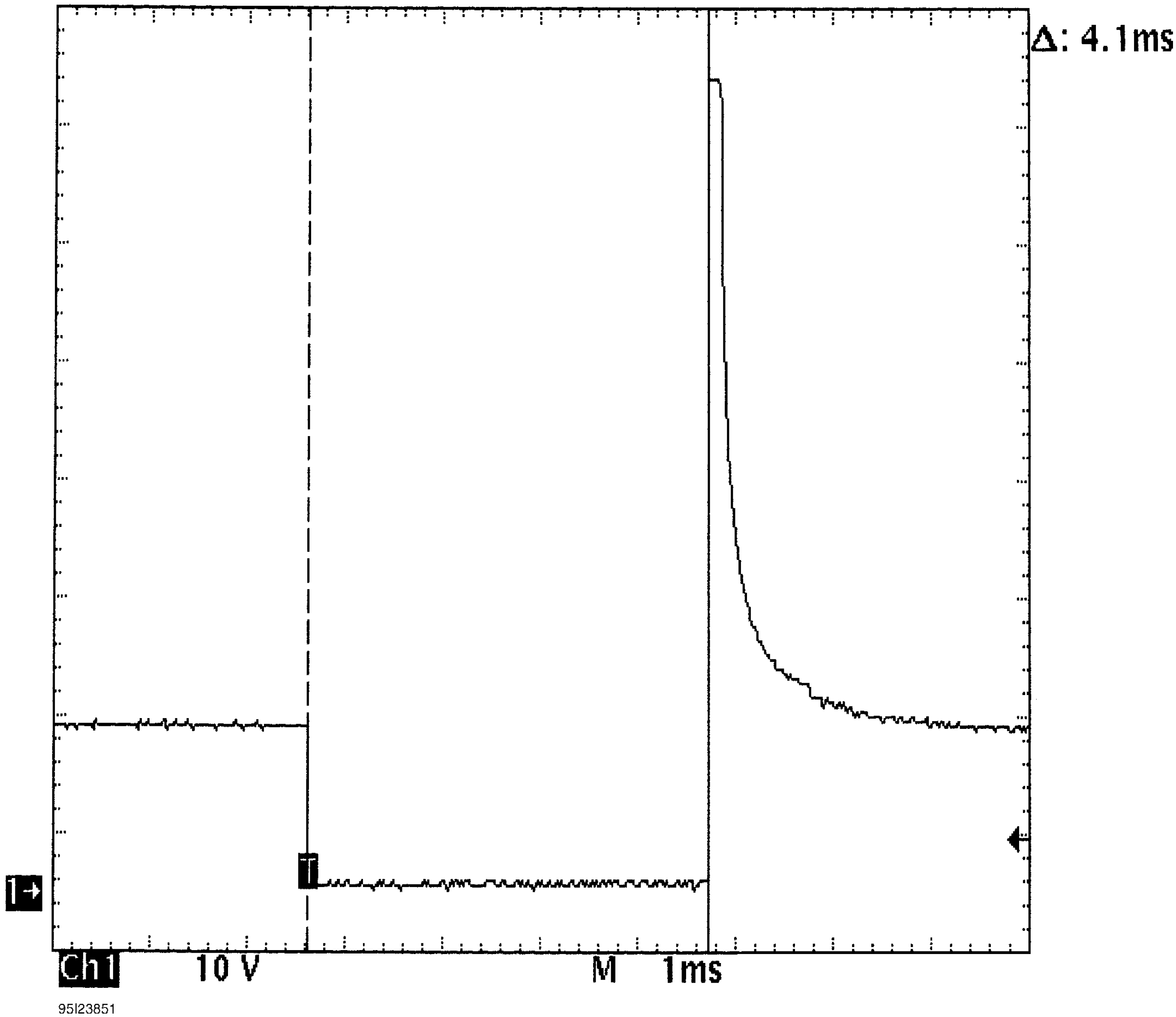


Fig. 20: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #3 - VOLTAGE CONTROLLED DRIVER

This known-good waveform pattern, Fig. 21, is from a GM 5.0L V8 TPI VIN [F]. It was taken during hot idle, closed loop and no load.

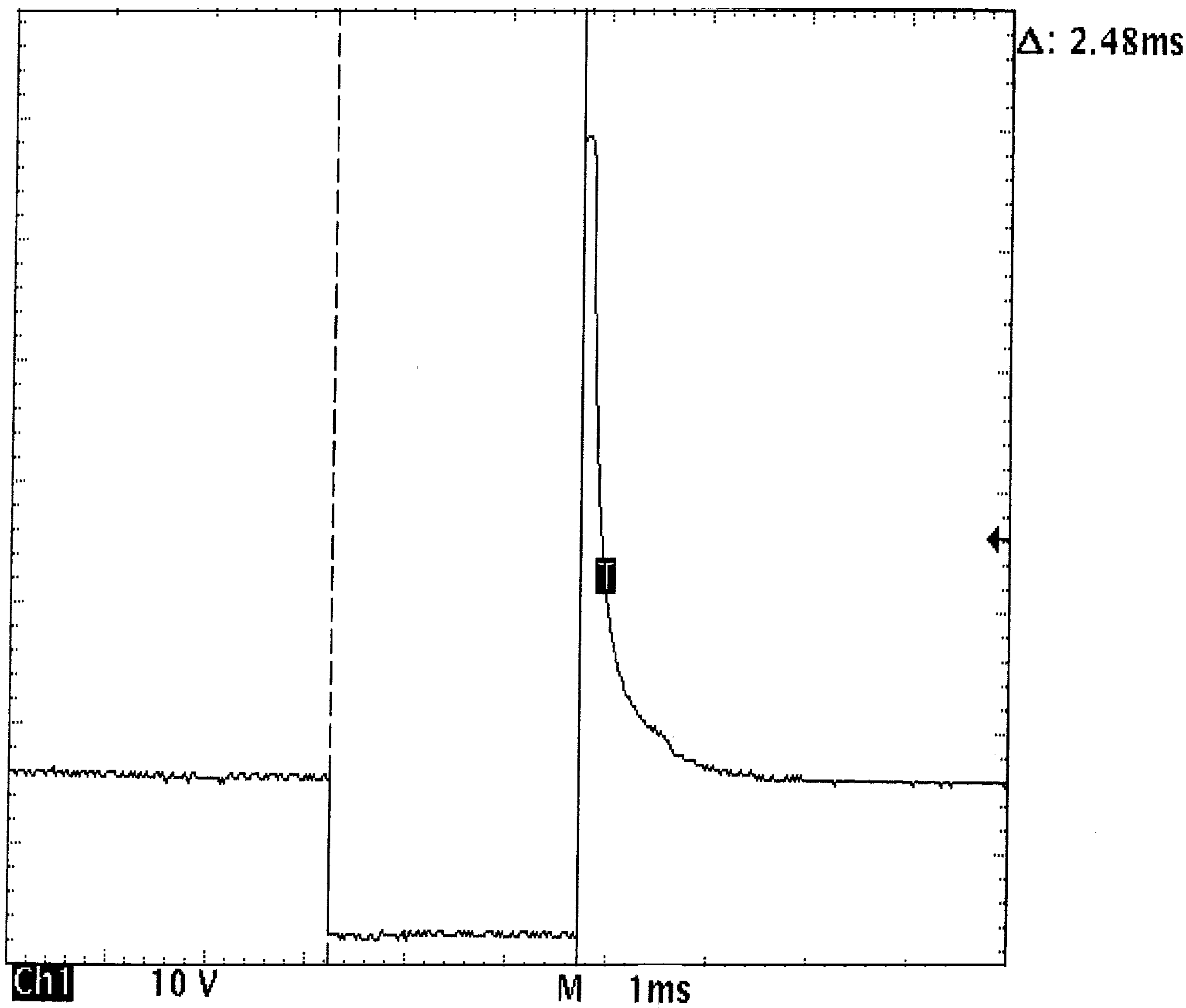
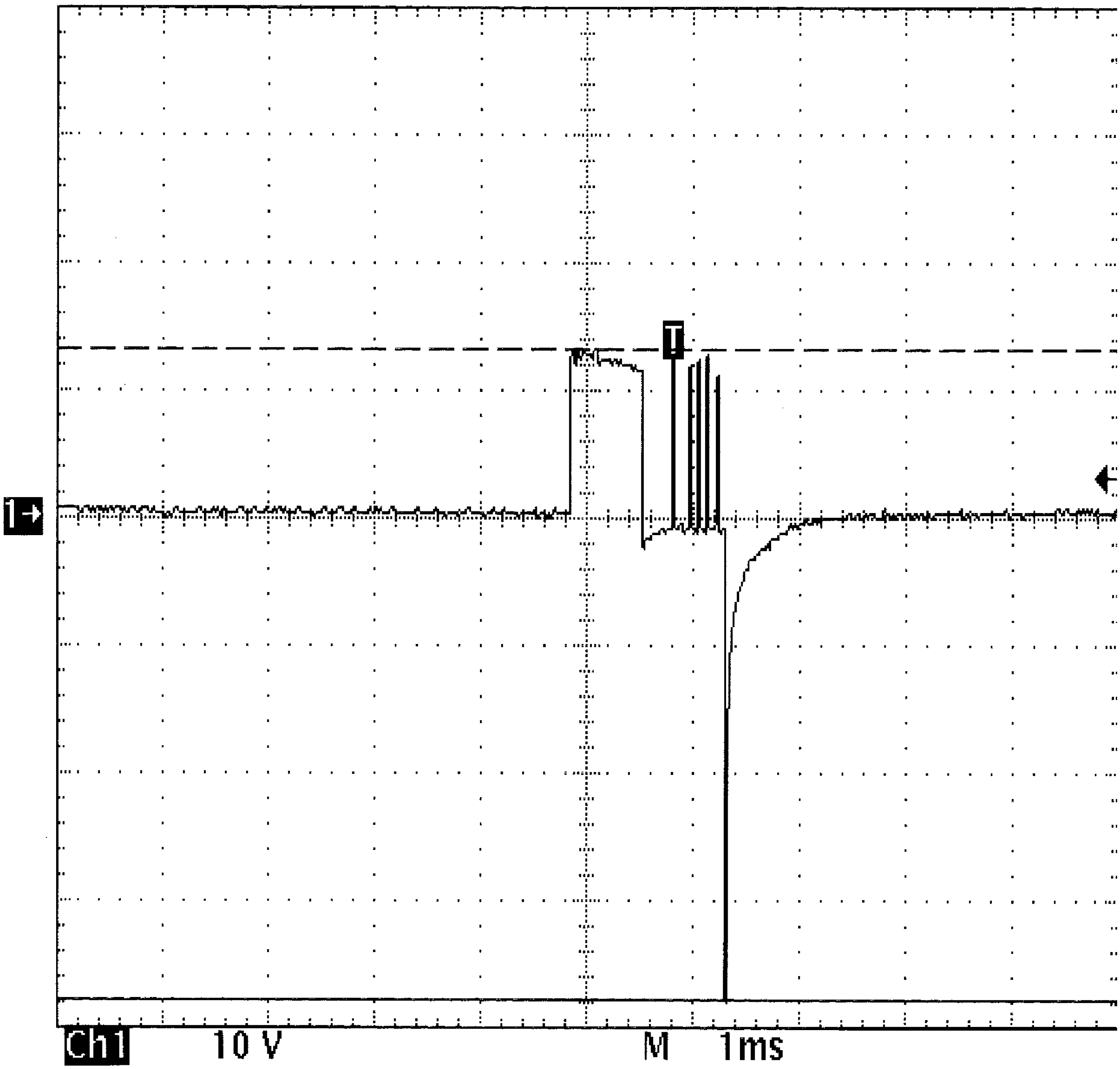


Fig. 21: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #4 - CURRENT CONTROLLED DRIVER

From 1984 to 1987, Chrysler used this type injector drive on their TBI-equipped engines. See Fig. 22 for a known-good pattern. Instead of the ground side controlling the injector, Chrysler permanently grounds out the injector and switches the power feed side. Most systems do not work this way.

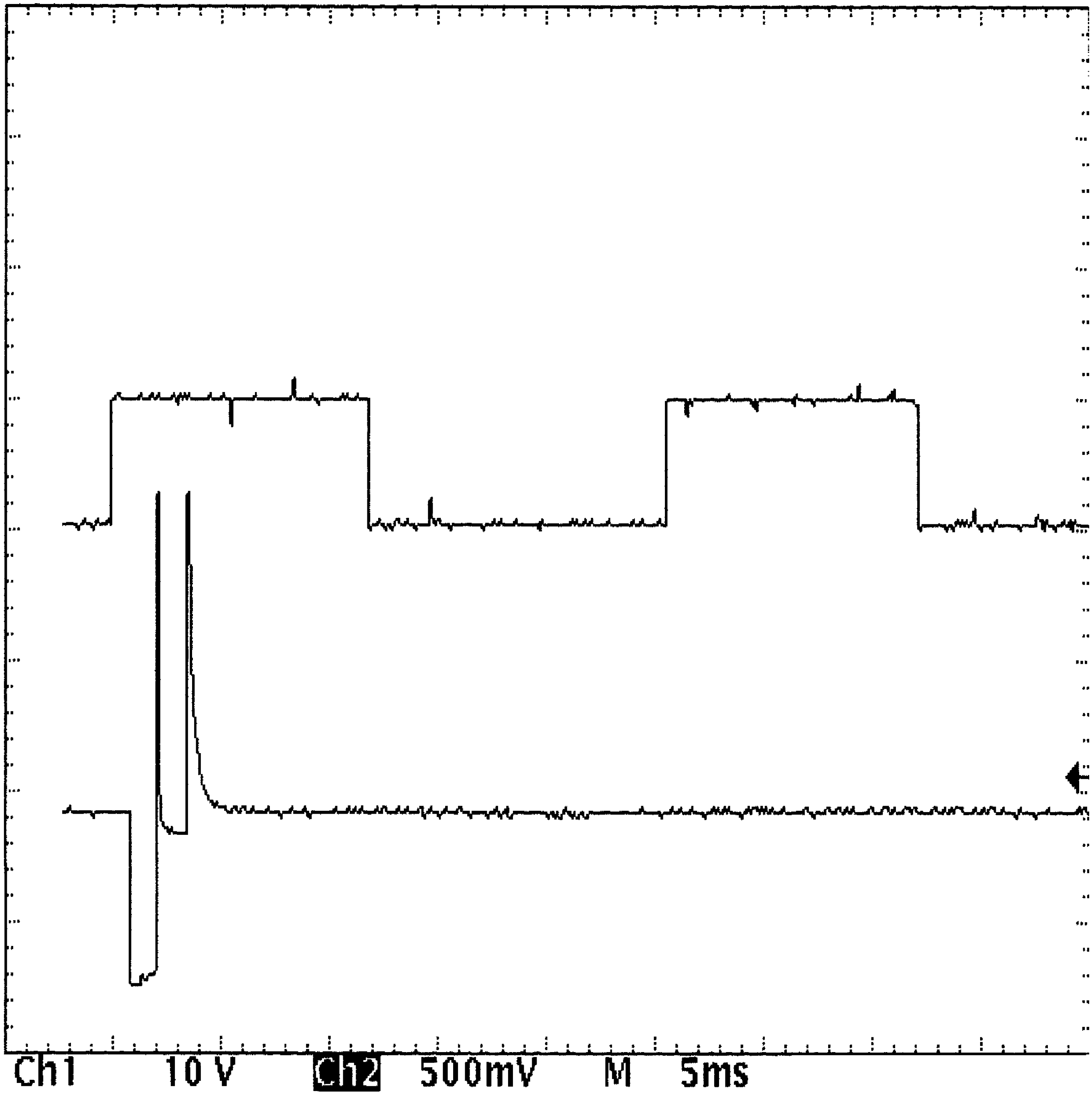
These injectors peak at 6 amps of current flow and hold at 1 amp.



95J23860
Fig. 22: Single Injector - Known Good - Voltage Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

These two known-good waveform patterns are from a Chrysler 3. 0L V6 VIN [3]. The first waveform, Fig. 23, is a dual trace pattern that illustrates how Chrysler uses the rising edge of the engine speed signal to trigger the injectors. The second waveform, Fig. 24, was taken during hot idle, closed loop, and no load.



95A23861
Fig. 23: Injector Bank - Known Good - Voltage Pattern

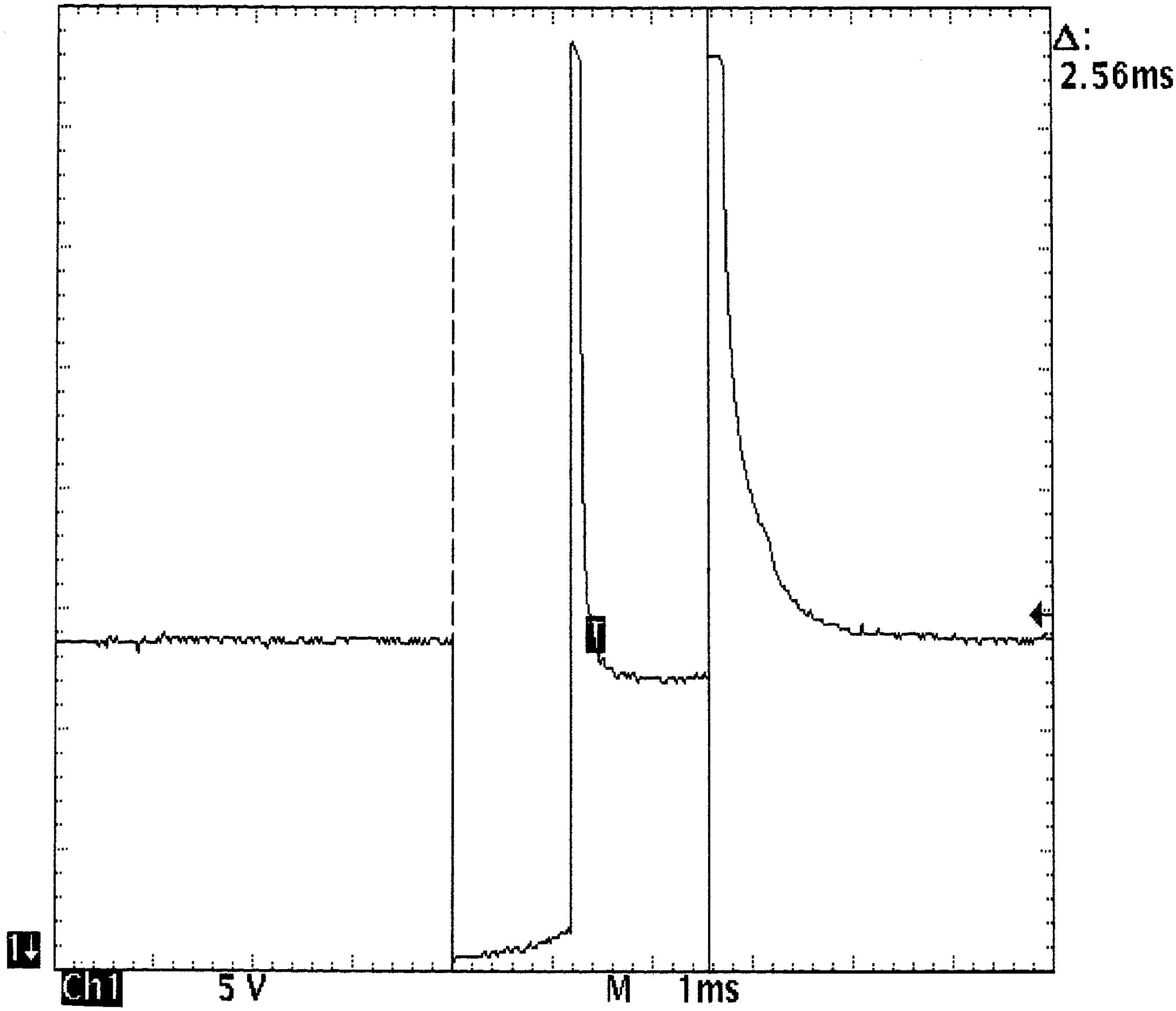
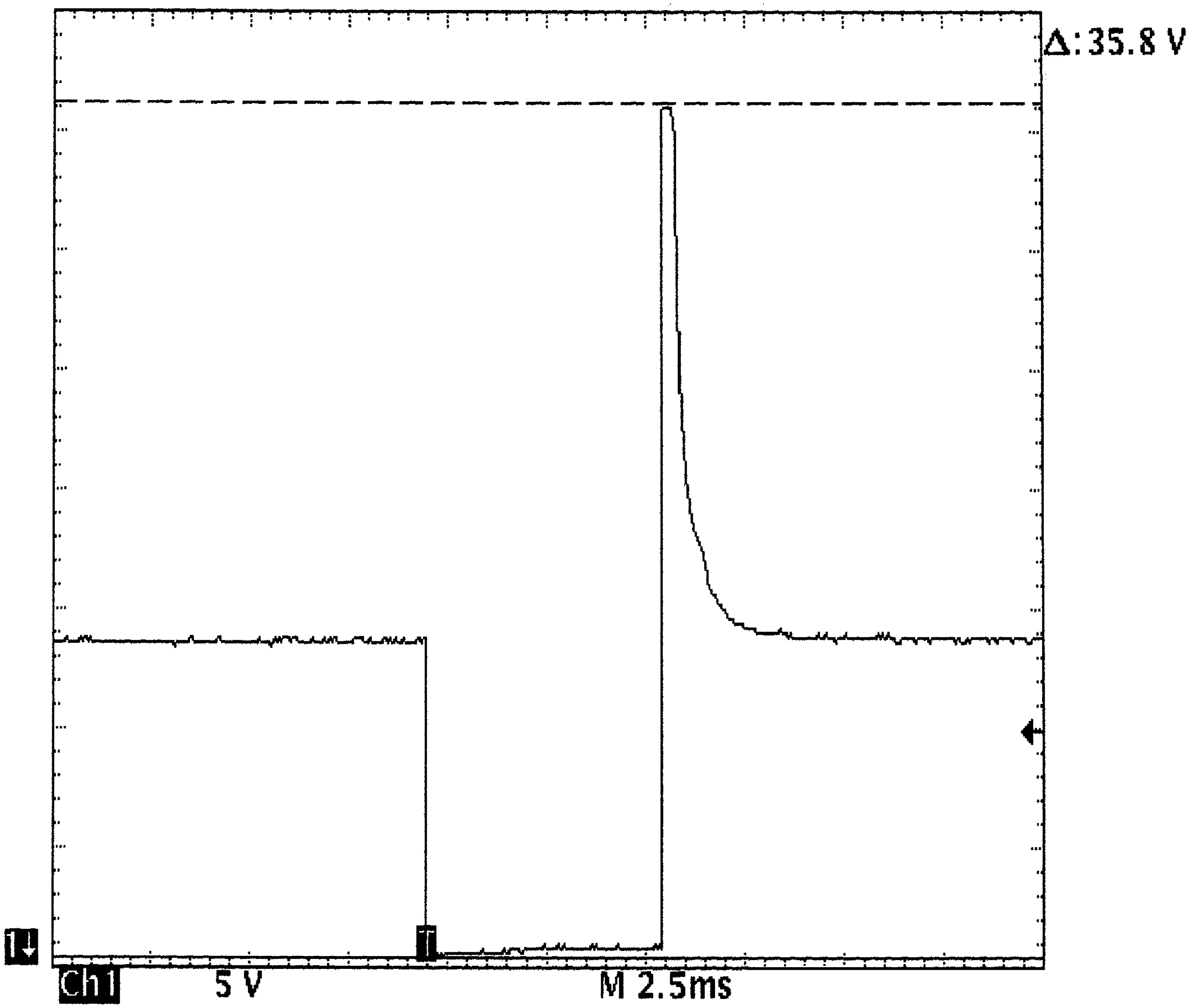


Fig. 24: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

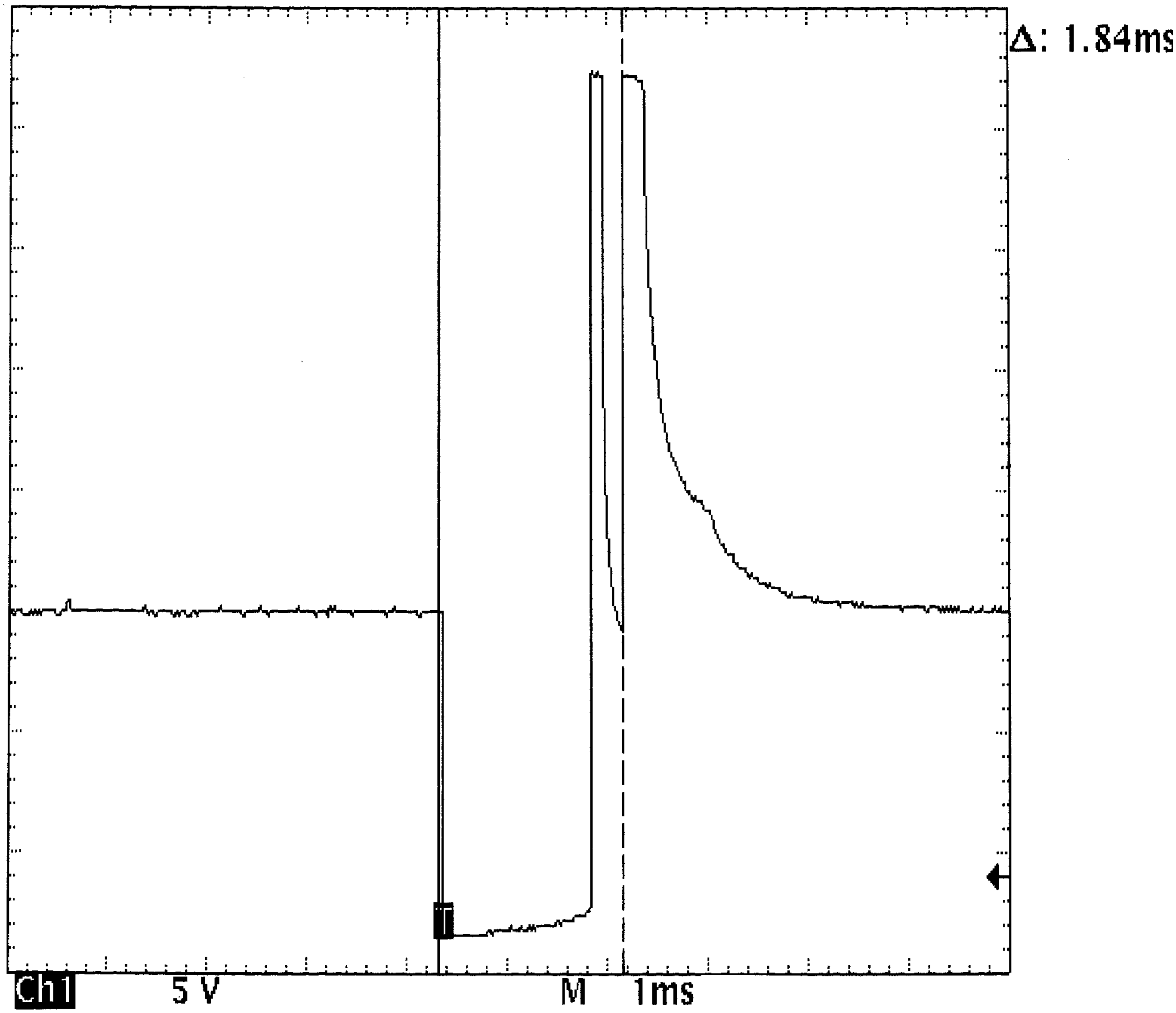
This known-good pattern from a Ford 3.0L V6 PFI VIN [U] illustrates that a zener diode inside the computer is used to clamp the injector's inductive kick to 35-volts on this system. See Fig. 25.



95J23852
Fig. 25: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #7 - CURRENT CONTROLLED DRIVER

This known-good waveform from a Ford 5.0L V8 CFI VIN [F] was taken during hot idle, closed loop, and no load. See Fig. 26.



95D23856
Fig. 26: Single Injector - Known Good - Voltage Pattern

EXAMPLE #8 - CURRENT CONTROLLED DRIVER

These two known-good waveform patterns are from a GM 2.0L In-Line 4 VIN [1]. Fig. 27 illustrates the 78 volt inductive spike that indicates a zener diode is not used. The second waveform, Fig. 28, was taken during hot idle, closed loop, and no load.

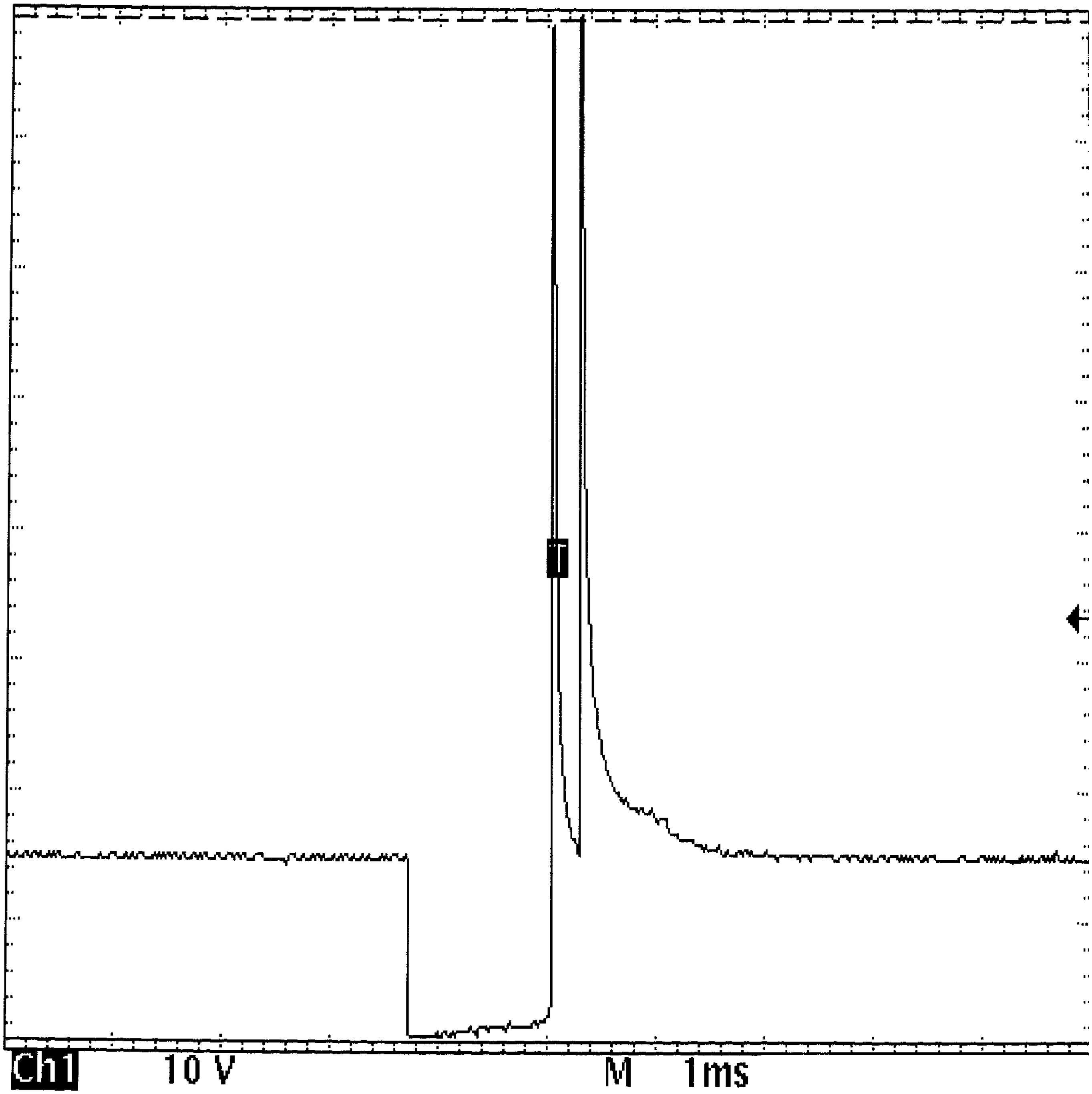


Fig. 27: Single Injector - Known Good - Voltage Pattern

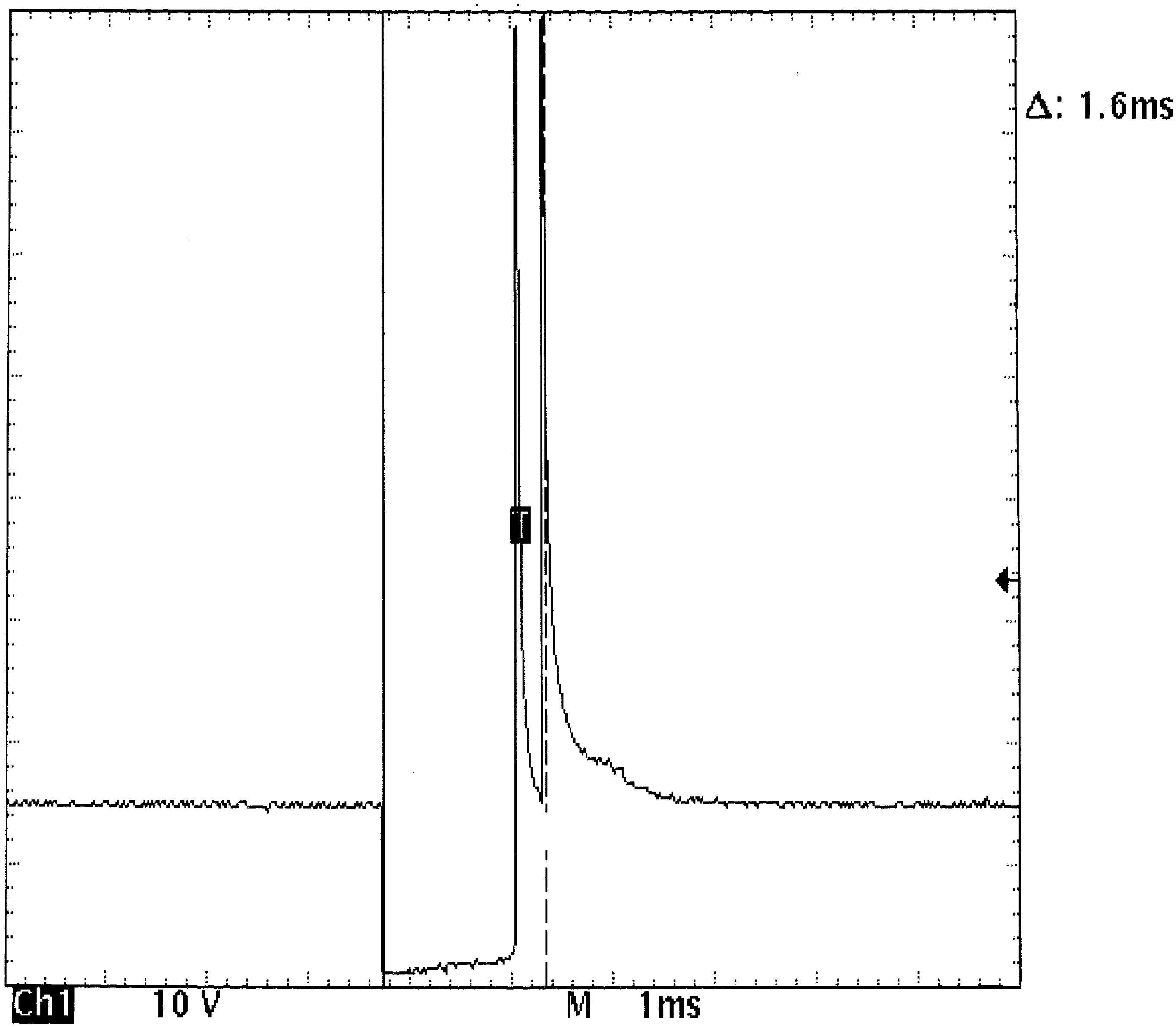


Fig. 28: Single Injector - Known Good - Voltage Pattern

WHEEL ALIGNMENT THEORY/OPERATION

1993 Toyota Celica

GENERAL INFORMATION
Wheel Alignment Theory & Operation

ALL MODELS

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PRE-ALIGNMENT INSTRUCTIONS

GENERAL ALIGNMENT CHECKS

Before adjusting wheel alignment, check the following:

* Each axle uses tires of same construction and tread style, equal in tread wear and overall diameter. Verify that radial and axial runout is not excessive. Inflation should be at manufacturer's specifications.
* Steering linkage and suspension must not have excessive play. Check for wear in tie rod ends and ball joints. Springs must not be sagging. Control arm and strut rod bushings must not have excessive play. See Fig. 1.

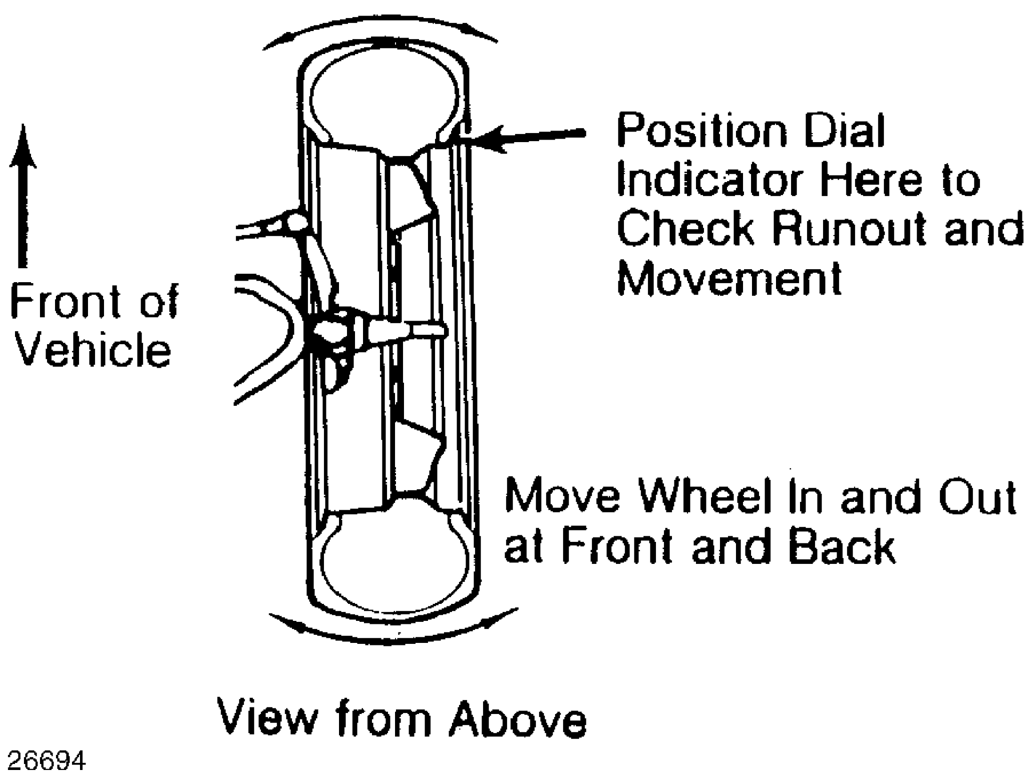


Fig. 1: Checking Steering Linkage

* Vehicle must be on level floor with full fuel tank, no passenger load, spare tire in place and no load in trunk. Bounce front and rear end of vehicle several times. Confirm

vehicle is at normal riding height.

* Steering wheel must be centered with wheels in straight ahead position. If required, shorten one tie rod adjusting sleeve and lengthen opposite sleeve (equal amount of turns). See Fig. 2.
* Wheel bearings should have the correct preload and lug nuts must be tightened to manufacturer's specifications. Adjust camber, caster and toe-in using this sequence. Follow instructions of the alignment equipment manufacturer.

CAUTION: Do not attempt to correct alignment by straightening parts. Damaged parts must be replaced.

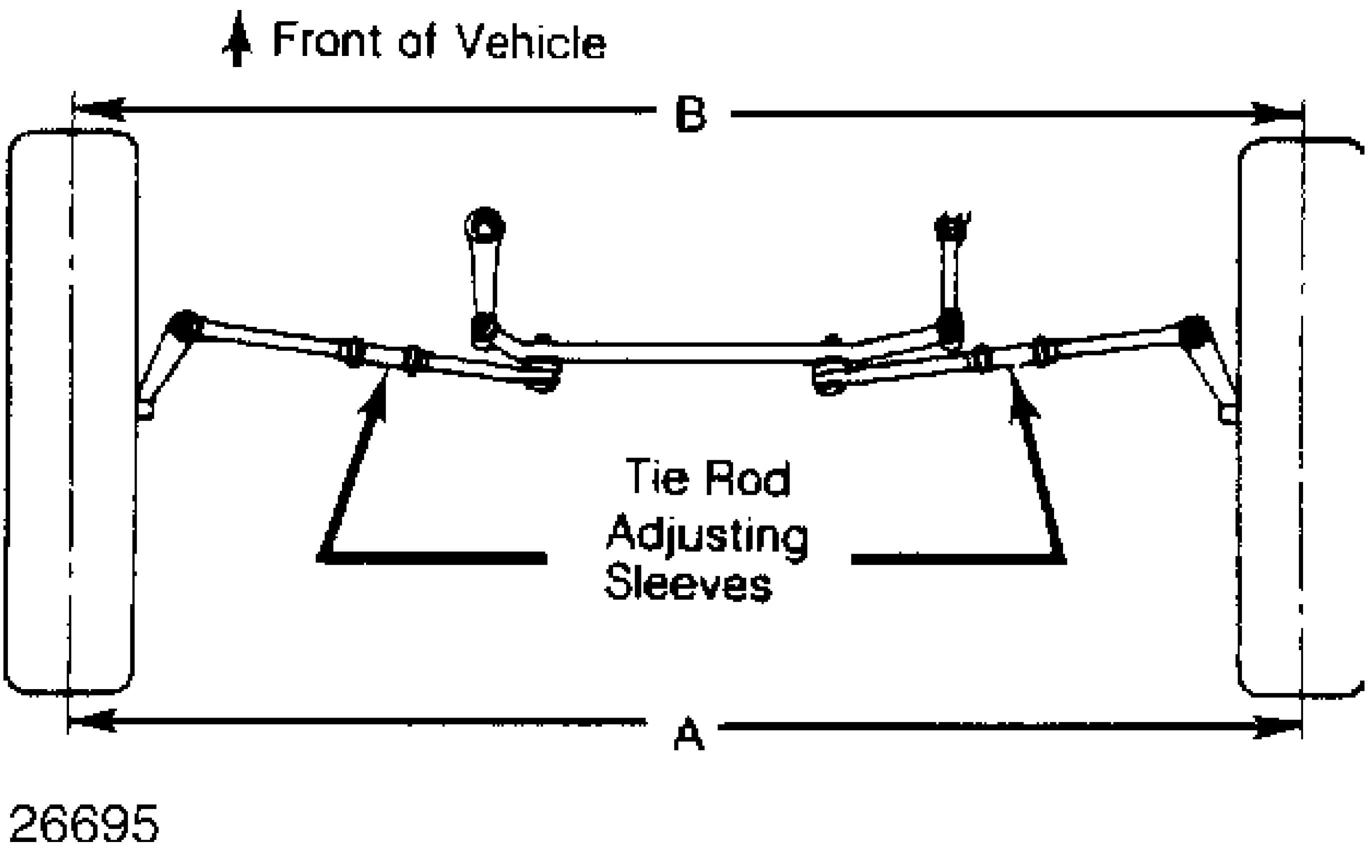
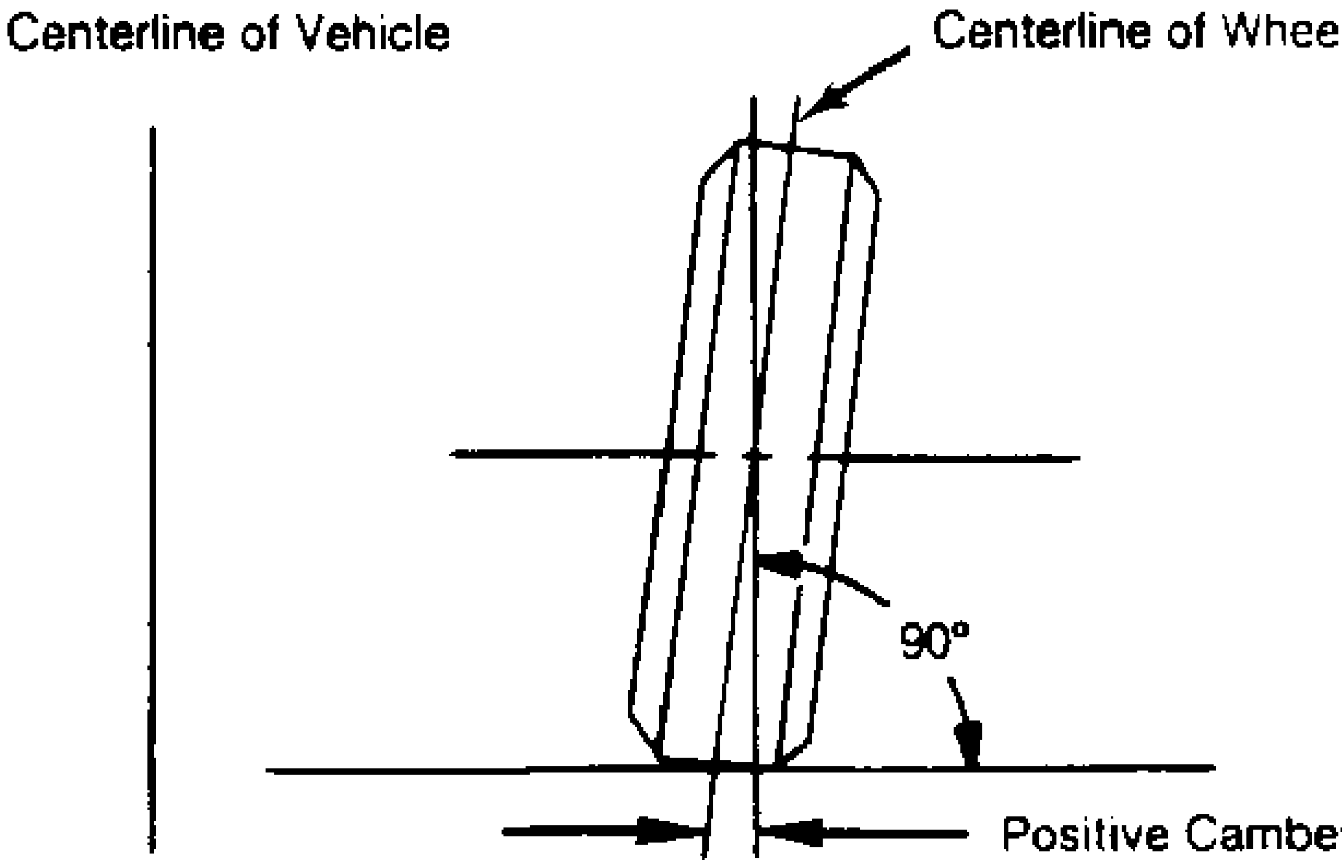


Fig. 2: Adjusting Tie Rod Sleeves (Top View)

CAMBER

1) Camber is the tilting of the wheel, outward at either top or bottom, as viewed from front of vehicle. See Fig. 3.

2) When wheels tilts outward at the top (from centerline of vehicle), camber is positive. When wheels tilt inward at top, camber is negative. Amount of tilt is measured in degrees from vertical.

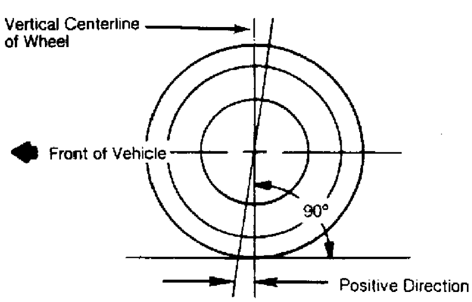


26696
Fig. 3: Determining Camber Angle

CASTER

1) Caster is tilting of front steering axis either forward or backward from vertical, as viewed from side of vehicle. See Fig. 4.

2) When axis is tilted backward from vertical, caster is positive. This creates a trailing action on front wheels. When axis is tilted forward, caster is negative, causing a leading action on front wheels.



26697
Fig. 4: Determining Caster Angle

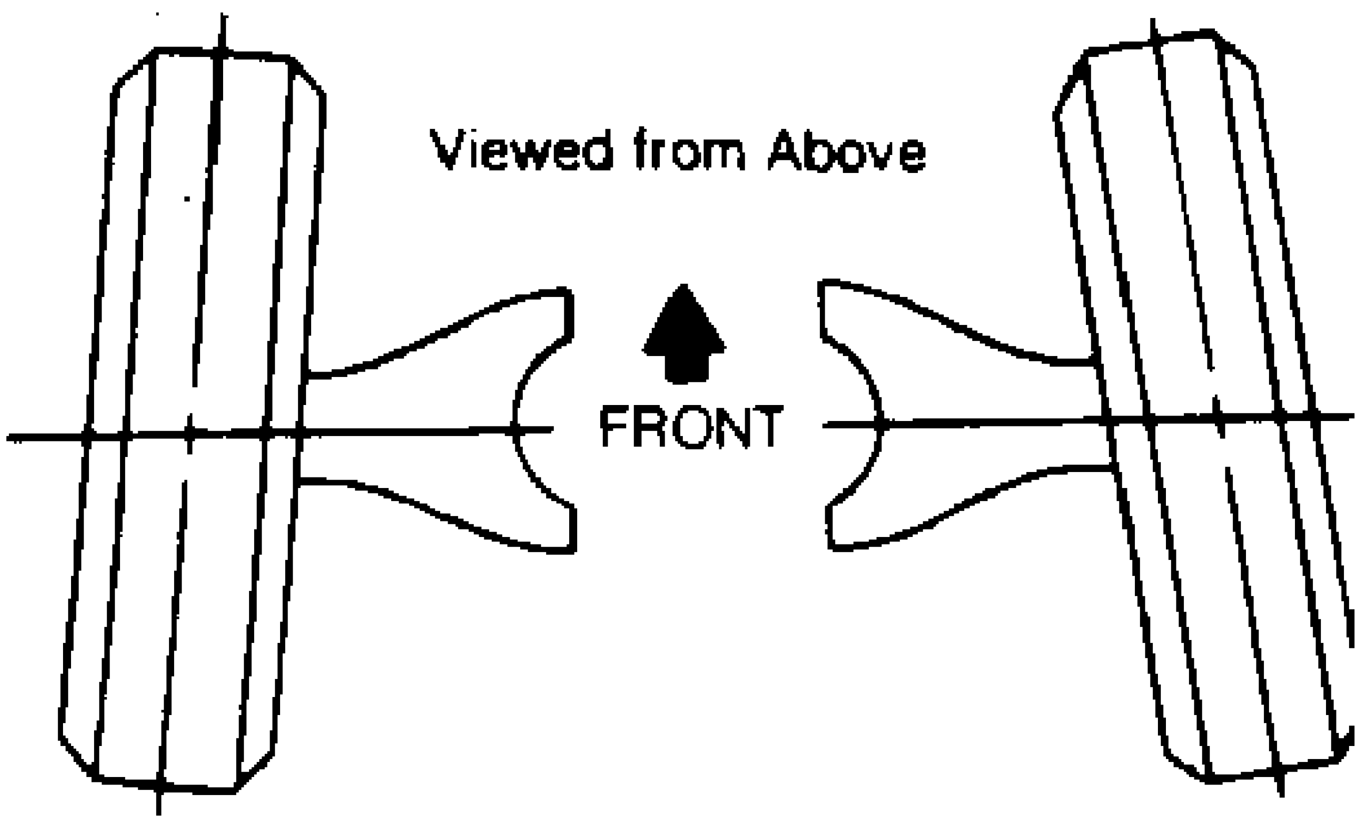
TOE-IN ADJUSTMENT

Toe-in is the width measured at the rear of the tires subtracted by the width measured at the front of the tires at about spindle height. A positive figure would indicate toe-in and a negative figure would indicate toe-out. If the distance between the front and rear of the tires is the same, toe measurement would be zero. To adjust:

1) Measure toe-in with front wheels in straight ahead position and steering wheel centered. To adjust toe-in, loosen clamps and turn adjusting sleeve or adjustable end on right and left tie rods. See Figs. 2 and 5.

2) Turn equally and in opposite directions to maintain steering wheel in centered position. Face of tie rod end must be parallel with machined surface of steering rod end to prevent binding.

3) When tightening clamps, make certain that clamp bolts are positioned so there will be no interference with other parts throughout the entire travel of linkage.



26698

Fig. 5: Wheel Toe-In (Dimension A Less Dimension B)

TOE-OUT ON TURNS

1) Toe-out on turns (turning radius) is a check for bent or damaged parts, and not a service adjustment. With caster, camber, and toe-in properly adjusted, check toe-out with weight of vehicle on wheels.

2) Use a full floating turntable under each wheel, repeating test with each wheel positioned for right and left turns. Incorrect toe-out generally indicates a bent steering arm. Replace arm, if necessary, and recheck wheel alignment.

STEERING AXIS INCLINATION

1) Steering axis inclination is a check for bent or damaged parts, and not a service adjustment. Vehicle must be level and camber should be properly adjusted. See Fig. 6.

2) If camber cannot be brought within limits and steering axis inclination is correct, steering knuckle is bent. If camber and steering axis inclination are both incorrect by approximately the same amount, the upper and lower control arms are bent.

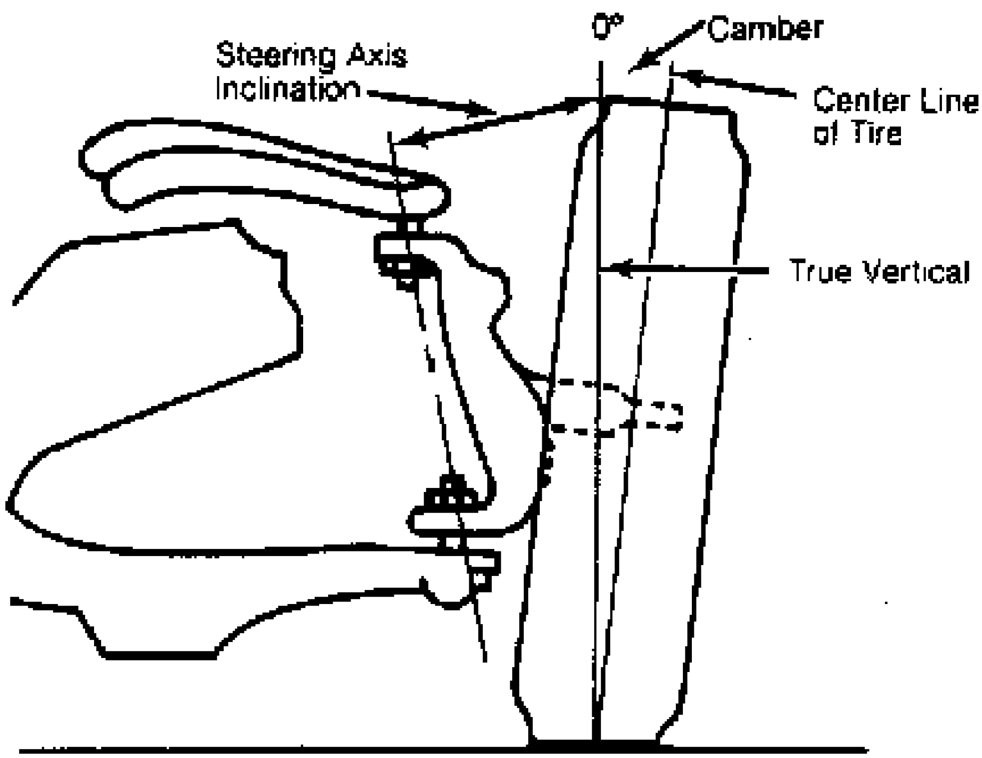


Fig. 6: Checking Steering Axis Inclination

1993 WHEEL ALIGNMENT
Toyota Specifications & Procedures

Celica

WHEEL ALIGNMENT PROCEDURES

TURNING ANGLE

Turn steering wheel fully right and then left, and observe turning radius on both wheels. If turning radius is incorrect, inspect and replace any damaged or worn front suspension components. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article.

CAMBER ADJUSTMENT

Front Suspension

1) Check tires for wear and improper inflation. Inspect front wheel bearings for looseness. Check wheel runout. Wheel runout should not exceed 0.04" (1.0 mm).

2) Inspect front suspension components for looseness. Ensure front shock absorbers work properly. Measure vehicle riding height. See RIDING HEIGHT ADJUSTMENT article in this section.

3) Measure camber of both front wheels. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article. If camber is not within specification, inspect and replace any damaged or worn front suspension components. Camber is not adjustable.

Rear Suspension

Check tires for wear and improper inflation. Measure camber of both rear wheels. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article. If camber is not within specification, inspect and replace any damaged or worn rear suspension components. Camber is not adjustable.

CASTER ADJUSTMENT

Front Suspension

1) Measure riding height, camber, and steering axis inclination. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article. If adjustment is necessary, see appropriate adjustment procedure.

2) Measure caster of both front wheels. If caster is not within specification, inspect and replace any damaged or worn front suspension components. Caster is not adjustable.

STEERING AXIS/KING PIN INCLINATION

Measure riding height and camber. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article. If adjustment is necessary, see appropriate adjustment procedure. Measure steering axis inclination of both front wheels. If steering axis inclination is not within specification, inspect and replace any damaged or worn front suspension components. See WHEEL ALIGNMENT SPECIFICATIONS table at the end of this article. Steering axis/king pin inclination is not adjustable.

TOE-IN ADJUSTMENT

Front Suspension

Measure riding height, camber, steering axis inclination, and caster. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article. If adjustment is necessary, see appropriate adjustment procedure. Set front wheels to straight-ahead position. Bounce both ends of vehicle several times to settle suspension. Measure toe-in. If necessary, adjust toe-in by changing length of tie rods.

Rear Suspension

1) Measure rear camber. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article. If adjustment is necessary, see appropriate adjustment procedure.

2) Bounce both ends of vehicle several times to settle suspension. On Celica, measure distance between each wheel rim and corner of cam bracket. See Fig. 1. Ensure both distances are the same.

3) If toe-in is not within specification, adjust toe-in by rotating rear toe adjuster cam. See WHEEL ALIGNMENT SPECIFICATIONS table at end of article.

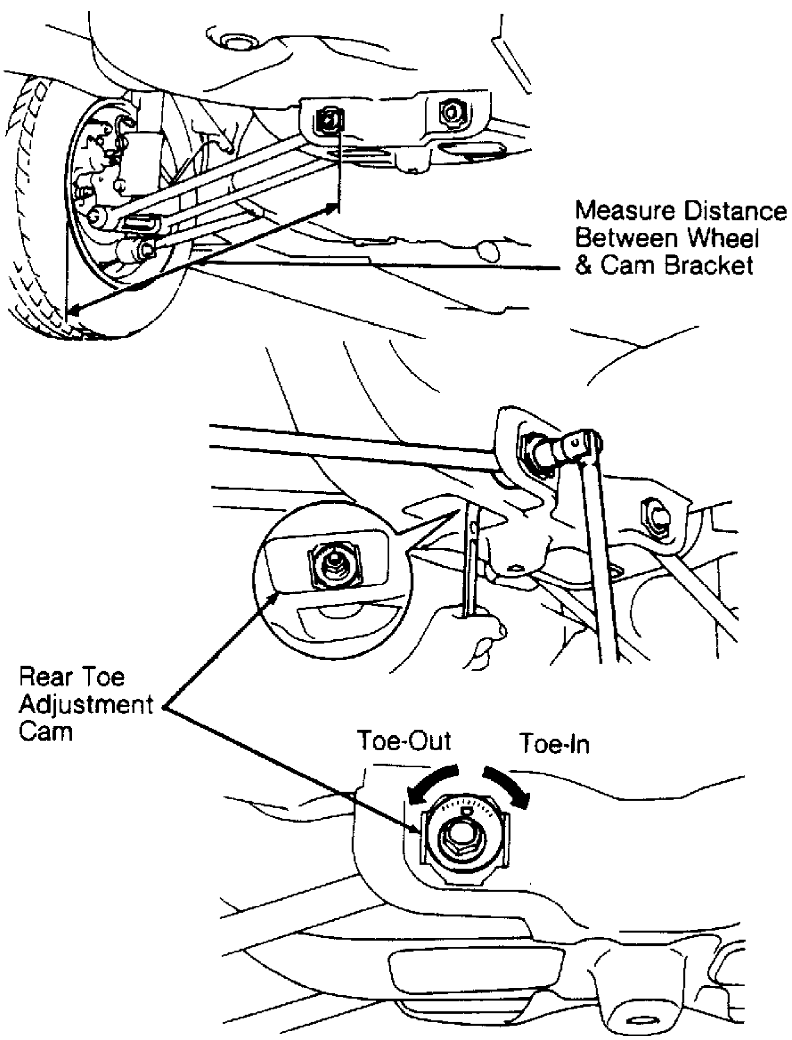


Fig. 1: Adjusting Rear Toe-In
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Rear Toe Adjuster Cams	83 (113)
Tie Rod Lock Nuts	41 (56)
Wheel Lug Nuts	76 (103)

WHEEL ALIGNMENT SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS TABLE

Application	Preferred	Range
Camber (1)		
Front	-0.17	-0.92 To 0.58
Rear	-1.25	-2 To -0.5
Caster (1)	0.92	0.17 To 1.67
Steering Axis		
Inclination (1)	14.17	.....
Toe-In (2)		
Front	0 (0)	-0.08 To 0.08 (-2 To 2)
Rear	0.2 (5)	0.12 To 0.28 (3 To 7)
Toe-In (1)		
Front	0	-0.2 To 0.2
Rear	0.5	0.3 To 0.7
Toe-Out On Turns (1)		
Inner	33.5	.....
Outer	29.5	.....

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WIPER/WASHER SYSTEM

1993 Toyota Celica

1993 ACCESSORIES/SAFETY EQUIPMENT
Toyota Wiper/Waher Systems

Camry, Celica, Corolla, Land Cruiser, MR2, Paseo, Pickup, Previa, Supra, Tercel, T100, 4Runner

WARNING: Camry, Celica, Corolla, MR2, Paseo, Previa, Supra and Tercel are equipped with a driver's side air bag. Use extreme caution while servicing components on steering column. Ensure ignition switch is in LOCK position and negative battery cable is disconnected for at least one minute before starting service. DO NOT apply electrical power to any component on steering column without disconnecting air bag control unit. Information labels are attached to air bag components. Follow all notices on labels. Use only DVOM with minimum of 10-k/ohms impedance to check ANY circuit.

DESCRIPTION & OPERATION

All models are equipped with 2-speed wiper motors. An intermittent wiper system is optional. Front wiper motors are protected by an internal circuit breaker. Celica, Corolla, Land Cruiser, Previa, Supra and 4Runner are equipped with rear wipers.

TESTING

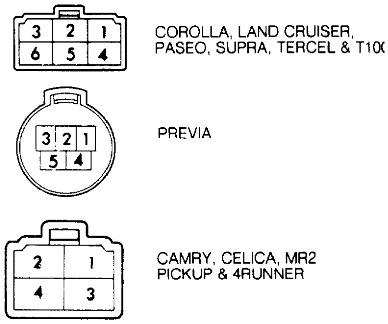
FRONT WIPER MOTOR TEST

Camry, Celica, MR2, Pickup & 4Runner

1) Using 12-volt battery, connect jumper wire from positive battery terminal to wiper motor terminal No. 2. See Fig. 1. Connect another jumper wire between negative battery terminal and wiper motor body or motor ground wire location at mounting bolt hole. Motor should operate at low speed.

2) Remove jumper wire from terminal No. 2. Reconnect jumper wire to wiper motor terminal No. 1. Motor should operate at high speed. Remove jumper wire from terminal No. 1 and reconnect jumper wire to wiper motor terminal No. 2. With motor running at low speed, stop motor at any position except PARK position by disconnecting jumper wire from terminal No. 2. Install another jumper wire between wiper motor terminals No. 2 and 3.

3) Ensure motor body ground is still connected to negative battery terminal. Connect positive battery terminal jumper wire to wiper motor terminal No. 4. Motor should start running and then stop at PARK position. Replace motor if operation is not as described.



93F84660
Fig. 1: Front Wiper Motor Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

All Other Models

1) Using 12-volt battery, connect jumper wire from positive battery terminal to wiper motor terminal No. 3. See Fig. 1. Connect another jumper wire between negative battery terminal and wiper motor terminal No. 1. Motor should operate at low speed.

2) Remove jumper wire from terminal No. 3. Reconnect positive battery terminal jumper wire to wiper motor terminal No. 2. Motor should operate at high speed.

3) Remove jumper wire from terminal No. 2 and reconnect jumper wire to wiper motor terminal No. 3. With motor running at low speed, stop motor at any position except PARK position by disconnecting jumper wire from terminal No. 3. Install another jumper wire between wiper motor terminals No. 3 and 4 on Previa, or terminals No. 3 and 5 on all other models.

4) Ensure motor terminal No. 1 (ground terminal) is still connected to battery negative terminal. Connect positive battery terminal jumper wire to wiper motor terminal No. 5 on Previa, or terminal No. 6 on all other models. Motor should start running and then stop at the PARK position. Replace motor if operation is not as described.

FRONT WIPER RELAY TEST

Previa

1) Ensure wiper motor operation is correct. See FRONT WIPER MOTOR TEST. If motor operates correctly when tested separately from switch, check wiper switch and front wiper relay. See FRONT WIPER SWITCH TEST. For front relay location, see Fig. 2.

2) Check front wiper relay. Using an ohmmeter, check continuity between relay terminals No. 1 and 4. See Fig. 3. No continuity should exist. Connect ohmmeter leads to relay terminals No. 1 and 3. Continuity should exist. If continuity is not as described, replace relay.

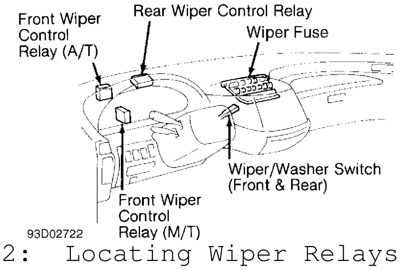


Fig. 2: Locating Wiper Relays (Previa)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

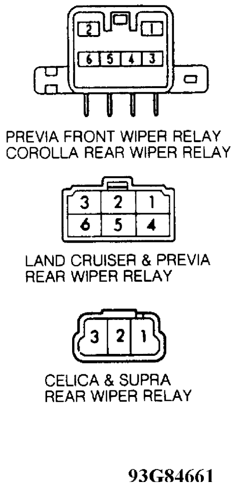


Fig. 3: Front & Rear Wiper Relay Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FRONT WIPER SWITCH TEST

With wiper switch in specified position, ensure continuity exists between terminals listed. See WIPER SWITCH CONTINUITY TEST table. See Fig. 4. Replace wiper switch assembly if continuity is not as specified.

WIPER SWITCH CONTINUITY TEST TABLE

Switch Position	(1) Terminals
Camry, Celica & MR2	
Off (Normal)	B4 & B7
Off (Mist)	B7 & B18
Intermittent (Normal)	B4 & B7
Intermittent (Mist)	B7 & B18
Low (Normal)	B7 & B18
Low (Mist)	B7 & B18
High (Normal)	B13 & B18
High (Mist)	B7, B13 & B18
Corolla	
Mist	B7 & B18
Off	B4 & B7
Intermittent	B4 & B7
Low	B7 & B18
High	B13 & B18
Land Cruiser	
Off	B4 & B7
Intermittent	B4 & B7
Low	B7 & B18
High	B13 & B18
Paseo & Tercel	
Intermittent	1 & 6
Mist	1 & 5
Off	1 & 6
Low	1 & 5
High	2 & 5
Pickup, T100 & 4Runner	
Intermittent	A7 & A8
Mist	A4 & A8
Off	A7 & A8
Low	A4 & A8

High	A4 & A9
Previa	
Off	B4 & B7
Intermittent	B4 & B7; B12 & B16
Low	B7 & B18
High	B13 & B18
Supra	
Off	B4 & B7
Off & Mist	B7 & B18
Intermittent	B4 & B7
Low	B7 & B18
Low & Mist	B7 & B18
Intermittent & Mist	B7 & B18
High	B13 & B18
High & Mist	B7 & B13; B13 & B18

(1) - See Fig. 4.

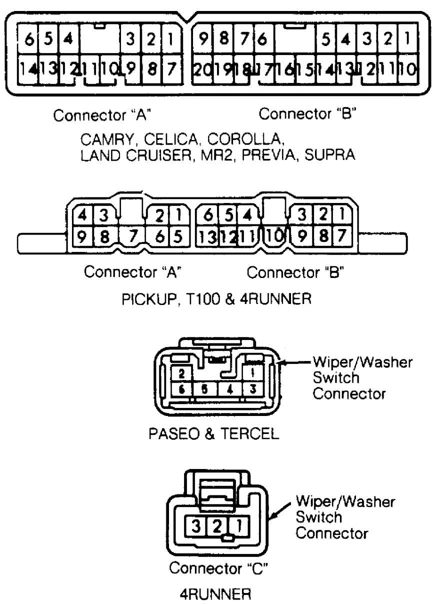


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Fig. 4: Combination Switch Connectors For Wiper ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FRONT WASHER SWITCH TEST

With washer switch in specified position, ensure continuity exists between terminals listed. See WASHER SWITCH CONTINUITY TEST table. See Fig. 4. Replace complete wiper switch assembly if continuity is not as specified.

WASHER SWITCH CONTINUITY TEST TABLE

Switch Position	(1) Terminals	Continuity
Paseo & Tercel		
Off	1, 2, 3, 4, 5 & 6	No
On	3 & 4	Yes
Pickup, T100 & 4Runner		

Off	A1 & A2	No
On	A1 & A2	Yes
All Others		
Off	B8 & B16	No
On	B8 & B16	Yes

(1) - See Fig. 4.

REAR WIPER MOTOR TEST

Celica & Supra

1) Disconnect wiring connector from wiper motor. Using 12-volt battery, connect jumper wire from positive battery terminal to wiper motor terminal No. 1. See Fig. 5. Using another jumper wire, connect wiper motor terminal No. 3 and motor body to negative battery terminal. Motor should operate.

2) To check automatic PARK operation, with motor running, motor should stop by disconnecting jumper wire from terminal No. 3. To check intermittent operation, connect jumper wire from negative battery terminal to wiper motor terminal No. 2. Motor should operate intermittently for about 9-15 seconds. Replace motor and relay as a complete assembly if operation is not as described.

Corolla

Disconnect wiring connector from wiper motor. Using 12-volt battery, connect jumper wire from positive battery terminal to wiper motor terminal No. 3. See Fig. 5. Using another jumper wire, connect wiper motor body (ground) to negative battery terminal. Motor should operate. Replace motor if operation is not as described.

Land Cruiser & Previa

1) Disconnect wiring connector from wiper motor. Using 12-volt battery, connect jumper wire from positive battery terminal to wiper motor terminal No. 3. See Fig. 5. Using another jumper wire, connect wiper motor terminal No. 2 to negative battery terminal. Motor should operate.

2) To check automatic PARK operation, with motor running, stop motor operation anywhere except PARK position by removing power from terminal No. 3. Install another jumper wire between terminals No. 3 and 4. Connect jumper wire from positive battery terminal to wiper motor terminal No. 1. Ensure motor operates and stops at PARK position. Replace motor if operation is not as described.

4Runner

Disconnect wiring connector from wiper motor. Using 12-volt battery, connect jumper wire from negative battery terminal to wiper motor terminal No. 3. See Fig. 5. Using another jumper wire, connect wiper motor terminal No. 1 to positive battery terminal. Motor should operate in clockwise direction. Reverse jumper wires. Motor should operate in counterclockwise direction. Replace motor if operation is not as described.

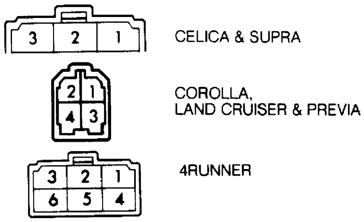

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Fig. 5: Rear Wiper Motor Terminal ID
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REAR WIPER RELAY TEST

NOTE: Testing information is not available from manufacturer for all models. For relay locations, see REAR WIPER RELAY LOCATION table.

Corolla

Using an ohmmeter, check continuity between relay terminals No. 3 and 4. See Fig. 3. No continuity should exist. Connect ohmmeter leads to relay terminals No. 4 and 5. Continuity should exist. If continuity is not as described, replace relay.

Land Cruiser & Previa

Using an ohmmeter, check continuity between relay terminals No. 1 and 3. See Fig. 3. No continuity should exist. Connect ohmmeter leads to relay terminals No. 2 and 3. Continuity should exist. If continuity is not as described, replace relay.

REAR WIPER RELAY LOCATION TABLE

Model	Location
Celica & Supra	Inside Back Door At Rear Wiper Motor
Corolla	Inside Back Door, To Right Of Motor
Land Cruiser	Inside Back Door, To Left Of Motor
Previa	Behind Center Of Instrument Cluster
4Runner	Behind Interior Left Rear Side Panel, Near Rear Door

REAR WIPER SWITCH TEST

With wiper switch in specified position, ensure continuity exists between terminals listed. See REAR WIPER/WASHER SWITCH CONTINUITY TEST table. See Fig. 4. Replace complete wiper switch if continuity is not as specified.

REAR WIPER/WASHER SWITCH CONTINUITY TEST TABLE

Switch Position	Terminals	Continuity
Celica, Corolla, Land Cruiser Supra & Previa (1)		
Off	B1, B2, B10, B16	No
Intermittent	B10 & B16	Yes
On	B1 & B16	Yes
Wash		

W/Wiper On	B2 & B16	Yes
W/Intermittent On	B1, B2 & B16	Yes
4Runner (1)		
Off	A1, C1, C2 & C3	No
Intermittent	A1 & C2	Yes
On	A1 & C1	Yes
Wash W/Wiper On	A1, C1 & C3	Yes
Wash Only	A1 & C3	Yes

(1) - See Fig. 4.

REMOVAL & INSTALLATION

WARNING: Camry, Celica, Corolla, MR2, Paseo, Previa, Supra and Tercel are equipped with a driver's side air bag. Use extreme caution while servicing components on steering column. Ensure ignition switch is in LOCK position and negative battery cable is disconnected for at least one minute before starting service. DO NOT apply electrical power to any component on steering column without disconnecting air bag control unit. Information labels are attached to air bag components. Follow all notices on labels. Use only DVOM with minimum of 10-k/ohms impedance to check any circuit.

FRONT WIPER SWITCH

NOTE: Wiper switch is component of combination switch, mounted to steering column. For further information and/or illustrations on removal procedure, see COMBINATION SWITCH under REMOVAL & INSTALLATION in appropriate STEERING COLUMN SWITCHES article listed below in the ACCESSORIES/SAFETY EQUIPMENT section.

* STEERING COLUMN SWITCHES (for Camry).
* STEERING COLUMN SWITCHES (for Celica).
* STEERING COLUMN SWITCHES (for Corolla).
* STEERING COLUMN SWITCHES (for Land Cruiser).
* STEERING COLUMN SWITCHES (for MR2).
* STEERING COLUMN SWITCHES (for Paseo).
* STEERING COLUMN SWITCHES (for Pickup).
* STEERING COLUMN SWITCHES (for Previa).
* STEERING COLUMN SWITCHES (for Supra).
* STEERING COLUMN SWITCHES (for T100).
* STEERING COLUMN SWITCHES (for Tercel).
* STEERING COLUMN SWITCHES (for 4Runner).

Removal & Installation (All Models)

1) Disconnect negative battery cable. To access combination switch connector, remove instrument panel lower finish panel under steering column. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION in appropriate INSTRUMENT PANELS article listed below in the ACCESSORIES/SAFETY EQUIPMENT section. Remove steering column upper and lower covers. Remove steering wheel. See STEERING WHEEL under REMOVAL & INSTALLATION.

* INSTRUMENT PANEL (for Camry).
* INSTRUMENT PANEL (for Celica).
* INSTRUMENT PANEL (for Corolla).
* INSTRUMENT PANEL (for Land Cruiser).
* INSTRUMENT PANEL (for MR2).
* INSTRUMENT PANEL (for Paseo).

*   INSTRUMENT PANEL (for Pickup).
*   INSTRUMENT PANEL (for Previa).
*   INSTRUMENT PANEL (for Supra).
*   INSTRUMENT PANEL (for T100).
*   INSTRUMENT PANEL (for Tercel).
*   INSTRUMENT PANEL (for 4Runner).

2) Locate wiper/washer switch wire terminal positions installed into combination switch harness connector. See Fig. 4. Lift tab locks on combination switch connector. See Fig. 6.

3) Using miniature screwdriver, release wire terminal securing tab inside connector. See Fig. 6. Pull wire(s) from connector and through harness jacket tubing. Remove wiper switch retaining screws from rear of combination switch body and remove switch. See Fig. 7.

Installation

To install, reverse removal procedure. When installing wiper switch wire terminals to harness connector, push inward on wire terminal until terminal clicks into place.

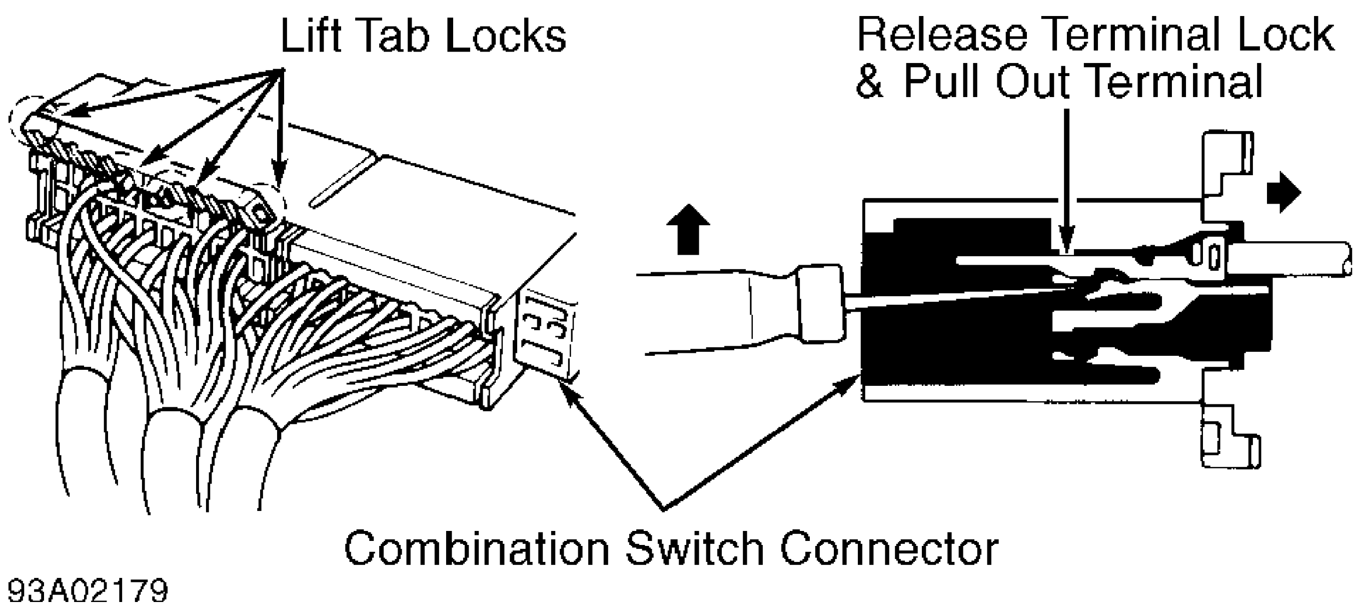

Fig. 6: Releasing Wire Terminal Inside Combination Connector
Courtesy of Toyota Motor Sales, U.S.A., Inc.

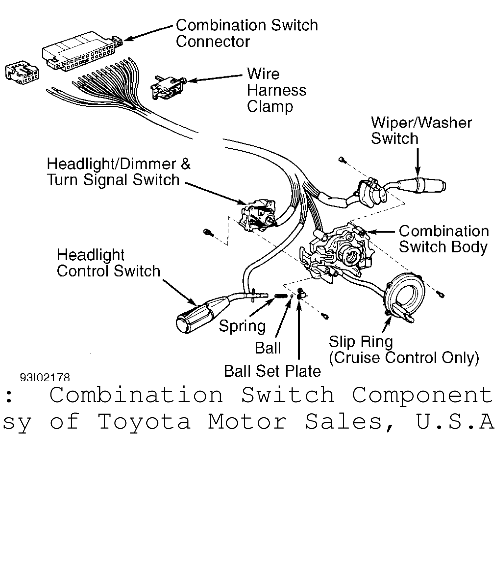

Fig. 7: Combination Switch Component ID (Typical)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REAR WIPER SWITCH

Removal & Installation (All Models)

Switch is integral part of wiper switch mounted to combination switch on steering column. See FRONT WIPER SWITCH under REMOVAL & INSTALLATION.

STEERING WHEEL

Removal (Without Air Bag)

1) On rear of steering wheel, locate and remove retaining screw securing horn pad. Remove horn pad enough to disconnect horn electrical connector(s).

2) Remove steering wheel lock nut and washer. Make alignment mark on steering shaft and steering wheel for installation reference. Install suitable steering wheel puller and pull steering wheel from shaft.

Installation

Align reference marks on steering shaft and steering wheel. Tighten steering wheel lock nut to 25 ft. lbs. (34 N.m). Install horn pad.

Removal (With Air Bag)

1) Ensure front wheels are in straight ahead position. Place ignition switch in LOCK position and remove key. Disconnect negative battery cable. Remove 2 screw covers from outer sides of steering wheel. Using Torx Wrench (T30), loosen 4 air bag pad retaining screws until screw head is snug against screw case. See Fig. 8.

2) Carefully pull air bag pad away from steering wheel enough to unlock and disconnect air bag electrical connector. DO NOT pull on electrical connector or wiring. Store air bag pad aside with pad facing upward.

3) Remove steering wheel lock nut and washer from steering shaft. Make alignment mark on steering shaft and steering wheel for installation reference. Using appropriate steering wheel puller, pull steering wheel from shaft while guiding spiral cable wire through steering wheel opening.

Installation

1) Ensure front wheels are in straight ahead position. Connect and install spiral cable to combination switch. Turn spiral cable counterclockwise by hand until it is hard to turn. Turn spiral cable clockwise about 2 1/2 turns and align Red mark at bottom with opening.

2) Guide spiral cable through steering wheel opening while installing steering wheel to shaft. Align reference marks on steering shaft and steering wheel. Tighten steering wheel lock nut to 25 ft. lbs. (34 N.m).

3) Connect air bag electrical connector and snap down connector lock. Before installing air bag pad, ensure Torx screws are retracted and snug against screw case. See Fig. 8.

4) Install air bag pad to steering wheel ensuring all wiring is NOT pinched and DOES NOT interfere with moving parts. Tighten 4 Torx screws to 65 INCH lbs. (7.4 N.m). Install screw covers. Connect negative battery cable.

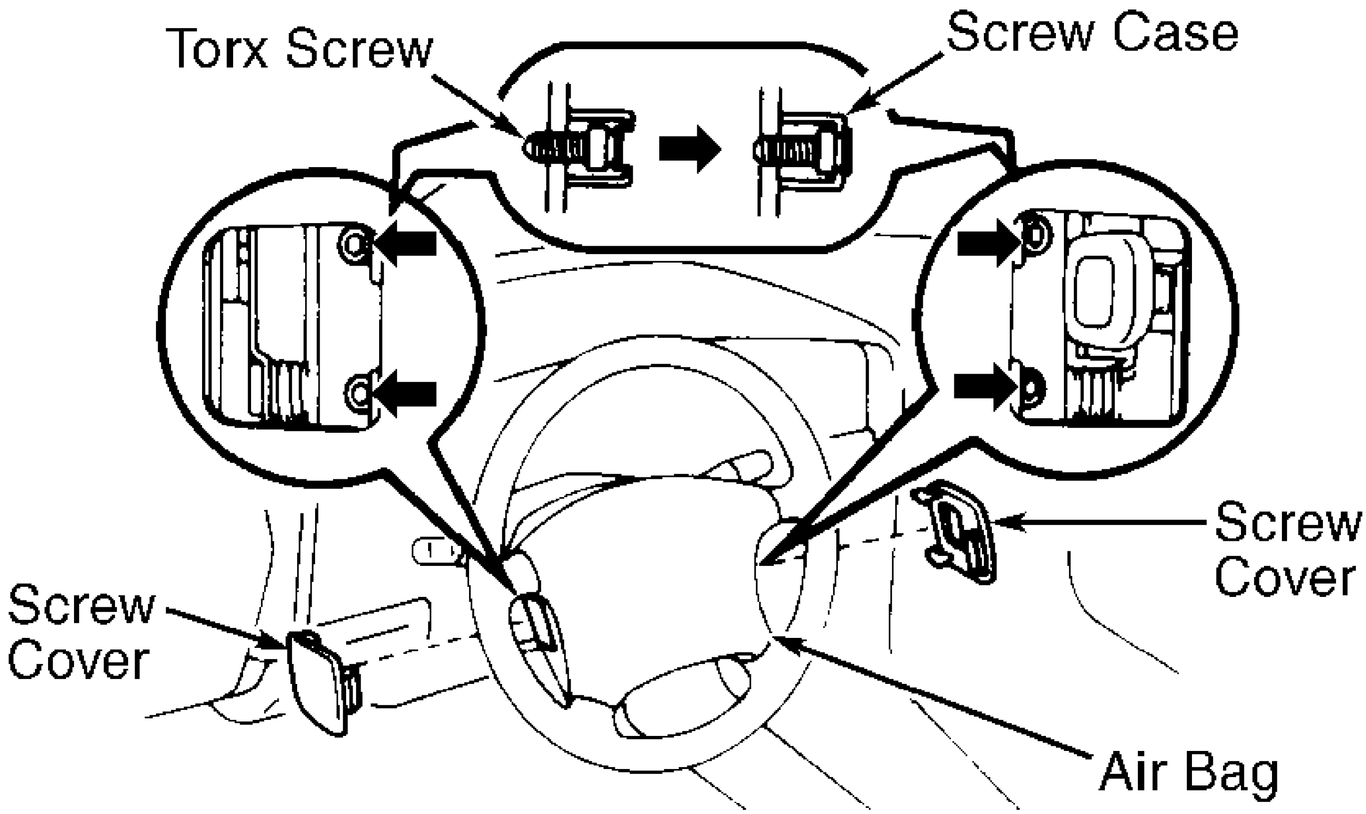

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Fig. 8: Removing Air Bag From Steering Wheel
Courtesy of Toyota Motor Sales, U.S.A., Inc.

WIRING DIAGRAMS

Proceed to appropriate WIRING DIAGRAMS article listed below in WIRING DIAGRAMS section.

* WIRING DIAGRAMS (for 4Runner).
* WIRING DIAGRAMS (for Camry).
* WIRING DIAGRAMS (for Celica).
* WIRING DIAGRAMS (for Corolla).
* WIRING DIAGRAMS (for Land Cruiser).
* WIRING DIAGRAMS (for MR2).
* WIRING DIAGRAMS (for Paseo).
* WIRING DIAGRAMS (for Pickup).
* WIRING DIAGRAMS (for Previa).
* WIRING DIAGRAMS (for Supra).
* WIRING DIAGRAMS (for T100).
* WIRING DIAGRAMS (for Tercel).

WIRING DIAGRAMS

1993 Toyota Celica

1993 WIRING DIAGRAMS
Toyota Wiring Diagrams

Toyota; Celica

IDENTIFICATION

COMPONENT LOCATION MENU

COMPONENT LOCATIONS TABLE

Component	Figure No. (Location)
A/C COMPRESSOR CLUTCH RELAY (AUTO A/C)	11 (D 41)
A/C CONDENSER FAN MOTOR (AUTO A/C)	11 (E 40)
A/C CONDENSER FAN RELAY #2 (AUTO A/C)	11 (D 40)
A/C POWER TRANSISTOR (AUTO A/C)	11 (D 41)
A/C SYSTEM (AUTO)	9 (A-E 32-35)
A/C SYSTEM (MANUAL)	10 (A-E 36-39)
AUTOMATIC TRANSMISSION INDICATOR SWITCH	14 (E 53-54)
ANTI-LOCK BRAKE SYSTEM (ABS)	13 (A-E 48—51)
ALTERNATOR	1 (B 3)
AUTO ANTENNA	14 (E 55)
AUTO TILT AWAY ECU	12 (E 47)
BACK-UP LIGHT SWITCH	16 (D 63)
BATTERY	1 (A 2)
BLOWER RESISTOR (AUTO A/C)	11 (D 43)
CENTER AIRBAG SENSOR ASSEMBLY	12 (E 44)
CHECK CONNECTOR (1.6L)	3 (D 11)
CHECK CONNECTOR (2.0L)	4 (C-D 15)
CHECK CONNECTOR (2.2L A/T)	5 (D-E 19)
CHECK CONNECTOR (2.2L M/T)	6 (D-E 23)
CIRCUIT OPENING RELAY (1.6L)	3 (A 10)
CIRCUIT OPENING RELAY (2.0L)	4 (A 13)
CIRCUIT OPENING RELAY (2.2L A/T)	5 (A 18)
CIRCUIT OPENING RELAY (2.2L M/T)	6 (A 22)
COLD START INJECTOR	1 (B 2)
COMBINATION SWITCH	15 (C-E 59)
CRUISE CONTROL SYSTEM	12 (A-D 44-47)
DEFOGGER SWITCH	14 (A 52)
DIRECTIONAL FLASHER	8 (D 30)
DOOR LOCK SYSTEM	16 (D-E 60-62)
ECM (1.6L)	3 (B-D 8)
ECM (2.0L)	4 (A-E 12)
ECM (2.2L A/T)	5 (A-E 16)
ECM (2.2L M/T)	6 (B-E 20)
ELECTRONICALLY CONTROLLED TRANSMISSION (ECT) PATTERN SELECT SWITCH	14 (C 52)
EXTRA HIGH SPEED RELAY (AUTO A/C)	11 (D 41)
FOG LIGHT SWITCH	1 (C-D 2)
FUEL SENDER	15 (A-B 59)
FUSIBLE LINK BOX	2 (C 5-6)
HAZARD SWITCH	15 (E 56)
HEATER RELAY (AUTO A/C)	11 (D 41)
HORNS	1 (C 1)
IGNITER (1.6L)	3 (E 9-10)
IGNITER (2.0L)	3 (D-E 15)
IGNITER (2.2L A/T)	5 (E 18)

IGNITION KEY CYLINDER LIGHT .... 11 (B 40)
IGNITION NOISE FILTER (1.6L) .... 3 (D 10)
IGNITION NOISE FILTER (2.0L) .... 4 (E 14)
IGNITION NOISE FILTER (2.2L A/T) .... 5 (E 17)
IGNITION NOISE FILTER (2.2L M/T) .... 6 (E 21)
IGNITION SWITCH .... 7 (A 24)
J1 JUNCTION CONN .... 11 (B-C 43)
J2 JUNCTION CONN .... 12 (B-C 44)
J3 JUNCTION CONN .... 7 (E 24)
J4 JUNCTION CONN (AUTO A/C) .... 11 (C-D 43)
J5 JUNCTION CONN (AUTO A/C) .... 11 (E 43)
J6 JUNCTION CONN .... 7 (A 27)
JUNCTION BLOCK #1 (J/B #1) .... 7,8 (B-D 25-30)
JUNCTION BLOCK #2 (J/B #2) .... 2 (B-E 5-6)
JUNCTION BLOCK #3 (J/B #3) .... 14 (A-B 53-54)
LEFT DOOR COURTESY SWITCH .... 11 (B 43)
LUGGAGE COMPARTMENT LIGHT .... 11 (A 42)
OVERDRIVE (O/D) MAIN SWITCH .... 14 (C-D 52)
OVERDRIVE (O/D) SOLENOID .... 14 (D 55)
POWER MIRROR SWITCH .... 16 (B 60)
POWER SEAT SWITCH .... 16 (A 60)
POWER WINDOW MASTER SWITCH .... 16 (C-D 62)
RADIATOR FAN MOTOR (AUTO A/C) .... 11 (E 40)
REAR WIPER MOTOR & RELAY .... 15 (C-D 57)
RELAY BLOCK # 2 (R/B #2) .... 8 (A 28)
RELAY BLOCK # 3 (R/B #3) .... 1 (C 3)
RELAY BLOCK # 4 (R/B #4) .... 8 (A-B 29-31)
RELAY BLOCK # 5 (R/B #5) .... 2 (A 5-6)
RETRACT CONTROL RELAY .... 1 (D 3)
RHEOSTAT .... 14 (C 55)
RIGHT DOOR COURTESY SWITCH .... 11 (A 43)
SHIFT LOCK ECU .... 14 (D-E 52)
STARTER .... 1 (A 3)
STOP LIGHT SWITCH .... 12 (B 47, C 47)
SUNROOF SYSTEM .... 16 (A-B 61-62)
TURBOCHARGING PRES SENSOR (2.0L) .... 4 (B 15)
UNLOCK WARNING SWITCH .... 7 (A 24)
WASHER MOTOR .... 1 (E 2)
WIPER MOTOR .... 1 (E 3)

COMPONENT LOCATOR:

A/C COMPRESSOR CLUTCH RELAY (AUTO A/C)	D 41
A/C CONDENSER FAN MOTOR (AUTO A/C)	E 40
A/C CONDENSER FAN RELAY #2 (AUTO A/C)	D 40
A/C POWER TRANSISTOR (AUTO A/C)	D 41
A/C SYSTEM (AUTO)	A-E 32-35
A/C SYSTEM (MANUAL)	A-E 36-39
A/T IND SW	E 53-54
ABS SYSTEM	A-E 48-51
ALTERNATOR	B-3
AUTO ANTENNA	E 55
AUTO TILT AWAY ECU	E 47
BACK-UP LT SW	D 63
BATTERY	A 2
BLOWER RESISTOR (AUTO A/C)	D 43
CENTER AIRBAG SENSOR ASSEMBLY	E 44
CHECK CONN (1.6L)	D 11
CHECK CONN (2.0L)	C-D 15
CHECK CONN (2.2L A/T)	D-E 19
CHECK CONN (2.2L M/T)	D-E 23
CIRCUIT OPENING RELAY (1.6L)	A 10
CIRCUIT OPENING RELAY (2.0L)	A 13
CIRCUIT OPENING RELAY (2.2L A/T)	A 18
CIRCUIT OPENING RELAY (2.2L M/T)	A 22
COLD START INJECTOR	B 2
COMBINATION SW	C-E 59
CRUISE CONTROL SYSTEM	A-D 44-47
DEFOG SW	A 52
DIR FLASHER	D 30
DOOR LOCK SYSTEM	D-E 60-62
ECM (1.6L)	B-D 8
ECM (2.0L)	A-E 12
ECM (2.2L A/T)	A-E 16
ECM (2.2L M/T)	B-E 20
ECT PATTERN SELECT SW	C 52
EXTRA HIGH SPEED RELAY (AUTO A/C)	D 41
FOG LT SW	C-D 2
FUEL SENDER	A 59, B 59
FUSE LINK BOX	C 5-6
HAZARD SW	E 56
HEATER RELAY (AUTO A/C)	D 41
HORNS	C 1
IGNITER (1.6L)	E 9-10
IGNITER (2.0L)	D-E 15
IGNITER (2.2L A/T)	E 18
IGNITION KEY CYLINDER LT	B 40
IGNITION NOISE FILTER (1.6L)	D 10
IGNITION NOISE FILTER (2.0L)	E 14
IGNITION NOISE FILTER (2.2L A/T)	E 17
IGNITION NOISE FILTER (2.2L M/T)	E 21
IGNITION SW	A 24
J1 JUNCTION CONN	B-C 43
J2 JUNCTION CONN	B-C 44
J3 JUNCTION CONN	E 24
J4 JUNCTION CONN (AUTO A/C)	C-D 43
J5 JUNCTION CONN (AUTO A/C)	E 43
J6 JUNCTION CONN	A 27
JUNCTION BLOCK #1 (J/B #1)	B-D 25-30
JUNCTION BLOCK #2 (J/B #2)	B-E 5-6
JUNCTION BLOCK #3 (J/B #3)	A-B 53-54
LEFT DOOR COURTESY SW	B 43
LUGGAGE COMPARTMENT LT	A 42
O/D MAIN SW	C-D 52
O/D SOLENOID	D 55
POWER MIRROR SW	B 60
POWER WINDOW MASTER SW	C-D 62
RADIATOR FAN MOTOR (AUTO A/C)	E 40
REAR WIPER MOTOR & RELAY	C-D 57
RELAY BLOCK #2 (R/B #2)	A 28
RELAY BLOCK #3 (R/B #3)	C 3
RELAY BLOCK #4 (R/B #4)	A-B 29-31
RELAY BLOCK #5 (R/B #5)	A 5-6
RETRACT CONTROL RELAY	D 3
RHEOSTAT	C 55
RIGHT DOOR COURTESY SW	A 43
SHIFT LOCK ECU	D-E 52
STARTER	A 3
STOP LT SW	B 47, C 47
SUNROOF SYSTEM	A-B 61-62
TURBOCHARGING PRES SENSOR (2.0L)	B 15
UNLOCK WARNING SW	A 24
WASHER MOTOR	E 2
WIPER MOTOR	E 3

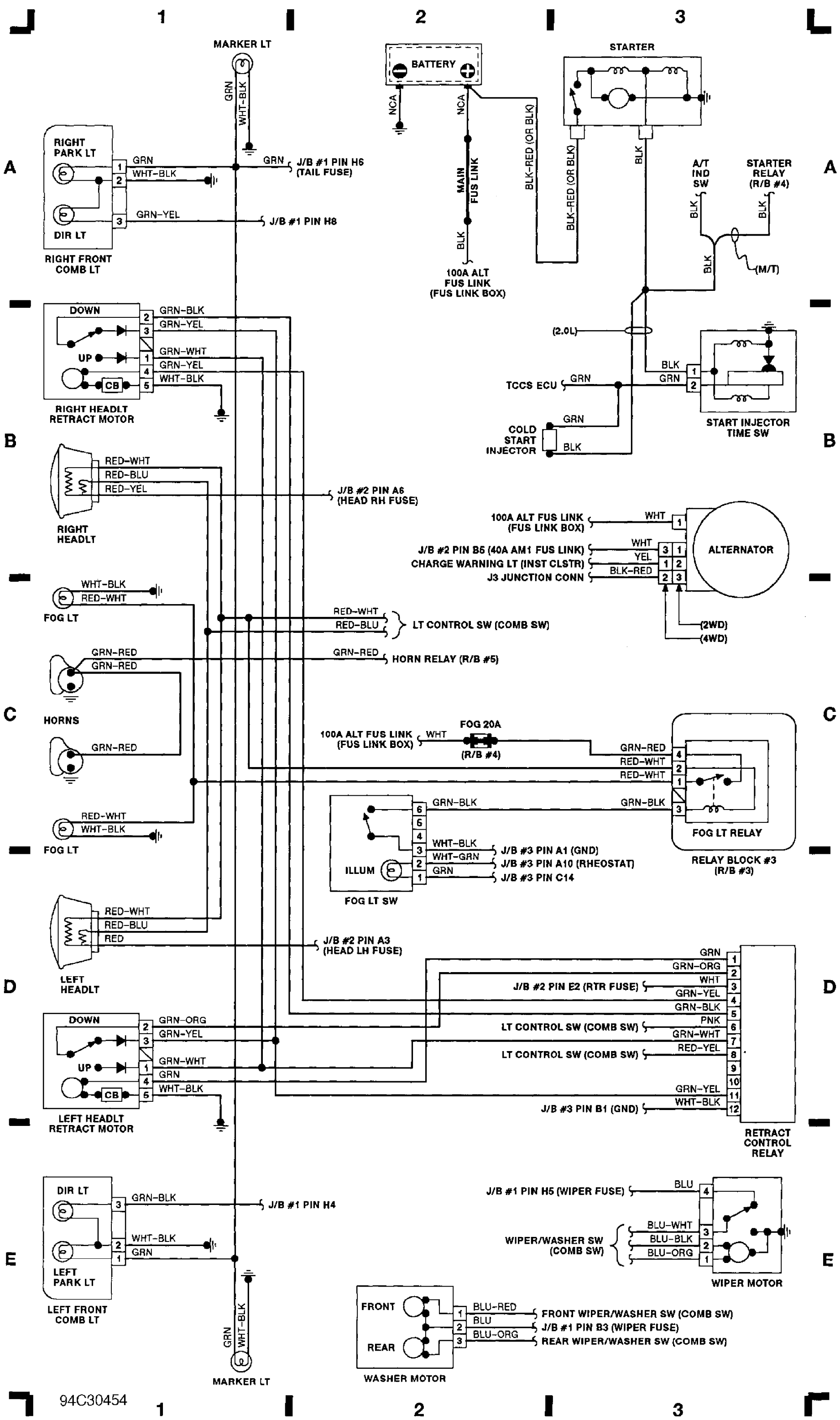

Fig. 1: Engine Compartment, Headlights, Starter (Grid 1-3)

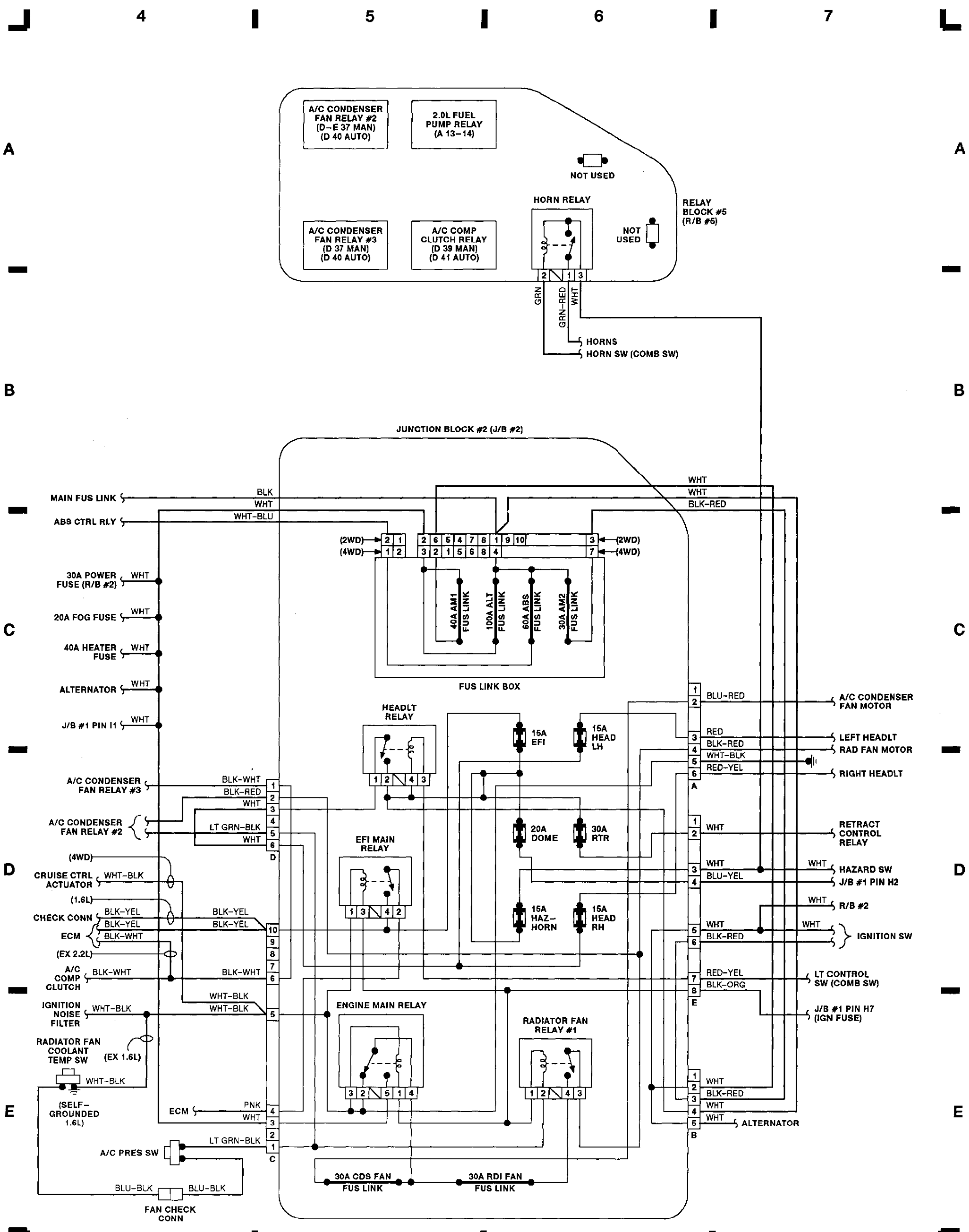

Fig. 2: Junction Block #2, Relay Block #5 (Grid 4-7)

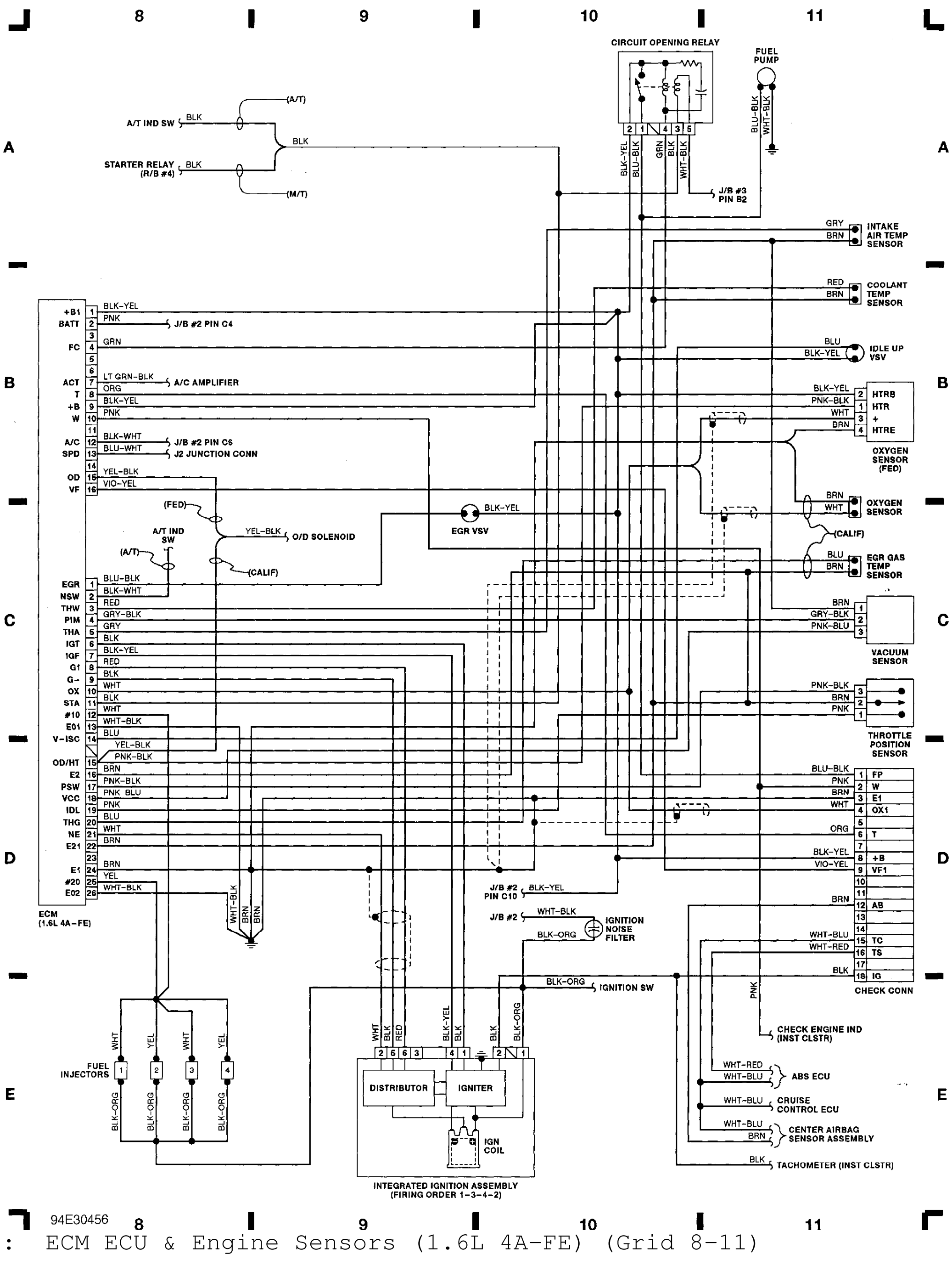

Fig. 3: ECM ECU & Engine Sensors (1.6L 4A-FE) (Grid 8-11)

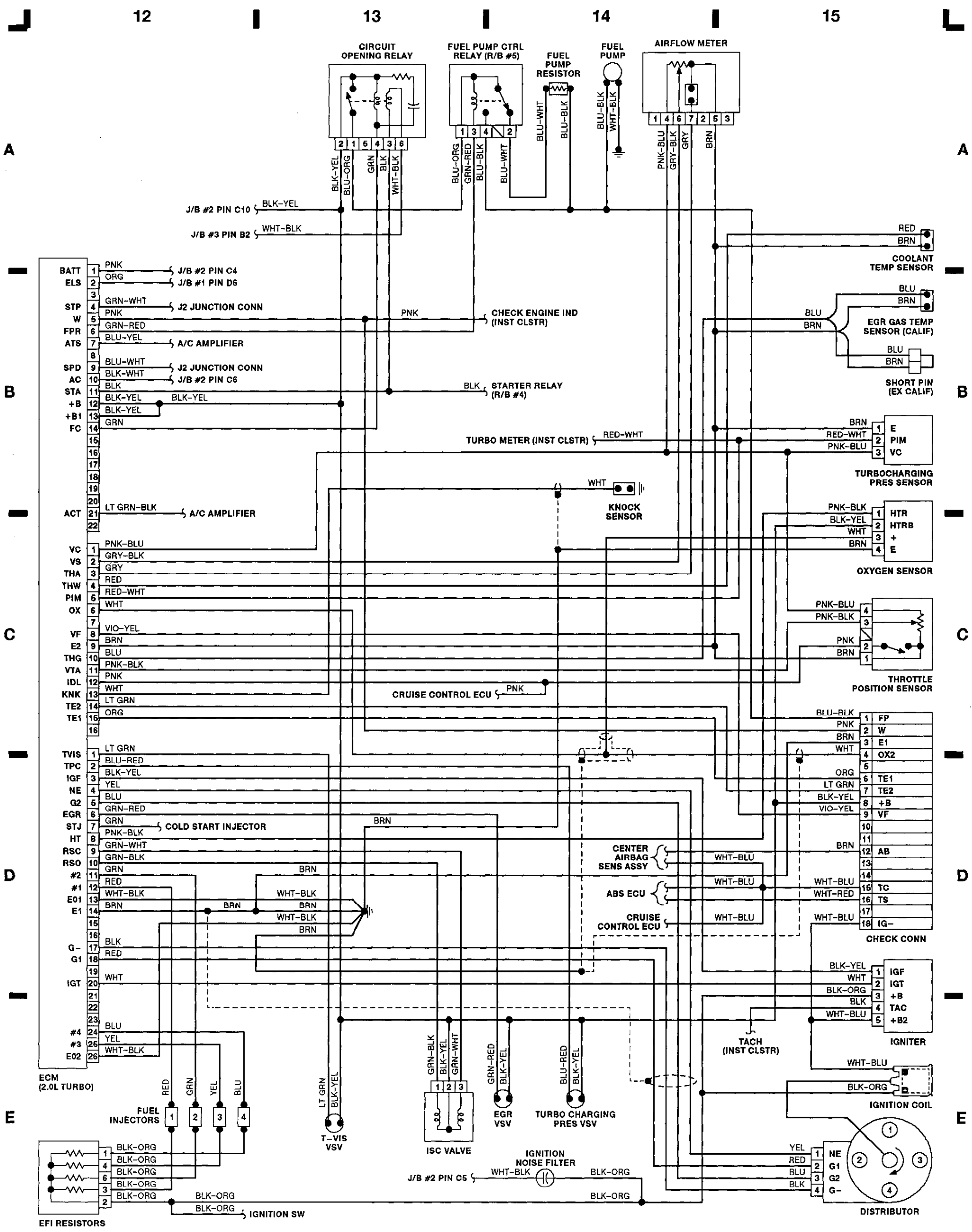

Fig. 4: ECM ECU & Engine Sensors (2.0L Turbo) (Grid 12-15)

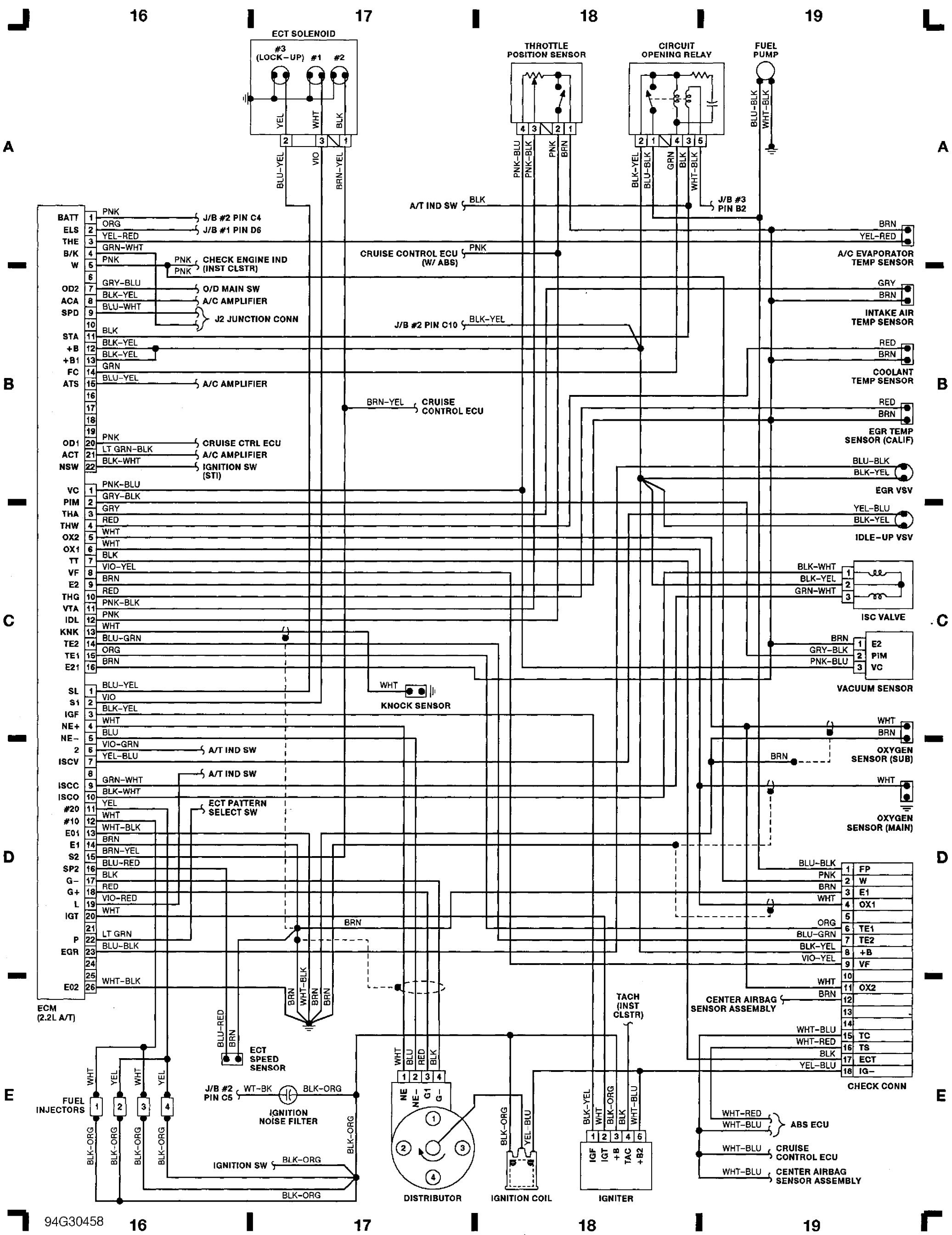

Fig. 5: ECM ECU & Engine Sensors (2.2L A/T) (Grid 16-19)

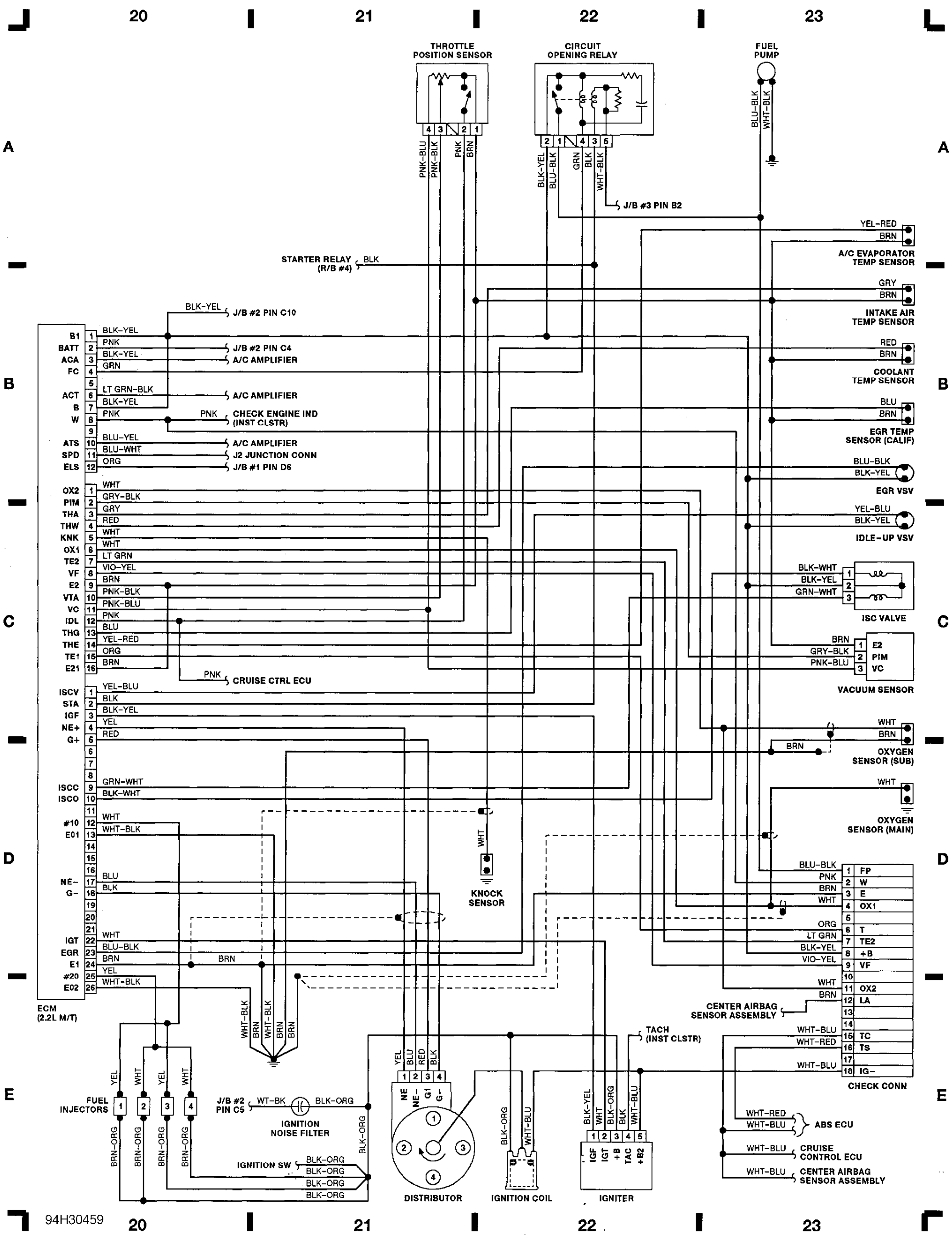

Fig. 6: ECM ECU & Engine Sensors (2.2L M/T) (Grid 20-23)

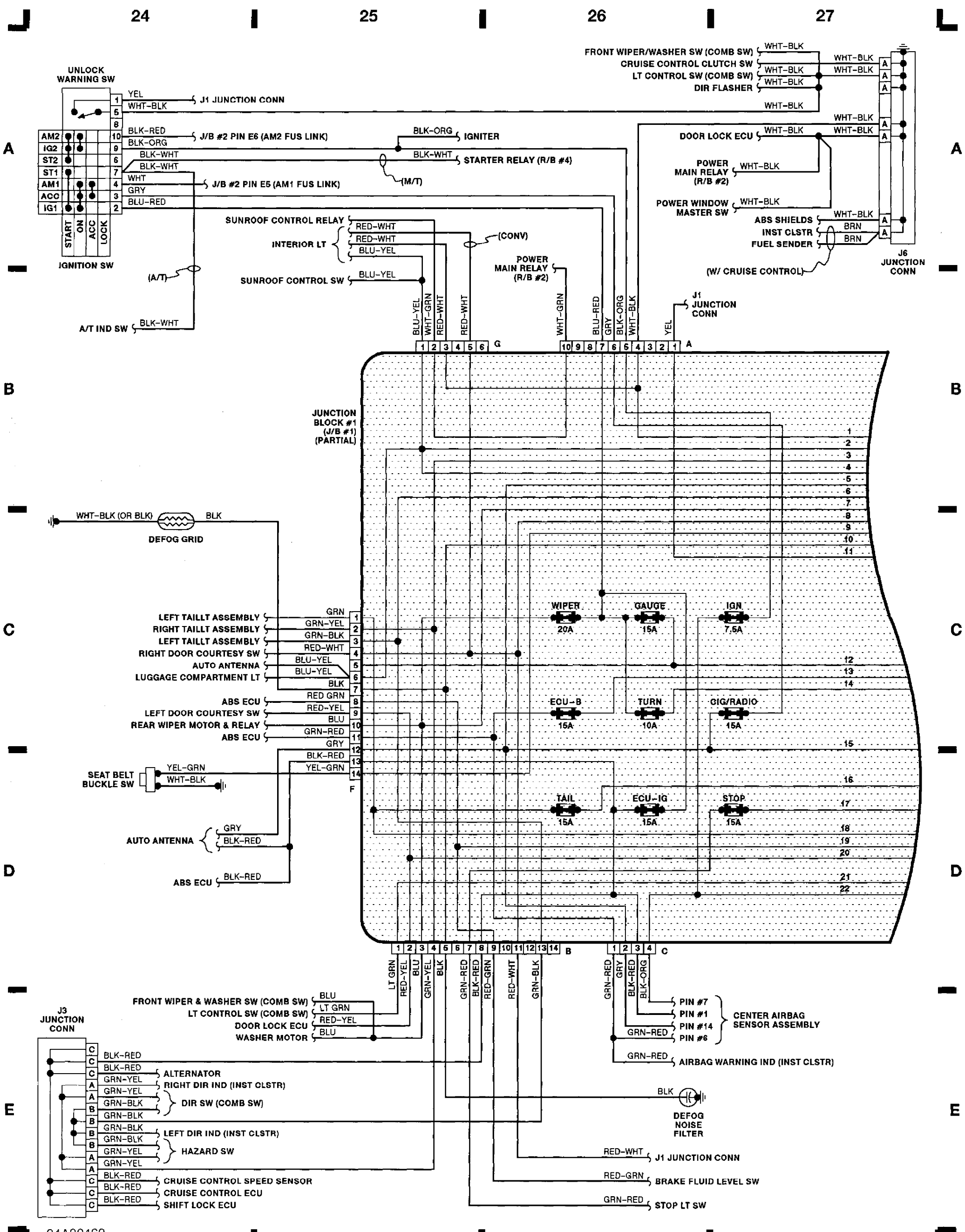

Fig. 7: Junction Block #1 (Partial), Ignition SW (Grid 24-27)

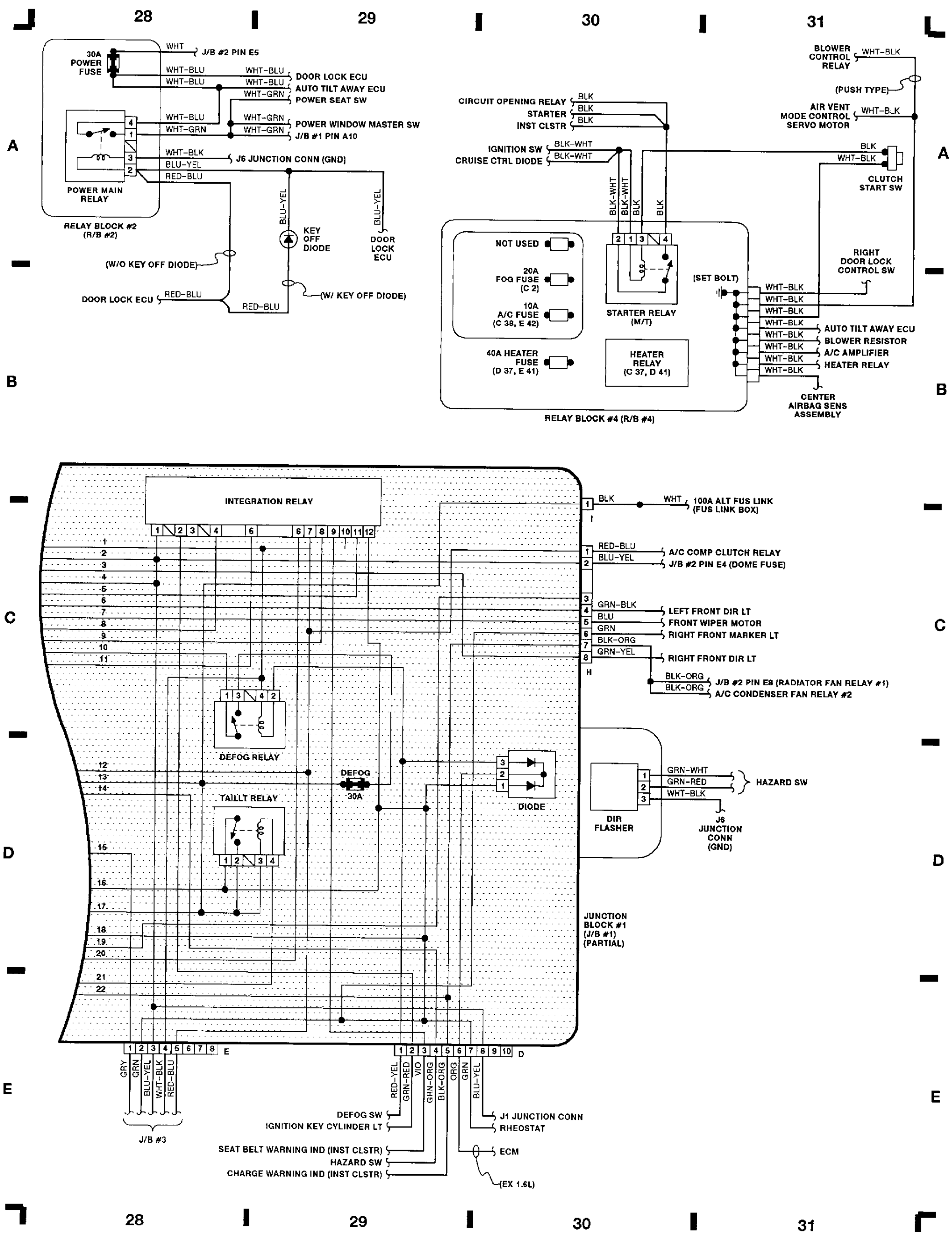

Fig. 8: Junction Block # 1 (Cont.), Relay Block #2 & #4 (Grid 28-31)

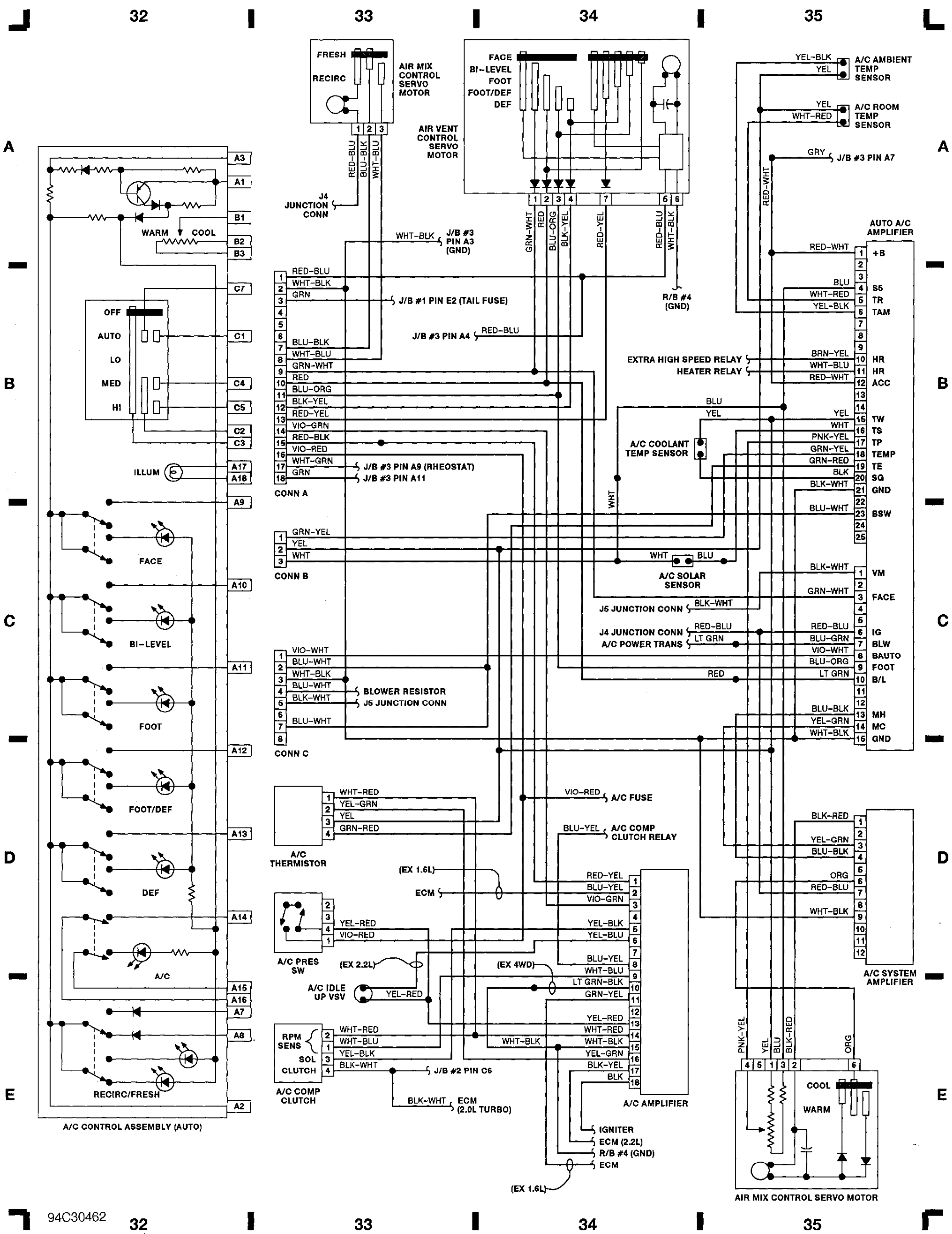

Fig. 9: Auto A/C & Heater System (Grid 32-35)

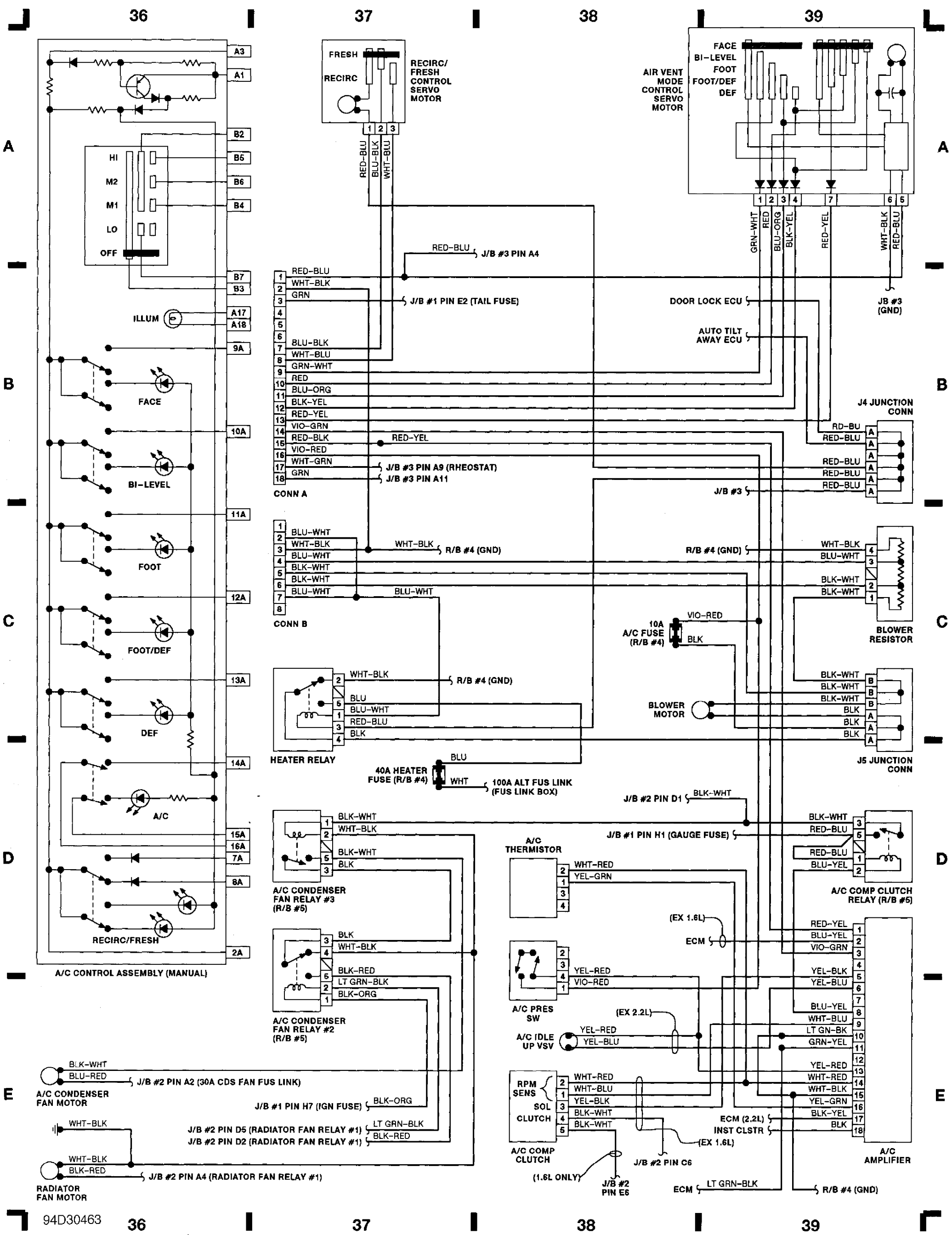

Fig. 10: Manual A/C & Heater System (Grid 36-39)

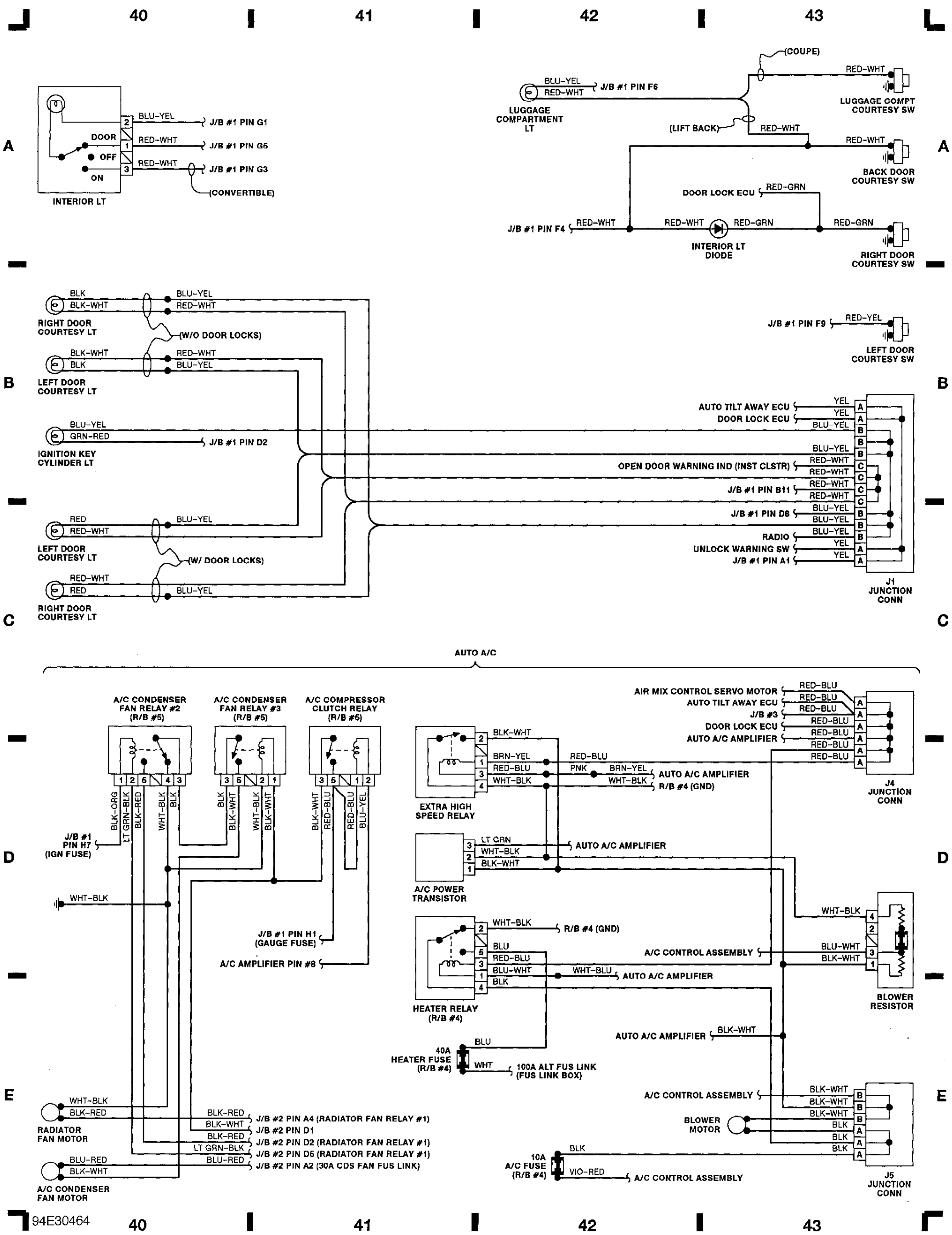

Fig. 11: Fan Relays, Courtesy Lights, Heater Relay (Grid 40-43)

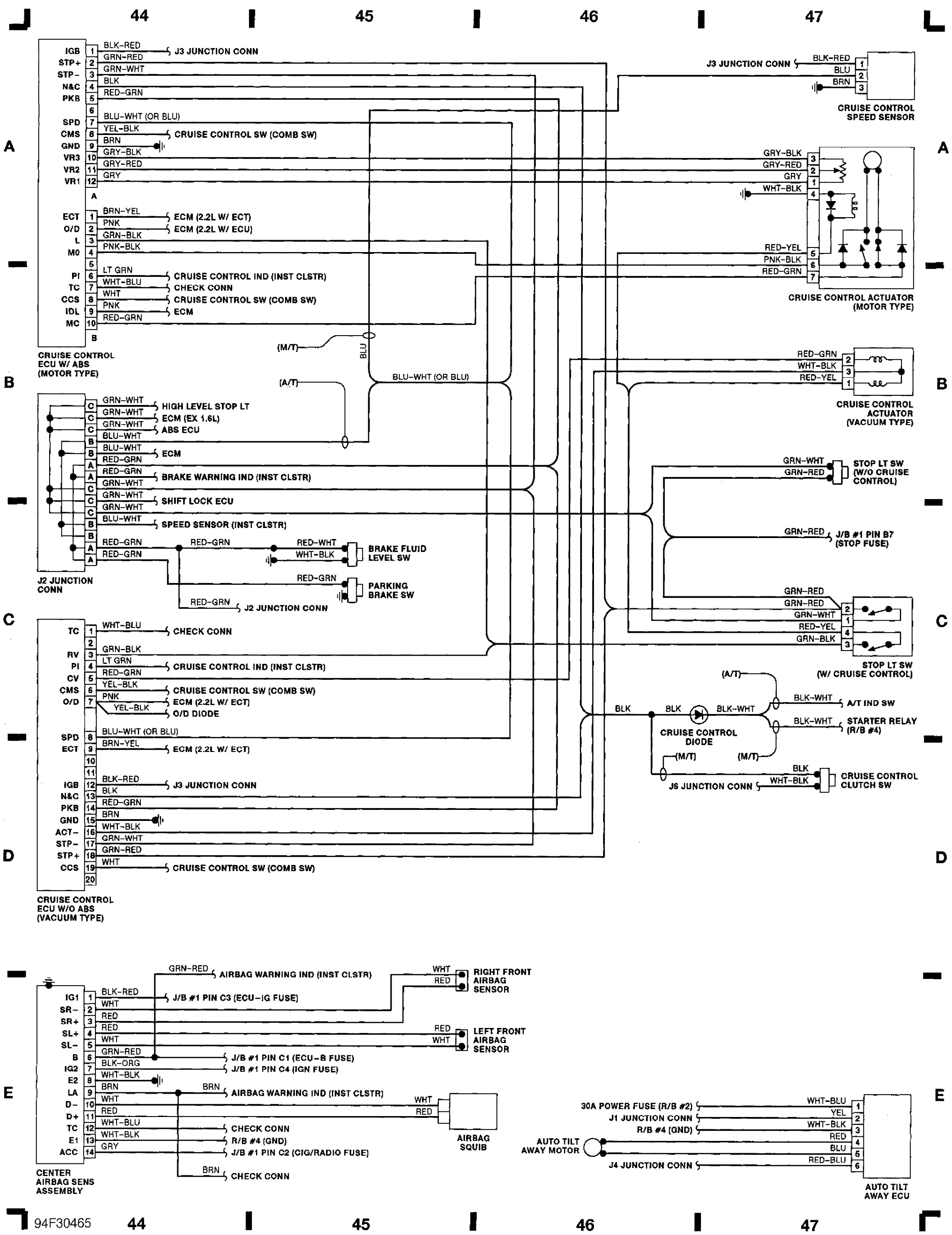

Fig. 12: Cruise Control System, Top Stack System (Grid 44-47)

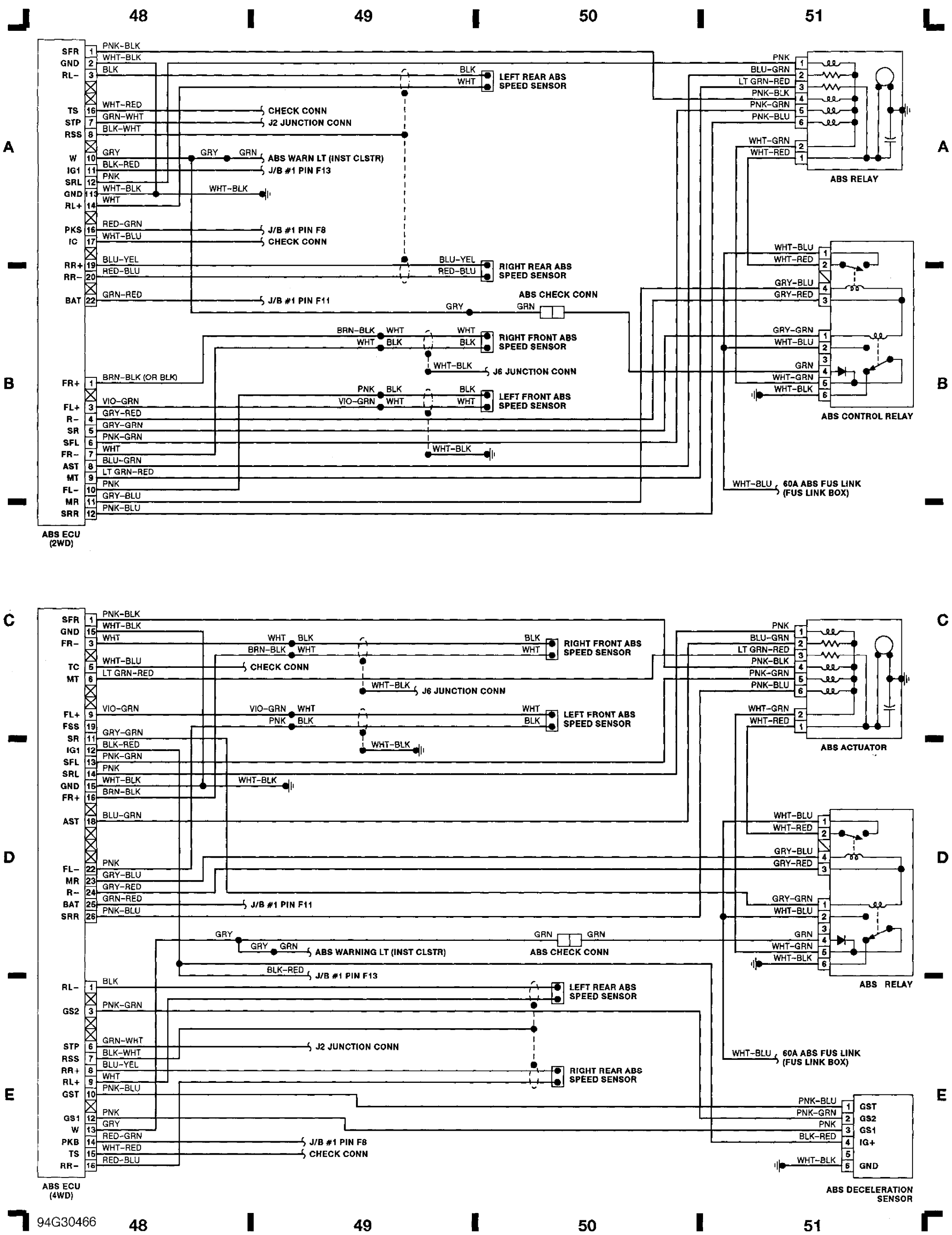

Fig. 13: ABS System (2WD, 4WD) (Grid 48-51)

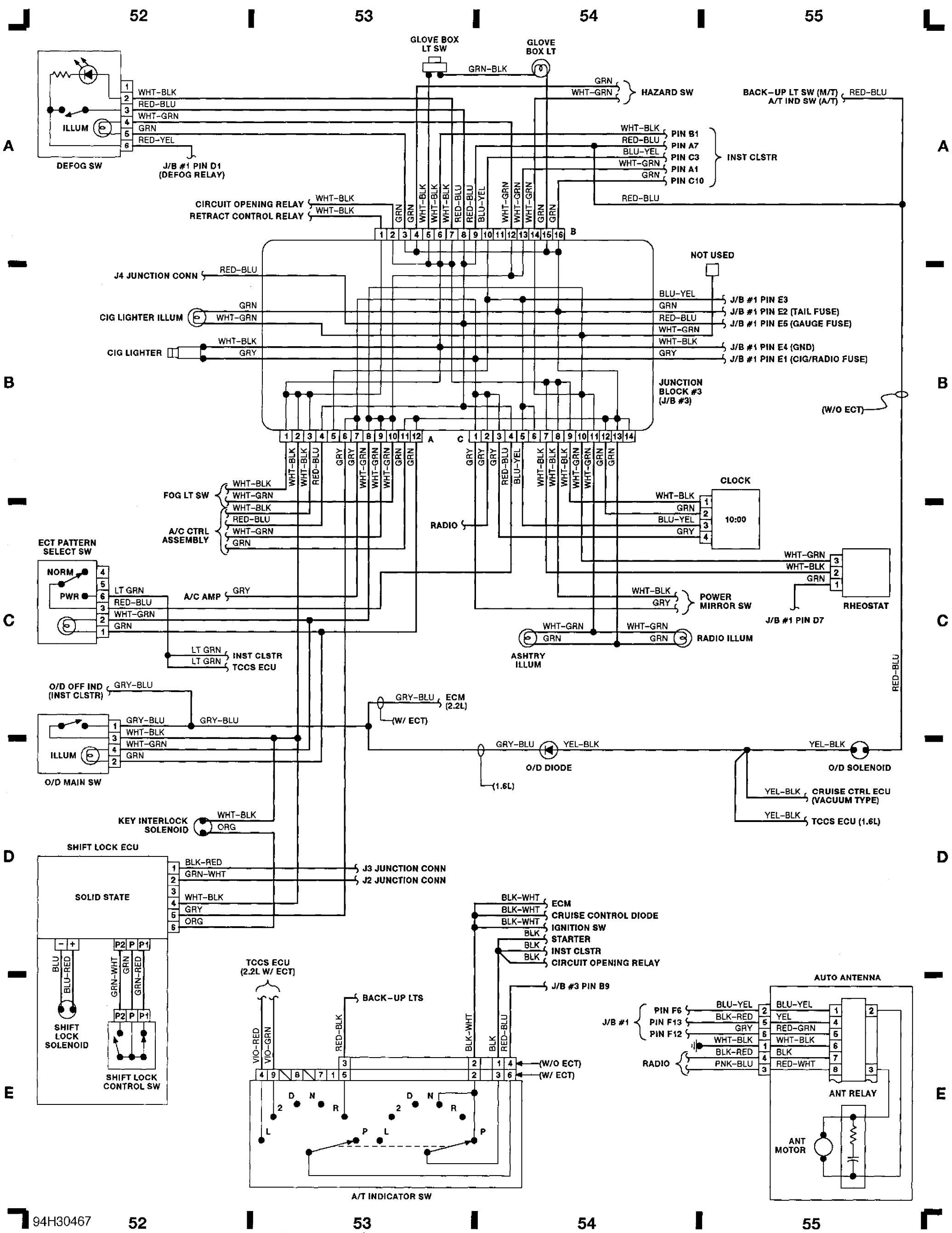

Fig. 14: Junction Block #3, A/T Control, Defogger (Grid 52-55)

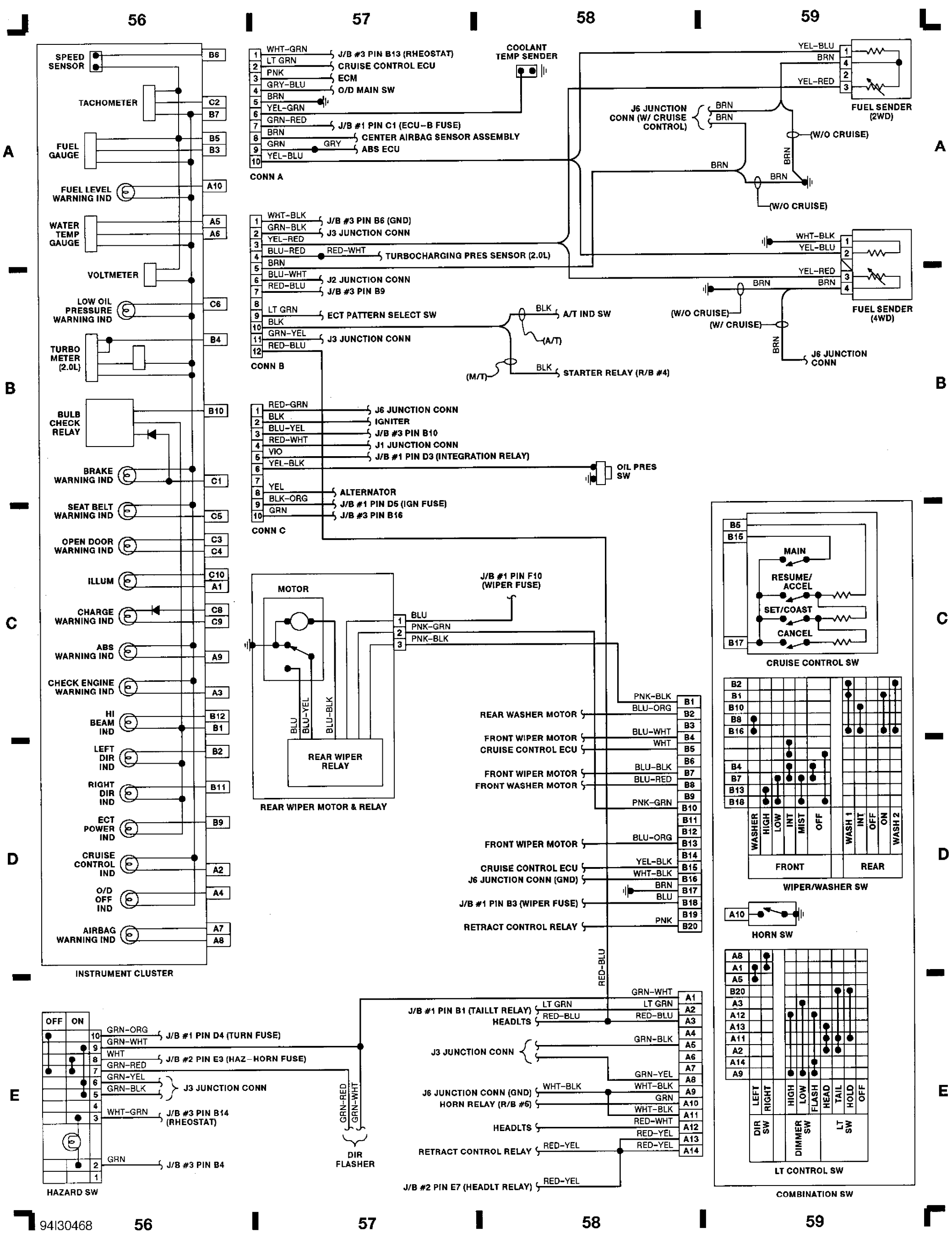

Fig. 15: Instrument Cluster, Combination Switch (Grid 56-59)

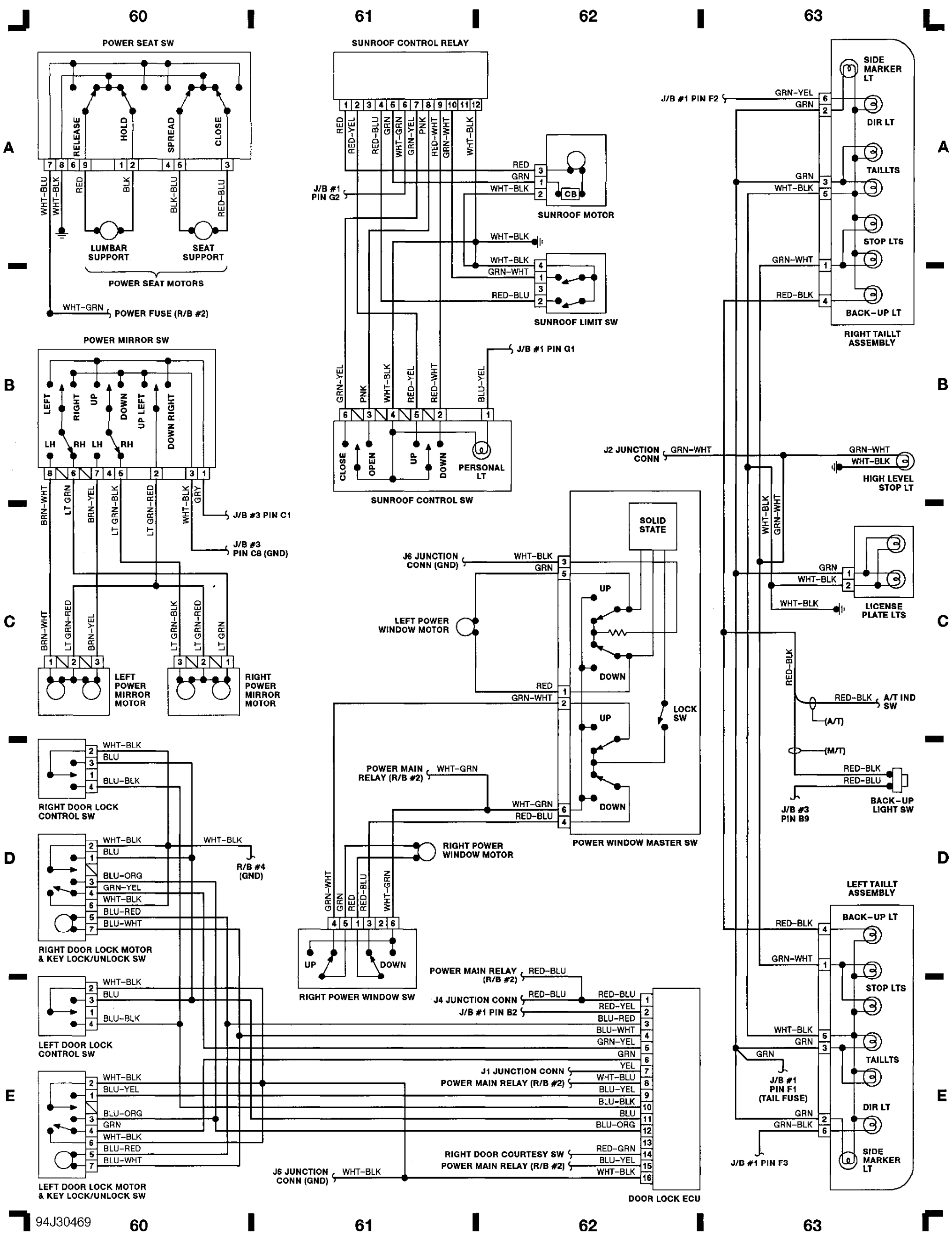

Fig. 16: Power Accessories, Taillights (Grid 60-63)

1993 ENGINE PERFORMANCE
Toyota Wiring Diagrams

Celica

WIRING DIAGRAMS

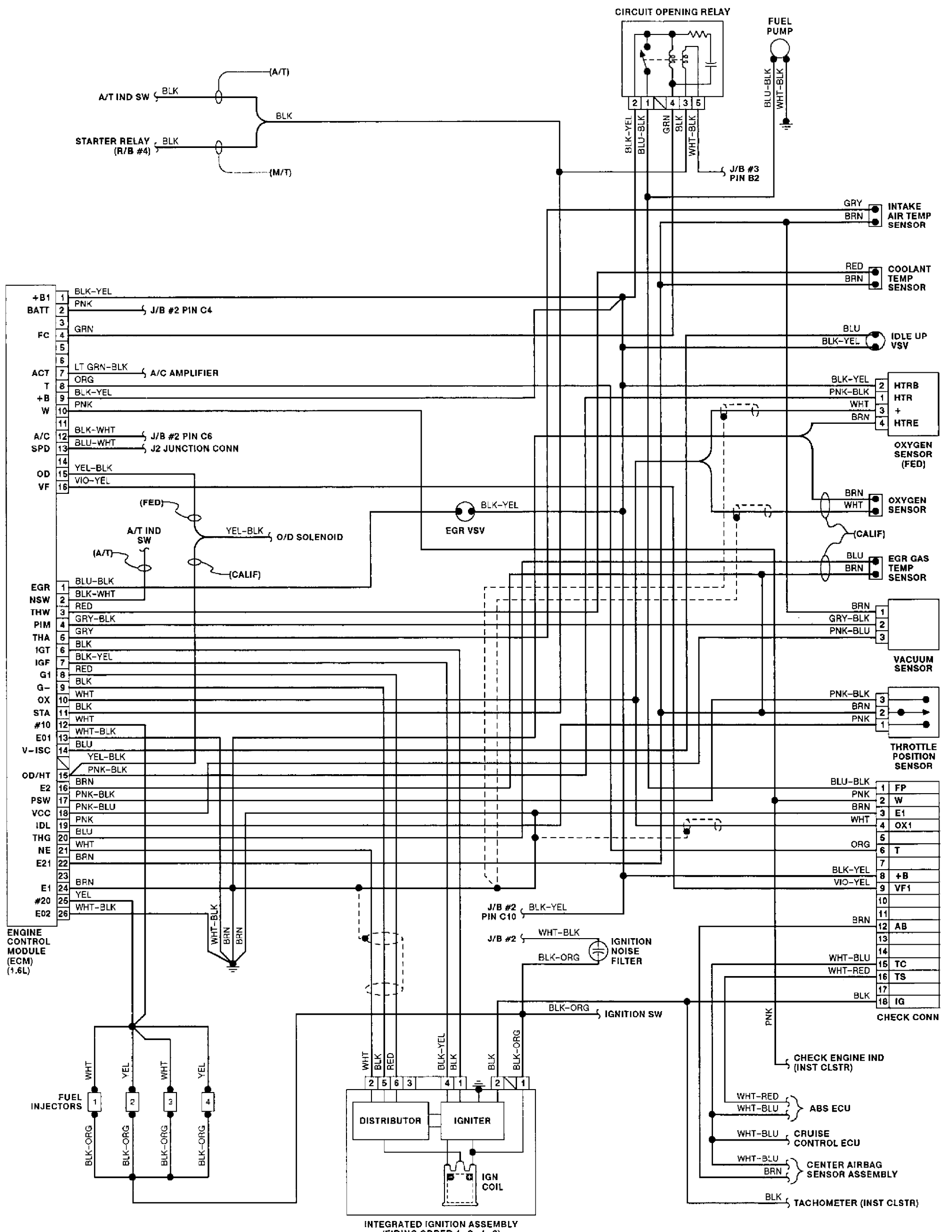

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Fig. 1: Wiring Diagram (Celica 1.6L)

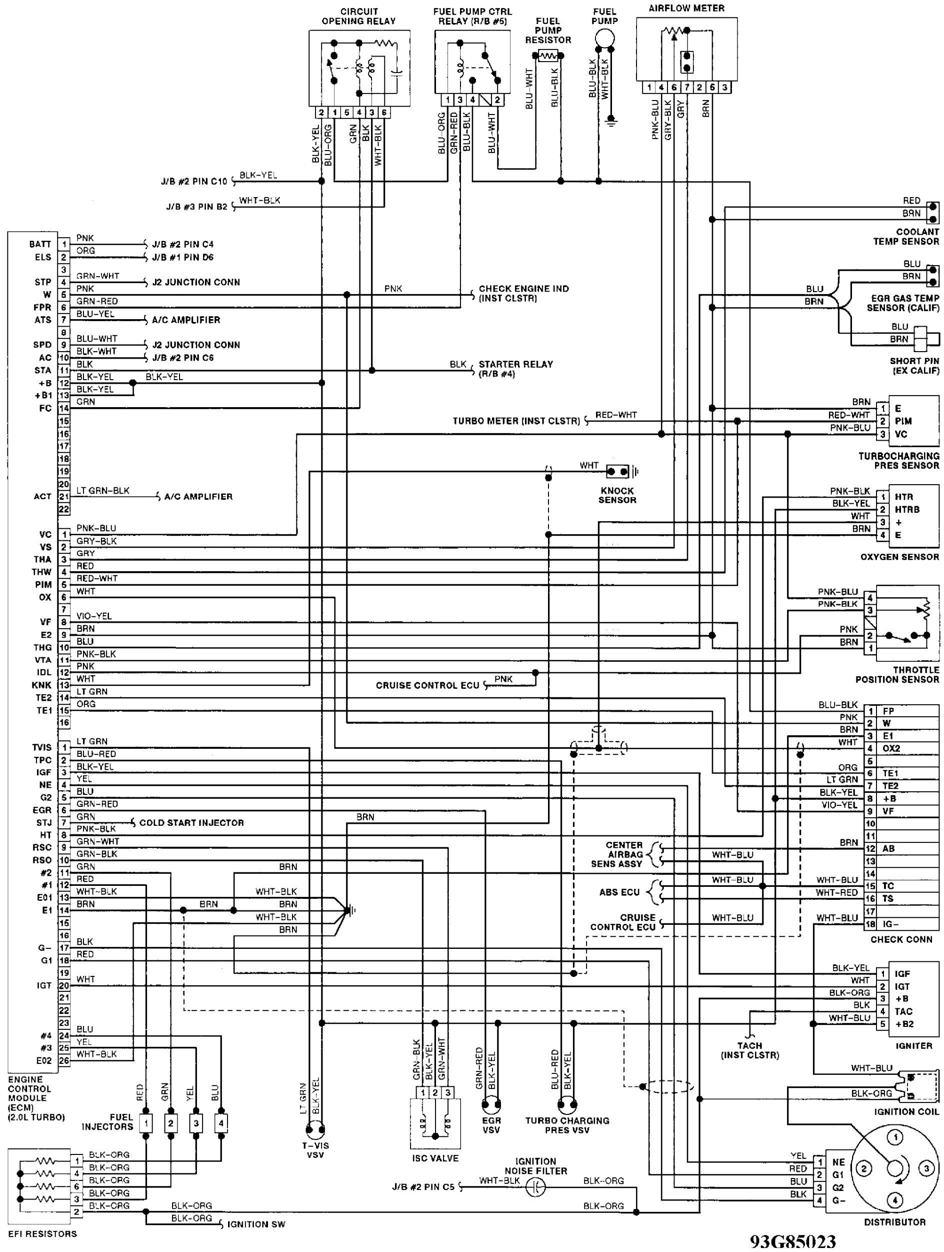

Fig. 2: Wiring Diagram (Celica 2.0L Turbo)

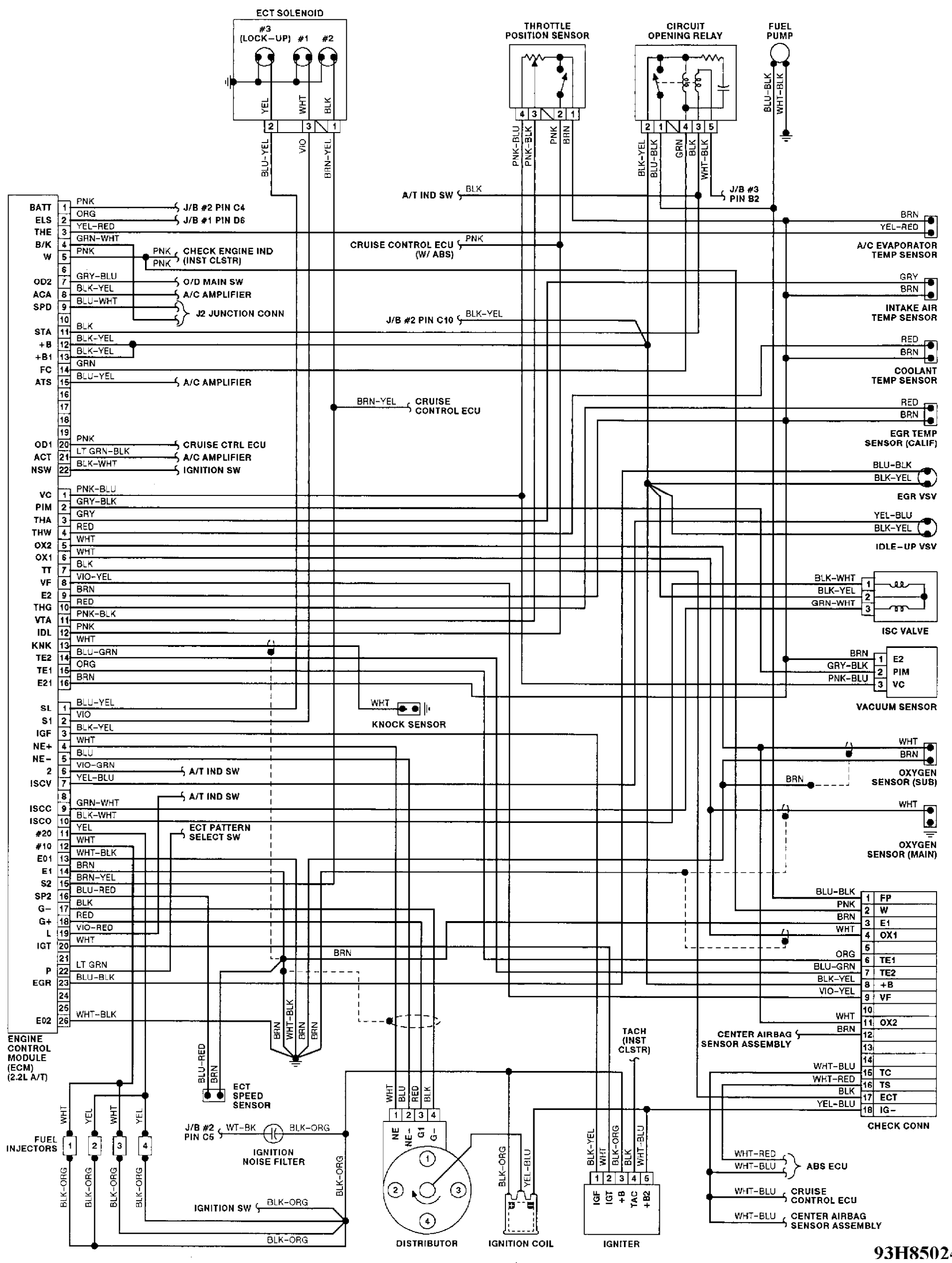

Fig. 3: Wiring Diagram (Celica 2.2L A/T)

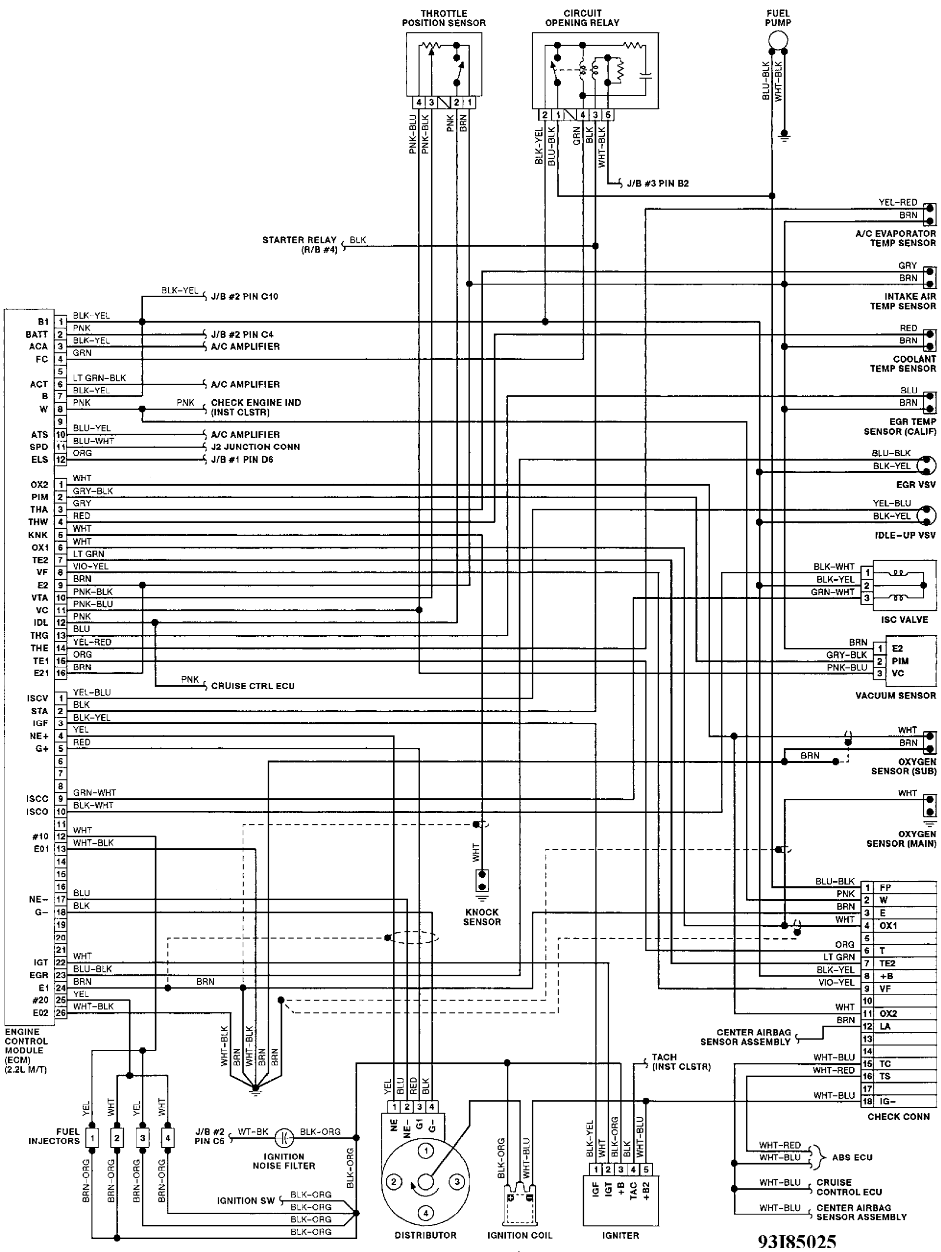

Fig. 4: Wiring Diagram (Celica 2.2L M/T)

WIRING DIAGRAM SYMBOLS

1993 Toyota Celica

WIRING DIAGRAMS
How To Use The Wiring Diagrams

WIRING DIAGRAMS

INTRODUCTION

The wiring diagrams and technical service bulletins, containing wiring diagram changes, are obtained from the domestic and import manufacturers. These are checked for accuracy and are all redrawn into a consistent format for easy use.

All diagrams are arranged with the front of the vehicle at the left side of the first page and the rear of the vehicle at the right side of the last page. Accessories are shown near the end of the diagram.

Components are shown in their approximate location on the vehicle. Due to the constantly increasing number of components on vehicles today, it is impossible to show exact locations.

In the past, when cars were simpler, diagrams were simpler. All components were connected by wires, and diagrams seldom exceeded 4 pages in length. Today some wiring diagrams require more than 16 pages. It would be impractical to expect a service technician to trace a wire from page 1 across every page to page 16.

Removing some of the wiring maze reduces eyestrain and time wasted searching across several pages. Today, the majority of diagrams now follow a much improved format, which permits space for internal switch details and connector shapes.

Any wires that don’t connect directly to their components are identified on the diagram to indicate where they go. There is a legend on the first page of each diagram, detailing component location. It refers you to sub-systems, using grid NUMBERS at the top and bottom of the page and grid LETTERS on each side. This grid system works in a manner similar to that of a road map.

HOW TO USE THE WIRING DIAGRAMS

1) On the first page of the diagram, you will find a listing of major electrical components or systems. Locate the specific component or system you wish to trace. A grid number and letter will follow the component’s name.

2) Use the grid NUMBERS (arranged horizontally across the top and bottom of each page) to find the page of the wiring diagram that contains the component you’re seeking. When you reach this page, use the grid LETTERS on the side of the page to determine the component’s vertical location.

3) Locate the circuit you need to service. The internals are shown for switches and relays to assist you in understanding how the circuit operates.

NOTE: In some of the newer wiring diagram articles in this product, there is a Legend for the wiring diagrams that has been created to make locating components easier. For these articles, there will be a COMPONENT LOCATION MENU title in the article main menu. These articles will also have the original legend available on the first graphic.

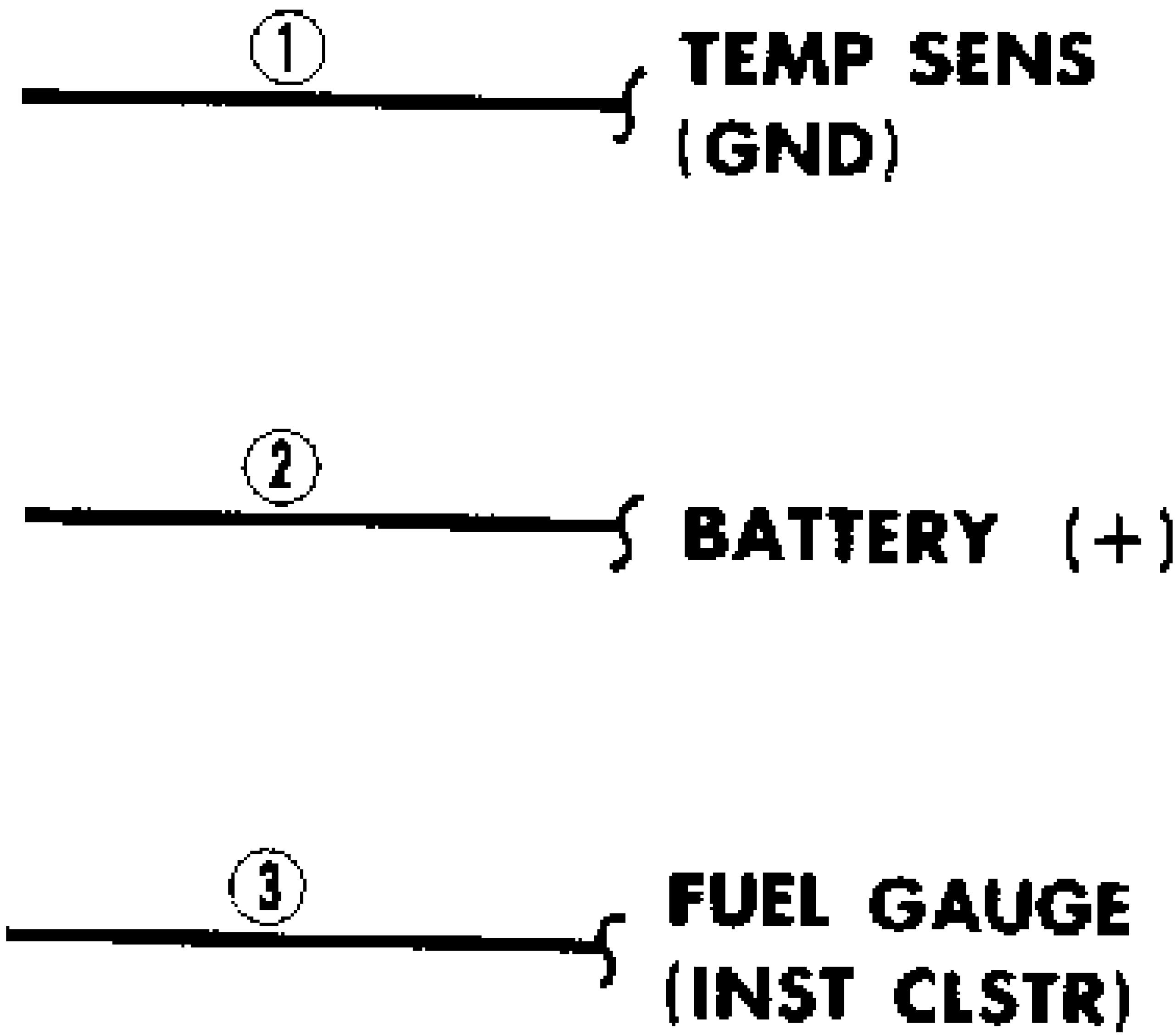

Fig. 1: Identifying Tie-Off Symbols

4) If the wires are not drawn all the way to another component (across several pages), a reference will tell you their final destination.

5) Again, use the legend on the first page of the wiring diagram to determine the grid number and letter of the referenced component. You can then turn directly to it without tracing wires across several pages.

6) The symbols shown in Fig. 1 are called tie-offs. The first tie-off shown indicates that the circuit goes to the temperature sensor, and is also a ground circuit.

7) The second symbol indicates that the circuit goes to a battery positive parallel circuit. The third symbol leads to a particular component and the location is also given.

8) The lines shown in Fig. 2 are called options. Which path or option to take depends on what engine or systems the vehicle has.

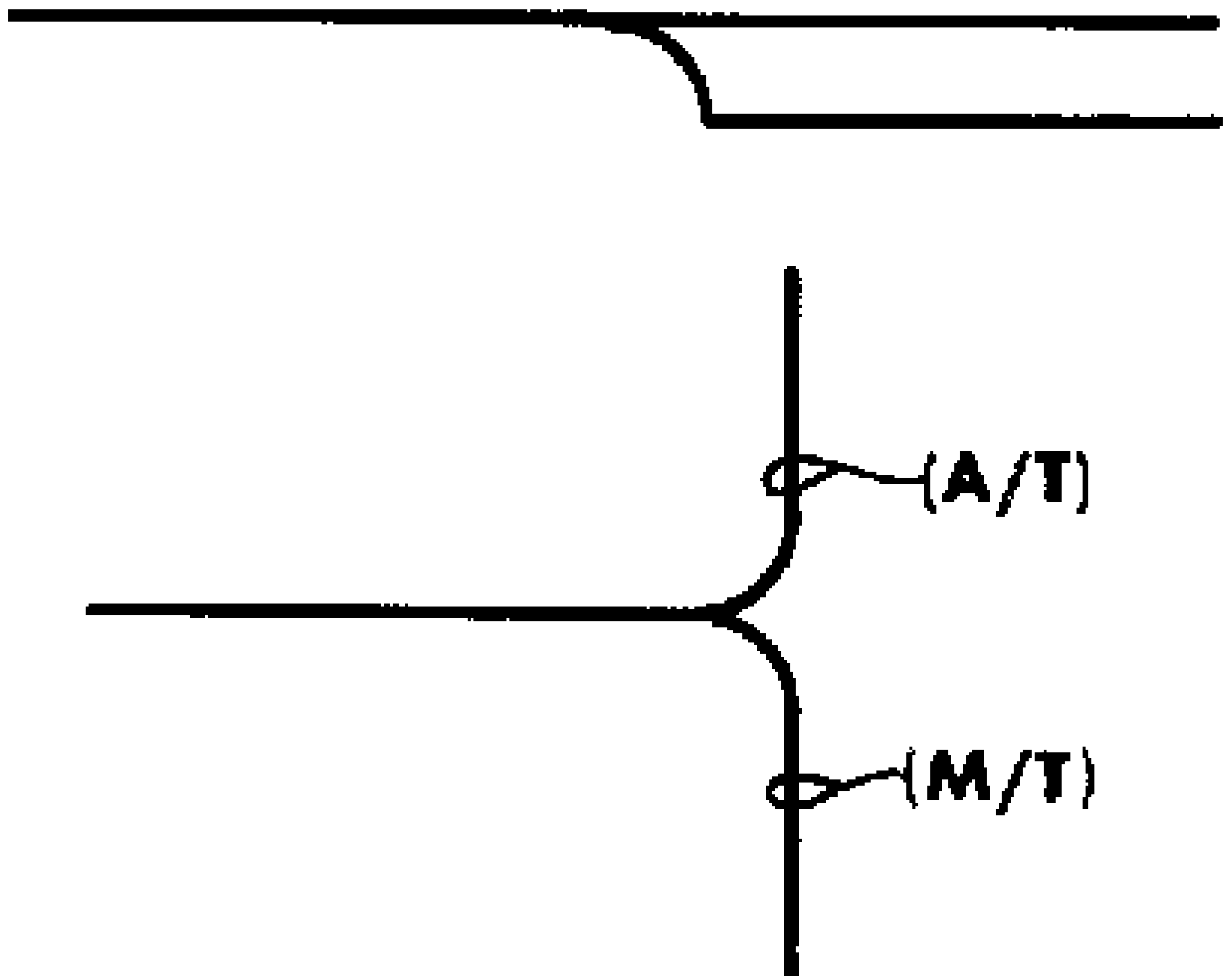

Fig. 2: Identifying Option Symbols

COLOR ABBREVIATIONS IDENTIFICATION

COLOR ABBREVIATIONS

Color	Normal	Optional
Black	BLK	BK
Blue	BLU	BU
Brown	BRN	BN
Clear	CLR	CR
Dark Blue	DK BLU	DK BU
Dark Green	DK GRN	DK GN
Green	GRN	GN
Gray	GRY	GY
Light Blue	LT BLU	LT BU
Light Green	LT GRN	LT GN
Orange	ORG	OG
Pink	PNK	PK
Purple	PPL	PL
Red	RED	RD
Tan	TAN	TN
Voilet	VIO	VI

White	WHT	WT
Yellow	YEL	YL

WIRING DIAGRAM SYMBOL IDENTIFICATION

NOTE: Standard wiring symbols are used on diagrams. The list below will help clarify any symbols that are not easily understood at a glance. Most components are labeled "Motor", "Switch" or "Relay" in addition to being drawn with the standard symbol.

WIRING DIAGRAM SYMBOLS

Views of the symbols used in the WIRING DIAGRAM articles are in the following graphics. See Figs. 3 through 25.

Fig. 3: Circuit Breaker

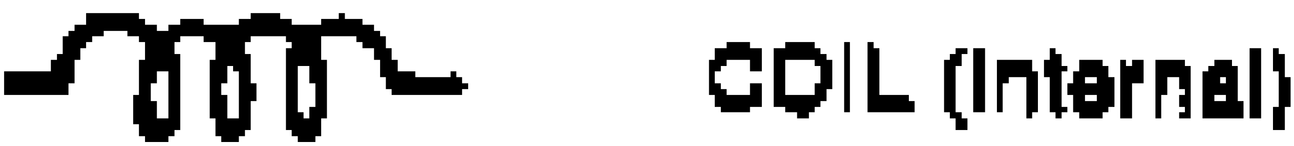

Fig. 4: Coil (Internal)

Fig. 5: Connector

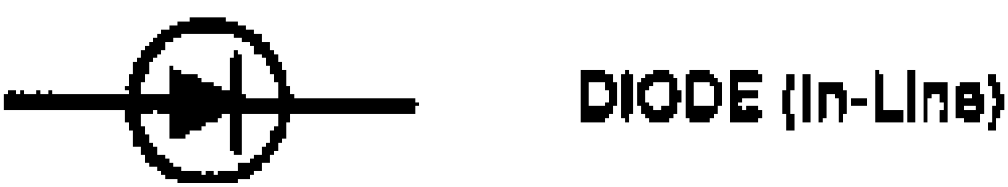

Fig. 6: Diode (In-Line)

Fig. 7: Diode (Internal)

Fig. 8: Diode (Light Emitting)

Fig. 9: Defogger Grid

Fig. 10: Fuse

Fig. 11: Fusible Link

Fig. 12: Ground

Fig. 13: Glow Plug Resistor (In-Line) or Mirror Heater

Fig. 14: Injector (Diesel) or Photocell (Gasoline)

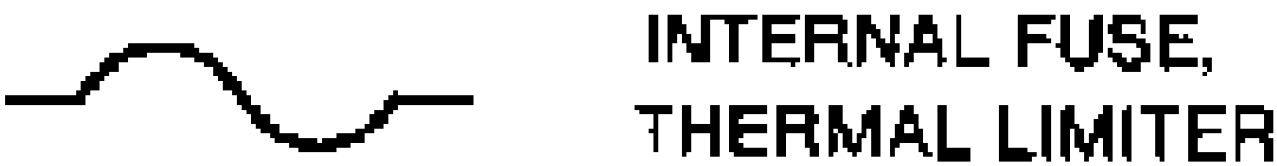

Fig. 15: Internal Fuse, Thermal Limiter

Fig. 16: Lamp (Dual Element)

Fig. 17: Lamp (Single Element)

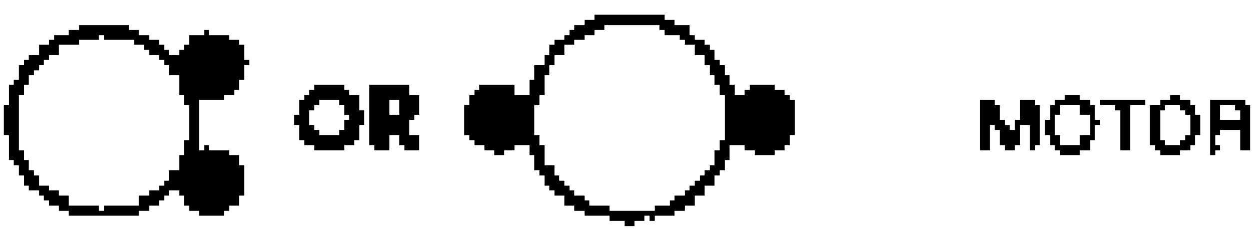

Fig. 18: Motor

Fig. 19: Resistor (Internal)

Fig. 20: Sensor, Thermistor

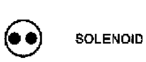

Fig. 21: Solenoid

Fig. 22: Solid State Device, Transistor

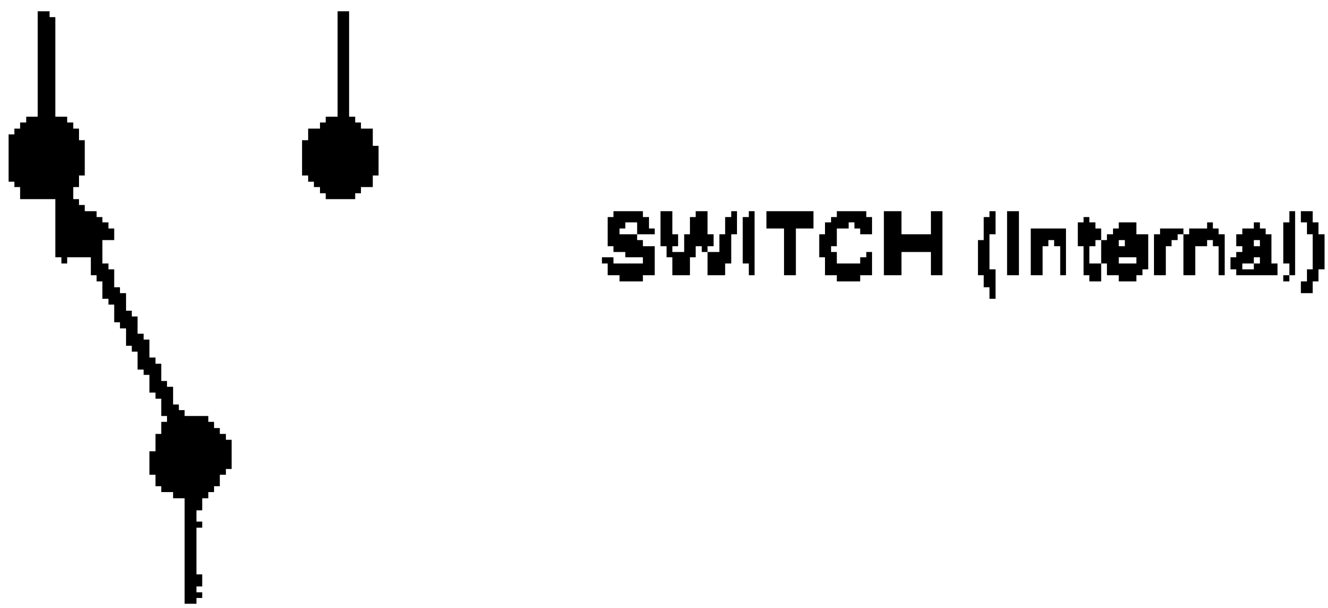

Fig. 23: Switch (Internal)

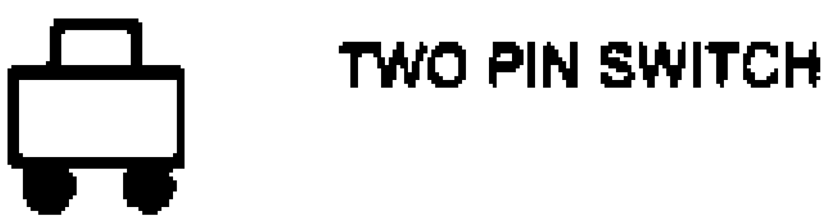

Fig. 24: Two Pin Switch

Fig. 25: Variable Resistor or Potentiometer