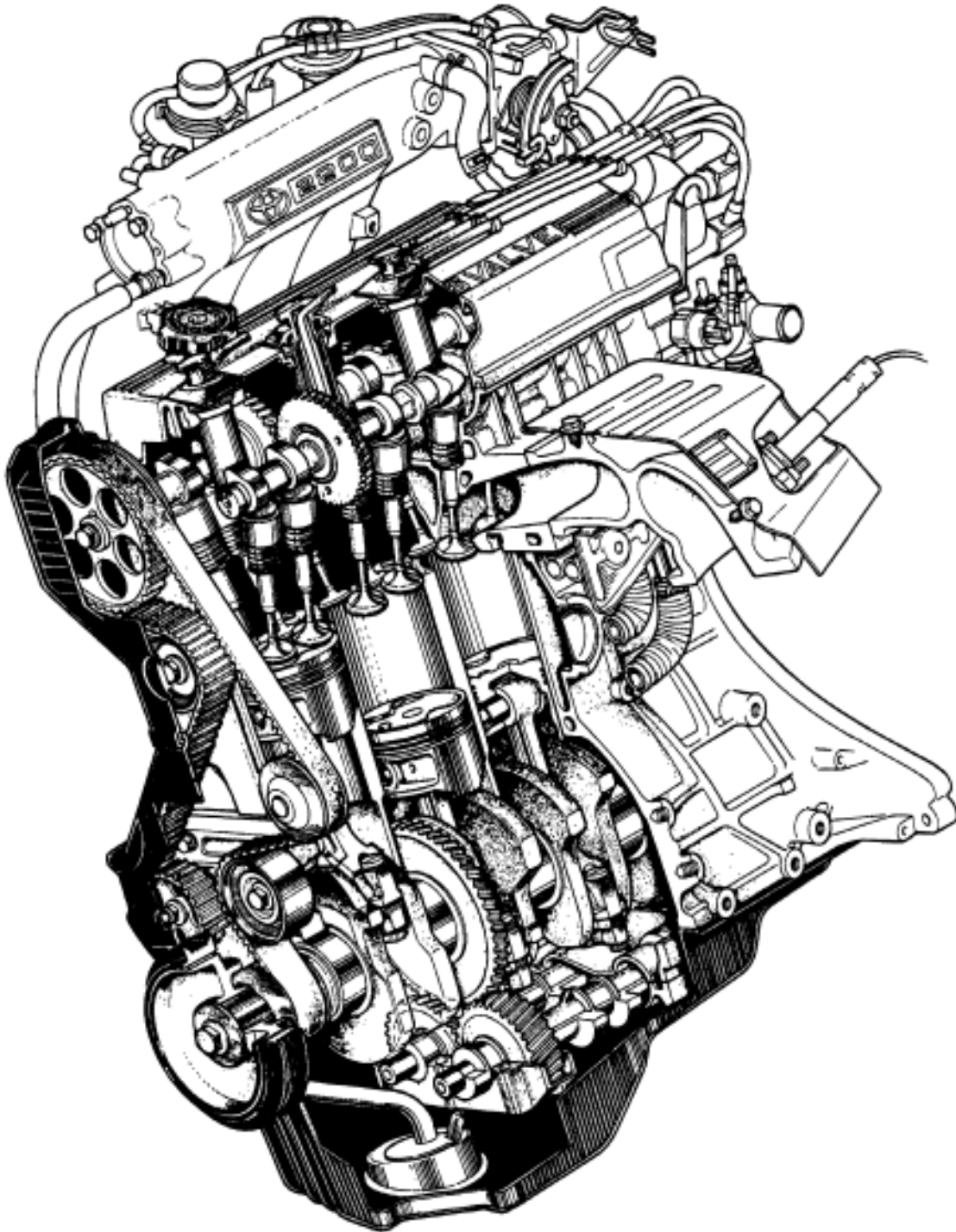


# 5S-FE ENGINE

# ENGINE MECHANICAL

## DESCRIPTION

The 5S-FE engine is an in-line, 4-cylinder, 2.2 liter DOHC 16-valve engine.



The 5S-FE engine is an in-line, 4-cylinder engine with the cylinders numbered 1-2-3-4 from the front. The crankshaft is supported by five bearings inside the crankcase. These bearings are made of aluminum alloy.

The crankshaft is integrated with eight weights for balance. Oil holes are placed in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

The firing order is 1-3-4-2. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout and with pent-roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

The intake manifold has four independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of functioning no matter what the engine speed.

The intake camshaft is driven by a timing belt, and a gear on the intake camshaft engages with a gear on the exhaust camshaft to drive it. The cam journal is supported at five places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and gears is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

Pistons are made of high temperature-resistant aluminum alloy, and a depression is built into the piston head to prevent interference with the valves.

Piston pins are the full-floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

The No.1 compression ring is made of steel and the No.2 compression ring is made of cast iron.

The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No.1 and No.2 work to prevent gas leakage from the cylinder and the oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chambers.














The cylinder block is made of cast iron. It has four cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed sheet steel. A dividing plate is included inside the oil pan to keep sufficient oil in the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and the oil shifts away from the oil pump suction pipe.












The 5S-FE engine uses two balance shafts. The balance shafts are fitted in balance shaft housings that are located at the bottom of the cylinder block. The No. 1 balance shaft is driven by the drive gear of the crankshaft No.3 counterweight at twice the speed of the crankshaft. The No. 2 balance shaft is driven by the No-1 balance shaft at the same speed in the same direction as the crankshaft. The balance shafts are designed to eliminate secondary inertia force from the engine, thereby reducing the engine noise (booming noise).

**PREPARATION****SST (SPECIAL SERVICE TOOLS)**

88A017-00



	09011-38121 12 mm Socket wrench for 12 Pointed Head	Cylinder head bolt and connecting rod bolt
	09201-41020 Valve Stem Oil Seal Replacer	
	09201-70010 Valve Guide Bushing Remover & Replacer	
	09202-70010 Valve Spring Compressor	
	09213-54015 Crankshaft Pulley Holding Tool	
	(91651 -60855) Bolt	
	09213-80017 Crankshaft Pulley & Gear Puller Set	
	(09213-00020) Body With Bolt	
	(09213-00030) Handle	
	(09213-00060) Bolt set	
	09222-30010 Connecting Rod Bushing Remover & Replacer	
	09223-46011 Crankshaft Front Oil Seal Replacer	Camshaft oil seal
	09223-63010 Crankshaft Rear Oil Seal Replacer	





	09224-74010 Engine Balancer Backlash Adjusting Tool	
	09248-55020 Valve Clearance Adjust Tool Set	
	(09248-05011) Valve Lifter Press	
	(09248-05021) Valve Lifter Stopper	
	09249-63010 Torque Wrench Adaptor	
	09226-10010 Crankshaft Front & Rear Bearing Replacer	
	09278-54012 Drive Shaft Holding Tool	Camshaft timing pulley
	09330-00021 Companion Flange Holding Tool	Crankshaft pulley
	09616-30011 Steering Worm Bearing Adjusting Screw Wrench	Oil pump pulley
	09816-30010 Oil Pressure Switch Socket	Knock sensor
	09843-18020 Diagnosis Check Wire	

## RECOMMENDED TOOLS

80642-91

	09090-04010 Engine Sling Device	For suspension engine
	09200-00010 Engine Adjust Kit	

	09256-00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.
	09904-00010 Expander Set	

## EQUIPMENT

EG000 - 01

Battery specific gravity gauge	
Caliper gauge	
CO/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Engine tune-up tester	
Heater	
Magnetic finger	
Micrometer	
Piston ring compressor	
Piston ring expander	
Plastigage	
Precision straight edge	
Soft brush	
Spring tester	Valve spring
Steel square	Valve spring
Thermometer	
Torque wrench	

Valve seat cutter	
Vernier calipers	

**SSM (SERVICE SPECIAL MATERIALS)**

SSM1-01

08826-00080 Seal packing or equivalent	Camshaft bearing cap Cylinder head cover Rear oil seal retainer
08833-00070 Adhesive 1311, THREE BOND 1311 or equivalent	Flywheel or drive plate bolt

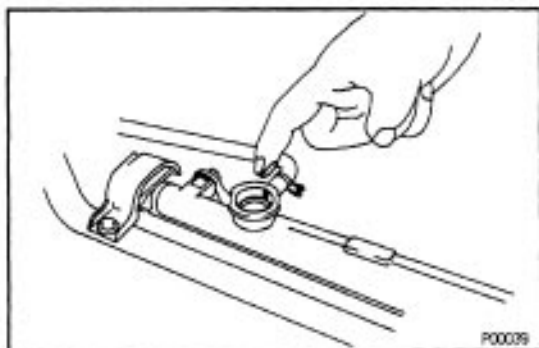


## TUNE-UP

### ENGINE COOLANT INSPECTION

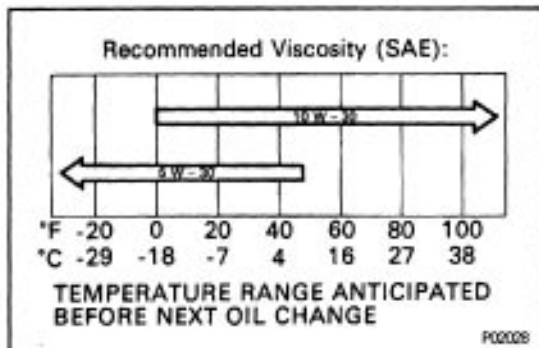
#### 1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK

The engine coolant level should be between the "LOW" and "FULL" lines at low temperature. If low, check for leaks and add engine coolant up to the "FULL"



#### 2. CHECK ENGINE COOLANT QUALITY

There should be no excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the engine coolant should be free from oil. If excessively dirty, replace the engine coolant.



## ENGINE OIL INSPECTION

#### 1. CHECK OIL QUALITY

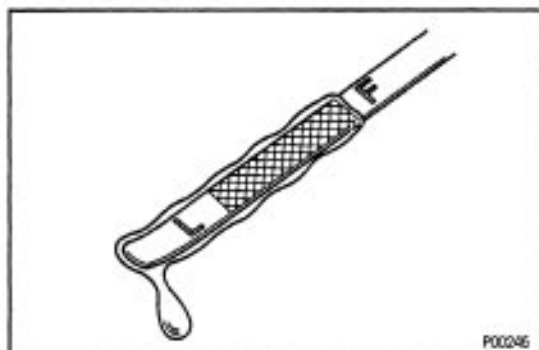
Check the oil for deterioration, entry of water, discoloring or thinning.

If oil quality is visibly poor, replace it.

**Oil grade:**

**API grade SG or SH, Energy Conserving II multi-grade engine oil or ILSAC multigrade engine oil.**

**Recommended viscosity is as shown in the illustration.**

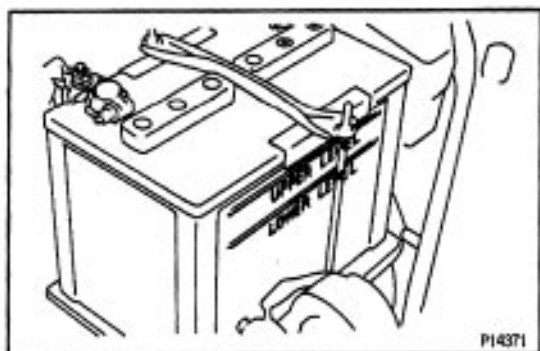


#### 2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to the "F" mark.

00000-91



## BATTERY INSPECTION

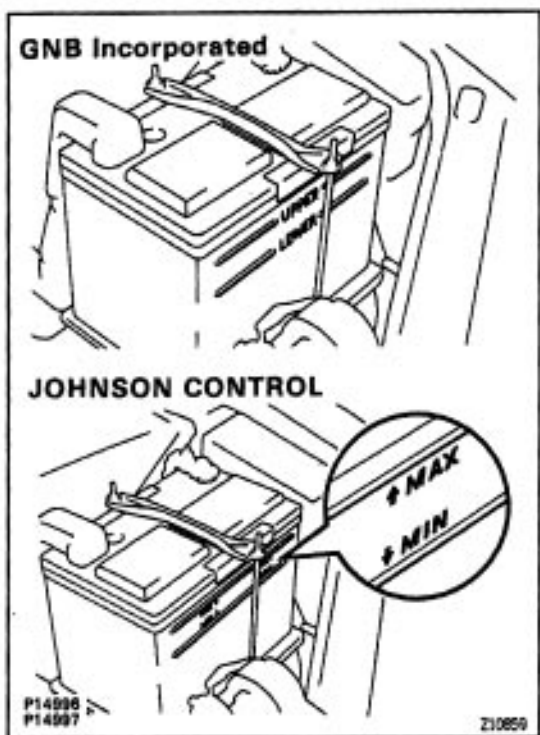
### 1. Except Delco Battery:

#### CHECK BATTERY ELECTROLYTE LEVEL

Check the electrolyte quantity of each cell.

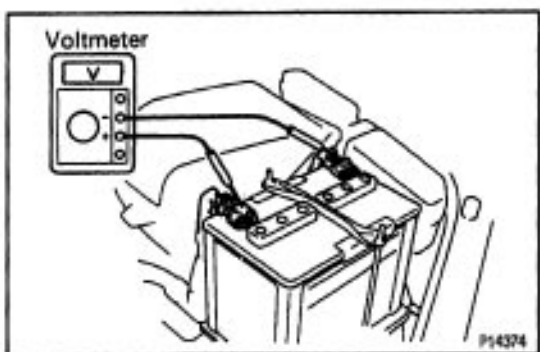
#### A. Maintenance Free Battery

If under the lower level, replace the battery (or add distilled water if possible). Check the charging system.



#### B. Except Maintenance Free Battery

If under the "LOWER" or "MIN" line, add distilled water.



### 2. Except Delco Battery:

#### CHECK BATTERY VOLTAGE AND SPECIFIC GRAVITY

#### A. Maintenance Free Battery

Measure the battery voltage between the terminals negative (-) and positive (+) of the battery.

#### Standard voltage:

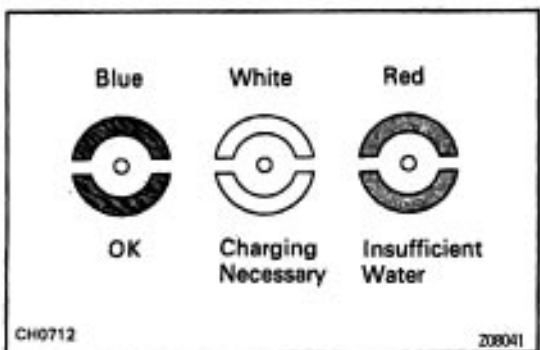
**12.7 – 12.9 V at 20°C (68°F)**

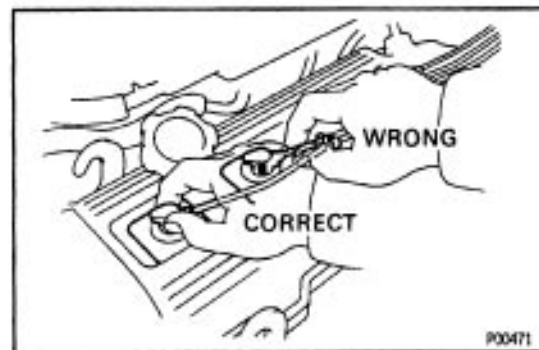
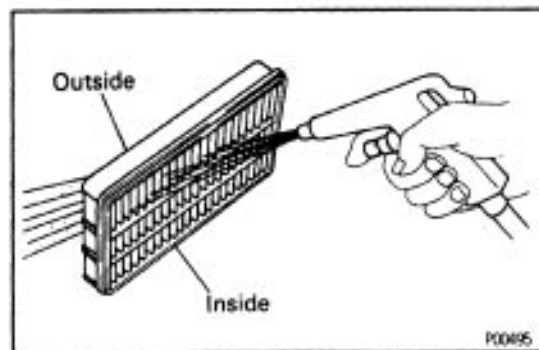
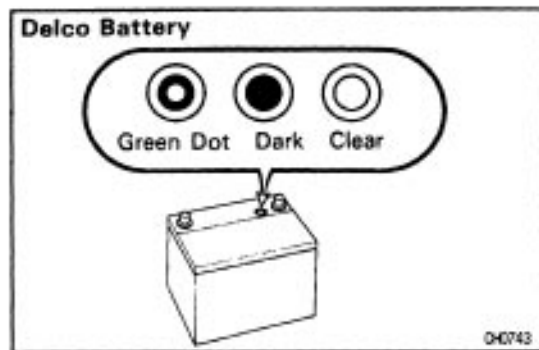
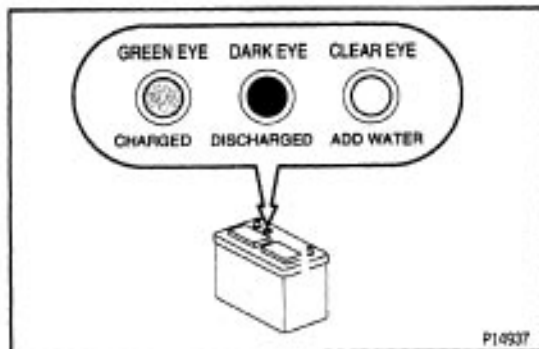
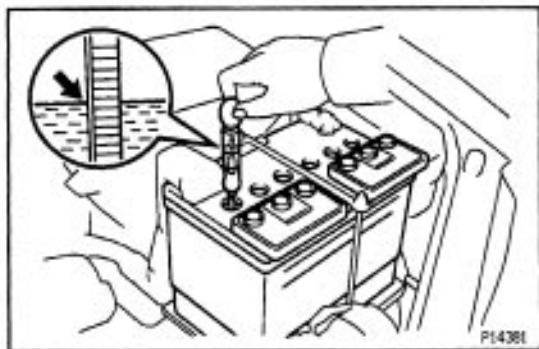
#### HINT:

- Before measuring the voltage, turn the ignition switch to LOCK and turn off the electrical systems (headlight, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
- If the vehicle has been running, wait 5 minutes or more after the vehicle stops before measuring the battery voltage.

If the voltage is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.





## B. Except Maintenance Free Battery

Check the specific gravity of each cell.

**Standard specific gravity:**

**55D23L battery for GNB Incorporated**

1.25 – 1.27 at 20°C (68°F)

**55D23L battery for JOHNSON CONTROLS**

1.26 – 1.28 at 27°C (81°F)

**80D26L battery for GNB Incorporated**

1.27 – 1.29 at 20°C (68°F)

**80D26L battery for JOHNSON CONTROLS**

1.28 – 1.30 at 27°C (81°F)

If the gravity is less than specification, charge the battery.

HINT: Check the indicator as shown in the illustration.

## 3. Delco Battery:

**CHECK HYDROMETER**

**Green Dot visible:**

**Battery is adequately charged**

**Dark (Green Dot not visible):**

**Battery must be charged**

**Clear or Light Yellow:**

**Replace battery**

HINT: There is no need to add water during the entire service life of the battery.

## AIR FILTER INSPECTION

### 1. INSPECT AIR FILTER

Visually check that the element is not excessively dirty, damaged or oily.

### 2. CLEAN AIR FILTER

Clean the element with compressed air.

First blow air from the inside thoroughly. Then blow off the outside of the element.

## HIGH-TENSION CORDS INSPECTION

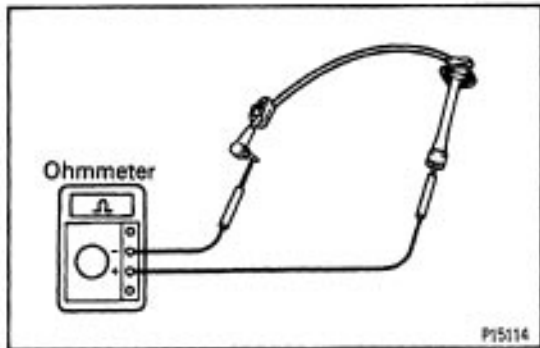
### 1. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

Disconnect the high – tension cords at the rubber boot. Do not pull on the high-tension cords.

**NOTICE:** Pulling on or bending the cords may damage the conductor inside.

**2. CALIFORNIA ONLY:**

**DISCONNECT HIGH-TENSION CORD FROM  
IGNITION COIL**

**3. DISCONNECT HIGH –TENSION CORDS FROM  
DISTRIBUTOR CAP****4. INSPECT HIGH-TENSION CORD RESISTANCE**

Using an ohmmeter, measure the resistance.

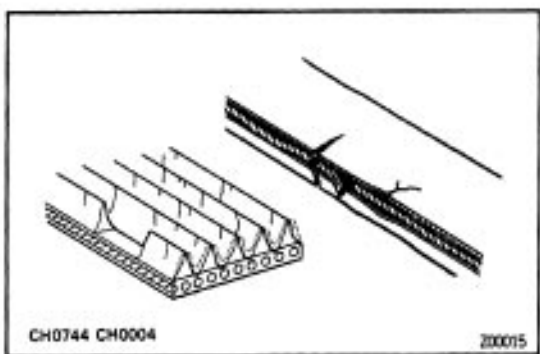
**Maximum resistance:**

**25 k $\Omega$  per cord**

If the resistance is greater than maximum, check the terminals. If necessary, replace the high – tension cord.

**5. RECONNECT HIGH-TENSION CORDS TO  
DISTRIBUTOR CAP****6. CALIFORNIA ONLY:**

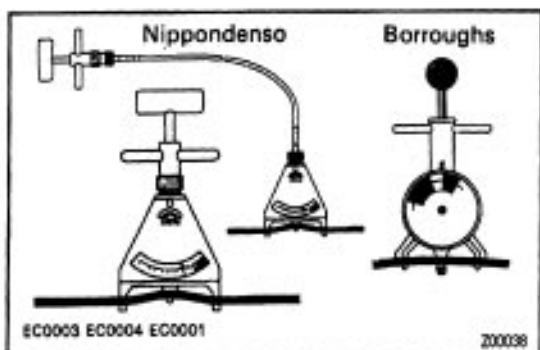
**RECONNECT HIGH-TENSION CORD TO IGNITION  
COIL**

**7. RECONNECT HIGH-TENSION CORDS TO SPARK  
PLUGS****GENERATOR DRIVE BELT INSPECTION  
INSPECT DRIVE BELT**

- (a) Visually check the drive belt for excessive wear, frayed cords etc.

If any defect has been found, replace the drive belt.

**HINT:** Cracks on the rib side of a drive belt are considered acceptable. If the drive belt has chunks missing from the ribs, it should be replaced.



- (b) Using a belt tension gauge, measure the belt tension.

Belt tension gauge:

Nippondenso BTG-20 (95506-00020)

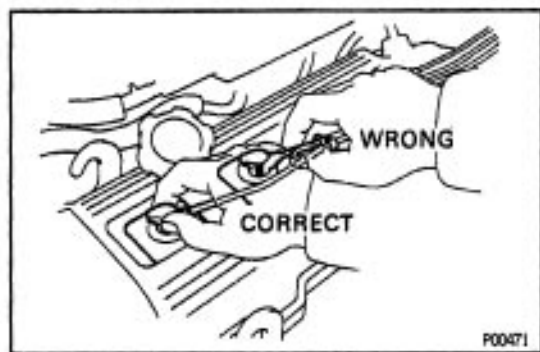
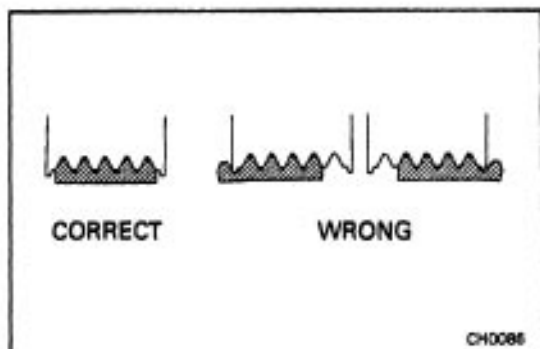
Borroughs No. BT-33-73F

**Drive belt tension:****w/ A/C****New belt** **$175 \pm 5$  lbf****Used belt** **$130 \pm 10$  lbf****w/o A/C****New belt** **$125 \pm 25$  lbf****Used belt** **$95 \pm 20$  lbf**

If the belt tension is not as specified, adjust it.

**HINT:**

- “New belt” refers to a belt which has been used less than 5 minutes on a running engine.
- “Used belt” refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.



## VALVE CLEARANCE INSPECTION AND ADJUSTMENT

**HINT:** Inspect and adjust the valve clearance when the engine is cold.

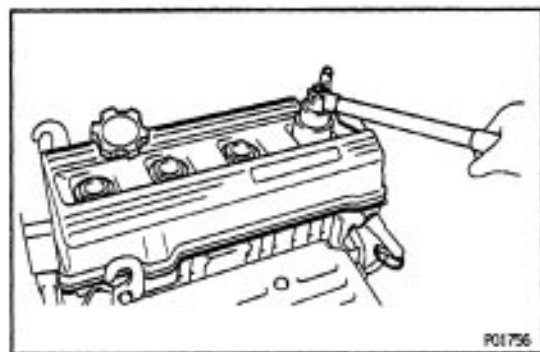
### 1. DISCONNECT HIGH – TENSION CORDS FROM SPARK PLUGS

Disconnect the high – tension cords at the rubber boot. DO NOT pull on the cords.

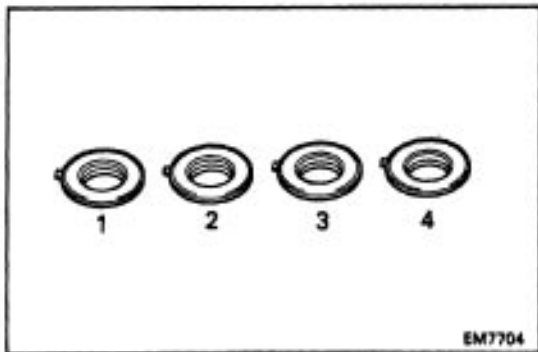
**NOTICE:** Pulling on or bending the cords may damage the conductor inside.

### 2. REMOVE CYLINDER HEAD COVER

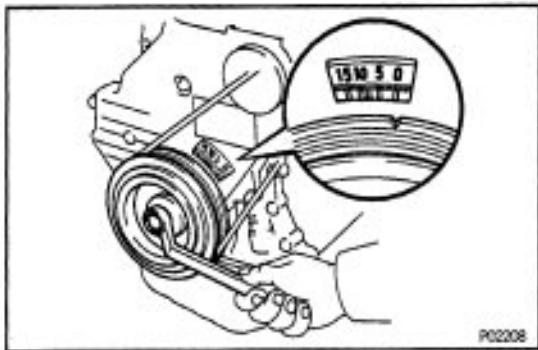
- Disconnect the PCV hoses.
- Loosen the 2 wire harness clamp bolts (No.2 timing belt cover) mounting bolts.
- Remove the 4 nuts, grommets, head cover and gasket.





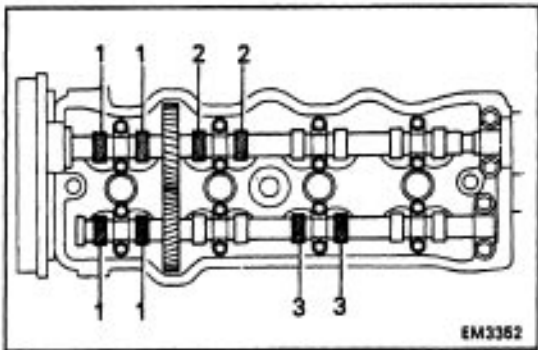


HINT: Arrange the grommets in correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of grommets.



### 3. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with timing mark "0" of the No.1 timing belt cover.
- (b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight. If not, turn the crankshaft one revolution (360°) and align the mark as above.



### 4. INSPECT VALVE CLEARANCE

- (a) Check only the valves indicated. Using a thickness gauge, measure the clearance between the valve lifter and camshaft. Record the out- of -specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

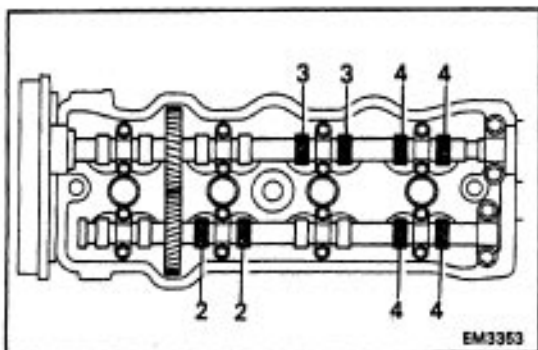
#### Valve clearance (Cold):

##### Intake

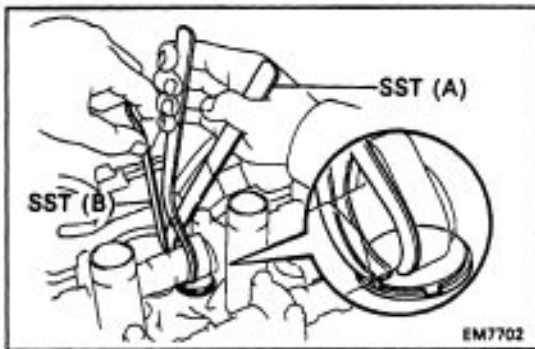
0.19 – 0.29 mm (0.007 – 0.011 in.)

##### Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)



- (b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure in step 3)
- (c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))



## 5. ADJUST VALVE CLEARANCE

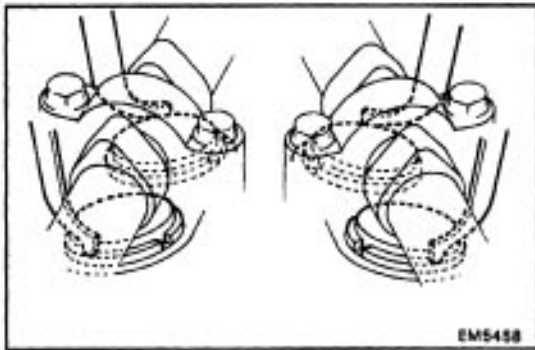
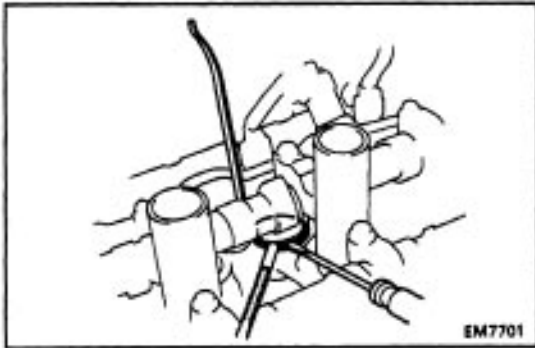
(a) Remove the adjusting shim.

- Turn the crankshaft so that the cam lobe for the valve to be adjusted faces up.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

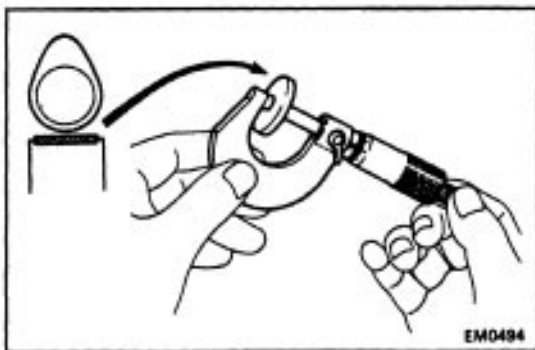
SST 09248 – 55020 (09248 – 05011, 09248–05021)

HINT: Before pressing down the valve lifter, position its notch toward the spark plug side.

- Remove the adjusting shim with a small screwdriver and magnetic finger.



HINT: For easy removed of the shim, when positioning SST (B), set it on the lifter so there is space enough to be able to remove the shim.



(b) Determine the replacement adjusting shim size by following the Formula or Charts:

- Using a micrometer, measure the thickness of the removed shim.
- Calculate the thickness of a new shim so that the valve clearance comes within specified value.

T ..... Thickness of removed shim

A ..... Measured valve clearance

N ..... Thickness of new shim

**Intake:**

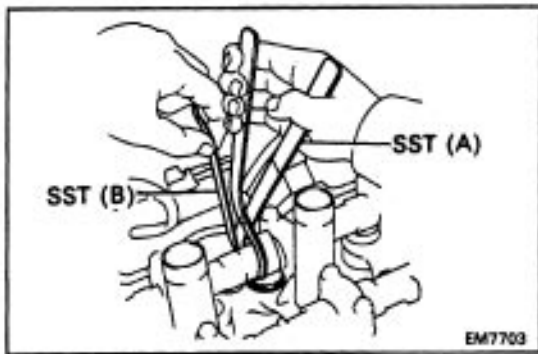
$$N = T + (A - 0.24 \text{ mm (0.009 in.)})$$

**Exhaust:**

$$N = T + (A - 0.33 \text{ mm (0.013 in.)})$$

- Select a new shim with a thickness as close as possible to the calculated value.

HINT: Shims are available in seventeen sizes in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).

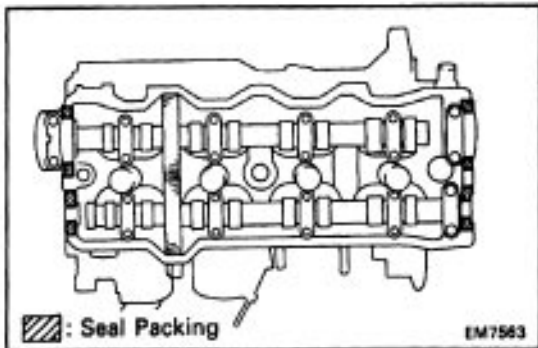


(c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).

SST 09248-50020 (09248-05011, 09248-05021)

(d) Recheck the valve clearance.



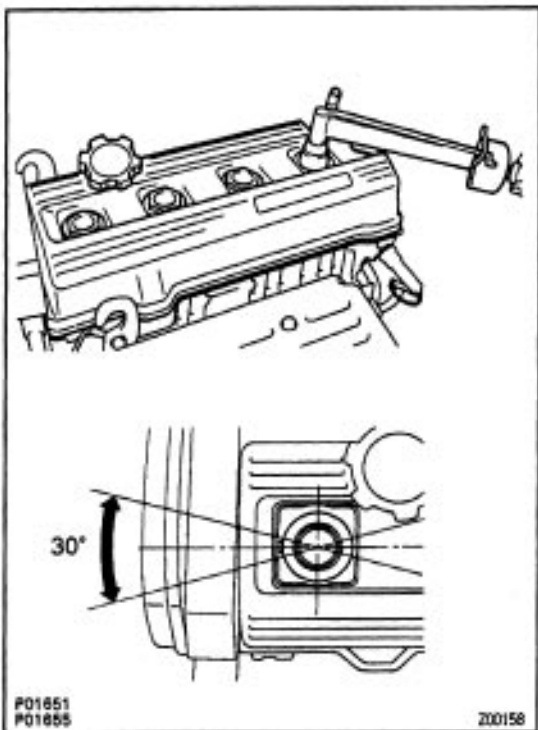
## 6. REINSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder head as shown in the illustration.

**Seal pecking:**

**Part No.08826-00080 or equivalent**



(c) Install the gasket to the head cover.

(d) Install the head cover with the 4 grommets and nuts.

Uniformly tighten the nuts in several passes.

**Torque: 23 N-m (230 kgf-cm. 17 ft-lbf)**

**HINT:** Install the grommets so that their markings are as shown in the illustration.

(e) Tighten the 2 wire harness clamp (No.2 timing belt cover) mounting bolts.

(f) Connect the PCV hoses.

## 7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

## Adjusting Shim Selection Chart (Intake)

Installed shim thickness mm (in.)	Measured clearance mm (in.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1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### Adjusting Shim Selection Chart (Exhaust)

[illegible]

**Exhaust valve clearance (Cold):**  
0.28 – 0.38 mm (0.011 – 0.015 in.)

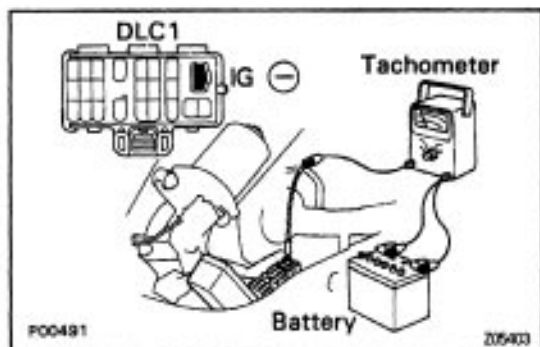
**EXAMPLE:** The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a No. 9 shim.



# IGNITION TIMING INSPECTION AND ADJUSTMENT

## 1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

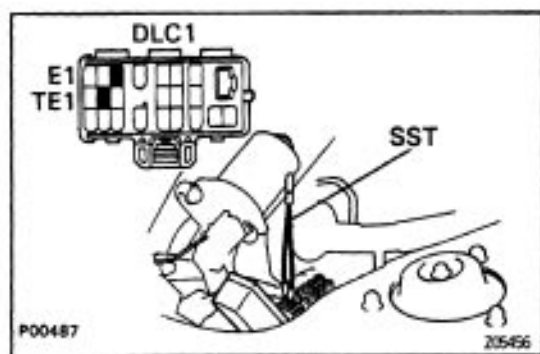


## 2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the test probe of a tachometer to terminal IG (-) of the data link connector 1.

### NOTICE:

- **NEVER** allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.
- As some tachometers are not compatible with this Ignition system, we recommend that you confirm the compatibility of yours before use.



## 3. ADJUST IGNITION TIMING

- (a) Using SST, connect terminals TE1 and E1 of the data link connector 1.

SST 09843-18020

HINT: After engine speed is kept at 1,000 – 1,300 rpm for 5 seconds, check that it returns to idle speed.

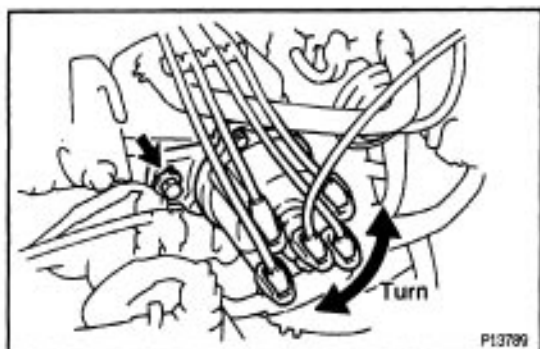


- (b) Using a timing light, check the ignition timing.

**Ignition timing:**

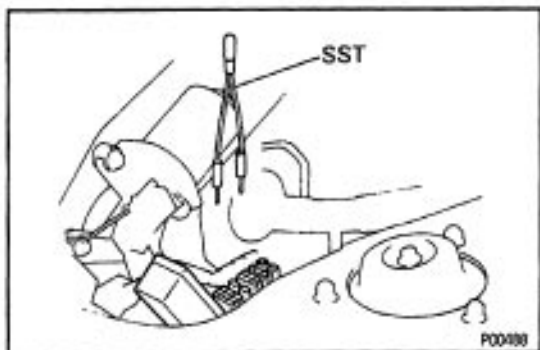
**10° BTDC @ idle**

**(Transmission in neutral position)**

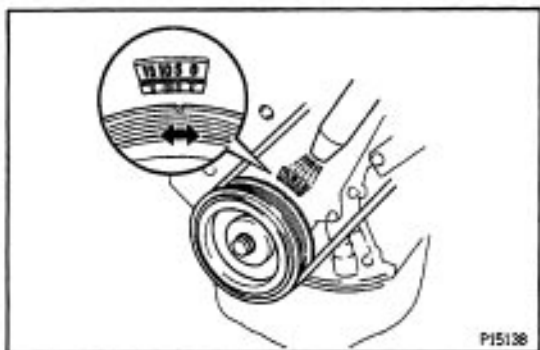


- (c) Loosen the bolt (California) or 2 bolts (except California), and adjust by turning the distributor.
- (d) Tighten the bolt (California) or 2 bolts (except California), and recheck the ignition timing.

**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**



- (e) Remove the SST.  
SST 09843-18020



#### 4. FURTHER CHECK IGNITION TIMING

**Ignition timing:**

**0 – 10° BTDC @ idle**

**(Transmission in neutral position)**

**HINT:** The timing mark moves in a range between 0° and 10°.

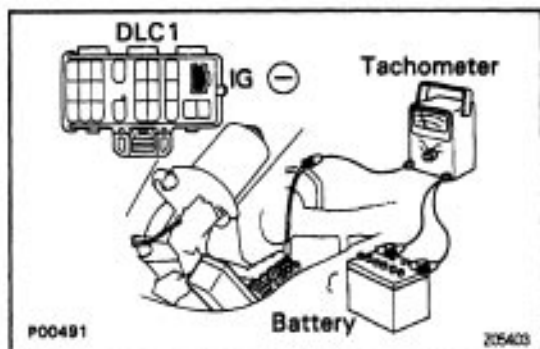
#### 5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

# IDLE SPEED INSPECTION

M358U-01

## 1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All vacuum lines properly connected
- (e) MFI/SFI system wiring connectors fully plugged
- (f) All operating accessories switched OFF
- (g) Ignition timing set correctly
- (h) Transmission in neutral position

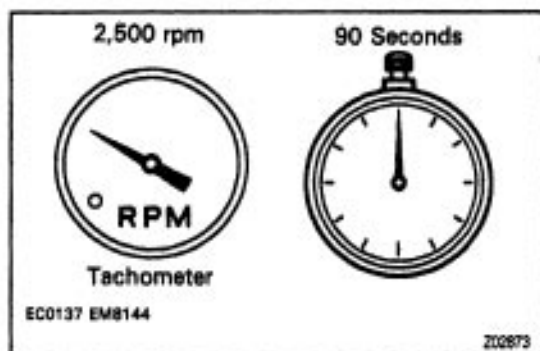


## 2. CONNECT TACHOMETER

Connect the test probe of a tachometer to terminal IG (-) of the data link connector 1.

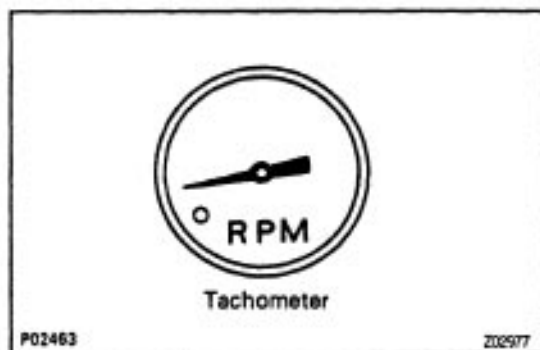
### NOTICE:

- Never allow the tachometer terminal to touch ground as it could result in damage to the Igniter and/or ignition coil.
- As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of yours before use.



## 3. INSPECT IDLE SPEED

- (a) Race the engine at 2,500 rpm for approx. 90 seconds.



- (b) Check the idle speed.

**Idle speed (w/ Cooling fan OFF):**

**750±50 rpm**

If the idle speed is not as specified, check the IAC system.

## 4. DISCONNECT TACHOMETER



## IDLE AND OR 2,500 RPM CO/HC CHECK

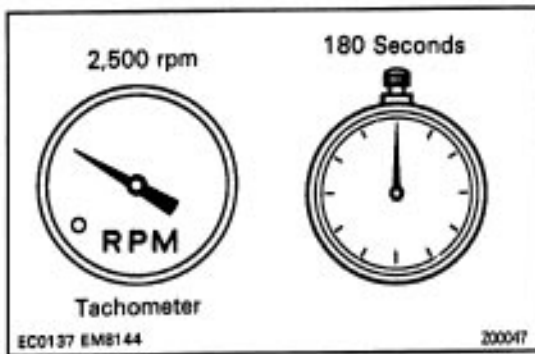
HINT: This check is used only to determine whether or not the idle CO/HC complies with regulations.

### 1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected

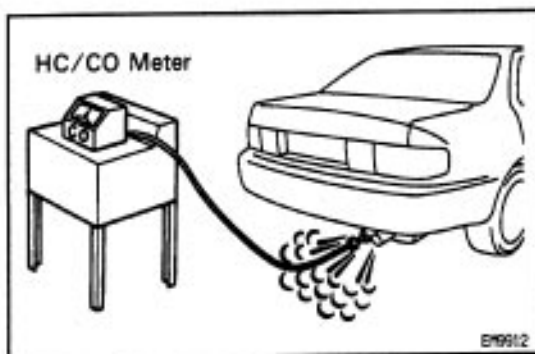
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

- (f) MFI/SFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in neutral position
- (i) Tachometer and CO/HC meter calibrated by hand.



### 2. START ENGINE

### 3. RACE ENGINE AT 2,500 RPM FOR APPROX. 180 SECONDS



### 4. INSERT CO/HC METER TESTING PROBE AT LEAST 40 cm (1.3 ft) INTO TAILPIPE DURING IDLING

### 5. IMMEDIATELY CHECK CO/HC CONCENTRATION AT IDLE AND/OR 2,500 RPM

Complete the measuring within 3 minutes.

HINT: When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.

**Troubleshooting**

**If the CO/HC concentration does not comply with regulations, perform troubleshooting in the order given below.**

- (a) Check oxygen sensor operation.  
(See page [EG1-231](#))
- (b) See the table below for possible causes, then inspect and correct the applicable causes if necessary.

HC	CO	Problems	Causes
High	Normal	Rough idle	1. Faulty ignitions: <ul style="list-style-type: none"> <li>• Incorrect timing</li> <li>• Fouled, shorted or improperly gapped plugs</li> <li>• Open or crossed high-tension cords</li> <li>• Cracked distributor cap</li> </ul> 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: <ul style="list-style-type: none"> <li>• PCV hose</li> <li>• EGR valve</li> <li>• Intake manifold</li> <li>• Throttle body</li> <li>• IAC valve</li> <li>• Brake booster line</li> </ul> 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty MFI/SFI systems <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Clogged fuel return line</li> <li>• Defective engine coolant temp. sensor</li> <li>• Defective intake air temp. sensor</li> <li>• Faulty ECM</li> <li>• Faulty injector</li> <li>• Faulty throttle position sensor</li> <li>• MAP sensor</li> </ul>

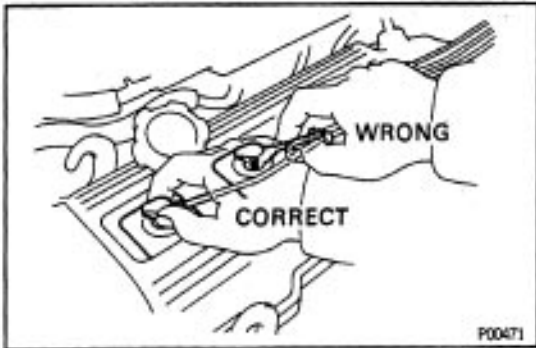
## COMPRESSION CHECK

HINT: If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

### 1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

### 2. DISCONNECT DISTRIBUTOR CONNECTOR(S)

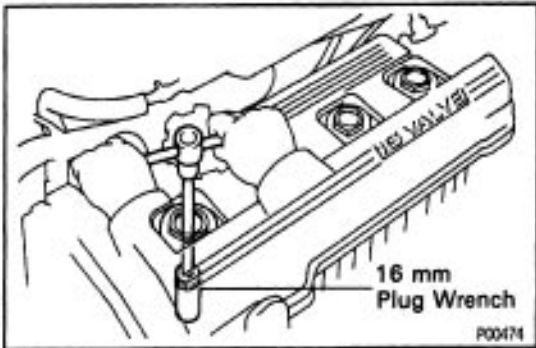


### 3. DISCONNECT HIGH –TENSION CORDS FROM SPARK PLUGS

Disconnect the high – tension cords at the rubber boot.

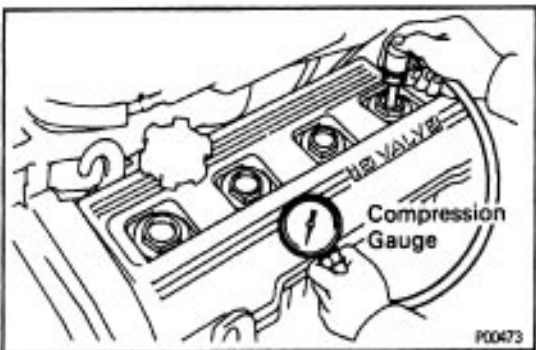
DO NOT pull on the cords.

**NOTICE:** Pulling on or bending the cords may damage the conductor inside.



### 4. REMOVE SPARK PLUGS

Using a 16 mm plug wrench, remove the spark plug.



### 5. CHECK CYLINDER COMPRESSION PRESSURE

- (a) Insert a compression gauge into the spark plug hole.
- (b) Fully open the throttle.
- (c) While cranking the engine, measure the compression pressure.

HINT: Always use a fully charged battery to obtain engine speed of 250 rpm or more.

- (d) Repeat steps
  - (a) through
  - (c) for each cylinder.

**NOTICE:** This measurement must be done in as short a time as possible.

Compression pressure:

1,226 kPa (12.5 kgf/cm<sup>2</sup>, 178 psi) or more

Minimum pressure:

981 kPa (10.0 kgf/cm<sup>2</sup>, 142 psi)

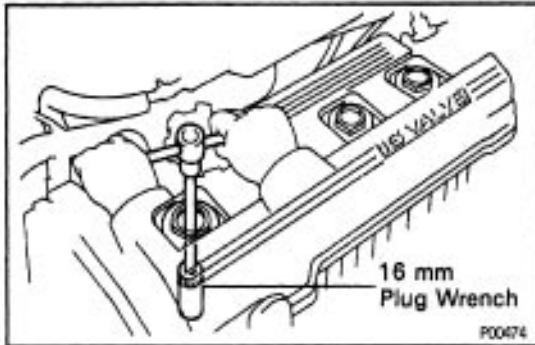
Difference between each cylinder:

98 kPa (1.0 kgf/cm<sup>2</sup>, 14 psi) or less

(e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through

(c) for cylinders with low compression.

- If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.



#### **6. REINSTALL SPARK PLUGS**

Using a 16 mm plug wrench, install the spark plug.

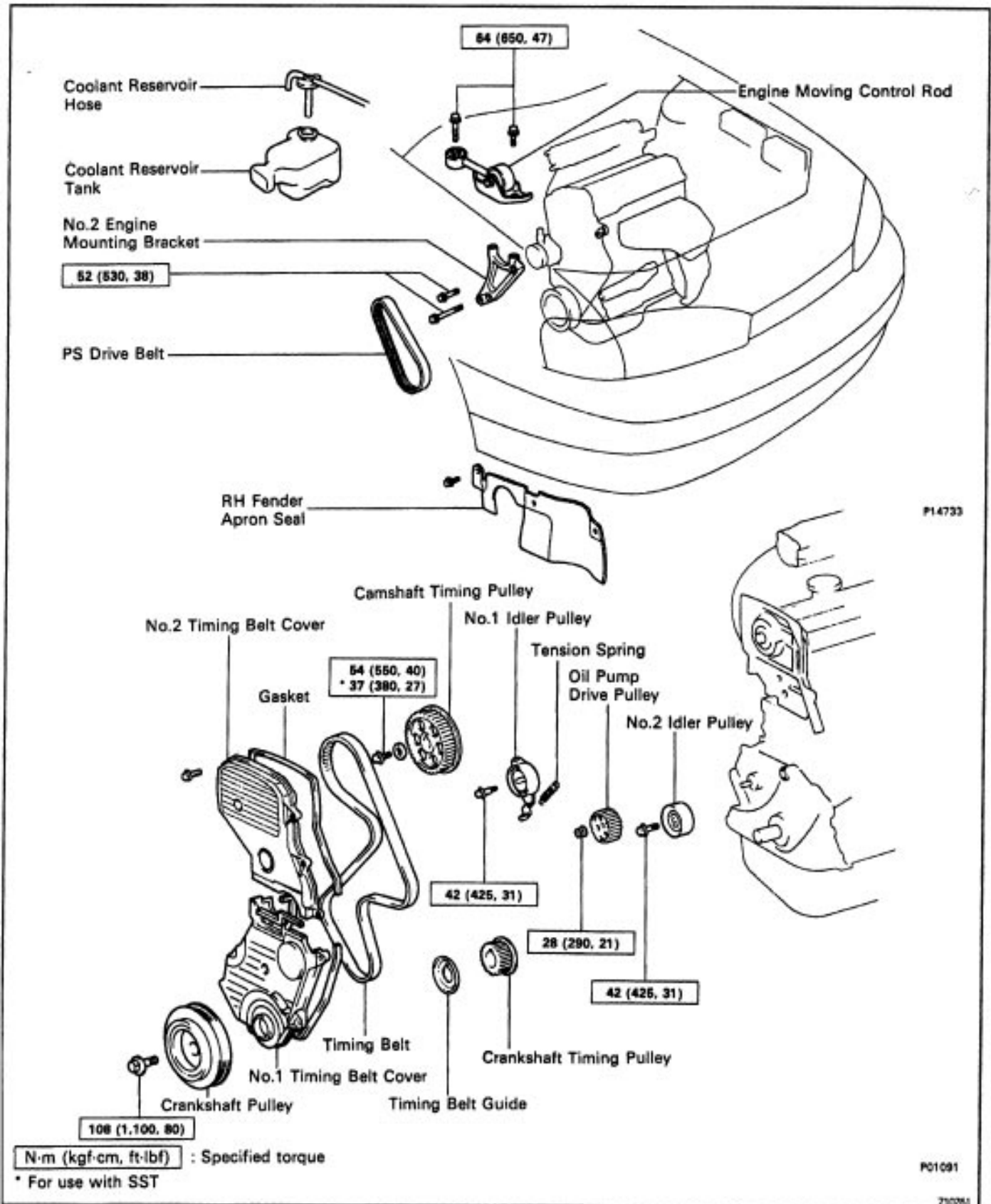
**Torque: 18 N-m (180 kgf-cm, 13 ft-lbf)**

#### **7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS**

#### **8. RECONNECT DISTRIBUTOR CONNECTOR(S)**

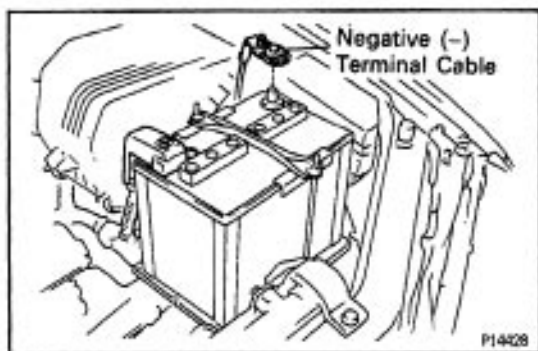
# TIMING BELT COMPONENTS FOR REMOVAL AND INSTALLATION

90087-04



P01091

Z30261

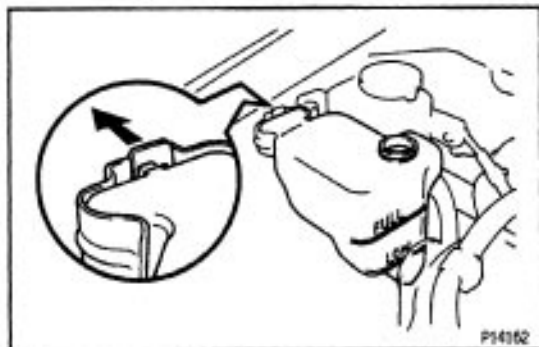


## TIMING BELT REMOVAL

(See Components for Removal and Installation)

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (-) terminal cable is disconnected from the battery.



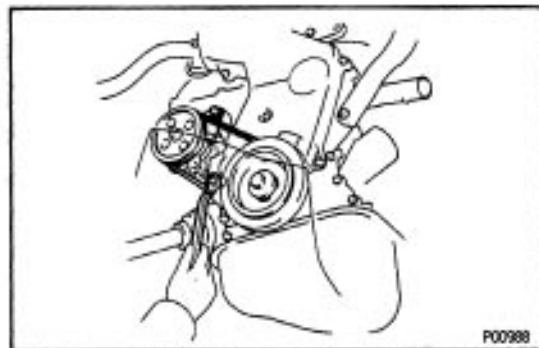
### 2. REMOVE ENGINE COOLANT RESERVOIR TANK

- (a) Disconnect the reservoir hose.
- (b) While pushing the tab of the bracket, remove the reservoir tank.

### 3. REMOVE GENERATOR (See page CH-10)

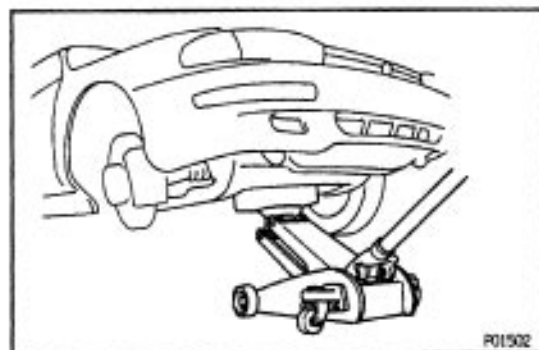
### 4. REMOVE RH FRONT WHEEL

### 5. REMOVE RH FENDER APRON SEAL



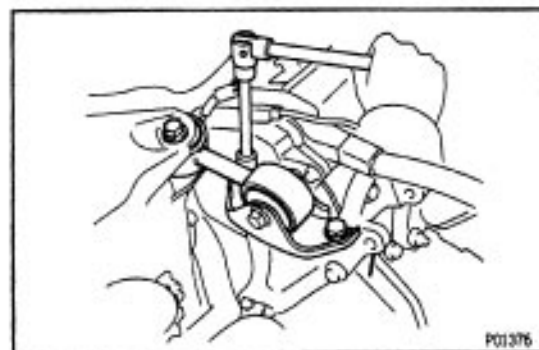
### 6. REMOVE PS DRIVE BELT

Loosen the 2 bolts, and remove the drive belt.



### 7. SLIGHTLY JACK UP ENGINE

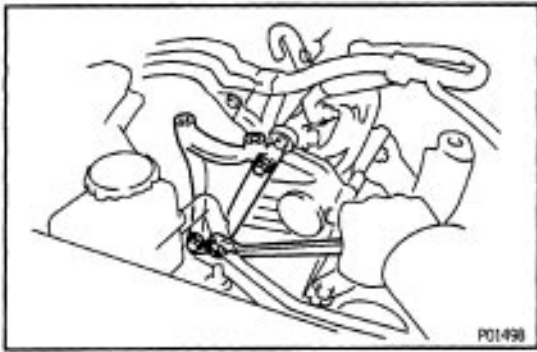
Raise the engine enough to remove the weight from the engine mounting on the right side.



### 8. REMOVE ENGINE MOVING CONTROL ROD

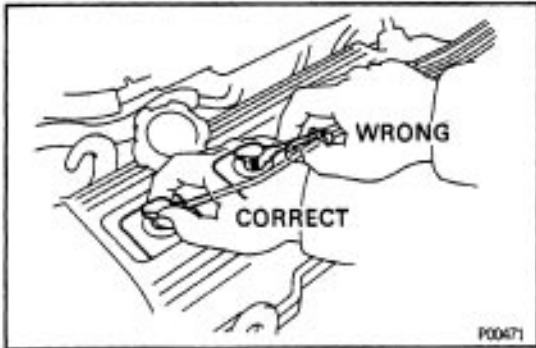
Remove the 3 bolts and control rod.

### 9. DISCONNECT CONNECTOR FROM GROUND WIRE ON RH FENDER APRON



### 10. REMOVE No.2 ENGINE MOUNTING BRACKET

Remove the 3 bolts and mounting bracket.

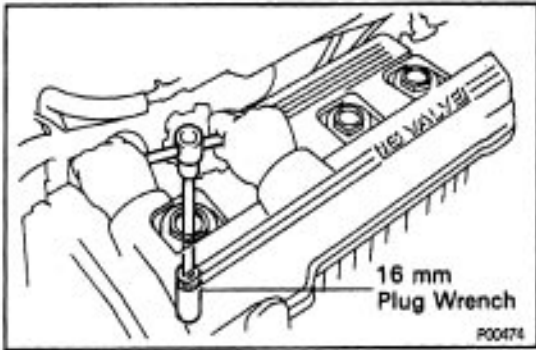


### 11. REMOVE SPARK PLUGS

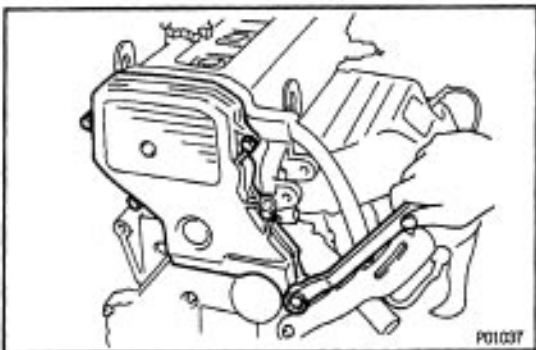
(a) Disconnect the high – tension cords at the rubber boot.

DO NOT pull on the cords.

**NOTICE:** Pulling on or bending the cords may damage the conductor inside.

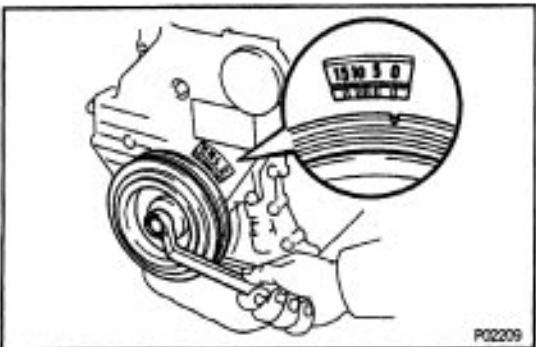


(b) Using a 16 mm plug wrench, remove the spark plug.



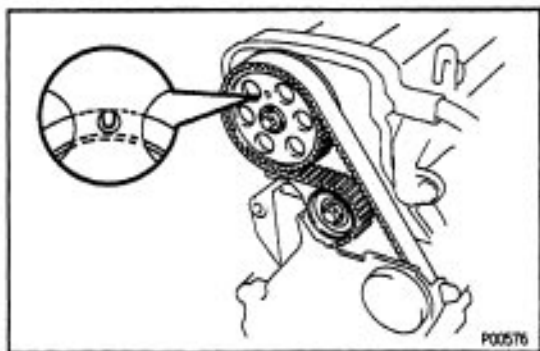
### 12. REMOVE NO.2 TIMING BELT COVER

Remove the 5 bolts, timing belt cover and 2 gaskets.

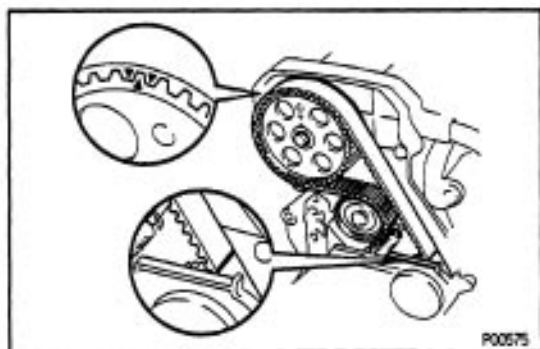


### 13. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove with timing mark "0" of the No.1 timing belt cover.

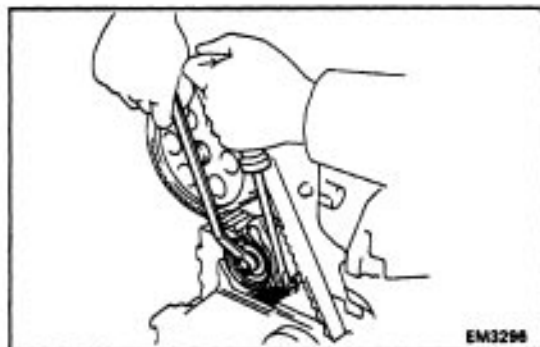


- (b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap. If not, turn the crankshaft one revolution (360°).

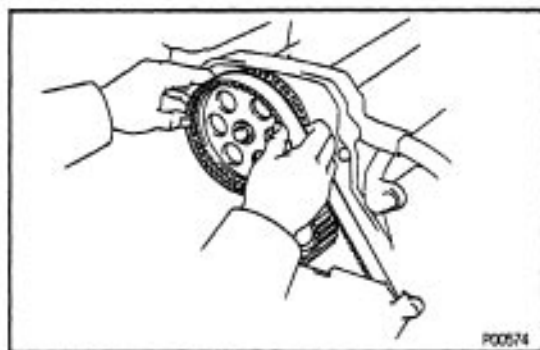


#### 14. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

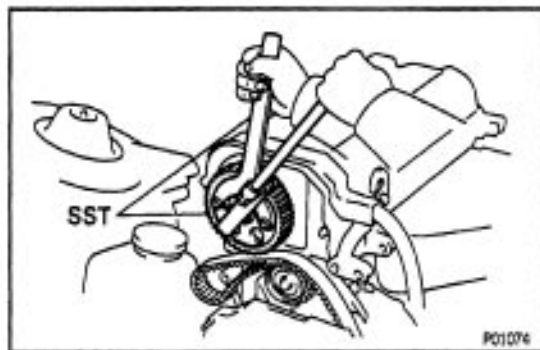
HINT (When re-using timing belt): Place the matchmarks on the timing belt and camshaft timing pulley, and place matchmark on timing belt to match the end of the No.1 timing belt cover.



- (a) Loosen the mounting bolt of the No.1 idler pulley and shift the pulley toward the left as far as it will go, and temporarily tighten it.



- (b) Remove the timing belt from the camshaft timing pulley.

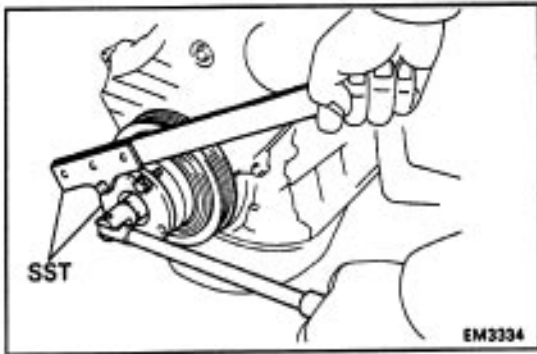


#### 15. REMOVE CAMSHAFT TIMING PULLEY

Using SST, remove the bolt, plate washer and timing pulley.

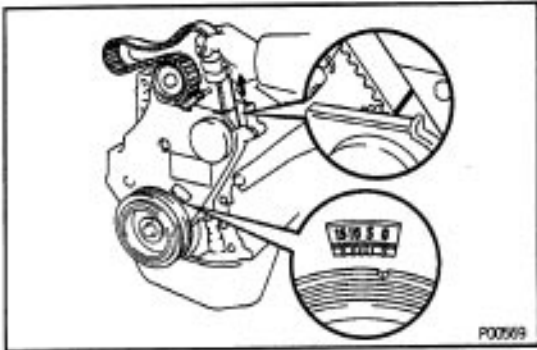
SST 09249-63010 and 09278-54012



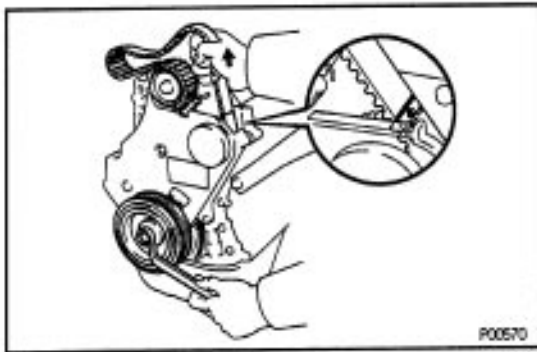


## 16. REMOVE CRANKSHAFT PULLEY

- (a) Using SST, remove the pulley bolt.  
SST 09213-54015 (91651- 60855),  
09330-00021

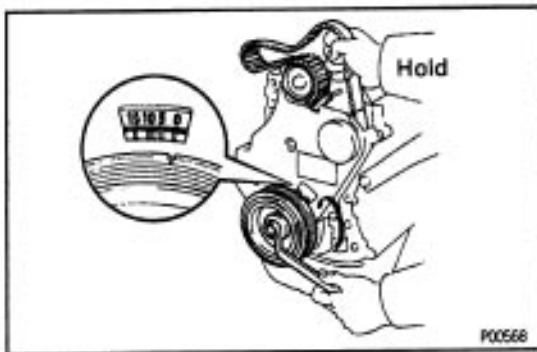


**HINT** (When re-using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No. 1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "0" of the No. 1 timing belt cover. If the matchmark does not align, align as follows:

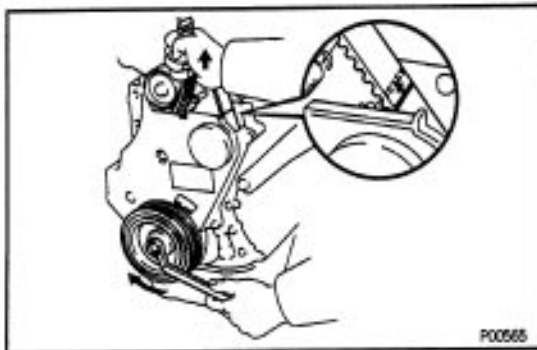


When matchmark is misaligned clockwise:

- Align the matchmark by pulling the timing belt up on the water pump pulley side while turning the crankshaft pulley counterclockwise.

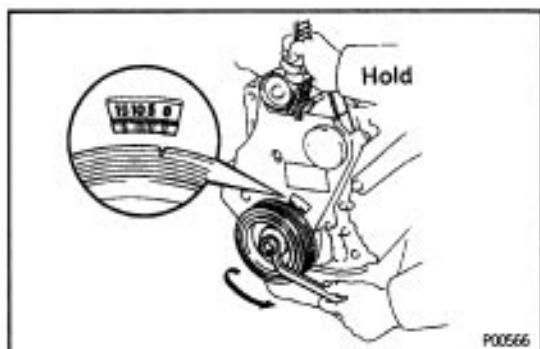


- After aligning the matchmark, hold the timing belt, turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.

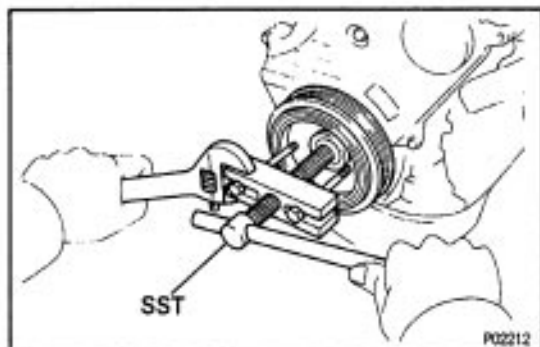


When matchmark is misaligned counterclockwise:

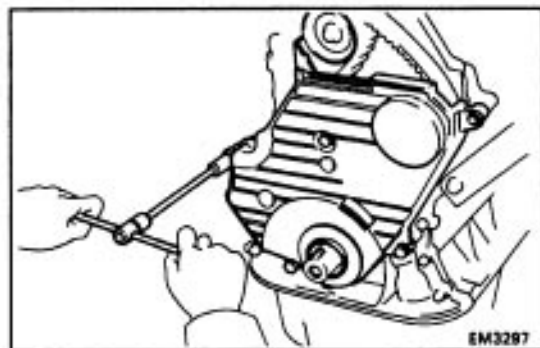
- Align the matchmarks by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



- After aligning the matchmark, hold the timing belt, turn the crankshaft pulley counterclockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.

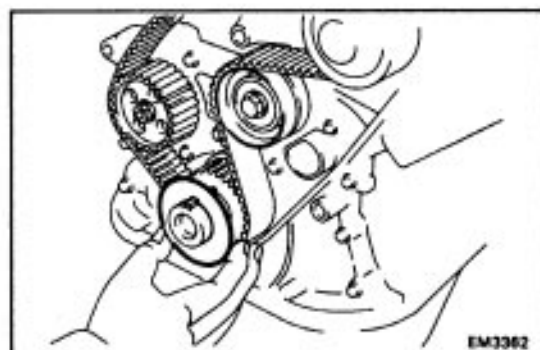


- (b) Using SST, remove the pulley.  
 SST 09213-60017 (09213-00020, 09213-00030, 09213-00060)  
 HINT (When re-using timing belt): Remove the pulley without turning it.

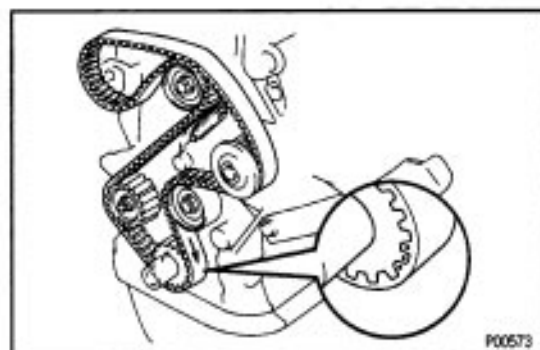


#### 17. REMOVE No.1 TIMING BELT COVER

Remove the 4 bolts, timing belt cover and gasket.

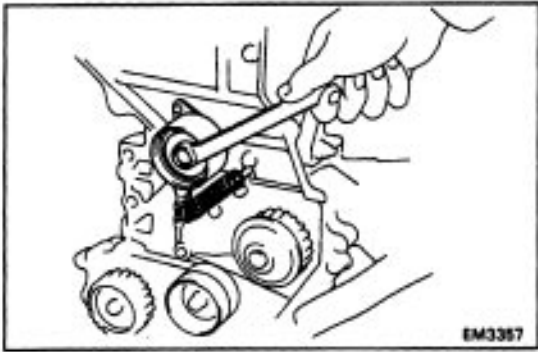


#### 18. REMOVE TIMING BELT GUIDE



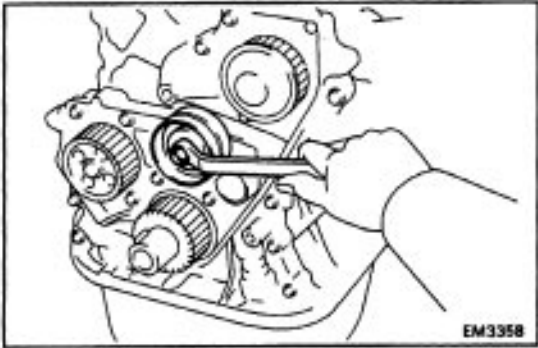
#### 19. REMOVE TIMING BELT

HINT (When re-using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.



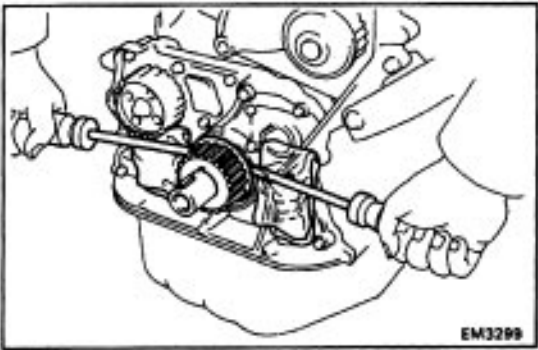
## 20. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.



## 21. REMOVE NO.2 IDLER PULLEY

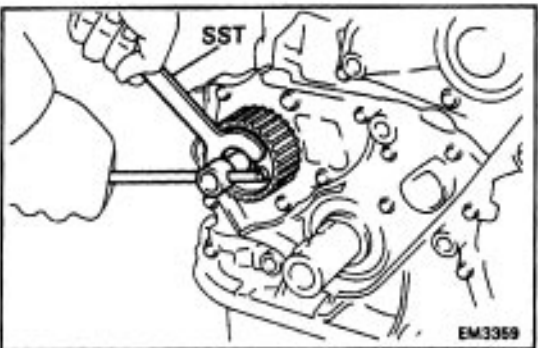
Remove the bolt and pulley.



## 22. REMOVE CRANKSHAFT TIMING PULLEY

If the pulley cannot be removed by hand, use 2 screwdrivers.

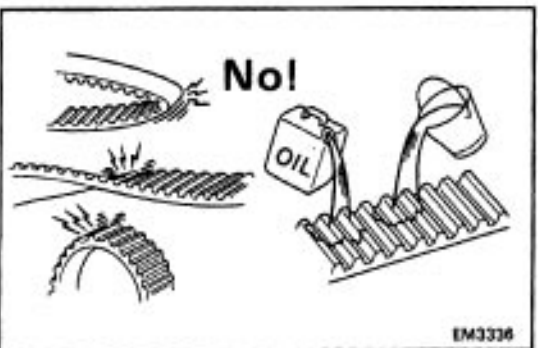
HINT: Position shop rags as shown to prevent damage.



## 23. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

SST 09616-30011

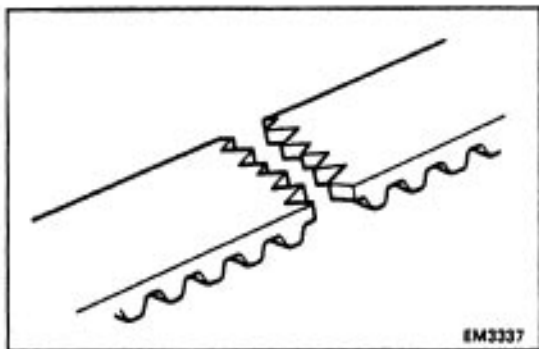


## TIMING BELT COMPONENTS INSPECTION

### 1. INSPECT TIMING BELT

#### NOTICE:

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.



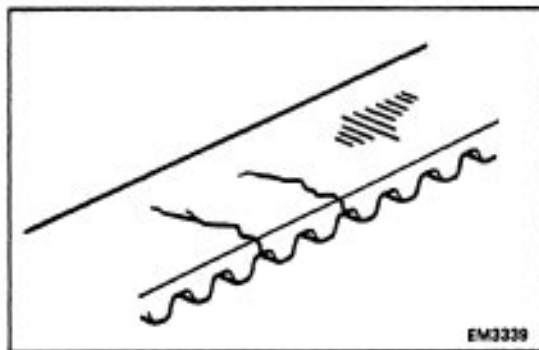
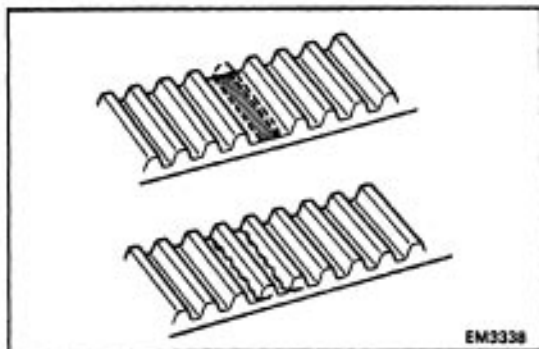
- **Do not utilize timing belt tension when installing or removing the mounting bolt of the camshaft timing pulley.**

If there are any defects as shown in the illustration, check the following points:

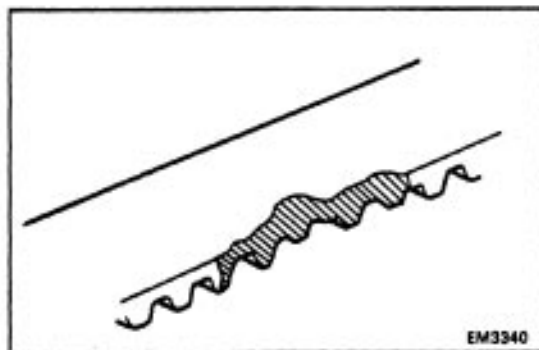
(a) Premature parting

- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

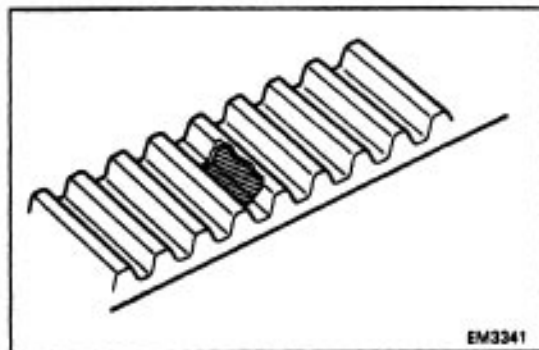
(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.



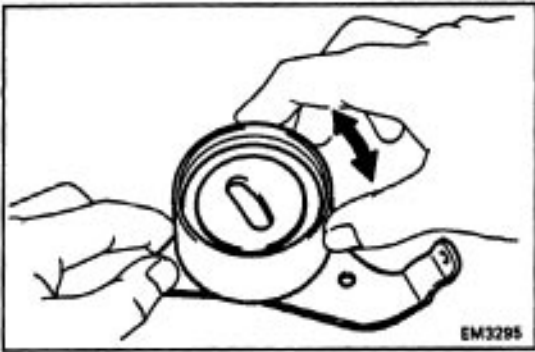
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.

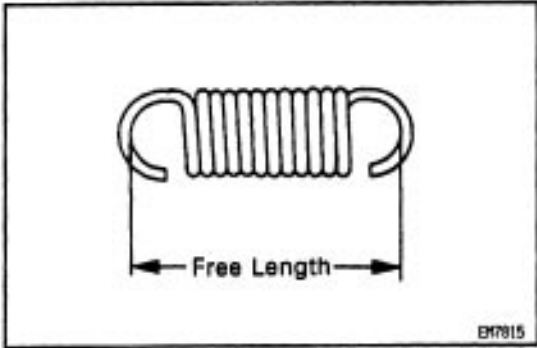


(e) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and for foreign material on the pulley teeth. If necessary, replace the timing belt.



## 2. INSPECT IDLER PULLEYS

Check that the idler pulley turns smoothly.  
If necessary, replace the idler pulley.



## 3. INSPECT TENSION SPRING

- (a) Measure the free length of tension spring.

**Free length:**

**46.0 mm (1.811 in.)**

If the free length is not as specified, replace the tension spring.

- (b) Measure the tension of the tension spring at the specified installed length.

**Installed tension (at 50.5 mm (1.988 in.)):**

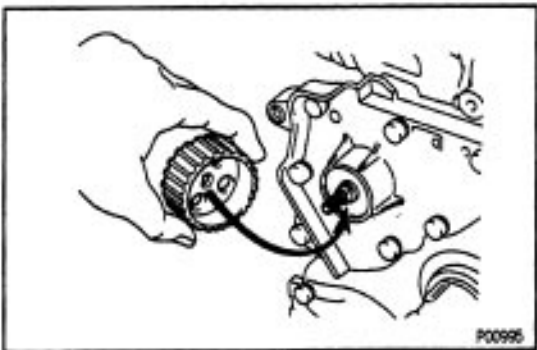
**Green color**

**32 – 37 N (3.25 – 3.75 kgf, 7.2 – 8.3 lbf)**

**Silver color**

**47 – 52 N (4.75 – 5.25 kgf, 10.5 – 11.8 lbf)**

If the installed tension is not as specified, replace the tension spring.



## TIMING BELT INSTALLATION

(See Components for Removal and Installation)

### 1. INSTALL OIL PUMP PULLEY

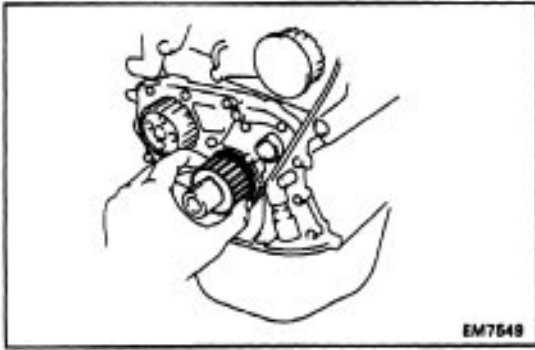
- (a) Align the cutouts of the pulley and shaft, and slide on the pulley.



- (b) Using SST, install the nut.

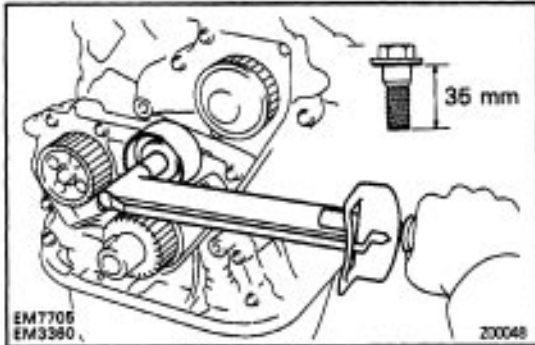
SST 09616 – 30011

**Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)**



## 2. INSTALL CRANKSHAFT TIMING PULLEY

- (a) Align the timing pulley set key with the key groove of the pulley.
- (b) Slide on the timing pulley, facing the flange side inward.



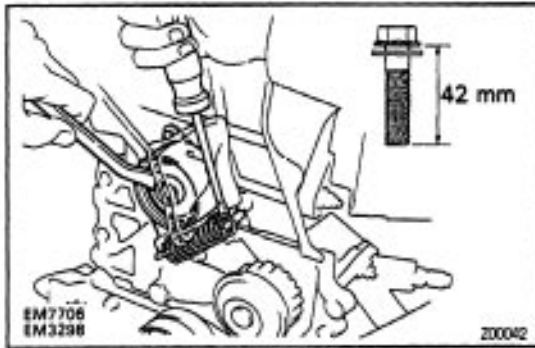
## 3. INSTALL NO.2 IDLER PULLEY

- (a) Install the pulley with the bolt.

**Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)**

**HINT:** Use a bolt 35 mm (1.38 in.) in length.

- (b) Check that the idler pulley moves smoothly.

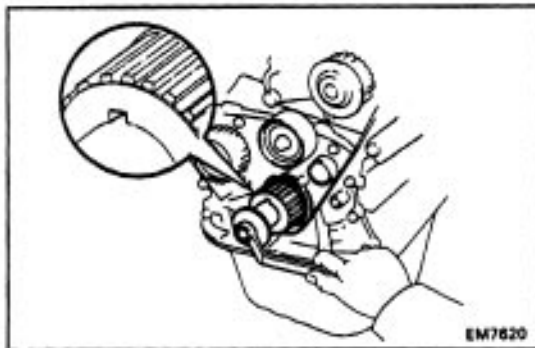


## 4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

- (a) Install the pulley with the bolt. Do not tighten the bolt yet.

**HINT:** Use a bolt 42 mm (1.65 in.) in length.

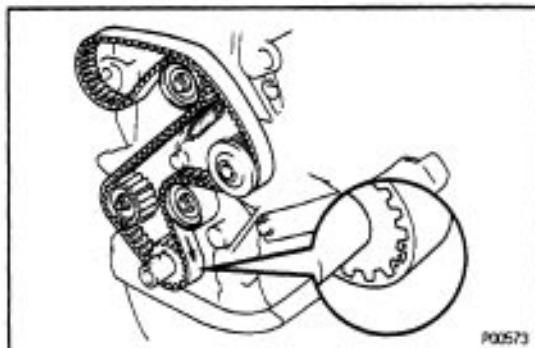
- (b) Install the tension spring.
- (c) Pry the pulley toward the left as far as it will go and tighten the bolt.
- (d) Check that the idler pulley moves smoothly.



## 5. TEMPORARILY INSTALL TIMING BELT

**NOTICE:** The engine should be cold.

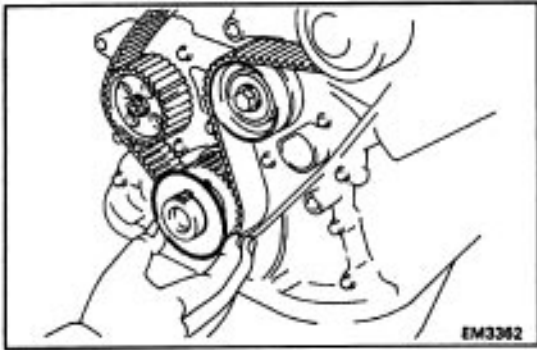
- (a) Using the crankshaft pulley bolt, turn the crankshaft and position the key groove of the crankshaft timing pulley upward.



- (b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No. 1 idler pulley, No. 2 idler pulley and keep them clean.

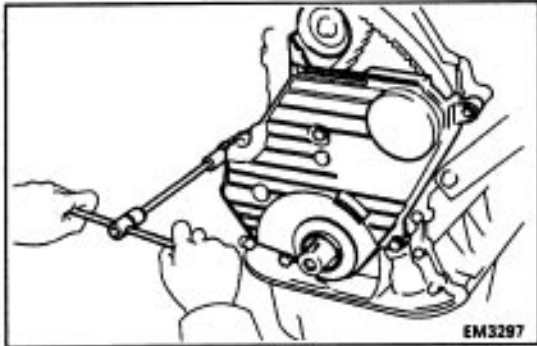
- (c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.1 idler pulley, water pump pulley and No.2 idler pulley.

**HINT (When re-using timing belt):** Align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.



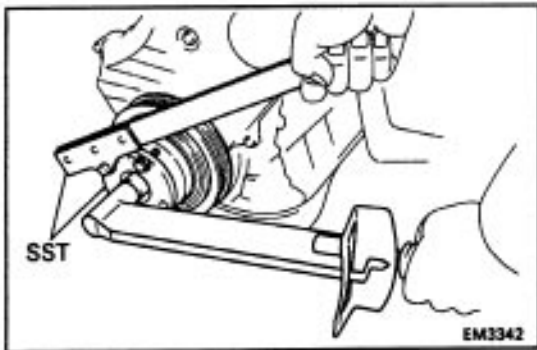
## 6. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.



## 7. INSTALL NO.1 TIMING BELT COVER

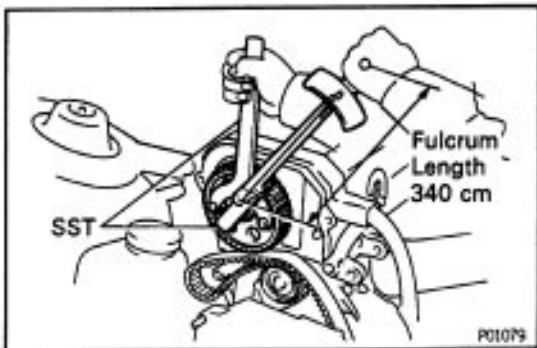
- Install the gasket to the timing belt cover.
- Install the timing belt cover with the 4 bolts.



## 8. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- Using SST, install the pulley bolt.  
SST 09213-54015 (91651 -60855)  
09330-00021

**Torque: 108 N-m (1,100 kgf-cm, 80 ft-lbf)**



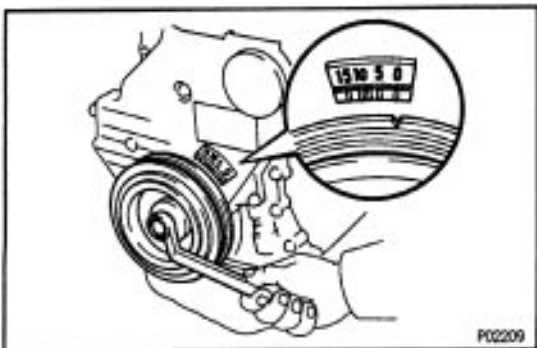
## 9. INSTALL CAMSHAFT TIMING PULLEY

- Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.
- Using SST, install the plate washer and bolt.

SST 09249 - 63010 and 09278 - 54012

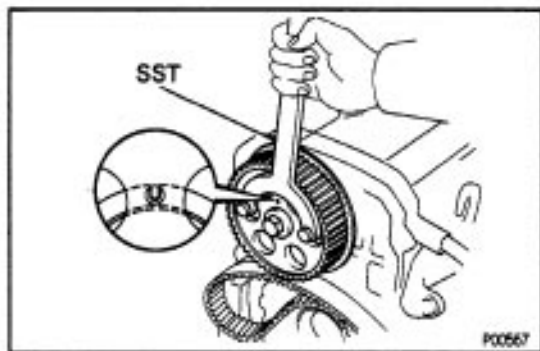
**Torque: 37 N-m (380 kgf-cm, 27 ft-lbf)**

**HINT:** Use a torque wrench with a fulcrum length of 340 cm (13.39 in.)



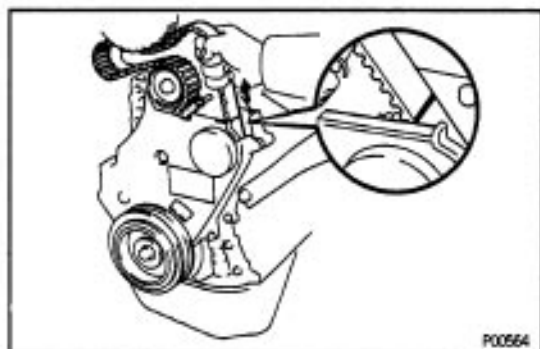
## 10. SET No.1 CYLINDER TO TDC/COMPRESSION

- Turn the crankshaft pulley, and align its groove with timing mark "0" of the No.1 timing belt cover.



- (b) Using SST, turn the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.

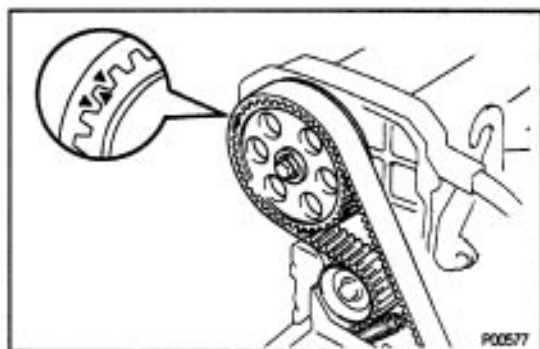
SST 09278-54012



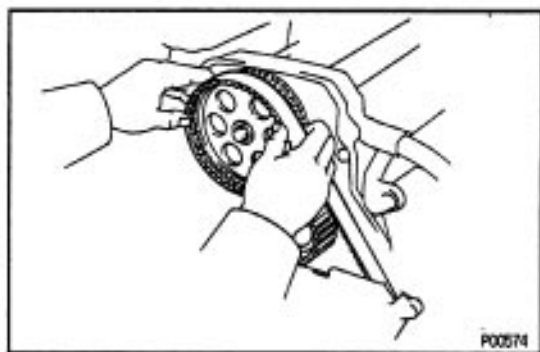
## 11. INSTALL TIMING BELT

HINT. (When re-using timing belt):

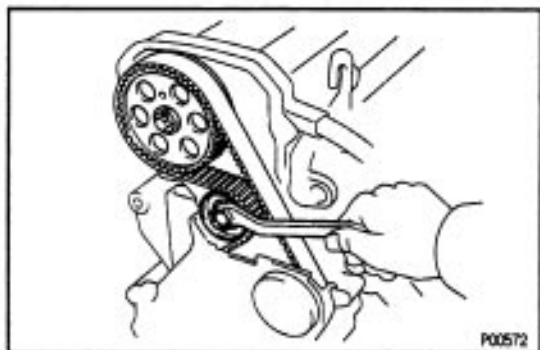
- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover. If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align. (See page [EG1-29](#))



- Align the matchmarks of the timing belt and camshaft timing pulley.



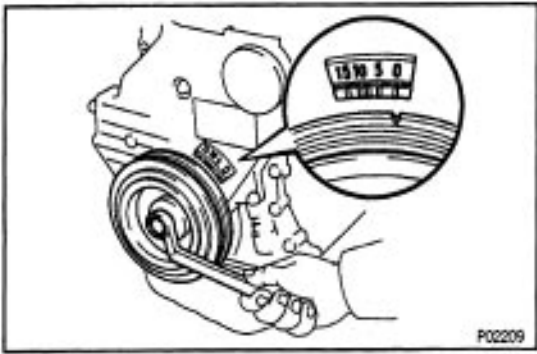
- (a) Remove any oil or water on the camshaft timing pulley, and keep it clean.
- (b) Install the timing belt, and check the tension between the crankshaft timing pulley and camshaft timing pulley.



## 12. CHECK VALVE TIMING

- (a) Loosen the No.1 idler pulley bolt 1/2 turn.





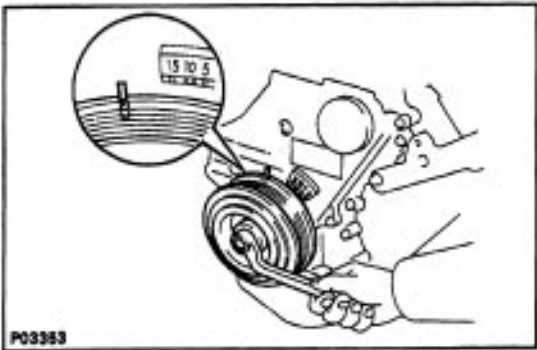
- (b) Turn the crankshaft pulley 2 revolutions from TDC to TDC.

**NOTICE: Always turn the crankshaft clockwise.**



- (c) Check that each pulley aligns with the timing marks as shown in the illustration..

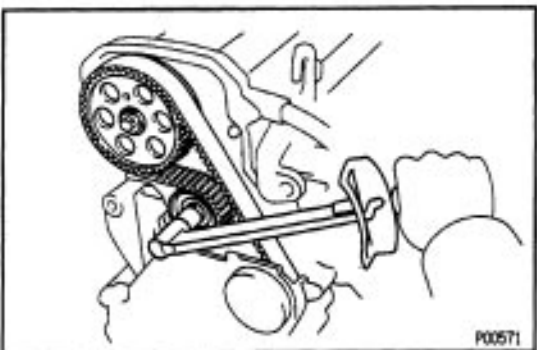
If the timing marks do not align, remove the timing belt and reinstall it.



- (d) w/ Green Tension Spring:

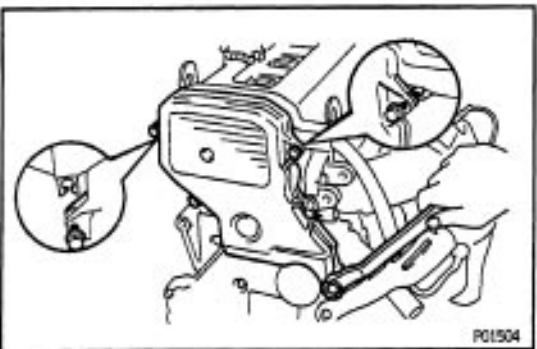
Slowly turn the crankshaft pulley 1 and 7/8 revolutions, and align its groove with the mark at 45<sup>1</sup> BTDC (for No.1 cylinder) of the No.1 timing belt cover.

**NOTICE: Always turn the crankshaft clockwise.**



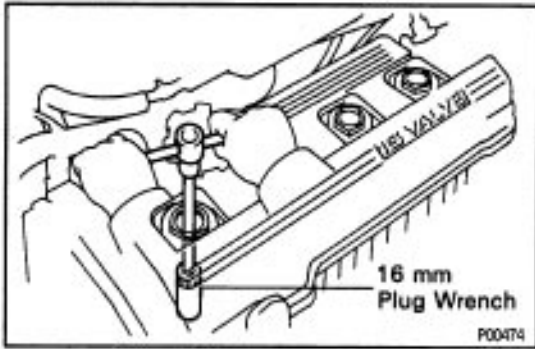
- (e) Torque the mounting bolt of the No.1 idler pulley.

**Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)**

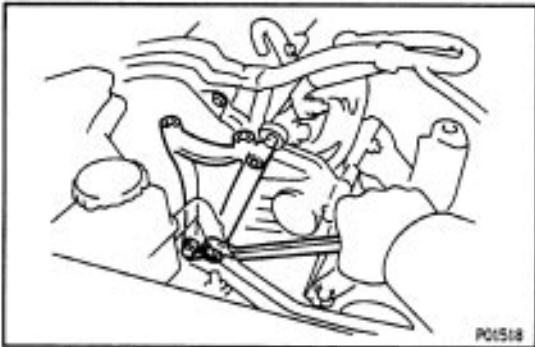


### 13. INSTALL NO.2 TIMING BELT COVER

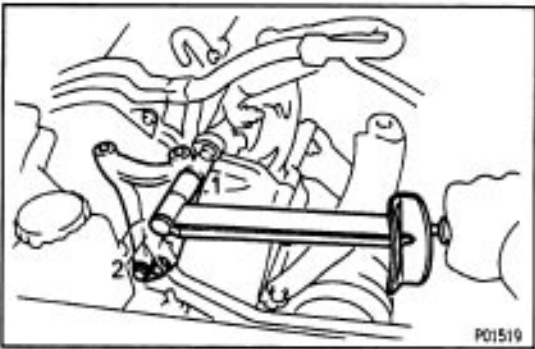
- Install the 2 gaskets to the No. 1 and No.2 belt covers.
- install the belt cover with the 5 bolts.
- Align the 2 clamps of the engine wire with cover mounting bolts.

**14. INSTALL SPARK PLUGS**

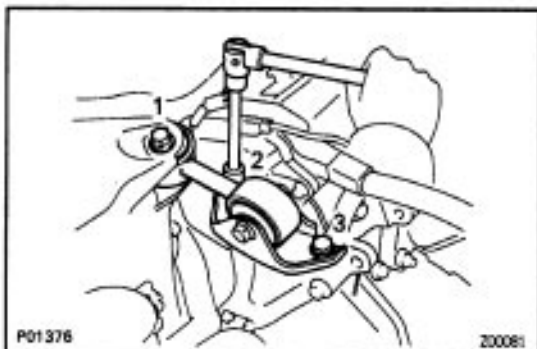
- (a) Using a 16 mm plug wrench, install the spark plug.
- (b) Connect the high-tension cords.

**15. INSTALL NO.2 ENGINE MOUNTING BRACKET**

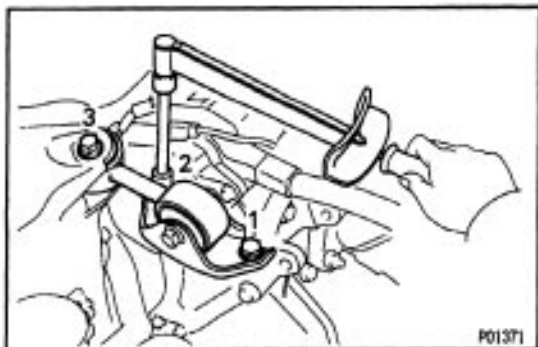
- (a) Temporarily install the No.2 engine mounting bracket with the 2 bolts.



- (b) Install the remaining bolt.
  - (c) Tighten the 3 bolts in the sequence shown.
- Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)**

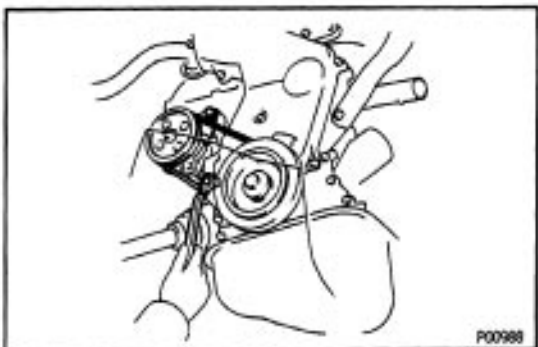
**16. CONNECT CONNECTOR TO GROUND WIRE ON RH FENDER APRON****17. INSTALL ENGINE MOVING CONTROL ROD**

- (a) Temporarily install the engine moving control rod with the 3 bolts in the sequence shown.



(b) Tighten the 3 bolts in the sequence shown.

Torque: 64 N-m (650 kgf-cm. 47 ft-lbf)



#### 18. INSTALL AND ADJUST PS DRIVE BELT

Install the drive belt with the pivot and adjusting bolts.

##### Drive belt tension:

New belt

$125 \pm 25$  lbf

Used belt

$80 \pm 20$  lbf

#### 19. INSTALL RH FENDER APRON SEAL

#### 20. INSTALL RH FRONT WHEEL

#### 21. INSTALL GENERATOR (See page [CH-24](#))

##### Drive belt tension:

w/ A/C

New belt

$175 \pm 5$  lbf

Used belt

$130 \pm 10$  lbf

w/o A/C

New belt

$125 \pm 25$  lbf

Used belt

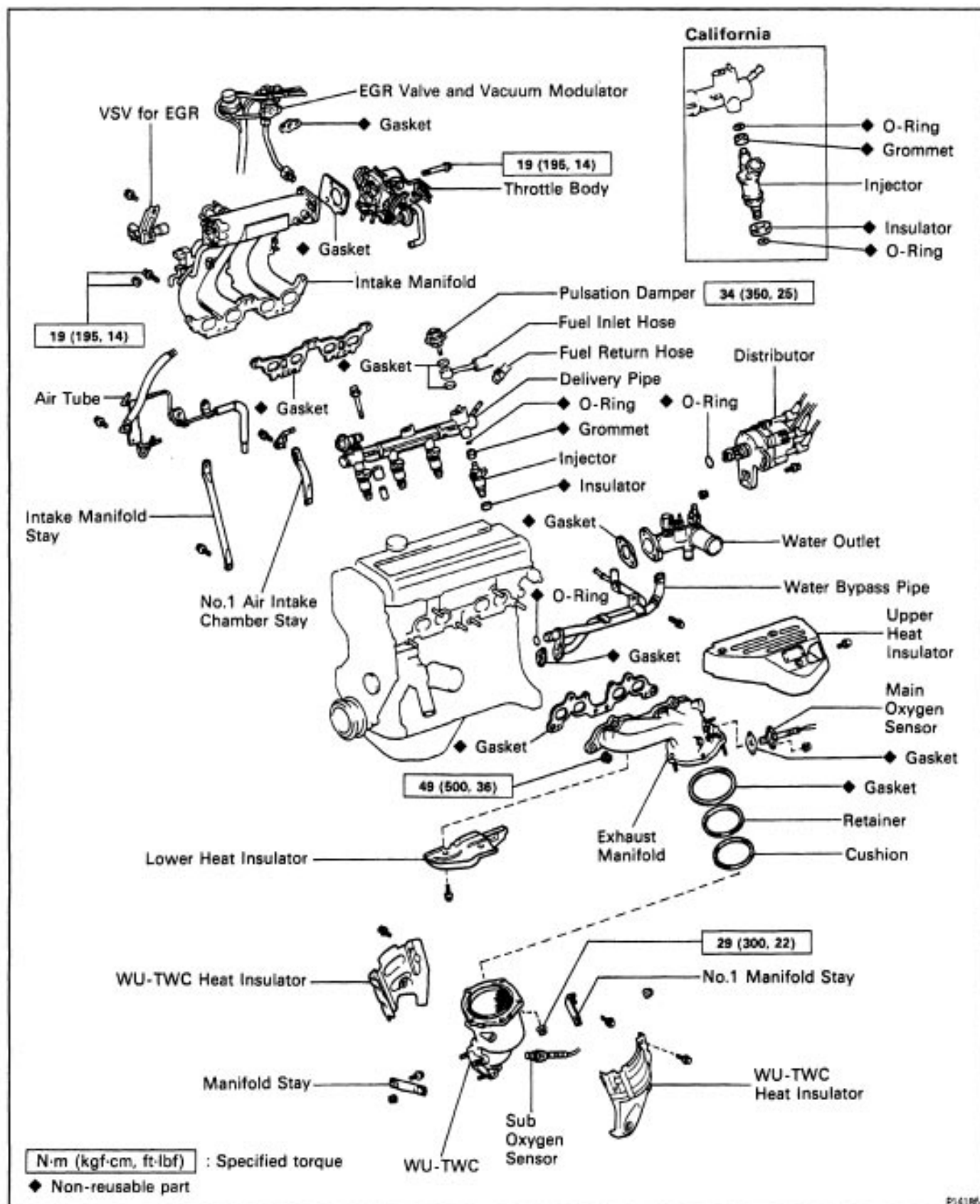
$95 \pm 20$  lbf

#### 22. INSTALL ENGINE COOLANT RESERVOIR TANK

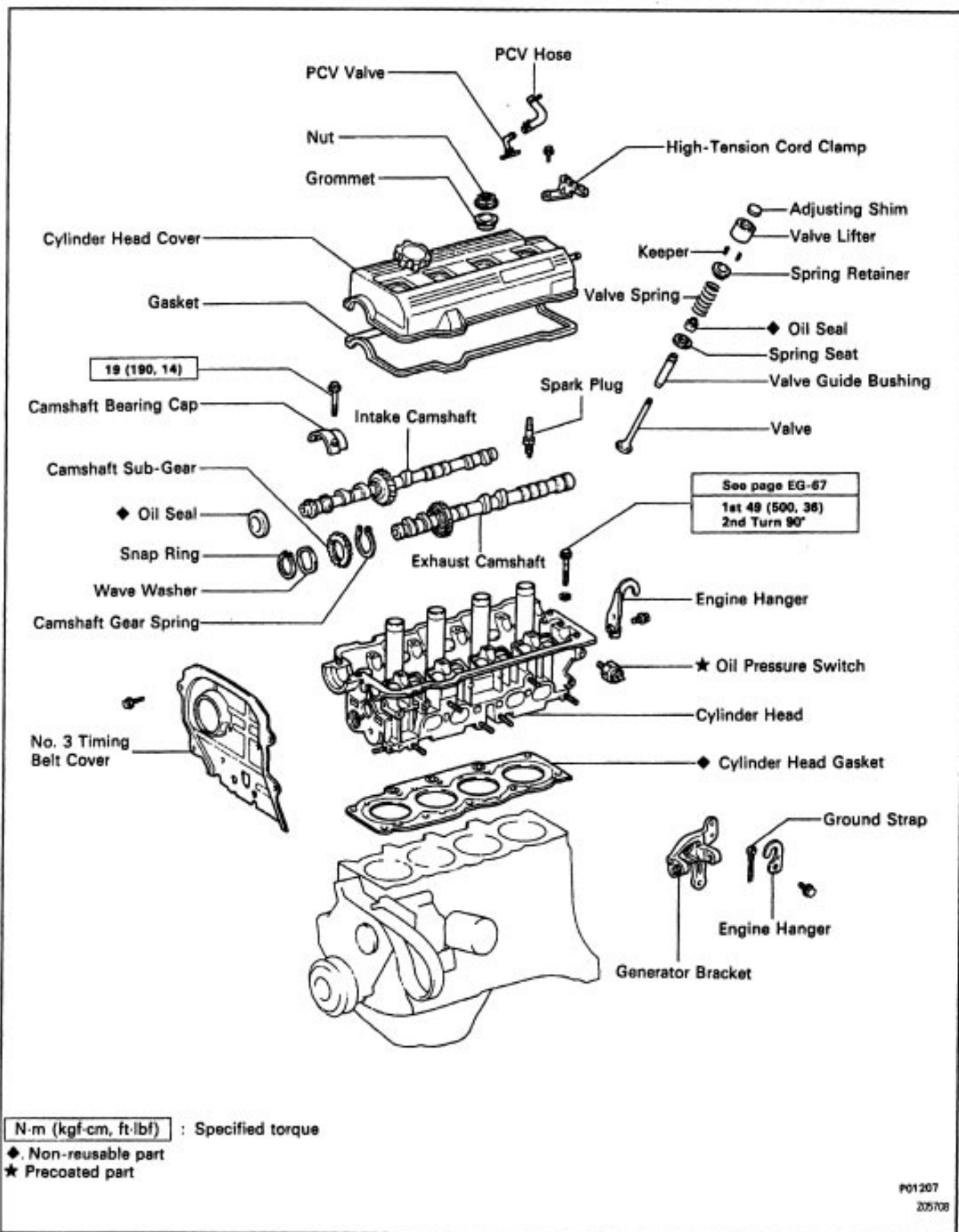
#### 23. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY

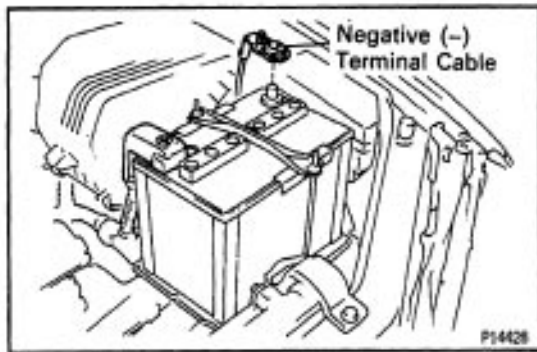
# CYLINDER HEAD COMPONENTS FOR REMOVAL AND INSTALLATION

90086-07



## COMPONENTS (Cont'd)





## CYLINDER HEAD REMOVAL

(See Components for Removal and Installation)

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

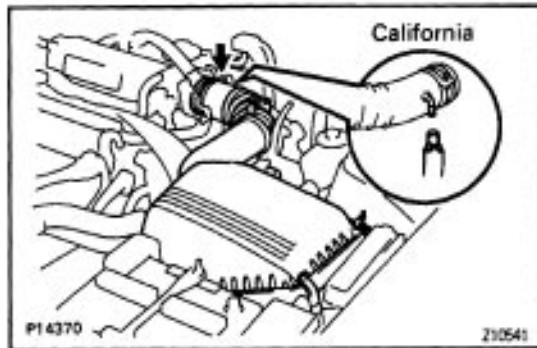
**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the “LOCK” position and the negative (-) terminal cable is disconnected from the battery.

### 2. DRAIN ENGINE COOLANT

### 3. A/T:

DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

### 4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY



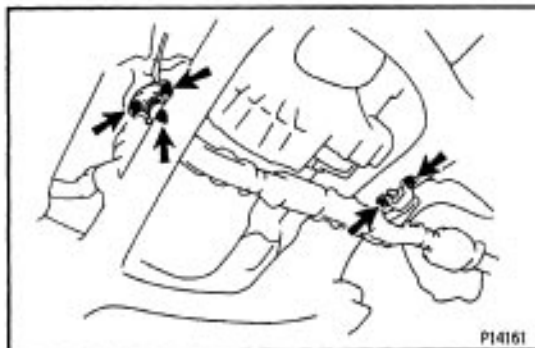
### 5. REMOVE AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

- (a) Disconnect the intake air temperature sensor connector.
- (b) California only:  
Disconnect the air hose from the air cleaner hose.
- (c) Loosen the air cleaner hose clamp bolt.
- (d) Disconnect the 4 air cleaner cap clips.
- (e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.

### 6. REMOVE GENERATOR (See page CH-10)

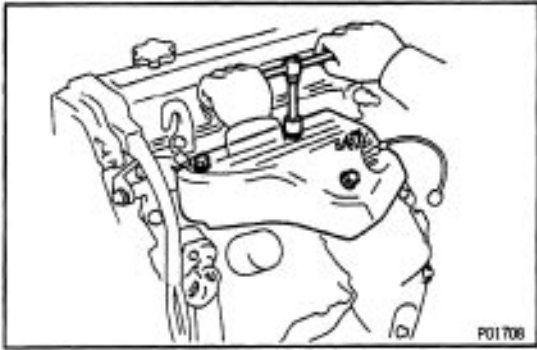
### 7. REMOVE DISTRIBUTOR

(See page IG-13 end 32)



### 8. DISCONNECT FRONT EXHAUST PIPE

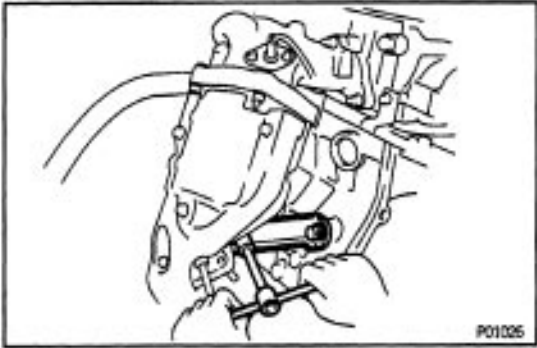
- (a) Loosen the 2 bolts, and disconnect the bracket.
- (b) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU-TWC.
- (c) Disconnect the front exhaust pipe and gaskets.



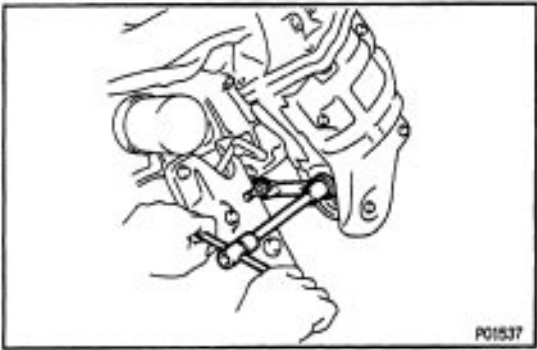
## 9. REMOVE EXHAUST MANIFOLD AND WARM UP

### THREE-WAY CATALYTIC CONVERTER ASSEMBLY

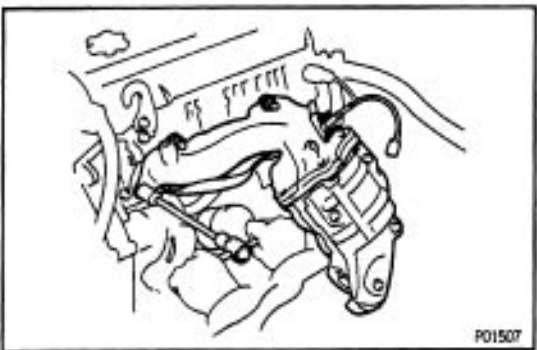
- (a) Disconnect the main oxygen and sub oxygen sensor connectors.
- (b) Remove the 4 bolts and upper heat insulator.



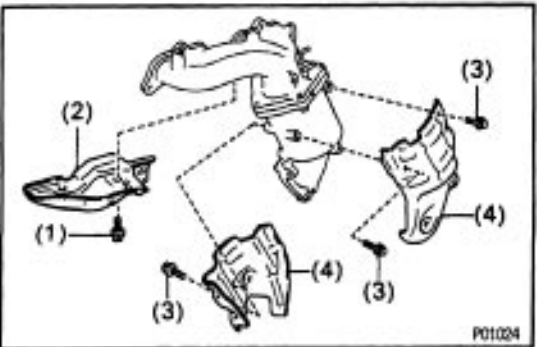
- (c) Remove the bolt, nut and No. 1 manifold stay.



- (d) Remove the bolt, nut and manifold stay.



- (e) Remove the 6 nuts, the exhaust manifold and WU – TWC assembly.



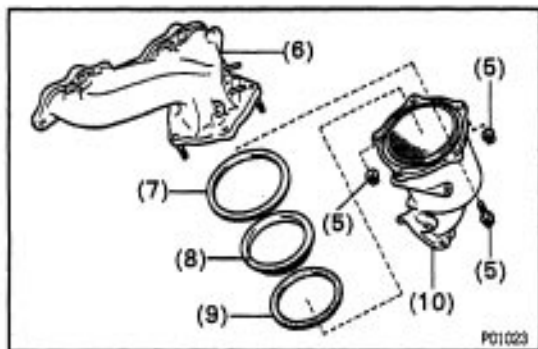
## 10. SEPARATE EXHAUST MANIFOLD AND WARM UP

### THREE-WAY CATALYTIC CONVERTER

Remove the following parts:

- (1) 3 bolts
- (2) Manifold lower heat insulator
- (3) 8 bolts
- (4) 2 WU-TWC heat insulators





- (5) 3 bolts and 2 nuts
- (6) Exhaust manifold
- (7) Gasket
- (8) Retainer
- (9) Cushion
- (10) WU-TWC

#### 11. DISCONNECT OIL PRESSURE SWITCH CONNECTOR

#### 12. DISCONNECT ENGINE WIRE (FOR OXYGEN SENSORS) FROM ENGINE HANGER

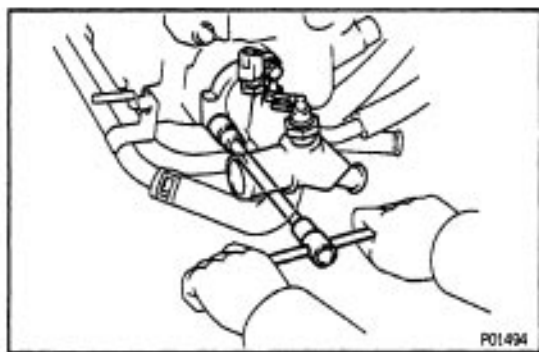
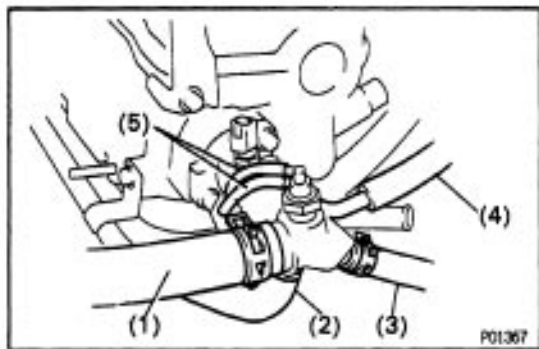
#### 13. REMOVE WATER OUTLET

(a) Disconnect the following connectors:

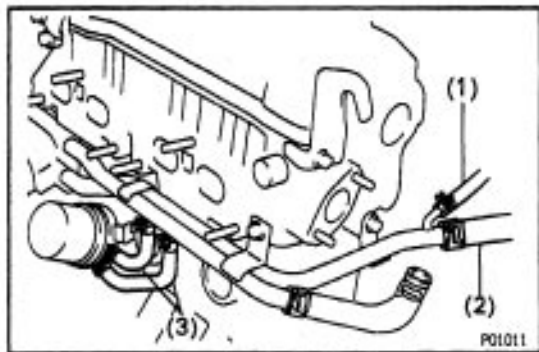
- (1) Engine coolant temperature sender gauge connector
- (2) Engine coolant temperature sensor connector

(b) Disconnect the following hoses:

- (1) Upper radiator hose
- (2) Water bypass pipe hose
- (3) Heater water hose
- (4) IAC water bypass hose
- (5) 2 TVV (for EVAP) vacuum hoses



(c) Remove the 2 bolts, water outlet and gasket.

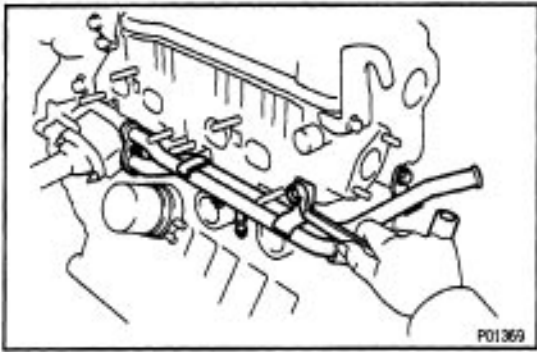


#### 14. REMOVE WATER BYPASS PIPE

(a) Disconnect the following hoses:

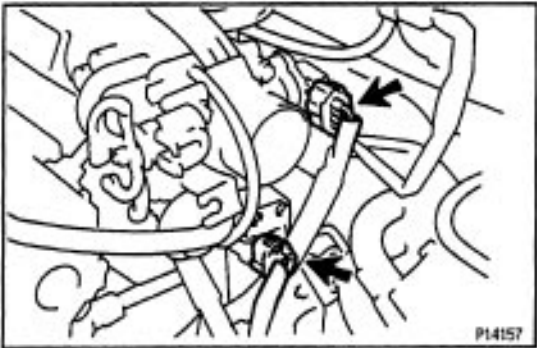
- (1) IAC water bypass hose
- (2) Heater water hose
- (3) w/ Oil Cooler:  
2 oil cooler water bypass hoses





(b) Remove the 2 bolts, 2 nuts, water bypass pipe and gasket.

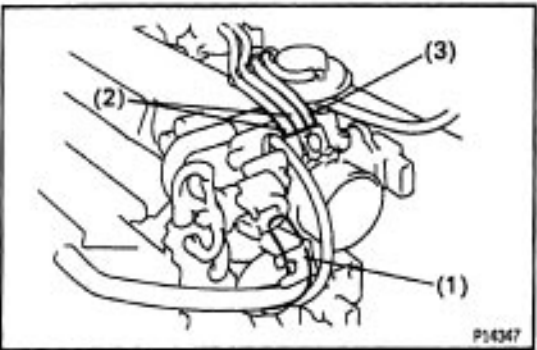
(c) Remove the O-ring from the water bypass hose.



## 15. REMOVE THROTTLE BODY

(a) Disconnect the throttle position sensor connector.

(b) Disconnect the IAC valve connector.

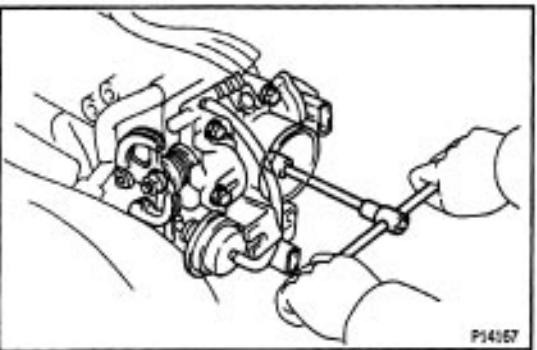


(c) Disconnect the following hoses from the throttle body.

(1) PCV hose

(2) 2 vacuum hoses from EGR vacuum modulator

(3) Vacuum hose from TVV (for EVAP)

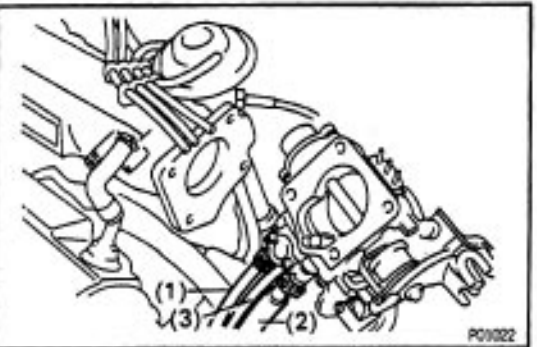


(d) Type A:

Remove the 4 bolts.

(e) Type B:

Remove the 2 bolts and 2 nuts.



(f) Disconnect the following hoses from the throttle body, and remove the throttle body.

(1) Water bypass hose from water outlet

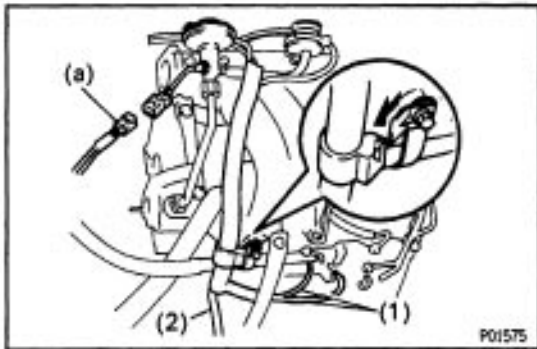
(2) Water bypass hose from water bypass pipe

(3) California:

Air hose from cylinder head

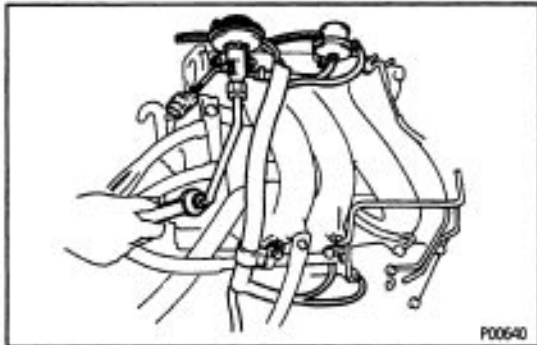
Except California:

Air hose from air tube

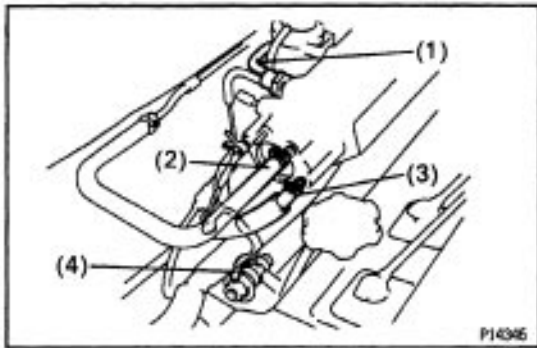


## 16. REMOVE EGR VALVE AND VACUUM MODULATOR

- (a) Disconnect the EGR gas temperature sensor connector.
- (b) Disconnect the following hoses:
  - (1) 2 vacuum hoses from VSV (for EGR)
  - (2) Vacuum hose from charcoal canister
- (c) Disconnect the vacuum hose clamp.



- (d) Loosen the union nut of the EGR pipe, and remove the 2 nuts, EGR valve, vacuum modulator, vacuum hoses assembly and gasket.



## 17. DISCONNECT VACUUM HOSES

Disconnect the following hoses:

- (1) MAP sensor hose from air intake chamber
- (2) Brake booster vacuum hose from air intake chamber
- (3) PS vacuum hose from air intake chamber
- (4) Vacuum sensing hose from fuel pressure regulator 1

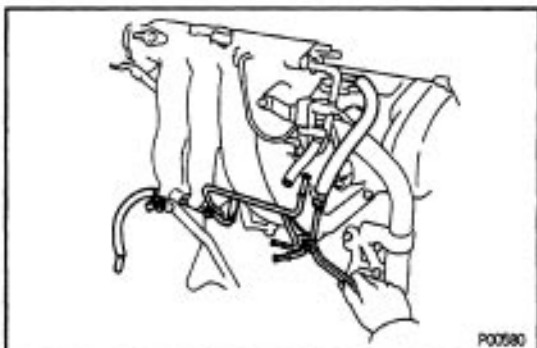
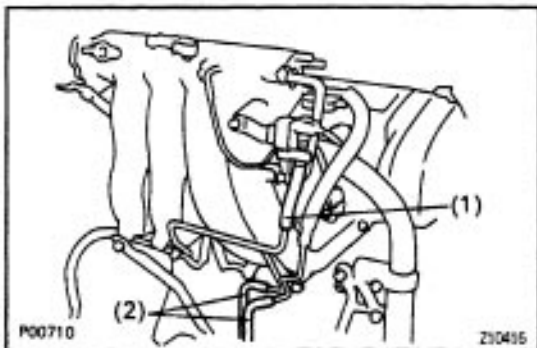
## S. W/ A/C:

### DISCONNECT A/C IDLE-UP VALVE CONNECTOR

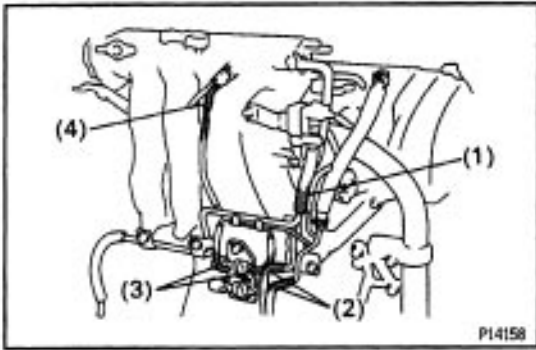
## 19. EXCEPT CALIFORNIA:

### REMOVE AIR TUBE

- (a) Disconnect the following hoses from the air tube:
  - (1) w/ A/C:
    - Air hose from ASV
  - (2) 2 air hoses from PS pump

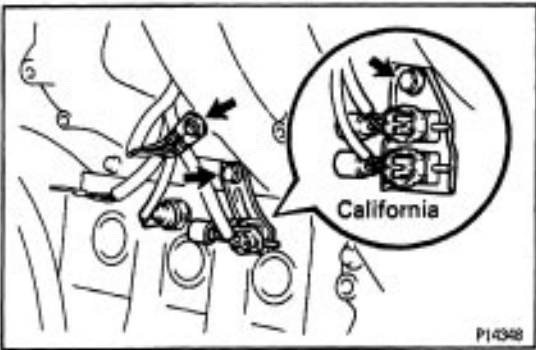
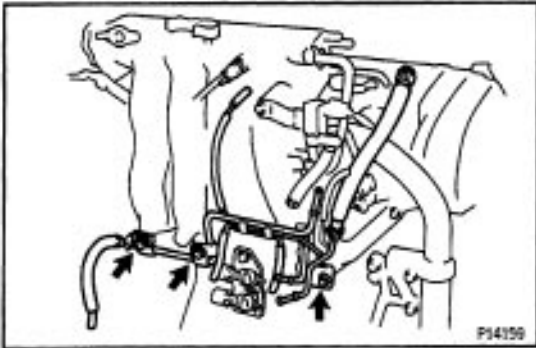


- (b) Remove the 3 bolts, wire clamp and air tube.



## 20. CALIFORNIA: REMOVE AIR TUBE

- (a) Disconnect the following hoses:
  - (1) w/ A/C:  
A/C hose (from ASV) from air tube
  - (2) 2 air hoses (from PS pump) from air tube
  - (3) California only:  
2 vacuum hoses from VSV (for fuel pressure control)
  - (4) Vacuum hose from air intake chamber
- (b) Remove the 3 bolts, wire clamp and air tube.

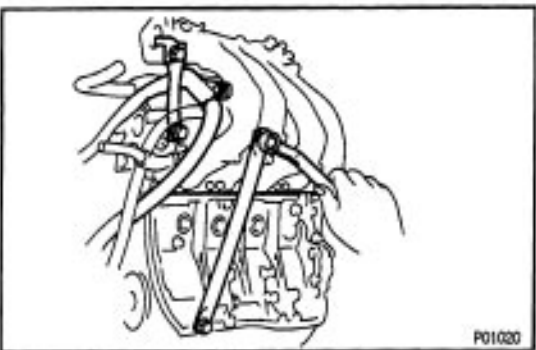


## 21. DISCONNECT 2 ENGINE WIRE GROUND STRAPS FROM INTAKE MANIFOLD

## 22. DISCONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS

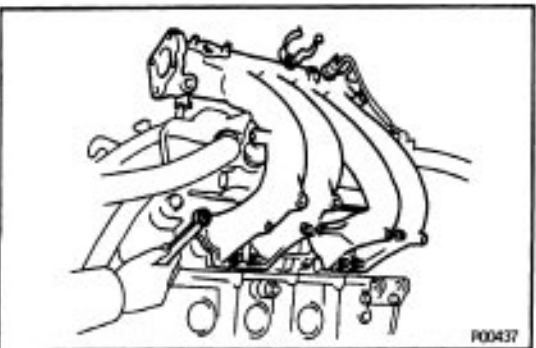
## 23. CALIFORNIA ONLY: DISCONNECT VSV (FOR FUEL PRESSURE CON- TROL) CONNECTOR

## 24. REMOVE VSV OR VSV ASSEMBLY

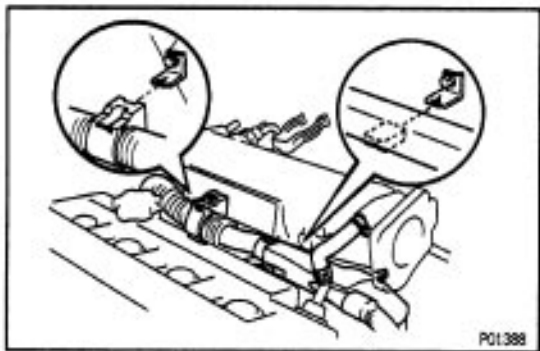


## 25. REMOVE INTAKE MANIFOLD

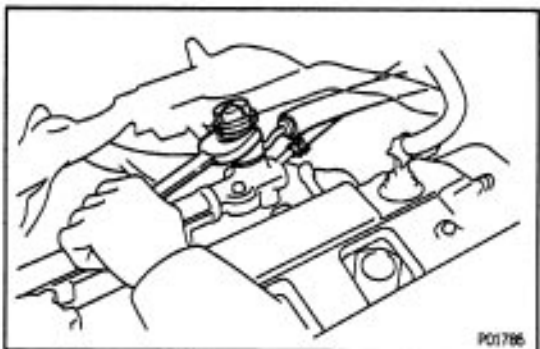
- (a) Remove the 4 bolts, wire bracket, No.1 air intake chamber and manifold stays.
- (b) Remove the bolt, vacuum hose bracket, and disconnect the engine wire.



- (c) Remove the 6 bolts, 2 nuts, intake manifold and gasket.

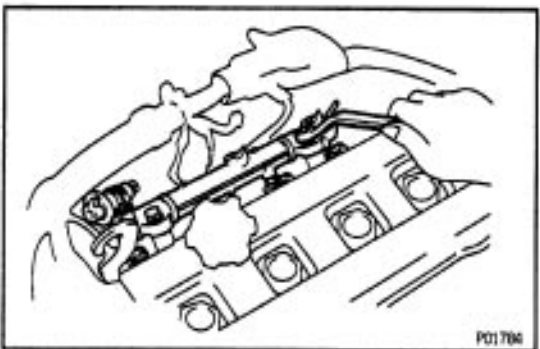


- (d) Disconnect the 2 wire clamps from the wire brackets on the intake manifold.



## 26. REMOVE DELIVERY PIPE AND INJECTORS

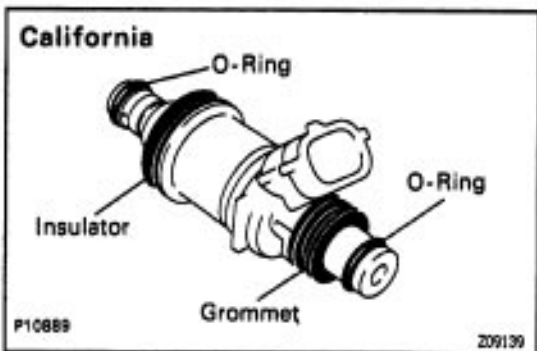
- (a) Disconnect the injector connectors.  
 (b) Loosen the pulsation damper, and disconnect the fuel inlet hose.  
 (c) Disconnect fuel return hose.



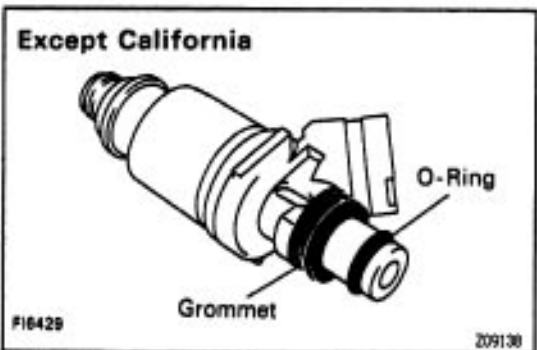
- (d) Remove the 2 bolts and delivery pipe together with the 4 injectors.

**NOTICE: Be careful not to drop the injectors when removing the delivery pipe.**

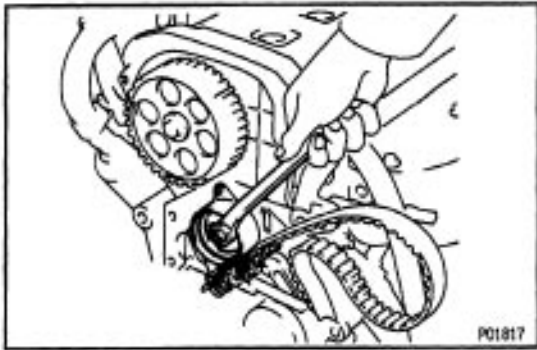
- (e) Remove the 4 insulators (except California) and 2 spacers from the cylinder head.  
 (f) Pull out the 4 injectors from the delivery pipe.



- (g) California:  
 Remove the 2 O-rings, insulator and grommet from each injector.



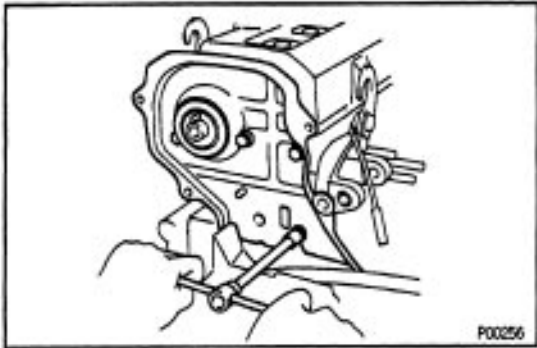
- (h) Except California:  
 Remove the O-ring and grommet from each injector.

**27. REMOVE CAMSHAFT TIMING PULLEY**

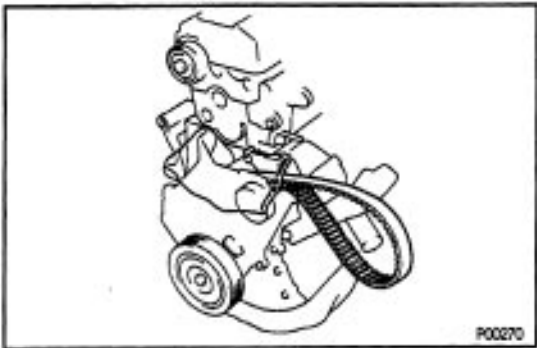
(See steps 2 to 15 on pages [EG1-26](#) to 28)

**28. REMOVE NO. 1 IDLER PULLEY AND TENSION SPRING**

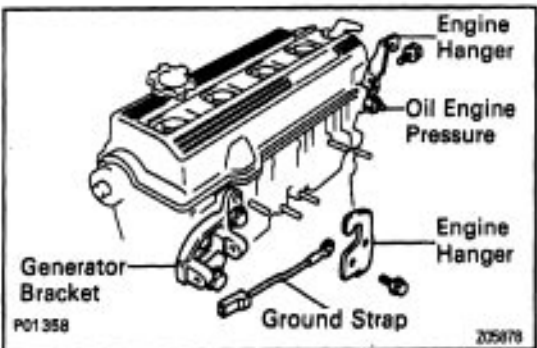
Remove the bolt, pulley and tension spring.

**29. REMOVE NO.3 TIMING BELT COVER**

Remove the 4 bolts and timing and cover.

**NOTICE:**

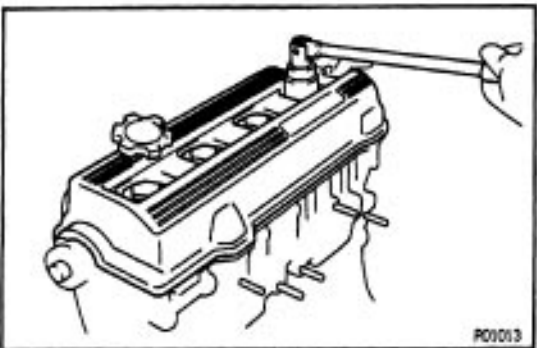
- Support the timing belt, so the meshing of crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the belt to come into contact with oil, water or dust.

**30. REMOVE ENGINE HANGERS**

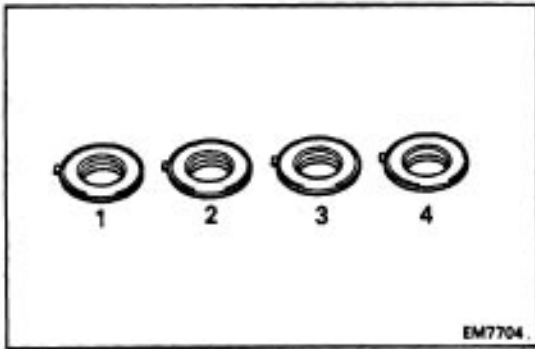
Remove the bolt and engine hanger. Remove the 2 engine hangers. Remove the ground strap.

**31. REMOVE GENERATOR BRACKET**

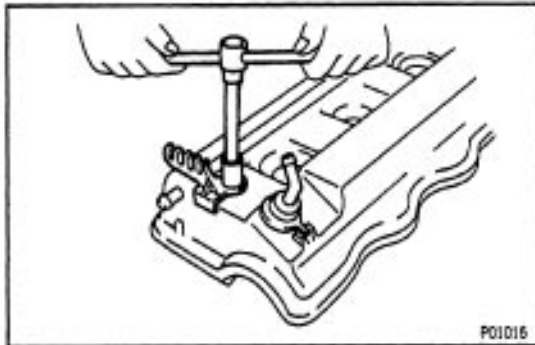
Remove the 3 bolts and generator bracket.

**32. REMOVE OIL PRESSURE SWITCH****33. REMOVE CYLINDER HEAD COVER**

Remove the 4 nuts, grommets, head cover and gasket.



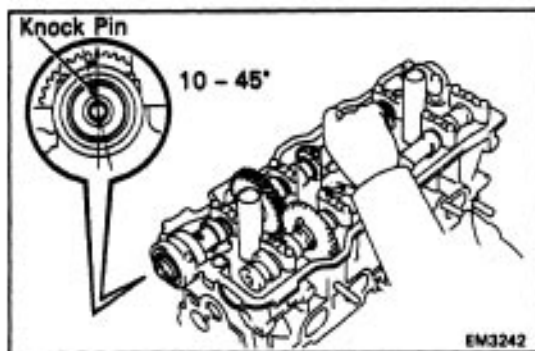
HINT: Arrange the grommets in correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of grommets.



#### 34. REMOVE HIGH – TENSION CORDS CLAMP AND PCV VALVE

#### 35. REMOVE CAMSHAFTS

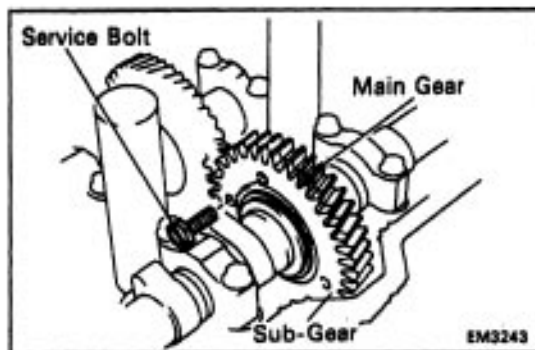
**NOTICE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



##### A. Remove exhaust camshaft

- (a) Set the knock pin of the intake camshaft at 10–45° BTDC of camshaft position.

HINT: The above angle allows No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



- (b) Secure the exhaust camshaft sub gear to drive gear with a service bolt.

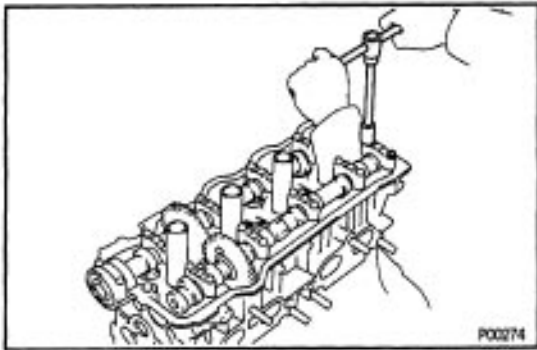
Recommended service bolt:

Thread diameter 6 mm

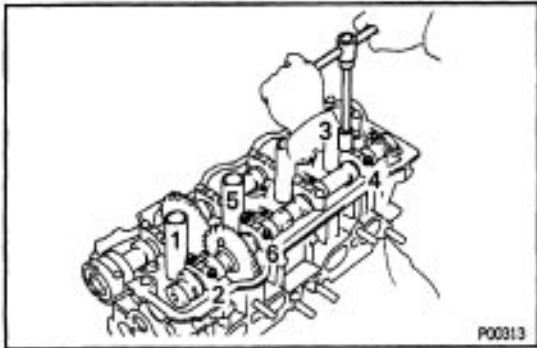
Thread pitch 1.0 mm

Bolt length 16–20 mm (0.63–0.79 in.)

HINT: When removing the camshaft, make sure that the torsional spring force of the sub gear has been eliminated by the above operation.



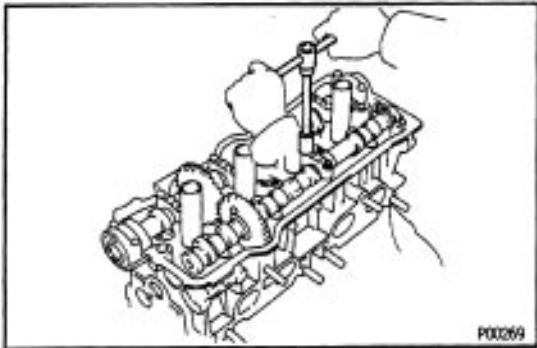
(c) Remove the 2 bolts and rear bearing cap.



(d) Uniformly loosen and remove the 6 bolts on the No. 1, No.2 and No.4 bearing caps in several passes in the sequence shown.

**NOTICE: Do not remove the No.3 bearing cap bolts at this stage.**

(e) Remove the No. 1, No.2 and No.4 bearing caps.



(f) Alternately loosen and remove the 2 bolts on the No. 3 bearing cap.

**HINT:**

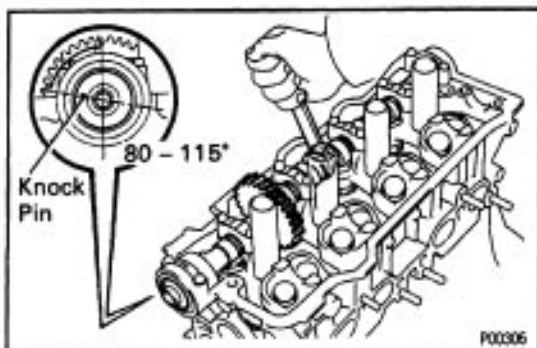
- As the 2 No.3 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the 2 No.3 bearing cap bolts. Then reverse the order of above steps from (f) to (a) and reset the knock pin of the intake camshaft at 10–45° BTDC, and repeat steps from

(b) to

(f) once again.

**NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.**

(g) Remove the No.3 bearing cap and exhaust camshaft.

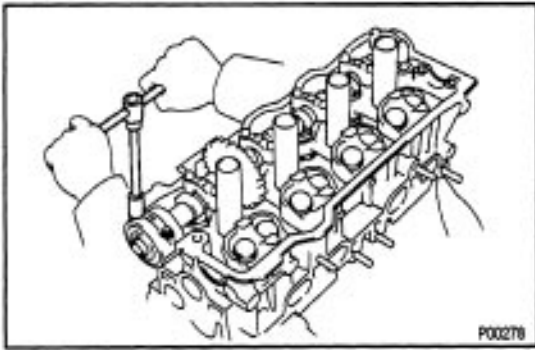


**B. Remove intake camshaft**

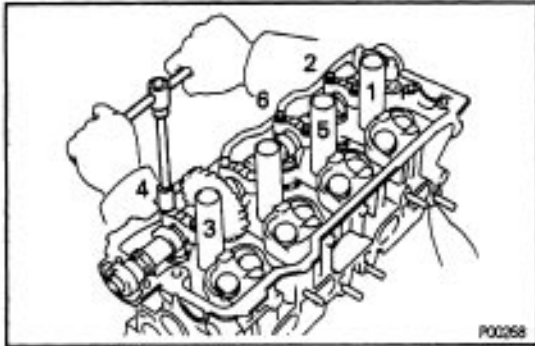
(a) Set the knock pin of the intake camshaft at 80–115° BTDC of camshaft angle.

**HINT:** The above angle allows the No.1 and No.3 cylinder cam lobes of intake camshaft to push their valve lifters evenly.





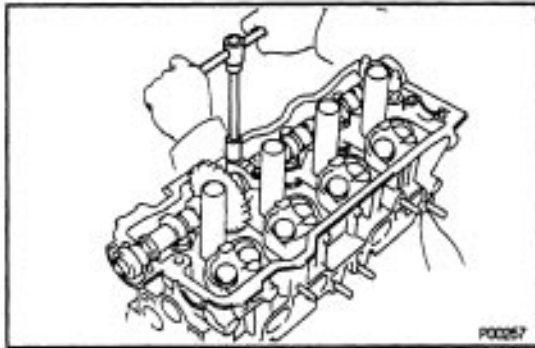
(b) Remove the 2 bolts, front bearing cap and oil seal.



(c) Uniformly loosen and remove the 6 bolts on the No.1, No.3 and No.4 bearing caps in several passes in the sequence shown.

**NOTICE: Do not remove the No.2 bearing cap bolts at this stage.**

(d) Remove the No. 1, No.3 and No.4 bearing caps.



(e) Alternately loosen and remove the 2 bolts on the No. 2 bearing cap.

**HINT:**

- As the 2 No.2 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level, after breaking adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, retighten the 2 No.2 bearing cap bolts. Reverse the order of above steps from (e) to (a) and reset the knock pin of the intake camshaft at 80–115°6TDC, and repeat steps from (b) to (e) once again.

**NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.**

(f) Remove the No.2 bearing cap and camshaft.

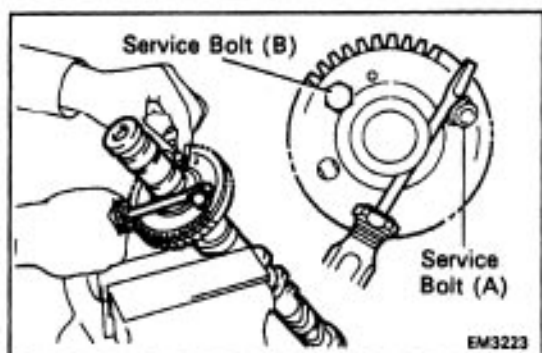


### 36. DISASSEMBLE EXHAUST CAMSHAFT

(a) Mount the hexagon wrench head portion of the camshaft in a vise.

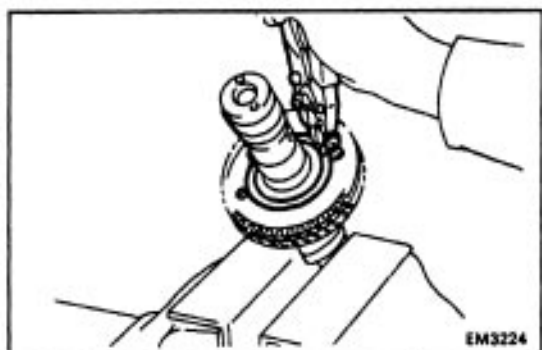
**NOTICE: Be careful not to damage the camshaft.**



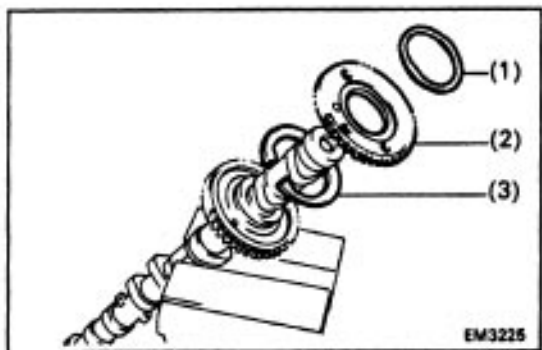


- (b) Insert a service bolt (A) into the service hole of the camshaft sub gear.
- (c) Using a screwdriver, turn the sub gear clockwise, and remove the service bolt (B).

**NOTICE:** Be careful not to damage the camshaft.

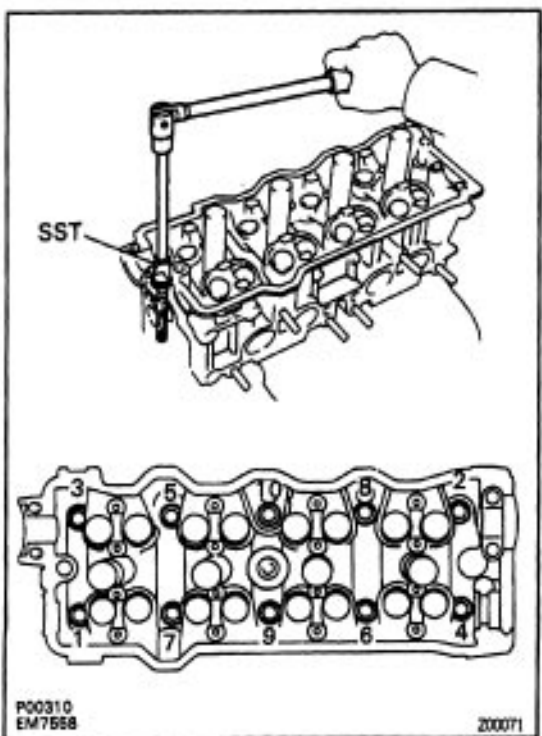


- (d) Using snap ring pliers, remove the snap ring.



- (e) Remove the following parts:

- (1) Wave washer
- (2) Camshaft sub gear
- (3) Camshaft gear spring

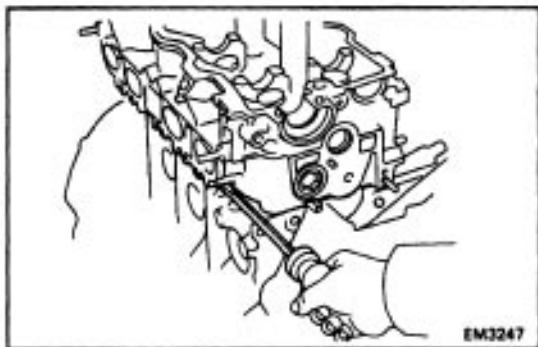


### 37. REMOVE CYLINDER HEAD

- (a) Using SST, uniformly loosen and remove the 10 cylinder head bolts in several passes, in the sequence shown.

SST 09011- 38121

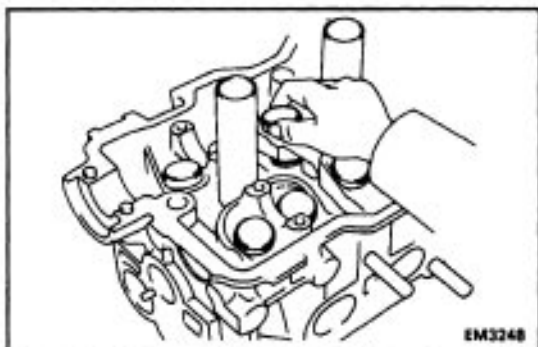
**NOTICE:** Cylinder head warpage or cracking could result from removing bolts in incorrect order.



- (b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

HINT: If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

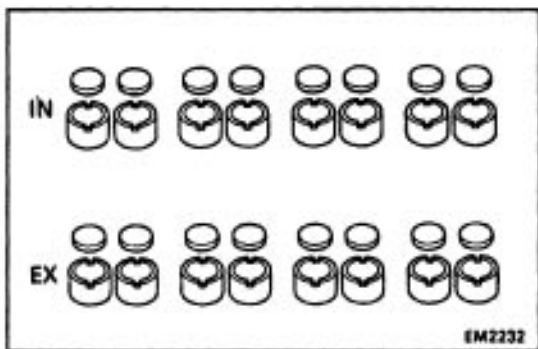
**NOTICE:** Be careful not to damage the contact surfaces of the cylinder head and cylinder block.



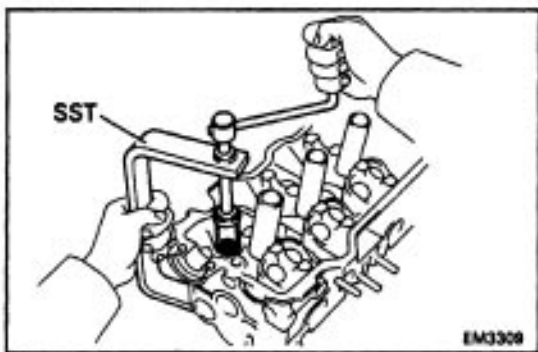
## CYLINDER HEAD DISASSEMBLY

(See Components for Removal and Installation)

### 1. REMOVE VALVE LIFTERS AND SHIMS



HINT: Arrange the valve lifters and shims in correct order.



### 2. REMOVE VALVES

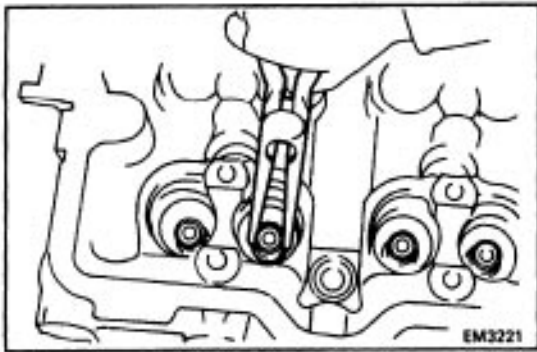
- (a) Using SST, compress the valve spring and remove the 2 keepers.

SST 09202 – 70010

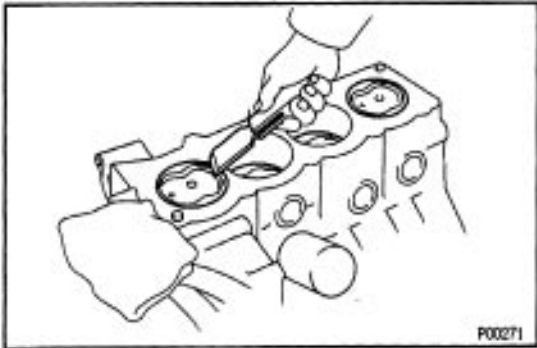
- (b) Remove the spring retainer, valve spring, valve and spring seat.



HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



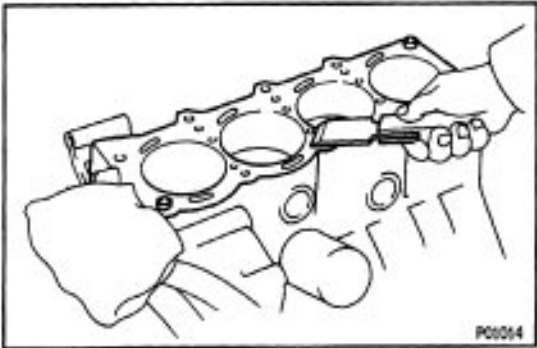
(c) Using needle-nose pliers, remove the oil seal.



## CYLINDER HEAD COMPONENTS INSPECTION, CLEANING AND REPAIR

### 1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

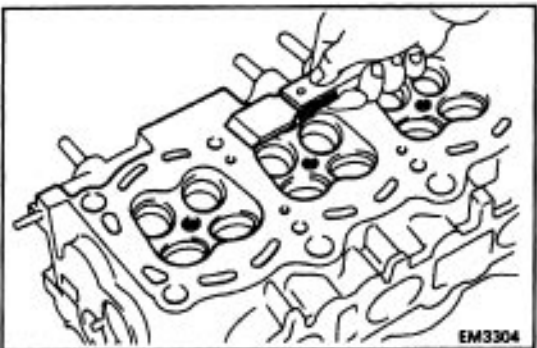
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



(b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.

(c) Using compressed air, blow carbon and oil from the bolt holes.

**CAUTION:** Protect your eyes when using high pressure compressed air.

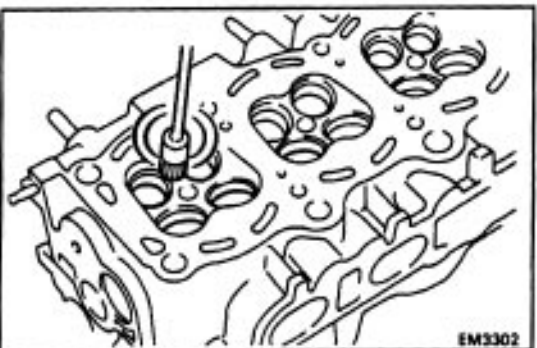


### 2. CLEAN CYLINDER HEAD

#### A. Remove gasket material

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

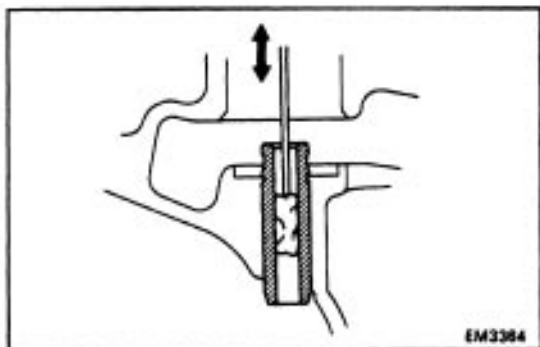
**NOTICE:** Be careful not to scratch the cylinder block contact surface.



#### B. Clean combustion chambers

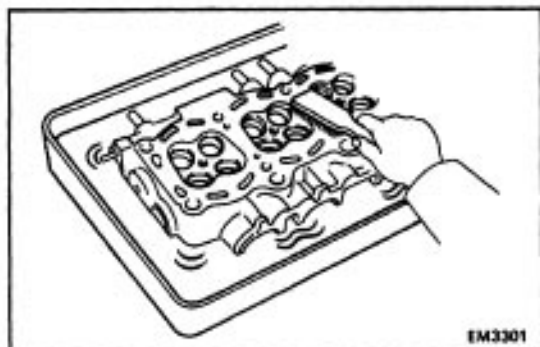
Using a wire brush, remove all the carbon from the combustion chambers.

**NOTICE:** Be careful not to scratch the cylinder block contact surface.



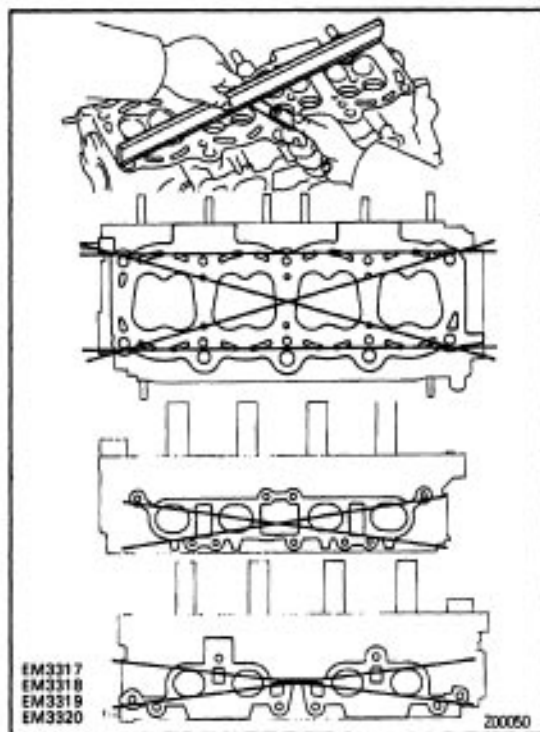
### C. Clean valve guide bushings

Using a valve guide bushing brush and solvent, clean all the guide bushings.



### D. Clean cylinder head

Using a soft brush and solvent, thoroughly clean the cylinder head.



## 3. INSPECT CYLINDER HEAD

### A. Inspect for flatness

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

#### Maximum warpage:

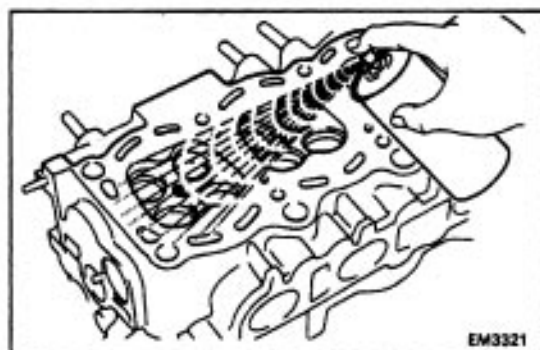
#### Cylinder block side

0.05 mm (0.0020 in.)

#### Manifold side

0.08 mm (0.0031 in.)

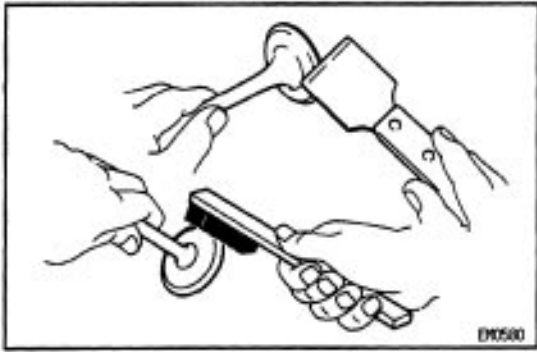
If warpage is greater than maximum, replace the cylinder head.



### B. Inspect for cracks

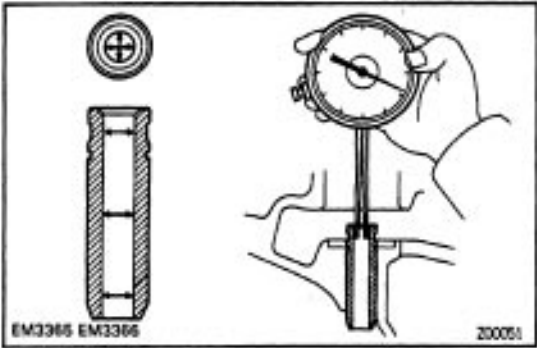
Using a dye penetrant, check the combustion chambers, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



#### 4. CLEAN VALVES

- (a) Using a gasket scraper, chip off any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.

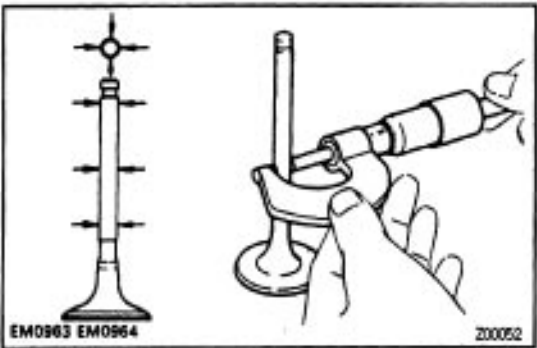


#### 5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.

**Bushing inside diameter:**

**6.010 – 6.030 mm (0.2366 – 0.2374 in.)**



- (b) Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**Intake**

**5.970 – 5.985 mm (0.2350 – 0.2356 in.)**

**Exhaust**

**5.965 – 5.980 mm (0.2348 – 0.2354 in.)**

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

**Standard oil clearance:**

**Intake**

**0.025 – 0.060 mm (0.0010 – 0.0024 in.)**

**Exhaust**

**0.030 – 0.065 mm (0.0012 – 0.0028 in.)**

**Maximum oil clearance:**

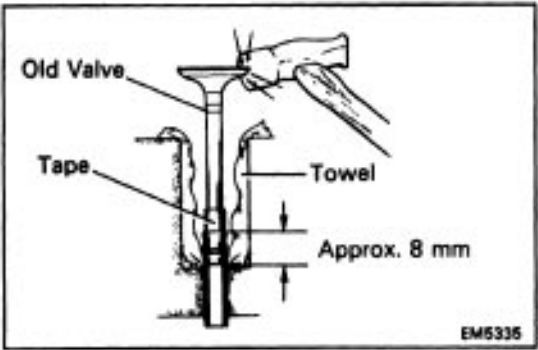
**Intake**

**0.08 mm (0.0031 in.)**

**Exhaust**

**0.10 mm (0.0039 in.)**

If the clearance is greater than maximum, replace the valve and guide bushing.

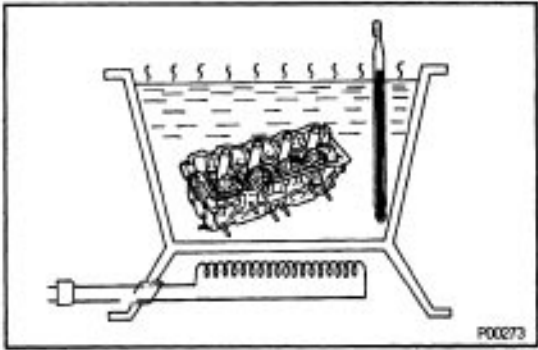


**6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS**

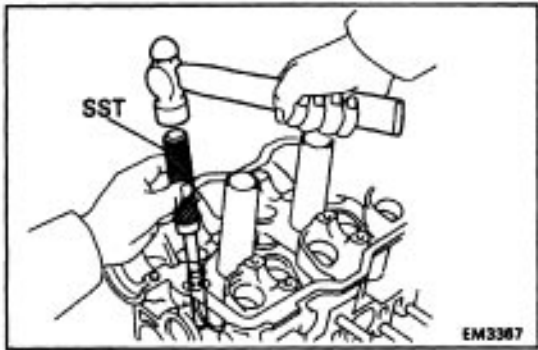
(a) w/ Snap Ring:

Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.  
HINT: Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.

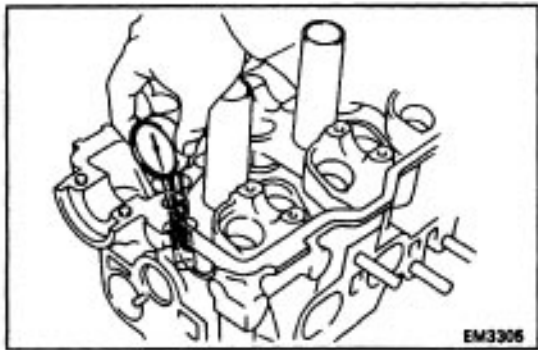
**NOTICE:** Be careful not to damage the valve lifter hole.



(b) Gradually heat the cylinder head to 80–100°C (176–212°F).



(c) Using SST and a hammer, tap out the guide bushing.  
SST 09201-70010



(d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

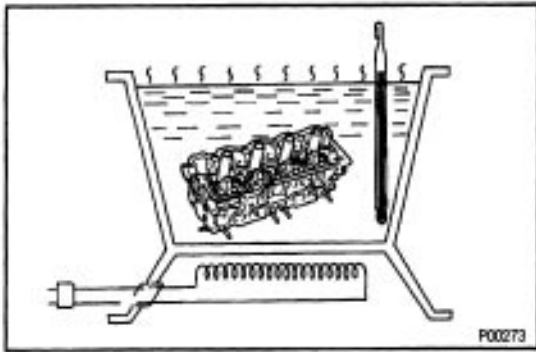
(e) Select a new guide bushing (STD size or O/S 0.05).

If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimension:  
11.050 – 11.077 mm (0.4350 – 0.4301 in.)

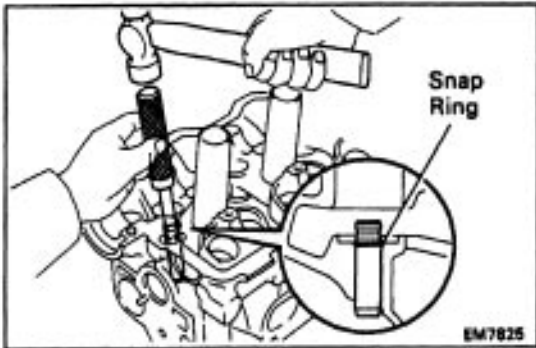
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.

Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 10.4331 – 0.4341)	Use STD
11.050 – 11.077 (0.4350 – 0.4361)	Use O/S 0.05

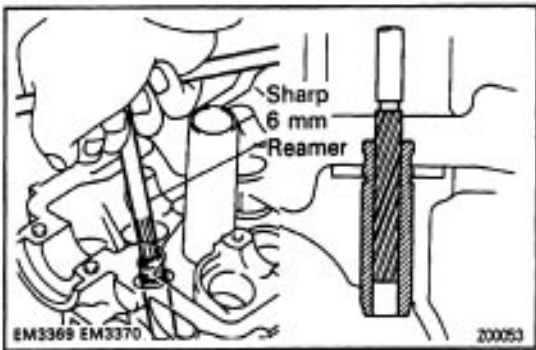


- (f) Gradually heat the cylinder head to 80 –100<sup>o</sup> C (117<sup>o</sup> – 212<sup>o</sup> F).

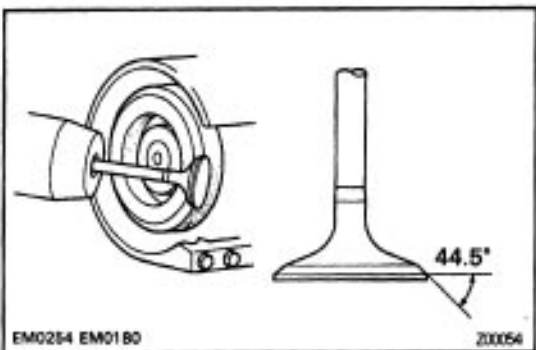


- (g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.

SST 09201– 70010



- (h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page [EG1-57](#)) between the guide bushing and valve stem.

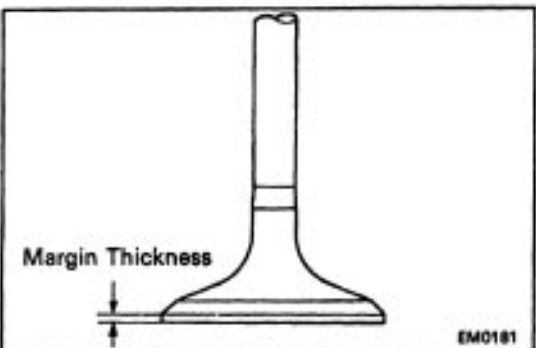


## 7. INSPECT AND GRIND VALVES

- (a) Grind the valve enough to remove pits and carbon.  
(b) Check that the valve is ground to the correct valve face angle.

**Valve face angle:**

**44.5<sup>o</sup>**



- (c) Check the valve head margin thickness.

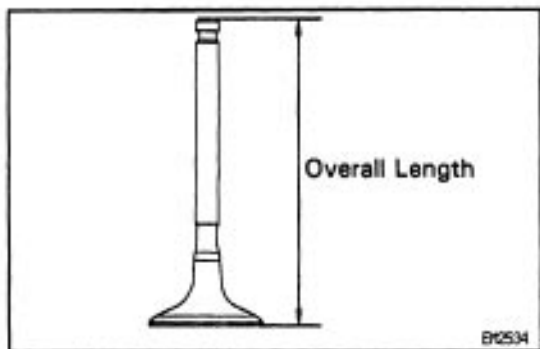
**Standard margin thickness:**

**0.8 – 1.2 mm (0.031 – 0.047 in.)**

**Minimum margin thickness:**

**0.5 mm (0.020 in.)**

If the margin thickness is less than minimum, replace the valve.



(d) Check the valve overall length.

**Standard overall length:**

**Intake**

**97.60 mm (3.8425 in.)**

**Exhaust**

**98.45 mm (3.8760 in.)**

**Minimum overall length:**

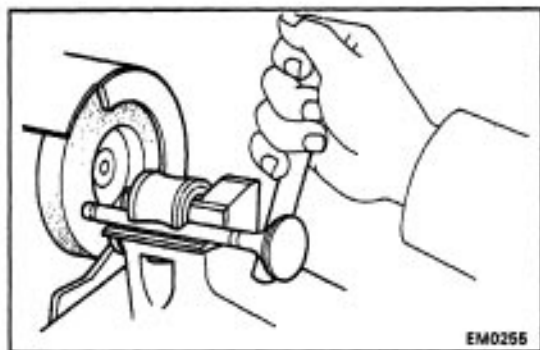
**Intake**

**97.1 mm (3.823 in.)**

**Exhaust**

**98.0 mm (3.858 in.)**

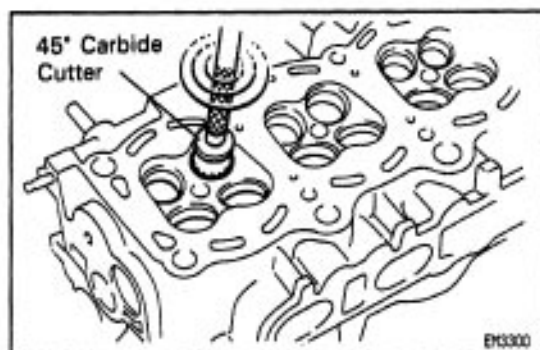
If the overall length is less than minimum, replace the valve.



(e) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

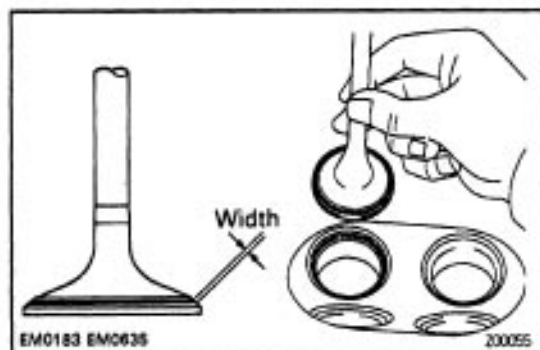
**NOTICE: Do not grind off more than minimum.**



## 8. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats.

Remove only enough metal to clean the seats.



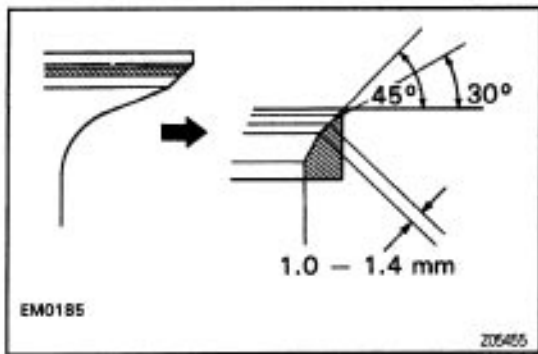
(b) Check the valve seating position.

Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

(c) Check the valve face and seat for the following:

If blue appears 360° around the face, the valve is concentric. If not, replace the valve.



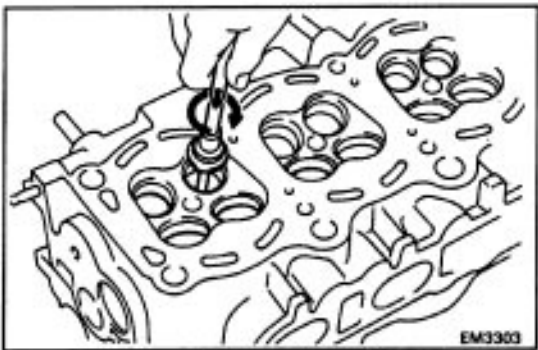
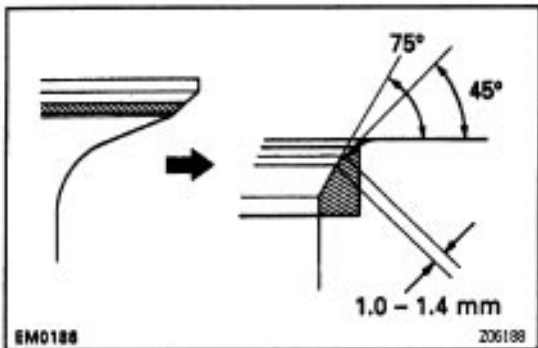


- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

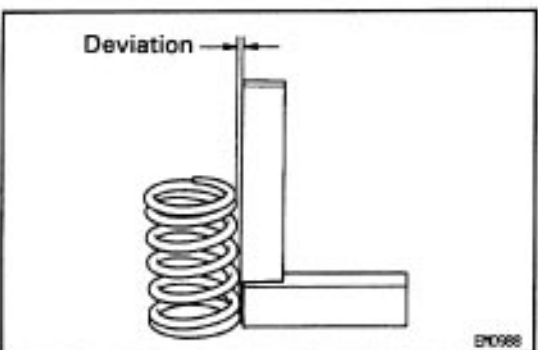
**1.0 – 1.4 mm (0.039 – 0.055 in.)**

If not, correct the valve seat as follows:

- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.
- (2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



- (d) Hand-lap the valve and valve seat with an abrasive compound.
- (e) After hand-lapping, clean the valve and valve seat.



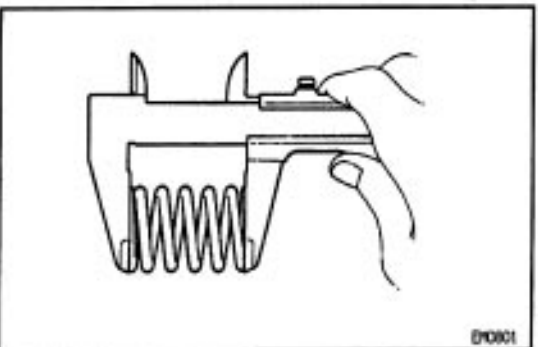
## 9. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the deviation of the valve spring.

**Maximum deviation:**

**2.0 mm (0.079 in.)**

If the deviation is greater than maximum, replace the valve spring.

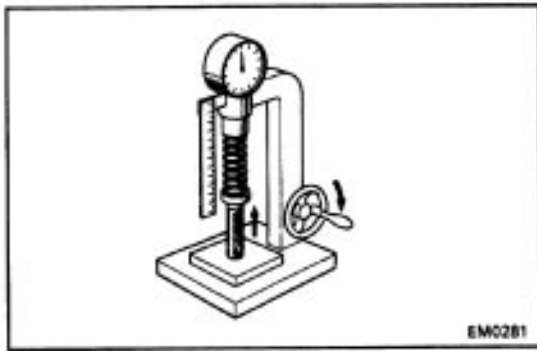


- (b) Using a vernier caliper, measure the free length of the valve spring.

**Free length:**

**41.96 – 41.99 mm (1.6520 – 1.6531 in.)**

If the free length is not as specified, replace the valve spring.

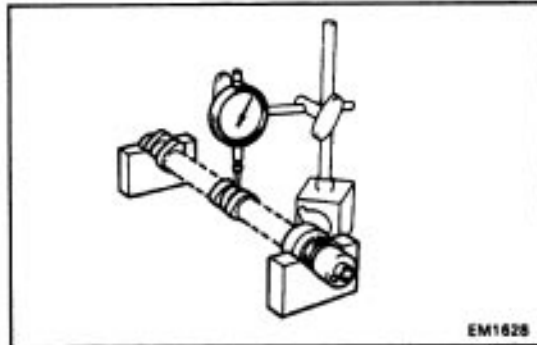


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

**Installed tension:**

**164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)  
at 34.7 mm (1.336 in.)**

If the installed tension is not as specified, replace the valve spring.



## 10. INSPECT CAMSHAFTS AND BEARINGS

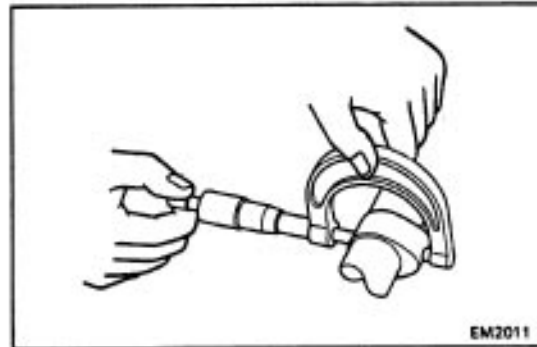
### A. Inspect camshaft for runout

- Place the camshaft on V – blocks.
- Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout:**

**0.04 mm (0.0016 in.)**

If the circle runout is greater than maximum, replace the camshaft.



### B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

**Standard cam lobe height:**

**Intake**

**42.01 – 42.11 mm (1.6539 – 1.6579 in.)**

**Exhaust**

**40.06 – 40.18 mm (1.5772 – 1.5811 in.)**

**Minimum cam lobe height:**

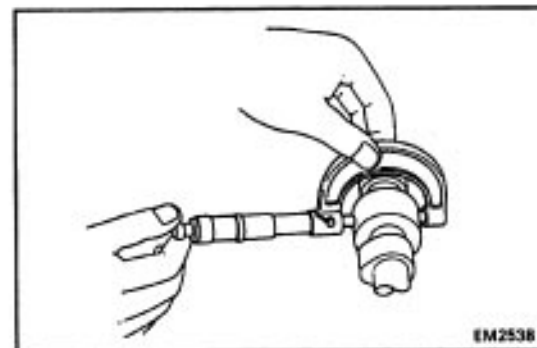
**Intake**

**41.90 mm (1.6496 in.)**

**Exhaust**

**39.95 mm (1.5728 in.)**

If the cam lobe height is less than minimum, replace the camshaft.



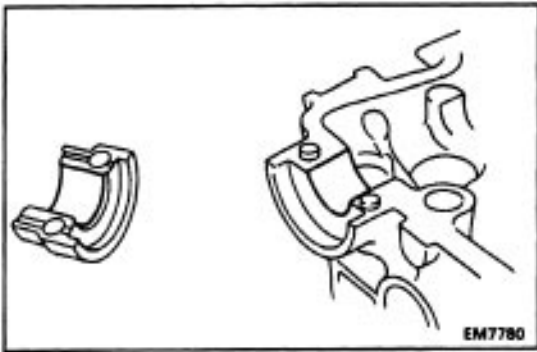
### C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

**Journal diameter:**

**26.959 – 28.975 mm 11.0814 – 1.0620 in.)**

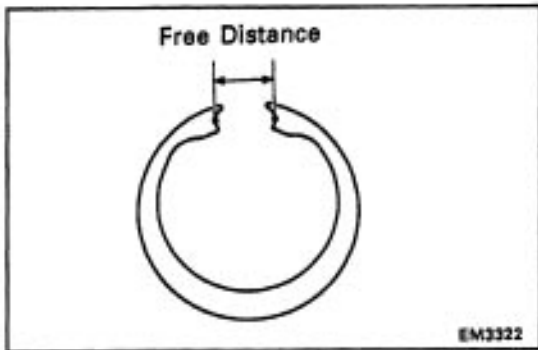
If the journal diameter is not as specified, check the oil clearance.



#### D. Inspect camshaft bearings

Check that bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.



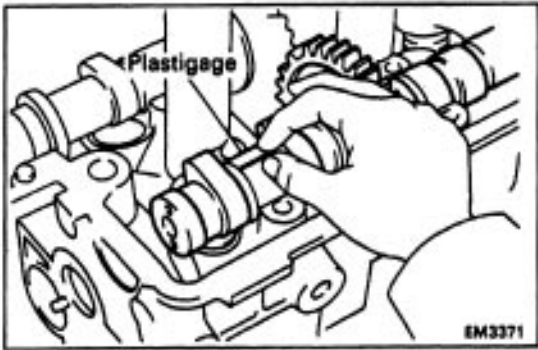
#### E. Inspect camshaft gear spring

Using a vernier caliper, measure the free distance between the spring ends.

**Free distance:**

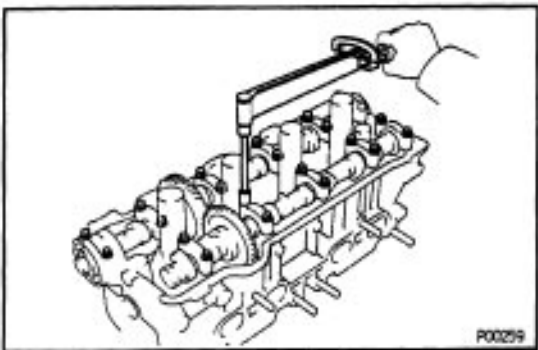
**22.5 – 22.9 mm (0.886 – 0.902 in.)**

If the free distance is not as specified, replace the gear spring.



#### F. Inspect camshaft journal oil clearance

- Clean the bearing caps and camshaft journals.
- Place the camshafts on the cylinder head.
- Lay a strip of Plastigage across each of the camshaft journals.

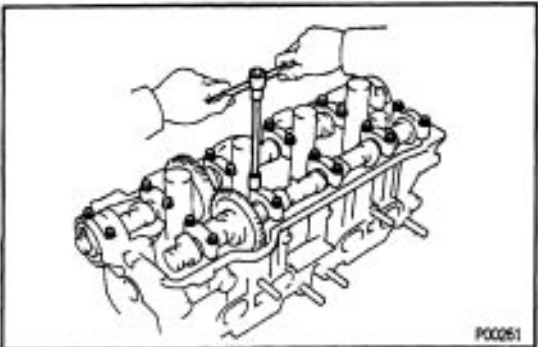


- Install the bearing caps.

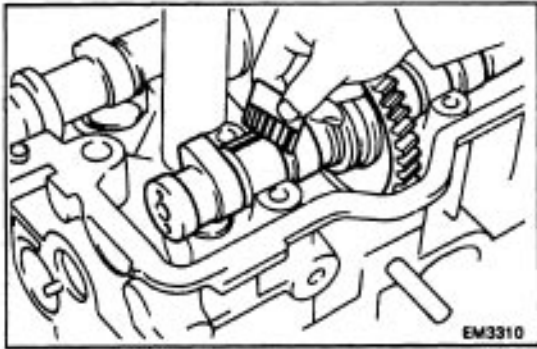
(See step 4 on pages [EG1-69](#) to 71)

**Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)**

**NOTICE: Do not turn the camshaft.**



- Remove the bearing caps.



(f) Measure the Plastigage at its widest point.

**Standard oil clearance:**

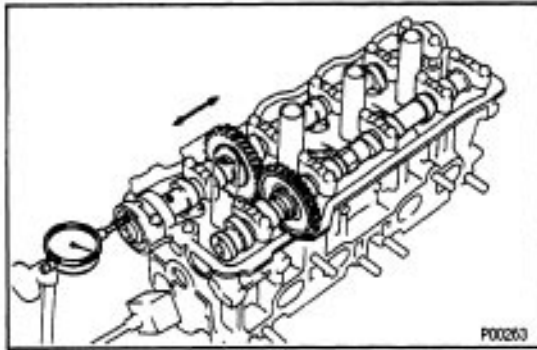
**0.025 – 0.062 mm (0.0010 – 0.0024 in.)**

**Maximum oil clearance:**

**0.10 mm (0.0039 in.)**

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(g) Completely remove the Plastigage.



### G. Inspect camshaft thrust clearance

(a) Install the camshaft.

(See step 4 on pages [EG1-69](#) to 71)

(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance:**

**Intake**

**0.045 – 0.100 mm (0.0018 – 0.0039 in.)**

**Exhaust**

**0.030 – 0.085 mm (0.0012 – 0.0033 in.)**

**Maximum thrust clearance:**

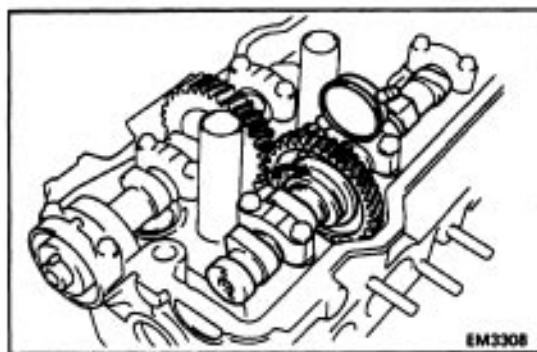
**Intake**

**0.12 mm (0.0047 in.)**

**Exhaust**

**0.10 mm (0.0039 in.)**

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



### H. Inspect camshaft gear backlash

(a) Install the camshafts without installing the exhaust cam sub gear.

(See step 4 on pages [EG1-69](#) to 71)

(b) Using a dial indicator, measure the backlash.

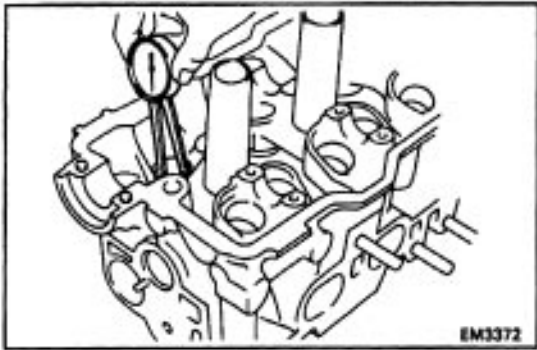
**Standard backlash:**

**0.020 – 0.200 mm (0.0008 – 0.0079 in.)**

**Maximum backlash:**

**6.30 mm (0.0188 in.)**

If the backlash is greater than maximum, replace the camshafts.

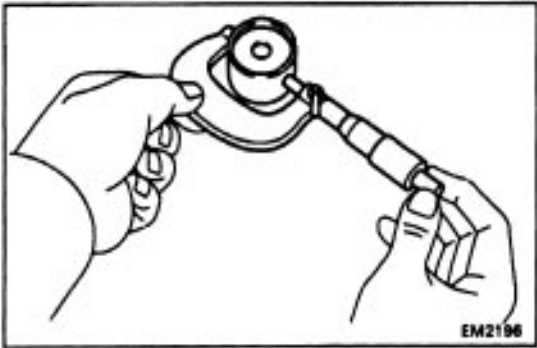


## 11. INSPECT VALVE LIFTERS AND LIFTER BORES

- (a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

**Lifter bore diameter:**

**31.000 – 31.018 mm (1.2205 – 1.2213 in.)**



- (b) Using a micrometer, measure the lifter diameter.

**Lifter diameter:**

**30.966 – 30.976 mm (1.2191 – 1.2195 in.)**

- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

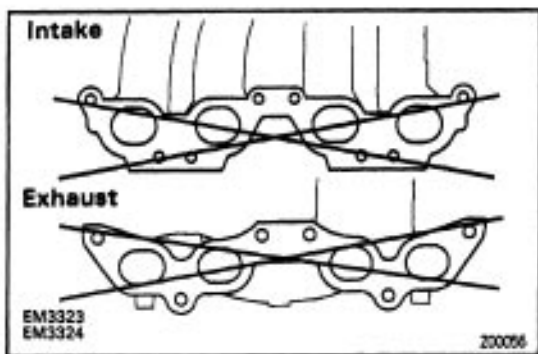
**Standard oil clearance:**

**0.024 – 0.052 mm (0.0009 – 0.0020 in.)**

**Maximum oil clearance:**

**0.07 mm (0.0028 in.)**

If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.



## 12. INSPECT MANIFOLDS

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

**Maximum warpage:**

**0.30 mm (0.0118 in.)**

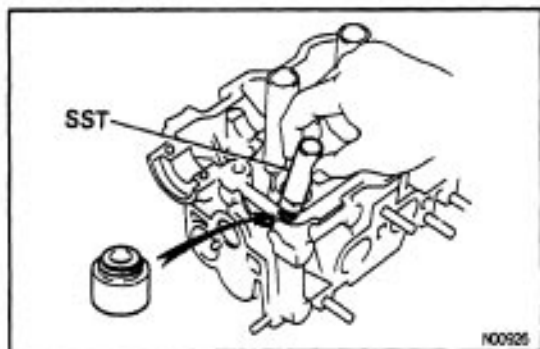
If warpage is greater than maximum, replace the manifold.

## CYLINDER HEAD ASSEMBLY

(See Components for Removal and Installation)

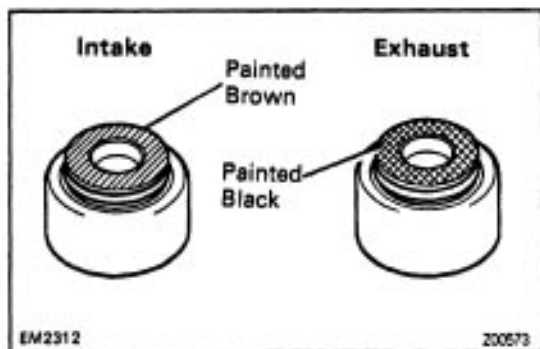
HINT:

- Thoroughly clean all parts to be assembled.  
Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

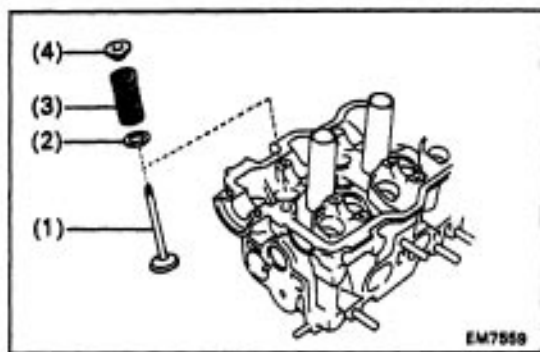


### 1. INSTALL VALVES

- (a) Using SST, push in a new oil seal.  
SST 09201 –41020

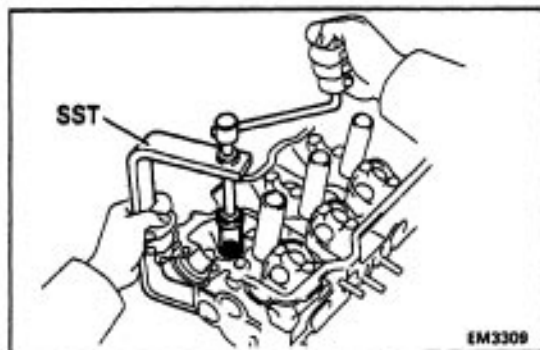


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.

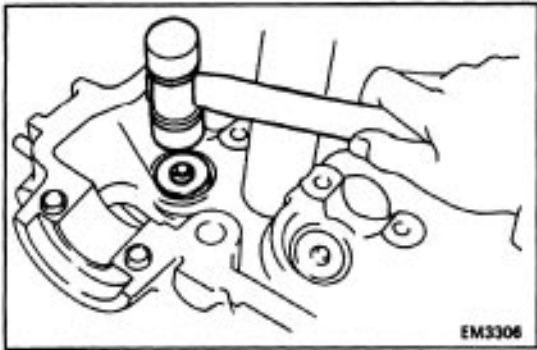


(b) Install the following parts:

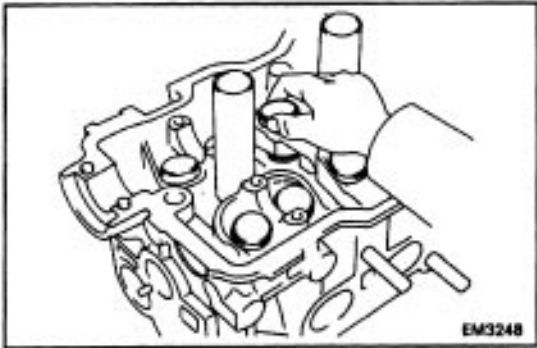
- (1) Valve
- (2) Spring seat
- (3) Valve spring
- (4) Spring retainer



- (c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.  
SST 09202 – 70010

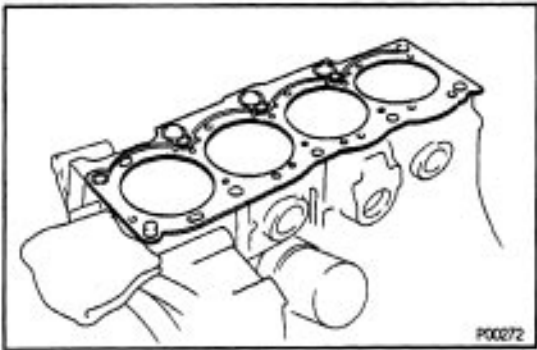


- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



## 2. INSTALL VALVE LIFTERS AND SHIMS

- (a) Install the valve lifter and shim.
- (b) Check that the valve lifter rotates smoothly by hand.



## CYLINDER HEAD INSTALLATION

(See Components for Removal and Installation)

### 1. INSTALL CYLINDER HEAD

#### A. Place cylinder head on cylinder block

- (a) Place a new cylinder head gasket in position on the cylinder block.

**NOTICE:** Be careful of the installation direction.

- (b) Place the cylinder head in position on the cylinder head gasket.

#### B. Install cylinder head bolts

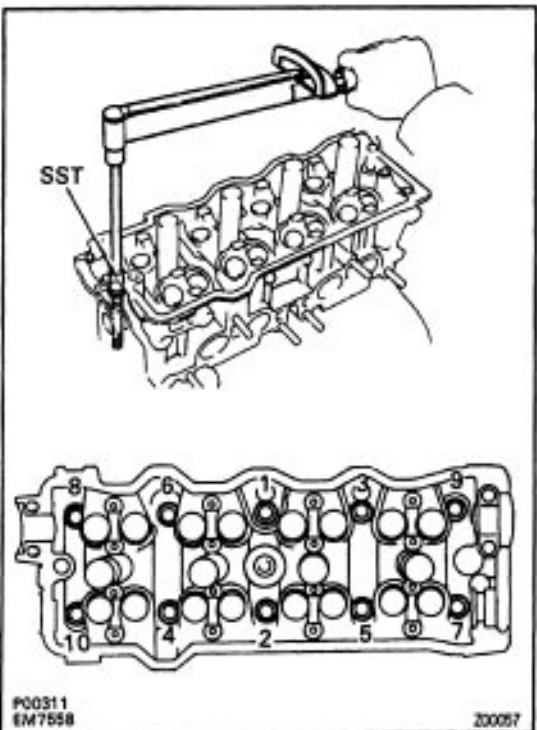
HINT:

- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.
  - (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
  - (b) Using SST, install and uniformly tighten the 10 cylinder head bolts and plate washers in several passes, in the sequence shown.

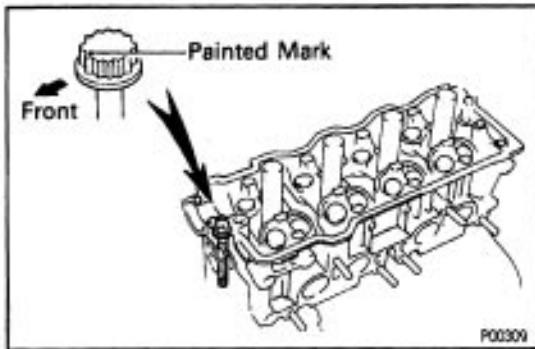
SST 09011– 38121

**Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)**

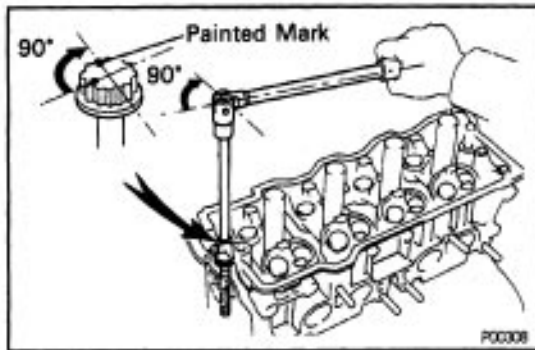
If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.





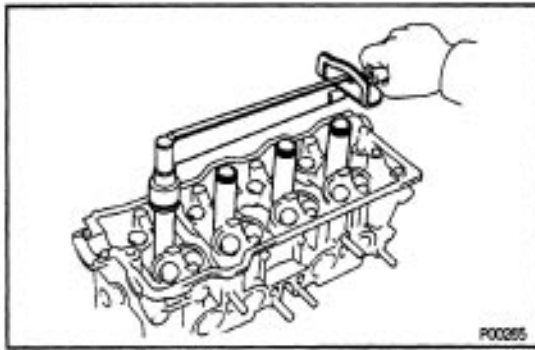


(c) Mark the front of the cylinder head bolt head with paint.



(d) Retighten the cylinder head bolts 90° in the sequence shown on the previous page.

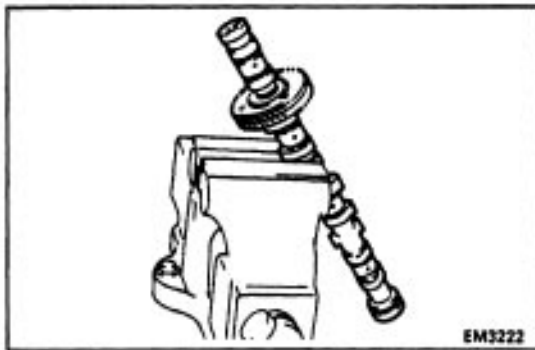
(e) Check that the painted mark is now at a 90° angle to front.



## 2. INSTALL SPARK PLUG TUBES

- Clean the cylinder head tube holes of any residual adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline.
- Screw the threads of the spark plug tube coated with adhesive into the cylinder head.
- Using the spark plug tube nut and a 30 mm socket wrench, tighten the spark plug tubes.

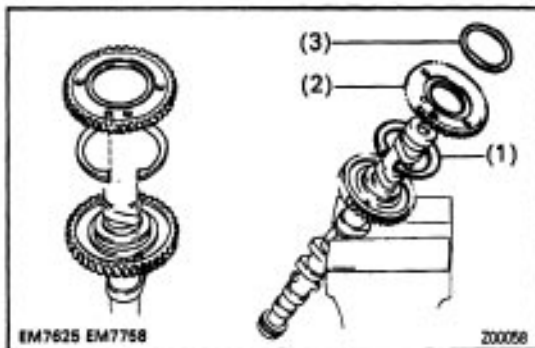
**Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**



## 3. ASSEMBLY EXHAUST CAMSHAFT

- Mount the hexagon wrench head portion of the camshaft in a vise.

**NOTICE: Be careful not to damage the camshaft.**

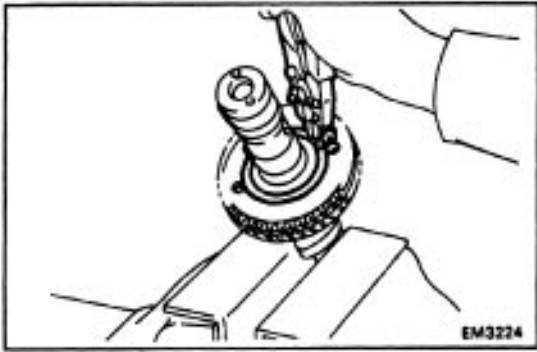


- Install the following parts:

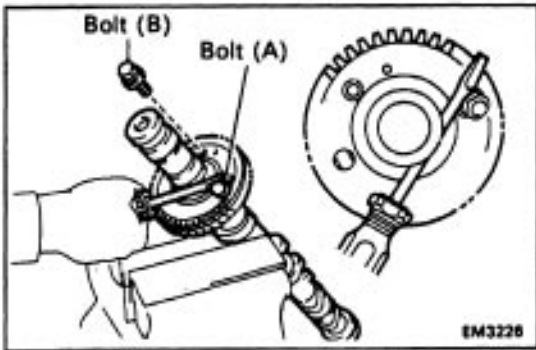
- Camshaft gear spring
- Camshaft sub gear
- Wave washer

**HINT:** Align the pins on the gears with the spring ends.





(c) Using snap ring pliers, install the snap ring.



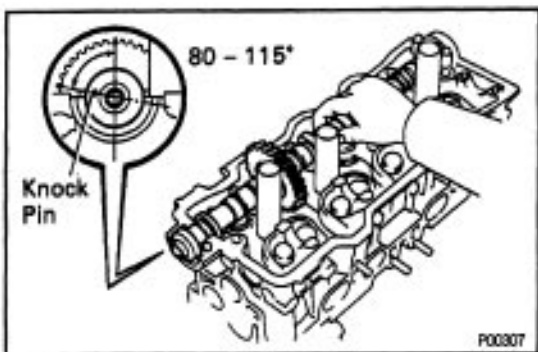
(d) Insert a service bolt (A) into the service hole of the camshaft sub gear.

(e) Using a screwdriver, align the holes of the camshaft main gear and sub gear by turning camshaft sub gear clockwise, and install a service bolt (13).

**NOTICE:** Be careful not to damage the camshaft.

#### 4. INSTALL CAMSHAFTS

**NOTICE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

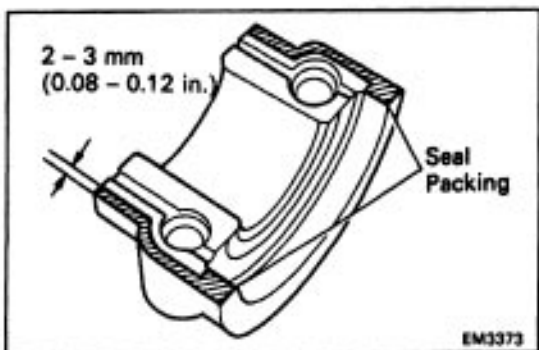


##### A. Install intake camshaft

(a) Apply MP grease to the thrust portion of the camshaft.

(b) Place the intake camshaft at 80–115° BTDC of camshaft angle, on the cylinder head.

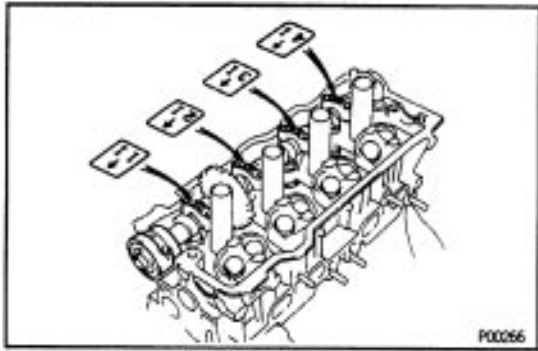
**HINT:** The above angle arrows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.



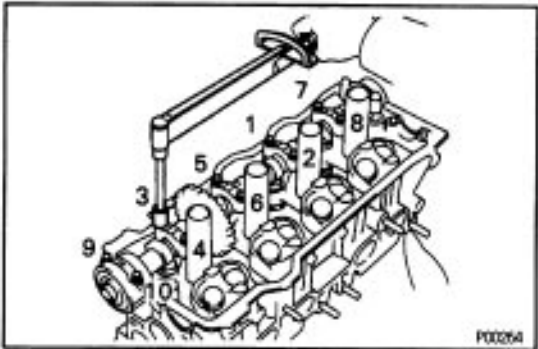
(c) Apply seal packing to the No. 1 bearing cap as shown.

**Seal packing:**

**Part No.08826 –00080 or equivalent**



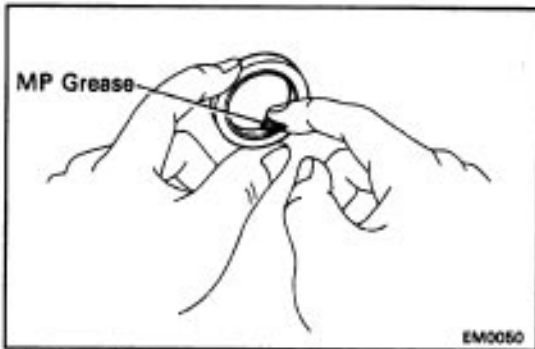
(d) Install the bearing caps in their proper locations.



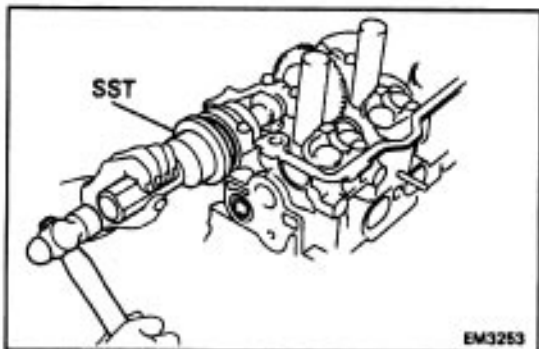
(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(f) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.

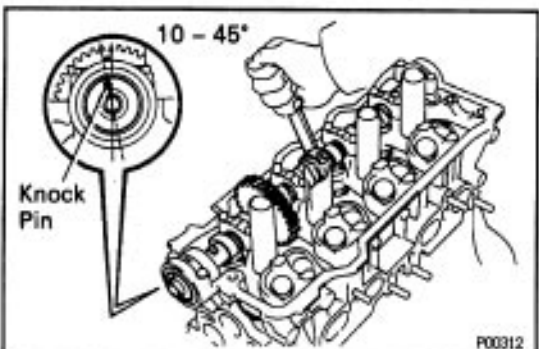
**Torque: 19 N-m (190 kgf-cm, 14 ft-lbf)**



(g) Apply MP grease to a new oil seal lip.



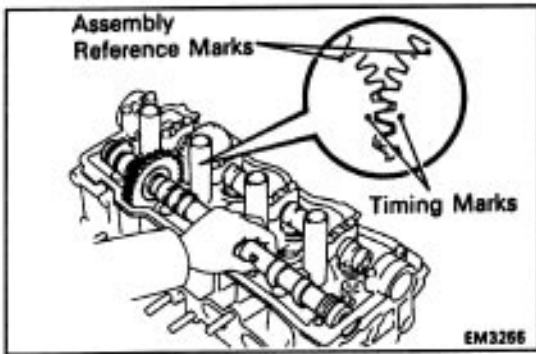
(h) Using SST, tap in the oil seal.  
SST 09223-4601 1



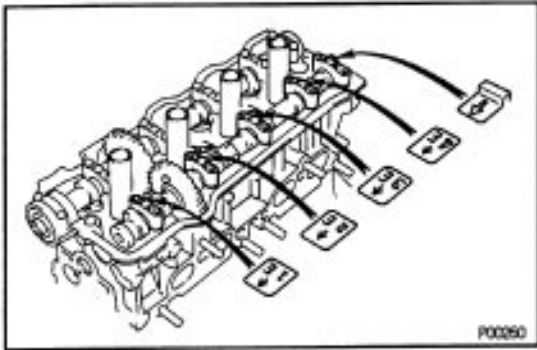
## B. Install exhaust camshaft

(a) Set the knock pin of the intake camshaft at 10–45° BTDC of camshaft angle.

HINT: The above angle allows the No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.

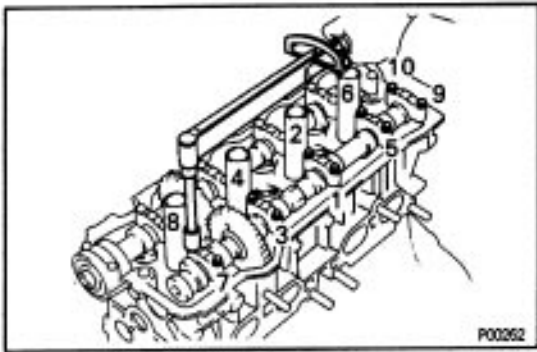


- (b) Apply MP grease to the thrust portion of the camshaft.
- (c) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks on each gear.
- (d) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.  
**NOTICE: There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.**

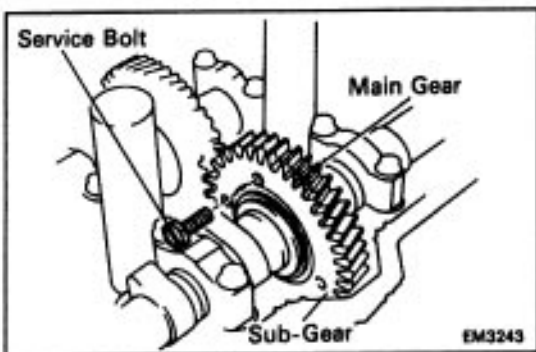


- (e) Turn the intake camshaft clockwise or counterclockwise little by little until the exhaust camshaft sits in the bearing journals evenly without rocking the camshaft on the bearing journals.  
**NOTICE: It is very important to replace the camshaft in the bearing journals evenly while tightening bearing caps in the subsequent steps.**

- (f) Install the bearing caps in their proper locations.



- (g) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (h) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.  
**Torque: 19 N-m (190 kgf-cm, 14 ft-lbf)**



- (i) Remove the service bolt (B).

## 5. CHECK AND ADJUST VALVE CLEARANCE

(See page [EG1-12](#))

Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.

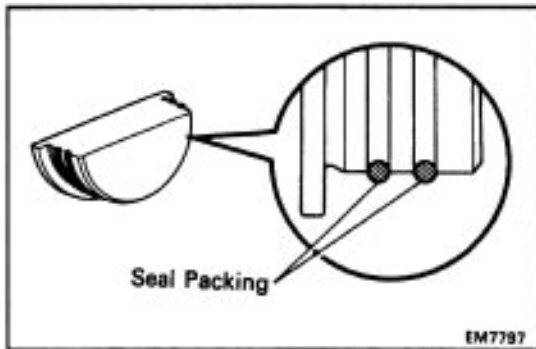
**Valve clearance (Cold):**

**Intake**

0.19 – 0.29 mm (0.007 – 0.011 in.)

**Exhaust**

0.28 – 0.38 mm (0.011 – 0.015 in.)



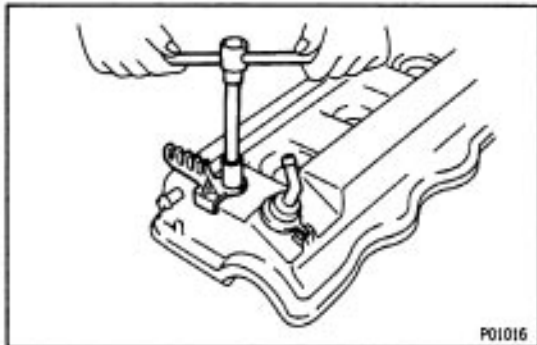
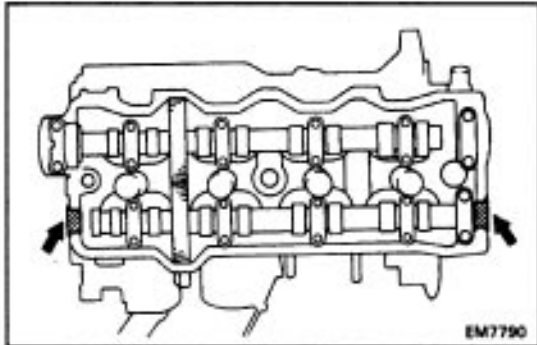
## 6. INSTALL SEMI-CIRCULAR PLUGS

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the semi-circular plug grooves.

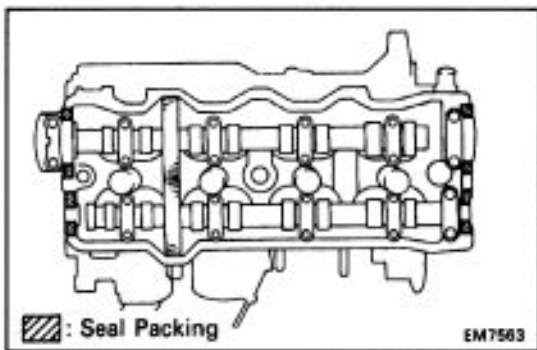
**Seal packing:**

**Part No.08826-00080 or equivalent**

- (c) Install the 2 semi-circular plugs to the cylinder head.



## 7. INSTALL PCV VALVE AND HIGH-TENSION CORDS CLAMP

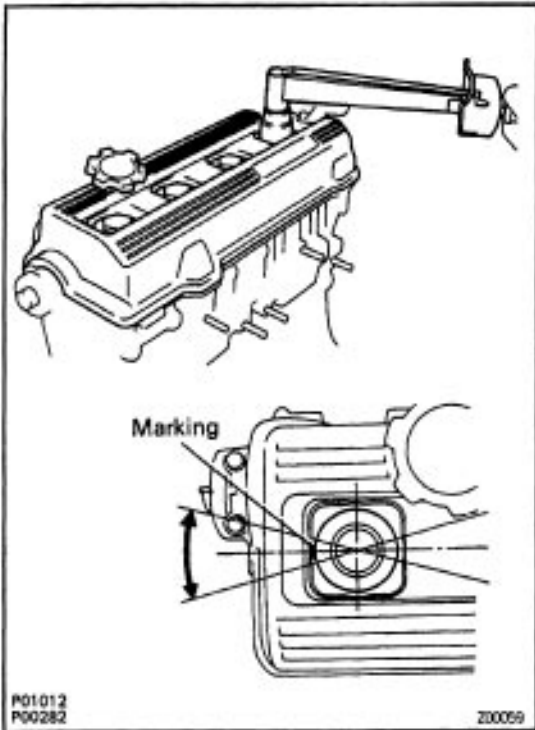


## 8. INSTALL CYLINDER HEAD COVER

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the cylinder head as shown in the illustration.

**Seal packing:**

**Part No.08826-00080 or equivalent**



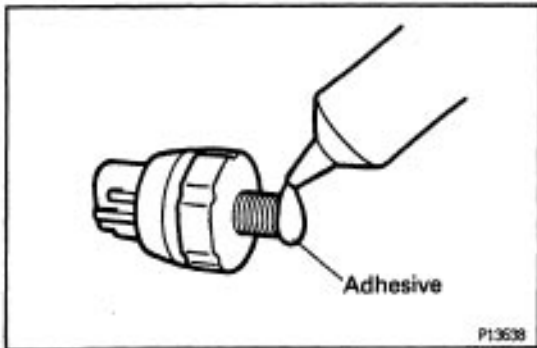
(c) Install the gasket to the head cover.

(d) Install the head cover with the 4 grommets and nuts.

Uniformly tighten the nuts in several passes.

**Torque: 23 N-m (230 kgf-cm, 17 ft-lbf)**

**HINT:** Install the grommets so that their markings are as shown in the illustration.

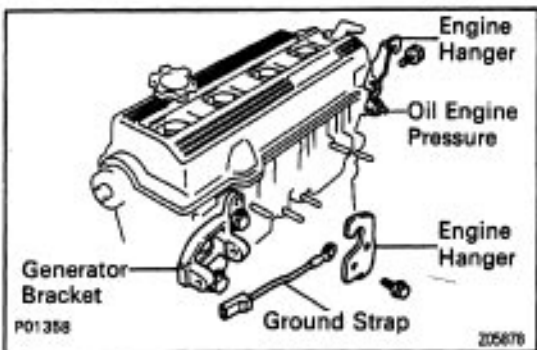


## 9. INSTALL OIL PRESSURE SWITCH

Apply adhesive to 2 or 3 threads.

Adhesive:

Part No.08833-00080, THREE BOND 1324 or equivalent



## 10. INSTALL GENERATOR BRACKET

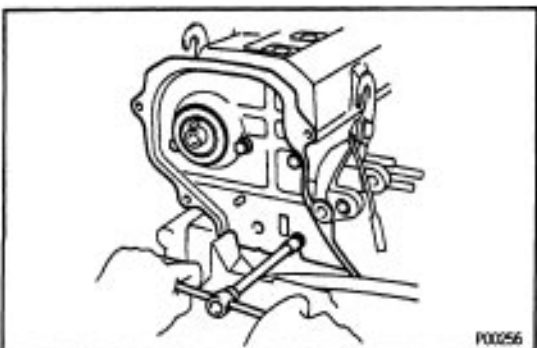
Install the generator bracket with the 3 bolts.

**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**

## 11. INSTALL ENGINE HANGERS

Install the engine hanger with the bolt. Install the 2 engine hangers. Install the ground strap.

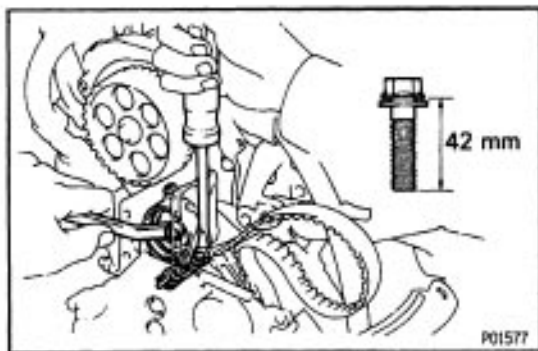
**Torque: 25 N-m (250 kgf-cm, 18 ft-lbf)**



## 12. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover with the 4 bolts.

**Torque: 7.8 N-m (80 kgf-cm, 69 in-lbf)**



### 13. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

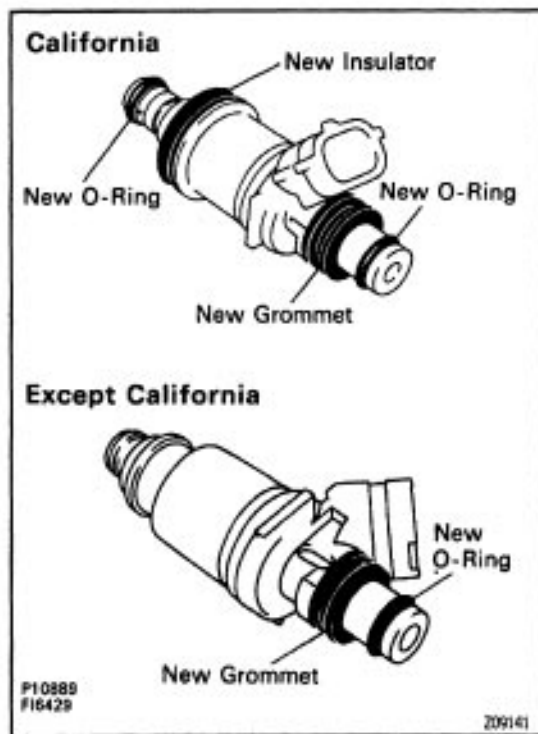
- (a) Install the pulley with the bolt. Do not tighten the bolt yet.

HINT: Use bolt 42 mm (1.65 in.) in length.

- (b) Install the tension spring.  
 (c) Pry the pulley toward the left as far as it will go and tighten the bolt.  
 (d) Check that the idler pulley moves smoothly.

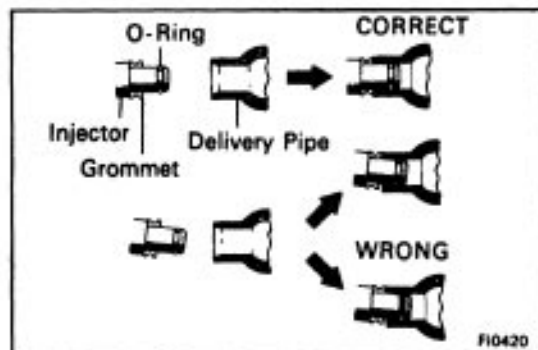
### 14. INSTALL CAMSHAFT TIMING PULLEY AND TIMING BELT

(See page [EG1-33](#))

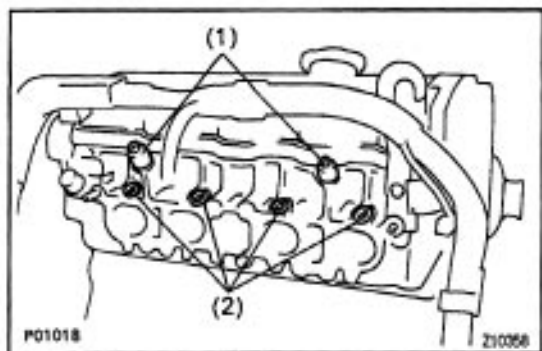


### 15. INSTALL INJECTORS AND DELIVERY PIPE

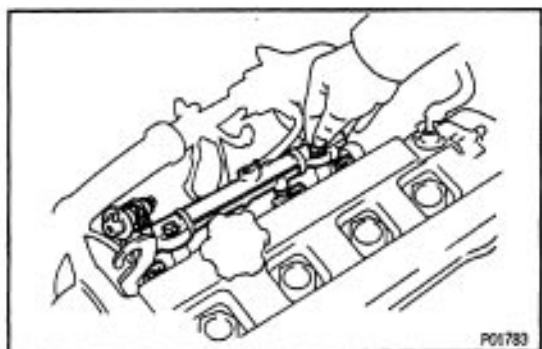
- (a) California:  
 Install new insulator and grommet to each injector.  
 (b) Except California:  
 Install a new grommet to each injector.  
 (c) California:  
 Apply a light coat of gasoline to 2 new O-rings, and install them to each injector.  
 (d) Except California:  
 Apply a light coat of gasoline to a new O-ring, and install it to each injector.



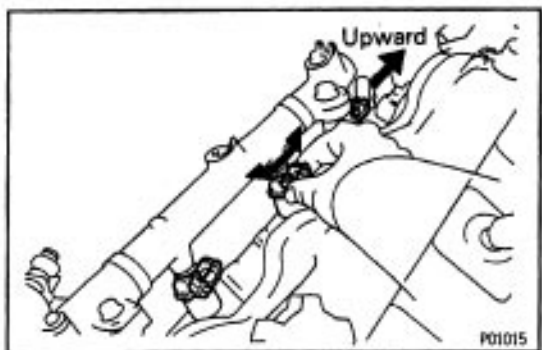
- (e) While turning the injector left and right, install it to the delivery pipes. Install the 4 injectors.



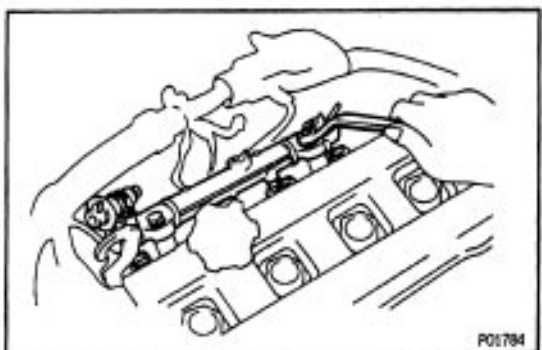
- (f) Install the following parts to the intake manifold:
- (1) 2 spacers
  - (2) Except California:  
4 new insulators



- (g) Place the 4 injectors together with the delivery pipe in position on the cylinder head.
- (h) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

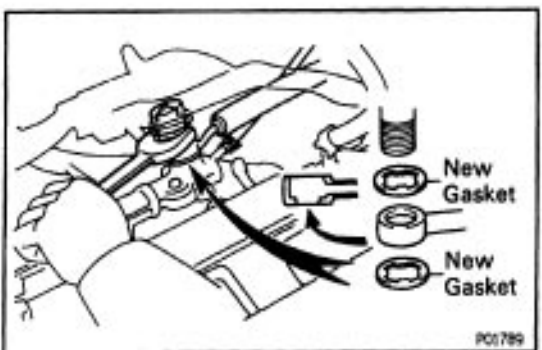


- (i) Check that the injectors rotate smoothly.  
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O-rings. Replace the O-rings.
- (j) Position the injector connector upward.



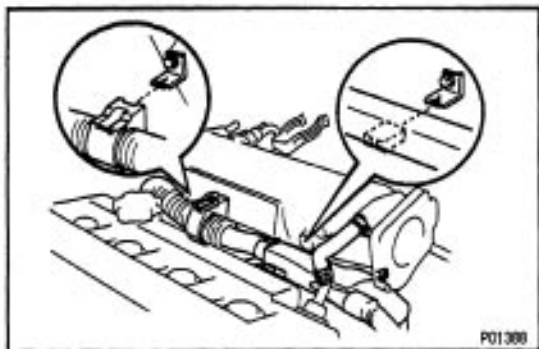
- (k) Tighten the 2 bolts holding the delivery pipe to the cylinder head.

**Torque: 13 N-m (130 kgf-cm, 9 ft-lbf)**

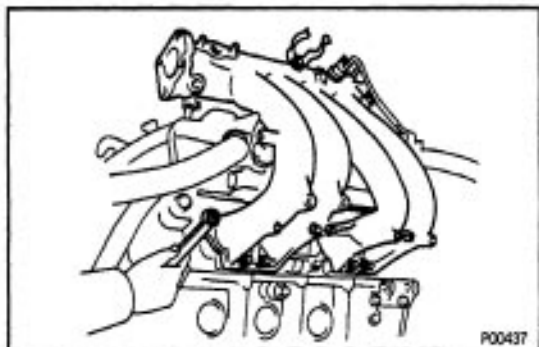


- (l) Connect the fuel return hose.
- (m) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the pulsation damper.
- Torque: 34 N-m (350 kgf-cm, 25 ft-lbf)**



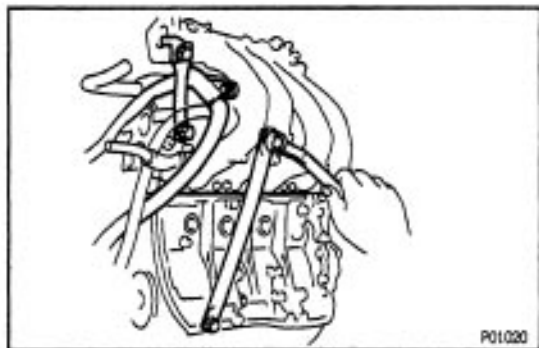
**16. INSTALL INTAKE MANIFOLD**

- (a) Connect the 2 wire clamps to the wire brackets on the intake manifold.



- (b) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**



- (c) Install the vacuum hose bracket and engine wire harness with the bolt.

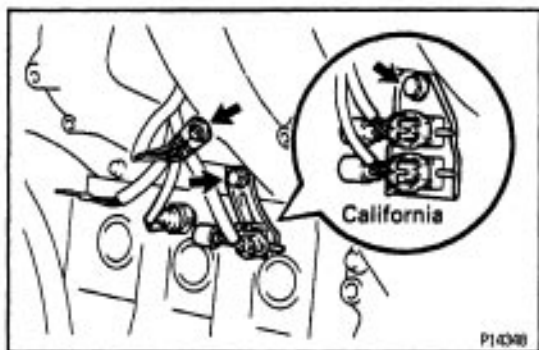
- (d) Install the No.1 air intake chamber and manifold stays, wire bracket with the 4 bolts.

14 mm head bolt

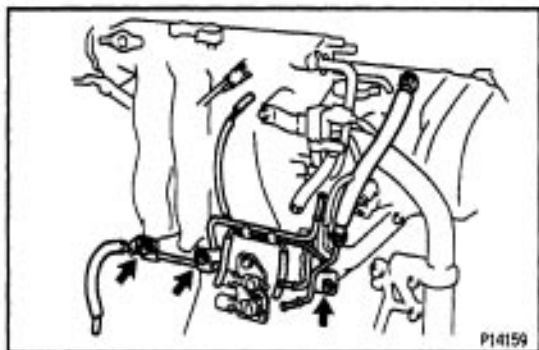
**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**

12 mm head bolt

**Torque: 22 N-m (220 kgf-cm, 16 ft-lbf)**

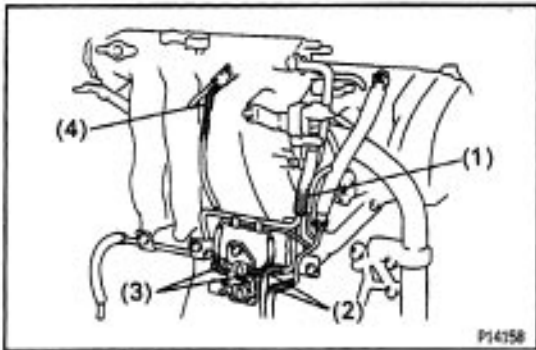
**17. INSTALL VSV OR VSV ASSEMBLY****18. CALIFORNIA ONLY:**

**CONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR**

**19. CONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS****20. INSTALL 2 ENGINE WIRE GROUND STRAPS TO INTAKE MANIFOLD****21. CALIFORNIA:****INSTALL AIR TUBE**

- (a) Install the air tube and wire clamp with the 3 bolts.





(b) Connect the following hoses:

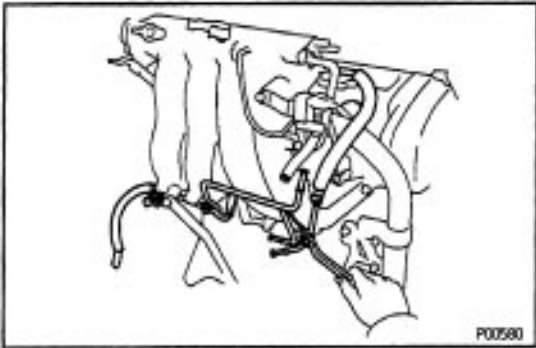
(1) w/ A/C:

A/C hose (from ASV) to air tube

(2) 2 air hoses (from PS pump) to air tube

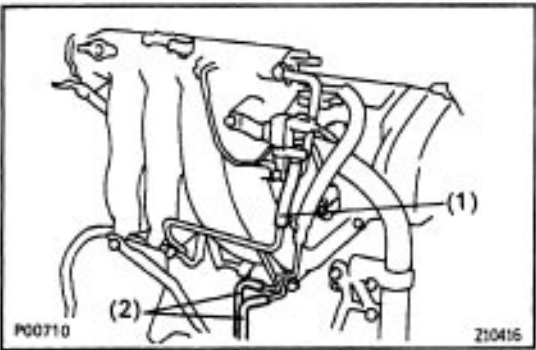
(3) 2 vacuum hoses to VSV (for fuel pressure control)

(4) Vacuum hose to air intake chamber



## 22. EXCEPT CALIFORNIA: INSTALL AIR TUBE

(a) Install the air tube and wire clamp with the 3 bolts.

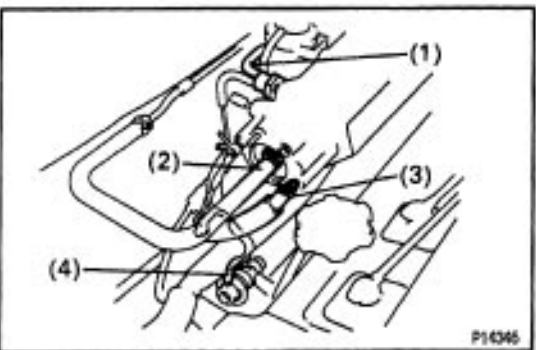


(b) Connect the following hoses to the air tube:

(1) w/ A/C:

Air hose from ASV

(2) 2 air hose from PS pump



## 23. CONNECT VACUUM HOSES

Connect the following hoses:

(1) MAP sensor hose to air intake chamber

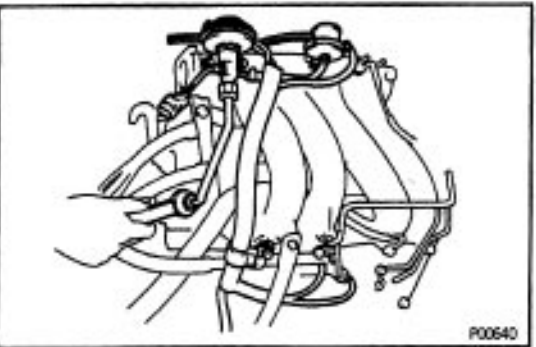
(2) Brake booster vacuum hose to air intake chamber

(3) PS vacuum hose to air intake chamber

(4) Vacuum sensing hose to fuel pressure regulator.

## 24. w/ A/C:

### CONNECT A/C IDLE-UP VALVE CONNECTOR



## 25. INSTALL EGR VALVE AND VACUUM MODULATOR

(a) Install a new gasket and the EGR valve with the union nut and 2 nuts.

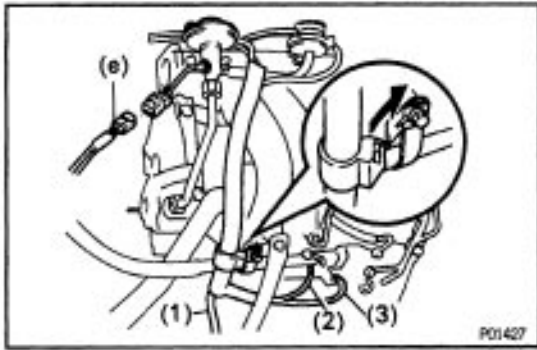
Union nut:

**Torque: 59 N-m (600 kgf-cm, 43 ft-lbf)**

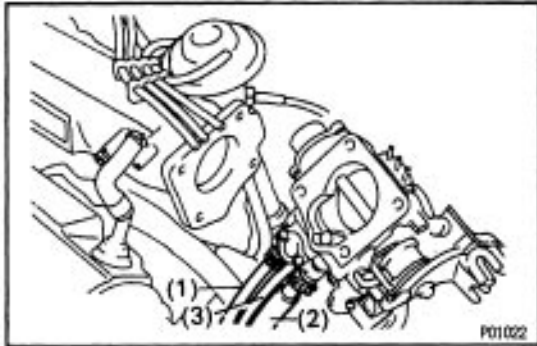
**Nut:**

**Torque: 13 N-m (130 kgf-cm, 9 ft-lbf)**

(b) Install the EGR modulator to the clamp.

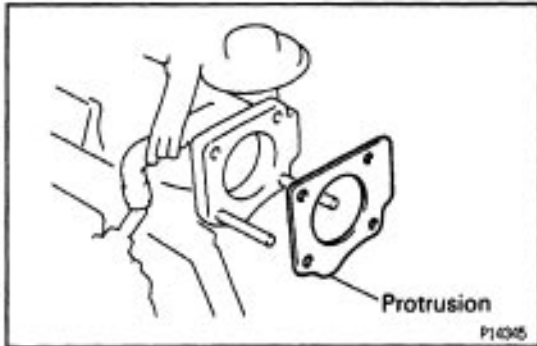


- (c) Connect the vacuum hose clamp.
- (d) Connect the following hoses:
  - (1) Vacuum hose to charcoal canister
  - (2) Vacuum hose (from EGR valve) to E port of VSV (for EGR)
  - (3) Vacuum hose (from Q port of EGR vacuum modulator) to G port of VSV (for EGR)
- (e) Connect the EGR gas temperature sensor connector.

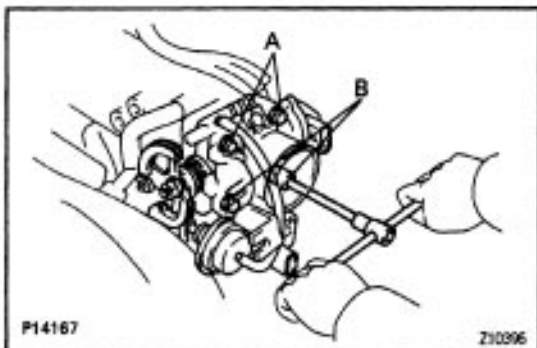


## 26. INSTALL THROTTLE BODY

- (a) Connect the following hoses to the throttle body:
  - (1) Water bypass hose from water outlet
  - (2) Water bypass hose from water bypass pipe
  - (3) California:
    - Air hose from cylinder head
  - Except California:
    - Air hose from air tube



- (b) Place a new gasket on the intake chamber, facing the protrusion downward.

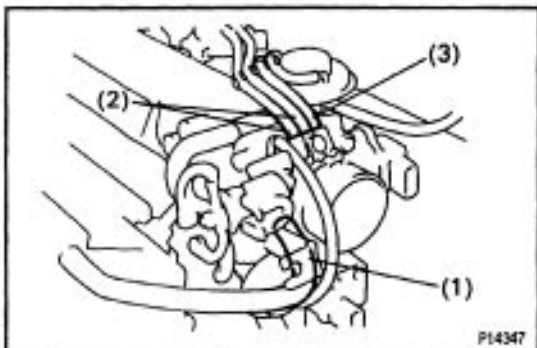


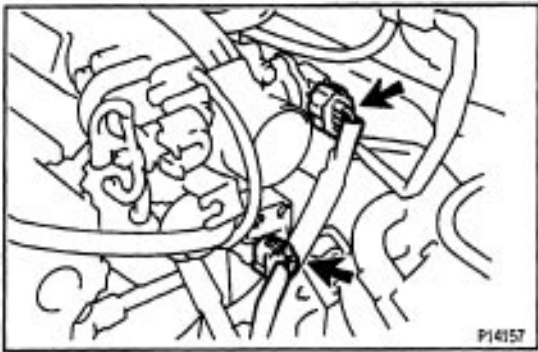
- (c) Type A:
  - Install the throttle body with the 4 bolts.
  - Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**
  - HINT: Each bolt is indicated in the illustration.
  - Bolt length:
    - A 45 mm (1.77 in.)
    - B 55 mm (2.17 in.)

- (d) Type e:
  - Install the throttle body with the 2 bolts and 2 nuts.

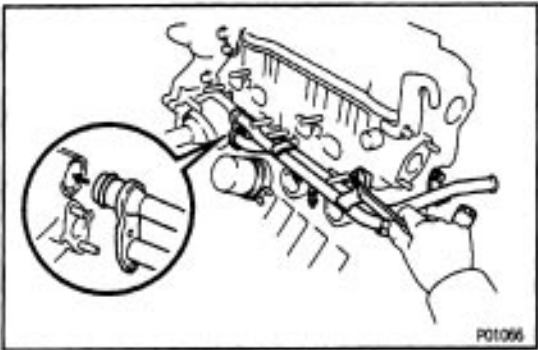
**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**

- (e) Connect the following hoses to the throttle body:
  - (1) PCV hose
  - (2) 2 vacuum hoses from EGR vacuum modulator
  - (3) Vacuum hose from TVV (for EVAP)





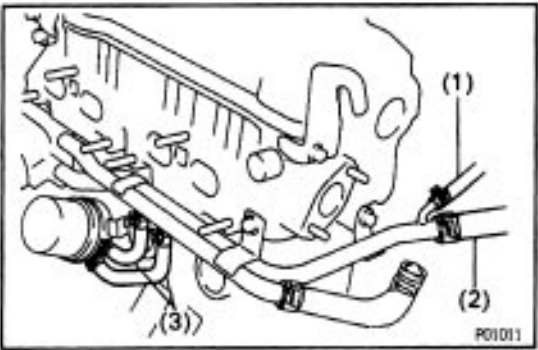
- (f) Connect the IAC valve connector.
- (g) Connect the throttle position sensor connector.



## 27. INSTALL WATER BYPASS PIPE

- (a) Install a new O-ring to the bypass pipe.
- (b) Apply soapy water on the O-ring.
- (c) Install a new gasket and the bypass pipe with the 2 nuts and 2 bolts.

**Torque (Nut): 8.8 N-m (90 kgf-cm, 78 in.-lbf)**



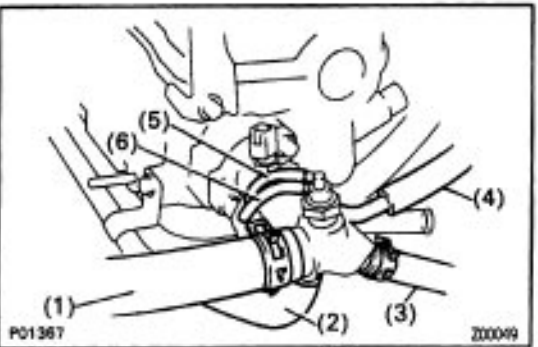
- (d) Connect the following hoses:
  - (1) IAC water bypass hose
  - (2) Heater water hose
  - (3) w/ Oil Cooler:
    - 2 oil cooler water bypass hoses



## 28. INSTALL WATER OUTLET

- (a) Install a new gasket and the water outlet with the 2 bolts.

**Torque: 15 N-m (150 kgf-cm, 11 ft-lbf)**



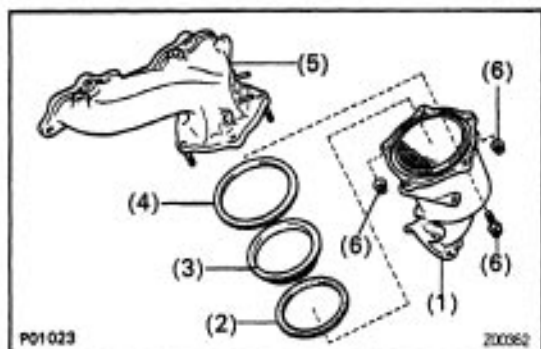
- (b) Connect the following hoses:
  - (1) Upper radiator hose
  - (2) Water bypass pipe hose
  - (3) Heater water hose
  - (4) IAC water bypass hose
  - (5) TVV (for EVAP) vacuum hose (from P port of throttle body)
  - (6) TVV (for EVAP) vacuum hose (from charcoal canister)

(c) Connect the following connectors:

- (1) Engine coolant temperature sender gauge connector
- (2) Engine coolant temperature sensor connector

### 29. CONNECT ENGINE WIRE (FOR OXYGEN SENSORS) TO ENGINE HANGER

### 30. CONNECT OIL PRESSURE SWITCH CONNECTOR

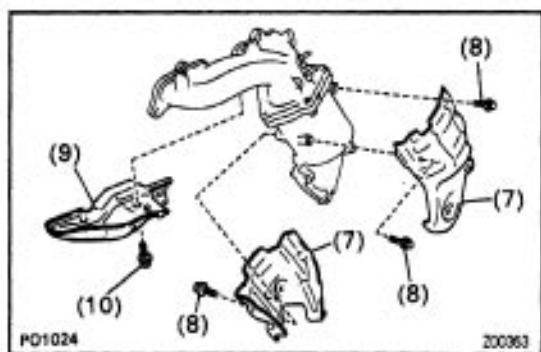
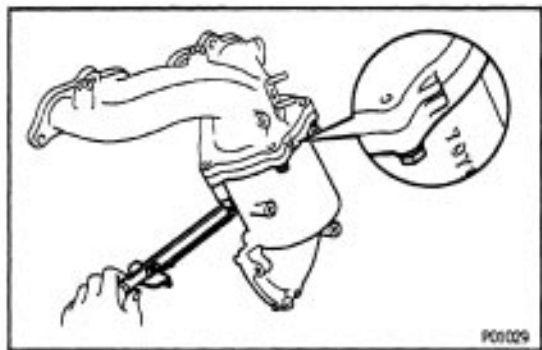


### 31. ASSEMBLE EXHAUST MANIFOLD AND WARM UP THREE-WAY CATALYTIC CONVERTER

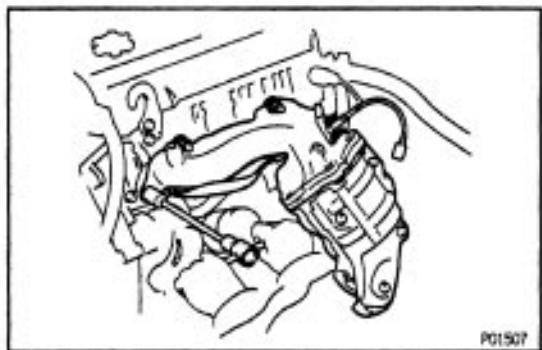
Assemble the following parts:

- (1) WU-TWC
- (2) Cushion
- (3) Retainer
- (4) Gasket
- (5) Exhaust manifold
- (6) 3 bolts and 2 nuts

Torque: 29 N-m (300 kgf-cm, 22 ft-lbf)



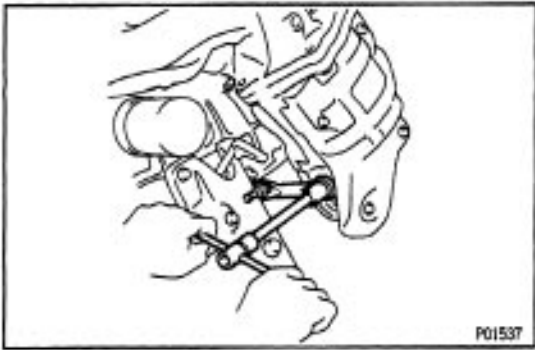
- (7) 2 converter heat insulators
- (8) 8 bolts
- (9) Manifold lower heat insulator
- (10) 3 bolts



### 32. INSTALL EXHAUST MANIFOLD AND WARM UP THREE-WAY CATALYTIC CONVERTER ASSEMBLY

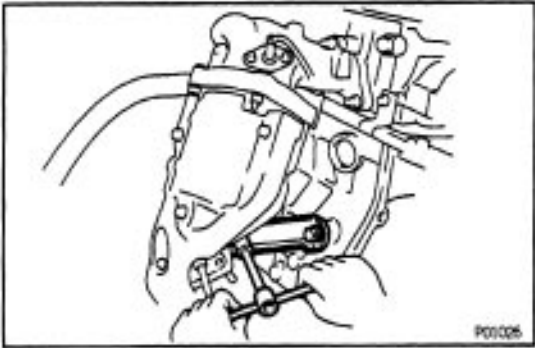
- (a) Install a new gasket, the exhaust manifold and WU – TWC assembly with the 6 nuts. Uniformly tighten the nuts in several passes.

Torque: 49 N-m (540 kgf-cm, 36 ft-lbf)



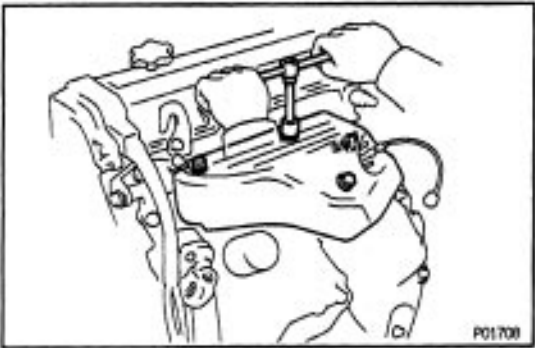
(b) Install the manifold stay with the bolt and nut.

**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**



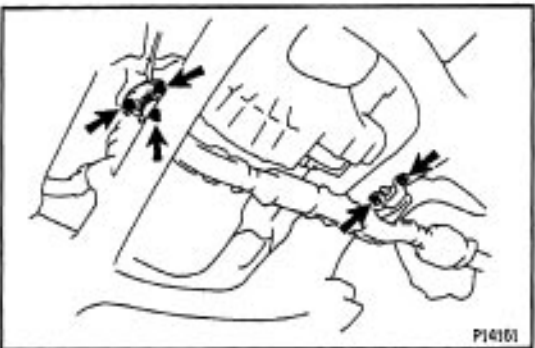
(c) Install the No. 1 manifold stay with the bolt and nut.

**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**



(d) Install the manifold upper heat insulator with the 4 bolts.

(e) Connect the main oxygen and sub oxygen sensor connectors.



### 33. CONNECT FRONT EXHAUST PIPE

(a) Place a new gasket on the front exhaust pipe.

(b) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.

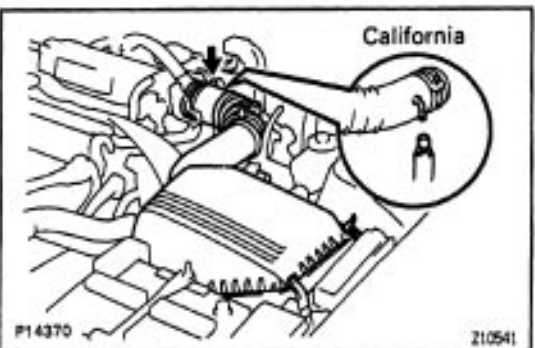
**Torque: 62 N-m (630 kgf-cm, 46 ft-lbf)**

(c) Install the bracket with the 2 bolts.

### 34. INSTALL DISTRIBUTOR

(See page [IG-17](#) and 37)

### 35. INSTALL GENERATOR (See page [CH-24](#))



### 36. INSTALL AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

(a) Connect the air cleaner hose to the throttle body.

(b) Install the air cleaner cap together with the resonator and air cleaner hose.

(c) California only:

Connect the air hose to the air cleaner hose.

(d) Connect the intake air temperature sensor connector.

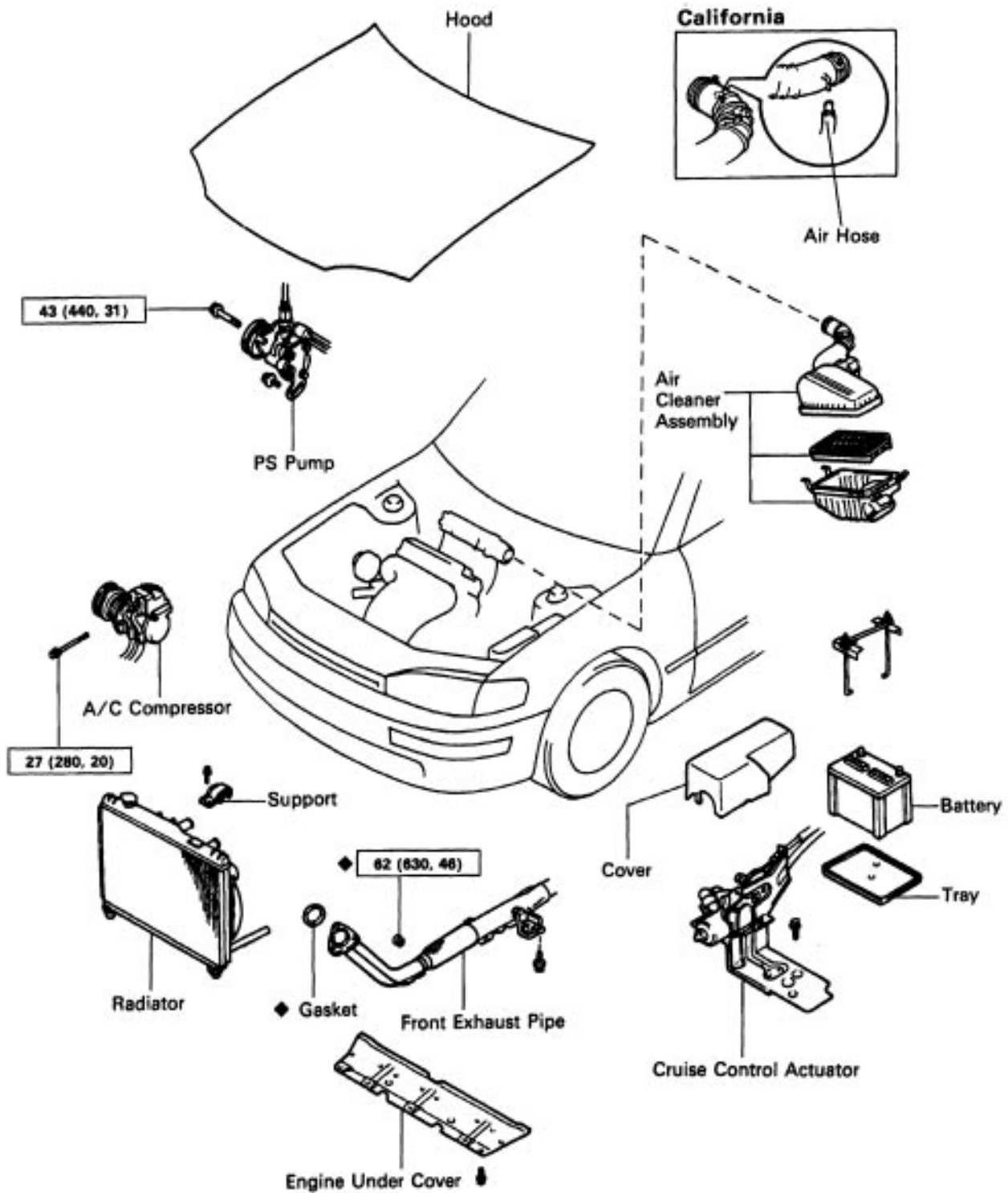
**37. A/T:****CONNECT AND ADJUST THROTTLE CABLE****38. CONNECT AND ADJUST ACCELERATOR CABLE****39. FILL WITH ENGINE COOLANT****Capacity:****6.3 liters (6.7 US qts, 5.5 Imp. qts)****40. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY****41. START ENGINE AND CHECK FOR LEAKS****42. ADJUST IGNITION TIMING****(See page IG -19 and 38)****Ignition timing:****10° BTDC @ idle****(w/ Terminals TO and E1 connected)****43. PERFORM ROAD TEST**

Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

**44. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL**

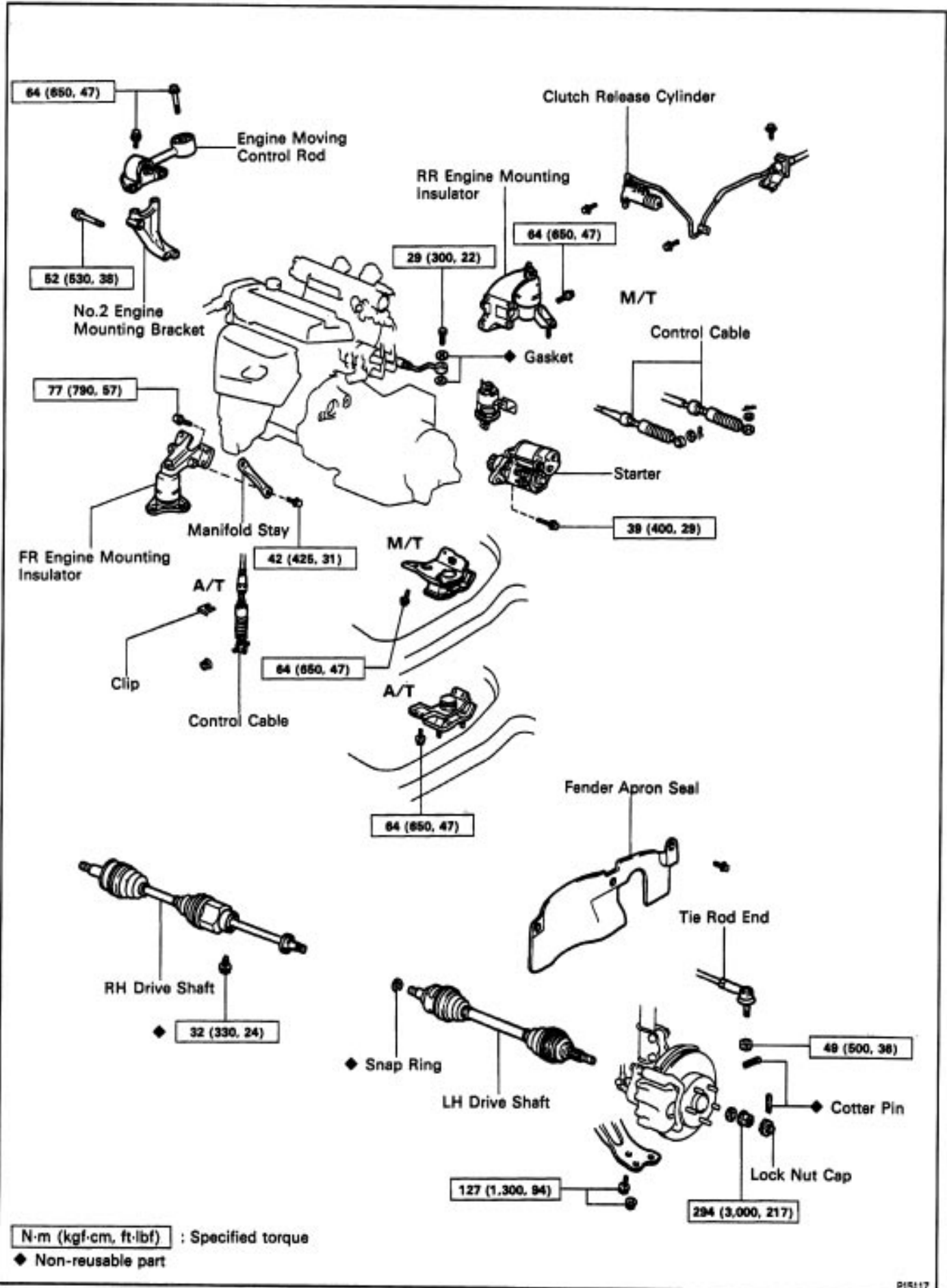
# CYLINDER BLOCK COMPONENTS FOR ENGINE REMOVAL AND INSTALLATION

ME100-02

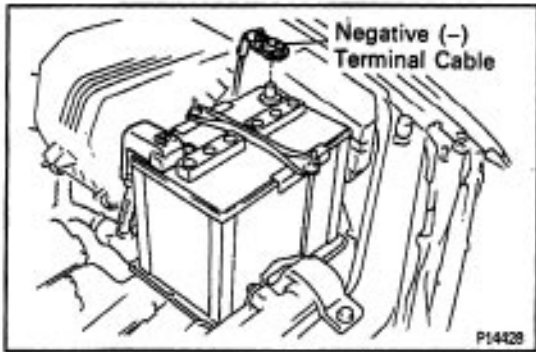


N·m (kgf-cm, ft-lbf) : Specified torque

◆ Non-reusable part







## ENGINE REMOVAL

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (-) terminal cable is disconnected from the battery.

### 2. REMOVE BATTERY AND TRAY

### 3. REMOVE HOOD

### 4. REMOVE ENGINE UNDER COVER

### 5. DRAIN ENGINE COOLANT

### 6. DRAIN ENGINE OIL

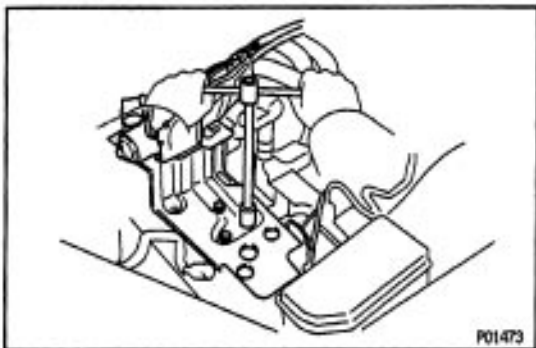
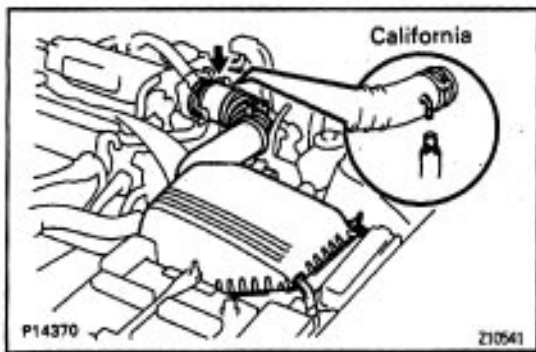
### 7. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

### 8. A/T:

### DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

### 9. REMOVE AIR CLEANER ASSEMBLY, RESONATOR AND AIR CLEANER HOSE

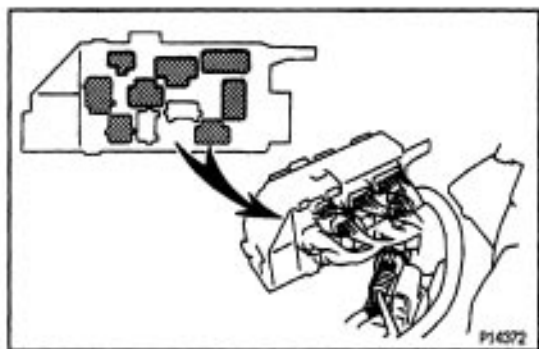
- (a) Disconnect the intake air temperature sensor connector.
- (b) California only:  
Disconnect the air hose from the air cleaner hose.
- (c) Loosen the air cleaner hose clamp bolt.
- (d) Disconnect the 4 air cleaner cap clips.
- (e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.
- (f) Remove the element.
- (g) Remove the 3 bolts and air cleaner case.



### 10. w/ CRUISE CONTROL SYSTEM: REMOVE CRUISE CONTROL ACTUATOR

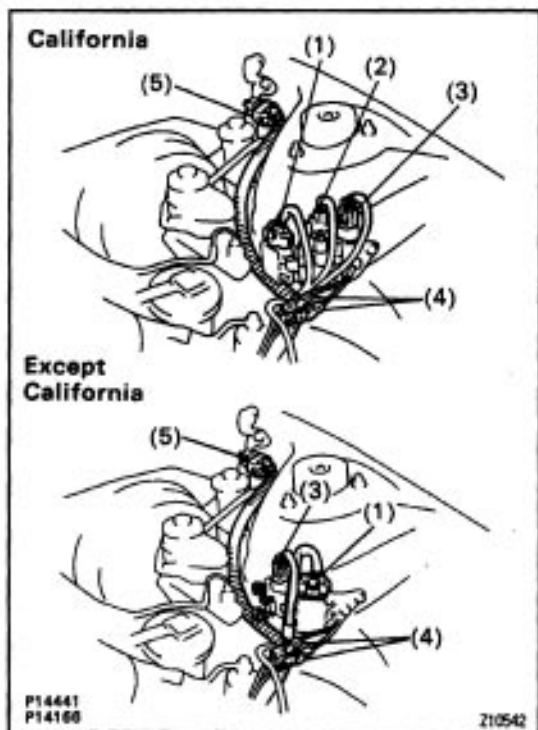
- (a) Remove the actuator cover.
- (b) Disconnect the actuator connector.
- (c) Remove the 3 bolts, and disconnect the actuator with the bracket.

### 11. REMOVE RADIATOR

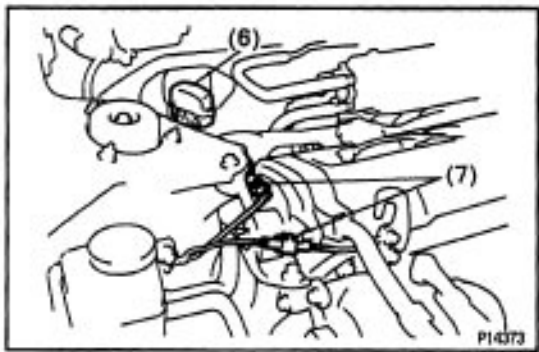


## 12. DISCONNECT WIRES AND CONNECTORS

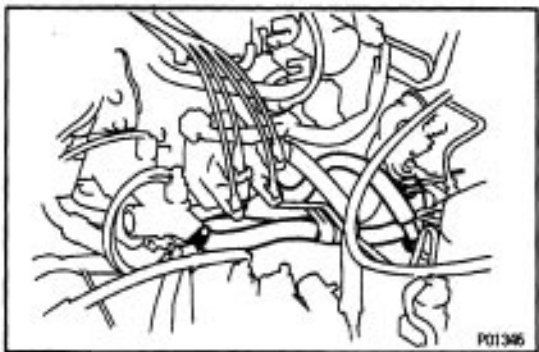
- (a) Remove the engine relay box, and disconnect the 5 connectors.
- (b) Connector from LH fender apron



- (c) Disconnect the following connectors:
  - (1) Igniter connector
  - (2) California only: Ignition coil connector
  - (3) Noise filter connector
  - (4) 2 ground straps from LH fender apron
  - (5) Connector from LH fender apron



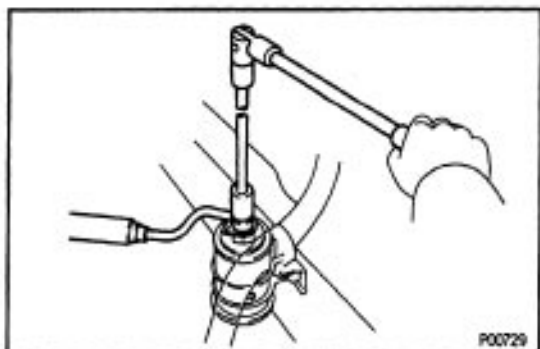
- (6) Data link connector 1
- (7) 2 ground straps from RH fender apron
- (d) Disconnect the MAP sensor connector.



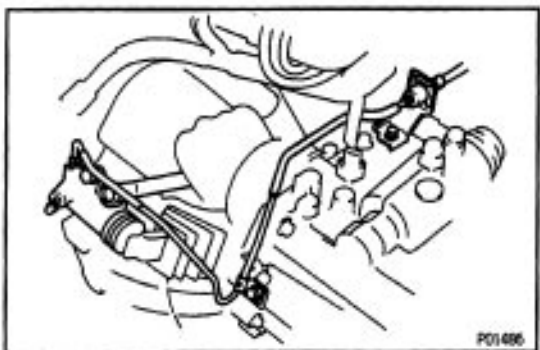
## 13. DISCONNECT HEATER HOSES

## 14. DISCONNECT FUEL RETURN HOSE

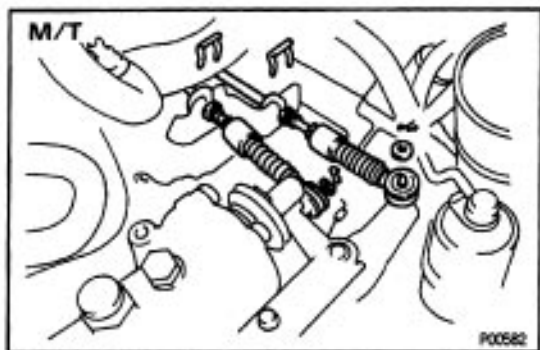
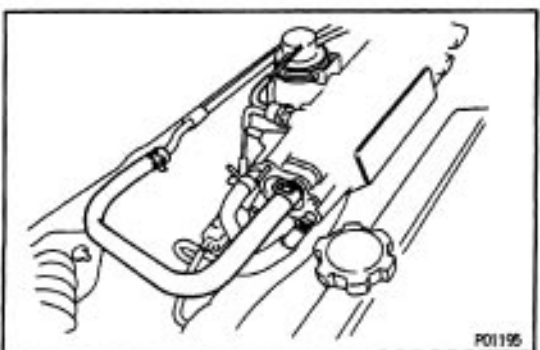
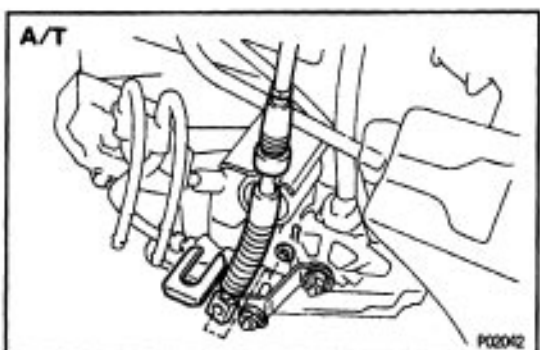
**CAUTION:** Catch leaking fuel in a container.

**15. DISCONNECT FUEL INLET HOSE**

**CAUTION:** Catch leaking fuel in a container.

**16. M/T:****REMOVE STARTER****17. M/T:****REMOVE CLUTCH RELEASE CYLINDER WITHOUT DISCONNECTING TUBE**

Remove the 4 bolts, release cylinder and tube from the transaxle.

**18. DISCONNECT TRANSAXLE CONTROL CABLE (S) FROM TRANSAXLE****19. DISCONNECT VACUUM HOSES**

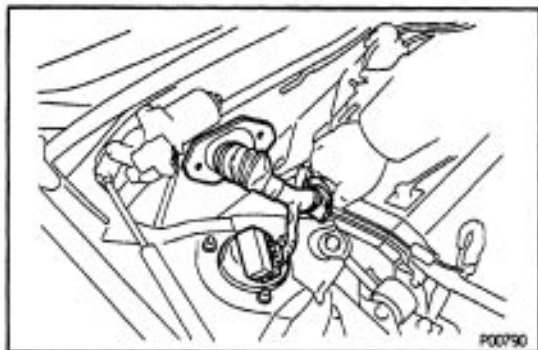
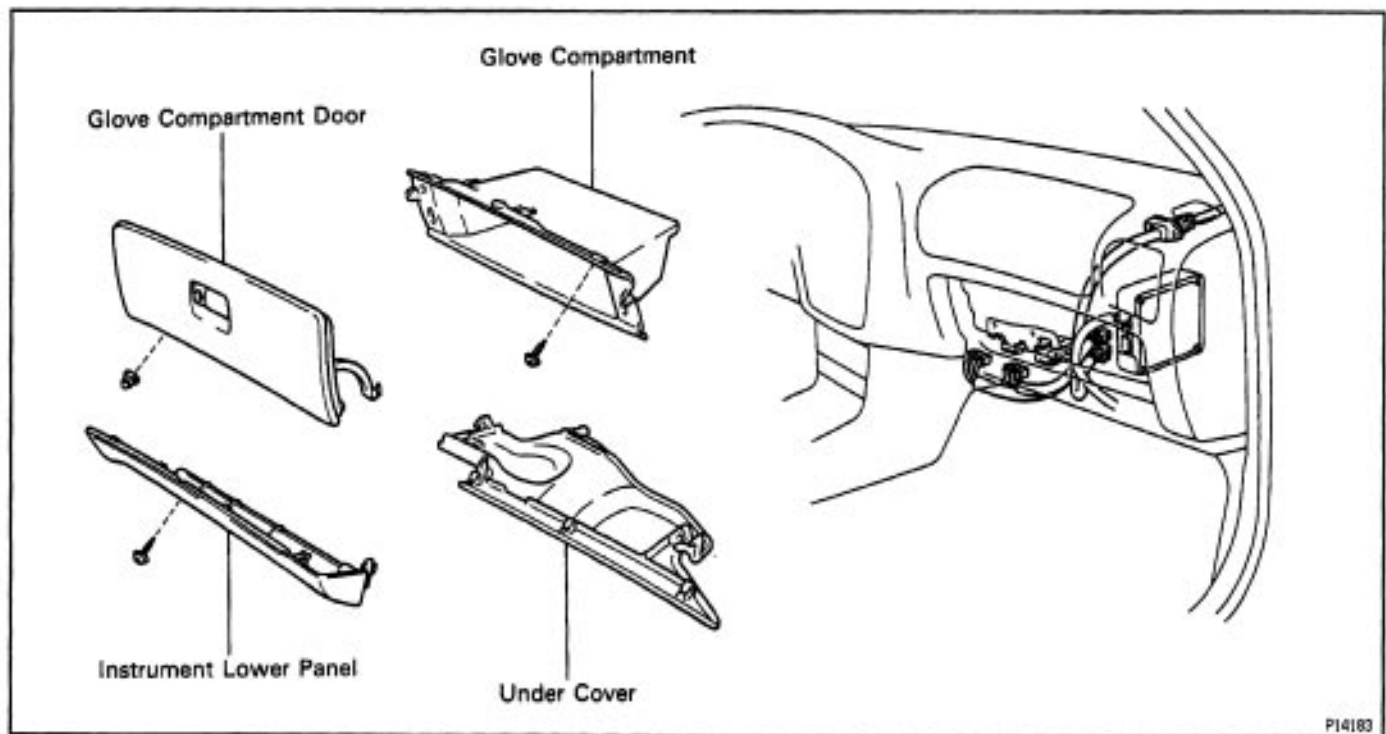
(a) MAP sensor hose from air intake chamber

(b) Brake booster vacuum hose from air intake chamber

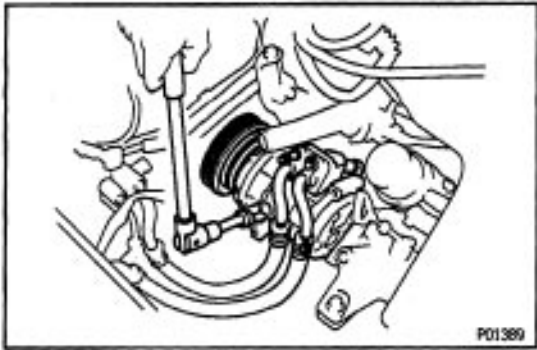
(c) Charcoal canister vacuum hose

## 20. DISCONNECT ENGINE WIRE FROM CABIN

- (a) Remove the under cover.
- (b) Remove the lower instrument panel.
- (c) Remove the glove compartment door.
- (d) Remove the glove compartment.
- (e) Disconnect the following connectors:
  - (1) 2 ECM connectors
  - (2) 2 cowl wire connector

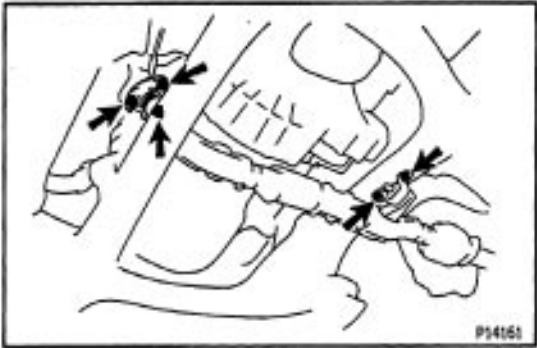


(f) Remove the 2 nuts, and pull out the engine wire from the cowl panel.

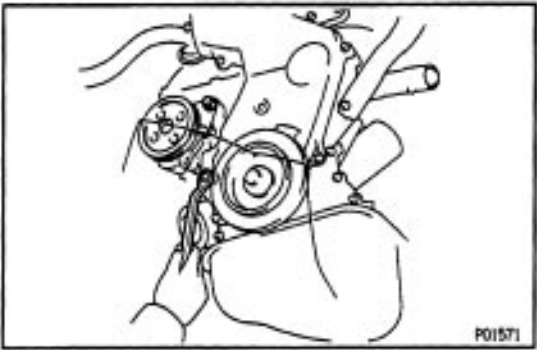
**21. w/ A/C:****REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES**

- (a) Disconnect the A/C compressor connector.
- (b) Remove the drive belt.
- (c) Remove the 3 bolts, and disconnect the A/C compressor.

HINT: Put aside the compressor, and suspend it to the radiator support with a string.

**22. DISCONNECT FRONT EXHAUST PIPE**

- (a) Loosen the 2 bolts, and disconnect the bracket.
- (b) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU-TWC.
- (c) Disconnect the front exhaust pipe and gaskets.

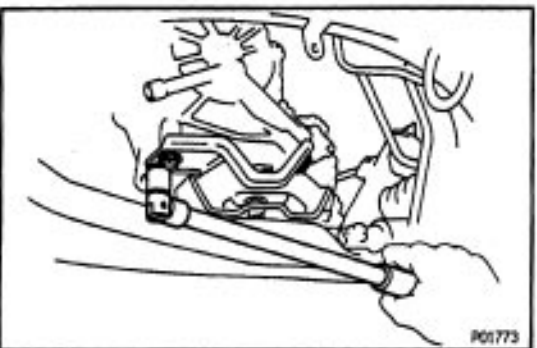
**23. REMOVE DRIVE SHAFTS (See page SA-38)****24. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES**

- (a) Disconnect the 2 air hoses from the air pipe.
- (b) Remove the PS drive belt.
- (c) Remove the 2 bolts, and disconnect the PS pump from the engine.

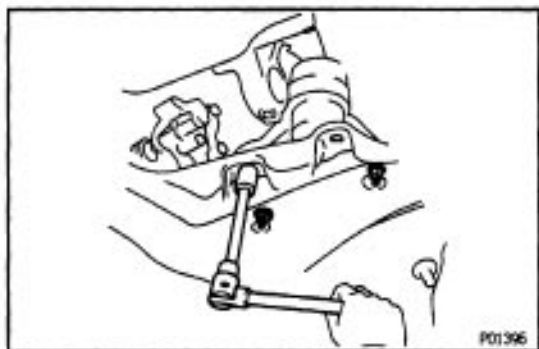
HINT: Put aside the pump and suspend it from the cowl with a string.

**25. DISCONNECT LH ENGINE MOUNTING INSULATOR M/T:**

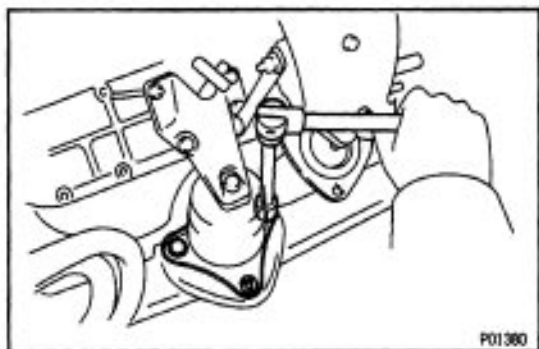
Remove the 3 bolts, and disconnect the mounting insulator.

**A/T:**

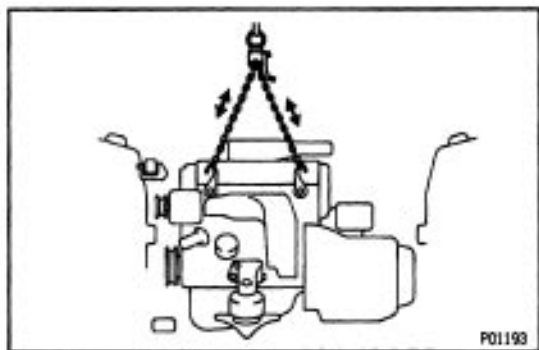
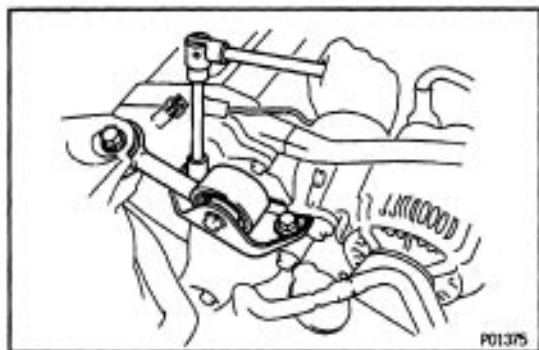
Remove the 4 bolts, and disconnect the mounting insulator.

**26. DISCONNECT RR ENGINE MOUNTING INSULATOR**

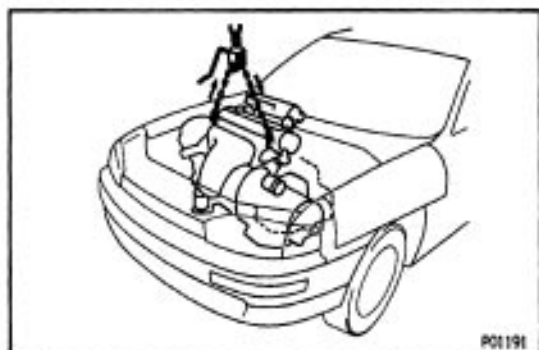
- (a) Remove the hole plugs.
- (b) Remove the 3 nuts, and disconnect the mounting insulator.

**27. DISCONNECT FR ENGINE MOUNTING INSULATOR**

Remove the 3 bolts, and disconnect the mounting insulator.

**28. ATTACH ENGINE SLING DEVICE TO ENGINE HANGERS****29. REMOVE ENGINE MOVING CONTROL ROD**

Remove the 3 bolts and control rod.

**30. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE**

- (a) Lift the engine out of the vehicle slowly and carefully.  
**NOTICE:** Be careful not to hit the PS gear housing or perk/neutral position switch (A/T).
- (b) Make sure the engine is clear of all wiring, hoses and cables.
- (c) Place the engine and transaxle assembly onto the stand.

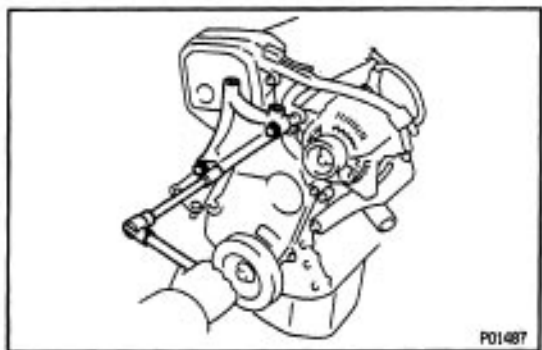
31. A/T:

**REMOVE STARTER**

**32. SEPARATE ENGINE AND TRANSAXLE**

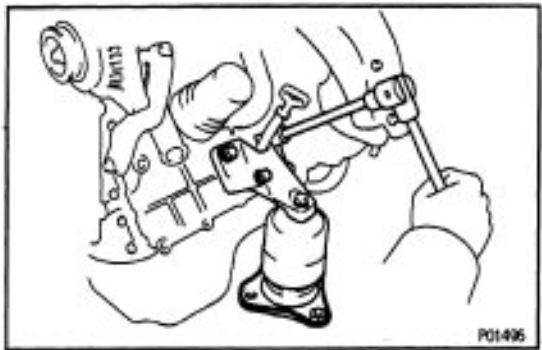
M/T (See page [MX-10](#))

A/T (See page [AX1-21](#))



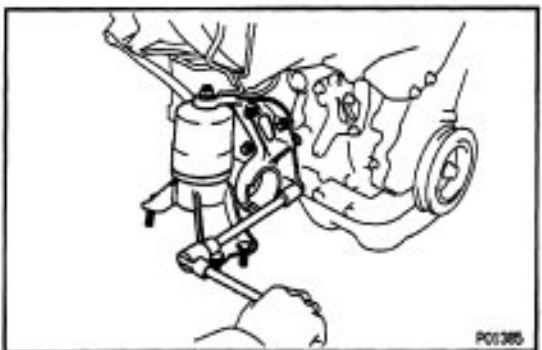
**33. REMOVE NO.2 RH ENGINE MOUNTING BRACKET**

Remove the 3 bolts and engine mounting bracket.



**34. REMOVE FR ENGINE MOUNTING INSULATOR**

- (a) Remove the bolt, nut and manifold stay.
- (b) Remove the 4 bolts and mounting insulator.

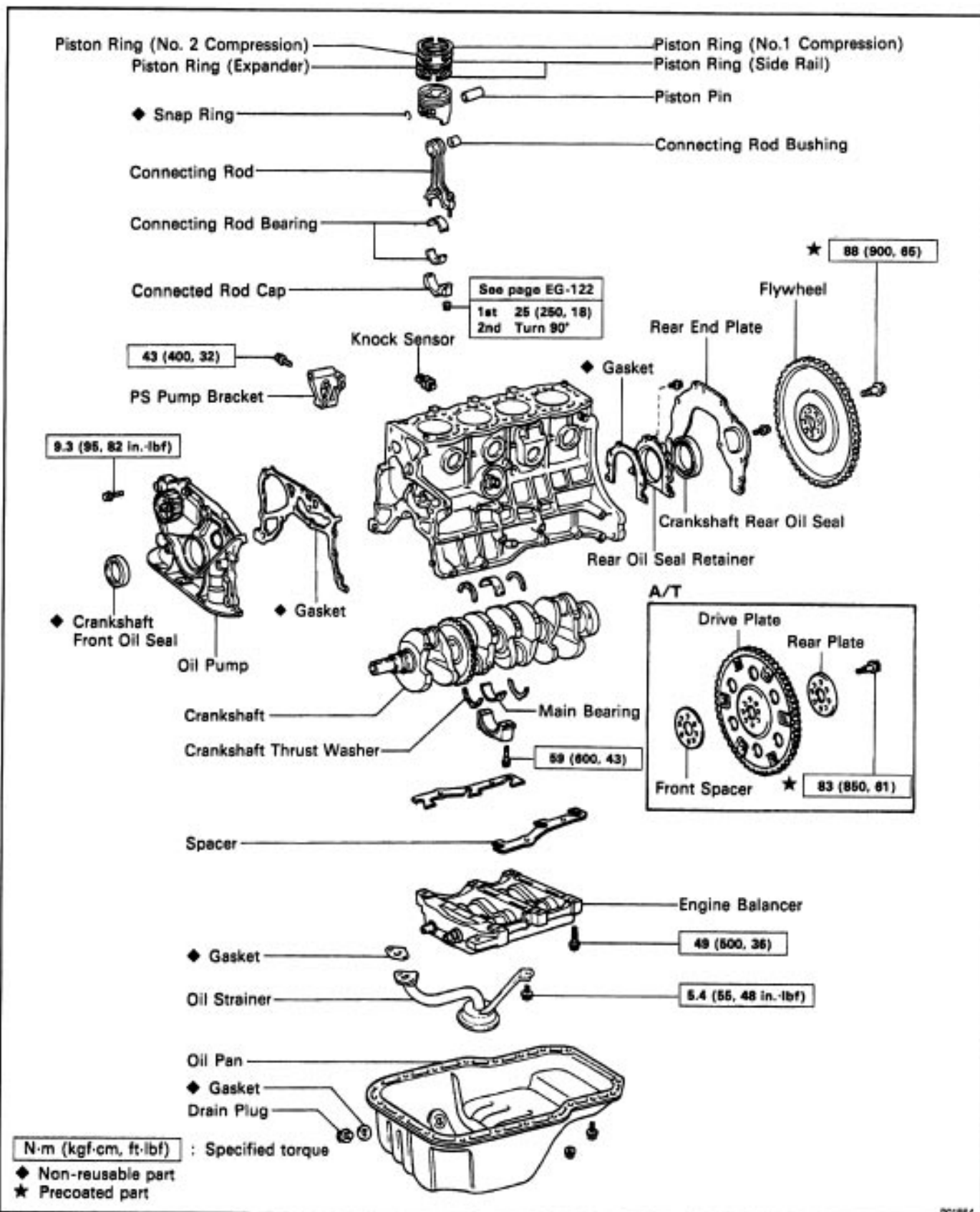


**35. REMOVE RR ENGINE MOUNTING INSULATOR**

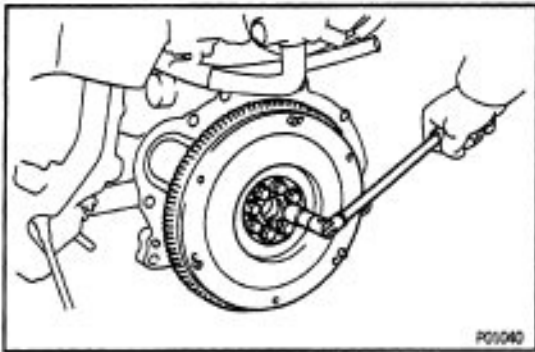
Remove the 4 bolts and mounting insulator.



## COMPONENTS FOR CYLINDER BLOCK DISASSEMBLY AND ASSEMBLY

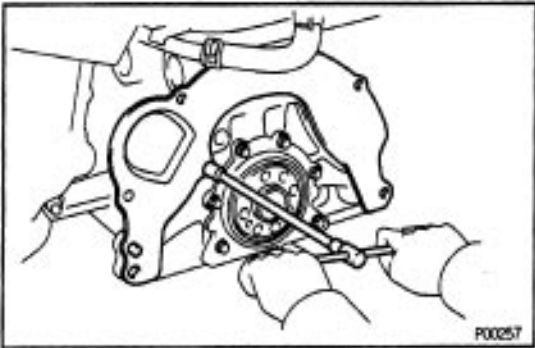






## PREPARATION FOR DISASSEMBLY

1. M/T:  
REMOVE CLUTCH COVER AND DISC
2. M/T:  
REMOVE FLYWHEEL
3. A/T:  
REMOVE DRIVE PLATE

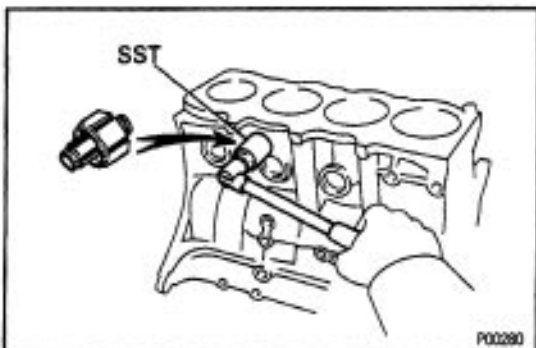


4. REMOVE REAR END PLATE  
Remove the bolt and end plate.
5. INSTALL ENGINE TO ENGINE STAND FOR  
DISASSEMBLY
6. REMOVE GENERATOR
7. REMOVE DISTRIBUTOR

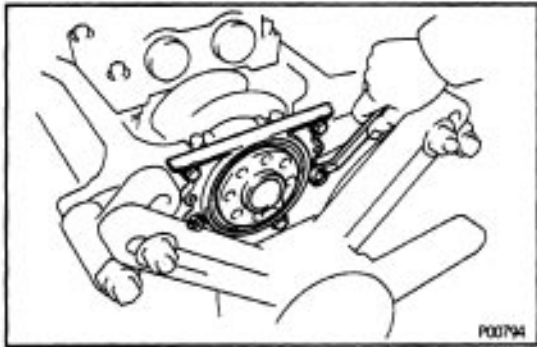


8. REMOVE PS PUMP BRACKET  
Remove the 3 bolts and PS pump bracket.

9. REMOVE TIMING BELT AND PULLEYS
10. REMOVE CYLINDER HEAD
11. REMOVE WATER PUMP AND GENERATOR  
ADJUSTING BAR
12. REMOVE OIL PAN AND OIL PUMP
13. REMOVE OIL FILTER
14. w/ OIL COOLER:  
REMOVE OIL COOLER



15. REMOVE KNOCK SENSOR  
Using SST, remove the knock sensor.  
SST 09816 – 30010

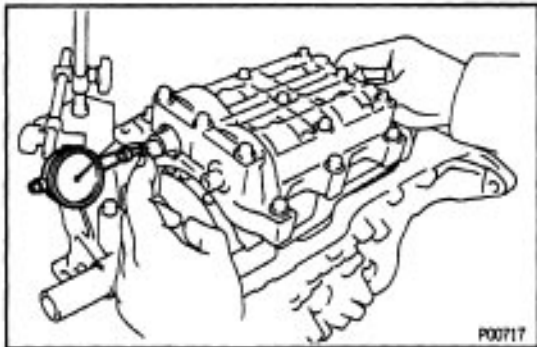


## CYLINDER BLOCK DISASSEMBLY

(See Components for Cylinder Block Disassembly and Assembly)

### 1. REMOVE REAR OIL SEAL RETAINER

Remove the 6 bolts, retainer and gasket.



### 2. CHECK THRUST CLEARANCES OF NO.1 AND NO.2 BALANCE SHAFT OF ENGINE BALANCER

Using a dial indicator, measure the thrust clearance while moving the balance shaft back and forth.

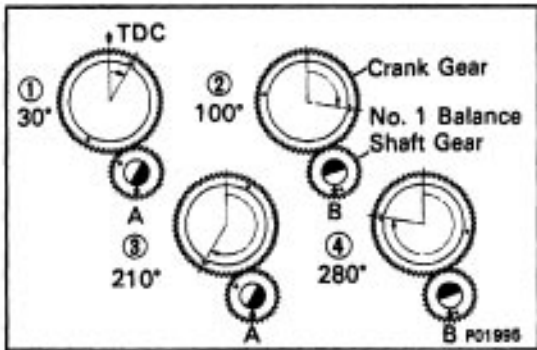
**Standard thrust clearance:**

**0.065 – 0.110 mm (0.0026 – 0.0043 in.)**

**Maximum clearance:**

**0.11 mm (0.0043 in.)**

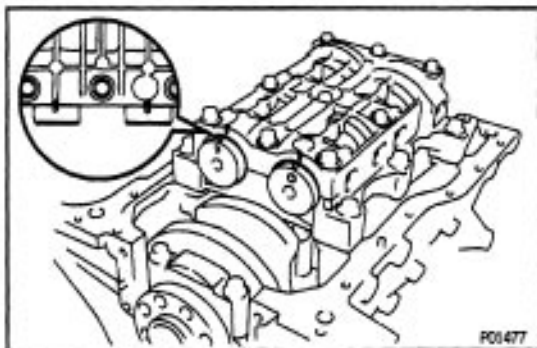
If the clearance is greater than maximum, replace the balance shaft housings and bearings. If necessary, replace the balance shafts.



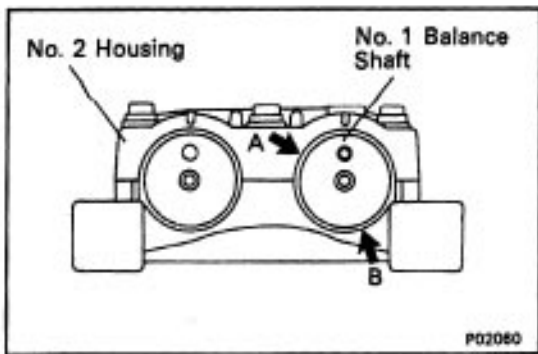
### 3. CHECK BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR

**NOTICE:**

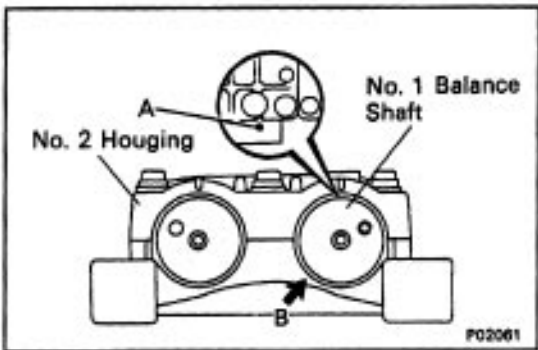
- Backlash between the crankshaft gear and No.1 balance shaft gear varies with the rotation of the balance shaft and the deviation of the crankshaft gear.
- Accordingly, it is necessary to measure the backlash at the 4 points shown in the illustration on the left. When this inspection is performed on-vehicle, the specifications are increased by approx. 0.025 mm (See specifications below)



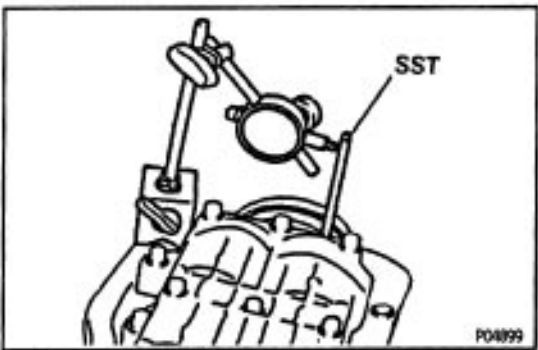
- Rotate the crankshaft 2 or 3 times to settle the crankshaft gear and No.1 balance shaft gear.
- When No.1 piston is at TDC, check that the punch marks shown in the illustration of the balance shafts are aligned with the grooves of the No.2 housing.



- (c) Check that the punch marks A and B are at the positions on the No.1 balance shaft indicated in the illustration.



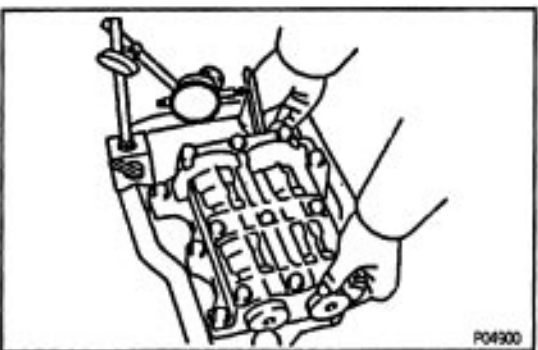
- (d) 1 st turn the crankshaft clockwise, and align the groove of the No.2 balance shaft housing with the punch mark A of the No. 1 balance shaft.



- (e) Set the SST and the dial indicator as shown in the illustration.

SST 09224- 74010

HINT: Make sure that the needle of the dial indicator is perpendicular to the SST and that it is placed in the middle of the third indentation.



- (f) Lightly turn the No. 1 balance shaft by hand and measure the backlash.

HINT:

- Turn the No.1 balance shaft 4 or 5 times to provide a steady backlash reading.
- To prevent excessive backlash due to thrust clearance, measure the backlash while pressing on the rear of the No.1 balance shaft.

**Standard backlash:**

**Off-vehicle**

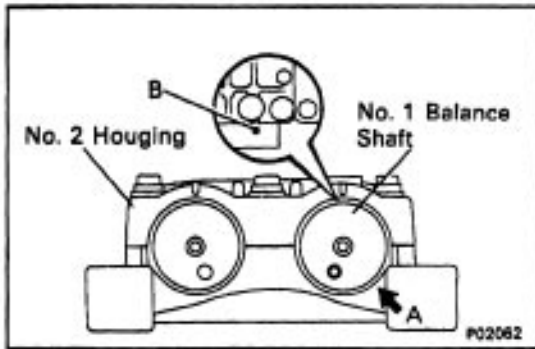
**0–0.06 mm (0–0.0024 in.)**

**On-vehicle**

**0.025 – 0.080 mm (0.0010 – 0.0035 in.)**

**NOTICE: Do not turn the No.1 balance shaft strongly.**

- (g) Remove the dial gauge and the SST.

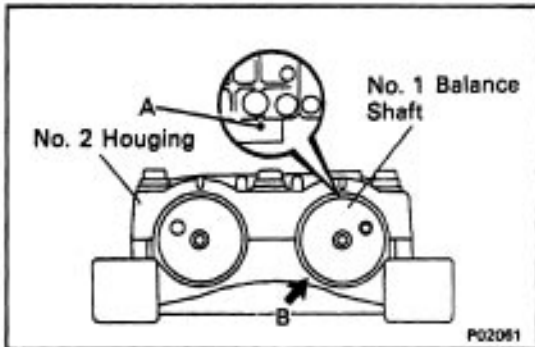


- (h) Turn the crankshaft clockwise to align the groove of the No.2 housing with the punch mark B.
- (i) Set the dial gauge. (See procedure in step (e))
- (j) Measure the backlash. (See procedure in step (f))

**Standard backlash:**

**0 – 0.06 mm (0 – 0.0024 in.)**

- (k) Remove the dial gauge.

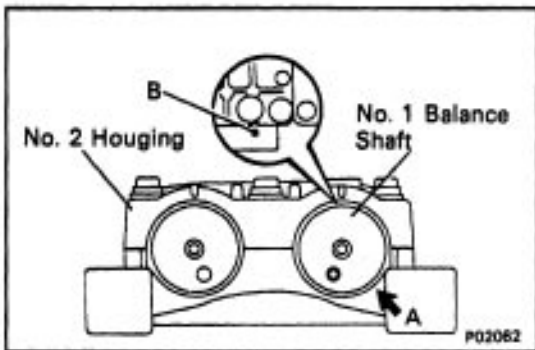


- (l) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark A.
- (m) Set the dial gauge. (See procedure in step (e))
- (n) Measure the backlash. (See procedure in step (f))

**Standard backlash:**

**0 – 0.06 mm (0 – 0.0024 in.)**

- (o) Remove the dial gauge.



- (p) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark B.
  - (q) Set the dial gauge. (See procedure in step (e))
  - (r) Measure the backlash. (See procedure in step (f))
- Standard backlash:**  
0 – 0.06 mm (0 – 0.0024 in.)
- (s) Remove the dial gauge.
- If even one of the 4 points measured above exceeds the backlash specification, adjust the backlash with new spacers.

**NOTICE: Use the same size spacers for both the left and right sides.**

**HINT:**

- Varying the spacer thickness by 0.02 mm (0.0008 in.) change the backlash by about 0.014 mm (0.0006 in.).
- If the backlash is greater than permitted maximum, select a thinner shim.
- If the backlash is less than the specification, select a thicker shim.

### Adjusting Spacer Selection Chart

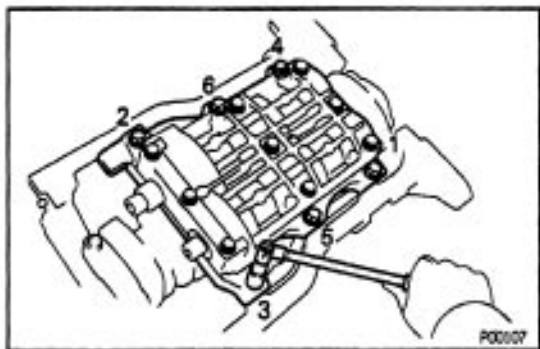
Measured clearance	Installed spacer																																												
	No.	mm (in.)	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40			
0.000 - 0.060 (0.0000 - 0.0022)																																													
0.061 - 0.067 (0.0023 - 0.0025)																																													
0.068 - 0.074 (0.0025 - 0.0027)																																													
0.075 - 0.081 (0.0028 - 0.0030)																																													
0.082 - 0.088 (0.0030 - 0.0033)																																													
0.089 - 0.095 (0.0033 - 0.0035)																																													
0.096 - 0.102 (0.0035 - 0.0038)																																													
0.103 - 0.109 (0.0038 - 0.0040)																																													
0.110 - 0.116 (0.0040 - 0.0043)																																													
0.117 - 0.123 (0.0043 - 0.0045)																																													
0.124 - 0.130 (0.0046 - 0.0048)																																													
0.131 - 0.137 (0.0048 - 0.0051)																																													
0.138 - 0.144 (0.0051 - 0.0053)																																													
0.145 - 0.151 (0.0054 - 0.0056)																																													
0.152 - 0.158 (0.0056 - 0.0058)																																													
0.159 - 0.165 (0.0059 - 0.0061)																																													
0.166 - 0.172 (0.0061 - 0.0064)																																													
0.173 - 0.179 (0.0064 - 0.0066)																																													
0.180 - 0.186 (0.0067 - 0.0069)																																													
0.187 - 0.193 (0.0069 - 0.0071)																																													
0.194 - 0.200 (0.0072 - 0.0074)																																													
0.201 - 0.207 (0.0074 - 0.0077)																																													
0.208 - 0.214 (0.0077 - 0.0079)																																													
0.215 - 0.221 (0.0079 - 0.0082)																																													
0.222 - 0.228 (0.0082 - 0.0084)																																													
0.229 - 0.235 (0.0085 - 0.0087)																																													
0.234 - 0.242 (0.0087 - 0.0089)																																													
0.243 - 0.249 (0.0090 - 0.0092)																																													
0.250 - 0.256 (0.0092 - 0.0095)																																													

**Backlash of crankshaft and No. 1 balance shaft gear:**

0 - 0.60 mm (0 - 0.0022 in.)

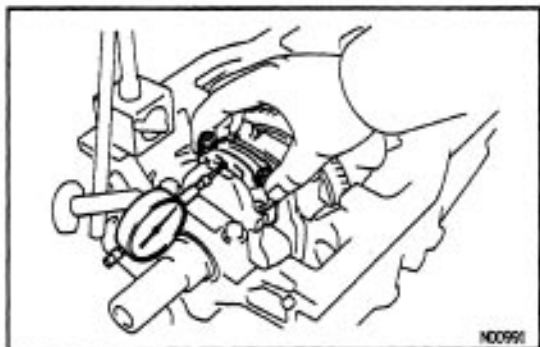
**EXAMPLE:** The No. 25 spacers are installed and the measured clearance is 0.140 mm (0.0055 in.). Replace the No. 25 spacers with No. 9 spacers.

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)



#### 4. REMOVE ENGINE BALANCER

- (a) Uniformly loosen and remove the 6 bolts in several passes, in the sequence shown.
- (b) Remove the engine balancer and spacers.



#### 5. CHECK CONNECTING ROD THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

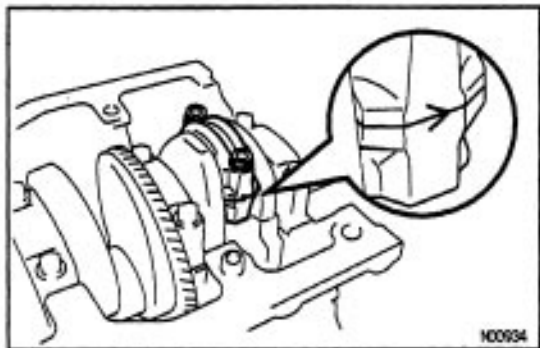
**Standard thrust clearance:**

**0.160 – 0.312 mm (0.0063 – 0.0123 in.)**

**Maximum thrust clearance:**

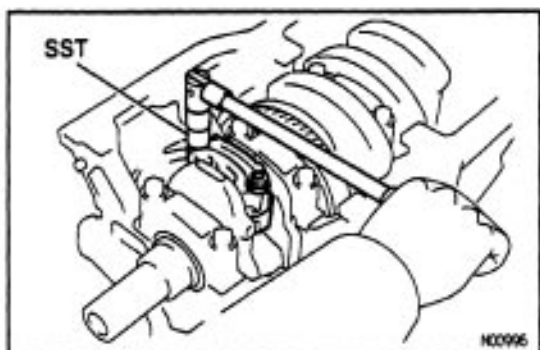
**0.36 mm (0.0138 in.)**

If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

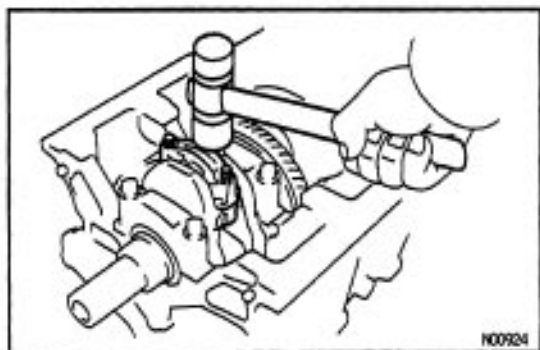


#### 6. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

- (a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.

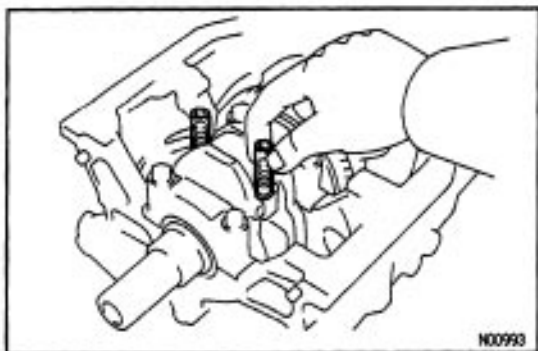


- (b) Using SST, remove the connecting rod cap nuts.  
SST 09011-38121

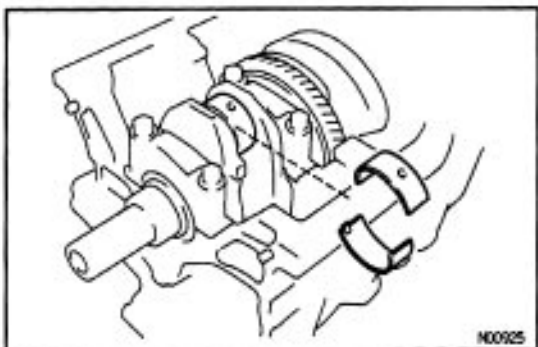


- (c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.  
HINT: Keep the lower bearing inserted with the connecting rod cap.





(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



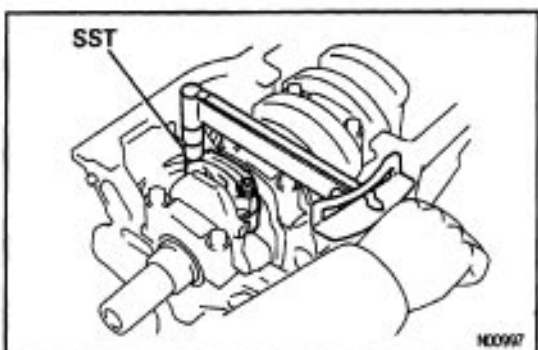
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(g) Lay a strip of Plastigage across the crank pin.



(h) Install the connecting rod cap.

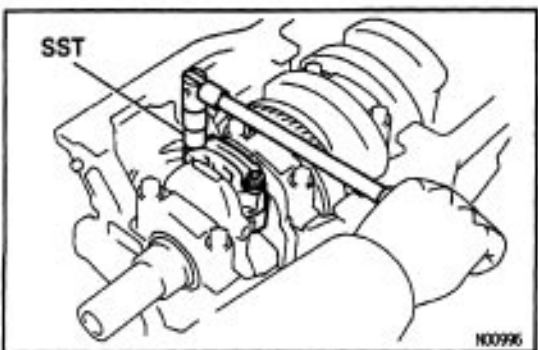
(See step 6 on pages [EG1-122](#))

**1st**

**Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)**

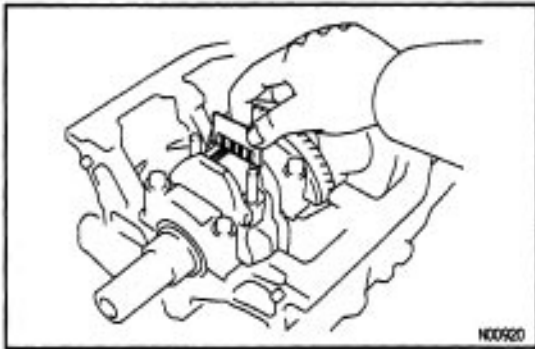
**2nd Turn 90°**

**NOTICE: Do not turn the crankshaft.**



(i) Remove the connecting rod cap.

(See procedure (b) and (c) on the previous page)



(j) Measure the Plastigage at its widest point.

**Standard oil clearance:**

**STD**

**0.024 – 0.055 mm (0.0009 – 0.0022 in.)**

**U/S 0.25**

**0.023 – 0.069 mm (0.0009 – 0.0027 in.)**

**Maximum oil clearance:**

**0.08 mm (0.0031 in.)**

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

HINT: If using a standard bearing, replace it with one having the same number marked on the connecting rod cap. There are 3 sizes of standard bearings, marked \*11, "2" and "3" accordingly.

**Standard sized bearing center wall thickness:**

**Mark "1"**

**1.484 – 1.488 mm (0.0584 – 0.0586 in.)**

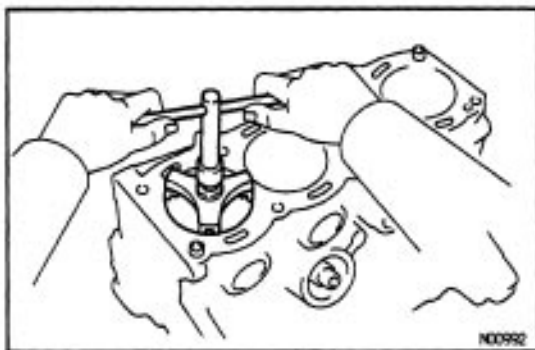
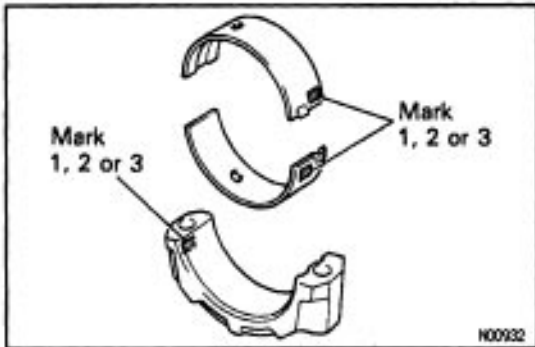
**Mark "2"**

**1.488 – 1.492 mm (0.0586 – 0.0587 in.)**

**Mark "3"**

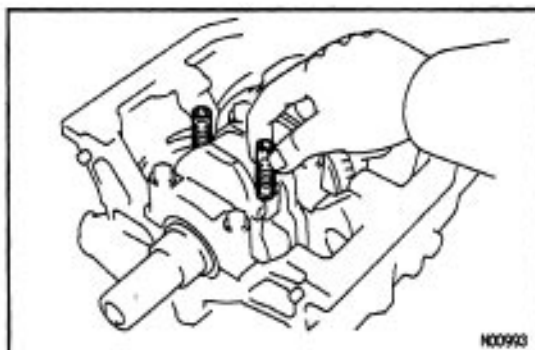
**1.492 – 1.498 mm (0.0587 – 0.0589 in.)**

(k) Completely remove the Plastigage.



## 7. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

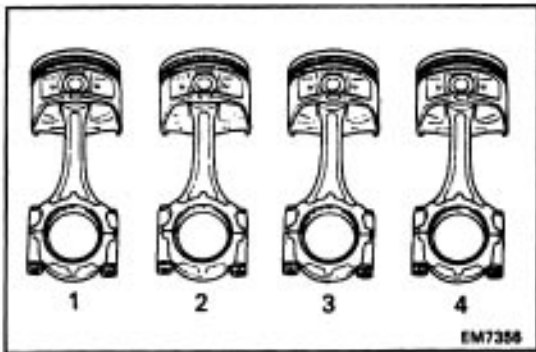
(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.



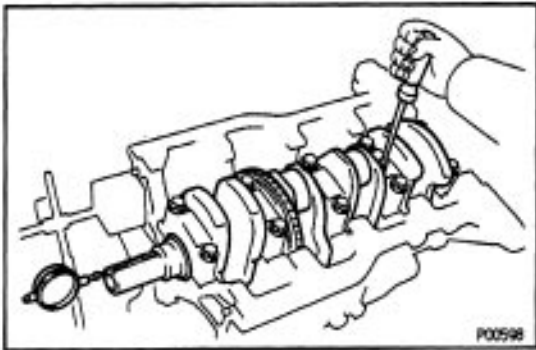
(b) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

(c) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.



**HINT:**

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.

**8. CHECK CRANKSHAFT THRUST CLEARANCE**

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

**Standard thrust clearance:**

**0.020 – 0.220 mm (0.0008 – 0.0087 in.)**

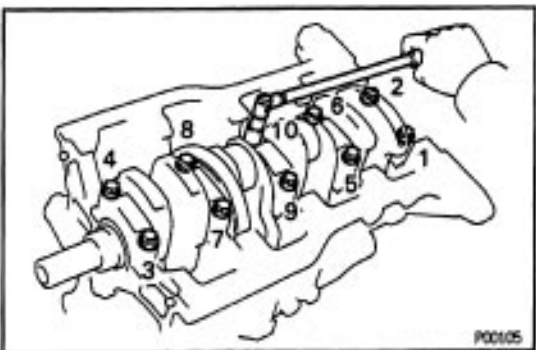
**Maximum thrust clearance:**

**0.30 mm (0.0118 in.)**

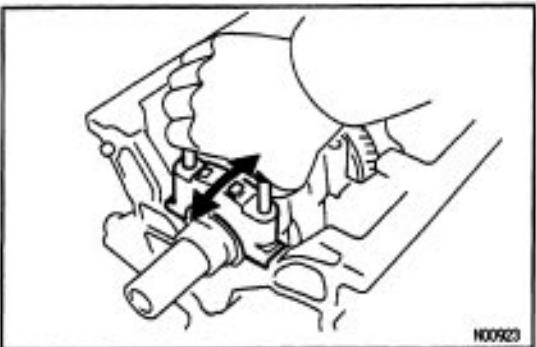
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

**Thrust washer thickness:**

**2.440 – 2.490 mm (0.0961 – 0.0980 in.)**

**9. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE**

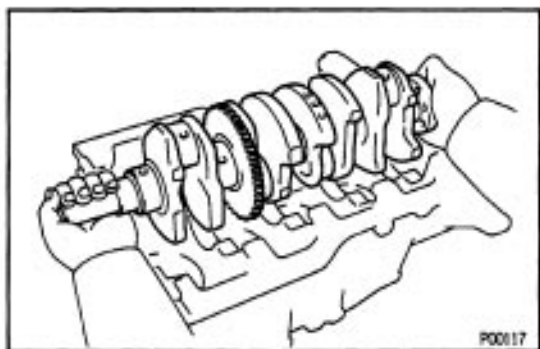
- (a) Uniformly loosen and remove the main bearing cap bolts in several passes, in the sequence shown.



- (b) Using the removed main bearing cap bolts, pry the main bearing cap back and forth, and remove the main bearing caps, lower bearings and lower thrust washers (No.3 main bearing cap only).

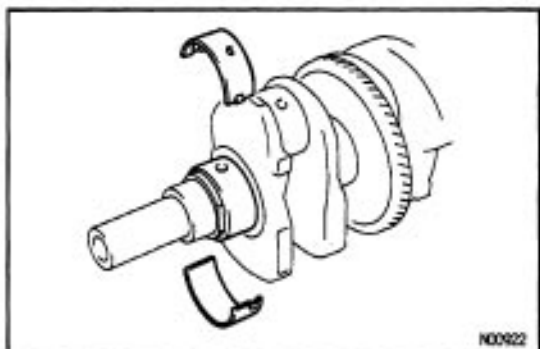
**HINT:**

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.



(c) Lift out the crankshaft.

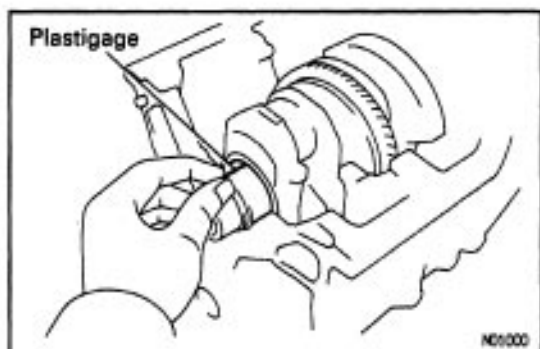
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.



(d) Clean each main journal and bearing.

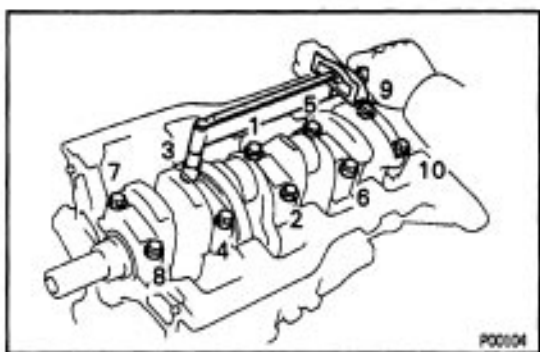
(e) Check each main journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(f) Place the crankshaft on the cylinder block.

(g) Lay a strip of Plastigage across each journal.

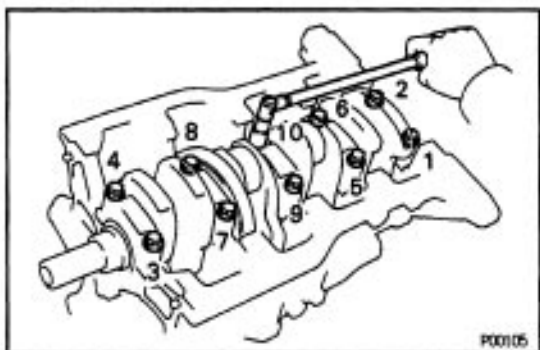


(h) Install the main bearing caps.

(See step 4 on page [EG1-121](#))

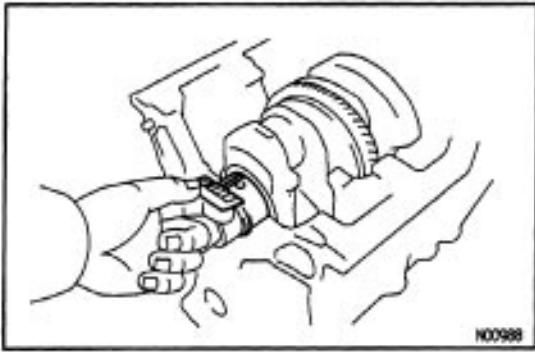
**Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)**

**NOTICE: Do not turn the crankshaft.**



(i) Remove the main bearing caps.

(See procedure (a) and (b) on the previous page)



Measure the Plastigage at its widest point.

**Standard clearance:**

**No.3**

**STD**

**0.025 – 0.044 mm (0.0010 – 0.0017 in.)**

**U/S 0.25**

**0.027 – 0.067 mm (0.0011 – 0.0026 in.)**

**Others**

**STD**

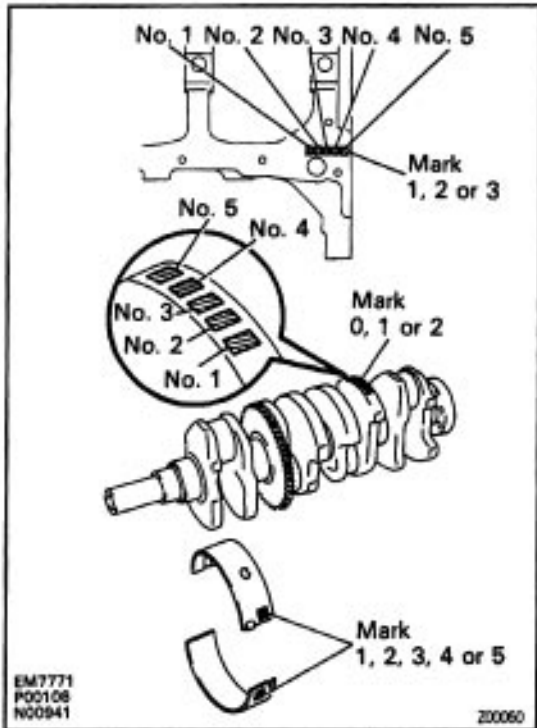
**0.015 – 0.034 mm (0.00015 – 0.0013 in.)**

**U/S 0.25**

**0.019 – 0.059 mm (0.0007 – 0.0023 in.)**

**Maximum clearance:**

**0.08 mm (0.0031 in.)**



HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

**No.3:**

**0.027 – 0.054 mm (0.0011 – 0.0021 in.)**

**Others**

**0.017 – 0.044 mm (0.0007 – 0.0017 in.)**

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

HINT: If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

	Number marked								
Cylinder block	1			2			3		
Crankshaft	0	1	2	0	1	2	0	1	2
Use bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block "2" + Crankshaft "11"  
= Total number 3 (Use bearing "3")

**Reference:****Cylinder block main journal bore diameter:****Mark "1"**

59.020 – 59.026 mm (2.32318 – 2.3239 in.)

**Mark "2"**

59.026 – 59.032 mm (2.3239 – 2.3241 in.)

**Mark "3"**

59.032 – 59.038 mm (2.3241 – 2.3243 in.)

**Crankshaft journal diameter:****Mark "0"**

54.998 – 55.003 mm (2.1653 – 2.1655 in.)

**Mark "11"**

54.993–54.998 mm (2.1651 – 2.1653 in.)

**Mark "2"**

54.988 – 54.993 mm (2.1649 – 2.1651 in.)

**Standard sized bearing center wall thickness:****No-3****Mark "1"**

1.992 – 1.995 mm (0.0784 – 0.0785 in.)

**Mark '2"**

1.995 – 1.998 mm (0.0785 – 0.0787 in.)

**Mark "3"**

1.998 – 2.001 mm (0.0787 – 0.0788 in.)

**Mark '4"**

2.001 – 2.004 mm (0.0788 – 0.0789 in.)

**Mark '5"**

2.004 – 2.007 mm (0.0789 – 0.0790 in.)

**Others****Mark "1"**

1.997 – 2.000 mm (0.0786 – 0.0787 in.)

**Mark '2"**

2.000 – 2.003 mm (0.0787 – 0.0789 in.)

**Mark "3"**

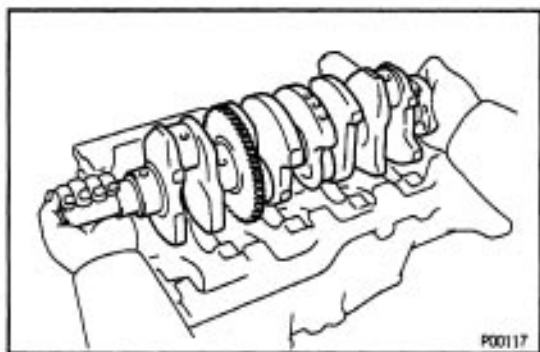
2.003 – 2.006 mm (0.0789 – 0.0790 in.)

**Mark '4"**

2.006 – 2.009 mm (0.0790 – 0.0791 in.)

**Mark '5"**

2.009 – 2.012 mm (0.0791 – 0.0792 in.)

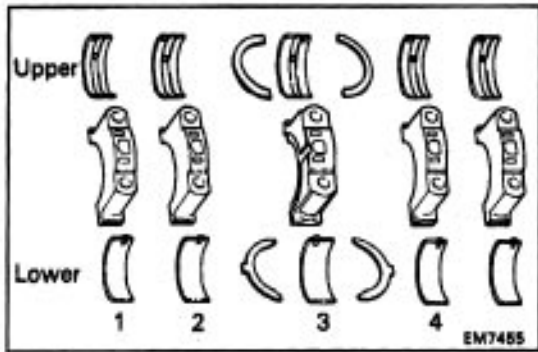


(k) Completely remove the Plastigage.

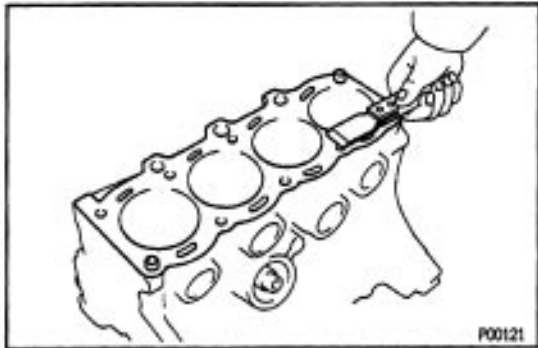
**10. REMOVE CRANKSHAFT**

(a) Lift out the crankshaft.

(b) Remove the upper bearings and upper thrust washers from the cylinder block.



HINT: Arrange the main bearing caps, bearings and thrust washers in correct order.



## CYLINDER BLOCK INSPECTION

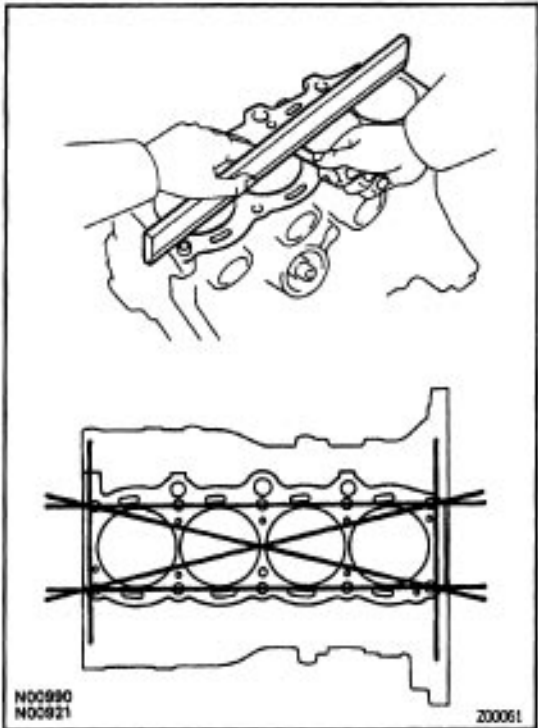
### 1. CLEAN CYLINDER BLOCK

#### A. Remove gasket material

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

#### B. Clean cylinder block

Using a soft brush and solvent, thoroughly clean the cylinder block.

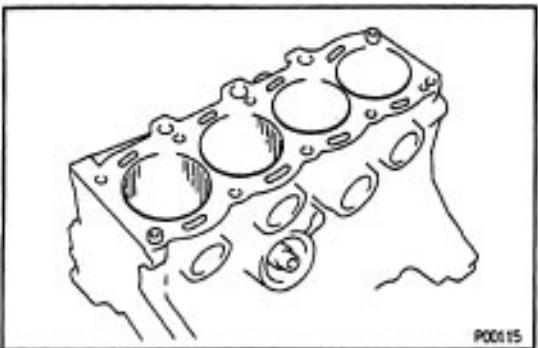


### 2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head gasket for warpage.

**Maximum warpage:**  
**0.05 mm (0.0020 In.)**

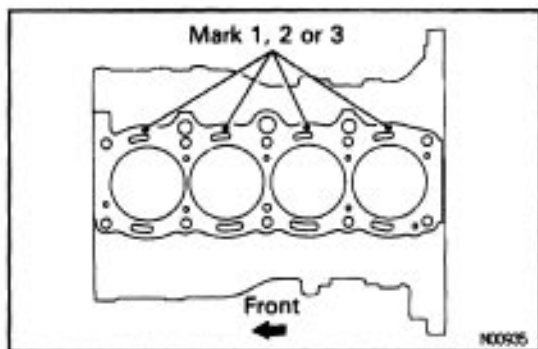
If warpage is greater than maximum, replace the cylinder block.



### 3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

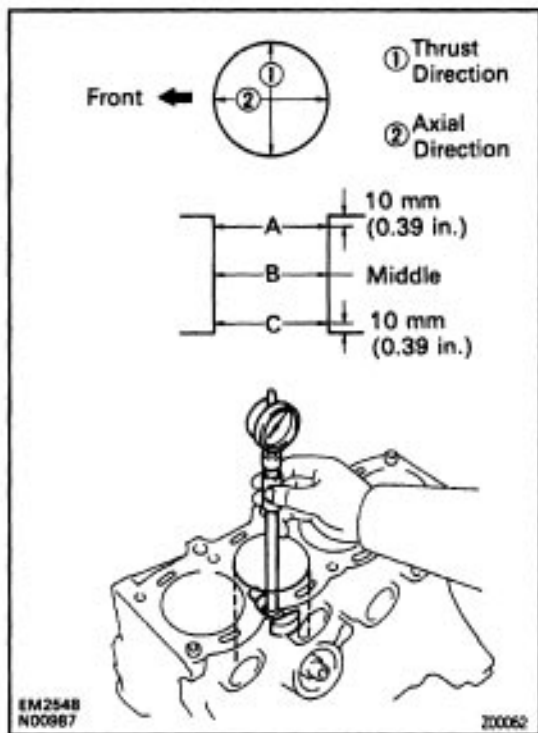
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 4 cylinders. If necessary, replace the cylinder block.



#### 4. INSPECT CYLINDER BORE DIAMETER

HINT: There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.



Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

**Standard diameter:**

**STD**

**Mark "1"**

**87.000 – 87.010 mm (3.4252 – 3.4256 in.)**

**Mark "2"**

**87.010 – 87.020 mm (3.4256 – 3.4260 in.)**

**Mark "3"**

**87.020 – 87.030 mm (3.4260 – 3.4264 in.)**

**Maximum diameter:**

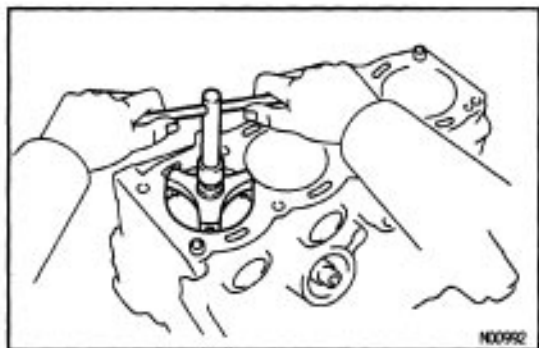
**STD**

**87.23 mm (3.4342 in.)**

**O/S 0.50**

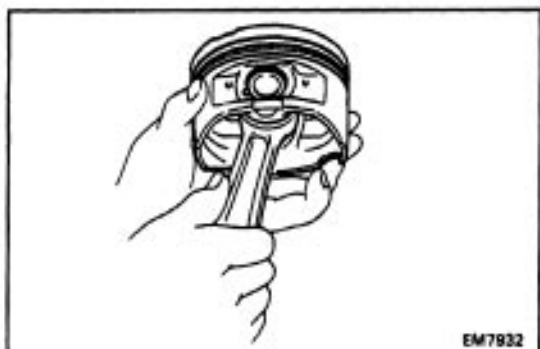
**87.73 mm (3.4350 in.)**

If the diameter is greater than maximum, rebore all the 4 cylinders. If necessary, replace the cylinder block.



#### 5. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

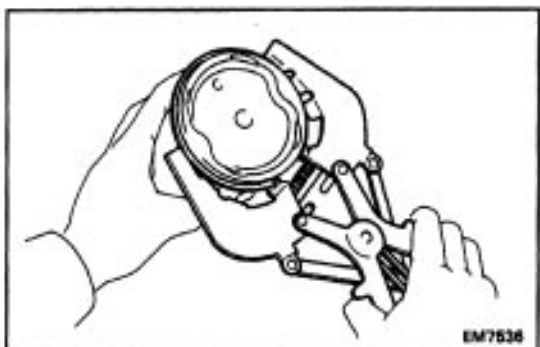


## PISTON AND CONNECTING ROD ASSY DISASSEMBLY

### 1. CHECK FIT BETWEEN PISTON AND PISTON PIN

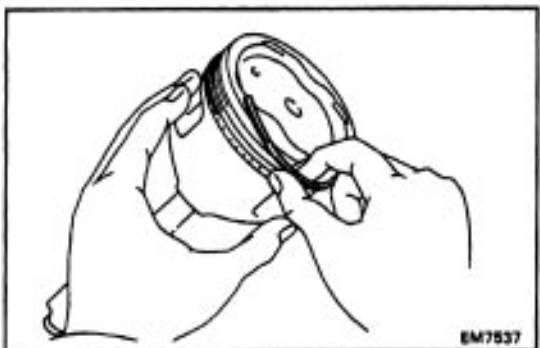
Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

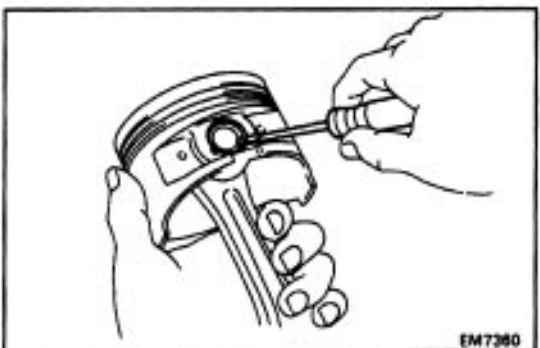


### 2. REMOVE PISTON RINGS

- (a) Using a piston ring expander, remove the 2 compression rings.

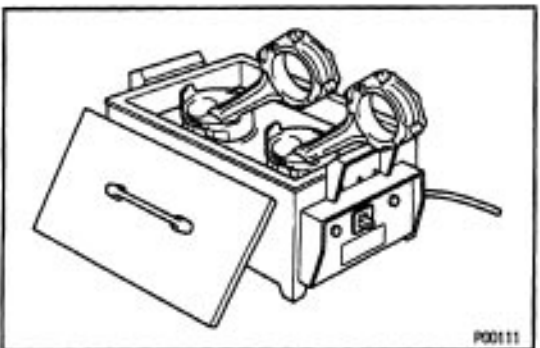


- (b) Remove the 2 side rails and oil ring by hand.  
HINT: Arrange the rings in correct order only.

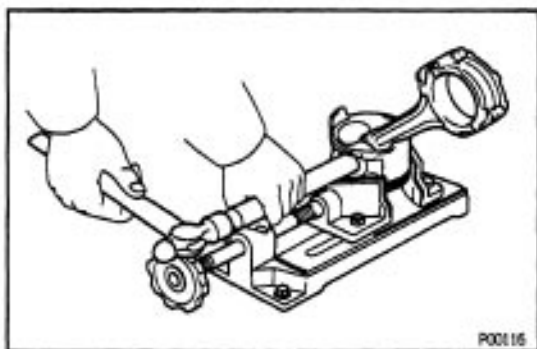


### 3. DISCONNECT CONNECTING ROD FROM PISTON

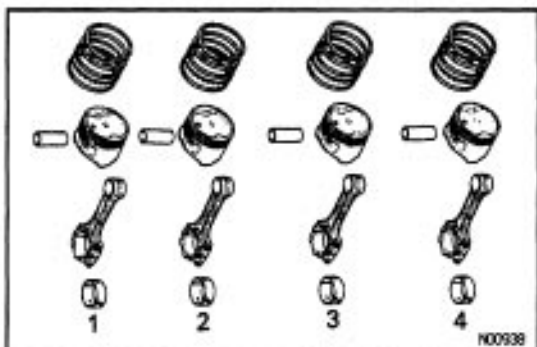
- (a) Using a small screwdriver, pry out the 2 snap rings.



- (b) Gradually heat the piston to 80–90°C (176–194°F).



- (c) Using plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.



#### HINT:

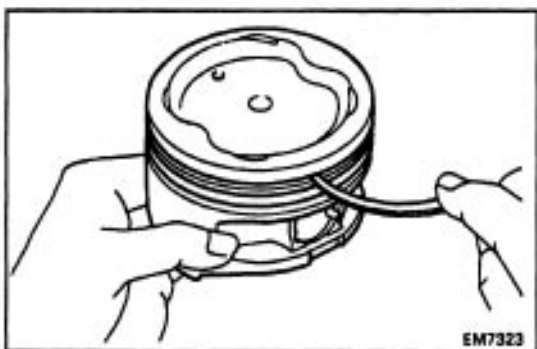
The piston and pin are a matched set.  
Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



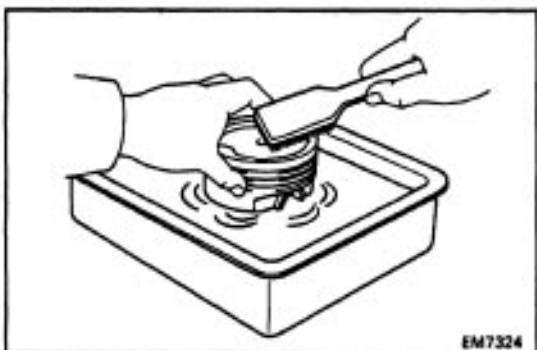
## PISTON AND CONNECTING ROD INSPECTION

### 1. CLEAN PISTON

- (a) Using a gasket scraper, remove the carbon from the piston top.



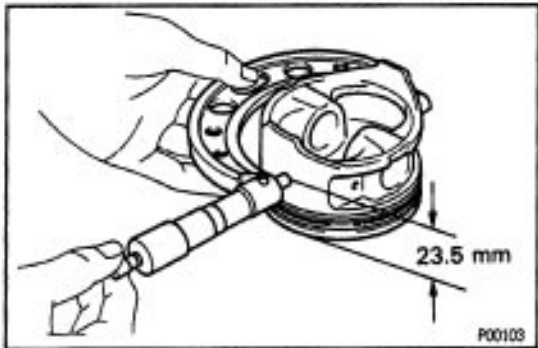
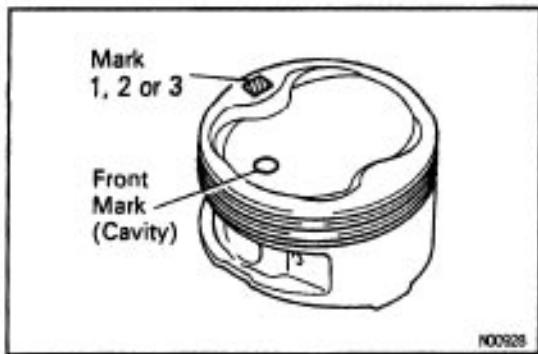
- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



- (c) Using solvent and a brush, thoroughly clean the piston.

**NOTICE:** Do not use a wire brush.





## 2. INSPECT PISTON

### A. Inspect piston oil clearance

HINT: There are 3 sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

- (a) Using a micrometer, measure the piston diameter at ring angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.

**Piston diameter:**

**STD**

**Mark "1"**

86.85–86.86 mm (3.4193 – 3.4197 in.)

**Mark "2"**

86.86–86.87 mm (3.4197 – 3.4201 in.)

**Mark "3"**

86.87 – 86.88 mm (3.4201 – 3.4205 in.)

**O/S 0.50**

87.35 – 87.38 mm (3.4390 – 3.4402 in.)

- (b) Measure the cylinder bore diameter in the thrust directions.

(See step 4 on page [EG1-106](#))

- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

**Standard oil clearance:**

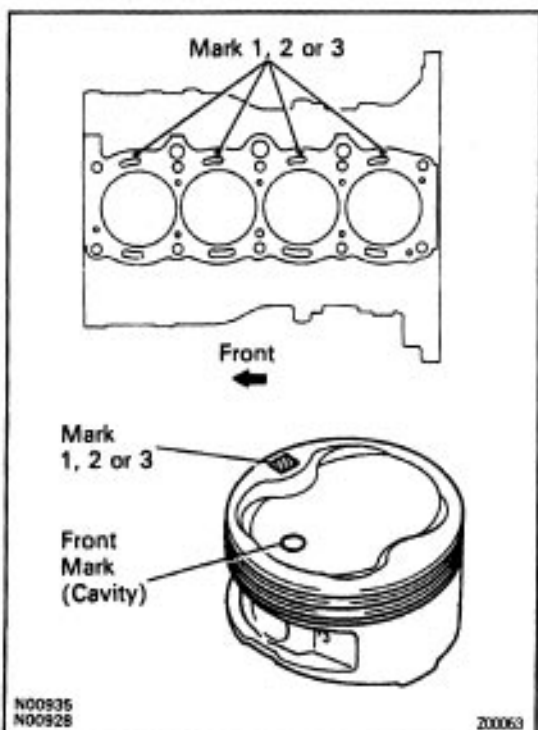
0.14 – 0.16 mm (0.0055 – 0.0063 in.)

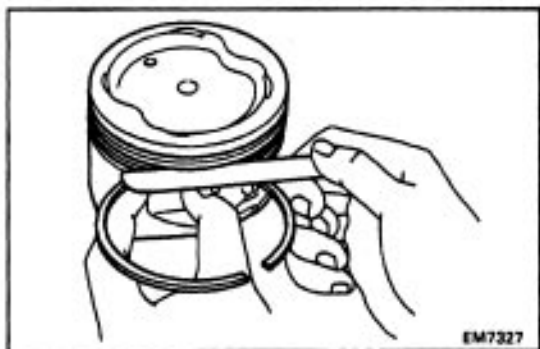
**Maximum oil clearance:**

0.18 mm (0.0071 in.)

If the oil clearance is greater than maximum, replace all the 4 pistons and rebore all the 4 cylinders. If necessary, replace the cylinder block.

HINT (Use new cylinder block): Use a piston with the same number mark as the cylinder bore diameter marked on the cylinder block.





### B. Inspect piston ring groove clearance

Using a thickness gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

#### Ring groove clearance:

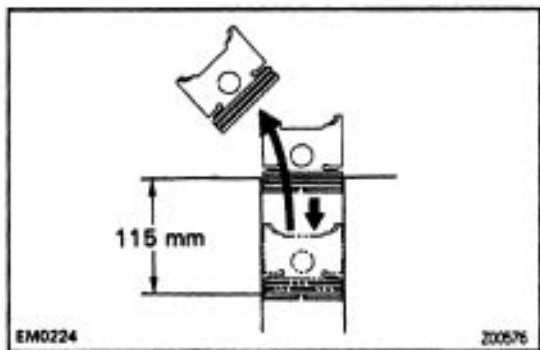
##### No.1

0.040 – 0.080 mm (0.0016 – 0.0031 in.)

##### No.2

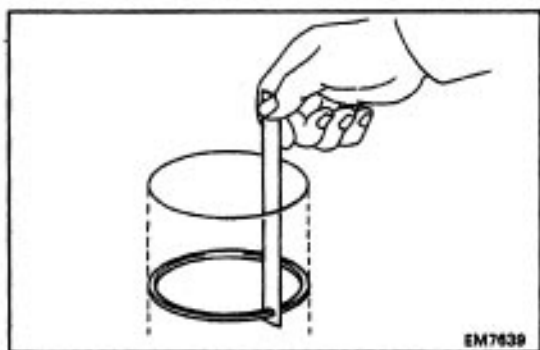
0.030 – 0.070 mm (0.0012 – 0.0028 in.)

If the clearance is greater than maximum, replace the piston.



### C. Inspect piston ring end gap

- Insert the piston ring into the cylinder bore.
- Using a piston, push the piston ring a little beyond the bottom of the ring travel, 115 mm (4.53 in.) from the top of the cylinder block.



- Using a thickness gauge, measure the end gap.

#### Standard and gap:

##### No.1

0.270 – 0.500 mm (0.0106 – 0.0197 in.)

##### No.2

0.350 – 0.600 mm (0.0138 – 0.0234 in.)

##### Oil (Side rail)

0.200 – 0.550 mm (0.0079 – 0.0217 in.)

#### Maximum end gap:

##### No.1

1.10 mm (0.0433 in.)

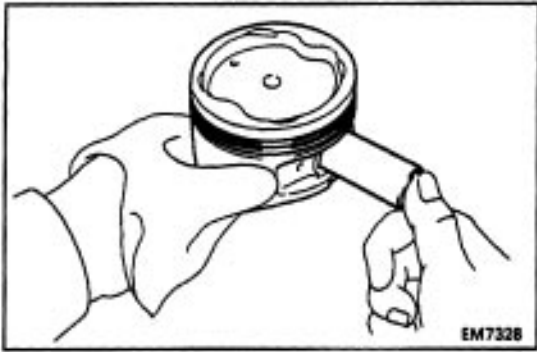
##### No.2

1.20 mm (0.0472 in.)

##### Oil (Side rail)

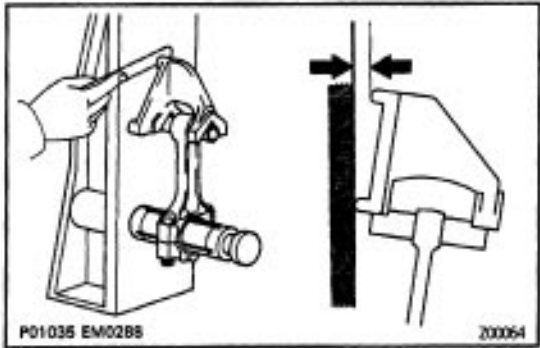
1.15 mm (0.0453 in.)

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, rebore all the 4 cylinders or replace the cylinder block.



### D. Inspect-piston pin fit

At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.



### 3. INSPECT CONNECTING ROD

#### A. Inspect connecting rod alignment

Using a rod aligner and thickness gauge, check the connecting rod alignment.

- Check for bend.

**Maximum bend:**

**0.05 mm (0.0020 in.) per 100 mm (3.94 in.)**

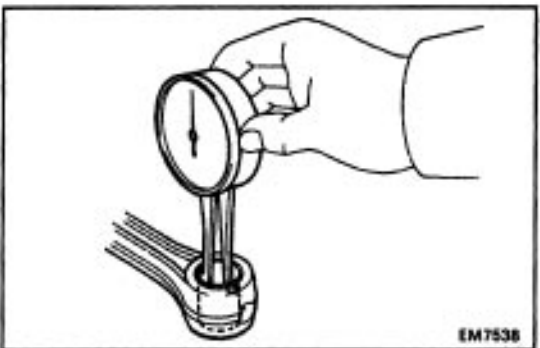
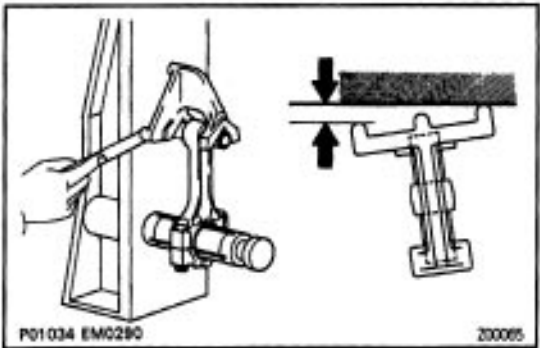
If bend is greater than maximum, replace the connecting rod assembly.

- Check for twist

**Maximum twist:**

**0.15 mm (0.0059 in.) per 100 mm (3.94 in.)**

If twist is greater than maximum, replace the connecting rod assembly.

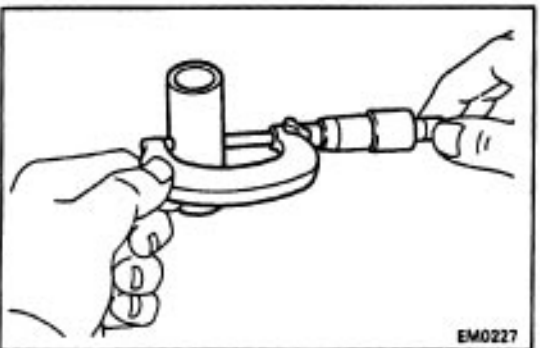


#### B. Inspect piston pin oil clearance

- Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

**Bushing inside diameter:**

**22.005 – 22.017 mm (0.8663 – 0.8668 in.)**



- Using a micrometer, measure the piston pin diameter.

**Piston pin diameter:**

**21.997 – 22.009 mm (0.8660 – 0.8865 in.)**

- (c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

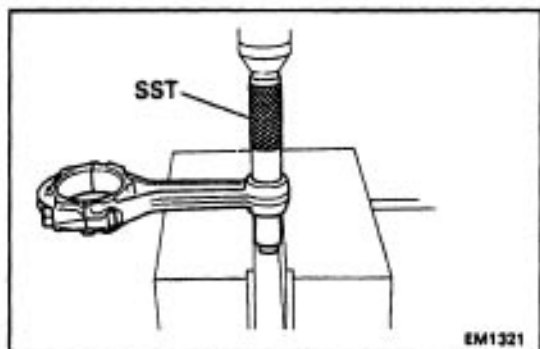
Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance:

0.05 mm (0.0020 in.)

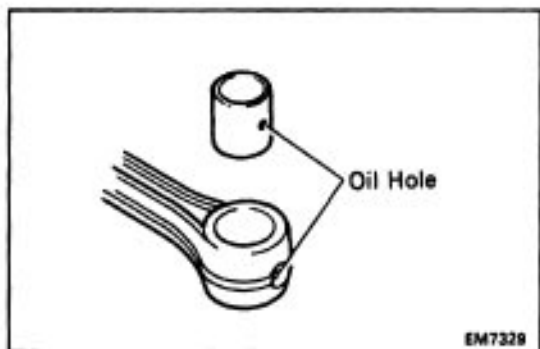
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



**C. If necessary, replace connecting rod bushing**

- (a) Using SST and a press, press out the bushing.

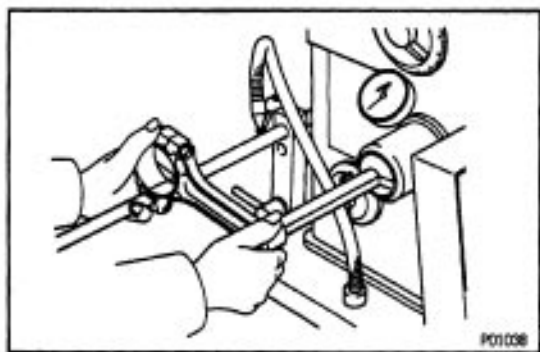
SST 09222 – 30010



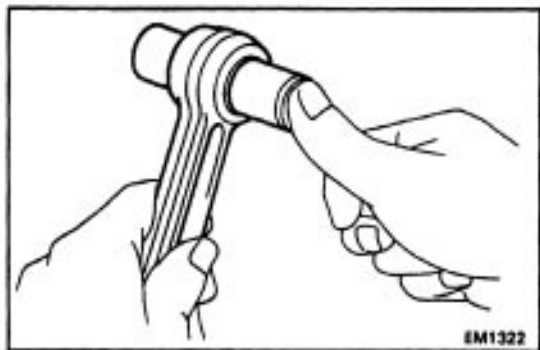
- (b) Align the oil holes of a new bushing and the connecting rod.

- (c) Using SST and a press, press in the bushing.

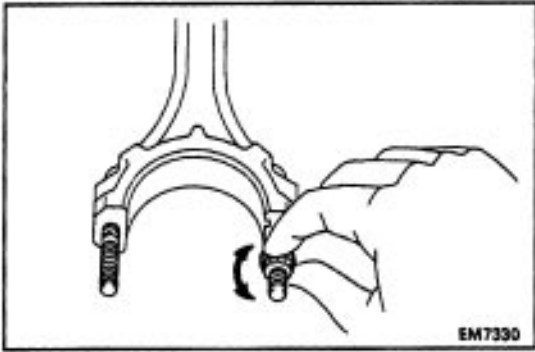
SST 09222-30010



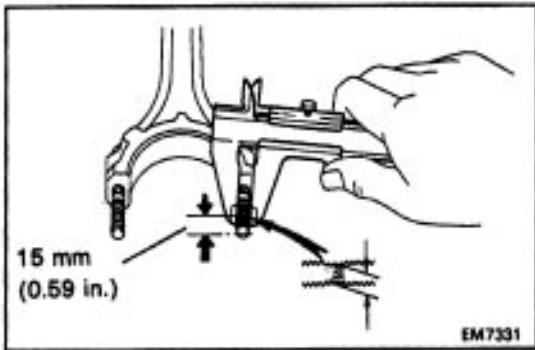
- (d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step B above) between the bushing and piston pin.



- (e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.

**D. Inspect connecting rod bolts**

- (a) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.



- (b) If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt with a vernier caliper.

**Standard outside diameter:**

**7.860–8.000 mm (0.3094–0.3150 in.)**

**Minimum outside diameter:**

**7.60 mm (0.2992 in.)**

HINT: If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

If the outside diameter is less than minimum, replace the connecting rod bolt and nut as a set.

## CYLINDER BORING

### HINT:

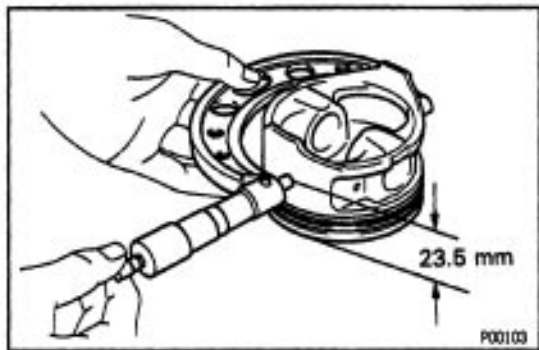
- Bore all the 4 cylinders for the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

### 1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50

87.35 – 87.38 mm (3.4390–3.4402 in.)



### 2. CALCULATE AMOUNT TO BORE CYLINDERS

- Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 23.5 mm (0.925 in.) from the piston head.
- Calculate the amount of each cylinder is to be rebored as follows:

**Size to be rebored = P + C–H**

**P = Piston diameter**

**C = Piston clearance**

**0.14 – 0.18 mm (0.0055 – 0.0063 in.)**

**H = Allowance for honing**

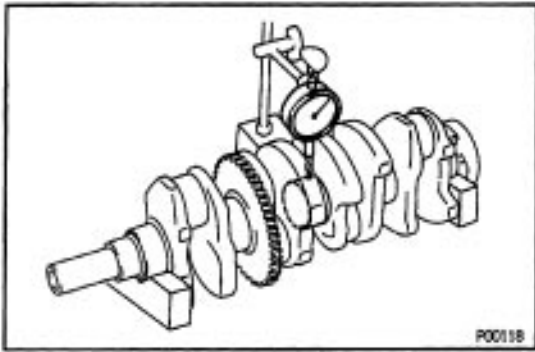
**0.20 mm (0.0008 in.) or less**

### 3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

**Maximum honing:**

**0.02 mm (0.0008 in.)**

**NOTICE:** Excess honing will destroy the finished roundness.



## CRANKSHAFT INSPECTION AND REPAIR

### 1. INSPECT CRANKSHAFT FOR RUNOUT

- (a) Place the crankshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout:**

**0.06 mm (0.0024 in.)**

If the circle runout is greater than maximum, replace the crankshaft.

### 2. INSPECT MAIN JOURNALS AND CRANK PINS

- (a) Using a micrometer, measure the diameter of each main journal and crank pin.

**Main journal diameter:**

**STD size**

**54.988 – 55.003 mm (2.1653–2.1655 in.)**

**U/S 0.25**

**54.745 – 54.755 mm (2.1553–2.1557 in.)**

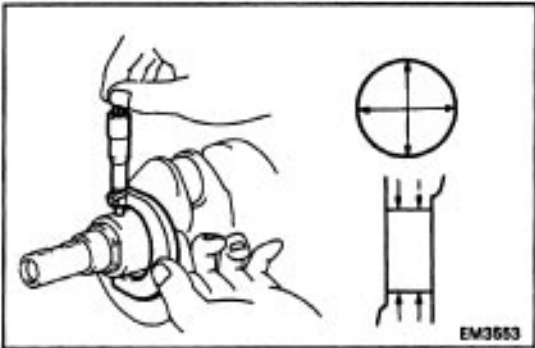
**Crank pin diameter:**

**STD size**

**51.985 – 52.000 mm (2.0466–2.0472 in.)**

**U/S 0.25**

**51.745 – 51.755 mm (2.0372–2.0376 in.)**



If the diameter is not as specified, check the oil clearance (See pages [EG1-98](#) to 104). If necessary, grind or replace the crankshaft.

- (b) Check each main journal and crank pin for taper and out-of-round as shown.

**Maximum taper and out-of-round:**

**0.02 mm (0.0008 in.)**

If the taper and out-of-round is greater than maximum, replace the crankshaft.

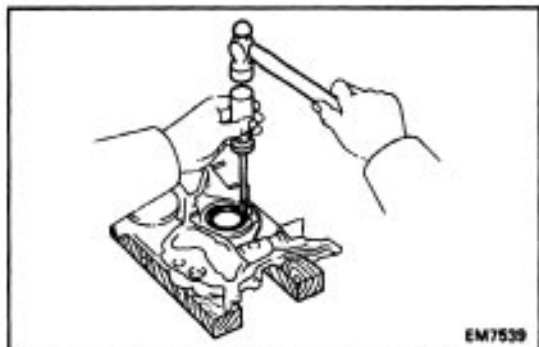
### 3. IF NECESSARY. GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 2).

Install new main journal and/or crankshaft pin undersized bearings.

## CRANKSHAFT OIL SEALS REPLACEMENT

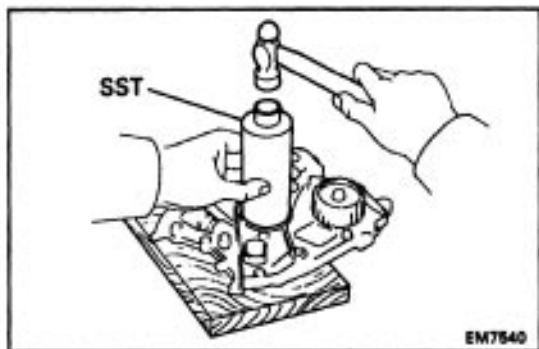
HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:



### 1. REPLACE CRANKSHAFT FRONT OIL SEAL

#### A. If oil pump is removed from cylinder block:

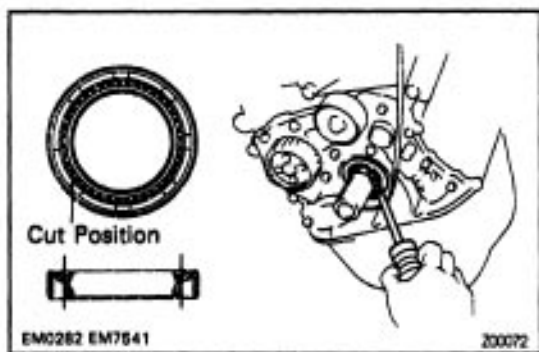
- (a) Using a screwdriver and a hammer, tap out the oil seal.



- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09223 – 63010

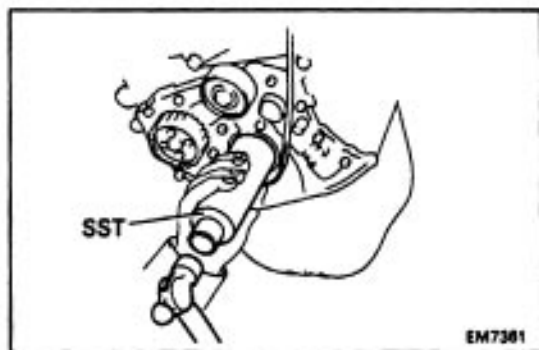
- (c) Apply MP grease to the oil seal lip.



#### B. If oil pump is installed to the cylinder block:

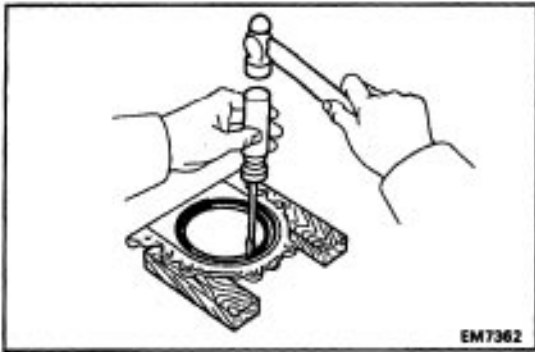
- (a) Using a knife, cut off the oil seal lip.  
 (b) Using a screwdriver, pry out the oil seal.

**NOTICE:** Be careful not to damage the crankshaft. Tape the screwdriver tip.



- (c) Apply MP grease to a new oil seal lip.  
 (d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.  
 SST 09226 –10010

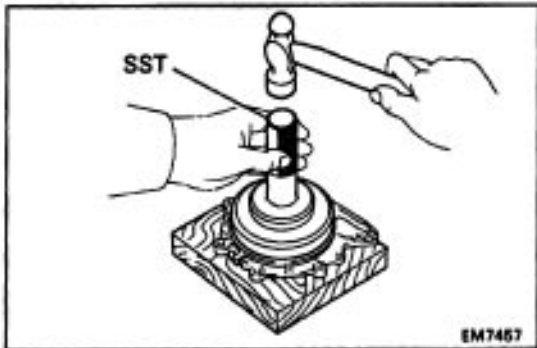




## 2. REPLACE CRANKSHAFT REAR OIL SEAL

### A. If rear oil seal retainer is removed from cylinder block:

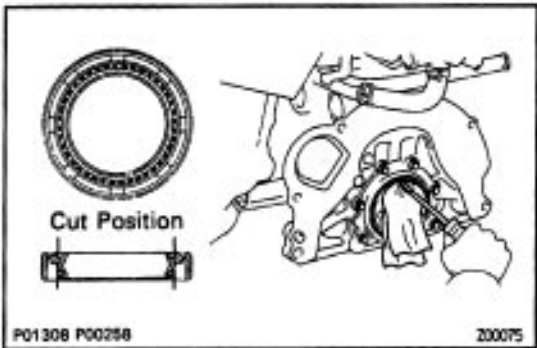
(a) Using screwdriver and hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal edge.

SST 09223-63010

(c) Apply MP grease to the oil seal lip.

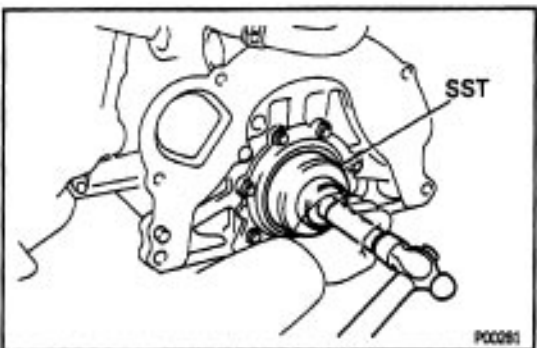


### B. If rear oil seal retainer is installed to cylinder block:

(a) Using a knife, cut off the oil seal lip.

(b) Using a screwdriver, pry out the oil seal.

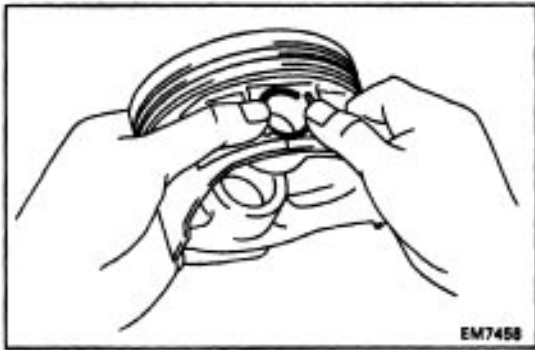
**NOTICE:** Be careful not to damage the crankshaft. Tape the screwdriver tip.



(c) Apply MP grease to a new oil seal lip.

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

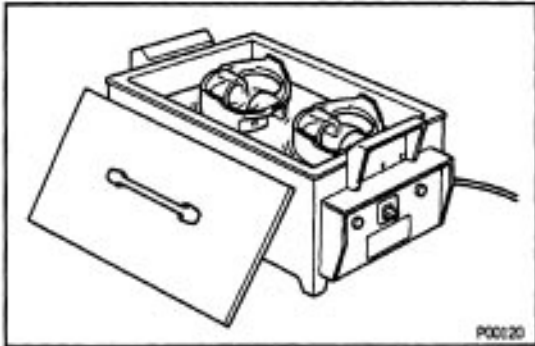
SST 09223 – 63010



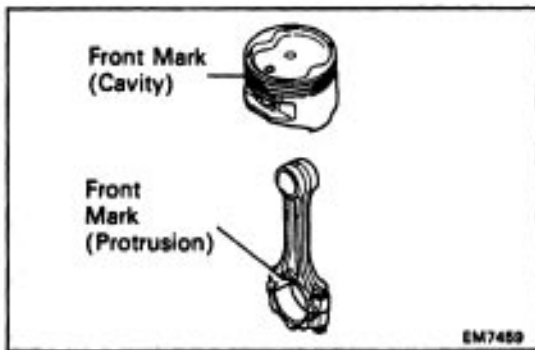
## PISTON AND CONNECTING ROD ASSEMBLY

### 1. ASSEMBLE PISTON AND CONNECTING ROD

- (a) Install a new snap ring on one side of the piston pin hole.



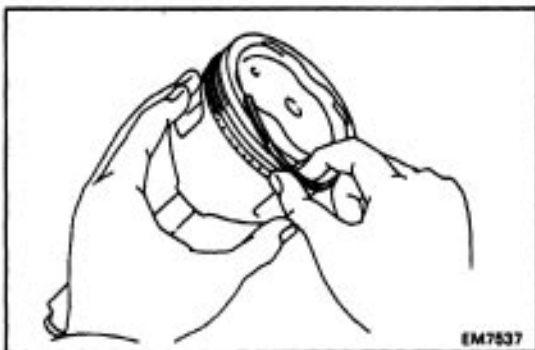
- (b) Gradually heat the piston to 80–90°C (176–194°F).



- (c) Coat the piston pin with engine oil.  
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

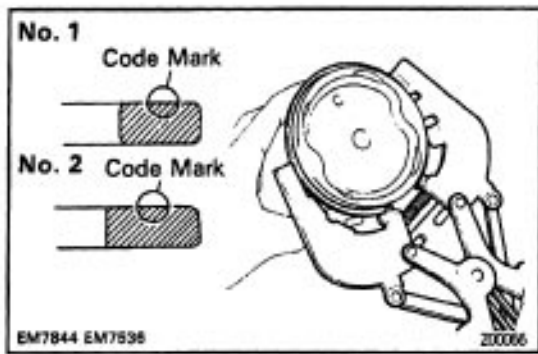


- (e) Install a new snap ring on the other side of the piston pin hole.



### 2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and 2 side rails by hand.



- (b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

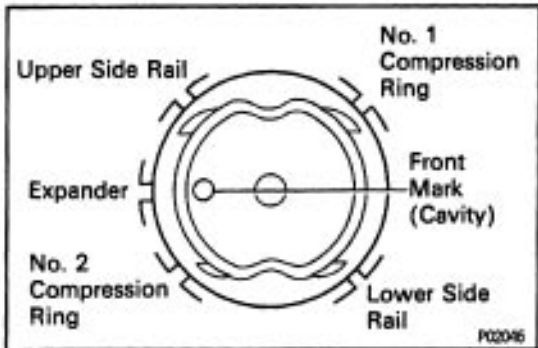
**Code mark:**

**No.1**

**1N or T**

**No.2**

**2N or 2T**



- (c) Position the piston rings so that the ring ends are as shown.

**NOTICE: Do not align the ring ends.**



### 3. INSTALL BEARINGS

- (a) Align the bearing claw with the groove of the connecting rod or connecting cap.
- (b) Install the bearings in the connecting rod and connecting rod cap.

## CYLINDER BLOCK ASSEMBLY

(See Components for Cylinder Block Disassembly and Assembly)

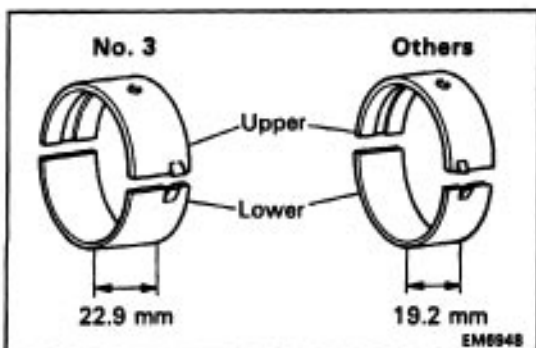
**HINT:**

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

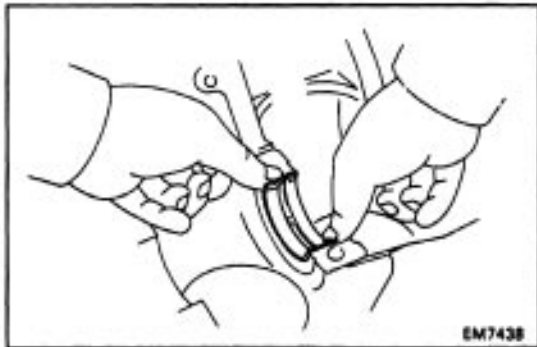
### 1. INSTALL MAIN BEARINGS

**HINT:**

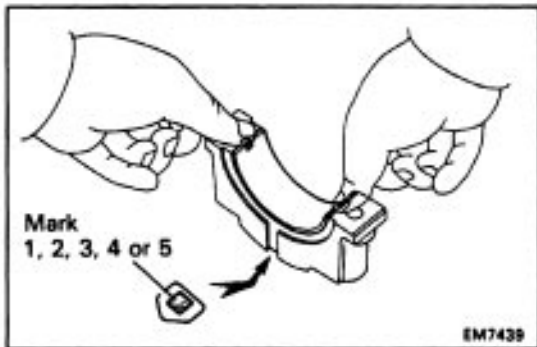
- Main bearings come in widths of 19.2 mm (0.756 in.) and 22.9 mm (0.902 in.). Install the 22.9 mm (0.902 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.



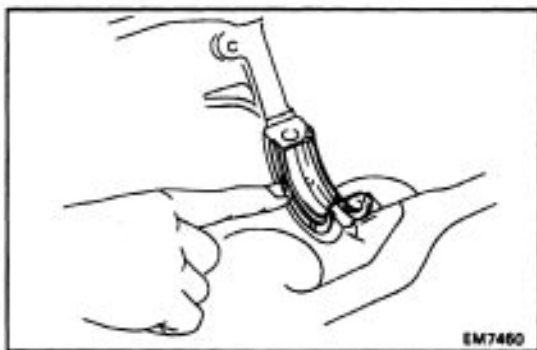
- Upper bearings have an oil groove and oil holes; lower bearings do not.



- (a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.

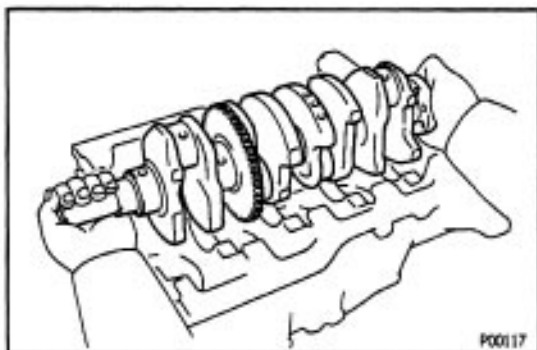


- (b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.  
HINT: A number is marked on each main bearing cap to indicate the installation position.

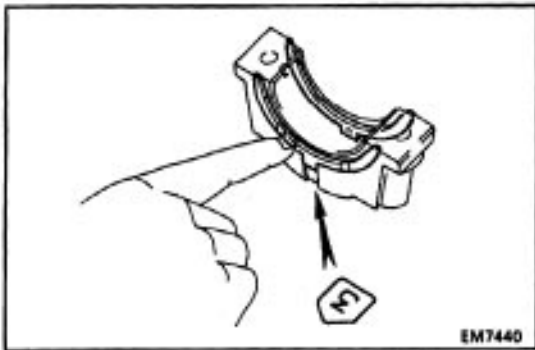


## 2. INSTALL UPPER THRUST WASHERS

Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

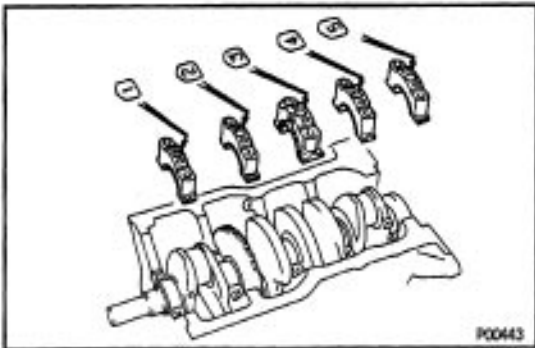


## 3. PLACE CRANKSHAFT ON CYLINDER BLOCK



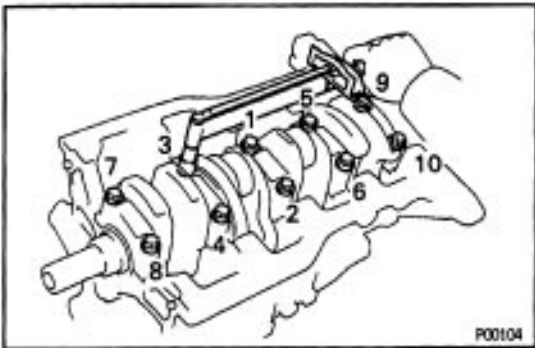
#### 4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

- (a) Install the 2 thrust washers on the No.3 bearing cap with the grooves facing outward.



- (b) Install the 5 main bearing caps in their proper locations.

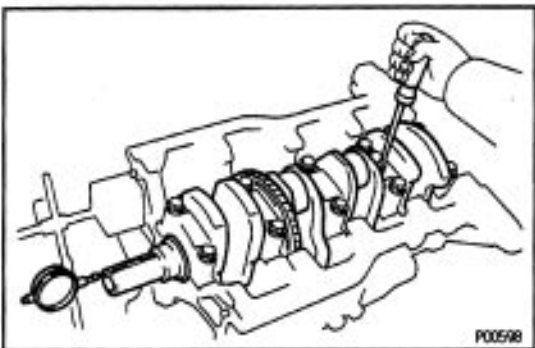
HINT: Each bearing cap has a number and front mark.



- (c) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.  
 (d) Install and uniformly tighten the 10 bolts of the main bearing caps in several passes, in the sequence shown.

**Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)**

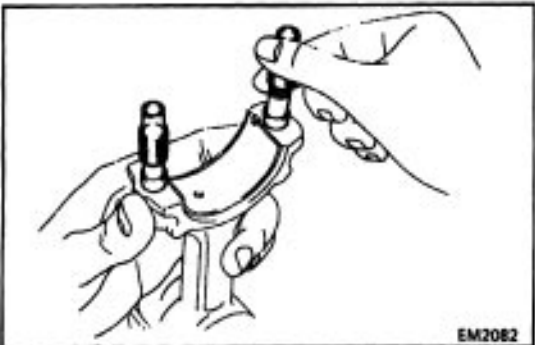
- (e) Check that the crankshaft turns smoothly.

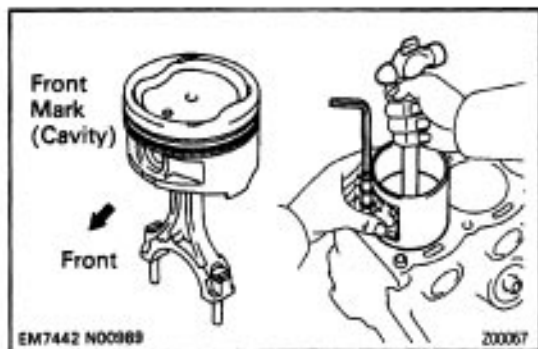


- (f) Check the crankshaft thrust clearance.  
 Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.  
 Standard thrust clearance:  
 0.020 – 0.220 mm (0.0008 – 0.0087 in.)  
 Maximum thrust clearance:  
 0.30 mm (0.0118 in.)  
 If the thrust clearance is greater than maximum, replace the thrust washers as a set.

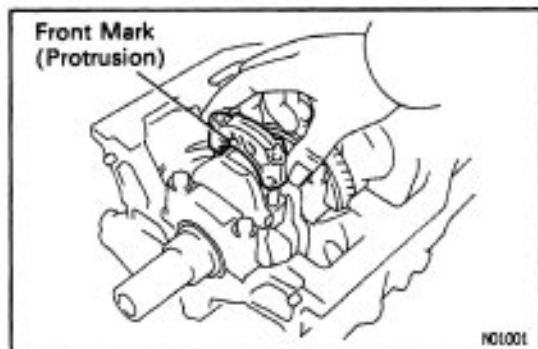
#### 5. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

- (a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.





- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



## 6. INSTALL CONNECTING ROD CAPS

### A. Place connecting rod cap on connecting rod

- Match the numbered connecting rod cap with the connecting rod.
- Install the connecting rod cap with the front mark facing forward.

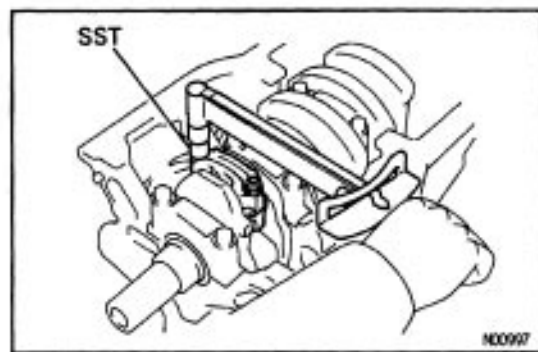
### B. Install connecting rod cap nuts

HINT:

The cap nuts are tightened in 2 progressive steps (steps

- (b) and
- (d)).

If any one of the connecting rod bolts is broken or deformed, replace it.

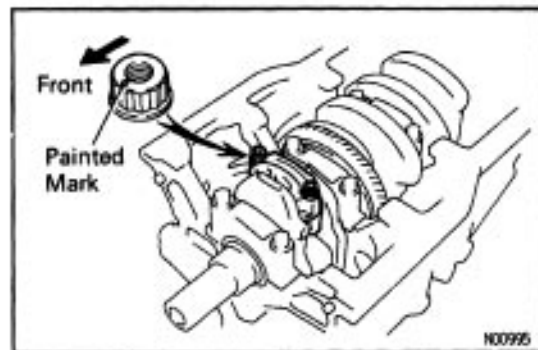


- Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.
- Using SST, install and alternately tighten the cap nuts in several passes.

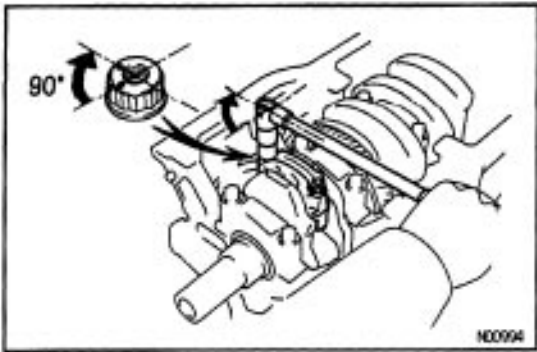
SST 09011- 38121

**Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)**

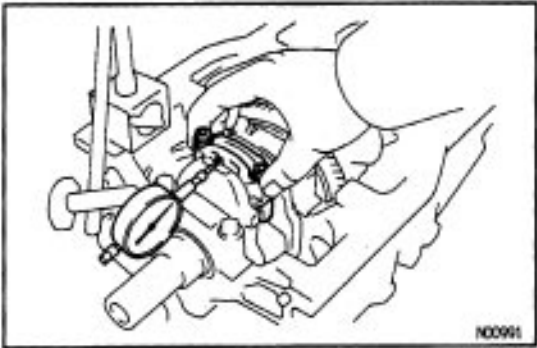
**If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.**



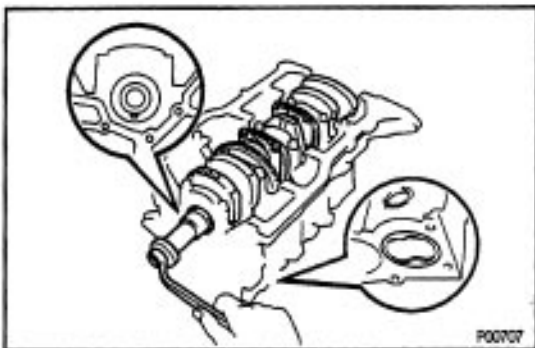
- Mark the front of the cap nut with the paint.



- (d) Retighten the cap nuts 90° as shown.
- (e) Check that the painted mark is now at a 90° angle to the front.
- (f) Check that the crankshaft turns smoothly.

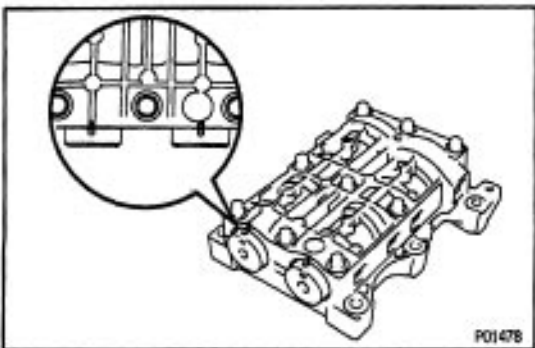


- (g) Check the connecting rod thrust clearance.  
Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.  
Standard thrust clearance:  
0.160 – 0.312 mm (0.0063 – 0.0123 In.)  
Maximum thrust clearance:  
0.35 mm 0.0138 In.)  
If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

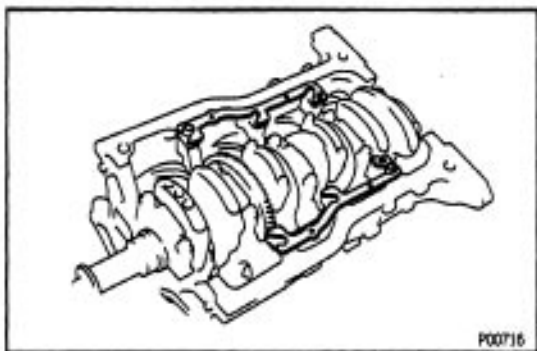


## 7. INSTALL ENGINE BALANCER

- (a) Turn the crankshaft, and set the No. 1 cylinder TDC as shown in the illustration.



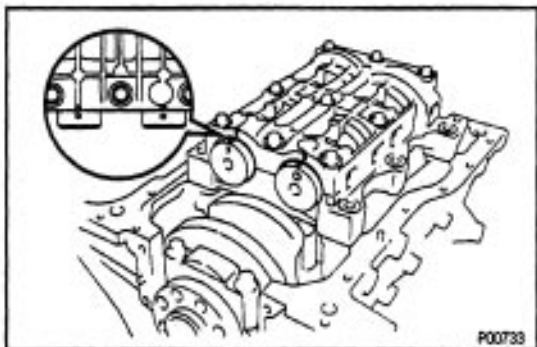
- (b) Set the balance shafts so that the punch marks of the balance shafts are aligned with the grooves of the No. 2 housing.



(c) Wipe clean the installation surface of the spacer.

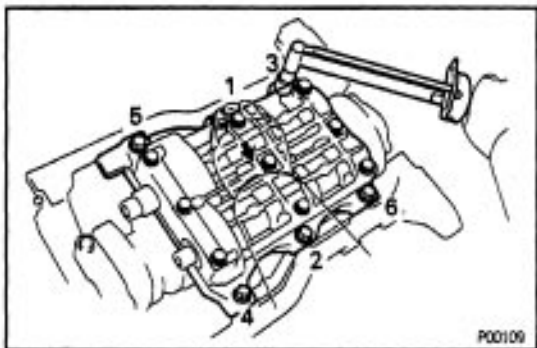
(d) Place the spacers on the cylinder block.

HINT: When replacing the crankshaft and/or balance shaft, use the thickest spacers.



(e) Place the engine balancer on the cylinder block.

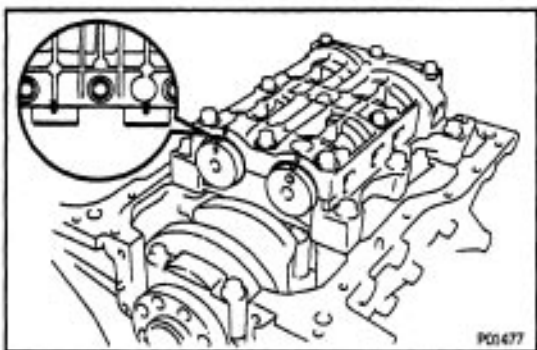
(f) Check that punch marks shown in the illustration of the balance shafts are align with the grooves of the No.2 housing.



(g) While pulling the center part of the engine balancer in the direction of the arrow, uniformly tighten the 6

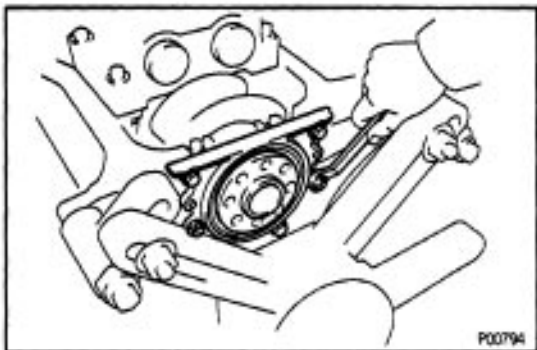
bolts in several passes, in the sequence shown.

Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)



(h) Recheck that the punch marks of the balance shafts are aligned with the grooves of No.2 housing.

## 8. CHECK AND ADJUST BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR (See page [EG1-94](#))

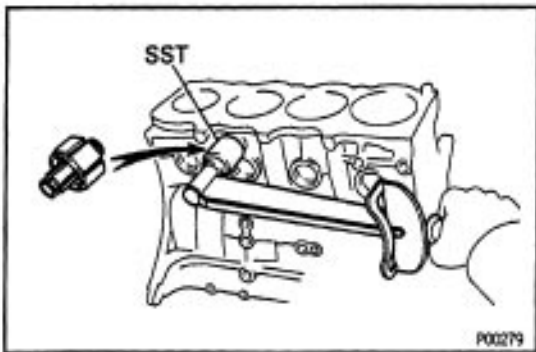


## 9. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the 6 bolts.

Torque: 9.3 N·m (95 kgf·cm, 82 in.-lbf)





## POST ASSEMBLY

### 1. INSTALL KNOCK SENSOR

Using SST, install the knock sensor.  
SST 09816-30010

Torque: 37 N-m (380 kgf-cm, 27 ft-lbf)

### 2. w/ OIL COOLER:

#### INSTALL OIL COOLER

### 3. INSTALL OIL FILTER

### 4. INSTALL OIL PUMP AND OIL PAN

### 5. INSTALL WATER PUMP AND GENERATOR ADJUSTING BAR

### 6. INSTALL CYLINDER HEAD

### 7. INSTALL PULLEYS AND TIMING BELT



### 8. INSTALL PS PUMP BRACKET

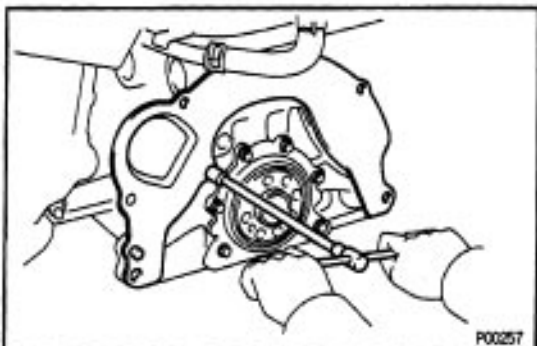
Install the PS pump bracket with 3 bolts.

Torque: 43 N-m (440 kgf-cm, 32 ft-lbf)

### 9. INSTALL GENERATOR

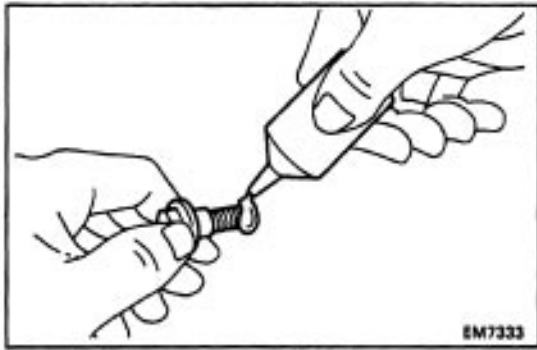
### 10. INSTALL DISTRIBUTOR

### 11. REMOVE ENGINE STAND



### 12. INSTALL REAR END PLATE

Torque: 9.3 N-m (95 kgf-cm, 82 in.-lbf)

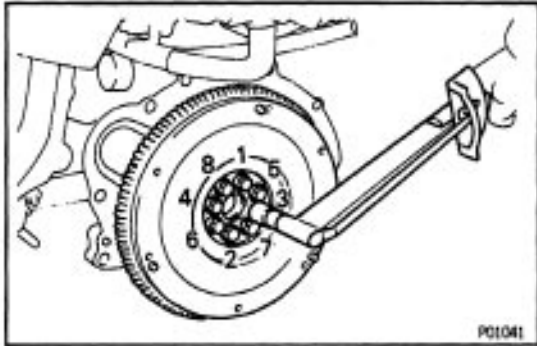


**13. M/T:**  
**INSTALL FLYWHEEL**

- (a) Apply adhesive to 2 or 3 threads of the mounting bolt end.

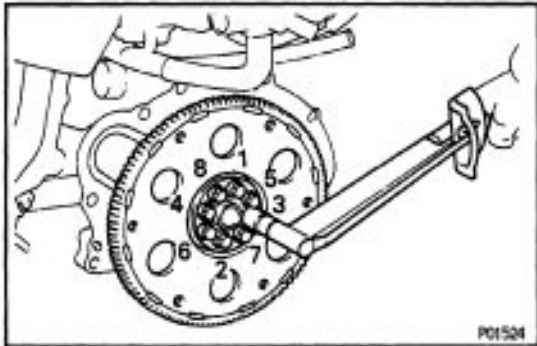
**Adhesive:**

**Part No.08833-00070. THREE BOND 1324 or equivalent**



- (b) Install the flywheel on the crankshaft.  
(c) install and uniformly tighten the mounting bolts in several passes, in the sequence shown.

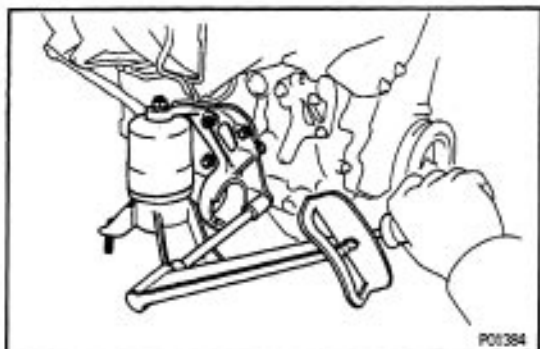
**Torque: 88 N-m (900 kgf-cm, 66 ft-lbf)**



**14. A/T:**  
**INSTALL DRIVE PLATE (See procedure step 13)**

**Torque: 83 N-m (850 kgf-cm, 61 ft-lbf)**

**15. M/T:**  
**INSTALL CLUTCH DISC AND COVER**



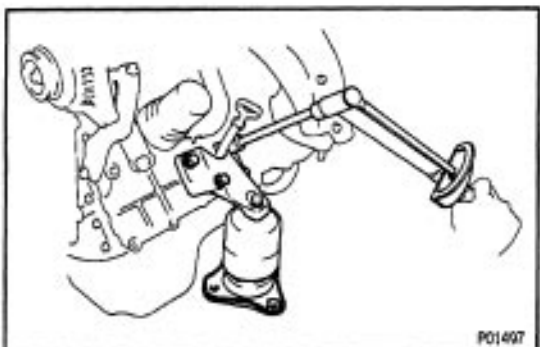
## ENGINE INSTALLATION

(See Components for Engine Removal and Installation)

### 1. INSTALL RR ENGINE MOUNTING INSULATOR

Install the mounting insulator with the 4 bolts.

**Torque: 64 N-m (650 kgf-cm, 47 ft-lbf)**



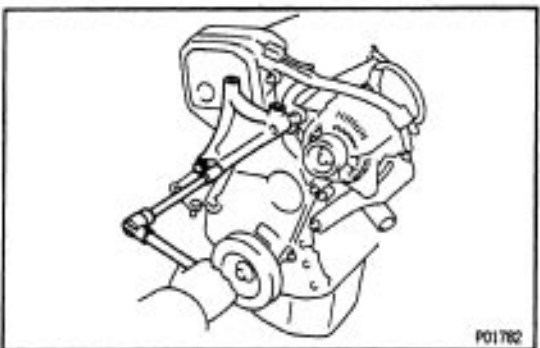
### 2. INSTALL FR ENGINE MOUNTING INSULATOR

(a) Install the mounting insulator with the 4 bolts.

**Torque: 77 N-m (790 kgf-cm, 57 ft-lbf)**

(b) Install the manifold stay with the bolt and nut.

**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**



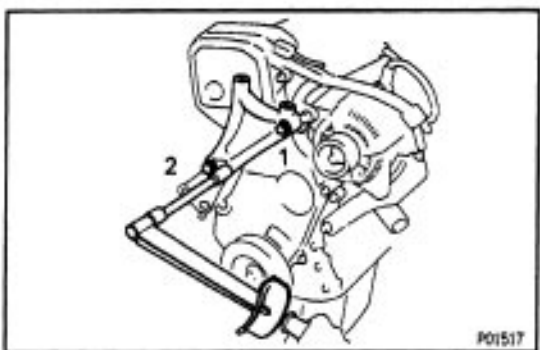
### 3. INSTALL NO.2 ENGINE MOUNTING BRACKET

(a) Temporarily install the No.2 engine mounting bracket with the 2 bolts.

(b) Install the remain bolt.

(c) Tighten the 3 bolts in the sequence shown.

**Torque: 52 N-m (530 kgf-cm, 38 ft-lbf)**



### 4. ASSEMBLE ENGINE AND TRANSAXLE

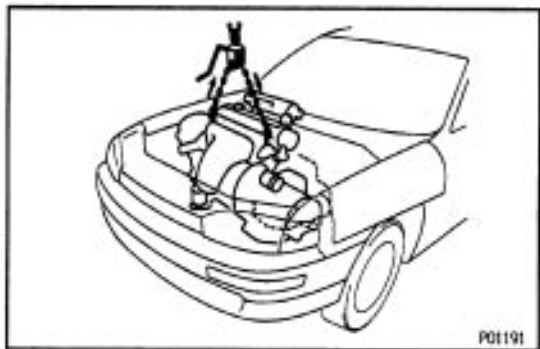
M/T (See page [MX-15](#))

A/T (See page [AX1-27](#))

### 5. A/T:

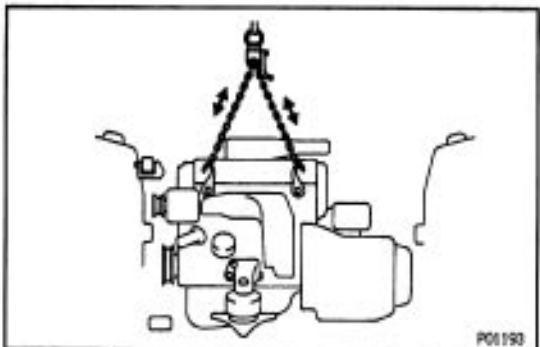
INSTALL STARTER

## 6. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE



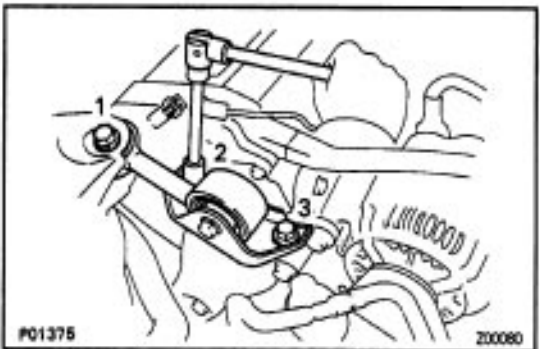
- (a) Attach the engine sling device to the engine hangers.
- (b) Lower the engine into the engine compartment.  
Tilt the transaxle downward, lower the engine and clear the LH mounting.

**NOTICE:** Be careful not to hit the PS gear housing or park/neutral position switch (A/T).

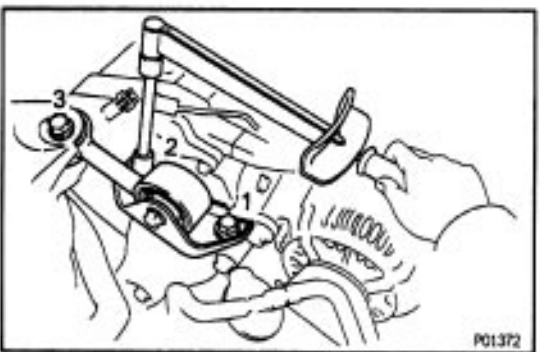


- (c) Keep the engine level, and align RH and LH mountings with the body bracket.

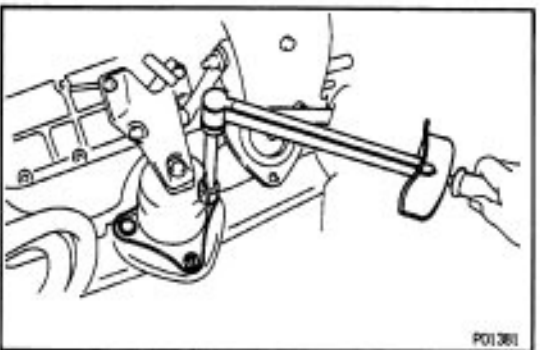
## 7. INSTALL ENGINE MOVING CONTROL ROD



- (a) Temporarily install the engine moving control rod with the 3 bolts in the sequence shown.



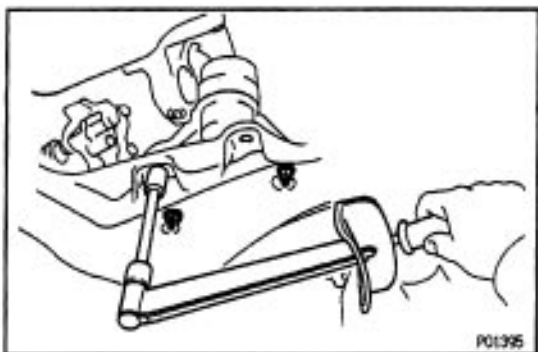
- (b) Tighten the 3 bolts in the sequence shown.  
**Torque: 64 N-m (650 kgf-cm, 47 ft-lbf)**



## 8. CONNECT FR ENGINE MOUNTING INSULATOR

Connect the mounting insulator with the 3 bolts.

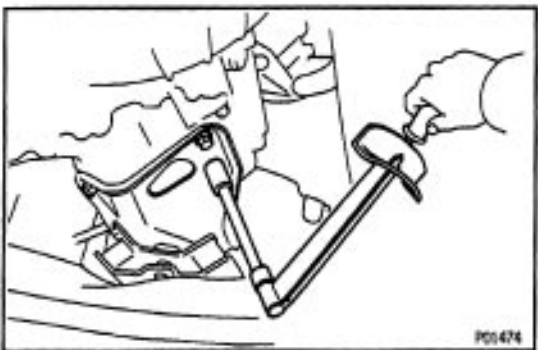
**Torque: 80 N-m (820 kgf-cm, 59 ft-lbf)**

**9. CONNECT RR ENGINE MOUNTING INSULATOR**

(a) Connect the mounting insulator with the 3 nuts.

**Torque: 66 N-m (670 kgf-cm, 48 ft-lbf)**

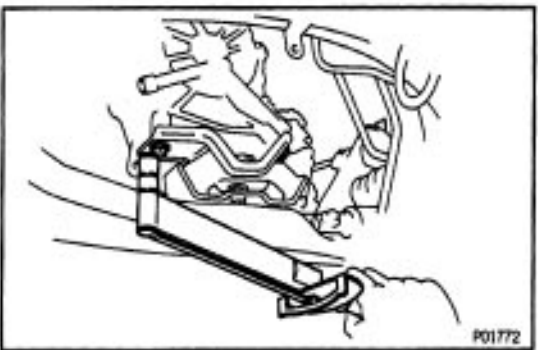
(b) Install the hole plugs:

**10. CONNECT LH ENGINE MOUNTING INSULATOR**

M/T:

Connect the mounting insulator with the 3 bolts.

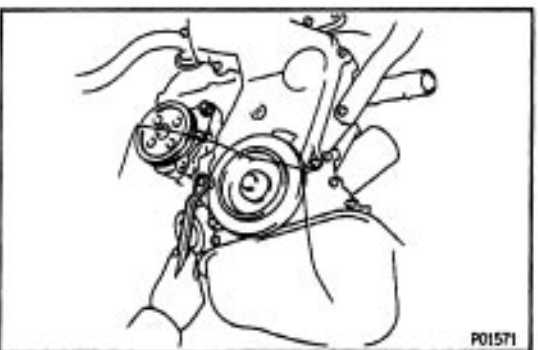
**Torque: 64 N-m (650 kgf-cm, 47 ft-lbf)**



A/T:

Connect the mounting insulator with the 4 bolts.

**Torque: 64 N-m (650 kgf-cm, 47 ft-lbf)**

**11. REMOVE ENGINE SLING DEVICE****12. INSTALL PS PUMP**

(a) Install the PS pump with the 2 bolts.

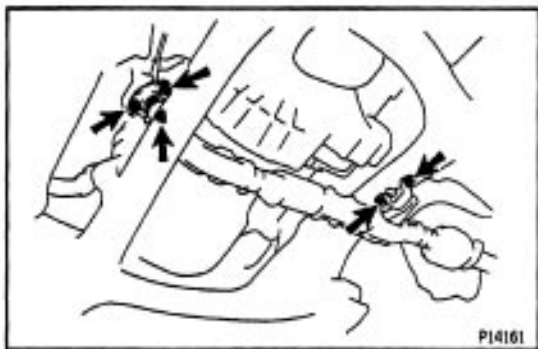
**Torque: 43 N-m (440 kgf-cm, 31 ft-lbf)**

(b) Install the drive belt.

(c) Connect the 2 air hoses to the air pipe.

**13. INSTALL DRIVE SHAFTS**

(See page [SA-40](#))

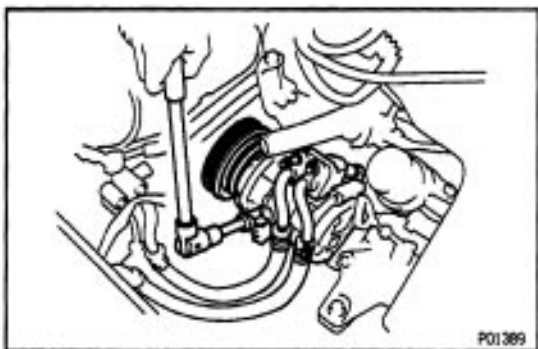


#### 14. CONNECT FRONT EXHAUST PIPE

- (a) Place a new gasket on the front exhaust pipe.
- (b) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU-TWC.

**Torque: 82 N-m (630 kgf-cm, 46 ft-lbf)**

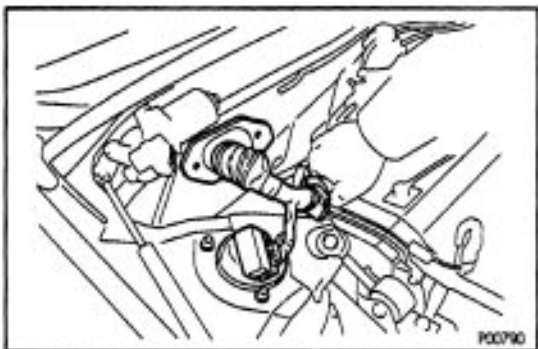
- (c) Install the bracket with the 2 bolts.



#### 15. w/ A/C:

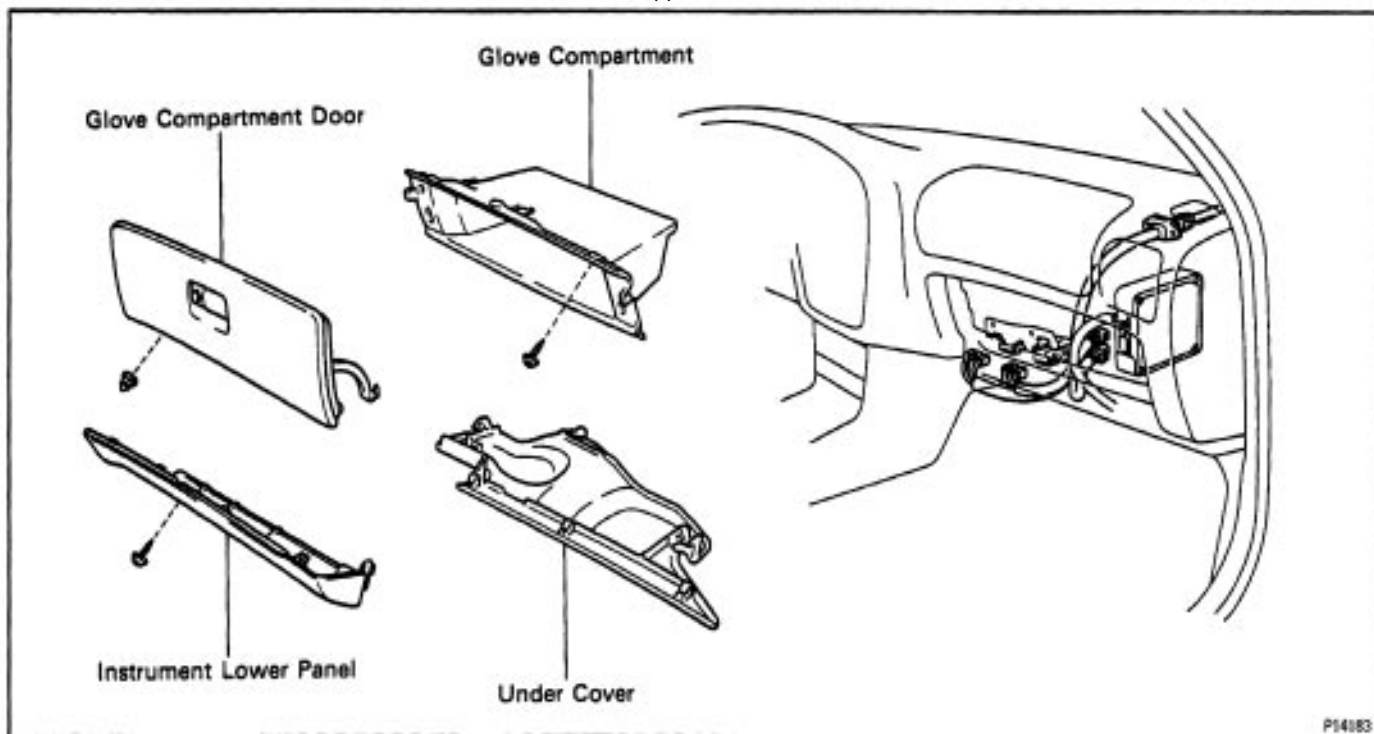
##### INSTALL A/C COMPRESSOR

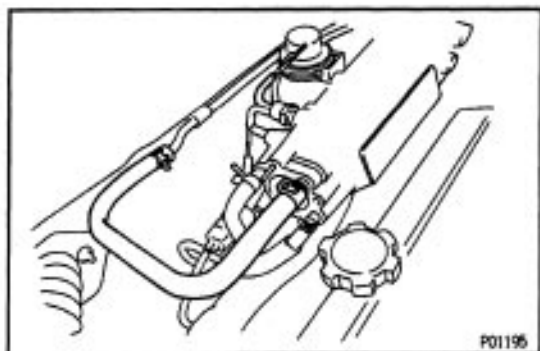
- (a) Install the compressor with the 3 bolts.
- Torque: 27 N-m (280 kgf-cm, 20 ft-lbf)**
- (b) Install the drive belt.
- (c) Connect the A/C compressor connector.



#### 16. CONNECT ENGINE WIRE TO CABIN

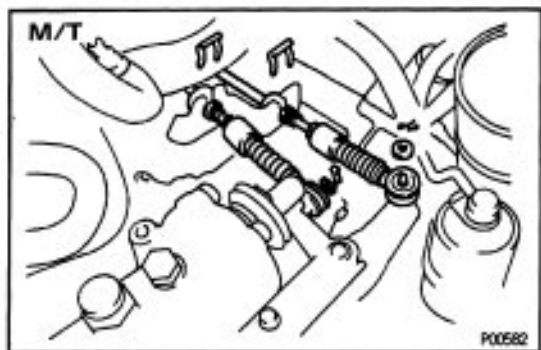
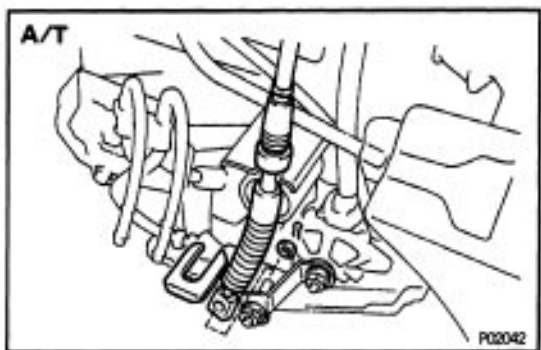
- (a) Push in the engine wire through the cowl panel. Install the 2 nuts.
- (b) Connect the following connectors:
  - (1) 2 ECM connectors
  - (2) 2 cowl wire connectors
- (c) Install the glove compartment.
- (d) Install the glove compartment door.
- (e) Install the lower instrument panel.
- (f) Install the under cover.



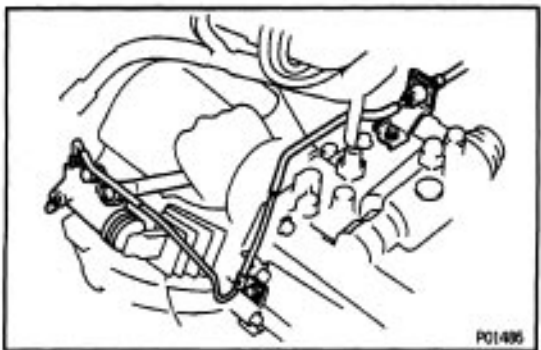
**17. CONNECT VACUUM HOSES**

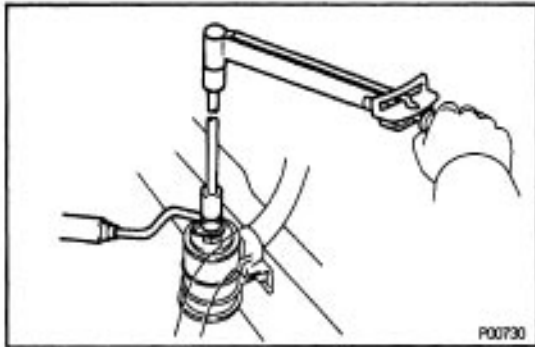
- (a) MAP sensor hose to air intake chamber
- (b) Brake booster vacuum hose to air intake chamber

- (c) Charcoal canister vacuum hose

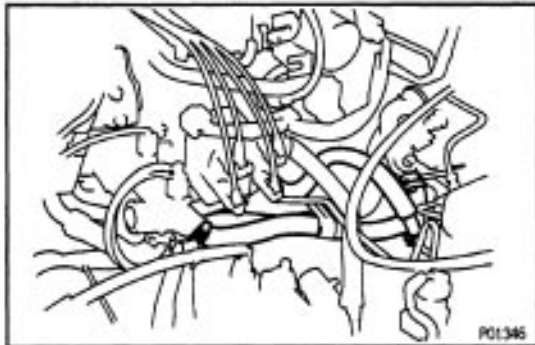
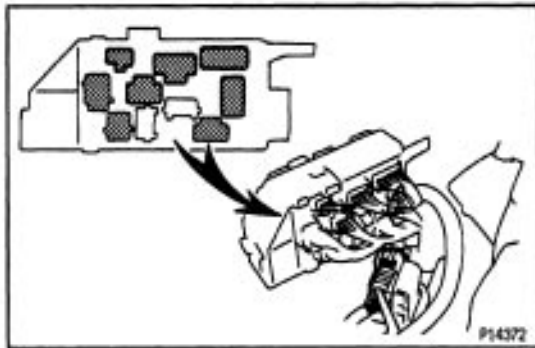
**18. CONNECT TRANSAXLE CONTROL CABLE (S) TO TRANSAXLE****19. M/T:****INSTALL CLUTCH RELEASE CYLINDER**

Install the release cylinder and tube with the 4 bolts.

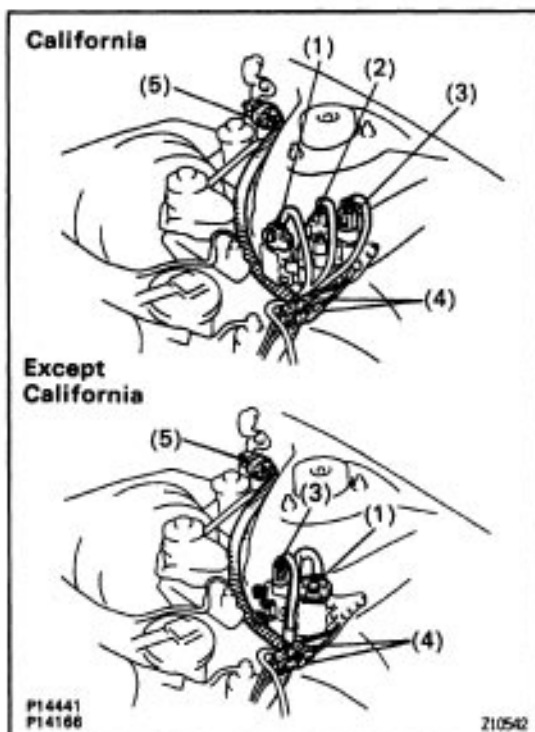
**20. M/T:****INSTALL STARTER**

**21. CONNECT FUEL INLET HOSE**

Torque: 29 N-m (300 kgf-cm, 22 ft-lbf)

**22. CONNECT FUEL RETURN HOSE****23. CONNECT HEATER HOSES****24. CONNECT WIRES AND CONNECTORS**

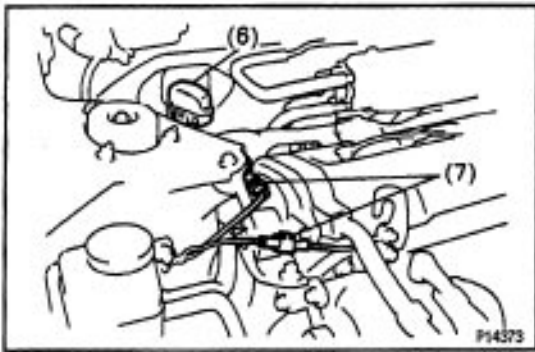
- (a) Connect the 5 connectors to the relay box.
- (b) Connectors from LH fender apron.
- (c) Install the engine relay box.



- (d) Connect the following connectors:

- (1) Igniter connector
- (2) California only:  
Ignition coil connector
- (3) Noise filter connector
- (4) 2 ground straps from LH fender apron
- (5) Connector from LH fender apron



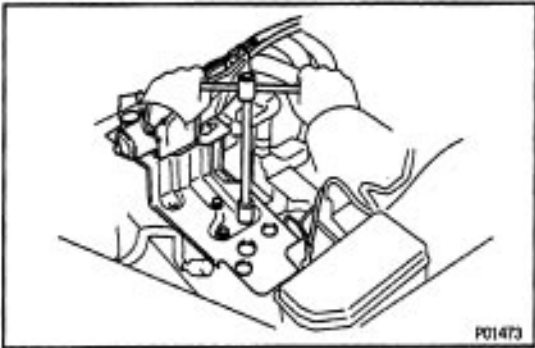


(6) Data link connector 1

(7) 2 ground straps from RH fender apron

(e) Connect the MAP sensor connector.

## 25. INSTALL RADIATOR



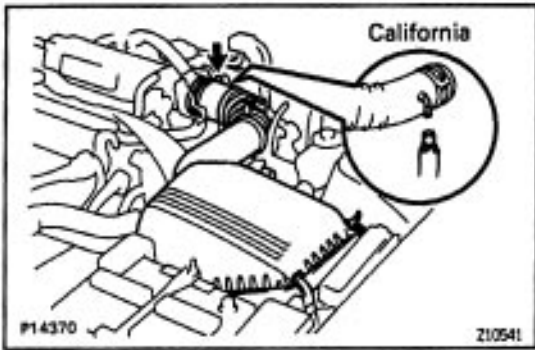
## 26. w/ CRUISE CONTROL SYSTEM:

### INSTALL CRUISE CONTROL ACTUATOR

(a) Install the actuator and bracket with the 3 bolts.

(b) Connect the actuator connector.

(c) Install the actuator cover.



## 27. INSTALL AIR CLEANER ASSEMBLY, RESONATOR AND AIR CLEANER HOSE

(a) Install the air cleaner case with 3 bolts.

(b) Install the element.

(c) Connect the air cleaner hose to the throttle body.

(d) Install the air cleaner cap together with the resonator and air cleaner hose.

(e) California only:

Connect the air hose to the air cleaner hose.

(f) Connect the intake air temperature sensor connector.

## 28. A/T:

### CONNECT AND ADJUST THROTTLE CABLE

## 29. CONNECT AND ADJUST ACCELERATOR CABLE

## 30. FILL WITH ENGINE COOLANT

## 31. FILL WITH ENGINE OIL

## 32. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

## 33. START ENGINE AND CHECK FOR LEAKS

## 34. PERFORM ENGINE ADJUSTMENT

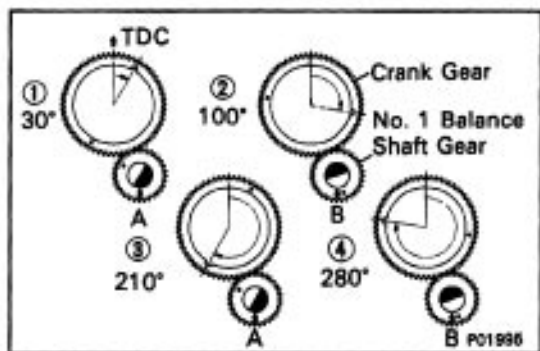
## 35. INSTALL ENGINE UNDER COVERS

## 36. INSTALL HOOD

## 37. PERFORM ROAD TEST

Check for abnormal noises, shock, slippage, correct shift points and smooth operation.

## 38. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS

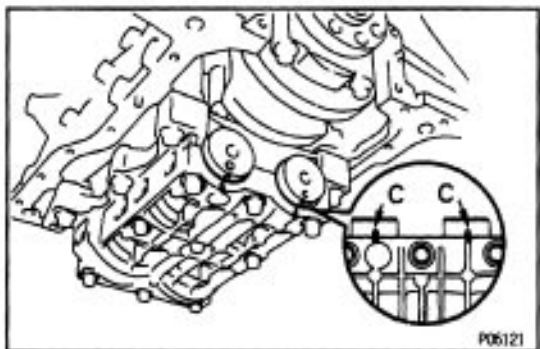


## BALANCE SHAFT BACKLASH ADJUSTMENT ON VEHICLE

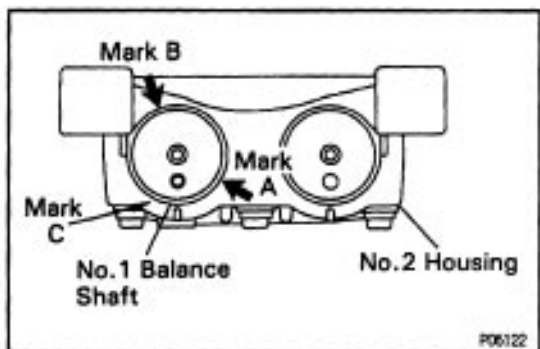
### 1. CHECK BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR

**NOTICE:** Backlash between the crankshaft gear and No.1 balance shaft gear varies with the rotation of the balance shaft and the deviation of the crankshaft gear.

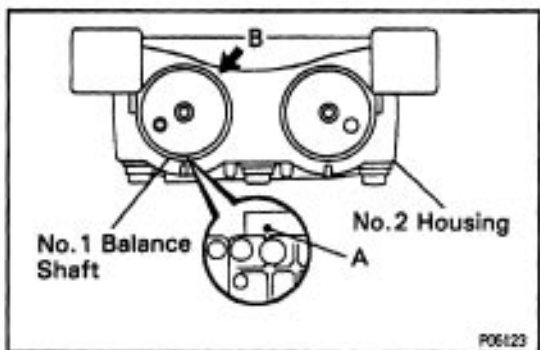
Accordingly, it is necessary to measure the backlash at the 4 points shown in the illustration on the left.



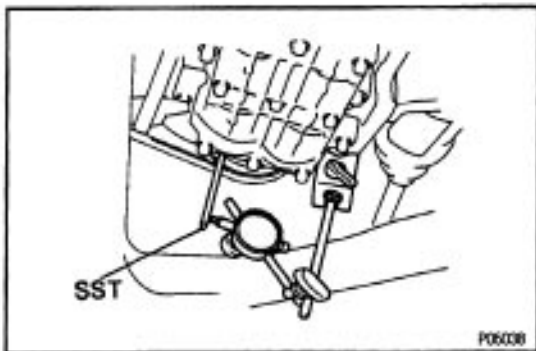
- Rotate the crankshaft 2 or 3 times to settle the crankshaft gear and No. 1 balance shaft gear.
- When No.1 piston is at TDC, check that the punch marks C shown in the illustration of the balance shafts are aligned with the grooves of the No. 2 housing.



- Check that the punch marks A and B are at the positions on the No.1 balance shaft indicated in the illustration.



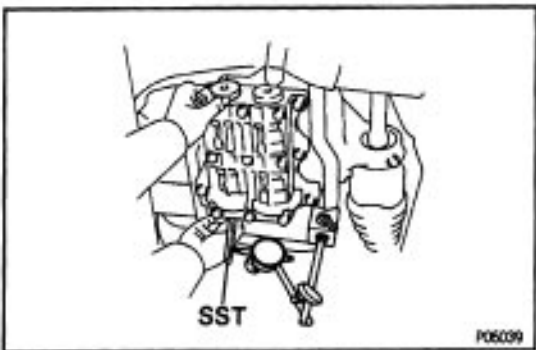
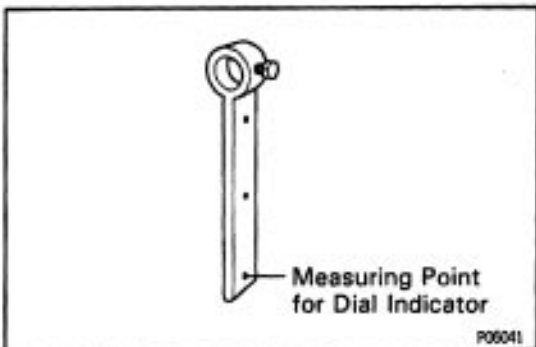
- First turn the crankshaft clockwise, and align the groove of the No.2 balance shaft housing with the punch mark A of the No. 1 balance shaft.



(e) Position the SST and dial indicator as shown in the illustration.

SST 09224 – 74010

HINT: Make sure that the stem of the dial indicator is perpendicular to the SST and that it is placed in the middle of the 3rd indentation.



(f) Gently turn the No.1 balance shaft by hand, until resistance is felt, and measure the backlash.

HINT:

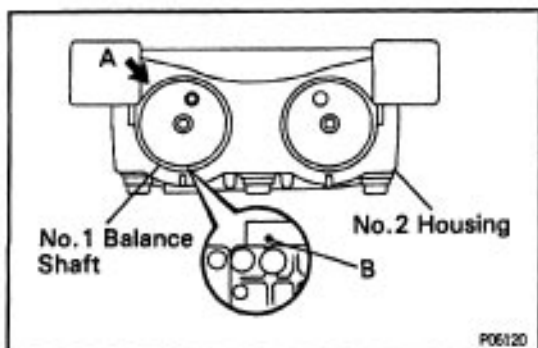
- Rotate the No. 1 balance shaft 4 or 5 times to provide a steady backlash reading.
- To prevent excessive backlash due to thrust clearance, measure the backlash while pressing on the rear of the No.1 balance shaft.

**Standard backlash (use SST):**

**0.060 – 0.100 mm (0.0024 – 0.0039 in.)**

**NOTICE: Do not turn the No.1 balance shaft strongly.**

(g) Remove the dial gauge and the SST.



(h) Turn the crankshaft clockwise to align the groove of the No.2 housing with the punch mark B.

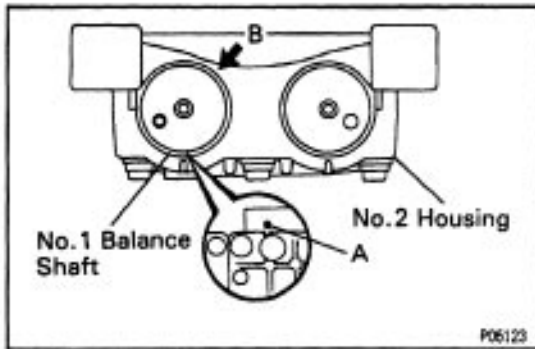
(i) Set the dial gauge. (See procedure in step (e))

(j) Measure the backlash. (See procedure in step (f))

**Standard backlash ( use SST ):**

**0.080 – 0.100 mm (0.0024 – 0.0039 in.)**

(k) Remove the dial gauge.

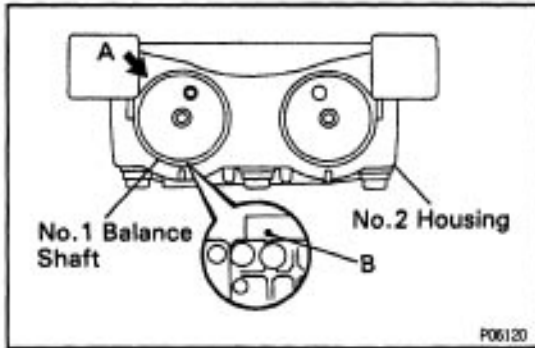


- (l) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark A.
- (m) Set the dial gauge. (See procedure in step (e))
- (n) Measure the backlash. (See procedure in step (f))

**Standard backlash ( use SST ):**

**0.060 – 0.100 mm (0.0024 – 0.0039 in.)**

- (o) Remove the dial gauge.



- (p) Turn the crankshaft clockwise again to align the groove of the No.2 housing with the punch mark B.
- (q) Set the dial gauge. (See procedure in step (e))
- (r) Measure the backlash. (See procedure in step (f))

**Standard backlash( use SST ):**

**0.06 – 0.100 mm (0.0024 – 0.0039 in.)**

- (s) Remove the dial gauge.

If even one of the 4 points measured above exceeds the backlash specification, adjust the backlash with new spacers.

**NOTICE: Use the same size spacers for both the left and right sides.**

**HINT:**

- Varying the spacer thickness by 0.02 mm (0.0008 in.) changes the backlash by about 0.042 mm (0.0017 in.).
- If the backlash is greater than permitted maximum, select a thinner shim.
- If the backlash is less than the specification, select a thicker shim.

### Adjusting Spacer Selection Chart (On Vehicle)

Measured clearance	Inverted space										Inverted space 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	29	30	31	32	33	34	35	36	37	38	39	40					
0.000 - 0.017 0.0000 - 0.0007	05	05	07	07	06	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39	41	41	43	43	45	45	47	47	49	49
0.018 - 0.036 0.0008 - 0.0015	03	05	07	07	06	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39	41	41	43	43	45	45	47	47	49	49
0.037 - 0.055 0.0016 - 0.0023	03	05	07	07	06	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39	41	41	43	43	45	45	47	47	49	49
0.056 - 0.100 0.0024 - 0.0038	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.101 - 0.121 0.0040 - 0.0047	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.122 - 0.142 0.0048 - 0.0056	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.143 - 0.163 0.0057 - 0.0064	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.164 - 0.184 0.0065 - 0.0072	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.185 - 0.205 0.0073 - 0.0081	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.206 - 0.226 0.0082 - 0.0089	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.227 - 0.247 0.0090 - 0.0097	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.248 - 0.268 0.0098 - 0.0105	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.269 - 0.289 0.0106 - 0.0114	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.290 - 0.310 0.0115 - 0.0123	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.311 - 0.331 0.0123 - 0.0130	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.332 - 0.352 0.0131 - 0.0139	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.353 - 0.373 0.0139 - 0.0147	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.374 - 0.394 0.0148 - 0.0155	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.395 - 0.415 0.0156 - 0.0163	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.416 - 0.436 0.0164 - 0.0172	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.437 - 0.457 0.0173 - 0.0180	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.458 - 0.478 0.0181 - 0.0188	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.479 - 0.499 0.0189 - 0.0196	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.500 - 0.520 0.0197 - 0.0205	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.521 - 0.541 0.0206 - 0.0213	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.542 - 0.562 0.0214 - 0.0221	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.563 - 0.583 0.0222 - 0.0230	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.584 - 0.604 0.0231 - 0.0238	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.605 - 0.625 0.0239 - 0.0246	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.626 - 0.646 0.0247 - 0.0254	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.647 - 0.667 0.0255 - 0.0263	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.668 - 0.688 0.0264 - 0.0271	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.689 - 0.709 0.0272 - 0.0279	01	01	03	03	05	06	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	33	33	35	35	37	37	39	39	41	41	43	43	45	45
0.710 - 0.730 0.0280 - 0.0287	01	01	03	03	05	06	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29																

Backlash of crankshaft and No. 1 balance shaft gear:

0.060 - 0.100 mm (0.0024 - 0.0039 in.)

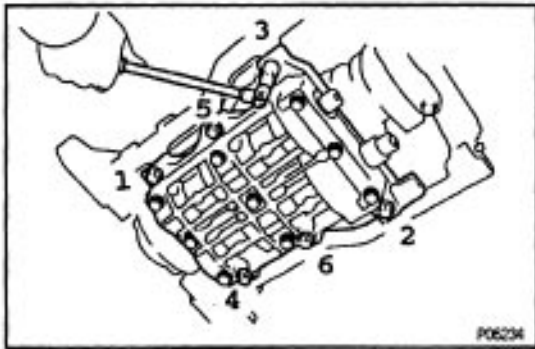
**EXAMPLE:** The No. 25 spacers are installed

and the measured clearance is 0.342 mm (0.0135 in.).

Replace the No. 25 spacers with No. 13 spacers.

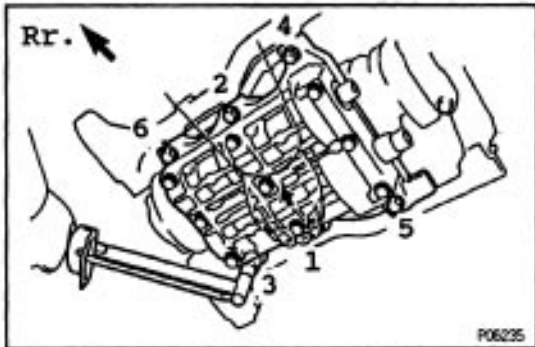
New spacer thickness  
mm (in.)

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)



## 2. REPLACE THE SPACERS

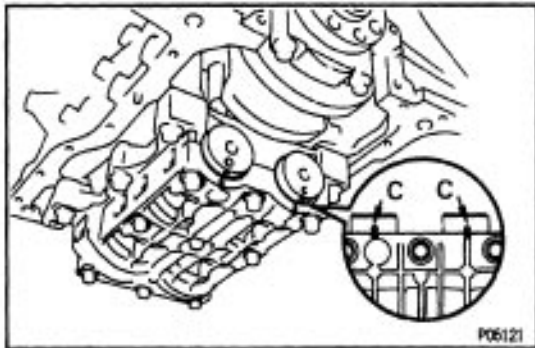
- (a) Uniformly loosen the 6 bolts in the sequence shown.
- (b) Replace the spacers with new ones.



## 3. TORQUE BALANCE SHAFT ASSEMBLY

While pulling the center part of the engine balancer in the direction of the arrow, uniformly tighten the 6 bolts in several passes, in the sequence shown.

**Torque: 49 N-m (500 kgf-cm, 36 ft-lbf)**



## 4. CHECK AND ADJUST BACKLASH OF CRANK-SHAFT GEAR AND No.1 BALANCE SHAFT GEAR (See procedure in step 1)

## 10-100000



# SERVICE SPECIFICATIONS

## SERVICE DATA

50022-00

Idle speed	—	750 ± 50 rpm
Intake manifold vacuum	at idle speed	60 kPa (450 mmHg, 17.7 in.Hg)
Compression pressure	et 250 rpm STD Limit Difference of pressure between each cylinder	1,226 kPa (12.5 kgf/cm <sup>2</sup> , 178 psi) or more 981 kPa (10.0 kgf/cm <sup>2</sup> , 142 psi) 98 kPa (1.0 kgf/cm <sup>2</sup> , 14 psi) or less
Idler pulley tension spring	Free length Installed load at 50.5 mm (1.988 in.) Green color Silver color	46.0 mm (1.811 in.) 32 – 37 N (3.25 – 3.75 kgf, 7.2 – 8.3 lbf) 47 – 52 N (4.75 – 5.25 kgf, 10.5 – 11.6 lbf)
Cylinder head	Warpage Cylinder block side Manifold side Valve seat Refacing angle Contacting angle Contacting width Limit Limit	0.05 mm (0.020 in.) 0.08 mm (0.031 in.) 30°, 45°, 75° 45° 1.0 – 1.4 mm (0.039 – 0.055 in.)
Valve guide bushing	Inside diameter Outside diameter (for repair part) STD O/S 0.05	6.010 – 6.030 mm (0.2366 – 0.2374 in.) 11.048 – 11.059 mm (0.4350 – 0.4354 in.) 11.098 – 11.109 mm (0.4369 – 0.4374 in.)
Valve	Valve overall length (Intake) (Exhaust) Limit (Intake) (Exhaust) Valve face angle Stem diameter (Intake) (Exhaust) Stem oil clearance STD (Intake) (Exhaust) Limit (Intake) (Exhaust) Margin thickness STD Limit	97.60 mm (3.8425 in.) 98.45 mm (3.8760 in.) 97.1 mm (3.823 in.) 98.0 mm (3.853 in.) 44.5° 5.970 – 5.985 mm (0.2350 – 0.2356 in.) 5.965 – 5.980 mm (0.2348 – 0.2354 in.) 0.025 – 0.060 mm (0.0010 – 0.0024 in.) 0.030 – 0.065 mm (0.0012 – 0.0026 in.) 0.08 mm (0.0031 in.) 0.10 mm (0.0039 in.) 0.8 – 1.2 mm (0.031 – 0.047 in.) 0.5 mm (0.020 in.)
Valve spring	Deviation Free length Installed tension et 34.7 mm (1.366 in.) Limit	2.0 mm (0.079 in.) 41.96 – 41.99 mm (1.6520 – 1.6531 in.) 164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)
Valve lifter	Lifter diameter Lifter bore diameter Oil clearance STD Limit	30.966 – 30.978 mm (1.2191 – 1.2195 in.) 31.000 – 31.018 mm (1.2205 – 1.2213 in.) 0.024 – 0.052 mm (0.0009 – 0.0020 in.) 0.07 mm (0.0028 in.)
Manifold	Warpage	Limit 0.30 mm (0.0118 in.)



Camshaft	Thrust clearance	STD (Intake)	0.045 – 0.100 mm (0.0018 – 0.0039 in.)
		(Exhaust)	0.030 – 0.085 mm (0.0012 – 0.0033 in.)
		Limit (Intake)	0.12 mm (0.0047 in.)
		(Exhaust)	0.10 mm (0.0039 in.)
	Journal oil clearance	STD	0.025 – 0.062 mm (0.0010 – 0.0024 in.)
		Limit	0.10 mm (0.0039 in.)
	Journal diameter		26.959 – 26.975 mm (1.0614 – 1.0620 in.)
	Circle runout	Limit	0.04 mm (0.0016 in.)
	Cam lobe height	STD (Intake)	42.01 – 42.11 mm (1.6539 – 1.6579 in.)
		(Exhaust)	40.06 – 40.16 mm (1.5772 – 1.5811 in.)
Cylinder block	Cylinder head surface warpage	Limit	0.05 mm (0.0020 in.)
		STD (Mark 1)	87.000 – 87.010 mm (3.4252 – 3.4258 in.)
		(Mark 2)	87.010 – 87.020 mm (3.4258 – 3.4260 in.)
		(Mark 3)	87.020 – 87.030 mm (3.4260 – 3.4264 in.)
		Limit (STD)	87.23 mm (3.4342 in.)
	Cylinder bore diameter	(O/S 0.50)	87.73 mm (3.4350 in.)
		STD (Mark 1)	86.850 – 86.860 mm (3.4193 – 3.4197 in.)
		(Mark 2)	86.860 – 86.870 mm (3.4197 – 3.4201 in.)
		(Mark 3)	86.870 – 86.880 mm (3.4201 – 3.4205 in.)
		O/S 0.50	87.350 – 87.380 mm (3.4390 – 3.4402 in.)
Piston and piston ring	Piston diameter	STD	0.14 – 0.016 mm (0.0055 – 0.0063 in.)
		Limit	0.18 mm (0.0071 in.)
		No.1	0.040 – 0.080 mm (0.0016 – 0.0031 in.)
		No.2	0.030 – 0.070 mm (0.0012 – 0.0028 in.)
		(Oil)	0.200 – 0.550 mm (0.0079 – 0.0217 in.)
	Piston oil clearance	STD (No.1)	0.270 – 0.500 mm (0.0106 – 0.0197 in.)
		(No.2)	0.350 – 0.600 mm (0.0138 – 0.0234 in.)
		(Oil)	1.10 mm (0.0433 in.)
	Piston ring groove clearance	(No.2)	1.20 mm (0.0472 in.)
	Piston ring end gap	(Oil)	1.15 mm (0.0453 in.)

Connecting rod	Thrust clearance	STD	0.160 – 0.312 mm (0.0063 – 0.0123 in.)
		Limit	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness (Reference)	STD (Mark 1)	1.484 – 1.488 mm (0.0584 – 0.0588 in.)
		(Mark 2)	1.488 – 1.492 mm (0.0588 – 0.0587 in.)
		(Mark 3)	1.492 – 1.496 mm (0.0587 – 0.0589 in.)
	Connecting rod oil clearance	STD (STD)	0.024 – 0.055 mm (0.0009 – 0.0022 in.)
		(U/S 0.25)	0.023 – 0.069 mm (0.0009 – 0.0027 in.)
		Limit	0.08 mm (0.0031 in.)
	Rod bend	Limit per 100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Limit per 100 mm (3.94 in.)	0.15 mm (0.0059 in.)
	Bushing inside diameter		22.005 – 22.017 mm (0.8663 – 0.8668 in.)
	Piston pin diameter		21.997 – 22.009 mm (0.8660 – 0.8665 in.)
	Piston pin oil clearance		
	Connecting rod bolt outside diameter	STD	0.005 – 0.011 mm (0.0002 – 0.0004 in.)
Crankshaft		Limit	0.05 mm (0.0020 in.)
		STD	7.860 – 8.000 mm (0.3094 – 0.3150 in.)
		Limit	7.60 mm (0.2992 in.)
	Thrust clearance	STD	0.020 – 0.220 mm (0.0008 – 0.0087 in.)
		Limit	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.440 – 2.490 mm (0.0961 – 0.0980 in.)
	Main journal oil clearance	STD (No.3 STD)	0.025 – 0.044 mm (0.0010 – 0.0017 in.)
		(No.3 U/S 0.25)	0.027 – 0.067 mm (0.0011 – 0.0026 in.)
		(Others STD)	0.015 – 0.034 mm (0.0006 – 0.0013 in.)
		(Others U/S 0.25)	0.019 – 0.059 mm (0.0007 – 0.0023 in.)
		Limit	0.08 mm (0.0031 in.)
	Main journal diameter	STD	54.988 – 55.003 mm (2.1653 – 2.1655 in.)
		U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)
	Main bearing center wall thickness (Reference)	STD (No.3 Mark 1)	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
		(No.3 Mark 2)	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
		(No.3 Mark 3)	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
		(No.3 Mark 4)	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
		(No.3 Mark 5)	2.004 – 2.007 mm (0.0789 – 0.0790 in.)
		(Others Mark 1)	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
		(Others Mark 2)	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
		(Others Mark 3)	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
		(Others Mark 4)	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
		(Others Mark 5)	2.009 – 2.012 mm (0.0791 – 0.0792 in.)
	Crank pin diameter	STD	51.985 – 52.000 mm (2.0466 – 2.0472 in.)
		U/S 0.25	51.745 – 51.755 mm (2.0372 – 2.0376 in.)
	Circle runout	Limit	0.06 mm (0.0024 in.)
	Main journal taper and out-of-round	Limit	0.02 mm (0.0008 in.)
	Crank pin taper and out-of-round	Limit	0.02 mm (0.0008 in.)

Engine balancer	Thrust clearance	STD	0.065 – 0.110 mm (0.0026 – 0.0043 in.)
		Limit	0.110 mm (0.0043 in.)
	Backlash		
	Crankshaft x No. 1 balance shaft		
	Off-vehicle		
	On-vehicle	STD	0 – 0.06 mm (0 – 0.0024 in.)
	No. 1 balance shaft x No.2 balance shaft	STD	0.025 – 0.090 mm (0.0010 – 0.0035 in.)
	at D mark		
	at E mark	STD	0.020 – 0.075 mm (0.0008 – 0.0030 in.)
	at F mark	STD	0.005 – 0.075 mm (0.0002 – 0.0030 in.)
	Spacer thickness	STD	0.005 – 0.055 mm (0.0002 – 0.0022 in.)
		No.01	1.74 mm (0.0685 in.)
		No.03	1.76 mm (0.0693 in.)
		No.05	1.78 mm (0.0701 in.)
		No.07	1.80 mm (0.0709 in.)
		No.09	1.82 mm (0.0717 in.)
		No.11	1.84 mm (0.0724 in.)
		No.13	1.86 mm (0.0732 in.)
		No.15	1.88 mm (0.0740 in.)
		No.17	1.90 mm (0.0748 in.)
		No.19	1.92 mm (0.0756 in.)
		No.21	1.94 mm (0.0764 in.)
		No.23	1.96 mm (0.0772 in.)
		No.25	1.98 mm (0.0780 in.)
		No.27	2.00 mm (0.0787 in.)
		No.29	2.02 mm (0.0795 in.)
		No.31	2.04 mm (0.0803 in.)
		No.33	2.06 mm (0.0811 in.)
		No.35	2.08 mm (0.0819 in.)
		No.37	2.10 mm (0.0827 in.)
		No.39	2.12 mm (0.0835 in.)
	Balance shaft housing bolt outer diameter	STD	6.5 – 6.7 mm (0.2559 – 0.2638 in.)
		Limit	6.3 mm (0.2480 in.)

## TORQUE SPECIFICATIONS

N0004-08

Part tightened	N-m	kgf-cm	ft-lbf
Cylinder head cover x Cylinder head	23	230	17
Spark plug x Cylinder head	18	180	13
Oil pump pulley x Oil pump drive 'shaft	28	280	21
No. 2 idler pulley x Cylinder block	42	425	31
Crankshaft pulley x Crankshaft	108	1,100	80
Camshaft timing pulley x Camshaft	54	550	40
Camshaft timing pulley x Camshaft (For use with SST)	37	380	27
No. 1 idler pulley x Cylinder head	42	425	31
No. 2 engine mounting bracket x Cylinder block	52	530	38
Engine moving control rod X Fender apron	64	650	47
Engine moving control rod x No. 2 engine mounting bracket	64	650	47
Cylinder head x Cylinder block (1 sty	49	500	36

Cylinder head x Cylinder block (2nd)	Turn 90°		
Spark plug tube x Cylinder head	39	400	29
Camshaft bearing cap x Cylinder head	19	190	14
Generator bracket x Cylinder head	42	425	31
Engine hanger x Cylinder head	25	250	18
No. 3 timing belt cover x Cylinder head	7.8	80	69 in.-lbf
Delivery pipe x Cylinder head	13	130	9
Pulsation damper x Delivery pipe	34	350	25
Intake manifold x Cylinder head	19	195	14
Intake manifold stay x Intake manifold	22	220	16
Intake manifold stay x Cylinder block	42	425	31
No. 1 air intake chamber stay x Intake manifold	42	425	31
No. 1 air intake chamber stay x Cylinder head	42	425	31
EGR valve x intake manifold	13	130	9
EGR pipe x Cylinder head	59	600	43
Throttle body x Intake manifold	19	195	14
Water bypass pipe x Water pump cover	8.8	90	78 in.-lbf
Water outlet x Cylinder head	15	150	11
WU-TWC x Exhaust manifold	29	300	22
Exhaust manifold x Cylinder head	49	500	36
Exhaust manifold stay x WU –TWC	42	425	31
Exhaust manifold stay x FR engine mounting insulator	42	425	31
No. 1 exhaust manifold stay x WU –TWC	42	425	31
No. 1 exhaust manifold stay x Cylinder block	42	425	31
Main bearing cap x Cylinder block	59	600	43
Connecting rod cap x Connecting rod (1 st)	25	250	18
Connecting rod cap x Connecting rod (2nd)	Turn 90°		
No. 1 balance shaft housing x No. 2 balance shaft housing (1st)	22	220	16
No. 1 balance shaft housing x No. 2 balance shaft housing (2nd)	Turn 90°		
Engine balancer x Cylinder block	49	500	36
Rear oil seal retainer x Cylinder block	9.3	95	82 in.-lbf
Knock sensor x Cylinder block	37	380	27
PS pump bracket x Cylinder block	43	440	32
Rear end plate x Cylinder block	9.3	95	82 in.-lbf
Flywheel x Crankshaft (M/T)	88	900	65
Drive plate x Crankshaft (A/T)	83	850	61
RR engine mounting insulator x Cylinder block	64	650	47
FR engine mounting insulator x Cylinder block	77	790	57
FR engine mounting insulator x Front suspension member	80	820	59
RR engine mounting insulator x Front suspension member	66	670	48
LH engine mounting insulator x Transaxle	64	650	47
PS pump x PS pump bracket	43	440	31
Front exhaust pipe x WU –TWC	62	630	46
A/C compressor x Cylinder block	27	280	20
Fuel inlet hose x Fuel filter (Union bolt)	29	300	22

# EMISSION CONTROL SYSTEMS

## SYSTEM PURPOSE

88817-80

system	Abbreviation	Purpose
Positive crankcase ventilation Fuel evaporative emission control Exhaust gas recirculation Three-way catalytic converter *Multiport fuel injection/Sequential multiport fuel injection	PCV EVAP EG R TWC MFI/SFI	Reduces blow-by gas (HC) Reduces evaporative HC Reduces NOx Reduces CO, HC and NOx Regulates all engine conditions for reduction of exhaust emissions.


\* For inspection and repair of the MFI/SFI system, refer to MFI/SFI Section.

V08544

## PREPARATION


### SST (SPECIAL SERVICE TOOLS)

88881-81

	09843-18020 Diagnosis Check Wire	
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## RECOMMENDED TOOLS

88881-81

	09082-00050 TOYOTA Electrical Tester Set	
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## EQUIPMENT

88881-81

Heater	TVV
Thermometer	TVV
Tachometer	
Torque wrench	
Vacuum gauge	

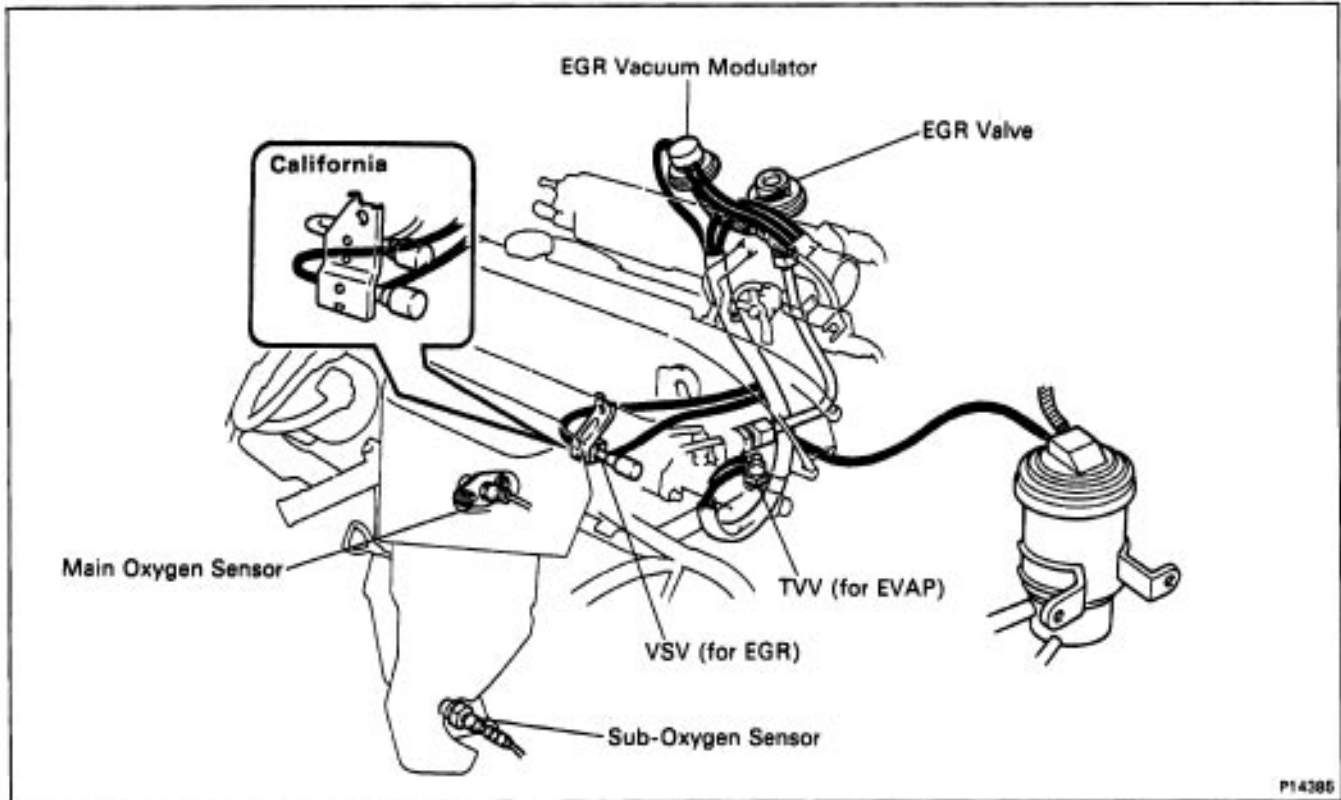
## SSM (SPECIAL SERVICE MATERIALS)

88881-81

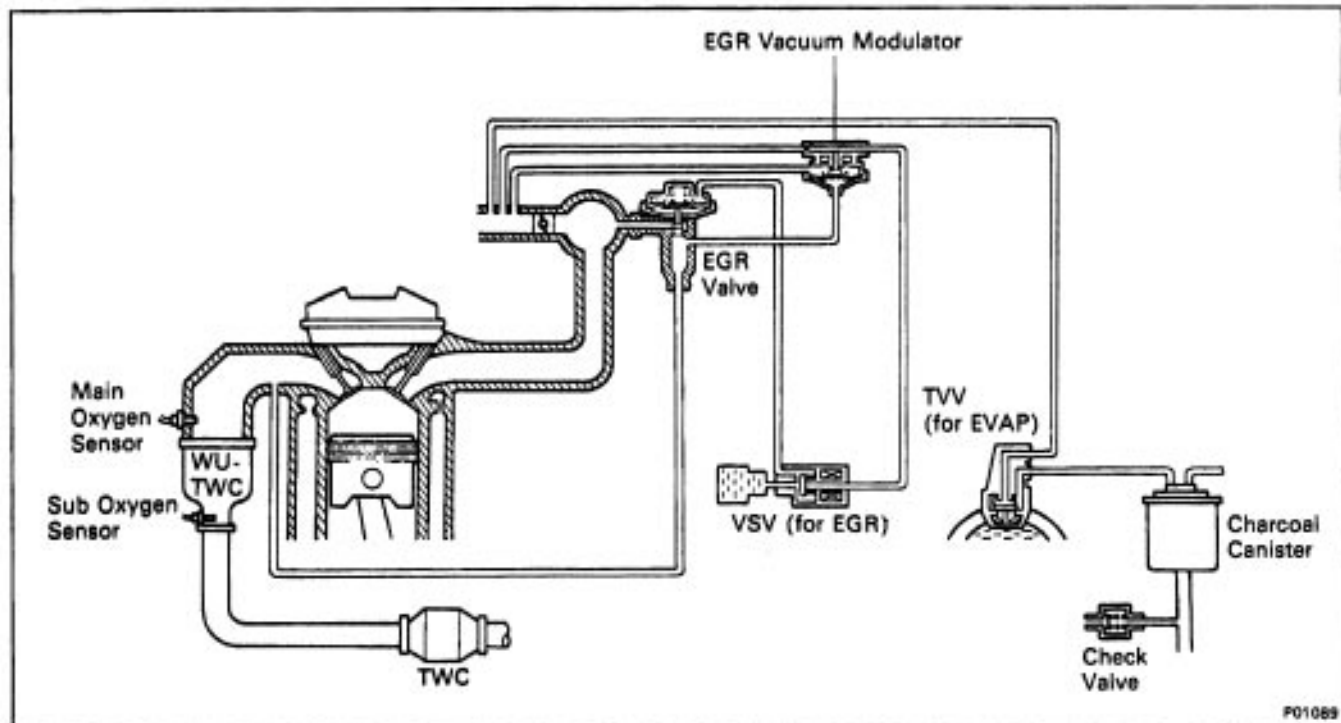
08833-00070 Adhesive 1311, THREE BOND 1311 or equivalent	22V
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# LAYOUT AND SCHEMATIC DRAWING

88067-68

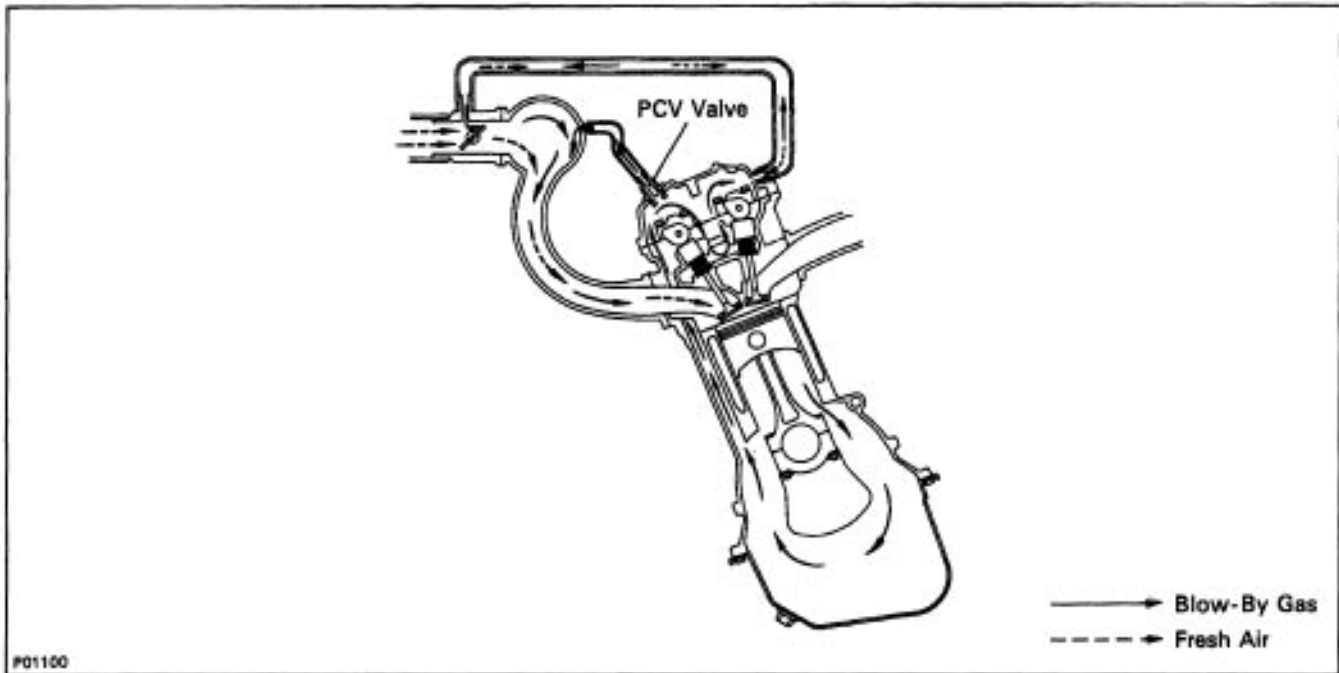


P14385



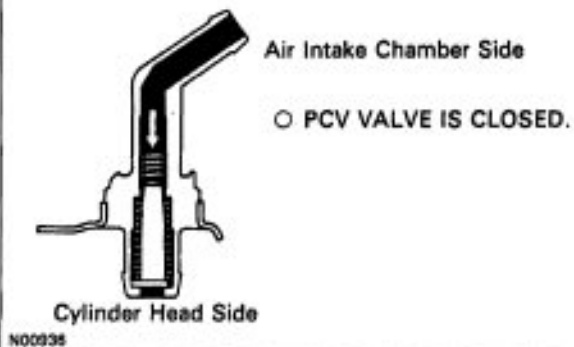
P01089

# POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

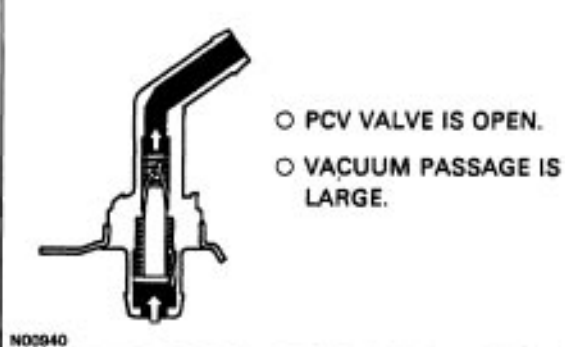


To reduce HC emission, crankcase blow-by gas is routed through the PCV valve to the air intake chamber for combustion in the cylinders.

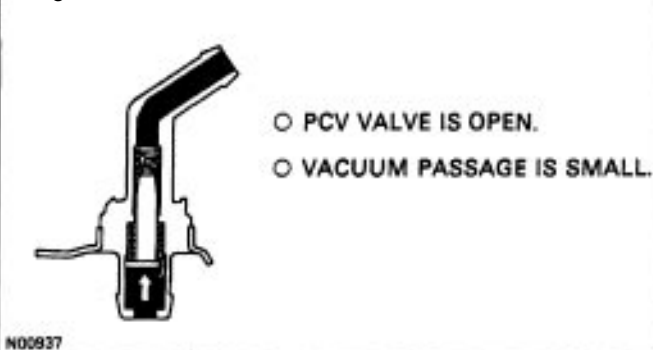
Engine not Running



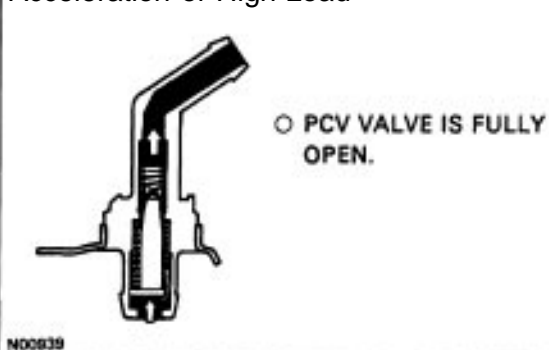
Normal Operation

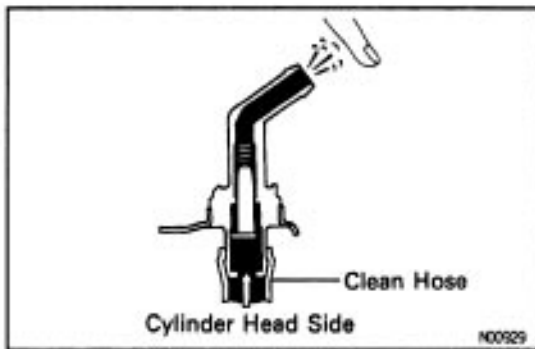


Idling or Deceleration



Acceleration or High Load





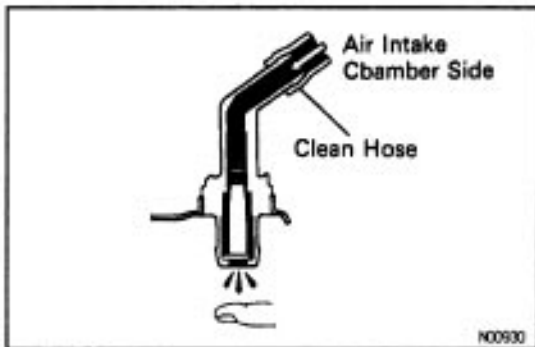
## PCV VALVE INSPECTION

1. REMOVE PCV VALVE
2. INSTALL CLEAN HOSE TO PCV VALVE
3. BLOW AIR FROM CYLINDER HEAD SIDE

Check that air passes through easily.

**NOTICE:** Do not suck air through the valve.

Petroleum substances inside the valve are harmful.

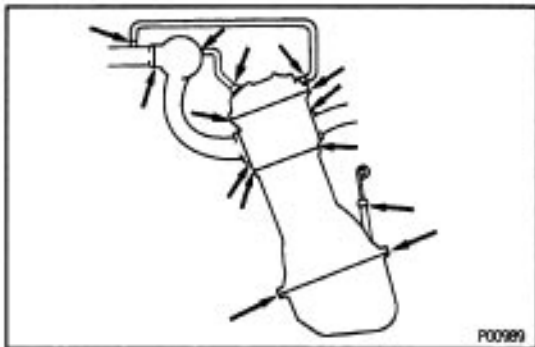


4. BLOW AIR FROM AIR INTAKE CHAMBER SIDE

Check that air passes through with difficulty.

If the PCV valve fails either of the checks, replace it.

5. REMOVE CLEAN HOSE FROM PCV VALVE
6. REINSTALL PCV VALVE



## PCV HOSES AND CONNECTIONS

### INSPECTION

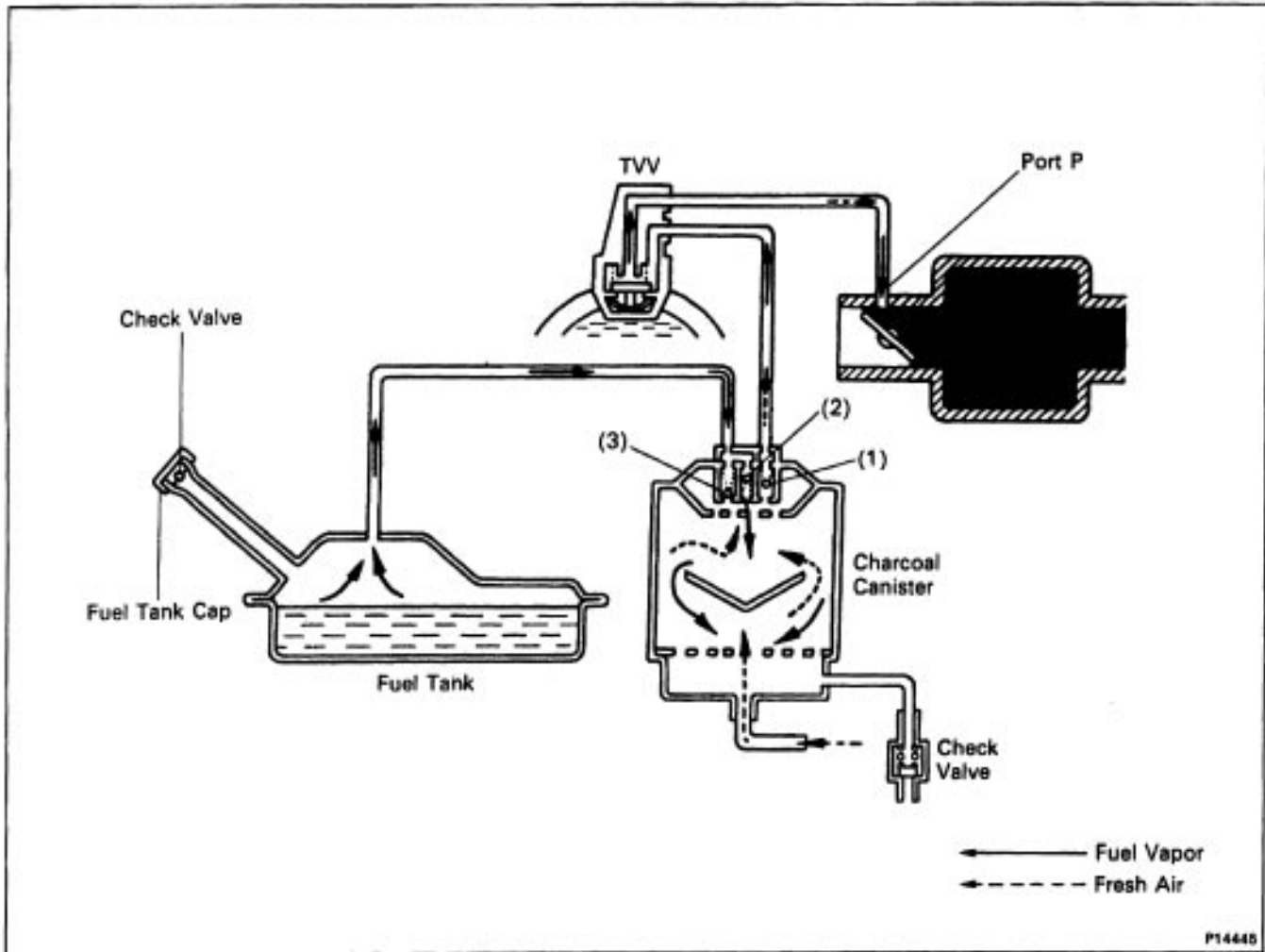
VISUALLY INSPECT HOSES, CONNECTIONS AND GASKETS

Check for cracks, leaks or damage.



# EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

82068-96

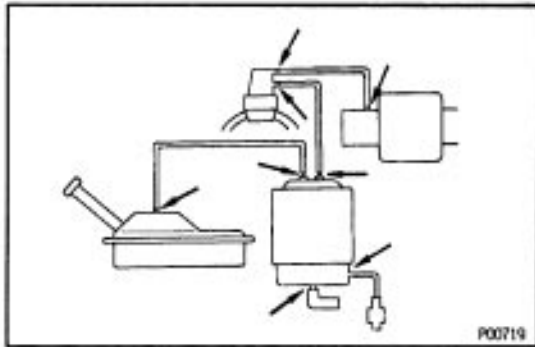


P14448

To reduce NC emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.

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	-	-	-	-	-	NC 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 tank	-	-	-	CLOSED	OPEN	OPEN	Air is led into the fuel tank.

V04477



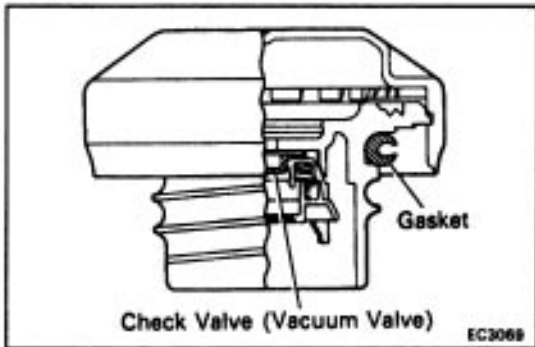
## FUEL VAPOR LINES. FUEL TANK AND TANK CAP INSPECTION

### 1. VISUALLY INSPECT LINES AND CONNECTIONS

Look for loosen connections, sharp bends or damage.

### 2. VISUALLY INSPECT FUEL TANK

Look for deformation, cracks or fuel leakage.



### 3. VISUALLY INSPECT FUEL TANK CAP

Check if the cap and/or gasket are deformed or damaged.

If necessary, repair or replace the cap.

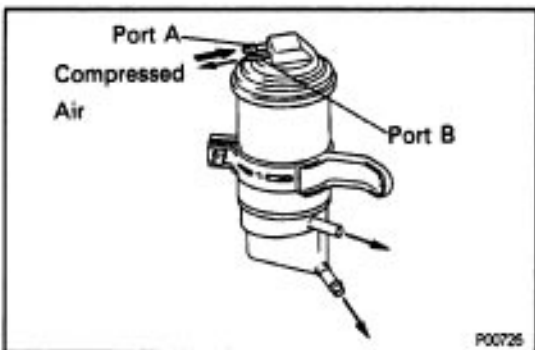


## CHARCOAL CANISTER INSPECTION

### 1. REMOVE CHARCOAL CANISTER

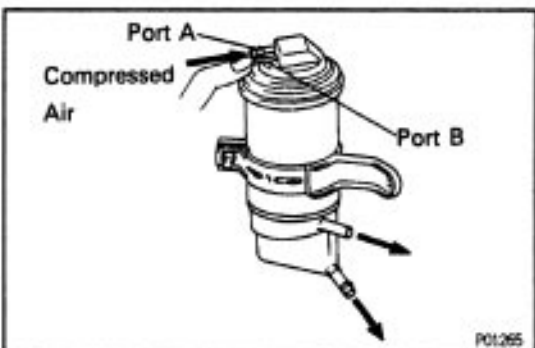
### 2. VISUALLY INSPECT CHARCOAL CANISTER

Look for cracks or damage.



### 3. CHECK FOR CLOGGED FILTER AND STUCK CHECK VALVE

- Using low pressure compressed air (4.71 kPa, 48 gf/cm<sup>2</sup>, 0.68 psi), blow into port A and check that air flows without resistance from the other ports.
  - Blow air (4.71 kPa, 48 gf/cm<sup>2</sup>, 0.68 psi) into port B and check that air does not flow from the other ports.
- If a problem is found, replace the charcoal canister.



### 4. CLEAN FILTER IN CANISTER

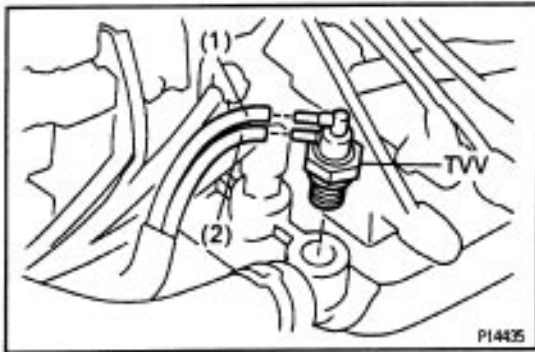
Clean the filter by blowing 294 kPa (3 kgf/cm<sup>2</sup>, 43 psi) of compressed air into port A while holding port B closed.

#### NOTICE:

- Do not attempt to wash the canister.
- No activated carbon should come out.

### 5. REINSTALL CHARCOAL CANISTER

88387-01

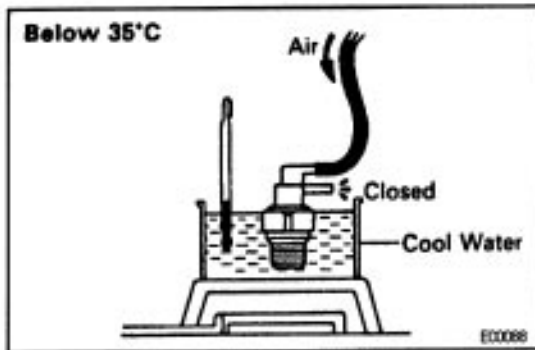


## TVV INSPECTION

### 1. DRAIN ENGINE COOLANT

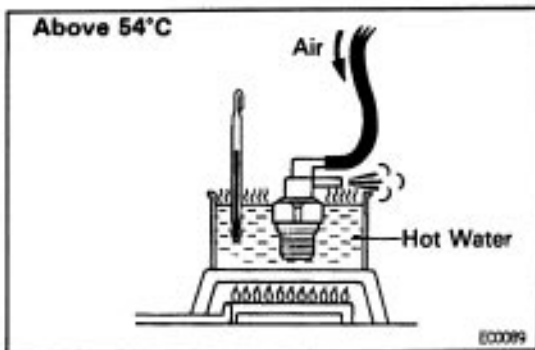
### 2. REMOVE TVV FROM WATER INLET HOUSING

- Disconnect the following hoses:
  - Vacuum hose (from throttle body)
  - Vacuum hose (from charcoal canister)
- Remove the TVV.

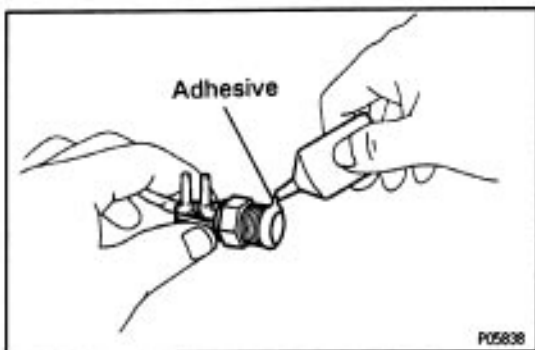


### 3. INSPECT TVV OPERATION

- Cool the TVV to below 35 C (95 F) with cool water.
- Check that air does not flow from the upper port to lower port.



- Heat the TVV to above 54 C (129 F) with hot water.
- Check that air flows from the upper port to lower port.  
If operation is not as specified, replace the TVV.



### 4. REINSTALL TVV

- Apply adhesive to 2 or 3 threads of the TVV, and install it.

Adhesive:

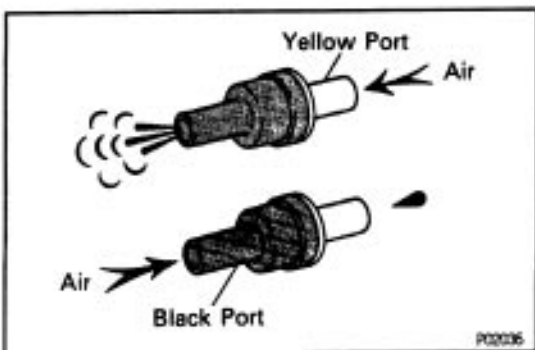
**Part No. 08833-00070, THREE BOND 1324  
or equivalent**

**Torque: 29 N-m (300 kgf-cm, 22 ft-lbf)**

- Reconnect 2 vacuum hoses.

### 5. REFILL WITH ENGINE COOLANT

88387-02



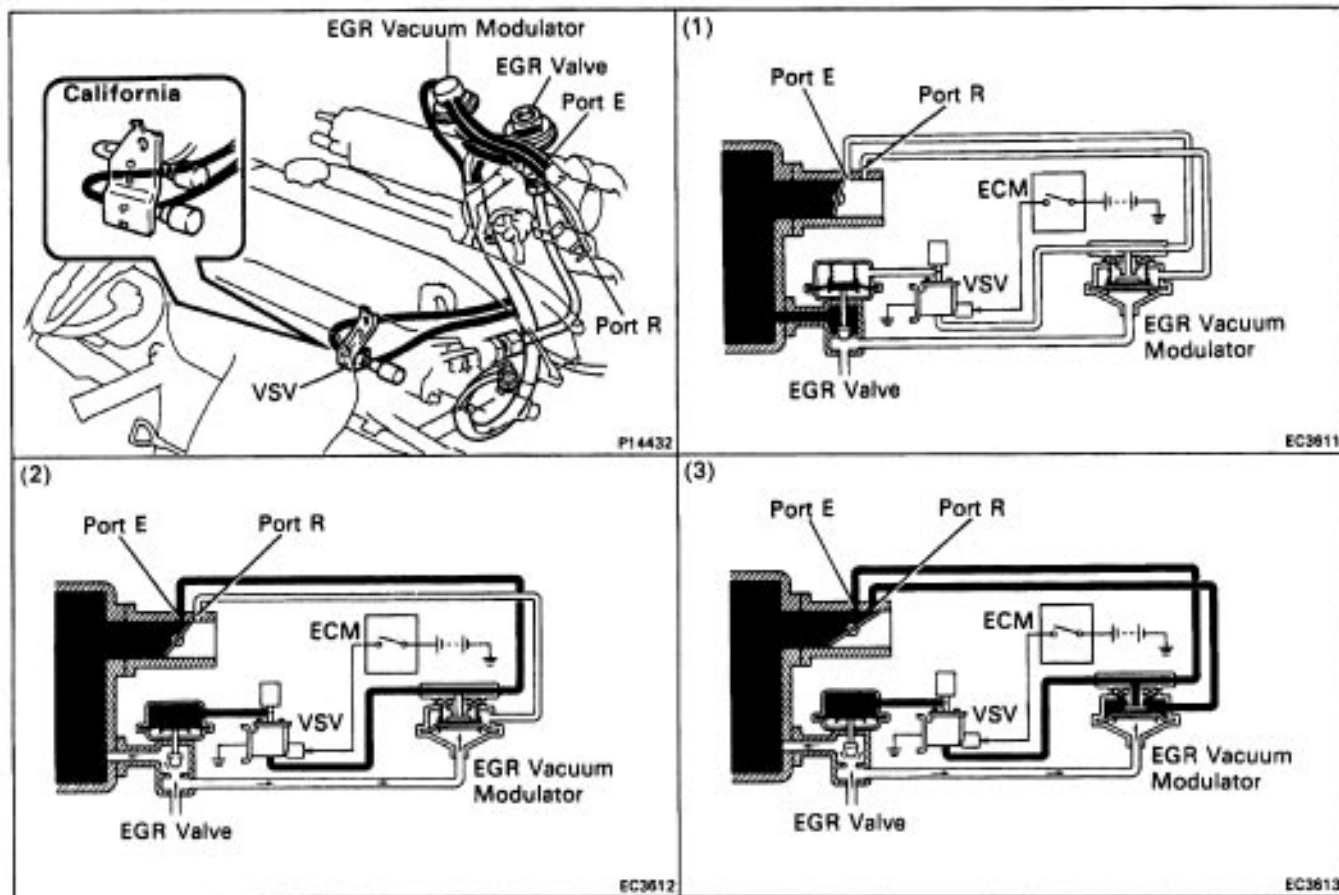
## CHECK VALVE INSPECTION

### INSPECT CHECK VALVE

- Check that air flows from the yellow port to the black port.
- Check that air does not flow from the black port to the yellow port.  
If operation is not as specified, replace the check valve.

# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

80086-08

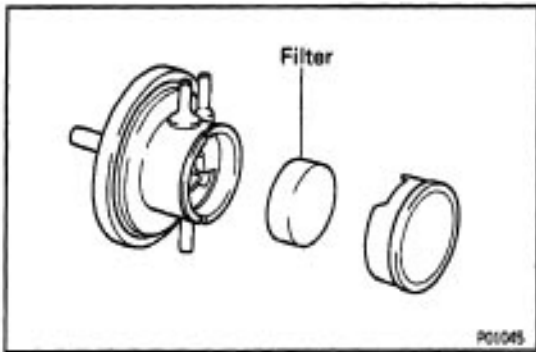


ECT	RPM	PIM (ECM)	VSV	Throttle Valve Opening Angle	Pressure the EGR Valve Pressure Chamber		EGR Vacuum Modulator	EGR Valve	Exhaust Gas
Below 55°C (131°F)	-	-	CLOSED	-	-		-	CLOSED	Not recirculated
Above 60°C (140°F)	Below 4,000 rpm	OFF	CLOSED	Position below port E	-		-	CLOSED	Not recirculated
			CLOSED	Position below port E	(1)	-	-	CLOSED	Not recirculated
		ON	OPEN	Positioned between port E and port R	(2) HIGH	*	CLOSES passage to atmosphere	OPEN	Recirculated
	Above 4,000 rpm	OFF	CLOSED	Position above port R	(3) HIGH	**	CLOSES passage to atmosphere	OPEN	Recirculated (increase)
				-	-		-	CLOSED	Not Recirculated

\* Pressure increases → Modulator closes → EGR valve opens → Pressure drops  
 → EGR valve closes ← Modulator opens ←

\*\* 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.

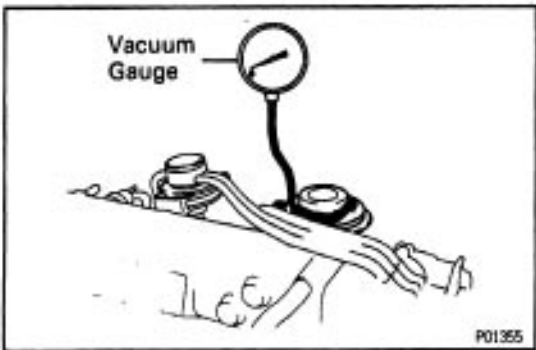


## EGR SYSTEM INSPECTION

### 1. CHECK AND CLEAN FILTER IN EGR VACUUM MODULATOR

- Check the filter for contamination or damage.
- Using compressed air, clean the filter.

HINT: Install the filter with the coarser surface facing the atmospheric side (outward).

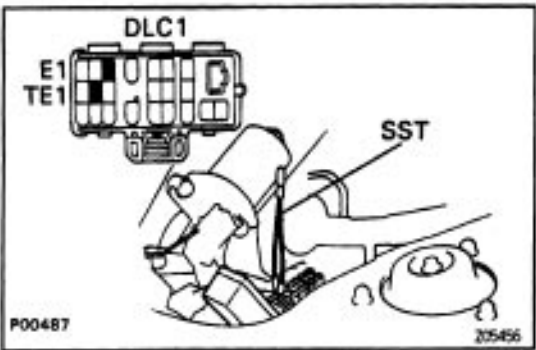


### 2. PREPARATION

Using a 3-way connector, connect a vacuum gauge to the hose between the EGR valve and VSV.

### 3. CHECK SEATING OF EGR VALVE

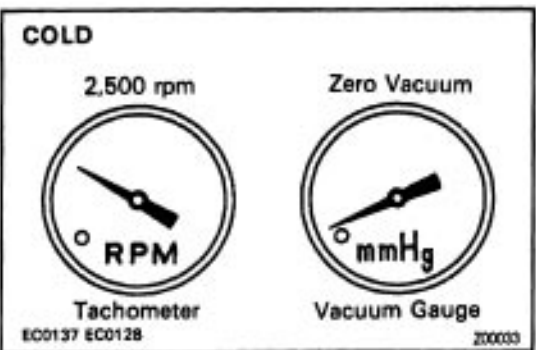
Start the engine and check that the engine starts and runs at idle.



### 4. CONNECT TERMINALS TE1 AND E1

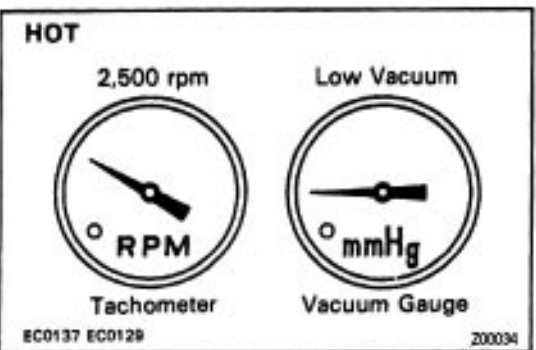
Using SST, connect terminals TE 1 and E 1 of the data link connector 1.

SST 09843-18020



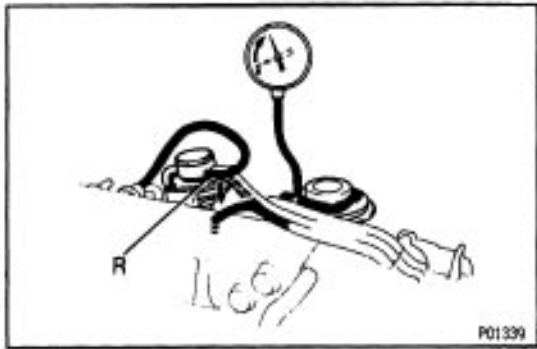
### 5. CHECK VSV

- The engine coolant temperature should be below 60°C (140°F) (A/T) or 55°C (131°F) (M/T).
- Check that the vacuum gauge indicates zero at 2,500 rpm.



### 6. CHECK VSV AND EGR VACUUM MODULATOR WITH HOT ENGINE

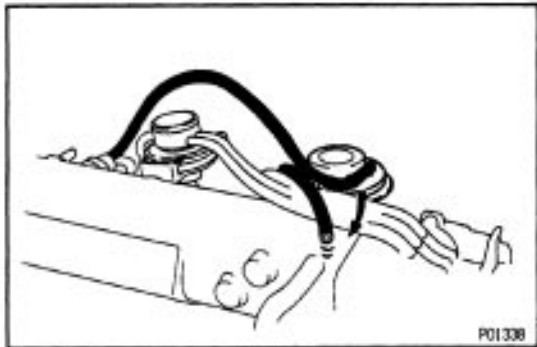
- Warm up the engine.
- Check that the vacuum gauge indicates low vacuum at 2,500 rpm.



- (c) Disconnect the vacuum hose port R of the EGR vacuum modulator and connect port R directly to the intake manifold with another hose.
- (d) Check that the vacuum gauge indicates high vacuum at 2,500 rpm.

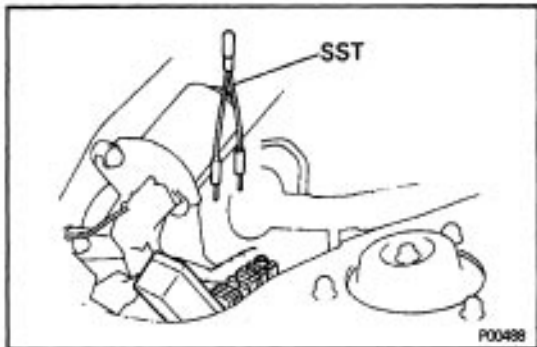
HINT: As a large amount of exhaust gas enters, the engine will misfire slightly.

- (e) Remove the vacuum gauge, and reconnect the vacuum hoses to the proper locations.



## 7. CHECK EGR VALVE

- (a) Apply vacuum directly to the EGR valve with the engine idling.
- (b) Check that the engine runs rough or dies.
- (c) Reconnect the vacuum hoses to the proper locations.

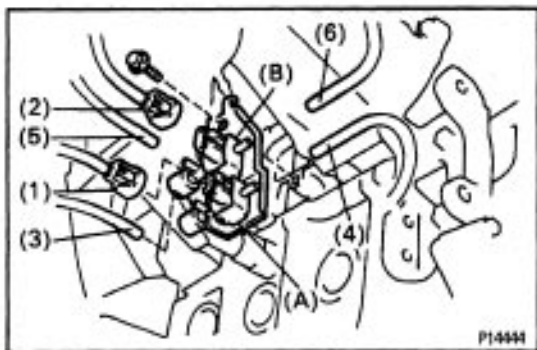


## 8. DISCONNECT TERMINALS TE1 AND E1

Remove the SST.

SST 09843-18020

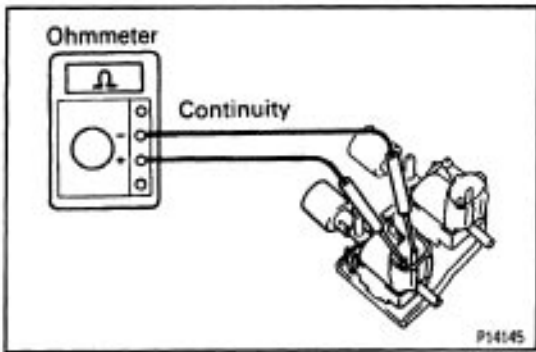
IF NO PROBLEM IS FOUND WITH THIS INSPECTION, SYSTEM IS NORMAL; OTHERWISE INSPECT EACH PART



## VSV INSPECTION (California)

### 1. REMOVE VSV

- (a) Disconnect the following connectors and hoses:
  - (1) VSV for EGR
  - (A) connector
  - (2) VSV for fuel pressure control
  - (B) connector
  - (3) Vacuum hose (from EGR valve) from port E of VSV (A)
  - (4) Vacuum hose (from port "a" of EGR vacuum modulator) from port G of VSV (A)
  - (5) Vacuum hose (from fuel pressure regulator) from port E of VSV (B)
  - (6) Vacuum hose (from air intake chamber) from port G of VSV (B)
- (b) Remove the bolt and VSV assembly.



## 2. INSPECT VSV

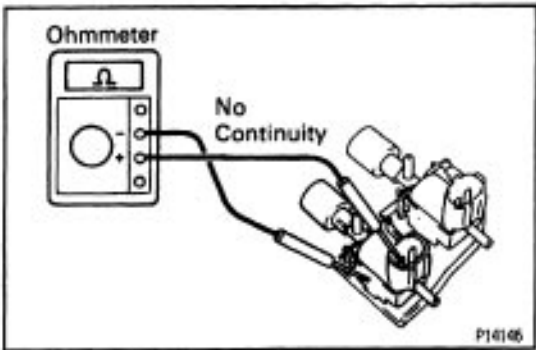
### A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

33–39Ω

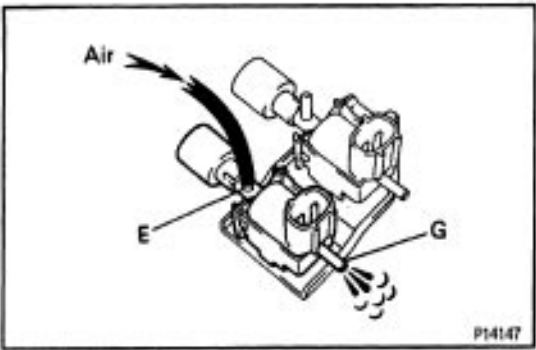
If there is no continuity, replace the VSV.



### B. Inspect VSV for ground

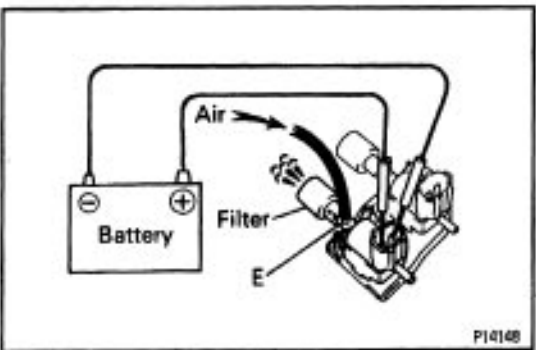
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



### C. Inspect VSV operation

- (a) Check that air flows from port E to port G.

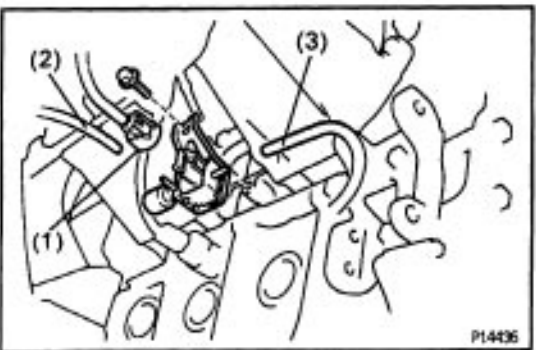


- (b) Apply battery voltage across the terminals.

- (c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

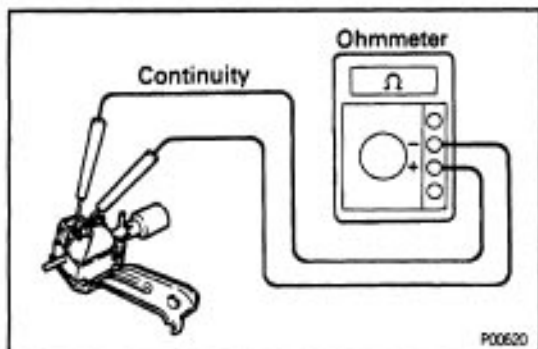
## 3. REINSTALL VSV



## VSV INSPECTION (Except California)

### 1. REMOVE VSV

- (a) Disconnect the following connector and hoses:
- (1) VSV connector
  - (2) Vacuum hose (from EGR valve) from port E of VSV
  - (3) Vacuum hose (from port "Q" of EGR vacuum modulator) from port G of VSV

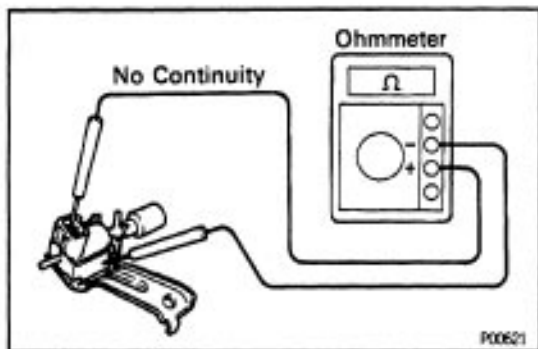
**(b) Remove the bolt and VSV.****2. INSPECT VSV****A. Inspect VSV for open circuit**

Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold):

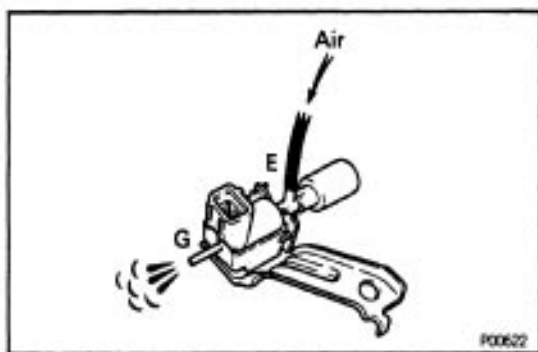
33–39Ω

If there is no continuity, replace the VSV.

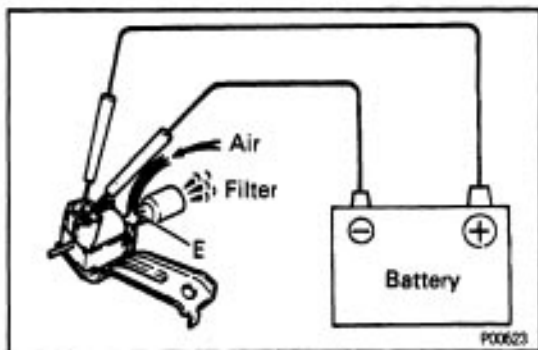
**B. Inspect VSV for ground**

Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.

**C. Inspect VSV operation**

(a) Check that air flows from port E to port G.



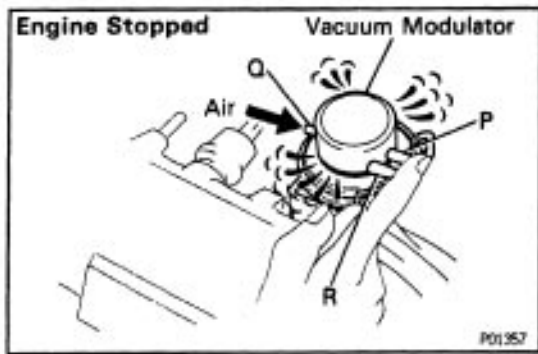
**(b) Apply battery voltage across the terminals.**

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

**3. REINSTALL VSV**

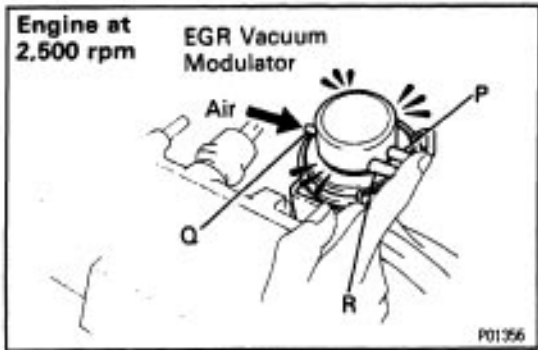




## EGR VACUUM MODULATOR INSPECTION

### CHECK EGR VACUUM MODULATOR OPERATION

- Disconnect the vacuum hoses from ports P, Q and R of the EGR vacuum modulator.
- Block ports P and R with your finger.
- Blow air into port Q, and check that the air passes through to the air filter side freely.
- Start the engine, and maintain speed at 2.500 rpm.
- Repeat the above test. Check that there is a strong resistance to air flow.
- Reconnect the vacuum hoses to the proper locations.



## EGR VALVE INSPECTION

### 1. REMOVE EGR VALVE

Check for sticking and heavy carbon deposits.

If a problem is found, replace the valve.

### 2. REINSTALL EGR VALVE WITH NEW GASKET

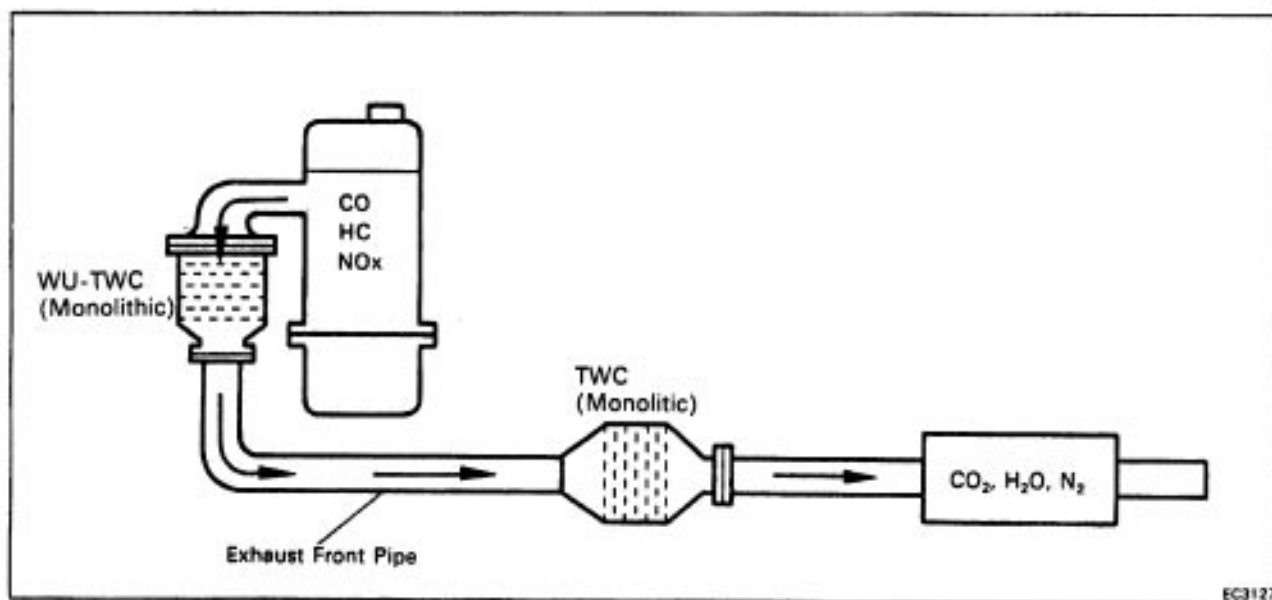
#### Nut

Torque: 13 N-m (130 kgf-cm, 9 ft-lbf)

#### Union nut

Torque: 59 N-m (600 kgf-cm, 43 ft-lbf)

## THREE-WAY CATALYTIC CONVERTER (TWC) SYSTEM

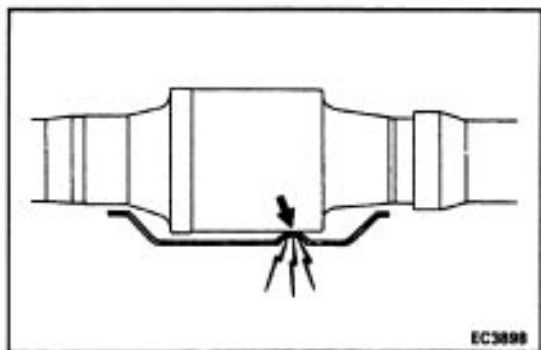


To reduce CO, HC and NO<sub>x</sub> emissions, they are oxidized, reduced and converted to carbon dioxide (CO<sub>2</sub>), water (H<sub>2</sub>O) and nitrogen (N<sub>2</sub>) by the catalyst.

Exhaust Port		WU-TWC		TWC		Exhaust Gas
CO HC NO <sub>x</sub>	→	OXIDATION AND REDUCTION	→	OXIDATION AND REDUCTION	→	CO <sub>2</sub> H <sub>2</sub> O N <sub>2</sub>

### EXHAUST PIPE ASSEMBLY INSPECTION

1. CHECK CONNECTIONS FOR LOOSENESS OR DAMAGE
2. CHECK CLAMPS FOR WEAKNESS, CRACKS OR DAMAGE

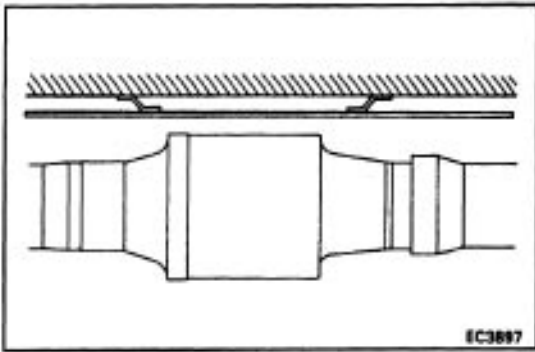


### THREE-WAY CATALYTIC CONVERTER INSPECTION

#### TWC:

#### CHECK FOR DENTS OR DAMAGE

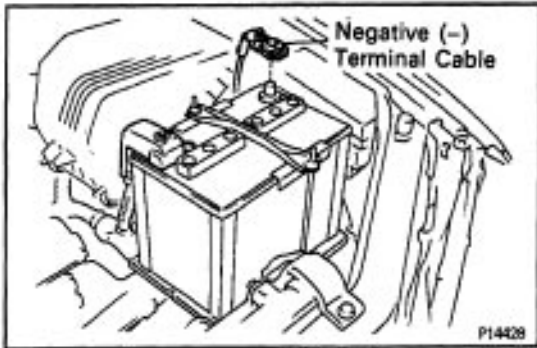
If any part of protector is damaged or dented to the extent that it contacts the TWC, repair or replace it.



## HEAT INSULATOR INSPECTION

### TWC:

1. CHECK HEAT INSULATOR FOR DAMAGE
2. CHECK FOR ADEQUATE CLEARANCE BETWEEN THREE – WAY CATALYTIC CONVERTER AND HEAT INSULATOR



## THREE-WAY CATALYTIC CONVERTER REPLACEMENT

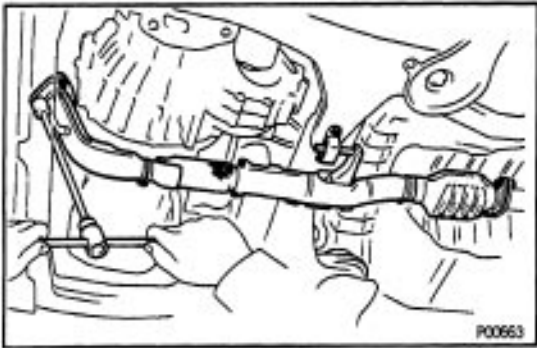
### WU-TWC:

1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (-) terminal cable is disconnected from the battery.

2. REMOVE FRONT EXHAUST PIPE

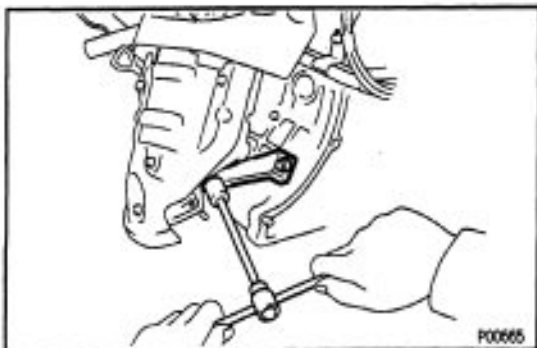
- (a) Loosen the 2 bolts, and disconnect the bracket.
- (b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.



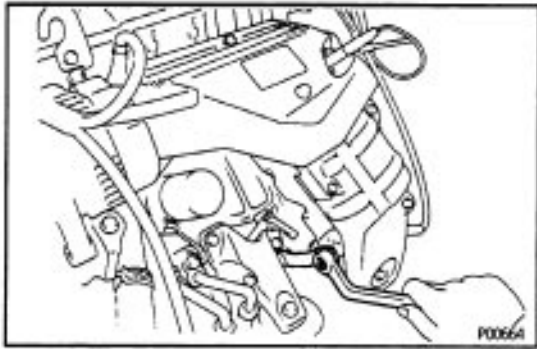
- (c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU-TWC.
- (d) Remove the front exhaust pipe and gaskets.

3. REMOVE WARM UP THREE – WAY CATALYTIC CONVERTER

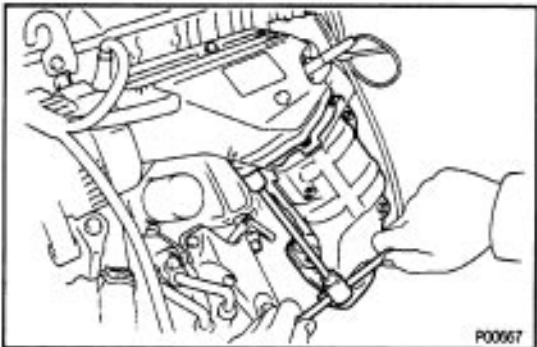
- (a) Check that the WU-TWC is cool.
- (b) Disconnect the sub oxygen sensor connector.



- (c) Remove the bolt, nut and No. 1 manifold stay.

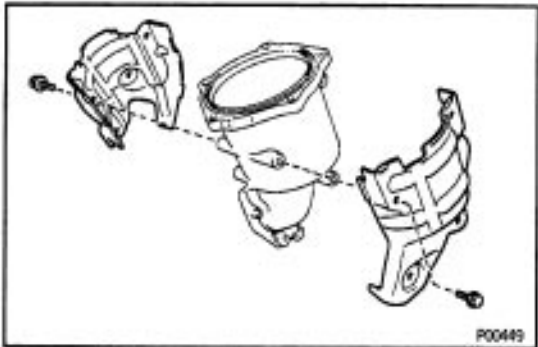


(d) Remove the bolt, nut and manifold stay.



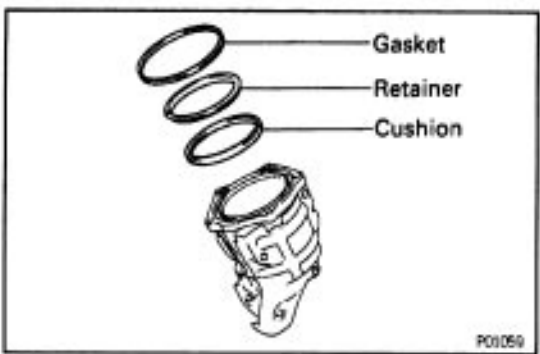
(e) Remove the 3 bolts, 2 nuts, WU –TWC, gasket, re-tainer and cushion.

(f) Remove the 8 bolts and 2 heat insulators from the WU –TWC.

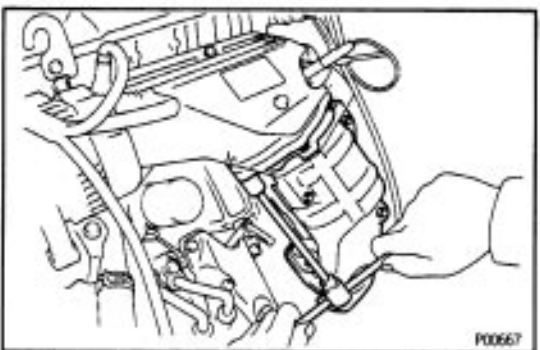


#### 4. REINSTALL WARM-UP THREE-WAY CATALYTIC CONVERTER

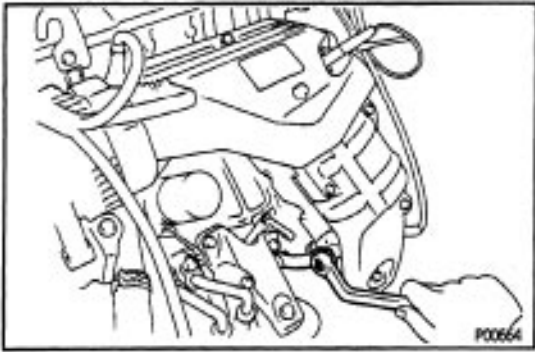
(a) Install the 2 heat insulators to a new WU –TWC with the 8 bolts.



(b) Place new cushion, retainer and gasket on the WU–TWC.

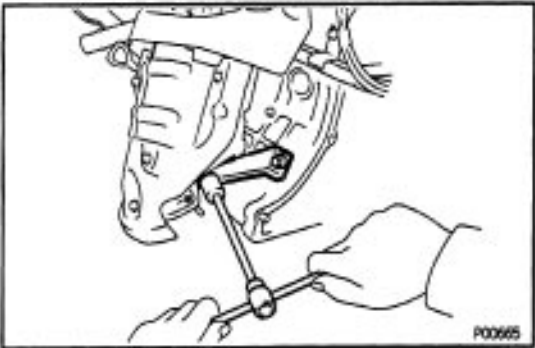


(c) Install the WU–TWC with the 3 bolts and 2 new nuts.  
**Torque: 29 N–m (300 kgf–cm, 22 ft–lbf)**



(d) Install the manifold stay with the bolt and nut.

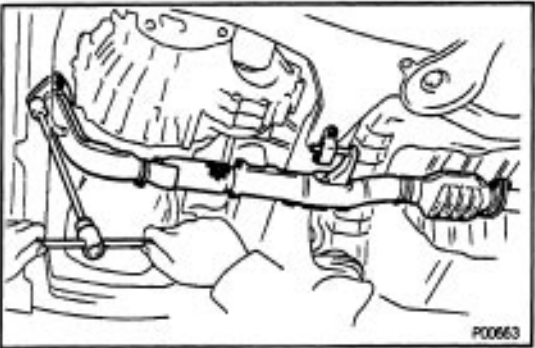
**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**



(e) Install the No. 1 manifold stay with the bolt and nut.

**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**

(f) Connect the sub oxygen sensor connector.



## 5. REINSTALL FRONT EXHAUST PIPE

(a) Place 2 new gaskets on the front and rear of the front exhaust pipe.

(b) Temporarily install the 2 bolts and 2 new nuts holding the front exhaust pipe to the center exhaust pipe.

(c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.

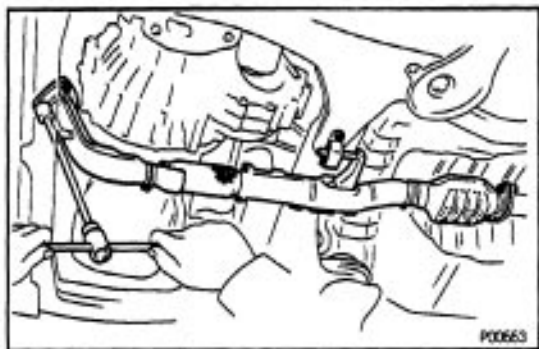
**Torque: 62 N-m (630 kgf-cm, 46 ft-lbf)**

(d) Tighten the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.

**Torque: 58 N-m (570 kgf-cm, 41 ft-lbf)**

(e) Install the bracket with the 2 bolts.

## 6. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

**TWC:****1. REMOVE FRONT EXHAUST PIPE (THREE – WAY CATALYTIC CONVERTER)**

- (a) Loosen the 2 bolts, and disconnect the bracket.
- (b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
- (c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU-TWC.
- (d) Remove the front exhaust pipe and gasket.

**2. REINSTALL FRONT EXHAUST PIPE (THREE-WAY CATALYTIC CONVERTER)**

- (a) Place 2 new gaskets on the front and rear of the front exhaust pipe.
- (b) Temporarily install the 2 bolts and 2 new nuts holding the front exhaust pipe to the center exhaust pipe.
- (c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU –TWC.  
**Torque: 412 N-m (630 kgf-cm, 46 ft-lbf)**
- (d) Tighten the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.  
**Torque: 58 N-m (570 kgf-cm, 41 ft-lbf)**
- (e) Install the bracket with the 2 bolts.

# SERVICE SPECIFICATIONS

## SERVICE DATA

8000P-27

VSV (for EGR)	Resistance	at 20°C (68°F)	33 – 39 Ω
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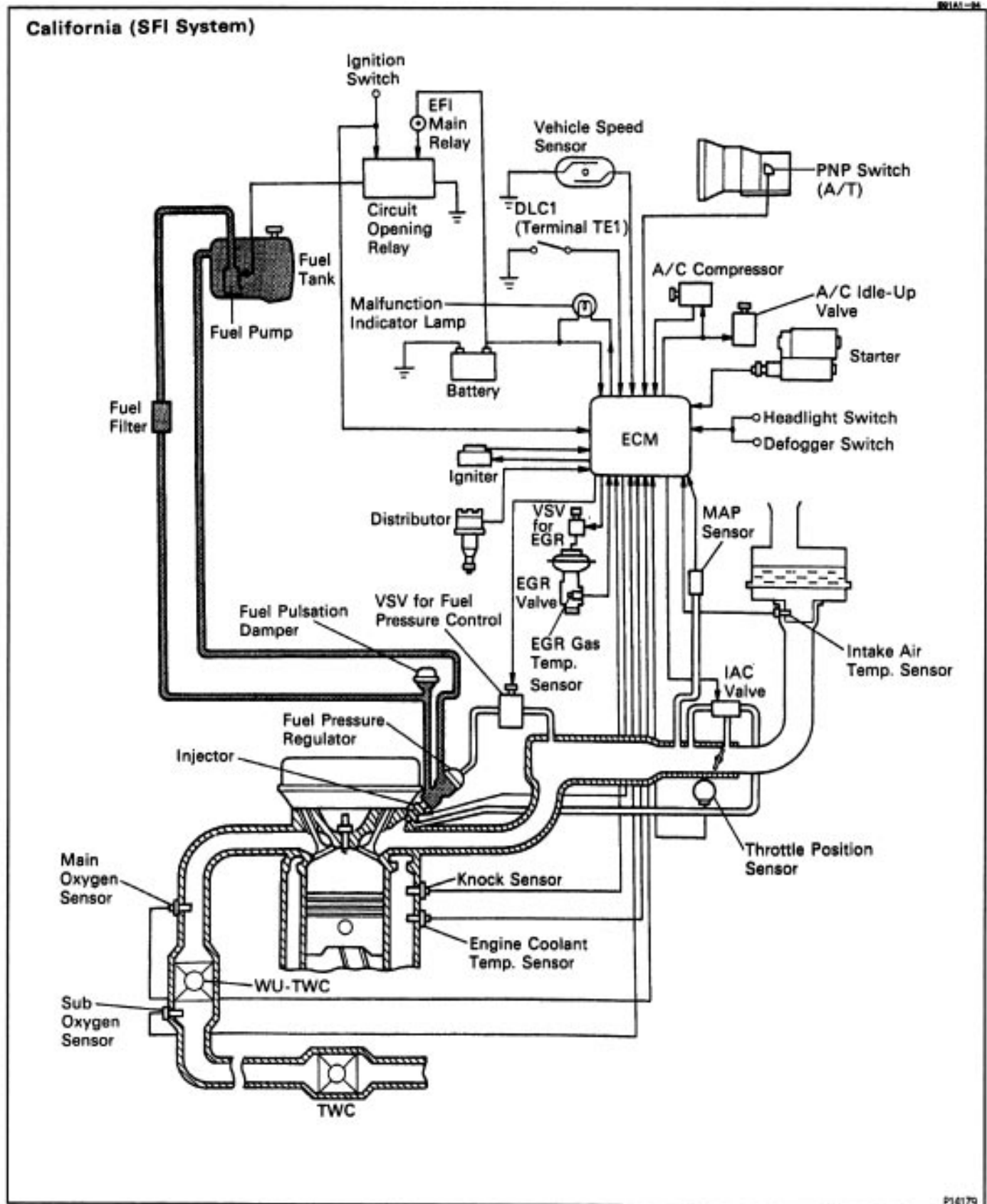
8000Q-3L

## TORQUE SPECIFICATIONS

Part tightened	N-m	kgf-cm	ft-lbf
TVV x Water outlet housing	29	300	22
EGR valve x Intake manifold	13	130	9
EG R valve x EGR pipe	59	600	43
WU-TWC x Exhaust manifold	29	300	22
Exhaust manifold stay x WU-TWC	42	425	31
Exhaust manifold stay x FR engine mounting insulator	42	425	31
No.1 exhaust manifold stay x WU-TWC	42	425	31
No.1 exhaust manifold stay x Cylinder block	42	425	31
Front exhaust pipe x WU-TWC	62	630	46
Front exhaust pipe x Center exhaust pipe	56	570	41

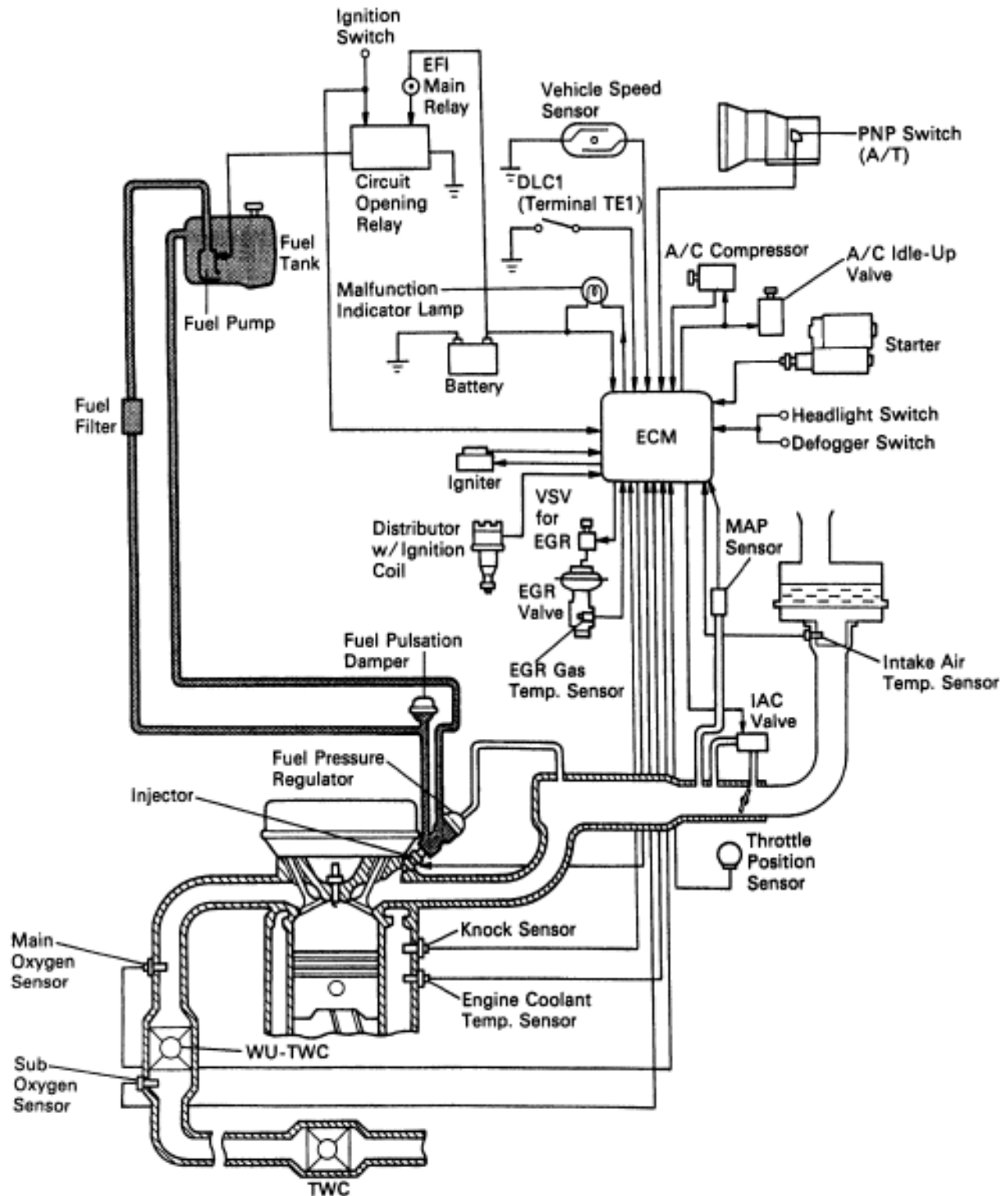
# MFI/SFI SYSTEM

## DESCRIPTION





## Except California (MFI System)



The MFI (Multiport Fuel Injection)/SFI (Sequential Multiport Fuel Injection) system is composed of 3 basic sub-systems: Fuel, Air Induction and Electronic Control Systems.

## FUEL SYSTEM

Fuel is supplied under constant pressure to the MFI/SFI injectors by an electric fuel pump. The injectors inject a metered quantity of fuel into the intake port in accordance with signals from the ECM (Engine Control Module).

## AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

## ELECTRONIC CONTROL SYSTEM

The CAMRY 5S-FE engine is equipped with a TOYOTA Computer Controlled System (TCCS) which centrally controls the MFI/SFI, ESA, IAC diagnosis systems etc. by means of an Engine Control Module (ECM—formerly MFI/SFI computer) employing a microcomputer.

The ECM controls the following functions:

1. Multiport Fuel Injection (MFI)/Sequential Multiport Fuel Injection (SFI)

The ECM receives signals from various sensors indicating changing engine operation conditions such as:

Intake manifold pressure

Intake air temperature

Engine coolant temperature

Engine speed

Throttle valve opening angle

Exhaust oxygen content etc.

The signals are utilized by the ECM to determine the injection duration necessary for an optimum air-fuel ratio.

2. Electronic Spark Advance (ESA)

The ECM is programmed with data for optimum ignition timing under all operating conditions.

Using data provided by sensors which monitor various engine functions (RPM, engine coolant temperature, etc.), the microcomputer (ECM) triggers the spark at precisely the right instant.

3. Idle Air Control (IAC)

The ECM is programmed with target idling speed values to respond to different engine conditions (engine coolant temperature, air conditioning ON/OFF, etc.). Sensors transmit signals to the ECM which controls the flow of air through the bypass of the throttle valve and adjusts idle speed to the target value.

4. Diagnosis

The ECM detects any malfunctions and abnormalities in the sensor network and lights a malfunction indicator lamp in the combination meter. At the same time, trouble is identified and a diagnostic trouble code is recorded by the EC

5. The diagnostic trouble code can be read by the

number of blinks of the malfunction indicator lamp when terminals TE1 and E1 are connected.

The diagnostic trouble codes are referred to in later page. (See page [EG1-300](#))

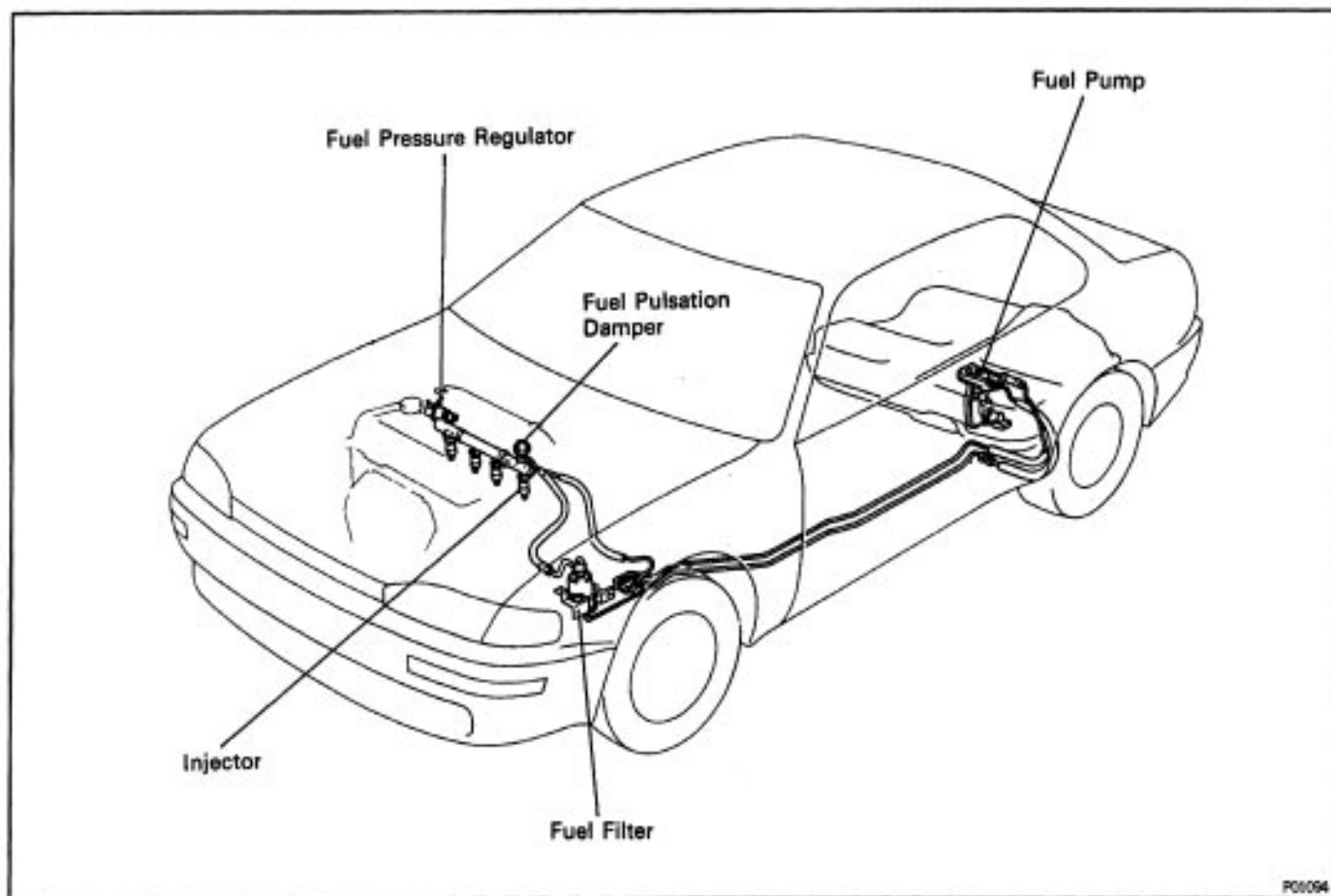
Fail-Safe Function

In the event of the sensor malfunction, a back-up circuit will take over to provide minimal driveability, and the malfunction indicator lamp will illuminate.

## OPERATION

### FUEL SYSTEM

IMAGE-06



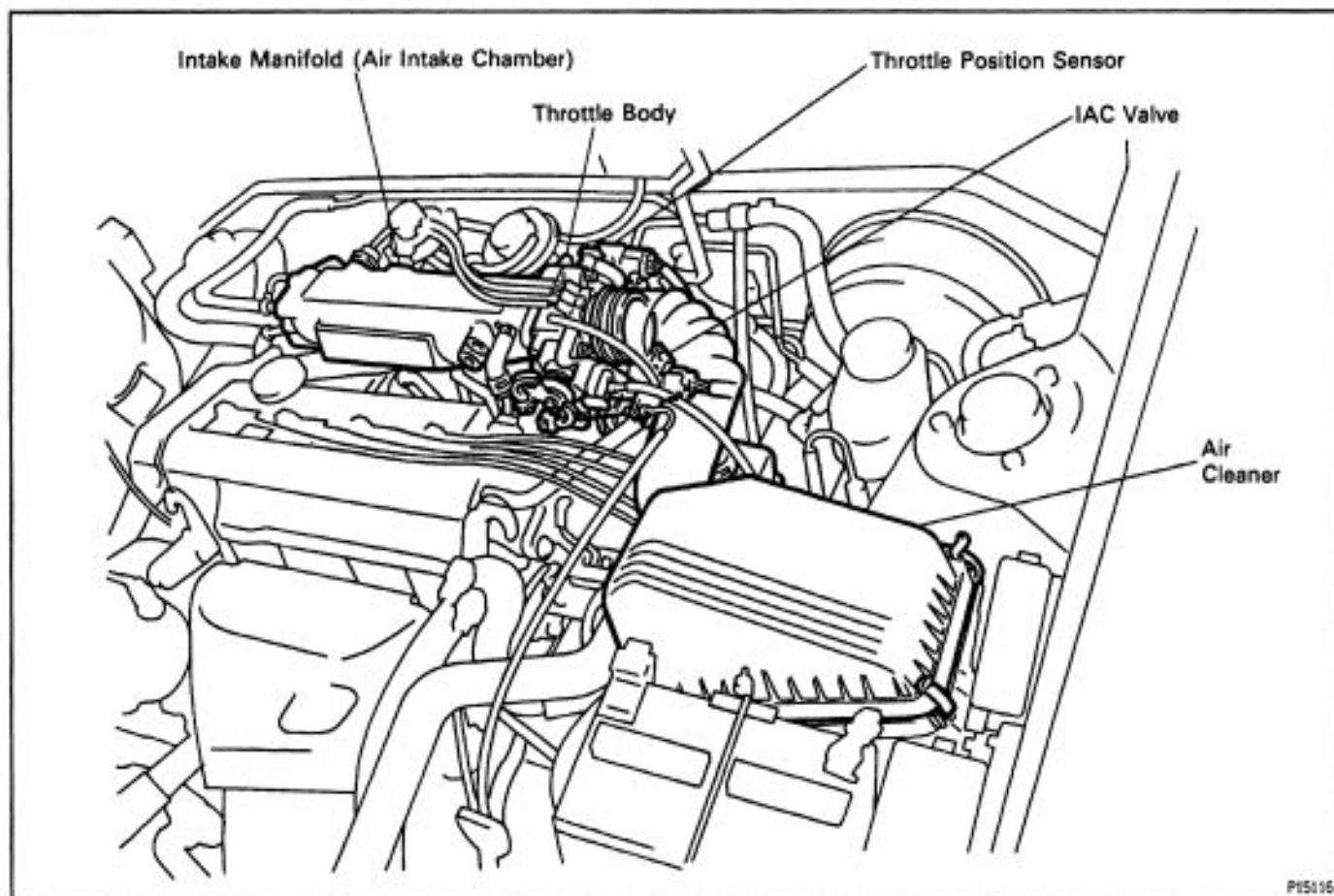
Fuel pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector at a set pressure maintained by the pressure regulator.

The fuel pressure regulator adjusts the pressure of the fuel from the fuel line (high pressure side) to a pressure 284 kPa (2.9 kgf/cm<sup>2</sup>, 41 psi) higher than the pressure inside the cylinder head, and excess fuel is returned to the fuel tank through the return pipe.

The pulsation damper absorbs the slight fluctuations in fuel pressure caused by fuel injector from the injector.

The injectors operate on input of injection signals from the ECM and inject fuel into the cylinder head.

## AIR INDUCTION SYSTEM

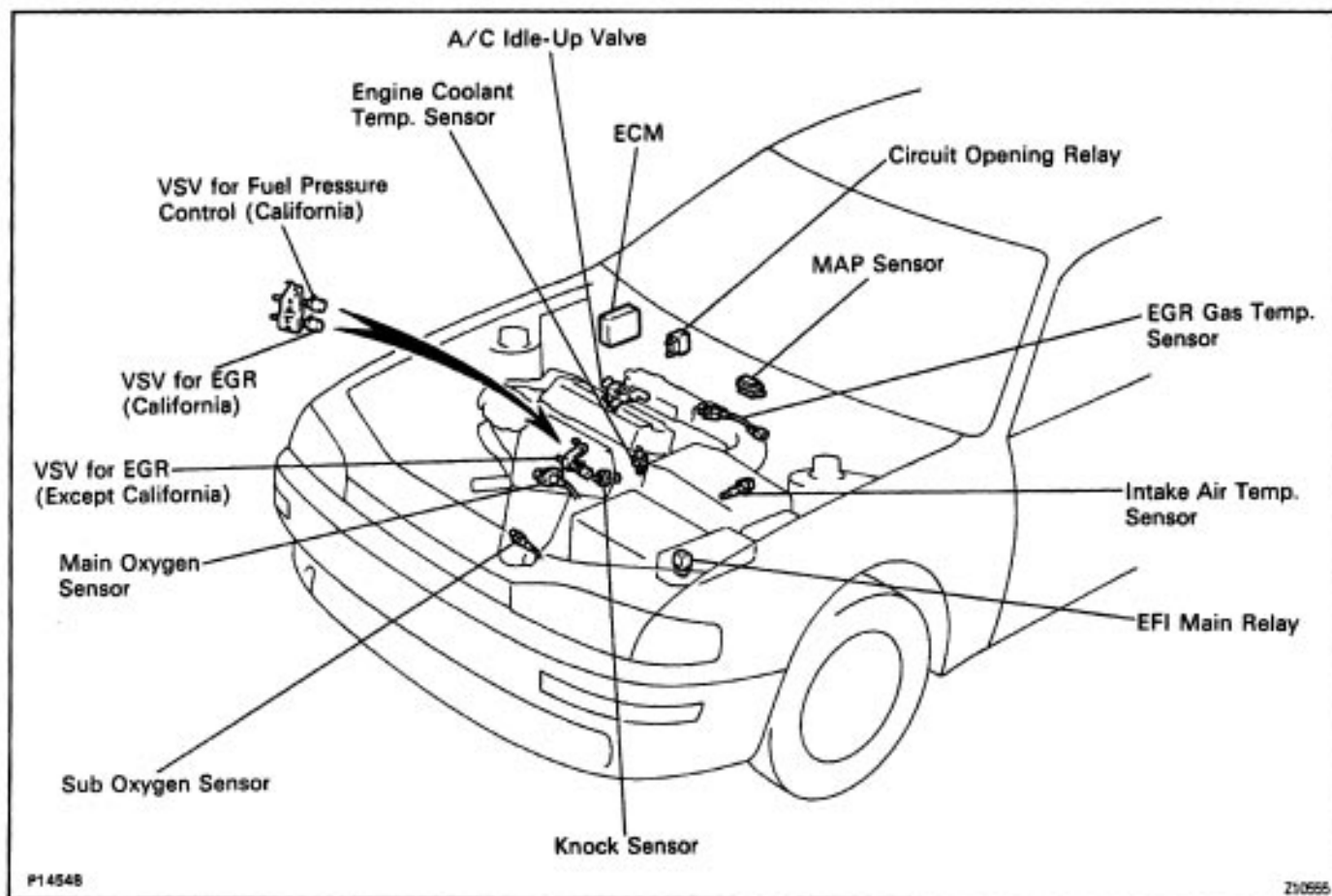


Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combustion chamber.

At low temperatures the IAC valve opens and the air flows through the IAC valve and the throttle body, into the air intake chamber. During engine warming up, even if the throttle valve is completely closed, air flows to the air intake chamber, thereby increasing the idle speed (first idle operation).

The air intake chamber prevents pulsation of the intake air. It also prevents intake air interference in each cylinder.

## ELECTRONIC CONTROL SYSTEM











The control system consists of sensors which detect various engine conditions, and a ECM which determines the injection volume (timing) based on the signals from the sensors.

The various sensors detect the intake air pressure, engine speed, oxygen density in the exhaust gas, engine coolant temperature, intake air temperature and atmospheric pressure etc. and convert the information into an electrical signal which is sent to the ECM. Based on these signals, the ECM calculates the optimum ignition timing for the current conditions and operates the injectors.

The ECM not only controls the fuel injection timing, but also the self diagnostic function which records the occurrence of a malfunction, ignition timing control, idle speed control and EGR control.




**PREPARATION****SST (SPECIAL SERVICE TOOLS)**

B906F-01

	09268-41045 Injection Measuring Tool Set	
	(09268-41080) No.6 union	
	(09268-41090) No.7 union	
	(90405-09015) No.1 Union	
	09268-45012 EFI Fuel Pressure Gauge	
	09631-22020 Power Steering Hose Nut 14 x 17 mm Wrench Set	Fuel line flare nut
	09842-30070 Wiring "F" EFI Inspection	
	09843-18020 Diagnosis Check Wire	

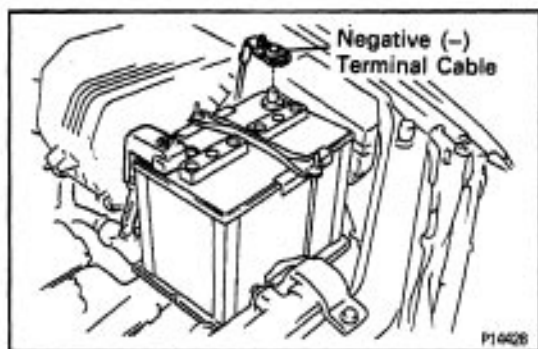
B906G-01

**RECOMMENDED TOOLS**

	09082-00050 TOYOTA Electrical Tester Set	
	09200-00010 Engine Adjust Kit	
	09258-00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.

**EQUIPMENT**

Carburetor cleaner	Throttle body
Graduated cylinder	Injector
Soft brush	Throttle body
Sound scope	Injector
Tachometer	
Torque wrench	
Vacuum gauge	



## PRECAUTION

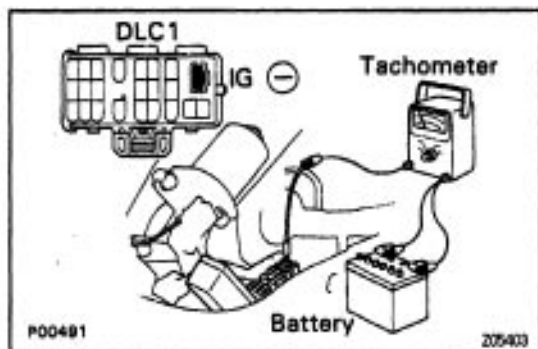
1. Before working on the fuel system, disconnect the negative (-) terminal cable from the battery.

HINT: Any diagnostic trouble code retained by the computer will be erased when the battery terminal is removed.

Therefore, if necessary, read the diagnosis before removing the terminal.

**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (-) terminal cable is disconnected from the battery.

2. Do not smoke or work near an open flame when working on the fuel system.
3. Keep gasoline away from rubber or leather parts.



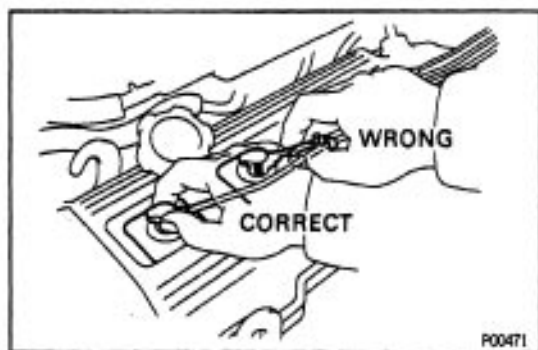
## MAINTENANCE PRECAUTIONS

1. CHECK CORRECT ENGINE TUNE-UP

(See page [EG1-8](#))

2. PRECAUTION WHEN CONNECTING GAUGE

- (a) Use battery as the power source for the timing light, tachometer, etc.
- (b) Connect the tester probe of a tachometer to the terminal IGE) of the data link connector 1.



3. IN EVENT OF ENGINE MISFIRE, FOLLOWING PRECAUTIONS SHOULD BE TAKEN

- (a) Check proper connection of battery terminals, etc.
- (b) Handle high-tension cords carefully.
- (c) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.
- (d) When cleaning the engine compartment, be especially careful to protect the electrical system from water.

4. PRECAUTIONS WHEN HANDLING OXYGEN SENSOR

- (a) Do not allow oxygen sensor to drop or hit against an object.
- (b) Do not allow the sensor to come into contact with water.



## IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

If the vehicle is equipped with a mobile communication system, refer to the precaution in the IN section.

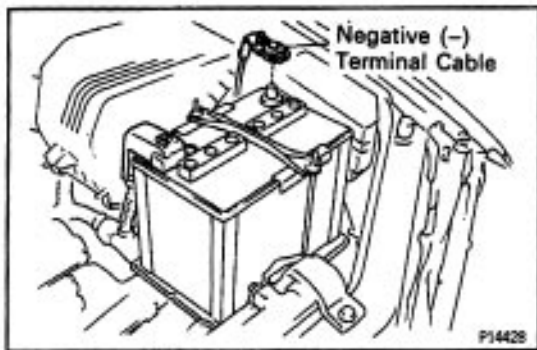
## AIR INDUCTION SYSTEM

BROCK-91

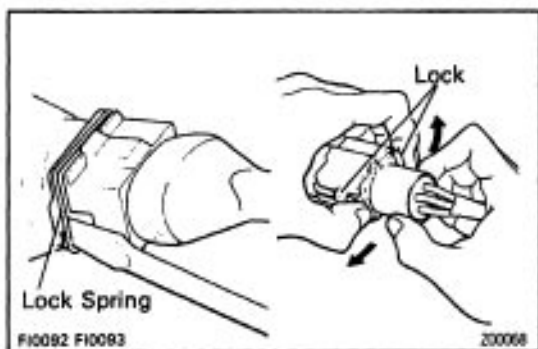
1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause the engine to run out of tune.

## ELECTRONIC CONTROL SYSTEM

BROCK-91

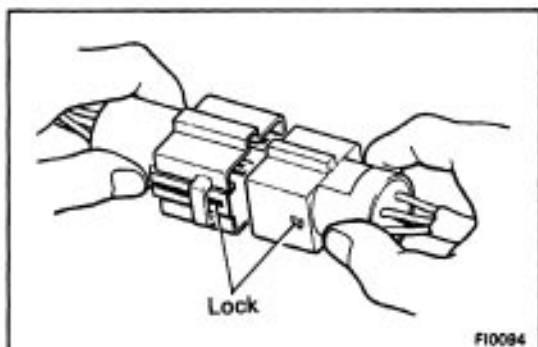


1. Before removing MFI/SFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the battery terminals.  
HINT: Always check the diagnostic trouble code before disconnecting the negative (-) terminal cable from the battery.
2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (-) cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all MFI/SFI parts carefully, especially the ECM.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can further troubles.
5. Do not open the ECM cover.
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the MFI/SFI parts and wiring connectors.
7. Parts should be replaced as an assembly.

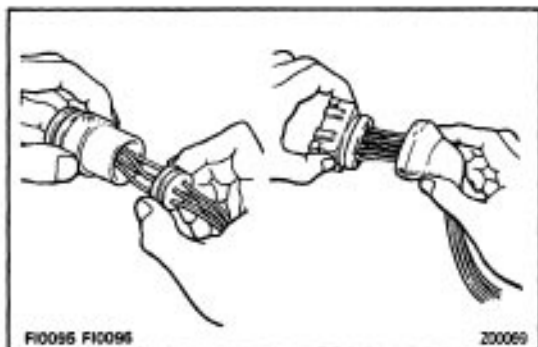


8. Care is required when pulling out and inserting wiring connectors.

- (a) Release the lock and pull out the connector, pulling on the connectors.

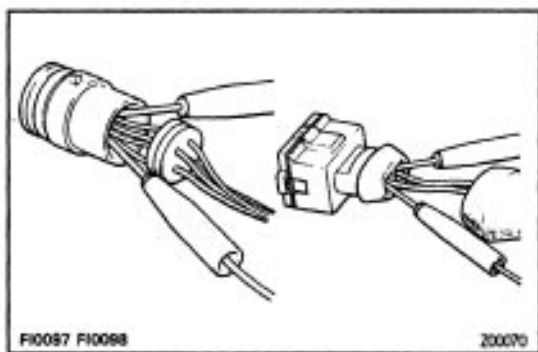


- (b) Fully insert the connector and check that it is locked.

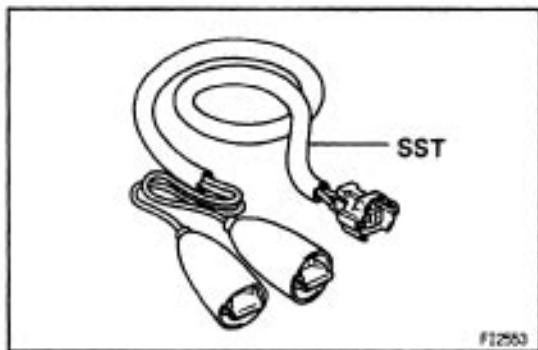


9. When inspecting a connector with a volt/ohmmeter.

- (a) Carefully take out the water-proofing rubber if it is a water-proof type connector.

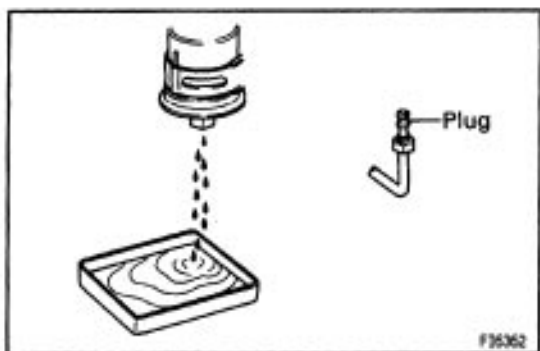


- (b) Insert the test probe into the connector from wiring side when checking the continuity, amperage or voltage.  
 (c) Do not apply unnecessary force to the terminal.  
 (d) After checking, install the water-proofing rubber on the connector securely.



10. Use SST for inspection or test of the injector or its wiring connector.  
 SST 09842-30070

800CF-94



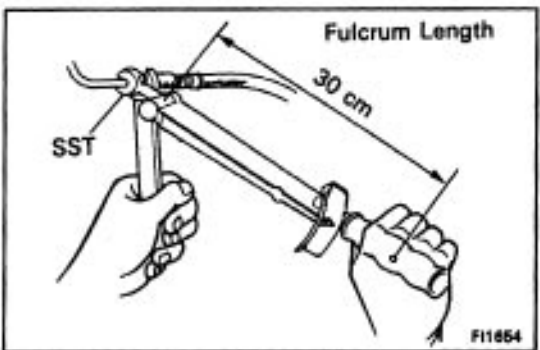
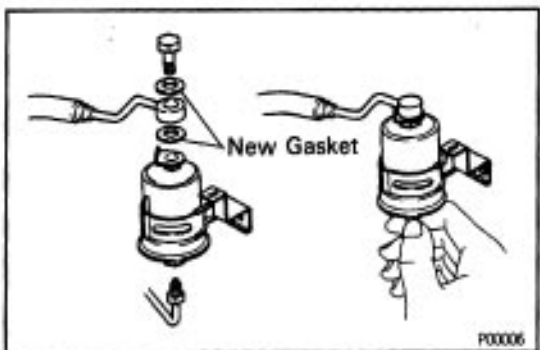
## FUEL SYSTEM

- When disconnecting the high pressure fuel line, a large amount of gasoline will spill out, so observe the following procedures:
  - Put a container under the connection.
  - Slowly loosen the connection.
  - Disconnect the connection.
  - Plug the connection with a rubber plug.
- When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedures:
 

Union Bolt Type:

  - Always use a new gasket.
  - Tighten the union bolt by hand.
  - Tighten the union bolt to the specified torque.

**Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)**



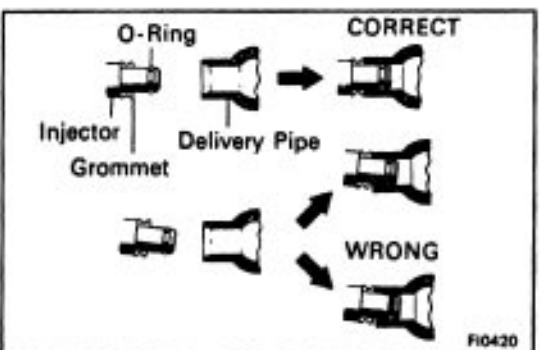
### Flare Nut Type:

- Apply a light coat of engine oil to the flare and tighten the flare nut by hand.
- Using SST, torque the flare nut.  
SST 09631-22020

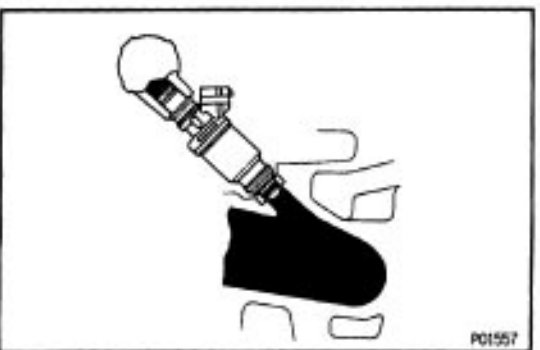
#### Torque:

**28 N·m (285 kgf·cm, 21 ft·lbf) for fuel pump side**  
**30 N·m (310 kgf·cm, 22 ft·lbf) for others**

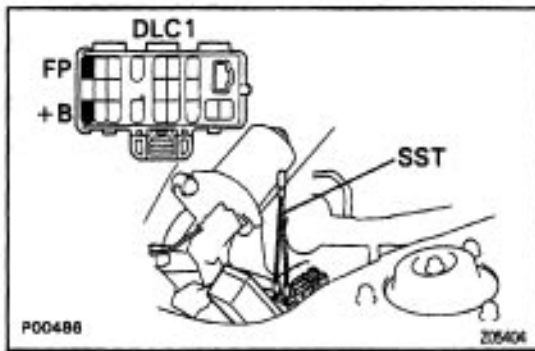
**HINT:** Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



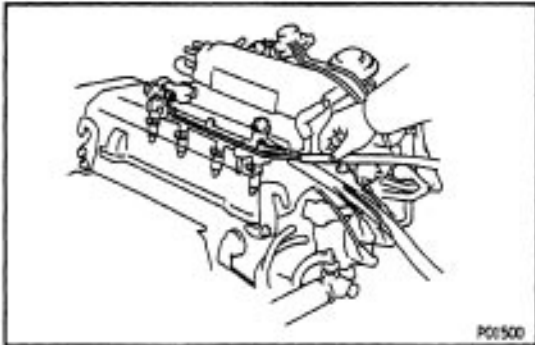
- Observe the following precautions when removing and installing the injectors.
  - Never reuse the O-ring.
  - When placing a new O-ring on the injector, take care not to damage it in any way.
  - Coat a new O-ring with spindle oil or gasoline before installing—never use engine, gear or brake oil.



- Install the injector to delivery pipe and intake manifold as shown in the illustration.

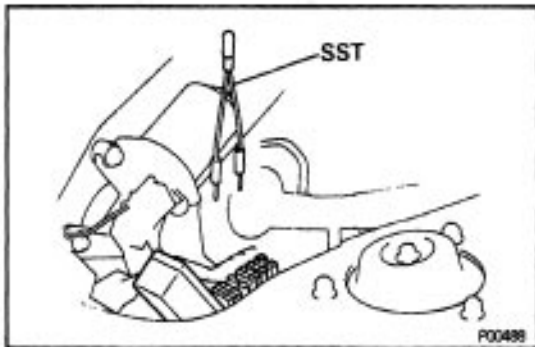


5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.
- (a) Using SST, connect terminals + B and FP of the data link connector 1.  
SST 09843-18020
- (b) With engine stopped, turn the ignition switch ON.



- (c) Pinch the fuel return hose. The pressure in high pressure line will rise to approx. 392 kPa (4kgf/cm<sup>2</sup>, 57 psi). In this state, check to see that there are no leaks from any part of the fuel system.

**NOTICE:** Always pinch the hose. Avoid bending as it may cause the hose to crack.



- (d) Turn the ignition switch OFF.
- (9) Remove the SST.  
SST 09843-18020

## 8844 • J. Neurosci., September 24, 2008 • 28(39):8839–8844



021047-5

(a) Using SST; connect terminals +B and FP of the data link connector 1.  
SST 09843-18020


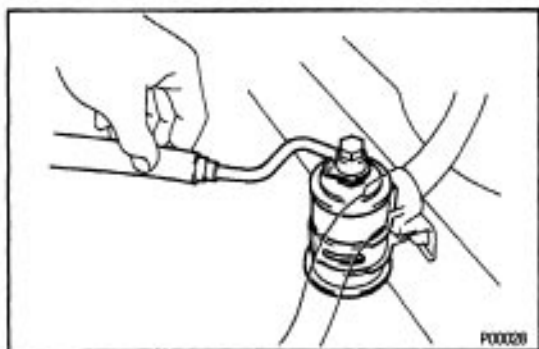


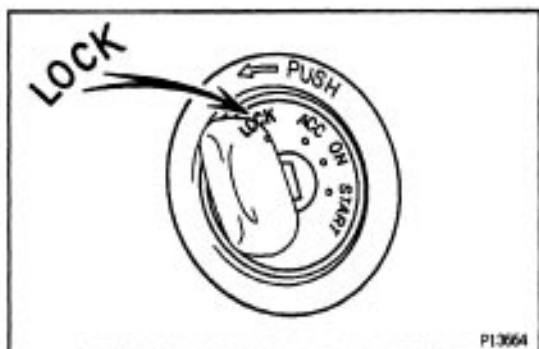
Diagram of the ignition switch with the key in the 'ON' position. An arrow points to the 'ON' position with the label 'ON'.

P13063

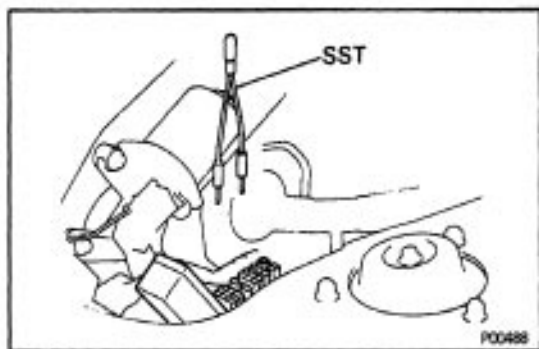


(c) Check that there is pressure in the hose from the fuel filter.

HINT: At this time, you will hear fuel return noise.



(d) Turn the ignition switch OFF.

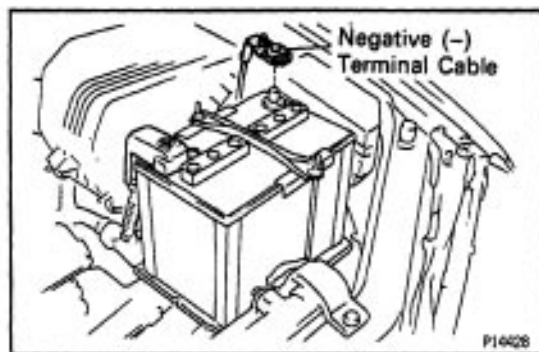


(e) Remove the SST.

SST 09843-18020

If there is no pressure, check the following parts:

- Fusible link
- Fuses (AM2 30A, EFI 15A, IGN 7.5A)
- EFI main relay
- Fuel pump
- Wiring connections

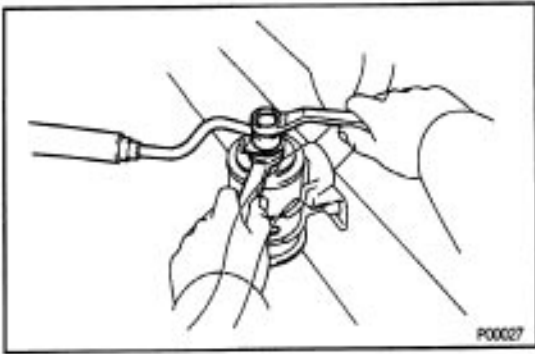


## 2. CHECK FUEL PRESSURE

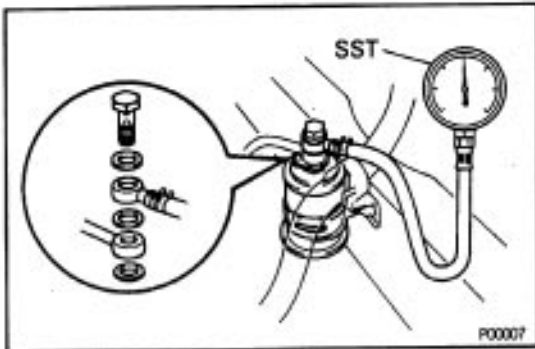
(a) Check that the battery voltages is above 12 volts.

(b) Disconnect the negative (-) terminal cable from the battery.

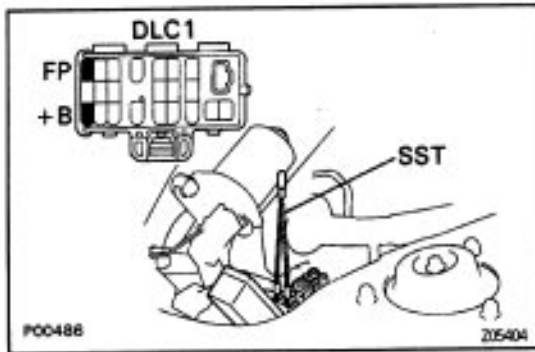
**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the “LOCK” position and the negative (-) terminal cable is disconnected from the battery.



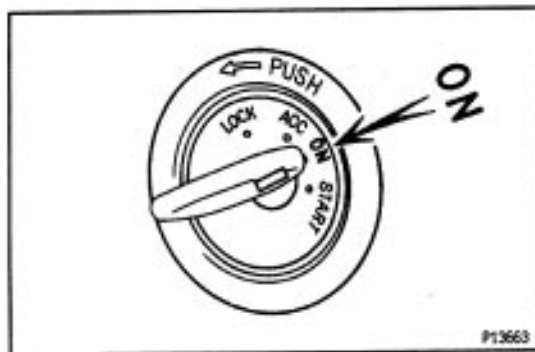
- (c) Put a suitable container or shop towel under the fuel filter.
- (d) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.
- HINT: Slowly loosen the union bolt.



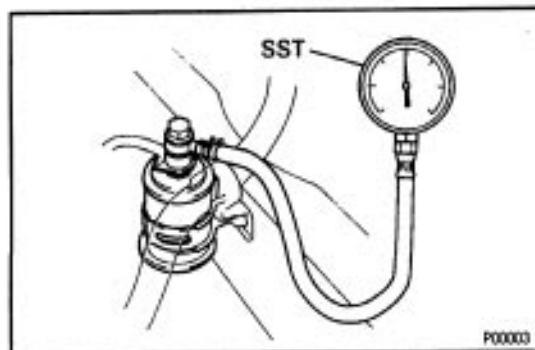
- (e) Install the fuel inlet hose and SST (pressure gauge) to the fuel filter outlet with 3 new gaskets and the union bolt.
- SST 09268-45012
- Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)**
- (f) Wipe off any splattered gasoline.
- (g) Reconnect the battery negative (–) cable.



- (h) Using SST, connect terminals +B and FP of the data link connector 1.
- SST 09843-18020



- (i) Turn the ignition switch ON.



Measure the fuel pressure.

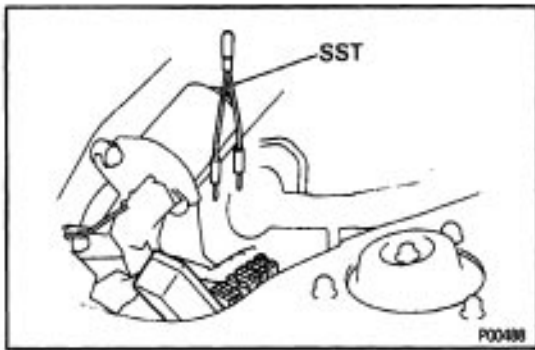
Fuel pressure:

265 – 304 kPa (2.7 – 3.1 kgf/cm<sup>2</sup>, 38 – 44 psi)

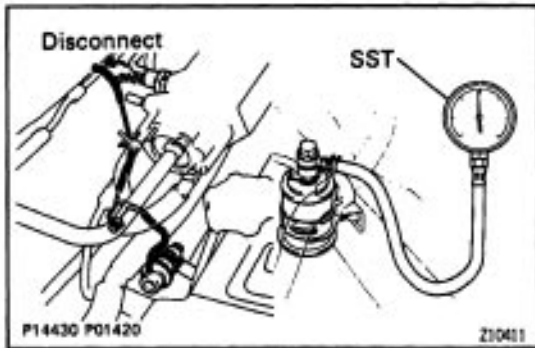
If pressure is high, replace the fuel pressure regulator.

If pressure is low, check the following parts:

- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator



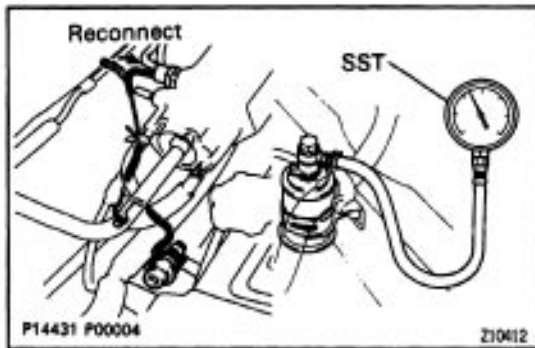
- (k) Remove the SST.  
SST 09483-18020



- (l) Start the engine.  
(m) Disconnect the vacuum sensing hose from the air intake chamber and plug the air intake chamber outlet.  
(n) Measure the fuel pressure at idle.

**Fuel pressure:**

**265 – 304 kPa (2.7 – 3.1 kgf/cm<sup>2</sup>, 38 – 44 psi)**

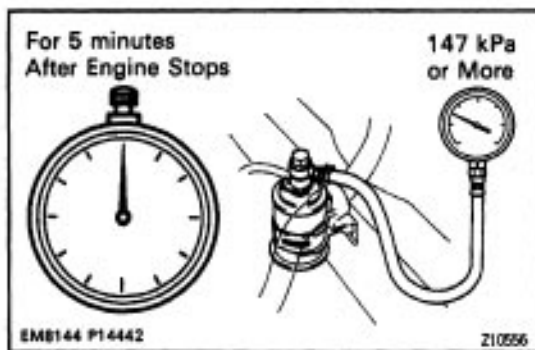


- (o) Reconnect the vacuum sensing hose to the air intake chamber.  
(p) Measure the fuel pressure at idle.

**Fuel pressure:**

**206 – 255 kPa (2.1 – 2.6 kgf/cm<sup>2</sup>, 31 – 37 psi)**

If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.



- (q) Stop the engine.  
(r) Check that the fuel pressure remains 147 kPa (1.5 kgf/cm<sup>2</sup>, 21 psi) or more for 5 minutes after the engine is turned off.  
If pressure is not as specified, check the fuel pump, pressure regulator and/or injector.

- (s) After checking fuel pressure, disconnect the battery negative (–) cable and carefully remove the SST to prevent gasoline from splashing.

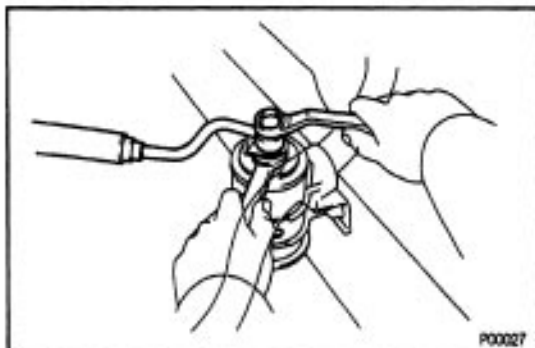
SST 09268-45012

- (t) Connect the fuel inlet hose with 2 new gaskets and the union bolt.

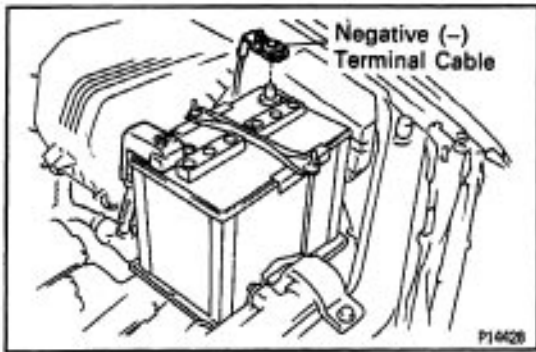
**Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)**

- (u) Reconnect the cable to the negative (–) terminal of the battery.

- (v) Check for fuel leakage.







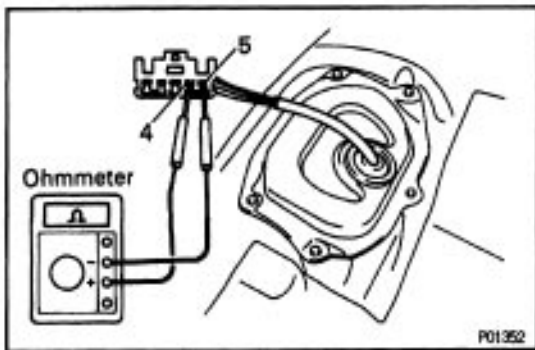
## FUEL PUMP INSPECTION

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

**CAUTION:** Work must be started after 90 seconds from the time the Ignition switch is turned to the 'LOCK' position and the negative (-) terminal cable is disconnected from the battery.

### 2. REMOVE REAR SEAT CUSHION

### 3. DISCONNECT FUEL PUMP & SENDER GAUGE CONNECTOR



### 4. INSPECT FUEL PUMP

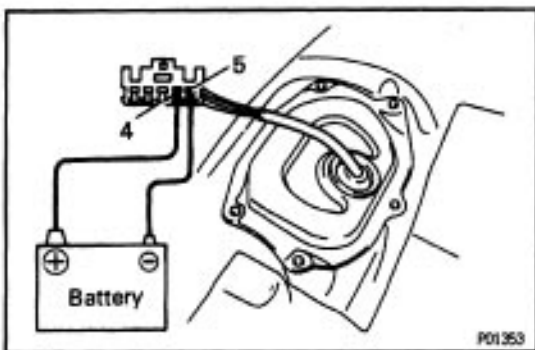
#### A. Inspect fuel pump resistance

Using an ohmmeter, measure the resistance between terminals 4 and 5.

#### Resistance (Cold):

**0.2–3.0  $\Omega$**

If the resistance is not as specified, replace the fuel pump.



#### B. Inspect fuel pump operation

Connect the positive (+) lead from the battery terminal 4 of the connector, and the negative (-) lead to terminal 5. Check that the fuel pump operates.

#### NOTICE:

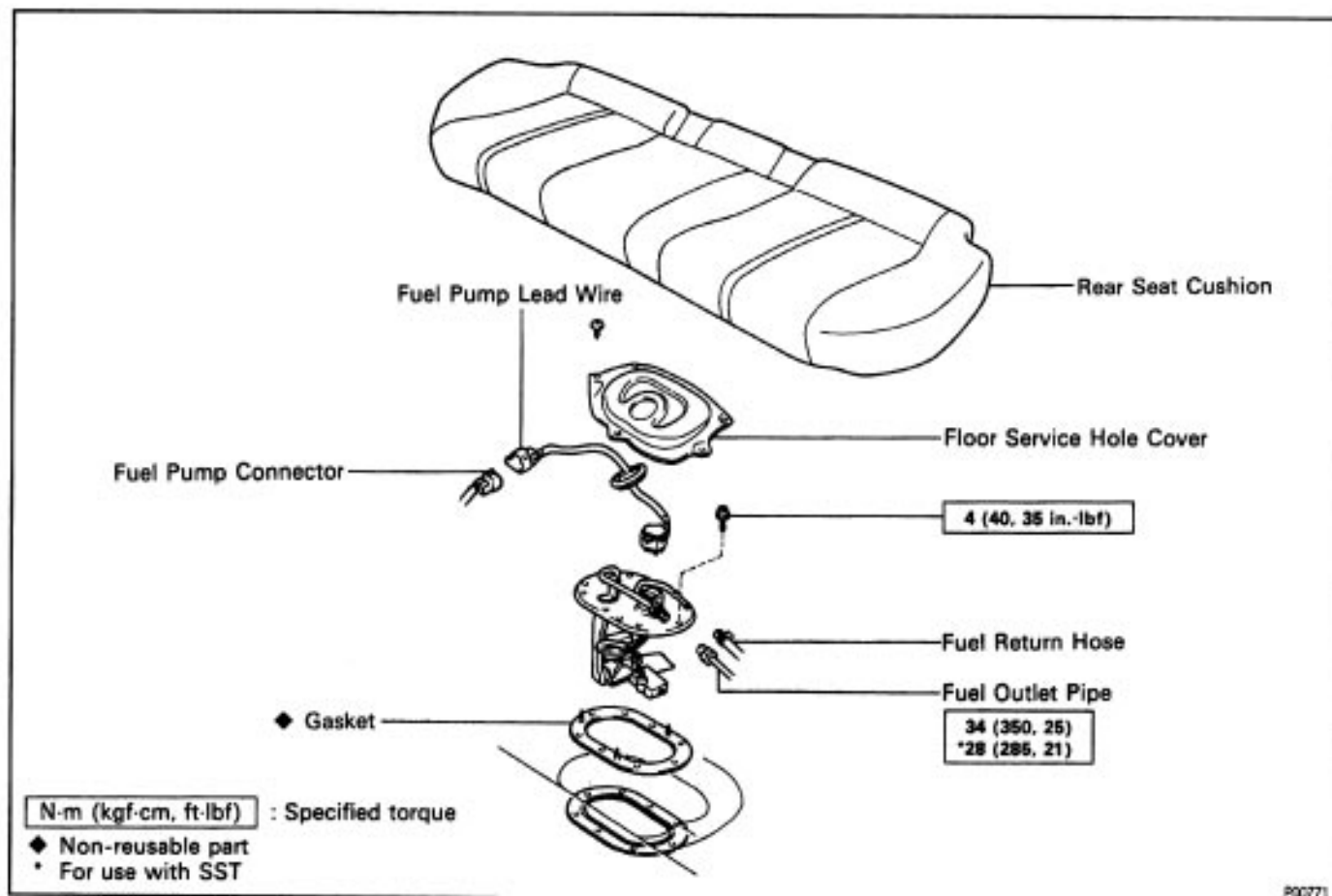
- These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out.
  - Keep the fuel pump as far away from the battery as possible.
  - Always perform switching at the battery side.
- If operation is not as specified, replace the fuel pump.

### 5. RECONNECT FUEL PUMP & SENDER GAUGE CONNECTOR

### 6. INSTALL REAR SEAT CUSHION

### 7. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY

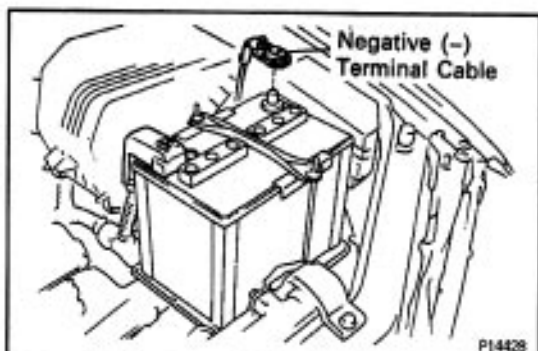
## COMPONENTS FOR REMOVAL AND INSTALLATION



80286-01

### FUEL PUMP REMOVAL

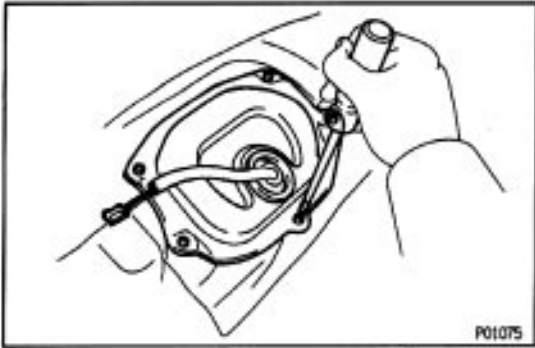
**CAUTION:** Do not smoke or work near an open flame when working on the fuel pump.



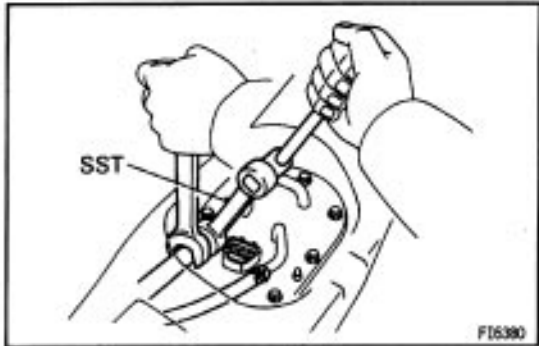
#### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

#### 2. REMOVE REAR SEAT CUSHION

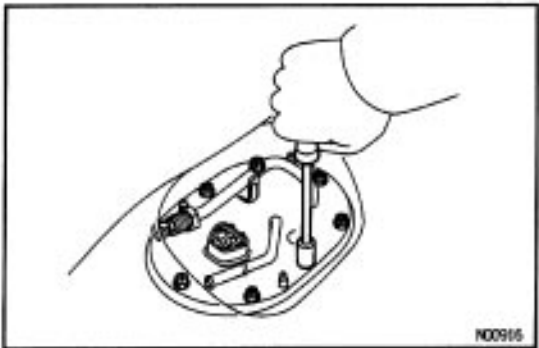
**3. REMOVE FLOOR SERVICE HOLE COVER**

- (a) Disconnect the fuel pump connector.
- (b) Remove the 5 screws and service hole cover.

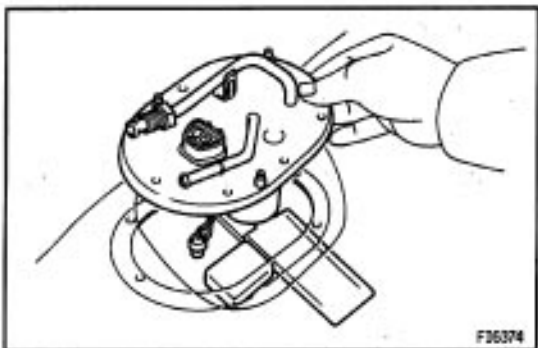
**4. REMOVE FUEL PUMP LEAD WIRE****5. DISCONNECT FUEL PIPE AND HOSE FROM FUEL PUMP BRACKET**

**CAUTION:** Remove the fuel filter cap to prevent the fuel from flowing out.

- (a) Using SST, disconnect the outlet pipe from the pump bracket.  
SST 09631-22020
- (b) Disconnect the return hose from the pump bracket.

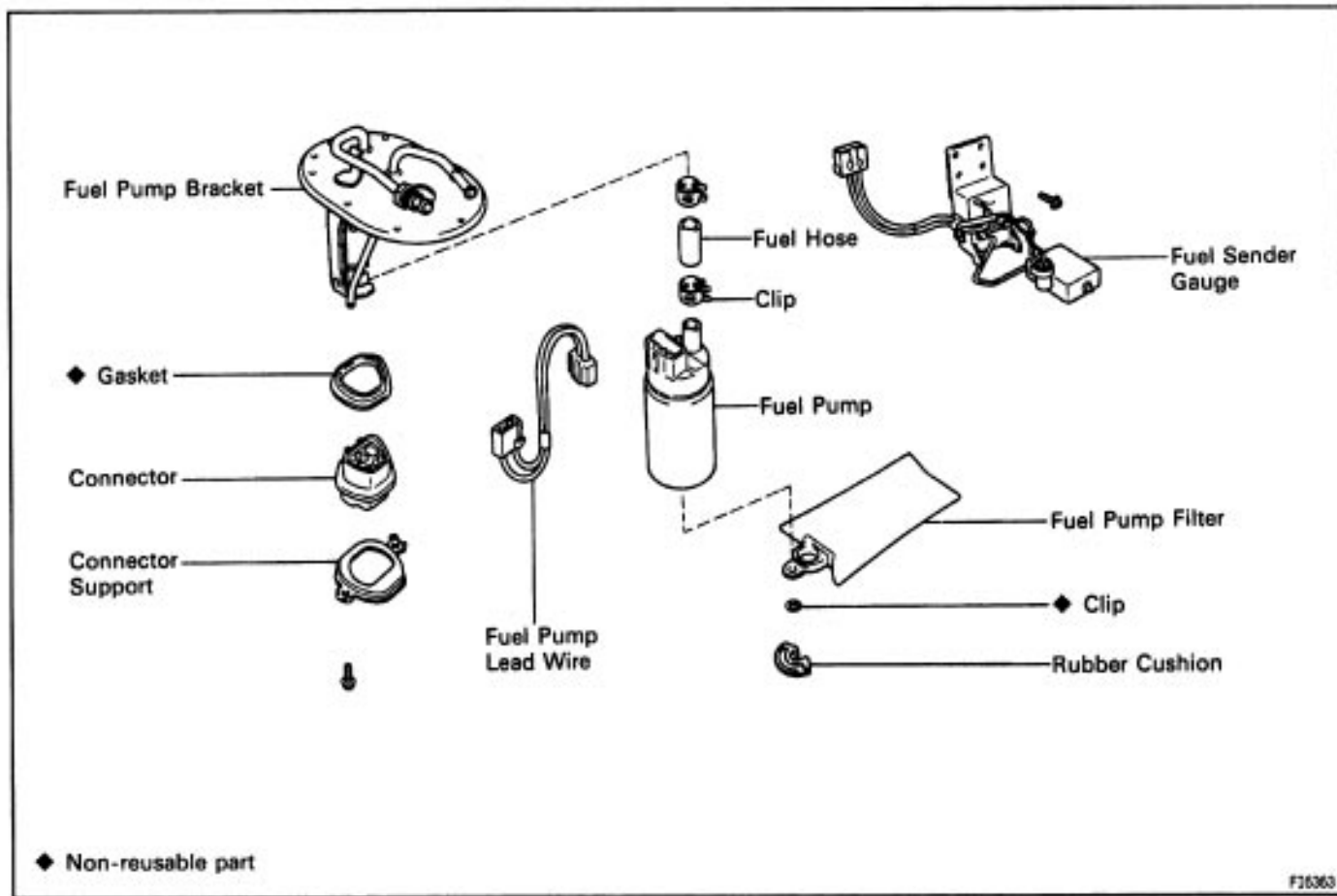
**6. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK**

- (a) Remove the 8 bolts.

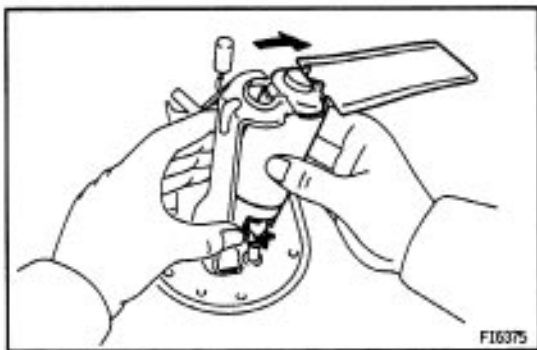


- (b) Pull out the pump bracket assembly.
- (c) Remove the gasket from the pump bracket.

## COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



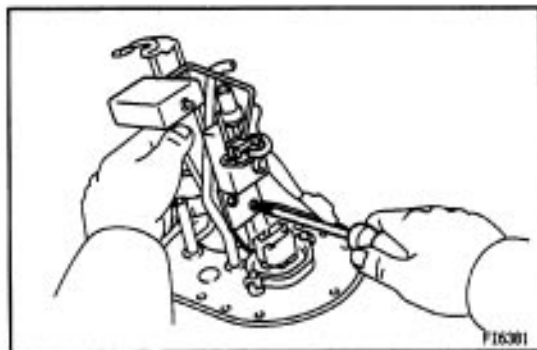
M16362-02



### FUEL PUMP DISASSEMBLY

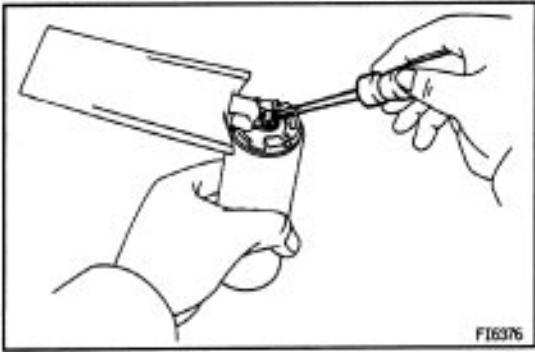
#### 1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

- Remove the fuel pump lead wire.
- Pull off the lower side of the fuel pump from the pump bracket.
- Disconnect the fuel hose from the fuel pump, and remove the fuel pump.
- Remove the rubber cushion from the fuel pump.



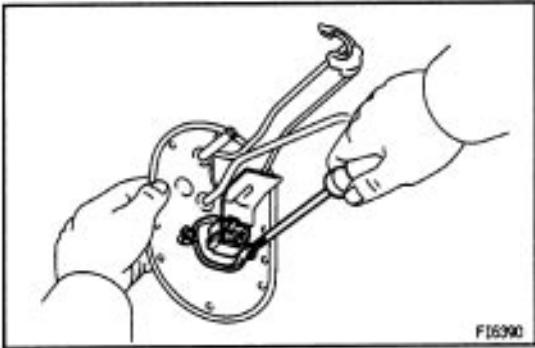
#### 2. REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET

- Disconnect the fuel sender gauge connector.
- Remove the 2 screws and sender gauge.



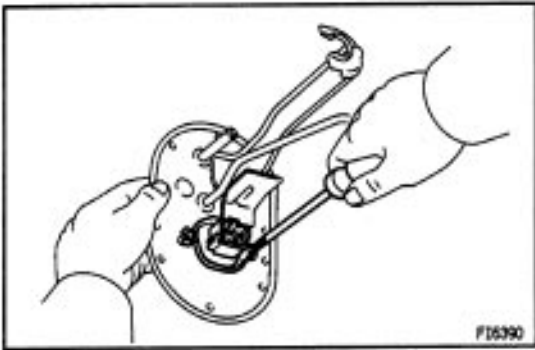
### 3. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

- (a) Using a small screwdriver, remove the clip.
- (b) Pull out the pump filter.



### 4. REMOVE CONNECTOR

Remove the 2 screws, connector support, connector and gasket.



## FUEL PUMP ASSEMBLY

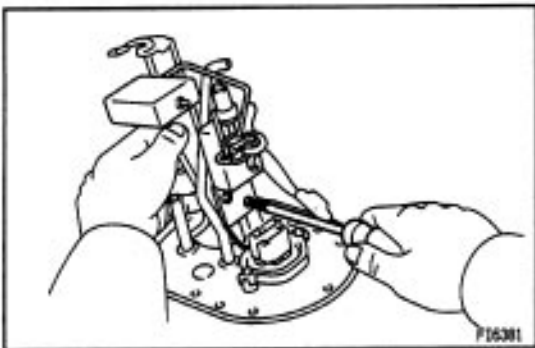
(See Components for Disassembly and Assembly)

### 1. INSTALL CONNECTOR

Install the gasket, connector and connector support with the 2 screws.

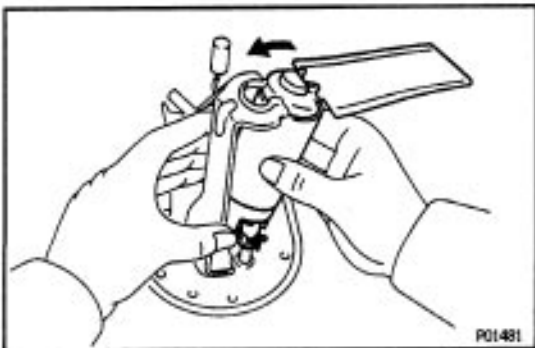
### 2. INSTALL FUEL PUMP FILTER TO FUEL PUMP

Install the pump filter with a new clip.



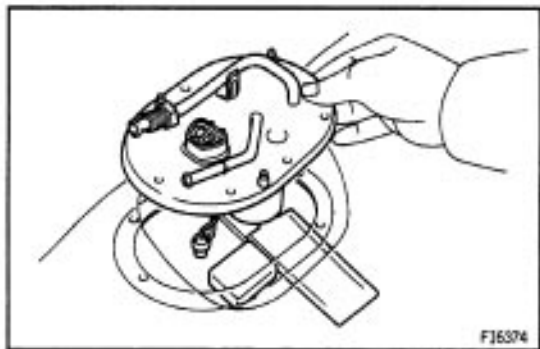
### 3. INSTALL FUEL SENDER GAUGE TO FUEL PUMP BRACKET

- (a) Install the sender gauge with the 2 screws.
- (b) Connect the fuel sender gauge connector.



### 4. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

- (a) Install the rubber cushion to the fuel pump.
- (b) Connect the fuel hose to the outlet port of the fuel pump.
- (c) Install the fuel pump by pushing the lower side of the fuel pump.
- (d) Install the fuel pump connector.

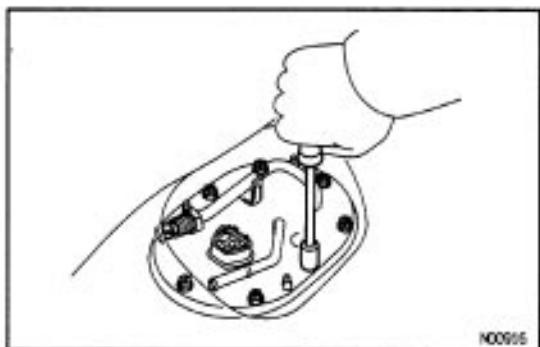


## FUEL PUMP INSTALLATION

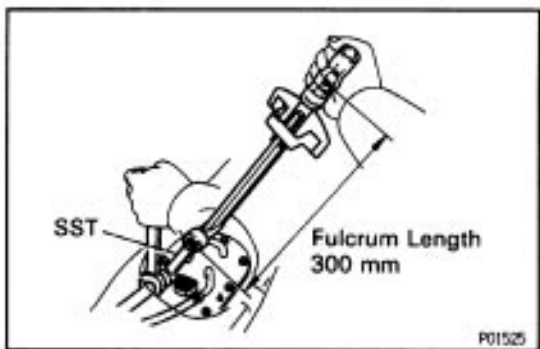
(See Components for Removal and Installation)

### 1. INSTALL FUEL PUMP BRACKET ASSEMBLY TO FUEL TANK

- (a) Install a new gasket to the pump bracket.
- (b) Insert the pump bracket assembly into the fuel tank.



- (c) Install the pump bracket with the 8 screws.  
**Torque: 3.9 N-m (40 kgf-cm, 35 in.-lbf)**



### 2. CONNECT FUEL PIPE AND HOSE TO FUEL PUMP BRACKET

- (a) Using SST, connect the outlet pipe to the pump bracket.  
SST 09631-22020  
**Torque: 28 N-m (285 kgf-cm, 21 ft-lbf)**
- (b) Connect the return hoses to the pump bracket.

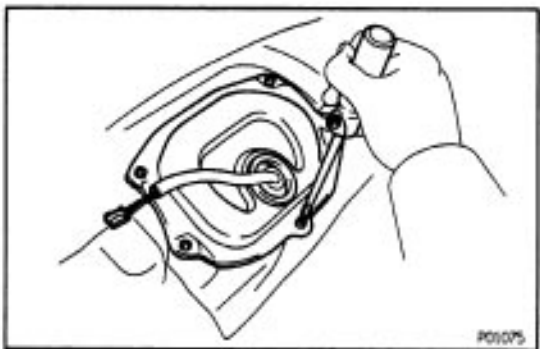
### 3. CHECK FOR FUEL LEAKAGE

(See page [EG1-176](#))

### 4. CONNECT FUEL PUMP LEAD WIRE

### 5. INSTALL FLOOR SERVICE HOLE COVER

- (a) Install the service hole cover with the 5 screws.
- (b) Connect the fuel pump (with fuel sender gauge) connector.



### 6. INSTALL REAR SEAT CUSHION

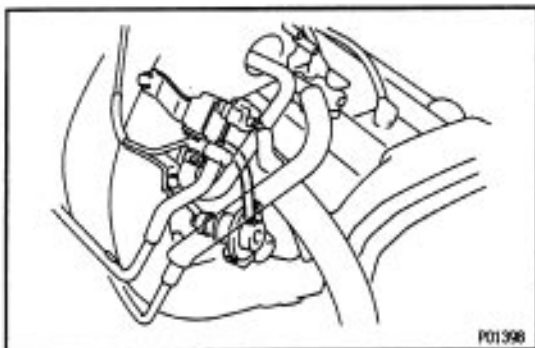
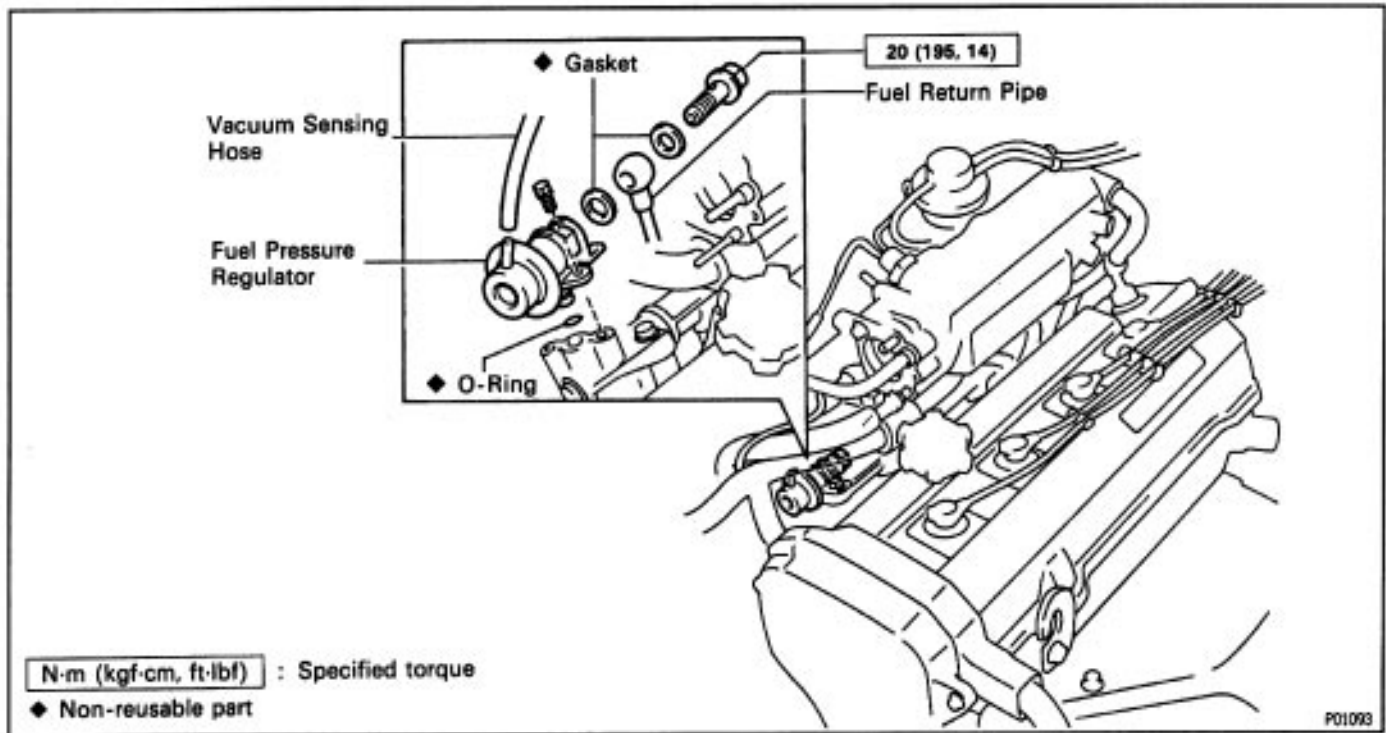
### 7. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY

# FUEL PRESSURE REGULATOR ON-VEHICLE INSPECTION

## INSPECT FUEL PRESSURE

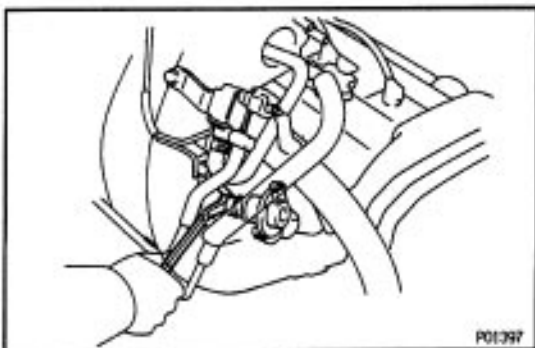
(See page [EG1-178](#))

## COMPONENTS FOR REMOVAL AND INSTALLATION



## FUEL PRESSURE REGULATOR REMOVAL

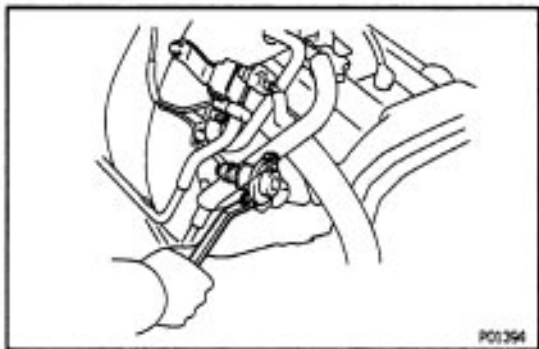
### 1. DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR



### 2. DISCONNECT FUEL RETURN PIPE FROM FUEL PRESSURE REGULATOR

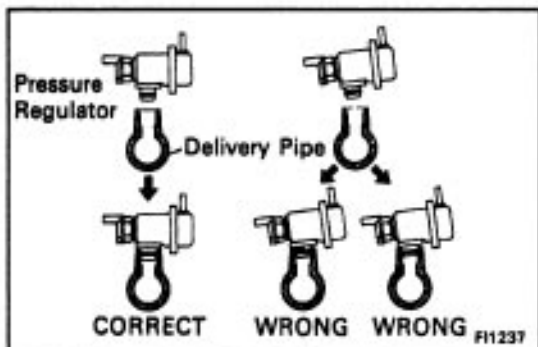
- Put a suitable container or shop rag under the pressure regulator.
  - Remove the union bolt and 2 gaskets, and disconnect the return pipe from the pressure regulator.
- HINT: Slowly loosen the union bolt.





### 3. REMOVE FUEL PRESSURE REGULATOR

- (a) Remove the 2 bolts, and pull out the pressure regulator.
- (b) Remove the O-ring from the pressure regulator.



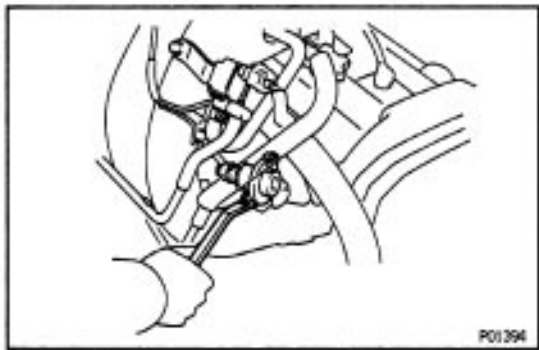
## FUEL PRESSURE REGULATOR INSTALLATION

(See Components for Removal and Installation)

### 1. INSTALL FUEL PRESSURE REGULATOR

- (a) Apply a light coat of gasoline to a new O-ring, and install it to the pressure regulator.

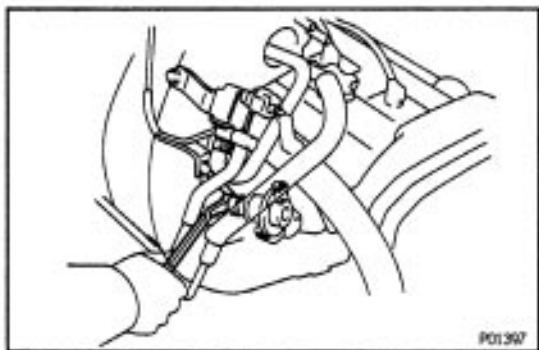
- (b) Install the pressure regulator with the 2 bolts.  
Torque: 5.4 N-m (55 kgf-cm, 48 in.-lbf)



### 2. CONNECT FUEL RETURN PIPE TO FUEL PRESSURE REGULATOR

Install the return pipe with 2 new gaskets and the union bolt.

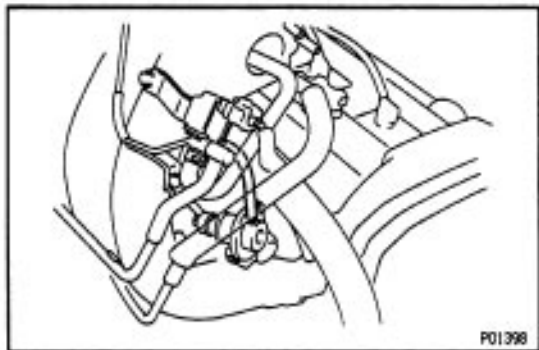
Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)



### 3. CONNECT VACUUM SENSING HOSE TO FUEL PRESSURE REGULATOR

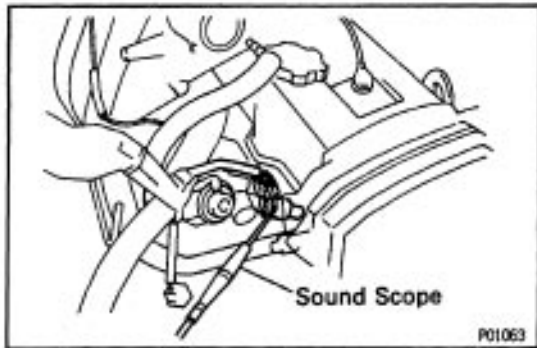
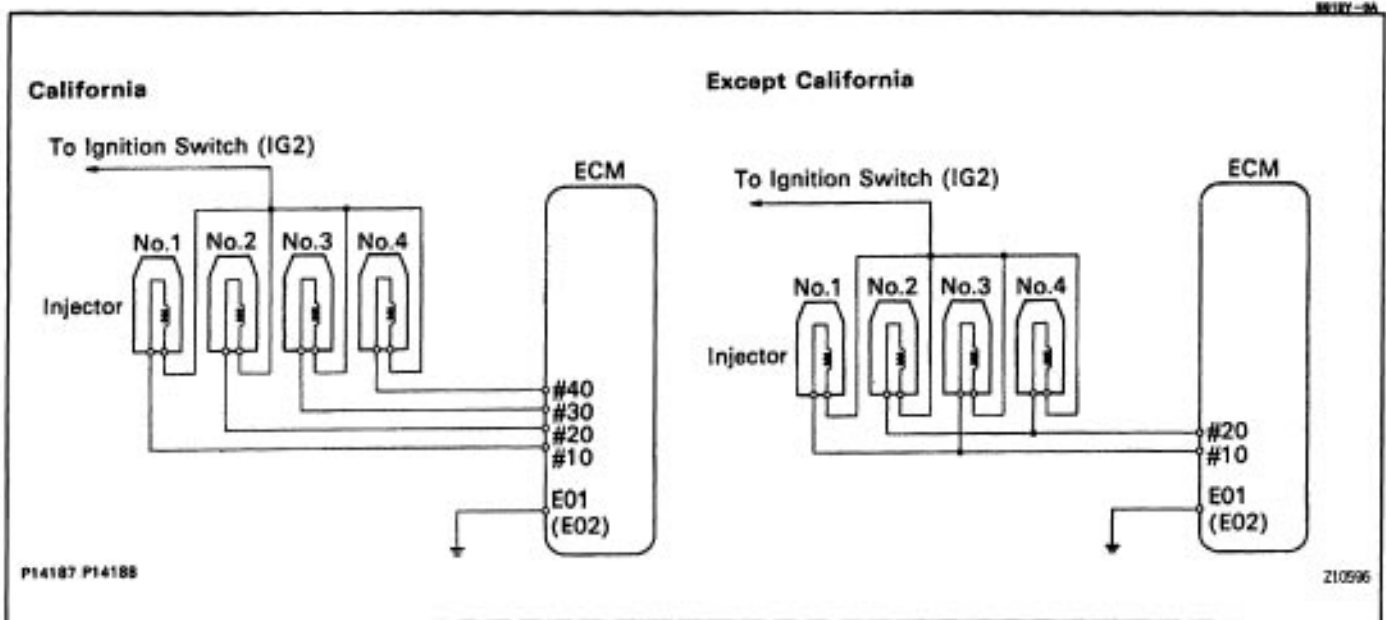
### 4. CHECK FOR FUEL LEAKAGE

(See page [EG1-176](#))





# INJECTOR

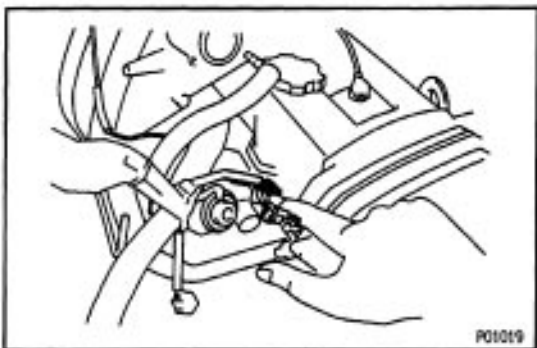


## ON-VEHICLE INSPECTION

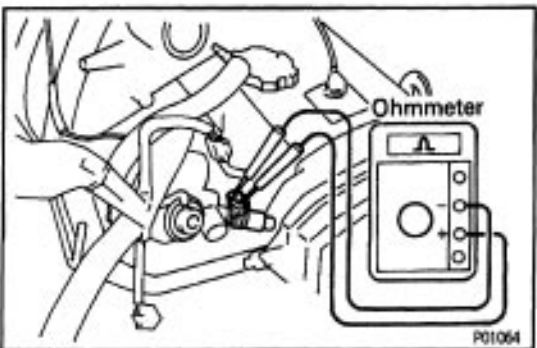
### 1. INSPECT INJECTOR OPERATION

Check operation sound from each injector.

- With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine speed.



- If you have no sound scope, you can check the injector transmission operation with your finger. If no sound or unusual sound is heard, check the wiring connector, injector or injection signal from the ECM.



### 2. INSPECT INJECTOR RESISTANCE

- Disconnect the injector connector.
- Using an ohmmeter, measure the resistance between the terminals.

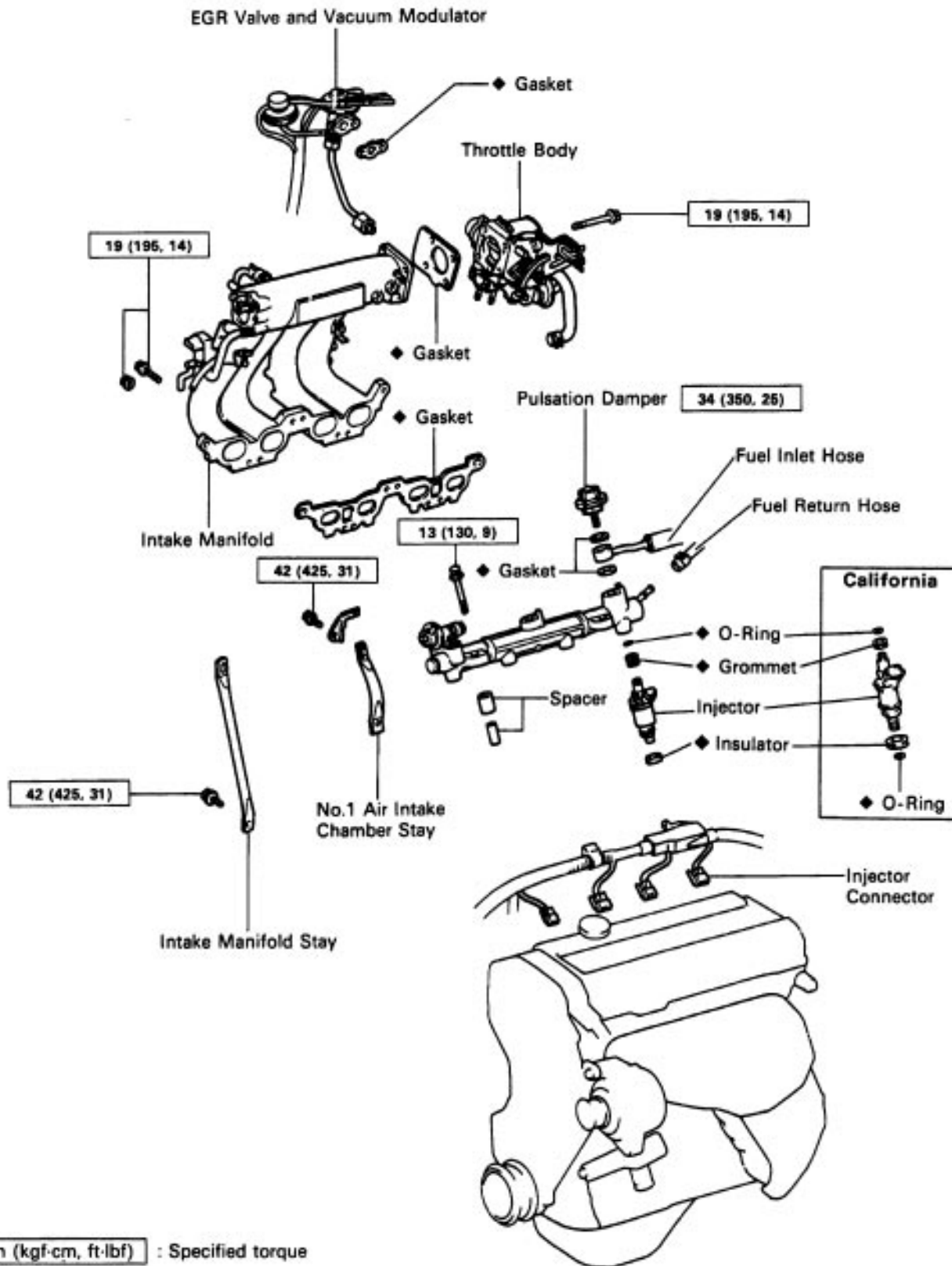
**Resistance:**

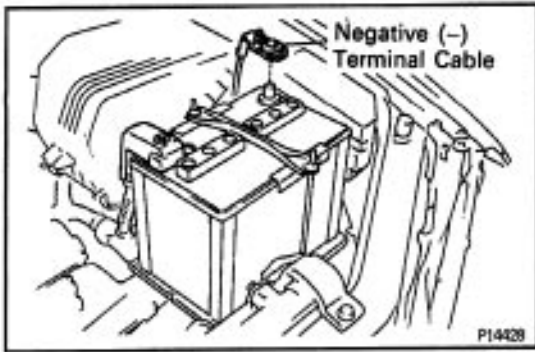
**Approx. 13.8Ω**

If the resistance is not as specified, replace the injector.

- Reconnect the injector connector.

# COMPONENTS FOR REMOVAL AND INSTALLATION





## INJECTORS REMOVAL

(See Components for Removal and Installation)

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

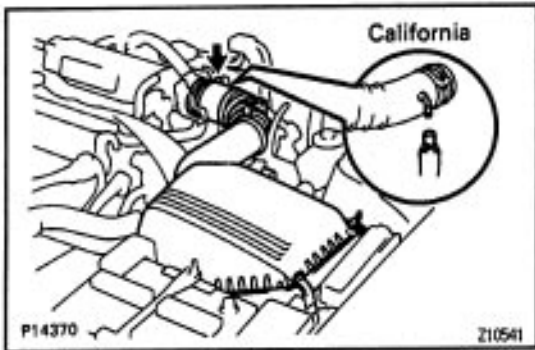
**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

### 2. DRAIN ENGINE COOLANT

### 3. A/T:

### DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

### 4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY



### 5. REMOVE AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

(a) Disconnect the intake air temperature sensor connector.

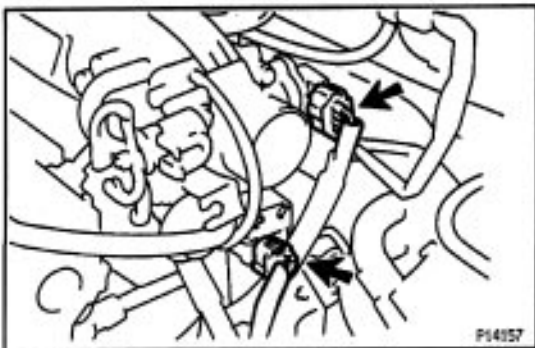
(b) California only:

Disconnect the air hose from the air cleaner hose.

(c) Loosen the air cleaner hose clamp bolt.

(d) Disconnect the 4 air cleaner cap clips.

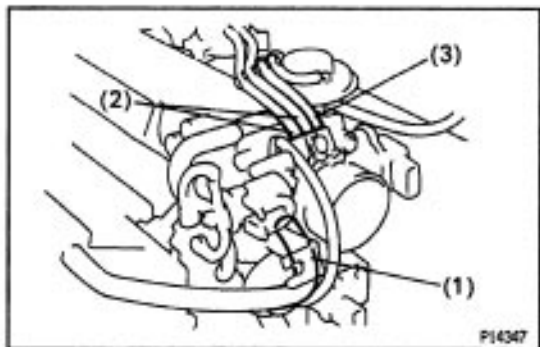
(e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.



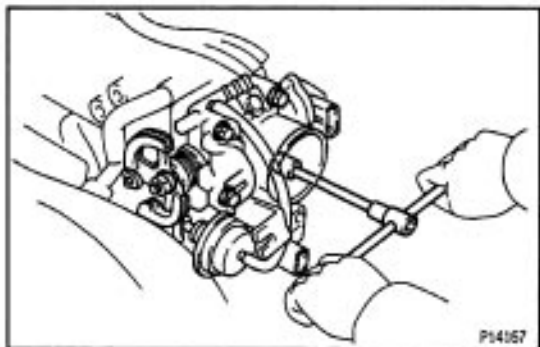
### 6. REMOVE THROTTLE BODY

(a) Disconnect throttle position sensor connector.

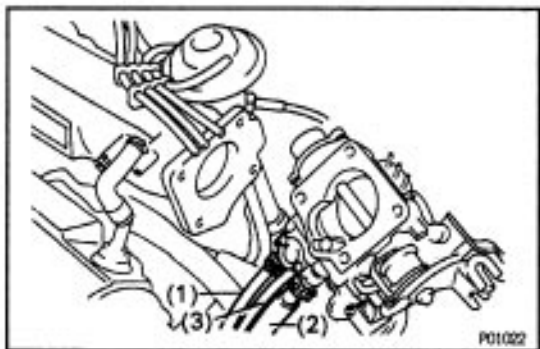
(b) Disconnect IAC valve connector.



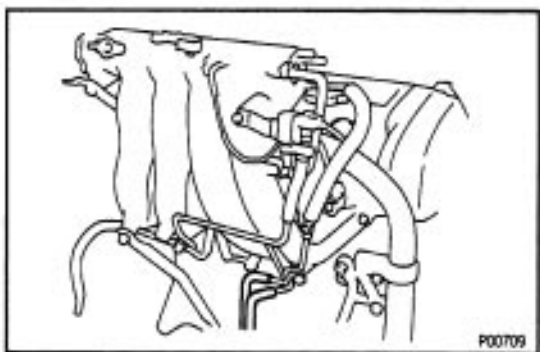
- (c) Disconnect the following hoses from the throttle body.
- (1) PCV hose
  - (2) 2 vacuum hoses from EGR vacuum modulator
  - (3) Vacuum hose from TVV (for EVAP)



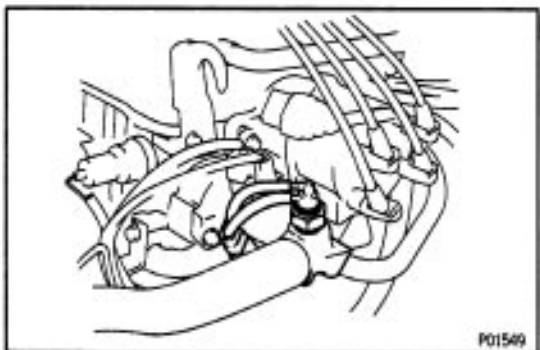
- (d) Type A:  
Remove the 4 bolts.
- (e) Type B:  
Remove the 2 bolts and 2 nuts.



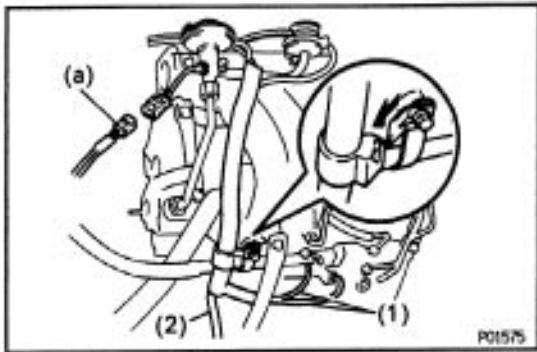
- (f) Disconnect the following hoses from the throttle body, and remove the throttle body.
- (1) Water bypass hose from water outlet
  - (2) Water bypass hose from water bypass pipe
  - (3) California:  
Air hose from cylinder head
  - Except California:  
Air hose from air tube



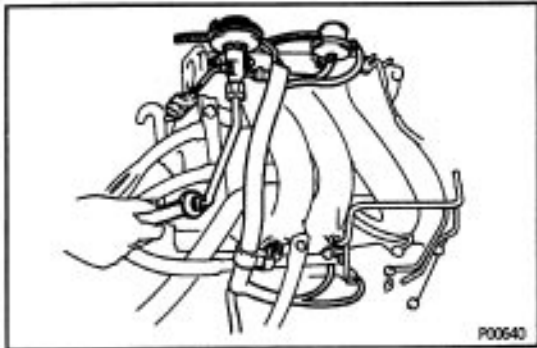
## 7. DISCONNECT PS VACUUM HOSES



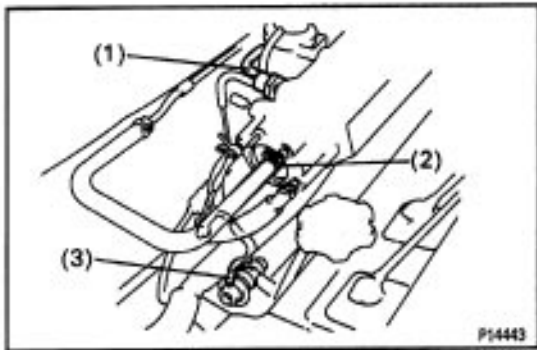
## 8. DISCONNECT VACUUM HOSES FROM TVV (FOR EVAP)

**9. REMOVE EGR VALVE AND VACUUM MODULATOR**

- (a) Disconnect the EGR gas temperature sensor connector.
- (b) Disconnect the following hoses:
  - (1) 2 vacuum hoses from VSV (for EGR)
  - (2) Vacuum hose from charcoal canister
- (c) Disconnect the vacuum hose clamp.

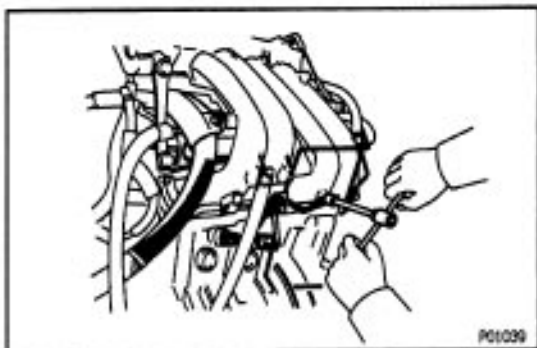
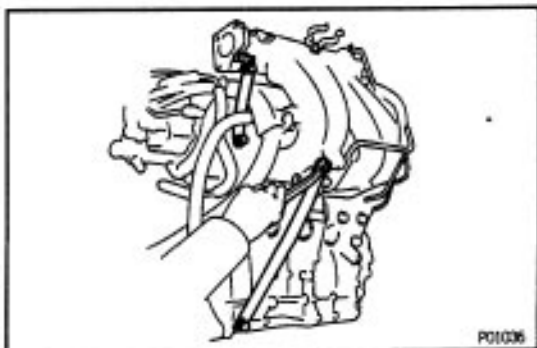


- (d) Loosen the union nut of the EGR pipe, and remove the 2 nuts, the EGR valve, vacuum modulator, vacuum hoses assembly and gasket.

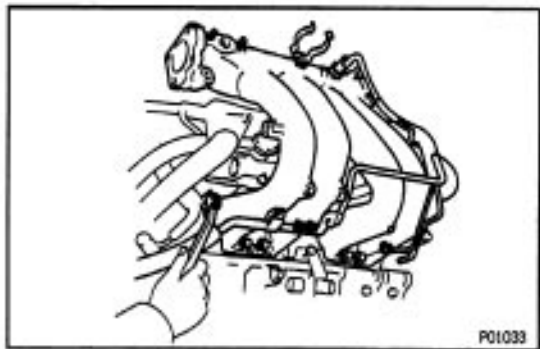
**10. DISCONNECT VACUUM HOSES**

Disconnect the following hoses:

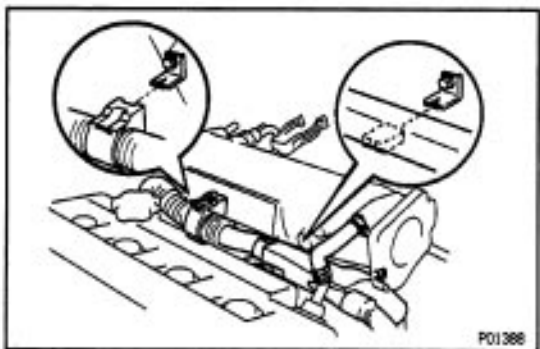
- (1) MAP sensor hose from air intake chamber
- (2) Brake booster vacuum hose from air intake chamber
- (3) Vacuum sensing hose from fuel pressure regulator

**11. w/ A/C:****DISCONNECT A/C IDLE-UP VALVE CONNECTOR****12. DISCONNECT 2 ENGINE WIRE GROUND STRAPS FROM INTAKE MANIFOLD****13. DISCONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS****14. CALIFORNIA ONLY:****DISCONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR AND VACUUM HOSES****15. REMOVE BOLT AND WIRE CLAMP, AND DISCONNECT ENGINE WIRE HARNESS****16. REMOVE INTAKE MANIFOLD**

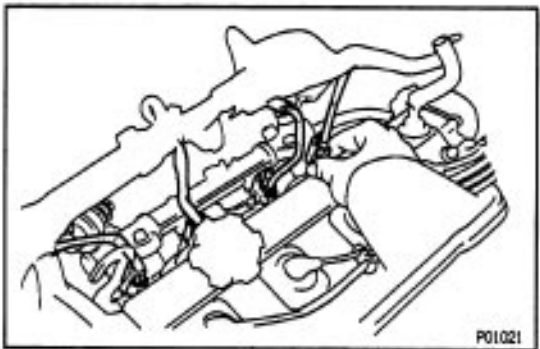
- (a) Remove the 4 bolts, wire bracket, No.1 air intake chamber and manifold stays.



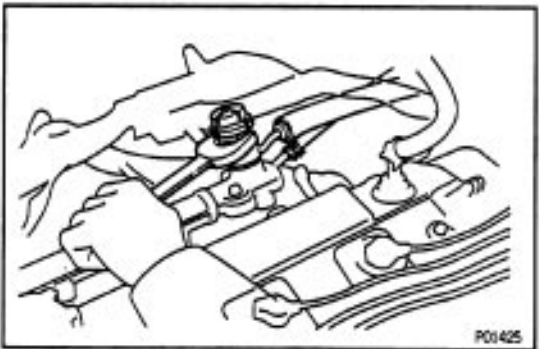
- (b) Remove the 6 bolts, 2 nuts, intake manifold and gasket.



- (c) Disconnect the 2 wire clamps from the wire brackets on the intake manifold.

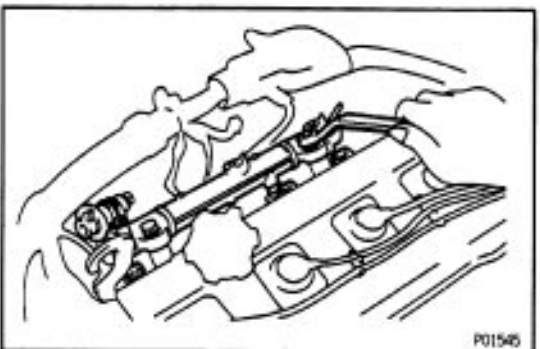


## 17. DISCONNECT INJECTOR CONNECTORS



## 18. REMOVE DELIVERY PIPE AND INJECTORS

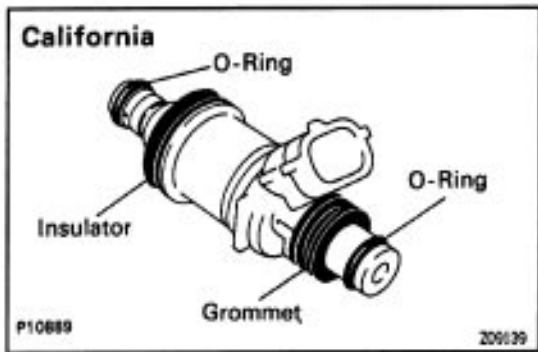
- (a) Loosen the pulsation damper, and disconnect the fuel inlet pipe.  
 (b) Disconnect the fuel return hose.



- (c) Remove the 2 bolts and delivery pipe together with the 4 injectors.

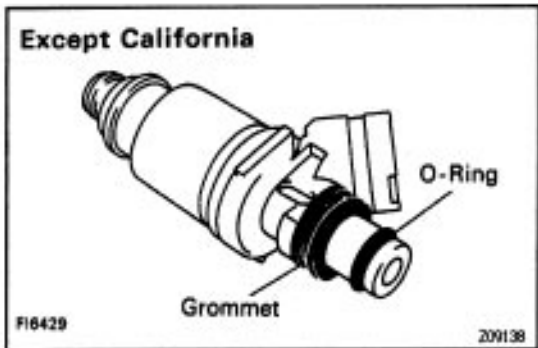
**NOTICE:** Be careful not to drop the injectors when removing the delivery pipe.

- (d) Remove the 4 insulators (except California) and 2 spacers from the cylinder head.  
 (e) Pull out the 4 injectors from the delivery pipe.



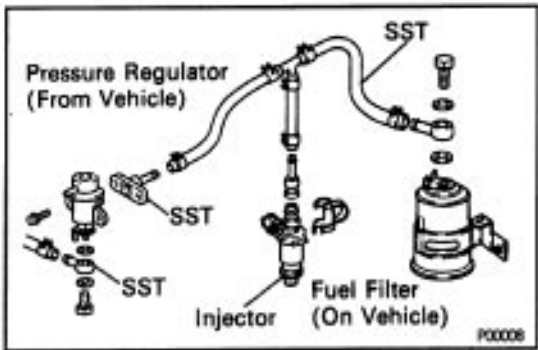
(f) California:

Remove the 2 O-rings, insulator and grommet from each injector.



(g) Except California:

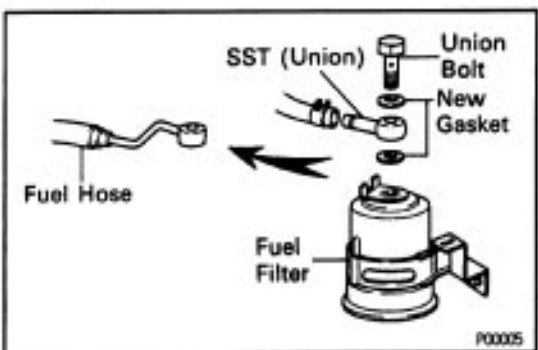
Remove the O-ring and grommet from each injector.



## INJECTORS INSPECTION

### 1. INSPECT INJECTOR INJECTION

**CAUTION:** Keep injector clear of sparks during the test.



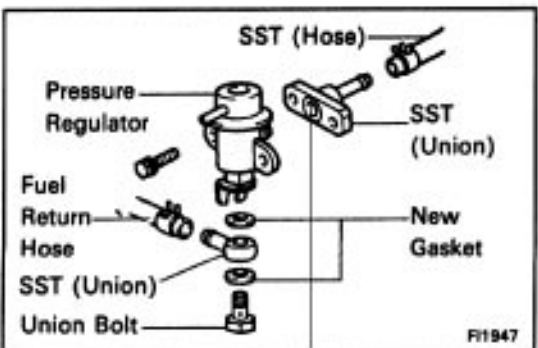
(a) Disconnect the fuel hose from the fuel filter outlet.

(b) Connect SST (union and hose) to the fuel filter outlet with 2 new gaskets and union bolts.

SST 09268-41045 (90405-09015)

**Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)**

**HINT:** Use the vehicle's fuel filter.



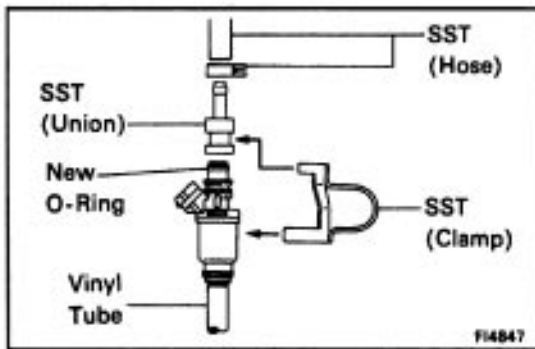
(c) Install a new O-ring to the fuel inlet of pressure regulator.

(d) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union) and the 2 bolts.

SST 09268-41045 (09268-41090)

**Torque: 5.4 N·m (55 kgf·cm, 48 ft·lbf)**

(e) Connect the fuel return hose to the fuel outlet of the pressure regulator with SST (union), 2 new gaskets and union bolts.



SST 09268-41045 (09268-41080)

**Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)**

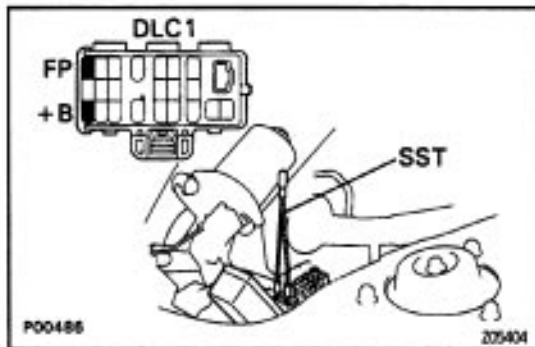
(f) Install the grommet and a new O-ring to the injector.

(g) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).

SST 09268-41045

(h) Put the injector into a graduated cylinder.

HINT: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.



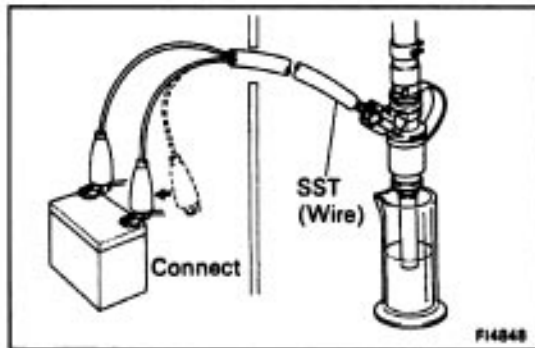
(i) Using SST, connect terminals +B and FP of the data link connector 1.

SST 09843-18020

(j) Reconnect the negative (-) terminal cable to the battery.

(k) Turn the ignition switch ON.

**NOTICE: Do not start the engine.**



(l) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector 2 or 3 times.

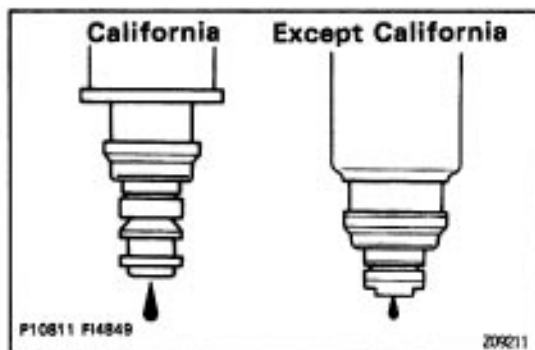
**Volume:**

**49 – 59 cm<sup>3</sup> (3.0–3.6 cu in.) per 15 sec.**

**Difference between each Injector:**

**5 cm<sup>3</sup> (0.3 cu in.) or less**

If the injection volume is not as specified, replace the injector.



## 2. INSPECT LEAKAGE

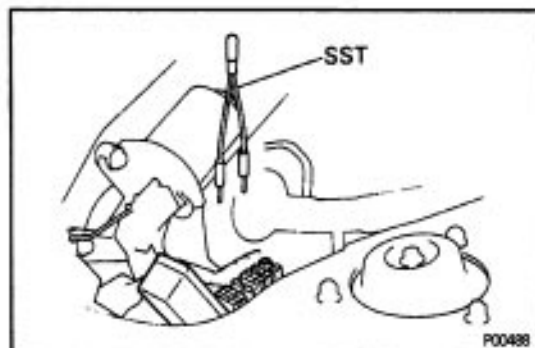
(a) In the condition above, disconnect the test probes of SST (wire) from the battery and check the fuel leakage from the injector.

SST 09842-30070

**Fuel drop:**

**One drop or less per minute**

(b) Disconnect the negative (-) terminal cable from the battery.

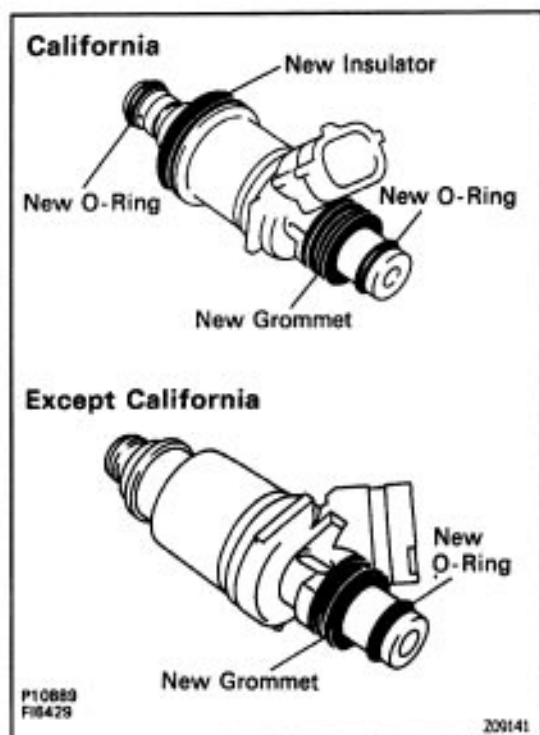


(c) Remove the SST.

SST 09268-41045 and 09843-18020



B0108-01

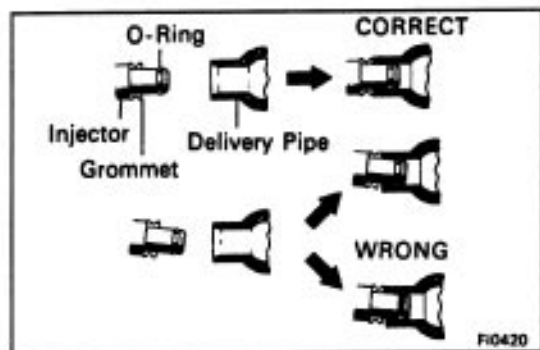


## INJECTORS INSTALLATION

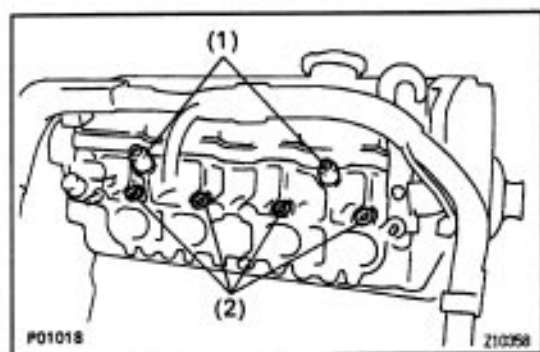
(See Components for Removal and Installation)

### 1. INSTALL INJECTORS AND DELIVERY PIPE

- (a) California:  
Install new insulator and grommet to each injector.
- (b) Except California:  
Install a new grommet to each injector.
- (c) California:  
Apply a light coat of gasoline to 2 new O-rings, and install them to each injector.
- (d) Except California:  
Apply a light coat of gasoline to a new O-ring, and install it to each injector.

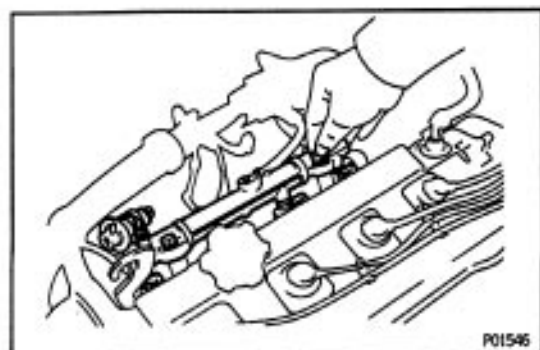


- (e) While turning the injector left and right, install it to the delivery pipes. Install the 4 injectors.

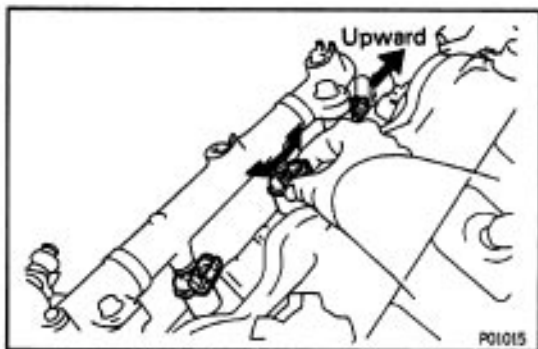


- (f) Install the following parts to the cylinder head:

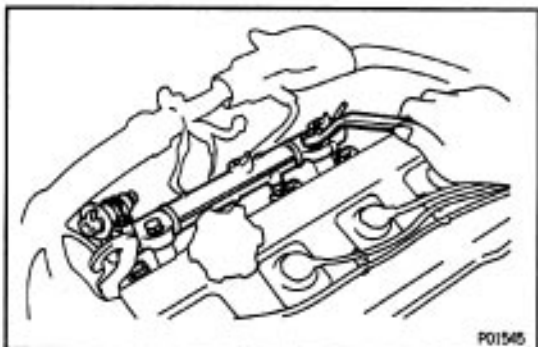
- (1) 2 spacers
- (2) Except California:  
4 new insulators



- (g) Place the 4 injectors together with the delivery pipe in position on the cylinder head.
- (h) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

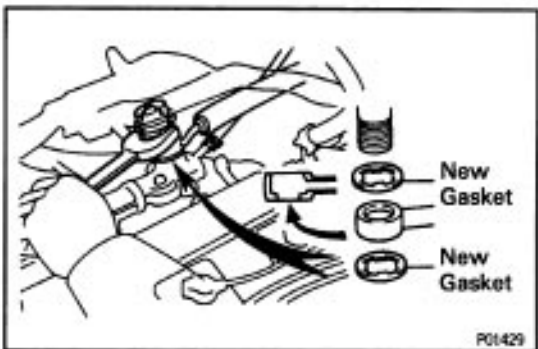


- (i) Check that the injectors rotate smoothly.  
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O – rings. Replace the O–rings.
- (j) Position the injector connector upward.



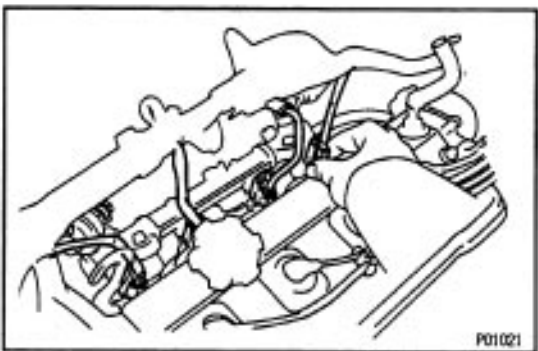
- (k) Tighten the 2 bolts holding the delivery pipe to the cylinder head.

**Torque: 13 N–m (130 kgf–cm, 9 ft–lbf)**

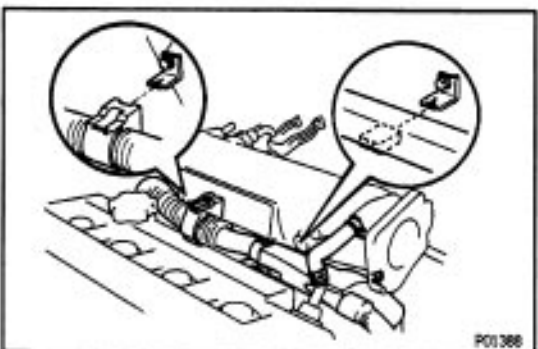


- (l) Connect the fuel return hose.
- (m) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the pulsation damper.

**Torque: 34 N–m (350 kgf–cm, 25 ft–lbf)**

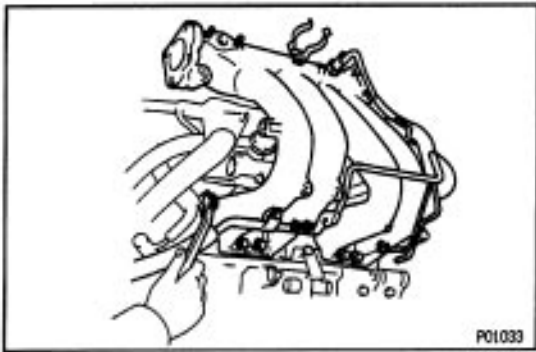


## 2. CONNECT INJECTOR CONNECTORS



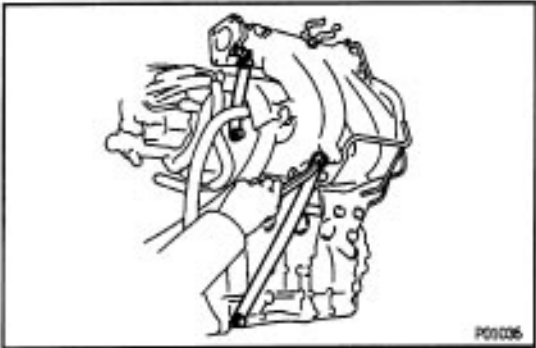
## 3. INSTALL INTAKE MANIFOLD

- (a) Connect the 2 wire clamps to the wire brackets on the intake manifold.



- (b) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**



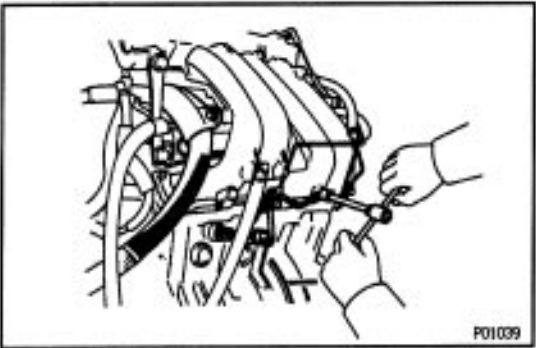
- (c) Install the No. 1 air intake chamber and manifold stays, wire bracket with the 4 bolts.

14 mm head bolt

**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**

12 mm head bolt

**Torque: 22 N-m (220 kgf-cm, 16 ft-lbf)**



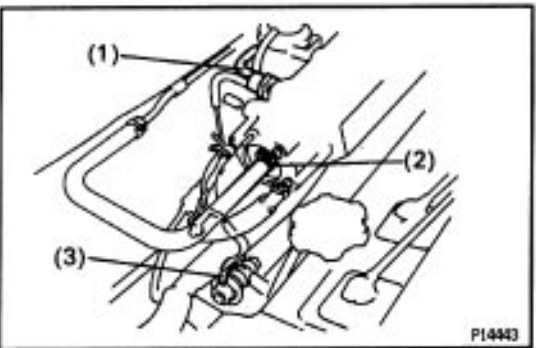
#### 4. CONNECT ENGINE WIRE HARNESS WITH WIRE CLAMP AND BOLT

#### 5. CALIFORNIA ONLY:

CONNECT VSV (FOR FUEL PRESSURE CONTROL) CONNECTOR AND VACUUM HOSES

#### 6. CONNECT KNOCK SENSOR AND VSV (FOR EGR) CONNECTORS

#### 7. CONNECT 2 ENGINE WIRE GROUND STRAPS TO INTAKE MANIFOLD



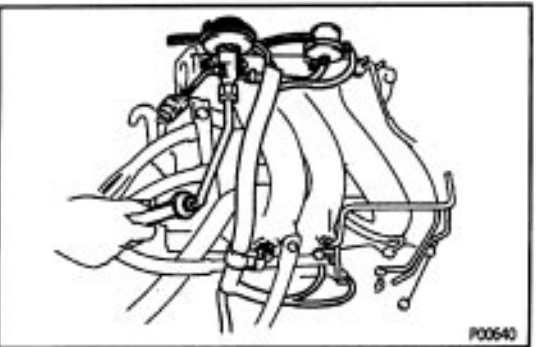
#### 8. CONNECT VACUUM HOSES

Connect the following hoses:

- (1) MAP sensor hose to air intake chamber
- (2) Brake booster vacuum hose to air intake chamber
- (3) Vacuum sensing hose to fuel pressure regulator.

#### 9. w/ A/C:

**CONNECT A/C IDLE-UP VALVE CONNECTOR**



#### 10. INSTALL EGR VALVE AND VACUUM MODULATOR

- (a) Install a new gasket and the EGR valve with the union nut and 2 nuts.

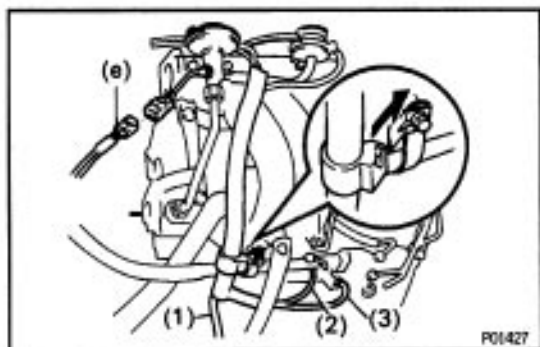
**Union nut**

**Torque: 59 N-m (600 kgf-cm, 43 ft-lbf)**

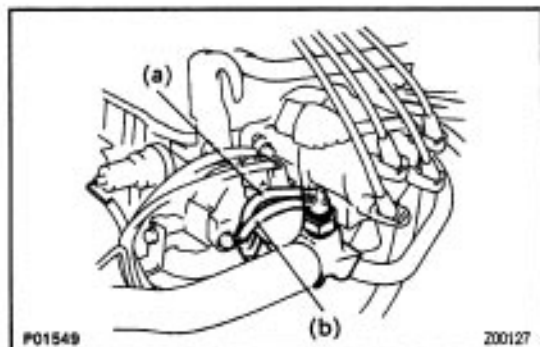
**Nut**

**Torque: 13 N-m (130 kgf-cm, 9 ft-lbf)**

- (b) Install the EGR vacuum modulator to the clamp.

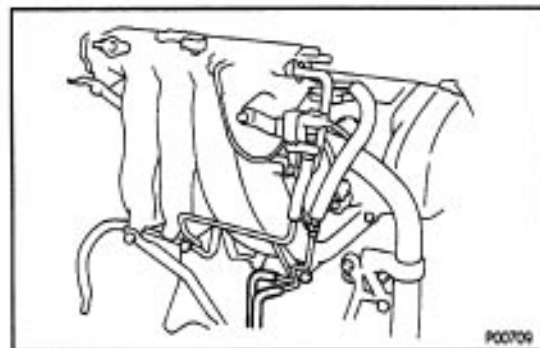


- (c) Connect the vacuum hose clamp.
- (d) Connect the following hoses:
  - (1) Vacuum hose to charcoal canister
  - (2) Vacuum hose (from EGR valves) to E port of VSV (for EGR)
  - (3) Vacuum hose (from Q port EGR vacuum modulator) to G port of VSV (for EGR)
- (e) Connect the EGR gas temperature sensor connector.

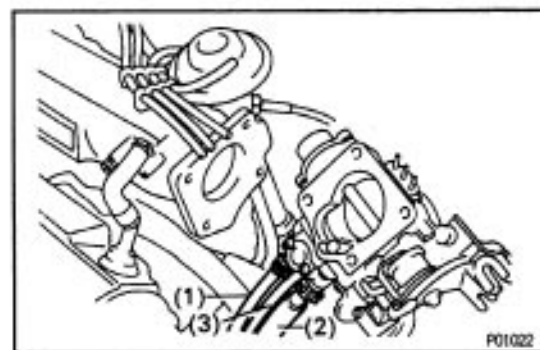


### 11. CONNECT VACUUM HOSES TO VSV (FOR EVAP)

- (a) From P port of throttle body
- (b) From charcoal canister

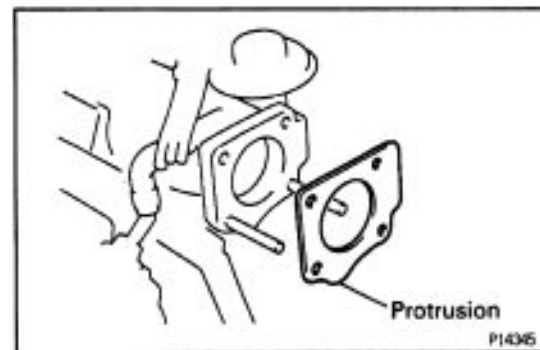


### 12. CONNECT PS VACUUM HOSES

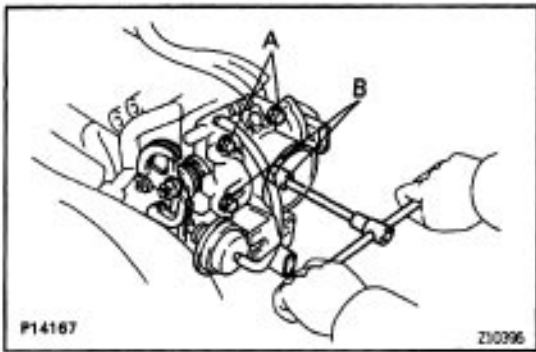


### 13. INSTALL THROTTLE BODY

- (a) Connect the following hoses to the throttle body:
  - (1) Water bypass hose from water outlet
  - (2) Water bypass hose from water bypass pipe
  - (3) California:
    - Air hose from cylinder head
  - Except California:
    - Air hose to air tube



- (b) Place a new gasket on the intake chamber, facing the protrusion downward.



(c) Type A:

Install the throttle body with the 4 bolts.

**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**

Bolt length:

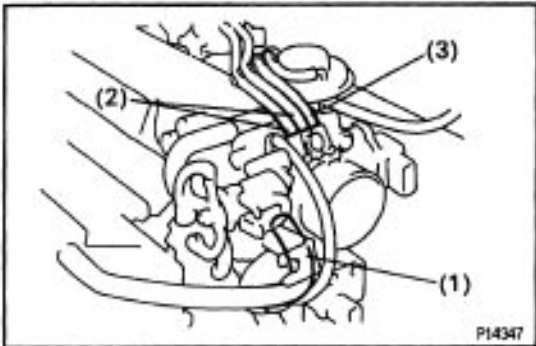
A 45 mm (1.77 in.)

B 55 mm (2.17 in.)

(d) Type B:

Install the throttle body with the 2 bolts and 2 nuts.

**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**

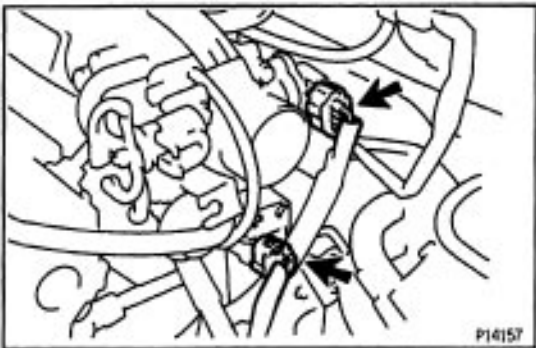


(e) Connect the following hoses to the throttle body:

(1) PCV hose

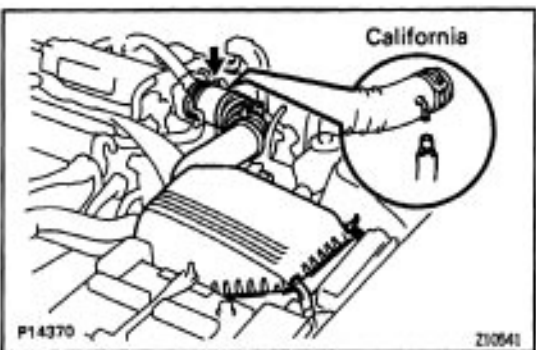
(2) 2 vacuum hoses from EGR vacuum modulator

(3) Vacuum hose from TVV (for EVAP)



(f) Connect the IAC valve connector.

(g) Connect the throttle position sensor connector.



#### 14. INSTALL AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

(a) Connect the air cleaner hose to the throttle body.

(b) Install the air cleaner cap together with the resonator and air cleaner hose.

(c) California only:

Connect the air hose to the air cleaner hose.

(d) Connect the intake air temperature sensor connector.

#### 15. A/T:

#### CONNECT AND ADJUST THROTTLE CABLE

#### 16. CONNECT AND ADJUST ACCELERATOR CABLE

#### 17. FILL WITH ENGINE COOLANT

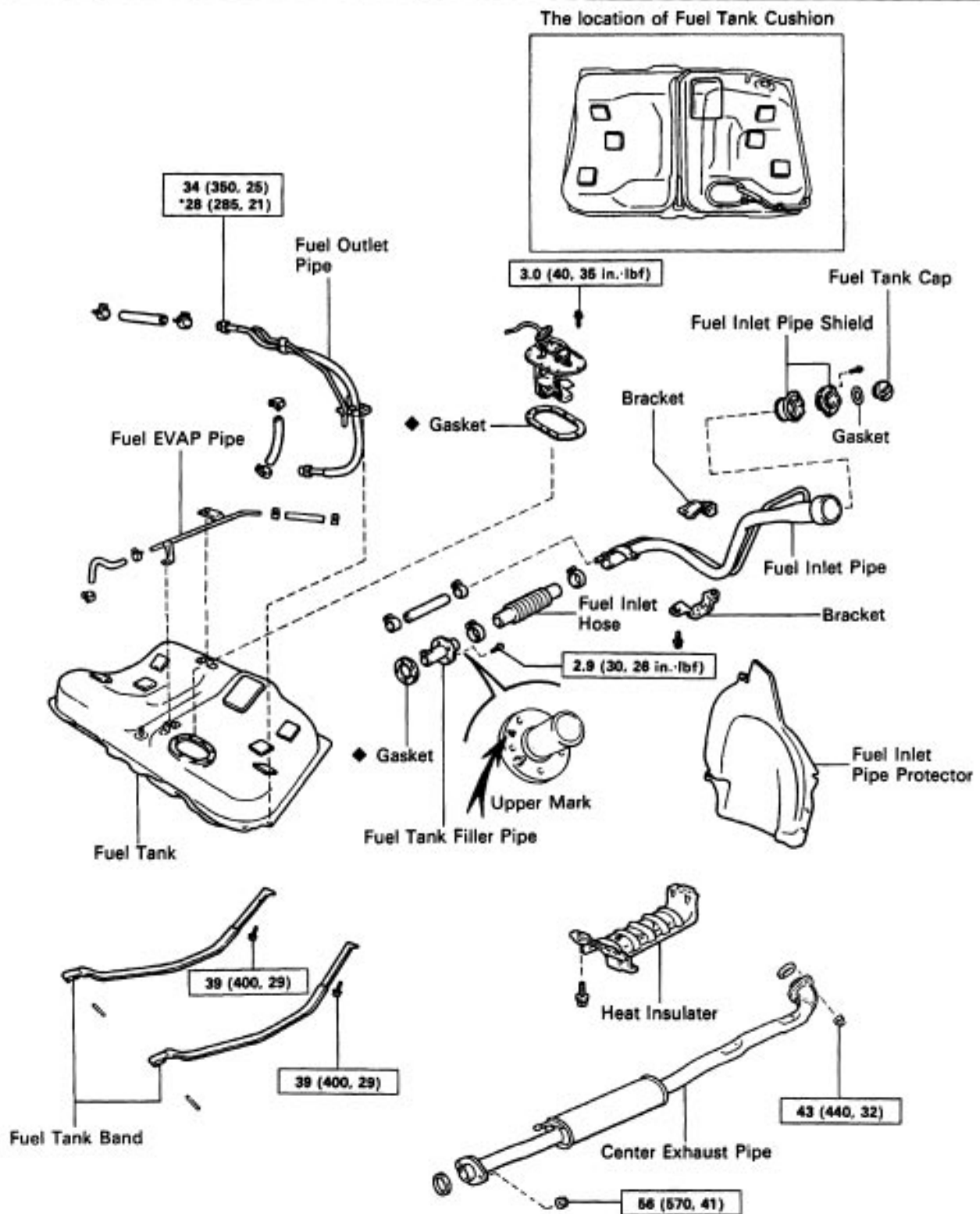
Capacity:

6.3 liters (6.7 US qts. 5.5 Imp. qts)

#### 18. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

# FUEL TANK AND LINE COMPONENTS

90300-01



P02030

N·m (kgf-cm, ft-lbf) : Specified torque

◆ Non-reusable part

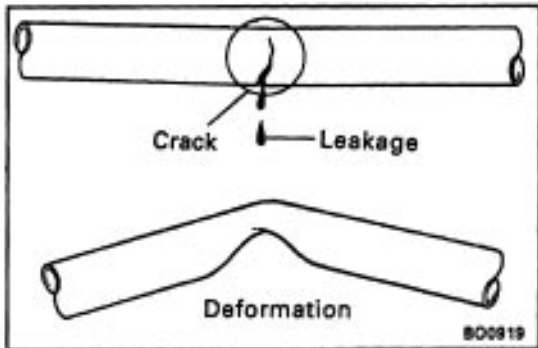
\* For use with SST

Z10903

## PRECAUTIONS

89300-01

1. Always use new gaskets when replacing the fuel tank or component parts.
2. Apply the proper torque to all parts tightened.

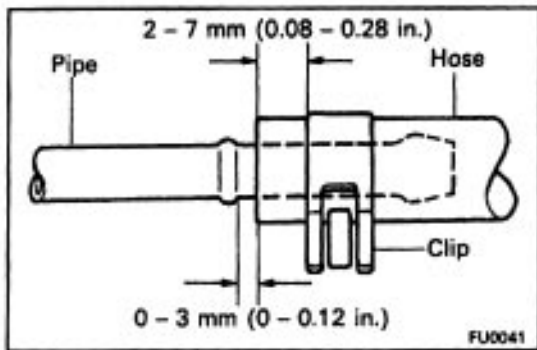


## FUEL LINES AND CONNECTIONS INSPECTION

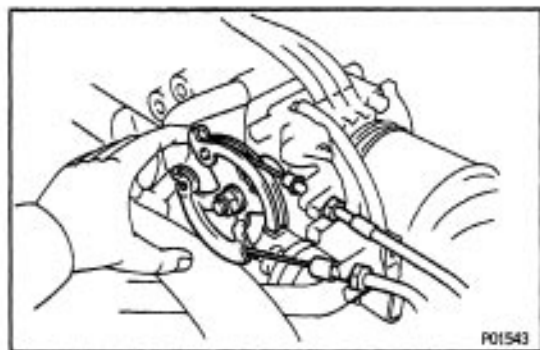
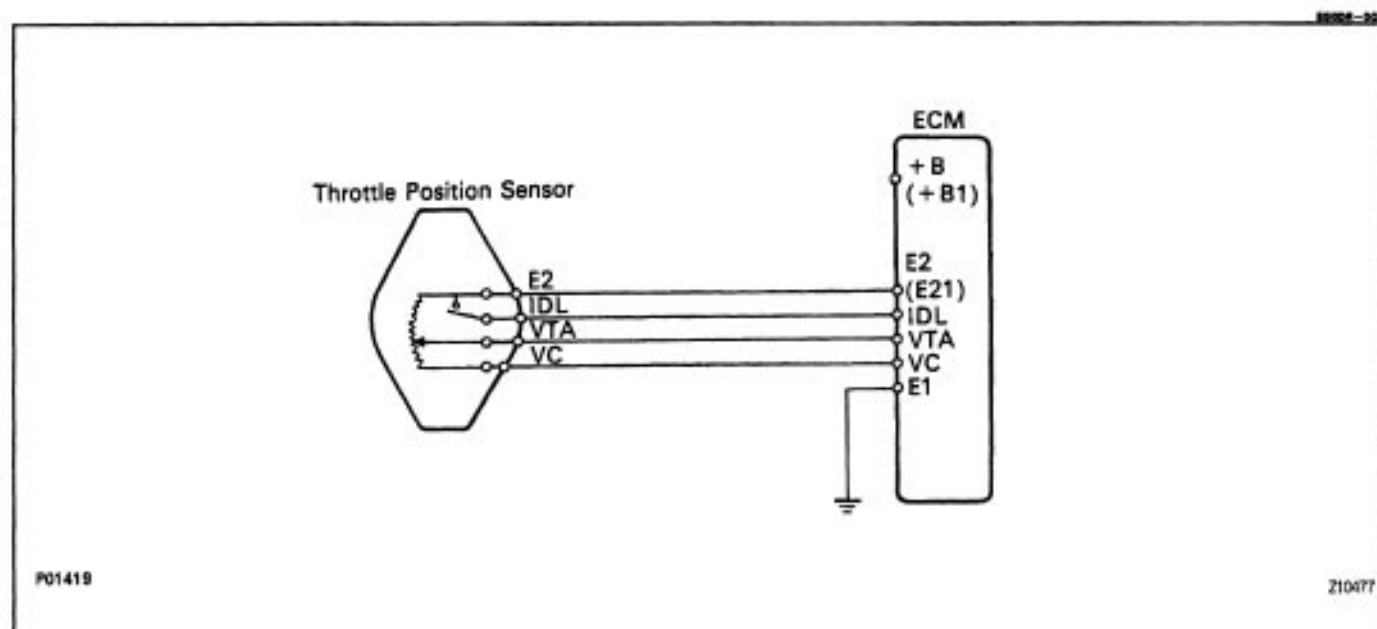
89300-01

- (a) Check the fuel lines for cracks, leakage and all connections for deformation.
- (b) Check the fuel tank vapor vent system hoses and connections for looseness, sharp bends or damage.
- (c) Check the fuel tank for deformation, cracks, fuel leakage and tank band looseness.
- (d) Check the filler neck for damage or fuel leakage.
- (e) Hose and tube connections are as shown in the illustration.

If a problem is found, repair or replace the part as necessary.



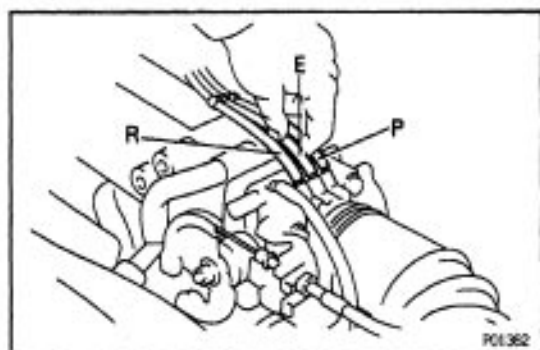
# THROTTLE BODY



## ON-VEHICLE INSPECTION

### 1. INSPECT THROTTLE BODY

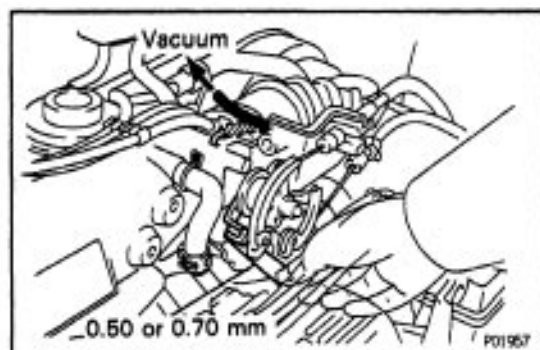
(a) Check that the throttle linkage moves smoothly.



(b) Check the vacuum at each port.

- Start the engine.
- Check the vacuum with your finger.

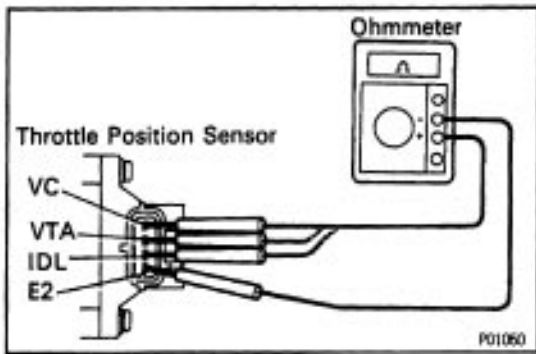
Port name	At idle	Other than idle
P	No vacuum	Vacuum
E	No vacuum	Vacuum
R	No vacuum	No vacuum



### 2. INSPECT THROTTLE POSITION SENSOR

- Apply vacuum to the throttle opener.
- Disconnect the sensor connector.
- Insert a thickness gauge between the throttle stop screw and stop lever.

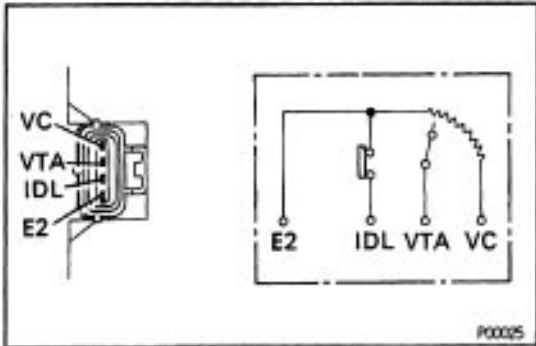




(d) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.50 mm (0.020 in.)	IDL – E2	2.3 kΩ or less
0.70 mm (0.028 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

(e) Reconnect the sensor connector.



### 3. INSPECT AND ADJUST THROTTLE OPENER

#### A. Warm up engine

Allow the engine to warm up to normal operating temperature.

#### B. Check idle speed

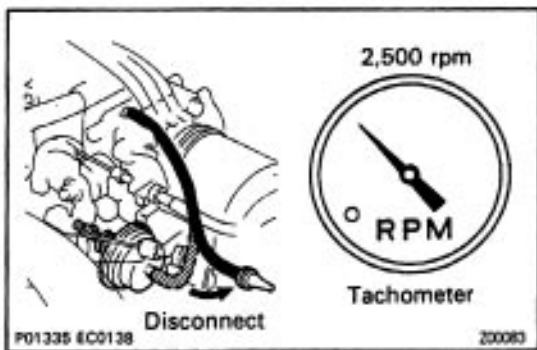
Idle speed:

$750 \pm 50$  rpm

#### C. Check and adjust throttle opener setting speed

(a) Disconnect the vacuum hose from the throttle opener, and plug the hose end.

(b) Maintain the engine at 2,500 rpm.

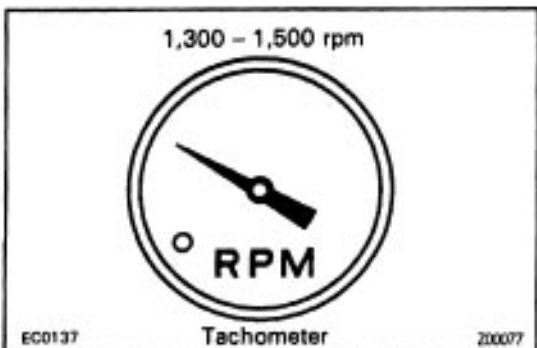


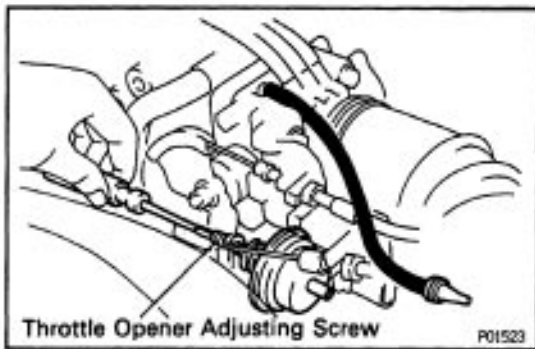
(c) Release the throttle valve.

(d) Check that the throttle opener is set.

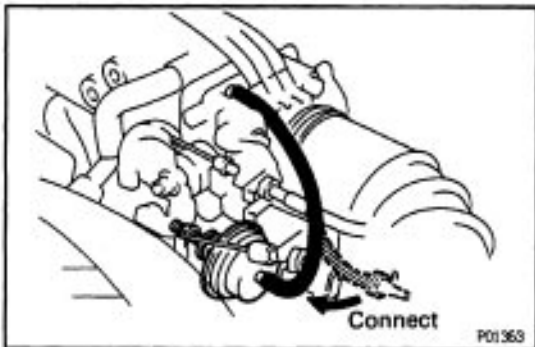
Throttle opener setting speed:

1,300 – 1,500 rpm (w/ Cooling fan OFF)





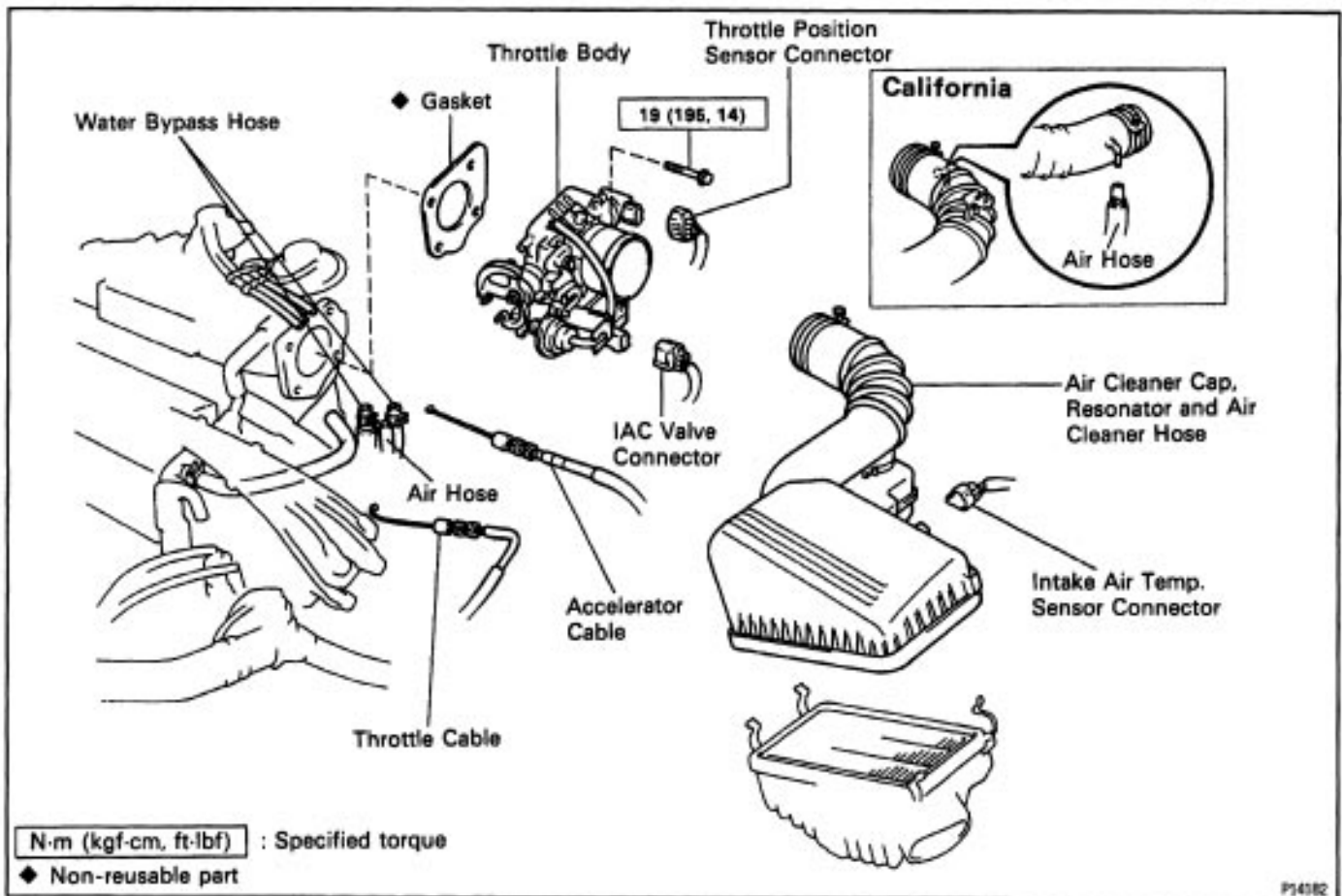
- (e) Adjust the throttle opener setting speed by turning the throttle opener adjusting screw.

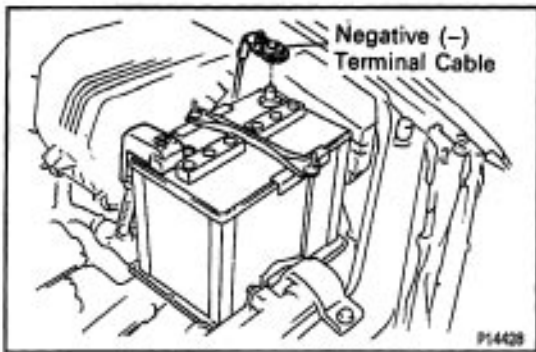


- (f) Reconnect the vacuum hose to the throttle opener.

80198-9F

## COMPONENTS FOR REMOVAL AND INSTALLATION





## THROTTLE BODY REMOVAL

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

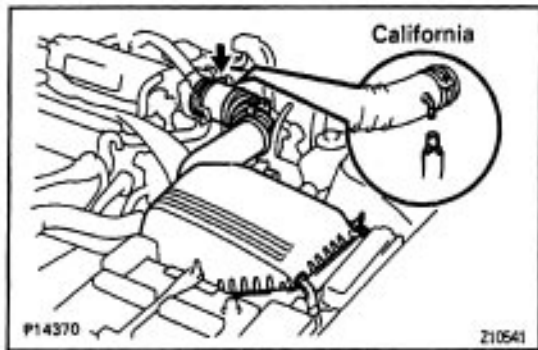
**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the “LOCK” position and the negative (-) terminal cable is disconnected from the battery.

### 2. DRAIN ENGINE COOLANT

### 3. DISCONNECT ACCELERATOR CABLE FROM THROTTLE LINKAGE

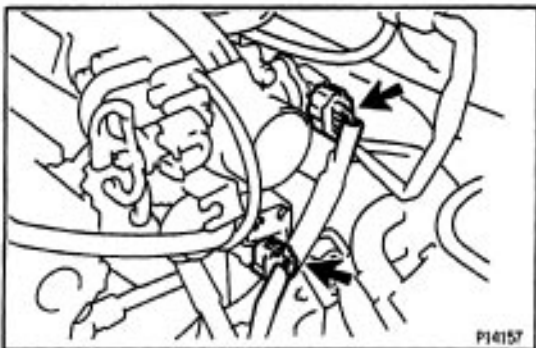
### 4. A/T:

DISCONNECT THROTTLE CABLE FROM THROTTLE LINKAGE



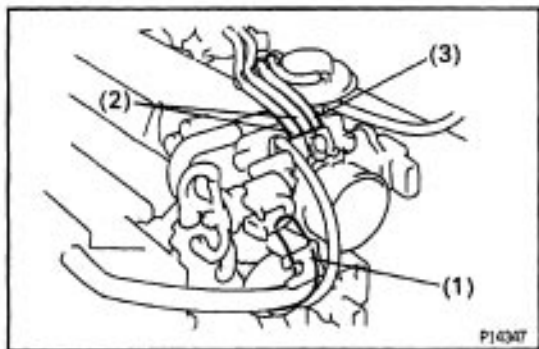
### 5. REMOVE AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

- (a) Disconnect the intake air temperature sensor connector.
- (b) California only:  
Disconnect the air hose from the air cleaner hose.
- (c) Loosen the air cleaner hose clamp bolt.
- (d) Disconnect the 4 air cleaner cap clips.
- (e) Disconnect the air cleaner hose from the throttle body, and remove the air cleaner cap together with the resonator and air cleaner hose.

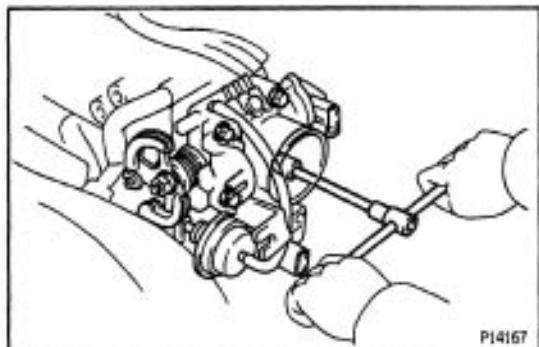


### 6. REMOVE THROTTLE BODY

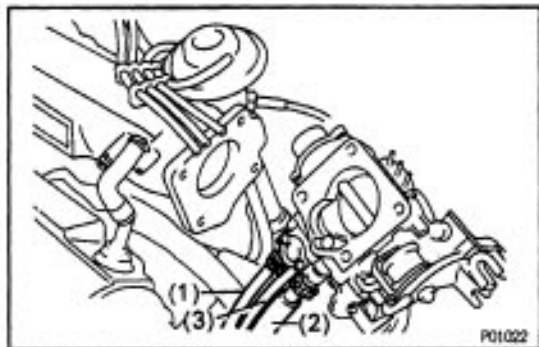
- (a) Disconnect the throttle position sensor connector.
- (b) Disconnect the IAC valve connector.



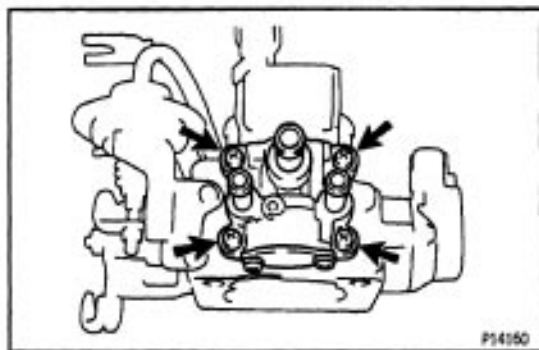
- (c) Disconnect the following hoses from the throttle body.
- (1) PCV hose
  - (2) 2 vacuum hoses from EGR vacuum modulator
  - (3) Vacuum hose from TVV (for EVAP)



- (d) Type A:  
Remove the 4 bolts.
- (e) Type B:  
Remove the 2 bolts and 2 nuts.

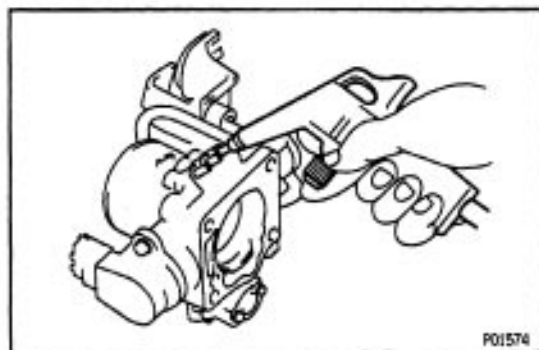


- (f) Disconnect the following hoses from the throttle body, and remove the throttle body.
- (1) Water bypass hose from water outlet
  - (2) Water bypass hose from water bypass pipe
  - (3) California:  
Air hose from cylinder head  
Except California:  
Air hose from air tube



## 7. IF NECESSARY, REMOVE IAC VALVE FROM THROTTLE BODY

Remove the 4 screws, IAC valve and gasket.

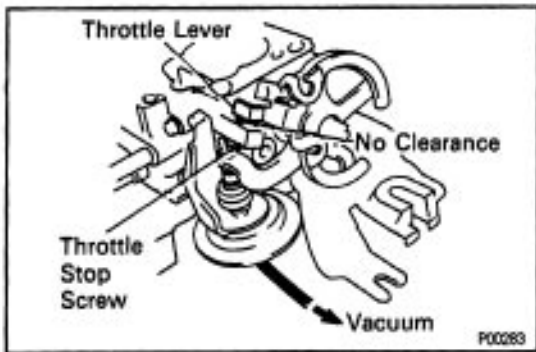


## THROTTLE BODY INSPECTION

### 1. CLEAN THROTTLE BODY

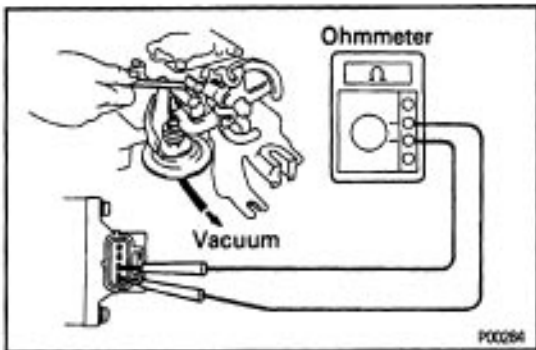
- (a) Using a soft brush and carburetor cleaner, clean the cast parts.
- (b) Using compressed air, clean all the passages and apertures.

**NOTICE:** To prevent deterioration, do not clean the throttle position sensor.



## 2. INSPECT THROTTLE VALVE

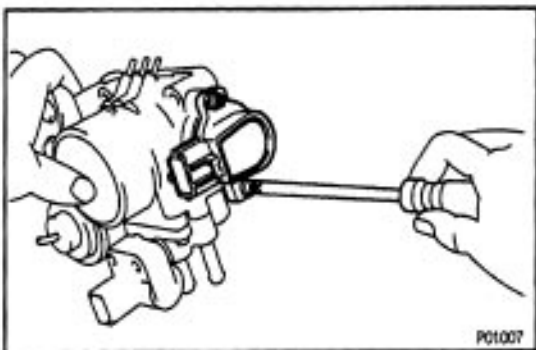
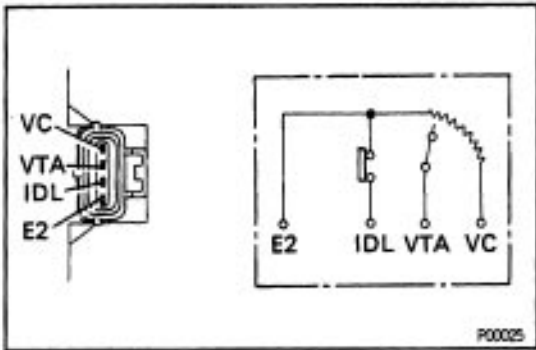
- Apply vacuum to the throttle opener.
- Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.



## 3. INSPECT THROTTLE POSITION SENSOR

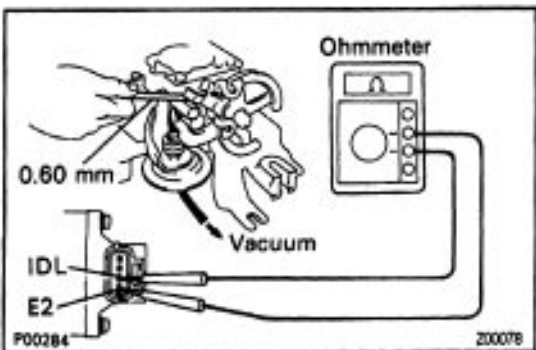
- Apply vacuum to the throttle opener.
- Insert a thickness gauge between the throttle stop screw and stop lever.
- Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 k $\Omega$
0.50 mm (0.020 in.)	IDL–E2	2.3 k $\Omega$ or less
0.70 mm (0.028 in.)	IDL–E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 k $\Omega$
–	VC – E2	2.5 – 5.9 k $\Omega$

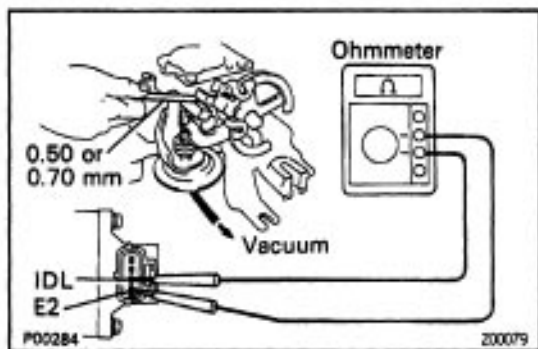


## 4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

- Loosen the 2 set screws of the sensor.

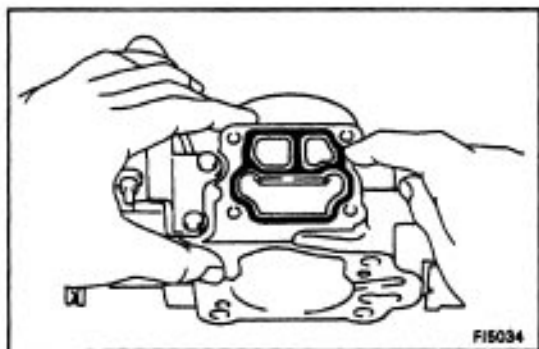


- Apply vacuum to the throttle opener.
- Insert a 0.60 mm (0.024 in.) thickness gauge between the throttle stop screw and stop lever.
- Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.
- Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the 2 set screws.



(f) Recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL – E2)
0.50 mm (0.020 in.)	Continuity
0.70 mm (0.028 in.)	No continuity

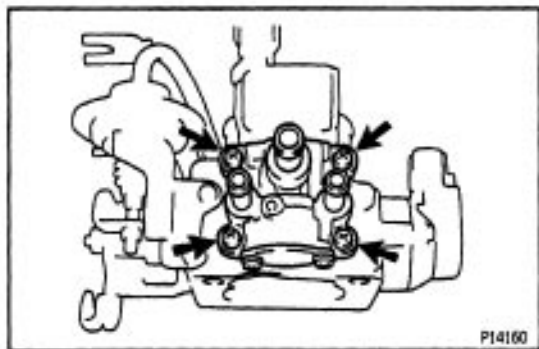


## THROTTLE BODY INSTALLATION

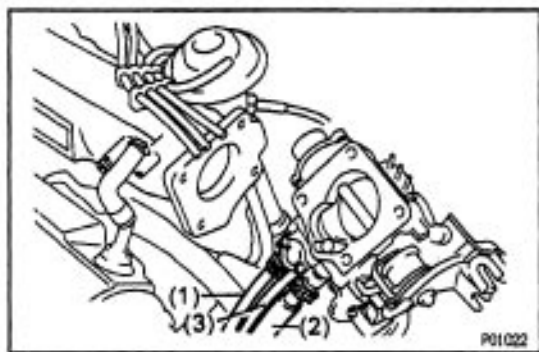
(See Components for Removal and Installation)

### 1. INSTALL IAC VALVE TO THROTTLE BODY

(a) Place a new gasket on the throttle body.



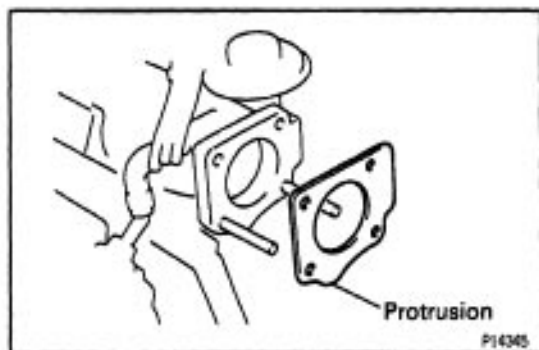
(b) install the IAC valve with the 4 screws.



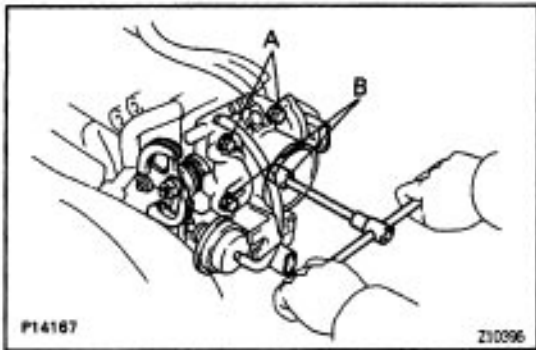
### 2. INSTALL THROTTLE BODY

(a) Connect the following hoses to the throttle body:

- (1) Water bypass hose from water outlet
- (2) Water bypass hose from water bypass pipe
- (3) California:  
Air hose from cylinder head
- Except California:  
Air hose from air tube



(b) Place a new gasket on the intake chamber, facing the protrusion downward.

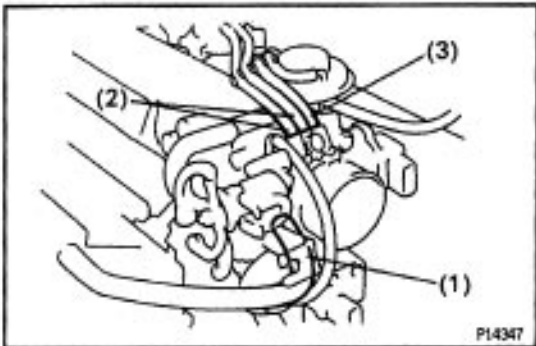


- (c) Type A:  
Install the throttle body with the 4 bolts.  
**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**

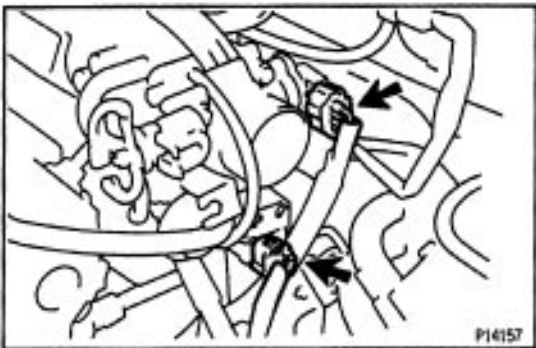
Bolt length:

- A 45 mm (1.77 in.)  
B 55 mm (2.17 in.)

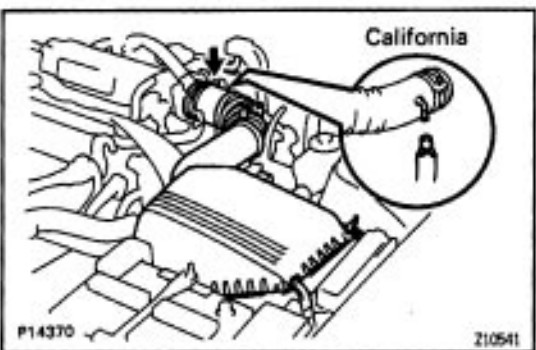
- (d) Type B:  
Install the throttle body with the 2 bolts and 2 nuts.  
**Torque: 19 N-m (195 kgf-cm, 14 ft-lbf)**



- (e) Connect the following hoses to the throttle body:  
(1) PCV hose  
(2) 2 vacuum hoses from EGR vacuum modulator  
(3) Vacuum hose from TVV (for EVAP)



- (f) Connect the IAC valve connector.  
(g) Connect the throttle position sensor connector.



### 3. INSTALL AIR CLEANER CAP, RESONATOR AND AIR CLEANER HOSE

- (a) Connect the air cleaner hose to the throttle body.  
(b) Install the air cleaner cap together with the resonator and air cleaner hose.  
(c) California only:  
Connect the air hose to the air cleaner hose.  
(d) Connect the intake air temperature sensor connector.

### 4. A/T:

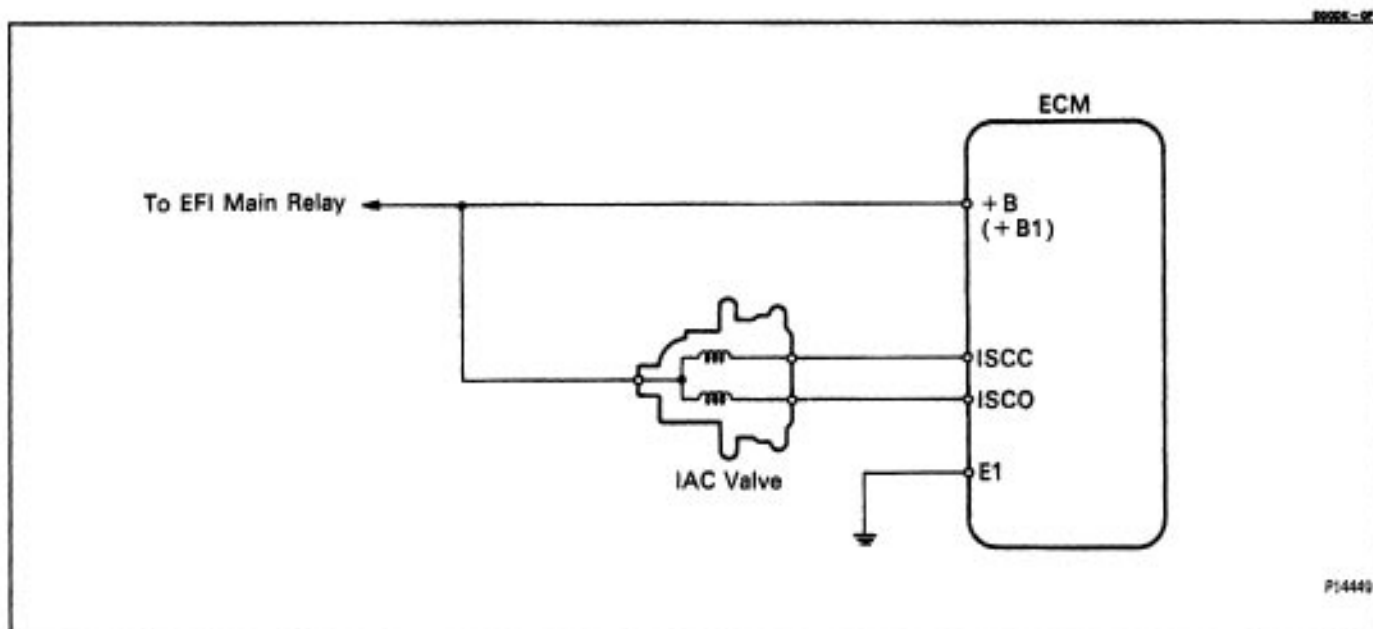
#### CONNECT AND ADJUST THROTTLE CABLE

#### 5. CONNECT AND ADJUST ACCELERATOR CABLE

#### 6. FILL WITH ENGINE COOLANT

#### 7. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY

## IDLE AIR CONTROL (IAC) VALVE

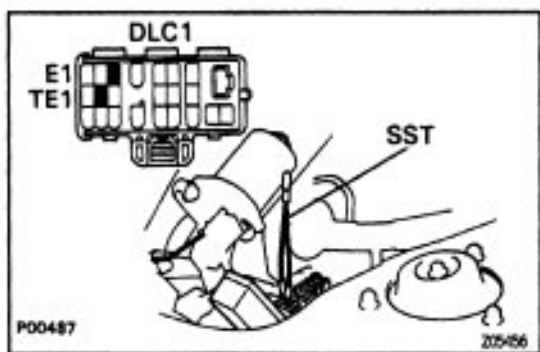


## ON-VEHICLE INSPECTION

### 1. INSPECT IAC VALVE OPERATION

(a) Initial conditions:

- Engine at normal operating temperature
- Idle speed set correctly
- Transmission in neutral position

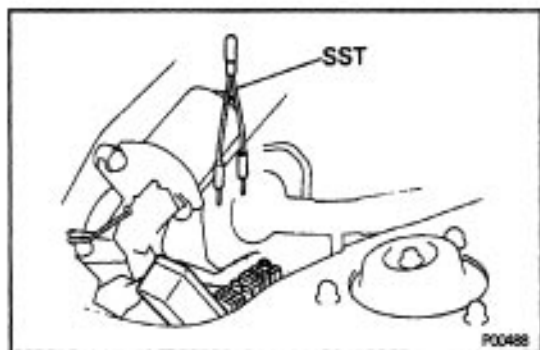


(b) Using SST, connect terminals TE1 and E1 of the data link connector 1.

SST 09843-18020

(c) Maintain engine speed in the range between 900 – 1,300 rpm for 5 seconds. Check that it returns to idle speed.

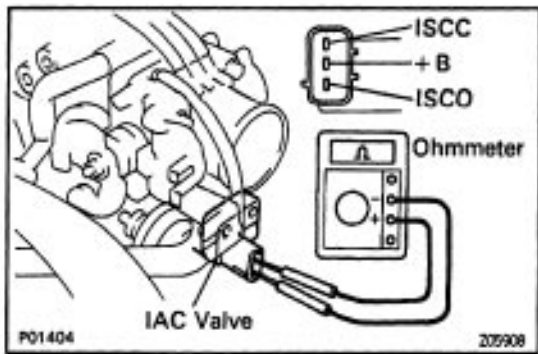
If the engine speed operation is not as specified, check the IAC valve, wiring and ECM.



(d) Remove the SST.

SST 09843-18020





## 2. INSPECT IAC VALVE RESISTANCE

- Disconnect the IAC valve connector.
- Using an ohmmeter, measure the resistance between terminal + B and other terminals (ISCC, ISCO).

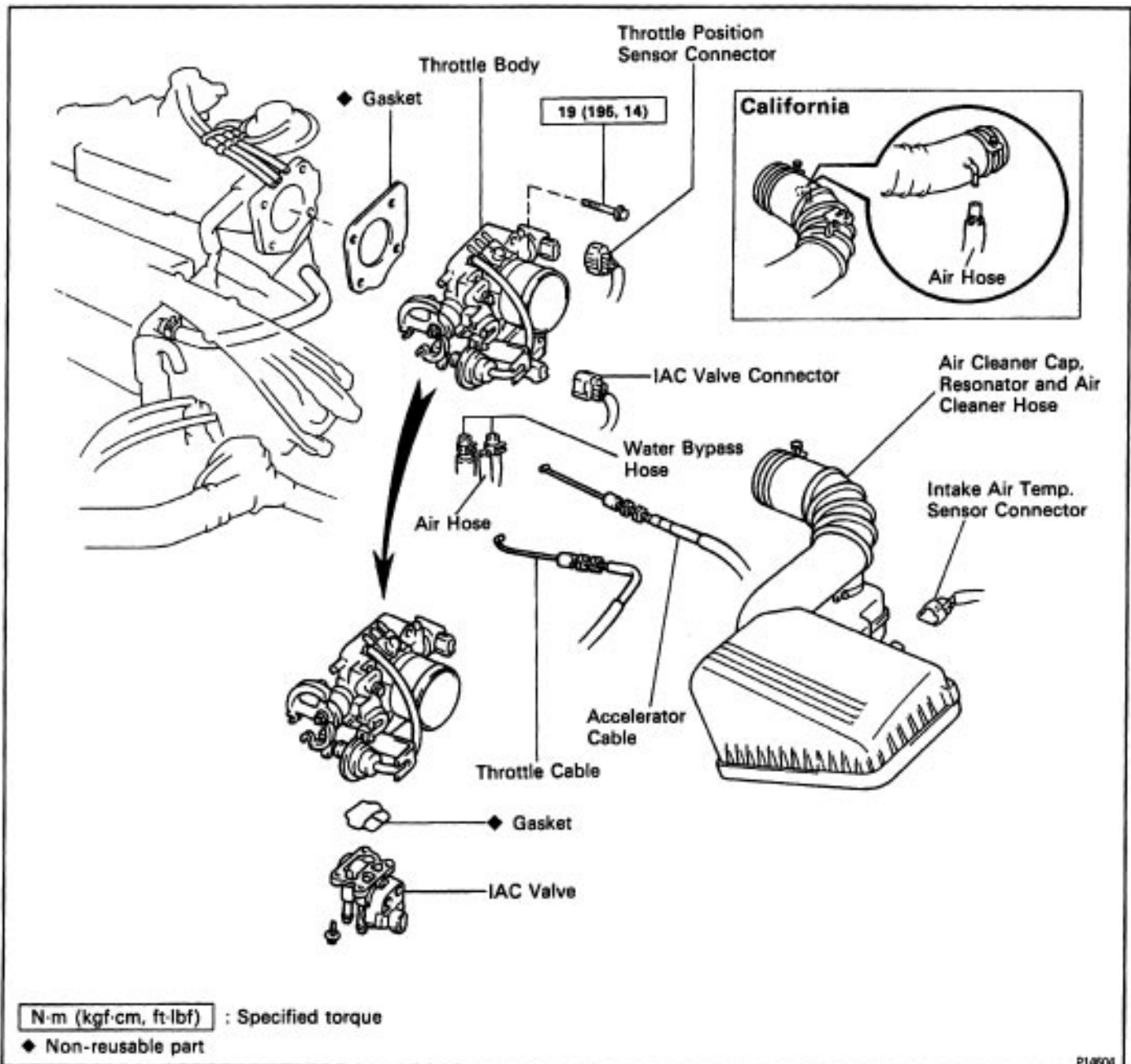
**Resistance:**

**19.3–22–3Ω**

If resistance is not as specified, replace the IAC valve.

- Reconnect the IAC valve connector.

## COMPONENTS FOR REMOVAL AND INSTALLATION



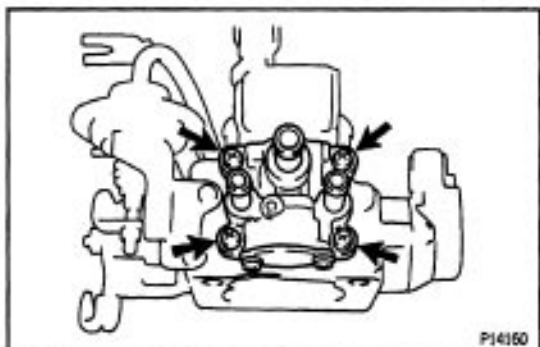
## IAC VALVE REMOVAL

800246-08

(See Components for Removal and Installation)

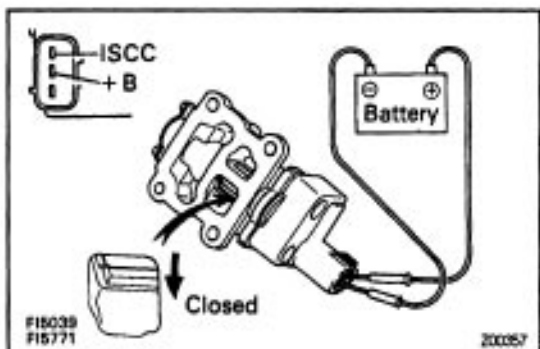
### 1. REMOVE THROTTLE BODY

(See steps 1 to 6 on pages [EG1-207](#) and 208)



### 2. REMOVE IAC VALVE

Remove the 4 screws, IAC valve and gasket.

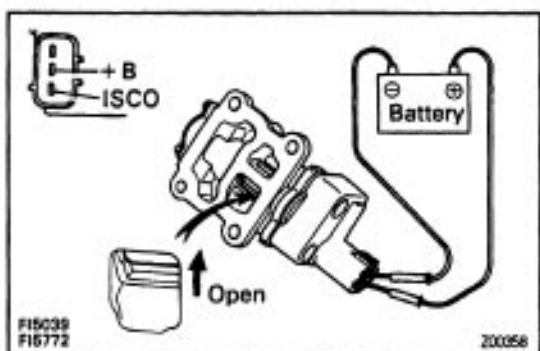


## IAC VALVE INSPECTION

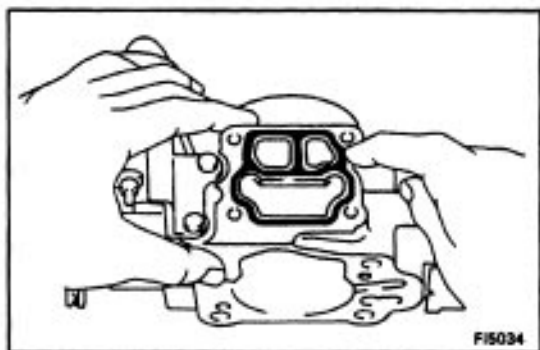
800246-08

### INSPECT IAC VALVE OPERATION

- (a) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal ISCC, and check that the valve is closed.



- (b) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal ISCO, and check that the valve is open.



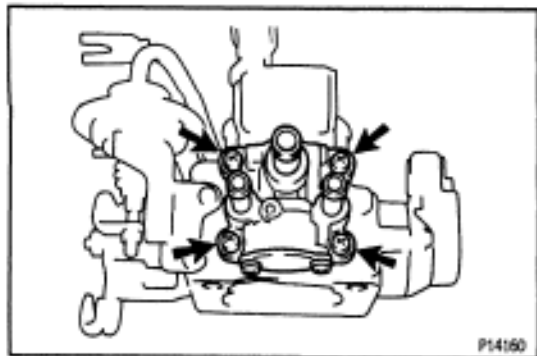
## IAC VALVE INSTALLATION

800246-08

(See Components for Removal and Installation)

### 1. INSTALL IAC VALVE

- (a) Place a new gasket on the throttle body.

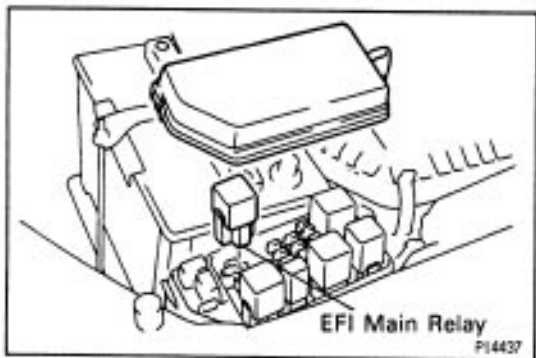
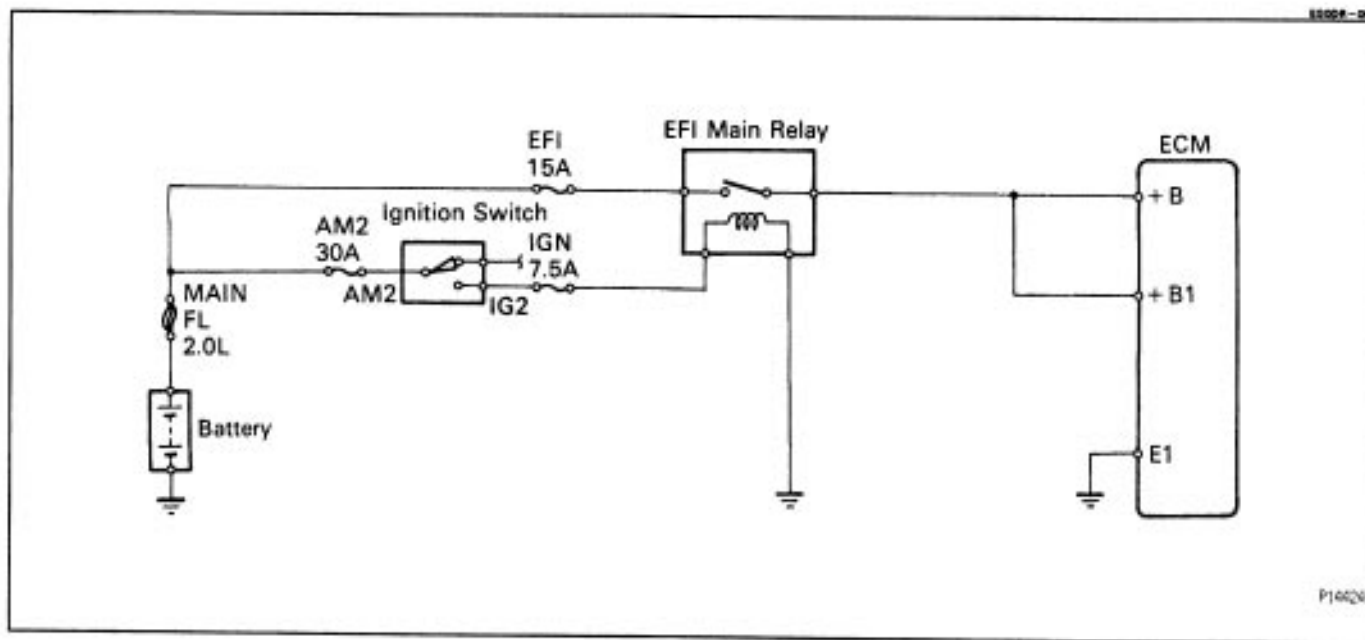


(b) Install the IAC valve with the 4 screws.

## 2. INSTALL THROTTLE BODY

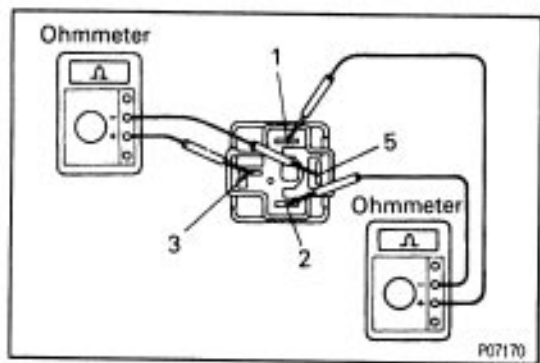
(See steps 2 to 7 on pages [EG1-210](#) and 211)

## EFI MAIN RELAY



## EFI MAIN RELAY INSPECTION

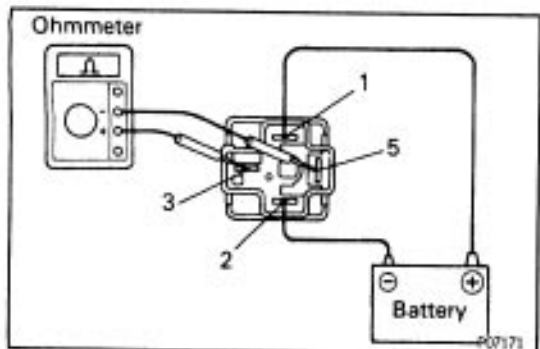
### 7. REMOVE EFI MAIN RELAY



### 2. INSPECT EFI MAIN RELAY

#### A. Inspect relay continuity

- Using an ohmmeter, check that there is continuity between terminals 1 and 2.
  - Check that there is no continuity between terminals 3 and 5.
- If continuity is not as specified, replace the relay.

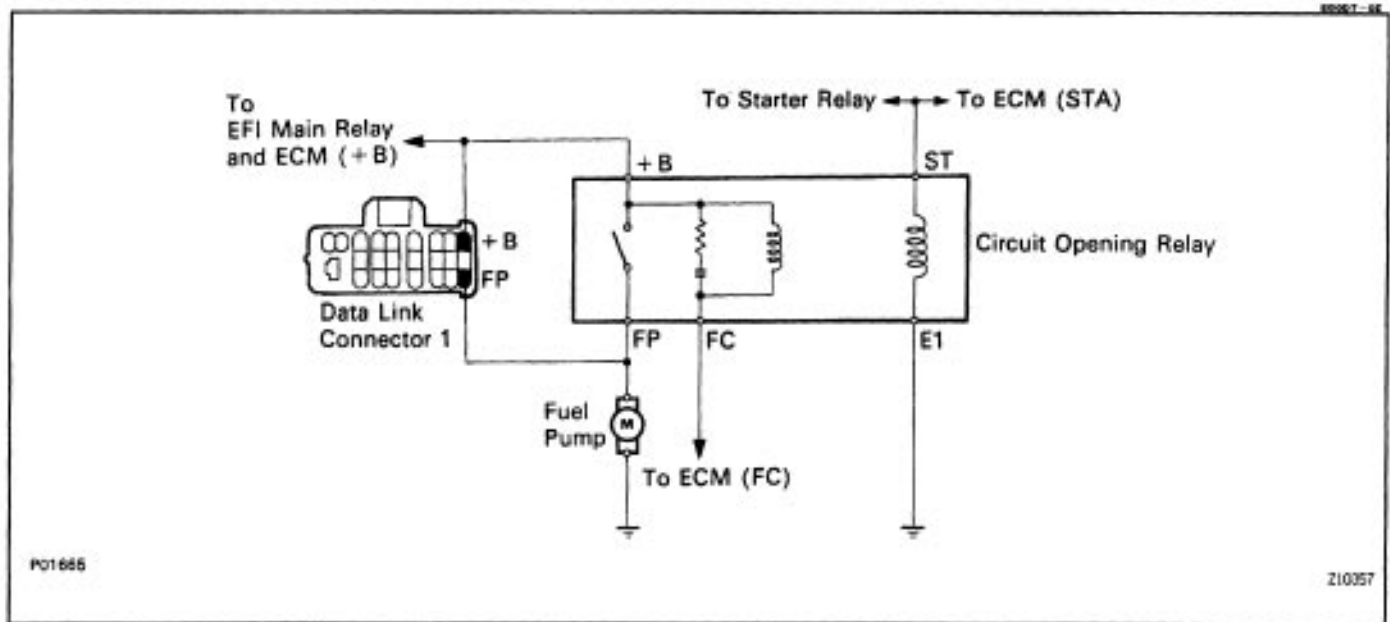


#### B. Inspect relay operation

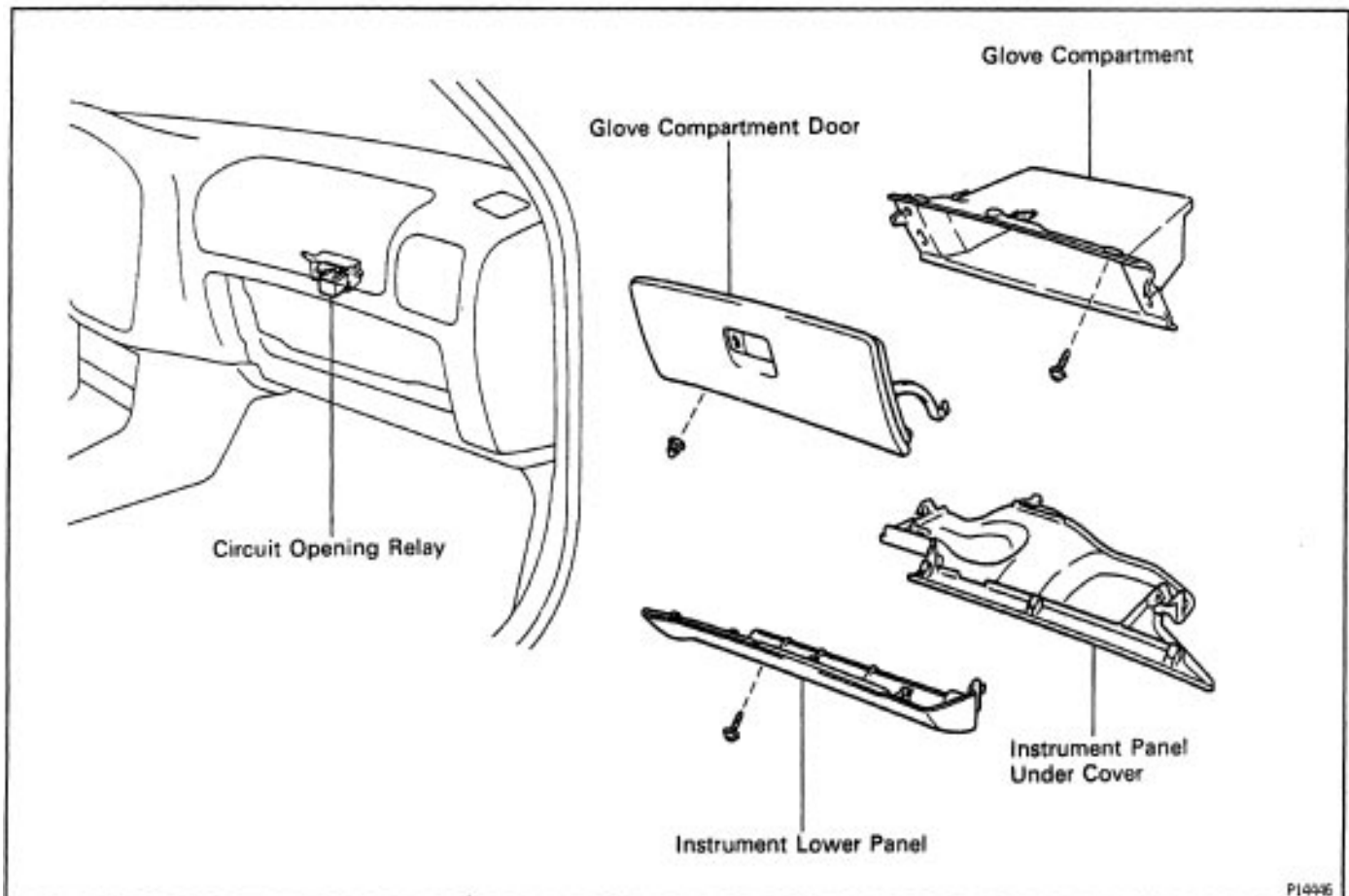
- Apply battery voltage across terminals 1 and 2.
  - Using an ohmmeter, check that there is continuity between terminals 3 and 5.
- If operation is not as specified, replace the relay.

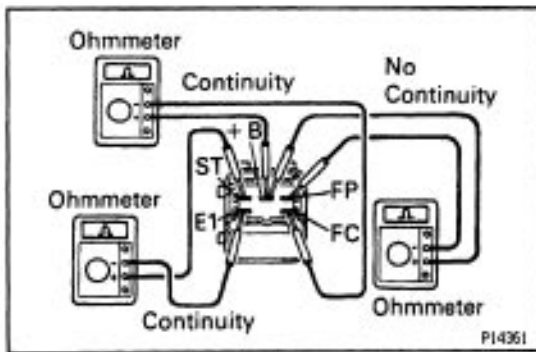
### 3. REINSTALL EFI MAIN RELAY

## CIRCUIT OPENING RELAY



## CIRCUIT OPENING RELAY REMOVAL AND INSTALLATION





## CIRCUIT OPENING RELAY INSPECTION

### 1. INSPECT RELAY CONTINUITY

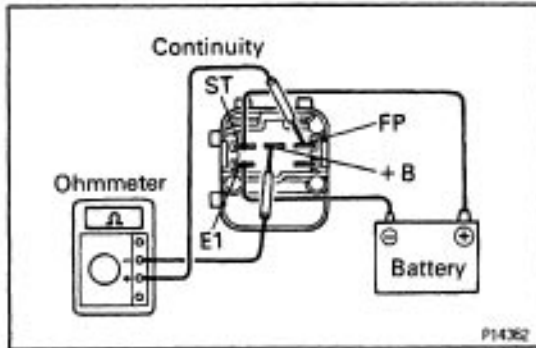
- Using an ohmmeter, check that there is continuity between terminals ST and E1.
- Check that there is continuity between terminals +B and FC.
- Check that there is no continuity between terminals +B and FP.

If continuity is not as specified, replace the relay.

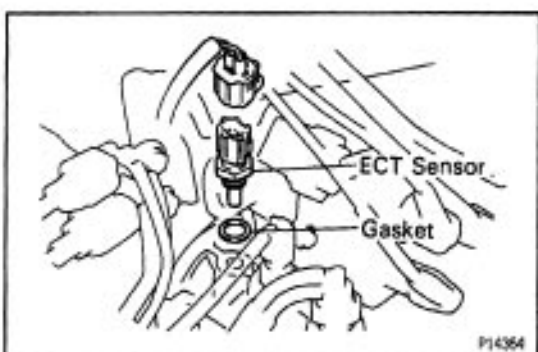
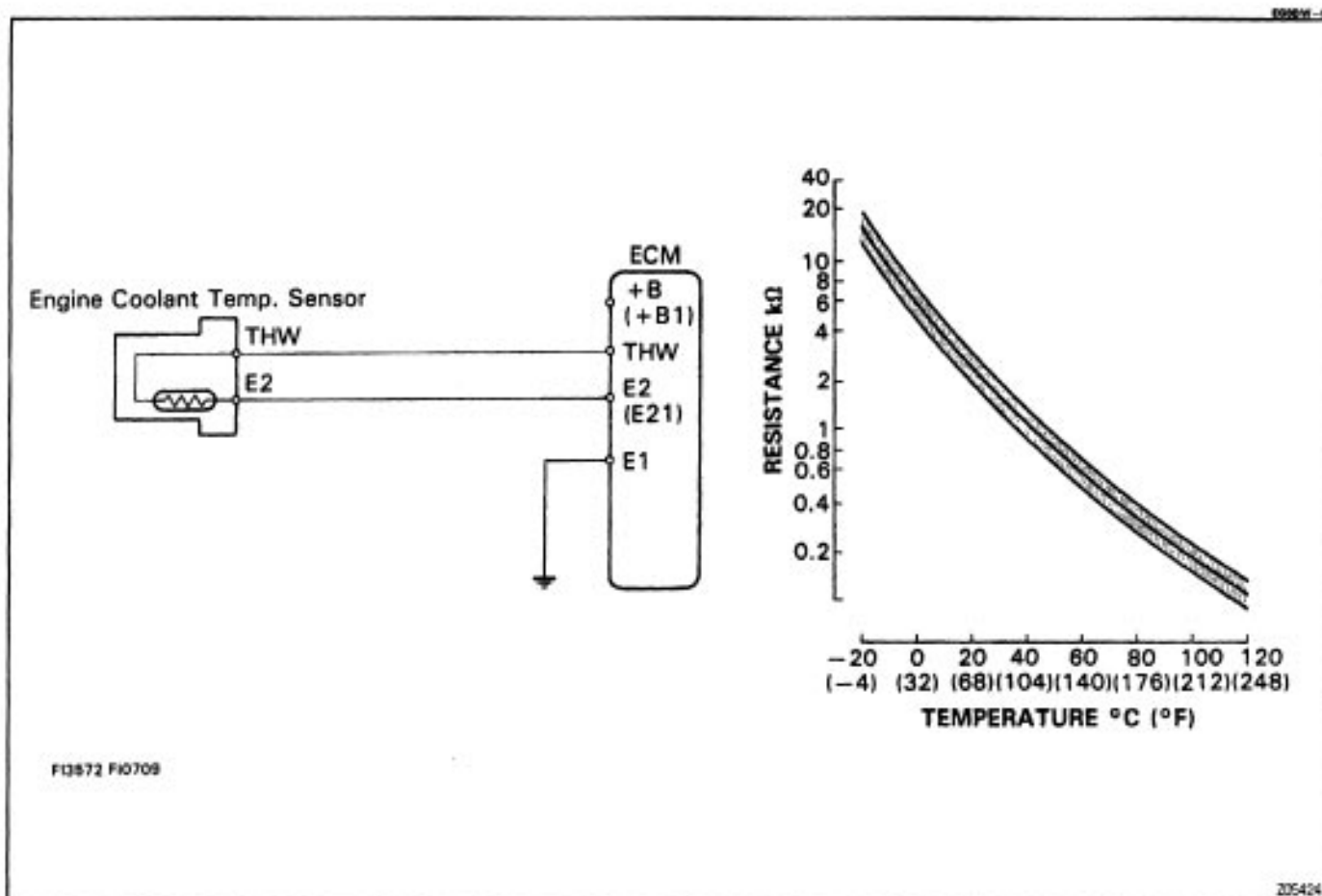
### 2. INSPECT RELAY OPERATION

- Apply battery voltage across terminals ST and E1.
- Using an ohmmeter, check that there is continuity between terminals +B and FP.

If operation is not as specified, replace the relay.

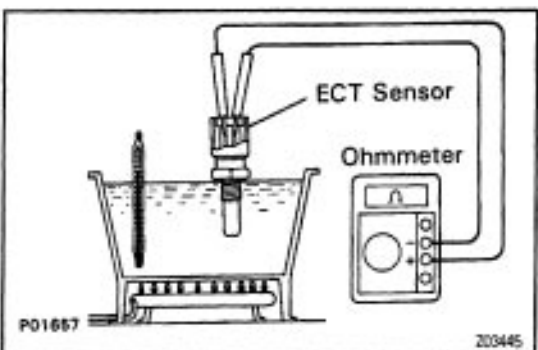


# ENGINE COOLANT TEMPERATURE (ECT) SENSOR



## ECT SENSOR INSPECTION

1. DRAIN ENGINE COOLANT
2. REMOVE ECT SENSOR



### 3. INSPECT ECT SENSOR RESISTANCE

Using an ohmmeter, measure the resistance between the terminals.

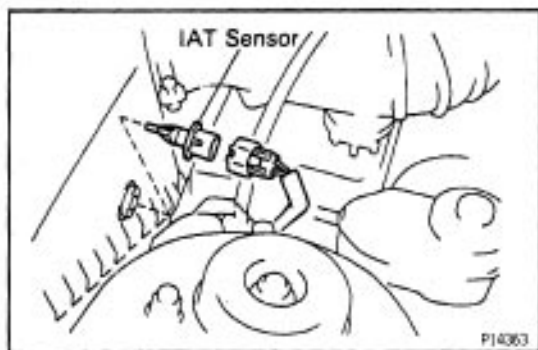
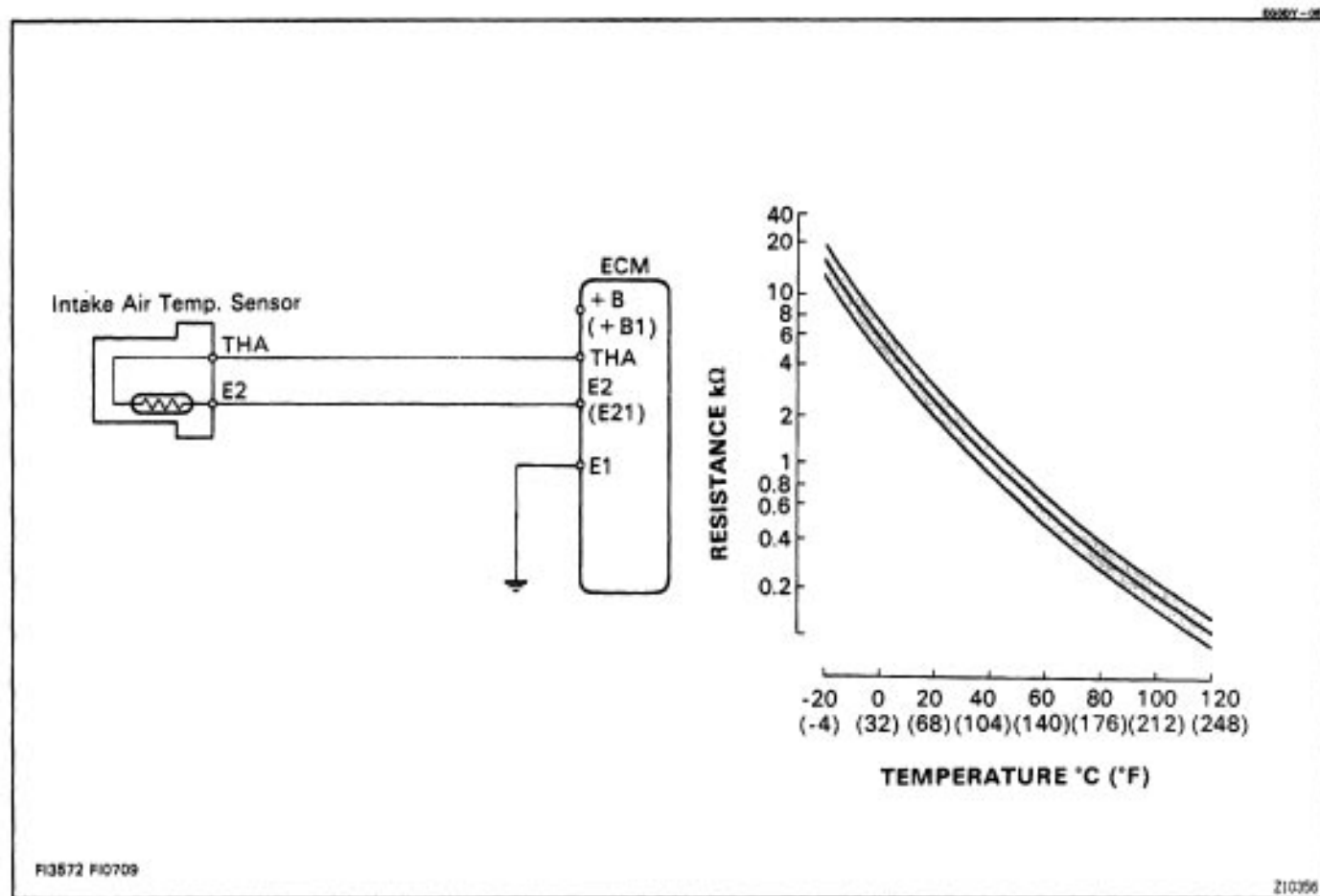
**Resistance:**

Refer to the graph above

If the resistance is not as specified, replace the sensor.

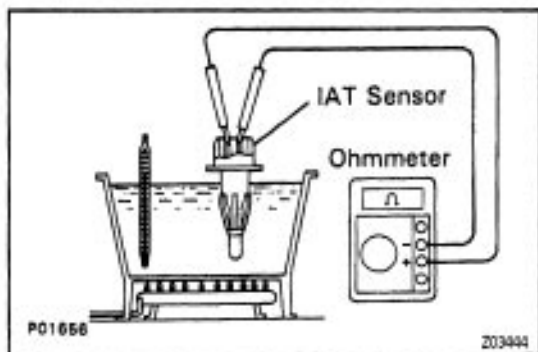
4. REINSTALL ECT SENSOR
5. FILL WITH ENGINE COOLANT

# INTAKE AIR TEMPERATURE (IAT) SENSOR



## IAT SENSOR INSPECTION

### 1. REMOVE IAT SENSOR



### 2. INSPECT IAT SENSOR RESISTANCE

Using an ohmmeter, measure the resistance between the terminals.

#### Resistance:

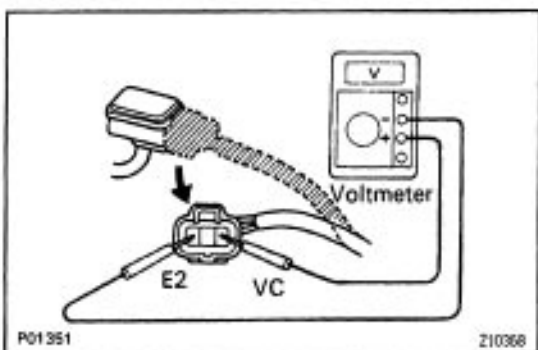
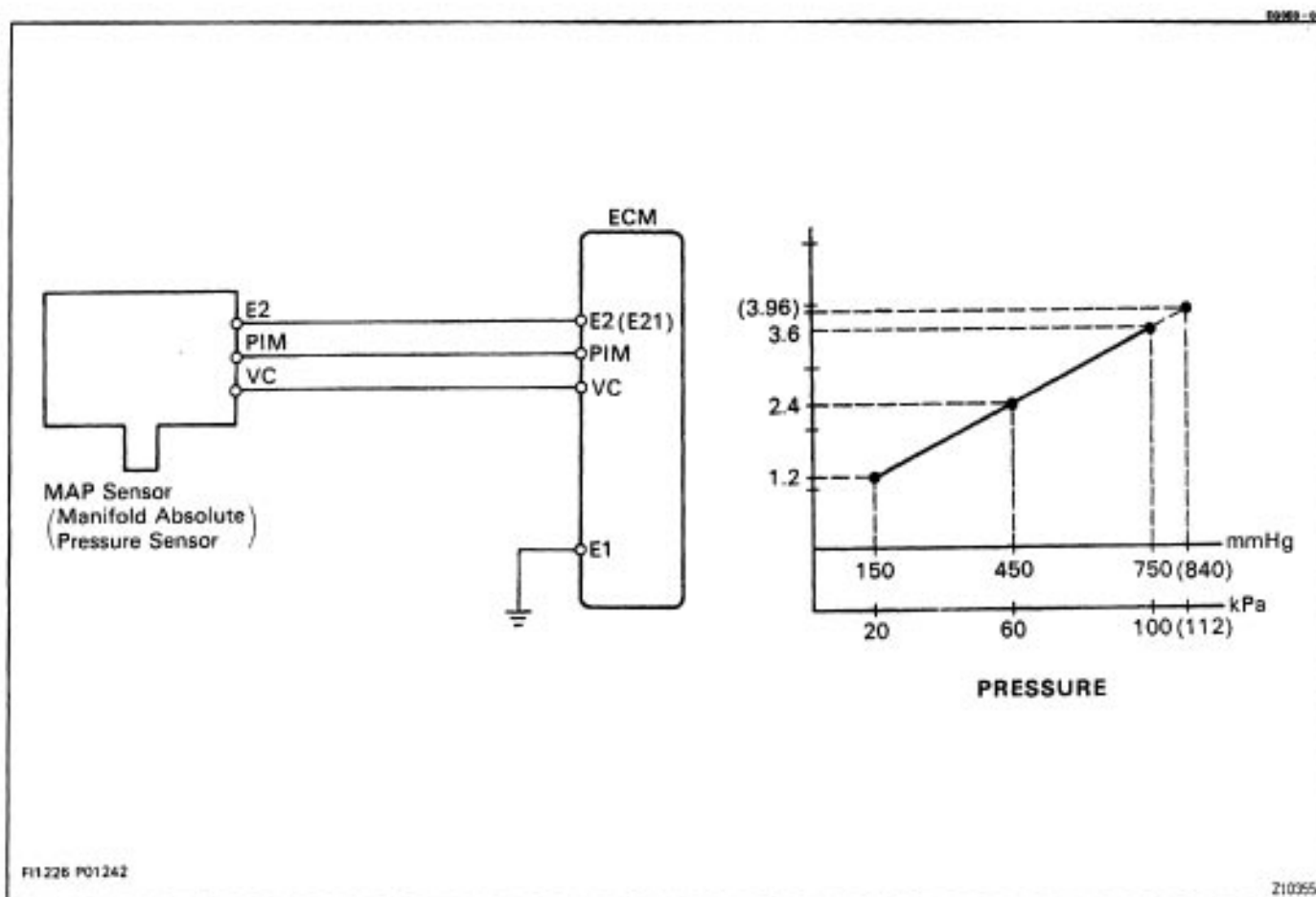
Refer to the graph above

If the resistance is not as specified, replace the sensor.

### 3. REINSTALL IAT SENSOR



# MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR



## MAP SENSOR INSPECTION

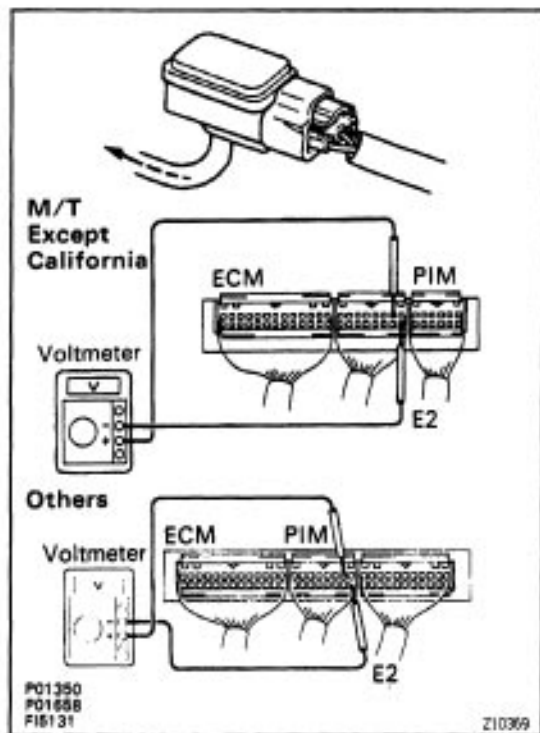
### 1. INSPECT POWER SOURCE VOLTAGE OF MAP SENSOR

- Disconnect the MAP sensor connector.
- Turn the ignition switch ON.
- Using a voltmeter measure the voltage between connector terminals VC and E2 of the wiring harness side.

**Voltage:**

**4.75 – 5.25 V**

- Reconnect the MAP sensor connector.



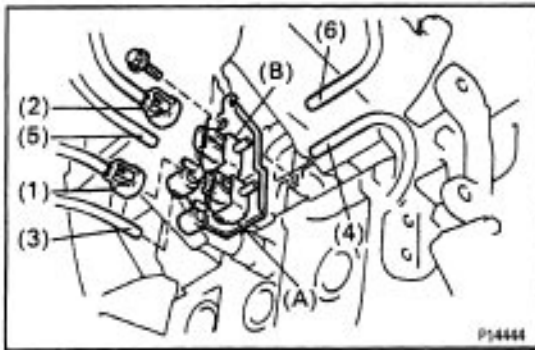
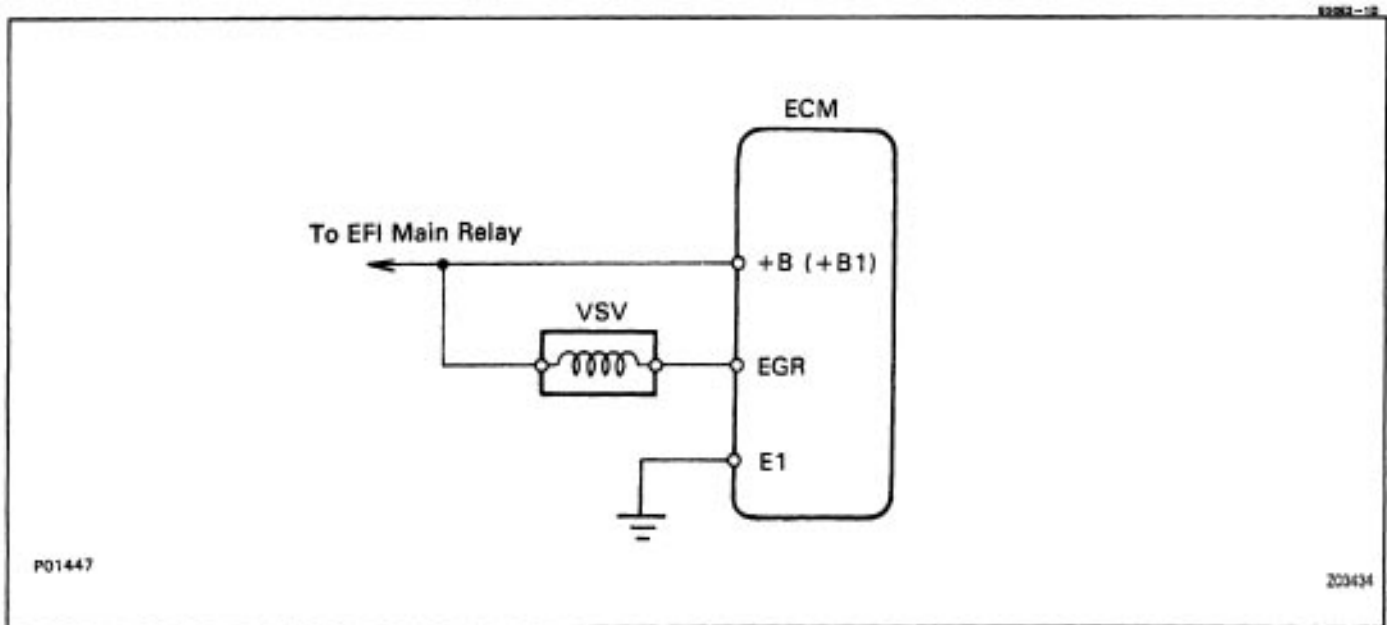
## 2. INSPECT POWER OUTPUT OF MAP SENSOR

- Turn the ignition switch ON.
- Disconnect the vacuum hose on the air intake chamber side.
- Connect a voltmeter to terminals PIM and E2 of the ECM, and measure the output voltage under ambient atmospheric pressure.
- Apply vacuum to the MAP sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).
- Measure the voltage drop from step (c) above for each segment.

### Voltage drop:

Applied Vacuum kPa (mmHg in.Hg)	13.3 (100 3.94 )	26.7 (200 7.87)	40.0 ( 300 111.8)	53.5 ( 400 15.75)	66.7 ( 500 19.69)
Voltage drop V	0.3-0.5	0.7-0.9	1.1 -1.3	1.5 - 1.7	1.9 - 2.1

## VSV FOR EGR



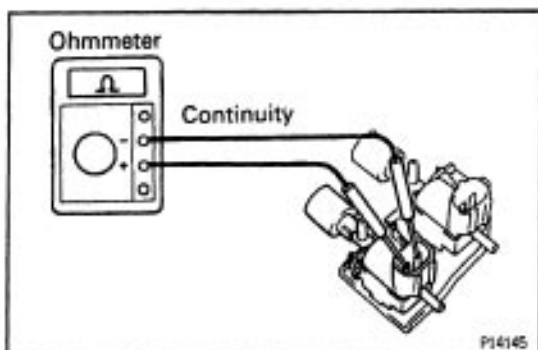
## VSV INSPECTION (California)

### 1. REMOVE VSV

(a) Disconnect the following connectors and hoses:

- (1) VSV for EGR (A) connector
- (2) VSV for fuel pressure control (B) connector
- (3) Vacuum hose (from EGR valve) from port E of VSV (A)
- (4) Vacuum hose (from port "Q" of EGR vacuum modulator) from port G of VSV (A)
- (5) Vacuum hose (from fuel pressure regulator) from port E of VSV (B)
- (6) Vacuum hose (from air intake chamber) from port G of VSV (B)

(b) Remove the bolt and VSV assembly.



### 2. INSPECT VSV

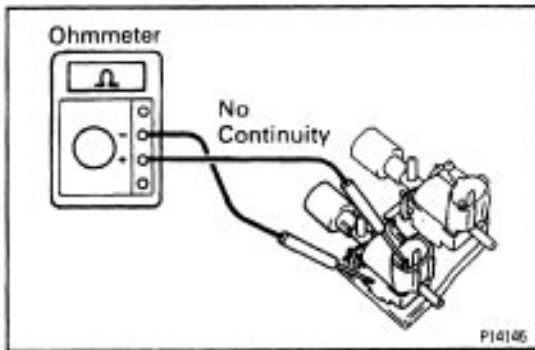
#### A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

**Resistance (Cold):**

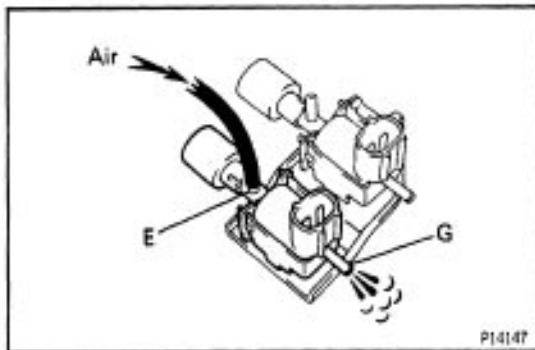
**33-39Ω**

If there is no continuity, replace the VSV.



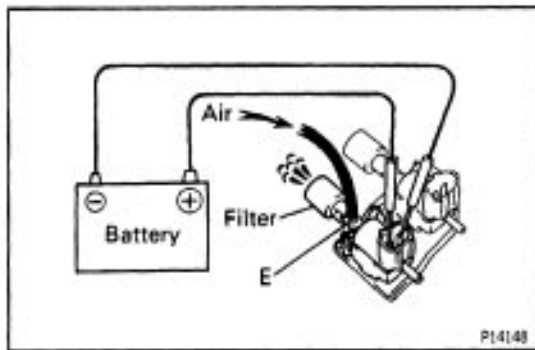
### B. Inspect VSV for ground

Using an ohmmeter, check that there is no continuity between each terminal and the body. If there is continuity, replace the VSV.



### C. Inspect VSV operation

(a) Check that air flows from port E to port G.

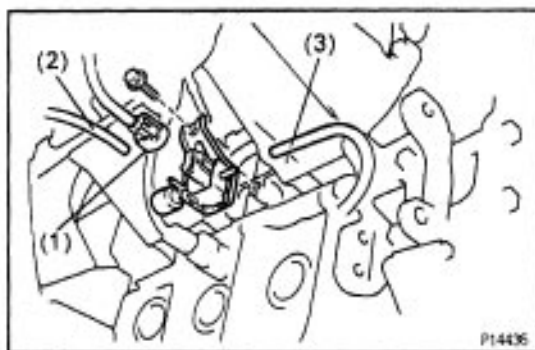


(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

### 3. REINSTALL VSV



## VSV INSPECTION (Except California)

### 1. REMOVE VSV

(a) Disconnect the following connector and hoses:

- (1) VSV connector
- (2) Vacuum hose (from EGR valve) from port E of VSV
- (3) Vacuum hose (from port "a" of EGR vacuum modulator) from port G of VSV

(b) Remove the bolt and VSV.

### 2. INSPECT VSV

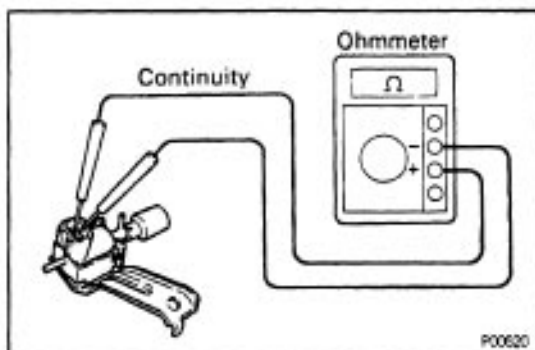
A. Inspect VSV for open circuit

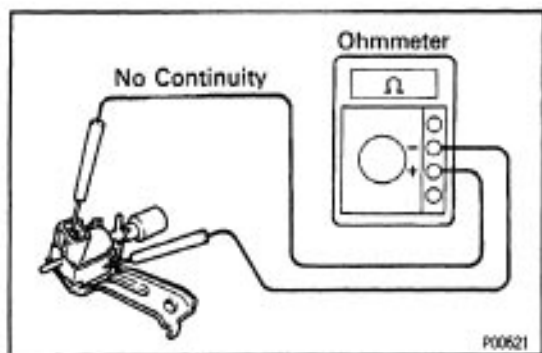
Using an ohmmeter, check that there is continuity between the terminals.

**Resistance (Cold):**

**33-39Ω**

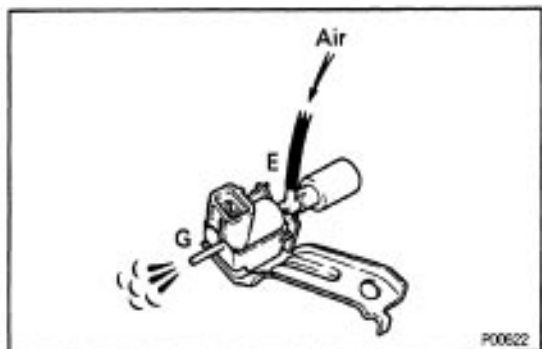
If there is no continuity, replace the VSV.





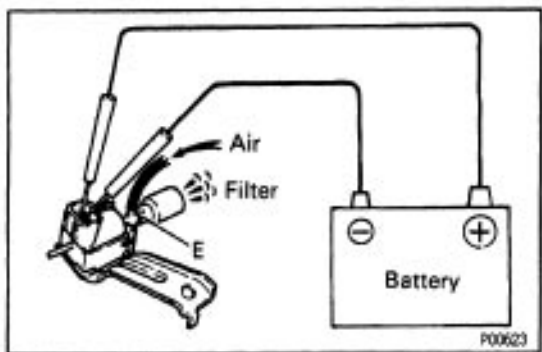
### B. Inspect VSV for ground

Using an ohmmeter, check that there is no continuity between each terminal and the body. If there is continuity, replace the VSV.



### C. Inspect VSV operation

(a) Check that air flows from port E to port G.



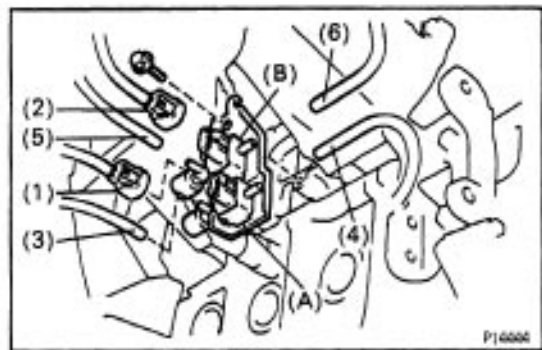
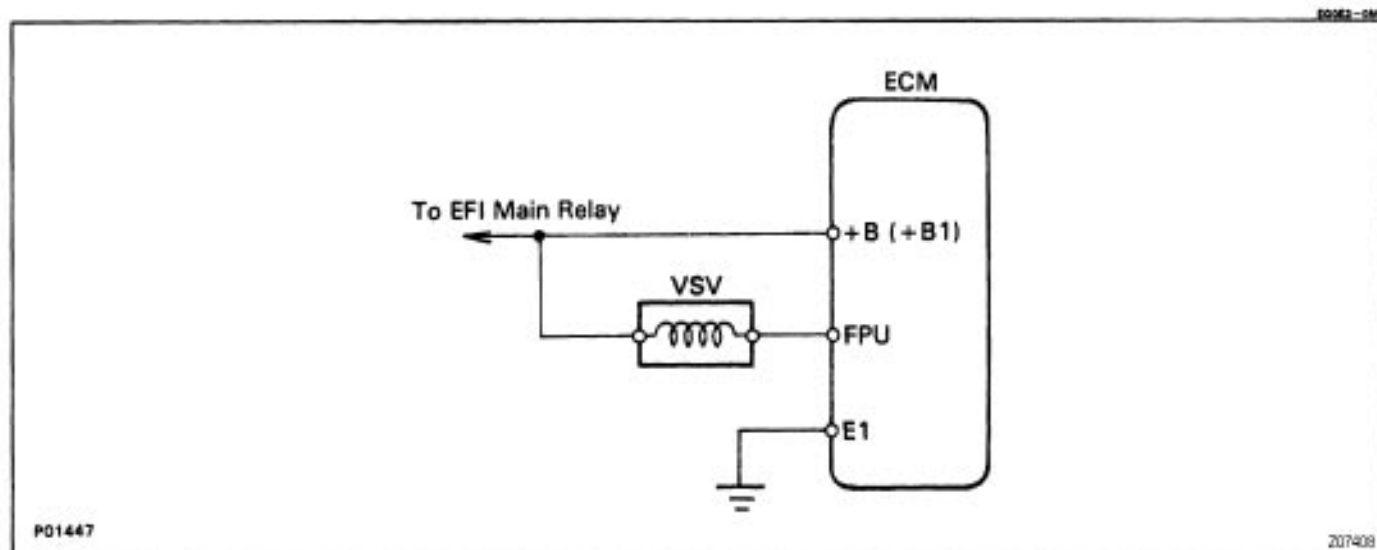
(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to the filter.

If operation is not as specified, replace the VSV.

### 3. REINSTALL VSV

## VSV FOR FUEL PRESSURE CONTROL (California only)



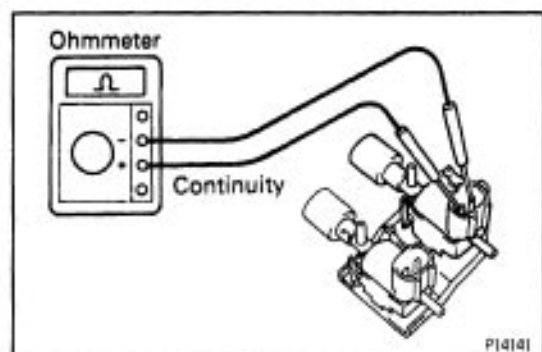
### VSV INSPECTION

#### 1. REMOVE VSV

(a) Disconnect the following connectors and hoses:

- (1) VSV for EGR (A) connector
- (2) VSV for fuel pressure control (B) connector
- (3) Vacuum hose (from EGR valve) from port E of VSV (A)
- (4) Vacuum hose (from port "a" of EGR vacuum modulator) from port G of VSV (A)
- (5) Vacuum hose (from fuel pressure regulator) from port E of VSV (B)
- (6) Vacuum hose (from air intake chamber) from port G of VSV (B)

(b) Remove the bolt and VSV assembly.



#### 2. INSPECT VSV

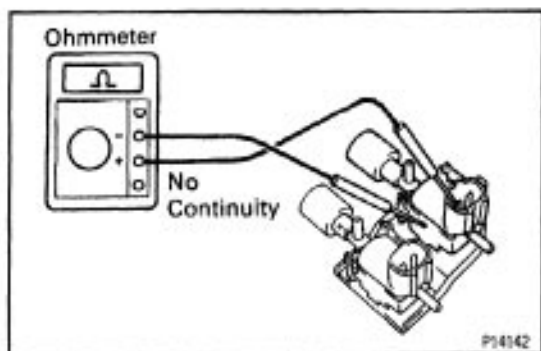
##### A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

**Resistance (Cold):**

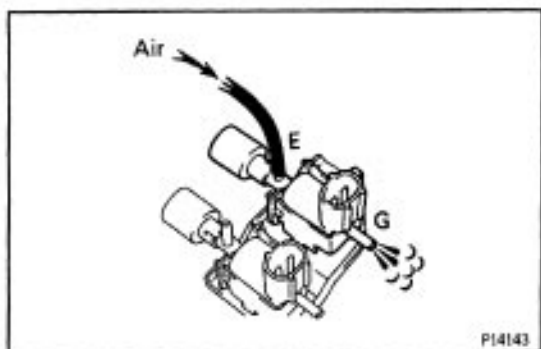
**33-39Ω**

If there is no continuity, replace the VSV.



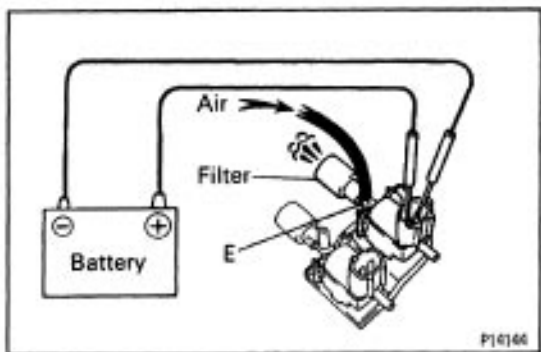
### B. Inspect VSV for ground

Using an ohmmeter, check that there is no continuity between each terminal and the body. If there is continuity, replace the VSV.



### C. Inspect VSV operation

(a) Check that air flows from pipe E to pipe G.



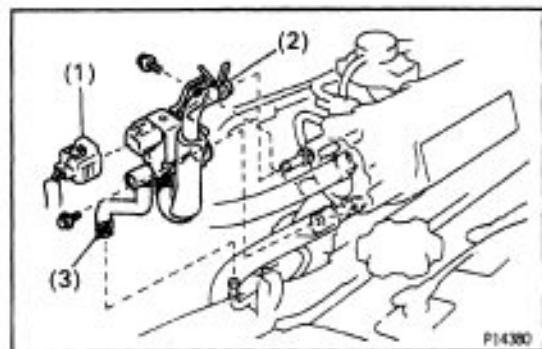
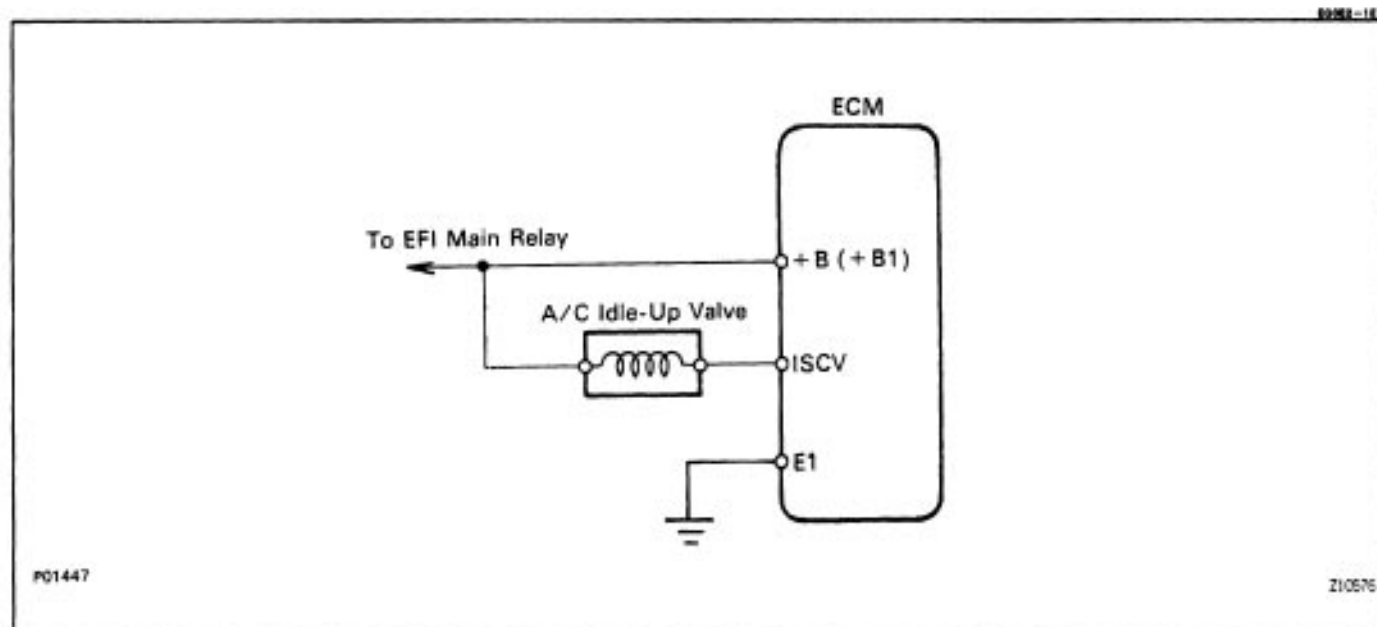
(b) Apply battery voltage across the terminals.

(c) Check that air flows from pipe E to the filter.

If operation is not as specified, replace the VSV.

## 3. REINSTALL VSV

# A-C IDLE-UP VALVE



## A/C IDLE-UP VALVE INSPECTION

### 1. REMOVE IDLE-UP VALVE

- Disconnect the following connector and hoses:
  - Idle-up valve connector
  - Air hose from air intake chamber
  - Air hose from air tube
- Remove the 2 bolts and idle-up valve together with the 2 air hoses.
- Disconnect the 2 air hoses from the idle-up valve.

### 2. INSPECT IDLE-UP VALVE

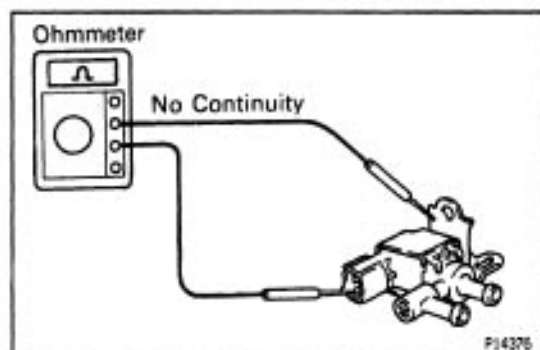
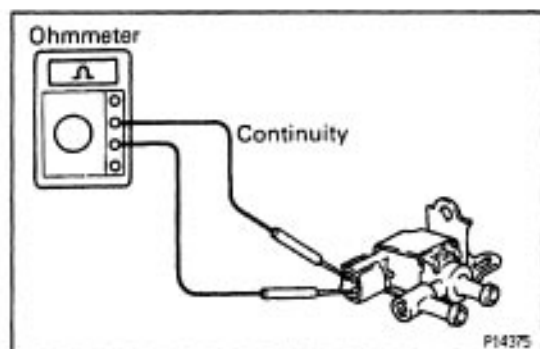
#### A. Inspect idle-up valve for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

#### Resistance (Cold):

**30-34Ω**

If there is no continuity, replace the idle-up valve.

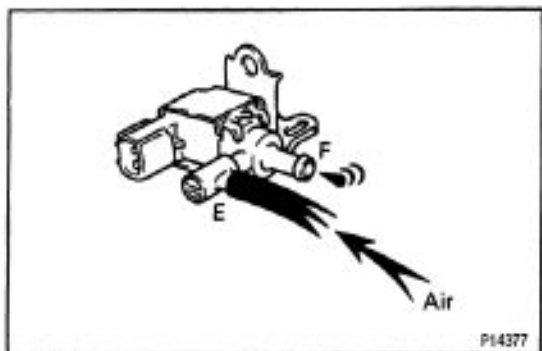


#### B. Inspect idle-up valve for ground

Using an ohmmeter, check that there is no continuity between each terminal and the body.

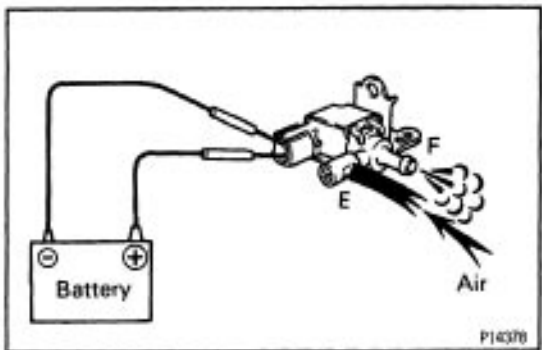
If there is continuity, replace the idle-up valve.





### C. Inspect idle-up valve operation

(a) Check that air does not flow from port E to port F.



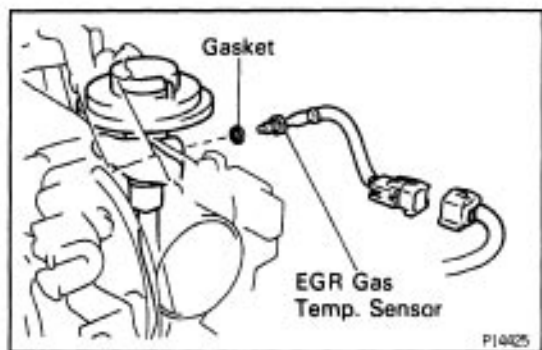
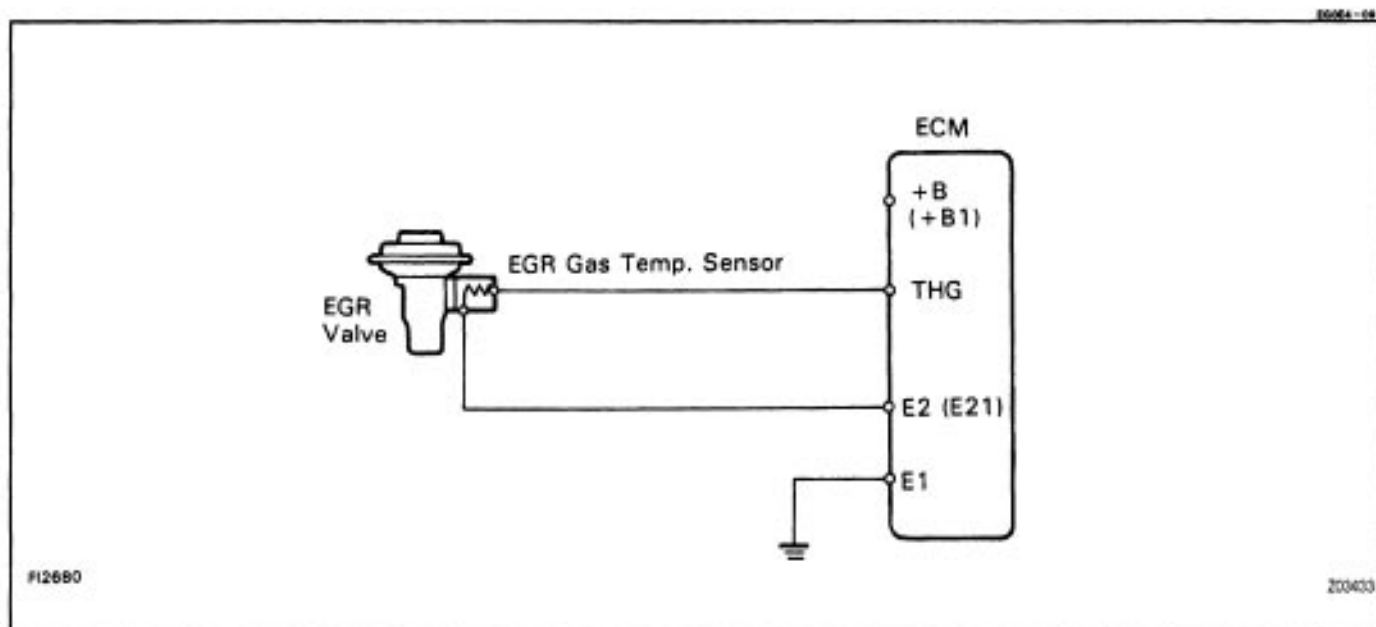
(b) Apply battery voltage across the terminals.

(c) Check that air flows from port E to port F.

If operation is not as specified, replace the idle-up valve.

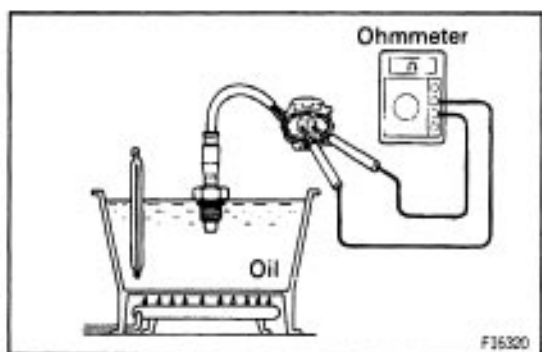
### 3. REINSTALL IDLE-UP VALVE

# EGR GAS TEMPERATURE SENSOR



## EGR GAS TEMPERATURE SENSOR INSPECTION

### 1. REMOVE EGR GAS TEMPERATURE SENSOR



### 2. INSPECT EGR GAS TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

**Resistance:**

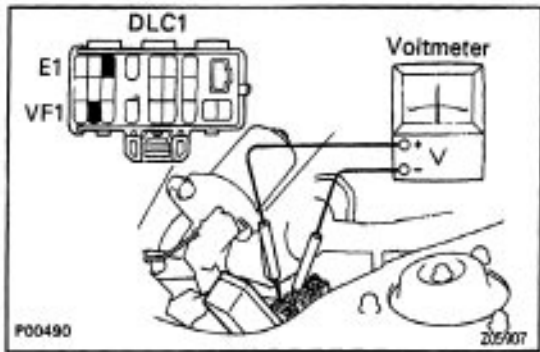
**64–97 k $\Omega$  at 50°C (122°F)**

**11–16 k $\Omega$  at 100°C (212°F)**

**2–4 k $\Omega$  at 150°C (302°F)**

If the resistance is not as specified, replace the sensor.

### 3. REINSTALL EGR GAS TEMPERATURE SENSOR



## OXYGEN SENSOR

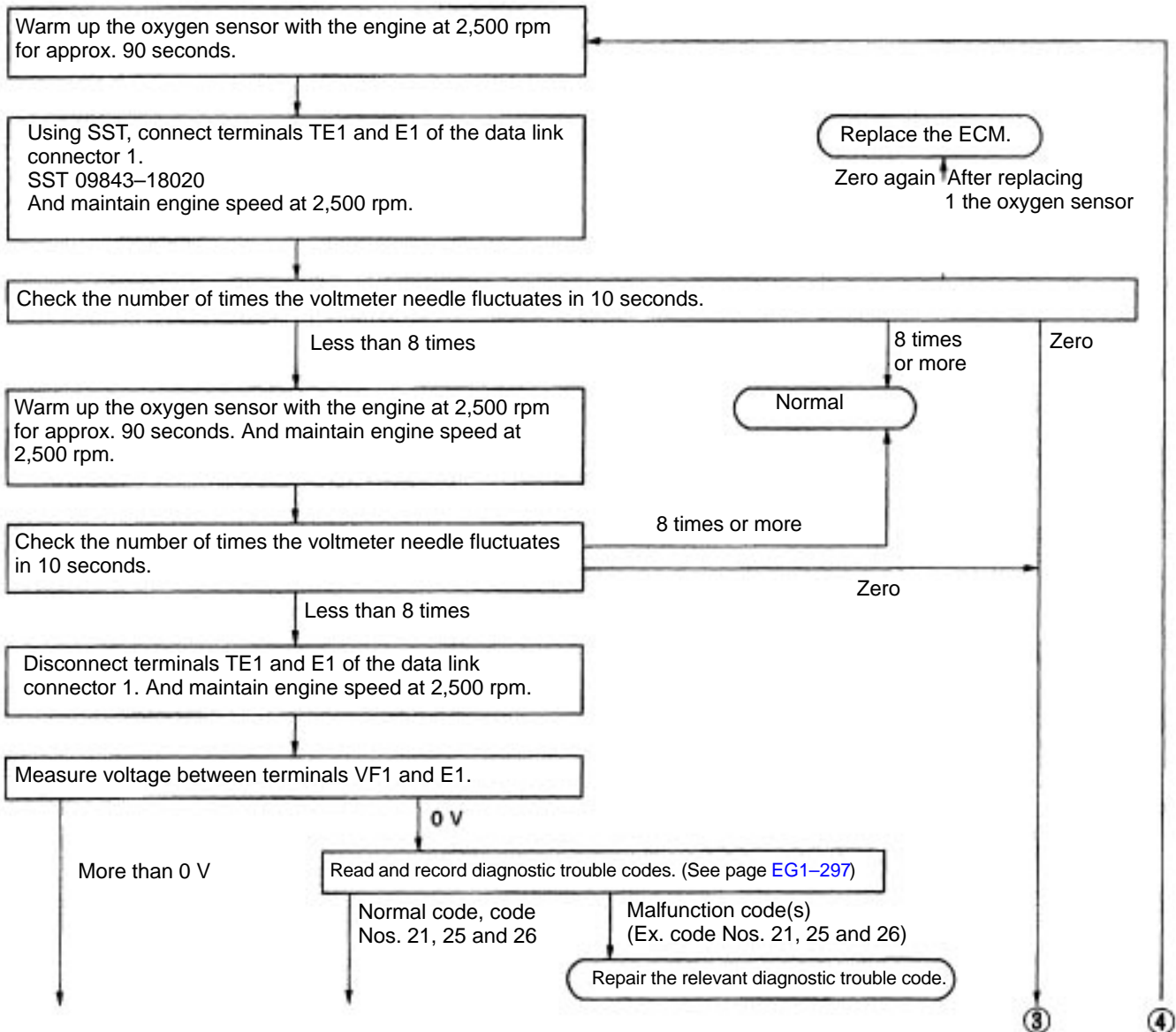
### OXYGEN SENSOR INSPECTION

#### 1. WARM UP ENGINE

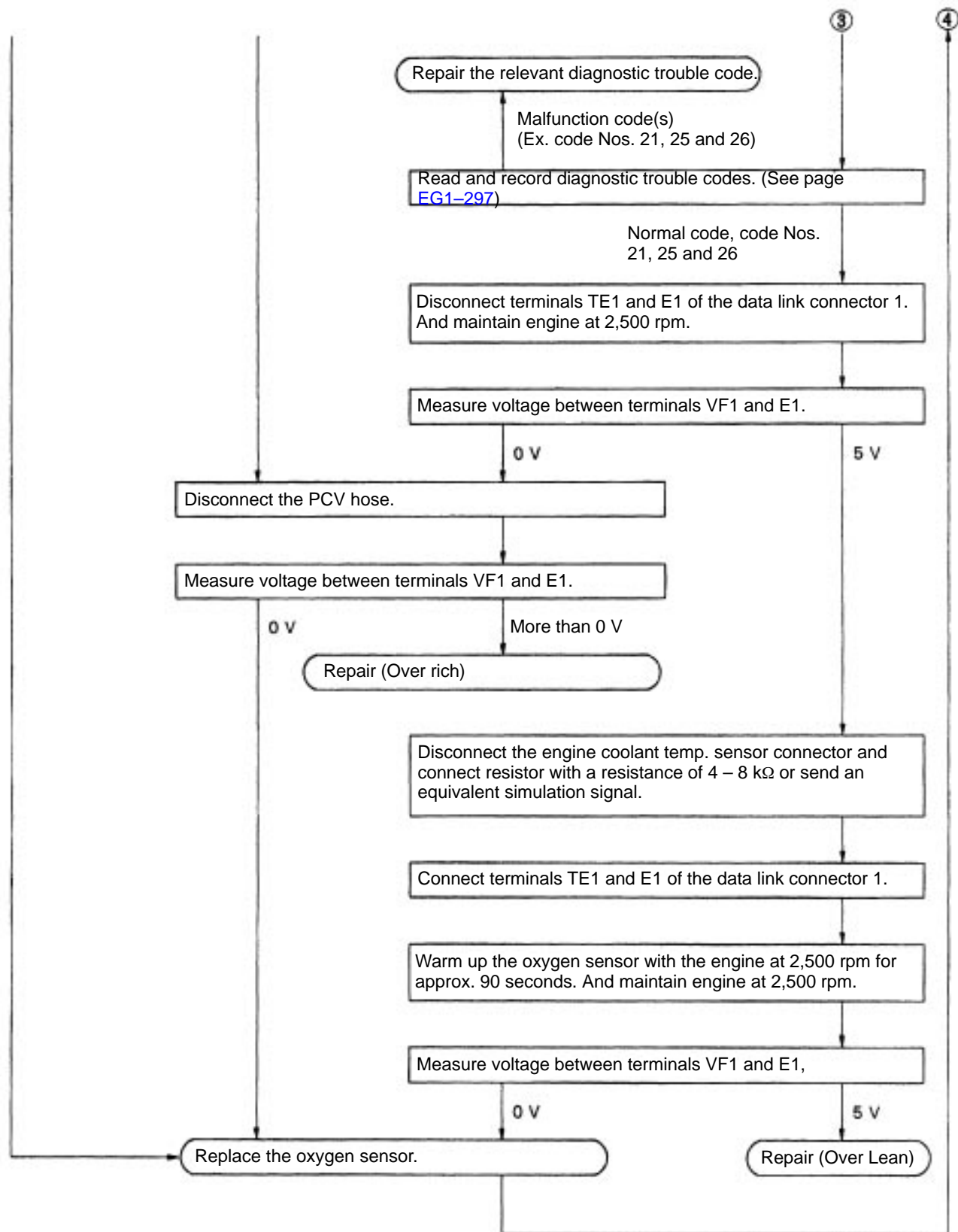
Allow the engine to warm up to normal operating temperature.

#### 2. INSPECT FEEDBACK VOLTAGE

Connect the positive (+) probe of a voltmeter to terminal VF1 of the data link connector 1 and negative (-) probe to terminal E1. Perform the test as follows:



## CONTINUED FROM PAGE EG1-231



## SUB OXYGEN SENSOR

BQ407-68

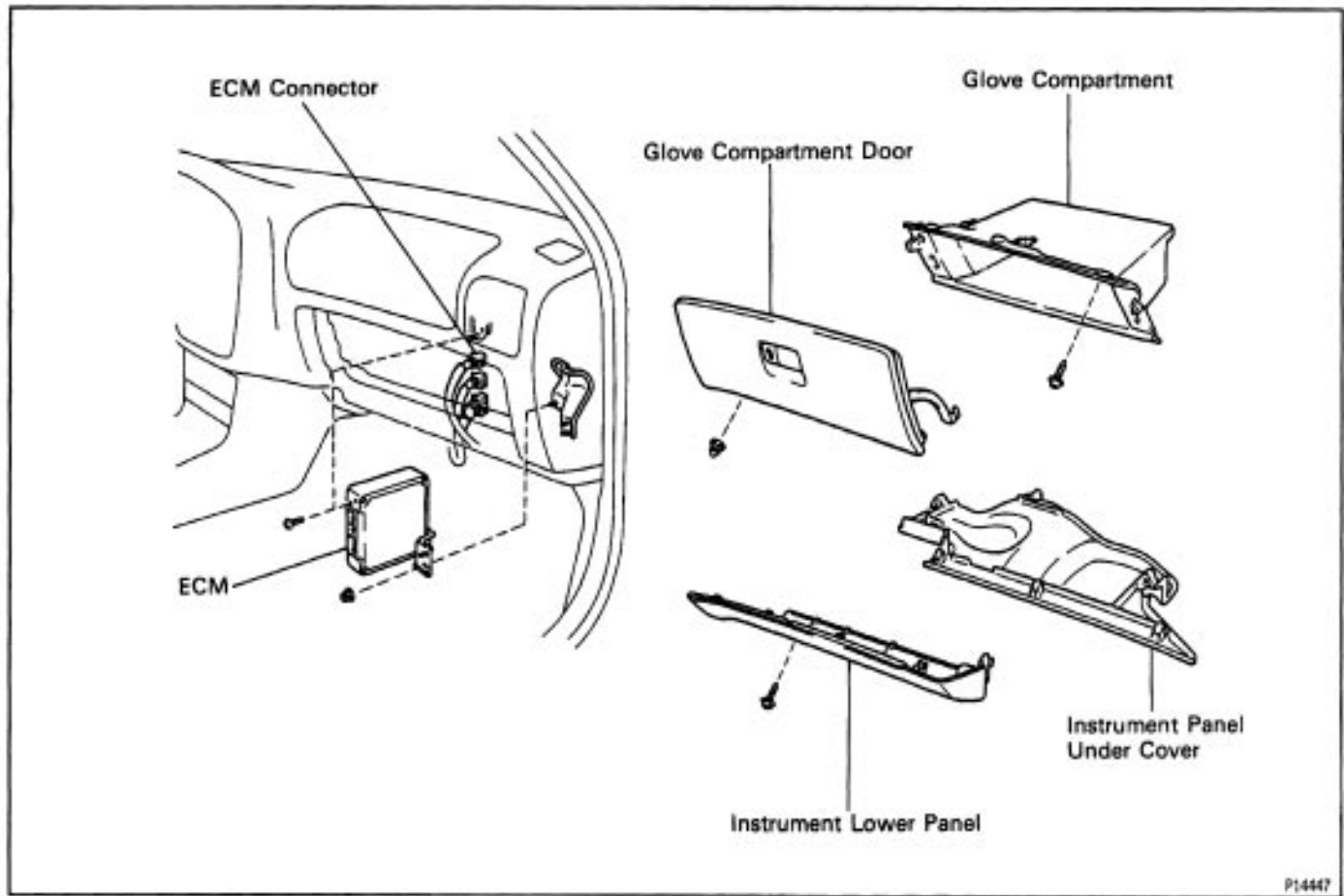
### SUB OXYGEN SENSOR INSPECTION

#### INSPECT SUB OXYGEN SENSOR

HINT: Inspect only when code No. 27 is displayed.

- (a) Cancel the diagnostic trouble code. (See page [EG1-299](#))
- (b) Warm up the engine until it reaches normal operating temperature.
- (c) M/T:
  - Drive for 5 minutes or more at a speed less than 80 km/h (50 mph) in 4th or 5th gear.A/T:
  - Drive for 5 minutes or more at a speed less than 80 km/h (50 mph) in "D" position.
- (d) Following the conditions in step (c), fully depress on the accelerator pedal for 2 seconds or more.
- (e) Stop the vehicle and turn the ignition switch OFF.
- (f) Carry out steps (b), (c) and (d) again to test acceleration. If code No.27 appears again, check the sub oxygen sensor circuit. If the circuit is normal, replace the sub oxygen sensor.

## ENGINE CONTROL MODULE (ECM) ECM REMOVAL AND INSTALLATION



### ECM INSPECTION

(See page [EG1-318](#))

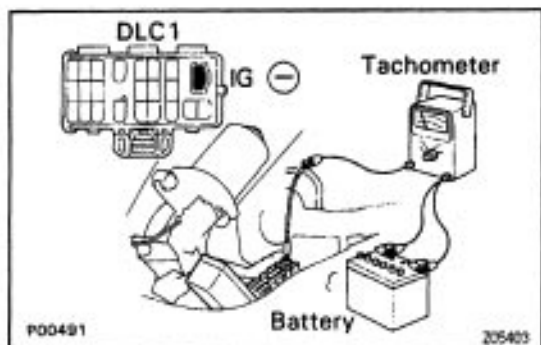
## FUEL CUT RPM

### FUEL CUT RPM INSPECTION

ISSUE-04

#### 1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



#### 2. CONNECT TACHOMETER TO ENGINE

Connect the test probe of a tachometer to terminal IG (–) of the data link connector 1.

##### NOTICE:

- **NEVER** allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.
- As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of yours before use.

#### 3. INSPECT FUEL CUT RPM

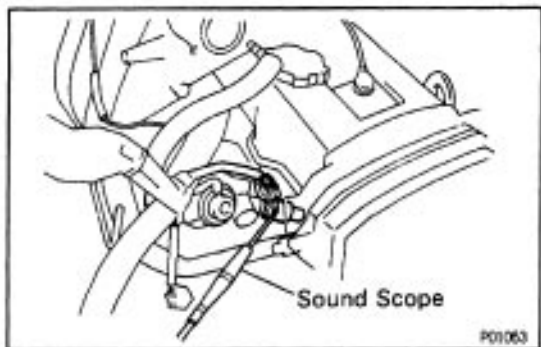
- (a) Increase the engine speed to at least 2,500 rpm.
- (b) Use a sound scope to check for injector operating noise.
- (c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.

HINT: Measure with the A/C OFF.

**Fuel return speed:**

**1,500 rpm**

#### 4. DISCONNECT TACHOMETER



# SERVICE SPECIFICATIONS

EG1-236

## SERVICE DATA

Fuel pressure regulator	Fuel pressure at no vacuum	265 - 304 kPa (2.7 - 3.1 kgf/cm <sup>2</sup> , 38 - 44 psi)
Fuel pump	Resistance	0.2 - 3.0 Ω
Injector	Resistance	Approx. 13.8 Ω
	Injection volume	49 - 59 cm <sup>3</sup> (3.0 - 3.6 cu in.) per 15 sec.
	Difference between each cylinder	5 cm <sup>3</sup> (0.3 cu in.) or less
	Fuel leakage	One drop or less per minute
Throttle body	Throttle body fully closed angle	6°
	Throttle opener setting speed	1,300 - 1,500 rpm (w/ Cooling fan OFF)
Throttle position sensor	Clearance between stop screw and lever	
	0 mm (0 in.) VTA - E2	0.2 - 5.7 kΩ
	0.50 mm (0.020 in.) IDL - E2	2.3 kΩ or less
	0.70 mm (0.028 in.) IDL - E2	Infinity
	Throttle valve fully open VTA - E2	2.0 - 10.2 kΩ
	VC - E2	2.5 - 5.9 kΩ
IAC valve	Resistance (+B - ISCC or ISCO)	19.3 - 22.3 Ω
ECT sensor	Resistance at -20°C (-4°F)	10 - 20 kΩ
	at 0°C (32°F)	4 - 7 kΩ
	at 20°C (68°F)	2 - 3 kΩ
	at 40°C (104°F)	0.9 - 1.3 kΩ
	at 60°C (140°F)	0.4 - 0.7 kΩ
	at 80°C (176°F)	0.2 - 0.4 kΩ
IAT sensor	Resistance at -20°C (-4°F)	10 - 20 kΩ
	at 0°C (32°F)	4 - 7 kΩ
	at 20°C (68°F)	2 - 3 kΩ
	at 40°C (104°F)	0.9 - 1.3 kΩ
	at 60°C (140°F)	0.4 - 0.7 kΩ
	at 80°C (176°F)	0.2 - 0.4 kΩ
MAP sensor	Power source voltage	4.75 - 5.25 V
VSV for EG R	Resistance	33 - 39 Ω
VSV for Fuel pressure (California only)	Resistance	33 - 39 Ω
A/C idle -up valve	Resistance	30 - 34 Ω
EG R gas temperature sensor	Resistance at 50°C (122°F)	64 - 97 kΩ
	at 100°C (212°F)	11 - 16 kΩ
	at 150°C (302°F)	2 - 4 kΩ
Fuel cut rpm	Fuel return rpm	1,500 rpm



## TORQUE SPECIFICATIONS

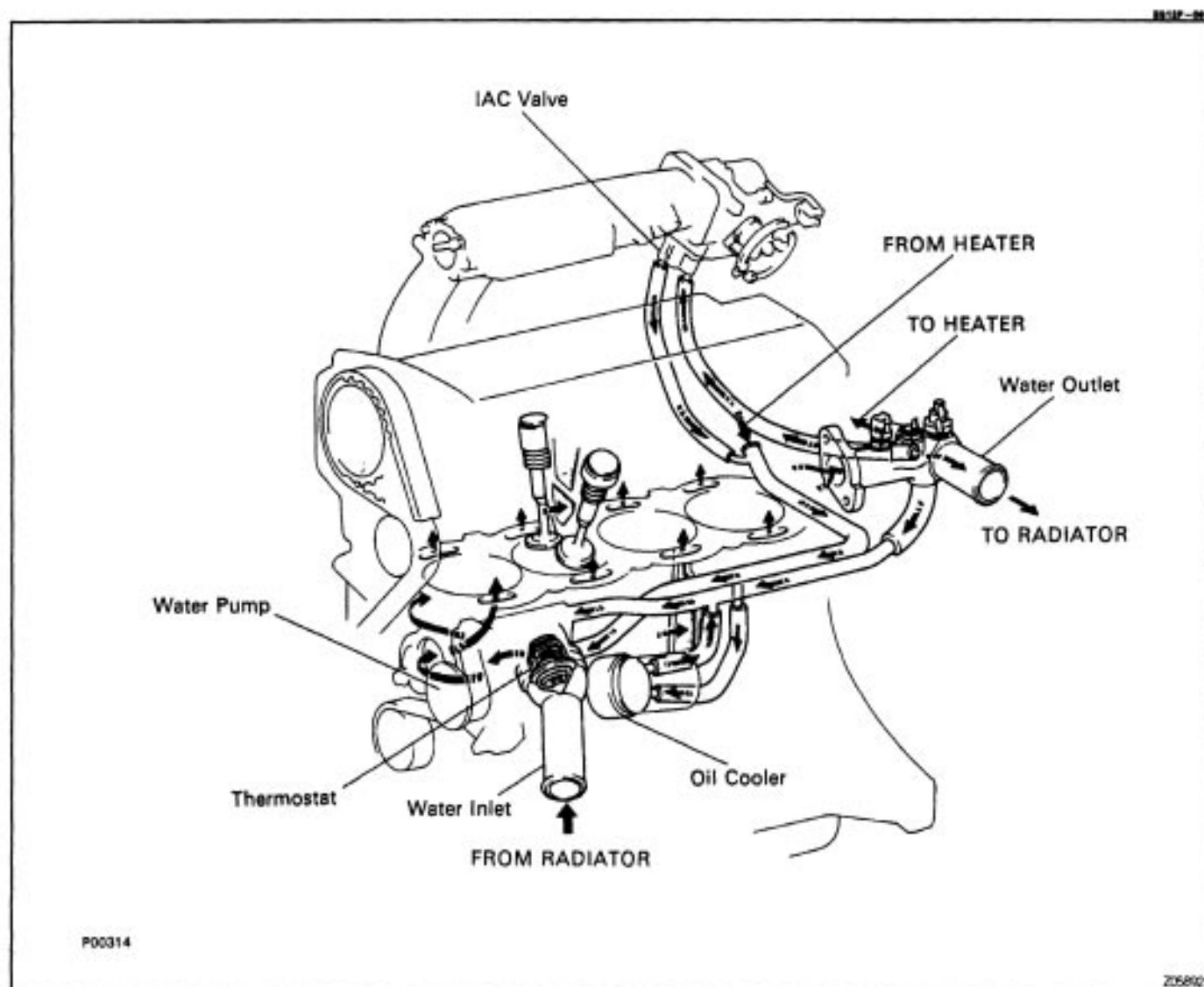
Part tightened	N·m	kgf·cm	ft·lbf
Fuel line (Union bolt type)	29	300	22
Fuel line (Flare nut type – use SST)	28	285	21
Fuel pump side	30	310	22
Others			
Fuel tank band x Body	39	400	29
Fuel pump x Fuel tank	3.9	40	35 in.·lbf
Fuel pressure regulator x Delivery pipe	5.4	55	48 in.·lbf
Fuel return pipe x Fuel pressure regulator	19	195	14
Delivery pipe x Cylinder head	13	130	9
Fuel pulsation damper x Delivery pipe	34	350	25
Intake manifold x Cylinder head	19	195	14
Intake manifold stay x Intake manifold	22	220	16
Intake manifold stay x Cylinder block	42	425	31
No.1 air intake chamber stay x Intake manifold	42	425	31
No.1 air intake chamber stay x Cylinder head	42	425	31
EGR pipe union nut	59	600	43
EGR pipe x Intake manifold	13	130	9
Throttle body x Intake manifold	19	195	14

# COOLING SYSTEM

## DESCRIPTION

This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equipped with a bypass valve mounted on the inlet side.

## OPERATION



The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, electric fan, hoses and other components.

Engine coolant which is heated in the water jacket is pumped to the radiator, through which an electric fan blows air to cool the coolant as it passes through. Engine coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.

The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders and combustion chambers which become heated during engine operation.

**RADIATOR**

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and it is mounted in the front of the vehicle. The radiator consists of an upper tank and lower tank, and a core which connects the two tanks. The upper tank contains the inlet for coolant from the water jacket and the filler inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank has an outlet and drain cock for the coolant. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as to cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by the electric fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling the coolant. Models with automatic transmission include an automatic transmission fluid cooler built into the lower tank of the radiator. A fan with an electric motor is mounted behind the radiator to assist the flow of air through the radiator. The fan operates when the engine coolant temperature becomes high in order to prevent it from becoming too high.

**RADIATOR CAP**

The radiator cap is a pressure type cap which seals the radiator, resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the engine coolant temperature exceeds 100°C (212°F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110–120°C (230–248°F), pressure; 58.8103.0 kpa (0.6–1.05 kgf/cm<sup>2</sup>, 8.5–14.9 psi). The vacuum valve opens to alleviate the vacuum which develops in the cooling system after the engine is stopped and the engine coolant temperature drops. The valve's opening allows the coolant in the reservoir tank to return to the cooling system.

**RESERVOIR TANK**

The reservoir tank is used to catch coolant which overflows from the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless coolant loss.

Check the reservoir tank level to learn if the coolant needs to be replenished.

**WATER PUMP**

The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a timing belt.



**THERMOSTAT**

The thermostat has a wax type bypass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the engine coolant temperature. This valve closes when the engine coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the engine coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contracts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction allows the force of the spring to take effect once more, closing the valve. The thermostat in this engine operates at a temperature of 82°C (180°F).

## PREPARATION


### SST (SPECIAL SERVICE TOOLS)

80068-01

	09228-06500 Oil Filter Wrench	
	09230-01010 Radiator Service Tool Set	

## RECOMMENDED TOOLS

80067-02

	09082-00050 TOYOTA Electrical Tester Set	
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## EQUIPMENT

80069-04

Heater	Engine coolant temperature switch
Radiator cap tester	
Thermometer	Engine coolant temperature switch
Torque wrench	

## COOLANT

80069-01

Item	Capacity	Classification
Engine coolant (w/ Heater)	6.3 liters (6.7 US qts, 5.5 Imp. qts)	Ethylene-glycol base

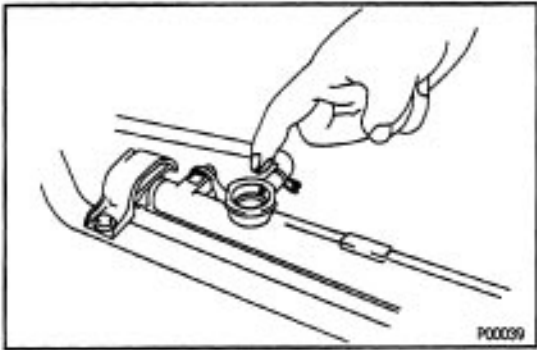


## COOLANT CHECK AND REPLACEMENT

### 1. CHECK ENGINE COOLANT LEVEL AT RESERVOIR TANK

The engine coolant level should be between the "LOW" and "FULL" lines.

If low, check for leaks and add engine coolant up to the "FULL" line.



### 2. CHECK ENGINE COOLANT QUALITY

There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole, and the engine coolant should be free from oil.

If excessively dirty, replace the engine coolant.

### 3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

**CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.**

(b) Drain the engine coolant from the radiator drain cock and engine drain plug. (Engine drain plug at the right rear of cylinder block.)

(c) Close the drain cock and plug.

**Torque (Engine drain plug):**

**13 N-m (130 kgf-cm, 9 ft-lbf)**

(d) Slowly fill the system with coolant.

Use a good brand of ethylene-glycol base coolant and mix it according to the manufacturer's directions.

Using engine coolant which includes more than 5096 ethylene-glycol (but not more than 7096) is recommended.

#### NOTICE:

- Do not use an alcohol type coolant.
- The engine coolant should be mixed with demineralized water or distilled water.

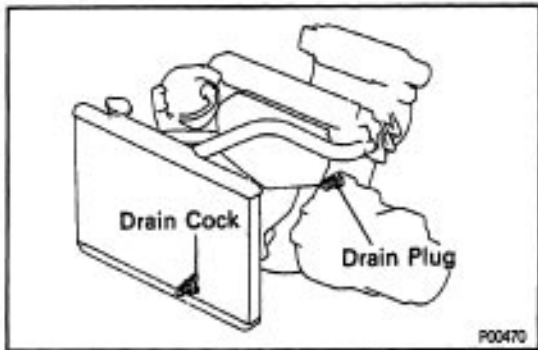
**Capacity (w/ Heater):**

**8.3 liters (6.7 US qts, 5.5 Imp.qts)**

(a) Reinstall the radiator cap.

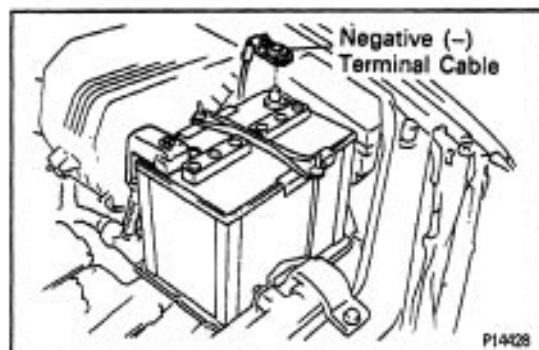
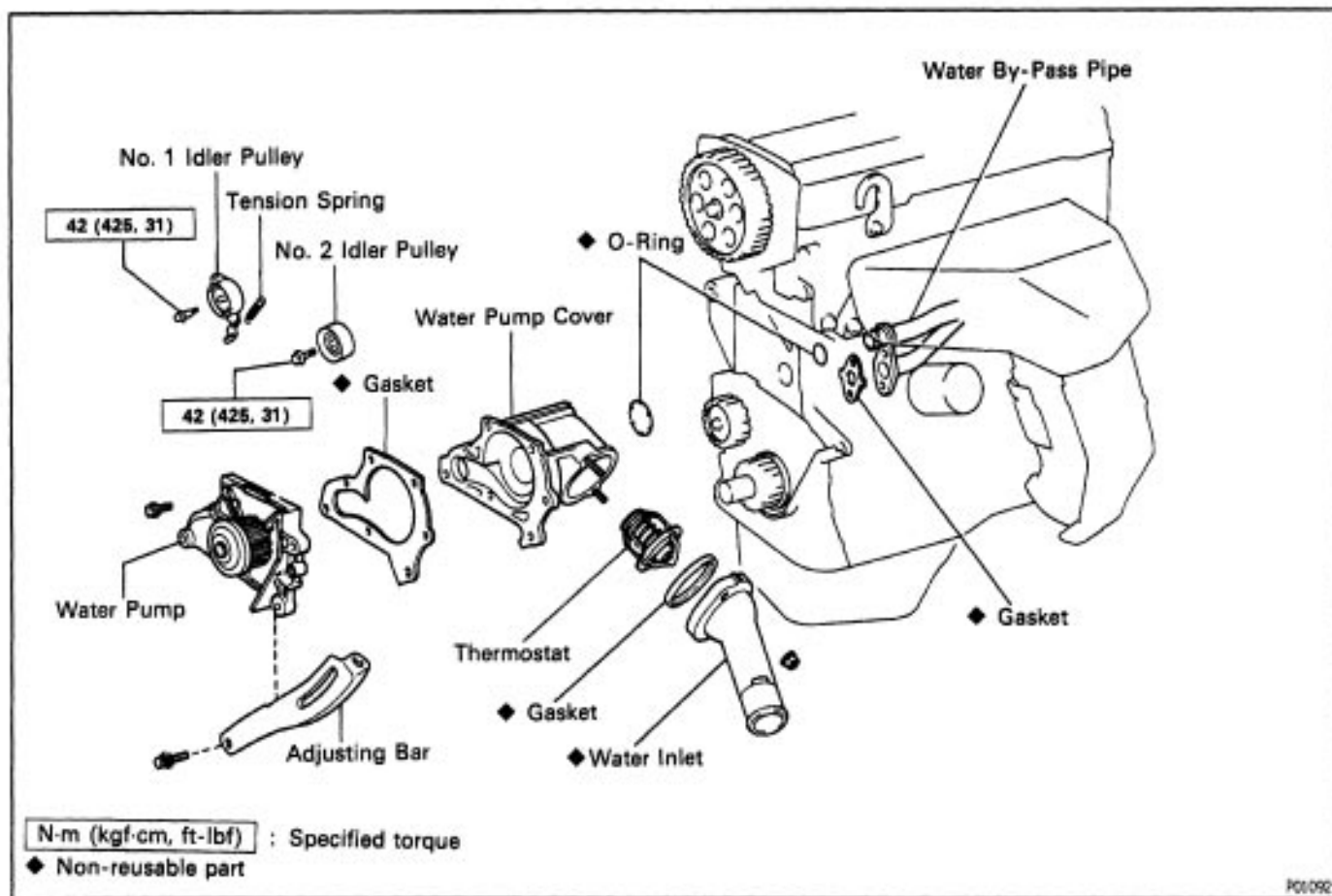
(f) Warm up the engine and check for leaks.

(g) Recheck the engine coolant level and refill as necessary.



# WATER PUMP COMPONENTS FOR REMOVAL AND INSTALLATION

800402-01



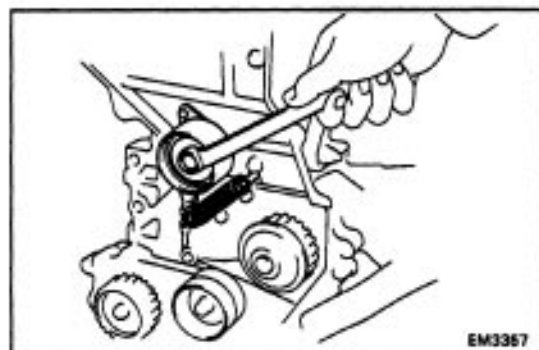
## WATER PUMP REMOVAL

800402-01

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

**CAUTION:** Work must be started after 90 seconds from the time the Ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

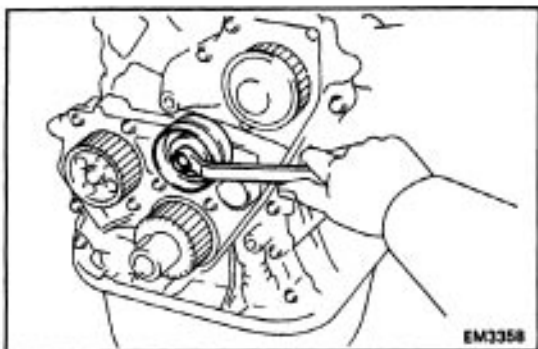
### 2. DRAIN ENGINE COOLANT (See page [EG1-241](#))



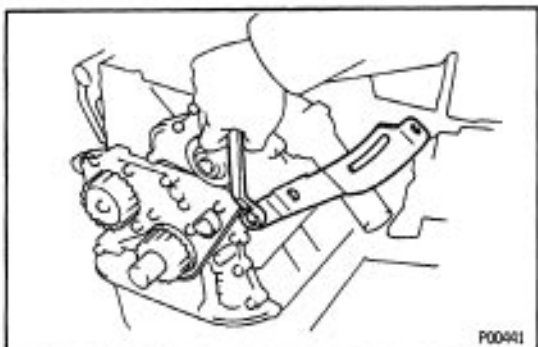
### 3. REMOVE TIMING BELT (See page [EG1-26](#))

### 4. REMOVE NO. 1 IDLER PULLEY AND TENSION SPRING

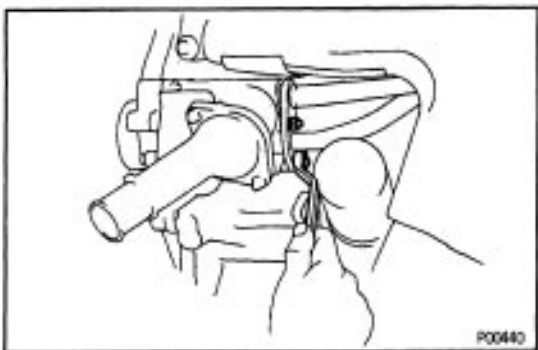
Remove the bolt, pulley and tension spring.

**5. REMOVE NO.2 IDLER PULLEY**

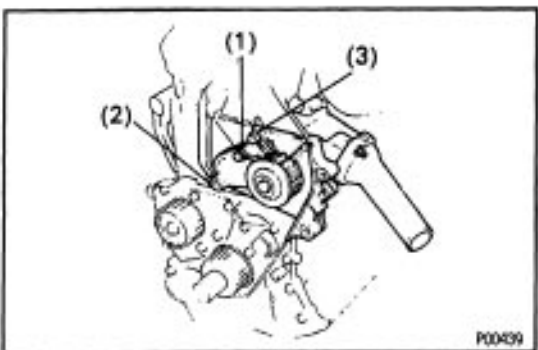
Remove the bolt and pulley.

**6. DISCONNECT LOWER RADIATOR HOSE FROM WATER INLET****7. REMOVE GENERATOR BELT ADJUSTING BAR**

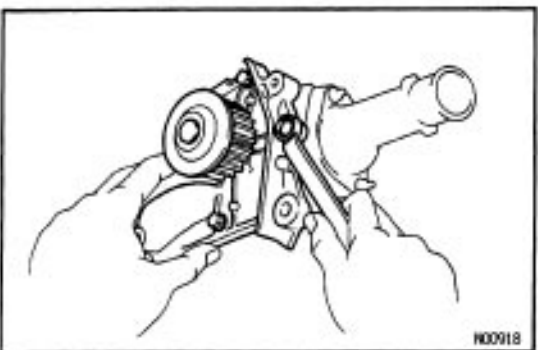
Remove the bolt and adjusting bar.

**8. REMOVE WATER PUMP AND WATER PUMP COVER ASSEMBLY**

- (a) Remove the 2 nuts holding the pump to the water bypass pipe.



- (b) Remove the 3 bolts in the sequence shown.
- (c) Pull out the water pump together with the water pump cover.
- (d) Remove the gasket and 2 O-rings from the water pump and water bypass pipe.

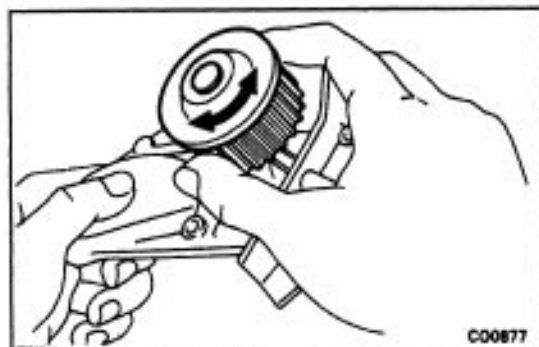
**9. SEPARATE WATER PUMP AND WATER PUMP COVER**

Remove the 3 bolts, water pump and gasket from the water pump cover.



## 10. REMOVE WATER INLET AND THERMOSTAT FROM WATER PUMP COVER

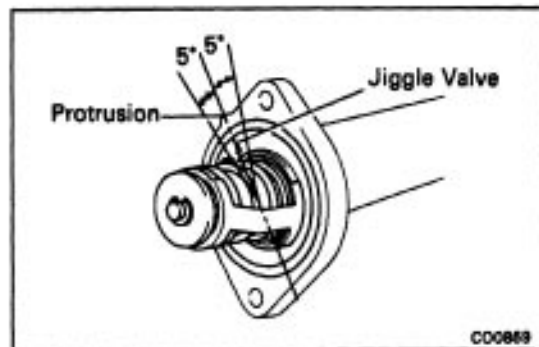
- Remove the 2 nuts and water inlet from the water pump.
- Remove the thermostat.
- Remove the gasket from the thermostat.



## WATER PUMP INSPECTION

### INSPECT WATER PUMP

Turn the pulley and check that the water pump bearing moves smoothly and quietly.



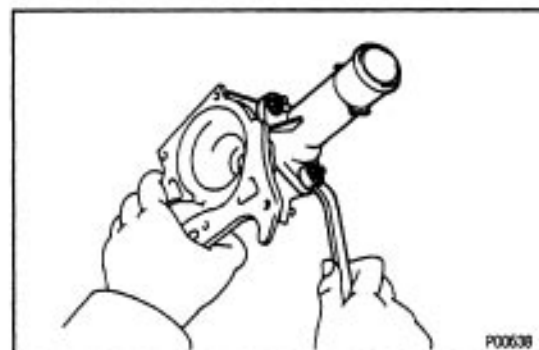
## WATER PUMP INSTALLATION

(See Components for Removal and Installation)

### 1. INSTALL THERMOSTAT AND WATER INLET TO WATER PUMP COVER

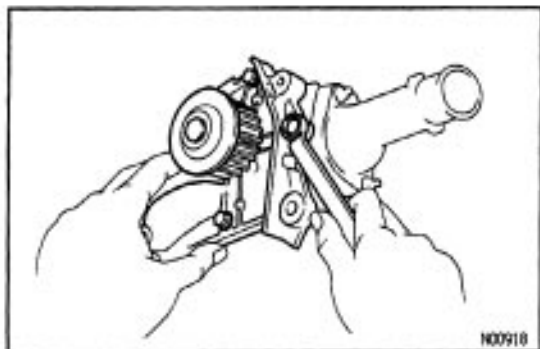
- Install a new gasket to the thermostat.
- Align the jiggle valve of the thermostat with the upper side of the stud bolt, and insert the thermostat in the water pump.

HINT: The jiggle valve may be set within 5° of either side of the prescribed position.



- Install the water inlet with the 2 nuts.  
Torque: 8.8 N-m (90 kgf-cm. 78 in.-lbf)

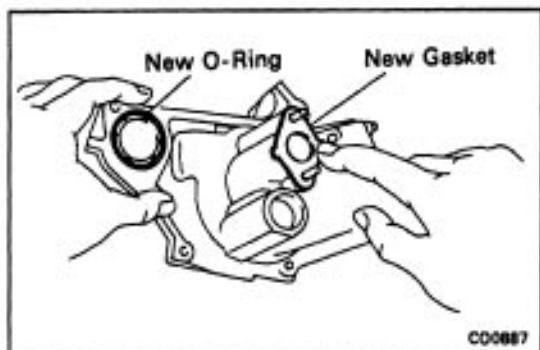




## 2. ASSEMBLE WATER PUMP AND WATER PUMP COVER

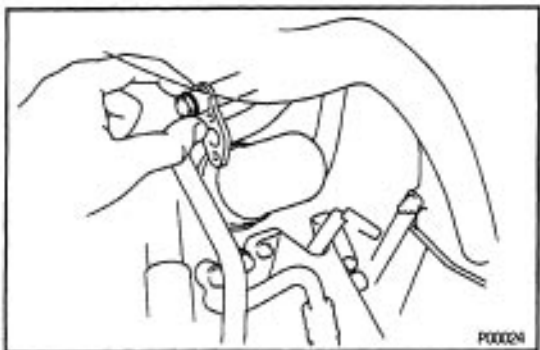
Install a new gasket and the water pump to the pump cover with the 3 bolts.

**Torque: 9.3 N-m (95 kgf-cm, 82 in.-lbf)**

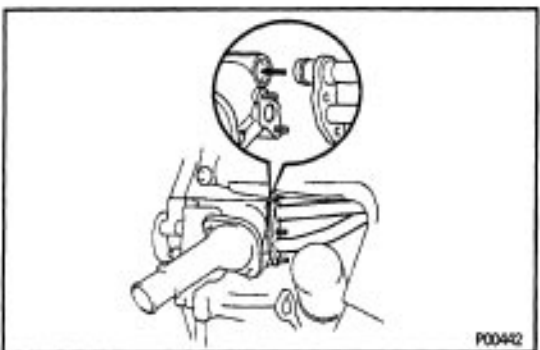


## 3. INSTALL WATER PUMP AND WATER PUMP COVER ASSEMBLY

(a) Install new O-ring and gasket to water pump cover.

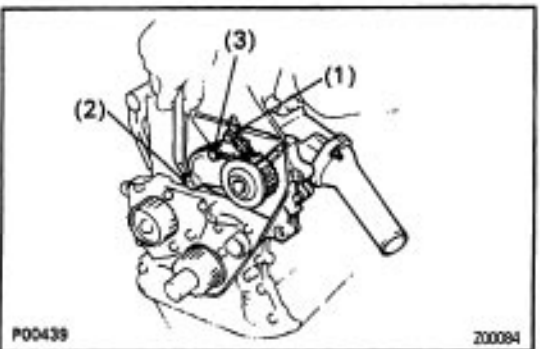


(b) Install a new O-ring to the water bypass pipe.



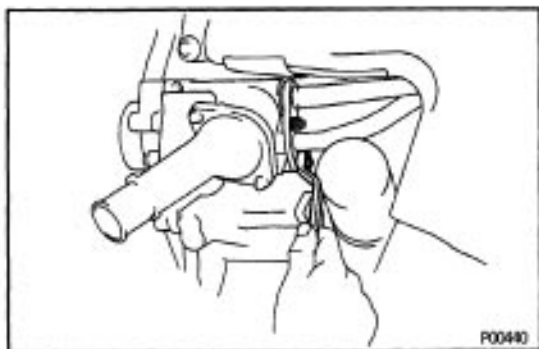
(c) Apply soapy water to the O-ring on the water bypass pipe.

(d) Connect the pump cover to the water bypass pipe.  
Do not install the nuts yet.



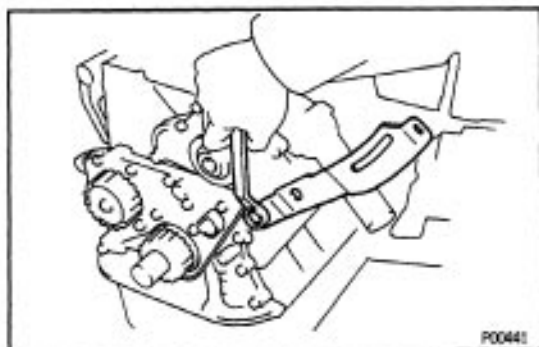
(e) Install the water pump with the 3 bolts. Tighten the bolts in the sequence shown.

**Torque: 9.3 N-m (95 kgf-cm, 82 in.-lbf)**



- (f) Install the 2 nuts holding the water pump cover to the water bypass pipe.

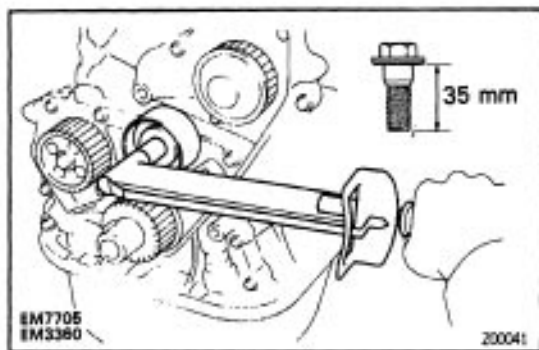
**Torque: 8.8 N-m (90 kgf-cm, 78 in.-lbf)**



#### 4. INSTALL GENERATOR BELT ADJUSTING BAR

Temporarily install the adjusting bar with the bolt.

#### 5. CONNECT LOWER RADIATOR HOSE TO WATER INLET



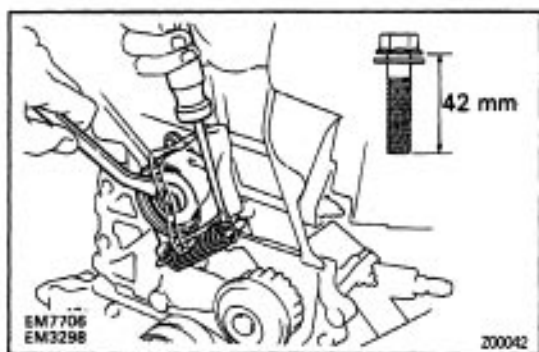
#### 6. INSTALL NO.2 IDLER PULLEY

- (a) Install the pulley with the bolt.

**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**

HINT: Use a bolt 35 mm (1.38 in.) in length.

- (b) Check that the idler pulley moves smoothly.



#### 7. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

- (a) Install the pulley with the bolt. Do not tighten the bolt yet.

HINT: Use bolt 42 mm (1.65 in.) in length.

- (b) Install the tension spring.

- (c) Pry the pulley toward the left as far as it will go and tighten the bolt.

- (d) Check that the idler pulley moves smoothly.

#### 8. INSTALL TIMING BELT (See page [EG1-33](#))

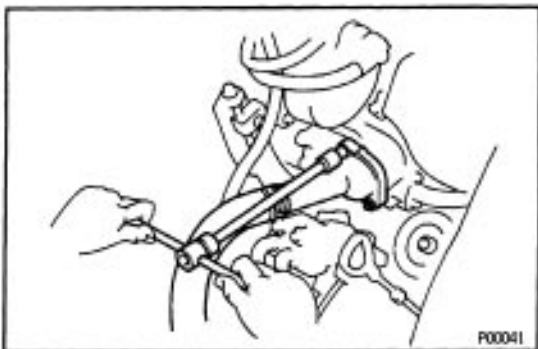
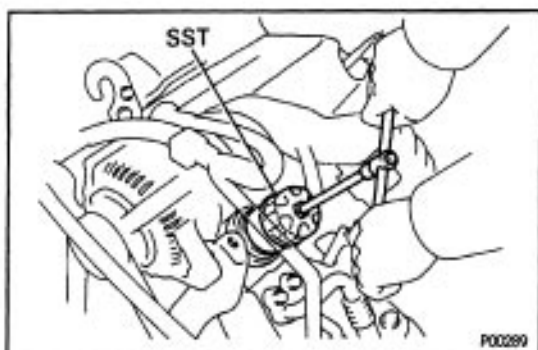
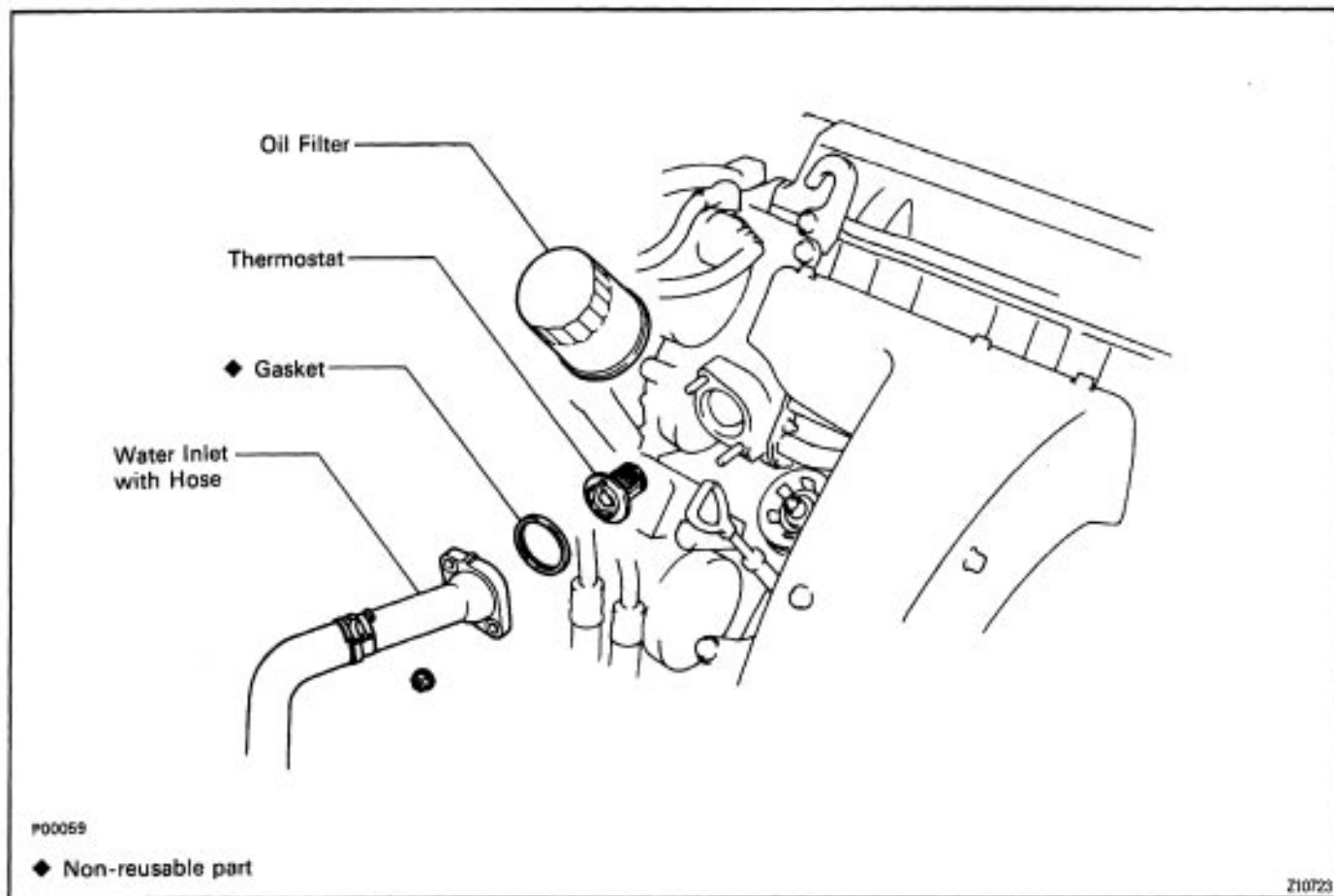
#### 9. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY

#### 10. FILL WITH ENGINE COOLANT

(See page [EG1-241](#))

# THERMOSTAT

## COMPONENTS FOR REMOVAL AND INSTALLATION



## THERMOSTAT REMOVAL

**HINT:** Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

### 1. DRAIN ENGINE COOLANT (See page [EG1-241](#))

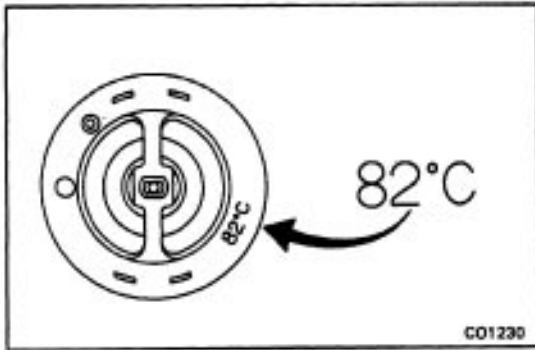
### 2. REMOVE OIL FILTER

Using SST, remove the oil filter.

SST 09228-06500

### 3. REMOVE WATER INLET AND THERMOSTAT

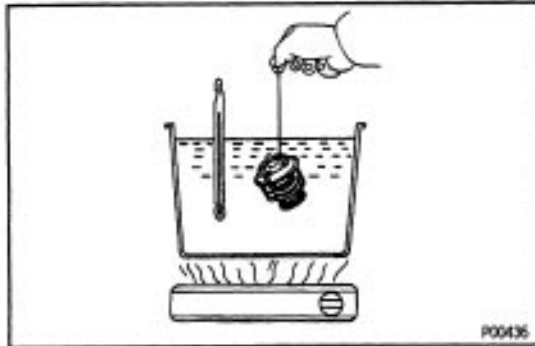
- Remove the 2 nuts and water inlet from the water pump.
- Remove the thermostat.
- Remove the gasket from the thermostat.



## THERMOSTAT INSPECTION

### INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.



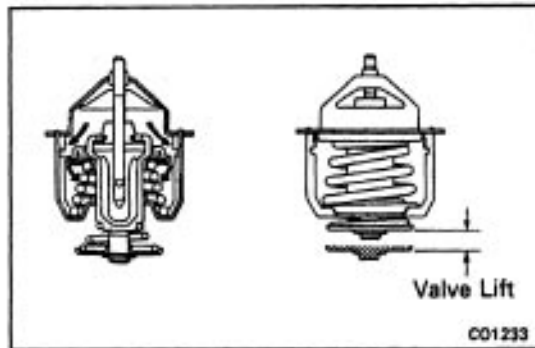
(a) Immerse the thermostat in water and gradually heat the water.

(b) Check the valve opening temperature.

**Valve opening temperature:**

**80 – 84°C (176 – 183°F)**

If the valve opening temperature is not as specified, replace the thermostat.



(c) Check the valve lift.

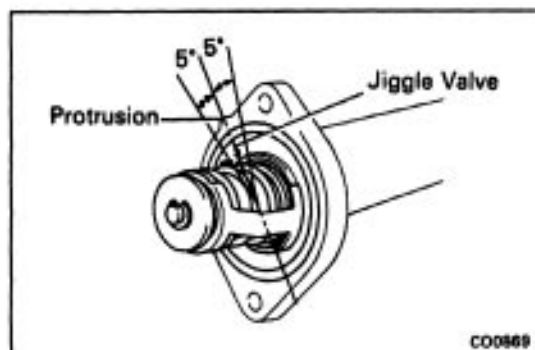
**Valve lift:**

**8 mm (0.31 in.) or more at 95°C (203°F)**

If the valve lift is not as specified, replace the thermostat.

(d) Check that the valve spring is tight when the thermostat is fully closed.

If not closed, replace the thermostat.



## THERMOSTAT INSTALLATION

(See Components for Removal and Installation)

### 1. PLACE THERMOSTAT IN WATER PUMP

(a) Install a new gasket to the thermostat.

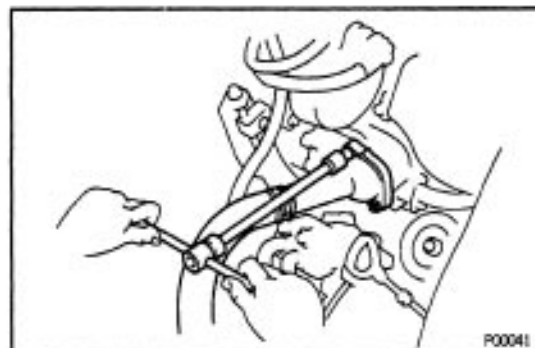
(b) Align the jiggle valve of the thermostat with the upper side of the stud bolt, and insert the thermostat in the water pump.

HINT: The jiggle valve may be set within 5° of either side of the prescribed position.

### 2. INSTALL WATER INLET

Install the water inlet with the 2 nuts.

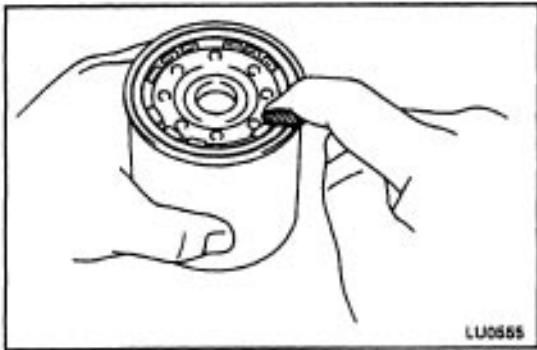
**Torque: 8.8 N·m (90 kgf·cm, 78in.-lbf)**



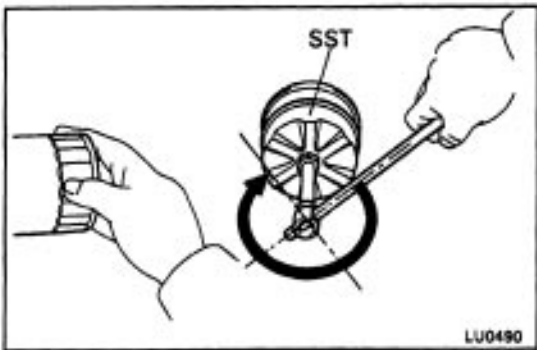


### 3. INSTALL OIL FILTER

(a) Clean the oil filter contact surface on the filter mounting.



(b) Lubricate the filter rubber gasket with engine oil.

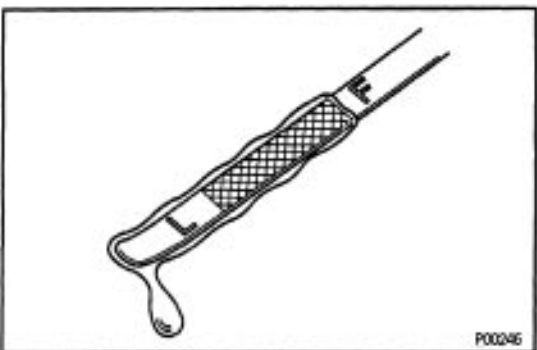


(c) Tighten the oil filter by hand until the rubber gasket contacts the seat of the filter mounting. Then using SST, give it an additional 3/4 turn to seat the oil filter. SST 09228-06500

### 4. FILL WITH ENGINE OIL

### 5. FILL WITH ENGINE COOLANT (SEE PAGE [EG1-241](#))

### 6. START ENGINE AND CHECK FOR LEAKS



### 7. CHECK ENGINE OIL LEVEL

The oil level should be between the “L” and “F” marks on the dipstick.

If low, check for leakage and add oil up to “F” mark.

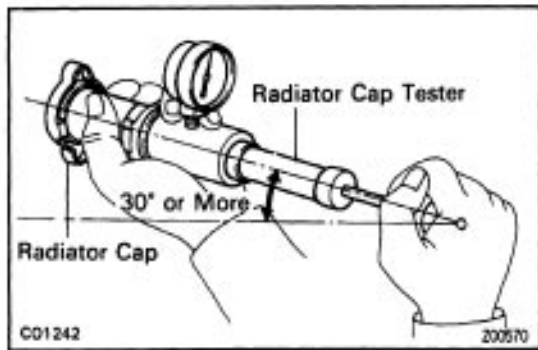
# RADIATOR

## RADIATOR CLEANING

80078-01

Using water or a steam cleaner, remove any mud or dirt from the radiator core.

**NOTICE:** If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 2,942 – 3,432 kPa (30 – 35 kgf/cm<sup>2</sup>, 427 – 498 psi), keep a distance of at least 40 cm (15.75 in.) between the radiator core and cleaner nozzle.



## RADIATOR INSPECTION

80078-04

### 1. INSPECT RADIATOR CAP

**NOTICE:** When performing steps (a) and (b) below, keep the radiator pump tester at an angle of over 30° above the horizontal.

- (a) Using a radiator cap tester, slowly pump the tester and check that air is coming from the relief valve.

**Pump speed:**

**1 push/ 3 seconds or more**

**NOTICE:** Push the pump at a constant speed.

If air is not coming from the relief valve, replace the radiator cap.

- (b) Pump the tester several times and measure the relief valve opening pressure.

**Pump speed:**

**1 at time**

**1 push/1 second or less**

**2nd time or more**

**Any speed**

**Standard opening pressure:**

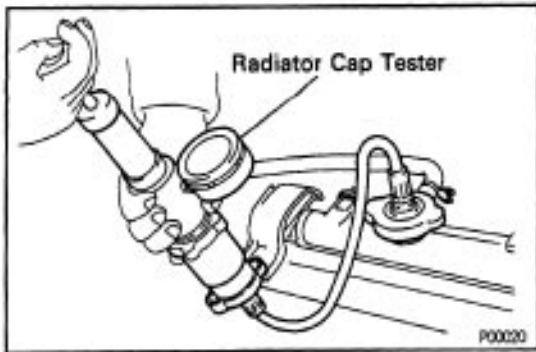
**74–103 kPa**

**(0.75–1.05 kgf/cm<sup>2</sup>, 10.7 – 14.9 psi)**

**Minimum opening pressure:**

**59 kPa (0.6 kgf/cm<sup>2</sup>, 8.5 psi)**

If the opening pressure is less than minimum, replace the radiator cap.

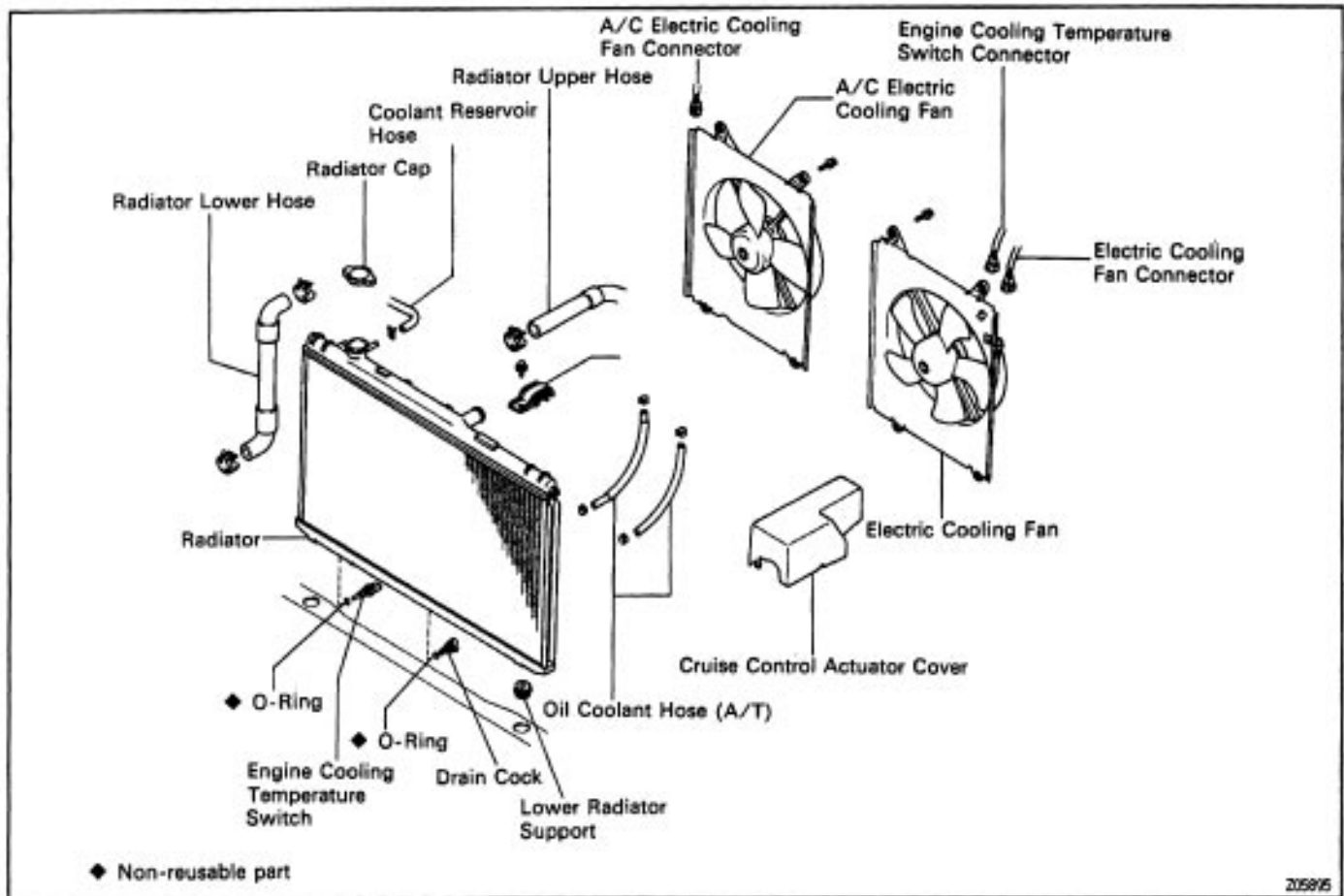


## 2. INSPECT COOLING SYSTEM FOR LEAKS

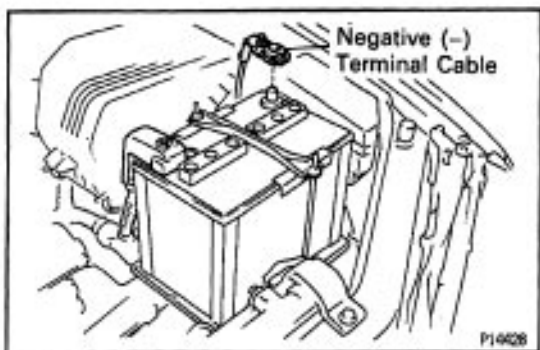
- Fill the radiator with coolant and attach a radiator cap tester.
- Warm up the engine.
- Pump it to 118 kPa (1.2 kgf/cm<sup>2</sup>, 17.1 psi), and check that the pressure does not drop.  
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and head.

80108-88

## COMPONENTS FOR REMOVAL AND INSTALLATION



80078-08



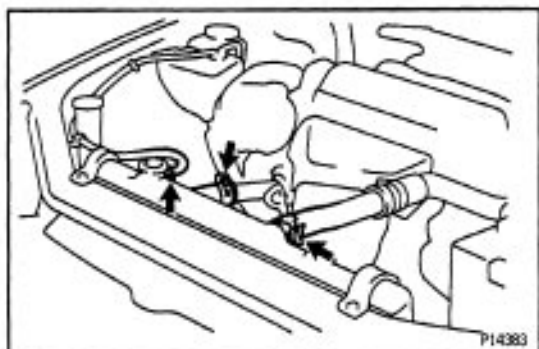
## RADIATOR REMOVAL

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

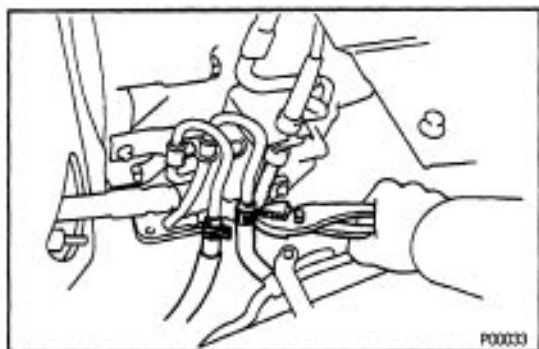
**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.



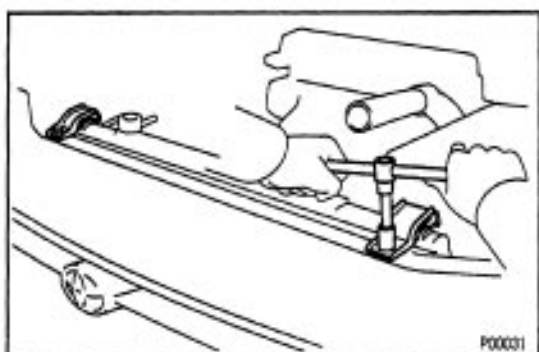
2. DRAIN ENGINE COOLANT (See page [EG1-241](#))
3. w/ CRUISE CONTROL SYSTEM:  
REMOVE CRUISE CONTROL ACTUATOR COVER
4. DISCONNECT ENGINE COOLANT TEMPERATURE  
SWITCH CONNECTOR FROM FAN SHROUD
5. DISCONNECT ELECTRIC COOLING FAN  
CONNECTORS



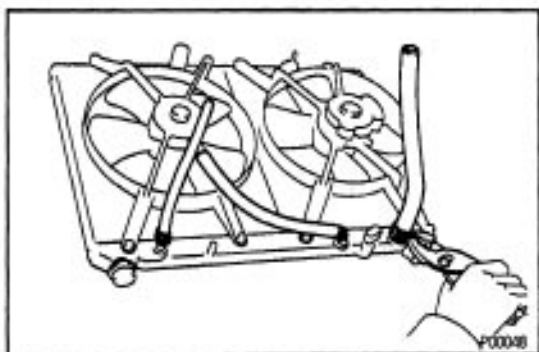
6. DISCONNECT RADIATOR HOSES
  - (a) Disconnect the upper hose from the radiator side.
  - (b) Disconnect the lower from the water inlet pipe.
7. DISCONNECT ENGINE COOLANT RESERVOIR  
HOSE



8. A/T:  
DISCONNECT OIL COOLER HOSES

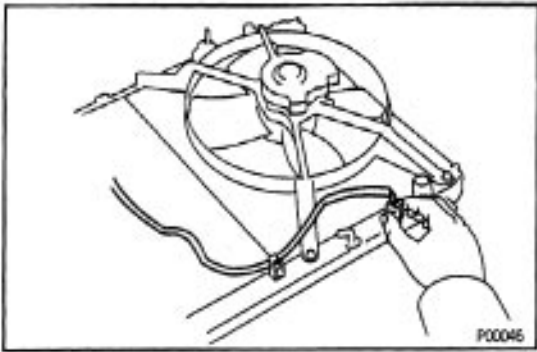


9. REMOVE RADIATOR AND ELECTRIC COOLING  
FANS
  - (a) Remove the 2 bolts and 2 upper supports.
  - (b) Lift out the radiator.
  - (c) Remove the 2 lower radiator supports.

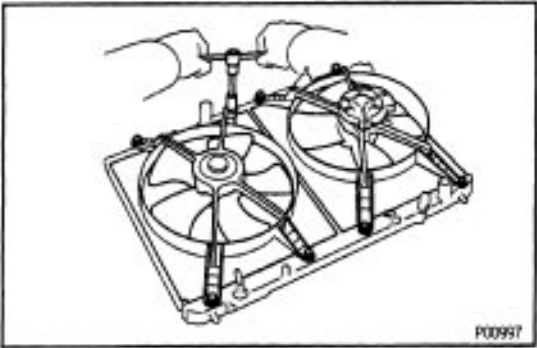


10. REMOVE RADIATOR LOWER HOSE
11. A/T:  
REMOVE A/T OIL COOLER HOSES



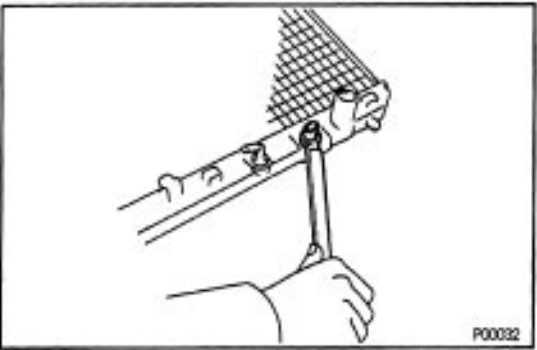


## 12. REMOVE ENGINE COOLANT TEMPERATURE SWITCH WIRE



## 13. REMOVE ELECTRIC COOLING FANS FROM RADIATOR

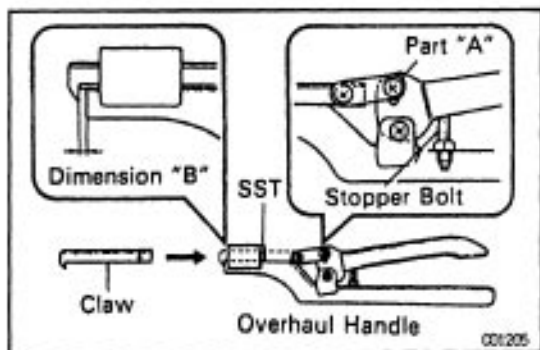
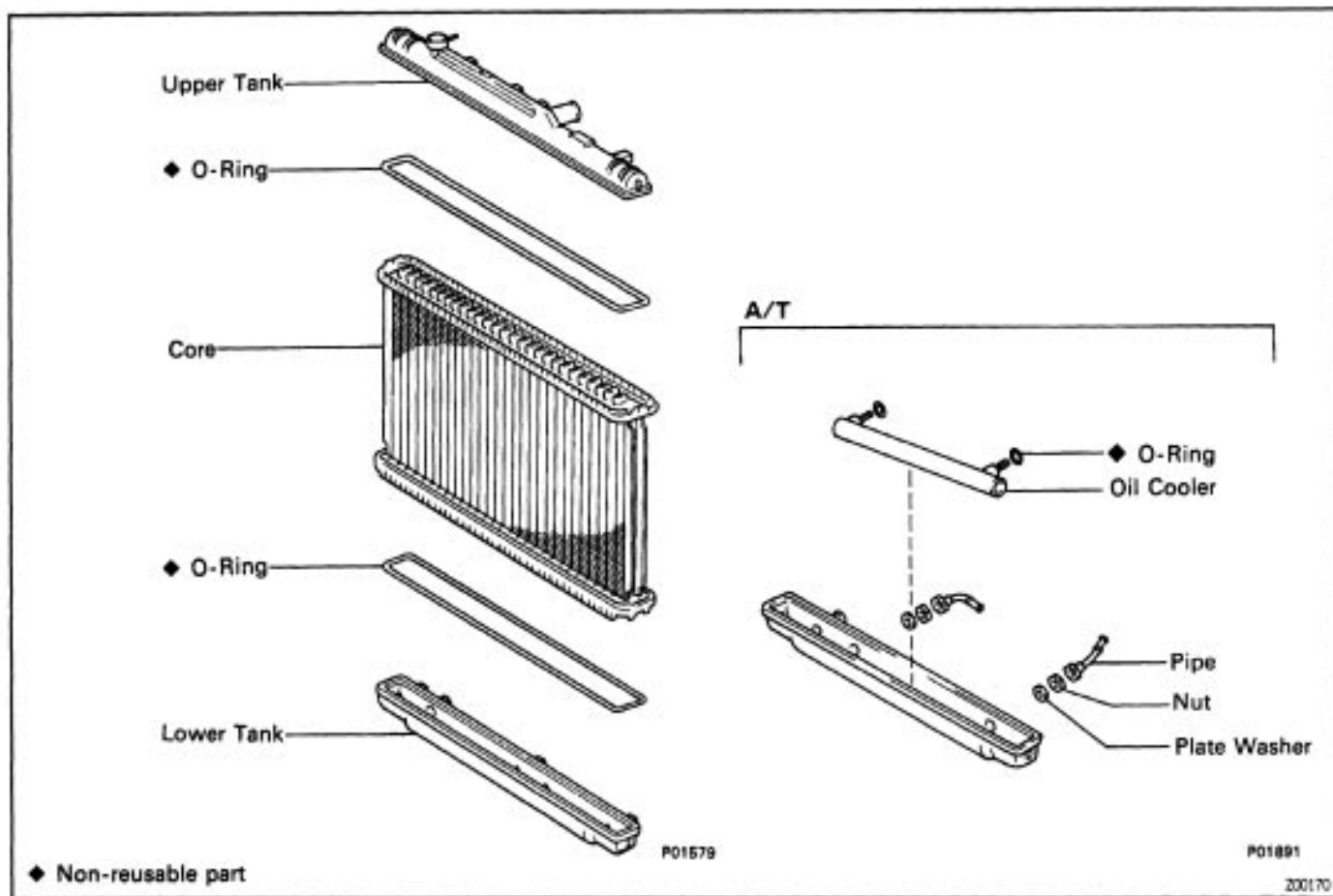
Remove the 8 bolts and cooling fans.



## 14. REMOVE ENGINE COOLANT TEMPERATURE SWITCH

- (a) Remove the engine coolant temperature switch.
- (b) Remove the O-ring.

## COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



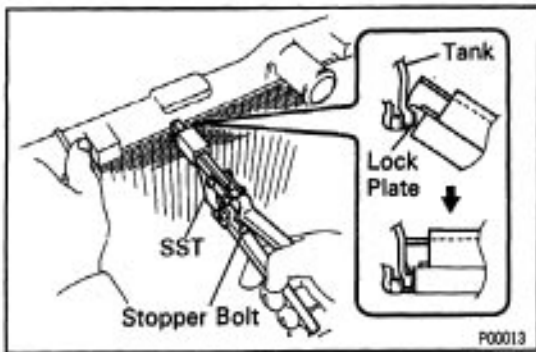
## RADIATOR DISASSEMBLY

### 1. ASSEMBLE SST

SST 09230-01010

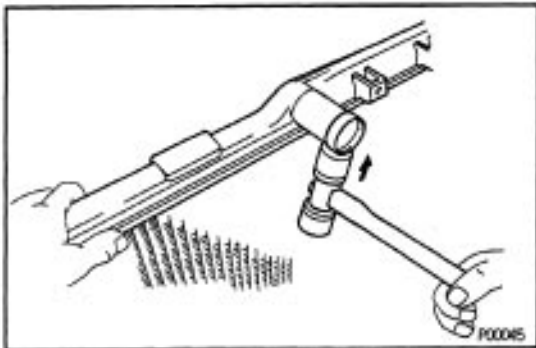
- Install the claw to the overhaul handle, inserting it in the hole in part "A" as shown in the diagram.
- While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 0.2–0.5 mm (0.008–0.020 in.).

**NOTICE:** If this adjustment is not performed, the claw may be damaged.



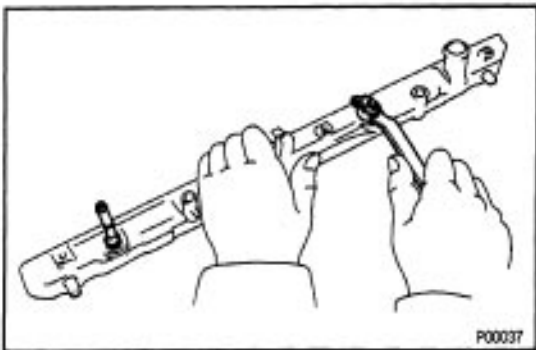
## 2. UNCAULK LOCK PLATES

Using SST to release the caulking, squeeze the handle until stopped by the stopper bolt.  
SST 09230-01010



## 3. REMOVE TANKS AND O-RINGS

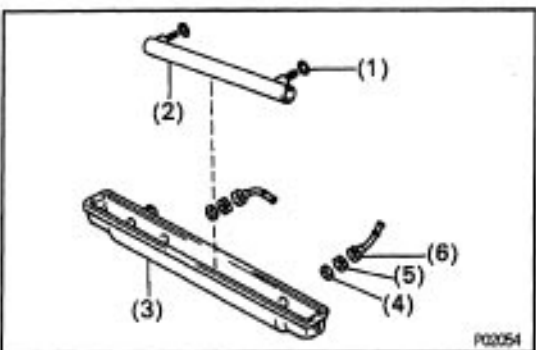
- Lightly tap the radiator hose inlet (or outlet) with a soft-faced hammer and remove the tank.
- Remove the O-ring.



## 4. A/T:

### REMOVE OIL COOLER FROM LOWER TANK

- Remove the pipes.
- HINT: Make a note of the direction to face the pipes.
- Remove the nuts and plate washers.
  - Remove the oil cooler and O-rings.



## RADIATOR ASSEMBLY

(See Components for Disassembly and Assembly)

### 1. A/T:

#### INSTALL OIL COOLER TO LOWER TANK

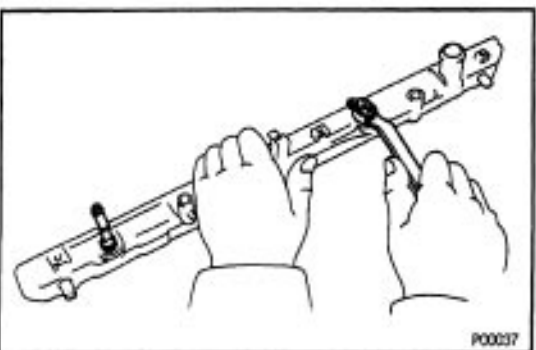
- Clean the O-ring contact surface of the lower tank and oil cooler.
- Install new O-rings (1) to the oil cooler (2).
- Install the oil cooler with the O-rings to the lower tank (3).
- Install the plate washers (4) and nuts (5). Torque the nuts.

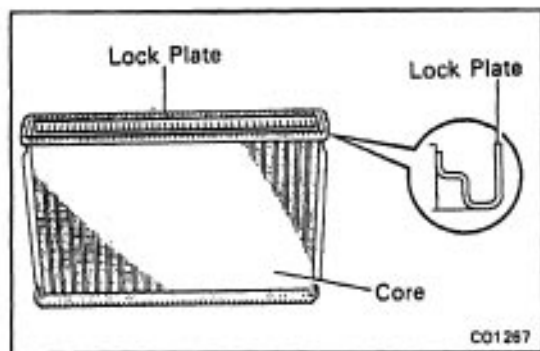
**Torque: 8.3 N·m (85 kgf·cm, 74 in.-lbf)**

- Install the pipes (6).

**Torque: 22 N·m (220 kgf·cm, 16 ft-lbf)**

HINT: Face the pipes in the same direction as before disassembly.



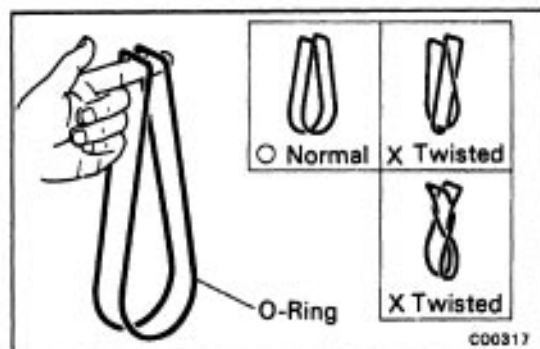


## 2. INSPECT LOCK PLATE

Inspect the lock plate for damage.

HINT:

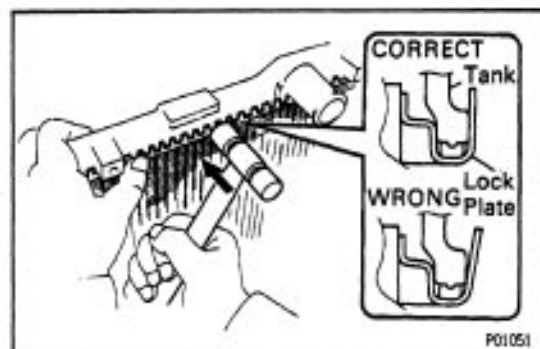
- If the sides of the lock plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or similar object. Water leakage will result if the bottom of the lock plate groove is damaged or dented. Therefore, repair or replace if necessary.



## 3. INSTALL NEW O-RINGS AND TANKS

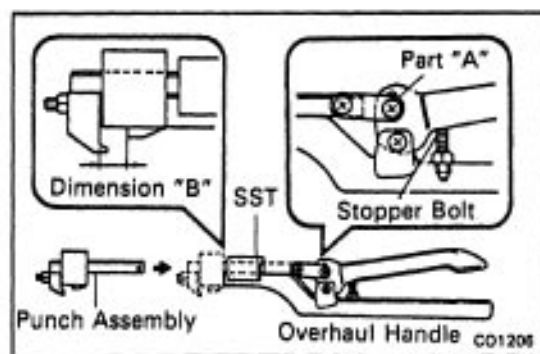
- (a) After checking that there are no foreign objects in the lock plate groove, install the new O-ring without twisting it.

HINT: When cleaning the lock plate groove, lightly rub it with sand paper without scratching it.



- (b) Install the tank without damaging the O-ring.

- (c) Tap the lock plate with a soft-faced hammer so that there is no gap between it and the tank.



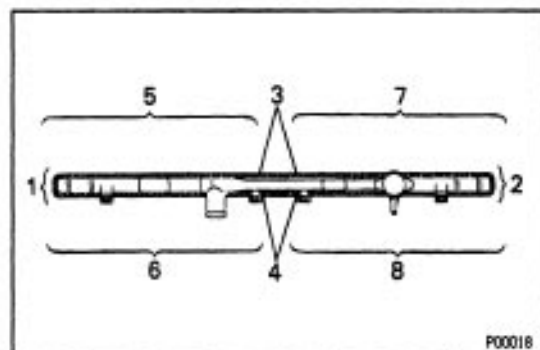
## 4. ASSEMBLE SST

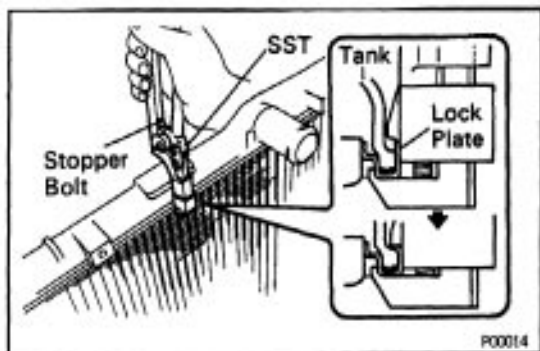
SST 09230-01010

- (a) Install the punch assembly to the overhaul handle, inserting it in the hole in part "A" as shown in the illustration.
- (b) While gripping the handle, adjust the stopper bolt so that dimension "B" shown in the diagram is 7.7 mm (0.03 in.)

## 5. CAULK LOCK PLATE

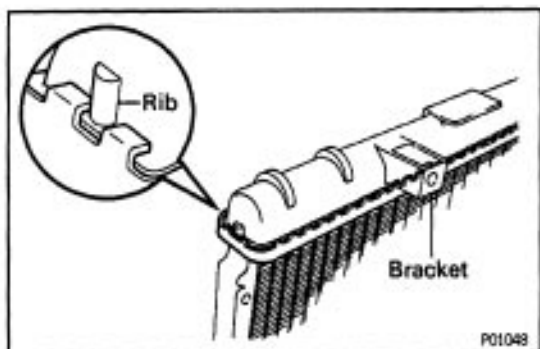
- (a) Lightly press SST against the lock plate in the order shown in the illustration.





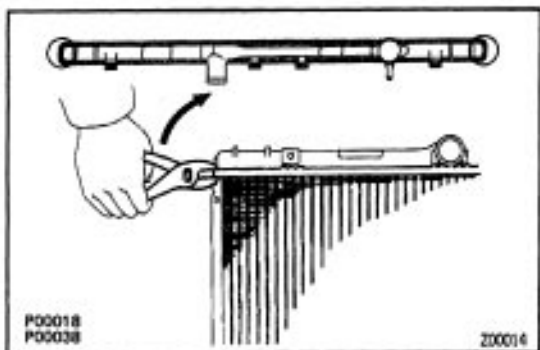
After repeating this a few times, fully caulk the lock plate by squeezing the handle until stopped by the stopper plate.

SST 09230 – 01010

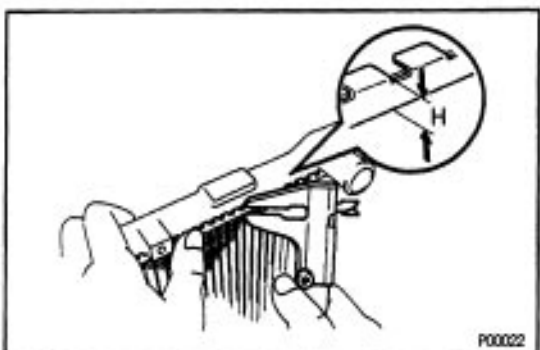


HINT:

- Do not stake the areas protruding around the pipes, brackets or tank ribs.



- The points shown in the illustration and oil cooler near here (A/T) cannot be staked with the SST. Use a plier or like object and be careful not to damage the core plates.

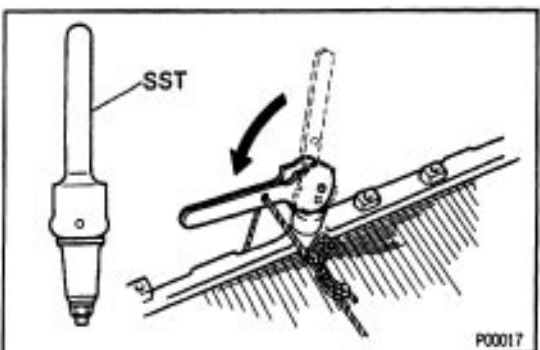


- (b) Check the lock plate height (H) after completing the caulking.

**Plate height:**

**7.75–8.25 mm (0–3051–0.3248 in.)**

If not within the specified height, adjust the stopper bolt of the handle again and perform the caulking again.

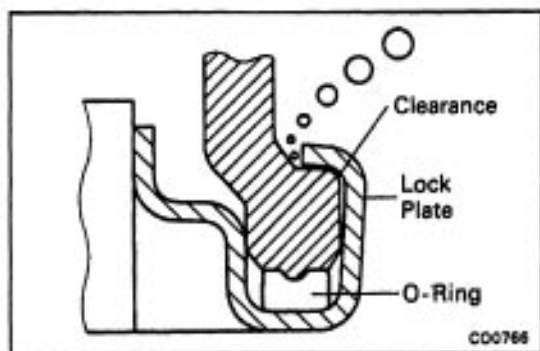


## 6. INSPECT FOR WATER LEAKS

- (a) Tighten the drain cock.
- (b) Plug the inlet and outlet pipes of the radiator with SST.
- (c) Using a radiator cap tester, apply pressure to the radiator.

**Test pressure:**

**177 kPa (1.8 kgf/cm<sup>2</sup>, 26 psi)**

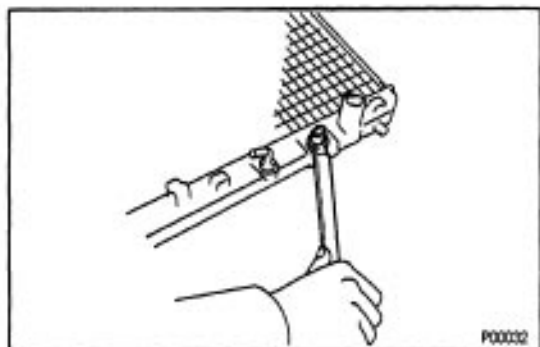


(d) Inspect for water leaks.

HINT: On radiators with resin tanks, there is a clearance between the tank and lock plate where a minute amount of air will remain, giving the appearance of an air leak when the radiator is submerged in water. Therefore, before performing the water leak test, first switch the radiator around in the water until all air bubbles disappear.

## 7. PAINT LOCK PLATES

HINT: If the water leak test checks out okay, allow the radiator to completely dry and then paint the lock plates.

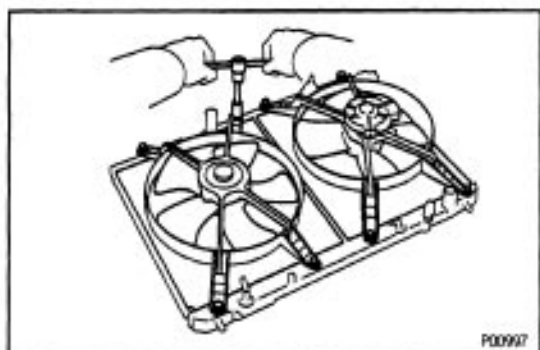


## RADIATOR INSTALLATION

(See Components for Removal and installation)

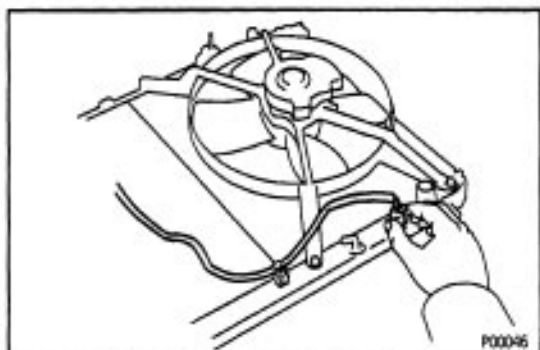
### 1. INSTALL ENGINE COOLANT TEMPERATURE SWITCH

- Install a new O-ring to the engine coolant temperature switch.
- Install the engine coolant temperature switch.

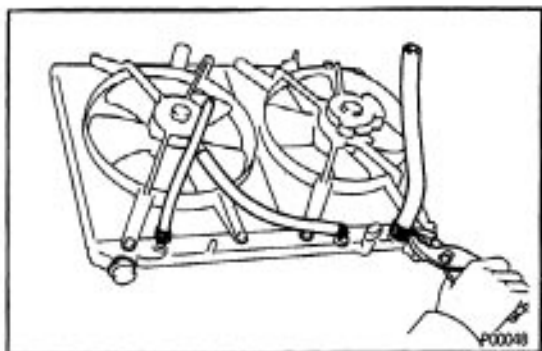
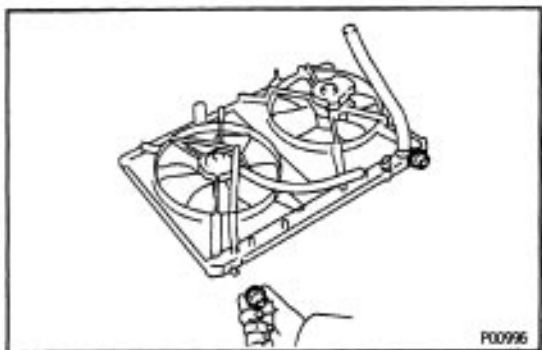


### 2. INSTALL ELECTRIC COOLING FANS TO RADIATOR

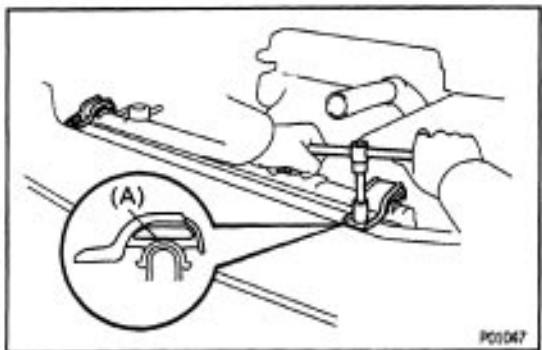
Install the cooling fans with the 8 bolts.



### 3. INSTALL ENGINE COOLANT TEMPERATURE SWITCH WIRE

**4. A/T:****INSTALL A/T OIL COOLER HOSES****5. INSTALL RADIATOR LOWER HOSE****6. INSTALL RADIATOR AND ELECTRIC COOLING FANS**

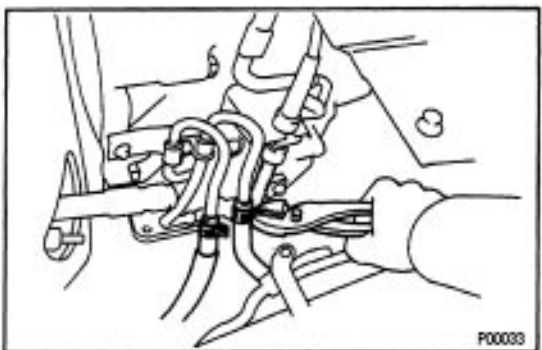
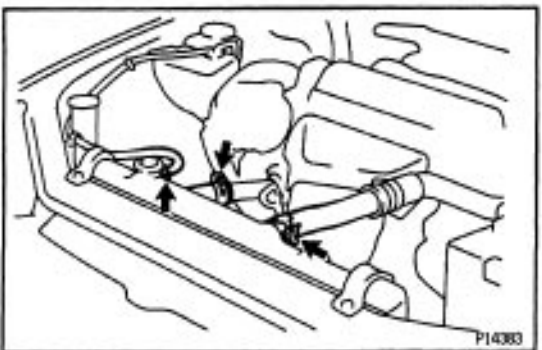
(a) Place the 2 lower radiator supports in position on the body.



(b) Place the radiator in position, and install the 2 upper supports with the 2 bolts.

HINT: After installation, check that the rubber cushion (A) of the support is not depressed.

**Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)**

**7. A/T:****CONNECT OIL COOLER HOSES****8. CONNECT ENGINE COOLANT RESERVOIR HOSE****9. CONNECT RADIATOR HOSES**

10. CONNECT ELECTRIC COOLING FAN CONNECTORS

11. CONNECT ENGINE COOLANT TEMPERATURE  
SWITCH CONNECTOR TO FAN SHROUD

12. w/ CRUISE CONTROL SYSTEM:

INSTALL CRUISE CONTROL ACTUATOR COVER

13. FILL WITH ENGINE COOLANT

(See page [EG1-241](#))

14. CONNECT NEGATIVE (–) TERMINAL CABLE TO  
BATTERY

15. START ENGINE AND CHECK FOR LEAKS

16. A/T:

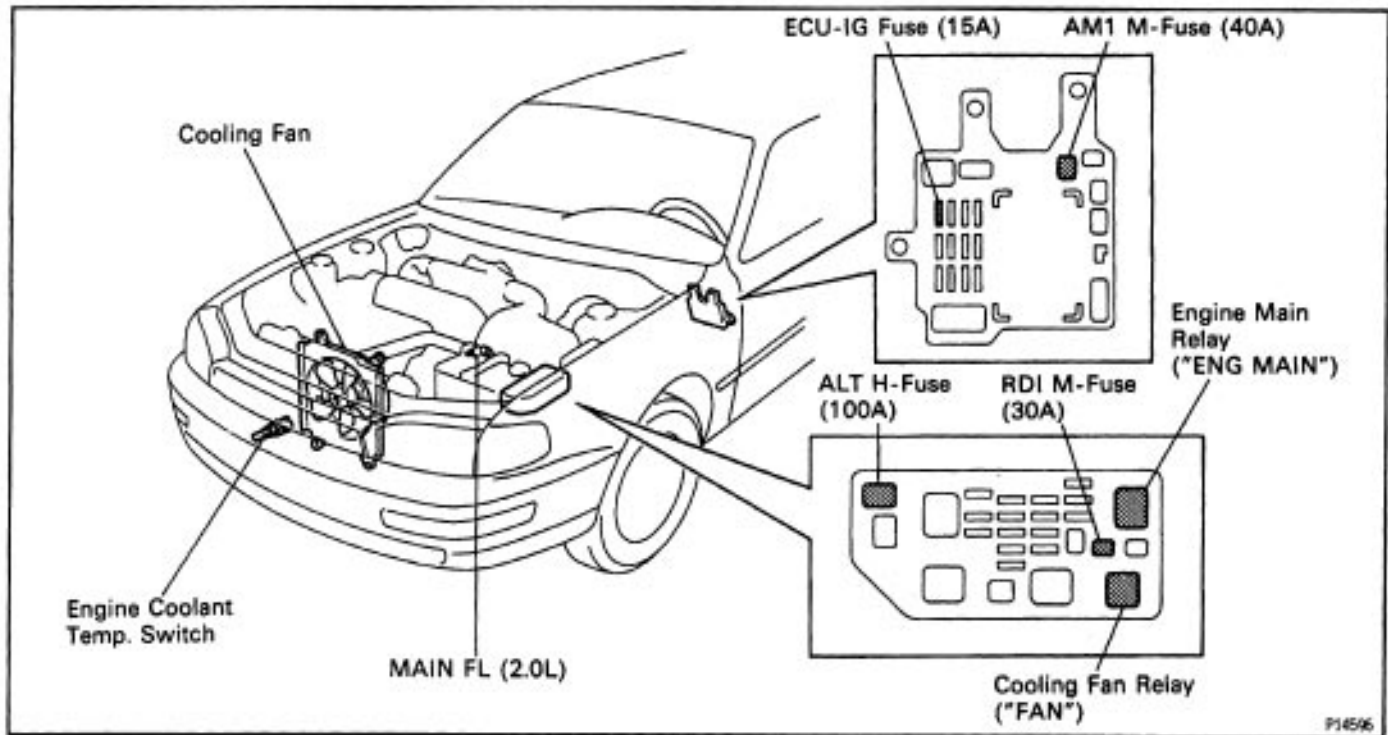
CHECK AUTOMATIC TRANSMISSION (A/T) FLUID  
LEVEL

NOTICE: Do not overfill.



# ELECTRIC COOLING FAN PART LOCATION

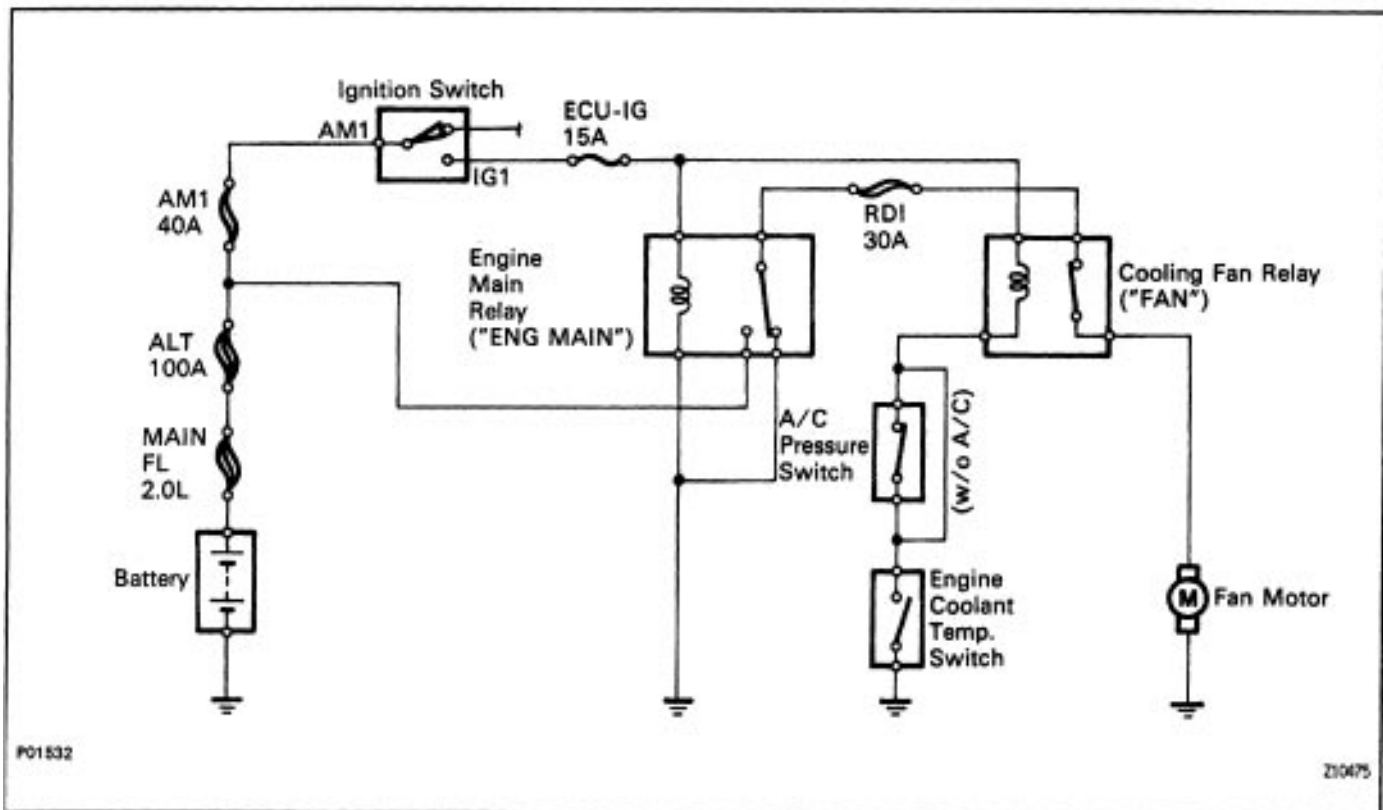
88078-9T



P145/96

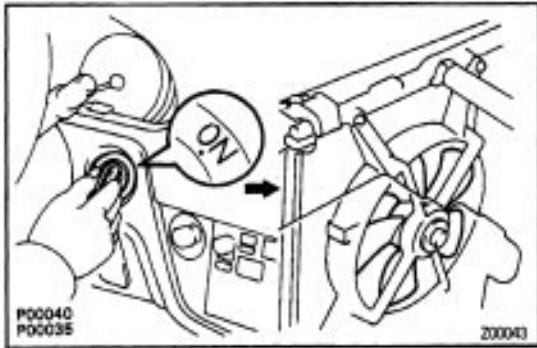
88078-0P

## SYSTEM CIRCUIT



P01532

Z10475



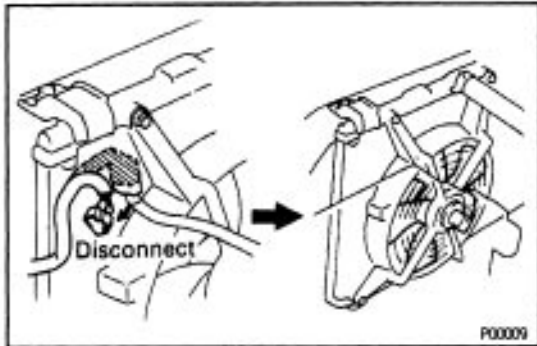
## ON-VEHICLE INSPECTION

### Low Temperature (Below 83°C (181°F))

#### 1. TURN IGNITION SWITCH "ON"

Check that the cooling fan stops.

If not, check the cooling fan relay and engine coolant temperature switch, and check for a separated connector or severed wire between the cooling fan relay and engine coolant temperature switch.

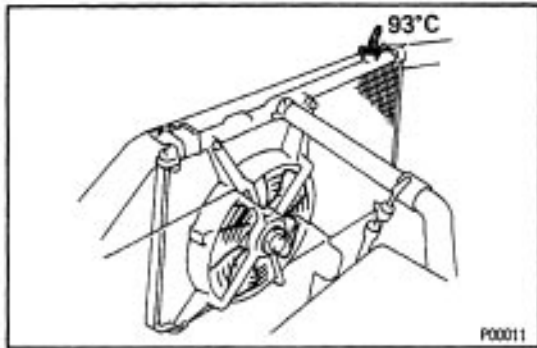


#### 2. DISCONNECT ENGINE COOLANT TEMPERATURE SWITCH CONNECTOR

Check that the cooling fan rotates.

If not, check the cooling fan relay, cooling fan, engine main relay and fuse, and check for a short circuit between the cooling fan relay and engine coolant temperature switch.

#### 3. CONNECT ENGINE COOLANT TEMPERATURE SWITCH CONNECTOR



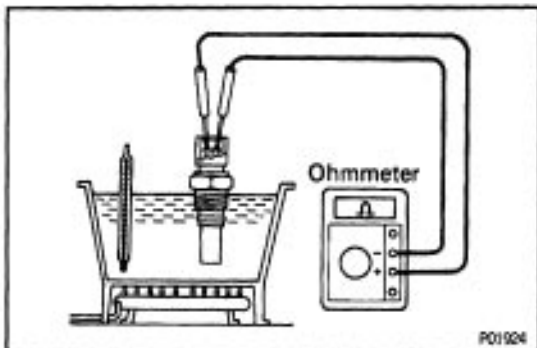
### High Temperature (Above 93°C (199°F))

#### 4. START ENGINE

(a) Raise engine coolant temperature to above 93°C (199°F).

(b) Check that the cooling fan rotates.

If not, replace the engine coolant temperature switch.



9-4-01

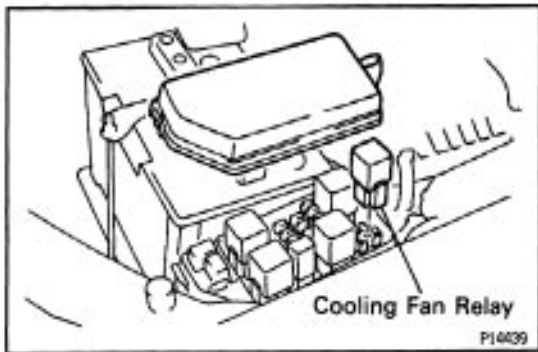
## ELECTRIC COOLING FAN COMPONENTS INSPECTION

### 1. INSPECT ENGINE COOLANT TEMPERATURE SWITCH

(a) Using an ohmmeter, check that there is no continuity between the terminals when the engine coolant temperature is above 93°C (199°F).

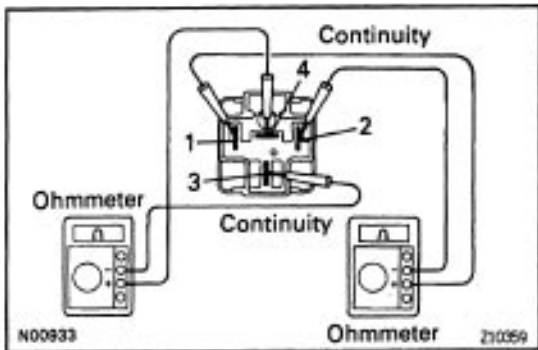
(b) Using an ohmmeter, check that there is continuity between the terminals when the engine coolant temperature is below 83°C (181°F).

If continuity is not as specified, replace the switch.



## 2. INSPECT COOLING FAN RELAY ("FAN")

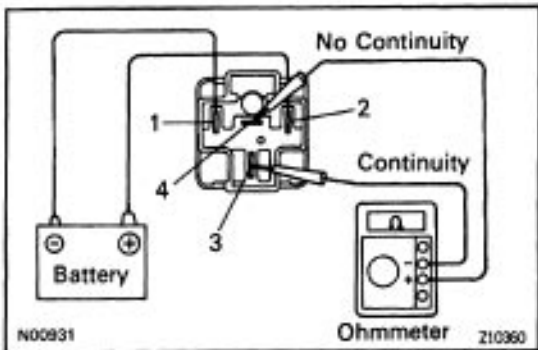
### A. Remove cooling fan relay



### B. Inspect relay continuity

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- (b) Check that there is continuity between terminals 3 and 4.

If continuity is not as specified, replace the relay.

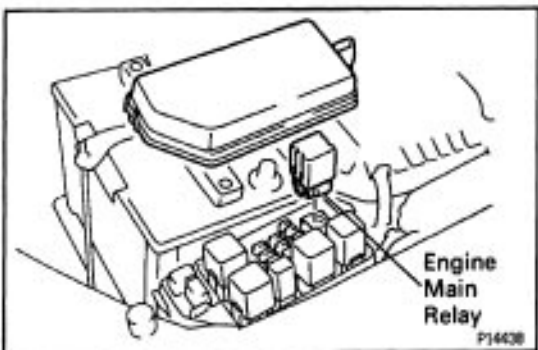


### C. Inspect relay operation

- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

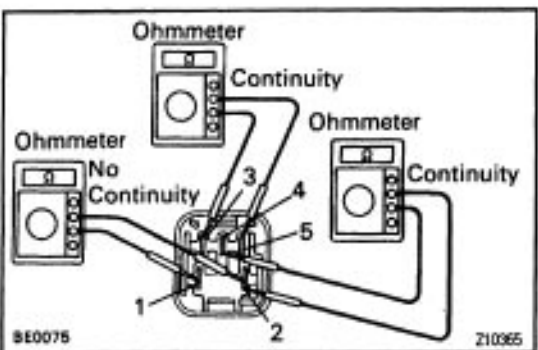
If operation is not as specified, replace the relay.

### D. Reinstall cooling fan relay



## 3. INSPECT ENGINE MAIN RELAY ("ENG MAIN")

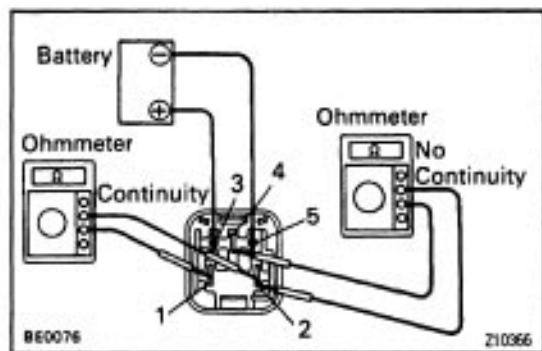
### A. Remove engine main relay



### B. Inspect relay continuity

- (a) Using an ohmmeter, check that there is continuity between terminals 3 and 5.
- (b) Check that there is continuity between terminals 2 and 4.
- (c) Check that there is no continuity between terminals 1 and 2.

If continuity is not as specified, replace the relay.

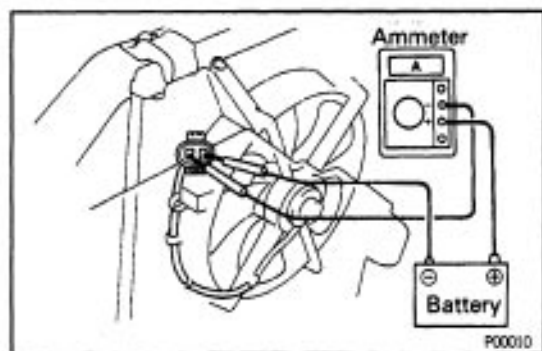


### C. Inspect relay operation

- Apply battery voltage across terminals 3 and 5.
- Using an ohmmeter, check that there is no continuity between terminals 2 and 4.
- Check that there is continuity between terminals 1 and 2.

If operation is not as specified, replace the relay.

### D. Reinstall engine main relay



### 4. INSPECT COOLING FAN

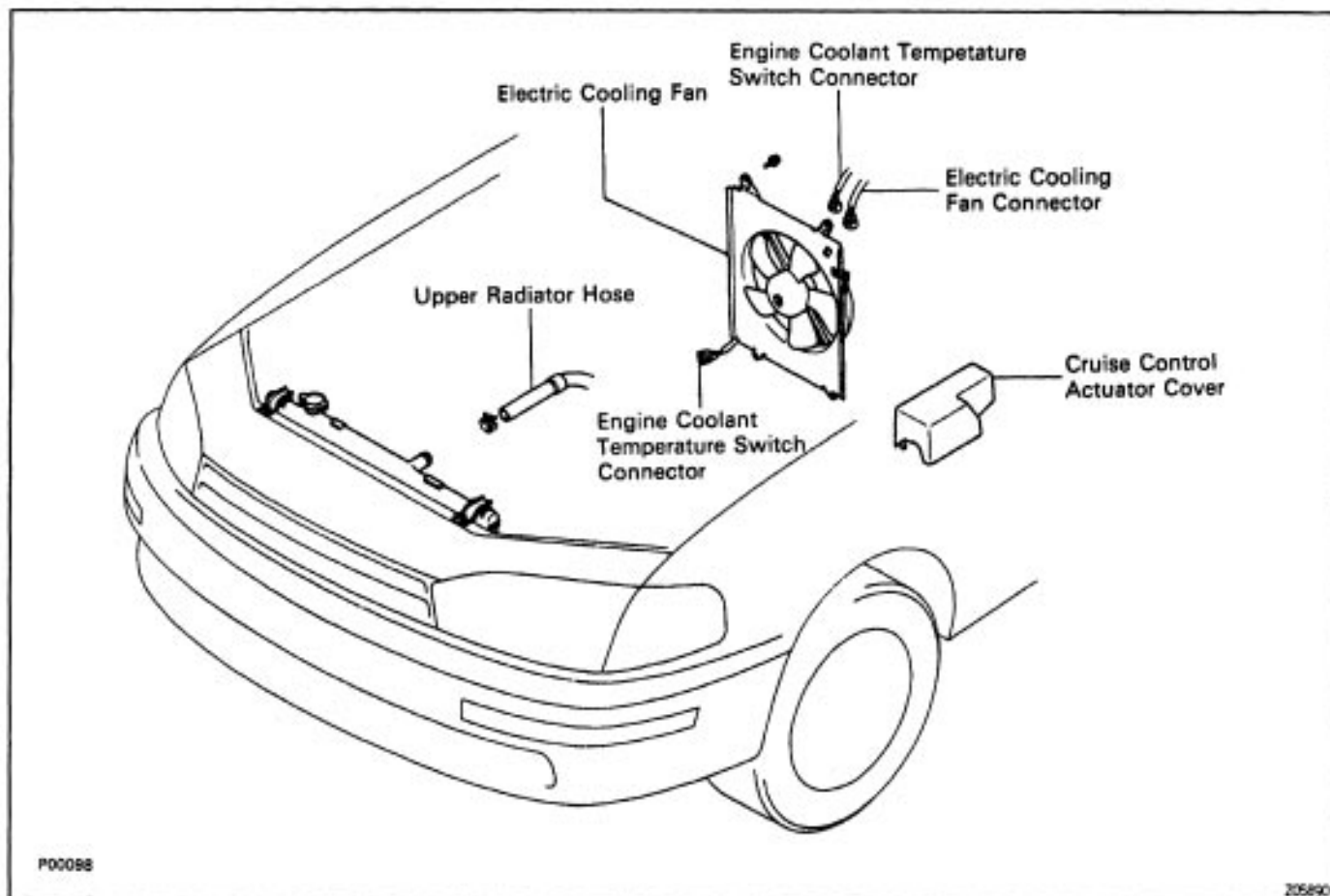
- Connect battery and ammeter to the cooling fan connector.
- Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

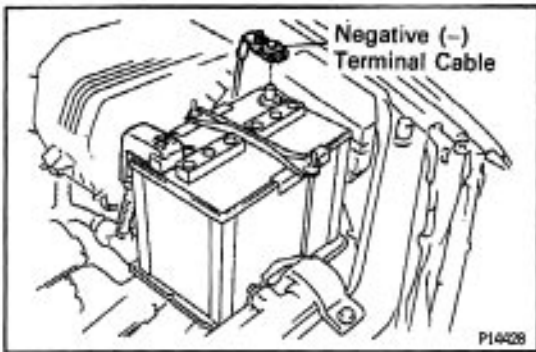
**Standard amperage:**

**5.8 – 7.4 A**

NOTICE-55

## COMPONENTS FOR REMOVAL AND INSTALLATION





## ELECTRIC COOLING FAN REMOVAL

(See Components for Removal and Installation)

### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

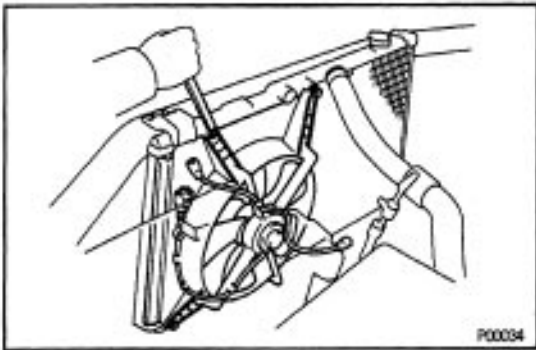
**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (-) terminal cable is disconnected from the battery.

### 2. DRAIN ENGINE COOLANT (See page [EG1-241](#))

### 3. w/ CRUISE CONTROL SYSTEM:

REMOVE CRUISE CONTROL ACTUATOR COVER

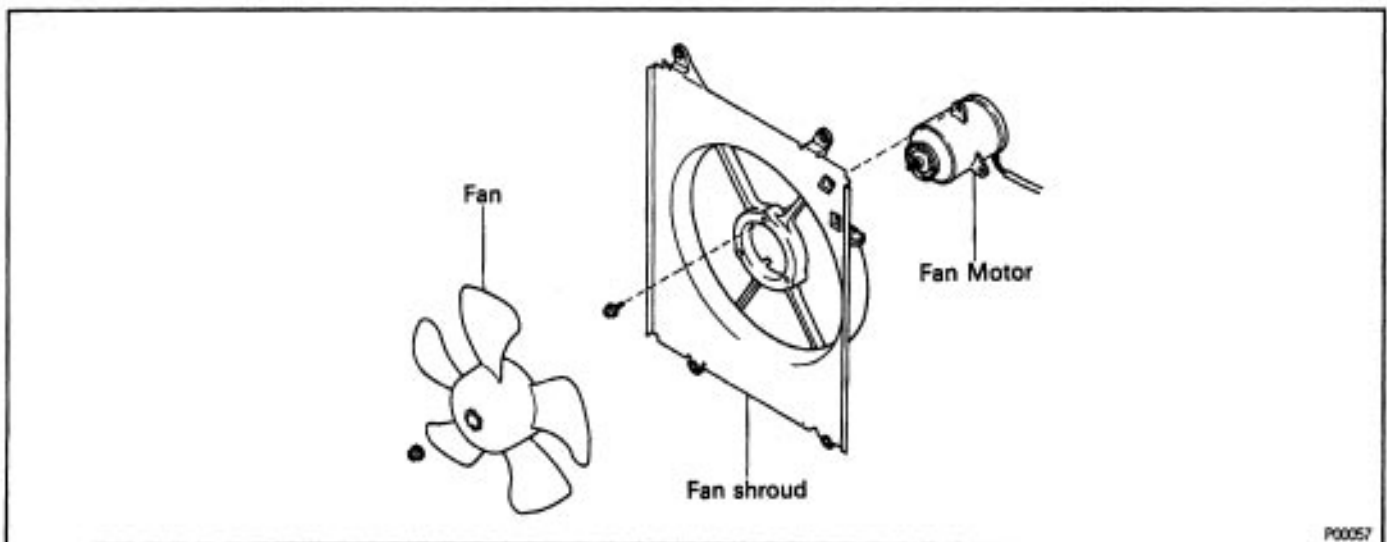
### 4. DISCONNECT UPPER RADIATOR HOSE FROM RADIATOR

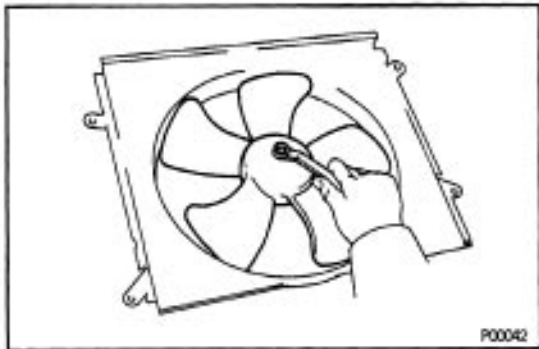


### 5. REMOVE ELECTRIC COOLING FAN

- Disconnect the engine coolant temperature switch connector from the radiator.
- Disconnect the engine coolant temperature switch and electric cooling fan connectors from the fan shroud.
- Remove the 4 bolts and cooling fan.

## COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



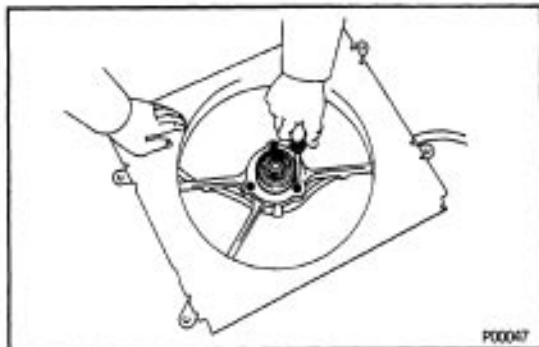


## ELECTRIC COOLING FAN DISASSEMBLY

(See Components for Disassembly and Assembly)

### 1. REMOVE FAN

Remove the nut and fan.



### 2. REMOVE FAN MOTOR

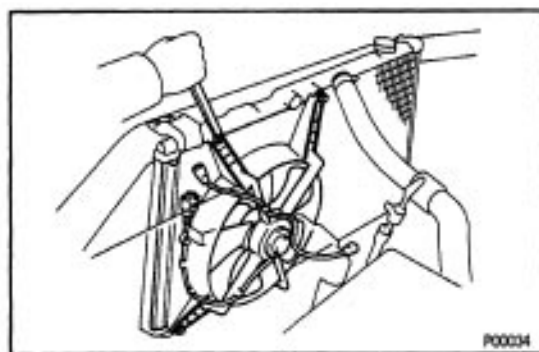
Remove the screws and fan motor.

## ELECTRIC COOLING FAN ASSEMBLY

(See Components for Disassembly and Assembly)

### 1. INSTALL FAN MOTOR

### 2. INSTALL FAN



## ELECTRIC COOLING FAN INSTALLATION

(See Components for Removal and Installation)

### 1. INSTALL ELECTRIC COOLING FAN

- (a) Install the cooling fan with the 4 bolts.
- (b) Connect the engine coolant temperature switch and electric cooling fan connectors to the fan shroud.
- (c) Connect the engine coolant temperature switch connector to the radiator.

### 2. CONNECT UPPER RADIATOR HOSE TO RADIATOR

### 3. w/ CRUISE CONTROL SYSTEM:

INSTALL CRUISE CONTROL ACTUATOR COVER

### 4. FILL WITH ENGINE COOLANT

(See page [EG1-241](#))

### 5. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

### 6. START ENGINE AND CHECK FOR LEAKS

# SERVICE SPECIFICATIONS

## SERVICE DATA

8907L-00

Thermostat	Valve opening temperature	80 – 84°C (176 – 183°F)
	Valve lift at 95°C (203°F)	8 mm (0.31 in.) or more
Radiator cap	Relief valve opening pressure	74 – 103 kPa (0.75 – 1.05 kgf/cm <sup>2</sup> , 10.7 – 14.9 psi)
	STD Limit	59 kPa (0.6 kgf/cm <sup>2</sup> , 8.5 psi)
Radiator	Plate height	7.75 – 8.25 mm (0.3051 – 0.3248 in.)
Electric cooling fan	Rotating amperage	5.8 – 7.4 A

8907M-00

## TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Cylinder block x Drain plug	13	130	9
Water inlet x Water pump cover	8.8	90	78 in·lbf
Water pump x Water pump cover	9.3	95	82 in·lbf
Water pump x Cylinder block	9.3	95	82 in·lbf
Water bypass pipe x Water pump cover	8.8	90	78 in·lbf
No.2 idler pulley x Cylinder block	42	425	31
Water inlet x Water pump	8.8	90	78 in·lbf
Radiator oil cooler x Radiator lower tank	8.3	85	74 in·lbf
Radiator oil cooler pipe	22	220	16
Radiator support bolt	13	130	9



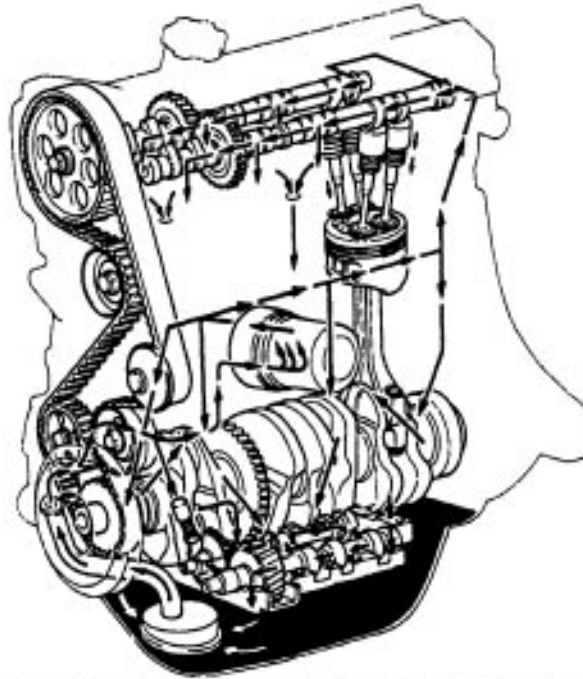
# LUBRICATION SYSTEM

## DESCRIPTION

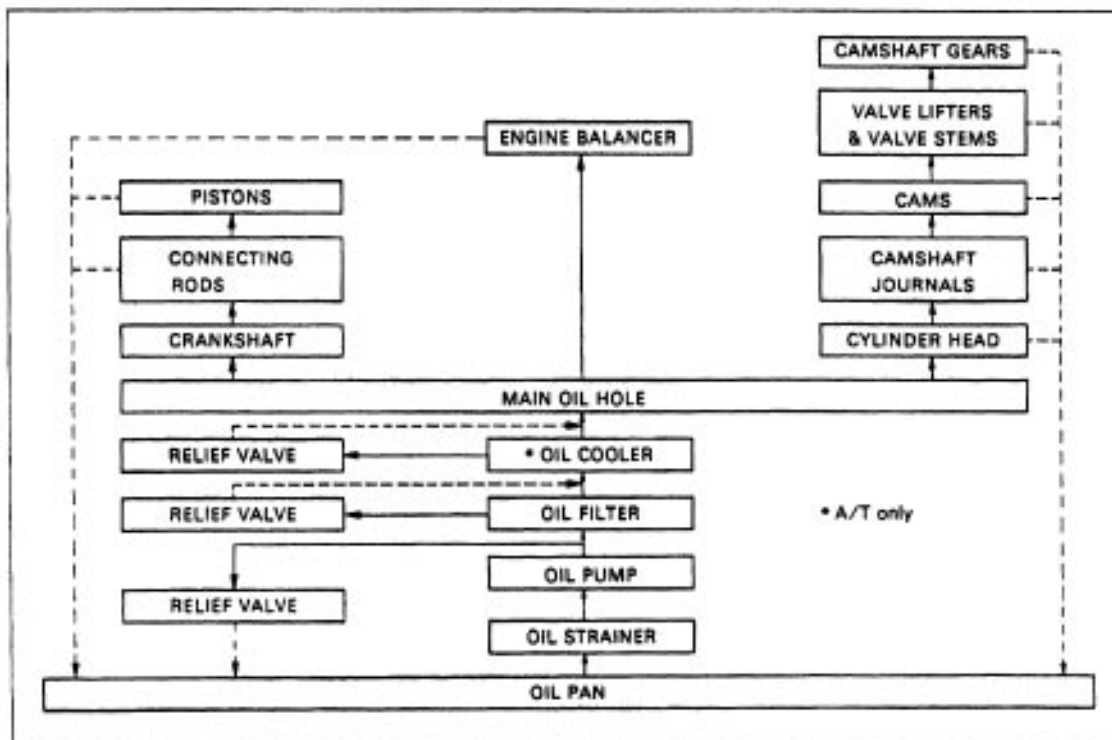
A fully pressurized, fully filtered lubrication system has been adopted for this engine.

## OPERATION

09A12-01



P01101



Z10118



A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the center left side of the cylinder block is provided to check the oil level.

### **OIL PUMP**

The oil pump pumps up oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump to remove impurities. The oil pump itself is a trochoid type pump, inside of which is a drive rotor and a driven rotor. When the drive rotor rotates, the driven rotor rotates in the same direction, and since the axis of the drive rotor shaft is different from the center of the driven rotor, the space between the two rotors changes as they rotate. Oil is drawn in when the space widens and is discharged when the space becomes narrow.

### **OIL PRESSURE REGULATOR (RELIEF VALVE)**

At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil. During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure becomes extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the oil pan.








### **OIL FILTER**

The oil filter is a full flow type filter with a relief valve built into the paper filter element. Particles of metal from wear, airborne dirt, carbon and other impurities can get into the oil during use and could cause accelerated wear or seizing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve bypasses the oil filter and flows directly into the main oil hole in the engine.

## PREPARATION




### SST (SPECIAL SERVICE TOOLS)

SST-01

	09032-00100 Oil Pan Seat Cutter	
	09226-10010 Crankshaft Front & Rear Bearing Replacer	Crankshaft front oil seal
	09228-06500 Oil Filter wrench	
	09616-30011 Steering Worm Bearing Adjusting Screw Wrench	Oil pump pulley
	09620-30010 Steering Gear Box Replacer Set	
	(09627-30010) Steering Sector Shaft Bushing Replacer	Oil pump oil seal
	(09631-00020) Handle	Oil pump oil seal

SST-02

## RECOMMENDED TOOLS

	09090-04000 Engine Sling Device	For suspending engine
	09200-00010 Engine Adjust Kit	
	09905-00013 Snap Ring Pliers	

SST-03

## EQUIPMENT

Oil pressure gauge	
Precision straight edge	Oil pump
Torque wrench	

83078-08

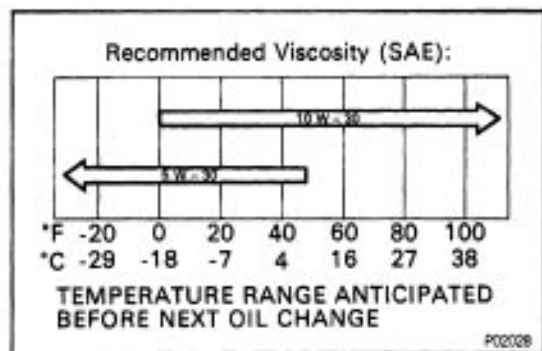
**LUBRICANT**

Item	Capacity	Classification
Engine oil (M/T)		API grade SG or SH, Energy-Conserving II multigrade engine oil or ILSAC multigrade engine oil and recommended viscosity oil
Dry fill	4.2 liters (4.4 US qts, 3.7 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.6 liters (3.8 US qts, 3.2 Imp. qts)	
w/o Oil filter change	3.4 liters (3.6 US qts, 3.0 Imp. qts)	
Engine oil (A/T)		
Dry fill	4.3 liters (4.5 US qts, 3.8 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.6 liters (3.8 US qts, 3.2 Imp. qts)	
w/o Oil filter change	3.4 liters (3.6 US qts, 3.0 Imp. qts)	

83071-01

**SSM (SPECIAL SERVICE MATERIALS)**

08826-00080 Seal packing or equivalent	Oil pan
08833-00080 Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch



## OIL PRESSURE CHECK

### 1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is visibly poor, replace the oil.

Oil grade:

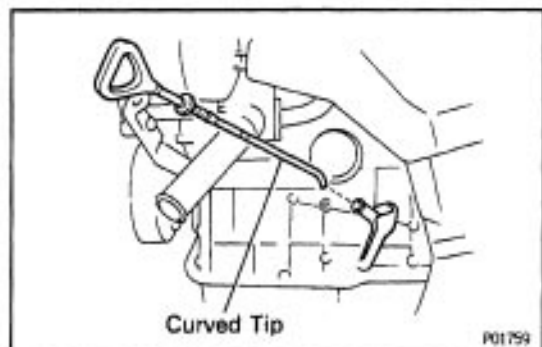
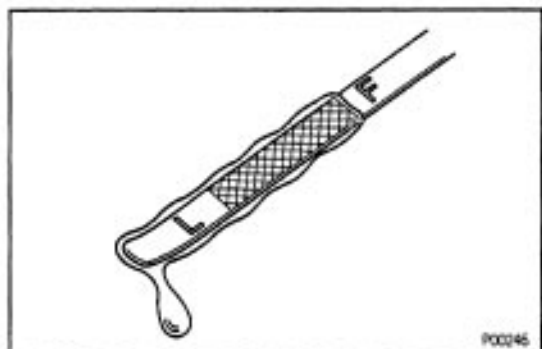
API grade SG or SH, Energy Conserving II multi-grade engine oil or ILSAC multigrade engine oil.

Recommended viscosity is as shown in the illustration.

### 2. CHECK ENGINE OIL LEVEL

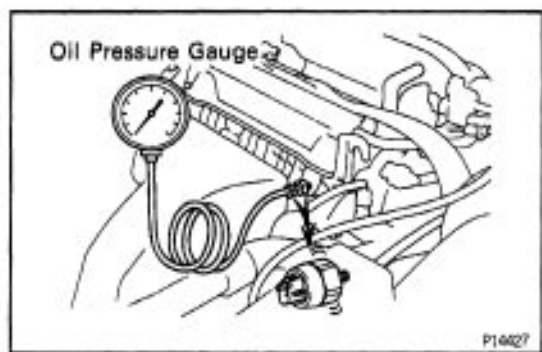
The oil level should be between the “L” and “F” marks on the dipstick.

If low, check for leakage and add oil up to “F” mark.



#### NOTICE:

- When inserting the oil dipstick, insert the curved tip of the dipstick facing the same direction as the curve of the guide.
- If the dipstick gets caught while inserting it, do not force it in. Reconfirm the direction of the dipstick.



### 3. REMOVE OIL PRESSURE SWITCH, AND INSTALL OIL PRESSURE GAUGE

### 4. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

### 5. CHECK OIL PRESSURE

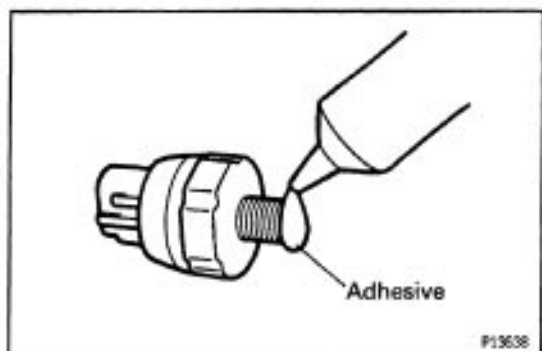
Oil pressure:

At idle

29 kPa (0.3 kgf/cm<sup>2</sup>, 4.3 psi) or more

At 3,000 rpm

245 – 490 kPa (2.5 – 5.0 kg f/cm<sup>2</sup>, 36 – 71 psi)



## 6. REMOVE OIL PRESSURE GAUGE AND REINSTALL OIL PRESSURE SWITCH

- (a) Remove the oil pressure gauge.
- (b) Apply adhesive to 2 or 3 threads of the oil pressure switch.

### Adhesive:

**Part No.08833 – 00080, THREE BOND 1344,  
LOCTITE 242 or equivalent**

- (c) Reinstall the oil pressure switch.

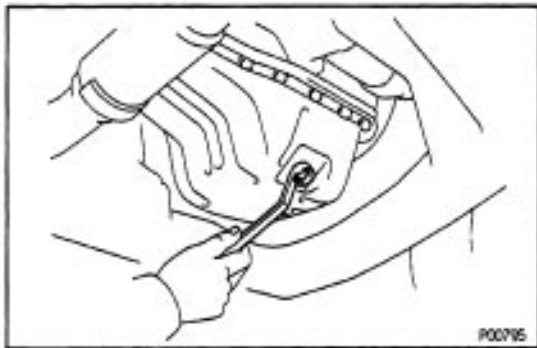
## 7. START ENGINE AND CHECK FOR LEAKS

## OIL AND FILTER REPLACEMENT

### CAUTION:

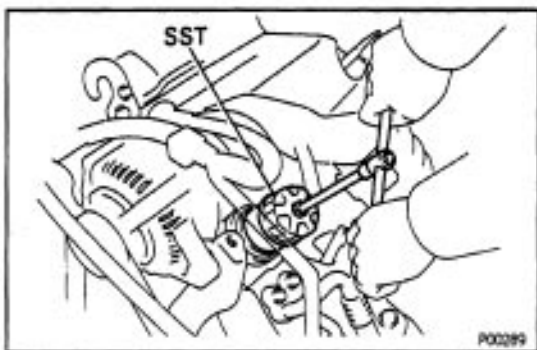
E842V-04

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Care should be taken, therefore, when changing engine oil to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves that cannot be penetrated by oil should be worn. The skin should be thoroughly washed with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.



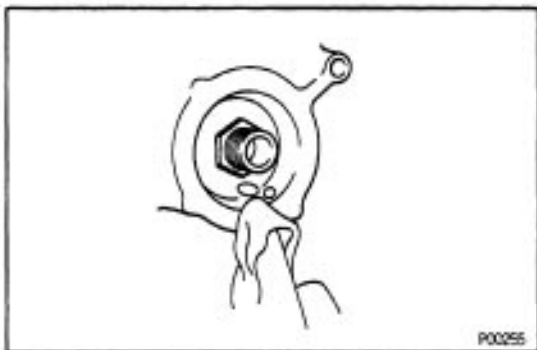
### 1. DRAIN ENGINE OIL

- (a) Remove the oil filler cap.
- (b) Remove the oil drain plug, and drain the oil into a container.

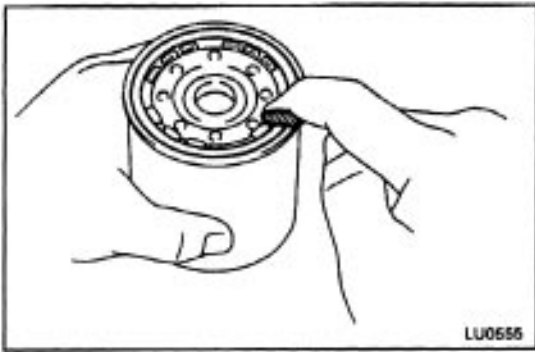


### 2. REPLACE OIL FILTER

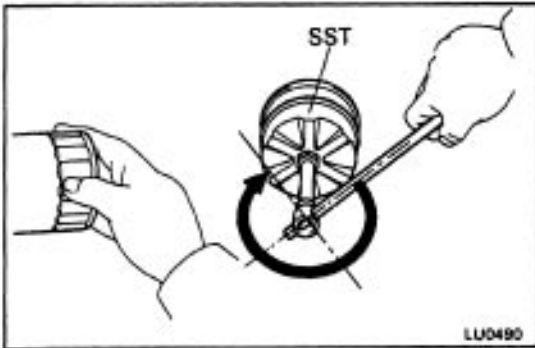
- (a) Using SST, remove the oil filter.  
SST 09228-06500



- (b) Check and clean the oil filter installation surface.



(c) Apply clean engine oil to the gasket of a new oil filter.



(d) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

(e) Using SST, tighten it an additional 3/4 turn.  
SST 09228-06500

### 3. FILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket.

**Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**

(b) Fill with new engine oil.

**Oil grade: (See step 1 on page [EG1-272](#))**

**Capacity (M/T):**

**Drain and refill**

**w/ Oil filter change**

**3.6 liters (3.8 US qts, 3.2 Imp. qts)**

**w/o Oil filter change**

**3.4 liters (3.6 US qts, 3.0 Imp. qts)**

**Dry fill**

**4.2 liters (4.4 US qts, 3.7 Imp. qts)**

**Capacity (A/T):**

**Drain and refill**

**w/ Oil filter change**

**3.6 liters (3.8 US qts, 3.2 Imp. qts)**

**w/o Oil filter change**

**3.4 liters (3.6 US qts, 3.0 Imp. qts)**

**Dry fill**

**4.3 liters (4.5 US qts, 3.8 Imp. qts)**

(c) Reinstall the oil filler cap.

### 4. START ENGINE AND CHECK FOR LEAKS

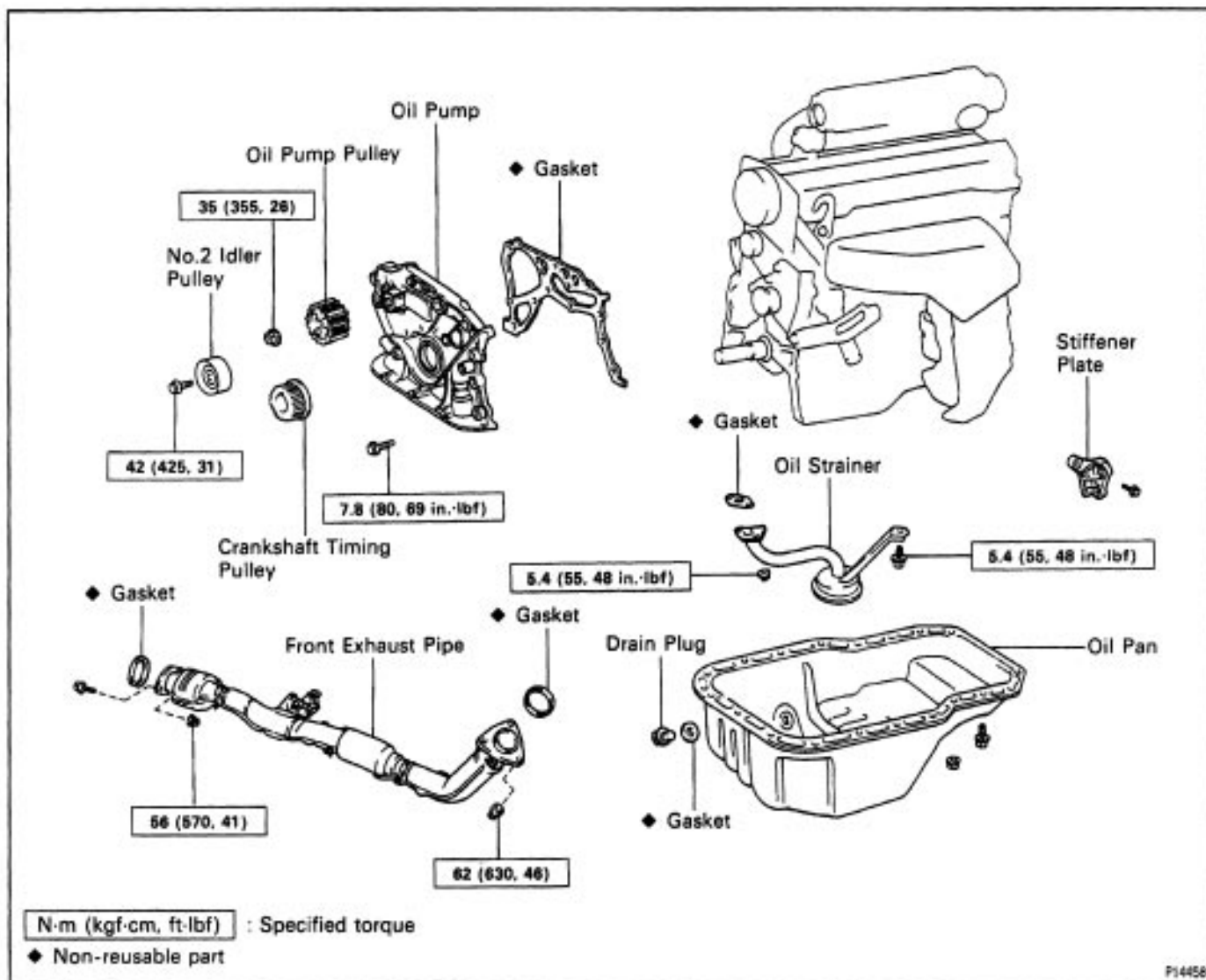
### 5. RECHECK ENGINE OIL LEVEL

(See page [EG1-272](#))

# OIL PUMP

## COMPONENTS FOR REMOVAL AND INSTALLATION

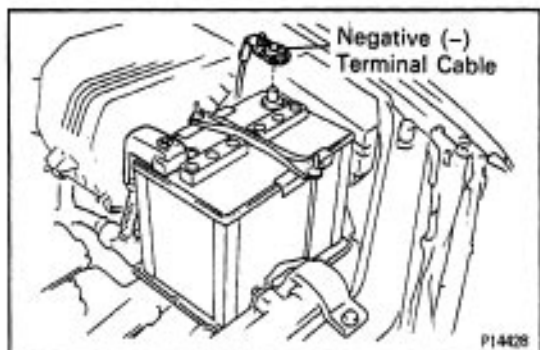
EG1-276-01



## OIL PUMP REMOVAL

EG1-276-01

HINT: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.



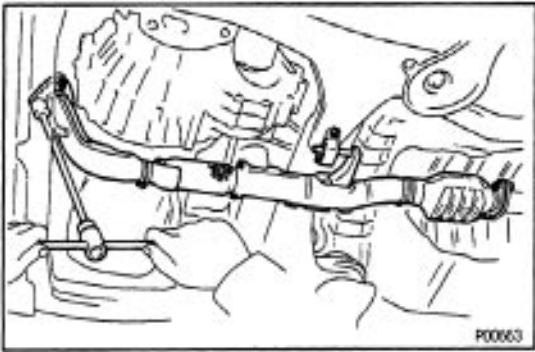
### 1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY

**CAUTION:** Work must be started after 90 seconds from the time the ignition switch is turned to the "LOCK" position and the negative (-) terminal cable is disconnected from the battery.

### 2. REMOVE HOOD

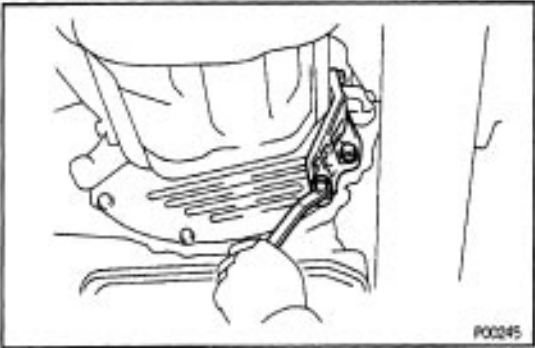
### 3. DRAIN ENGINE OIL (See page [EG1-274](#))





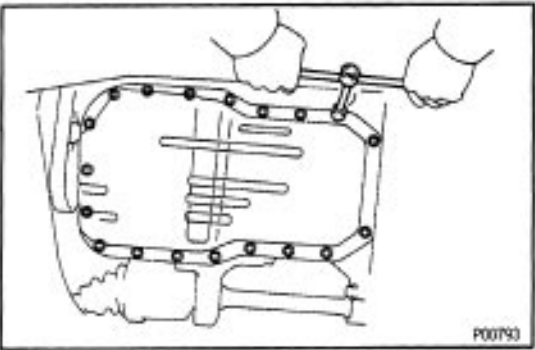
#### 4. REMOVE FRONT EXHAUST PIPE

- (a) Loosen the 2 bolts, and disconnect the bracket.
- (b) Remove the 2 bolts and nuts holding the front exhaust pipe to the center exhaust pipe.
- (c) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the WU-TWC.
- (d) Remove the front exhaust pipe and gaskets.



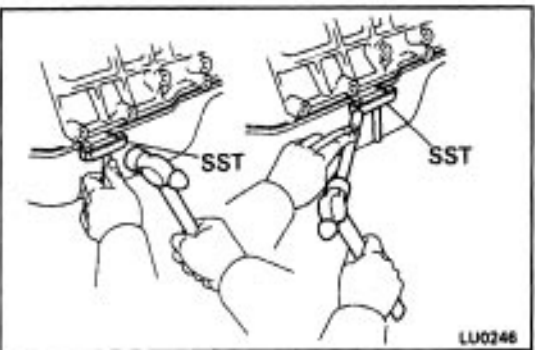
#### 5. REMOVE STIFFENER PLATE

Remove the 3 bolts and stiffener plate.



#### 6. REMOVE OIL PAN

- (a) Remove the dipstick.
- (b) Remove the 17 bolts and 2 nuts.

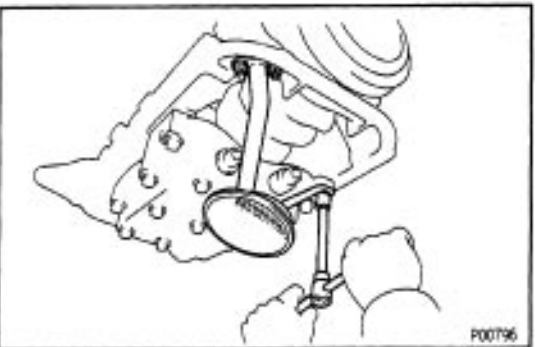


- (c) Insert the blade of SST between the cylinder block and oil pan, and cut off applied sealer and remove the oil pan.

SST 09032 – 00100

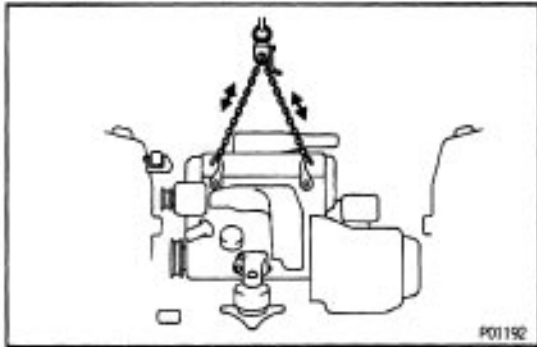
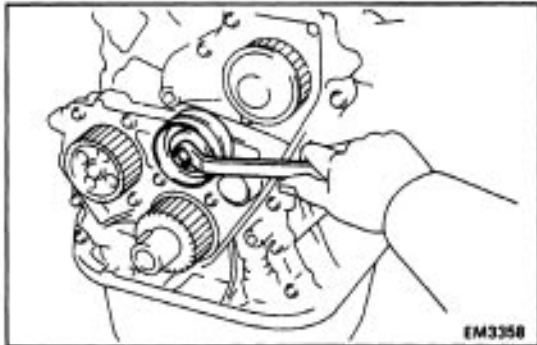
#### NOTICE:

- Do not use SST for the oil pump body side and rear oil seal retainer.
- Be careful not to damage the oil pan flange.

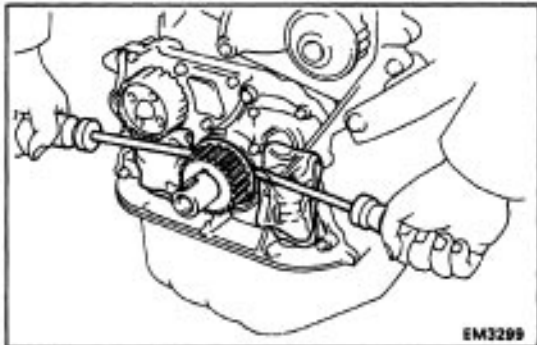


#### 7. REMOVE OIL STRAINER

Remove the bolt, nuts, oil strainer and gasket.

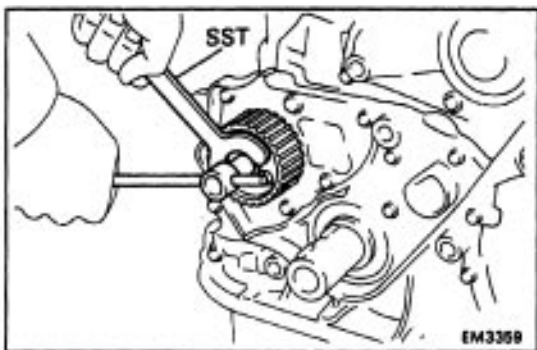
**8. SUSPEND ENGINE WITH ENGINE SLING DEVICE****9. REMOVE TIMING BELT (See page [EG1-26](#))****10. REMOVE NO.2 IDLER PULLEY**

Remove the bolt and pulley.

**11. REMOVE CRANKSHAFT TIMING PULLEY**

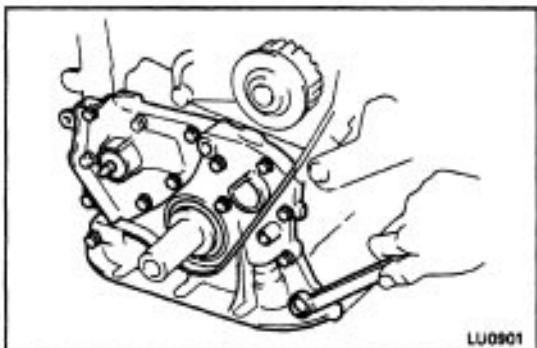
If the pulley cannot be removed by hand, use 2 screwdrivers.

HINT: Position shop rags as shown to prevent damage.

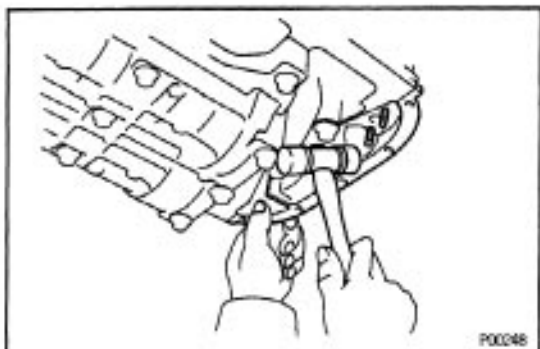
**12. REMOVE OIL PUMP PULLEY**

Using SST, remove the nut and pulley.

SST 09616 – 30011

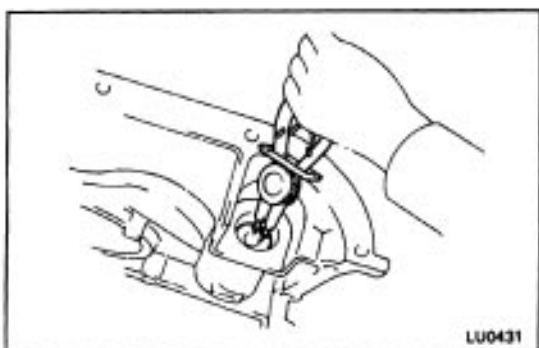
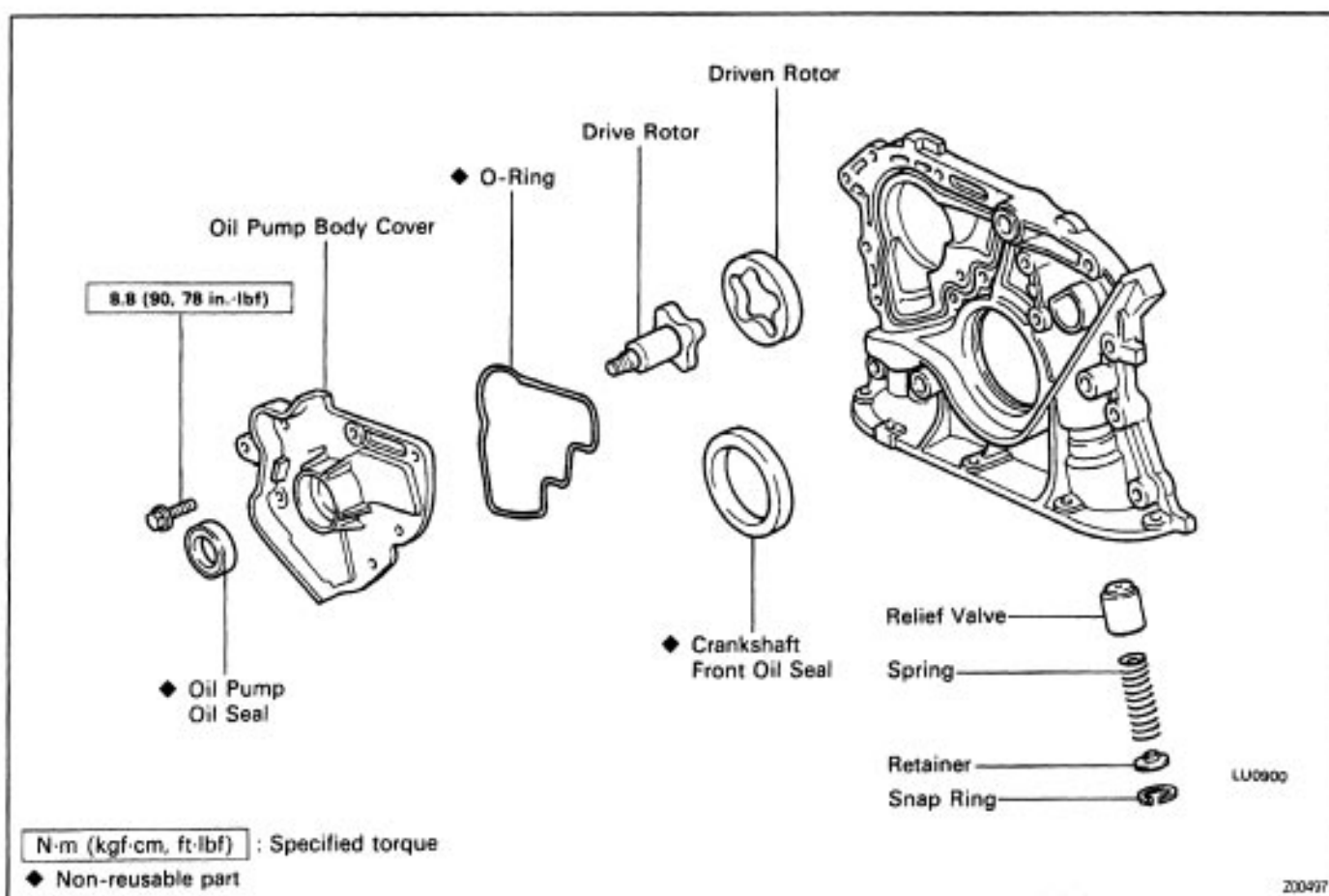
**13. REMOVE OIL PUMP**

(a) Remove the 12 bolts.



- (b) Using a plastic-faced hammer, remove the oil pump by carefully tapping the oil pump body.
- (c) Remove the gasket.

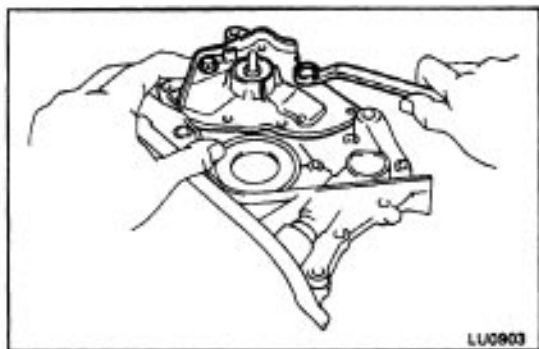
## COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



## OIL PUMP DISASSEMBLY

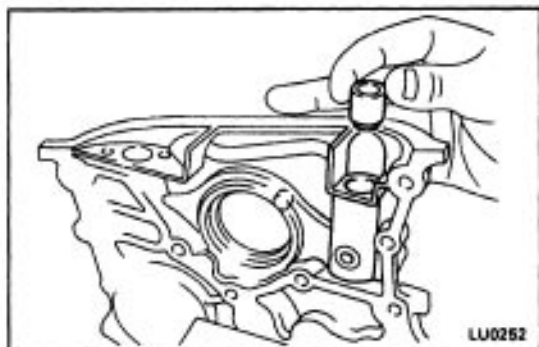
### 1. REMOVE RELIEF VALVE

- (a) Using snap ring pliers, remove the snap ring.
- (b) Remove the retainer, spring and relief valve.



## 2. REMOVE DRIVE AND DRIVEN ROTORS

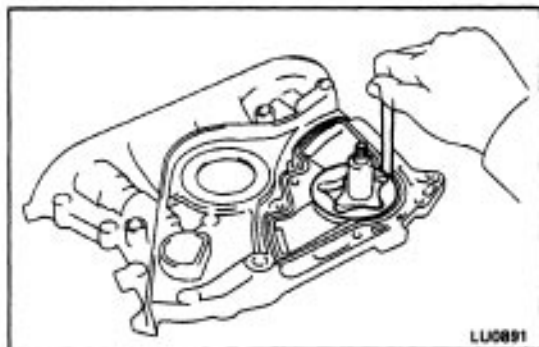
Remove the 2 bolts, pump body cover, O-ring, the drive and driven rotors.



## OIL PUMP INSPECTION

### 1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight. If it doesn't, replace the relief valve. If necessary, replace the oil pump assembly.



### 2. INSPECT DRIVE AND DRIVEN ROTORS

#### A. Inspect rotor body clearance

Using a thickness gauge, measure the clearance between the driven rotor and body.

**Standard body clearance:**

**0.10 – 0.16 mm (0.0039 – 0.0063 in.)**

**Maximum body clearance:**

**0.20 mm (0.0079 in.)**

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

#### B. Inspect rotor tip clearance

Using a thickness gauge, measure the clearance between the drive and driven rotor tips.

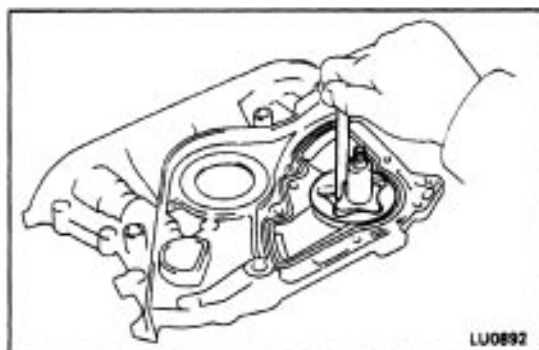
**Standard tip clearance:**

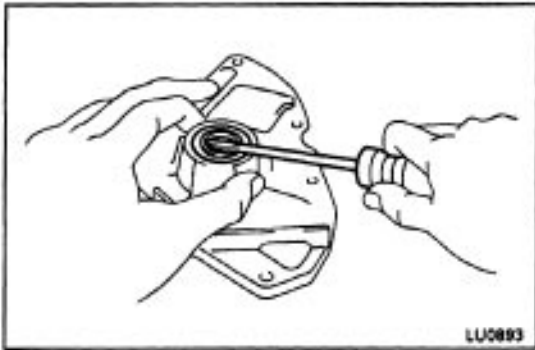
**0.04 – 0.16 mm (0.0016 – 0.0063 in.)**

**Maximum tip clearance:**

**0.20 mm (0.0079 in.)**

If the tip clearance is greater than maximum, replace the rotors as a set.

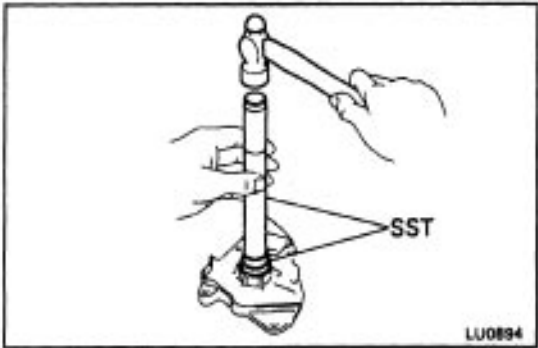




## OIL PUMP OIL SEAL REPLACEMENT

### 1. REMOVE OIL SEAL

Using a screwdriver, pry out the oil seal.



### 2. INSTALL OIL SEAL

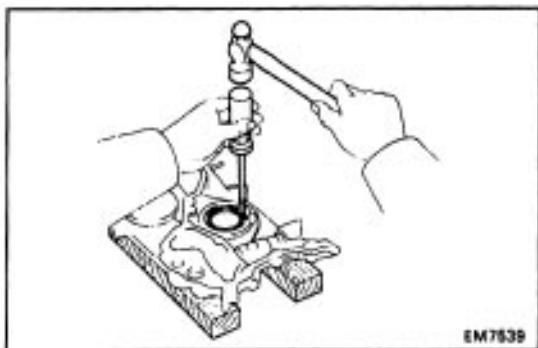
- (a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump cover edge.

SST 09620-30010 (09627-30010, 09631-00020)

- (b) Apply MP grease to the oil seal lip.

## CRANKSHAFT FRONT OIL SEAL REPLACEMENT

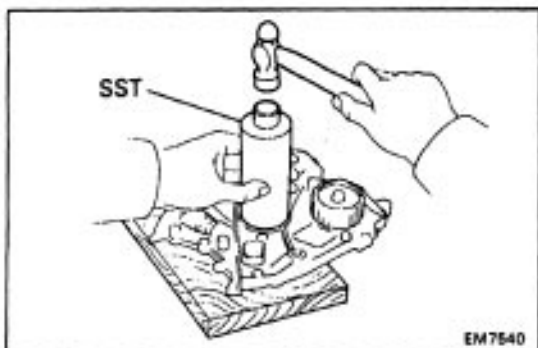
HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:



### REPLACE CRANKSHAFT FRONT OIL SEAL

#### A. If oil pump is removed from cylinder block:

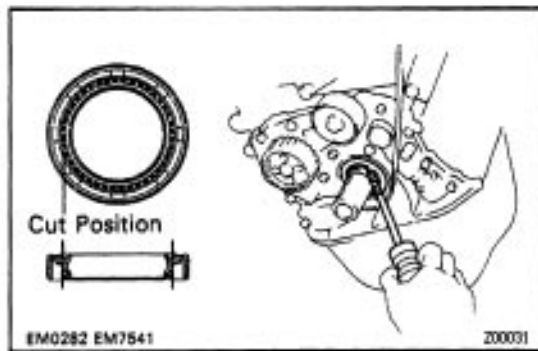
- (a) Using screwdriver and hammer, tap out the oil seal.



- (b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09226-10010

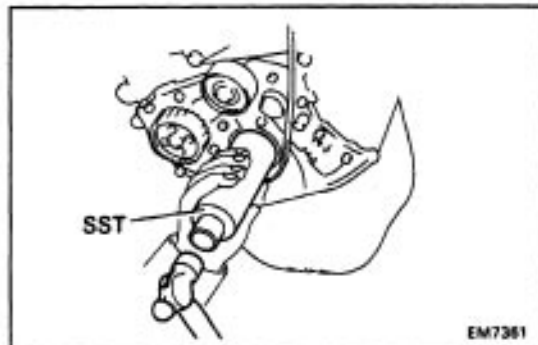
- (c) Apply MP grease to the oil seal lip.



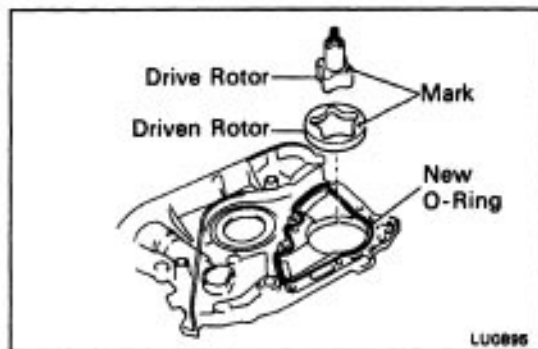
**B. If oil pump is installed to the cylinder block:**

- (a) Using a knife, cut off the oil seal lip.
- (b) Using a screwdriver, pry out the oil seal.

**NOTICE:** Be careful not to damage the crankshaft. Tape the screwdriver tip.



- (c) Apply MP grease to a new oil seal lip.
- (d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.  
SST 09226 -10010

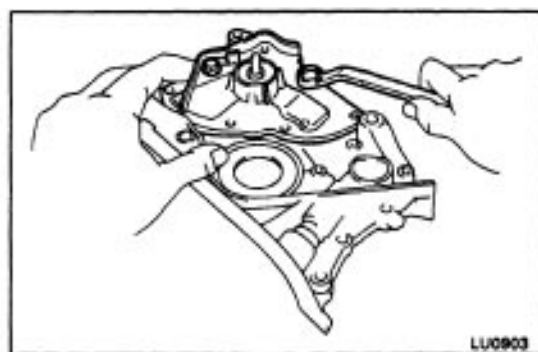


## OIL PUMP ASSEMBLY

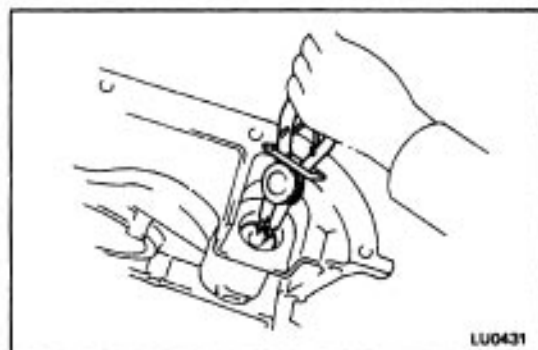
(See Components for Disassembly and Assembly)

### 1. INSTALL DRIVE AND DRIVEN ROTORS

- (a) Place the drive and driven rotors into pump body with the marks facing the pump body cover side.

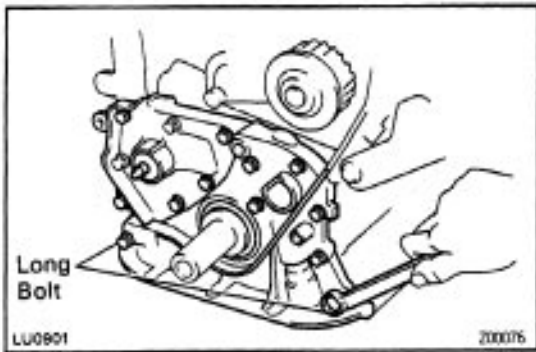


- (b) Install the pump body cover with the 2 bolts.  
**Torque: 8.8 N-m (90 kgf-cm. 78 in.-lbf)**



### 2. INSTALL RELIEF VALVE

- (a) Insert the relief valve, spring and retainer into the pump body hole.
- (b) Using snap ring pliers, install the snap ring.



## OIL PUMP INSTALLATION

(See Components for Removal and Installation)

### 1. INSTALL OIL PUMP

Install a new gasket and the oil pump with the 12 bolts.

**Torque: 9.3 N-m (95 kgf-cm, 82 in.-lbf)**

HINT: Long bolts are indicated in the illustration.

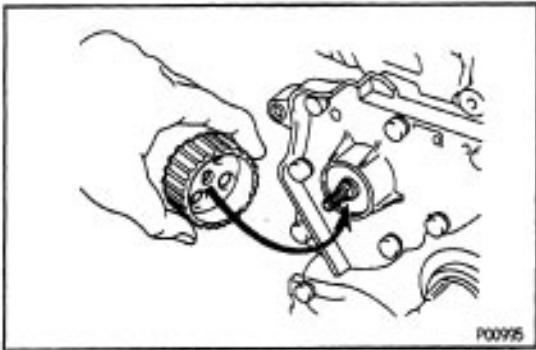
Bolt length:

Long bolt

35 mm (1.38 in.)

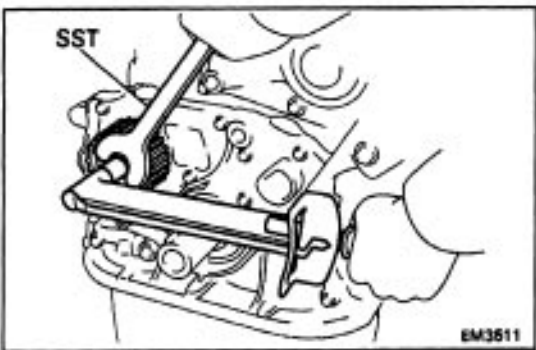
Others

25 mm (0.98 in.)



### 2. INSTALL OIL PUMP PULLEY

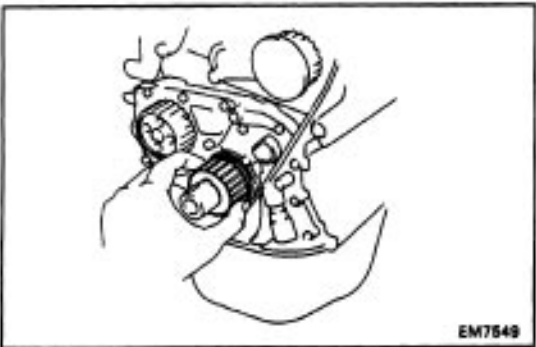
(a) Align the cutouts of the pulley and shaft, and slide on the pulley.



(b) Using SST, install the nut.

SST 09616-30011

**Torque: 28 N-m (290 kgf-cm, 21 ft-lbf)**

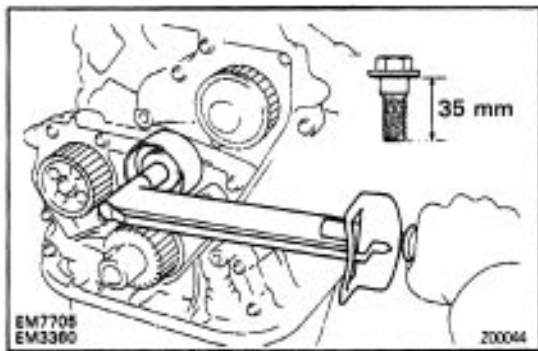


### 3. INSTALL CRANKSHAFT TIMING PULLEY

(a) Align the timing pulley set key with the key groove of the pulley.

(b) Slide on the timing pulley, facing the flange side inward.





#### 4. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.

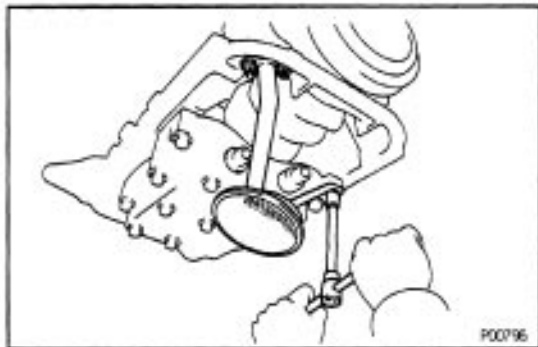
**Torque: 42 N-m (425 kgf-cm, 31 ft-lbf)**

HINT: Use a bolt 35 mm (1.38 in.) in length.

(b) Check that the idler pulley moves smoothly.

#### 5. INSTALL TIMING BELT (See page EG1-33)

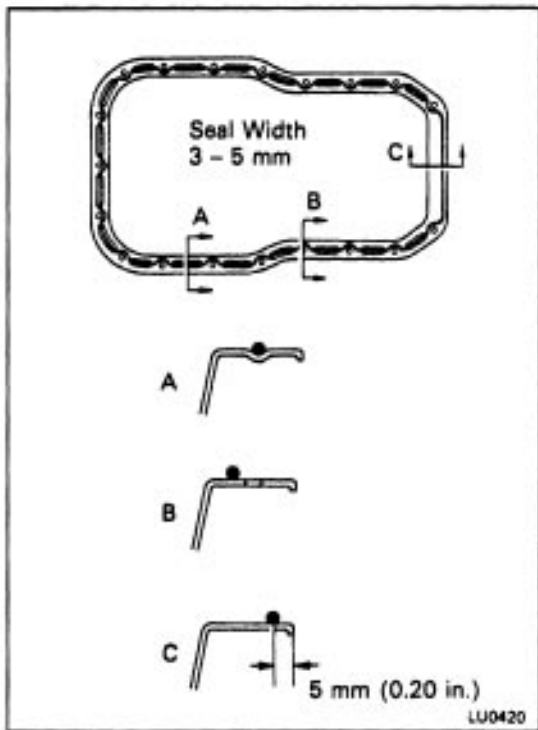
#### 6. REMOVE ENGINE SLING DEVICE



#### 7. INSTALL OIL STRAINER

Install a new gasket and the oil strainer with bolt and nuts.

**Torque: 5.4 N-m (55 kgf-cm, 48 in.-lbf)**



#### 8. INSTALL OIL PAN

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and cylinder block.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.

**NOTICE: Do not use a solvent which will affect the painted surfaces.**

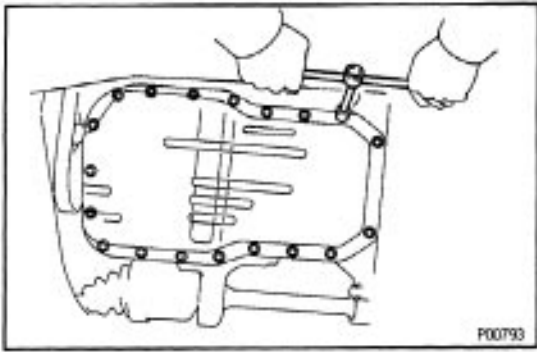
(b) Apply seal packing to the oil pan as shown in the illustration.

Seal packing:

Part No.08826 - 00080 or equivalent

- Install a nozzle that has been cut to a 3-5 mm (0.12-0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

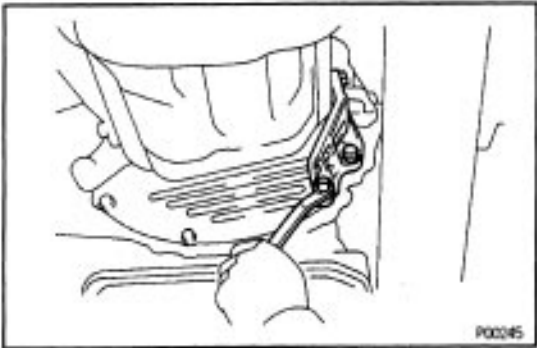




(c) Install the oil pan with 17 bolts and 4 nuts.

**Torque: 5.4 N-m (55 kgf-cm, 48 in.-lbf)**

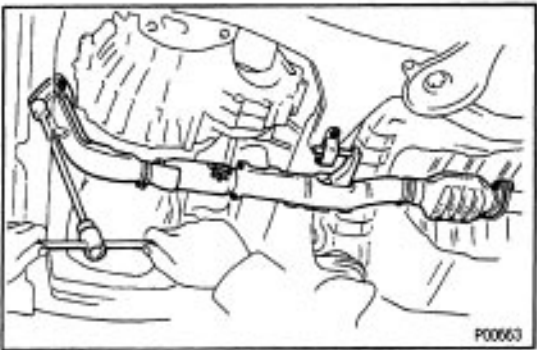
(d) Install the dipstick.



## 9. INSTALL STIFFENER PLATE

Install the stiffener plate with the 3 bolts.

**Torque: 37 N-m (380 kgf-cm, 27 ft-lbf)**



## 10. INSTALL FRONT EXHAUST PIPE

(a) Place 2 new gaskets on the front and rear of the front exhaust pipe.

(b) Temporarily install the 2 bolts and 2 new nuts holding front exhaust pipe to the center exhaust pipe.

(c) Using a 14 mm deep socket wrench, install the 3 new nuts holding the front exhaust pipe to the WU-TWC.

**Torque: 62 N-m (630 kgf-cm, 46 ft-lbf)**

(d) Tighten the 2 bolts and 2 nuts holding front exhaust pipe to the center exhaust pipe.

**Torque: 56 N-m (570 kgf-cm, 41 ft-lbf)**

(e) Install the bracket with the 2 bolts.

## 11. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY

**12. FILL WITH ENGINE OIL (See page [EG1-275](#))**

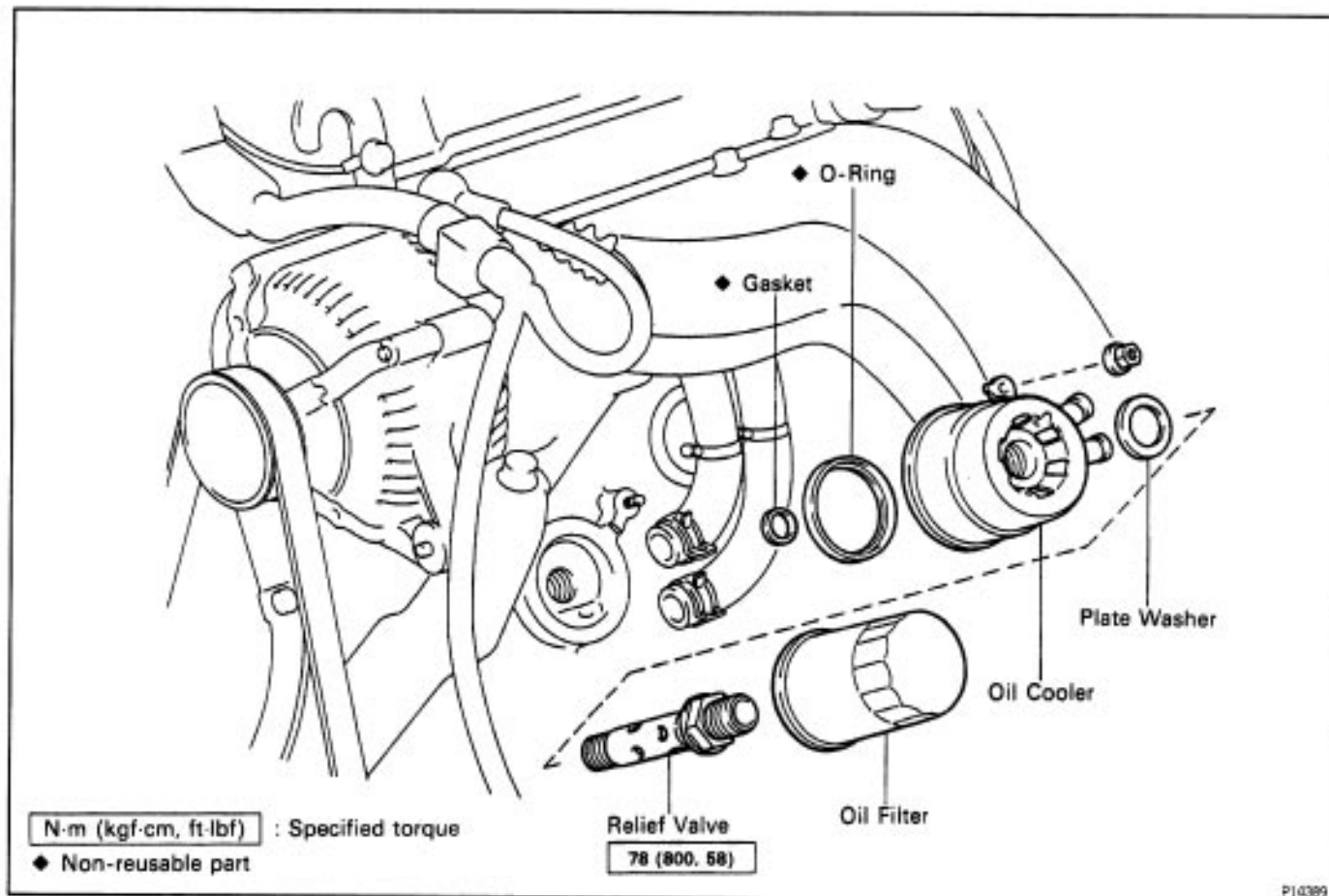
**13. START ENGINE AND CHECK FOR LEAKS**

**14. RECHECK ENGINE OIL LEVEL**

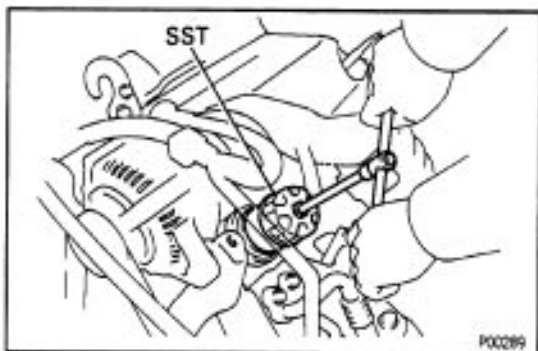
**15. INSTALL HOOD**

# OIL COOLER COMPONENTS FOR REMOVAL AND INSTALLATION

IS004-C2



P14389



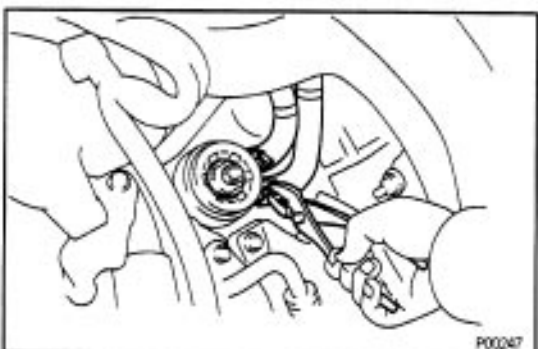
## OIL COOLER REMOVAL

### 1. DRAIN ENGINE COOLANT

### 2. REMOVE OIL FILTER

Using SST, remove the oil filter.  
SST 09228-06500

IS005-C2



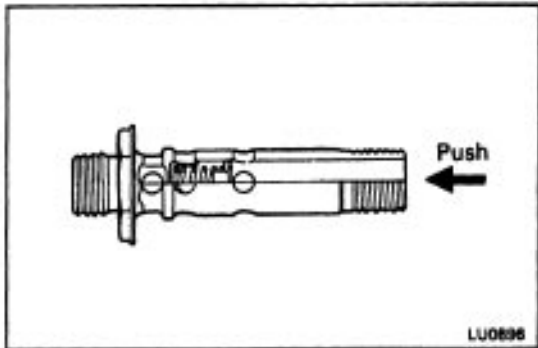
### 3. DISCONNECT WATER BYPASS HOSES FROM OIL COOLER

Disconnect the 2 water bypass hoses.



#### 4. REMOVE OIL COOLER

- Remove the relief valve and plate washer.
- Remove the nut and oil cooler.
- Remove the O-ring and gasket from the oil cooler.

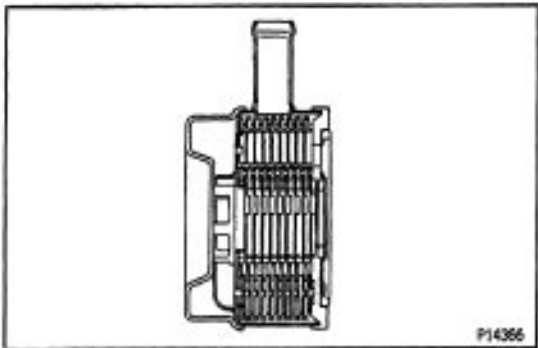


### OIL COOLER INSPECTION

#### 1. INSPECT RELIEF VALVE

Push the valve with a wooden stick to check if it is stuck.

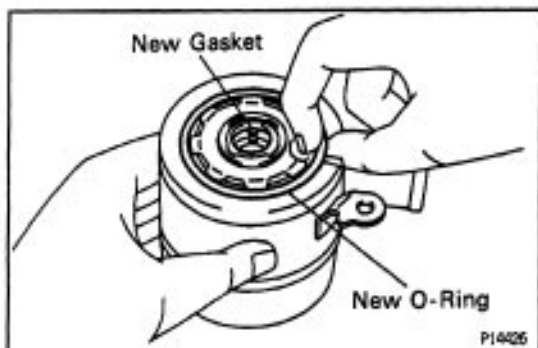
If stuck, replace the relief valve.



#### 2. INSPECT OIL COOLER

Check the oil cooler for damage or clogging.

If necessary, replace the oil cooler.



### OIL COOLER INSTALLATION

(See Components for Removal and Installation)

#### 1. INSTALL OIL COOLER

- Install new O-ring and gasket to the oil cooler.



- Apply a light coat of engine oil on the threads and under the head of the relief valve.

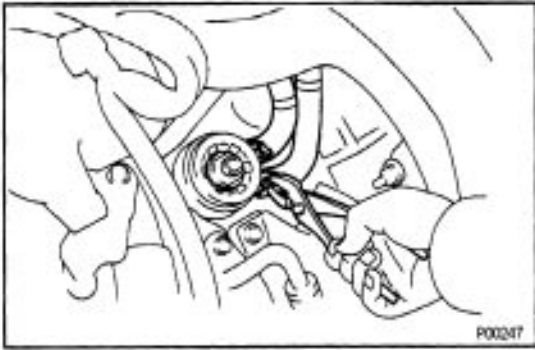
- Temporarily install the oil cooler with the nut.

- Install the plate washer and relief valve.

**Torque: 78 N-m (800 kgf-cm, 58 ft-lbf)**

- Tighten the nut.

**Torque: 7.8 N-m (80 kgf-cm, 69 In.-lbf)**



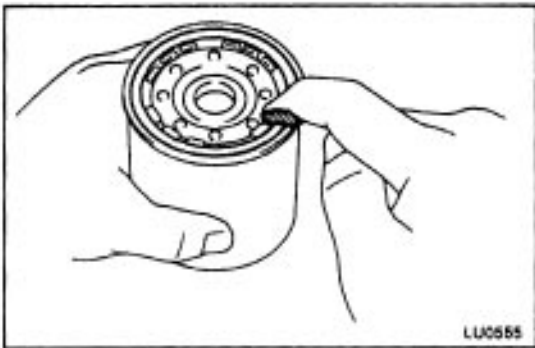
## 2. CONNECT WATER BYPASS HOSES

Connect the 2 water bypass hoses.

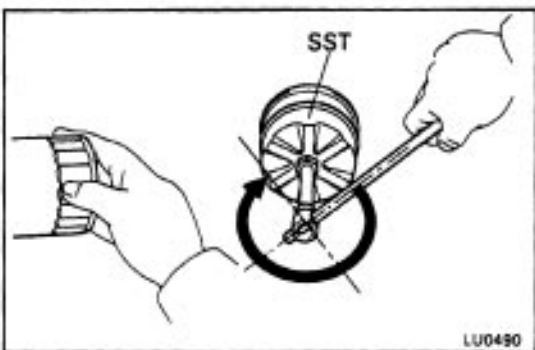


## 3. INSTALL OIL FILTER

(a) Clean the oil filter contact surface on the filter mounting.



(b) Lubricate the filter rubber gasket with engine oil.



(c) Tighten the oil filter by hand until the rubber gasket contacts the seat of the filter mounting. Then using SST, give it an additional 3/4 turn to seat the oil filter. SST 09228-06500

## 4. FILL WITH ENGINE COOLANT

(See page [EG1-241](#))

## 5. START ENGINE AND CHECK FOR LEAKS

## 6. CHECK ENGINE OIL LEVEL

# SERVICE SPECIFICATIONS

## SERVICE DATA

83368-01

Oil pressure		at idle speed at 3,000 rpm	29 kPa (0.3 kgf/cm <sup>2</sup> , 43 psi) or more 245 – 490 kPa (2.5 – 5.0 kgf/cm <sup>2</sup> , 36 – 71 psi)
Oil pump	Body clearance	STD	0.10 – 0.16 mm (0.0039 – 0.0063 in.)
		Limit	0.20 mm (0.0079 in.)
	Tip clearance	STD	0.04 – 0.16 mm (0.0016 – 0.0063 in.)
		Limit	0.20 mm (0.0079 in.)

## TORQUE SPECIFICATIONS

83368-07

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	39	400	29
Oil pump body cover x Oil pump body	8.8	90	78 in.-lbf
Oil pump x Cylinder block	9.3	95	82 in.-lbf
Oil pump pulley x Oil pump drive shaft	28	290	21
No.2 idler pulley x Cylinder block	42	425	31
Oil strainer x Cylinder block	5.4	55	48 in.-lbf
Oil strainer x Oil pump	5.4	55	48 in.-lbf
Oil pan x Cylinder block	5.4	55	48 in.-lbf
Oil pan x Oil pump	5.4	55	48 in.-lbf
Stiffener plate x Cylinder block	37	380	27
Stiffener plate x Transaxle case	37	380	27
Front exhaust pipe x WU-TWC	62	630	46
Front exhaust pipe x Center exhaust pipe	56	570	41
Oil cooler x Cylinder block (Relief valve)	78	800	58
Oil cooler x Cylinder block (Nut)	7.8	80	69 in.-lbf

-Memo

---

# 5S-FE ENGINE TROUBLESHOOTING

# HOW TO PROCEED WITH TROUBLESHOOTING

The Engine Control System broadly consists of the sensors, Engine Control Module (ECM) and actuators. The ECM receives signals from various sensors, judges the operating conditions and determines the optimum injection duration, timing, ignition timing and idle speed.

In general, the Engine Control System is considered to be a very intricate system to troubleshoot. But, the fact is that if you proceed to inspect the circuit one by one following the procedures directed in this manual, troubleshooting of this system is not complex.

This section explains the most ideal method of troubleshooting and tells how to carry out the necessary repairs.

## 1. CUSTOMER PROBLEM ANALYSIS

Using the customer problem analysis check sheet for reference, ask the customer in as much details as possible about the problem.

## 2. CHECK AND CLEAR DIAGNOSTIC TROUBLE CODE (PRECHECK)

Before confirming the problem symptom, first check the diagnostic trouble code and make a note of any malfunction code which is output, then clear the code.

HINT: Output of the malfunction code indicates that there is a malfunction in the circuit indicated.

However, it does not indicate whether the malfunction is still occurring or occurred in the past and returned to normal. In order to determine this, the problem symptoms should be confirmed in step 4 first and the diagnostic trouble code be rechecked in step [6].

Accordingly, if troubleshooting is begun based on the malfunction code only in diagnostic trouble code check in step [2], it could result in a misdiagnosis, leading to troubleshooting of circuits which are normal and making it more difficult to locate the cause of the problem.

## 3. SETTING THE TEST MODE DIAGNOSIS, [4] PROBLEM SYMPTOM CONFIRMATION, [5] SYMPTOM SIMULATION

In order to find out the trouble more quickly, set the diagnosis check in test mode and with higher sensing ability of the ECM, confirm the problem symptoms. If the trouble does not reappear, use the symptom simulation method to make sure the trouble is reproduced.

## 6. DIAGNOSTIC TROUBLE CODE CHECK IN TEST MODE

Check the diagnostic trouble code in test mode. If the malfunction code is output, proceed to step. If the normal code is output, proceed to step [7].

## 7. BASIC INSPECTION

Carry out basic inspection such as the spark check and fuel pressure check, etc.

## 8. DIAGNOSTIC TROUBLE CODE CHART

If the malfunction code is displayed, proceed to inspect the circuit indicated by the chart for each code.

## 9. MATRIX CHART OF PROBLEM SYMPTOMS

If the normal code is displayed in the diagnosis in test mode, perform troubleshooting according to the inspection order in the Matrix Chart of Problem Symptoms.

## 10. PARTS INSPECTION

When the Matrix Chart of Problem Symptoms instructs to check the parts, proceed to parts inspection section included in this manual.

## 11. CIRCUIT INSPECTION

Determine if the malfunction is the sensor, actuator, wire harness, connector or the ECM.



**12 CHECK FOR MOMENTARY INTERRUPTION**


By performing the check for momentary interruption, the place where momentary interruptions or momentary shorts are occurring due to poor contacts can be isolated.

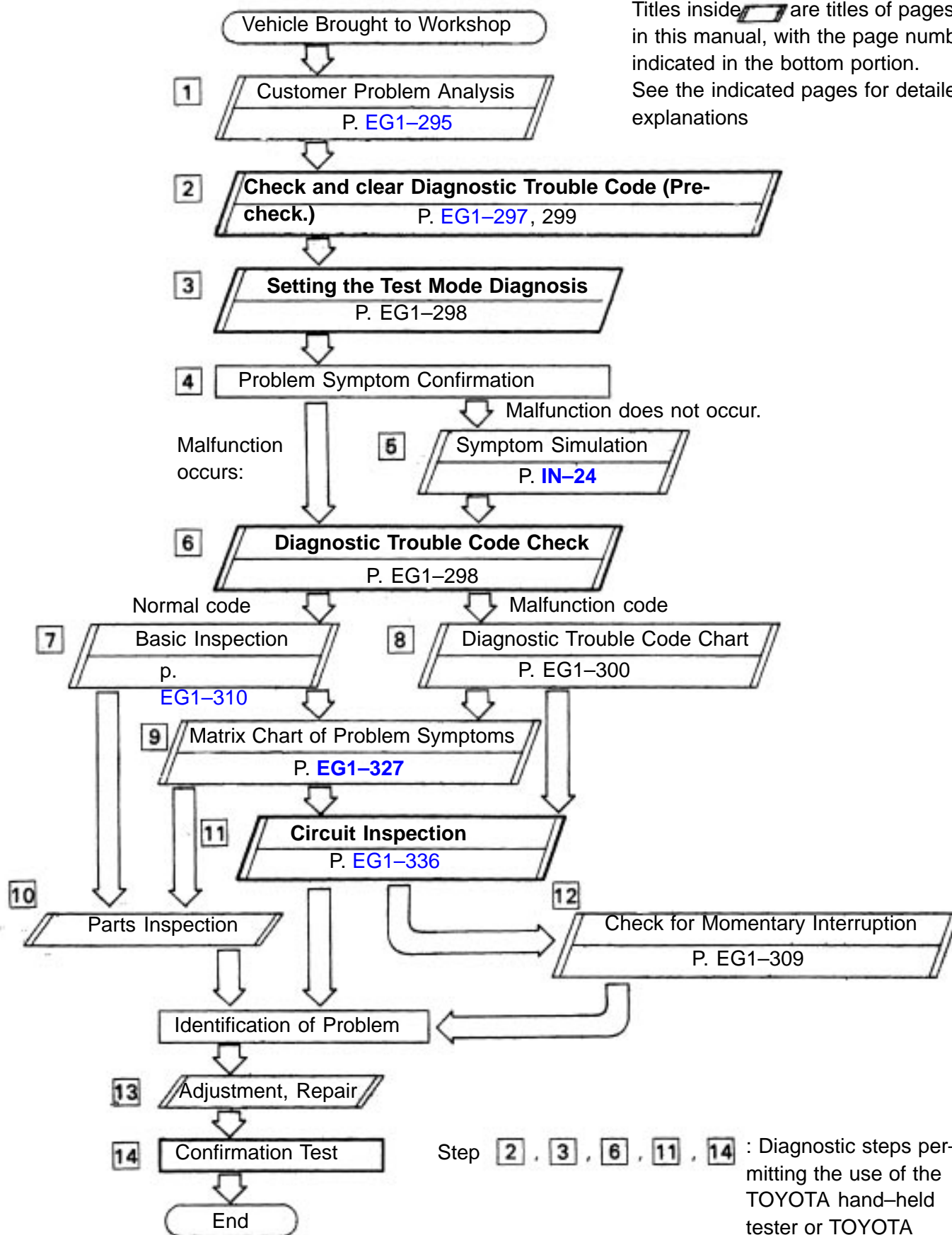
**13 ADJUSTMENT, REPAIR**

After the cause of the problem is located, perform adjustment or repairs by following the inspection and replacement procedures in this manual.

**14 CONFIRMATION TEST**

After completing adjustment or repairs, confirm not only that the malfunction is eliminated, but also conduct a test drive, etc., to make sure the entire Engine Control System is operating normally.

Titles inside  are titles of pages in this manual, with the page number indicated in the bottom portion. See the indicated pages for detailed explanations



# CUSTOMER PROBLEM ANALYSIS CHECK SHEET

## ENGINE CONTROL System Check Sheet

Inspector's :  
Name \_\_\_\_\_

Customer's Name		Registration No.	
		Registration Year	/ /
		Frame No.	
Date Vehicle Brought In		Odometer Reading	km Miles

Dates Problem Occured					
Frequency Problem Occurs		<input type="checkbox"/> Constant <input type="checkbox"/> Sometime (    times per    day/month) <input type="checkbox"/> Once only <input type="checkbox"/> Other (    )			
Conditions When Problem Occurrence	Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Various/Other			
	Outdoor Temperature	<input type="checkbox"/> Hot <input type="checkbox"/> Warm <input type="checkbox"/> Cool <input type="checkbox"/> Cold (Approx. °F ( °C))			
	Place	<input type="checkbox"/> Highway <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner City <input type="checkbox"/> Hill ( <input type="checkbox"/> Up, <input type="checkbox"/> Down) <input type="checkbox"/> Rough road <input type="checkbox"/> Other (    )			
	Engine Temp.	<input type="checkbox"/> Cold <input type="checkbox"/> Warming up <input type="checkbox"/> After warming up <input type="checkbox"/> Any temp. <input type="checkbox"/> Other			
	Engine Operation	<input type="checkbox"/> Starting <input type="checkbox"/> Just after starting <input type="checkbox"/> Idling <input type="checkbox"/> Racing without load <input type="checkbox"/> Driving ( <input type="checkbox"/> Constant speed <input type="checkbox"/> Acceleration <input type="checkbox"/> Deceleration <input type="checkbox"/> Other (    ))			

Problem Symptoms	<input type="checkbox"/> Engine does not Start	<input type="checkbox"/> Engine does not crank <input type="checkbox"/> No initial combustion <input type="checkbox"/> No complete combustion		
	<input type="checkbox"/> Difficult to Start	<input type="checkbox"/> Engine cranks slowly <input type="checkbox"/> Other (    )		
	<input type="checkbox"/> Poor Idling	<input type="checkbox"/> Incorrect first idle <input type="checkbox"/> Idling rpm is abnormal    [ <input type="checkbox"/> High <input type="checkbox"/> Low (    rpm)] <input type="checkbox"/> Rough idling <input type="checkbox"/> Other (    )		
	<input type="checkbox"/> Poor Driveability	<input type="checkbox"/> Hesitation <input type="checkbox"/> Back fire <input type="checkbox"/> Muffler explosion (after fire) <input type="checkbox"/> Surging <input type="checkbox"/> Knocking <input type="checkbox"/> Other (    )		
	<input type="checkbox"/> Engine Stall	<input type="checkbox"/> Engine stall soon after starting <input type="checkbox"/> After acceleration pedal depressed <input type="checkbox"/> After acceleration pedal released <input type="checkbox"/> During A/C operation <input type="checkbox"/> When N to D shift <input type="checkbox"/> Other (    )		
	<input type="checkbox"/> Others			

Condition of Malfunction Indicator Lamp		<input type="checkbox"/> Remains on <input type="checkbox"/> Sometimes lights up <input type="checkbox"/> Does not light up	
Diagnostic Trouble Code Inspection	Normal Mode (Precheck)	<input type="checkbox"/> Normal code <input type="checkbox"/> Malfunction code [code    ]	
	Test Mode	<input type="checkbox"/> Normal code <input type="checkbox"/> Malfunction code [code    ]	



## DIAGNOSIS SYSTEM

### DESCRIPTION

The ECM contains a built-in self-diagnosis system by which troubles with the engine signal network are detected and a Malfunction indicator lamp on the instrument panel lights up. By analyzing various signals as shown in the later table (See page [EG1-300](#)) the Engine Control Module (ECM) detects system malfunctions relating to the sensors or actuators.

In the normal mode, the self-diagnosis system monitors 14 items, indicated by code No. as shown in [EG1-300](#). A malfunction indicator lamp informs the driver that a malfunction has been detected. The light goes off automatically when the malfunction has been repaired. But the diagnostic trouble code(s) remains stored in the ECM memory (except for code Nos. 16). The ECM stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.

The diagnostic trouble code can be read by the number of blinks of the malfunction indicator lamp when TE1 and E1 terminals on the data link connector 1 or 2 are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

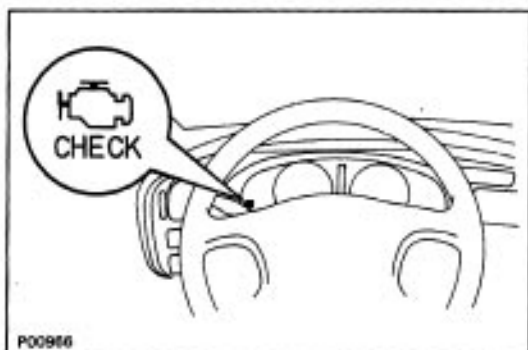
In the test mode, 9 items, indicated by code No. as shown in [EG1-300](#) are monitored. If a malfunction is detected in any one of the systems indicated by code Nos. 13, 22, 24, 25, 26, 27, 31, 41 and 71 the ECM lights the malfunction indicator lamp to warn the technician that malfunction has been detected. In this case, TE2 and E1 terminals on the data link connector 1 or 2 should be connected as shown later. (See page [EG1-298](#)).

In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECM memory even when the ignition switch is off (except code Nos. 43 and 51). This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the malfunction indicator lamp can be selected by connecting the TE1, TE2 and E1 terminals on the data link connector 1 or 2, as shown later.

A test mode function has been added to the functions of the self-diagnostic system of the normal mode for the purpose of detecting malfunctions such as poor contact, which are difficult to detect in the normal mode. This function fills up the self-diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later.

(See page

[EG1-298](#))



## Diagnosis Inspection (Normal Mode) MALFUNCTION INDICATOR LAMP CHECK

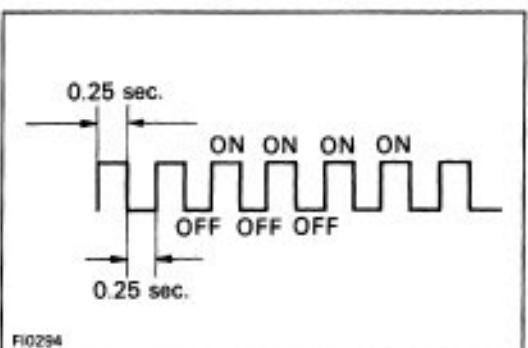
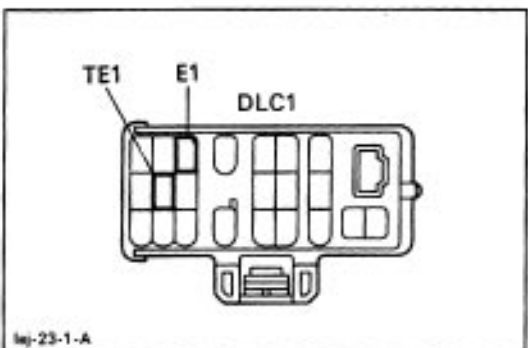
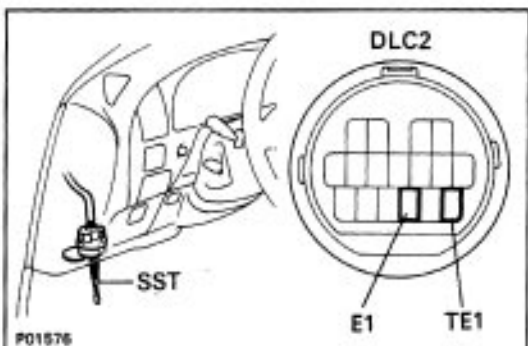
1. The Malfunction indicator lamp will come on when the ignition switch is turned ON and the engine is not running.  
HINT: If the malfunction indicator lamp does not light up, proceed to troubleshooting of the combination meter (See page [BE-64](#)).

2. When the engine is started, the malfunction indicator lamp should go off.  
If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

## DIAGNOSTIC TROUBLE CODE CHECK

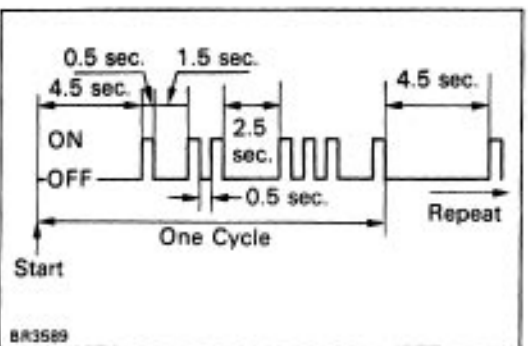
1. Turn ignition switch on.
2. Using SST, connect terminals between TE1 and E1 of data link connector 1 or 2.

SST 09843-18020



3. Read the diagnostic trouble code from malfunction indicator lamp.

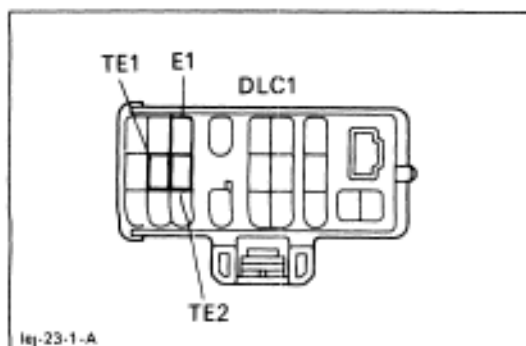
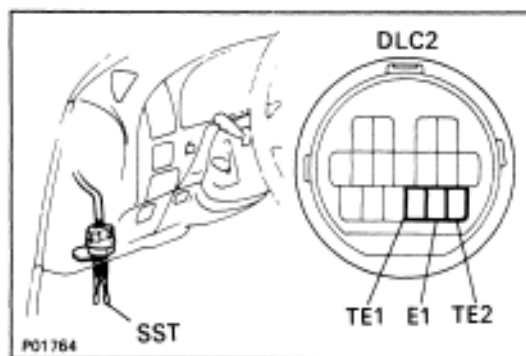
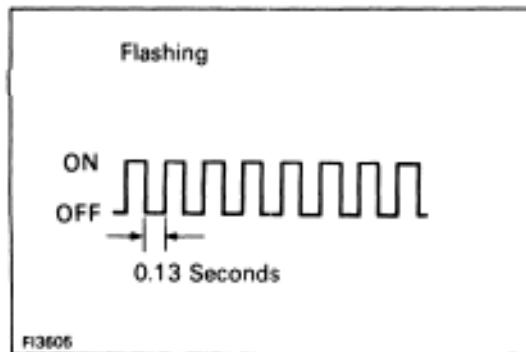
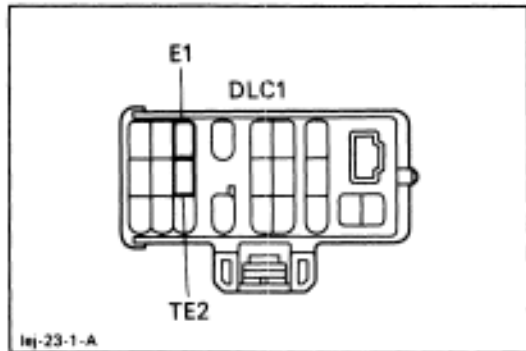
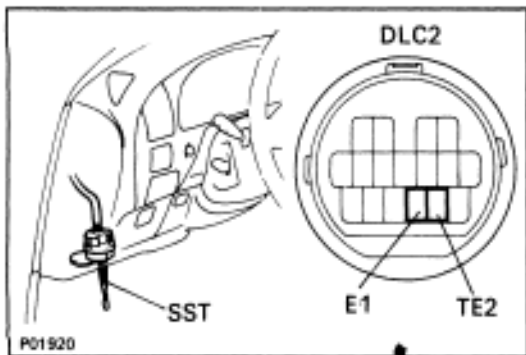
HINT: If a diagnostic trouble code is not output, check the TE1 terminal circuit (See page [EG1-430](#)).



As an example, the blinking patterns for codes; normal, 12 and 31 are as shown on the illustration.

4. Check the details of the malfunction using the diagnostic trouble code table on page [EG1-300](#).
5. After completing the check, disconnect terminals TE1 and E1, and turn off the display.

HINT: In the event of 2 or more malfunction codes, indication will begin from the smaller numbered code and continue in order to the larger.



## Diagnosis Inspection (Test Mode)

Compared to the normal mode, the test mode has high sensing ability to detect malfunctions.

It can also detect malfunctions in the starter signal circuit, the IDL contact signal of the throttle position sensor, air conditioning signal and Park/Neutral Position switch signal. Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the test mode.

## DIAGNOSTIC TROUBLE CODE CHECK

### 1. Initial conditions.

- (a) Battery voltage 11 V or more.
- (b) Throttle valve fully closed.
- (c) Transmission in neutral position.
- (d) Air conditioning switched off.

### 2. Turn ignition switch off.

### 3. Using SST, connect terminals TE2 and E1 of data link connector 1 or 2.

SST 09843-18020

### 4. Turn ignition switch on.

#### HINT:

- To confirm that the test mode is operating, check that the malfunction indicator lamp flashes when the ignition switch is turned to ON.
- If the malfunction indicator lamp does not flash, proceed to troubleshooting of the TE2 terminal circuit on page [EG1-430](#).

### 5. Start the engine.

### 6. Simulate the conditions of the malfunction described by the customer.

### 7. After the road test, using SST, connect terminals TE1 and E1 of data link connector 1 or 2.

SST 09843-18020

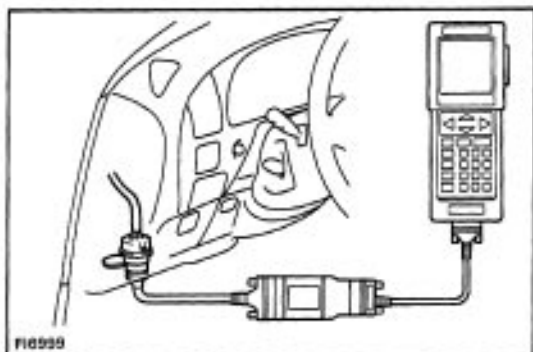
### 8. Read the diagnostic trouble code on malfunction indicator lamp on the combination meter (See page [EG1-297](#)).

### 9. After completing the check, disconnect terminals TE1, TE2 and E1, and turn off the display.

#### HINT:

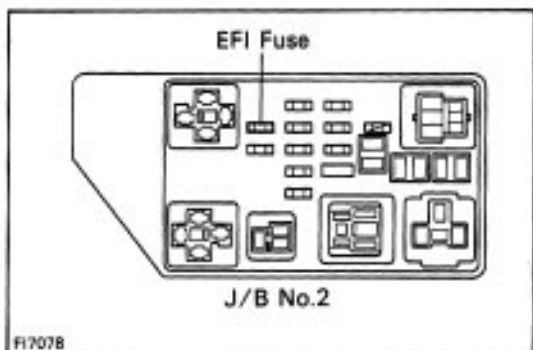
- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned on.
- When vehicle speed is 3 mph (5 km/h) or below, diagnostic trouble code "42" (Vehicle speed signal) is output, but this is not abnormal.
- When the engine is not cranked, diagnostic trouble code "43" (Starter signal) output, but this is not abnormal.
- When the automatic transmission shift lever is in the "D", "2", "L" or "R" shift position, or when the air conditioning is on or when the accelerator pedal is depressed, code "51" (Switch condition signal) is output, but this is not abnormal.





## DIAGNOSTIC TROUBLE CODE CHECK USING TOYOTA HAND-HELD TESTER

1. Hook up the TOYOTA hand-held tester to the DLC2.
  2. Read the diagnostic trouble codes by following the prompts on the tester screen.
- Please refer to the TOYOTA hand-held tester operator's manual for further details.

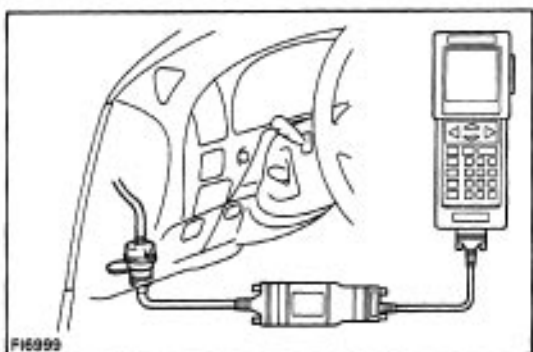


## DIAGNOSTIC TROUBLE CODE CLEARANCE

1. After repair of the trouble areas, the diagnostic trouble code retained in the ECM memory must be cleared out by removing the E F I fuse (15A) from J/13 No. 2 for 10 seconds or more, with the ignition switch OFF.

### HINT:

- Cancellation can also be done by removing the battery negative (-) terminal, but in this case, other memory systems (clock, etc.) will also be cancelled out.
  - If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic trouble code has been recorded.
2. After cancellation, road test the vehicle to check that a normal code is now read on the malfunction indicator lamp.
- If the same diagnostic trouble code appears, it indicates that the trouble area has not been repaired thoroughly.

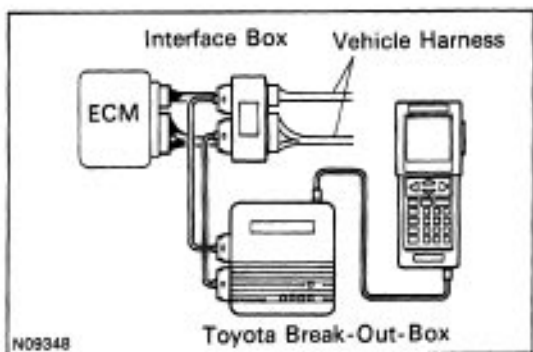


## ECM DATA MONITOR USING TOYOTA HAND-HELD TESTER

1. Hook up the TOYOTA hand-held tester to the D LC2.
2. Monitor the ECM data by following the prompts on the tester screen.

HINT: TOYOTA hand-held tester has a "Snapshot" function which records the monitored data.

Please refer to the TOYOTA hand-held tester operator's manual for further details.



## ECM TERMINAL VALUES MEASUREMENT USING TOYOTA BREAK-OUT-BOX AND TOYOTA HAND-HELD TESTER






1. Hook up the TOYOTA break-out-box and TOYOTA hand-held tester to the vehicle.
2. Read the ECM input/output values by following the prompts on the tester screen.

HINT: TOYOTA hand-held tester has "Snapshot" function. This records the measured values and is effective in the diagnosis of intermittent problems.

Please refer to the TOYOTA hand-held tester/Toyota break-out-box operator's manual for further details.

# DIAGNOSTIC TROUBLE CODE CHART

HINT: Parameters listed in the chart may not be exactly same as your reading due to type of the instruments or other factors.

DTC No.	Number of MIL Blinks	Circuit	Diagnostic Trouble Code Detecting Condition
	 BE3931	Normal	No code is recorded.
12	 BE3931	G, NE Signal Circuit (No. 1) (Exc. California spec.)	No NE signal to ECM within 2 sec. or more after cranking.
			No G signal to ECM for 3 sec. or more with engine speed between 600 rpm and 4,000 rpm.
		G, NE Signal Circuit (No. 1) (Only for California spec.)	No NE or G 1 and G2 signal to ECM for 2 sec. or more after cranking.
			Open in G (–) circuit
13	 BE3931	G, NE Signal Circuit (No. 2)	No NE signal to ECM for 0.3 sec. or more at 1,500 rpm or more.
			No G signal to ECM while NE signal is input 4 times to ECM when engine speed is between 500 rpm and 4,000 rpm.
			* No NE signal to ECM for 0.1 sec. or more at 1,000 rpm or more.
			* NE signal does not pulse 12 times to ECM during the interval between G1 and G2 pulses.
14	 BE3931	Ignition Signal Circuit	No IGF signal to ECM for 4 consecutive IGT signals.
			* No IGF signal to ECM for 8 consecutive IGT signals.
16 <sup>*4</sup>	 BE3931	A/T Control Signal	Fault in communications between the engine CPU and A/T CPU in the ECM





\* , \*4 : See page [EG1-306](#)



If a malfunction code is displayed during the diagnostic trouble code check in test mode, check the circuit for that code listed in the table below (Proceed to the page given for that circuit).

Trouble Area	Malfunction Indicator Lamp* <sup>1</sup>		Memory*	See page
	Normal Mode	Test Mode		
_____			_____	
<ul style="list-style-type: none"> <li>• Open or short in NE, G circuit</li> <li>• Distributor</li> <li>• Open or short in STA circuit</li> <li>9 ECM</li> </ul>	ON	N.A.	○	EG1-336
				EG1-339
<ul style="list-style-type: none"> <li>• Open or short in NE circuit</li> <li>• Distributor</li> <li>• ECM</li> </ul>	ON	N.A.	○	EG-343
	N.A.	ON		
	ON	N.A.		
	N.A.	ON		
<ul style="list-style-type: none"> <li>• Open or short in IGF or IGT circuit from igniter to ECM</li> <li>• Igniter</li> <li>• ECM</li> </ul>	ON	N.A.	○	EG1-344
<ul style="list-style-type: none"> <li>• ECM</li> </ul>	ON	N.A.	X	EG1-351






\*1,\* : See page [EG1-306](#)

DTC No.	Number of MIL Blinks	Circuit	Diagnostic Trouble Code Detecting Condition
21		Main Oxygen Sensor Signal	<p>Main oxygen sensor signal voltage is reduced to between 0.35 V and 0.70 V for 60 sec. under conditions (a) ~ (d). (2 trip detection logic) *5</p> <p>(a) Engine coolant temp.: 80 C (176 F) or more. (b) Engine speed: 1,500 rpm or more. (c) Load driving (Ex. A/T in overdrive (5th for M/T), A/C ON, Flat road, 50 mph (80 km/h)). (d) Main oxygen sensor signal voltage: Alternating above and below 0.45 V.</p>
22		Engine Coolant Temp. Sensor Signal	Open or short in engine coolant temp. sensor circuit for 0.5 sec. or more.
24		Intake Air Temp. Sensor Signal	Open or short in intake air temp. sensor circuit for 0.5 sec. or more.
25		Air-Fuel Ratio Lean Malfunction	<p>(1) Main oxygen sensor voltage is 0.45 V or less (lean) for 90 sec. under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine coolant temp.: 60 C (140 F) or more. (b) Engine speed: 1,500 rpm or more.</p> <p>(2) Engine speed varies by more than 15 rpm over the preceding crankshaft position period during a period of 50 sec. or more under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine speed: Idling (b) Engine coolant temp.: 60 C (140 F) or more.</p>

\*5: See page [EG1-307](#)

Trouble Area	Malfunction Indicator Lamp*1		Memory'	See page
	Normal Mode	Test Mode		
<ul style="list-style-type: none"> <li>Main oxygen sensor circuit</li> <li>Main oxygen sensor</li> </ul>	ON	ON	○	<a href="#">EG1-352</a>
<ul style="list-style-type: none"> <li>Open or short in engine coolant temp. sensor circuit</li> <li>Engine coolant temp. sensor</li> <li>ECM</li> </ul>	ON	ON	○	<a href="#">EG1-356</a>
<ul style="list-style-type: none"> <li>Open or short in intake air temp. sensor circuit</li> <li>Intake air temp. sensor</li> <li>ECM</li> </ul>	ON	ON	○	<a href="#">EG1-360</a>
<ul style="list-style-type: none"> <li>Open or short in main oxygen sensor circuit</li> <li>Main oxygen sensor</li> <li>ignition system</li> <li>ECM</li> </ul>	ON	ON	○	<a href="#">EG1-363</a>
<ul style="list-style-type: none"> <li>Open or short in injector circuit</li> <li>Fuel line pressure (injector leak, blockage)</li> <li>Mechanical system malfunction (skipping teeth of timing belt)</li> <li>Ignition system</li> <li>Compression pressure (foreign object caught in valve)</li> <li>Air leakage</li> <li>ECM</li> </ul>				





\*1, \* : See page [EG1-306](#)

DTC No.	Number of MIL Blinks	Circuit	Diagnostic Trouble Code Detecting Condition
26	 BE3932	Air-Fuel Ratio Rich Malfunction	Engine speed varies by more than 15 rpm over the preceding crankshaft position period during a period of 50 sec. or more under conditions (a) and (b), (2 trip detection logic)*5 (a) Engine speed: Idling (b) Engine coolant temp.: 60 C (140 F) or more.
27	 BE3932	Sub Oxygen Sensor Signal	Main oxygen sensor signal is 0.45 V or more and sub oxygen sensor signal is 0.45 V or less under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine coolant temp.: 80 C (176 F) or more. (b) Accel. pedal: Fully depressed for 2 sec. or more.
31	 BE3933	Manifold Absolute Pressure Sensor Signal	Open or short in manifold absolute pressure sensor circuit for 0.5 sec. or more.
41	 BE3934	Throttle Position Sensor Signal	Open or short in throttle position sensor circuit for 0.5 sec. or more.
42	 BE3934	No-1 Vehicle Speed Sensor Signal (for A/T)	All conditions below are detected continuously for 8 sec. or more. (a) No.1 vehicle speed sensor signal: 0 mph (km/h) (b) Engine speed: 3,100 rpm or more. (c) Park/Neutral position switch: OFF
		No.1 Vehicle Speed Sensor Signal (for M/T)	All conditions below are detected continuously for 8 sec. or more. (a) No.1 vehicle speed sensor signal: 0 mph (km/h) (b) Engine speed: Between 3,100 rpm and 5,000 rpm. (e) Engine coolant temp.: 80 C (176 F) or more. (d) Load driving.

\*5: See page EG1-307

Trouble Area	Malfunction Indicator Lamp*1		Memory*	See page
	Normal Mode	Test Mode		
<ul style="list-style-type: none"> <li>• Open or short in injector circuit</li> <li>• Fuel line pressure (injector leak, blockage)</li> <li>• Mechanical system malfunction (skipping teeth of timing belt)</li> <li>• Ignition system</li> <li>• Compression pressure (foreign object caught in valve)</li> <li>• Air leakage</li> <li>• ECM</li> </ul>	ON	ON	○	EG1-363
<ul style="list-style-type: none"> <li>• Open or short in sub oxygen sensor circuit</li> <li>• Sub oxygen sensor</li> <li>• ECM</li> </ul>	ON	ON	○	EG1-369
<ul style="list-style-type: none"> <li>• Open or short in manifold absolute pressure sensor circuit.</li> <li>• Manifold absolute pressure sensor</li> <li>• ECM</li> </ul>	ON	ON	○	EG1-372
<ul style="list-style-type: none"> <li>• Open or short in throttle position sensor circuit</li> <li>• Throttle position sensor</li> <li>• ECM</li> </ul>	ON	ON	○	EG1-376
<ul style="list-style-type: none"> <li>• Open or short in No.1 vehicle speed sensor circuit</li> <li>• No.1 vehicle speed sensor</li> <li>• Combination meter</li> <li>• ECM</li> </ul>	OFF	OFF	○	EG1-380

\*1,\* : See page EG1-306

DTC No.	Number of MIL Blinks	Circuit	Diagnostic trouble Code Detecting Condition
43	 BE3934	Starter Signal	No starter signal to ECM.
52	 BE3935	Knock Sensor Signal	Open or short in knock sensor circuit with engine speed between 1,200 rpm and 6,000 rpm.
71	 BE3937	EG R System Malfunction	EGR gas temp. is 70 C (158 F) or below for 50 sec. under conditions (a) and (b). (2 trip detection logic)*5 (a) Engine coolant temp.: 80 C (176 F) or more. (b) EGR operation possible (Ex. A/T in 3rd speed (5th for M/T), 55 – 60 mph (88 – 96 km/h), Flat road).
51	 BE3938	Switch Condition Signal	(1) 3 sec. or more after engine starts with closed throttle position switch OFF (IDL). (2) *4 Park/Neutral switch OFF (PNP). (Shift position in "R", "D", "2", or "L" positions). (3) A/C switch ON.

\*1; "ON" displayed in the diagnosis mode column indicates that the Malfunction Indicator Lamp is lighted up when a malfunction is detected. "OFF" indicates that the "CHECK" does not light up during malfunction diagnosis, even if a malfunction is detected. "N.A." indicates that the item is not included in malfunction diagnosis.

\*2; "O" in the memory column indicates that a diagnostic trouble code is recorded in the ECM memory when a malfunction occurs. "X" indicates that a diagnostic trouble code is not recorded in the ECM memory even if a malfunction occurs. Accordingly, output of diagnostic results in normal or test mode is performed with the IG switch ON.

\*3; Only for California specification vehicles.

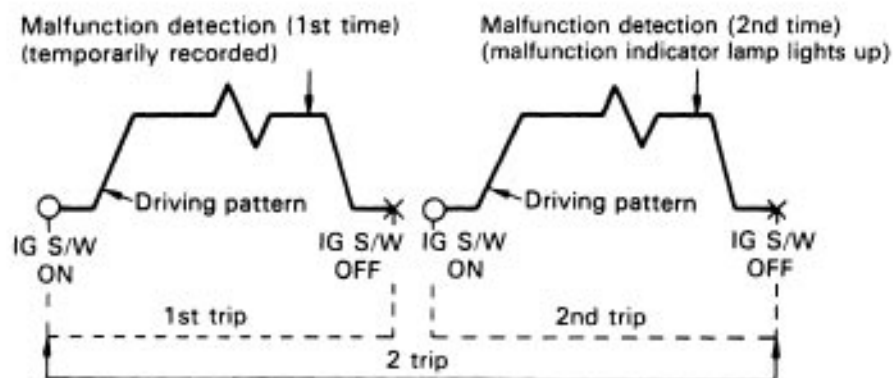
\*4; Only vehicles with A/T.

Trouble Area	Malfunction Indicator Lamp*1		Memory*	See page
	Normal Mode	Test Mode		
<ul style="list-style-type: none"> <li>Open or short in starter signal circuit</li> <li>Open or short in ignition switch or starter relay circuit ECM</li> </ul>	N.A.	OFF	X	EG1-383
<ul style="list-style-type: none"> <li>Open or short in knock sensor circuit</li> <li>Knock sensor (looseness).</li> <li>ECM</li> </ul>	ON	N.A.	○	EG1-385
<ul style="list-style-type: none"> <li>open in EGR gas temp. sensor circuit</li> <li>Short in VSV circuit for EGR</li> <li>EGR hose disconnected, valve stuck</li> <li>Clogged EGR gas passage</li> <li>ECM</li> </ul>	ON	ON	○	EG1-390
<ul style="list-style-type: none"> <li>Throttle position sensor IDL circuit</li> <li>Accelerator pedal and cable</li> <li>Park/Neutral Position switch circuit</li> <li>A/C switch circuit</li> <li>ECM</li> </ul>	N.A.	OFF	X	EG1-396

\*5: This indicates items for which "2 trip detection logic" is used. With this logic, when a logic malfunction is first detected, the malfunction is temporarily stored in the ECM memory. If the same case is detected again during the second drive test, this second detection causes the Malfunction Indicator Lamp to light up.

The 2 trip repeats the same mode a 2nd time. (However, the IG switch must be turned OFF between the 1st trip and 2nd trip),

In the Test Mode, the Malfunction Indicator Lamp lights up the 1st trip a malfunction is detected.



## FAIL-SAFE CHART

If any of the following codes is recorded, the ECM enters fail-safe mode.

DTC No.	Fail-Safe Operation	Fail-Safe Deactivation Conditions
14	Fuel cut	1 IGF detected in consecutive 2 (4*) ignitions.
16	Torque control prohibited.	Returned to normal condition.
22	THW is fixed at 80°C (176°F).	Returned to normal condition.
24	THA is fixed at 20°C (68°F).	Returned to normal condition.
31	<ul style="list-style-type: none"> <li>Ignition timing fixed at 5° BTDC.</li> <li>Injection time fixed               <ul style="list-style-type: none"> <li>Starting ..... 12.1 m sec.</li> <li>I D L 0 N ..... 3.3 m sec.</li> <li>IDL OFF .... 6.1 m sec.</li> </ul> </li> <li>Intake manifold vacuum is fixed at 46.7 kPa. (350 mmHg, 13.8 inHg)</li> </ul>	Returned to normal condition.
41	VTA1 is fixed at 0°.	The following must each be repeated at least 2 time consecutively. <ul style="list-style-type: none"> <li><math>0.1 \text{ V} \leq \text{VTA} \leq 0.95 \text{ V}</math></li> <li>IDL : ON</li> </ul>
52	Max. timing retardation.	IG switch OFF.

\*: Only for California specification vehicles.

### Back-Up Function

If there is trouble with the program in the ECM and the ignition signals (IGT) are not output from microcomputer the ECM controls fuel injection and ignition timing at predetermined levels as a back-up function to make it possible to continue to operate the vehicle.

Furthermore, the injection duration is calculated from the starting signal (STA) and the throttle position signal (IDL). Also, the ignition timing is fixed at the initial ignition timing, 5° BTDC, without relation to the engine speed.

HINT: If the engine is controlled by the back-up function, the malfunction indicator lamp lights up to warn the driver of the malfunction but the diagnostic trouble code is not output.



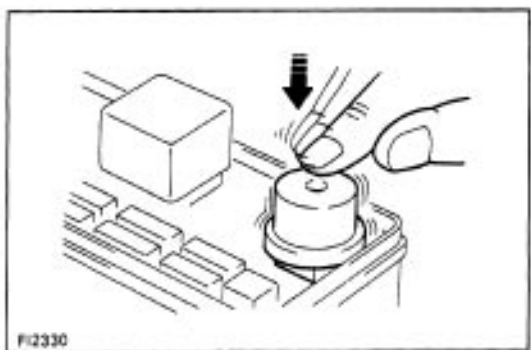
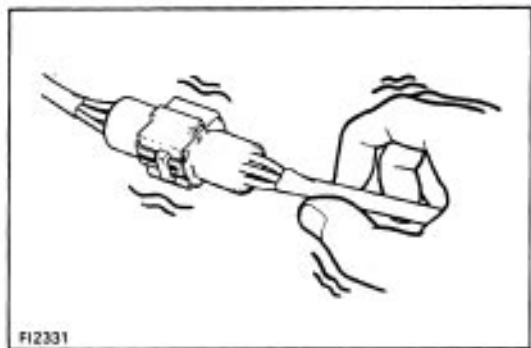
## CHECK FOR MOMENTARY INTERRUPTION

As described in the preceding paragraph, abnormality detection ability in the test mode is increased compared to that in the normal mode, so that when momentary interruptions or momentary shorts occur in the ECM signal circuits (G, NE, THW, THA, PIM, VTA) shown in the table below, the appropriate diagnostic trouble code is output.

Accordingly, when the diagnostic trouble codes shown in the table below (13, 22, 24, 31, 41) are output during the diagnostic trouble code check, and inspection of the appropriate circuits reveals no abnormality, perform the check for momentary interruption as described below.

By performing the check for momentary interruption, the place where momentary interruptions or momentary shorts are occurring due to poor contacts can be isolated.

DTC	Circuit
13	G, NE signal circuit (No.2)
22	Engine coolant temp. sensor circuit
24	Intake air temp. sensor circuit
31	Manifold absolute pressure sensor circuit
41	Throttle position sensor circuit



## CLEAR DIAGNOSTIC TROUBLE CODES

See page [EG1-299](#).

## SET TEST MODE

1. With the ignition switch off, using SST, connect the terminals TE2 and E1 of the data link connector 1 and 2.  
SST 09843-18020
2. Start the engine and check to see the malfunction indicator lamp to go off.

## PERFORM A SIMULATION TEST

Using the symptom simulation (See page IN -24), apply vibration to and pull lightly on the wire harness, connector or terminals in the circuit indicated by the malfunction code.

In this test, if the malfunction indicator lamp light up, it indicates that the place where the wire harness, connector or terminals being pulled or vibrated has faulty contact. Check that point for loose connections, dirt on the terminals, poor fit or other problems and repair as necessary.

**HINT:** After cancelling out the diagnostic trouble code in memory and set the test mode, if the malfunction indicator lamp does not go off after the engine is started, check thoroughly for faulty contact, etc., then try the check again. If the malfunction indicator lamp still does not go off, check and replace ECM.

## BASIC INSPECTION

When the normal code is displayed in the diagnostic trouble code check, troubleshooting should be performed in the order for all possible circuits to be considered as the causes of the problems.

In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in engine troubleshooting.

**1** Is battery positive voltage 11 V or more when engine is stopped?

**YES**

**NO**

Charge or replace battery.

**2** Is engine cranked ?

**YES**

**NO**

Proceed to matrix chart of problem symptoms on page [EG1-327](#).

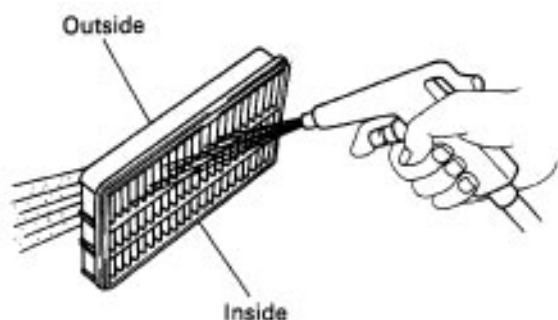
**3** Does engine start

**YES**

**NO**

Go to step **7**

**4** Check air filter.



**P**

Remove air filter.

**C**

Visually check that the air filter is not excessively damaged or oily.

**Hint**

If necessary, clean the air filter with compressed air. First blow from inside thoroughly, then blow off outside of the air filter.

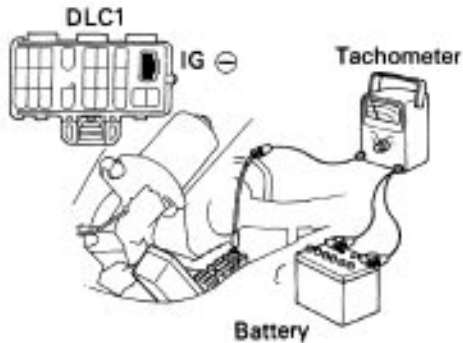
**OK**

**NG**

Repair or replace.

Go to step **5**

## 5 Check idle speed.



P00481

- P** (1) Shift transmission into “N” position or neutral.  
 (2) Warm up engine at normal operating temperature.  
 (3) Switched off all accessories.  
 (4) Switched off air conditioning.  
 (5) Connect tachometer test probe to terminal IG (–) of data link connector 1, and set the tachometer to the 4-cylinder range.

**C** Check idle speed.

**OK** Idle speed: 700 ~ 800 rpm

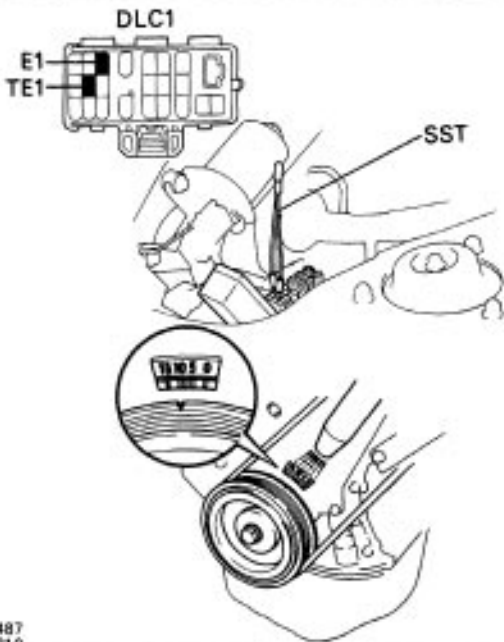
- Caution**
- **NEVER** allow tachometer test probe to touch ground as it could result in damage to igniter and/or ignition coil.
  - As some tachometers are not compatible with this ignition system, we recommended that you confirm compatibility of your unit before use.

OK

NG

Proceed to matrix chart of problem symptoms on page [EG1-327](#).

## 6 Check ignition timing.

P00487  
P02210

- P** (1) Shift transmission into “N” position or neutral.  
 (2) Warm up engine at normal operating temperature.  
 (3) Keep the engine speed at idle.  
 (4) Using SST, connect terminals TE1 and E1 of data link connector 1.  
 SST 09843-18020  
 (5) Using a timing light, connect the tester to No. 1 high-tension cord.

**C** Check ignition timing.

**OK** Ignition timing: 10° BTDC at idle

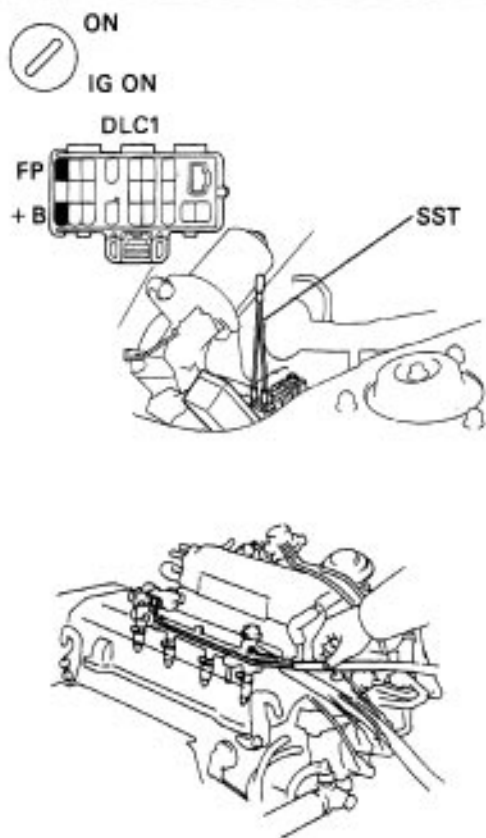
OK

NG

Proceed to page [IG-19](#), 38\* and continue to troubleshoot.

\*Except California specification vehicles.

Proceed to matrix chart of problem symptoms on page [EG1-327](#).

**7****Check fuel pressure.**

818853  
P00486  
P01500

**P**

- (1) Be sure that fuel is enough in tank.
- (2) Turn ignition switch on.
- (3) Using SST, connect terminals FP and + B of data link connector 1.

SST 09843-18020

**C**

Check for fuel pressure in the return hose when it is pinched off.

**Halt**

At this time, you will hear fuel return noise.

**Caution**

**Never make a mistake with the terminal connection position as this will cause a malfunction.**

**OK****NG**

Proceed to page [EG1-178](#) and continue to troubleshoot.

**8****Check for spark.****C**

Disconnect the high-tension cord from the distributor and, hold the end about 12.5 mm (1/2") from the ground, see if spark occurs while the engine is being cranked.

**Halt**

To prevent excessive fuel injected from the injectors during this test, don't crank the engine for more than 1-2 seconds at a time.

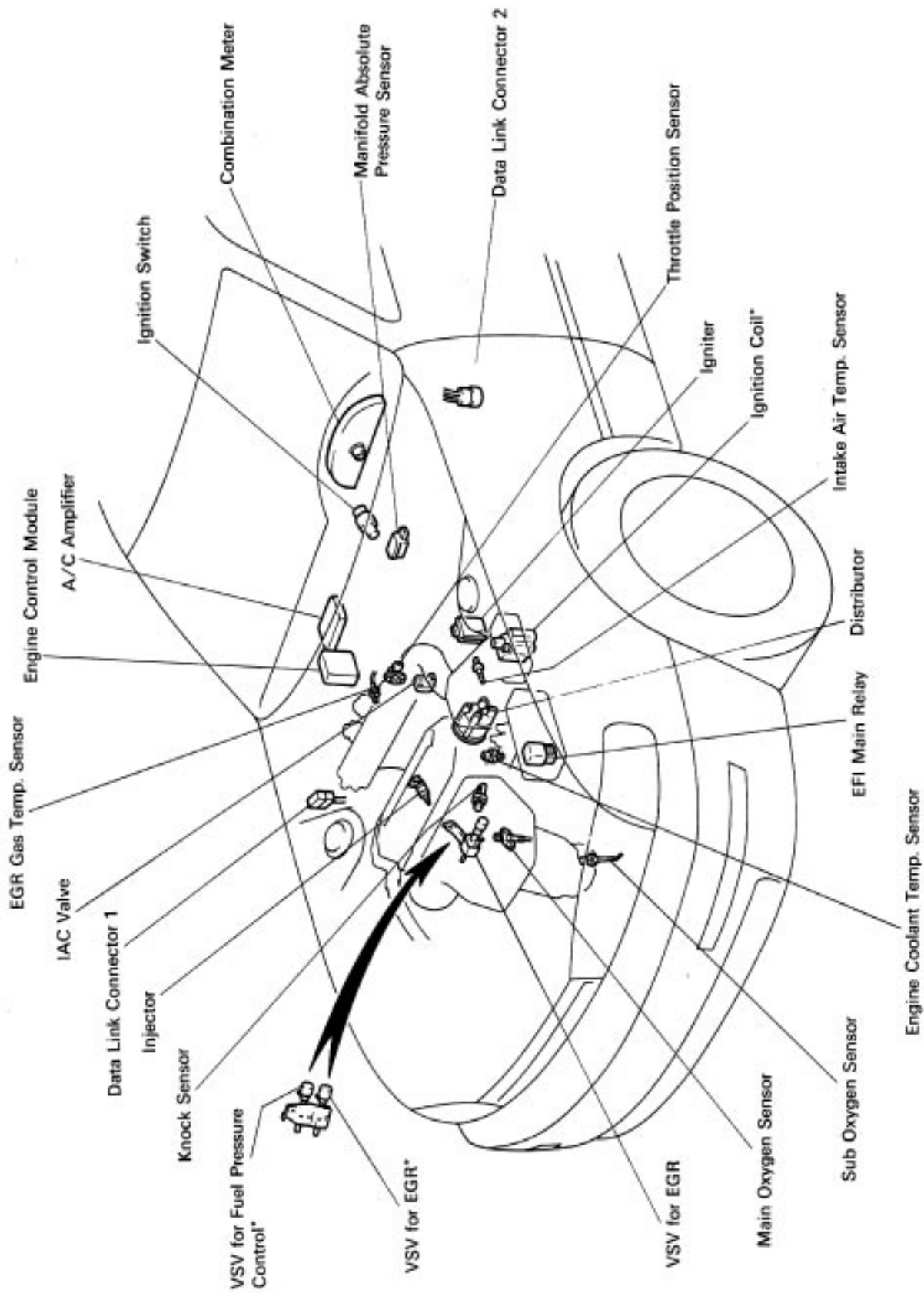
**OK****NG**

Proceed to page [IG-6](#), 26\* and continue to troubleshoot.

\* : Except California specification vehicles.

Proceed to matrix chart of problem symptoms on page [EG1-327](#).

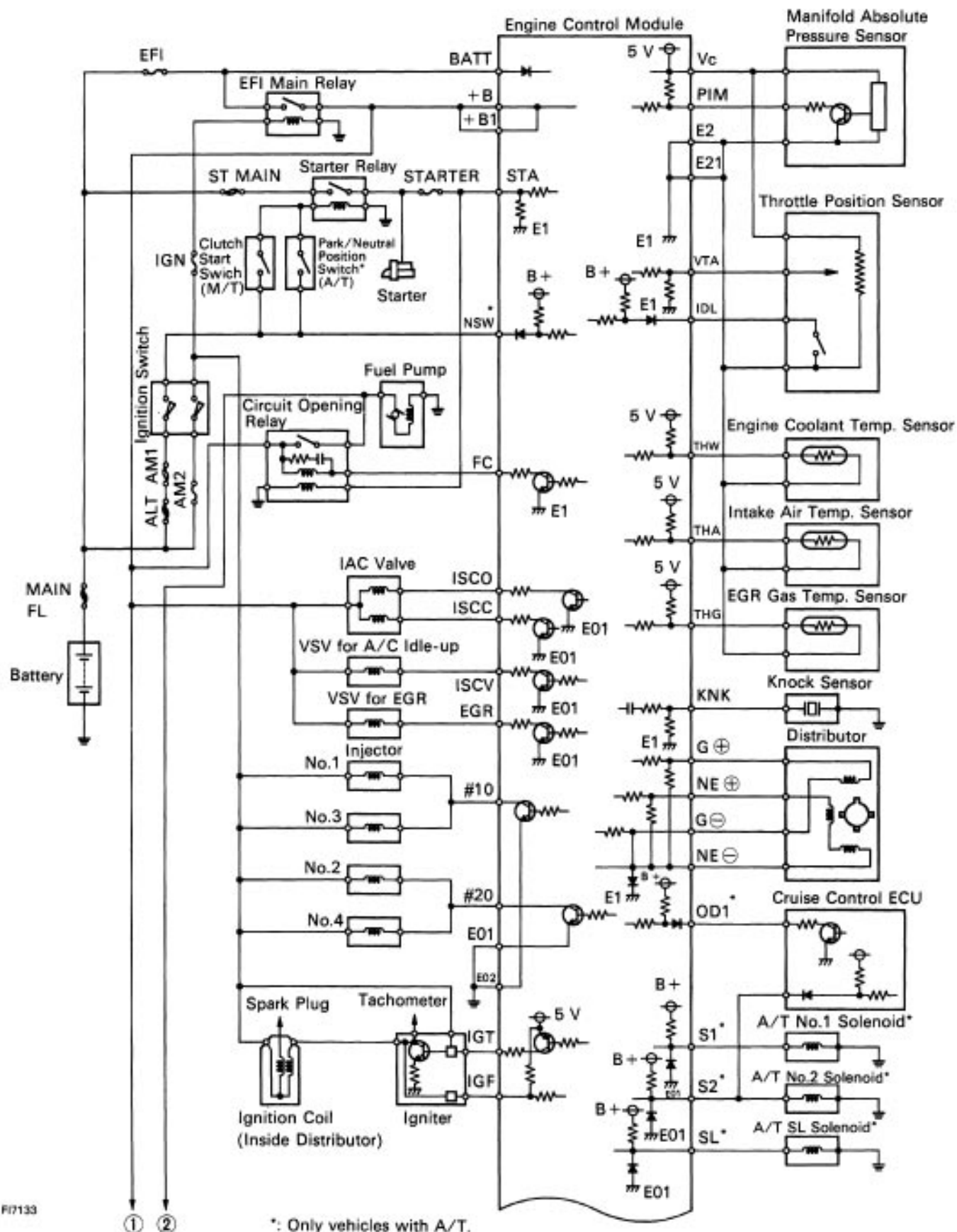
## PARTS LOCATION



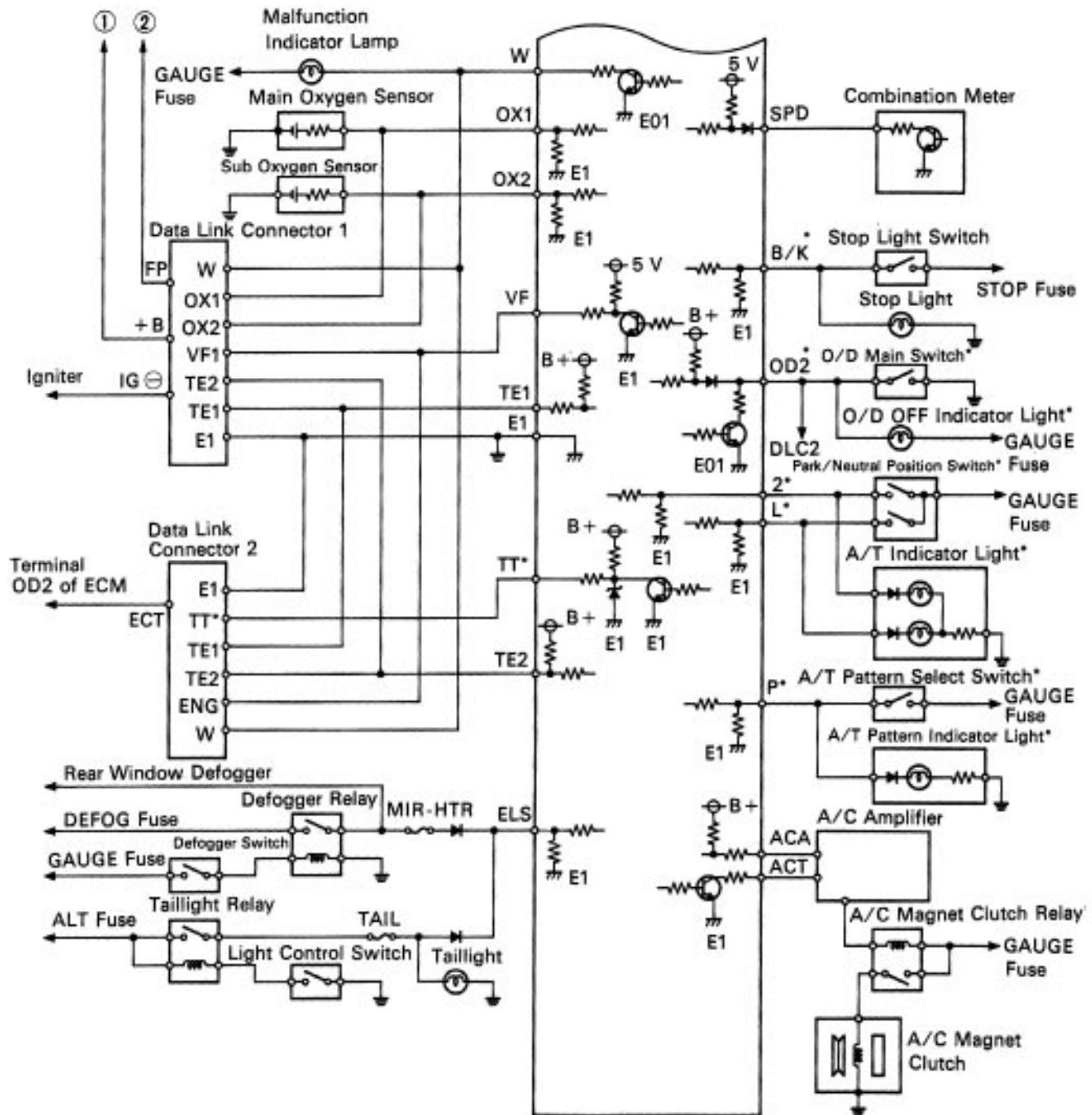
\*: Only for California specification vehicles.

# WIRING DIAGRAM

Except California specification vehicles.

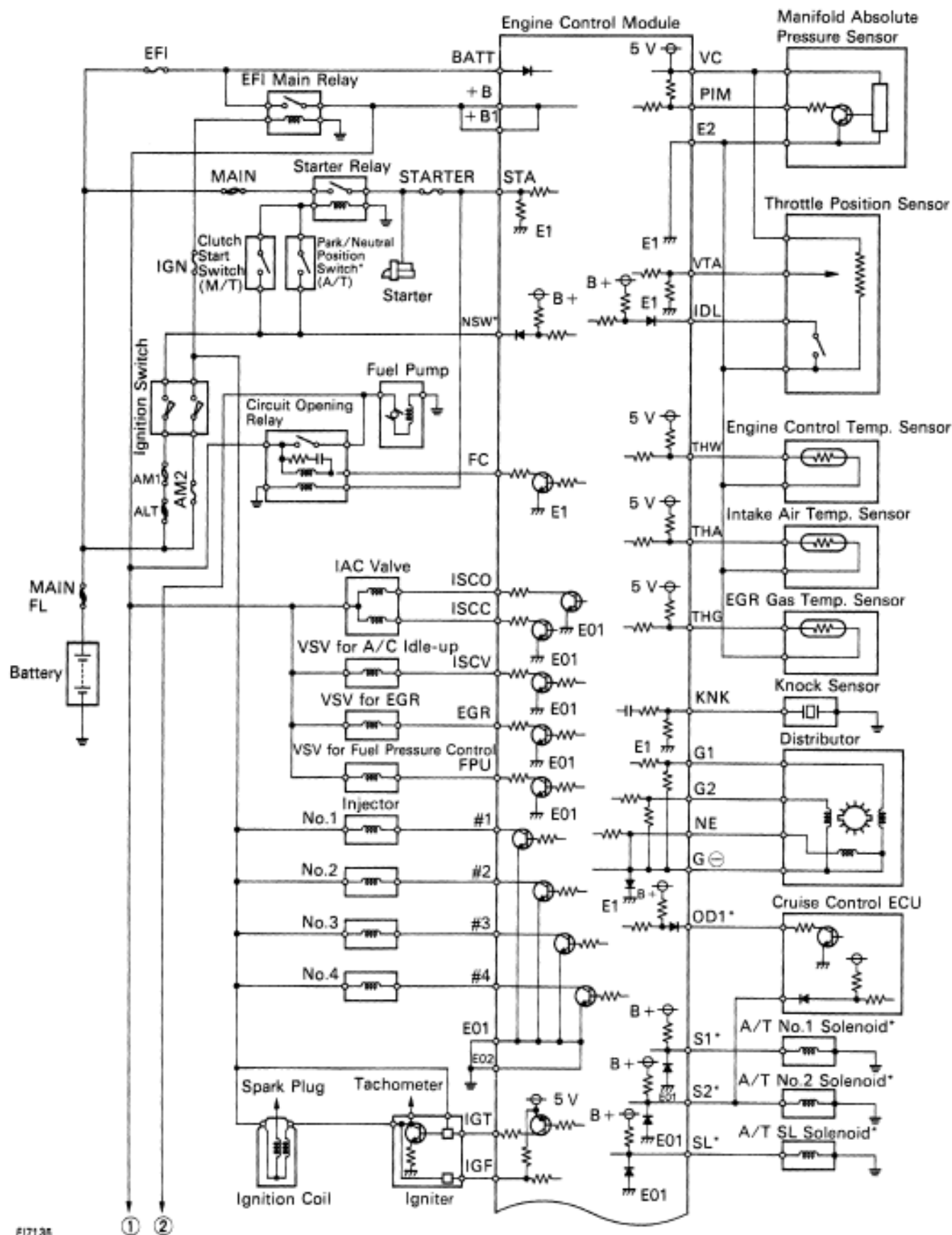




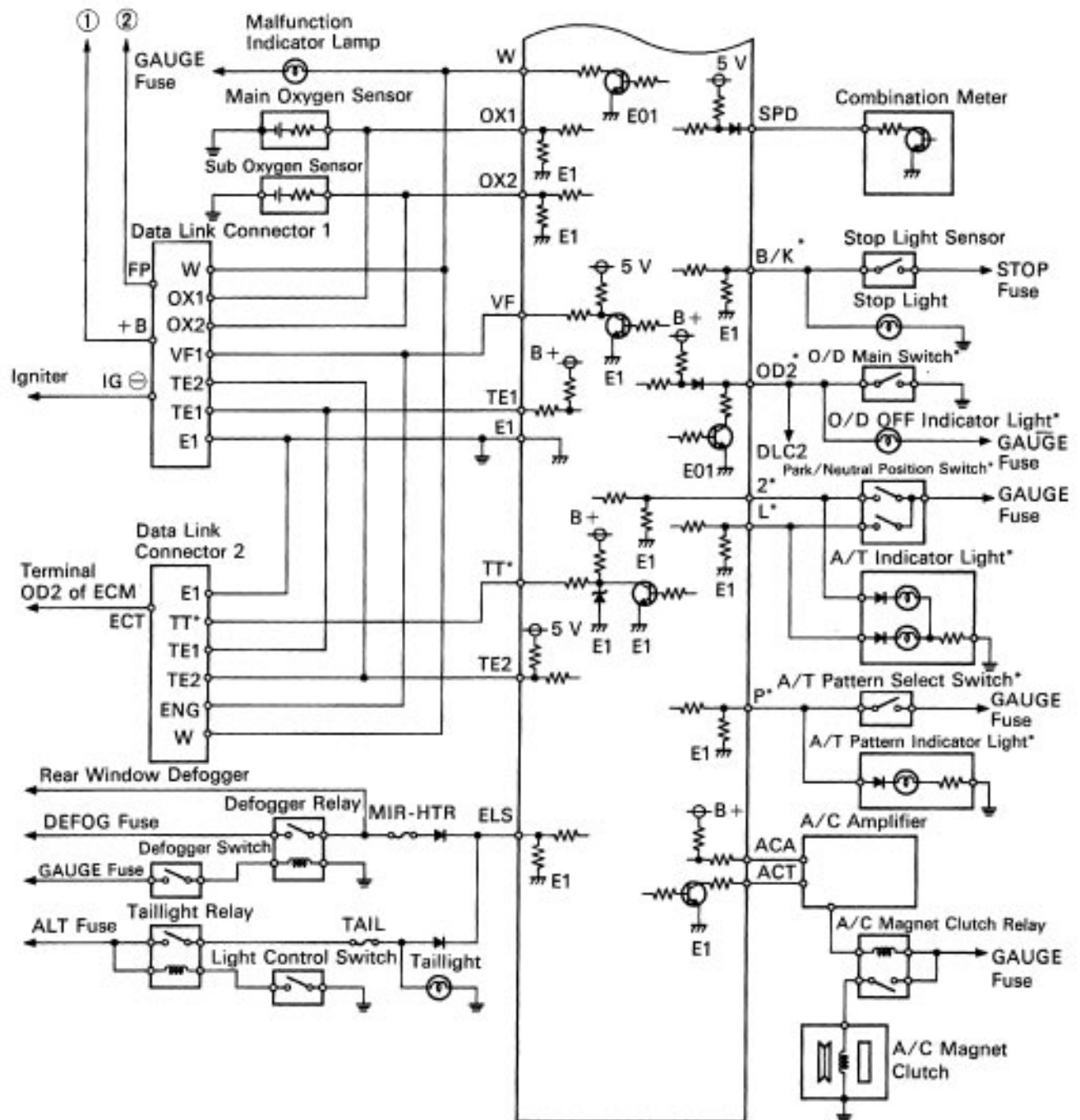


#17134

\*: Only vehicles with A/T.

**WIRING DIAGRAM (Cont'd)****Only for California specification vehicles.**





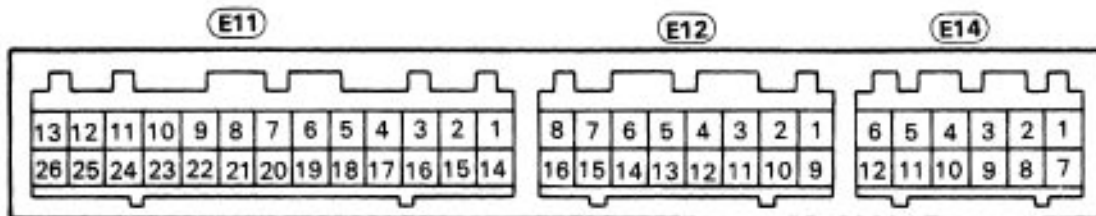
F0134

\*: Only vehicles with A/T.

## TERMINALS OF ECM

When measuring the voltage or resistance of the connector part of the ECM, always insert the test probe into the connector from the wire harness side.

ECM (Except California specification vehicles with M/T)



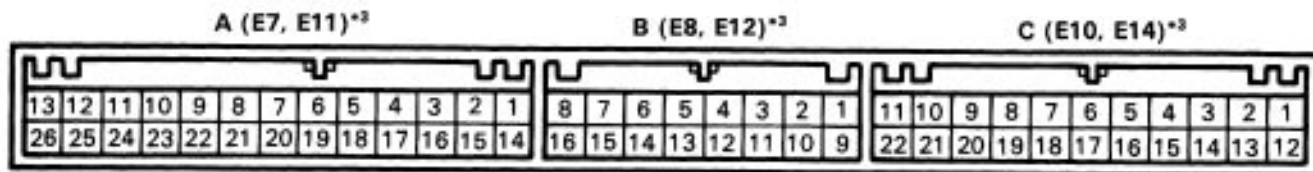
P01821

Terminal No.	Symbol	Connection	Terminal No.	Symbol	Connection
E11- 1	ISCV	VSV for A/C Idle up	E11-11	-	_____
- 2	STA	Starter relay	-12	#10	Injectors (No.1 and No.3)
- 3	IGF	Igniter	-13	E01	Power ground
- 4	NE⊕	Distributor	-14	-	_____
- 5	G⊕	Distributor	-15	-	_____
- 6	-	_____	-16	-	_____
- 7	-	_____	-17	NE⊖	Distributor
- 8	-	_____	-18	G⊖	Distributor
- 9	ISCC	IAC valve	-19	-	_____
-10	ISCO	IAC valve	-20	-	_____

Terminal No.	Symbol	Connection	Terminal No.	Symbol	Connection
E11-21	-	_____	E12-12	IDL	Throttle position sensor
-22	IGT	Igniter	-13	THG	EG R gas temp. sensor
-23	EGR	VSV for EG R	-14	-	_____
-24	E1	ECM ground	-15	TE1	Data link connector 1 and 2
-25	#20	Injectors (No.2 and No.4)	-16	E21	Sensor ground
-26	E02	Power ground	E14- 1	+B1	EFI main relay
E12- 1	OX2	Sub oxygen sensor	- 2	BATT	Battery
- 2	PIM	Manifold absolute pressure sensor	- 3	ACA	A/C amplifier
- 3	THA	Intake air temp. sensor	- 4	FC	Circuit opening relay
- 4	THW	Engine coolant temp. sensor	- 5	-	_____
- 5	KNK	Knock sensor	- 6	ACT	A/C amplifier
- 6	OX1	Main oxygen sensor	- 7	+B	EFI main relay
- 7	TE2	Data link connector 1 and 2	- 8	W	Malfunction indicator lamp
- 8	VF	Data link connector 1	- 9	-	_____
- 9	E2	Sensor ground	-10	-	_____
-10	VTA	Throttle position sensor	-11	SPD	No.1 vehicle speed sensor
-11	VC	<ul style="list-style-type: none"> <li>Manifold absolute pressure sensor</li> <li>Throttle position sensor</li> </ul>	-12	ELS	<ul style="list-style-type: none"> <li>Defogger relay</li> <li>Taillight relay</li> </ul>

## TERMINAL OF ECM (Cont'd)

ECM (California specification vehicles and except California specification vehicles with A/T)



F12796

Terminal No.*	Symbol	Connection	Terminal No.*	Symbol	Connection
A- 1	SL	A/T SL solenoid	A-17	G ⊖	Distributor
- 2	S1	A/T No.1 solenoid	-18	G1* <sup>1</sup> G ⊕* <sup>2</sup>	Distributor
- 3	IGF	Igniter	-19	-	—
- 4	NE* <sup>1</sup> NE ⊕* <sup>2</sup>	Distributor	-20	IGT	Igniter
- 5	G2* <sup>1</sup> NE ⊖* <sup>2</sup>	Distributor	-21	-	—
- 6	-	—	-22	-	—
- 7	ISCV	VSV for A/C Idle up	-23	EGR	VSV for EG R
- 8	FPU* <sup>1</sup>	VSV for fuel pressure control	-24	#4* <sup>1</sup>	No.4 injector
- 9	ISCC	IAC valve	-25	#3* <sup>1</sup>	No.3 injector
-10	ISCO	IAC valve	-26	E02	Power ground
-11	#2* <sup>1</sup> #20* <sup>2</sup>	No.2 injector No.2 and No.4 injectors	B- 1	VC	<ul style="list-style-type: none"> <li>Manifold absolute pressure sensor</li> <li>Throttle position sensor</li> </ul>
-12	#1* <sup>1</sup> #20* <sup>2</sup>	No.1 injector No.1 and No.3 injectors	- 2	PIM	Manifold absolute pressure sensor
-13	E01	Power ground	- 3	THA	Intake air temp. sensor
-14	E1	ECM ground	- 4	THW	Engine coolant temp. sensor
-15	S2	A/T No.2 solenoid	- 5	OX2	Sub oxygen sensor
-16	-	—	- 6	OX1	Main oxygen sensor

\*1: Only for California specification vehicles.

\*4: Except California specification vehicles with A/T.

\*3:

Connector Mark	A	B	C
ECM for A/T	E7	E8	E10
ECM for M/T	E11	E12	E14

Terminal No.	Symbol	Connection	Terminal No.	Symbol	Connection
B- 7	TT	Data link connector 2	C- 7	OD2	O/D main switch
- 8	VF	Data link connector 1	- 8	-	—
- 9	E2	Sensor ground	- 9	SPD	No.1 vehicle speed sensor
-10	THG	EGR gas temp. sensor	-10	ACA	A/C amplifier
-11	VTA	Throttle position sensor	-11	STA	Starter relay
-12	IDL	Throttle position sensor	-12	+ B	EFI main relay
-13	KNK	Knock sensor	-13	+ B1	EFI main relay
-14	TE2	Data link connector 1 and 2	-14	FC	Circuit opening relay
-15	TE1	Data link connector 1 and 2	-15	-	—
-16	E21 <sup>*2</sup>	Sensor ground	-16	-	—
C- 1	BATT	Battery	-17	-	—
- 2	ELS	<ul style="list-style-type: none"> <li>Defogger relay</li> <li>Taillight relay</li> </ul>	-18	2	Park/neutral position switch
- 3	-	—	-19	L	Park/neutral position switch
- 4	B/K	<ul style="list-style-type: none"> <li>Stoplight switch</li> <li>Stoplight</li> </ul>	-20	OD1	Cruise control ECU
- 5	W	Malfunction indicator lamp	-21	ACT	A/C amplifier
- 6	P	<ul style="list-style-type: none"> <li>Park/neutral position switch</li> </ul>	-22	NSW	Park/neutral position switch

\*1: Only for California specification vehicles.

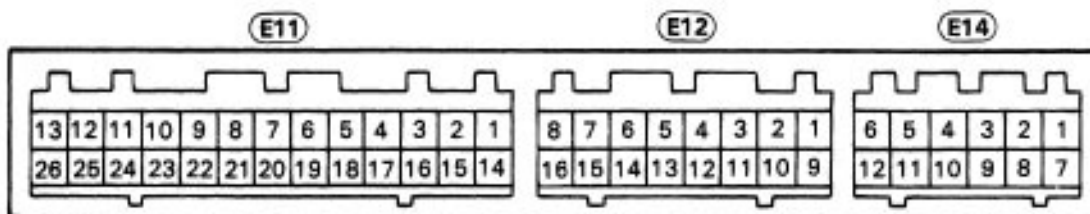
\*4: Except California specification vehicles with A/T.

\*3:

Connector Mark	A	B	C
ECM for A/T	E7	EB	E10
ECM for M/T	E11	E12	E14

# STANDARD VALUE OF ECM TERMINALS

ECM (Except California specification vehicles with M/T)



P01821

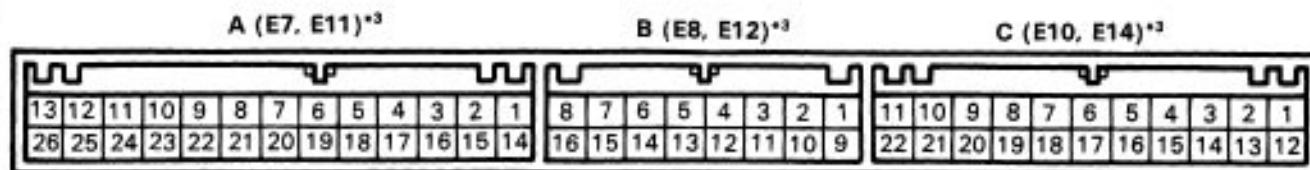
Symbols (Terminals No.)	Wiring Color	STD Voltage (V)	Condition
BATT (E14-2) - E1 (E11-24)	W-L ↔ BR	9 ~ 14	Always
+B (E14-7) - E1 (E11-24) +B1 (E14-1)	B-O ↔ BR B-O ↔ BR	9 ~ 14	IG switch ON
VC (E12-11) - E2 (E12-9)	R ↔ BR	4.5 ~ 5.5	IG switch ON
IDL (E12-12) - E2 (E12-9)	L ↔ BR	0 ~ 3.0	IG switch ON and apply vacuum to the throttle opener. Throttle valve fully closed.
		9 ~ 14	IG switch ON Throttle valve fully open
VTA (E12-10) - E2 (E12-9)	B ↔ BR	0.3 ~ 0.8	IG switch 0 N Throttle valve fully closed
		3.2 ~ 4.9	IG switch ON Throttle valve fully open
PIN (E12-2) - E2 (E12-9)	B-Y ↔ BR	3.3 ~ 3.9	IG switch ON
		2.5 ~ 3.1	Idling
THA (E12-3) - E2 (E12-9)	L-B ↔ BR	0.5 ~ 3.4	Idling, Intake air temp. 20°C (68°F)
THW (E12-4) - E2 (E12-9)	LG ↔ BR	0.2 ~ 1.0	Idling, Engine coolant temp, 80°C (176°F)
#10 (E11-12) - E01 (E11-13) #20 (E11-25) - E02 (E11-26)	W ↔ W-B Y ↔ W-B	9 ~ 14	IG switch ON
		Pulse generation	Idling
IGT (E11-22) - E1 (E11-24)	W ↔ BR	Pulse generation (See page <a href="#">EG1-347</a> )	Idling
IGF (E11-3) - E1 (E11-24)	W-R ↔ BR	Below 2.0	IG switch ON
		Pulse generation (See page <a href="#">EG1-347</a> )	Idling
G ⊕ (E11-5) - G ⊖ (E11-18)	Y ↔ B	Pulse generation (See page <a href="#">EG1-336</a> )	Idling
NE ⊕ (E11-4) - NE ⊖ (E11-17)	R ↔ L	Pulse generation (See page <a href="#">EG1-336</a> )	Idling

Symbols (Terminals No.)	Wiring Color	STD Voltage (V)	Condition
ISCC (E11-9) – E01 (E11-3) ISCO (E11-10)	G-R G-Y ↔ W-B	9 ~ 14	IG switch ON
VF (E12-8) – E1 (E11-24)	R-W ↔ BR	1.8 ~ 3.2	Maintain engine speed at 2,500 rpm for 2 minutes after warming up then return to idling
OX1 (E12-6) – E1 (E11-24)	W ↔ BR	Pulse generation (See page <a href="#">EG1-355</a> )	Maintain engine speed at 2,500 rpm for 2 minutes after warming up
EGR (E11-23) – E01 (E11-13)	G ↔ W-B	9 ~ 14	IG switch ON
KNK (E12-5) – E1 (E11-24)	W ↔ BR	Pulse generation (See page <a href="#">EG1-389</a> )	Idling
SPD (E14-11) – E1 (E11-24)	V-Y ↔ BR	Pulse generation (See page <a href="#">EG1-380</a> )	IG switch ON Rotate driving wheel slowly
TE1 (E12-15) – E1 (E11-24)	GR ↔ BR	9 ~ 14	IG switch ON
TE2 (E12-7) – E1 (E11-24)	G-W ↔ BR	9 ~ 14	IG switch ON
W (E14-8) – E1 (E11-24)	G-R ↔ BR	9 ~ 14	Idling
		Below 3.0	IG switch ON
ACA (E14-3) – E1 (E11-24)	B-Y ↔ BR	Below 1.5	A/C switch ON (at idling)
		9 ~ 14	A/C switch OFF
ISCV (E11-1) – E01 (E11-13)	LG ↔ W-B	Below 2.0	Idling, A/C switch ON
		9 ~ 14	Idling, A/C switch OFF



## STANDARD VALUE OF ECM TERMINALS (Cont'd)

ECM (California specification vehicles and except California specification vehicles with A/T)



FI2798

Symbols (Terminals No.)*3	Wiring Color	STD Voltage (V)	Condition
BATT (C-1) - E1 (A-14)	W-L ↔ BR	9 ~ 14	Always
+ B (C-12) + B1 (C-13) - E1 (A-14)	B-O B-O ↔ BR	9 ~ 14	IG switch ON
VC (B-1) - E2 (B-9)	R ↔ BR	4.5 ~ 5.5	IG switch ON
IDL (B-12) - E2 (B-9)	L ↔ BR	0 ~ 3.0	IG switch ON and apply vacuum to the throttle opener. Throttle valve fully closed.
		9 ~ 14	IG switch ON Throttle valve fully open
VTA (B-11) - E2 (B-9)	B ↔ BR	0.3 ~ 0.8	IG switch ON Throttle valve fully closed
		3.2 ~ 4.9	IG switch ON Throttle valve fully open
PIM (B-2) - E2 (B-9)	B-Y ↔ BR	3.3 ~ 3.9	IG switch ON
		2.5 ~ 3.1	Idling
THA (B-3) - E2 (B-9)	L-B ↔ BR	0.5 ~ 3.4	Idling, Intake air temp. 20°C (68°F)
THW (B-4) - E2 (B-9)	LG ↔ BR	0.2 ~ 1.0	Idling, Engine coolant temp. 80°C (176°F)
#10 (#1*) (A-12) - E01 (A-13) #20 (#2*) (A-11) - E01 (A-13) #3* (A-25) - E01 (A-13) #4* (A-24) - E01 (A-13)	W ↔ W-B Y ↔ W-B R-L ↔ W-B R-B ↔ W-B	9 ~ 14	IG switch ON
IGT (A-20) - E1 (A-14)	W ↔ BR	Pulse generation (See page EG1-410)	Idling
		Below 2.0	IG switch ON
IGF (A-3) - E1 (A-14)	W-R ↔ BR	Pulse generation (See page EG1-347)	Idling
G1 (A-18), G2 (A-5) - G⊖ (A-17)*1	Y, L ↔ B	Pulse generation (See page EG1-341)	Idling
NE (A-4) - G⊖ (A-17)*1	R ↔ B	Pulse generation (See page EG1-341)	Idling
G⊕ (A-18) - G⊖ (A-17)*2	Y ↔ B	Pulse generation (See page EG1-336)	Idling
NE⊕ (A-4) - NE⊖ (A-5)*2	R ↔ L	Pulse generation (See page EG1-336)	Idling

\*1: Only for California specification vehicles.

\*2: Except California specification vehicles with A/T.

\*3:

Connector Mark	A	B	C
ECM for A/T	E7	E8	E10
ECM for M/T	E11	E12	E14



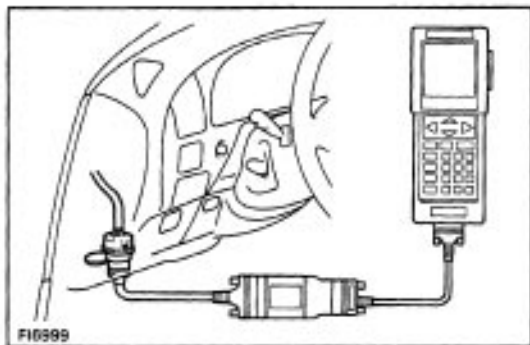
Symbols (Terminals No.)*3	Wiring Color	STD Voltage (V)	Condition
ISCC (A-9) - E01 (A-13) ISCO (A-10)	G-R ↔ W-B G-Y	9 ~ 14	IG switch ON
VF (B-8) - E1 (A-14)	R-W ↔ BR	1.8 ~ 3.2	Maintain engine speed at 2,500 rpm for 2 minutes after warming up then return to idling
OX1 (B-6) - E1 (A-14)	W ↔ BR	Pulse generation (See page EG1-355)	Maintain engine speed at 2,500 rpm for 2 minutes after warming up
EGR (A-23) - E01 (A-13)	G ↔ W-B	9 ~ 14	IG switch ON
KNK (B-13) - E1 (A-14)	W ↔ BR	Pulse generation (See page EG1-389)	Idling
NSW (C-22) - E1 (A-14)	B-W ↔ BR	9 ~ 14	IG switch ON Other shift position in "P", "N" position
		0 ~ 3.0	IG switch ON Shift position in "P", "N" position
SPD (C-9) - E1 (A-14)	V-Y ↔ BR	Pulse generation (See page EG1-380)	IG switch ON Rotate driving wheel slowly
TE1 (B-15) - E1 (A-14)	GR ↔ BR	9 ~ 14	IG switch ON
TE2 (B-14) - E1 (A-14)	G-W ↔ BR	9 ~ 14	IG switch ON
W (C-5) - E1 (A-14)	G-R ↔ BR	9 ~ 14	Idling
		Below 3.0	IG switch ON
OD1 (C-20) - E1 (A-14)	Y-B ↔ BR	9 ~ 14	IG switch ON
OD2 (C-7) - E01 (A-13)	G-O ↔ W-B	9 ~ 14	IG switch ON O/D main switch pushed in
		Below 1.0	IG switch ON O/D main switch pushed out
ACA (C-8) - E1 (A-14)	B-Y ↔ BR	Below 1.5	A/C switch ON (At idling)
		9 ~ 14	A/C switch OFF
ISCV (A-7) - E01 (A-13)	LG ↔ W-B	Below 2.0	Idling, A/C switch ON
		9 ~ 14	Idling, A/C switch OFF
FPU (A-8) - E01 (A-13)*1	B-R ↔ W-B	9 ~ 14	IG switch ON
		Below 2.0	Restarting at high engine coolant temp.

\*1: Only for California specification vehicles.

\*3:

Connector Mark	A	B	C
ECM for A/T	E7	E8	E10
ECM for M/T	E11	E12	E14

## REFERENCE VALUE OF ECM DATA



HINT: ECM data can be monitored by TOYOTA hand-held tester.

1. Hook up the TOYOTA hand-held tester to the DLC2.
2. Monitor ECM data by following the prompts on the tester screen.

Please refer to the TOYOTA hand-held tester operator's manual for further details.

## REFERENCE VALUE

Item	Inspection condition	Reference value
INJECTOR	Engine cold to hot Engine idling at normal operating temp.	Gradually decreases Approx. 2 ~ 5 msecs
IGNITION	Increase engine speed	Gradually increases
IAC DUTY	Engine idling at normal operating temp.	30~60%
ENGINE SPEED	RPM kept stable (Comparison with tachometer)	No great changes
MAP	Engine idling at normal operating temp. increase engine load	Approx. 180 ~ 280 mm Hg Gradually increases
ECT	Engine at normal operating temp.	75 – 95°C (185 – 203°F) *1
THROTTLE	Closed throttle position Wide open throttle From closed throttle position to wide open throttle	Below 5° Above 70° Gradually increases
VEHICLE SPD	During driving (Comparison with speedometer)	No large differences
TARGET A/F L	Engine idling at normal operating temp.	2.50± 1.25 V *2
A/F FB LEFT	RPM stable at 2,500 rpm with normal operating temp.	ON
STA SIGNAL	During cranking	ON
CTP SIGNAL	Closed throttle position	ON
A/C SIGNAL	A/C switch ON	ON
PNP SIGNAL *3	When shifting from "P" or "N" position into a position other than "P" or "N"	G E A R
OxL	PRM stable at 2,500 rpm with normal operating temp.	RICH LEAN is repeated

\*1: If the engine coolant temp, sensor circuit is open or shorted, the ECM assumes an engine coolant temp, value of 80°C (176°F).

\*2: When feedback control is forbidden, 0 V is displayed,

\*3: A/T only.

# MATRIX CHART OF PROBLEM SYMPTOMS

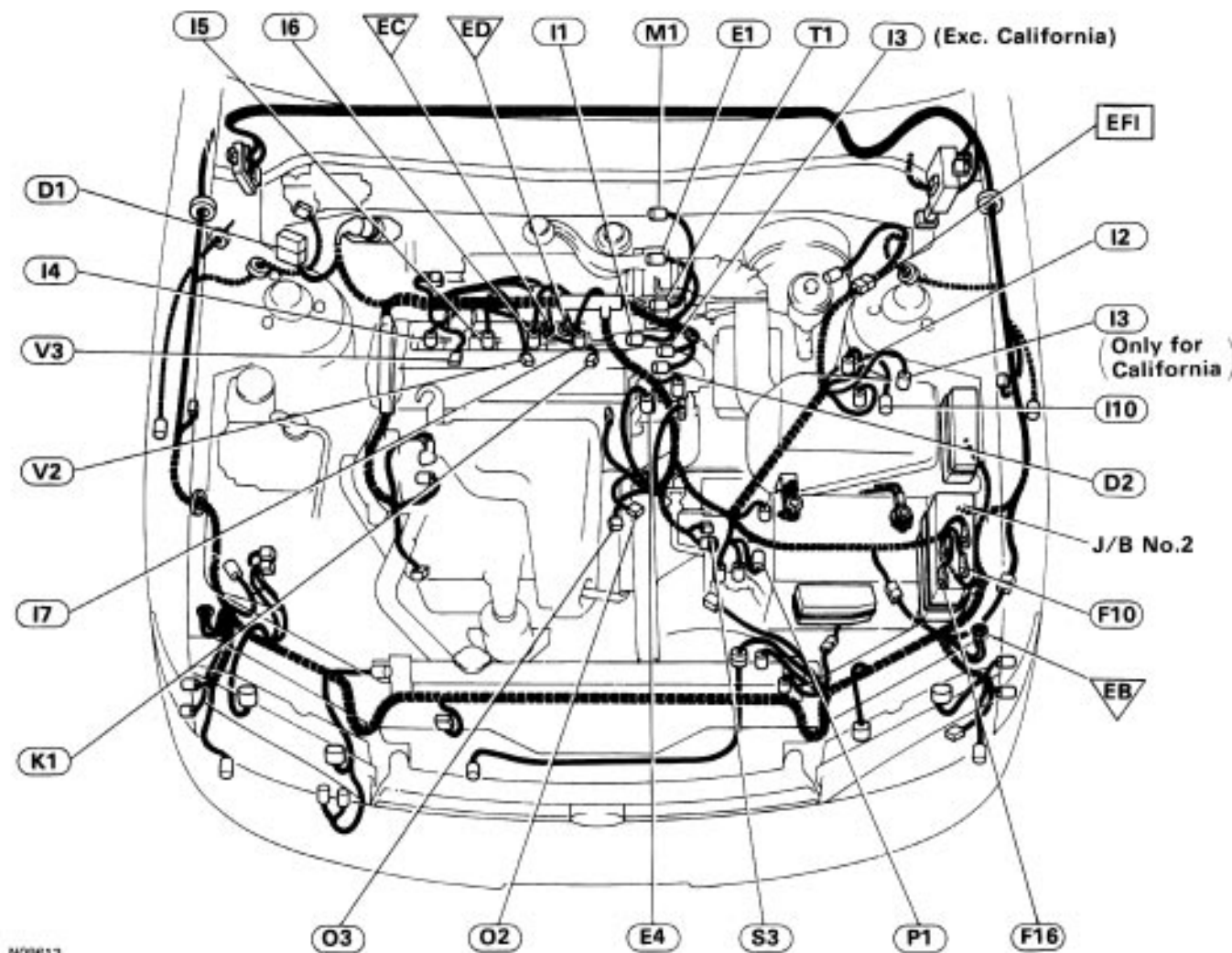
When the malfunction code is not confirmed in the diagnostic trouble code check and the problem still can not be confirmed in the basic inspection, then proceed to this step and perform troubleshooting according to the numbered order given in the table below.

See page		EG1-372	EG1-383	EG1-390	EG1-396	EG1-400	EG1-403	EG1-408	EG1-410	EG1-415	EG1-419	EG1-428	EG1-424	ST-19,21	IG-6,26*	IG-8,28*	IG-10,30*	IG-11,30	EG1-23	AX1-68	IN-36
Suspect area		Manifold absolute pressure sensor circuit	Starter signal circuit	EG R system	Switch condition signal circuit	Park/Neutral position switch circuit	ECM power source circuit	Back up power source circuit	Injector circuit	IAC valve circuit	Fuel system circuit	A/C cut control circuit	VSV circuit for fuel pressure control	Starter and Starter relay	Ignition signal circuit (Spark test)	Spark plug	Ignition coil	Distributor	Compression	A/T faulty	Engine control module
Does not start	Engine does not crank					2								1							
	No initial combustion						1		5	3					2	4					
	No complete combustion								6	1					5	4	2	3			
Difficult to start	Under normal condition		1						8	2	3					6	4	5	7		
	Cold engine		1						4	2	3					7	5	6			
	Hot engine		1						5	2	4		3			8	6	7			
Poor Idling	Incorrect first idle				1					2											
	High engine idle speed				1	4	3	5		2											
	Low engine idle speed	6			2	3		7	5	1	4										
	Rough idling	3		5	1			12	4	2	8				6	11	9	10	7		
	Hunting	3			1		4			2	5										
Poor Driveability	Hesitation/Poor acceleration	2			1				3		4	9			5	8	6	7		10	
	Muffler explosion (after fire)				1				5							4	2	3			
	Surging				1				5		2					4		3			
Engine Stall	Soon after starting	2								3	1										
	After acceleration pedal depressed	2			1																
	After acceleration pedal released								1	2											3
	During A/C operation									1											2
	When N to D shift					1				2											

\*: Except California specification vehicles.

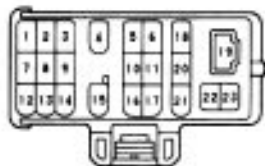
# LOCATION OF CONNECTORS

## Location of Connectors in Engine Compartment



N09613

**D1**  
Data Link Connector 1



Iej-23-1-A

**D2**  
Distributor



Ie-4-1-E

**E1**  
EGR  
Gas Temp. Sensor



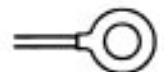
Ie-2-1-C

**E4**  
Engine Coolant  
Temp. Sensor



V-2-1-C

**F10 F16**  
Fuse Box



A-A

**I1**  
IAC Valve



Ie-3-1-H

**I2**  
Igniter



Ie-5-1

**I3**  
Ignition Coil  
(Exc. California)



Ie-2-1-X

**I3**  
Ignition Coil  
(Only for California)



Ie-2-1-n

**I4 I5**  
**I6 I7**  
Injector  
No.1 ~ No.4

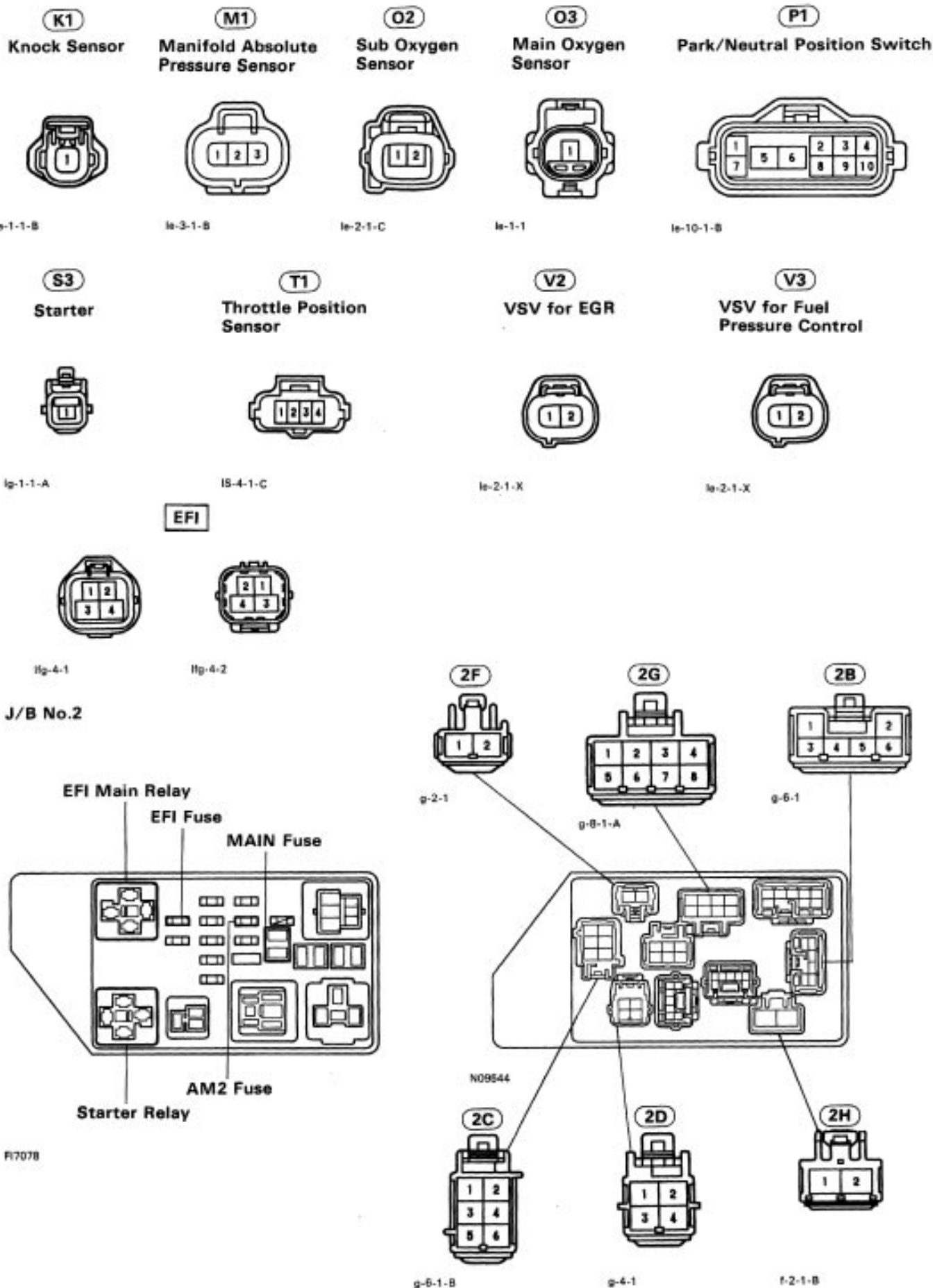


Ie-2-1-a

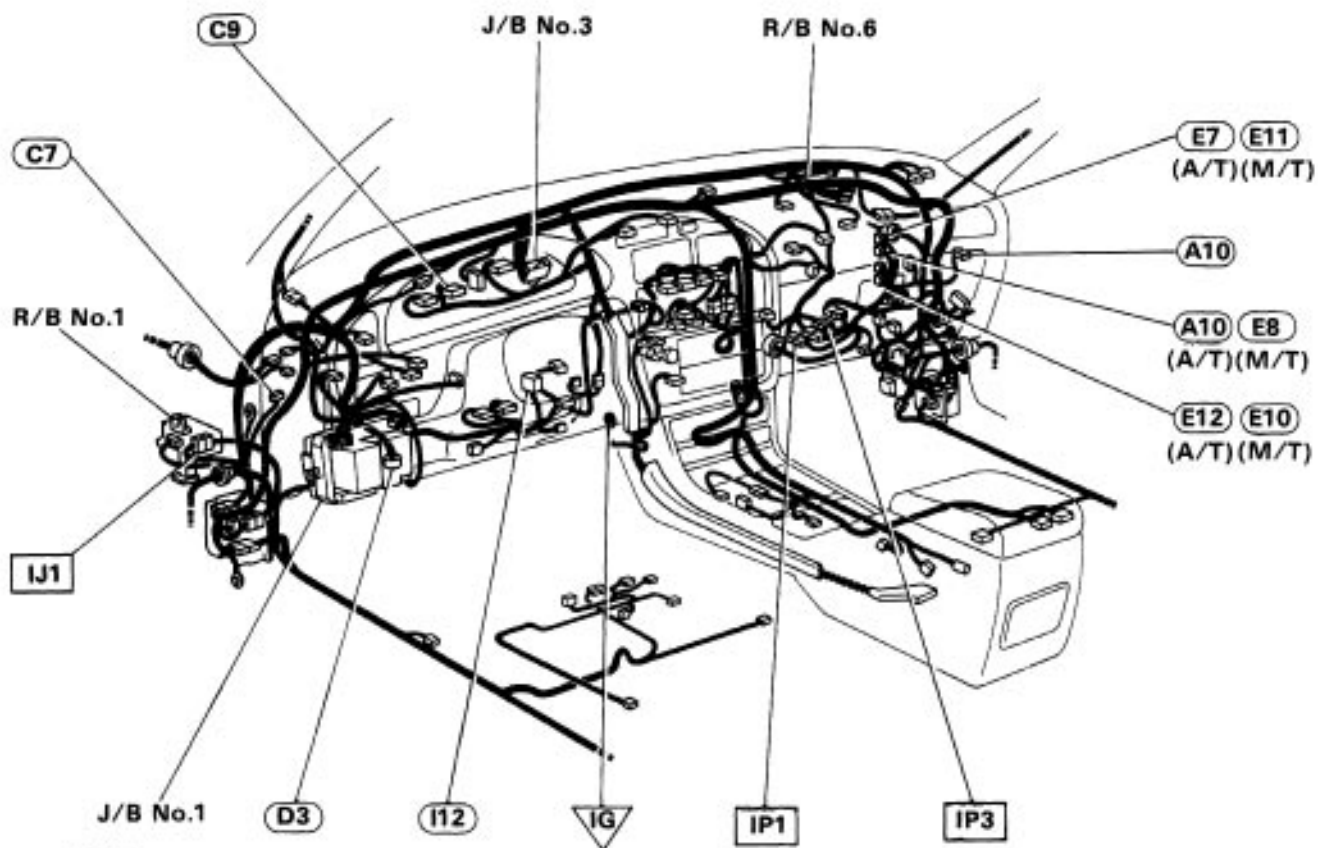
**I10**  
Intake Air Temp.  
Sensor



Ie-2-1-Z



## Location of Connectors in Instrument Panel



N09614

**A10**  
A/C Amplifier



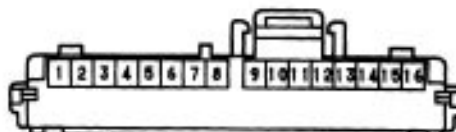
e-14-1-A

**C7**  
Clutch Start  
Switch (M/T)



e-2-1

**C9**  
Combination Meter



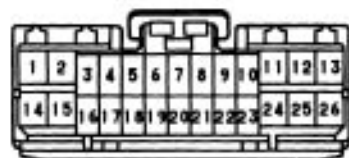
j-16-1

**D3**  
Data Link Connector 2



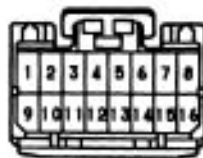
S-17-1

**E7 (A/T)**  
**E11 (M/T)**  
Engine Control Module



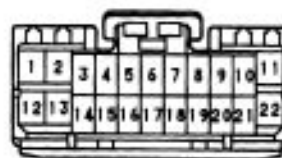
mn-26-1

**E8 (A/T)**  
**E12 (M/T)**  
Engine Control Module



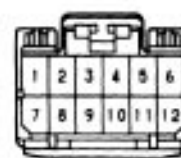
n-16-1-A

**E10 (A/T)**  
**E14 (California spec.  
with M/T)**  
Engine Control Module



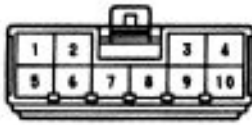
ms-22-1

**E14 (Exc. California  
spec. with M/T)**  
Engine Control Module



m-12-1



**I12****Ignition Switch**

g-10-1-B

**IJ1**

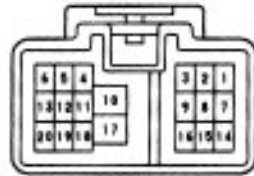
eg-19-1



eg-19-2

**IP1**

e-20-1-B



e-20-2-B

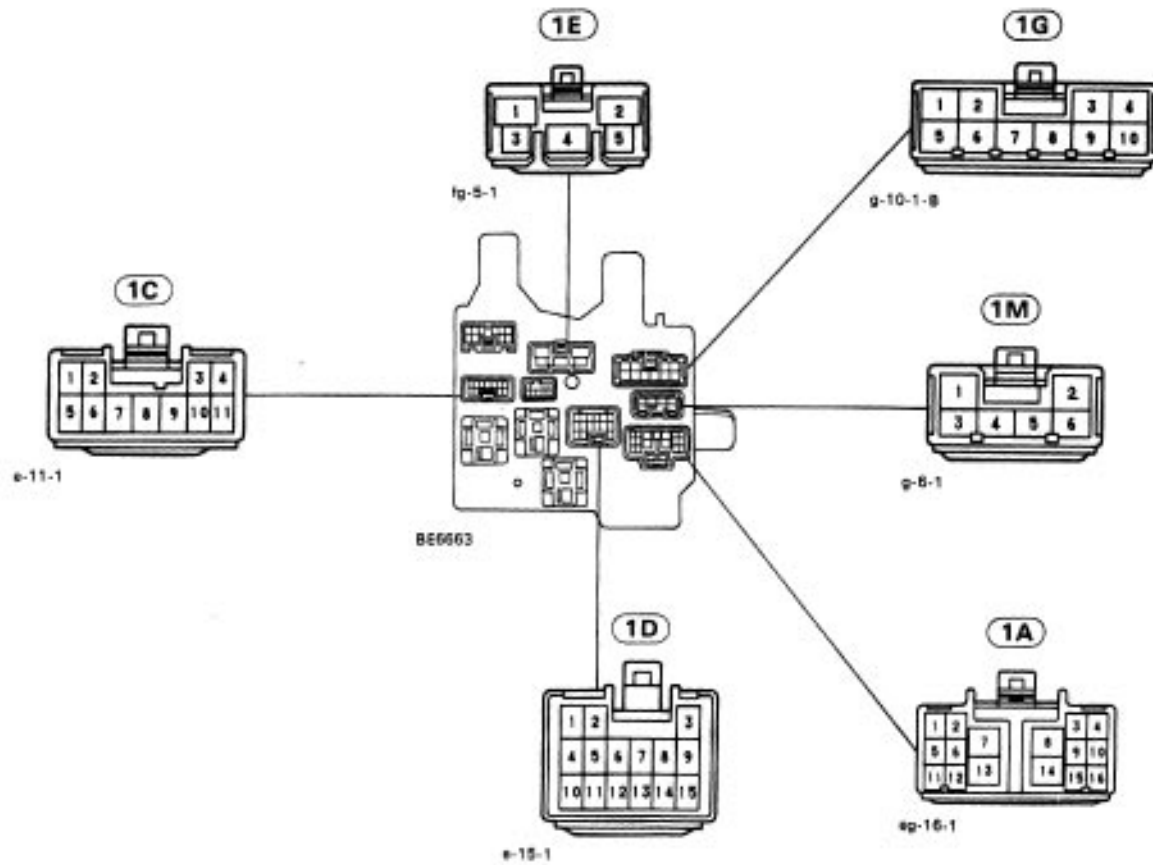
**IP3**

ef-19-1



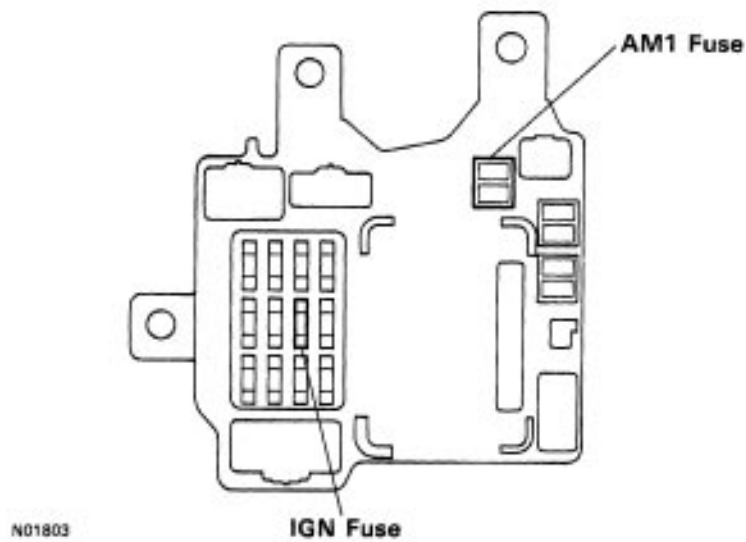
ef-19-2

I/B No.1

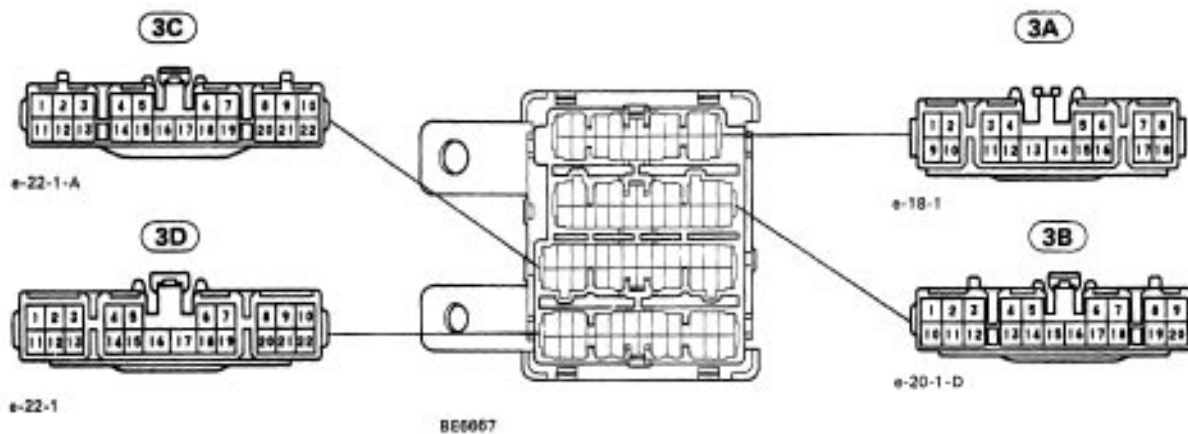


## Location of Connectors in Instrument Panel (Cont'd)

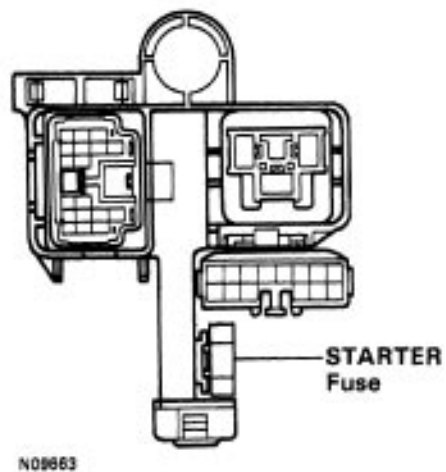
J/B No.1



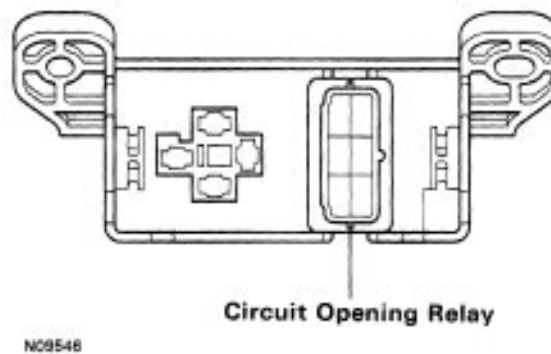
J/B No.3



R/B No.1



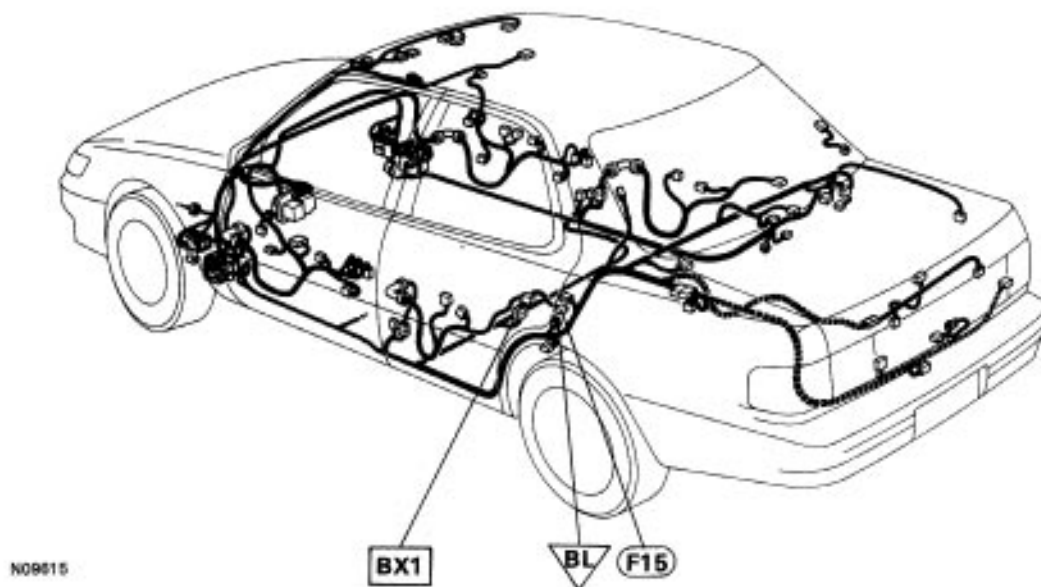
R/B No.6



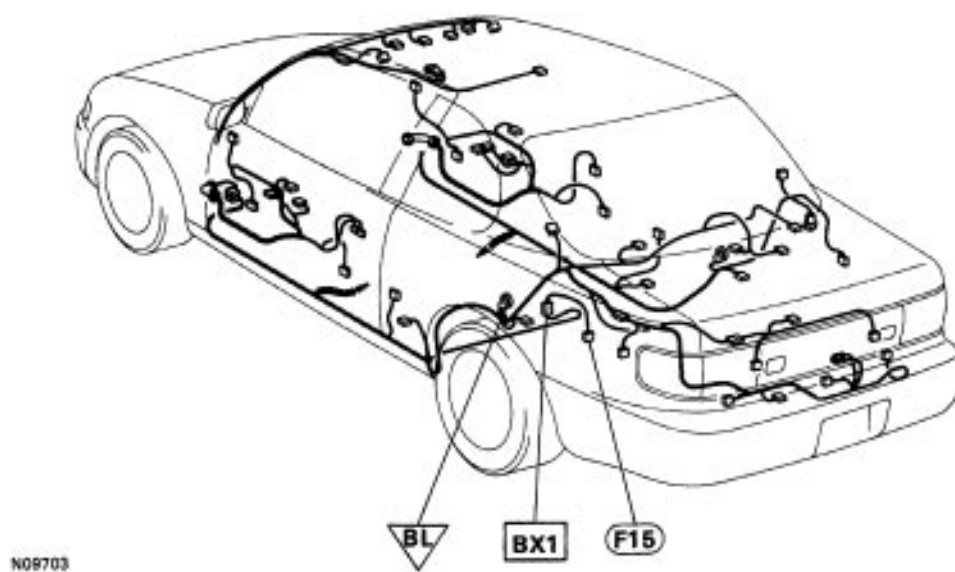


## Location of Connectors in Body

### Sedan

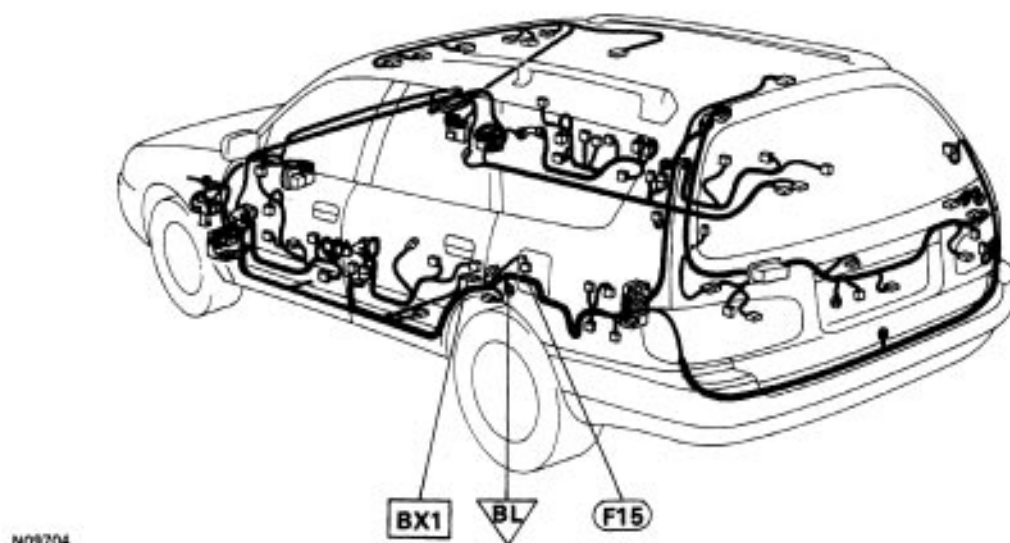


### Coupe



## Location of Connectors in Body (Cont'd)

### Wagon



**F15**  
Fuel Pump

**BX1**



1e-5-1-A



e-5-1



e-5-2

-Memo

## CIRCUIT INSPECTION

### DTC 12 G NE Signal Circuit (No.1) (Exc. California spec.)

#### CIRCUIT DESCRIPTION

The distributor in the Engine Control System contains 3 pickup coils.

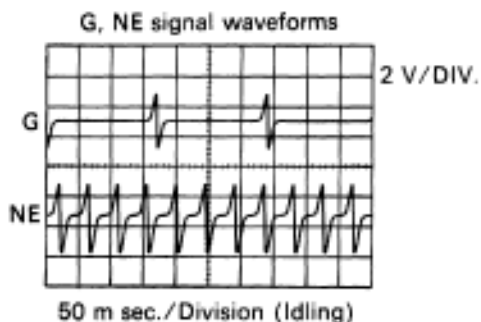
The G signals inform the ECM of the standard crankshaft position.

The NE signals inform the ECM of the crankshaft position and the engine speed.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
12	No N E signal to ECM with 2 sec. or more after cranking.	<ul style="list-style-type: none"><li>• Open or short in NE, G circuit</li><li>• Distributor</li><li>• Open or short in STA circuit</li><li>• ECM</li></ul>
	No G signal to ECM for 3 sec. or more with engine speed between 600 rpm and 4,000 rpm.	

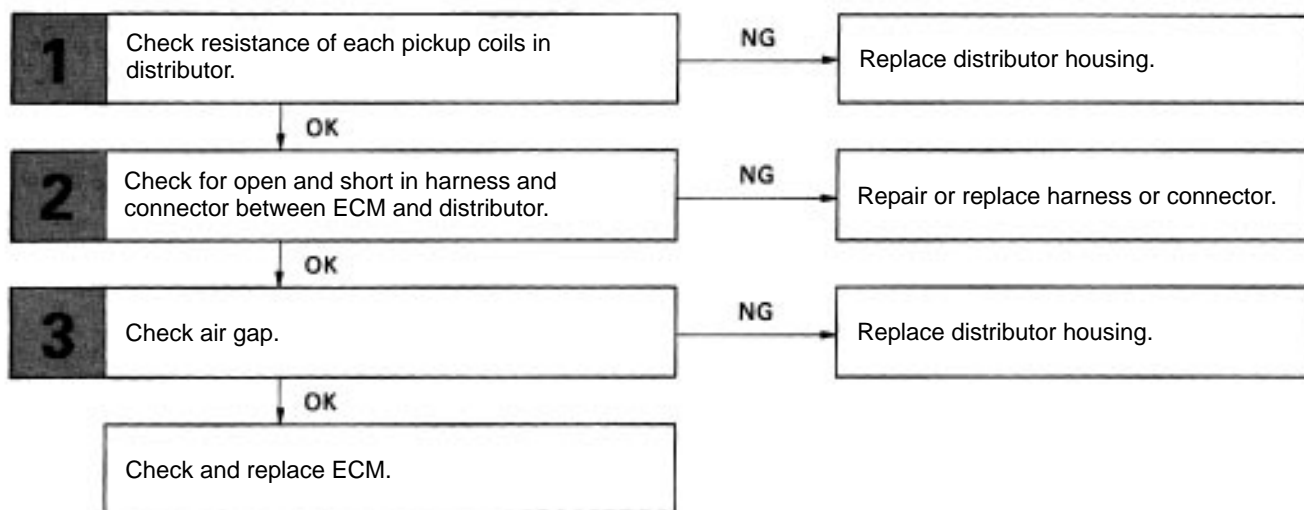
#### Reference

#### INSPECTION USING OSCILLOSCOPE

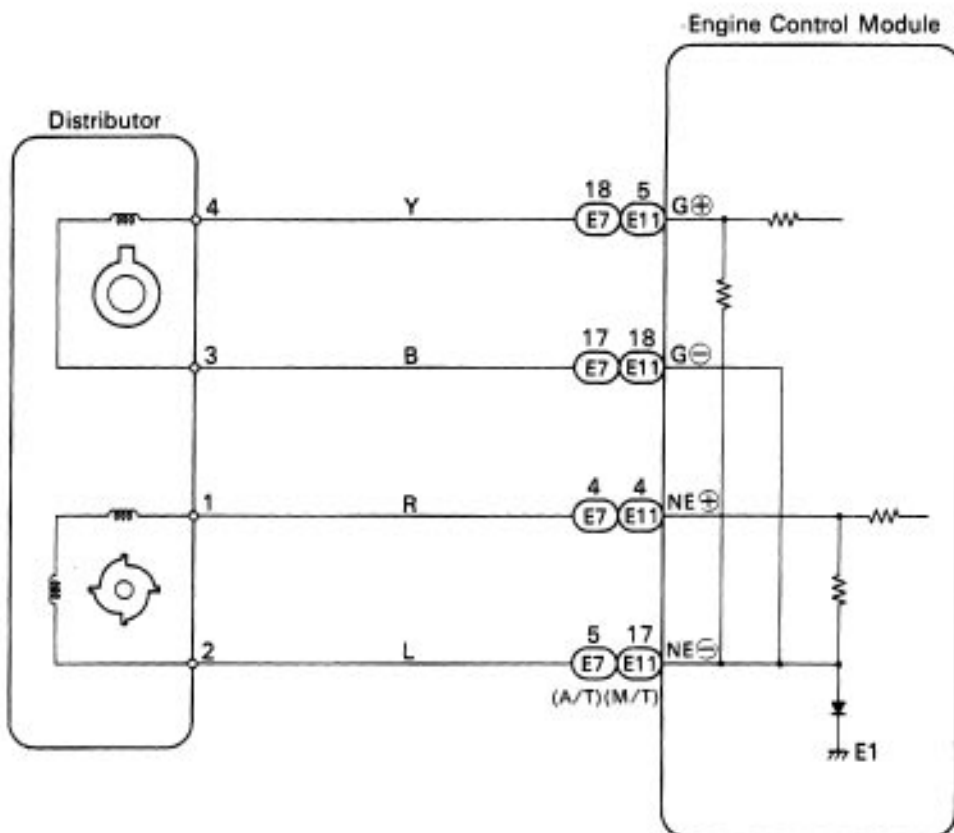


- During cranking or idling, check waveforms between terminals G (+) and G (-), NE (+) and NE (-) of engine control module.
- HINT: The correct waveforms appear as shown in the illustration on the left.

## DIAGNOSTIC CHART

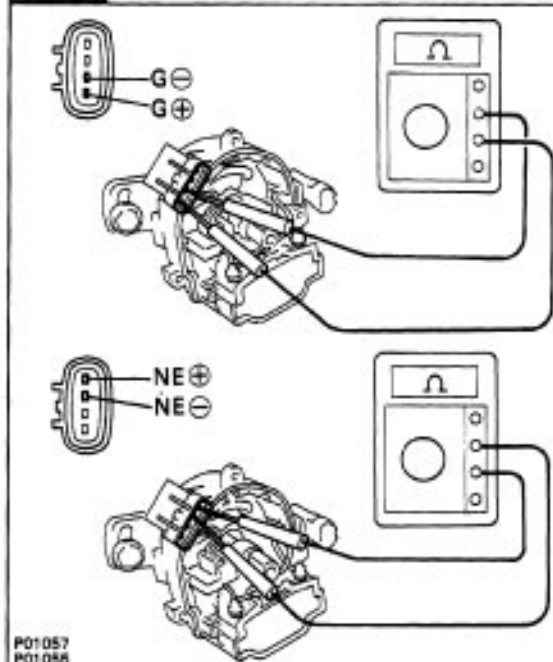


## WIRING DIAGRAM



## INSPECTION PROCEDURE

### Check resistance of each pickup coils in distributor.



- P** Disconnect distributor connector.
- C** Measure resistance between each terminal shown in table below.

**OK**

		Resistance
G Pickup Coil (G1 – G (–))	Cold	185 ~ 275Ω
	Hot	240 ~ 325 Ω
NE Pickup Coil (NE (+) – NE (–) )	Cold	370 ~ 550Ω
	Hot	475 ~ 650Ω

“Cold” is from –10°C (14°F) to 50°C (122°F) and  
“Hot” is from 50°C (122°F) to 100°C (212°F).

**OK**

**NG**

Replace distributor housing.

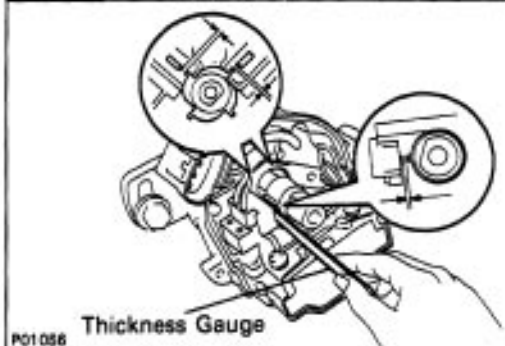
### Check for open and short in harness and connector between engine control module and distributor (See page IN-31).

**OK**

**NG**

Repair or replace harness or connector.

### Check air gap.



- P** Remove distributor cap and rotor.
- C** Using a thickness gauge, measure the air gap between the signal rotor and pickup coil projection.
- OK** Air gap: 0.2 – 0.4 mm (0.008 – 0.006 in.)

**OK**

**NG**

Replace distributor housing.

Check and replace engine control module.

## DTC 12 G NE Signal Circuit (No.1) (Only for California spec.)

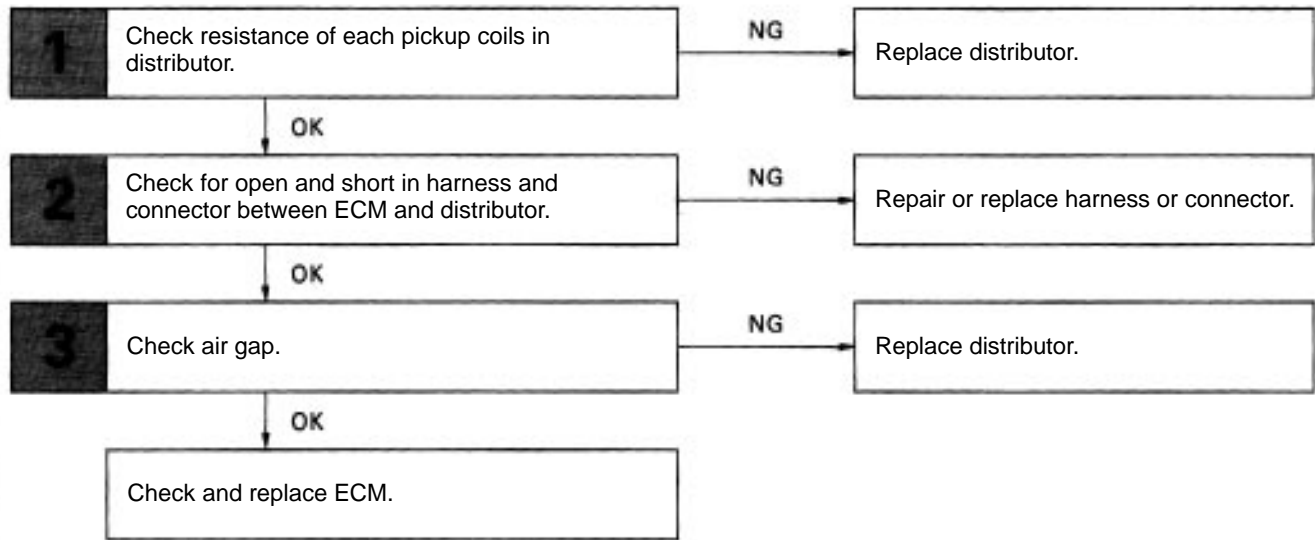
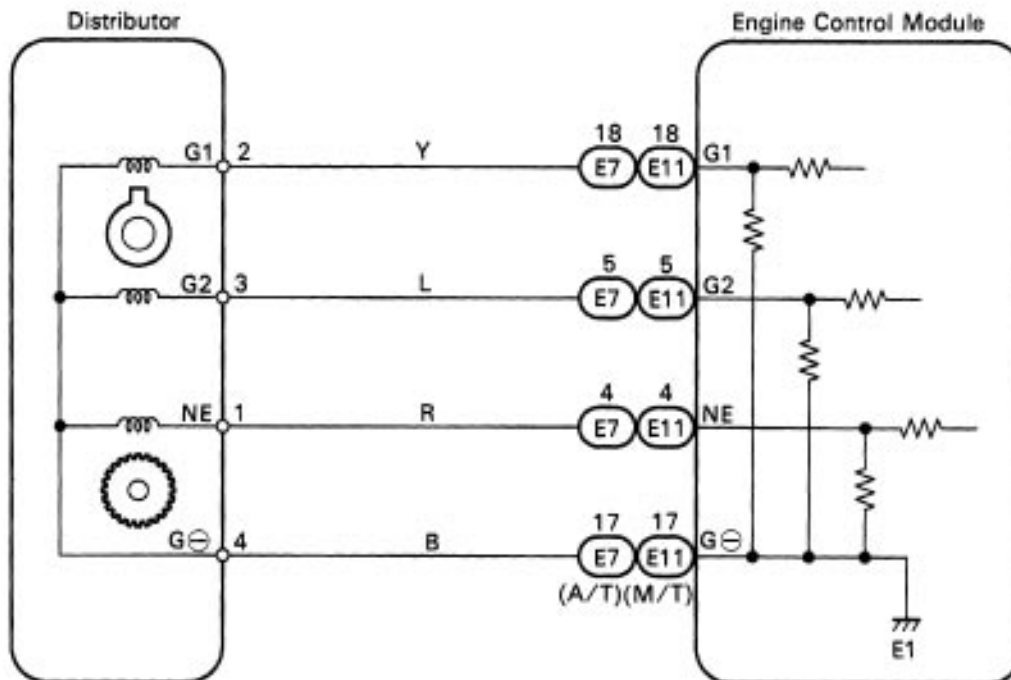
### CIRCUIT DESCRIPTION

The distributor in the Engine Control System contains 3 pick-up coils (G1, G2 and NE).

The G1, G2 signals inform the ECM of the standard crankshaft angle.

The NE signals inform the ECM of the crankshaft angle and the engine speed.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
12	No NE or G1 and G2 signal to ECM for 2 sec. or more after cranking.	<ul style="list-style-type: none"><li>• Open or short in NE, G circuit.</li><li>• Distributor</li><li>• Open or short in STA circuit.</li><li>• ECM</li></ul>
	Open in G (-) circuit.	

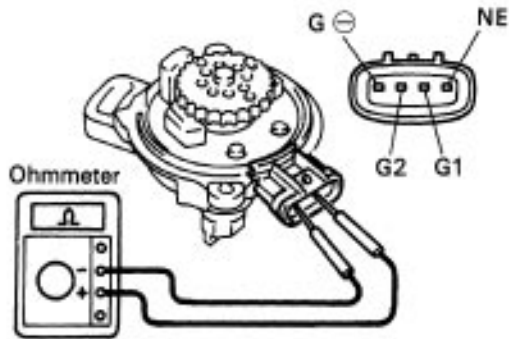
**DIAGNOSTIC CHART****WIRING DIAGRAM**



# INSPECTION PROCEDURE

## 1

Check resistance of each pickup coils in distributor.



- P** Disconnect distributor connector.
- C** Measure resistance between each terminal shown in table below.

**OK**

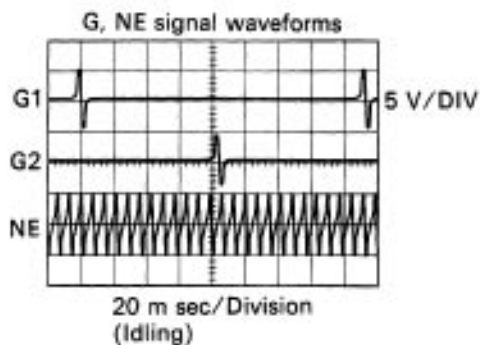
		Resistance
G1 pickup coil (G1 - G ⊖)	Cold	125 ~ 200 Ω
	Hot	160 ~ 235 Ω
G2 pickup coil (G2 - G ⊖)	Cold	125 ~ 200 Ω
	Hot	160 ~ 235 Ω
NE pickup coil (NE - G ⊖)	Cold	155 ~ 250 Ω
	Hot	190 ~ 290 Ω

"Cold" is from -10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).

P13791

Reference

## INSPECTION USING OSCILLOSCOPE



- During cranking or idling, check waveforms between terminals G1, G2, NE and G O of engine control module.

HINT: The correct waveforms appear as shown in the illustration on the left.

F16519

**OK**

**NG**

Replace distributor.

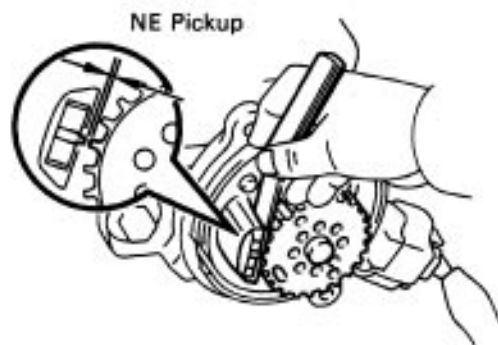
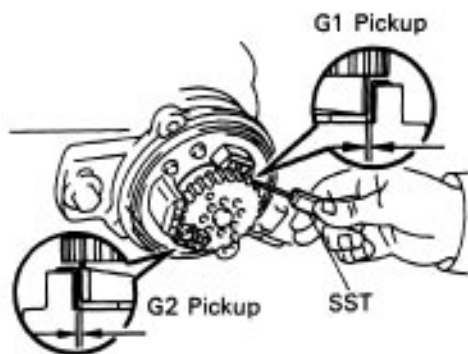
## 2

Check for open and short in harness and connector between engine control module and distributor (See page [IN-31](#)).

**OK**

**NG**

Repair or replace harness or connector.

**3****Check air gap.**P13787  
P13786**P** Remove distributor cap & rotor.**C** Using SST (G1 and G2 pickups) and a thickness gauge (NE pickup), measure the air gap between the signal rotor and pickup coil projection.  
SST 09240-00020 for G1 and G2 pickups**OK** Air gap: 0.2–0.5 mm (0.008–0.020 in.)**OK****NG**

Replace distributor housing assembly.

Check and replace engine control module.

## DTC 13 G NE Signal Circuit (No.2)

### CIRCUIT DESCRIPTION

Refer to G, NE signal circuit (No. 1) on page [EG1-336](#), 339.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
13	No NE signal to ECM for 0.3 sec. or more at 1,500 rpm or more.	<ul style="list-style-type: none"> <li>• Open or short in NE circuit</li> <li>• Distributor</li> <li>• ECM</li> </ul>
	No G signal to ECM while N E signal is input 4 times to ECM when engine speed is between 500 rpm and 4,000 rpm.	
	* No NE signal to ECM for 0.1 sec. or more at 1,000 rpm or more.	
	* NE signal does not pulse 12 times to ECM during the interval between G1 and G2 pulses.	

\*: Only for California specification vehicles.

### DIAGNOSIS

This code indicates that a momentary interruption of the G, N E signal from the distributor to the ECM has occurred, but that it is returned to normal. Note that although this problem may not necessarily appear at the time of inspection, it cannot be ignored because this diagnostic trouble code is output, indicating that there is or was a malfunction in the G, NE signal circuit; this "malfunction" is usually a loose connector.

The distributor connector and the N E terminal of the ECM connector must therefore be checked for the following:

1. Loose connectors
2. Dirty connector terminals
3. Loose connector terminals

## DTC 14 Ignition Signal Circuit

### CIRCUIT DESCRIPTION

The ECM determines the ignition timing, turns on Tr, at a predetermined angle (\*CA) before the desired ignition timing and outputs an ignition signal (IGT) "1" to the igniter.

Since the width of the IGT signal is constant, the dwell angle control circuit in the igniter determines the time the control circuit starts primary current flow to the ignition coil based on the engine rpm and ignition timing one revolution ago, that is, the time the Tr<sub>2</sub> turns on.

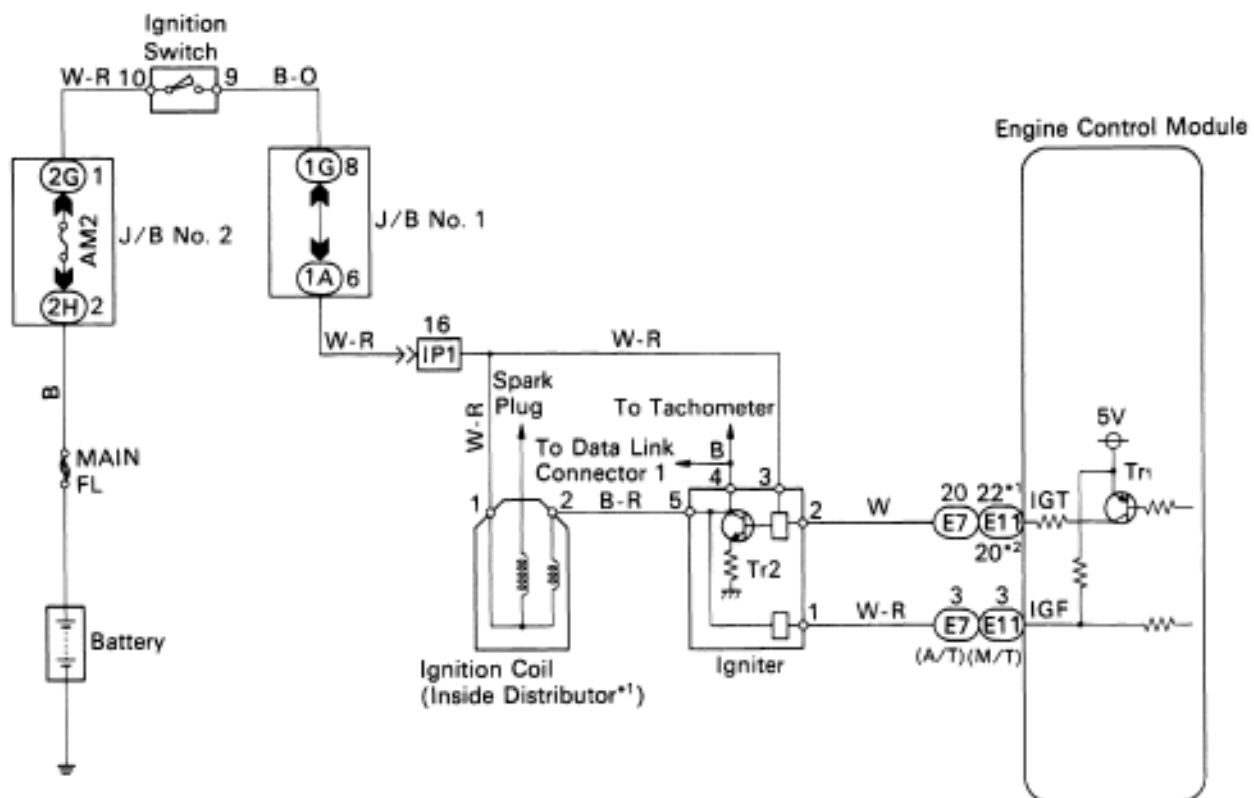
When it reaches the ignition timing, the ECM turns Tr, off and outputs the IGT signal "0".

This turns Tr<sub>2</sub> off, interrupting the primary current flow and generating a high voltage in the secondary coil which causes the spark plug to spark. Also, by the counter electromotive force generated when the primary current is interrupted, the igniter sends an ignition confirmation signal (IGF) to the ECM.

The ECM stops fuel injection as a fail safe function when the IG F signal is not input to the ECM.

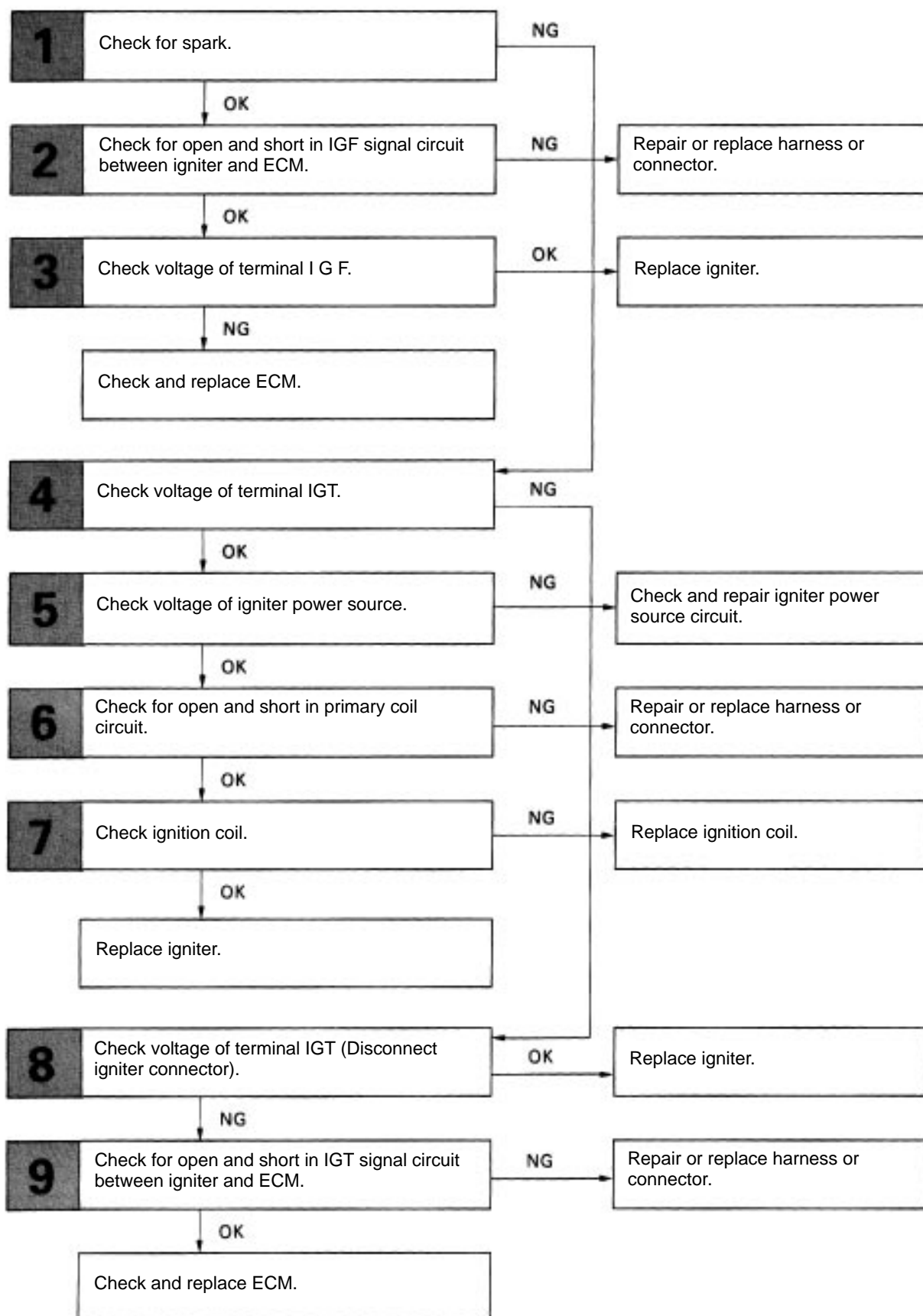
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
<b>14</b>	No IGF signal to ECM for 4 (8*2) consecutive IGT signals.	<ul style="list-style-type: none"> <li>Open or short in IG F or IGT circuit from igniter to ECM.</li> <li>Igniter</li> <li>ECM</li> </ul>

### WIRING DIAGRAM



\*1: Except California specification vehicles.

\*2: Only for California specification vehicles.

**DIAGNOSTIC CHART**

## INSPECTION PROCEDURE

### 1

#### Check for spark.

**C** Disconnect the high-tension cord from the distributor, hold its end about 12.5 mm (1/2") from the ground, see if spark occurs while the engine is being cranked.

**OK** Spark should be generated.

**Hint** To prevent excessive fuel injected from the injectors during this check, don't crank the engine for more than 1 – 2 seconds at a time.

**OK**

**NG**

Go to step **4**

### 2

#### Check for open and short in harness and connector in IGF signal circuit between engine control module and igniter (See page [IN-31](#)).

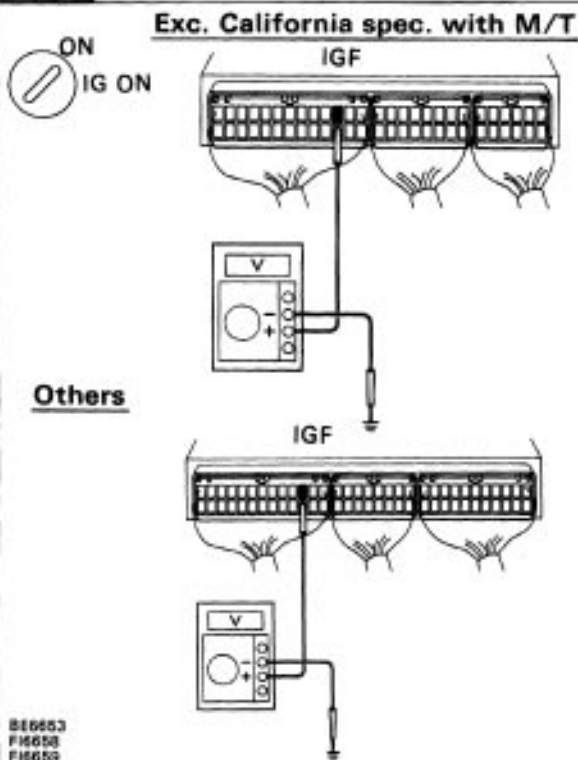
**OK**

**NG**

Repair or replace harness or connector.

### 3

#### Disconnect igniter connector and check voltage between terminal IGF of engine control module connector and body ground.



- P** (1) Disconnect igniter connector.  
(2) Remove glove compartment.  
(See page [EG1-234](#)).  
(3) Turn ignition switch on.

**C** Measure voltage between terminal IGF of engine control module connector and body ground.

**OK** Voltage: 4.5 ~ 5.5 V

**NG**

**OK**

Replace igniter.

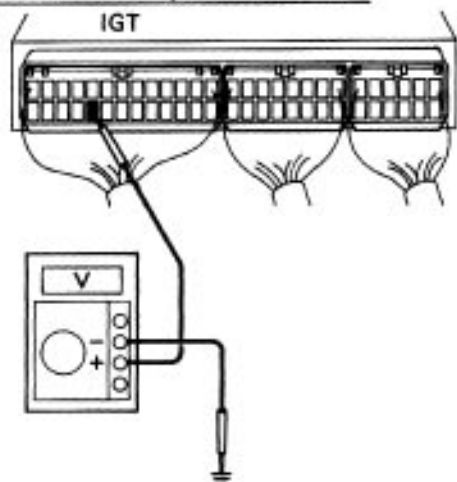
Check and replace engine control module.

4

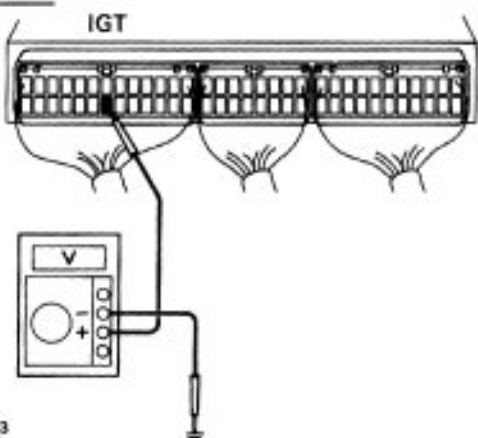
## Check voltage between terminal IGT of engine control module connector and body ground.



Exc. California spec. with M/T

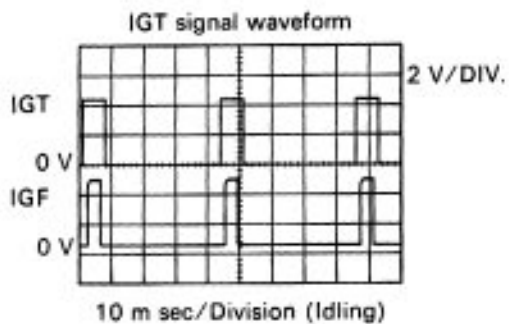


Others

BE6663  
FI6660  
FI6661

- P** Remove glove compartment.  
(See page [EG1-234](#)).
- C** Measure voltage between terminal IGT of engine control module connector and body ground when engine is cranked.
- OK** **Voltage: 0.5 – 1.0 V**  
(Neither 0 V nor 5 V)

## Reference INSPECTION USING OSCILLOSCOPE



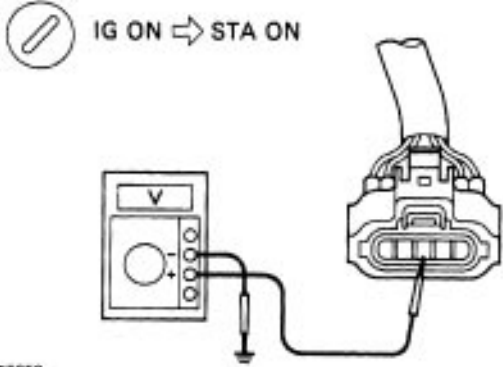
- During cranking or idling, check waveform between terminal IGT and E1 of engine control module.
- HINT: The correct waveform appears as shown in the illustration on the left, with rectangle waves.

FI6680

OK

NG

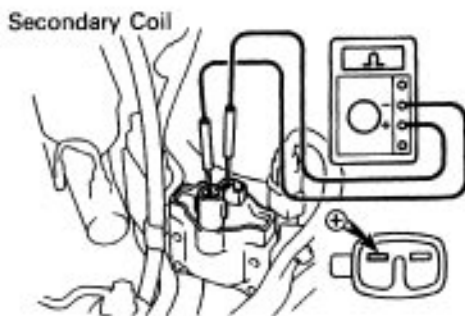
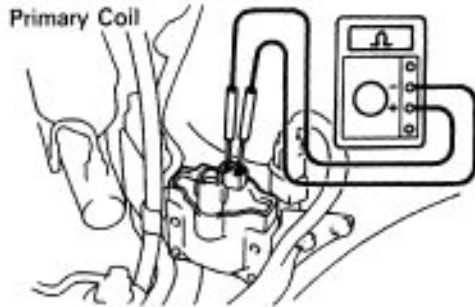
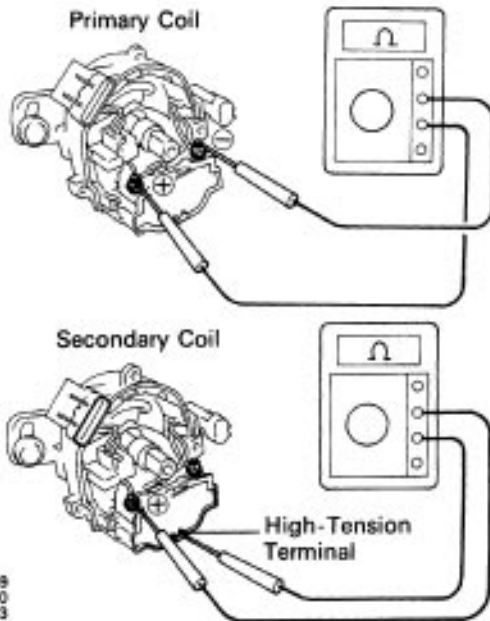
Go to step **8**

<b>5</b>	<b>Check voltage between terminal 3 of igniter connector and body ground.</b>
 <p>IG ON =&gt; STA ON</p> <p>BT6653 F16438</p>	<p><b>P</b> Disconnect igniter connector.</p> <p><b>C</b> Measure voltage between terminal 3 of igniter connector and body ground, when ignition switch is turned to "ON" and "STA" position.</p> <p><b>OK</b> <b>Voltage: 9 ~ 14 V</b></p>
<b>OK</b>	<b>NG</b> Check and repair igniter power source circuit.
<b>6</b>	<b>Check for open and short in harness and connector between ignition switch and ignition coil, ignition coil and igniter (See page <a href="#">IN-31</a>).</b>
<b>OK</b>	<b>NG</b> Repair or replace harness or connector.



## 7

## Check ignition coil.

**For California spec.****Exc. California spec.**

P14139  
P14140  
P01053  
P01054

**P****For California spec.**

- (1) Disconnect ignition coil connector.
- (2) Disconnect high-tension cord from ignition coil.

**Exc. California spec.**

- (1) Disconnect distributor connectors.
- (2) Remove distributor cap and rotor.
- (3) Remove ignition coil dust cover.

**C****(1) Check primary coil.**

Measure resistance between the positive (+) and negative (-) terminals.

**(2) Check secondary coil.**

Measure resistance between the positive (+) and high-tension terminals.

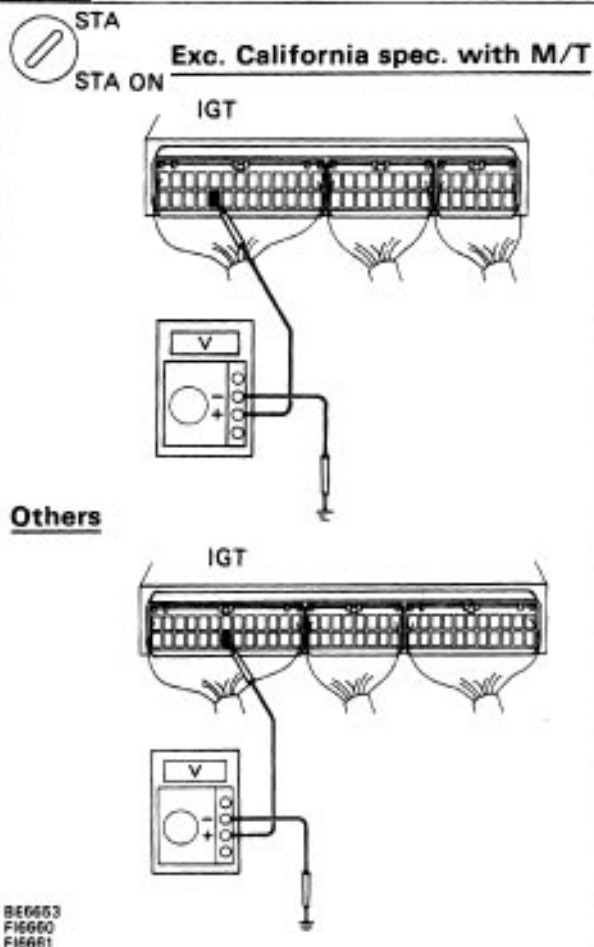
**OK**

		Resistance
Primary Coil	Cold	0.36 ~ 0.55 $\Omega$
	Hot	0.45 ~ 0.65 $\Omega$
Secondary Coil	Cold	9.0 ~ 15.4 k $\Omega$
	Hot	11.4 ~ 18.1 k $\Omega$

"Cold" is from  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ) to  $50^{\circ}\text{C}$  ( $122^{\circ}\text{F}$ ) and "Hot" is from  $50^{\circ}\text{C}$  ( $122^{\circ}\text{F}$ ) to  $100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ ).

**OK****NG****Replace ignition coil.****Replace igniter.**

**Disconnect igniter connector and check voltage between terminal IGT of engine control module connector and body ground.**



- P** Disconnect igniter connector.
- C** Measure voltage between terminal IGT of engine control module connector and body ground when engine is cranked.
- OK** Voltage: 0.5–1.0 V  
(Neither 0 V nor 5 V)

**NG**

**OK**

Replace igniter.

**9**

**Check for open and short in harness and connector in IGT signal circuit between engine control module and igniter (See page [IN-31](#)).**

**OK**

**NG**

Repair or replace harness or connector.

Check and replace engine control module.

## DTC 16 A–T Control Signal Malfunction

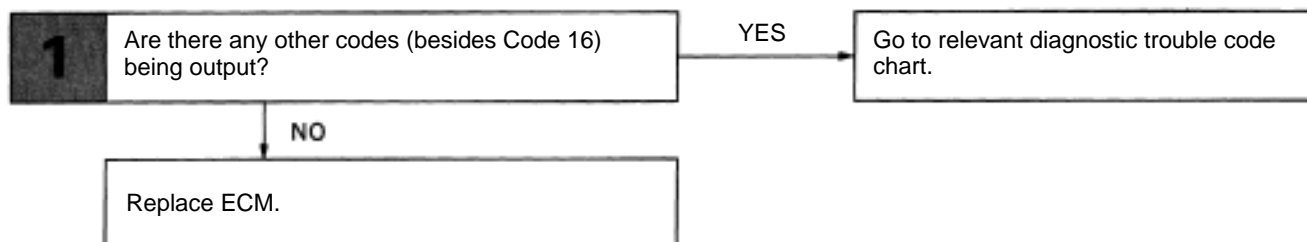
### CIRCUIT DESCRIPTION

The signal from the A/T CPU retards the ignition timing of the engine during A/T shifting, thus momentarily reducing torque output of the engine for smooth clutch operation inside the transmission and reduced shift shock.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
16	Fault in communications between the engine CPU and A/T CPU in the ECM	• ECM

If the ECM detects the diagnostic trouble code “16” in memory, it prohibits the torque control of the A/T which performs smooth gear shifting.

### DIAGNOSTIC CHART

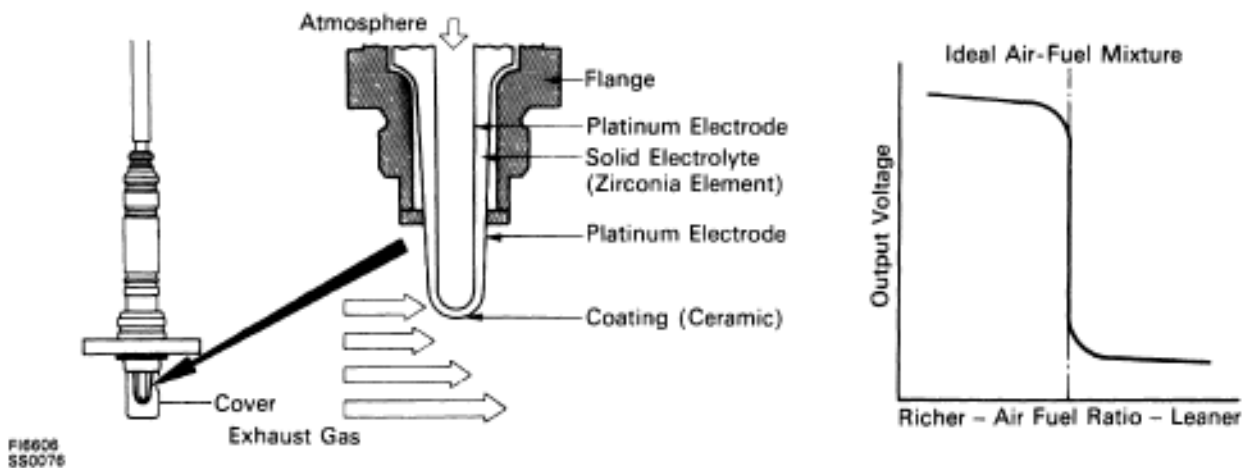


## DTC 21 Main Oxygen Sensor Circuit

### CIRCUIT DESCRIPTION

To obtain a high purification rate for the CO, HC and NO<sub>x</sub> components of the exhaust gas, a three-way catalytic converter is used, but for most efficient use of the three-way catalytic converter, the air-fuel ratio must be precisely controlled so that it is always close to the stoichiometric air-fuel ratio. The oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air-fuel ratio. This characteristic is used to detect the oxygen concentration in the exhaust gas and provide feedback to the computer for control of the air-fuel ratio. When the air-fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the oxygen sensor informs the ECM of the LEAN condition (small electromotive force; 0 V).

When the air-fuel ratio is RICHER than the stoichiometric air-fuel ratio the oxygen concentration in the exhaust gas is reduced and the oxygen sensor informs the ECM of the RICH condition (large electromotive force: 1 V). The ECM judges by the electromotive force from the oxygen sensor whether the air-fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the ECM is unable to perform accurate air-fuel ratio control.



DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
21	<p>Main oxygen sensor signal voltage is reduced to between 0.35 V and 0.70 V for 60 sec. under conditions (a) - (d).</p> <p>(2 trip detection logic) *</p> <p>(a) Engine coolant temp. : 80°C (176°F) or more.</p> <p>(b) Engine speed : 1,500 rpm or more.</p> <p>(c) Load driving (EX. A/T in overdrive (5th for M/T), A/C ON, Flat road, 50 mph (80km/h)).</p> <p>(d) Main oxygen sensor signal voltage : Alternating above and below 0.45 V.</p>	<ul style="list-style-type: none"> <li>• Main oxygen sensor circuit.</li> <li>• Main oxygen sensor.</li> </ul>

\*See page [EG1-307](#)

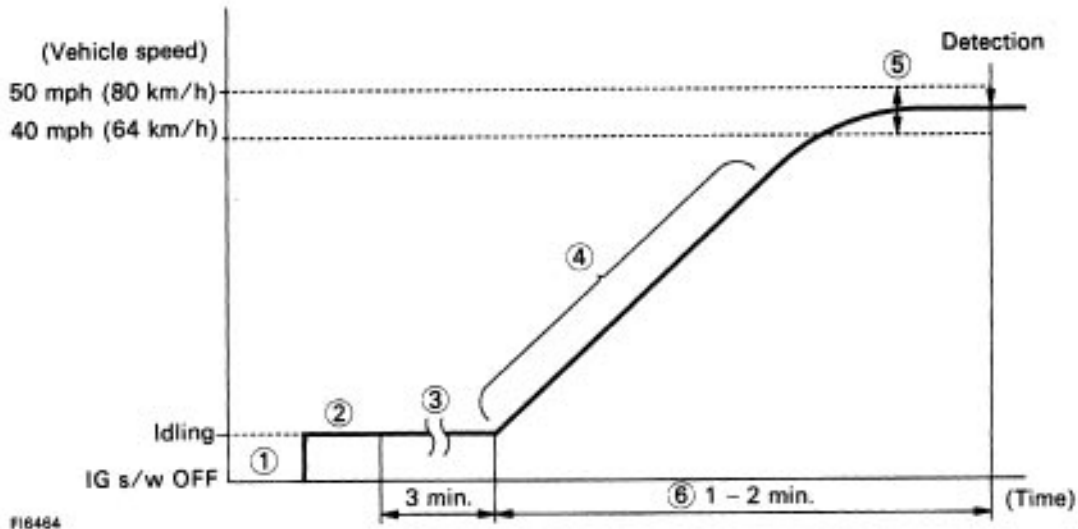
## CIRCUIT DESCRIPTION (Cont'd)

### DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

- (a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

#### Malfunction: Main Oxygen Sensor Deterioration



- ① Disconnect the EFI fuse (15A) for 10 sec. or more, with IG switch OFF.  
Initiate test mode (Connect terminal TE2 and E1 of data link connector 1 or 2 with IG switch OFF).
- ② Start the engine and warm up with all ACC switch OFF.
- ③ After the engine is warmed up, let it idle for 3 min.
- ④ After performing the idling in (3), perform gradual acceleration with in the range 1,300~1,700 rpm (centered around 1,500 rpm) with the A/C switch ON and D position for A/T (5th for M/T).  
(Take care that the engine speed does not fall below 1,200 rpm when shifting. Gradually depress the accelerator pedal and keep it. Steady so that engine braking does not occur).
- ⑤ Maintain the vehicle speed at 40 – 50 mph (64 – 80 km/h).
- ⑥ Keep the vehicle running for 1 – 2 min. after starting acceleration.  
HINT: If a malfunction exists, the malfunction indicator lamp will light up after approx. 60 sec. from the start of acceleration.

**NOTICE:** If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

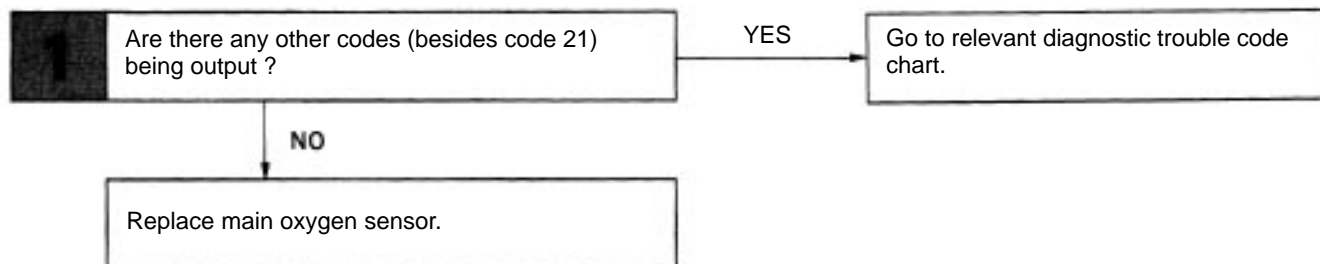
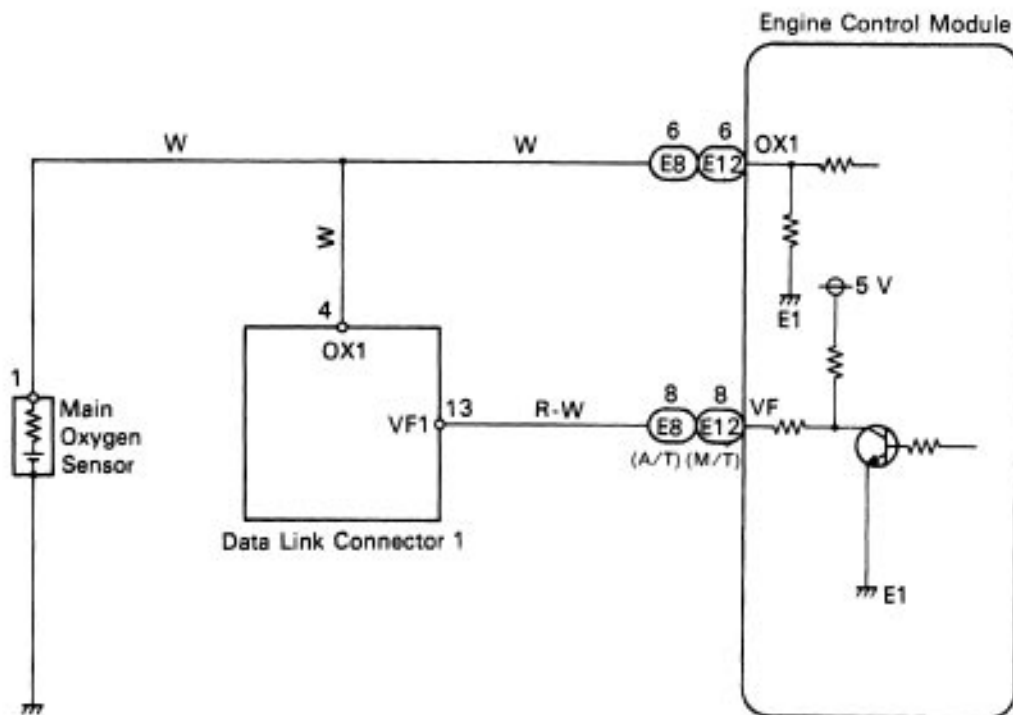
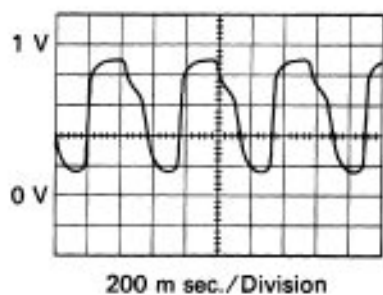
**DIAGNOSTIC CHART****WIRING DIAGRAM**

Fig6681

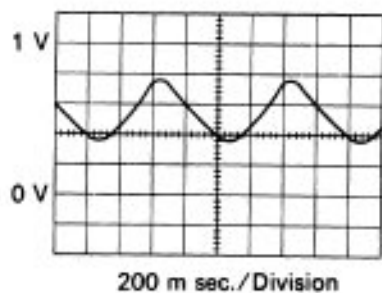
**Reference INSPECTION USING OSCILLOSCOPE**

Ox signal waveform



- With the engine racing (4,000 rpm) measure waveform between terminals OX1 and E1 of engine control module.

HINT: The correct waveform appears as shown in the illustration on the left, oscillating between approx. 0.1 V and 0.9 V.



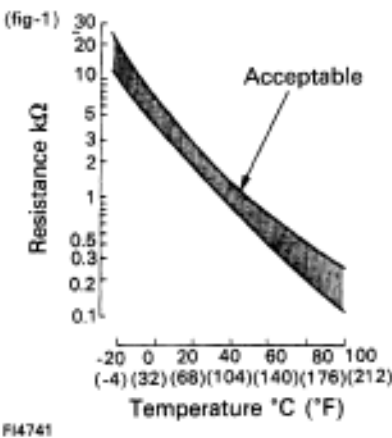
If the oxygen sensor is deteriorated, the amplitude of the voltage is reduced as shown on the left.

# DTC 22 Engine coolant Temp. Sensor Circuit

## CIRCUIT DESCRIPTION

The engine coolant temperature sensor senses the engine coolant temperature. A thermistor built in the sensor changes its resistance value according to the engine coolant temperature. The lower the engine coolant temperature, the greater the thermistor resistance value, and the higher the engine coolant temperature, the lower the thermistor resistance value (See Fig. 1.).

The engine coolant temperature sensor is connected to the ECM (See next page). The 5 V power source voltage in the ECM is applied to the engine coolant temperature sensor from the terminal THW via a resistor R. That is, resistor R and the engine coolant temperature sensor are connected in series. When the resistance value of the engine coolant temperature sensor changes in accordance with changes in the engine coolant temperature, the potential at the terminal THW also changes. Based on this signal, the ECM increases the fuel injection volume to improve driveability during cold engine operation. If the ECM detects the diagnostic trouble code 22, it operates the fail safe function in which the engine coolant temperature is assumed to be 80°C (176°F).



( Reference )

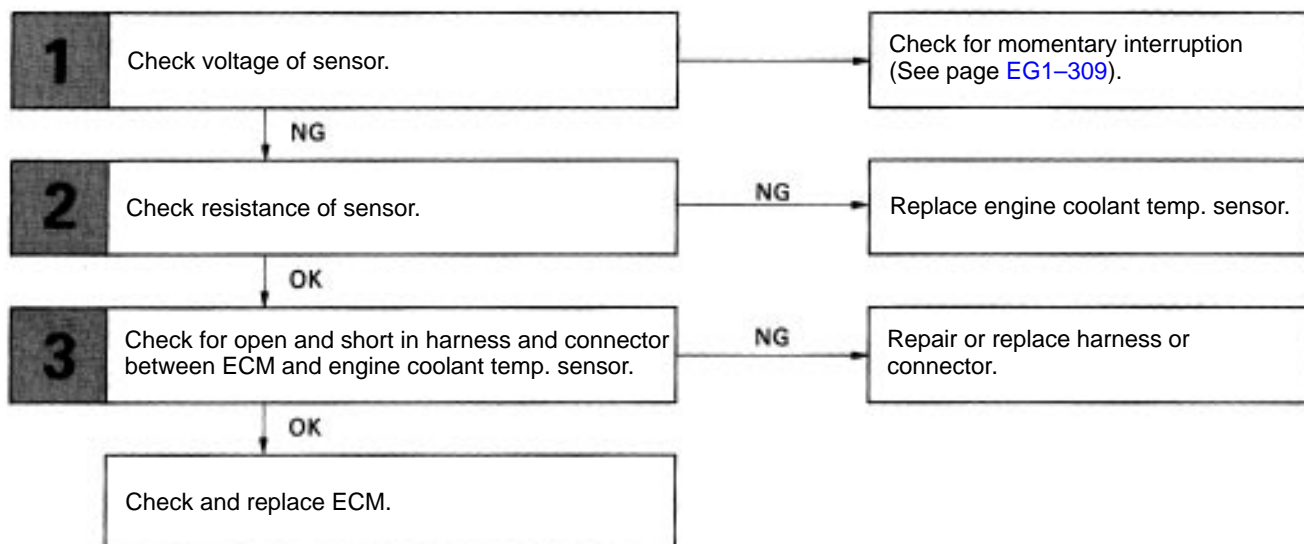
Engine coolant Temp. 1C (1F)	Resistance (kΩ)	Voltage (V)
-20 (-4)	16.0	4.3
0 (32)	5.9	3.4
20 (68)	2.5	2.4
40 (104)	1.2	1.5
60 (140)	0.6	0.9
80 (176)	0.3	0.5
100 (212)	0.2	0.3

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
22	Open or short in engine coolant temp. sensor circuit for 0.5 sec. or more.	<ul style="list-style-type: none"><li>Open or short in engine coolant temp, sensor circuit</li><li>Engine coolant temp. sensor</li><li>ECM</li></ul>

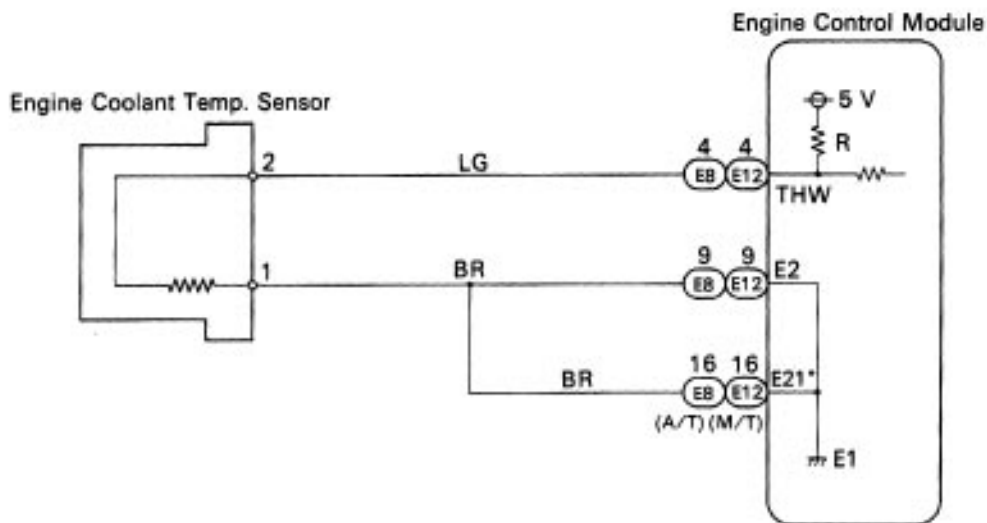


## DIAGNOSTIC CHART

HINT If diagnostic trouble codes "22" (engine coolant temperature sensor circuit), "24" (intake air temperature sensor circuit), "31" (manifold absolute pressure sensor circuit) and "41" (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open, OK Check for momentary interruption



## WIRING DIAGRAM



\*: Except California specification vehicles.

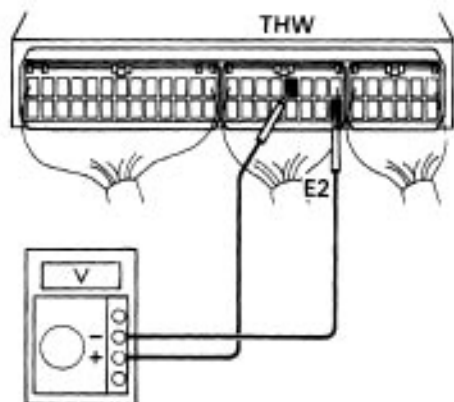
## INSPECTION PROCEDURE

HINT: If diagnostic trouble codes "22" (engine coolant temperature sensor circuit), "24" (intake air temperature sensor circuit), "31" (manifold absolute pressure sensor circuit) and "41" (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open,

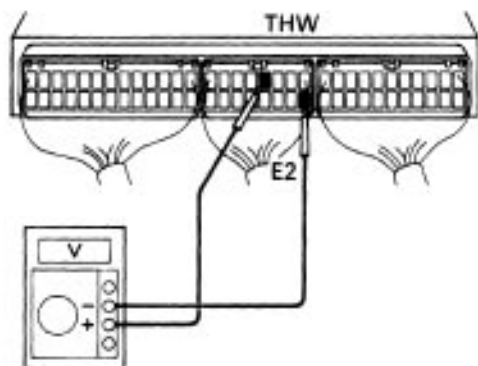
**Check voltage between terminals THW and E2 of engine control module connector.**



**Exc. California spec. with M/T**



**Others**



8E6653  
F16662  
F16663

**P**

(1) Remove glove compartment  
(See page [EG1-234](#))

(2) Turn ignition switch on.

Measure voltage between terminals THW and E2 of engine control module connector.

**C**

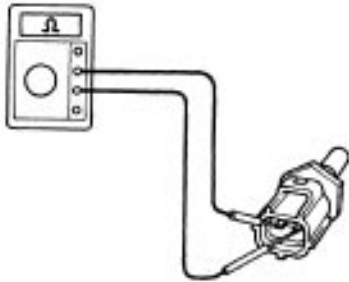
**OK**

Engine Coolant Temp. 1C (1F)	Voltage
20 (68) ( Engine is cool )	0.5 ~ 3.4 V
80 (176) (Engine is hot)	0.2 ~1.0 v

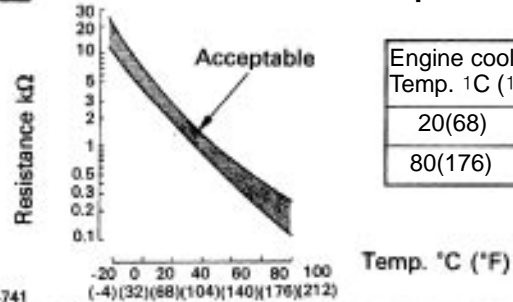
**NG**

**OK**

Check for momentary interruption  
(See page [EG1-309](#))

**2****Check engine coolant temp. sensor.**

FI4178

**P** Disconnect the engine coolant temp. sensor connector.**C** Measure resistance between terminals.**OK** Resistance is within Acceptable Zone on chart.

FI4741

**OK****NG****Replace engine coolant temp. sensor.****3****Check for open and short in harness and connector between engine control module and engine coolant temp. sensor (See page [IN-31](#)).****OK****NG****Repair or replace harness or connector.****Check and replace engine control module.**

## DTC 24 Intake Air Temp. Sensor Circuit

### CIRCUIT DESCRIPTION

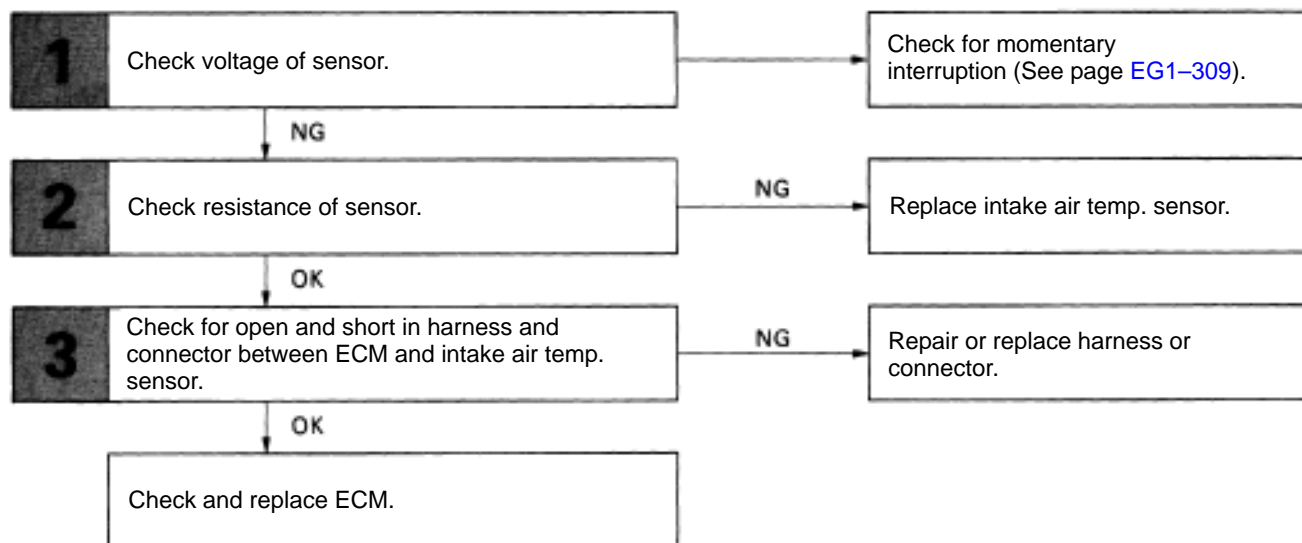
The intake air temp. sensor is built into the air cleaner cap and senses the intake air temperature. The structure of the sensor and connection to the ECM is the same as in the engine coolant temp. sensor shown on page [EG1-356](#).

If the ECM detects the diagnostic trouble code "24", it operates the fail safe function in which the intake air temperature is assumed to be 20°C (68°F).

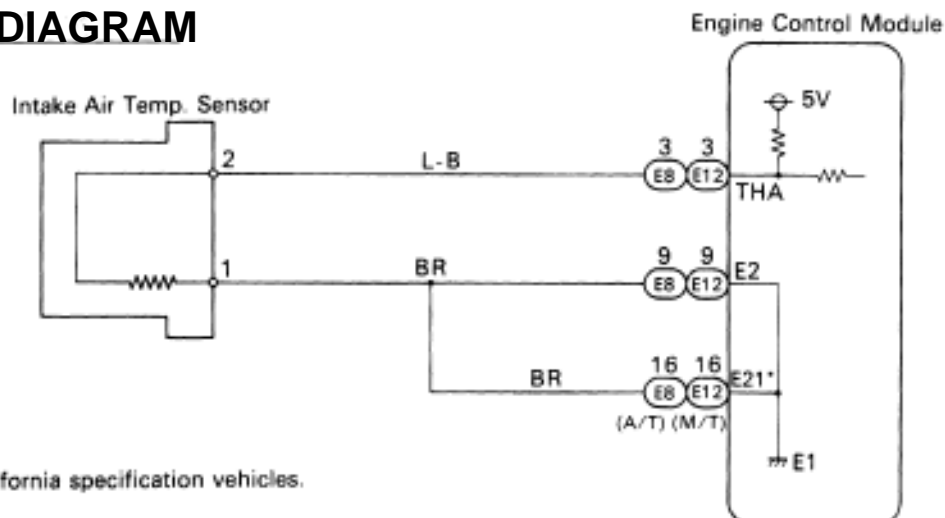
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
<b>24</b>	Open or short in intake air temp. sensor circuit for 0.5 sec. or more.	<ul style="list-style-type: none"> <li>Open or short in intake air temp. sensor circuit</li> <li>Intake air temp. sensor</li> <li>ECM</li> </ul>

### DIAGNOSTIC CHART

**HINT:** If diagnostic trouble codes "22" (engine coolant temperature sensor circuit), "24" (intake air temperature sensor circuit), "31" (manifold absolute pressure sensor circuit) and "41" (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.



### WIRING DIAGRAM



\*: Except California specification vehicles.

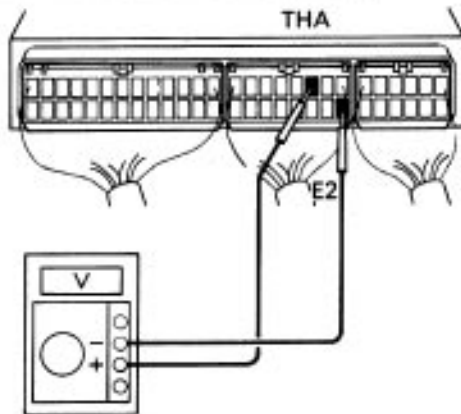
## INSPECTION PROCEDURE

1

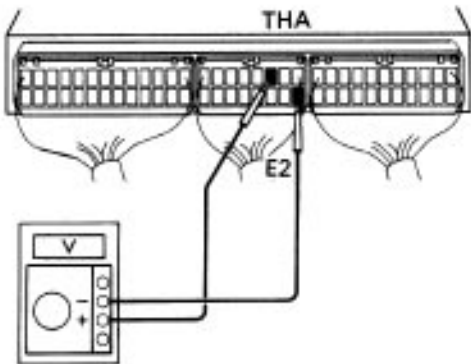
Check voltage between terminals THA and E2 of engine control module connector.



Exc. California spec. with M/T



Others



B16653  
F16664  
F16665

P

(1) Remove glove compartment.  
(See page [EG1-234](#))

(2) Turn ignition switch on.

C

Measure voltage between terminals THA and E2 of engine control module connector.

OK

Intake air temp. °C (°F)	Voltage
20 (68)	0.5 ~ 3.4 V
60 (140)	0.2 ~ 1.0 V

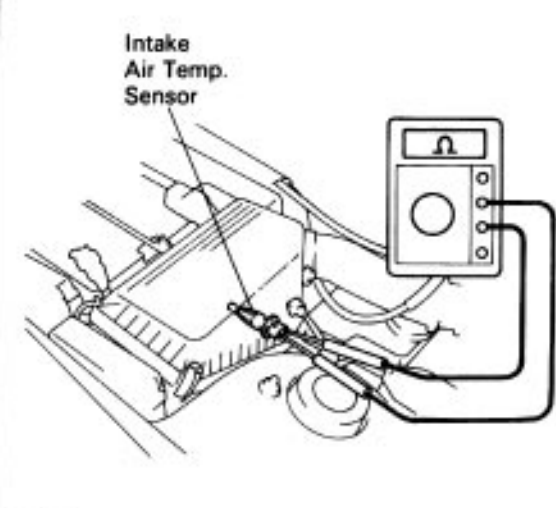
NG

OK

Check for momentary interruption  
(See page [EG1-309](#)).

2

Check intake air temp. sensor.



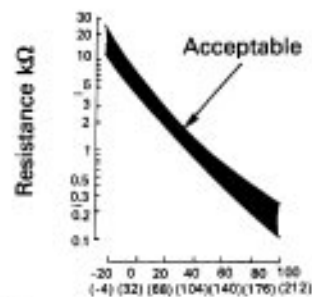
Intake Air Temp. Sensor

P01068

**P** Disconnect the air temp. sensor connector.

**C** Measure resistance between terminals.

**OK** Resistance is within Acceptable Zone on chart.



Intake air temp. °C (°F)	Resistance
20(68)	2 – 3kΩ
60 (140)	0.4 – 0.7 kΩ

F14741

OK

NG Replace intake air temp. sensor.

3

Check for open and short in harness and connector between engine control module and intake air temp. sensor (See page [IN-31](#)).

OK

NG Repair or replace harness or connector.

Check and replace engine control module.

## DTC 25 26 Air-Fuel Ratio Lean Rich Malfunction

### CIRCUIT DESCRIPTION

The main oxygen sensor is located in the exhaust manifold.

It indirectly determines whether the fuel mixture is rich or lean by detecting the concentration of oxygen present in the exhaust gas.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
25	(1) Main oxygen sensor voltage is 0.45 V or less (lean) for 90 sec. under conditions (a) and (b). (2 trip detection logic) * (a) Engine coolant temp.: 60°C (140°F) or more. (b) Engine speed: 1,500 rpm or more.	<ul style="list-style-type: none"> <li>• Open or short in main oxygen sensor circuit</li> <li>• Main oxygen sensor</li> <li>• Ignition system</li> <li>• ECM</li> </ul>
	(2) Engine speed varies by more than 15 rpm over the preceding crank position period during a period of 50 sec. or more under conditions (a) and (b). (2 trip detection logic) * (a) Engine speed: Idling (b) Engine coolant temp.: 60°C (140°F) or more.	<ul style="list-style-type: none"> <li>• Open or short in injector circuit</li> <li>• Fuel line pressure (injector leak, blockage)</li> <li>• Mechanical system malfunction (skipping teeth of timing belt)</li> <li>• Ignition system</li> <li>• Compression pressure (foreign object caught in valve)</li> <li>• Air leakage</li> <li>• ECM</li> </ul>
26	Engine speed varies by more than 15 rpm over the preceding crank position period during a period of 50 sec. or more under conditions (a) and (b). (2 trip detection logic) * (a) Engine speed: Idling (b) Engine coolant temp.: 60°C (140°F) or more	<ul style="list-style-type: none"> <li>• Open or short in injector circuit</li> <li>• Fuel line pressure (injector leak, blockage)</li> <li>• Mechanical system malfunction (skipping teeth of timing belt)</li> <li>• Ignition system</li> <li>• Compression pressure (foreign object caught in valve)</li> <li>• Air leakage</li> <li>• ECM</li> </ul>

\*: See page [EG1-307](#)

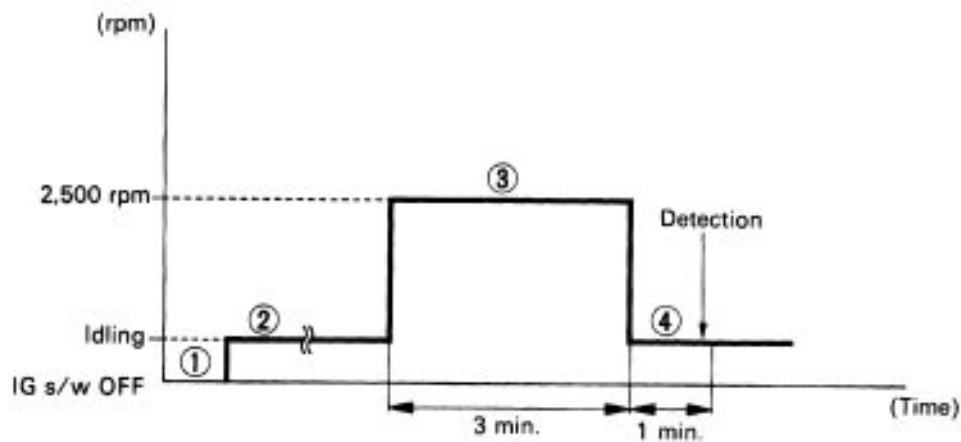
**CIRCUIT DESCRIPTION (Cont'd)****DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN**

Purpose of the driving pattern.

- (a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

**Malfunction: Open or Short in Main Oxygen Sensor.**

**Open or Short in Injector Circuit, Injector Leak or Blockage.**



F18679

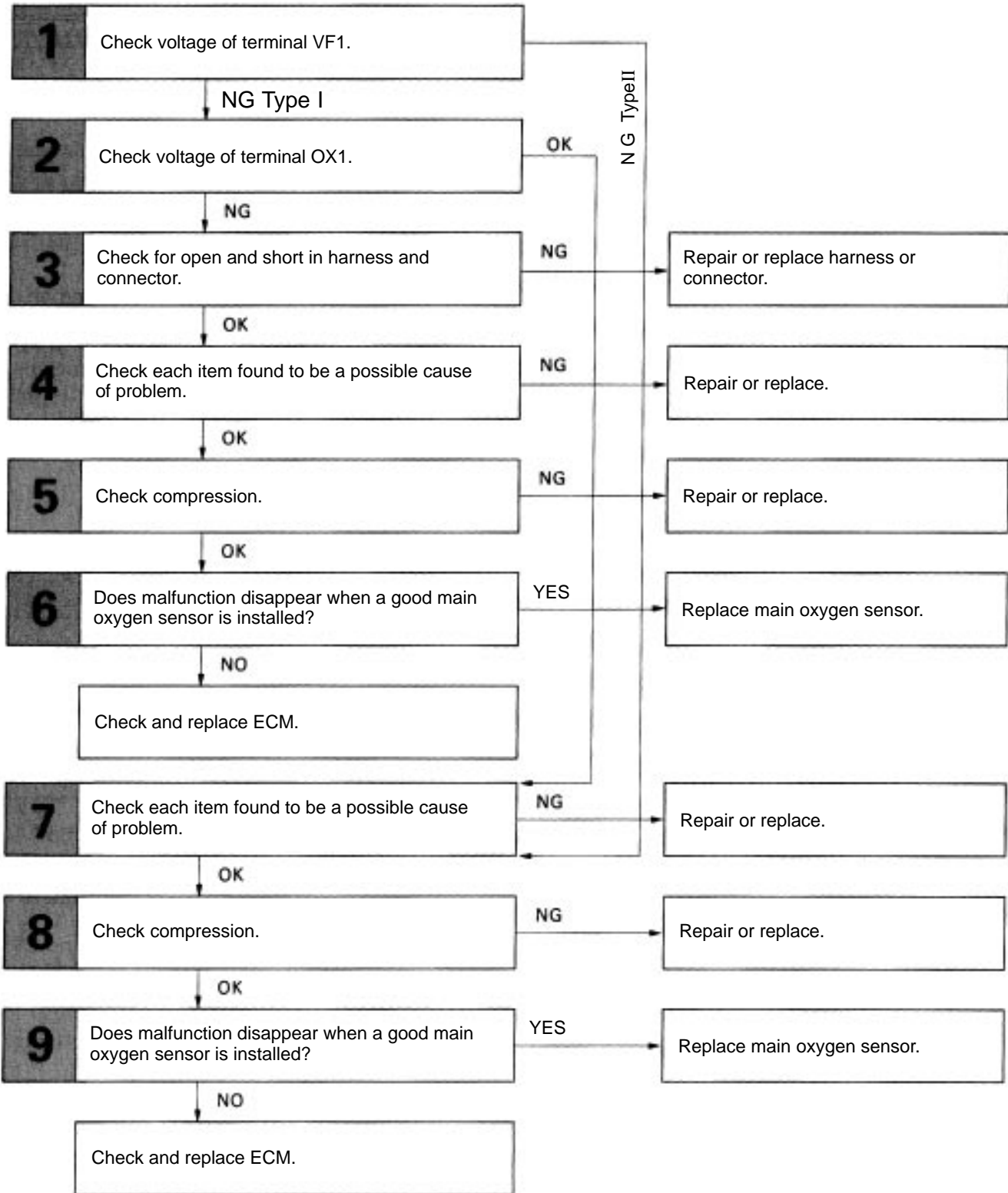
**H I N T:** Before this test, check the feedback voltage for oxygen sensor.

- ① Disconnect the EFI fuse (15 A) for 10 sec. or more, with IG switch OFF.  
Initiate test mode (Connect terminal TE2 and E1 of data link connector 1 or 2 with IG switch OFF).
- ② Start engine and warm up.
- ③ After the engine is warmed up, let it race at 2,500 rpm for 3 min.
- ④ After performing the racing in (3), perform idling 1 min.

**H I N T:** If a malfunction exists, the malfunction indicator lamp will light up during step (4).

**NOTICE:** If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

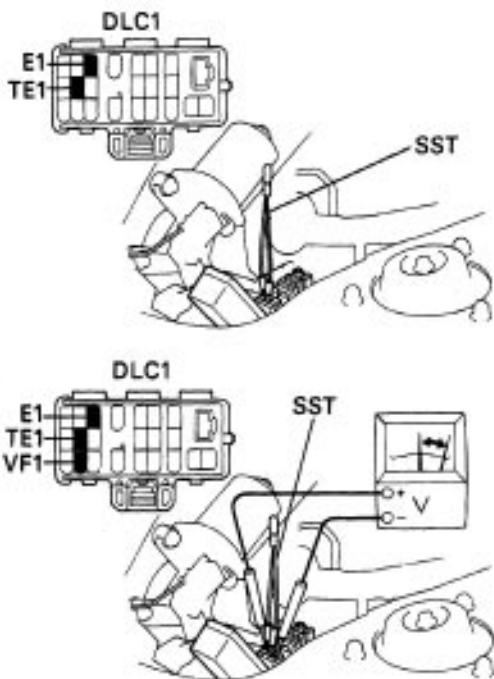


**DIAGNOSTIC CHART****WIRING DIAGRAM**

Refer to page [EG1-354](#) for the WIRING DIAGRAM.

## INSPECTION PROCEDURE

Check voltage between terminals VF1 and E1 of data link connector 1.



- P** (1) Warm up engine at normal operating temperature.  
 (2) Connect terminals TE1 and E1 of data link connector 1.  
 (3) Connect positive probe to terminal VF1 and negative probe to terminal E1 of data link connector 1.

- C** (1) Warm up the oxygen sensor by running engine at 2,500 rpm for about 2 minutes.  
 (2) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter fluctuates between 0 and 5 V.

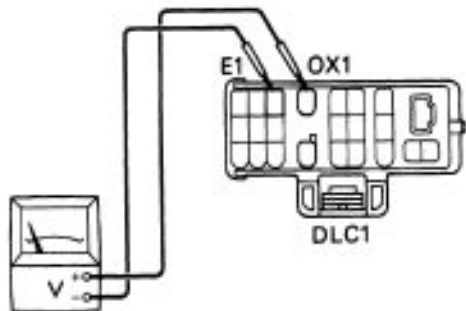
Result	Result	
	Needle fluctuates of 8 times or more for every ten seconds	OK
	Continue at 0 V	NG Type II
	Continue at 5 V	NG Type II

NG  
Type I

NG  
Type II

Go to step **7**

Check voltage between terminals OX1 and E1 of data link connector 1.



- P** Warm up engine at normal operating temperature.  
**C** Measure voltage between terminals OX1 and E1 of data link connector 1 when engine is suddenly raced to full throttle.

**OK** The voltage should be 0.5 V or higher at least once.

**Hint** Perform inspection within 1 second.

NG

OK

Go to step **7**

**3**

Check for open and short in harness and connector between engine control module and main oxygen sensor, engine control module and data link connector 1 (See page [IN-31](#)).

**OK****NG**

Repair or replace harness or connector.

**4**

Check each item found to be a possible cause of problem.

Check each circuit found to be a possible cause of trouble according to the results of the check in **1** or **2**. The numbers in the table below show the order in which the checks should be performed.

Main oxygen sensor signal continue at OV.	Possible Cause	See page
1	Faulty sensor installation.	-
5	Injector circuit	<a href="#">EG1-410</a>
3	Misfire	<a href="#">IG-6</a> , 26*
9	Valve timing	<a href="#">EG1-36</a>
2	Air leakage	<a href="#">EG1-173</a>
4	Fuel system	<a href="#">EG1-419</a>
8	Characteristics deviation in manifold absolute pressure sensor.	<a href="#">EG1-372</a>
6	Characteristics deviation in engine coolant temp. sensor.	<a href="#">EG1-356</a>
7	Characteristics deviation in intake air temp. sensor.	<a href="#">EG1-360</a>

\*: Except California specification vehicles.

**OK****NG**

Repair or replace.

**5**

Check compression (See page [EG1-23](#)).

**OK****NG**

Repair or replace.

**6**

Does malfunction disappear when a good main oxygen sensor is installed?

**NO****YES**

Replace main oxygen sensor.

Check and replace engine control module.

**7****Check each item found to be a possible cause of problem.**

Check each circuit found to be a possible cause of trouble according to the results of the check in **1**. The numbers in the table below show the order in which the checks should be performed.

Main oxygen sensor signal continue at 5.0 V.	Main oxygen sensor signal is normal.	Possible Cause	See page
2	7	Injector circuit	EG1-410
	3	Misfire	IG-6, 26*
8	4	Valve timing	EG1-36
	1	Air leakage	EG1-173
1	2	Fuel system	EG1-419
5	8	Characteristics deviation in manifold absolute pressure sensor.	EG1-372
3	5	Characteristics deviation in engine coolant temp. sensor.	EG1-356
4	6	Characteristics deviation in intake air temp. sensor.	EG1-360

x: Except California specification vehicles.

**OK****NG****Repair or replace.****8****Check compression (See page EG1-23).****OK****NG****Repair or replace.****9****Does malfunction disappear when a good main oxygen sensor is installed?****NO****YES****Replace main oxygen sensor.**

Check and replace engine control module.

## DTC 27 Sub Oxygen Sensor Circuit

### CIRCUIT DESCRIPTION

The sub oxygen sensor is installed on the exhaust pipe. Its construction and operation is the same as the main oxygen sensor on page [EG1-352](#).

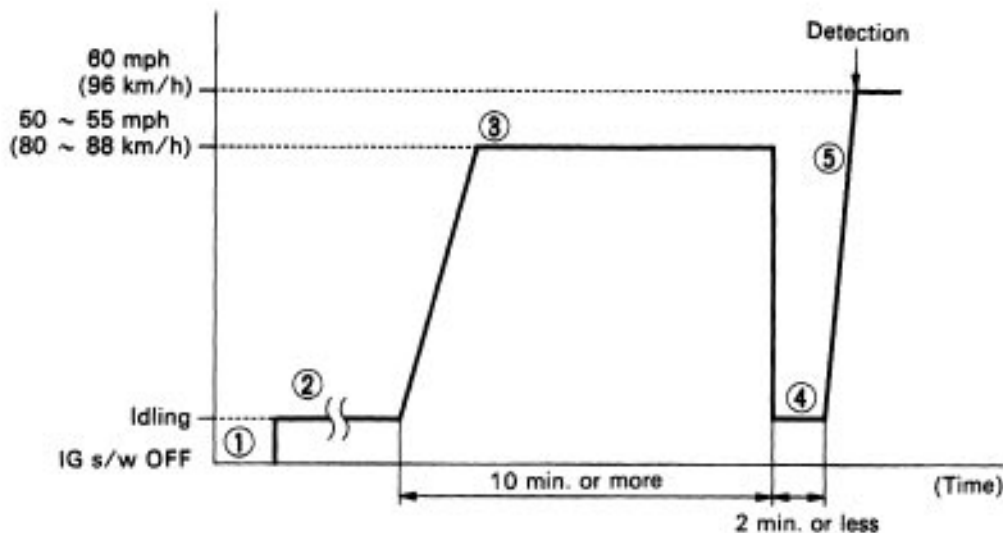
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
<b>27</b>	Main oxygen sensor signal is 0.45 V or more and sub oxygen sensor signal is 0.45 V or less under conditions (a) and (b). (2 trip detection logic) * (a) Engine coolant temp. : 80°C (176°F) or more. (b) Accel. pedal : Fully depressed for 2 sec. or more.	<ul style="list-style-type: none"><li>• Open or short in sub oxygen sensor circuit.</li><li>• Sub oxygen sensor</li><li>• ECM</li></ul>

\* : See page [EG1-307](#).

**CIRCUIT DESCRIPTION (Cont'd)****DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN**

Purpose of the driving pattern.

- (a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

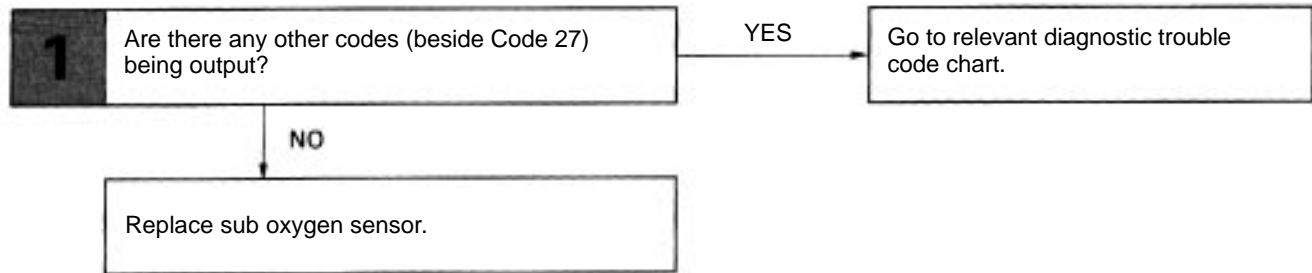
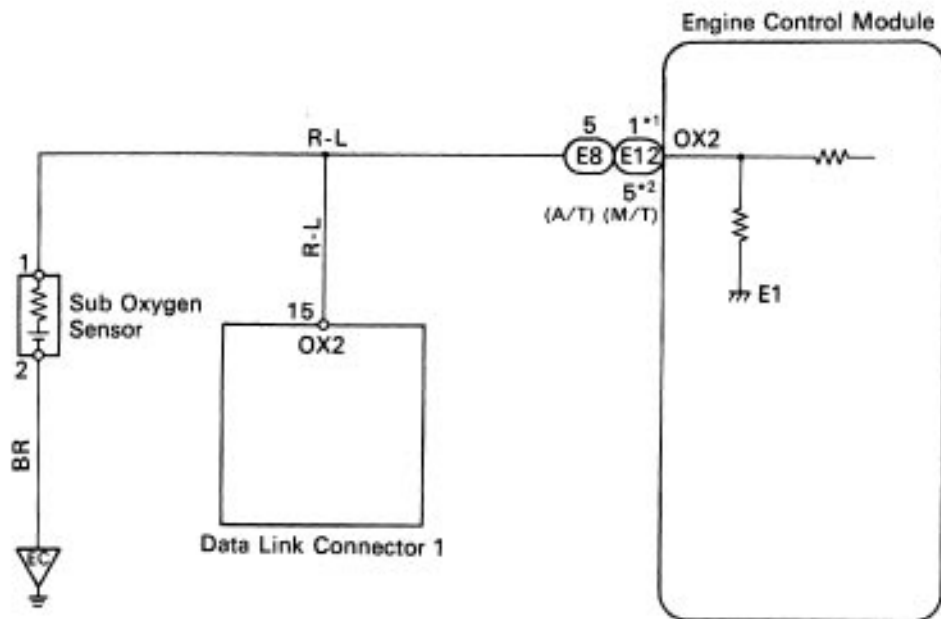
**Malfunction: Open or Short in Sub Oxygen Sensor**

F16527

- ① Disconnect the E F I fuse (15 A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of data link connector 1 or 2 with I G switch OFF).
- ② Start the engine and warm up, with all ACC switch OFF.
- ③ After the engine is warmed up, let it drive at 50 ~ 55 mph (80 ~ 88 km/h) for 10 min. or more.
- ④ After driving, stop at a safe place and perform idling for 2 min. or less.
- ⑤ After performing the idling in (4) , perform acceleration to 60 mph (96 km/h) with the throttle valve fully open.

HINT: If a malfunction exists, the malfunction indicator lamp will light up during step.

**NOTICE:** If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

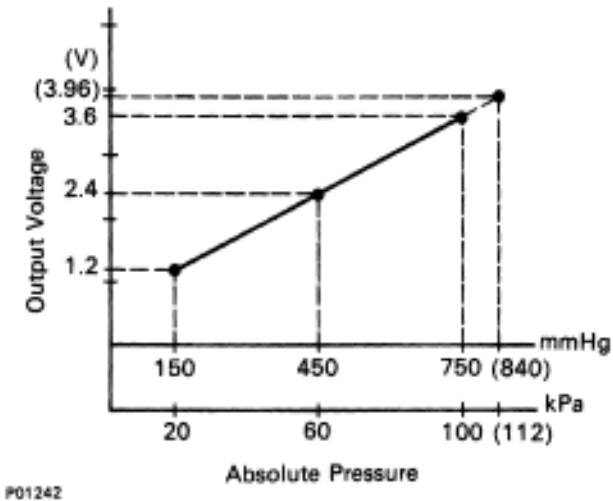
**DIAGNOSTIC CHART****WIRING DIAGRAM**

\*1: Except California specification vehicles with M/T.  
 \*2: Only for California specification vehicles with M/T.

# DTC 31 Manifold Absolute Pressure Sensor Circuit

## CIRCUIT DESCRIPTION

By a built-in sensor unit, the manifold absolute pressure sensor detects the intake manifold absolute pressure as a voltage. The ECM then determines the basic injection duration and basic ignition advance angle based on this voltage. Since the manifold absolute pressure sensor does not use the atmospheric pressure as a criterion, but senses the absolute pressure inside the intake manifold (the pressure in proportion to the preset absolute vacuum O), it is not influenced by fluctuations in the atmospheric pressure due to high altitude and other factors. This permits it to control the air-fuel ratio at the proper level under all conditions.



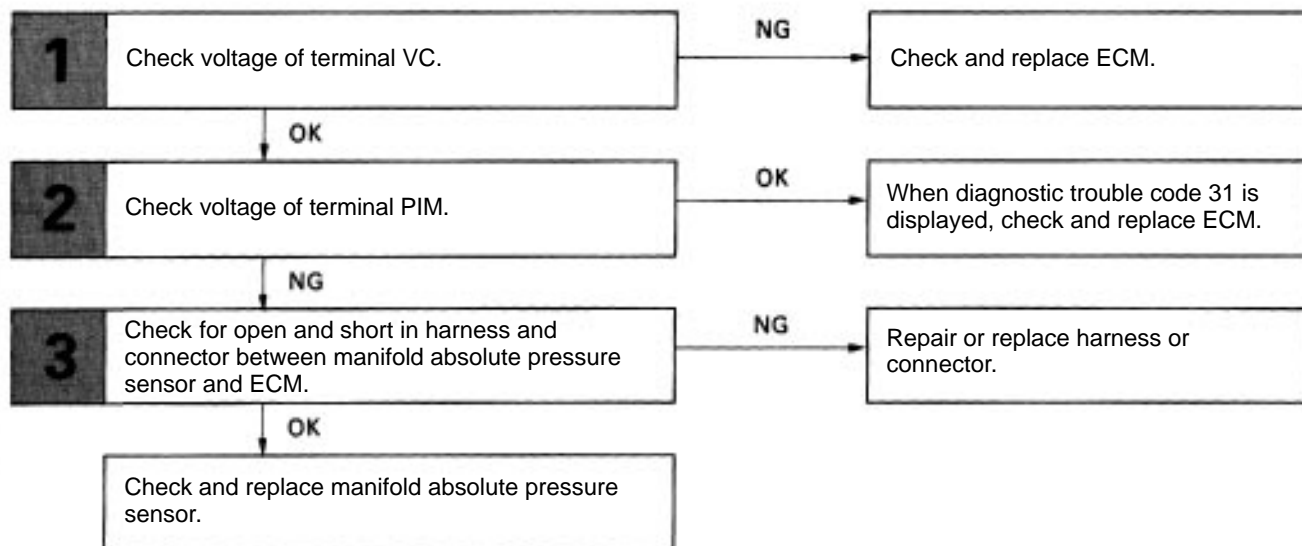
P01242

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
31	Open or short in manifold absolute pressure sensor circuit for 0.5 sec. or more.	<ul style="list-style-type: none"><li>• Open or short in manifold absolute pressure sensor circuit.</li><li>• Manifold absolute pressure sensor.</li><li>• ECM</li></ul>

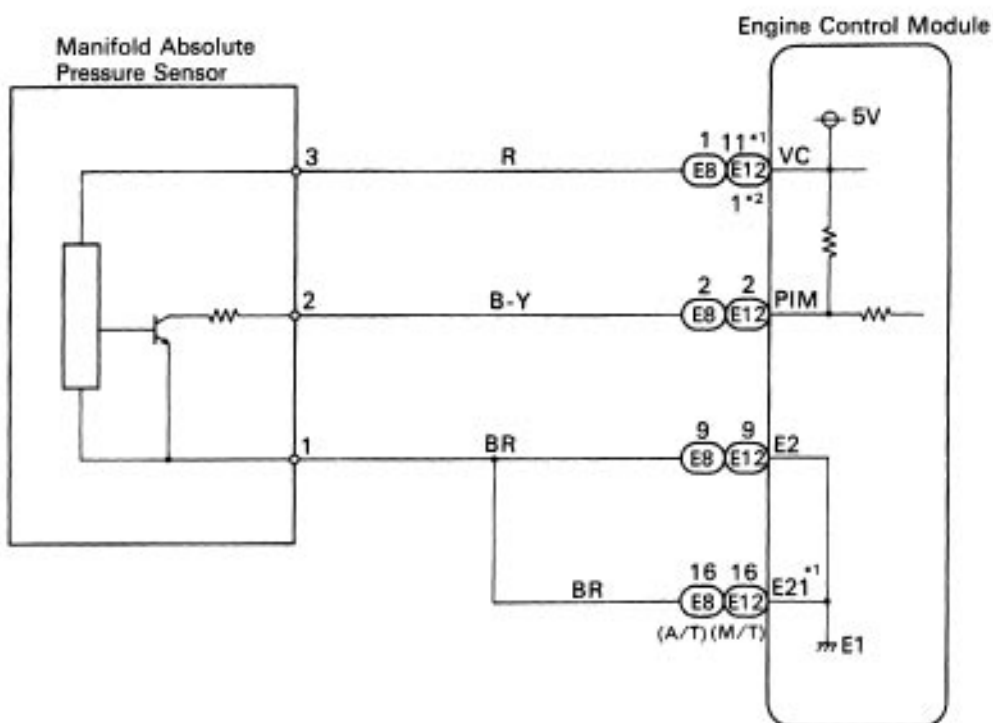
If the ECM detect diagnostic trouble code “31 “, it operates the fail safe function, keeping the ignition timing and fuel injection volume constant and making it possible to drive the vehicle.




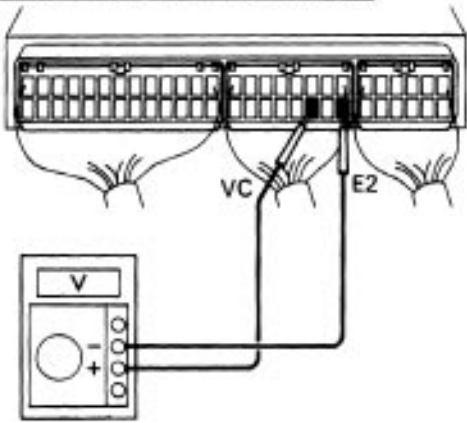
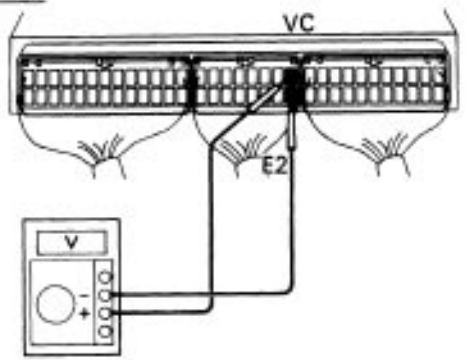
## DIAGNOSTIC CHART



## WIRING DIAGRAM

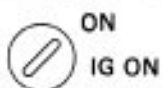


## INSPECTION PROCEDURE

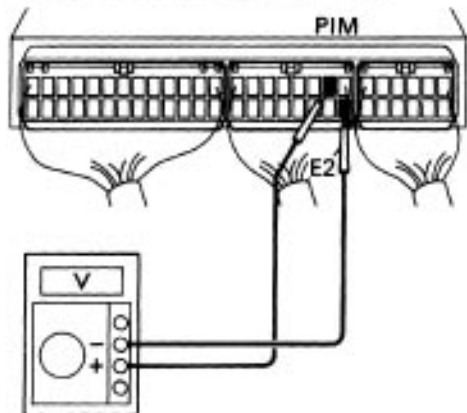
<b>1</b> Check voltage between terminals VC and E2 of engine control module connector.	
<p> ON IG ON</p> <p><u>Exc. California spec. with M/T</u></p>  <p><u>Others</u></p>  <p>BC6653 FI6666 FI6667</p>	<p><b>P</b> (1) Remove glove compartment. (See page <a href="#">EG1-234</a>). (2) Turn ignition switch on.</p> <p><b>C</b> Measure voltage between terminals VC and E2 of engine control module connector.</p> <p><b>OK</b> Voltage: 4.5 ~ 5.5 V</p>
<div><b>OK</b></div>	<div><b>NG</b> Check and replace engine control module.</div>

**2**

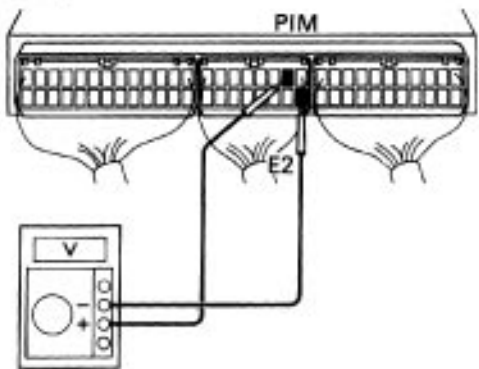
Check voltage between terminals PIM and E2 of engine control module connector.



Exc. California spec. with M/T



Others



B16653  
F16658  
F16659

- P** Turn ignition switch on
- C** Measure voltage between terminals PIM and E2 of engine control module connector.
- OK** Voltage: 13 – 3.9 V

NG

OK

When diagnostic trouble code 31 is displayed, check and replace engine control module.

**3**

Check for open and short in harness and connector between engine control module and manifold absolute pressure sensor  
(See page [IN-31](#)).

OK

NG

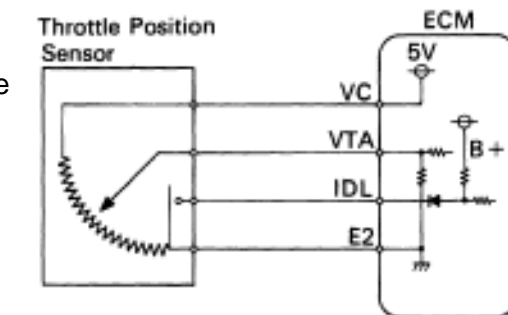
Repair or replace harness or connector.

Check and replace manifold absolute pressure sensor.

## DTC 41 Throttle Position Sensor Circuit

### CIRCUIT DESCRIPTION

The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle. When the throttle valve is fully closed, the I D L contacts in the throttle position sensor are on, so the voltage at the terminal I D L of the ECM become 0 V. At this time, a voltage of approximately 0.7 V is applied to the terminal VTA of the ECM. When the throttle valve is opened, the I D L contacts go off and thus the power source voltage of approximately 12 V in the ECM is applied to the terminal IDL of the ECM. The voltage applied to the terminal VTA of the ECM increases in proportion to the opening angle of the throttle valve and becomes approximately 3.2 – 4.9 V when the throttle valve is fully opened. The ECM judges the vehicle driving conditions from these signals input from the terminals VTA and IDL, and uses them as one of the conditions for deciding the air–fuel ratio correction, power increase correction and fuel–cut control etc.



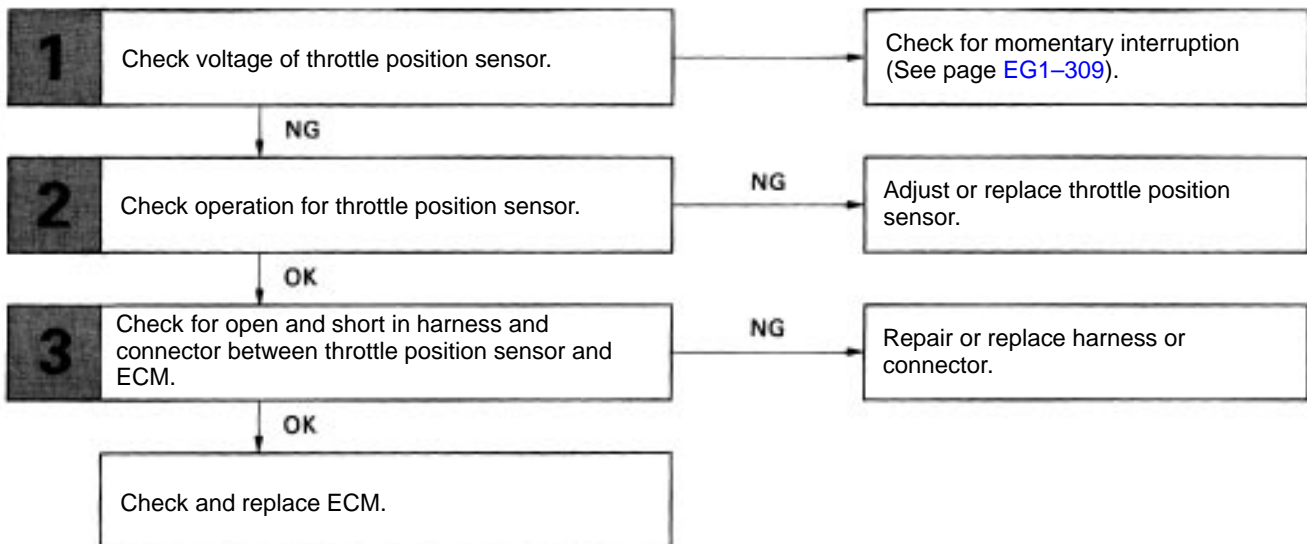
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
41	Open or short in throttle position sensor circuit for 0.5 sec. or more.	<ul style="list-style-type: none"> <li>Open or short in throttle position sensor circuit.</li> <li>Throttle position sensor.</li> <li>ECM</li> </ul>

#### HINT;

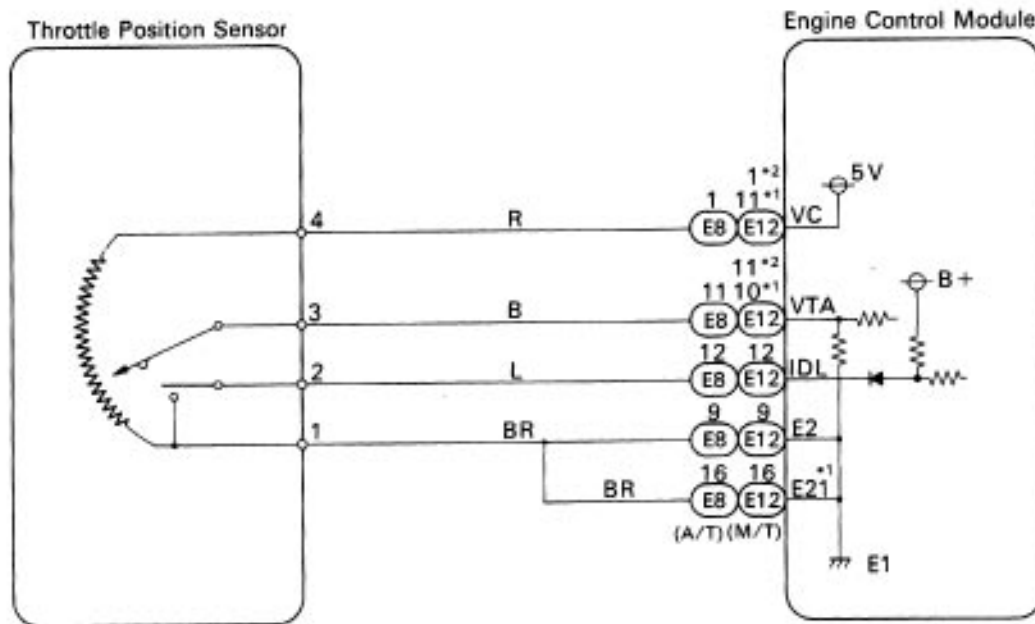
- When the connector for the throttle position sensor is disconnected, diagnostic trouble code 41 is not displayed. Diagnostic trouble code 41 is displayed only when there is an open or short in the VTA signal circuit of the throttle position sensor.

## DIAGNOSTIC CHART

HINT: If diagnostic trouble codes "22" (engine coolant temperature sensor circuit), "24" (intake air temperature sensor circuit), "31" (manifold absolute pressure sensor circuit) and "41" (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.



## WIRING DIAGRAM



\*1: Except California specification vehicles.

\*2: Only for California specification vehicles.

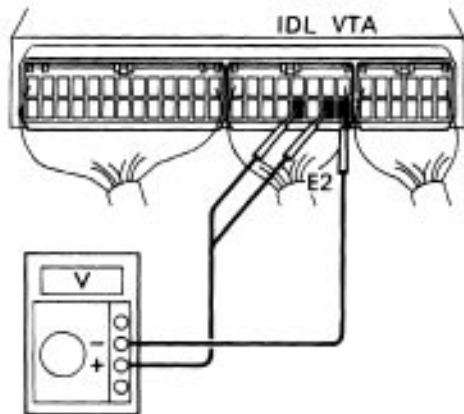
## INSPECTION PROCEDURE

HINT: If diagnostic trouble code "22" (engine coolant temperature sensor circuit), "24" (intake air temperature sensor circuit), "31" (manifold absolute pressure sensor circuit) and "41" (throttle position sensor circuit) are output simultaneously, E2 (sensor ground) may be open.

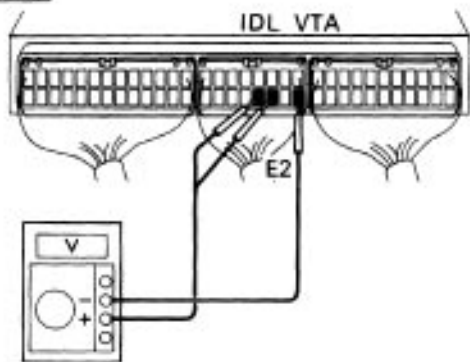
### Check voltage between terminals VTA, IDL and E2 of engine control module connector.



Exc. California spec. with M/T



Others



886653  
F16670  
F16671

- P** (1) Remove glove compartment.  
(See page [EG1-234](#)).  
(2) Disconnect the vacuum hose from the throttle body, then apply vacuum to the throttle opener (See page [EG1-204](#)).  
(3) Turn ignition switch ON.
- C** Measure voltage between terminals VTA, IDL and E2 of engine control module connector when the throttle valve is opened gradually from the closed condition.

**OK**

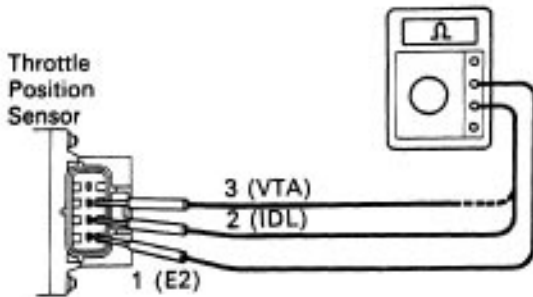
Terminal	VTA - E2	IDL - E2
Throttle Valve		
Fully Closed	0.3 - 0.8 V	0 - 3.0 V
Fully Open	3.2 - 4.9 V	9 - 14 V

**HINT** The voltage should increase steadily in proportion to the throttle valve opening angle.

**NG**

**OK**

Check for momentary interruption  
(See page [EG1-309](#)).

**2****Check throttle position sensor.**

- P** (1) Disconnect throttle position sensor connector.  
(2) Disconnect the vacuum hose from the throttle body, then apply vacuum to the throttle opener (See page [EG1-204](#)).

- C** Measure resistance between terminals 3 (VTA), 2 (IDL) and 1 (E2) of throttle position sensor connector when the throttle valve is opened gradually from the closed condition.

**OK**

Terminal	3 (VTA) – 1 (E2)	2 (IDL) – 1 (E2)
Throttle Valve		
Fully Closed	0.2 – 5.7 kΩ	Less than 2.3 kΩ
Fully Open	2.0 – 10.2 kΩ	1MΩ or higher

- Hint** Resistance between terminals 3 (VTA) and 1 (E2) should increase gradually in accordance with the throttle valve opening angle.

**OK****NG**

**Adjust or replace throttle position sensor**  
(See page [EG1-209](#)).

**3****Check for open and short in harness and connector between engine control module and throttle position sensor (See page [IN-31](#)).****OK****NG**

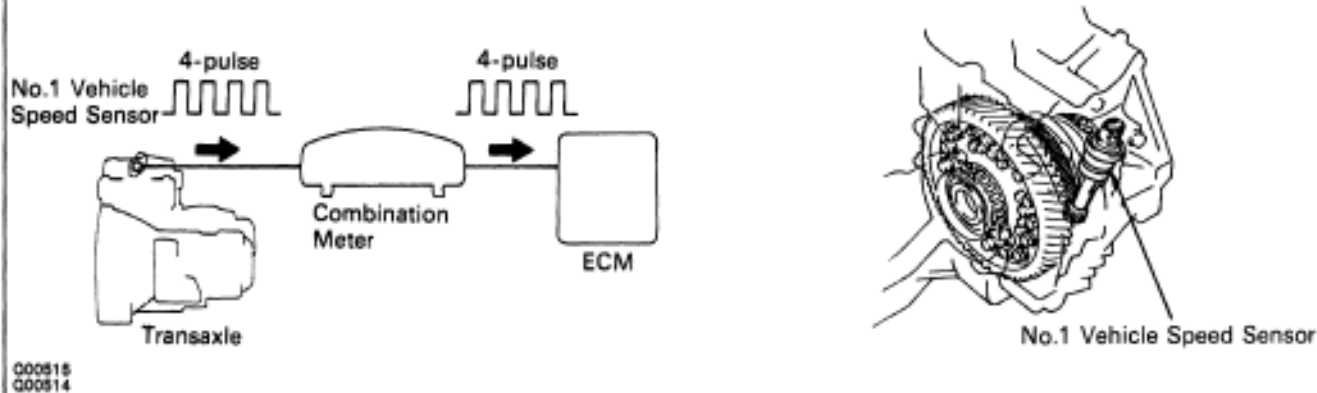
**Repair or replace harness or connector.**

**Check and replace engine control module.**

# DTC 42 No.1 Vehicle Speed Sensor Signal Circuit

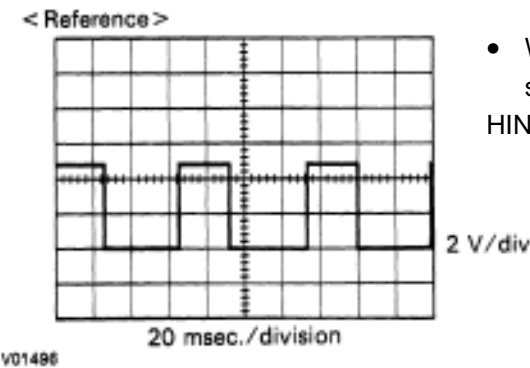
## CIRCUIT DESCRIPTION

The No.1 vehicle speed sensor outputs a 4-pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is then transmitted to the ECM. The ECM determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
42	For A/T All conditions below are detected continuously for 8 sec. or more. (a) No.1 Vehicle speed signal: 0 mph (km/h) (b) Engine speed: 3,100 rpm or more (c) Park/Neutral position switch: OFF	<ul style="list-style-type: none"><li>• Open or short in No.1 vehicle speed sensor circuit.</li><li>• No.1 vehicle speed sensor.</li><li>• Combination meter.</li><li>• ECM</li></ul>
	For M/T All conditions below are detected continuously for 8 sec. or more. (a) No.1 vehicle speed signal: 0 mph (km/h) (b) Engine speed: Between 3,100 rpm and 5,000 rpm (c) Engine coolant temp.: 80°C (176°F) or more (d) Load driving	

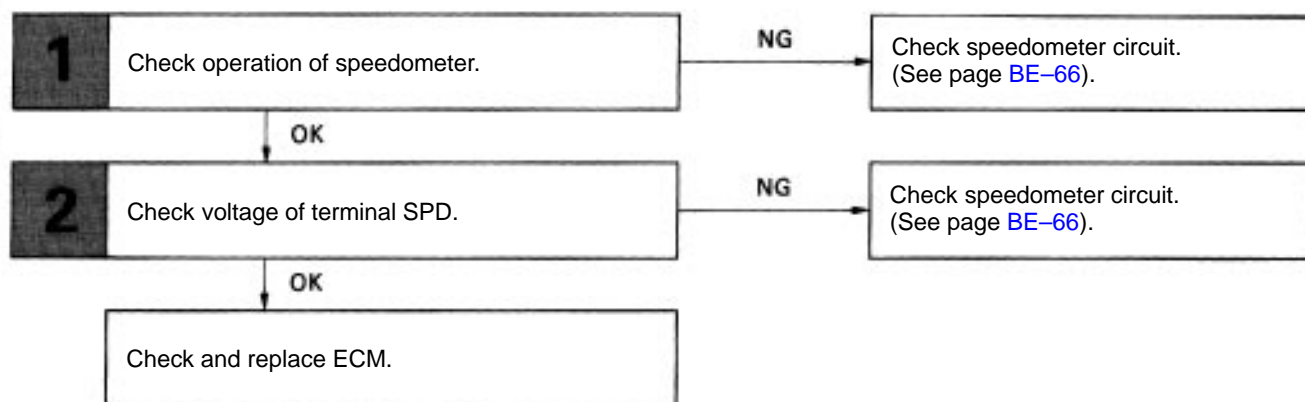
HINT: In test mode, diagnostic trouble code 42 is output when vehicle speed is 3 mph (5 km/h) or below.



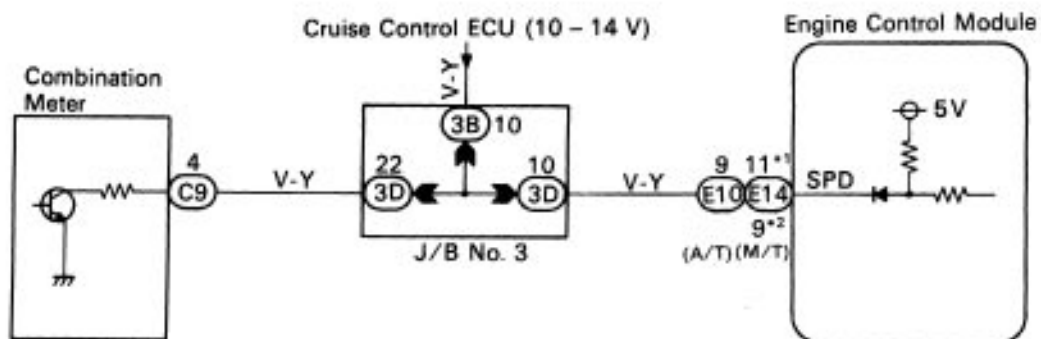
- Waveform between terminals SPD and E1 when vehicle speed is approx. 12 mph (20 km/h).
- HINT: The greater the vehicle speed, the greater the number of No.1 vehicle speed sensor signals produced.



## DIAGNOSTIC CHART



## WIRING DIAGRAM



\*1: Except California specification vehicles.  
 \*2: Only for California specification vehicles.

## INSPECTION PROCEDURE

### 1

Check operation of speedometer.

**C** Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.

**Hint** The No. 1 vehicle speed sensor is operating normally if the speedometer display is normal.

**OK**

**NG**

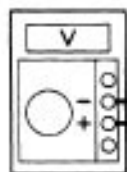
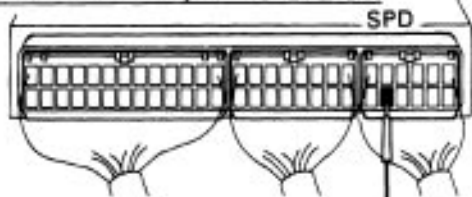
Check speedometer circuit. See combination meter troubleshooting on page [BE-66](#).

### 2

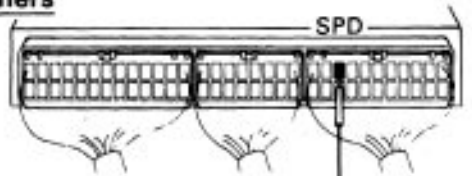
Check voltage between terminal SPD of engine control module connector and body ground.

ON  
IG ON

Exc. California spec. with M/T



Others



810653  
F16072  
F16073

**P**

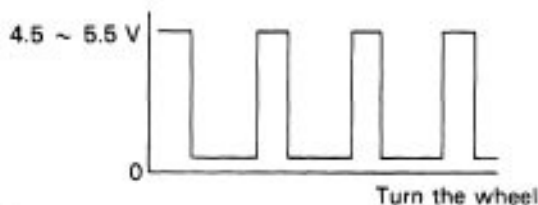
- (1) Remove glove compartment. (See page [EG1-234](#)).
- (2) Disconnect cruise control ECU connector.
- (3) Shift the shift lever to N position or neutral.
- (4) Jack up a front wheel on one side.
- (5) Turn ignition switch on.

**C**

Measure voltage between terminal SPD of engine control module connector and body ground when the wheel is turned slowly.

**OK**

Voltage is generated intermittently.



A77809

**OK**

**NG**

Check speedometer circuit. See combination meter troubleshooting on page [BE-66](#).

Check and replace engine control module.

## DTC 43 Starter Signal Circuit

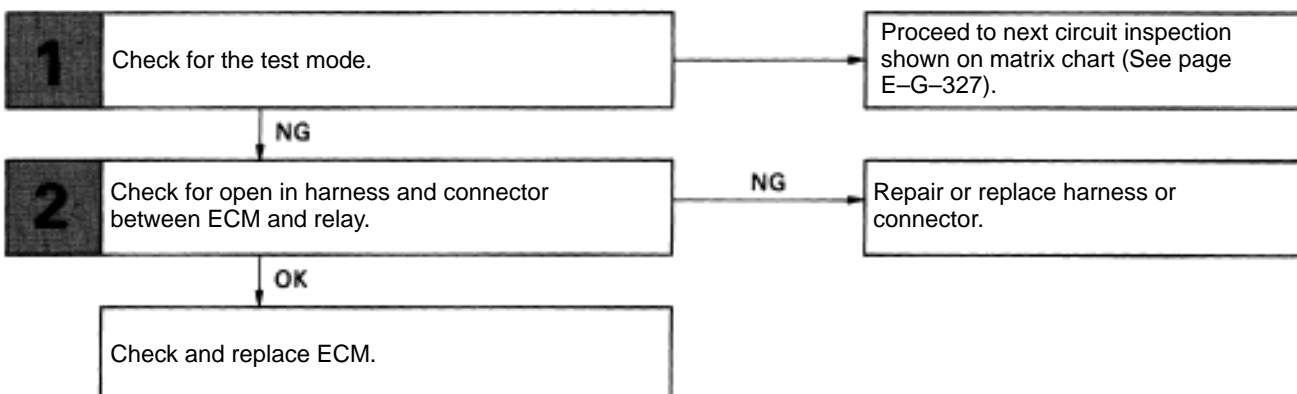
### CIRCUIT DESCRIPTION

When the engine is cranked, the intake air flow is slow, so fuel vaporization is poor. A rich mixture is therefore necessary in order to achieve good startability. While the engine is being cranked, the battery positive voltage is applied to terminal STA of the ECM. The starter signal is mainly used to increase the fuel injection volume for the starting injection control and after-start injection control.

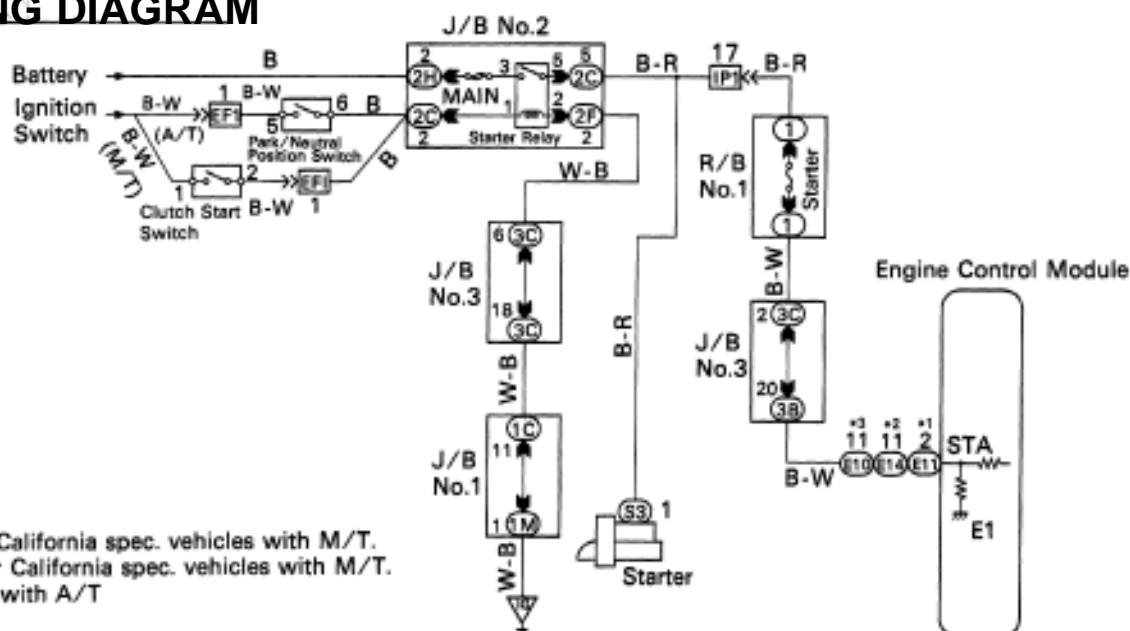
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
<b>43</b>	No starter signal to ECM.	<ul style="list-style-type: none"> <li>Open or short in starter signal circuit.</li> <li>Open or short in ignition switch or starter relay circuit.</li> <li>ECM</li> </ul>

### DIAGNOSTIC CHART

HINT: This diagnostic chart is based on the premise that the engine is cranked normally. If the engine is not cranked, proceed to the matrix chart of problem symptoms on page [EG1-327](#),



### WIRING DIAGRAM



- \*1: Except California spec. vehicles with M/T.  
 \*2: Only for California spec. vehicles with M/T.  
 \*3: Vehicle with A/T

## INSPECTION PROCEDURE

### 1

Check output condition of diagnostic trouble code 43.



P00956

- P** Setting the test mode.
  - (1) Turn ignition switch OFF.
  - (2) Connect terminals TE2 and E1 of DLC2.
  - (3) Turn ignition switch ON.
  - (Don't start the engine)
  - (4) Connect terminals TE1 and E1 of DLC2.
- C** Check if code "43" is output by the malfunction indicator lamp.
- OK** Code "43" is output.
- C** Start the engine.  
Check if the code "43" disappear.
- OK** Code "43" is not output.

**NG**

**OK**

Proceed to next circuit inspection shown on matrix chart (See page [EG1-327](#)).

### 2

Check for open in harness and connector between engine control module and starter relay (See page [IN-31](#)).

**OK**

**NG**

Repair or replace harness or connector.

Check and replace engine control module.

## DTC 52 Knock Sensor Circuit

### CIRCUIT DESCRIPTION

Knock sensor is fitted the cylinder block to detect engine knocking. This sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, ignition timing is retarded to suppress it.

DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
<b>52</b>	Open or short in knock sensor circuit with engine speed between 1,200 rpm and 6,000 rpm.	<ul style="list-style-type: none"> <li>• Open or short in knock sensor circuit.</li> <li>• Knock sensor (looseness)</li> <li>• ECM</li> </ul>

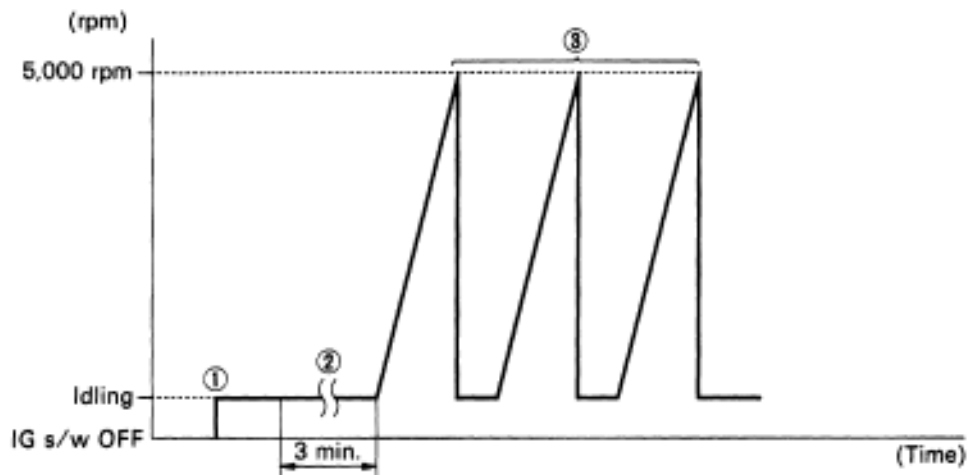
If the ECM detects the above diagnosis conditions, it operates the fail safe function in which the corrective retard angle value is set to the maximum value.

### DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN

#### Purpose of the driving pattern.

- To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
- To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

#### Malfunction: Open or Short in Knock Sensor

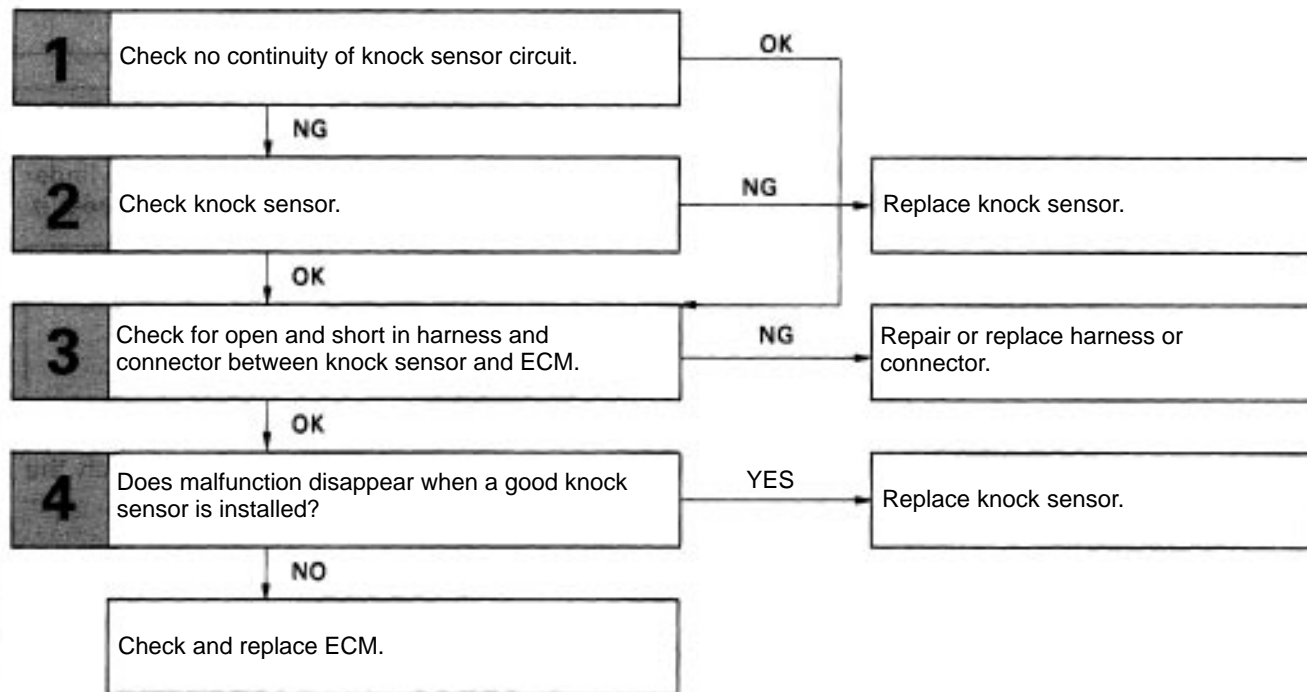
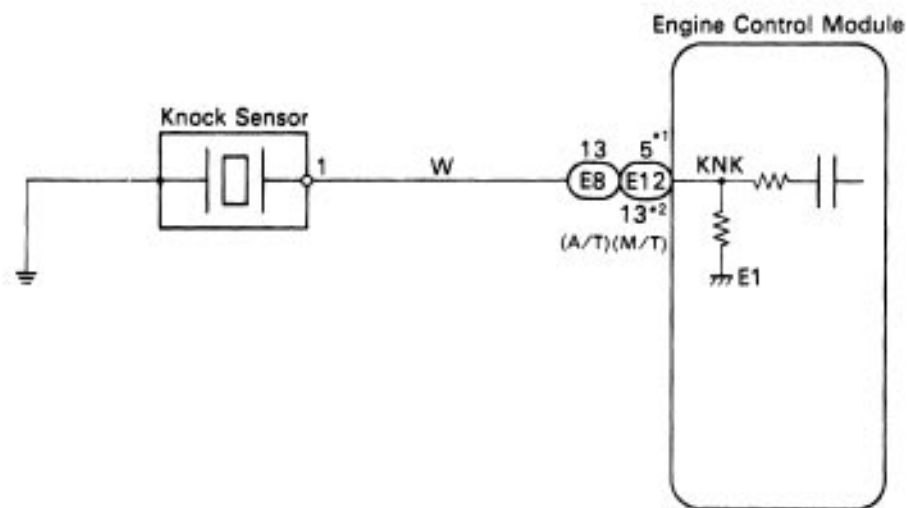


FI6461

- ① Start engine and warm up.
- ② After engine is warmed up, let it idle for 3 min.
- ③ With the A/C ON, perform quick racing (5,000 rpm) 3 times.  
(Rapidly depress the accelerator pedal and suddenly release it.)

HINT: If a malfunction exists, the malfunction indicator lamp will light up when sudden racing is performed.

**NOTICE:** If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

**DIAGNOSTIC CHART****WIRING DIAGRAM**

\*1: Except California specification vehicles with M/T.

\*2: Only for California specification vehicles with M/T.

## INSPECTION PROCEDURE

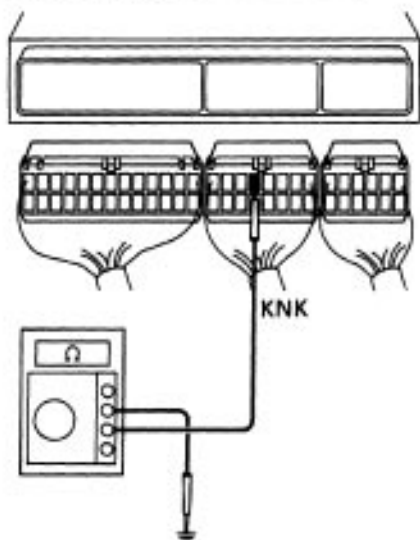
1

Check continuity between terminal **KNK** of engine control module connector and body ground.

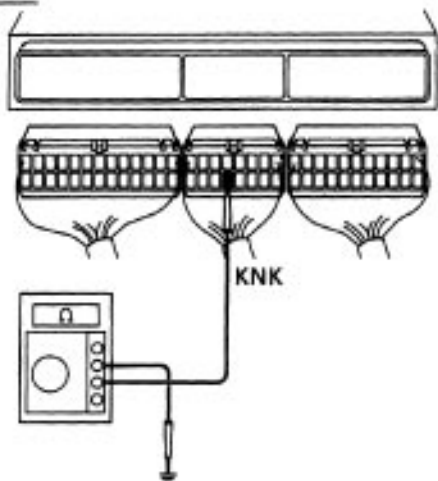
OFF



Exc. California spec. with M/T



Others



B06653  
F16723  
F16724

- P** (1) Remove glove compartment.  
(See page [EG1-234](#))  
(2) Disconnect the engine control module connector.
- C** Measure resistance between terminal **KNK** of engine control module connector and body ground.
- OK** **Resistance: 1 MΩ or higher**

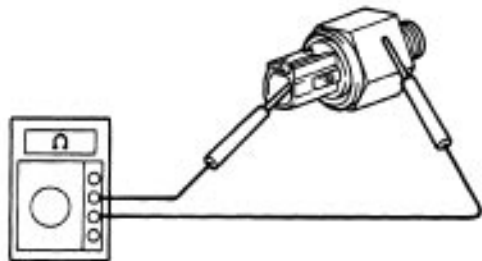
**NG**

**OK**

Go to step

**3**

## 2 Check knock sensor.



F16630

**P** Disconnect knock sensor connector.

**C** Measure resistance between the knock sensor terminal and body.

**OK** Resistance: 1 M $\Omega$  or higher

**OK****NG**Replace knock sensor (See page [EG1-93](#)).

## 3

Check for open and short in harness and connector between engine control module and knock sensor (See page [IN-31](#)).

**OK****NG**

Repair or replace harness or connector.

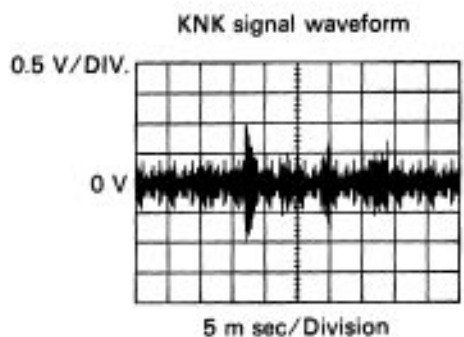
## 4

Does malfunction disappear when a good knock sensor is installed?

**NO****YES**Replace knock sensor (See page [EG1-93](#)).

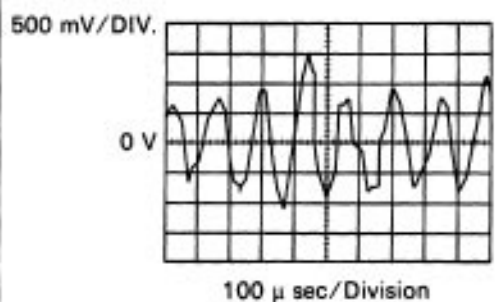
Check and replace engine control module.



**Reference** **INSPECTION USING OSCILLOSCOPE**

- With the engine racing (4,000 rpm) measure waveform between terminal KN K of engine control module and body ground.

HINT: The correct waveform appears as shown in the illustration on the left.



- Spread the time on the horizontal axis, and confirm that period of the wave is 132  $\mu$  sec. (Normal mode vibration frequency of knock sensor: 7.6 KHz).

HINT: If normal mode vibration frequency is not 7.6 KHz, the sensor is malfunctioning.

## DTC 71 EGR System Malfunction

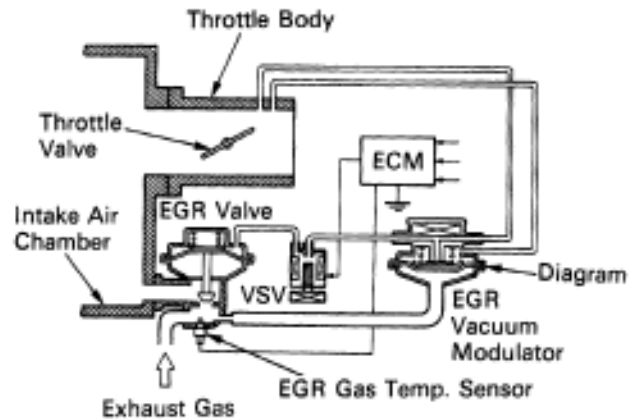
### CIRCUIT DESCRIPTION

The EGR system recirculates exhaust gas, which is controlled to the proper quantity to suit the driving conditions, into the intake air mixture to slow down combustion, reduce the combustion temperature and reduces NOx emissions. The amount of EGR is regulated by the EGR vacuum modulator according to the engine load.

If even one of the following conditions is fulfilled, the VSV is turned ON by a signal from the ECM. This results in atmospheric air acting on the EGR valve, closing the EGR valve and shutting off the exhaust gas (EGR cut-OFF).

Under the following conditions, EGR is cut to maintain driveability.

- Engine coolant temp. below 60°C (140°F).
- During deceleration (throttle valve closed).
- Light engine load (amount of intake air very small).
- Engine speed over 4,400 rpm.
- Engine racing.



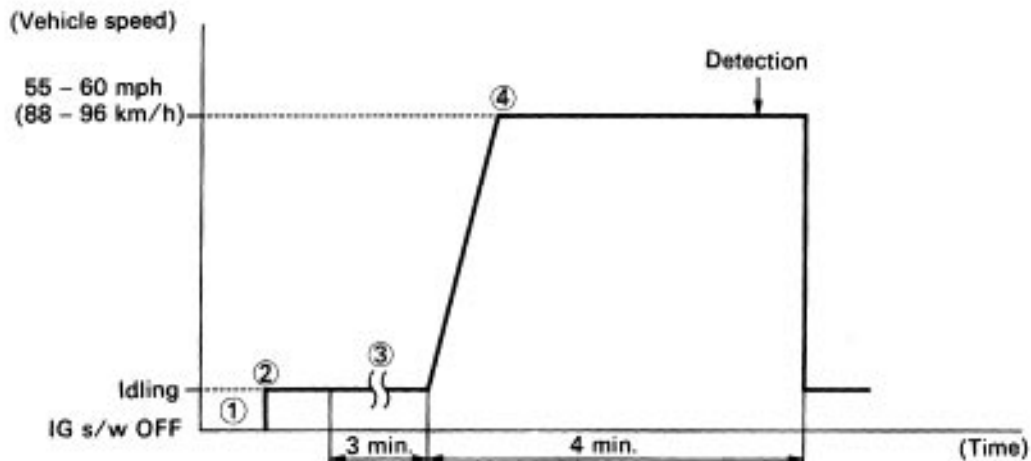
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
71	<p>EG R gas temp. is 70°C (158°F) or below for 50 sec. under conditions (a) and (b). (2 trip detection logic) *</p> <p>(a) Engine coolant temp.: 80°C (176°F) or more. (b) EGR operation possible (EX. A/T in 3rd speed (5th for M/T), 55 – 60 mph (88 – 96 km/h), Flat road).</p>	<ul style="list-style-type: none"> <li>• Open in EGR gas temp. sensor circuit.</li> <li>• Short in VSV circuit for EGR.</li> <li>• EGR hose disconnected, valve stuck.</li> <li>• Clogged EGR gas passage.</li> <li>• ECM</li> </ul>

\*: See page [EG1-307](#).

**CIRCUIT DESCRIPTION (Cont'd)****DIAGNOSIS TROUBLE CODE DETECTION DRIVING PATTERN**

Purpose of the driving pattern.

- (a) To simulate diagnostic trouble code detecting condition after diagnostic trouble code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed confirming that diagnostic trouble code is no longer detected.

**Malfunction: Open in EGR gas temp. sensor circuit**

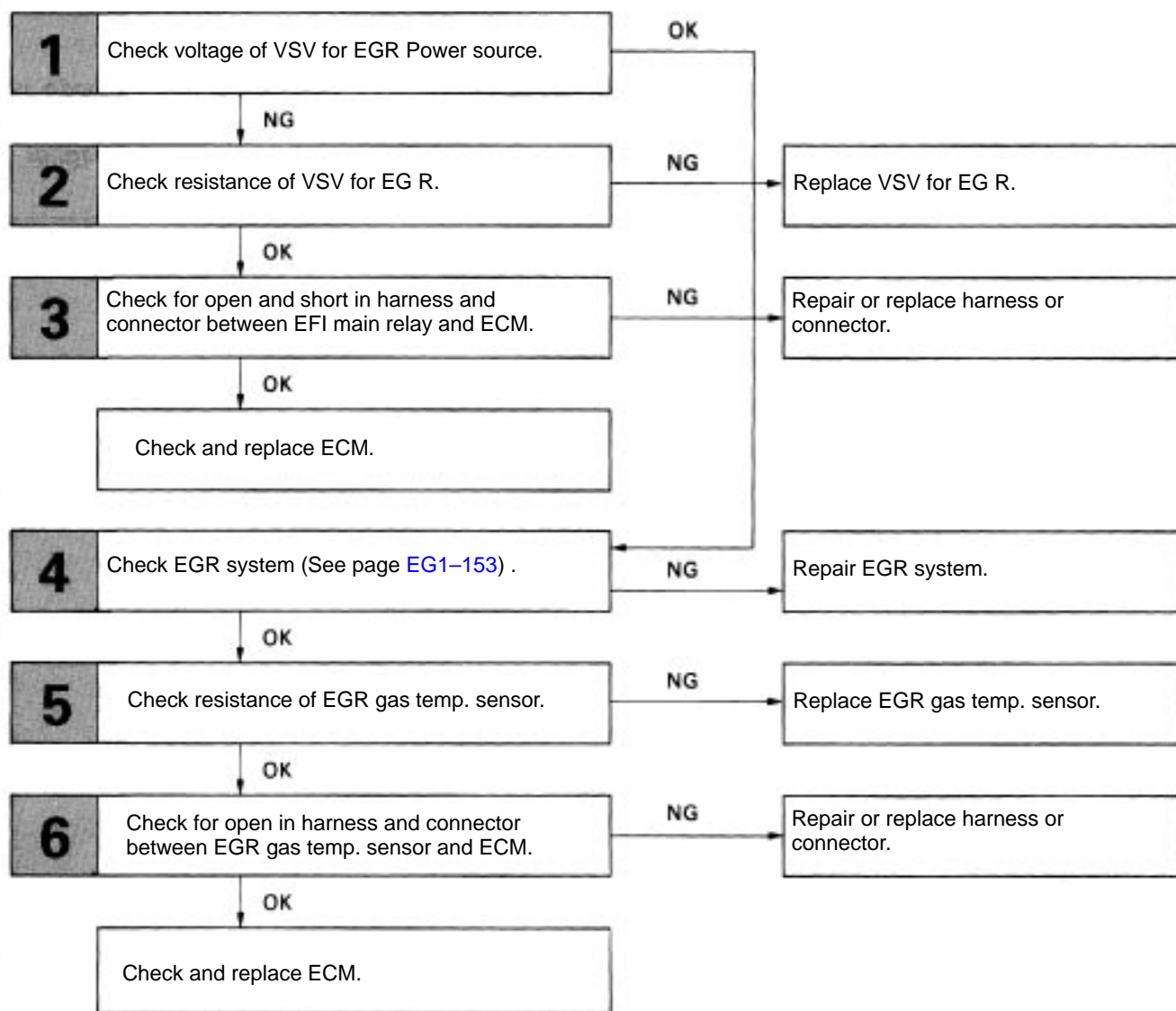
FI6528

- ① Disconnect the EFI fuse (15 A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of data link connector, 1 or 2 with IG switch OFF).
- ② Start the engine and warm up.
- ③ After the engine is warmed up, let it idle for 3 min.
- ④ With the A/C ON and transmission in 5th gear A/T in "D" position), drive at 55 - 60 mph (88 - 96 km/h) for 4 min. or less.

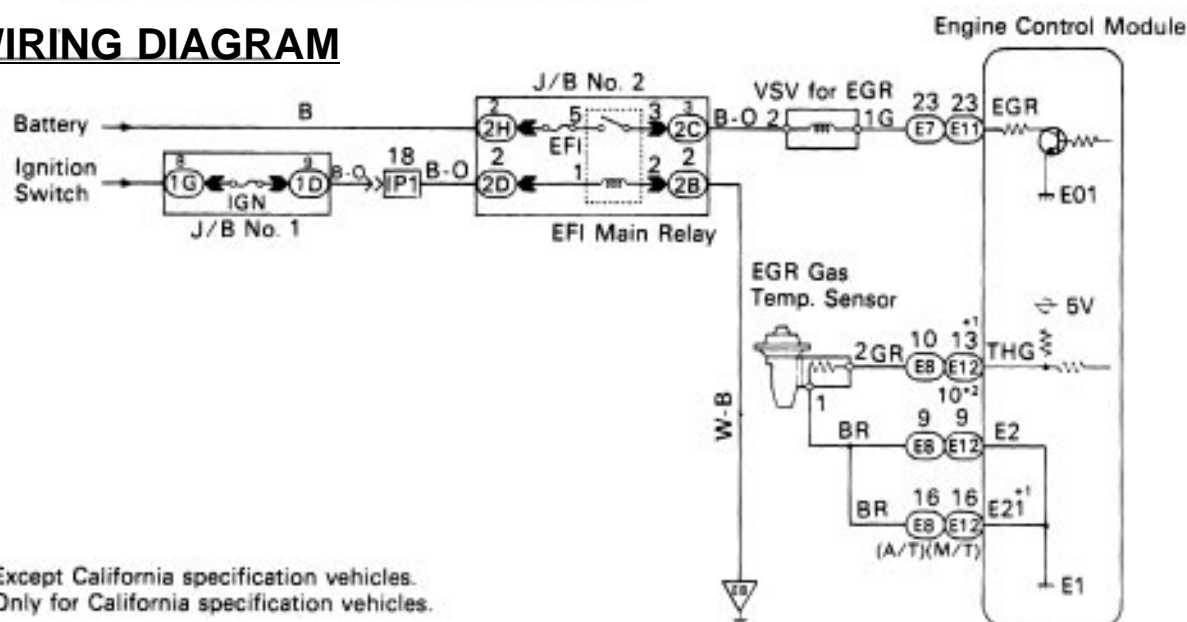
HINT: If a malfunction exists, the malfunction indicator lamp will light up during step (4) .

**NOTICE:** If the conditions in this test are not strictly observed, detection of the malfunction will not be possible.

## DIAGNOSTIC CHART



## WIRING DIAGRAM



\*1: Except California specification vehicles.

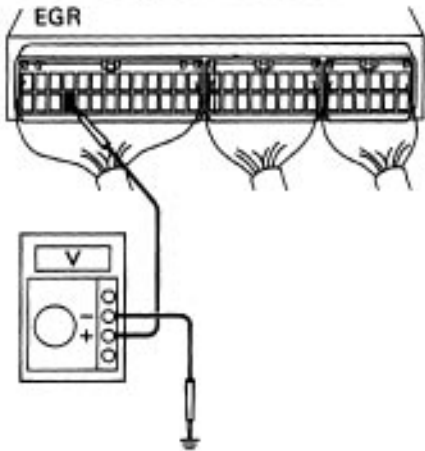
\*2: Only for California specification vehicles.

# INSPECTION PROCEDURE

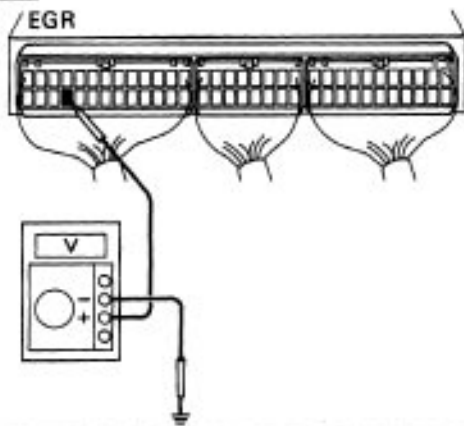
## 1

Check voltage between terminal EGR of engine control module connector and body ground.

**Exc. California spec. with M/T**



**Others**



F16726  
F16725

- P** (1) Remove glove compartment.  
(See page [EG1-234](#)).  
(2) Warm up engine to normal operating temperature.

- C** Measure voltage between terminal EGR of engine control module connector and body ground.

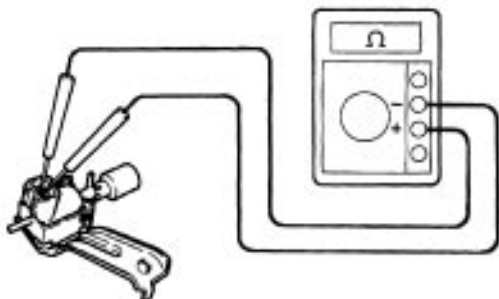
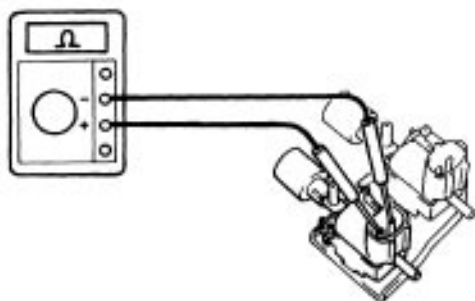
**OK** Voltage: 9 –14 V

**NG**

**OK**

Go to step



**2****Check resistance between terminals of VSV for EGR.**Exc. California spec.Only for California spec.P00620  
P14145

- P** Remove VSV for EGR. (See page [EG1-154](#), 155\*).
- C** Measure resistance between terminals of VSV for EGR.

**OK** Resistance: 33 – 39Ω (Cold)

\*: Except California specification vehicle.

**OK****NG**

Replace VSV for EGR.

**3****Check for open and short in harness and connector between EFI main relay and VSV for EGR, VSV and engine control module. (See page [IN-31](#)).****OK****NG**

Repair or replace harness or connector.

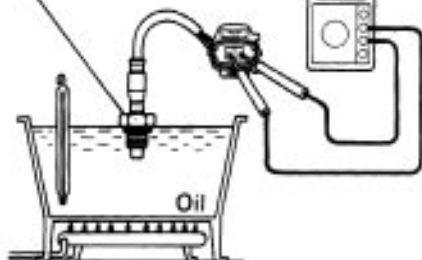
Check and replace engine control module.

**4****Check EGR system (See page [EG1-153](#)).****OK****NG**

Repair EGR system.

**5****Check resistance of EGR gas temp. sensor.**

EGR Gas Temp. Sensor



#16320

- P** Remove EGR gas temp. sensor.  
**C** Measure resistance between terminals of EGR gas temp. sensor connector.  
**OK** Resistance: 64 – 97 k $\Omega$  at 50°C (122°F)  
11 – 16 k $\Omega$  at 100°C (212°F)  
2 – 4 k $\Omega$  at 150°C (302°F)

**OK****NG**

Replace EGR gas temp. sensor.

**6****Check for open in harness and connector between EGR gas temp. sensor and engine control module (See page [IN-31](#)).****OK****NG**

Repair or replace harness or connector.

Check and replace engine control module.

## DTC 51 Switch Condition Signal Circuit

### CIRCUIT DESCRIPTION

#### Park/Neutral Position Switch Signal\*

The ECM uses the signals from the park/neutral position switch to determine whether the transmission is in park or neutral, or in some other gear.

#### Air Conditioning Switch Signal

The ECM uses the output from the air conditioning switch to determine whether or not the air conditioning is operating so that it can increase the idling speed of the engine if necessary.

#### Throttle Position Sensor IDL Signal

The IDL contacts are mounted in the throttle position sensor, and detects the idle condition.

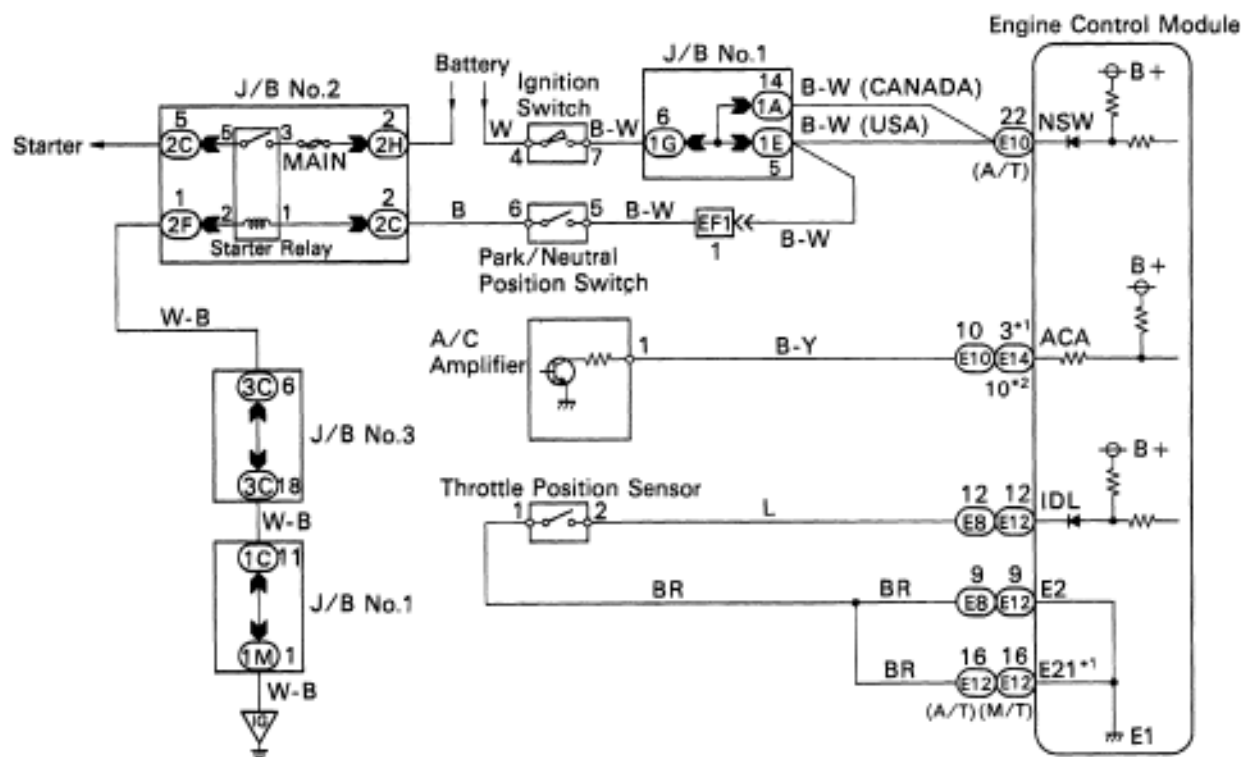
DTC No.	Diagnostic Trouble Code Detecting Condition	Trouble Area
<b>51</b>	(1) 3 sec. or more after engine starts with closed throttle position switch OFF (IDL). (2) * Park/ Neutral position switch OFF. (Shift position in "R", "D", "2" or "L" positions). (3) A/C switch ON.	<ul style="list-style-type: none"> <li>• Throttle position sensor IDL circuit</li> <li>• Accelerator pedal and cable</li> <li>• Park/Neutral position switch circuit</li> <li>• A/C switch circuit</li> <li>• ECM</li> </ul>

\*: Only vehicles with A/T.

HINT: In this circuit, diagnosis can only be made in the test mode.

### DIAGNOSTIC CHART

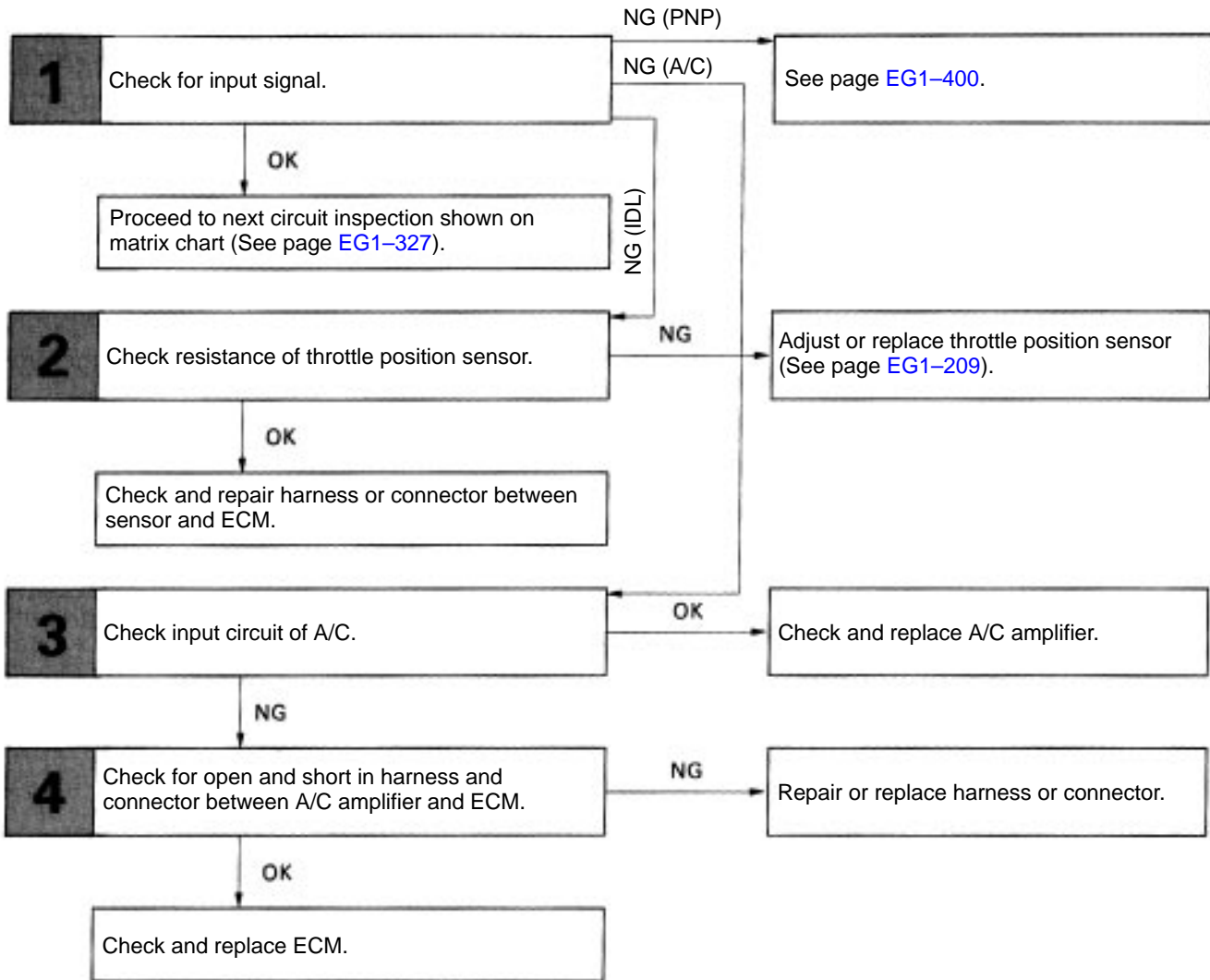
### WIRING DIAGRAM



\*1: Except California specification vehicles.

\*2: Only for California specification vehicles.



**DIAGNOSTIC CHART**

# INSPECTION PROCEDURE

1

Check output condition of diagnostic trouble code 51.



- P** Setting the test mode.
- (1) Turn ignition switch OFF.
  - (2) Connect terminals TE2 and E1 of DLC2.
  - (3) Turn ignition switch ON.
- (For checking terminal IDL, disconnect the vacuum hose from the throttle body, then apply vacuum to the throttle opener (See page [EG1-204](#)).)
- (For checking terminal A/C, start the engine.)
- (4) Connect terminals TE1 and E1 of DLC2.
- C** Check if code "51" is output by the malfunction indicator lamp.

OK

	Condition	Code
Park/Neutral Position Switch (PNP)	P or N position	Normal*
	R, D, 2 or L position	51*
Throttle Position Sensor (IDL)	Accelerator pedal released	Normal*
	Accelerator pedal depressed	51*
A/C Switch (A/C)	A/C SW ON	51
	A/C SW OFF	Normal

\*: Before the STA signal is input (ST is not ON), diagnostic trouble code 43 is also output.

Hint

Diagnostic trouble code 42 is output with vehicle speed 3 mph (5 km/h) or below.

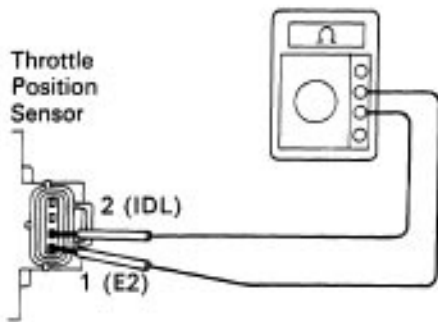
OK

NG

IDL .... Go to step  
A/C ... Go to step

PN P ... Go to page  
[EG1-400](#).

Proceed to next circuit inspection shown on matrix chart (See page [EG1-327](#)).

**2****Check resistance of throttle position sensor.**

F16564

- P** (1) Disconnect throttle position sensor connector.  
 (2) Disconnect the vacuum hose from the throttle body, then apply vacuum to the throttle opener (See page [EG1-204](#)).
- C** Measure resistance between terminals 2 (IDL) and 1 (E2) of throttle position sensor connector.

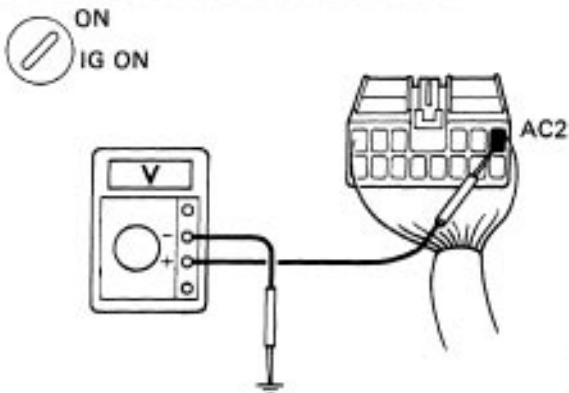
**OK**

Throttle Valve	Resistance
Fully closed	Less than 2.3 kΩ
Opened	1 MΩ or higher

**OK****NG**

**Adjust or replace throttle position sensor**  
 (See page [EG1-209](#)).

Check and repair harness or connector between engine control module and throttle position sensor.

**3****Disconnect A/C amplifier connector, check voltage between terminal AC2 of A/C amplifier connector and body ground.**B16653  
F16689

- P** (1) Remove glove compartment (See page [BO-114](#)).  
 (2) Disconnect A/C amplifier connector.
- C** (3) Turn ignition switch on.  
 Measure voltage between terminal AC2 of A/C amplifier connector and body ground.

**OK****Voltage: 9 –14 V****OK****OK**

**Check and replace A/C amplifier.**

**4****Check for open and short in harness and connector between engine control module and A/C amplifier (See page [IN-31](#)).****OK****NG**

**Repair or replace harness or connector.**

Check and replace engine control module.

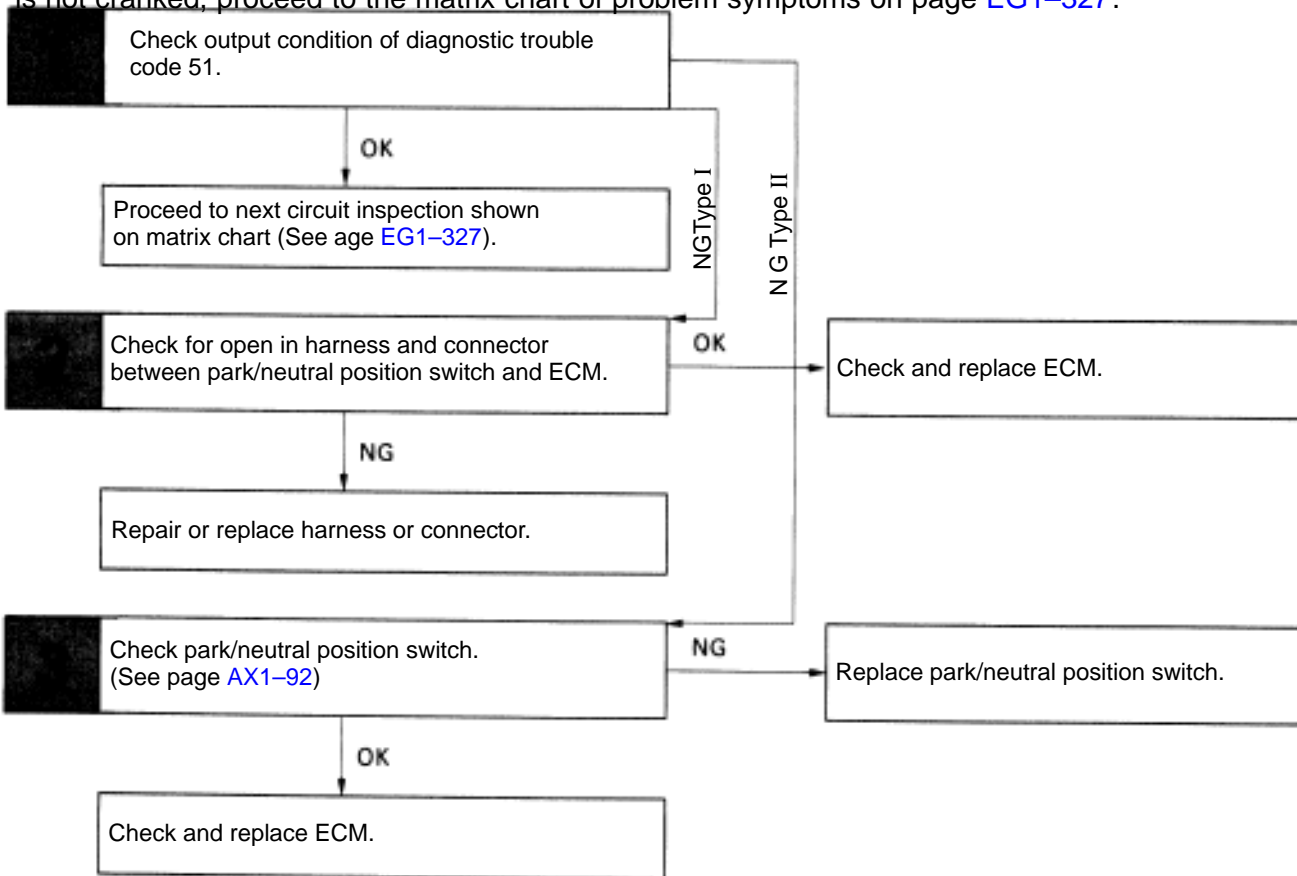
## Park Neutral Position Switch Circuit (Only vehicles with A-T)

### CIRCUIT DESCRIPTION

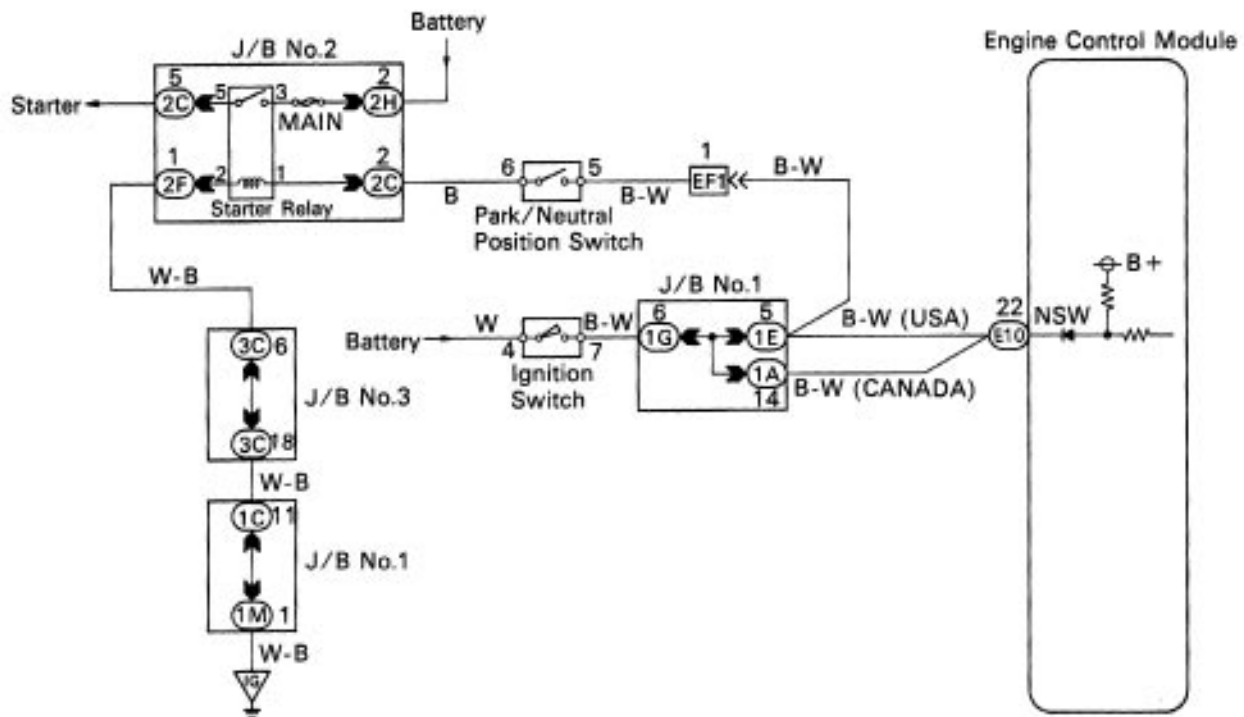
The Park/Neutral position switch goes on when the shift lever is in the N or P shift position. When it goes on the terminal NSW of the ECM is grounded to body ground via the starter relay and theft deterrent ECU, thus the terminal NSW voltage becomes 0V. When the shift lever is in the D, 2, L or R position, the Park/Neutral position switch goes off, so the voltage of ECM terminal NSW becomes battery voltage, the voltage of the ECM internal power source. If the shift lever is moved from the N position to the D position, this signal is used for air-fuel ratio correction and for idle speed control (estimated control), etc. When the Park/Neutral position switch is off, code "51" is output in the test mode diagnosis. (This is not abnormal.)

### DIAGNOSTIC CHART

HINT: This diagnosis chart is based on premise that the engine is cranked normally. If the engine is not cranked, proceed to the matrix chart of problem symptoms on page [EG1-327](#).

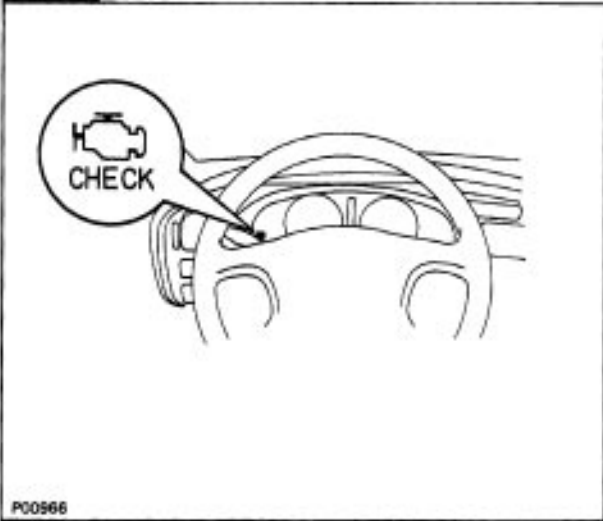


# WIRING DIAGRAM



INSPECTION PROCEDURE

Check output condition of diagnostic trouble code 51.



- P** (1) Connect terminals TE2 and E1 of DLC2.
- (2) Turn ignition switch on.
- (3) Crank the engine.
- C** (4) Connect terminals TE1 and E1 of DLC2.
- Check if diagnostic trouble code "51" is output when the shift lever is in the P and D shift positions.

Result

Shift Position	Result		
	OK	NG Type I	NG Type II
"P"	Normal Code	Code 51	Normal Code
"D"	Code 51	Code 51	Normal Code

OK

NG Type I Go to step **2**

NG Type II Go to step **3**

Proceed to next circuit inspection shown on matrix chart (See age [EG1-327](#)).

Check for open in harness and connector between engine control module and park/neutral position switch (See page [IN-31](#)).

NG

OK Check and replace engine control module.

Repair or replace harness or connector.

Check park/neutral position switch (See page [AX1-92](#)).

OK

NG Replace park/neutral position switch.

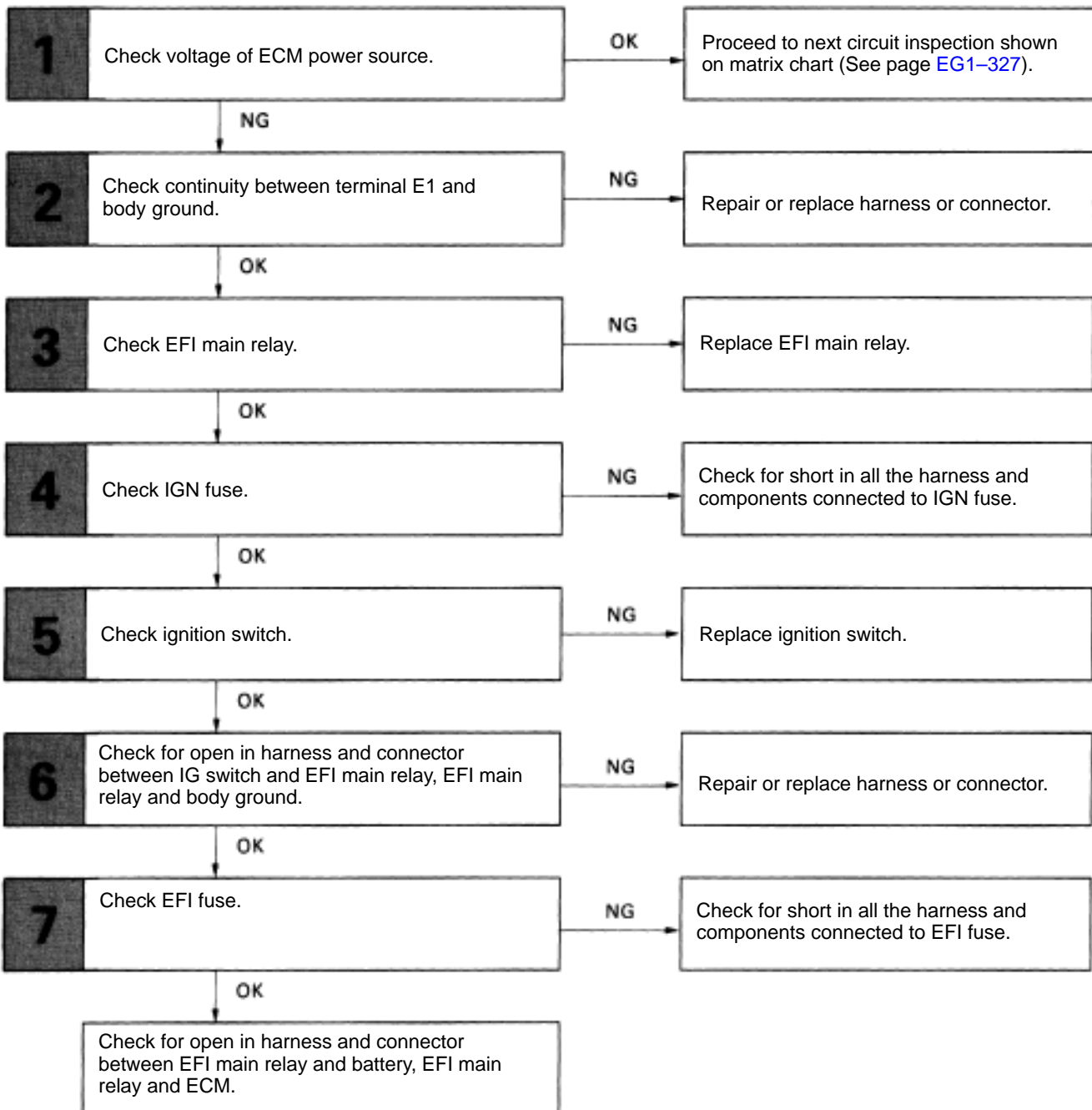
Check and replace engine control module.

# ECM Power Source Circuit

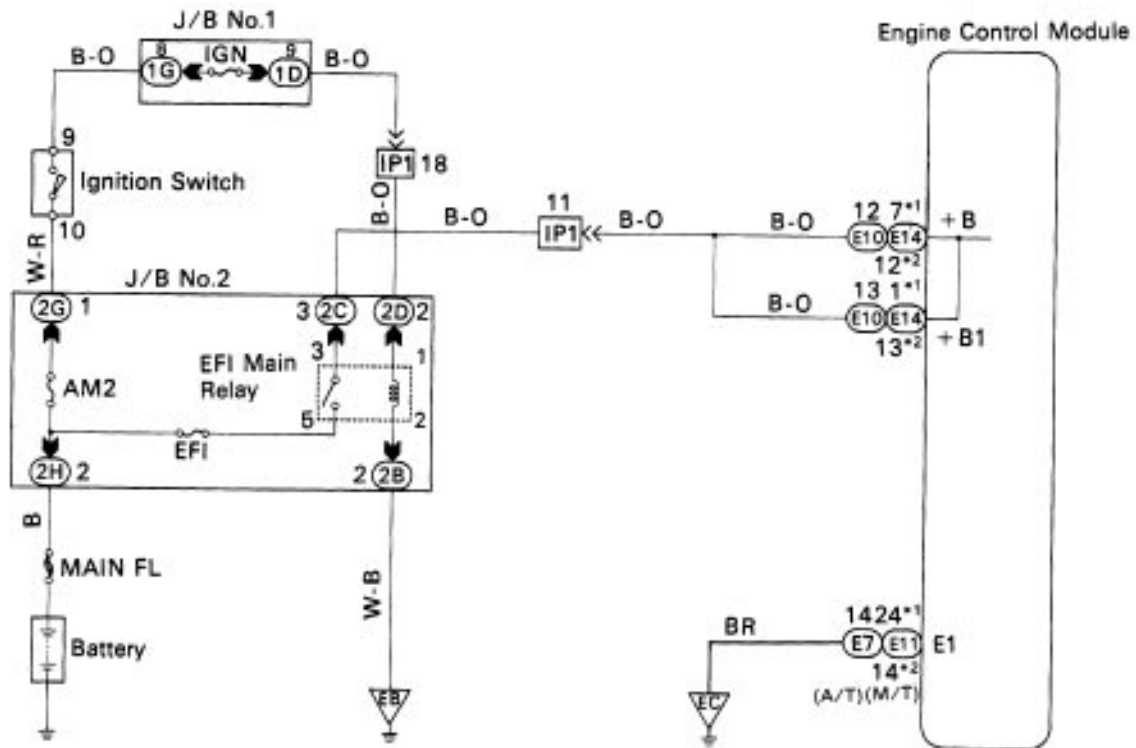
## CIRCUIT DESCRIPTION

When the ignition switch is turned on, battery positive voltage is applied to the coil, closing the contacts of the EFI main relay and supplying power to the terminals + B and + 131 of the ECM.

## DIAGNOSTIC CHART



# WIRING DIAGRAM



- \*1: Except California specification vehicles with M/T.
- \*2: Only for California specification vehicles with M/T.



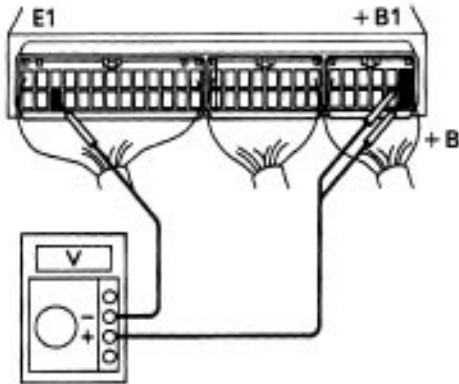
## INSPECTION PROCEDURE

1

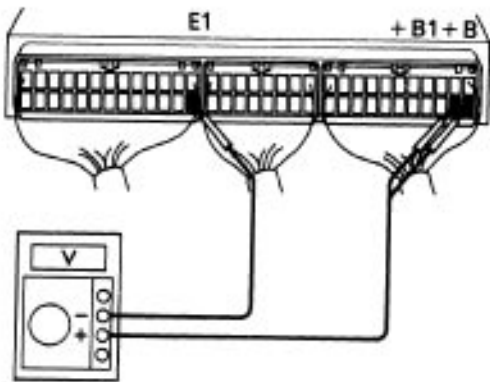
Check voltage between terminals + B, + 131 and E1 of engine control module connector.



Exc. California spec. with M/T



Others



886653  
F16727  
F16728

P

(1) Remove glove compartment.  
(See page [EG1-234](#))

C

Measure voltage between terminals + B, + 131 and E1 of engine control module connector.

OK

**Voltage: 9 –14 V**

NG

OK

Proceed to next circuit inspection shown on matrix chart (See page [EG1-327](#)).

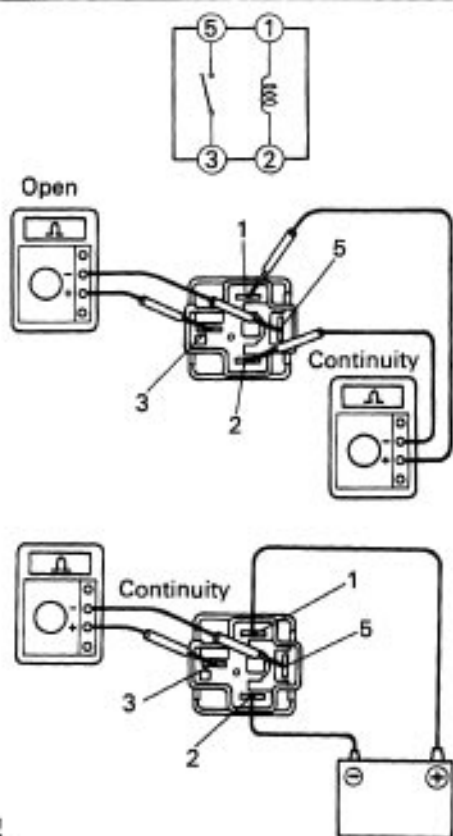
2

Check for open in harness and connector between terminal E1 of engine control module and body ground (See page [IN-31](#)).

OK

NG

Repair or replace harness or connector.

**3****Check EFI main relay.**

881841  
P07170  
P07171

**OK**

- P** Remove EFI main relay from J/B No-2.  
**C** Check continuity between terminals of EFI main relay shown below.

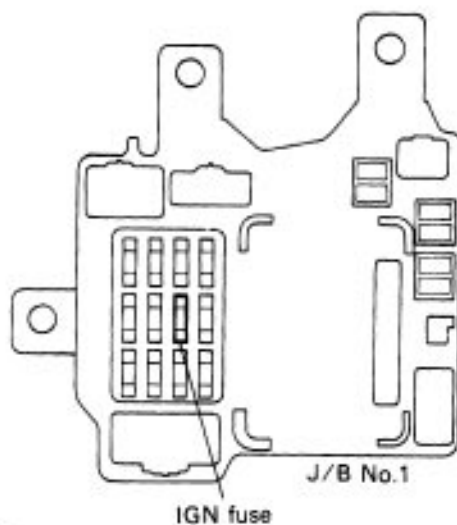
**OK**

Terminals 3 and 5	Open
Terminals 1 and 2	Continuity (Reference value 72Ω)

- C** (1) Apply battery voltage between terminals 1 and 2.  
 (2) Check continuity between terminals 3 and 5.

**OK**

Terminals 3 and 5	Continuity
-------------------	------------

**NG****Replace EFI main relay.****Check IGN fuse.**

N01803

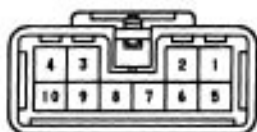
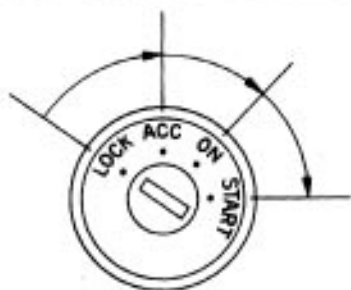
**OK**

- P** Remove IGN fuse from J/B No.1.

- C** Check continuity of IGN fuse.

**OK** **Continuity****NG**

**Check for short in all the harness and components connected to IGN fuse (See attached wiring diagram).**

**5****Check ignition switch.**BE3582  
p.10.2-B**P**

Remove under cover and finish panel.

**C**

Check continuity between terminals.

**OK**

continuity

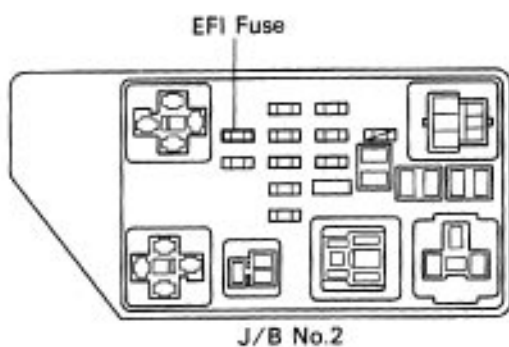
Terminal Switch position	2 IG1	3 ACC	4 AM1	6 ST2	7 ST1	9 IG2	10 AM2
LOCK							
ACC							
ON							
START							

**OK****NG**

Replace ignition switch.

**6****Check for open in harness and connector between IG switch and EFI main relay, EFI main relay and body ground (See page IN-31).****OK****NG**

Repair or replace harness or connector.

**7****Check EFI fuse.**

J/B No.2

**P**

Remove EFI fuse from J/B No.2.

**C**

Check continuity of EFI fuse.

**OK**

Continuity

F17078

**OK****NG**

Check for short in all the harness and components connected to EFI fuse (See attached wiring diagram).

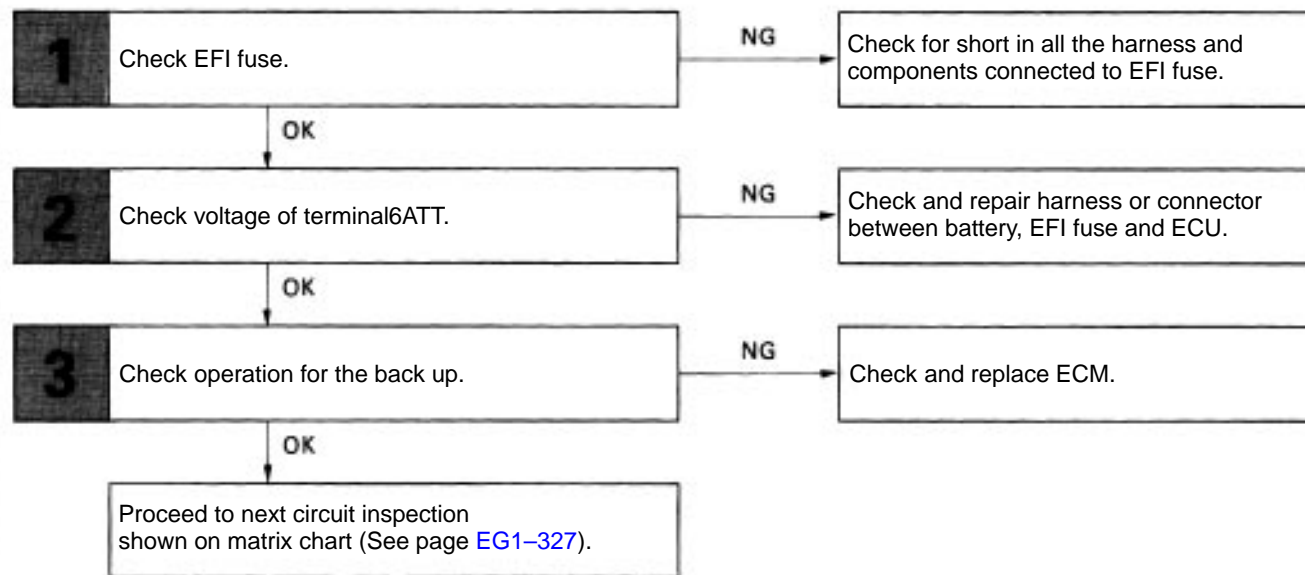
Check for open in harness and connector between EFI main relay and battery, EFI main relay and engine control module.

## Back Up Power Source Circuit

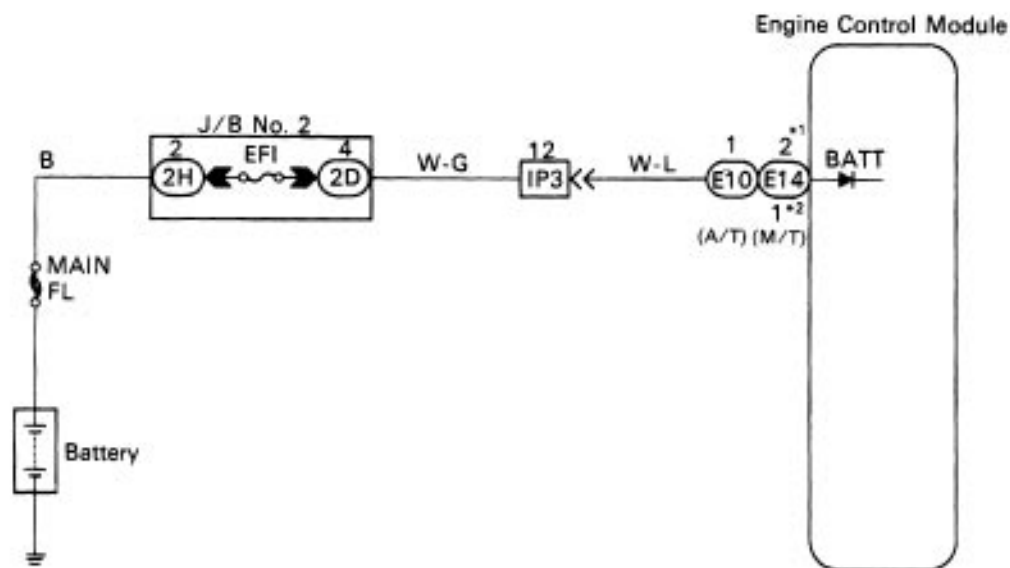
### CIRCUIT DESCRIPTION

Battery positive voltage is supplied to terminal BATT of the ECM even when the ignition switch is off for use by the diagnostic trouble code memory and air-fuel ratio adaptive control value memory, etc.

### DIAGNOSTIC CHART



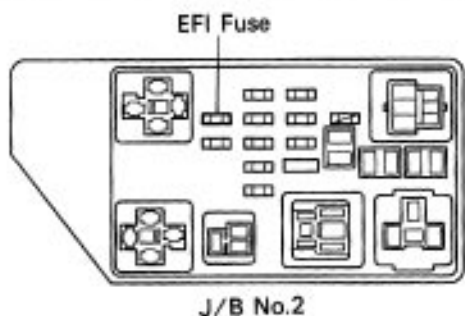
### WIRING DIAGRAM



\*1: Except California specification vehicles with M/T.

\*2: Only for California specification vehicles with M/T.

## INSPECTION PROCEDURE

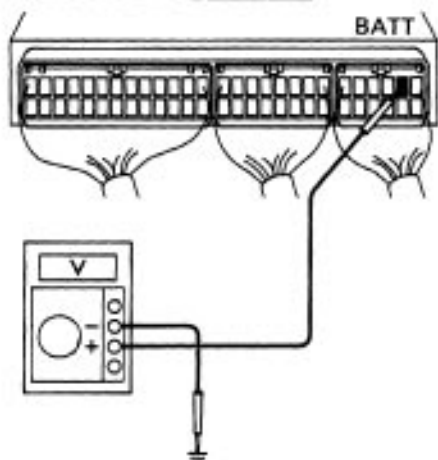
**1** Check EFI fuse.

FI7078

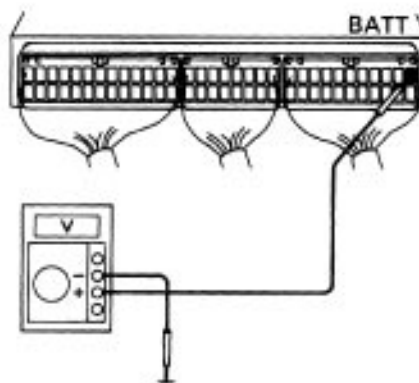
- P** Remove EFI fuse from J/B No.2.
- C** Check continuity of EFI fuse.
- OK** Continuity

**OK****NG**

Check for short in all the harness and components connected to EFI fuse (See attached wiring diagram).

**2** Check voltage between terminal BATT of engine control module connector and body ground.Exc. California spec. with M/T

- P** Remove glove compartment. (See page [EG1-234](#))
- C** Measure voltage between terminal BATT of engine control module connector and body ground.
- OK** Voltage: 9 -14 V

Others**OK****NG**

Check and repair harness or connector between engine control module and EN fuse, EFI fuse and battery.

**3** Are the diagnostic trouble codes still in the memory when the ignition switch is turned OFF?**YES****NO**

Check and replace engine control module.

Proceed to next circuit inspection shown on matrix chart (See page [EG1-327](#)).

## Injector Circuit

### CIRCUIT DESCRIPTION

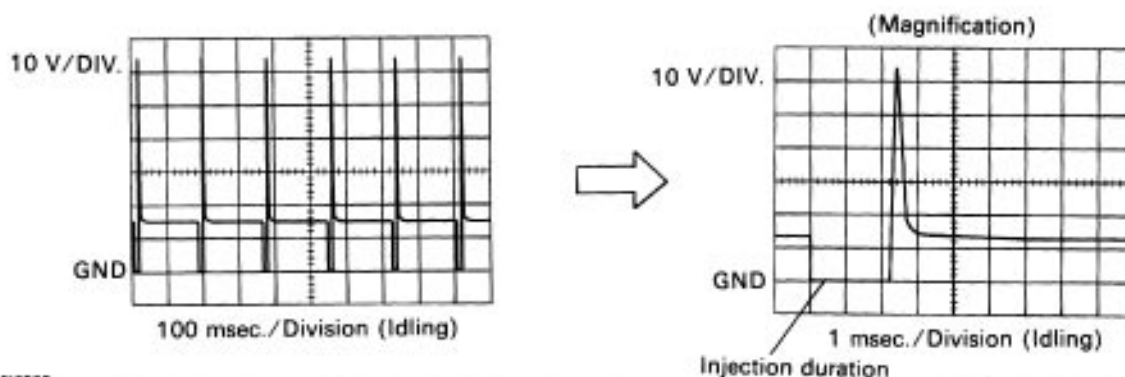
The injectors are provided to the intake manifold. They inject fuel into the cylinders based on the signals from the engine control module.

### Reference INSPECTION USING OSCILLOSCOPE

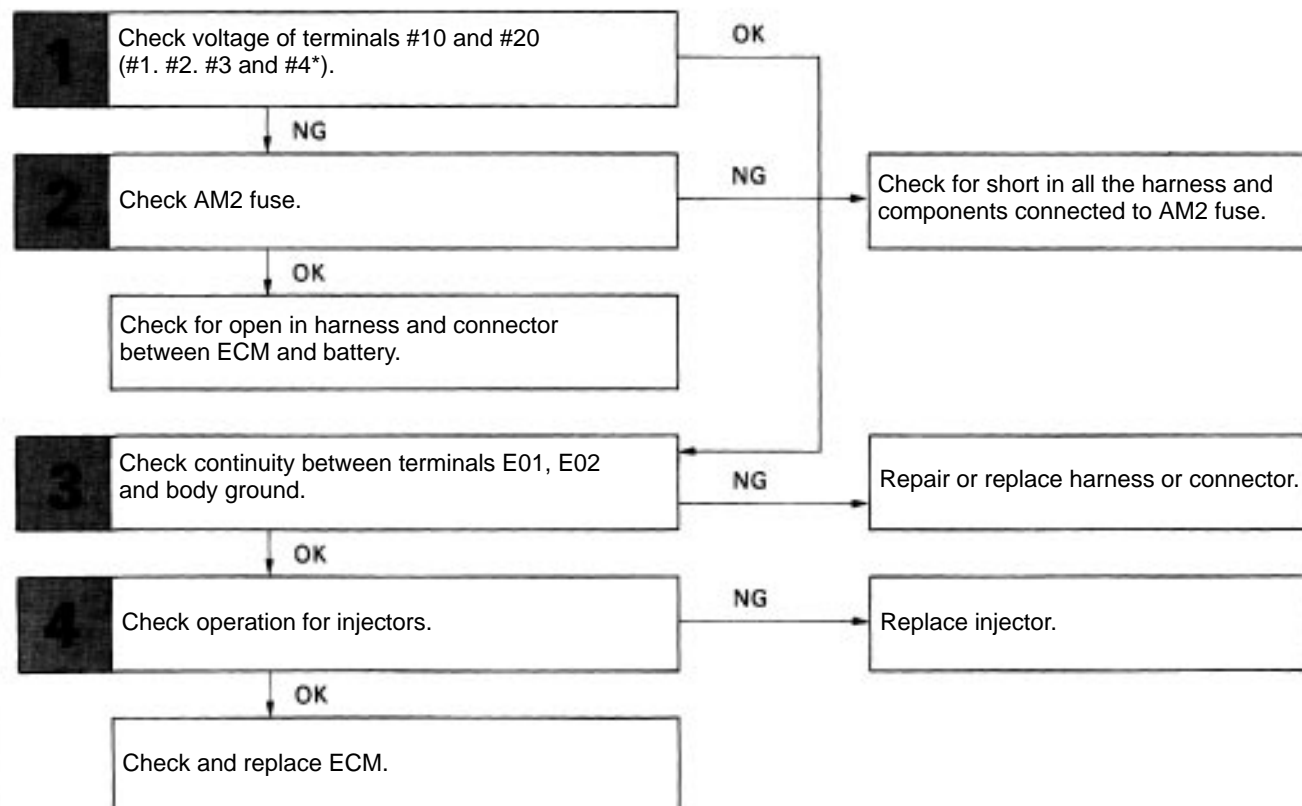
#### INJECTOR SIGNAL WAVEFORM

- With the engine idling measure waveform between terminals #10, #20 (#1, #2, #3 and #4\*) and E01 of engine control module.

HINT: The correct waveform appears as shown in the illustration on the below.



### DIAGNOSTIC CHART

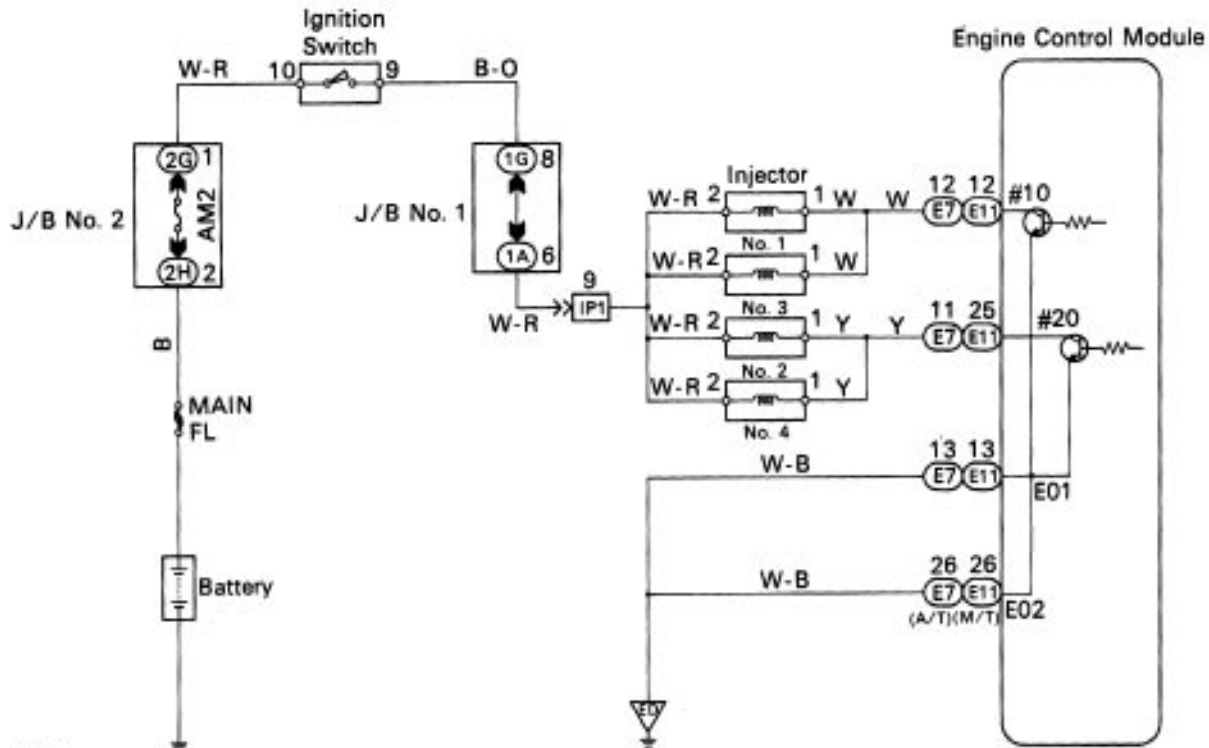


\*: Only for California specification vehicles.



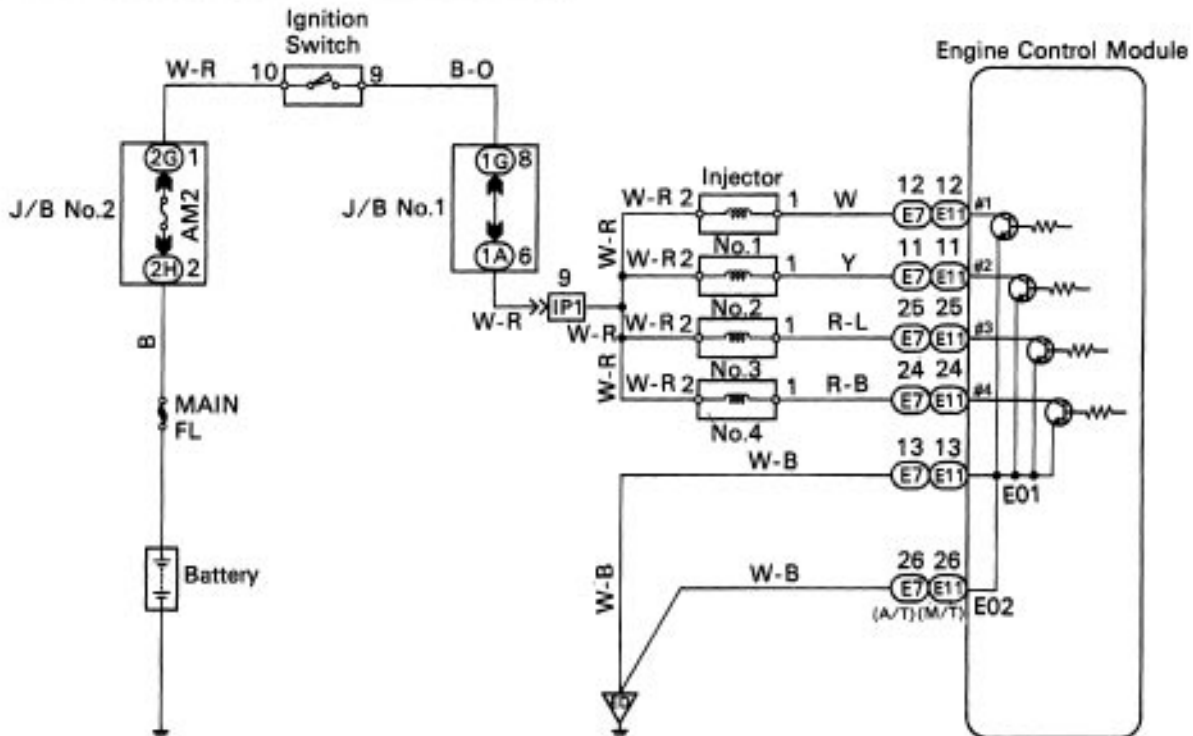
## WIRING DIAGRAM

Except California specification vehicles.



F16884

Only for California specification vehicles.



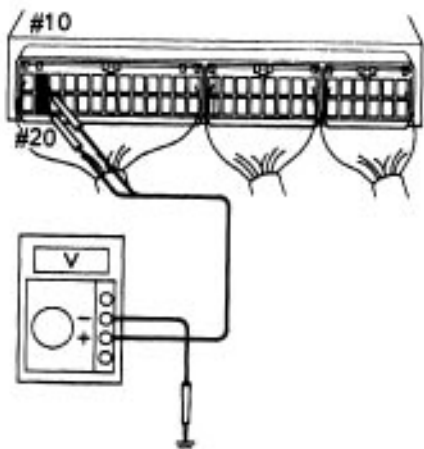
F17180

# INSPECTION PROCEDURE

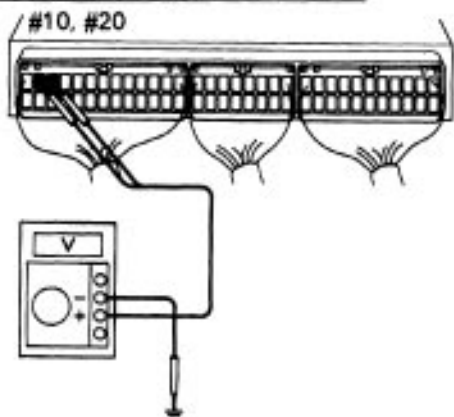
Check voltage between terminals #10, #20 (#1, #2, #3 and #4) of engine control module connector and body ground.



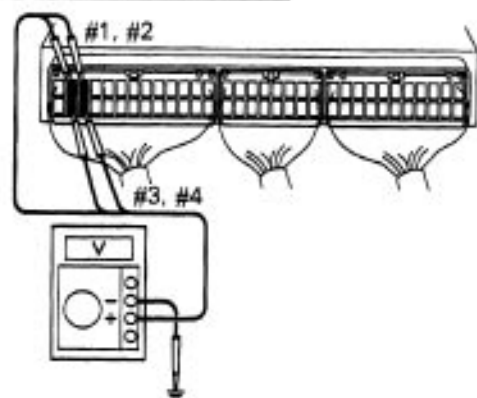
Exc. California spec. with M/T



Exc. California spec. with A/T



Only for California spec.



886653  
F16731  
F16732  
F17165

**P** (1) Remove glove compartment.  
(See page [EG1-234](#))

(2) Turn ignition switch ON.

**C** Exc. California spec.

Measure voltage between terminals #10, #20 of engine control module connector and body ground.

Only for California spec.

Measure voltage between terminals #1, #2, #3 and #4 of engine control module connector and body ground.

**OK** **Voltage: 9 -14 V**

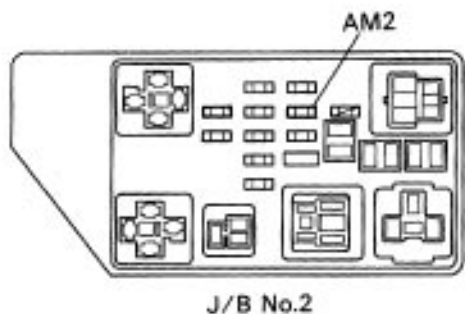
**NG**

**OK**

Go to step **3**



## 2 Check AM2 fuse.



FI7078

- P** Remove AM2 fuse from J/B No. 2.
- C** Check continuity of AM2 fuse.
- OK**

**OK****NG**

Check for short in all the harness and components connected to AM2 fuse.

Check for open in harness and connector between engine control module and battery.

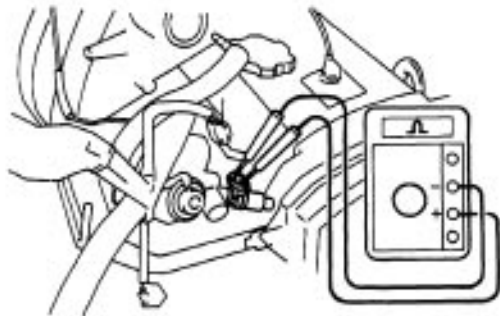
## 3

Check for open in harness and connector between terminals E01, E02 of engine control module connector- and body ground (See page [IN-31](#)).

**OK****NG**

Repair or replace harness or connector.

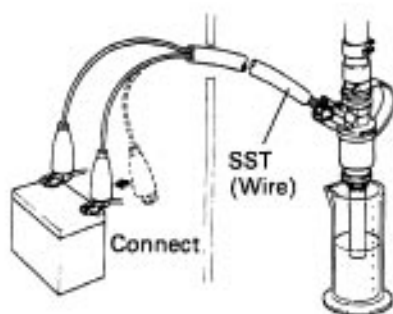
## Check injectors.



**P** Disconnect injector connector  
(See page [EG1-189](#)).

**C** Measure resistance of injector.

**OK** Resistance: Approx.  $13.8\Omega$  at 20 C (68 F)



**C** Check injection volume of injector  
(See page [EG1-195](#)).

- OK**
- Injection volume  
49 – 59 cm<sup>3</sup> (3.0 – 3.6 cu in.)/15 sec.  
Difference between each injector:  
Less than 5 cm<sup>3</sup> (0.3 cu in.)
  - Leakage  
Fuel drop: One drop or less per minute.

Exc. California



California



P01064  
F14848  
F14849  
P10811

**OK**

**NG**

Replace injector.

Check and replace engine control module.

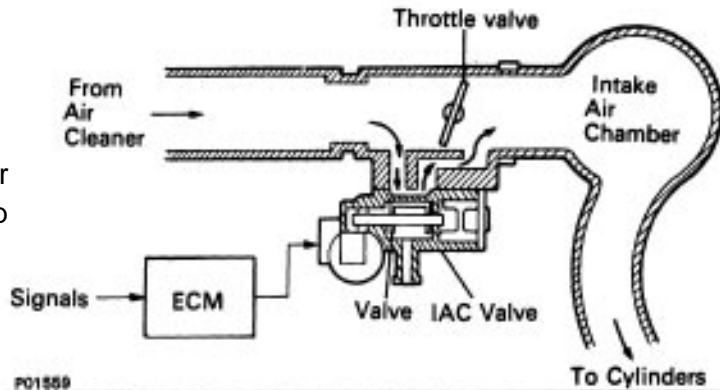
## IAC Valve Circuit

### CIRCUIT DESCRIPTION

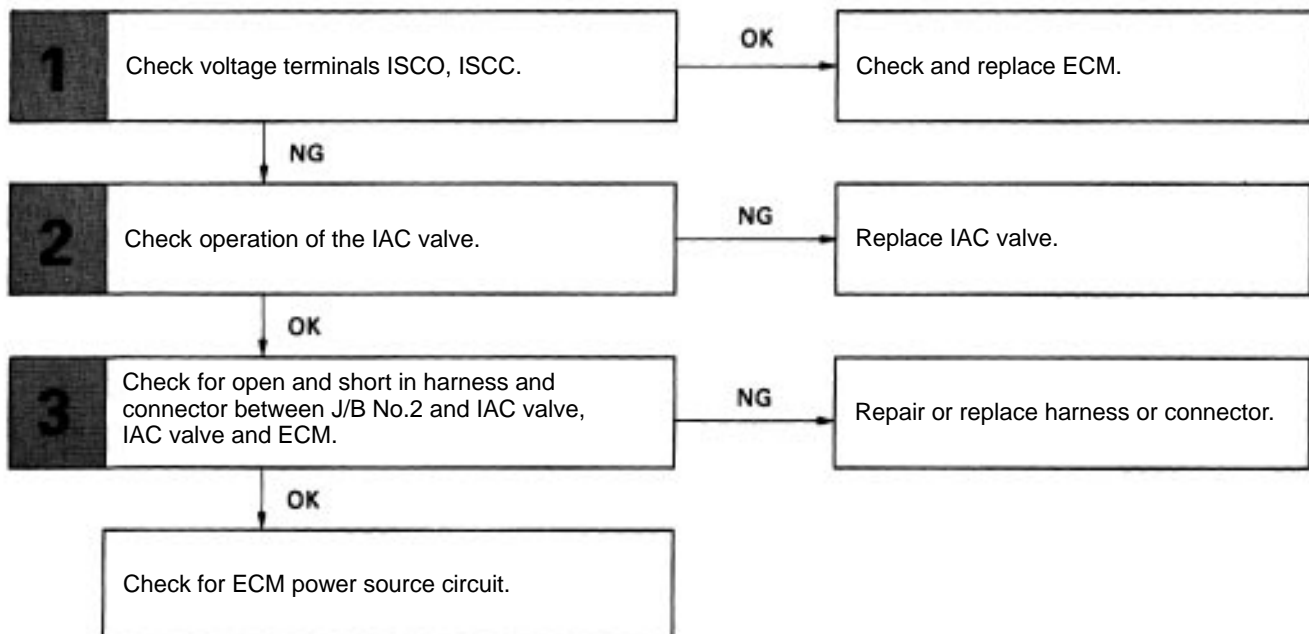
The rotary solenoid type IAC valve is provided on the intake air chamber and intake air bypassing the throttle valve is directed to the IAC valve through a passage.

In this way the intake air volume bypassing the throttle valve is regulated, controlling the engine speed.

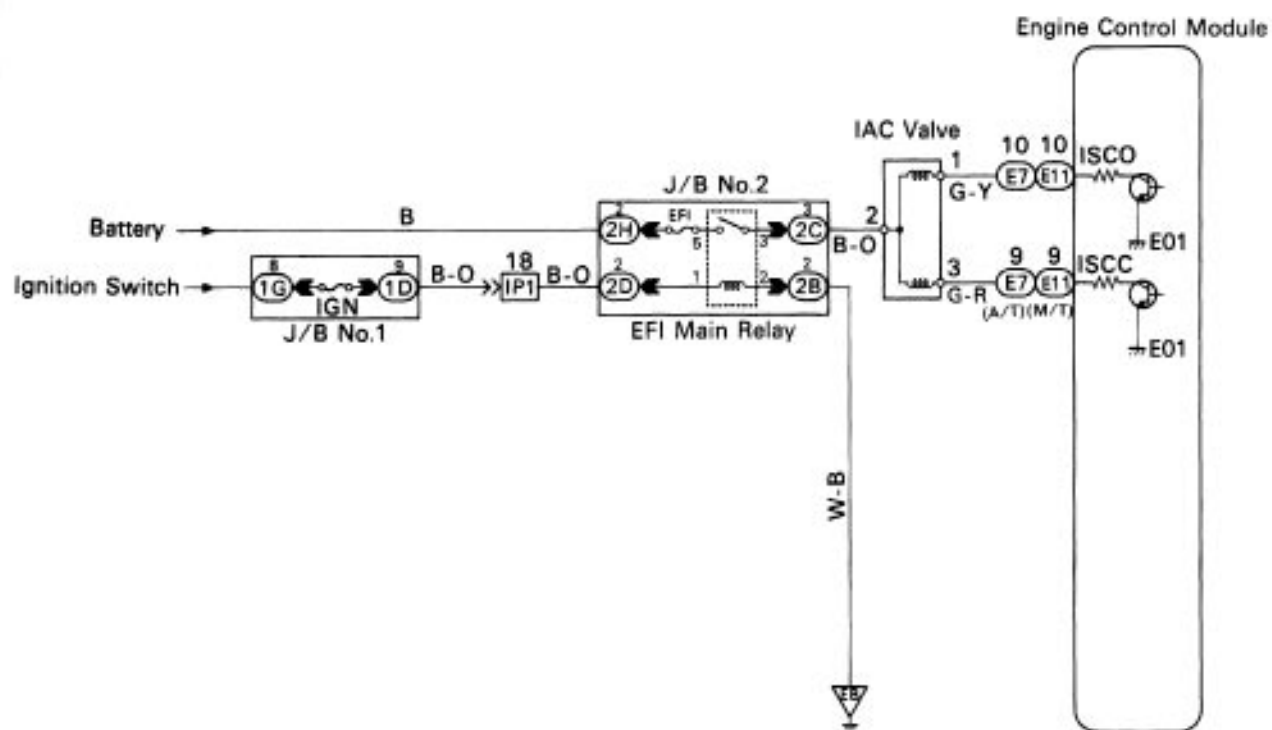
The ECM operated only the IAC valve to perform idle-up and provide feedback for the target idling speed, a VSV for idle-up control is also added (for air conditioning).



### DIAGNOSTIC CHART



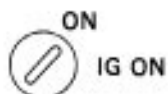
## WIRING DIAGRAM



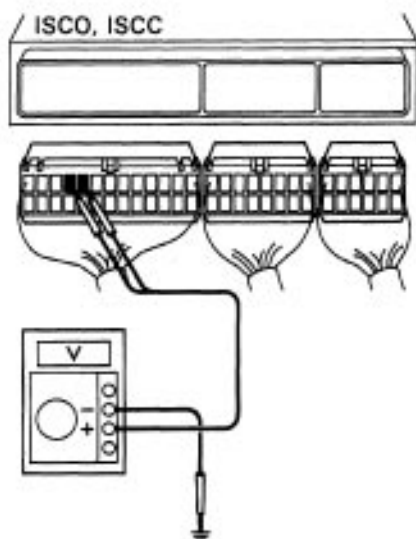
## INSPECTION PROCEDURE

1

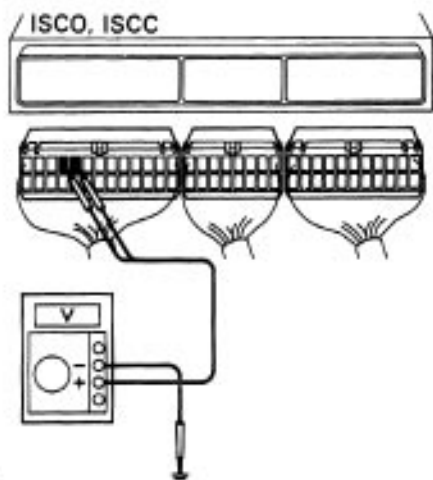
Check voltage between terminals ISCO, ISCC of engine control module connector and body ground.



Exc. California spec. with M/T



Others



BE0053  
FI7100  
FI7171

- P** (1) Remove glove compartment (See page [EG1-234](#)),  
(2) Disconnect the engine control module connectors.  
(3) Turn ignition switch ON.
- C** Measure voltage between terminals ISCO, ISCC of engine control module connector and body ground.

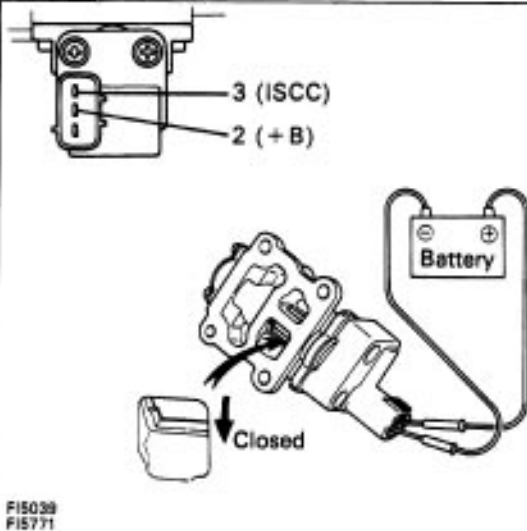
**OK** Voltage: 9 –14 V

NG

OK

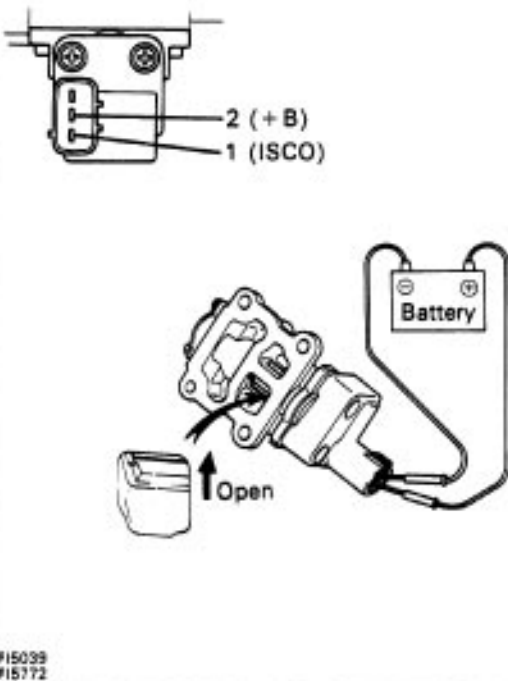
Check and replace engine control module.

## Check operation of the IAC valve.



- P** (1) Disconnect IAC valve connector.  
(2) Remove IAC valve (See page [EG1-213](#)).
- C** (1) Connect the positive (+) lead from the battery to terminal 2 (+ B) and negative (-) lead to terminal 3 (ISCC), and check that the valve is closed.  
(2) Connect the. positive (+) lead from the battery to terminal 2 (+ B) and negative (-) lead to terminal 1 (ISCO), and check that the valve is open.

- OK** (1) The valve is closed.  
(2) The valve is open.



OK

NG

Replace IAC valve.

Check for open and short in harness and connector between J/B No.2 and IAC valve, IAC valve and engine control module (See page [IN-31](#)).

OK

NG

Repair or replace harness or connector.

Check for ECM power source circuit (See page [EG1-403](#)).

## Fuel System Circuit

### CIRCUIT DESCRIPTION

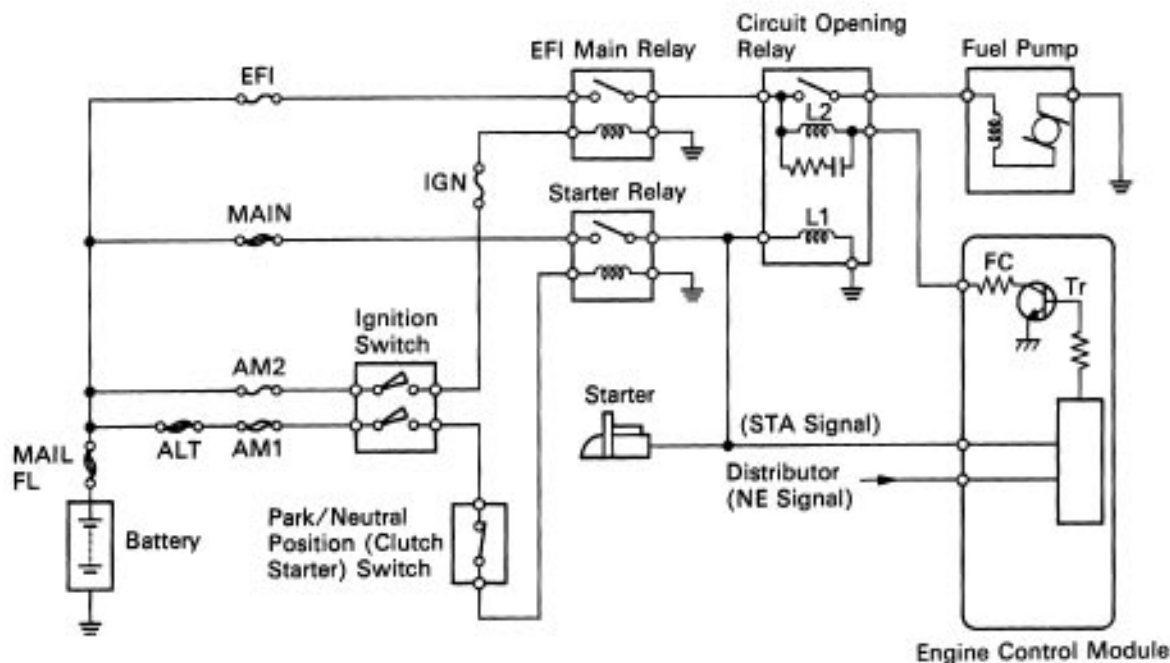
#### Fuel pump control

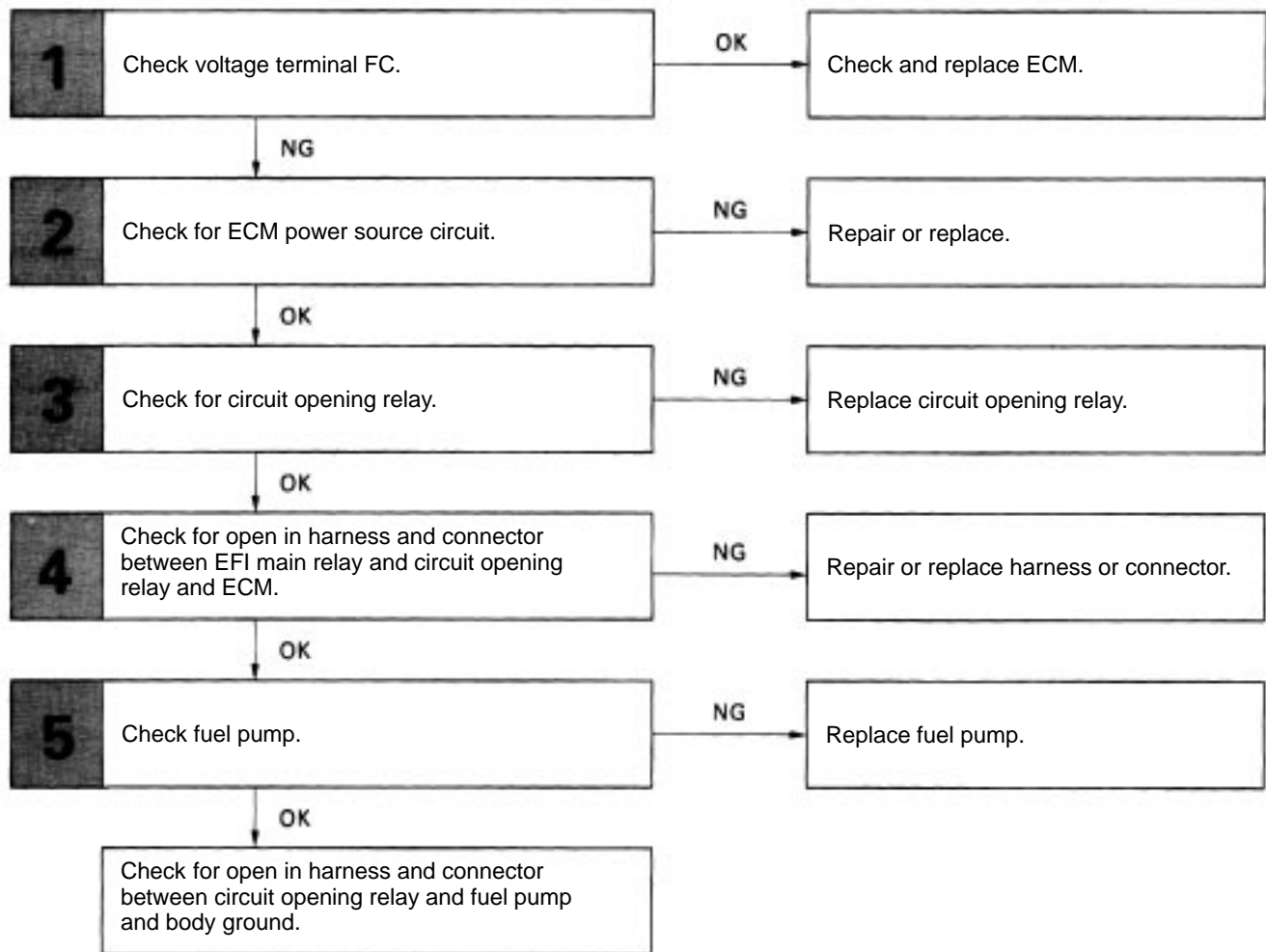
The fuel pump is switched on (low voltage at terminal FC) when STA is on or while the NE signal is input to the ECM.

In the diagram below, when the engine is cranked, current flows from terminal ST of the ignition switch to the starter relay coil, the starter relay switches on and current flows to coil L1 of the circuit opening relay. Thus the circuit opening relay switches on, power is supplied to the fuel pump and the fuel pump operates.

When the STA signal and NE signal are input to the ECM, Tr is turned ON, current flows to coil L2 of the circuit opening relay, the relay switches on and the fuel pump operates.

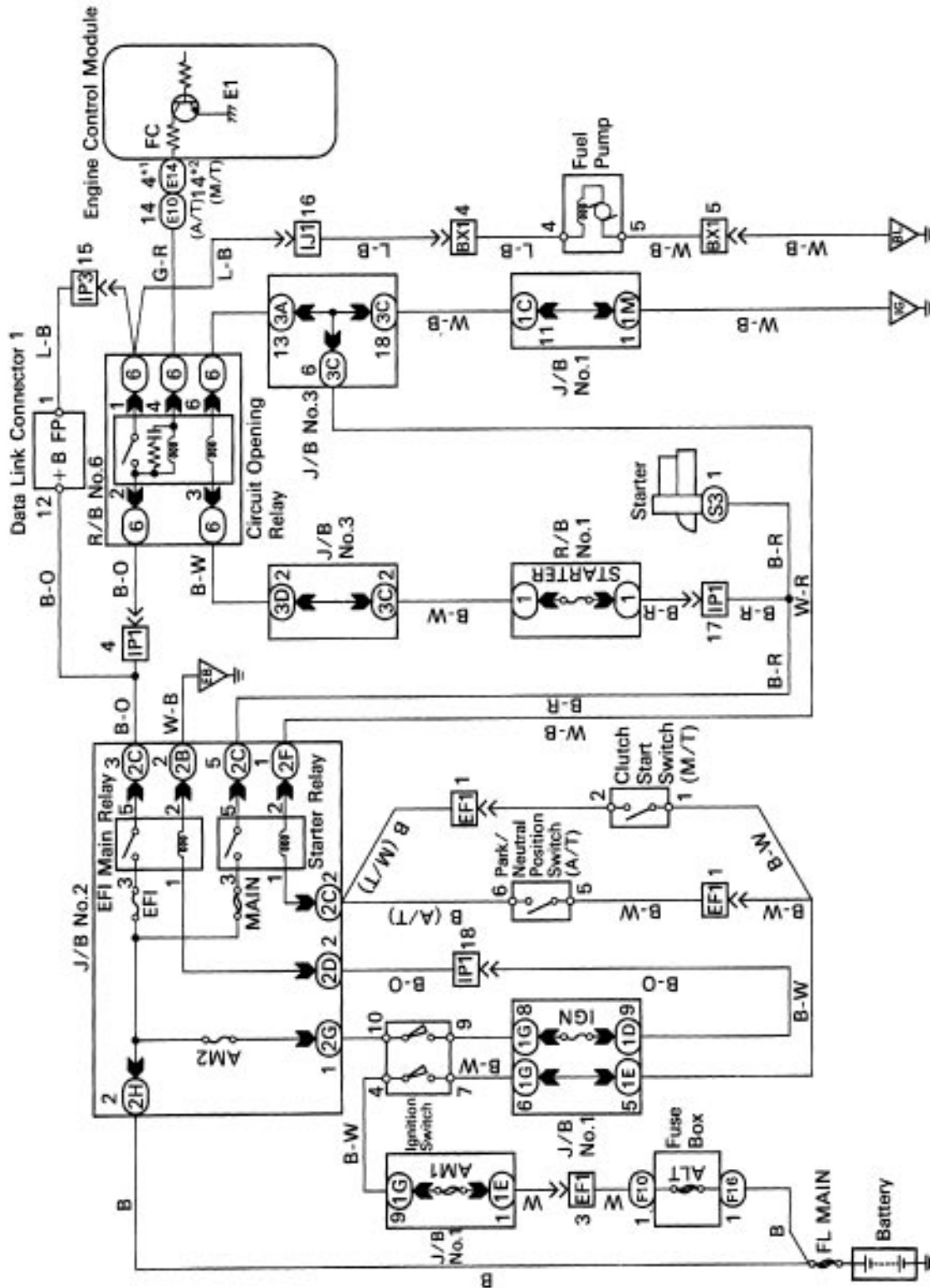
While the NE signal is generated (engine running), the ECM keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.



**DIAGNOSTIC CHART**



# WIRING DIAGRAM



\*1: Except California specification vehicles with M/T.

\*2: Only for California specification vehicles with M/T.

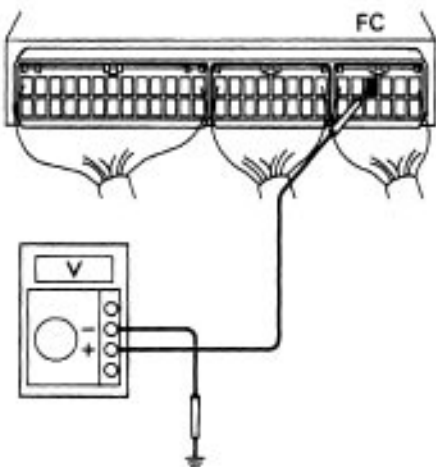
## INSPECTION PROCEDURE

### 1

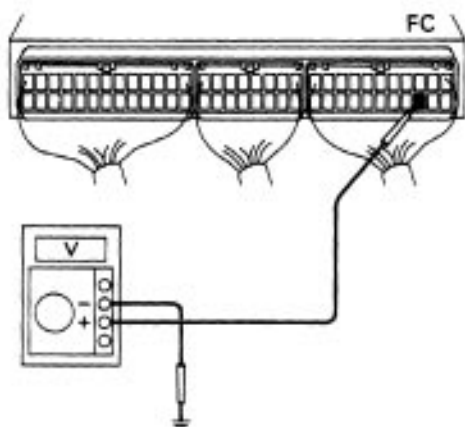
Check voltage between terminals FC of engine control module connector and body ground.



Exc. California spec. with M/T



Others



8E6653  
F16735  
F16736

- P** (1) Remove glove compartment.  
(See page [EG1-234](#)).  
(2) Turn ignition switch ON.
- C** Measure voltage between terminal FC of engine control module connector and body ground.
- OK** Voltage: 9 -14 V

NG

OK

Check and replace engine control module.

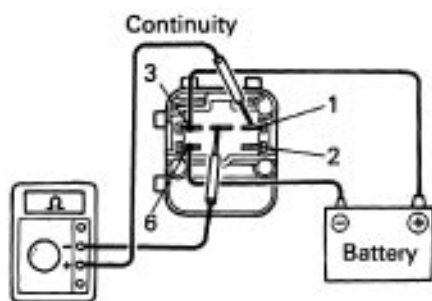
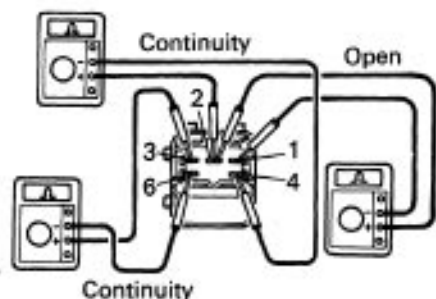
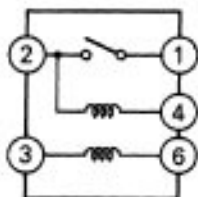
### 2

Check for ECM power source circuit (See page [EG1-403](#)).

OK

NG

Repair or replace.

**3****Check circuit opening relay.**F16782  
P14361  
P14362

- P** (1) Remove glove compartment  
(See page [EG1-217](#)).  
(2) Remove circuit opening relay from R/B No.6.
- C** Check continuity between terminals of circuit opening relay shown below.

**OK**

Terminals 1 and 2	Open
Terminals 2 and 4	Continuity
Terminals 3 and 6	Continuity

- C** (1) Apply battery voltage between terminals 3 and 6.  
(2) Check continuity between terminals 1 and 2.

**OK**

Terminals 1 and 2	Continuity
-------------------	------------

**OK****NG**

Replace circuit opening relay.

**4****Check for open in harness and connector between EFI main relay and circuit opening relay, circuit opening relay and engine control module (See page [IN-31](#)).****OK****NG**

Repair or replace harness or connector.

**5****Check fuel pump (See page [EG1-177](#)).****OK****NG**

Replace fuel pump.

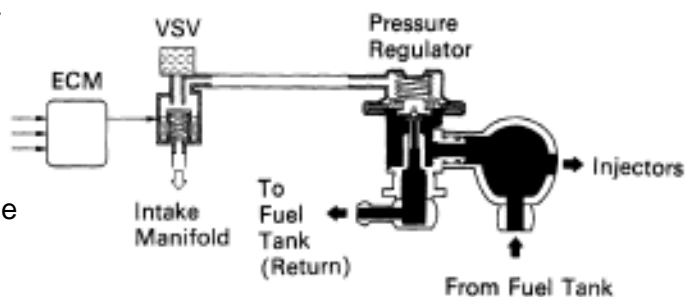
Check for open in harness and connector between circuit opening relay and fuel pump, fuel pump and body ground.

## VSV Circuit for Fuel Pressure Control (Only for California spec.)

### CIRCUIT DESCRIPTION

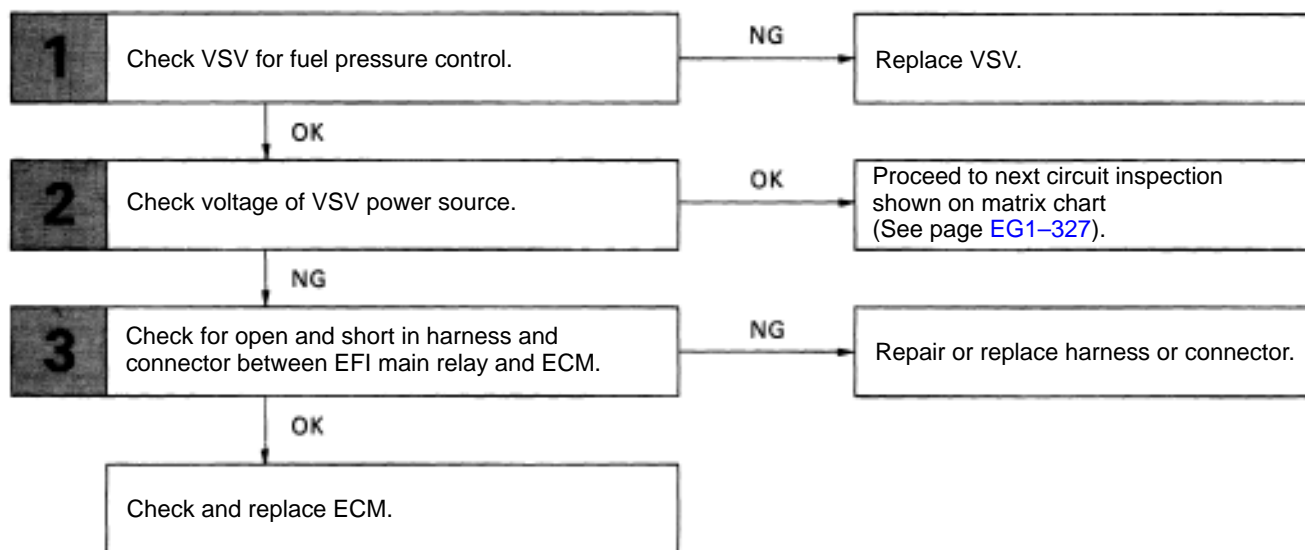
The ECM turns on a VSV (Vacuum Switching Valve) to draw the air into the diaphragm chamber of the pressure regulator if it detects that the temperature of the engine coolant is too high during engine starting. The air drawn into the chamber increases the fuel pressure to prevent fuel vapor lock at high engine temperature in order to help the engine start when it is warm.

Fuel pressure control ends approx. 90 secs. after the engine is started.



F16897

### DIAGNOSTIC CHART

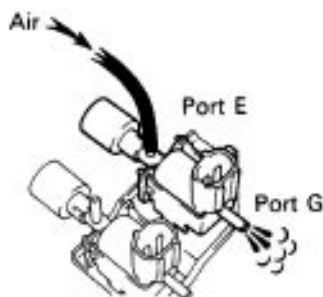
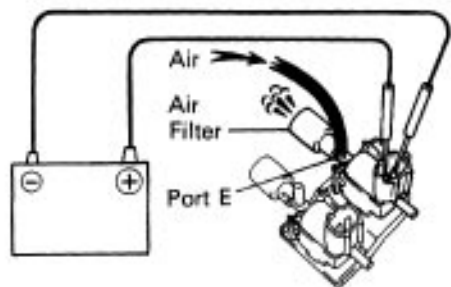
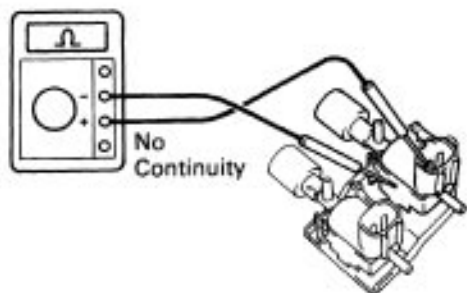
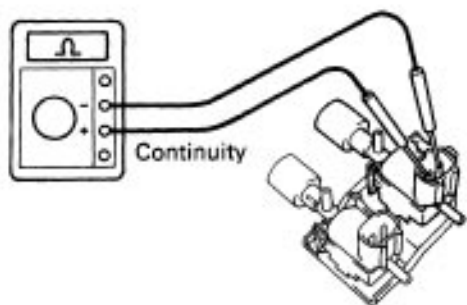


## WIRING DIAGRAM

## INSPECTION PROCEDURE

1

## Check VSV for fuel pressure control.



P14141  
P14142  
P14144  
P14143

- P** (1) Disconnect VSV connector.  
(2) Remove VSV.
- C** (1) Measure resistance between terminals.  
(2) Measure resistance between each terminal and the body.
- OK** (1) **Resistance: 33 – 39Ω at 20°C (68°F)**  
(2) **Resistance: 1 MΩ or higher.**

- C** Check operation of VSV when battery positive voltage is applied and released to the VSV terminals.

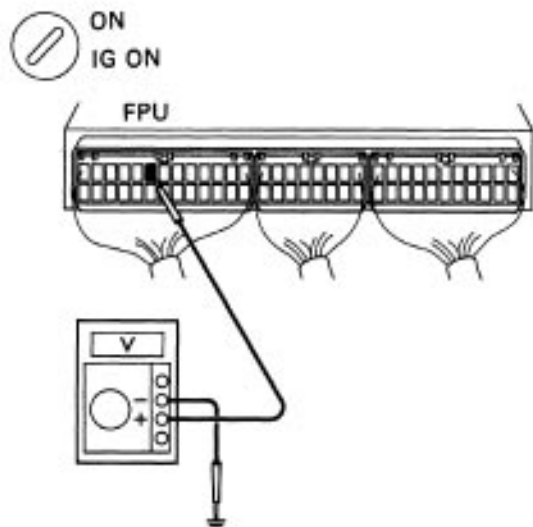
- OK** **Battery positive voltage is applied:**  
The air from port E is flowing out through the air filter.  
**Battery positive voltage is not applied:**  
The air from port E is flowing out through port G.

OK

NG

Replace VSV for fuel pressure control VSV.

Go to step **2**

**2****Check voltage between terminal FPU of engine control module connector and body ground.**BE0053  
F17174**P** (1) Remove glove compartment  
(See page [EG1-234](#)).

(2) Turn ignition switch ON.

**C** Measure voltage between terminal FPU of engine control module connector and body ground.**OK** Voltage: 9 -14 V**NG****OK**Proceed to next circuit inspection shown on matrix chart (See page [EG1-327](#)).**3****Check for open and short in harness and connector between engine control module and VSV, VSV and EFI main relay (See page [IN-31](#)).****OK****NG**

Repair or replace harness or connector.

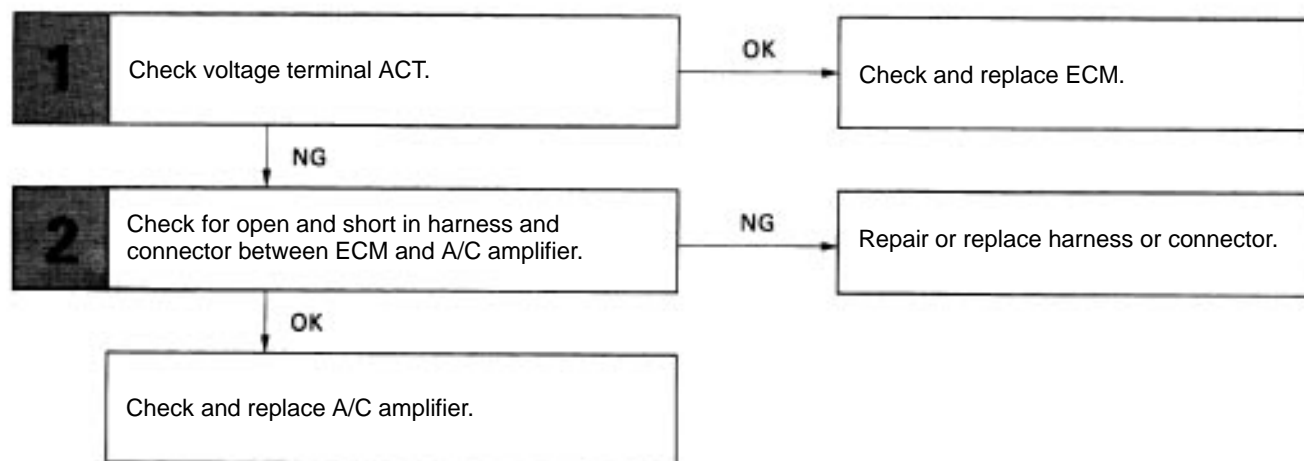
Check and replace engine control module.

## Air Conditioning Cut Control Circuit

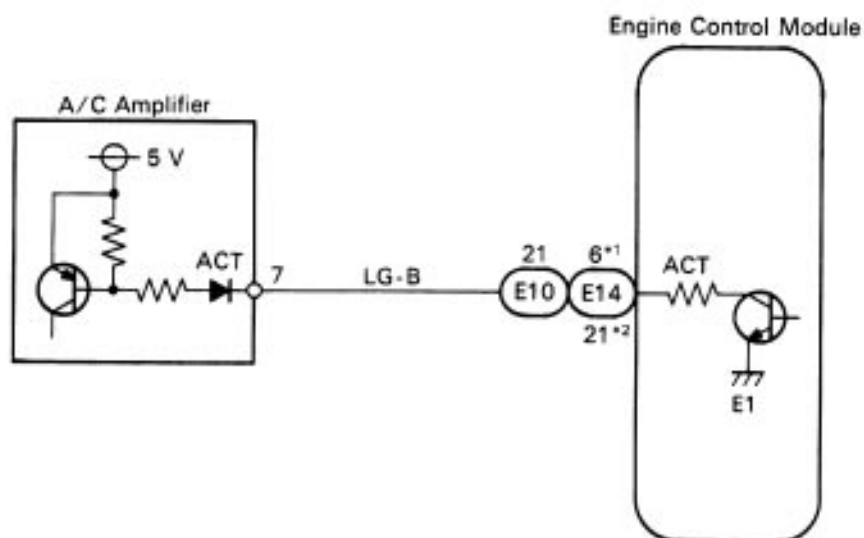
### CIRCUIT DESCRIPTION

This circuit cuts air conditioning operation during vehicle acceleration in order to increase acceleration performance. During acceleration with the vehicle speed at 16 mph (25 km/h) or less, engine speed at 1,200 rpm or less and throttle valve opening angle at 60° or more, the A/C magnet switch is turned OFF for several seconds.

### DIAGNOSTIC CHART



### WIRING DIAGRAM



\*1: Except California specification vehicles with M/T.

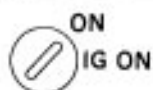
\*2: Only for California specification vehicles with M/T.



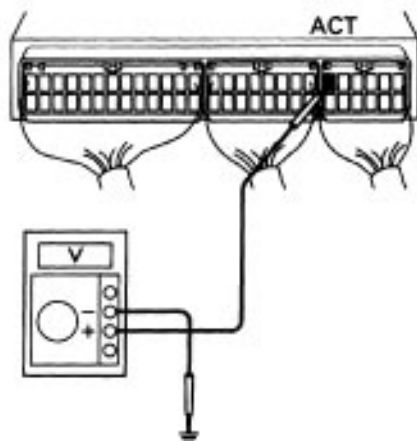
# INSPECTION PROCEDURE

## 1

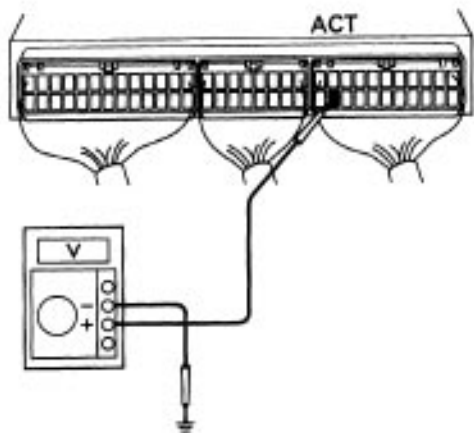
Check voltage between terminal ACT of engine control module connector and body ground.



Exc. California spec. with M/T



Others



BE6653  
FI6737  
FI6738

- P** (1) Remove glove compartment.  
(See page [EG1-234](#)).  
(2) Turn ignition switch ON.
- C** Measure voltage between terminal ACT of engine control module connector and body ground when A/C switch is turned to ON.
- OK** Voltage: 9 -14 V

NG

OK

Check and replace engine control module.

## 2

Check for open and short in harness and connector between engine control module and A/C amplifier (See page [IN-31](#)).

OK

NG

Repair or replace harness or connector.

Check and replace A/C amplifier.

## TE1 TE2 Terminal Circuit

## CIRCUIT DESCRIPTION

Terminals TE1 and TE2 are located in the data link connector 1 and 2.

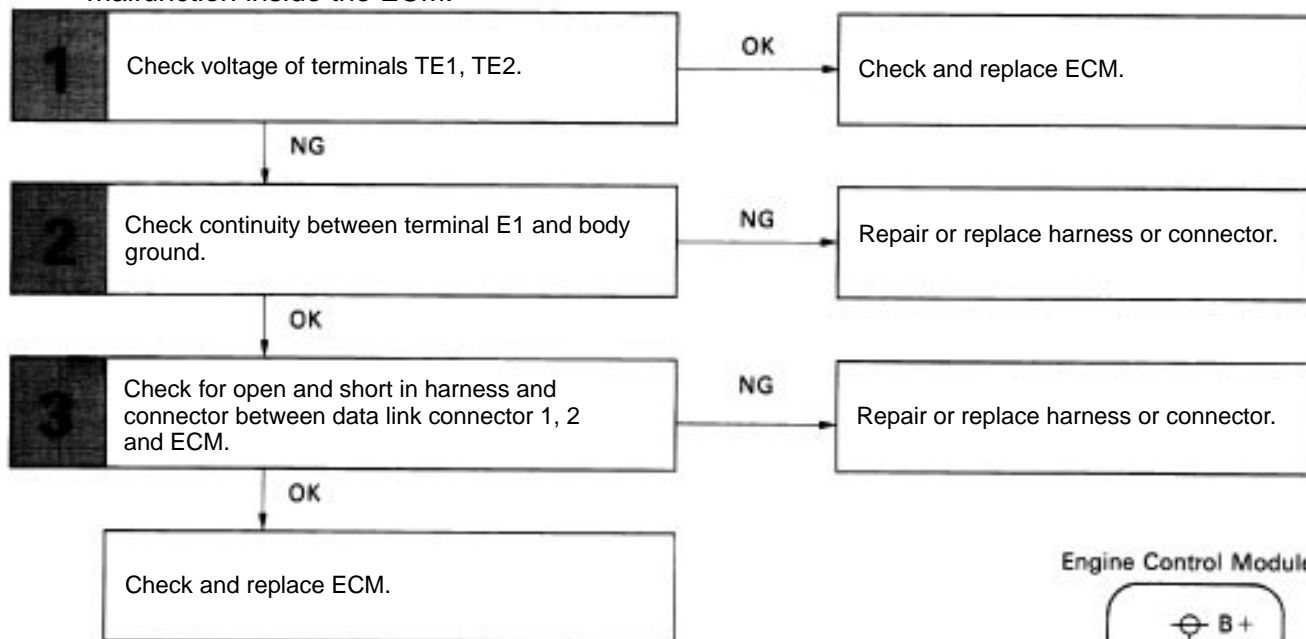
The data link connector 1 located in the engine compartment and the data link connector 2 located in the cabin. When these terminals are connected with the E1 terminal, diagnostic trouble codes in normal mode or test mode can be read from the malfunction indicator lamp on the combination meter.

## DIAGNOSTIC CHART

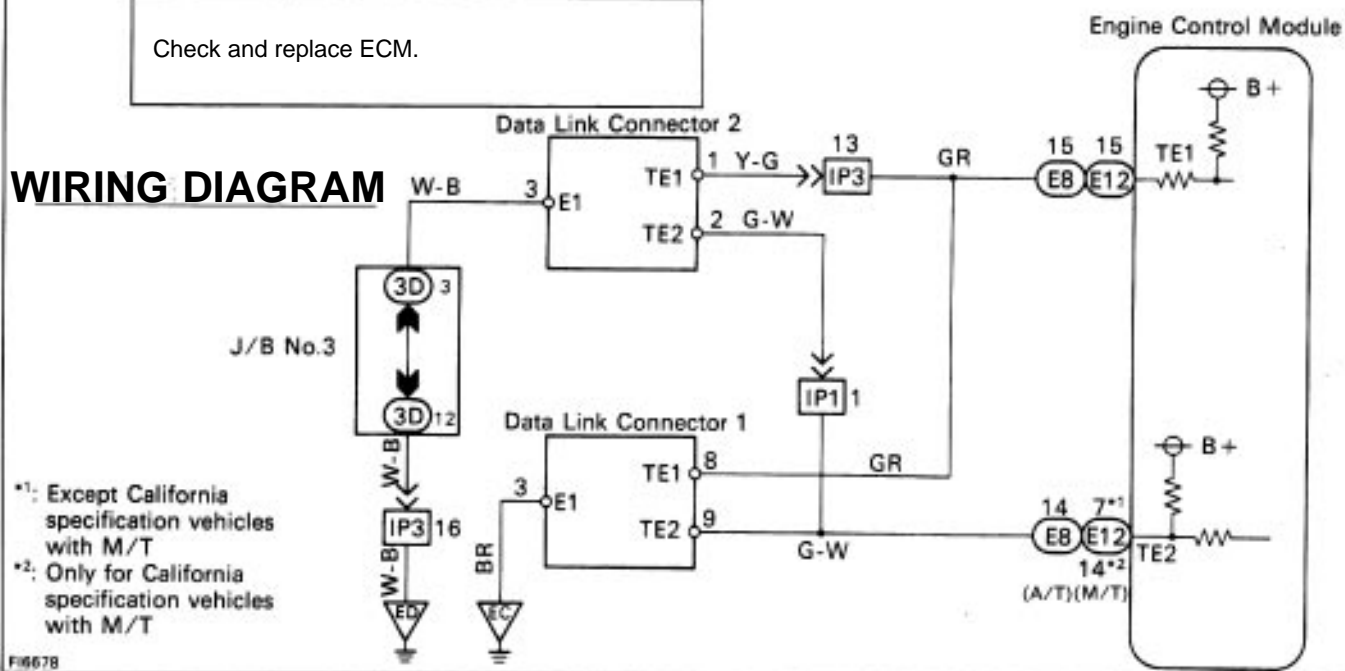
HINT: If terminals TE1 and TE2 are connected with terminal E1, diagnostic trouble code is not output or test mode is not activated.

Even though terminal TE1 is not connected with terminal E1, the malfunction indicator lamp blinks.

For the above phenomenon, the likely cause is an open or short in the wire harness, or malfunction inside the ECM.



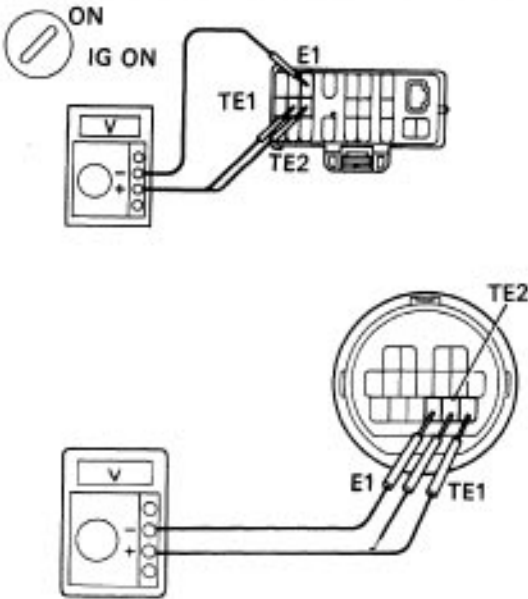
## WIRING DIAGRAM



## INSPECTION PROCEDURE

**1**

Check voltage between terminals TE1, TE2, and E1 of data link connector 1 and 2.

BE6653  
F16592 F14412

**P** Turn ignition switch ON.

**C** Measure voltage between terminals TE1, TE2 and E1 of data link connector 1 and 2.

**OK** Voltage: 9 -14 v

**NG****OK**

Check and replace engine control module.

**2**

Check continuity between terminal E1 of data link connector 1, 2 and body ground.

**OK****NG**

Repair or replace harness or connector.

**3**

Check for open and short in harness and connector between engine control module and data link connector 1, 2 (See page [IN-31](#)).

**OK****NG**

Repair or replace harness or connector.

Check and replace engine control module.