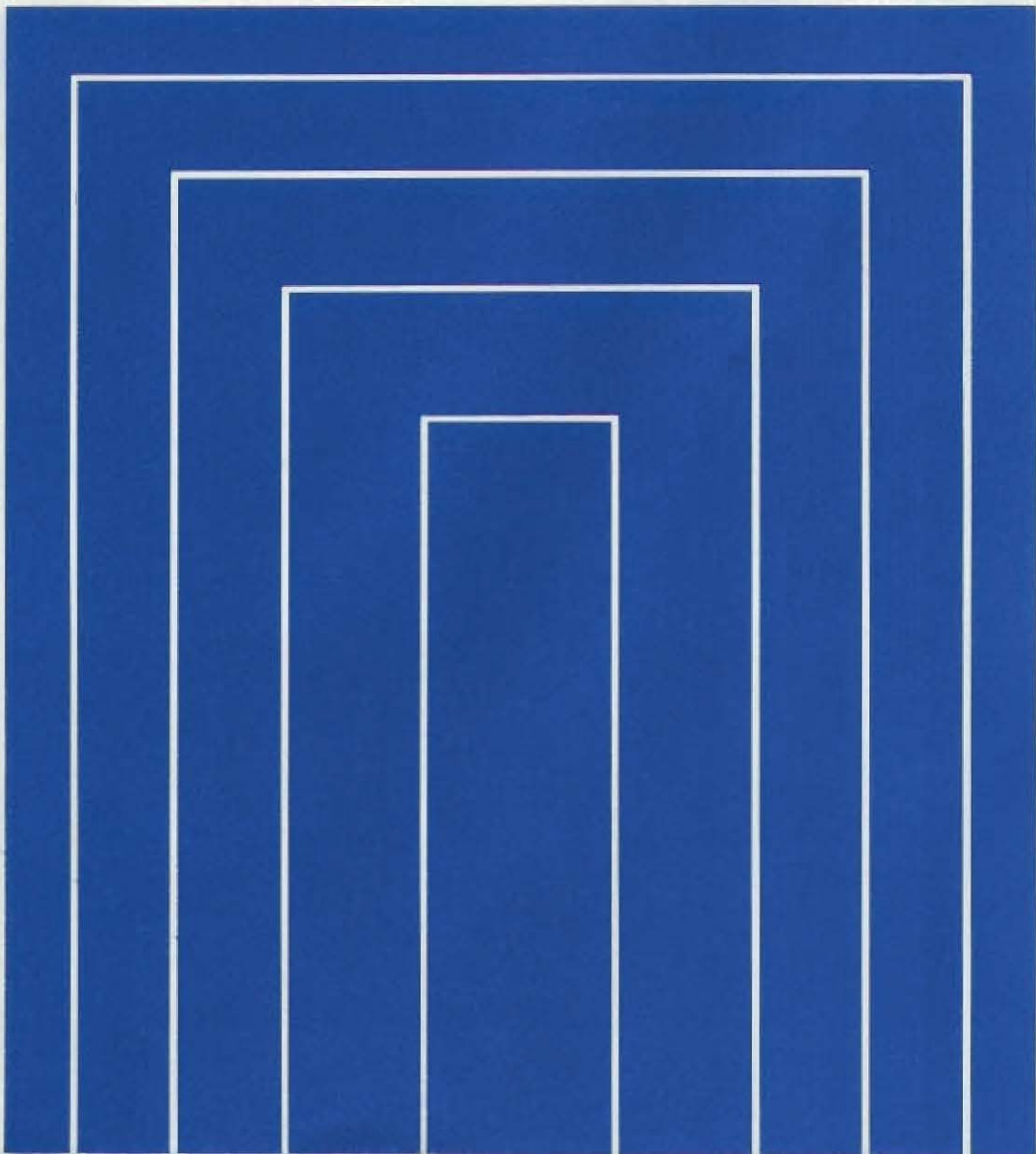


3S-GE ENGINE

REPAIR MANUAL

Oct., 1993



FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the 3S-GE engine equipped in the TOYOTA CELICA and MR2.

Applicable models: ST202 series
SW20 series

Please note that the publications below have also been prepared as relevant service manuals for the components and system in this engine.

Manual Name	Pub. No.
● 3S-GE Engine Emission Control Repair Manual (For CELICA)	ERM107E
● 3S-GE Engine Emission Control Repair Manual (For MR2)	ERM102E

All information in this manual is based on the latest product information at the time of publication. However, specifications and procedures are subject to change without notice.

TOYOTA MOTOR CORPORATION

INTRODUCTION	IN
ENGINE	EG
IGNITION SYSTEM	IG
STARTING SYSTEM	ST
CHARGING SYSTEM	CH

HOW TO USE THIS MANUAL

INDEX

IN00F-01

An INDEX is provided on the first page of each section to guide you to the item to be repaired. To assist you in finding your way through the manual, the Section Title and major heading are given at the top of every page.

IN

GENERAL DESCRIPTION

IN00G-01

At the beginning of each section, a General Description (Precautions) is given that pertains to all repair operations contained in that section.

Read these precautions before starting any repair task.

TROUBLESHOOTING

IN00H-01

TROUBLESHOOTING tables are included for each system to help you diagnose the problem and find the cause.

PREPARATION

IN00J-01

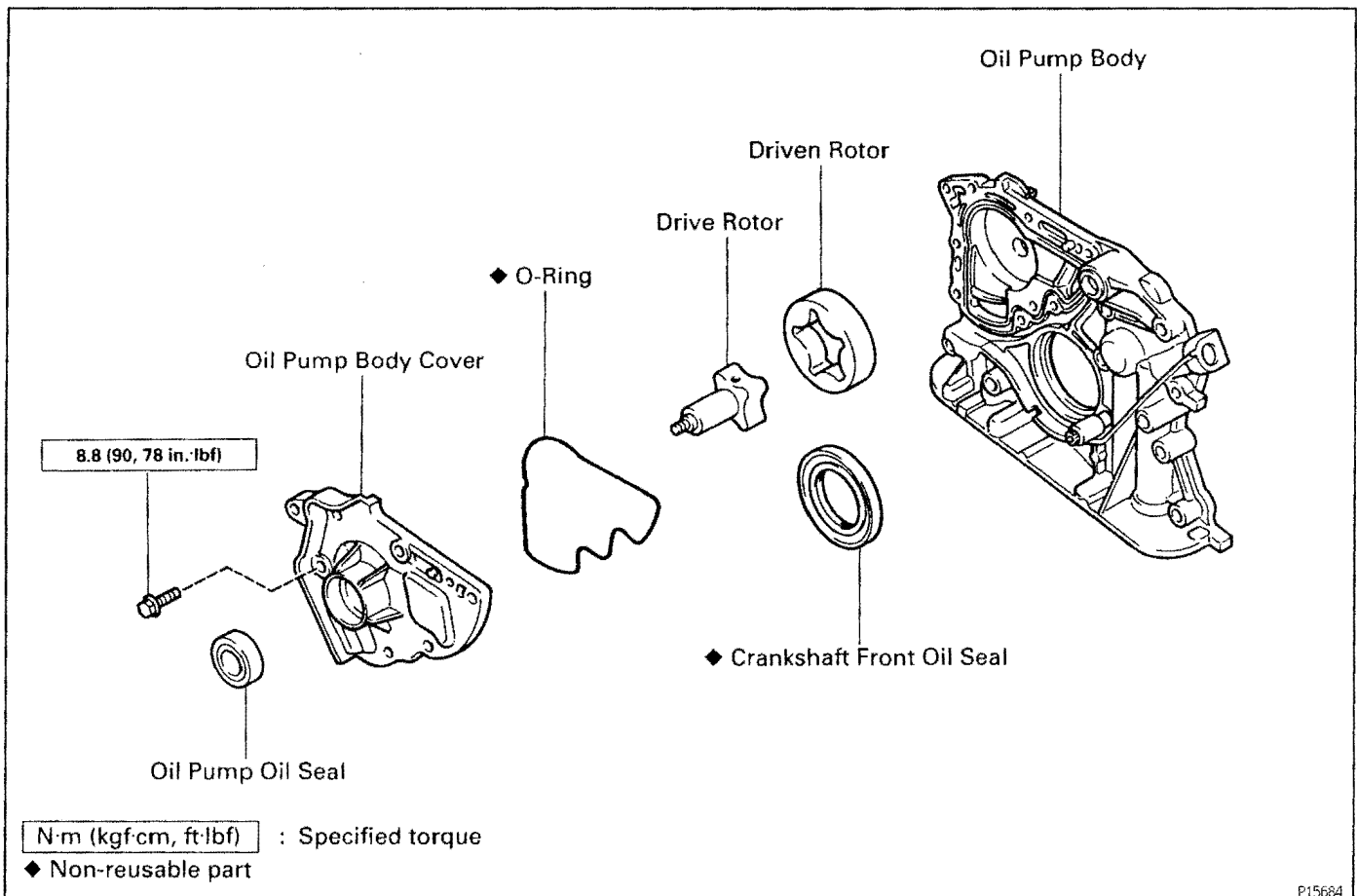
Preparation lists the SST (Special Service Tools), recommended tools, equipment, lubricant and SSM (Special Service Materials) which should be prepared before beginning the operation and explains the purpose of each one.

REPAIR PROCEDURES

IN00K-06

Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

Example:



The procedures are presented in a step-by-step format:

- The illustration shows what to do and Where to do it.
- The task heading tells what to do.
- The detailed text tells how to perform the task and gives other information such as specifications and warnings.

Example:

IN

Task heading: what to do

6. INSTALL CRANKSHAFT PULLEY

(a) Using SST, install the bolt.
SST 09213-54015 (90119-08126)

Set part No. *Component part No.*

Detailed text: how to do task

(b) Install the bolt.
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

Specification

Illustration: what to do and where

V00301

This format provides the experienced technician with a FAST TRACK to the information needed. The upper case task heading can be read at a glance when necessary, and the text below it provides detailed information. Important specifications and warnings always stand out in bold type.

IN00L-01

REFERENCES

References have been kept to a minimum. However, when they are required you are given the page to refer to.

IN00M-01

SPECIFICATIONS

Specifications are presented in bold type throughout the text where needed. You never have to leave the procedure to look up your specifications. They are also found at the end of each section, for quick reference.

CAUTIONS, NOTICES, HINTS:

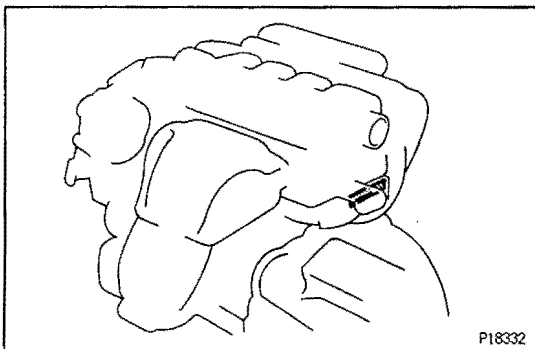
- **CAUTIONS** are presented in bold type, and indicate there is a possibility of injury to you or other people.
- **NOTICES** are also presented in bold type, and indicate the possibility of damage to the components being repaired.
- **HINTS** are separated from the text but do not appear in bold. They provide additional information to help you efficiently perform the repair.

SI UNIT

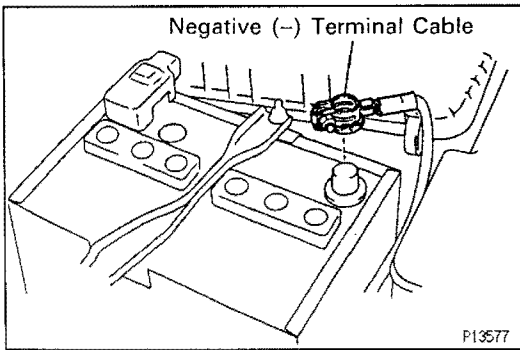
The UNIT given in this manual are primarily expressed with the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.

Example:

Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

**IDENTIFICATION INFORMATION
ENGINE SERIAL NUMBER**

The engine serial number is stamped on the engine block as shown.

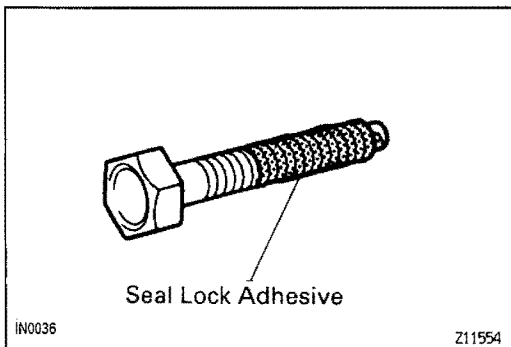


GENERAL REPAIR INSTRUCTIONS

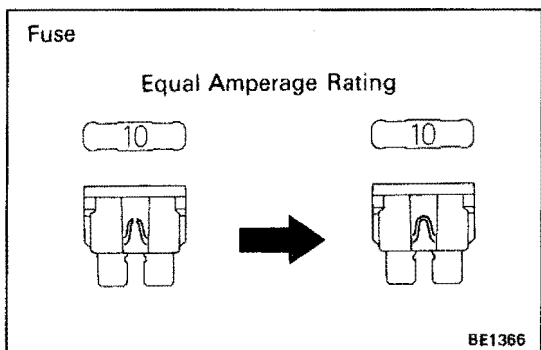
1. Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in the appropriate order to facilitate reassembly.
3. Observe the following:
 - (a) Before performing electrical work, disconnect the negative (-) terminal cable from the battery.
 - (b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the cable from the negative (-) terminal which is grounded to the vehicle body.
 - (c) To prevent damage to the battery terminal post, loosen the terminal nut and raise the cable straight up without twisting or prying it.
 - (d) Clean the battery terminal posts and cable terminals with a shop rag. Do not scrape them with a file or other abrasive objects.
 - (e) Install the cable terminal to the battery post with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the terminal onto the post.
 - (f) Be sure the cover for the positive(+) terminal is properly in place.
4. Check hose and wiring connectors to make sure that they are secure and correct.
5. Non-reusable parts.
 - (a) Always replace cotter pins, gaskets, O-rings and oil seals etc. with new ones.
 - (b) Non-reusable parts are indicated in the component illustrations by the "◆" symbol.
6. Precoated parts.

Precoated parts are bolts and nuts, etc. that are coated with a seal lock adhesive at the factory.

 - (a) If a precoated part is retightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.
 - (b) When reusing precoated parts, clean off the old adhesive and dry with compressed air. Then apply the specified seal lock adhesive to the bolt, nut or threads.
 - (c) Precoated parts are indicated in the component illustrations by the "★" symbol.
7. When necessary, use a sealer on gaskets to prevent leaks.
8. Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.



9. Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found in the preparation part at the front of each section in this manual.



10. When replacing fuses, be sure the new fuse has the correct amperage rating . DO NOT exceed the rating or use one with a lower rating.

Illustration	Symbol	Part Name	Abbreviation
 BE5594	 IN0365	FUSE	FUSE
 BE5595	 IN0366	MEDIUM CURRENT FUSE	M-FUSE
 BE5596	 IN0367	HIGH CURRENT FUSE	H-FUSE
 BE5597	 IN0367	FUSIBLE LINK	FL
 BE5598	 IN0368	CIRCUIT BREAKER	CB

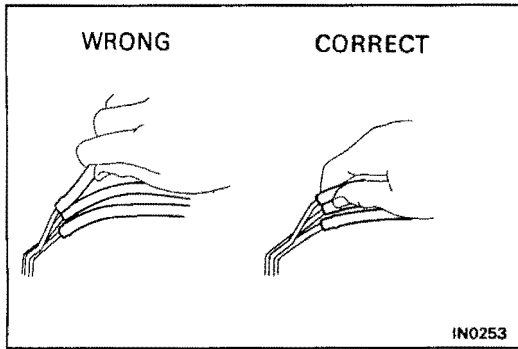
V00076

11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.
 - (a) If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels at the opposite end in order to ensure safety.

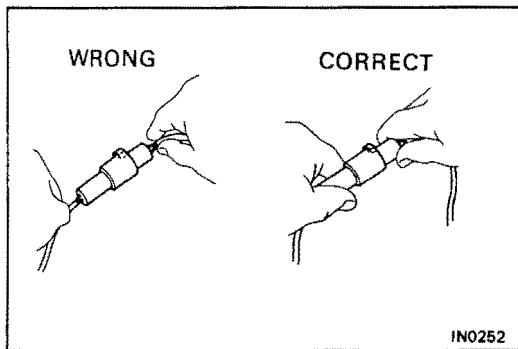
- (b) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on a vehicle raised on a jack alone, even for a small job that can be finished quickly.

12. Observe the following precautions to avoid damage to the parts:

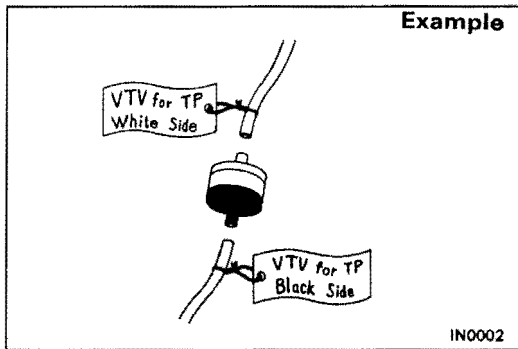
- (a) Do not open the cover or case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)



- (b) To disconnect vacuum hoses, pull on the end, not the middle of the hose.
- (c) To pull apart electrical connectors, pull on the connector itself, not the wires.
- (d) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
- (e) When steam cleaning an engine, protect the distributor, air filter, and VCV from water.



- (f) Never use an impact wrench to remove or install temperature switches or temperature sensors.
- (g) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
- (h) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.



13. Tag hoses before disconnecting them:

- (a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
- (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

14. Unless otherwise stated, all resistance is measured at an ambient temperature of 20°C (68°F). Because the resistance may be outside specifications if measured at high temperatures immediately after the vehicle has been running, measurements should be made when the engine has cooled down.

PRECAUTION FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

IN007-02

CAUTION: If large amounts of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

1. **Use only unleaded gasoline.**
2. **Avoid prolonged idling.**
Avoid running the engine at idle speed for more than 20 minutes.
3. **Avoid spark jump test.**
 - (a) Perform spark jump test only when absolutely necessary. Perform this test as rapidly as possible.
 - (b) While testing, never race the engine.
4. **Avoid prolonged engine compression measurement.**
Engine compression tests must be done as rapidly as possible.
5. **Do not run engine when fuel tank is nearly empty.**
This may cause the engine to misfire and create an extra load on the converter.
6. **Avoid coasting with ignition turned off and prolonged braking.**
7. **Do not dispose of used catalyst along with parts contaminated with gasoline or oil.**

IF VEHICLE IS EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

IN028-06

For vehicles with mobile communication systems such as two-way radios and cellular telephones, observe the following precautions.

- (1) Install the antenna as far as possible away from the ECU and sensors of the vehicle's electronic system.
- (2) Install the antenna feeder at least 20 cm (7.87 in.) away from the ECU and sensors of the vehicle's electronics systems. For details about ECU and sensors locations, refer to the section on the applicable component.
- (3) Do not wind the antenna feeder together with the other wiring. As much as possible, also avoid running the antenna feeder parallel with other wire harnesses.
- (4) Confirm that the antenna and feeder are correctly adjusted.
- (5) Do not install powerful mobile communications system.

ABBREVIATIONS USED IN THIS MANUAL







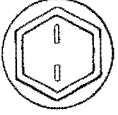
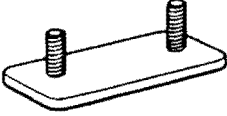


IN031-05

A/C	Air conditioner
ACIS	Acoustic Control Induction System
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CB	Circuit Breaker
DOHC	Double Over Head Cam
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
ESA	Electronic Spark Advance
FIPG	Formed in Place Gasket
FL	Fusible Link
H-Fuse	High Current Fuse
IG	Ignition
ISC	Idle Speed Control
LH	Left-Hand
LHD	Left-Hand Drive
M-Fuse	Medium Current Fuse
MP	Multipurpose
O/S	Oversize
PCV	Positive Crankcase Ventilation
PS	Power Steering
RH	Right-Hand
RHD	Right-Hand Drive
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TDC	Top Dead Center
TEMP.	Temperature
TWC	Three-Way Catalyst
U/S	Undersize
VSV	Vacuum Switching Valve
w/	With
w/o	Without

STANDARD BOLT TORQUE SPECIFICATIONS

IND08-03

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class		Mark	Class
Hexagon head bolt	 <p>Bolt head No.</p> <p>4— 4T 5— 5T 6— 6T 7— 7T 8— 8T 9— 9T 10— 10T 11— 11T</p>		Stud bolt	 <p>No mark</p> <p>4T</p>	
	 <p>No mark</p> <p>4T</p>				
Hexagon flange bolt w/ washer hexagon bolt	 <p>No mark</p> <p>4T</p>		Welded bolt	 <p>Grooved</p> <p>6T</p>	
Hexagon head bolt	 <p>2 protruding lines</p> <p>5T</p>				
Hexagon flange bolt w/ washer hexagon bolt	 <p>2 protruding lines</p> <p>6T</p>		 <p>4T</p>		
Hexagon head bolt	 <p>3 protruding lines</p> <p>7T</p>				
Hexagon head bolt	 <p>4 protruding lines</p> <p>8T</p>				

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N·m	kgf·cm	ft·lbf	N·m	kgf·cm	ft·lbf
4T	6	1	5	55	48 in.·lbf	6	60	52 in.·lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.·lbf	7.5	75	65 in.·lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.·lbf	9	90	78 in.·lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

IN

– MEMO –

IN

ENGINE

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ENGINE MECHANICAL

DESCRIPTION

The 3S-GE engine is an in-line, 4 cylinder, 2.0 liter DOHC 16-valve engine.

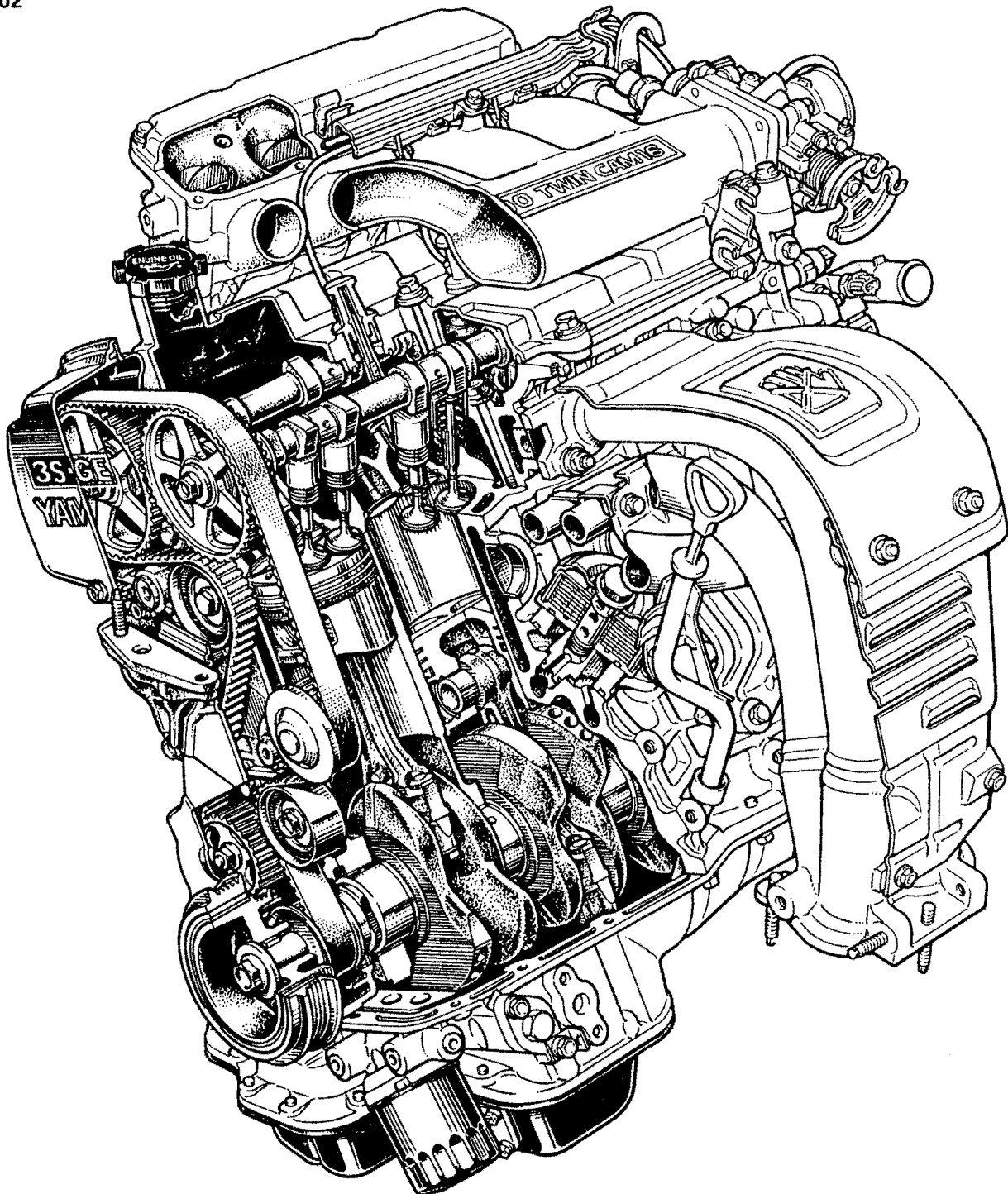
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OPERATION

EG

ST202

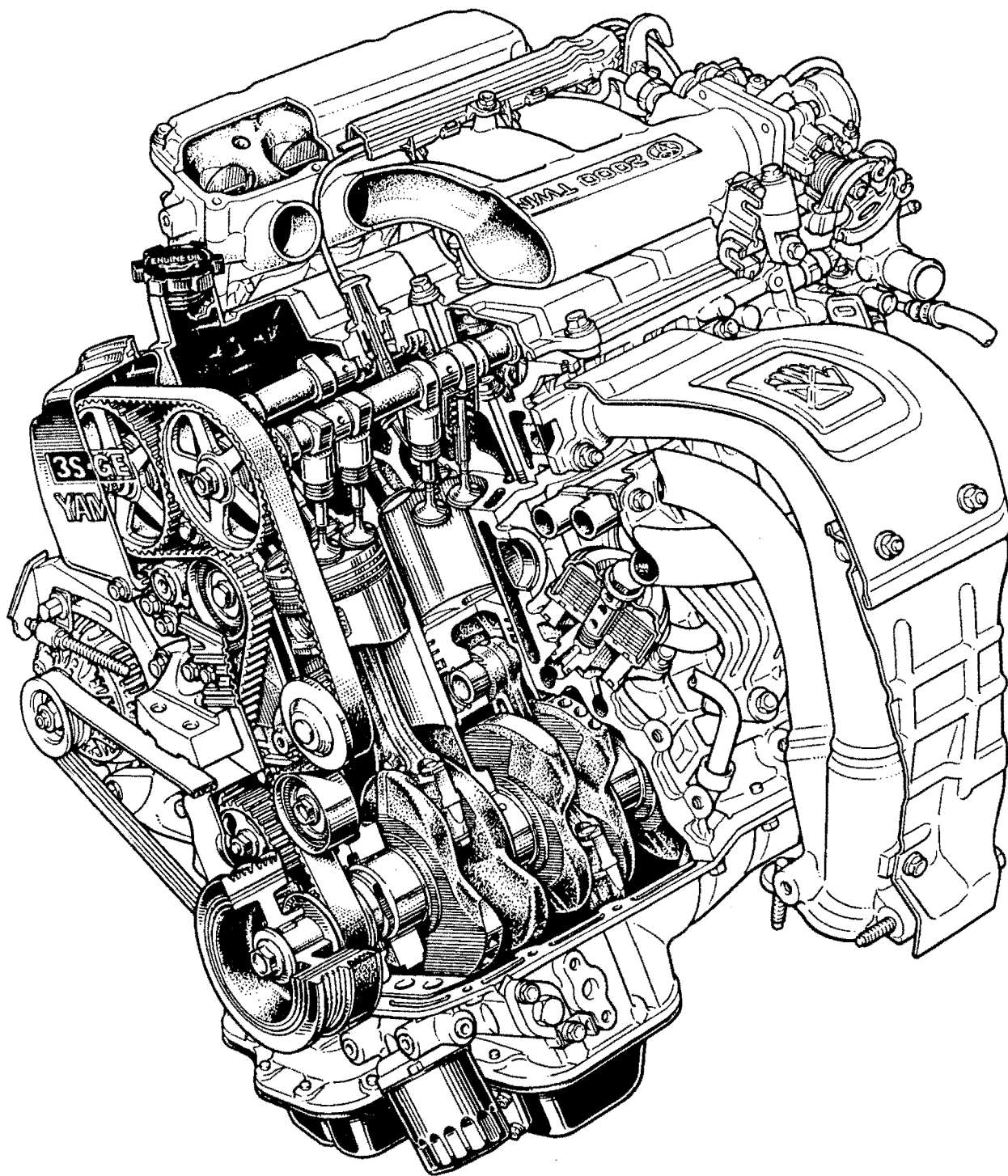
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P15953

SW20

EG



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

The crankshaft is integrated with 8 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 ignition 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 4 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Both the intake camshaft and the exhaust camshaft are driven by a single timing belt. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and cams 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 inner shim type system, in which valve adjusting shims are located below the valve lifters. To replace the shims, the camshafts must be removed.

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

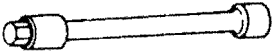
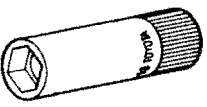
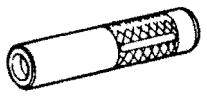
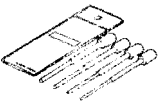




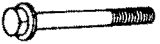
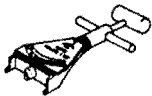
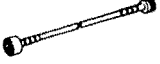


The cast iron cylinder block has 4 cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes crankcase, in which the crankshaft is installed. In addition, the cylinder contains a water jacket, through which coolant is pumped to cool the cylinders.

The No.1 and No.2 oil pans are bolted onto the bottom the cylinder block. The No.1 oil pan is made of aluminum alloy. The No.2 oil pan is an oil reservoir made of pressed sheet steel. The dividing plate also prevents the oil from shifting away from the oil pump suction pipe when the vehicle is stopped suddenly.

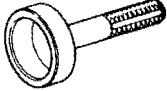

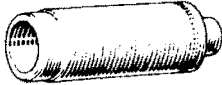

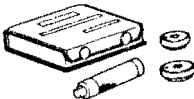



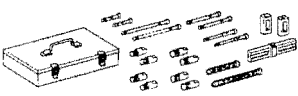
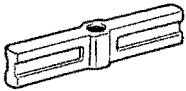
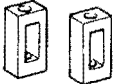



PREPARATION

SST (SPECIAL SERVICE TOOLS)



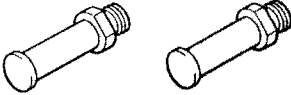

EGGAY-10

	09043-38100 Hexagon 10 mm Wrench	Cylinder head bolt
	09155-16100 Spark Plug Wrench	
	09201-41020 Valve Stem Oil Seal Replacer	
	09201-10000 Valve Guide Bushing Remover & Replacer Set	
	(09201-01060) Valve Guide Bushing Remover & Replacer 6	
	09202-70010 Valve Spring Compressor	
	09213-54015 Crankshaft Pulley Holding Tool	
	(90119-08216) Bolt	ST202
	(91651-60855) Bolt	SW20
	09216-00021 Belt Tension Gauge	
	09216-00030 Belt Tension Gauge Cable	
	09222-30010 Connecting Rod Bushing Remover & Replacer	
	09223-46011 Crankshaft Front Oil Seal Replacer	Camshaft oil seal

EG

	<p>09223-63010 Crankshaft Rear Oil Seal Replacer</p>	
	<p>09249-63010 Torque Wrench Adaptor</p>	
	<p>09226-10010 Crankshaft Front & Rear Bearing Replacer</p>	
	<p>09330-00021 Companion Flange Holding Tool</p>	<p>Crankshaft pulley</p>
	<p>09608-30022 Front Hub Bearing Replacer Set</p>	
	<p>(09608-05010) Handle</p>	<p>Valve guide bushing</p>
	<p>09816-30010 Oil Pressure Switch Socket</p>	<p>Knock sensor</p>
	<p>09843-18020 Diagnosis Check Wire</p>	
	<p>09950-50010 Puller C Set</p>	
	<p>(09951-05010) Hanger 150</p>	<p>Crankshaft pulley</p>
	<p>(09952-05010) Slide Arm</p>	<p>Crankshaft pulley</p>
	<p>(09953-05010) Center Bolt 100</p>	<p>Crankshaft pulley</p>
	<p>(09953-05020) Center Bolt 150</p>	<p>Crankshaft pulley</p>
	<p>(09954-05020) Claw No.2</p>	<p>Crankshaft pulley</p>





	<p>09960-10010 Variable Pin Wrench Set</p>	
	<p>(09962-01000) Variable Pin Wrench Arm Assy</p>	<p>Camshaft timing pulley Oil pump pulley</p>
	<p>(09963-01000) Pin 10</p>	<p>Camshaft timing pulley</p>
	<p>(09963-00500) Pin 5</p>	<p>Oil pump pulley</p>

EG

RECOMMENDED TOOLS

EG0AZ-0K

	<p>09200-00010 Engine Adjust Kit</p>	
	<p>09904-00010 Expander Set</p>	

EQUIPMENT

EG0B0-0G

<p>Battery specific gravity gauge</p>	
<p>Caliper gauge</p>	
<p>CO/HC meter</p>	
<p>Compression gauge</p>	
<p>Connecting rod aligner</p>	
<p>Cylinder gauge</p>	
<p>Dial indicator</p>	
<p>Dye penetrant</p>	
<p>Engine tune-up tester</p>	
<p>Heater</p>	
<p>Micrometer</p>	
<p>Piston ring compressor</p>	

EG

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	

COOLANT

EG13X-08

Item	Capacity	Classification
Engine coolant (w/ Heater) ST202	7.0 liters (7.4 US qts, 6.2 Imp. qts)	Ethylene—glycol base
SW20	13.7 liters (14.4 US qts, 12.1 Imp. qts)	

LUBRICANT

EG14X-0L

Item	Capacity	Classification
Engine oil		API grade SG, SH or ILSC multigrade engine oil and recommended viscosity oil
Dry fill	5.2 liters (5.5 US qts, 4.6 Imp. qts)	
Drain and refill		
w/ Oil filter change	4.5 liters (4.8 US qts, 4.0 Imp. qts)	
w/o Oil filter change	4.0 liters (4.2 US qts, 3.5 Imp. qts)	

SSM (SERVICE SPECIAL MATERIALS)

EG081-1Q

08826-00080	Seal packing or equivalent	Camshaft bearing cap Cylinder head cover Rear oil seal retainer
08833-00070	Adhesive 1324, THREE BOND 1324 or equivalent	Flywheel mounting bolt
08833-00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	No.1 idler pulley pivot bolt Oil pressure switch

TROUBLESHOOTING

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

EGOR2-00

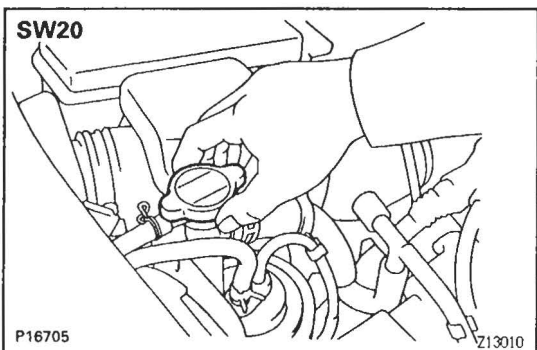
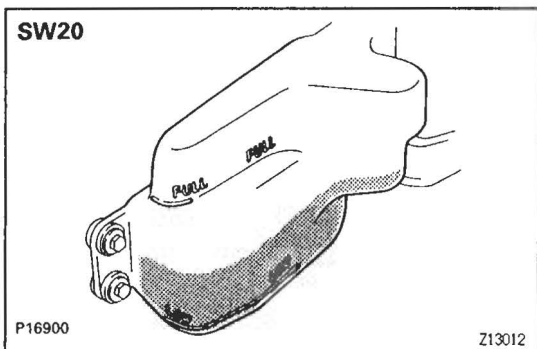
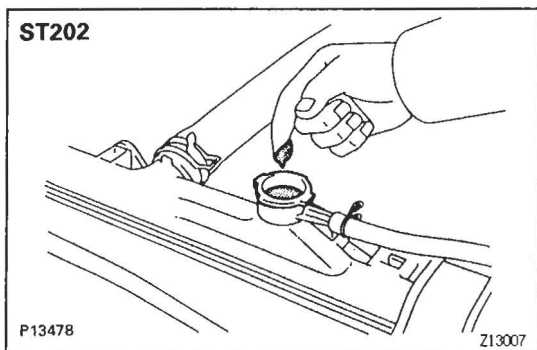
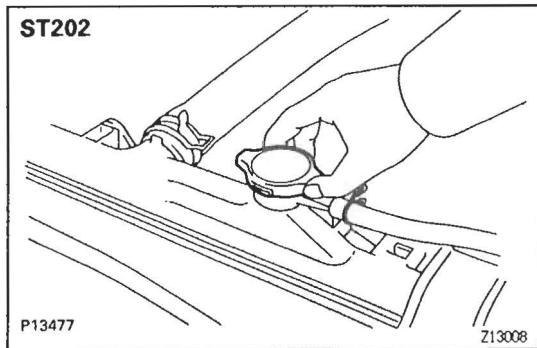
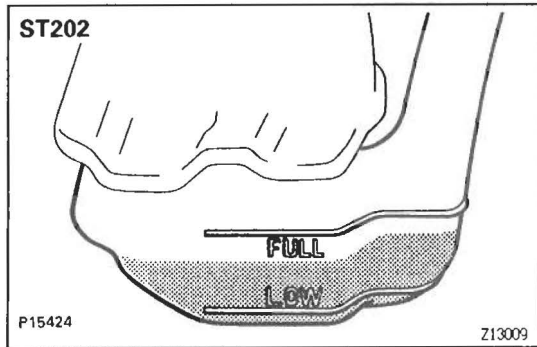
EG

See page		IG-5	IG-5	EG-204	EG-199	EG-198	EG-196	EG-194	EG-200	EG-284	-	EG-205 EG-217	EG-234	-	EG-238	EG-259	EG-45
Suspect area		RPM Signal Circuit	Ignition Circuit	Oxygen Sensor Circuit	Water Temp. Sensor Circuit	Intake Air Temp. Sensor Circuit	Vacuum Sensor Circuit	Throttle Position Sensor Circuit	STA Signal Circuit	Knock Sensor Circuit	A/C Signal Circuit	Fuel Pump	Fuel Pressure Regulator	Fuel Lines	Injectors	Idle Speed Control Valve	Compression
Symptom																	
Does not start	Engine does not crank																
	Starter runs – engine does not crank																
	No combustion	12	2				5					6				8	9
	No complete combustion				4		1						3		9	2	5
Difficult to start	Engine cranks slowly										2						
	Engine cranks normally	11	12		4	13						6	5	7	15	3	8
	Cold engine				1	5			2			7	6	8	9	4	
	Hot engine				1	4						6	5	7	8	3	
Poor idling	Incorrect first idle				2											3	
	High engine idle speed				2	4		5			6				7	3	
	Low engine idle speed				1		3								4	2	
	Rough idling		16		2		11					6	5	7	15	8	9
	Misfire		3		5		7								8		6
Poor drivability	Hesitant acceleration			11	9	10	8	7				13	12	14	17		6
	Backfire			5	2	6	4	3				8	7	9	10		
	Muffler explosion (after fire)			8	3	7	5	6					4		9		
	Surging												1		4		
	Knocking									1							
Engine stall	Soon after starting				7		6					3	2	4	8	5	
	After accelerator pedal depressed						1	2					4	5	6		
	After accelerator pedal released						2									1	
	During A/C operation										1					2	
	When shifting N to D															1	
Ohters	Poor fuel economy			16	12	17	14	13			15				11		8
	Engine overheat									9							
	Engine overcool																
	Excessive oil consumption																3
	Low oil pressure																
	High oil pressure																
	Starter keeps running																
Battery often discharges																	

See page		EG-18	EG-63	EG-56	EG-318	EG-92	EG-389	EG-131	EG-134	EG-91	EG-143	-	EG-325 EG-327	EG-323	CH-9	-	-
Suspect area		Valve Clearance	Valve Timing	Timing Belt	Water Pump	Valve Stem Guide Bushing	Oil Pump	Connecting Rod Bearing	Crankshaft Bearing	Cylinder Head	Piston Ring	Flywheel	Radiator and Radiator Cap	Thermostat	Drive Belt	Water Temp. Sender Gauge	Oil Pressure Switch
Symptom		Valve Clearance	Valve Timing	Timing Belt	Water Pump	Valve Stem Guide Bushing	Oil Pump	Connecting Rod Bearing	Crankshaft Bearing	Cylinder Head	Piston Ring	Flywheel	Radiator and Radiator Cap	Thermostat	Drive Belt	Water Temp. Sender Gauge	Oil Pressure Switch
Does not start	Engine does not crank																
	Starter runs – engine does not crank											2					
	No combustion		10	11													
	No complete combustion		7	8													
Difficult to start	Engine cranks slowly							3	4								
	Engine cranks normally		10								9						
	Cold engine																
	Hot engine																
Poor idling	Incorrect first idle																
	High engine idle speed																
	Low engine idle speed																
	Rough idling	12	13	14						18	10						
	Misfire																
Poor drivability	Hesitant acceleration	15	16														
	Backfire		1														
	Muffler explosion (after fire)		2														
	Surging																
	Knocking		4		8								5	7			
Engine stall	Soon after starting																
	After accelerator pedal depressed																
	After accelerator pedal released																
	During A/C operation																
	When shifting N to D																
Others	Poor fuel economy		10								9						
	Engine overheat		7	5	6		10			11			3	4		13	
	Engine overcool													2		3	
	Excessive oil consumption					2				5	4						
	Low oil pressure						2	3	4								5
	High oil pressure						1										2
	Starter keeps running																
	Battery often discharges														1		

See page		CH-19	EG-138	EG-262 EG-263	EG-264	EG-293	EG-289	-	-	-	-	ST-20 ST-21	ST-9	IG-9	IG-12	-	-	EG-329
Suspect area		Alternator	Cylinder Block	EFI Main Relay	Circuit Opening Relay	Fuel Cut System	ECU	Fuel Quality	Fuel Leakage	Coolant Leakage	Oil Leakage	Starter Relay	Starter	Spark Plug	Distributor	Accelerator Pedal Link	Brakes drag even when released	Cooling Fan System
Symptom																		
Does not start	Engine does not crank											1	2					
	Starter runs – engine does not crank												1					
	No combustion			3	4		13	7							1			
	No complete combustion						10											
Difficult to start	Engine cranks slowly											1						
	Engine cranks normally						16	1					2	14				
	Cold engine						10	3										
	Hot engine						9	2										
Poor idling	Incorrect first idle						4									1		
	High engine idle speed						8									1		
	Low engine idle speed						5											
	Rough idling						17	1					3	4				
	Misfire						9	1					2	4				
Poor drivability	Hesitant acceleration						18	2					4	5		1		
	Backfire						11											
	Muffler explosion (after fire)				1		10											
	Surging						5						2	3				
	Knocking						9	2					3					6
Engine stall	Soon after starting						9	1										
	After accelerator pedal depressed						7						3					
	After accelerator pedal released						3											
	During A/C operation						2											
	When shifting N to D						3											
Others	Poor fuel economy					5	21	2	1					6	7	3	4	
	Engine overheat		12							1				8				2
	Engine overcool																	1
	Excessive oil consumption		6								1							
	Low oil pressure										1							
	High oil pressure																	
	Starter keeps running											1	2					
	Battery often discharges	2																

EG



TUNE-UP ENGINE COOLANT INSPECTION

ST202:

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

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

(a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

(b) There should not be any excessive deposits of rust or scale around the radiator cap or water filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.

SW20:

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

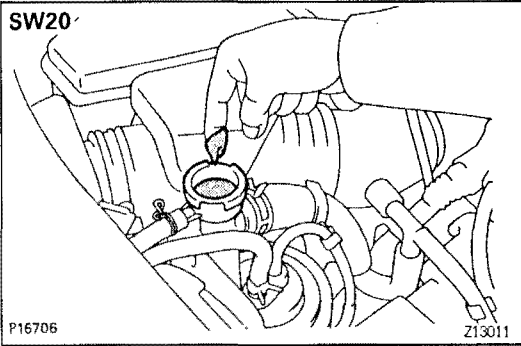
The engine coolant level should be between the "LOW" and "FULL" lines.

If low, check for leaks and add engine coolant up to the "FULL" line.

2. CHECK ENGINE COOLANT QUALITY

(a) Remove the water filler cap.

CAUTION: To avoid the danger of being burned, do not remove the water filler cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

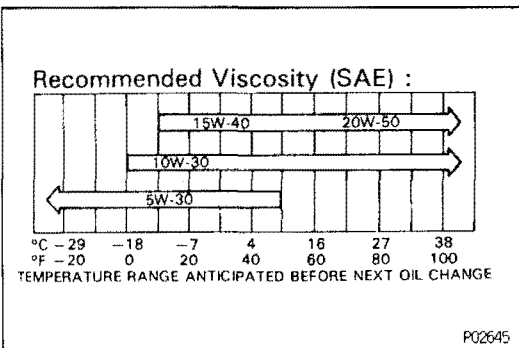


- (b) There should not be any excessive deposits of rust or scale around the water filler cap or water filler hole, and the coolant should be free from oil. If excessively dirty, replace the coolant.
- (c) Reinstall the water filler cap.

EG

EG084-0W

ENGINE OIL INSPECTION



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:

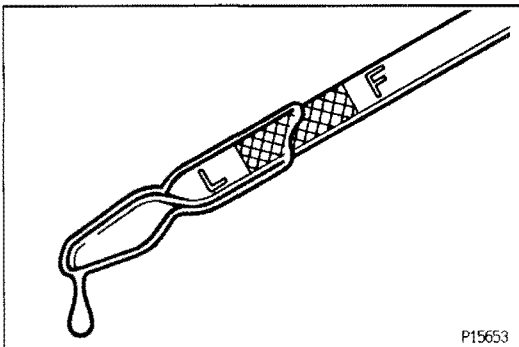
API grade SG, SH or ILSAC multigrade engine oil.

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.

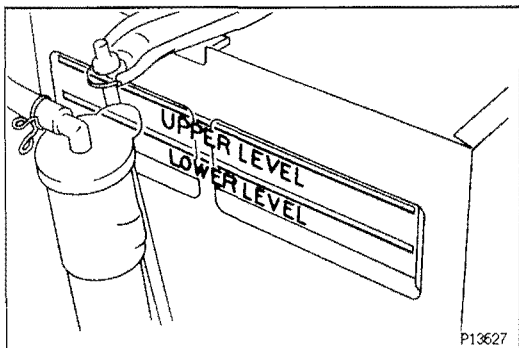


EG086-06

BATTERY INSPECTION

1. CHECK BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

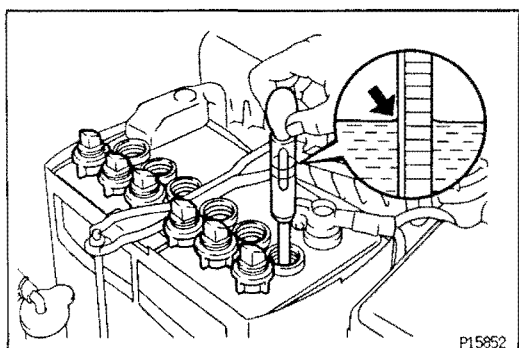
- (a) Check the electrolyte quantity of each cell. If insufficient, refill with distilled (or purified) water.



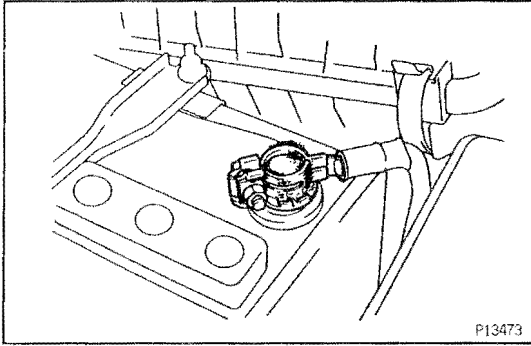
- (b) Check the specific gravity of each cell. **Standard specific gravity at 20°C (68°F):**

1.25 – 1.27

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

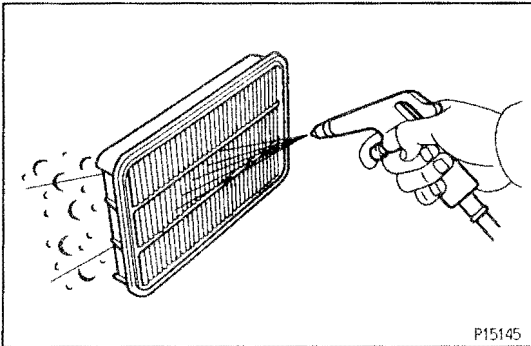


EG



2. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

- (a) Check that the battery terminals are not loose or corroded.
- (b) Check the fusible link and fuses for continuity.



AIR FILTER INSPECTION AND CLEANING ^{EG47V-01}

1. REMOVE AIR FILTER
2. INSPECT AND CLEAN AIR FILTER

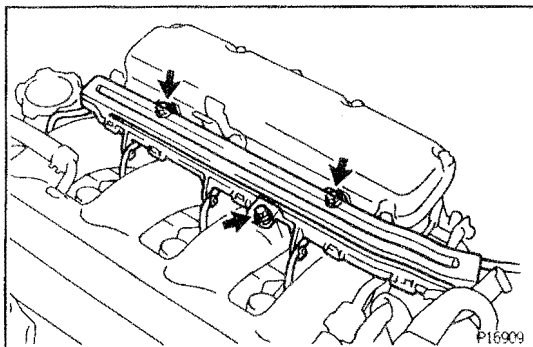
- (a) Visually check that the air filter is not damaged or excessively oily.

If necessary, replace the air filter.

- (b) Clean the air filter with compressed air.

First blow from the inside thoroughly, then blow off the outside of the air filter.

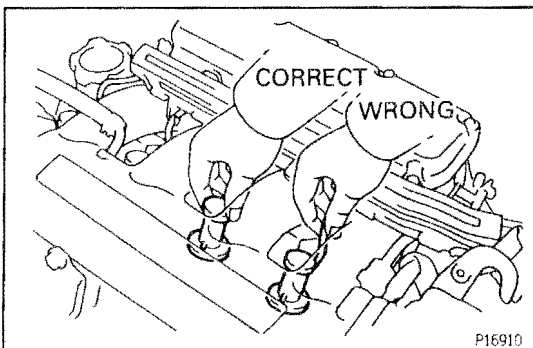
3. REINSTALL AIR FILTER



HIGH-TENSION CORDS INSPECTION ^{EG41W-01}

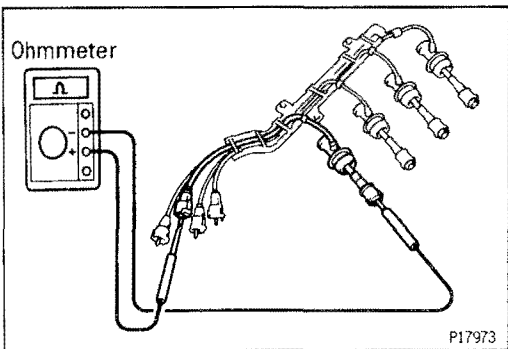
1. REMOVE HIGH-TENSION CORDS

- (a) Remove the 3 bolts, and disconnect the high-tension cord clamp from the ACIS valve.



- (b) 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. INSPECT HIGH – TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance.

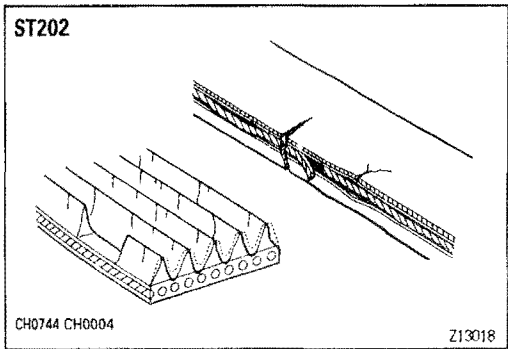
Maximum resistance:

25 kΩ per cord

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

3. REINSTALL HIGH – TENSION CORDS

EG



ALTERNATOR DRIVE BELT INSPECTION
ST202:

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) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

Drive belt deflection:

w/ A/C

New belt

10 – 11 mm (0.39 – 0.43 in.)

Used belt

13 – 16 mm (0.51 – 0.63 in.)

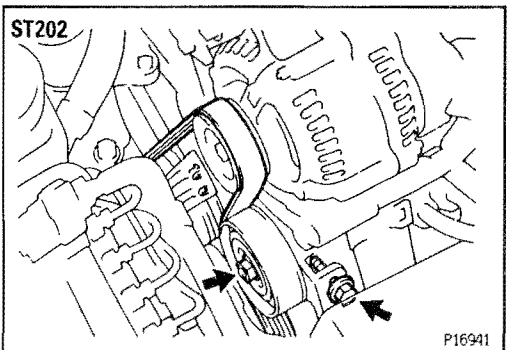
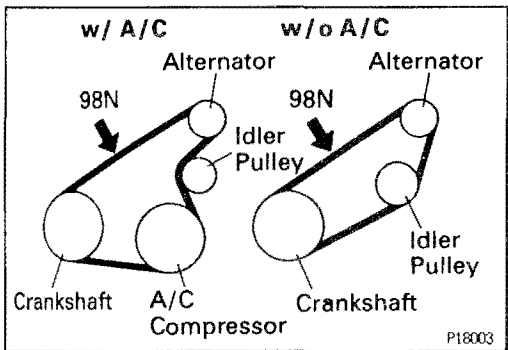
w/o A/C

New belt

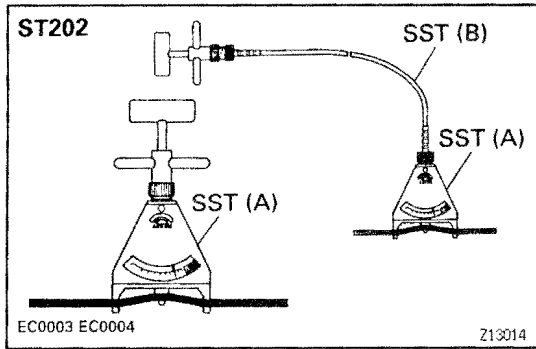
11 – 14 mm (0.43 – 0.55 in.)

Used belt

12 – 18 mm (0.47 – 0.71 in.)



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



Reference:

Using SST, check the drive belt tension.

SST 09216-00021 (A),

09216-00030 (B)

Drive belt tension:

w/ A/C

New belt

686 – 785 N (70 – 80 kgf)

Used belt

294 – 441 N (30 – 45 kgf)

w/o A/C

New belt

461 – 706 N (47 – 72 kgf)

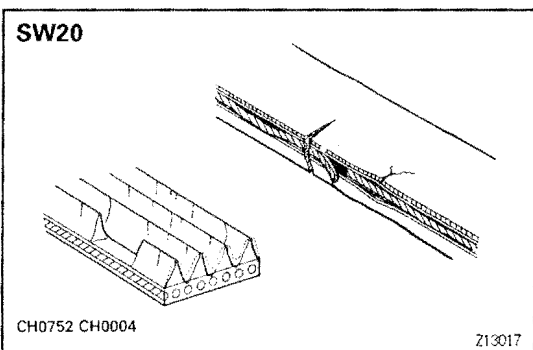
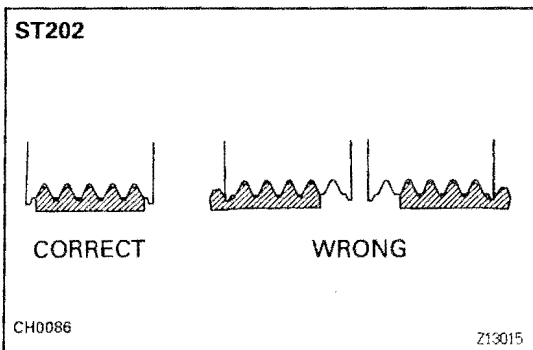
Used belt

353 – 610 N (36 – 62 kgf)

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.



SW20:

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) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

Drive belt deflection:

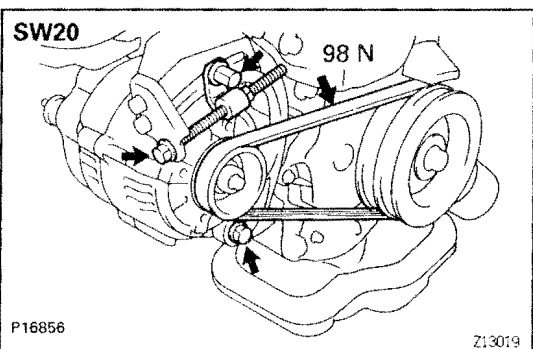
New belt

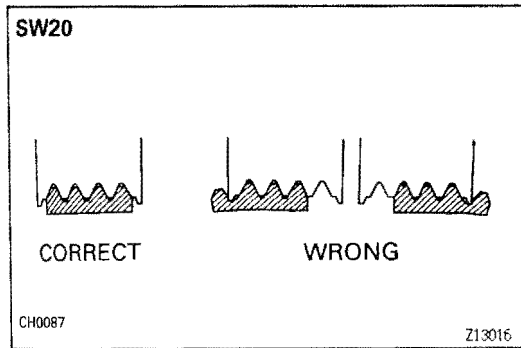
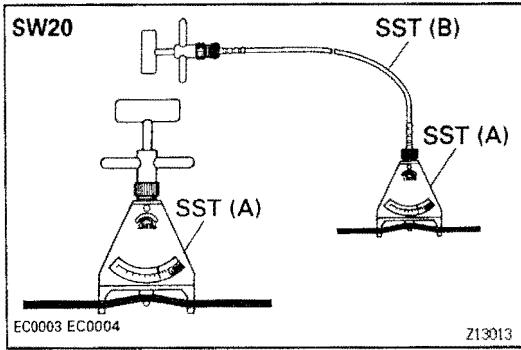
9 – 12 mm (0.35 – 0.47 in.)

Used belt

10 – 15 mm (0.39 – 0.59 in.)

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



**Reference:**

Using SST, check the drive belt tension.

SST 09216-00021 (A),

09216-00030 (B)

Drive belt tension:**New belt**

539 – 637 N (55 – 65 kgf)

Used belt

245 – 392 N (25 – 40 kgf)

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

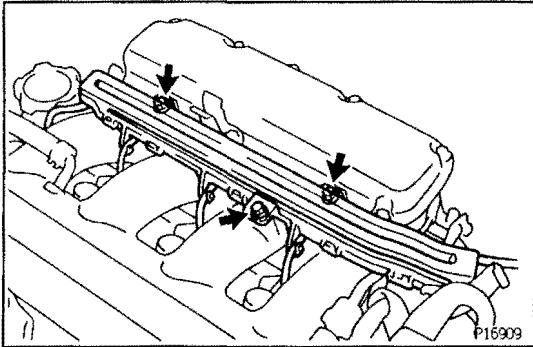
HINT:

- "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

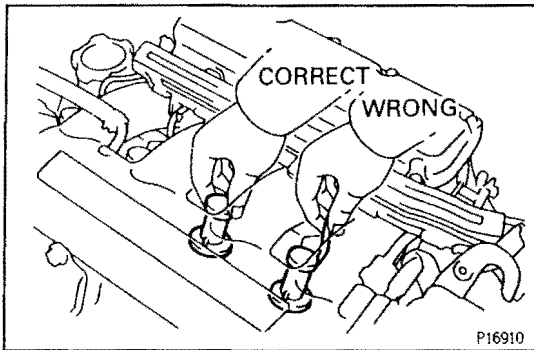
HINT: Inspect and adjust the valve clearance when the engine is cold.

EG

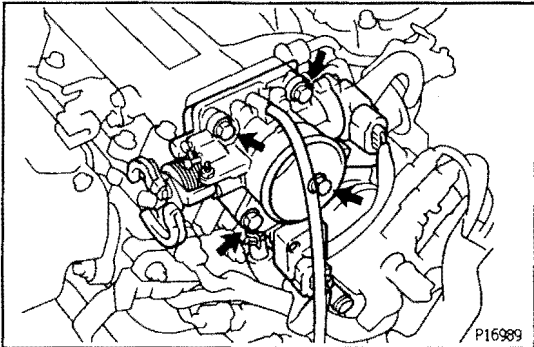


1. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

- (a) Remove the 3 bolts, and disconnect the high-tension cord clamp from the ACIS valve.

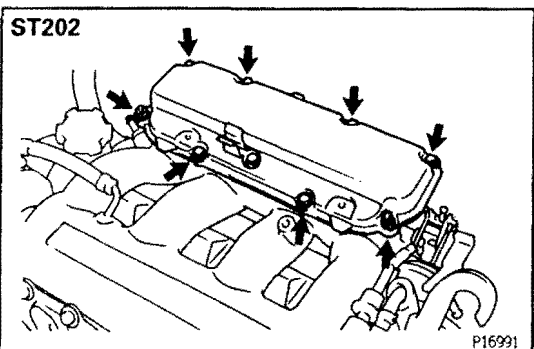


- (b) Disconnect the high-tension cords at the rubber boot. Do not pull on the high-tension cords. **NOTICE:** Pulling on or bending the cords may damage the conductor inside.



2. DISCONNECT THROTTLE BODY FROM ACIS VALVE

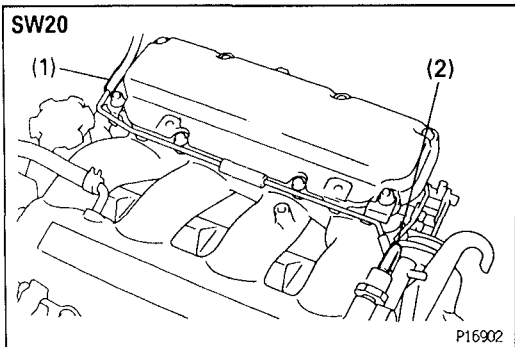
- (a) Remove the 4 bolts, and disconnect the throttle body from the ACIS valve.
- (b) Remove the throttle body gasket.



3. ST202:

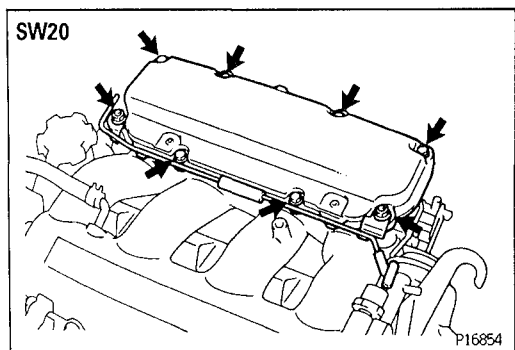
REMOVE ACIS VALVE COVER

Remove the 6 bolts, 2 nuts and ACIS valve cover.

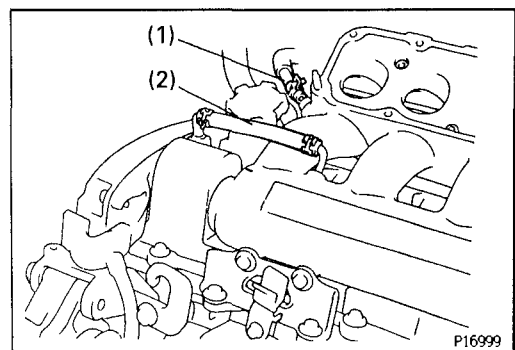


4. SW20: REMOVE VACUUM PIPE AND ACIS VALVE COVER

- (a) Disconnect the following hoses:
- (1) Vacuum hose (from vacuum sensor) from vacuum pipe
 - (2) Vacuum hose from gas filter

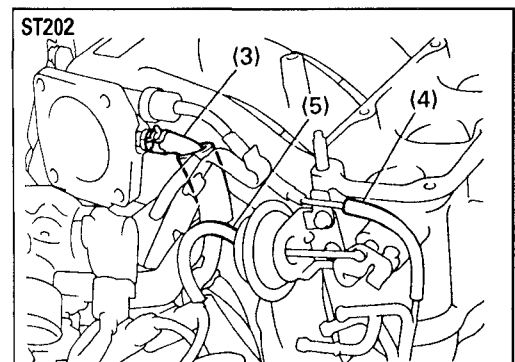


- (b) Remove the 6 bolts, 2 nuts, vacuum pipe and ACIS valve cover.

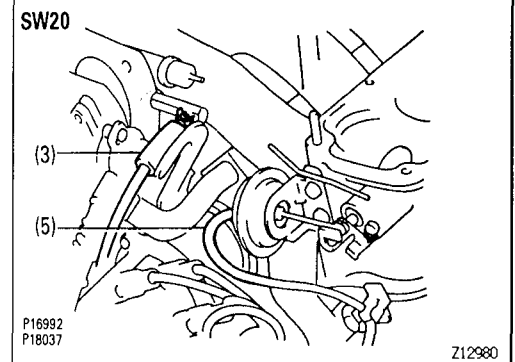


5. REMOVE ACIS VALVE ASSEMBLY

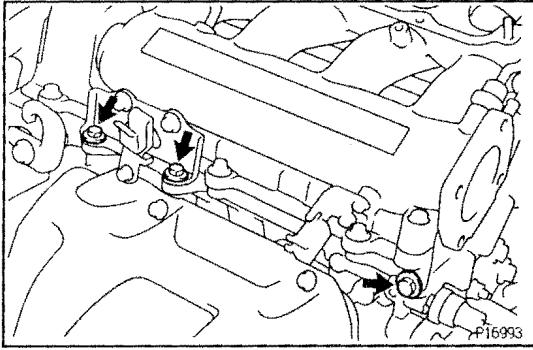
- (a) Disconnect the following hoses:
- (1) Brake booster vacuum hose from port of ACIS valve
 - (2) PCV hose from port of ACIS valve



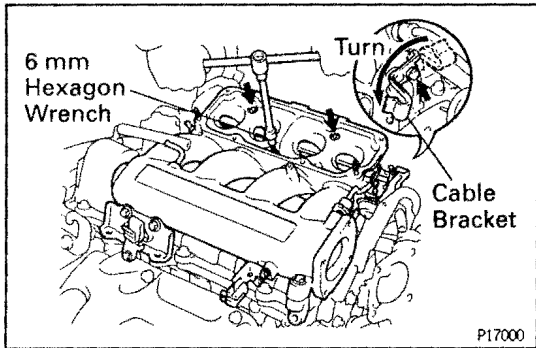
- (3) Air hose from port of ACIS valve
- (4) ST202:
Vacuum hose (from vacuum sensor) from vacuum pipe on ACIS actuator
- (5) Vacuum hose (from VSV for ACIS) from ACIS actuator



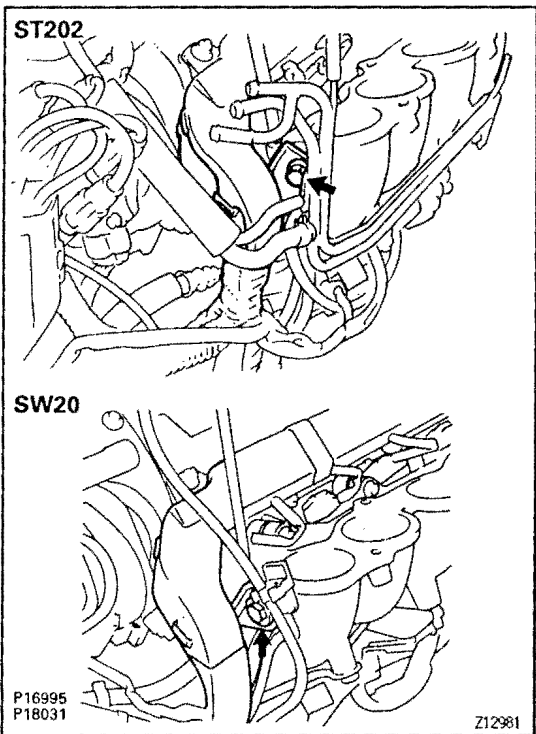
EG



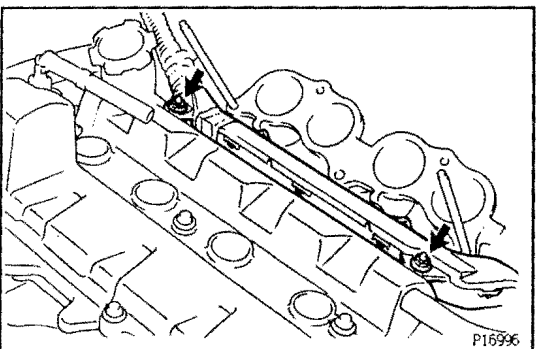
- (b) Remove the 3 bolts holding the ACIS valve stays to the cylinder head.



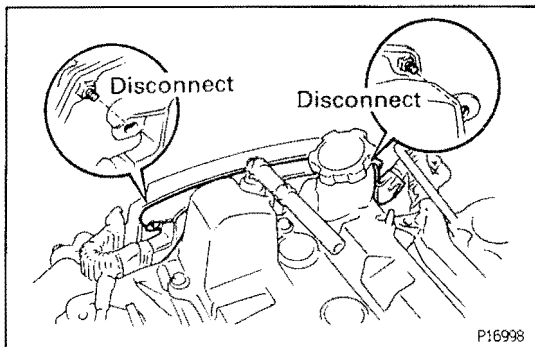
- (c) **ST202:**
Loosen the bolt, and turn the cable bracket on the LH engine hanger.
- (d) Using 6 mm hexagon wrench, remove the 3 bolts, the ACIS valve assembly and gasket.



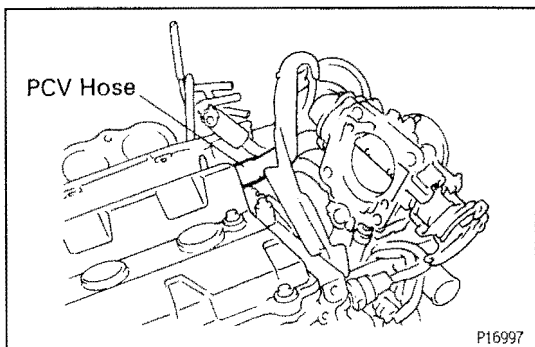
- 6. REMOVE CYLINDER HEAD COVER**
- (a) Remove the bolt, and disconnect the engine wire protector from the intake manifold.



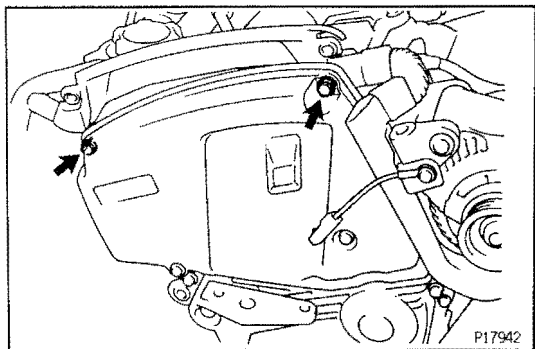
- (b) Remove the 2 nuts, and disconnect the the engine wire protector from the cylinder head cover.



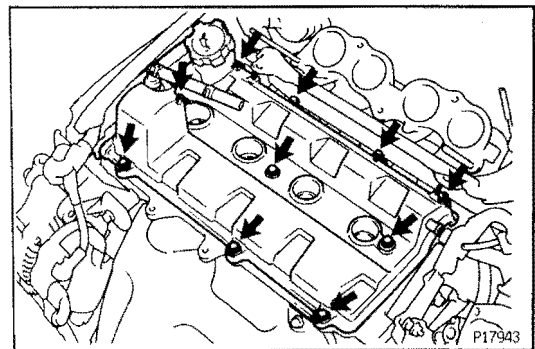
- (c) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover.



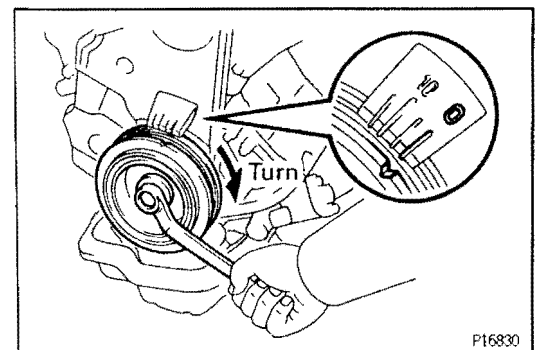
- (d) Disconnect the PCV hose from the cylinder head cover.



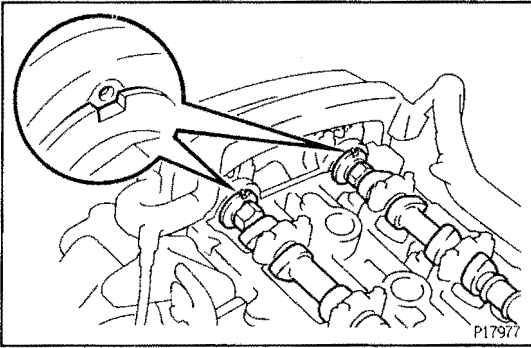
- (e) Remove the 2 bolts holding the No.2 timing belt cover to the No.4 timing belt cover.



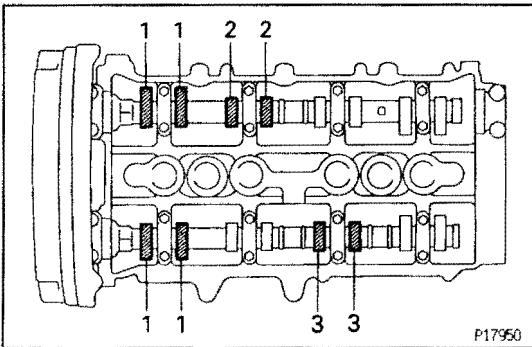
- (f) Remove the 10 bolts, seal washers, cylinder head cover and 2 gaskets.



- 7. 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 grooves of the camshafts are aligned with the dot marks of the No.1 camshaft bearing caps. If not, turn the crankshaft 1 revolution (360°) and align the mark as above.



8. INSPECT VALVE CLEARANCE

- (a) Check only the valves indicated.
- Using a feeler 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):

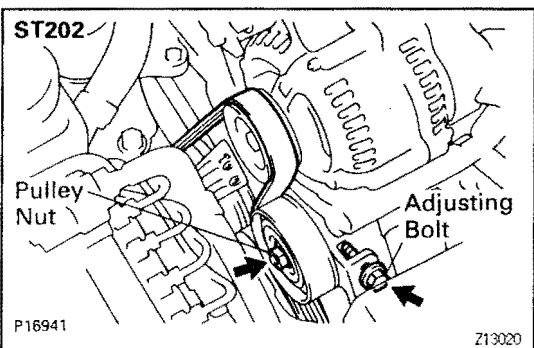
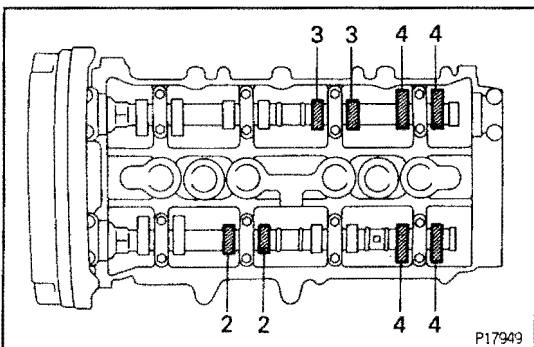
Intake

0.15 – 0.25 mm (0.006 – 0.010 in.)

Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)

- (b) Turn the crankshaft 1 revolution (360°) and align the mark as above. (See procedure in step 8)
- (c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure in step (a))

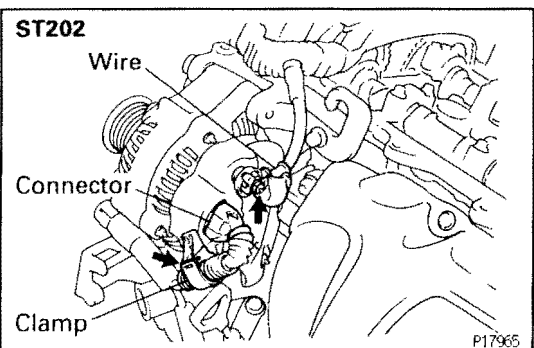


9. ADJUST VALVE CLEARANCE

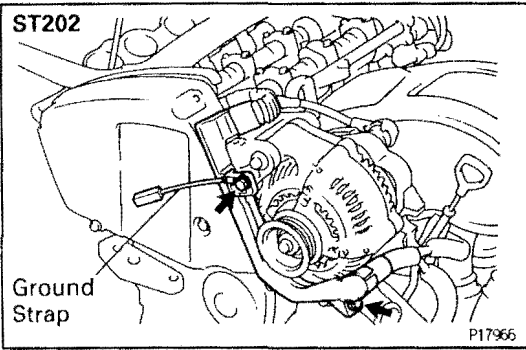
A. ST202:

Remove alternator

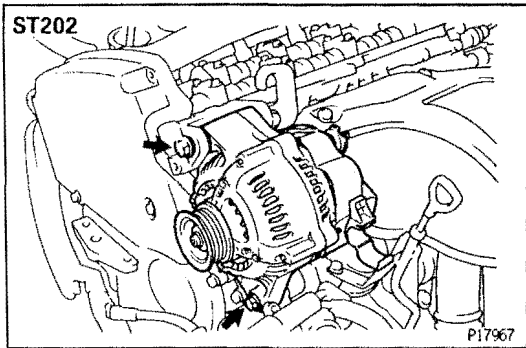
- (a) Loosen the pulley nut and adjusting bolt.
- (b) Remove the drive belt.



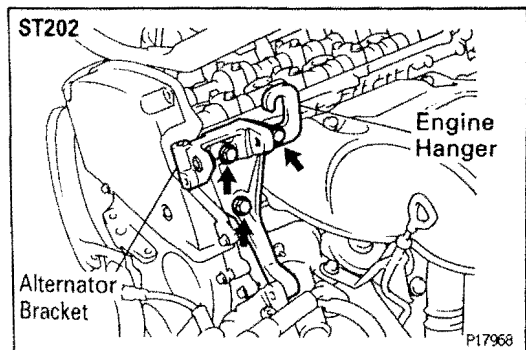
- (c) Disconnect the wire from the clamp on the rear end cover.
- (d) Disconnect the alternator connector.
- (e) Remove the rubber cap and nut, and disconnect the alternator wire.



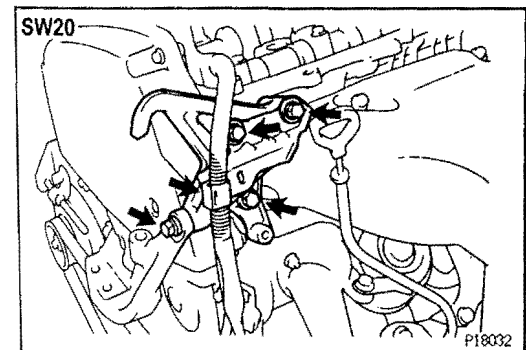
- (e) Remove the 2 bolts and ground strap, and disconnect the engine wire protector from the brackets.



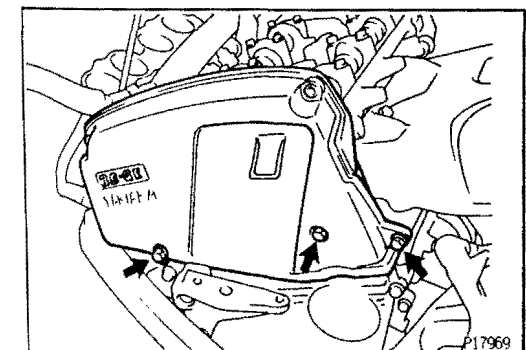
- (g) Remove the 2 bolts and alternator.



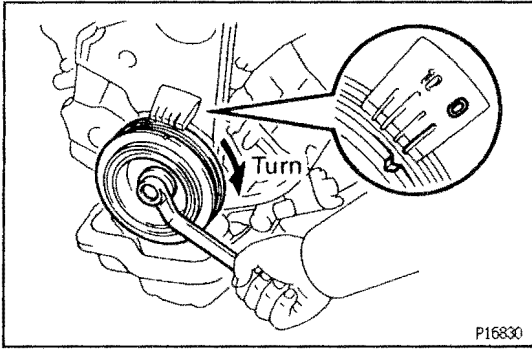
- B. ST202:**
 Remove RH front engine hanger and alternator bracket
 Remove the 3 bolts, engine hanger and alternator bracket.



- C. SW20:**
 Remove RH front engine hanger and engine wire bracket
 (a) Disconnect the engine wire from the clamp on the wire bracket.
 (b) Remove the 4 bolts, wire bracket and engine hanger.

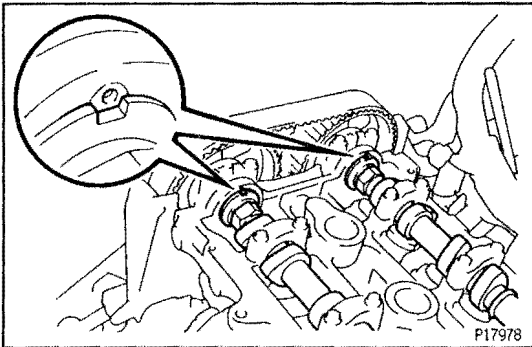


- D. Remove No.2 timing belt cover**
 Remove the 3 bolts, timing belt cover and gasket.

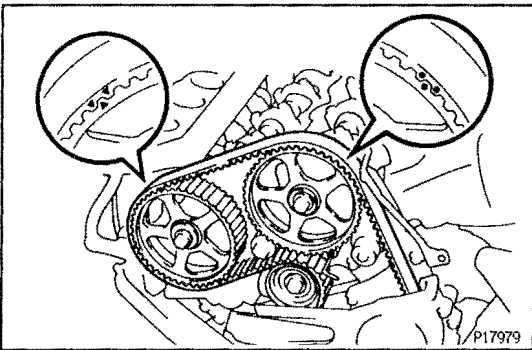


E. Set No.1 cylinder to TDC/compression

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

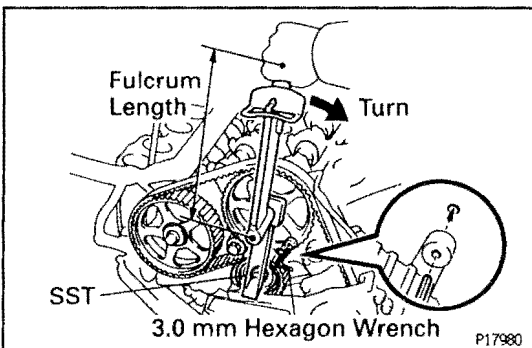


- (b) Check that the grooves of the camshafts are aligned with the dot marks of the No.1 camshaft bearing caps. If not, turn the crankshaft 1 revolution (360°).



F. Disconnect timing belt from camshaft timing pulleys

- (a) Place matchmarks on the timing belt and camshaft timing pulleys.



- (b) Turn the No.1 idler pulley bolt to obtain the specified torque or less, and align the holes of the pulley bracket and cylinder head, pass a 3.0 mm hexagon wrench through the holes to keep the setting position of the pulley bracket.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

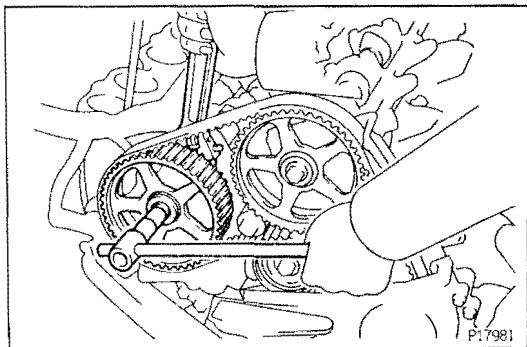
48 N·m (490 kgf·cm, 35 ft·lbf) for SST

HINT (On vehicle):

- Use SST.

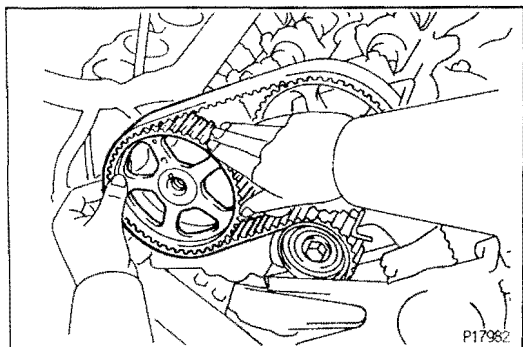
SST 09249-63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

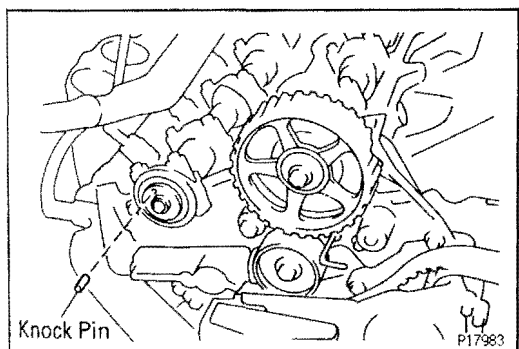


- (c) Hold the hexagon wrench head portion of the camshaft with a wrench, and loosen the intake camshaft timing pulley bolt.
- (d) Remove the intake camshaft timing pulley bolt.

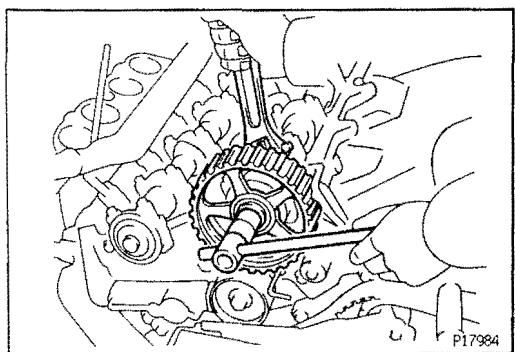
EG



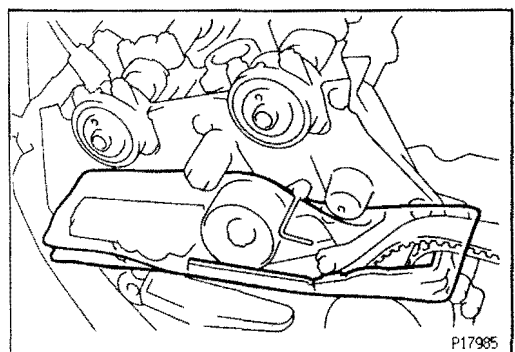
- (e) Disconnect the intake camshaft timing pulley together with the timing belt from the camshaft, and remove the intake camshaft timing pulley.



- (f) Remove the knock pin from the intake camshaft.

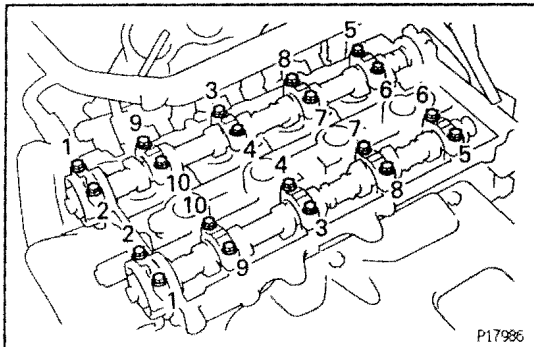


- G. Remove exhaust manifold timing pulley**
- (a) Hold the hexagon wrench head portion of the camshaft with a wrench, and loosen the pulley bolt.
- (b) Remove the bolt, timing pulley and knock pin.

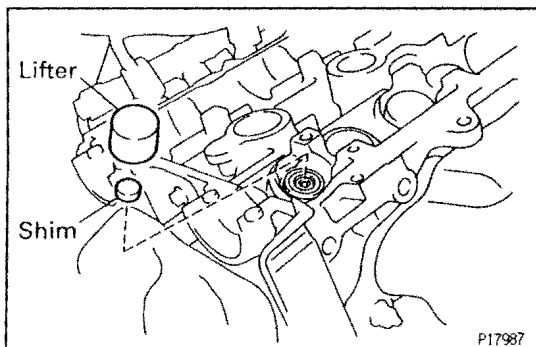
**NOTICE:**

- 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.

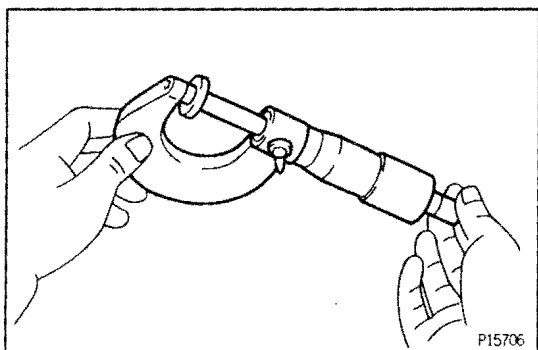
EG

**H. Remove camshafts**

Uniformly loosen and remove the 10 bearing cap bolts in several passes, in the sequence shown, and remove the 5 bearing caps, oil seal and camshaft. Remove the intake and exhaust camshafts.

**I. Remove adjusting shims**

Remove the valve lifter and adjusting shim.

**J. Replace adjusting shims**

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:

$$N = T + (A - 0.20 \text{ mm (0.008 in.)})$$

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 19 sizes. 18 sizes are available in equal increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.35 mm (0.1319 in.). The largest shim size available is 3.39 mm (0.1335 in.).

Adjusting Shim Selection Chart (Intake)

Installed shim thickness mm (in.)	Measured clearance mm (in.)	Shim No.	Shim Thickness
0.000 - 0.020 (0.0000 - 0.0008)	0.000	00	2.500 (0.0984)
0.021 - 0.040 (0.0008 - 0.0016)	0.021	05	2.516 (0.0989)
0.041 - 0.060 (0.0016 - 0.0024)	0.041	10	2.532 (0.0992)
0.061 - 0.080 (0.0024 - 0.0031)	0.061	15	2.548 (0.1000)
0.081 - 0.100 (0.0032 - 0.0039)	0.081	20	2.564 (0.1004)
0.101 - 0.120 (0.0040 - 0.0047)	0.101	25	2.580 (0.1009)
0.121 - 0.140 (0.0048 - 0.0055)	0.121	30	2.596 (0.1016)
0.141 - 0.149 (0.0059 - 0.0059)	0.141	35	2.612 (0.1022)
0.150 - 0.250 (0.0059 - 0.0098)	0.150	40	2.628 (0.1029)
0.251 - 0.260 (0.0099 - 0.0102)	0.251	45	2.644 (0.1034)
0.261 - 0.280 (0.0103 - 0.0110)	0.261	50	2.660 (0.1040)
0.281 - 0.300 (0.0111 - 0.0118)	0.281	55	2.676 (0.1047)
0.301 - 0.320 (0.0119 - 0.0126)	0.301	60	2.692 (0.1053)
0.321 - 0.340 (0.0126 - 0.0134)	0.321	65	2.708 (0.1060)
0.340 - 0.380 (0.0134 - 0.0142)	0.340	70	2.724 (0.1067)
0.361 - 0.380 (0.0142 - 0.0150)	0.361	75	2.740 (0.1073)
0.381 - 0.400 (0.0150 - 0.0157)	0.381	80	2.756 (0.1080)
0.401 - 0.420 (0.0158 - 0.0166)	0.401	85	2.772 (0.1086)
0.421 - 0.440 (0.0166 - 0.0173)	0.421	90	2.788 (0.1093)
0.441 - 0.460 (0.0174 - 0.0181)	0.441	95	2.804 (0.1100)
0.461 - 0.480 (0.0181 - 0.0189)	0.461	100	2.820 (0.1106)
0.481 - 0.500 (0.0189 - 0.0197)	0.481	105	2.836 (0.1113)
0.501 - 0.520 (0.0197 - 0.0205)	0.501	110	2.852 (0.1119)
0.521 - 0.540 (0.0205 - 0.0213)	0.521	115	2.868 (0.1126)
0.541 - 0.560 (0.0213 - 0.0220)	0.541	120	2.884 (0.1133)
0.561 - 0.580 (0.0221 - 0.0229)	0.561	125	2.900 (0.1139)
0.581 - 0.600 (0.0229 - 0.0236)	0.581	130	2.916 (0.1146)
0.601 - 0.620 (0.0237 - 0.0244)	0.601	135	2.932 (0.1154)
0.621 - 0.640 (0.0244 - 0.0252)	0.621	140	2.948 (0.1161)
0.641 - 0.660 (0.0252 - 0.0260)	0.641	145	2.964 (0.1167)
0.661 - 0.680 (0.0260 - 0.0268)	0.661	150	2.980 (0.1175)
0.681 - 0.700 (0.0269 - 0.0276)	0.681	155	2.996 (0.1181)
0.701 - 0.720 (0.0276 - 0.0283)	0.701	160	3.012 (0.1189)
0.721 - 0.740 (0.0284 - 0.0291)	0.721	165	3.028 (0.1195)
0.741 - 0.760 (0.0292 - 0.0299)	0.741	170	3.044 (0.1202)
0.761 - 0.780 (0.0300 - 0.0307)	0.761	175	3.060 (0.1210)
0.781 - 0.800 (0.0307 - 0.0315)	0.781	180	3.076 (0.1216)
0.801 - 0.820 (0.0315 - 0.0323)	0.801	185	3.092 (0.1224)
0.821 - 0.840 (0.0323 - 0.0331)	0.821	190	3.108 (0.1231)
0.841 - 0.860 (0.0331 - 0.0339)	0.841	195	3.124 (0.1238)
0.861 - 0.880 (0.0339 - 0.0346)	0.861	200	3.140 (0.1246)
0.881 - 0.900 (0.0347 - 0.0354)	0.881	205	3.156 (0.1253)
0.901 - 0.920 (0.0355 - 0.0362)	0.901	210	3.172 (0.1261)
0.921 - 0.940 (0.0363 - 0.0370)	0.921	215	3.188 (0.1268)
0.941 - 0.960 (0.0370 - 0.0378)	0.941	220	3.204 (0.1276)
0.961 - 0.980 (0.0378 - 0.0386)	0.961	225	3.220 (0.1283)
0.981 - 1.000 (0.0385 - 0.0394)	0.981	230	3.236 (0.1291)
1.001 - 1.020 (0.0394 - 0.0402)	1.001	235	3.252 (0.1298)
1.021 - 1.040 (0.0402 - 0.0409)	1.021	240	3.268 (0.1306)
1.041 - 1.060 (0.0410 - 0.0417)	1.041	245	3.284 (0.1313)
1.061 - 1.080 (0.0418 - 0.0425)	1.061	250	3.300 (0.1321)
1.081 - 1.100 (0.0426 - 0.0433)	1.081	255	3.316 (0.1328)
1.101 - 1.120 (0.0433 - 0.0441)	1.101	260	3.332 (0.1336)
1.121 - 1.140 (0.0441 - 0.0449)	1.121	265	3.348 (0.1343)

New shim thickness mm (in.)

Shim No.1	Thickness	Shim No.	Thickness
00	2.500 (0.0984)	50	3.000 (0.1181)
05	2.550 (0.1004)	55	3.050 (0.1201)
10	2.600 (0.1024)	60	3.100 (0.1220)
15	2.650 (0.1043)	65	3.150 (0.1240)
20	2.700 (0.1063)	70	3.200 (0.1260)
25	2.750 (0.1083)	75	3.250 (0.1280)
30	2.800 (0.1102)	80	3.300 (0.1299)
35	2.850 (0.1122)	85	3.350 (0.1319)
40	2.900 (0.1142)	89	3.390 (0.1335)
45	2.950 (0.1161)		

Intake valve clearance (Cold): 0.15 - 0.25 mm (0.006 - 0.010 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 new No.55 shim.



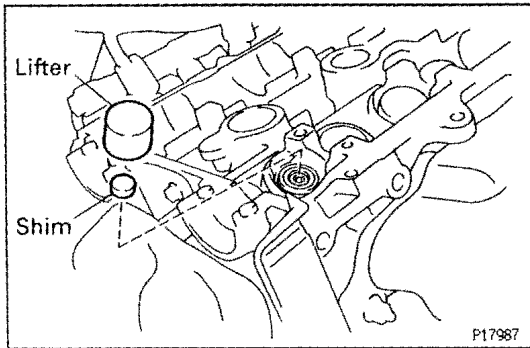
Adjusting Shim Selection Chart (Exhaust)

Installed shim thickness mm (in.)	Measured clearance mm (in.)	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.020	0.021	0.022	0.023	0.024	0.025	0.026	0.027	0.028	0.029	0.030	0.031	0.032	0.033	0.034	0.035	0.036	0.037	0.038	0.039	0.040	0.041	0.042	0.043	0.044	0.045	0.046	0.047	0.048	0.049	0.050	0.051	0.052	0.053	0.054	0.055	0.056	0.057	0.058	0.059	0.060	0.061	0.062	0.063	0.064	0.065	0.066	0.067	0.068	0.069	0.070	0.071	0.072	0.073	0.074	0.075	0.076	0.077	0.078	0.079	0.080	0.081	0.082	0.083	0.084	0.085	0.086	0.087	0.088	0.089	0.090	0.091	0.092	0.093	0.094	0.095	0.096	0.097	0.098	0.099	0.100	0.101	0.102	0.103	0.104	0.105	0.106	0.107	0.108	0.109	0.110	0.111	0.112	0.113	0.114	0.115	0.116	0.117	0.118	0.119	0.120	0.121	0.122	0.123	0.124	0.125	0.126	0.127	0.128	0.129	0.130	0.131	0.132	0.133	0.134	0.135	0.136	0.137	0.138	0.139	0.140	0.141	0.142	0.143	0.144	0.145	0.146	0.147	0.148	0.149	0.150	0.151	0.152	0.153	0.154	0.155	0.156	0.157	0.158	0.159	0.160	0.161	0.162	0.163	0.164	0.165	0.166	0.167	0.168	0.169	0.170	0.171	0.172	0.173	0.174	0.175	0.176	0.177	0.178	0.179	0.180	0.181	0.182	0.183	0.184	0.185	0.186	0.187	0.188	0.189	0.190	0.191	0.192	0.193	0.194	0.195	0.196	0.197	0.198	0.199	0.200	0.201	0.202	0.203	0.204	0.205	0.206	0.207	0.208	0.209	0.210	0.211	0.212	0.213	0.214	0.215	0.216	0.217	0.218	0.219	0.220	0.221	0.222	0.223	0.224	0.225	0.226	0.227	0.228	0.229	0.230	0.231	0.232	0.233	0.234	0.235	0.236	0.237	0.238	0.239	0.240	0.241	0.242	0.243	0.244	0.245	0.246	0.247	0.248	0.249	0.250	0.251	0.252	0.253	0.254	0.255	0.256	0.257	0.258	0.259	0.260	0.261	0.262	0.263	0.264	0.265	0.266	0.267	0.268	0.269	0.270	0.271	0.272	0.273	0.274	0.275	0.276	0.277	0.278	0.279	0.280	0.281	0.282	0.283	0.284	0.285	0.286	0.287	0.288	0.289	0.290	0.291	0.292	0.293	0.294	0.295	0.296	0.297	0.298	0.299	0.300	0.301	0.302	0.303	0.304	0.305	0.306	0.307	0.308	0.309	0.310	0.311	0.312	0.313	0.314	0.315	0.316	0.317	0.318	0.319	0.320	0.321	0.322	0.323	0.324	0.325	0.326	0.327	0.328	0.329	0.330	0.331	0.332	0.333	0.334	0.335	0.336	0.337	0.338	0.339	0.340	0.341	0.342	0.343	0.344	0.345	0.346	0.347	0.348	0.349	0.350	0.351	0.352	0.353	0.354	0.355	0.356	0.357	0.358	0.359	0.360	0.361	0.362	0.363	0.364	0.365	0.366	0.367	0.368	0.369	0.370	0.371	0.372	0.373	0.374	0.375	0.376	0.377	0.378	0.379	0.380	0.381	0.382	0.383	0.384	0.385	0.386	0.387	0.388	0.389	0.390	0.391	0.392	0.393	0.394	0.395	0.396	0.397	0.398	0.399	0.400	0.401	0.402	0.403	0.404	0.405	0.406	0.407	0.408	0.409	0.410	0.411	0.412	0.413	0.414	0.415	0.416	0.417	0.418	0.419	0.420	0.421	0.422	0.423	0.424	0.425	0.426	0.427	0.428	0.429	0.430	0.431	0.432	0.433	0.434	0.435	0.436	0.437	0.438	0.439	0.440	0.441	0.442	0.443	0.444	0.445	0.446	0.447	0.448	0.449	0.450	0.451	0.452	0.453	0.454	0.455	0.456	0.457	0.458	0.459	0.460	0.461	0.462	0.463	0.464	0.465	0.466	0.467	0.468	0.469	0.470	0.471	0.472	0.473	0.474	0.475	0.476	0.477	0.478	0.479	0.480	0.481	0.482	0.483	0.484	0.485	0.486	0.487	0.488	0.489	0.490	0.491	0.492	0.493	0.494	0.495	0.496	0.497	0.498	0.499	0.500	0.501	0.502	0.503	0.504	0.505	0.506	0.507	0.508	0.509	0.510	0.511	0.512	0.513	0.514	0.515	0.516	0.517	0.518	0.519	0.520	0.521	0.522	0.523	0.524	0.525	0.526	0.527	0.528	0.529	0.530	0.531	0.532	0.533	0.534	0.535	0.536	0.537	0.538	0.539	0.540	0.541	0.542	0.543	0.544	0.545	0.546	0.547	0.548	0.549	0.550	0.551	0.552	0.553	0.554	0.555	0.556	0.557	0.558	0.559	0.560	0.561	0.562	0.563	0.564	0.565	0.566	0.567	0.568	0.569	0.570	0.571	0.572	0.573	0.574	0.575	0.576	0.577	0.578	0.579	0.580	0.581	0.582	0.583	0.584	0.585	0.586	0.587	0.588	0.589	0.590	0.591	0.592	0.593	0.594	0.595	0.596	0.597	0.598	0.599	0.600	0.601	0.602	0.603	0.604	0.605	0.606	0.607	0.608	0.609	0.610	0.611	0.612	0.613	0.614	0.615	0.616	0.617	0.618	0.619	0.620	0.621	0.622	0.623	0.624	0.625	0.626	0.627	0.628	0.629	0.630	0.631	0.632	0.633	0.634	0.635	0.636	0.637	0.638	0.639	0.640	0.641	0.642	0.643	0.644	0.645	0.646	0.647	0.648	0.649	0.650	0.651	0.652	0.653	0.654	0.655	0.656	0.657	0.658	0.659	0.660	0.661	0.662	0.663	0.664	0.665	0.666	0.667	0.668	0.669	0.670	0.671	0.672	0.673	0.674	0.675	0.676	0.677	0.678	0.679	0.680	0.681	0.682	0.683	0.684	0.685	0.686	0.687	0.688	0.689	0.690	0.691	0.692	0.693	0.694	0.695	0.696	0.697	0.698	0.699	0.700	0.701	0.702	0.703	0.704	0.705	0.706	0.707	0.708	0.709	0.710	0.711	0.712	0.713	0.714	0.715	0.716	0.717	0.718	0.719	0.720	0.721	0.722	0.723	0.724	0.725	0.726	0.727	0.728	0.729	0.730	0.731	0.732	0.733	0.734	0.735	0.736	0.737	0.738	0.739	0.740	0.741	0.742	0.743	0.744	0.745	0.746	0.747	0.748	0.749	0.750	0.751	0.752	0.753	0.754	0.755	0.756	0.757	0.758	0.759	0.760	0.761	0.762	0.763	0.764	0.765	0.766	0.767	0.768	0.769	0.770	0.771	0.772	0.773	0.774	0.775	0.776	0.777	0.778	0.779	0.780	0.781	0.782	0.783	0.784	0.785	0.786	0.787	0.788	0.789	0.790	0.791	0.792	0.793	0.794	0.795	0.796	0.797	0.798	0.799	0.800	0.801	0.802	0.803	0.804	0.805	0.806	0.807	0.808	0.809	0.810	0.811	0.812	0.813	0.814	0.815	0.816	0.817	0.818	0.819	0.820	0.821	0.822	0.823	0.824	0.825	0.826	0.827	0.828	0.829	0.830	0.831	0.832	0.833	0.834	0.835	0.836	0.837	0.838	0.839	0.840	0.841	0.842	0.843	0.844	0.845	0.846	0.847	0.848	0.849	0.850	0.851	0.852	0.853	0.854	0.855	0.856	0.857	0.858	0.859	0.860	0.861	0.862	0.863	0.864	0.865	0.866	0.867	0.868	0.869	0.870	0.871	0.872	0.873	0.874	0.875	0.876	0.877	0.878	0.879	0.880	0.881	0.882	0.883	0.884	0.885	0.886	0.887	0.888	0.889	0.890	0.891	0.892	0.893	0.894	0.895	0.896	0.897	0.898	0.899	0.900	0.901	0.902	0.903	0.904	0.905	0.906	0.907	0.908	0.909	0.910	0.911	0.912	0.913	0.914	0.915	0.916	0.917	0.918	0.919	0.920	0.921	0.922	0.923	0.924	0.925	0.926	0.927	0.928	0.929	0.930	0.931	0.932	0.933	0.934	0.935	0.936	0.937	0.938	0.939	0.940	0.941	0.942	0.943	0.944	0.945	0.946	0.947	0.948	0.949	0.950	0.951	0.952	0.953	0.954	0.955	0.956	0.957	0.958	0.959	0.960	0.961	0.962	0.963	0.964	0.965	0.966	0.967	0.968	0.969	0.970	0.971	0.972	0.973	0.974	0.975	0.976	0.977	0.978	0.979	0.980	0.981	0.982	0.983	0.984	0.985	0.986	0.987	0.988	0.989	0.990	0.991	0.992	0.993	0.994	0.995	0.996	0.997	0.998	0.999	1.000
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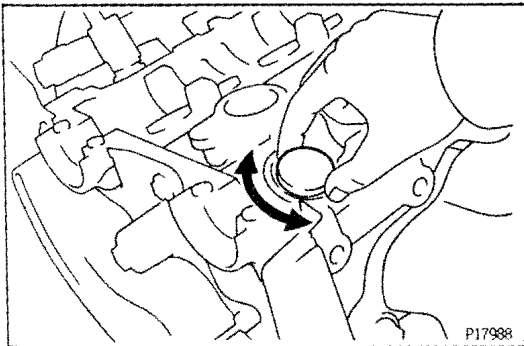
Exhaust valve clearance (Cold):
0.28 – 0.38 mm (0.011 – 0.015 in.)

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 new No.40 shim.

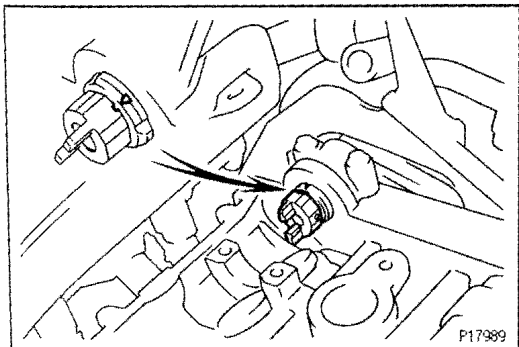
New shim thickness		mm (in.)	
Shim No.1	Thickness	Shim No.	Thickness
00	2.500 (0.0984)	50	3.000 (0.1181)
05	2.550 (0.1004)	55	3.050 (0.1201)
10	2.600 (0.1024)	60	3.100 (0.1220)
15	2.650 (0.1043)	65	3.150 (0.1240)
20	2.700 (0.1063)	70	3.200 (0.1260)
25	2.750 (0.1083)	75	3.250 (0.1280)
30	2.800 (0.1102)	80	3.300 (0.1299)
35	2.850 (0.1122)	85	3.350 (0.1319)
40	2.900 (0.1142)	89	3.390 (0.1335)
45	2.950 (0.1161)		

**K. Reinstall adjusting shims**

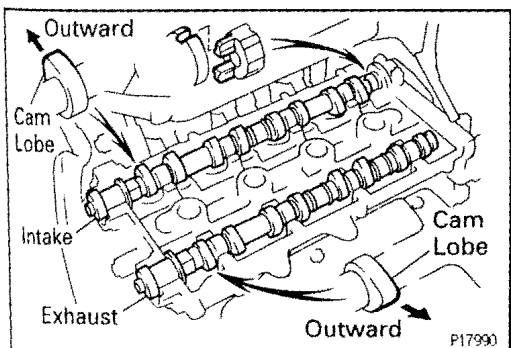
- (a) Install the adjusting shim and valve lifter.



- (b) Check that the valve lifter rotates smoothly by hand.

**L. Reinstall camshafts**

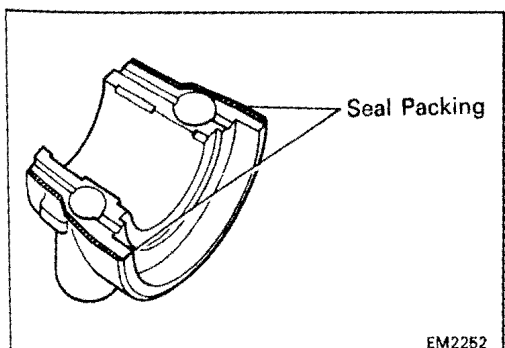
- (a) Align the cutout portion of the coupling with the groove of the distributor housing.



- (b) Attach the slit of the intake camshaft to the coupling of the distributor.

- (c) Place the camshafts on the cylinder head with the No. 1 cam lobes facing outward as shown.

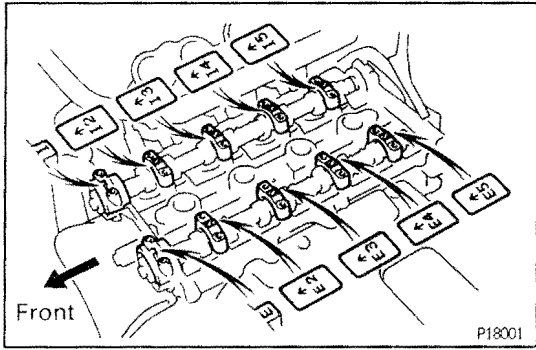
HINT: Intake camshaft have an slit; exhaust camshaft do not.



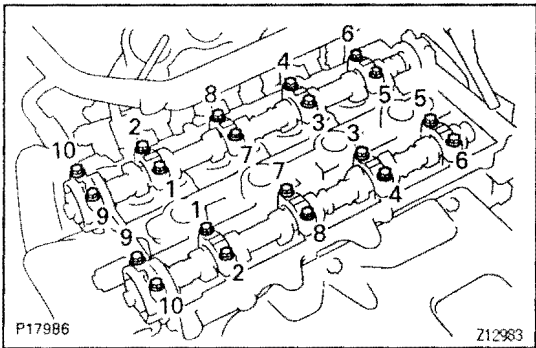
- (d) Apply seal packing to the No.1 bearing cap as shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent



- (e) Install the bearing caps in their proper locations.
HINT: Each bearing cap has a number and front mark.



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

M. Check valve clearance

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

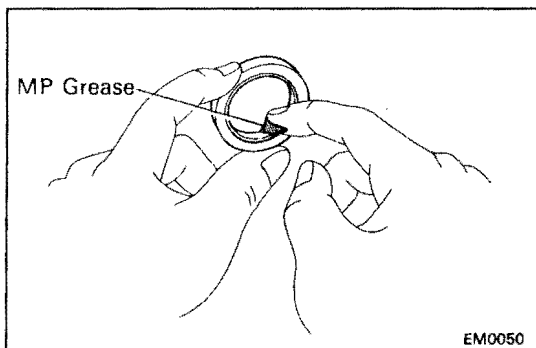
Valve clearance (Cold):

Intake

0.15 – 0.25 mm (0.006 – 0.010 in.)

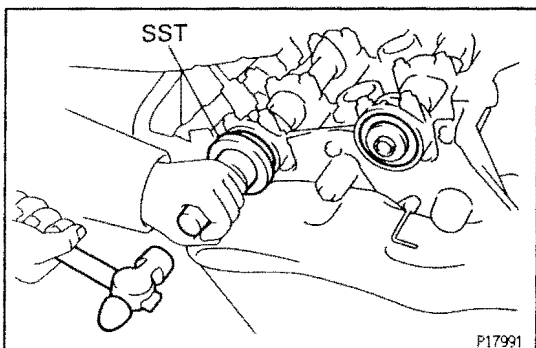
Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)

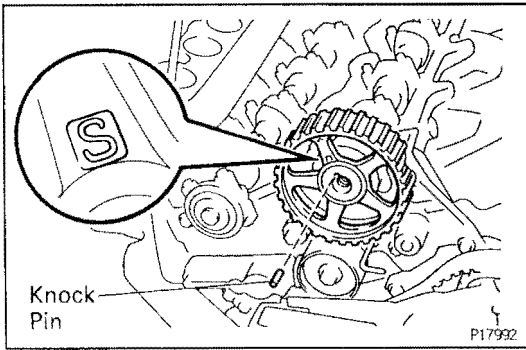


N. Reinstall camshaft oil seals

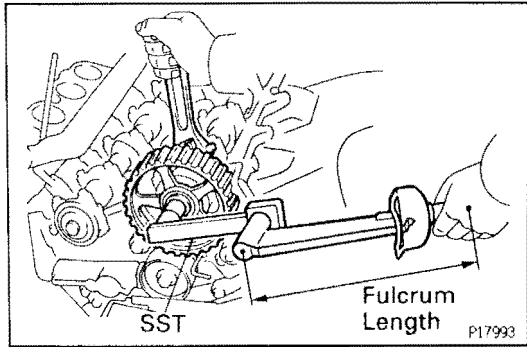
- (a) Apply MP grease to a new oil seal lip.



- (b) Using SST, tap in the 2 camshaft oil seals.
SST 09223-46011



- O. Reinstall exhaust camshaft timing pulley**
- Slide the timing pulley onto the camshaft, facing mark "S" outward.
 - Align the pin holes of the camshaft and timing pulley, and insert the knock pin.



- Hold the hexagon wrench head portion of the camshaft with a wrench, and install the pulley bolt.

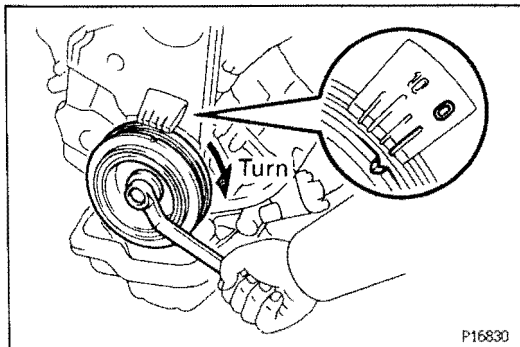
Torque:

59 N·m (600 kgf·cm, 43 ft·lbf)

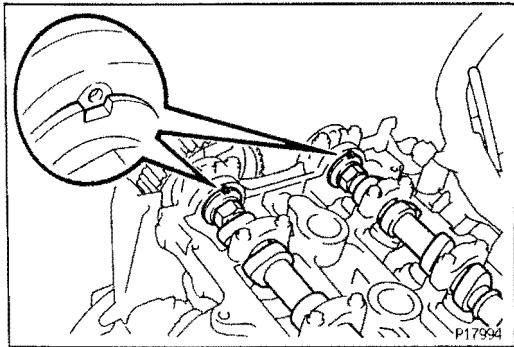
41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

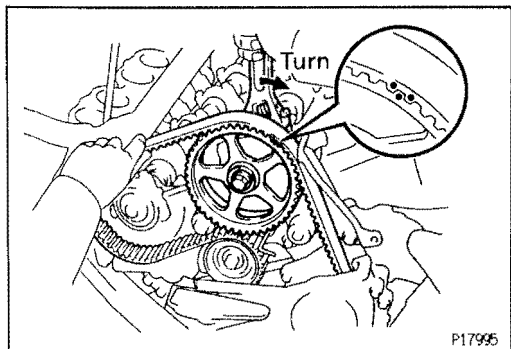
- Use SST.
- SST 09249-63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

**P. 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.

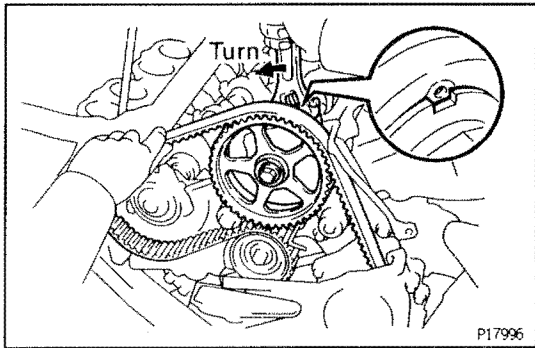


- Turn the hexagon head portion of the camshaft, align the groove of the camshaft with the dot mark of the No.1 camshaft bearing cap.

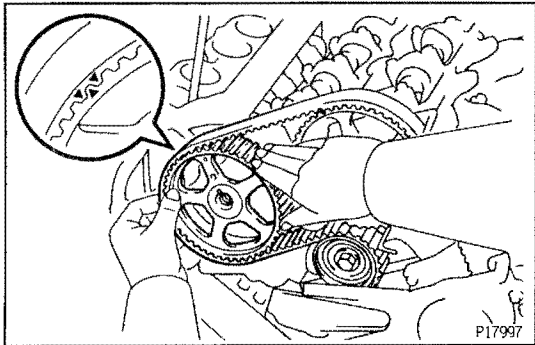
**Q. Reconnect timing belt to camshaft timing pulleys**

- Remove any oil or water on the exhaust camshaft timing pulley, and keep it clean.
- Turn the hexagon wrench head portion of the camshaft with a wrench, and turn the exhaust camshaft timing pulley clockwise. Align the matchmarks of the timing belt and exhaust camshaft timing pulley, and hang the timing belt on the exhaust camshaft timing pulley.

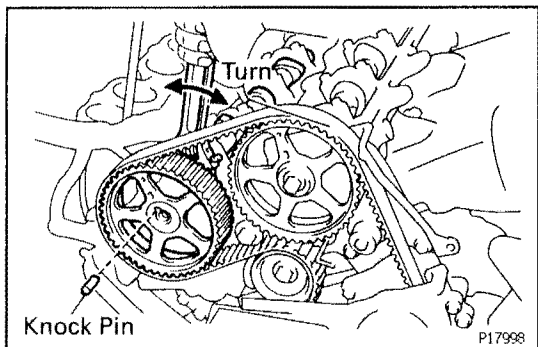
EG



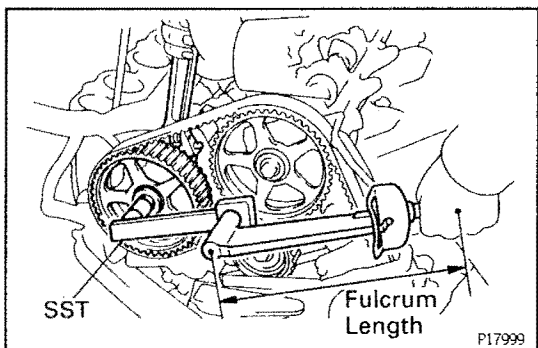
- (c) Align the groove of the camshaft with the dot mark of the No.1 camshaft bearing cap.
- (d) Check that the timing belt has tension between the crankshaft timing pulley and exhaust camshaft timing pulley.



- (e) Remove any oil or water on the intake camshaft timing pulley and No.1 idler pulley, and keep them clean.
- (f) Align the matchmarks of the timing belt and intake camshaft timing pulley, and hang the timing belt on the intake camshaft timing pulley, facing mark "S" outward.
- (g) Slide the intake camshaft timing pulley on the camshaft.



- (h) Turn the hexagon wrench head portion of the camshaft with a wrench, and align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin.



- (i) Hold the hexagon wrench head portion of the camshaft with a wrench, and install the intake camshaft timing pulley bolt.

Torque:

59 N·m (600 kgf·cm, 43 ft·lbf)

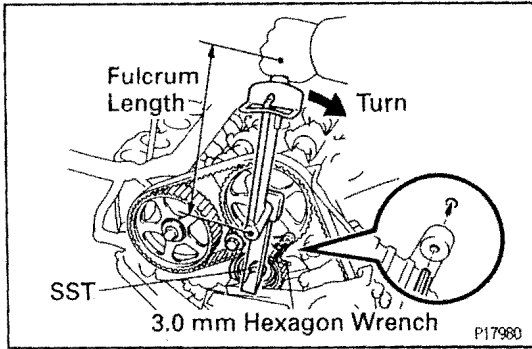
41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

- Use SST.

SST 09249-63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).



- (j) Turn the No.1 idler pulley bolt to obtain the specified torque or less, remove the 3.0 mm hexagon wrench.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

48 N·m (490 kgf·cm, 35 ft·lbf) for SST

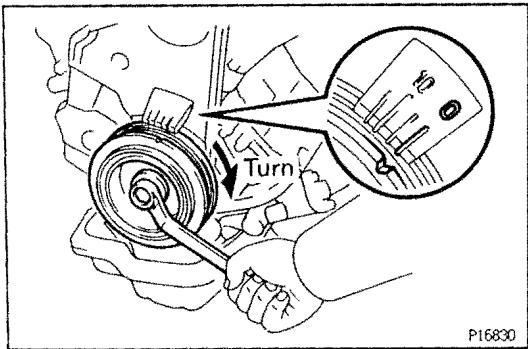
HINT (On vehicle):

- Use SST.
- SST 09249-63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

R. Check valve timing

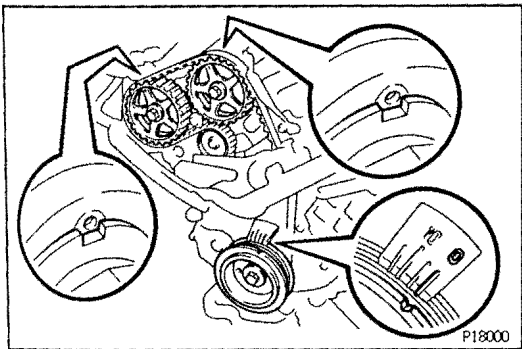
- (a) Slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



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

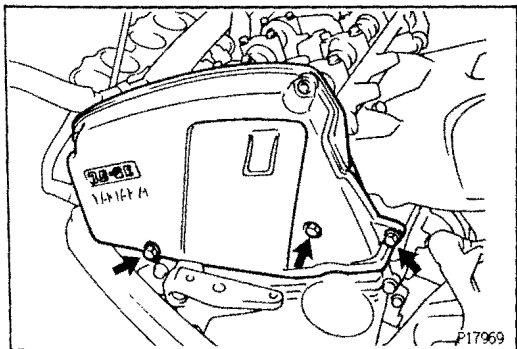
If the timing marks do not align, disconnect the timing belt and reconnect it.



S. Reinstall No.2 timing belt cover

- (a) Install the gasket to the timing belt cover.
 (b) Install the timing belt cover with the 3 bolts.

HINT: Use the 20 mm (0.79 in.) long bolt.

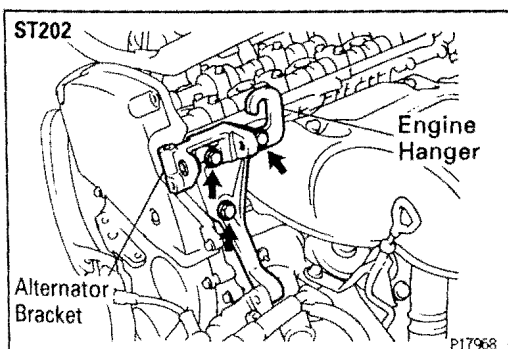


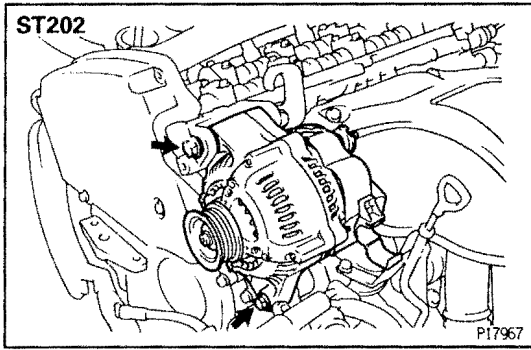
T. ST202:

Reinstall alternator bracket and RH front engine hanger

Install the alternator bracket and engine hanger with the 3 bolts.

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



**U. ST202:****Reinstall alternator**

- (a) Install the alternator with the 2 bolts.

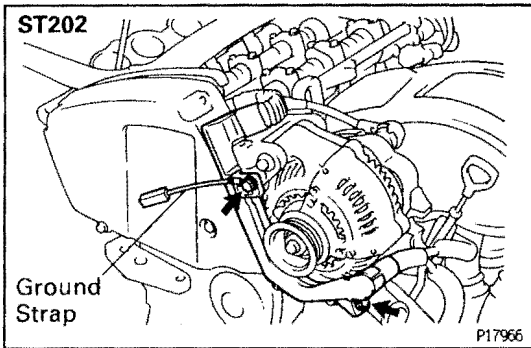
Torque:

12 mm head

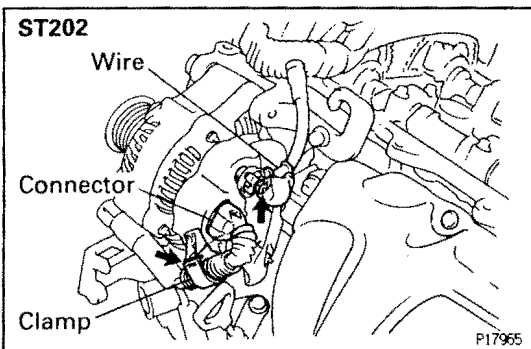
19 N·m (190 kgf·cm, 14 ft·lbf)

14 mm head

52 N·m (530 kgf·cm, 38 ft·lbf)



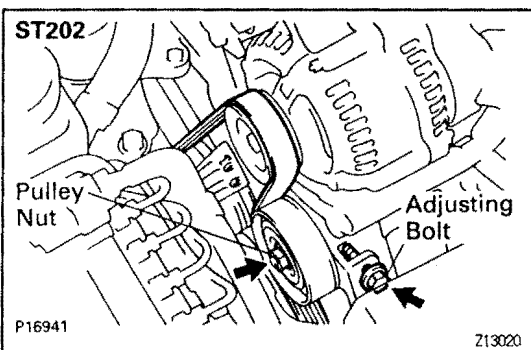
- (b) Install the engine wire protector and ground strap with the 2 bolts.



- (c) Connect the alternator connector.

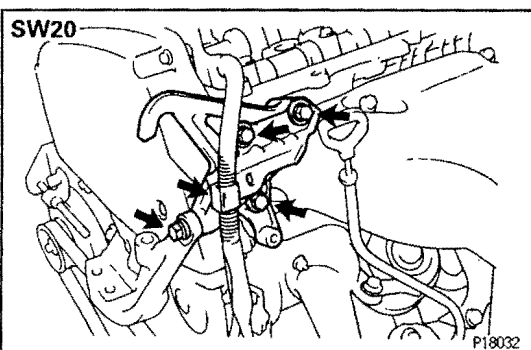
- (d) Connect the alternator wire with the nut and rubber cap.

- (e) Install the wire to the clamp on the rear end cover.



- (f) Install the drive belt with the adjusting bolt.

- (g) Tighten the pulley nut.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**V. SW20:****Reinstall RH front engine hanger and engine wire bracket**

- (a) Install the engine hanger and wire bracket with the 4 bolts. Alternately tighten the bolts.

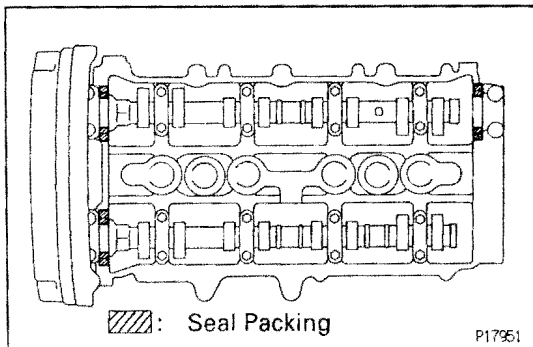
Torque:**Cylinder head side**

39 N·m (400 kgf·cm, 29 ft·lbf)

RH engine mounting bracket side

60 N·m (620 kgf·cm, 45 ft·lbf)

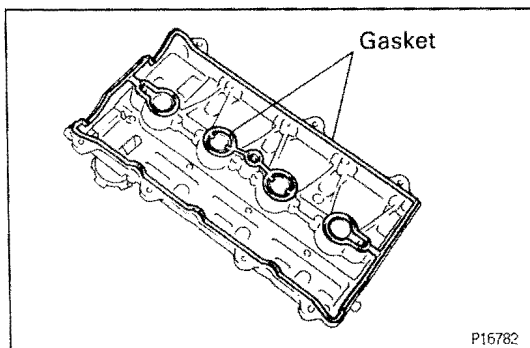
- (b) Install the engine wire to the clamp on the wire bracket.

**10. REINSTALL CYLINDER HEAD COVER**

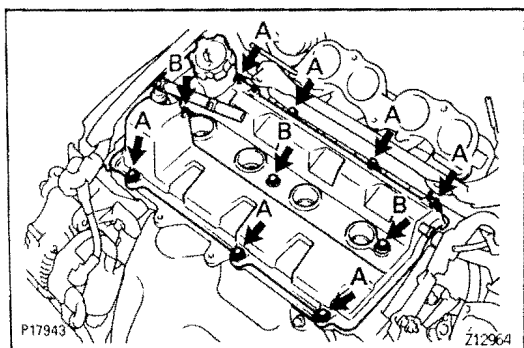
- (a) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:

Part No. 08826–00080 or equivalent



- (b) Install the 2 gaskets to the head cover.



- (c) Install the head cover with the 10 seal washers and bolts. Uniformly tighten the bolts in several passes.

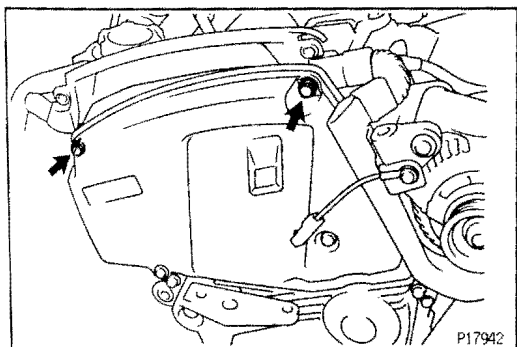
Torque: 6.0 N·m (61 kgf·cm, 53 in.-lbf)

HINT: Each bolt length is indicated in the illustration.

Bolt length:

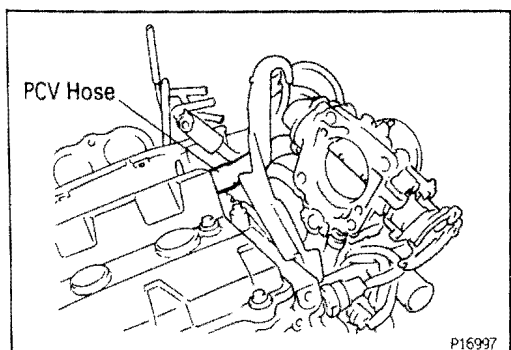
A 25 mm (0.98 in.)

B 50 mm (1.97 in.)

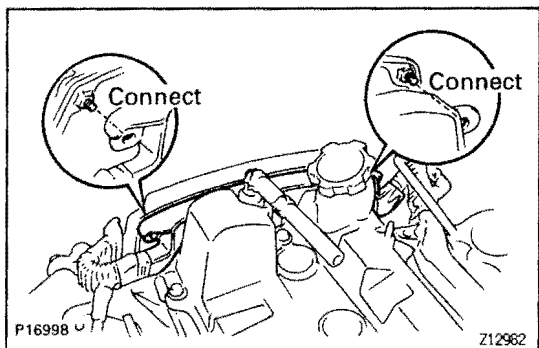


- (d) Install the 2 bolts holding the No.2 timing belt cover to the No.4 timing belt cover.

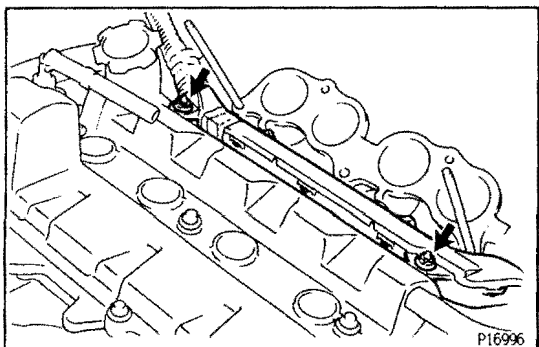
HINT: Use the 25 mm (0.98 in.) long bolt.



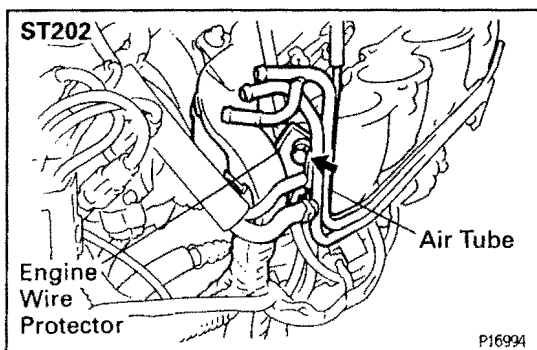
- (e) Connect the PCV hose to the cylinder head cover.

**11. REINSTALL ENGINE WIRE**

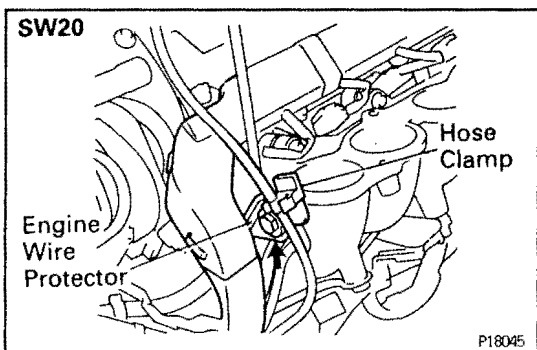
- (a) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover.



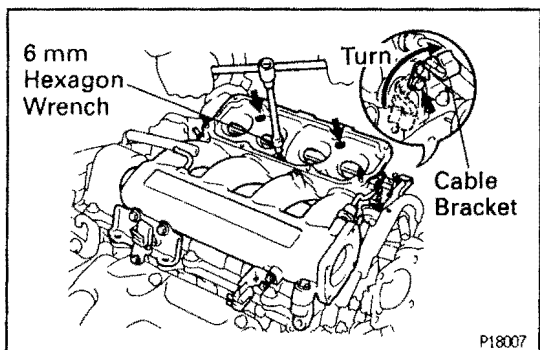
- (b) Install the the engine wire protector to the cylinder head cover with the 2 nuts.



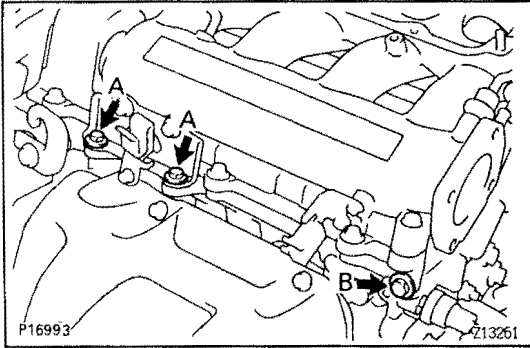
- (c) **ST202:**
Install the air tube and engine wire protector with the bolt.



- (d) **SW20:**
Install the hose clamp and engine wire protector with the bolt.

**12. REINSTALL ACIS VALVE ASSEMBLY**

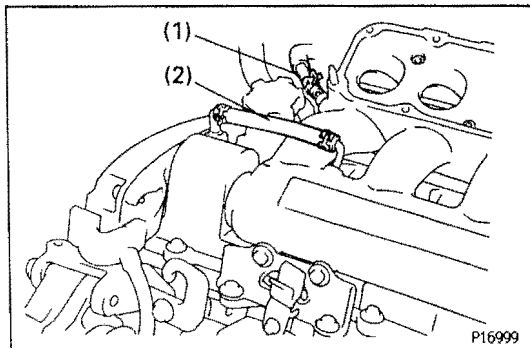
- (a) Using a 6 mm hexagon wrench, install a new gasket and the ACIS valve assembly with the 3 bolts. Uniformly tighten the bolts in several passes.
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)
- (b) **ST202:**
Install the cable bracket on the LH engine hanger with the bolt.



- (c) Install the 3 bolts holding the ACIS valve stays to the cylinder head.

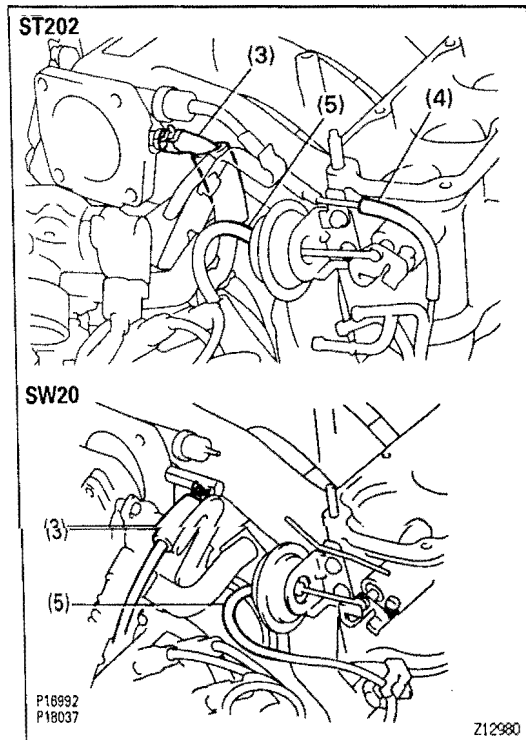
Torque:

- A 18 N·m (180 kgf·cm, 13 ft·lbf)
B 19 N·m (190 kgf·cm, 14 ft·lbf)



- (d) Connect the following hoses:

- (1) Brake booster vacuum hose to port of ACIS valve
(2) PCV hose to port of ACIS valve



- (3) Air hose to port of ACIS valve

- (4) ST202:

Vacuum hose (from vacuum sensor) to vacuum pipe on ACIS actuator

- (5) Vacuum hose (from VSV for ACIS) to ACIS actuator

13. ST202:

REINSTALL ACIS VALVE COVER

Install a new gasket and the ACIS valve cover with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

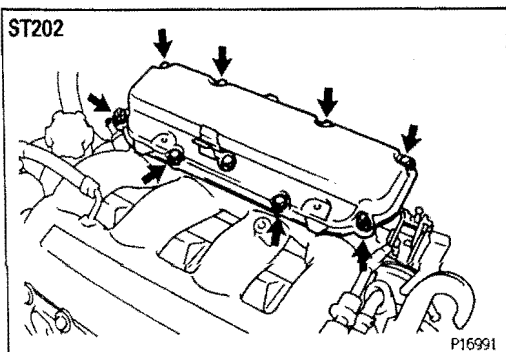
Torque:

Bolt

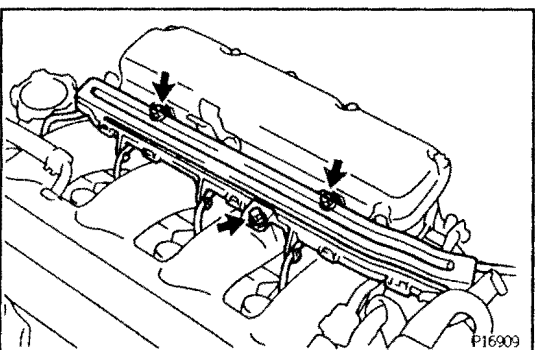
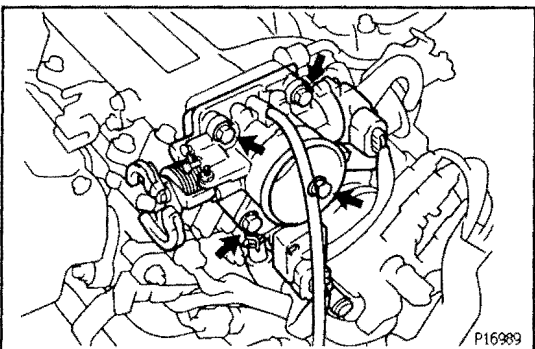
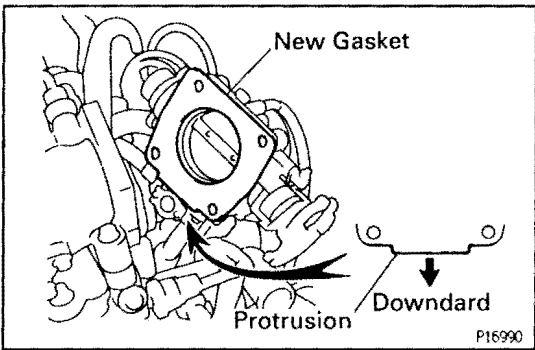
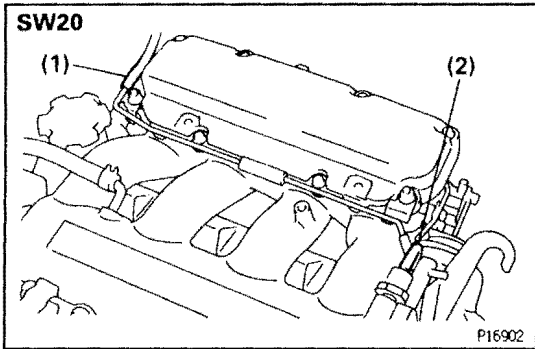
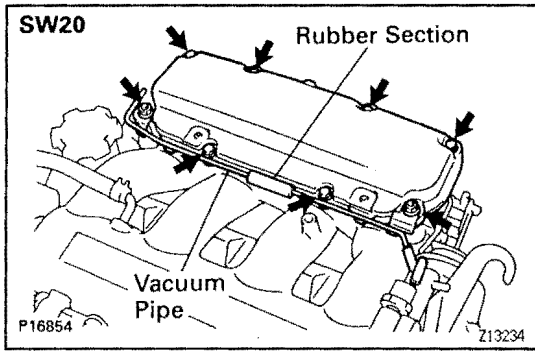
8.5 N·m (87 kgf·cm, 75 in·lbf)

Nut

21 N·m (210 kgf·cm, 15 ft·lbf)



EG



**14. SW20:
INSTALL ACIS VALVE COVER AND VACUUM PIPE**

- (a) Install a new gasket and the ACIS valve cover with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

Torque:

Bolt

8.5 N·m (87 kgf·cm, 75 in.-lbf)

Nut

21 N·m (210 kgf·cm, 15 ft-lbf)

- (b) Check that the rubber section at the center of the vacuum pipe is firmly pressed against the ACIS cover.

- (c) Connect the following hoses:

- (1) Vacuum hose (from vacuum sensor) to vacuum pipe
- (2) Vacuum hose to gas filter

15. REINSTALL THROTTLE BODY

- (a) Attach a new gasket to the throttle body, facing the protrusion downward.

- (b) Install the gasket and throttle body with the 4 bolts.
Torque: 21 N·m (210 kgf·cm, 15 ft-lbf)

HINT: Different bolt lengths are used for the upper and lower sides.

Bolt length:

Upper side

40 mm (1.77 in.)

Lower side

65 mm (2.17 in.)

16. RECONNECT CONNECT HIGH – TENSION CORDS TO SPARK PLUGS

- (a) Connect the 4 high – tension cords to the spark plugs.
- (b) Install the high – tension cord clamp with the 3 bolts.

IGNITION TIMING INSPECTION AND ADJUSTMENT

1. WARM UP ENGINE

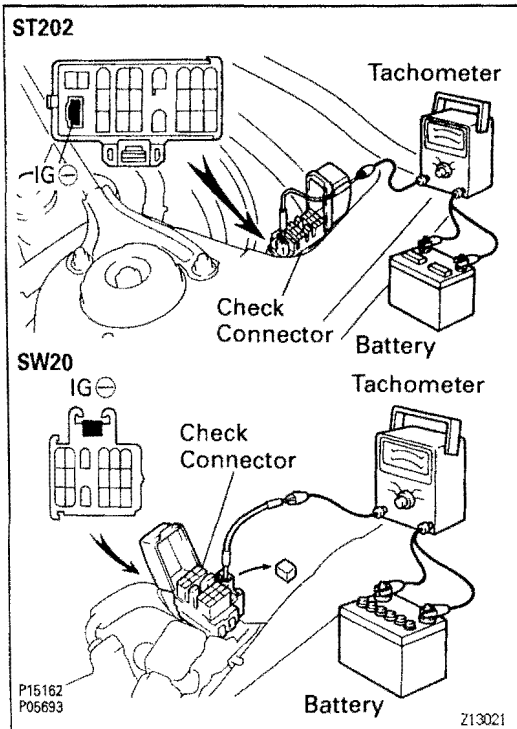
Allow the engine to warm up to normal operating temperature.

2. CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE

Connect the tester probe of a tachometer to terminal IG \ominus of the check connector.

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 your unit before use.

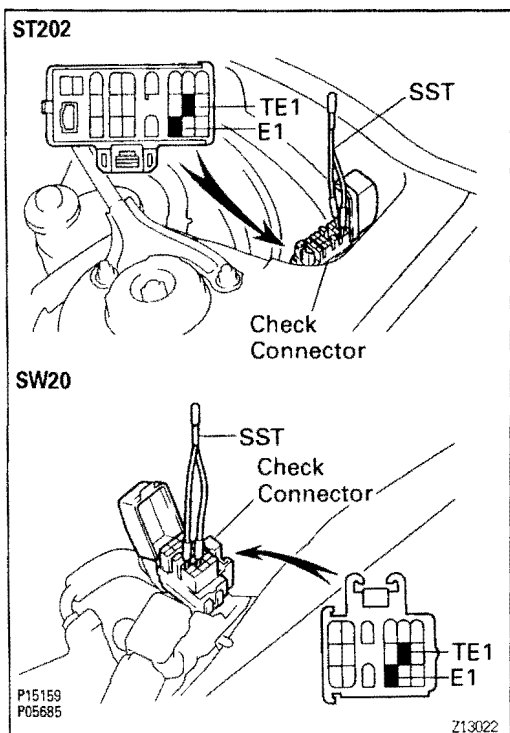


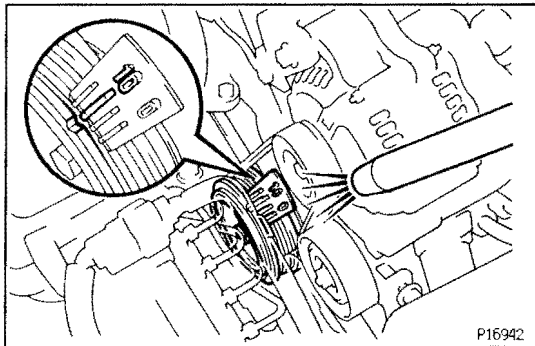
3. ADJUST IGNITION TIMING

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

SST 09843-18020

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





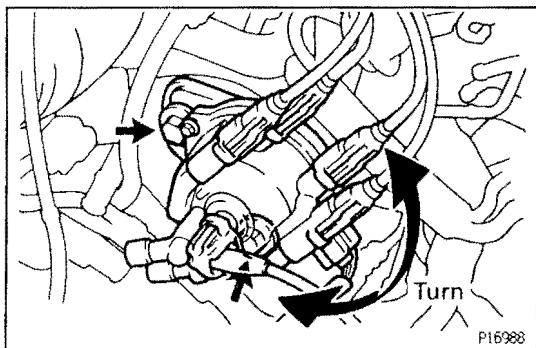
(b) Using a timing light, check the ignition timing.

Ignition timing:

10° BTDC @ idle

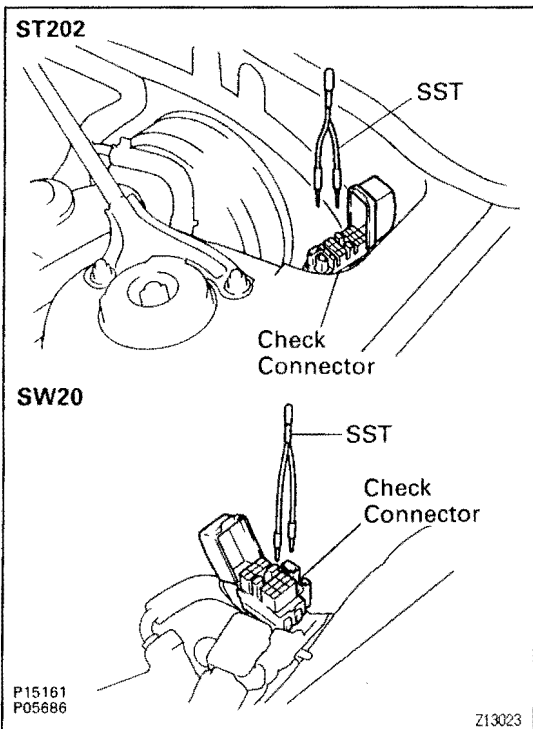
(Transmission in neutral position)

EG



(c) Loosen the 2 bolts, and adjust by turning the distributor.

(d) Tighten the 2 bolts, and recheck the ignition timing.
Torque: **39 N·m (400 kgf·cm, 29 ft·lbf)**



(e) Remove the SST from the check connector.
SST 09843-18020

4. FURTHER CHECK IGNITION TIMING

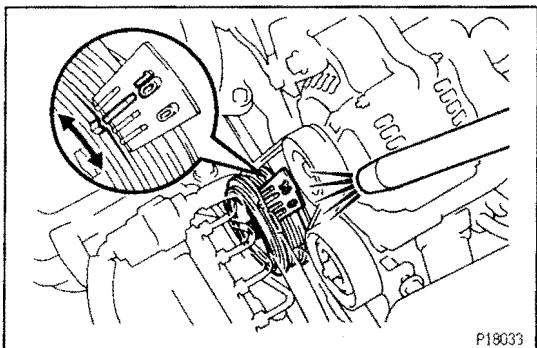
Ignition timing:

9 – 24° BTDC @ idle

(Transmission in neutral position)

HINT: The timing mark moves in a range between 9° and 24°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE



IDLE SPEED INSPECTION

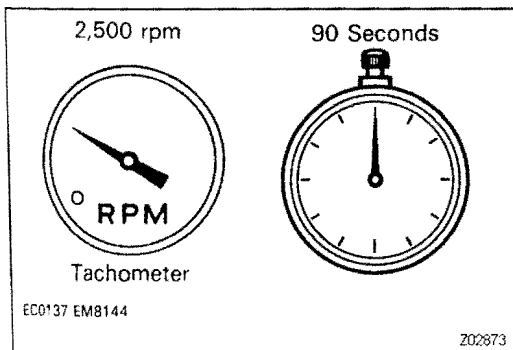
EG

1. INITIAL CONDITIONS

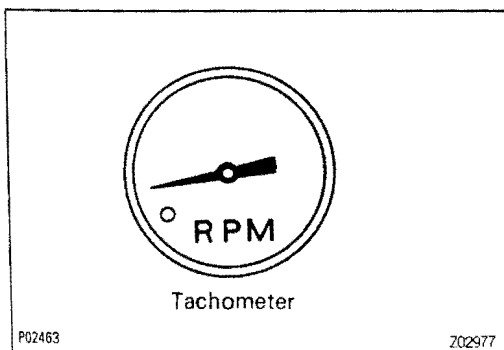
- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h)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

2. CONNECT TACHOMETER

(See step 2 on page EG-39)

**3. INSPECT IDLE SPEED**

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



- (b) Check the idle speed.

Idle speed:**ST202****w/ Daytime running light system****750 ± 50 rpm****w/o Daytime running light system****700 ± 50 rpm****SW20****w/ Daytime running light system****850 ± 50 rpm****w/o Daytime running light system****750 ± 50 rpm**

If the idle speed is not as specified, check the ISC valve.

4. DISCONNECT TACHOMETER

ACOUSTIC CONTROL INDUCTION SYSTEM (ACIS) ACIS INSPECTION

EGOW4-04

EG

1. WARM UP AND STOP ENGINE

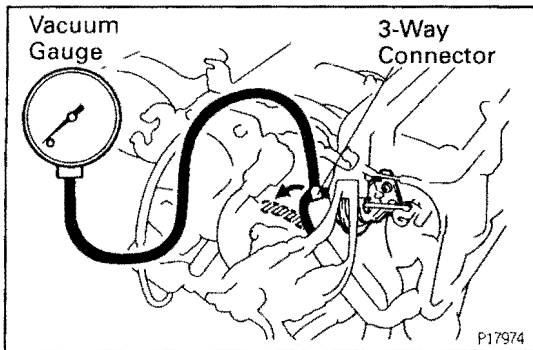
Allow the engine to warm up to normal operating temperature.

2. CONNECT TACHOMETER

(See step 2 on page EG-39)

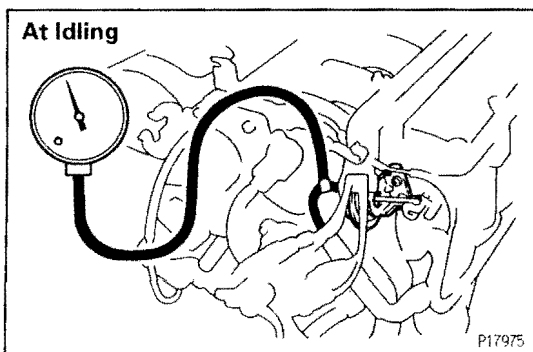
3. CONNECT VACUUM GAUGE

Using a 3-way connector, connect the vacuum gauge to the hose between the VSV and actuator.



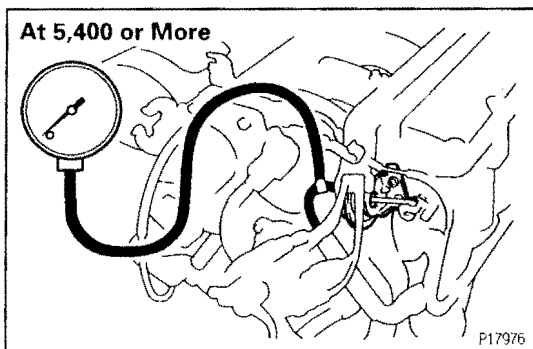
4. CHECK VACUUM GAUGE

- (a) Check that the vacuum gauge indicates vacuum at idling.



- (b) Check that the vacuum gauge indicates zero at 5,400 rpm or more.

HINT: If regular unleaded gasoline is used, the vacuum gauge also indicates zero below 5,400 rpm.



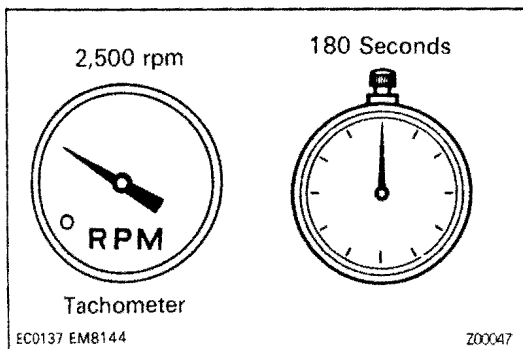
5. DISCONNECT TACHOMETER

IDLE CO/HC CHECK

HINT: This check is used only to determine whether or not the idle CO/HC complies with regulations. ^{EGOW5-04}

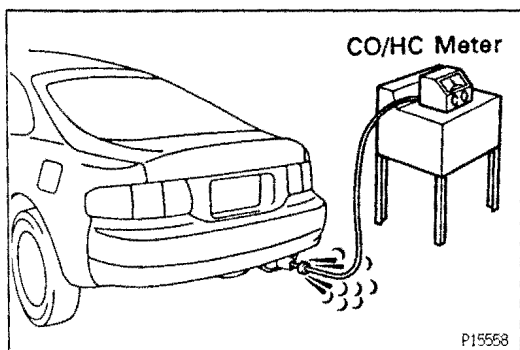
1. INITIAL CONDITIONS

- (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
- (f) EFI 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. CHECK CO/HC CONCENTRATION AT IDLE

Idle CO concentration:

0 – 0.5 %

Idle HC concentration:

Applicable local regulation

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 EG–286)
- (b) See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

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

COMPRESSION CHECK

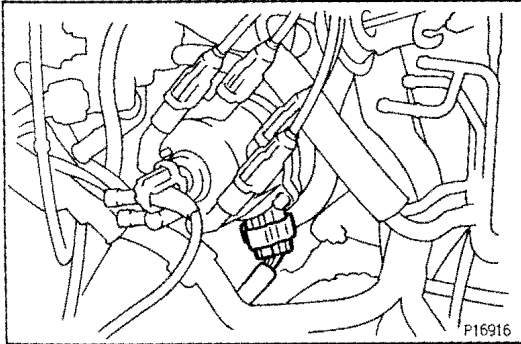
HINT: If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure. ^{EG425-01}

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

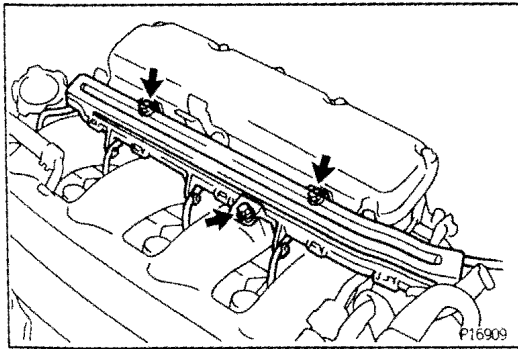
EG

2. DISCONNECT DISTRIBUTOR CONNECTOR

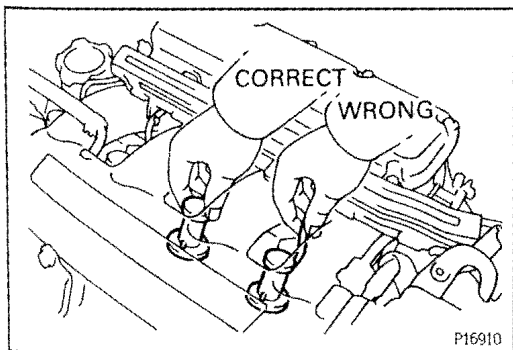


3. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

- (a) Remove the 3 bolts, and disconnect the high-tension cord clamp from the ACIS valve.

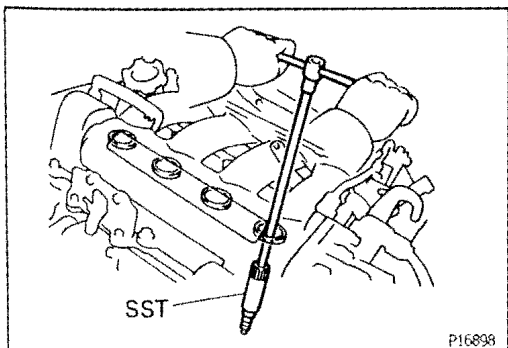


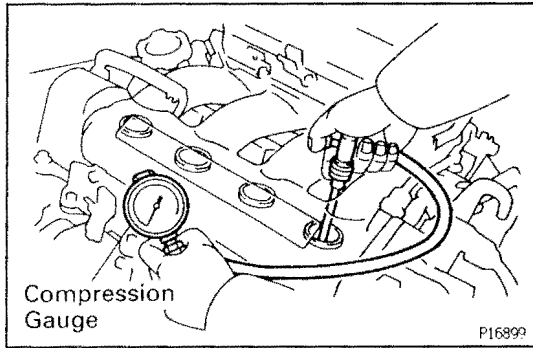
- (b) Disconnect the high-tension cords at the rubber boot. Do not pull on the high-tension cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.



4. REMOVE SPARK PLUGS

Using SST, remove the 4 spark plugs.
SST 09155-16100





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:

1,324 kPa (13.5 kgf/cm², 192 psi) or more

Minimum pressure:

1,079 kPa (11.0 kgf/cm², 156 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm², 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, it is likely 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

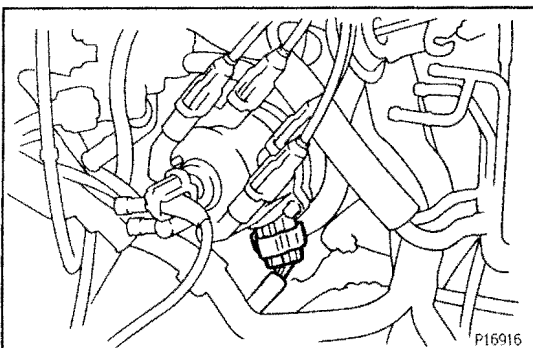
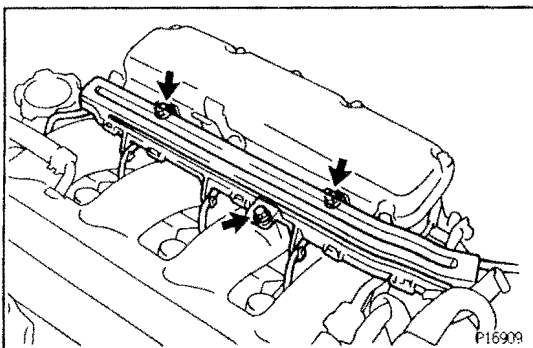
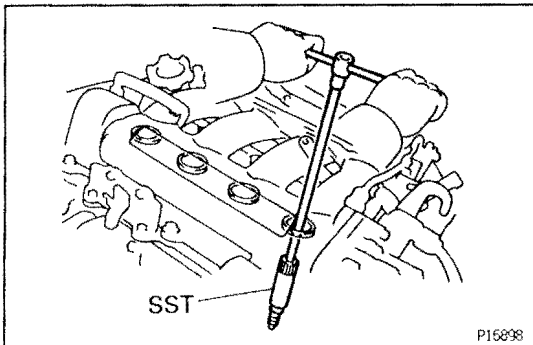
Using SST, install the 4 spark plugs.

SST 09155-16100

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

7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

- (a) Connect the 4 high-tension cords to the spark plugs.
- (b) Install the high-tension cord clamp with the 3 bolts.

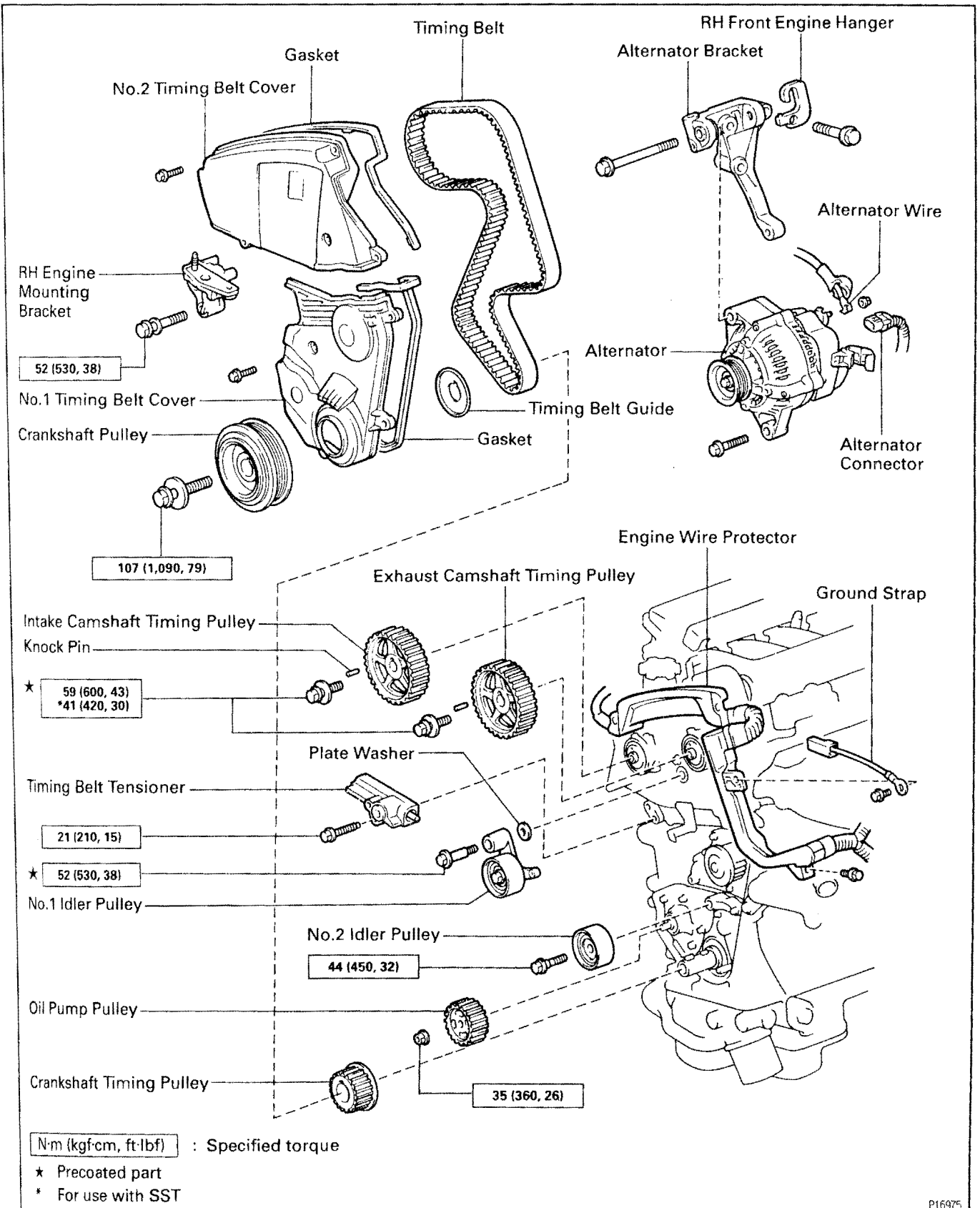


8. RECONNECT DISTRIBUTOR CONNECTOR

TIMING BELT COMPONENTS FOR REMOVAL AND INSTALLATION (ST202)

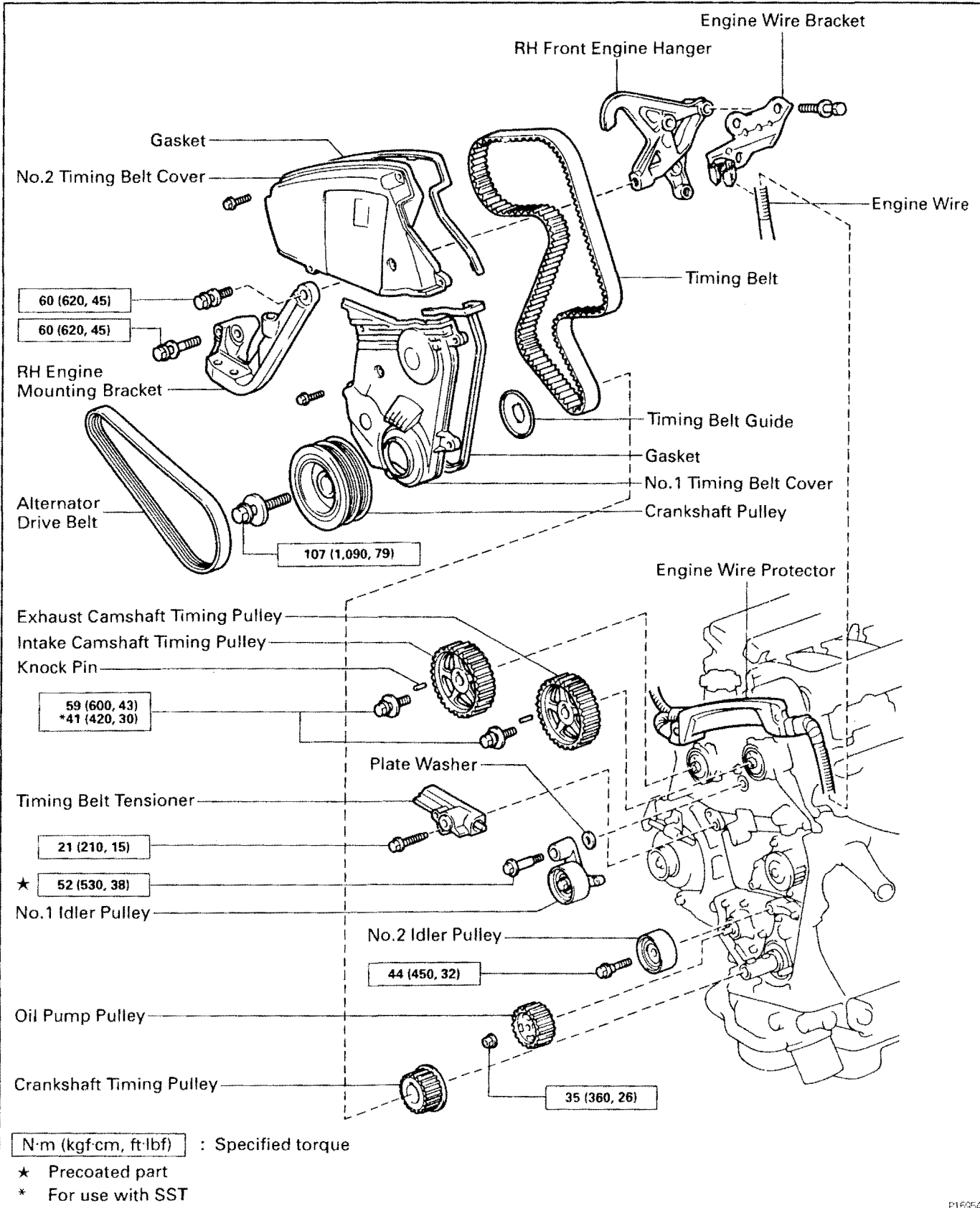
EG42N-01

EG



COMPONENTS FOR REMOVAL AND INSTALLATION (SW20)

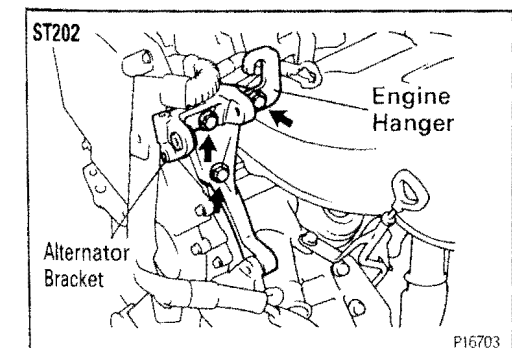
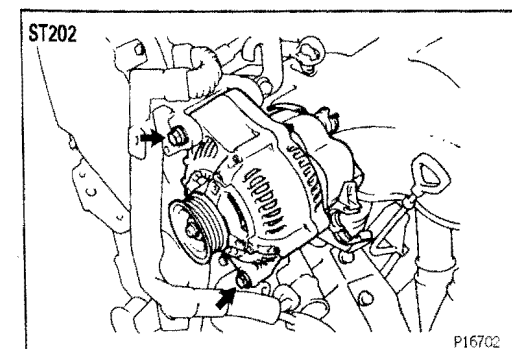
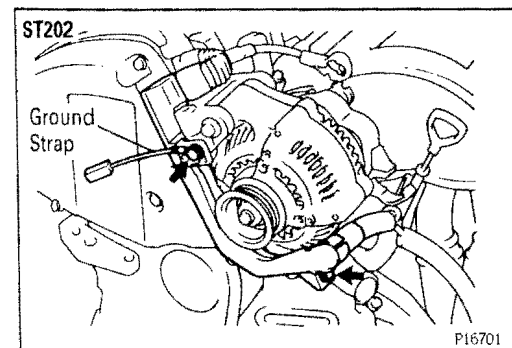
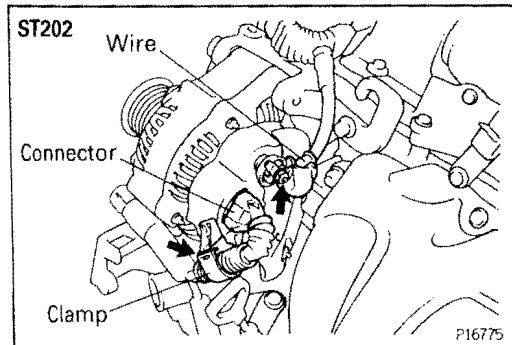
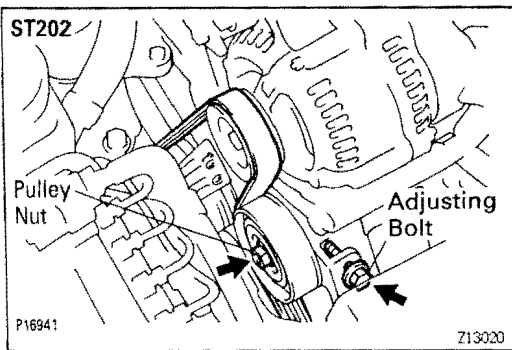
EG



TIMING BELT REMOVAL**(See Components for Removal and Installation)****1. ST202:****REMOVE ALTERNATOR**

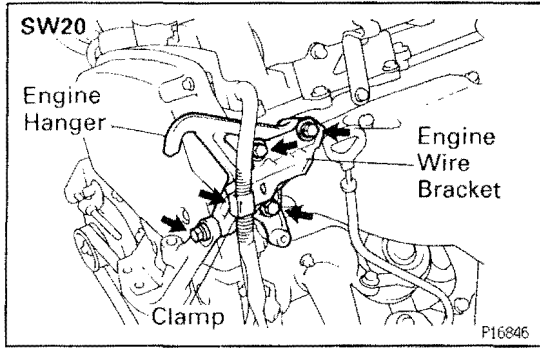
- (a) Loosen the pulley nut and adjusting bolt.
- (b) Remove the drive belt.
- (c) Disconnect the wire from the clamp on the rear end cover.
- (d) Disconnect the alternator connector.
- (e) Remove the rubber cap and nut, and disconnect the alternator wire.
- (f) Remove the 2 bolts and ground strap, and disconnect the engine wire protector from the brackets.
- (g) Remove the 2 bolts and alternator.

EG

**2. ST202:****REMOVE RH FRONT ENGINE HANGER AND ALTERNATOR BRACKET**

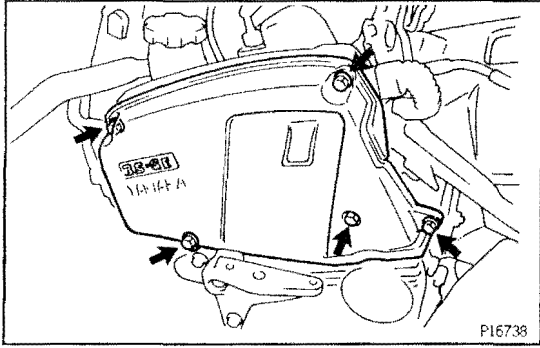
Remove the 3 bolts, engine hanger and alternator bracket.

EG

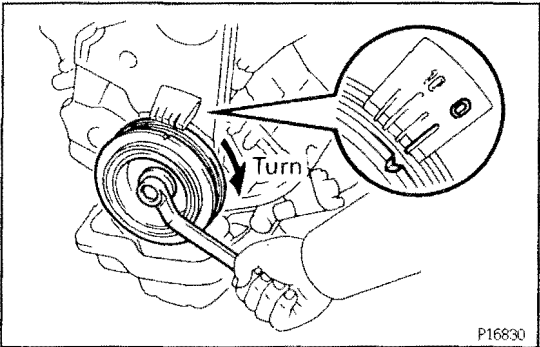


**3. SW20:
REMOVE RH FRONT ENGINE HANGER AND ENGINE WIRE BRACKET**

- (a) Disconnect the engine wire from the clamp on the wire bracket.
- (b) Remove the 4 bolts, wire bracket and engine hanger.

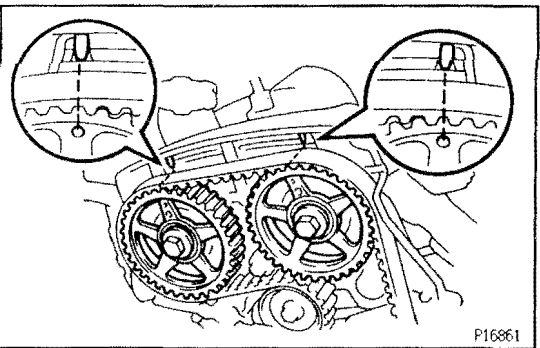


4. REMOVE NO.2 TIMING BELT COVER
Remove the 5 bolts, timing belt cover and gasket.

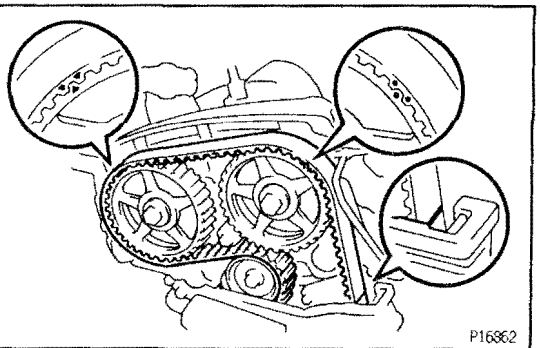


5. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

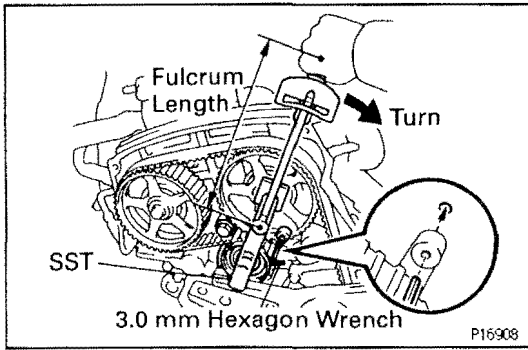


- (b) Check that the timing marks of the camshaft timing pulleys are aligned with the timing marks of the No.4 timing belt cover.
If not, turn the crankshaft 1 revolution (360°).



6. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

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



- (a) Turn the No.1 idler pulley bolt to obtain the specified torque or less, and align the holes of the pulley bracket and cylinder head, pass a 3.0 mm hexagon wrench through the holes to keep the setting position of the pulley bracket.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

48 N·m (490 kgf·cm, 35 ft·lbf) for SST

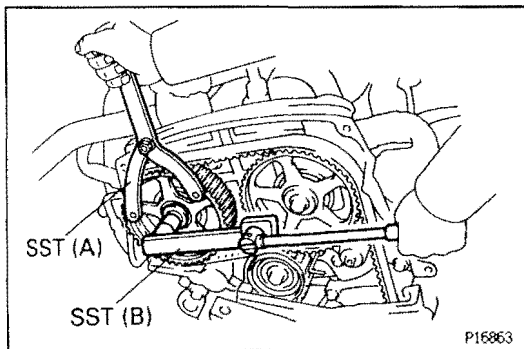
HINT (On vehicle):

- Use SST.

SST 09249-63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

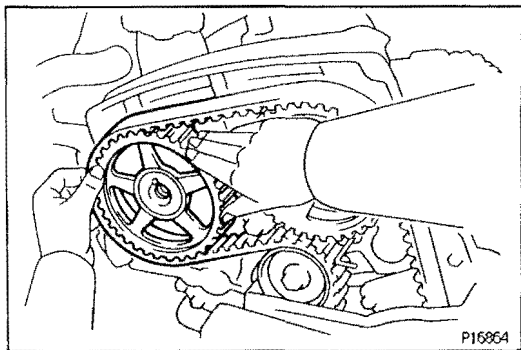
EG



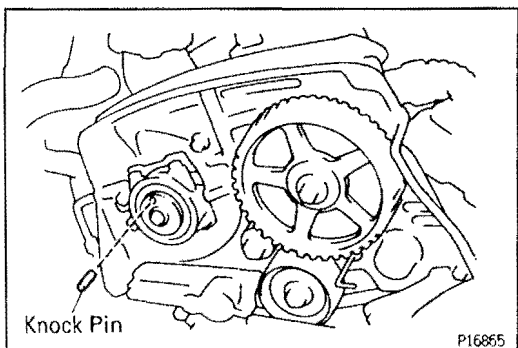
- (b) Using SST, loosen the intake camshaft timing pulley bolt.

SST 09960-10010 (09962-01000, 09963-01000)

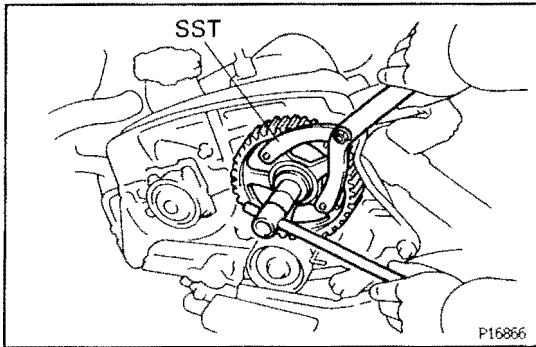
- (c) Remove the intake camshaft timing pulley bolt.



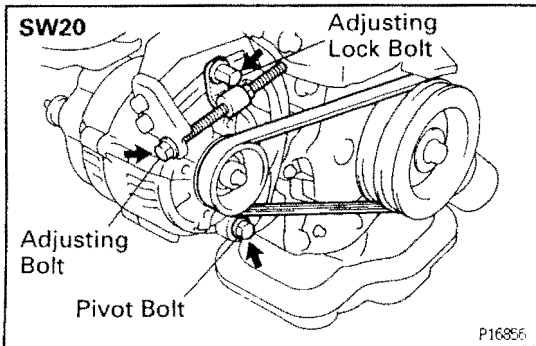
- (d) Disconnect the intake camshaft timing pulley together with the timing belt from the camshaft, and remove the intake camshaft timing pulley.



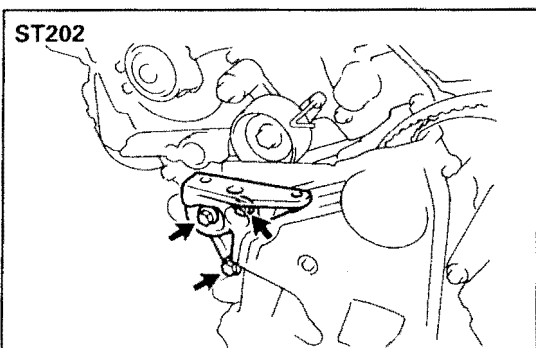
- (e) Remove the knock pin from the intake camshaft.

**7. REMOVE EXHAUST CAMSHAFT TIMING PULLEY**

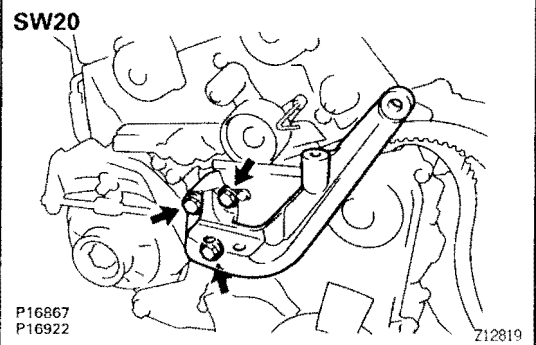
- (a) Using SST, loosen the pulley bolt.
SST 09960–10010 (09962–01000, 09963–01000)
- (b) Remove the bolt, timing pulley and knock pin.

**8. SW20:****REMOVE ALTERNATOR DRIVE BELT**

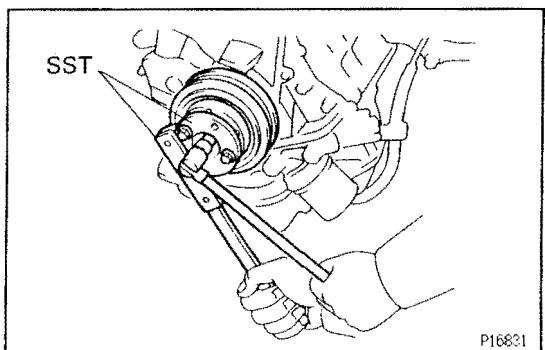
- (a) Loosen the adjusting lock bolt and pivot bolt.
- (b) Loosen the adjusting bolt, and remove the drive belt.

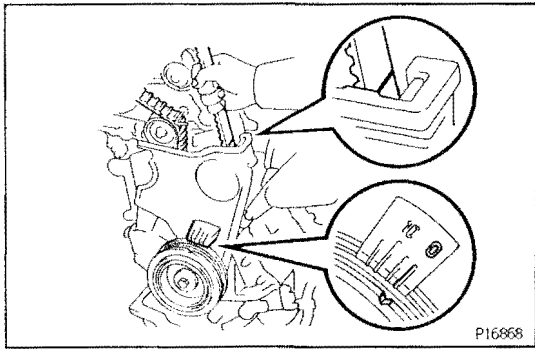
**9. REMOVE RH ENGINE MOUNTING BRACKET**

Remove the 3 bolts and mounting bracket.

**10. REMOVE CRANKSHAFT PULLEY**

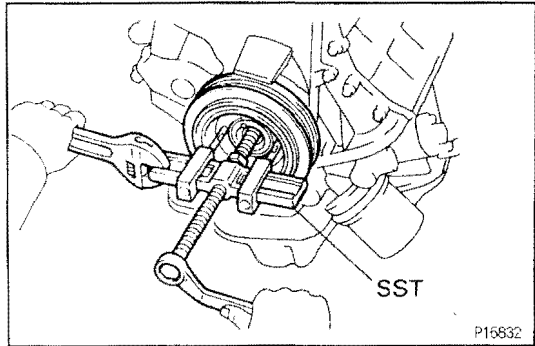
- (a) Using SST, loosen the pulley bolt.
SST 09213–54015 (90119–08216 for ST202, 91651
–60855 for SW20), 09330–00021





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.

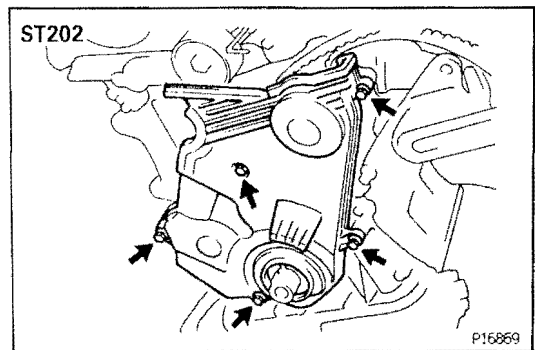
- (b) Remove the pulley bolt.



- (c) Using SST, remove the pulley.

SST 09950-50010 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05020)

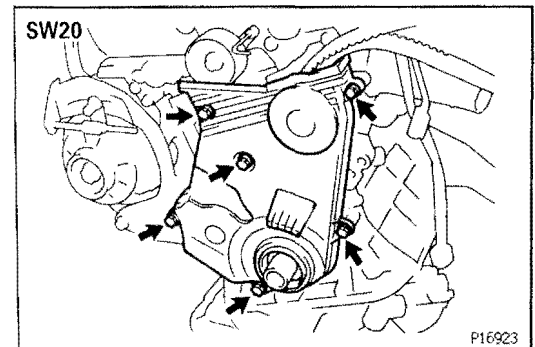
HINT (When re-using timing belt): Remove the pulley without turning it.



11. REMOVE NO.1 TIMING BELT COVER

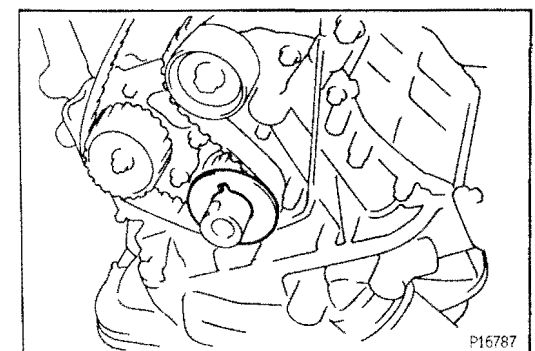
ST202:

Remove the 5 bolts, timing belt cover and gasket.

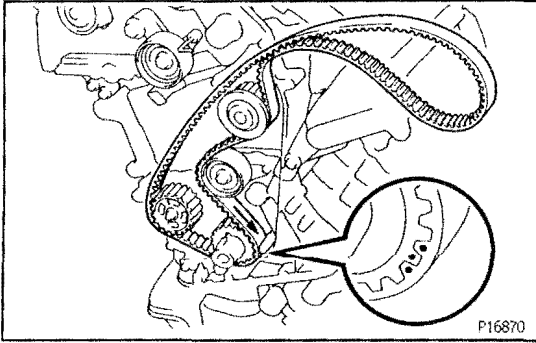


SW20:

Remove the 6 bolts, timing belt cover and gasket.

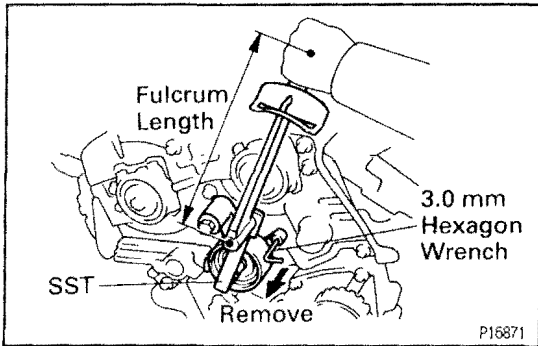


12. REMOVE TIMING BELT GUIDE

**13. 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.

EG

**14. REMOVE NO.1 IDLER PULLEY**

- (a) Turn the No.1 idler pulley bolt to obtain the specified torque or less, and remove the 3.0 mm hexagon wrench.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

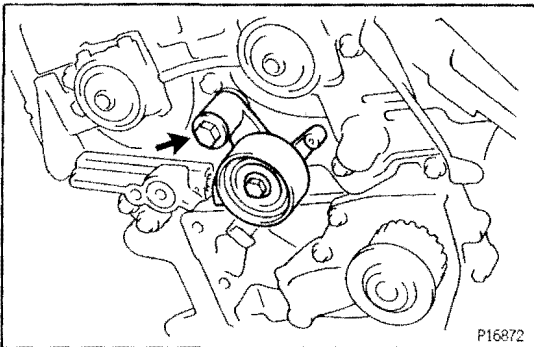
48 N·m (490 kgf·cm, 35 ft·lbf) for SST

HINT (On vehicle):

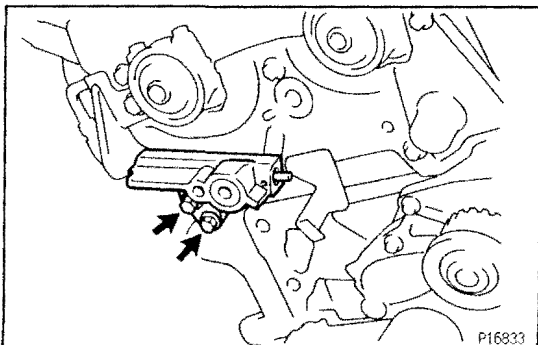
- Use SST.

SST 09249—63010

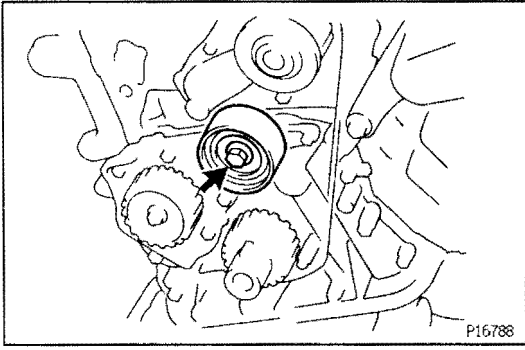
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).



- (b) Remove the pivot bolt, pulley and plate washer.

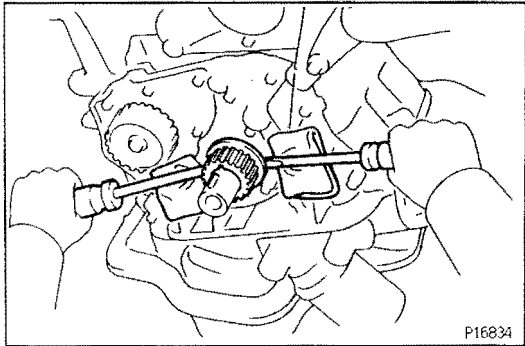
**15. REMOVE TIMING BELT TENSIONER**

Remove the 2 bolts and tensioner.

**16. REMOVE NO.2 IDLER PULLEY**

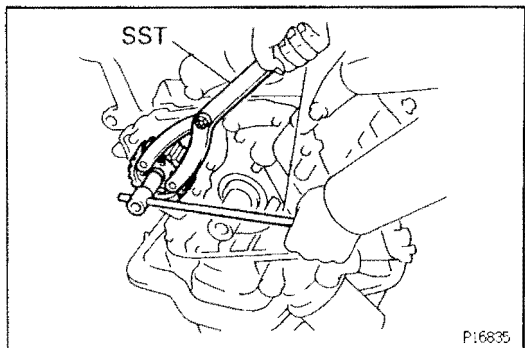
Remove the bolt and pulley.

EG

**17. REMOVE CRANKSHAFT TIMING PULLEY**

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

HINT: Position shop rags as shown to prevent damage.

**18. REMOVE OIL PUMP PULLEY**

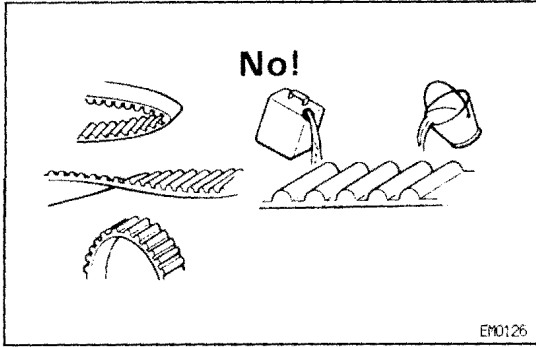
(a) Using SST, loosen the pulley nut.

SST 09960-10010 (09962-01000, 09963-00500)

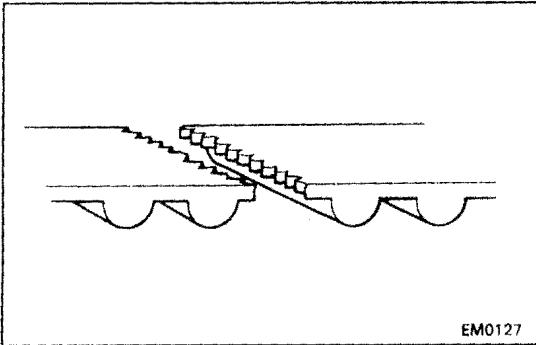
(b) Remove the nut and pulley.

TIMING BELT COMPONENTS INSPECTION

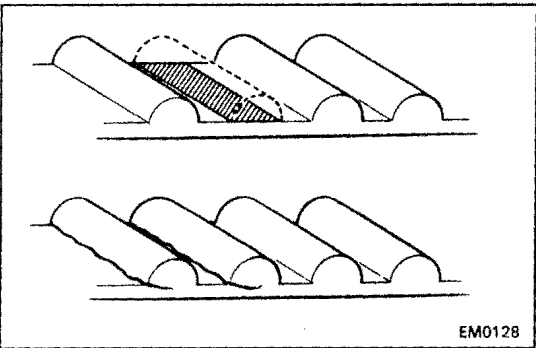
EG



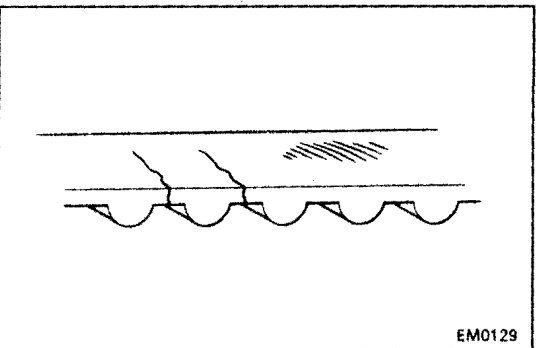
EM0126



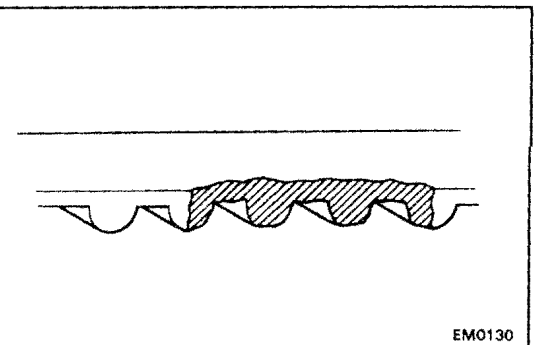
EM0127



EM0128



EM0129



EM0130

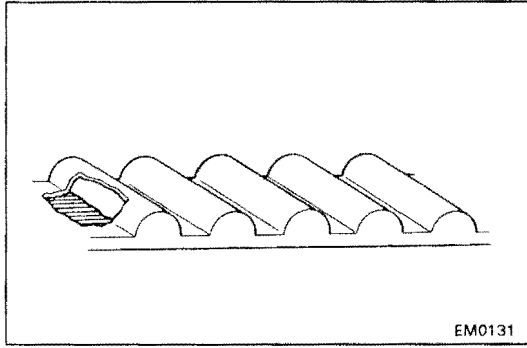
1. INSPECT TIMING BELT

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.

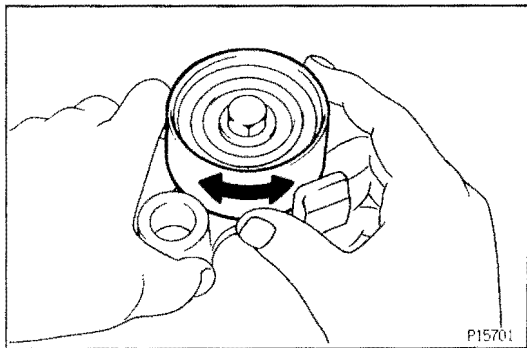
If there are any defects as shown in the illustration, check the following points:

- (a) Premature parting
 - Check 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.



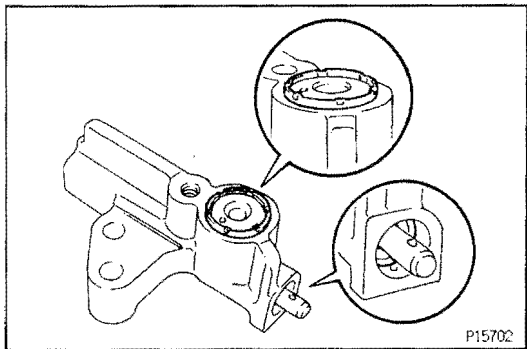
- (e) If there is noticeable wear on the belt teeth, check the timing cover for damage and check that the gasket has been installed correctly. Check for foreign material on the pulley teeth.
If necessary, replace the timing belt.

EG



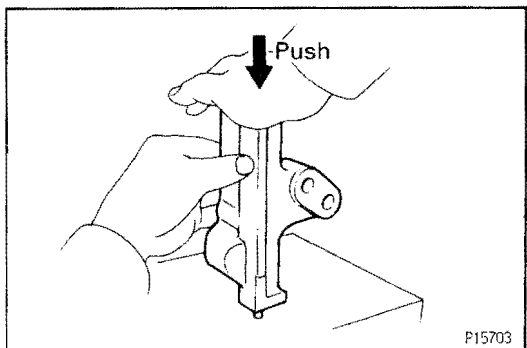
2. INSPECT IDLER PULLEYS

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

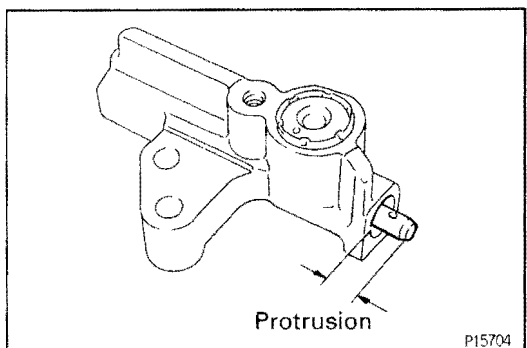


3. INSPECT TIMING BELT TENSIONER

- (a) Visually check tensioner for leakage.
HINT: A small trace of oil on the push rod seal is permissible.
If leakage is found, replace the tensioner.



- (b) Hold the tensioner with both hands, and push the push rod firmly against the floor or wall to check that it doesn't move.
If push rod moves, replace the tensioner.

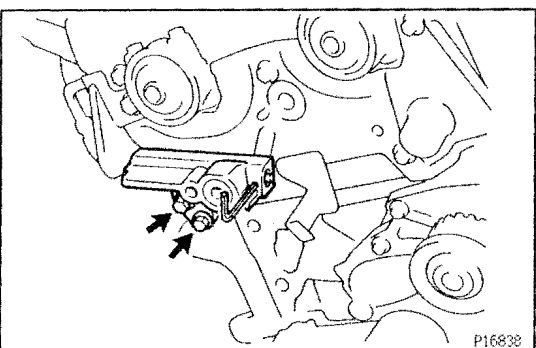
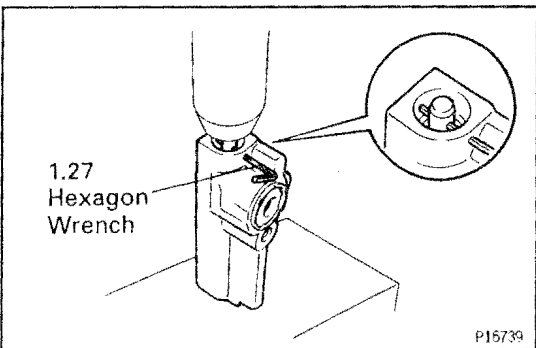
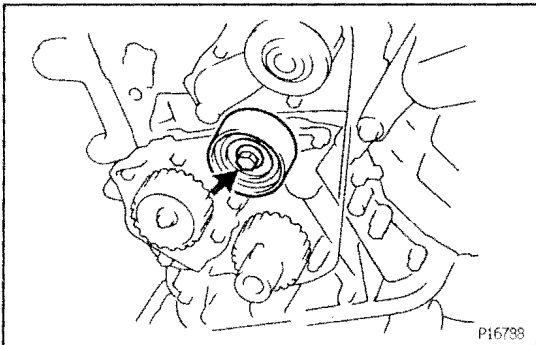
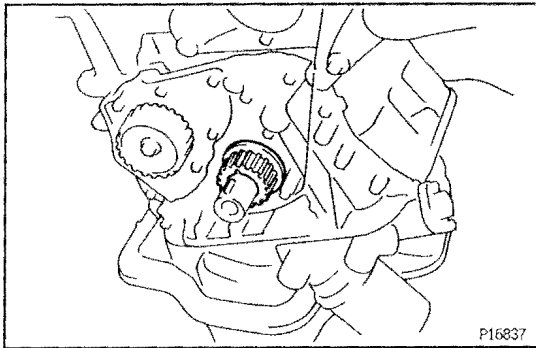
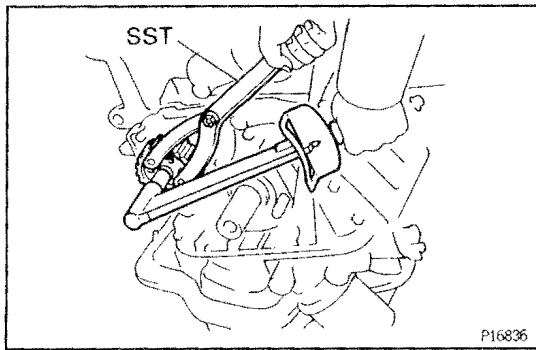


- (c) Measure the protrusion of the push rod from the housing end.

Protrusion:

10.0 – 11.0 mm (0.394 – 0.433 in.)

If the protrusion is not as specified, replace the tensioner.



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 pulley nut.
SST 09960-10010 (09962-01000, 09963-00500)
Torque: 35 N·m (360 kgf·cm, 26 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

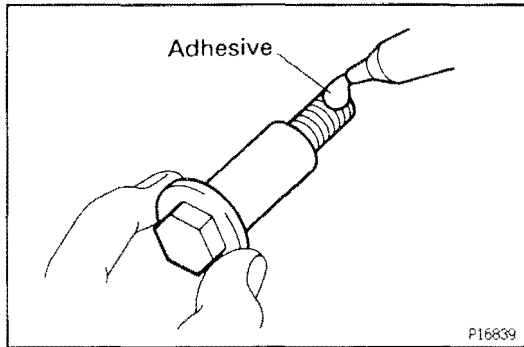
- (a) Install the pulley with the bolt.
Torque: 44 N·m (450 kgf·cm, 32 ft·lbf)
- (b) Check that the idler pulley moves smoothly.

4. SET TIMING BELT TENSIONER

- (a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of force.
- (b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
- (c) Release the press.

5. INSTALL TIMING BELT TENSIONER

Install the tensioner with the 2 bolts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

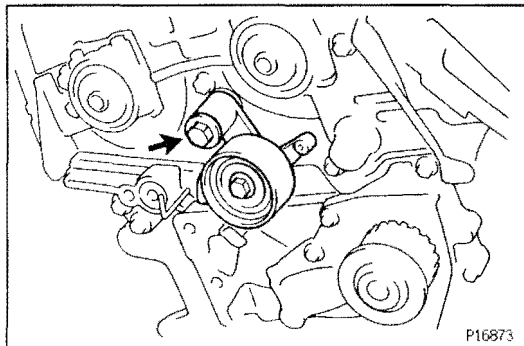


6. INSTALL NO.1 IDLER PULLEY

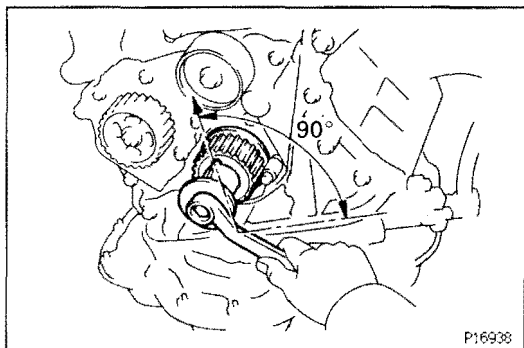
- (a) Apply adhesive to 2 or 3 threads of the pivot bolt.

Adhesive:

**Part No. 08833—00080, THREE BOND 1344,
LOCTITE 242 or equivalent**



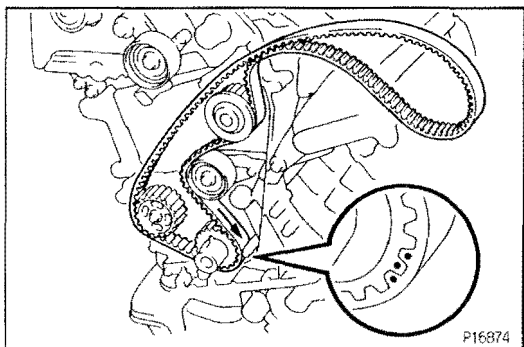
- (b) Install the plate washer and pulley with the pivot bolt.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)
- (c) Check that the idler pulley moves smoothly.



7. TEMPORARILY INSTALL TIMING BELT

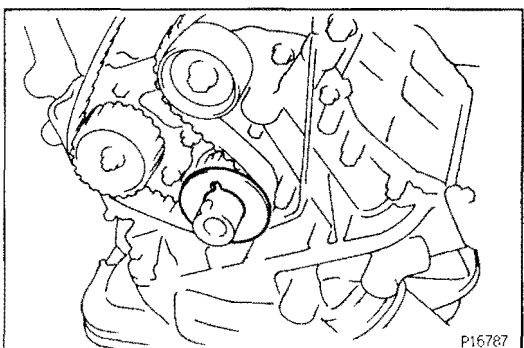
NOTICE: The engine should be cold.

- (a) Using the crankshaft pulley bolt, turn the crankshaft and position the key groove of the crankshaft timing pulley as shown in the illustration.



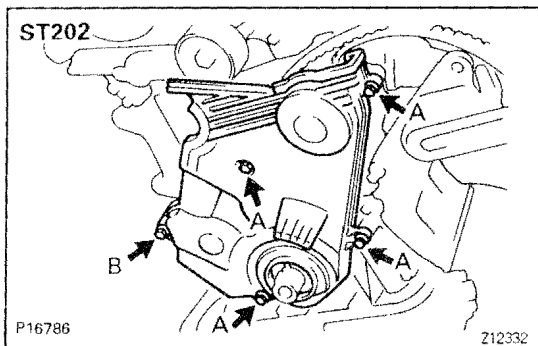
- (b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley and No.2 idler pulley, and keep them clean.
- (c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.2 idler pulley and water pump pulley.

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.



8. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.

**9. INSTALL NO.1 TIMING BELT COVER**

(a) Install the gasket to the timing belt cover.

(b) ST202:

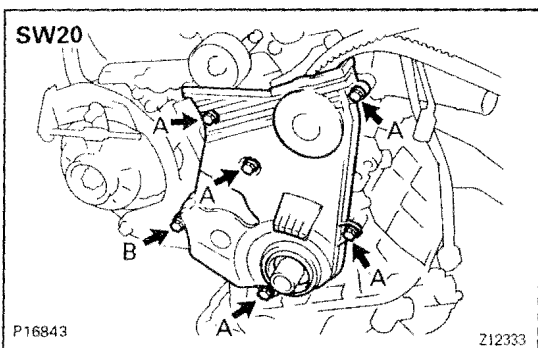
Install the timing belt cover with the 5 bolts.

HINT: Each bolt length is indicated in the illustration.

Bolt length:

A 20 mm (0.79 in.)

B 42 mm (1.65 in.)



(b) SW20:

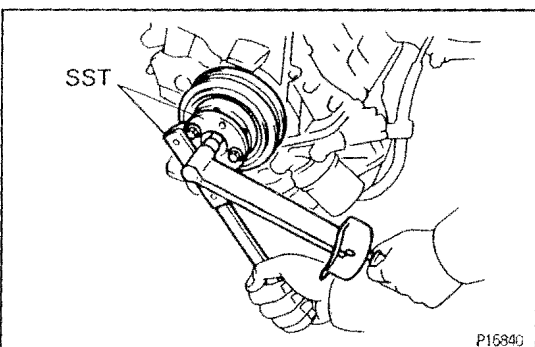
Install the timing belt cover with the 6 bolts.

HINT: Each bolt length is indicated in the illustration.

Bolt length:

A 20 mm (0.79 in.)

B 42 mm (1.65 in.)

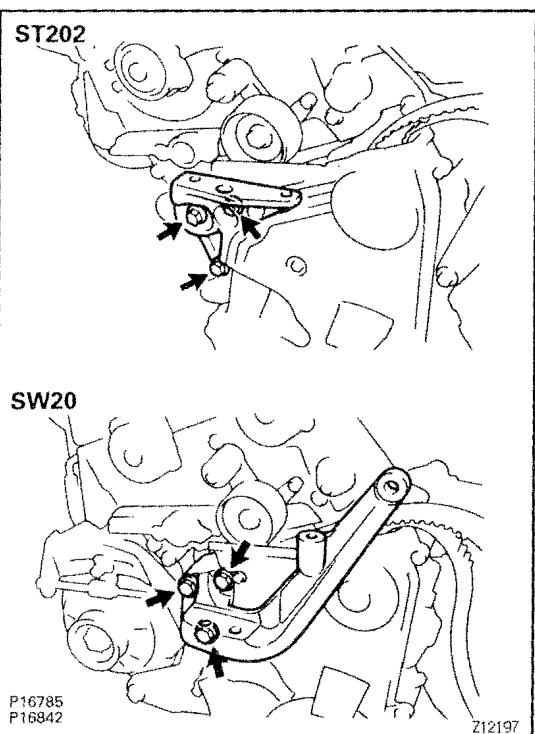
**10. INSTALL CRANKSHAFT PULLEY**

(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.

(b) Using SST, install the pulley bolt.

SST 09213-54015 (90119-08216 for ST202, 91651-60855 for SW20), 09330-00021

Torque: 107 N·m (1,090 kgf·cm, 79 ft·lbf)

**11. INSTALL RH ENGINE MOUNTING BRACKET**

Install the mounting bracket with the 3 bolts.

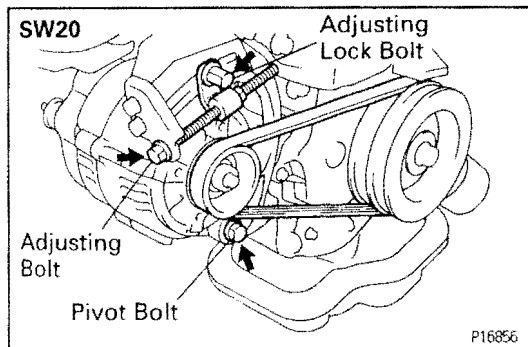
Torque:

ST202

52 N·m (530 kgf·cm, 38 ft·lbf)

SW20

60 N·m (620 kgf·cm, 45 ft·lbf)

**12. SW20:****INSTALL ALTERNATOR DRIVE BELT**

- (a) Install the drive belt with the adjusting bolt.
- (b) Tighten the pivot bolt and adjusting lock bolt.

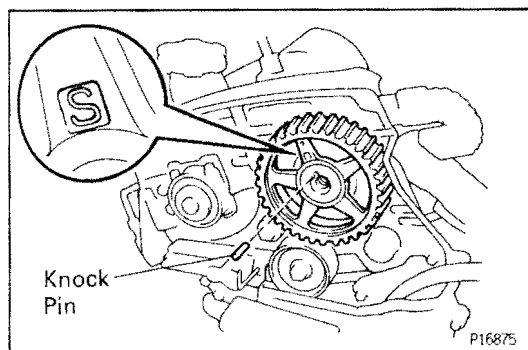
Torque:**Pivot bolt**

52 N·m (530 kgf·cm, 38 ft·lbf)

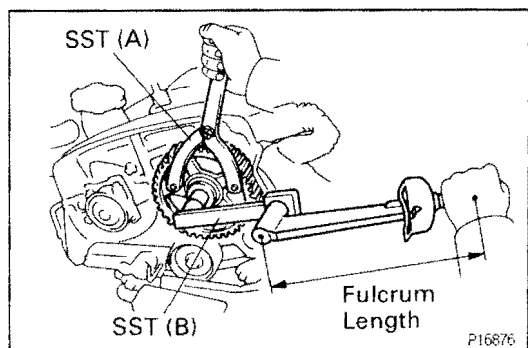
Adjusting lock bolt

19 N·m (190 kgf·cm, 14 ft·lbf)

EG

**13. INSTALL EXHAUST CAMSHAFT TIMING PULLEY**

- (a) Slide the timing pulley onto the camshaft, facing mark "S" outward.
- (b) Align the pin holes of the camshaft and timing pulley, and insert the knock pin.



- (c) Using SST (A), install the pulley bolt.

SST 09960-10010 (09962-01000, 09963-01000)

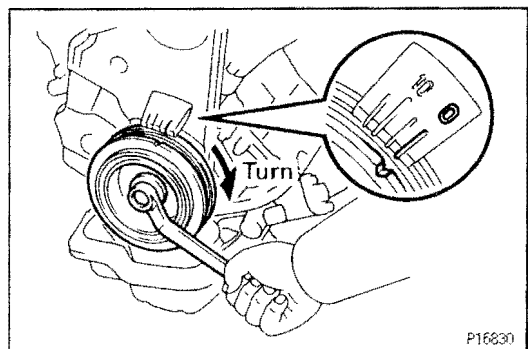
Torque:

59 N·m (600 kgf·cm, 43 ft·lbf)

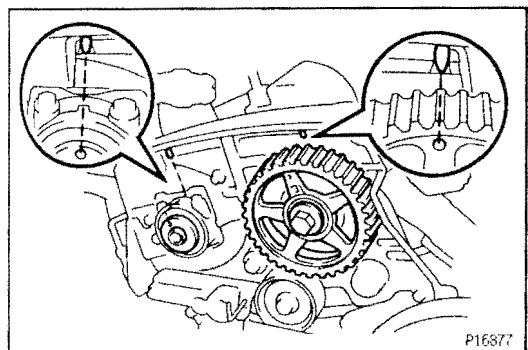
41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

- Use SST (B).
- SST 09249-63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

**14. 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.



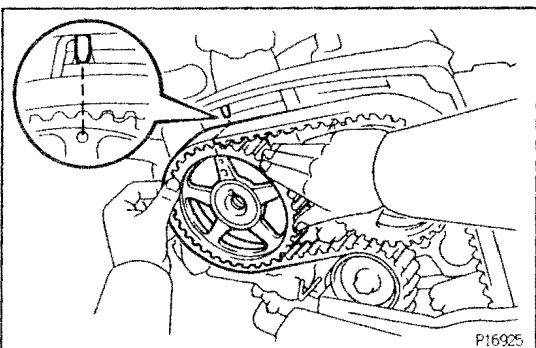
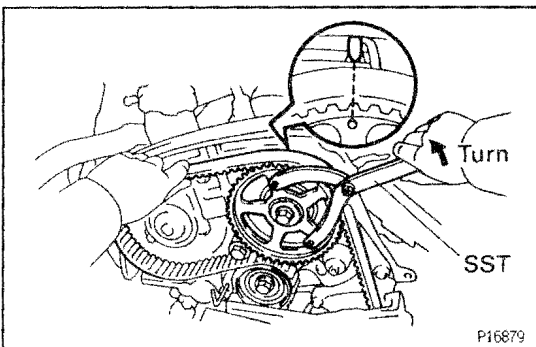
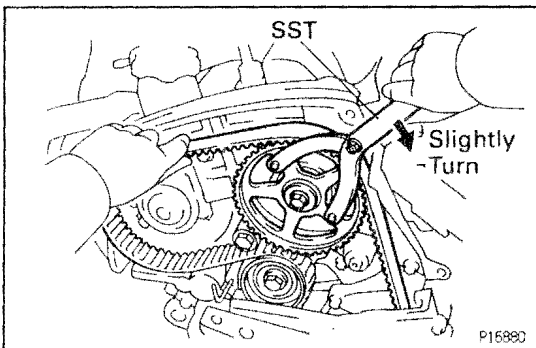
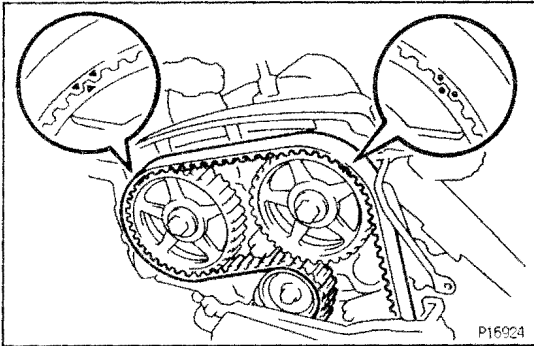
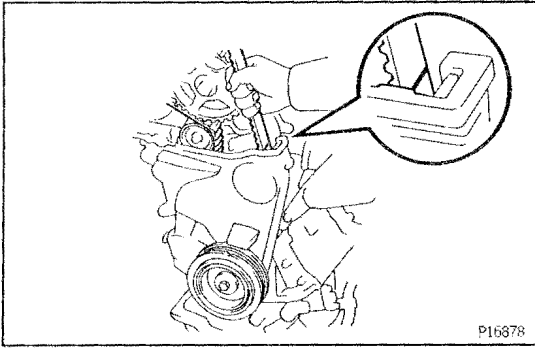
- (b) Intake Camshaft Position:

Turn the camshaft, align the knock pin hole of the camshaft with the timing mark of the No.4 timing belt cover.

- (c) Exhaust Camshaft Timing Pulley Position:

Turn the camshaft timing pulley, align the timing marks of the camshaft timing pulley and No.4 timing belt cover.

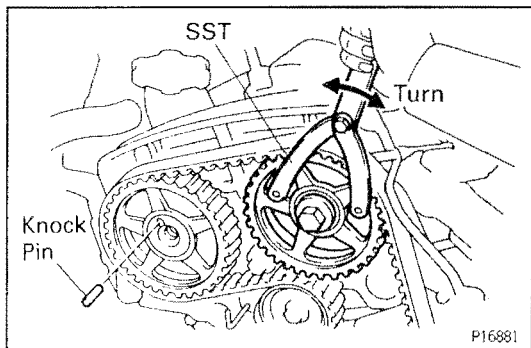
EG



15. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEYS

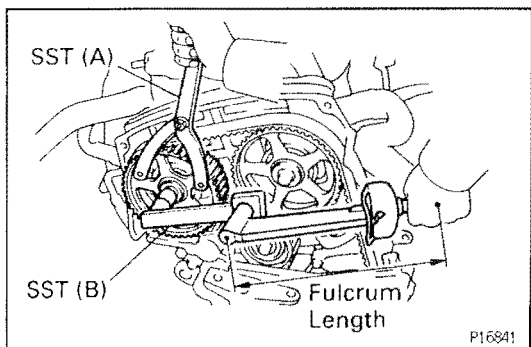
HINT (When re-using timing belt):

- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.
 - Align the matchmarks of the timing belt and camshaft timing pulleys.
- (a) Remove any oil or water on the exhaust camshaft timing pulley, and keep it clean.
 - (b) Using SST, slightly turn the exhaust camshaft timing pulley clockwise and hang the timing belt on the exhaust camshaft timing pulley.
SST 09960-10010 (09962-01000, 09963-01000)
 - (c) Using SST, align the timing marks of the exhaust camshaft pulley and No.4 timing belt cover.
SST 09960-10010 (09962-01000, 09963-01000)
 - (d) Check that the timing belt has tension between the crankshaft timing pulley and exhaust camshaft timing pulley.
 - (e) Remove any oil or water on the intake camshaft timing pulley and No.1 idler pulley, and keep them clean.
 - (f) Align the timing marks of the intake camshaft timing pulley and No.4 timing belt cover, and hang the timing belt on the intake camshaft timing pulley, facing mark "S" outward.
 - (g) Slide the intake camshaft timing pulley on the camshaft.



- (h) Using SST, turn the exhaust camshaft timing pulley and align the knock pin hole of the camshaft with the knock pin groove of the pulley and install the knock pin.

SST 09960-10010 (09962-01000, 09963-01000)



- (i) Using SST (A), install the intake camshaft timing pulley bolt.

SST 09960-10010 (09962-01000, 09963-01000)

Torque:

59 N·m (600 kgf·cm, 43 ft·lbf)

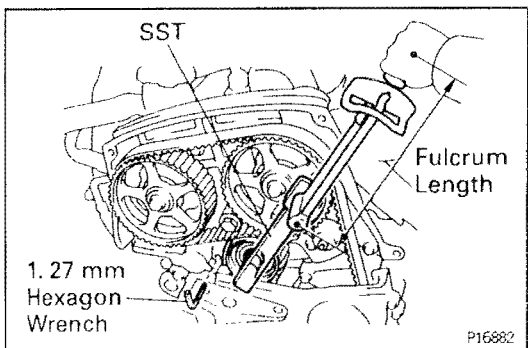
41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

- Use SST (B).

SST 09249-63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).



- (j) Turn the No.1 idler pulley bolt to obtain the specified torque or less, remove the 1.27 mm hexagon wrench.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

48 N·m (490 kgf·cm, 35 ft·lbf) for SST

HINT (On vehicle):

- Use SST.

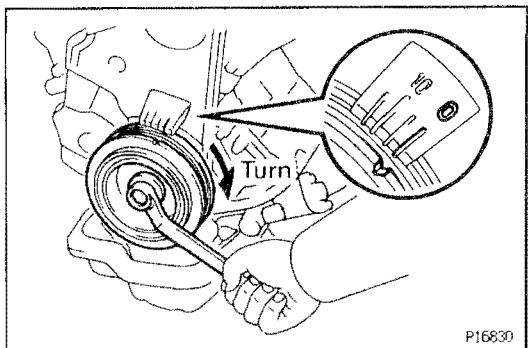
SST 09249-63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

16. CHECK VALVE TIMING

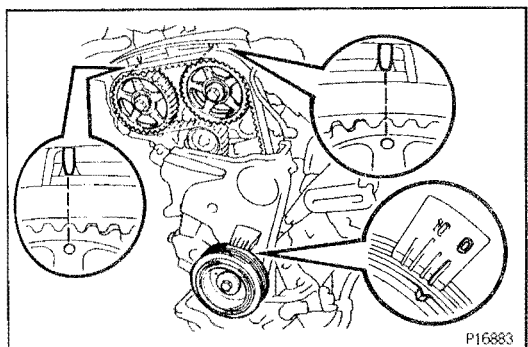
- (a) Slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

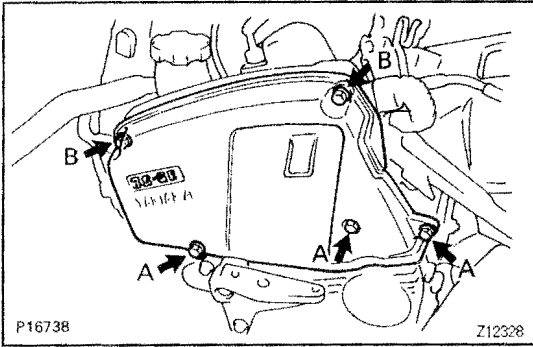
NOTICE: Always turn the crankshaft clockwise.



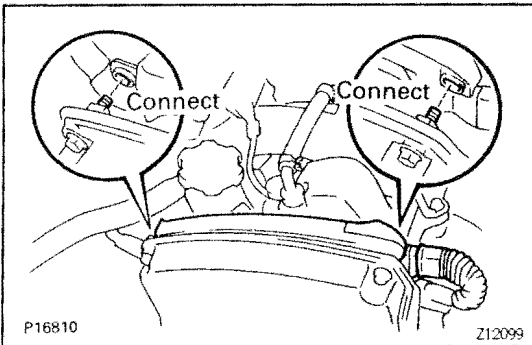
- (b) Check that each pulley aligns with the timing marks as shown in the illustration.

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

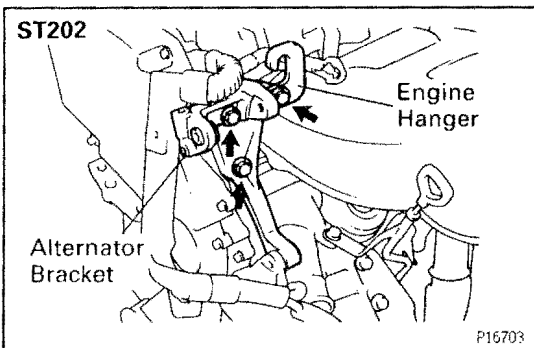


**17. INSTALL NO.2 TIMING BELT COVER**

- (a) Install the gasket to the timing belt cover.
- (b) Install the timing belt cover with the 5 bolts.
HINT: Each bolt length is indicated in the illustration.
Bolt length:
 - A 20 mm (0.79 in.)
 - B 25 mm (0.98 in.)

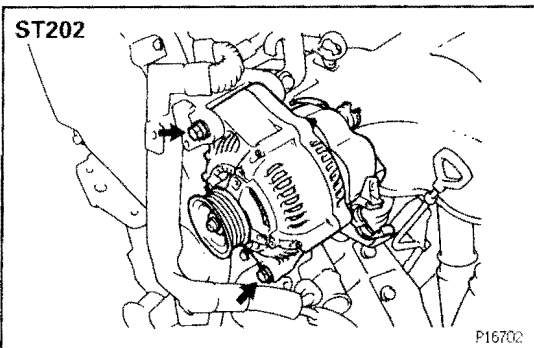


- (c) Connect the 2 clamps of the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover.

**18. ST202:****INSTALL ALTERNATOR BRACKET AND RH FRONT ENGINE HANGER**

Install the alternator bracket and engine hanger with the 3 bolts.

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

**19. ST202:****INSTALL ALTERNATOR**

- (a) Install the alternator with the 2 bolts.

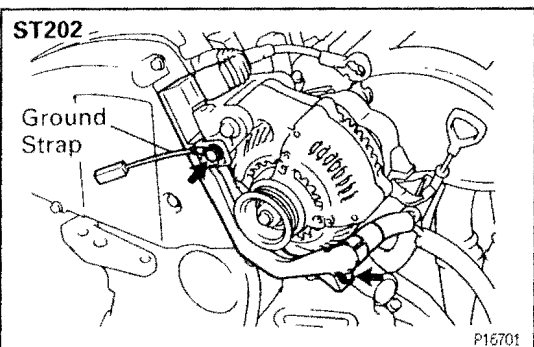
Torque:

12 mm head

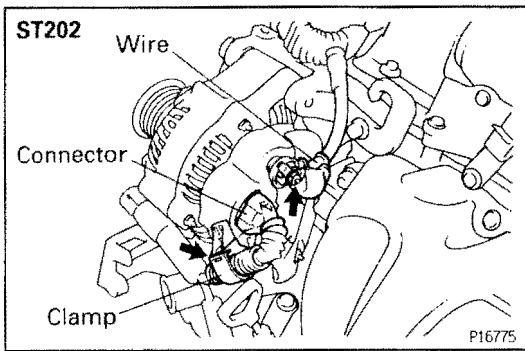
19 N·m (190 kgf·cm, 14 ft·lbf)

14 mm head

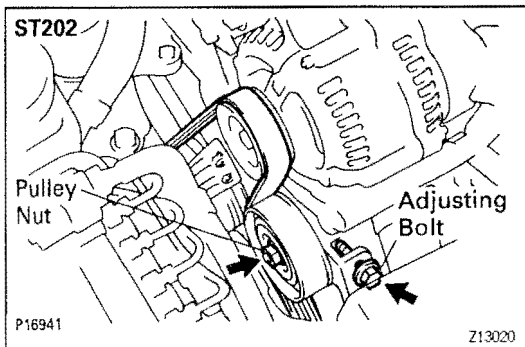
52 N·m (530 kgf·cm, 38 ft·lbf)



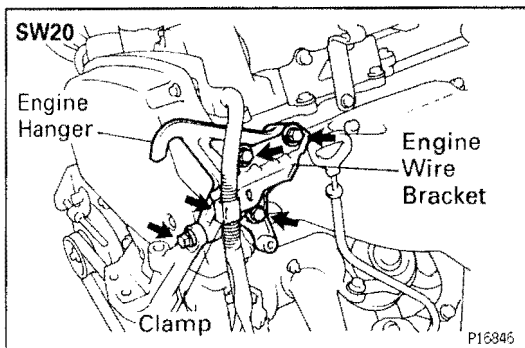
- (b) Install the engine wire protector and ground strap with the 2 bolts.



- (c) Connect the alternator connector.
- (d) Connect the alternator wire with the nut and rubber cap.
- (e) Install the wire to the clamp on the rear end cover.



- (f) Install the drive belt with the adjusting bolt.
 - (g) Tighten the pulley nut.
- Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)**



20. SW20: INSTALL RH FRONT ENGINE HANGER AND ENGINE WIRE BRACKET

- (a) Install the engine hanger and wire bracket with the 4 bolts. Alternately tighten the bolts.

Torque:

Cylinder head side

39 N·m (400 kgf·cm, 29 ft·lbf)

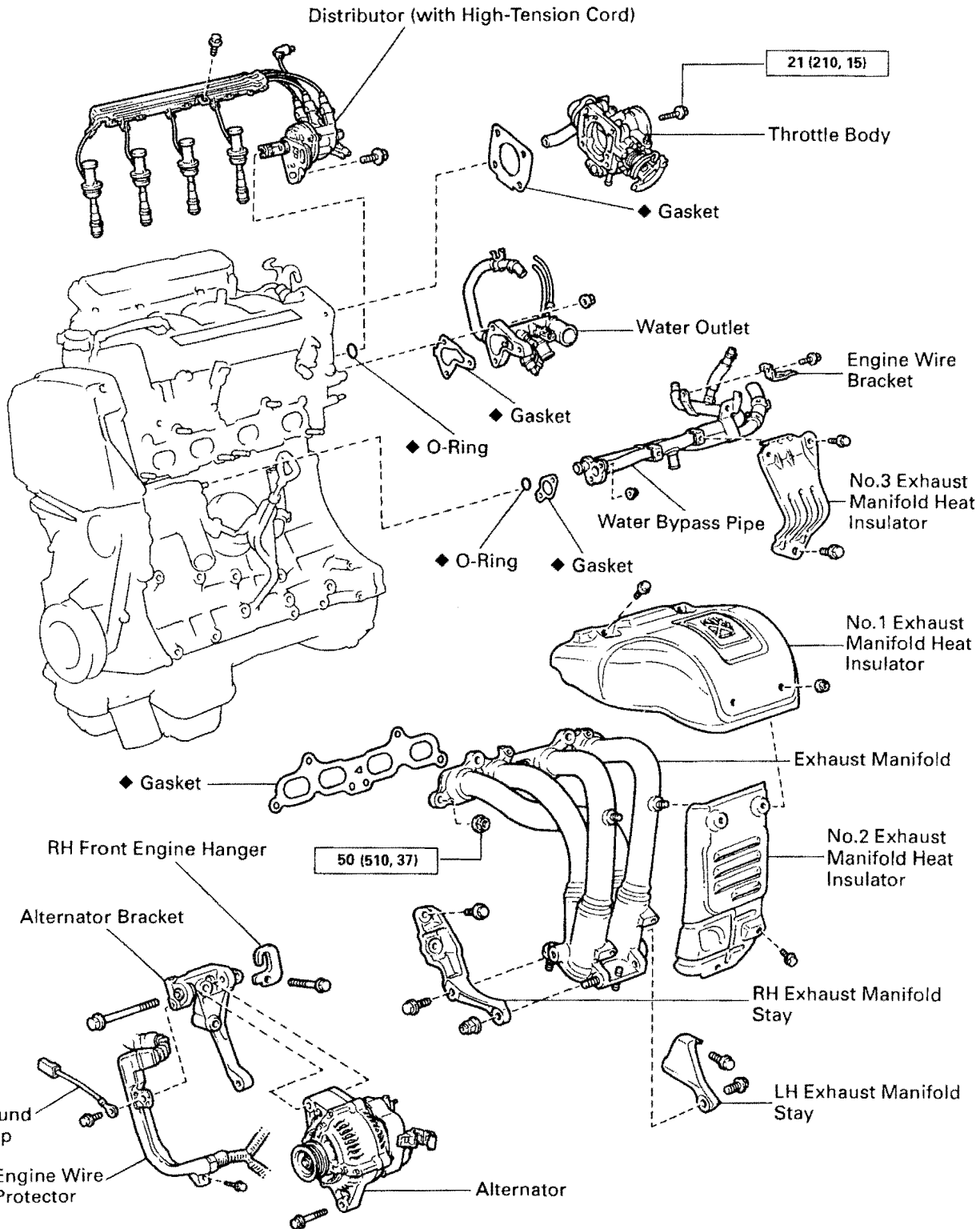
RH engine mounting bracket side

60 N·m (620 kgf·cm, 45 ft·lbf)

- (b) Install the engine wire to the clamp on the wire bracket.

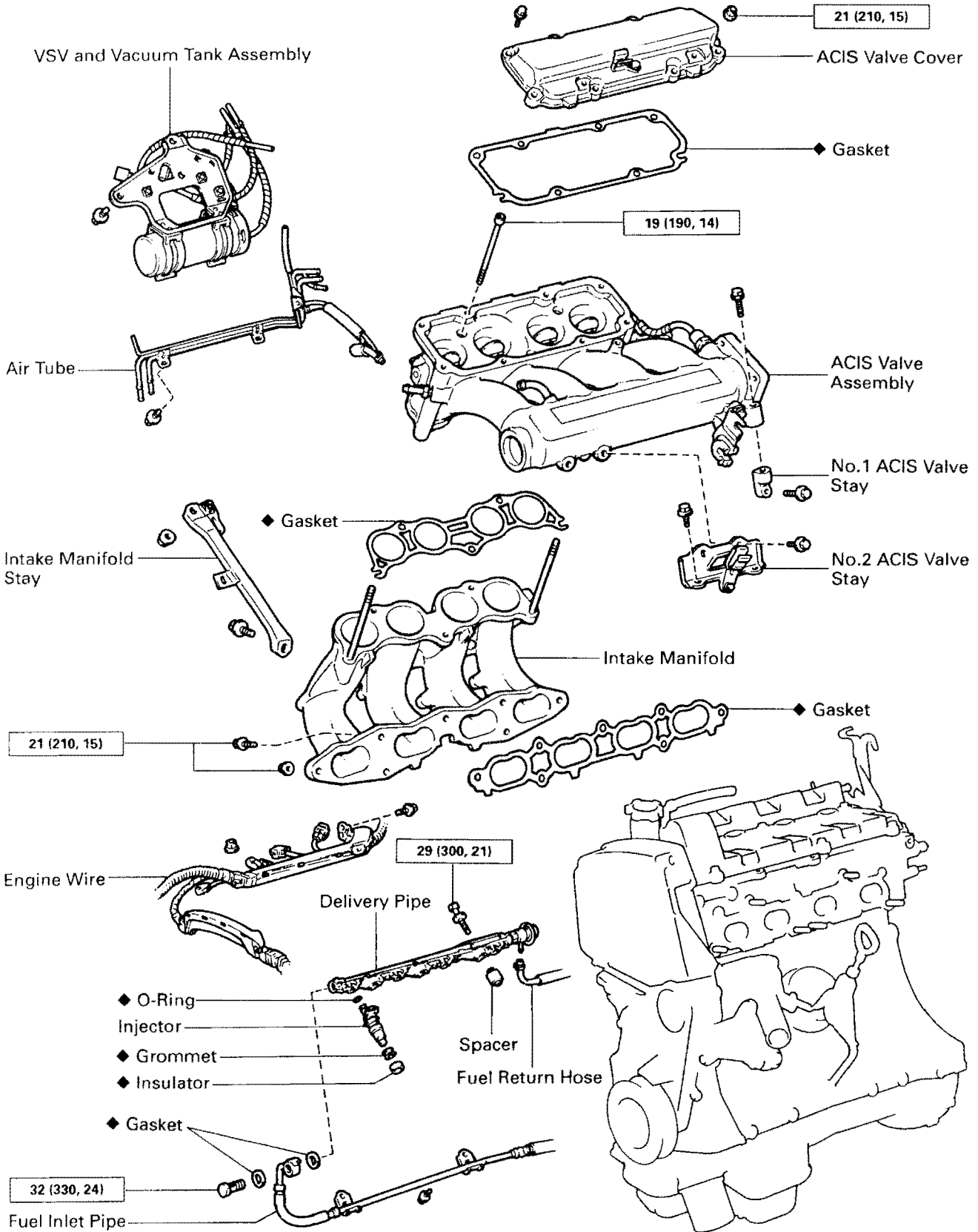
CYLINDER HEAD COMPONENTS FOR REMOVAL AND INSTALLATION (ST202)

EG



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

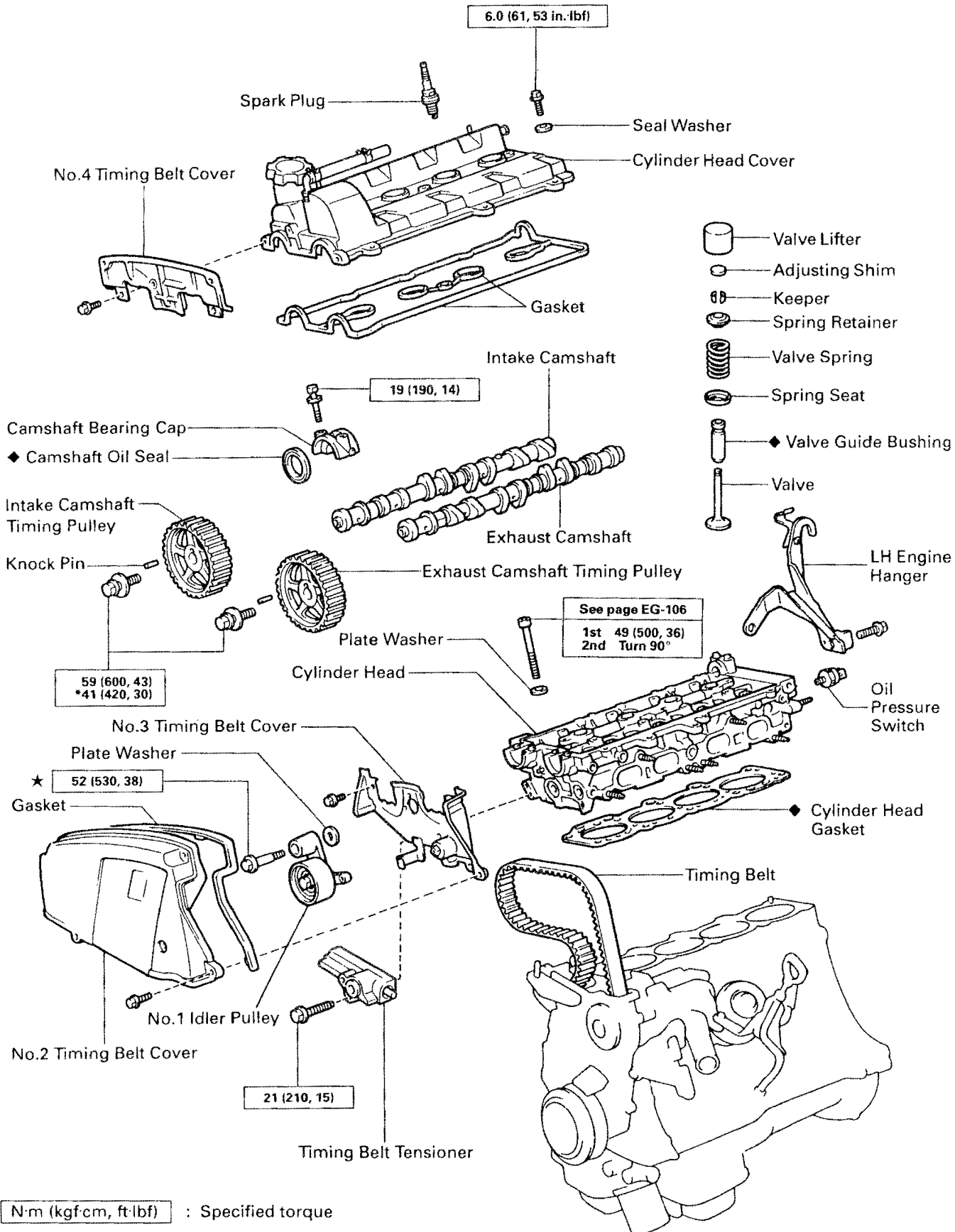
◆ Non-reusable part



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

◆ Non-reusable part

EG

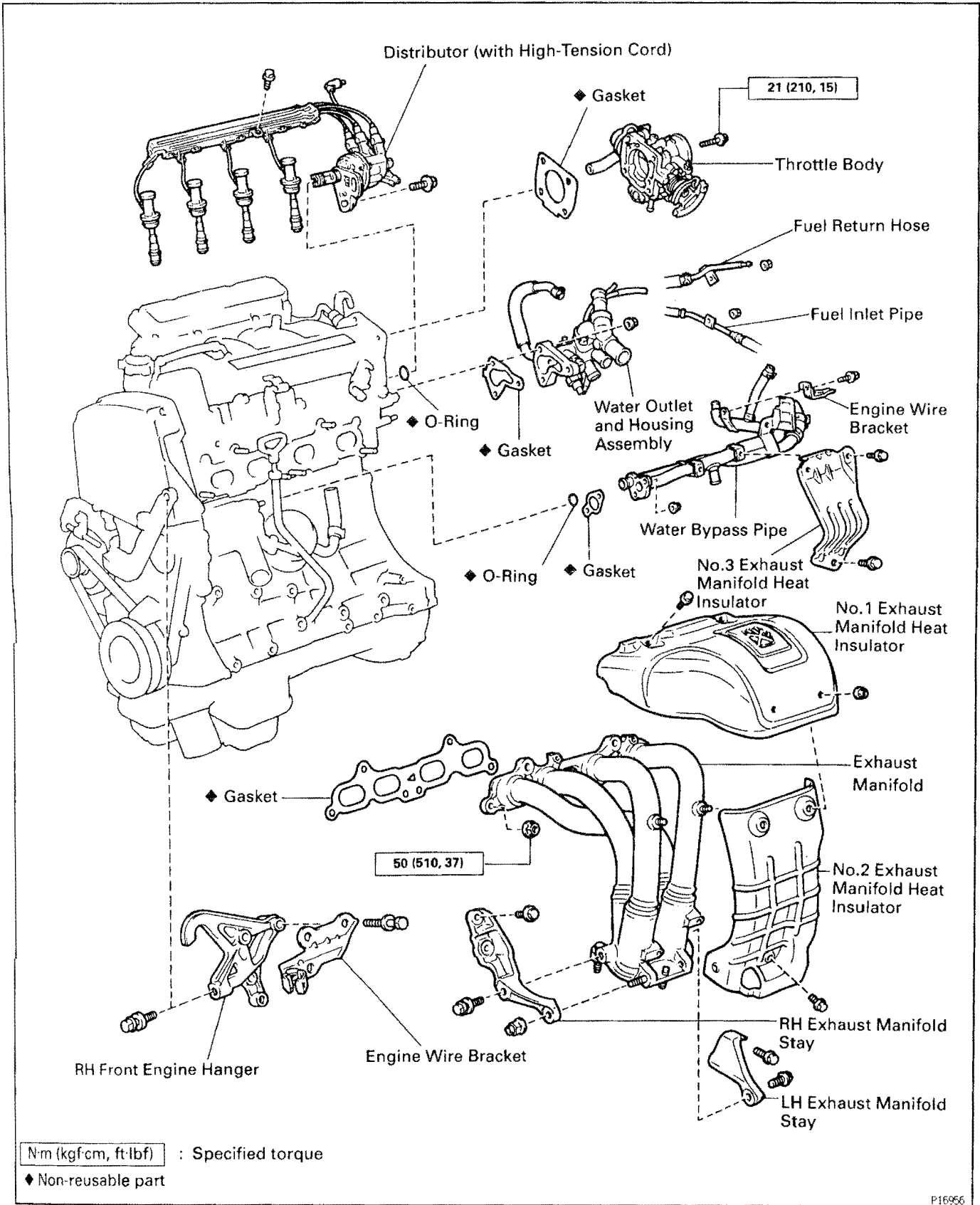


N·m (kgf·cm, ft·lbf) : Specified torque

- ◆ Non-reusable part
- ★ Precoated part
- * For use with SST

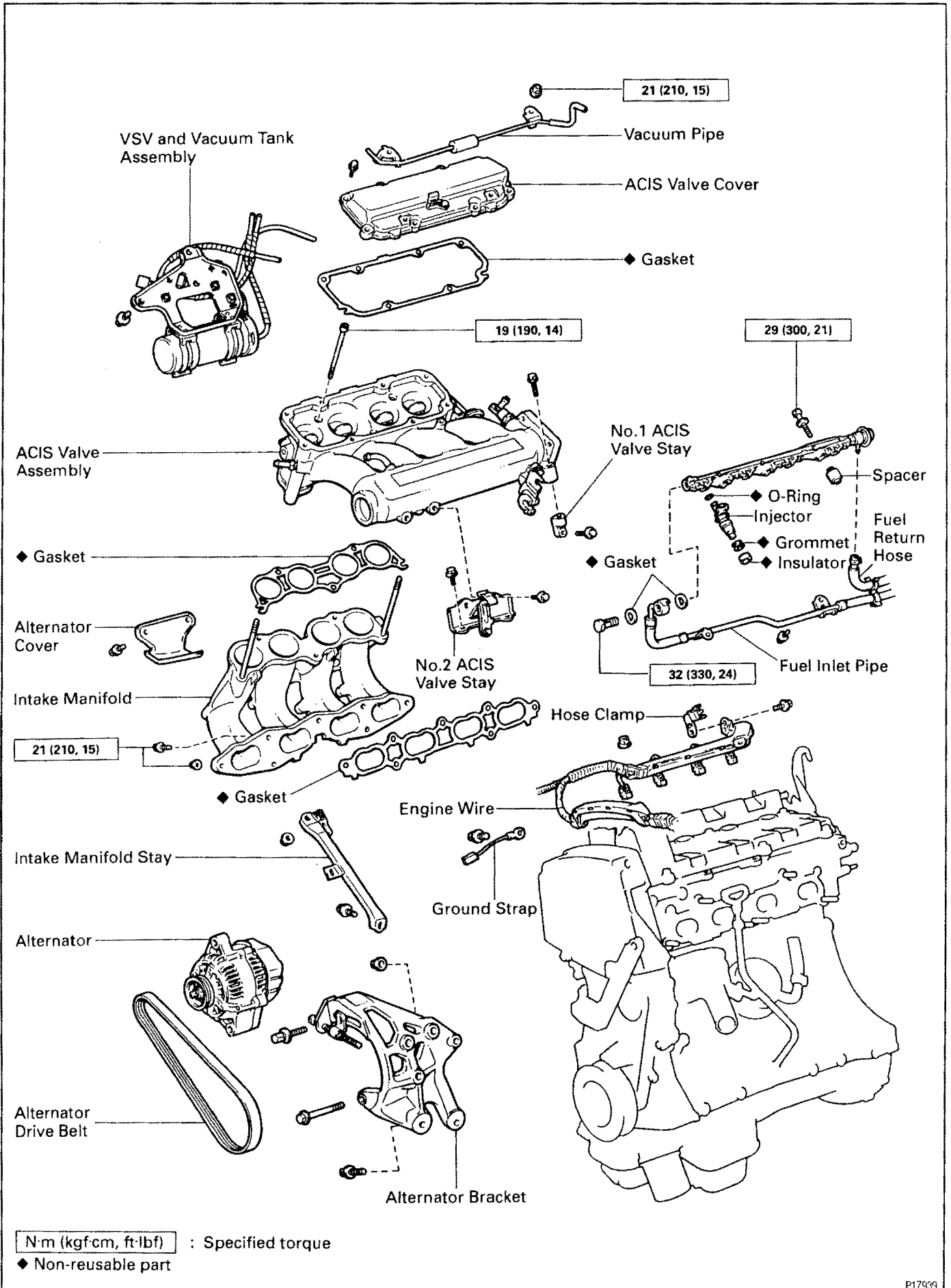
COMPONENTS FOR REMOVAL AND INSTALLATION (SW20)

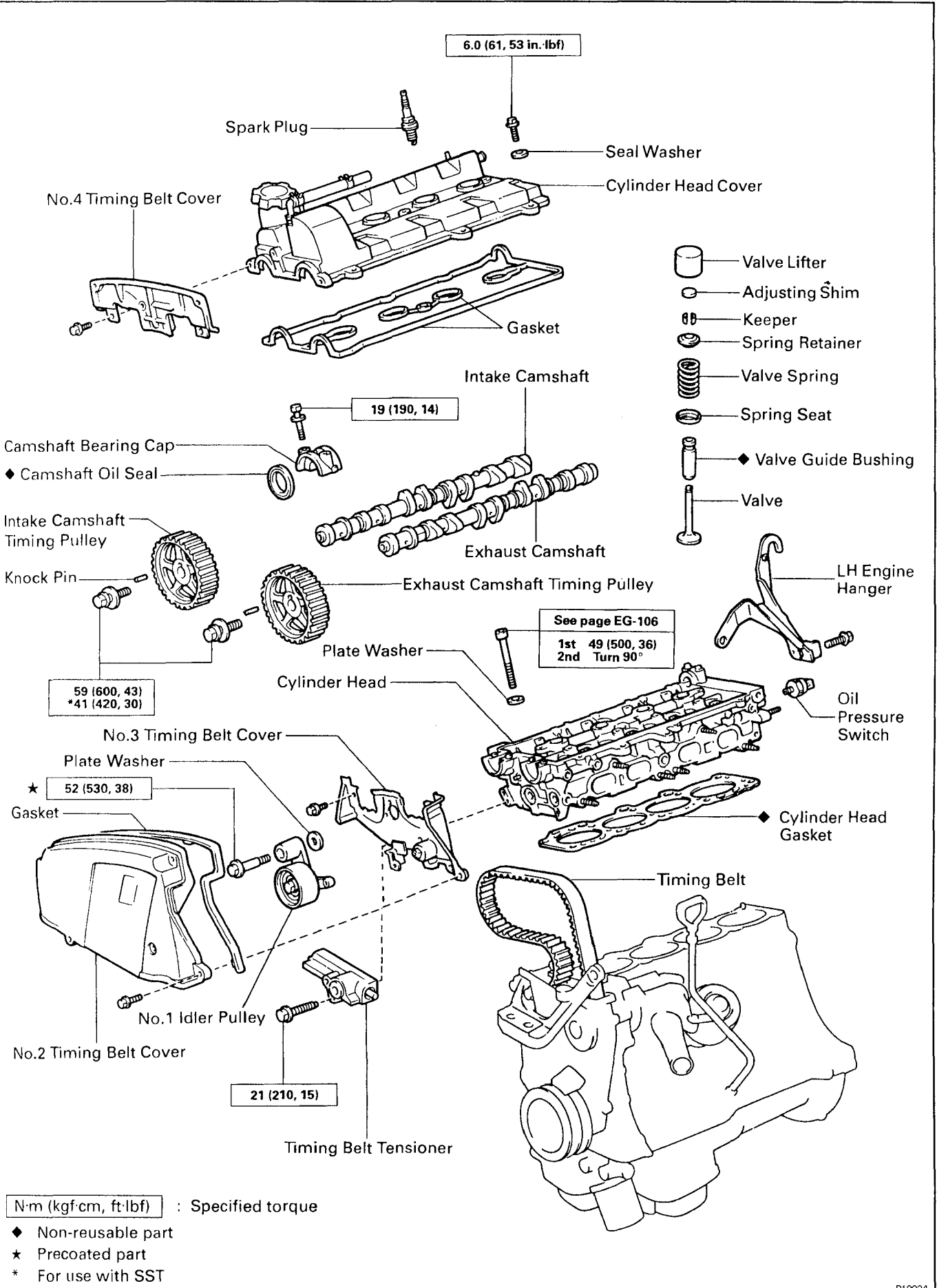
EG



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

◆ Non-reusable part

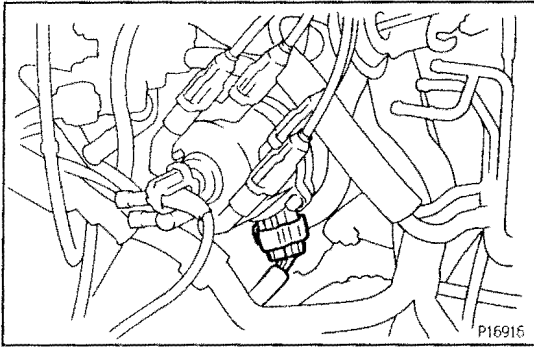




N·m (kgf·cm, ft·lbf) : Specified torque

- ◆ Non-reusable part
- ★ Precoated part
- * For use with SST

EG



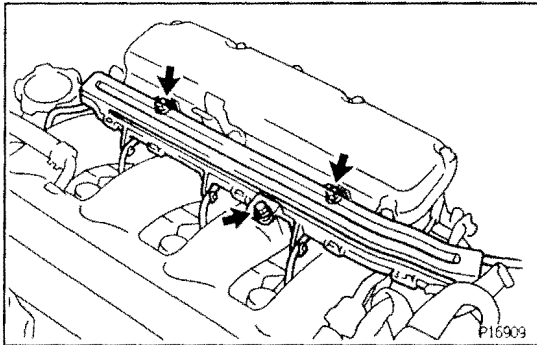
CYLINDER HEAD REMOVAL

(See Components for Removal and Installation)

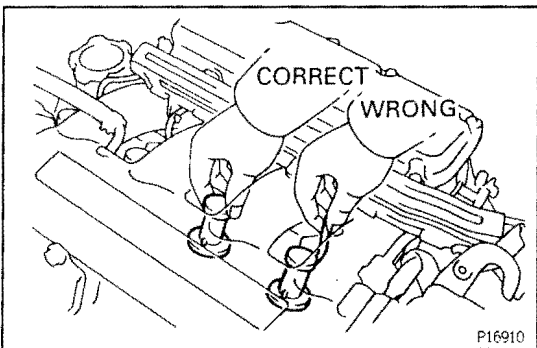
1. DRAIN ENGINE COOLANT

2. REMOVE DISTRIBUTOR

(a) Disconnect the distributor connector.

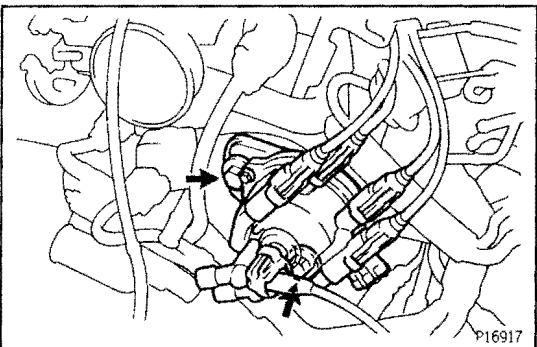


(b) Remove the 3 bolts, and disconnect the high – tension cord clamp from the ACIS valve.



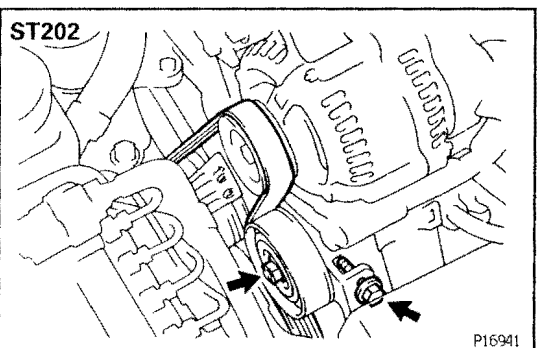
(c) Disconnect the high – tension cords at the rubber boot. Do not pull on the high – tension cords.

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



(d) Remove the 2 bolts, and pull out the distributor.

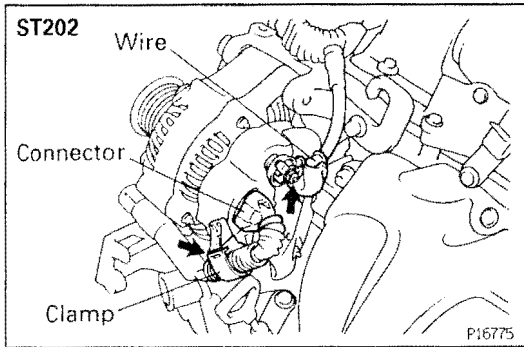
(e) Remove the O – ring from the distributor housing.



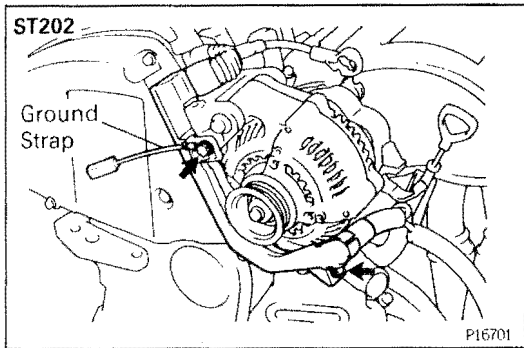
3. ST202: REMOVE ALTERNATOR

(a) Loosen the pulley nut and adjusting bolt.

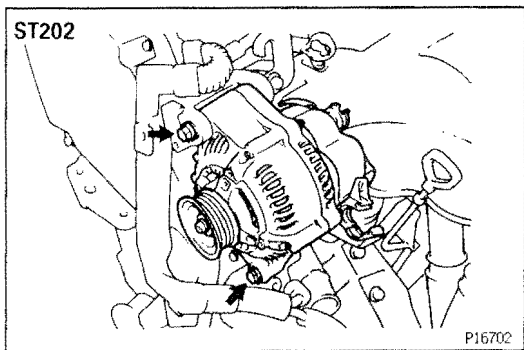
(b) Remove the drive belt.



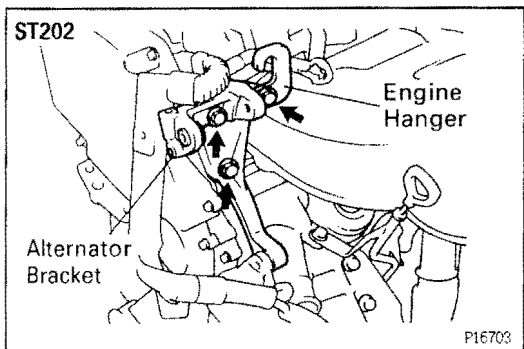
- (c) Disconnect the wire from the clamp on the rear end cover.
- (d) Disconnect the alternator connector.
- (e) Remove the rubber cap and nut, and disconnect the alternator wire.



- (f) Remove the 2 bolts and ground strap, and disconnect the engine wire protector from the brackets.

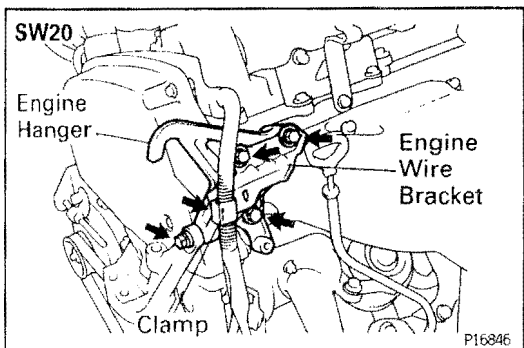


- (g) Remove the 2 bolts and alternator.



**4. ST202:
REMOVE RH FRONT ENGINE HANGER AND
ALTERNATOR BRACKET**

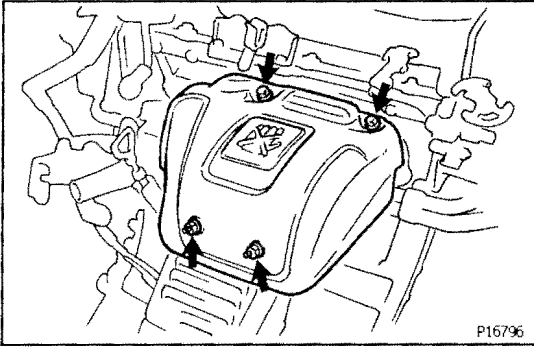
Remove the 3 bolts, engine hanger and alternator bracket.



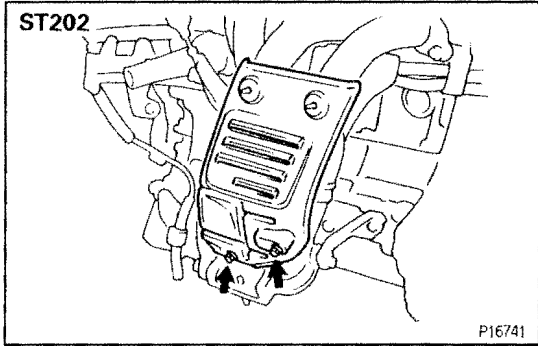
**5. SW20:
REMOVE RH FRONT ENGINE HANGER AND ENGINE
WIRE BRACKET**

- (a) Disconnect the engine wire from the clamp on the wire bracket.
- (b) Remove the 4 bolts, wire bracket and engine hanger.

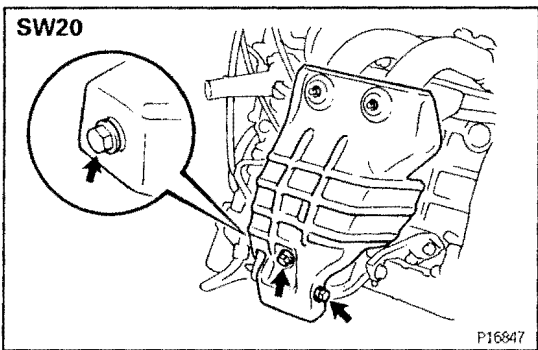
EG

**6. REMOVE EXHAUST MANIFOLD**

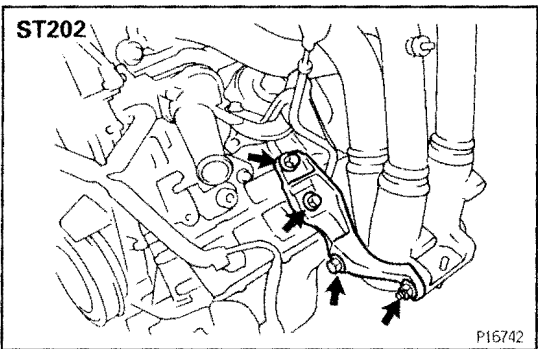
- (a) Remove the 2 bolts, 2 nuts and No.1 exhaust manifold heat insulator.



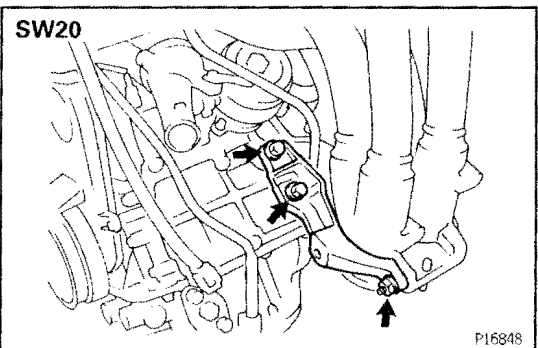
- (b) ST202:
Remove the 2 bolts and No.2 exhaust manifold heat insulator.



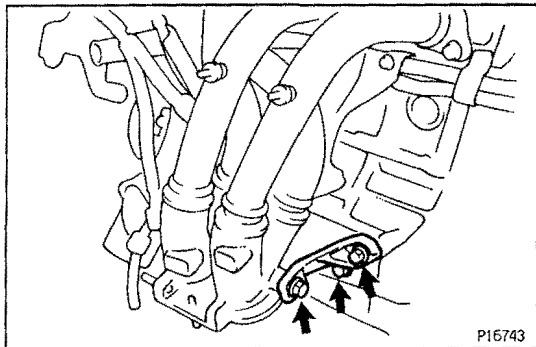
- (c) SW20:
Remove the 3 bolts and No.2 exhaust manifold heat insulator.



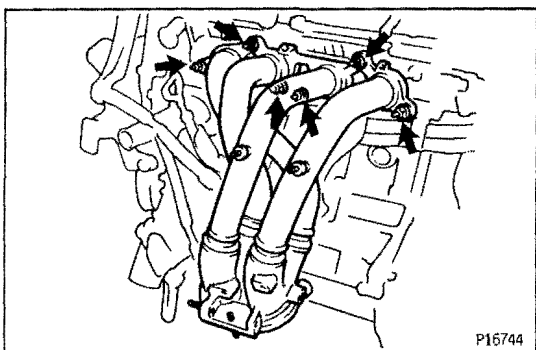
- (d) ST202:
Remove the 3 bolts, nut and RH exhaust manifold stay.



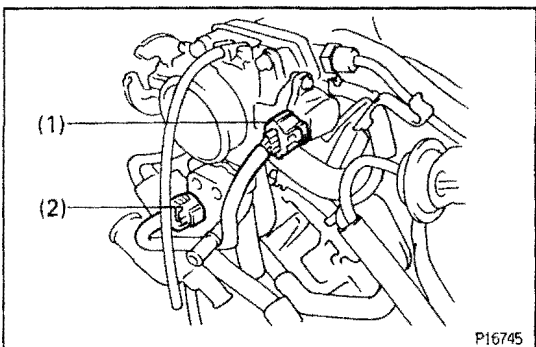
- (e) SW20:
Remove the 2 bolts, nut and RH exhaust manifold stay.



- (f) Remove the 3 bolts and LH exhaust manifold stay.

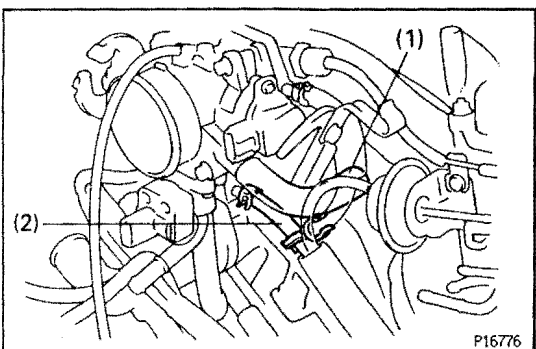


- (g) Remove the 6 nuts, exhaust manifold and gasket.

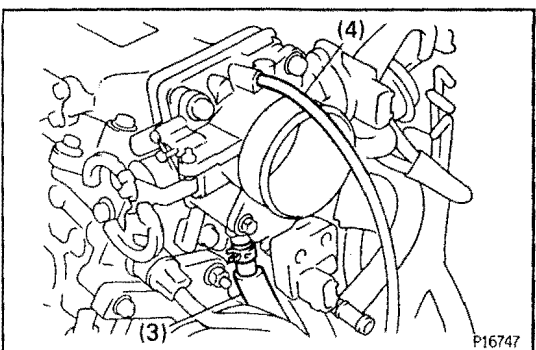


7. REMOVE THROTTLE BODY

- (a) Disconnect the following connectors:
- (1) Throttle position sensor connector
 - (2) ISC valve connector

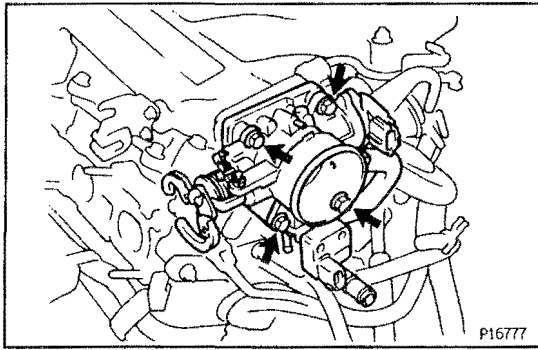


- (b) Disconnect the following hoses:
- (1) PCV hose from cylinder head cover
 - (2) Water bypass hose (from water outlet) from throttle body

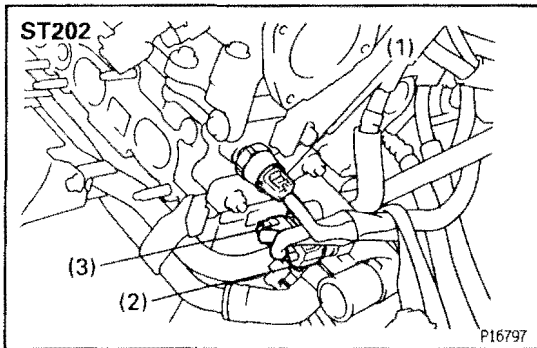


- (3) Water bypass hose (from water bypass pipe) from throttle body
- (4) Vacuum hose (from upper port of BVSV) from throttle body

EG



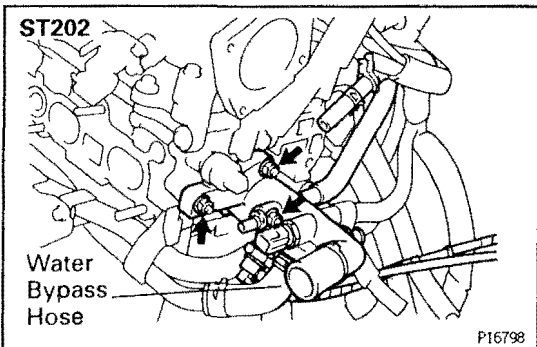
- (c) Remove the 4 bolts, throttle body and gasket.



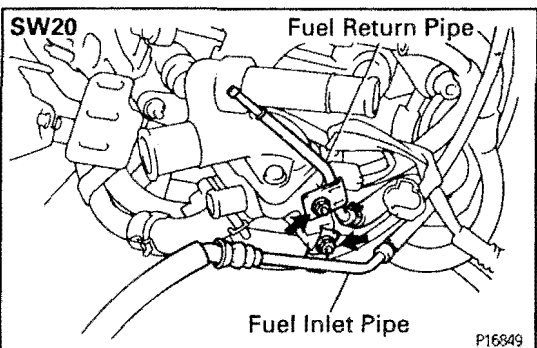
8. ST202:

REMOVE WATER OUTLET

- (a) Disconnect the following connectors:
- (1) Oil pressure switch connector
 - (2) Water temperature sensor connector
 - (3) Water temperature sender gauge connector



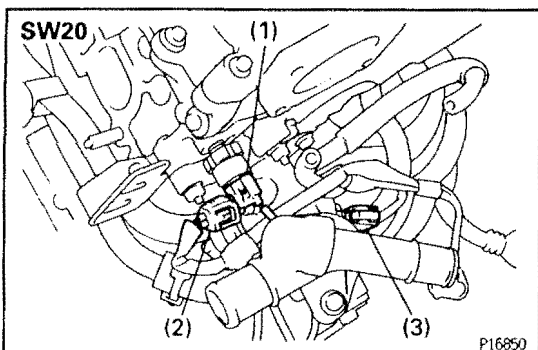
- (b) Remove the 3 nuts.
- (c) Disconnect the water bypass hose from the water outlet, and remove the water outlet and gasket.



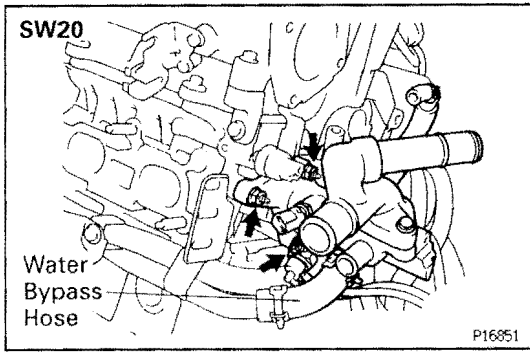
9. SW20:

REMOVE WATER OUTLET AND HOUSING ASSEMBLY

- (a) Remove the nut, and disconnect the fuel inlet pipe from the water outlet.
- (b) Remove the nut, and disconnect the fuel return pipe from the water outlet.

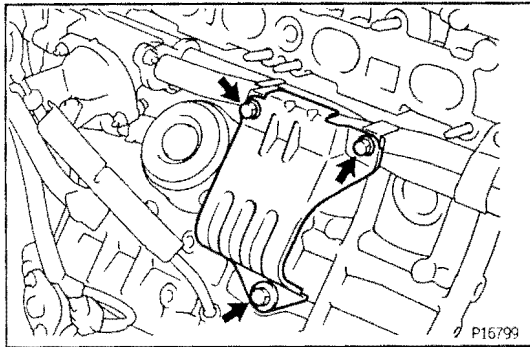


- (c) Disconnect the following connectors:
- (1) Oil pressure switch connector
 - (2) Water temperature sensor connector
 - (3) Water temperature sender gauge connector



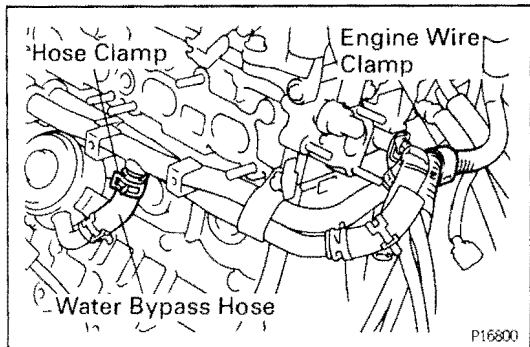
- (d) Remove the 3 nuts.
- (e) Disconnect the water bypass hose from the water outlet, and remove the water outlet, housing assembly and gasket.

EG

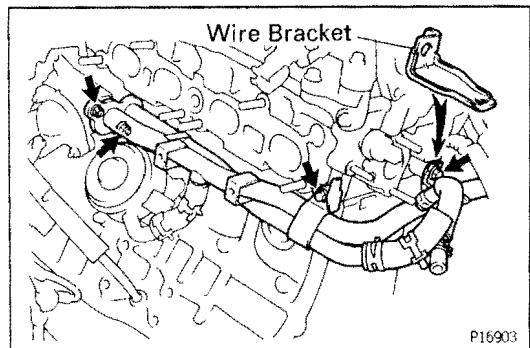


10. REMOVE WATER BYPASS PIPE

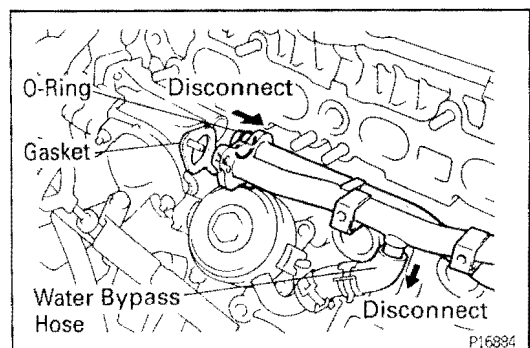
- (a) Remove the 3 bolts and No.3 exhaust manifold heat insulator.



- (b) Disconnect the engine wire clamp from the wire bracket.
- (c) Disconnect the hose clamp on the water bypass hose.

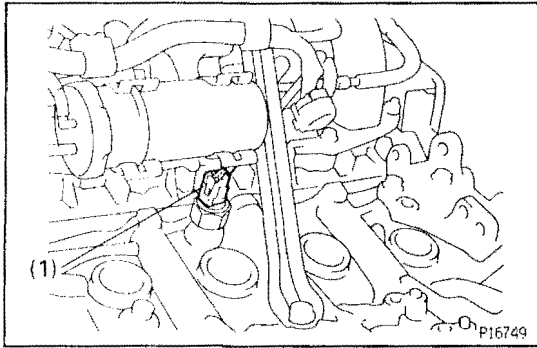


- (d) Remove the 2 bolts, 2 nuts and engine wire bracket.



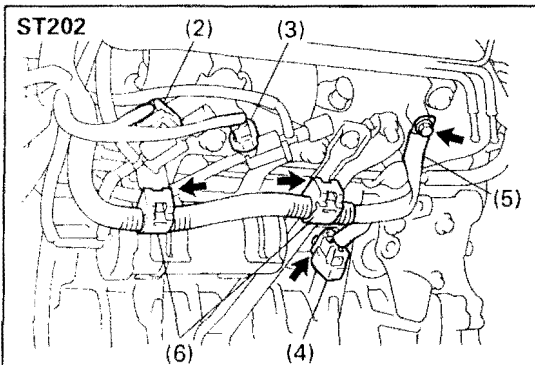
- (e) Disconnect the water bypass pipe from the water pump cover and water bypass hose, and remove the water bypass pipe.
- (f) Remove the gasket and O-ring.

EG

**11. DISCONNECT ENGINE WIRE**

Disconnect the following connectors, ground cable and clamps:

- (1) Knock sensor connector



- (2) VSV connector for ACIS

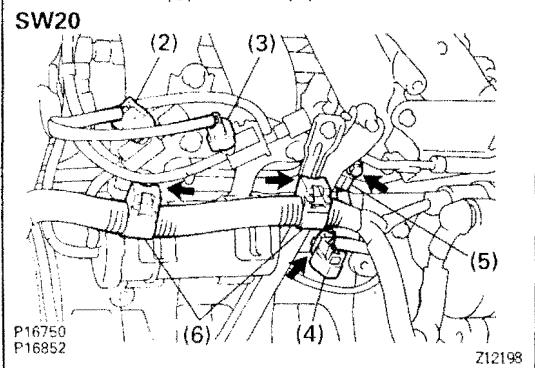
- (3) VSV connector for fuel pressure control

NOTICE: When disconnecting the VSV connectors ((2) and (3)), do not apply strong force to the VSV body.

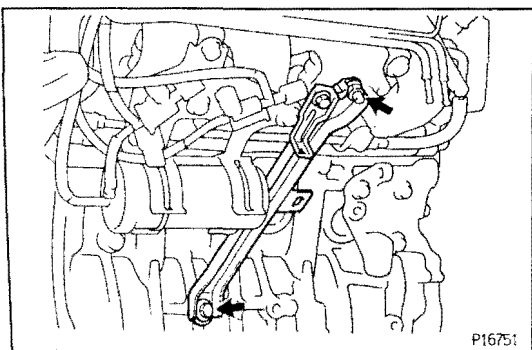
- (4) Oxygen sensor connector from bracket

- (5) Ground cable

- (6) 2 wire clamps from brackets

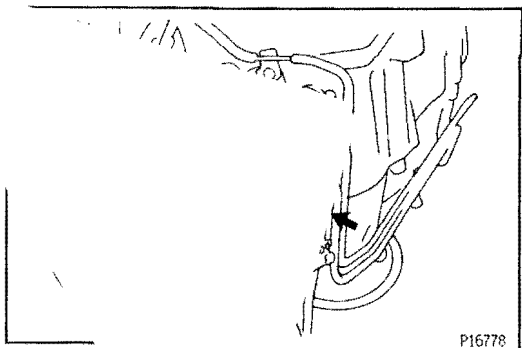
**12. REMOVE INTAKE MANIFOLD STAY**

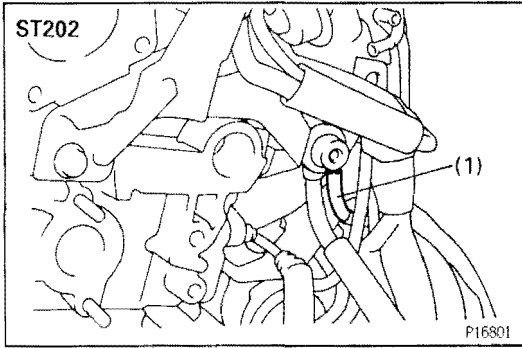
Remove the bolt, nut and intake manifold stay.

**13. ST202:**

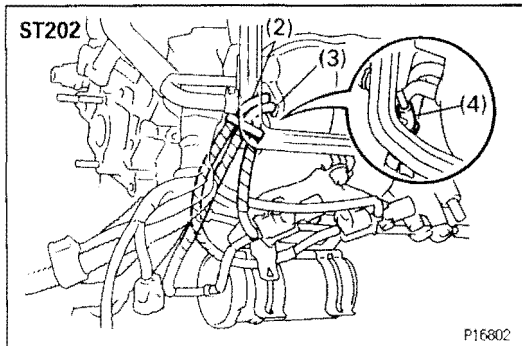
REMOVE VSV, VACUUM TANK ASSEMBLY AND AIR TUBE

- (a) Remove the bolt, and disconnect the engine wire protector from the intake manifold.

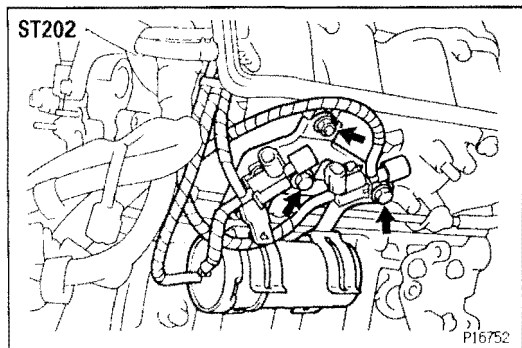




- (b) Disconnect the following hoses:
- (1) Vacuum hose (from VSV for fuel pressure control) from fuel pressure regulator

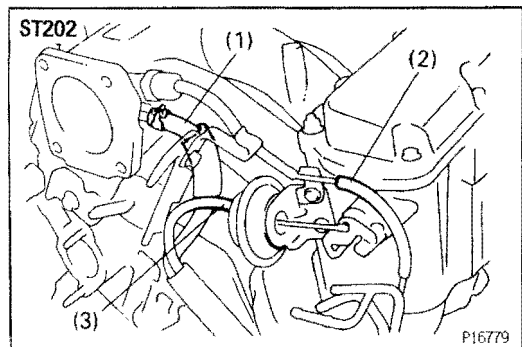


- (2) Vacuum hose (from VSV for fuel pressure control) from intake manifold
- (3) Vacuum hose (from vacuum tank) from intake manifold
- (4) Vacuum hose (from VSV for ACIS) from air tube

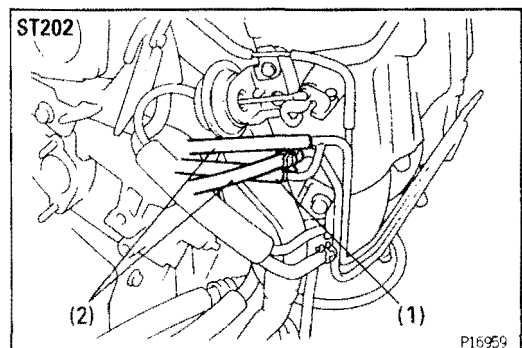


- (c) Remove the 2 bolts, nut, the VSV and vacuum tank assembly.

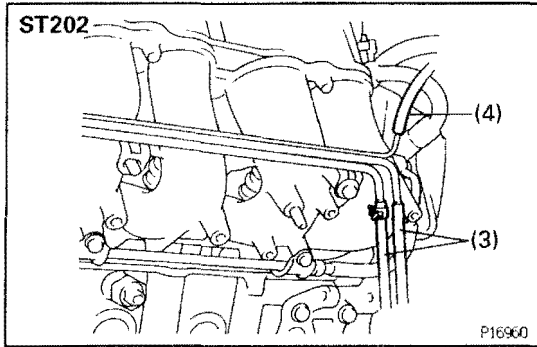
NOTICE: Remove the VSV with the bracket still installed on the VSV. Only remove the VSV from the bracket when replacing the VSV with a new one.



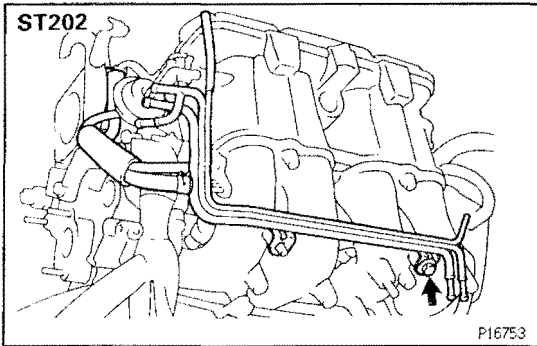
- (d) Disconnect the following hoses:
- (1) Air hose from port of ACIS valve
 - (2) Vacuum hose (from vacuum sensor) from vacuum pipe on ACIS actuator
 - (3) Vacuum hose (from VSV for ACIS) from ACIS actuator



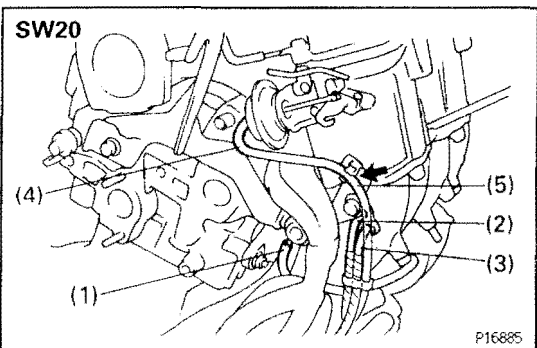
- HINT (On vehicle):** Disconnect the following hose:
- (1) Air hose (from air cleaner hose) from air tube
 - (2) 2 air hoses (from A/C idle-up valve) from air tube



- (3) 2 air hoses (from air control valve on PS pump) from air tube
- (4) Vacuum hose (from vacuum sensor) from vacuum pipe on air tube



- (e) Remove the bolt and air tube.

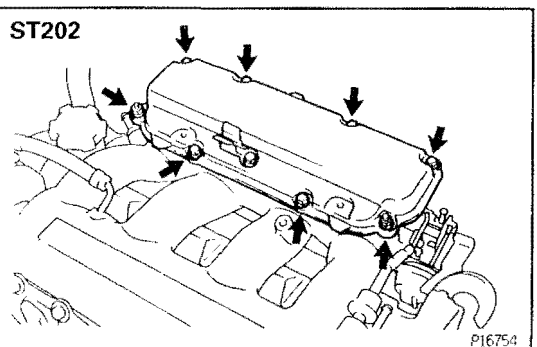
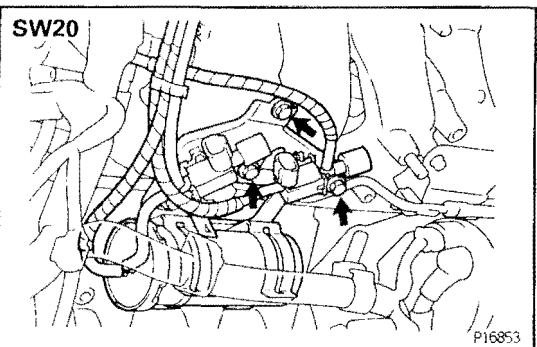


14. SW20:

REMOVE VSV AND VACUUM TANK ASSEMBLY

- (a) Disconnect the following hoses:
 - (1) Vacuum hose (from VSV for fuel pressure control) from fuel pressure regulator
 - (2) Vacuum hose (from VSV for fuel pressure control) from intake manifold
 - (3) Vacuum hose (from vacuum tank) from intake manifold
 - (4) Vacuum hose (from VSV for ACIS) from ACIS actuator
 - (5) Vacuum hose (between VSV and actuator for ACIS) from clamp on intake manifold
- (b) Remove the 3 bolts, the VSV and vacuum tank assembly.

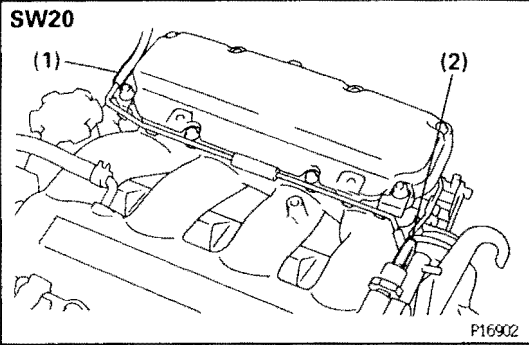
NOTICE: Remove the VSV with the bracket still installed on the VSV. Only remove the VSV from the bracket when replacing the VSV with a new one.



15. ST202:

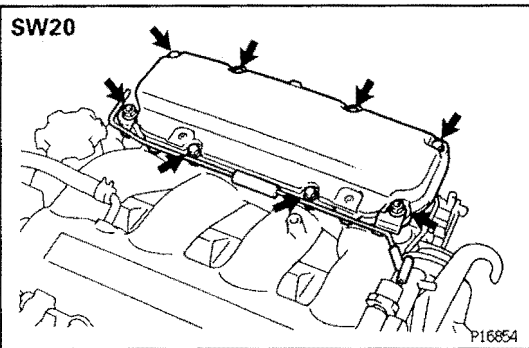
REMOVE ACIS VALVE COVER

Remove the 6 bolts, 2 nuts and ACIS valve cover.

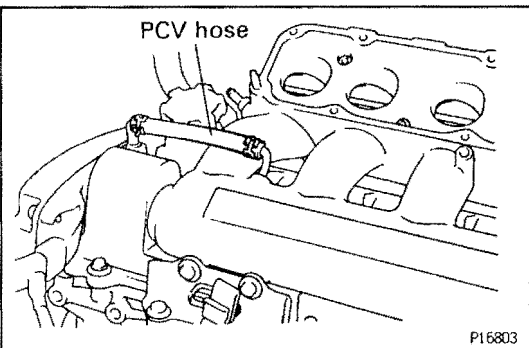
**16. SW20:****REMOVE VACUUM PIPE AND ACIS VALVE COVER**

(a) Disconnect the following hoses:

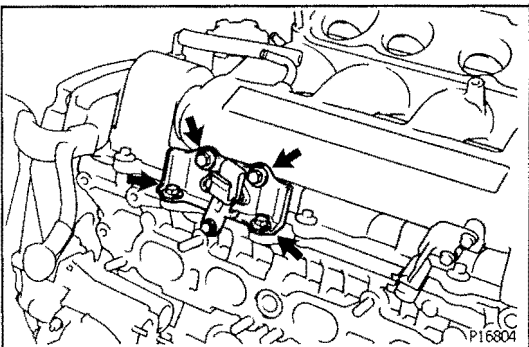
- (1) Vacuum hose (from vacuum sensor) from vacuum pipe
- (2) Vacuum hose from gas filter



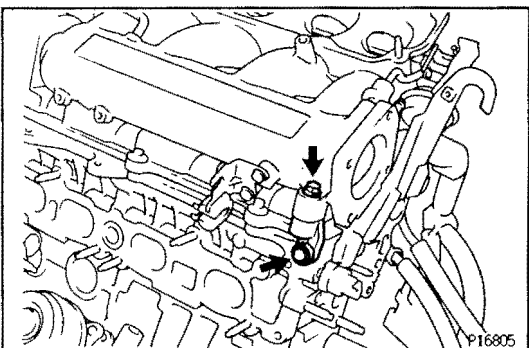
(b) Remove the 6 bolts, 2 nuts, vacuum pipe and ACIS valve cover.

**17. REMOVE ACIS VALVE ASSEMBLY**

(a) Disconnect the PCV hose from the port of the ACIS valve.

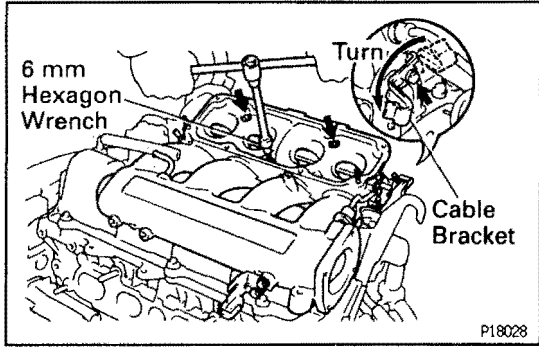


(b) Remove the 4 bolts and No.2 ACIS valve stay.

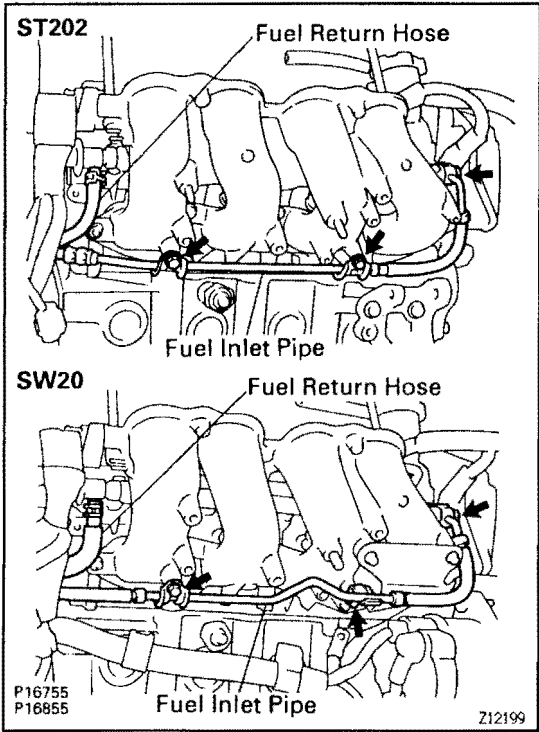


(c) Remove the 2 bolts and No.1 ACIS valve stay.

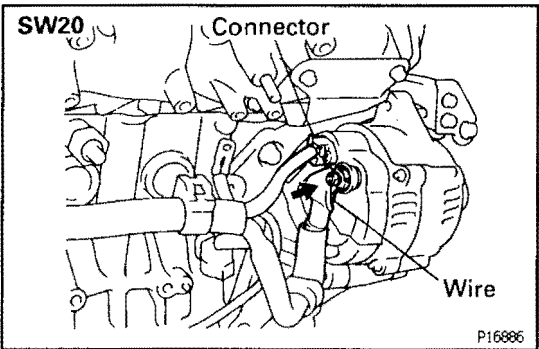
EG



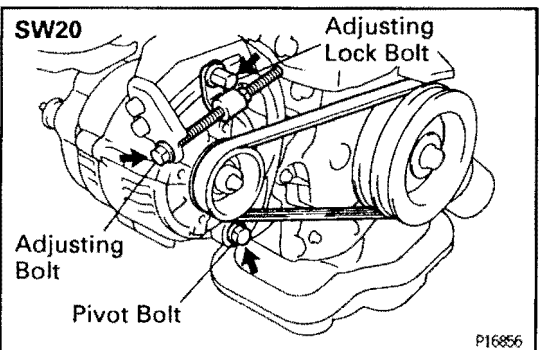
- (d) **ST202:**
Loosen the bolt, and turn the cable bracket on the LH engine hanger.
- (e) Using a 6 mm hexagon wrench, remove the 3 bolts, the ACIS valve assembly and gasket.



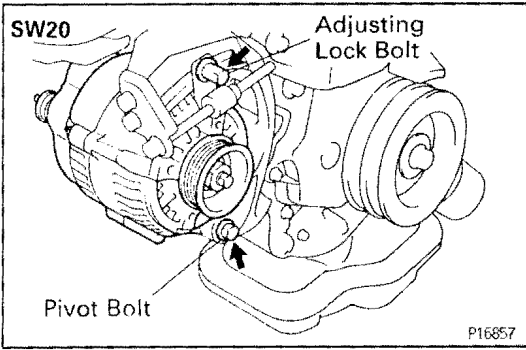
- 18. DISCONNECT FUEL INLET PIPE FROM DELIVERY PIPE**
 - (a) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet pipe from the delivery pipe.
 - (b) Remove the 2 bolts and fuel inlet pipe.
- 19. DISCONNECT FUEL RETURN HOSE FROM FUEL PRESSURE REGULATOR**



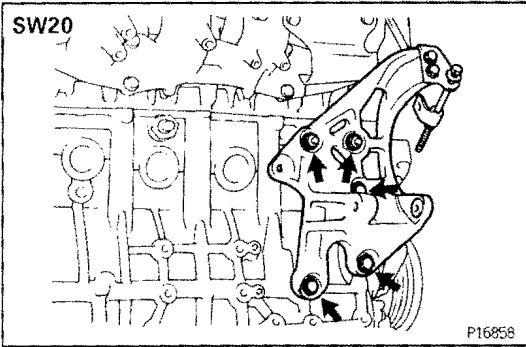
- 20. SW20: REMOVE ALTERNATOR**
 - (a) Disconnect the alternator connector.
 - (b) Remove the rubber cap and nut, and disconnect the alternator wire.



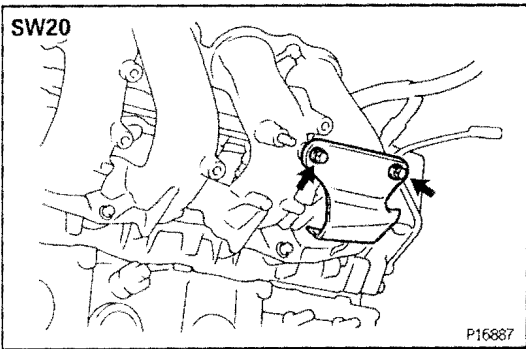
- (c) Loosen the adjusting lock bolt and pivot bolt.
- (d) Loosen the adjusting bolt, and remove the drive belt.



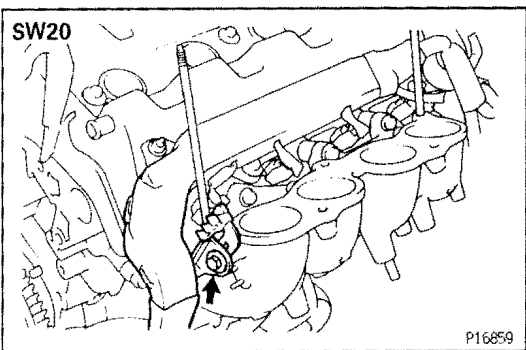
- (e) Remove the adjusting lock bolt, pivot bolt and alternator.



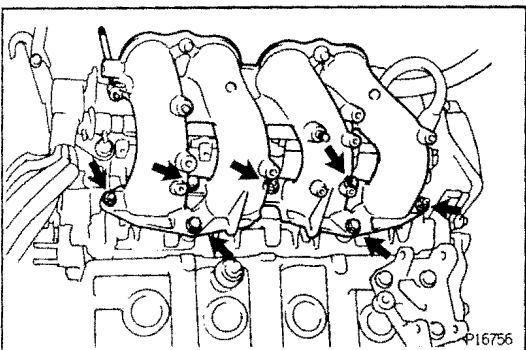
21. **SW20:**
REMOVE ALTERNATOR BRACKET
 Remove the 3 bolts, 2 nuts and alternator bracket.



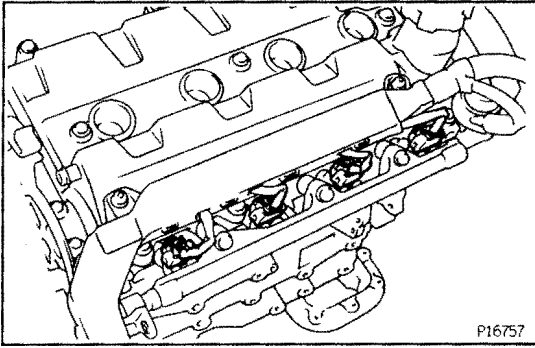
22. **SW20:**
REMOVE ALTERNATOR COVER
 Remove the 2 bolts and alternator cover.



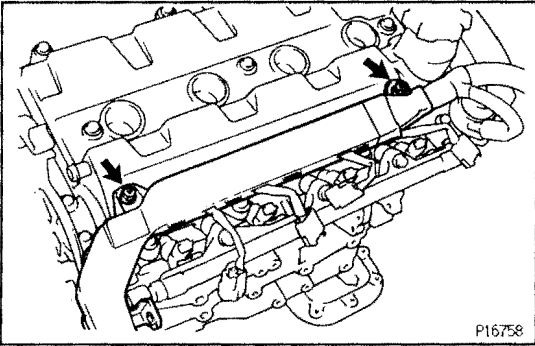
23. **REMOVE INTAKE MANIFOLD**
 (a) **SW20:**
 Remove the bolt and hose clamp, and disconnect the engine wire protector from the intake manifold.



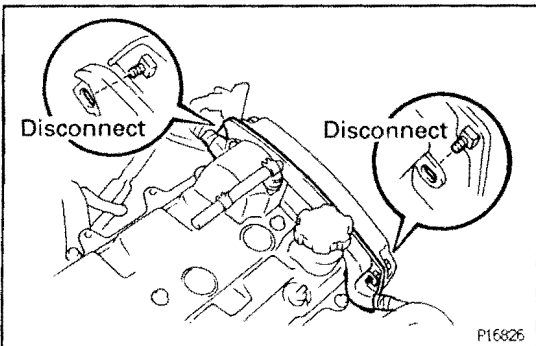
- (b) Remove the 4 bolts, 3 nuts, intake manifold and gasket.

**24. DISCONNECT ENGINE WIRE**

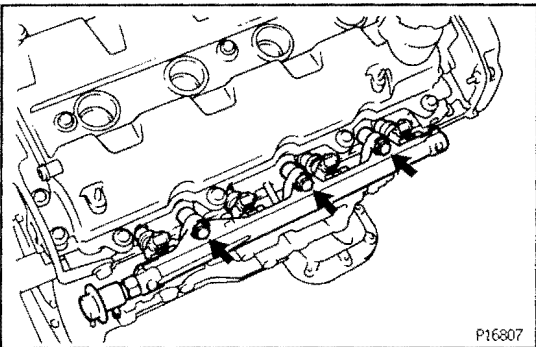
- (a) Disconnect the 4 injector connectors.



- (b) Remove the 2 nuts, and disconnect the the engine wire protector from the cylinder head cover.

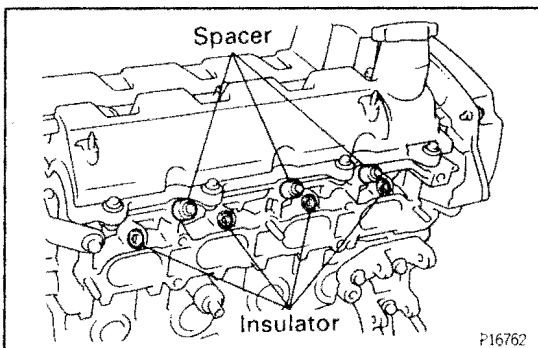


- (c) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover.

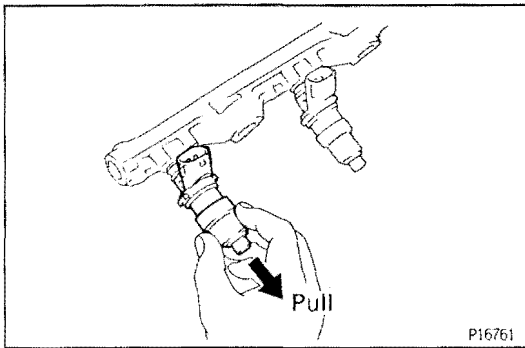
**25. REMOVE DELIVERY PIPE AND INJECTORS**

- (a) Remove the 3 bolts and delivery pipe together with the 4 injectors.

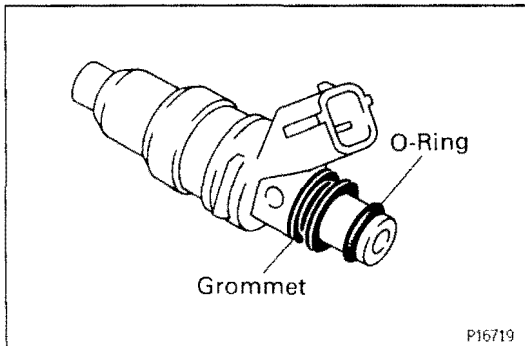
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.



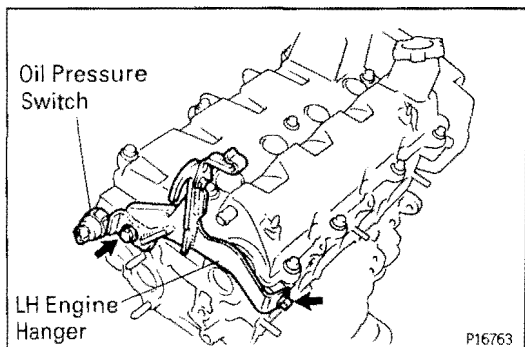
- (b) Remove the 4 insulators and 3 spacers from the cylinder head.



(c) Pull out the 4 injectors from the delivery pipe.



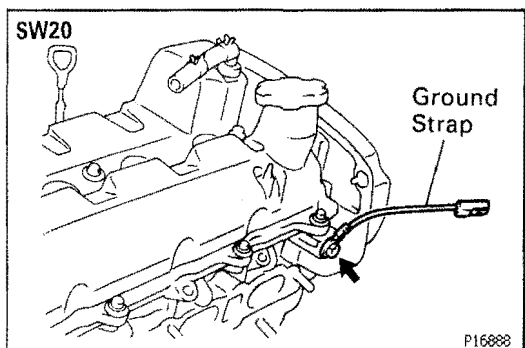
(d) Remove the O-ring and grommet from each injector.



26. REMOVE LH ENGINE HANGER

Remove the 2 bolts and engine hanger.

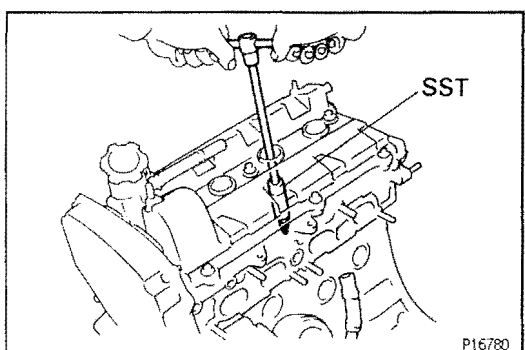
27. REMOVE OIL PRESSURE SWITCH



28. SW20:

REMOVE GROUND STRAP

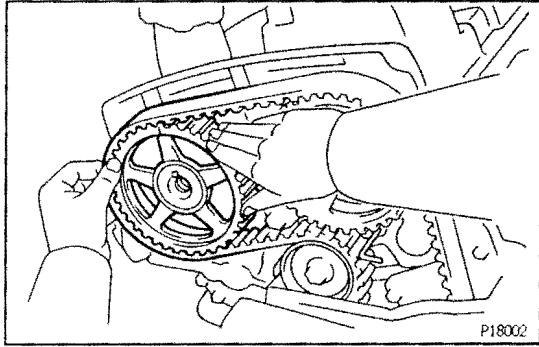
Remove the bolt and ground strap.



29. REMOVE SPARK PLUGS

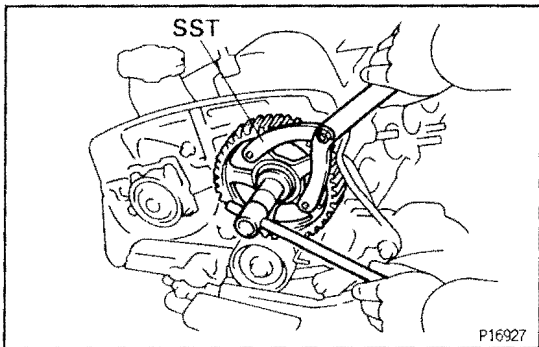
Using SST, remove the 4 spark plugs.

SST 09155-16100



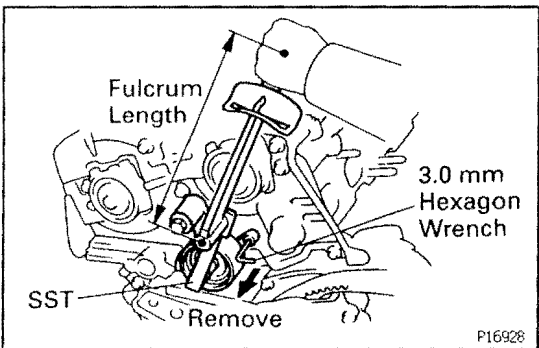
30. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

(See steps 4 to 6 on pages EG-50 to 51)



31. REMOVE EXHAUST CAMSHAFT TIMING PULLEY

- (a) Using SST, loosen the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
- (b) Remove the bolt, timing pulley and knock pin.



32. REMOVE NO.1 IDLER PULLEY

- (a) Turn the No.1 idler pulley bolt to obtain the specified torque or less, and remove the 3.0 mm hexagon wrench.

Torque:

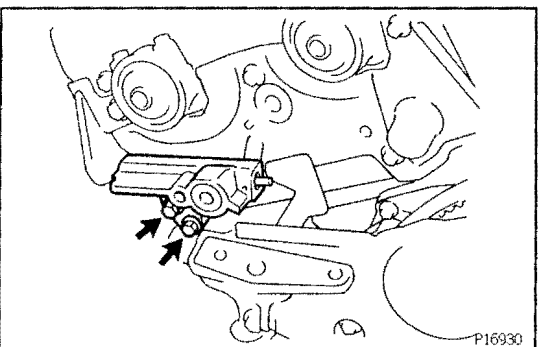
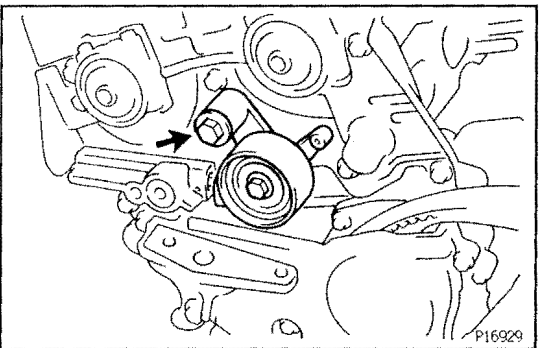
59 N·m (600 kgf·cm, 43 ft·lbf)

41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

- Use SST.
SST 09249-63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

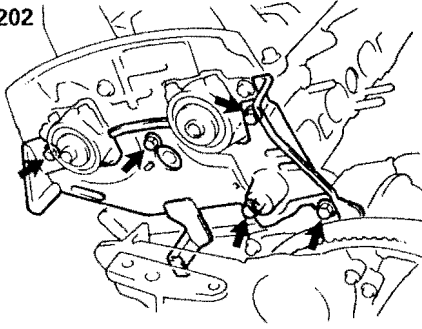
- (b) Remove the pivot bolt, pulley and plate washer.



33. REMOVE TIMING BELT TENSIONER

Remove the 2 bolts and tensioner.

ST202



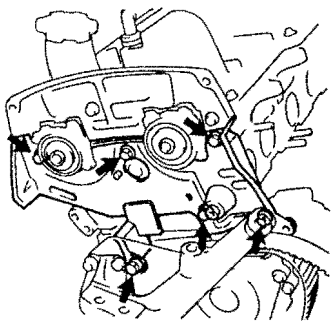
P16764

34. REMOVE NO.3 TIMING BELT COVER

ST202:

Remove the 5 bolts and timing belt cover.

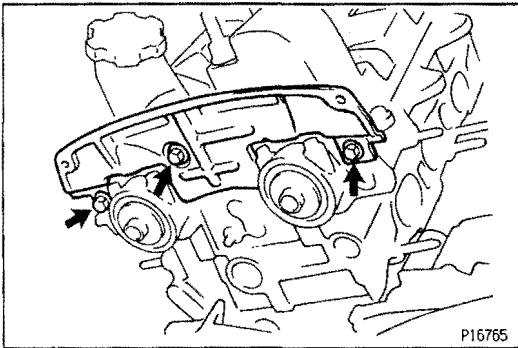
SW20



P18035

SW20:

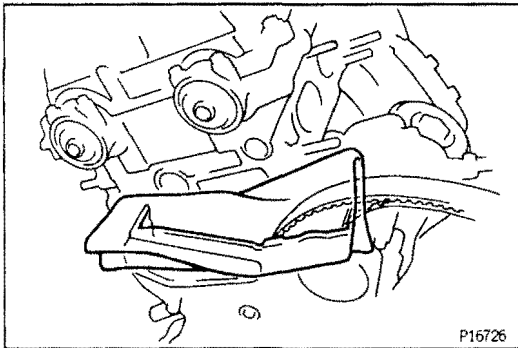
Remove the 6 bolts and timing belt cover.



P16765

35. REMOVE NO.3 TIMING BELT COVER

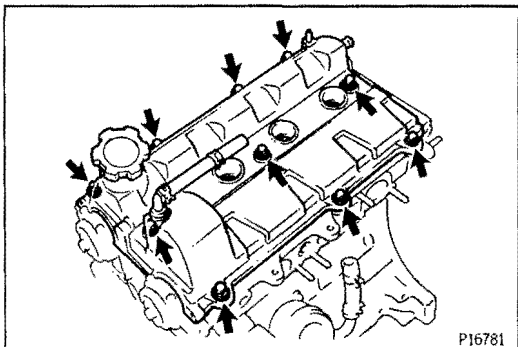
Remove the 3 bolts and timing belt cover.



P16726

NOTICE:

- 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.

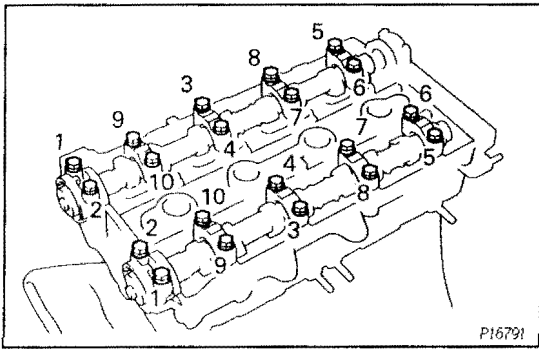


P16781

36. REMOVE CYLINDER HEAD COVER

Remove the 10 bolts, seal washers, cylinder head cover and 2 gaskets.

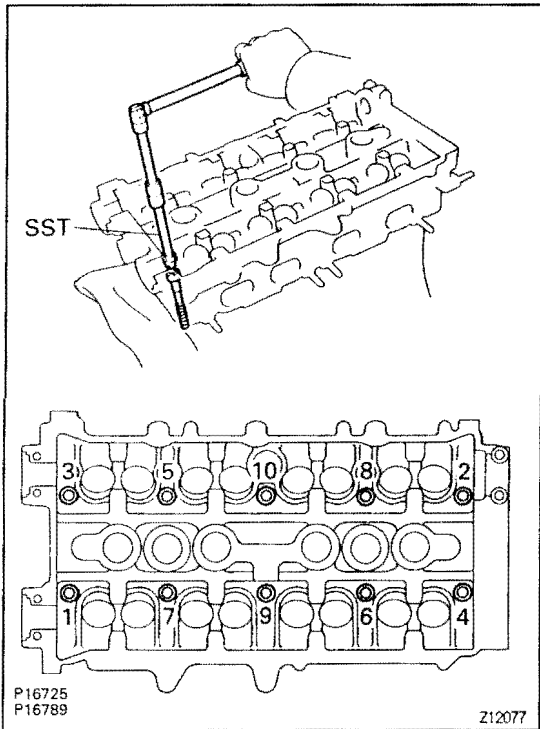
EG



37. REMOVE CAMSHAFTS

Uniformly loosen and remove the 10 bearing cap bolts in several passes, in the sequence shown, and remove the 5 bearing caps, oil seal and camshaft. Remove the intake and exhaust camshafts.

EG

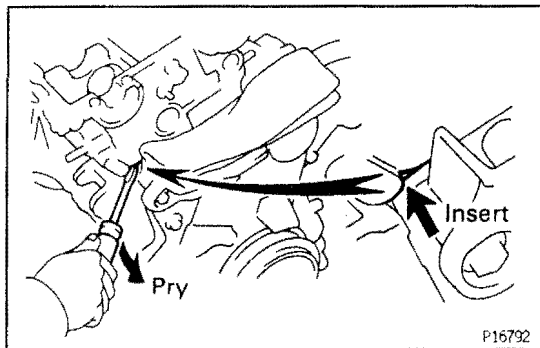


38. REMOVE CYLINDER HEAD

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

SST 09043-38100

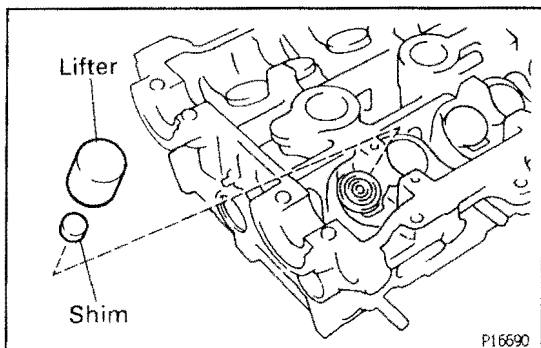
HINT: Cylinder head warpage or cracking could result from removing in the incorrect order.



- (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 off, pry between the cylinder head and cylinder block with a screwdriver.

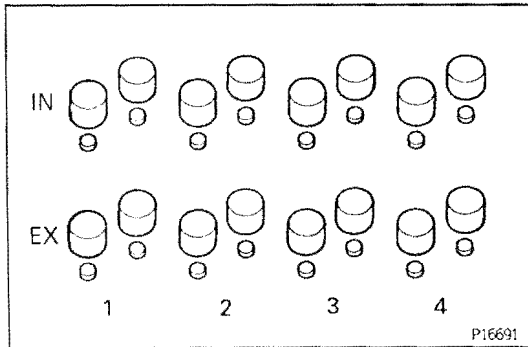
NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.



CYLINDER HEAD DISASSEMBLY

(See Components for Removal and Installation)

1. REMOVE VALVE LIFTERS AND SHIMS



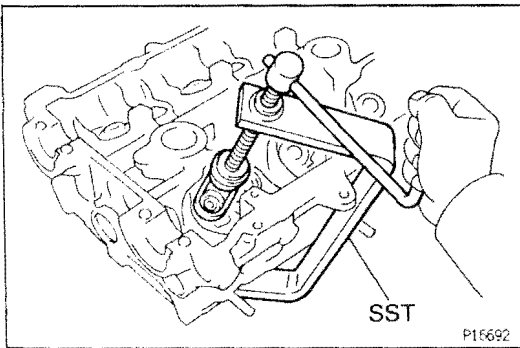
HINT: Arrange the valve lifters and shims in the correct order.

EG

2. REMOVE VALVES

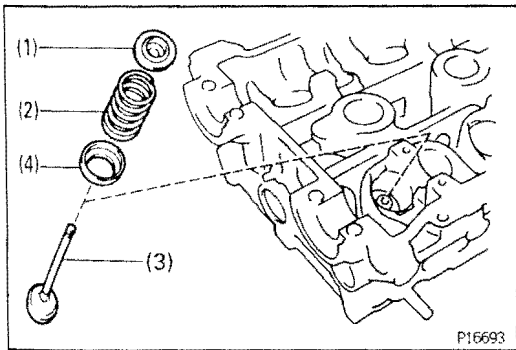
- (a) Using SST, compress the valve spring and remove the 2 keepers.

SST 09202-70010

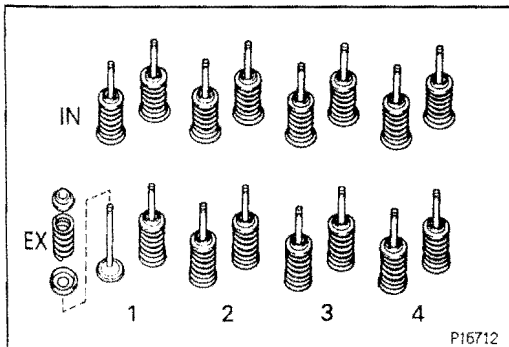


- (b) Remove the following parts:

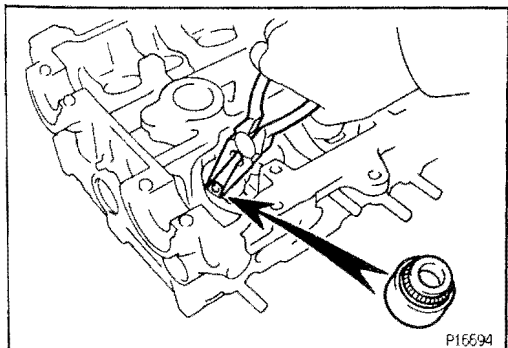
- (1) Spring retainer
- (2) Valve spring
- (3) Valve
- (4) Spring seat

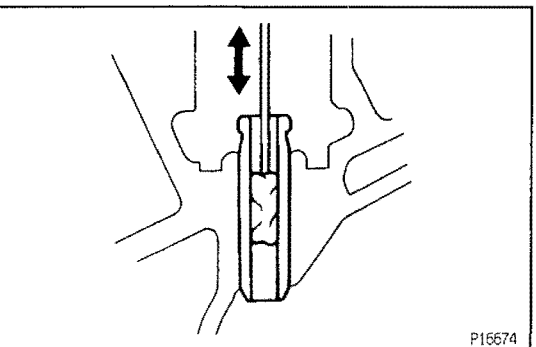
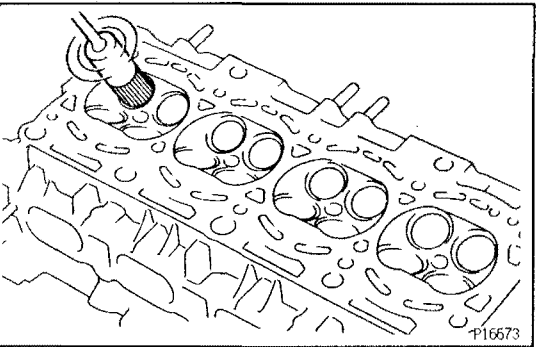
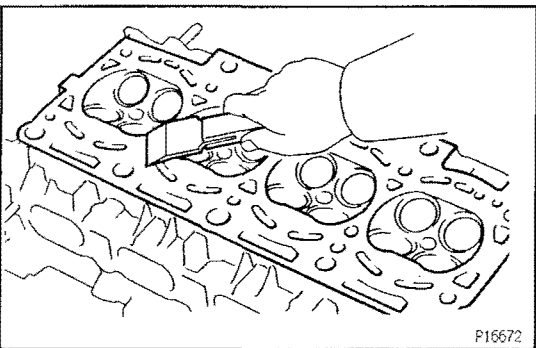
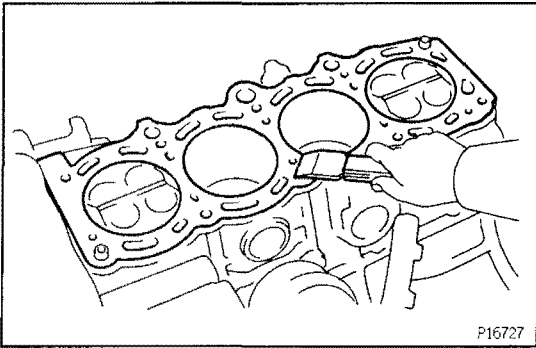
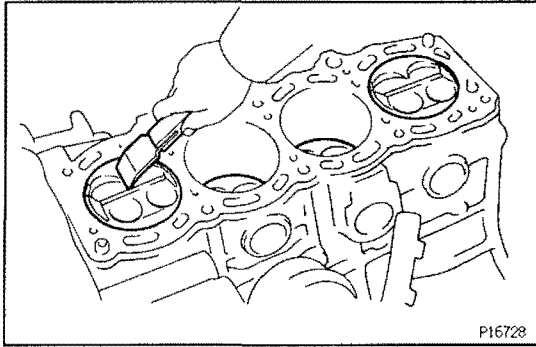


HINT: Arrange the valves, valve springs, spring seats and spring retainers in the correct order.



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





CYLINDER HEAD COMPONENTS INSPECTION 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.

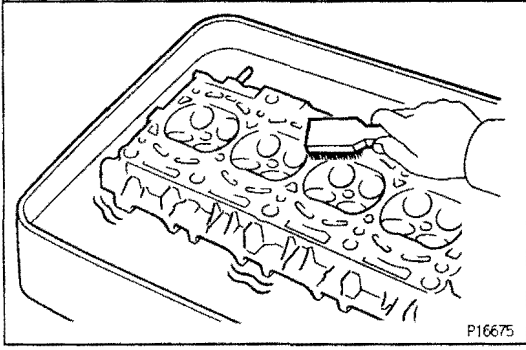
B. Clean combustion chambers

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

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

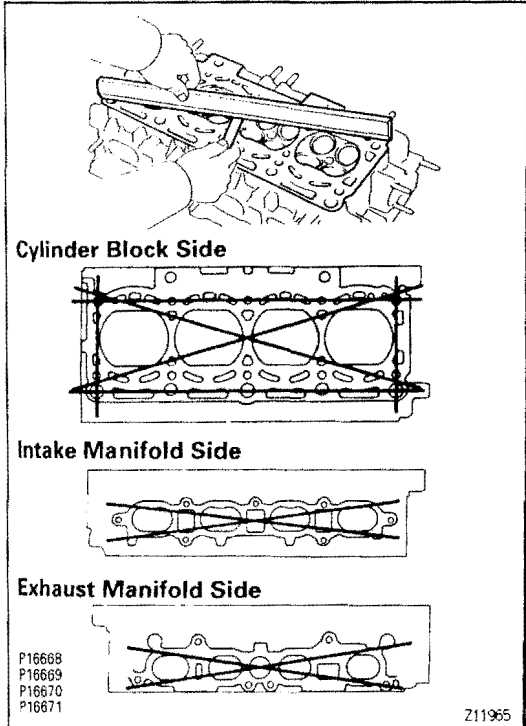
C. Clean valve guide bushings

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.

EG

**3. INSPECT CYLINDER HEAD****A. Inspect for flatness**

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

Maximum warpage:

Cylinder block side

0.20 mm (0.0079 in.)

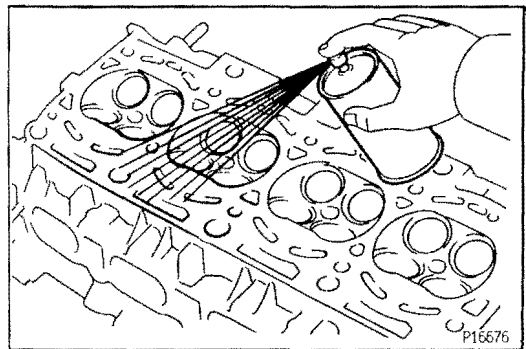
Intake manifold side

0.20 mm (0.0079 in.)

Exhaust manifold side

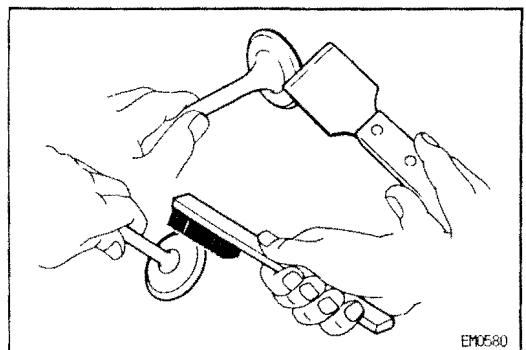
0.30 mm (0.0118 in.)

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

**B. Inspect for cracks**

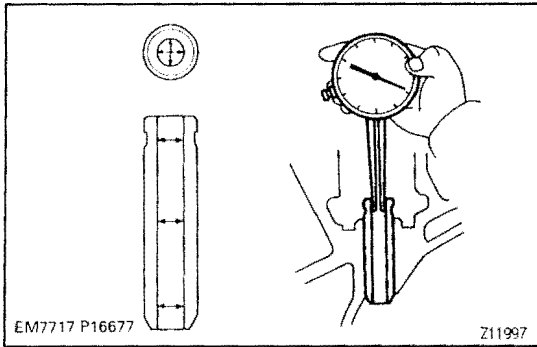
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

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.

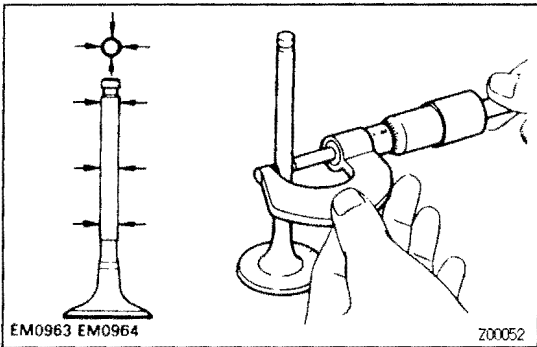


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.000 – 6.018 mm (0.2362 – 0.2369 in.)



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

Valve stem diameter:

Intake

5.960 – 5.975 mm (0.2346 – 0.2352 in.)

Exhaust

5.955 – 5.970 mm (0.2344 – 0.2350 in.)

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

Standard oil clearance:

Intake

0.025 – 0.058 mm (0.0010 – 0.0023 in.)

Exhaust

0.030 – 0.063 mm (0.0012 – 0.0025 in.)

Maximum oil clearance:

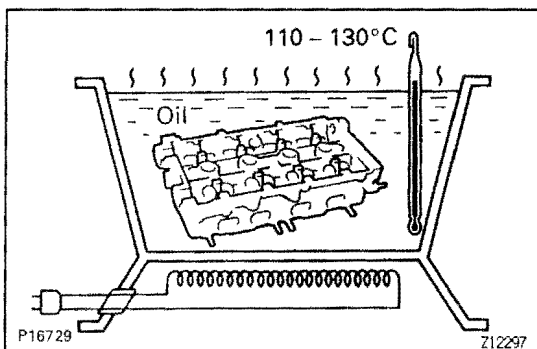
Intake

0.08 mm (0.0031 in.)

Exhaust

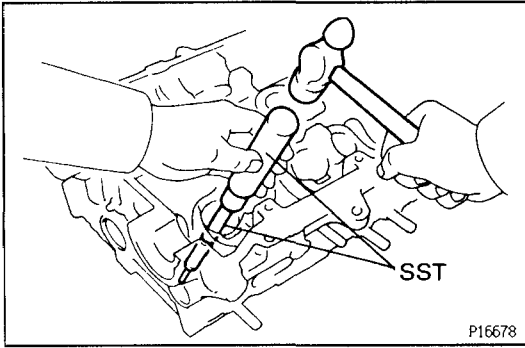
0.10 mm (0.0039 in.)

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

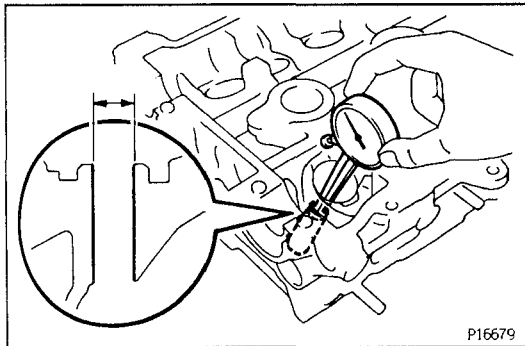


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

- (a) Gradually heat the cylinder head to 110 – 130°C (230 – 266°F).



- (b) Using SST and a hammer, tap out the guide bushing.
SST 09201-10000 (09201-01060),
09608-30022 (09608-05010)

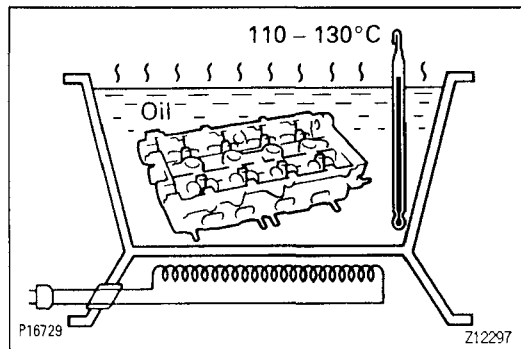


- (c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

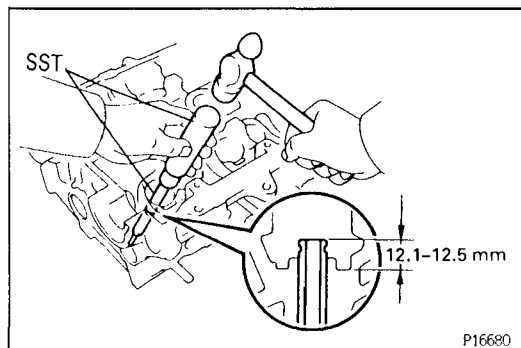
Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
10.988 – 11.006 (0.4326 – 0.4333)	Use STD
11.038 – 11.056 (0.4346 – 0.4353)	Use O/S 0.05

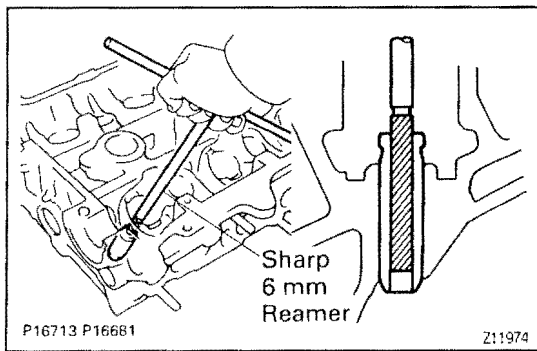
V00866



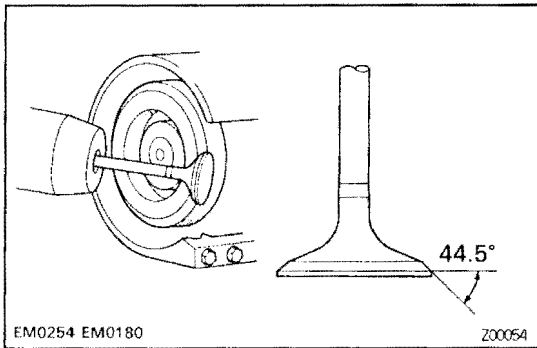
- (e) Gradually heat the cylinder head to 110 – 130°C
(230 – 266°F).



- (f) Using SST and a hammer, tap in a new guide bushing until there is 12.1 – 12.5 mm (0.476 – 0.492 in.) protruding from the cylinder head.
SST 09201-10000 (09201-01060),
09608-30022 (09608-05010)



- (g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 5 above) between the guide bushing and valve stem.

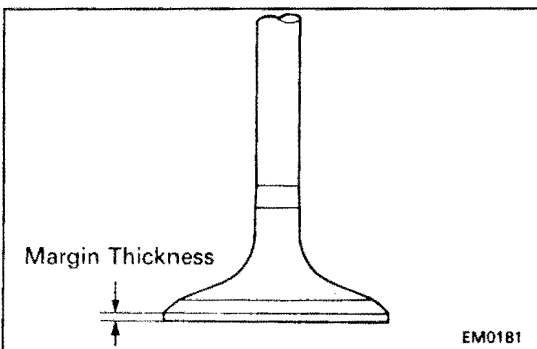


7. INSPECT AND GRIND VALVES

- (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°



- (c) Check the valve head margin thickness.

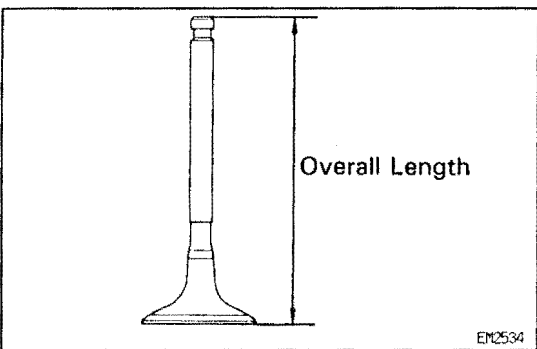
Standard margin thickness:

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

99.80 — 100.20 mm (3.9291 — 3.9449 in.)

Exhaust

98.85 — 99.25 mm (3.8917 — 3.9075 in.)

Minimum overall length:

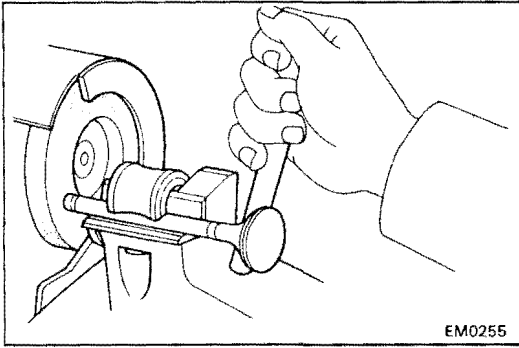
Intake

99.30 mm (3.9094 in.)

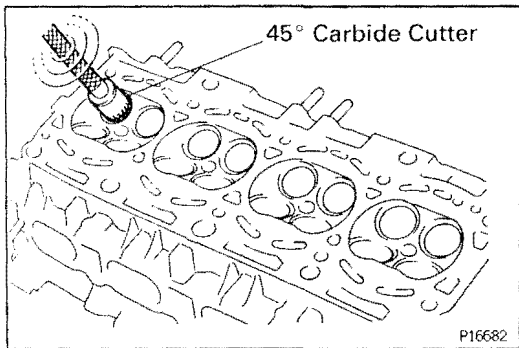
Exhaust

98.35 mm (3.8720 in.)

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

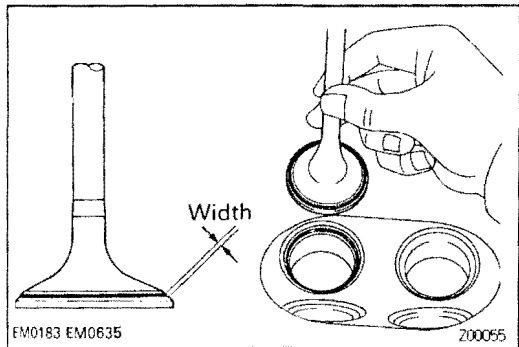


- (e) Check the surface of the valve stem tip for wear. If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE: Do not grind off more than the minimum length.

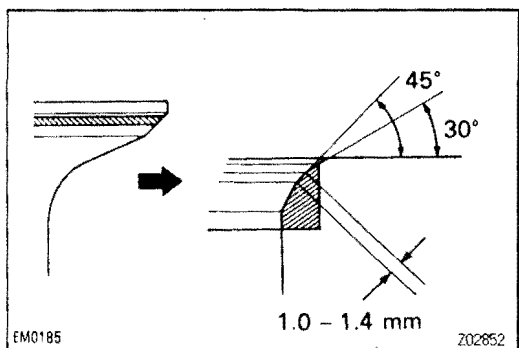


8. INSPECT AND CLEAN VALVE SEATS

- (a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.

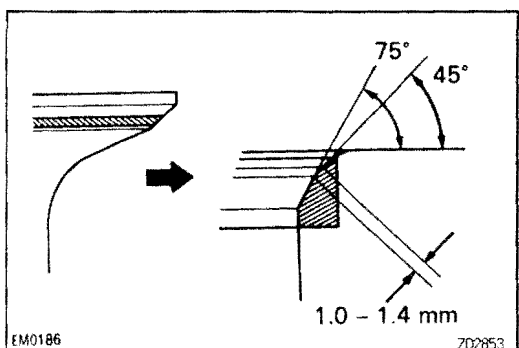


- (b) Check the valve seating position. Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
- (c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, 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.)

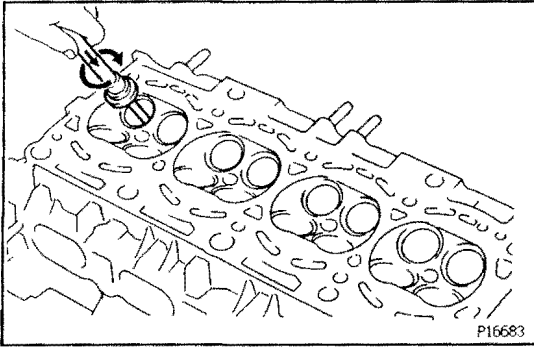


If not, correct the valve seats as follows:

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

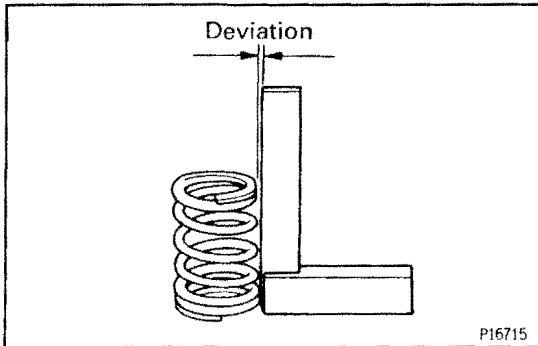


- (2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



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

EG



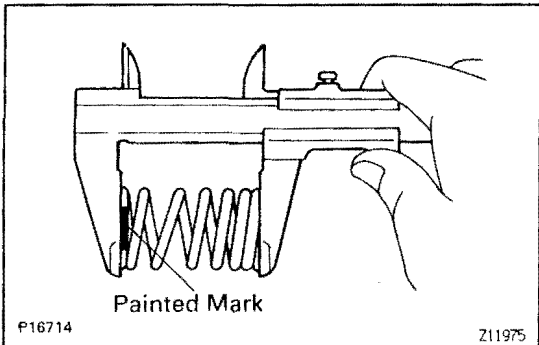
9. INSPECT VALVE SPRINGS

- (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:

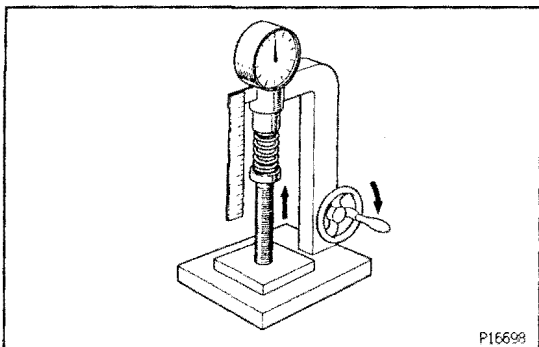
Intake (Red painted mark)

43.18 mm (1.7000 in.)

Exhaust (Green painted mark)

43.34 mm (1.7063 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 (at 35.4 mm (1.394 in.):

Intake (Red painted mark)

163 — 190 N

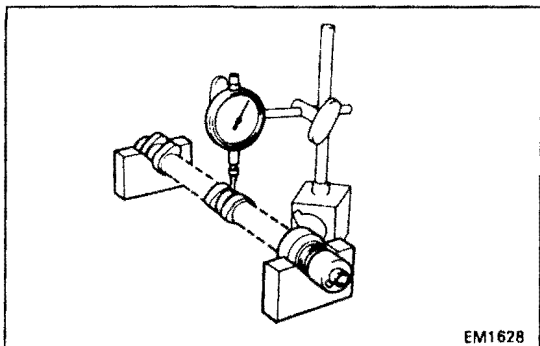
(16.6 — 19.4 kgf, 36.6 — 42.8 lbf)

Exhaust (Green painted mark)

153 — 180 N

(15.6 — 18.4 kgf, 34.4 — 40.6 lbf)

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



10. INSPECT CAMSHAFTS AND BEARINGS

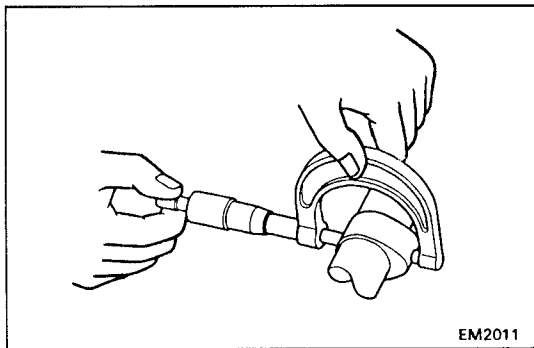
A. Inspect camshaft for runout

- (a) Place the camshaft 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 camshaft.

**B. Inspect cam lobes**

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake

42.610 – 42.710 mm (1.6778 – 1.6815 in.)

Exhaust

41.010 – 41.110 mm (1.6146 – 1.6185 in.)

Minimum cam lobe height:

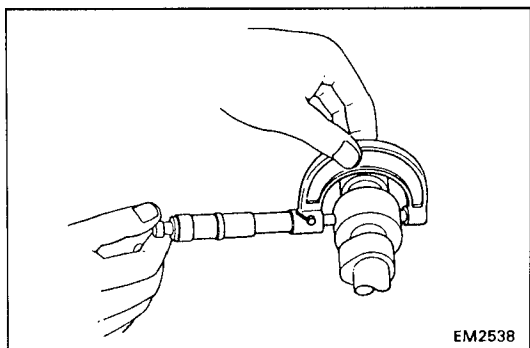
Intake

42.50 mm (1.6732 in.)

Exhaust

39.90 mm (1.5709 in.)

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

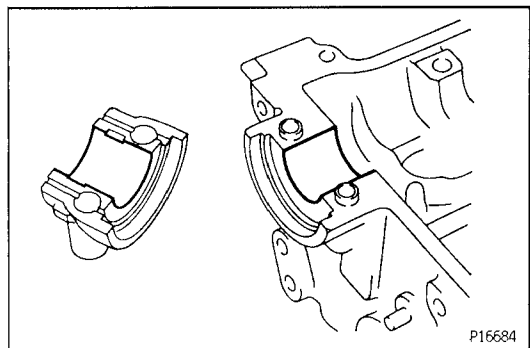
**C. Inspect camshaft journals**

Using a micrometer, measure the journal diameter.

Journal diameter:

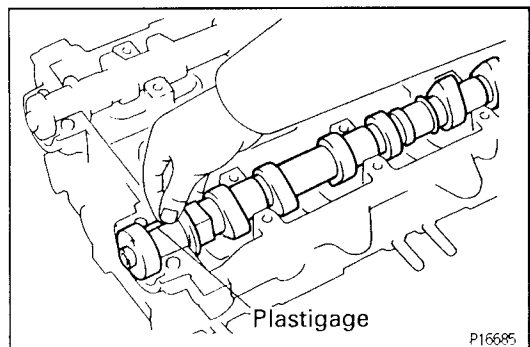
26.959 – 26.975 mm (1.0614 – 1.0620 in.)

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

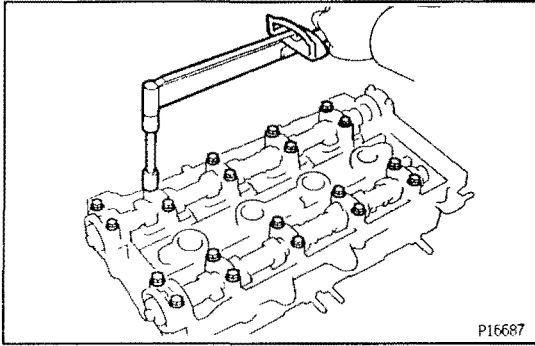
**D. Inspect camshaft bearings**

Check that bearings for flaking and scoring.

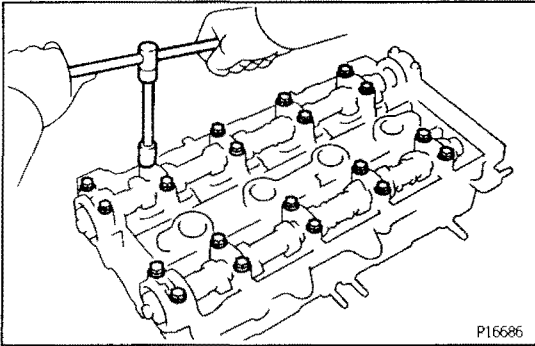
If the bearings are damaged, replace the bearing caps and cylinder head as a set.

**E. Inspect camshaft journal oil clearance**

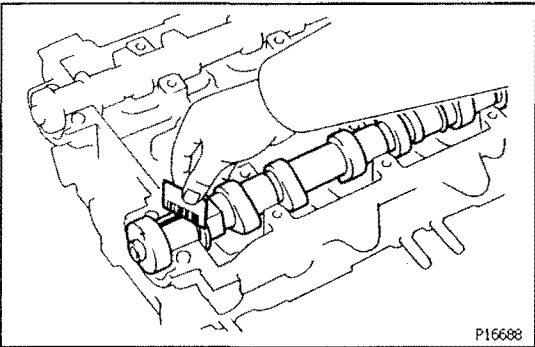
- (a) Clean the bearing caps and camshaft journals.
- (b) Place the camshafts on the cylinder head.
- (c) Lay a strip of Plastigage across each of the camshaft journals.



- (d) Install the bearing caps.
 (See step 2 on page EG-107)
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)
NOTICE: Do not turn the camshaft.



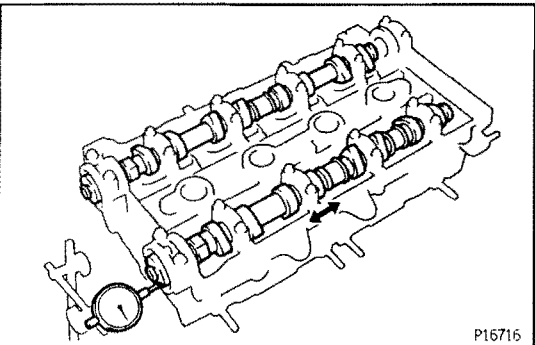
- (e) Remove the bearing caps.



- (f) Measure the Plastigage at its widest point.
Standard oil clearance:
 0.025 – 0.062 mm (0.0010 – 0.0024 in.)
Maximum oil clearance:
 0.08 mm (0.0031 in.)

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

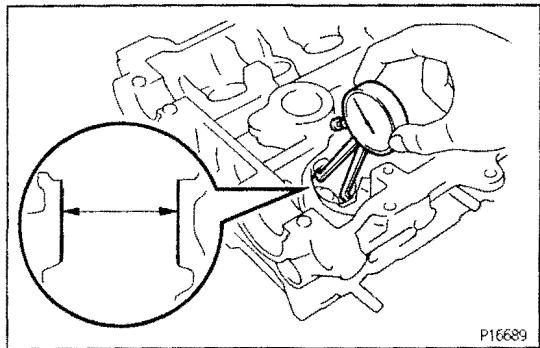
- (g) Completely remove the Plastigage.



F. Inspect camshaft thrust clearance

- (a) Install the camshaft. (See step 2 on page EG-107)
 (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
 0.100 – 0.240 mm (0.0039 – 0.0094 in.)
Maximum thrust clearance:
 0.30 mm (0.0118 in.)

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

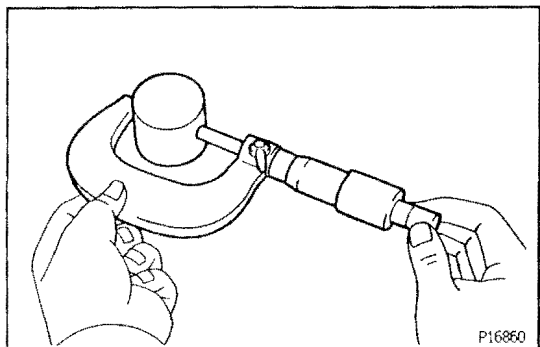


11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:

31.000 – 31.021 mm (1.2205 – 1.2213 in.)



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

Lifter diameter:

30.975 – 30.985 mm (1.2195 – 1.2199 in.)

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

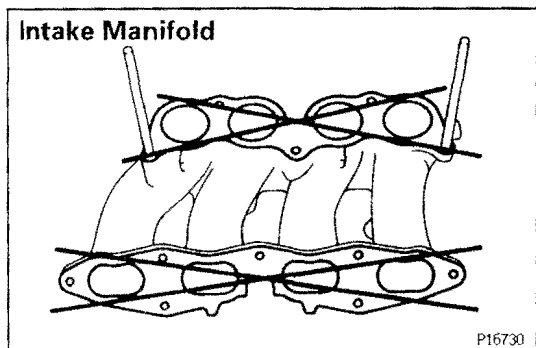
Standard oil clearance:

0.015 – 0.046 mm (0.0006 – 0.0018 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

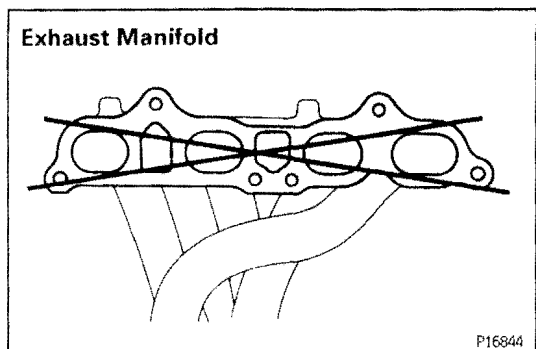
Intake Manifold:

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

Maximum warpage:

0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.



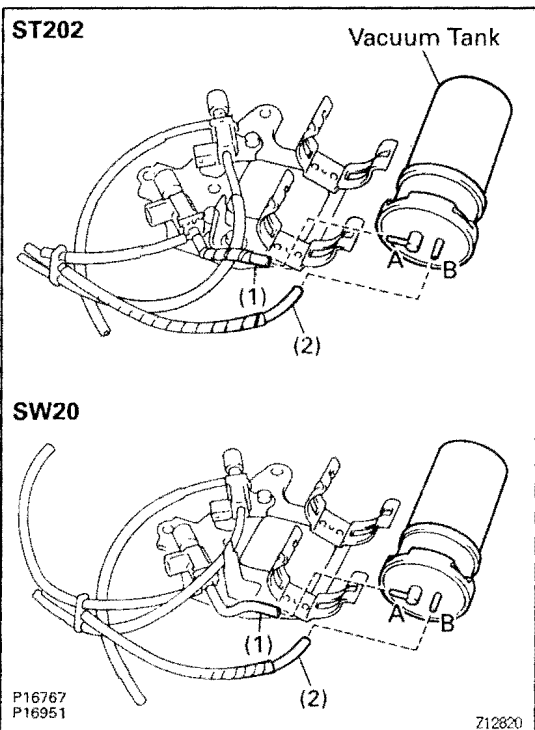
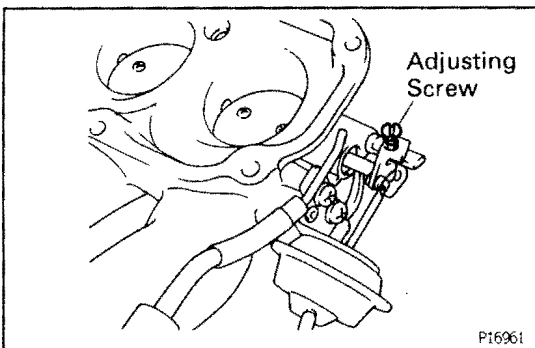
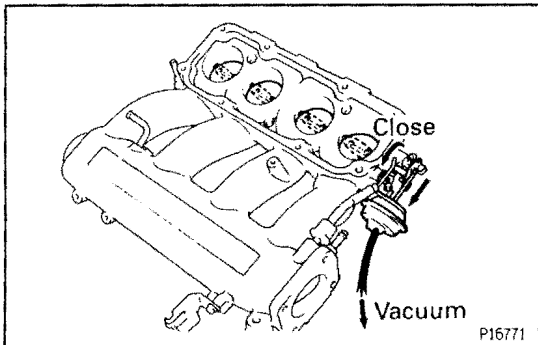
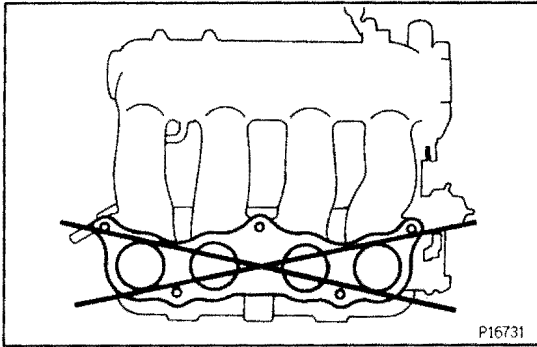
Exhaust Manifold:

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

Maximum warpage:

1.00 mm (0.0394 in.)

If warpage is greater than maximum, replace the manifold.



ACOUSTIC CONTROL INDUCTION SYSTEM (ACIS) COMPONENTS INSPECTION

1. INSPECT ACIS VALVE

A. Inspect for flatness

Using precision straight edge and feeler gauge, measure the surface contacting the intake manifold for warpage.

Maximum warpage:

0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the ACIS valve assembly.

B. Inspect for operation

- (a) With 53.3 kPa (400 mmHg, 15.75 in.Hg) of vacuum applied to the actuator, check that the valve moves smoothly to the fully closed position.

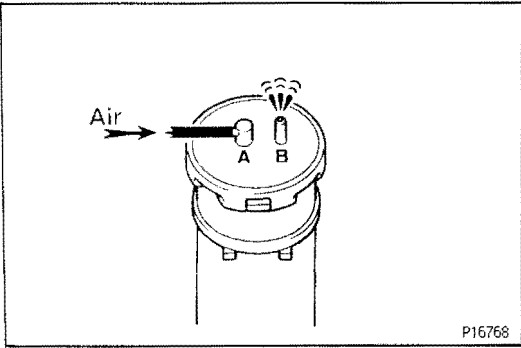
If operation is not as specified, adjust the adjusting screw.

- (b) One minute after applying the vacuum in (a), check that the actuator rod does not return.

2. INSPECT VACUUM TANK

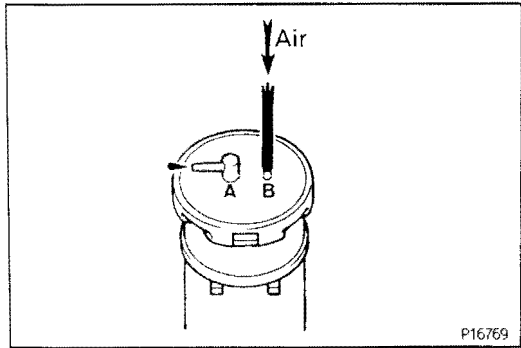
A. Remove vacuum tank from bracket

- (a) Disconnect the following hoses:
- (1) Vacuum hose from port A of vacuum tank
 - (2) Vacuum hose from port B of vacuum tank
- (b) Remove the vacuum tank.

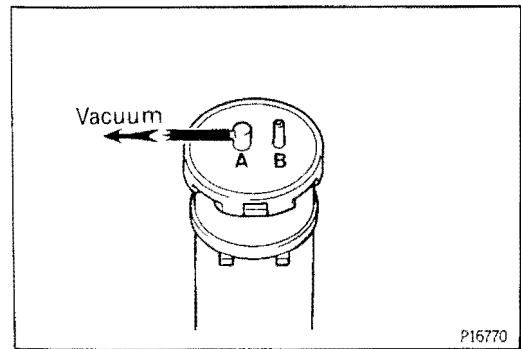


B. Inspect vacuum tank

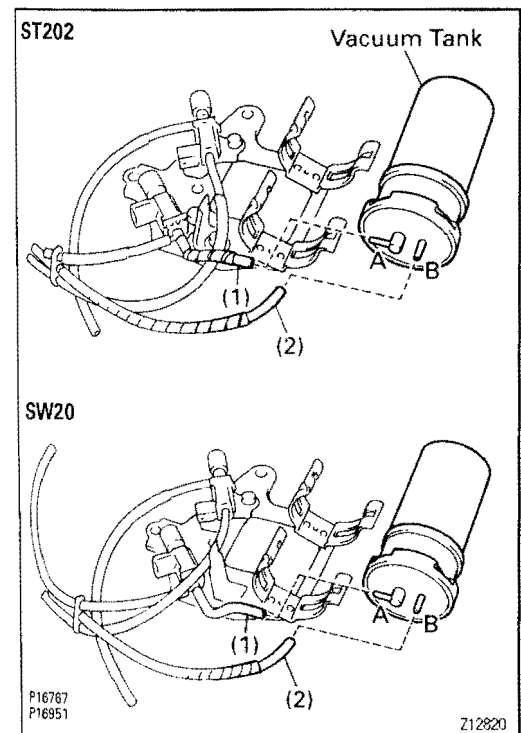
(a) Check that air flows from port A to B.



(b) Check that air does not flow from port B to A.



(c) Apply 67.7 kPa (500 mmHg, 19.69 in.Hg) of vacuum to port A, and check that there is no change in vacuum after one minute.
If operation is not as specified, replace the vacuum tank.

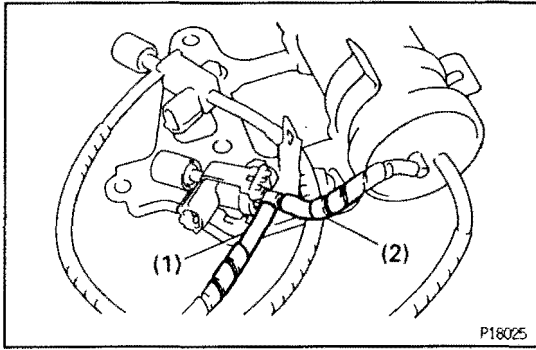


C. Reinstall vacuum tank to bracket

(a) Install the vacuum tank.

(b) Connect the following hoses:

- (1) Vacuum hose to port A of vacuum tank
- (2) Vacuum hose to port B of vacuum tank

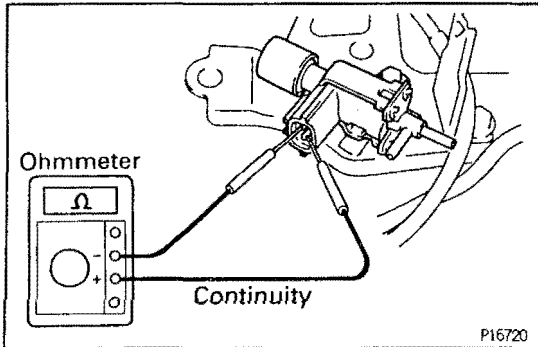


3. INSPECT VSV

A. Disconnect hoses from VSV

Disconnect the following hoses:

- (1) Vacuum hose from port E of VSV
- (2) Vacuum hose from port F of VSV



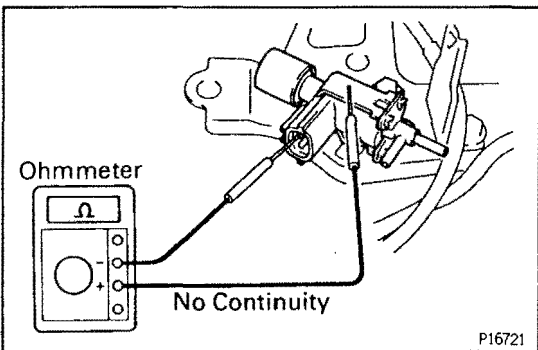
B. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance:

33 – 39 Ω at 20°C (68°F)

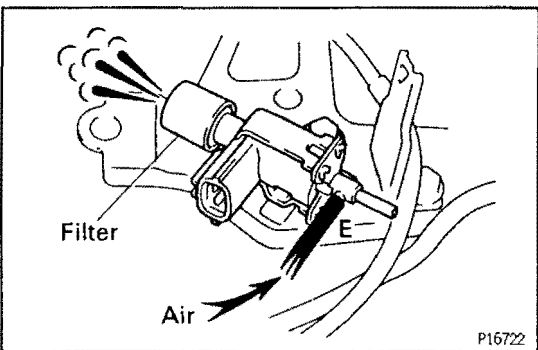
If there is no continuity, replace the VSV.



C. Inspect VSV for ground

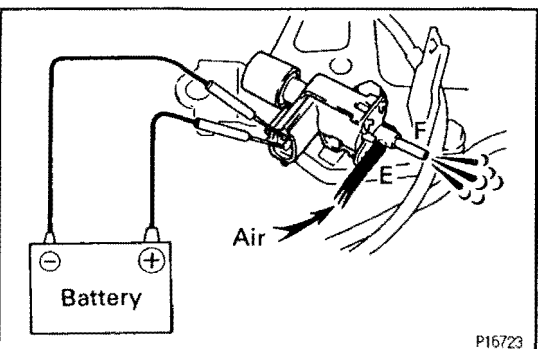
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



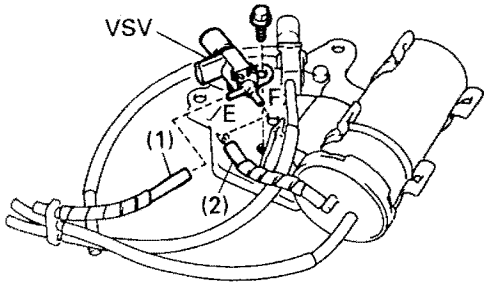
D. Inspect VSV operation

- (a) Check that air flows from port E to the filter.



- (b) Apply battery voltage across the terminals.
- (c) Check that air flows from port E to F.

ST202



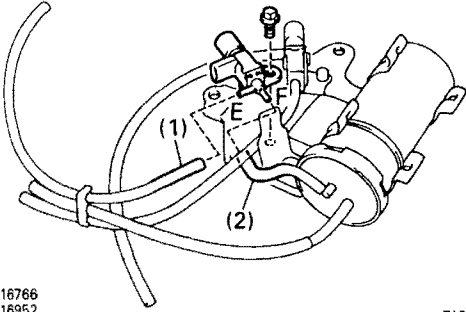
If operation is not as specified, replace the VSV.

E. Reconnect hoses to VSV

Connect the following hoses:

- (1) Vacuum hose to port E of VSV
- (2) Vacuum hose to port F of VSV

SW20



P16766
P16952

Z12821

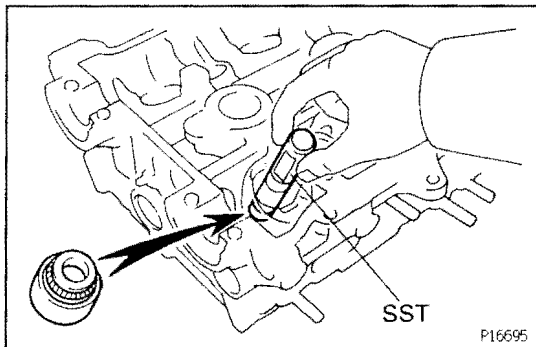
CYLINDER HEAD ASSEMBLY

(See Components for Removal and Installation)

HINT:

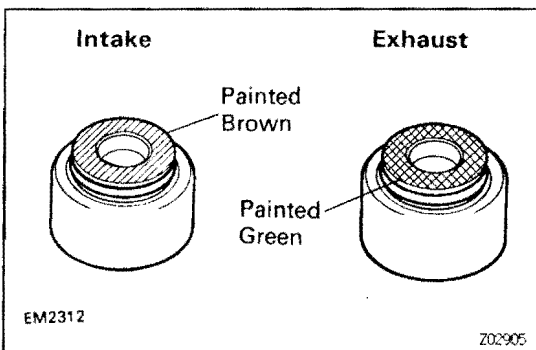
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

EG

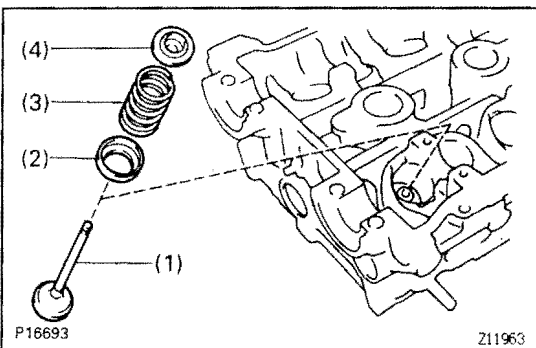


1. INSTALL VALVES

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

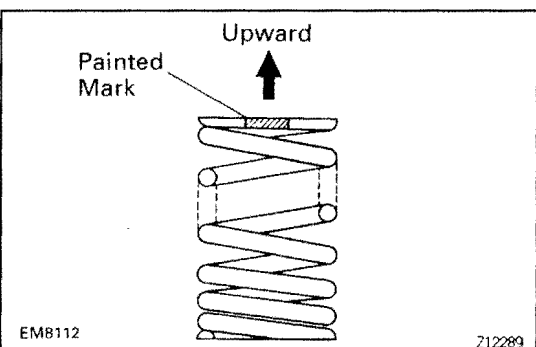


HINT: The intake valve oil seal is brown and the exhaust valve oil seal is green.



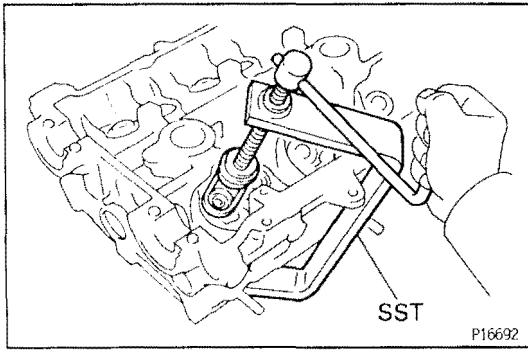
- (b) Install the following parts:

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

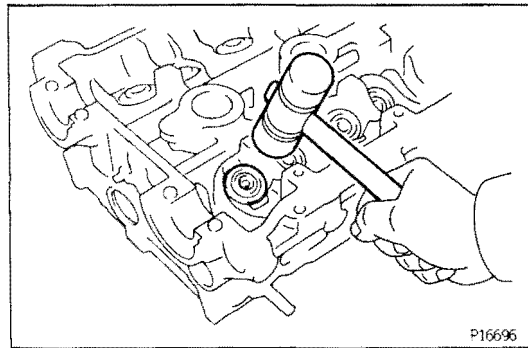


HINT:

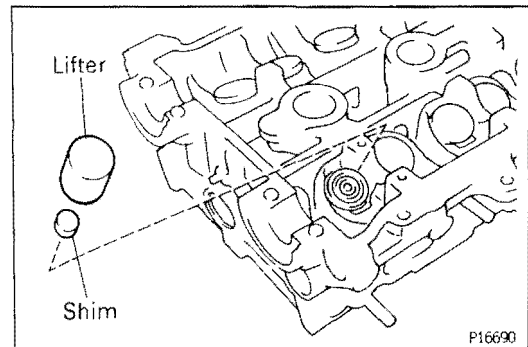
- Install the valve spring, facing the painted mark upward.
- The intake valve spring is red and the exhaust valve spring is green.



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

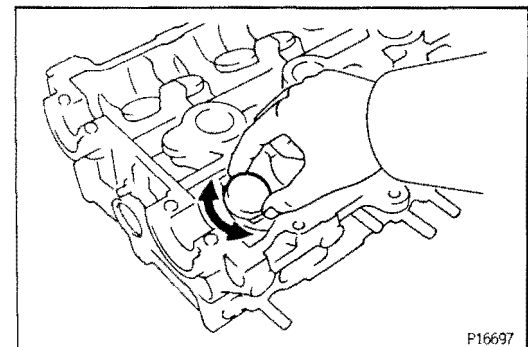


- (d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure a proper fit.

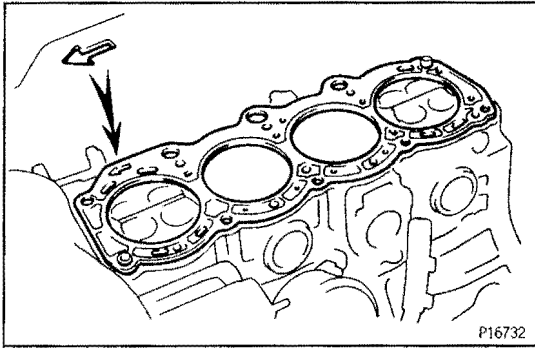


2. INSTALL ADJUSTING SHIMS AND VALVE LIFTERS

- (a) Install the adjusting shim and valve lifter.



- (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:

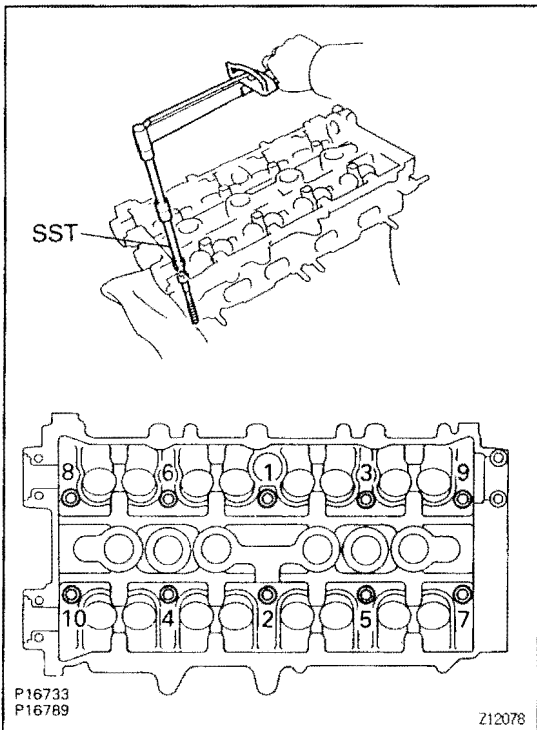
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

- (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

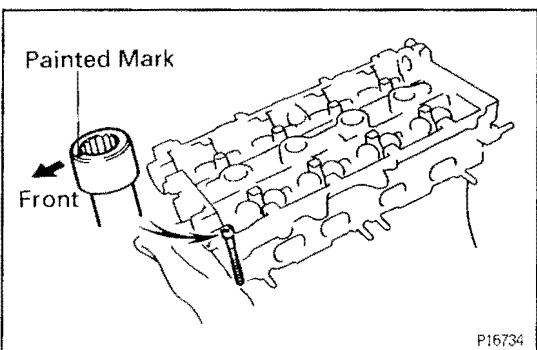
- (b) Install and uniformly tighten the 10 cylinder head bolts and plate washers in several passes, in the sequence shown.

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.

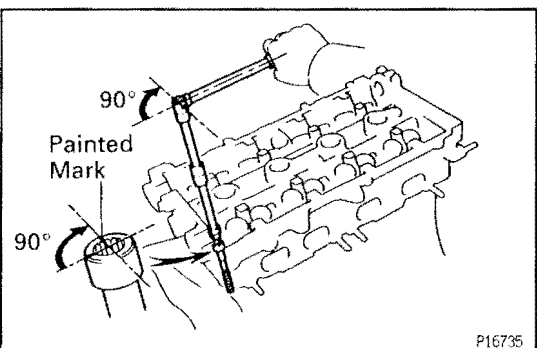


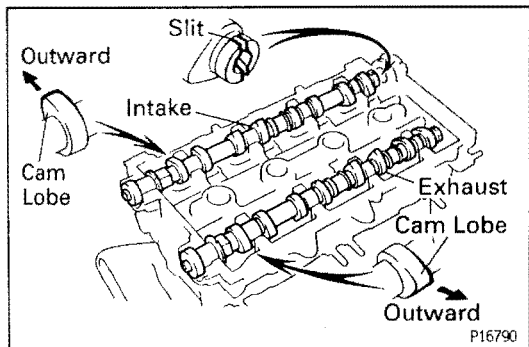
- (c) Mark the front of the cylinder head bolt head with paint.



- (d) Retighten the cylinder head bolts 90° in the numerical order shown.

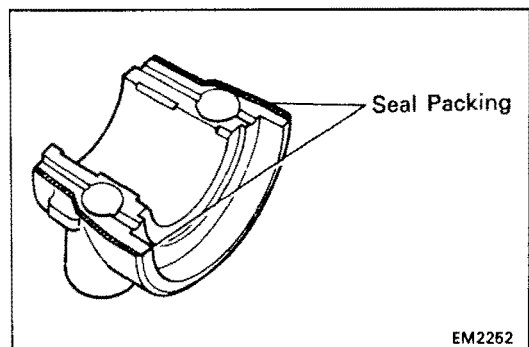
- (e) Check that the painted mark is now at a 90° angle to the front.





2. INSTALL CAMSHAFTS

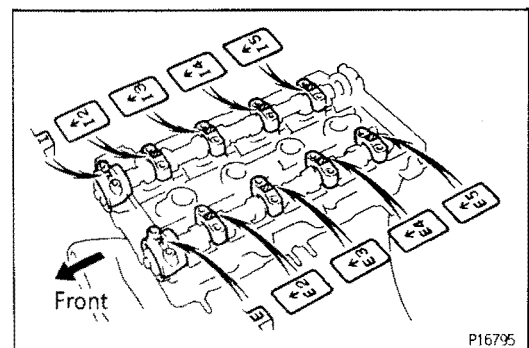
- (a) Place the 2 camshafts on the cylinder head with the No.1 cam lobes facing outward as shown.
HINT: Intake camshaft has slit; exhaust camshaft does not.



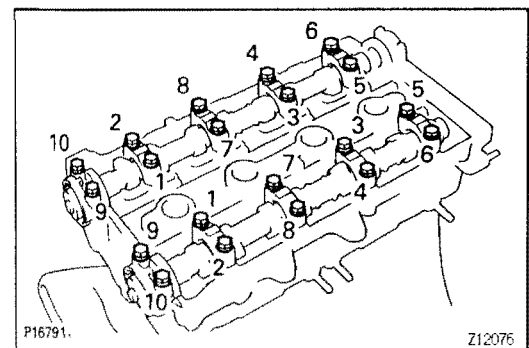
- (b) Apply seal packing to the No.1 bearing cap as shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent



- (c) Install the bearing caps in their proper locations.
HINT: Each bearing cap has a number and front mark.



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

3. CHECK AND ADJUST VALVE CLEARANCE (See page EG-22)

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

Valve clearance (Cold):

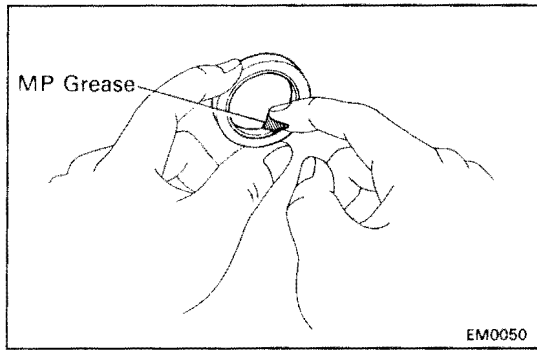
Intake

0.15 — 0.25 mm (0.006 — 0.010 in.)

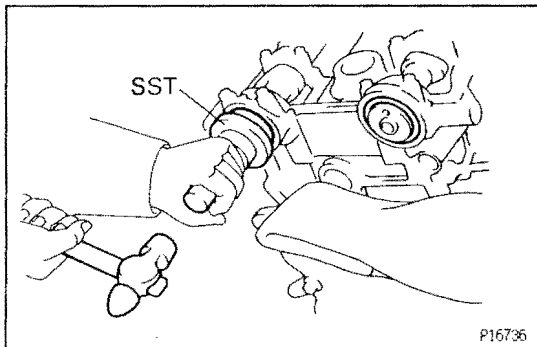
Exhaust

0.28 — 0.38 mm (0.011 — 0.015 in.)

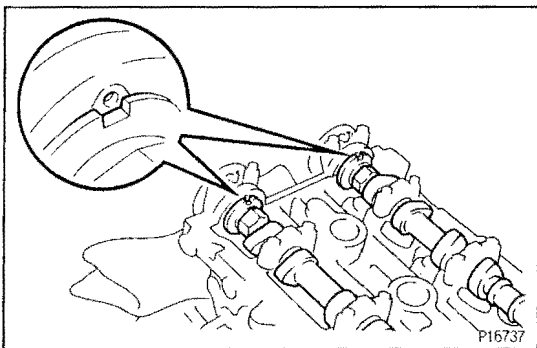
EG

**4. INSTALL CAMSHAFT OIL SEALS**

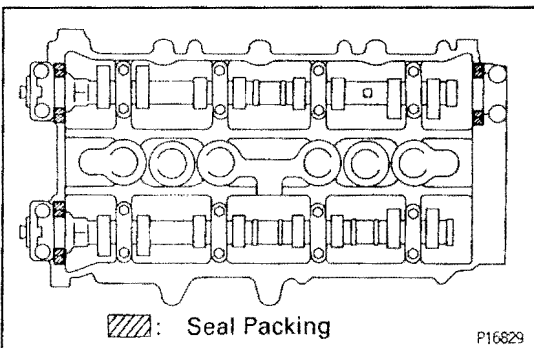
- (a) Apply MP grease to a new oil seal lip.



- (b) Using SST, tap in the 2 camshaft oil seals.
SST 09223-46011

**5. INSTALL CYLINDER HEAD COVER**

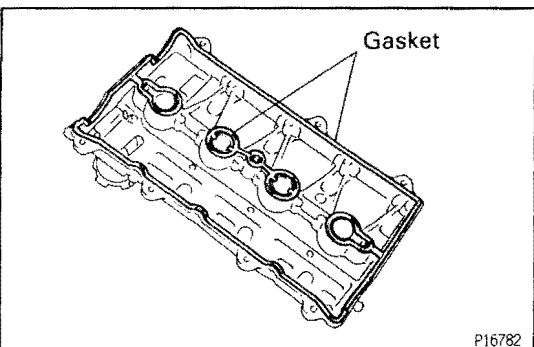
- (a) Turn the hexagon head portion of the camshaft, align the groove of the camshaft with the dot mark of the No.1 camshaft bearing cap.



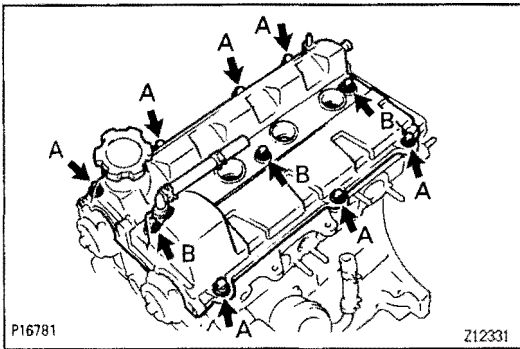
- (b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent



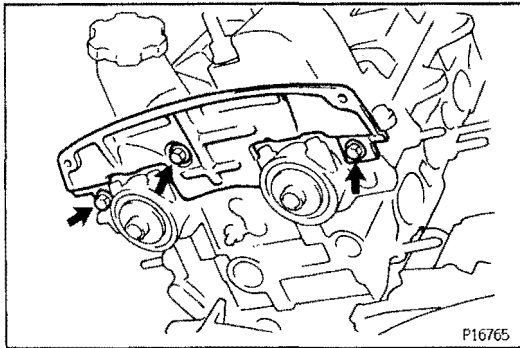
- (c) Install the 2 gaskets to the head cover.



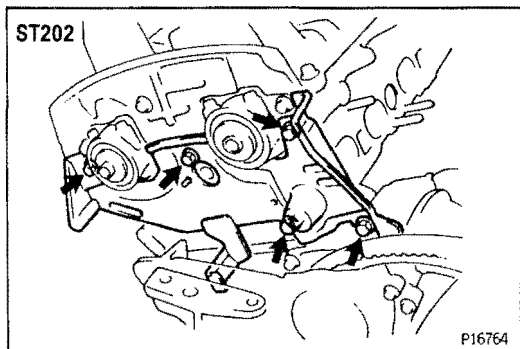
- (d) Install the head cover with the 10 seal washers and bolts. Uniformly tighten the bolts in several passes.
Torque: 6.0 N·m (61 kgf·cm, 53 in.-lbf)
HINT: Each bolt length is indicated in the illustration.
Bolt length:

A 25 mm (0.98 in.)
 B 50 mm (1.97 in.)

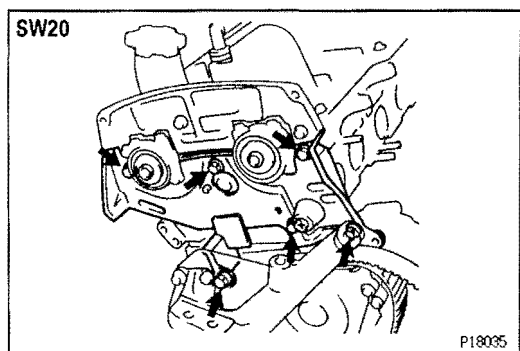
EG



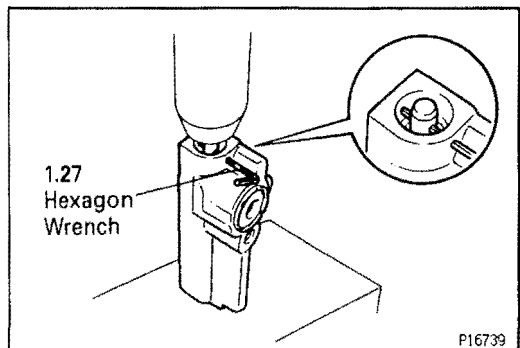
- 6. INSTALL NO.4 TIMING BELT COVER**
 Install the timing belt cover with the 3 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)



- 7. INSTALL NO.3 TIMING BELT COVER**
ST202:
 Install the timing belt cover with the 5 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)

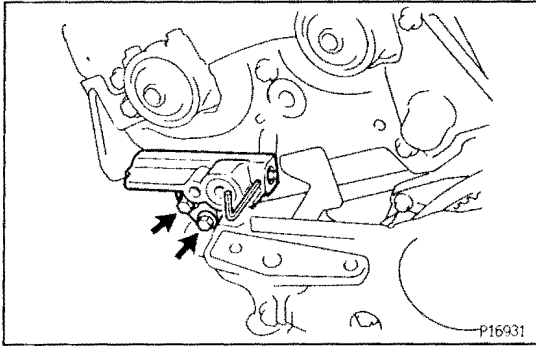


- SW20:**
 Install the timing belt cover with the 6 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)

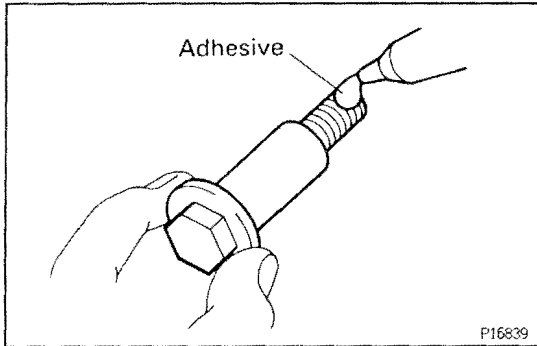


- 8. SET TIMING BELT TENSIONER**
- Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of force.
 - Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
 - Release the press.

EG

**9. INSTALL TIMING BELT TENSIONER**

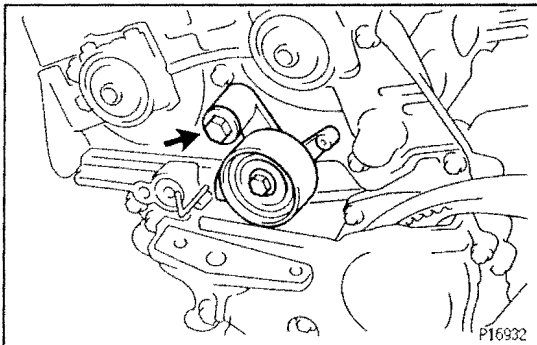
Install the tensioner with the 2 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)**10. INSTALL NO.1 IDLER PULLEY**

(a) Apply adhesive to 2 or 3 threads of the pivot bolt.

Adhesive:

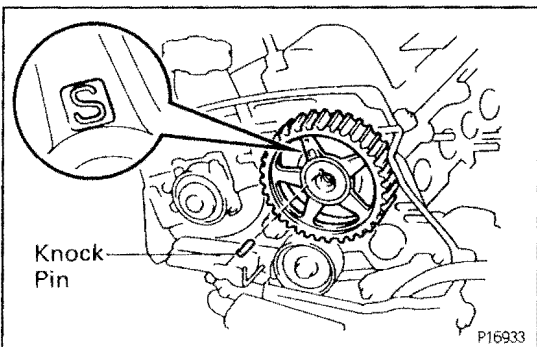
**Part No. 08833-00080, THREE BOND 1344,
LOCTITE 242 or equivalent**



(b) Install the plate washer and pulley with the pivot bolt.

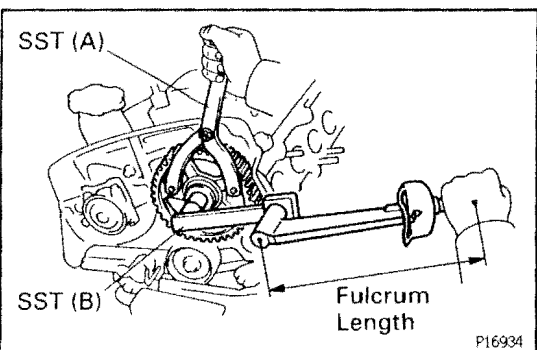
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

(c) Check that the idler pulley moves smoothly.

**11. INSTALL EXHAUST CAMSHAFT TIMING PULLEY**

(a) Slide the timing pulley onto the camshaft, facing mark "S" outward.

(b) Align the pin holes of the camshaft and timing pulley, and insert the knock pin.



(c) Using SST (A), install the pulley bolt.

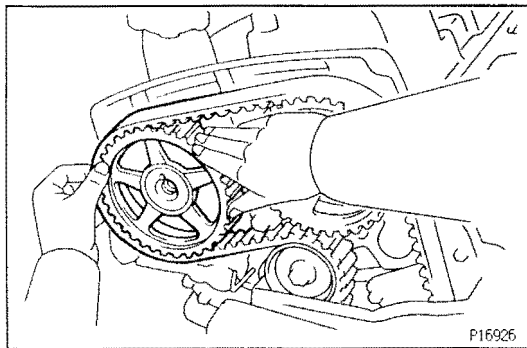
SST 09960-10010 (09962-01000, 09963-01000)

Torque:**59 N·m (600 kgf·cm, 43 ft·lbf)****41 N·m (420 kgf·cm, 30 ft·lbf) for SST****HINT (On vehicle):**

- Use SST (B).

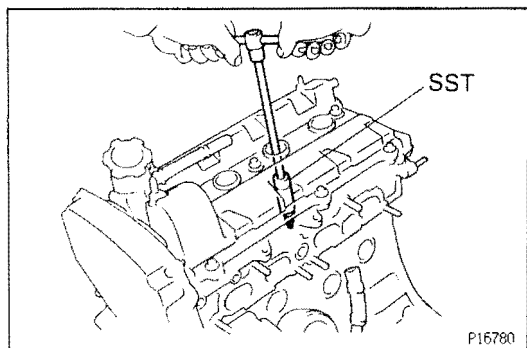
SST 09249-63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).



12. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEYS

(See steps 14 to 17 on pages EG-61 to 64)

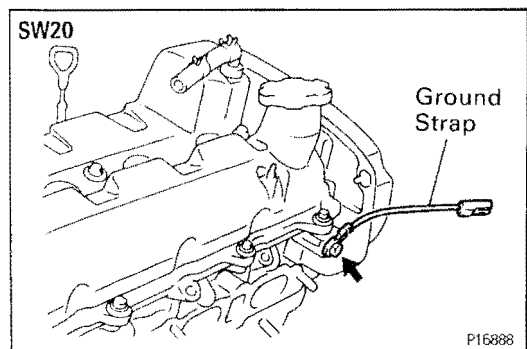


13. INSTALL SPARK PLUGS

Using SST, install the 4 spark plugs.

SST 09155-16100

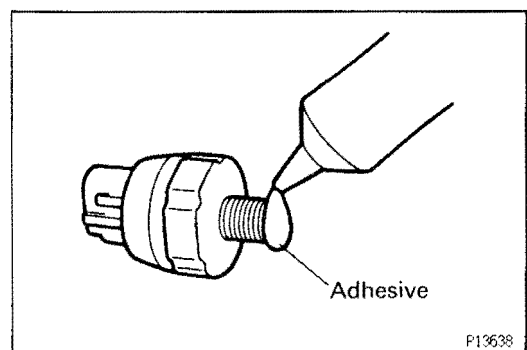
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



14. SW20:

INSTALL GROUND STRAP

Install the ground strap with the bolt.

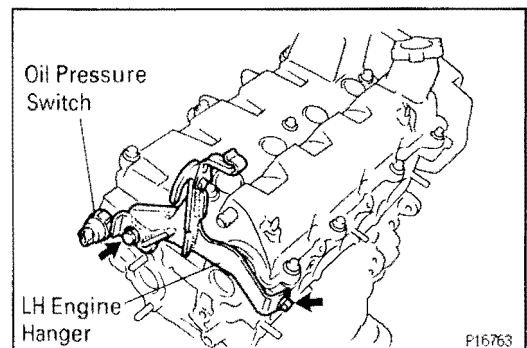


15. INSTALL OIL PRESSURE SWITCH

(a) Apply adhesive to 2 or 3 threads.

Adhesive:

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



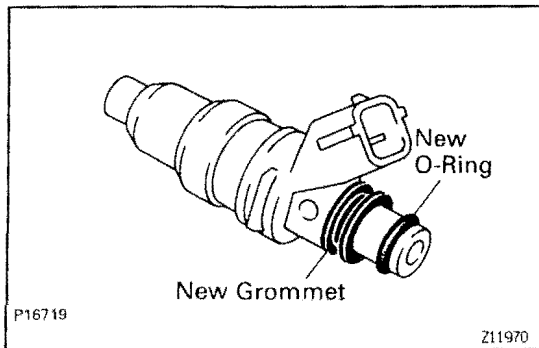
(b) Install the oil pressure switch.

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

16. INSTALL LH ENGINE HANGER

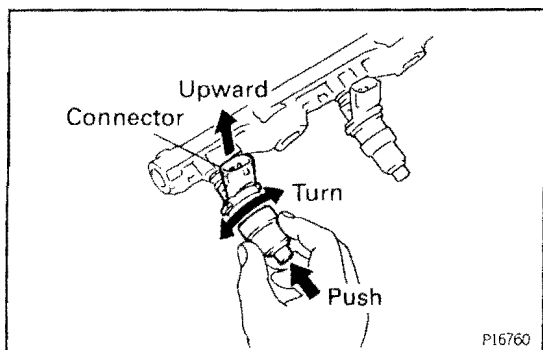
Install the LH engine hanger with the 2 bolts.

Torque: 44 N·m (450 kgf·cm, 32 ft·lbf)

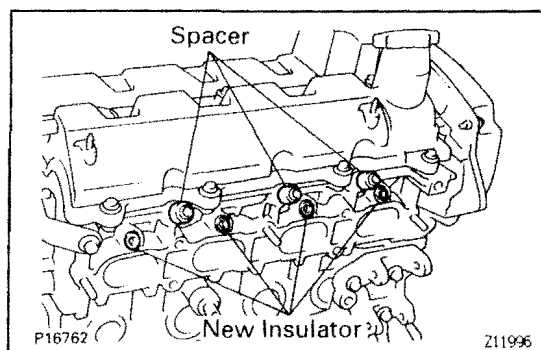


17. INSTALL INJECTORS AND DELIVERY PIPE

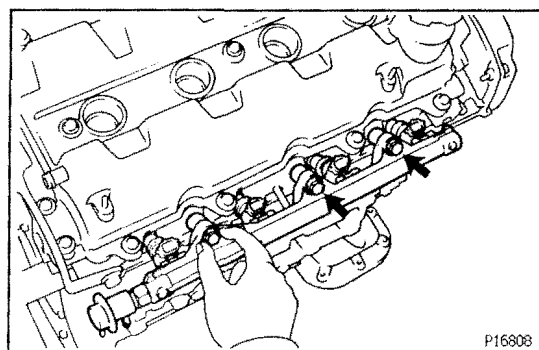
- (a) Install a new grommet to each injector.
- (b) Apply a light coat of gasoline onto a new O—ring, and install it to each injector.



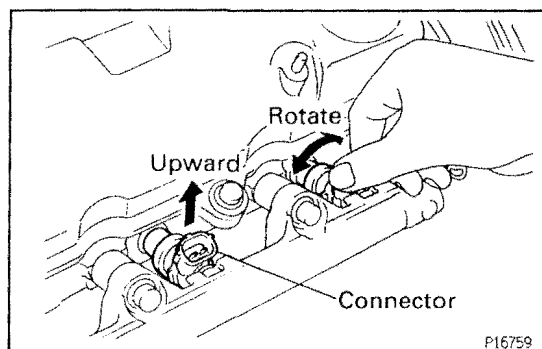
- (c) While turning the injector clockwise and counter-clockwise, push it to the delivery pipe. Install the 4 injectors.
- (d) Position the injector connector upward.



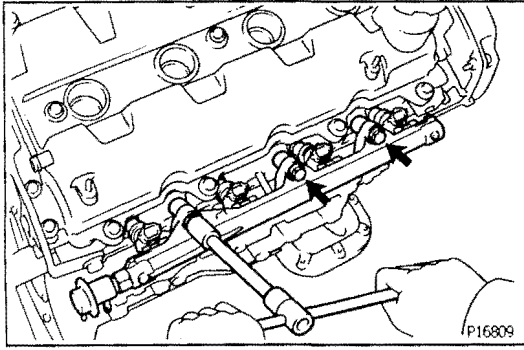
- (e) Install the 2 spacers and 4 new insulators to the cylinder head.



- (f) Attach the 4 injectors together with the delivery pipe to the cylinder head.
- (g) Temporarily install the 3 bolts holding the delivery pipe to the cylinder head.

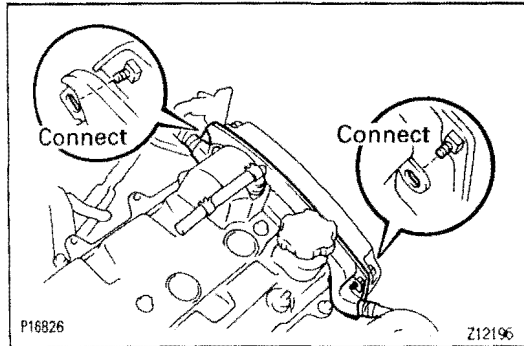


- (h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O—rings. Replace the O—rings.
- (i) Position the injector connector upward.



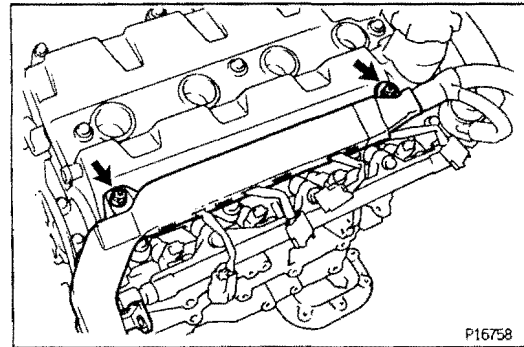
- (j) Tighten the 3 bolts holding the delivery pipe to the cylinder head.
Torque: 29 N·m (300 kgf·cm, 21 ft·lbf)

EG

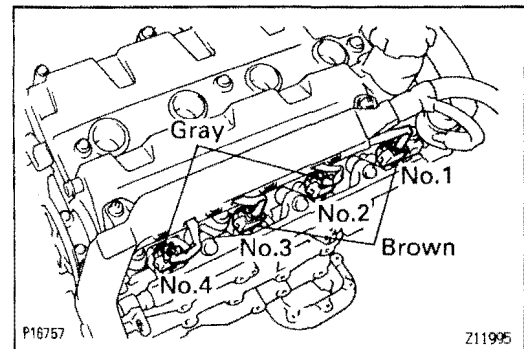


18. INSTALL ENGINE WIRE

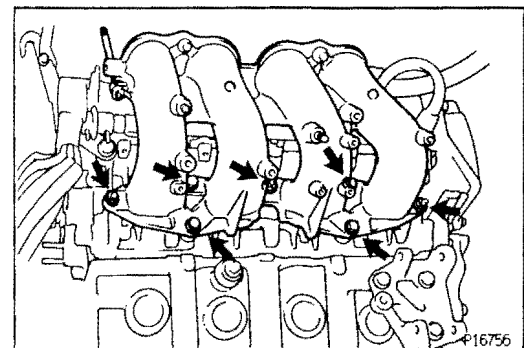
- (a) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover.



- (b) Install the engine wire protector to the cylinder head cover with the 2 nuts.

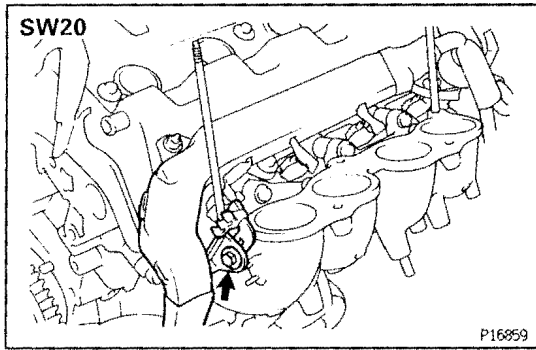


- (c) Connect the 4 injector connectors.
HINT: The No.1 and No.3 injector connectors are brown, and the No.2 and No.4 injector connectors are gray.

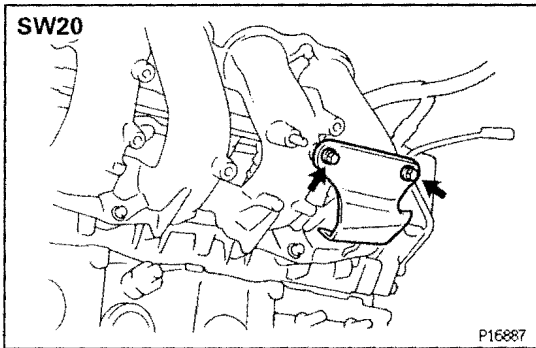


19. INSTALL INTAKE MANIFOLD

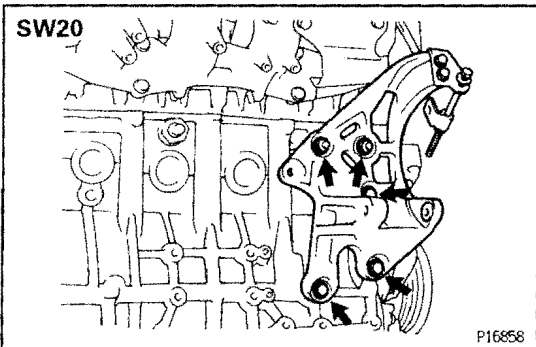
- (a) Install a new gasket and the intake manifold with the 4 bolts and 3 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



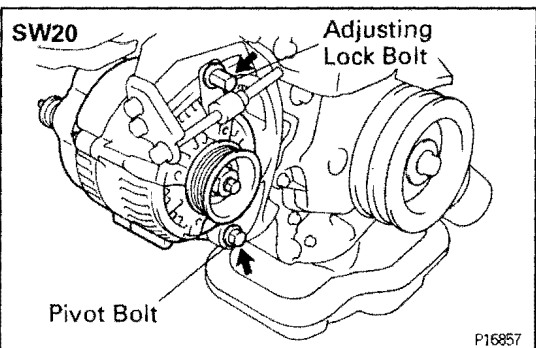
- (b) SW20:
Install the hose clamp and engine wire protector with the bolt.



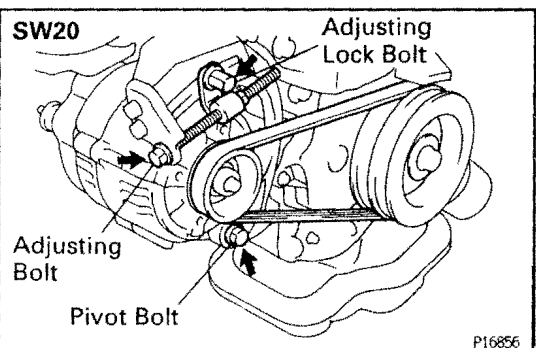
20. SW20:
INSTALL ALTERNATOR COVER
Install the alternator cover with the 2 bolts.



21. SW20:
INSTALL ALTERNATOR BRACKET
Install the alternator bracket with the 3 bolts and 2 nuts.
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)



22. SW20:
INSTALL ALTERNATOR
(a) Install the alternator with the pivot bolt and adjusting lock bolt. Do not tighten the bolts yet.



- (b) Install the drive belt with the adjusting bolt.
(c) Tighten the pivot bolt and adjusting lock bolt.

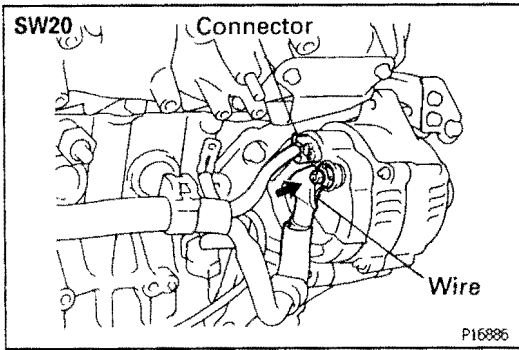
Torque:

Pivot bolt

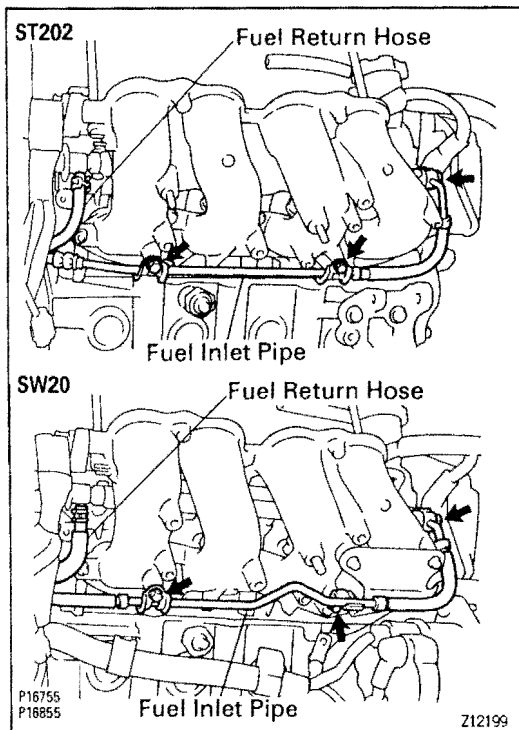
52 N·m (530 kgf·cm, 38 ft·lbf)

Adjusting lock bolt

19 N·m (190 kgf·cm, 14 ft·lbf)



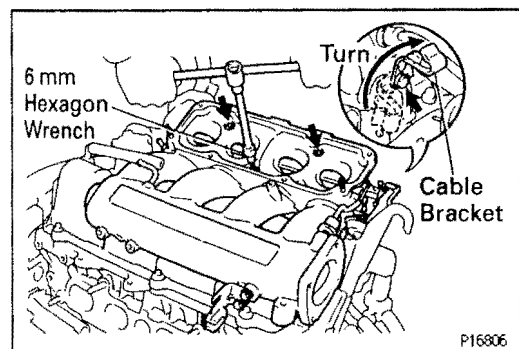
- (d) Connect the alternator connector.
- (e) Connect the alternator wire with the nut and rubber cap.



23. CONNECT FUEL INLET PIPE TO DELIVERY PIPE

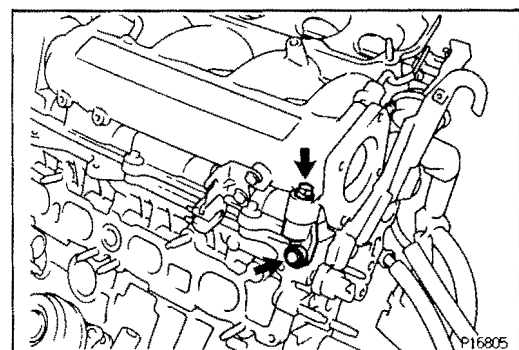
- (a) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the union bolt.
Torque: 32 N·m (330 kgf·cm, 24 ft·lbf)
- (b) Install the fuel inlet pipe to the cylinder head with the 2 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)

24. CONNECT FUEL RETURN HOSE TO FUEL PRESSURE REGULATOR



25. INSTALL ACIS VALVE ASSEMBLY

- (a) Using a 6 mm hexagon wrench, install a new gasket and the ACIS valve assembly with the 3 bolts. Uniformly tighten the bolts in several passes.
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)
- (b) ST202:
Install the cable bracket on the LH engine hanger with the bolt.



- (c) Install the No.1 ACIS valve stay with the 2 bolts. Alternately tighten the bolts.

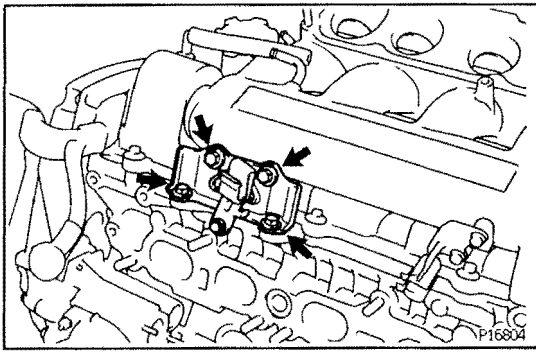
Torque:

Cylinder head side

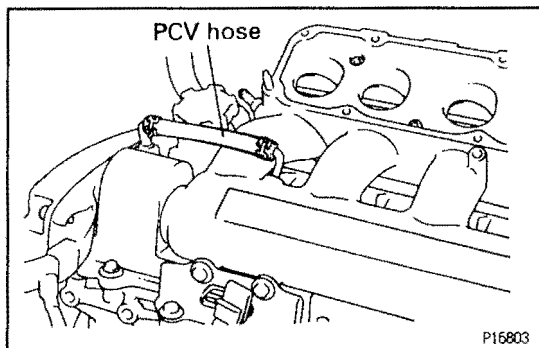
19 N·m (190 kgf·cm, 14 ft·lbf)

ACIS valve side

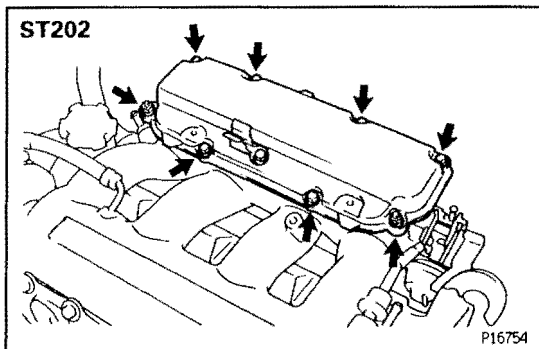
21 N·m (210 kgf·cm, 15 ft·lbf)



- (d) Install the No.2 ACIS valve stay with the 4 bolts. Alternately tighten the bolts.
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



- (e) Connect the PCV hose to the port of the ACIS valve assembly.



26. ST202:

INSTALL ACIS VALVE COVER

Install a new gasket and the ACIS valve cover with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

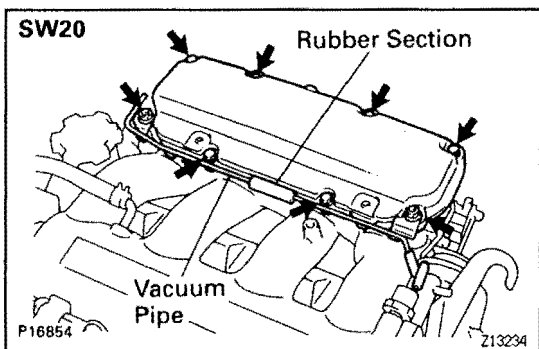
Torque:

Bolt

8.5 N·m (87 kgf·cm, 75 in·lbf)

Nut

21 N·m (210 kgf·cm, 15 ft·lbf)



27. SW20:

INSTALL ACIS VALVE COVER AND VACUUM PIPE

- (a) Install a new gasket and the ACIS valve cover with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

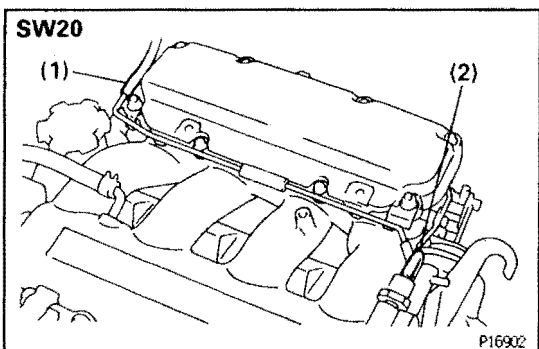
Torque:

Bolt

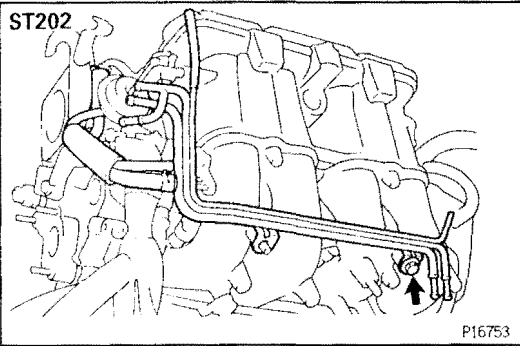
8.5 N·m (87 kgf·cm, 75 in·lbf)

Nut

21 N·m (210 kgf·cm, 15 ft·lbf)

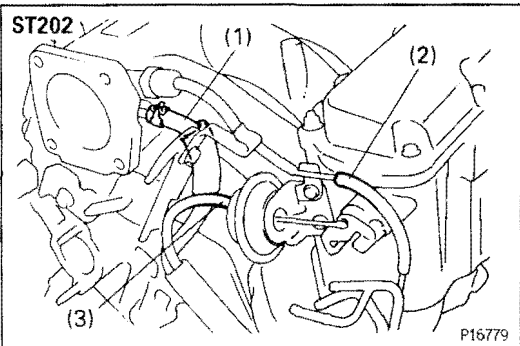


- (b) Check that the rubber section at the center of the vacuum pipe is firmly pressed against the ACIS cover.
- (c) Connect the following hoses:
- (1) Vacuum hose (from vacuum sensor) to vacuum pipe
 - (2) Vacuum hose to gas filter

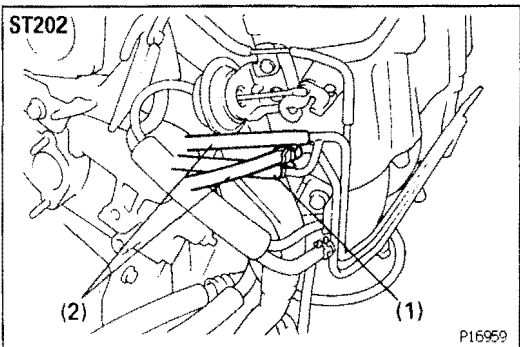


28. ST202: INSTALL AIR TUBE, VSV AND VACUUM TANK ASSEMBLY

- (a) Install the air tube with the bolt.

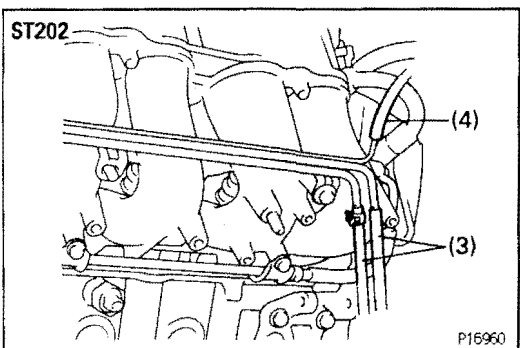


- (b) Connect the following hoses:
- (1) Air hose to port of ACIS valve
 - (2) Vacuum hose (from vacuum sensor) to vacuum pipe on ACIS actuator
 - (3) Vacuum hose (from VSV for ACIS) to ACIS actuator

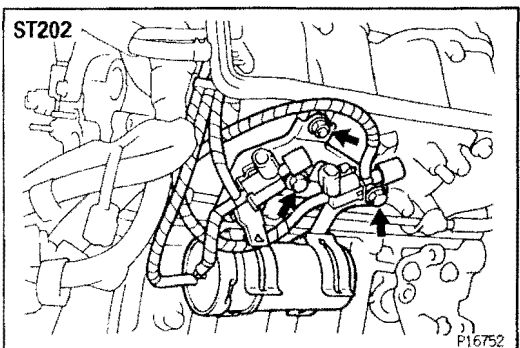


HINT (On vehicle): Connect the following hose:

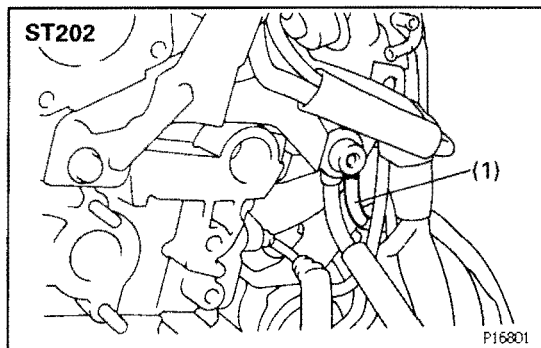
- (1) Air hose (from air cleaner hose) to air tube
- (2) 2 air hoses (from A/C idle-up valve) to air tube



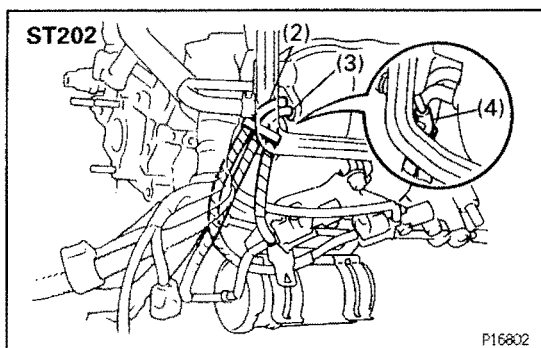
- (3) 2 air hoses (from air control valve on PS pump) to air tube
- (4) Vacuum hose (from vacuum sensor) to vacuum pipe on air tube



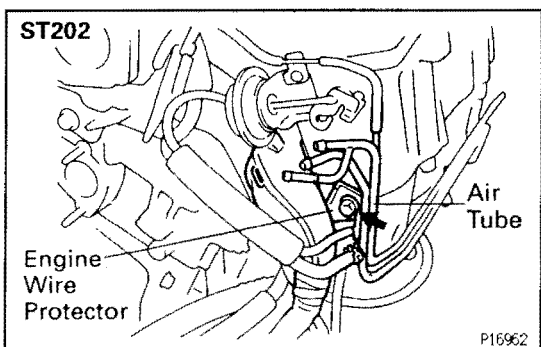
- (c) Install the VSV and vacuum tank assembly with the 2 bolts and nut.



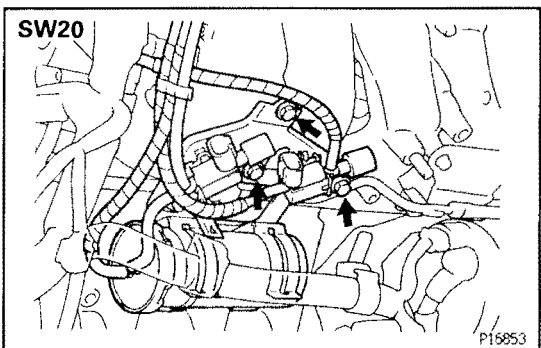
- (d) Connect the following hoses:
- (1) Vacuum hose (from VSV for fuel pressure control) to fuel pressure regulator



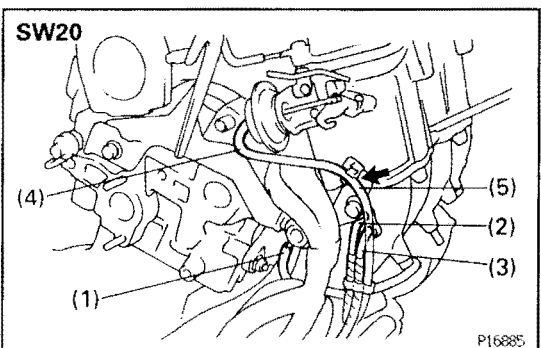
- (2) Vacuum hose (from VSV for fuel pressure control) to intake manifold
- (3) Vacuum hose (from vacuum tank) to intake manifold
- (4) Vacuum hose (from VSV for ACIS) to air tube



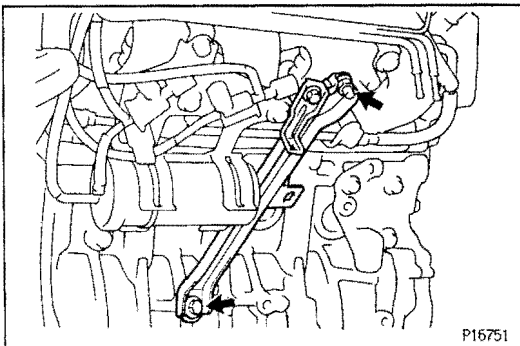
- (e) Install the air tube and engine wire protector with the bolt.



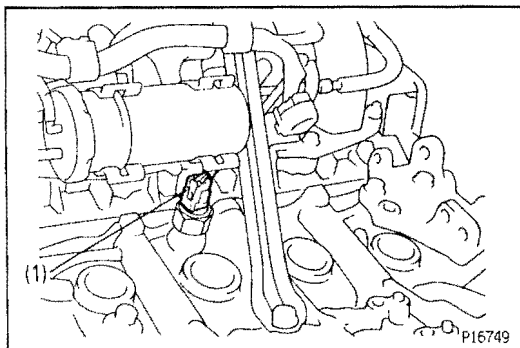
29. SW20:
- INSTALL VSV AND VACUUM TANK ASSEMBLY**
- (a) Install the VSV and vacuum tank assembly with the 3 bolts.



- (b) Connect the following hoses:
 - (1) Vacuum hose (from VSV for fuel pressure control) to fuel pressure regulator
 - (2) Vacuum hose (from VSV for fuel pressure control) to intake manifold
 - (3) Vacuum hose (from vacuum tank) to intake manifold
 - (4) Vacuum hose (from VSV for ACIS) to ACIS actuator
 - (5) Vacuum hose (between VSV and actuator for ACIS) to clamp on intake manifold

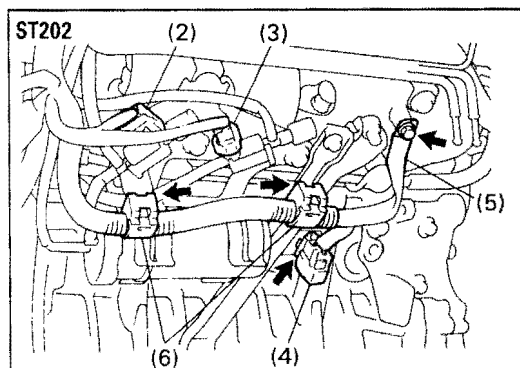
**30. REMOVE INTAKE MANIFOLD STAY**

Install the intake manifold stay with the bolt and nut.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

**31. CONNECT ENGINE WIRE**

Connect the following connectors, ground cable and clamps:

(1) Knock sensor connector



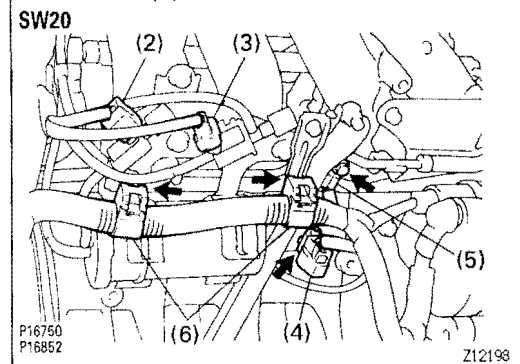
(2) VSV connector for ACIS

(3) VSV connector for fuel pressure control

(4) Oxygen sensor connector to bracket

(5) Ground cable

(6) 2 wire clamps to brackets

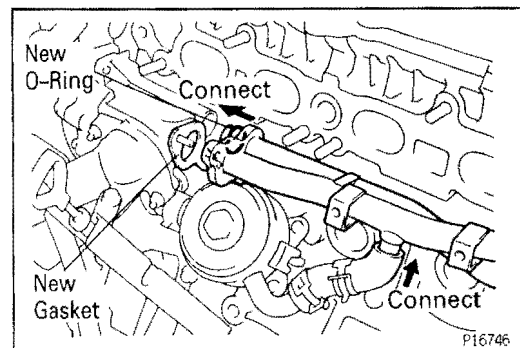
**32. INSTALL WATER BYPASS PIPE**

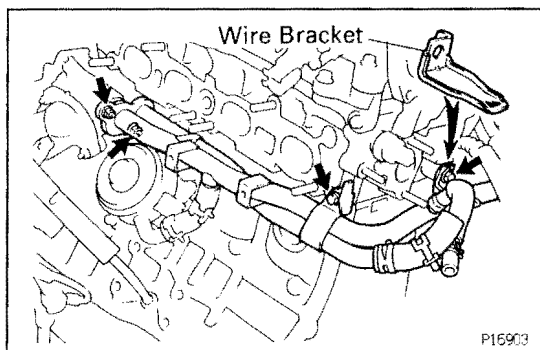
(a) Install a new gasket to the water pump cover.

(b) Install a new O-ring to the bypass pipe.

(c) Apply soapy water on the O-ring.

(d) Connect the water bypass pipe to the water bypass hose and water pump cover.





- (e) Install the bypass pipe and engine wire bracket with the 2 nuts and 2 bolts.

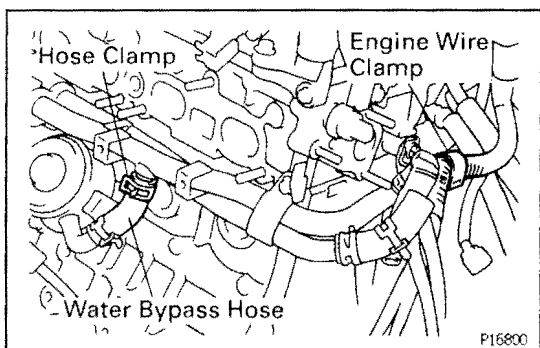
Torque:

Nut

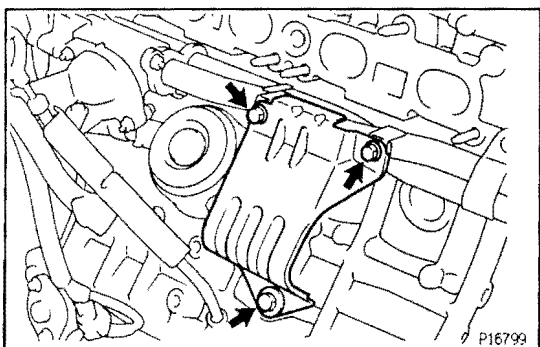
10 N·m (100 kgf·cm, 7 ft·lbf)

Bolt

24 N·m (240 kgf·cm, 18 ft·lbf)



- (f) Secure the water bypass hose with the hose clamp.
 (g) Install the engine wire clamp to the wire bracket.



- (h) Install the No.3 exhaust manifold heat insulator with the 3 bolts.

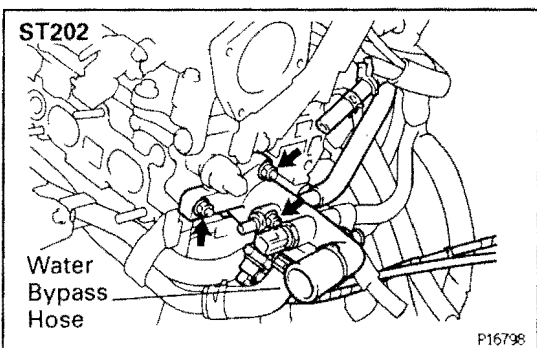
Torque:

12 mm bolt head

18 N·m (180 kgf·cm, 13 ft·lbf)

14 mm bolt head

37 N·m (380 kgf·cm, 27 ft·lbf)

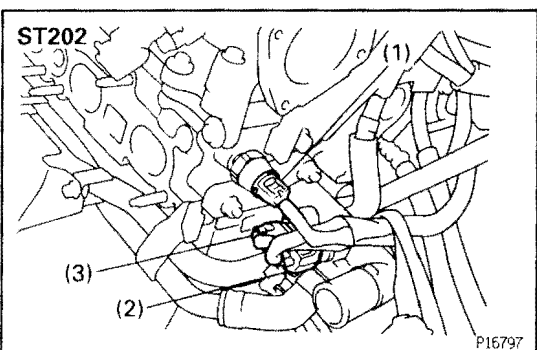


33. ST202:

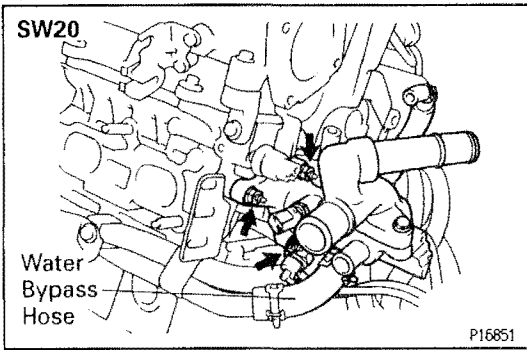
INSTALL WATER OUTLET

- (a) Install a new gasket to the cylinder head.
 (b) Connect the water bypass hose to the water outlet, and install the water outlet with the 3 nuts.

Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)

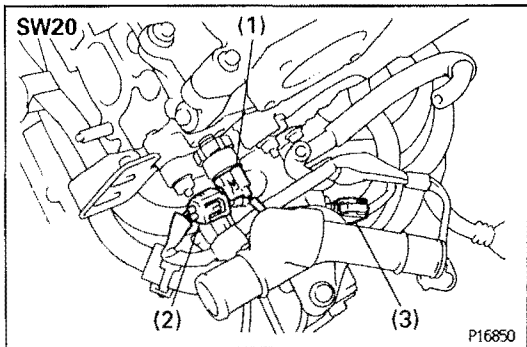


- (c) Connect the following connectors:
 (1) Oil pressure switch connector
 (2) Water temperature sensor connector
 (3) Water temperature sender gauge connector

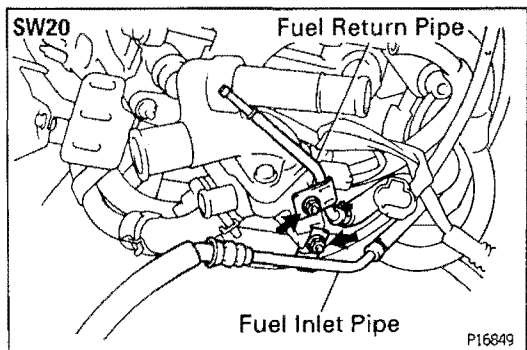
**34. SW20:****INSTALL WATER OUTLET AND HOUSING ASSEMBLY**

- (a) Install a new gasket to the cylinder head.
- (b) Connect the water bypass hose to the water outlet, and install the water outlet and housing assembly with the 3 nuts.

Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



- (c) Connect the following connectors:
 - (1) Oil pressure switch connector
 - (2) Water temperature sensor connector
 - (3) Water temperature sender gauge connector

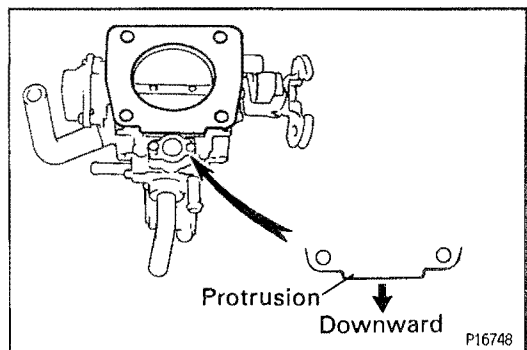


- (d) Install the fuel inlet pipe to the water outlet with the nut.

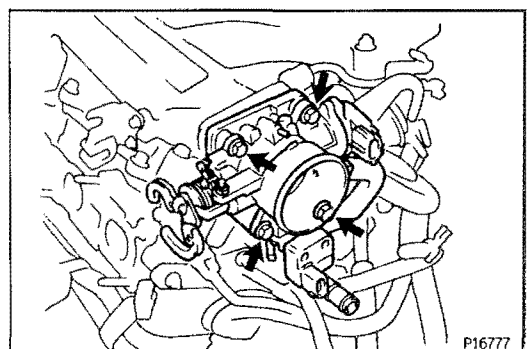
Torque: 9.0 N·m (92 kgf·cm, 80 in.-lbf)

- (e) Install the fuel return pipe to the water outlet with nut.

Torque: 9.0 N·m (92 kgf·cm, 80 in.-lbf)

**35. INSTALL THROTTLE BODY**

- (a) Attach a new gasket to the throttle body, facing the protrusion downward.



- (b) Install the gasket and throttle body with the 4 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

HINT: Different bolt lengths are used for the upper and lower sides.

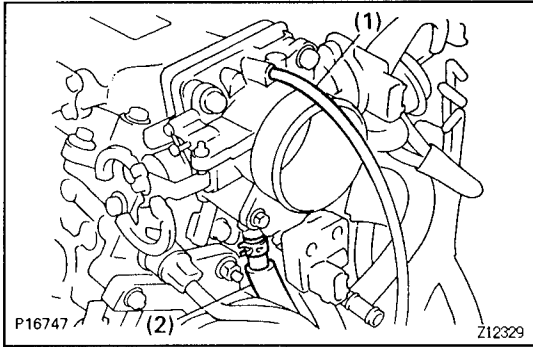
Bolt length:

Upper side

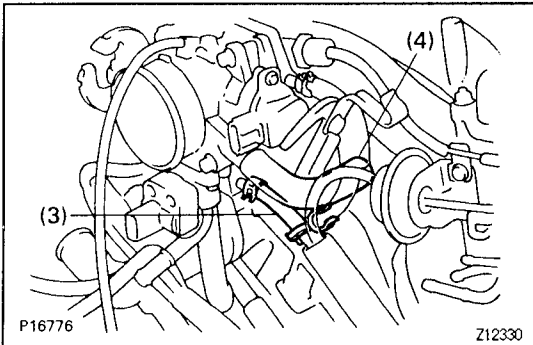
40 mm (1.77 in.)

Lower side

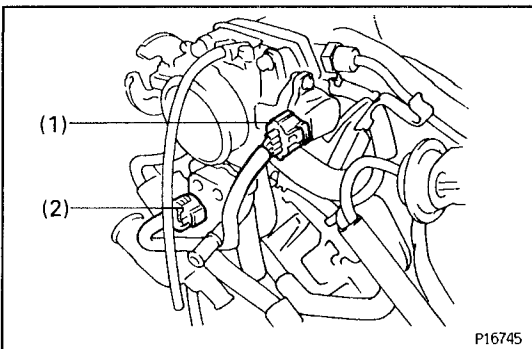
65 mm (2.17 in.)



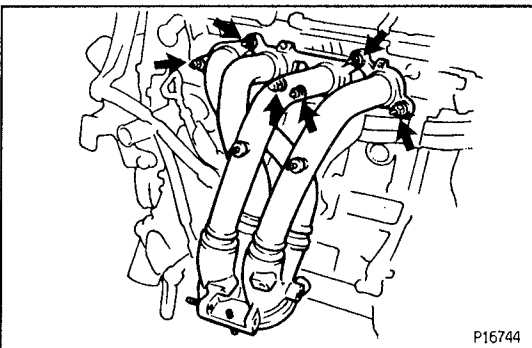
- (c) Connect the following hoses:
- (1) Vacuum hose (from upper port of BVSV) to throttle body
 - (2) Water bypass hose (from water bypass pipe) to throttle body



- (3) Water bypass hose (from water outlet) to throttle body
- (4) PCV hose to cylinder head cover

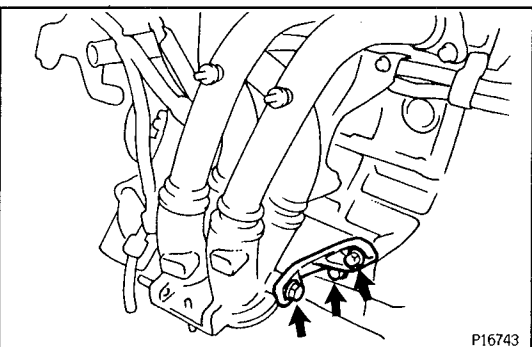


- (d) Connect the following connectors:
- (1) Throttle position sensor connector
 - (2) ISC valve connector

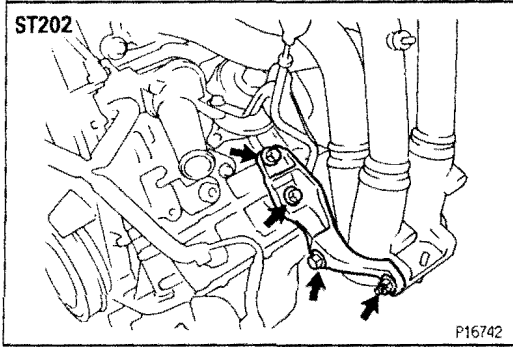


36. INSTALL EXHAUST MANIFOLD

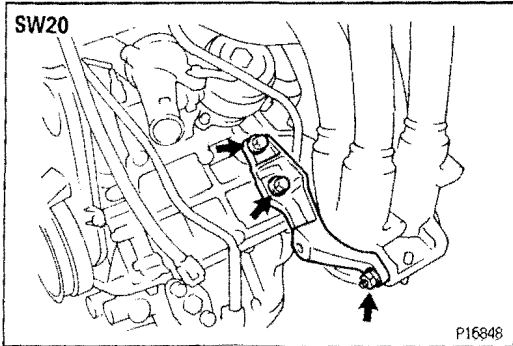
- (a) Install a new gasket and the exhaust manifold with the 6 nuts. Uniformly tighten the nuts in several passes.
Torque: 50 N·m (510 kgf·cm, 37 ft·lbf)



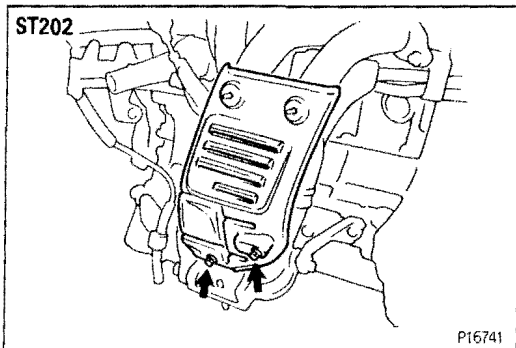
- (b) Install the LH exhaust manifold stay with the 3 bolts. Alternately tighten the bolts.
Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)



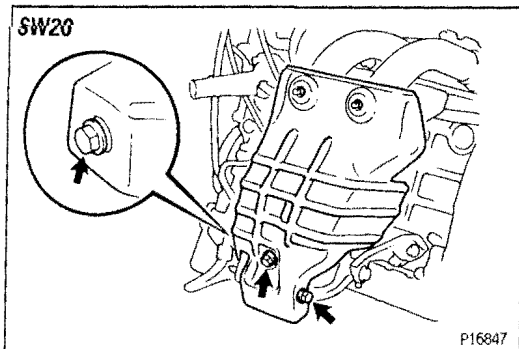
- (c) **ST202:**
Install the RH exhaust manifold stay with the 3 bolts and nut. Alternately tighten the bolts and nut.
Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)



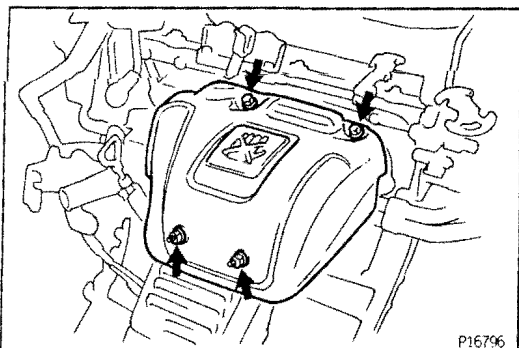
- (d) **SW20:**
Install the RH exhaust manifold stay with the 2 bolts and nut. Alternately tighten the bolts and nut.
Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)



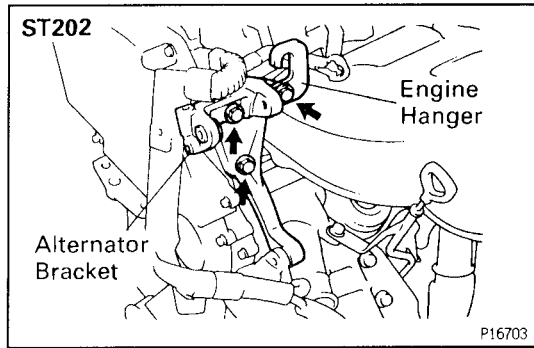
- (e) **ST202:**
Install the No.2 exhaust manifold heat insulator with the 2 bolts.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



- (f) **SW20:**
Install the No.2 exhaust manifold heat insulator with the 3 bolts.
Torque:
12 mm head
20 N·m (200 kgf·cm, 15 ft·lbf)
14 mm head
37 N·m (380 kgf·cm, 27 ft·lbf)



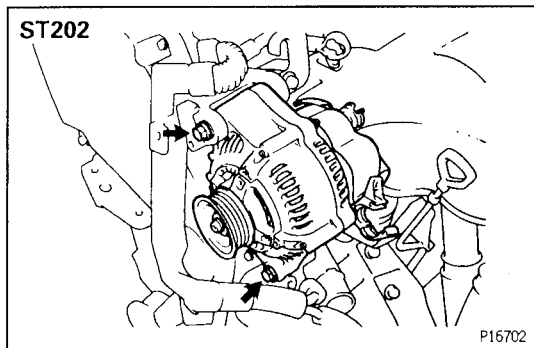
- (g) Install the No.1 exhaust manifold heat insulator with the 2 bolts and 2 nuts.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



37. ST202:
INSTALL ALTERNATOR BRACKET AND RH FRONT ENGINE HANGER

Install the alternator bracket and engine hanger with the 3 bolts.

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



38. ST202:
INSTALL ALTERNATOR

(a) Install the alternator with the 2 bolts.

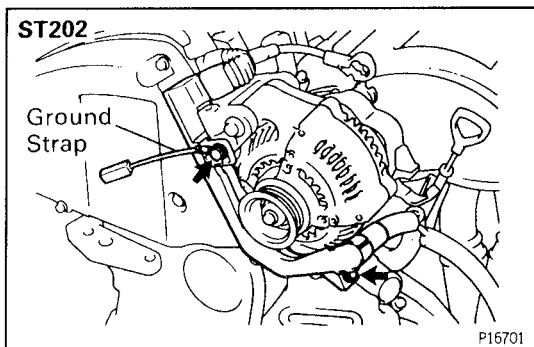
Torque:

12 mm head

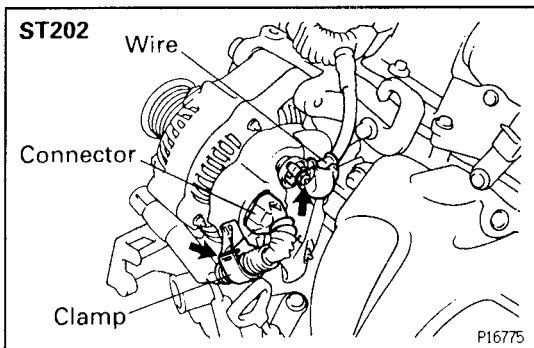
19 N·m (190 kgf·cm, 14 ft·lbf)

14 mm head

52 N·m (530 kgf·cm, 38 ft·lbf)



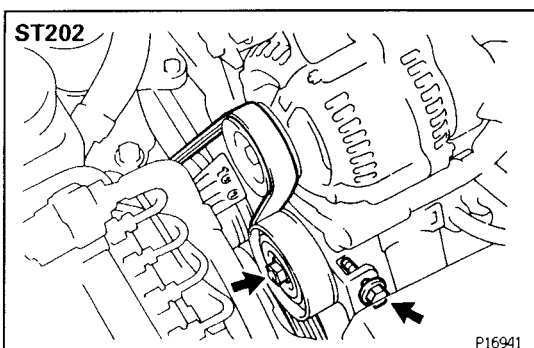
(b) Install the engine wire protector and ground strap with the 2 bolts.



(c) Connect the alternator connector.

(d) Connect the alternator wire with the nut and rubber cap.

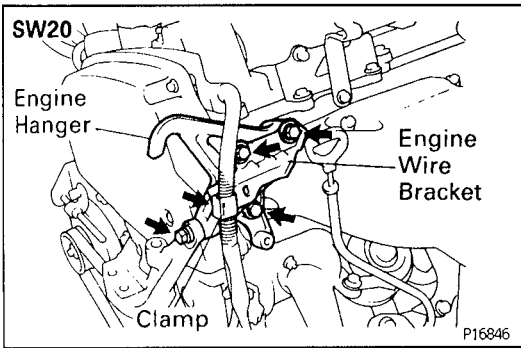
(e) Install the wire to the clamp on the rear end cover.



(f) Install the drive belt with the adjusting bolt.

(g) Tighten the pulley nut.

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



39. SW20: INSTALL RH FRONT ENGINE HANGER AND ENGINE WIRE BRACKET

- (a) Install the engine hanger and wire bracket with the 4 bolts. Alternately tighten the bolts.

Torque:

Cylinder head side

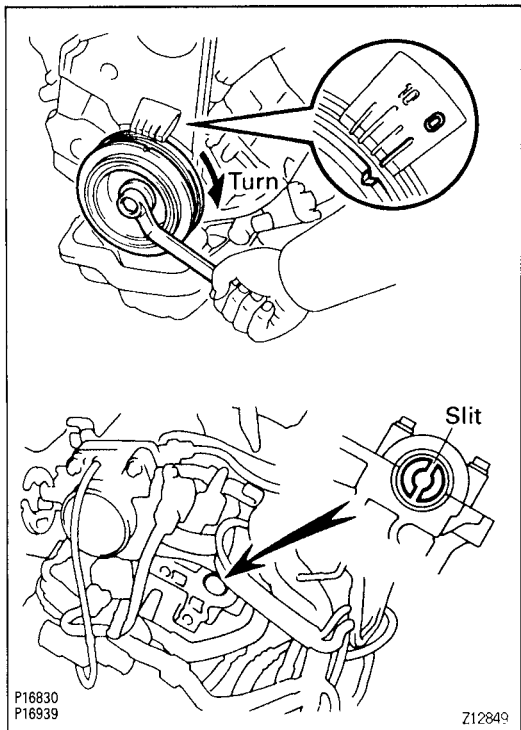
39 N·m (400 kgf·cm, 29 ft·lbf)

RH engine mounting bracket side

60 N·m (620 kgf·cm, 45 ft·lbf)

- (b) Install the engine wire to the clamp on the wire bracket.

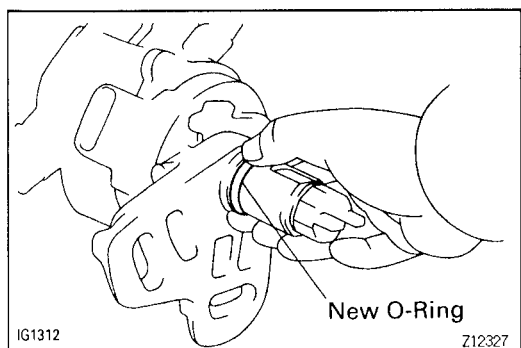
EG

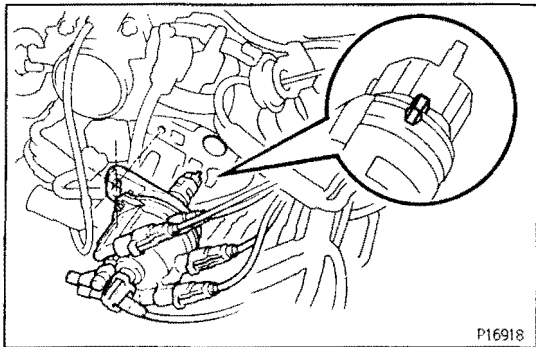


40. INSTALL DISTRIBUTOR

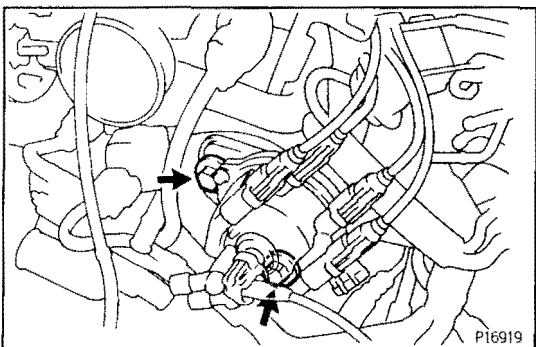
- (a) Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the illustration.

- (b) Install a new O-ring to the distributor housing.
(c) Apply a light coat of engine oil on the O-ring.

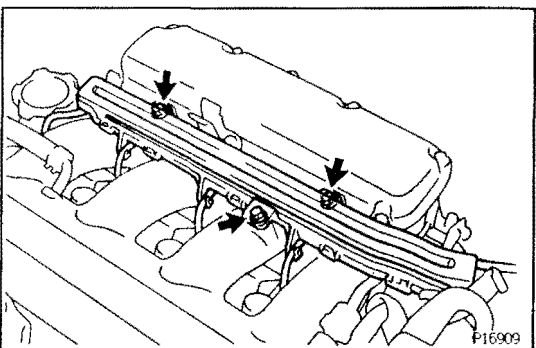




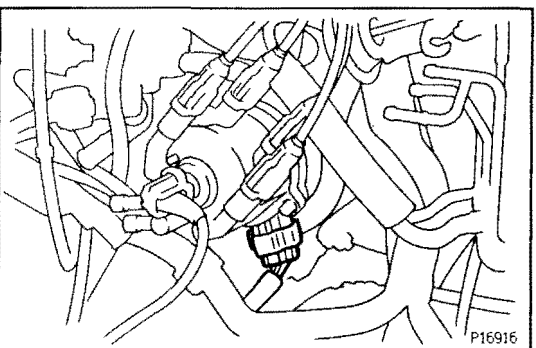
- (d) Align the cutout portion of the coupling with the groove of the housing.
- (e) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.



- (f) Lightly tighten the 2 bolts.



- (g) Connect the 4 high-tension cords to the spark plugs.
- (h) Install the high-tension cord clamp with the 3 bolts.

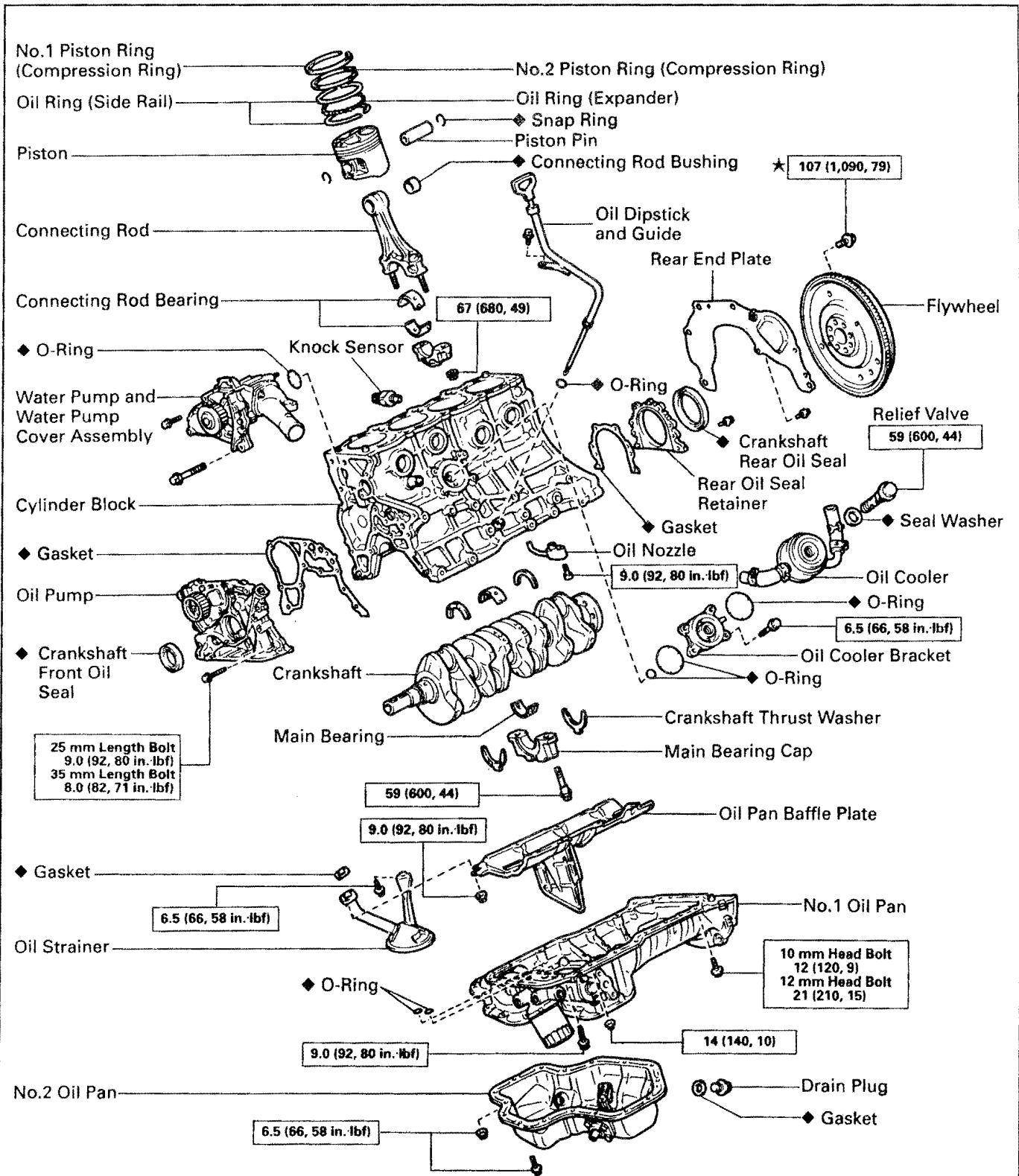


- (i) Connect the distributor connector.

- 41. FILL WITH ENGINE COOLANT**
- 42. START ENGINE AND CHECK FOR LEAKS**
- 43. PERFORM ENGINE ADJUSTMENT**
(See pages EG-12 to 41)
- 44. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL**

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY (SW20)

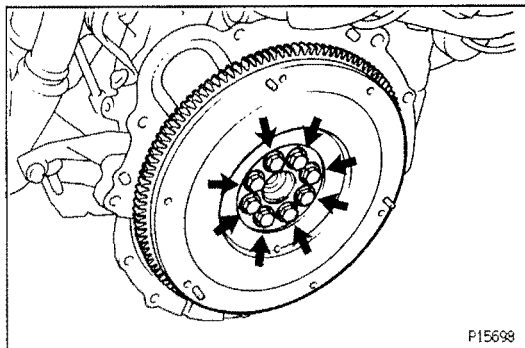
EG



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

◆ Non-reusable part

★ Precoated part

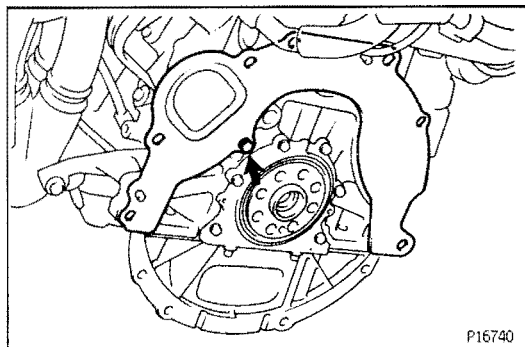


PREPARATION FOR DISASSEMBLY

(See Components for Disassembly and Assembly)

1. REMOVE FLYWHEEL

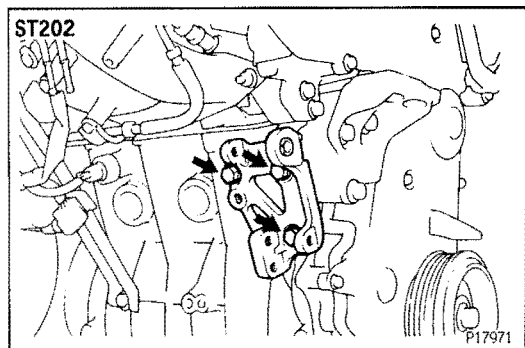
Remove the 8 bolts and flywheel.



2. REMOVE REAR END PLATE

Remove the bolt and end plate.

3. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY



4. ST202:

REMOVE PS PUMP BRACKET

Remove the 3 bolts and PS pump bracket.

5. REMOVE TIMING BELT AND PULLEYS

(See pages EG-49 to 55)

6. REMOVE CYLINDER HEAD

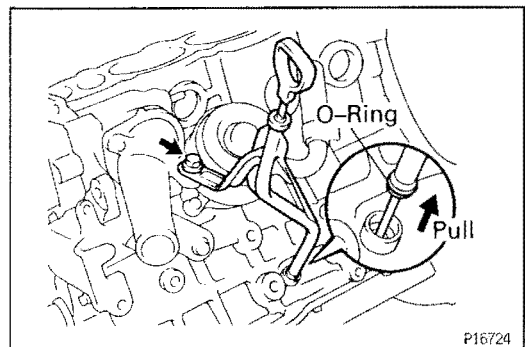
(See pages EG-72 to 88)

7. REMOVE OIL PANS AND OIL PUMP

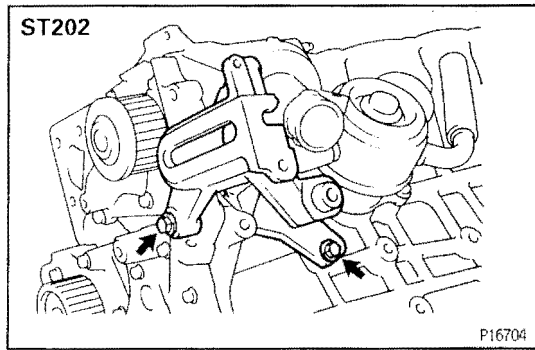
(See pages EG-386 and 388)

8. REMOVE OIL DIPSTICK AND GUIDE

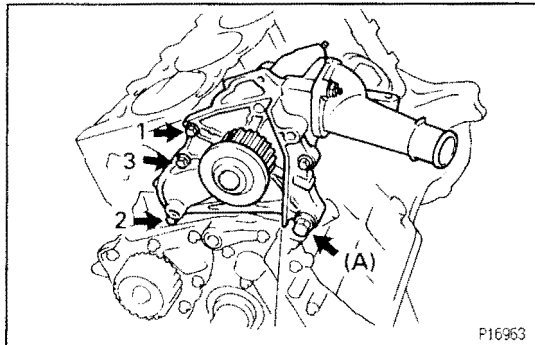
- (a) Remove the bolt.
- (b) Pull out the oil dipstick guide, and remove it and the oil dipstick.
- (c) Remove the O-ring from the oil dipstick guide.



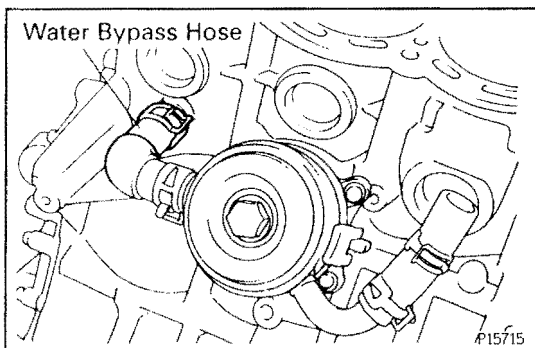
EG



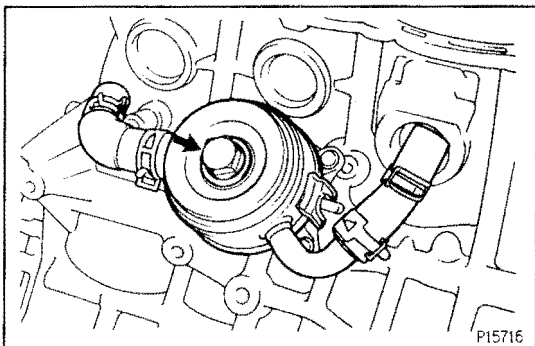
9. **ST202:**
REMOVE IDLER PULLEY BRACKET FOR ALTERNATOR DRIVE BELT
 Remove the 2 bolts and idler pulley bracket.



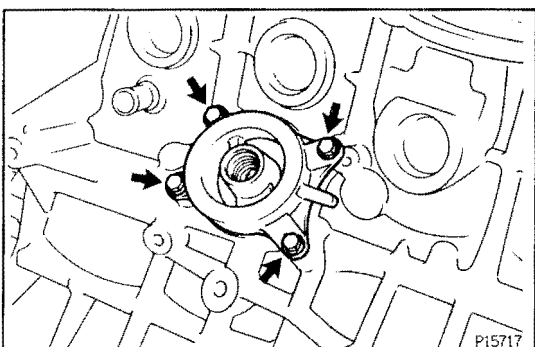
10. **REMOVE WATER PUMP AND WATER PUMP COVER ASSEMBLY**
- SW20 w/o A/C:
Remove the bolt (A).
 - Loosen and remove the 3 bolts in the sequence shown, and remove the water pump and water pump cover assembly.
 - Remove the O-ring from the water pump cover.



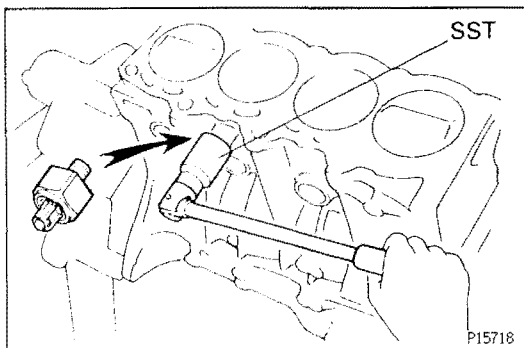
11. **REMOVE OIL COOLER**
- Disconnect the water bypass hose from the cylinder block.



- Remove the relief valve, seal washer and oil cooler.
- Remove the O-ring from the oil cooler.

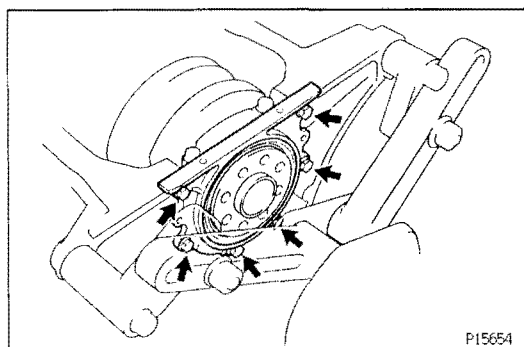


12. **REMOVE OIL COOLER BRACKET**
- Remove the 4 bolts and oil cooler bracket.
 - Remove the 2 O-rings from the oil cooler bracket.



13. REMOVE KNOCK SENSOR

Using SST, remove the knock sensor.
SST 09816–30010



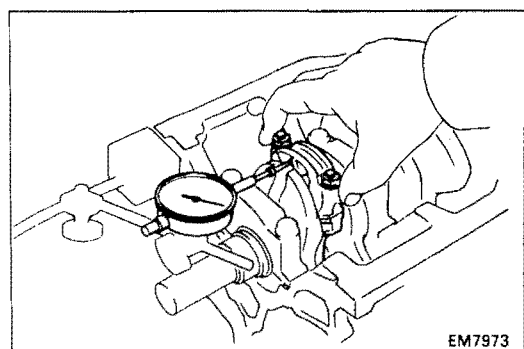
CYLINDER BLOCK DISASSEMBLY

EG42J-01

(See Components for Disassembly and Assembly)

1. REMOVE REAR OIL SEAL RETAINER

Remove the 6 bolts, retainer and gasket.



2. CHECK CONNECTING ROD THRUST CLEARANCE

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

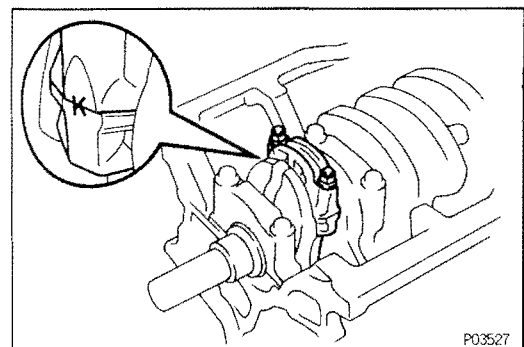
Standard thrust clearance:

0.160 – 0.312 mm (0.0063 – 0.0123 in.)

Maximum thrust clearance:

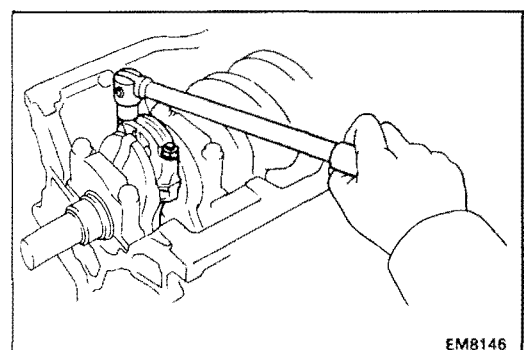
0.35 mm (0.0138 in.)

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

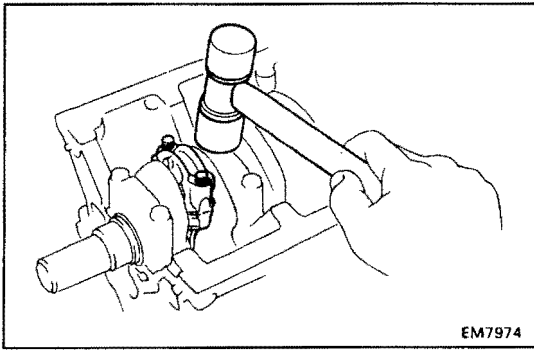


3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

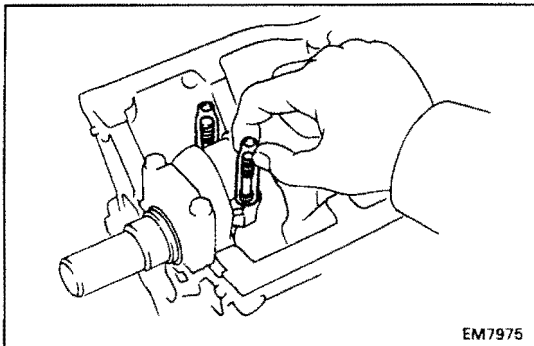
(a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.



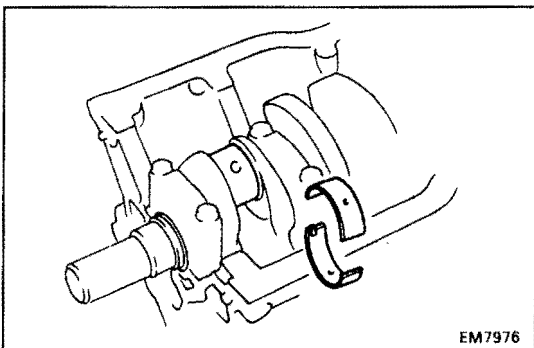
(b) Remove the 2 connecting rod cap nuts.



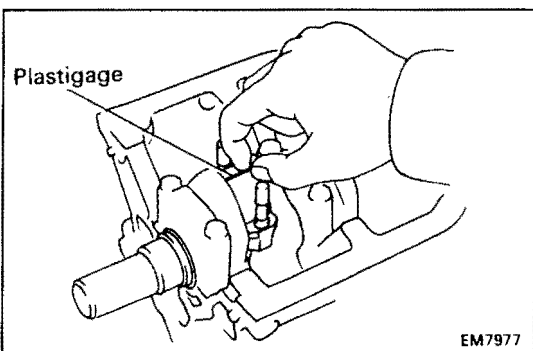
- (c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap. **HINT:** Keep the lower bearing inserted with the connecting rod cap.



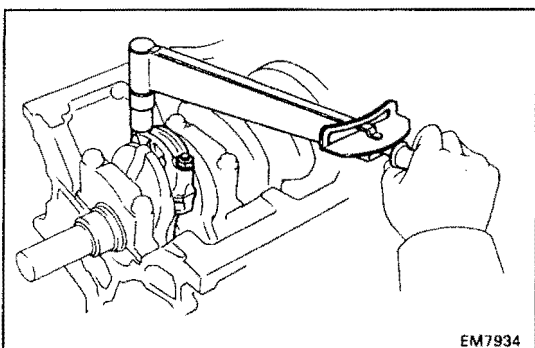
- (d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



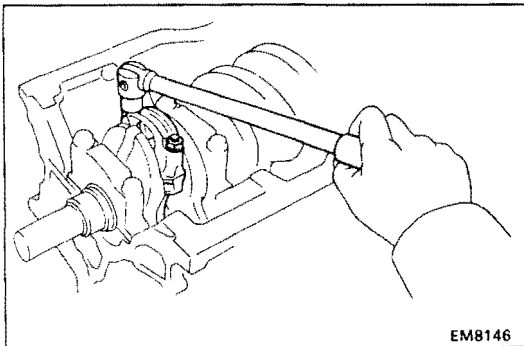
- (e) Clean the crank pin and bearing.
 (f) Check the crank pin and bearing for pitting and scratches.
 If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



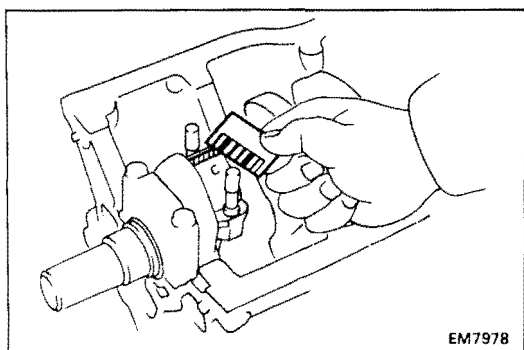
- (g) Lay a strip of Plastigage across the crank pin.



- (h) Install the connecting rod cap.
 (See step 7 on page EG – 153)
Torque: 67 N·m (680 kgf·cm, 49 ft·lbf)
NOTICE: Do not turn the crankshaft.



- (i) Remove the connecting rod cap.
(See procedure (b) and (c) above)



- (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 "1", "2" and "3" accordingly.

Standard sized bearing center wall thickness:

Mark "1"

1.484 — 1.488 mm (0.0584 — 0.0586 in.)

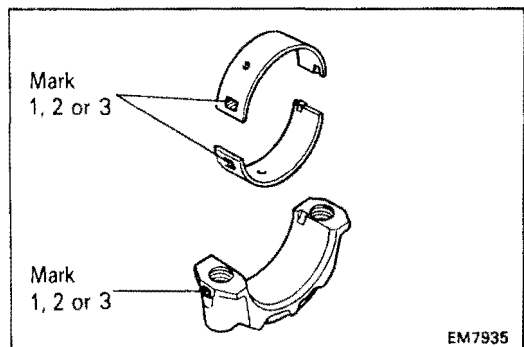
Mark "2"

1.488 — 1.492 mm (0.0586 — 0.0587 in.)

Mark "3"

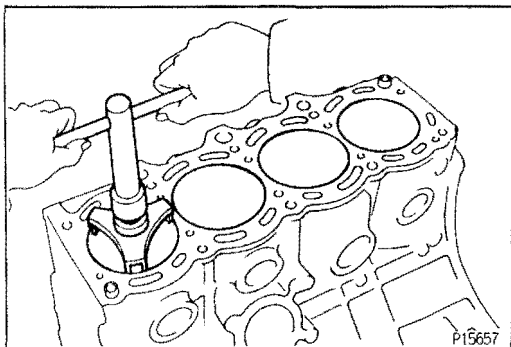
1.492 — 1.496 mm (0.0587 — 0.0589 in.)

- (k) Completely remove the Plastigage.

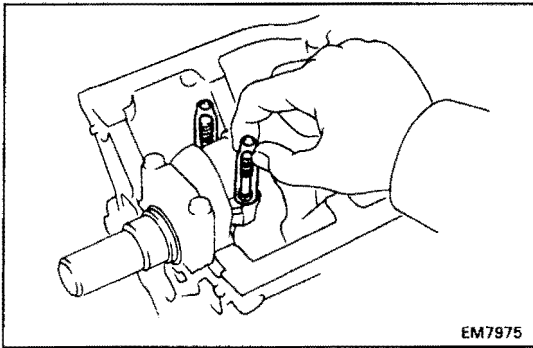


4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

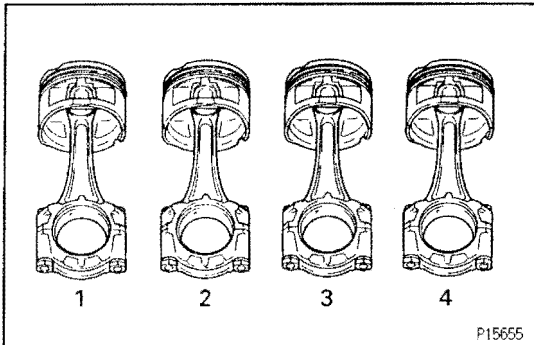
- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.



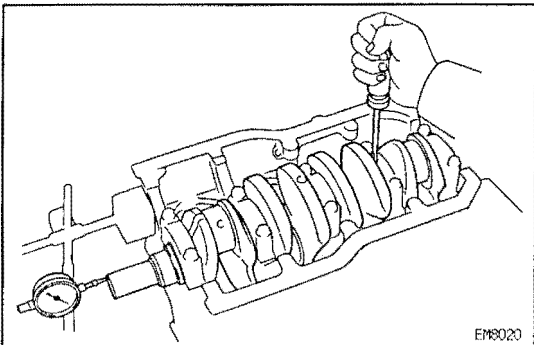
EG



- (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 the correct order.

**5. 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.)

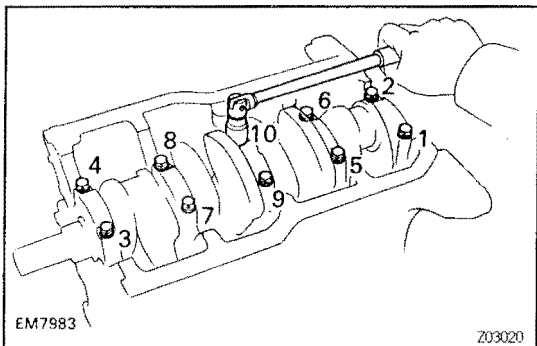
If the thrust clearance is greater than maximum, replace the thrust washer as a set.

Thrust washer thickness:

2.440 – 2.490 mm (0.0961 – 0.0980 in.)

6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

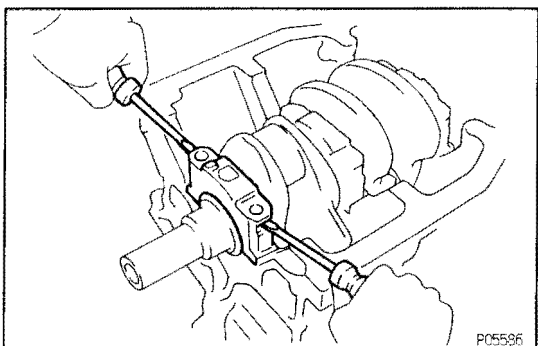
- (a) Uniformly loosen and remove the 10 main bearing cap bolts in several passes, in the sequence shown.

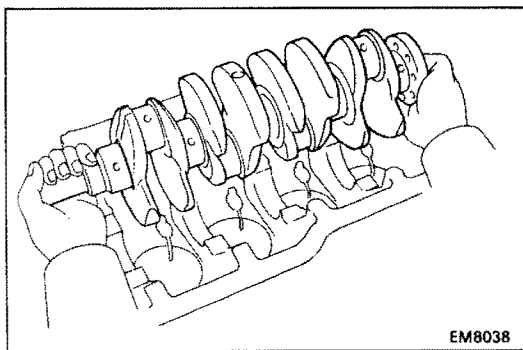


- (b) Using 2 screwdrivers, pry out the main bearing cap, and remove the 5 main bearing caps, 5 lower bearings and 2 lower thrust washers (No.3 main bearing cap only).

HINT:

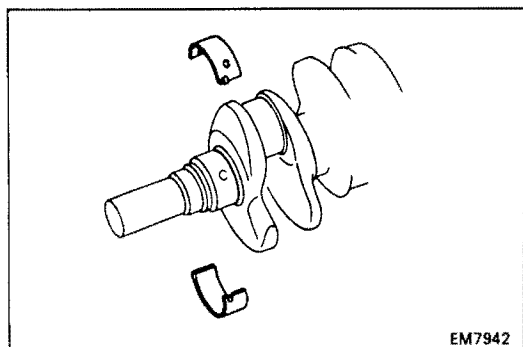
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in the correct order.



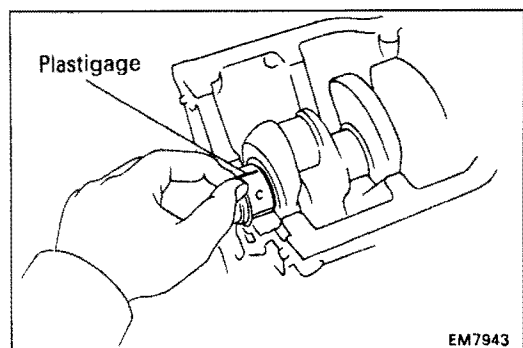


- (c) Lift out the crankshaft.
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.

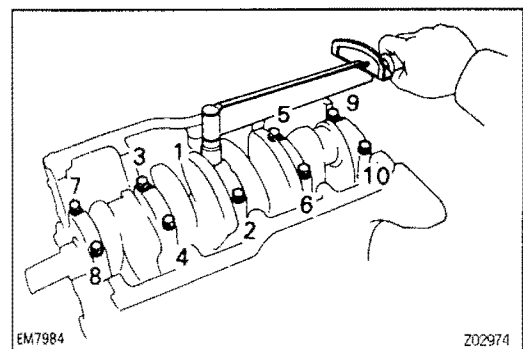
EG



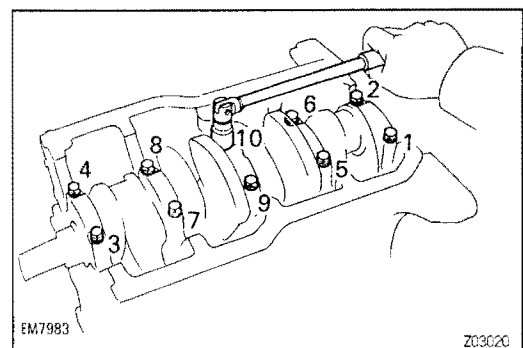
- (d) Clean each main journal and bearing.
 (e) Check each main journal and bearing for pitting and scratches.
 If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



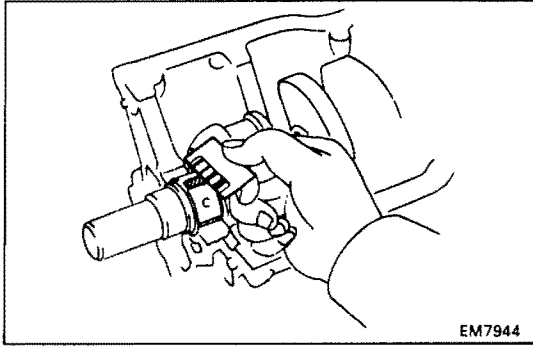
- (f) Place the crankshaft on the cylinder block.
 (g) Lay a strip of Plastigage across each journal.



- (h) Install the main bearing caps.
 (See step 5 on page EG-152)
Torque: 59 N·m (600 kgf·cm, 44 ft·lbf)
NOTICE: Do not turn the crankshaft.



- (i) Remove the main bearing caps.
 (See procedure (a) and (b) above)



EG

(j) Measure the Plastigage at its widest point.

Standard clearance:

No.3

STD

0.028 – 0.047 mm (0.0011 – 0.0019 in.)

U/S 0.25

0.027 – 0.067 mm (0.0011 – 0.0026 in.)

Others

STD

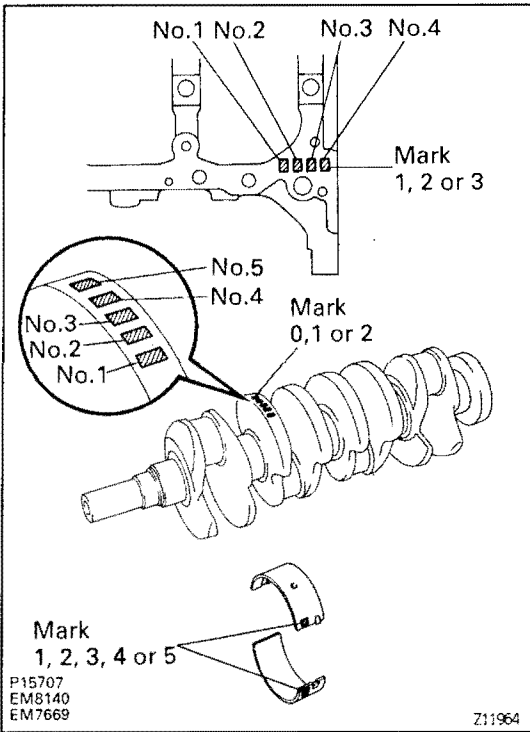
0.018 – 0.037 mm (0.0007 – 0.0015 in.)

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

0.030 – 0.057 mm (0.0012 – 0.0022 in.)

Others

0.020 – 0.047 mm (0.0008 – 0.0019 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									
	1			2			3			
Cylinder block										
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 "1"
= Total number 3 (Use bearing "3")

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

59.020 — 59.026 mm (2.3236 — 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"**

54.995 — 55.000 mm (2.1652 — 2.1654 in.)

Mark "1"

54.990 — 54.995 mm (2.1650 — 2.1652 in.)

Mark "2"

54.985 — 54.990 mm (2.1648 — 2.1650 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.)

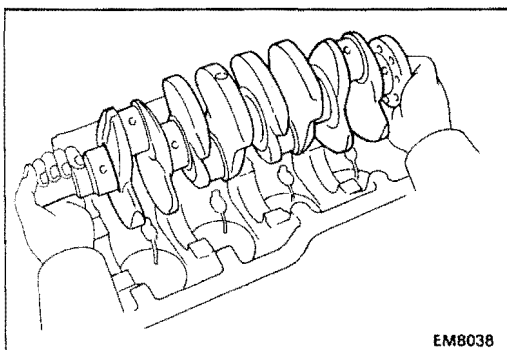
Mark "5"

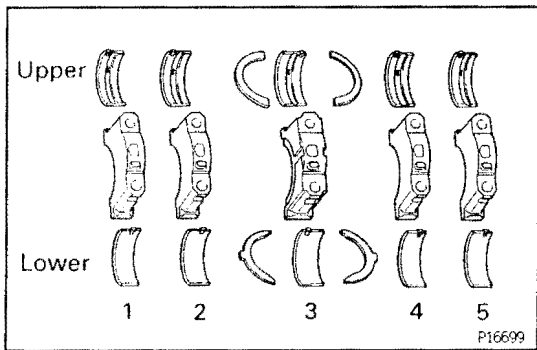
2.009 — 2.012 mm (0.0791 — 0.0792 in.)

- (k) Completely remove the Plastigage.

7. REMOVE CRANKSHAFT

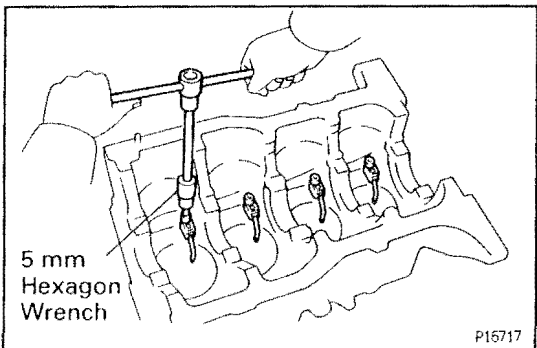
- (a) Lift out the crankshaft.
 (b) Remove the 5 upper bearings and 2 upper thrust washers from the cylinder block.





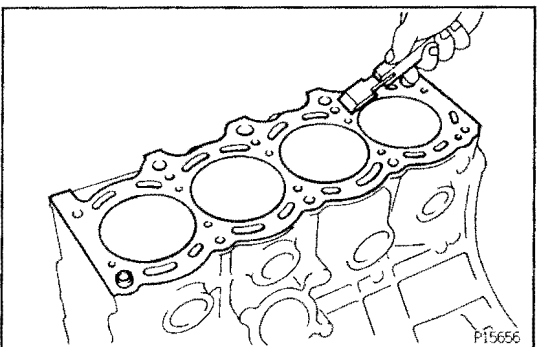
HINT: Arrange the main bearing caps, bearings and thrust washers in the correct order.

EG



8. REMOVE OIL NOZZLES

Using a 5 mm hexagon wrench, remove the bolt and oil nozzle. Remove the 4 oil nozzles.



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.

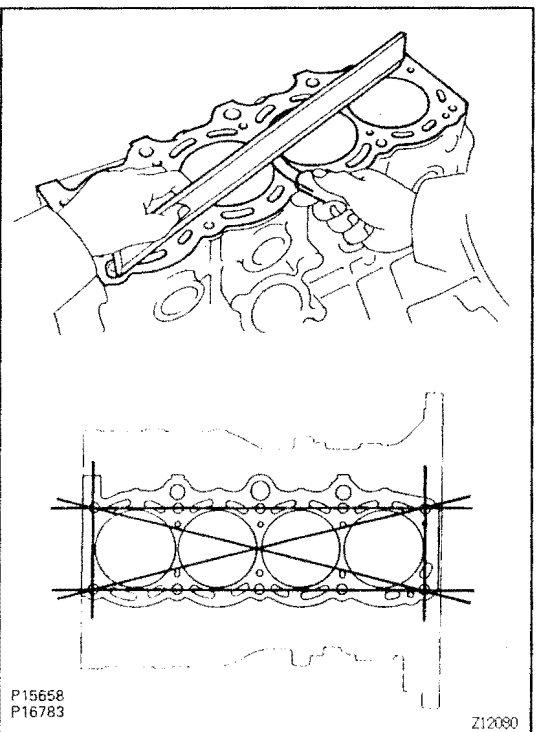
2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

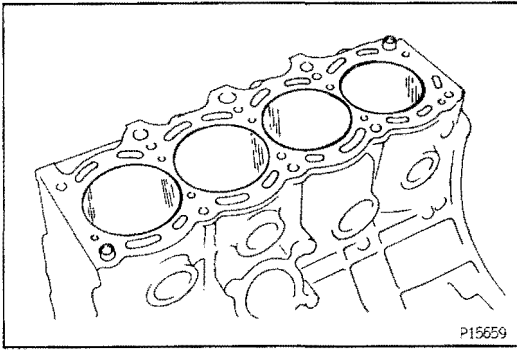
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head gasket for warpage.

Maximum warpage:

0.05 mm (0.0020 in.)

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

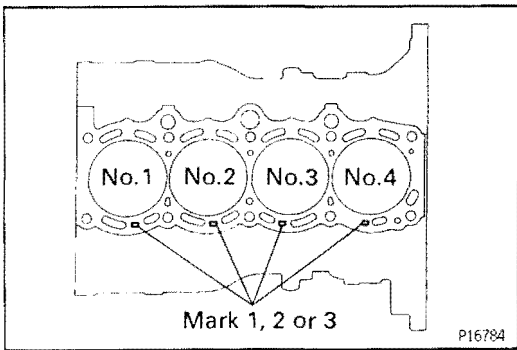




3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

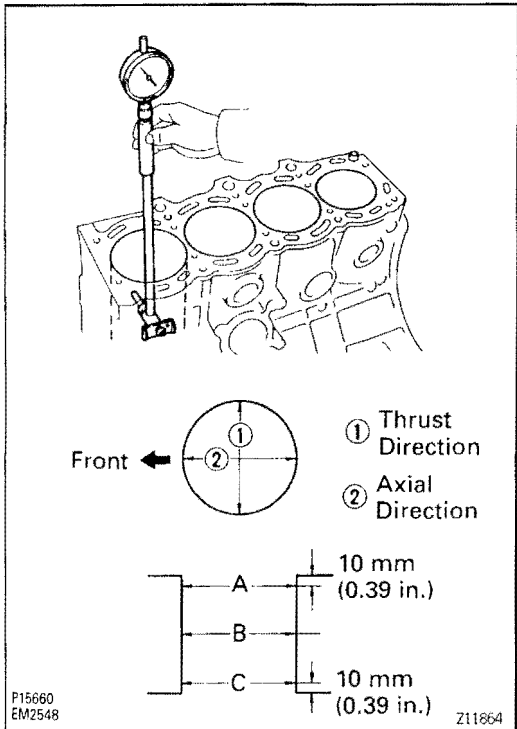
Visually check the cylinder for vertical scratches.
If deep scratches are present, replace the cylinder block.

EG



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:

Mark "1"

86.000 – 86.010 mm (3.3858 – 3.3862 in.)

Mark "2"

86.010 – 86.020 mm (3.3862 – 3.3866 in.)

Mark "3"

86.020 – 86.030 mm (3.3866 – 3.3870 in.)

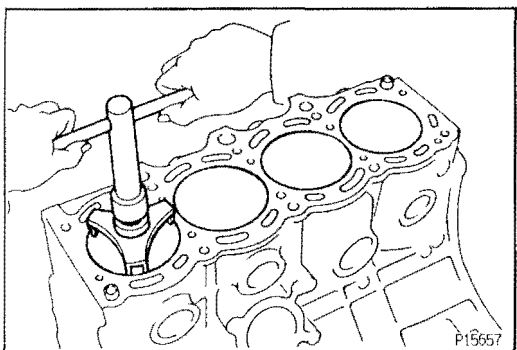
Maximum diameter:

86.23 mm (3.3949 in.)

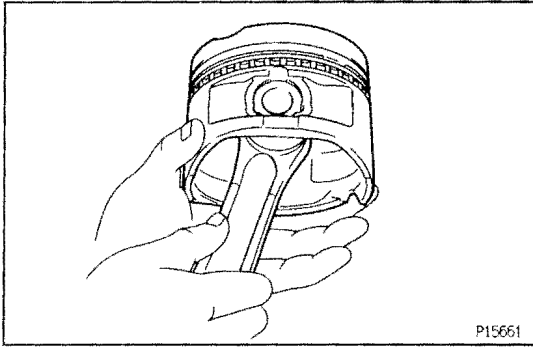
If the diameter is greater than maximum, replace the cylinder block.

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.

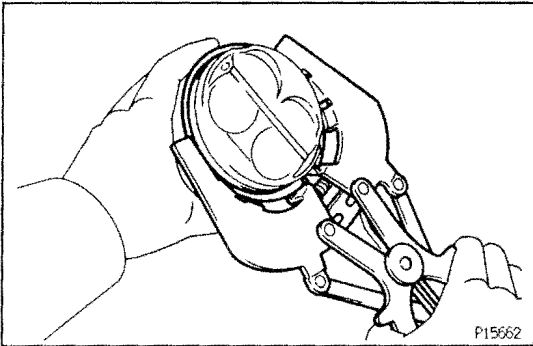


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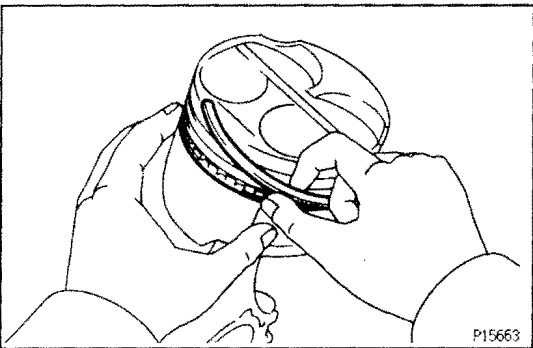


PISTON AND CONNECTING ROD DISASSEMBLY

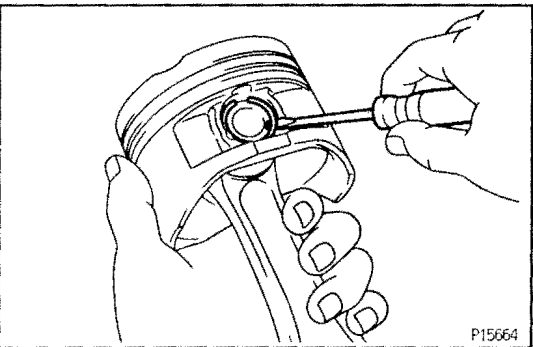
1. **CHECK FIT BETWEEN PISTON AND PISTON PIN**
Try to move the piston back and forth on the piston pin.
If any movement is felt, replace the piston and pin as a set.



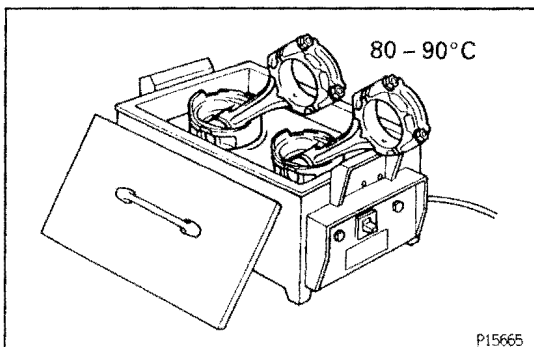
2. **REMOVE PISTON RINGS**
 - (a) Using a piston ring expander, remove the 2 compression rings.



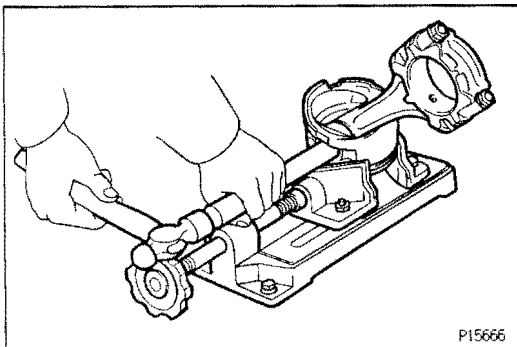
- (b) Remove the 2 side rails and oil ring expander by hand.
HINT: Arrange the piston rings in correct order only.



3. **DISCONNECT CONNECTING ROD FROM PISTON**
 - (a) Using a small screwdriver, pry out the 2 snap rings.

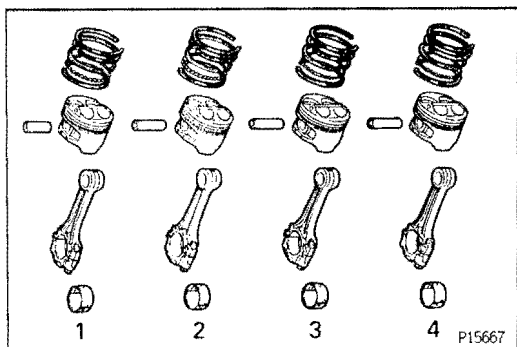


- (b) Gradually heat the piston to 80 – 90°C (176 – 194°F).

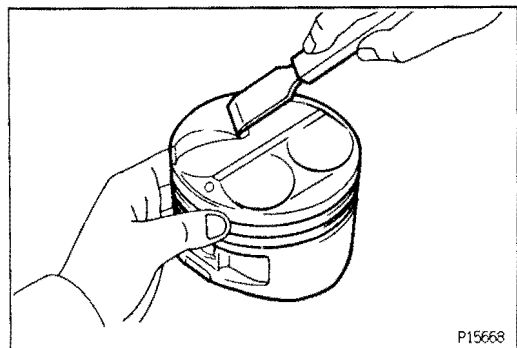


- (c) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

EG

**HINT:**

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

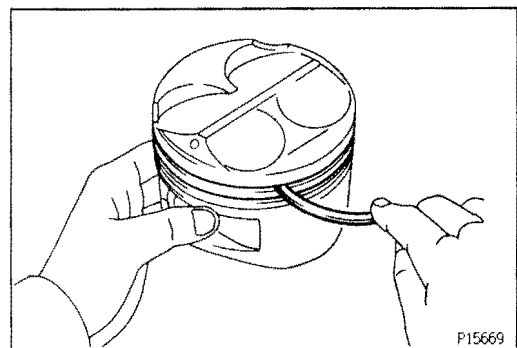


PISTON AND CONNECTING ROD INSPECTION

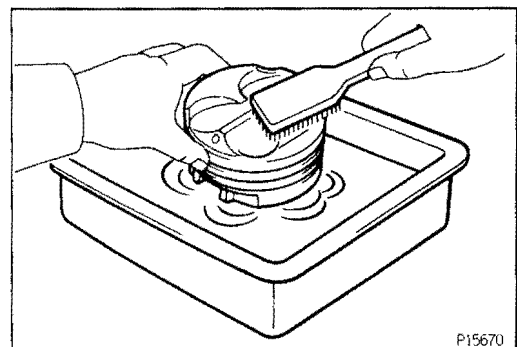
E042K-01

1. CLEAN PISTON

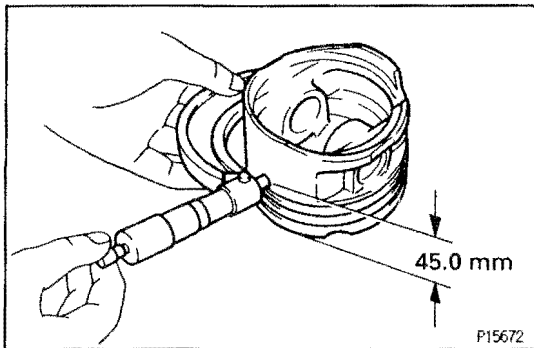
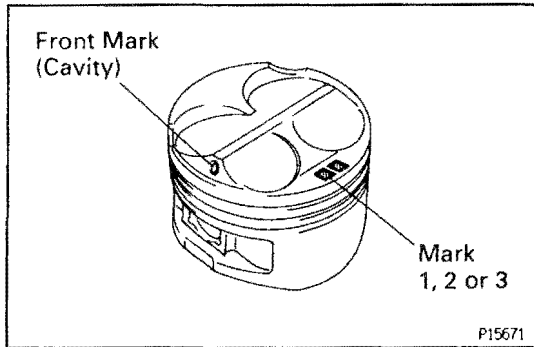
- (a) Using a gasket scraper, remove the carbon from the piston top.



- (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 right angles to the piston pin center line, 45.0 mm (1.772 in.) from the piston head.

Piston diameter:

Mark "1"

85.970 – 85.980 mm (3.3846 – 3.3850 in.)

Mark "2"

85.980 – 85.990 mm (3.3850 – 3.3854 in.)

Mark "3"

85.990 – 86.000 mm (3.3854 – 3.3858 in.)

- (b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EG-139)
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

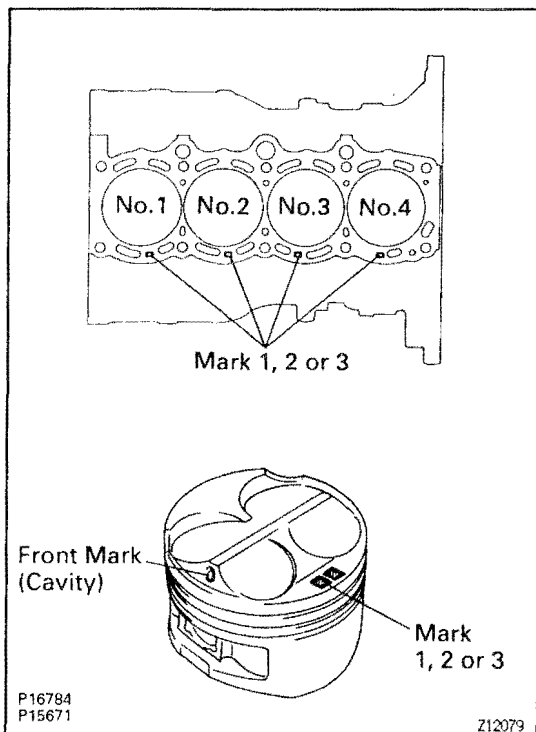
0.020 – 0.040 mm (0.0008 – 0.0016 in.)

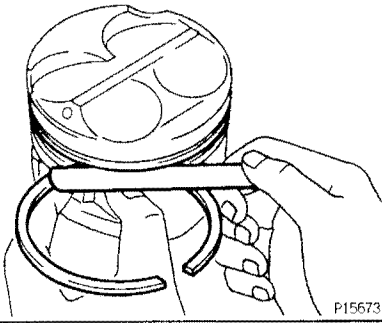
Maximum oil clearance:

0.06 mm (0.0024 in.)

If the oil clearance is greater than maximum, replace all the 4 pistons. 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.





P15673

B. Inspect piston ring groove clearance

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

Ring groove clearance:

No.1

0.040 — 0.080 mm (0.0016 — 0.0031 in.)

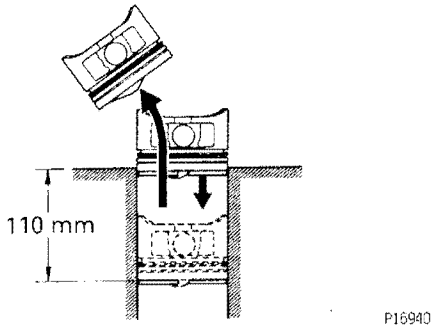
No.2

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

- (a) Insert the piston ring into the cylinder bore.
- (b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.



P16940

- (c) Using a feeler gauge, measure the end gap.

Standard end gap:

No.1

0.330 — 0.550 mm (0.0130 — 0.0217 in.)

No.2

0.450 — 0.670 mm (0.0177 — 0.0264 in.)

Oil (Side rail)

0.150 — 0.500 mm (0.0059 — 0.0197 in.)

Maximum end gap:

No.1

0.85 mm (0.0335 in.)

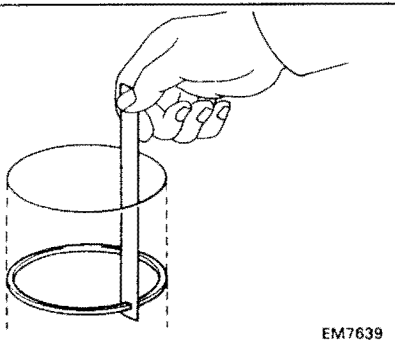
No.2

0.97 mm (0.0382 in.)

Oil (Side rail)

0.80 mm (0.0315 in.)

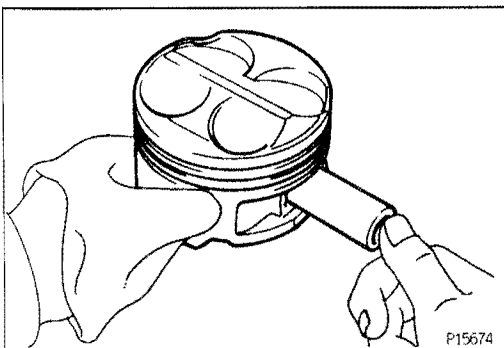
If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.



EM7639

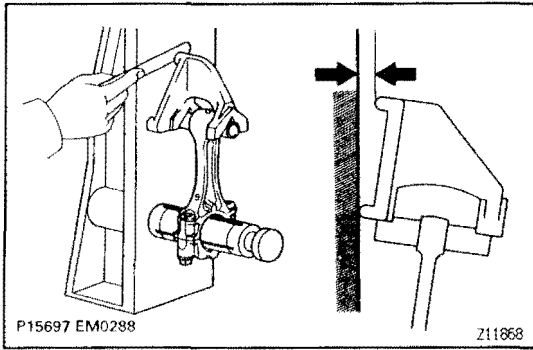
D. Inspect piston pin fit

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



P15674

EG



3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

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

- Check for bend.

Maximum bend:

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

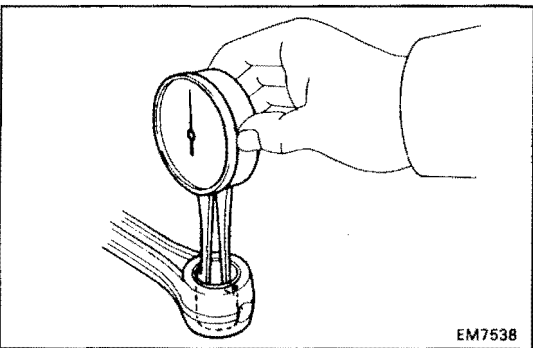
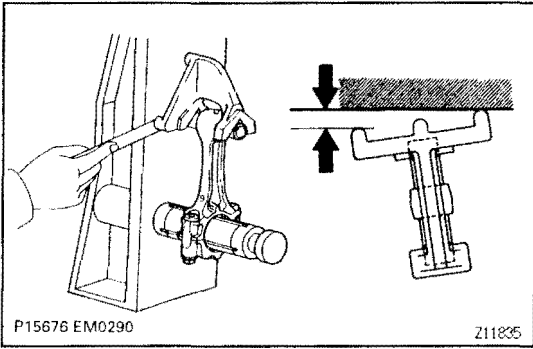
If bend is greater than maximum, replace the connecting rod assembly.

- 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.

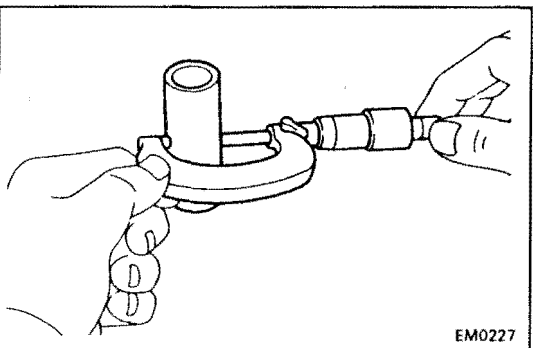


B. Inspect piston pin oil clearance

- (a) 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.)



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

Piston pin diameter:

21.997 – 22.009 mm (0.8660 – 0.8665 in.)

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

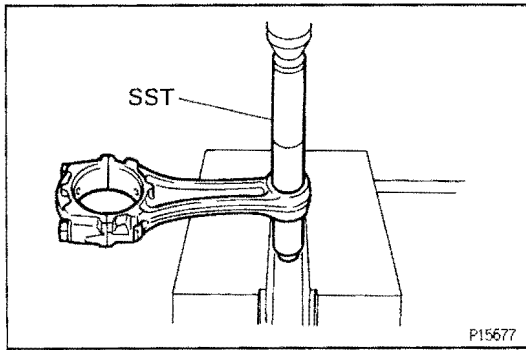
Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance:

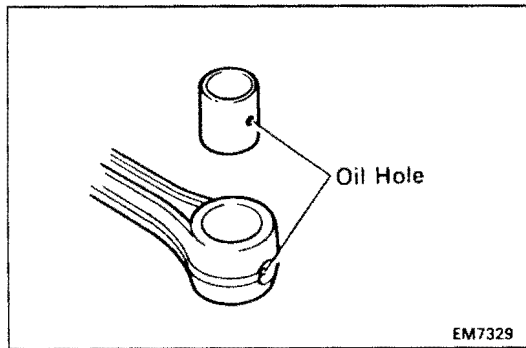
0.05 mm (0.0020 in.)

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



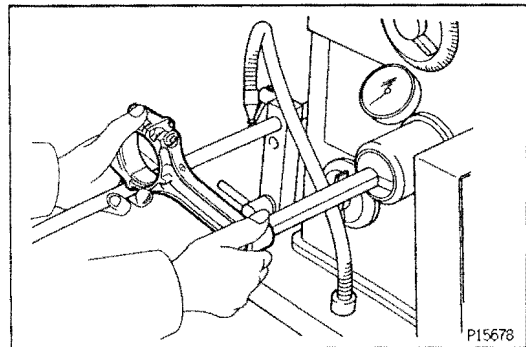
C. If necessary, replace connecting rod bushing

- (a) Using SST and a press, press out the bushing.
SST 09222-30010

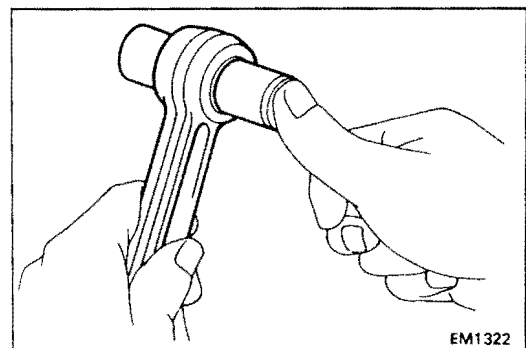


- (b) Align the oil holes of a new bushing and the connecting rod.

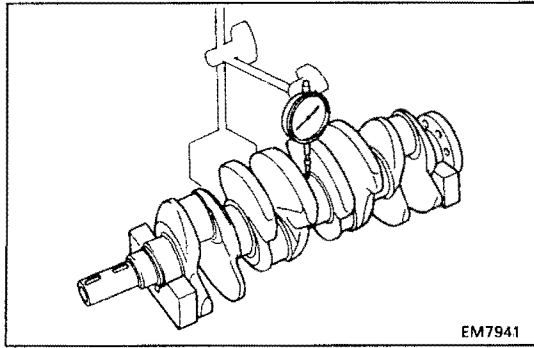
- (c) Using SST and a press, press in the bushing.
SST 09222-30010



- (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.



CRANKSHAFT INSPECTION AND REPAIR

1. INSPECT CRANKSHAFT FOR CIRCLE 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

54.985 — 55.000 mm (2.1648 — 2.1654 in.)

U/S 0.25

54.745 — 54.755 mm (2.1553 — 2.1557 in.)

Crank pin diameter:

STD

47.985 — 48.000 mm (1.8892 — 1.8898 in.)

U/S 0.25

47.745 — 47.755 mm (1.8797 — 1.8801 in.)

If the diameter is not as specified, check the oil clearance (See steps 3 and 6 on pages EG-131 to 134). 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:

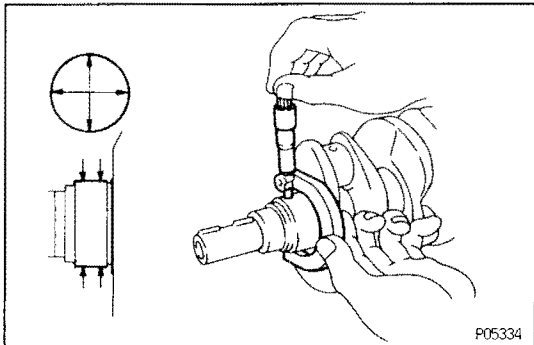
0.02 mm (0.0008 in.)

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 EG000-07

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

EG

1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

(a) Using a 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 body 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.

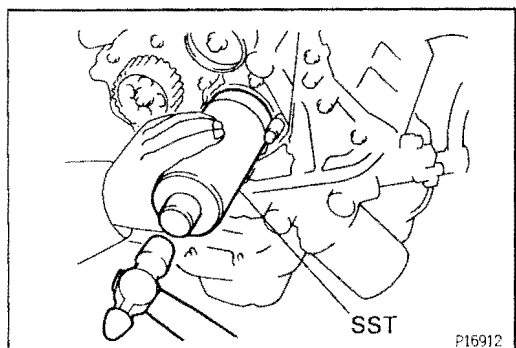
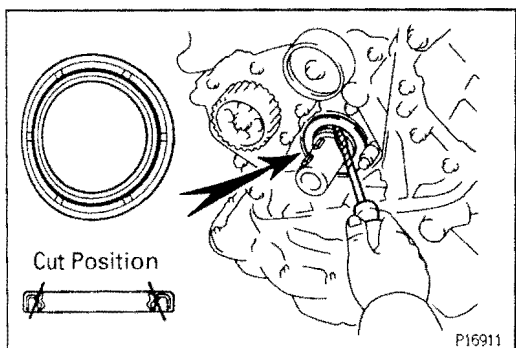
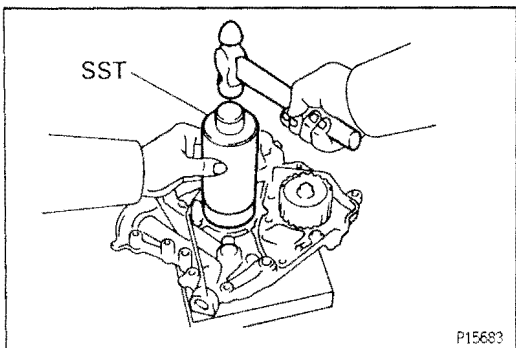
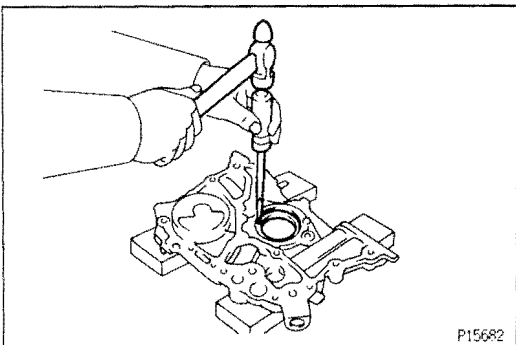
(b) Using a screwdriver, pry out the oil seal.

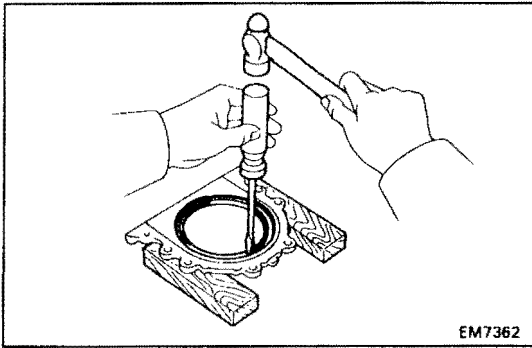
NOTICE: Be careful not to damage the crankshaft. Tap the screwdriver tip.

(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 body edge.

SST 09226-10010

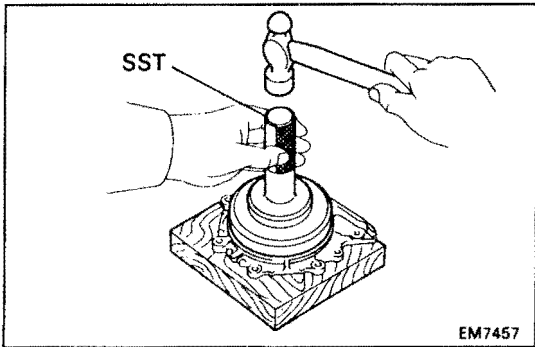




2. REPLACE CRANKSHAFT REAR OIL SEAL

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

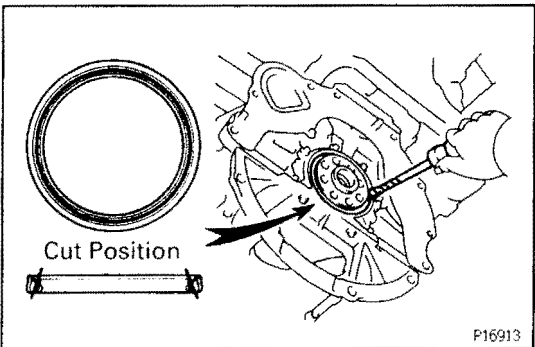
(a) Using a screwdriver and hammer, tap out the oil seal.



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

SST 09223-63010

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

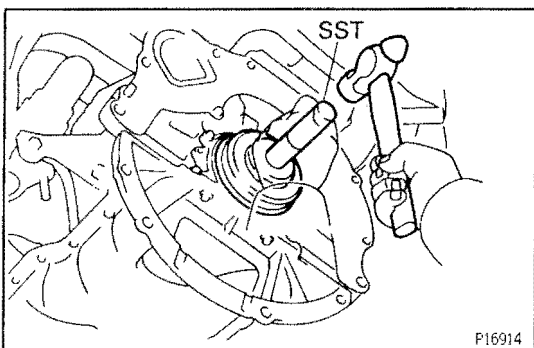


B. If rear oil seal retainer is installed to cylinder block:

(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. Tap 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) Using a small screwdriver, install a new snap ring on one side of the piston pin hole.

EG

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

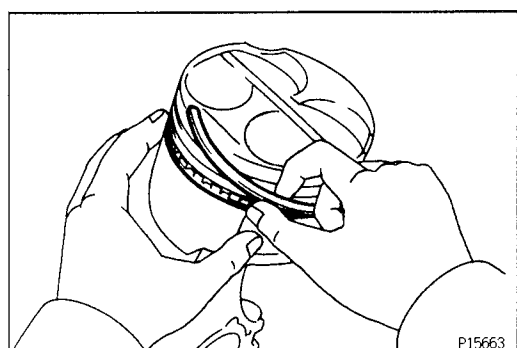
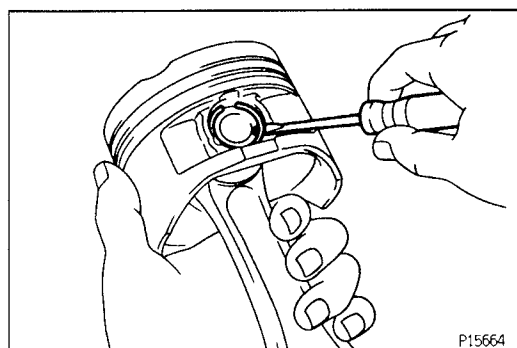
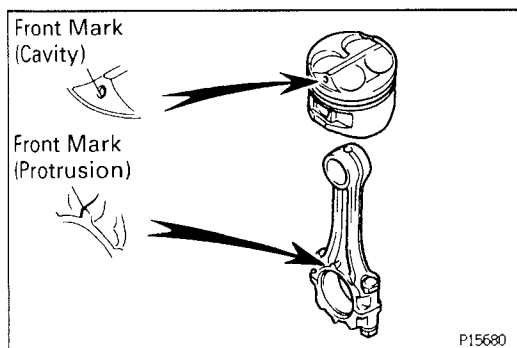
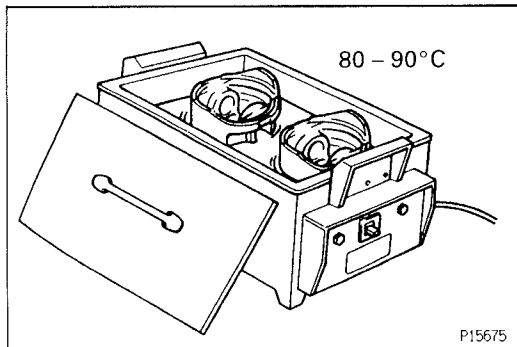
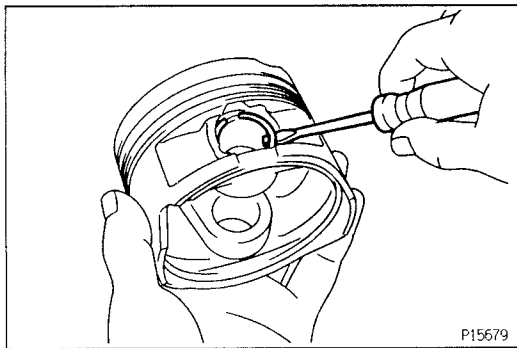
- (c) Coat the piston pin with engine oil.

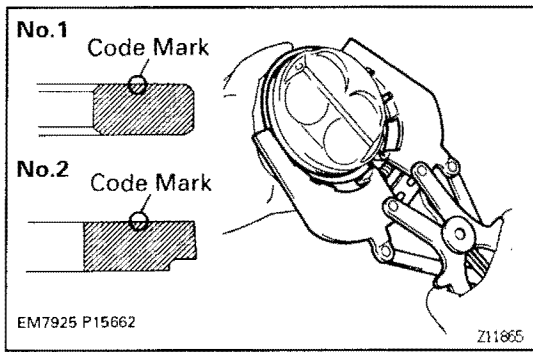
- (d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

- (e) Using a small screwdriver, 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.

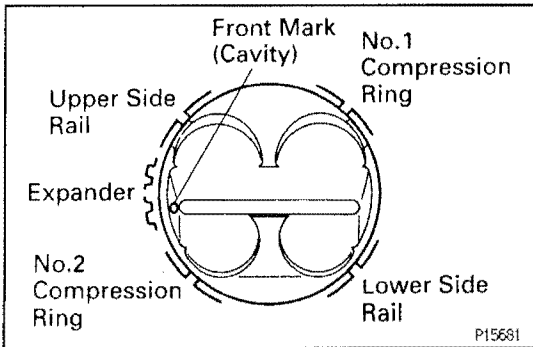




- (b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

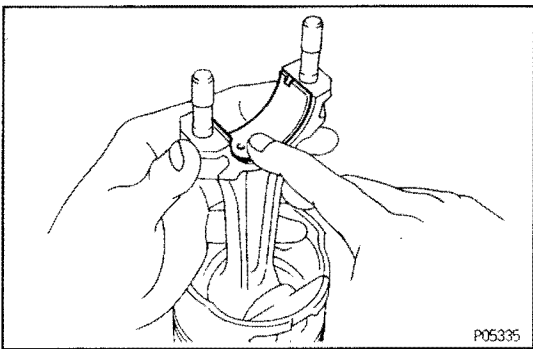
Code mark:

R



- (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 Disassembly and Assembly)

HINT:

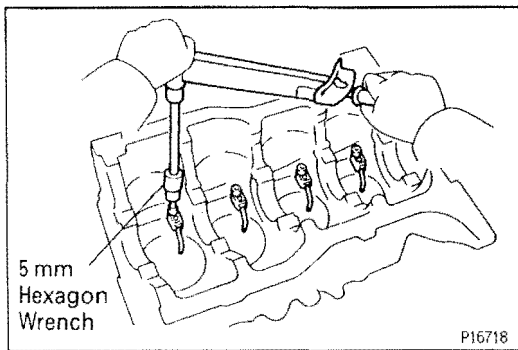
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

EG

1. INSTALL OIL NOZZLES

Using a 5 mm hexagon wrench, install the oil nozzle with the bolt. Install the 4 oil nozzles.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

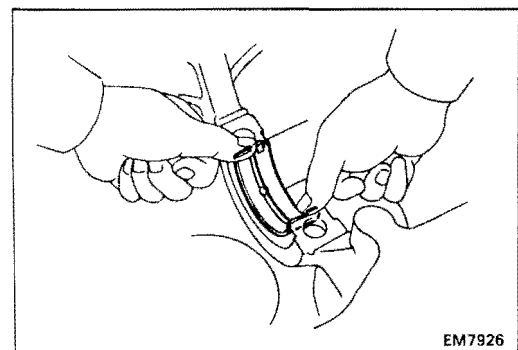
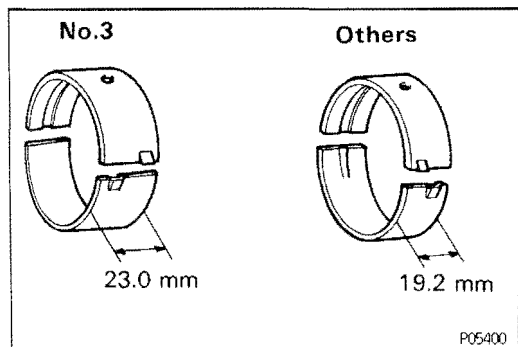


2. INSTALL MAIN BEARINGS

HINT:

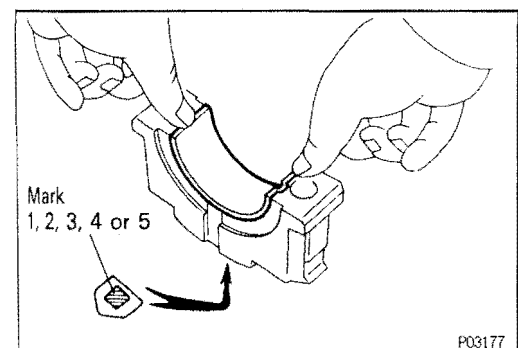
- Main bearings come in widths of 19.2 mm (0.756 in.) and 23.0 mm (0.906 in.). Install the 23.0 mm (0.906 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

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

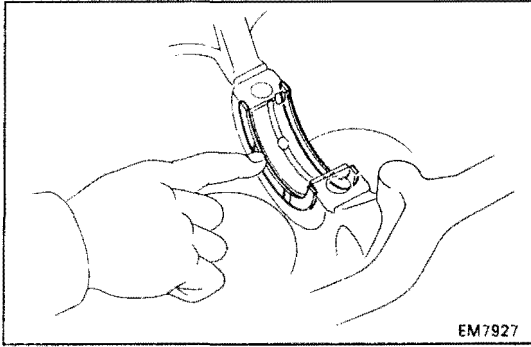


(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

HINT: A number is marked on each main bearing cap to indicate the installation position.

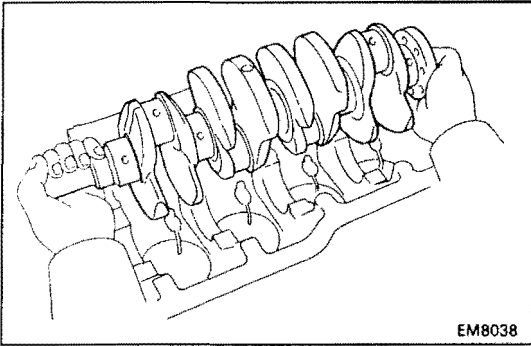


EG

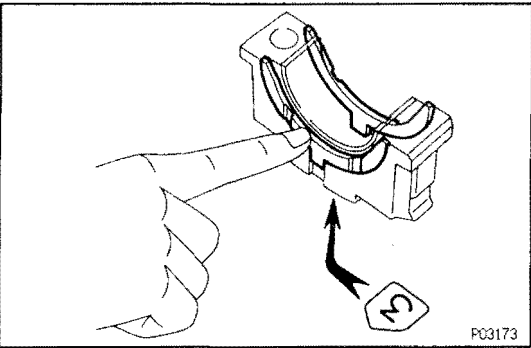


3. INSTALL UPPER THRUST WASHERS

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

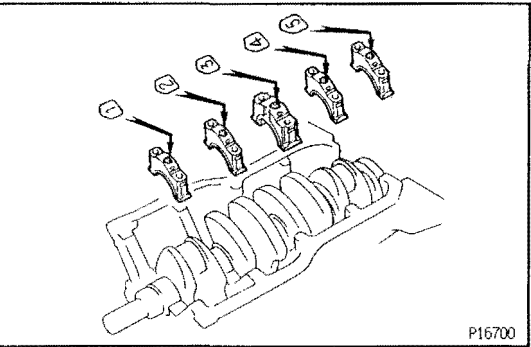


4. PLACE CRANKSHAFT ON CYLINDER BLOCK



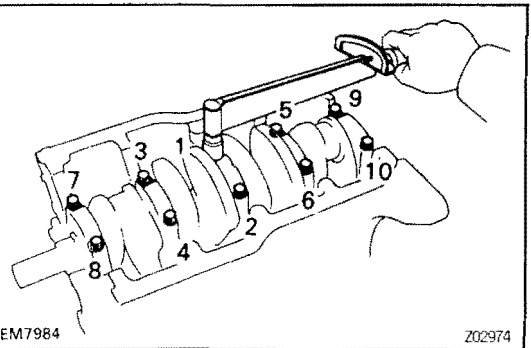
5. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

(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.

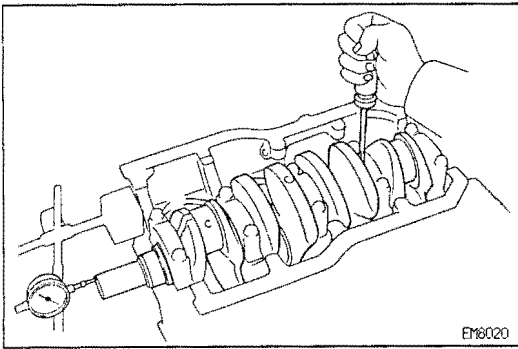
HINT: Each bearing cap has a number and front mark.



(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 cap in several passes, in the sequence shown. Torque: 59 N·m (600 kgf·cm, 44 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.)

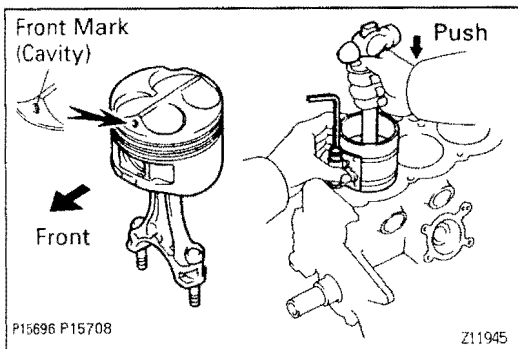
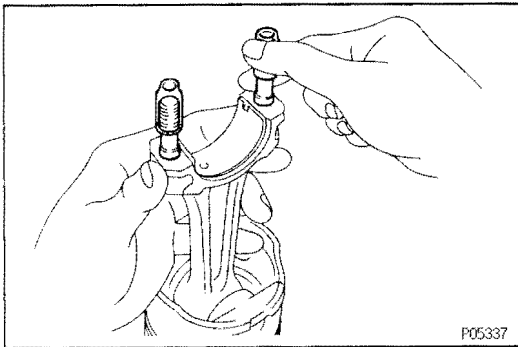
Maximum thrust clearance:

0.30 mm (0.0118 in.)

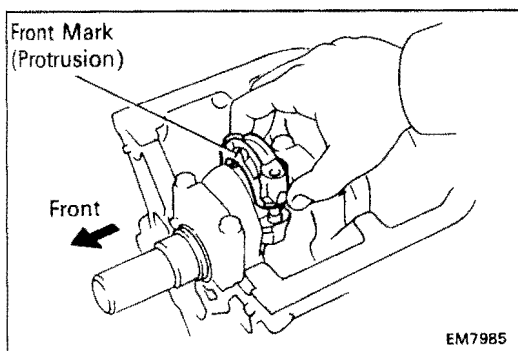
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

6. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

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

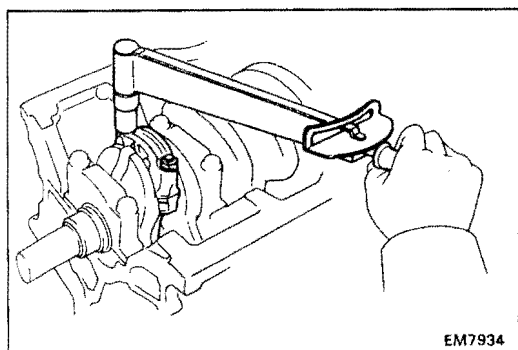


- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

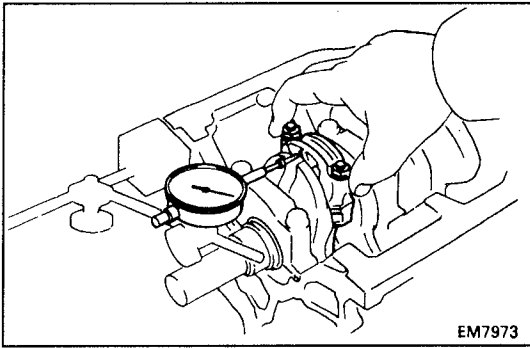


7. INSTALL CONNECTING ROD CAPS

- (a) Match the numbered connecting rod cap with the connecting rod.
- (b) Install the connecting rod cap with the front mark facing forward.



- (c) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.
- (d) Install and alternately tighten the 2 cap nuts in several passes.
- Torque: 67 N·m (680 kgf·cm, 49 ft·lbf)**
- (e) Check that the crankshaft turns smoothly.



- (f) 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.)

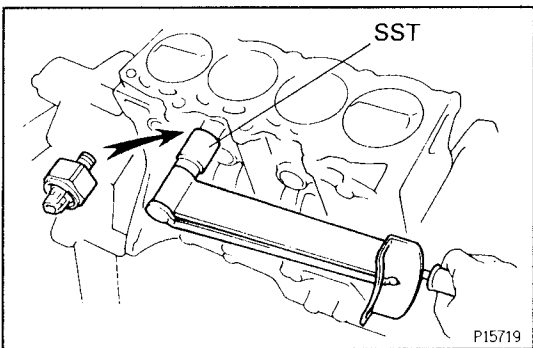
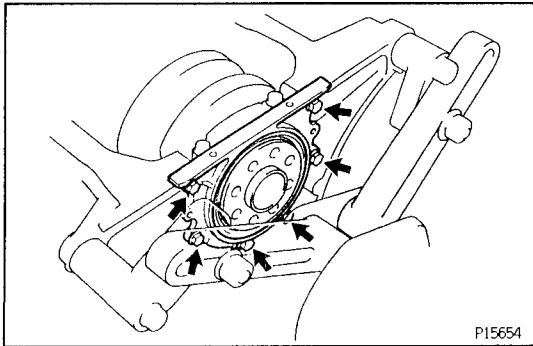
Maximum thrust clearance:

0.35 mm (0.0138 in.)

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

8. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the 6 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)



POST ASSEMBLY

EG42M-01

(See Components for Disassembly and Assembly)

1. INSTALL KNOCK SENSOR

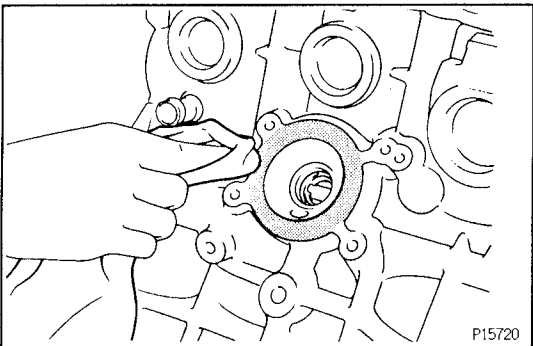
Using SST, install the knock sensor.

SST 09816-30010

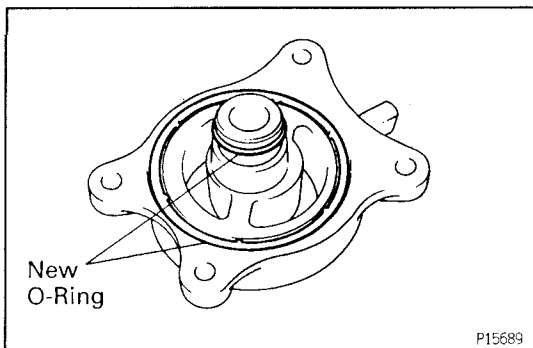
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

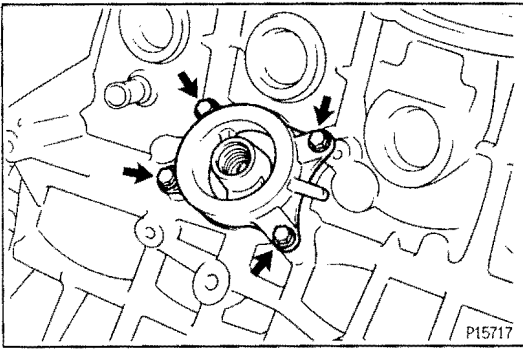
2. INSTALL OIL COOLER BRACKET

- (a) Clean the oil cooler bracket contact surface on the cylinder block.

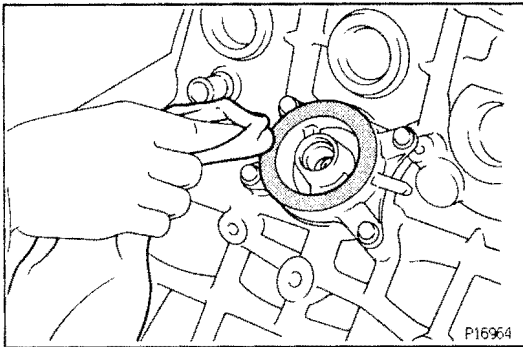


- (b) Install 2 new O-rings to the oil cooler bracket.
(c) Apply a light coat of engine oil on the small O-ring.



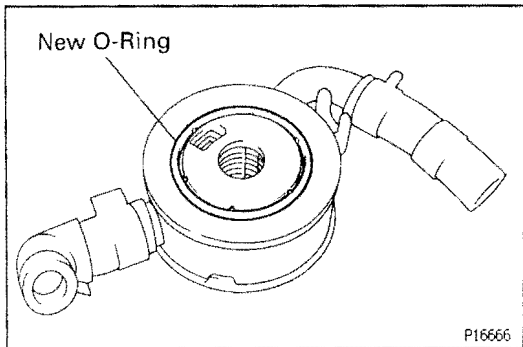


- (d) Install the oil cooler bracket with the 4 bolts.
Torque: 6.5 N·m (66 kgf·cm, 58 in.-lbf)

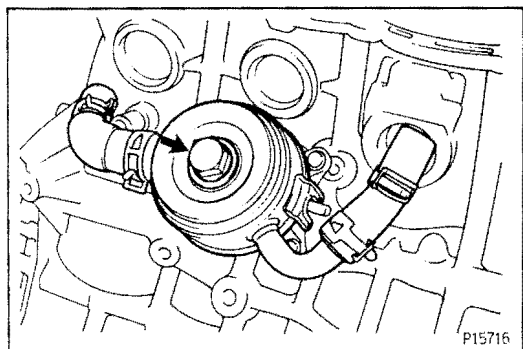


3. INSTALL OIL COOLER

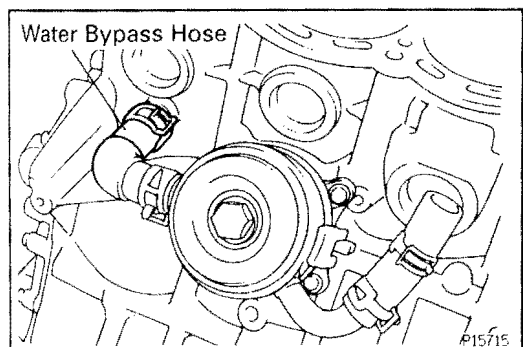
- (a) Clean the oil cooler contact surface on the oil cooler bracket.



- (b) Install a new O-ring to the oil cooler.

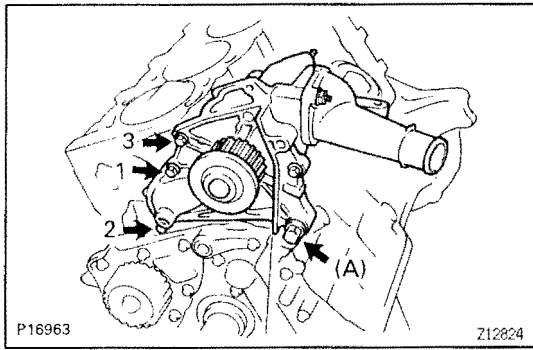


- (c) Apply a light coat of engine oil on the threads and under the head of the relief valve.
(d) Install the oil cooler with a new seal washer and the relief valve.
Torque: 59 N·m (600 kgf·cm, 44 ft.-lbf)



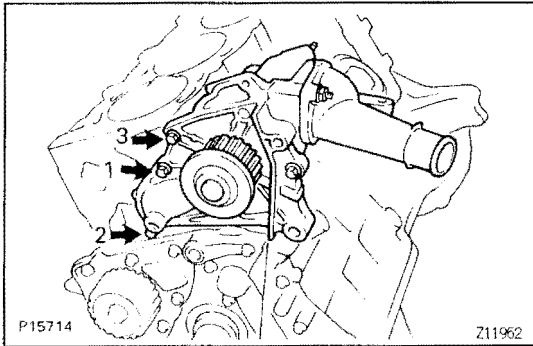
- (e) Connect the water bypass hose to the cylinder block.

EG



4. INSTALL WATER PUMP AND WATER PUMP COVER ASSEMBLY

- (a) Install a new O-ring to the water pump cover.



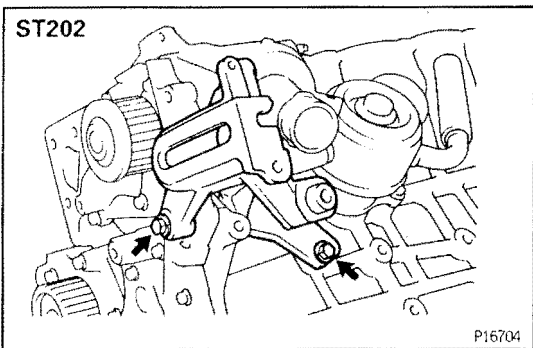
- (b) Install the water pump and water pump cover assembly with the 3 bolts. Tighten the bolts in the sequence shown.

Torque: 7.5 N·m (76 kgf·cm, 66 in.-lbf)

- (c) SW20 w/o A/C:

Install the bolt (A).

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



5. ST202: INSTALL IDLER PULLEY BRACKET FOR ALTERNATOR DRIVE BELT

Install the idler pulley bracket with the 2 bolts.

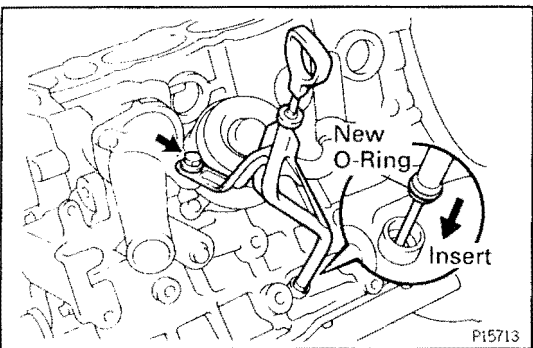
Torque:

Water pump side

19 N·m (190 kgf·cm, 14 ft-lbf)

Cylinder block side

23 N·m (230 kgf·cm, 17 ft-lbf)



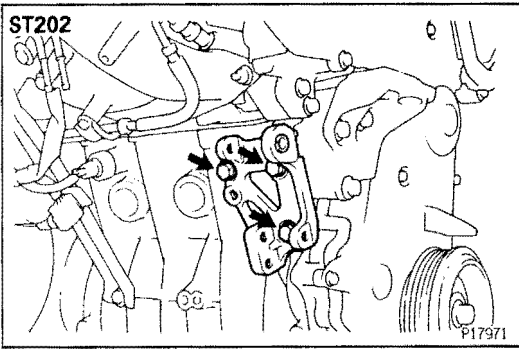
6. INSTALL OIL DIPSTICK AND GUIDE

- (a) Install a new O-ring to the oil dipstick guide.
 (b) Apply soapy water to the O-ring.
 (c) Insert the oil dipstick guide into the guide hole of the cylinder block.
 (d) Install the oil dipstick and guide with the bolt.

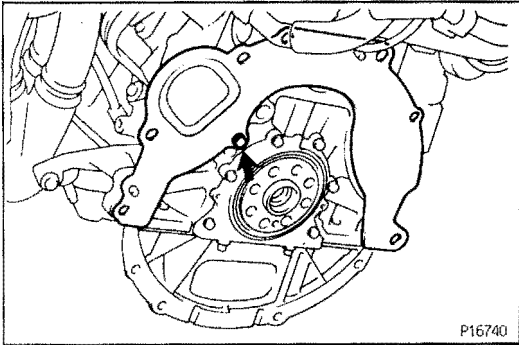
7. INSTALL OIL PUMP AND OIL PAN (See pages EG-391 to 394)

8. INSTALL CYLINDER HEAD (See pages EG-106 to 126)

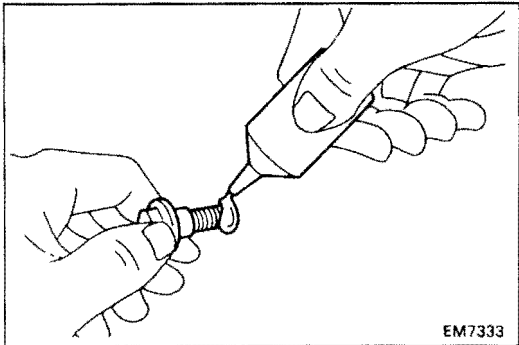
9. INSTALL TIMING BELT AND PULLEYS (See pages EG-58 to 65)

**10. ST202:****INSTALL PS PUMP BRACKET**

Install the PS pump bracket with the 3 bolts.
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

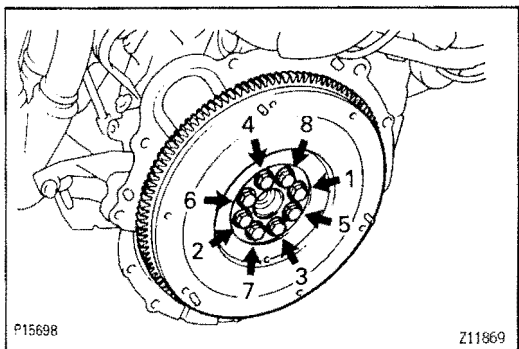
11. DISCONNECT ENGINE FROM ENGINE STAND**12. INSTALL REAR END PLATE**

Install the rear end plate with the bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in·lbf)

**13. INSTALL FLYWHEEL**

- (a) Apply adhesive to 2 or 3 threads of the 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 6 bolts in several passes, in the sequence shown.

Torque: 107 N·m (1,090 kgf·cm, 79 ft·lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

EG005-01

Tune-up	Battery specific gravity	at 20°C (68°F)	1.25 — 1.27	
	High-tension cord resistance	Limit	25 kΩ per cord	
	Alternator drive belt deflection			
	ST202	w/ A/C	New belt	10 — 11 mm (0.39 — 0.43 in.)
			Used belt	13 — 16 mm (0.51 — 0.63 in.)
		w/o A/C	New belt	11 — 14 mm (0.43 — 0.55 in.)
			Used belt	12 — 18 mm (0.47 — 0.71 in.)
	SW20	New belt	9 — 12 mm (0.35 — 0.47 in.)	
		Used belt	10 — 15 mm (0.39 — 0.59 in.)	
	Alternator drive belt tension (Reference)			
	ST202	w/ A/C	New belt	686 — 785 N (70 — 80 kgf)
			Used belt	294 — 441 N (30 — 45 kgf)
		w/o A/C	New belt	461 — 706 N (47 — 72 kgf)
			Used belt	353 — 610 N (36 — 62 kgf)
	SW20	New belt	539 — 637 N (55 — 65 kgf)	
		Used belt	245 — 392 N (25 — 40 kgf)	
	Valve clearance (Cold)	Intake		0.15 — 0.25 mm (0.006 — 0.010 in.)
		Exhaust		0.28 — 0.38 mm (0.011 — 0.015 in.)
	Valve clearance adjusting shim (for repair part)			
		No.00		2.500 mm (0.0984 in.)
		No.53		2.550 mm (0.1004 in.)
		No.10		2.600 mm (0.1024 in.)
		No.15		2.650 mm (0.1043 in.)
		No.20		2.700 mm (0.1063 in.)
		No.25		2.750 mm (0.1083 in.)
		No.30		2.800 mm (0.1102 in.)
		No.35		2.850 mm (0.1122 in.)
		No.40		2.900 mm (0.1142 in.)
		No.45		2.950 mm (0.1161 in.)
		No.50		3.000 mm (0.1181 in.)
		No.55		3.050 mm (0.1201 in.)
		No.60		3.100 mm (0.1220 in.)
		No.65		3.150 mm (0.1240 in.)
	No.70		3.200 mm (0.1260 in.)	
	No.75		3.250 mm (0.1280 in.)	
	No.80		3.300 mm (0.1299 in.)	
	No.85		3.350 mm (0.1319 in.)	
	No.89		3.390 mm (0.1335 in.)	
Ignition timing			10° BTDC @ idle (w/ Terminals TE1 and E1 of check connector connected)	
Idle speed				
ST202	w/ Daytime running light system		750 ± 50 rpm	
	w/o Daytime running light system		700 ± 50 rpm	
SW20	w/ Daytime running light system		850 ± 50 rpm	
	w/o Daytime running light system		750 ± 50 rpm	
Idle CO	Concentration		0 — 0.5 %	

EG

Intake manifold vacuum	at idle speed		60 kPa (450 mmHg, 17.7 in.Hg)
Compression pressure	at 250 rpm	STD	1,226 kPa (12.5 kgf/cm ² , 178 psi) or more
		Limit	981 kPa (10.0 kgf/cm ² , 142 psi)
	Difference of pressure between each cylinder		98 kPa (1.0 kgf/cm ² , 14 psi) or less
Timing belt tensioner	Protrusion		10.0 – 11.0 mm (0.394 – 0.433 in.)
Cylinder head	Warpage		
	Cylinder block side	Limit	0.20 mm (0.0079 in.)
	Intake manifold side	Limit	0.20 mm (0.0079 in.)
	Exhaust manifold side	Limit	0.30 mm (0.0118 in.)
	Valve seat		
	Refacing angle		30°, 45°, 75°
	Contacting angle		45°
	Contacting width		1.0 – 1.4 mm (0.039 – 0.055 in.)
Valve guide bushing	Inside diameter		6.000 – 6.018 mm (0.2362 – 0.2369 in.)
	Outside diameter (for repair part)	STD	11.033 – 11.044 mm (0.4344 – 0.4348 in.)
		O/S 0.05	11.088 – 11.099 mm (0.4365 – 0.4370 in.)
Valve	Valve overall length	STD Intake	99.80 – 100.20 mm (3.9291 – 3.9449 in.)
		Exhaust	98.55 – 99.25 mm (3.8917 – 3.9075 in.)
		Limit Intake	99.30 mm (3.9094 in.)
		Exhaust	98.35 mm (3.8720 in.)
	Vale face angle		44.5°
	Stem diameter	Intake	5.960 – 5.975 mm (0.2346 – 0.2352 in.)
		Exhaust	5.955 – 5.970 mm (0.2344 – 0.2350 in.)
	Stem oil clearance	STD Intake	0.025 – 0.058 mm (0.0010 – 0.0023 in.)
		Exhaust	0.030 – 0.063 mm (0.0012 – 0.0025 in.)
		Limit Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	0.8 – 1.2 mm (0.031 – 0.047 in.)
		Limit	0.5 mm (0.020 in.)
Valve spring	Squareness	Limit	2.0 mm (0.079 in.)
	Free length	Intake	43.18 mm (1.7000 in.)
		Exhaust	43.34 mm (1.7063 in.)
	Installed tension at 35.4 mm (1.394 in.)	Intake	163 – 190 N (16.6 – 19.4 kgf, 36.6 – 42.8 lbf)
		Exhaust	153 – 180 N (15.6 – 18.4 kgf, 34.4 – 40.6 lbf)
Valve lifter	Lifter diameter		30.975 – 30.985 mm (1.2195 – 1.2199 in.)
	Lifter bore diameter		31.000 – 31.021 mm (1.2205 – 1.2213 in.)
	Oil clearance	STD	0.015 – 0.046 mm (0.0006 – 0.0018 in.)
		Limit	0.07 mm (0.0028 in.)
Manifold	Warpage	Limit Intake	0.30 mm (0.0118 in.)
		Exhaust	1.00 mm (0.0394 in.)
ACIS valve	Warpage	Limit	0.20 mm (0.0079 in.)
VSV for ACIS	Resistance	at 20°C (68°F)	33 – 39 Ω

Camshaft	Thrust clearance	STD	0.100 — 0.240 mm (0.0039 — 0.0094 in.)	
		Limit	0.30 mm (0.0118 in.)	
	Journal oil clearance	STD	0.0025 — 0.062 mm (0.0010 — 0.0024 in.)	
		Limit	0.08 mm (0.0031 in.)	
	Journal diameter		26.959 — 26.975 mm (1.0614 — 1.0620 in.)	
	Circle runout	Limit	0.06 mm (0.0024 in.)	
	Cam lobe height	STD Intake	42.610 — 42.710 mm (1.6778 — 1.6815 in.)	
Exhaust		41.010 — 41.110 mm (1.6146 — 1.6185 in.)		
Limit Intake		42.50 mm (1.6732 in.)		
	Exhaust	39.90 mm (1.5709 in.)		
Cylinder block	Cylinder head surface warpage	Limit	0.05 mm (0.0020 in.)	
		STD Mark 1	86.000 — 86.010 mm (3.3858 — 3.3862 in.)	
	Mark 2	86.010 — 86.020 mm (3.3862 — 3.3866 in.)		
	Mark 3	86.020 — 86.030 mm (3.3866 — 3.3870 in.)		
	Limit	86.23 mm (3.3949 in.)		
Piston and piston ring	Piston diameter	STD Mark 1	85.970 — 85.980 mm (3.3846 — 3.3850 in.)	
		Mark 2	85.980 — 85.990 mm (3.3850 — 3.3854 in.)	
		Mark 3	85.990 — 86.000 mm (3.3854 — 3.3858 in.)	
	Piston oil clearance	STD	0.020 — 0.040 mm (0.0008 — 0.0016 in.)	
		Limit	0.06 mm (0.0024 in.)	
	Piston 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.)	
	Piston ring end gap	STD No.1	0.330 — 0.550 mm (0.0130 — 0.0217 in.)	
		No.2	0.450 — 0.670 mm (0.0177 — 0.0264 in.)	
		Oil	0.150 — 0.500 mm (0.0059 — 0.0197 in.)	
		Limit No.1	0.85 mm (0.0335 in.)	
No.2		0.97 mm (0.0382 in.)		
	Oil	0.80 mm (0.0315 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 — 0.0586 in.)	
		Mark 2	1.488 — 1.492 mm (0.0586 — 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	STD	0.005 — 0.011 mm (0.0002 — 0.0004 in.)		
	Limit	0.05 mm (0.0020 in.)		
Crankshaft	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.)	

Crankshaft (cont'd)	Main journal oil clearance	STD No.3 STD	0.028 — 0.047 mm (0.0011 — 0.0019 in.)	
		No.3 U/S 0.25	0.027 — 0.067 mm (0.0011 — 0.0026 in.)	
		Others STD	0.018 — 0.037 mm (0.0007 — 0.0015 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	54.985 — 55.000 mm (2.1648 — 2.1654 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.)	
			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.)
		Crank pin diameter	STD	47.985 — 48.000 mm (1.8892 — 1.8898 in.)
			U/S 0.25	47.745 — 47.755 mm (1.8797 — 1.8801 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.)	

EG

TORQUE SPECIFICATION

E00C8-0X

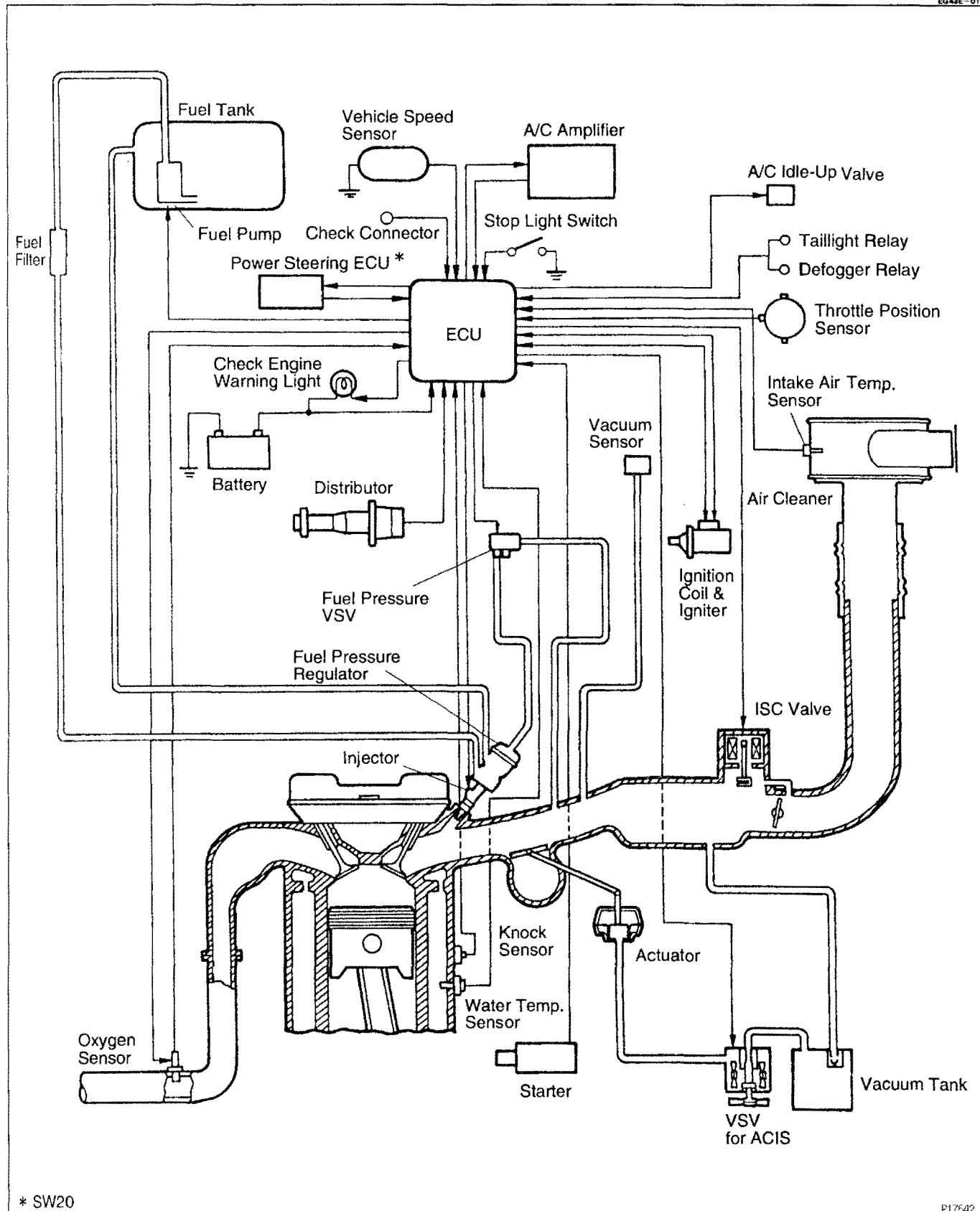
Part tightened		N-m	kgf-cm	ft-lbf
Distributor x Cylinder head		39	400	29
Spark plug x Cylinder head		18	180	13
Oil pump pulley x Oil pump drive shaft		35	360	26
No.2 idler pulley x Oil pump		44	450	32
Timing belt tensioner x Cylinder head		21	210	15
No.1 idler pulley x Cylinder head		52	530	38
Crankshaft pulley x Crankshaft		107	1,090	79
RH engine mounting bracket x Cylinder block	ST202	52	530	38
	SW20	60	620	45
Alternator x Alternator bracket (SW20)	Pivot bolt	52	530	38
	Adjusting lock bolt	19	190	14
Camshaft timing pulley x Camshaft		59	600	43
	for SST	41	420	30
Alternator bracket x Cylinder head (ST202)		39	400	29
Alternator x Alternator bracket (ST202)	12 mm head	19	190	14
	14 mm head	52	530	38
Idler pulley for alternator drive belt x Idler pulley bracket (ST202)		39	400	29
RH front engine hanger x Cylinder head		39	400	29
RH engine mounting bracket x Engine hanger (SW20)		60	620	45
Cylinder head x Cylinder block	1st	49	500	36
	2nd	Turn 90°		
Camshaft bearing cap x Cylinder head		19	190	14

Cylinder head cover x Cylinder head		6.0	61	53 in.-lbf
No.4 timing belt cover x Cylinder head cover		8.0	82	71 in.-lbf
No.3 timing belt cover x Cylinder head		8.0	82	71 in.-lbf
LH engine hanger x Cylinder head		44	450	32
Delivery pipe x Cylinder head		29	300	21
Intake manifold x Cylinder head		21	210	15
Alternator bracket x Cylinder block (SW20)		43	440	32
Fuel inlet pipe x Delivery pipe		32	330	24
Fuel inlet pipe x Cylinder head		9.0	92	80 in.-lbf
ACIS valve x Intake manifold		19	195	14
No.1 ACIS valve stay x Cylinder head		19	195	14
No.1 ACIS valve stay x ACIS valve		21	210	15
No.2 ACIS valve stay x Cylinder head		18	180	13
No.2 ACIS valve stay x ACIS valve		18	180	13
ACIS valve cover x ACIS cover	Bolt	8.5	87	75 in.-lbf
	Nut	21	210	15
Intake manifold stay x Intake manifold		39	400	29
Intake manifold stay x Cylinder block		39	400	29
Water bypass pipe x Water pump cover		10	100	7
Water bypass pipe x Cylinder head		24	240	18
No.3 exhaust manifold heat insulator x Water bypass pipe		18	180	13
No.3 exhaust manifold heat insulator x Cylinder block		37	380	27
Water outlet x Cylinder head		20	200	15
Fuel inlet pipe x Water outlet		9.0	92	80 in.-lbf
Fuel return pipe x Water outlet		9.0	92	80 in.-lbf
Throttle body x ACIS valve		21	210	15
Exhaust manifold x Cylinder head		50	510	37
Exhaust manifold stay x Exhaust manifold		58	590	43
Exhaust manifold stay x Cylinder block		58	590	43
No.2 exhaust manifold heat insulator x Exhaust manifold	12 mm head	20	200	15
	14 mm head	37	380	27
No.1 exhaust manifold heat insulator x Exhaust manifold		20	200	15
Oil nozzle x Cylinder block		9.0	92	80 in.-lbf
Main bearing cap x Cylinder block		59	600	44
Connecting rod cap x Connecting rod		67	680	49
Rear oil seal retainer x Cylinder block		9.0	92	80 in.-lbf
Knock sensor x Cylinder block		37	380	27
Oil cooler bracket x Cylinder block		6.5	66	58 in.-lbf
Oil cooler x Oil cooler bracket (Relief valve)		59	600	44
Water pump x Cylinder block	10 mm head	7.5	76	66 in.-lbf
	12 mm head (SW20 w/o A/C)	19	190	14
Idler pulley bracket for alternator drive belt x Cylinder block (ST202)	Water pump side	23	230	17
	Cylinder block side	19	190	14
PS pump bracket x Cylinder block		43	440	32
Rear end plate x Cylinder block		9.3	95	82 in.-lbf
Flywheel x Crankshaft		107	1,090	79

EFI SYSTEM

DESCRIPTION

EG49E-01



EG

* SW20

The EFI system is composed of three basic sub—systems: Fuel, Air Induction and Electronic Control Systems.

FUEL SYSTEM

Fuel is supplied under constant pressure to the EFI injectors by an electric fuel pump. The injectors inject a metered quantity of fuel into the intake manifold in accordance with signals from the ECU (Engine Control Unit).

EG

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The 3S—GE engine is equipped with a TOYOTA Computer Controlled System (TCCS) which centrally controls the EFI, ESA, ISC, Diagnosis systems etc. by means of an ECU—formerly EFI computer employing a microcomputer.

The ECU controls the following functions:

1. Electronic Fuel Injection (EFI)

The ECU receives signals from various sensors indicating changing engine operating 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 ECU to determine the injection duration necessary for an optimum air—fuel ratio.

2. Electronic Spark Advance (ESA)

The ECU is programmed with data for optimum ignition timing under all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.

3. Idle Speed Control (ISC)

The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioning ON/OFF, etc.). Sensors transmit signals to the ECU which control the flow of air through the throttle valve bypass and adjust idle speed to the target value.

4. Diagnosis

The ECU detects any malfunctions and abnormalities in the sensor network and lights a check engine warning light in the combination meter. At the same time, trouble is identified and a diagnostic code is recorded by the ECU. The diagnostic code can be read by the number of blinks of the check engine warning light when terminals TE1 and E1 of the check connector are connected. The diagnostic code are referred to in a later page. (See page EG—182)

5. Self—Correction Function

If any sensor malfunctions, an average value recorded in the back—up circuit is substituted to make driving possible. If danger is predicted, the engine is stopped and the check engine warning light will light up.

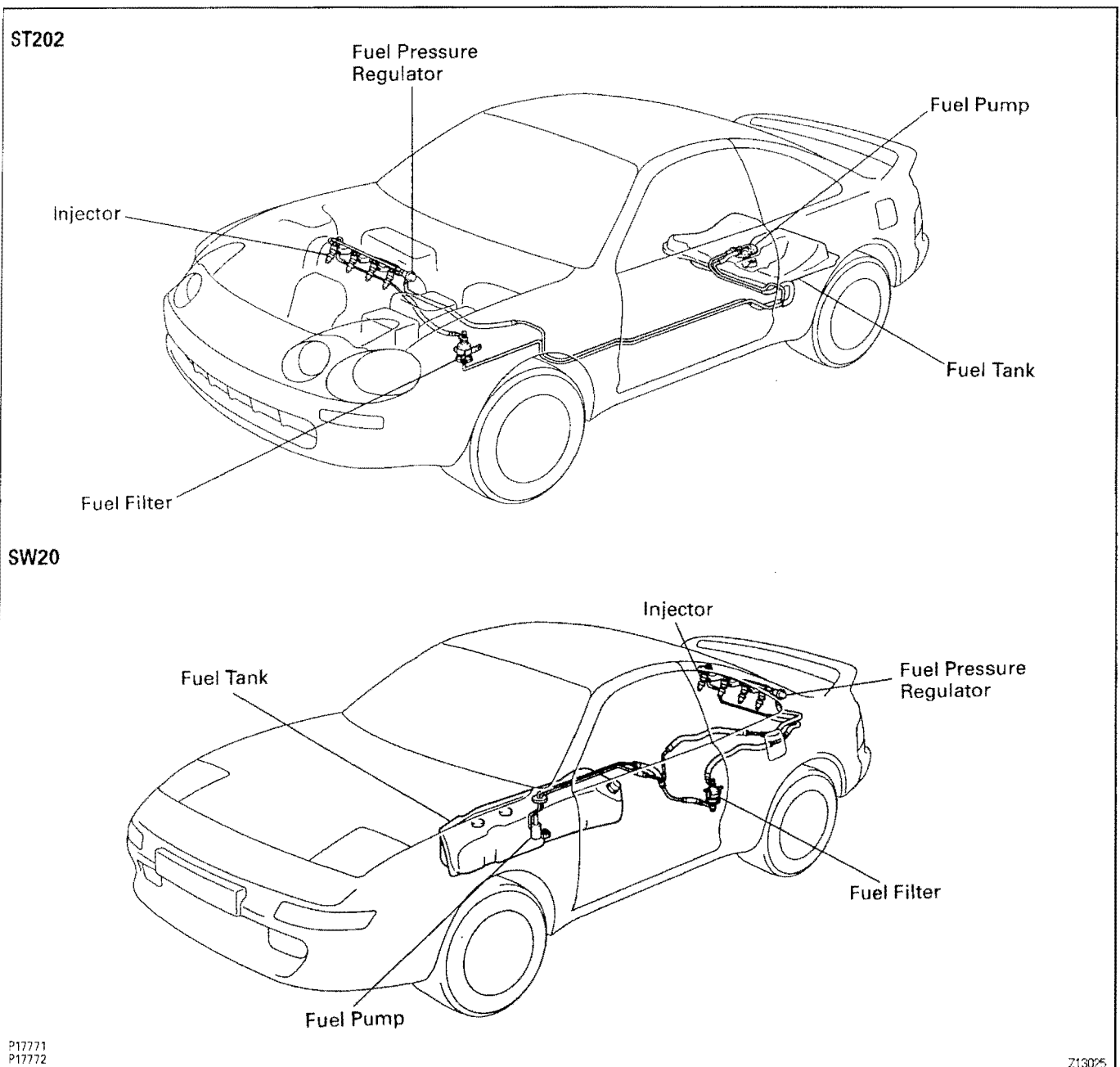
6. Fail—Safe Function

In the event of the sensor malfunctioning, a back—up circuit will take over to provide minimal driveability, and the check engine warning light will illuminate.

OPERATION

FUEL SYSTEM

EG

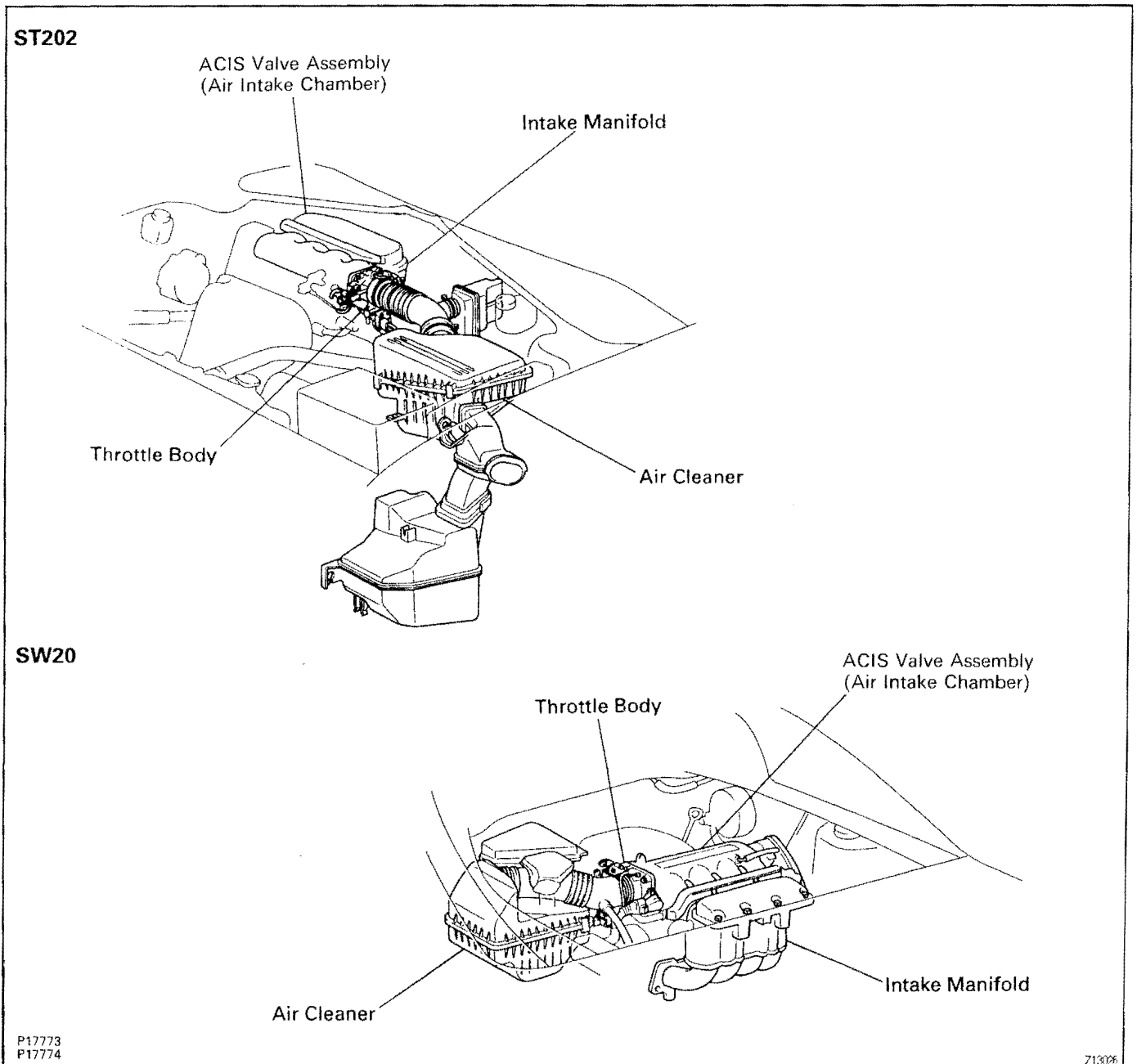


Fuel pumped up by the fuel pump, flows through the fuel filter and is distributed to each injector at a set pressure maintained by the fuel pressure regulator.

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/cm², 41 psi) higher than the pressure inside the intake manifold, and excess fuel is returned to the fuel tank through the return pipe.

Fuel is injected into the intake manifold according to signals from the ECU.

AIR INDUCTION SYSTEM

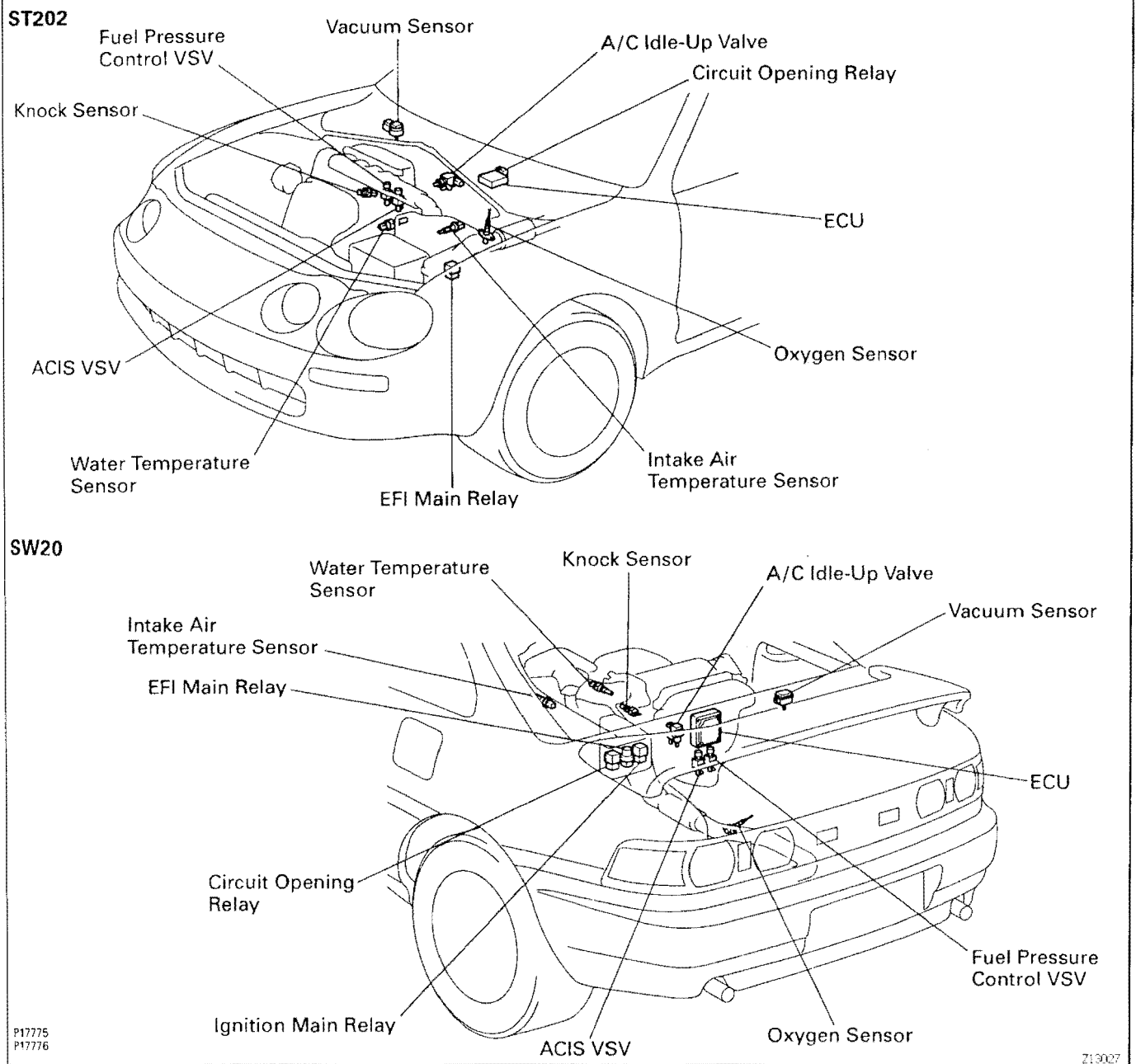


Air is filtered through the air cleaner and the amount flowing to the air intake chamber is determined according to the throttle valve opening in the throttle body and the engine speed. Intake air controlled by the throttle valve opening is distributed from the air intake chamber to the manifold of each cylinder and is drawn into the combination chamber.

At low temperatures the ISC valve opens and air flows through the ISC 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

EG



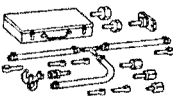

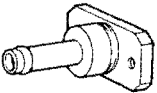
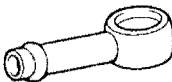
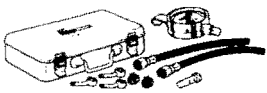
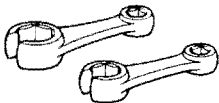



The control system consists of sensors which detect various engine conditions, and an ECU which determines the injection volume (timing) based on the signals from the sensors.

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 ECU. Based on these signals, the ECU calculates the optimum ignition timing for the current conditions and operates the injectors. The ECU not only controls the fuel injection timing, but also the self-diagnostic function which records the occurrence of a malfunction, ignition timing control and idle speed control.

PREPARATION

SST (SPECIAL SERVICE TOOLS)




EG0CF-0L

	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
	09816-30010 Oil Pressure Switch Socket	Knock sensor
	09842-30070 Wiring "F" EFI Inspection	Injector
	09843-18020 Diagnosis Check Wire	

EG

RECOMMENDED TOOLS

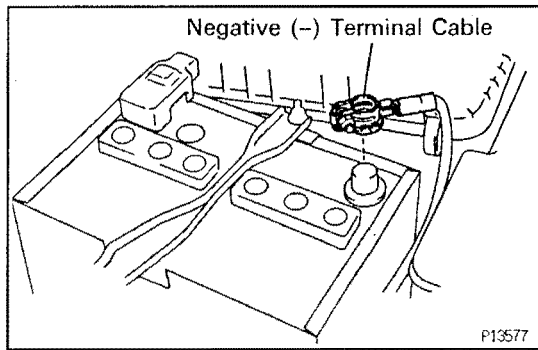
EG0CG-01

	09082-00050 TOYOTA Electrical Tester Set	
	09200-00010 Engine Adjust Kit	
	09258-00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.

EQUIPMENT

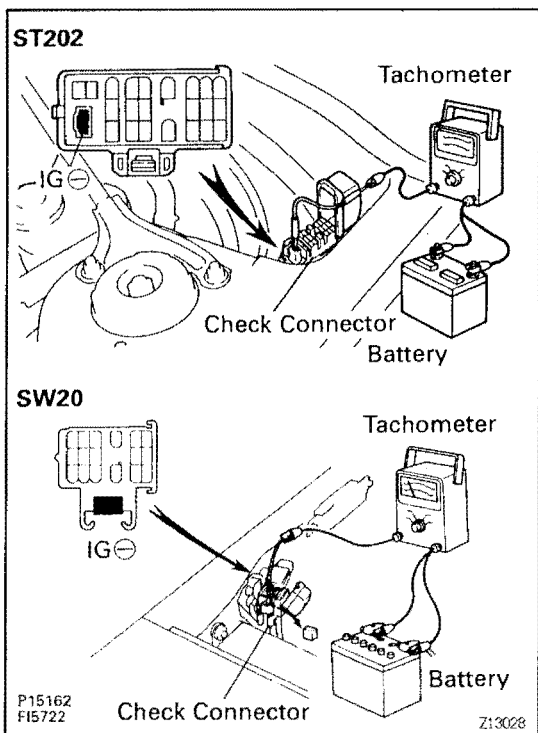
Carburetor cleaner	Throttle body
Graduated cylinder	Injector
Soft brush	Throttle body
Sound scope	Injector
Tachometer	
Torque wrench	
Vacuum gauge	
Thermometer	

EG



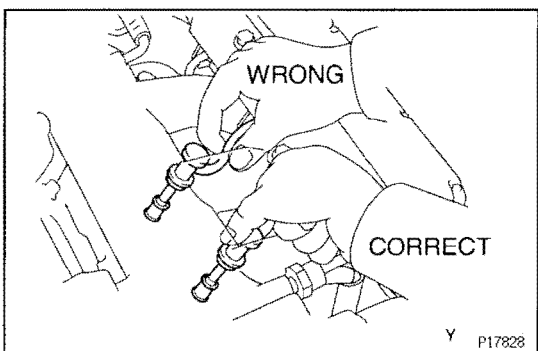
PRECAUTION

1. **Before working on the fuel system, disconnect the negative (-) terminal cable from the battery.**
EG484-01
HINT: Any diagnostic code retained by the computer will be erased when the negative (-) terminal cable is disconnected.
 Therefore, if necessary, read the diagnosis before disconnecting the negative (-) terminal cable 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 EG-12)
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 IG- of the check connector.
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 the oxygen sensor to drop or hit against an object.
- (b) Do not allow the sensor to come into contact with water.

EG

IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

EG435-01

If the vehicle is equipped with a mobile communication system, refer to the precaution in the IN section.

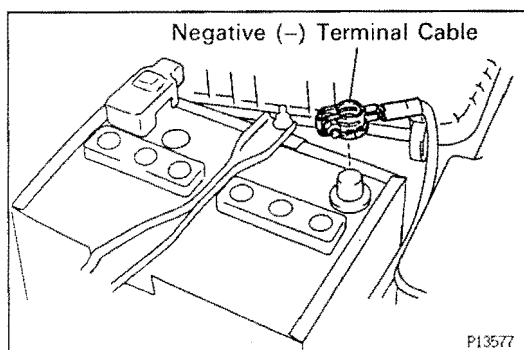
EG436-01

AIR INDUCTION SYSTEM

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 cause air suction and cause the engine to run out of tune.

EG44J-01

ELECTRONIC CONTROL SYSTEM



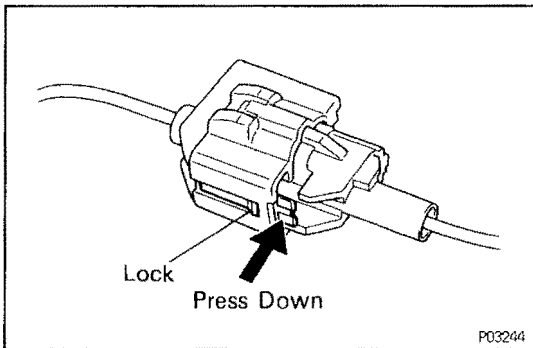
1. Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF or disconnecting the negative (-) terminal cable from the battery.

HINT: Always check the diagnostic code before disconnecting the negative (-) terminal cable from the battery.

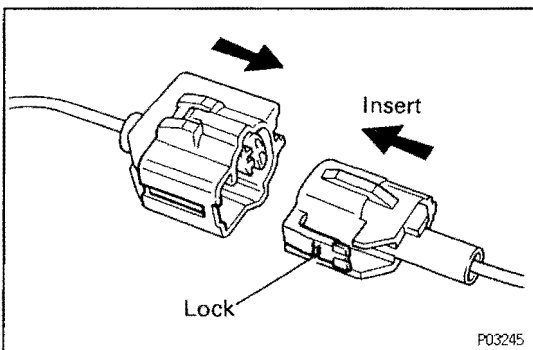
2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (-) cables.
3. Do not permit parts to receive a severe impact during removal or installation. Handle all EFI parts carefully, especially the ECU.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECU cover.

EG

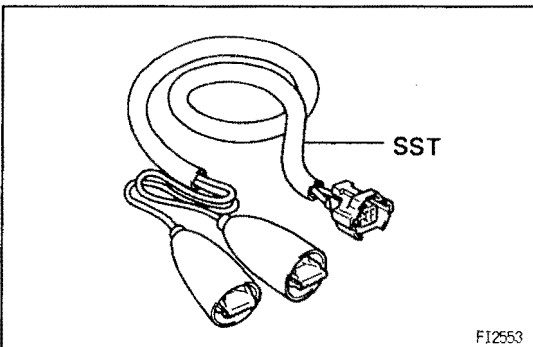
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.



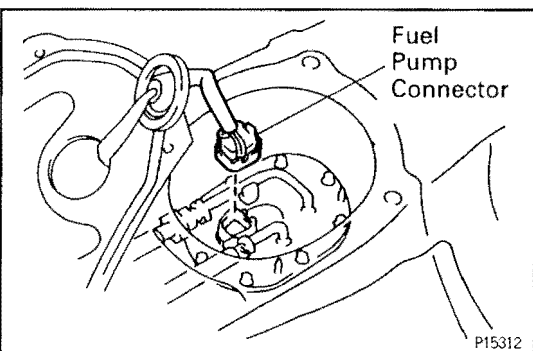
8. Care is required when pulling out and inserting wiring connectors.
 - (a) Release the lock and pull out the connector, pulling on the connectors.



- (b) Fully insert the connector and check that it is locked.



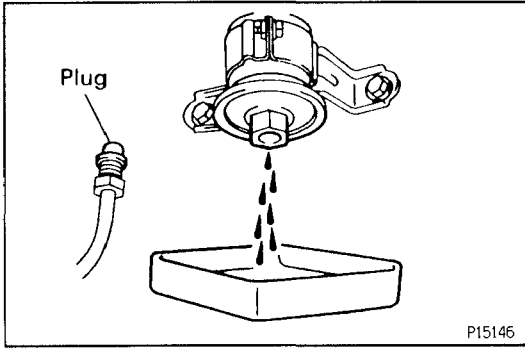
9. Use SST for inspection or test of the injector or its wiring connector.
SST 09842-30070



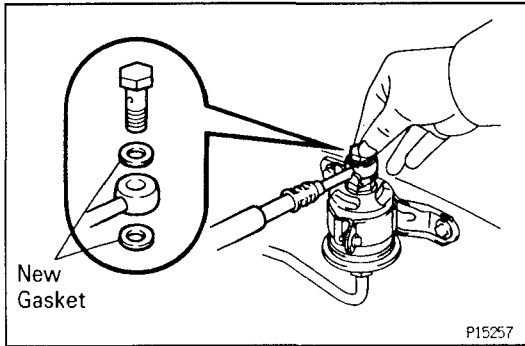
FUEL SYSTEM

EG43K-01

1. When disconnecting the high pressure fuel line, a large amount of gasoline will spill out, so observe the following procedures:
 - (a) Disconnect the fuel pump connector.
 - (b) Start the engine. After the engine has stopped on its own, turn the ignition switch OFF.



- (c) Put a container under the connection.
- (d) Slowly loosen the connection.
- (e) Disconnect the connection.
- (f) Plug the connection with a rubber plug.
- (g) Reconnect the fuel pump connector.

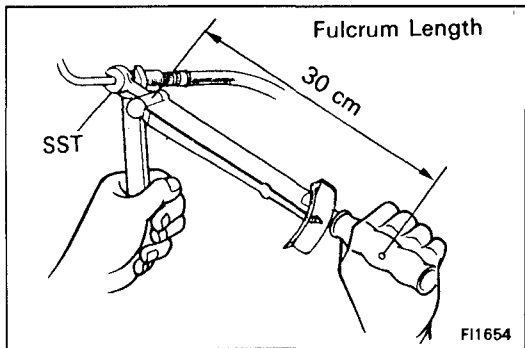


2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedures:

Union Bolt Type:

- (a) Always use a new gasket.
- (b) Tighten the union bolt by hand.
- (c) Tighten the union bolt to the specified torque.

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



Flare Nut Type:

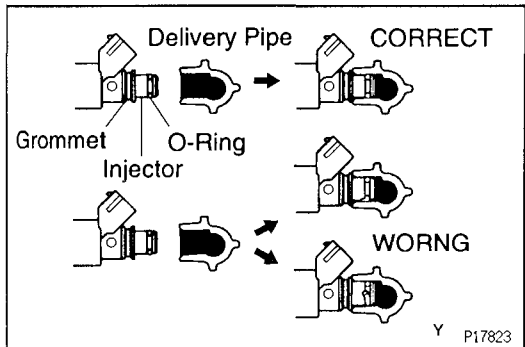
- (a) Apply a light coat of engine oil to the flare nut, and tighten the flare nut by hand.
- (b) Using SST, tighten the flare nut to specified torque. SST 09631 – 22020

Torque:

Fuel pump side: 24 N·m (240 kgf·cm, 18 ft·lbf)

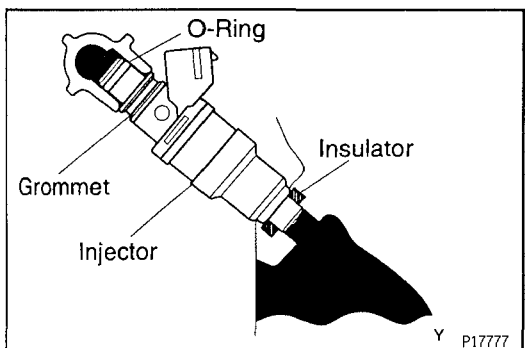
Others: 30 N·m (310 kgf·cm, 22 ft·lbf)

HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).

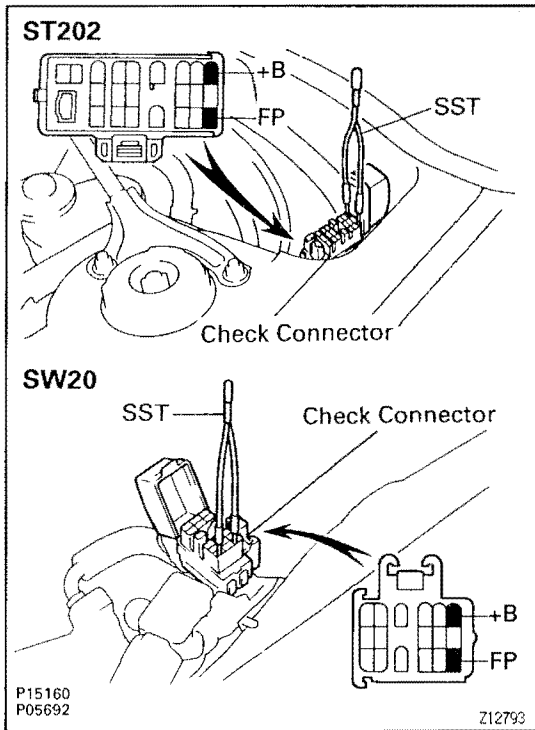


3. Observe the following precautions when removing and installing the injectors.

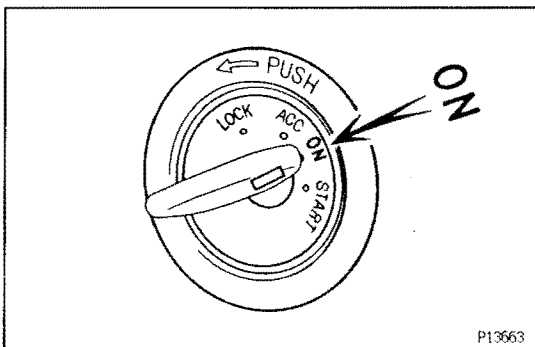
- (a) Never reuse the O-ring.
- (b) When placing a new O-ring on the injector, take care not to damage it in any way.
- (c) Coat a new O-ring with spindle oil or gasoline before installing—never use engine, gear or brake oils.



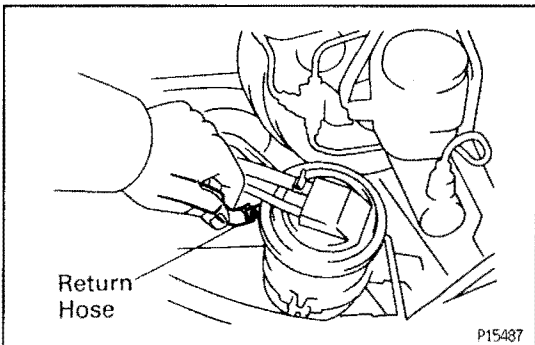
4. Install the injector to the delivery pipe and intake manifold as shown in the illustration.



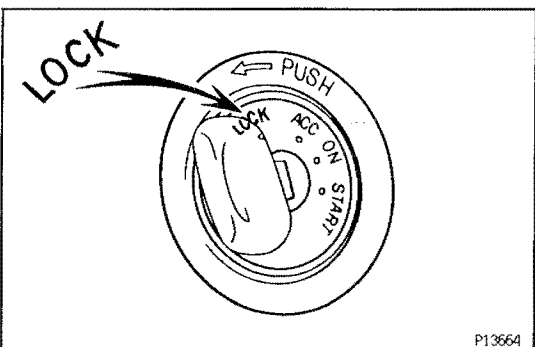
5. Check that there are no fuel leaks after performing maintenance anywhere on the fuel system.
- (a) Using SST, connect terminals +B and FP of the check connector.
SST 09843-18020



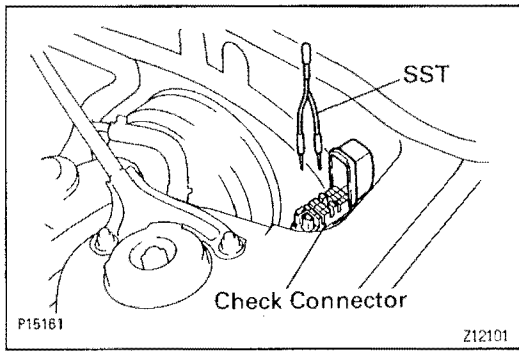
- (b) Turn the ignition switch ON.
NOTICE: Do not start the engine.



- (c) Pinch the fuel return hose.
The pressure in the high pressure line will rise to approx. 392 kPa (4 kgf/cm², 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 to LOCK.



- (e) Remove the SST from the check connector.
SST 09843-18020

DIAGNOSIS SYSTEM DESCRIPTION

EG48L-02

The ECU contains a built-in self-diagnosis system by which troubles with the engine signal network are detected and the check engine warning light on the combination meter lights up. By analyzing various signals as shown in the later table (See page EG-182) the ECU detects system malfunctions relating to the sensors or actuators.

The self-diagnosis system has 2 modes, a normal mode and a test mode.

If a malfunction is detected when in the normal mode, the ECU lights up the check engine warning light to inform the driver of the occurrence of a malfunction. (For some codes the light does not come on.) The light goes OFF automatically when the malfunction has been repaired. But the diagnostic code(s) remains stored in the ECU memory. The ECU stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch OFF.

The diagnostic code can be read by the number of blinks of the check engine warning light when TE1 and E1 terminals on the check connector are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

If a malfunction is detected when in the test mode, the ECU lights up the check engine warning light to inform the technician of the occurrence of a malfunction (except for code Nos. 42, 43 and 51). In this case, TE2 and E1 terminals on the check connector should be connected as shown later. (See page EG-179).

In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECU memory even when the ignition switch is OFF (except code Nos. 42, 43 and 51). This also applies in the normal mode. The diagnostic mode (normal or test) and the output of the check engine warning light can be selected by connecting the TE1, TE2 and E1 terminals on the check connector, as shown later. (See page EG-179)

A test mode function has been added to the functions of the self-diagnosis 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 EG-179)

EG487-01



"CHECK" Engine Warning Light

P0777

CHECK ENGINE WARNING LIGHT CHECK

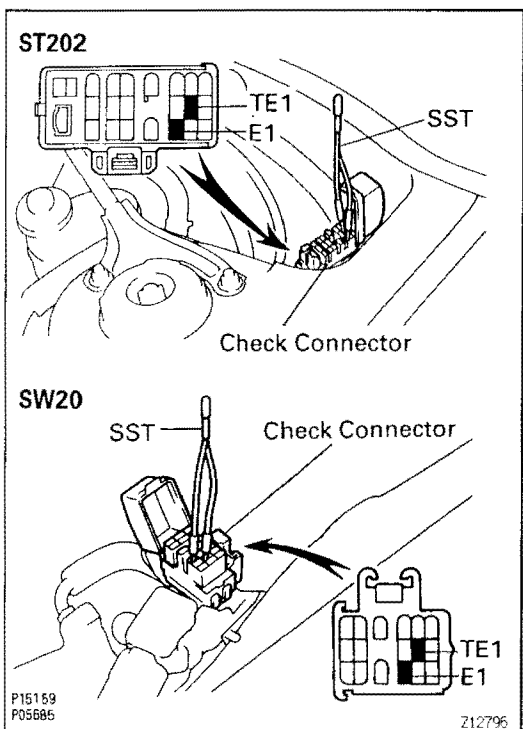
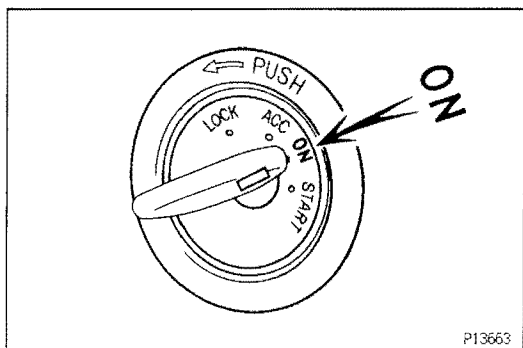
1. The check engine warning light will come on when the ignition switch is at ON and the engine is not running.
2. When the engine is started, the check engine warning light should go off.

If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

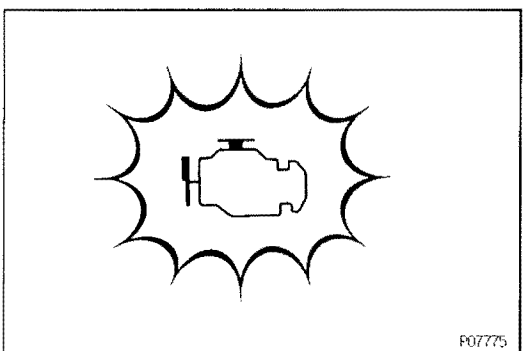
DIAGNOSTIC CODES OUTPUT**(Normal mode)**

To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Throttle valve fully closed (throttle position sensor IDL points closed)
 - (c) Accessories switched OFF
 - (d) Engine at normal operating temperature
2. Turn the ignition switch ON.
NOTICE: Do not start the engine.

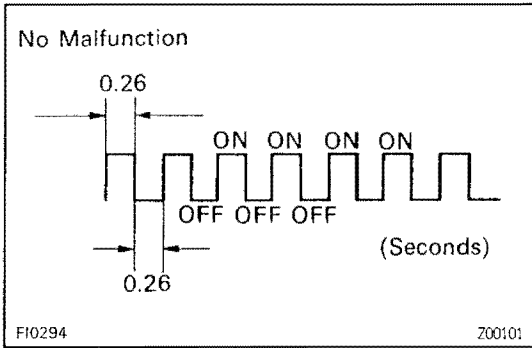


3. Using SST, connect terminals TE1 and E1 of the check connector.
 SST 09843-18020



4. Read the diagnostic code as indicated by the number of flashes of the check engine warning light.

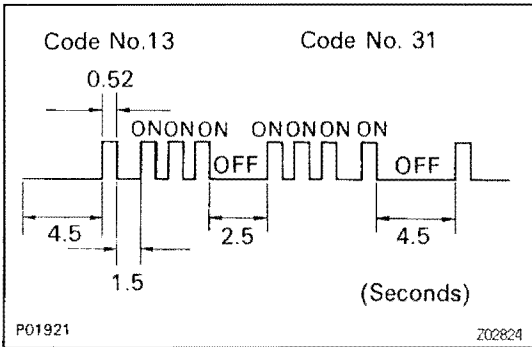
EG



Diagnostic Codes (See page EG — 182)

(a) Normal System Operation (no malfunction)

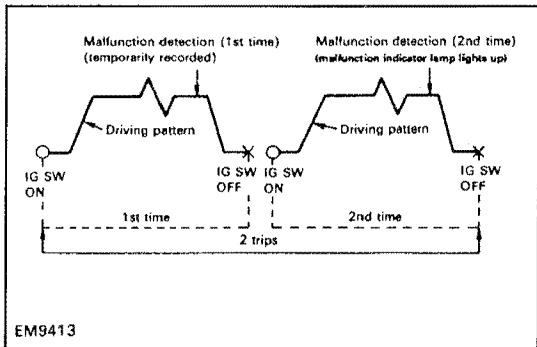
- The light will alternately blink ON and OFF at 0.26 second intervals.



(b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.52 seconds. The first number of blinks will equal the first digit of a 2 digit diagnostic code and, after a 1.5 second pause, the 2nd number of blinks will equal the 2nd. If there are two or more codes, there will be a 2.5 second pause between each code.
- After all the codes have been output, there will be a 4.5 second pause and they will all be repeated as long the terminals TE1 and E1 of the check connector are connected.

HINT: In the event of a number of codes, indication will begin from the smaller value and continue to the larger.

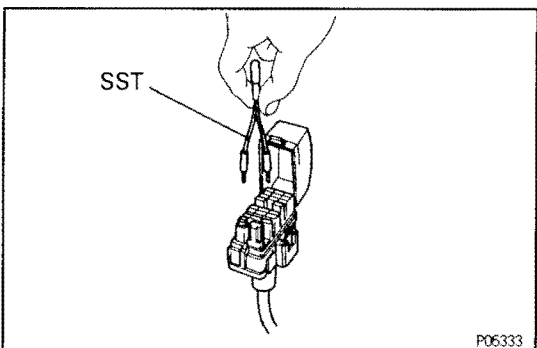


(c) 2 Trip Detection Logic

Diagnostic codes 21 and 25 use "2 trip detection logic". With this logic, when a malfunction is first detected, the malfunction is temporarily stored in the ECU memory. If the same case is detected again during the second drive test, this second detection causes the check engine warning light to light up. The 2 trip repeats the same mode a 2nd time. (However, the ignition switch must be turned OFF between the 1st time and 2nd time.) In the Test Mode, the check engine warning light lights up the 1st time a malfunction is detected.

5. After the diagnosis check, remove the SST from the check connector.

SST 09843-18020



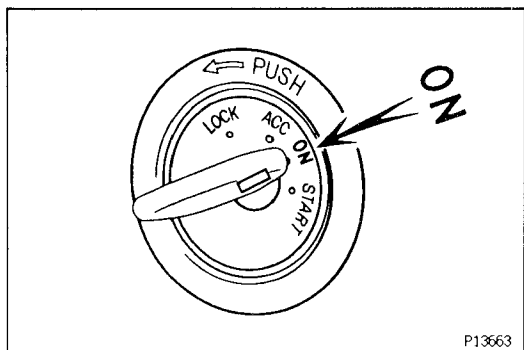
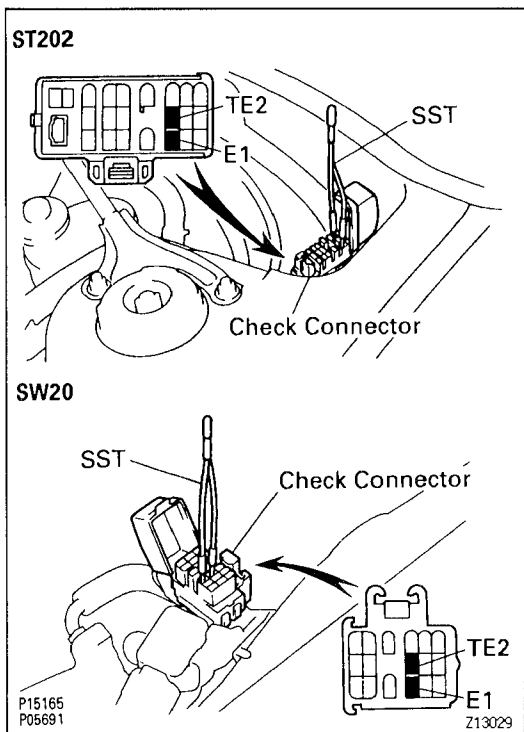
(Test mode)**HINT:**

- 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 and air conditioner signal.
- Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the test mode.

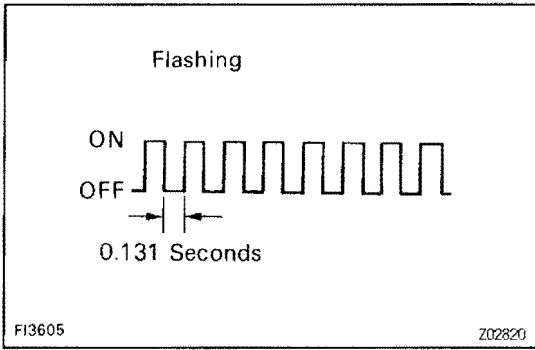
To obtain an output of diagnostic codes, proceed as follows:

1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Accessories switched OFF
 - (c) Engine at normal operating temperature
2. First, using SST, connect terminals TE2 and E1 of the check connector.

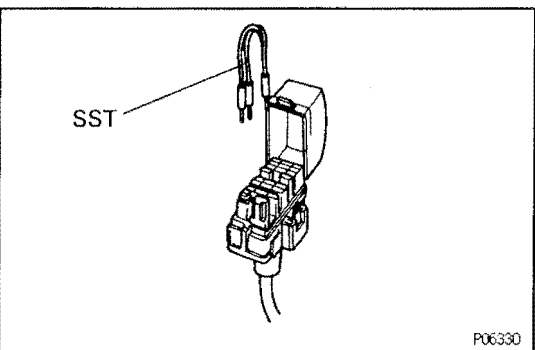
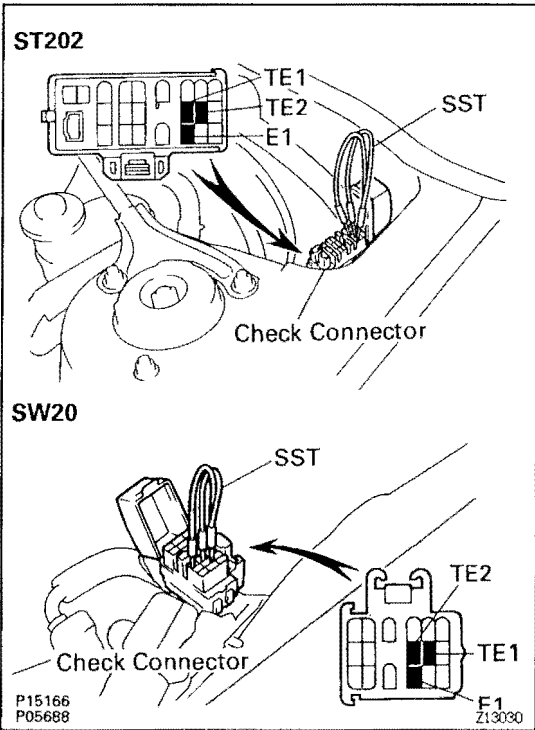
SST 09843–18020



3. Turn the ignition switch ON to begin the diagnosis in the test mode.



EG



HINT: To confirm that the test mode is operating, check that the check engine warning light flashes when the ignition switch is turned ON.

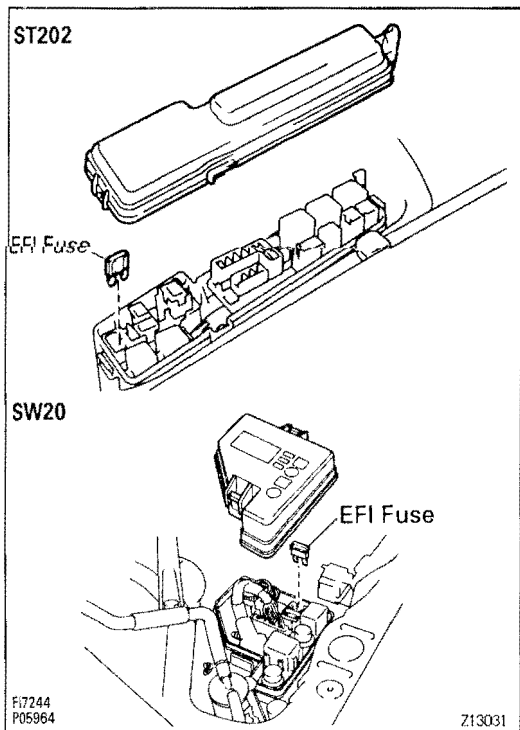
4. Start the engine and drive the vehicle at a speed of 10 km/h (6 mph) or higher.
5. Simulate the conditions of the malfunction described by the customer.

6. Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843–18020
7. Read the diagnostic code as indicated by the number of flashes of the check engine warning light. (See page EG–182)

8. After the diagnosis check, remove the SST from the check connector.
SST 09843–18020

HINT:

- The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned on.
- The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and code Nos. 42 and 43 will be output, if the operation in step 4 is not performed.
- When the air conditioner is ON or when the accelerator pedal is depressed, code No. 51 (Switch Condition Signal) is output, but this is not abnormal.



DIAGNOSTIC CODE CANCELLATION

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the EFI fuse 15A for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.

HINT:

- Cancellation can also be done by removing the negative (–) terminal cable from the battery, but in this case, other memory systems (clock, etc.) will also be cancelled out.
 - If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
 - 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 code has been recorded.
2. After cancellation, perform road test of the vehicle to check that a normal code is now read on the check engine warning light.
If the same diagnostic code appears, it indicates that the trouble area has not been repaired thoroughly.

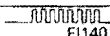

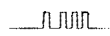
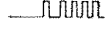
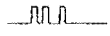
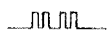
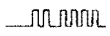
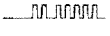
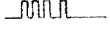
DIAGNOSIS INDICATION

1. When 2 or more codes are indicated, the lowest numbered code will appear first.
2. All detected diagnostic codes, except code Nos. 42, 43 and 51 under the test mode will be retained in memory by the ECU from the time of detection until cancelled out.
3. Once malfunction is cleared, the check engine warning light on the combination meter will go off but the diagnostic code(s) remains stored in ECU memory (except for code Nos. 42, 43 and 51 under the test mode).

DIAGNOSTIC CODES

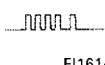
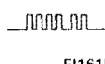

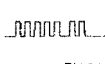
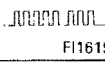

HINT:

- If a malfunction is detected during the diagnostic code check, refer to the circuit indicated in the table, and turn to the corresponding page.
- Your readings may vary from the parameters listed in the table, depending on the instruments used.

Code No.	Number of blinks of Check Engine Warning Light	System	*1 Check Engine Warning Light		Diagnosis	Trouble Area	*2 Memory	See page
			Normal Mode	Test Mode				
-	 F11401	Normal	-	-	No trouble code is recorded.	-	-	-
12	 F11606	RPM Signal	ON	N.A.	<ul style="list-style-type: none"> • No G1, G2 or NE signal is input to the ECU for 2 secs. or more after STA turns ON. • Open in G and NE - circuits 	<ul style="list-style-type: none"> • Open or short in NE, G circuit • Distributor • Open or short in STA circuit • ECU 	○	IG-5 EG-200
13	 F11607	RPM Signal	ON	ON	NE signal is not input to ECU for 0.05 sec. or more when engine speed is 1,500 rpm or more.	<ul style="list-style-type: none"> • Open or short in NE circuit • Distributor • ECU 	○	IG-5
14	 F11608	Ignition Signal	ON	N.A.	IG signal from igniter is not input to ECU for 8 consecutive ignition.	<ul style="list-style-type: none"> • Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU 	○	EG-201
21	 F11609	Oxygen Sensor Signal	ON	N.A.	Open or short in heater circuit of oxygen sensor for 0.5 sec. or more. (HT)	<ul style="list-style-type: none"> • Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • ECU 	○	EG-204 EG-286
				ON	At normal driving speed (below 100 km/h (60 mph) and engine speed is above 1,500 rpm), amplitude of oxygen sensor signal (OX1) is reduced to between 0.35 - 0.70 V continuously for 60 secs. or more. *3 (2 trip detection logic)	<ul style="list-style-type: none"> • Open or short in oxygen sensor circuit • Oxygen sensor • Open or short in vacuum sensor circuit • Vacuum sensor • ECU 		
22	 F11610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 0.5 sec. or more. (THW)	<ul style="list-style-type: none"> • Open or short in water temp. sensor circuit • Water temp. sensor • ECU 	○	EG-199
24	 F11611	Intake Air Temp. Sensor Signal	ON	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	<ul style="list-style-type: none"> • Open or short in intake air temp. circuit • Intake air temp. sensor • ECU 	○	EG-198
25	 F12562	Air-Fuel Ratio Lean Mal-function	ON	ON	Oxygen sensor output in less than 0.45 V for at least 90 secs. when oxygen sensor is warmed up (racing at 1,500 rpm). *3 (2 trip detection logic)	<ul style="list-style-type: none"> • Engine ground bolt loose • Open in E1 circuit • Open in injector circuit • Fuel line pressure (Injector blockage, etc.) • Open or short in oxygen sensor circuit. • Oxygen sensor • Ignition system • Water temp. sensor • ECU 	○	EG-204 EG-286
31	 F11612	Vacuum Sensor Signal	ON	ON	Open or short detected continuously for 500 msec. or more in vacuum sensor sensor circuit. (PIM)	<ul style="list-style-type: none"> • Open or short in vacuum sensor circuit • Vacuum sensor • ECU 	○	EG-196

EG

DIAGNOSTIC CODES (Cont'd)

Code No.	Number of blinks of Check Engine Warning Light	System	*1 Check Engine Warning Light		Diagnosis	Trouble Area	*2 Memory	See page
			Normal Mode	Test Mode				
41	 FI1614	Throttle Position Sensor Signal	ON	ON	Open or short detected in throttle position sensor signal (VTA) for 0.5 sec. or more.	<ul style="list-style-type: none"> • Open or short in throttle position sensor circuit • Throttle position sensor • ECU 	○	EG-194
42	 FI1615	Vehicle Speed Sensor Signal	OFF	OFF	SPD signal is not input to the ECU for at least 8 seconds during high load driving with engine speed between 2,500 rpm and 5,000 rpm.	<ul style="list-style-type: none"> • Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU 	○	-
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECU until TE1 and E1 are connected.	<ul style="list-style-type: none"> • Open or short in starter signal circuit • Open or short in IG SW or EFI main relay circuit • ECU 	X	EG-200
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 2,850 rpm and 7,300 rpm, signal from knock sensor is not input to ECU for 2 revolutions. (KNK)	<ul style="list-style-type: none"> • Open or short in knock sensor circuit • Knock sensor (looseness, etc.) • ECU 	○	-
53	 FI1619	Knock Control Signal	ON	N.A.	Engine speed is between 700 rpm and 7,300 rpm and ECU (for knock control) malfunction is detected.	<ul style="list-style-type: none"> • ECU 	X	-
51	 FI1617	Switch Condition Signal	N.A.	OFF	Displayed when A/C is ON or IDL contact OFF with the check terminals E1 and TE1 connected.	<ul style="list-style-type: none"> • A/C switch circuit • Throttle position sensor IDL circuit. • Accelerator pedal, cable • ECU 	X	EG-194

REMARKS:

- *1 "ON" displayed in the diagnosis mode column indicates that the check engine warning light is lit up when a malfunction is detected. "OFF" indicates that the check engine warning light 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 "○" in the memory column indicates that a diagnostic code is recorded in the ECU memory when a malfunction occurs. "X" indicates that a diagnostic code is not recorded in the ECU memory even if a malfunction occurs. Accordingly, output of diagnostic results in normal or test mode is performed with the ignition switch ON.
- *3 "2 trip detection logic" (See page EG-178)

DIAGNOSTIC CODE DETECTION DRIVING PATTERN

Purpose of the driving pattern.

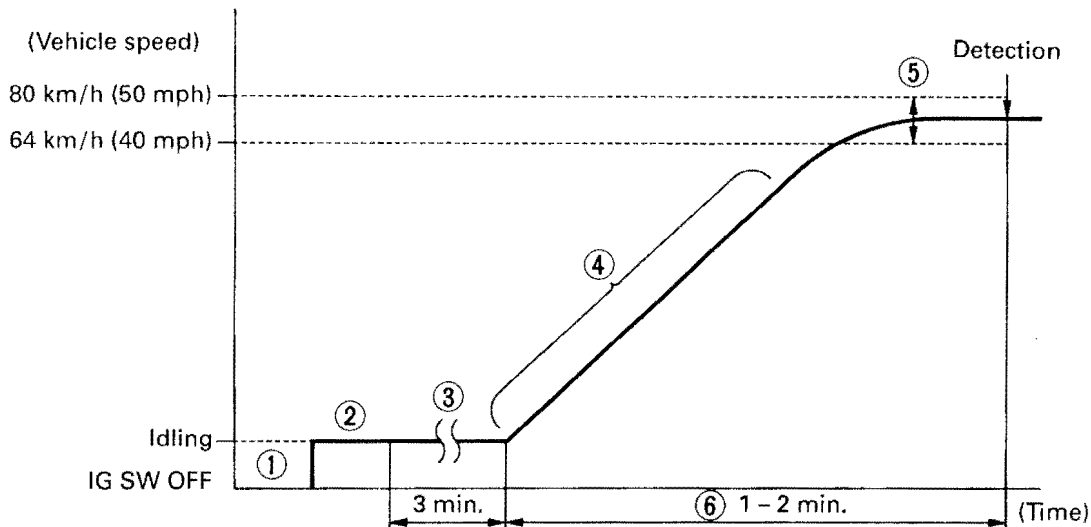
- (a) To simulate diagnostic code detecting condition after diagnostic code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed, confirming that diagnostic code is not longer detected.

Code No.

21

Oxygen Sensor Circuit

Malfunction: Deterioration of Oxygen Sensor



FI6464

It is vital that test routine is adhered to detect the malfunction:

- ① Disconnect the EFI fuse (15A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of check connector with IG switch OFF).
- ② Start the engine and warm up with all ACC switched OFF.
- ③ Idle the engine for 3 minutes.
- ④ With A/C switched ON, A/T in D range (M/T in 5th gear), accelerate gradually within the range 1,300 – 1,700 rpm centered around 1,500 rpm.

HINT:

- Ensure engine speed does NOT fall below 1,200 rpm.
- Gradually depress the accelerator pedal at a suitable rate to comply with the test requirements on the above graph.
- Never allow engine speed to drop at any time during the test.

- ⑤ Maintain the vehicle speed at 64 – 80 km/h (40 – 50 mph).
- ⑥ Keep the vehicle running for 1 – 2 min. after starting acceleration.

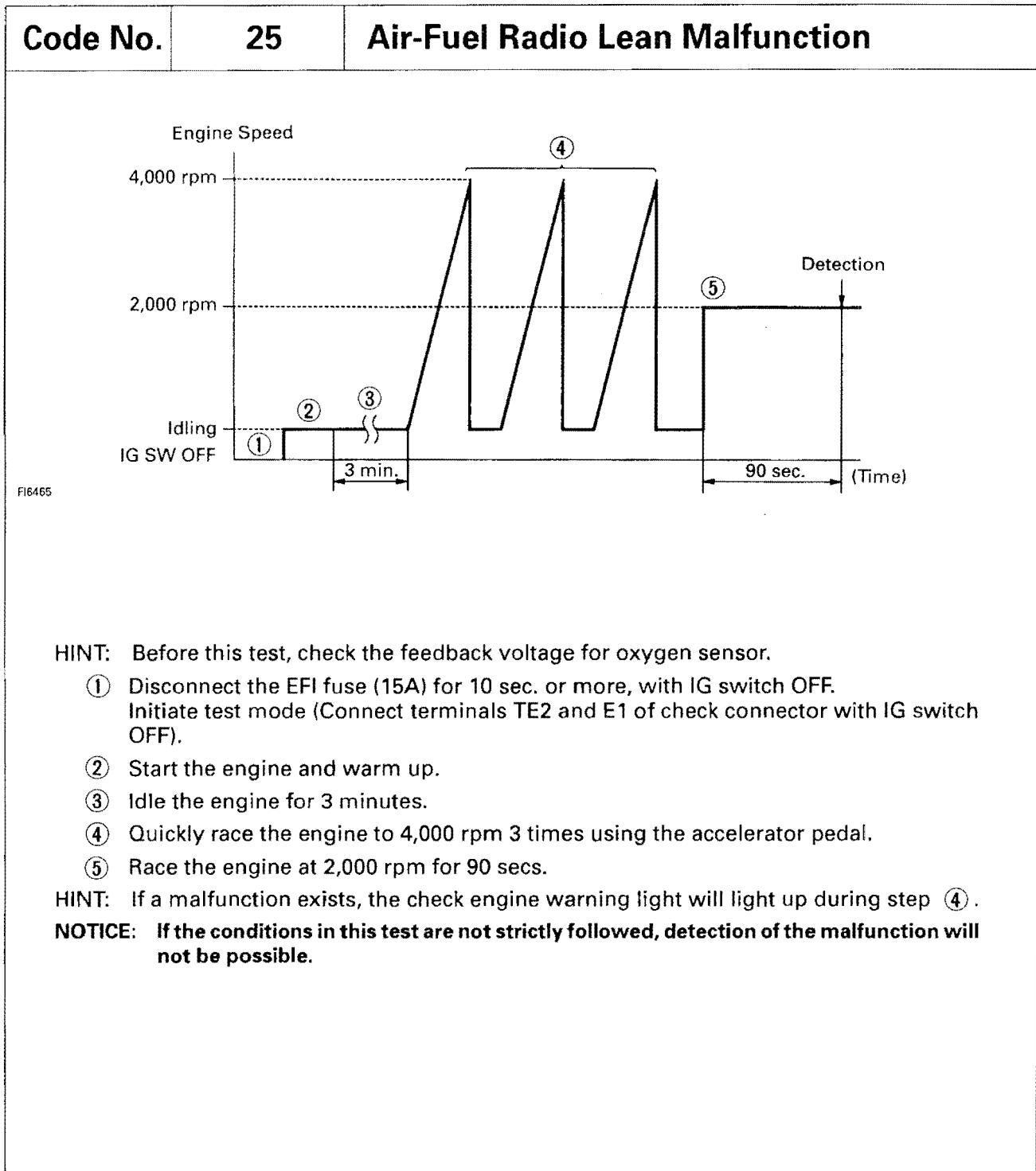
HINT: If a malfunction exists, the check engine warning light will light up after approx. 60 sec. from the start of acceleration.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSTIC TROUBLE CODE DETECTION DRIVING PATTERN (Cont'd)

Purpose of the driving pattern.

- (a) To simulate diagnostic code detecting condition after diagnostic code is recorded.
- (b) To check that the malfunction is corrected when the repair is completed, confirming that diagnostic code is no longer detected.



HINT: Before this test, check the feedback voltage for oxygen sensor.

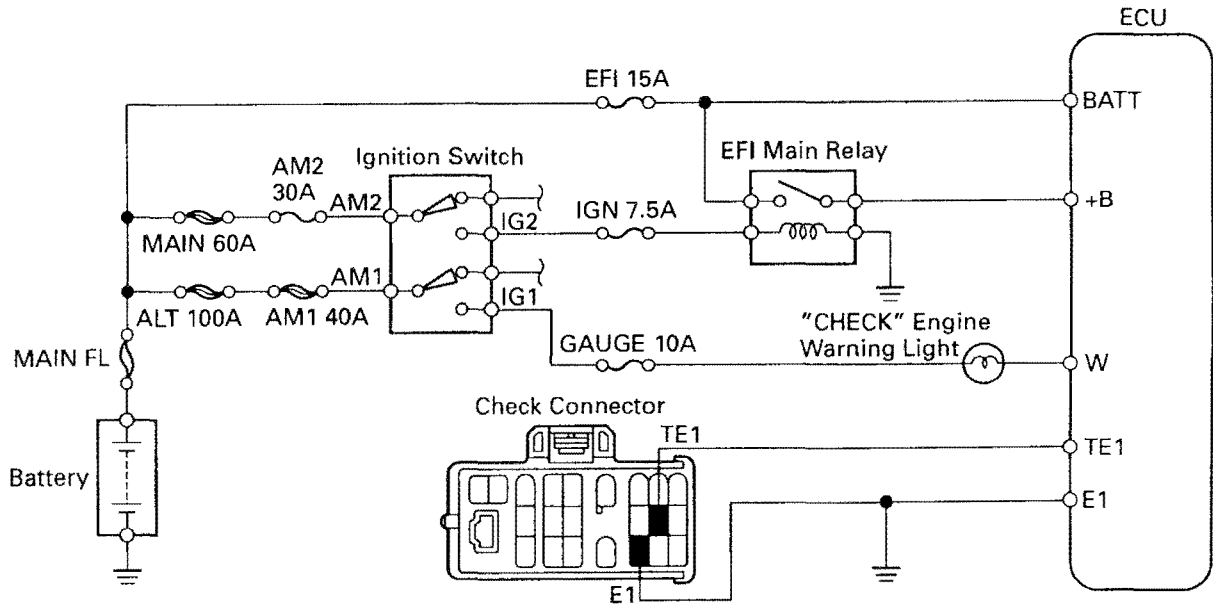
- ① Disconnect the EFI fuse (15A) for 10 sec. or more, with IG switch OFF. Initiate test mode (Connect terminals TE2 and E1 of check connector with IG switch OFF).
- ② Start the engine and warm up.
- ③ Idle the engine for 3 minutes.
- ④ Quickly race the engine to 4,000 rpm 3 times using the accelerator pedal.
- ⑤ Race the engine at 2,000 rpm for 90 secs.

HINT: If a malfunction exists, the check engine warning light will light up during step ④.

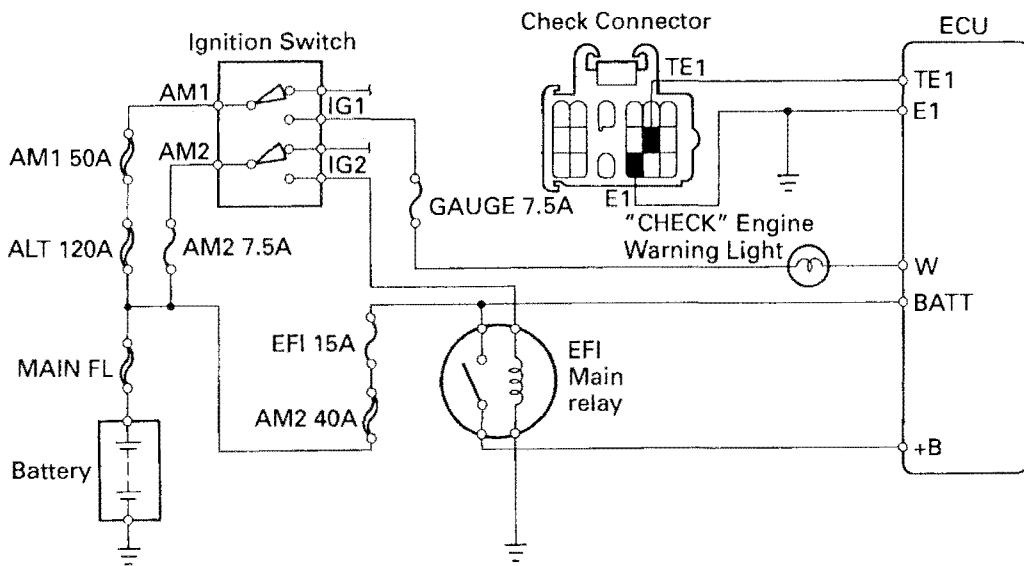
NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

DIAGNOSIS CIRCUIT INSPECTION

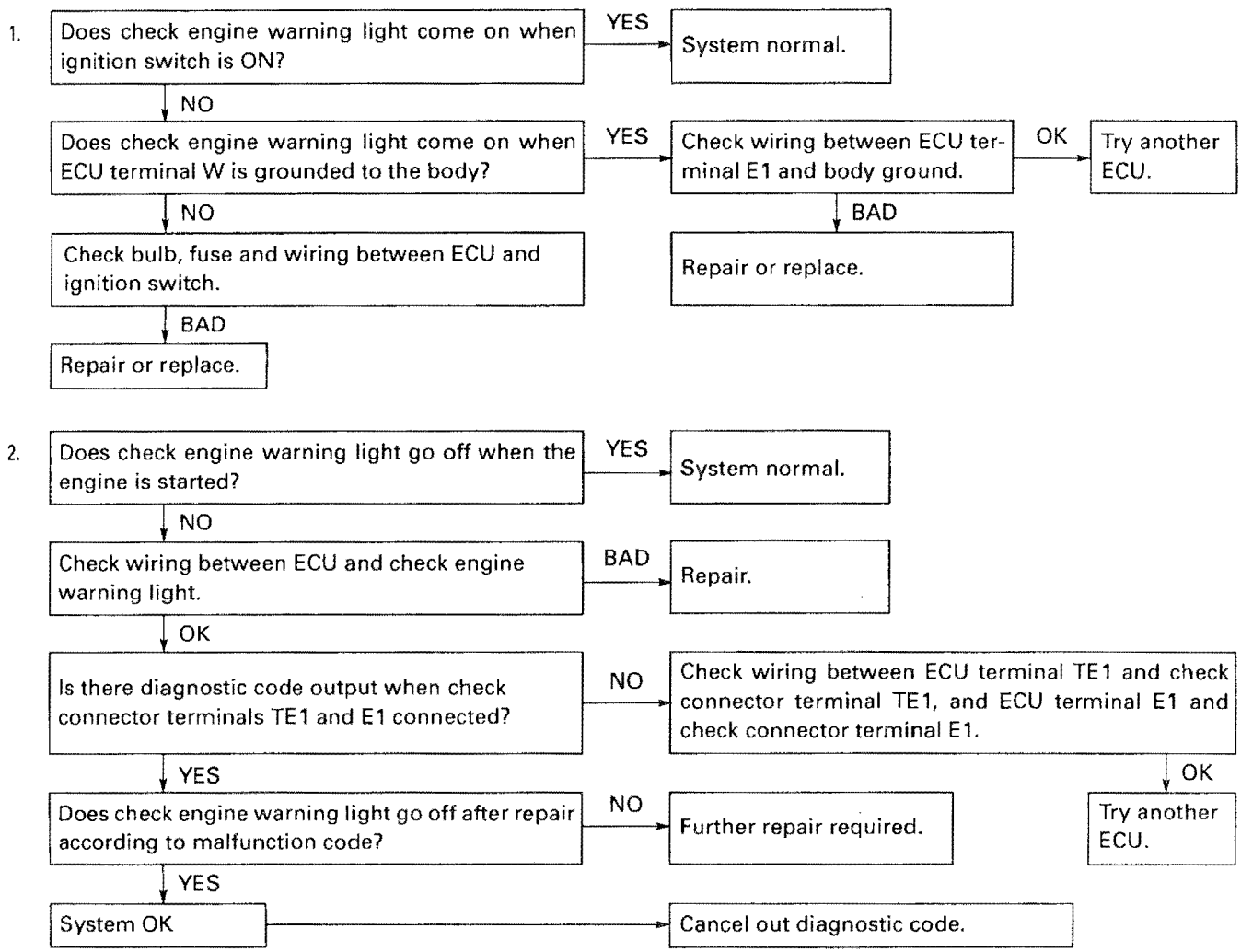
ST202



SW20



EG



TROUBLESHOOTING w/ VOLT, OHMMETER

EG129-04

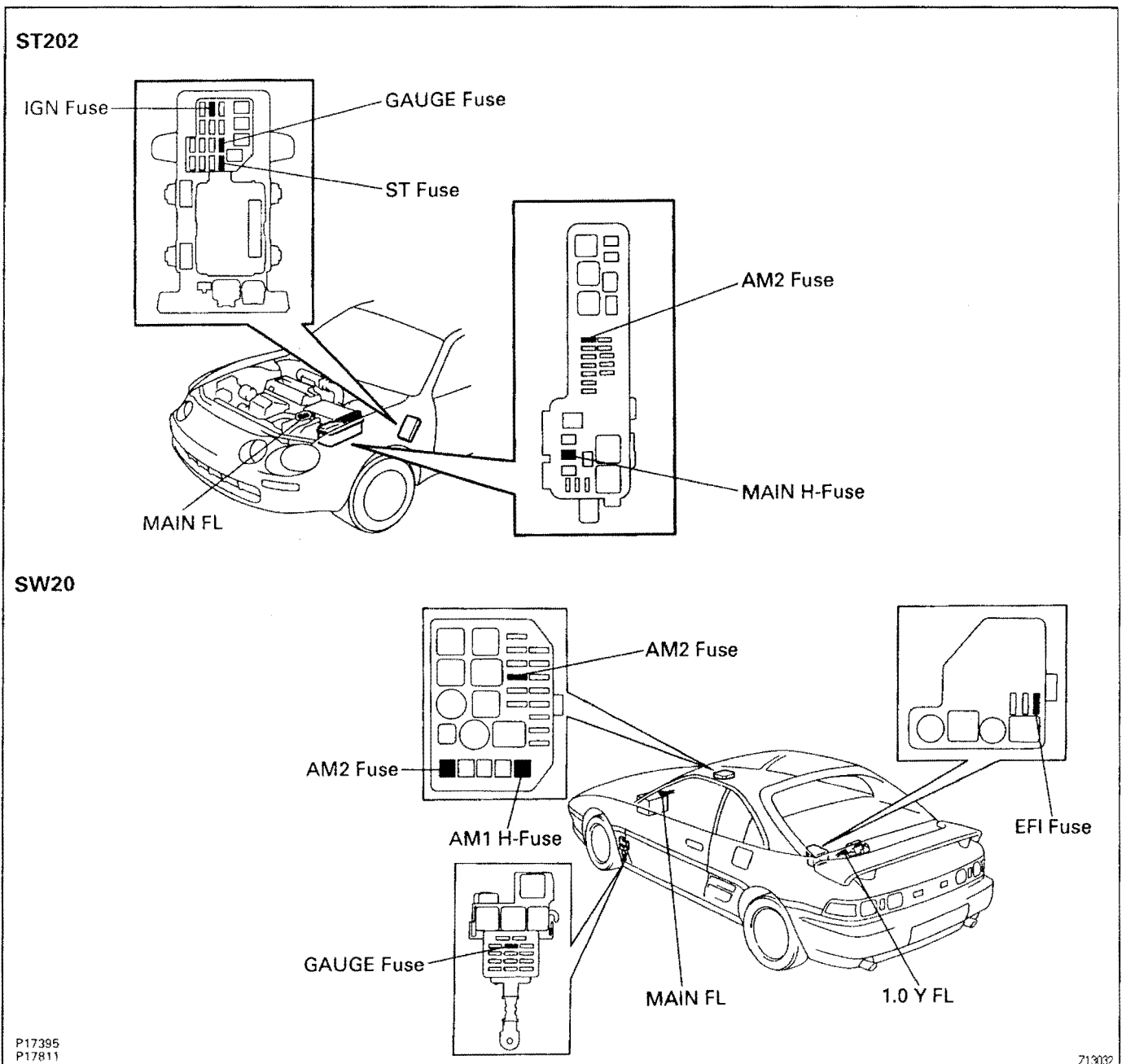
HINT:

- The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed while referring to the inspection methods described in this manual.
- Before beginning inspection, it is best to first make a simple check of the fuses, fusible link and the condition of the connectors.
- The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit within the computer.
- If engine trouble occurs even though proper operating voltage is detected in the computer connector, then it can be assumed that the ECU is faulty and should be replaced.

EG

FUSES AND FUSIBLE LINK LOCATION

EG447-01



EFI SYSTEM CHECK PROCEDURE

PREPARATION

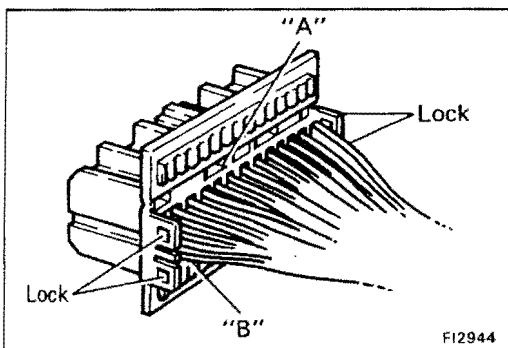
- (a) Disconnect the connectors from the ECU.
- (b) Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.

NOTICE: Pay attention to sections "A" and "B" in the illustration which can be easily broken.

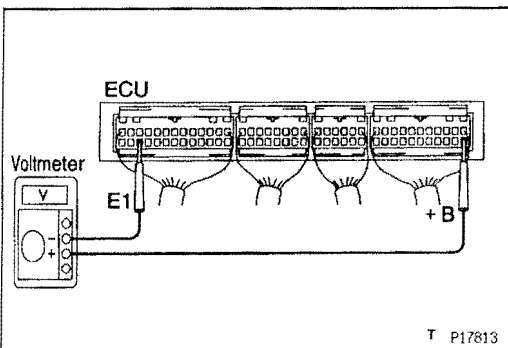
- (c) Reconnect the connectors to the ECU.

HINT:

- Perform all voltage measurements with the connectors connected.
 - Verify that the battery voltage is 11 V or more when the ignition switch is in the "ON" position.
- Using a voltmeter with high impedance (10 k Ω /V minimum), measure the voltage at each terminal of the wiring connectors.



F12944



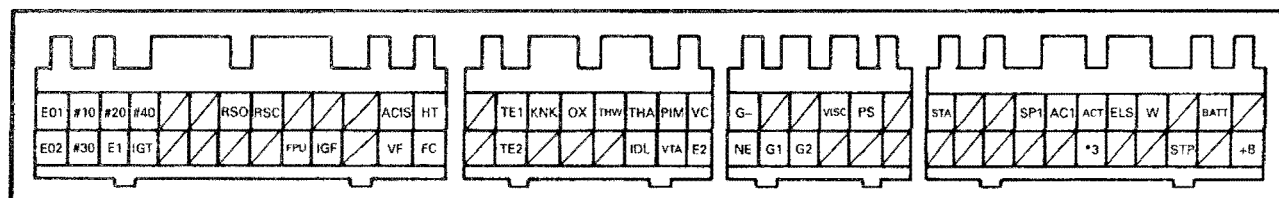
T P17813

ECU Terminals

EG

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	/	-	/	-
E02	POWER GROUND	/	-	/	-
#10	INJECTOR	TE1	CHECK CONNECTOR	STA	STARTER SWITCH
#30	INJECTOR	TE2	CHECK CONNECTOR	/	-
#20	INJECTOR	KNK	KNOCK SENSOR	/	-
E1	COMPUTER GROUND	/	-	/	-
#40	INJECTOR	OX	OXYGEN SENSOR	/	-
IGT	IGNITER	/	-	/	-
/	-	THW	WATER TEMP. SENSOR	SP1	SPEED SENSOR
/	-	/	-	/	-
/	-	THA	INTAKE AIR TEMP. SENSOR	AC1	A/C AMPLIFIER
/	-	IDL	THROTTLE POSITION SENSOR	/	-
RSO	ISC VALVE	PIM	VACUUM SENSOR	ACT	A/C AMPLIFIER
/	-	VTA	THROTTLE POSITION SENSOR	ATS*2	A/C AMPLIFIER
RSC	ISC VALVE	VC	THROTTLE POSITION SENSOR	PSCT*1	POWER STEERING ECU
/	-	E2	SENSOR GROUND	ELS	TAILLIGHT RELAY DEFOGGER RELAY
/	-	G-	DISTRIBUTOR	/	-
FPU	FUEL PRESSURE VSV	NE	DISTRIBUTOR	W	WARNING LIGHT
/	-	/	-	/	-
IGF	IGNITER	G1	DISTRIBUTOR	/	-
/	-	/	-	STP	STOP LIGHT SWITCH
/	-	G2	DISTRIBUTOR	BATT	BATTERY
ACIS	ACIS VSV	VISC	A/C IDLE-UP VALVE	/	-
VF	CHECK CONNECTOR	/	-	/	-
HT	OXYGEN SENSOR HEATER	PS*1	POWER STEERING ECU	+B	EFI MAIN RELAY
FC	CIRCUIT OPENING RELAY	/	-	/	-

ECU Terminals



P01399

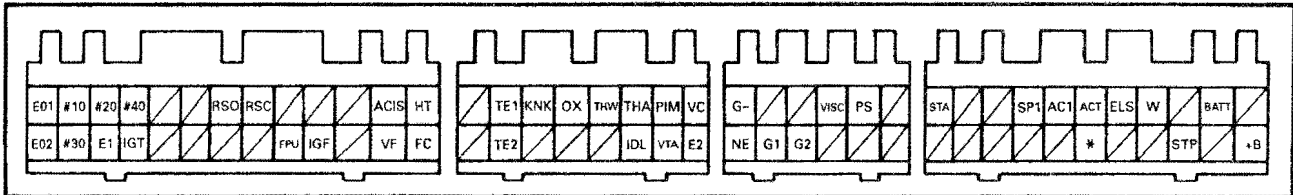
- *1 SW20
- *2 ST202
- *3 ST202: ATS
SW20: PSCT

ECU Wiring Connectors Voltage

No.	Terminals	Condition		STD voltage (V)	See page
1	+B – E1	IG SW ON		9 – 14	EG-192
2	BATT – E1	-		9 – 14	EG-193
3	IDL – E2	IG SW ON	Throttle valve open	9 – 14	EG-194
	VC – E2		-	4.5 – 5.5	
	VTA – E2		Throttle valve fully closed	0.3 – 0.8	
			Throttle valve fully open	3.2 – 4.9	
4	PIM – E2	IG SW ON		3.3 – 3.9	EG-196
	VC – E2			4.5 – 5.5	
5	#10, #30 _ E01 #20, #40 _ E02			9 – 14	EG-197
6	THA – E2	IG SW ON	Intake air temp. 20°C (68°F)	0.5 – 3.4	EG-198
7	THW – E2		Coolant temp. 80°C (176°F)	0.2 – 1.0	EG-199
8	STA – E1	Cranking		6 or more	EG-200
9	IGT – E1	Cranking or idling		Pulse generation	EG-201
10	RSC – E1 RSO	IG SW ON	ECU connectors disconnected	9 – 14	EG-202
11	W – E1	No trouble (Check engine warning light off) and engine running		9 – 14	EG-203

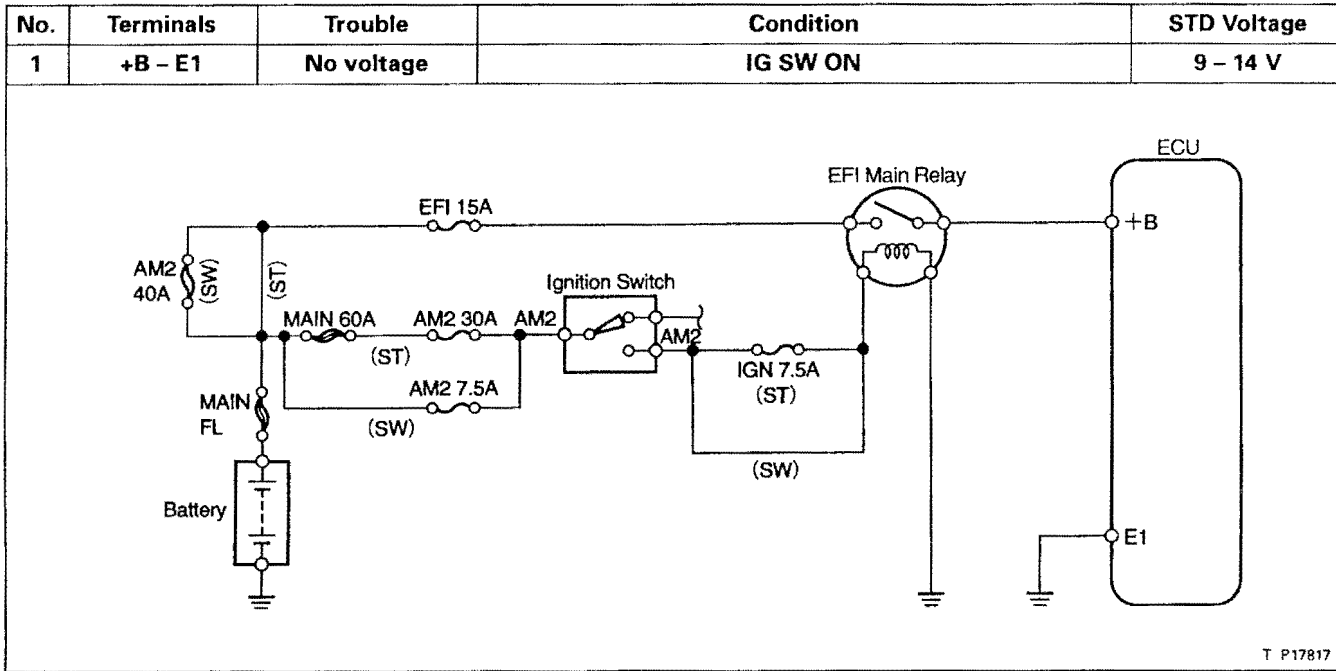
EG

ECU Terminals

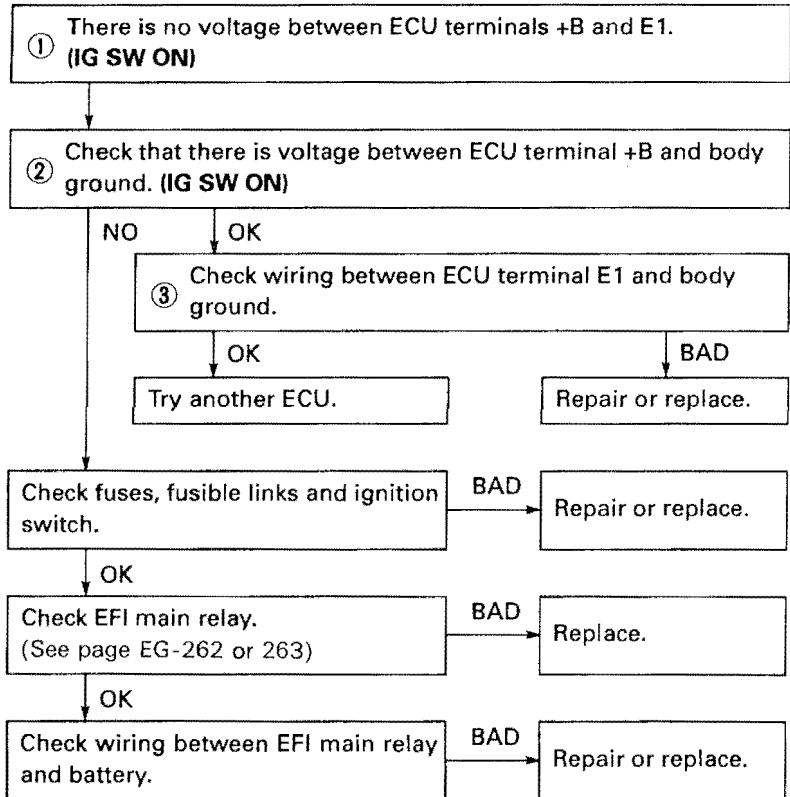
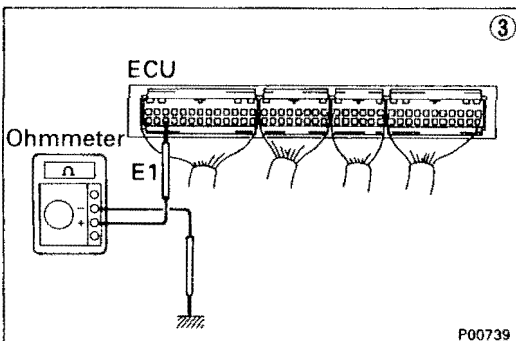
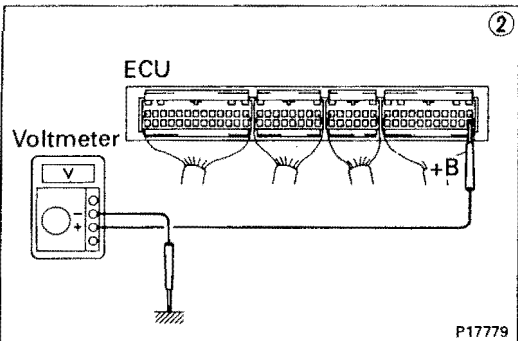
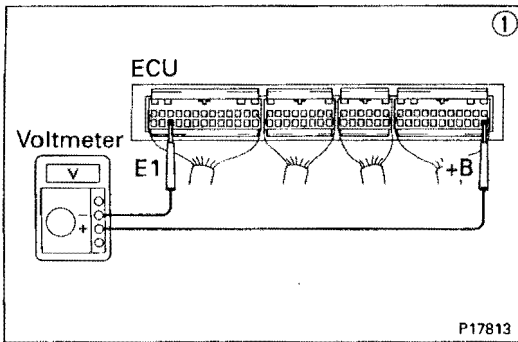


P01399

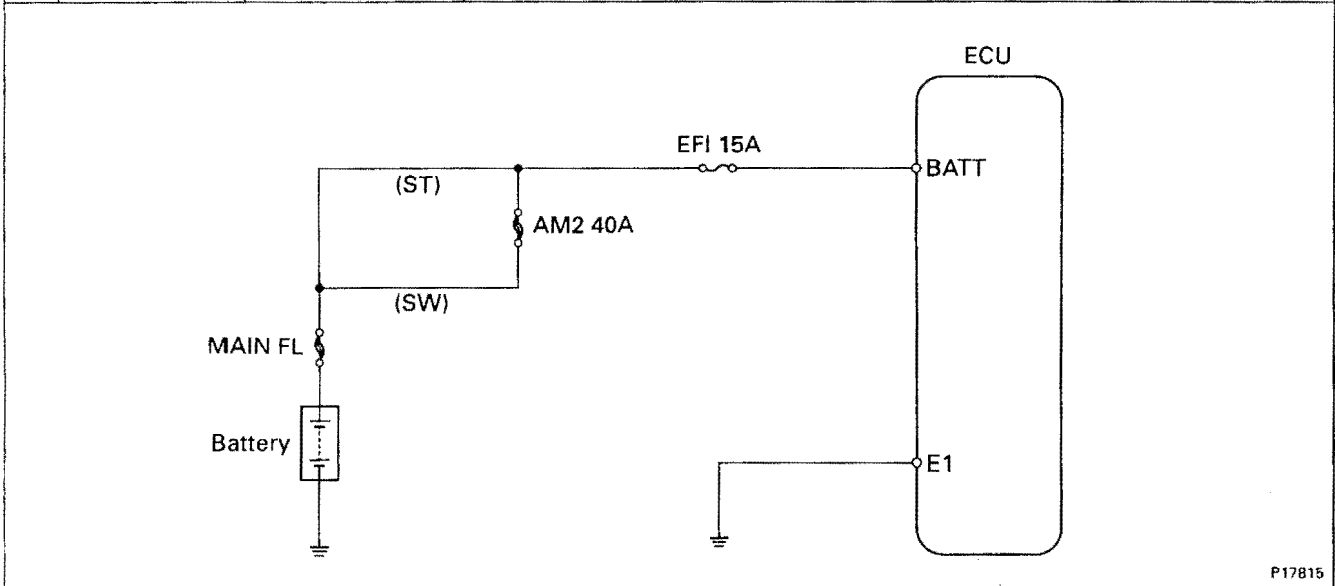
* ST202: ATS
SW20: PSCT



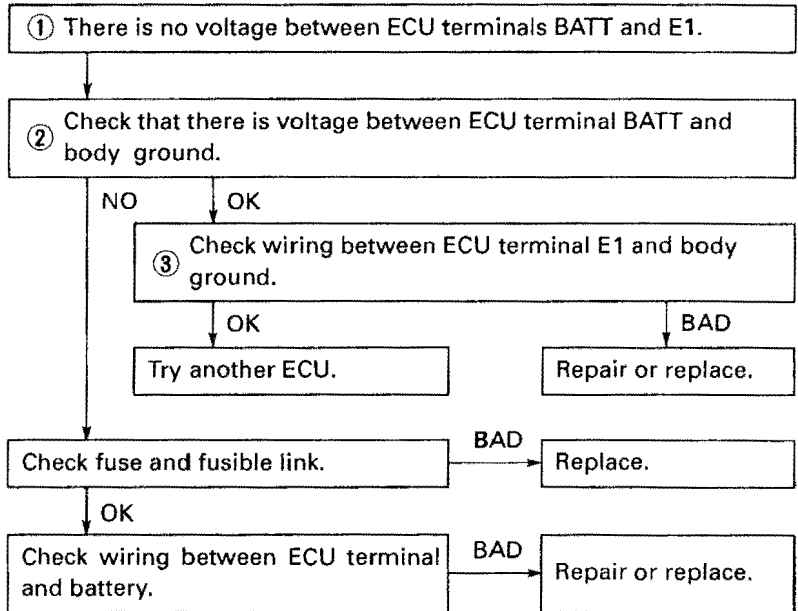
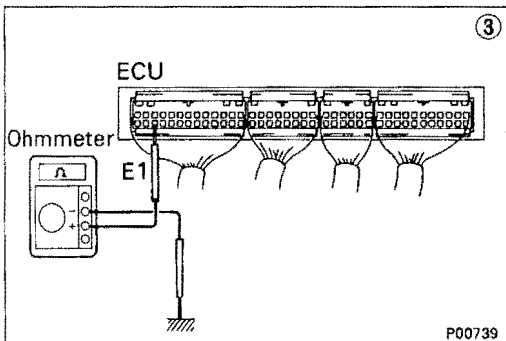
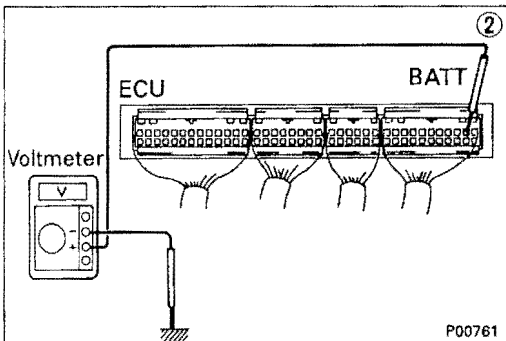
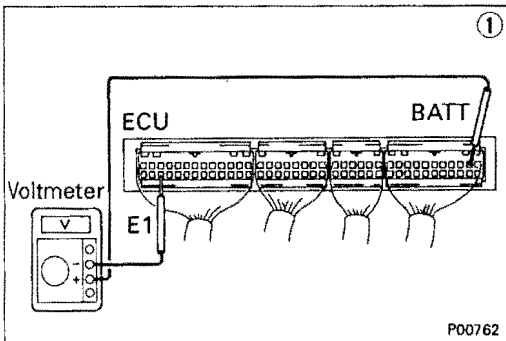
EG



No.	Terminals	Trouble	Condition	STD Voltage
2	BATT - E1	No voltage	-	9 - 14 V



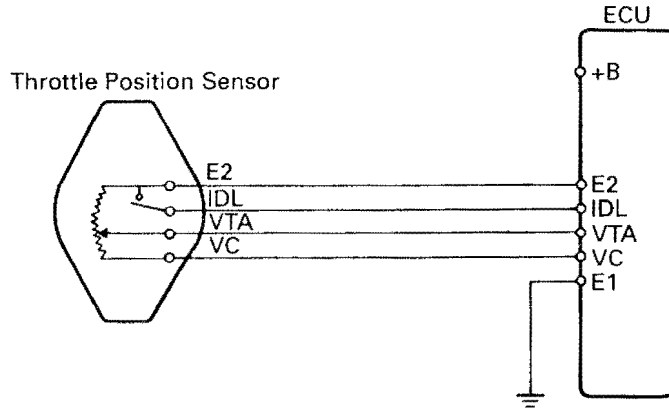
P17815



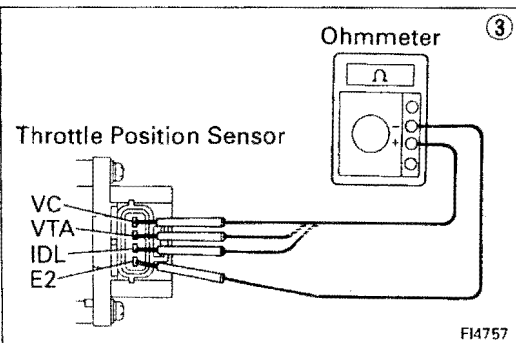
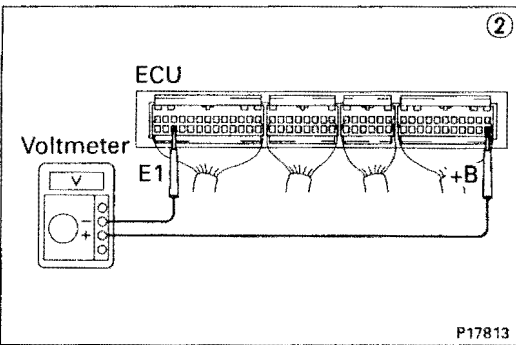
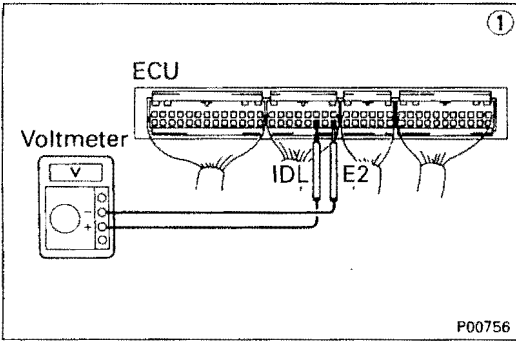
EG

No.	Terminals	Trouble	Condition	STD Voltage	
3	IDL – E2	No voltage	Ignition switch ON	Throttle valve open	9 – 14 V
	VC – E2			–	4.5 – 5.5 V
	VTA – E2			Throttle valve fully closed	0.3 – 0.8 V
				Throttle valve fully open	3.2 – 4.9 V

EG



F11366

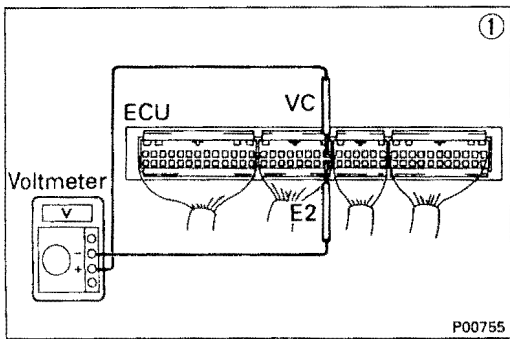


• IDL – E2

```

    graph TD
      Start[① There is no voltage between ECU terminals IDL and E2.  
(IG SW ON) (Throttle valve open)] --> Step2[② Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)]
      Step2 -- NO --> Step3[③ Check throttle position sensor. (See page EG-253)]
      Step2 -- OK --> CheckE1[Check wiring between ECU terminal E1 and body ground.]
      CheckE1 -- OK --> TryECU[Try another ECU.]
      CheckE1 -- BAD --> RepairECU[Repair or replace.]
      Step3 -- BAD --> RepairSensor[Repair or replace throttle position sensor.]
      Step3 -- OK --> CheckWiring[Check wiring between ECU and throttle position sensor.]
      CheckWiring -- OK --> TryECU2[Try another ECU.]
      CheckWiring -- BAD --> RepairECU2[Repair or replace.]
      TryECU --> RepairECU2
      TryECU2 --> RepairECU2
  
```

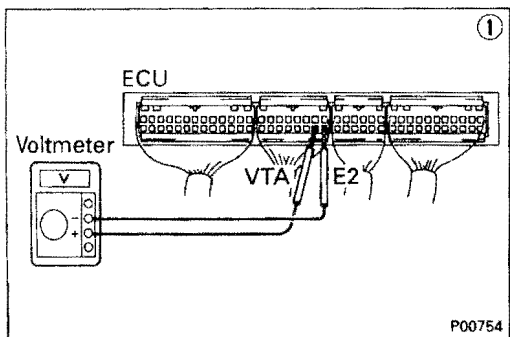
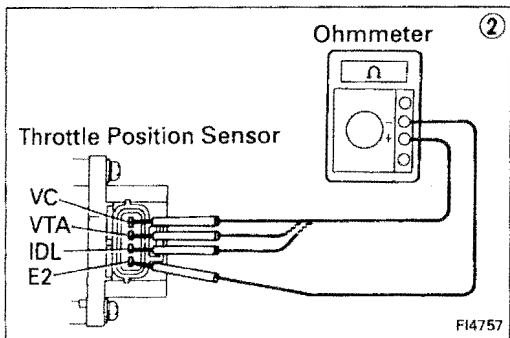

EG



• VC – E2

```

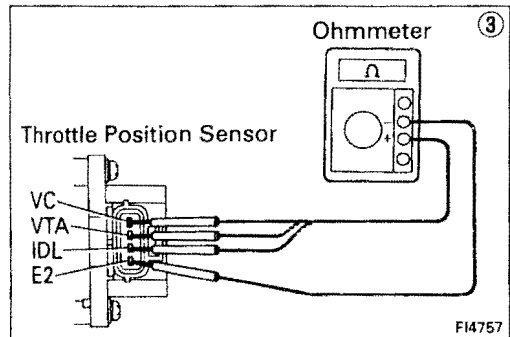
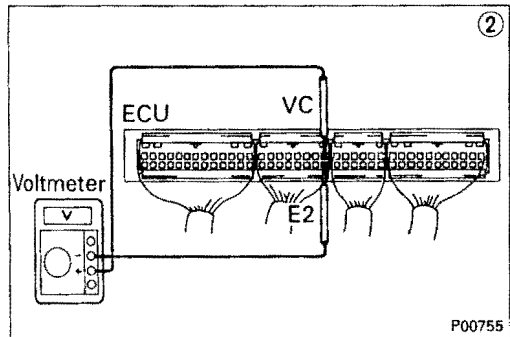
    graph TD
        A["① No voltage between ECU terminals VC and E2.  
(IG SW ON)"] --> B["Check that there is voltage between ECU terminal +B and body ground.  
(IG SW ON)"]
        B -- OK --> C["② Check throttle position sensor.  
(See page EG-253)"]
        B -- NO --> D["Refer to +B – E1 trouble section (No.1).  
(See page EG-192)"]
        C -- BAD --> E["Repair or replace."]
        C -- OK --> F["Check wiring between ECU and throttle position sensor."]
        F -- OK --> G["Try another ECU."]
        F -- BAD --> H["Repair or replace."]
    
```



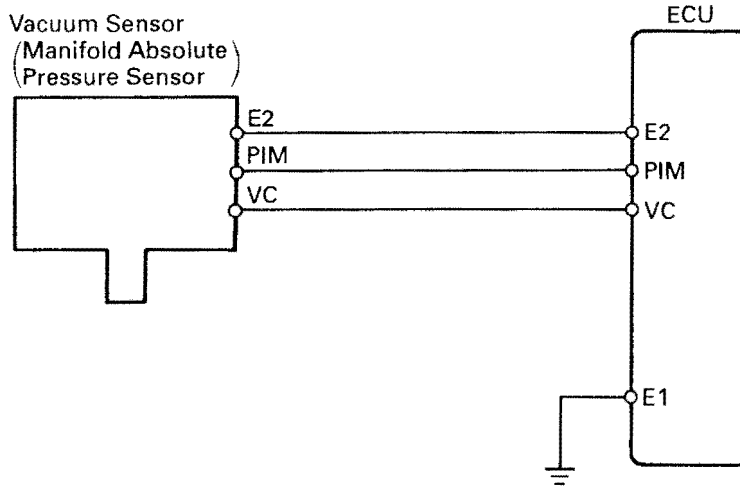
• VTA – E2

```

    graph TD
        A["① No specified voltage at ECU terminals VTA and E2.  
(IG SW ON)"] --> B["② Check that there is voltage between ECU terminals VC and E2.  
(IG SW ON)"]
        B -- NO --> C["Refer to VC – E2 trouble section."]
        B -- OK --> D["③ Check throttle position sensor.  
(See page EG-253)"]
        D -- BAD --> E["Repair or replace."]
        D -- OK --> F["Check wiring between ECU and throttle position sensor."]
        F -- BAD --> G["Repair or replace."]
        F -- OK --> H["Try another ECU."]
    
```

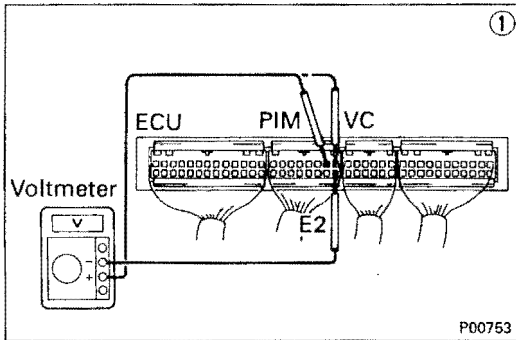


No.	Terminals	Trouble	Condition	STD voltage
4	PIM – E2	No voltage	IG SW ON	3.3 – 4.9 V
	VC – E2			4.5 – 5.5 V



FI1226

EG



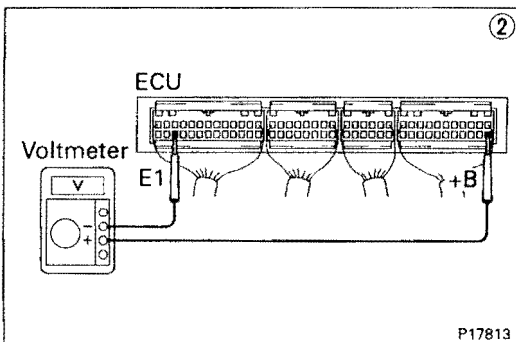
① There is no voltage between ECU terminals PIM or VC and E2. (IG SW ON)

② Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)

OK

NO

Refer to +B – E1 trouble section (No.1). (See page EG-192)



③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Check vacuum sensor. (See page EG-280)

BAD

Repair or replace.

Replace vacuum sensor.

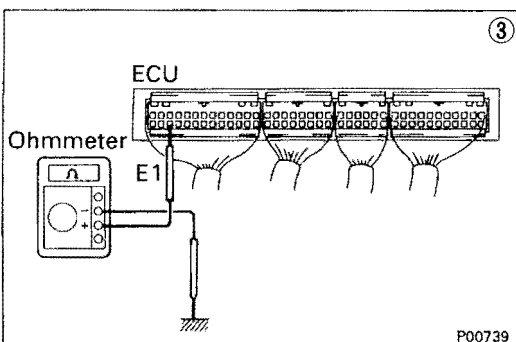
Check wiring between ECU and vacuum sensor.

BAD

OK

OK

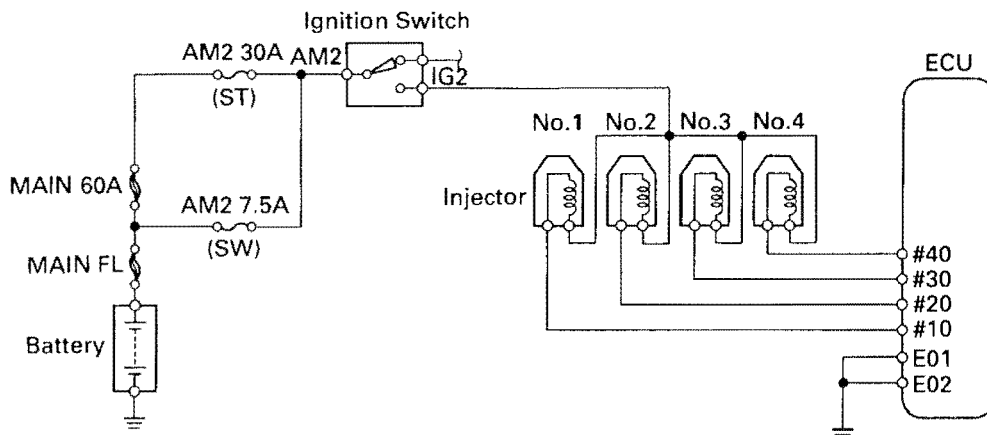
BAD



Try another ECU.

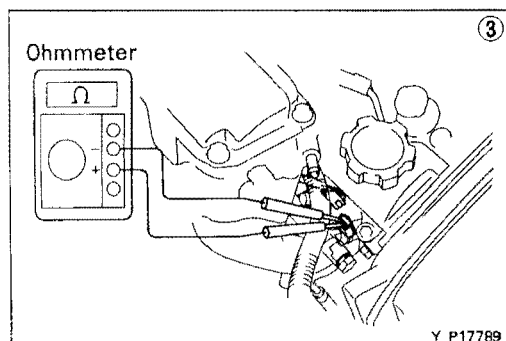
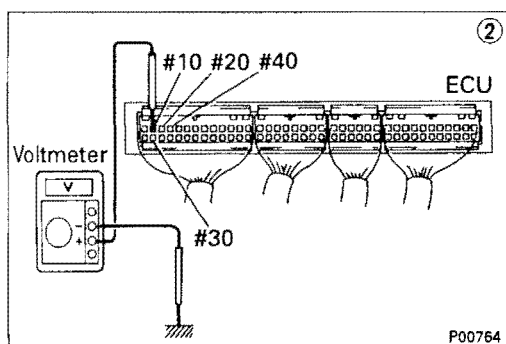
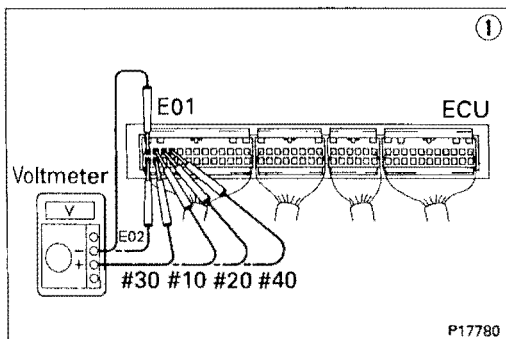
Repair or replace.

No.	Terminals	Trouble	Condition	STD voltage
5	#10, #30 - E01 #20, #40 - E02	No voltage	IG SW ON	9 - 14 V



T P17819

EG

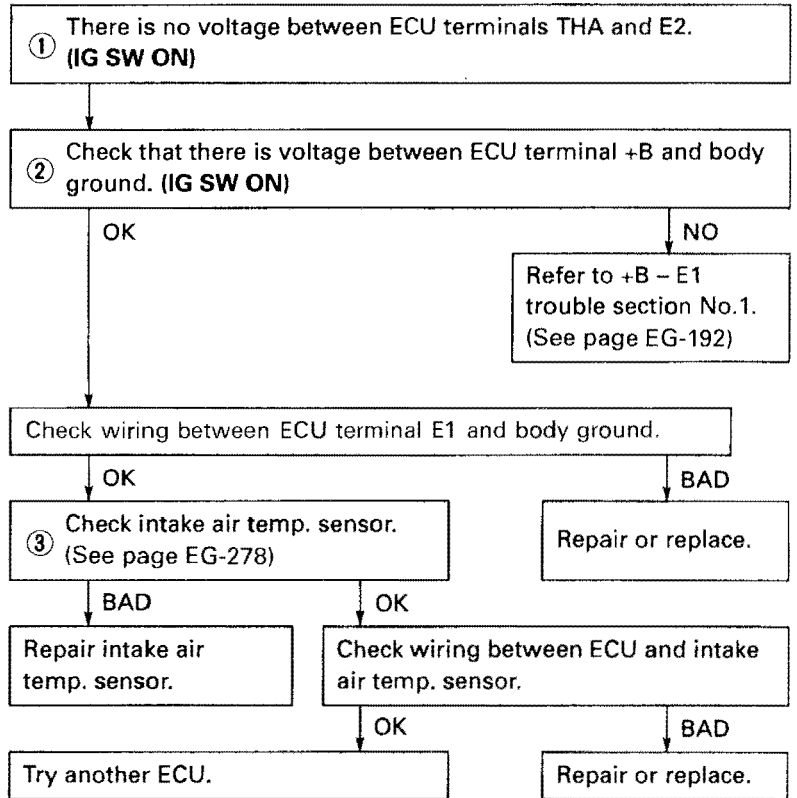
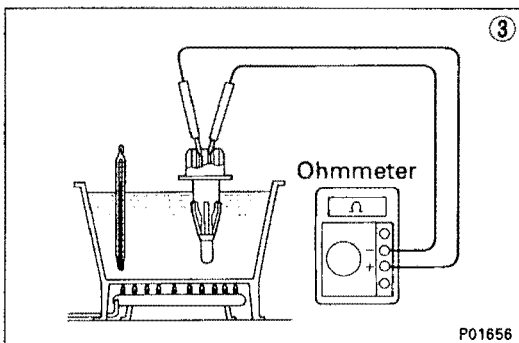
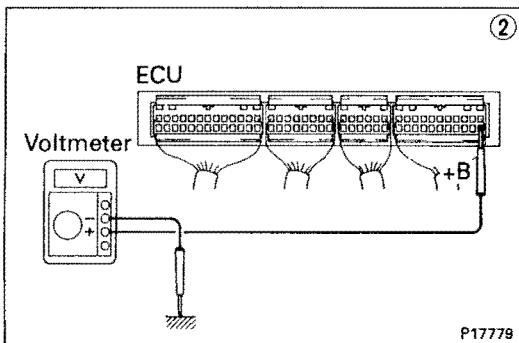
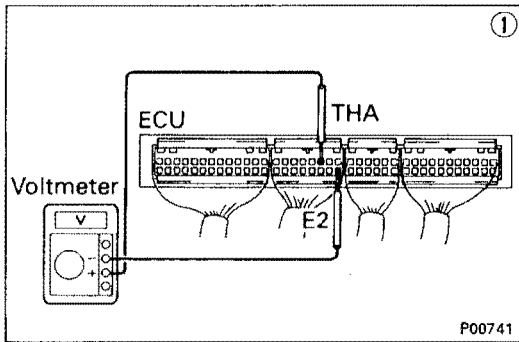
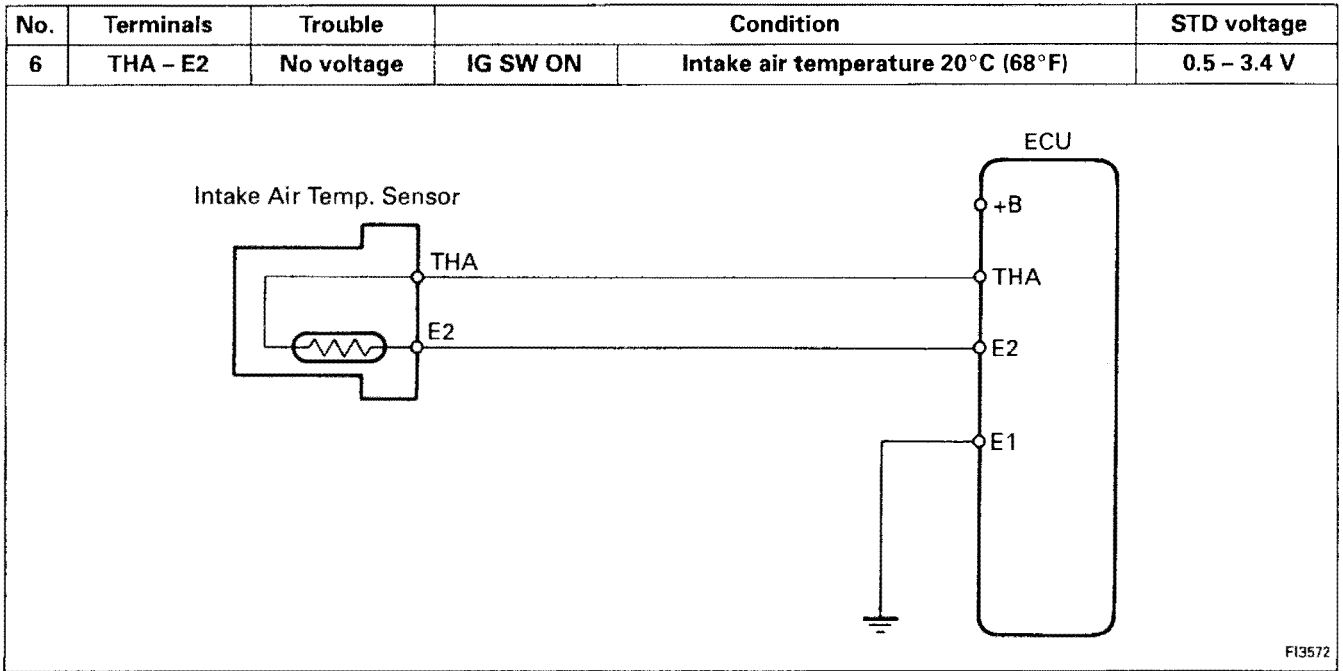


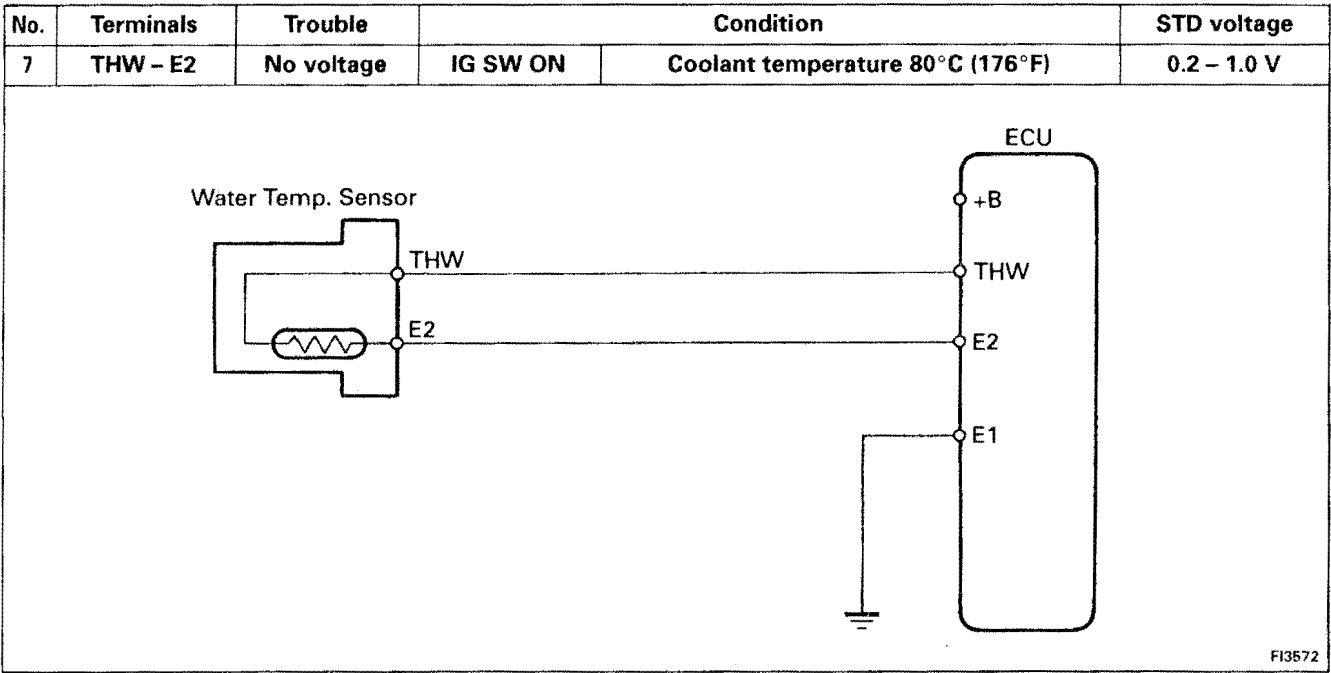
• IDL - E2

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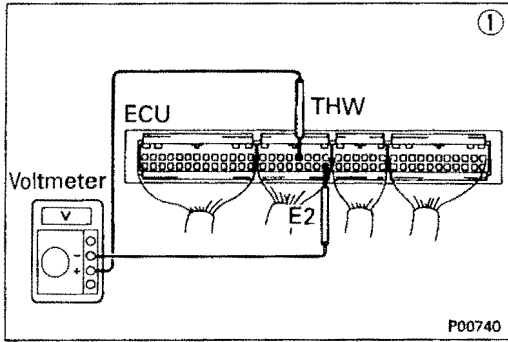
    graph TD
      A["① There is no voltage between ECU terminals #10, #20, #30 and/or #40 and E01 and/or E02. (IG SW ON)"] --> B["② Check that there is voltage between ECU terminal #10, #20, #30 and/or #40 and body ground."]
      B -- NO --> C["Check fuse, fusible links and ignition switch."]
      B -- OK --> D["Check wiring between ECU terminal E01 and/or E02 and body ground."]
      C -- BAD --> E["Repair or replace."]
      C -- OK --> F["③ Check resistance of each injector. STD resistance: Approx. 13.8 Ω"]
      D -- OK --> G["Try another ECU."]
      D -- BAD --> H["Repair or replace."]
      F -- OK --> I["Replace injector."]
      F -- BAD --> J["Check wiring between ECU terminal #10, #20, #30 and/or #40 and battery."]
      J -- BAD --> K["Repair or replace."]
  
```

EG





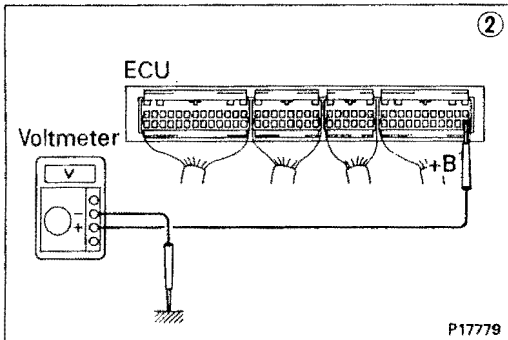
EG



① There is no voltage between ECU terminals THW and E2. (IG SW ON)

② Check that there is voltage between ECU terminal + B and body ground. (IG SW ON)

NO
Refer to +B – E1 trouble section (No.1). (See page EG-192)



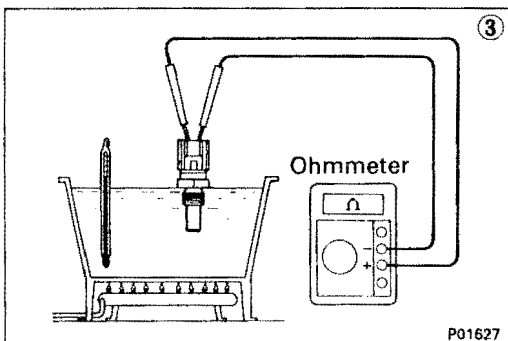
Check wiring between ECU terminal E1 and body ground.

BAD
Repair or replace.

③ Check water temp. sensor. (See page EG-275)

BAD
Replace water temp. sensor.

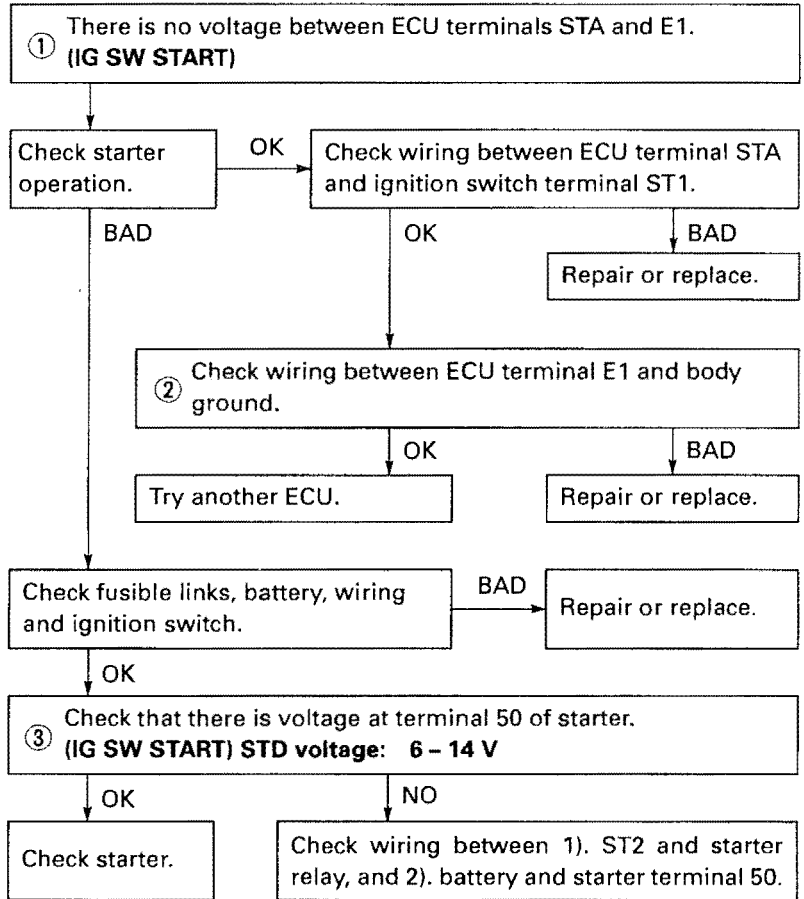
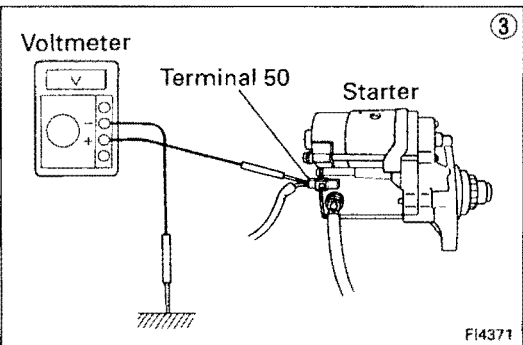
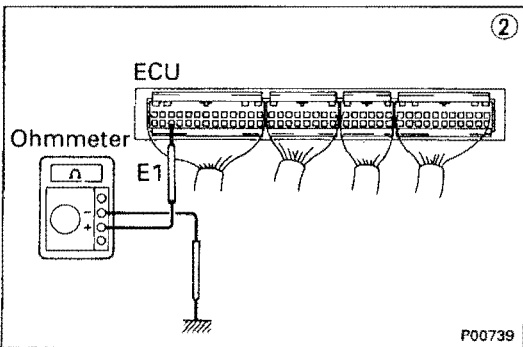
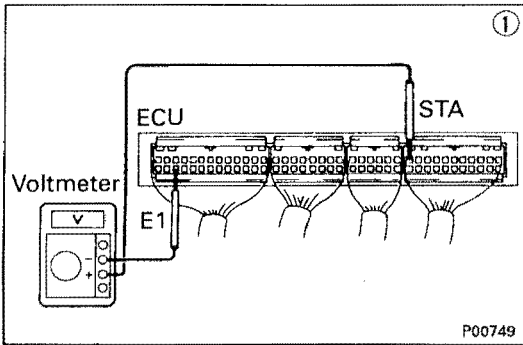
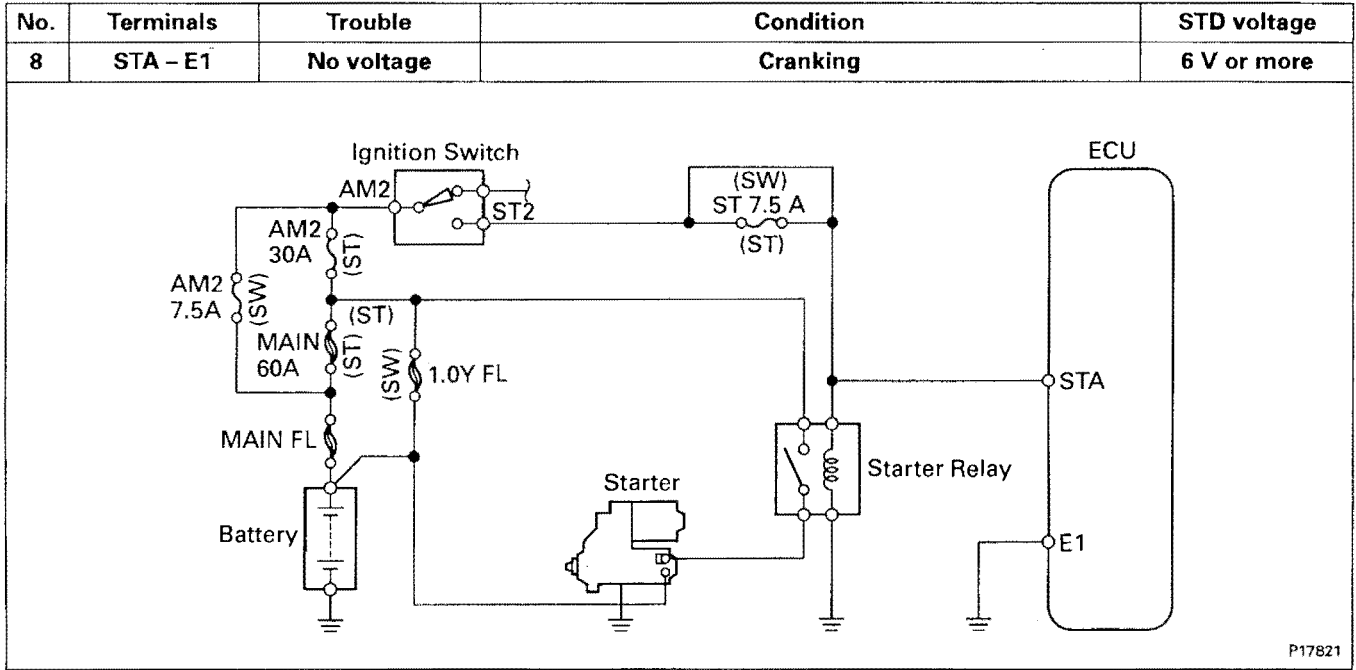
OK
Check wiring between ECU and water temp. sensor.



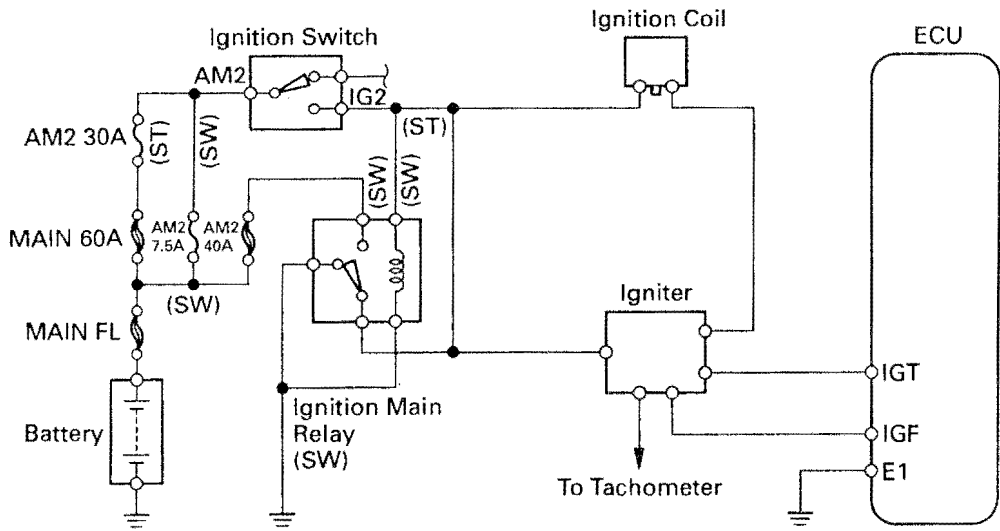
OK
Try another ECU.

BAD
Repair or replace.

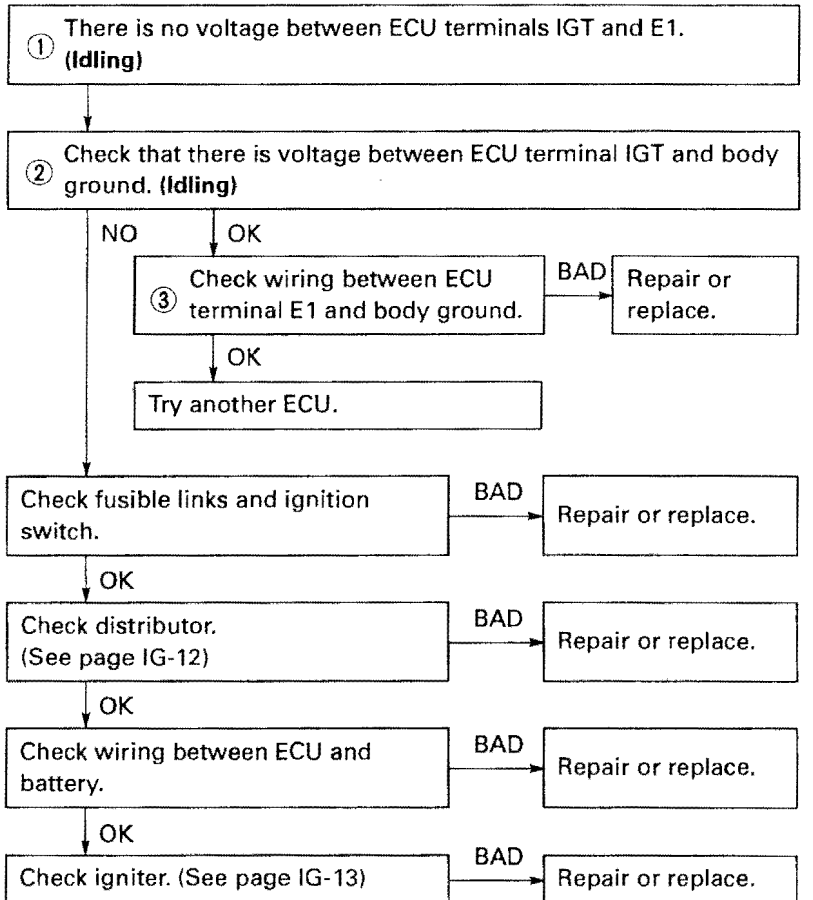
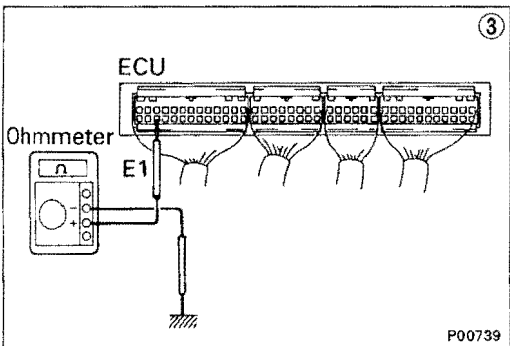
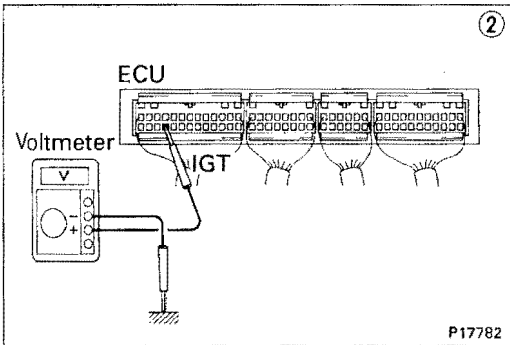
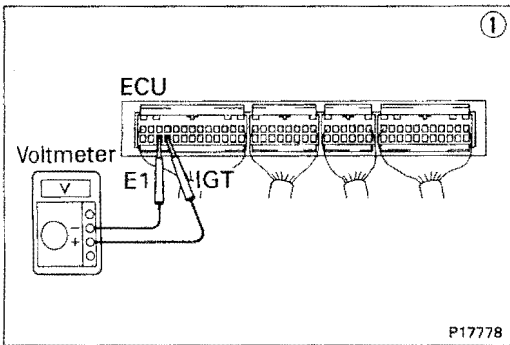
EG



No.	Terminals	Trouble	Condition	STD voltage
9	IGT – E1	No voltage	Idling	Pulse generation



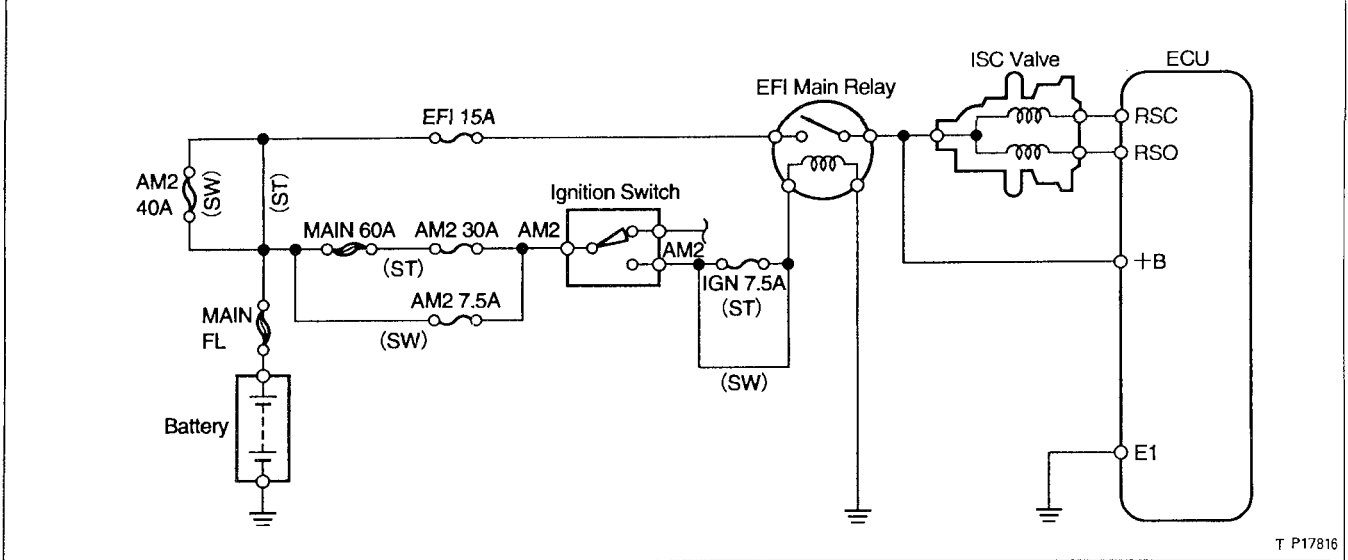
T P17820



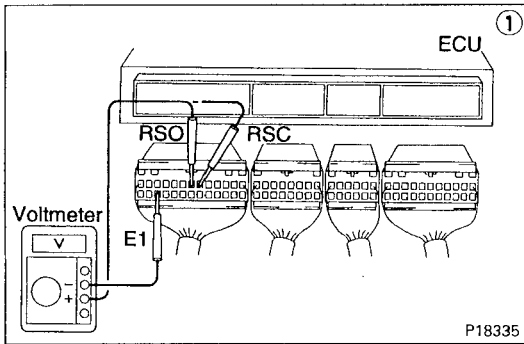
EG

EG

No.	Terminals	Trouble	Condition		STD voltage
10	RSC RSO – E1	No voltage	IG SW ON	ECU connectors disconnected	9 – 14 V



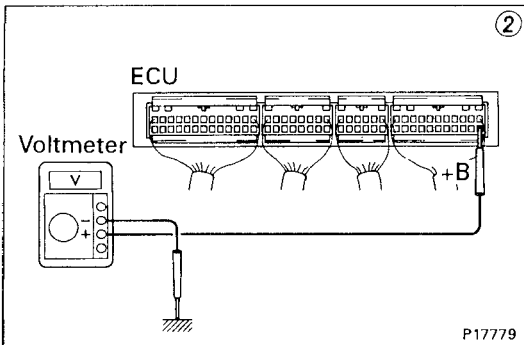
T P17816



① There is no voltage between ECU terminals RSC or RSO and E1. (IG SW ON)

② Check that there is voltage between ECU terminal +B and body ground. (IG SW ON)

NO
Refer to +B – E1 trouble section (No.1). (See page EG-192)



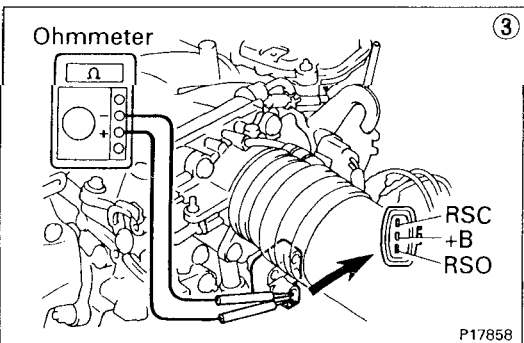
Check resistance between ISC valve terminals +B and RSC or RSO.
③ STD resistance:
Approx. 19.3 – 22.3 Ω

BAD → Replace ISC valve.

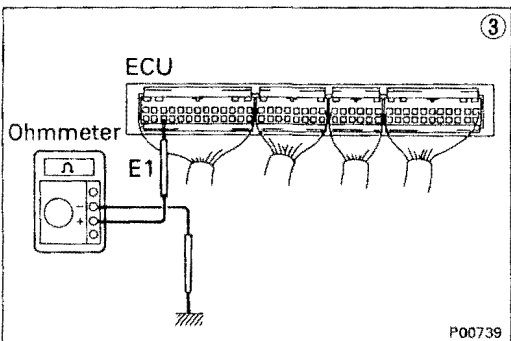
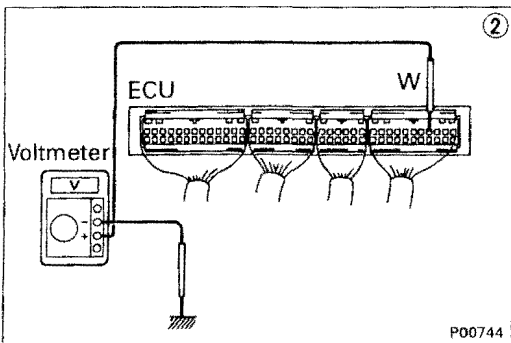
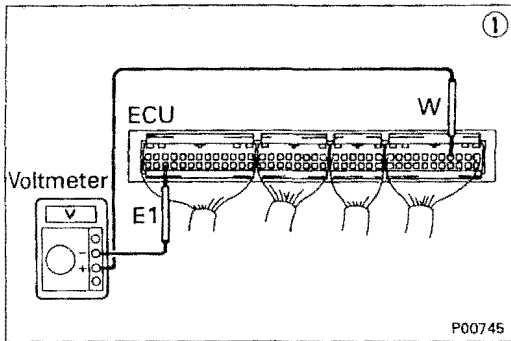
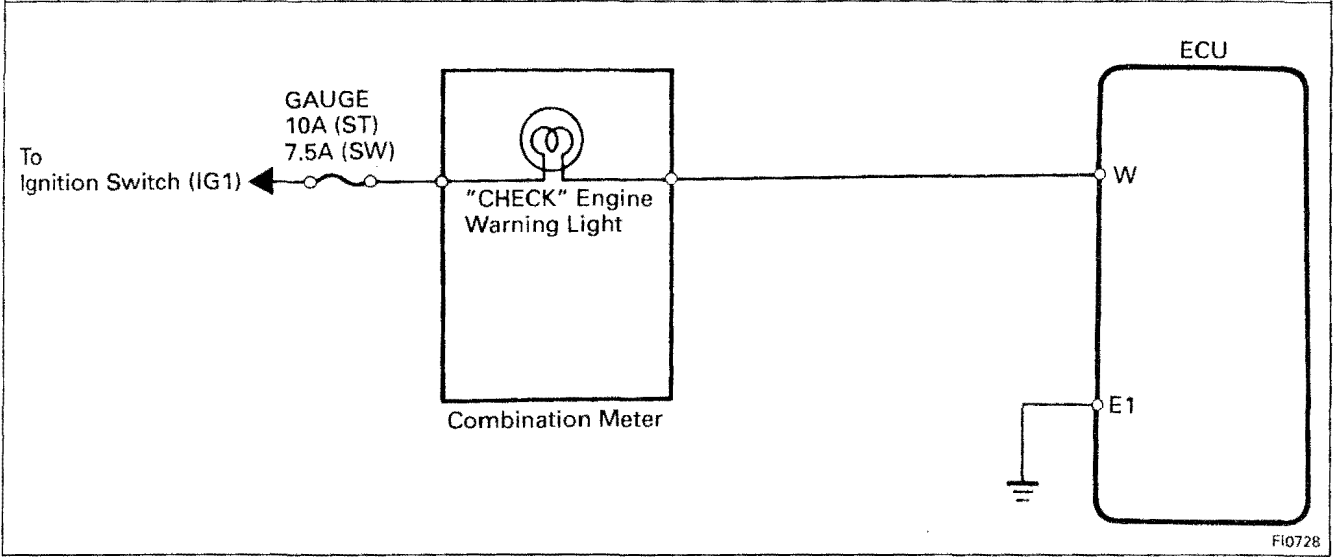
Check wiring between ECU and ISC valve.

BAD → Repair or replace.

Try another ECU.



No.	Terminals	Trouble	Condition	STD voltage
11	W – E1	No voltage	No trouble ("CHECK" engine warning light off) and engine running.	9 – 14 V

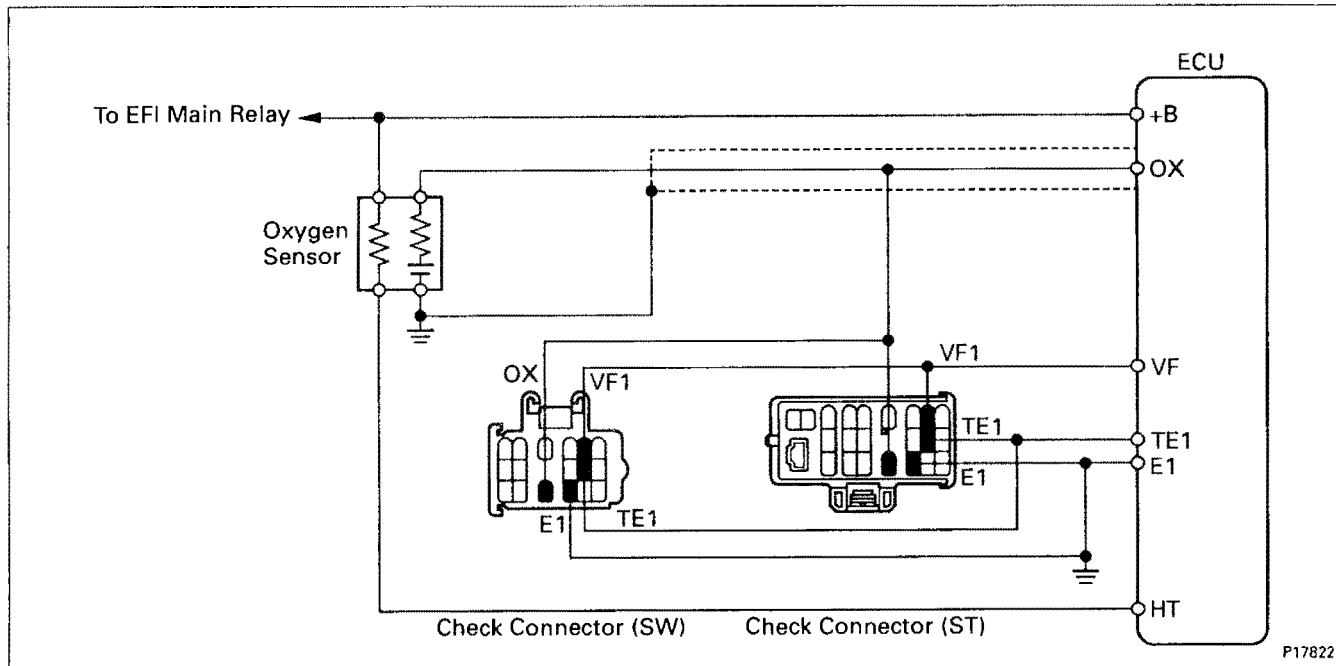


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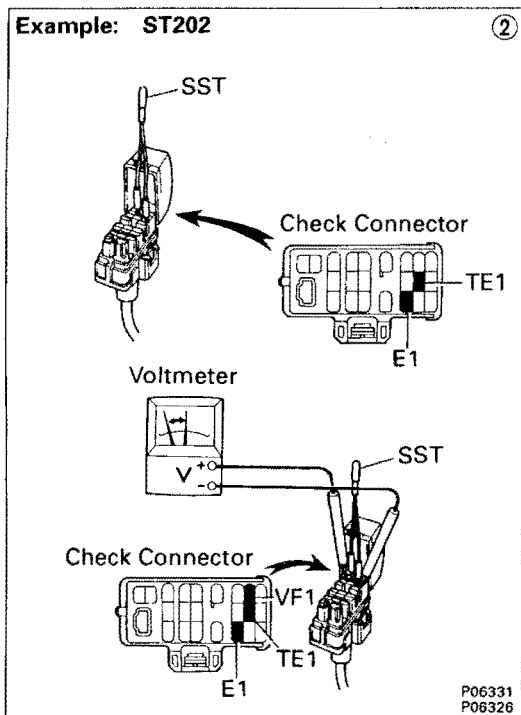
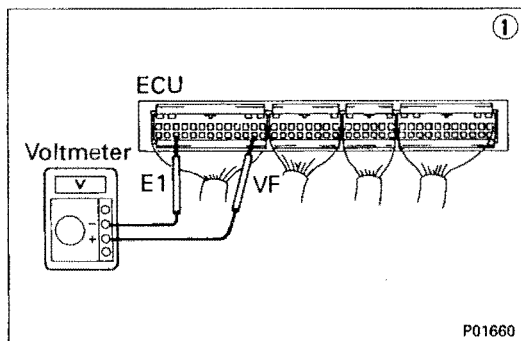
    graph TD
      Step1["① There is no voltage between ECU terminals W and E1.  
(Idling)"] --> Step2["② Check that there is voltage between ECU terminal W and body ground."]
      Step2 -- NO --> Step3["③ Check wiring between ECU terminal E1 and body ground."]
      Step2 -- OK --> FuseCheck["Check GAUGE fuse (10A or 7.5A) and 'CHECK' engine warning light."]
      Step3 -- OK --> FuseCheck
      Step3 -- BAD --> RepairECU["Try another ECU."]
      Step3 --> RepairE1["Repair or replace."]
      FuseCheck -- OK --> FuseCheck
      FuseCheck -- BAD --> RepairFuse["Repair or replace."]
      RepairFuse --> FuseCheck
      FuseCheck --> FuseCheck
      FuseCheck -- Fuse blows again --> RepairW["Check wiring between ECU terminal W and fuse."]
      RepairW -- BAD --> RepairW
      RepairW --> RepairW
  
```

EG

EG



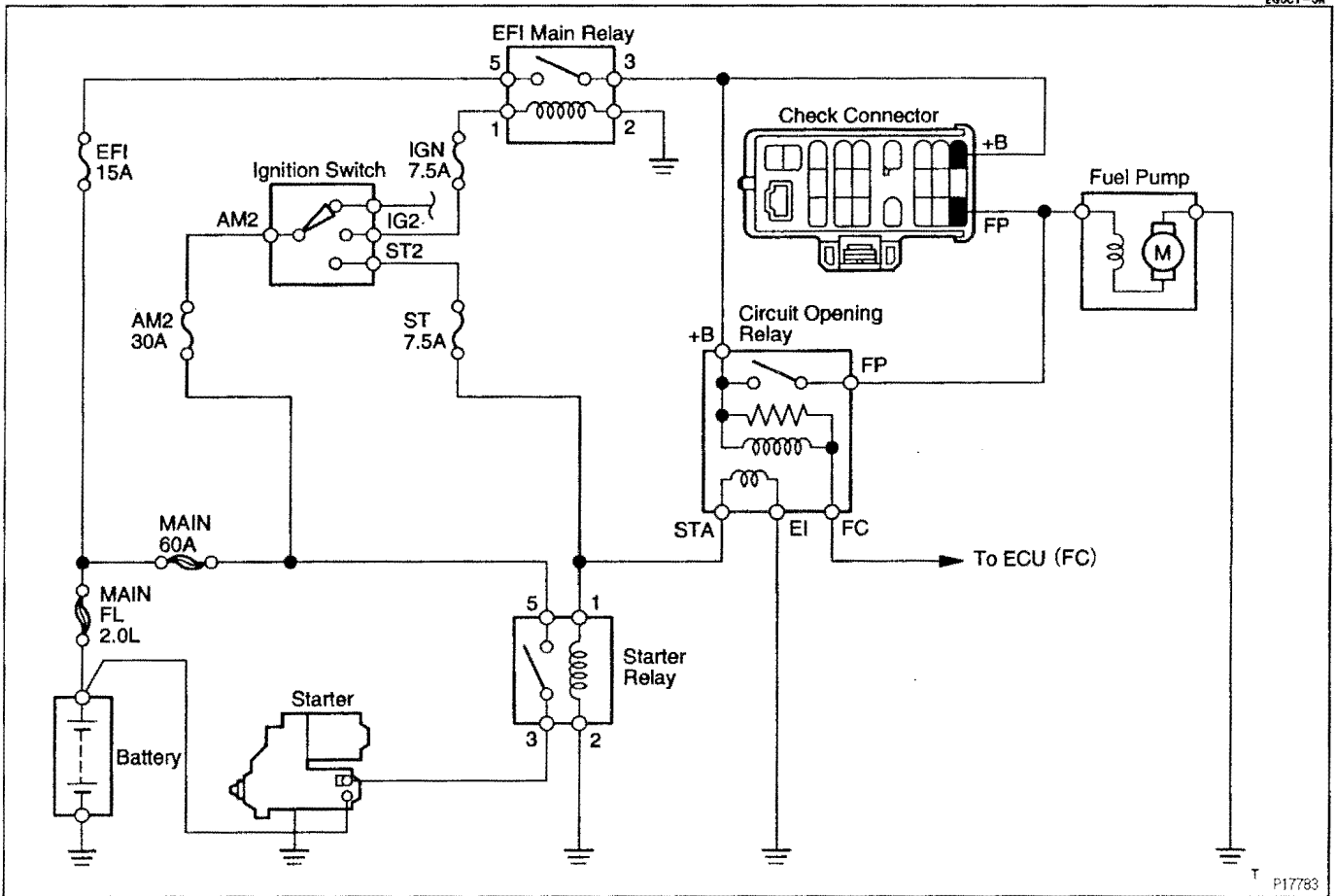
P17822



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    graph TD
      A["① There is no voltage between ECU terminals VF and E1."] --> B["Check that there is voltage between ECU terminal VF and body ground."]
      B -- NO --> C["Is air leaking into air induction system?"]
      B -- OK --> D["Check wiring between ECU terminal E1 and body ground."]
      D -- OK --> E["Try another ECU."]
      D -- BAD --> F["Repair or replace."]
      E -- BAD --> F
      C -- BAD --> G["Repair or replace."]
      C -- OK --> H["Check spark plugs. (See page IG-9)"]
      H -- BAD --> I["Repair or replace."]
      H -- OK --> J["Check distributor and ignition system. (See page IG-7)"]
      J -- BAD --> I
      J -- OK --> K["Check fuel pressure. (See page EG-205)"]
      K -- BAD --> I
      K -- OK --> L["Check injectors. (See page EG-237)"]
      L -- BAD --> I
      L -- OK --> M["Check vacuum sensor. (See page EG-280)"]
      M -- BAD --> I
      M -- OK --> N["② Check operation of oxygen sensor. (See page EG-286)"]
      N -- OK --> O["System normal."]
      N -- BAD --> P["Check wiring between oxygen sensor and ECU."]
      P -- BAD --> Q["Repair wiring."]
      P -- OK --> R["Replace oxygen sensor."]
    
```

FUEL PUMP (ST202)

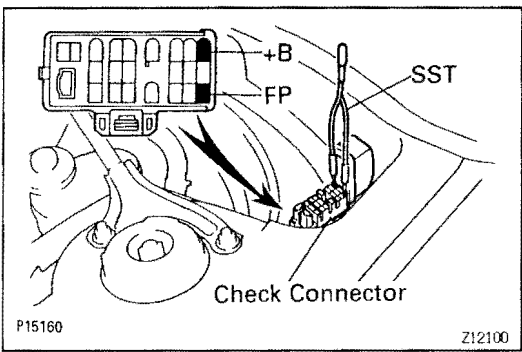


EGOCY-0N

EG

P17783

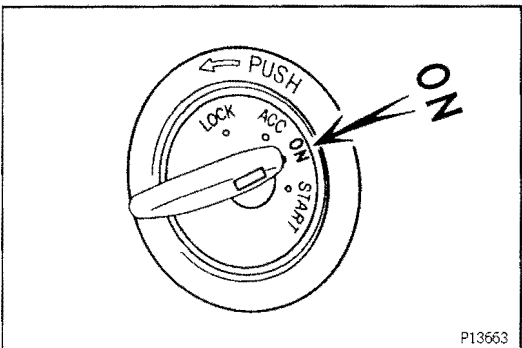
EG3MH-02



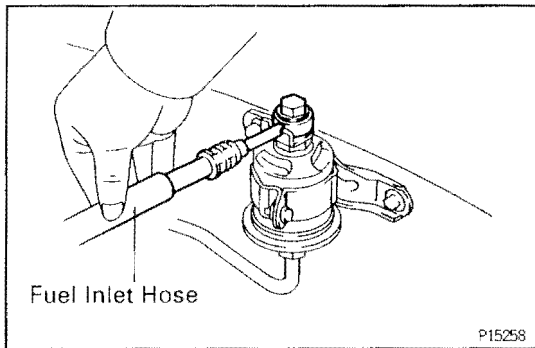
ON – VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION

- (a) Using SST, connect terminals +B and FP of the check connector.
SST 09843-18020



- (b) Turn the ignition switch ON.
NOTICE: Do not start the engine.



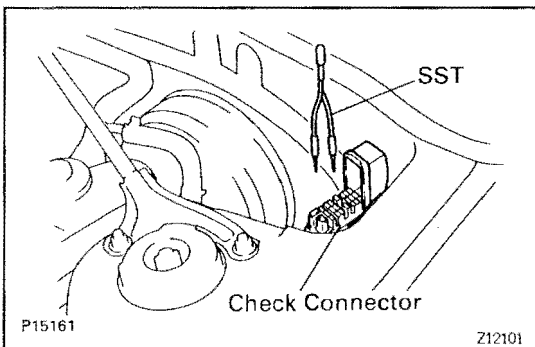
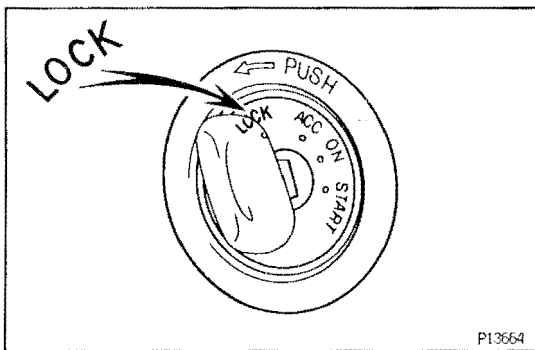
- (c) Check that there is pressure in the fuel inlet hose from the fuel filter.

HINT: If there is fuel pressure, you will hear the sound of fuel flowing.

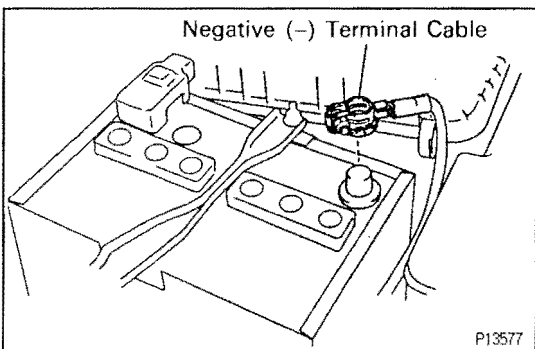
If there is no pressure, check the following parts:

- Fusible link
- H-fuse
- Fuses
- EFI main relay
- Fuel pump
- Wiring connections

- (d) Turn the ignition switch to LOCK.

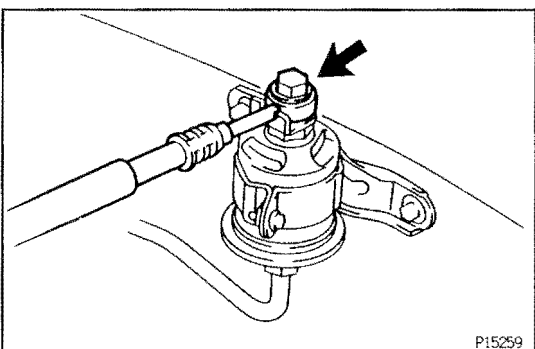


- (e) Remove the SST from the check connector.
SST 09843-18020



2. CHECK FUEL PRESSURE

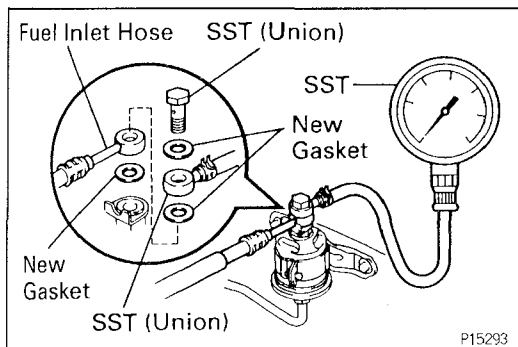
- (a) Check that the battery voltage is above 12 V.
(b) Disconnect the negative (-) terminal cable from the battery.



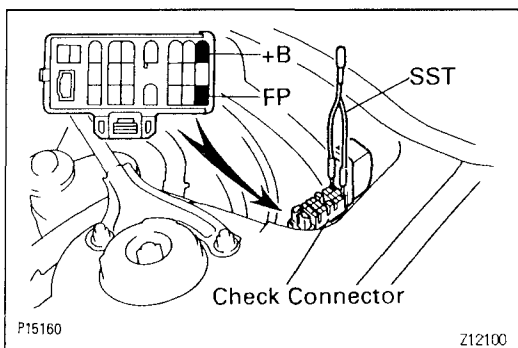
- (c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.

CAUTION:

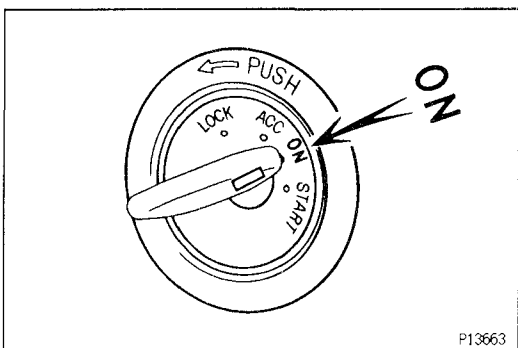
- Put a suitable container or shop rag under the fuel filter.
- Slowly loosen the union bolt.
- When removing or installing the union bolt, fix the fuel filter in place using a spanner.



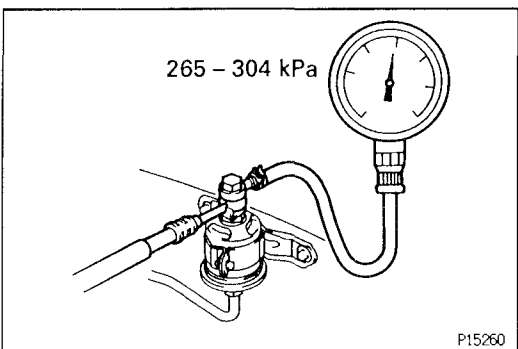
- (d) Install the fuel inlet hose and SST (pressure gauge) to the fuel filter with 3 new gaskets and SST (union bolt).
SST 09268-45012
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
- (e) Wipe off any splattered gasoline.



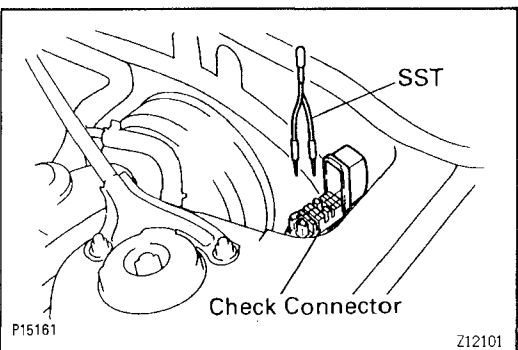
- (f) Using SST, connect terminals +B and FP of the check connector.
SST 09843-18020
- (g) Reconnect the negative (-) terminal cable to the battery.



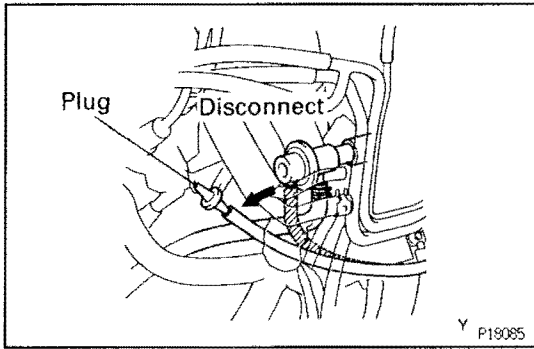
- (h) Turn the ignition switch ON.



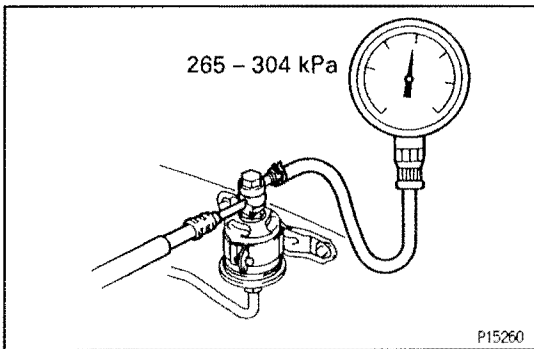
- (i) Measure the fuel pressure.
Fuel pressure:
265 - 304 kPa (2.7 - 3.1 kgf/cm², 38 - 44 psi)
If pressure is high, replace the fuel pressure regulator.
If pressure is low, check the following parts:
- Fuel hoses and connections
 - Fuel pump
 - Fuel filter
 - Fuel pressure regulator



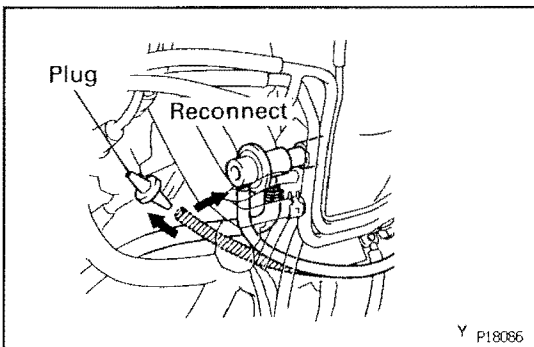
- (j) Remove the SST from the check connector.
SST 09483-18020



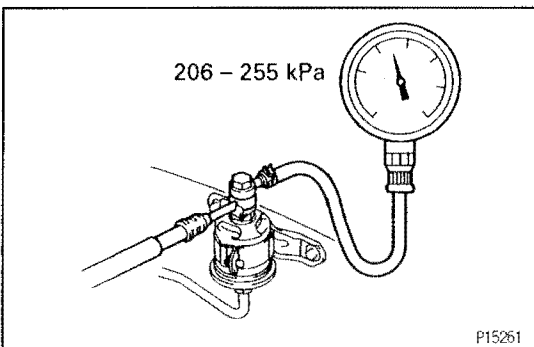
- (k) Start the engine.
- (l) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.



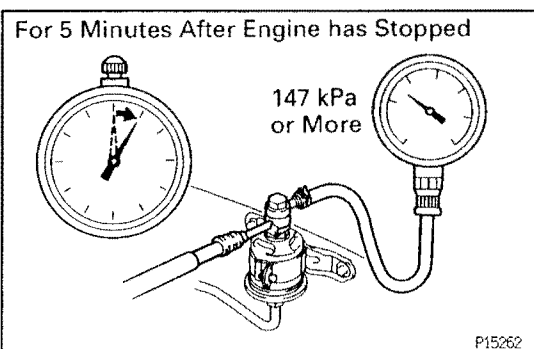
- (m) Measure the fuel pressure at idle.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)



- (n) Reconnect the vacuum sensing hose to the fuel pressure regulator.



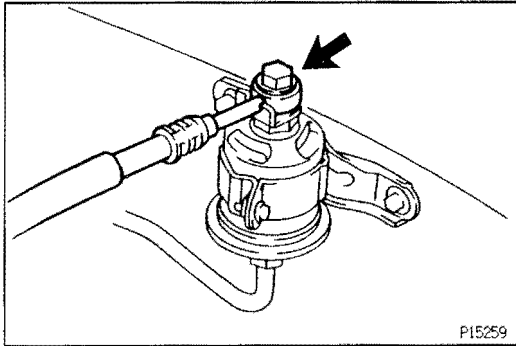
- (o) Measure the fuel pressure at idle.
Fuel pressure:
206 – 255 kPa (2.1 – 2.6 kgf/cm², 31 – 37 psi)
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.



- (p) Stop the engine.
- (q) Check that the fuel pressure remains as specified for 5 minutes after the engine has stopped.
Fuel pressure:
147 kPa (1.5 kgf/cm², 21 psi) or more
If pressure is not as specified, check the fuel pump, pressure regulator and/or injector.

- (r) After checking fuel pressure, disconnect the battery negative (–) terminal cable from the battery and carefully remove the SST to prevent gasoline from splashing.
SST 09268–45012

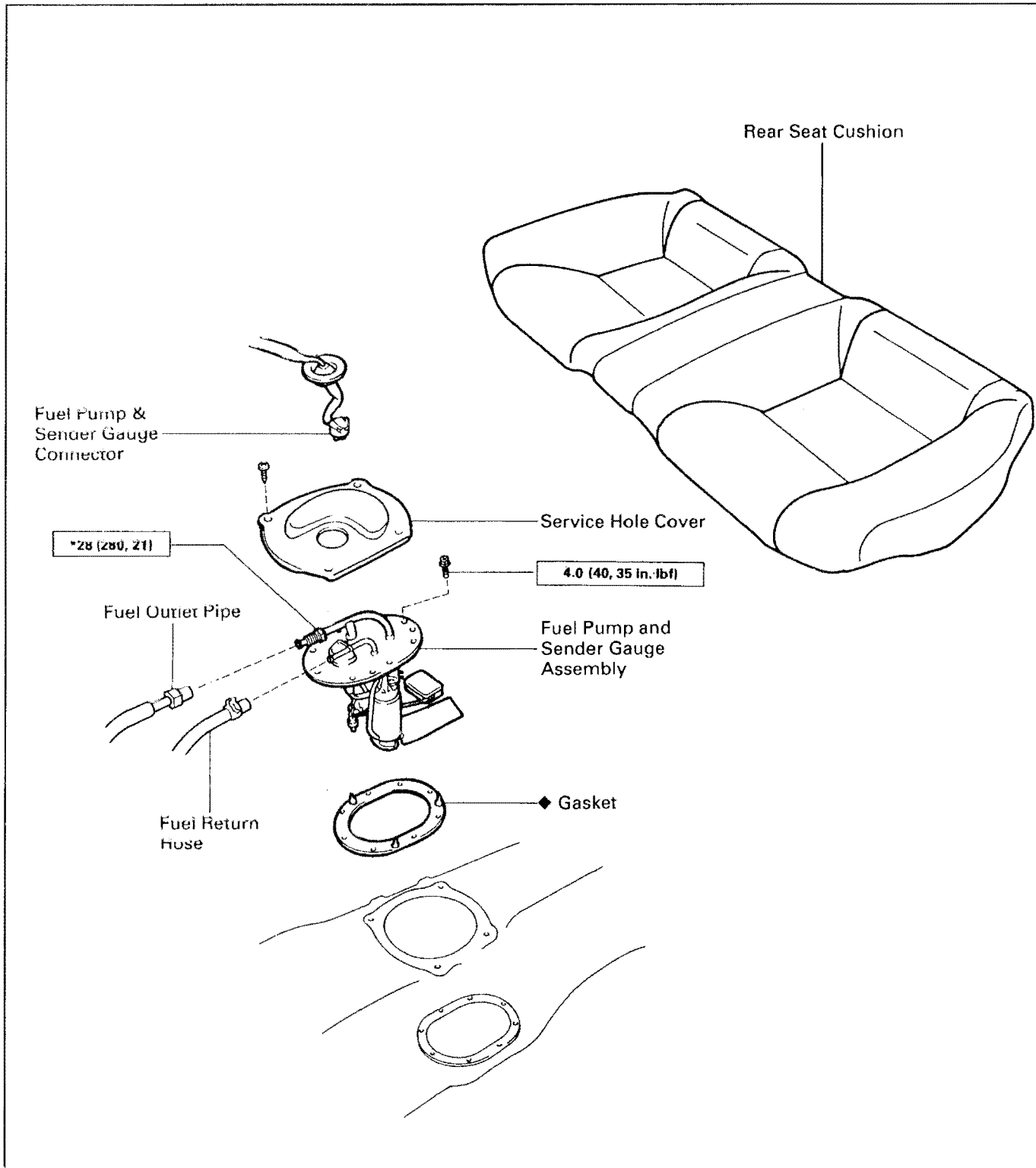
EG



- (s) Reconnect the fuel inlet hose to the fuel filter with with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
CAUTION: When removing or installing the union bolt, fix the fuel filter in place using a spanner.
- (t) Reconnect the negative (–) terminal cable to the battery.
- (u) Check for fuel leaks. (See page EG–173)

COMPONENTS FOR REMOVAL AND INSTALLATION

EG

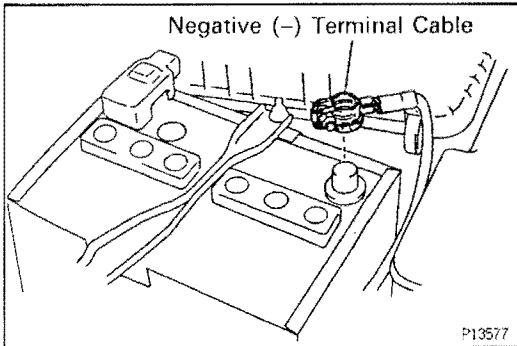


P15291

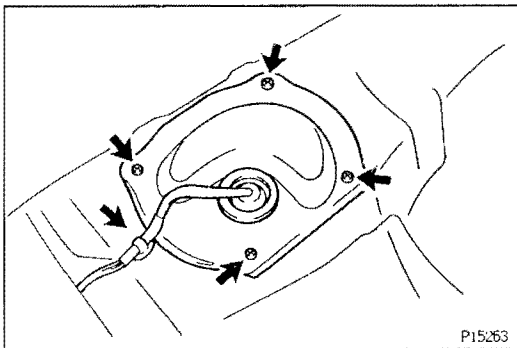
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

* For use with SST

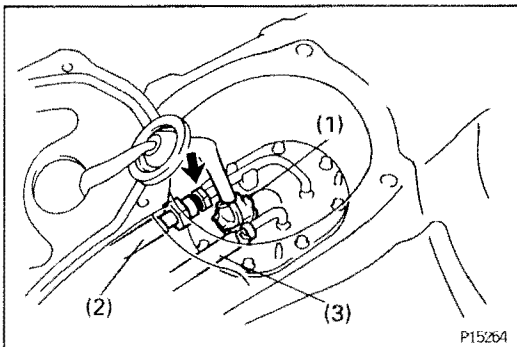
FUEL PUMP REMOVAL**(See Components for Removal and Installation)****CAUTION:** Do not smoke or work near an open flame when working on the fuel pump.

1. **DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY**
2. **REMOVE REAR SEAT CUSHION**



3. **REMOVE SERVICE HOLE COVER**

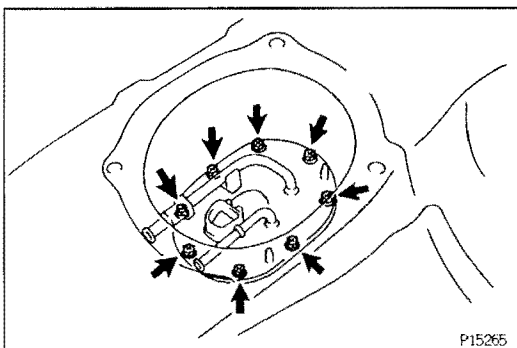
Remove the 4 screws, and disconnect the wire harness clamp, service hole cover from the floor panel.



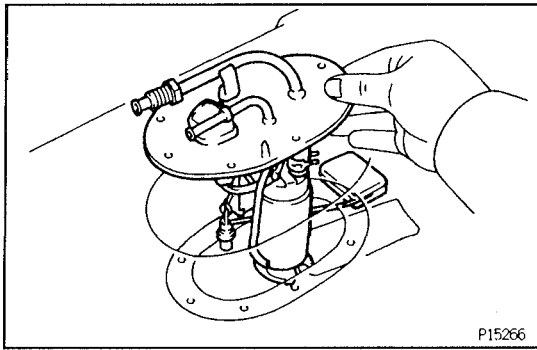
4. **REMOVE FUEL PUMP AND SENDER GAUGE ASSEMBLY**

(a) Disconnect the following connector, pipe and hose:

- (1) Fuel pump & sender gauge connector
- (2) Fuel outlet pipe
- (3) Fuel return hose

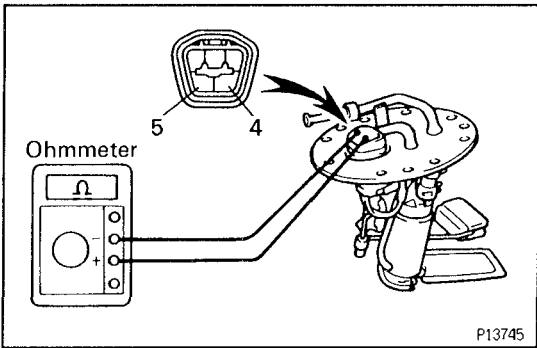


(b) Remove the 8 bolts.



- (c) Remove the fuel pump & sender gauge assembly and gasket.

EG



FUEL PUMP INSPECTION

EQ1LY-00

1. INSPECT FUEL PUMP RESISTANCE

Using an ohmmeter, measure the resistance between terminals 4 and 5.

Resistance:

0.2 – 3.0 Ω at 20°C (68°F)

If the resistance is not as specified, replace the fuel pump, lead wire or connector.

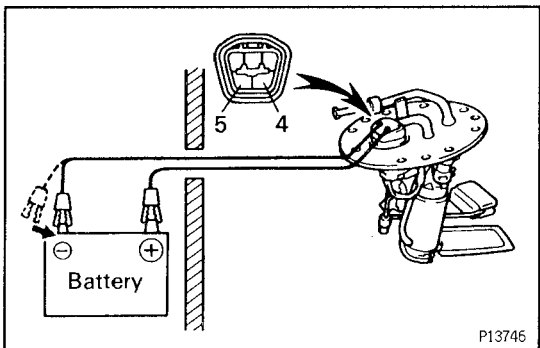
2. INSPECT FUEL PUMP OPERATION

Connect a tester lead from terminal 4 of the connector to the positive (+) terminal of the battery; connect another tester lead from terminal 5 of the connector to the negative (–) terminal of the battery.

NOTICE:

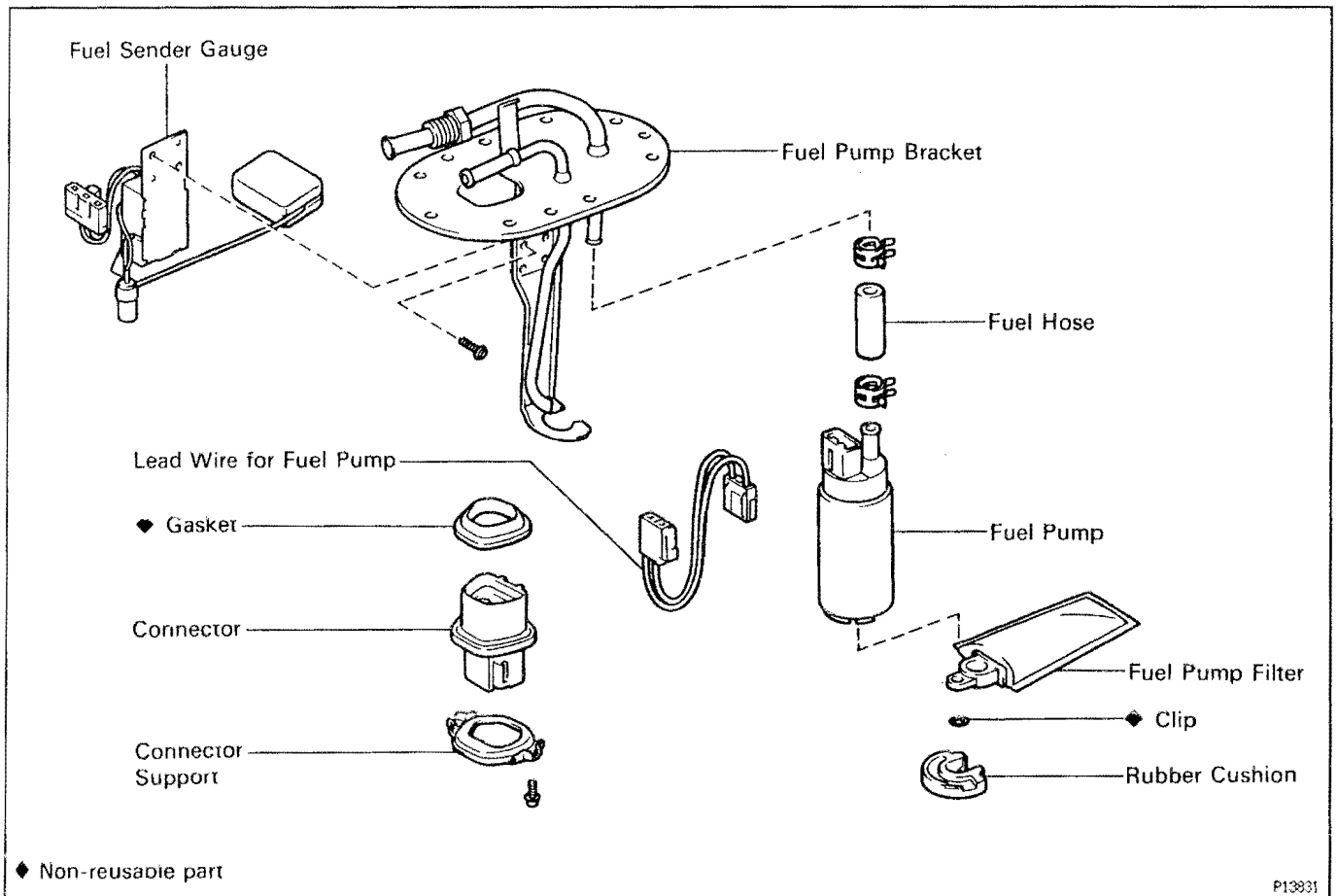
- These tests must be performed quickly (within 10 seconds) to prevent the coil from burning out.
- Keep the fuel pump as far away from the battery as possible.
- Always connect or disconnect at the battery.

If operation is not as specified, replace the fuel pump, lead wire or connector.



COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EQ001-0E



EG

EQ246-03

FUEL PUMP DISASSEMBLY

(See Components for Disassembly and Assembly)

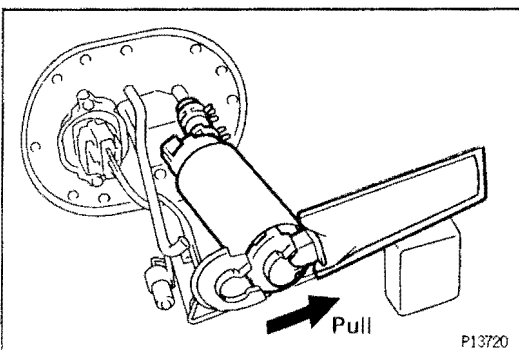
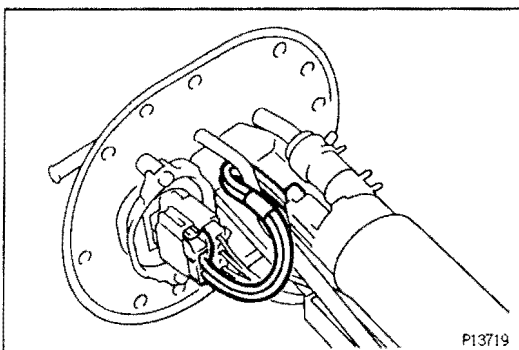
1. REMOVE FUEL PUMP FROM PUMP BRACKET

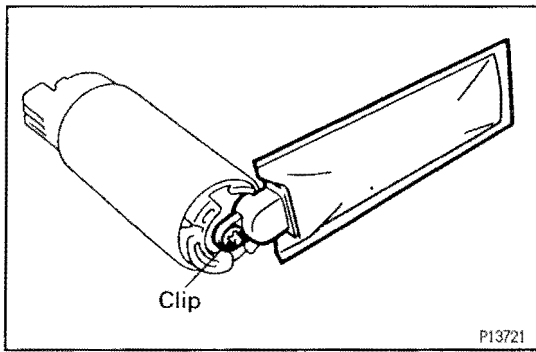
(a) Remove the lead wire.

(b) Pull out the lower side of the fuel pump from the connector.

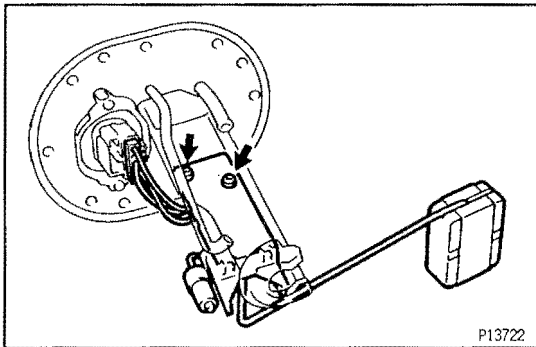
(c) Remove the rubber cushion from the fuel pump.

(d) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.

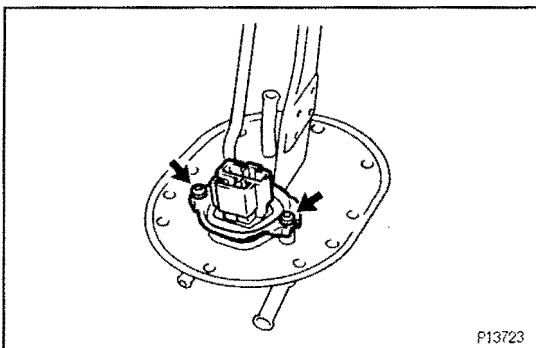


**2. REMOVE FUEL PUMP FILTER FROM FUEL PUMP**

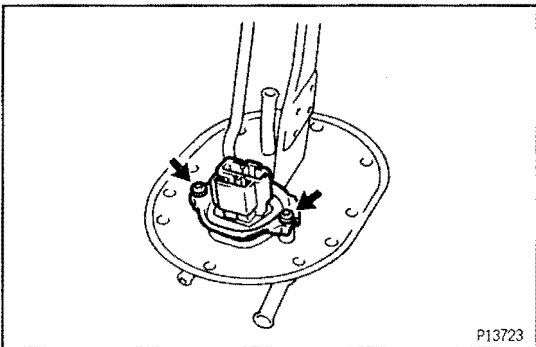
- (a) Remove the clip.
- (b) Pull out the pump filter.

**3. REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET**

- (a) Disconnect the connector from the connector.
- (b) Remove the 2 screws and sender gauge.

**4. REMOVE CONNECTOR**

Remove the 2 screws, connector support, connector and gasket.

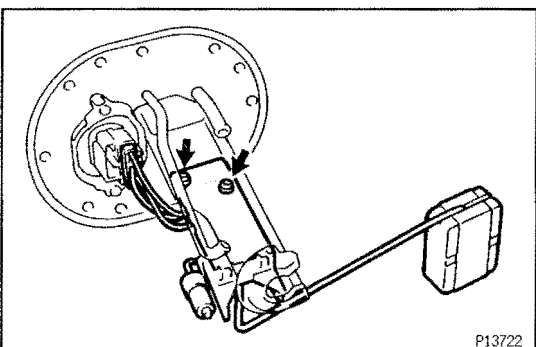
**FUEL PUMP ASSEMBLY**

EG3MK-01

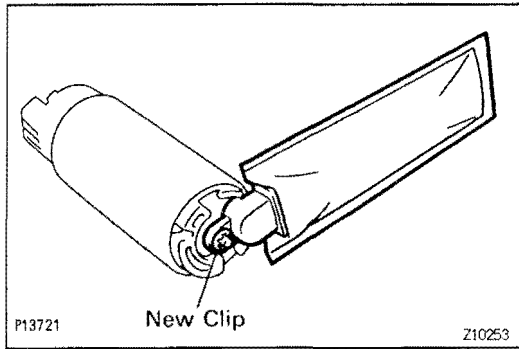
(See Components for Disassembly and Assembly)

1. INSTALL CONNECTOR

Install a new gasket, the connector and connector support with the 2 screws.

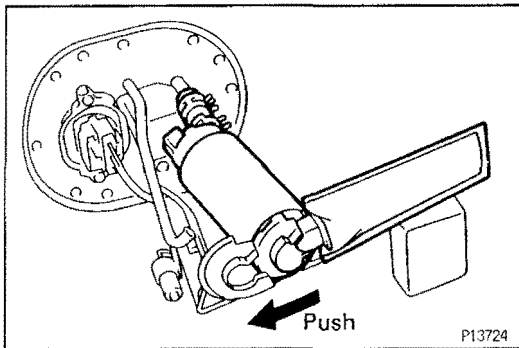
**2. INSTALL FUEL SENDER GAUGE TO FUEL PUMP BRACKET**

- (a) Install the sender gauge with the 2 screws.
- (b) Connect the connector to the connector.



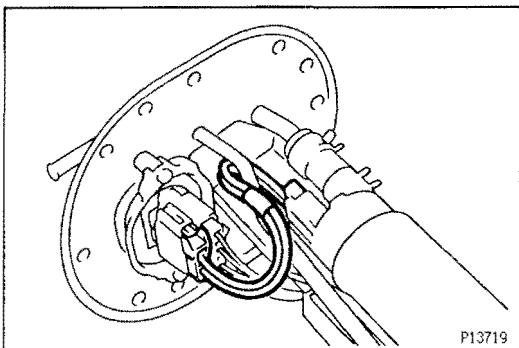
3. INSTALL FUEL PUMP FILTER TO FUEL PUMP

Install the pump filter with a new clip.

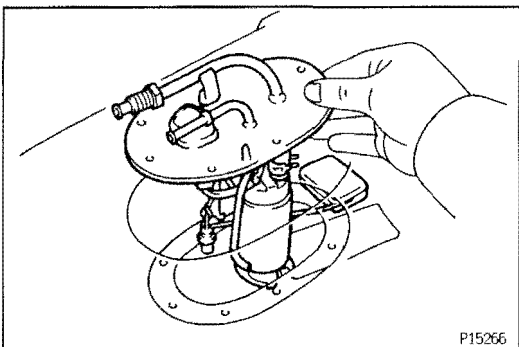


4. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

- (a) Connect the fuel hose to the outlet port of the fuel pump.
- (b) Install the rubber cushion to the fuel pump.
- (c) Install the fuel pump by pushing the lower side of the fuel pump.



- (d) Install the lead wire.



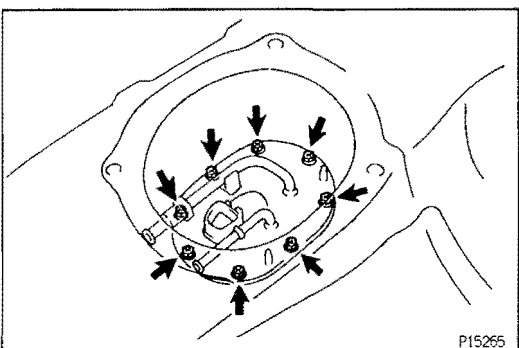
FUEL PUMP INSTALLATION

EG3ML-03

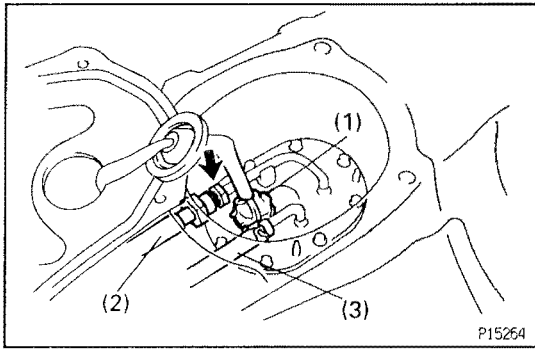
(See Components for Removal and Installation)

1. INSTALL FUEL PUMP AND SENDER GAUGE ASSEMBLY

- (a) Install a new gasket to the connector.
- (b) Insert the fuel pump & sender gauge assembly into the fuel tank.

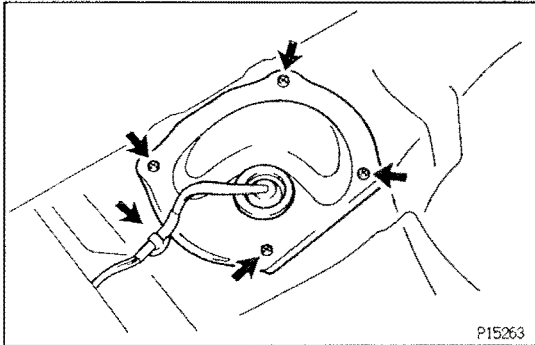


- (c) Install the fuel pump bracket with the 8 bolts.
Torque: 4.0 N·m (40 kgf·cm, 35 in.-lbf)



- (d) Connect the following connector, pipe and hose:
- (1) Fuel pump & sender gauge connector
 - (2) Fuel outlet pipe
- HINT: Use SST. (See page EG-173)
SST 09631-22020
Torque: 28 N·m (280 kgf·cm, 21 ft·lbf)

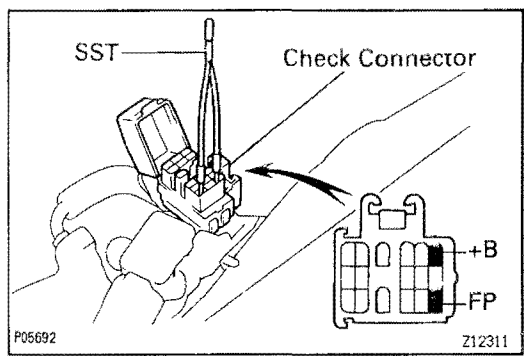
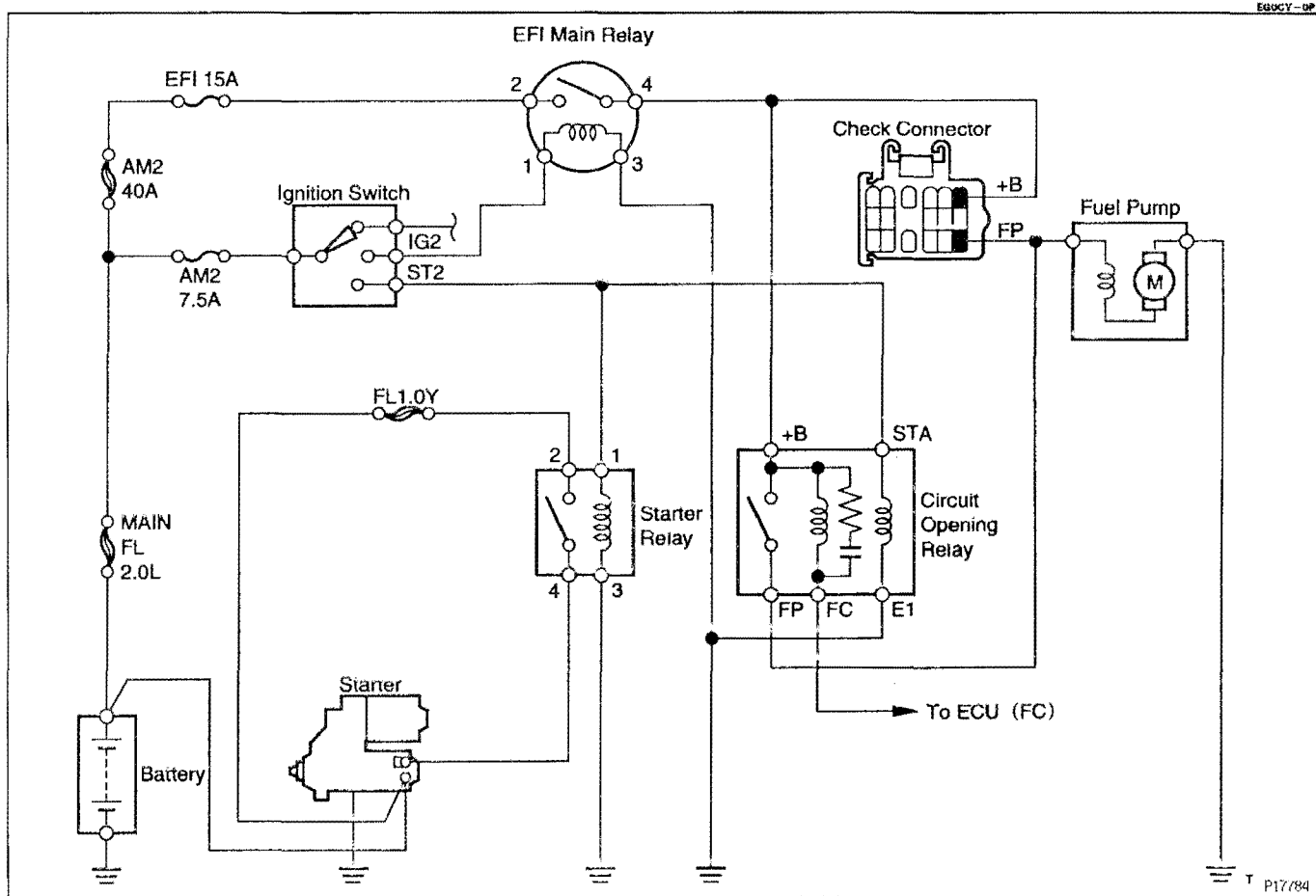
- (3) Fuel return hose
- 2. CHECK FOR FUEL LEAKS**
(See page EG-173)



- 3. INSTALL SERVICE HOLE COVER**
Connect the service hole cover, wire harness clamp and install the 4 screws.

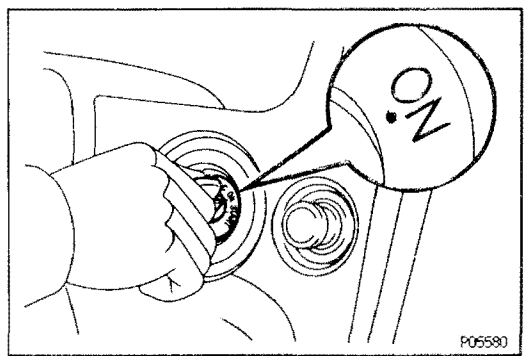
- 4. INSTALL REAR SEAT CUSHION**
- 5. CONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY**

FUEL PUMP (SW20)

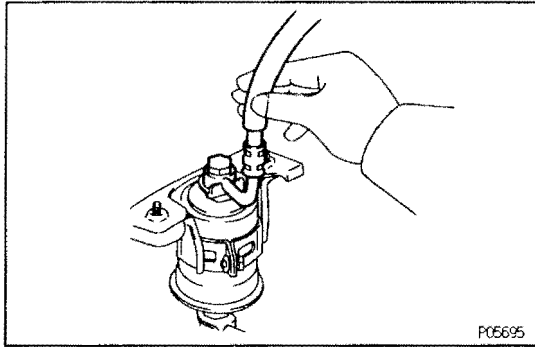


ON – VEHICLE INSPECTION

1. **CHECK FUEL PUMP OPERATION**
 - (a) Using SST, connect terminals +B and FP of the check connector.
SST 09843 – 18020



- (b) Turn the ignition switch ON.
NOTICE: Do not start the engine.



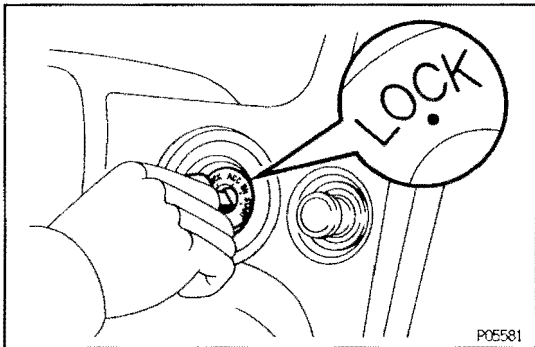
- (c) Check that there is pressure in the hose from the fuel filter.

HINT: At this time, you will hear fuel return noise.

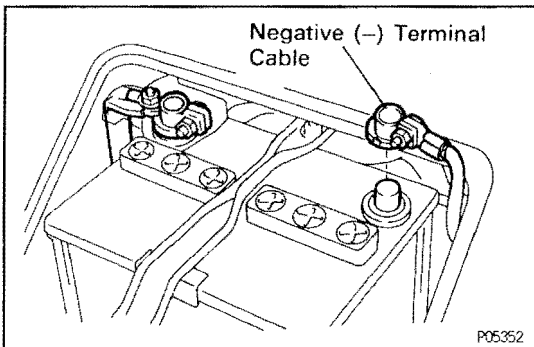
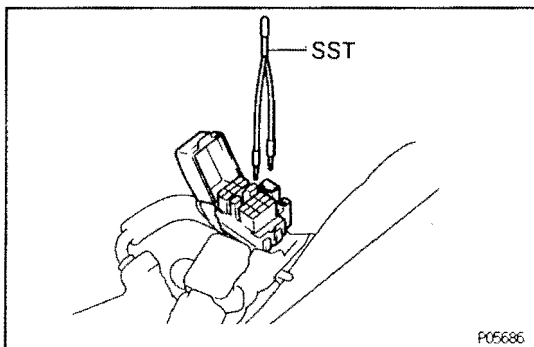
If there is no pressure, check the following parts:

- Fusible links
- H—fuse
- Fuses
- EFI main relay
- Fuel pump
- Wiring connections

- (d) Turn the ignition switch to LOCK.

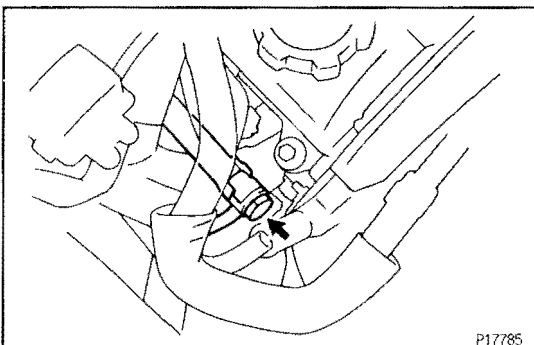


- (e) Remove the SST from the check connector.
SST 09843—18020



2. CHECK FUEL PRESSURE

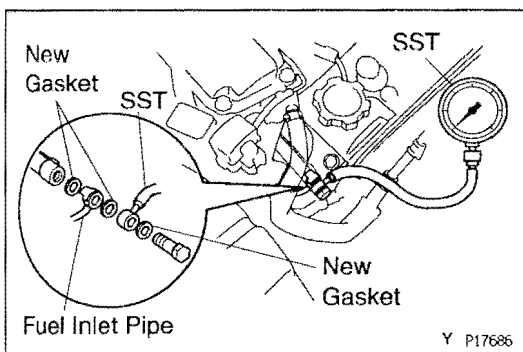
- (a) Check that the battery voltage is above 12 V.
(b) Disconnect the negative (-) terminal cable from the battery.



- (c) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet pipe from the delivery pipe.

CAUTION:

- Put a suitable container or shop towel under the delivery pipe.
- Slowly loosen the union bolt.

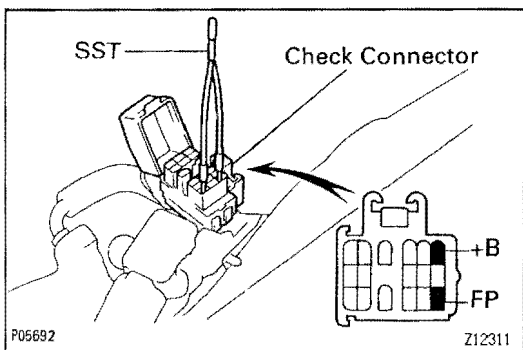


- (d) Install the fuel inlet hose and SST (pressure gauge) to the delivery pipe with 3 new gaskets and SST (union bolt).

SST 09268–45012

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

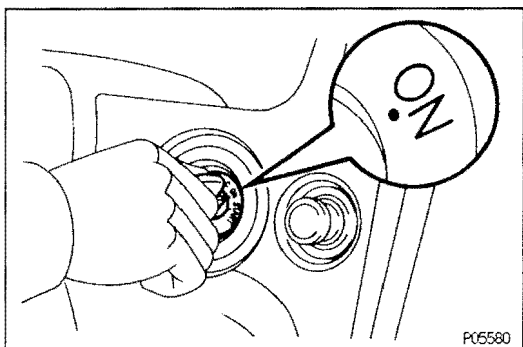
- (e) Wipe off any splattered gasoline.



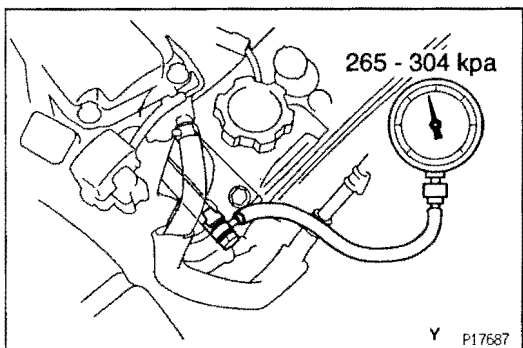
- (f) Using SST, connect terminals +B and FP of the check connector.

SST 09843–18020

- (g) Reconnect the negative (–) terminal cable to the battery.



- (h) Turn the ignition switch ON.



- (i) Measure the fuel pressure.

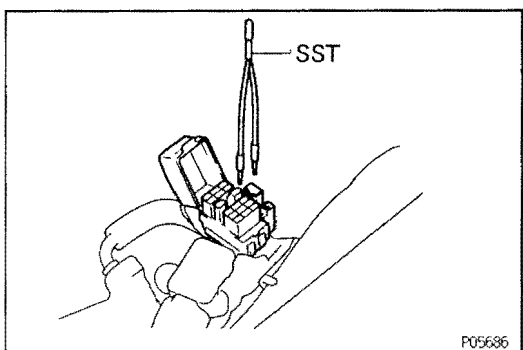
Fuel pressure:

265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)

If pressure is high, replace the fuel pressure regulator.

If pressure is low, check the following parts:

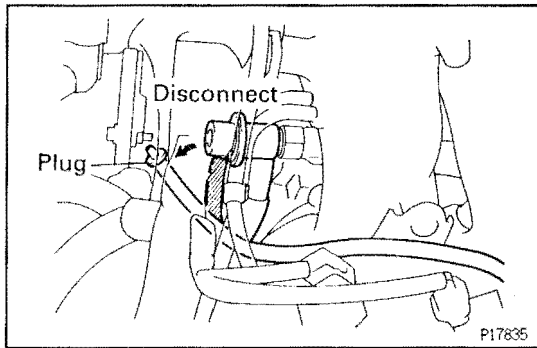
- Fuel hoses and connections
- Fuel pump
- Fuel filter
- Fuel pressure regulator



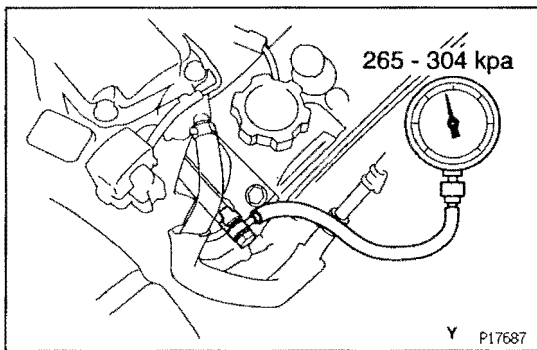
- (j) Remove the SST from the check connector.

SST 09483–18020

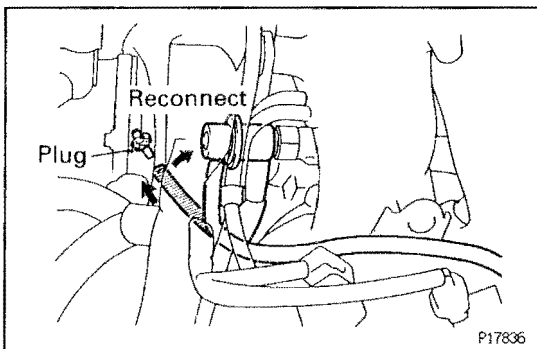
EG



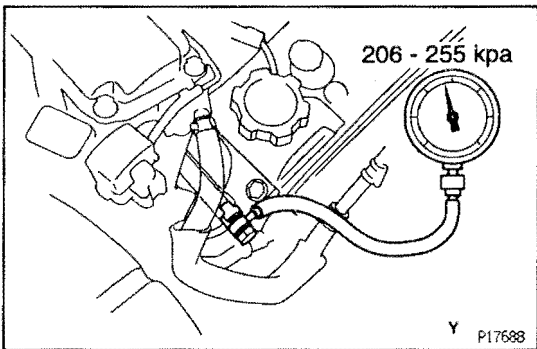
- (k) Start the engine.
- (l) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.



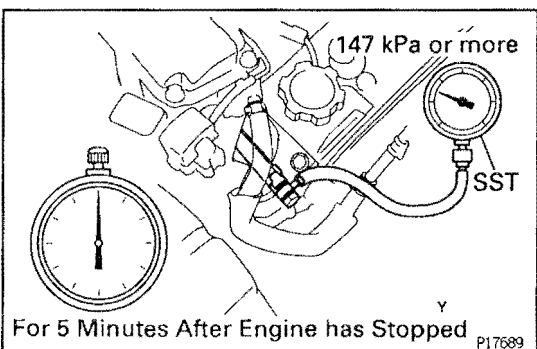
- (m) Measure the fuel pressure at idle.
Fuel pressure:
265 – 304 kPa (2.7 – 3.1 kgf/cm², 38 – 44 psi)



- (n) Reconnect the vacuum sensing hose to the fuel pressure regulator.



- (o) Measure the fuel pressure at idle.
Fuel pressure:
206 – 255 kPa (2.1 – 2.6 kgf/cm², 30 – 37 psi)
If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.

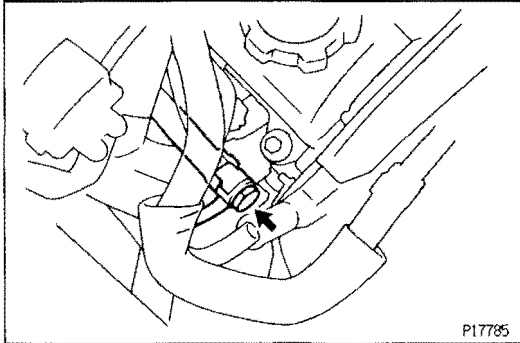


- (p) Stop the engine.
- (q) Check that the fuel pressure remains as specified for 5 minutes after the engine has stopped.
Fuel pressure:
147 kPa (1.5 kgf/cm², 21 psi) or more
If pressure is not as specified, check the fuel pump, pressure regulator and/or injector.

- (r) After checking fuel pressure, disconnect the negative (–) terminal cable from the battery and carefully remove the SST to prevent gasoline from splashing.

SST 09268–45012

EG



- (s) Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the union bolt.

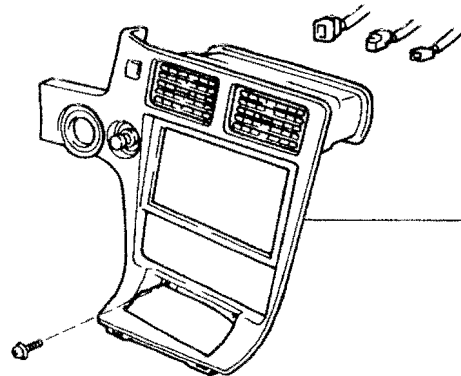
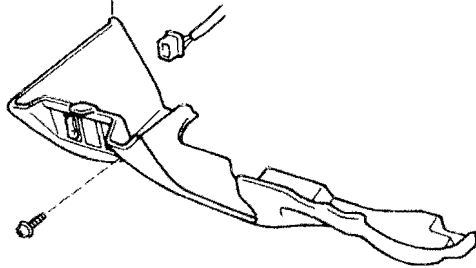
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

- (t) Reconnect the negative (–) terminal cable to the battery.
- (u) Check for fuel leaks.
(See page EG–173)

COMPONENTS FOR REMOVAL AND INSTALLATION

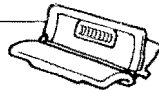
EG

Lower No.1 Instrument Panel Finish Panel

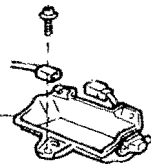


Center Instrument Cluster Finish Panel

Ash Receptacle Box



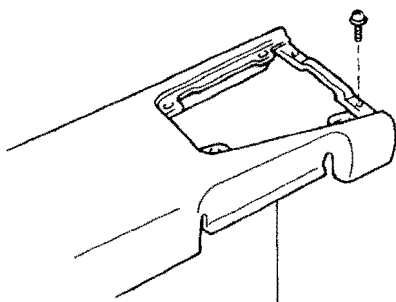
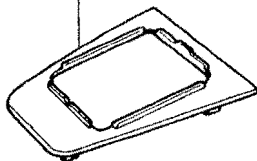
Ash Receptacle Retainer



Grommet

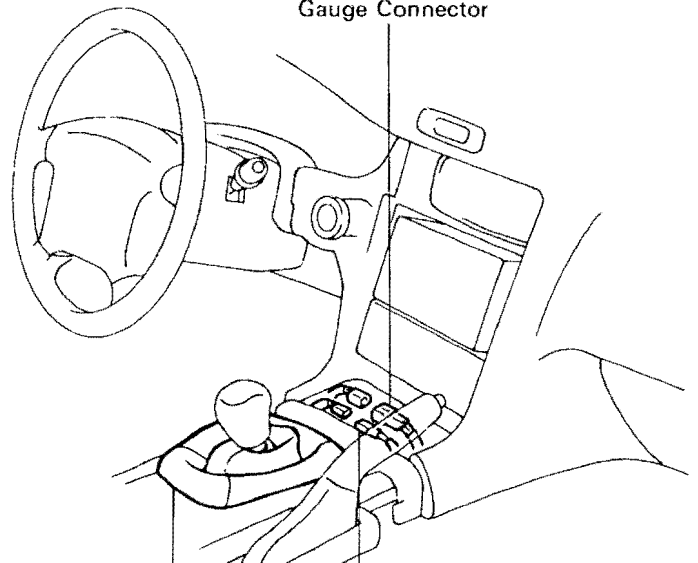
Service Hole Cover

Upper Console Panel



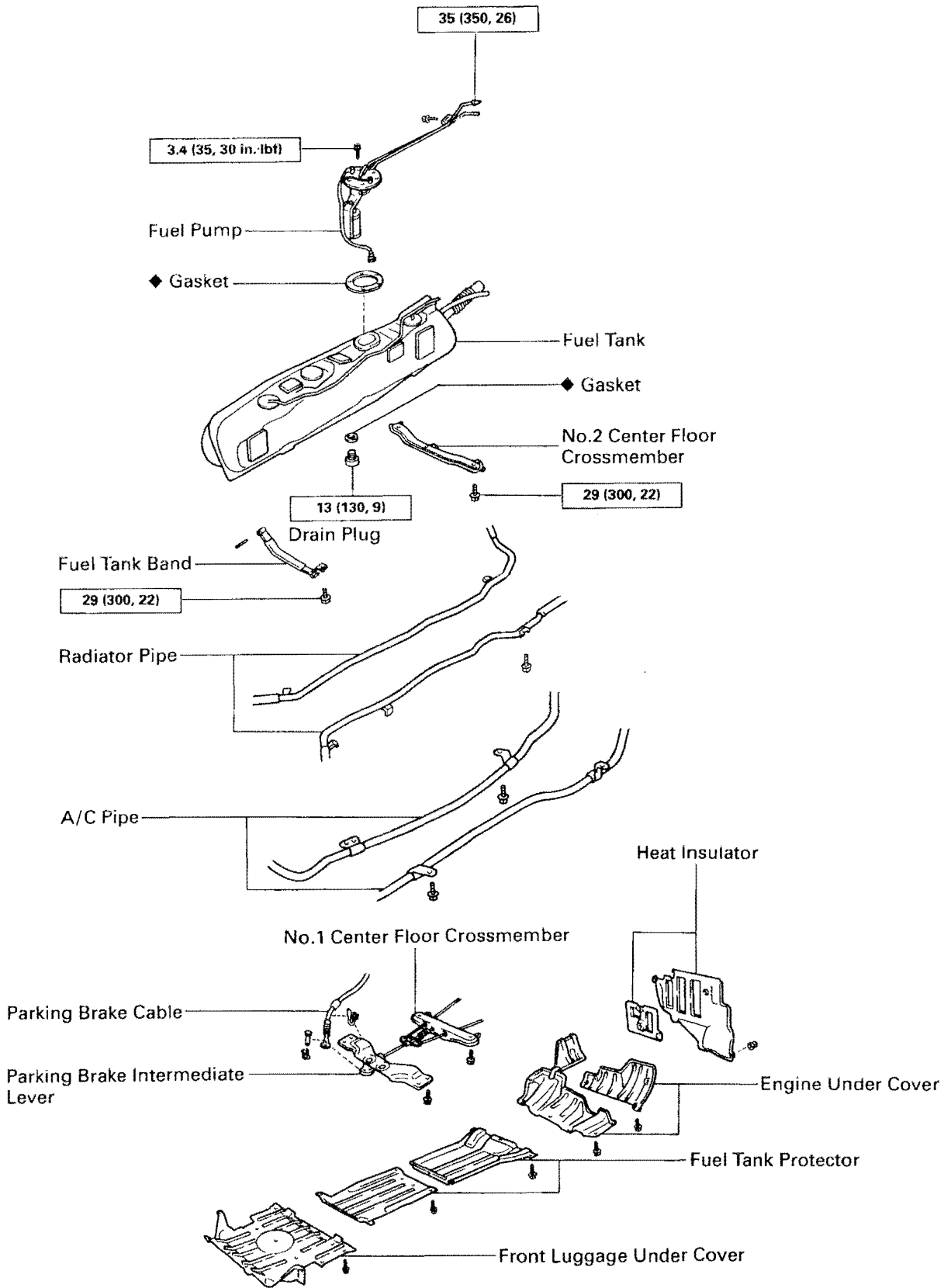
Console Box

Fuel Sender Gauge Connector



Shifting Hole Cover

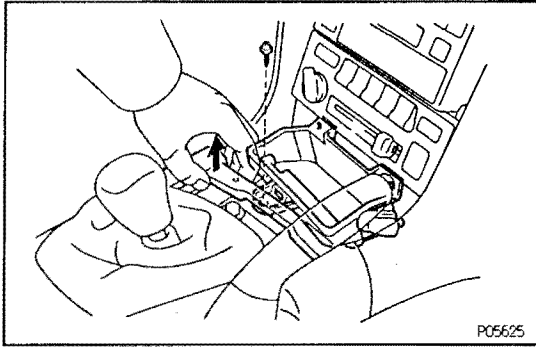
Fuel Pump Connector



FI5801

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

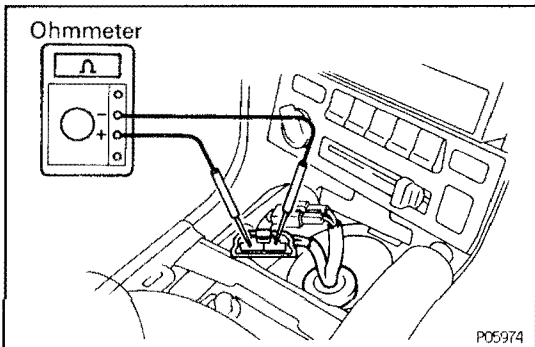
◆ Non-reusable part



FUEL PUMP INSPECTION

(See Components for Removal and Installation)

1. REMOVE ASH RECEPTACLE RETAINER
(See steps 1 and 2 on page EG-225)
2. DISCONNECT FUEL PUMP CONNECTOR



3. INSPECT FUEL PUMP

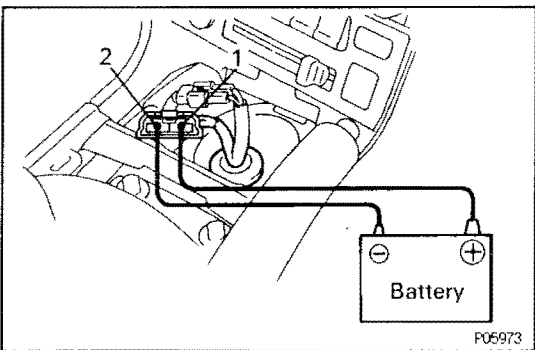
A. Inspect fuel pump resistance

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

0.2 — 3.0 Ω at 20°C (68°F)

If the resistance is not as specified, replace the fuel pump.



B. Inspect fuel pump operation

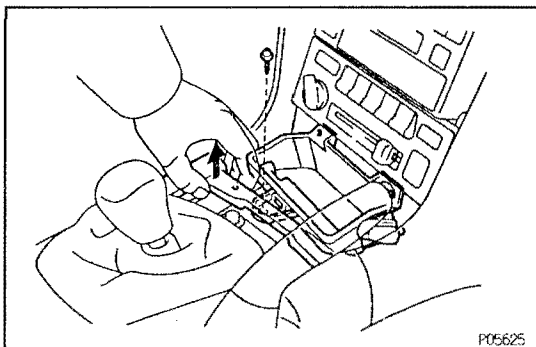
Connect the positive (+) lead from the battery to terminal 1 of the connector, and the negative (-) lead to terminal 2. Check that the fuel pump operates.

If operation is not as specified, replace the fuel pump.

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.

4. RECONNECT FUEL PUMP CONNECTOR



5. REINSTALL ASH RECEPTACLE RETAINER

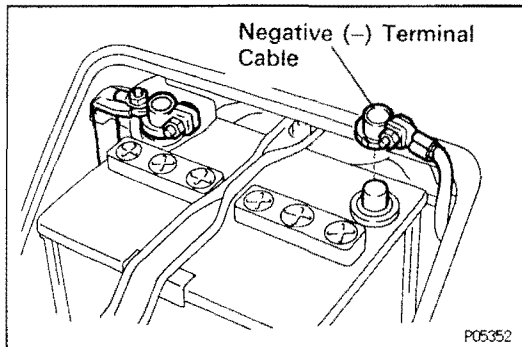
(See steps 7 and 9 on page EG-231 and EG-232)

FUEL PUMP REMOVAL

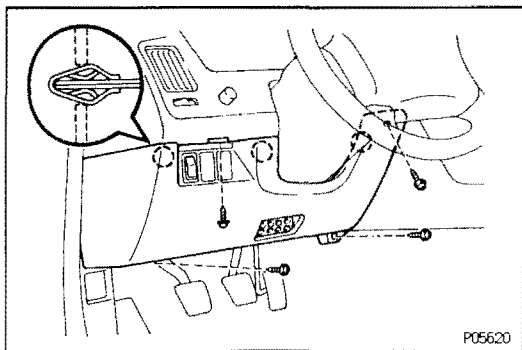
(See Components for Removal and Installation)

CAUTION: Do not smoke or work near an open flame when working on the fuel pump.

EG

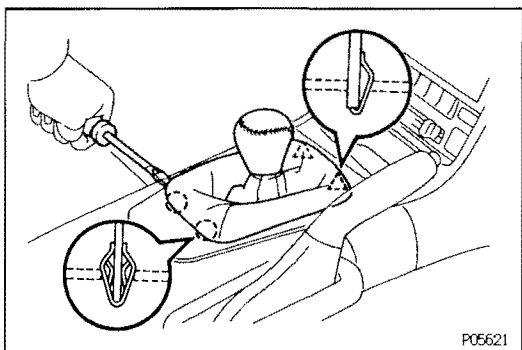


1. **DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY**

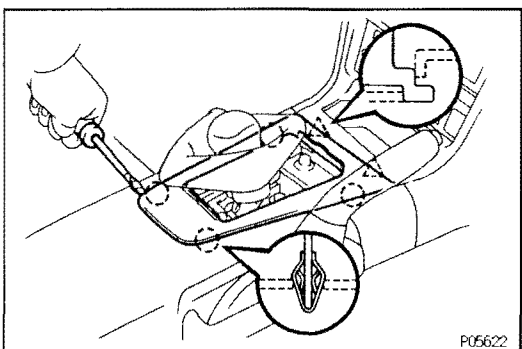


2. **DISCONNECT FUEL PUMP CONNECTOR AND FUEL SENDER GAUGE CONNECTOR**

- (a) Remove the 4 screws, and disconnect the lower No.1 instrument panel finish panel by pulling it.
- (b) Disconnect the connector, and remove the lower No.1 instrument panel finish panel.
- (c) Remove the ash receptacle box.

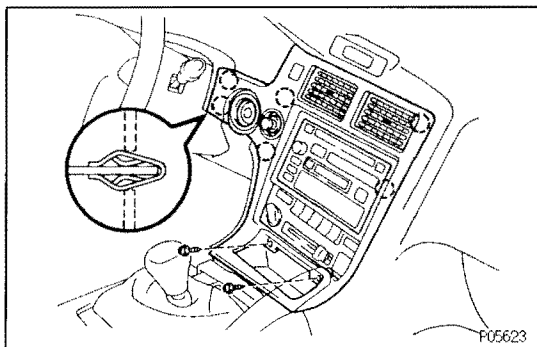


- (d) Using a screwdriver, pry out the shifting hole cover.

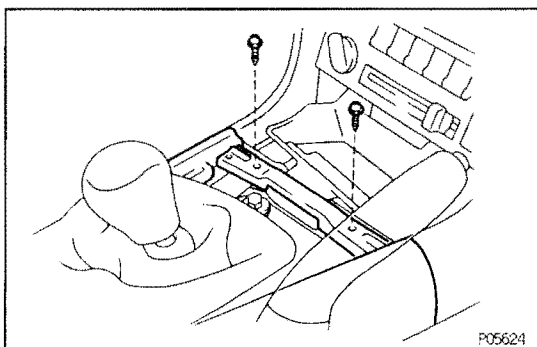


- (e) Using a screwdriver, pry out the upper console panel.

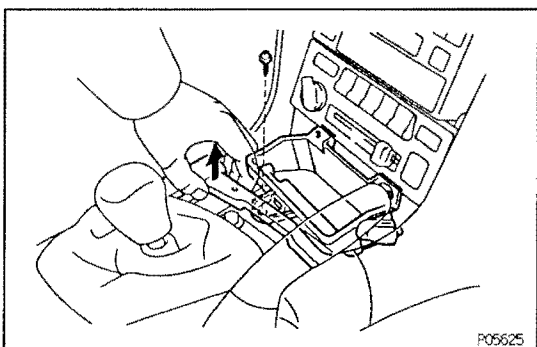
EG



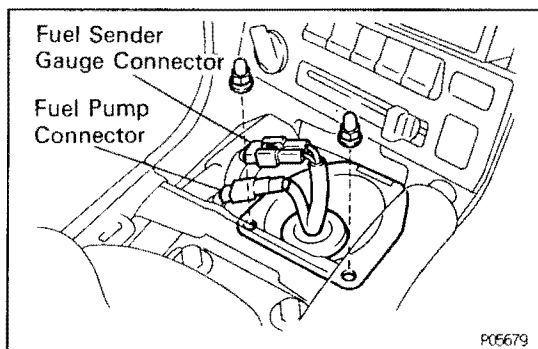
- (f) Remove the 2 screws, and disconnect the center instrument cluster finish panel by pulling it.
- (g) Disconnect the connectors, and remove the center instrument cluster finish panel.



- (h) Remove the 2 screws holding the console box to the instrument panel safety pad.

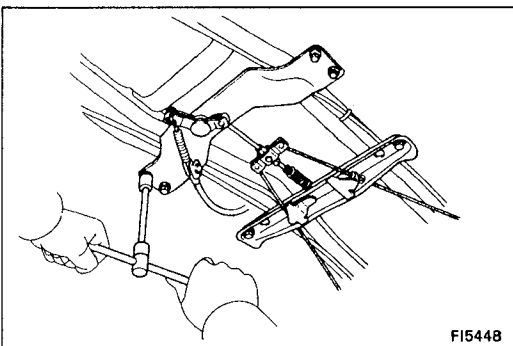


- (i) Remove the ash receptacle retainer mounting screw by lifting the front side of the console box.
- (j) Disconnect the connector, and remove the ash receptacle retainer.



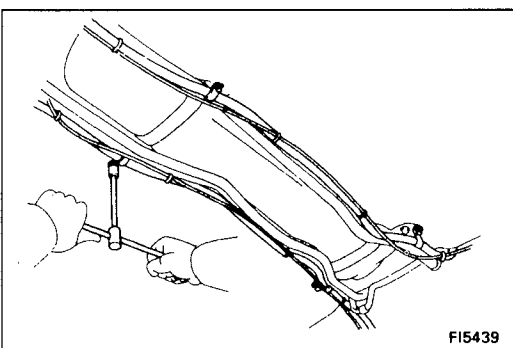
- (k) Disconnect the fuel pump connector and fuel sender gauge connector.
- (l) Remove the grommet from the service hole cover.
- (m) Remove the 2 nuts and service hole cover.

- 3. REMOVE ENGINE UNDER COVERS**
- 4. REMOVE FRONT LUGGAGE UNDER COVER**
- 5. REMOVE FUEL TANK PROTECTORS**
- 6. DRAIN FUEL**



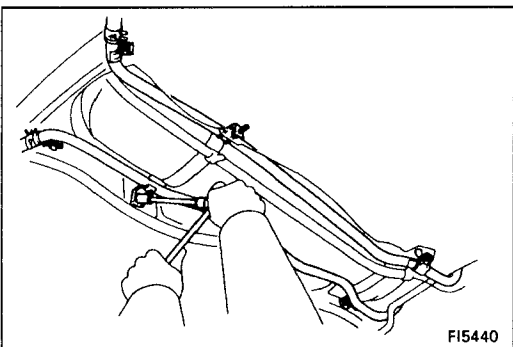
7. REMOVE PARKING BRAKE INTERMEDIATE LEVER AND NO.1 CENTER FLOOR CROSSMEMBER

- (a) Remove the 4 bolts and intermediate lever.
- (b) Remove the 2 bolts and crossmember.
- (c) Disconnect the parking brake cable from the intermediate lever.



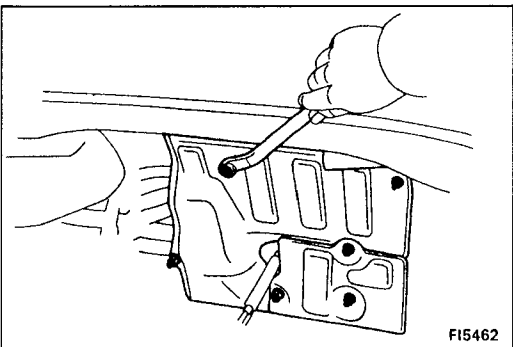
8. REMOVE A/C PIPES FROM BODY

Remove the 4 bolts, and disconnect the 2 A/C pipes from the body.



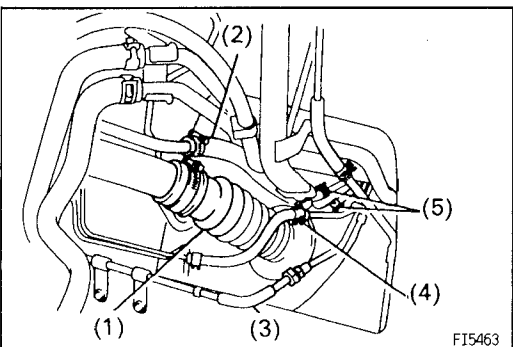
9. DISCONNECT RADIATOR PIPES FROM BODY

Remove the 6 bolts, and disconnect the 2 radiator pipes from the body.



10. REMOVE FUEL TANK HEAT INSULATORS

Remove the 6 nuts and 2 heat insulators.

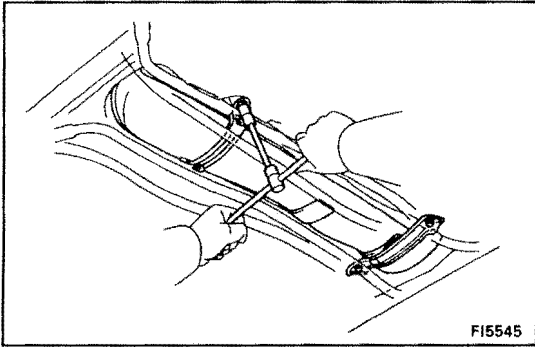


11. DISCONNECT HOSES AND PIPE

CAUTION: Remove the fuel filter cap to prevent the fuel from flowing out.

Disconnect the following hoses and pipe:

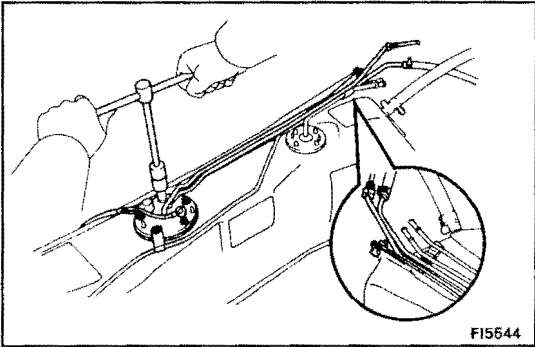
- (1) Fuel inlet hose
- (2) Fuel breather hose
- (3) Fuel pump pipe
- (4) Fuel return hose
- (5) 2 fuel evaporative vent hoses



FI5545

12. REMOVE FUEL TANK

- (a) Remove the bolt, pin and tank band.
- (b) Remove the 2 bolts and No.2 center floor crossmember.
- (c) Remove the fuel tank.



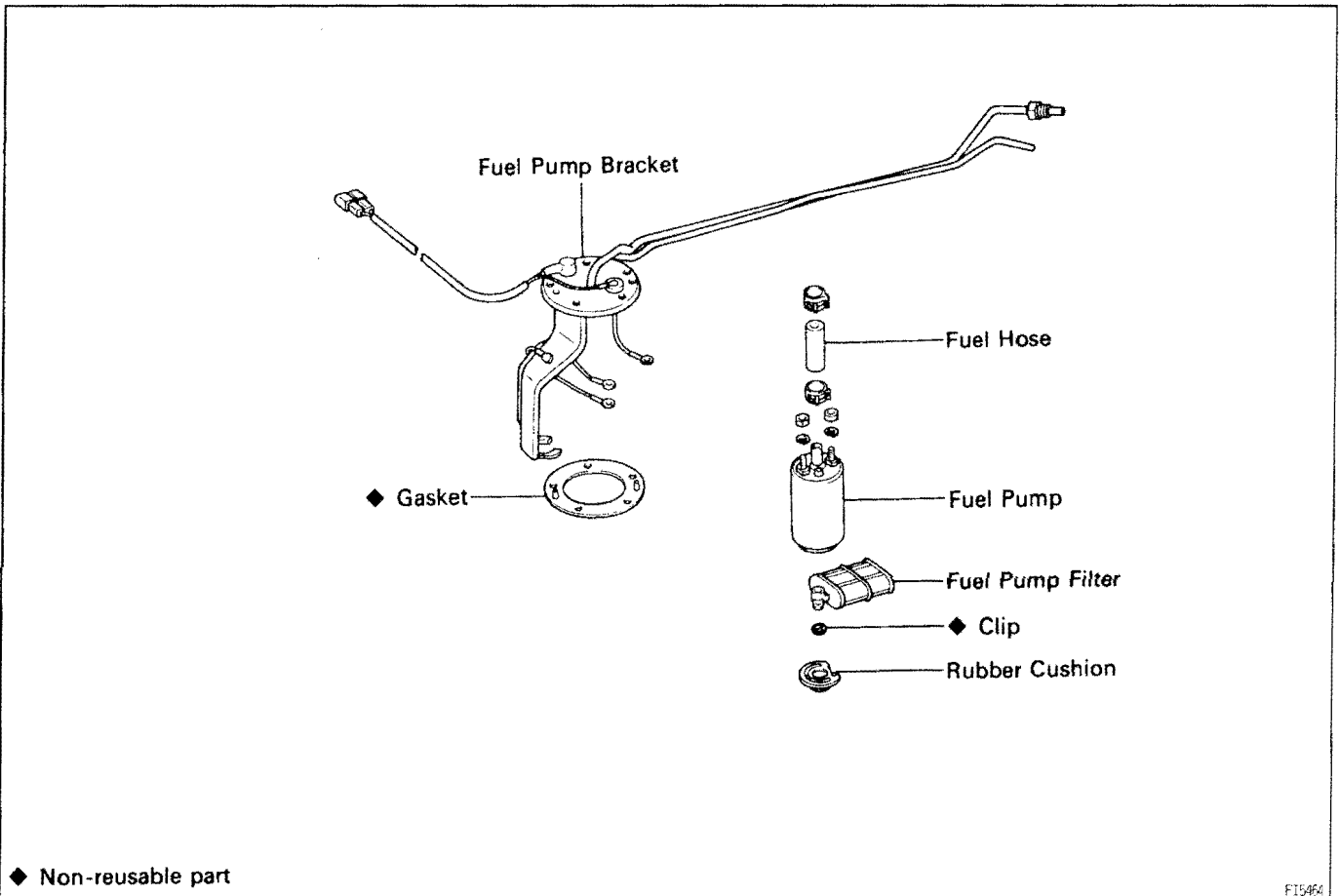
FI5544

13. REMOVE FUEL PUMP ASSEMBLY FROM FUEL TANK

- (a) Remove the bolt holding the fuel pump pipe to the fuel tank.
- (b) Remove the 5 bolts, and pull out the fuel pump assembly.
- (c) Remove the gasket from the pump bracket.

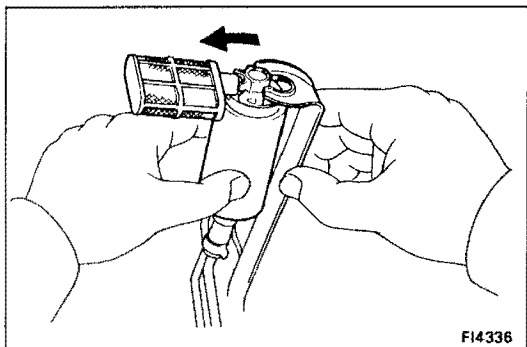
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG001-02



FI5464

EG

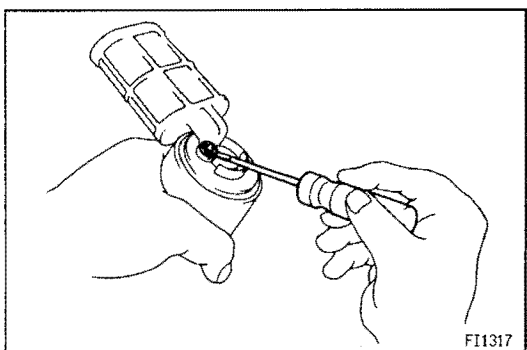


FUEL PUMP DISASSEMBLY

(See Components for Disassembly and Assembly)

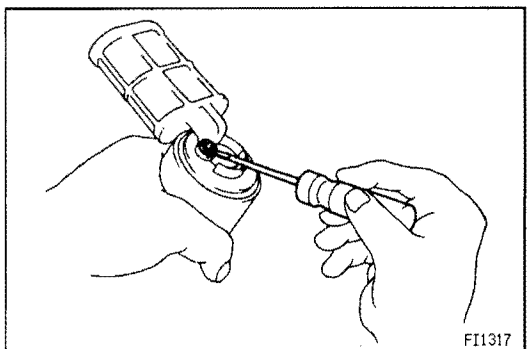
1. REMOVE FUEL PUMP FROM FUEL PUMP BRACKET

- (a) Pull out the lower side of the fuel pump from the pump bracket.
- (b) Remove the rubber cushion from the fuel pump.
- (c) Remove the nut and spring washer, and disconnect the lead wire from the fuel pump. Disconnect the 3 lead wires.
- (d) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.



2. REMOVE FUEL PUMP FILTER FROM FUEL PUMP

- (a) Using a small screwdriver, pry out the clip.
- (b) Pull out the pump filter.

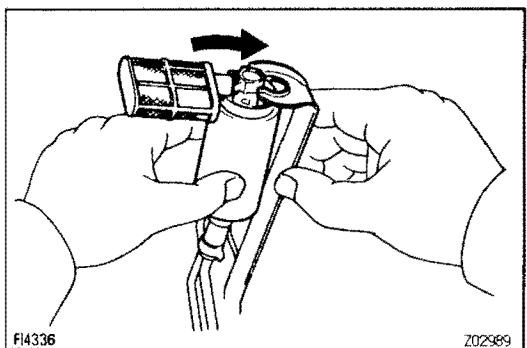


FUEL PUMP ASSEMBLY

(See Components for Disassembly and Assembly)

1. INSTALL FUEL PUMP FILTER TO FUEL PUMP

Install the pump filter with a new clip.



2. INSTALL FUEL PUMP TO FUEL PUMP BRACKET

- (a) Connect the fuel hose to the outlet port of the fuel pump.
- (b) Connect the lead wire to the fuel pump with the spring washer and nut. Connect the 3 lead wires.
- (c) Install the rubber cushion to the fuel pump.
- (d) Install the fuel pump by pushing the lower side of the fuel pump.

FUEL PUMP INSTALLATION

(See Components for Removal and Installation)

1. INSTALL FUEL PUMP ASSEMBLY TO FUEL TANK

- (a) Install a new gasket to the pump bracket.
- (b) Insert the fuel pump assembly into the fuel tank.
- (c) Install the 5 bolts holding the fuel pump bracket to the fuel tank.

Torque: 3.4 N·m (35 kgf·cm, 30 in.-lbf)

- (d) Install the 5 bolts holding the fuel pump pipe to the fuel tank.

2. INSTALL FUEL TANK

- (a) Apply soapy water to the cushions on the fuel tank.

- (b) Attach the fuel tank to the body.
- (c) Install the fuel tank band with the pin and bolt.
- (d) Install the No.2 center floor crossmember with the 2 bolts.

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

3. CONNECT HOSES AND PIPE

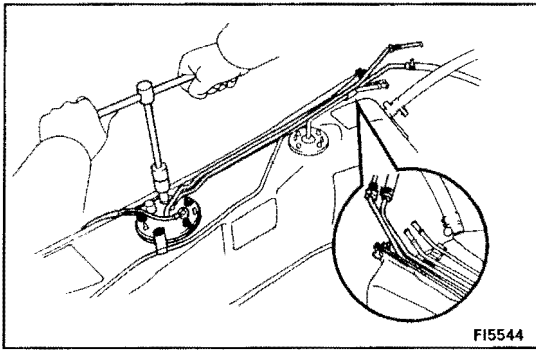
Connect the following hoses and pipe:

- (1) Fuel inlet hose
- (2) Fuel breather hose
- (3) Fuel pump pipe
- (4) Fuel return hose
- (5) 2 fuel evaporative vent hoses

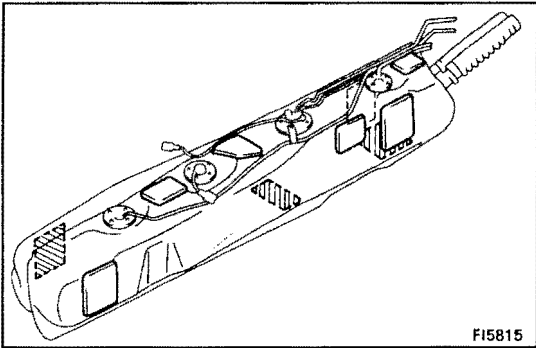
Torque: 35 N·m (350 kgf·cm, 26 ft-lbf)

4. INSTALL RADIATOR PIPES TO BODY

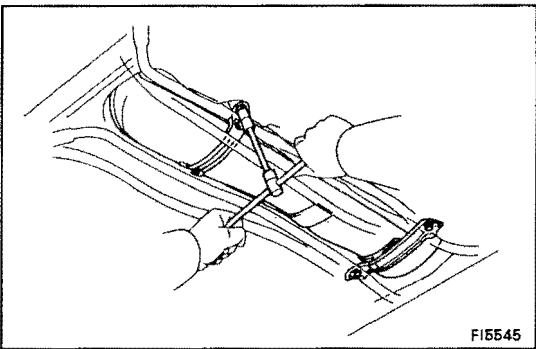
Install the 2 radiator pipes with the 6 bolts.



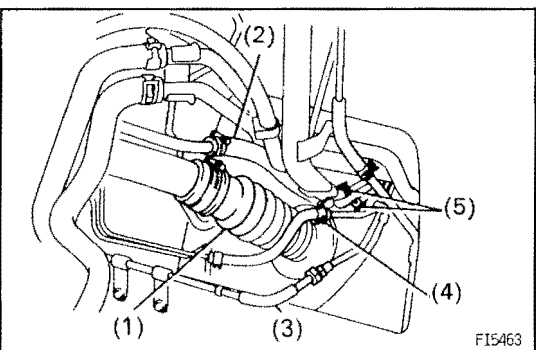
FI5544



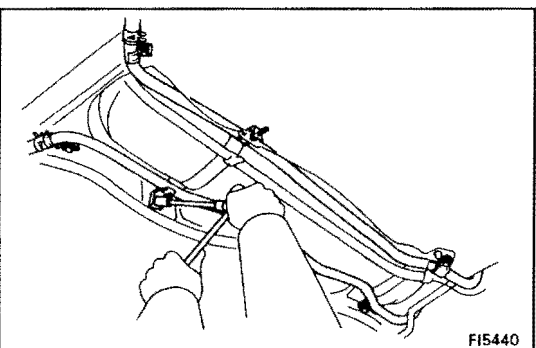
FI5815



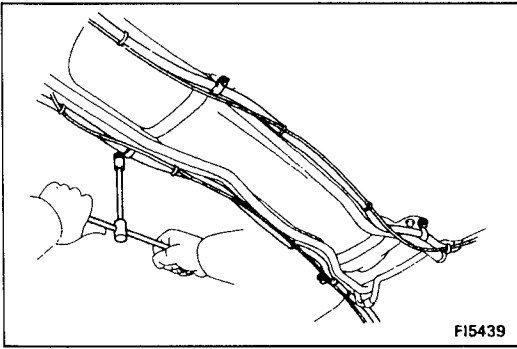
FI5545



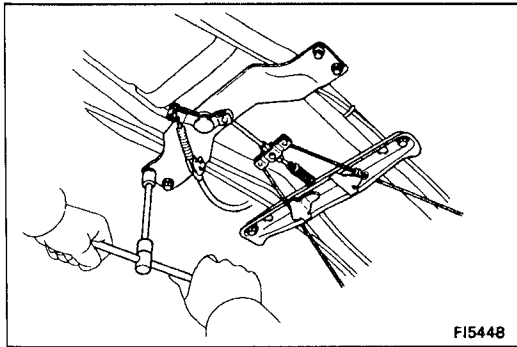
FI5463



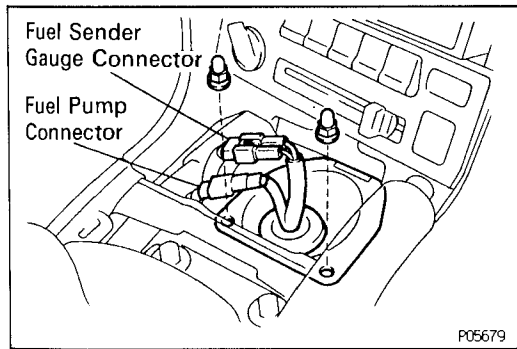
FI5440

**5. INSTALL A/C PIPES TO BODY**

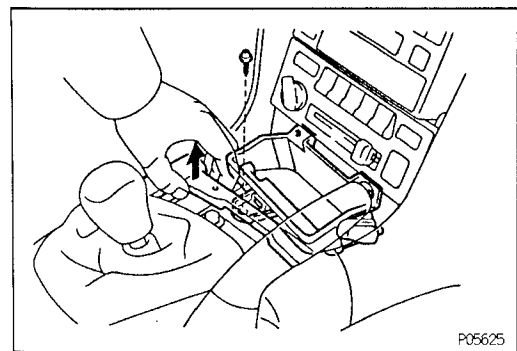
Install the 2 A/C pipes with the 4 bolts.

**6. INSTALL PARKING BRAKE INTERMEDIATE LEVER AND NO.1 CENTER FLOOR CROSSMEMBER**

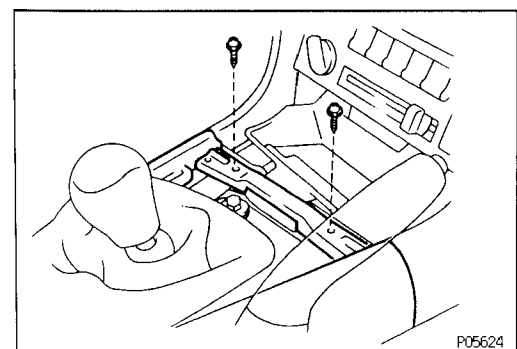
- (a) Connect the parking brake cable to the intermediate lever.
- (b) Install the intermediate lever with the 4 bolts.
- (c) Install the crossmember with the 2 bolts.

**7. CONNECT FUEL PUMP CONNECTOR AND FUEL SENDER GAUGE CONNECTOR**

- (a) Install the service hole cover with the 2 nuts.
- (b) Install the grommet to the service hole cover.
- (c) Connect the fuel pump connector and fuel sender gauge connector.

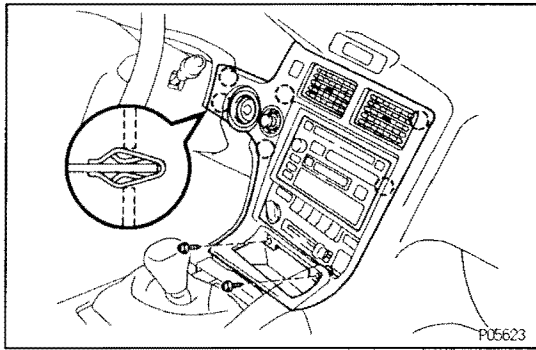


- (d) Connect the connector, and install the ash receptacle retainer with the screw by lifting the front side of the console box.

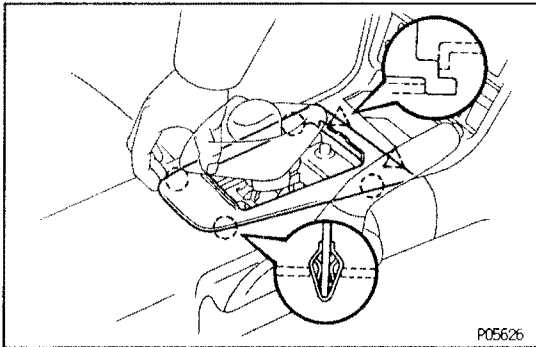


- (e) Install the console box to the instrument panel safety pad with the 2 screws.

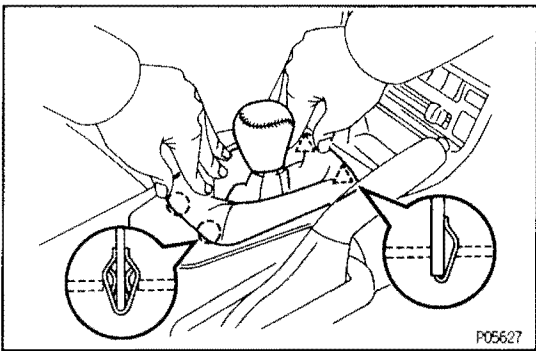
EG



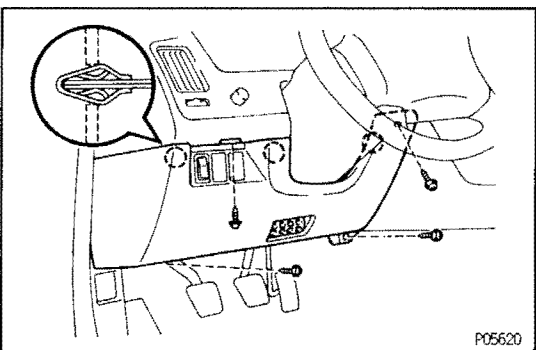
- (f) Connect the connectors, and attach the center instrument cluster finish panel to the instrument panel safety pad with the clips.
- (g) Install the 2 screws.



- (h) Connect the connector, and attach the upper console panel to the console panel with the 2 claws and 2 clips.



- (i) Attach the shifting hole cover with the 4 clips.
- (j) Install the ash receptacle box.



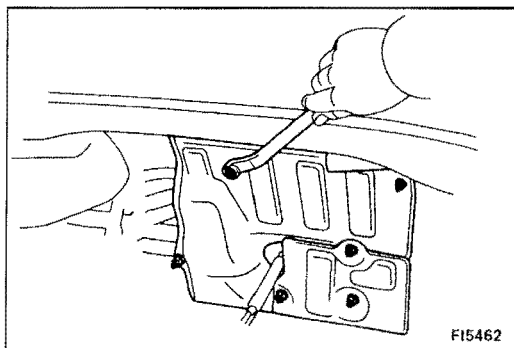
- (k) Connect the connector, and attach the lower No.1 instrument panel finish panel with the 3 clips.
- (l) Install the 4 screws.

8. FILL WITH FUEL

9. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

10. CHECK FOR FUEL LEAKS

(See page EG – 173)

**11. INSTALL FUEL TANK HEAT INSULATORS**

Install the 2 heat insulators with the 6 nuts.

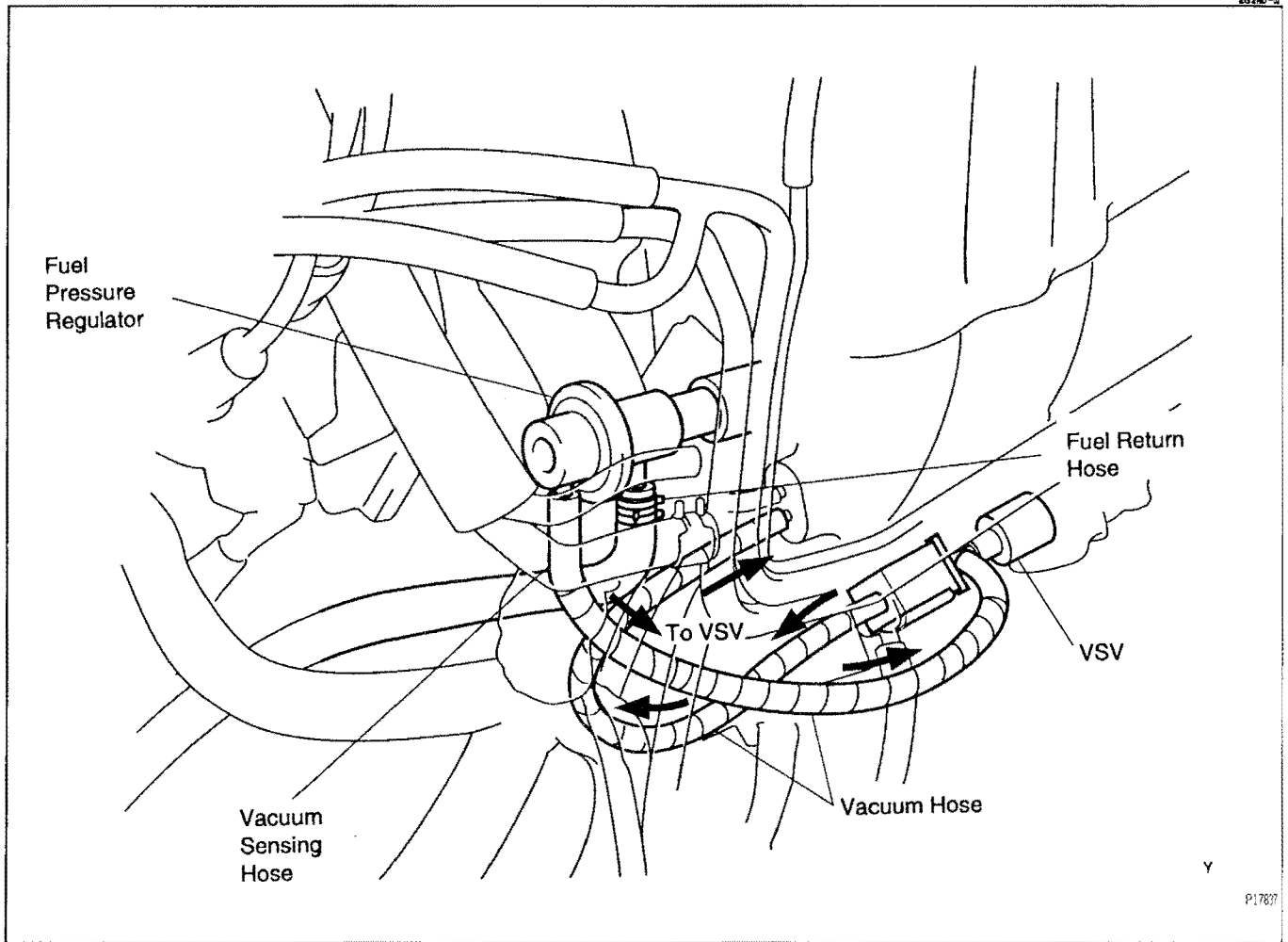
EG

12. INSTALL FUEL TANK PROTECTORS**13. INSTALL FRONT LUGGAGE UNDER COVER****14. INSTALL ENGINE UNDER COVERS**

FUEL PRESSURE REGULATOR

EG2ND-3

EG



P17837

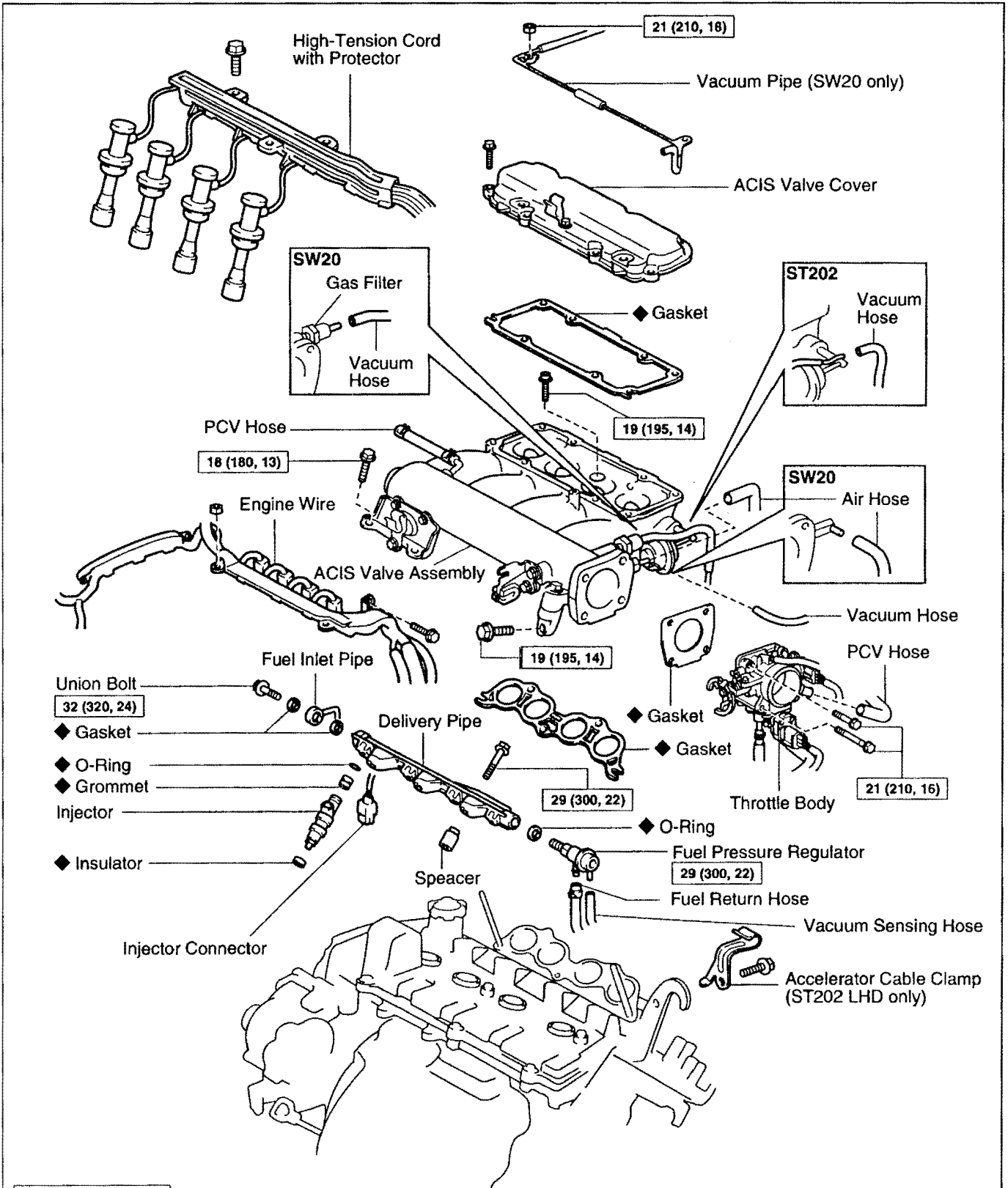
ON – VEHICLE INSPECTION

EG2NE-01

INSPECT FUEL PRESSURE (See step 2 on page EG – 206)

COMPONENTS FOR REMOVAL AND INSTALLATION

EG



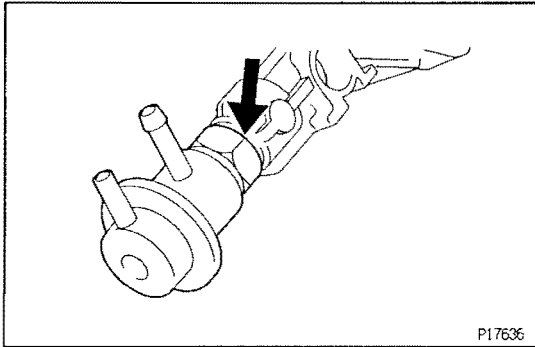
N·m (kgf·cm, ft·lbf) : Specified torque
 ◆ Non-reusable part

FUEL PRESSURE REGULATOR REMOVAL

(See Components for Removal and Installation)

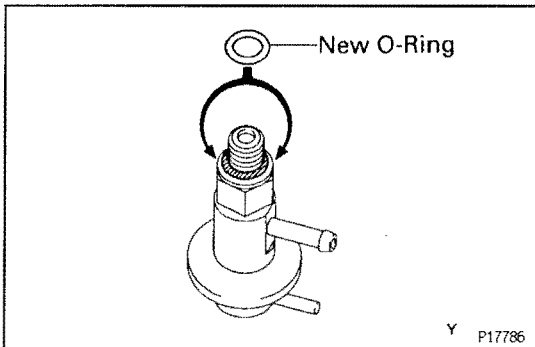
1. REMOVE INJECTORS AND DELIVERY PIPE
(See steps 1 to 10 on page EG-240 to EG-242)

EG



2. REMOVE FUEL PRESSURE REGULATOR

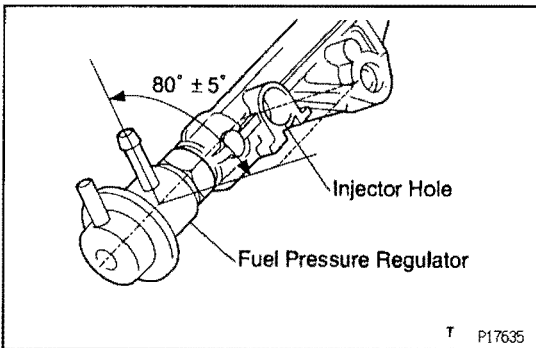
- (a) Loosen the lock nut, and remove the pressure regulator.
- (b) Remove the O-ring from the pressure regulator.



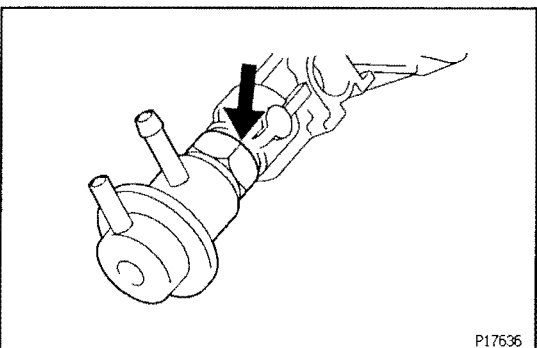
FUEL PRESSURE REGULATOR INSTALLATION

1. INSTALL FUEL PRESSURE REGULATOR

- (a) Fully loosen the lock nut of the pressure regulator.
- (b) Apply a light coat of gasoline to a new O-ring, and install it to the pressure regulator.
- (c) Thrust the pressure regulator completely into the delivery pipe by hand.
- (d) Turn the pressure regulator counterclockwise until the fuel return pipe faces in the direction indicated in the illustration.



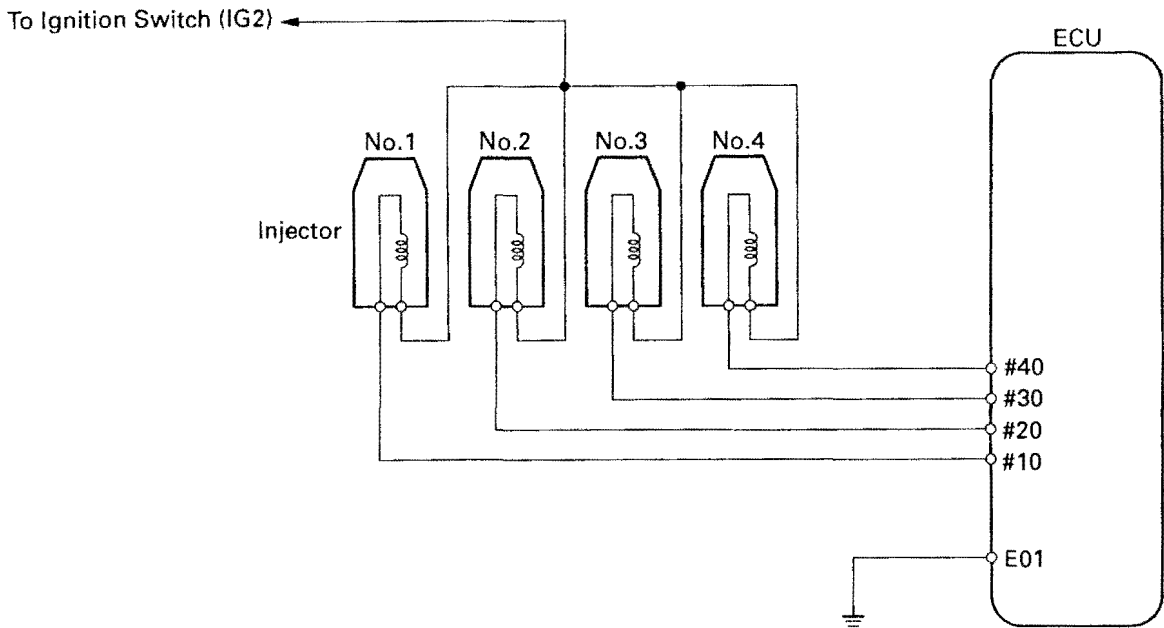
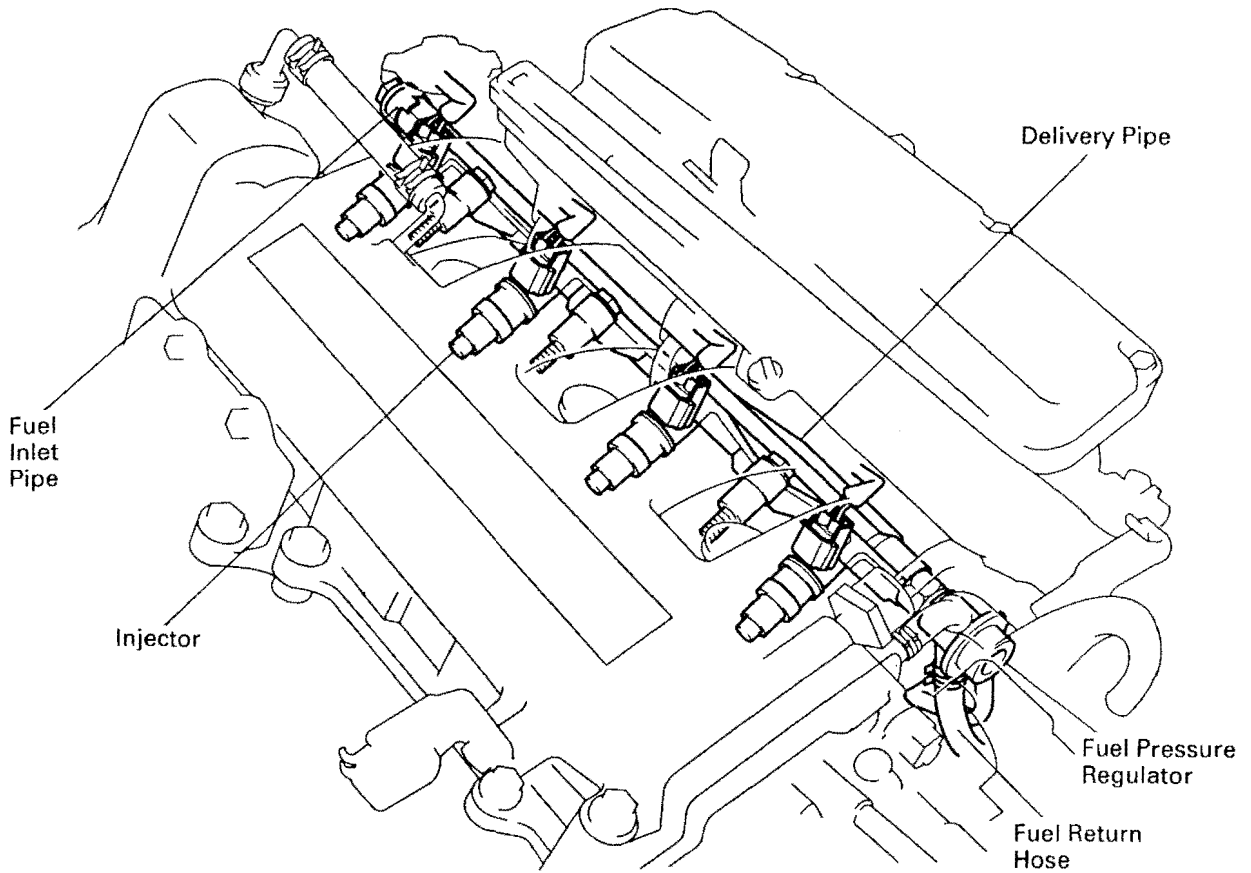
- (e) Tighten the lock nut
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
2. INSTALL INJECTORS AND DELIVERY PIPE
(See steps 1 to 11 on page EG-247 to EG-251)



INJECTOR

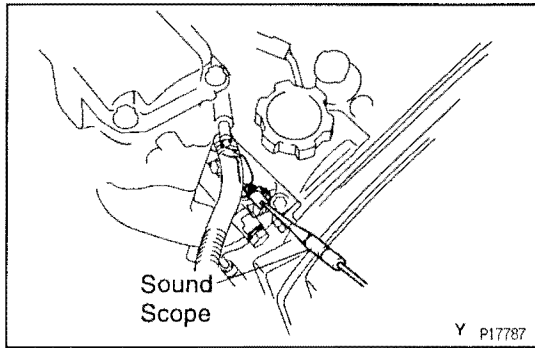
EG12Y-00

EG



P17839
P14187

Z12792

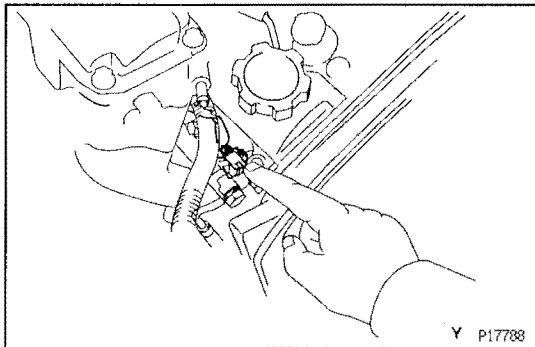


ON – VEHICLE INSPECTION

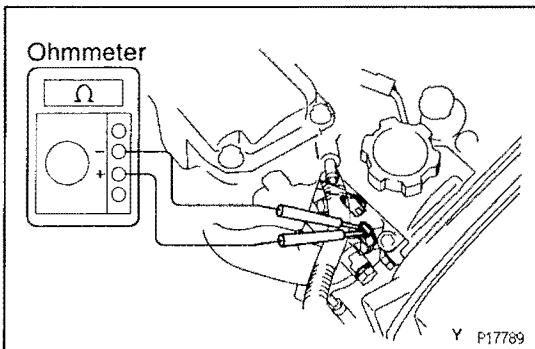
1. INSPECT INJECTOR OPERATION

Check operation sound from each injector.

- (a) With the engine running or cranking, use a sound scope to check that there is a normal operating noise in proportion to engine speed.



- (b) 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 ECU.



2. INSPECT INJECTOR RESISTANCE

- (a) Disconnect the injector connector.
 (b) Using an ohmmeter, measure the resistance between the terminals.

Resistance:

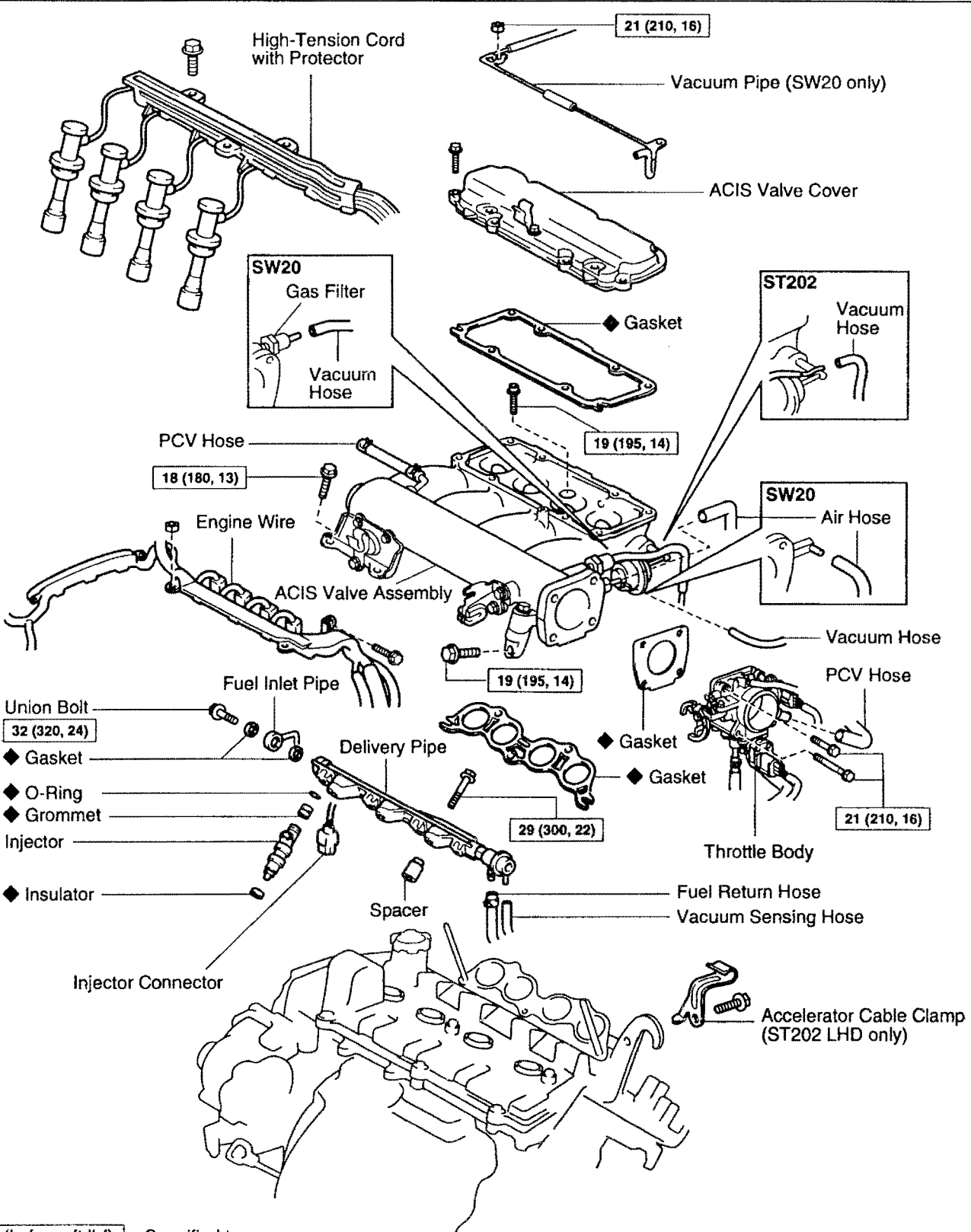
13.4 – 14.2 Ω at 20°C (68°F)

If the resistance is not as specified, replace the injector.

- (c) Reconnect the injector connector.

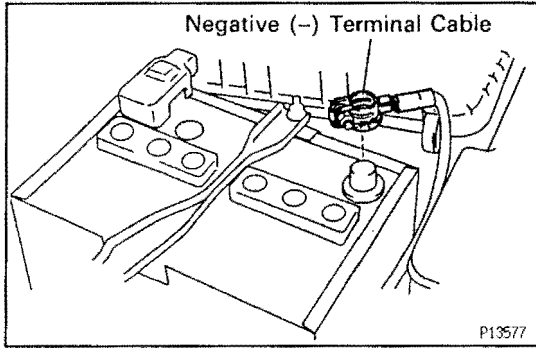
COMPONENTS FOR REMOVAL AND INSTALLATION

EG



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

◆ Non-reusable part



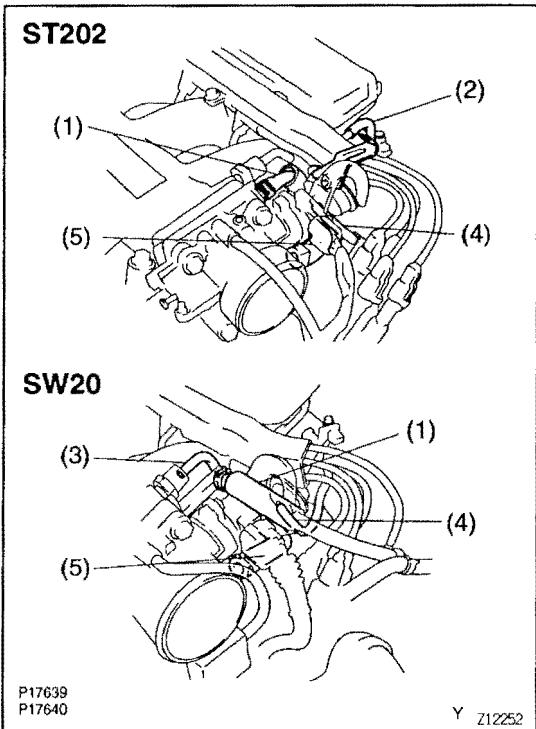
INJECTORS REMOVAL

(See Components for Removal and Installation)

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

2. **DISCONNECT INTAKE AIR TEMPERATURE SENSOR FROM AIR CLEANER CAP**
3. **REMOVE AIR CLEANER CAP AND HOSE**
4. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**

EG



5. **DISCONNECT THROTTLE BODY FROM AIR INTAKE CHAMBER**

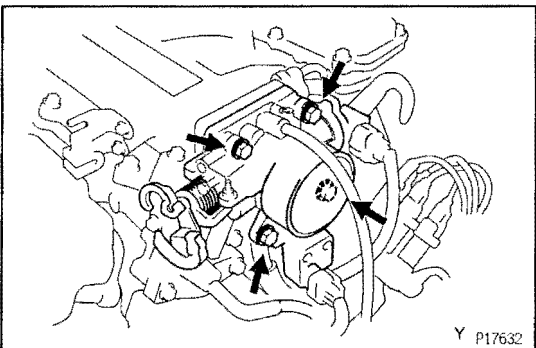
(a) Disconnect the following hoses:

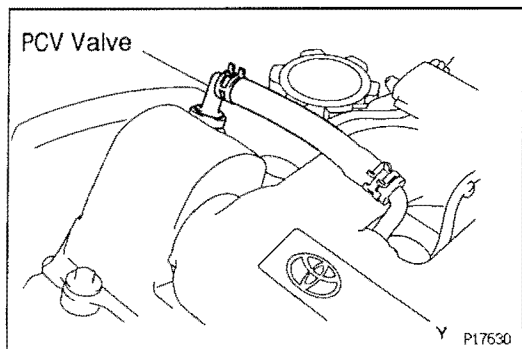
- (1) Air hose (from A/C idle-up valve)
- (2) ST202:
Vacuum hose (from vacuum pipe)
- (3) SW20:
Vacuum hose (from gas filter)
- (4) Vacuum hose (from ACIS valve actuator)
- (5) PCV hose

(b) ST202 LHD only:

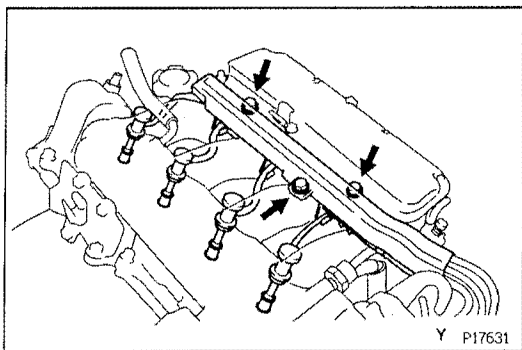
Remove the accelerator cable clamp and bolt from the engine hanger.

- (c) Remove the 4 bolts and the throttle body from the ACIS valve assembly.



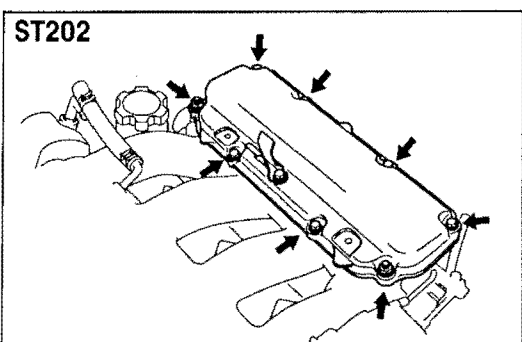


6. DISCONNECT PCV HOSE FROM PCV VALVE



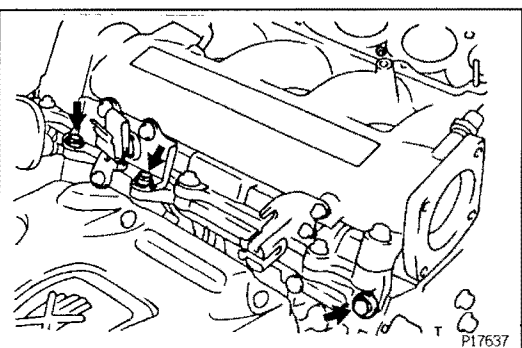
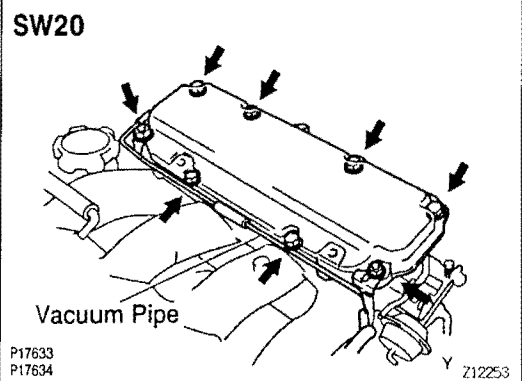
7. DISCONNECT HIGH-TENSION CORDS

- (a) Remove the 3 bolts and high-tension cord protector from the ACIS valve assembly.
- (b) Disconnect the high-tension cords from the spark plugs.

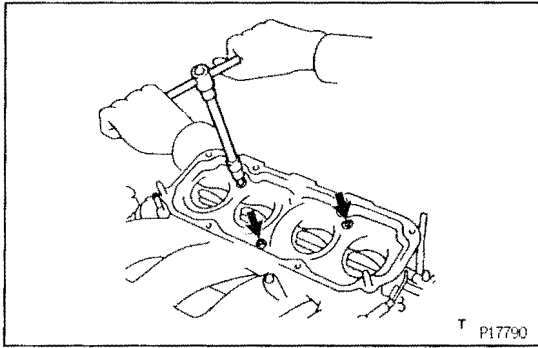


8. REMOVE ACIS VALVE ASSEMBLY

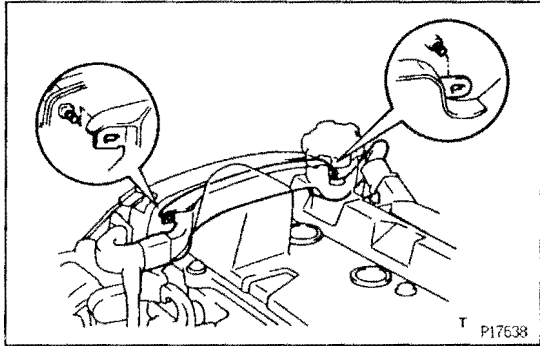
- (a) ST202:
Remove the 6 bolts and 2 nuts.
- (b) SW20:
Remove the 6 bolts and 2 nuts and vacuum pipe.
- (c) Remove the ACIS valve cover and gasket.



- (d) Remove the 3 bolts from the ACIS valve stays and cylinder head.

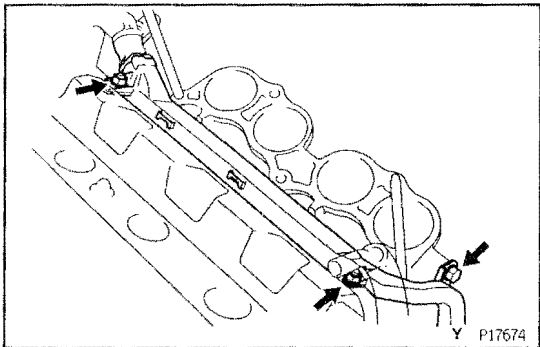


- (e) Using 6 mm hexagon wrench, remove the 3 bolts from the ACIS valve assembly.
- (f) Remove the ACIS valve assembly and gasket.

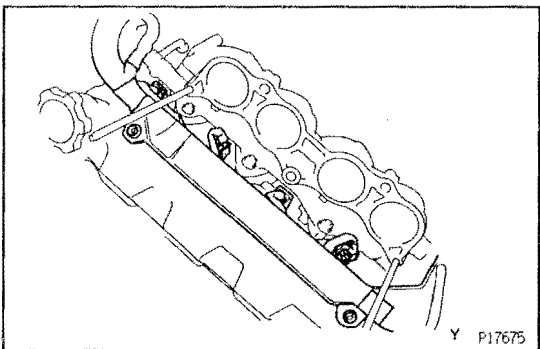


9. DISCONNECT WIRE HANESS

- (a) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.

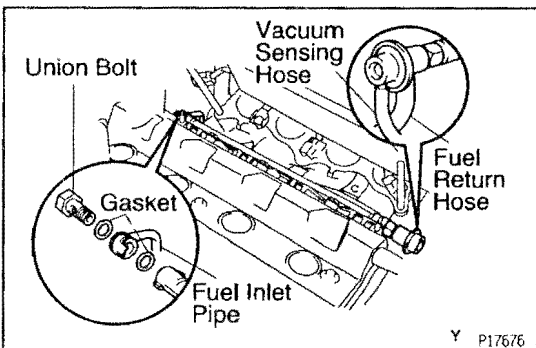


- (b) Disconnect the 2 nuts, bolt and engine wire.

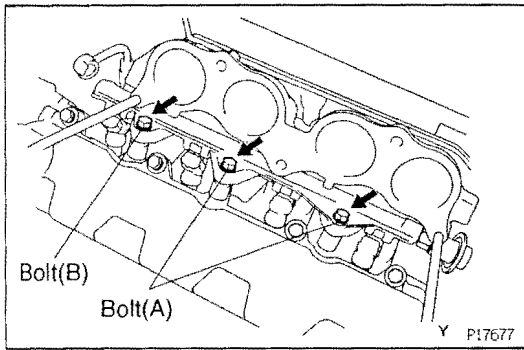


10. REMOVE DELIVERY PIPE AND INJECTOR

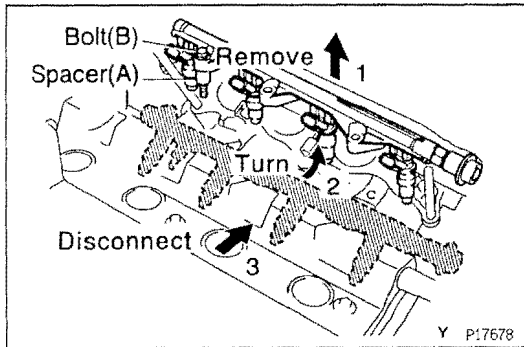
- (a) Disconnect the 4 injector connectors.



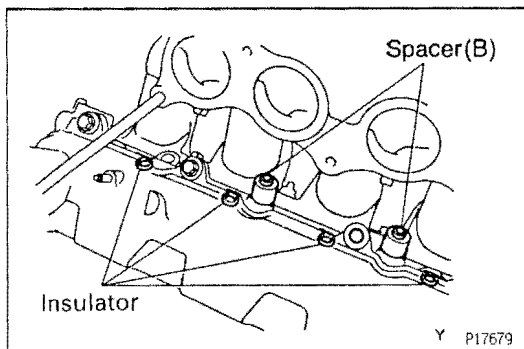
- (b) Remove the union bolt, 2 gaskets and disconnect the fuel inlet pipe from delivery pipe.
- (c) Disconnect the fuel return hose and vacuum sensing hose from the pressure regulator.



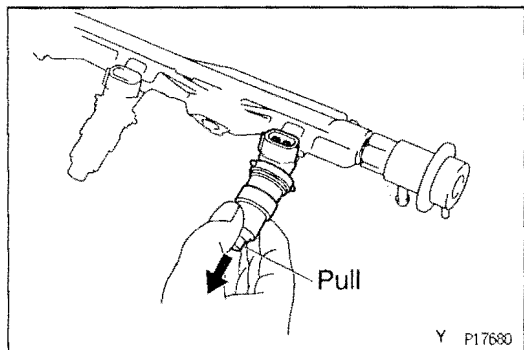
- (d) Remove the 2 bolts (A) holding the delivery pipe to the cylinder head.
- (e) Loosen the bolt (B).



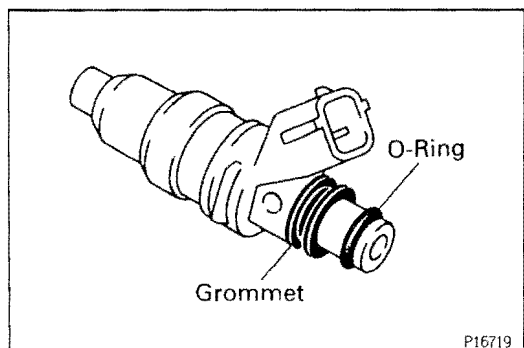
- (f) Remove the delivery pipe together with bolt (B), spacer (A) and 4 injectors by following the instructions as shown in the illustration.
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.



- (g) Remove the 4 insulators and 2 spacers (B) from the cylinder head.



- (h) Pull out the 4 injectors from the delivery pipe.

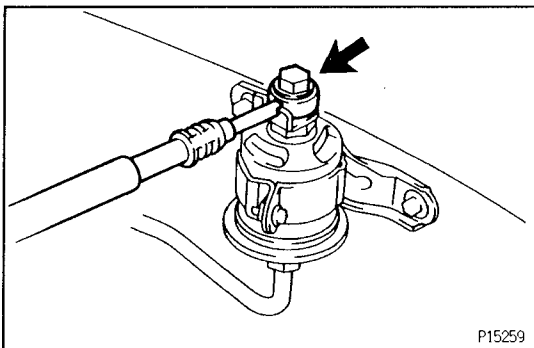
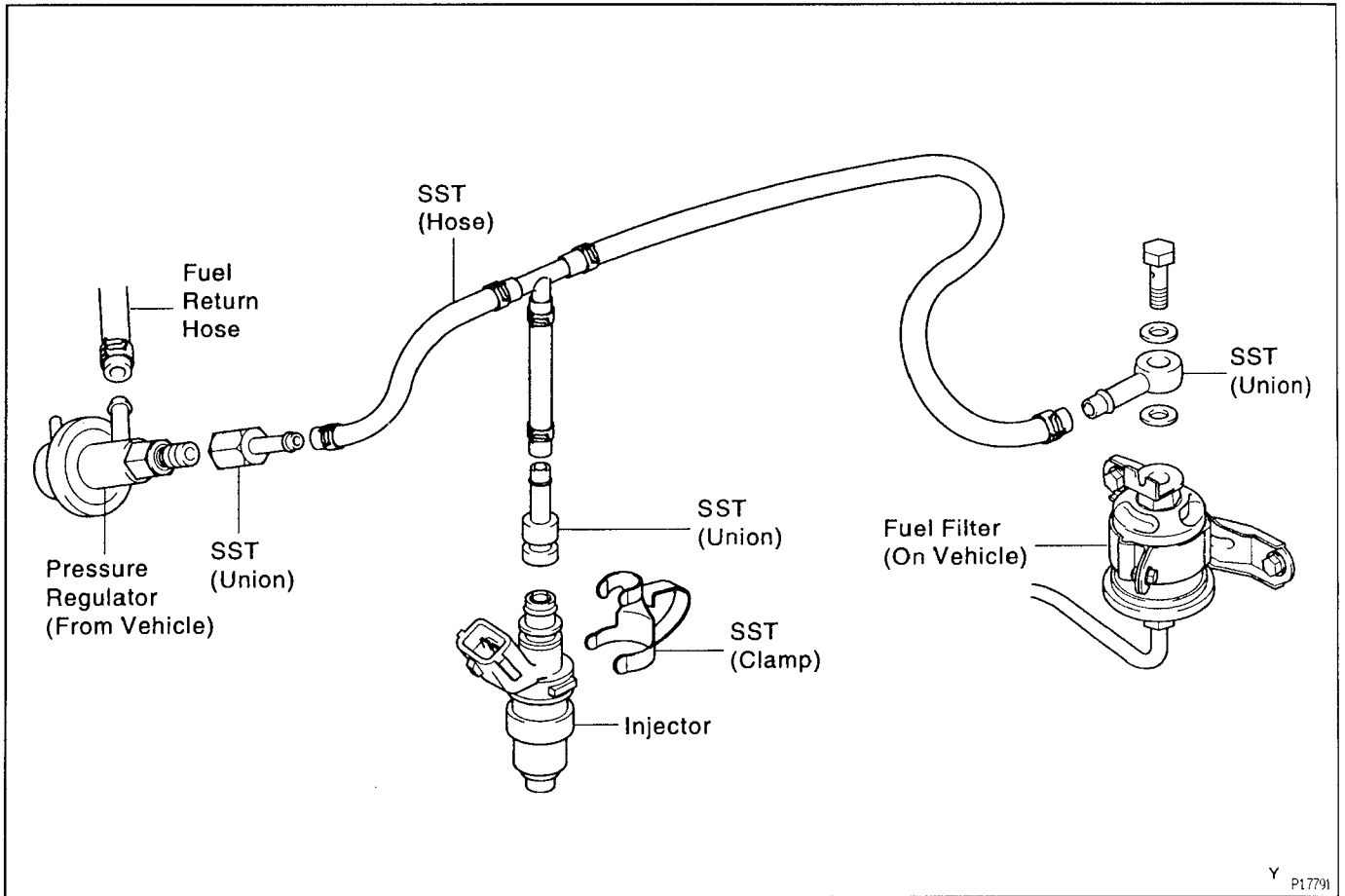


- (i) Remove the O-ring and grommet from each injector.

INJECTORS INSPECTION

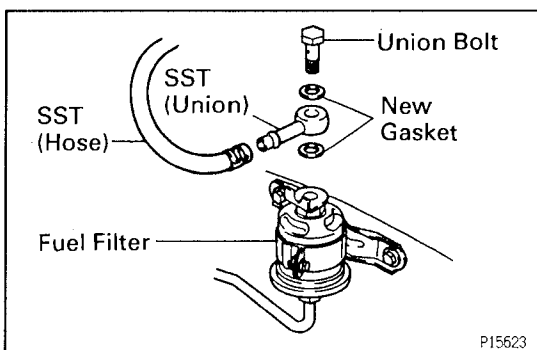
1. INSPECT INJECTOR INJECTION

CAUTION: Keep injector clear of sparks during the test.



- (a) Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter outlet.

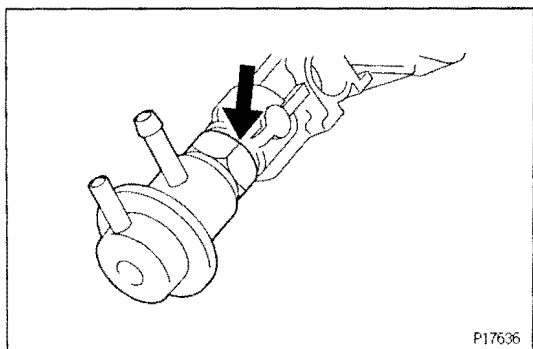
CAUTION: When removing or installing the union bolt, fix the fuel filter in place using a spanner.



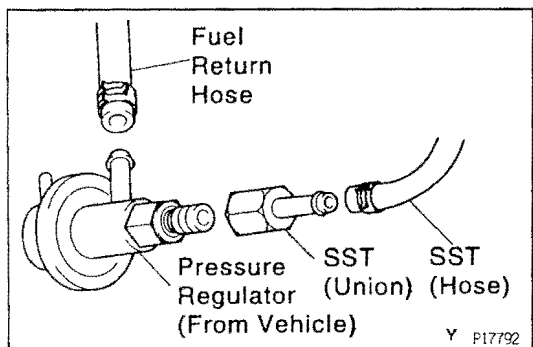
- (b) Connect SST (union and hose) to the fuel filter outlet with 2 new gaskets and union bolts.

SST 09268-41045 (90405-09015)

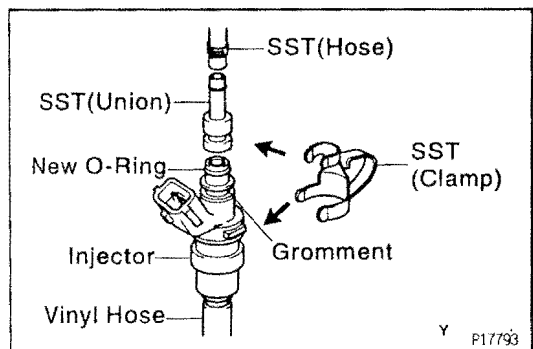
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



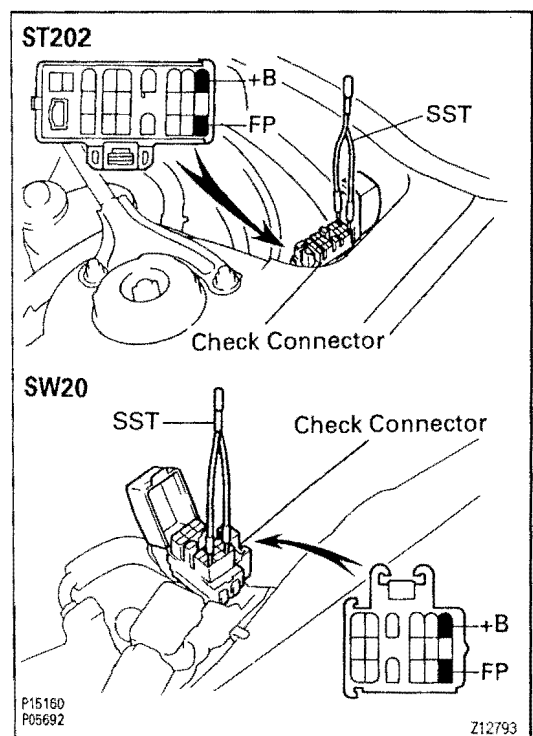
- (c) Remove the pressure regulator from the delivery pipe.
(See step 2 on page EG-236)



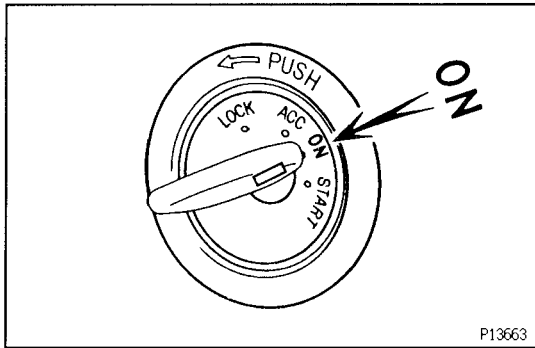
- (d) Install a new O-ring to the fuel pressure regulator inlet.
(e) Connect SST (hose) to the fuel inlet of the pressure regulator with SST (union).
SST 09268-41045 (09268-41090)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
(f) Connect the fuel return hose to the fuel pressure regulator outlet.



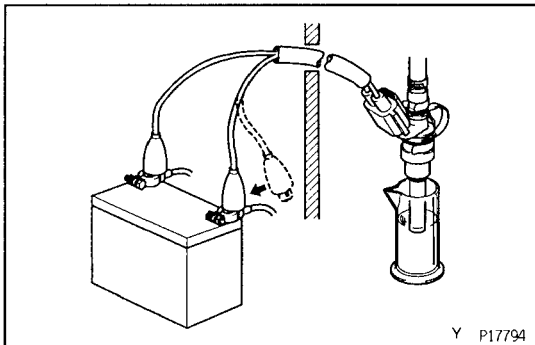
- (g) Install the grommet and a new O-ring to the injector.
(h) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).
SST 09268-41045
(i) Put the injector into a graduated cylinder.
CAUTION: Install a suitable vinyl hose onto the injector to prevent gasoline from splashing out.



- (j) Using SST, connect terminals +B and FP of the check connector.
SST 09843-18020
(k) Reconnect the negative (-) terminal cable to the battery.



- (l) Turn the ignition switch ON.
NOTICE: Do not start the engine.



- (m) 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.
 SST 09842–30070

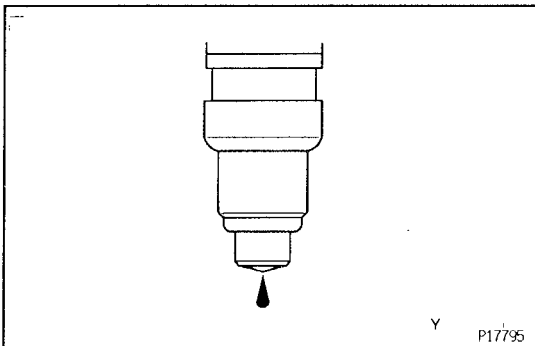
Volume:

81 – 102 cm³ (4.9 – 6.2 cu in.) per 15 sec.

Difference between each injector:

5 cm³ (0.3 cu in.) or less

If the injection volume is not as specified, replace the injector.

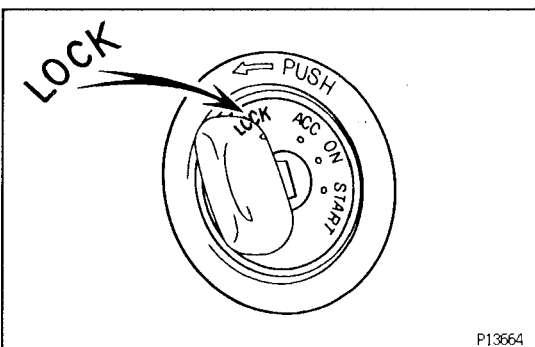


2. INSPECT LEAKAGE

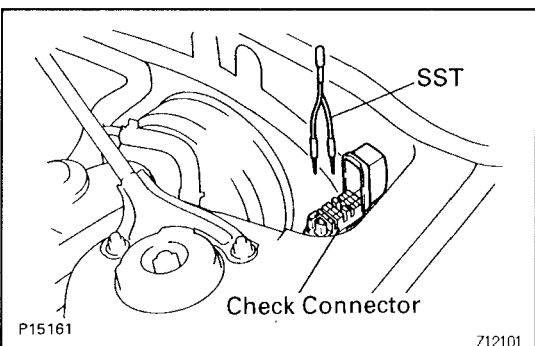
- (a) In the condition above, disconnect the tester probes of SST (wire) from the battery and check the fuel leakage from the injector.
 SST 09842–30070

Fuel drop:

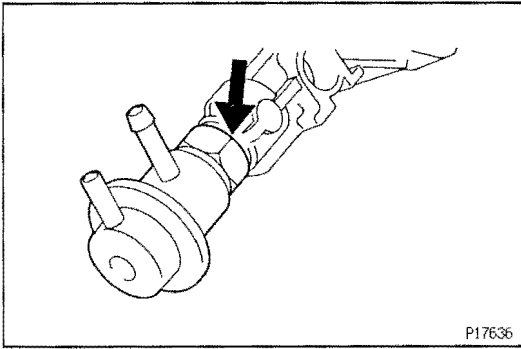
One drop or less per minute



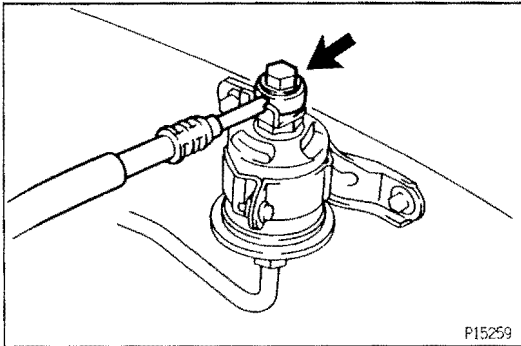
- (b) Turn the ignition switch to LOCK.



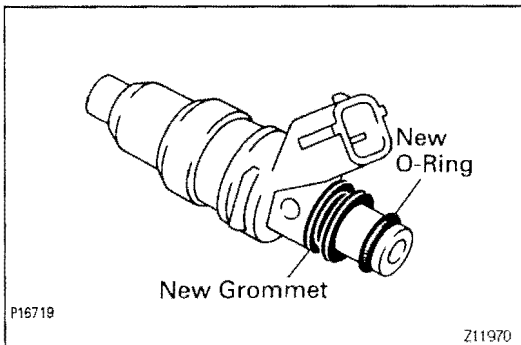
- (c) Disconnect the negative (–) terminal cable from the battery.
 (d) Remove the SST from the check connector.
 SST 09268–41045, 09842–30070, 09843–18020



- (e) Reinstall the pressure regulator to the delivery pipe.
(See steps 1 and 2 on page EG-236)
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



- (f) Reconnect the fuel inlet hose to the fuel filter outlet with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
CAUTION: When installing the union bolt, fix the fuel filter in place using a spanner.



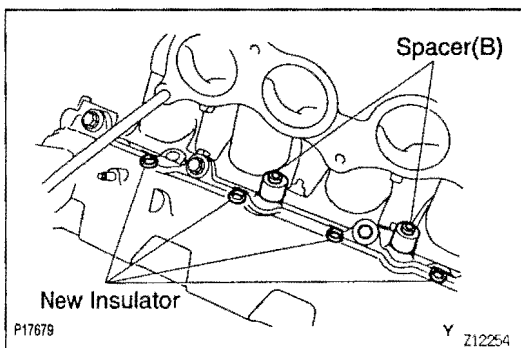
INJECTORS INSTALLATION

EG3WA-01

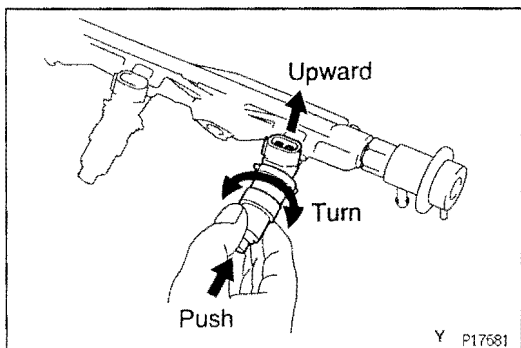
(See Components for Removal and Installation)

1. INSTALL INJECTORS AND DELIVERY PIPE

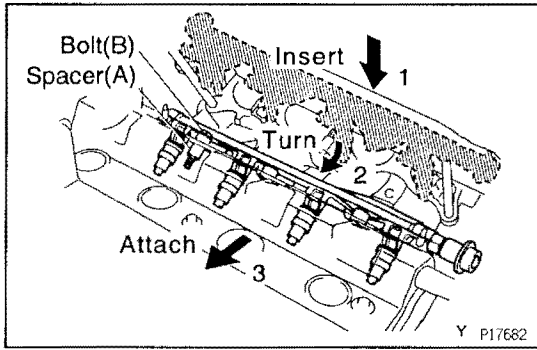
- (a) Install a new grommet to the injector.
(b) Apply a light coat of gasoline onto a new O-ring, and install it to each injector.



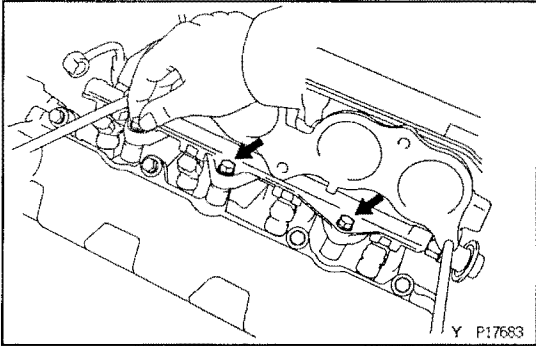
- (c) Place 4 new insulators and the 2 spacers (B) in position on the cylinder head.



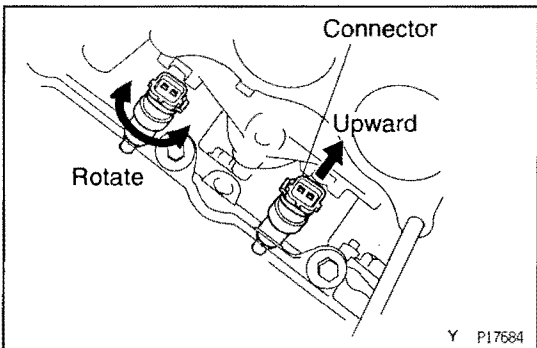
- (d) While turning the injector left and right, install it to the delivery pipe. Install the 4 injectors.
(e) Position the injector connector upward.



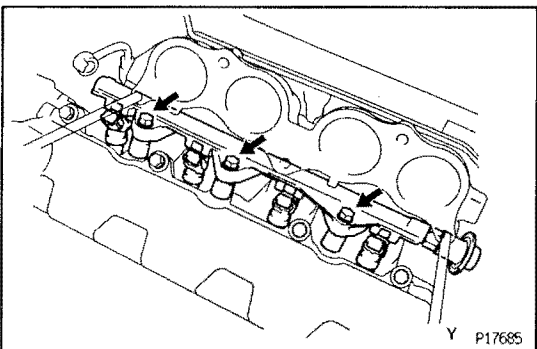
- (f) Install the delivery pipe together with 4 injectors, bolt (B) and spacer (A) to the cylinder head by following the instructions as shown in the illustration.



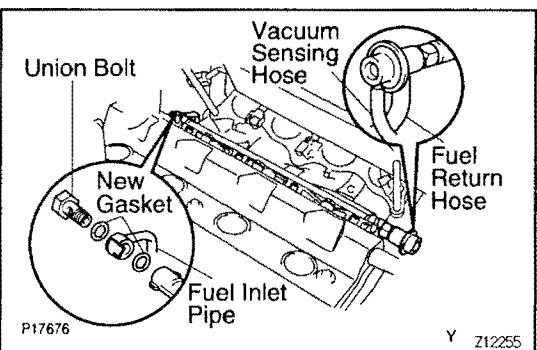
- (g) Temporarily install the 3 bolts holding the delivery pipe to the cylinder head.



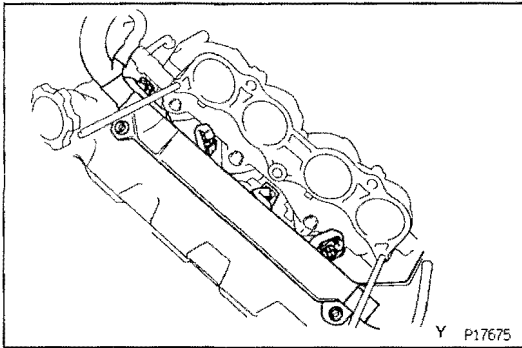
- (h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O-rings. Replace the O-rings.
- (i) Position the injector connector upward.



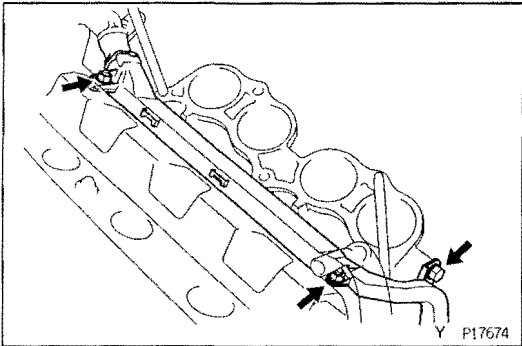
- (j) Tighten the 3 bolts holding the delivery pipe to the cylinder head.
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



- (k) Connect the fuel return hose and vacuum sensing hose from the pressure regulator.
- (l) Install the union bolt, 2 new gaskets and connect the fuel inlet pipe from the pressure regulator.
Torque: 32 N·m (320 kgf·cm, 24 ft·lbf)

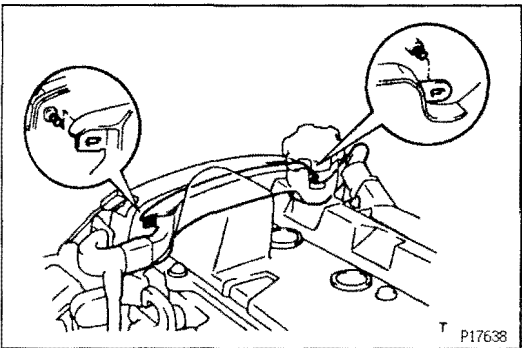


- (m) Connect the 4 injector connectors.

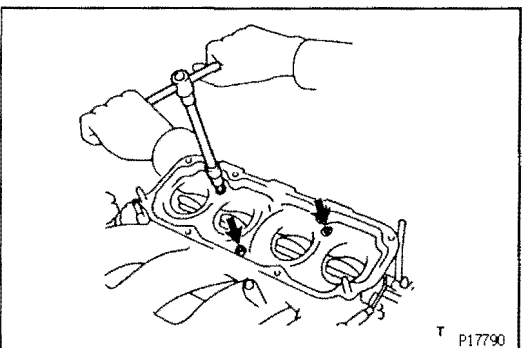


2. INSTALL WIRE HARNESS

- (a) Install the 2 nuts, bolt and engine wire.



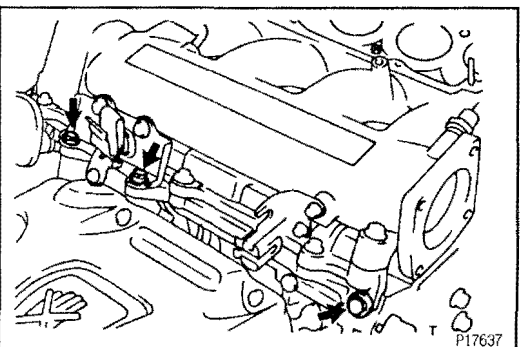
- (b) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.



3. INSTALL ACIS VALVE ASSEMBLY

- (a) Install the ACIS valve assembly and gasket.
 (b) Using 6 mm hexagon wrench, install the 3 bolts to the ACIS valve assembly.

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

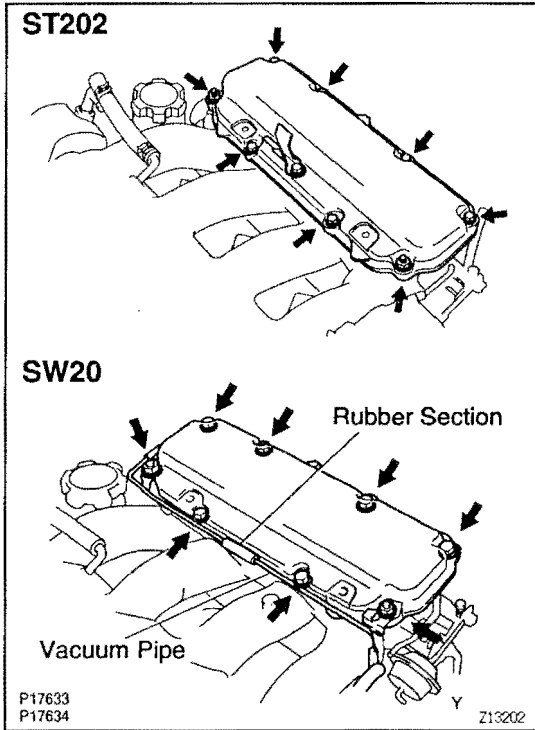


- (c) Install the 3 bolts to the ACIS valve stays and cylinder head.

Torque:

No.1 ACIS valve stay: 19 N·m (195 kgf·cm, 14 ft·lbf)

No.2 ACIS valve stay: 18 N·m (180 kgf·cm, 13 ft·lbf)



(d) Install the ACIS valve cover and gasket.

(e) ST202:
Install the 6 bolts and 2 nuts.

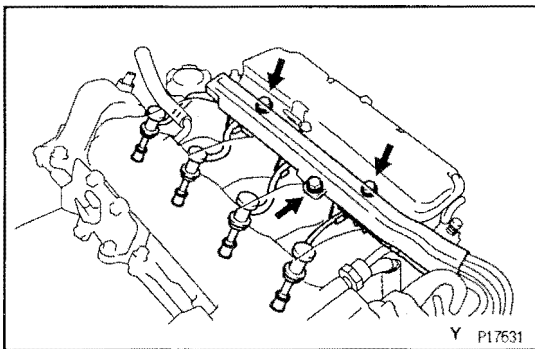
(f) SW20:
Install the 6 bolts, 2 nuts and vacuum pipe.

Torque:

Bolt: 8.5 N·m (85 kgf·cm, 75 in.-lbf)

Nut : 21 N·m (210 kgf·cm, 14 ft-lbf)

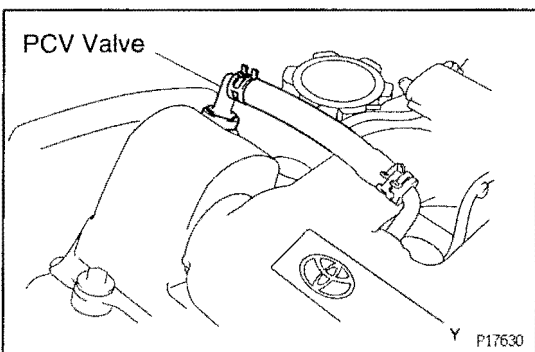
(g) Check that rubber section at the center, of the vacuum pipe is firmly pressed against the ACIS valve cover.



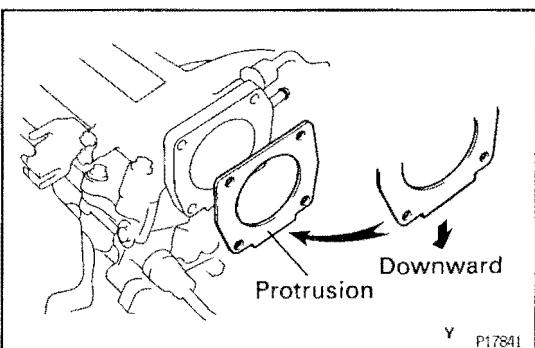
4. CONNECT HIGH – TENSION CORDS

(a) Install the high – tension cord protector and 3 bolts to the ACIS valve assembly.

(b) Connect the high – tension cords to the spark plugs.

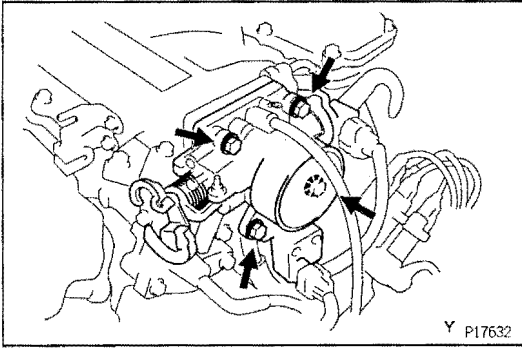


5. CONNECT PCV HOSE TO PCV VALVE



6. INSTALL THROTTLE BODY

(a) Attach a new gasket to the ACIS valve assembly, facing the protrusion downward.



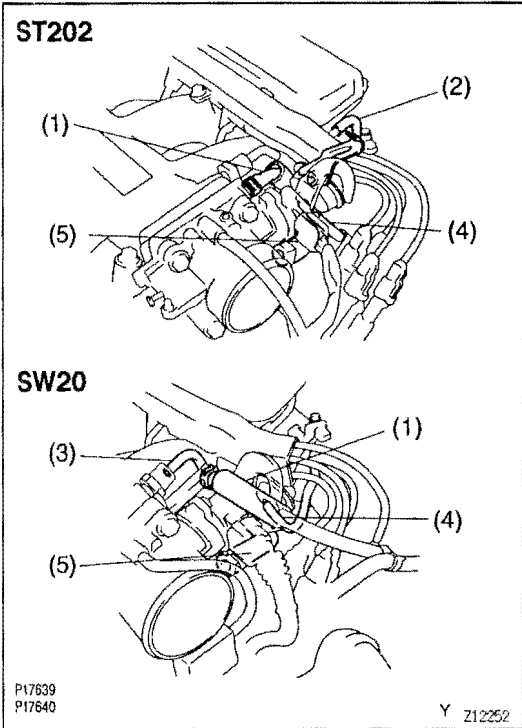
- (b) Install the throttle body with the 4 bolts.
Torque: 21 N·m (210 kgf·cm, 16 ft·lbf)
HINT: Different bolt lengths are used for the upper and lower sides.

Bolt length:

Upper side: 40 mm (1.59 in.)

Lower side: 65 mm (2.56 in.)

EG



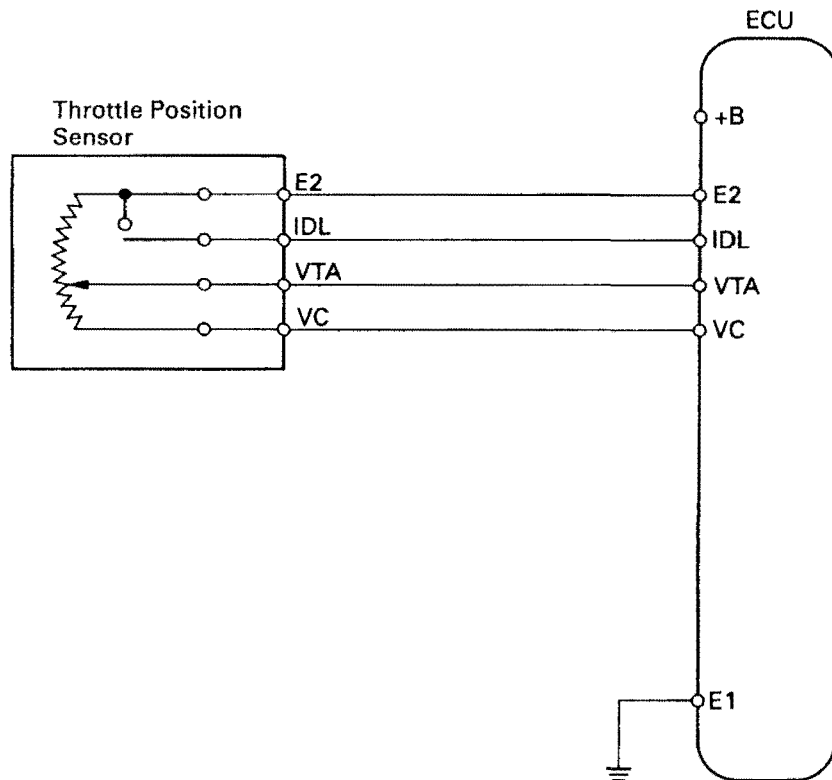
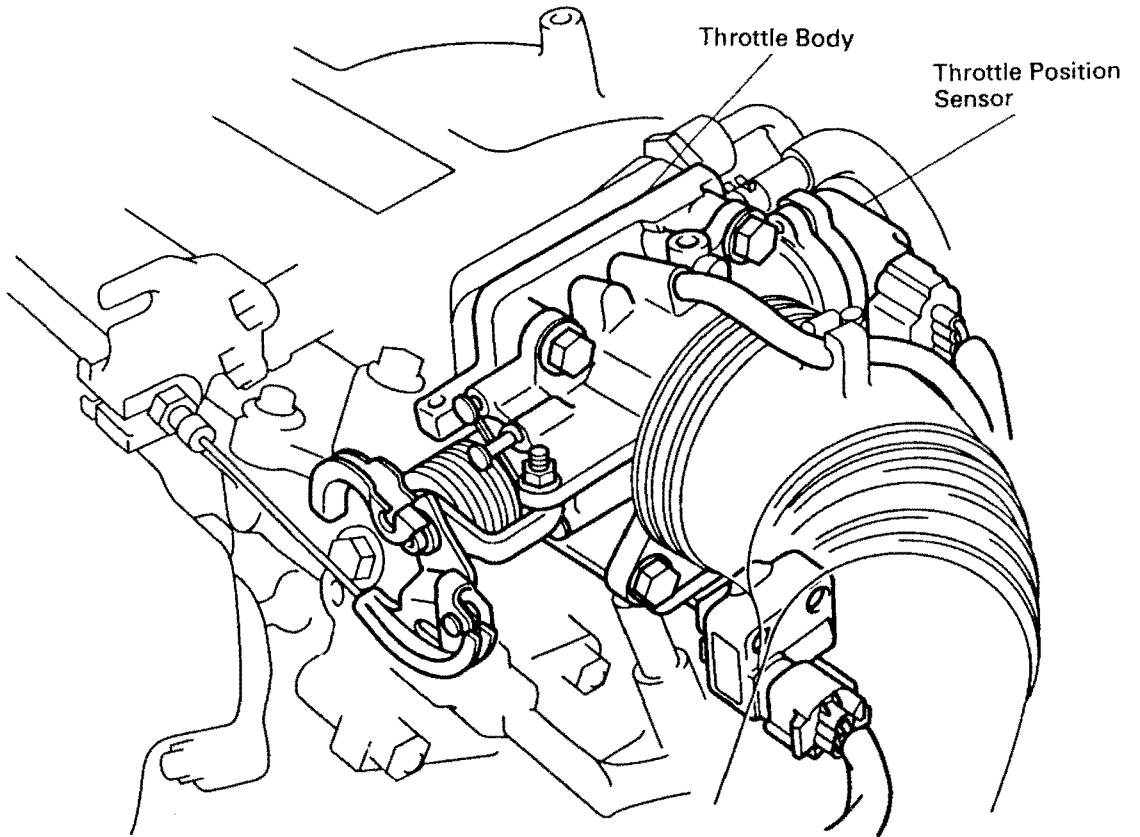
- (c) ST202 LHD only:
 Install the accelerator cable clamp and bolt to the engine hanger.
- (d) Connect the following hoses:
- (1) Air hose (from A/C idle-up valve)
 - (2) ST202:
 Vacuum hose (from vacuum pipe)
 - (3) SW20:
 Vacuum hose (from gas filter)
 - (4) Vacuum hose (to ACIS actuator)
 - (5) PCV hose

7. **CONNECT ACCELERATOR CABLE TO THROTTLE BODY**
8. **INSTALL AIR CLEANER CAP AND HOSE**
9. **INSTALL INTAKE AIR TEMPERATURE SENSOR TO AIR CLEANER CAP**
10. **CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY**
11. **CHECK FOR FUEL LEAKS**
 (See page EG – 173)

THROTTLE BODY

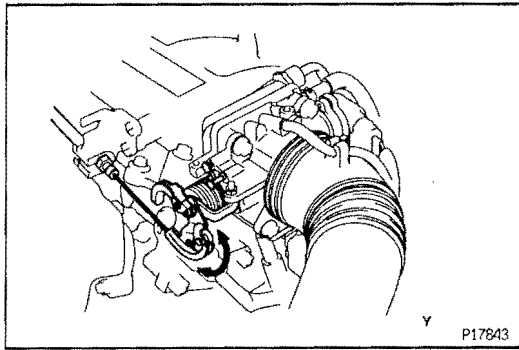
EG190-08

EG



P17842
P12555

Z12794

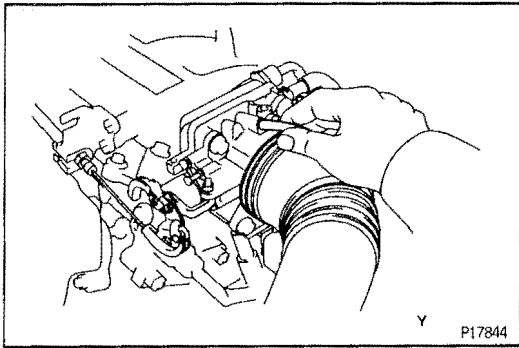


ON – VEHICLE INSPECTION

1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.

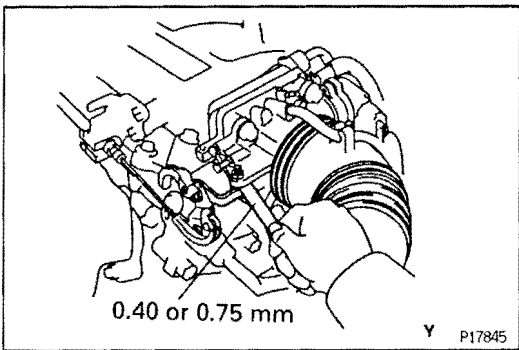
EG



(b) Check the vacuum at P port.

- Start the engine.
- Check the vacuum with the vacuum hose pick your finger.

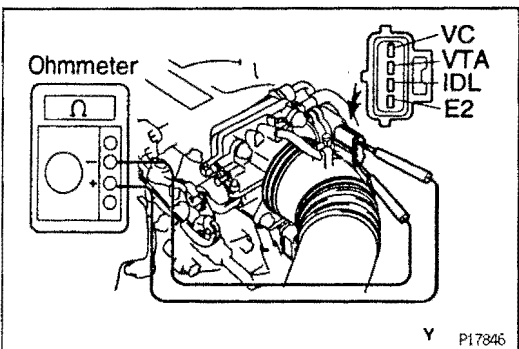
Port name	At idle	Other than idle
P	No vacuum	Vacuum



2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the throttle position sensor connector.

(b) Insert a feeler gauge between the throttle stop screw and stop lever.

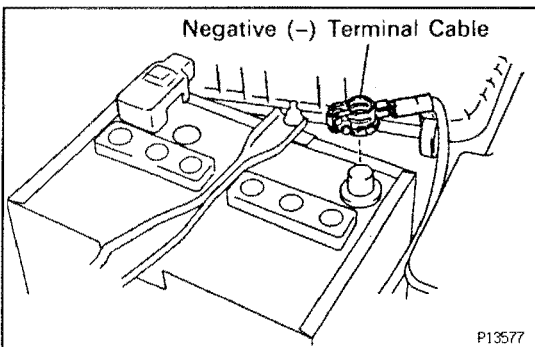
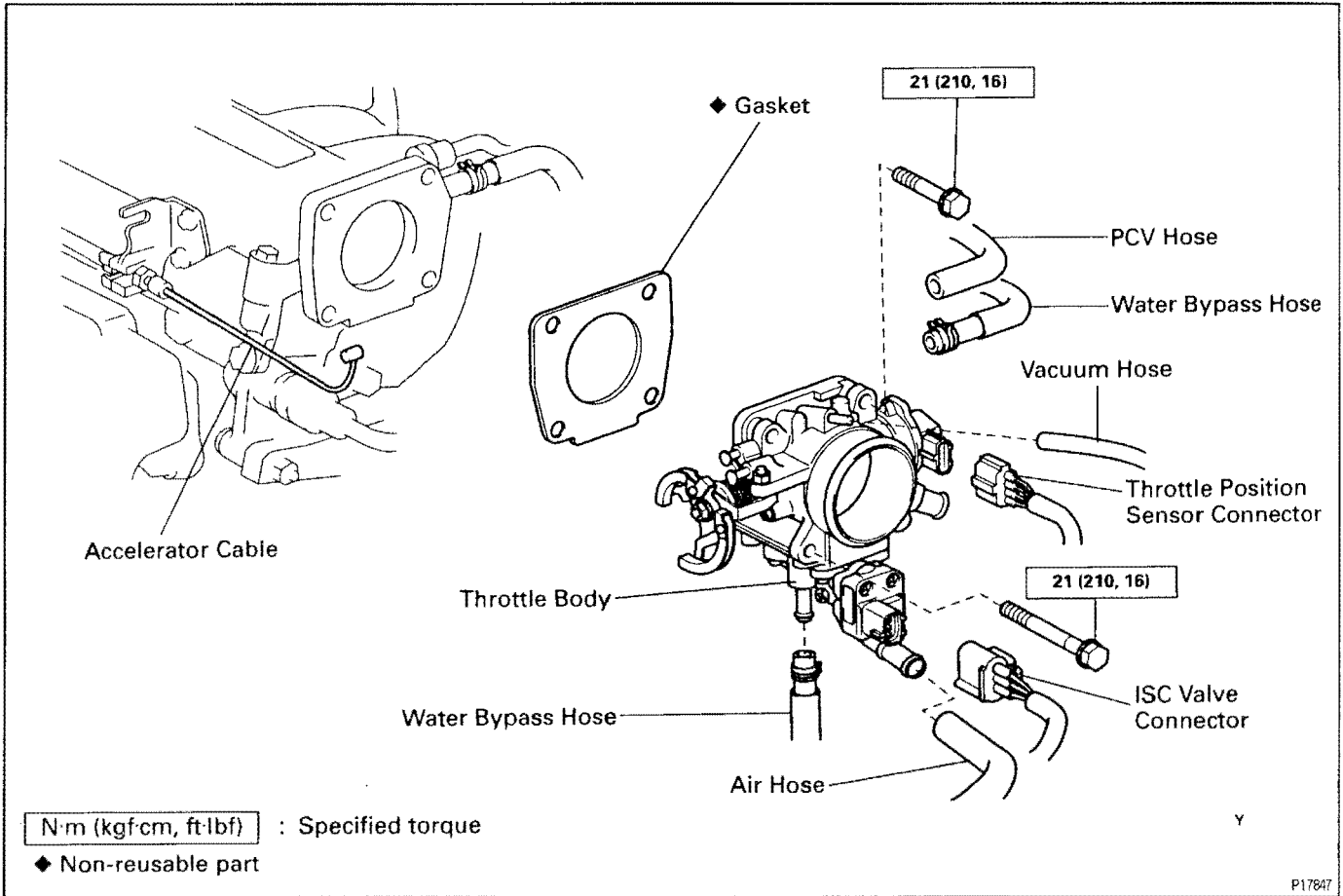


(c) Using an ohmmeter, measure the resistance between each terminal.

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.2 – 5.7 kΩ
0.40 mm (0.016 in.)	IDL – E2	2.3 kΩ or less
0.75 mm (0.030 in.)	IDL – E2	Infinity
Throttle valve fully open	VTA – E2	2.0 – 10.2 kΩ
–	VC – E2	2.5 – 5.9 kΩ

(d) Reconnect the throttle position sensor connector.

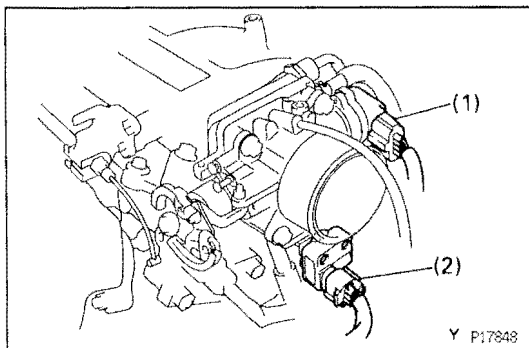
COMPONENTS FOR REMOVAL AND INSTALLATION



THROTTLE BODY REMOVAL

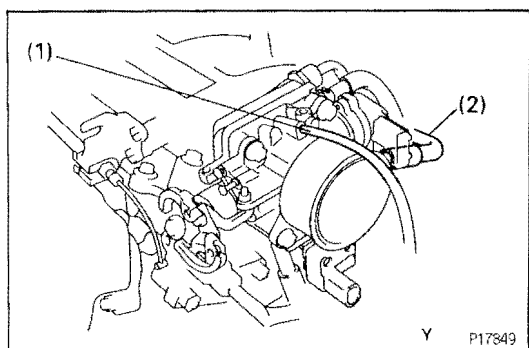
(See Components for Removal and Installation)

1. DISCONNECT NEGATIVE (-) TERMINAL CABLE FROM BATTERY
2. DRAIN ENGINE COOLANT
3. DISCONNECT INTAKE AIR TEMPERATURE SENSOR FROM AIR CLEANER CAP
4. DISCONNECT AIR CLEANER CAP AND HOSE
5. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

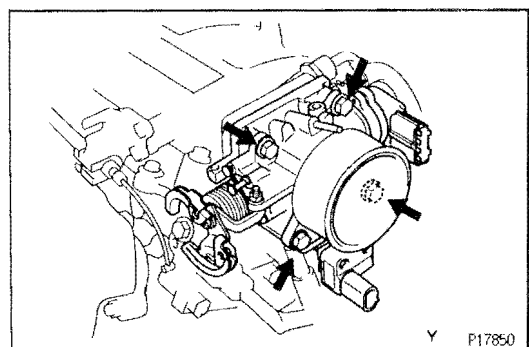


6. REMOVE THROTTLE BODY

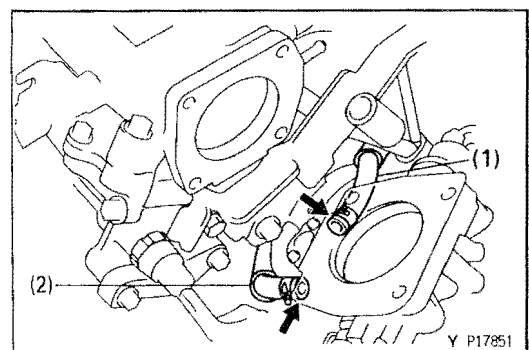
- (a) Disconnect the following connectors:
- (1) Throttle position sensor connector
 - (2) ISC valve connector



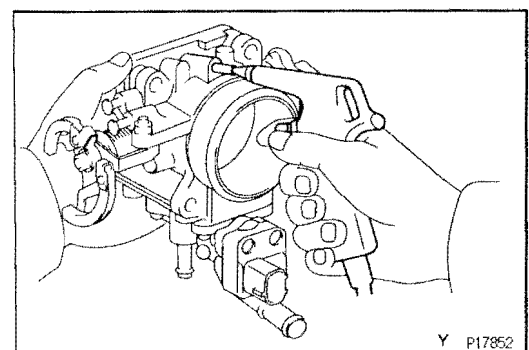
- (b) Disconnect the following hoses:
- (1) Vacuum hose (from BVSV for EVAP)
 - (2) PCV hose



- (c) Remove the 4 bolts and gasket.



- (d) 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)



THROTTLE BODY INSPECTION

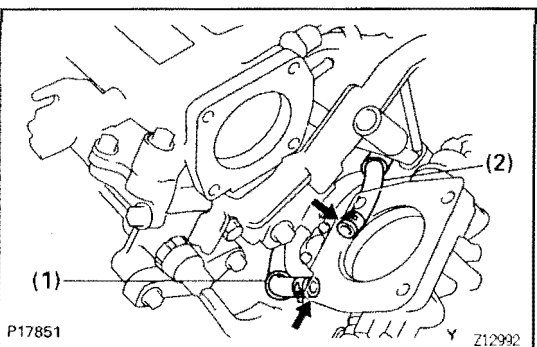
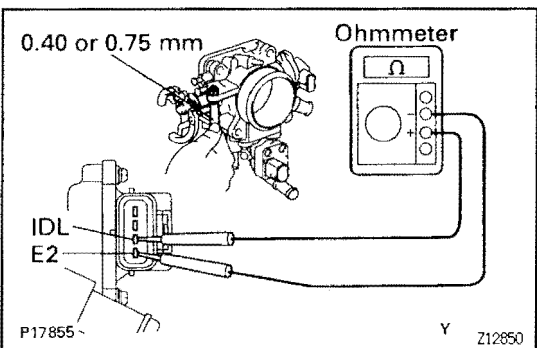
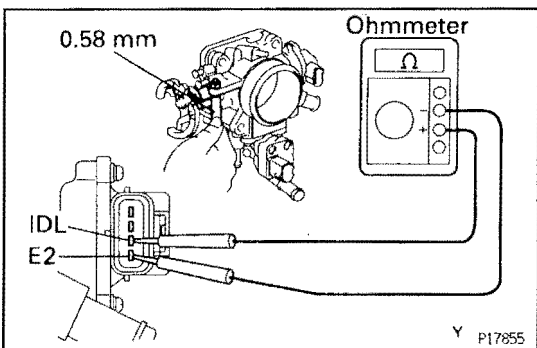
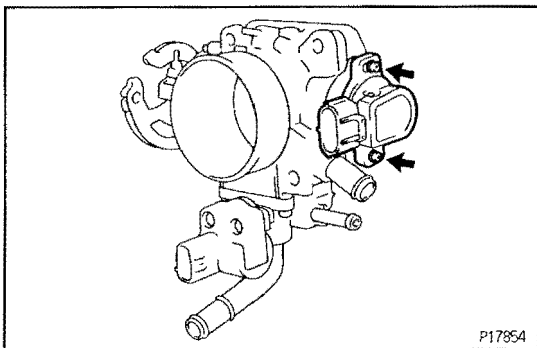
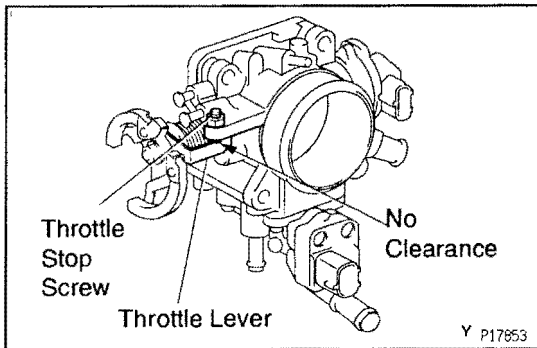
EG287-02

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.

EG



2. INSPECT THROTTLE VALVE

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

(See step 2 on page EG-253)

4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

(a) Loosen the 2 set screws of the throttle position sensor

(b) Insert a 0.58 mm (0.023 in.) feeler gauge, between the throttle stop screw and stop lever.

(c) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the throttle position sensor.

(d) Gradually turn the sensor clockwise until the ohmmeter indicator deflects, and secure it with the 2 set screws.

(e) Recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL - E2)
0.40 mm (0.016 in.)	Continuity
0.75 mm (0.030 in.)	No continuity

THROTTLE BODY INSTALLATION

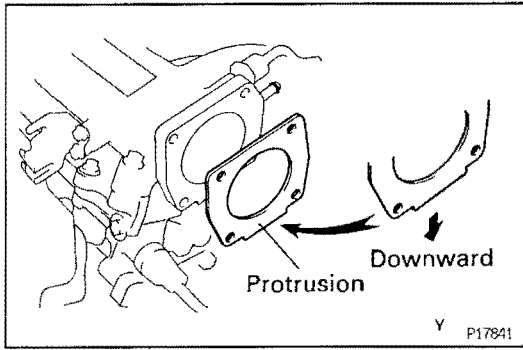
EG3WC-01

(See Components for Removal and Installation)

1. INSTALL THROTTLE BODY

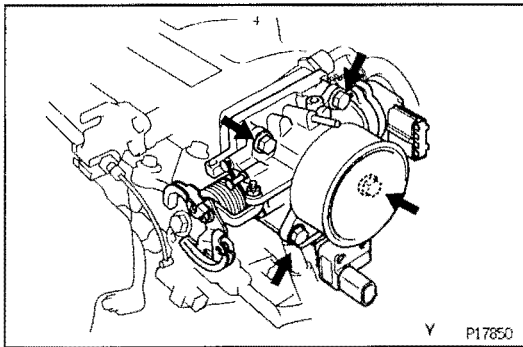
(a) Connect the following hoses to throttle body:

- (1) Water bypass hose (from water bypass pipe)
- (2) Water bypass hose (from water outlet)

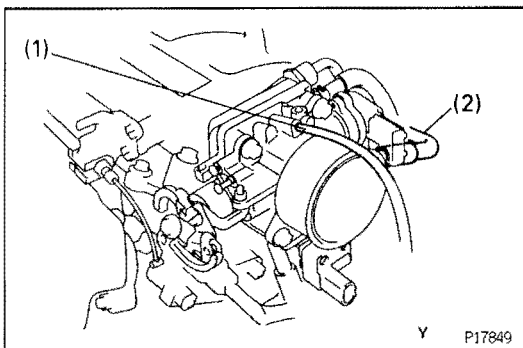


- (b) Attach a new gasket to the ACIS assembly, facing the protrusion downward.

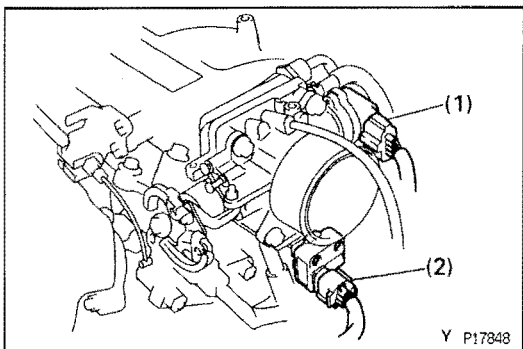
EG



- (c) Install the throttle body with the 4 bolts.
Torque: 21 N·m (210 kgf·cm, 16 ft·lbf)
HINT: Different bolt lengths are used for the upper and lower sides.
Bolt length:
 Upper side: 40 mm (1.59 in.)
 Lower side: 65 mm (2.56 in.)



- (d) Connect the following hoses:
 (1) Vacuum hose (from BSV for EVAP)
 (2) PCV hose



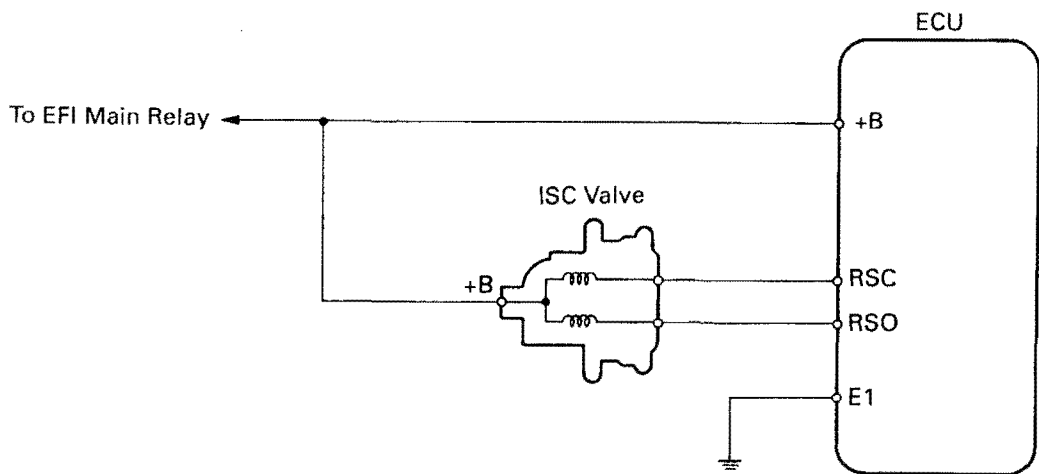
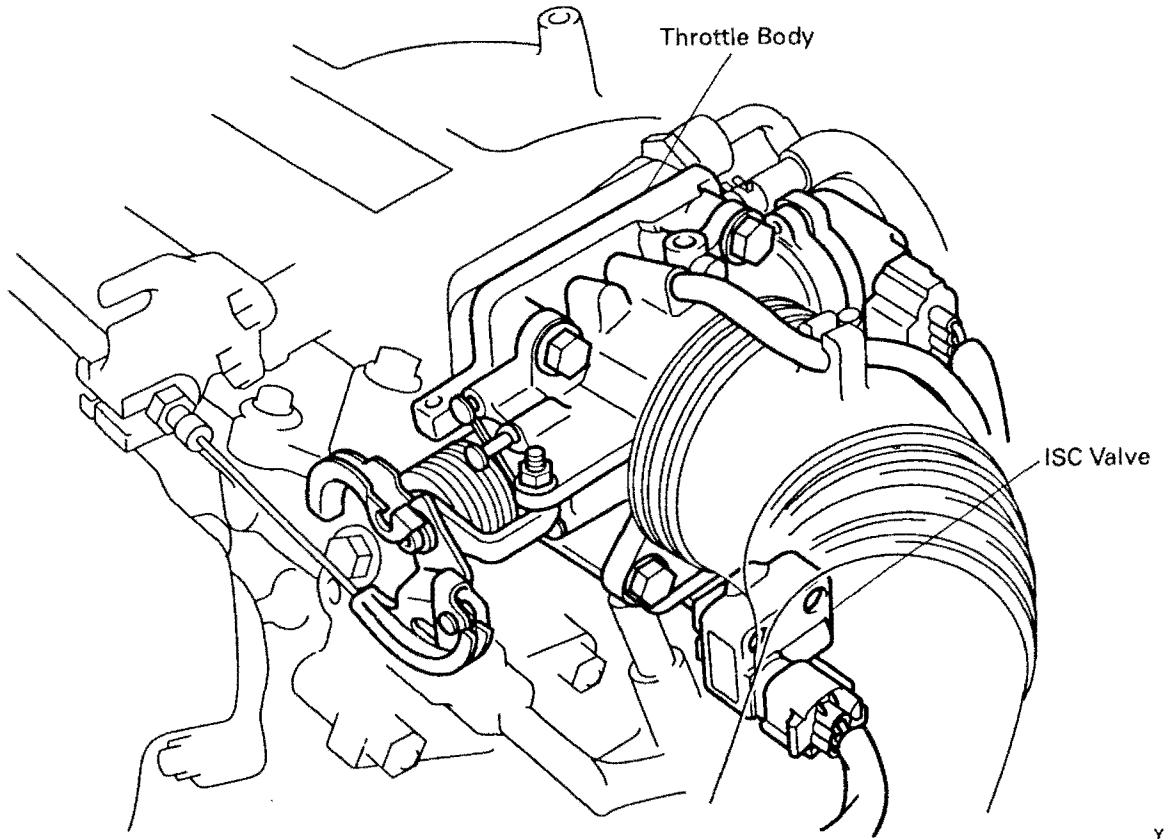
- (e) Connect the following connectors:
 (1) Throttle position sensor connector
 (2) ISC valve connector

2. CONNECT ACCELERATOR CABLE TO THROTTLE BODY
3. INSTALL AIR CLEANER CAP AND HOSE
4. CONNECT INTAKE AIR TEMPERATURE SENSOR TO AIR CLEANER CAP
5. FILL WITH ENGINE COOLANT
6. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

ISC VALVE

EG00K-0M

EG



P17857
P14449

Z12795

ON – VEHICLE INSPECTION

EG

1. INSPECT ISC VALVE OPERATION

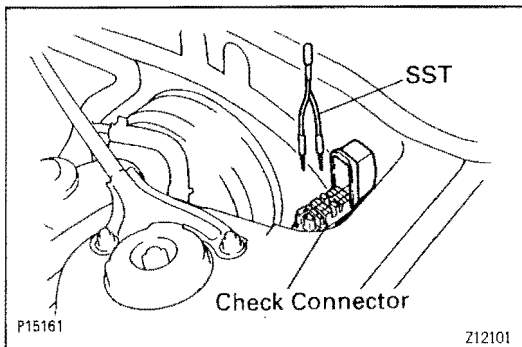
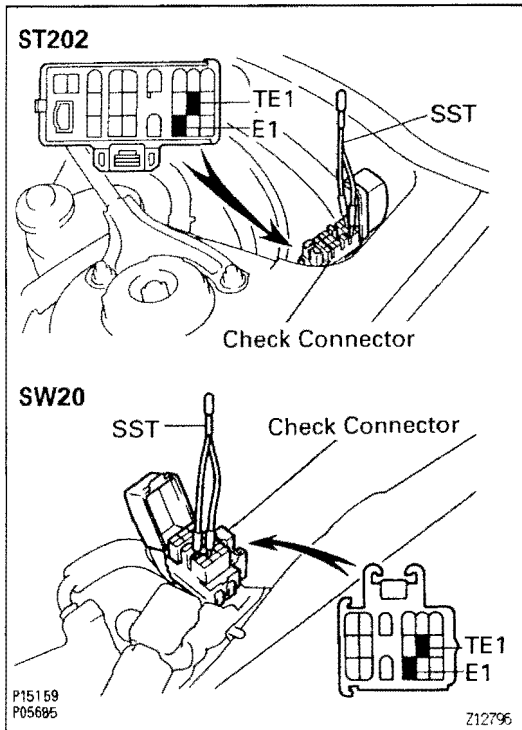
- (a) Initial conditions:
- Engine at normal operating temperature
 - Idle speed set correctly

- (b) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843–18020

- (c) After engine rpm are kept at 1,000 – 1,300 rpm for 5 seconds, check that the rpm drops to about idle speed.

If the rpm operation is not as specified, check the ISC valve, wiring and engine ECU.



- (d) Remove SST.
SST 09843–18020
- (e) Check the idle speed.

Idle speed:

ST202:

w/ Daytime running light system
750 ± 50 rpm

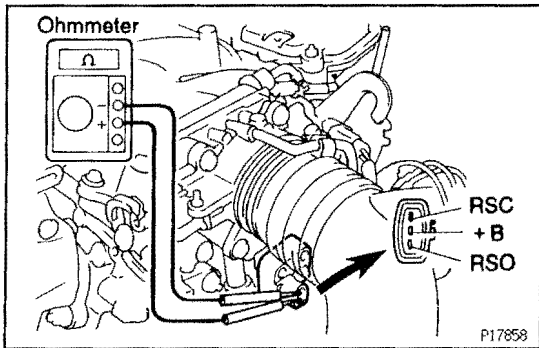
w/o Daytime running light system
700 ± 50 rpm

SW20:

w/ Daytime running light system
850 ± 50 rpm

w/o Daytime running light system
750 ± 50 rpm

EG



2. INSPECT ISC VALVE RESISTANCE

- (a) Disconnect the ISC valve connector.
- (b) Using an ohmmeter, measure the resistance between terminal +B and other terminals (RSC, RSO).

Resistance:

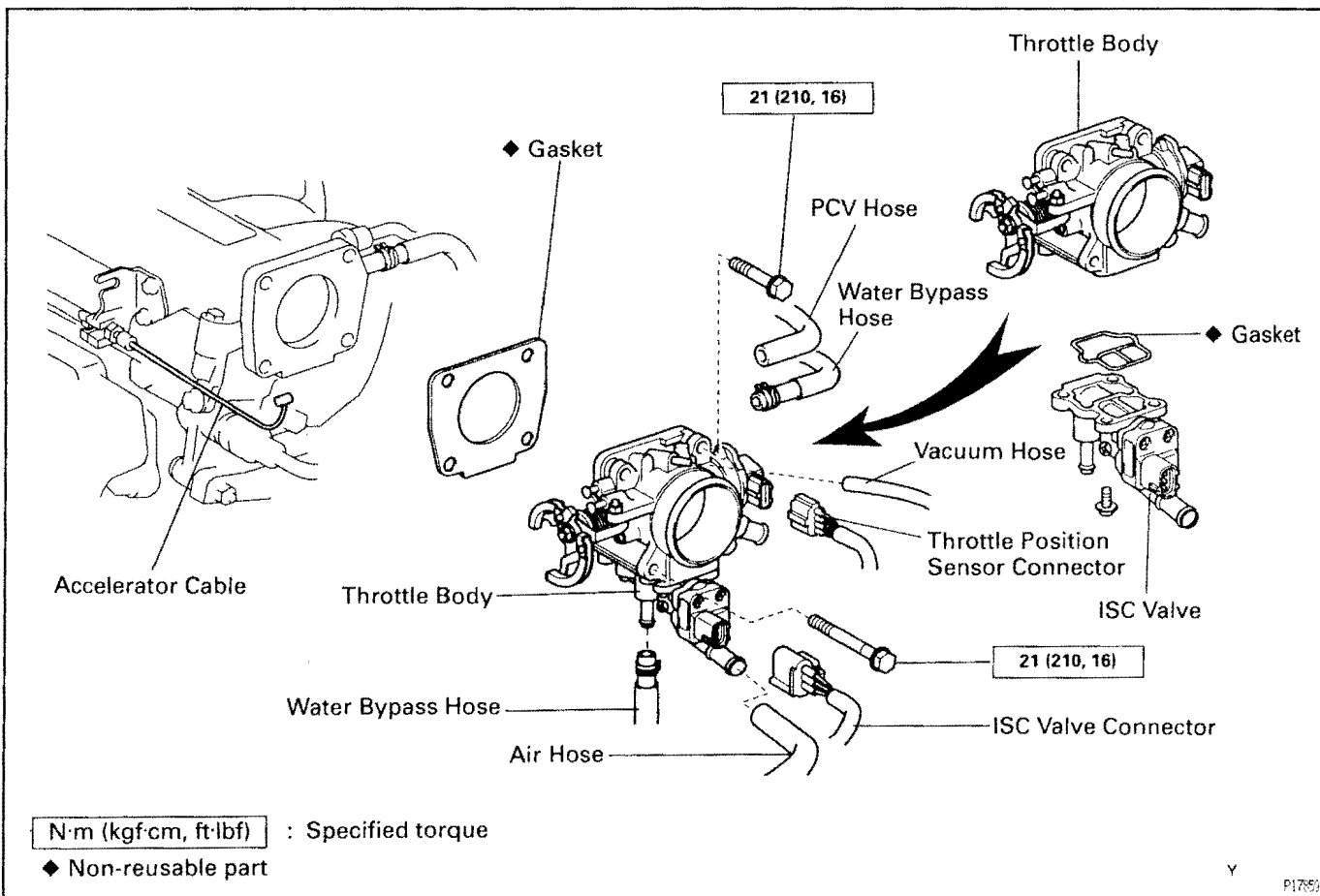
19.3 – 22.3 Ω at 20°C (68°F)

If resistance is not as specified, replace the ISC valve.

- (c) Reconnect the ISC valve connector.

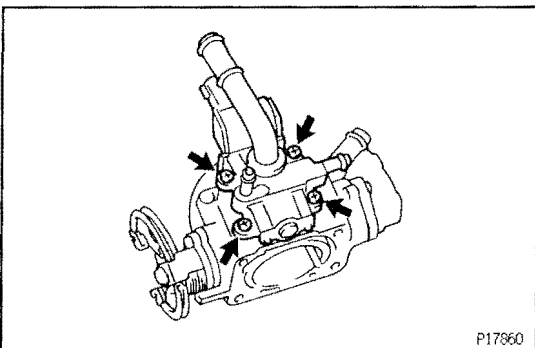
COMPONENTS FOR REMOVAL AND INSTALLATION

EG138-01



Y

P17859

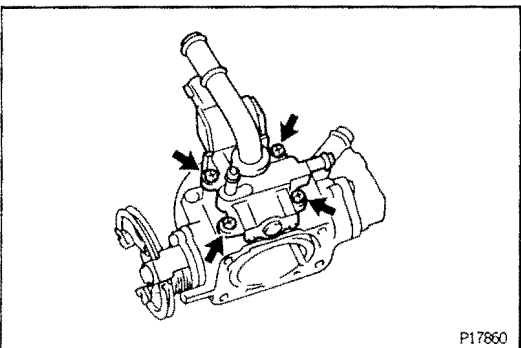
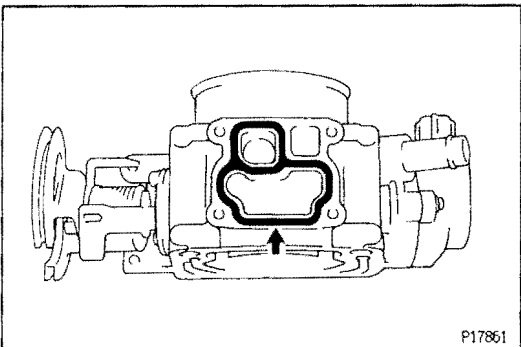
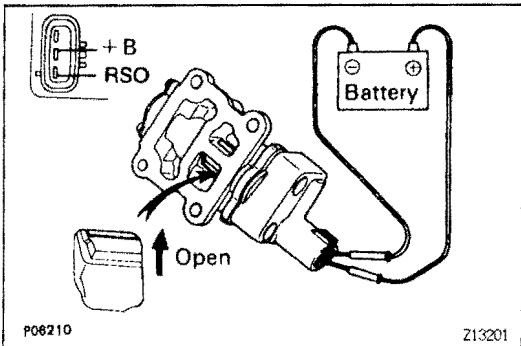
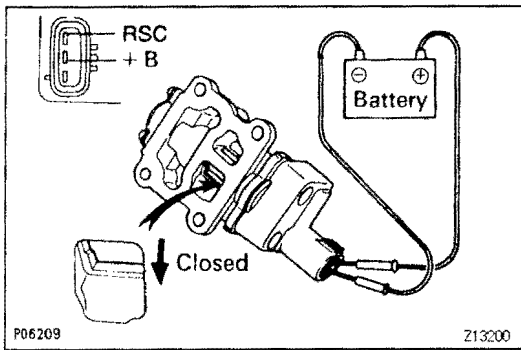


ISC VALVE REMOVAL

(See Components for Removal and Installation)

- 1. REMOVE THROTTLE BODY**
(See steps 1 to 6 on page EG-254 and EG-255)
- 2. REMOVE ISC VALVE**
Remove the 4 screws, ISC valve and gasket.

EG138-01



ISC VALVE INSPECTION

INSPECT ISC VALVE OPERATION

- (a) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal RSC, and check that the valve is closed.
- (b) Connect the positive (+) lead from the battery to terminal +B and negative (-) lead to terminal RSO, and check that the valve is open.
If operation is not as specified, replace the ISC valve.

EG

ISC VALVE INSTALLATION

(See Components for Removal and Installation)

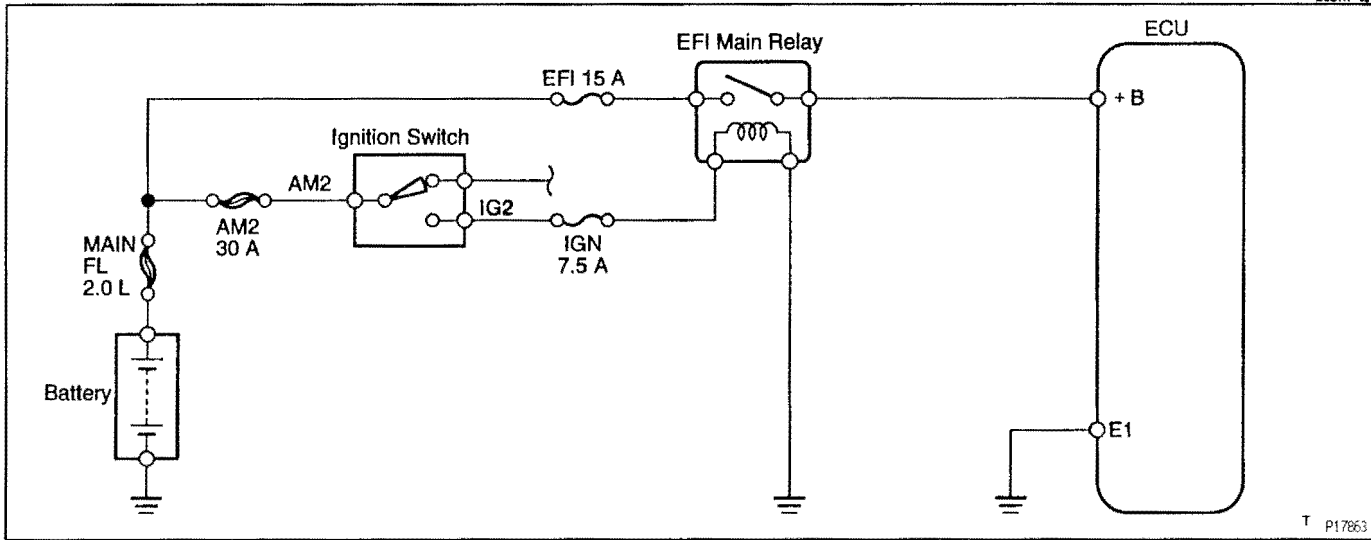
1. INSTALL ISC VALVE

- (a) Place a new gasket on the throttle body.
 - (b) Install the ISC valve with the 4 screws.
- ### 2. INSTALL THROTTLE BODY
- (See steps 1 to 6 on page EG-256 and EG-257)

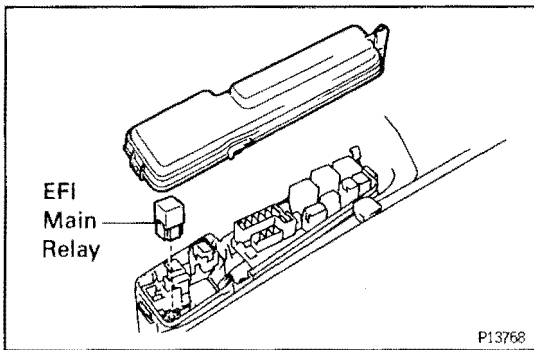
EFI MAIN RELAY (ST202)

EG2TA-01

EG



T P17863



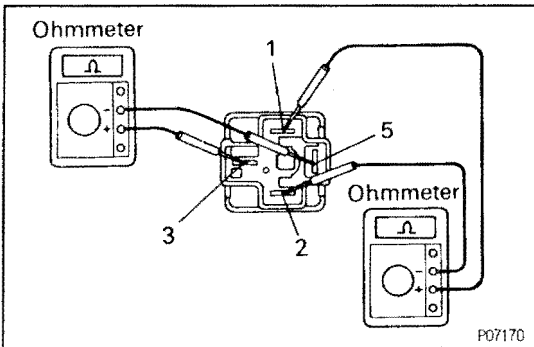
P13768

EFI MAIN RELAY INSPECTION

EG13W-00

1. REMOVE EFI MAIN RELAY

LOCATION: In the engine compartment relay box.



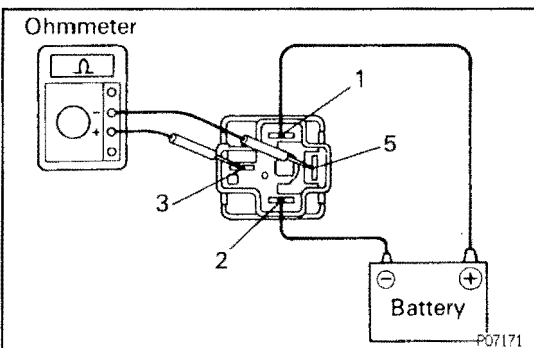
P07170

2. INSPECT EFI MAIN RELAY

A. Inspect relay continuity

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- (b) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the EFI main relay.



P07171

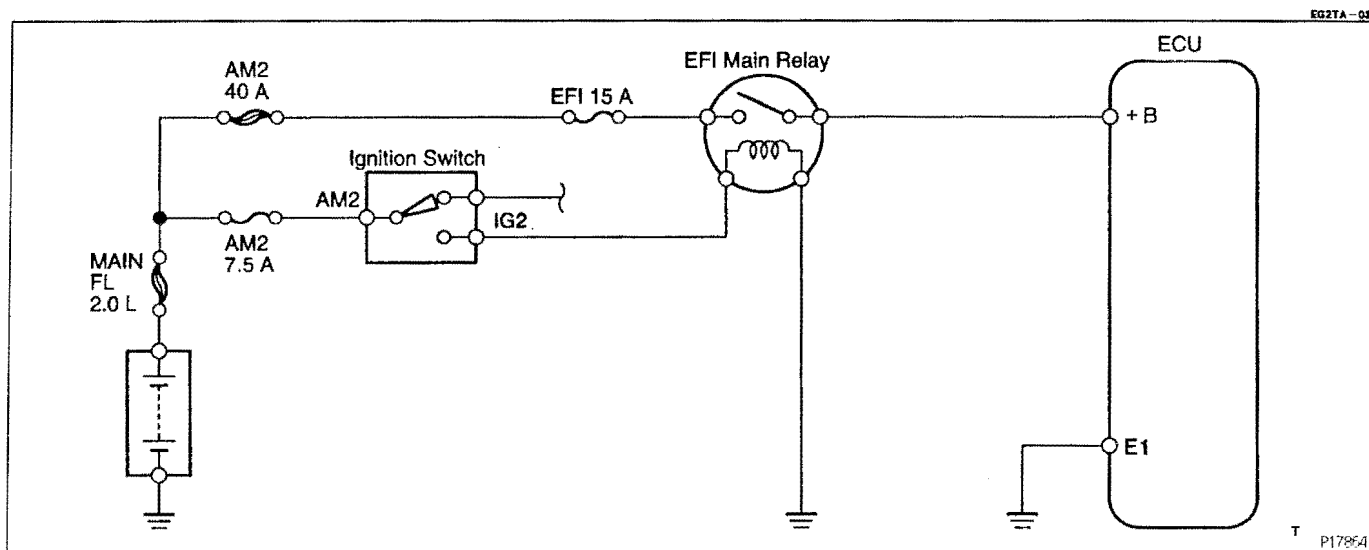
B. Inspect relay operation

- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

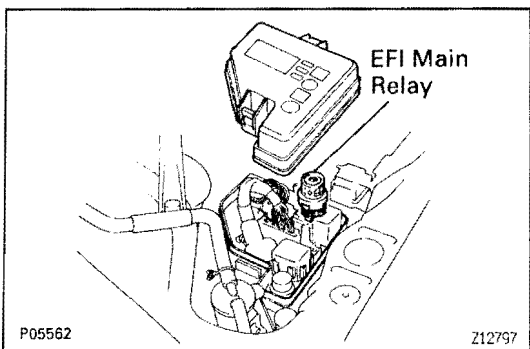
If operation is not as specified, replace the EFI main relay.

3. REINSTALL EFI MAIN RELAY

EFI MAIN RELAY (SW20)



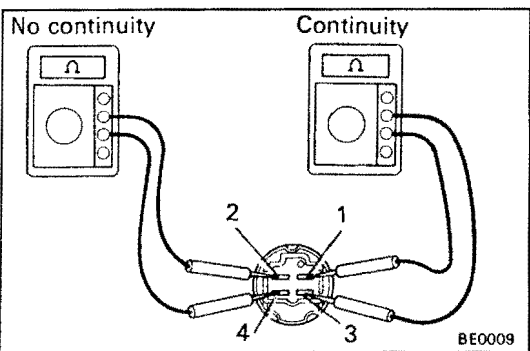
EG



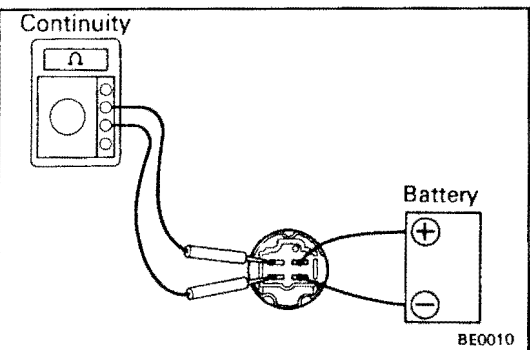
EFI MAIN RELAY INSPECTION

EG3WD-01

1. REMOVE EFI MAIN RELAY
LOCATION: In the engine compartment relay box.



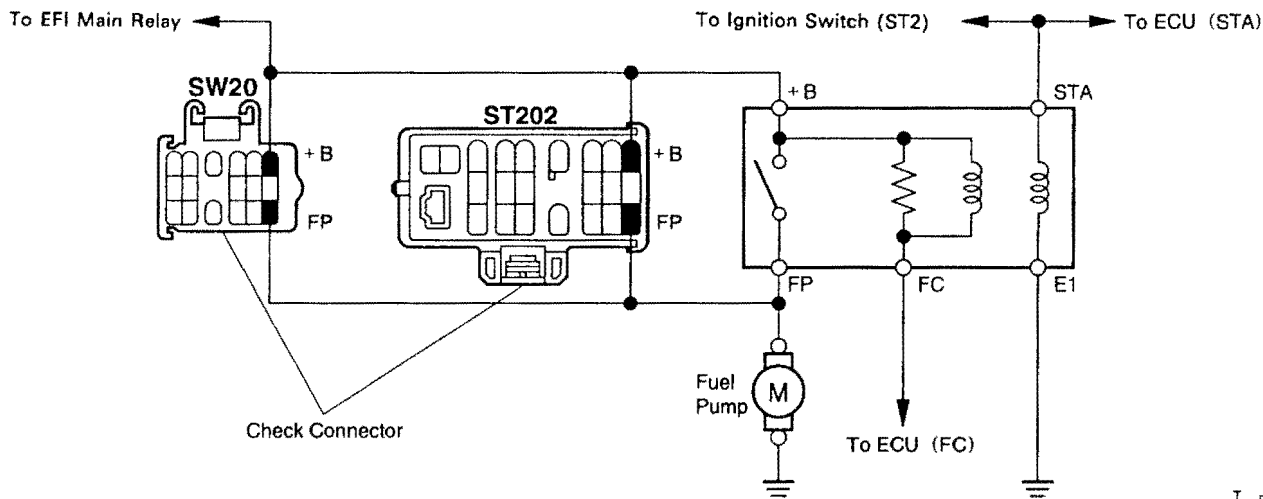
2. INSPECT EFI MAIN RELAY
 - A. Inspect relay continuity
 - (a) Using an ohmmeter, check that there is continuity between terminals 1 and 3.
 - (b) Check that there is no continuity between terminals 2 and 4.
 If continuity is not as specified, replace the EFI main relay.



- B. Inspect relay operation
 - (a) Apply battery voltage across terminals 1 and 3.
 - (b) Using an ohmmeter, check that there is continuity between terminals 2 and 4.
 If operation is not as specified, replace the EFI main relay.
3. REINSTALL EFI MAIN RELAY

CIRCUIT OPENING RELAY

EG001-01



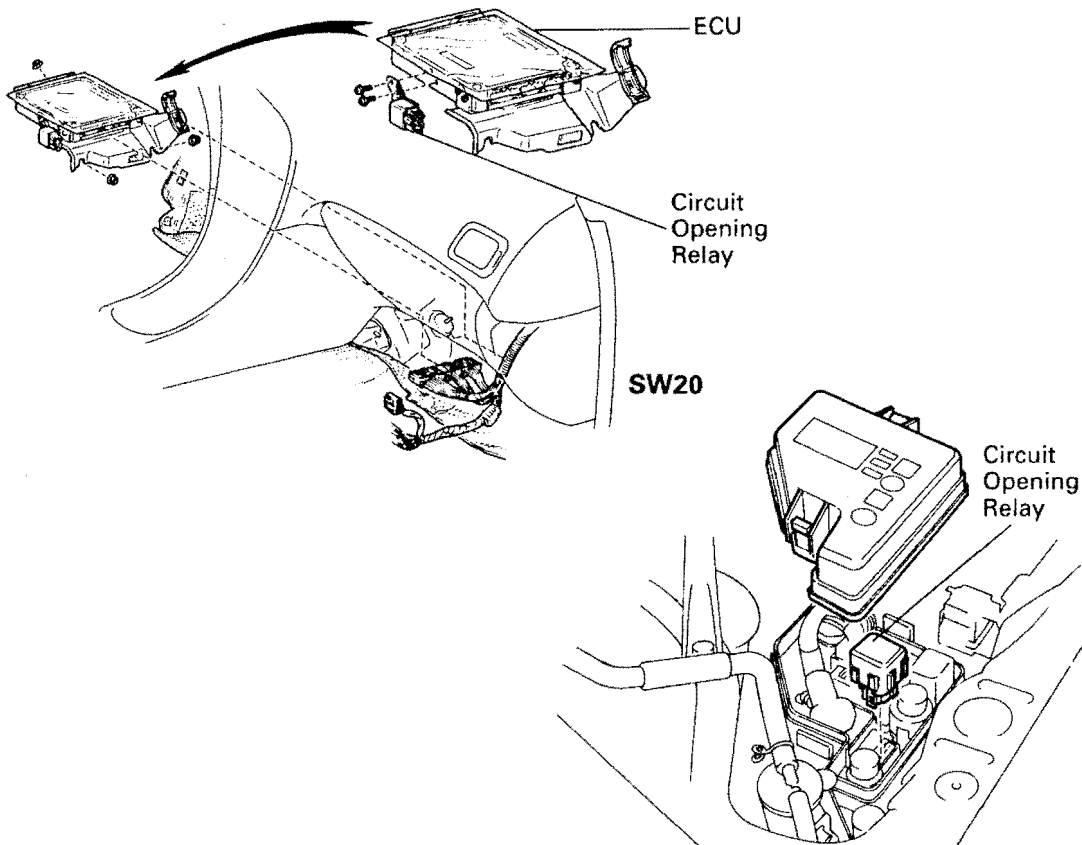
EG

T P17955

COMPONENTS FOR REMOVAL AND INSTALLATION

EG14F-01

ST202



P15389
P05563

Z12792

CIRCUIT OPENING RELAY INSPECTION EQ&JF-03

(See Components for Removal and Installation)

1. REMOVE CIRCUIT OPENING RELAY

2. INSPECT CIRCUIT OPENING RELAY

A. Inspect relay continuity

- (a) Using an ohmmeter, check that there is continuity between terminals STA and E1.
- (b) Check that there is continuity between terminals +B and FC.
- (c) Check that there is no continuity between terminals +B and FP.

If continuity is not as specified, replace the circuit opening relay.

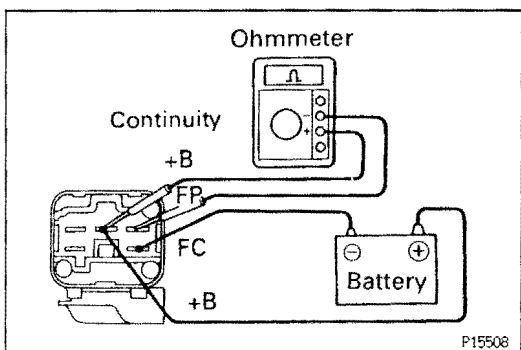
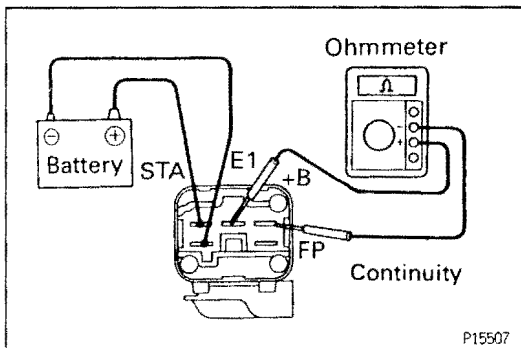
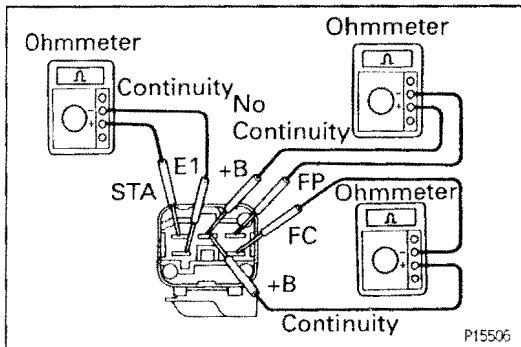
B. Inspect relay operation

- (a) Apply battery voltage across terminals STA and E1.
- (b) Using an ohmmeter, check that there is continuity between terminals +B and FP.

- (c) Apply battery voltage across terminals +B and FC.
- (d) Check that there is continuity between terminals +B and FP.

If operation is not as specified, replace the circuit opening relay.

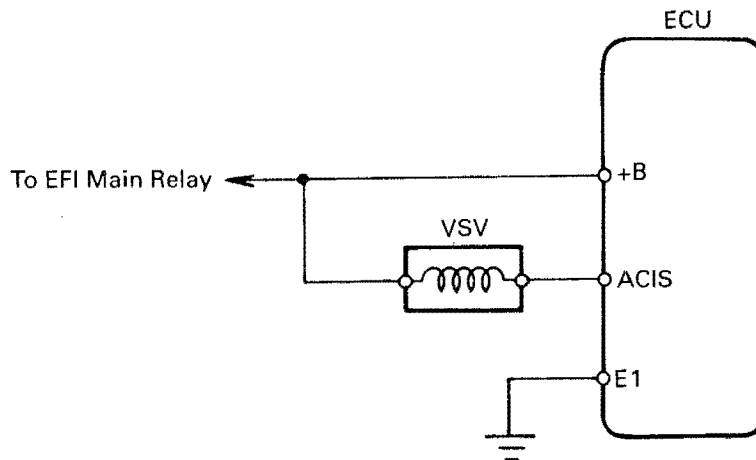
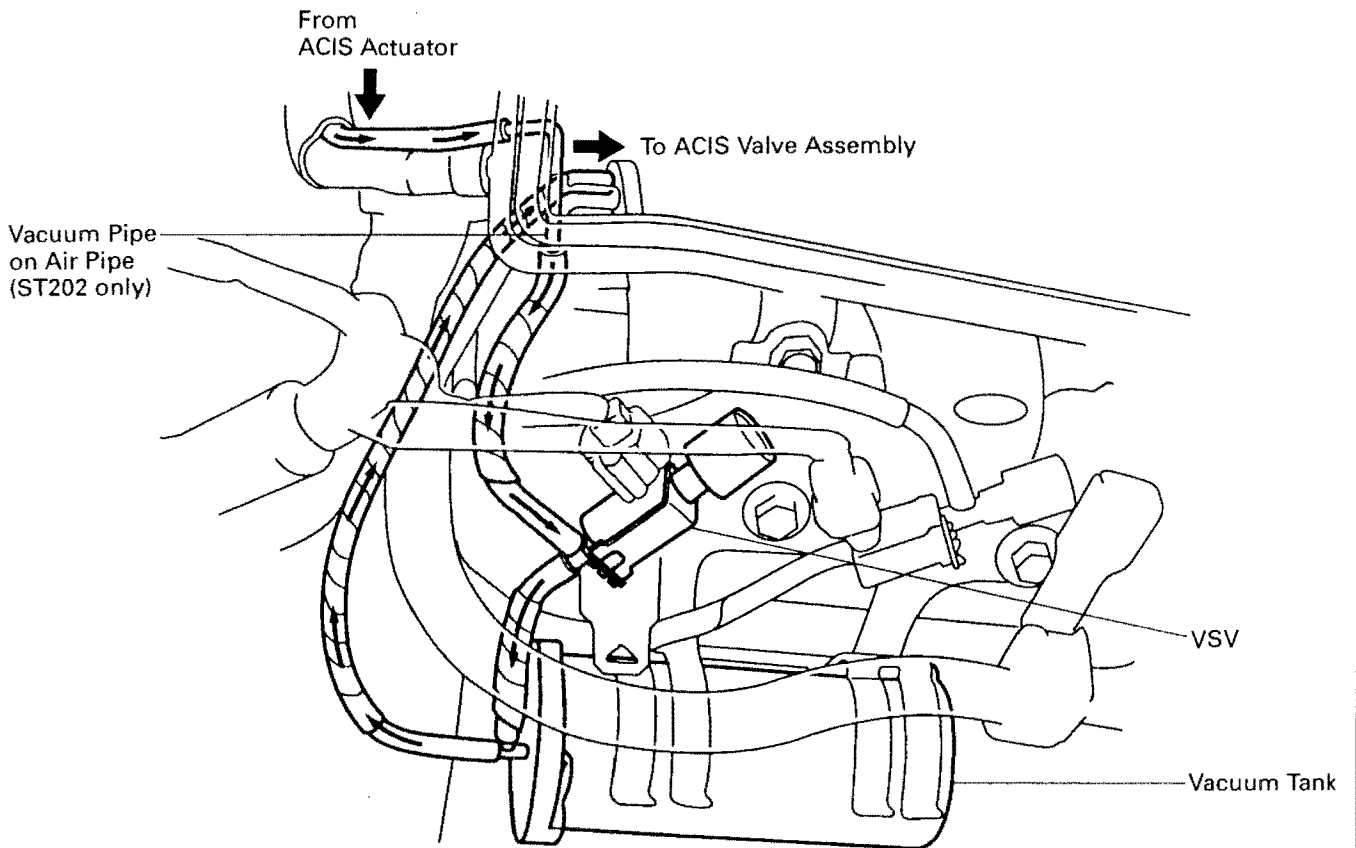
3. REINSTALL CIRCUIT OPENING RELAY



VSV FOR ACIS

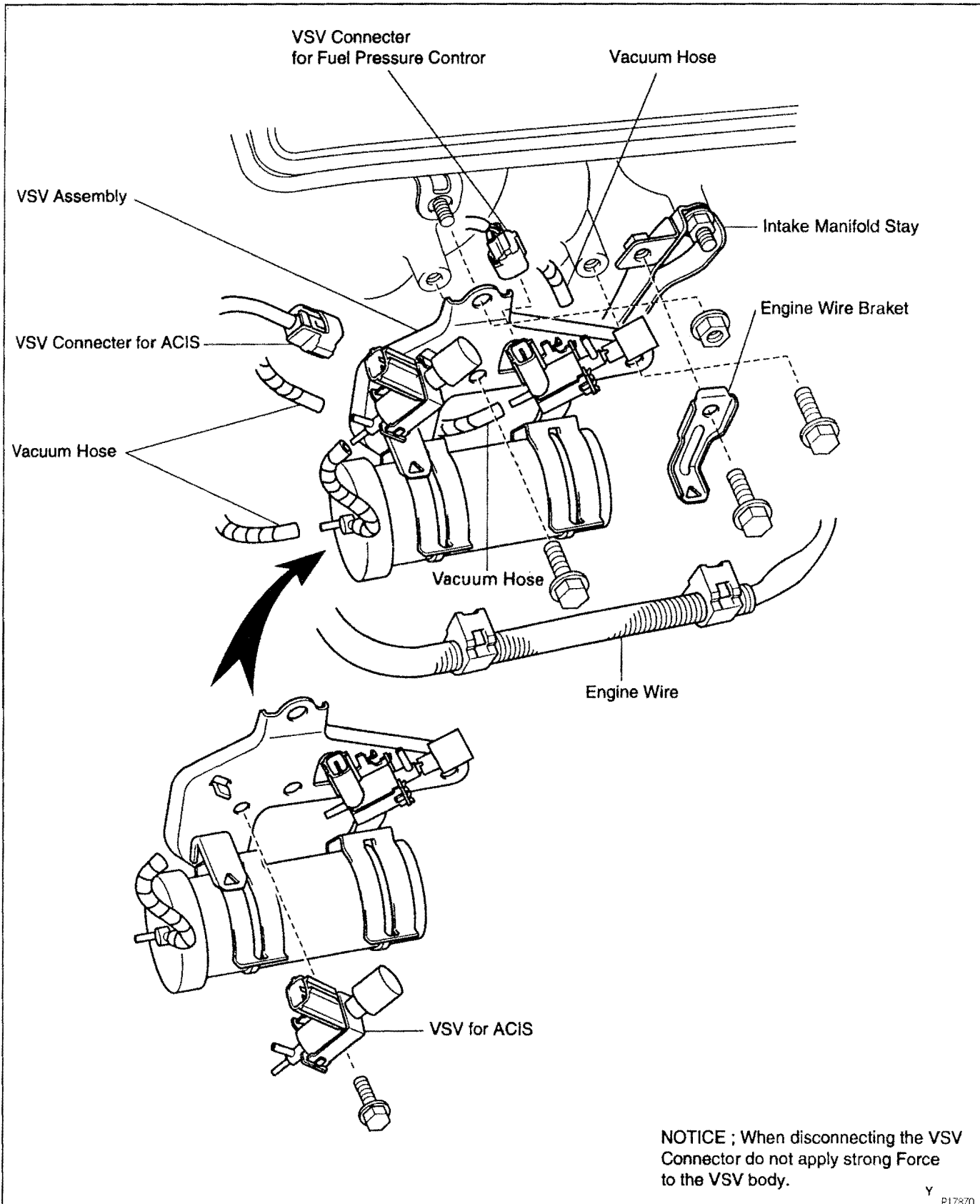
EG046-0Y

EG



COMPONENTS FOR REMOVAL AND INSTALLATION

EG



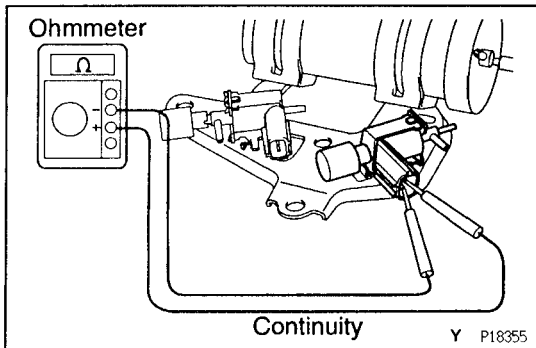
NOTICE ; When disconnecting the VSV Connector do not apply strong Force to the VSV body.

ACIS VSV INSPECTION

(See Components for Removal and Installation)

1. REMOVE VSV

EG



2. INSPECT VSV

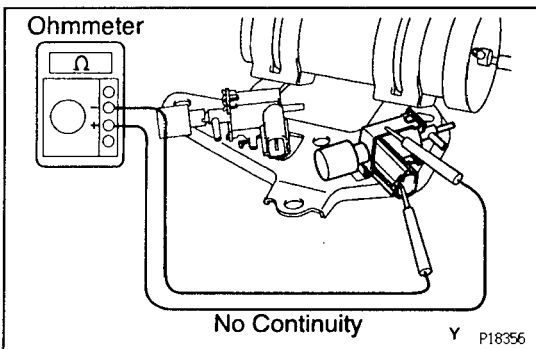
A. Inspect VSV for open circuit

Using an ohmmeter, check that there is resistance between the terminals.

Resistance:

33 – 39 Ω at 20°C (68°F)

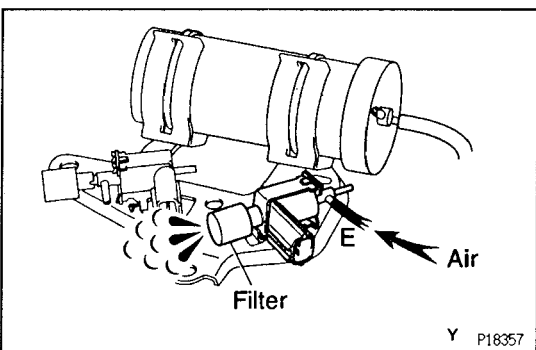
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

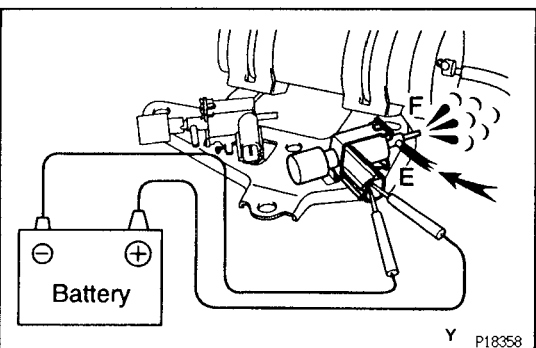
Using an ohmmeter, check that there is no continuity between each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

(a) Check that air flow from port E to the filter.



(b) Apply battery voltage across the terminals.

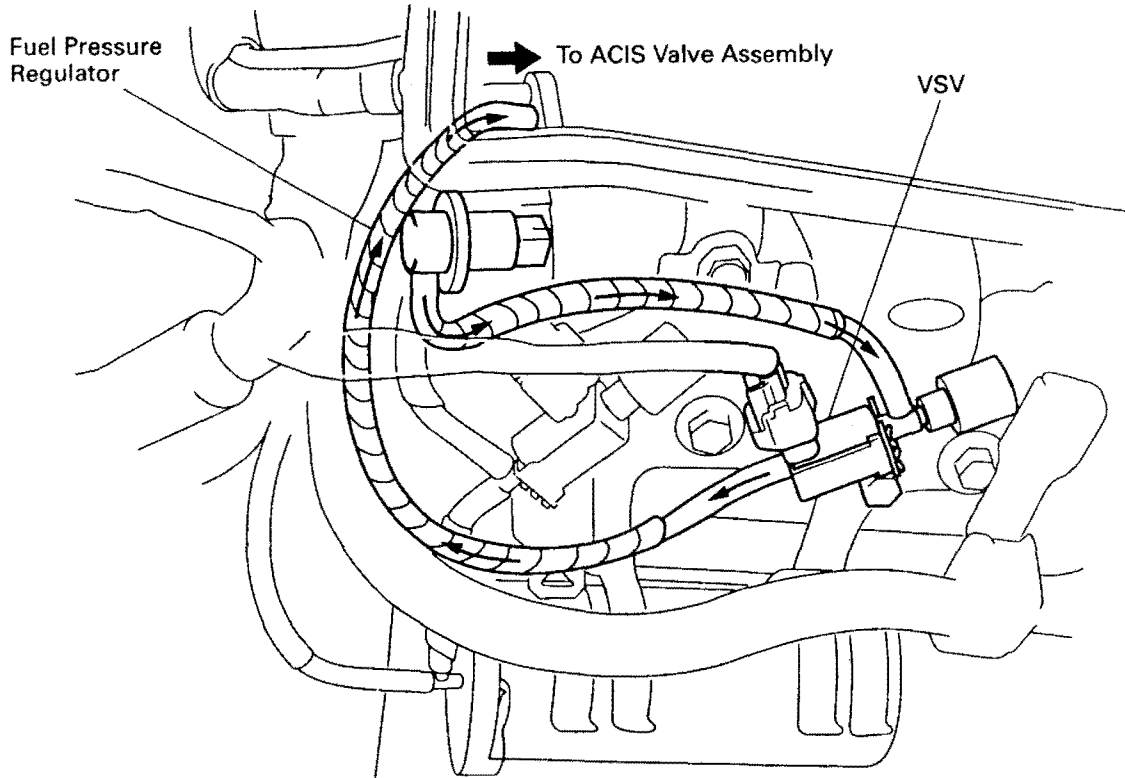
(c) Check that air flows from ports E to F.

If operation is not as specified, replace the VSV.

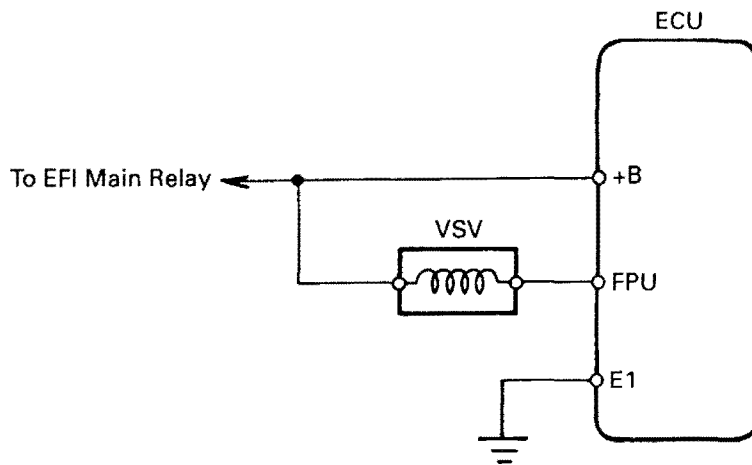
3. REINSTALL VSV

VSV FOR FUEL PRESSURE CONTROL

EG02-24



EG



VSV INSPECTION

(See Components for Removal and Installation)

1. REMOVE VSV

2. INSPECT VSV

A. Inspect VSV for open circuit

Using an ohmmeter, check that there is resistance between the terminals.

Resistance:

$33 - 39 \Omega$ at 20°C (68°F)

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

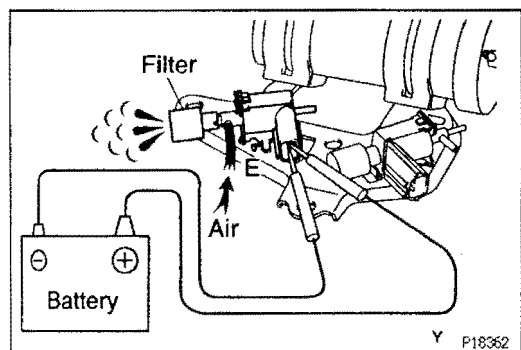
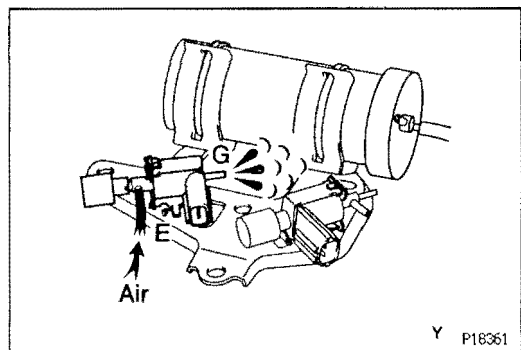
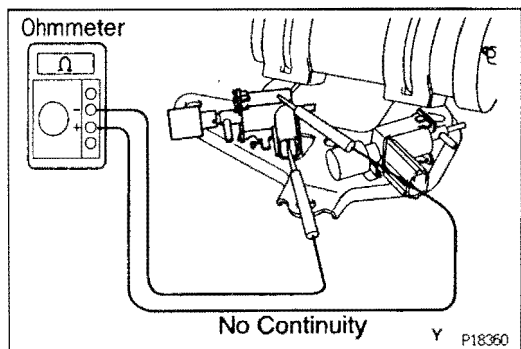
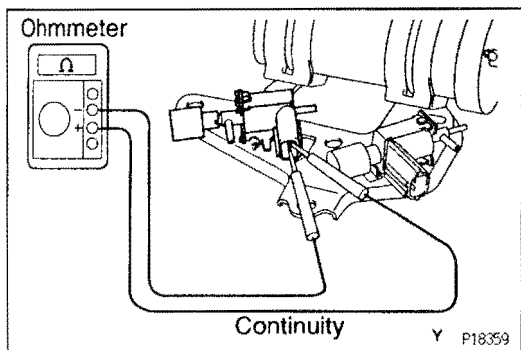
(a) Check that air flows from ports E to G.

(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.

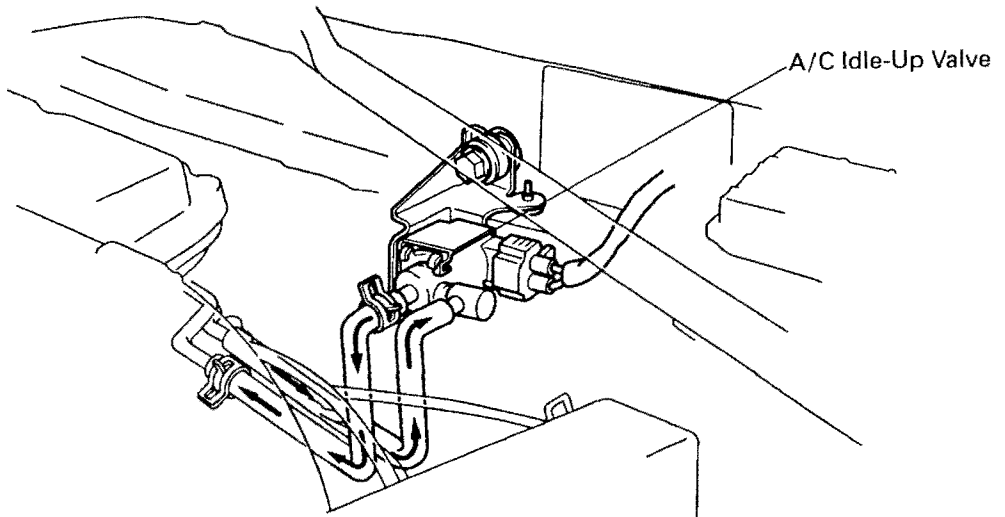
3. REINSTALL VSV



A/C IDLE – UP VALVE

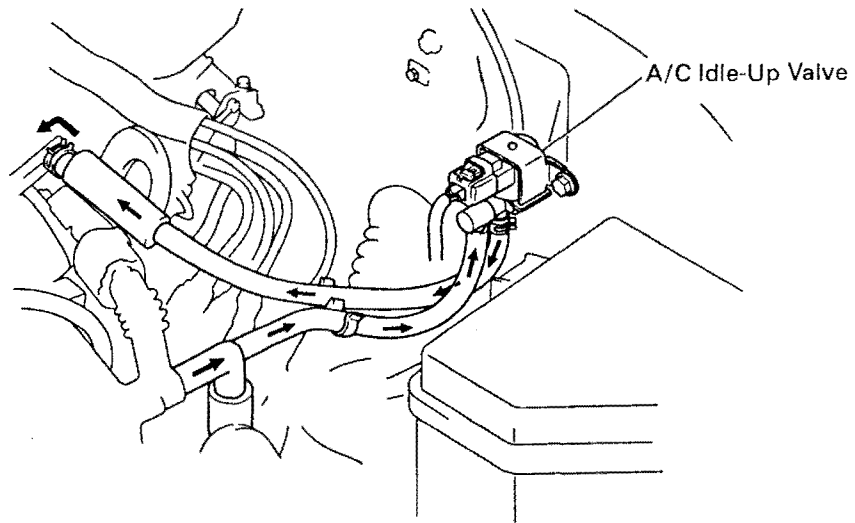
EG02-11

ST202

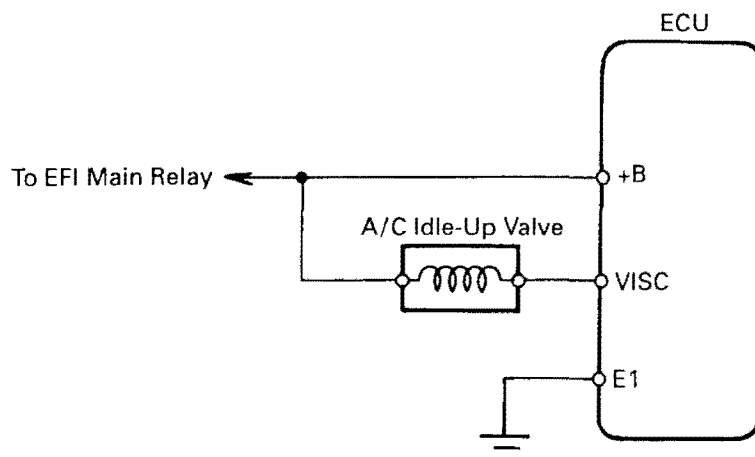


Y

SW20



Y



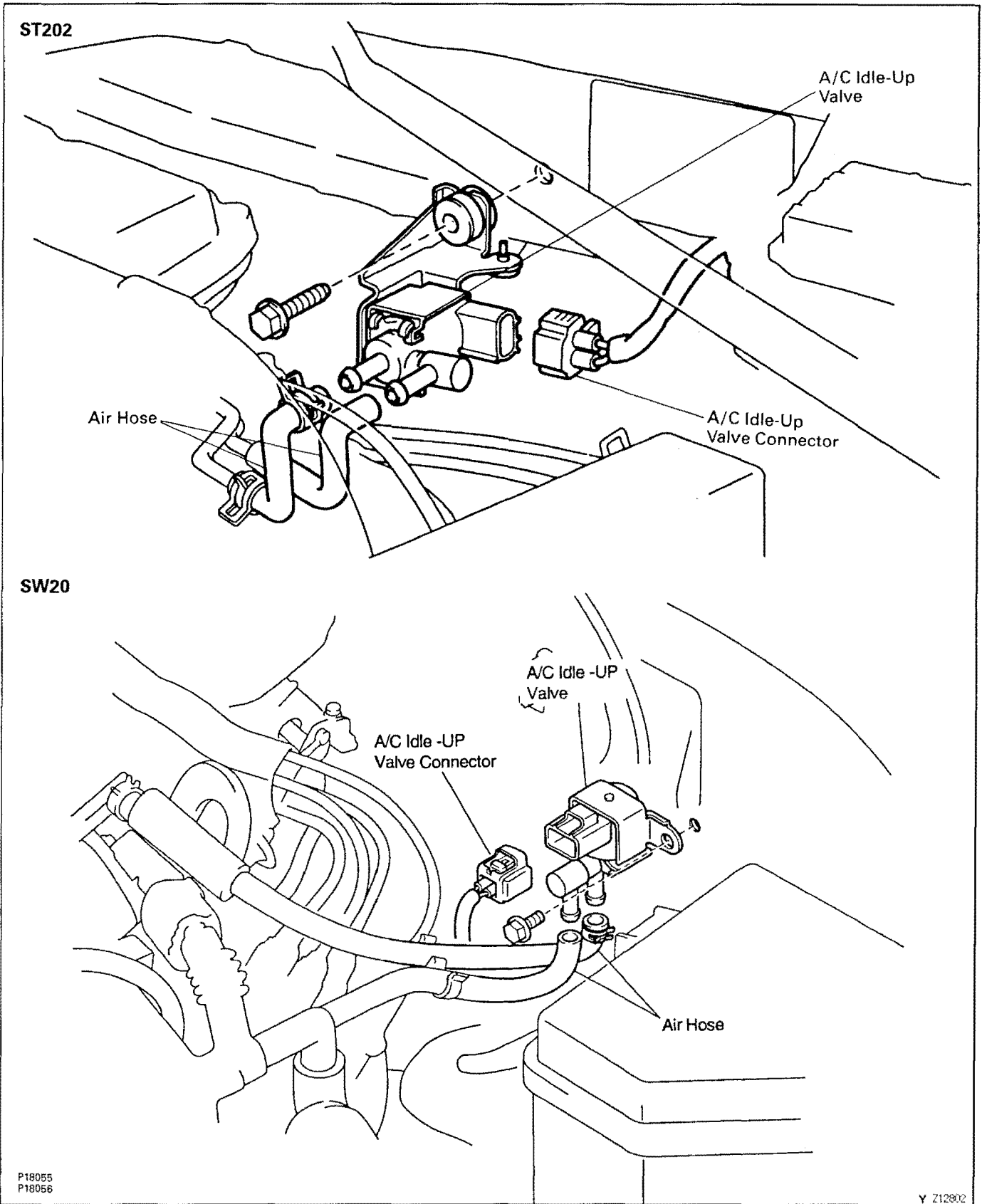
P18053
P18054
P01447

Z12301

EG

COMPONENTS FOR REMOVAL AND INSTALLATION

EG

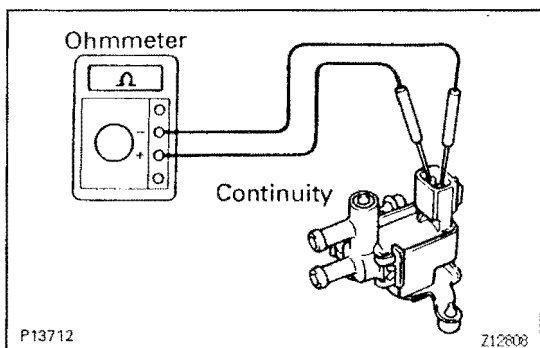


A/C IDLE—UP VALVE INSPECTION

(See Components for Removal and Installation)

1. REMOVE IDLE—UP VALVE

EG



2. INSPECT IDLE—UP VALVE

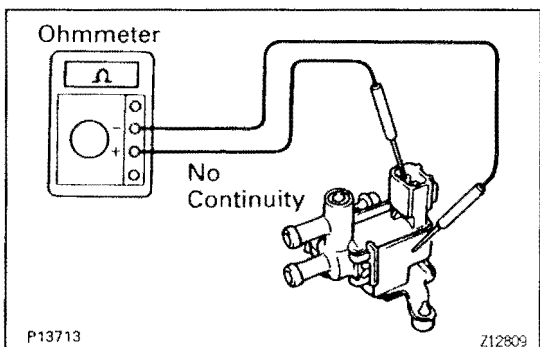
A. Inspect idle—up valve for open circuit

Using an ohmmeter, check that there is resistance between the terminals.

Resistance:

30 – 34 Ω at 20°C (68°F)

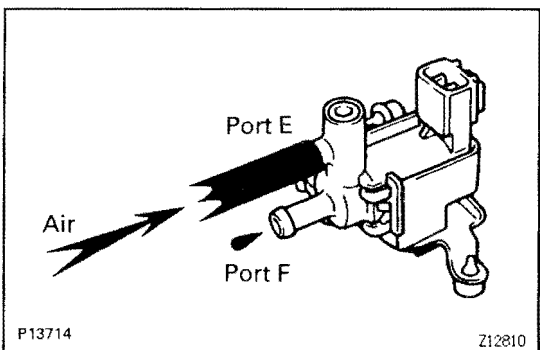
If there is no continuity, replace the idle—up valve.



B. Inspect idle—up valve for ground

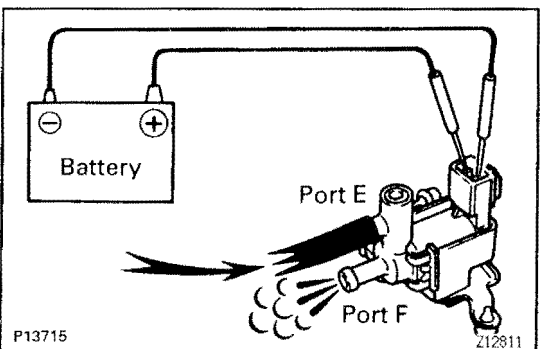
Using an ohmmeter, check that there is no continuity between each terminal and the body.

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.

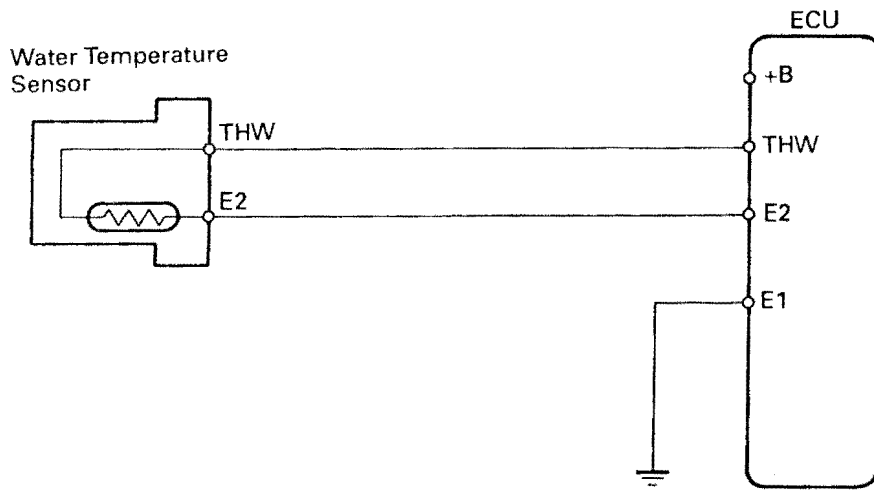
(c) Check that air flows from port E to port F.

If operation is not as specified, replace the idle—up valve.

3. REINSTALL IDLE—UP VALVE

WATER TEMPERATURE SENSOR

EG27L-02



P12037

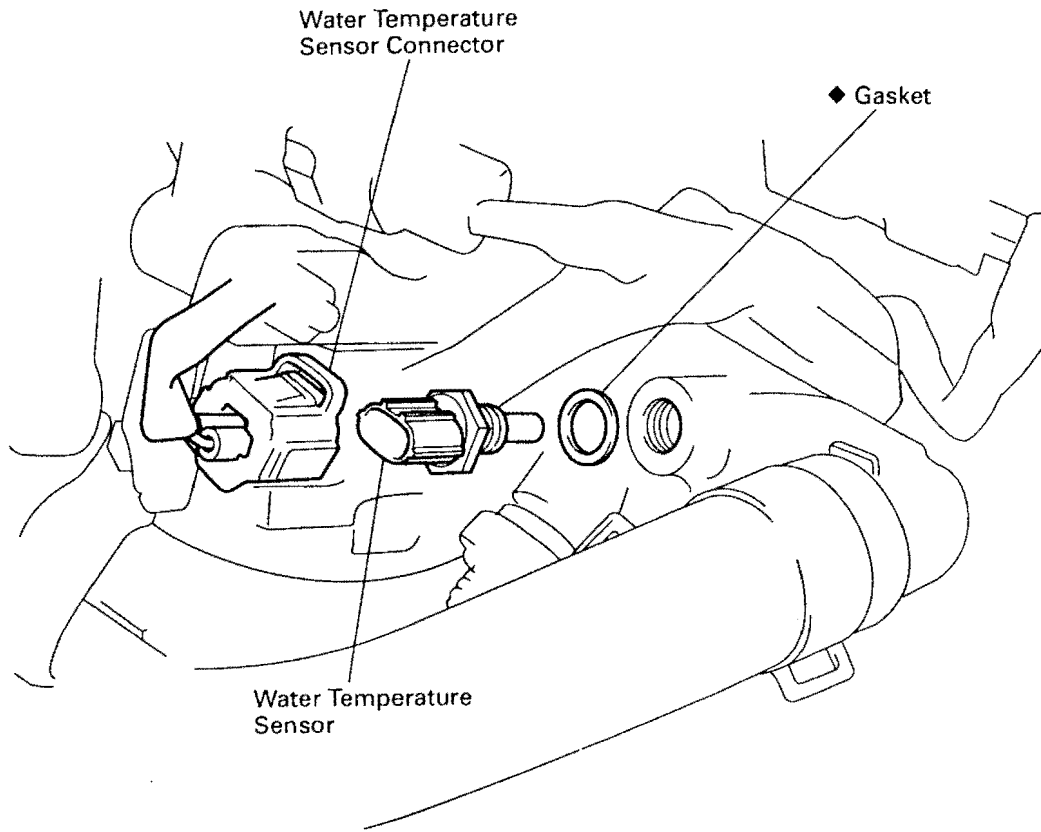
Z12812

EG

COMPONENTS FOR REMOVAL AND INSTALLATION

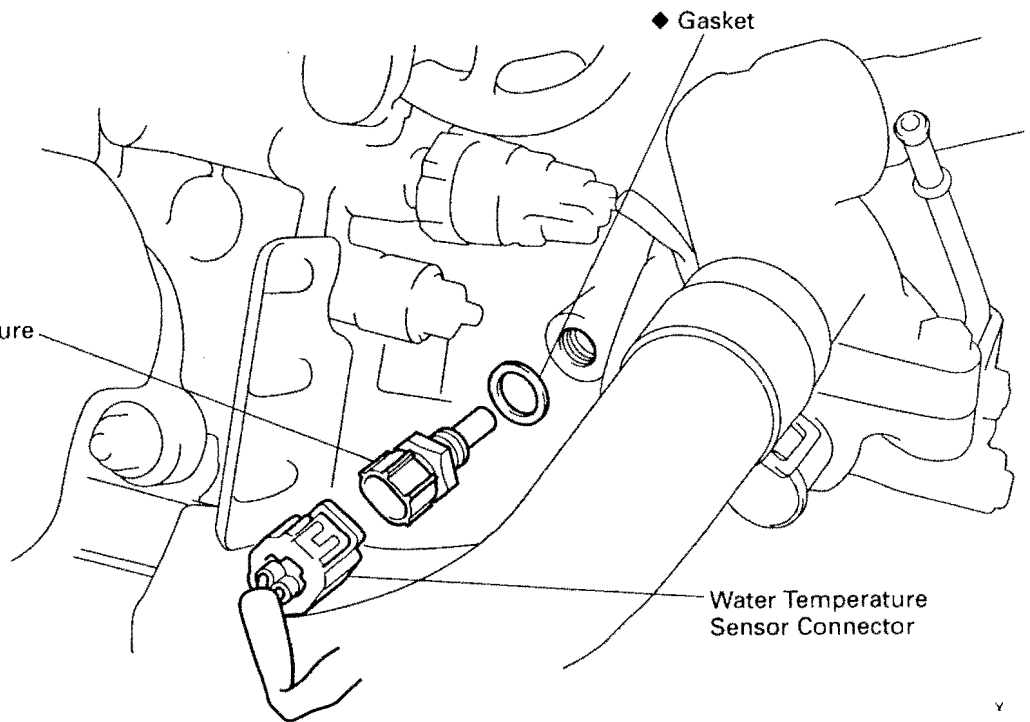
ST202

EG



SW20

Water Temperature Sensor



P17883
P17884

◆ Non-reusable part

WATER TEMPERATURE SENSOR INSPECTION

(See Components for Removal and Installation)

1. DRAIN ENGINE COOLANT
2. REMOVE WATER TEMPERATURE SENSOR

EG

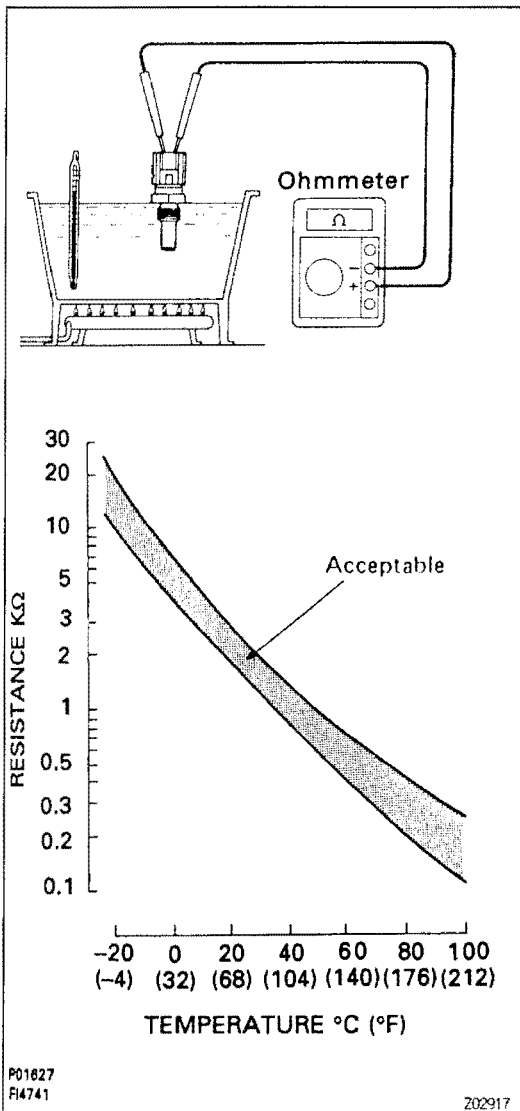
3. INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Refer to the graph

If the resistance is not as specified, replace the water temperature sensor.

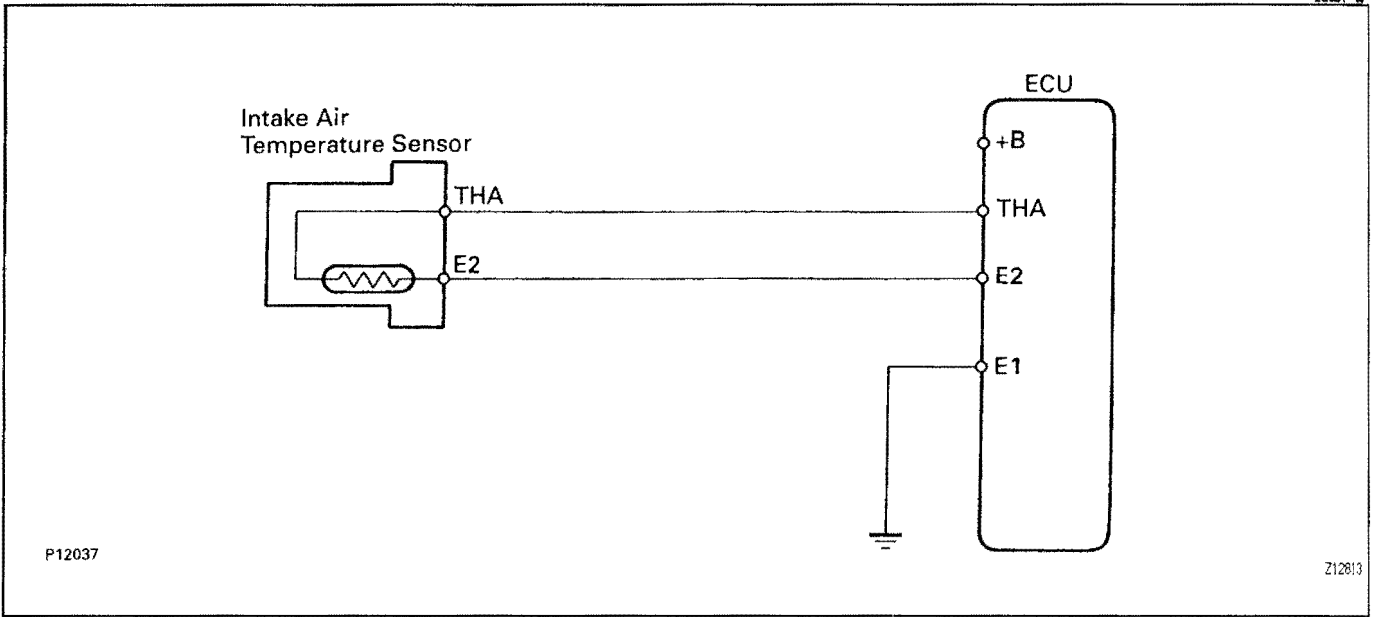


4. REINSTALL WATER TEMPERATURE SENSOR
5. REFILL WITH ENGINE COOLANT

INTAKE AIR TEMPERATURE SENSOR

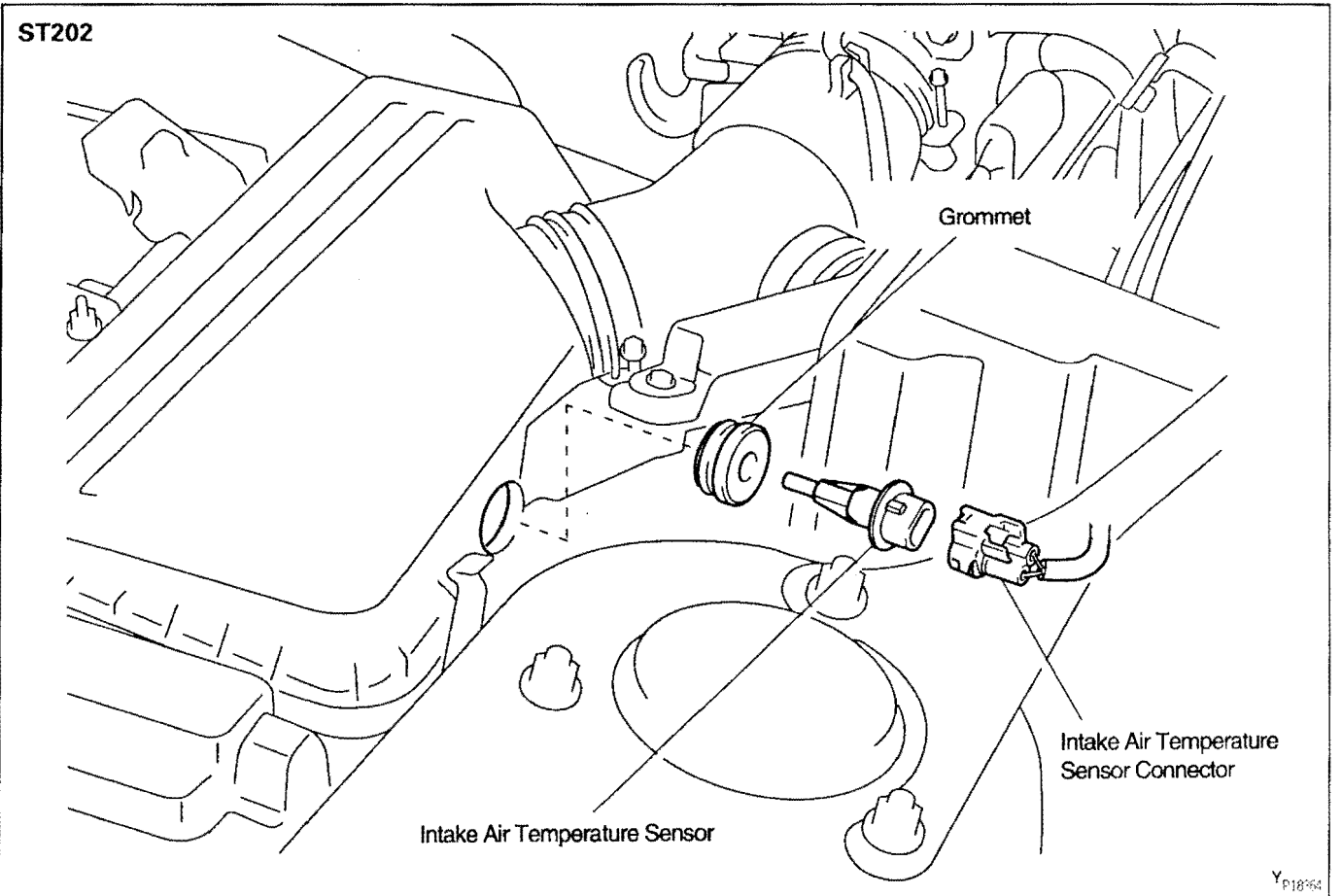
EGDY-16

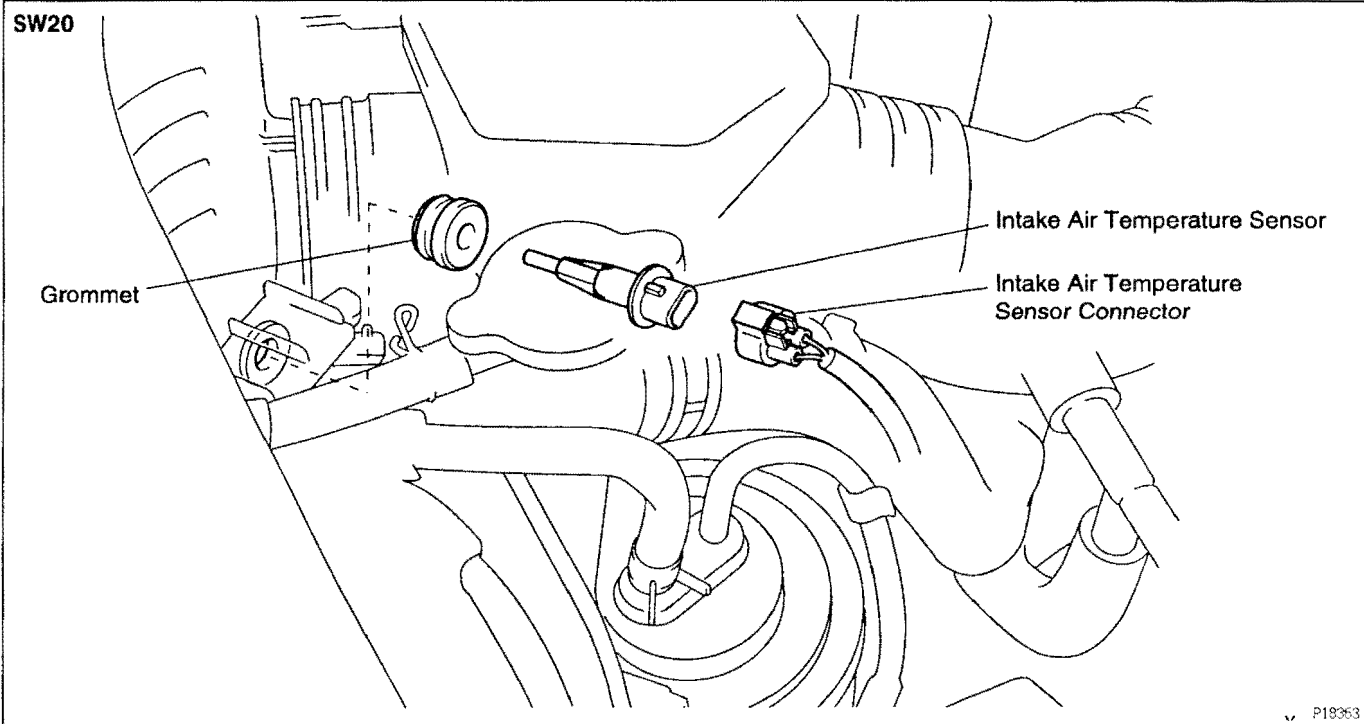
EG



COMPONENTS FOR REMOVAL AND INSTALLATION

EG420-01





EG

EG431-01

INTAKE AIR TEMPERATURE SENSOR INSPECTION

(See Components for Removal and Installation)

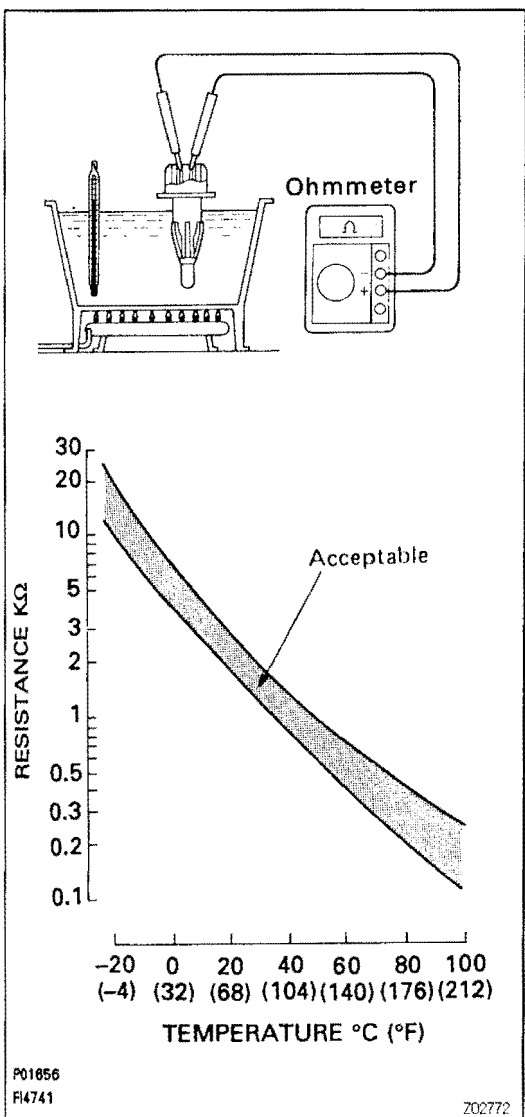
1. REMOVE INTAKE AIR TEMPERATURE SENSOR
2. INSPECT INTAKE AIR TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Refer to the graph

If the resistance is not as specified, replace the intake air temperature sensor.



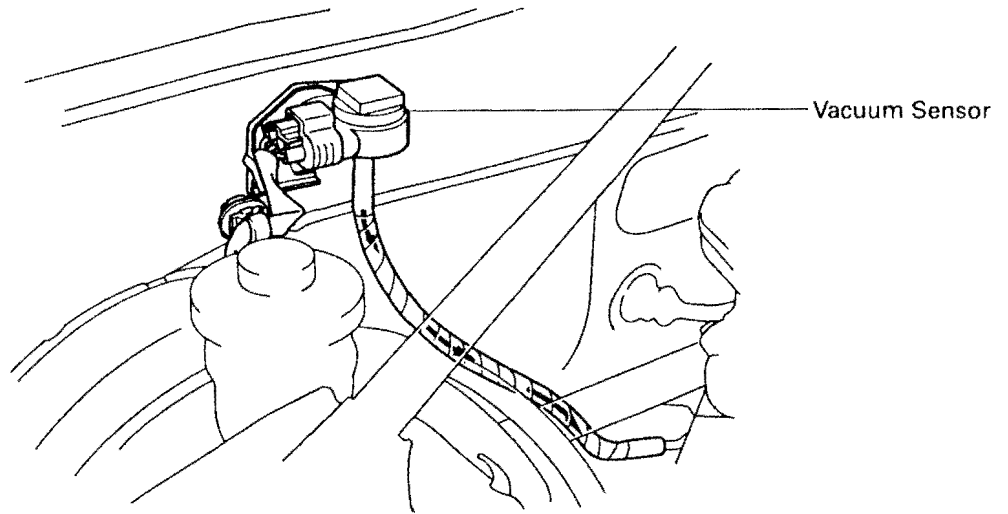
3. REINSTALL INTAKE AIR TEMPERATURE SENSOR

VACUUM SENSOR

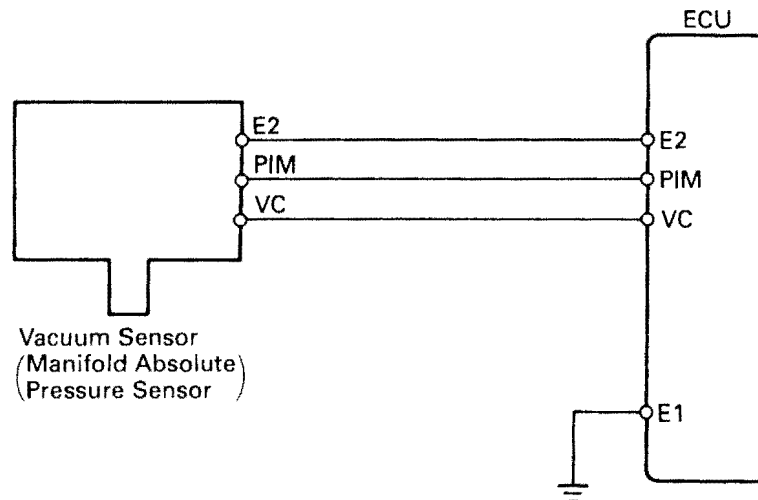
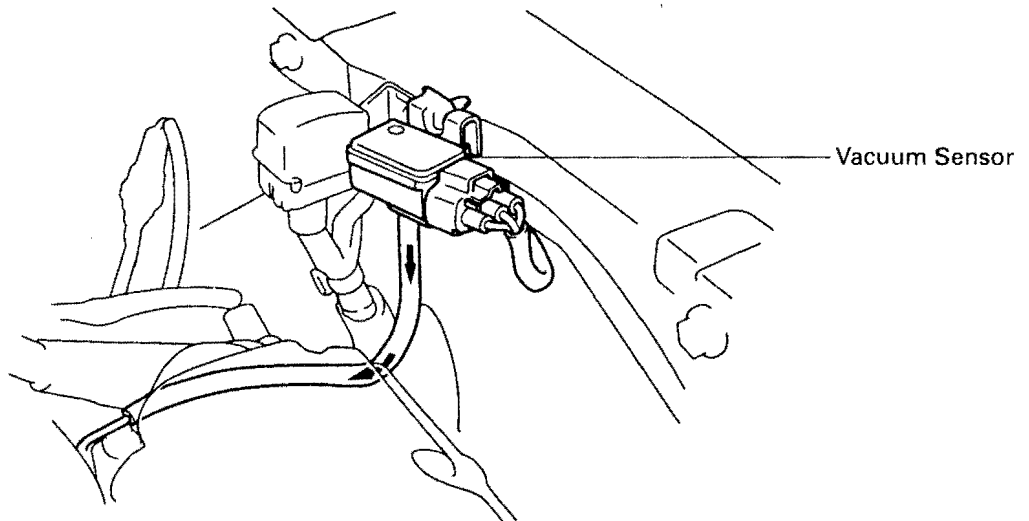
EG000-01

ST202

EG



SW20



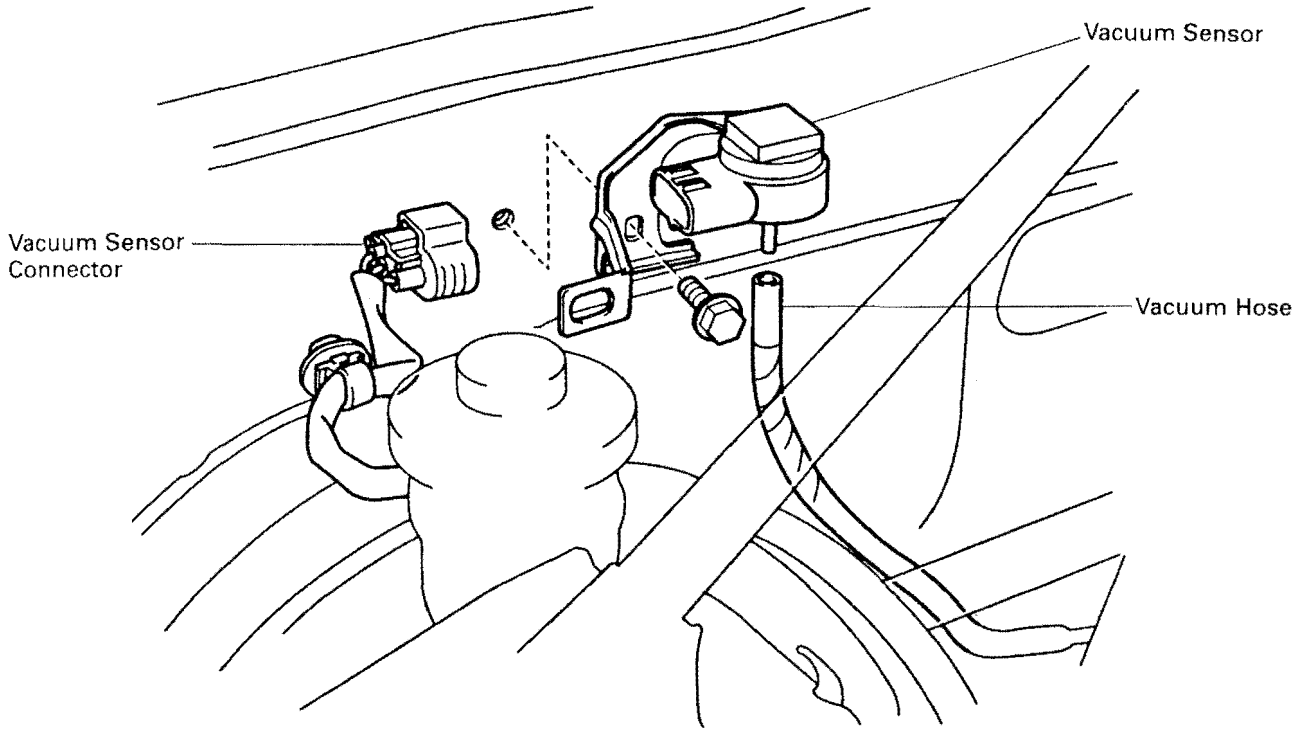
Vacuum Sensor
(Manifold Absolute
Pressure Sensor)

COMPONENTS FOR REMOVAL AND INSTALLATION

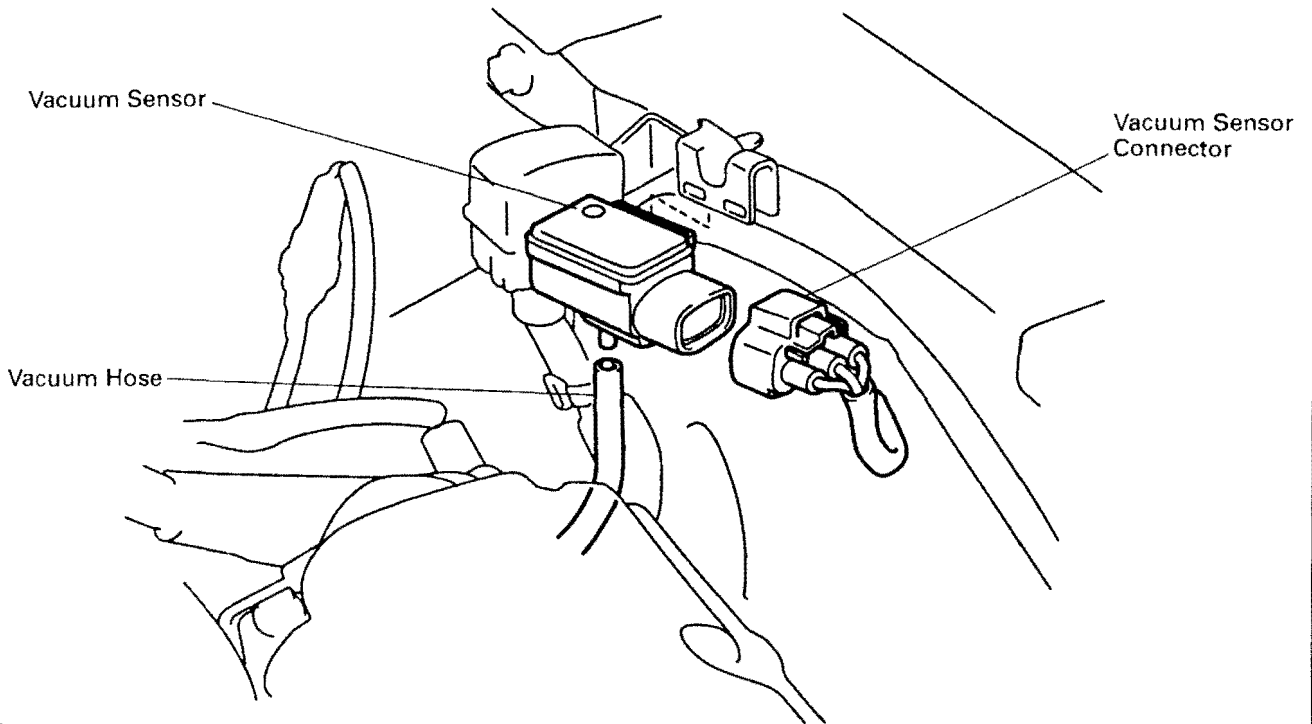
EG14F-0H

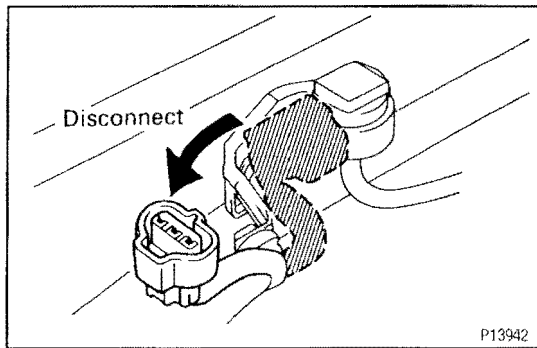
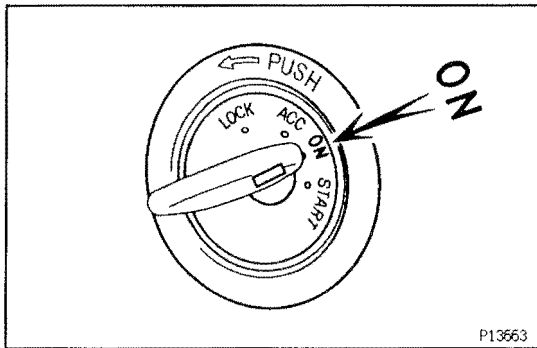
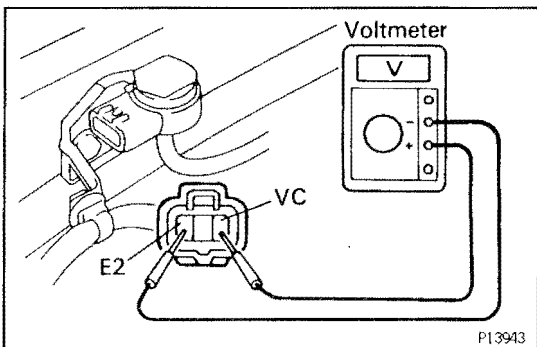
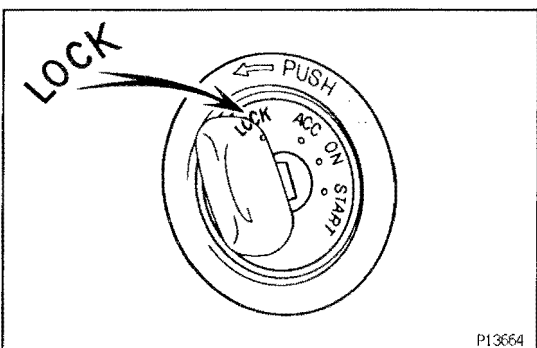
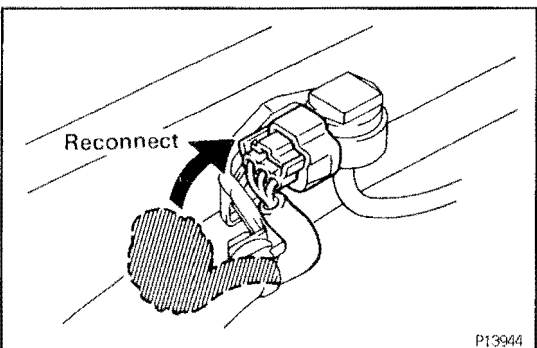
EG

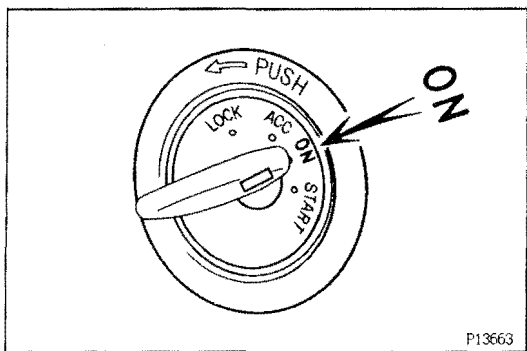
ST202



SW20



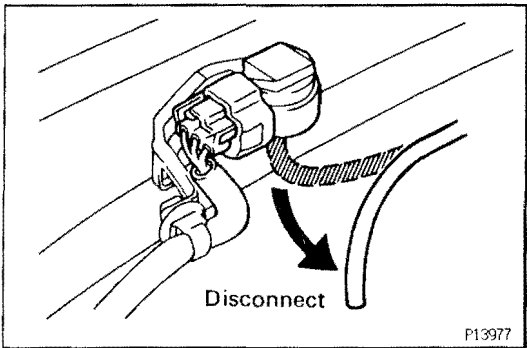
VACUUM SENSOR INSPECTION**(See Components for Removal and Installation)****1. INSPECT POWER SOURCE VOLTAGE OF VACUUM SENSOR****(a)** Disconnect the vacuum sensor connector.**(b)** Turn the ignition switch ON.**(c)** Using a voltmeter, measure the voltage between connector terminals VC and E2 of the wiring harness side.**Voltage:****4.5 – 5.5 V****(d)** Turn the ignition switch to LOCK.**(e)** Reconnect the vacuum sensor connector.



P13663

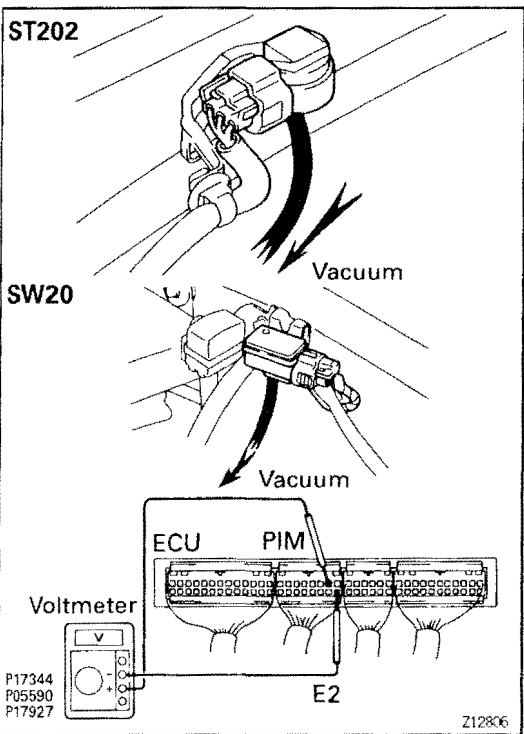
2. INSPECT POWER OUTPUT OF VACUUM SENSOR

(a) Turn the ignition switch ON.



P13977

(b) Disconnect the vacuum hose from the vacuum sensor.



(c) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure the output voltage under ambient atmospheric pressure.

(d) Apply vacuum to the vacuum sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg).

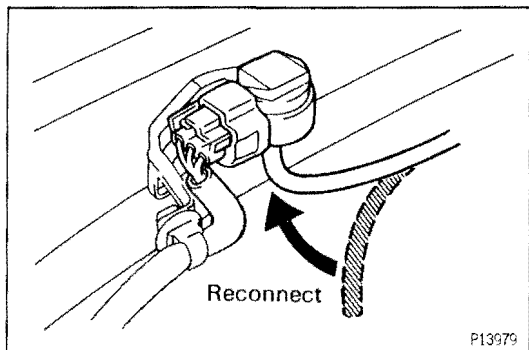
(e) Measure the voltage drop from step (c) above for each segment.

Voltage drop

Applied Vacuum kPa	13.3	26.7	40.0	53.5	66.7
(mmHg)	(100)	(200)	(300)	(400)	(500)
(in.Hg)	(3.94)	(7.87)	(11.81)	(15.75)	(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

V00494

(f) Reconnect the vacuum hose to the vacuum sensor.

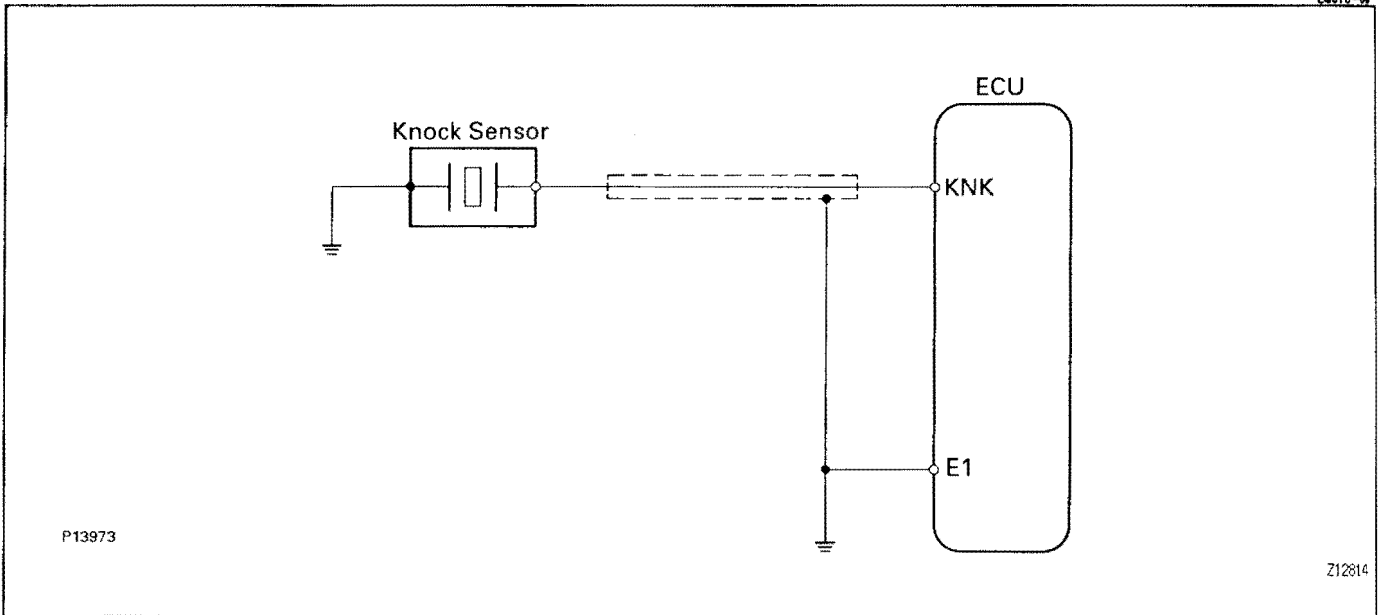


P13979

KNOCK SENSOR

EG0TU-08

EG

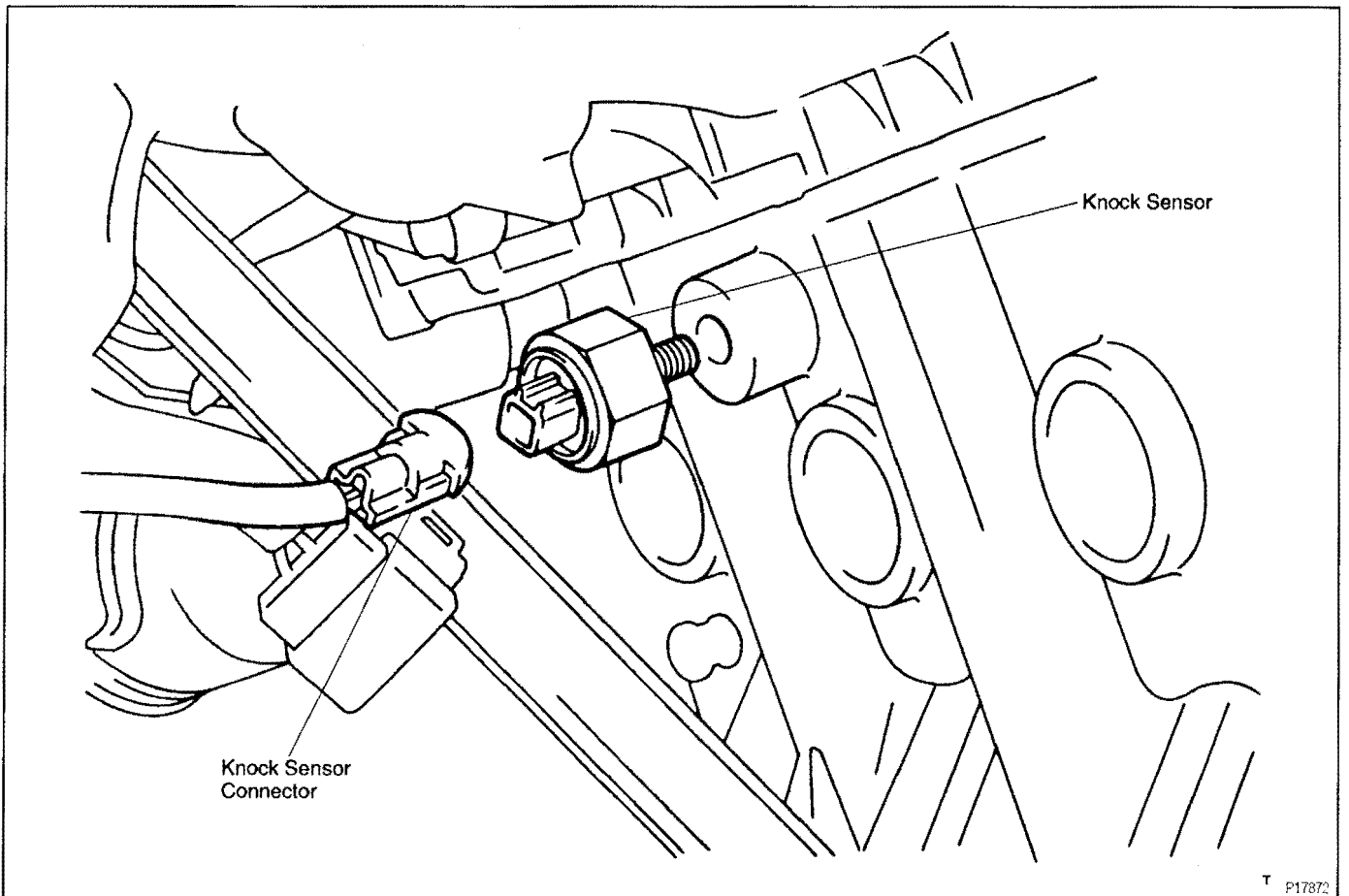


P13973

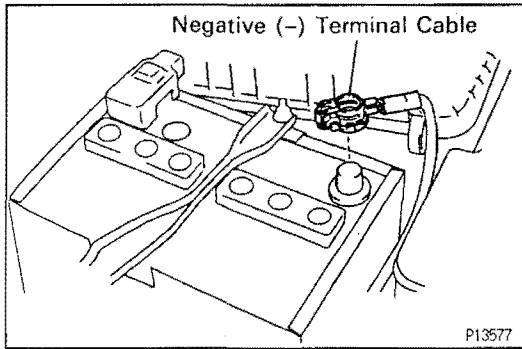
Z12814

COMPONENTS FOR REMOVAL AND INSTALLATION

EG0YY-00



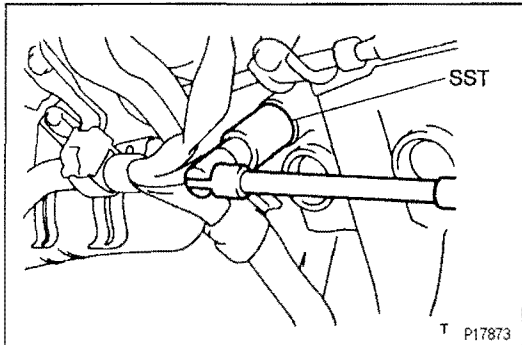
T P17872



KNOCK SENSOR INSPECTION

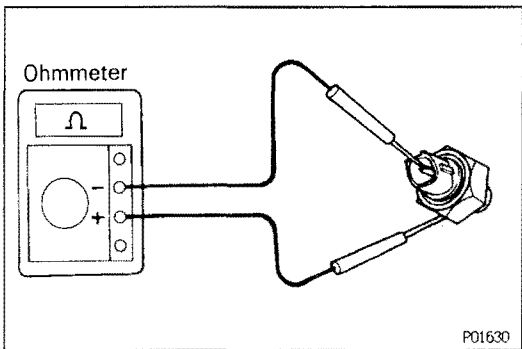
(See Components for Removal and Installation)

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



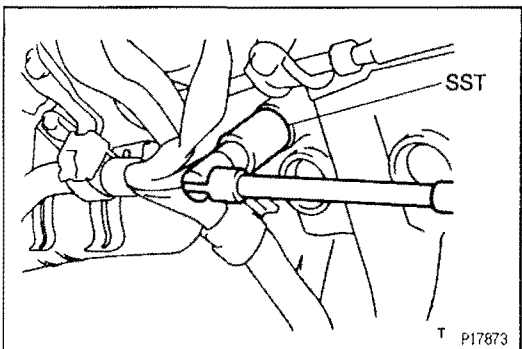
2. **REMOVE KNOCK SENSOR**

- (a) Disconnect the knock sensor connector.
- (b) Using SST, remove the knock sensor.
SST 09816-30010



3. **INSPECT KNOCK SENSOR**

Using an ohmmeter, check that there is no continuity between the terminal and body.
If there is continuity, replace the sensor.

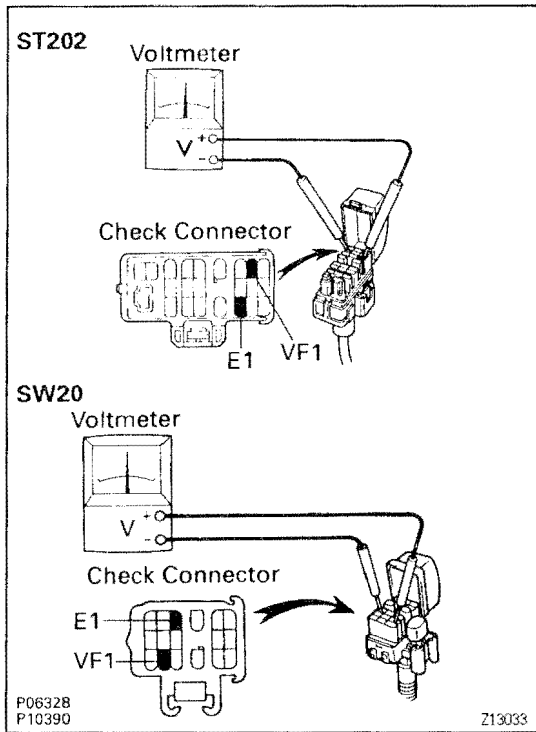


4. **REINSTALL KNOCK SENSOR**

- (a) Using SST, install the knock sensor.
SST 09816-30010
Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)
- (b) Connect the knock sensor connector.

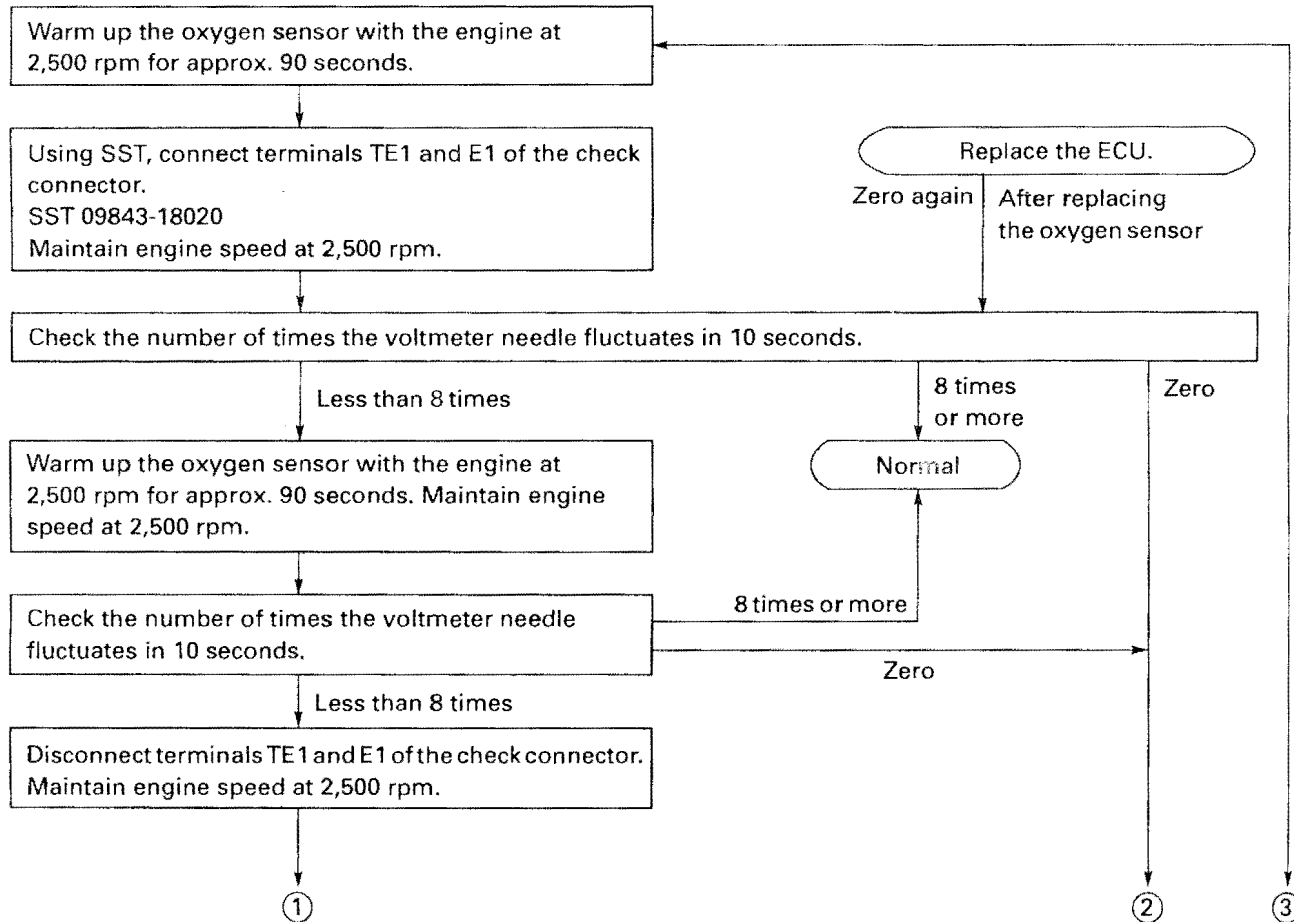
5. **RECONNECT NEGATIVE (-) TERMINAL CABLE TO BATTERY**

EG



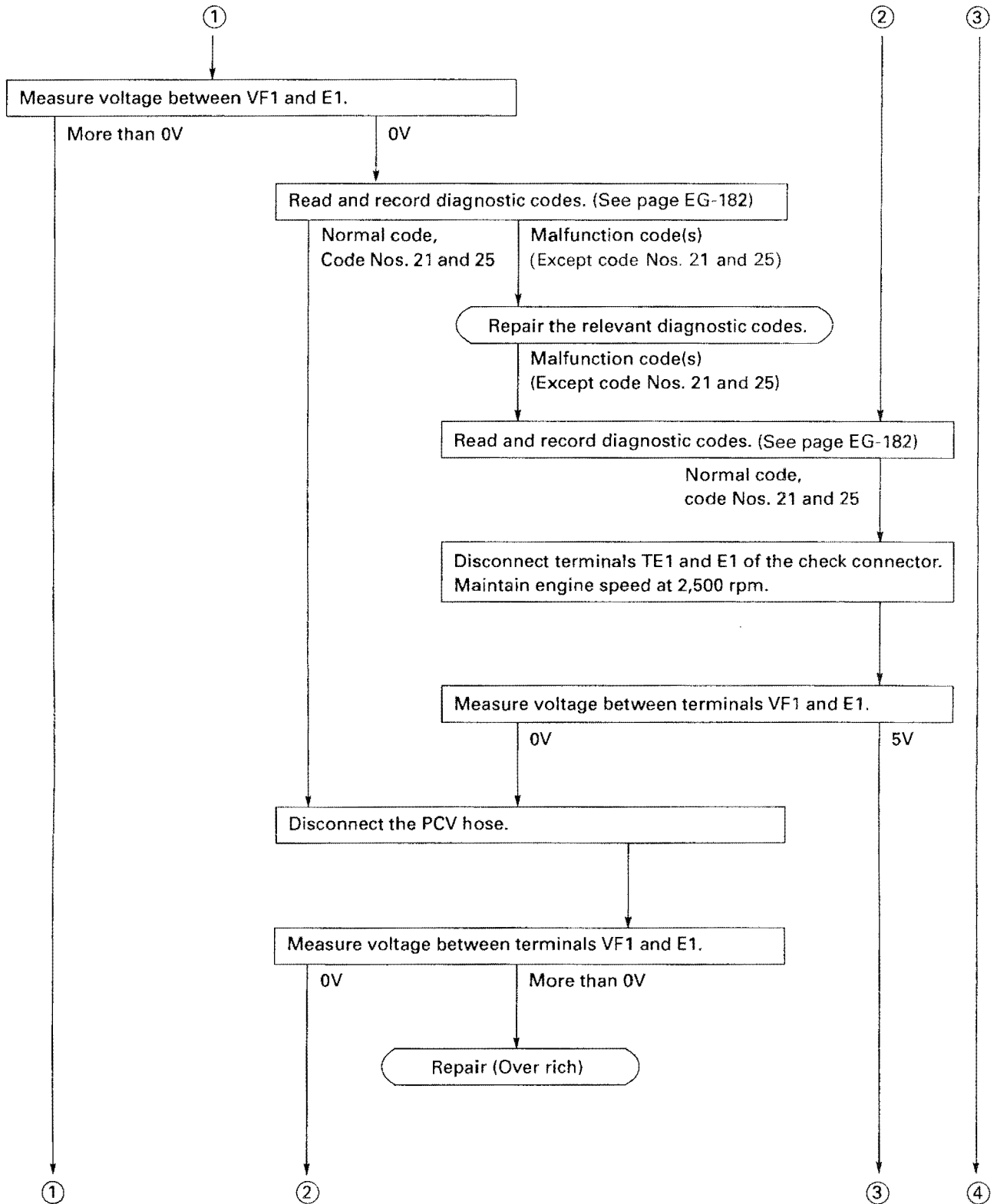
OXYGEN SENSOR OXYGEN SENSOR INSPECTION

1. **WARM UP ENGINE**
Allow the engine to reach normal operating temperature.
2. **INSPECT FEEDBACK VOLTAGE**
Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (-) probe to terminal E1. Perform the test as follows:



CONTINUED ON PAGE EG-287

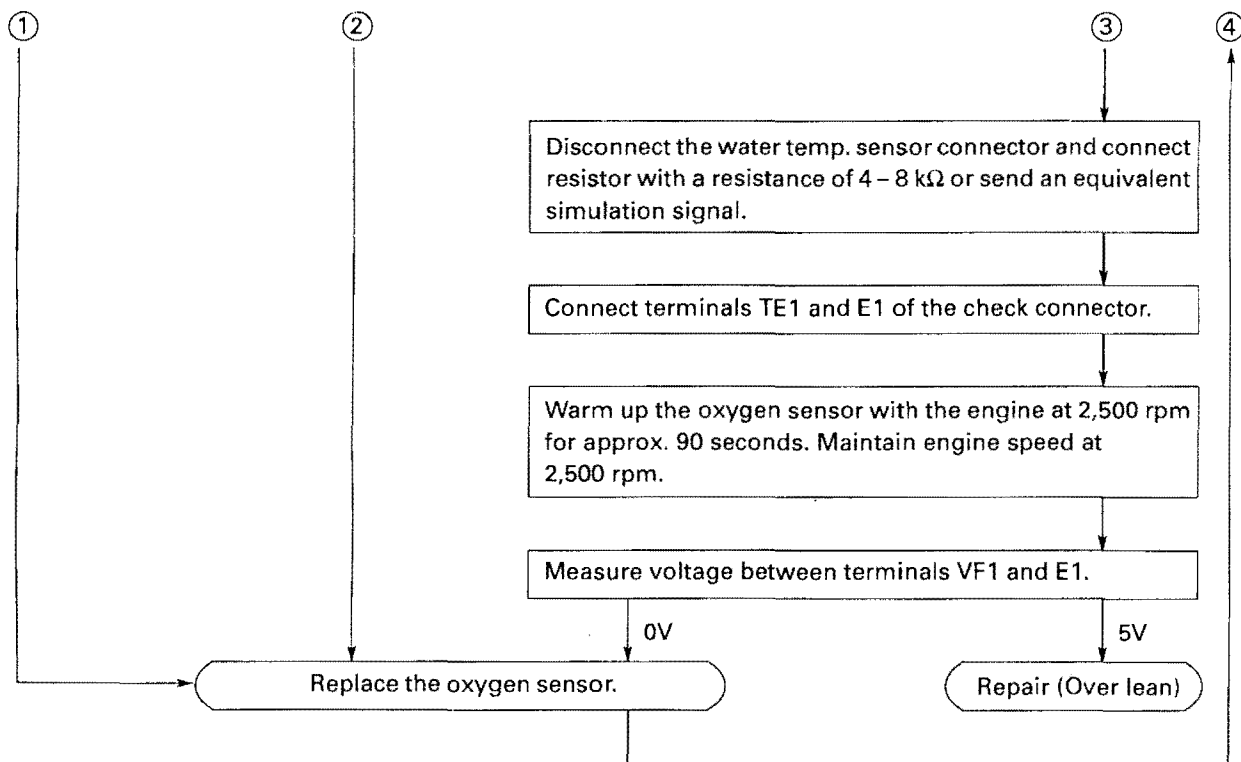
CONTINUED FROM PAGE EG-286



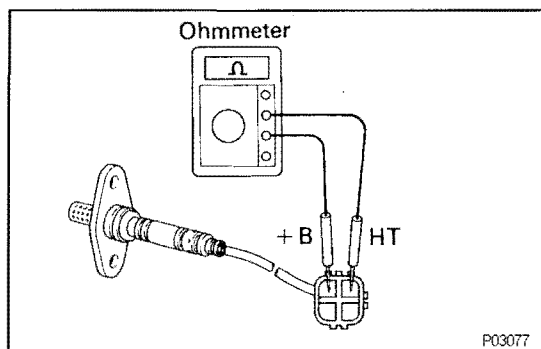
EG

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V05431



3. INSPECT HEATER RESISTANCE OF OXYGEN SENSOR

Using an ohmmeter, measure the resistance between the terminal +B and HT.

Resistance (Cold):

5.1 – 6.3 Ω at 20°C(68°F)

If the resistance is not as specified, replace the sensor.

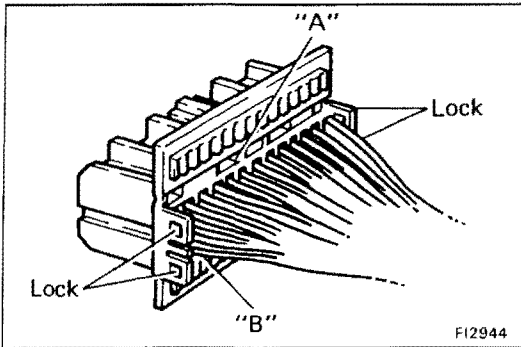
ECU

ECU INSPECTION

EG430-01

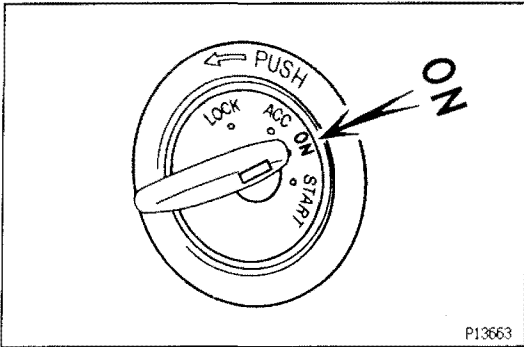
HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.

EG



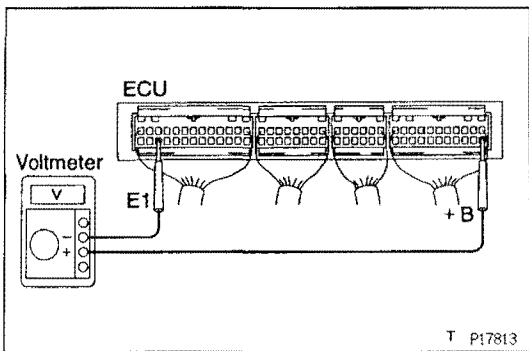
1. PREPARATION

- (a) Disconnect the 3 connectors from the ECU.
- (b) Remove the locks as shown in the illustration so that the tester probe(s) can easily come in.
NOTICE: Pay attention to sections A and B in the illustration which can easily be broken.
- (c) Reconnect the 3 connectors to the ECU.



2. INSPECT VOLTAGE OF ECU

- (a) Turn the ignition switch ON.



- (b) Measure the voltage between each terminal of the wiring connectors.

HINT:

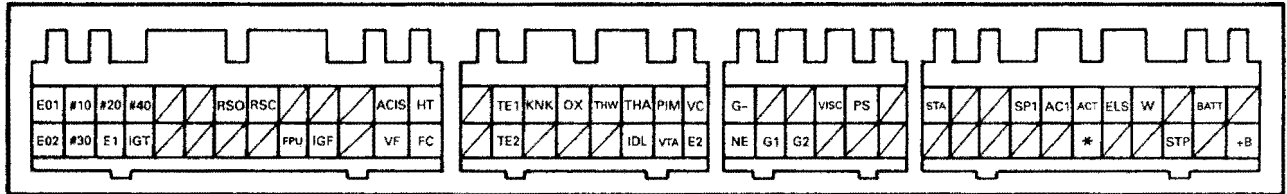
- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is ON.

ECU Wiring Connectors Voltage

EG

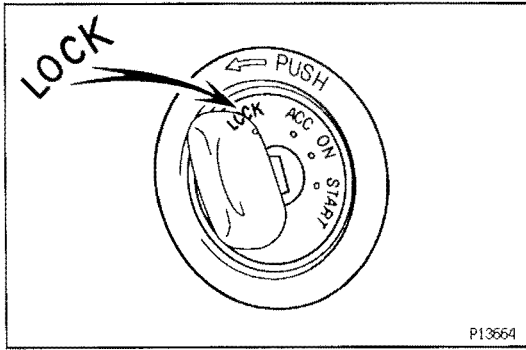
Terminals	Condition		STD voltage (V)
+B - E1	IG SW ON		9 - 14
BATT - E1	-		9 - 14
IDL - E2	IG SW ON	Throttle valve open	9 - 14
VTA - E2		Throttle valve fully closed	0.3 - 0.8
		Throttle valve fully open	3.2 - 4.9
PIM - E2	IG SW ON		3.3 - 3.9
VC - E2			4.5 - 5.5
#10, #30 - E01 #20, #40 - E02			9 - 14
THA - E2	IG SW ON	Intake air temp. 20°C (68°F)	0.5 - 3.4
THW - E2		Coolant temp. 80°C (68°F)	0.2 - 1.0
STA - E1	Cranking		6 or more
IGT - E1	Idling		Pulse generation
RSO - E1 RSC - E1	IG SW ON	ECU connectors disconnected	9 - 14
W - E1	No trouble (check engine warning light off) and engine running		9 - 14
TE1 - E1 TE2 - E1	IG SW ON	Check connector TE1 - E1 not connected	9 - 14
		Check connector TE1 - E1 connected	0 - 3

ECU Terminals



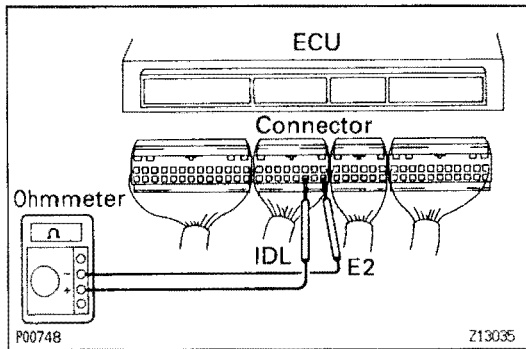
P01399

*ST202: ATS
SW20: PSCT



3. INSPECT RESISTANCE OF ECU

- (a) Turn the ignition switch OFF.
- (b) Disconnect the 3 connectors from the ECU.



- (c) Measure the resistance between each terminal of the wiring connectors.

NOTICE:

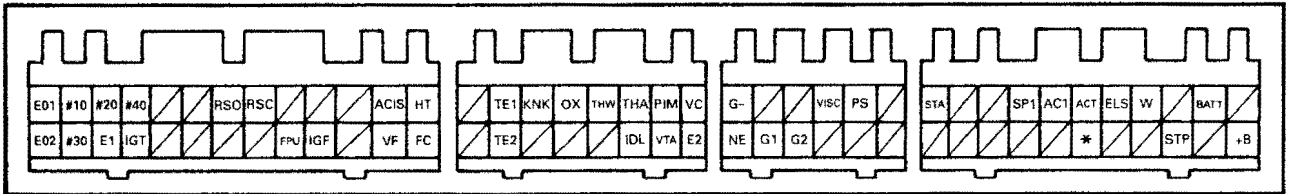
- Do not touch the ECU terminals.
- The tester probe should be inserted in the wiring connector from the wiring side.

ECU Wiring Connectors Resistance

EG

Terminals	Condition	STD resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	2,300 or less
VTA – E2	Throttle valve fully open	2,000 – 10,200
	Throttle valve fully closed	200 – 5,700
VC – E2	–	2,500 – 5,900
THA – E2	Intake air temp. 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temp. 80°C (176°F) 76°F)	200 – 400
G1 – G– G2 – G–	Cold (–10°C (14°F) to 50°C (122°F))	125 – 200
	Hot (50°C (122°F) to 100°C (212°F))	160 – 235
NE – G–	Cold (–10°C (14°F) to 50°C (122°F))	155 – 250
	Hot (50°C (122°F) to 100°C (212°F))	190 – 290
RSC RSO – +B	–	19.3 – 22.3

ECU Terminals



P01399

*ST202: ATS
SW20: PSCT

FUEL CUT RPM FUEL CUT PRM INSPECTION

EQ48C-01

EG

1. WARM UP ENGINE

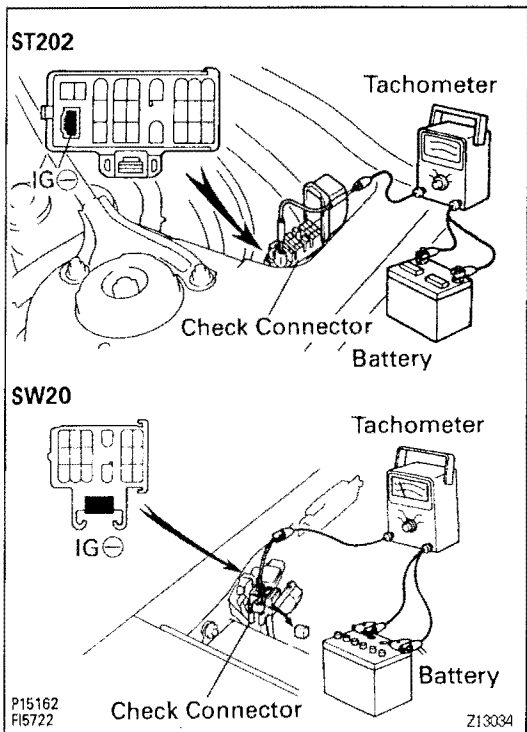
Allow the engine to warm up to normal operating temperature.

2. CONNECT TACHOMETER TO ENGINE

Connect the test probe of a tachometer to terminal IG \ominus of the check connector.

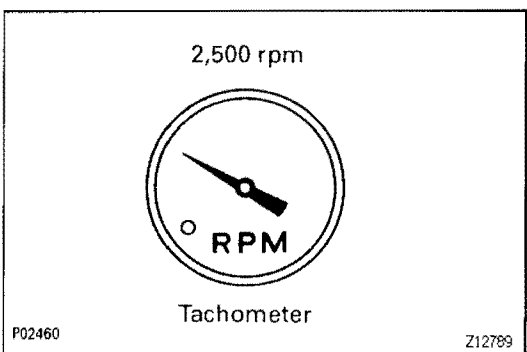
NOTICE:

- 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 your unit before use.



3. INSPECT FUEL CUT RPM

(a) Increase the engine speed to at least 2,500 rpm.

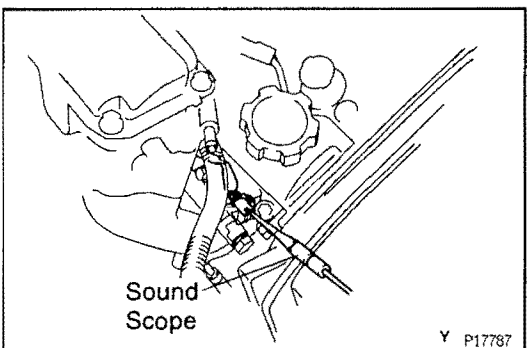


- (b) Using a sound scope, check for injector operating noise.
- (c) Check that when the throttle lever is released, injector operation noise stops momentarily and then resumes.
- HINT: Measure with the A/C OFF.

Fuel return rpm:

1,500 rpm

4. DISCONNECT TACHOMETER



SERVICE SPECIFICATIONS

SERVICE DATA

EG43R-01

Fuel pressure regulator	Fuel pressure at no vacuum	265 — 304 kPa (2.7 — 3.1 kgf/cm ² , 38 — 44 psi)
Fuel pump	Resistance at 20°C (68°F)	0.2 — 3.0 Ω
Injector	Resistance at 20°C (68°F)	13.4 — 14.2 Ω
	Injection volume	81 — 102 cm ³ (4.9 — 6.2 cu in.) per 15 sec.
	Difference between each cylinder	5 cm ³ (0.3 cu in.) or less
	Fuel leakage	One drop or less per minute
Throttle body	Throttle body fully closed angle	6°
Throttle position sensor	Clearance between stop screw and lever	
	0 mm (0 in.) VTA — E2	0.2 — 5.7 kΩ
	0.40 mm (0.016 in.) IDL — E2	2.3 kΩ or less
	0.75 mm (0.030 in.) IDL — E2	Infinity
	Throttle valve fully open VTA — E2	2.0 — 10.2 kΩ
	VC — E2	2.5 — 5.9 kΩ
ISC valve	Resistance (+B — RSC or RSO) at 20°C (68°F)	19.3 — 22.3 Ω
VSV for EGR	Resistance	33 — 39 Ω
A/C idle-up valve	Resistance	30 — 34 Ω
Water Temp. 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
Intake Air Temp. 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
Oxygen sensor	Heater coil resistance	5.1 — 6.3 Ω
Fuel cut rpm	Fuel return rpm	1,500 rpm

SERVICE DATA (Cont'd)

ECU		
	Voltage	
	+B — E1	IG SW ON 9 — 14 V
	BATT — E1	9 — 14 V
	IDL — E2	IG SW ON (Throttle valve open) 9 — 14 V
	VTA — E2	IG SW ON (Throttle valve fully closed) 0.3 — 0.8 V
		IG SW ON (Throttle valve fully open) 3.2 — 4.9 V
	PIM — E2	IG SW ON 3.3 — 3.9 V
	VC — E2	IG SW ON 4.5 — 5.5 V
	#10, #20, #30 or #40 — E01	IG SW ON 9 — 14 V
	#10, #20, #30 or #40 — E02	IG SW ON 9 — 14 V
	THA — E2	IG SW ON (Intake air temp. 20°C (68°F)) 0.5 — 3.4 V
	THW — E2	IG SW ON (Coolant temp. 80°C (176°F)) 0.2 — 1.0 V
	STA — E1	Cranking 6 V or more
	IGT — E1	Idling Pulse generation
	RSC — E1	IG SW ON (ECU connectors disconnected) 9 — 14 V
	RSO — E1	IG SW ON (ECU connectors disconnected) 9 — 14 V
	W — E1	No trouble (Check engine warning light off) and engine running 9 — 14 V
	TE1 — E1	IG SW ON (Check connector terminals TE1 — E1 not connected) 9 — 14 V
		IG SW ON (Check connector terminals TE1 — E1 connected) 0 — 3 V
	Resistance	
	IDL — E2	at throttle valve open Infinity
		at throttle valve fully closed 2,300 Ω or less
	VTA — E2	at throttle valve fully open 2,000 — 10,200 Ω
		at throttle valve fully closed 200 — 5,700 Ω
	VC — E2	2,500 — 5,900 Ω
	THA — E2	at intake air temp. 20°C (68°F) 2,000 — 3,000 Ω
	THW — E2	at coolant temp. 80°C (176°F) 200 — 400 Ω
	G1 or G2 — G—	at cold (−10°C (14°F) to 50°C (122°F)) 125 — 200 Ω
		at hot (50°C (122°F) to 100°C (212°F)) 160 — 235 Ω
	NE — G—	at cold (−10°C (14°F) to 50°C (122°F)) 155 — 250 Ω
		at hot (50°C (122°F) to 100°C (212°F)) 190 — 290 Ω
	+B — RSC or RSO	19.3 — 22.3 Ω

TORQUE SPECIFICATIONS

Part tightened		N·m	kgf·cm	ft·lbf
Fuel line				
Union bolt type		29	300	22
Flare nut type		Fuel pump side		
		35	350	26
		Others		
		30	310	22
Drain plug x Fuel tank	SW20	13	130	9
Fuel pump x Fuel tank				
		ST202	3.5	31 in.-lbf
		SW20	3.4	30 in.-lbf
Fuel sender gauge x Fuel tank	SW20	1.5	15	13 in.-lbf
Fuel evaporatin vent tube x Fuel Tank	SW20	1.5	15	13 in.-lbf
Fuel tank filler pipe x Fuel tank	SW20	3.4	35	30 in.-lbf
Fuel tank band x Body	SW20	29	300	22
No.2 center floor crossmember x Body	SW20	29	300	22
Fuel pressure regulator x Delivery pipe		29	300	22
Delivery pipe x Cylinder head		29	300	22
Fuel inlet pipe x Delivery pipe		32	320	24
Intake chamber stay x Intake manifold		19	195	14
Intake chamber stay x No.1 stay		19	195	14
Intake chamber stay x No.2 stay		18	180	13
Intake chamber stay x ACIS assembly cover		Bolt	8.5	75 in.-lbf
		Nut	21	16
Throttle body x Intake manifold		21	210	16
Knock sensor x Cylinder block		44	450	33
Oxygen sensor x Exhaust manifold		20	200	14

EG

COOLING SYSTEM

DESCRIPTION

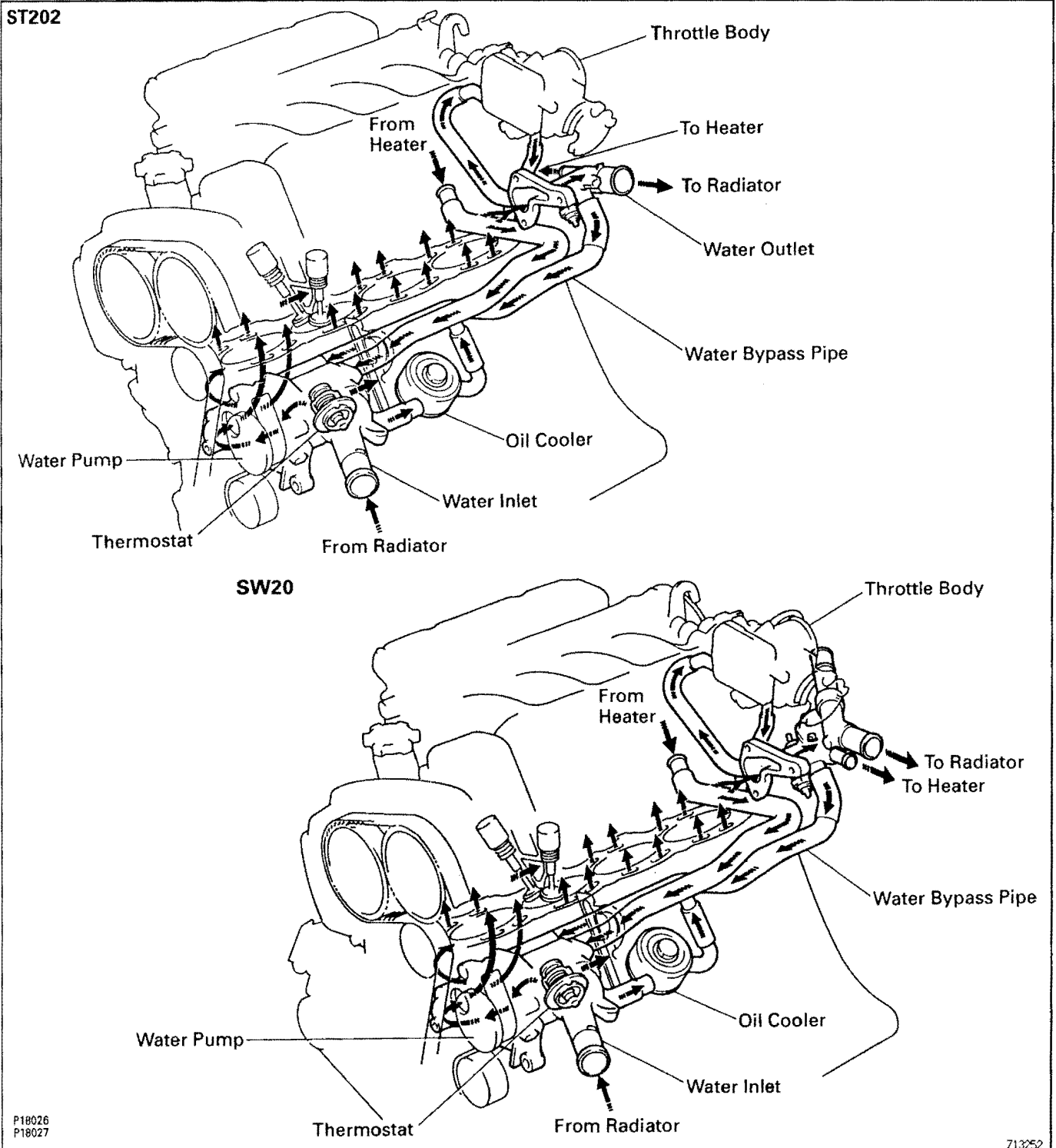
This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equipped with a bypass valve mounted on the inlet side.

EG12N-05

OPERATION

EG

EG12P-0E



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.

Coolant which is heated in the water jacket is pumped to the radiator, through which the electric fan draws air to cool the coolant as it passes through. 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.

EG

RADIATOR (ST202)

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 2 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 drawn through the radiator by the electric fan, as well as the wind generated by the vehicle's motion, passes through the radiator, cooling the coolant. 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 (SW20)

The radiator cools the coolant which has passed through the water jacket and become hot, and it is mounted in the front of the vehicle. The MR2 radiator is different from that in other models, in that it is a cross flow type in which the coolant flows horizontally. It includes side tanks and a core which connects them. The inlet for coolant from the water jacket and the drain cock for draining out coolant are located in the left tank. The outlet coolant and an air drain, which facilitates the supply of coolant to the engine are located in the right tank. The core contains many tubes through which coolant flows from the left tank to the right tank as well as cooling fins which radiate heat away from the coolant in the tubes. Air drawn in by the electric cooling fan, as well as the wind generated by the vehicle's motion, passes through the radiator, cooling the coolant heated in the water jacket as it passes through the tubes in the core. 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 coolant temperature becomes high in order to prevent it from becoming too high.

RADIATOR CAP (ST202), WATER FILLER CAP (SW20)

The radiator (water filler) 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 coolant temperature exceeds 100°C (212°F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator (water filler) 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; 59 – 103 kPa (0.60 – 1.05 kgf/cm², 8.5 – 14.9 psi). The vacuum valve opens to alleviate the vacuum which develops in the coolant system after the engine is stopped and the coolant temperature drops. The valve's opening allows the coolant in the reservoir tank to return to the cooling system.

RADIATOR RESERVOIR

The reservoir is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir 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 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 coolant temperature. This valve closes when the 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 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

RECOMMENDED TOOLS

EG12V-07

	09082-00050 TOYOTA Electrical Tester Set	
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EG

EQUIPMENT

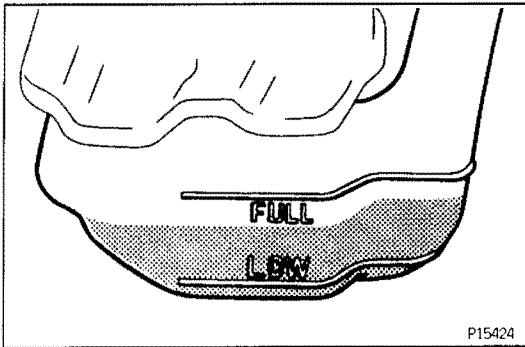
EG12W-01

Heater	
Radiator cap tester	
Thermometer	
Torque wrench	

COOLANT

EG12X-0A

Item	Capacity	Classification
Engine coolant (w/ Heater) ST202	7.0 liters (7.4 US qts, 6.2 Imp. qts)	Ethylene—glycol base
SW20	13.7 liters (14.4 US qts, 12.1 Imp. qts)	



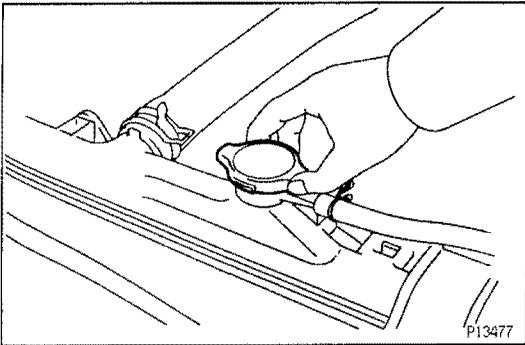
COOLANT CHECK (ST202)

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

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.

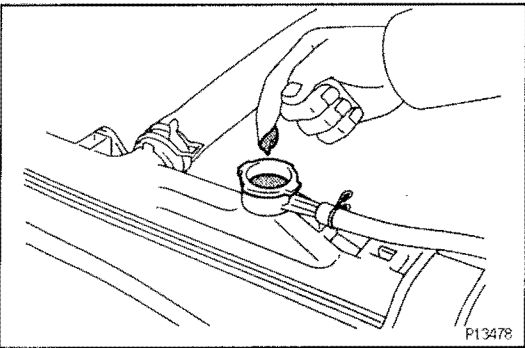
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2. CHECK ENGINE COOLANT QUALITY

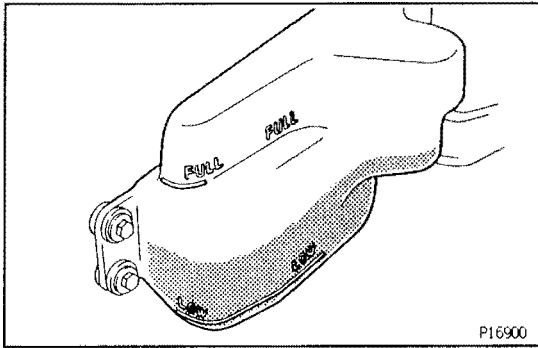
(a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



(b) There should not be any excessive deposits of rust or scale around the radiator cap or water filler hole, and the coolant should be free from oil. If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.

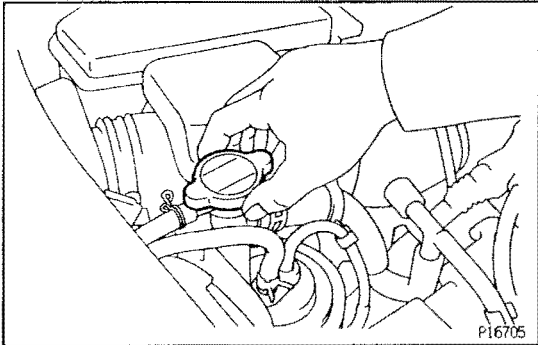


COOLANT CHECK (SW20)

1. CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR

The engine coolant level should be between the "LOW" and "FULL" lines.

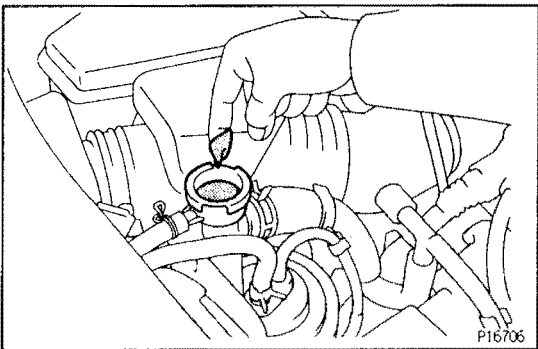
If low, check for leaks and add engine coolant up to the "FULL" line.



2. CHECK ENGINE COOLANT QUALITY

(a) Remove the water filler cap.

CAUTION: To avoid the danger of being burned, do not remove the water filler cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



(b) There should not be any excessive deposits of rust or scale around the water filler cap or water filler hole, and the coolant should be free from oil. If excessively dirty, replace the coolant.

(c) Reinstall the water filler cap.

COOLANT REPLACEMENT (ST202)

EG321-06

1. DRAIN ENGINE COOLANT

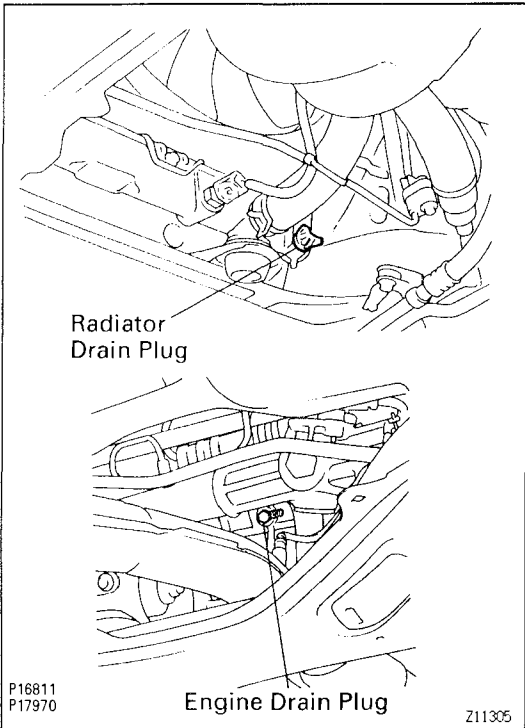
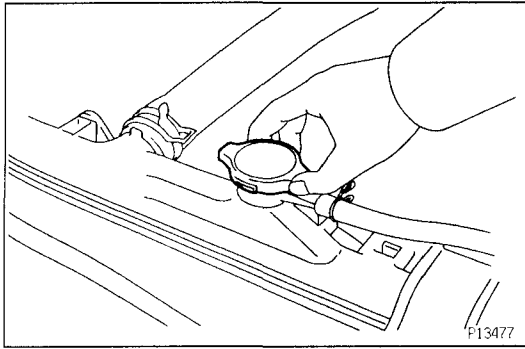
- (a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

- (b) Loosen the radiator drain plug (on the right side of the radiator lower tank) and engine drain plug (on the left rear of the cylinder block), and drain the coolant.

- (c) Close the drain plugs.

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



2. FILL ENGINE COOLANT

- (a) Slowly fill the system with coolant.

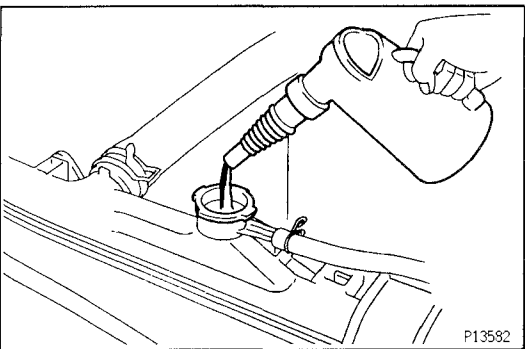
- Use a good brand of ethylene–glycol base coolant and mix it according to the manufacturer's directions.
- Using coolant which includes more than 50 % ethylene–glycol (but not more than 70 %) is recommended.

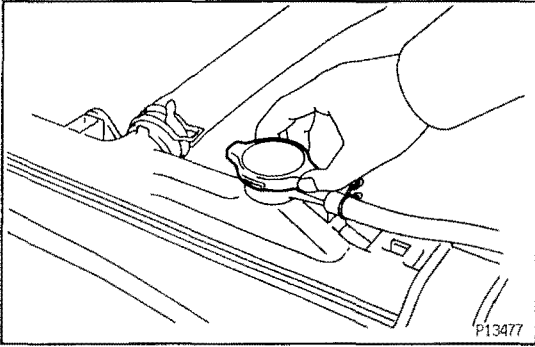
NOTICE:

- Do not use an alcohol type coolant.
- The coolant should be mixed with demineralized water or distilled water.

Capacity (w/ Heater):

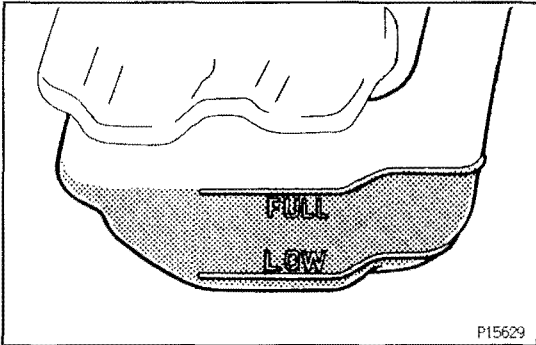
7.0 liters (7.4 US qts, 6.2 Imp. qts)





- (b) Install the radiator cap.
- (c) Start the engine, and bleed the cooling system.

EG



- (d) Refill the radiator reservoir with coolant until it reaches the "FULL" line.

3. CHECK ENGINE COOLANT FOR LEAKS

COOLANT REPLACEMENT (SW20)

NOTICE:

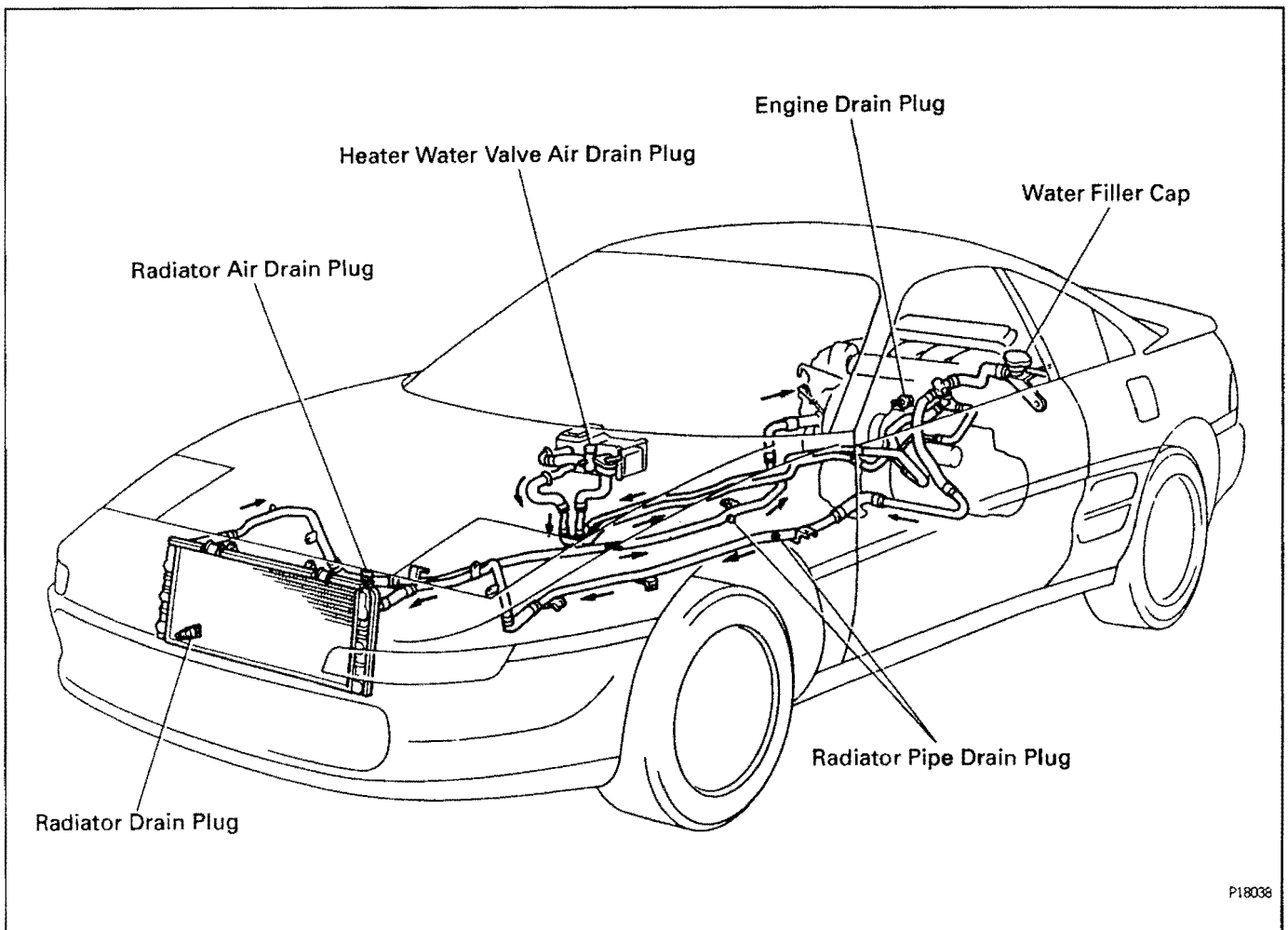
EG182-03

- To avoid the danger of burns, do not begin work until the engine and coolant have properly cooled down.
- To ensure that coolant is poured in properly, perform the operation on a level area. Performing work with the vehicle inclined may cause improper removal of coolant or improper air removal when pouring coolant.
- After replacing the coolant, check the water level in the water filler and reservoir tank once or twice within 500 km (311 miles) of driving or within one week.

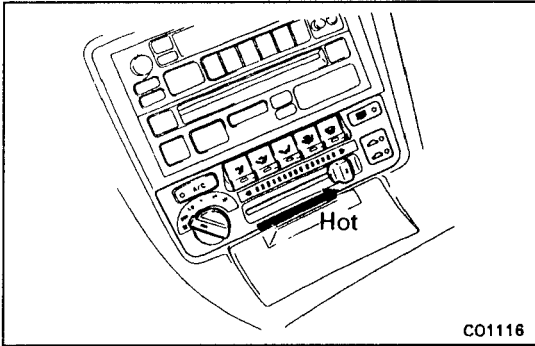
EG

COOLANT CIRCUIT

EG184-02

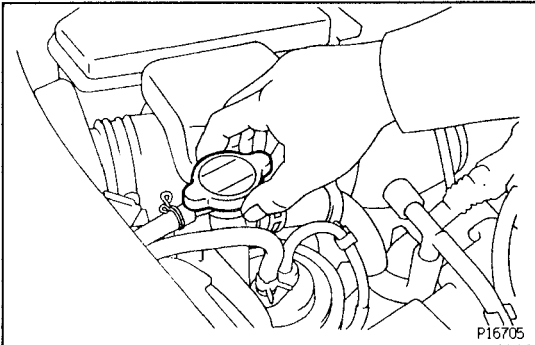


P18038



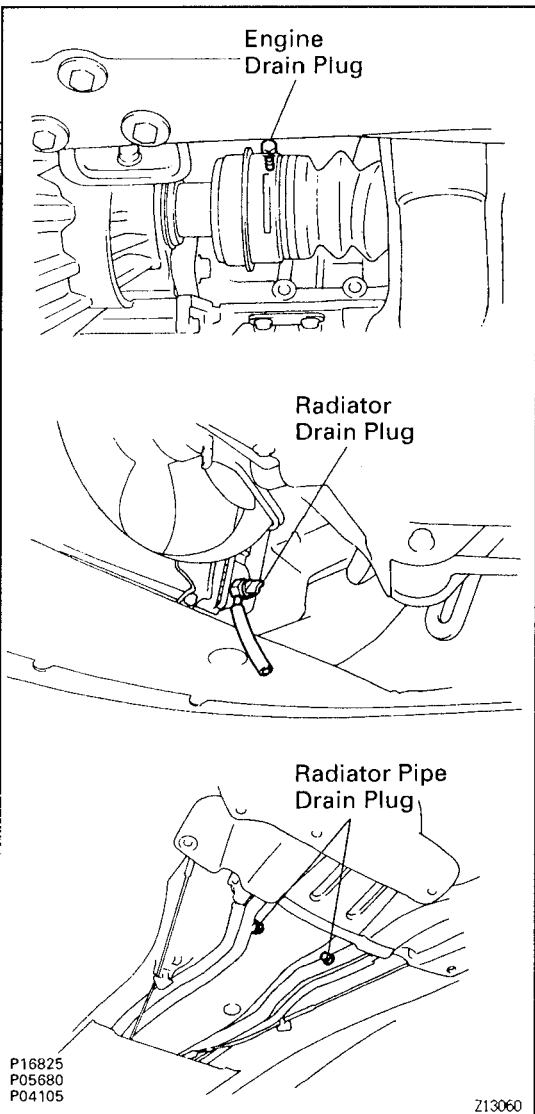
ENGINE COOLANT DRAINAGE

1. REMOVE REAR FUEL TANK PROTECTOR
2. DRAIN ENGINE COOLANT
 - (a) Set the heater control lever to hot.



- (b) Remove the water filler cap.

CAUTION: To avoid the danger of being burned, do not remove the water filler cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



- (c) Remove the drain cocks (engine, radiator and radiator pipes), and drain the coolant.
- (d) Close the drain plugs.

Torque:

Engine

25 N·m (250 kgf·cm, 18 ft·lbf)

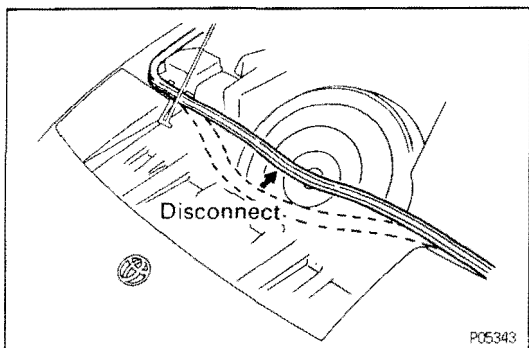
Radiator pipe

17 N·m (170 kgf·cm, 12 ft·lbf)

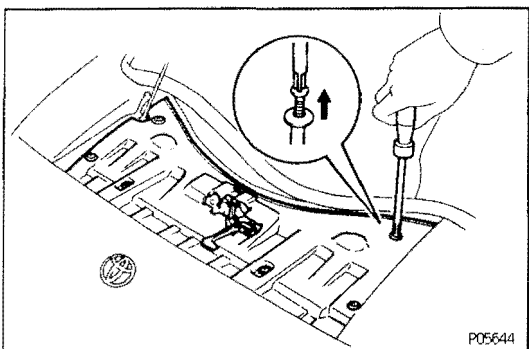
ENGINE COOLANT REFILL

EG

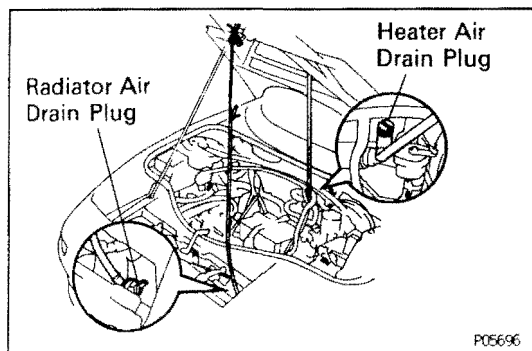
1. REMOVE SPARE TIRE
2. REMOVE DASH PANEL FRONT TRIM COVER



3. REMOVE UPPER RADIATOR SUPPORT SEAL
 - (a) Disconnect the hood weatherstrip.

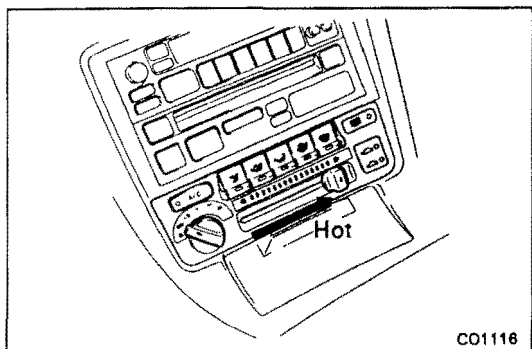


- (b) Remove the 7 clips.
 - (c) Remove the 2 hood lock mounting bolts, and remove the support seal.

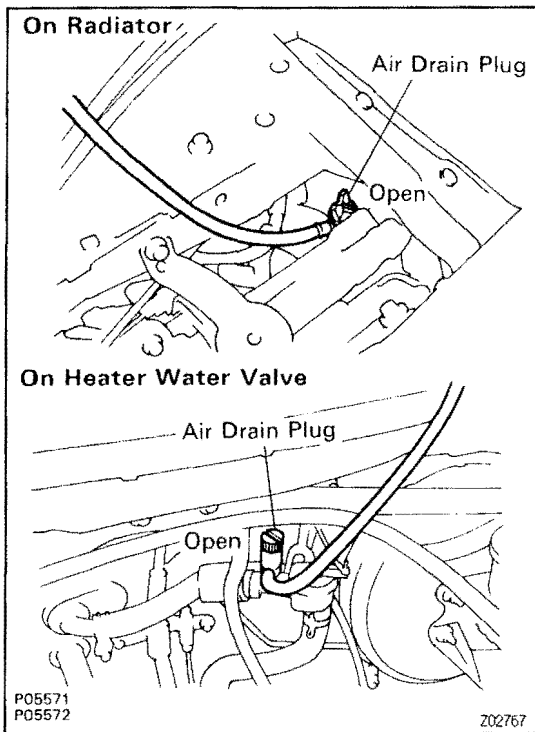


4. SET SERVICE HOSES
 - (a) Connect the service hoses to the air drain plugs of the radiator and heater water valve.
 - (b) Suspend the opposite ends the front hood as shown in the illustration.

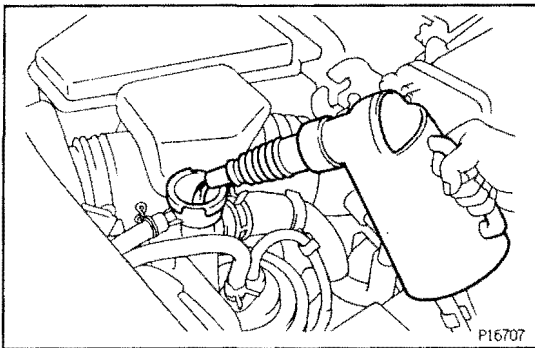
NOTICE: Do not close-off or pinch any of the service hoses.



5. FILL WITH ENGINE COOLANT
 - (a) Set the heater control lever to hot.



- (b) Open the air drain plugs of the radiator or heater water valve above 3 turns.



- (c) 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 coolant which includes more than 50 % ethylene—glycol (but not more than 70 %) is recommended.

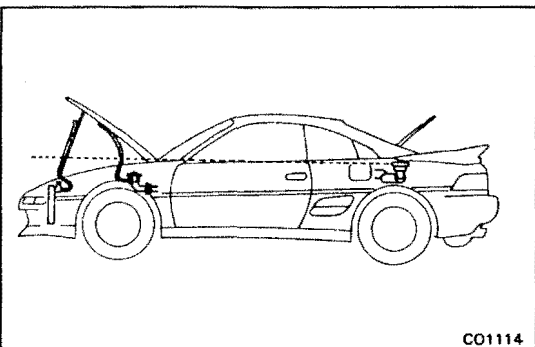
NOTICE:

- Do not use a alcohol type coolant.
- The coolant should be mixed with demineralized water or distilled water.

Capacity (w/ Heater):

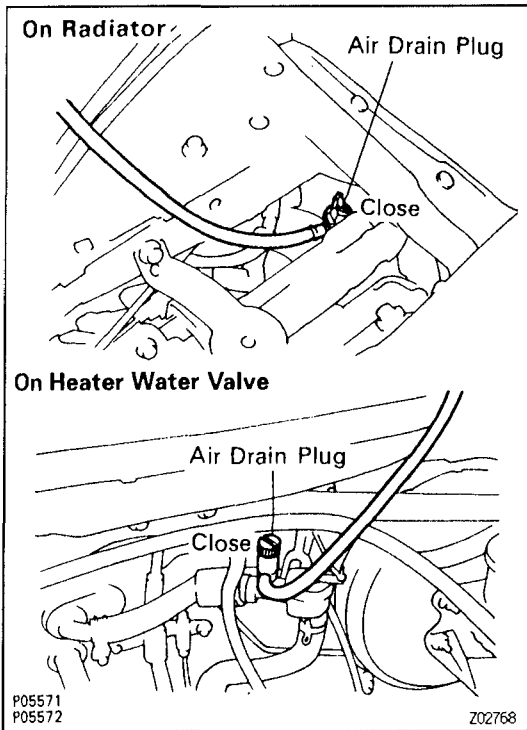
13.7 liters (14.4 US qts, 12.1 Imp. qts)

- (d) Check that air is absent from the air drain plugs of the radiator and heater water valve while filling the water filler inlet to the top with coolant.

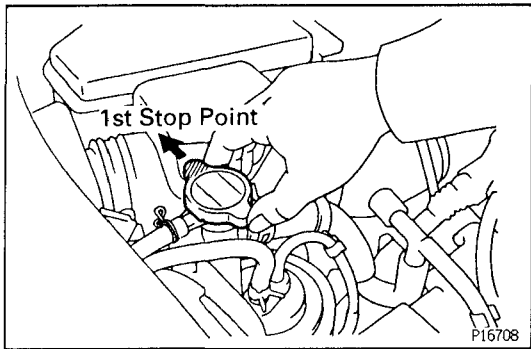


- (e) Visually check that the level of coolant in the air drain service hoses of the radiator and heater water valve are the same as in the water filler.

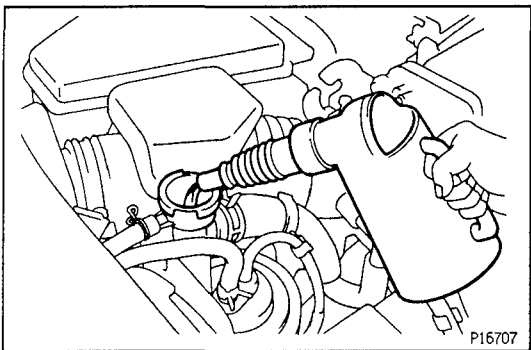
NOTICE: If the water level of coolant in the air drain service hose is clear, air removal has been incomplete, so check if the service hose is crushed or bent, then perform step (c).



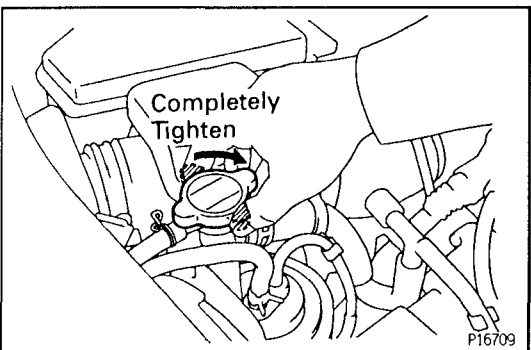
- (f) When the coolant level in the air drain service hoses stops dropping, close the air drain plugs of the radiator and heater water valve.



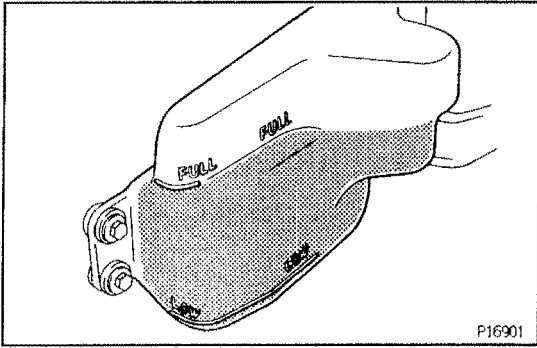
- (g) Fasten the water filler cap to the 1st stop point.
NOTICE: Do not tighten the water filler cap completely (to the 2nd stop point).
- (h) Start the engine, and run at idle for approx. 3 minutes, and stop the engine.



- (i) Add more coolant, and repeat steps (h) and (i).
HINT: By performing steps (h) and (i), 0.2 – 0.5 liters (0.2 – 0.5 US qts, 0.2 – 0.4 Imp. qts) can normally be added.
- (j) Check that coolant level in the water filler has not dropped.
If the coolant level has dropped, add coolant and repeat the steps from (g) onward.

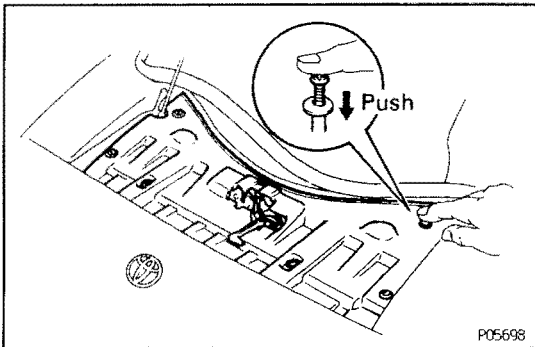


- (k) Completely tighten the water filler cap.



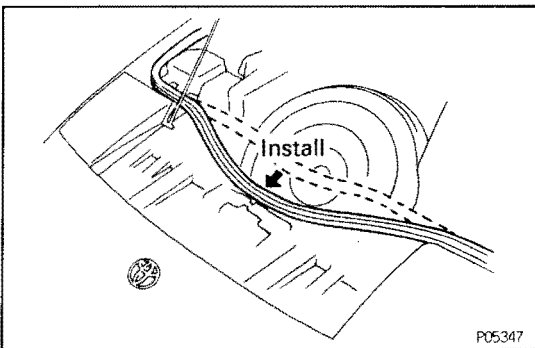
- (l) Fill coolant into the reservoir tank up to the "FULL" line.
- (m) Check coolant for leaks.

EG



6. INSTALL UPPER RADIATOR SUPPORT SEAL

- (a) Temporarily install the hood lock with the RH side bolt.
- (b) Place the support seal in position.
- (c) Install the hood lock with the 2 bolts.
- (d) Install the 7 clips.



- (e) Install the hood weatherstrip.

7. REINSTALL SPARE TIRE

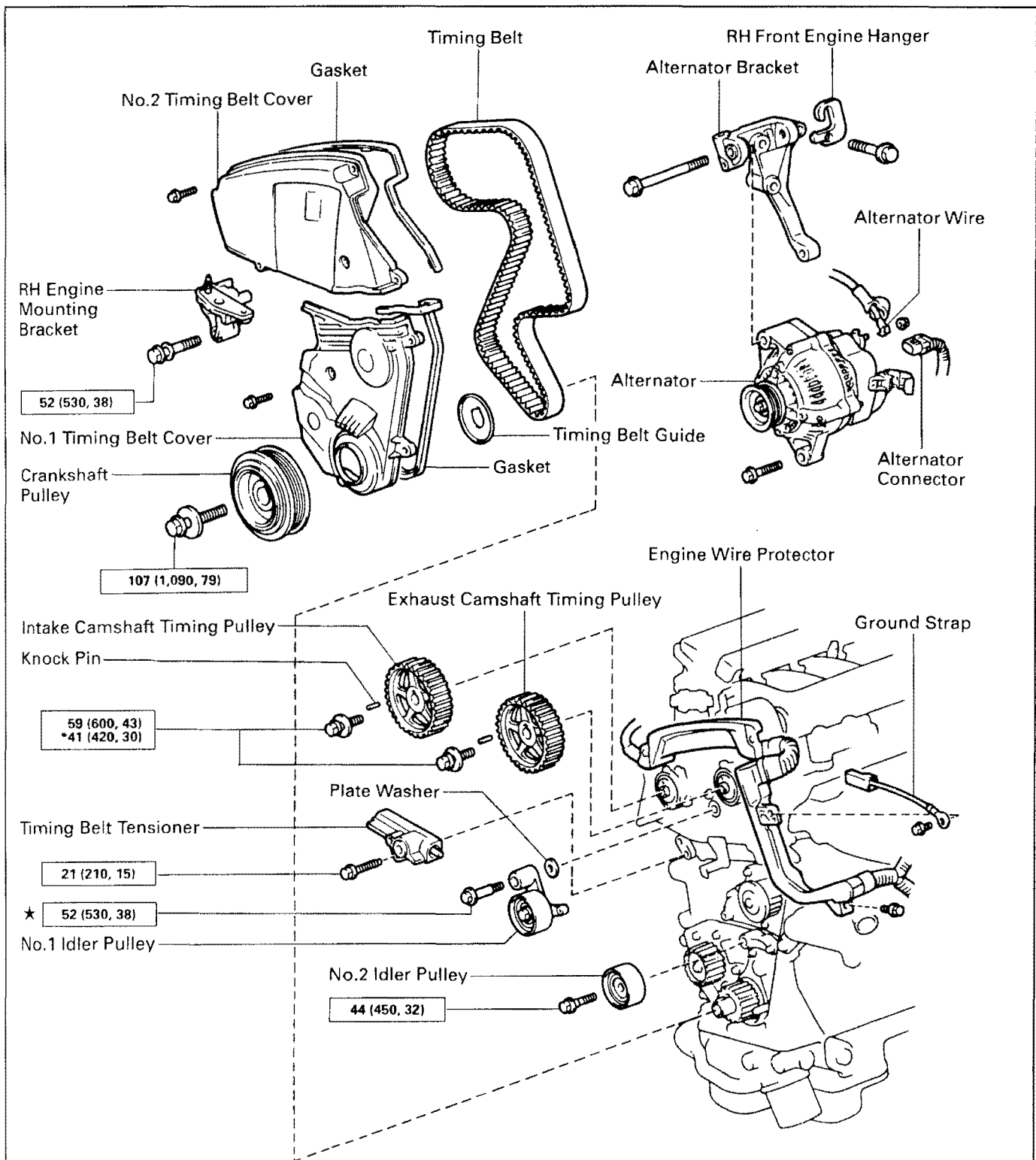
8. REINSTALL DASH PANEL FRONT TRIM COVER

9. REINSTALL REAR FUEL TANK PROTECTOR

WATER PUMP COMPONENTS FOR REMOVAL AND INSTALLATION (ST202)

EG138-03

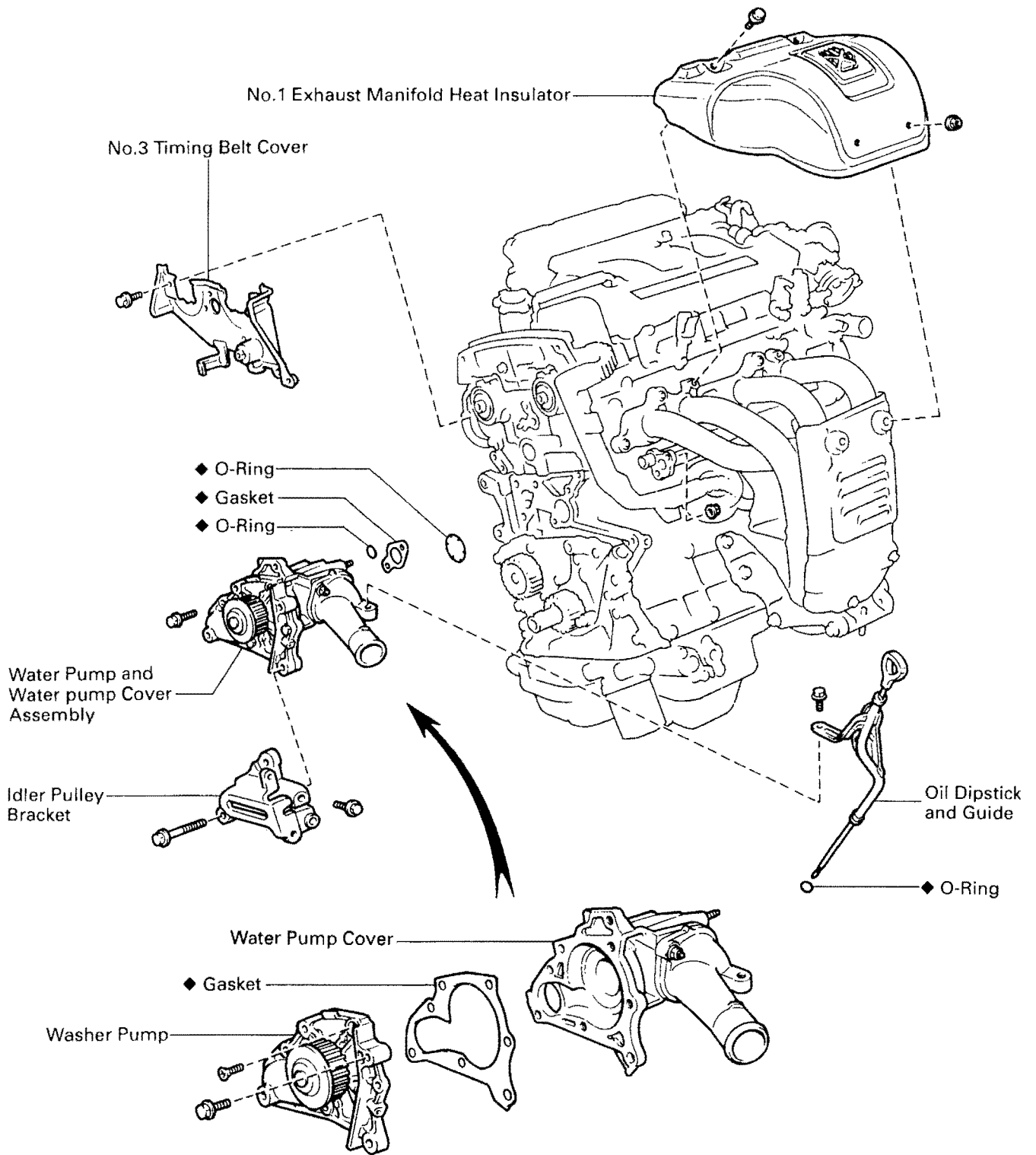
EG



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

- ★ Precoated part
- * For use with SST

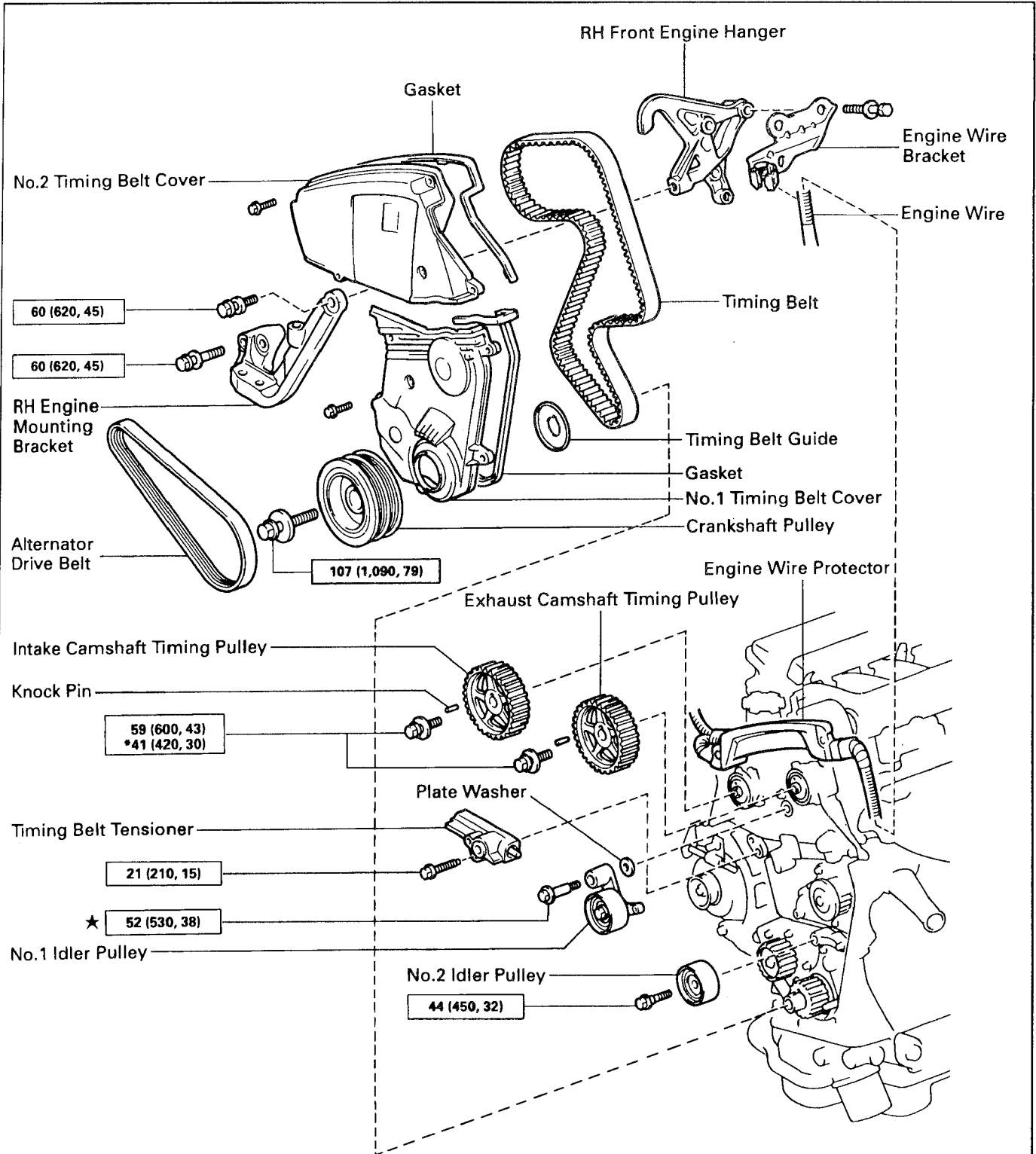
EG



◆ Non-reusable part

COMPONENTS FOR REMOVAL AND INSTALLATION (SW20)

EG

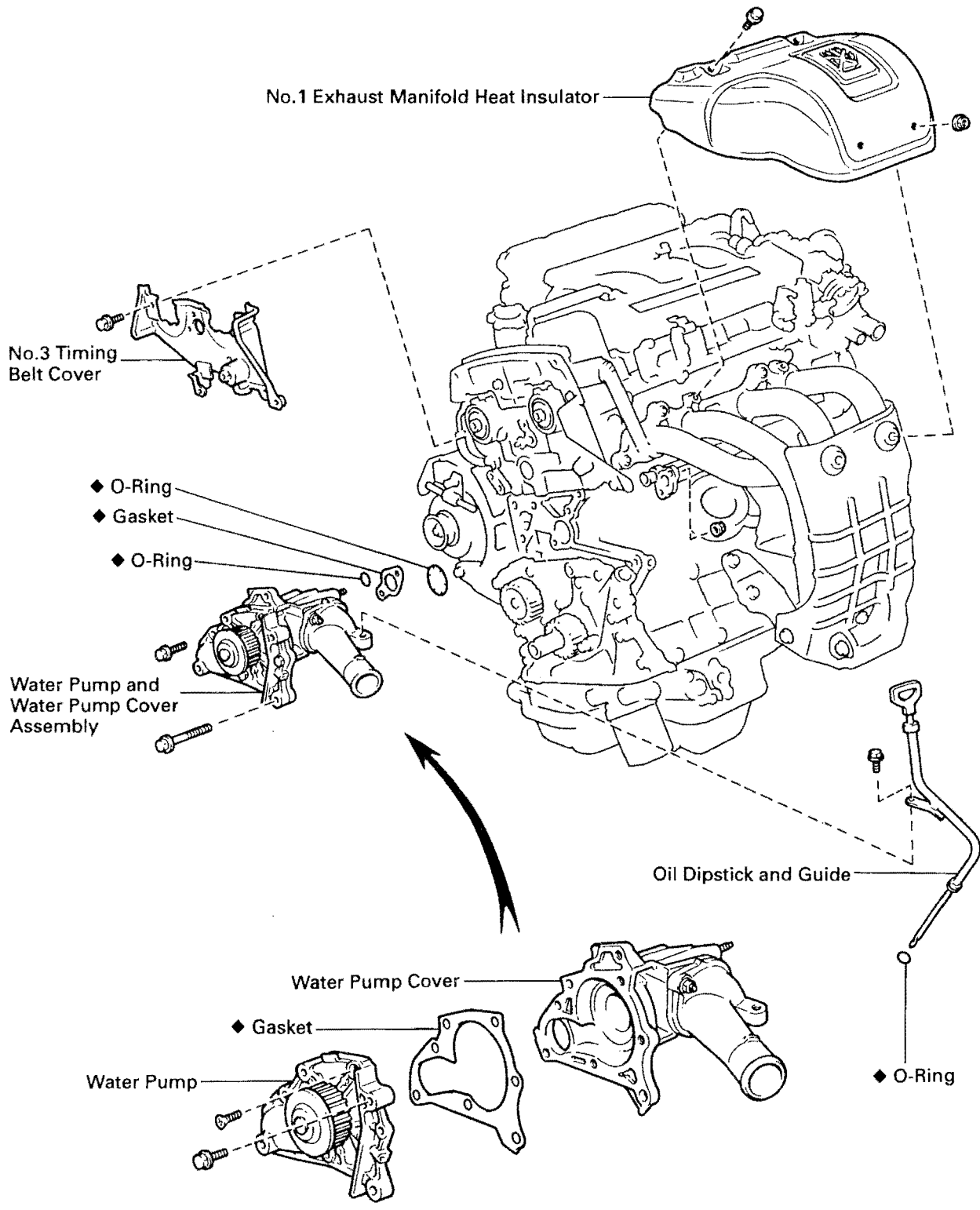


N·m (kgf·cm, ft·lbf) : Specified torque

★ Precoated part

* For use with SST

EG



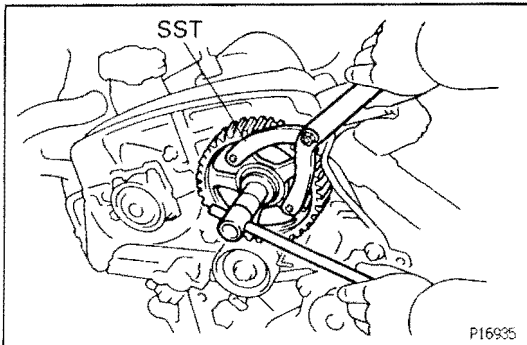
WATER PUMP REMOVAL

(See Components for Removal and Installation)

1. DRAIN ENGINE COOLANT

2. REMOVE TIMING BELT

(See steps 1 to 6 and 8 to 13 on pages EG-49 to 54)

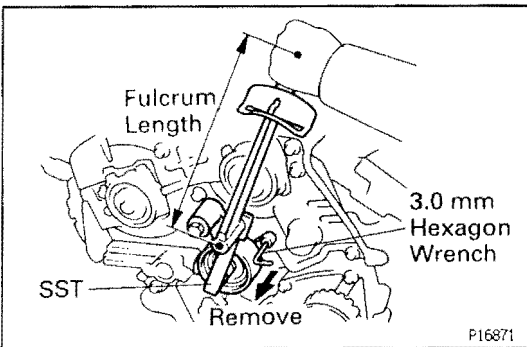


3. REMOVE EXHAUST CAMSHAFT TIMING PULLEY

(a) Using SST, loosen the pulley bolt.

SST 09960-10010 (09962-01000, 09963-01000)

(b) Remove the bolt, timing pulley and knock pin.



4. REMOVE NO.1 IDLER PULLEY

(a) Turn the No.1 idler pulley bolt to obtain the specified torque or less, and remove the 3.0 mm hexagon wrench.

Torque:

69 N·m (700 kgf·cm, 51 ft·lbf)

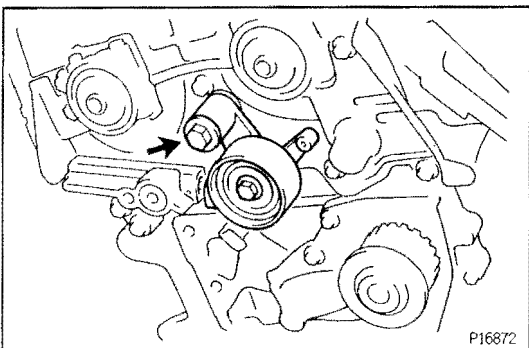
48 N·m (490 kgf·cm, 35 ft·lbf) for SST

HINT (On vehicle):

- Use SST.

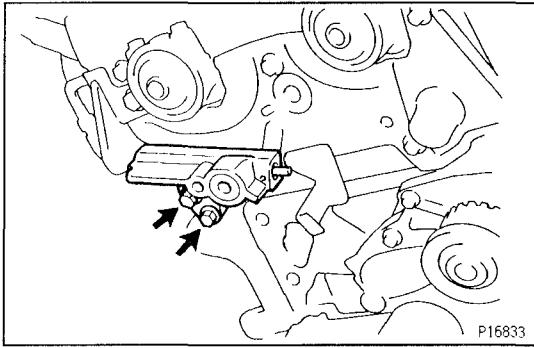
SST 09249-63010

- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).



(b) Remove the pivot bolt, pulley and plate washer.

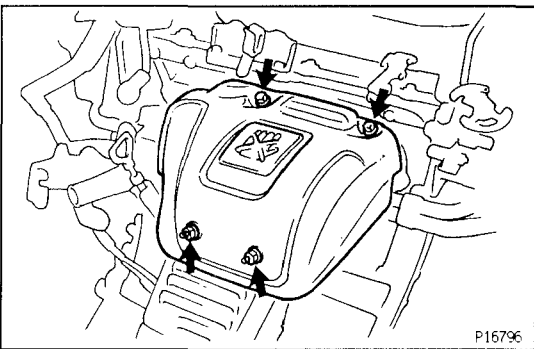
EG

**5. REMOVE TIMING BELT TENSIONER**

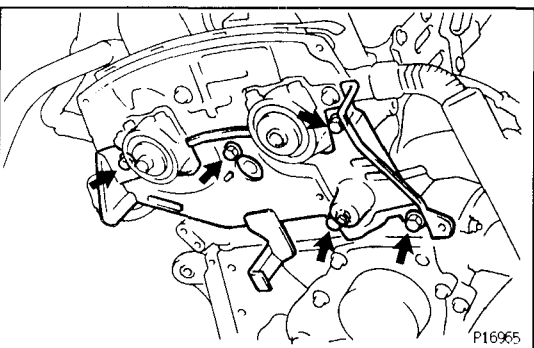
Remove the 2 bolts and tensioner.

**6. REMOVE NO.2 IDLER PULLEY**

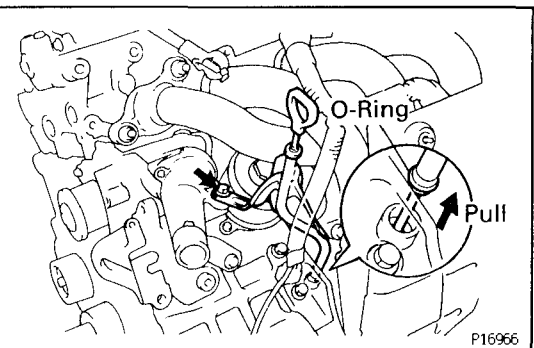
Remove the bolt and pulley.

7. DISCONNECT LOWER RADIATOR HOSE FROM WATER OUTLET**8. REMOVE NO.1 EXHAUST MANIFOLD HEAT INSULATOR**

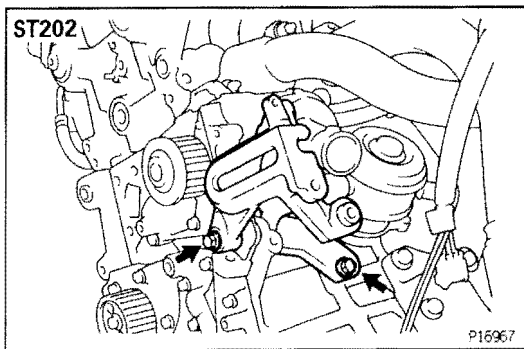
Remove the 2 bolts, 2 nuts and heat insulator.

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

Remove the 5 bolts and timing belt cover.

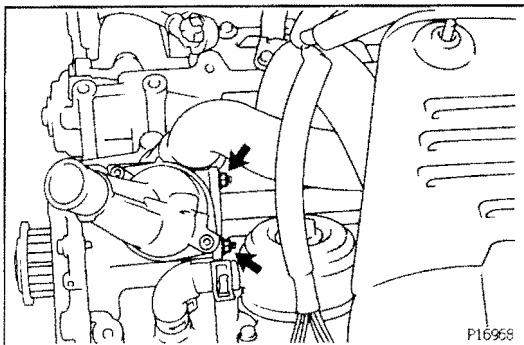
**10. REMOVE OIL DIPSTICK AND GUIDE**

- (a) Remove the bolt.
- (b) Pull out the oil dipstick guide, and remove it and the oil dipstick.
- (c) Remove the O-ring from the oil dipstick guide.



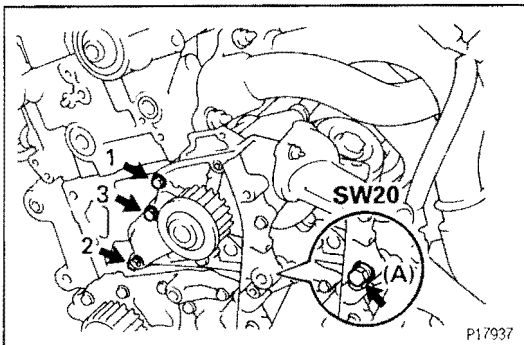
- 11. ST202:**
REMOVE IDLER PULLEY BRACKET FOR ALTERNATOR DRIVE BELT
 Remove the 2 bolts and idler pulley bracket.

EG

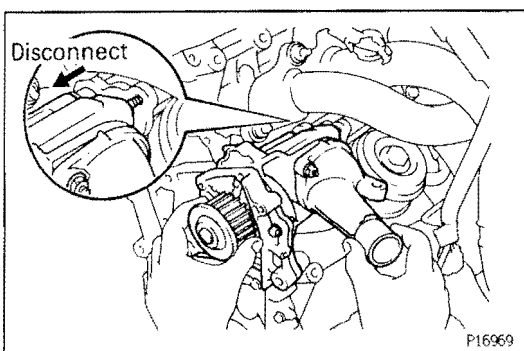


12. REMOVE WATER PUMP AND WATER PUMP COVER ASSEMBLY

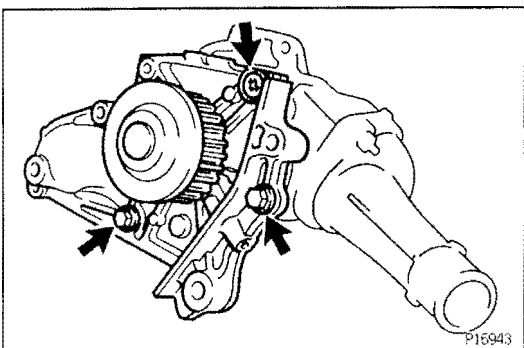
- (a) Remove the 2 nuts holding the water pump to the water bypass pipe.



- (b) SW20 w/o A/C:
 Remove the bolt (A).
- (c) Loosen and remove the 3 bolts in the sequence shown.

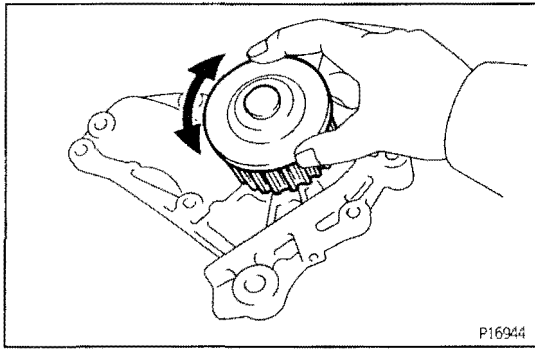


- (d) Disconnect the water pump cover from the water bypass pipe, and remove the water pump and water pump cover assembly.
- (e) Remove the gasket and 2 O-rings from the water pump and water bypass pipe.



13. REMOVE WATER PUMP FROM WATER PUMP COVER

- Remove the 2 bolts and screw, water pump and gasket.

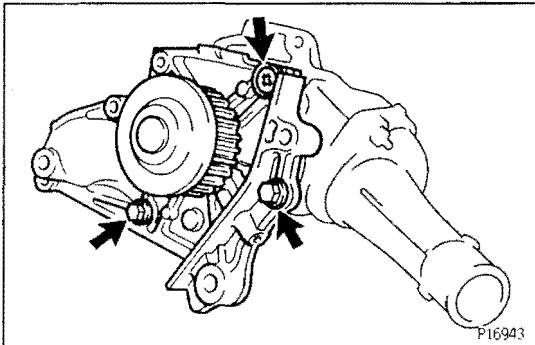


WATER PUMP INSPECTION

INSPECT WATER PUMP

Turn the pulley and check that the water pump bearing moves smoothly and quietly.

EG



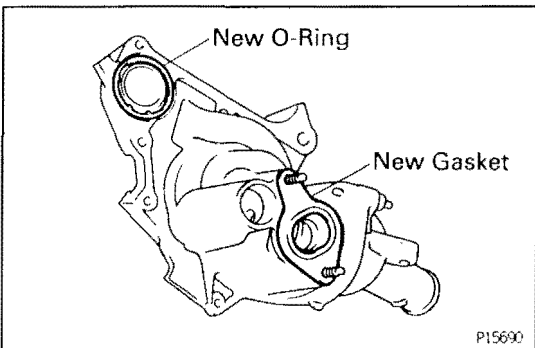
WATER PUMP INSTALLATION

(See Components for Removal and Installation)

1. INSTALL WATER PUMP TO WATER PUMP COVER

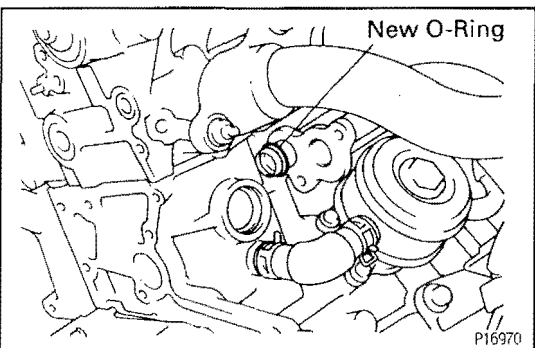
Install a new gasket and the water pump with the 2 bolts and screw.

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



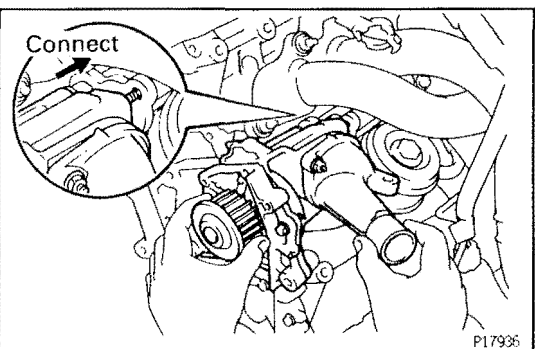
2. INSTALL WATER PUMP AND WATER PUMP COVER ASSEMBLY

(a) Install new O—ring and gasket to water pump cover.

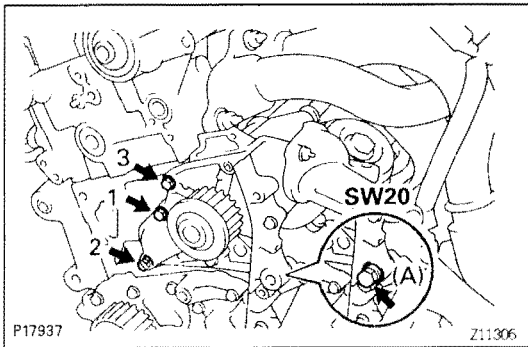


(b) Install a new O—ring to the water bypass pipe.

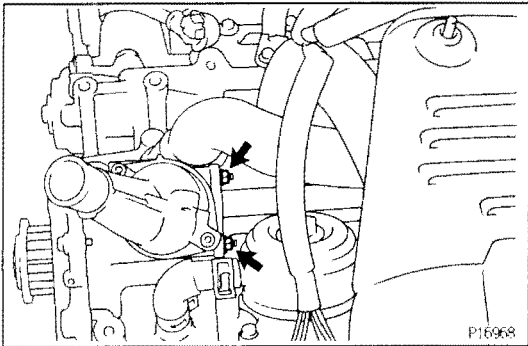
(c) Apply soapy water to the O—ring on the water bypass pipe.



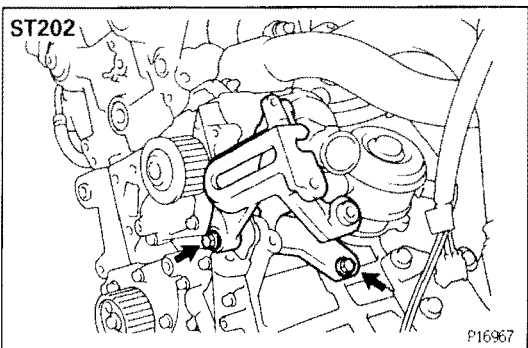
(d) Connect the water pump cover to the water bypass pipe. Do not install the nuts yet.



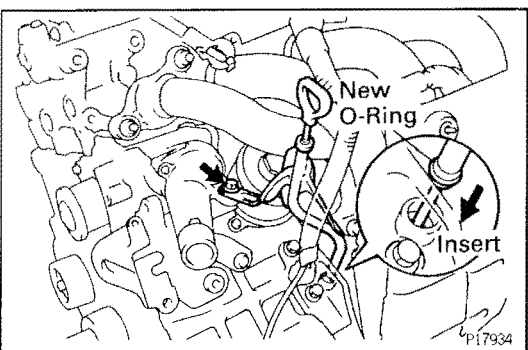
- (e) Install the water pump with the 3 bolts. Tighten the bolts in the sequence shown.
Torque: 7.5 N·m (76 kgf·cm, 66 in.-lbf)
- (f) SW20 w/o A/C:
Install the bolt (A).
Torque: 19 N·m (190 kgf·cm, 14 ft-lbf)



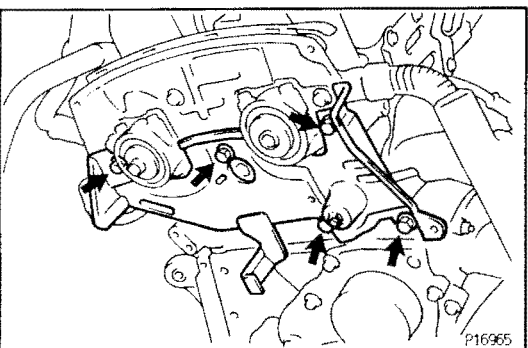
- (g) Install the 2 nuts holding the water pump cover to the water bypass pipe.
Torque: 10 N·m (100 kgf·cm, 7 ft-lbf)



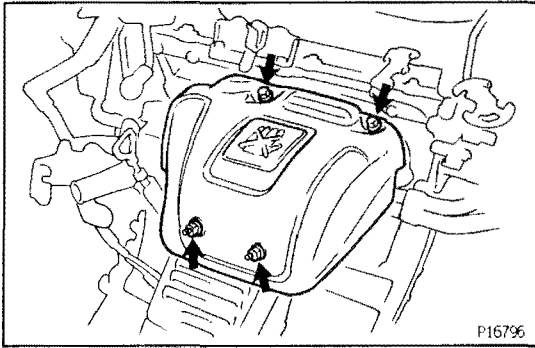
3. **ST202:**
INSTALL IDLER PULLEY BRACKET FOR ALTERNATOR DRIVE BELT
Install the idler pulley bracket with the 2 bolts.
Torque:
 Water pump side
 19 N·m (190 kgf·cm, 14 ft-lbf)
 Cylinder block side
 23 N·m (230 kgf·cm, 17 ft-lbf)



4. **INSTALL OIL DIPSTICK AND GUIDE**
- (a) Install a new O—ring to the oil dipstick guide.
(b) Apply soapy water to the O—ring.
(c) Insert the oil dipstick guide into the guide hole of the cylinder block.
(d) Install the oil dipstick and guide with the bolt.

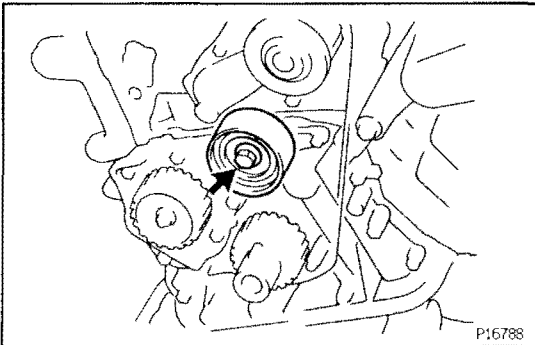


5. **INSTALL NO.3 TIMING BELT COVER**
Install the timing belt cover with the 5 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.-lbf)
6. **CONNECT LOWER RADIATOR HOSE TO WATER INLET**



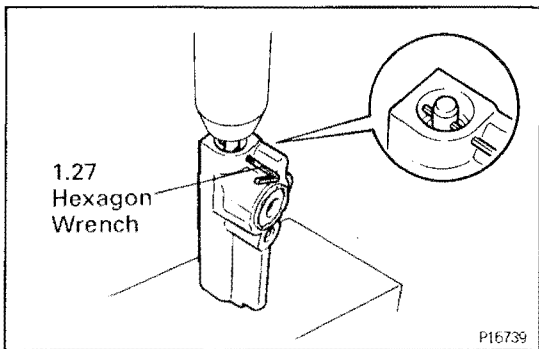
7. INSTALL NO.1 EXHAUST MANIFOLD HEAT INSULATOR

Install the heat insulator with the 2 bolts and 2 nuts.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)



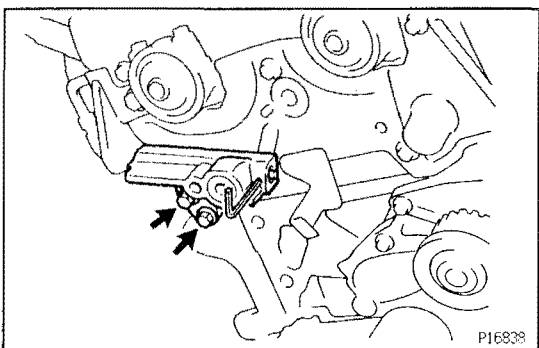
8. INSTALL NO.2 IDLER PULLEY

- (a) Install the pulley with the bolt.
Torque: 44 N·m (450 kgf·cm, 32 ft·lbf)
- (b) Check that the idler pulley moves smoothly.



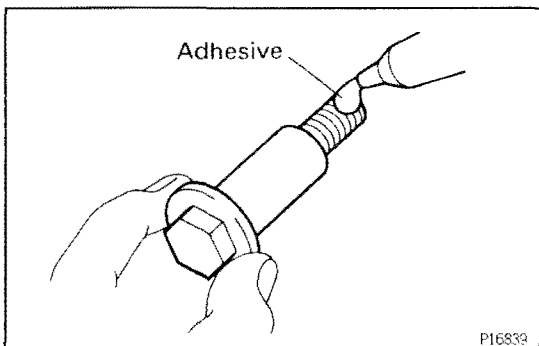
9. SET TIMING BELT TENSIONER

- (a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of force.
- (b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
- (c) Release the press.



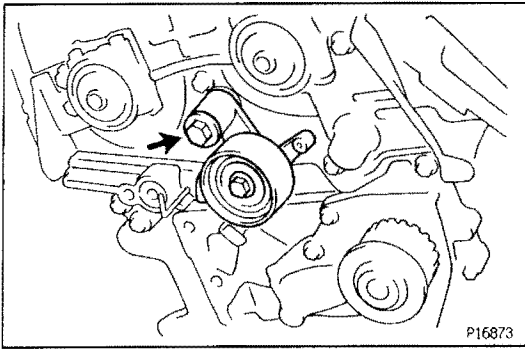
10. INSTALL TIMING BELT TENSIONER

Install the tensioner with the 2 bolts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



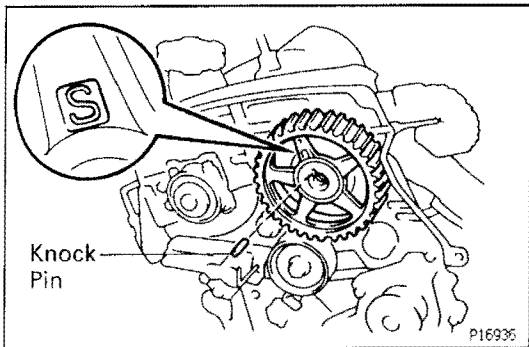
11. INSTALL NO.1 IDLER PULLEY

- (a) Apply adhesive to 2 or 3 threads of the pivot bolt.
Adhesive:
Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent



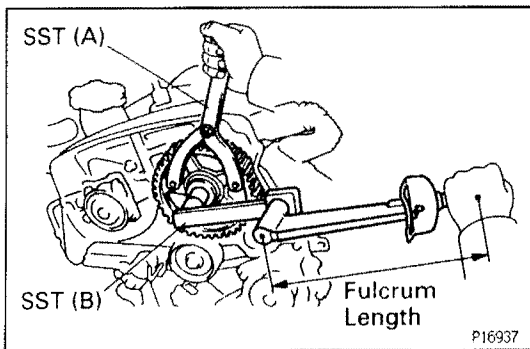
- (b) Install the plate washer and pulley with the pivot bolt.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)
- (c) Check that the idler pulley moves smoothly.

EG



12. INSTALL EXHAUST CAMSHAFT TIMING PULLEY

- (a) Slide the timing pulley onto the camshaft, facing mark "S" outward.
- (b) Align the pin holes of the camshaft and timing pulley, and insert the knock pin.



- (c) Using SST (A), install the pulley bolt.
SST 09960–10010 (09962–01000, 09963–01000)

Torque:

59 N·m (600 kgf·cm, 43 ft·lbf)

41 N·m (420 kgf·cm, 30 ft·lbf) for SST

HINT (On vehicle):

- Use SST (B).
SST 09249–63010
- Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

13. INSTALL TIMING BELT

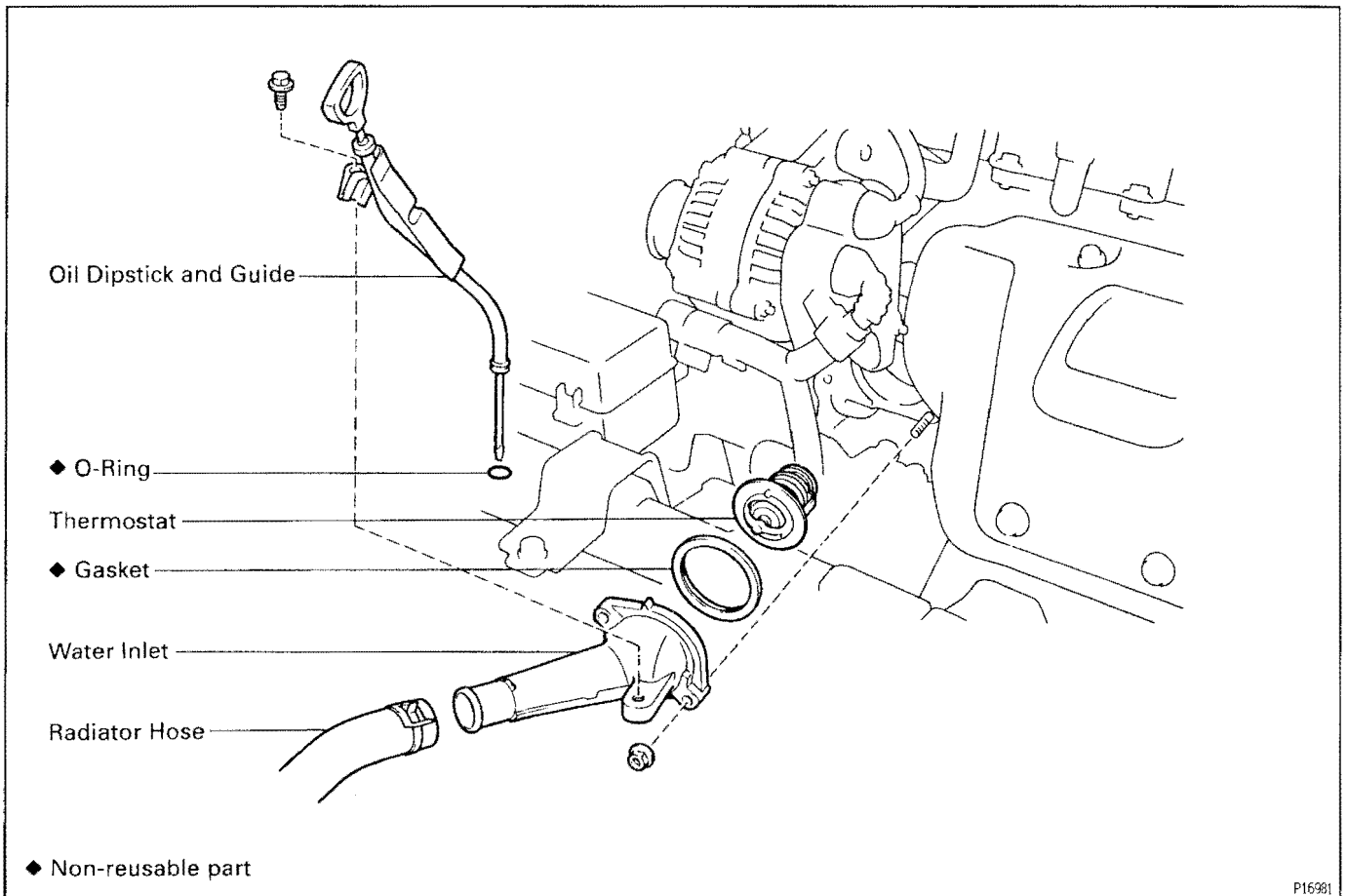
(See steps 7 to 12 and 14 to 20 on pages EG–59 to 65)

14. FILL WITH ENGINE COOLANT

15. START ENGINE AND CHECK FOR COOLANT LEAKS

THERMOSTAT COMPONENTS FOR REMOVAL AND INSTALLATION

EG120-08



THERMOSTAT REMOVAL

EG419-01

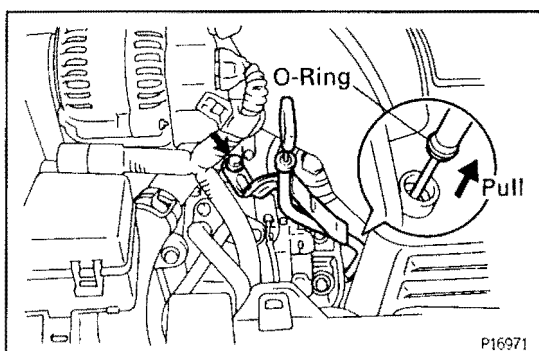
(See Components for Removal and Installation)

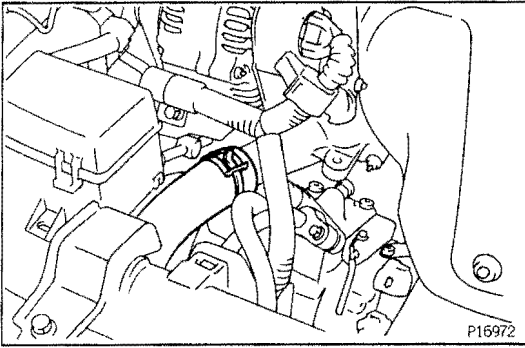
HINT: Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. DRAIN ENGINE COOLANT

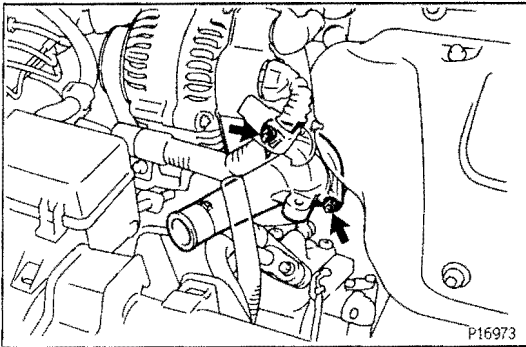
2. REMOVE OIL DIPSTICK AND GUIDE

- (a) Remove the bolt.
- (b) Pull out the oil dipstick guide, and remove it and the oil dipstick.
- (c) Remove the O-ring from the oil dipstick guide.

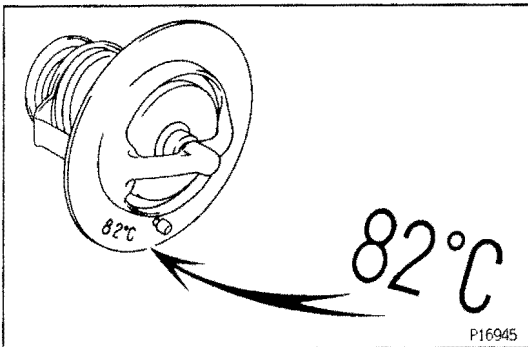




3. DISCONNECT RADIATOR HOSE FROM WATER INLET



4. REMOVE WATER INLET AND THERMOSTAT
- Remove the 2 nuts, water inlet and thermostat.
 - Remove the gasket from the thermostat.

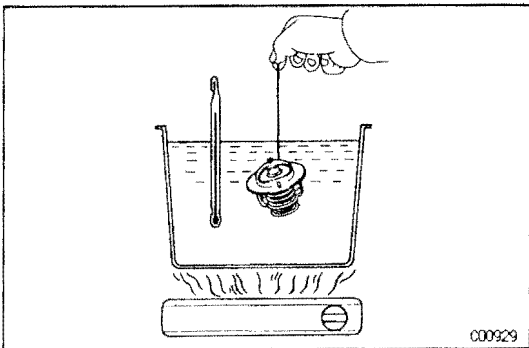


THERMOSTAT INSPECTION

EG13H-06

INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.

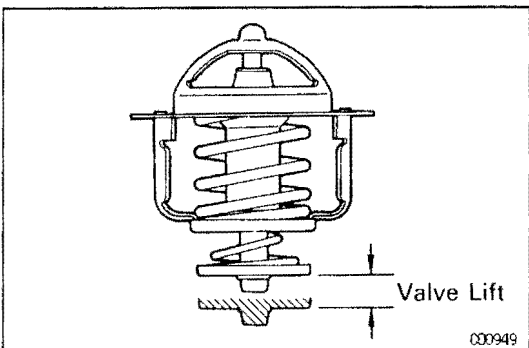


- Immerse the thermostat in water and gradually heat the water.
- Check the valve opening temperature.

Valve opening temperature:

80 — 84°C (176 — 183°F)

If the valve opening temperature is not as specified, replace the thermostat.



- Check the valve lift.

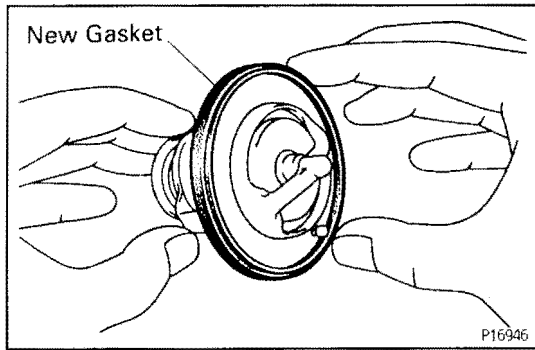
Valve lift:

10 mm (0.39 in.) or more at 95°C (203°F)

If the valve lift is not as specified, replace the thermostat.

- Check that the valve spring is tight when the thermostat is fully closed.

If not closed, replace the thermostat.

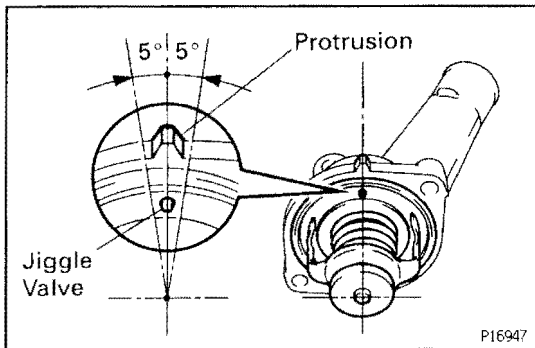


THERMOSTAT INSTALLATION

(See Components for Removal and Installation)

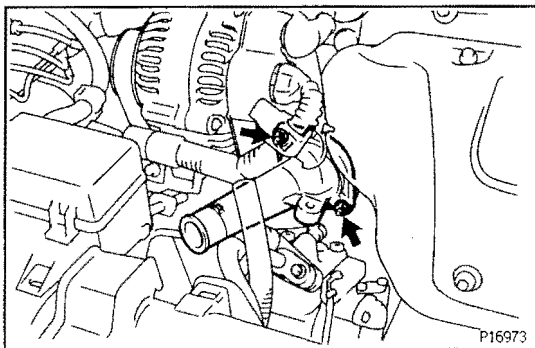
1. PLACE THERMOSTAT IN WATER PUMP

- (a) Install a new gasket to the thermostat.



- (b) Align the jiggle valve of the thermostat with the protrusion of the water inlet, and insert the thermostat in the water inlet.

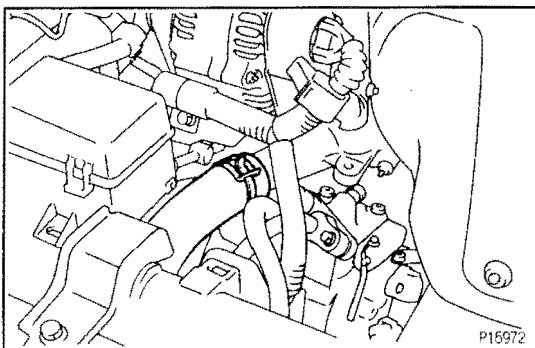
HINT: The jiggle valve may be set within 5° of either side of the prescribed position.



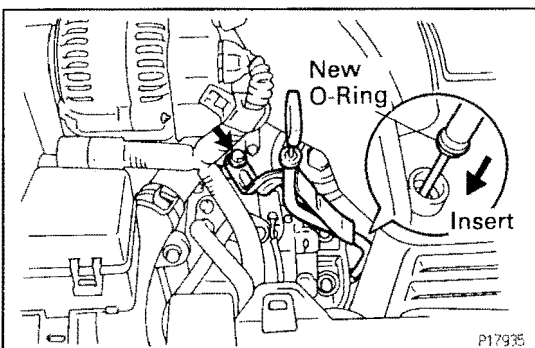
2. INSTALL WATER INLET AND THERMOSTAT

Install the water inlet and thermostat with the 2 nuts.

Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)



3. CONNECT RADIATOR HOSE TO WATER INLET



4. INSTALL OIL DIPSTICK AND GUIDE

- (a) Install a new O-ring to the oil dipstick guide.
 (b) Apply soapy water to the O-ring.
 (c) Insert the oil dipstick guide into the guide hole of the cylinder block.
 (d) Install the oil dipstick and guide with the bolt.

5. FILL WITH ENGINE COOLANT

6. START ENGINE AND CHECK FOR LEAKS

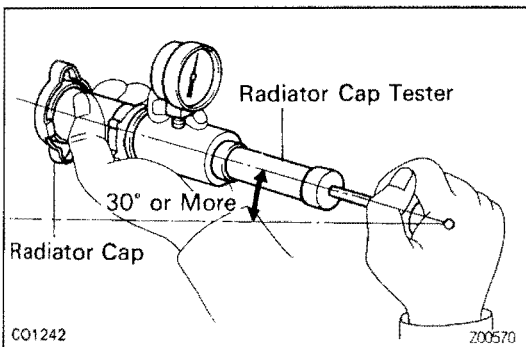
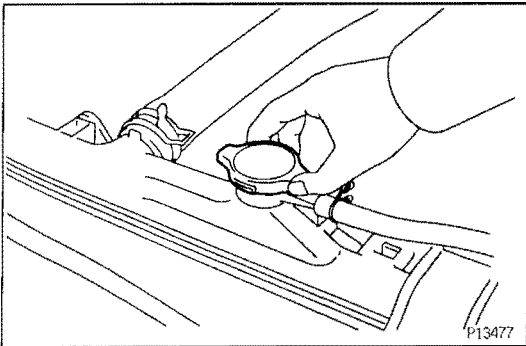
7. CHECK ENGINE OIL LEVEL

RADIATOR (ST202) RADIATOR CLEANING

E02UP-04

Using water or a steam cleaner, remove any mud and 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/cm², 427 – 498 psi), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.



RADIATOR INSPECTION

1. REMOVE RADIATOR CAP

CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

2. 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:

1st time

1 push/1 second or less

2nd time or more

Any speed

Standard opening pressure:

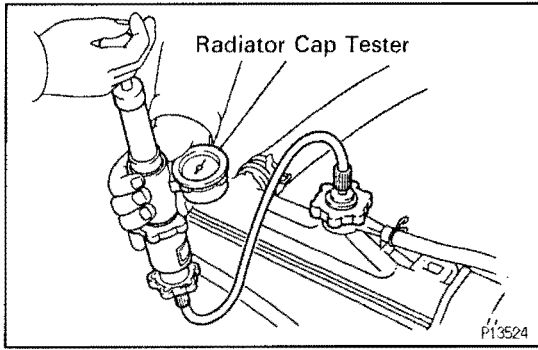
74 – 103 kPa

(0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)

Minimum opening pressure:

59 kPa (0.6 kgf/cm², 8.5 psi)

If the opening pressure is less than minimum, replace the radiator cap.

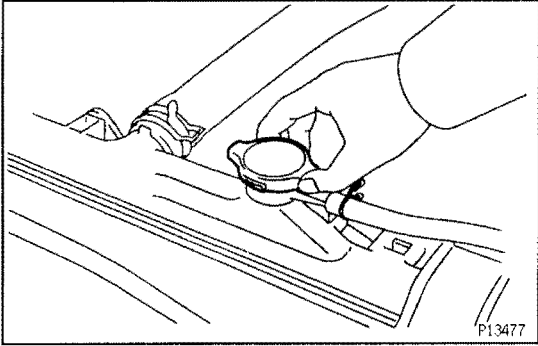


3. INSPECT COOLING SYSTEM FOR LEAKS

- (a) Fill the radiator with coolant, and attach a radiator cap tester to the water filler.
- (b) Warm up the engine.
- (c) Pump it to 118 kPa (1.2 kgf/cm², 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 cylinder head.

4. REINSTALL RADIATOR CAP



RADIATOR

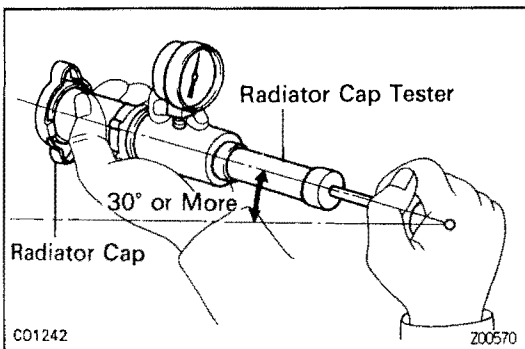
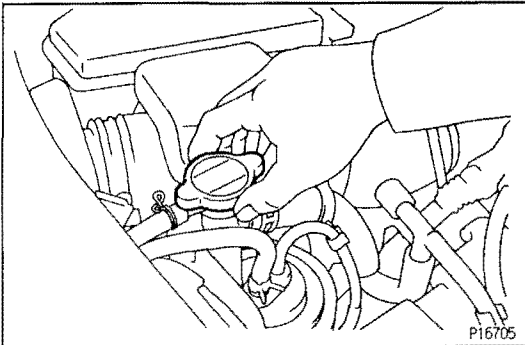
(SW20)

RADIATOR CLEANING

EQ2UP-06

Using water or a steam cleaner, remove any mud and 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/cm², 427 – 498 psi), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.



RADIATOR INSPECTION

1. REMOVE WATER FILLER CAP

CAUTION: To avoid the danger of being burned, do not remove the water filler cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

2. INSPECT WATER FILLER 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 water filler cap.

- (b) Pump the tester several times, and measure the relief valve opening pressure.

Pump speed:

1st time

1 push/1 second or less

2nd time or more

Any speed

Standard opening pressure:

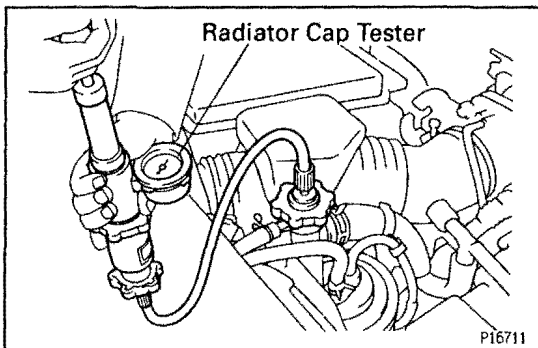
74 – 103 kPa

(0.75 – 1.05 kgf/cm², 10.7 – 14.9 psi)

Minimum opening pressure:

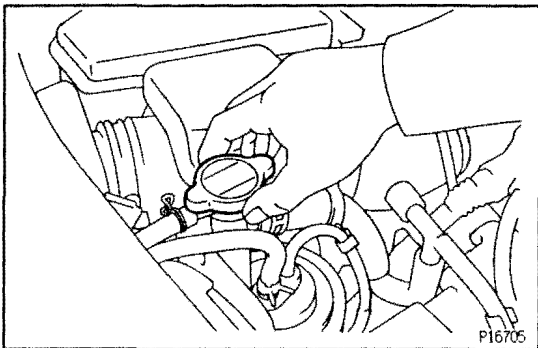
59 kPa (0.6 kgf/cm², 8.5 psi)

If the opening pressure is less than minimum, replace the water filler cap.

**3. INSPECT COOLING SYSTEM FOR LEAKS**

- (a) Fill the system with coolant, and attach a radiator cap tester to the water filler.
- (b) Warm up the engine.
- (c) Pump it to 118 kPa (1.2 kgf/cm², 17.1 psi), and check that the pressure does not drop.

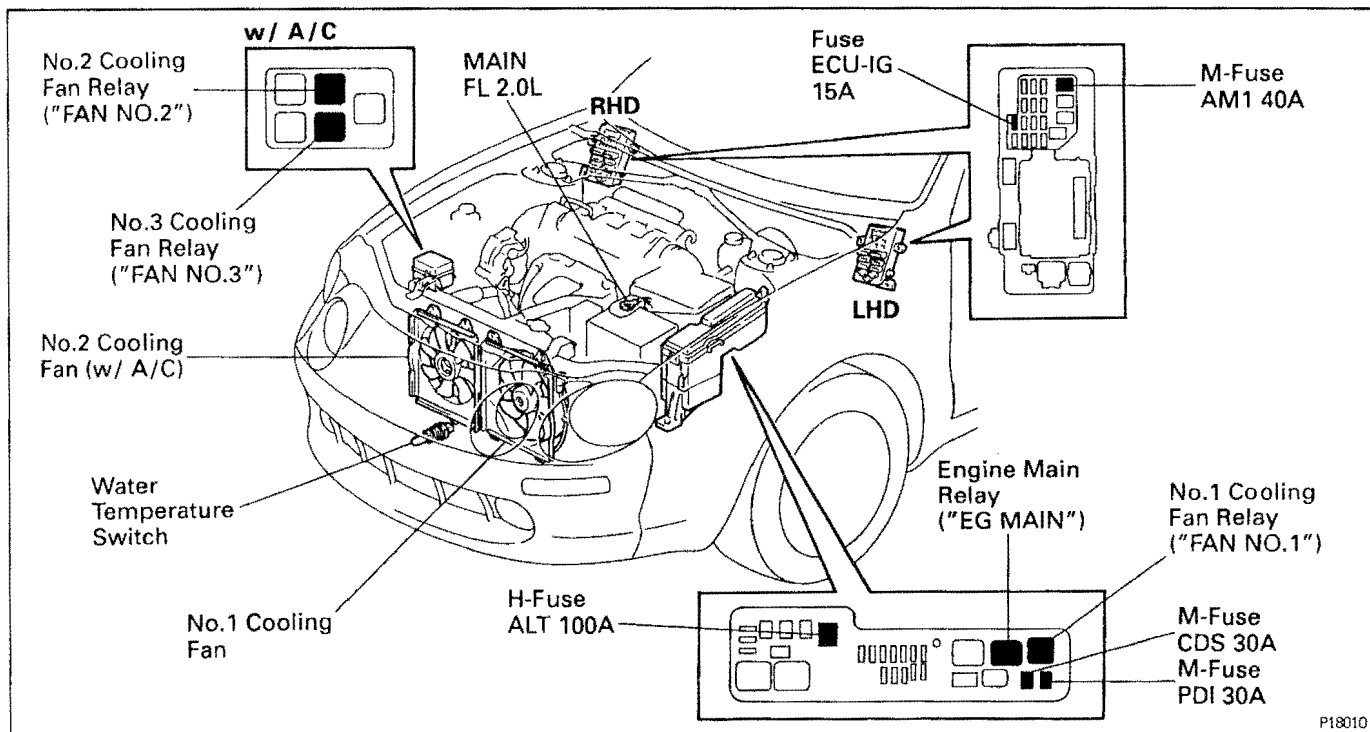
If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, cylinder block and cylinder head.

4. REINSTALL WATER FILLER CAP

ELECTRIC COOLING FAN (ST202)

Part Location

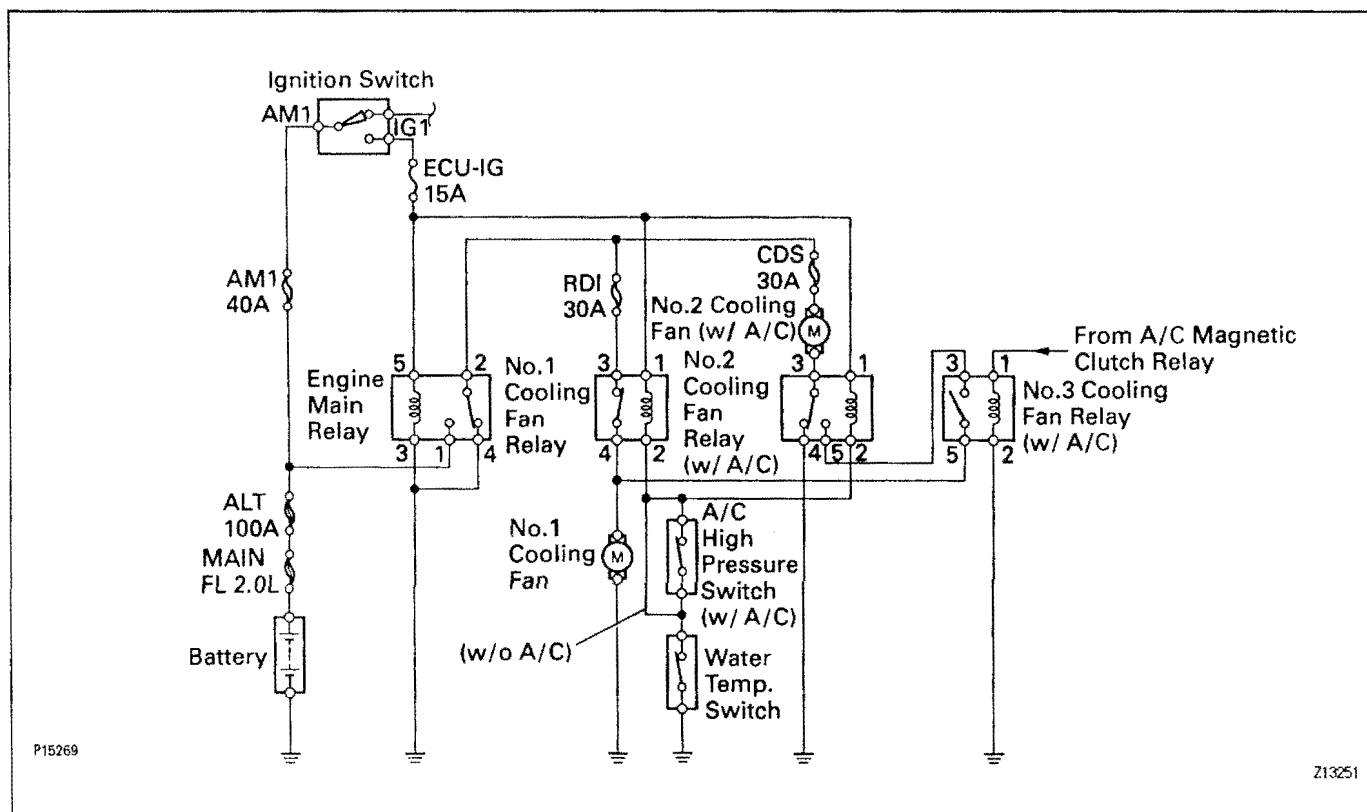
E0078-12



P18010

System Circuit

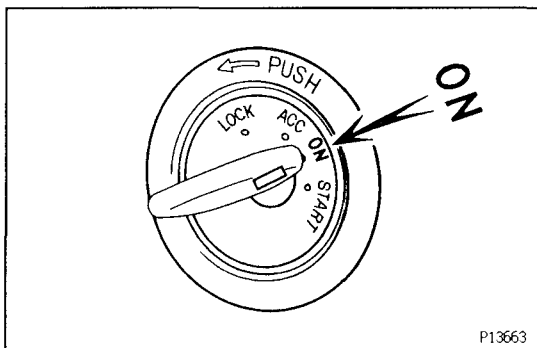
E007C-0W



P15269

Z13251

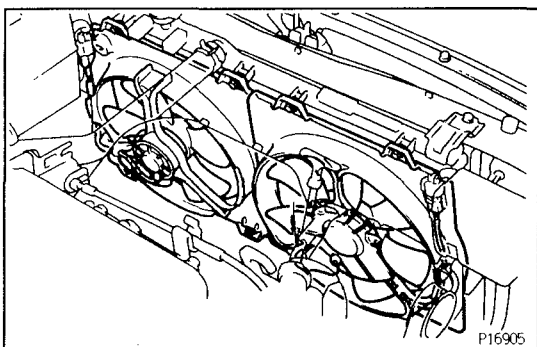
EG



On – Vehicle Inspection

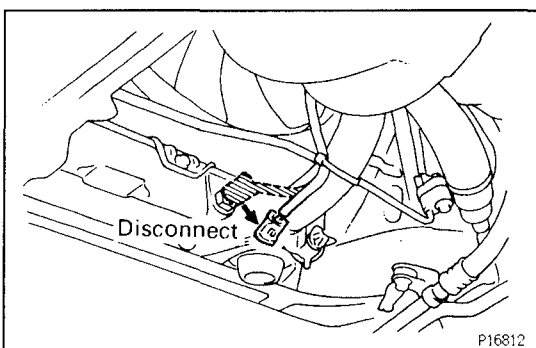
1. CHECK COOLING FAN OPERATION WITH LOW TEMPERATURE (Below 83°C (181°F))

(a) Turn the ignition switch ON.

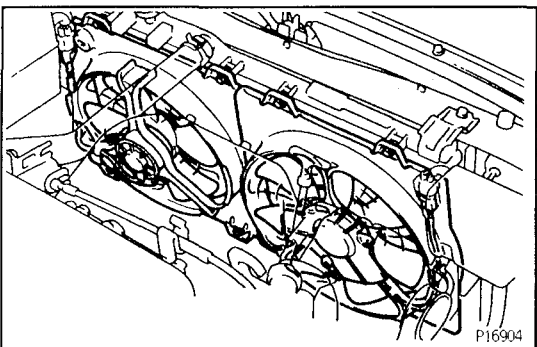


(b) Check that the cooling fan stops.

If not, check the cooling fan relay and water temperature switch, and check for a separated connector or severed wire between the cooling fan relay and water temperature switch.

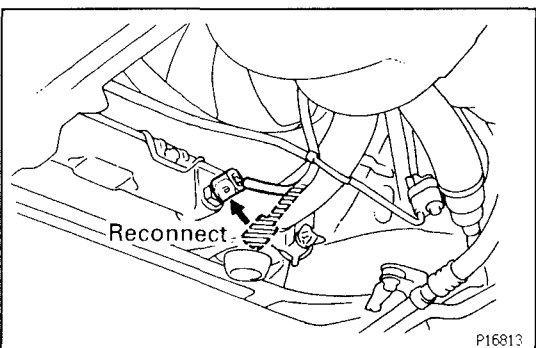


(c) Disconnect the water temperature switch connector.

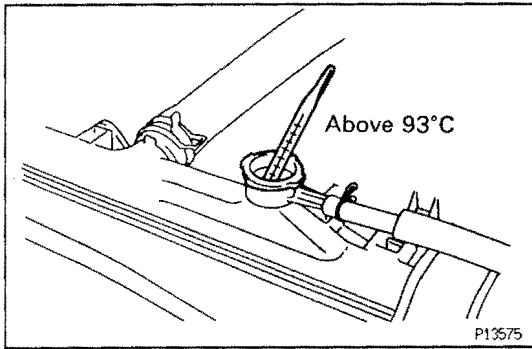


(d) Check that the cooling fan rotates.

If not, check the fan main relay, cooling fan relay, cooling fan, fuses, and check for short circuit between the cooling fan relay and water temperature switch.

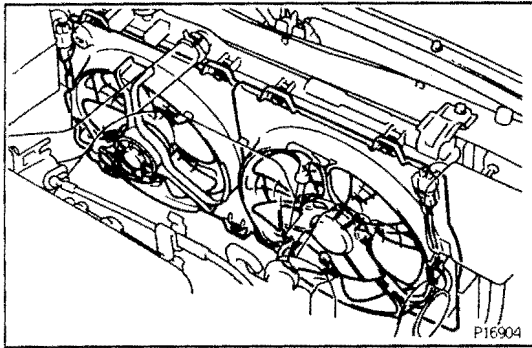


(e) Reconnect the water temperature switch connector.

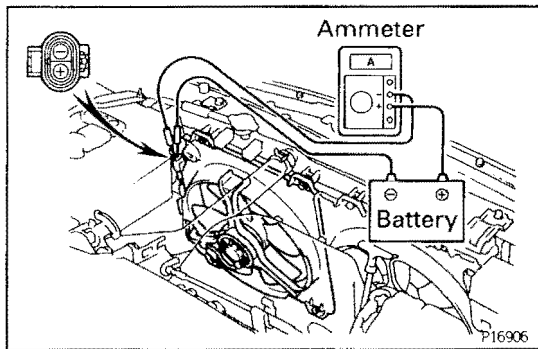
**2. CHECK COOLING FAN OPERATION WITH HIGH TEMPERATURE (Above 93°C (199°F))**

- (a) Start the engine, and raise coolant temperature to above 93°C (199°F).

EG



- (b) Check that the cooling fan rotates.
If not, replace the water temperature switch.

No.1 Cooling Fan**NO.1 COOLING FAN INSPECTION****1. DISCONNECT COOLING FAN CONNECTOR****2. INSPECT NO.1 COOLING FAN**

- (a) Connect battery and ammeter to the cooling fan connector.
- (b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

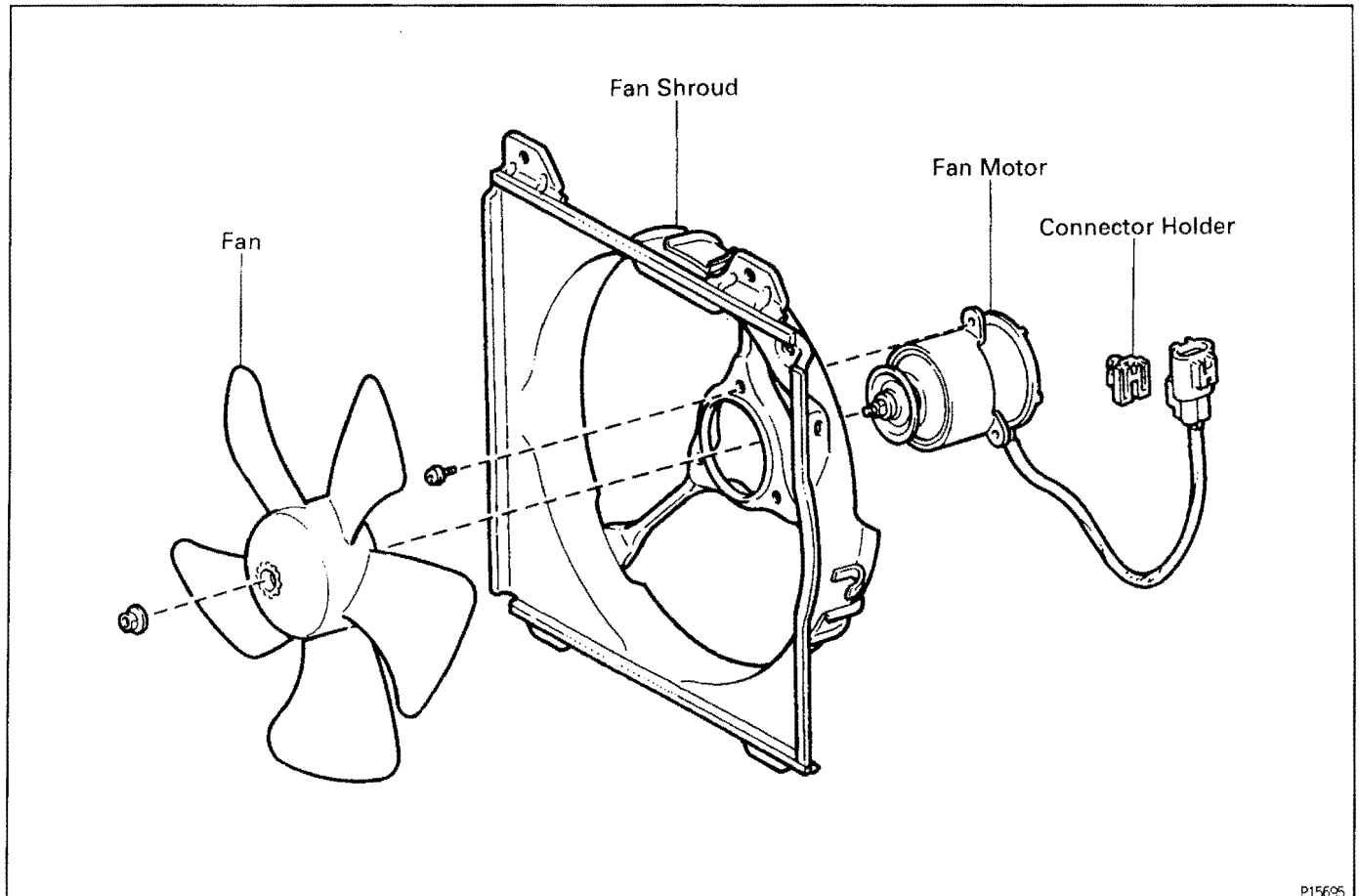
Standard amperage:

5.7 – 7.7 A

3. RECONNECT COOLING FAN CONNECTOR

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

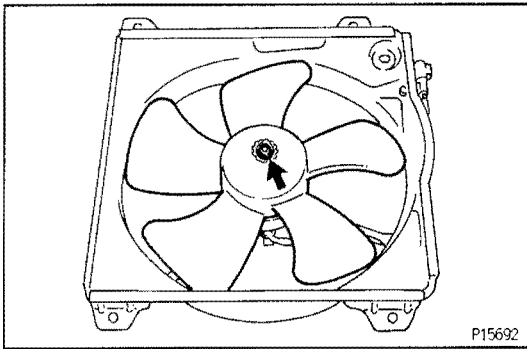
EG078-13



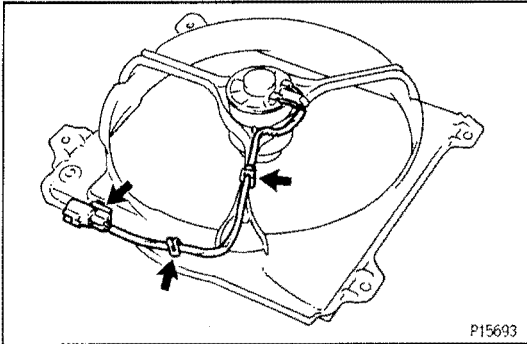
P15695

NO.1 COOLING FAN DISASSEMBLY**(See Components for Disassembly and Assembly)****1. REMOVE FAN**

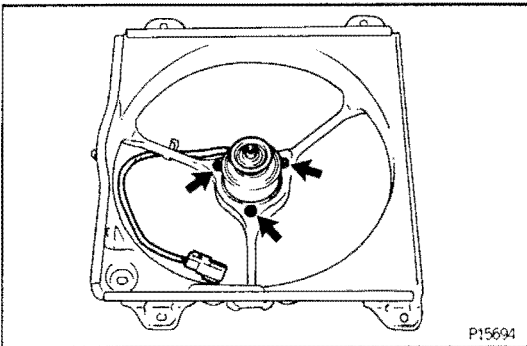
Remove the nut and fan.

**2. REMOVE FAN MOTOR**

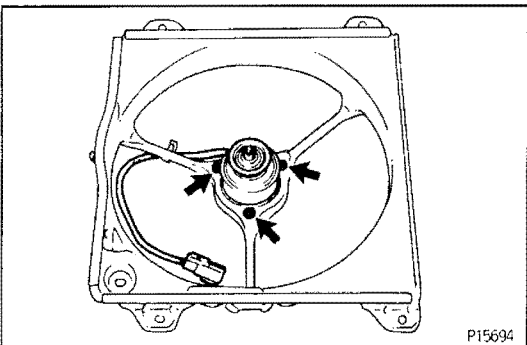
(a) Disconnect the wire and connector from the fan shroud.



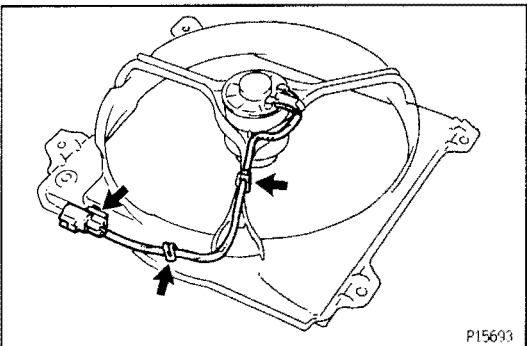
(b) Remove the 3 screws and fan motor.

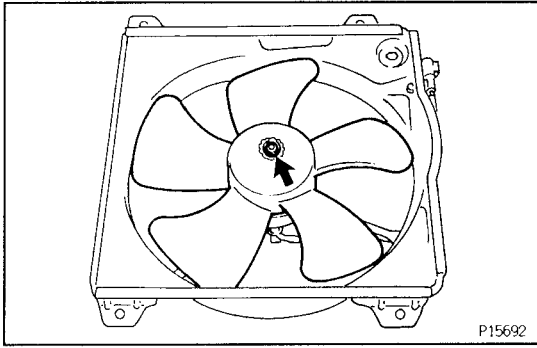
**NO.1 COOLING FAN ASSEMBLY****(See Components for Disassembly and Assembly)****1. INSTALL FAN MOTOR**

(a) Install the fan motor with the 3 screws.



(b) Install the wire and connector to the fan shroud.



**2. INSTALL FAN**

Install the fan with the nut.

EG

No.2 Cooling Fan (w/ A/C) NO.2 COOLING FAN INSPECTION

1. DISCONNECT COOLING FAN CONNECTOR

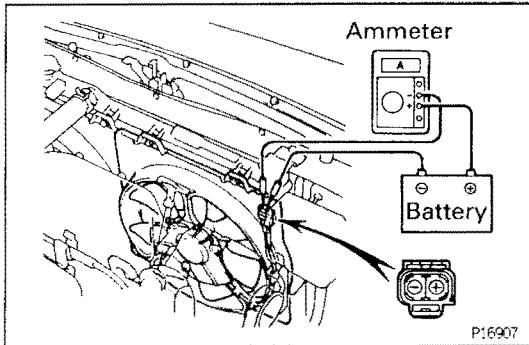
2. INSPECT NO.2 COOLING FAN

- (a) Connect battery and ammeter to the cooling fan connector.
- (b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

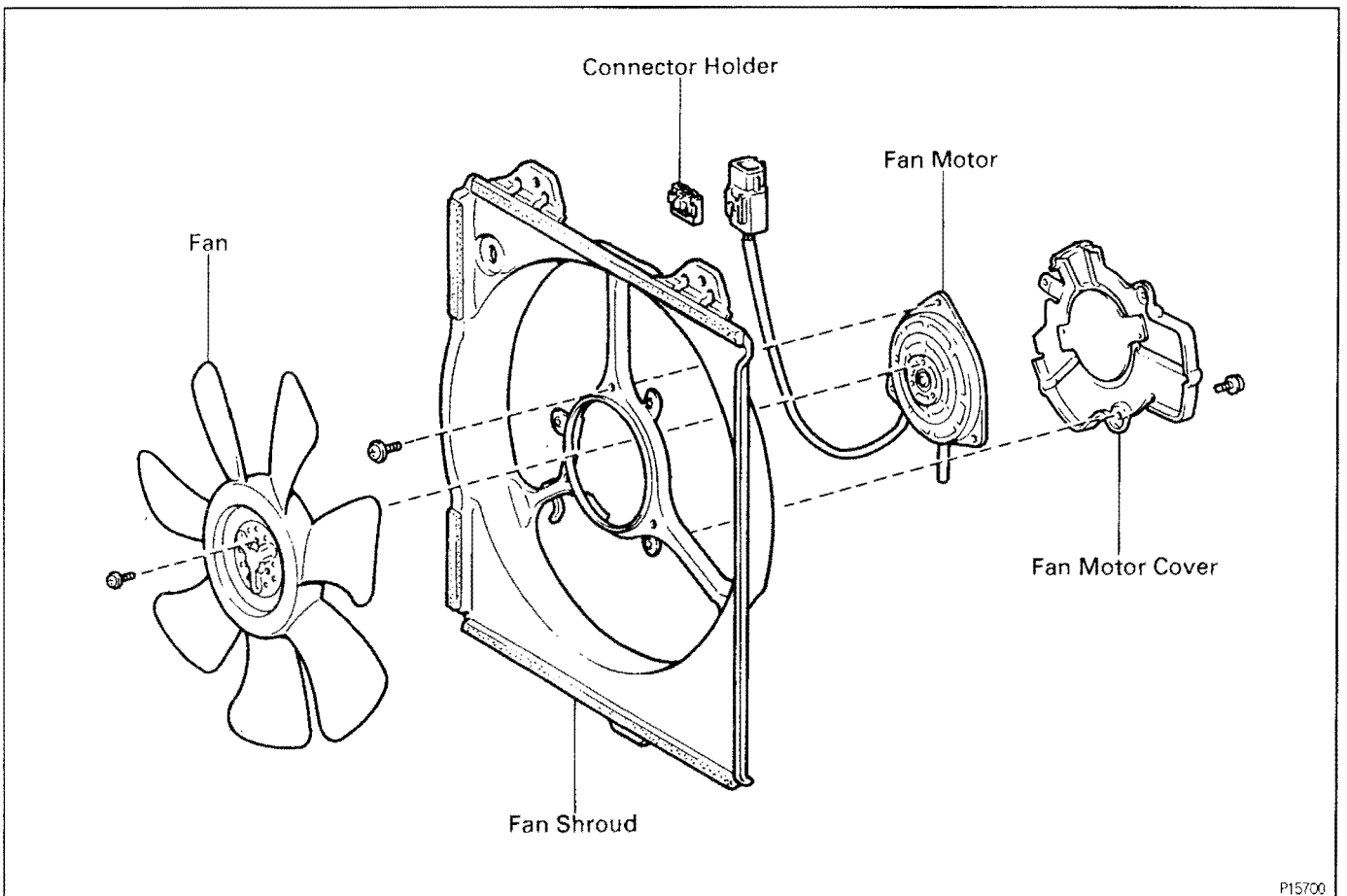
Standard amperage:

5.7 – 7.7 A

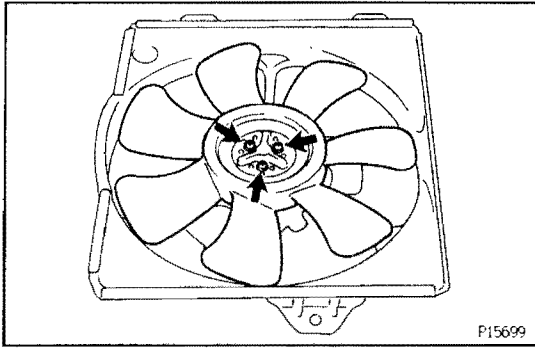
3. RECONNECT COOLING FAN CONNECTOR



COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



EG

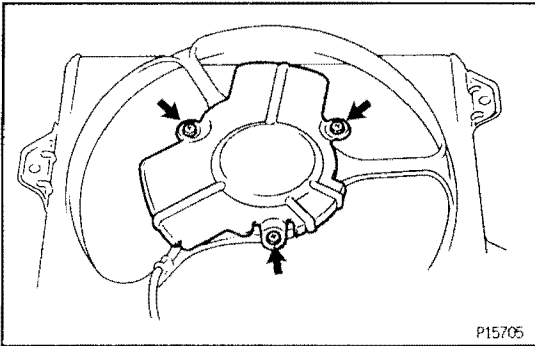


NO.2 COOLING FAN DISASSEMBLY

(See Components for Disassembly and Assembly)

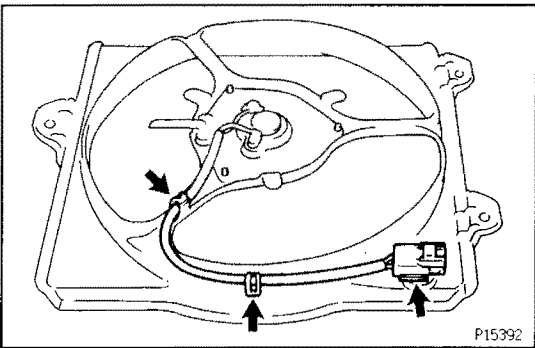
1. REMOVE FAN

Remove the 3 screws and fan.



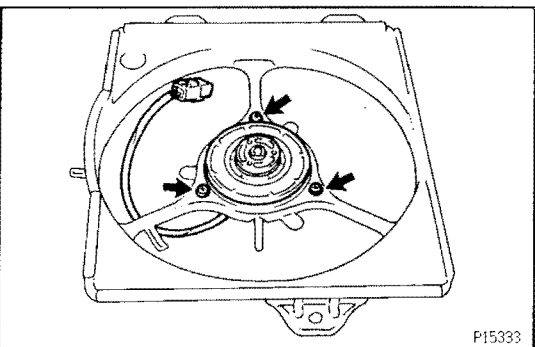
2. REMOVE FAN MOTOR COVER

Remove the 3 screws and motor cover.

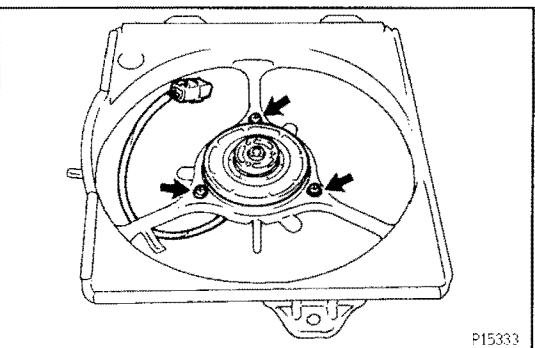


3. REMOVE FAN MOTOR

- (a) Disconnect the wire and connector from the fan shroud.



- (b) Remove the 3 screws and fan motor.

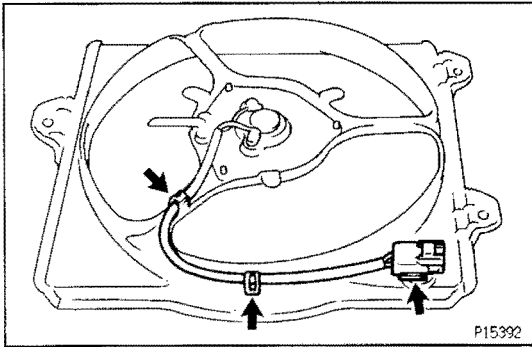


NO.2 COOLING FAN ASSEMBLY

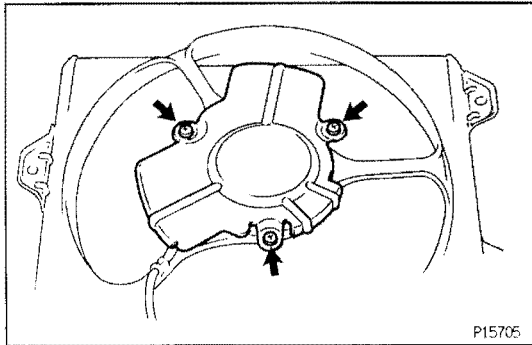
(See Components for Disassembly and Assembly)

1. INSTALL FAN MOTOR

- (a) Install the fan motor with the 3 screws.

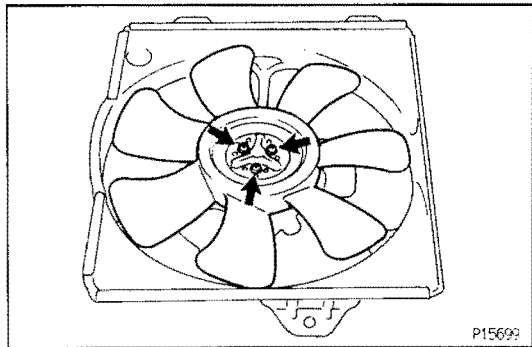


(b) Install the wire and connector to the fan shroud.



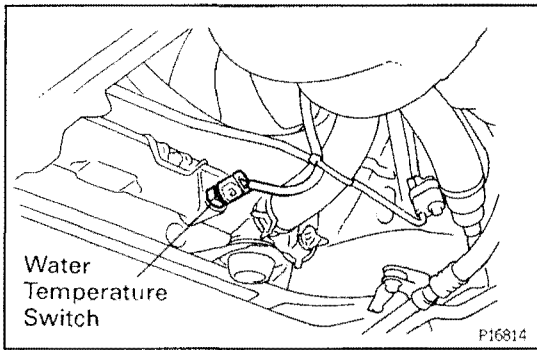
2. INSTALL FAN MOTOR COVER

Install the motor cover with the 3 screws.



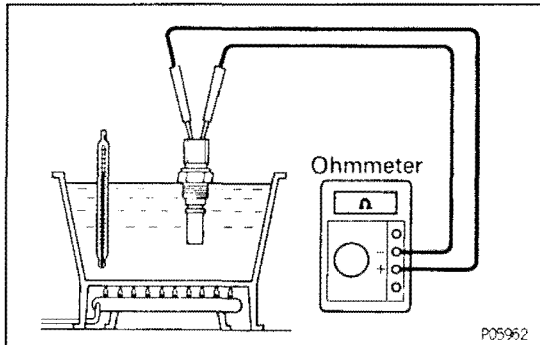
3. INSTALL FAN

Install the fan with the 3 screws.



Water Temperature Switch WATER TEMPERATURE SWITCH INSPECTION

1. DRAIN ENGINE COOLANT
2. REMOVE WATER TEMPERATURE SWITCH

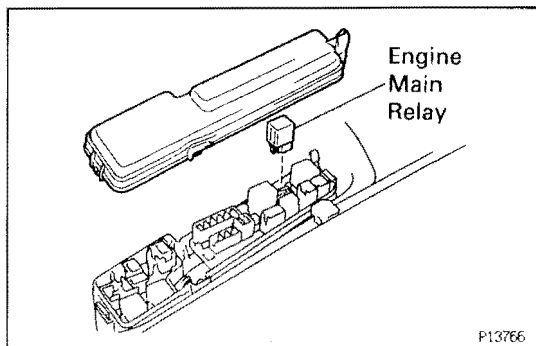


3. INSPECT WATER TEMPERATURE SWITCH

- (a) Using an ohmmeter, check that there is no continuity between the terminals when the coolant temperature is above 93°C (199°F).
- (b) Using an ohmmeter, check that there is continuity between the terminals when the coolant temperature is below 83°C (181°F).

If continuity is not as specified, replace the switch.

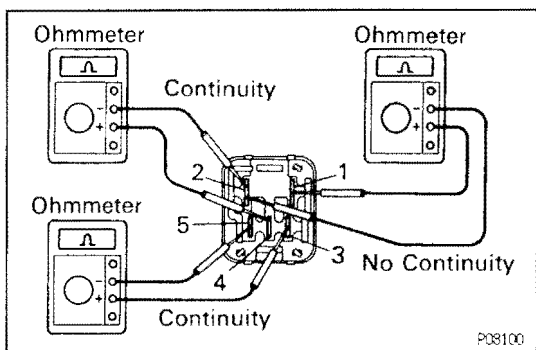
4. REINSTALL WATER TEMPERATURE SWITCH
5. REFILL WITH ENGINE COOLANT
6. START ENGINE AND CHECK FOR COOLANT LEAKS



Engine Main Relay ("EG MAIN")

ENGINE MAIN RELAY INSPECTION

1. REMOVE RELAY BOX COVER
2. REMOVE ENGINE MAIN RELAY

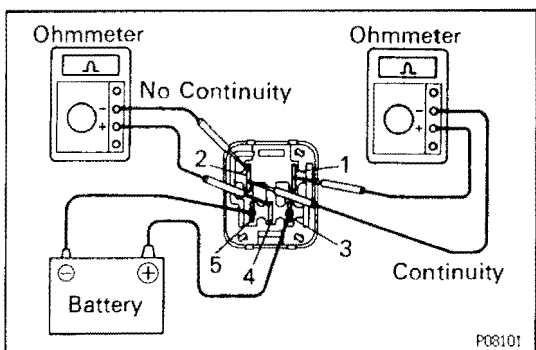


3. INSPECT ENGINE MAIN RELAY

A. 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.

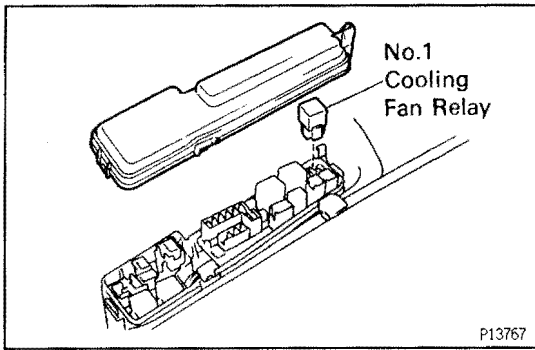


B. Inspect relay operation

- (a) Apply battery voltage across terminals 3 and 5.
- (b) Using an ohmmeter, check that there is no continuity between terminals 2 and 4.
- (c) Check that there is continuity between terminals 1 and 2.

If operation is not as specified, replace the relay.

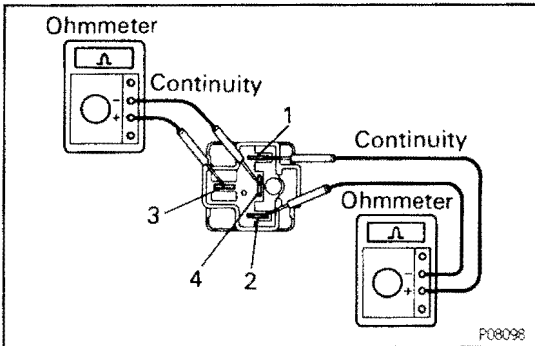
4. REINSTALL ENGINE MAIN RELAY
5. REINSTALL RELAY BOX COVER



No.1 Cooling Fan Relay ("FAN NO.1")

NO.1 COOLING FAN RELAY INSPECTION

1. REMOVE RELAY BOX COVER
2. REMOVE NO.1 COOLING FAN RELAY

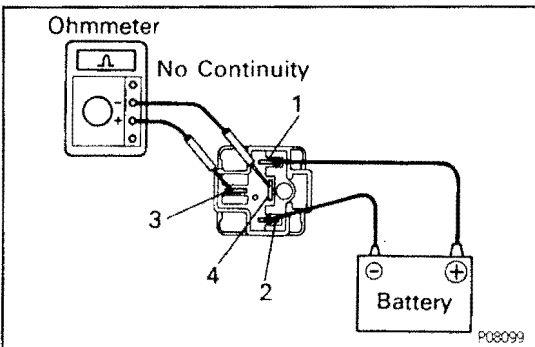


3. INSPECT NO.1 COOLING FAN RELAY

A. 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.

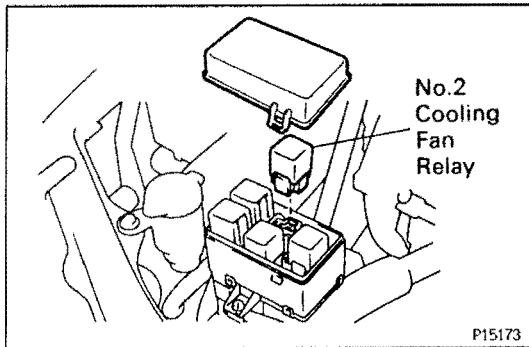


B. Inspect relay operation

- (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.

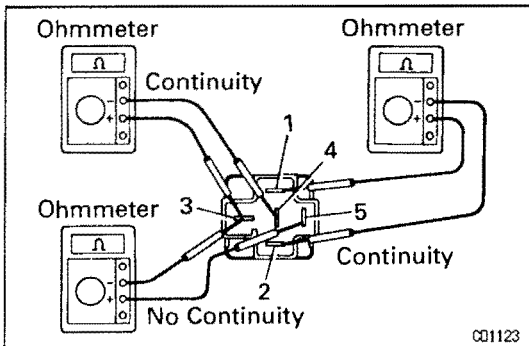
4. REINSTALL NO.1 COOLING FAN RELAY
5. REINSTALL RELAY BOX COVER



No.2 Cooling Fan Relay ("FAN NO.2") (w/ A/C)

NO.2 COOLING FAN RELAY INSPECTION

1. REMOVE RELAY BOX COVER
2. REMOVE NO.2 COOLING FAN RELAY

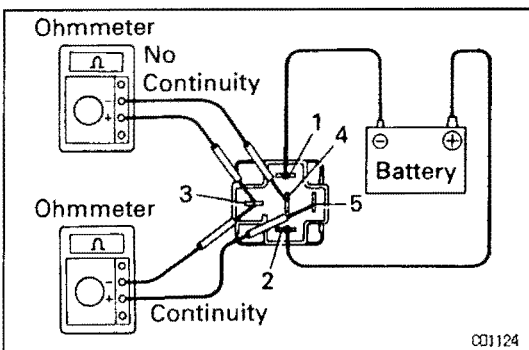


3. INSPECT NO.2 COOLING FAN RELAY

A. 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.
- (c) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the relay.

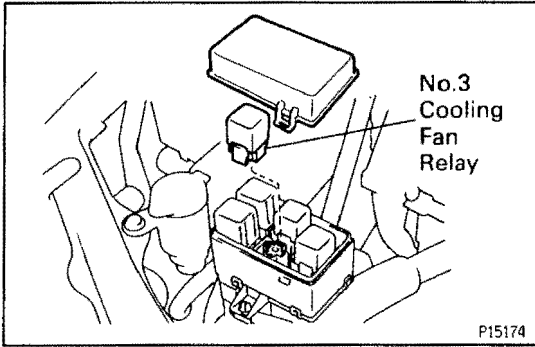


B. Inspect relay operation

- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.
- (c) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

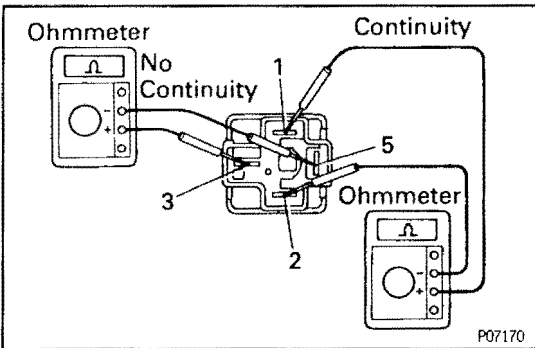
4. REINSTALL NO.2 COOLING FAN RELAY
5. REINSTALL RELAY BOX COVER



No.3 Cooling Fan Relay ("FAN NO.3") (w/ A/C)

NO.3 COOLING FAN RELAY INSPECTION

1. REMOVE RELAY BOX COVER
2. REMOVE NO.3 COOLING FAN RELAY

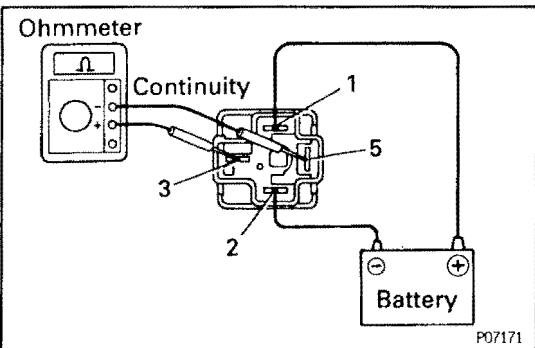


3. INSPECT NO.3 COOLING FAN RELAY

A. Inspect relay continuity

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- (b) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

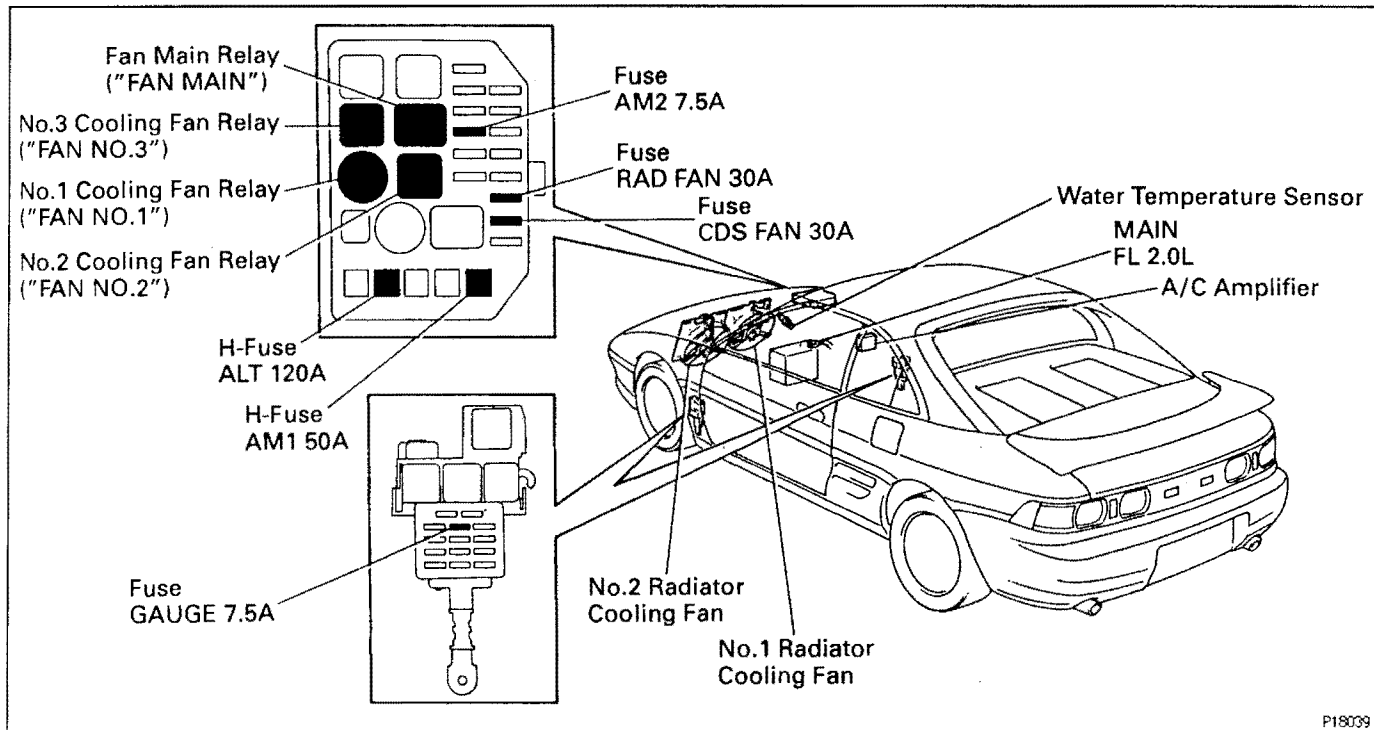
If operation is not as specified, replace the relay.

4. REINSTALL NO.3 COOLING FAN RELAY
5. REINSTALL RELAY BOX COVER

RADIATOR ELECTRIC COOLING FAN (SW20 w/ A/C)

Part Location

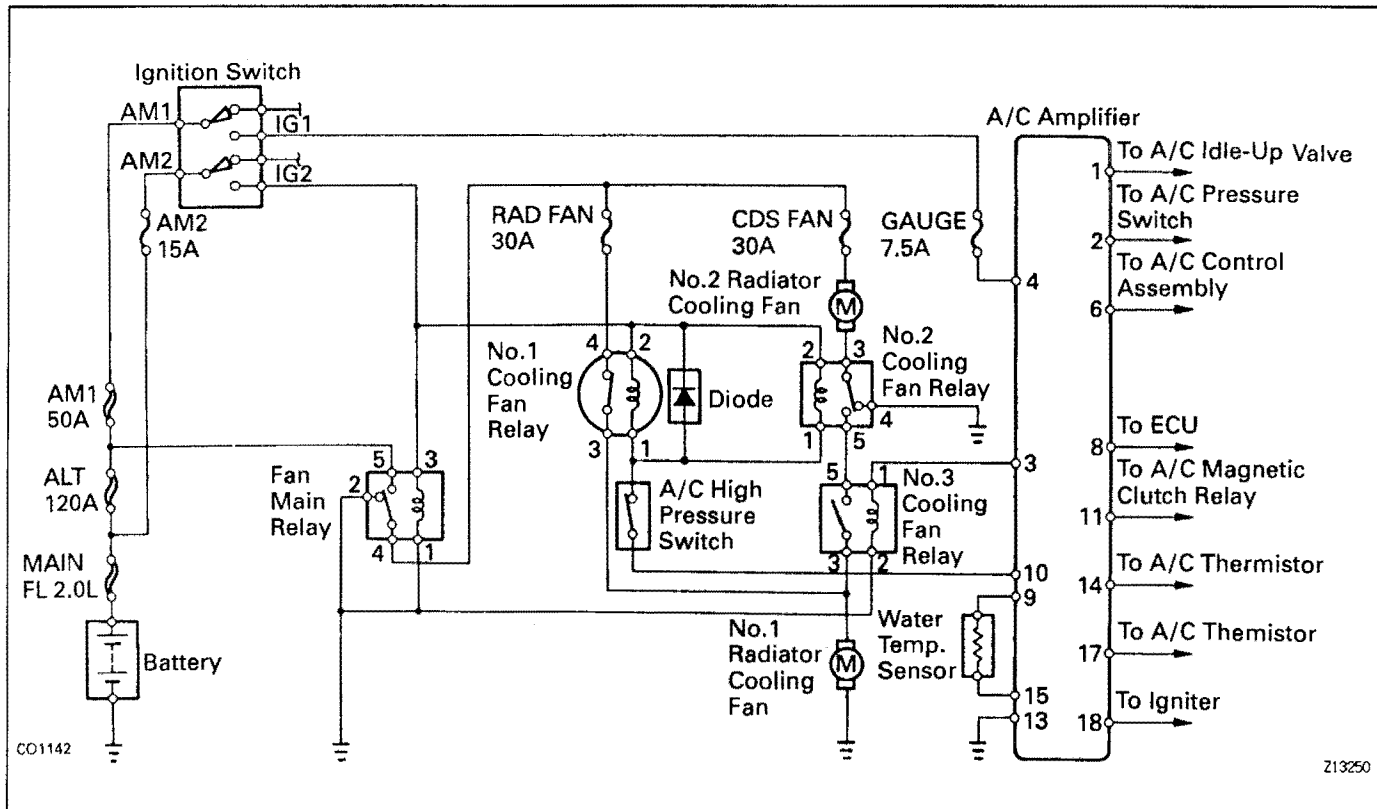
EG078-14



P18039

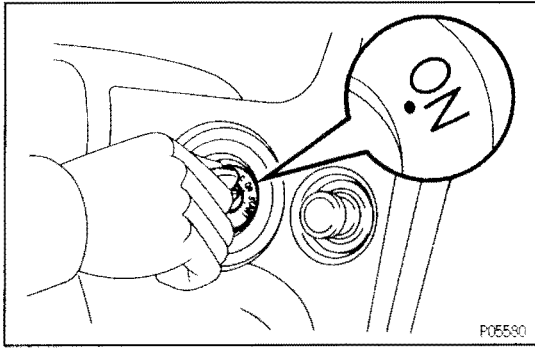
System Circuit

EG07C-0X



CD1142

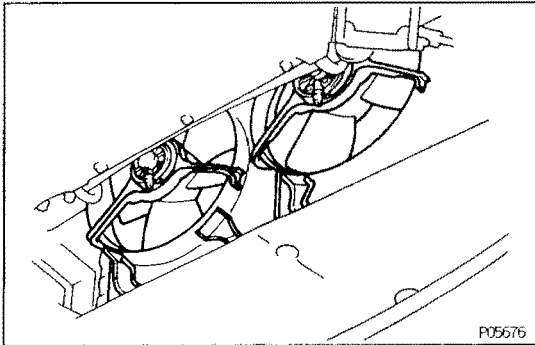
Z13250



On – Vehicle Inspection

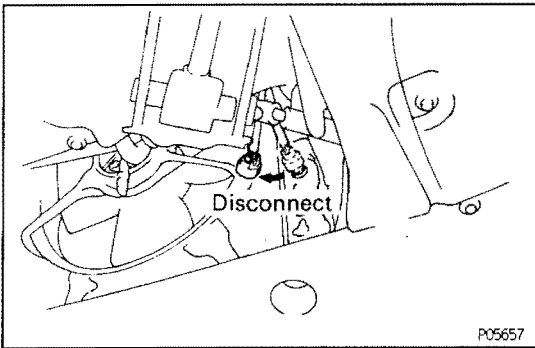
1. INSPECT COOLING FAN OPERATION AT LOW TEMPERATURE (Below 85°C (185°F))

(a) Turn the ignition switch ON.

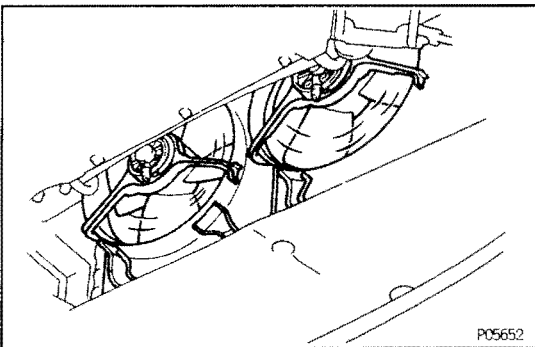


(b) Check that the cooling fans stops.

If not, check the cooling fan relays and water temperature sensor, and check for a separated connector or severed wire between the cooling fan relay and water temperature sensor.

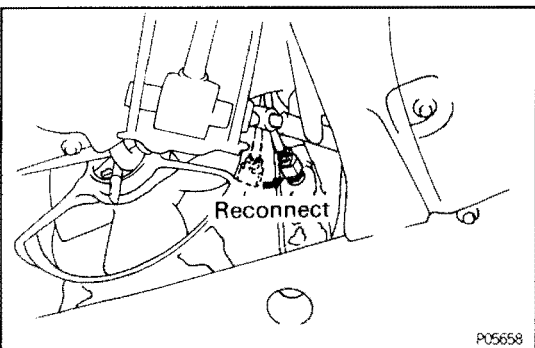


(c) Disconnect the water temperature sensor connector.

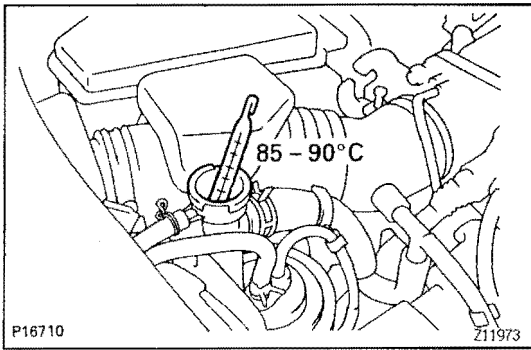


(d) Check that the cooling fans rotates.

If not, check the fuses, fan main relay, cooling fan relays, A/C amplifier, cooling fan, and check for a short circuit between the cooling fan relay and water temperature sensor.



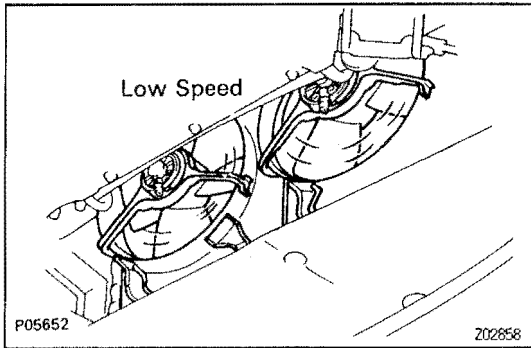
(e) Reconnect the water temperature sensor connector.



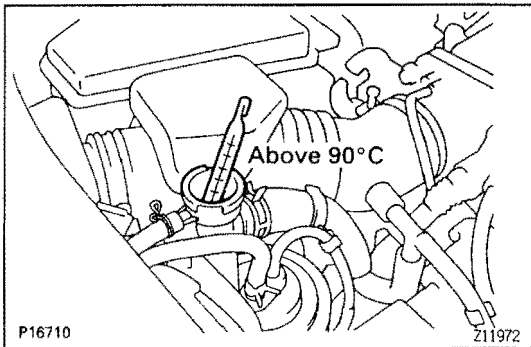
2. INSPECT COOLING FAN OPERATION AT HIGH TEMPERATURE (85 – 90°C (185 – 194°F))

- (a) Start the engine, and raise coolant temperature to 85 – 90°C (185 – 194°F).

EG

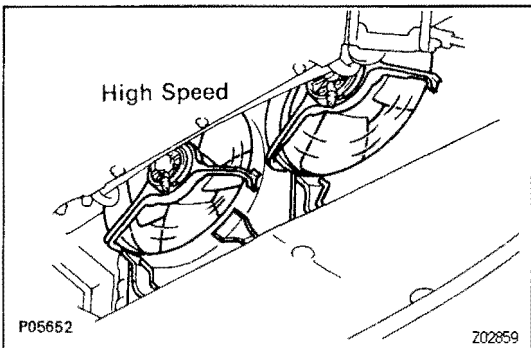


- (b) Check that the cooling fans rotates at low speed. If not, replace the water temperature sensor.

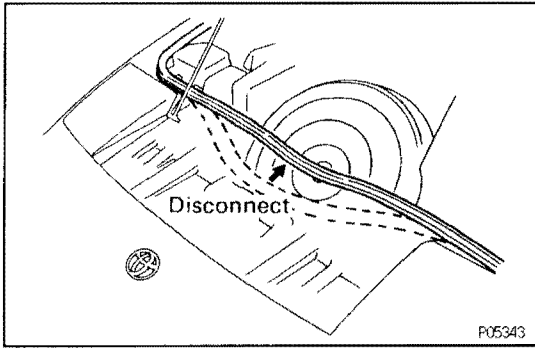


3. INSPECT COOLING FAN OPERATION AT HIGH TEMPERATURE (Above 90°C (194°F))

- (a) Start the engine, and raise coolant temperature to above 90°C (194°F).



- (b) Check that the cooling fans rotates at high speed. If not, replace the water temperature sensor.

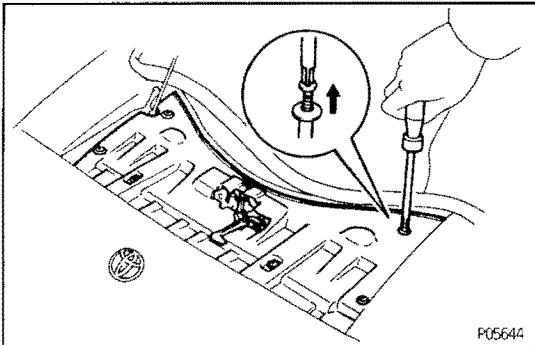


Cooling Fans

COOLING FANS INSPECTION

1. REMOVE UPPER RADIATOR SUPPORT SEAL

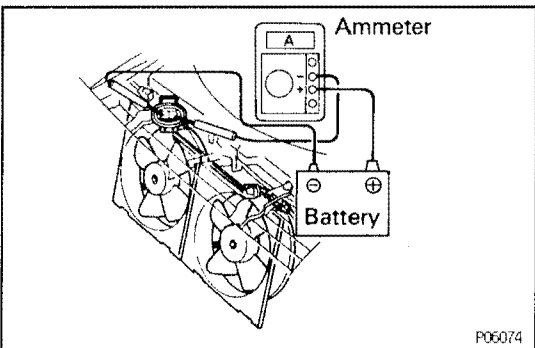
- (a) Disconnect the hood weatherstrip.



- (b) Remove the 7 clips.

- (c) Remove the 2 hood lock mounting bolts, and remove the support seal.

2. DISCONNECT COOLING FAN CONNECTORS



3. INSPECT COOLING FANS

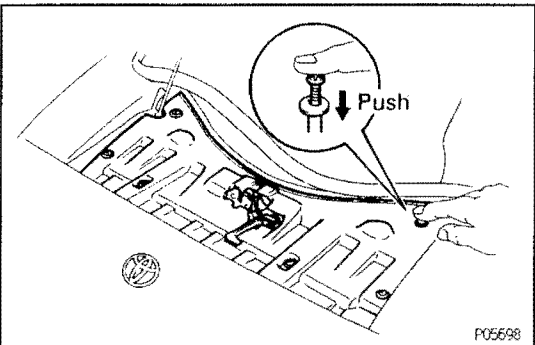
- (a) Connect battery and ammeter to the cooling fan connector.

- (b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

Standard amperage:

8.6 – 11.6 A

4. RECONNECT COOLING FAN CONNECTORS



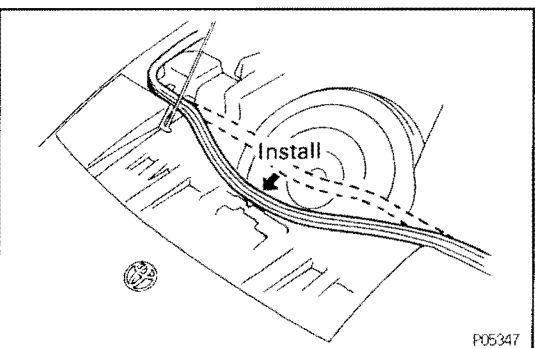
5. REINSTALL UPPER RADIATOR SUPPORT SEAL

- (a) Temporarily install the hood lock with the RH side bolt.

- (b) Place the support seal in position.

- (c) Install the hood lock with the 2 bolts.

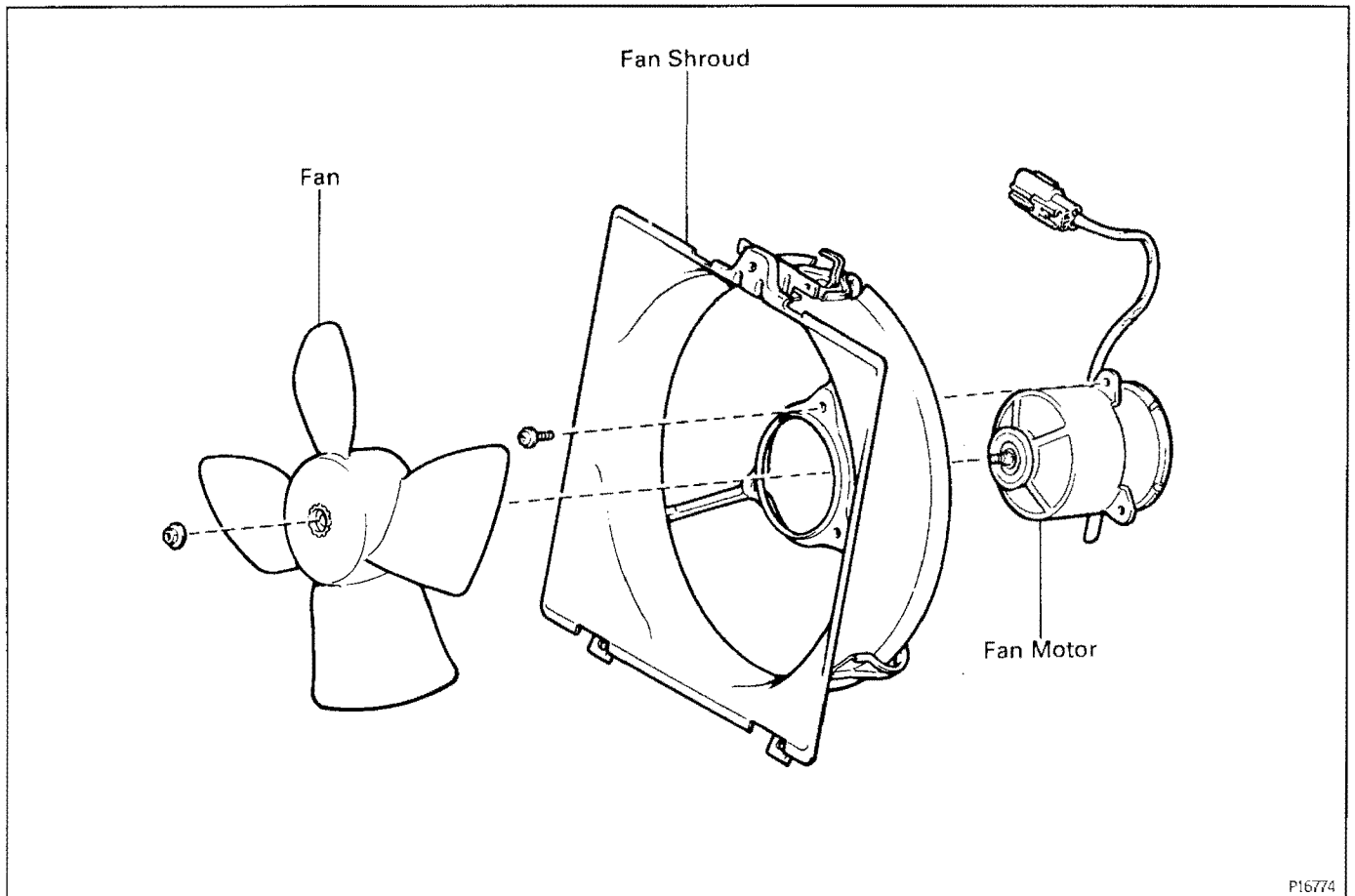
- (d) Install the 7 clips.



- (e) Install the hood weatherstrip.

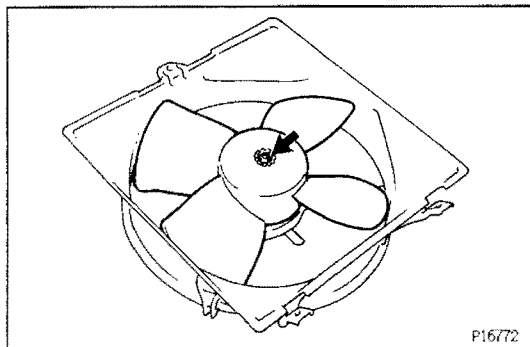
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG07G-0F



EG

P16774



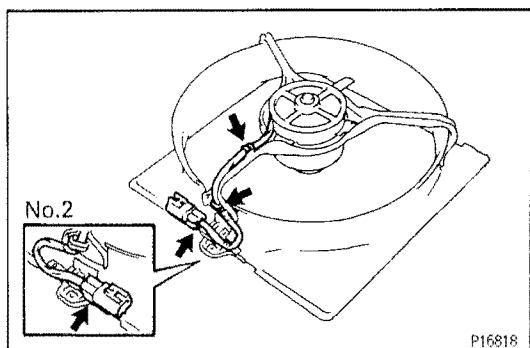
P16772

COOLING FAN DISASSEMBLY

(See Components for Disassembly and Assembly)

1. REMOVE FAN

Remove the nut and fan.



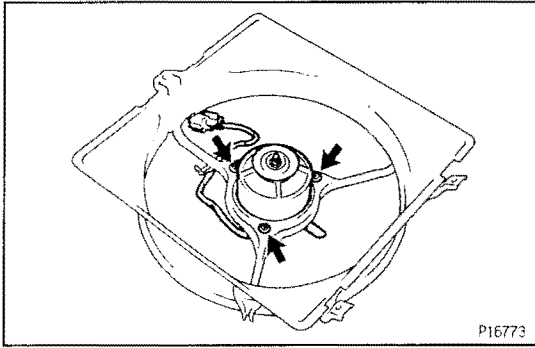
P16818

2. REMOVE FAN MOTOR

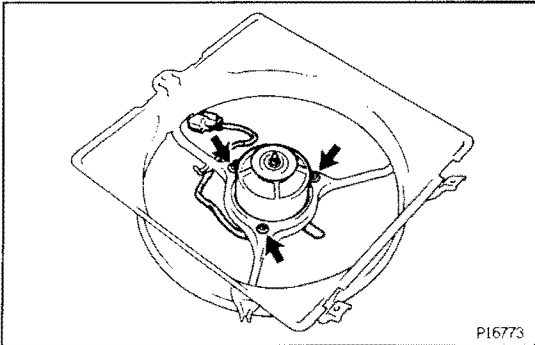
(a) Disconnect the wire and connector from the fan shroud.

EG02R-03

EG



(b) Remove the 3 screws and fan motor.



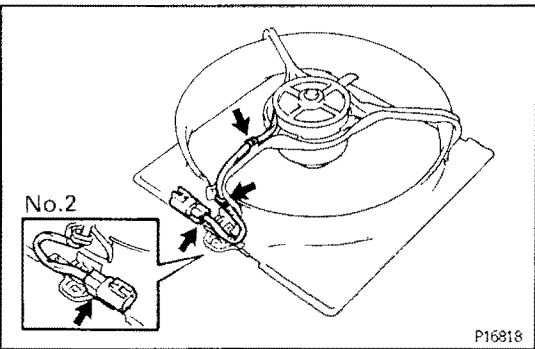
COOLING FAN ASSEMBLY

EG024-04

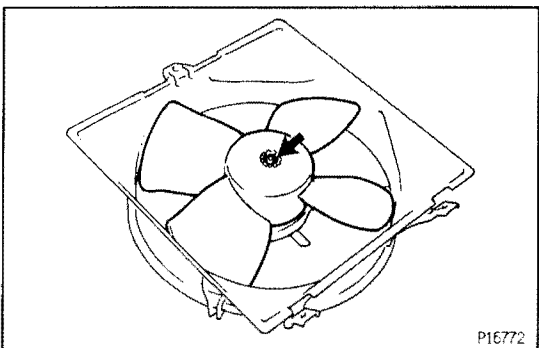
(See Components for Disassembly and Assembly)

1. INSTALL FAN MOTOR

(a) Install the fan motor with the 3 screws.



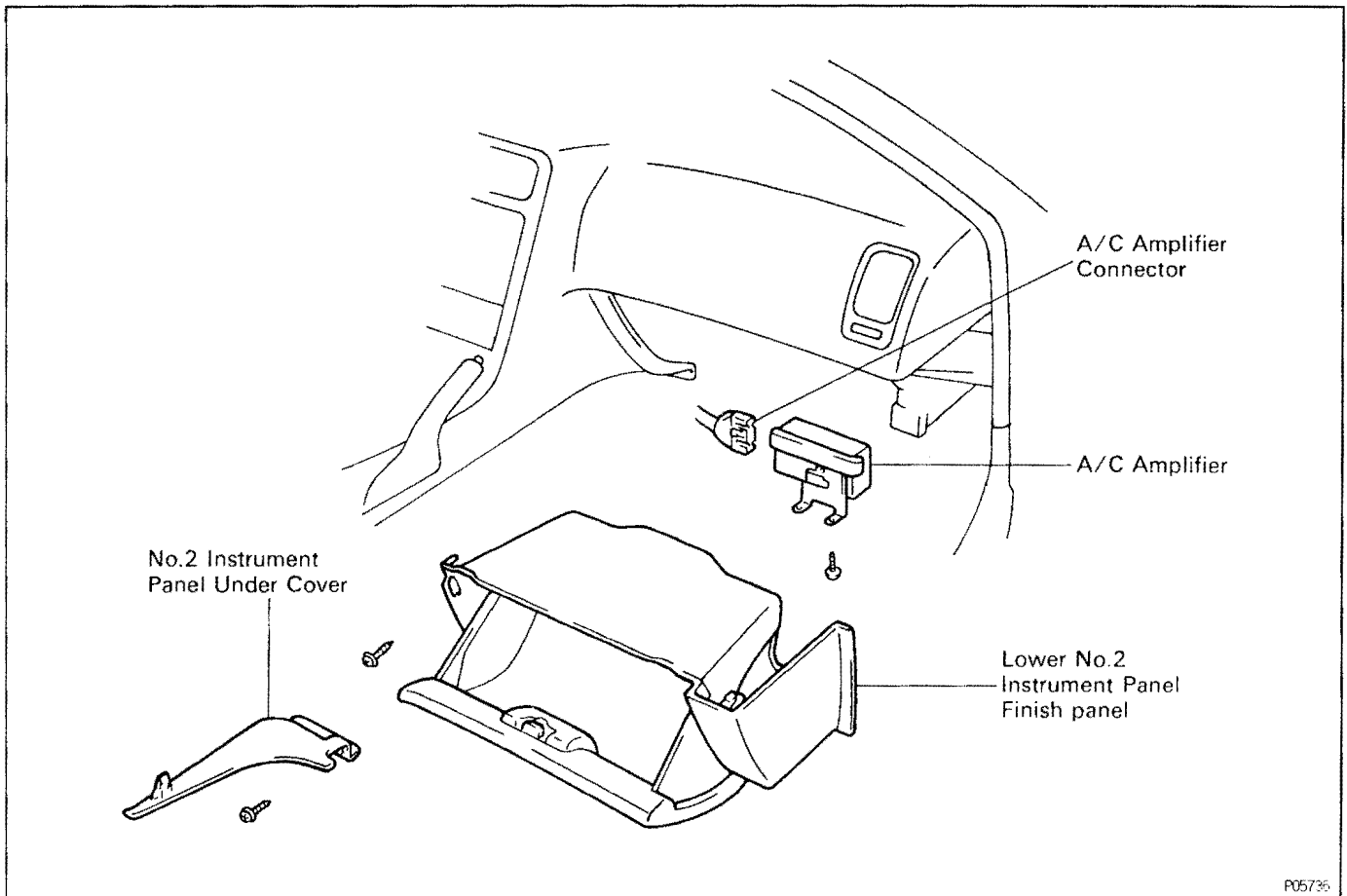
(b) Install the wire and connector to the fan shroud.



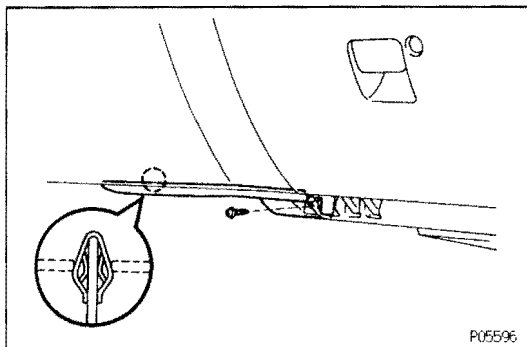
2. INSTALL FAN

Install the fan with the nut.

A/C Amplifier COMPONENTS FOR REMOVAL AND INSTALLATION



P05736

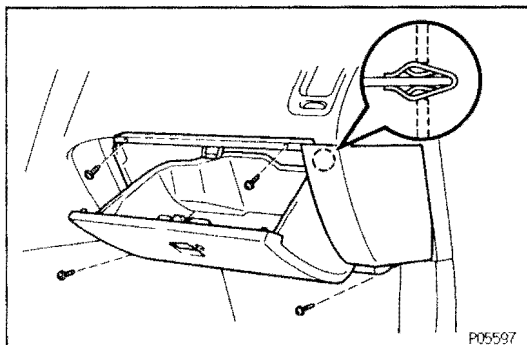


P05596

A/C AMPLIFIER INSPECTION

1. REMOVE NO.2 INSTRUMENT PANEL UNDER COVER

- (a) Remove the screw.
- (b) Remove the under cover by pulling it.



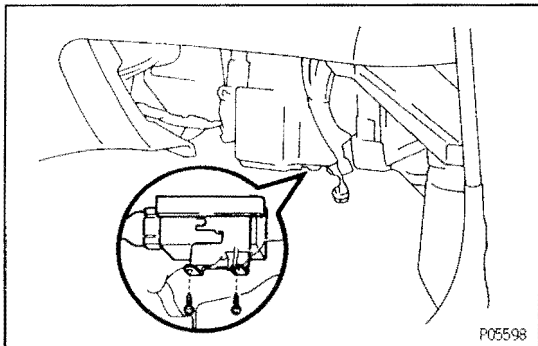
P05597

2. REMOVE LOWER NO.2 INSTRUMENT FINISH PANEL

- (a) Remove the 4 screws.
- (b) Remove the finish panel by pulling it.

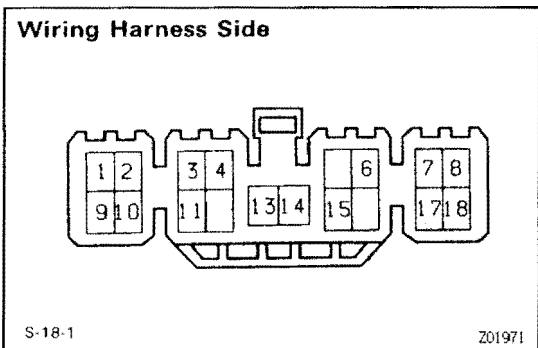
EG41D-01

EG



3. DISCONNECT A/C AMPLIFIER CONNECTOR

- (a) Remove the 2 screws, and disconnect the A/C amplifier from the cooler unit.
- (b) Disconnect the A/C amplifier connector.

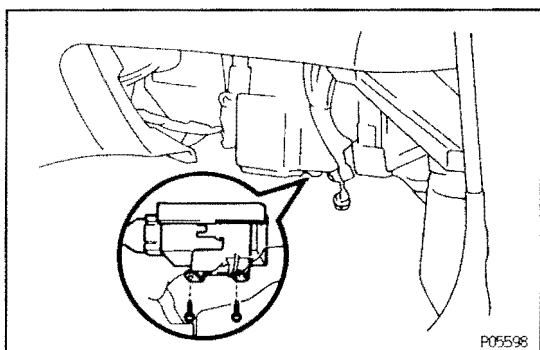


4. INSPECT A/C AMPLIFIER

Check the connector on the wiring harness side as shown in the chart.

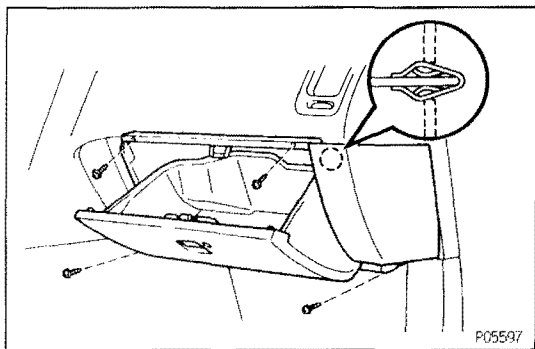
Check for	Tester connection	Condition		Specified value
Continuity	3 – Ground	–		Continuity
Voltage	4 – Ground	Ignition switch ON		Battery voltage
Resistance	9 – 15	Coolant temp.	85°C (185°F)	Approx. 1.35 kΩ
			90°C (194°F)	Approx. 1.19 kΩ
			95°C (203°F)	Approx. 1.05 kΩ
Voltage	10 – Ground	Ignition switch ON		Battery voltage
Continuity	13 – Ground	–		Continuity

V00873

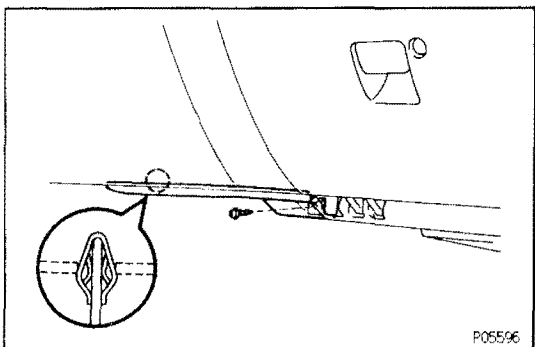


5. DISCONNECT A/C AMPLIFIER CONNECTOR

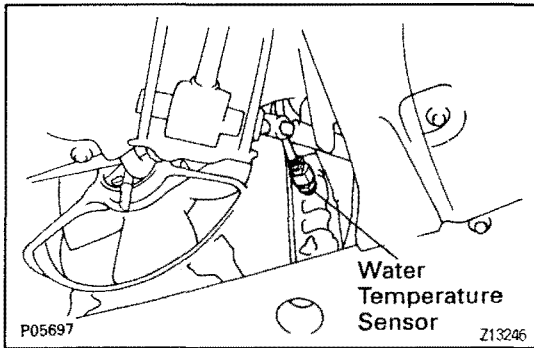
- (a) Connect the A/C amplifier connector.
- (b) Install the A/C amplifier with the 2 screws.

**6. REINSTALL LOWER NO.2 INSTRUMENT FINISH PANEL**

- (a) Attach the finish panel to the instrument panel with the clips.
- (b) Install the 4 screws.

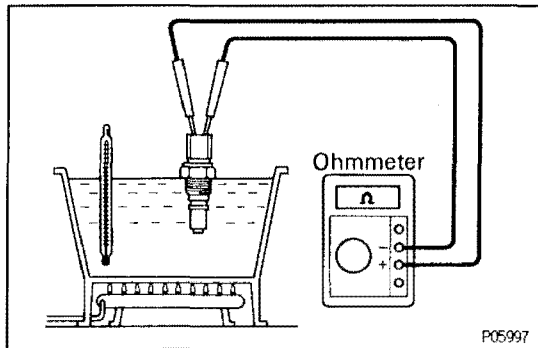
**7. REINSTALL NO.2 INSTRUMENT PANEL UNDER COVER**

- (a) Attach the finish panel to the instrument panel with the clip.
- (b) Install the screw.



Water Temperature Sensor WATER TEMPERATURE SENSOR INSPECTION

1. DRAIN ENGINE COOLANT FROM RADIATOR
2. REMOVE WATER TEMPERATURE SENSOR



3. INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance:

At 85°C (185°F)

Approx. 1.35 kΩ

At 90°C (194°F)

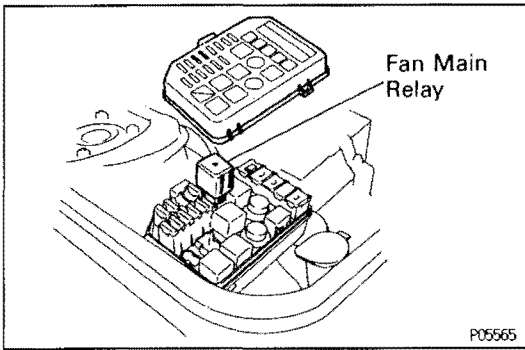
Approx. 1.19 kΩ

At 95°C (203°F)

Approx. 1.05 kΩ

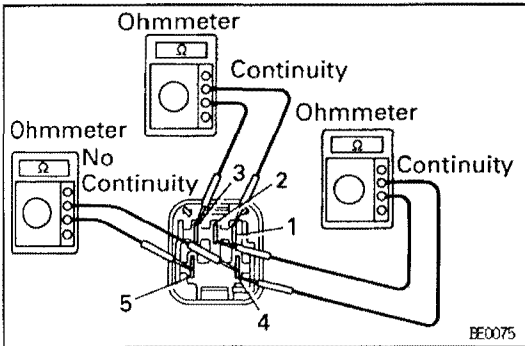
If resistance is not as specified, replace the sensor.

4. REINSTALL WATER TEMPERATURE SENSOR
5. REFILL WITH ENGINE COOLANT
6. START ENGINE AND CHECK FOR COOLANT LEAKS



Fan Main Relay ("FAN MAIN") FAN MAIN RELAY INSPECTION

1. REMOVE FAN MAIN RELAY



2. INSPECT FAN MAIN RELAY

A. Inspect relay continuity

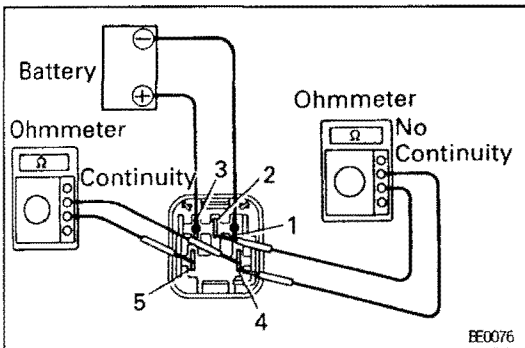
- Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- Check that there is continuity between terminals 2 and 4.
- Check that there is no continuity between terminals 4 and 5.

If continuity is not as specified, replace the relay.

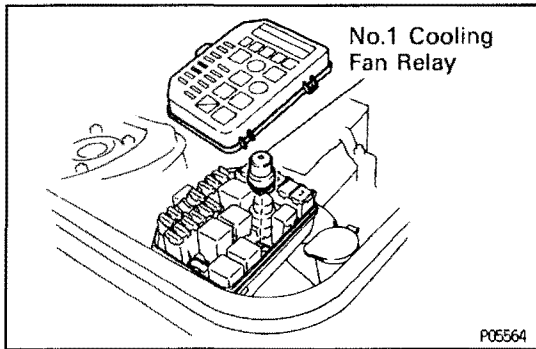
B. Inspect relay operation

- Apply battery voltage across terminals 1 and 3.
- Using an ohmmeter, check that there is no continuity between terminals 2 and 4.
- Check that there is continuity between terminals 4 and 5.

If operation is not as specified, replace the relay.



3. REINSTALL FAN MAIN RELAY



No.1 Cooling Fan Relay ("FAN NO.1") NO.1 COOLING FAN RELAY INSPECTION

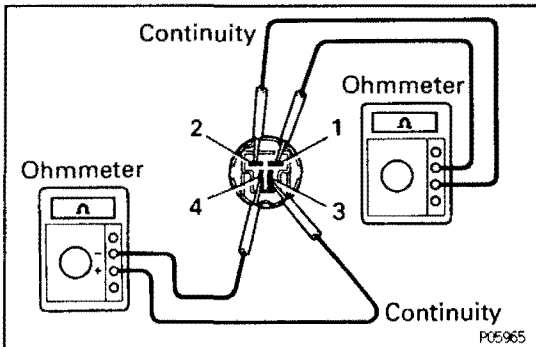
1. REMOVE NO.1 COOLING FAN RELAY

2. INSPECT NO.1 COOLING FAN RELAY

A. 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.

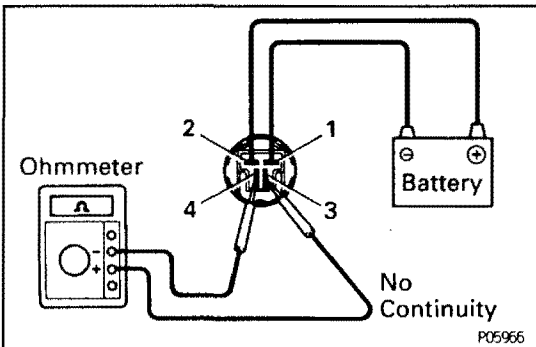
If continuity is not as specified, replace the relay.



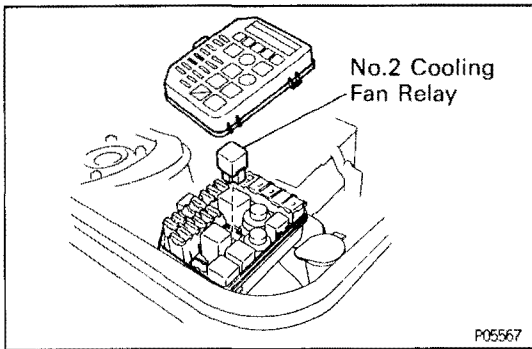
B. Inspect relay operation

- (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.

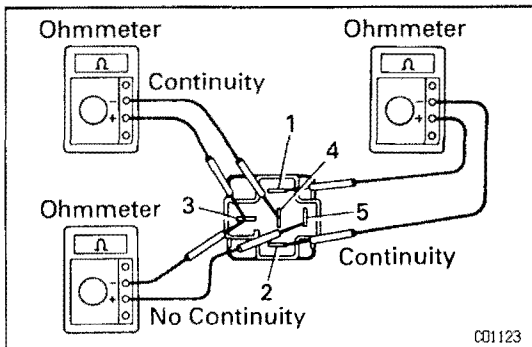


3. REINSTALL NO.1 COOLING FAN RELAY



No.2 Cooling Fan Relay ("FAN NO.2") NO.2 COOLING FAN RELAY INSPECTION

1. REMOVE NO.2 COOLING FAN RELAY

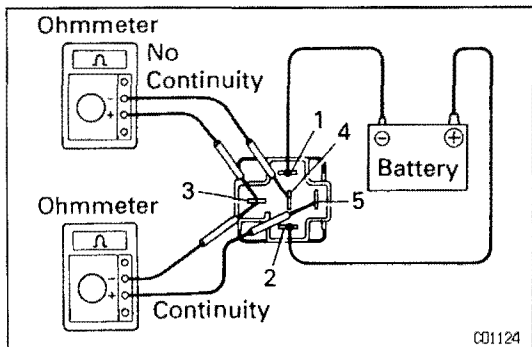


2. INSPECT NO.2 COOLING FAN RELAY

A. 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.
- (c) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the relay.

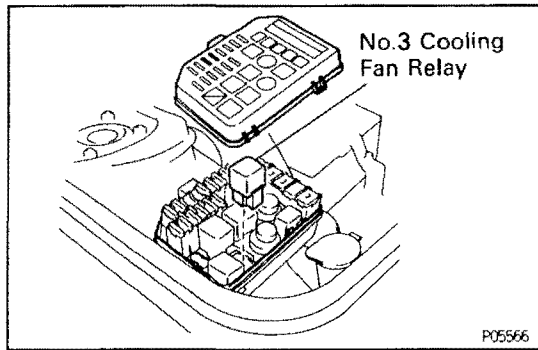


B. Inspect relay operation

- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.
- (c) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

3. REINSTALL NO.2 COOLING FAN RELAY



No.3 Cooling Fan Relay ("FAN NO.3") NO.3 COOLING FAN RELAY INSPECTION

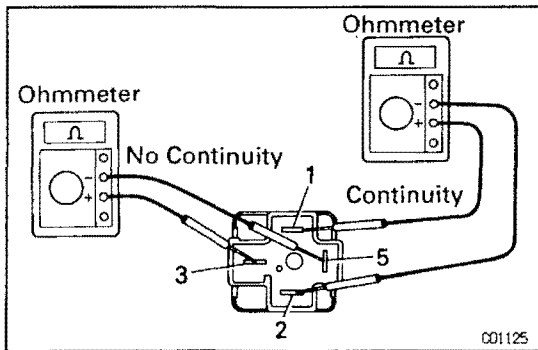
1. REMOVE NO.3 COOLING FAN RELAY

2. INSPECT NO.3 COOLING FAN 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.

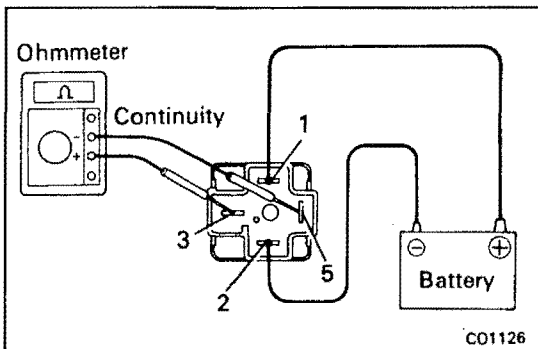
If continuity is not as specified, replace the relay.



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.

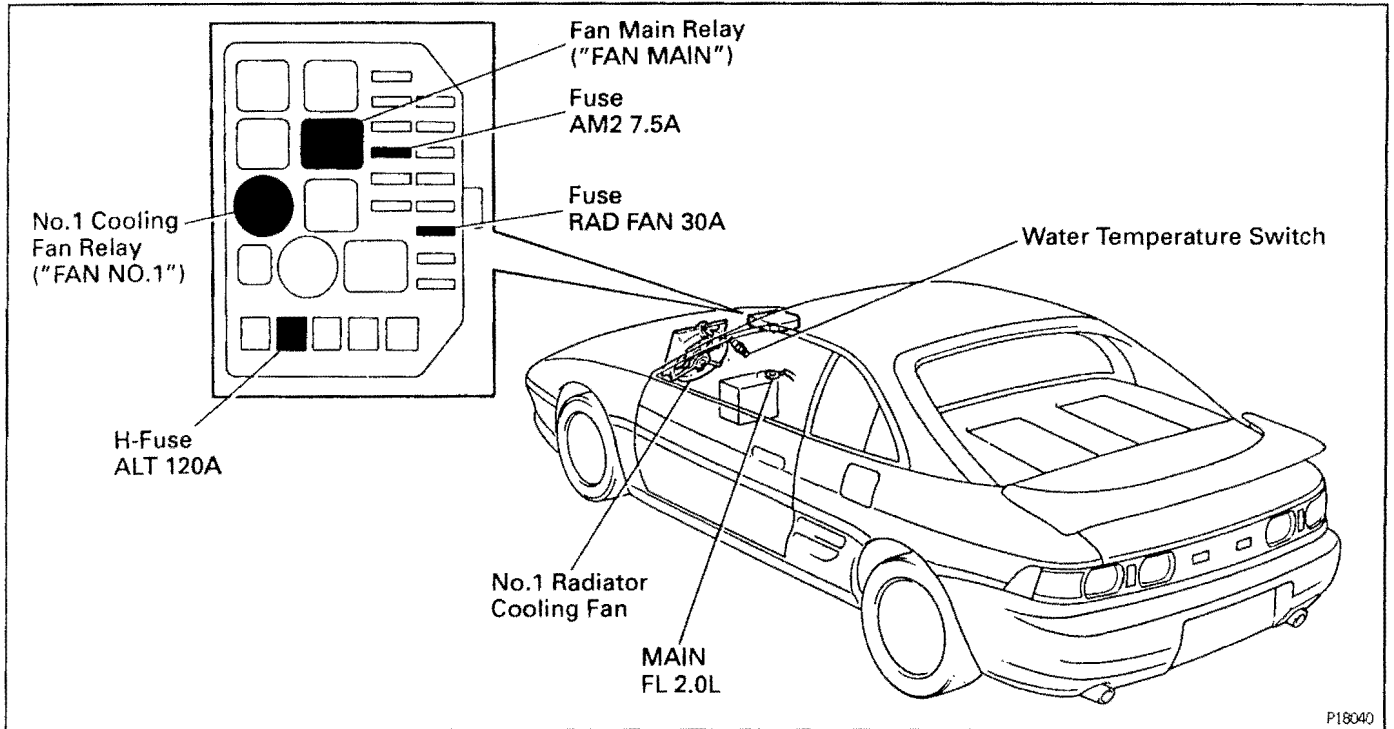
If operation is not as specified, replace the relay.



3. REINSTALL NO.3 COOLING FAN RELAY

RADIATOR ELECTRIC COOLING FAN (SW20 w/o A/C) Part Location

EG079-16

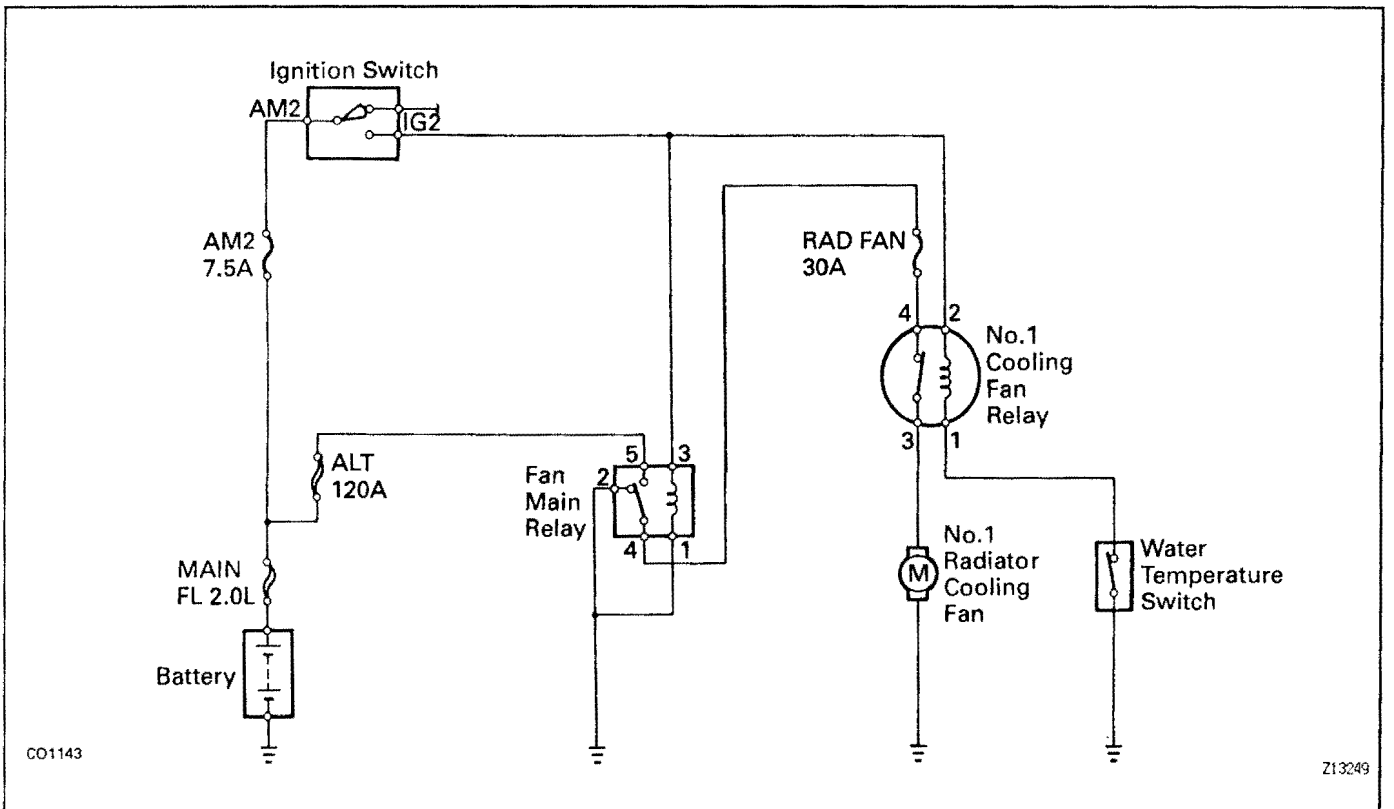


EG

P18040

System Circuit

EG07C-0Y

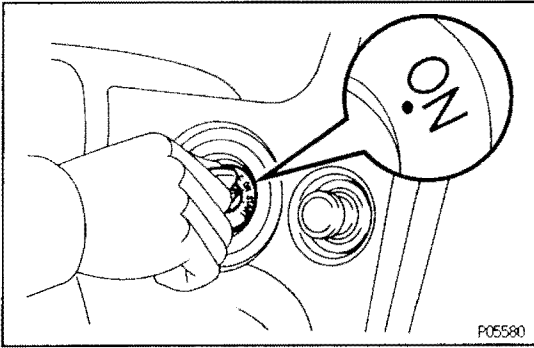


CO1143

Z13249

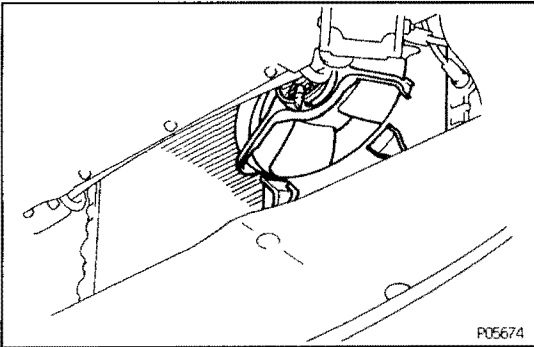
On — Vehicle Inspection**1. CHECK COOLING FAN OPERATION WITH LOW TEMPERATURE (Below 83°C (181°F))**

(a) Turn the ignition switch ON.

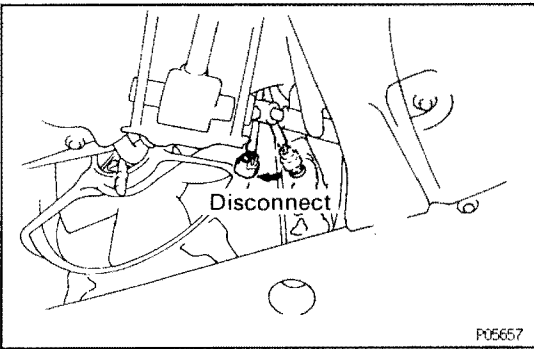


(b) Check that the cooling fan stops.

If not, check the cooling fan relay and water temperature switch, and check for a separated connector or severed wire between the cooling fan relay and water temperature switch.

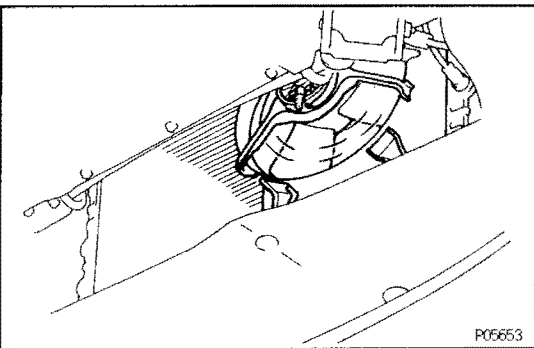


(c) Disconnect the water temperature switch connector.

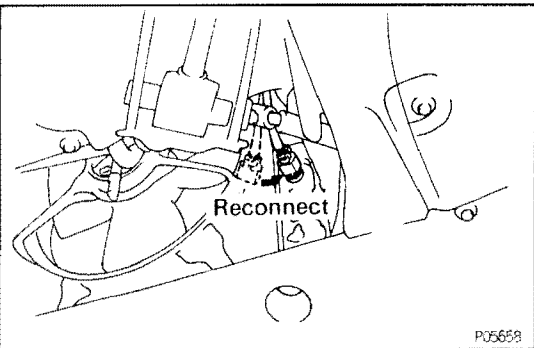


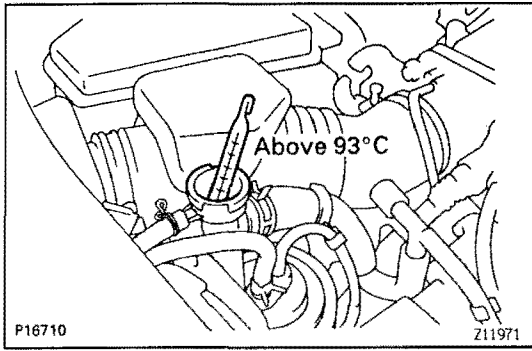
(d) Check that the cooling fan rotates.

If not, check the fan main relay, cooling fan relay, cooling fan, fuses, and check for short circuit between the cooling fan relay and water temperature switch.



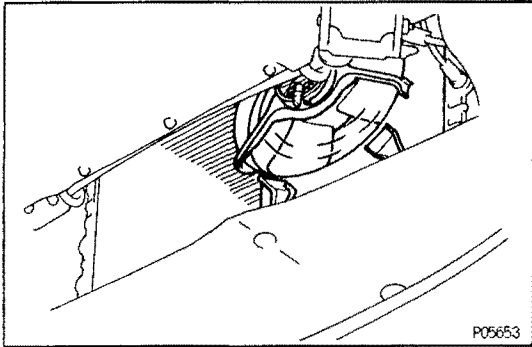
(e) Reconnect the water temperature switch connector.



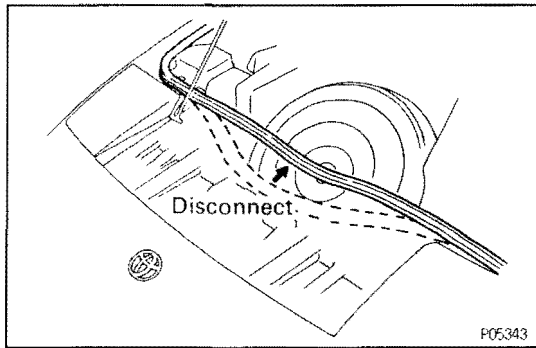
**2. CHECK COOLING FAN OPERATION WITH HIGH TEMPERATURE (Above 93°C (199°F))**

- (a) Start the engine, and raise coolant temperature to above 93°C (199°F).

EG



- (b) Check that the cooling fan rotates.
If not, replace the water temperature switch.

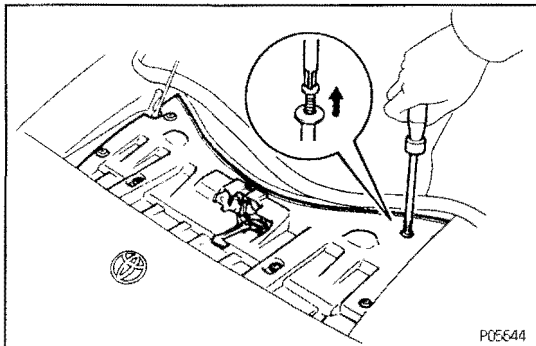


Cooling Fan

COOLING FAN INSPECTION

1. REMOVE UPPER RADIATOR SUPPORT SEAL

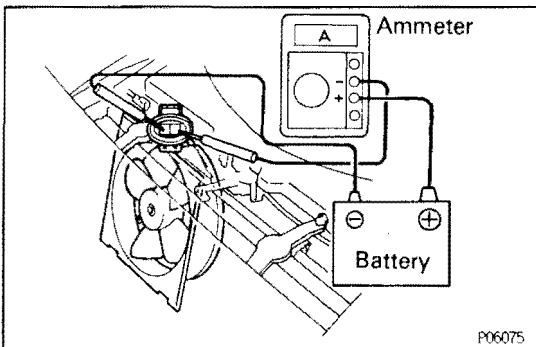
- (a) Disconnect the hood weatherstrip.



- (b) Remove the 7 clips.

- (c) Remove the 2 hood lock mounting bolts, and remove the support seal.

2. DISCONNECT COOLING FAN CONNECTOR



3. INSPECT COOLING FAN

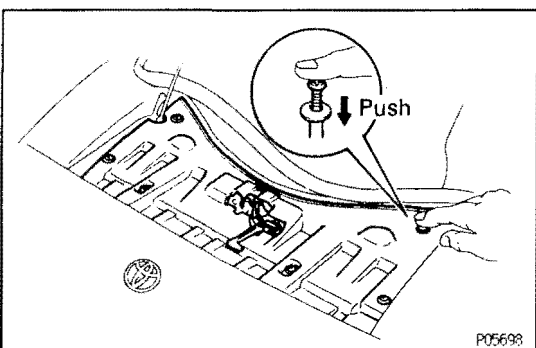
- (a) Connect battery and ammeter to the cooling fan connector.

- (b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

Standard amperage:

8.6 – 11.6 A

4. RECONNECT COOLING FAN CONNECTOR



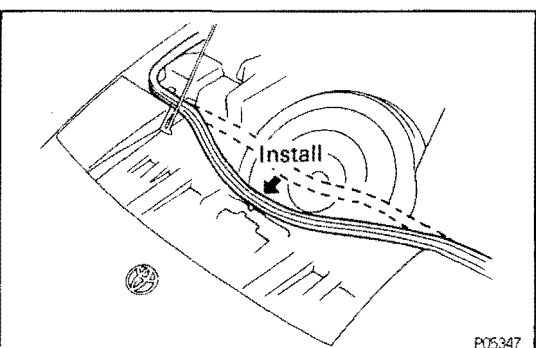
5. REINSTALL UPPER RADIATOR SUPPORT SEAL

- (a) Temporarily install the hood lock with the RH side bolt.

- (b) Place the support seal in position.

- (c) Install the hood lock with the 2 bolts.

- (d) Install the 7 clips.



- (e) Install the hood weatherstrip.

**COMPONENTS FOR DISASSEMBLY AND
ASSEMBLY**

EG102-03

(See page EG-347)

COOLING FAN DISASSEMBLY

EG103-03

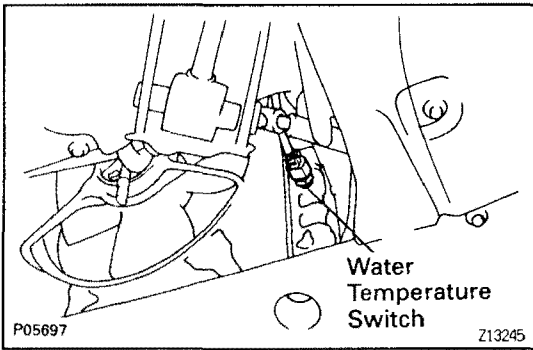
(See page EG-347)

EG

COOLING FAN ASSEMBLY

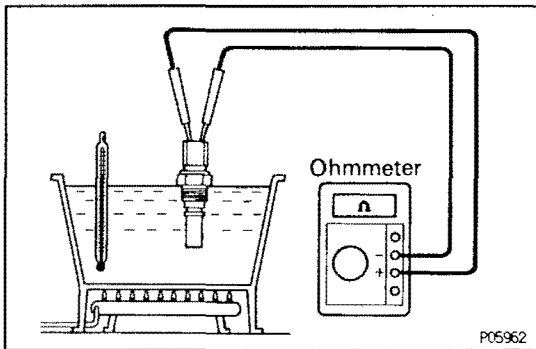
EG07J-06

(See page EG-348)



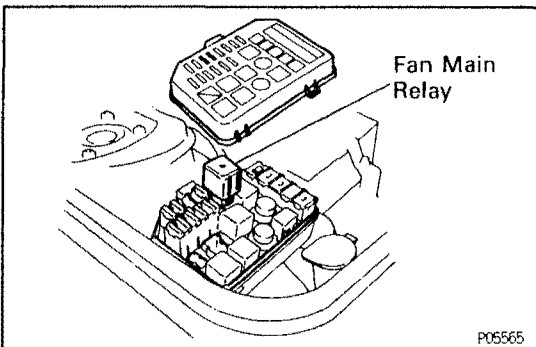
Water Temperature Switch WATER TEMPERATURE SWITCH INSPECTION

1. DRAIN ENGINE COOLANT
2. REMOVE WATER TEMPERATURE SWITCH



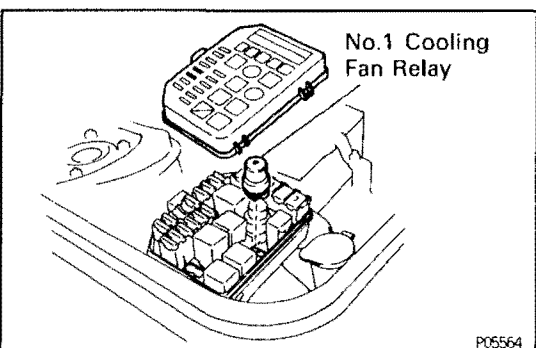
3. INSPECT WATER TEMPERATURE SWITCH
 - (a) Using an ohmmeter, check that there is no continuity between the terminals when the coolant temperature is above 93°C (199°F).
 - (b) Using an ohmmeter, check that there is continuity between the terminals when the coolant temperature is below 83°C (181°F).
 If continuity is not as specified, replace the switch.

4. REINSTALL WATER TEMPERATURE SWITCH
5. REFILL WITH ENGINE COOLANT
6. START ENGINE AND CHECK FOR COOLANT LEAKS



Fan Main Relay ("FAN MAIN") FAN MAIN RELAY INSPECTION

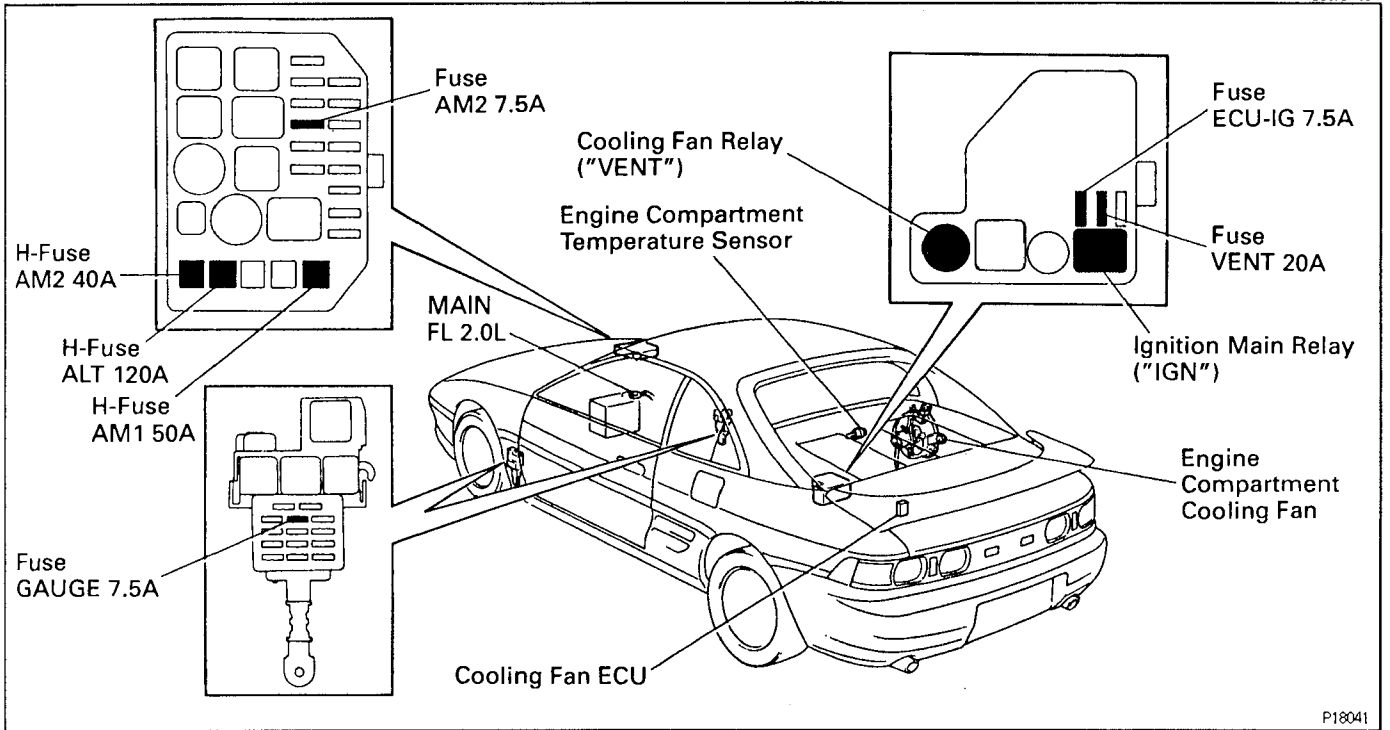
(See page EG-353)



No.1 Cooling Fan Relay ("FAN NO.1") NO.1 COOLING FAN RELAY INSPECTION

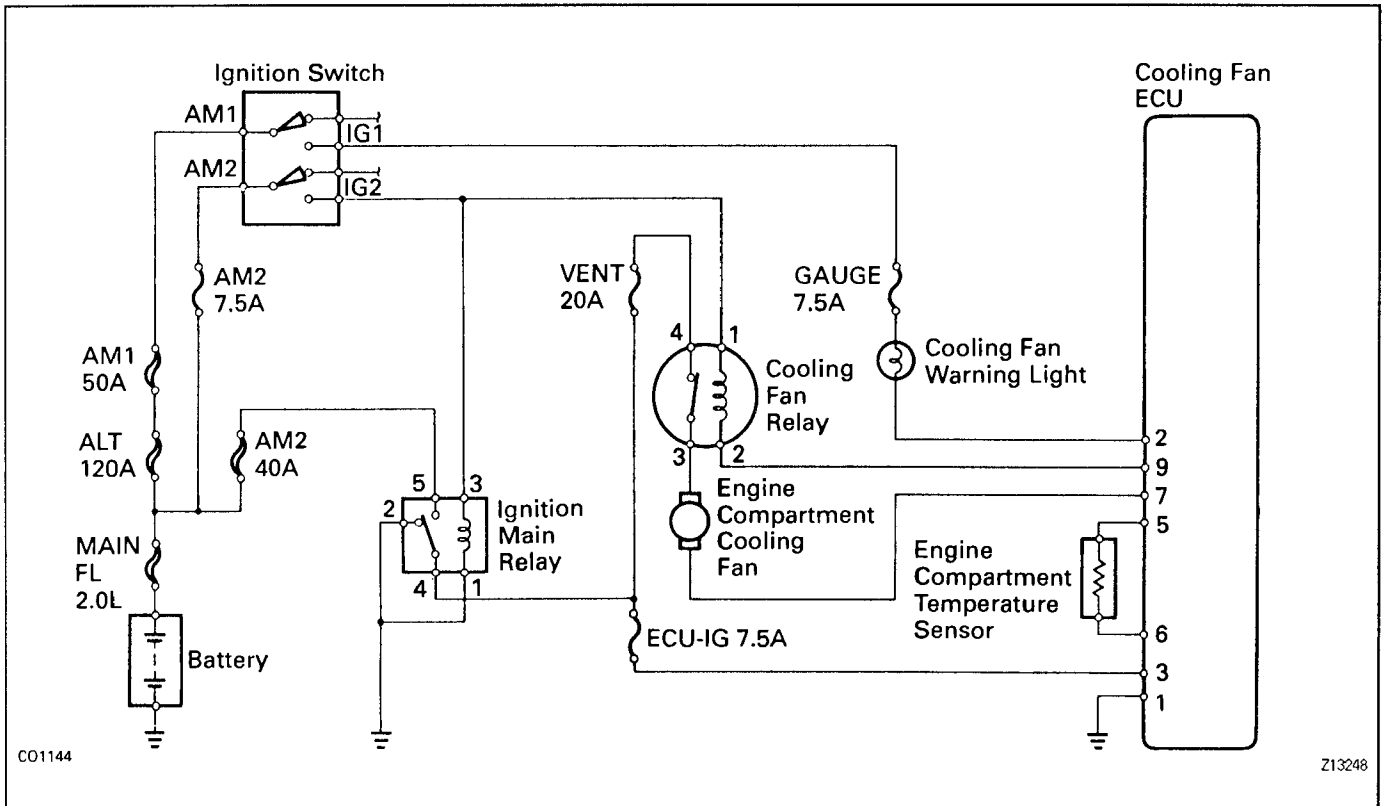
(See page EG-354)

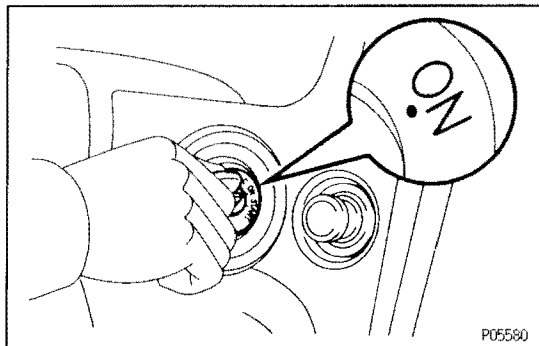
ENGINE COMPARTMENT ELECTRIC COOLING FAN (SW20) Part Location



System Circuit

EQ07C-02

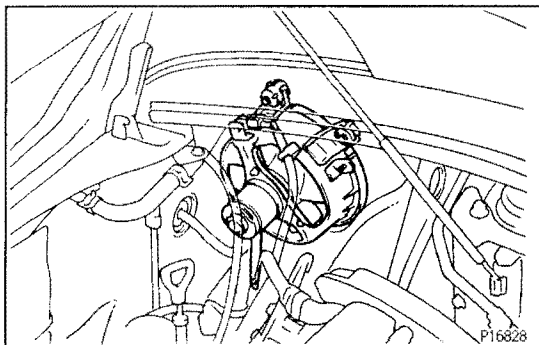




On – Vehicle Inspection

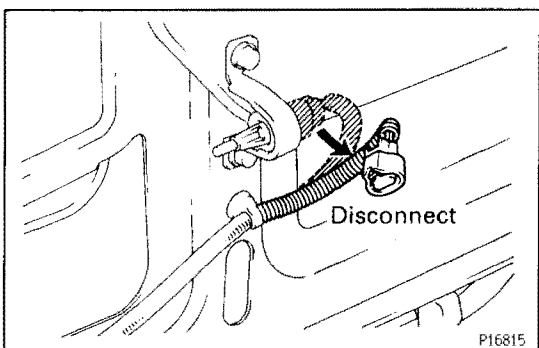
1. CHECK COOLING FAN OPERATION WITH LOW TEMPERATURE (Below 45.5°C (113.9°F))

(a) Turn the ignition switch ON.

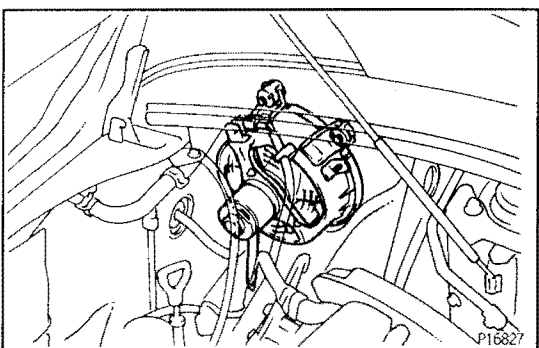


(b) Check that the cooling fan stops.

If not, check the cooling fan relay and engine compartment temperature switch, and check for a separated connector or severed wire between the cooling fan relay and engine compartment temperature sensor.



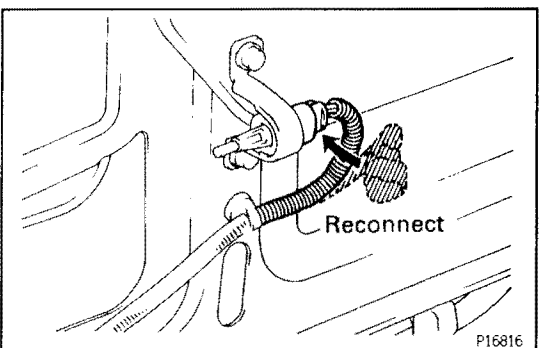
(c) Disconnect the engine compartment temperature sensor connector.



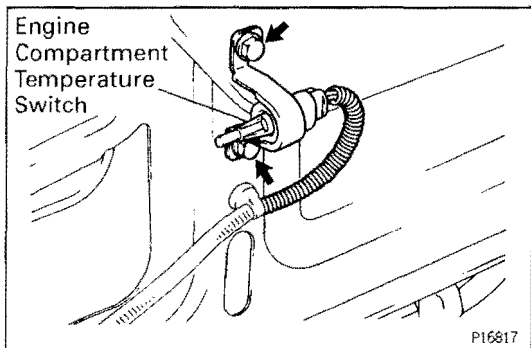
(d) Check that the cooling fan rotates.

If not, check the fan main relay, cooling fan relay, cooling fan ECU, cooling fan, fuses, and check for short circuit between the cooling fan relay and engine compartment temperature sensor.

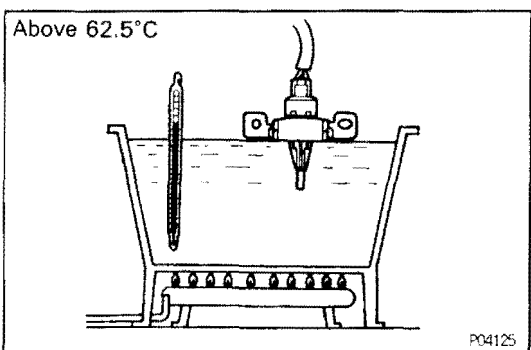
(e) Turn the ignition switch OFF.



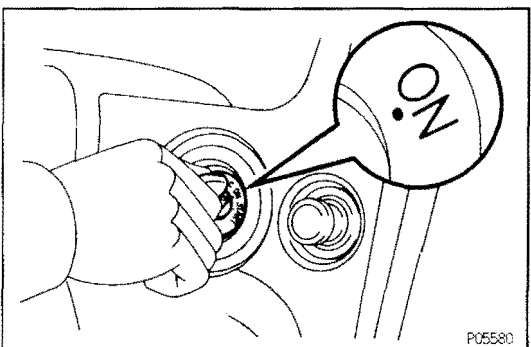
(f) Reconnect the engine compartment temperature sensor connector.



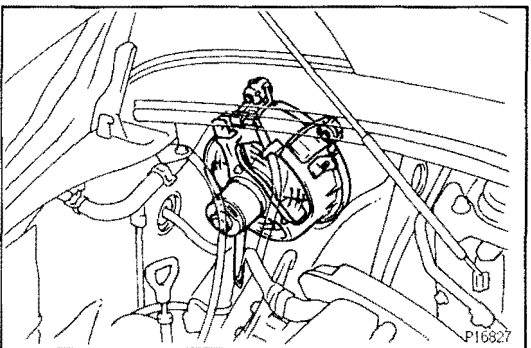
- 2. CHECK COOLING FAN OPERATION WITH HIGH TEMPERATURE (Above 62.5° C (144.5° F))**
- (a) Remove the 2 bolts, and disconnect the engine compartment temperature sensor from the engine hood.



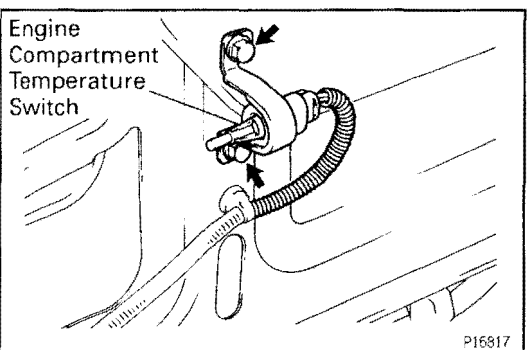
- (b) Heat the engine compartment temperature sensor to above 62.5° C (144.5° F).



- (c) Turn the ignition switch ON.



- (d) Check that the cooling fan rotates. If not, replace the engine compartment temperature switch.



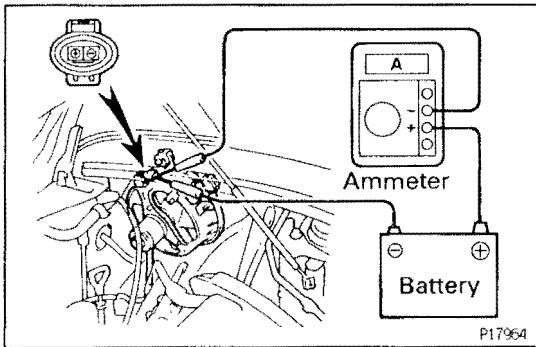
- (e) Reinstall the engine compartment temperature sensor with the 2 bolts.

Cooling Fan

COOLING FAN INSPECTION

1. DISCONNECT COOLING FAN CONNECTOR

EG



2. INSPECT COOLING FAN

- (b) Connect battery and ammeter to the cooling fan connector.
- (c) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

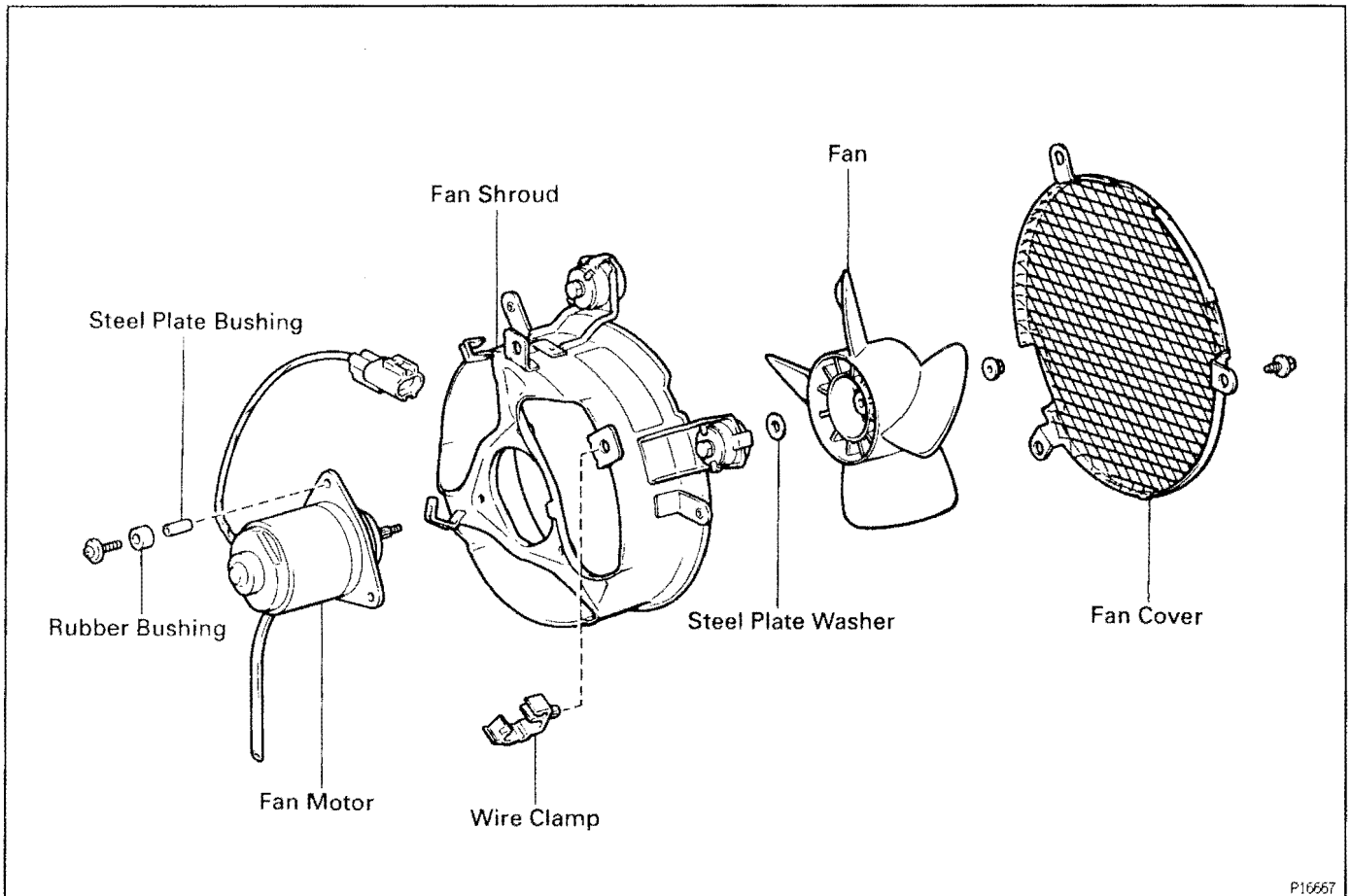
Standard amperage:

1.7 – 2.9 A

3. RECONNECT COOLING FAN CONNECTOR

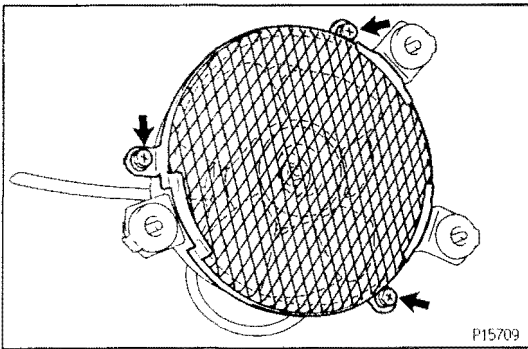
COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG07B-17

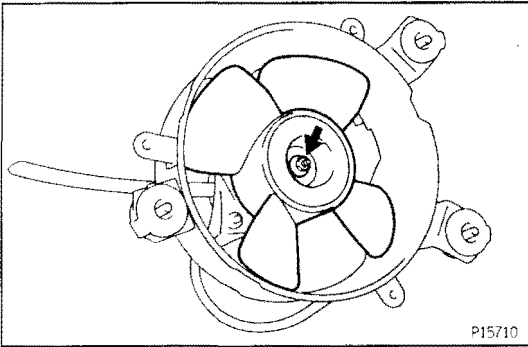


COOLING FAN DISASSEMBLY**(See Components for Disassembly and Assembly)****1. REMOVE FAN COVER**

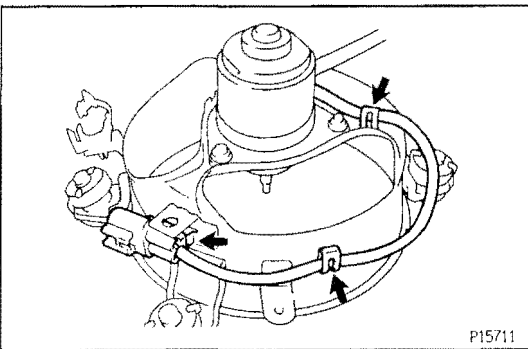
Remove the 3 screws and fan cover.

**2. REMOVE FAN**

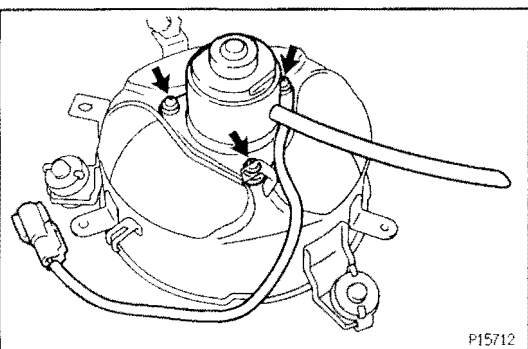
Remove the nut, fan and steel plate washer.

**3. REMOVE FAN MOTOR**

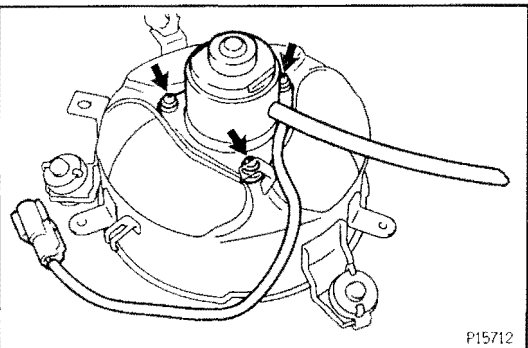
(a) Disconnect the wire and connector from the fan shroud.

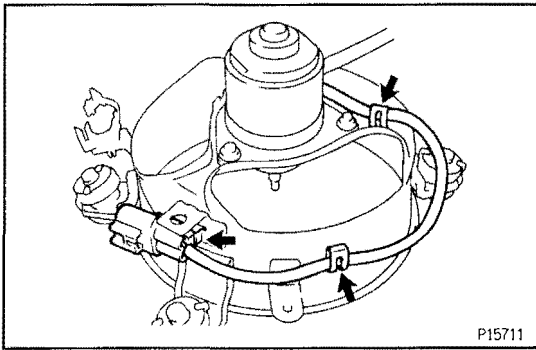


(b) Remove the 3 screws, rubber bushings, steel plate bushings and motor.

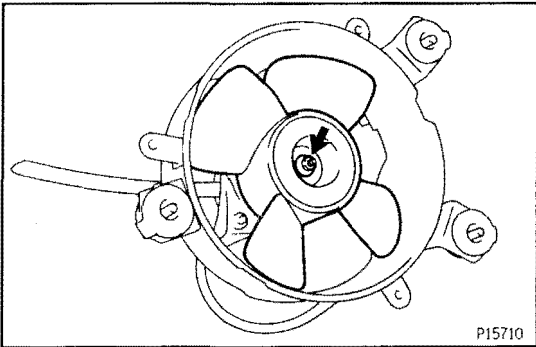
**COOLING FAN ASSEMBLY****(See Components for Disassembly and Assembly)****1. INSTALL FAN MOTOR**

(a) Install the fan motor with the 3 steel plate bushings, rubber bushings and screws.



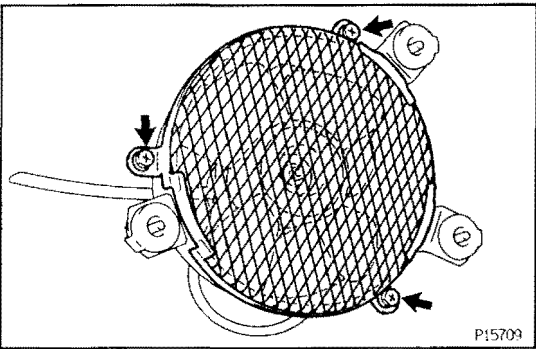


(b) Install the wire and connector to the fan shroud.



2. INSTALL FAN

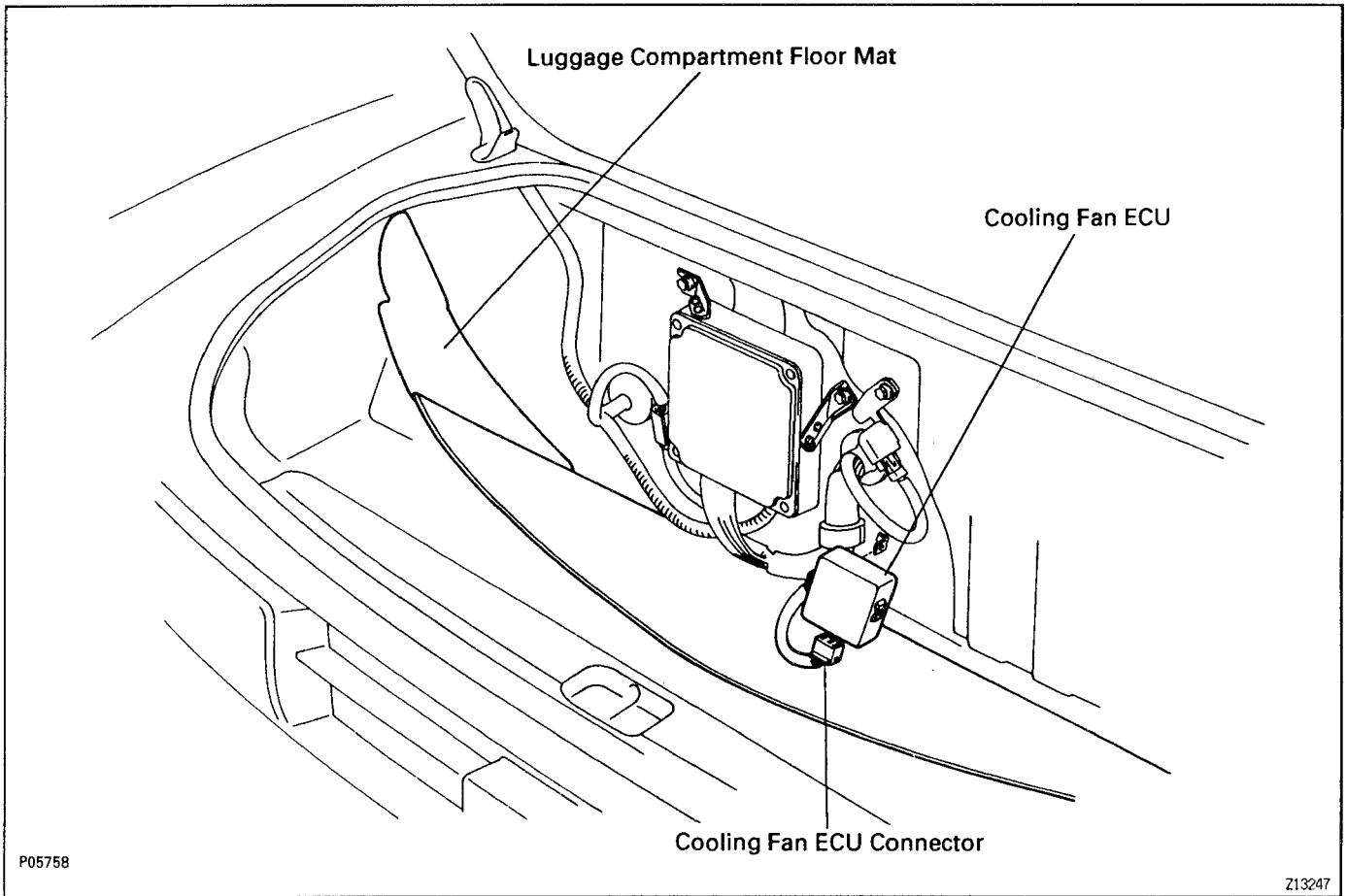
Install the fan with the steel plate washer and nut.



3. INSTALL FAN COVER

Install the fan cover with the 3 screws.

Cooling Fan ECU COMPONENTS FOR REMOVAL AND INSTALLATION

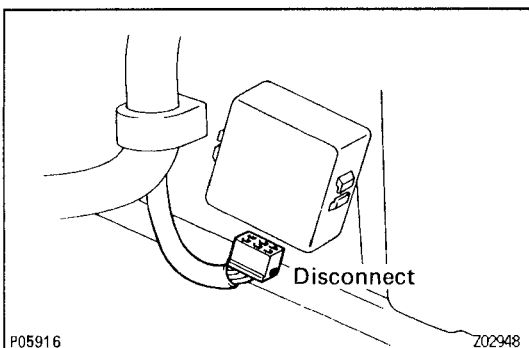


EG

COOLING FAN ECU INSPECTION

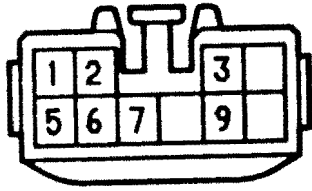
EG41P-01

1. DISCONNECT FRONT SIDE OF LUGGAGE LUGGAGE COMPARTMENT FLOOR MAT FROM PARTITION PANEL



2. DISCONNECT COOLING FAN ECU CONNECTOR

Wiring Harness Side



AE-10-1

Z01977

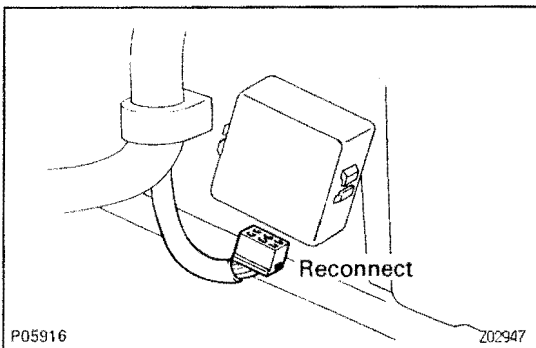
EG

3. INSPECT COOLING FAN ECU

Check the connector on the wiring harness side as shown in the chart.

Check for	Tester connection	Condition		Specified value
Continuity	1 – Ground	–		Continuity
Voltage	2 – Ground	Ignition switch ON		Battery voltage
Voltage	3 – Ground	Ignition switch ON		Battery voltage
Resistance	5 – 6	Coolant temp.	20°C (68°F)	Approx. 2.45 kΩ
			57.5°C (135.5°F)	Approx. 0.63 kΩ
			80°C (176°F)	Approx. 0.32 kΩ
Voltage	7 – Ground	Ignition switch ON		Battery voltage
Continuity	9 – Ground	Ignition switch ON		Battery voltage

V00874

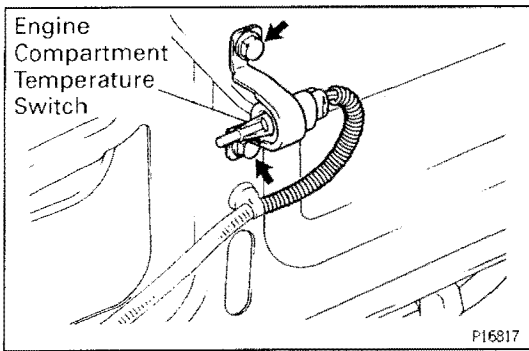


P05916

Z02947

4. RECONNECT COOLING FAN ECU CONNECTOR

5. REINSTALL LUGGAUGE COMPARTMENT FLOOR MAT

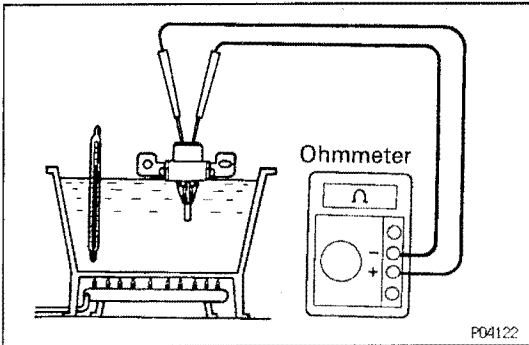


Engine Compartment Temperature Sensor

ENGINE COMPARTMENT TEMPERATURE SENSOR INSPECTION

1. REMOVE ENGINE COMPARTMENT TEMPERATURE SENSOR

- (a) Disconnect the sensor connector.
- (b) Remove the 2 bolts and sensor.



2. INSPECT ENGINE COMPARTMENT TEMPERATURE SENSOR

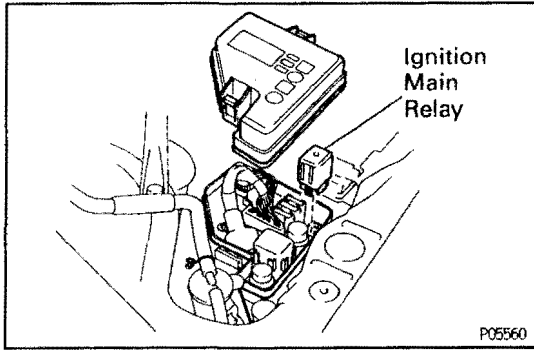
Using an ohmmeter, measure the resistance between the terminals.

Resistance:

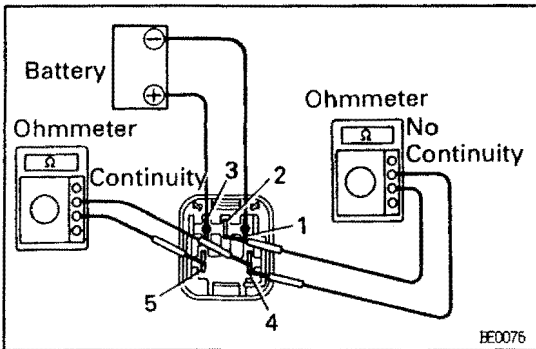
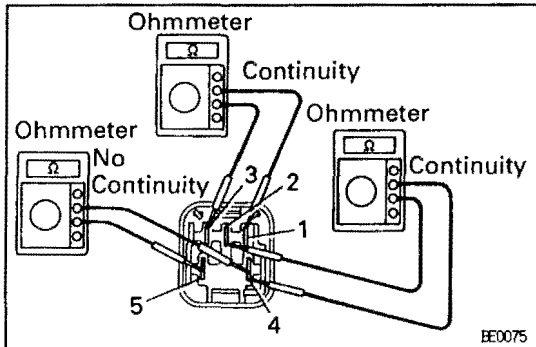
- At 20° C (68° F)
Approx. 2.45 k Ω
- At 57.5° C (135.5° F)
Approx. 0.63 k Ω
- At 80° C (176° F)
Approx. 0.32 k Ω

If resistance is not as specified, replace the sensor.

3. REINSTALL ENGINE COMPARTMENT TEMPERATURE SENSOR



EG



Ignition Main Relay ("IGN")

IGNITION MAIN RELAY INSPECTION

1. REMOVE IGNITION MAIN RELAY

2. INSPECT IGNITION MAIN RELAY

A. Inspect relay continuity

- Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- Check that there is continuity between terminals 2 and 4.
- Check that there is no continuity between terminals 4 and 5.

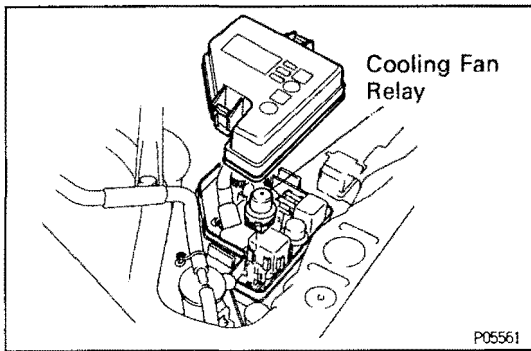
If continuity is not as specified, replace the relay.

B. Inspect relay operation

- Apply battery voltage across terminals 1 and 3.
- Using an ohmmeter, check that there is no continuity between terminals 2 and 4.
- Check that there is continuity between terminals 4 and 5.

If operation is not as specified, replace the relay.

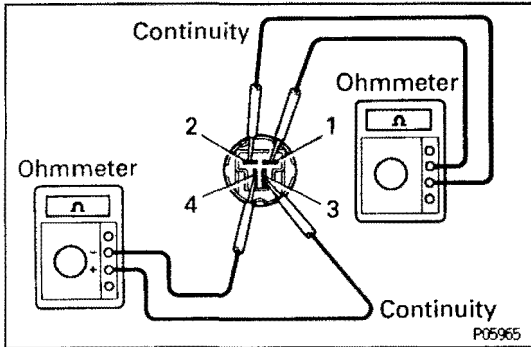
3. REINSTALL IGNITION MAIN RELAY



Cooling Fan Relay ("VENT")

COOLING FAN RELAY INSPECTION

1. REMOVE COOLING FAN RELAY

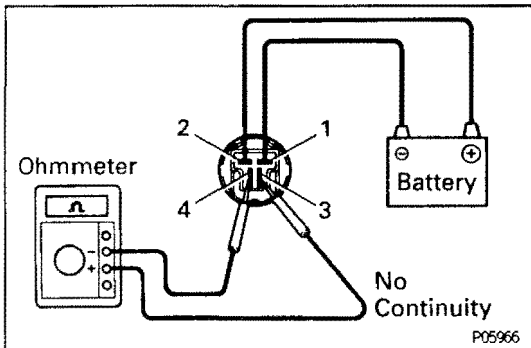


2. INSPECT COOLING FAN RELAY

A. 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.



B. 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.

3. REINSTALL COOLING FAN RELAY

SERVICE SPECIFICATIONS

SERVICE DATA

EG07L-00

Thermostat	Valve opening temperature	80 — 84°C (176 — 183°F)
	Valve lift at 95°C (203°F)	10 mm (0.39 in.) or more
Radiator cap	Relief valve opening pressure	74 — 103 kPa (0.75 — 1.05 kgf/cm ² , 10.7 — 14.9 psi)
	STD Limit	59 kPa (0.6 kgf/cm ² , 8.5 psi)
Electric cooling fan (ST202)	Rotating amperage	5.7 — 7.7 A
Radiator electric cooling fan (SW20)	Rotating amperage	8.6 — 11.6 A
Engine compartment cooling fan (SW20)	Rotating amperage	1.7 — 2.9 A
Water temperature sensor (SW20 w/ A/C)	Resistance at 85°C (185°F)	Approx. 1.35 kΩ
	at 90°C (194°F)	Approx. 1.19 kΩ
	at 95°C (203°F)	Approx. 1.05 kΩ
Engine compartment temperature sensor (SW20)	Resistance at 20°C (68°F)	Approx. 2.45 kΩ
	at 57.5°C (135.5°F)	Approx. 0.63 kΩ
	at 80°C (176°F)	Approx. 0.32 kΩ

TORQUE SPECIFICATIONS

EG07M-01

Part tightened	N-m	kgf-cm	ft-lbf
Cylinder block x Drain plug	25	250	18
Radiator pipe x Drain plug (SW20)	17	170	12
Water pump x Water pump cover	8.8	90	78 in.-lbf
Water pump x Cylinder block	10 mm head	7.5	66 in.-lbf
	12 mm head (SW20 w/o A/C)	19	14
Water bypass pipe x Water pump cover	10	100	7
Idler pulley bracket for alternator drive belt x Cylinder block (ST202)	Water pump side	23	17
	Cylinder block side	19	14
No.3 timing belt cover x Cylinder head	8.0	82	71 in.-lbf
No.1 exhaust manifold heat insulator x Exhaust manifold	20	200	15
No.2 idler pulley x Oil pump	44	450	32
Timing belt tensioner x Cylinder head	21	210	15
No.1 idler pulley x Cylinder head	52	530	38
Camshaft timing pulley x Camshaft		59	43
	for SST	41	30
Water inlet x Water pump cover	9.0	92	80 in.-lbf

LUBRICATION SYSTEM

DESCRIPTION

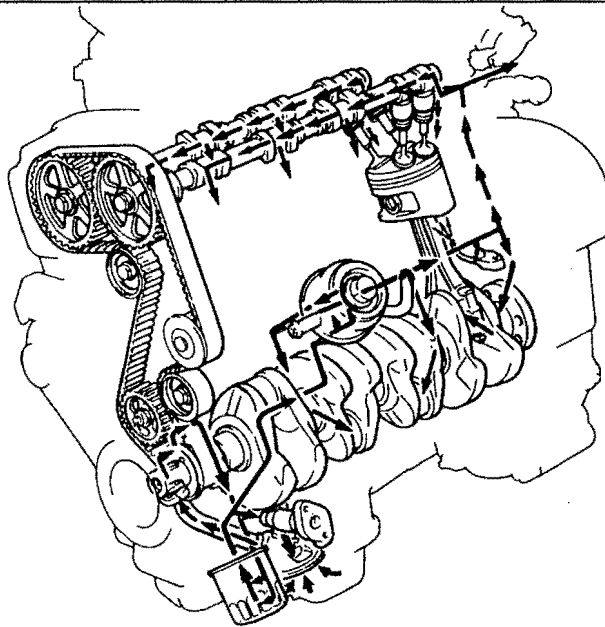
A fully pressurized, fully filtered lubrication system has been adopted for this engine.

EG140-01

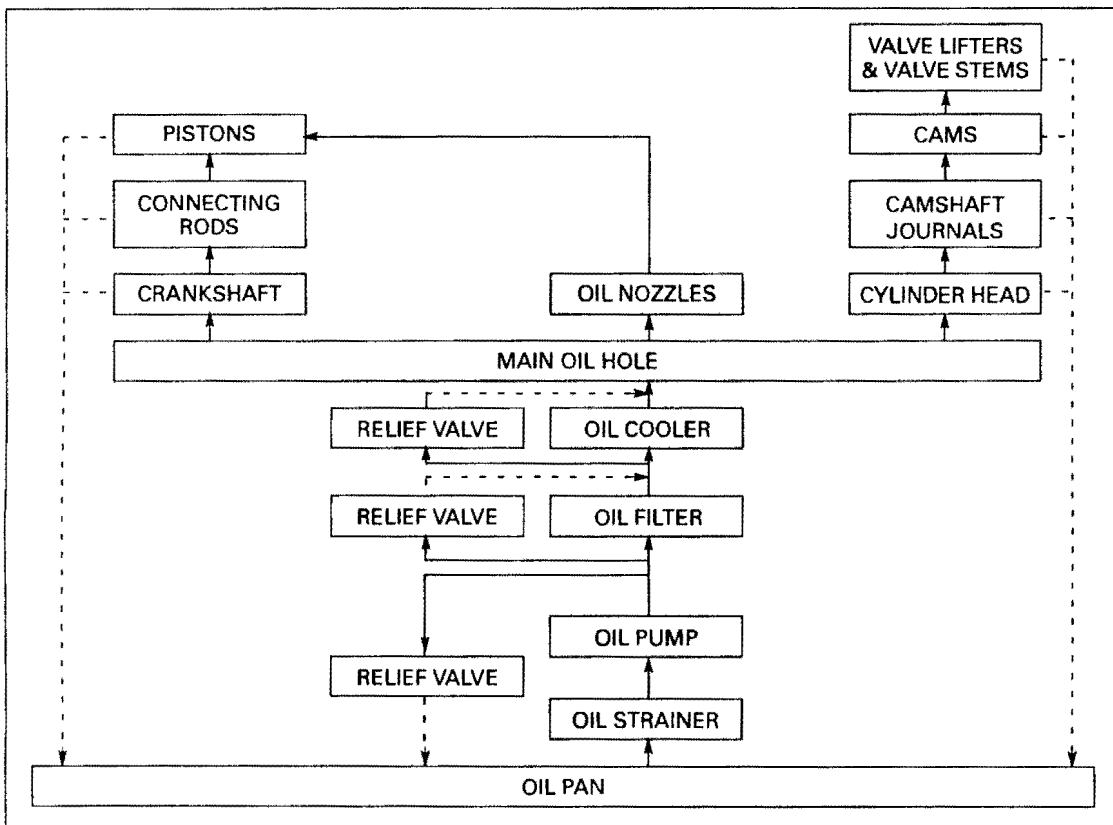
OPERATION

EG

EG148-03



P18018



Z13239

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 fed 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 2 rotors changes as they rotate. Oil is drawn in when the space widens and 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.


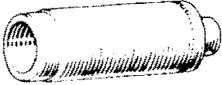

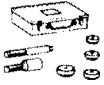

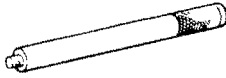

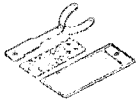


OIL FILTER

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)



EG14U-08

	09032-00100	Oil Pan Seal Cutter	
	09226-10010	Crankshaft Front & Rear Bearing Replacer	Crankshaft front oil seal
	09228-06500	Oil Filter Wrench	
	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
	09816-30010	Oil Pressure Switch Socket	Oil pressure switch for ST202
	09960-10010	Variable Pin Wrench Set	
	(09962-01000)	Variable Pin Wrench Arm Assy	Oil pump pulley
	(09963-00500)	Pin 5	Oil pump pulley

EG

RECOMMENDED TOOLS

EG14V-08

	09090-04000	Engine Sling Device	For suspending engine
	09200-00010	Engine Adjust Kit	

EQUIPMENT

Oil pressure gauge	
Torque wrench	

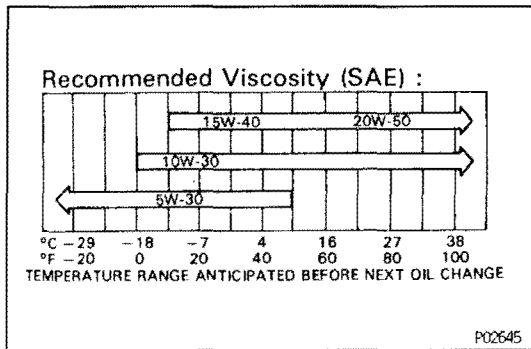
LUBRICANT

EG

Item	Capacity	Classification
Engine oil		API grade SG, SH or ILSC multigrade engine oil and recommended viscosity oil
Dry fill	5.2 liters (5.5 US qts, 4.6 Imp. qts)	
Drain and refill		
w/ Oil filter change	4.5 liters (4.8 US qts, 4.0 Imp. qts)	
w/o Oil filter change	4.0 liters (4.2 US qts, 3.5 Imp. qts)	

SSM (SPECIAL SERVICE MATERIALS)

08826-00080	Seal packing or equivalent	No.1 oil pan No.2 oil pan
08833-00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch



OIL PRESSURE CHECK

EQ428-01

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:

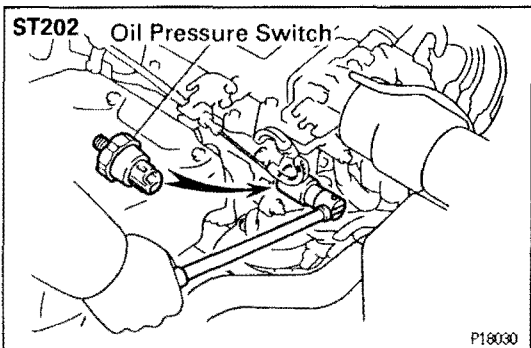
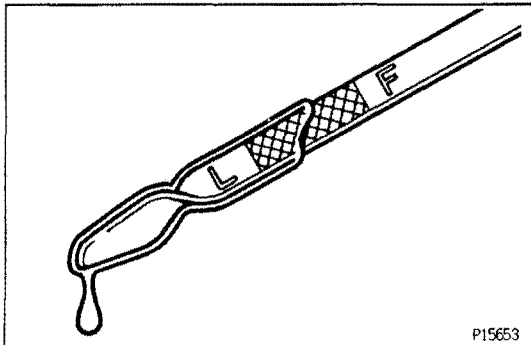
API grade SG, SH or ILSAC multigrade engine oil.

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.



3. REMOVE OIL PRESSURE SWITCH, AND INSTALL OIL PRESSURE GAUGE

(a) SW20:

Disconnect the throttle body from the ACIS valve.

(b) Remove the oil pressure switch.

HINT (ST202): Use SST.

SST 09816-30010

(c) Install the 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/cm², 4.3 psi) or more

At 5,000 rpm

245 - 490 kPa

(2.5 - 5.0 kgf/cm², 36 - 71 psi)

6. REMOVE OIL PRESSURE GAUGE, AND REINSTALL OIL PRESSURE SWITCH

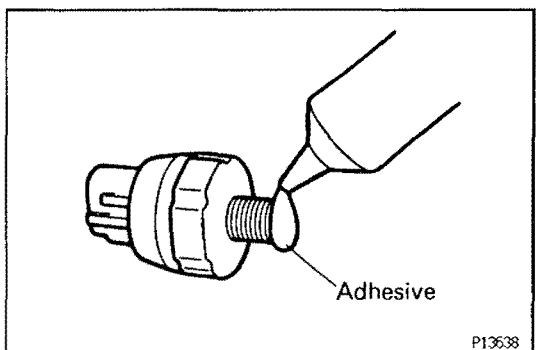
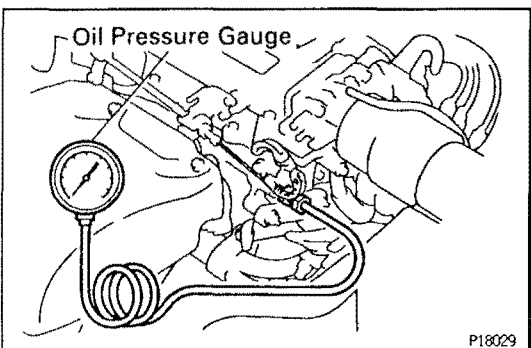
Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Part No. 08833-00080, THREE BOND 1344,

LOCTITE 242 or equivalent

7. START ENGINE, AND CHECK FOR OIL LEAKS



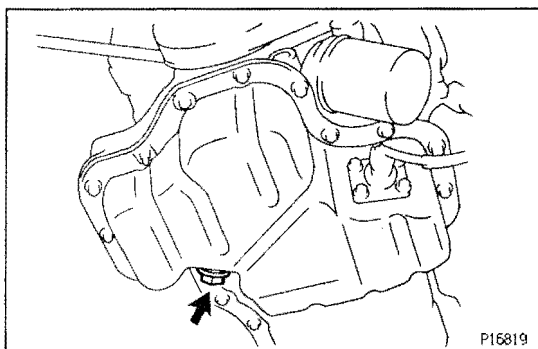
OIL AND FILTER REPLACEMENT

E0180-05

CAUTION:

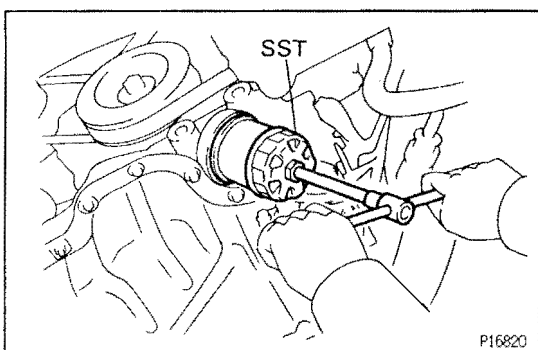
- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Care should be taken, therefore, when changing 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 waterless 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 filters must be disposed of only at designated disposal sites.

EG



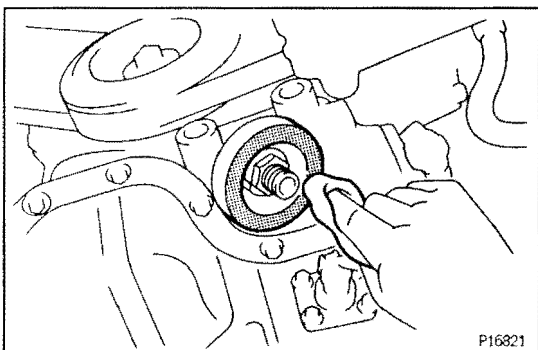
1. DRAIN ENGINE OIL

- Remove the oil filler cap.
- Remove the oil drain plug, and drain the oil into a container.

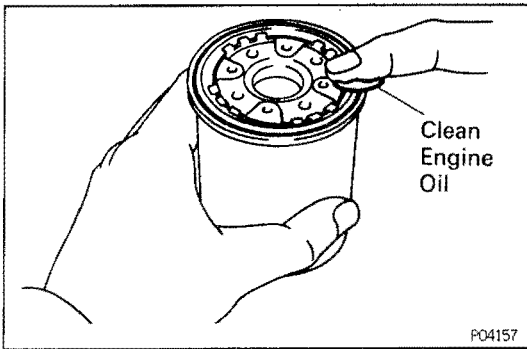


2. REPLACE OIL FILTER

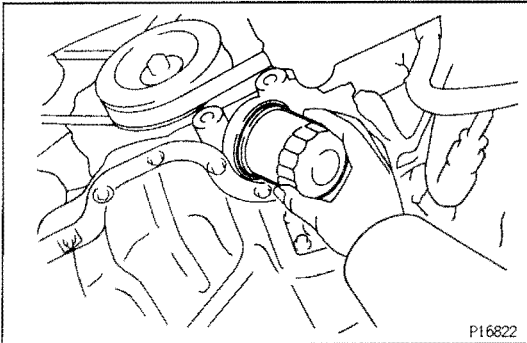
- Using SST, remove the oil filter.
SST 09228-06500



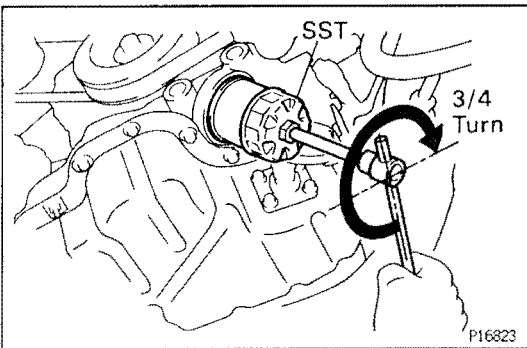
- Clean the oil filter contact surface on the oil filter mounting.



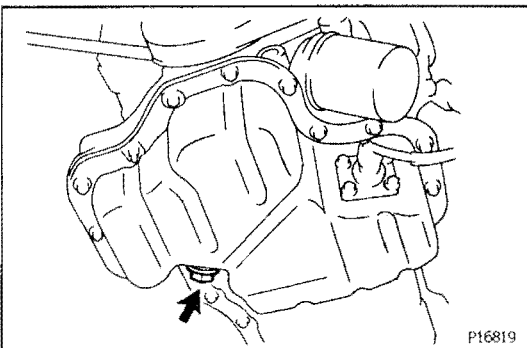
- (c) Lubricate the filter rubber gasket with clean engine oil.



- (d) Tighten the oil filter by hand until the rubber gasket contacts the seat of the filter mounting.



- (e) Using SST, give it an additional 3/4 turn to seat the filter.
SST 09228-06500



3. FILL WITH ENGINE OIL

- (a) Clean and install the oil drain plug with a new gasket.
Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

- (b) Fill with new engine oil.

Oil grade:

See step 1 on page EG-379)

Capacity:

Drain and refill

w/ Oil filter change

4.5 liters (4.8 US qts, 4.0 Imp. qts)

w/o Oil filter change

4.0 liters (4.2 US qts, 3.5 Imp. qts)

Dry fill

5.2 liters (5.5 US qts, 4.6 Imp. qts)

- (c) Reinstall the oil filler cap.

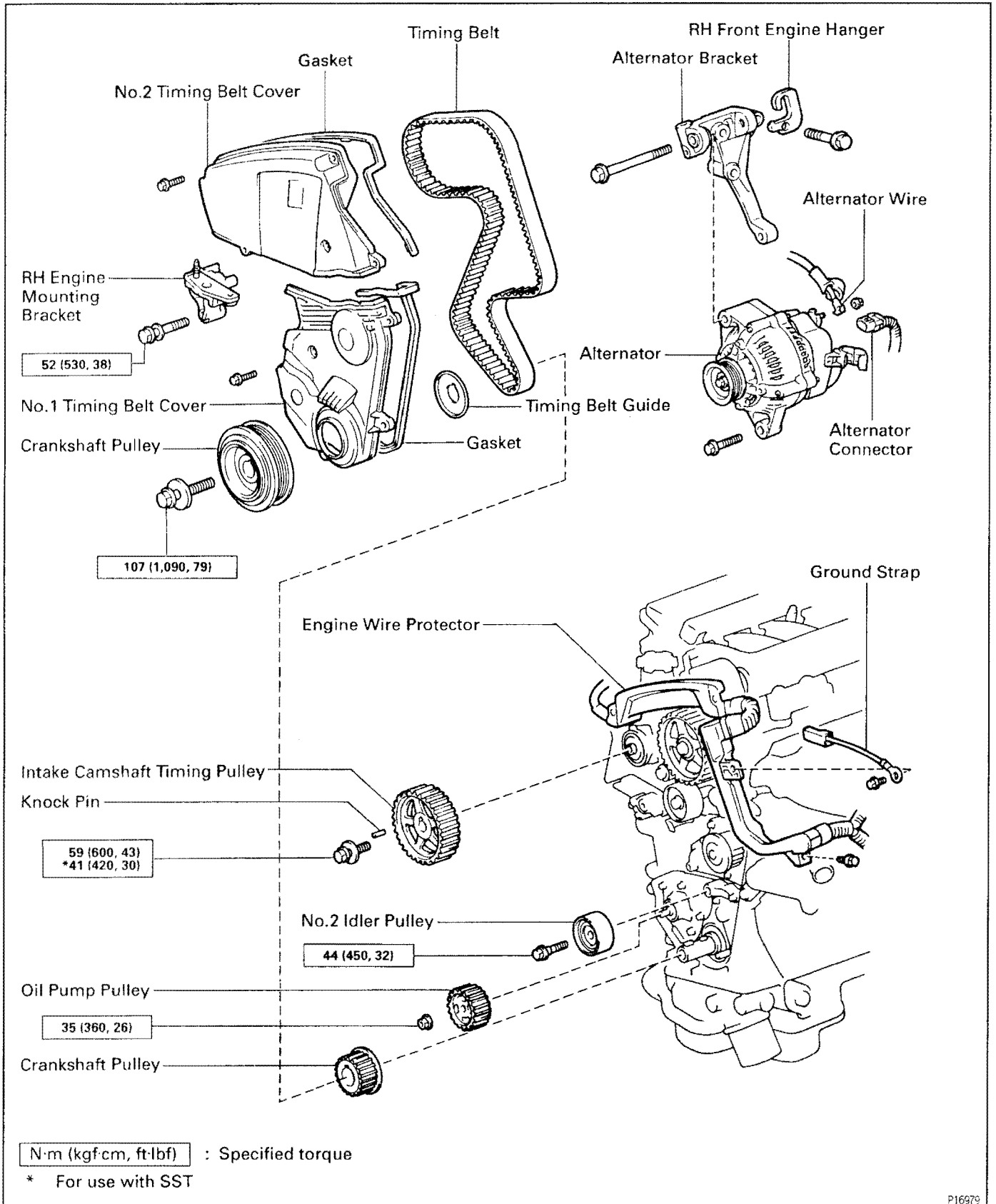
4. START ENGINE AND CHECK FOR OIL LEAKS

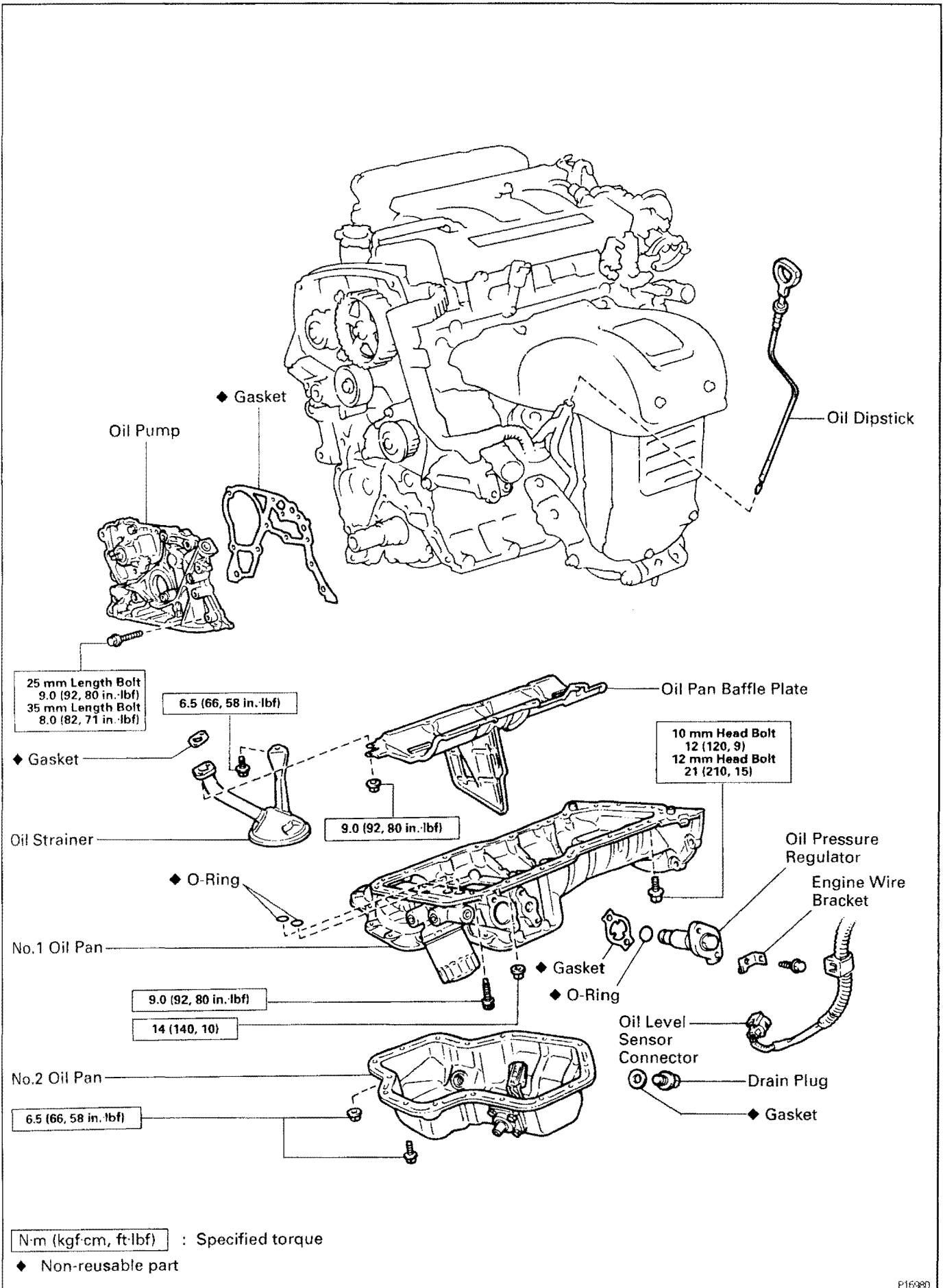
5. RECHECK ENGINE OIL LEVEL

OIL PUMP COMPONENTS FOR REMOVAL AND INSTALLATION (ST202)

EG182-00

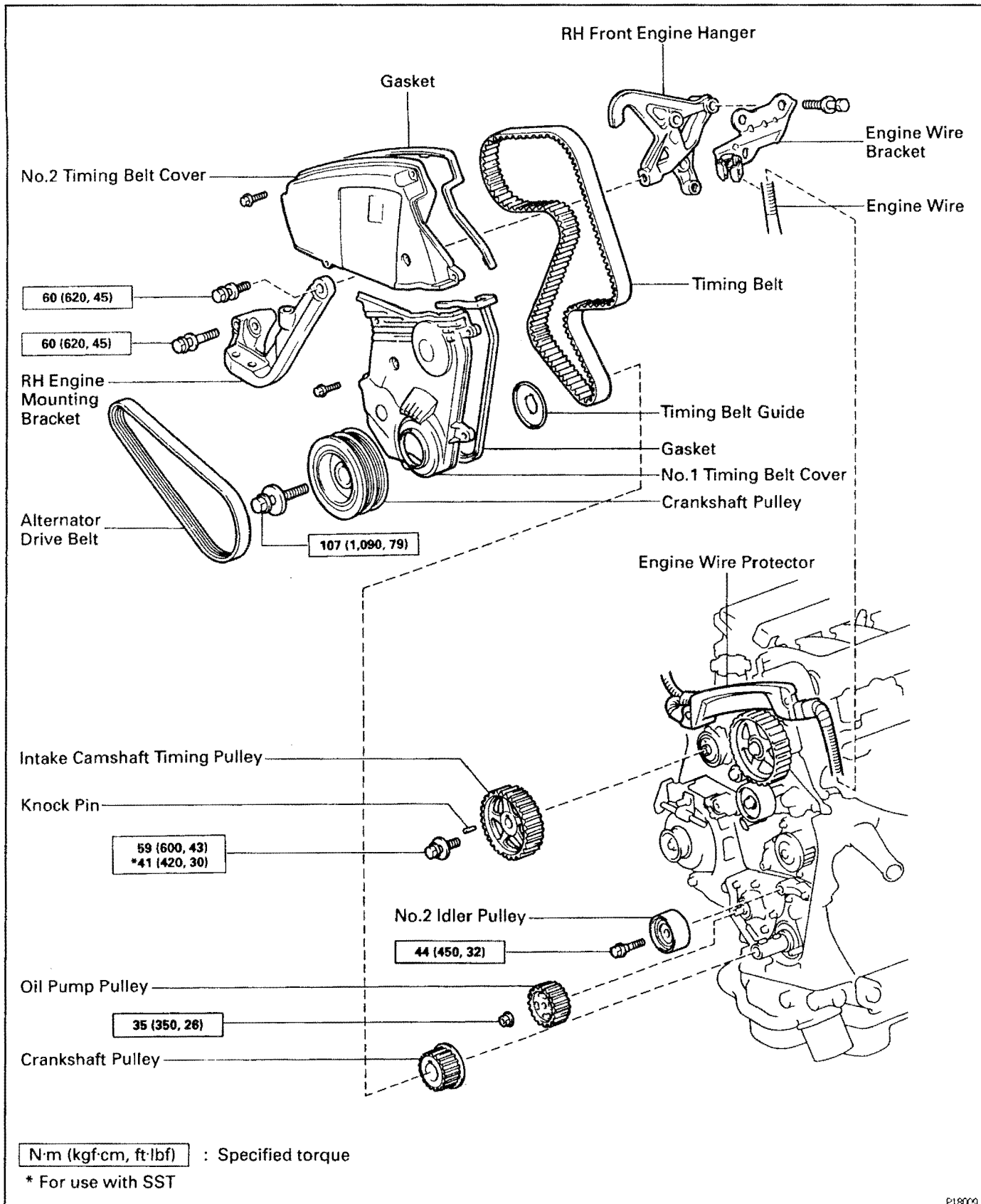
EG

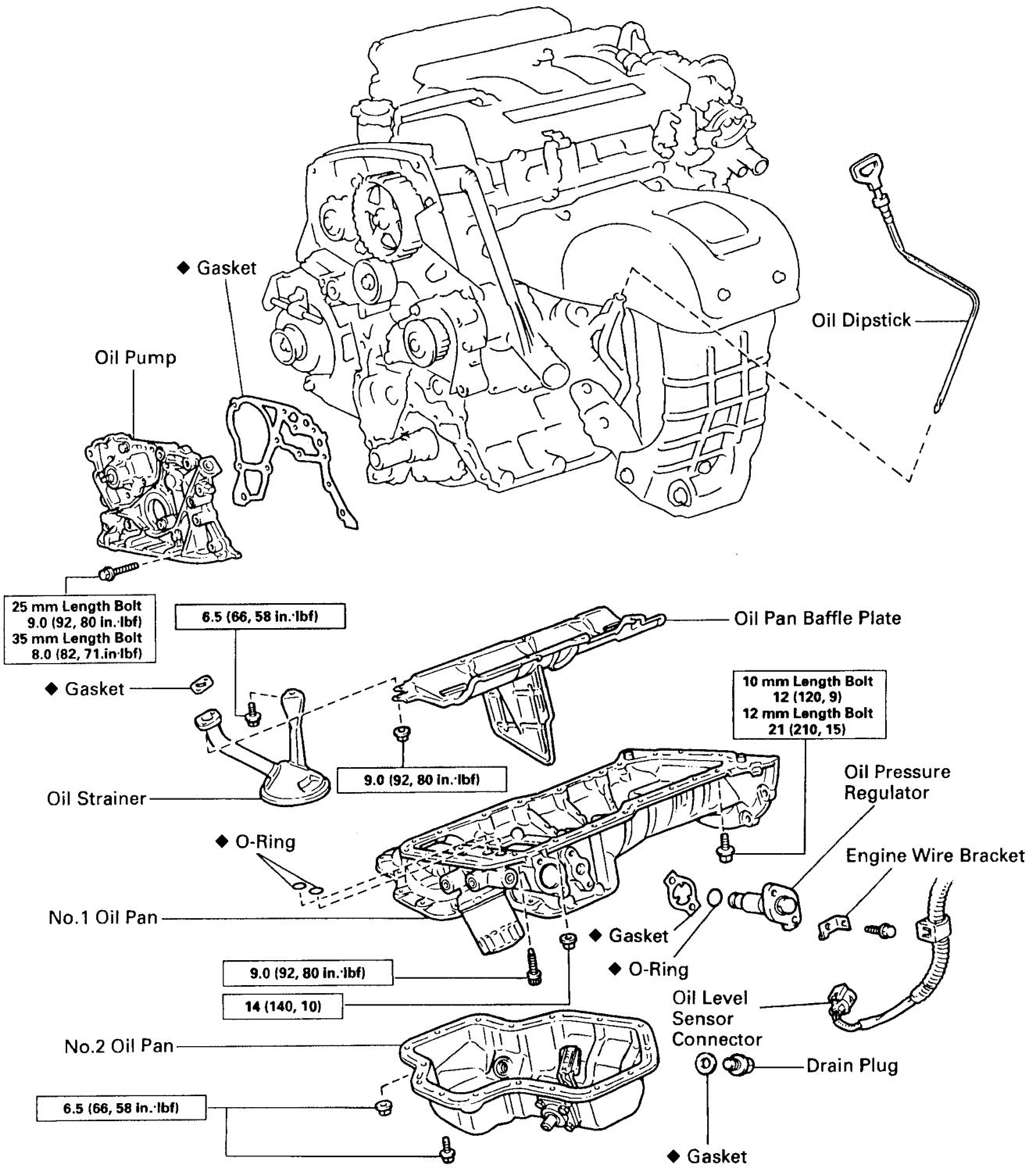




COMPONENTS FOR REMOVAL AND INSTALLATION (SW20)

EG





N·m (kgf·cm, ft·lbf) : Specified torque
 ◆ Non-reusable part
 ★ Precoated part

OIL PUMP REMOVAL

(See Components for Removal and Installation)

HINT: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.

1. REMOVE TIMING BELT

(See steps 1 to 6 and 8 to 13 on pages EG—49 to 54)

2. REMOVE NO.2 IDLER PULLEY

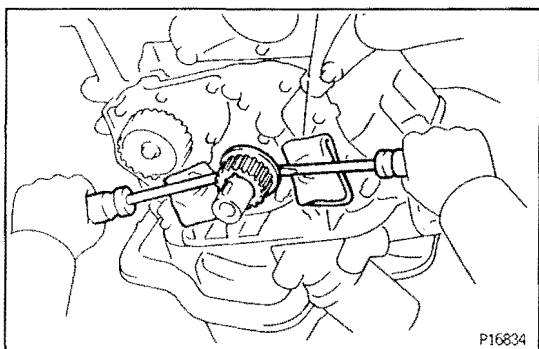
Remove the bolt and pulley.



3. REMOVE CRANKSHAFT TIMING PULLEY

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

HINT: Position shop rags as shown to prevent damage.

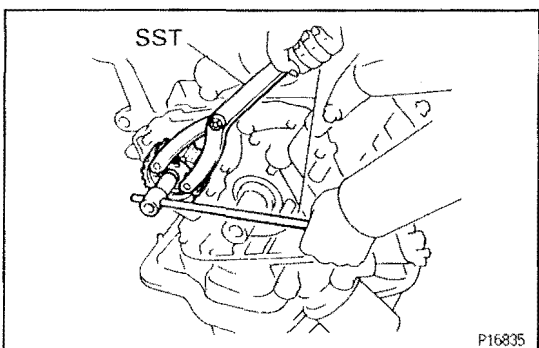


4. REMOVE OIL PUMP PULLEY

(a) Using SST, loosen the pulley nut.

SST 09960-10010 (09962-01000, 09963-00500)

(b) Remove the nut and pulley.

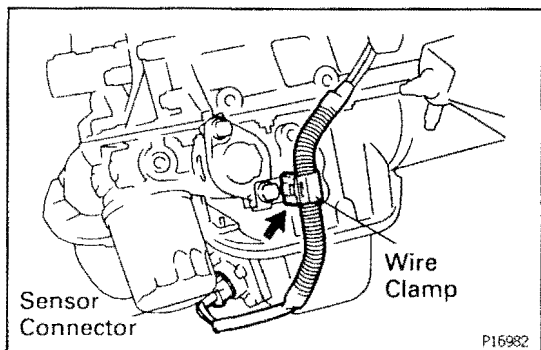


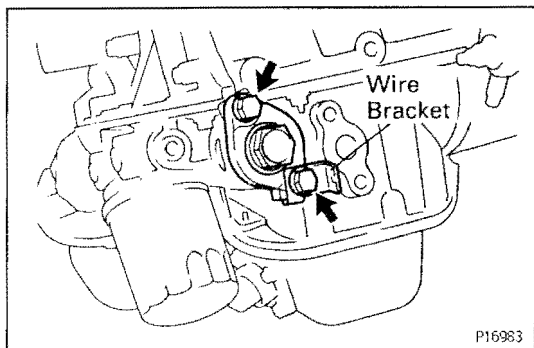
5. DISCONNECT OIL LEVEL SENSOR CONNECTOR

(a) Disconnect the wire clamp from the wire bracket on the oil pressure regulator.

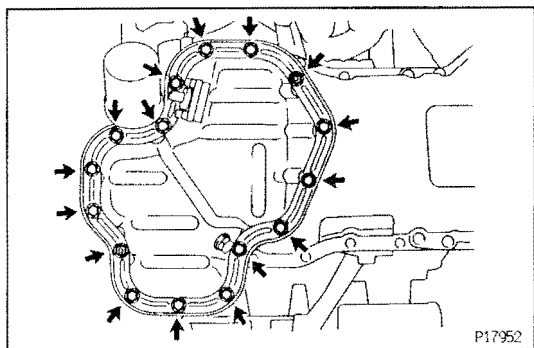
(b) Disconnect the oil level sensor connector.

6. REMOVE OIL DIPSTICK

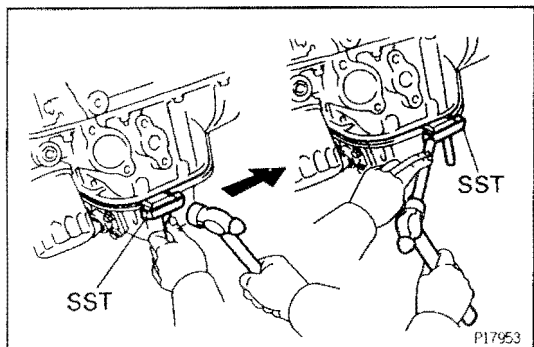


**7. REMOVE OIL PRESSURE REGULATOR**

- (a) Remove the 2 bolts, wire bracket, pressure regulator and gasket.
- (b) Remove the O-ring from the pressure regulator.

**8. REMOVE NO.2 OIL PAN**

- (a) Remove the 14 bolts and 2 nuts.

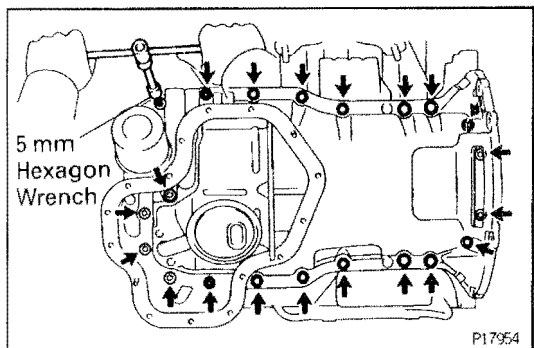


- (b) Insert the blade of SST between the No.1 oil pan and No.2 oil pan, and cut off applied sealer and remove the No.1 oil pan.

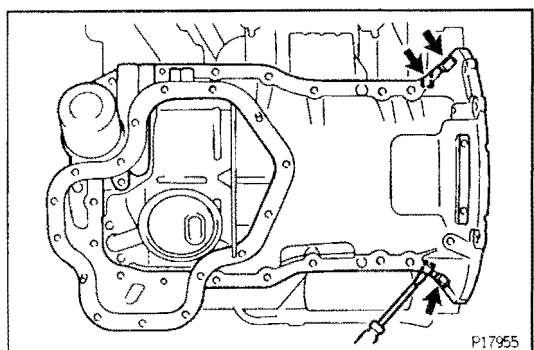
SST 09032-00100

NOTICE:

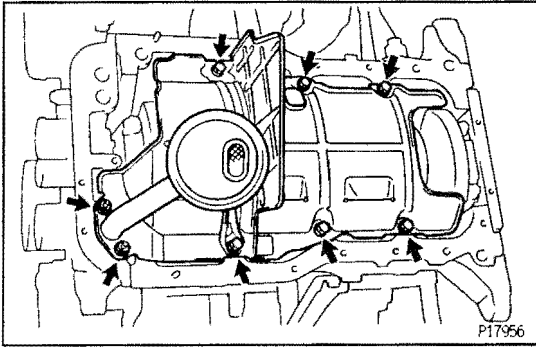
- Be careful not to damage the No.2 oil pan contact surface of the No.1 oil pan.
- Be careful not to damage the No.2 oil pan flange.

**9. REMOVE NO.1 OIL PAN**

- (a) Remove the 12 bolts, 7 hexagon bolts (use a 5 mm hexagon wrench) and 2 nuts.



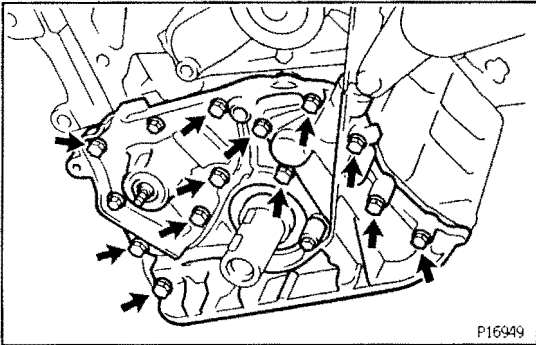
- (b) Remove the oil pan by prying the portions between the cylinder block and oil pan with a screwdriver. **NOTICE:** Be careful not to damage the contact surfaces of the cylinder block and oil pan.
- (c) Remove the 2 O-rings from the oil pump.



10. REMOVE OIL STRAINER AND OIL PAN BAFFLE PLATE

Remove the 2 bolts, 6 nuts, oil strainer, baffle plate and gasket.

EG

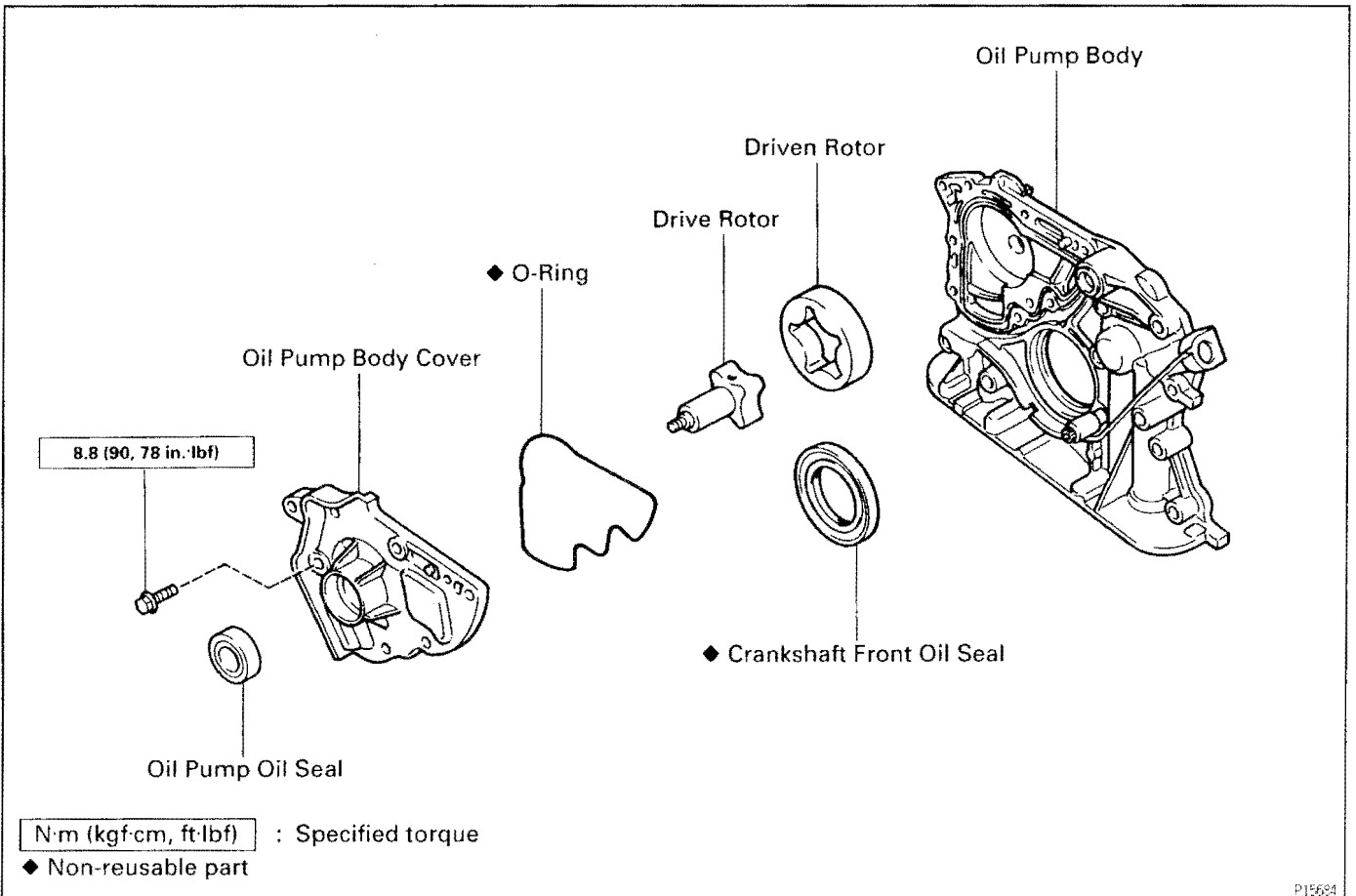


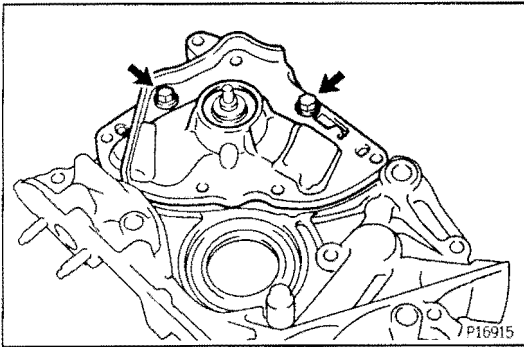
11. REMOVE OIL PUMP

- (a) Remove the 12 bolts.
- (b) Remove the oil pump and gasket.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

EG155-0A



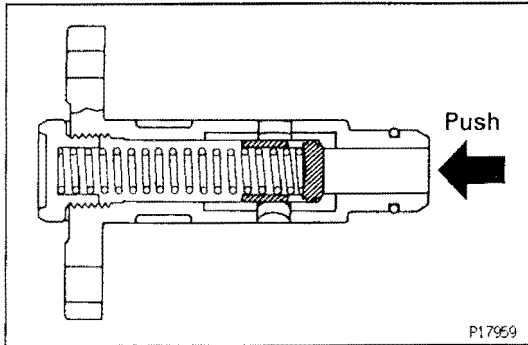


OIL PUMP DISASSEMBLY

(See Components for Disassembly and Assembly)

REMOVE DRIVE AND DRIVEN ROTORS

Remove the 2 bolts, pump body cover, O-ring, the drive and driven rotors.



OIL PUMP INSPECTION

1. INSPECT OIL PRESSURE REGULATOR

Push the valve with a wooden stick to check if it is stuck.

If stuck, replace the pressure regulator assembly.

2. INSPECT DRIVE AND DRIVEN ROTORS

A. Inspect rotor body clearance

Using a feeler 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 feeler gauge, measure the clearance between the drive and driven rotor tips.

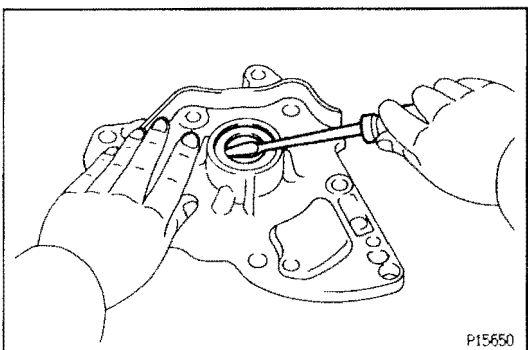
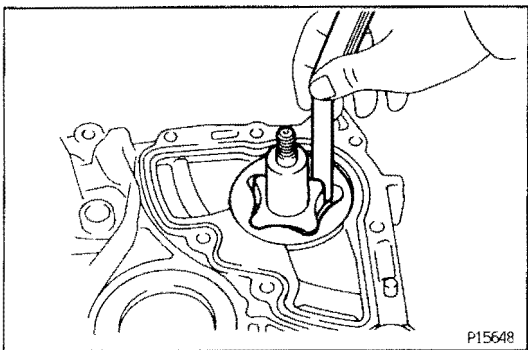
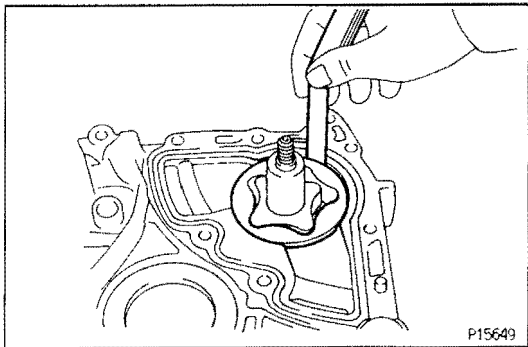
Standard tip clearance:

0.04 – 0.16 mm (0.0016 – 0.0063 in.)

Maximum tip clearance:

0.20 mm (0.0079 in.)

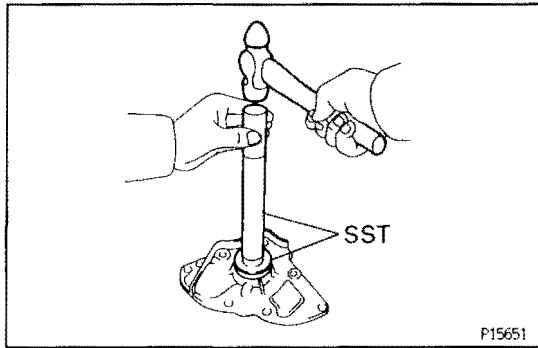
If the tip clearance is greater than maximum, replace the rotors as a set.



OIL PUMP OIL SEAL REPLACEMENT

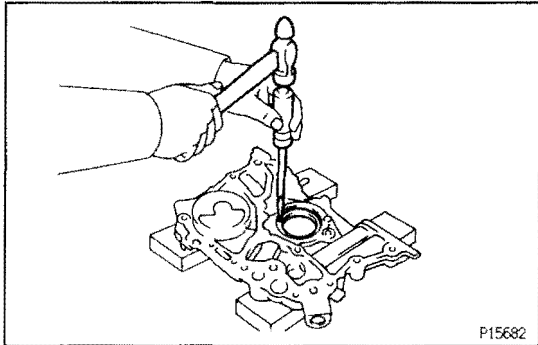
1. REMOVE OIL SEAL

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

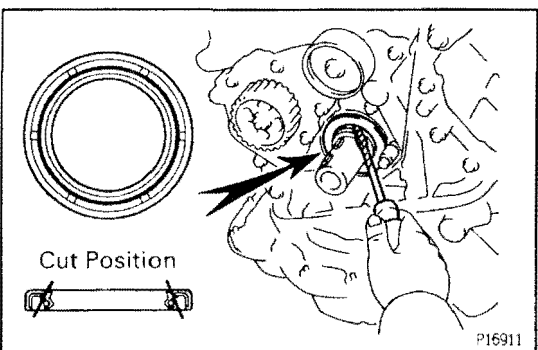
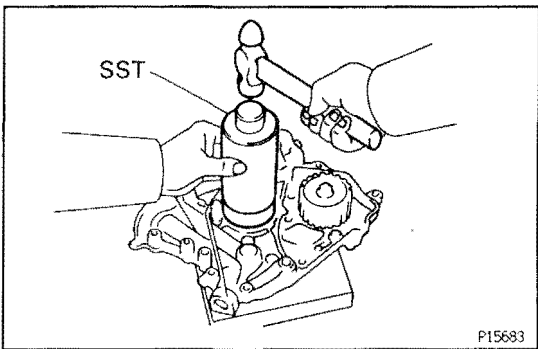
EG180-08

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

REPLACE CRANKSHAFT FRONT OIL SEAL

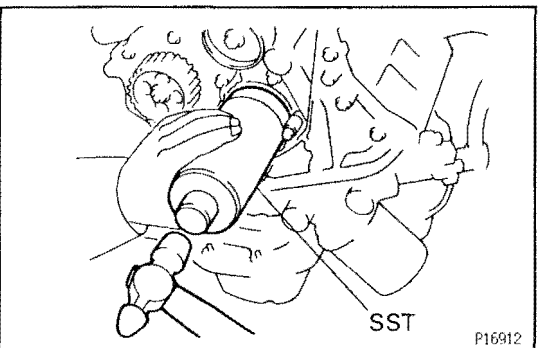
A. If oil pump is removed from cylinder block:

- (a) Using a 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 body 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 body edge.
SST 09226–10010

OIL PUMP ASSEMBLY

(See Components for Disassembly and Assembly)

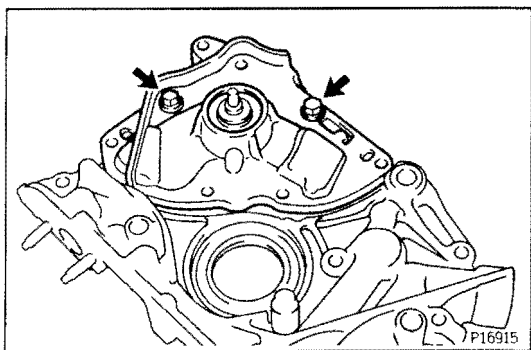
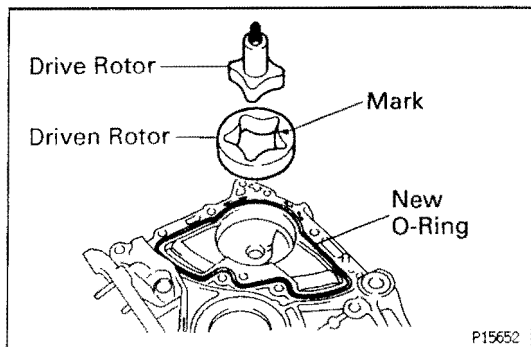
INSTALL DRIVE AND DRIVEN ROTORS

- (a) Place the drive and driven rotors into pump body with the mark on the driven rotor facing the pump body cover side.
- (b) Install a new O-ring to the oil pump body.

- (c) Install the oil pump body cover with the 2 bolts.

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

HINT: Use the 16 mm (0.63 in.) long bolt.



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. Uniformly tighten the the bolts in several passes.

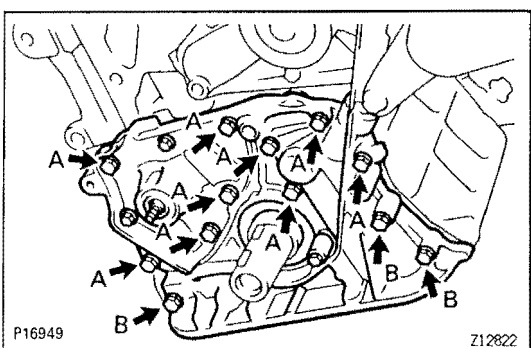
Torque:

25 mm (0.98 in.) long bolt (A)

9.0 N·m (92 kgf·cm, 80 in.-lbf)

35 mm (1.38 in.) long bolt (B)

8.0 N·m (82 kgf·cm, 71 in.-lbf)



2. INSTALL OIL PAN BAFFLE PLATE AND OIL STRAINER

Install a new gasket, the oil strainer and baffle plate with the 6 bolts and 2 nuts.

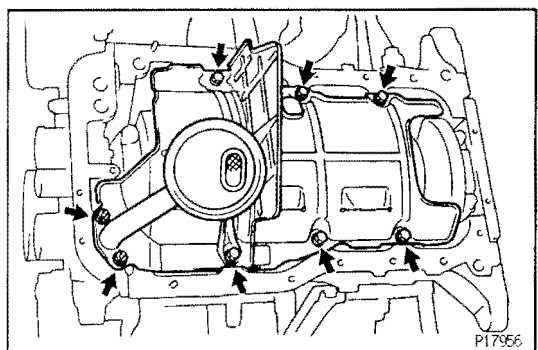
Torque:

Bolt

6.5 N·m (66 kgf·cm, 58 in.-lbf)

Nut

9.0 N·m (92 kgf·cm, 80 in.-lbf)

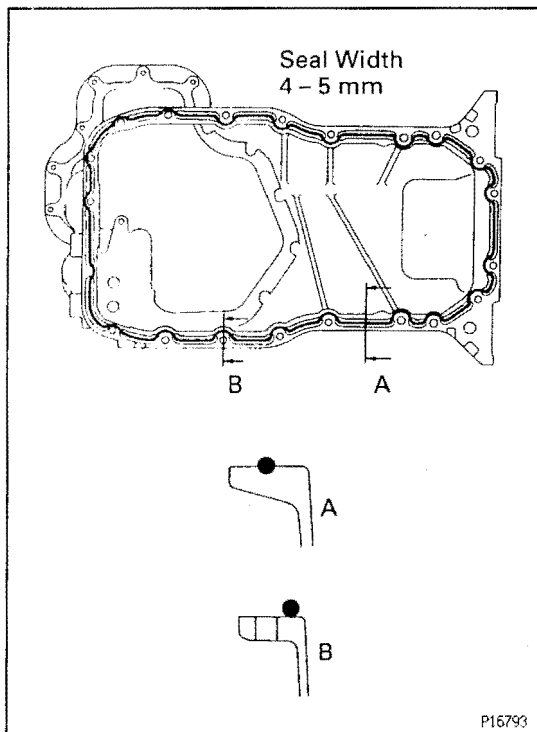


EG

3. INSTALL NO.1 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.

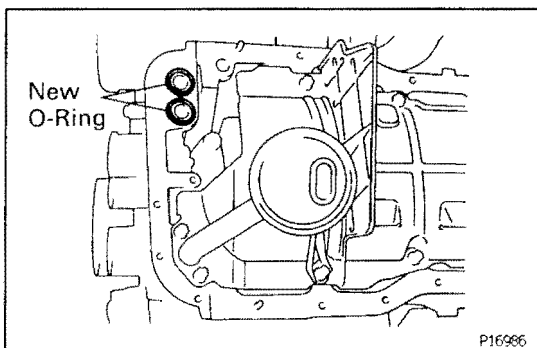


- (b) Apply seal packing to the oil pan as shown in the illustration.

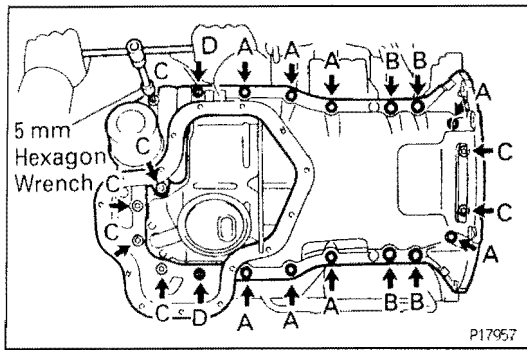
Seal packing:

Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 4 - 5 mm (0.16 - 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 2 new O-rings to the oil pump.



- (d) Install the oil pan with the 12 bolts, 7 hexagon bolts (use a 5 mm hexagon wrench) and 2 nuts. Uniformly tighten the the bolts and nuts in several passes.

Torque:

20 mm (0.79 in.) long bolt for 10 mm head (A)

12 N·m (120 kgf·cm, 9 ft·lbf)

25 mm (0.98 in.) long bolt for 12 mm head (B)

21 N·m (210 kgf·cm, 15 ft·lbf)

Hexagon bolt (C)

9.0 N·m (92 kgf·cm, 80 in·lbf)

Nut (D)

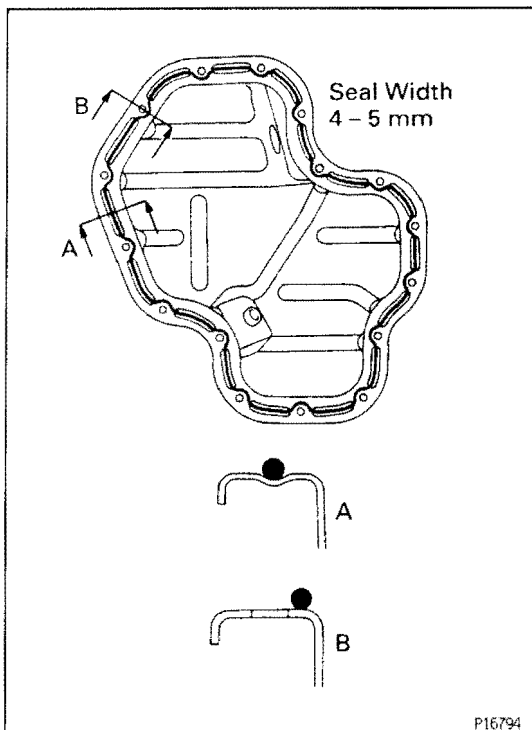
14 N·m (140 kgf·cm, 10 ft·lbf)

4. INSTALL NO.2 OIL PAN

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the No.1 oil pan and No.2 oil pan.

- 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.



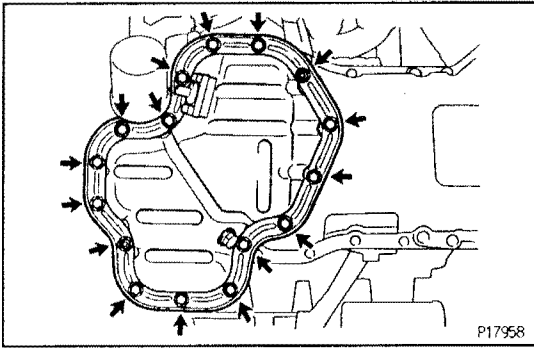
- (b) Apply seal packing to the oil pan as shown in the illustration.

Seal packing:

Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 4 – 5 mm (0.16 – 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.

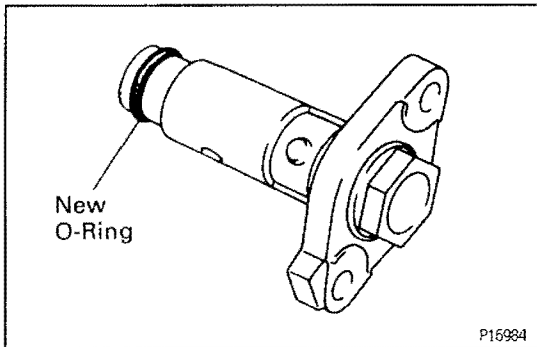
EG



- (c) Install the oil pan with the 14 bolts and 2 nuts. Uniformly tighten the the bolts and nuts in several passes.

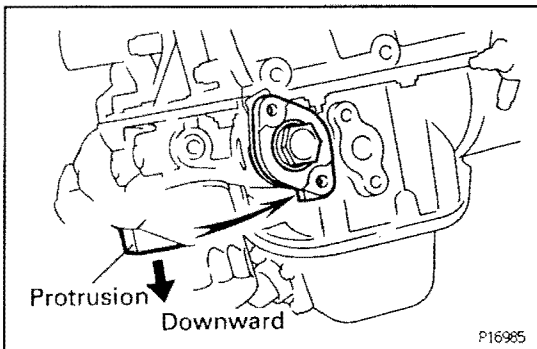
Torque: 6.5 N·m (66 kgf·cm, 58 in·lbf)

HINT: Use the 18 mm (0.71 in.) long bolt.

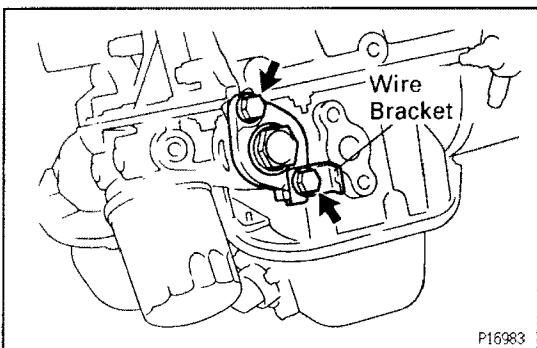


5. INSTALL OIL PRESSURE REGULATOR

- (a) Install a new O-ring to the pressure regulator.
 (b) Luricate the O-ring with clean engine oil.

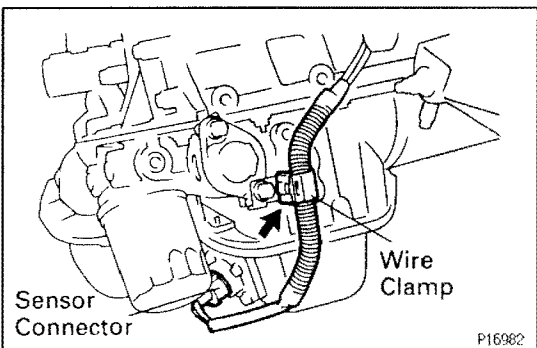


- (c) Install a new gasket to the pressure regulator.
 (d) Attach the pressure regulator to the No.1 oil pan, facing the protrusion downward.



- (e) Install the pressure regulator and wire bracket with the 2 bolts.

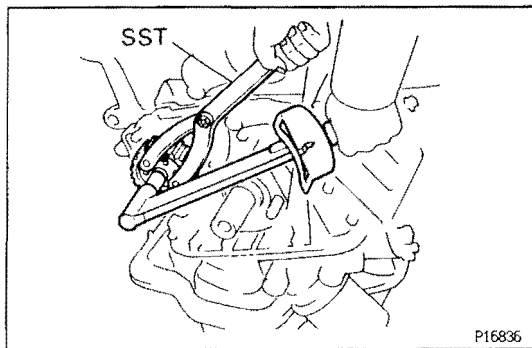
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



6. CONNECT OIL LEVEL SENSOR CONNECTOR

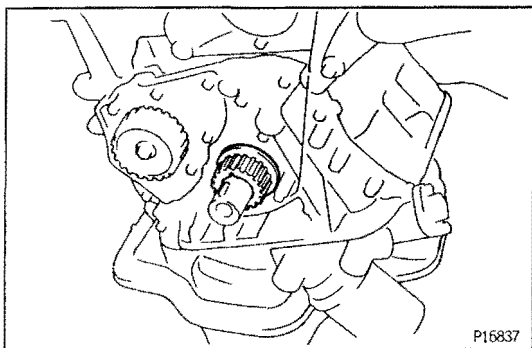
- (a) Connect the level sensor connector.
 (b) Install the wire clamp to the wire bracket on the pressure regulator.

7. INSTALL OIL DIPSTICK

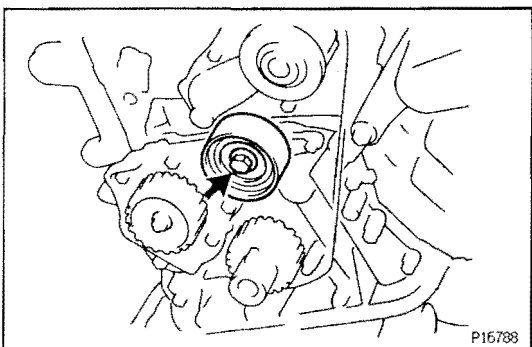
**8. INSTALL OIL PUMP PULLEY**

- (a) Align the cutouts of the pulley and shaft, and slide on the pulley.
- (b) Using SST, install the pulley nut.
SST 09960–10010 (09962–01000, 09963–00500)
Torque: 35 N·m (360 kgf·cm, 26 ft·lbf)

EG

**9. 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.

**10. INSTALL NO.2 IDLER PULLEY**

- (a) Install the pulley with the bolt.
Torque: 44 N·m (450 kgf·cm, 32 ft·lbf)
- (b) Check that the idler pulley moves smoothly.

11. INSTALL TIMING BELT

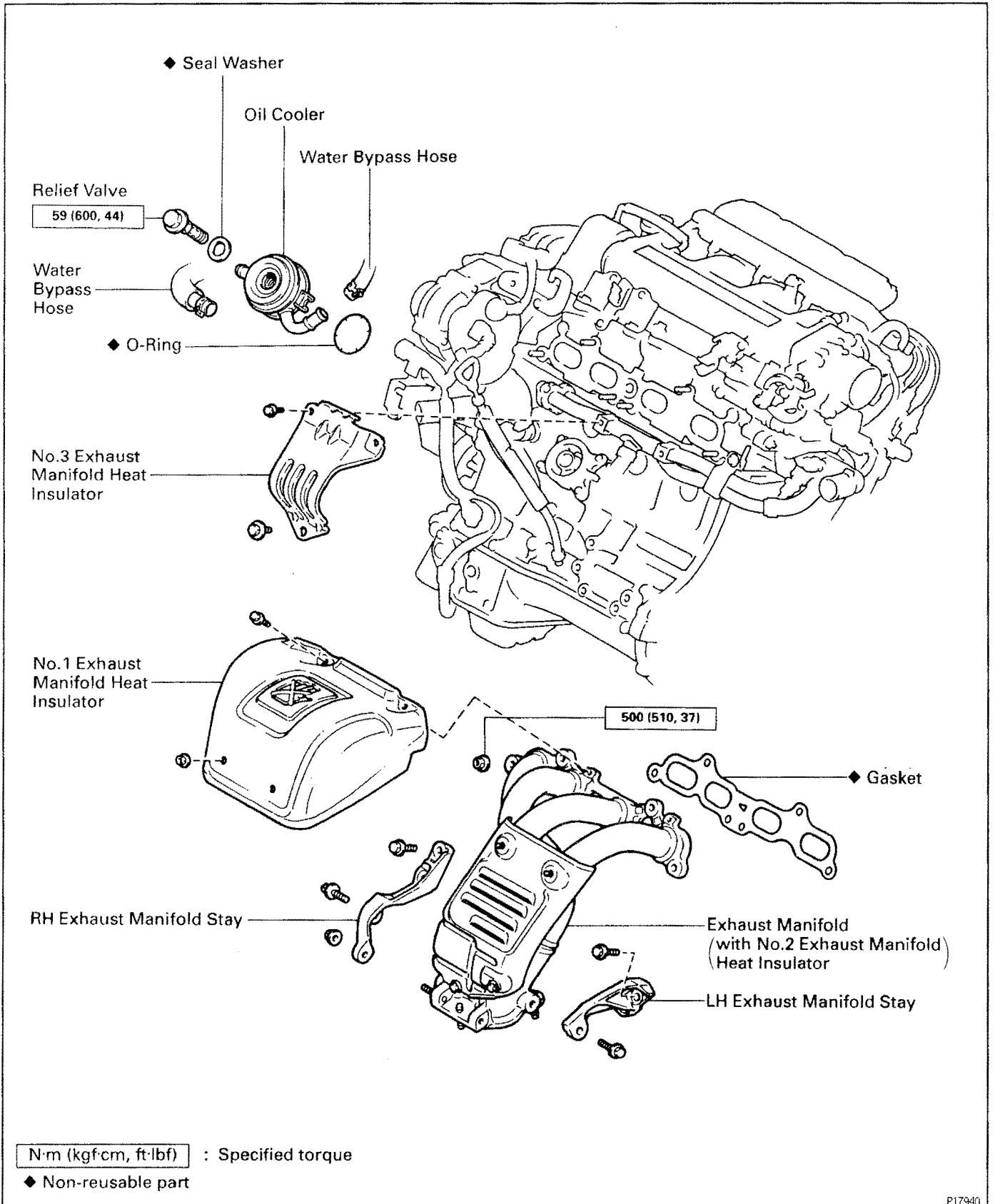
(See steps 7 to 12 and 14 to 20 on pages EG–59 to 65)

12. INSTALL OIL DIPSTICK**13. FILL WITH ENGINE OIL****14. START ENGINE AND CHECK FOR OIL LEAKS****15. RECHECK ENGINE OIL LEVEL**

OIL COOLER COMPONENTS FOR REMOVAL AND INSTALLATION (ST202)

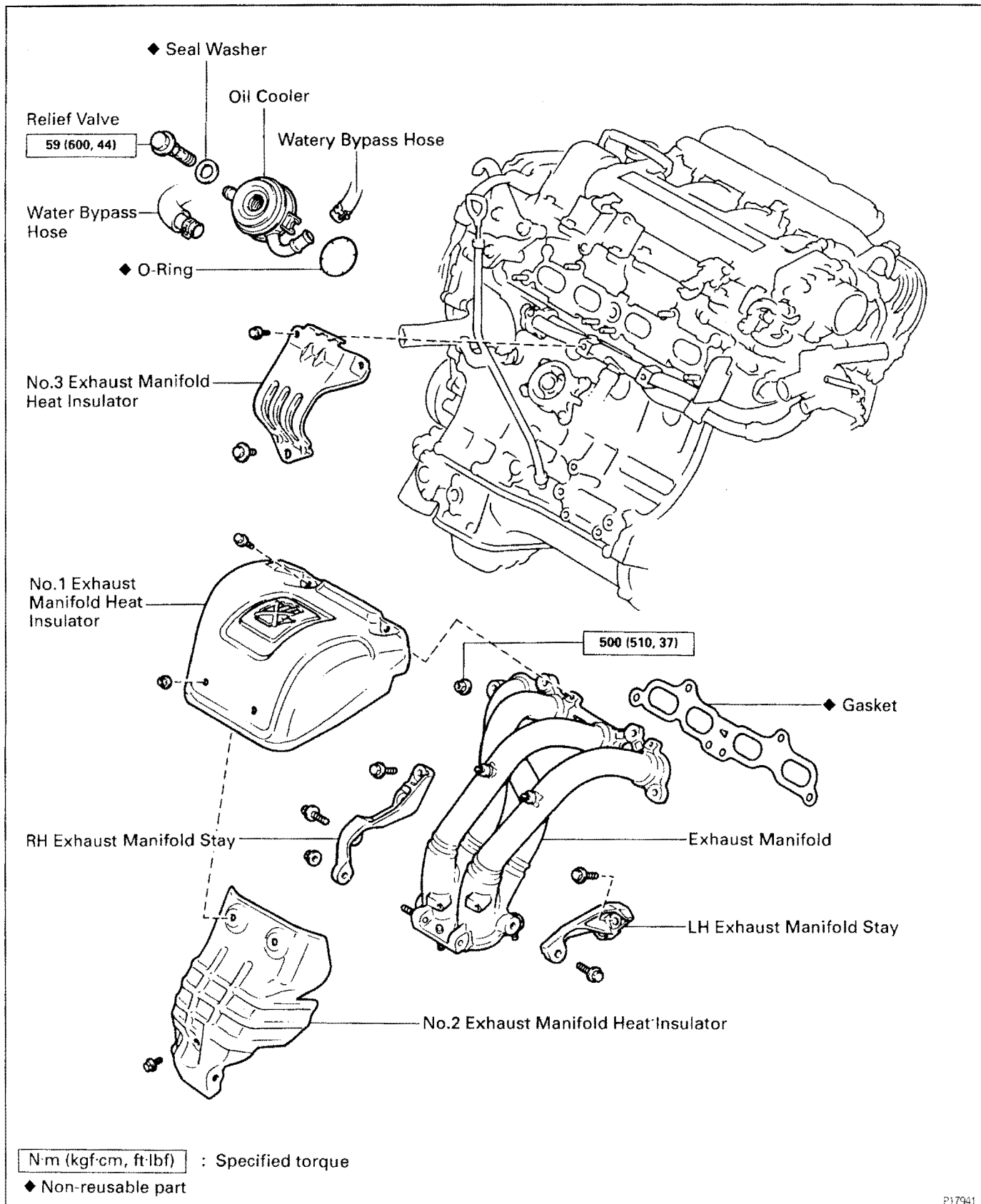
EG308-03

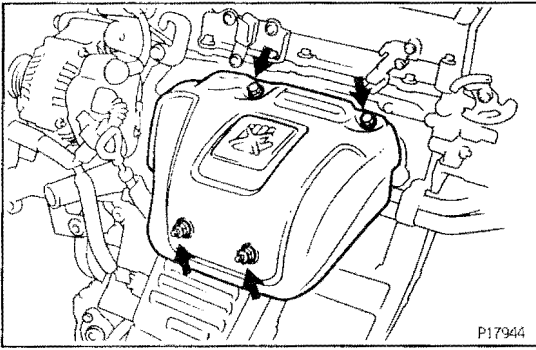
EG



COMPONENTS FOR REMOVAL AND INSTALLATION (SW20)

EG





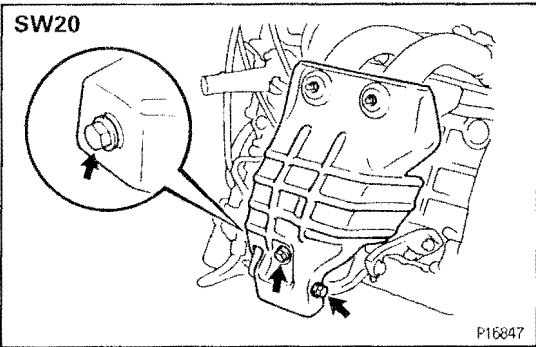
OIL COOLER REMOVAL

(See Components for Removal and Installation)

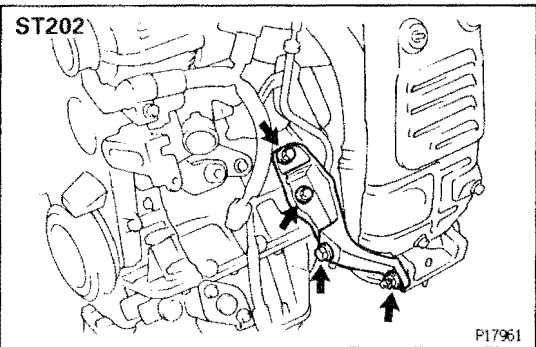
1. REMOVE EXHAUST MANIFOLD

- (a) Remove the 2 bolts, 2 nuts and No.1 exhaust manifold heat insulator.

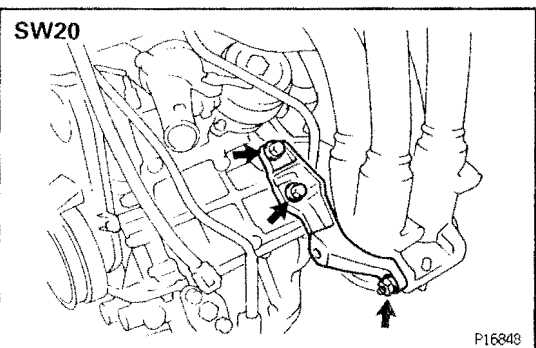
EG



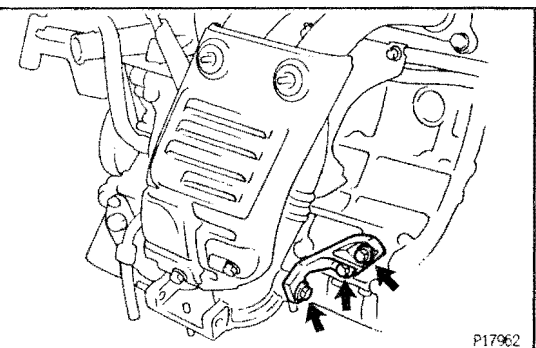
- (b) SW20:
Remove the 3 bolts and No.2 exhaust manifold heat insulator.



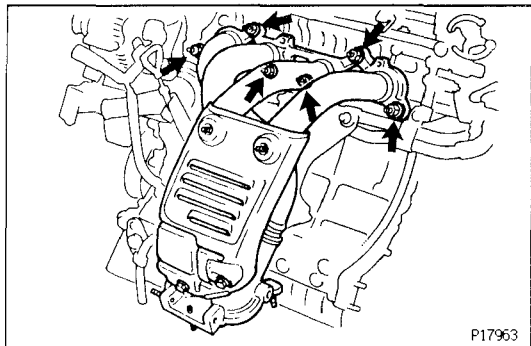
- (c) ST202:
Remove the 3 bolts, nut and RH exhaust manifold stay.



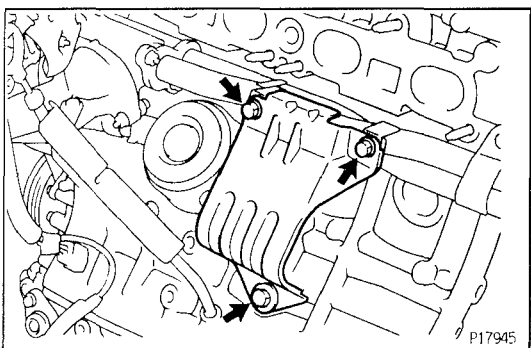
- (d) SW20:
Remove the 2 bolts, nut and RH exhaust manifold stay.



- (e) Remove the 3 bolts and LH exhaust manifold stay.

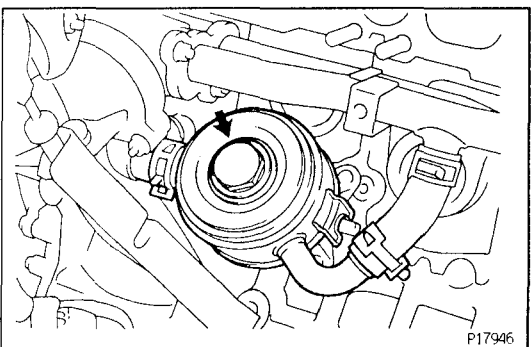


- (f) Remove the 6 nuts, exhaust manifold and gasket.



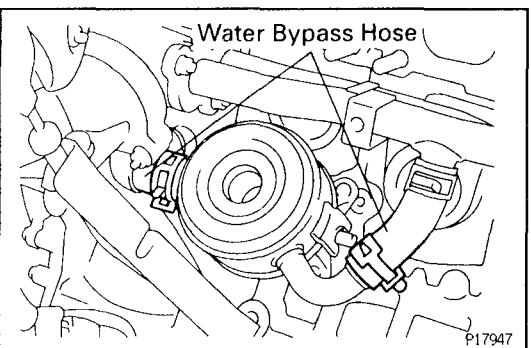
2. REMOVE NO.3 EXHAUST MANIFOLD HEAT INSULATOR

Remove the 3 bolts and No.3 exhaust manifold heat insulator.

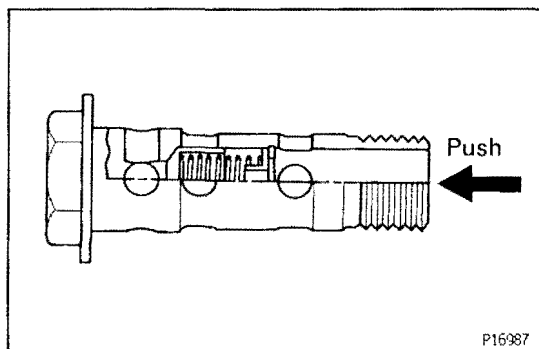


3. REMOVE OIL COOLER

- (a) Remove the relief valve and seal washer.



- (b) Disconnect the 2 water bypass hoses from the oil cooler, and remove the oil cooler.
 (c) Remove the O-ring from the oil cooler.

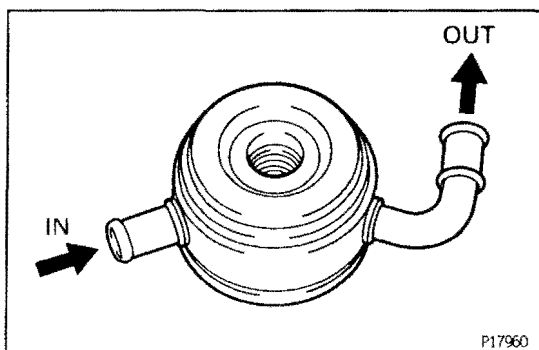


OIL COOLER INSPECTION

1. INSPECT RELIEF VALVE

Push the valve with a wooden stick to check if it is stuck.

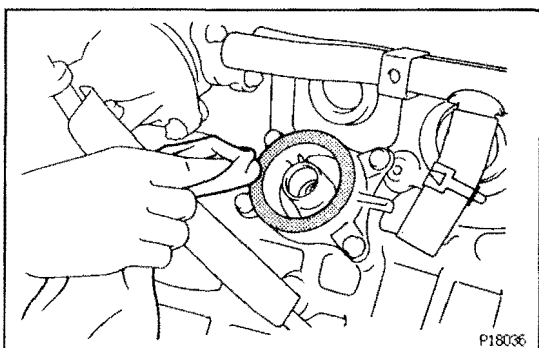
If stuck, replace the relief valve.



2. INSPECT OIL COOLER

Check the oil cooler for damage or clogging.

If necessary, replace the oil cooler.



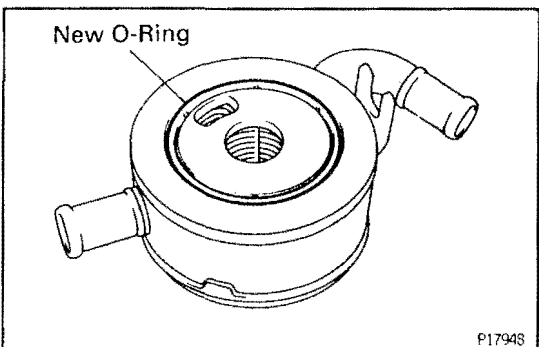
OIL COOLER INSTALLATION

(See Components for Removal and Installation)

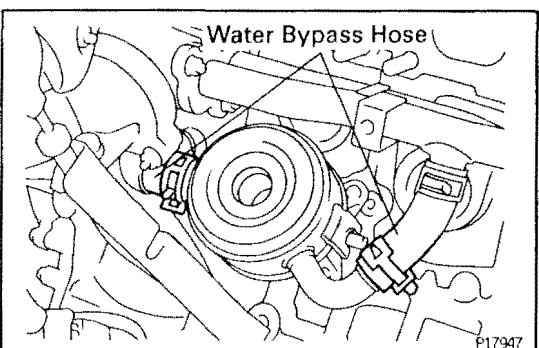
1. INSTALL OIL COOLER

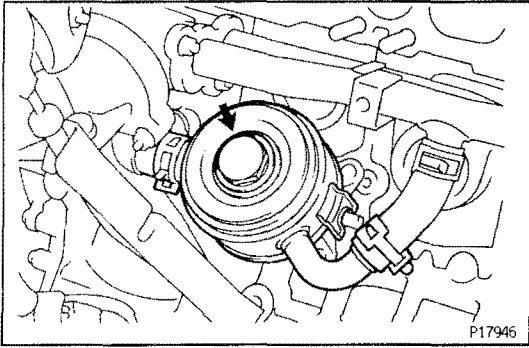
(a) Clean the oil cooler contact surface on the oil cooler mounting.

(b) Install a new O-ring to the oil cooler.

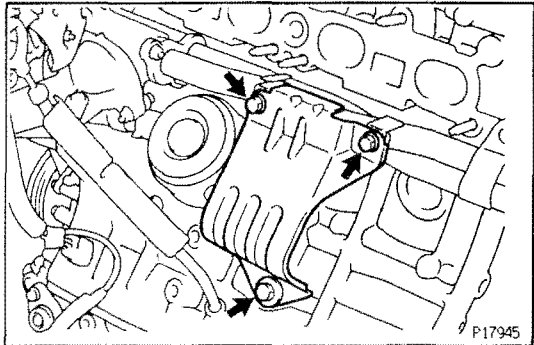


(c) Connect the 2 water bypass hoses to the oil cooler.





- (d) Apply a light coat of engine oil on the threads of the relief valve.
- (e) Install a new seal washer and the relief valve.
Torque: 59 N·m (600 kgf·cm, 44 ft·lbf)

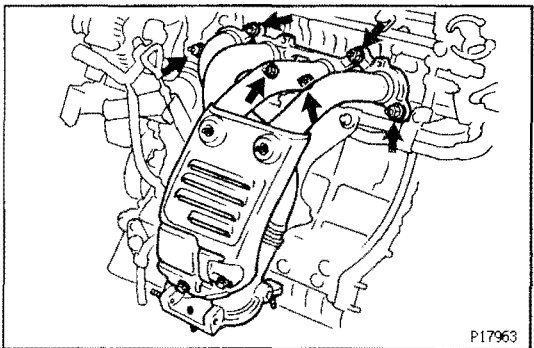


2. INSTALL NO.3 EXHAUST MANIFOLD HEAT INSULATOR

Install the heat insulator with the 3 bolts.

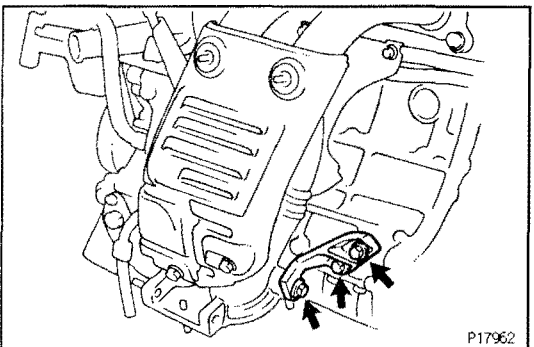
Torque:

- 12 mm bolt head
18 N·m (180 kgf·cm, 13 ft·lbf)
- 14 mm bolt head
37 N·m (380 kgf·cm, 27 ft·lbf)

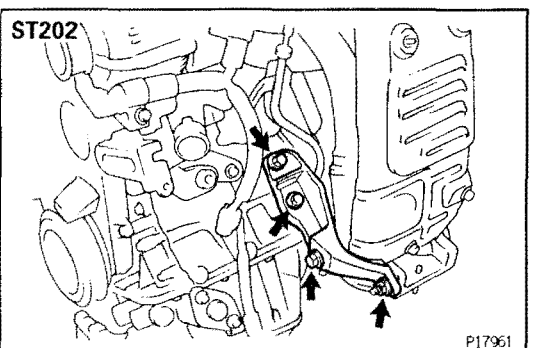


3. INSTALL EXHAUST MANIFOLD

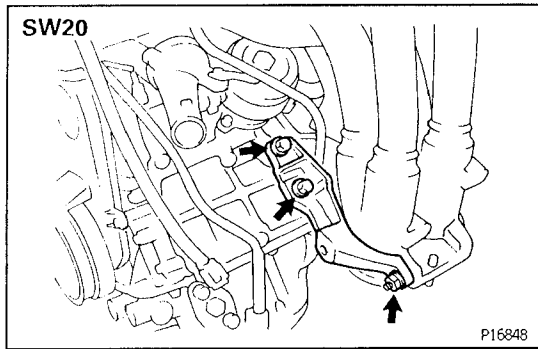
- (a) Install a new gasket and the exhaust manifold with the 6 nuts. Uniformly tighten the nuts in several passes.
Torque: 50 N·m (510 kgf·cm, 37 ft·lbf)



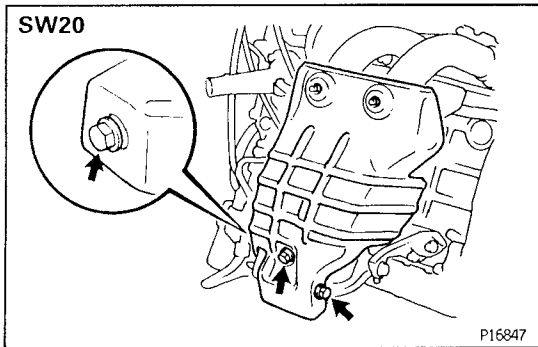
- (b) Install the LH exhaust manifold stay with the 3 bolts. Alternately tighten the bolts.
Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)



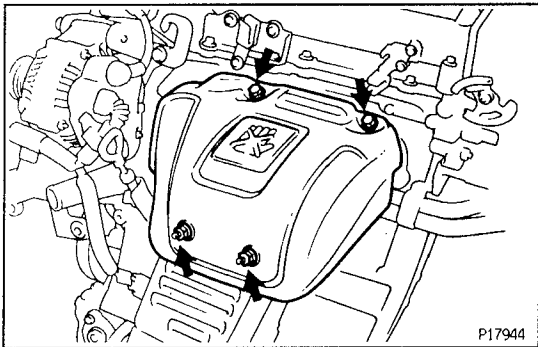
- (c) ST202:
Install the RH exhaust manifold stay with the 3 bolts and nut. Alternately tighten the bolts and nut.
Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)



- (d) **SW20:**
Install the RH exhaust manifold stay with the 2 bolts and nut. Alternately tighten the bolts and nut.
Torque: 58 N·m (590 kgf·cm, 43 ft·lbf)



- (e) **SW20:**
Install the No.2 exhaust manifold heat insulator with the 3 bolts.
Torque:
 12 mm head
 20 N·m (200 kgf·cm, 15 ft·lbf)
 14 mm head
 37 N·m (380 kgf·cm, 27 ft·lbf)

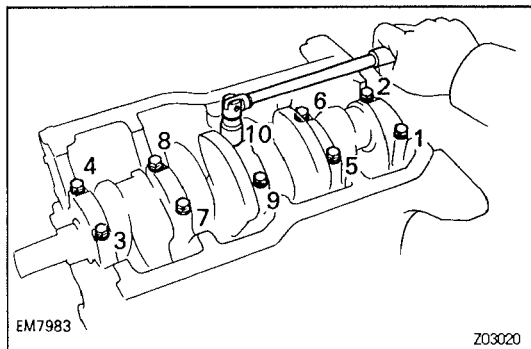
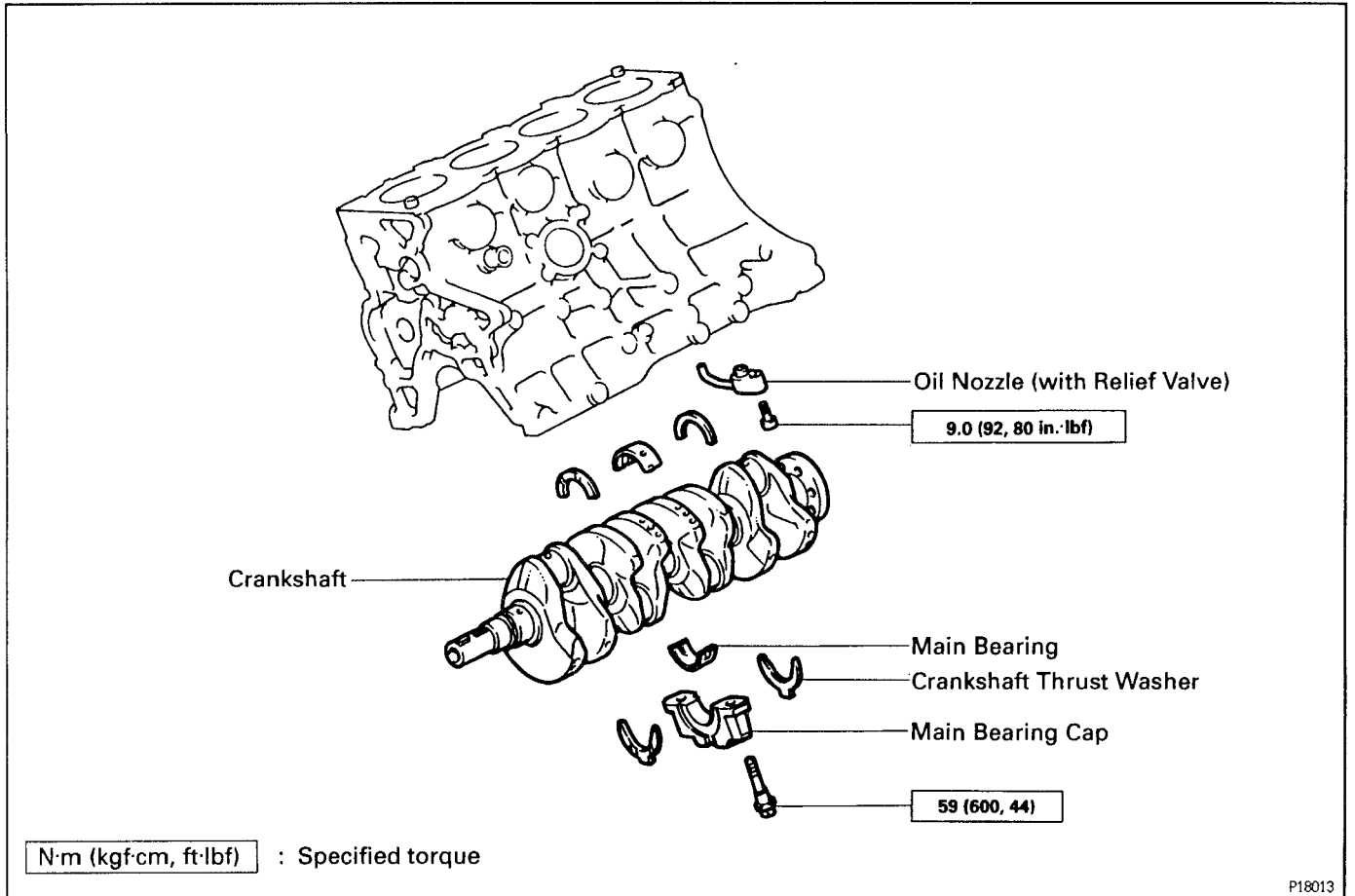


- (f) Install the No.1 exhaust manifold heat insulator with the 2 bolts and 2 nuts.
Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)

- 4. FILL WITH ENGINE COOLANT**
- 5. START ENGINE AND CHECK FOR LEAKS**
- 6. CHECK ENGINE OIL LEVEL**

OIL NOZZLE COMPONENTS FOR REMOVAL AND INSTALLATION

EG084-04



OIL NOZZLES REMOVAL

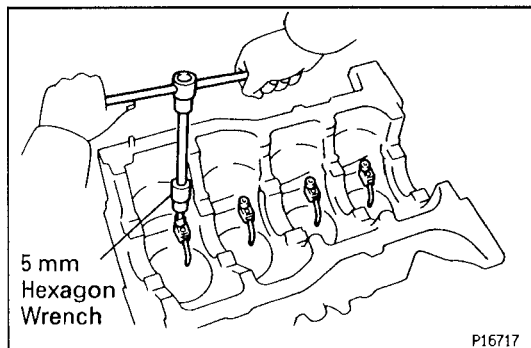
EG432-01

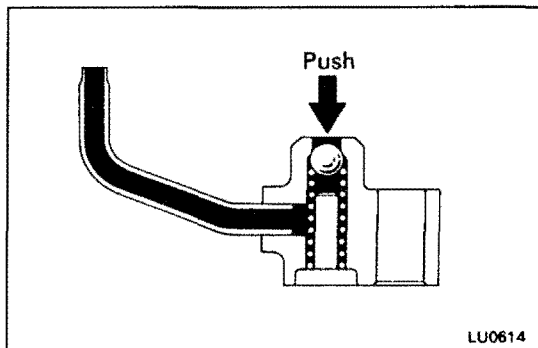
(See Components for Removal and Installation)

1. REMOVE OIL CRANKSHAFT
(See pages EG – 129 to 138)

2. REMOVE OIL NOZZLES

Using a 5 mm hexagon wrench, remove the bolt and oil nozzle. Remove the 4 nozzles.





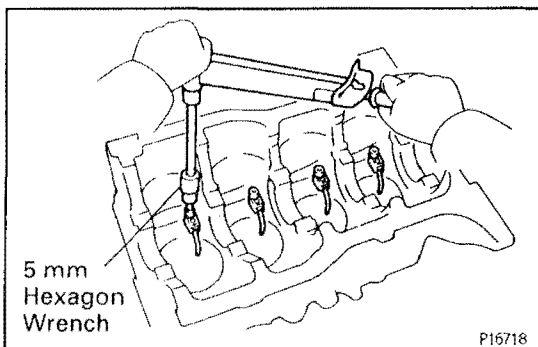
OIL NOZZLES INSPECTION

INSPECT RELIEF VALVE

Push the valve with a wooden stick to check if it is stuck.

If stuck, replace the relief valve.

EG



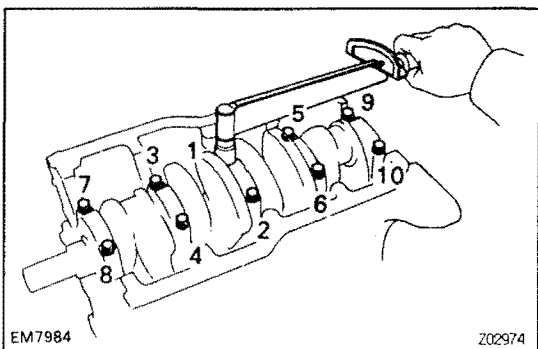
OIL NOZZLES INSTALLATION

(See Components for Removal and Installation)

1. INSTALL OIL NOZZLES

Using a 5 mm hexagon wrench, install the oil nozzle with the bolt. Install the 4 nozzles.

Torque: 9.0 N·m (92 kgf·cm, 80 in.-lbf)



2. INSTALL CRANKSHAFT

(See pages EG-151 to 157)

SERVICE SPECIFICATIONS

SERVICE DATA

EG18A-08

Oil pressure		at idle speed	29 kPa (0.3 kgf/cm ² , 43 psi) or more
		at 5,000 rpm	245 — 490 kPa (2.5 — 5.0 kgf/cm ² , 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.)

EG

EG18C-0F

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
Oil pan x Drain plug	37	380	27
Oil pump body cover x Oil pump body	8.8	90	78 in.-lbf
Oil pump x Cylinder block	25 mm long bolt	9.0	92
	35 mm long bolt	8.0	82
Oil strainer x Oil pump	9.0	92	80 in.-lbf
Oil strainer x Cylinder block	6.5	66	58 in.-lbf
Oil pan baffle plate x Cylinder block	6.5	66	58 in.-lbf
No.1 oil pan x Oil pump	9.0	92	80 in.-lbf
No.1 oil pan x Rear oil seal retainer	9.0	92	80 in.-lbf
No.1 oil pan x Cylinder block	20 mm (0.79 in.) long bolt for 10 mm head	12	120
	25 mm (0.98 in.) long bolt for 12 mm head	21	210
	Nut	14	140
No.1 oil pan x No.2 oil pan	6.5	66	58 in.-lbf
Oil pressure regulator x No.2 oil pan	18	180	13
Oil pump pulley x Oil pump drive shaft	35	360	26
No.2 idler pulley x Oil pump	44	450	32
Oil cooler x Oil cooler bracket (Relief valve)	59	600	44
No.3 exhaust manifold heat insulator x Water bypass pipe	18	180	13
No.3 exhaust manifold heat insulator x Cylinder block	37	380	27
Exhaust manifold x Cylinder head	50	510	37
Exhaust manifold stay x Exhaust manifold	58	590	43
Exhaust manifold stay x Cylinder block	58	590	43
No.2 exhaust manifold heat insulator x Exhaust manifold	12 mm head	20	200
	14 mm head	37	380
No.1 exhaust manifold heat insulator x Exhaust manifold	20	200	15
Oil nozzle x Cylinder block	9.0	92	80 in.-lbf

—MEMO—

EG

IGNITION SYSTEM

DESCRIPTION IG- 2
PRECAUTION IG- 4
SYSTEM CIRCUIT IG- 5
OPERATION IG- 6
PREPARATION IG- 6
ON-VEHICLE INSPECTION..... IG- 7
DISTRIBUTOR IG- 14
IGNITION MAIN RELAY (SW20) IG- 18
SERVICE SPECIFICATIONS IG- 19

IG

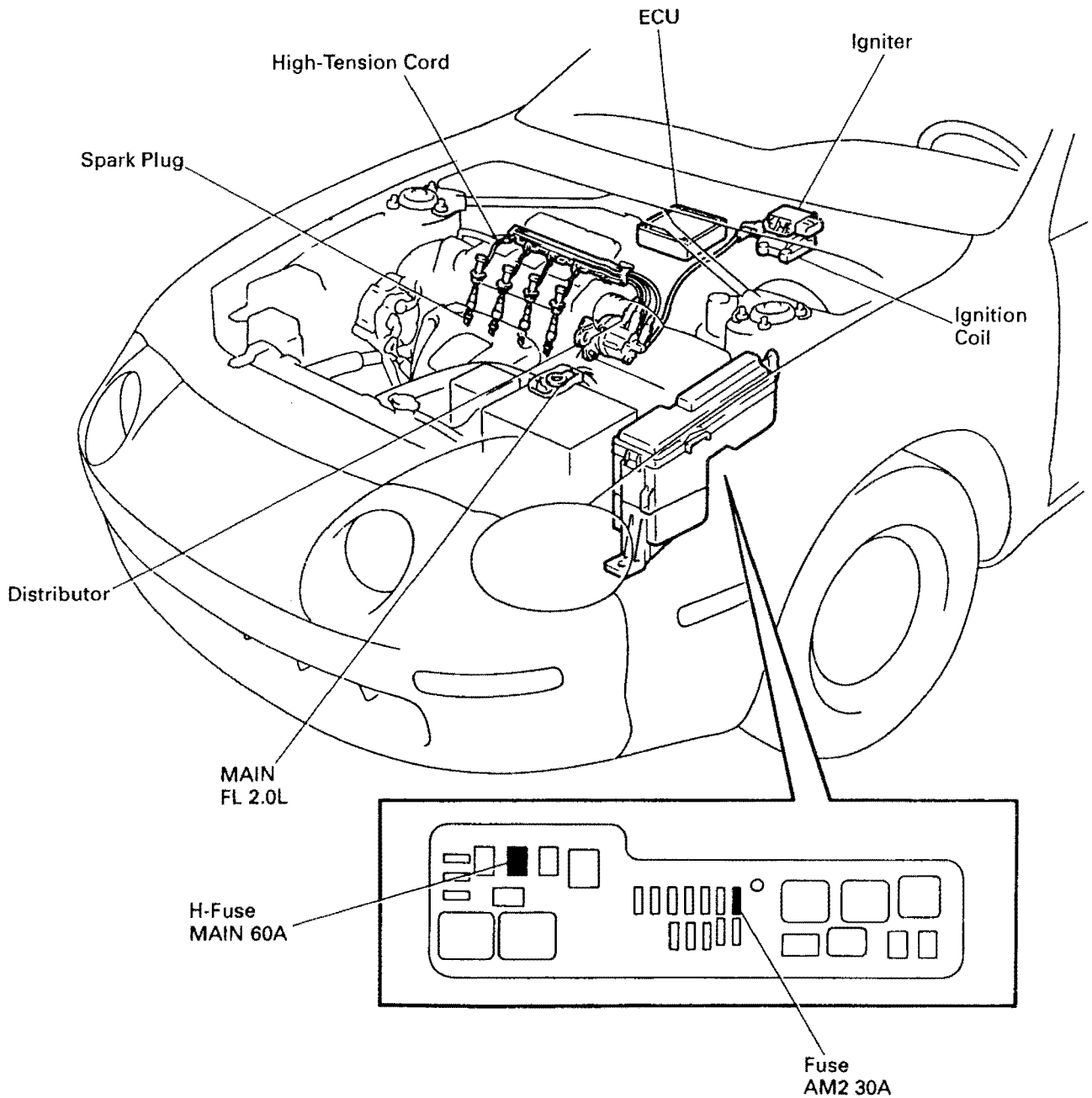
DESCRIPTION

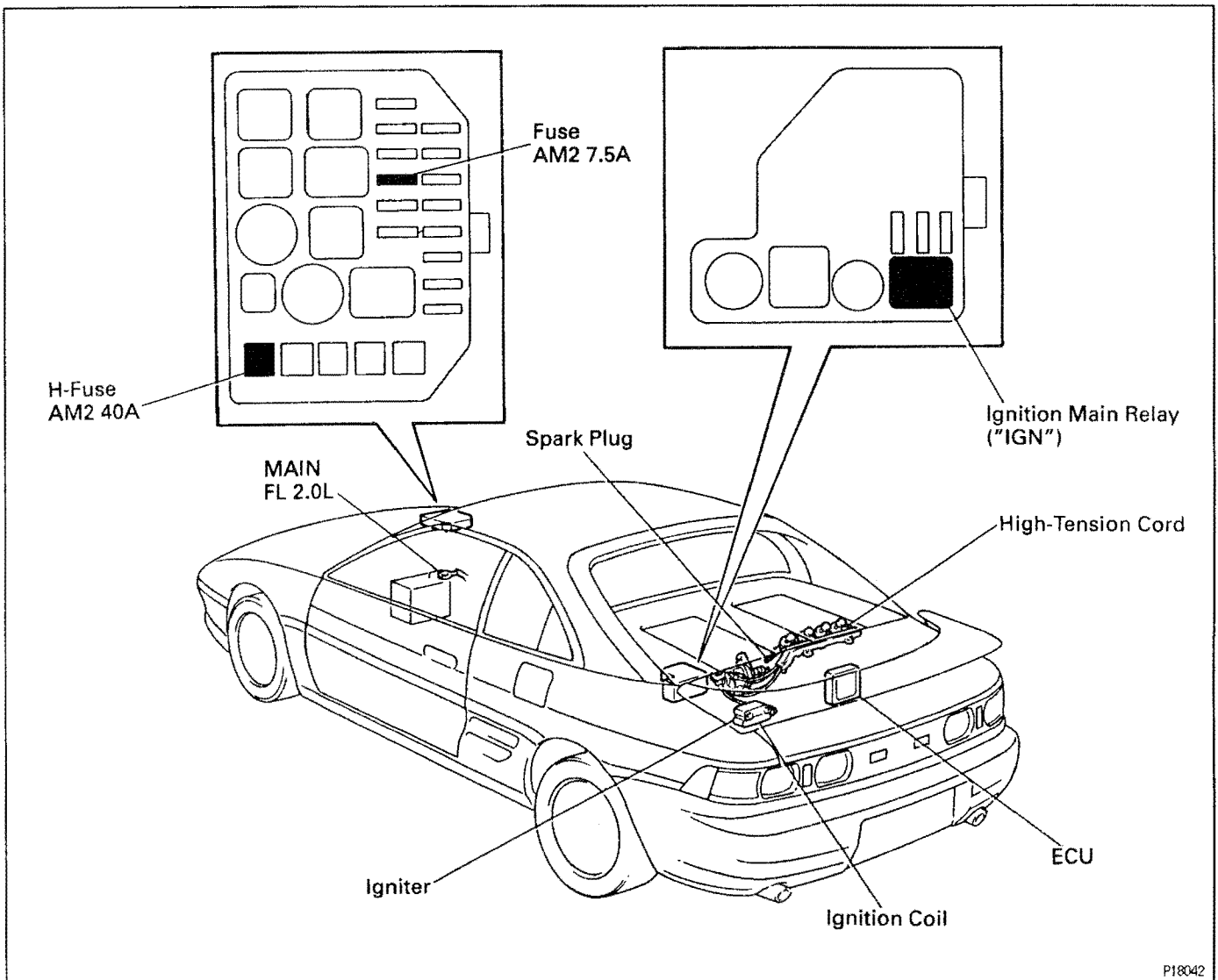
The ECU is programmed with data for optimum ignition timing under all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, intake air volume, engine temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant.

IG080-01

IG

ST202





IG

The ECU monitors the engine condition by signals from each sensor, calculates the ignition timing and sends an ignition signal to the igniter. High voltage from the ignition is distributed to each spark plug in the appropriate order to generate a spark between the electrodes, which ignites the air-fuel mixture.

IGNITER

The igniter temporarily interrupts the primary current with the ignition signal (IGT signal) from the ECU and generates sparks at the spark plug. Also, as a fail-safe measure, when ignition occurs an ignition confirmation signal (IGF signal) is sent to the ECU.

IGNITION COIL

The ignition coil uses a closed core coil with the primary coil wrapped around the core and the secondary coil wrapped around the primary coil. This allows the generation of a high voltage sufficient to cause a spark to jump across the spark plug gap.

DISTRIBUTOR

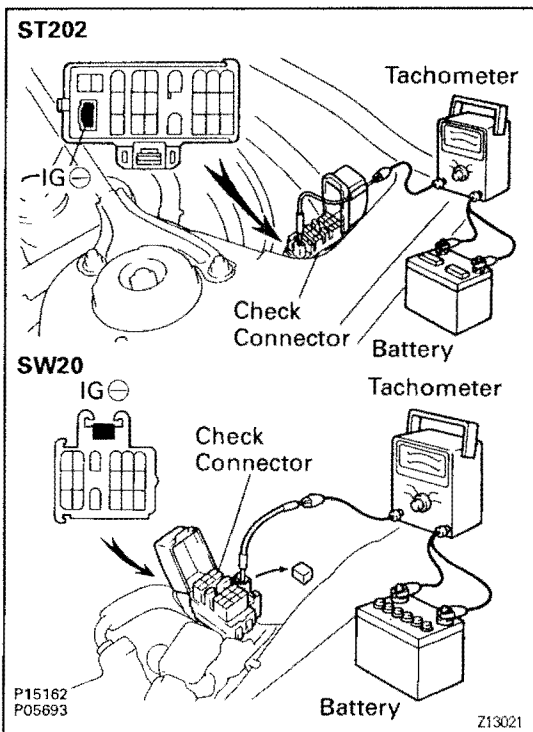
This correctly distributes high voltage to the spark plug of each cylinder in the specified ignition order.

PICKUP COILS

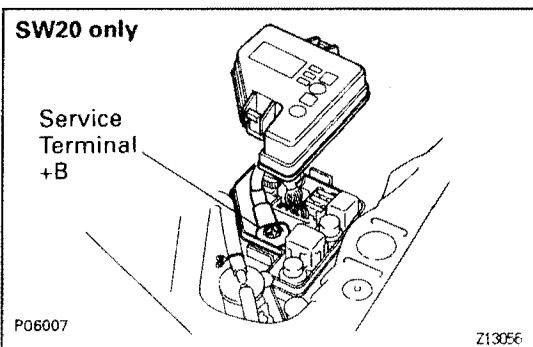
The NE coil detects the crankshaft angle, and the G1 and G2 coils detect the camshaft angle.

PRECAUTION

1. Do not leave the ignition switch ON for more than 10 minutes if the engine does not start. IG08Y-01



2. With a tachometer connected to the system, connect the tester probe of the tachometer to terminal IG⁻ of the check connector.

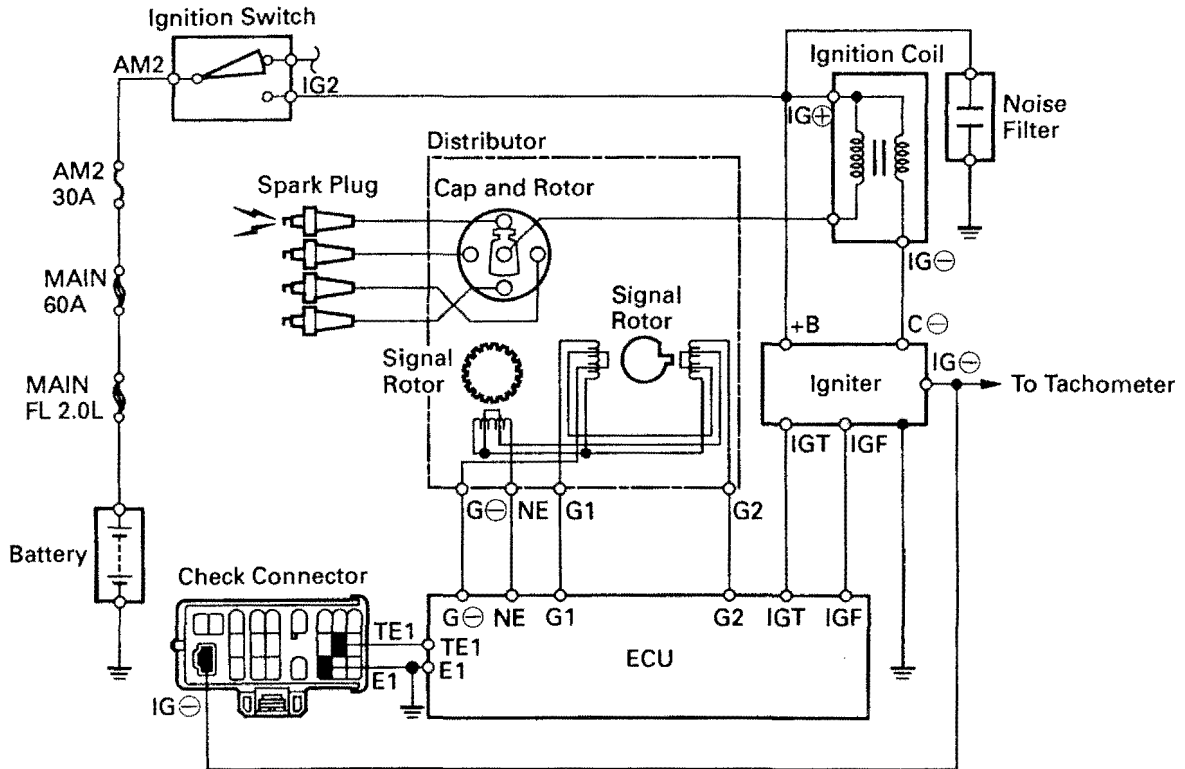


3. SW20 only:
With a tachometer connected to the system, connect the power source probe of the tachometer to service terminal +B of the engine compartment relay box.
4. As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.
5. Never allow the tachometer terminals to touch ground as it could result in damage to the igniter and/or ignition coil.
6. Do not disconnect the battery while the engine is running.
7. Check that the igniter is properly grounded to the body.

SYSTEM CIRCUIT

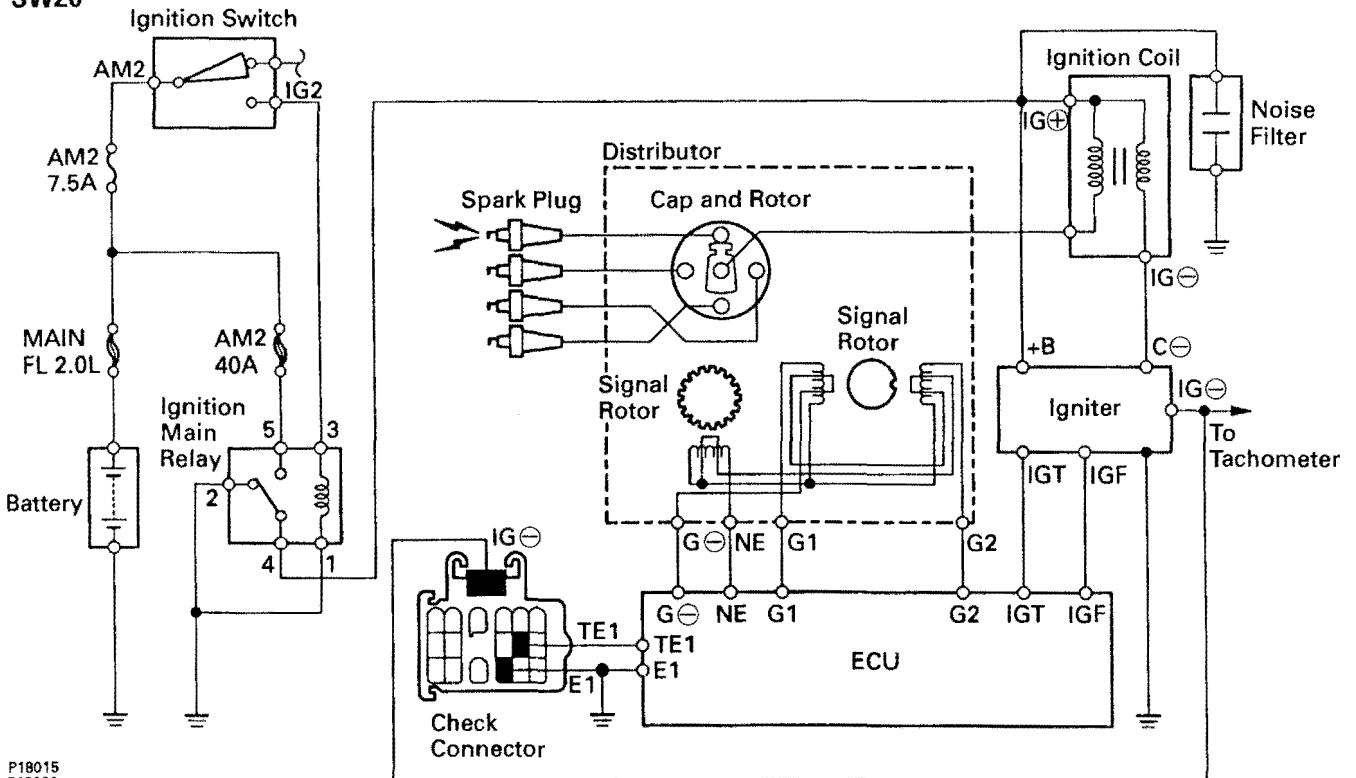
IG01A-0A

ST202



IG

SW20



P18015
P18022

Z13240

OPERATION



To maintain the most appropriate ignition timing, the ECU sends a control signal so that the igniter sends current to the ignition coil and the spark plugs produce a spark. IG01B-0A

PREPARATION

SST (SPECIAL SERVICE TOOLS)



IG01C-04

IG

	09155-16100 Spark Plug Wrench	
	09240-00020 Wire Gauge Set	Air gap
	09843-18020 Diagnosis Check Wire	

RECOMMENDED TOOLS

IG01D-04

	09082-00050 TOYOTA Electrical Tester Set	
	09200-00010 Engine Adjust Kit	

EQUIPMENT

IG00Y-01

Megger insulation resistance meter	Insulation resistance meter
Spark plug cleaner	
Tachometer	
Timing light	Ignition timing

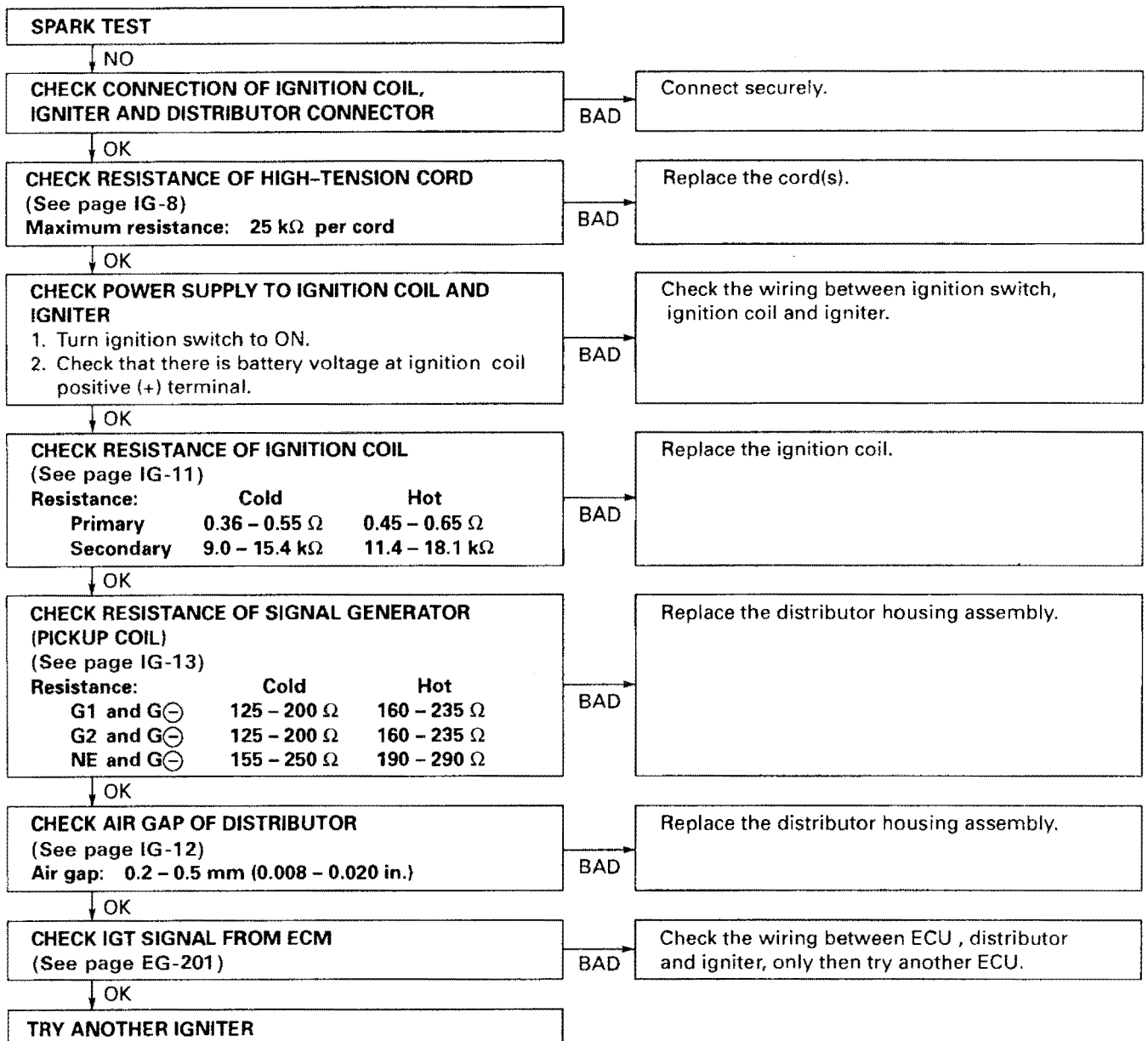
ON–VEHICLE INSPECTION SPARK TEST

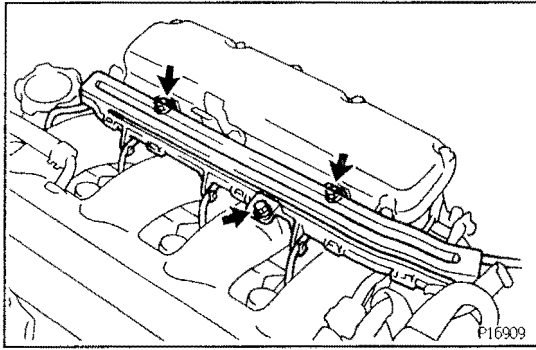
IG01R-09

CHECK THAT SPARK OCCURS

- (a) Disconnect the high–tension cord (from the ignition coil) from the distributor cap.
 - (b) Hold the end approx. 12.5 mm (0.50 in.) from the body ground.
 - (c) See if spark occurs while engine is being cranked.
- HINT: To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1 – 2 seconds at time.

If the spark does not occur, perform the test as follows:

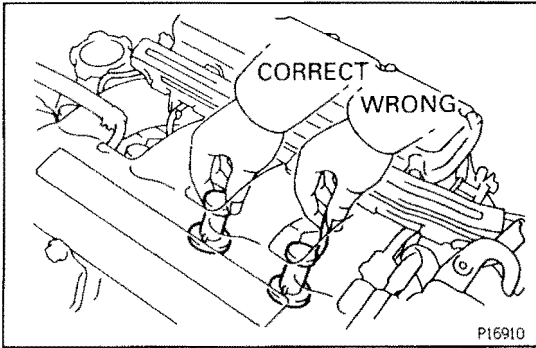




HIGH-TENSION CORDS INSPECTION

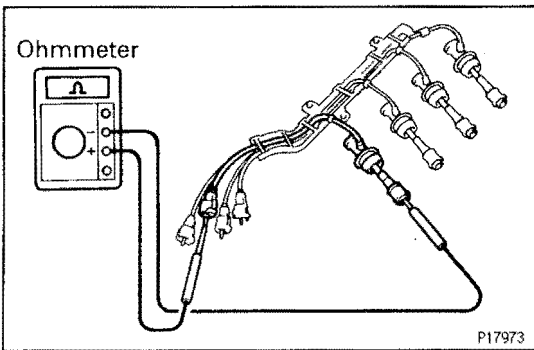
1. REMOVE HIGH-TENSION CORDS

- (a) Remove the 3 bolts, and disconnect the high-tension cord clamp from the ACIS valve.



- (b) 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. INSPECT HIGH-TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance.

Maximum resistance:

25 k Ω per cord

If the resistance is greater than maximum, replace the high-tension cord.

3. REINSTALL HIGH-TENSION CORDS

SPARK PLUGS INSPECTION

IG

NOTICE:

- Never use a wire brush for cleaning.
- Never attempt to adjust the electrode gap on a used spark plug.
- Spark plugs should be replaced every 100,000 km (60,000 miles).

1. DISCONNECT HIGH—TENSION CORDS FROM SPARK PLUGS

2. INSPECT ELECTRODE

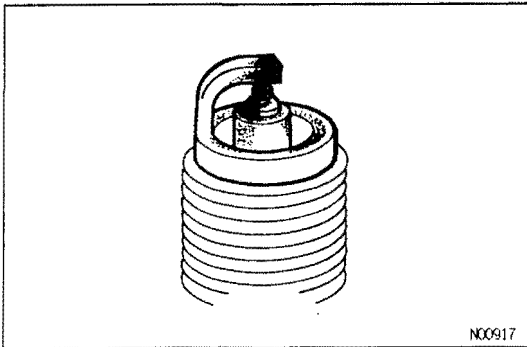
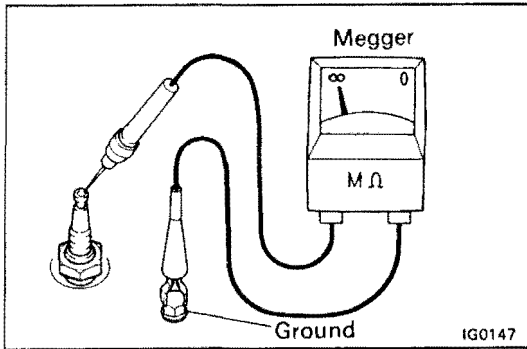
Using a megger (insulation resistance meter), measure the insulation resistance.

Standard correct insulation resistance:

10 MΩ or more

If the resistance is less than specified, proceed to step 3.

HINT: If a megger is not available, the following simple method of inspection provides fairly accurate results.

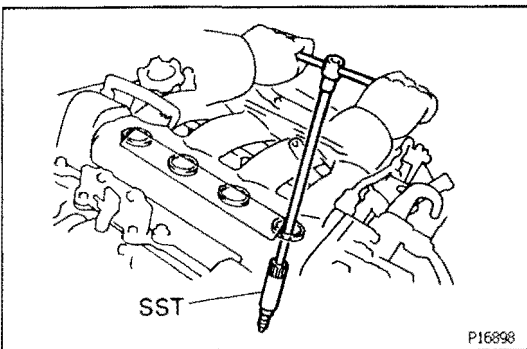


Simple Method:

- (a) Quickly race the engine to 4,000 rpm 5 times.
- (b) Remove the spark plug. (See step 3)
- (c) Visually check the spark plug.
If the electrode is dry ... OK
If the electrode is wet ... Proceed to step 4
- (d) Reinstall the spark plug. (See step 7)

3. REMOVE SPARK PLUGS

Using SST, remove the 4 spark plugs.
SST 09155-16100



4. VISUALLY INSPECT SPARK PLUGS

Check the spark plug for thread damage and insulator damage.

If abnormal, replace the spark plug.

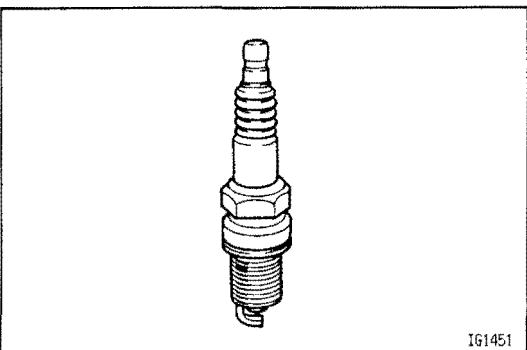
Recommended spark plug:

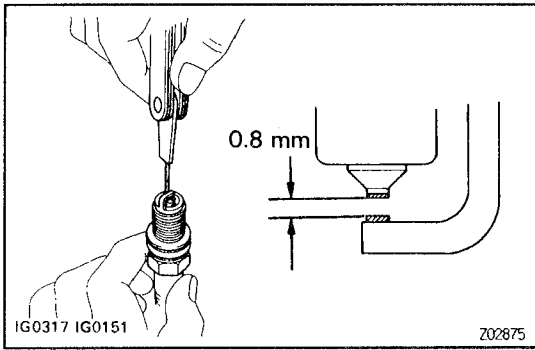
ND

PK20R8

NGK

BKR6EP-8





5. INSPECT ELECTRODE GAP

Maximum electrode gap for used spark plug:

1.0 mm (0.039 in.)

If the gap is greater than maximum, replace the spark plug.

Correct electrode gap for new spark plug:

0.8 mm (0.031 in.)

NOTICE: If adjusting the gap of a new spark plug, bend only the base of the ground electrode. Do not touch the tip. Never attempt to adjust the gap on the used plug.

6. CLEAN SPARK PLUGS

If the electrode has traces of wet carbon, allow it to dry and then clean with a spark plug cleaner.

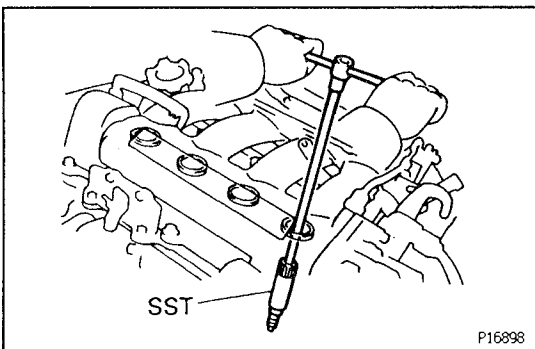
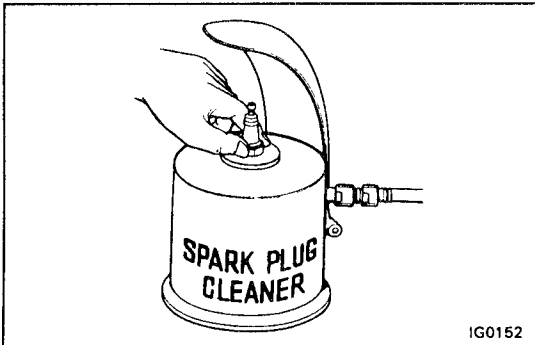
Air pressure:

Below 588 kPa (6 kgf/cm², 85 psi)

Duration:

20 seconds or less

HINT: If there are traces of oil, remove it with gasoline before using the spark plug cleaner.



7. REINSTALL SPARK PLUGS

Using SST, install the 4 spark plugs.

SST 09155—16100

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

8. RECONNECT HIGH—TENSION CORDS TO SPARK PLUGS

IGNITION COIL INSPECTION

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the coils themselves. "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).

1. **DISCONNECT IGNITION COIL CONNECTOR**
2. **DISCONNECT HIGH—TENSION CORD FROM IGNITION COIL**

IG

3. INSPECT PRIMARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) and negative (–) terminals.

Primary coil resistance:

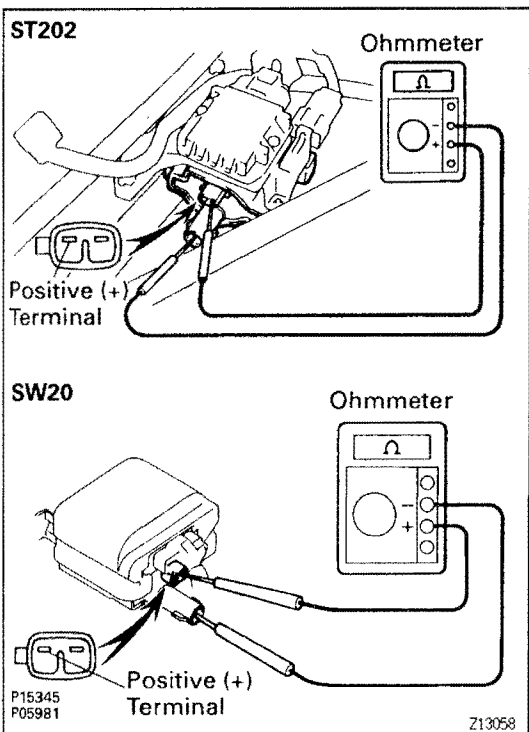
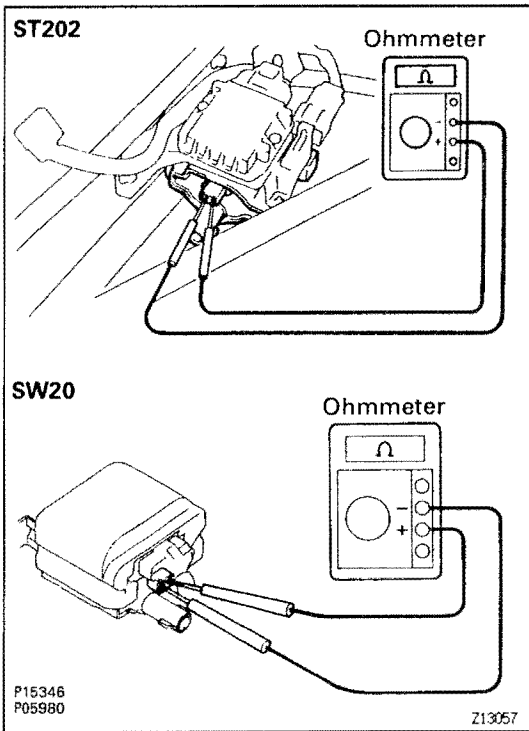
Cold

0.36 – 0.55 Ω

Hot

0.45 – 0.65 Ω

If the resistance is not as specified, replace the ignition coil.



4. INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) and high—tension terminals.

Secondary coil resistance:

Cold

9.0 – 15.4 k Ω

Hot

11.4 – 18.1 k Ω

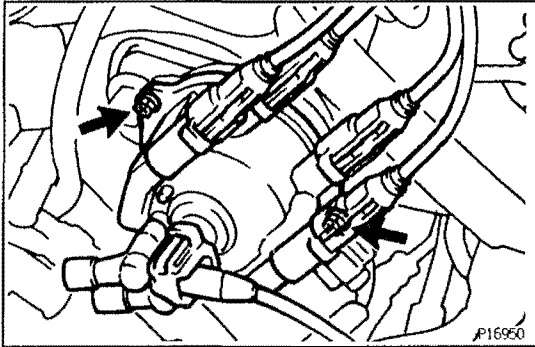
If the resistance is not as specified, replace the ignition coil.

5. **RECONNECT HIGH—TENSION CORD TO IGNITION COIL**
6. **RECONNECT IGNITION COIL CONNECTOR**

DISTRIBUTOR INSPECTION

NOTICE: "Cold" and "Hot" in the following sentences express the temperature of the coils themselves. "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).

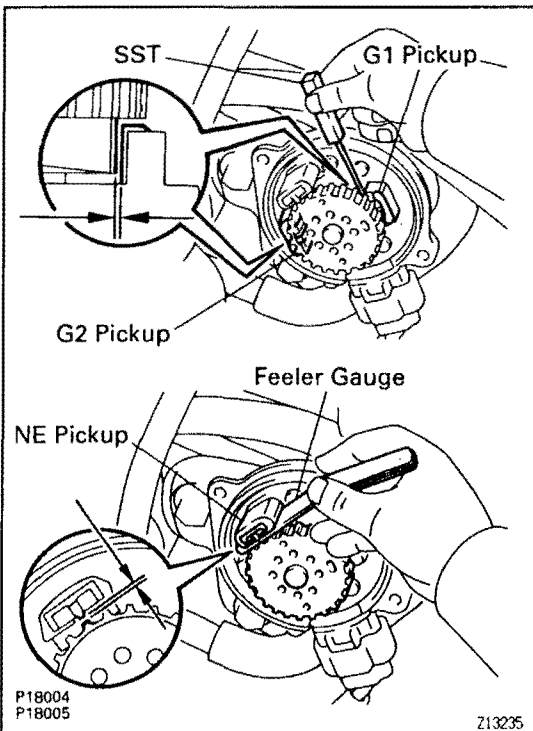
IG



1. REMOVE DISTRIBUTOR CAP

Remove the 2 bolts, and disconnect the distributor cap from the distributor housing.

2. REMOVE ROTOR



3. INSPECT AIR GAP

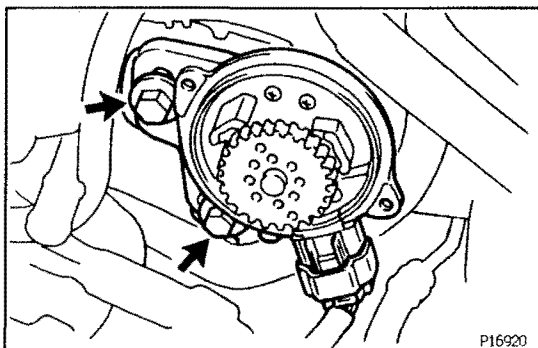
Using SST (G1 and G2 pickups) and a feeler gauge (NE pickup), measure the air gap between the signal rotor and pickup coil projection.

SST 09240-00020 for G1 and G2 pickups

Air gap:

0.2 – 0.5 mm (0.008 – 0.020 in.)

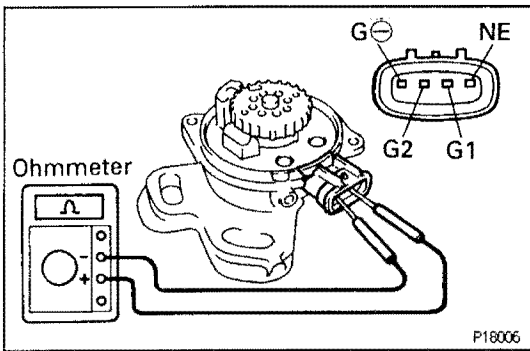
If the air gap is not as specified, replace the distributor housing assembly.



4. DISCONNECT DISTRIBUTOR CONNECTOR

5. REMOVE DISTRIBUTOR HOUSING ASSEMBLY

Remove the bolt, and pull out the distributor housing.



- 6. INSPECT SIGNAL GENERATOR (PICKUP COIL) RESISTANCE**
Using an ohmmeter, measure the resistance between terminals.

Pickup coil resistance:

Cold

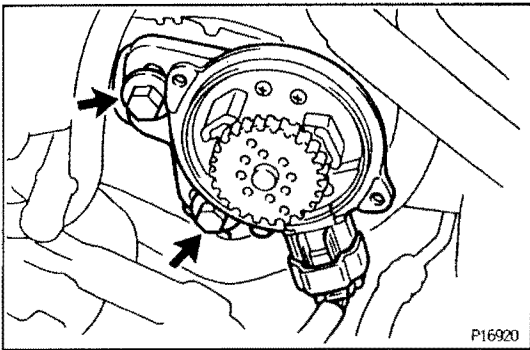
- G1 and G⊖**
125 – 200 Ω
- G2 and G⊖**
125 – 200 Ω
- NE and G⊖**
155 – 250 Ω

Hot

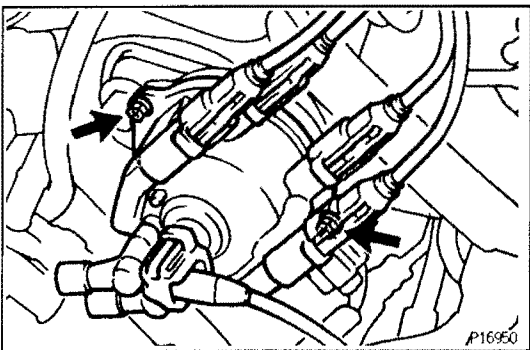
- G1 and G⊖**
160 – 235 Ω
- G2 and G⊖**
160 – 235 Ω
- NE and G⊖**
190 – 290 Ω

If the resistance is not as specified, replace the distributor housing assembly.

- 7. REINSTALL DISTRIBUTOR HOUSING ASSEMBLY**
(See page IG-16)
- 8. RECONNECT DISTRIBUTOR CONNECTOR**
- 9. REINSTALL ROTOR**



- 10. REINSTALL DISTRIBUTOR CAP**
Install a new packing and distributor cap with the 2 bolts.
- 11. ADJUST IGNITION TIMING**
(See page EG-39)



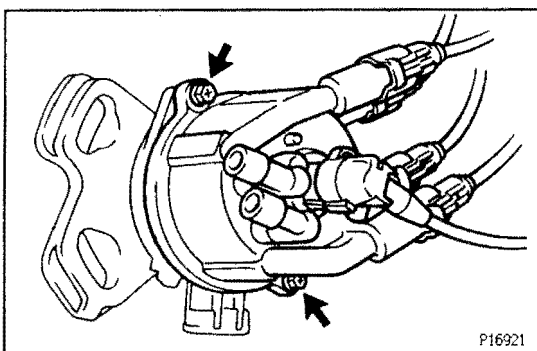
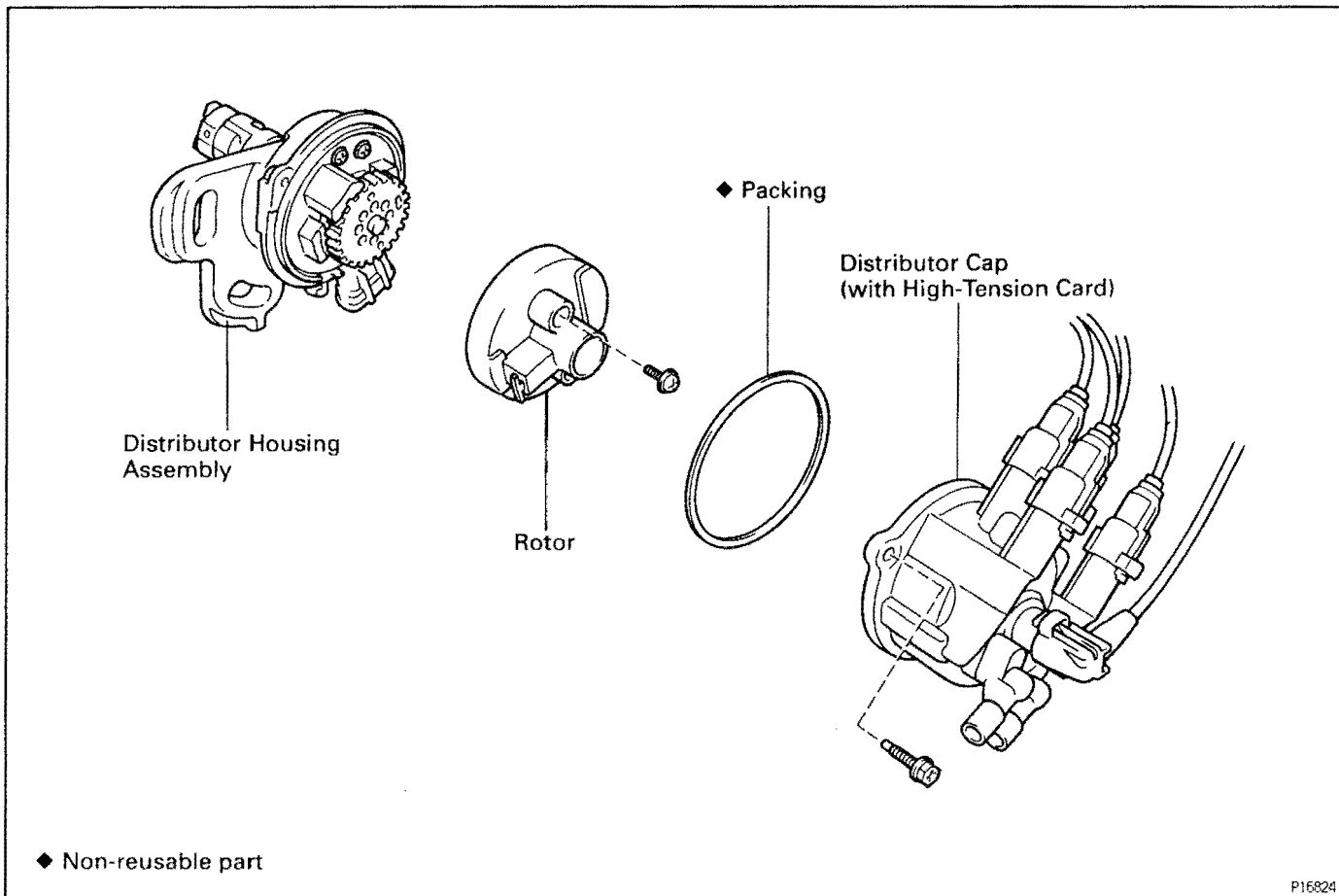
IGNITER INSPECTION

IG013-08

(See procedure Spark Test on page IG-7)

DISTRIBUTOR COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

IG01K-00



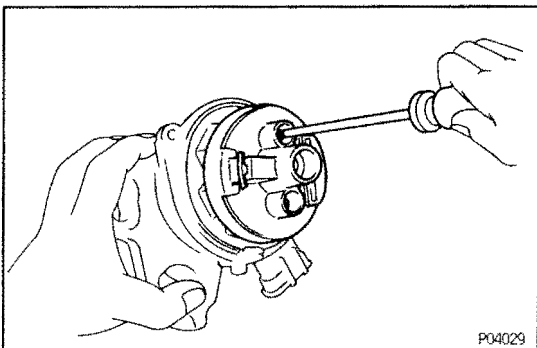
DISTRIBUTOR DISASSEMBLY

IG02N-04

(See Components for Disassembly and Assembly)

1. REMOVE DISTRIBUTOR CAP

Remove the 2 bolts, distributor cap and packing.



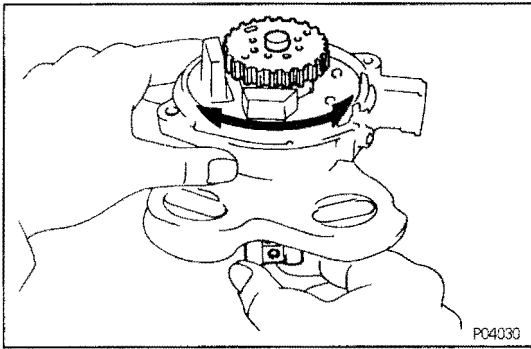
2. REMOVE ROTOR

Remove the 2 screws and rotor.

DISTRIBUTOR INSPECTION

INSPECT SHAFT

Turn the shaft and check that it is not rough or worn. If it feels rough or worn, replace the distributor housing assembly.

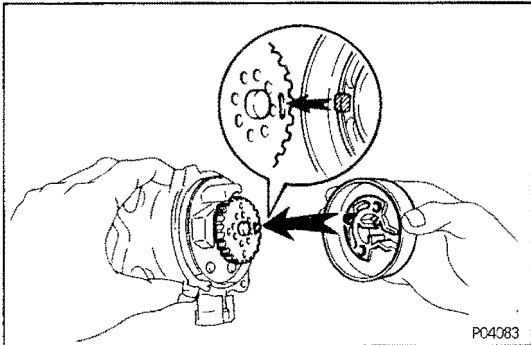


DISTRIBUTOR ASSEMBLY

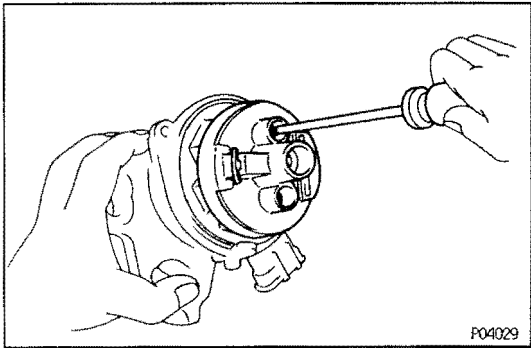
(See Components for Disassembly and Assembly)

1. INSTALL ROTOR

(a) Align the hollow of the signal rotor with the protrusion of the rotor.

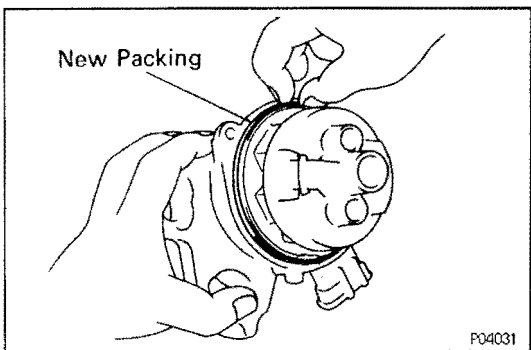


(b) Install the rotor with the 2 screws.

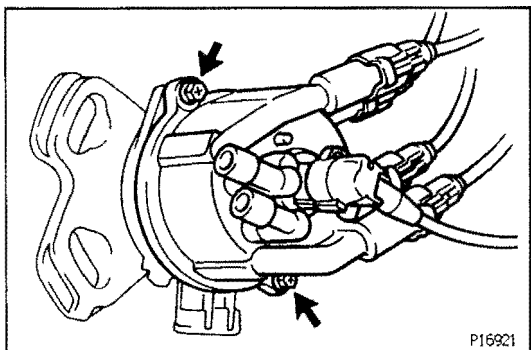


2. INSTALL DISTRIBUTOR CAP

(a) Install a new packing to the distributor housing.



(b) Install the distributor cap with the 2 bolts.

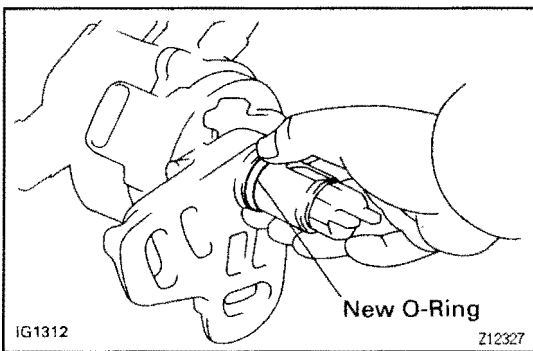
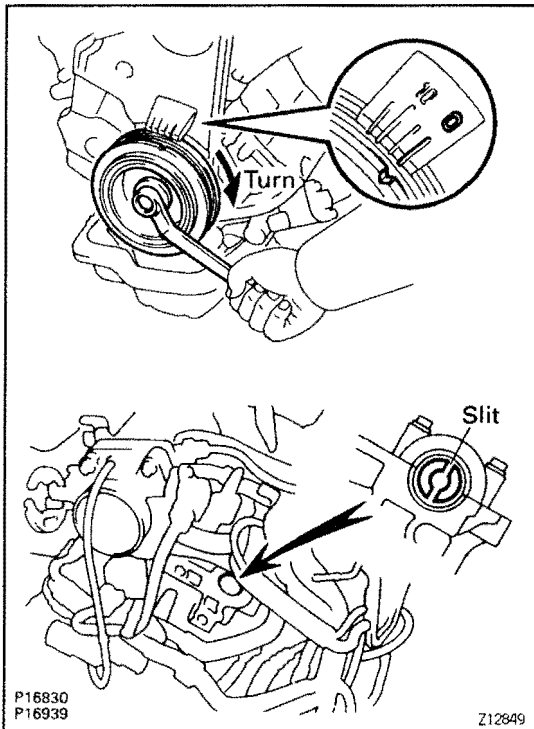


DISTRIBUTOR INSTALLATION

(See Components for Removal and Installation)

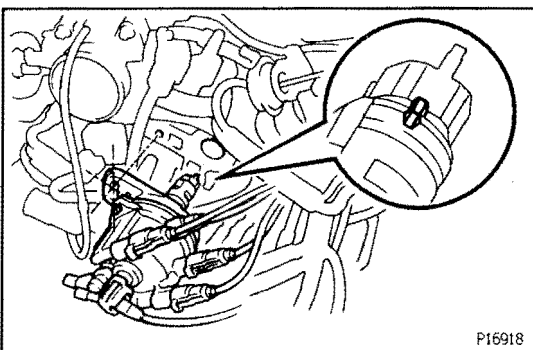
1. SET NO.1 CYLINDER TO TDC/COMPRESSION

Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the illustration.

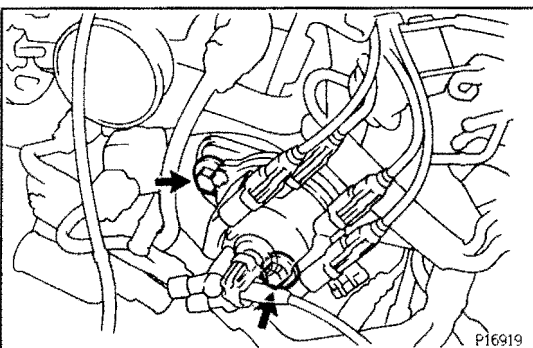


2. INSTALL DISTRIBUTOR

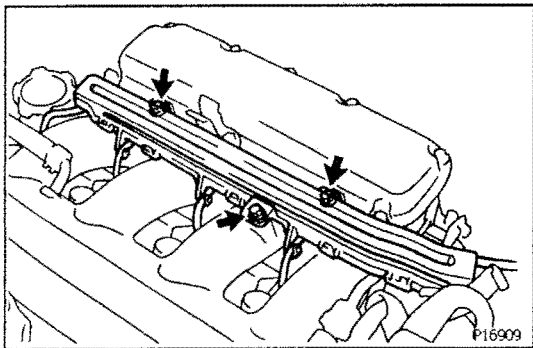
- (a) Install a new O—ring to the distributor housing.
- (b) Apply a light coat of engine oil on the O—ring.



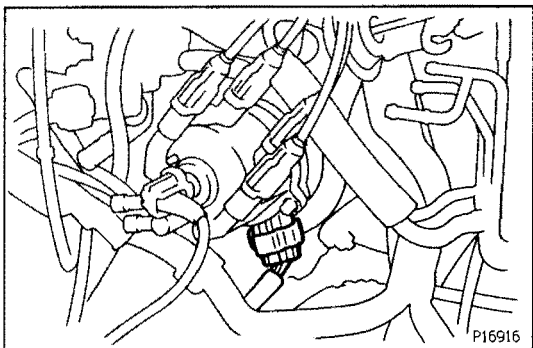
- (c) Align the cutout portion of the coupling with the groove of the housing.
- (d) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.



- (e) Lightly tighten the 2 bolts.



- (f) Connect the 5 high-tension cords to the spark plugs and ignition coil.
- (g) Install the high-tension cord clamp with the 3 bolts.



- (h) Connect the distributor connector.

IG

3. ADJUST IGNITION TIMING (See page EG-39)

SERVICE SPECIFICATIONS

SERVICE DATA

IG01P-0C

Ignition timing	–		10° BTDC @ idle (w/ Terminals TE1 and E1 of check connector connected)	
Firing order	–		1 – 3 – 4 – 2	
High – tension cord	Resistance	Limit	25 kΩ per cord	
Spark plug	Recommended spark plug	ND	PK20R8	
		NGK	BKR6EP–8	
	Correct electrode gap for new plug		0.8 mm (0.031 in.)	
	Maximum electrode gap for used plug		1.0 mm (0.039 in.)	
Ignition coil	Primary coil resistance	at cold	0.36 – 0.55 Ω	
		at hot	0.45 – 0.65 Ω	
	Secondary coil resistance	at cold	9.0 – 15.4 kΩ	
		at hot	11.4 – 18.1 kΩ	
Distributor	Air gap		0.2 – 0.5 mm (0.008 – 0.020 in.)	
	Pickup coil resistance	at cold	G1 – G⊖	125 – 200 Ω
			G2 – G⊖	125 – 200 Ω
			NE – G⊖	155 – 250 Ω
		at hot	G1 – G⊖	160 – 235 Ω
			G2 – G⊖	160 – 235 Ω
			NE – G⊖	190 – 290 Ω

IG

TORQUE SPECIFICATIONS

IG017-06

Part tightened	N-m	kgf-cm	ft-lbf
Spark plug x Cylinder head	18	180	13

— MEMO —

IG

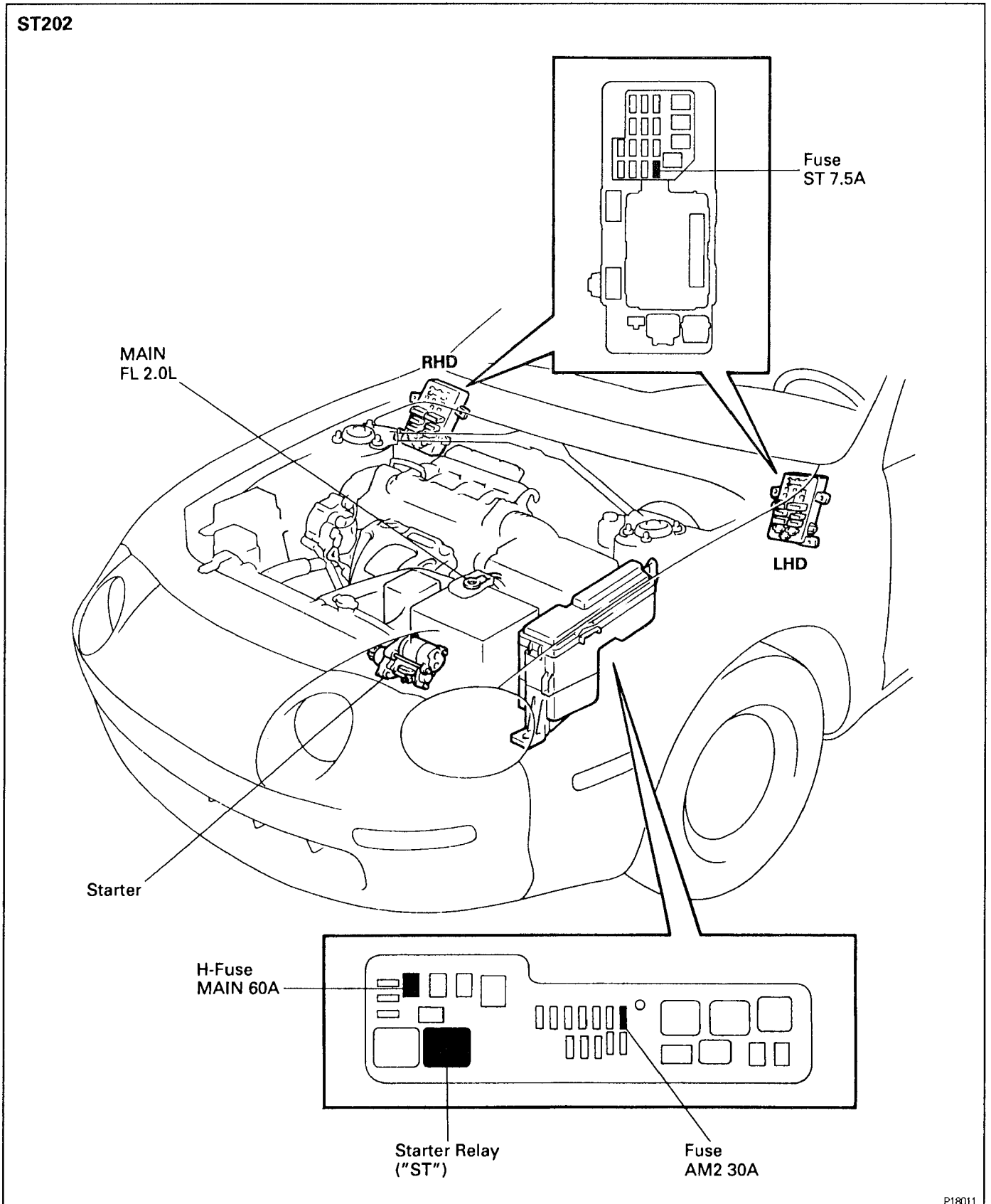
STARTING SYSTEM

DESCRIPTION ST- 2
SYSTEM CIRCUIT ST- 4
OPERATION..... ST- 5
PREPARATION ST- 5
STARTER ST- 6
STARTER RELAY (ST202) ST- 20
STARTER RELAY (SW20) ST- 21
SERVICE SPECIFICATIONS..... ST- 23

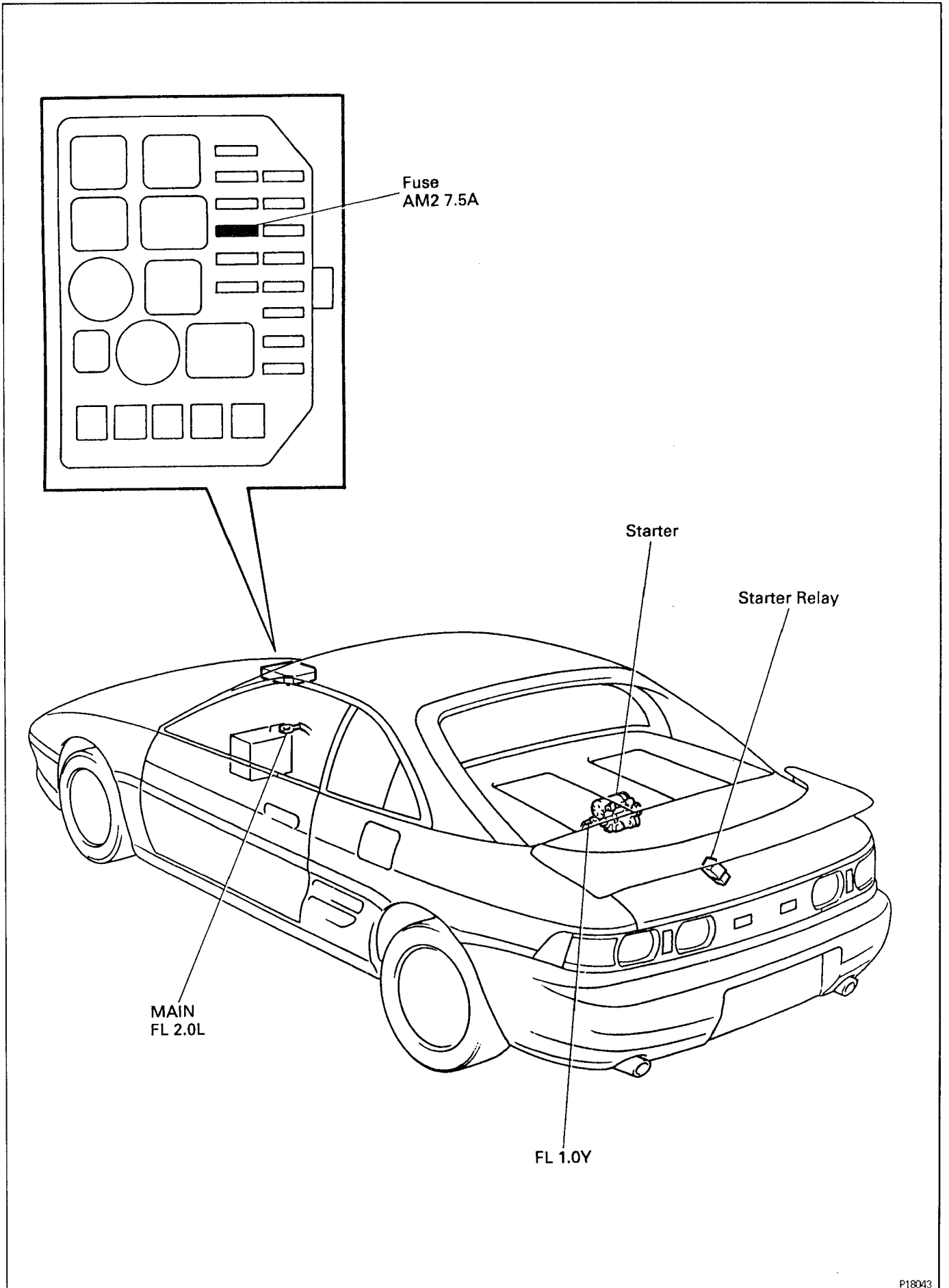
ST

DESCRIPTION

The starter is a reduction type with a small, high-speed motor used to drive the pinion gear. ST07W-01



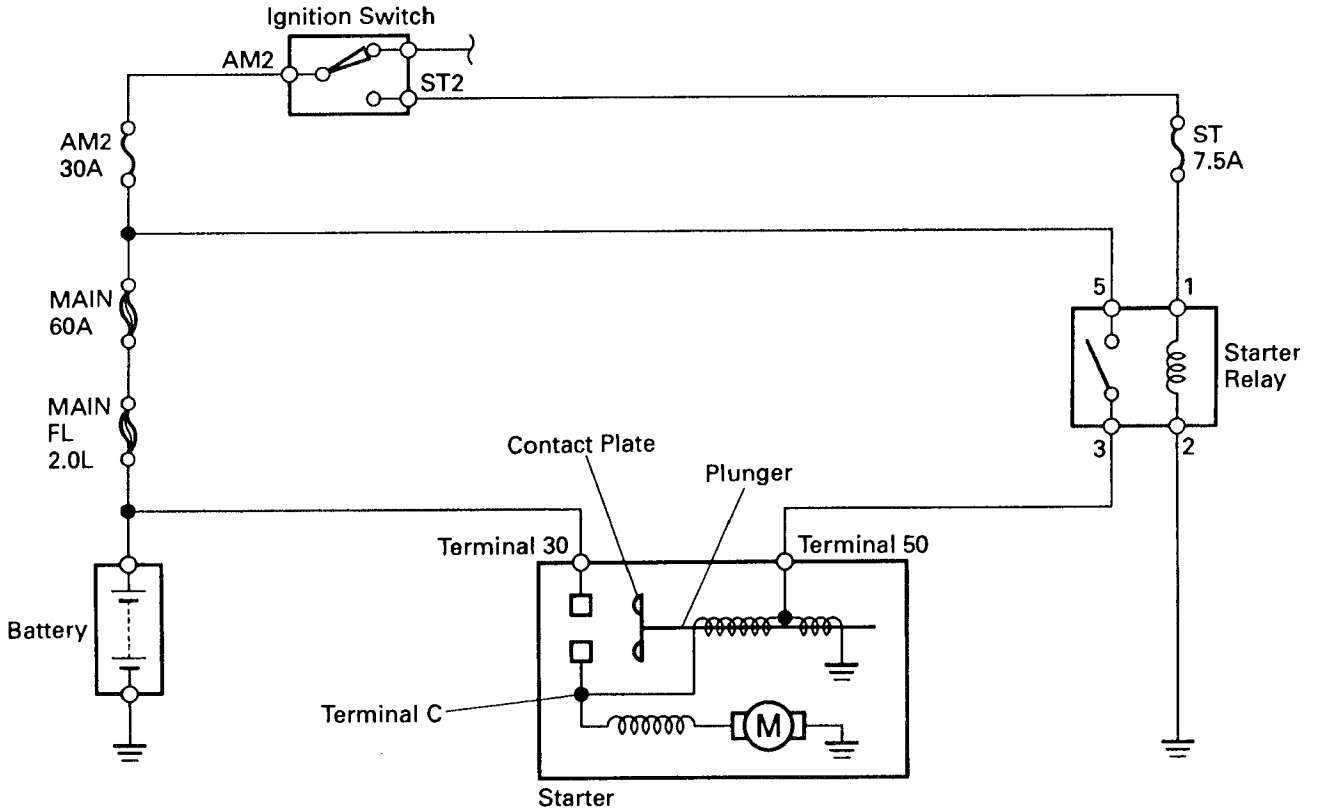
ST



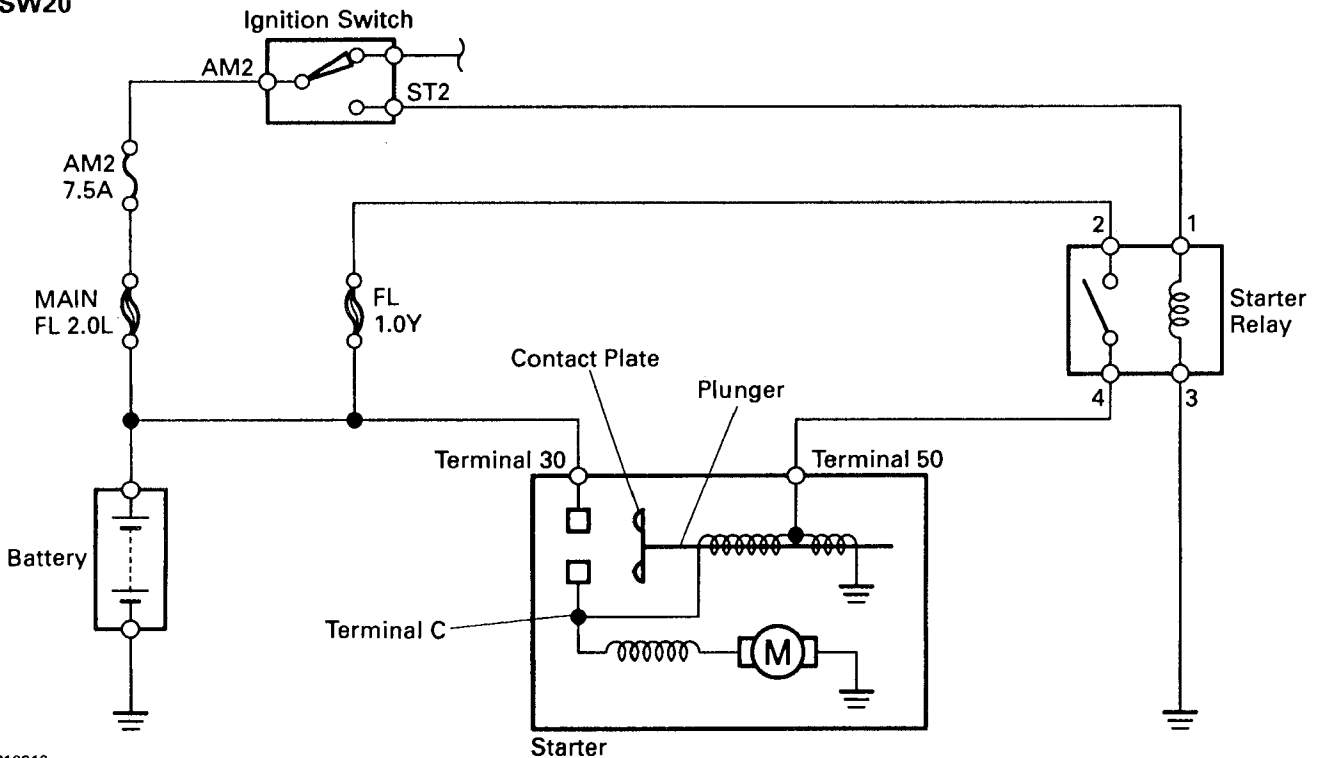
SYSTEM CIRCUIT

ST000-0H

ST202



SW20



OPERATION

When the ignition switch is turned to **START** position, current flows from terminal 50 to the coil of the solenoid and the plunger is pulled by the magnetic force of the coil. When the plunger is pulled to the left, the contact plate of the plunger allows current from the battery to flow directly from terminal 30 to the motor, and the starter rotates.

When the engine is running and the ignition switch is returned to **ON**, the magnetic force of the coil disappears and the contact plate of the plunger is returned to its original position by the return spring. Battery voltage no longer flows from terminal 30, so the motor stops.



STOOR-01

PREPARATION

SST (SPECIAL SERVICE TOOLS)


STOOS-0A

ST

	09286-46011 Injection Pump Spline Shaft Puller	Armature bearing
	09820-00030 Alternator Rear Bearing Replacer	Armature front bearing

RECOMMENDED TOOLS

STOOT-01

	09082-00050 TOYOTA Electrical Tester Set	
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EQUIPMENT

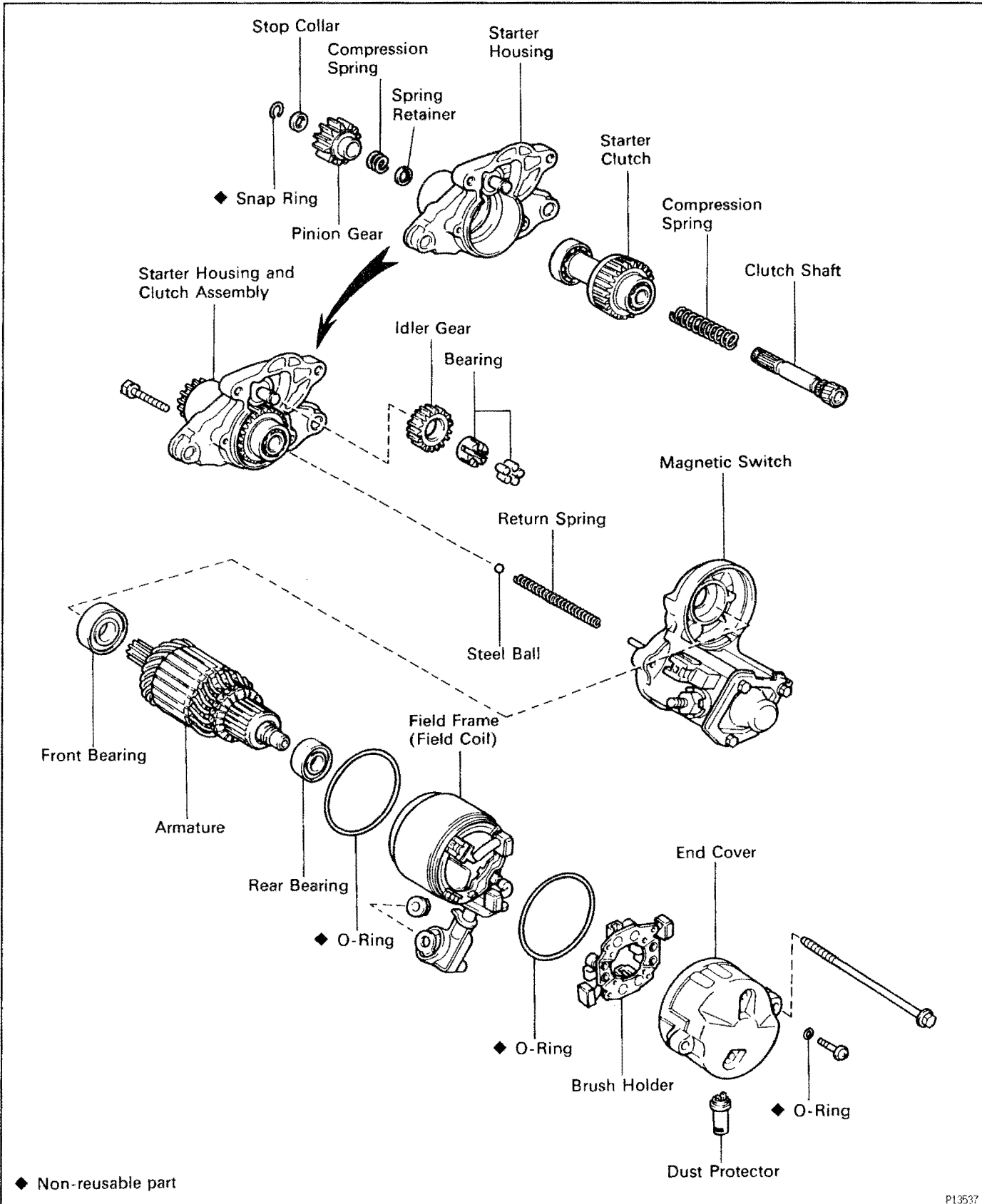
STOOU-01

Dial indicator	Commutator
Magnetic finger	
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V-block	
Vernier calipers	Commutator, Brush

STARTER COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

8100W-0K

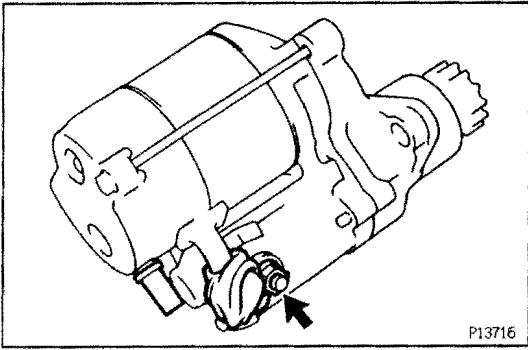
ST



◆ Non-reusable part

STARTER DISASSEMBLY**(See Components for Disassembly and Assembly)****1. REMOVE DUST PROTECTOR****2. REMOVE FIELD FRAME AND ARMATURE**

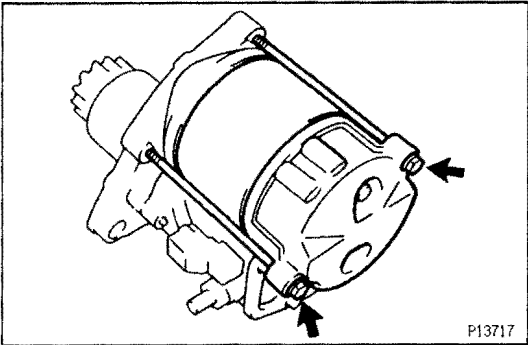
- (a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.



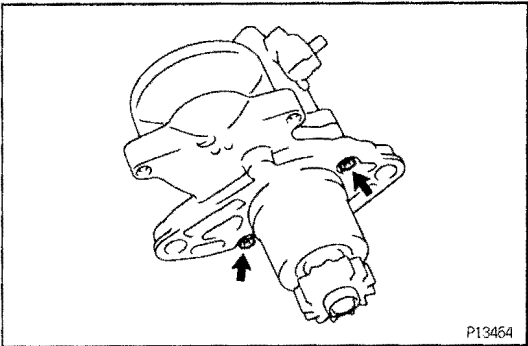
- (b) Remove the 2 through bolts.

- (c) Pull out the field frame together with the armature from the magnetic switch.

- (d) Remove the O-ring.

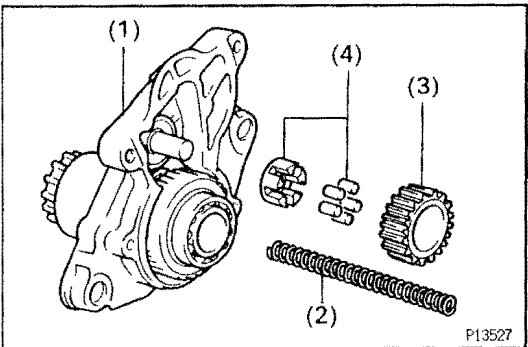
**3. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR**

- (a) Remove the 2 screws.

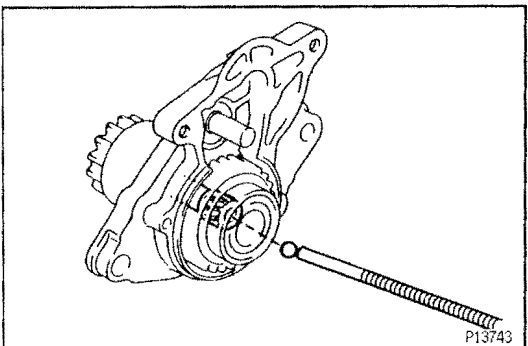


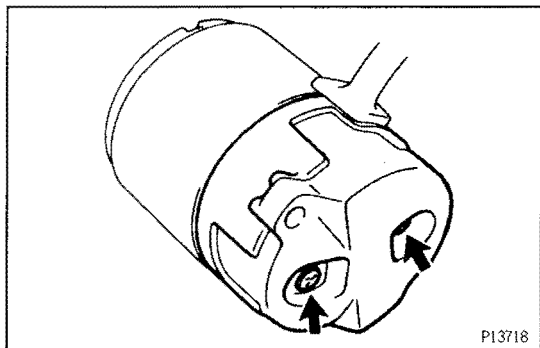
- (b) Remove the following parts from the magnetic switch:

- (1) Starter housing and clutch assembly
 (2) Return spring
 (3) Idler gear
 (4) Bearing

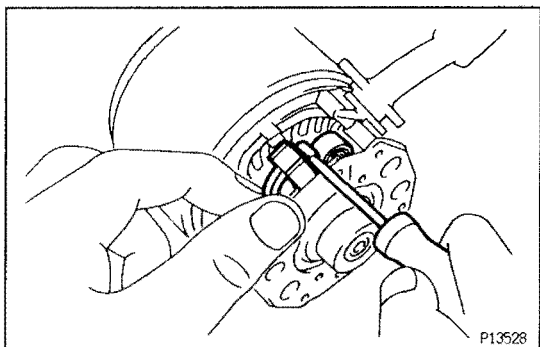
**4. REMOVE STEEL BALL**

Using a magnetic finger, remove the steel ball from the clutch shaft hole.

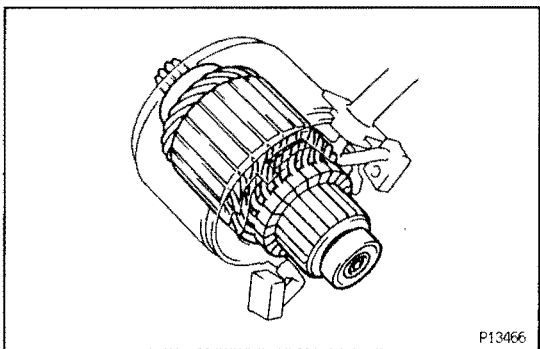


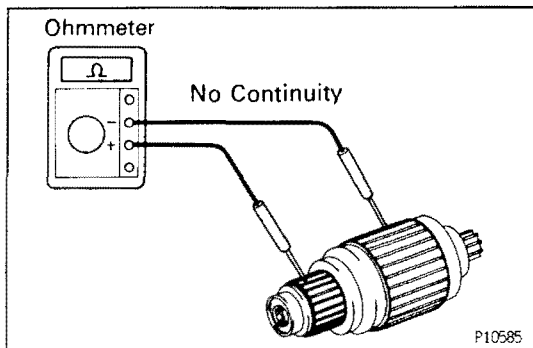
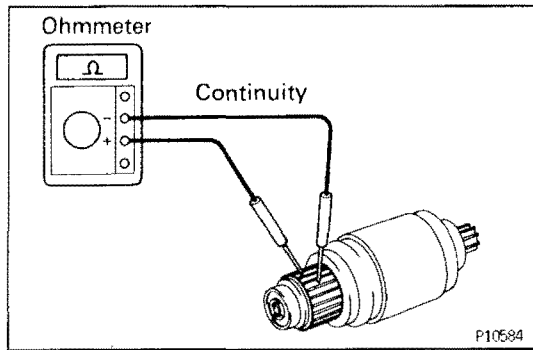
**5. REMOVE BRUSH HOLDER**

- (a) Remove the 2 screws, 2 O-rings and end cover from the field frame.
- (b) Remove the O-ring from the field frame.



- (c) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder. Disconnect the 4 brushes, and remove the brush holder.

**6. REMOVE ARMATURE FROM FIELD FRAME**



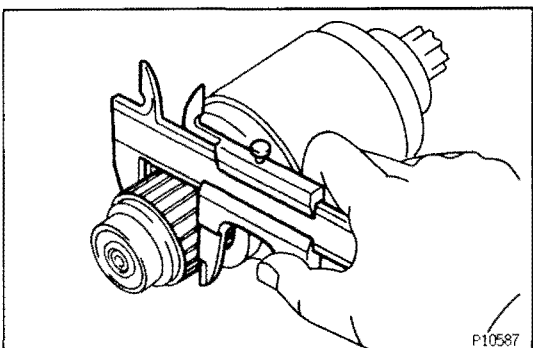
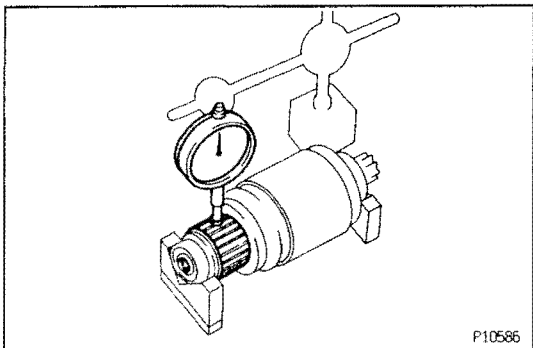
STARTER INSPECTION AND REPAIR

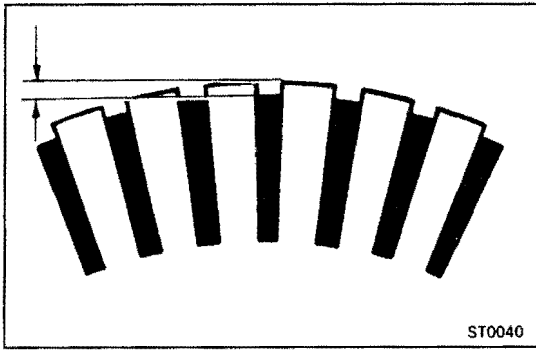
Armature Coil

- 1. INSPECT COMMUTATOR FOR OPEN CIRCUIT**
 Using an ohmmeter, check that there is continuity between the segments of the commutator. If there is no continuity between any segment, replace the armature.
- 2. INSPECT COMMUTATOR FOR GROUND**
 Using an ohmmeter, check that there is no continuity between the commutator and armature coil core. If there is continuity, replace the armature.

Commutator

- 1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES**
 If the surface is dirty or burnt, correct it with sandpaper (No.400) or on a lathe.
- 2. INSPECT COMMUTATOR CIRCLE RUNOUT**
 - Place the commutator on V-blocks.
 - Using a dial gauge, measure the circle runout.
Maximum circle runout:
 0.05 mm (0.0020 in.)
 If the circle runout is greater than maximum, correct it on a lathe.
- 3. INSPECT COMMUTATOR DIAMETER**
 Using a vernier caliper, measure the commutator diameter.
Standard diameter:
 30 mm (1.18 in.)
Minimum diameter:
 29 mm (1.14 in.)
 If the diameter is less than minimum, replace the armature.





4. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth:

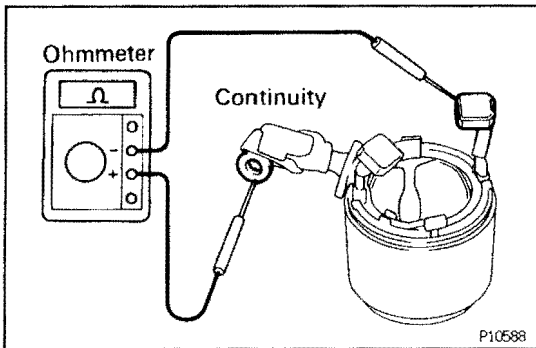
0.6 mm (0.024 in.)

Minimum undercut depth:

0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

ST

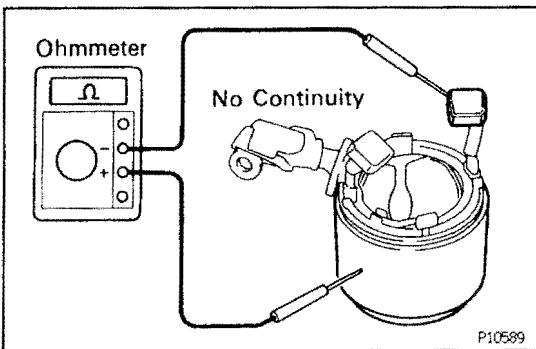


Field Coil (Field frame)

1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

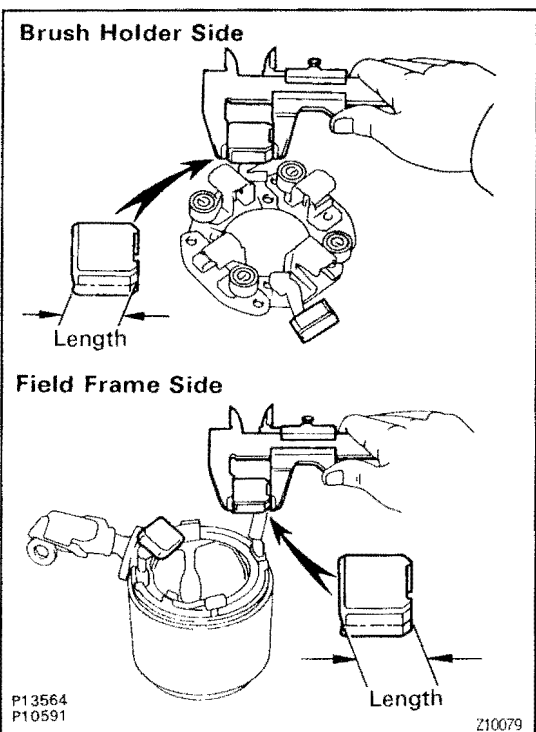
If there is no continuity, replace the field frame.



2. INSPECT FIELD COIL FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil end and field frame.

If there is continuity, replace the field frame.



Brushes

INSPECT BRUSH LENGTH

Using a vernier caliper, measure the brush length.

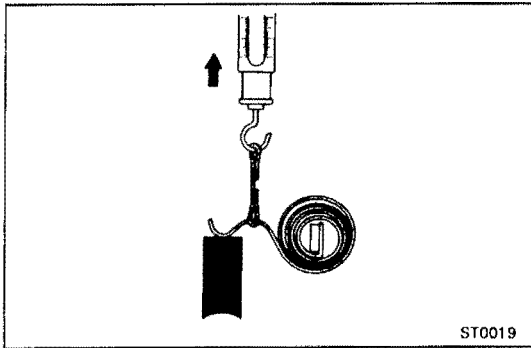
Standard length:

15.0 mm (0.591 in.)

Minimum length:

8.0 mm (0.315 in.)

If the length is less than minimum, replace the brush holder and field frame.



ST0019

Brush Springs

INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:

12 – 20 N (1.2 – 2.0 kgf, 2.6 – 4.4 lbf)

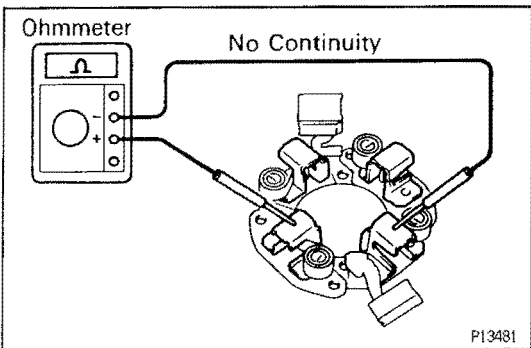
If the installed load is not as specified, replace the brush springs.

Brush Holder

INSPECT BRUSH HOLDER INSULATION

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (-) brush holders.

If there is continuity, repair or replace the brush holder.



P13481

Clutch and Gears

1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idle gear and clutch assembly for wear or damage.

If damaged, replace the gear or clutch assembly.

If damaged, also check the ring gear of the flywheel/ drive plate for wear or damage.

2. INSPECT CLUTCH PINION GEAR

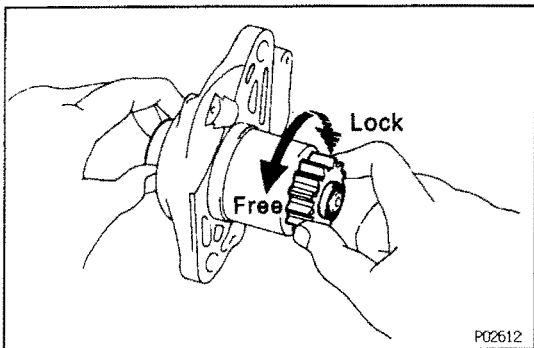
Hold the starter clutch and rotate the pinion gear counterclockwise, and check that it turns freely. Try to rotate the pinion gear clockwise and check that it locks.

If necessary, replace the clutch assembly.

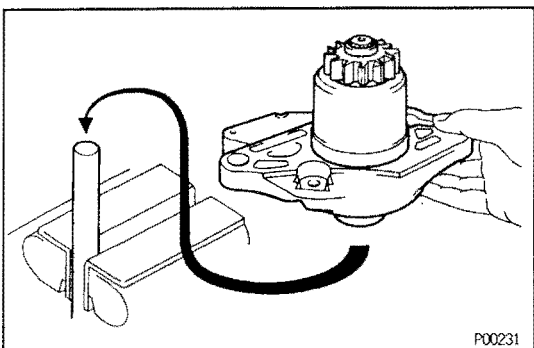
3. IF NECESSARY, REPLACE CLUTCH ASSEMBLY

A. Disassemble starter housing and clutch assembly

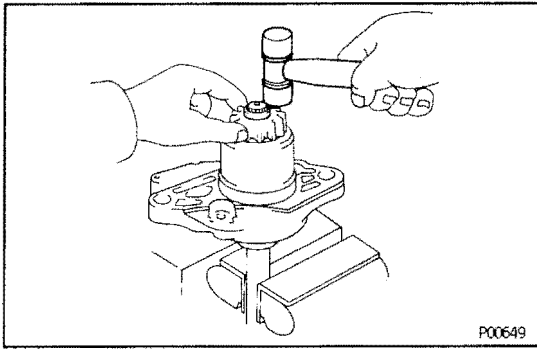
- (a) Mount a brass bar in a vise, and install the starter housing and clutch assembly onto the brass bar.



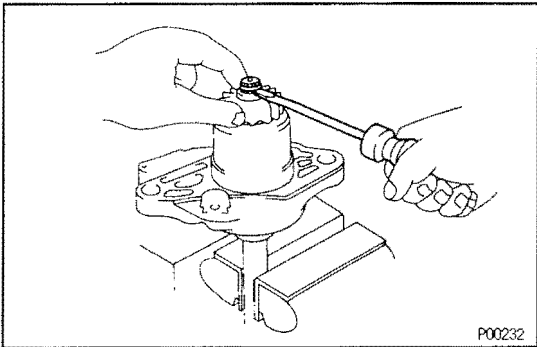
P02612



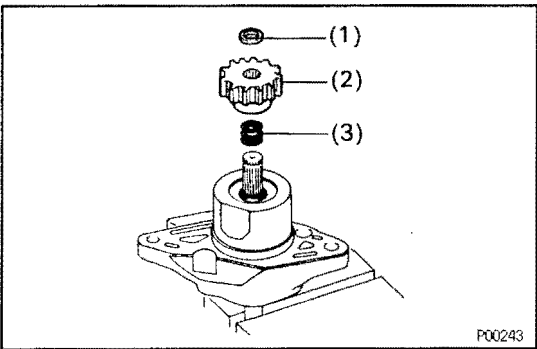
P00231



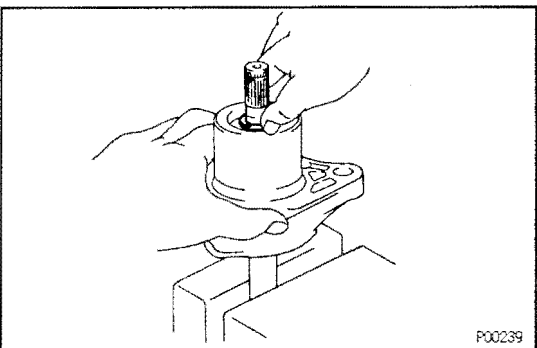
- (b) Push down the pinion gear.
- (c) Using a plastic-faced hammer, tap down the stop collar.



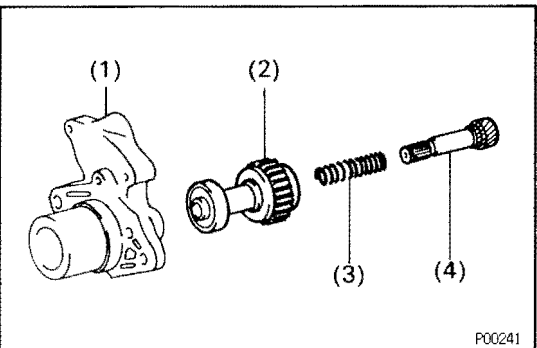
- (d) Using a screwdriver, pry out the snap ring.



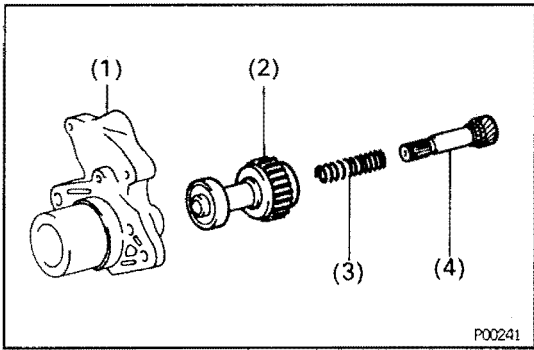
- (e) Remove the following parts:
 - (1) Stop collar
 - (2) Pinion gear
 - (3) Compression spring



- (f) Push down the starter housing, and remove the spring retainer.



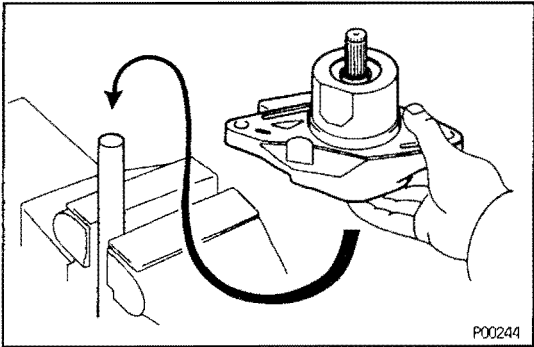
- (g) Disassemble the following parts:
 - (1) Starter housing
 - (2) Starter clutch
 - (3) Compression spring
 - (4) Clutch shaft



B. Assemble starter housing and clutch assembly

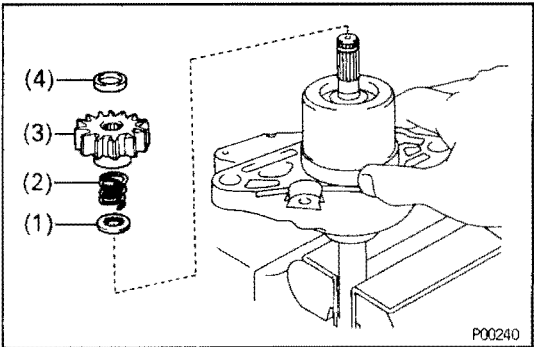
(a) Assemble the following parts:

- (1) Starter housing
- (2) Starter clutch
- (3) Compression spring
- (4) Clutch shaft



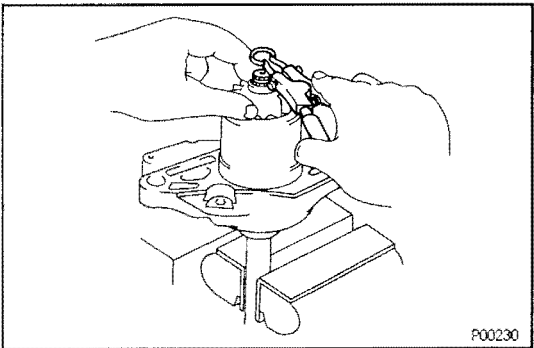
(b) Mount a brass bar in a vise, install the starter housing and clutch assembly onto the brass bar.

ST



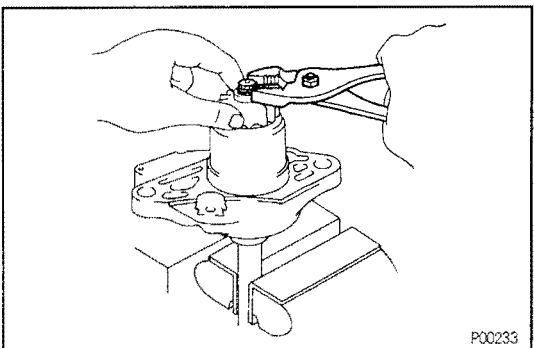
(c) Push down the starter housing, and install the following parts:

- (1) Spring retainer
- (2) Compression spring
- (3) Pinion gear
- (4) Stop collar



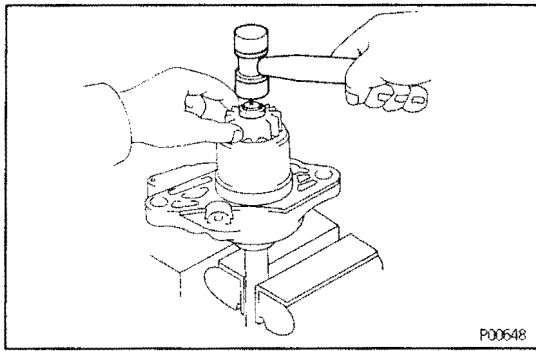
(d) Push down the pinion gear.

(e) Using snap ring pliers, install a new snap ring.



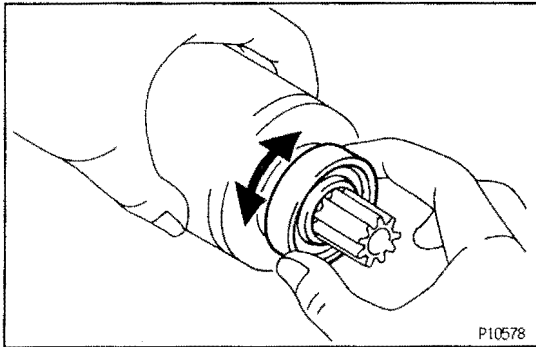
(f) Using pliers, compress the snap ring.

(g) Check that the snap ring fits correctly.



- (h) Remove the starter housing and clutch assembly from the brass bar.
- (i) Using a plastic-faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.

ST

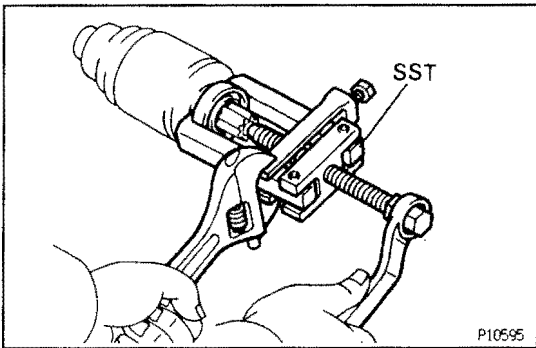


Bearings

1. INSPECT FRONT BEARING

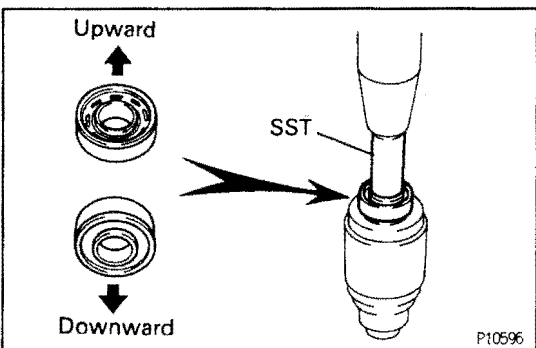
Turn each bearing by hand while applying inward force.

If resistance is felt or the bearing sticks, replace the bearing.

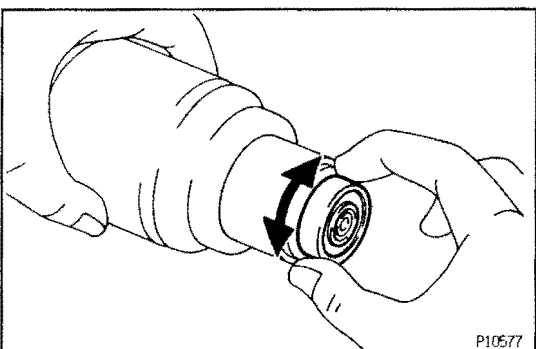


2. IF NECESSARY, REPLACE FRONT BEARING

- (a) Using SST, remove the bearing.
SST 09286-46011



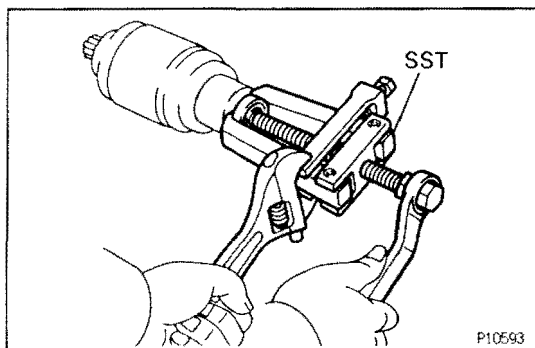
- (b) Using SST and a press, press in a new bearing.
SST 09820-00030
NOTICE: Be careful of the bearing installation direction.



3. INSPECT REAR BEARING

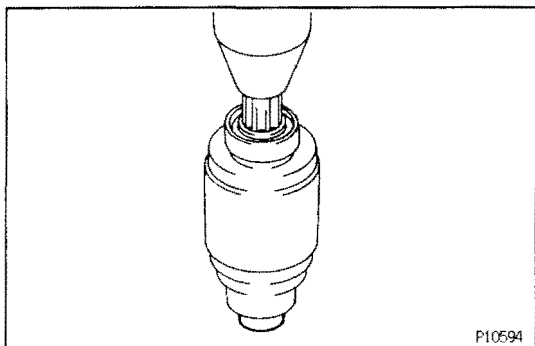
Turn each bearing by hand while applying inward force.

If resistance is felt or the bearing sticks, replace the bearing.

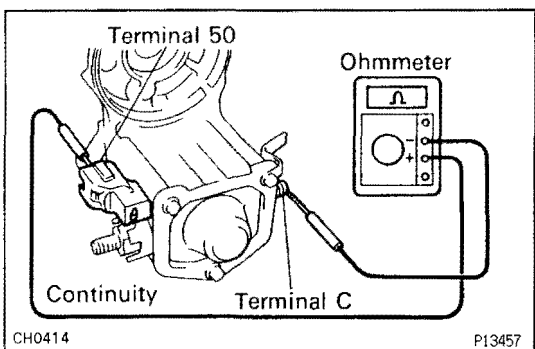


4. IF NECESSARY, REPLACE REAR BEARING

- (a) Using SST, remove the bearing.
SST 09286–46011

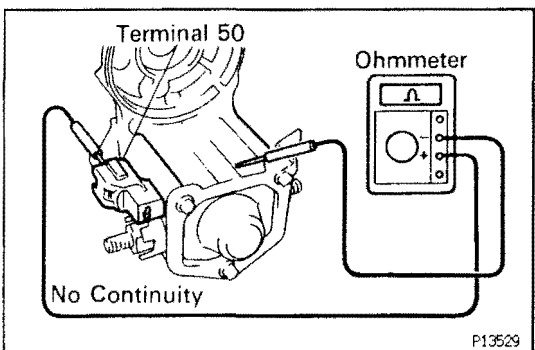


- (b) Using a press, press in a new bearing.



Magnetic Switch

1. **PERFORM PULL–IN COIL OPEN CIRCUIT TEST**
Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.



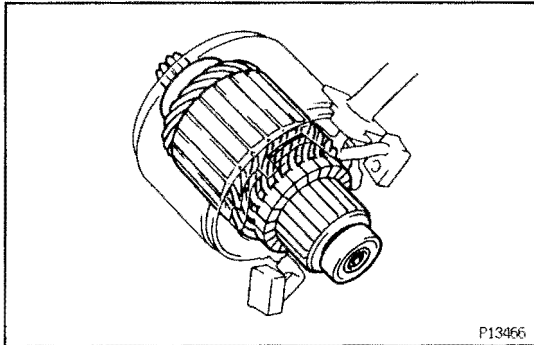
2. **PERFORM HOLD–IN COIL OPEN CIRCUIT TEST**
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.

STARTER ASSEMBLY

(See Components for Disassembly and Assembly)

HINT: Use high-temperature grease to lubricate the bearings and gears when assembling the starter.

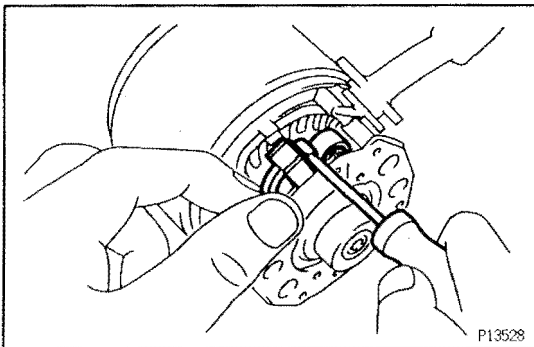
ST



P13466

1. PLACE ARMATURE INTO FIELD FRAME

Apply grease to the armature bearings, and insert the armature into the field frame.



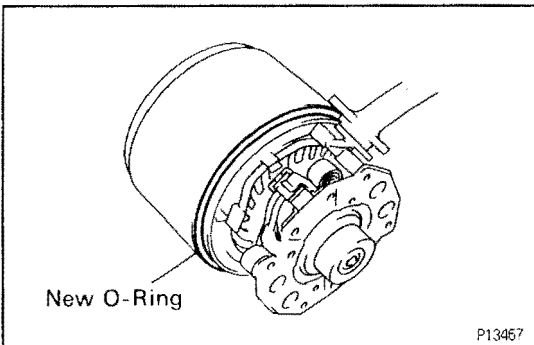
P13528

2. INSTALL BRUSH HOLDER

(a) Place the brush holder on the armature.

(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the 4 brushes.

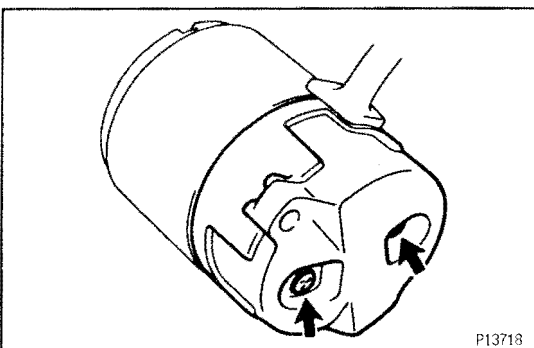
NOTICE: Check that the positive (+) lead wires are not grounded.



New O-Ring

P13467

(c) Install a new O-ring to the groove of the field frame.

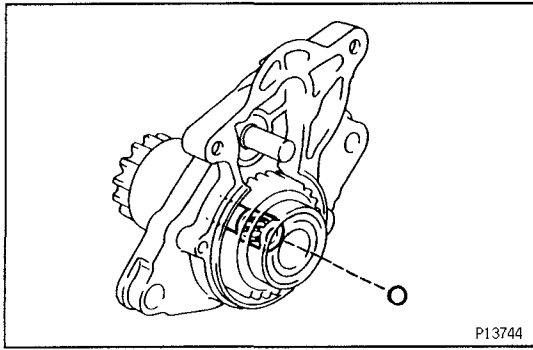


P13718

(d) Install a new O-ring to the screw.

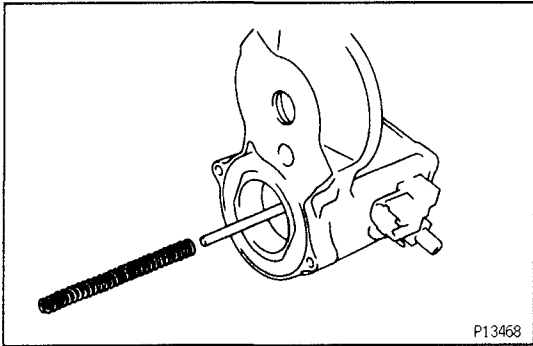
(e) Install the end cover to the field frame with the 2 screws.

Torque: 1.5 N·m (15 kgf·cm, 13 in.-lbf)



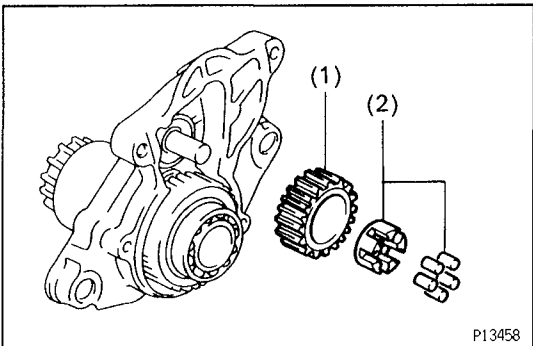
3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

- (a) Apply grease to the steel ball.
- (b) Insert the steel ball into the clutch shaft hole.



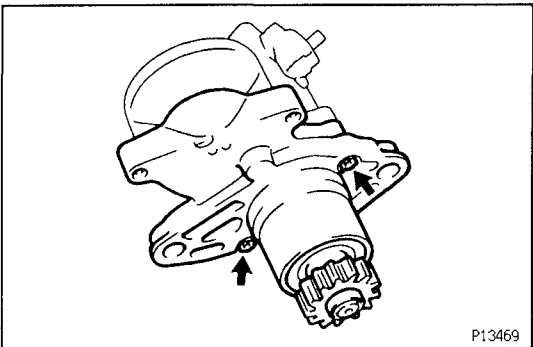
4. INSTALL STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

- (a) Apply grease to the return spring.
- (b) Insert the return spring into the magnetic switch hole.



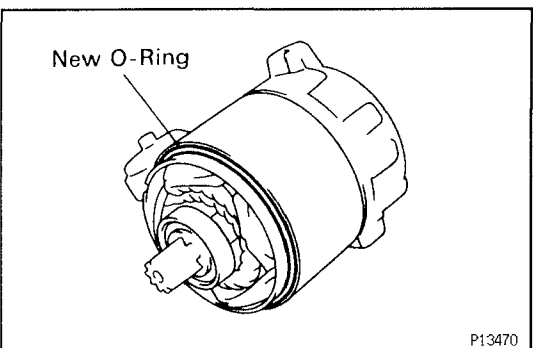
- (c) Place the following parts in position on the starter housing:

- (1) Idler gear
- (2) Bearing



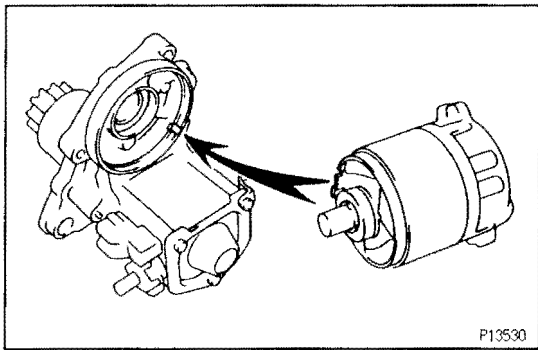
- (d) Install the starter housing to the magnetic switch with the 2 screws.

Torque: 5.9 N·m (60 kgf·cm, 52 in.-lbf)

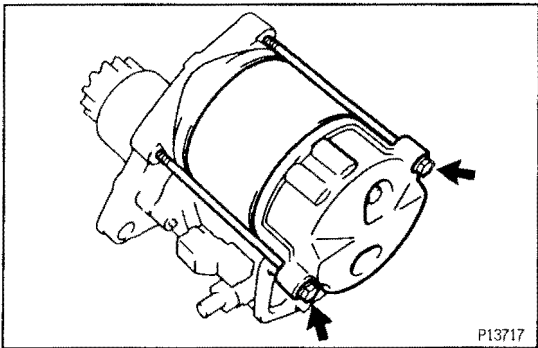


5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

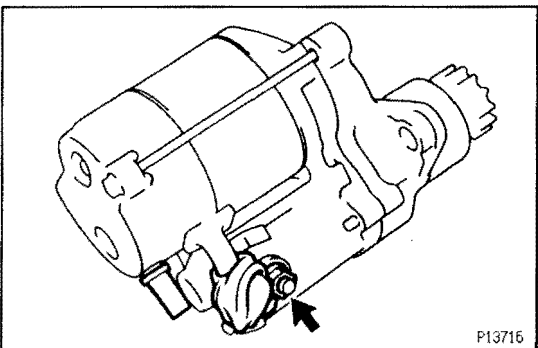
- (a) Install a new O—ring to the groove of the field frame.



- (b) Align the protrusion of the field frame with the cutout of the magnetic switch.



- (c) Install the field frame and armature assembly with the 2 through bolts.
Torque: 5.9 N·m (60 kgf·cm, 52 in·lbf)



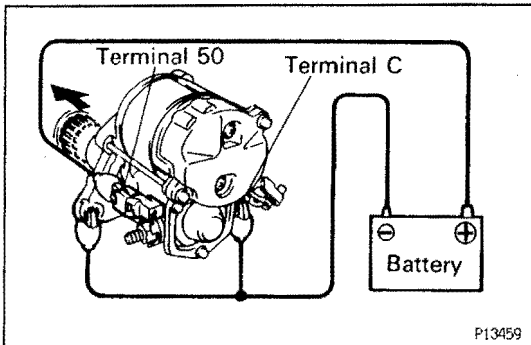
- (d) Connect the lead wire to terminal C, and install the nut.

Torque: 7.9 N·m (81 kgf·cm, 70 in·lbf)

6. INSTALL DUST PROTECTOR

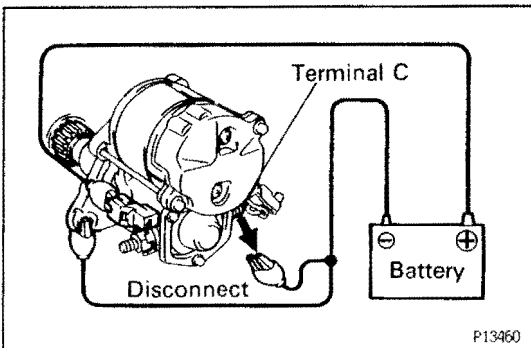
STARTER PERFORMANCE TEST

NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.



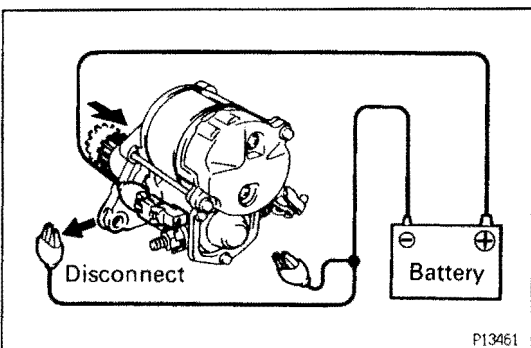
1. PERFORM PULL-IN TEST

- Disconnect the field coil lead wire from terminal C.
- Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward. If the clutch pinion gear does not move, replace the magnetic switch assembly.



2. PERFORM HOLD-IN TEST

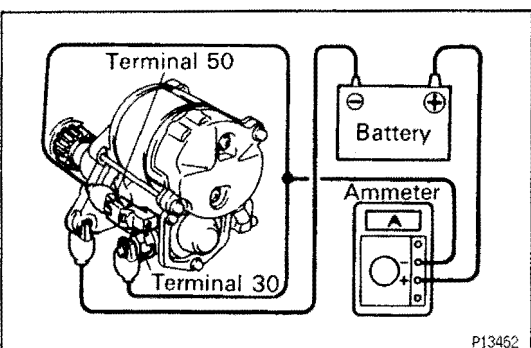
With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out. If the clutch pinion gear returns inward, replace the magnetic switch assembly.



3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body. Check that the clutch pinion gear returns inward.

If the clutch pinion gear does not return, replace the magnetic switch assembly.

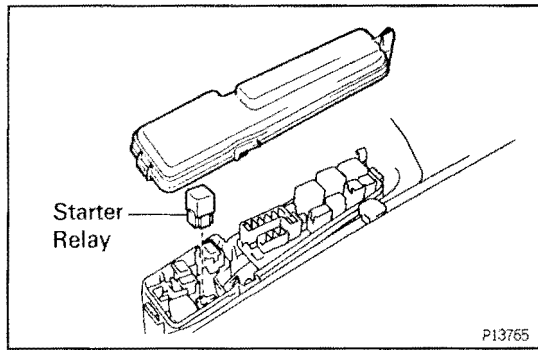


4. PERFORM NO-LOAD PERFORMANCE TEST

- Connect the battery and ammeter to the starter as shown.
- Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current.

Specified current:

90 A or less at 11.5 V



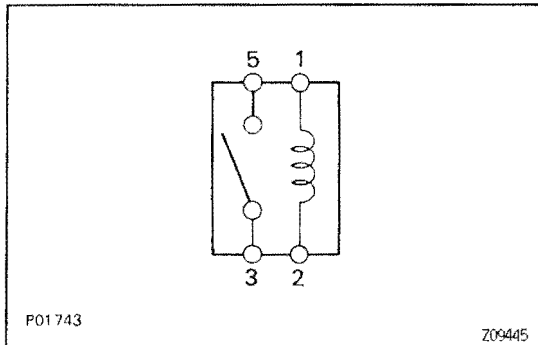
STARTER RELAY (ST202)

STARTER RELAY INSPECTION

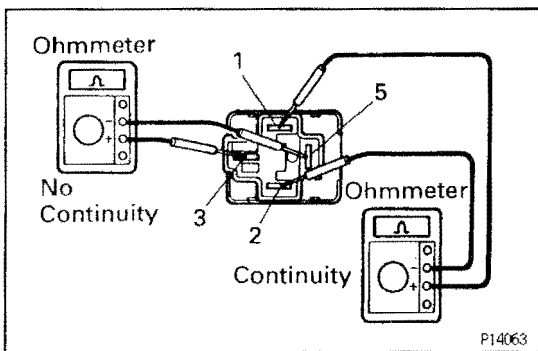
ST04F-0A

1. **REMOVE STARTER RELAY ("ST")**
LOCATION: In the engine compartment relay box.
Remove the relay box cover and starter relay.

ST



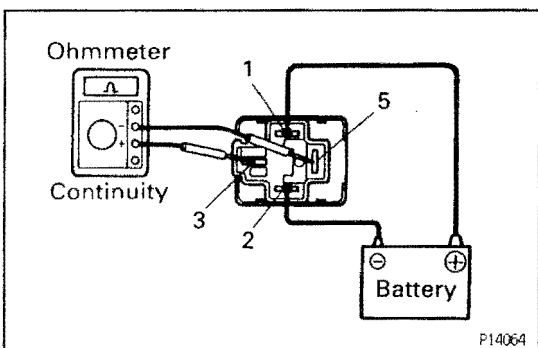
2. **INSPECT STARTER RELAY**



A. Inspect relay continuity

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- (b) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

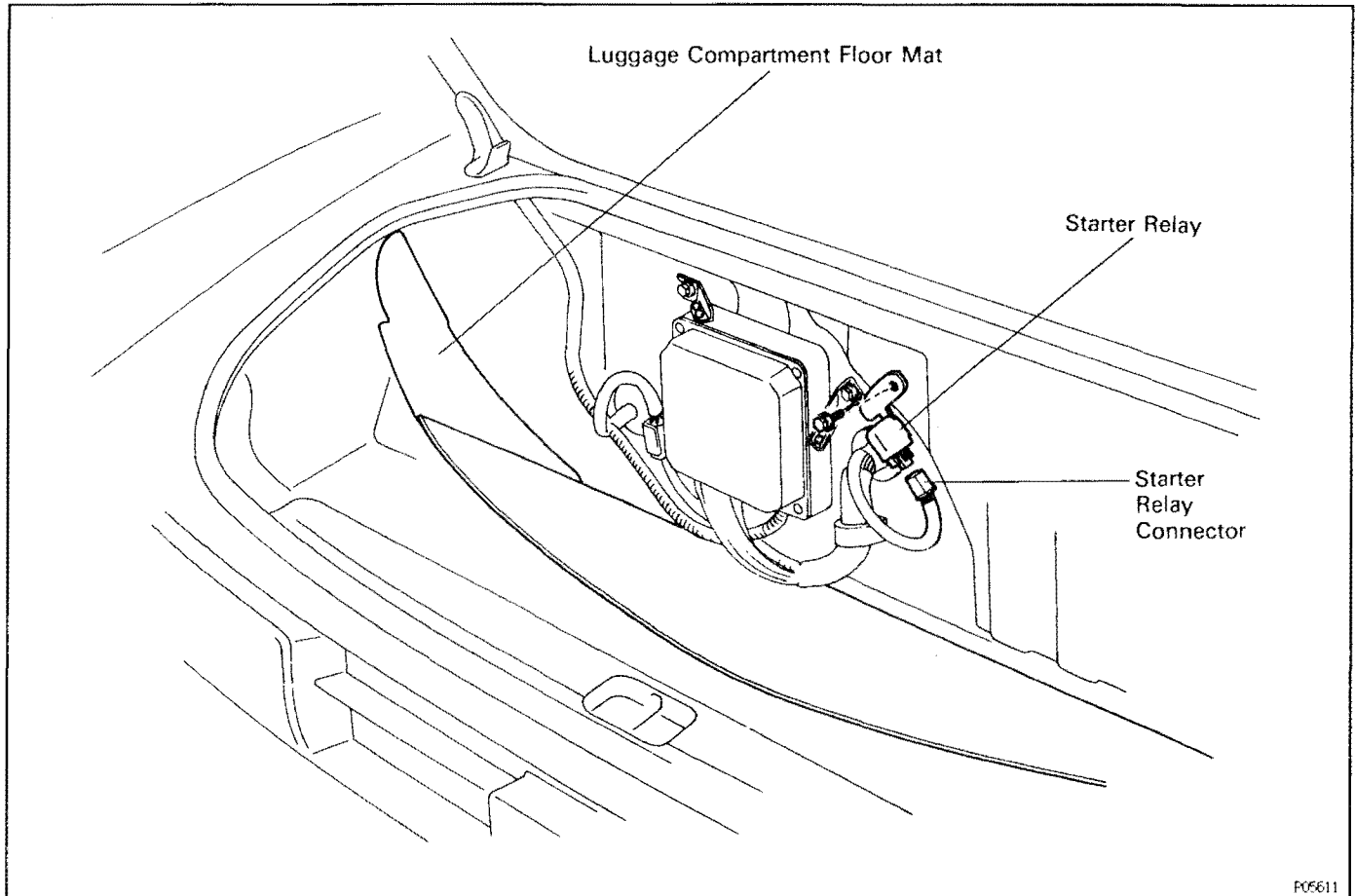
- (a) Apply battery voltage across terminals 1 and 2.
- (b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

3. **REINSTALL STARTER RELAY**

STARTER RELAY (SW20) COMPONENTS FOR REMOVAL AND INSTALLATION

ST02Z-01



ST

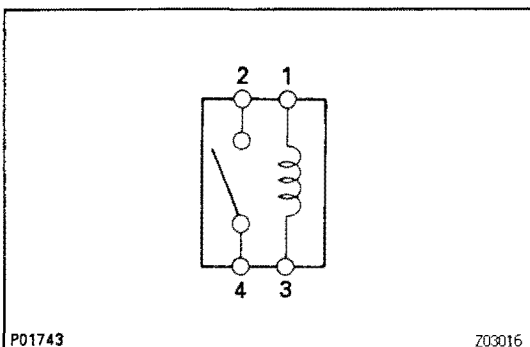
STARTER RELAY INSPECTION

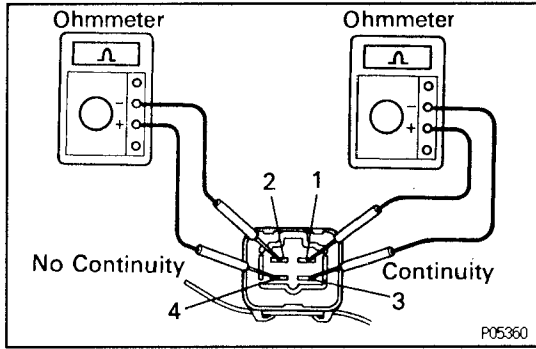
ST07X-01

(See Components for Removal and Installation)

1. DISCONNECT FRONT SIDE OF LUGGAGE COMPARTMENT FLOOR MAT FROM PARTITION PANEL
2. REMOVE STARTER RELAY

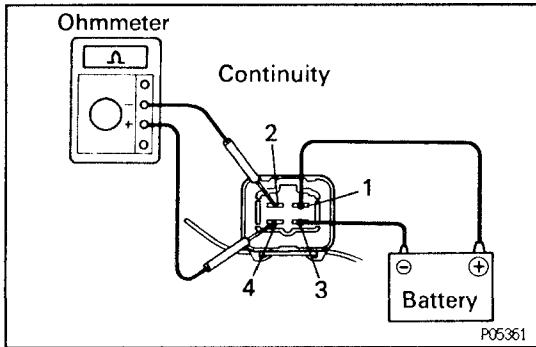
3. INSPECT STARTER RELAY



**A. Inspect relay continuity**

- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- (b) Check that there is no continuity between terminals 2 and 4.

If continuity is not as specified, replace the relay.

**B. Inspect relay operation**

- (a) Apply battery voltage across terminals 1 and 3.
- (b) Using an ohmmeter, check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

4. REINSTALL STARTER RELAY**5. REINSTALL LUGGAGE COMPARTMENT FLOOR MAT**

SERVICE SPECIFICATIONS

ST018-04

SERVICE DATA

Starter	Rated voltage and output power		12 V 1.4 kW	
	No-load characteristics	Current	90 A or less at 11.5 V	
		rpm	3,000 rpm or more	
	Brush length	STD	15.0 mm (0.591 in.)	
		Limit	8.0 mm (0.315 in.)	
	Spring installed load		12 – 20 N (1.2 – 2.0 kgf, 2.6 – 4.4 lbf)	
	Commutator	Diameter	STD	30 mm (1.18 in.)
			Limit	29 mm (1.14 in.)
		Undercut depth	STD	0.6 mm (0.024 in.)
		Limit	0.2 mm (0.008 in.)	
Circle runout	Limit	0.05 mm (0.0020 in.)		

ST

TORQUE SPECIFICATIONS

ST018-00

Part tightened	N-m	kgf-cm	ft-lbf
End cover x Brush holder	1.5	15	13 in.-lbf
Starter housing x Magnetic switch	5.9	60	52 in.-lbf
End cover x Starter Housing	5.9	60	52 in.-lbf
Lead wire of field frame x Magnetic switch	7.9	81	70 in.-lbf

– MEMO –

ST

CHARGING SYSTEM

DESCRIPTION.....	CH- 2
PRECAUTION	CH- 3
SYSTEM CIRCUIT	CH- 4
OPERATION	CH- 5
PREPARATION	CH- 6
ON-VEHICLE INSPECTION	CH- 8
ALTERNATOR	CH- 14
IGNITION MAIN RELAY (SW20)	CH- 29
SERVICE SPECIFICATIONS.....	CH- 29

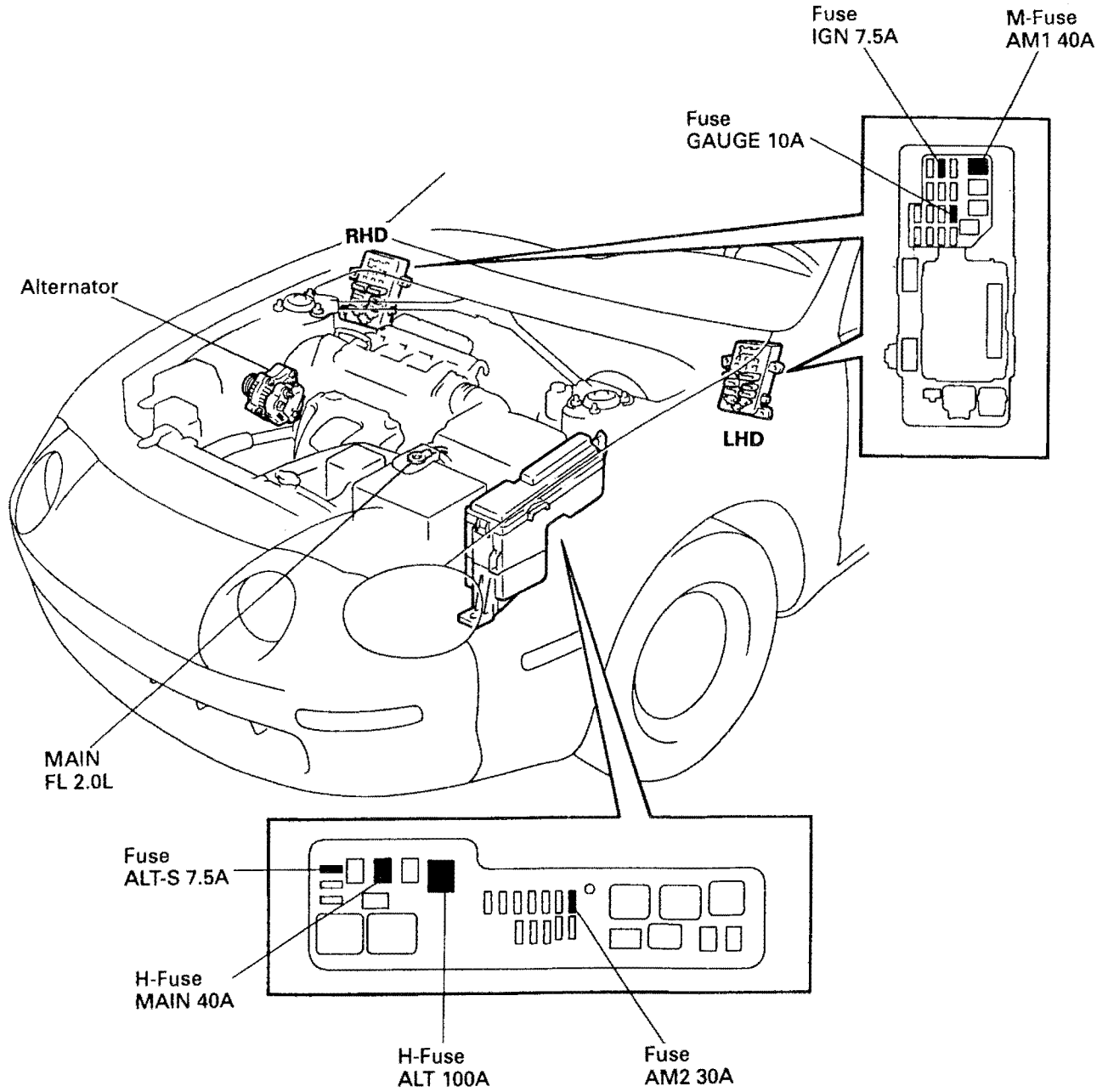
CH

DESCRIPTION

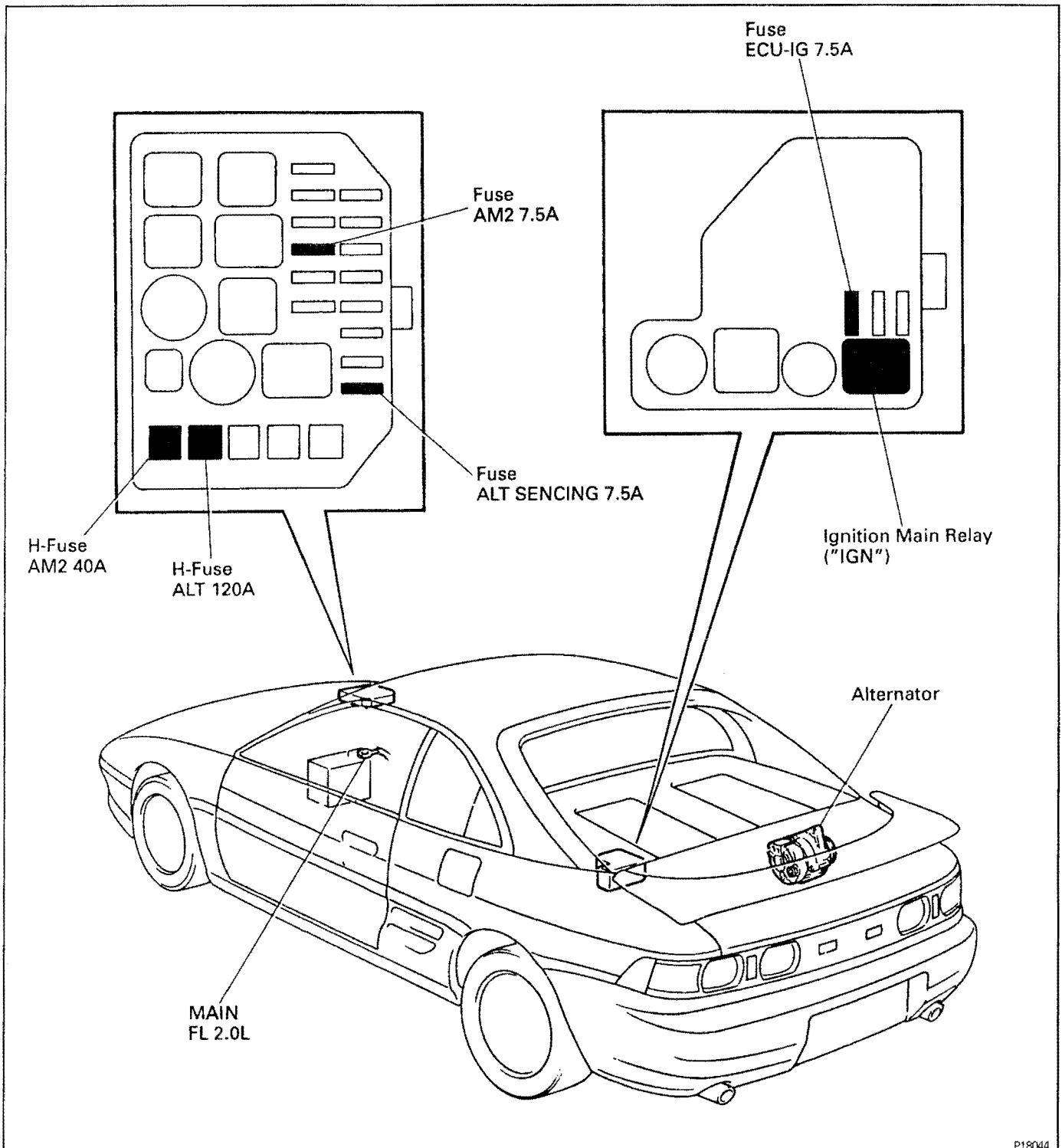
CH07B-01

The alternator is a small, high-rpm, high-performance type with a IC regulator incorporated. The IC regulator uses integrated circuits and controls the voltage produced by the alternator.

ST202



CH



CH

PRECAUTION

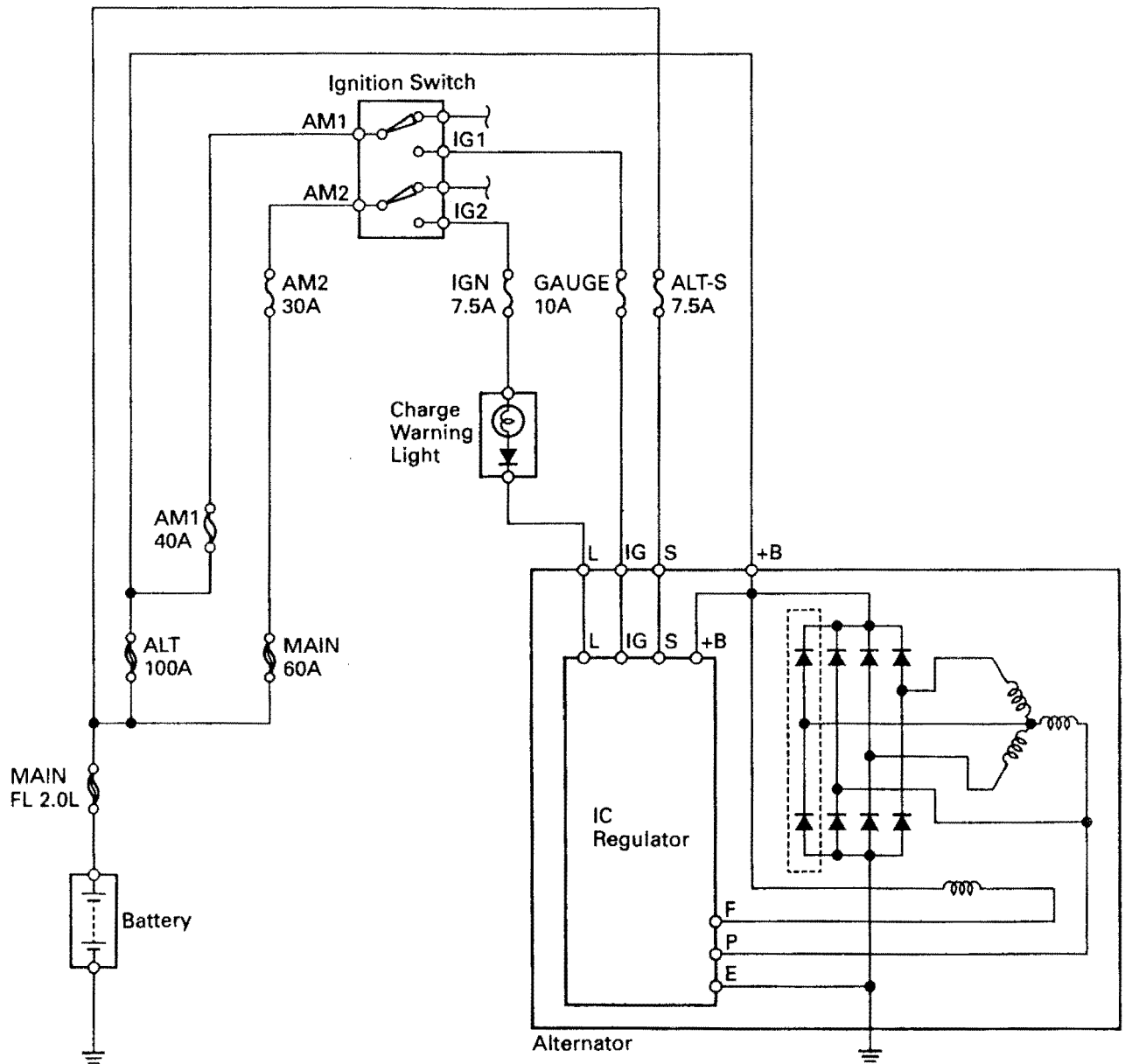
1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.

SYSTEM CIRCUIT

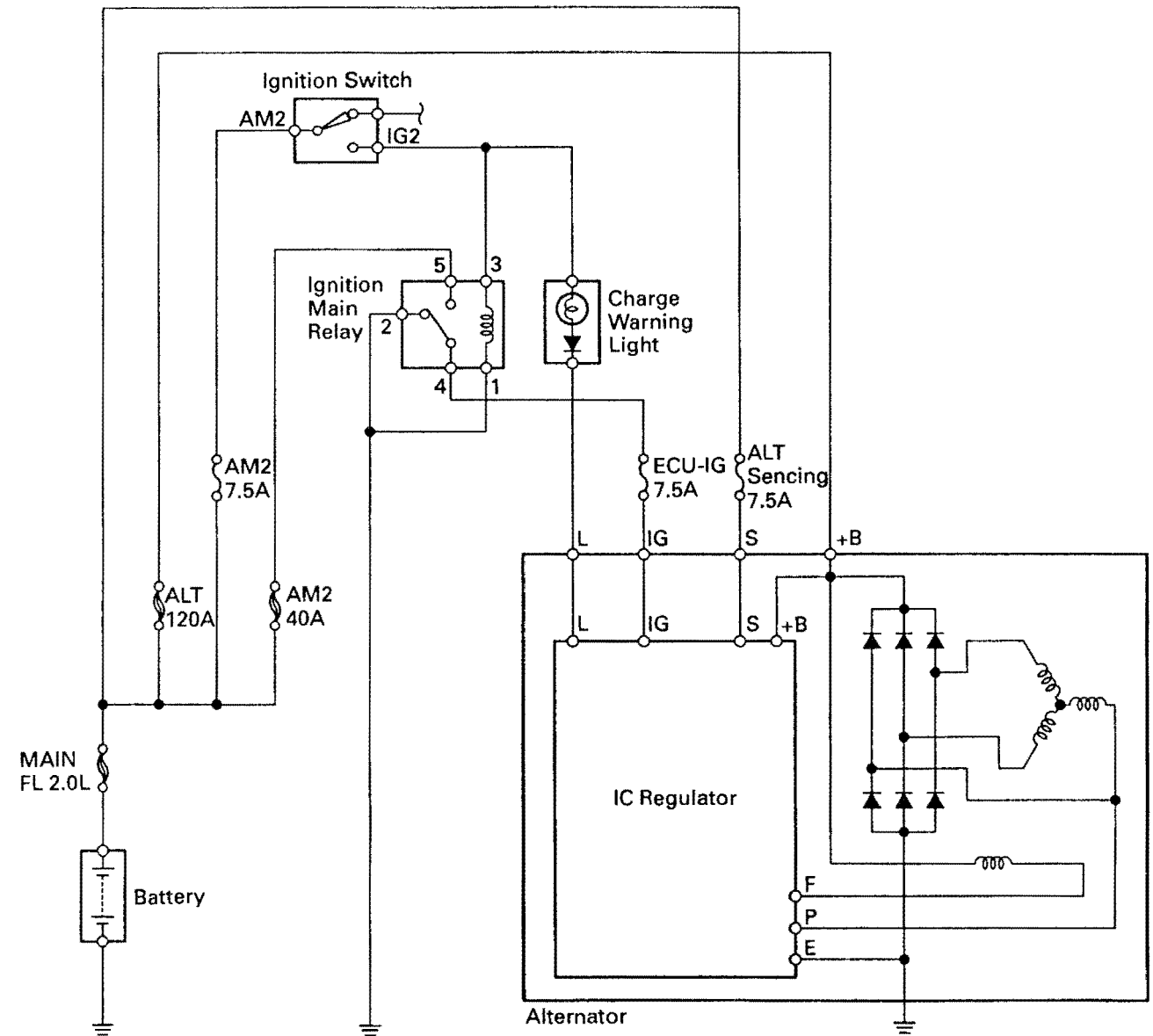
CH07C-01

ST202

CH



SW20



P18023

Z13242

OPERATION



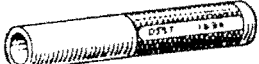

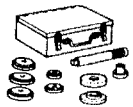

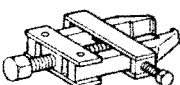


When the ignition switch is turned ON, current from the battery flows from terminal L of the alternator through the IC regulator to terminal E, causing the charge warning light to light up. When the engine is started, the voltage output increases as the alternator speed increases. When the voltage output becomes greater than the battery voltage, current for recharging flows from terminal B. Simultaneously, voltage at terminal L increases and the potential difference between battery and terminal L disappears, causing the charge warning light to go off. When the voltage output exceeds the regulator adjustment voltage, the transistor inside the IC regulator regulates the voltage so that the voltage from the alternator remains constant.

CHOOP-OF

PREPARATION

SST (SPECIAL SERVICE TOOLS)



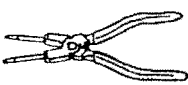
CH000-0C

	09216-00021	Belt Tension Gauge	
	09216-00030	Belt Tension Gauge Cable	
	09285-76010	Injection Pump Camshaft Bearing Cone Replacer	Rotor rear bearing cover
	09286-46011	Injection Pump Spline Shaft Puller	Rectifier end frame
	09608-20012	Front Hub & Drive Pinion Bearing Tool Set	
	(09608-00030)	Replacer	Rotor front bearing
	09820-00021	Alternator Rear Bearing Puller	Rotor rear bearing
	09820-00030	Alternator Rear Bearing Replacer	Rotor rear bearing
	09820-63010	Alternator Pulley Set Nut Wrench Set	

CH

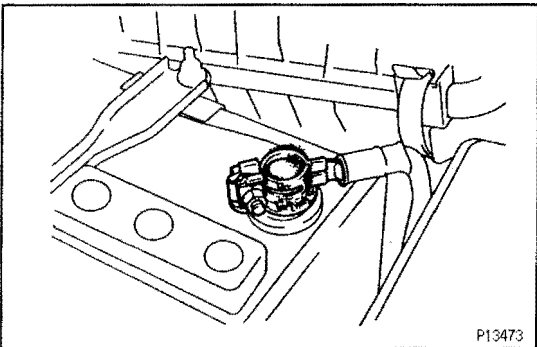
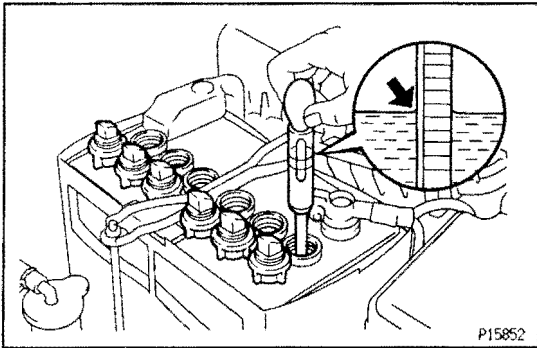
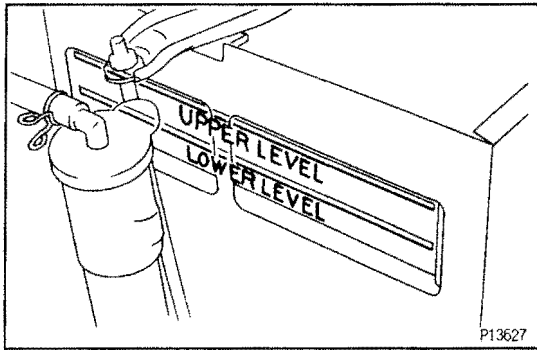
RECOMMENDED TOOLS

CH008-0A

	09082-00050	TOYOTA Electrical Tester Set	
	09200-00010	Engine Adjust Kit	
	09905-00013	Snap Ring Pliers	Alternator washer for ST202

EQUIPMENT

Battery specific gravity gauge	
Belt tension gauge	
Torque wrench	
Vernier calipers	Rotor (Slip ring), Brush



ON—VEHICLE INSPECTION

CH070-01

1. CHECK BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

- (a) Check the electrolyte level of each cell.
If insufficient, refill with distilled (or purified) water.

- (b) Check the specific gravity of each cell.
Standard specific gravity at 20°C (68°F):

1.25 — 1.27

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

2. CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

- (a) Check that the battery terminals are not loose or corroded.
If the terminals are corroded, clean the terminals.

- (b) Check the fusible link, H—fuses, M—fuse and fuses for continuity.

ST202:

Fusible link

MAIN 2.0L

H—fuse

ALT 100A

MAIN 60A

M—fuse

AM1 40A

Fuse

AM2 30A

ALT—S 7.5A

GAUGE 10A

IGN 7.5A

SW20:

Fusible link

MAIN 2.0L

H—fuse

ALT 120A

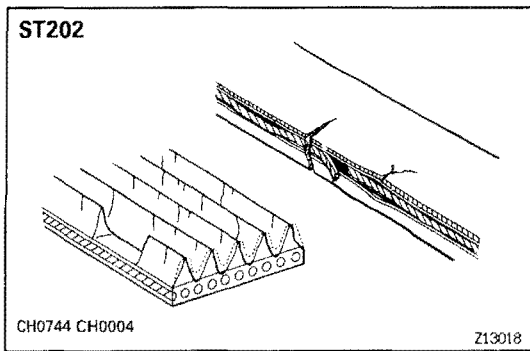
AM2 40A

Fuse

AM2 7.5A

ALT SENCING 7.5A

ECU—IG 7.5A

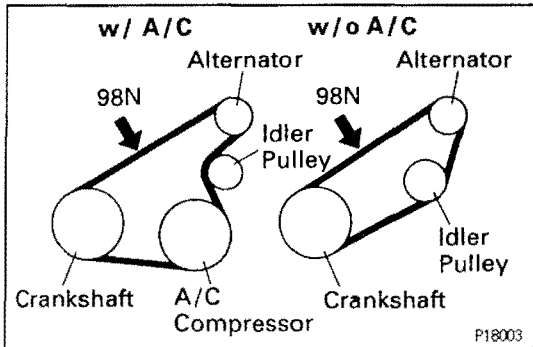


3. INSPECT DRIVE BELT

ST202:

(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) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

Drive belt deflection:

w/ A/C

New belt

10 – 11 mm (0.39 – 0.43 in.)

Used belt

13 – 16 mm (0.51 – 0.63 in.)

w/o A/C

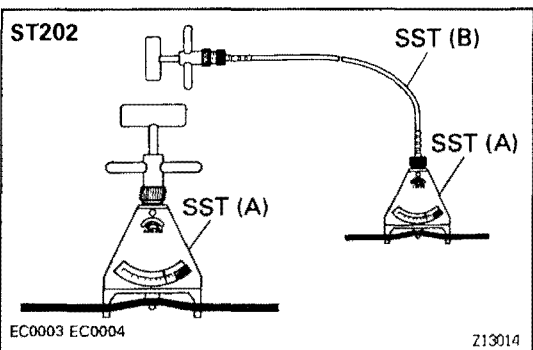
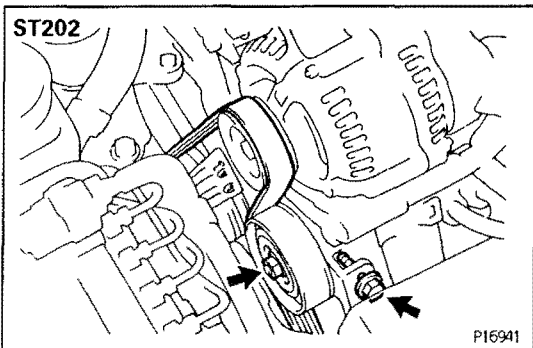
New belt

11 – 14 mm (0.43 – 0.55 in.)

Used belt

12 – 18 mm (0.47 – 0.71 in.)

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



Reference:

Using SST, check the drive belt tension.

SST 09216-00021 (A),

09216-00030 (B)

Drive belt tension:

w/ A/C

New belt

686 – 785 N (70 – 80 kgf)

Used belt

294 – 441 N (30 – 45 kgf)

w/o A/C

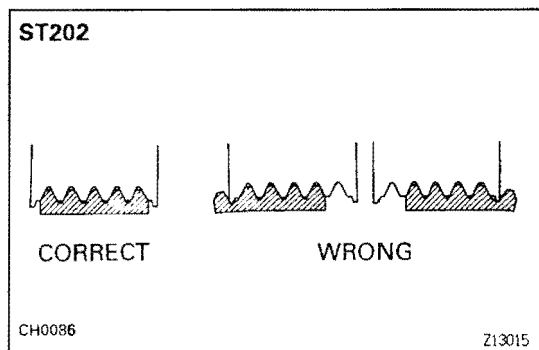
New belt

461 – 706 N (47 – 72 kgf)

Used belt

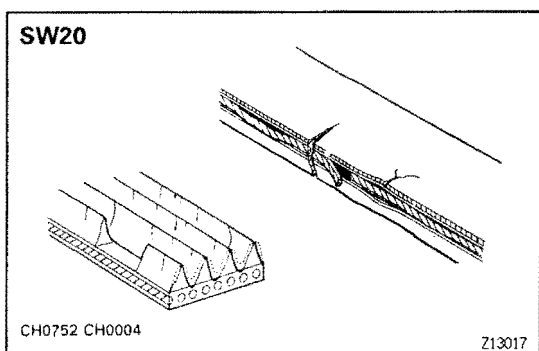
353 – 610 N (36 – 62 kgf)

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.

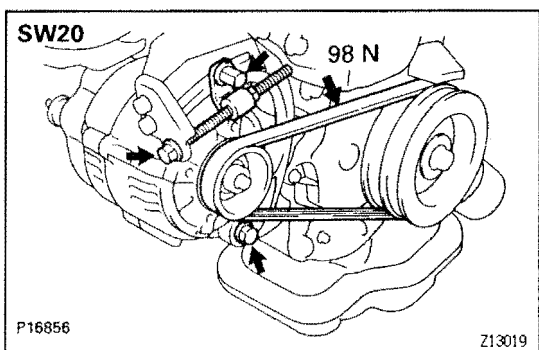


SW20:

- (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) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

Drive belt deflection:

New belt

9 – 12 mm (0.35 – 0.47 in.)

Used belt

10 – 15 mm (0.39 – 0.59 in.)

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

Reference:

Using SST, check the drive belt tension.

SST 09216-00021 (A),

09216-00030 (B)

Drive belt tension:

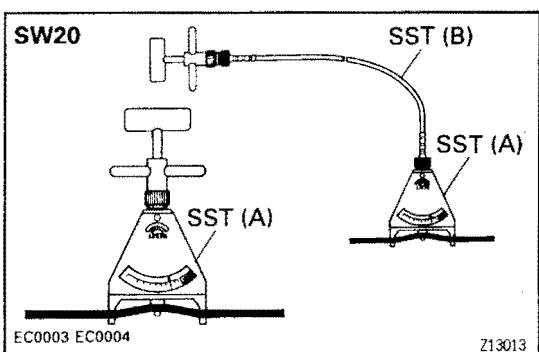
New belt

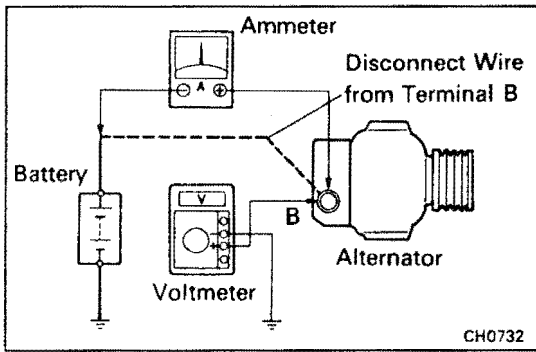
539 – 639 N (55 – 65 kgf)

Used belt

245 – 392 N (25 – 40 kgf)

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



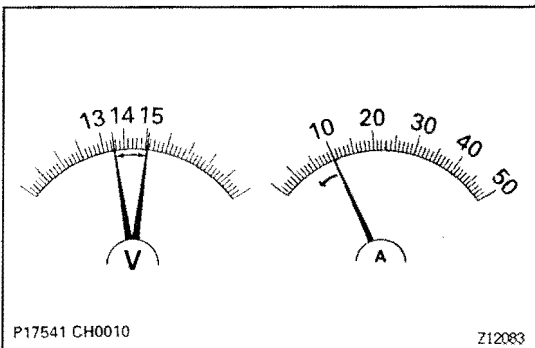


6. INSPECT CHARGING CIRCUIT WITHOUT LOAD

HINT: If a battery/alternator tester is available, connect the tester to the charging circuit as per manufacturer's instructions.

(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:

- Disconnect the wire from terminal B of the alternator, and connect it to the negative (–) tester probe of the ammeter.
- Connect the positive (+) tester probe of the ammeter to terminal B of the alternator.
- Connect the positive (+) tester probe of the voltmeter to terminal B of the alternator.
- Ground the negative (–) tester probe of the voltmeter.



P17541 CH0010

Z12083

(b) Check the charging circuit as follows:

With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage:

10 A or less

Standard voltage:

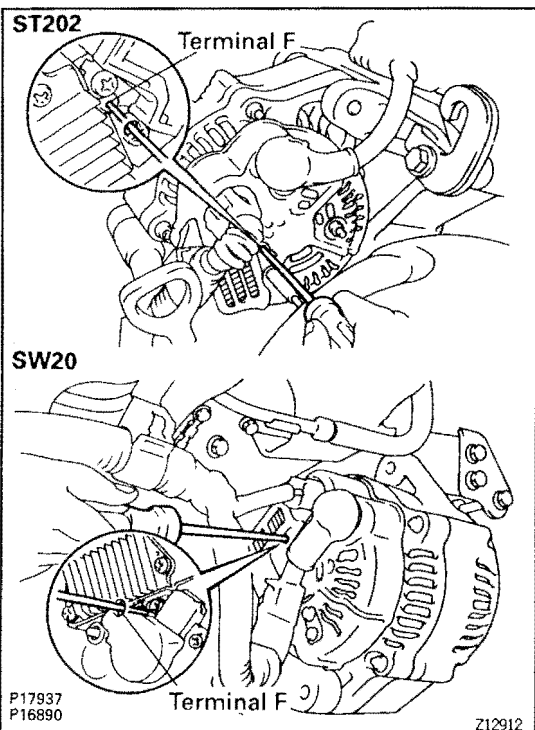
13.9 – 15.1 V at 25°C (77°F)

13.5 – 14.3 V at 115°C (239°F)

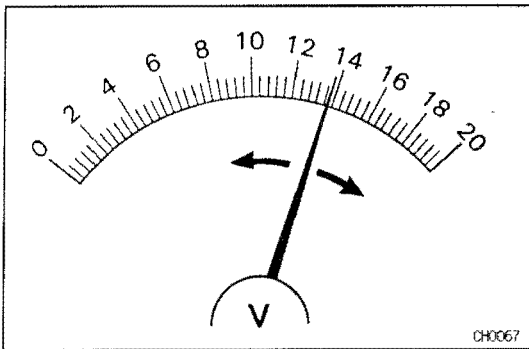
If the voltmeter reading is more than standard voltage, replace the IC regulator.

If the voltmeter reading is less than standard voltage, check the IC regulator and alternator as follows:

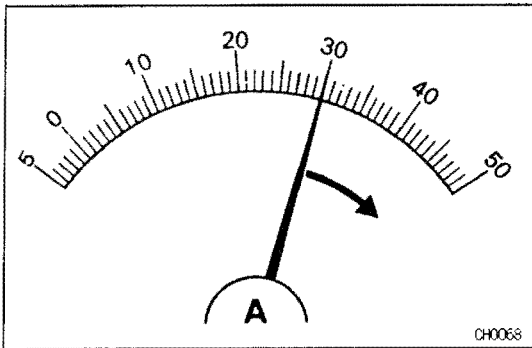
- With terminal F grounded, start the engine and check the voltmeter reading of terminal B.

P17937
P16890

Z12912



- If the voltmeter reading is more than standard voltage, replace the IC regulator.
- If the voltmeter reading is less than standard voltage, check the alternator.

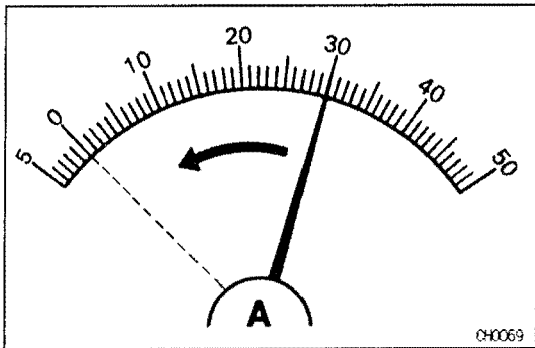


7. INSPECT CHARGING CIRCUIT WITH LOAD

- With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at "HI".
- Check the reading on the ammeter.

Standard amperage:

30 A or more

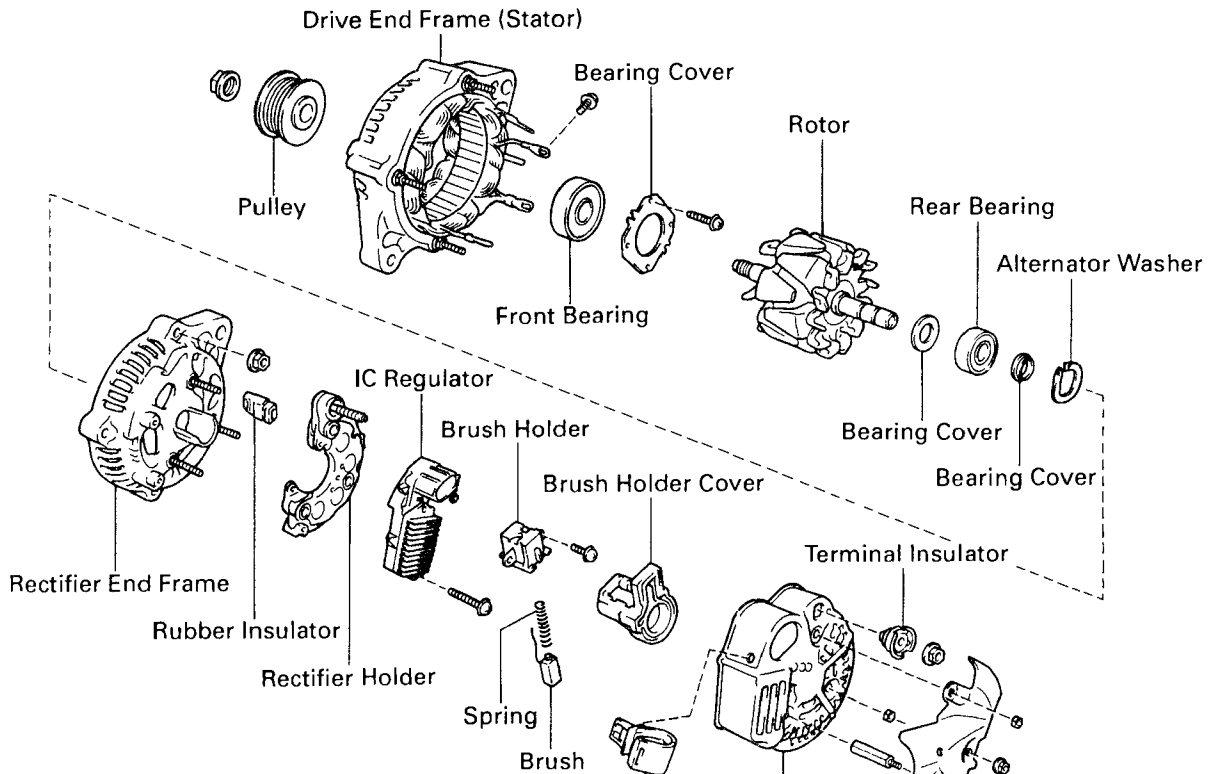


If the ammeter reading is less than the standard amperage, repair the alternator.

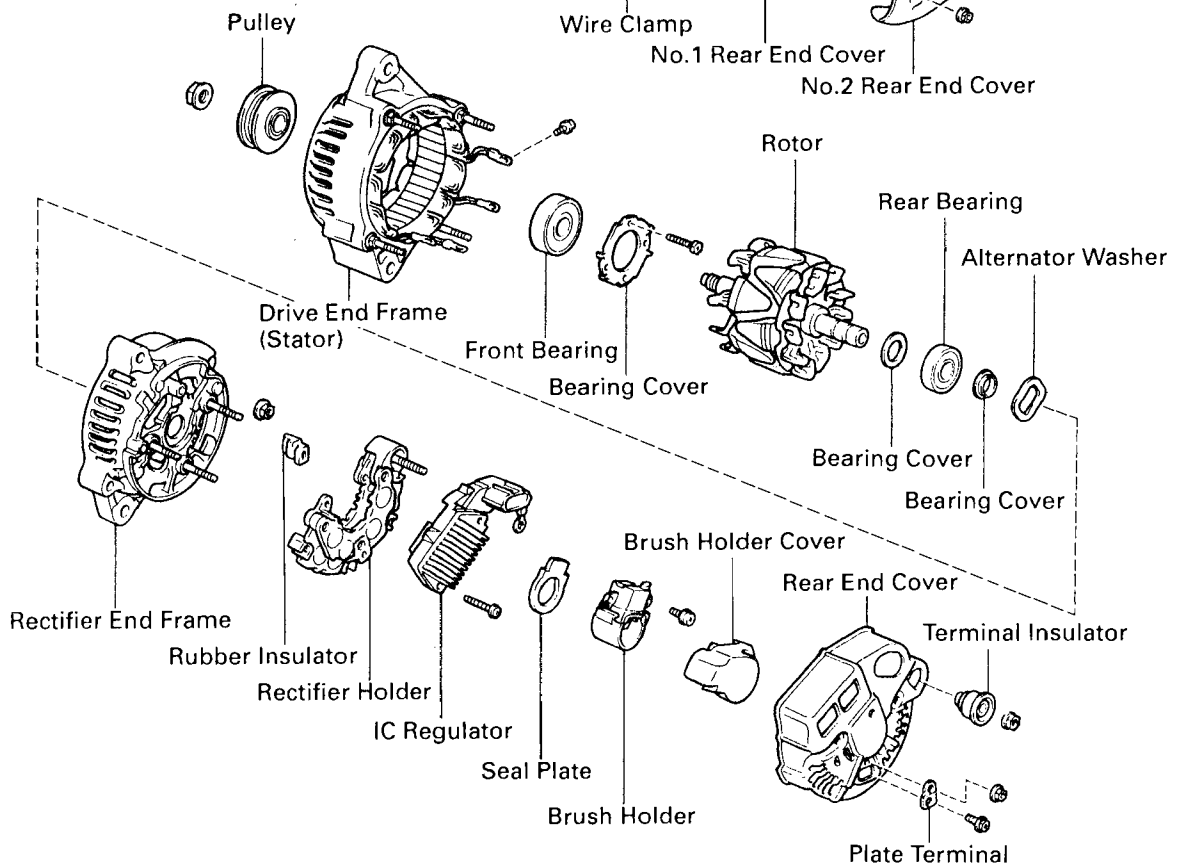
HINT: If the battery is fully charged, the indication will sometimes be less than standard amperage.

ALTERNATOR COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

ST202



SW20



CH

ALTERNATOR DISASSEMBLY

(See Components for Disassembly and Assembly)

1. ST202:

REMOVE REAR END COVERS

(a) Remove the nut and terminal insulator.

(b) Remove the 3 nuts and No.2 rear end cover.

(c) Remove the 2 nuts and No.1 rear end cover.

(d) Remove the wire clamp from the rear end cover.

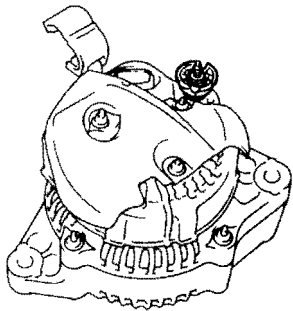
2. SW20:

REMOVE REAR END COVER

(a) Remove the nut and terminal insulator.

(b) Remove the bolt, 3 nuts, plate terminal and rear end cover.

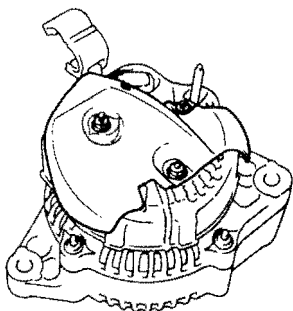
ST202



P15686

Z11866

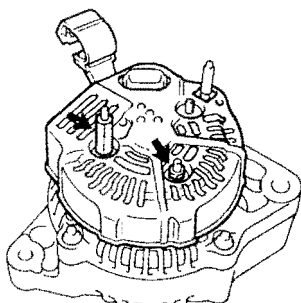
ST202



P15687

Z11867

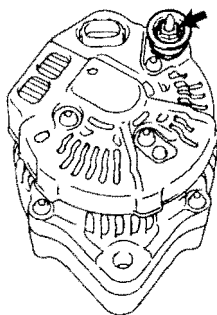
ST202



P15688

Z12271

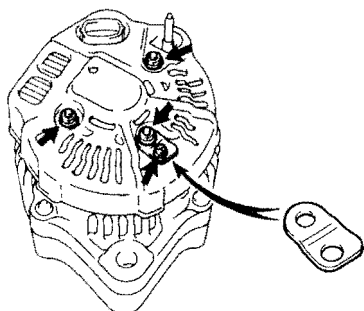
SW20



P16891

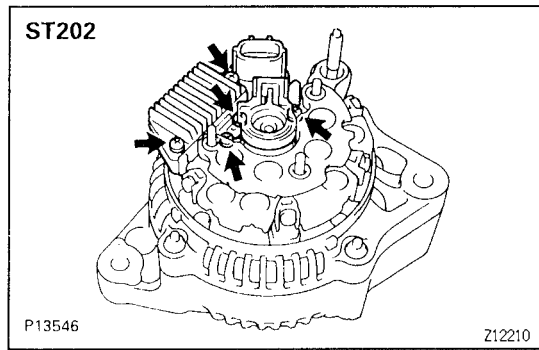
Z12272

SW20

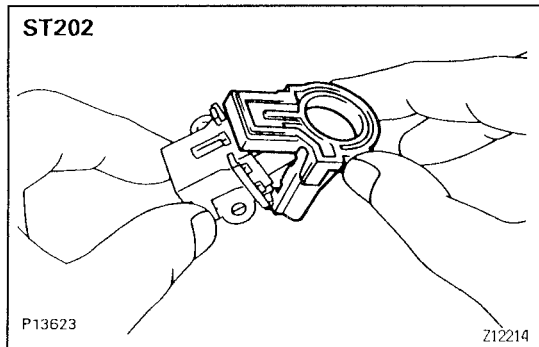


P16892

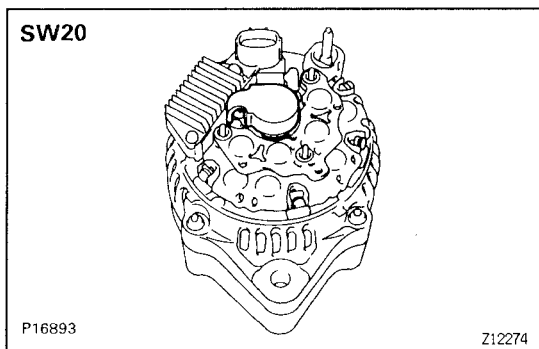
Z12273



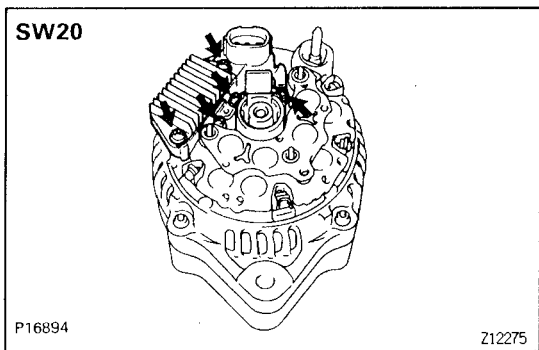
- 3. REMOVE BRUSH HOLDER AND IC REGULATOR**
ST202:
 (a) Remove the 5 screws, brush holder and IC regulator.



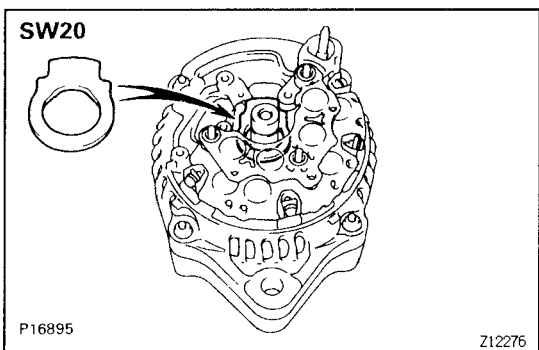
- (b) Remove the brush holder cover from the brush holder.



- SW20:**
 (a) Remove the brush holder cover from the brush holder.

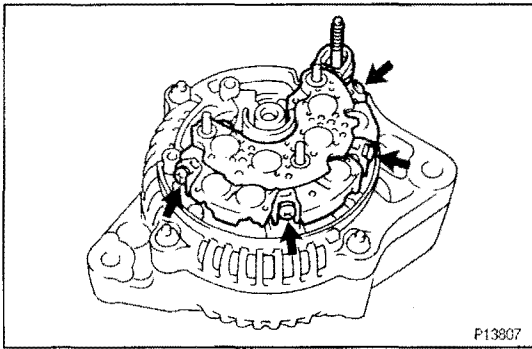


- (b) Remove the 5 screws, brush holder and IC regulator.



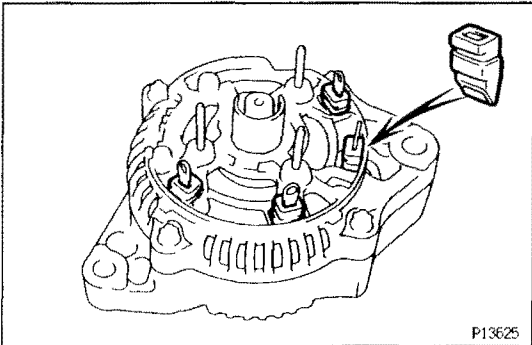
- (c) Remove the seal plate from the rectifier end frame.

CH

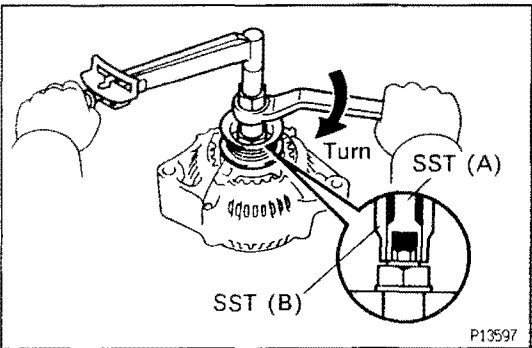


4. REMOVE RECTIFIER HOLDER

- (a) Remove the 4 screws and rectifier holder.

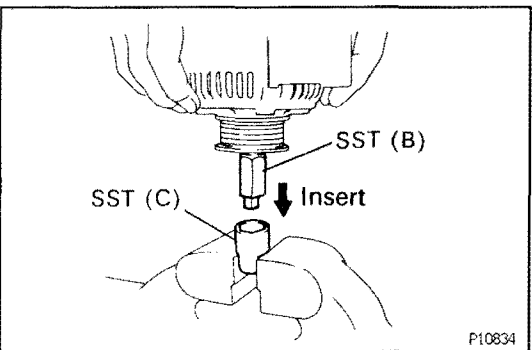


- (b) Remove the 4 rubber insulators.

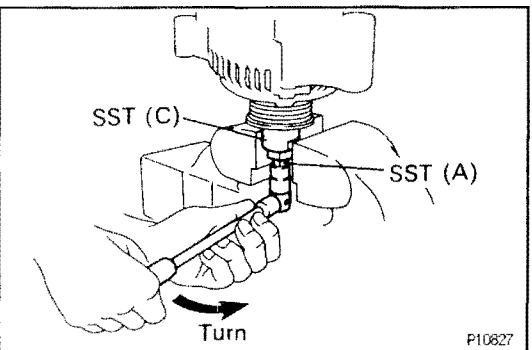


5. REMOVE PULLEY

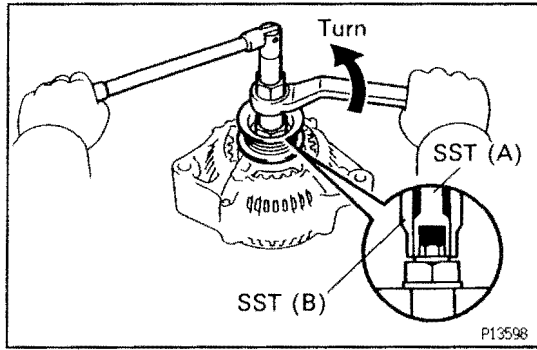
- (a) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820-63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
- (b) Check that SST (A) is secured to the rotor shaft.



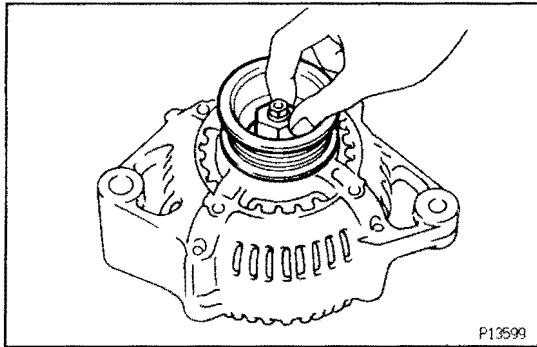
- (c) Mount SST (C) in a vise.
- (d) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



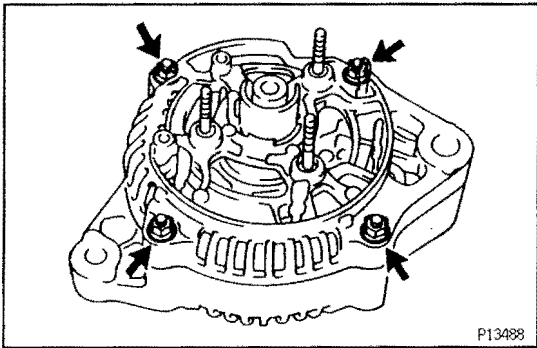
- (e) To loosen the pulley nut, turn SST (A) in the direction shown in the illustration.
NOTICE: To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.
- (f) Remove the alternator from SST (C).



(g) Turn SST (B), and remove SST (A and B).

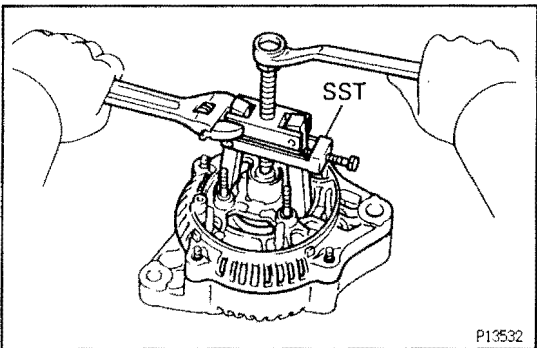


(h) Remove the pulley nut and pulley.

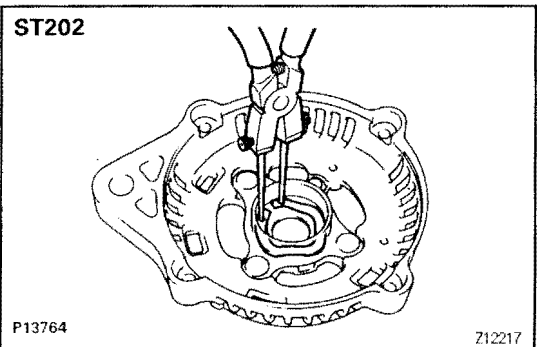


6. REMOVE RECTIFIER END FRAME

(a) Remove the 4 nuts.

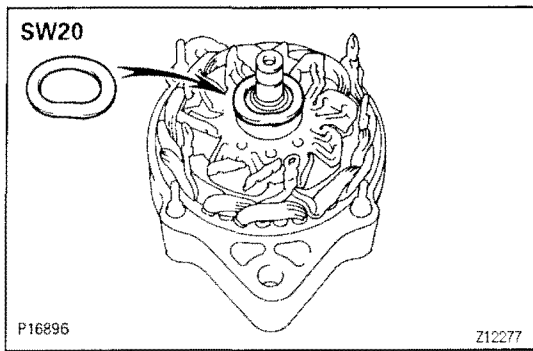


(b) Using SST, remove the rectifier end frame.
SST 09286-46011

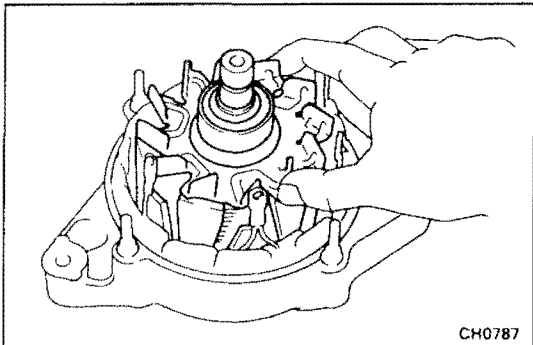


(c) ST202:
Using snap ring pliers, remove the alternator washer from the rectifier end frame.

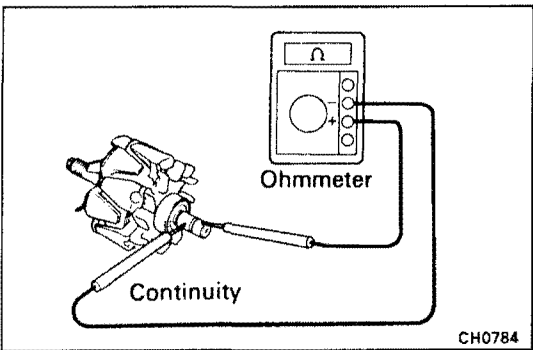
CH



- (d) SW20:
Remove the alternator washer from the rotor.



7. REMOVE ROTOR FROM DRIVE END FRAME



ALTERNATOR INSPECTION AND REPAIR CH06R-03

Rotor

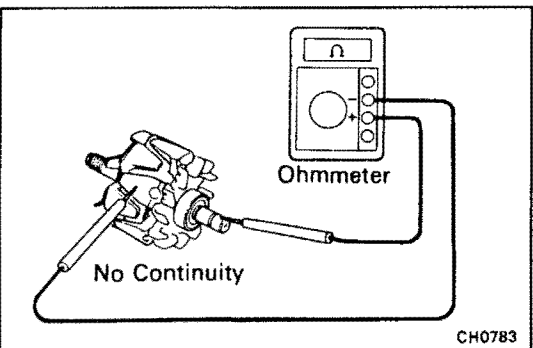
1. INSPECT ROTOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the slip rings.

Standard resistance:

2.8 – 3.0 Ω at 20°C (68°F)

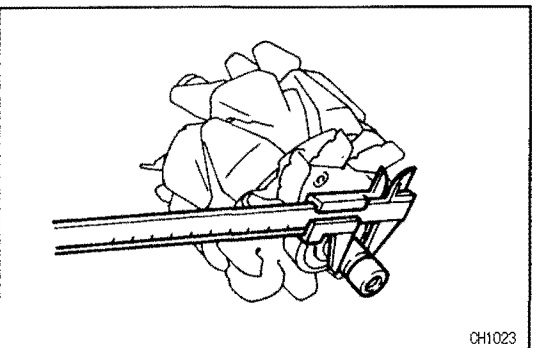
If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and rotor.

If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

- (a) Check that the slip rings are not rough or scored. If rough or scored, replace the rotor.

- (b) Using a vernier caliper, measure the slip ring diameter.

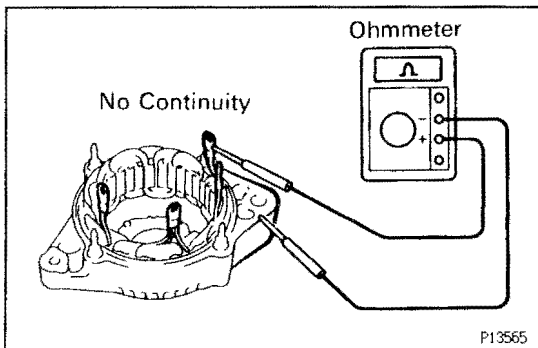
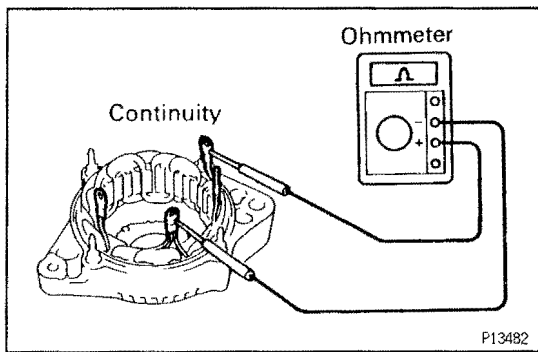
Standard diameter:

14.2 – 14.4 mm (0.559 – 0.567 in.)

Minimum diameter:

12.8 mm (0.504 in.)

If the diameter is less than minimum, replace the rotor.



Stator (Drive End Frame)

1. INSPECT STATOR FOR OPEN CIRCUIT

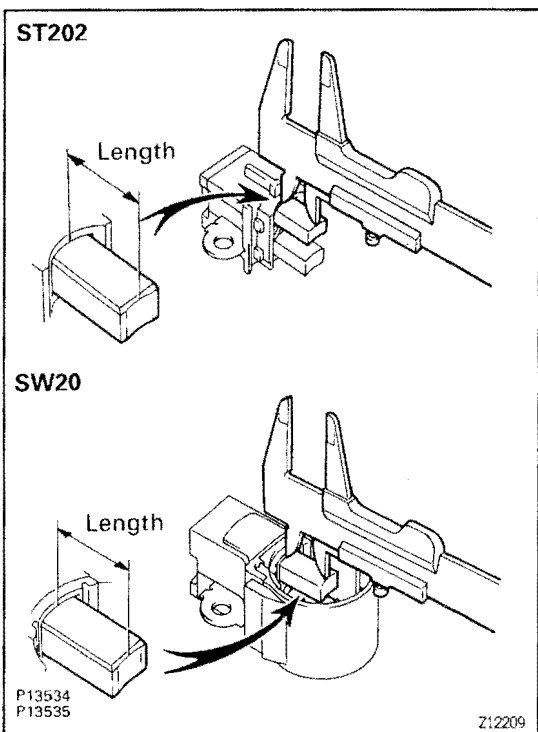
Using an ohmmeter, check that there is continuity between the coil leads.

If there is no continuity, replace the drive end frame assembly.

2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil lead and drive end frame.

If there is continuity, replace the drive end frame assembly.



Brushes

1. INSPECT EXPOSED BRUSH LENGTH

Using vernier calipers, measure the exposed brush length.

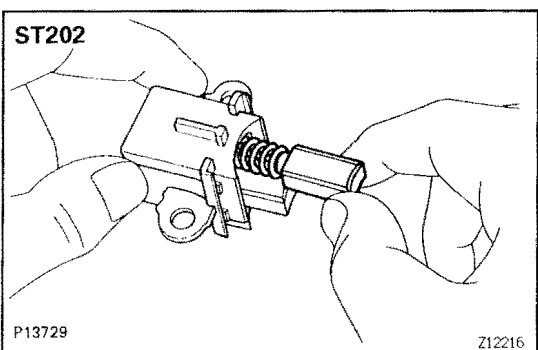
Standard exposed length:

10.5 mm (0.413 in.)

Minimum exposed length:

1.5 mm (0.059 in.)

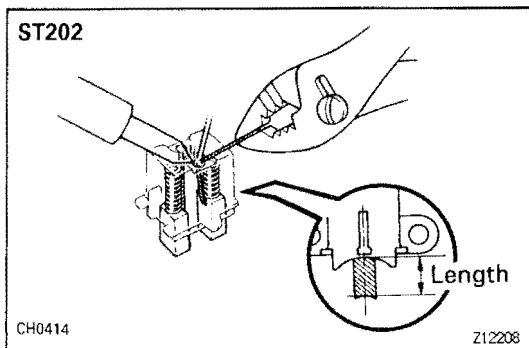
If the exposed length is less than minimum, replace the brushes (ST202) or brush holder assembly (SW20).



2. ST202:

IF NECESSARY, REPLACE BRUSHES

- Unsolder and remove the brush and spring.
- Run the wire of a new brush through the spring and the hole in the brush holder, and insert the spring and brush into the brush holder.

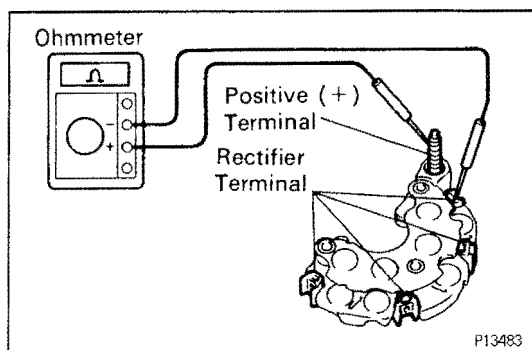


- (c) Solder the brush wire to the brush holder at specified exposed length.

Exposed length:

10.5 mm (0.413 in.)

- (d) Check that the brush moves smoothly in the brush holder.
 (e) Cut off the excess wire.
 (f) Apply insulation paint to the soldered area.

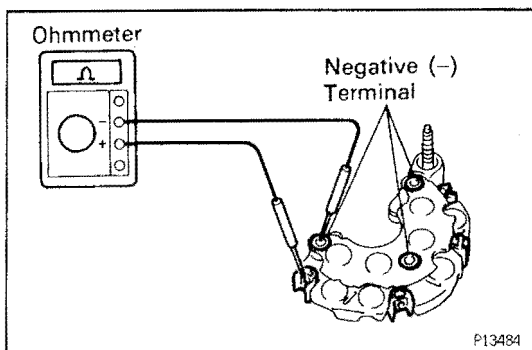


Rectifiers (Rectifier Holder)

1. INSPECT POSITIVE RECTIFIER

- (a) Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.
 (b) Reverse the polarity of the tester probes and repeat step (a).
 (c) Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.



2. INSPECT NEGATIVE RECTIFIER

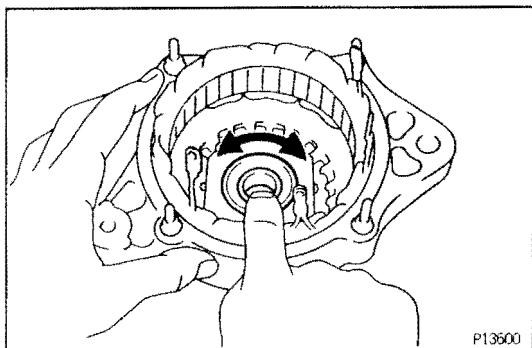
- (a) Using an ohmmeter, connect one tester probe to each negative (-) terminal and the other to each rectifier terminal.
 (b) Reverse the polarity of the tester probes and repeat step (a).
 (c) Check that one shows continuity and the other shows no continuity.

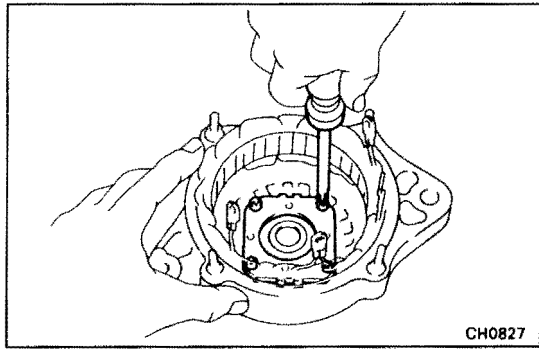
If continuity is not as specified, replace the rectifier holder.

Bearings

1. INSPECT FRONT BEARING

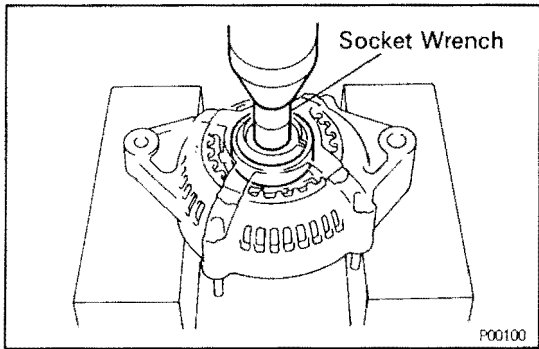
Check that the bearing is not rough or worn.



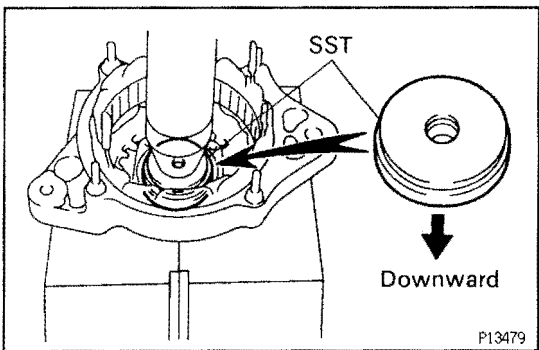


2. IF NECESSARY, REPLACE FRONT BEARING

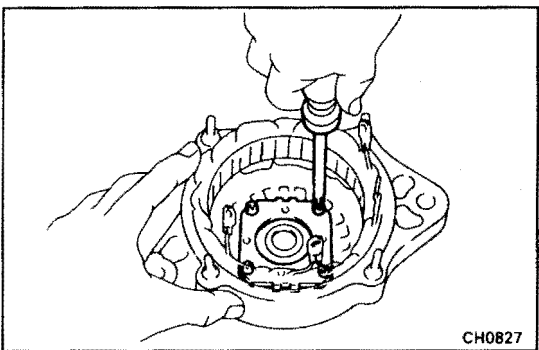
(a) Remove the 4 screws, bearing retainer and bearing.



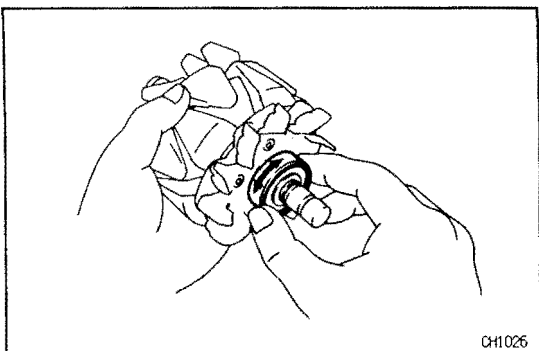
(b) Using a socket wrench and press, press out the bearing.



(c) Using SST and a press, press in a new bearing.
SST 09608-20012 (09608-00030)



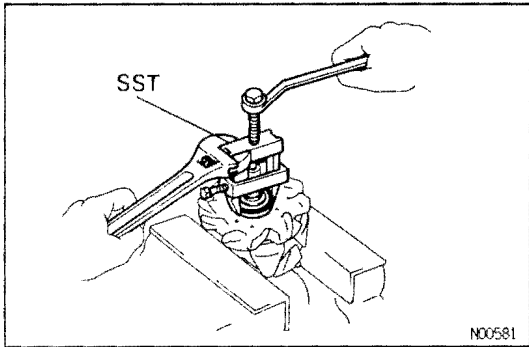
(d) Install the bearing retainer with the 4 screws.
Torque: 2.6 N·m (27 kgf·cm, 23 in·lbf)



3. INSPECT REAR BEARING

Check that the bearing is not rough or worn.

CH

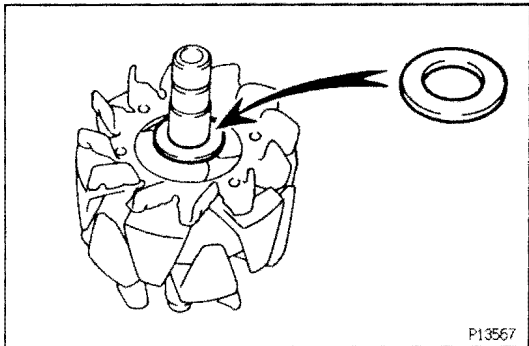
**4. IF NECESSARY, REPLACE REAR BEARING**

- (a) Using SST, remove the bearing cover (outside) and bearing.

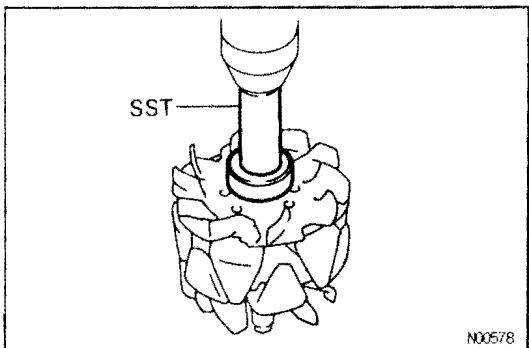
SST 09820-00021

NOTICE: Be careful not to damage the fan.

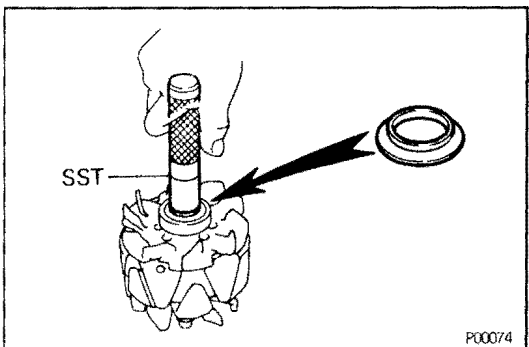
- (b) Remove the bearing cover (inside).



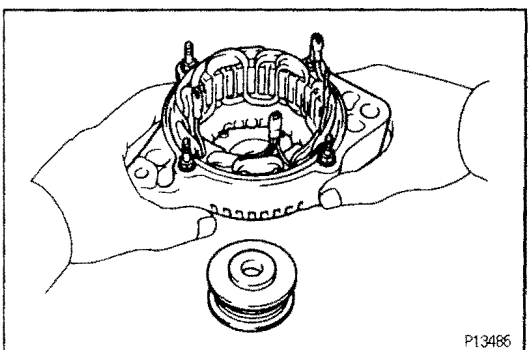
- (c) Place the bearing cover (inside) on the rotor.



- (d) Using SST and a press, press in a new bearing.
SST 09820-00030



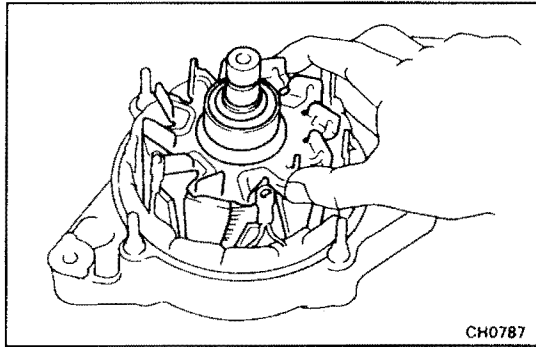
- (e) Using SST, push in the bearing cover (outside).
SST 09285-76010

**ALTERNATOR ASSEMBLY**

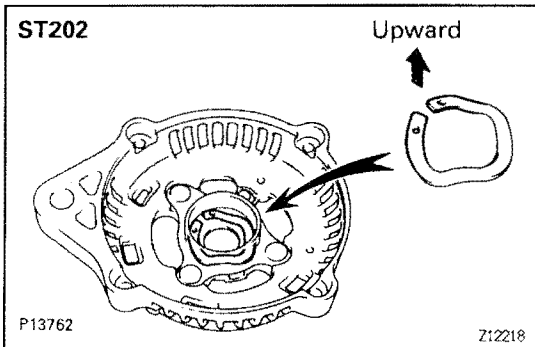
CH07F-01

(See Components for Disassembly and Assembly)

1. PLACE RECTIFIER END FRAME ON PULLEY

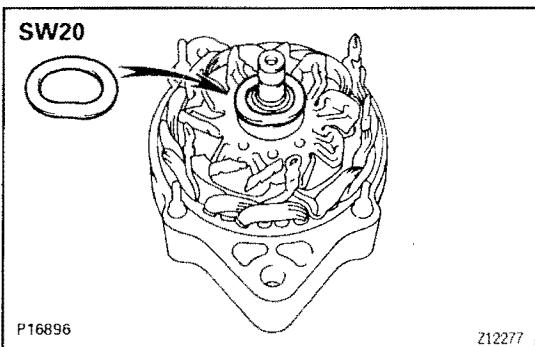


2. INSTALL ROTOR TO DRIVE END FRAME

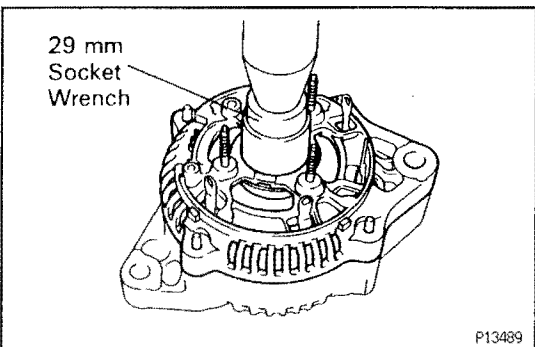


3. INSTALL RECTIFIER END FRAME

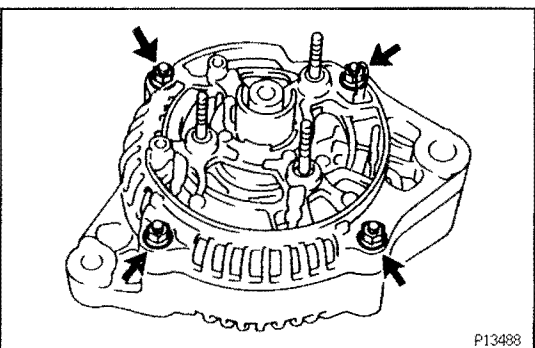
- (a) **ST202:**
Install the alternator washer to the rectifier end frame.
NOTICE: Be careful of the alternator washer installation direction.



- (b) **SW20:**
Place the alternator washer on the rotor.



- (c) Using a 29 mm socket wrench and press, slowly press in the rectifier end frame.

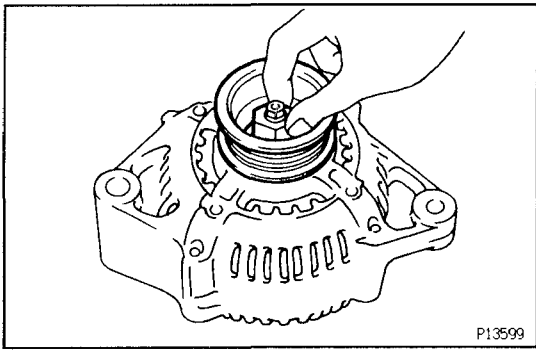


- (d) Install the 4 nuts.
Torque: 4.5 N·m (46 kgf·cm, 40 in·lbf)

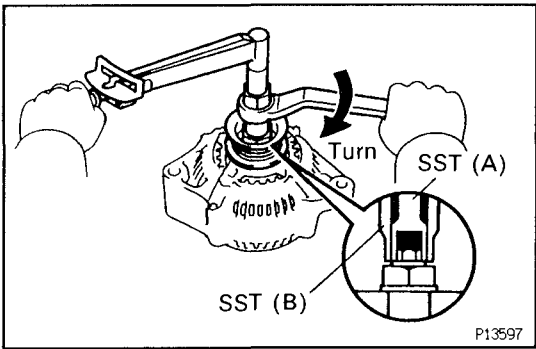
CH

4. INSTALL PULLEY

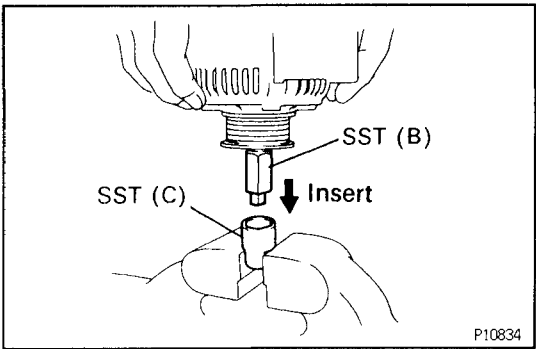
- (a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.



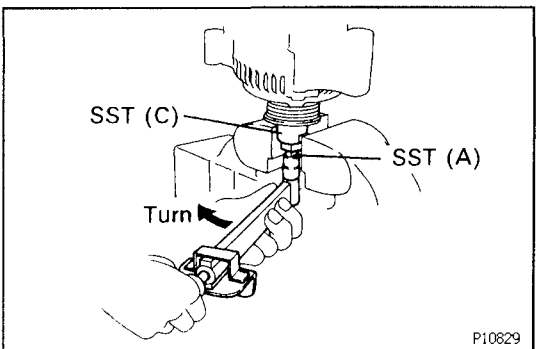
- (b) Hold SST (A) with a torque wrench, and tighten SST (B) clockwise to the specified torque.
SST 09820–63010
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
- (c) Check that SST (A) is secured to the pulley shaft.



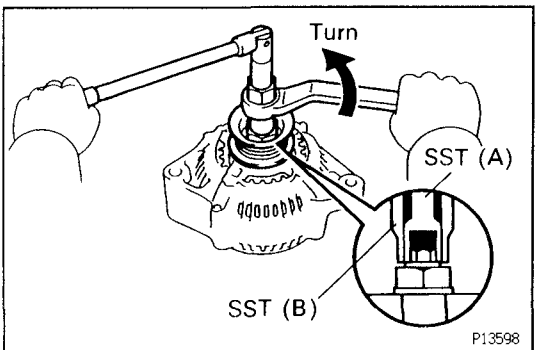
- (d) Mount SST (C) in a vise.
- (e) Insert SST (B) into SST (C), and attach the pulley nut to SST (C).



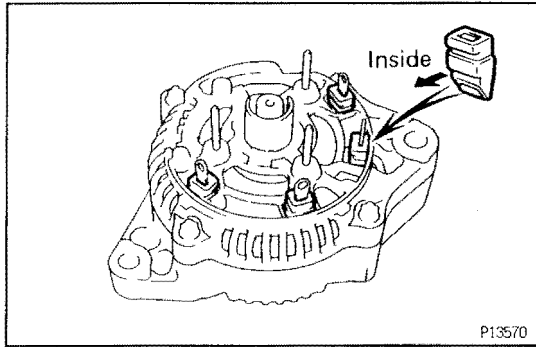
- (f) To torque the pulley nut, turn SST (A) in the direction shown in the illustration.
Torque: 110 N·m (1,125 kgf·cm, 81 ft·lbf)
- (g) Remove the alternator from SST (C).



- (h) Turn SST (B), and remove SST (A and B).

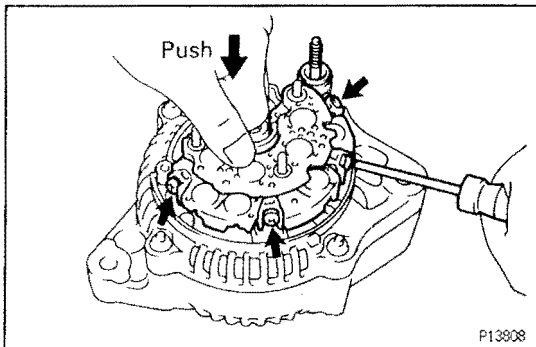


CH



5. INSTALL RECTIFIER HOLDER

- (a) Install the 4 rubber insulators on the lead wires.
NOTICE: Be careful of the rubber insulators installation direction.



- (b) Install the rectifier holder while pushing it with the 4 screws.

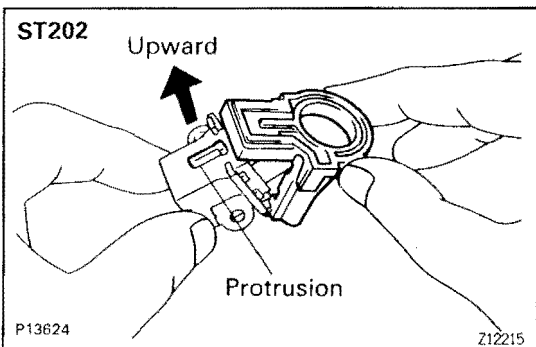
Torque:

ST202

2.0 N·m (20 kgf·cm, 17 in.·lbf)

SW20

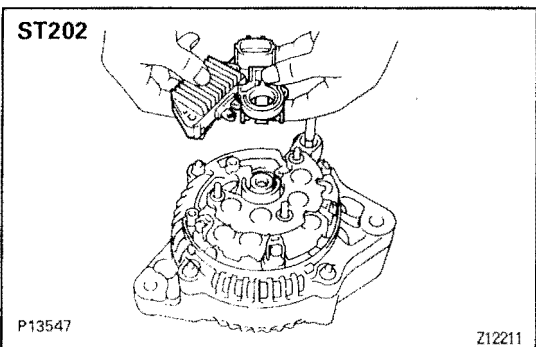
3.0 N·m (31 kgf·cm, 27 in.·lbf)



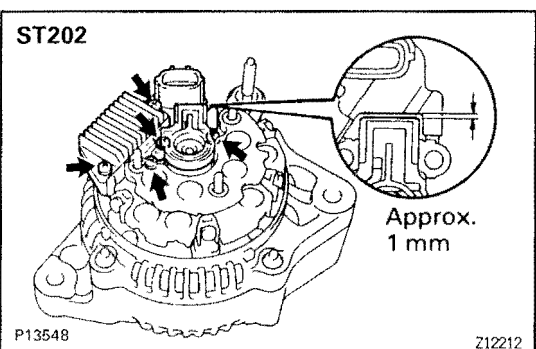
6. INSTALL IC REGULATOR AND BRUSH HOLDER

ST202:

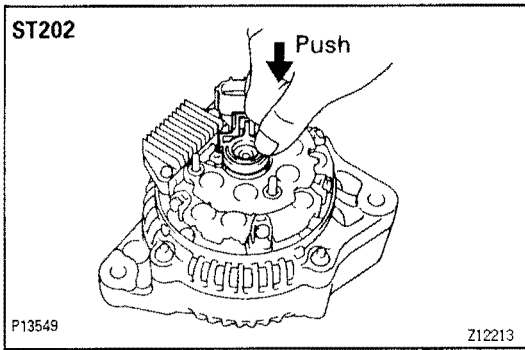
- (a) Install the brush holder cover to the brush holder.
NOTICE: Be careful of the holder installation direction.



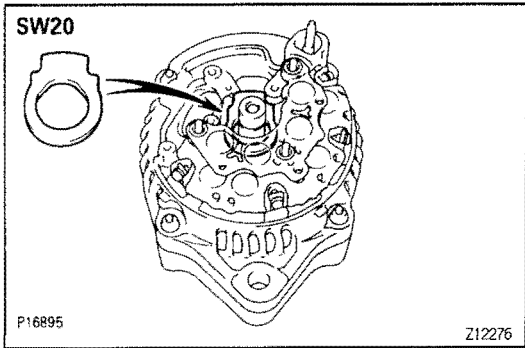
- (b) Place the IC regulator together with the brush holder horizontally on the rectifier end frame.



- (c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and IC regulator.

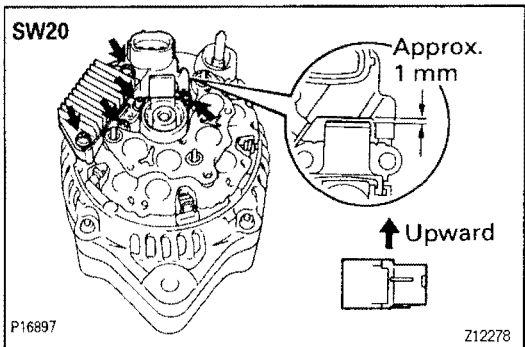


(d) Fit the brush holder cover.



SW20:

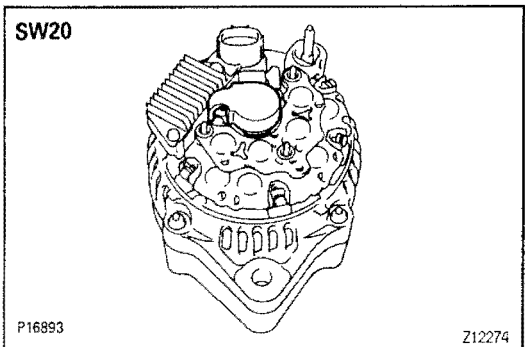
(a) Place the seal plate on the rectifier end frame.



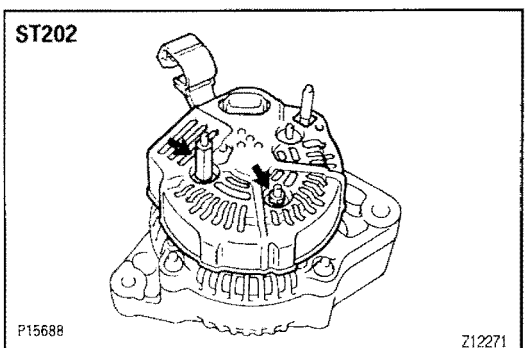
(b) Place the IC regulator and brush holder on the rectifier end frame.

NOTICE: Be careful of the holder installation direction.

(c) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and IC regulator.



(d) Place the brush holder cover on the brush holder.



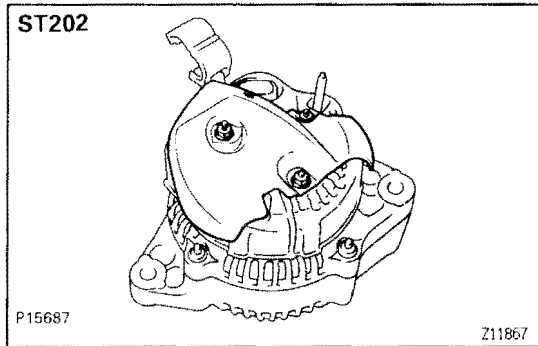
**7. ST202:
INSTALL REAR END COVERS**

(a) Install the No.1 rear end cover with the 2 nuts.

Torque: 4.4 N·m (45 kgf·cm, 39 in·lbf)

(b) Install the wire clamp to the rear end cover.

CH

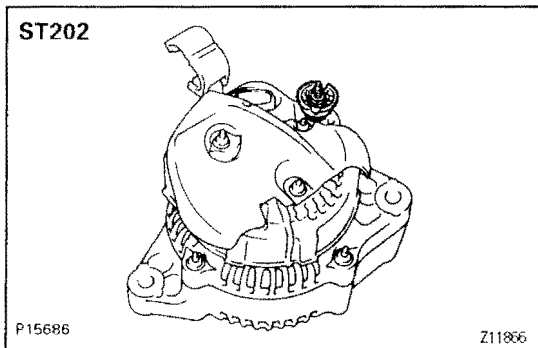


(c) Install the No.2 rear end cover with the 3 nuts.

Torque:

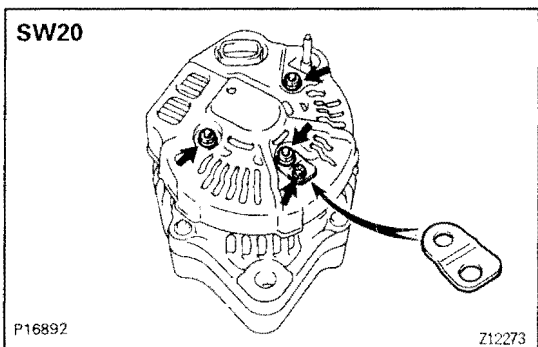
A 4.4 N·m (45 kgf·cm, 39 in.-lbf)

B 6.1 N·m (63 kgf·cm, 54 in.-lbf)



(d) Install the terminal insulator with the nut.

Torque: 4.1 N·m (42 kgf·cm, 36 in.-lbf)



8. SW20:

INSTALL REAR END COVER

(a) Install the rear end cover and plate terminal with the bolt and 3 nuts.

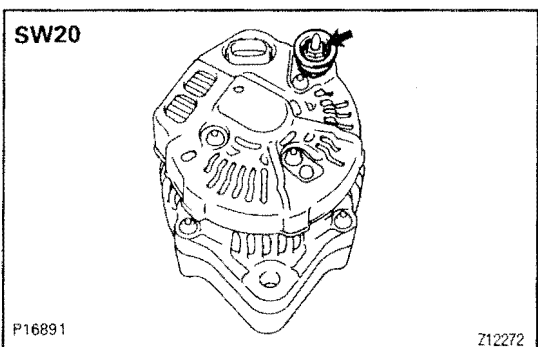
Torque:

Nut

4.4 N·m (45 kgf·cm, 39 in.-lbf)

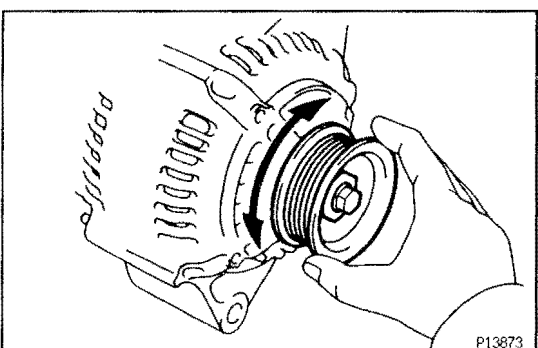
Bolt

3.8 N·m (39 kgf·cm, 34 in.-lbf)



(b) Install the terminal insulator with the nut.

Torque: 4.1 N·m (42 kgf·cm, 36 in.-lbf)



9. CHECK THAT ROTOR ROTATES SMOOTHLY

IGNITION MAIN RELAY (SW20)

(See page IG — 18)

ST014-0A

SERVICE SPECIFICATIONS SERVICE DATA

CH01A-0E

Battery	Specific gravity	at 20°C (68°F)	1.25 — 1.27	
Drive belt	Deflection	ST202	w/ A/C New belt	10 — 11 mm (0.39 — 0.43 in.)
			Used belt	13 — 16 mm (0.51 — 0.63 in.)
		SW20	w/o A/C New belt	11 — 14 mm (0.43 — 0.55 in.)
			Used belt	12 — 18 mm (0.47 — 0.71 in.)
	Tension	ST202	New belt	9 — 12 mm (0.35 — 0.47 in.)
			Used belt	10 — 15 mm (0.39 — 0.59 in.)
		SW20	w/ A/C New belt	686 — 785 N (70 — 80 kgf)
			Used belt	294 — 441 N (30 — 45 kgf)
		SW20	w/o A/C New belt	461 — 706 N (47 — 72 kgf)
			Used belt	353 — 610 N (36 — 62 kgf)
	SW20	New belt	539 — 639 N (55 — 65 kgf)	
		Used belt	245 — 392 N (25 — 40 kgf)	
Alternator	Rated output			
	ST202		12 V 70 A	
	SW20		12 V 80 A	
	Rotor coil resistance		2.8 — 3.0 Ω	
	Slip ring diameter	STD	14.2 — 14.4 mm (0.559 — 0.567 in.)	
		Limit	12.8 mm (0.504 in.)	
Brush exposed length	STD		10.5 mm (0.413 in.)	
	Limit		1.5 mm (0.059 in.)	
IC regulator	Regulating voltage	at 25 °C (77°F)	13.9 — 15.1 V	
		at 115°C (239°F)	13.5 — 14.3 V	

TORQUE SPECIFICATIONS

CH01C-0J

Part tightened		N-m	kgf-cm	ft.-lbf
Bearing retainer x Drive end frame		2.6	27	23 in.-lbf
Rectifier end frame x Drive end frame		4.5	46	40 in.-lbf
Alternator pulley x Rotor		110	1,125	81
Rectifier holder x Coil lead on rectifier end frame	ST202	2.0	20	17 in.-lbf
	SW20	3.0	31	27 in.-lbf
No.1 rear end cover x Rectifier holder (ST202)		4.4	45	39 in.-lbf
No.2 rear end cover x No.1 rear end cover (ST202)	Nut A	4.4	45	39 in.-lbf
	B	6.1	63	54 in.-lbf
Rear end cover x Rectifier holder (SW20)		4.4	45	39 in.-lbf
Plate terminal x Rectifier holder (SW20 only)	Nut	4.4	45	39 in.-lbf
	Bolt	3.8	39	34 in.-lbf
Terminal insulator x Rectifier holder		4.1	42	36 in.-lbf

– MEMO –

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TOYOTA
QUALITY SERVICE