IMPORTANT

WARNING/CAUTION/NOTE

Please read this manual and follow its instructions carefully. To emphasize special information, the words **WARNING, CAUTION** and **NOTE** have special meanings. Pay special attention to the messages highlighted by these signal words.

WARNING:
Indicates a potential hazard that could result in death or injury.

CAUTION:
Indicates a potential hazard that could result in vehicle damage.

NOTE:
Indicates special information to make maintenance easier or instructions clearer.

WARNING:
This service manual is intended for authorized Suzuki dealers and qualified service mechanics only. Inexperienced mechanics or mechanics without the proper tools and equipment may not be able to properly perform the services described in this manual.
Improper repair may result in injury to the mechanic and may render the vehicle unsafe for the driver and passengers.

WARNING:
For vehicles equipped with a Supplemental Restraint Air Bag System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer.**
  Please observe all WARNINGS and CAUTIONS in SECTION 10B and Precautions, Air Bag System Components and Wiring Location View in SECTION 10B or before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.
- **If the air bag system and another vehicle system both need repair, Suzuki recommends that the air bag system be repaired first, to help avoid unintended air bag deployment.**
- **Do not modify the steering wheel, instrument panel or any other air bag system component (on or around air bag system components or wiring). Modifications can adversely affect air bag system performance and lead to injury.**
- **If the vehicle will be exposed to temperatures over 93°C (200°F)(for example, during a paint baking process), remove the air bag system components (air bag (inflator) modules, SDM and/or seatbelt with pretensioner) beforehand to avoid component damage or unintended deployment.**

FOREWORD

This manual contains only different service information of the following applicable model as compared with RB413 SERVICE MANUAL.

Applicable model: RB310

Therefore, whenever servicing the above applicable model, consult this manual first. And for any section, item or description not found in this manual, refer to the related manual below.

When replacing parts or servicing by disassembling, it is recommended to use SUZUKI genuine parts, tools and service materials (lubricant, sealants, etc.) as specified in each description.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. And used as the main subject of description is the vehicle of standard specifications among others.
Therefore, note that illustrations may differ from the vehicle being actually serviced.
The right is reserved to make changes at any time without notice.

RELATED MANUAL:

Manual Name	Manual No.
RB413 Service Manual	99500-83E00-01E
RB310/RB413 Wiring Diagram Manual	99512U83E10-669

MAGYAR SUZUKI CORPORATION

SERVICE DEPARTMENT

NOTE:
For the screen toned Sections in the above table, refer to the same section of the Related Manuals mentioned in FOREWORD of this manual.

SECTION 0B

MAINTENANCE AND LUBRICATION

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

MAINTENANCE SCHEDULE

NORMAL CONDITION SCHEDULE

Interval: This interval should be judged by odometer reading or months, whichever comes first.		This table includes services as scheduled up to 90,000 km (54,000 miles) mileage. Beyond 90,000 km (54,000 miles), carry out the same services at the same intervals respectively.						
		Km (× 1,000)	15	30	45	60	75	90
		Miles (× 1,000)	9	18	27	36	45	54
		Months	12	24	36	48	60	72
1. ENGINE								
1-1. Drive belt (tension, damage)		V-rib belt (Flat type)	–	–	I	–	–	R
1-2. Camshaft timing belt			Replace every 100,000 km (60,000 miles).					
1-3. Blank								
1-4. Engine oil and oil filter	When SG, SH or SJ grade oil is used.		R	R	R	R	R	R
	When SE or SF grade oil is used.		Replace every 10,000 km (6,000 miles) or 8 months					
1-5. Engine coolant			–	R	–	R	–	R
1-6. Exhaust system (leakage, damage, tightness)			–	I	–	I	–	I
2. IGNITION SYSTEM								
2-1. Spark plugs	When unleaded fuel is used		–	–	R	–	–	R
	When leaded fuel is used		Refer to “Severe Driving Condition” schedule.					
2-2. Distributor cap and rotor			–	–	I	–	–	I
3. FUEL SYSTEM								
3-1. Air cleaner filter		Paved-road	I	I	R	I	I	R
		Dusty condition	Refer to “Severe Driving Condition” schedule.					
3-2. Fuel lines (deterioration, leakage, damage)			–	I	–	I	–	I
3-3. Fuel tank			–	–	I	–	–	I

NOTES:

- **For Item 2-1 “spark plugs”, replace every 50,000 km if the local law requires.**
- **For Sweden, Item 2-1, 4-1 and 4-2 should be performed by odometer reading only.**
- **For Item 1-2 Camshaft timing belt: This belt may be replaced every 90,000 km (54,000 miles) according to customer’s maintenance convenience.**

Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services as scheduled up to 90,000 km (54,000 miles) mileage. Beyond 90,000 km (54,000 miles), carry out the same services at the same intervals respectively.						
	Km (× 1,000)	15	30	45	60	75	90
	Miles (× 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
4. EMISSION CONTROL SYSTEM							
4-1. PCV (Positive Crankcase Ventilation) Valve		–	–	–	–	–	I
4-2. Fuel evaporative emission control system		–	–	–	–	–	I
5. BRAKE							
5-1. Brake discs and pads (thickness wear, damage)		I	I	I	I	I	I
Brake drums and shoes (wear, damage)		–	I	–	I	–	I
5-2. Brake hoses and pipes (leakage, damage, clamp)		–	I	–	I	–	I
5-3. Brake fluid		–	R	–	R	–	R
5-4. Brake lever and cable (damage, stroke, operation)		Inspect at first 15,000 km (9,000 miles) only.					
6. CHASSIS AND BODY							
6-1. Clutch pedal (for manual transmission)		–	I	–	I	–	I
6-2. Tires/wheel discs (wear, damage, rotation)		I	I	I	I	I	I
6-3. Drive shafts (breakage, damage)		–	–	I	–	–	I
6-4. Suspension system (tightness, damage, rattle, breakage)		–	I	–	I	–	I
6-5. Steering system (tightness, damage, breakage, rattle)		–	I	–	I	–	I
6-6. Manual transmission oil		I	–	R	–	–	R
6-7. Automatic transmission	Fluid level	–	I	–	I	–	I
	Fluid change	Replace every 165,000 km (99,000 miles).					
	Fluid hose	–	–	–	R	–	–
6-8. All latches, hinges and locks		–	I	–	I	–	I
6-9. Ventilator air filter (if equipped)		–	I	R	–	I	R

NOTES:

- **"R": Replace or change**
- **"I": Inspect and correct or replace if necessary**

MAINTENANCE RECOMMENDED UNDER SEVERE DRIVING CONDITIONS

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, it is recommended that applicable maintenance operation be performed at the particular interval as given in the chart below.

Severe condition code

A – Repeated short trips
B – Driving on rough and/or muddy roads
C – Driving on dusty roads
D – Driving in extremely cold weather and/or salted roads
E – Repeated short trips in extremely cold weather
F – Leaded fuel use
G – (For Diesel engine) Town use/Towing a trailer/ Sustained high speed driving/ Hot climates above 30°C (86°F)/ Low quality lubricants or fuel
H – Trailer towing (if admitted)

Severe Condition Code	Maintenance	Maintenance Operation	Maintenance Interval
– B C D – – – –	ITEM 1-1 Drive belt (V-rib belt)	I	Every 15,000 km (9,000 miles) or 12 months
		R	Every 45,000 km (27,000 miles) or 36 months
A – C D E F – H	ITEM 1-4 Engine oil and filter	R	Every 5,000 km (3,000 miles) or 4 months
A B C – E F – H	ITEM 2-1 Spark plugs	R	Every 10,000 km (6,000 miles) or 8 months
– – C – – – – –	ITEM 3-1 Air cleaner filter *1	I	Every 2,500 km (1,500 miles)
		R	Every 30,000 km (18,000 miles) or 24 months
– B C D – – – H	ITEM 6-2 Wheel bearings	I	Every 15,000 km (9,000 miles) or 12 months
– B – D E – – H	ITEM 6-3 Drive shafts	I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	ITEM 6-6 Manual transmission oil	R	Every 30,000 km (18,000 miles) or 24 months
– B – – E – – H	ITEM 6-7 Automatic transmission fluid	R	Every 30,000 km (18,000 miles) or 24 months
– – CD – – – –	ITEM 6-9 Ventilator air filter*2 (if equipped)	I	Every 15,000 km (9,000 miles) or 12 months
		R	Every 45,000 km (27,000 miles) or 36 months

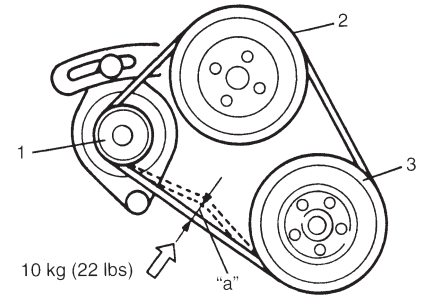
NOTES:

- **"R": Replace or change**
- **"I": Inspect and correct or replace if necessary**
- ***1: Inspect or replace more frequently if necessary**
- ***2: Clean or replace more frequently if air from ventilator decreases.**

MAINTENANCE SERVICE
ENGINE
ITEM 1-1
Drive Belt Inspection and Replacement

WARNING:
Disconnect negative cable at battery before checking and adjusting belt tension.

Water pump belt inspection
1) Remove engine under cover of right side from vehicle body.



1. Generator pulley
2. Water pump pulley
3. Crankshaft pulley

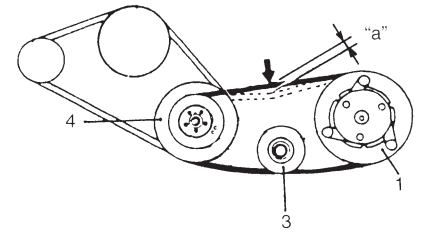
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. Replace, if necessary.
3) Check pump belt for tension and adjust it as necessary.

Water pump belt tension "a":
8 – 10 mm (0.32 – 0.39 in.) deflection under 100 N, 10 kg or 22 lb pressure

NOTE:
When replacing belt with a new one, adjust belt tension to 6 – 7 mm (0.24 – 0.27 in.).

A/C compressor drive belt inspection (If equipped)
1) Hoist vehicle and remove engine under cover of right side from vehicle body.
2) Inspect belt for wear, deterioration and tension. Replace or adjust, if necessary.

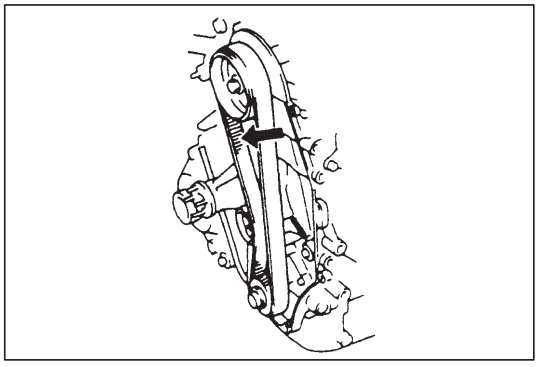
A/C compressor drive belt tension "a":
7 – 9 mm (0.28 – 0.35 in.) deflection under 100 N, 10 kg or 22 lb pressure



1. A/C compressor pulley
2. Blank
3. Tension pulley
4. Crankshaft pulley

A/C compressor drive belt replacement
1) Disconnect negative cable from battery.
2) Remove engine under cover of right side.
3) Loosen belt tension and replace belt with new one.
4) Adjust belt tension to specification.
5) Install engine under cover and connect negative cable to battery.

Water pump belt replacement
Replace belt with new one. Refer to SECTION 6B for replacement procedure of pump belt.

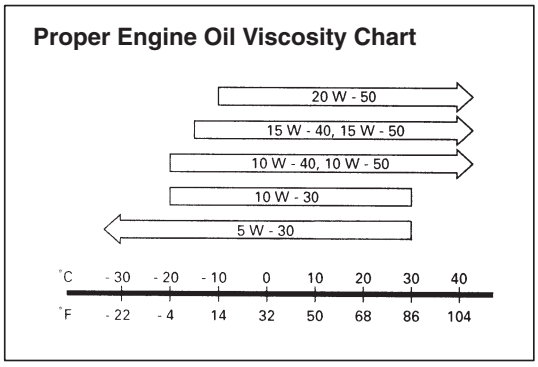


ITEM 1-2

Camshaft Timing Belt Replacement

Replace belt with new one. Refer to SECTION 6A for replacement procedure.

CAUTION:
- **Do not bend or twist timing belt.**
- **Do not allow timing belt to come into contact with oil, water, etc.**

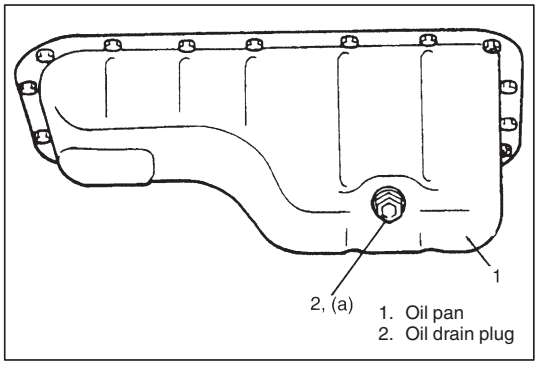


ITEM 1-4

Engine Oil and Filter Change

WARNING:
New and used engine oil can be hazardous.
Be sure to read "WARNING" in General Precaution in SECTION 0A and observe what in written there.

Use engine oil of SE, SF, SG, SH or SJ grade.
Select the appropriate oil viscosity according to the left chart.

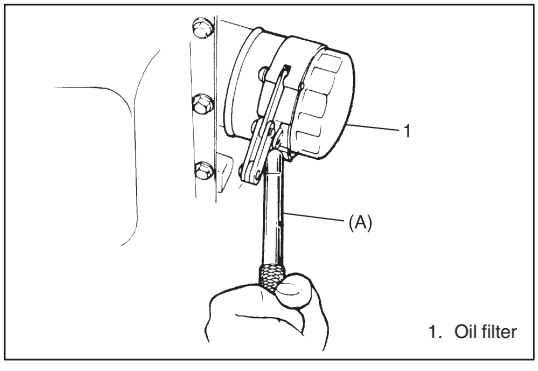


1. Oil pan
2. Oil drain plug

Before draining engine oil, check engine for oil leakage. If any evidence of leakage is found, make sure to correct defective part before proceeding to following work.

1) Drain engine oil by removing drain plug.
2) After draining oil, wipe drain plug clean. Reinstall drain plug, and tighten it securely as specified below.

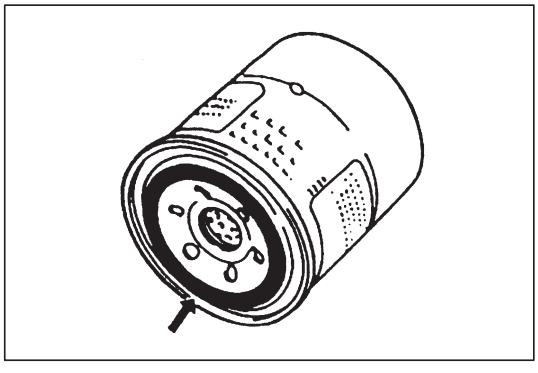
Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



1. Oil filter

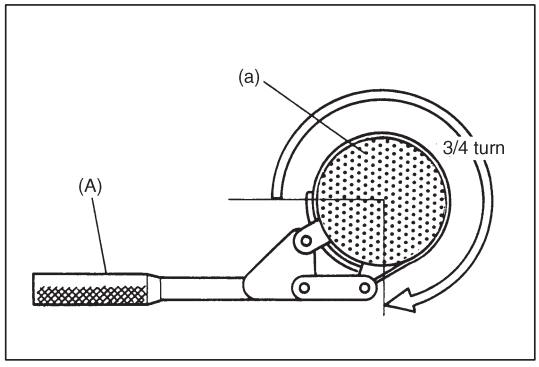
3) Loosen oil filter by using oil filter wrench (Special tool).

Special Tool
(A): 09915-47330



4) Apply engine oil to new oil filter O-ring.
5) Screw new filter on oil filter stand by hand until filter O-ring contacts mounting surface.

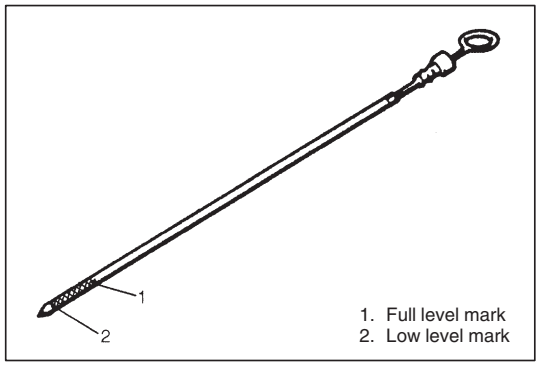
CAUTION:
To tighten oil filter properly, it is important to accurately identify the position at which filter O-ring first contacts mounting surface.



6) Tighten filter 3/4 turn from the point of contact with mounting surface using an oil filter wrench.

Special Tool
(A): 09915-47330

Tightening Torque (Reference)
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)



7) Replenish oil until oil level is brought to FULL level mark on dipstick (oil pan and oil filter capacity). Filler inlet is at the top of cylinder head cover.
8) Start engine and run it for three minutes. Stop it and wait another 5 minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

Engine Oil Capacity

Oil pan capacity	About 3.1 liters (6.5/5.5 US/Imp pt.)
Oil filter capacity	About 0.2 liter (0.4/0.3 US/Imp pt.)
Others	About 0.3 liter (0.6/0.5 US/Imp pt.)
Total	About 3.6 liters (7.5/6.3 US/Imp pt.)

NOTE:
Engine oil capacity is specified as left table.
However, note that amount of oil required when actually changing oil may somewhat differ from data in left table depending on various conditions (temperature, viscosity, etc.).

9) Check oil filter and drain plug for oil leakage.

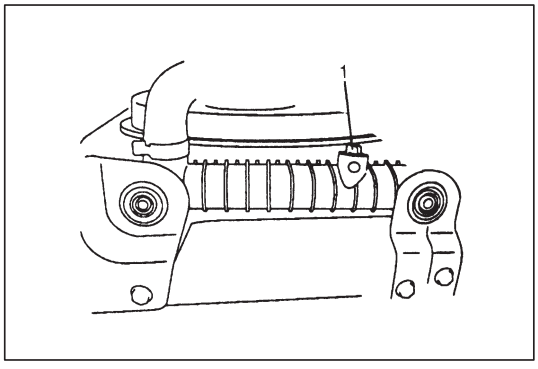
ITEM 1-5

Engine Coolant Change

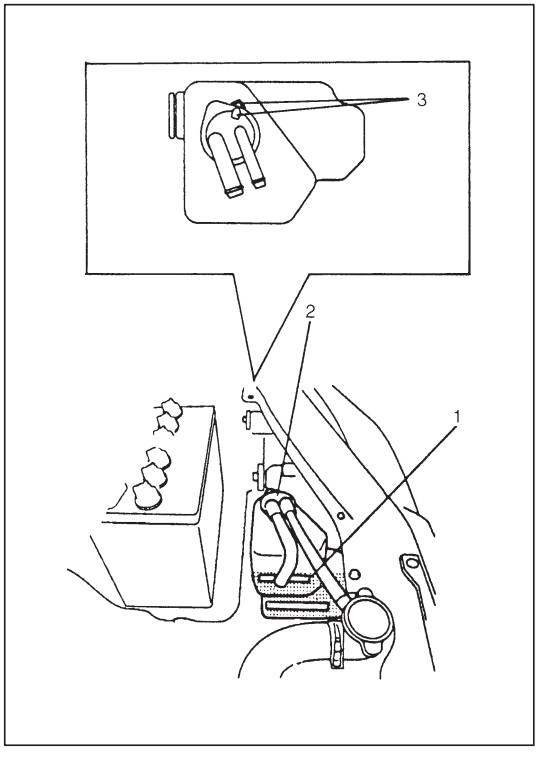
WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

CAUTION:
When changing engine coolant, use mixture of 50% water and 50% ethylene-glycol base coolant (Anti-Freeze/Anti-corrosion coolant) for the market where ambient temperature falls lower than –16°C (3°F) in winter and mixture of 70% water and 30% ethylene-glycol base coolant for the market where ambient temperature doesn't fall lower than –16°C (3°F).
Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene-glycol base coolant should be used for the purpose of corrosion protection and lubrication.

Refer to SECTION 6B for COOLANT CAPACITY.



1) Remove radiator cap when engine is cool.
2) Loosen radiator drain plug (1) to drain coolant.
3) Remove reservoir and drain.
4) Tighten drain plug securely. Also install reservoir.
5) Slowly pour specified amount of coolant to the base of radiator filler neck, and run engine, with radiator cap removed, until radiator upper hose is hot. This drives out any air which may still be trapped within cooling system. Add coolant as necessary until coolant level reaches filler throat of radiator. Reinstall radiator cap.

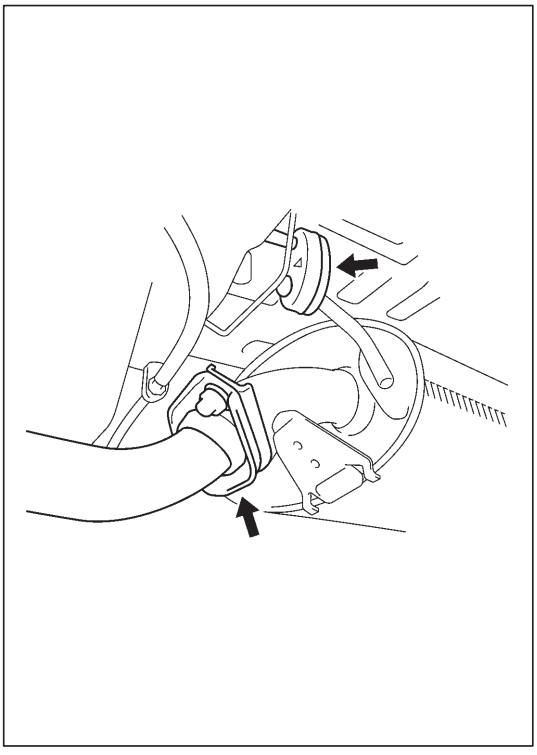


6) Add coolant to reservoir so that its level aligns with Full mark (1). Then, reinstall cap (2) to reservoir aligning match marks (3) on reservoir and cap.

ITEM 1-6

Exhaust System Inspection

WARNING:
To avoid danger of being burned, do not touch exhaust system when it is still hot.
Any service on exhaust system should be performed when it is cool.



When carrying out periodic maintenance or vehicle is raised for other service, check exhaust system as follows:

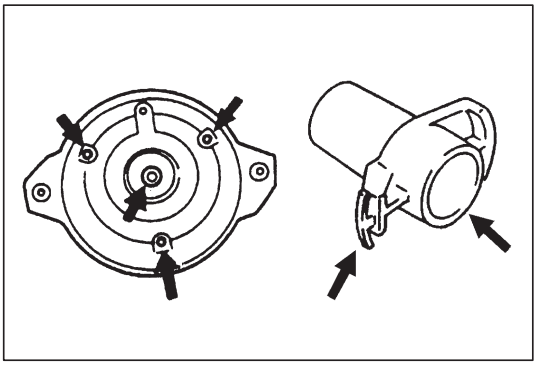
- Check rubber mountings for damage and deterioration.
- Check exhaust system for leakage, loose connections, dents, and damages.
  If bolts or nuts are loose, tighten them to specification. Refer to SECTION 6K for torque specification of bolts and nuts.
- Check nearby body areas for damaged, missing or mispositioned parts, open seams, holes, loose connections or other defects which could permit exhaust fumes to seep into vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to floor carpet.
- Any defects should be fixed at once.

IGNITION SYSTEM

ITEM 2-1

Spark Plugs Replacement

Replace spark plugs with new ones referring to SECTION 6F.

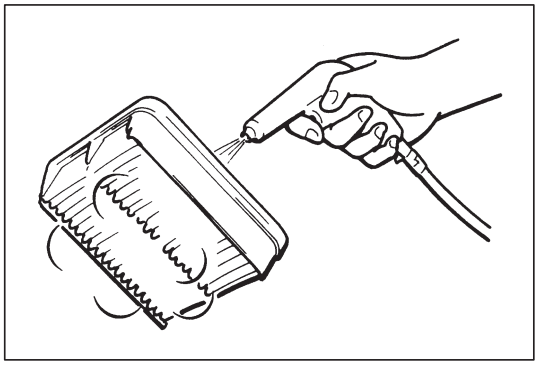


ITEM 2-2

Distributor Cap and Rotor Inspection (if equipped)

- Check distributor cap and rubber caps for cracks.
- Clean dusty and stained parts using a dry, soft cloth.
- Check center electrode and terminals for wear.
- Check rotor for cracks and its electrode for wear.

Repair or replace any component which is found to be in malcondition.



FUEL SYSTEM

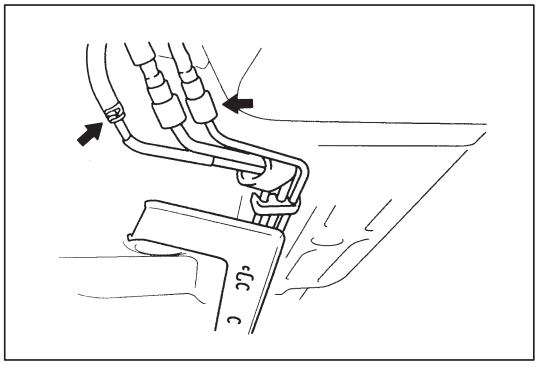
ITEM 3-1

Air Cleaner Filter Inspection

1) Unclamp air cleaner case clamps.
2) Take cleaner filter out of air cleaner case.
3) Visually check that air cleaner filter is not excessively dirty, damaged or oily.
4) Clean filter with compressed air from air outlet side of filter.
5) Install air cleaner filter into case referring to Section 6A.
6) Clamp case securely.

Air Cleaner Filter Replacement

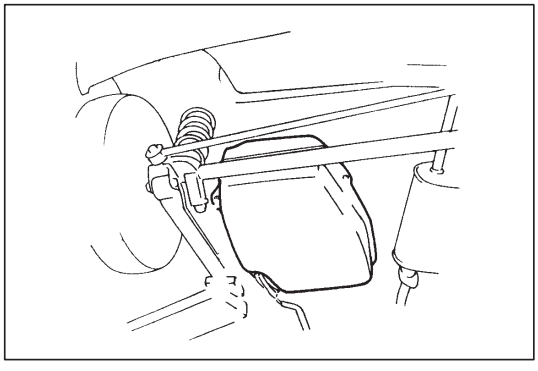
Replace air cleaner filter with new one according to steps 1), 2), 5) and 6) of Air Cleaner Filter Inspection.



ITEM 3-2

Fuel Lines Inspection

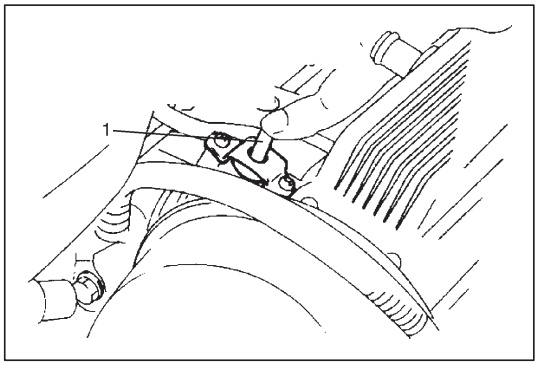
- Check fuel lines for loose connection, deterioration or damage which could cause leakage.
  Make sure all clamps are secure.
- Replace any damaged or deteriorate parts.
  There should be no sign of fuel leakage or moisture at any fuel connection.



ITEM 3-3

Fuel Tank Inspection

Check fuel tank for damage, cracks, fuel leakage, corrosion and tank bolts looseness.
If a problem is found, repair or replace.



EMISSION CONTROL SYSTEM

ITEM 4-1

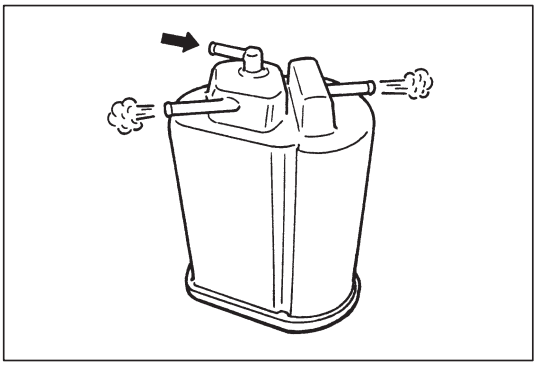
PCV (Positive Crankcase Ventilation) Valve Inspection

Check crankcase ventilation and PCV hose for leaks, cracks or clog, and PCV valve (1) for stick or clog. Refer to ON-VEHICLE SERVICE of SECTION 6E1 for PCV valve checking procedure.

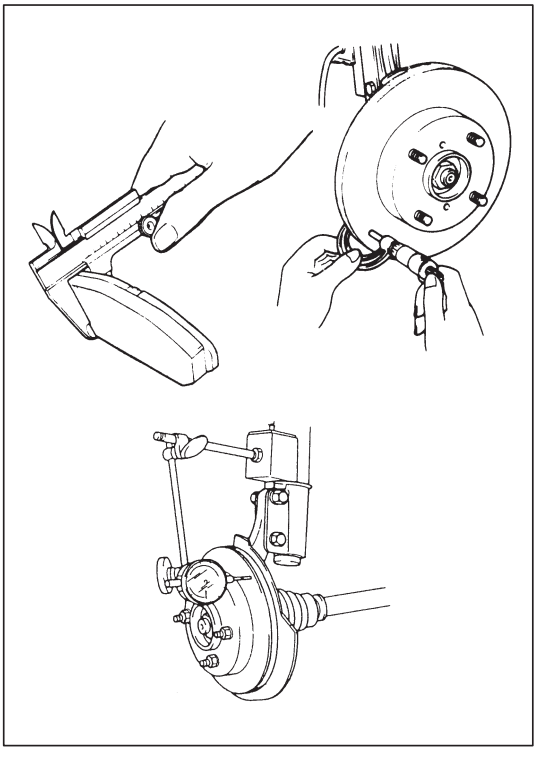
ITEM 4-2

Fuel Evaporative Emission Control System Inspection

WARNING:
DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.



1) Visually inspect hoses for cracks, damage or excessive bends.
   Inspect all clamps for damage and proper position.
2) Check EVAP canister for operation and clog, referring to SECTION 6E1.
   If a malfunction is found, repair or replace.



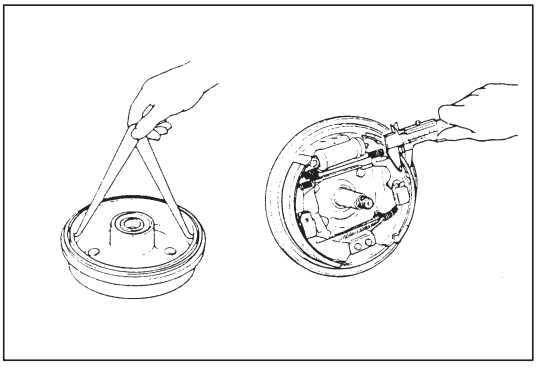
BRAKE

ITEM 5-1

Brake Discs, Pads, Drums and Shoes Inspection

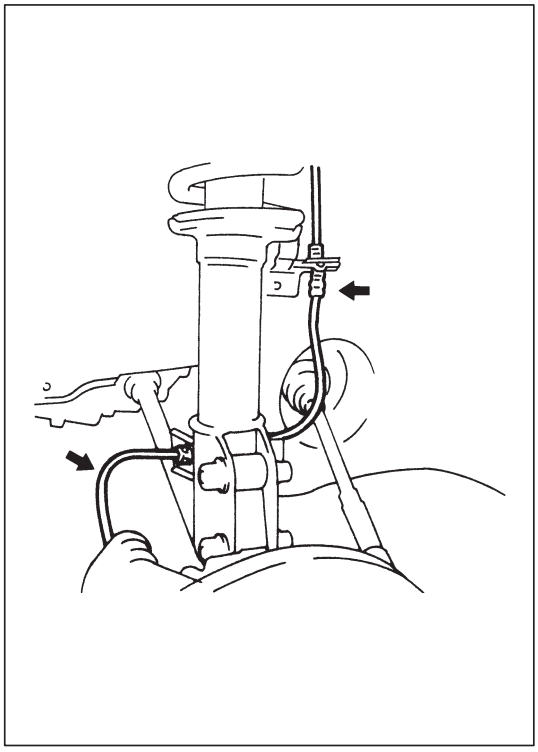
Brake discs and pads

1) Remove wheel and caliper but don't disconnect brake hose from caliper.
2) Check front disc brake pads and discs for excessive wear, damage and deflection. Replace parts as necessary. For the details, refer to SECTION 5B.
3) Install caliper and wheel.



Brake drums and shoes

1) Remove wheel and brake drum.
2) Check rear brake drums and brake linings for excessive wear and damage, while wheels and drums are removed.
   At the same time, check wheel cylinders for leakage.
   Replace as necessary.
   For the details, refer to SECTION 5C.
3) Install brake drum and wheel.



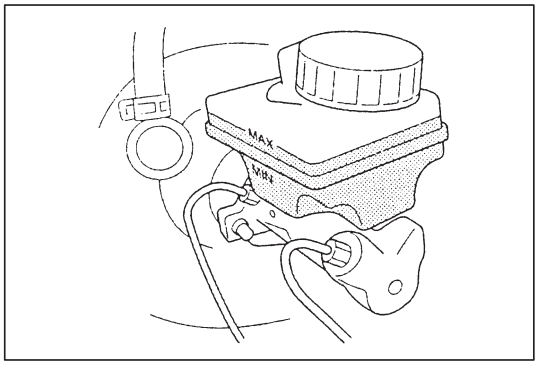
ITEM 5-2

Brake Hoses and Pipes Inspection

Perform this inspection where there is enough light and use a mirror as necessary.

- Check brake hoses and pipes for proper hook-up, leaks, cracks, chafing, wear, corrosion, bends, twists and other damage. Replace any of these parts as necessary.
- Check all clamps for tightness and connections for leakage.
- Check that hoses and pipes are clear of sharp edges and insecure parts.

CAUTION:
After replacing any brake pipe or hose, be sure to carry out air purge operation.

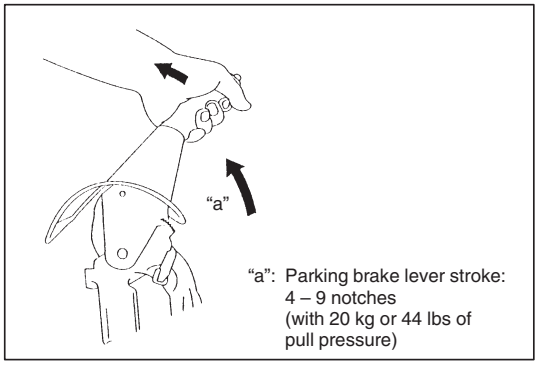


ITEM 5-3

Brake Fluid Change

CAUTION:
Do not use old or used brake fluid, or any fluid from any unsealed container.

Change brake fluid as follows.
Drain existing fluid from brake system completely, fill system with above recommended fluid and carry out air purge operation.
For air purging procedure, refer to SECTION 5.

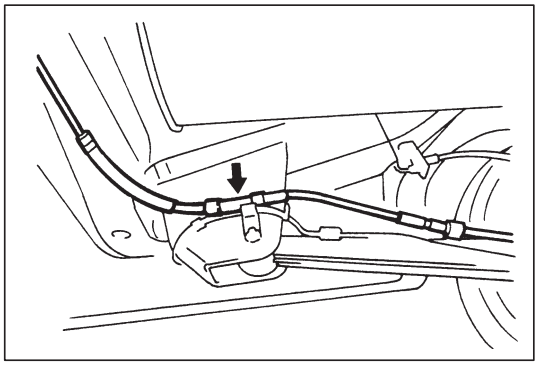


ITEM 5-4

Brake Lever and Cable Inspection

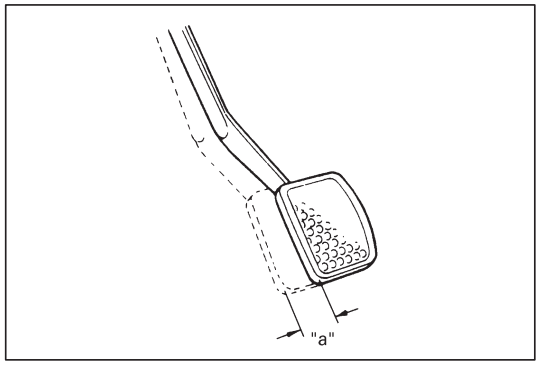
Parking brake lever

- Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking lever.
- Check parking brake lever for proper operation and stroke, and adjust it if necessary.
  For checking and adjusting procedures, refer to PARKING BRAKE INSPECTION AND ADJUSTMENT in SECTION 5C.



Parking brake cable

Inspect brake cable for damage and smooth movement.
Replace cable if it is in deteriorated condition.

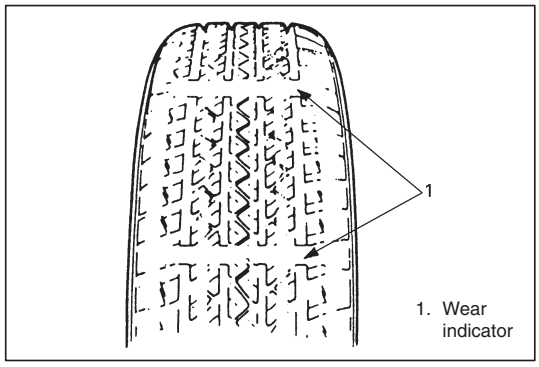


CHASSIS AND BODY

ITEM 6-1

Clutch Pedal Free Travel Inspection (Cable type only)

Check clutch pedal free travel “a”. Refer to SECTION 7C for procedure to check and adjust it.



ITEM 6-2

Tire/Wheel Disc Inspection

[Tire inspection]

1) Check tire for uneven or excessive wear, cuts or damage. If defective, replace.

2) Check inflating pressure of each tire and adjust pressure to specification as necessary.

NOTE:

- **Tire inflation pressure should be checked when tires are cool.**
- **Specified tire inflation pressure should be found on tire placard or in owner’s manual which came with vehicle.**

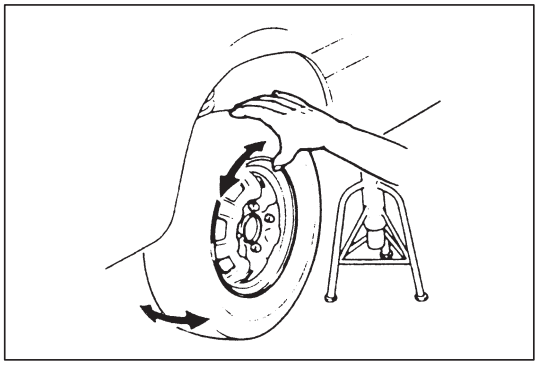
[Wheel disc inspection]

Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.

[Tire rotation]

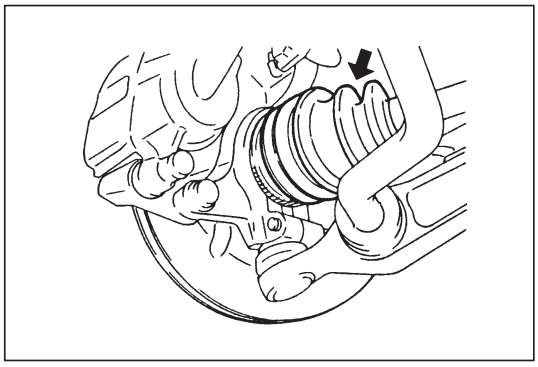
Rotate tires.

For details of the steps, refer to SECTION 3F.



Wheel Bearing Inspection

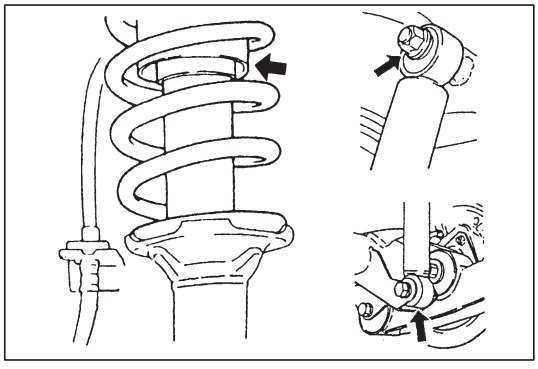
1) Check front wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to FRONT SUSPENSION INSPECTION of SECTION 3D.
2) Check rear wheel bearing for wear, damage abnormal noise or rattle. For details, refer to REAR SUSPENSION INSPECTION of SECTION 3E.



ITEM 6-3

Drive Shaft (Axle) Boot Inspection

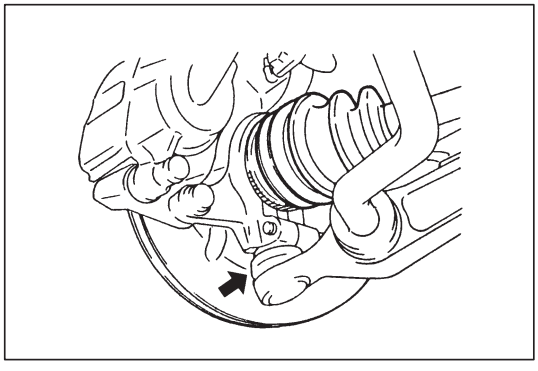
Check drive shaft boots (wheel side and differential side) for leakage, detachment, tear or any other damage.
Replace boot as necessary.



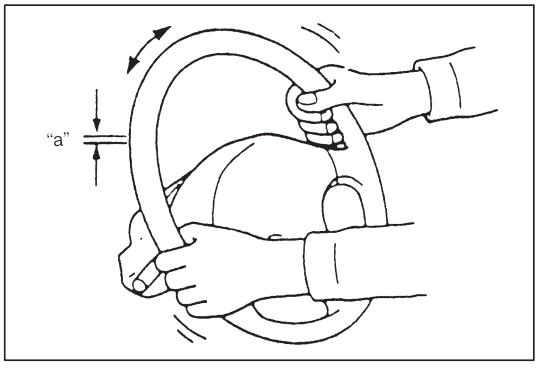
ITEM 6-4

Suspension System Inspection

- Inspect front struts & rear shock absorbers for evidence of oil leakage, dents or any other damage on sleeves; and inspect anchor ends for deterioration.
  Replace defective parts, if any.
- Check front and rear suspension systems for damaged, loose or missing parts; also for parts showing signs of wear or lack of lubrication.
  Repair or replace defective parts, if any.



- Check front suspension arm ball joint stud dust seals for leakage, detachment, tear or any other damage.
  Replace defective boot, if any.



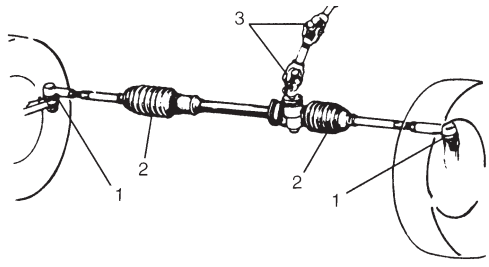
ITEM 6-5

Steering System Inspection

1) Check steering wheel for play and rattle, holding vehicle straight on ground.

   Steering wheel play "a": 0 – 30 mm (0 – 1.1 in.)

2) Check bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any.



1. Tie-rod end boot
2. Steering gear case boot
3. Universal joint

3) Check steering linkage for looseness and damage. Repair or replace defective parts, if any.
4) Check boots of steering linkage and steering gear case for damage (leaks, detachment, tear, etc.). If damage is found, replace defective boot with new one.
   If any dent is found on steering gear case boots, correct it to original shape by turning steering wheel to the right or left as far as it stops and holding it for a few seconds.
5) Check universal joints of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.
6) Check that steering wheel can be turned fully to the right and left. Repair or replace defective parts, if any.
7) If equipped with power steering system, check also, in addition to above check items, that steering wheel can be turned fully to the right and left more lightly when engine is running at idle speed than when it is stopped. Repair, if found faulty.
8) Check wheel alignment referring to Section 3A.

ITEM 6-6

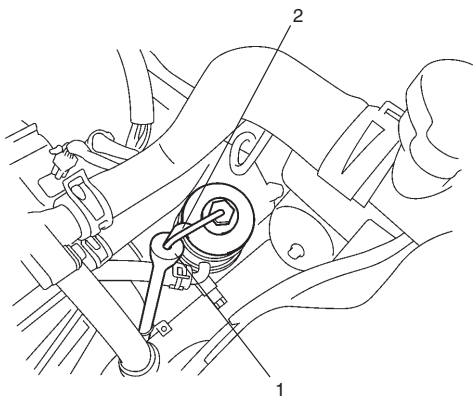
Manual Transmission Oil Inspection and Change

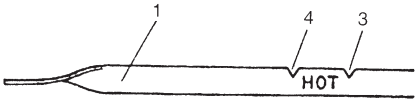
[Inspection]

1) Inspect transmission case for evidence of oil leakage. Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove oil filler/level plug (1) of transmission.
4) Check oil level.
   Oil level can be checked roughly by means of filler/level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
   If oil is found insufficient, pour specified oil up to level hole.
   For specified oil, refer to description of oil change under On-Vehicle Service in Section 7A.
5) Apply sealant to filler/level plug and tighten it to specified torque.

[Change]

1) Place the vehicle level and drain oil by removing drain plug (2).
2) Apply sealant to drain plug after cleaning it and tighten drain plug to specified torque.
3) Pour specified oil up to level hole.
4) Tighten filler plug to specified torque.
   For recommended oil, its amount and tightening torque data, refer to On-Vehicle Service of Section 7A.





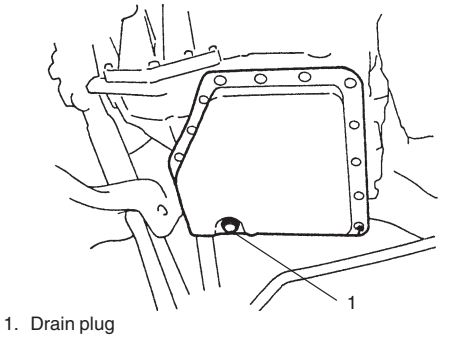
1. Dipstick
2. Clamp
3. FULL HOT mark
4. LOW HOT mark

ITEM 6-7

Automatic Transmission Fluid Inspection and Change

[Fluid level inspection]

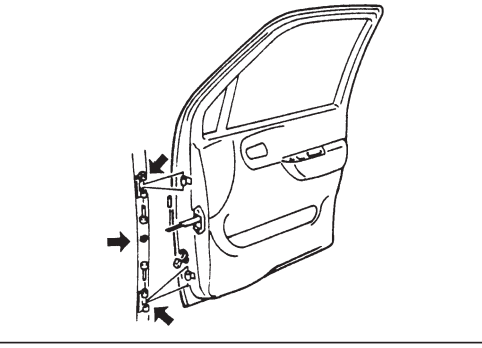
1) Inspect transmission case for evidence of fluid leakage. Repair leaky point, if any.
2) Make sure that vehicle is placed level for fluid level check.
3) Unclamp dipstick and pull out it. Check fluid level. For fluid level checking procedure, refer to SECTION 7B and be sure to perform it under specified conditions. If fluid level is low, replenish specified fluid.



1. Drain plug

[Fluid change]

1) Perform steps 1) and 2) of above Fluid Level Inspection.
2) Change fluid with new specified fluid referring to SECTION 7B.



ITEM 6-8

All Latches, Hinges and Locks Inspection

Doors

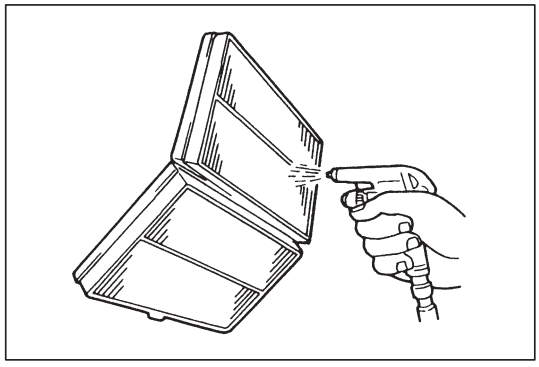
Check that each door of front, rear and back doors opens and closes smoothly and locks securely when closed.

If any malfunction is found, lubricate hinge and latch or repair door lock system.

Engine hood

Check that secondary latch operates properly (check that secondary latch keeps hood from opening all the way even when pulling hood release handle inside vehicle.) Also check that hood opens and closes smoothly and properly and hood locks securely when closed.

If any malfunction is found, lubricate hinge and latch, or repair hood lock system.



ITEM 6-9

Ventilator Air Filter (if equipped)

Inspection

1) Remove air filter from air inlet box or cooling unit by removing filter cover located on bottom of case.
2) Check filter for dirt. Replace excessively dirty filter.
3) Blow off dust by compressed air from air outlet side of filter.
4) Install filter to air inlet box or cooling unit referring to Section 1B.

Replacement

Replace ventilator air filter with new one referring to Section 1B.

FINAL INSPECTION

WARNING:
When carrying out road tests, select a safe place where no man or no running vehicle is seen so as to prevent any accident.

Seats
Check that seat slides smoothly and locks securely at any position. Also check that reclining mechanism of front seat back allows it to be locked at any angle.

Seat Belt
Inspect belt system including webbing, buckles, latch plates, retractors and anchors for damage or wear. Check that seat belt is securely locked.

Battery Electrolyte Level Check
Check that the electrolyte level of all battery cells is between the upper and lower level lines on the case. If battery is equipped with built-in indicator, check battery condition by the indicator.

Accelerator Pedal Operation
Check that pedal operates smoothly without getting caught or interfered by other part.

Engine Start
Check engine start for readiness.

WARNING:
Before performing the following check, be sure to have enough room around the vehicle. Then, firmly apply both the parking brake and the regular brakes. Do not use the accelerator pedal. If the engine starts, be ready to turn off the ignition promptly. Take these precautions because the car could move without warning and possibly cause personal injury or property damage.

On automatic transmission vehicles, try to start the engine in each select lever position. The starting motor should crank only in “P” (Park) or “N” (Neutral).
On manual transmission vehicles, place the shift lever in “Neutral”, depress clutch pedal fully and try to start.

Exhaust System Check
Check for leakage, cracks or loose supports.

Clutch (For Manual transmission)
Check for the following.
- Clutch is completely released when depressing clutch pedal,
- No slipping clutch occurs when releasing the clutch pedal and accelerating,
- Clutch itself is free from any abnormal condition.

Gearshift or Select Lever (Transmission)
Check gear shift or select lever for smooth shifting to all positions and for good performance of transmission in any position.
With automatic transmission equipped vehicle, also check that shift indicator indicates properly according to which position select lever is shifted to.

Brake
[Foot brake]
Check the following;
- that brake pedal has proper travel,
- that brake works properly,
- that it is free from noise,
- that vehicle does not pull to one side when brake is applied,
- and that brake do not drag.

[Parking brake and automatic transmission “P” (Park) mechanism]
Check that parking brake lever has proper travel.

WARNING:
With vehicle parked on a fairly steep slope, make sure nothing is in the way downhill to avoid any personal injury or property damage. Be prepared to apply regular brake quickly even if vehicle should start to move.

Check to ensure that parking brake is fully effective when the vehicle is stopped on the safe slope and brake lever is pulled all the way.
Make sure that vehicle is at complete stop when select lever is shifted to “P” range position and all brakes are released.

Steering
- Check to ensure that steering wheel is free from instability, or abnormally heavy feeling.
- Check that the vehicle does not wander or pull to one side.

Engine
- Check that engine responds readily at all speeds.
- Check that engine is free from abnormal noise and abnormal vibration.

Body, Wheels and Power Transmitting System
Check that body, wheels and power transmitting system are free from abnormal noise and abnormal vibration or any other abnormal condition.

Meters and Gauge
Check that speedometer, odometer, fuel meter, temperature gauge, etc. are operating accurately.

Lights
Check that all lights operate properly.

Windshield Defroster
Periodically check that air comes out from defroster outlet when operating heater or air conditioning.
Set fan switch lever to “HI” position for this check.

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	SE, SF, SG, SH or SJ (Refer to engine oil viscosity chart in item 1-4.)
Engine coolant (Ethylene glycol base coolant)	“Anti-freeze/Anti-corrosion coolant”
Brake fluid	DOT4 or SAE J1704
Manual transmission oil	API GL-4, SAE75W-90 (Refer to Section 7A for detail)
Automatic transmission fluid	An equivalent of DEXRON®-III
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	
Key lock cylinder	Spray lubricant

SECTION 1B

AIR CONDITIONING (OPTIONAL)

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

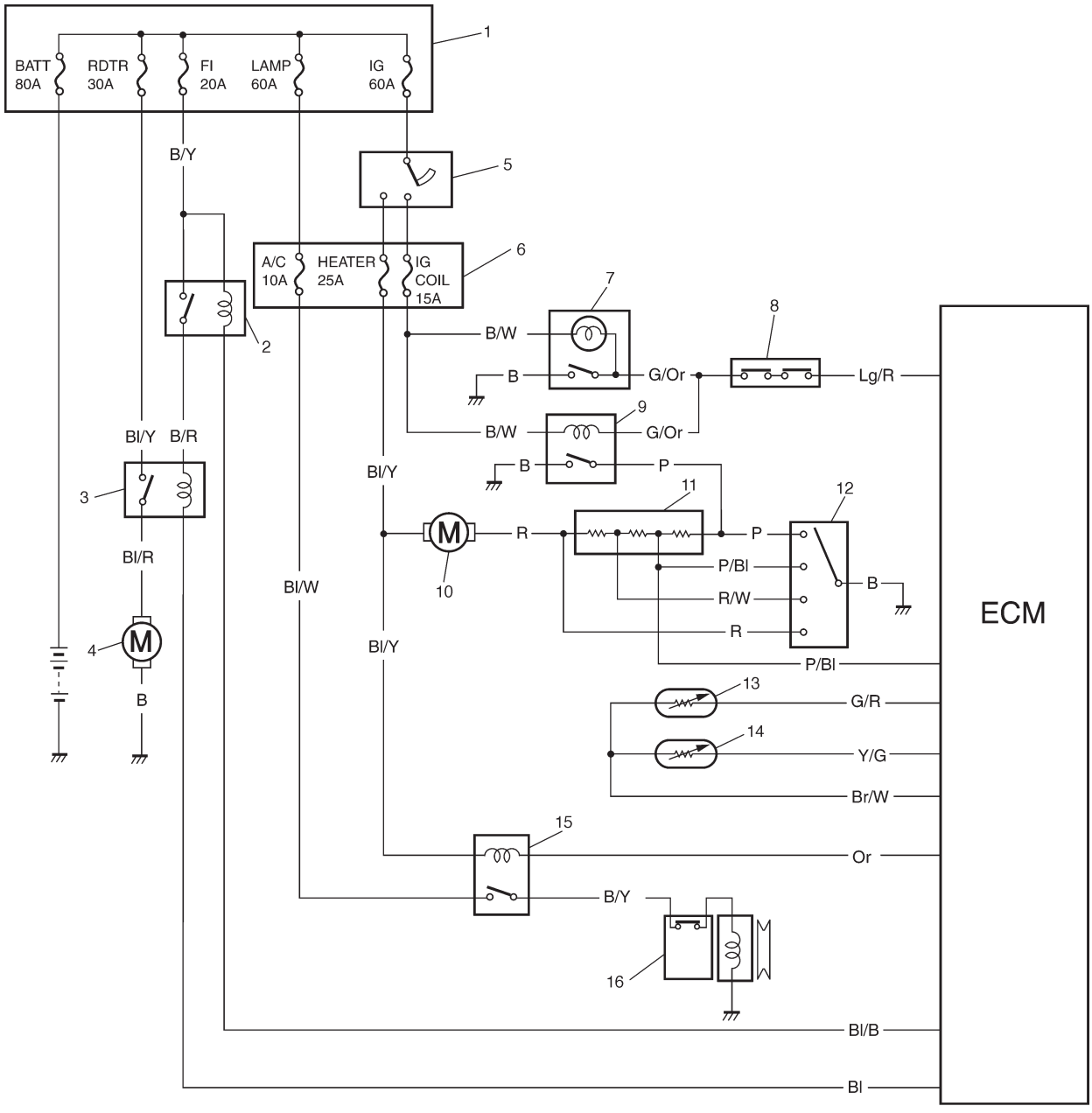
CAUTION:
The air conditioning system of this vehicle uses refrigerant HFC-134a (R-134a).
None of refrigerant, compressor oil and component parts is interchangeable between two types of A/C: one using refrigerant CFC-12 (R-12) and the other using refrigerant HFC-134a (R-134a).
Be sure to check which refrigerant is used before any service work including inspection and maintenance. For identification between these two types, refer to "GENERAL DESCRIPTION" in the same section of the Service Manual mentioned in FOREWORD of this manual.
When replenishing or changing refrigerant and compressor oil and when replacing parts, make sure that the material or the part to be used is appropriate to the A/C installed in the vehicle being serviced. Use of incorrect one will result in leakage of refrigerant, damage in parts or other faulty condition.

NOTE:
- **For descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.**
- **For basic servicing method of the air conditioning system that is not described in this section, refer to AIR CONDITIONING BASIC MANUAL (99520-02130).**

CONTENTS

DIAGNOSIS

WIRING CIRCUIT



1. Main fuse box
2. Main relay
3. Radiator (and condenser) cooling fan motor relay
4. Radiator (and condenser) cooling fan motor
5. Ignition switch
6. Circuit fuse box
7. A/C switch
8. Dual pressure switch
9. Blower fan motor relay
10. Blower fan motor
11. Blower fan motor resistor
12. Blower fan switch
13. A/C evaporator thermistor
14. ECT sensor
15. Compressor relay
16. Compressor

Fig. A

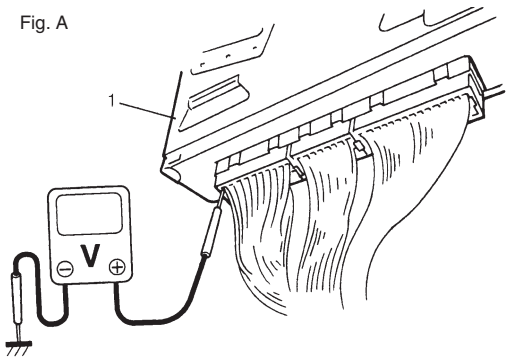
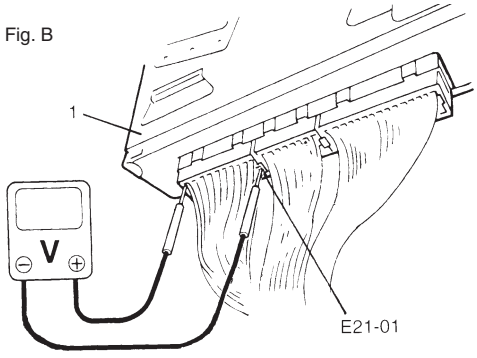


Fig. B



A/C SYSTEM INSPECTION OF ECM AND ITS CIRCUITS

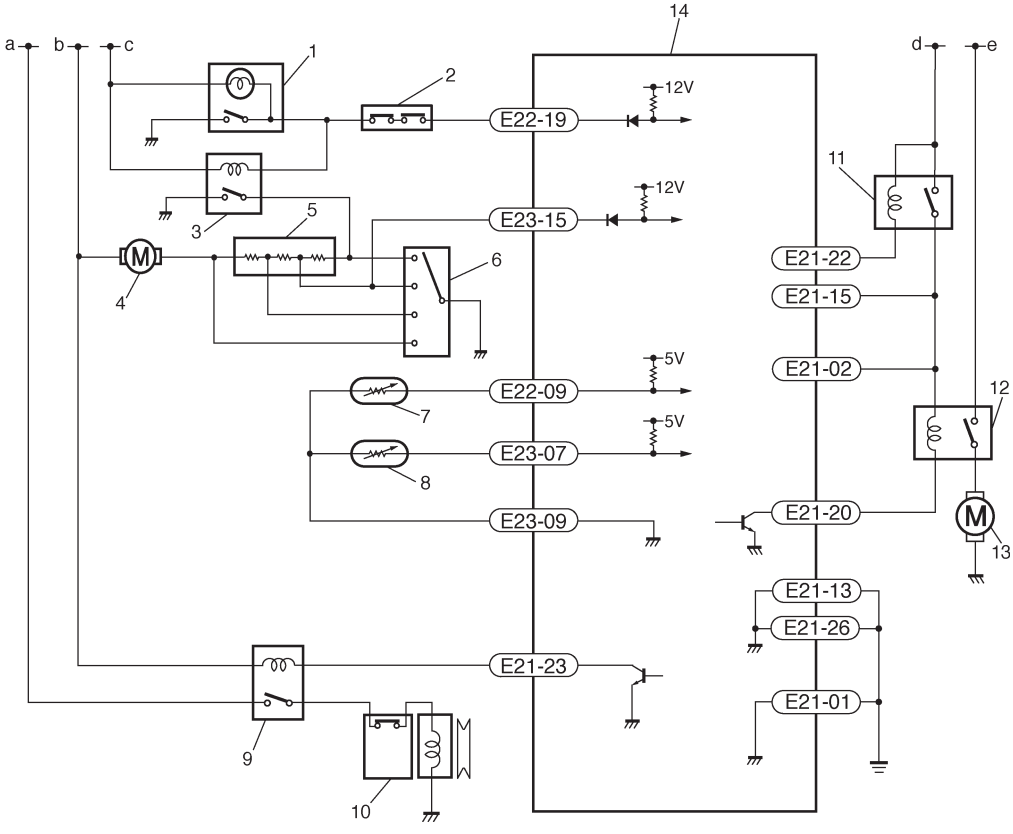
ECM and its Circuits can be checked at ECM wiring couplers by measuring voltage.

CAUTION:
ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with couplers disconnected from it.

Voltage Check

1) Remove ECM (1) from vehicle.
2) Connect ECM (1) couplers to ECM.
3) Check voltage at each terminal of couplers connected.
   Refer to next page and "INSPECTION OF ECM AND ITS CIRCUIT" in Section 6E1.

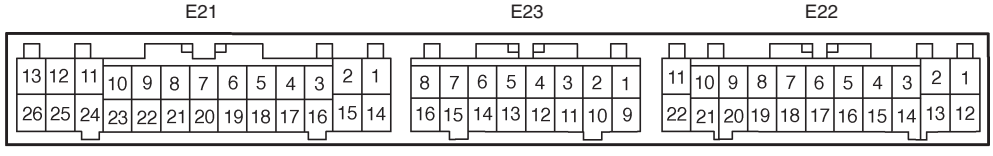
NOTE:
As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when ignition switch is ON.



a. To "A/C 10 A" fuse in circuit fuse box
b. To "HEATER 25 A" fuse in circuit fuse box
c. To "IG COIL 15 A" fuse in circuit fuse box
d. To "FI 20 A" fuse in main fuse box
e. To "RDTR 30 A" fuse in main fuse box

1. A/C switch
2. Dual pressure switch
3. Blower fan motor relay
4. Blower fan motor
5. Blower fan motor resistor
6. Blower fan switch
7. A/C evaporator thermistor
8. ECT sensor
9. Compressor relay
10. Compressor
11. Main relay
12. Radiator (and condenser) cooling fan motor relay
13. Radiator (and condenser) cooling fan motor
14. ECM

TERMINAL ARRANGEMENT OF ECM COUPLER (VIEWED FROM HARNESS SIDE)



ECM VOLTAGE VALUES TABLE FOR RELATION OF A/C CONTROL

Terminal	Wire	Circuit	Measurement ground	Normal value	Condition
E21-01	B	Main ground for ECM	Ground to body (Fig. A)	−0.3 – 0.3 V	Ignition switch ON
E21-02	B/R	Power supply for engine control	Ground to engine Fig. B)	10 – 14 V	Ignition switch ON
E21-13	B/Y	ECM ground for power circuit	Ground to body (Fig. A)	−0.3 – 0.3 V	Ignition switch ON
E21-15	B/R	Power supply for engine control	Ground to engine (Fig. B)	10 – 14 V	Ignition switch ON
E21-20	Bl	Radiator (condenser) cooling fan relay output	Ground to engine (Fig. B)	0 – 1 V	A/C switch ON or engine coolant temp. sensor more than 96°C (205°F) with engine running
				10 – 14 V	Except the above-mentioned with engine running
E21-22	Bl/B	Main relay	Ground to engine (Fig. B)	0 – 1 V	Ignition switch ON
				10 – 14 V	Ignition switch OFF
E21-23	Or	Compressor magnet clutch relay output	Ground to engine (Fig. B)	0 – 1 V	Blower switch and A/C switch ON with engine running
				10 – 14 V	Except the above-mentioned with engine running
E21-26	B/Y	ECM ground for power circuit	Ground to body (Fig. A)	−0.3 – 0.3 V	Ignition switch ON
E22-09	G/R	Evaporator thermistor temp. input	Ground to engine (Fig. B)	2.0 – 2.3 V (1800 – 2200 Ω)	Evaporator thermistor temp. at Approx. 25°C (77°F) with ignition switch ON
				3.5 – 3.6 V (6300 – 7000 Ω)	Evaporator thermistor temp. at Approx. 0°C (32°F) with ignition switch ON
E22-19	Lg/R	A/C switch input	Ground to engine (Fig. B)	0 – 1 V	A/C switch ON with ignition switch ON
				10 – 14 V	A/C switch OFF with ignition switch ON
E23-07	Y/G	Engine coolant temperature sensor input	Ground to engine (Fig. B)	0.71 – 0.76 V (290 – 320 Ω)	Engine coolant temperature at Approx. 80°C (176°F) with ignition ON
				0.35 – 0.37 V (136 – 144 Ω)	Engine coolant temperature at Approx. 110°C (230°F) with ignition ON
E23-09	Br/W	Sensor ground	Ground to body (Fig. A)	−0.3 – 0.3 V	Ignition switch ON
E23-15	P/Bl	Blower fan speed input	Ground to engine (Fig. B)	0 – 2 V	Blower switch 2nd, 3rd or 4th position with ignition switch ON
				3 – 5 V	Blower switch 1st position with ignition switch ON
				10 – 14 V	Blower switch OFF position with ignition switch ON

SECTION 6-1

GENERAL INFORMATION AND ENGINE DIAGNOSIS

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

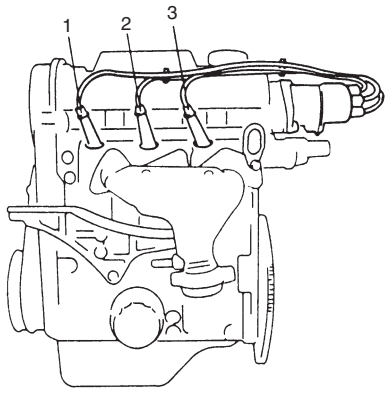
CONTENTS

GENERAL INFORMATION

STATEMENT ON CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of an inch).
Accordingly, when any internal engine parts are serviced, care and cleanliness are important.
Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
  At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine.
  Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- Throughout this manual, the three cylinders of the engine are identified by numbers; No.1 (1), No.2 (2) and No.3 (3) counted from crankshaft pulley side to flywheel side.



1. No.1 cylinder
2. No.2 cylinder
3. No.3 cylinder

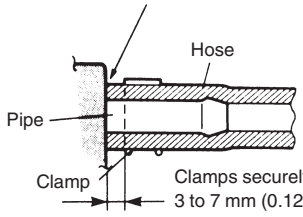
GENERAL INFORMATION ON ENGINE SERVICE

THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

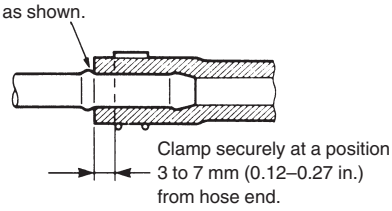
- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.
  When performing any work where electrical terminals can be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.

HOSE CONNECTION

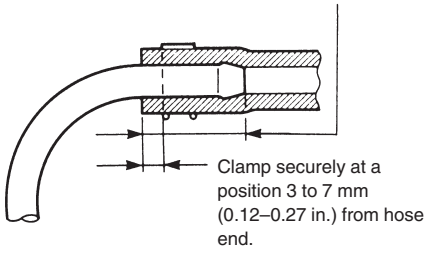
With short pipe, fit hose as far as it reaches pipe joint as shown.



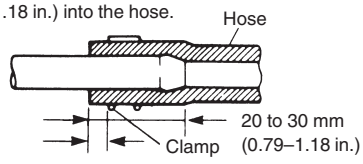
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as its bent part as shown or till pipe is about 20 to 30 mm (0.79–1.18 in.) into the hose.



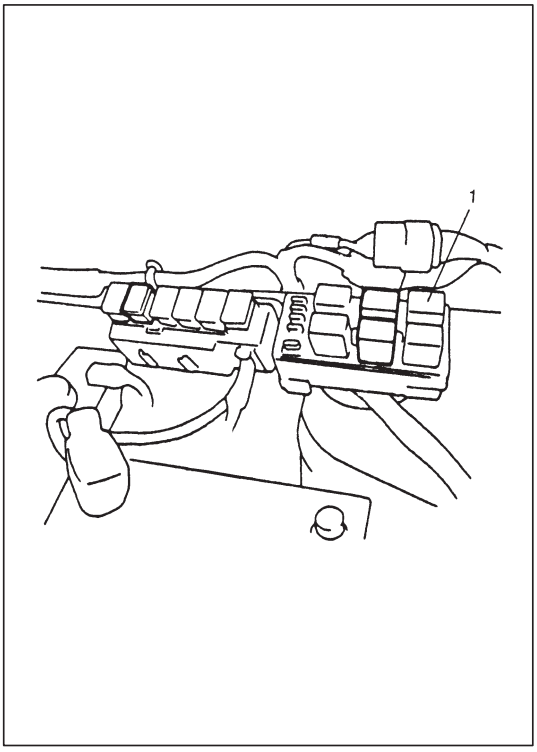
With straight pipe, fit hose till pipe is, about 20 to 30 mm (0.79–1.18 in.) into the hose.



Clamp securely at a position 3 to 7mm (0.12–0.27 in.) from hose end.

PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel delivery pipe) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.
  Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to “FUEL PRESSURE RELIEF PROCEDURE”. A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.
- Fuel or fuel vapor hose connection varies with each type of pipe. When reconnecting fuel or fuel vapor hose, be sure to connect and clamp each hose correctly referring to left figure Hose Connection.
  After connecting, make sure that it has no twist or kink.
- When installing injector or fuel delivery pipe, lubricate its O-ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.



FUEL PRESSURE RELIEF PROCEDURE

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

After making sure that engine is cold, release fuel pressure as follows.

1) Place transmission gear shift lever in “Neutral” (Shift selector lever to “P” range for A/T model), set parking brake, and block drive wheels.
2) Remove relay box cover.
3) Disconnect fuel pump relay (1) from relay box.
4) Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
5) Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2-3 times for about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6) Upon completion of servicing, connect fuel pump relay to relay box and install relay box cover.

FUEL LEAKAGE CHECK PROCEDURE

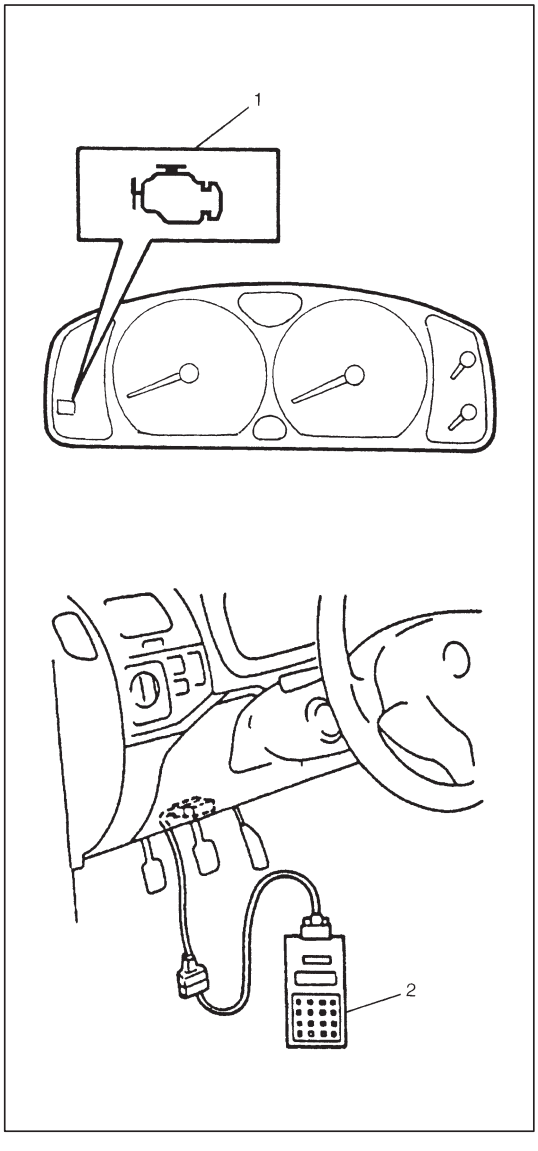
After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

1) Turn ON ignition switch for 2 seconds (to operate fuel pump) and then turn it OFF.
   Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line. (till fuel pressure is felt by hand placed on fuel feed hose.)
2) In this state, check to see that there are no fuel leakages from any part of fuel system.

ENGINE DIAGNOSIS

GENERAL DESCRIPTION

This vehicle is equipped with an engine and emission control system which are under control of ECM (PCM). The engine and emission control system in this vehicle are controlled by ECM (PCM). ECM (PCM) has an On-Board Diagnostic system which detects a malfunction in this system and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, be sure to have full understanding of the outline of “On-Board Diagnostic System” and each item in “Precaution in Diagnosing Trouble” and execute diagnosis according to “ENGINE DIAGNOSTIC FLOW TABLE”.
There is a close relationship between the engine mechanical, engine cooling system, ignition system, exhaust system, etc. and the engine and emission control system in their structure and operation. In case of an engine trouble, even when the malfunction indicator lamp (MIL) doesn’t turn ON, it should be diagnosed according to this flow table.



ON-BOARD DIAGNOSTIC SYSTEM

ECM (PCM) in this vehicle has following functions.

- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) (1) turns ON to check the bulb of the malfunction indicator lamp (1).
- When ECM (PCM) detects a malfunction which gives an adverse effect to vehicle emission while the engine is running, it makes the malfunction indicator lamp (1) in the meter cluster of the instrument panel turn ON or flash (flashing only when detecting a misfire which can cause damage to the catalyst) and stores the malfunction area in its memory.
  (If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL (1) turn OFF although DTC stored in its memory will remain.)
- As a condition for detecting a malfunction in some areas in the system being monitored by ECM (PCM) and turning ON the malfunction indicator lamp (1) due to that malfunction, 2 driving cycle detection logic is adopted to prevent erroneous detection.
- When a malfunction is detected, engine and driving conditions then are stored in ECM (PCM) memory as freeze frame data. (For the details, refer to description on Freeze frame data.)
- It is possible to communicate by using not only SUZUKI scan tool (Tech-1) (2) but also generic scan tool. (Diagnostic information can be accessed by using a scan tool.)

Warm-up Cycle
A warm-up cycle means sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 70°C (160°F).

Driving Cycle
A “Driving Cycle” consists of engine startup, driving mode where a malfunction would be detected if present and engine shutoff.

2 Driving Cycles Detection Logic
The malfunction detected in the first driving cycle is stored in ECM (PCM) memory (in the form of pending DTC and freeze frame data) but the malfunction indicator lamp does not light at this time. It lights up at the second detection of same malfunction also in the next driving cycle.

Pending DTC
Pending DTC means a DTC detected and stored temporarily at 1 driving cycle of the DTC which is detected in the 2 driving cycles detection logic.

An Example of Freeze Frame Data

1.	Trouble Code	P0102 (1st)
2.	Engine Speed	782 RPM
3.	Eng Cool Tmp.	80°C
4.	Vehicle Spd.	0 km/h
5.	MAP Sensor	39 kPa
6.	St. Term FT1	– 0.8% Lean
7.	Lg. Term FT1	– 1.6% Lean
8.	Fuel 1 Stat.	Closed Loop
9.	Fuel 2 Stat.	Not used
10.	Load value	25.5%

1st, 2nd or 3rd in parentheses here represents which position in the order the malfunction is detected.

Freeze Frame Data
ECM (PCM) stores the engine and driving conditions (in the from of data as shown at the left) at the moment of the detection of a malfunction in its memory. This data is called “Freeze frame data”. Therefore, it is possible to know engine and driving conditions (e.g., whether the engine was warm or not, where the vehicle was running or stopped, where air/fuel mixture was lean or rich) when a malfunction was detected by checking the freeze frame data. Also, ECM (PCM) has a function to store each freeze frame data for three different malfunctions in the order as the malfunction is detected. Utilizing this function, it is possible to know the order of malfunctions that have been detected. Its use is helpful when rechecking or diagnosing a trouble.

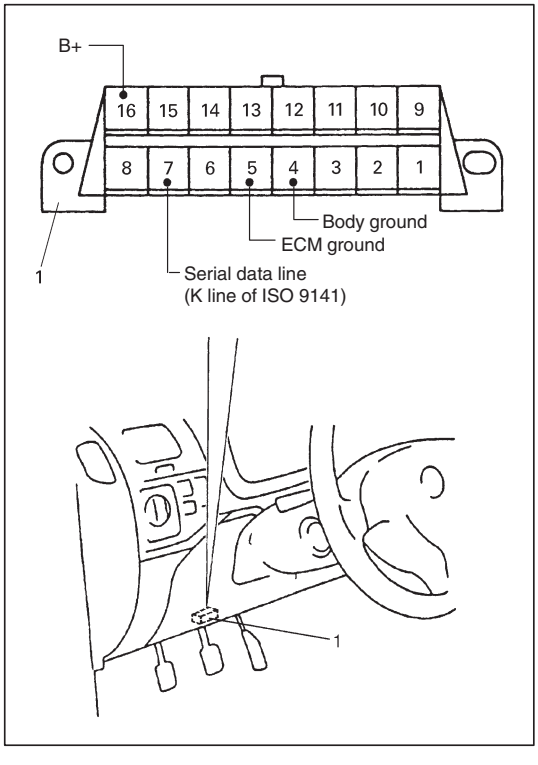
Priority of freeze frame data:
ECM (PCM) has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction as described in the upper square “1” below is detected while the freeze frame data in the lower square “2” has been stored, the freeze frame data “2” will be updated by the freeze frame data “1”.)

PRIORITY	FREEZE FRAME DATA IN FRAME 1
1	Freeze frame data at initial detection of malfunction among misfire detected (P0300-P0303), fuel system too lean (P0171) and fuel system too rich (P0172)
2	Freeze frame data when a malfunction other than those in “1” above is detected

In the 2nd through the 4th frames, the freeze frame data of each malfunction is stored in the order as the malfunction is detected. These data are not updated.
Shown in the table below are examples of how freeze frame data are stored when two or more malfunctions are detected.

FRAME / MALFUNCTION DETECTED ORDER		FRAME 1	FRAME 2	FRAME 3	FRAME 4
		FREEZE FRAME DATA to be updated	1st FREEZE FRAME DATA	2nd FREEZE FRAME DATA	3rd FREEZE FRAME DATA
	No malfunction	No freeze frame data			
1	P0400 (EGR) detected	Data at P0400 detection	Data at P0400 detection	–	–
2	P0171 (Fuel system) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	–
3	P0300 (Misfire) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	Data at P0300 detection
4	P0301 (Misfire) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	Data at P0300 detection

Freeze frame data clearance:
The freeze frame data is cleared at the same time as clearance of diagnostic trouble code (DTC).



Data Link Connector (DLC)
DLC (1) is in compliance with SAEJ1962 in its installation position, the shape of connector and pin assignment.

Serial data line (K line of ISO 9141) is used for SUZUKI scan tool (Tech-1) or generic scan tool to communicate with ECM (PCM).

PRECAUTION IN DIAGNOSING TROUBLE

- Don't disconnect couplers from ECM (PCM), battery cable from battery, ECM (PCM) ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM (PCM) memory. Such disconnection will erase memorized information in ECM (PCM) memory.
- Diagnostic information stored in ECM (PCM) memory can be cleared as well as checked by using SUZUKI scan tool (Tech-1) or generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
- Priorities for diagnosing troubles.
  If two or more DTCs are stored, proceed to the flow table of the DTC which has detected earliest in the order and follow the instruction in that table.
  If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.
  1. Diagnostic trouble codes (DTCs) other than DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0300/P0301/P0302/P0303 (Misfire detected)
  2. DTC P0171/P0172 (Fuel system too lean/too rich)
  3. DTC P0300/P0301/P0302/P0303 (Misfire detected)
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- ECM (PCM) Replacement
  When substituting a known-good ECM (PCM), check for following conditions. Neglecting this check may cause damage to a known-good ECM (PCM).
  – Resistance value of all relays, actuators is as specified respectively.
  – MAP sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.

ENGINE DIAGNOSTIC FLOW TABLE

Refer to the following pages for the details of each step.

STEP	ACTION	YES	NO
1	Customer Complaint Analysis 1) Perform customer complaint analysis referring to the next page. Was customer complaint analysis performed?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC) and Freeze Frame Data Check, Record and Clearance 1) Check for DTC (including pending DTC) referring to the next page. Is there any DTC(s)?	1) Print DTC and freeze frame data or write them down and clear them by referring to “DTC Clearance” section. 2) Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the next page. Is there any faulty condition?	1) Repair or replace malfunction part. 2) Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the next page. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the next page. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to “DTC Check” section. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to “DTC Check” section. Is there any DTC(s)?		Go to Step 10.
8	Engine Basic Inspection and Engine Diag. Table 1) Check and repair according to “Engine Basic Check” and “Engine Diag. Table” section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
9	Trouble shooting for DTC 1) Check and repair according to applicable DTC diag. flow table. Are check and repair complete?		
10	Check for Intermittent Problems 1) Check for intermittent problems referring to the next page. Is there any faulty condition?	1) Repair or replace malfunction part(s). 2) Go to Step 11.	Go to Step 11.
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to the next page. Is there any problem symptom, DTC or abnormal condition?	Go to Step 6.	End.

1. CUSTOMER COMPLAINT ANALYSIS

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

2. DIAGNOSTIC TROUBLE CODE (DTC)/FREEZE FRAME DATA CHECK, RECORD AND CLEARANCE

First, check DTC (including pending DTC), referring to "DTC check" section. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to "DTC clearance" section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 4 and recheck DTC according to Step 5.

Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

NOTE:

If only Immobilizer DTCs (P1620 – P1623) are indicated in this step, perform trouble diagnosis according to "Diagnosis" in Section 8G.

3. and 4. VISUAL INSPECTION

As a preliminary step, be sure to perform visual check of the items that support proper function of the engine referring to "Visual Inspection" section.

5. TROUBLE SYMPTOM CONFIRMATION

Based on information obtained in Step 1 Customer complaint analysis and Step 2 DTC/freeze frame data check, confirm trouble symptoms. Also, reconfirm DTC according to "DTC Confirmation Procedure" described in each DTC Diagnosis section.

6. and 7. RECHECKING AND RECORD OF DTC/FREEZE FRAME DATA

Refer to "DTC check" section for checking procedure.

8. ENGINE BASIC INSPECTION AND ENGINE DIAGNOSIS TABLE

Perform basic engine check according to the "Engine Basic Inspection Flow Table" first. When the end of the flow table has been reached, check the parts of the system suspected as a possible cause referring to ENGINE DIAGNOSIS FLOW TABLE and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

9. TROUBLESHOOTING FOR DTC (See each DTC Diag. Flow Table)

Based on the DTC indicated in Step 5 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM (PCM) or other part and repair or replace faulty parts.

10. CHECK FOR INTERMITTENT PROBLEM

Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to "INTERMITTENT AND POOR CONNECTION" in Section 0A and related circuit of DTC recorded in Step 2.

11. FINAL CONFIRMATION TEST

Confirm that the problem symptom has gone and the engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no DTC is indicated.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

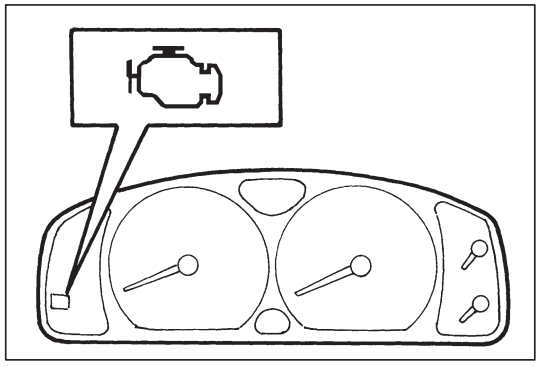
User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
☐ **Difficult Starting** ☐ No cranking ☐ No initial combustion ☐ No combustion ☐ Poor starting at (☐cold ☐warm ☐always) ☐ Other_____	☐ **Poor Driveability** ☐ Hesitation on acceleration ☐ Back fire/☐After fire ☐ Lack of power ☐ Surging ☐ abnormal knocking ☐ Other_____
☐ **Poor Idling** ☐ Poor fast idle ☐ Abnormal idling speed (☐High ☐Low) (r/min.) ☐ Unstable ☐ Hunting (r/min. to r/min.) ☐ Other_____	☐ **Engine Stall when** ☐ Immediately after start ☐ Accel. pedal is depressed ☐ Accel. pedal is released ☐ Load is applied ☐ A/C ☐Electric load ☐P/S ☐ Other_____ ☐ Other_____
☐ OTHERS:	

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather Temperature Frequency Road	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other_____ ☐Hot ☐Warm ☐Cool ☐Cold (°F/ °C) ☐Always ☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition ☐Urban ☐Suburb ☐Highway ☐Mountainous (☐Uphill ☐Downhill) ☐Tarmacadam ☐Gravel ☐Other_____
Vehicle Condition	
Engine condition	☐Cold ☐Warming up phase ☐Warmed up ☐Always ☐Other at starting ☐Immediately after start ☐Racing without load ☐Engine speed (r/min.)
Vehicle condition	During driving: ☐Constant speed ☐Accelerating ☐Decelerating ☐Right hand corner ☐Left hand corner ☐When shifting (Lever position) ☐At stop ☐Vehicle speed when problem occurs (km/h, Mile/h) ☐Other_____

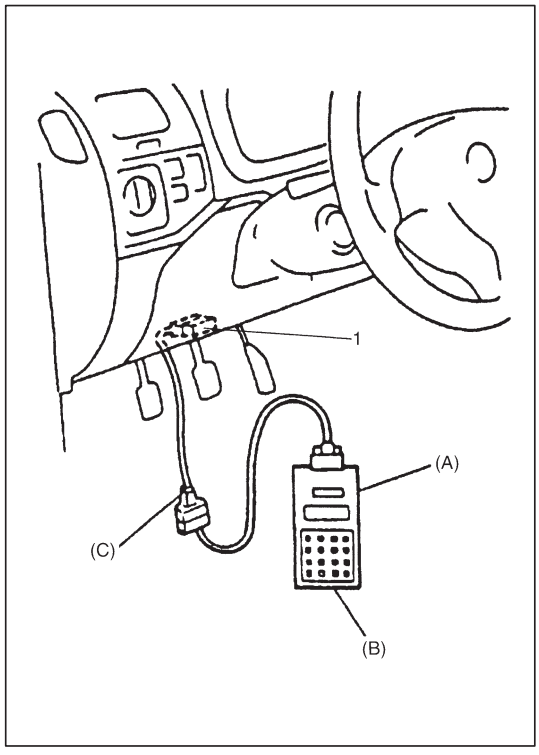
Malfunction indicator lamp condition	☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition
Diagnostic trouble code	First check: ☐No code ☐Malfunction code ( )
	Second check: ☐No code ☐Malfunction code ( )

NOTE:
The above form is a standard sample. It should be modified according to conditions characteristic of each market.



MALFUNCTION INDICATOR LAMP (MIL) CHECK

1) Turn ON ignition switch (but the engine at stop) and check that MIL lights.
   If MIL does not light up (or MIL dims), go to "Diagnostic Flow Table A-1" for troubleshooting.
2) Start engine and check that MIL turns OFF.
   If MIL remains ON and no DTC is stored in ECM (PCM), go to "Diagnostic Flow Table A-2" for troubleshooting.



DIAGNOSTIC TROUBLE CODE (DTC) CHECK

1) Prepare SUZUKI scan tool (Tech-1) or generic scan tool.
2) With ignition switch OFF, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

   Special Tool:
   (A): SUZUKI scan tool
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable
3) Turn ignition switch ON and confirm that MIL lights.
4) Read DTC, pending DTC and freeze frame data according to instructions displayed on scan tool and print it or write it down. Refer to scan tool operator's manual for further details.
   If communication between scan tool and ECM (PCM) is not possible, check if scan tool is communicable by connecting it to ECM (PCM) in another vehicle. If communication is possible in this case, scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.
5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

1) Connect SUZUKI scan tool (Tech-1) or generic scan tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch ON.
3) Erase DTC and pending DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch off and disconnect scan tool from data link connector.

NOTE:
DTC and freeze frame data stored in ECM (PCM) memory are also cleared in following cases. Be careful not to clear them before keeping their record.
- **When power to ECM (PCM) is cut off (by disconnecting battery cable, removing fuse or disconnecting ECM (PCM) connectors for 30 sec. or longer)**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles.**

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0105	Manifold absolute pressure circuit malfunction	Low pressure-high vacuum-low voltage (or MAP sensor circuit shorted to ground) High pressure-low vacuum-high voltage (or MAP sensor circuit open)	1 driving cycle
P0110	Intake air temp. circuit malfunction	Intake air temp. circuit low input Intake air temp. circuit high input	1 driving cycle
P0115	Engine coolant temp. circuit malfunction	Engine coolant temp. circuit low input Engine coolant temp. circuit high input	1 driving cycle
P0120	Throttle position circuit malfunction	Throttle position circuit low input Throttle position circuit high input	1 driving cycle
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles
P0130	HO2S circuit malfunction (Sensor-1)	Min. output voltage of HO2S-higher than specification Max. output voltage of HO2S-lower than specification	2 driving cycles
P0133	HO2S circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles
P0134	HO2S circuit no activity detected (Sensor-1)	HO2S-1 output voltage is high or low continuously.	2 driving cycles
P0135	HO2S heater circuit malfunction (Sensor-1)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON.	2 driving cycles
P0136	HO2S circuit malfunction (Sensor-2)	Max. voltage of HO2S-2 is lower than specification or its min. voltage is higher than specification	2 driving cycles
P0141	HO2S heater circuit malfunction (Sensor-2)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON. (or heater circuit or short)	2 driving cycles
P0171	Fuel system too lean	Short term fuel trim or total fuel trim (short and long terms added) is larger than specification for specified time or longer. (fuel trim toward rich side is large.)	2 driving cycles
P0172	Fuel system too rich	Short term fuel trim or total fuel trim (short and long term added) is smaller than specification for specified time or longer. (fuel trim toward lean side is large.)	2 driving cycles
P0300 P0301 P0302 P0303	Random misfire detected Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected	Misfire of such level as to cause damage to three way catalyst	MIL flashing during misfire detection
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst	2 driving cycles

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0335	Crankshaft position sensor circuit malfunction	No signal during engine running	1 driving cycle
P0340	Camshaft position sensor circuit malfunction	No signal for 2 sec. during engine cranking	1 driving cycle
P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar. (Time from output voltage change of HO2S-1 to that of HO2S-2 is shorter than specification.)	2 driving cycles
P0443	EVAP Purge control valve circuit malfunction	Purge control valve circuit is open or shorted to ground	2 driving cycles
P0480	Radiator fan control circuit malfunction	Radiator cooling fan relay terminal voltage is low when cooling temp. is lower than specification	2 driving cycles
P0500	Vehicle speed sensor malfunction	No signal while running in “D” range or during fuel cut at decelerating	2 driving cycles
P0505	Idle control system malfunction	Throttle opening change is small as compared with electrically live time. Throttle valve opening is not within its target range with CTP switch ON or drive voltage exists though ECM (PCM) is not outputting ISC drive command.	1 driving cycle
P0510	Closed throttle position switch malfunction	Switch does not change from ON to OFF (or from OFF to ON) even when vehicle speed reaches over (or below) specification.	2 driving cycle
P1250	Early Fuel Evaporation Heater Circuit Malfunction	Heater monitor terminal voltage is higher than specified value when EFE OFF or it is lower than specified value when EFE ON.	2 driving cycles
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification. (or sensor malfunction)	1 driving cycle
P1451	Barometric pressure sensor performance problem	Difference between manifold absolute pressure (MAP sensor value) and barometric pressure (barometric pressure sensor value) is larger than specification during cranking.	2 driving cycles
P1500	Starter signal circuit malfunction	Starter signal is not inputted from engine cranking till its start and after or it is always inputted	2 driving cycles
P1510	ECM (PCM) backup power source malfunction	No backup power after starting engine	1 driving cycle
P1620	ECU code not registered	Refer to Section 8G.	
P1621	No ECU code transmitted from Immobilizer Control Module		
P1622	Fault in ECM (PCM)		
P1623	ECU code not matched		

FAIL-SAFE TABLE

When any of the following DTCs is detected, ECM (PCM) enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM (PCM) detects normal condition after that.

DTC NO.	DETECTED ITEM	FAIL-SAFE OPERATION
P0105	Manifold absolute pressure circuit malfunction	● ECM (PCM) uses value determined by throttle opening and engine speed. ● ECM (PCM) stops EVAP purge control.
P0110	Intake air temp. circuit malfunction	ECM (PCM) controls actuators assuming that intake air temperature is 20°C (68°F).
P0115	Engine coolant temp. circuit malfunction	● ECM (PCM) controls actuators assuming that engine coolant temperature is 80°C (176°F). ● ECM (PCM) operates radiator fan. ● ECM (PCM) stops A/C and idle speed control.
P0120	Throttle position circuit malfunction	● ECM (PCM) controls actuators assuming that throttle opening is 20°. ● ECM (PCM) stops idle speed control.
P0500	Vehicle speed sensor malfunction	ECM (PCM) stops idle air control.
P1450	Barometric pressure sensor low/ high input	ECM (PCM) controls actuators assuming that barometric pressure is 100 kPa (760 mmHg).

VISUAL INSPECTION

Visually check following parts and systems.

INSPECTION ITEM	REFERRING SECTION
● Engine oil – – – – – level, leakage	Section 0B
● Engine coolant – – – – – level, leakage	Section 0B
● Fuel – – – – – level, leakage	Section 0B
● A/T fluid – – – – – level, leakage	Section 0B
● Air cleaner element – – – – – dirt, clogging	Section 0B
● Battery – – – – – fluid level, corrosion of terminal	
● Water pump belt – – – – – tension, damage	Section 0B
● Throttle cable – – – – – play, installation	Section 6E1
● Vacuum hoses of air intake system – – – – – disconnection, looseness, deterioration, bend	
● Connectors of electric wire harness – – – – – disconnection, friction	
● Fuses – – – – – burning	Section 8
● Parts – – – – – installation, bolt – – – – – looseness	
● Parts – – – – – deformation	
● Other parts that can be checked visually	
Also check following items at engine start, if possible	
● Malfunction indicator lamp	Section 6
● Charge warning lamp	Section 6H
● Engine oil pressure warning lamp (Operation)	Section 8 (section 6A for pressure check)
● Engine coolant temp. meter (Operation)	Section 8
● Fuel level meter (Operation)	Section 8
● Tachometer, if equipped (Operation)	
● Abnormal air being inhaled from air intake system	
● Exhaust system – – – – – leakage of exhaust gas, noise	
● Other parts that can be checked visually	

ENGINE BASIC INSPECTION

This check is very important for troubleshooting when ECM (PCM) has detected no DTC and no abnormality has been found in visual inspection.
Follow the flow table carefully.

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check battery voltage. Is it 11 V or more?	Go to Step 3.	Charge or replace battery.
3	Is engine cranked?	Go to Step 4.	Go to “DIAGNOSIS” in Section 6G.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check idle speed as follows. 1) Warm up engine to normal operating temp. 2) Shift transmission to neutral position for M/T (“P” position for A/T). 3) All of electrical loads are switched off. 4) Check engine idle speed with scan tool. See Fig. 1. Is it 750 – 850 r/min.?	Go to Step 6.	Go to “ENGINE DIAGNOSIS TABLE”.
6	Check ignition timing as follows. 1) Select “MISC” mode on SUZUKI scan tool and fix ignition timing to initial one. See Fig. 2. 2) Using timing light (1), check initial ignition timing. See Fig. 3. Is it 5° ± 3° BTDC at specified idle speed?	Go to “ENGINE DIAGNOSIS TABLE”.	Check ignition control related parts referring to Section 6F.
7	Check immobilizer system malfunction as follows. 1) Check immobilizer indicator lamp for flashing. Is it flashing when ignition switch is turned to ON position?	Go to “DIAGNOSIS” in Section 8G.	Go to Step 8.
8	Check fuel supply as follows. 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 2 seconds and then OFF. See Fig. 4. Is fuel return pressure (returning sounds) felt from fuel feed hose (1) when ignition switch is turned ON?	Go to Step 10.	Go to Step 9.
9	Check fuel pump for operating. 1) Was fuel pump operating sound heard from fuel filler for about 2 seconds after ignition switch ON and stop?	Go to “DIAG. FLOW TABLE B-3”.	Go to “DIAG. FLOW TABLE B-2”.
10	Check ignition spark as follows. 1) Disconnect injector coupler. 2) Remove spark plugs and connect them to high tension cords. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. Is it in good condition?	Go to Step 11.	Go to “DIAGNOSIS” in Section 6F.
11	Check fuel injector for operation as follows. 1) Install spark plugs and connect injector connectors. 2) Check that fuel is injected out in conical shape from fuel injector when cranking. Is it in good condition?	Go to “ENGINE DIAGNOSIS TABLE”.	Go to “DIAG. FLOW TABLE B-1”.

Fig. 1 for Step 5

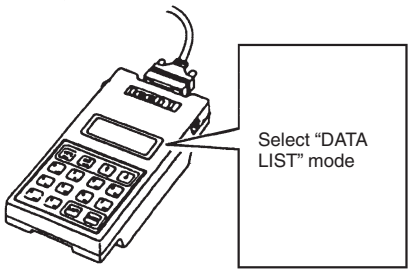


Fig. 2 for Step 6

Fig. 3 for Step 6

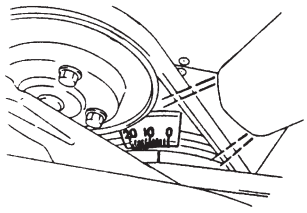


Fig. 4 for Step 8

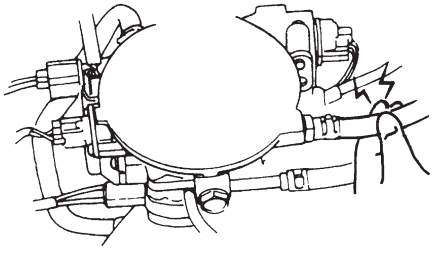
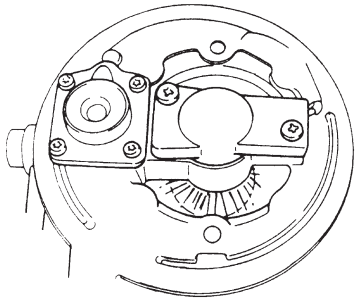


Fig. 5 for Step 11



ENGINE DIAGNOSIS TABLE

Perform troubleshooting referring to following table when ECM (PCM) has detected no DTC and no abnormality has been found in visual inspection and engine basic inspection previously.

Condition	Possible Cause	Referring Item
Hard Starting (Engine cranks OK)	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Leaky high-tension cord	High-tension cords in Section 6F
	● Loose connection or disconnection of high-tension cords or lead wires	High-tension cords in Section 6F
	● Faulty ignition coil	Ignition coil in Section 6F
	Fuel system out of order	
	● Dirty or clogged fuel hose or pipe	Diagnostic Flow Table B-3
	● Malfunctioning fuel pump	Diagnostic Flow Table B-3
	● Air inhaling from intake manifold gasket or throttle body gasket	
	● Fuel injector resistor malfunction	Fuel injector resistor in Section 6E1
	Engine and emission control system out of order	
	● Faulty idle control system	Diagnostic Flow Table P0505
	● Faulty ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E1
	● Faulty ECM (PCM)	
	Low compression	Compression check in Section 6A
	● Poor spark plug tightening or faulty gasket	Spark plugs in Section 6F
	● Compression leak from valve seat	Valves inspection in Section 6A
	● Sticky valve stem	Valves inspection in Section 6A
	● Weak or damaged valve springs	Valve springs inspection in Section 6A
	● Compression leak at cylinder head gasket	Cylinder head inspection in Section 6A
	● Sticking or damaged piston ring	Cylinders, pistons and piston rings inspection in Section 6A
	● Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Section 6A
	Others	
	● Malfunctioning PCV valve	PCV system in Section 6E1

Condition	Possible Cause	Referring Item
Low oil pressure	● Improper oil viscosity	Engine oil and oil filter change in Section 0B
	● Malfunctioning oil pressure switch	Oil pressure switch inspection in Section 8
	● Clogged oil strainer	Oil pan and oil pump strainer cleaning in Section 6A
	● Functional deterioration of oil pump	Oil pump in Section 6A
	● Worn oil pump relief valve	Oil pump in Section 6A
	● Excessive clearance in various sliding parts	
Engine noise Note: Before checking mechanical noise, make sure that: ● Specified spark plug is used. ● Specified fuel is used.	**Valve noise**	
	● Improper valve lash	Valve lash in Section 6A
	● Worn valve stem and guide	Valves inspection in Section 6A
	● Weak or broken valve spring	Valve springs inspection in Section 6A
	● Warped or bent valve	Valves inspection in Section 6A
	Piston, ring and cylinder noise	
	● Worn piston, ring and cylinder bore	Pistons and cylinders inspection in Section 6A
	Connecting rod noise	
	● Worn rod bearing	Crank pin and connecting rod bearing inspection in Section 6A
	● Worn crank pin	Crank pin and connecting rod bearing inspection in Section 6A
	● Loose connecting rod nuts	Connecting rod installation in Section 6A
	● Low oil pressure	Previously outlined
	Crankshaft noise	
	● Low oil pressure	Previously outlined
	● Worn bearing	Crankshaft and bearing inspection in Section 6A
	● Worn crankshaft journal	Crankshaft and bearing inspection in Section 6A
	● Loose bearing cap bolts	Crankshaft inspection in Section 6A
	● Excessive crankshaft thrust play	Crankshaft thrust play inspection in Section 6A

Condition	Possible Cause	Referring Item
Overheating	● Inoperative thermostat	Thermostat in Section 6B
	● Poor water pump performance	Water pump in Section 6B
	● Clogged or leaky radiator	Radiator in Section 6B
	● Improper engine oil grade	Engine oil and oil filter change in Section 0B
	● Clogged oil filter or oil strainer	Oil pressure check in Section 6A
	● Poor oil pump performance	Oil pressure check in Section 6A
	● Faulty radiator fan control system	Radiator fan control system in Section 6E1
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C
	● Blown cylinder head gasket	Cylinder head in Section 6A
Poor gasoline mileage	**Ignition system out of order**	
	● Leaks or loose connection of high-tension cord	High-tension cords in Section 6F
	● Faulty spark plug (improper gap, heavy deposits and burned electrodes, etc.)	Spark plugs in Section 6F
	Engine and emission control system out of order	
	● High idle speed	Refer to item “Improper engine idle speed” previously outlined
	● Poor performance of TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty fuel injector resistor	Fuel injector resistor in Section 6E1
	● Faulty ECM (PCM)	
	Low compression	Previously outlined
	Others	
	● Poor valve seating	Valves inspection in Section 6A
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C
	● Thermostat out of order	Thermostat in Section 6B
	● Improper tire pressure	Refer to Section 3F
Excessive engine oil consumption	**Oil leakage**	
	● Blown cylinder head gasket	Cylinder head in Section 6A
	● Leaky camshaft oil seals	Camshaft in Section 6A
	Oil entering combustion chamber	
	● Sticky piston ring	Piston cleaning in Section 6A
	● Worn piston and cylinder	Pistons and cylinders inspection in Section 6A
	● Worn piston ring groove and ring	Pistons inspection in Section 6A
	● Improper location of piston ring gap	Pistons assembly in Section 6A
	● Worn or damaged valve stem seal	Valves removal and installation in Section 6A
	● Worn valve stem	Valves inspection in Section 6A

Condition	Possible Cause	Referring Item
Engine hesitates (Momentary lack of response as accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make vehicle move, as from a stop sign.)	**Ignition system out of order**	
	● Spark plug faulty or plug gap out of adjustment	Spark plugs in Section 6F
	● Leaky high-tension cord	High-tension cords in Section 6F
	Fuel system out of order	
	● Fuel pressure out of specification	Diagnostic Flow Table B-3
	Engine and emission control system out of order	Trouble diagnosis in Section 6-1
	● Poor performance of TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty ECM (PCM)	
	Engine overheating	Refer to “Overheating” section
	Low compression	Previously outlined
Surge (Engine power variation under steady throttle or cruise. Feels like vehicle speeds up and down with no change in accelerator pedal.)	**Ignition system out of order**	
	● Leaky or loosely connected high-tension cord	High-tension cords in Section 6F
	● Faulty spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.)	Spark plugs in Section 6F
	Fuel system out of order	
	● Variable fuel pressure	Diagnostic Flow Table B-3
	● Kinky or damaged fuel hose and lines	
	● Faulty fuel pump (clogged fuel filter)	
	Engine and emission control system out of order	
	● Poor performance of MAP sensor	MAP sensor in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty ECM (PCM)	
Excessive detonation (Engine makes continuously sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	**Engine overheating**	Refer to “Overheating” section
	Ignition system out of order	
	● Faulty spark plug	Spark plugs in Section 6F
	● Loose connection of high-tension cord	High-tension cords in Section 6F
	Fuel system out of order	
	● Clogged fuel filter (faulty fuel pump) or fuel lines	Diagnostic Flow Table B-1 or B-2
	● Air inhaling from intake manifold or throttle body gasket	
	Engine and emission control system out of order	Trouble diagnosis in Section 6-1
	● Poor performance of ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty ECM (PCM)	
	● Excessive combustion chamber deposits	Piston and cylinder head cleaning in Section 6A

Condition	Possible Cause	Referring Item
Engine has no power	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Faulty ignition coil with ignitor	Ignition coil in Section 6F
	● Leaks, loose connection or disconnection of high-tension cord	High-tension cords in Section 6F
	Engine overheating	Refer to “Overheating” section
	Fuel system out of order	
	● Clogged fuel hose or pipe	Diagnostic Flow Table B-3 in Section 6-1
	● Malfunctioning fuel pump	Diagnostic Flow Table B-2
	● Air inhaling from intake manifold gasket or throttle body gasket	
	Engine and emission control system out of order	
	● Maladjusted accelerator cable play	Accelerator cable play in Section 6E1
	● Poor performance of TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty ECM (PCM)	
	Low compression	Previously outlined
	Others	
	● Dragging brakes	Trouble diagnosis in Section 5
	● Slipping clutch	Trouble diagnosis in Section 7C

Condition	Possible Cause	Referring Item
Improper engine idling or engine fails to idle	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Leaky or disconnected high-tension cord	High-tension cords in Section 6F
	● Faulty ignition coil with ignitor	Ignition coil in Section 6F
	Fuel system out of order	
	● Fuel pressure out of specification	Diagnostic Flow Table B-3 in Section 6-1
	● Leaky manifold, throttle body, or cylinder head gasket	
	Engine and emission control system out of order	
	● Faulty idle control system	Diagnostic Flow Table P0505
	● Faulty evaporative emission control system	EVAP control system in Section 6E1
	● Faulty fuel injector	Diagnostic Flow Table B-1
	● Faulty fuel injector resistor	Fuel injector resistor in Section 6E1
	● Poor performance of ECT sensor, TP sensor or MAP sensor	ECT sensor, TP sensor or MAP sensor in Section 6E1
	● Faulty ECM (PCM)	
	Engine overheating	Refer to “Overheating” section
	Low compression	Previously outlined
	Others	
	● Loose connection or disconnection of vacuum hoses	
	● Malfunctioning PCV valve	PCV system in Section 6E1
	● Faulty A/C signal circuit	Diagnostic Flow Table B-4

Condition	Possible Cause	Referring Item
Excessive hydrocarbon (HC) emission or carbon monoxide (CO)	**Ignition system out of order**	
	● Faulty spark plug	Spark plugs in Section 6F
	● Leaky or disconnected high-tension cord	High-tension cords in Section 6F
	● Faulty ignition coil with ignitor	Ignition coil assembly in Section 6F
	Low compression	Refer to “Low compression” section
	Engine and emission control system out of order	
	● Lead contamination of three way catalytic converter	Check for absence of filler neck restrictor
	● Faulty evaporative emission control system	EVAP control system in Section 6E1
	● Fuel pressure out of specification	Diagnostic Flow Table B-3
	● Closed loop system (A/F feed back compensation) fails	
	– Faulty TP sensor	TP sensor in Section 6E1
	– Poor performance of ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E1
	● Faulty injector	Diagnostic Flow Table B-1
	● Faulty fuel injector resistor	Fuel injector resistor in Section 6E1
	● Faulty ECM (PCM)	
	Others	
	● Engine not at normal operating temperature	
	● Clogged air cleaner	
	● Vacuum leaks	
Excessive nitrogen oxides (NOx) emission	**Ignition system out of order**	
	● Improper ignition timing	See section 6F1
	Engine and emission control system out of order	
	● Lead contamination of catalytic converter	Check for absence of filler neck restrictor.
	● Fuel pressure out of specification	Diagnostic Flow Table B-3
	● Closed loop system (A/F feed back compensation) fails	
	– Faulty TP sensor	TP sensor in Section 6E1
	– Poor performance of ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E1
	● Faulty injector	Diagnostic Flow Table B-1
	● Faulty fuel injector resistor	Fuel injector resistor in Section 6E1
	● Faulty ECM (PCM)	

SCAN TOOL DATA

As the data values given below are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.
Also, conditions in the below table that can be checked by the scan tool are those detected by ECM (PCM) and output from ECM (PCM) as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool. Be sure to use the timing light to check the ignition timing.

NOTE:
- **With the generic scan tool, only star (☆) marked data in the table below can be read.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C, all electric loads, P/S and all the other necessary switches.**

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
☆	FUEL SYSTEM B1 (FUEL SYSTEM STATUS)	At specified idle speed after warming up		CLOSED (closed loop)
☆	CALC LOAD (CALCULATED LOAD VALUE)	At specified idle speed with no load after warming up		3 – 5%
		At 2500 r/min with no load after warming up		10 – 18%
☆	COOLANT TEMP. (ENGINE COOLANT TEMP.)	At specified idle speed after warming up		85 – 95°C, 185 – 203°F
☆	SHORT FT BI (SHORT TERM FUEL TRIM)	At specified idle speed after warming up		–20 – +20%
☆	LONG FT BI (LONG TERM FUEL TRIM)	At specified idle speed after warming up		–15 – +15%
☆	MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after warming up		29 – 48 kPa, 220 – 360 mmHg
☆	ENGINE SPEED	At idling with no load after warming up		Desired idle speed ± 50 r/min
☆	VEHICLE SPEED	At stop		0 km/h, 0 MPH
☆	IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER)	At specified idle speed with no load after warming up		–1 – 18° BTDC
☆	INTAKE AIR TEMP.	At specified idle speed after warming up		Ambient temp. +35°C (+63°F) / –5°C (–9°F)
☆	MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		1.0 – 3.0 gm/sec
		At 2500 r/min with no load after warming up		3.0 – 6.0 gm/sec
☆	THROTTLE POS (ABSOLUTE THROTTLE POSITION)	Ignition switch ON/ engine stopped	Throttle valve fully closed	7 – 18%
			Throttle valve fully open	70 – 90%
☆	O2S B1 S1 (HEATED OXYGEN SENSOR-1)	At specified idle speed after warming up		0.05 – 0.95 V
☆	O2S B1 S2 (HEATED OXYGEN SENSOR-2)	When engine is running at 2000 r/min. for 3 min. or longer after warming up.		0 – 0.95 V
☆	O2S FT B1 S1	At specified idle speed after warning up		–20 – +20%
☆	DIS. WITH MIL ON	——		——

	SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUES
	DESIRED IDLE (DESIRED IDLE SPEED)	At idling with no load after warming up, M/T at neutral, A/T at "P" range		800 r/min
	TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE)	Ignition switch ON/engine stopped	Throttle valve fully closed	More than 0.2 V
			Throttle valve fully open	Less than 4.8 V
	INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH)	At specified idle speed with no load after warming up		0.8 – 2.3 msec.
		At 2500 r/min with no load after warming up		0.8 – 2.3 msec.
	IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY)	At idling with no load after warming up		20 – 40%
	TOTAL FUEL TRIM	At specified idle speed after warming up		–35 – +35%
	BATTERY VOLTAGE	Ignition switch ON/engine stop		10 – 14 V
	CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY)	At specified idle speed after warming up		0 – 100%
	CLOSED THROT POS (CLOSED THROTTLE POSITION)	Throttle valve at idle position		ON
		Throttle valve opens larger than idle position		OFF
	FUEL CUT	When engine is at fuel cut condition		ON
		Other than fuel cut condition		OFF
	RAD FAN (RADIATOR FAN CONTROL RELAY)	Ignition switch ON	Engine coolant temp.: Lower than 91.5°C (197°F)	OFF
			Engine coolant temp.: 96°C (205°F) or higher	ON
	ELECTRIC LOAD	Ignition switch ON/Headlight, small light, heater fan and rear window defogger all turned OFF		OFF
		Ignition switch ON/Headlight, small light, heater fan or rear window defogger turned ON		ON
	A/C SWITCH	Engine running after warming up, A/C not operating		OFF
		Engine running after warming up, A/C operating		ON
	FUEL TANK LEVEL	————————		0 – 100%
	BAROMETRIC PRESS	————————		Display the barometric pressure
	FUEL PUMP	Within 3 seconds after ignition switch ON or engine running		ON
		Engine stop at ignition switch ON.		OFF

SCAN TOOL DATA DEFINITIONS

FUEL SYSTEM (FUEL SYSTEM STATUS)
Air/fuel ratio feedback loop status displayed as either open or closed loop. Open indicates that ECM (PCM) ignores feedback from the exhaust oxygen sensor. Closed indicates final injection duration is corrected for oxygen sensor feedback.

CALC LOAD (CALCULATED LOAD VALUE, %)
Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume x 100%.

COOLANT TEMP. (ENGINE COOLANT TEMPERATURE, °C, °F)
It is detected by engine coolant temp. sensor

SHORT FT B1 (SHORT TERM FUEL TRIM, %)
Short term fuel trim value represents short term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

LONG FT B1 (LONG TERM FUEL TRIM, %)
Long term fuel trim Value represents long term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE, kPa, inHg)
It is detected by manifold absolute pressure sensor and used (among other things) to compute engine load.

ENGINE SPEED (rpm)
It is computed by reference pulses from crankshaft position sensor.

VEHICLE SPEED (km/h, MPH)
It is computed based on pulse signals from vehicle speed sensor.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)
Ignition timing of NO.1 cylinder is commanded by ECM (PCM). The actual ignition timing should be checked by using the timing light.

INTAKE AIR TEMP. (°C, °F)
It is detected by intake air temp. sensor and used to determine the amount of air passing into the intake manifold as air density varies with temperature.

MAF (MASS AIR FLOW RATE, gm/s, lb/min)
It represents total mass of air entering intake manifold which is computed based on signals from MAP sensor, IAT sensor, TP sensor, etc.

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)
When throttle position sensor is fully closed position, throttle opening is indicated as 0% and 100% full open position.

OXYGEN SENSOR B1 S1 (HEATED OXYGEN SENSOR-1, V)
It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

OXYGEN SENSOR B1 S2 (HEATED OXYGEN SENSOR-2, V)
It indicates output voltage of HO2S-2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

DESIRED IDLE (DESIRED IDLE SPEED, rpm)
The Desired Idle Speed is an ECM (PCM) internal parameter which indicates the ECM (PCM) requested idle. If the engine is not running, this number is not valid.

TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE, V)
The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec.)
This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (PCM) (but injector drive time of NO.1 cylinder for multiport fuel injection).

IAC FLOW DUTY (IDLE AIR (SPEED) CONTROL DUTY, %)
This parameter indicates opening of the throttle valve in terms of percentage to opening controllable by the ISC actuator.

TOTAL FUEL TRIM (%)
The value of Total Fuel Trim is obtained by putting values of short Term Fuel Trim and Long Term Fuel Trim together. This value indicates how much correction is necessary to keep the stoichiometric air/fuel mixture.

BATTERY VOLTAGE (V)
This parameter indicates battery positive voltage inputted from main relay to ECM (PCM).

CANIST PURGE DUTY (EVAP CANISTER PURGE FLOW DUTY, %)
This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP purge solenoid valve which controls the amount of EVAP purge.
0% means that the purge valve is completely closed while 100% is a fully open valve.

CLOSED THROTTLE POSITION (ON/OFF)
This parameter will read ON when throttle valve is fully closed, or OFF when the throttle is not fully closed.

FUEL CUT (ON/OFF)
ON : Fuel being cut (output signal to injector is stopped)
OFF : Fuel not being cut

RAD FAN (RADIATOR FAN CONTROL RELAY, ON/OFF)
ON : Command for radiator fan control relay operation being output.
OFF : Command for relay operation not being output.

ELECTRIC LOAD (ON/OFF)
ON : Headlight, small light, heater fan or rear window defogger ON signal inputted.
OFF : Above electric loads all turned OFF.

A/C SWITCH (ON/OFF)
ON : Command for A/C operation being output from ECM (PCM) to A/C amplifier.
OFF : Command for A/C operation not being output.

FUEL TANK LEVEL (%)
This parameter indicates approximate fuel level in the fuel tank. As the detectable range of the fuel level sensor is set as 0 to 100%, however, with some models whose fuel tank capacity is smaller, the indicated fuel level may be only 70% even when the fuel tank is full.

PSP SWITCH (ON/OFF)
ON : PSP switch detects P/S operation (high PS pressure).
OFF : PSP switch not detects P/S operation.

BAROMETRIC PRESS (kPa, inHg)
This parameter represents a measurement of barometric air pressure and is used for altitude correction of the fuel injection quantity and ISC actuator control.

FUEL PUMP (ON/OFF)
ON is displayed when the ECM (or PCM) activates the fuel pump via the fuel pump relay switch.

VSS (A/T) (km/h, MPH)
If is computed by using pulse signals from vehicle (output) speed sensor on automatic transmission.

TRANS RANGE (TRANSMISSION RANGE SENSOR, P, R, N, D, 2 OR L)
It is indicated transmission range detected by transmission range sensor.

SHIFT SOL 1-CON (SHIFT SOLENOID-1, ON/OFF)
ON : ON command being output to shift solenoid-1
OFF : ON command not being output.

SHIFT SOL 2-CON (SHIFT SOLENOID-2, ON/OFF)
ON : ON command being output to shift solenoid-2
OFF : ON command not being output.

SHIFT SOL 1-MON (SHIFT SOLENOID-1, ON/OFF)
The monitor result of the shift solenoid-1 circuit is displayed.
ON : Electricity being passed to shift solenoid-1 or circuit open.
OFF : Electricity not being passed or circuit short.

SHIFT SOL 2-MON (SHIFT SOLENOID-2, ON/OFF)
The monitor result of the shift solenoid-2 circuit is displayed.
ON : Electricity being passed to shift solenoid-2 or circuit open.
OFF : Electricity not being passed or circuit short.

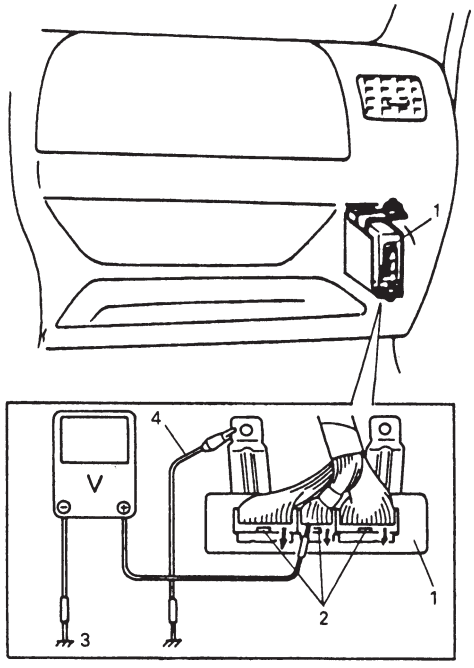
THROT POS LEVEL (THROTTLE POSITION LEVEL FOR A/T, “0”, “1”, “2”, “3”, “4”, “5”, “6” or “7”)
This parameter indicates which level (zone) the throttle valve opening is in. The throttle opening is divided into 8 levels (zones) from “0” (about idle position) to “7” (about full open) and signals are assigned to each opening level (zone). ECM (PCM) control the automatic gear change of the automatic transmission by using these signals according to the signal from the TP sensor.

GEAR POSITION
This parameter indicates the A/T gear position which is computed on signals from the Transmission Range Switch, VSS, TP Sensor, and so forth.

INSPECTION OF ECM (PCM) AND ITS CIRCUITS

ECM (PCM) and its circuits can be checked at ECM (PCM) wiring couplers by measuring voltage and resistance.

CAUTION:
ECM (PCM) cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM (PCM) with coupler disconnected from it.

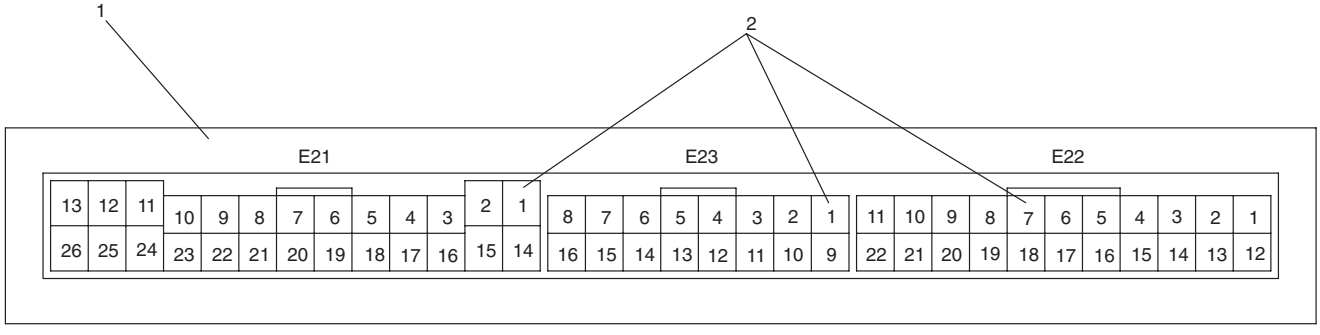


3. Body ground
4. Service wire

Voltage Check

1) Remove ECM (PCM) (1) from body referring to Section 6E1.
2) Check voltage at each terminal of couplers (2) connected.

NOTE:
As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when ignition switch is ON.

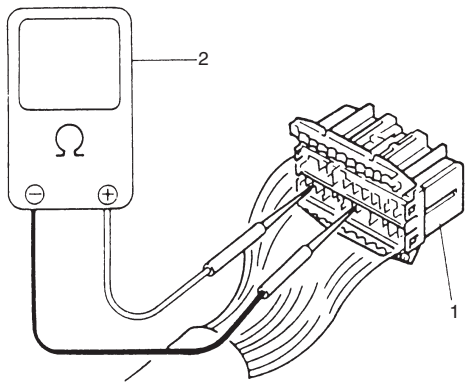


1. ECM (PCM)
2. ECM (PCM) couplers
   (Viewed from harness side)

	TER-MINAL	WIRE COLOR	CIRCUIT	STANDARD VOLTAGE	CONDITION
CONNECTOR "E21"	1	BLK	ECM (PCM) ground	–	–
	2	BLK/RED	Power source	10 – 14 V	Ignition switch ON
	3	—	Blank	—	—
	4	—	Blank	—	—
	5	—	Blank	—	—
	6	—	Blank	—	—
	7	RED/BLK	EVAP canister purge valve	10 – 14 V	Ignition switch ON
	8	—	Blank	—	—
	9	—	Blank	—	—
	10	YEL/BLU	Igniter (IGT)	—	—
	11	GRN/WHT	ISC actuator	—	—
	12	BLU/WHT	Fuel injector	10 – 14 V	Ignition switch ON
	13	BLK/YEL	Ground	—	—
	14	WHT/BLU	Power source for back-up	10 – 14 V	Ignition switch ON and OFF
	15	BLK/RED	Power source	10 – 14 V	Ignition switch ON
	16	BLU/RED	ISC actuator relay	0 – 1.0 V	Ignition switch ON
	17	PPL/WHT	Malfunction indicator lamp	0 – 2.0 V	Ignition switch ON
				10 – 14 V	When engine running
	18	—	Blank	—	—
	19	BLU/RED	Heater of H02S-2	10 – 14 V	Ignition switch ON
	20	BLU	Radiator fan control relay	10 – 14 V	Ignition switch ON, Engine coolant temp: Below 91.5°C (197°F)
				0.3 – 1.0 V	Ignition switch ON, Engine coolant temp: 96.0°C (205°F) or higher
	21	GRN	Fuel pump relay	0 – 1.3 V	For 2 seconds after ignition switch ON
				10 – 14 V	After the above time
	22	BLU/BLK	Main relay	0.4 – 1.5 V	Ignition switch ON
	23	ORN	A/C compressor magnet clutch relay	10 – 14 V	Ignition switch ON
	24	GRN/RED	ISC actuator	—	—
	25	WHT/BLK	EFE heater relay	10 – 14 V	Ignition switch ON
	26	BLK/YEL	Ground	—	—

	TER-MINAL	WIRE COLOR	CIRCUIT	STANDARD VOLTAGE	CONDITION
CONNECTOR "E23"	1	WHT/GRN	Power source for sensor	4.75 – 5.25 V	Ignition switch ON
	2	WHT	Camshaft position sensor (+)	—	—
	3	PNK	Crankshaft position sensor (+)	—	—
	4	YEL/RED	Closed throttle position switch (In ISC actuator)	0 – 1 V	Ignition switch ON, ISC actuator plunger is in contact with throttle lever screw
				4 – 6 V	Ignition switch ON Plunger is apart from throttle lever screw
	5	LT GRN/ RED	Manifold absolute pressure sensor	3.3 – 4.0 V	Ignition switch ON Barometric pressure: 100 kPa, 760 mmHg
	6	GRY	Throttle position sensor	0.2 – 1.0 V	Ignition switch ON Throttle valve at idle position
				2.8 – 4.8 V	Ignition switch ON Throttle valve at full open position
	7	YEL/GRN	Engine coolant temp. sensor	0.55 – 0.95 V	Ignition switch ON Engine coolant temp.: 80°C (176°F)
	8	YEL	Heater of H02S-1	10 – 14 V	Ignition switch ON
	9	BRN/WHT	Ground for sensors	—	—
	10	BLK	Camshaft position sensor (–)	—	—
	11	BLU	Crankshaft position sensor (–)	—	—
	12	RED/WHT	EFE heater monitor	0 – 1 V	Heater relay OFF
				10 – 14 V	Heater relay ON
	13	RED	Heated oxygen sensor-1	Refer to DTC flow chart	
	14	LT GRN	Intake air temp. sensor	2.0 – 2.7 V	Ignition switch ON Sensor ambient temp. (Intake air temp): 20°C (68°F)
	15	PNK/BLU	Electric load signal (–) (Blower fan switch signal)	0 – 2 V	Ignition switch ON Blower fan switch ON
				10 – 14 V	Ignition switch ON Blower fan switch OFF
	16	BLK/YEL	Engine start switch (Engine start signal)	6 – 12 V	While engine cranking
				0 – 1 V	Other than above

	TER-MINAL	WIRE COLOR	CIRCUIT	STANDARD VOLTAGE	CONDITION
CONNECTOR "E22"	1	BRN/YEL	Tachometer signal	0 – 1 V	Ignition switch ON
	2	PPL	Vehicle speed sensor	Indicator deflection repeated 0 V and 4 – 6 V	Ignition switch ON Front left tire turned slowly with front right tire locked
	3	—	Blank	—	—
	4	—	Blank	—	—
	5	—	Blank	—	—
	6	GRN/WHT	Stop lamp switch	0 V	Ignition switch ON, Stop lamp switch OFF
				10 – 14 V	Ignition switch ON, Stop lamp switch ON
	7	—	Blank	—	—
	8	BLU	Heated oxygen sensor-2	Refer to DTC flow chart	
	9	GRN/RED	A/C evaporator temp. sensor	—	—
	10	YEL/RED	Fuel level sensor (gauge)	0 – 2 V	Ignition switch ON, fuel tank fully filled
				4.5 – 7.5 V	Ignition switch ON, fuel tank emptied
	11	—	Blank	—	—
	12	WHT/BLK	Data link connector	10 – 14 V	Ignition switch ON
	13	—	Blank	—	—
	14	—	Blank	—	—
	15	—	Blank	—	—
	16	—	Blank	—	—
	17	—	Blank	—	—
	18	RED/WHT	Electric load signal (+)	0 –1 V	Ignition switch ON Headlight, small light and rear window defogger turned OFF
				10 – 14 V	Ignition switch ON Headlight, small light or rear window defogger turned ON
	19	LT GRN/ RED	A/C (input) signal	10 – 14 V	Ignition switch ON A/C switch OFF
				0 – 2 V	Ignition switch ON A/C switch ON
	20	BLK/WHT	Ignition switch	10 – 14 V	Ignition switch ON
	21	—	Blank	—	—
	22	BRN/WHT	Ground for sensor	—	—



1. ECM (PCM) coupler disconnected
2. Ohmmeter

RESISTANCE CHECK

1) Disconnect ECM (PCM) couplers from ECM (PCM) with ignition switch OFF.

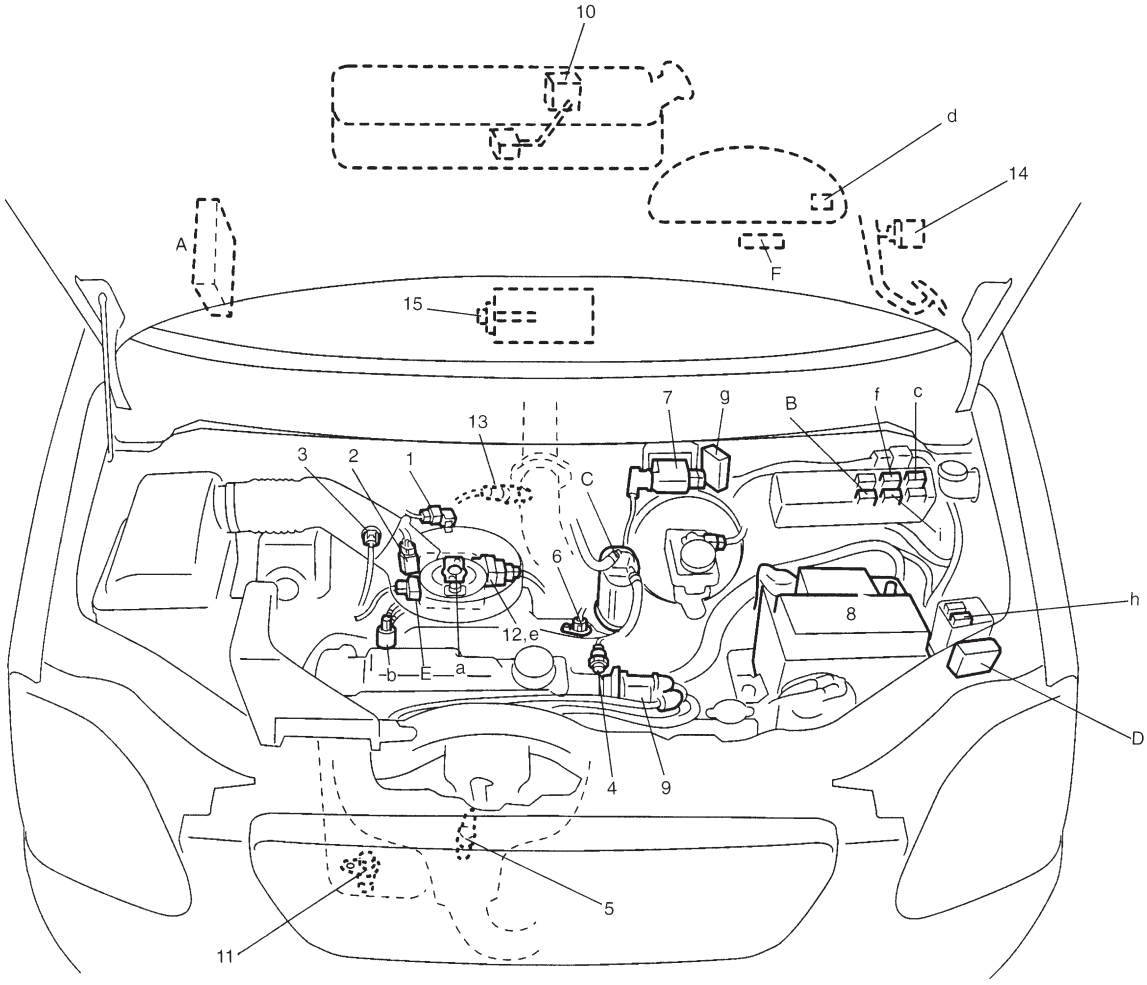
CAUTION:
Never touch terminals of ECM (PCM) itself or connect voltmeter or ohmmeter.

2) Check resistance between each terminal of couplers disconnected.

CAUTION:
- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn OFF ignition switch for this check.**
- **Resistance in table below represents that when parts temperature is 20°C (68°F).**

TERMINALS	CIRCUIT	STANDARD RESISTANCE
E23-8 to E22-20	H02S-1 heater	11.7 – 14.3 Ω
E21-19 to E22-20	H02S-2 heater	11.7 – 14.3 Ω
E21-12 to E21-2/15	Fuel injector	2.4 – 3.6 Ω
E21-7 to E21-2/15	EVAP canister purge valve	30 – 34 Ω
E21-21 to E22-20	Fuel pump relay	100 – 120 Ω
E21-16 to E21-2/15	ISC actuator relay	100 – 120 Ω
E21-25 to E21-2/15	EFE heater relay	100 – 120 Ω
E21-20 to E21-2/15	Radiator fan control relay	100 – 120 Ω
E21-22 to E21-14	Main relay	100 – 120 Ω
E21-1 to Body ground	Ground	Continuity
E21-13 to Body ground	Ground	Continuity
E21-26 to Body ground	Ground	Continuity

COMPONENT LOCATION



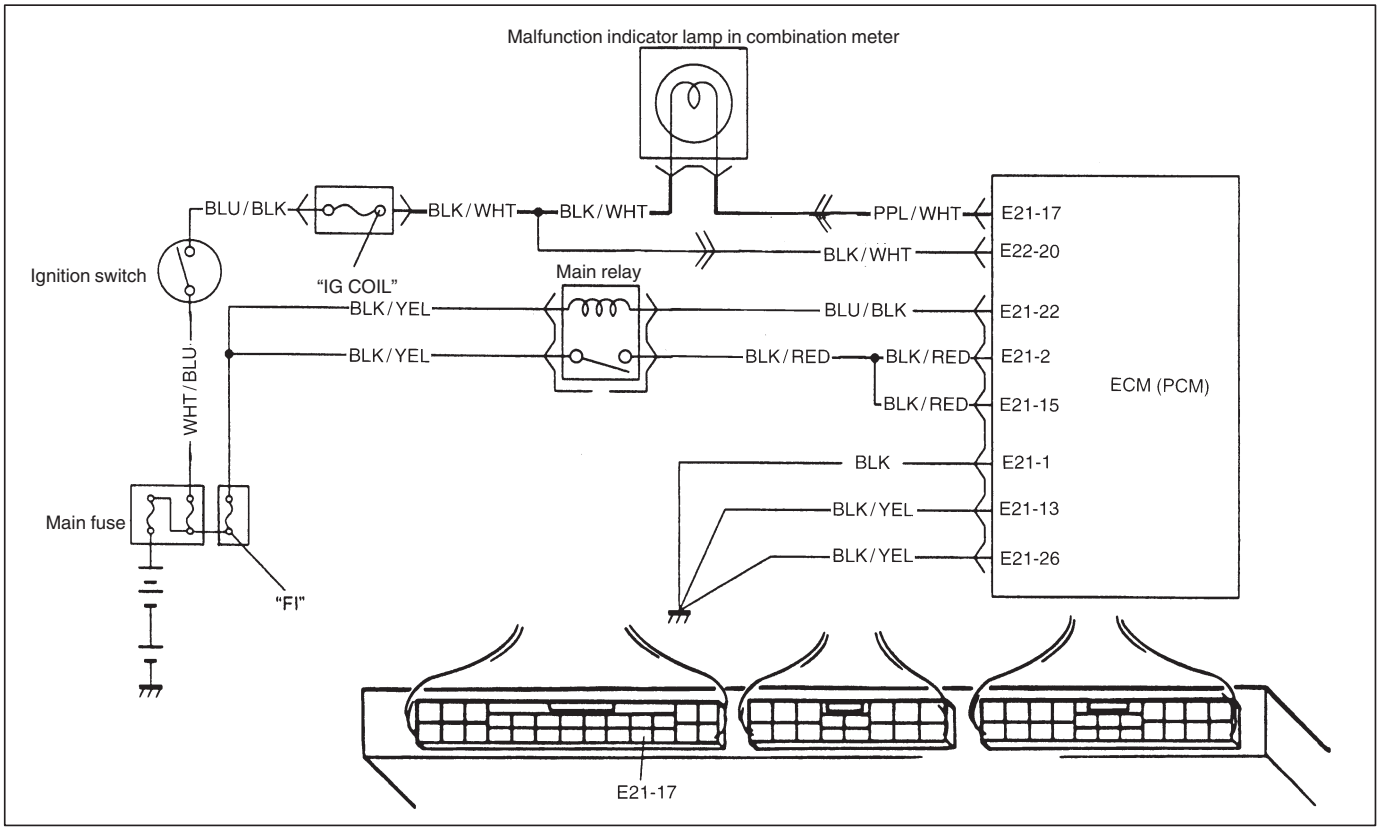
INFORMATION SENSORS
1. MAP sensor
2. TP sensor
3. IAT sensor
4. ECT sensor
5. Heated oxygen sensor-1
6. VSS
7. Ignition coil
8. Battery
9. CMP sensor (in Distributor)
10. Fuel level sensor (gauge) (in fuel tank)
11. CKP sensor
12. CTP switch (in ISC actuator)
13. Heated oxygen sensor-2
14. Stop lamp switch
15. A/C EVAP temp. sensor (if equipped)

CONTROL DEVICES
- a: Fuel injector
- b: EVAP canister purge valve
- c: Fuel pump relay
- d: Malfunction indicator lamp
- e: ISC actuator
- f: Radiator fan control relay
- g: Igniter
- h: EFE heater relay
- i: ISC actuator relay

OTHERS
- A: ECM (PCM)
- B: Main relay
- C: EVAP canister
- D: Injector resistor
- E: EFE heater
- F: Data link connector

TABLE A-1 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP DOES NOT COME "ON" AT IGNITION SWITCH ON (BUT ENGINE AT STOP)

CIRCUIT DESCRIPTION



When the ignition switch is turned ON, ECM (PCM) causes the main relay to turn ON (close the contact point). Then, ECM (PCM) being supplied with the main power, turns ON the malfunction indicator lamp (MIL). When the engine starts to run and no malfunction is detected in the system, MIL goes OFF but if a malfunction was or is detected, MIL remains ON even when the engine is running.

INSPECTION

STEP	ACTION	YES	NO
1	MIL Power Supply Check 1) Turn ignition switch ON. Do other indicator/warning lights in combination meter comes ON?	Go to Step 2.	"IG COIL" fuse blown, main fuse blown, ignition switch malfunction, "BLK/WHT" circuit between "IG COIL" fuse and combination meter or poor coupler connection at combination meter.
2	ECM (PCM) Power and Ground Circuit Check Does engine start?	Go to Step 3.	Go to TABLE A-3 ECM (PCM) POWER AND GROUND CIRCUIT CHECK. If engine is not cranked, go to DIAGNOSIS in SECTION 6G.
3	MIL Circuit Check 1) Turn ignition switch OFF and disconnect connectors from ECM (PCM). 2) Check for proper connection to ECM (PCM) at terminal E21-17. 3) If OK, then using service wire, ground terminal E21-17 in connector disconnected. Does MIL turn on at ignition switch ON?	Substitute a known-good ECM (PCM) and recheck.	Bulb burned out or "PPL/WHT" wire circuit open.

TABLE A-2 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – LAMP REMAINS "ON" AFTER ENGINE STARTS

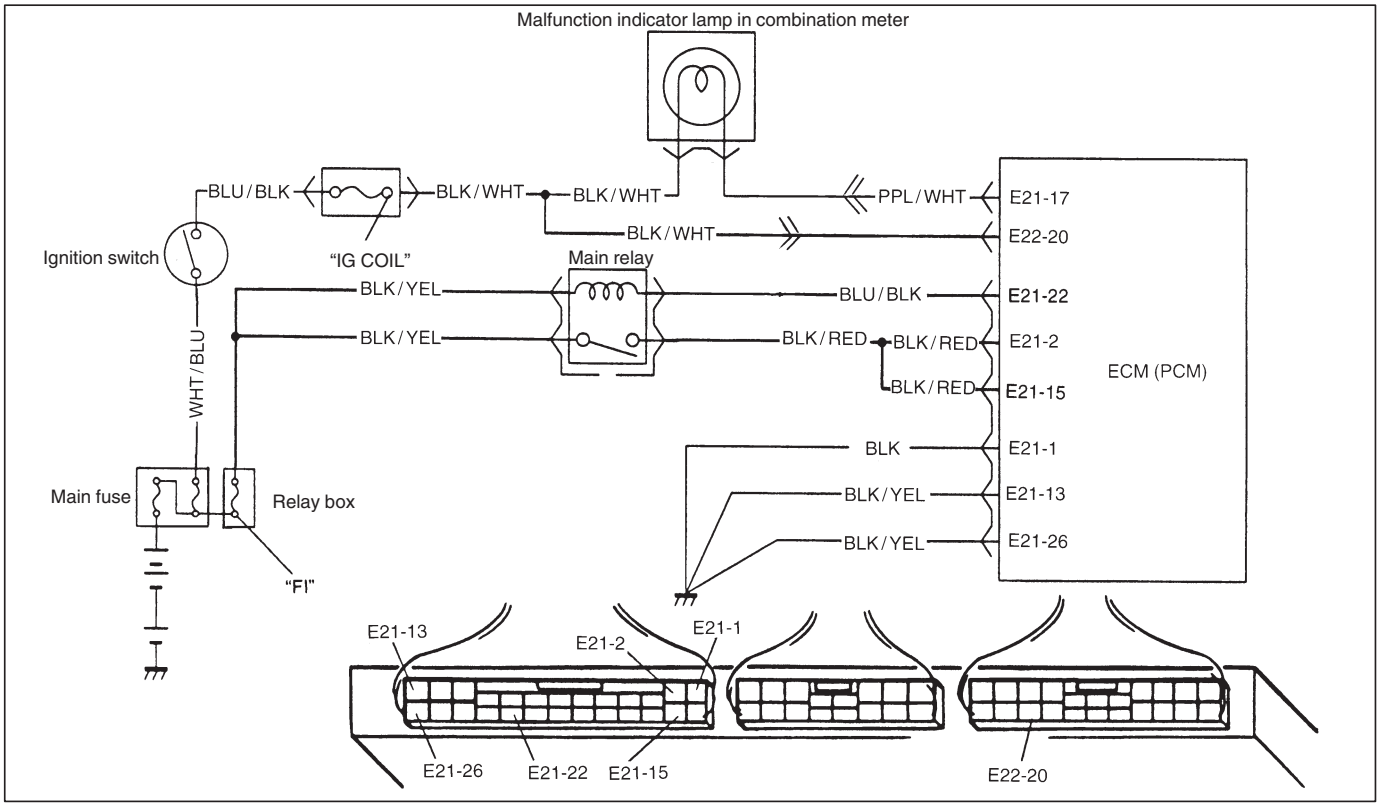
WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to table A-1.

INSPECTION

STEP	ACTION	YES	NO
1	Diagnostic Trouble Code (DTC) check 1) Check DTC referring to DTC CHECK section. Is there any DTC(s)?	Go to Step 2 of ENGINE DIAG. FLOW TABLE.	Go to Step 2.
2	DTC check Start engine and recheck DTC while engine running. Is there any DTC(s)?		Go to Step 3.
3	MIL Circuit check 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM (PCM). Does MIL turn ON at ignition switch ON?	"PPL/WHT" wire circuit shorted to ground.	Substitute a known-good ECM (PCM) and recheck.

TABLE A-3 ECM (PCM) POWER AND GROUND CIRCUIT CHECK – MIL DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP

CIRCUIT DESCRIPTION



When the ignition switch tuned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM (PCM).

INSPECTION

STEP	ACTION	YES	NO
1	Main Relay Operating Sound Check Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	Main Relay Check 1) Turn OFF ignition switch and remove main relay (1). 2) Check for proper connection to main relay (1) at terminal C and D. 3) Check resistance between each two terminals. See Fig. 1 and 2. Between terminals A and B: Infinity Between terminals C and D: 100 – 120 Ω 4) Check that there is continuity between terminals A and B when battery is connected to terminals C and D. See Fig. 3. Is main relay in good condition?	Go to Step 3.	Replace main relay.
3	Fuse Check Is "FI" fuse (2) in good condition? See Fig. 4.	Go to Step 4.	Check for short in circuits connected to this fuse.
4	ECM (PCM) Power Circuit Check 1) Turn OFF ignition switch, disconnect connectors from ECM (PCM) and install main relay. 2) Check for proper connection to ECM (PCM) at terminals E22-20, E21-2, E21-15 and E21-22. 3) If OK, then measure voltage between terminal E22-20 and ground, E21-22 and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	"BLK/WHT", "BLK/YEL" or "BLU/BLK" circuit open.

STEP	ACTION	YES	NO
5	ECM (PCM) Power Circuit Check 1) Using service wire, ground terminal E21-22 and measure voltage between terminal E21-2 and ground at ignition switch ON. Is it 10 – 14 V?	Check ground circuits "BLK" and "BLK/YEL" for open. If OK, then substitute a known-good ECM (PCM) and recheck.	Go to Step 6.
6	Is operating sound of main relay heard in Step 1?	Go to Step 7.	"BLK/YEL" or "BLK/RED" wire open.
7	Main Relay Check 1) Check main relay according to procedure in Step 2. Is main relay in good condition?	"BLK/YEL" or "BLK/RED" wire open.	Replace main relay.

Fig. 1 for Step 2

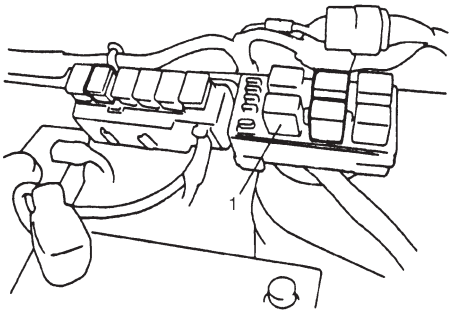


Fig. 2 for Step 2

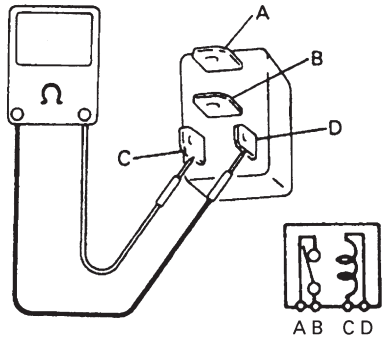


Fig. 3 for Step 2

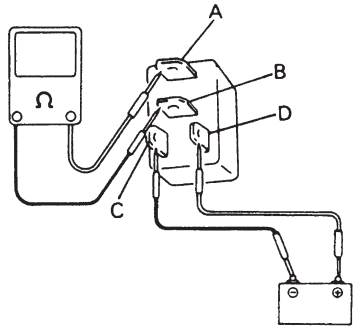
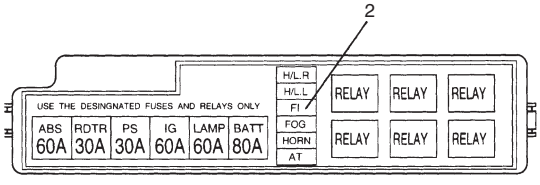
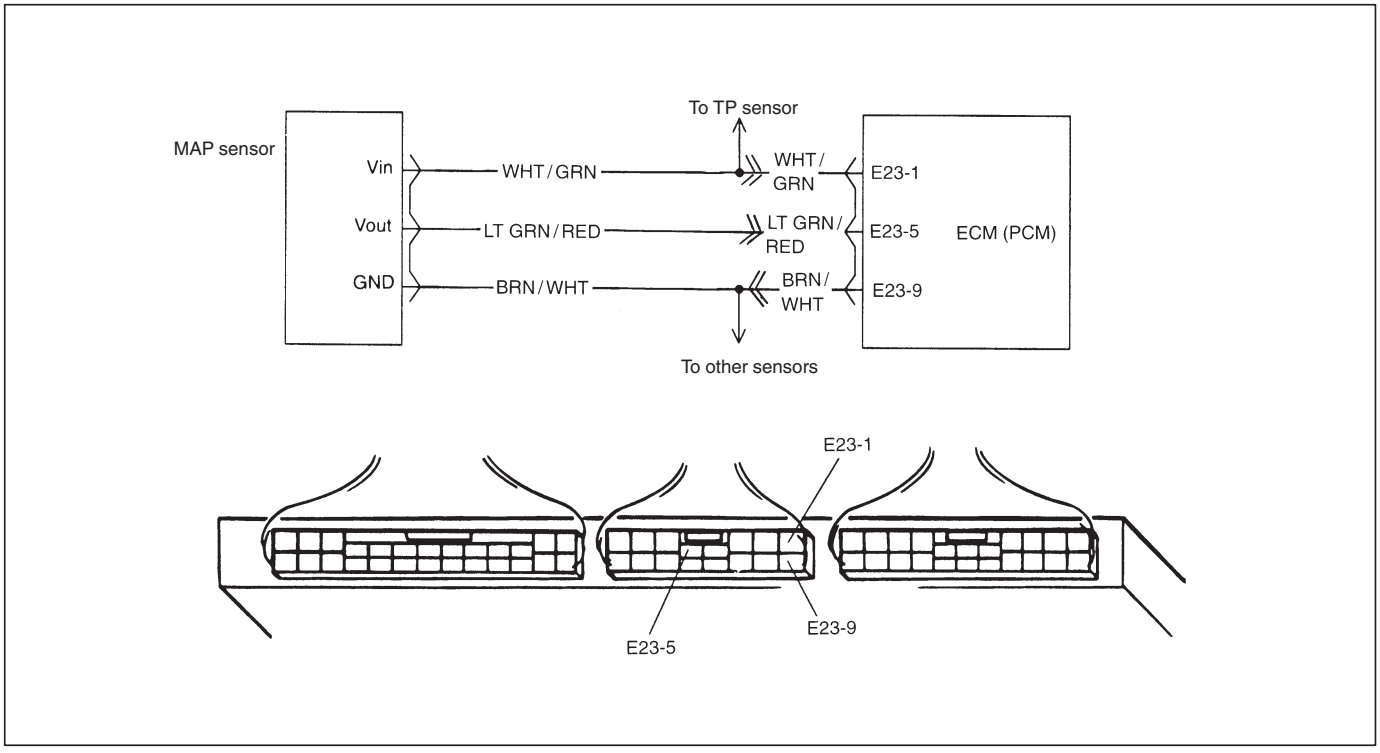


Fig. 4 for Step 3



DTC P0105 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● MAP: 5 kPa, 37.5 mmHg or less (Low pressure – High vacuums – Low voltage) or ● MAP: 130 kPa, 975 mmHg or more (High pressure – Low vacuums – High voltage)	● "BRN/WHT" circuit open ● "WHT/GRN" circuit open or shorted to ground ● "LT GRN/RED" circuit open or shorted to ground ● MAP sensor malfunction ● ECM (PCM) malfunction

NOTE:

- **When DTC P0105, and/or P0120, P0510 are indicated together, it is possible that "WHT/GRN" circuit is open.**
- **When DTC P0105, P0110, P0115 and/or P0120 are indicated together, it is possible that "BRN/WHT" circuit is open.**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check MAP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake manifold pressure. See Fig. 1. Is it 130 kPa or more or 5 kPa or less?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “INTERMITTENT AND POOR CONNECTION” in Section 0A.
3	Check Wire Harness. 1) Disconnect MAP sensor connector with ignition switch OFF. 2) Check for proper connection of MAP sensor at “LT GRN/RED” and “BRN/WHT” wire terminals. 3) If OK, then with ignition switch ON, check voltage at each of “WHT/GRN” and “LT GRN/RED” wire terminals. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	“WHT/GRN” wire open or shorted to ground circuit or shorted to power circuit, “LT GRN/RED” wire open or shorted to ground, poor E23-5 connection or E23-1 connection. If wire and connection are OK, confirm that MAP sensor is normal and then substitute a known-good ECM (PCM) and recheck. **NOTE: When battery voltage is applied to “WHT/GRN” wire, it is possible that MAP sensor is also faulty.**
4	Check MAP sensor according to “MAP Sensor Individual Check” in Section 6E1. Is it in good condition?	“WHT/GRN” wire shorted to “LT GRN/RED” wire, “BRN/WHT” wire open, poor E23-9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace MAP sensor.

Fig. 1 for Step 2

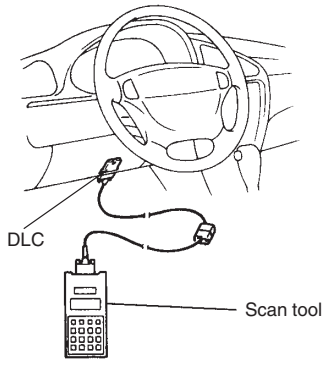
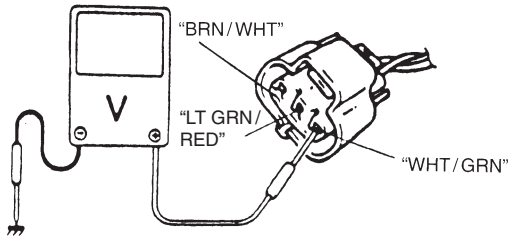
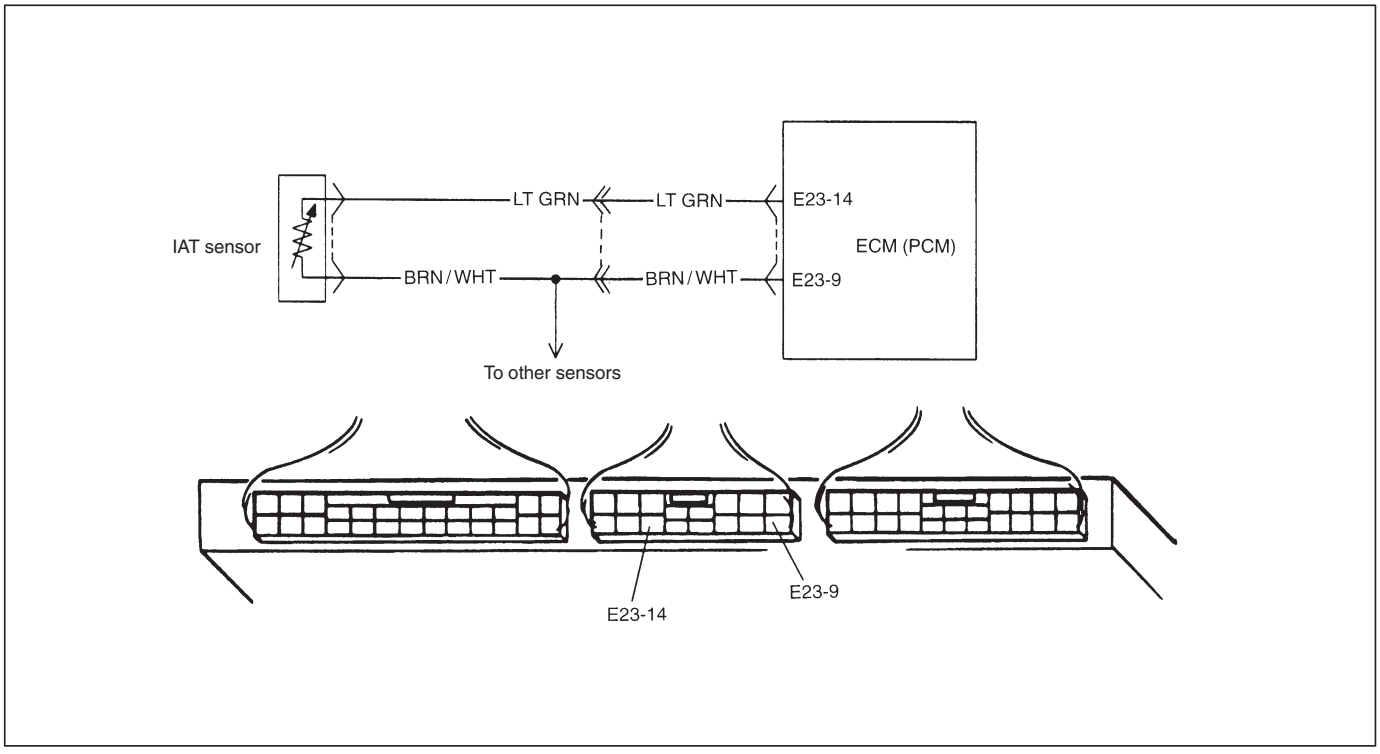


Fig. 2 for Step 3



DTC P0110 INTAKE AIR TEMP. (IAT) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low intake air temperature (High voltage-High resistance) or ● High intake air temperature (Low voltage-Low resistance)	● "LT GRN" circuit open or shorted to power ● "BRN/WHT" circuit open ● IAT sensor malfunction ● ECM (PCM) malfunction

NOTE:

- **When DTC P0105, P0110, P0115 and P0120 are indicated together, it is possible that "BRN/WHT" circuit is open.**
- **Before inspecting, be sure to check that ambient temperature is higher than –40°C (–40°F).**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode no scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check IAT Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake air temp. displayed on scan tool. See Fig. 1. Is –40°C (–40°F) or 119°C (246°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check Wire Harness. 1) Disconnect IAT sensor connector with ignition switch OFF. 2) Check for proper connection to IAT sensor at “BRN/WHT” and “LT GRN” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “LT GRN” wire terminal about 4 – 6 V? See Fig. 2.	Go to Step 4.	“LT GRN” wire open or shorted to power, or poor E23-14 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
4	Does scan tool indicate –40°C (–40°F) at Step 2.	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Check intake air temp. displayed on scan tool with ignition switch ON. Is –40°C (–40°F) indicated?	Replace IAT sensor.	“LT GRN” wire shorted to ground. If wire is OK, substitute a known-good ECM (PCM) and recheck.
6	Check Wire Harness. 1) Using service wire, connect IAT sensor connector terminals. 2) Check intake air temp. displayed on scan tool with ignition switch ON. See Fig. 3. Is 119°C (246°F) indicated?	Replace IAT sensor.	“BRN/WHT” wire open or poor E23-9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

Fig. 1 for Step 2

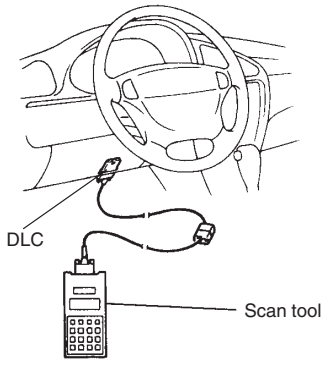


Fig. 2 for Step 3

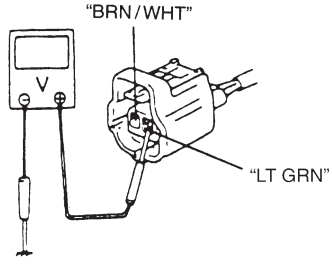
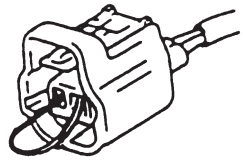
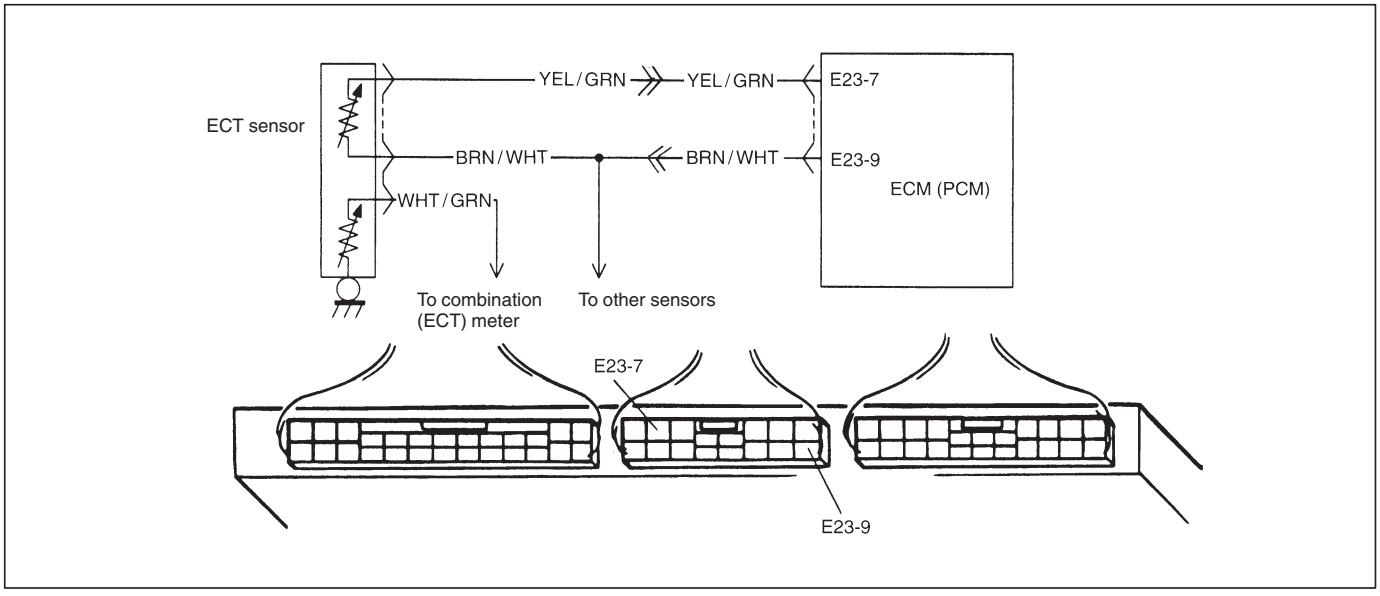


Fig. 3 for Step 6



DTC P0115 ENGINE COOLANT TEMPERATURE (ECT) CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low engine coolant temperature (High voltage-High resistance) or ● High engine coolant temperature (Low voltage-Low resistance)	● "YEL/GRN" circuit open or shorted to power ● "BRN/WHT" circuit open ● ECT sensor malfunction ● ECM (PCM) malfunction

NOTE:
Before inspecting, be sure to check that coolant temp. meter in combination meter indicates normal operating temperature (Engine is not overheating).

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check ECT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. See Fig. 1. Is –40°C (–40°F) or 119°C (246°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0 A.
3	Check Wire Harness. 1) Disconnect ECT sensor connector with ignition switch OFF. 2) Check for proper connection to ECT sensor at “YEL/GRN” and “BRN/WHT” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “YEL/GRN” wire terminal about 4 – 6 V? See Fig. 2.	Go to Step 4.	“YEL/GRN” wire open or shorted to power, or poor E23-7 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate –40°C (–40°F) at Step 2.	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Check engine coolant temp. displayed on scan tool with ignition switch ON. Is –40°C (–40°F) indicated?	Replace ECT sensor.	“YEL/GRN” wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire, connect ECT sensor connector terminals. See Fig. 3. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 119°C (246°F) indicated?	Replace ECT sensor.	“BRN/WHT” wire open or poor E23-9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

Fig. 1 for Step 2

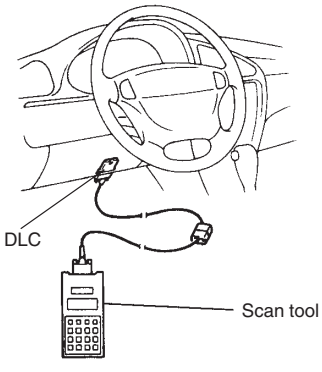


Fig. 2 for Step 3

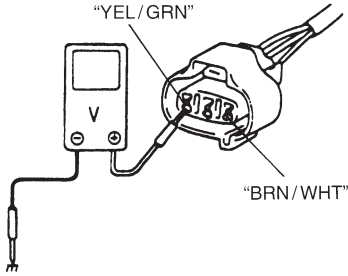
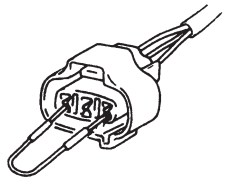
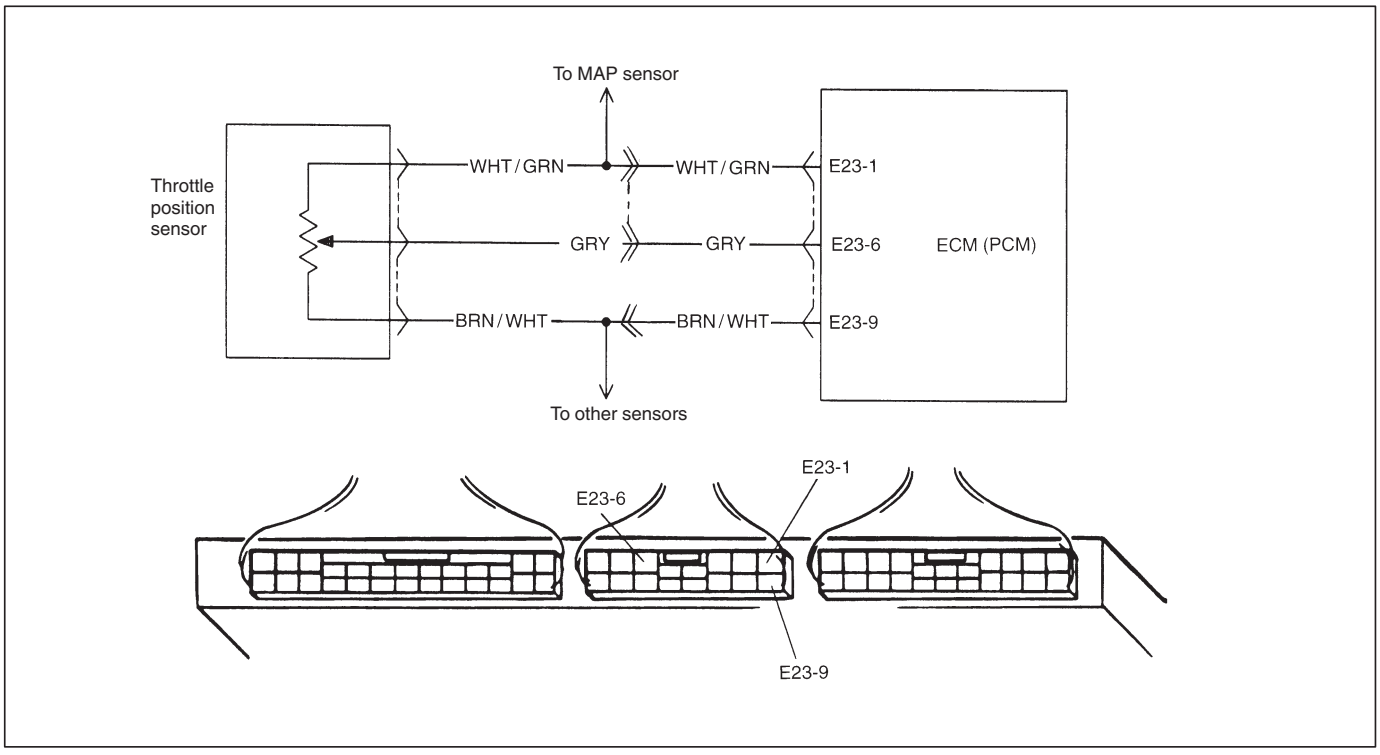


Fig. 3 for Step 6



DTC P0120 THROTTLE POSITION CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Signal voltage high or ● Signal voltage low	● "BRN/WHT" circuit open ● "GRY" circuit open or shorted to ground ● "WHT/GRN" circuit open or shorted to power or ground ● TP sensor malfunction ● ECM (PCM) malfunction

NOTE:

- **When DTC P0105, P0110, P0115 and/or P0120 are indicated together, it is possible that "BRN/WHT" circuit is open.**
- **When DTC P0105, P0120 and/or P0510 are indicated together it is possible that "WHT/GRN" circuit is open.**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check TP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF and then turn ignition switch ON. 2) Check throttle valve opening percentage displayed on scan tool. See Fig. 1. Is it displayed 2% or less? 3) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. See Fig. 1. Is it displayed 96% or higher?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0 A.
3	Check Wire Harness. 1) Disconnect connector from TP sensor with ignition switch OFF. 2) Check for proper connection to TP sensor at “WHT/GRN”, “GRY” and “BRN/WHT” wire terminals. 3) If OK, then with ignition switch ON, check voltage at each of “WHT/GRN” and “GRY” wire terminals. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	“WHT/GRN” wire open, “WHT/GRN” wire shorted to ground circuit or power circuit or “BRN/WHT” wire, “GRY” wire open or shorted to ground circuit or poor E23-1 or E23-6 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
4	Check TP Sensor. 1) Check resistance between terminals of TP sensor. See Fig. 3. Between 1 and 4: 2.87 – 5.33 kΩ Between 1 and 3: 100 Ω – 20 kΩ, varying according to throttle valve opening. Are measured values within specifications?	“BRN/WHT” wire open or poor E23-9 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. 1 for Step 2

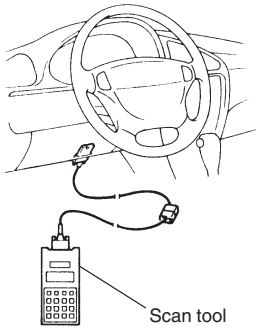


Fig. 2 for Step 3

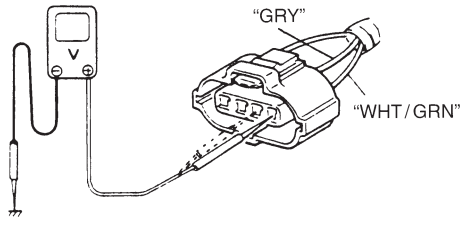
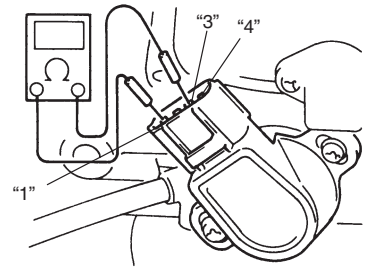
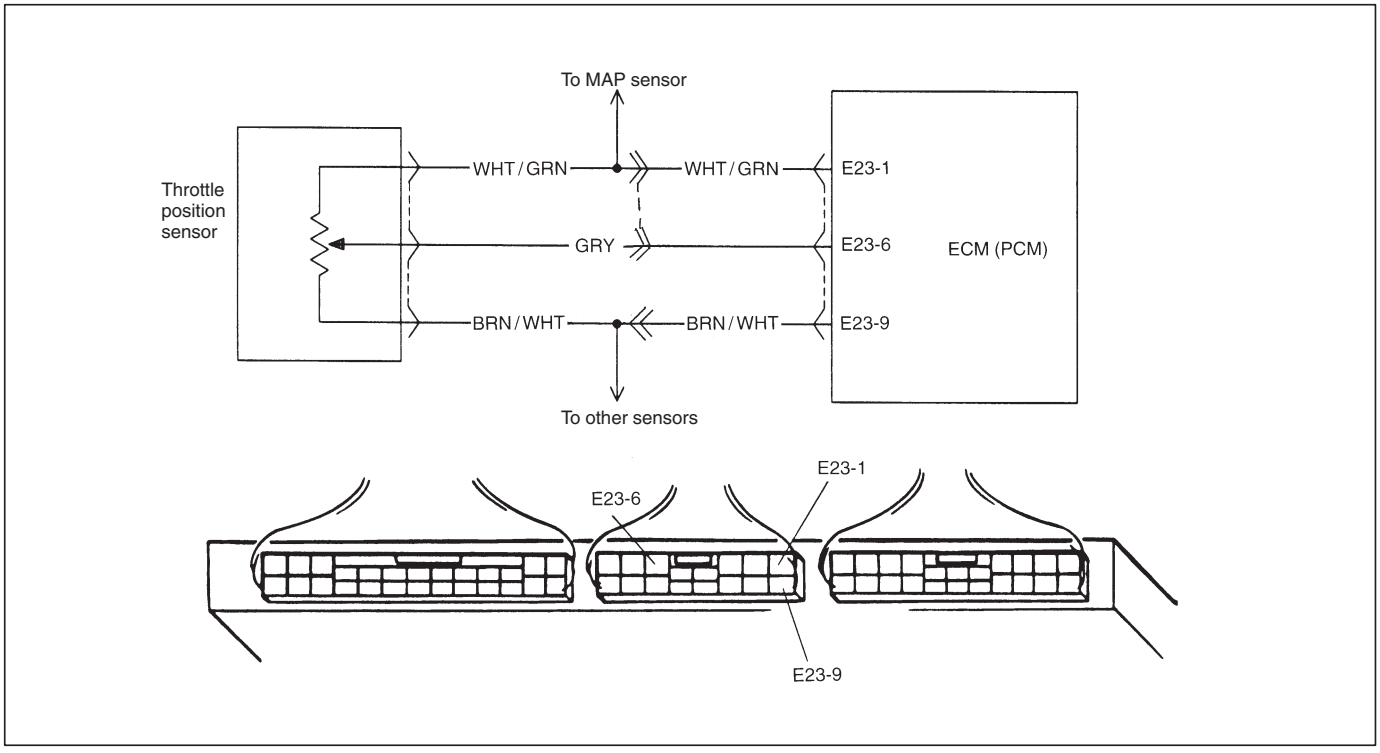


Fig. 3 for Step 4



DTC P0121 THROTTLE POSITION CIRCUIT RANGE/PERFORMANCE PROBLEM

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● After engine warmed up. ● While vehicle running at specified engine speed. ● No change in intake manifold pressure (constant throttle opening) ● Difference between actual throttle opening (detected from TP sensor) and opening calculated by ECM (PCM) (Obtained on the basis of engine speed and intake manifold pressure) in larger than specified value. ⁎ 2 driving cycle detection logic, continuous monitoring	● TP sensor malfunction ● High resistance in the circuit ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – Engine coolant temp.: 70 – 110°C, 158 – 230°F
2) Warm up engine to normal operating temperature.
3) Increase vehicle speed to 30 – 40 mph, 50 – 60 km/h in 3rd gear or “D” range and hold throttle valve at that opening position for 1 min.
4) Stop vehicle.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check TP Sensor and Its Circuit. 1) Turn ignition switch OFF and connect SUZUKI scan tool to DLC. 2) Turn ignition switch ON and check TP sensor output voltage when throttle valve is at idle position and fully opened. See Fig. 1 and 2. Dose voltage vary within specified value linearly as shown in figure?	If voltmeter was used, check terminal E23-6 for poor connection. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	Check TP Sensor. 1) Turn ignition switch OFF. 2) Disconnect TP sensor connector. 3) Check for proper connection to TP sensor at each terminal. 4) If OK, then measure resistance between terminals and check if each measured value is as specified below. See Fig. 3. Between 1 and 4: 2.87 – 5.33 kΩ Between 1 and 3: 100 Ω – 20 kΩ, varying according to throttle valve opening. Are measured values as specified?	High resistance in “WHT/GRN”, “GRY” or “BRN/WHT” circuit. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. 1 for Step 2

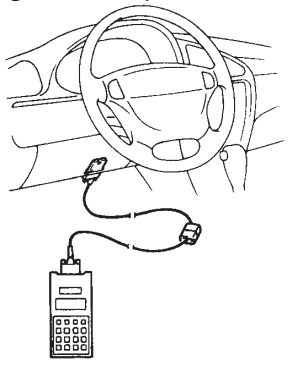


Fig. 2 for Step 2

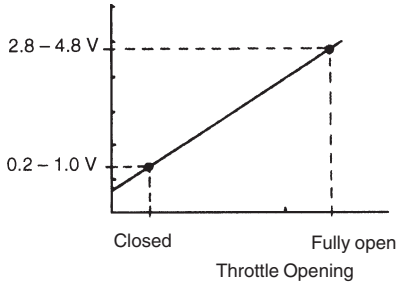
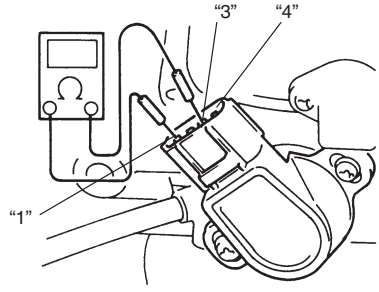
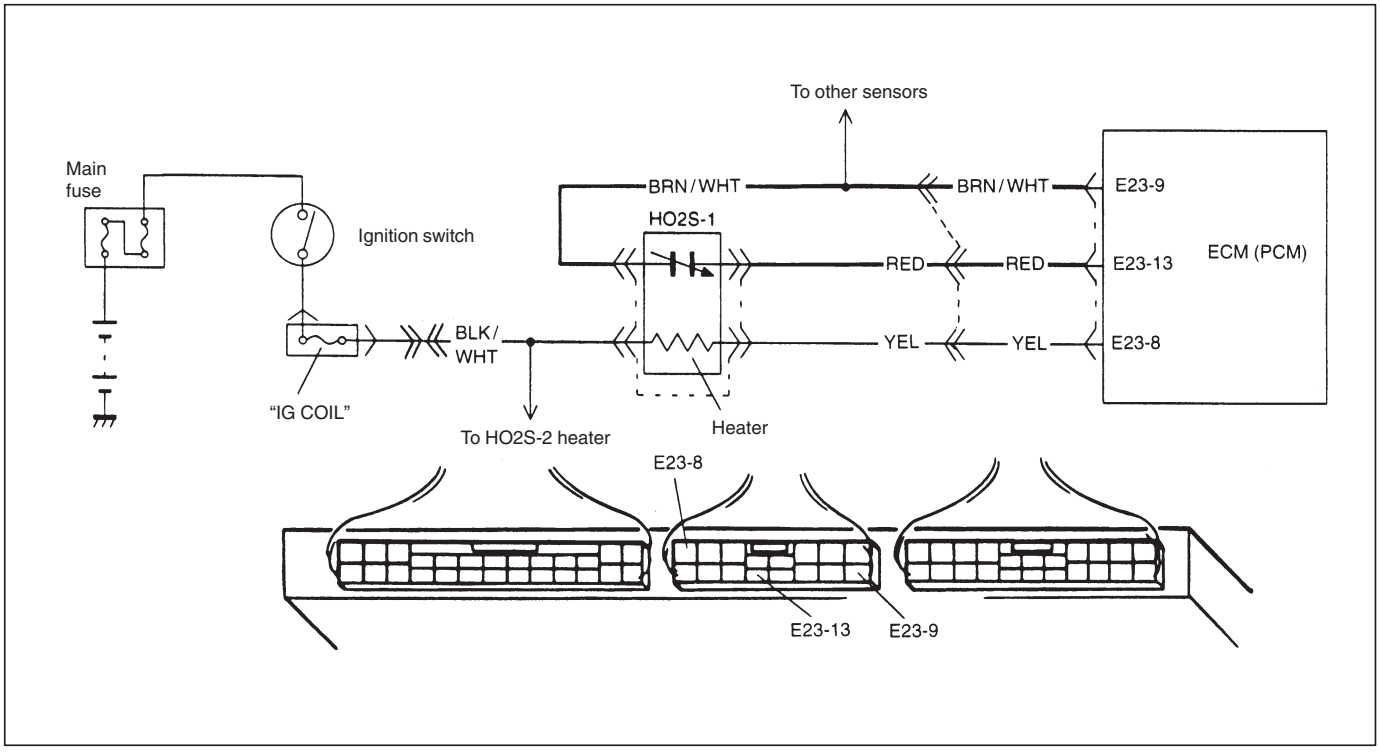


Fig. 3 for Step 3



DTC P0130 HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (SENSOR-1)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● When running at idle speed after engine warmed up and running at specified vehicle speed, HO2S-1 output voltage does not go below 0.3 V or over 0.6 V. ✳ 2 driving cycle detection logic, Monitoring once/1 driving.	● Heated oxygen sensor-1 malfunction ● "RED" or "BRN/WHT" circuit open (poor connection) or short

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
2) Warm up engine to normal operating temperature.
3) Drive vehicle at 30 – 40 mph, 50 – 60 km/h for 2 min.
4) Stop vehicle and run engine at idle for 2 min.
5) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than HO2S-1 (DTC P0130)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1 and 2. Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Check “RED” and “BRN/WHT” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-1.

Fig. 1 for Step 3

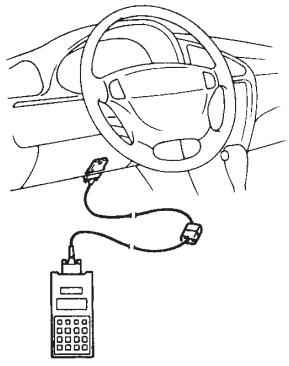
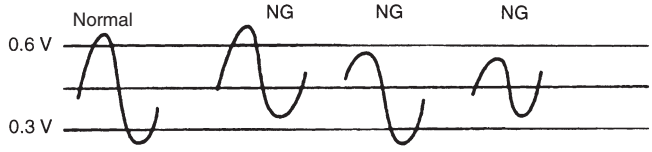


Fig. 2 for Step 3

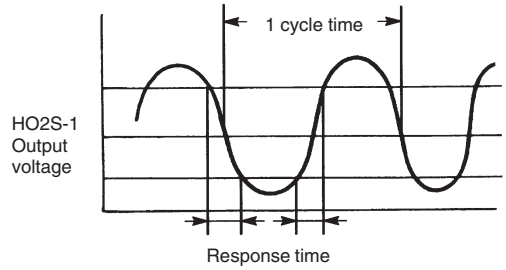


DTC P0133 HEATED OXYGEN SENSOR (HO2S) CIRCUIT SLOW RESPONSE (SENSOR-1)

WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to DTC P0130 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● When running at specified idle speed after engine warmed up and running at specified vehicle speed, response time (time to change from lean to rich or from rich to lean) of HO2S-1 output voltage is about 1 sec. at minimum or average time of 1 cycle is 5 sec. at minimum. See. Fig. 1 ⁎ 2 driving cycle detection logic, Monitoring once/1 driving.	● Heated oxygen sensor-1 malfunction

Fig. 1



DTC CONFIRMATION PROCEDURE – Refer to DTC P0130 section.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC(s) other than HO2S-1 (DTC P0133)?	Go to applicable DTC Diag. Flow Table.	Replace HO2S-1.

DTC P0134 HEATED OXYGEN SENSOR (HO2S) CIRCUIT NO ACTIVITY DETECTED (SENSOR-1)

WIRING DIAGRAM/CIRCUIT DESCRIPTION – Refer to DTC P0130 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Engine warmed up. ● While running under other than high load and high engine speed conditions or at specified idle speed (engine is in closed loop condition), HO2S-1 output voltage is high or low continuously. ✳ 2 driving cycle detection logic, Continuous monitoring.	● "RED" or "BRN/WHT" circuit open or short ● Heated oxygen sensor malfunction ● Fuel system malfunction ● Exhaust gas leakage

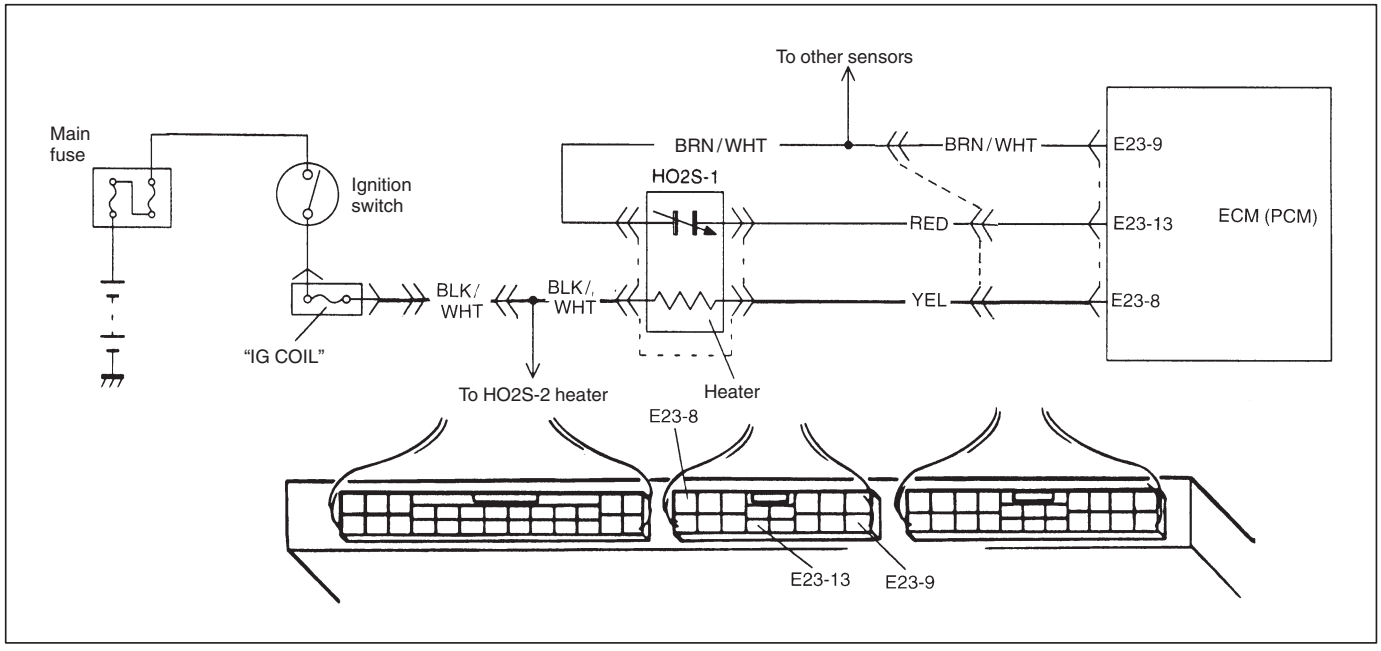
DTC CONFIRMATION PROCEDURE – Refer to DTC P0130 section.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there DTC(s) other than Fuel system (DTC P0171/P0172) and HO2S-1 (DTC P0134)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Go to DTC P0171 and P0172 Diag. Flow Table (Fuel System Check).	Check "RED" and "BRN/WHT" wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-1.

DTC P0135 HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (SENSOR-1)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is met. A: ● Low voltage at terminal E23-8 when engine is running at high load. B: ● High voltage at terminal E23-8 when engine is running under condition other than above. ⁎ 2 driving cycle detection logic, Continuous monitoring.	● HO2S-1 heater circuit open or shorted to ground ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, start engine and keep it at idle for 1 min.
3) Start vehicle and depress accelerator pedal fully for 5 sec. or longer.
4) Stop vehicle.
5) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Heater for Operation. 1) Check voltage at terminal E23-8. See Fig. 1. 2) Warm up engine to normal operating temperature. 3) Stop engine. 4) Turn ignition switch ON and Check voltage at terminal E23-8. See Fig. 1. Voltage should be over 10 V. 5) Start engine, run it at idle and check voltage at the same terminal. Voltage should be below 1.9 V. Are check results are specified?	Intermittent trouble Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check Heater of Sensor-1. 1) Disconnect HO2S-1 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-1 at “BRN/WHT” and “YEL” wire terminals. 3) If OK, then check heater resistance. See Fig. 2. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	“YEL” wire open or shorted to ground or poor connection at E23-8. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-1.

Fig. 1 for Step 2

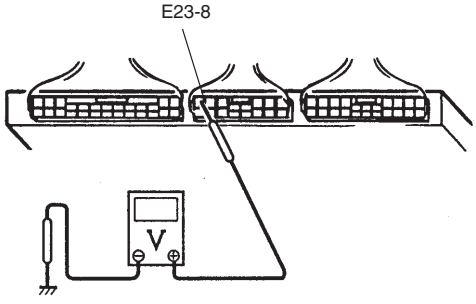
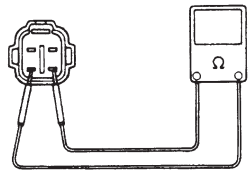
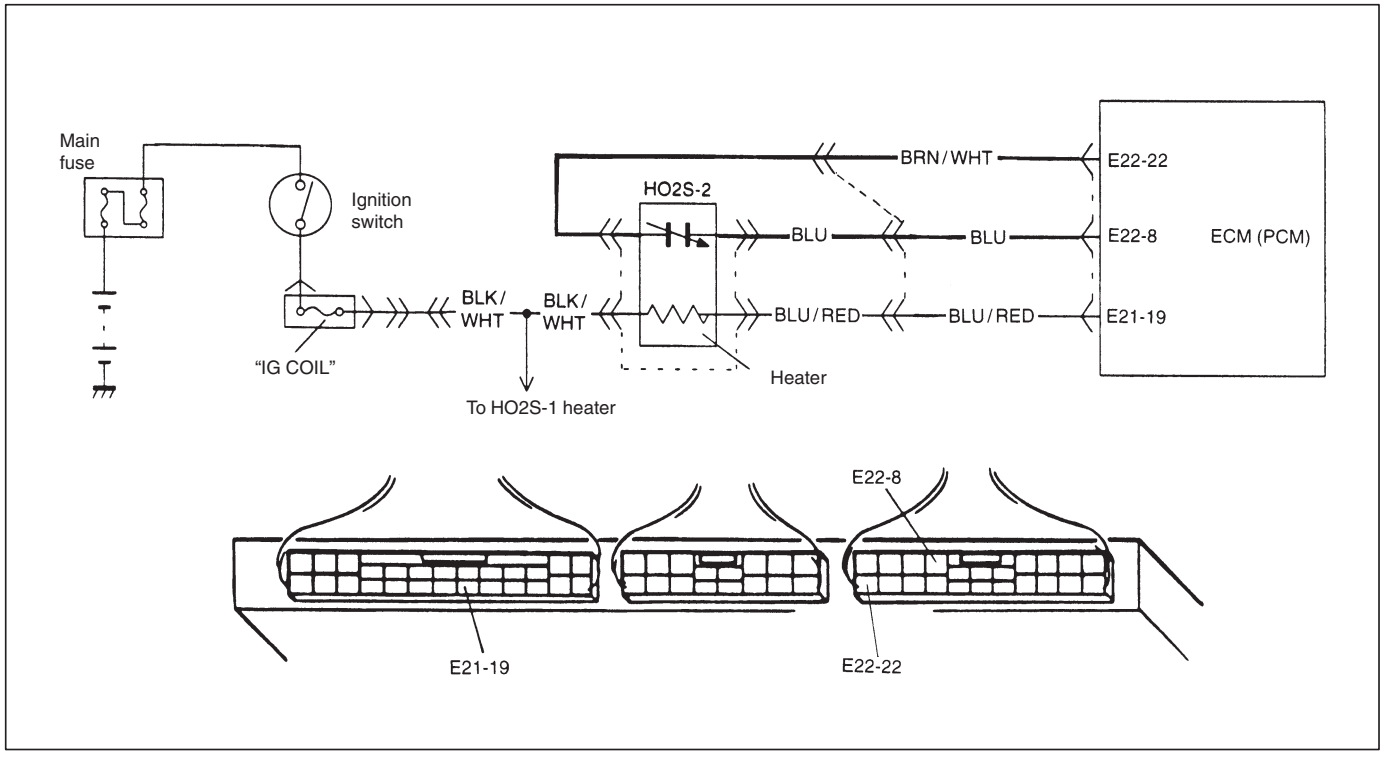


Fig. 2 for Step 3



DTC P0136 HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (SENSOR-2)

CIRCUIT DESCRIPTION

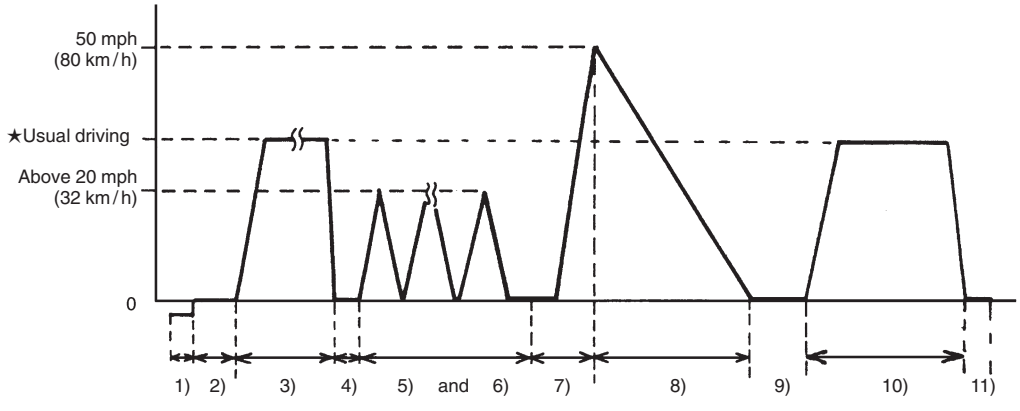


DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is detected. A. Max. output voltage of HO2S-2 is lower than specified value or Min. output voltage is higher than specified value while vehicle driving. B. Engine is warmed up and HO2S-2 voltage is 4.5 V or more. (circuit open) ✳ 2 driving cycle detection logic, monitoring once/1 driving.	● Exhaust gas leakage ● "BLU" or "BRN/WHT" circuit open or short ● Heated oxygen sensor-2 malfunction ● Fuel system malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – No exhaust gas leakage and loose connection
2) Warm up engine to normal operating temperature.
3) Drive vehicle under usual driving condition for 5 min. and check HO2S-2 output voltage and "short term fuel trim" with "Data List" mode on scan tool, and write it down.
4) Stop vehicle (don't turn ignition switch OFF).
5) Increase vehicle speed to higher than 20 mph, 32 km/h and then stop vehicle.
6) Repeat above steps 5) 4 times.
7) Increase vehicle speed to about 50 mph (80 km/h) in 3rd gear or 2 range.
8) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 10sec. or more.
9) Stop vehicle (don't turn ignition switch OFF) and run engine at idle for 2 min.
   After this step 9), if "Oxygen Sensor Monitoring TEST COMPLETED" is displayed in "READINESS TESTS" mode and DTC is not displayed in "DTC" mode, confirmation test is completed.
   If "TEST NOT COMPLTD" is still being displayed, proceed to next step 10).
10) Drive vehicle under usual driving condition for 10 min. (or vehicle is at a stop and run engine at idle for 10 min. or longer)
11) Stop vehicle (don't turn ignition switch OFF). Confirm test results according to "Test Result Confirmation Flow Table" in "DTC CONFIRMATION PROCEDURE" of DTC P0420.



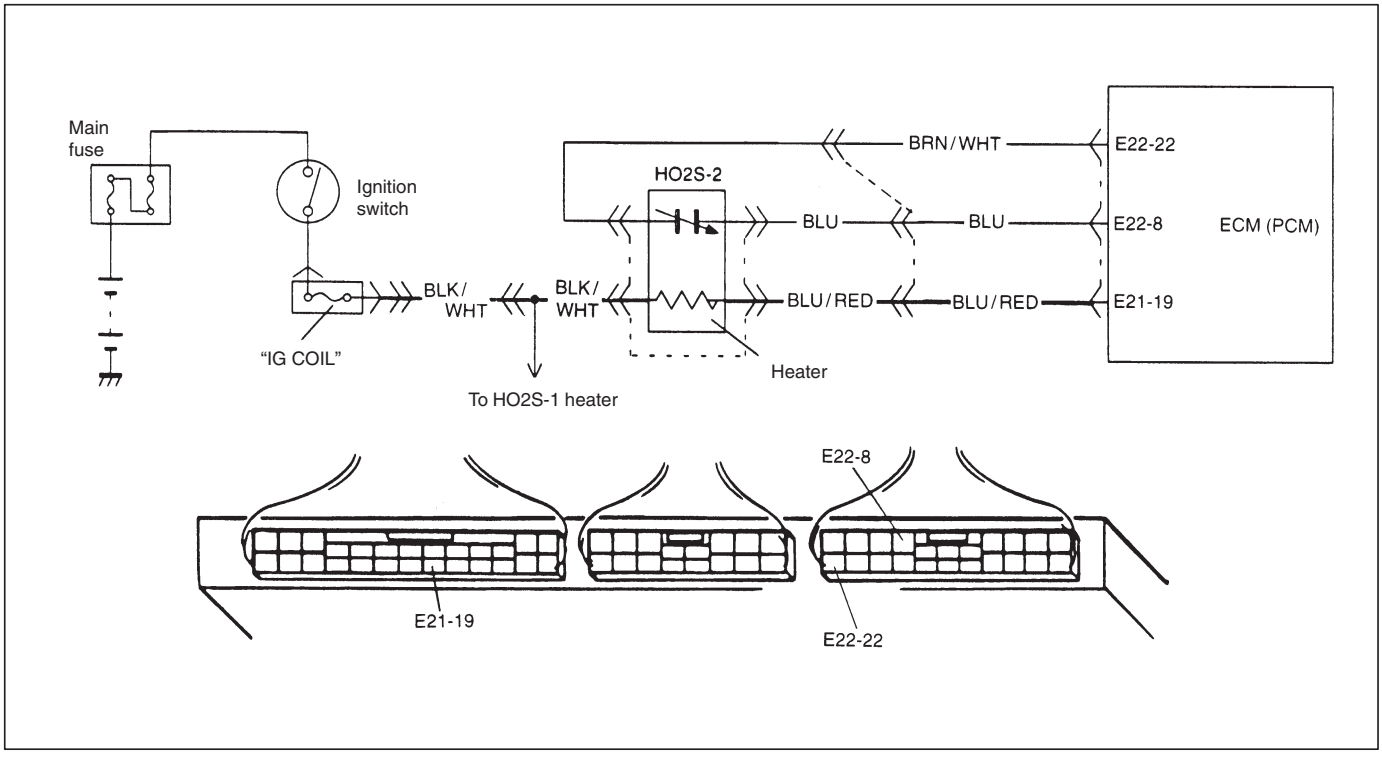
★Usual driving: Driving at 30 – 40 mph, 50 – 60 km/h including short stop according to traffic signal. (under driving condition other than high-load, high-engine speed, rapid accelerating and decelerating)

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check exhaust system for leakage, loose connection and damage. Is it good condition?	Go to Step 3.	Repair or replace.
3	Check HO2S-2 and Its Circuit. Was HO2S-2 output voltage indicated on scan tool in step 3) of DTC confirmation test less than 1.275 V?	Go to Step 4.	“BLU” or “BRN/WHT” circuit open or HO2S-2 malfunction.
4	Check Short Term Fuel Trim. Did short term fuel trim very within –20 – +20% range in step 3) of DTC confirmation test?	Check “BLU” and “BRN/WHT” wire for open and short, and connection for poor connection. If wire and connection are OK, replace HO2S-2.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table.

DTC P0141 HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (SENSOR-2)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition it met. A. Low voltage at terminal E21-19 for specified time after engine start or while engine running at high load. B. High voltage at terminal E21-19 while engine running under other than above condition. ⁎ 2 driving cycle detection logic, continuous monitoring.	● HO2S-2 heater circuit open or shorted to ground ● ECM (PCM) malfunction

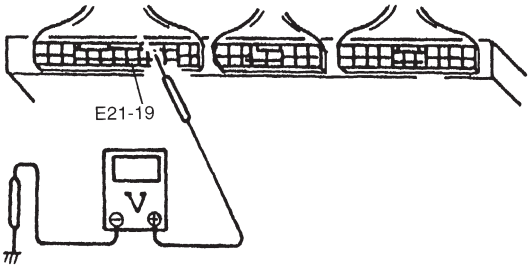
DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF once and then ON.
2) Clear DTC, start engine and warm up engine to normal operating temperature.
3) Keep it at 2000 r/min for 2 min.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

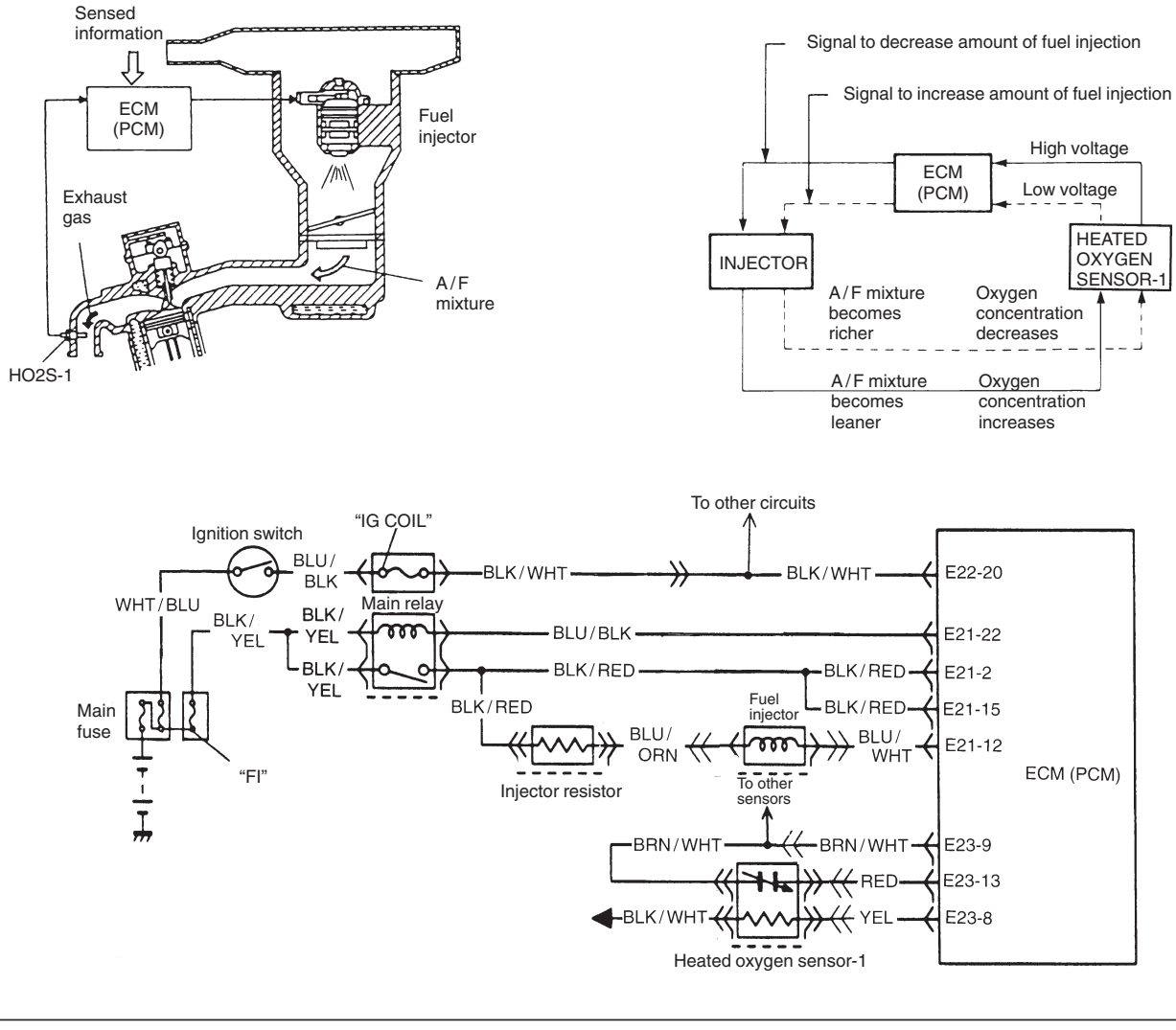
STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check HO2S-2 Heater and Its Circuit. 1) Warm up engine to normal operating temperature. 2) Stop engine. 3) Turn ignition switch ON and check voltage at terminal E21-19 See Fig. 1. Voltage should be over 10 V. 4) Start engine, run it at idle and check voltage at the same terminal after 1 min. from engine start. Voltage should be below 1.9 V. Are check result as specified?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check Heater or Sensor-2. 1) Disconnect HO2S-2 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-2 at “BLK/WHT” and “BLU/RED” wire terminals. 3) If OK, then check heater resistance. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	“BLU/RED” wire open or shorted to ground or poor connection at E21-19. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-2.

Fig. 1 for Step 2



DTC P0171 FUEL SYSTEM TOO LEAN
DTC P0172 FUEL SYSTEM TOO RICH

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● When following condition occurs while engine running under closed loop condition. – Air/fuel ratio too lean (Total fuel trim (short and long terms added) is more than 30%) or – Air/fuel ratio too rich (Total fuel trim is less than –30%) ✳ 2 driving cycle detection logic, continuous monitoring.	● Vacuum leaks (air drawn in). ● Exhaust gas leakage. ● Heated oxygen sensor-1 circuit malfunction. ● Fuel pressure out of specification. ● Fuel injector malfunction (clogged or leakage). ● MAP sensor poor performance. ● ECT sensor poor performance. ● IAT sensor poor performance. ● TP sensor poor performance. ● EVAP control system malfunction. ● PCV valve malfunction.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester on a level road.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
4) Start engine and drive vehicle under usual driving condition (described in DTC confirmation procedure of DTC P0136) for 5 min. or longer and until engine is warmed up to normal operating temperature.
5) Keep vehicle speed at 30 – 40 mph, 50 – 60 km/h in 5th gear or “D” range for 5 min. or more.
6) Stop vehicle (do not turn ignition switch OFF).
7) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than fuel system (DTC P0171/P0172)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 Output Voltage. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1. Does HO2S-1 output voltage deflect between below 0.3 V and over 0.6 V repeatedly?	Go to Step 4.	Go to DTC P0130 Diag. Flow Table (HO2S-1 circuit check).
4	Check Fuel Pressure (Refer to section 6E1 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 3) Check fuel pressure. See Fig. 2. With fuel pump operating and engine at stop : 160 – 210 kPa, 1.6 – 2.1 kg/cm^2, 22.7 – 29.9 psi. At specified idle speed : 90 – 140 kPa, 0.9 – 1.4 kg/cm^2, 12.8 – 20.0 psi. Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 Fuel Pressure Check.
5	Check Fuel Injector and Circuit. 1) Turn ignition switch OFF and disconnect fuel injector connector. 2) Check for proper connection to fuel injector at each terminals. 3) If OK, then check injector resistance. See Fig. 3. **Injector resistance: 0.5 – 1.5 Ω at 20°C (68°F)** 4) Connect injector connector. 5) Check that fuel is injected out in conical shape from fuel injector when running engine. 6) Check injector for fuel leakage after engine stop. **Fuel leakage: Less than 1 drop/min.** Is check result satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector.
6	Check EVAP Canister Purge Valve. 1) Disconnect purge hose (1) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there when engine is cool and running at idle. See Fig. 4. Is vacuum felt?	Check EVAP control system (See Section 6E1).	Go to Step 7.
7	Check intake manifold absolute pressure sensor for performance (See DTC P0105 Diag. Flow Table). Is it in good condition?	Go to Step 8.	Repair or replace.

STEP	ACTION	YES	NO
8	Check engine coolant temp. sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 9.	Replace engine coolant temp. sensor.
9	Check intake air temp. sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 10.	Replace intake air temp. sensor.
10	Check throttle position sensor for performance (See Step 4 of DTC P0121 Diag. Flow Table). Is it in good condition?	Go to Step 11.	Replace throttle position sensor.
11	Check PCV valve for valve clogging (See Section 6E1). Is it good condition?	Substitute a known-good ECM (PCM) and recheck.	Replace PCV valve.

Fig. 1 for Step 3

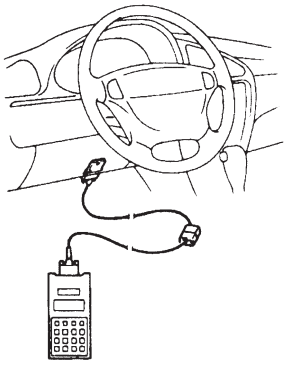
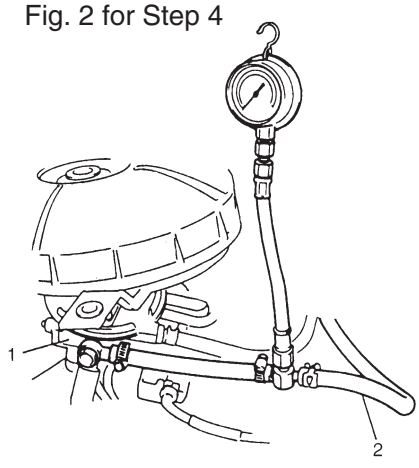


Fig. 2 for Step 4



1. Throttle body
2. Fuel feed hose

Fig. 3 for Step 5

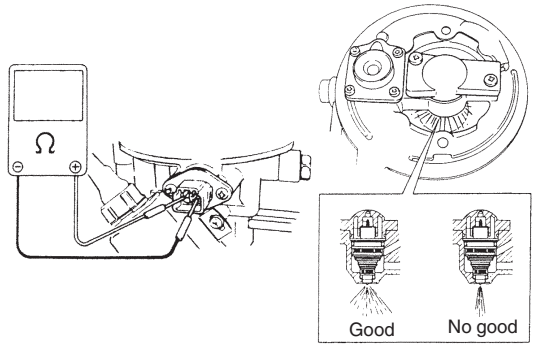
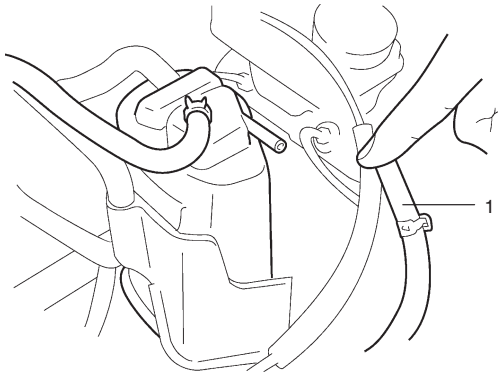
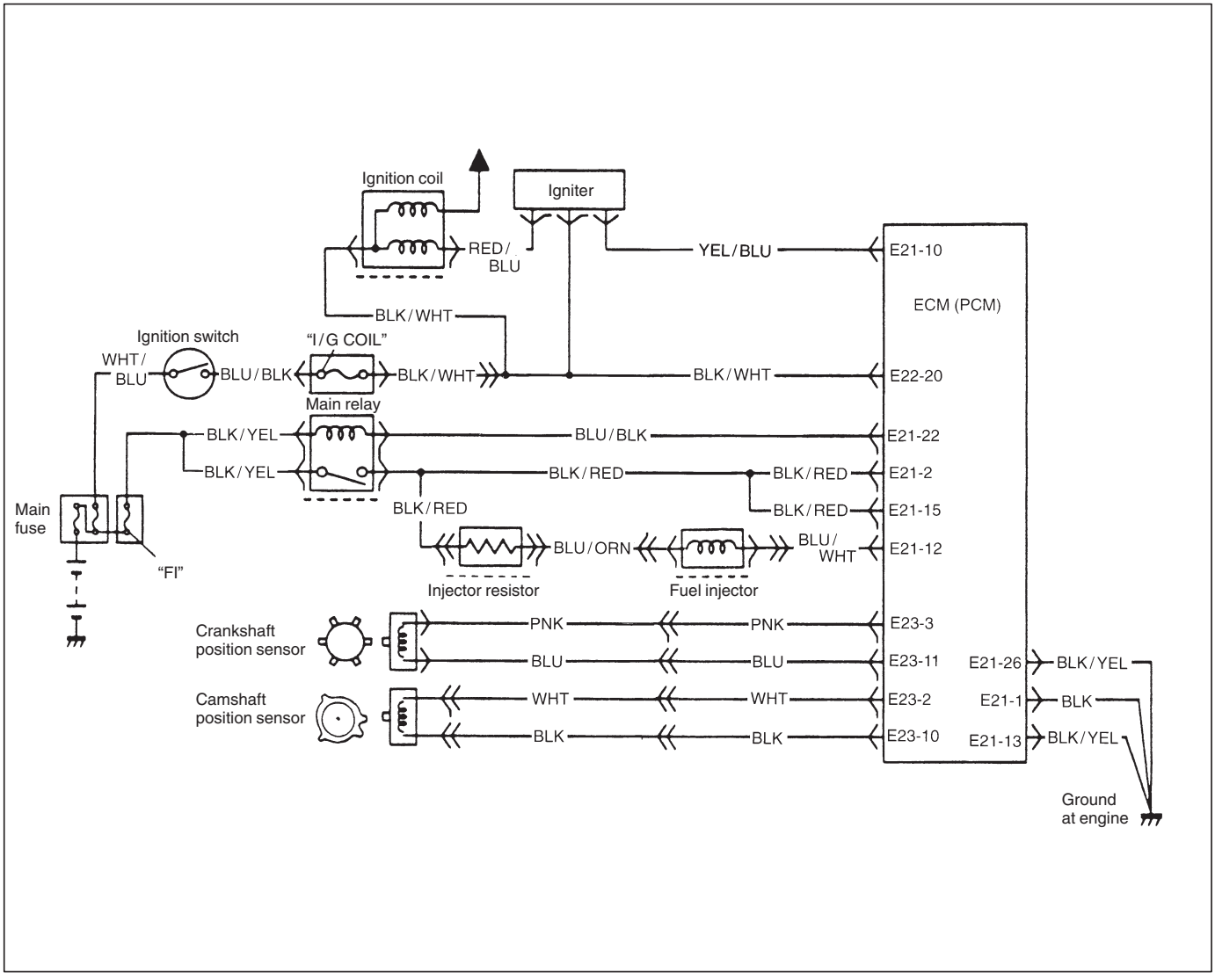


Fig. 4 for Step 6



DTC P0300 RANDOM MISFIRE DETECTED (Misfire detected at 2 or more cylinders)
DTC P0301 CYLINDER 1 MISFIRE DETECTED
DTC P0302 CYLINDER 2 MISFIRE DETECTED
DTC P0303 CYLINDER 3 MISFIRE DETECTED



CIRCUIT DESCRIPTION

ECM (PCM) monitors crankshaft revolution speed and engine speed via the crankshaft position sensor and cylinder No. via the camshaft position sensor. Then it calculates the change in the crankshaft revolution speed and from how many times such change occurred in every 200 or 1000 engine revolutions, it detects occurrence of misfire.
When ECM (PCM) detects a misfire (misfire rate per 200 revolutions) which can cause overheat and damage to the three way catalytic converter, it makes the malfunction indicator lamp (MIL) flash as long as misfire occurs at that rate.
After that, however, when the misfire rate drops, MIL remains ON until it has been judged as normal 3 times under the same driving conditions.
Also, when ECM (PCM) detects a misfire (misfire rate per 1000 revolutions) which will not cause damage to three way catalytic converter but can cause exhaust emission to be deteriorated, it makes MIL light according to the 2 driving cycle detection logic.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Engine under other than high revolution condition ● Not on rough road ● Engine speed changing rate, ● Manifold absolute pressure changing rate, ● Throttle opening changing rate: Below specified value ● Misfire rate per 200 or 1000 engine revolutions (how much and how often crankshaft revolution speed changes) is higher than specified value	● Engine overheating ● Vacuum leaks (air inhaling) from air intake system ● Ignition system malfunction (spark plug(s), high-tension cord(s), ignition coil assembly) ● Fuel pressure out of specification ● Fuel injector malfunction (clogged or leakage) ● Engine compression out of specification ● Valve lash (clearance) out of specification ● Manifold absolute pressure sensor malfunction ● Engine coolant temp. sensor malfunction ● PCV valve malfunction ● EVAP control system malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – Engine coolant temp.: –10 – 110°C, 14 – 230°F
4) Start engine and keep it at idle for 2 min. or more.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.
6) If DTC is not detected at idle, consult usual driving based on information obtained in “Customer complaint analysis” and “Freeze frame data check”.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE“.
2	Is there DTC other than Fuel system (DTC P0171/P0172) and misfire (DTC P0300-P0303)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check Ignition System. 1) Remove spark plugs and check them for; ● Air gap: 1.0 – 1.1 mm (0.040 – 0.043 in.) See Fig. 1. ● Carbon deposits ● Insulator damage ● Plug type If abnormality is found, adjust, clean or replace. 2) Disconnect injector connector. See Fig. 2. 3) Connect spark plugs to high tension cords and then ground spark plugs. 4) Crank engine and check that each spark plug sparks. Are above check results satisfactory?	Go to Step 4.	Check ignition system parts (Refer to Section 6F).
4	Check Fuel Pressure (Refer to Section 6E1 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. See Fig. 3. 3) Check fuel pressure. With fuel pump operating and engine at stop : 160 – 210 kPa, 1.6 – 2.1 kg/cm^2, 22.7 – 29.9 psi. At specified idle speed : 90 – 140 kPa, 0.9 – 1.4 kg/cm^2, 12.8 – 20.0 psi. Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 fuel pressure check.
5	Check Fuel Injector and Circuit. 1) Turn ignition switch OFF and disconnect fuel injector connector. 2) Check for proper connection to fuel injector at each terminal. 3) If OK, then check injector resistance. See Fig. 4. Injector resistance: 0.5 – 1.5 Ω at 20°C (68°F). 4) Connect injector connector. 5) Check that fuel is injected out in conical shape from fuel injector when running engine. 6) Check injector for fuel leakage after engine stop. Fuel leakage: Less than 1 drop/min. Is check result satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector.

STEP	ACTION	YES	NO
6	Check PCV valve for clogging (See Section 6E1). Is it in good condition?	Go to Step 7.	Replace PCV valve.
7	Check EVAP Canister Purge Valve for Closing. 1) Disconnect purge hose (1) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there, when engine is cool and running at idle. See Fig. 5. Is vacuum felt?	Check EVAP control system (See Section 6E1).	Go to Step 8.
8	Check intake manifold pressure sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 9.	Repair or replace.
9	Check engine coolant temp. sensor for performance (See Section 6E1). Is it in good condition?	Go to Step 10.	Replace engine coolant temp. sensor.
10	Check parts or system which can cause engine rough idle or poor performance. – Engine compression (See Section 6A). – Valve lash (See Section 6A). – Valve timing (Timing belt installation. See Section 6A). Are they in good condition?	Check wire harness and connection of ECM (PCM) ground, ignition system and fuel injector for intermittent open and short.	Repair or replace.

Fig. 1 for Step 3

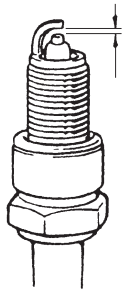
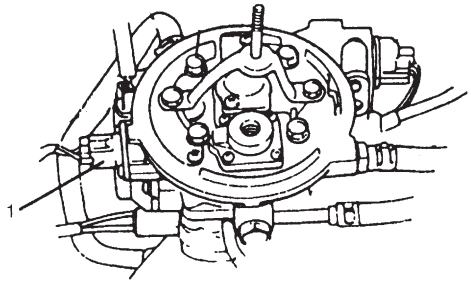
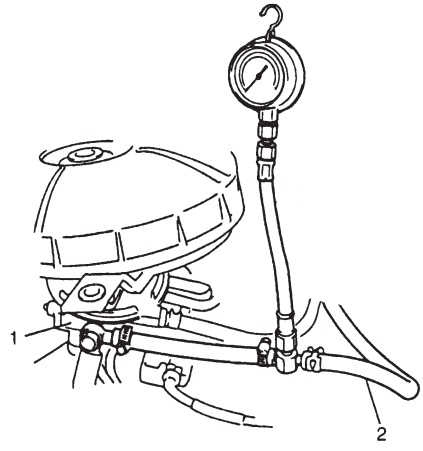


Fig. 2 for Step 3



1. Injector connector

Fig. 3 for Step 4



1. Throttle body
2. Fuel feed hose

Fig. 4 for Step 5

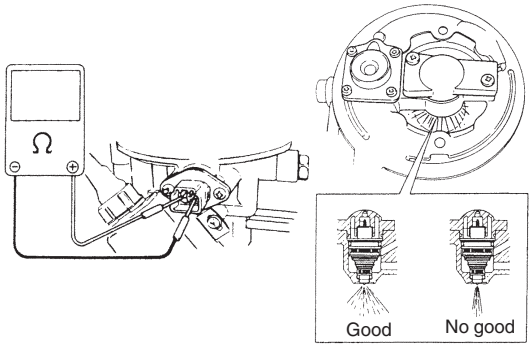
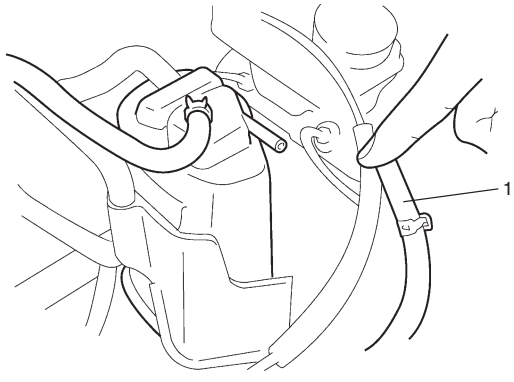
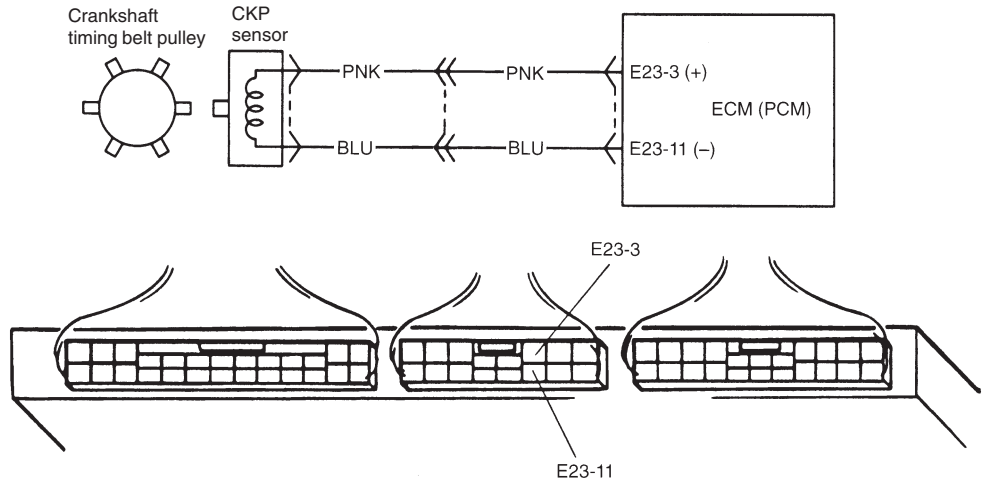


Fig. 5 for Step 7



DTC P0335 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION

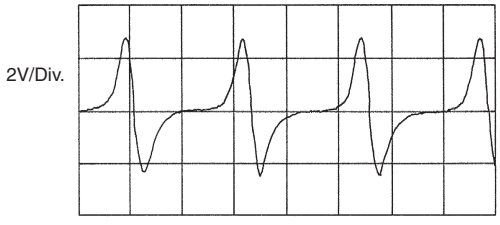


DTC DETECTING CONDITION	POSSIBLE CAUSE
● No CKP sensor signal during 1 revolution of camshaft.	● CKP sensor circuit open or short. ● Crankshaft timing belt pulley teeth damaged. ● CKP sensor malfunction, foreign material being attached or improper installation. ● ECM (PCM) malfunction.

Reference

Connect oscilloscope between terminals E23-3 (+) and E23-11 (–) of ECM (PCM) connector connected to ECM (PCM) and check CKP sensor signal.

Oscilloscope Waveforms



5ms/Div.
Waveforms at specified idle speed

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check CKP Sensor for Resistance. 1) Disconnect CKP sensor connector with ignition switch OFF. 2) Then check for proper connection to CKP sensor at “PNK” and “BLU” wire terminals. 3) If OK, measure sensor resistance between terminals. See Fig. 1. **CKP sensor resistance: 360 – 460 Ω at 20°C, (68°F)** 4) Measure resistance between each terminal and ground. **Insulation resistance: 1 MΩ or more.** Were measured resistance valves in step 3) and 4) as specified?	Go to Step 3.	Replace CKP sensor.
3	Check visually CKP sensor and pulley for the following. See Fig. 2. ● Damage ● No foreign material attached. ● Correct installation. Are they in good condition?	“PNK” or “BLU” wire open or shorted to ground, or poor connection at E23-3 or E23-11. If wire and connection are OK, intermittent trouble or faulty ECM (PCM). Recheck for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Clean, repair or replace.

Fig. 1 for Step 2

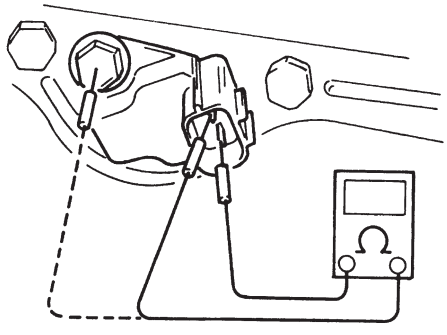
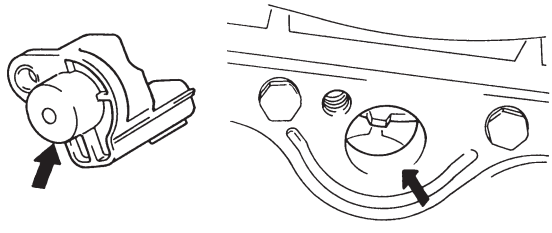
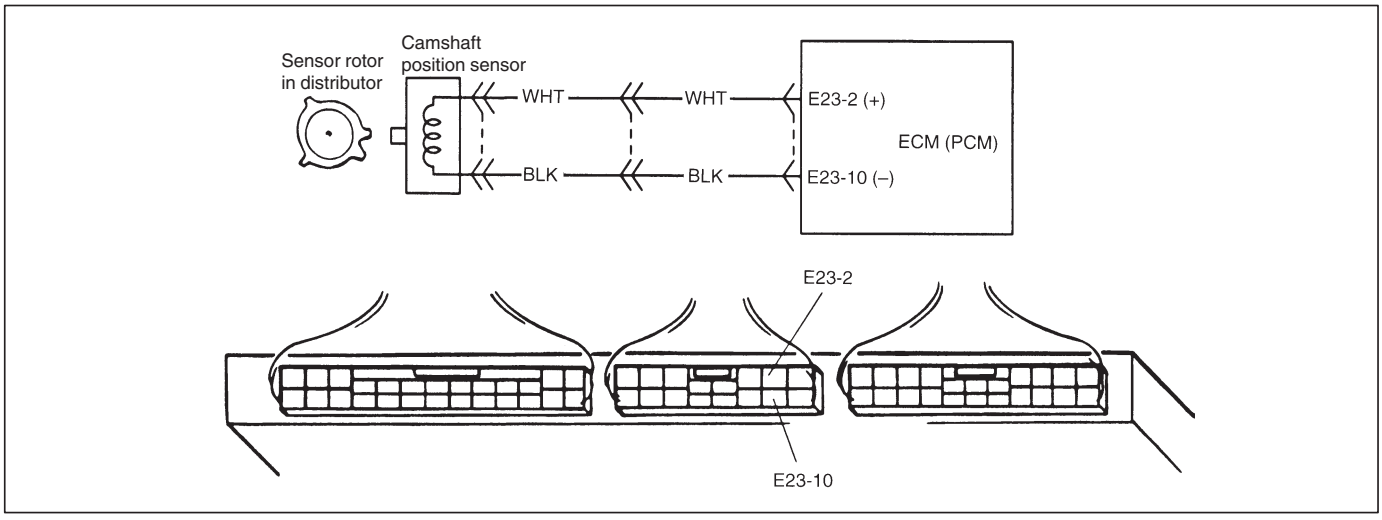


Fig. 2 for Step 3



DTC P0340 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION

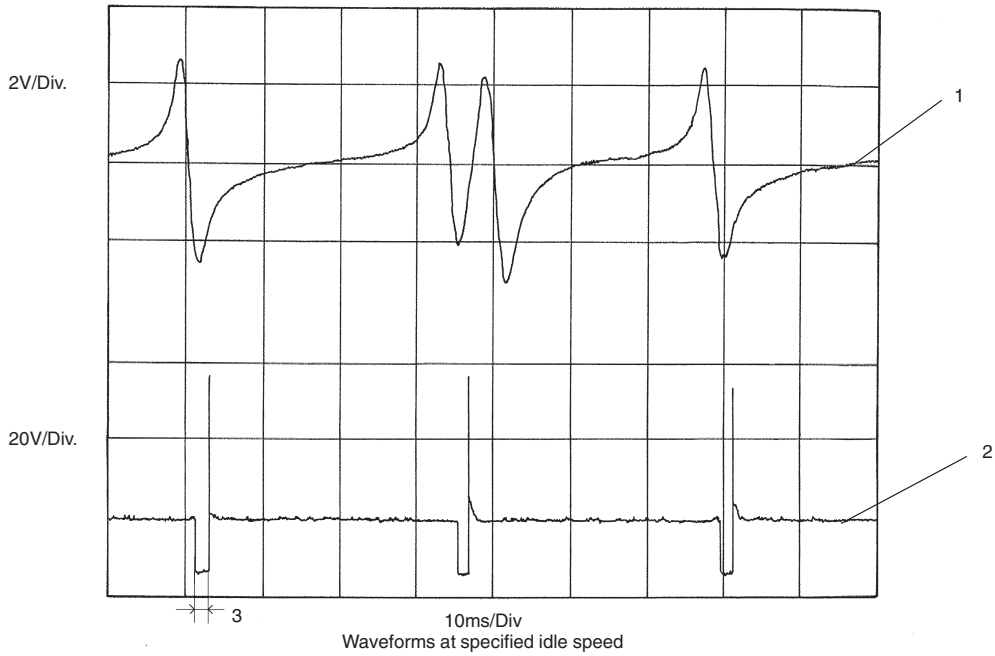


DTC DETECTING CONDITION	POSSIBLE CAUSE
● No CMP sensor signal for 2 seconds at engine cranking (CKP sensor signal is inputted).	● CMP sensor circuit open or short. ● Signal rotor teeth damaged. ● CMP sensor malfunction, foreign material being attached or improper installation. ● ECM (PCM) malfunction.

Reference

Connect oscilloscope between terminals E23-2 and E23-10 of ECM (PCM) connector connected to ECM (PCM) and check CMP sensor signal.

Display of fuel injection signal using oscilloscope



1. CMP sensor signal
2. Fuel injector signal
3. Fuel injection time

Waveforms at specified idle speed

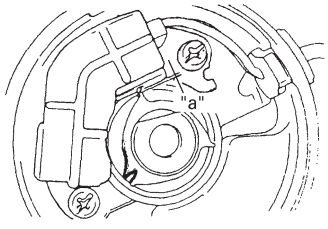
DTC CONFIRMATION PROCEDURE

1) Clear DTC.
2) Start engine and keep it at idle for 1 min.
3) Select “DTC” mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is DTC P1500 (Engine starter signal circuit malfunction) detected?	Go to DTC P1500 Diag. Flow Table.	Go to Step 3.
3	Check CMP Sensor for Resistance. 1) Measure resistance of CMP sensor by referring to “CMP SENSOR (PICK UP COIL) RESISTANCE” in SECTION 6F. Is resistance within specified value?	Go to Step 4.	Faulty CMP sensor.
4	Check Wire Harness. 1) With ignition switch at OFF position, disconnect ECM (PCM) electrical connectors. 2) Measure resistance from terminal “E23-2” to “E23-10” of ECM (PCM) connector. Is resistance within 185 – 275 Ω at 20°C (68°F)?	Go to Step 5.	“WHT” or “BLK” wire open or short. Poor connection of CMP sensor connector terminal.
5	Check Air Gap Between Rotor Tooth and Sensor. See Fig. 1. 1) Remove Distributor cap. 2) Visually inspect CMP sensor signal rotor for damage. 3) Measure air gap by referring “SIGNAL ROTOR AIR GAP” in Section 6F. Was any damage found?	Faulty CMP sensor signal rotor.	Poor connection of ECM (PCM) connector terminal. If OK, substitute a known-good ECM (PCM) and recheck CMP.

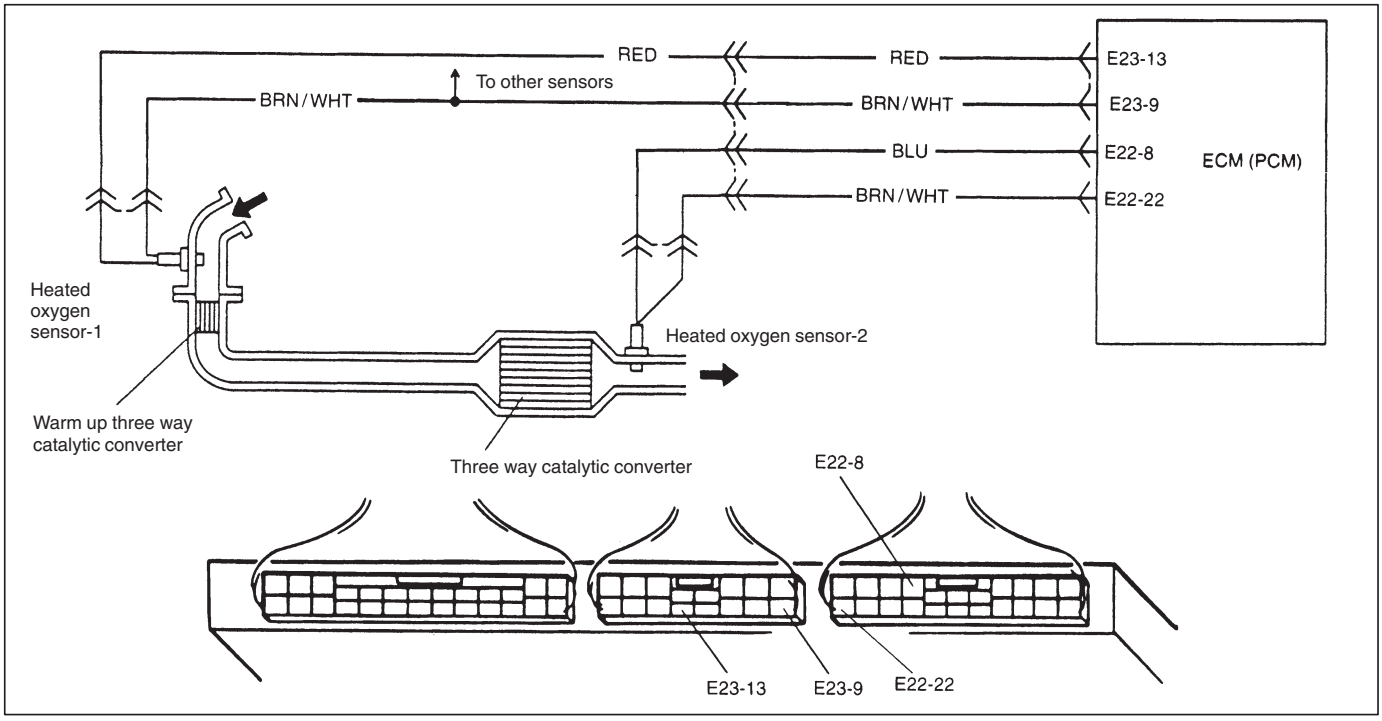
Fig. 1 for Step 5



“a”: Air gap

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

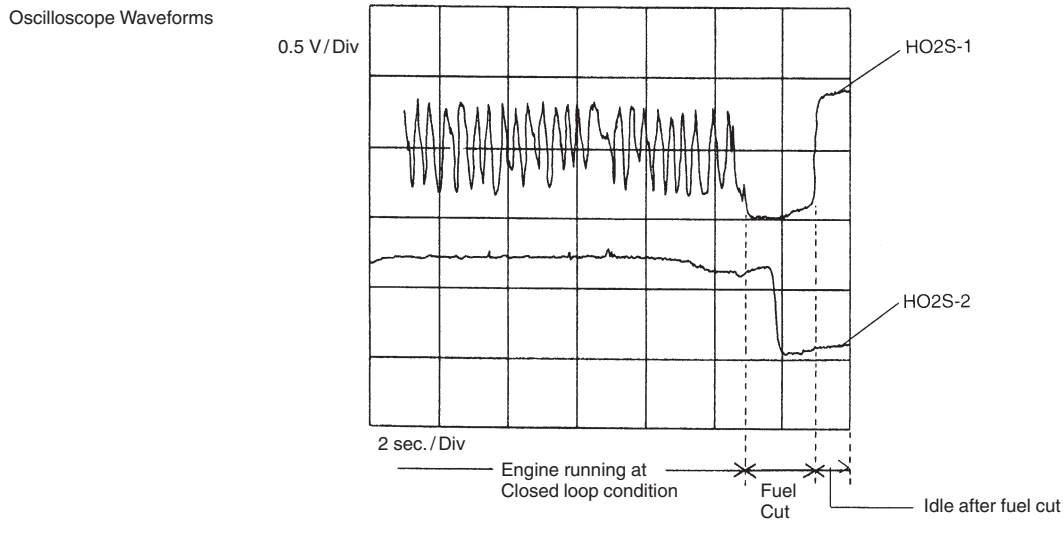
CIRCUIT DESCRIPTION



ECM (PCM) monitors oxygen concentration in the exhaust gas which has passed the three way catalytic converter by HO2S-2.

When the catalyst is functioning properly, the variation cycle of HO2S-2 output voltage (oxygen concentration) is slower than that of HO2S-1 output voltage because of the amount of oxygen in the exhaust gas which has been stored in the catalyst.

Reference

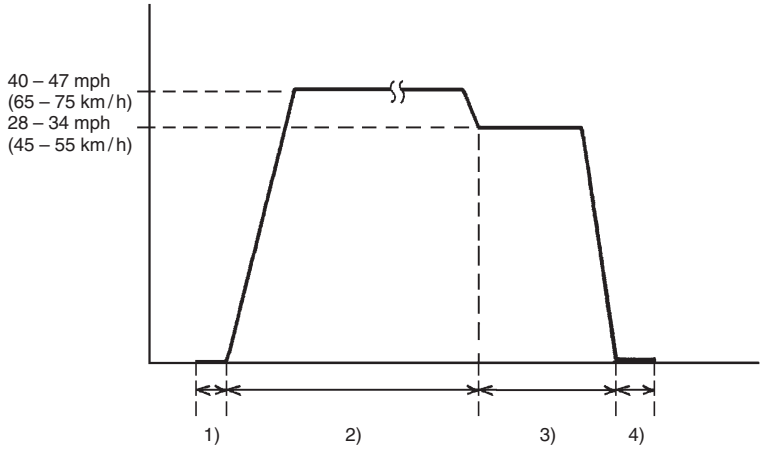


DTC DETECTING CONDITION	POSSIBLE CAUSE
● While vehicle running at constant speed under other than high load. ● Time from rich or lean switching command is output till HO2S-2 output voltage crosses 0.45 V is less than specified value. 2 driving cycle detection logic, monitoring once/1 driving.	● Exhaust gas leak ● Three way catalytic converter malfunction ● Fuel system malfunction ● HO2S-2 malfunction ● HO2S-1 malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and tester, on a level road.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp.: –10°C, 14°F or higher
   – Intake air temp.: 70°C, 158°F or lower
   – Engine coolant temp.: 70 – 110°C, 158 – 230°F
2) Start engine and drive vehicle at 40 – 47 mph, 65 – 75 km/h for 15 min. or longer.
   While this driving, if "Catalyst Monitoring TEST COMPLETED" is displayed in "READINESS TESTS" mode and DTC is not displayed in "DTC" mode, confirmation test is completed.
   If "TEST NOT COMPLTD" is still being displayed, continue test driving.
3) Decrease vehicle speed at 28 – 34 mph, 45 – 55 km/h, and hold throttle valve at that opening position for 2 min. and confirm that short term fuel trim vary within –20% –+20% range.
4) Stop vehicle (do not turn ignition switch OFF) and confirm test results according to following "Test Result Confirmation Flow Table".



Test Result Confirmation Flow Table

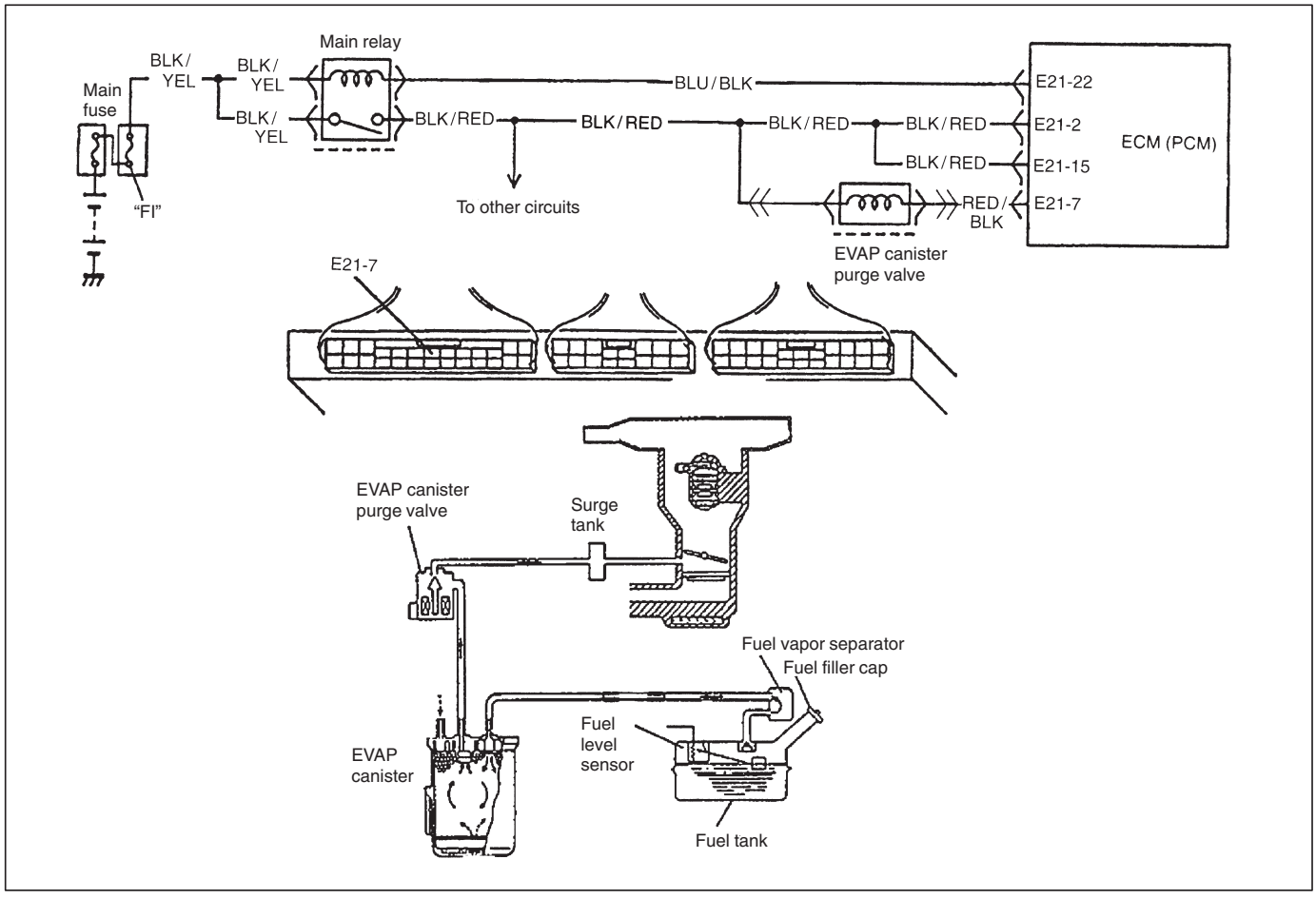
STEP	ACTION	YES	NO
1	Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode. Is DTC or pending DTC displayed?	Proceed to applicable DTC Diag. Flow Table.	Go to Step 2.
2	Set scan tool to "READINESS TESTS" mode and check if testing has been completed. Is test completed?	No DTC is detected (confirmation test is completed).	Repeat DTC confirmation procedure.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Short Term Fuel Trim. Did short term fuel trim vary within −20% −+20% range in step 3) of DTC confirmation test?	Go to Step 3.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table.
3	Check HO2S-2 for Output Voltage. Perform steps 1) through 9) of DTC confirmation procedure for DTC P0136 (HO2S-2 malfunction) and check output voltage of HO2S-2 then. Is over 0.6 V and below 0.3 V indicated?	Replace three way catalytic converter.	Check “BLU” and “BRN/WHT” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-2.

DTC P0443 PURGE CONTROL VALVE CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
Canister Purge control valve circuit is opened or shorted.	● "RED/BLK" circuit open or short ● "BLK/RED" circuit open ● Canister purge valve malfunction

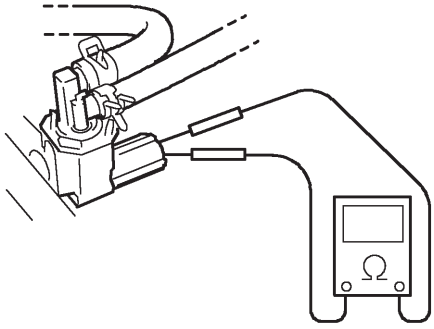
DTC CONFIRMATION PROCEDURE

1) Clear DTC with ignition switch ON.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

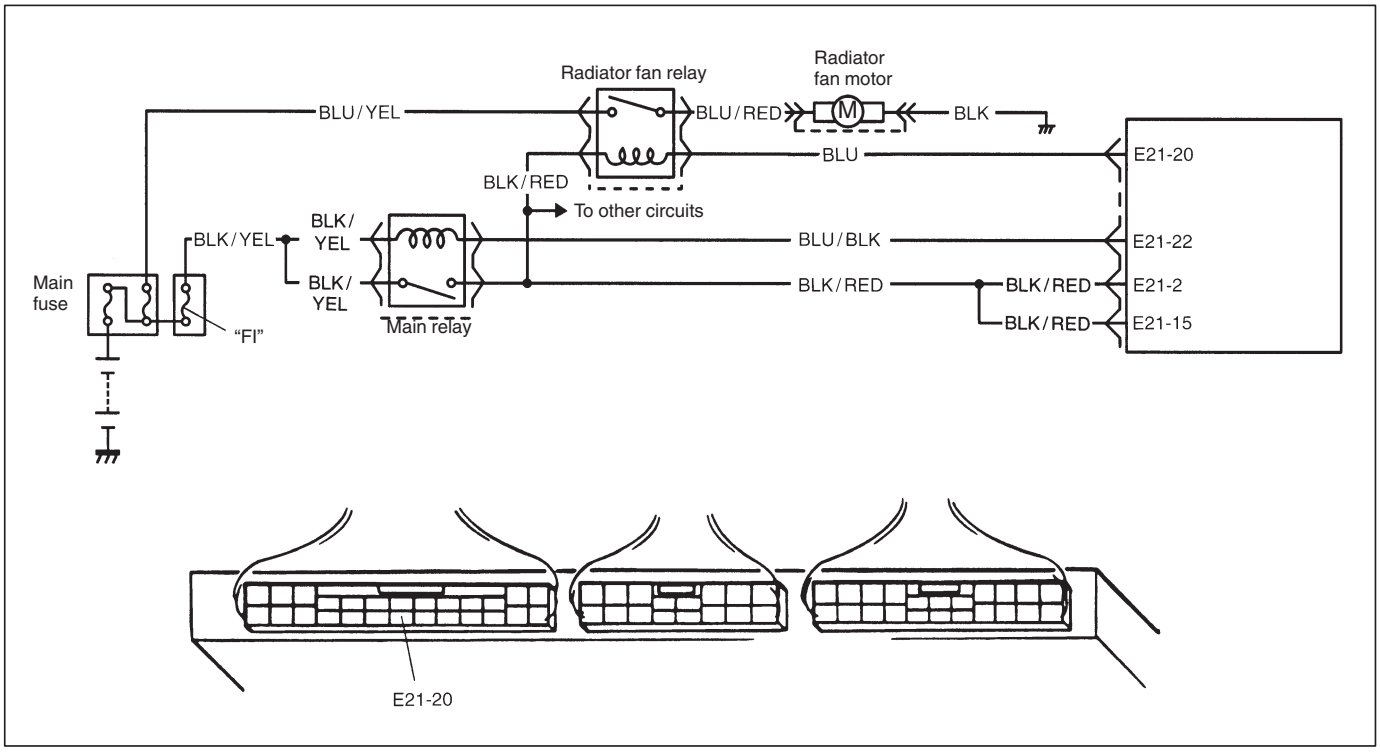
STEP	ACTION	YES	NO
1	Check EVAP canister purge valve operation 1) With ignition switch OFF, disconnect coupler from canister purge valve. 2) Check resistance of EVAP canister purge valve. See Fig. 1. Resistance between two terminals : 30 – 34 Ω at 20°C (68°F) Resistance between terminal and body : 1M Ω or higher Is it as specified?	"RED/BLK" circuit open or short.	Replace EVAP canister purge valve.

Fig. 1 for Step 1



DTC P0480 RADIATOR FAN CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low voltage at terminal E21-20 when engine coolant temp. is below 91°C, 195°F. 2 driving cycle detection logic, continuous monitoring.	● "BLK/RED" or "BLU" circuit open or short ● Radiator fan relay malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Warm up engine until radiator cooling fan starts to operate.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Radiator Cooling Fan Relay and Its Circuit. 1) Turn ignition switch ON. 2) Check for voltage at terminal E21-20 of ECM (PCM) connector connected, under following condition. See Fig. 1. When engine coolant temp. is lower than 91°C, 196°F and A/C switch turns OFF: 10 – 14 V Is voltage as specified?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check Radiator Fan Control Relay. 1) Turn ignition switch OFF and remove radiator fan relay. 2) Check for proper connection to the relay at “BLK/RED” and “BLU” wire terminals. 3) If OK, then measure resistance between terminals a and b. See Fig. 2. Is it 100 – 120 Ω?	“BLK/RED” or “BLU” circuit open or short. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace radiator fan relay.

Fig. 1 for Step 2

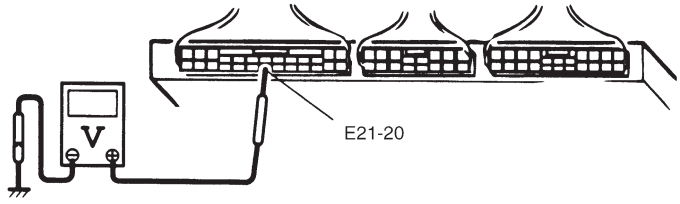
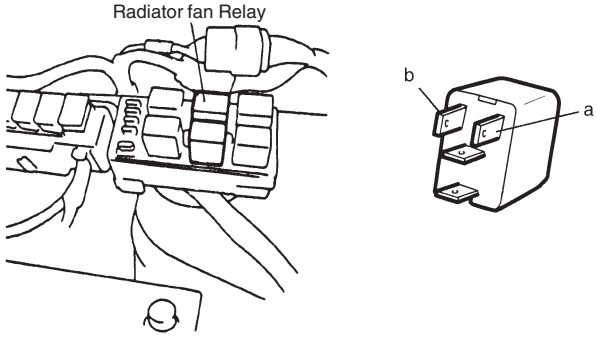
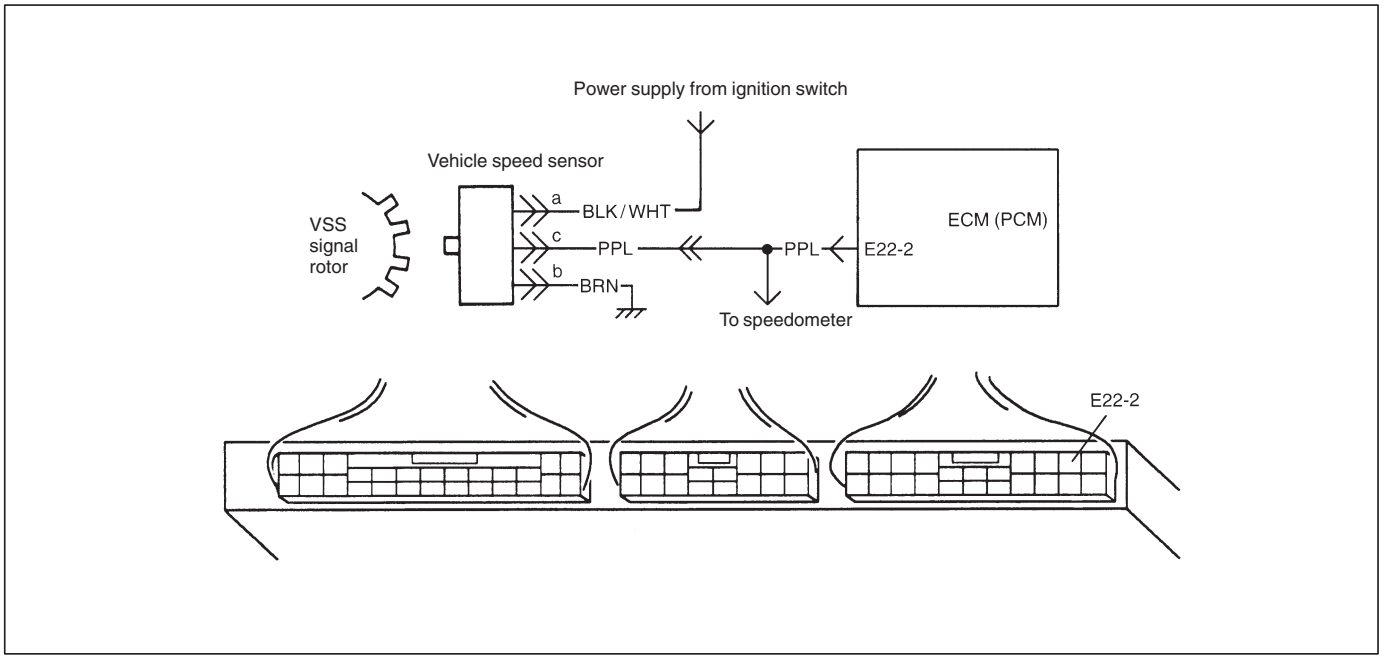


Fig. 2 for Step 3



DTC P0500 VEHICLE SPEED SENSOR (VSS) MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● While fuel is kept cut at lower than 4000 r/min for longer than 4 sec. ● VSS signal not inputted. 2 driving cycle detection logic, continuous monitoring.	● "BRN" circuit open ● "PPL" or "BLK/WHT" circuit open or short ● VSS (speedometer driven gear) malfunction ● ECM malfunction ● Speedometer malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Clear DTC and warm up engine to normal operating temperature.
2) Increase vehicle speed to 50 mph, 80 km/h in 3rd gear or "2" range while observing vehicle speed displayed on scan tool.
3) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 4 sec. or more.
4) Check pending DTC and DTC.

DTC P0500

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Does speedometer indicate vehicle speed?	Go to Step 3.	Go to Step 5.
3	Check Vehicle Speed Signal. Is vehicle speed displayed on scan tool in step 2) and 3) of DTC confirmation procedure?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 4.
4	1) Turn ignition switch to OFF position. 2) Disconnect combination meter connectors. Refer to Section 8C. 3) Turn ignition switch to ON position, without running engine. 4) Measure voltage from terminal “c” of VSS connector to ground. See Fig. 2. Is voltage within 4 – 5 V?	Faulty speedometer.	“PPL” wire open or short. Poor connection of ECM connector terminal. If OK, substitute a known-good ECM and recheck.
5	1) With ignition switch at OFF position, disconnect VSS connector. 2) Turn ignition switch to ON position, without running engine. 3) Measure voltage from terminal “a” to “b” of VSS connector. See Fig. 1. Is voltage within 10 – 14 V?	Go to Step 6.	“BLK/WHT” or “BRN” wire open or short.
6	1) Measure voltage from terminal “c” of VSS connector to ground. See Fig. 2. Is voltage more than 4 V?	Go to Step 7.	“PPL” wire open or short. Poor connection of ECM connector terminal. If OK, substitute a known-good ECM and recheck.
7	1) Remove VSS. 2) Visually inspect VSS sensor signal rotor for damage. Was any damage found?	Faulty VSS signal rotor.	Poor connection of VSS connector terminal. If OK, substitute a known-good VSS and recheck.

Fig. 1 for Step 5

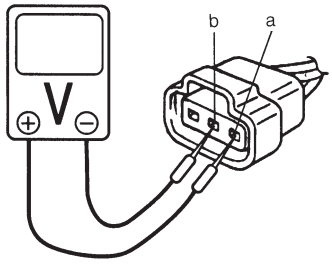
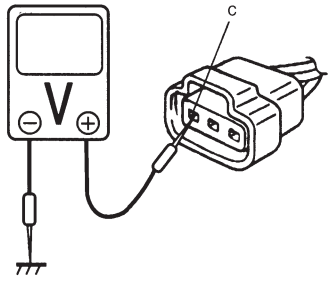
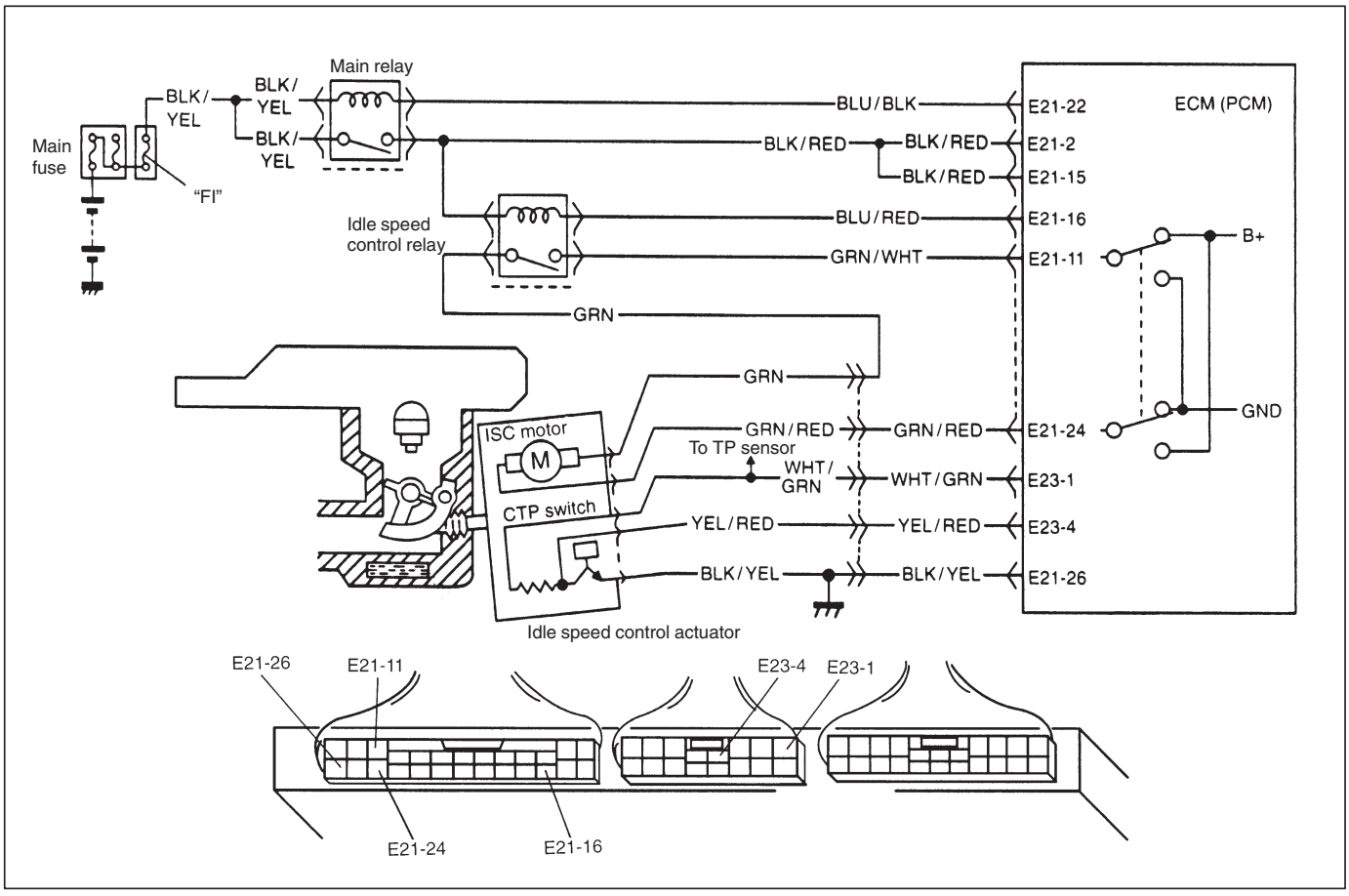


Fig. 2 for Step 4 and Step 6



DTC P0505 IDLE CONTROL SYSTEM MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A, B or C condition is met. A: Throttle opening change is small as compared with electrically live time. B: Throttle valve opening is not within its target range with CTP switch ON. C: Drive voltage exists though ECM (PCM) is not outputting ISC drive command.	● Maladjusted accelerator cable ● Poor movement of throttle valve ● Closed throttle position switch malfunction ● Idle speed control actuator malfunction ● Idle speed control relay malfunction ● "BLU/RED", "GRN/WHT", "GRN", "GRN/RED", "WHT/GRN", "YEL/RED" or "BLK/YEL" circuit open or short ● Throttle position sensor malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Start cold engine.
4) Run it idle for 5 min.
5) Select "DTC" mode on scan tool and check DTC.

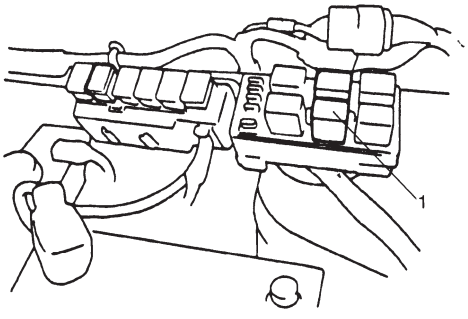
NOTE:
If engine speed changes up and down when engine speed is increased by opening throttle valve more than half but not changing its opening, it is possible that closed throttle position switch is malfunctioning.

DTC P0505

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check Idle Control System. 1) Connect SUZUKI scan tool to DLC with ignition switch OFF, set parking brake and block drive wheels. 2) Warm up engine to normal operating temperature. 3) Clear DTC and select “MISC TEST” mode on SUZUKI scan tool. Is it possible to control (increase and reduce) engine idle speed by using SUZUKI scan tool?	Check TP sensor (Go to DTC P0121 Flow Table) If TP sensor is OK, intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check ISC Relay. 1) Ignition switch OFF and remove ISC relay (“ISCA”). 2) Check for proper connection to ISC relay at terminals 3 and 4. 3) Check resistance between each two terminals. Between terminals 1 and 2: Infinity Between terminals 3 and 4: 100 – 120 Ω 4) Check that there is continuity between terminals 1 and 2 when battery is connected to terminals 3 and 4. Is ISC relay in good condition?	Go to Step 4.	Replace ISC relay.
4	Check Idle Speed Control Actuator. 1) Check ISC actuator operation by referring to ISC ACTUATOR INSPECTION in Section 6E1. Is it good condition?	Check “GRN/RED”, “GRN”, “GRN/WHT” and “BLU/RED” circuit for open and short. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace throttle body with ISC actuator.

Fig. 1 for Step 3



1. ISC relay

Fig. 2 for Step 3

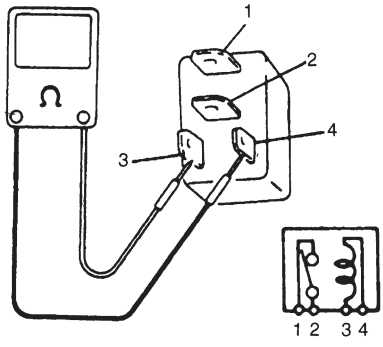
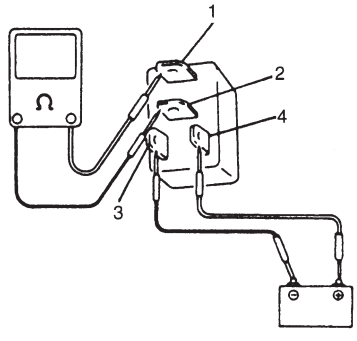


Fig. 3 for Step 3



DTC P0510 CLOSED THROTTLE POSITION (CTP) SWITCH MALFUNCTION

CIRCUIT DESCRIPTION – Refer to DTC P0505 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Even when vehicle is started from stop and accelerated to specified vehicle speed, CTP switch does not turn from ON to OFF (or from OFF to ON). 2 driving cycle detection logic, continuous monitoring	● "WHT/GRN", "YEL/RED" or "BLK/YEL" circuit open or short ● CTP switch malfunction ● ECM (PCM) malfunction

NOTE:

When DTC P0105, P0120 and/or P0510 are indicated together, it is possible that "WHT/GRN" circuit is open.

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF, clear DTC with ignition switch ON and start engine.
2) Increase vehicle speed to 20 mph, 32 km/h and then stop vehicle.
3) Repeat above step 2) 15 times.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check CTP Switch Operation. 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. Does CTP switch operate properly under following conditions respectively? See Fig. 1. Condition "A": ON displayed on scan tool Condition "B": OFF displayed on scan tool Is test result satisfactory?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection in Section 0A.	Go to Step 3.
3	Check CTP switch. 1) Arrange 3 new 1.5 V batteries in series (4.5 V in total). 2) Connect these batteries to CTP switch terminals "4" and "5". 3) Under following each condition, check voltage between CTP switch terminals "6" and "5". See Fig. 2. Condition "A": 0 – 1 V Condition "B": 3.5 – 5.5 V Is measured voltage as specified?	Check "WHT/GRN", "YEL/RED" and "BLK/YEL" wires and connections for open or short. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace ISC motor set (throttle body with ISC actuator).

Fig. 1 for Step 2

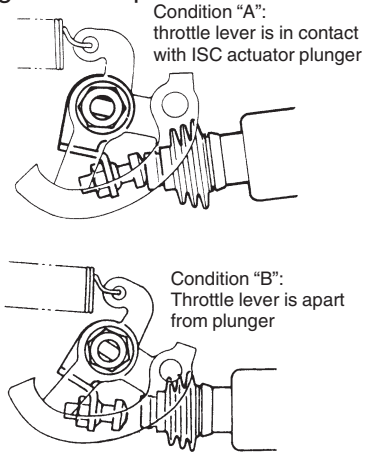
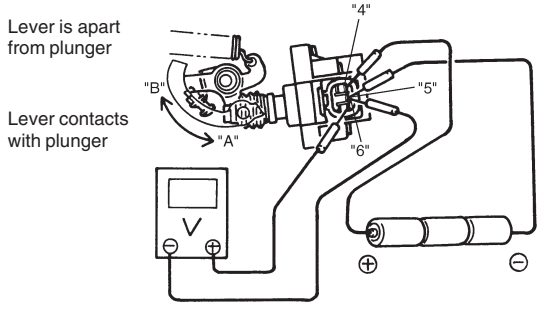


Fig. 2 for Step 3



DTC P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P0601: Data write error (or check sum error) when written into ECM (PCM) 2 driving cycle detection logic, continuous monitoring.	ECM (PCM)

DTC CONFIRMATION PROCEDURE

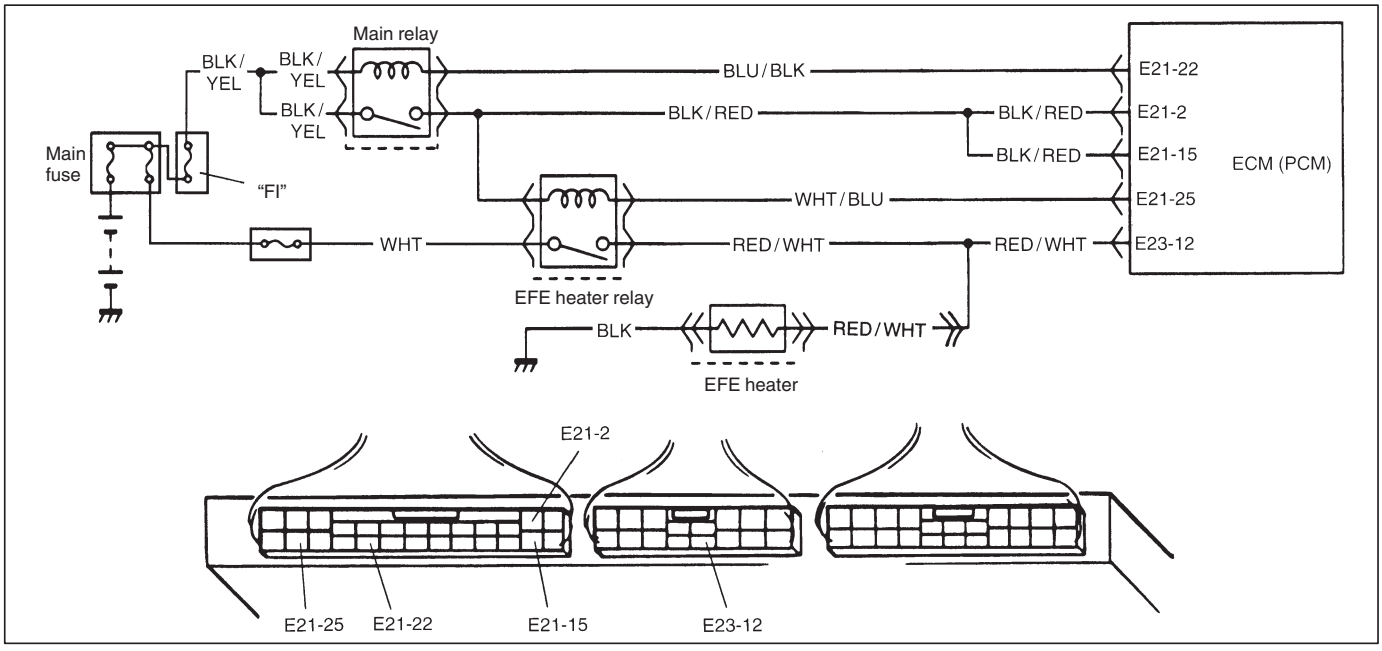
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON and then turn ignition switch OFF.
3) Start engine and run it at idle if possible.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

Substitute a known-good ECM (PCM) and recheck.

DTC P1250 EARLY FUEL EVAPORATION (EFE) HEATER CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● Voltage low at terminal E23-12 during engine warming up or ● Voltage high at terminal E23-12 after engine warming up 2 driving cycle detection logic, continuous monitoring	● "WHT/BLU", "RED/WHT" or "WHT" circuit open or short ● EFE heater relay malfunction ● EFE heater malfunction ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for:
   – Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp: –10°C, 14°F or higher
   – Intake air temp: 70°C, 158°F or lower
4) Start cool engine and warm it up to normal operating temperature.
5) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check EFE Heater and Its Circuit. Check for voltage at terminal E23-12 of ECM (PCM) connector connected, under following each condition. During engine warming up (Coolant temp.: Below 80°C, 176°F, Engine speed: Over 750 r/min): Over 1.0 V After warming up: Below 1.0 V Is each voltage as specified?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check EFE Heater Relay. 1) Turn OFF ignition switch and remove EFE heater relay (“PTC”). See Fig. 2. 2) Check for proper connection to relay at terminal 3 and 4. See Fig. 3. 3) Check resistance between each two terminals. Between terminals 1 and 2: Infinity Between terminals 3 and 4: 100 – 120 Ω 4) Check that there is continuity between terminals 1 and 2 when battery is connected to terminals 3 and 4. See Fig. 4. Is EFE heater relay in good condition?	Go to Step 4.	Replace EFE heater relay.
4	Check EFE Heater and Its Circuit. 1) Turn ignition switch OFF and disconnect ECM (PCM) connectors. 2) Check for proper connection to ECM (PCM) at terminals E21-25 and E23-12. 3) If OK, then measure resistance between terminal E23-12 and ground. Is it 0.5 – 30 Ω at 20°C (68°F)?	“WHT/BLU”, “RED/WHT” or “WHT” circuit open or short. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	“RED/WHT” circuit open or short. If wire and connections are OK, replace EFE heater.

Fig 1. for Step 4

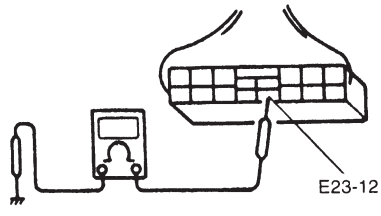


Fig. 2 for Step 3

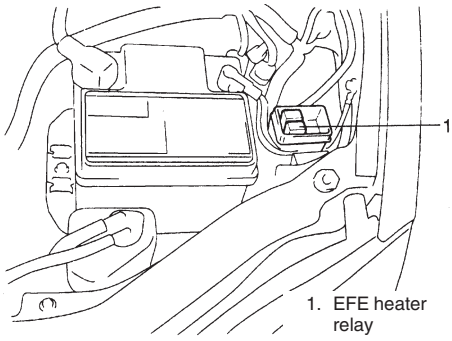


Fig. 3 for Step 3

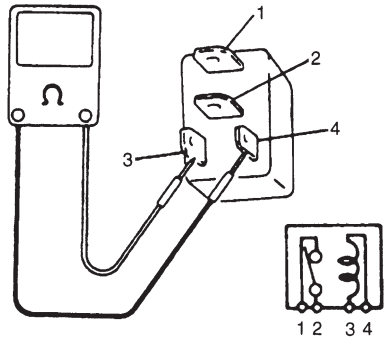
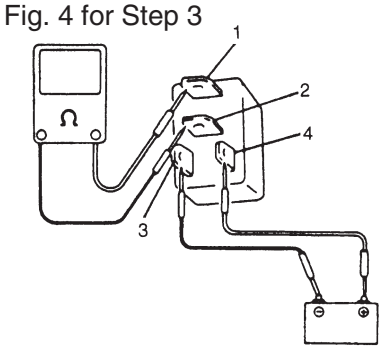


Fig. 4 for Step 3



DTC P1450 BAROMETRIC PRESSURE SENSOR LOW/HIGH INPUT
DTC P1451 BAROMETRIC PRESSURE SENSOR PERFORMANCE PROBLEM

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Barometric pressure sensor is installed in ECM (PCM).

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P1450: ● Barometric pressure: 136 kPa 1025 mmHg or higher, or 33 kPa 250 mmHg or lower	● ECM (PCM) (barometric pressure sensor) malfunction
DTC P1451: ● Vehicle stopped. ● Engine cranking. ● Difference between barometric pressure and intake manifold absolute pressure is 26 kPa, 200 mmHg or more. 2 driving cycle detection logic, monitoring once/1 driving.	● Manifold absolute pressure sensor and its circuit malfunction ● ECM (PCM) (barometric pressure sensor) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Turn ignition switch ON for 2 sec., crank engine for 2 sec. and run it at idle for 1 min.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

DTC P1450:

Substitute a known-good ECM (PCM) and recheck.

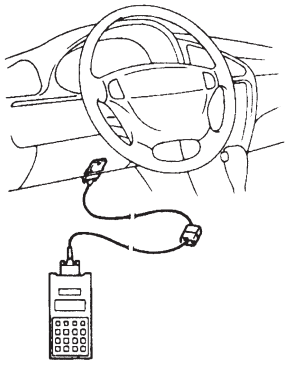
DTC P1451:

NOTE:

Note that atmospheric pressure varies depending on weather conditions as well as altitude. Take that into consideration when performing these check.

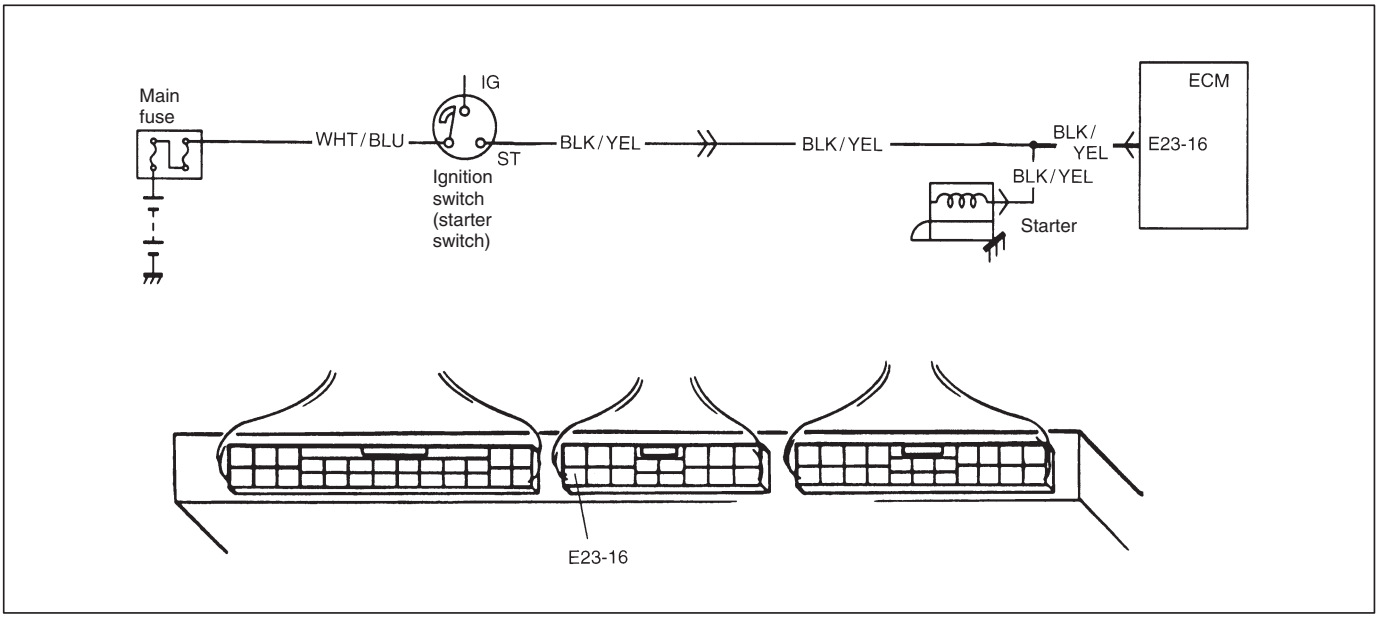
STEP	ACTION	YES	NO
1	1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and select “DATA LIST” mode on scan tool. 3) Check manifold absolute pressure. See Fig. 1. Is it barometric pressure (approx. 100 kPa, 760 mmHg) at sea level?	Substitute a known-good ECM (PCM) and recheck.	Check intake manifold pressure sensor and its circuit. Go to P0105 DIAG. FLOW TABLE.

Fig. 1 for Step 1



DTC P1500 ENGINE STARTER SIGNAL CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
● High voltage at terminal E23-16 for 3 min. after engine start. ● Low voltage at terminal E23-16 during starting engine. 2 driving cycle detection logic, continuous monitoring.	● "BLK/YEL" circuit open ● ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

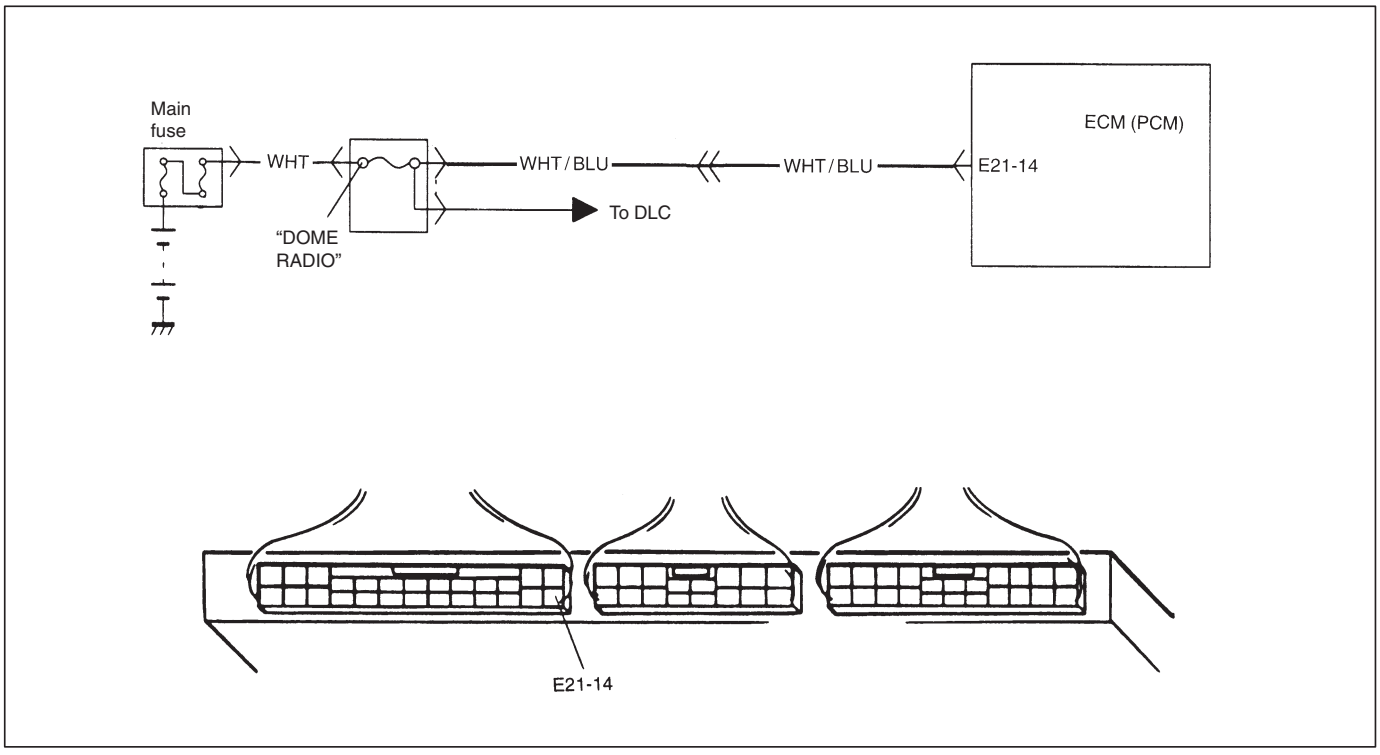
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, crank engine and run it at idle for 3 min.
3) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check for voltage at terminal E23-16 of ECM (PCM) connector connected, under following condition. While engine cranking : 6 – 10 V After starting engine : 0 V Is voltage as specified?	Poor E23-16 connection or intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	"BLK/YEL" circuit open.

DTC P1510 ECM (PCM) BACK-UP POWER SUPPLY MALFUNCTION

CIRCUIT DESCRIPTION



Battery voltage is supplied so that diagnostic trouble code memory, values for engine control learned by ECM (PCM), etc. are kept in ECM (PCM) even when the ignition switch is turned OFF.

DTC DETECTING CONDITION	POSSIBLE CAUSE
● Low voltage at terminal E21-14 after starting engine.	● "WHT/BLU" circuit open ● ECM (PCM) malfunction

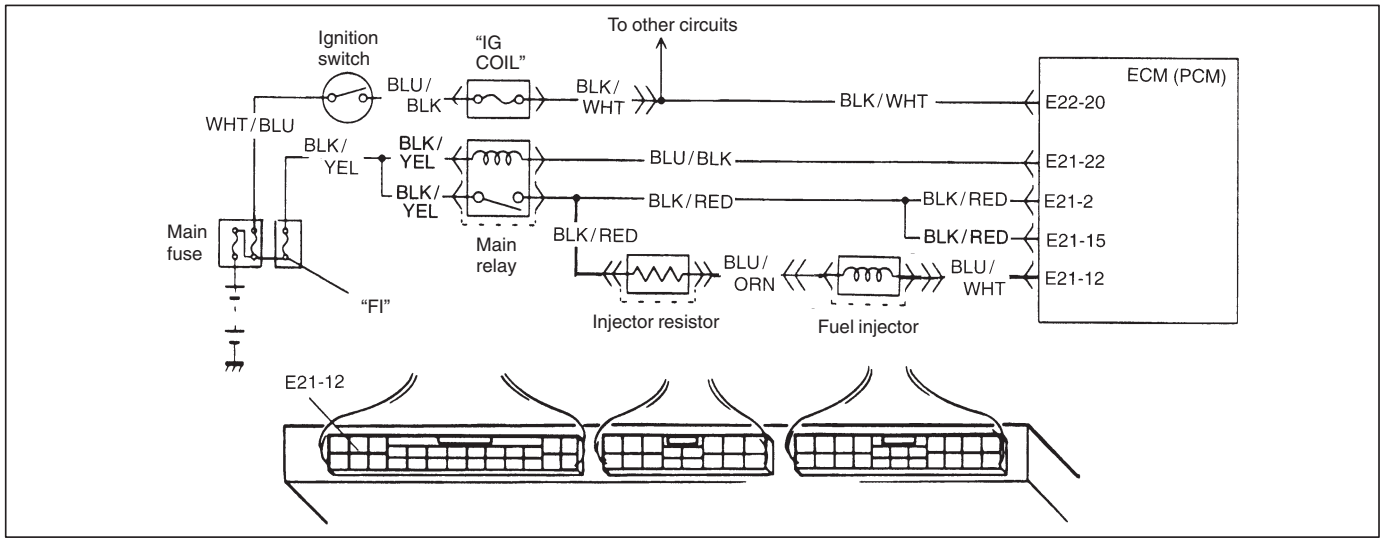
DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and run it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

STEP	ACTION	YES	NO
1	Check for voltage at terminal E21-14 of ECM (PCM) connector connected, under each condition, ignition switch OFF and engine running. Is it 10 – 14 V at each condition?	Poor E21-14 connection or intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If wire and connections are OK, substitute a known- good ECM (PCM) and recheck.	"WHT/BLU" circuit open.

TABLE B-1 FUEL INJECTOR CIRCUIT CHECK

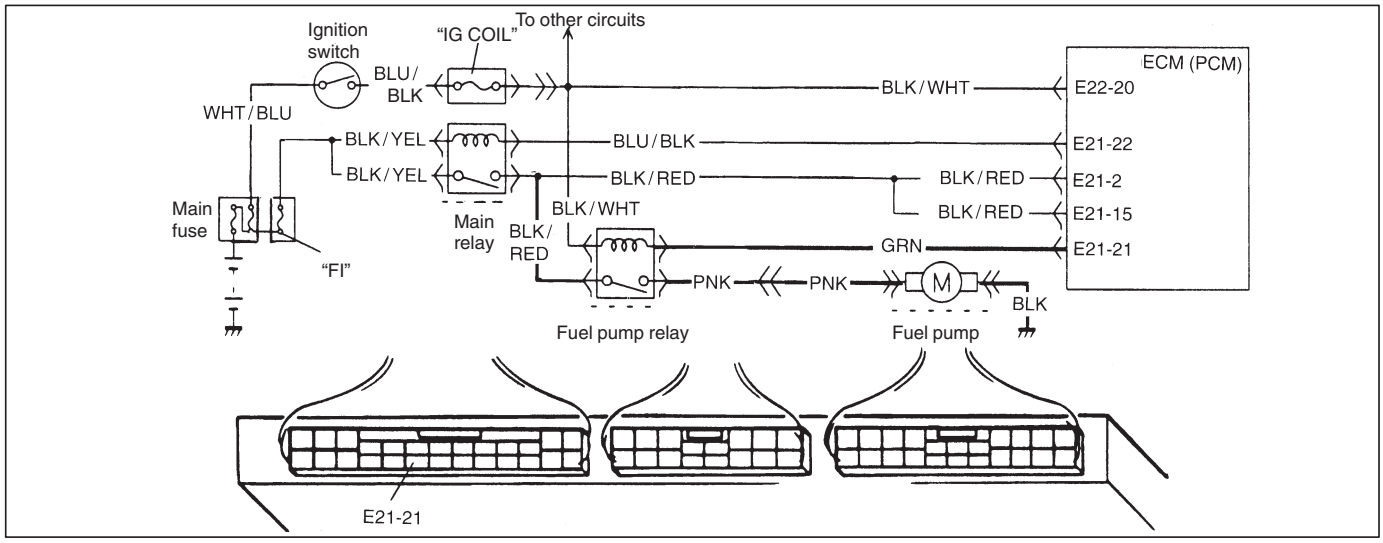


INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Injector Circuit Check 1) Check injector circuit for short. Is fuel injected from injector at ignition switch ON?	"BLU/WHT" wire shorted to ground or faulty injector. If wire and injector is as specified respectively and then substitute known-good ECM (PCM) and recheck.	Go to Step 3.
3	Injector Check 1) Check injector for fuel Injection referring to FUEL INJECTOR ON-VEHICLE INSPECTION in Section 6E1. Is fuel injected from injector at engine cranking?	Go to Step 4.	Go to Step 5.
4	Injector Leakage Check 1) Check injector for leaks referring to FUEL INJECTOR ON-VEHICLE INSPECTION in Section 6E1. Is it in good condition?	Injector and its circuit are in good condition.	Faulty fuel injector.
5	Check Injector for Operating Sound. 1) Using sound scope, check injector for operating sound at engine cranking. Is it detected?	Proceed to DIAG. FLOW TABLE B-2 and B-3.	Go to Step 6.

STEP	ACTION	YES	NO
6	Check Injector Resistor for Resistance. 1) Disconnect resistor connector with ignition switch OFF. 2) Check for proper connection to resistor at each terminals. 3) If connection is OK, check resistance. Is resistance 1.9 – 2.1 Ω (at 20°C, 68°F)?	"BLK/RED", "BLU/ORN" or "BLU/WHT" wire open or poor E21-12 connection. If wires and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace resistor.

TABLE B-2 FUEL PUMP AND ITS CIRCUIT CHECK



INSPECTION

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check Fuel Pump Control System for Operation. See Fig. 1. Is fuel pump heard to operate for 2 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 3.
3	Check Fuel Pump for Operation. 1) Remove fuel pump relay from relay box with ignition switch OFF. 2) Check for proper connection to relay at each terminals. 3) If OK, using service wire, connect terminals of relay connector. See Fig. 2. **CAUTION: Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM (PCM), wire harness, etc.** Is fuel pump heard to operate at ignition switch ON?	Go to Step 4.	"PNK", "BLK" or "BLK/RED" circuit open or fuel pump malfunction.
4	Check Fuel Pump Relay for Operation. 1) Check resistance between each two terminals of fuel pump relay. See Fig.3. Between terminals "1" and "2": Infinity Between terminals "3" and "4": 100 – 120 Ω 2) Check that there is continuity between terminals "1" and "2" when battery is connected to terminals "3" and "4". Is fuel pump relay in good condition?	"GRN" circuit open or poor E21-21 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace fuel pump relay.

Fig. 1 for Step 2

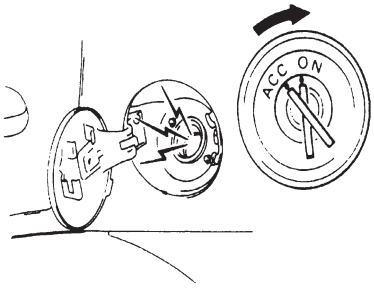


Fig. 2 for Step 3

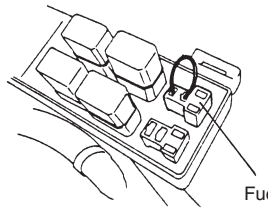


Fig. 3 for Step 4

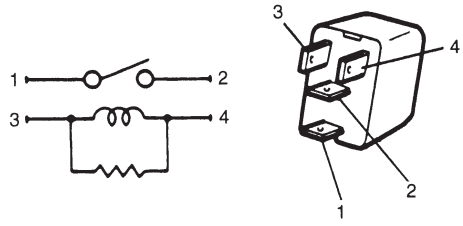
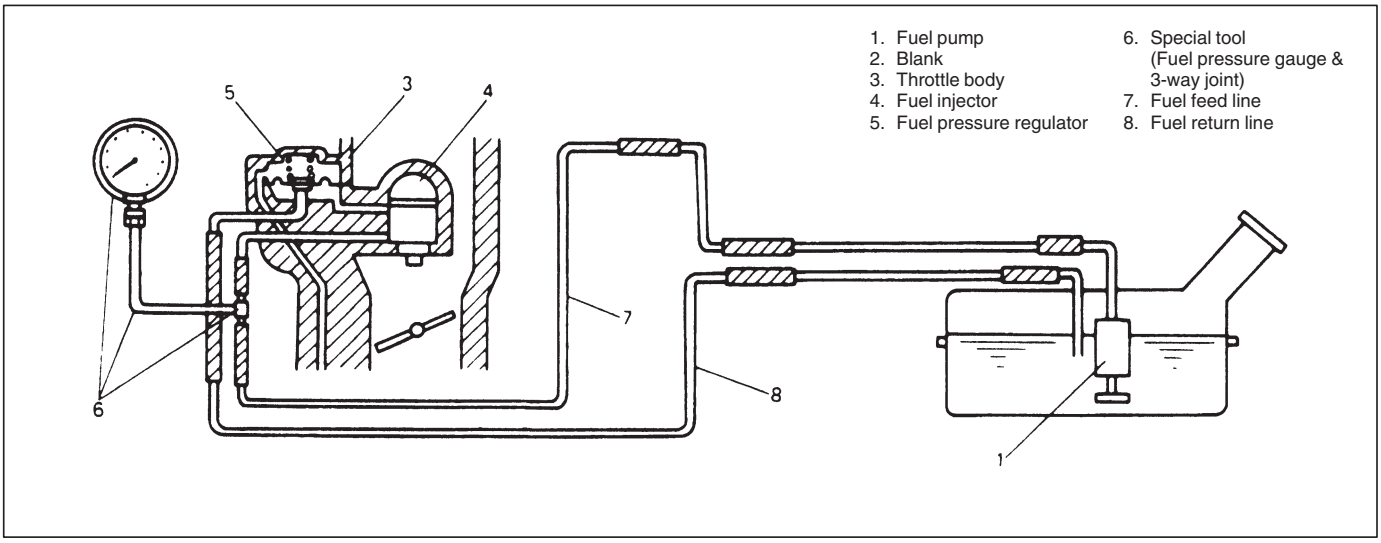


TABLE B-3 FUEL PRESSURE CHECK

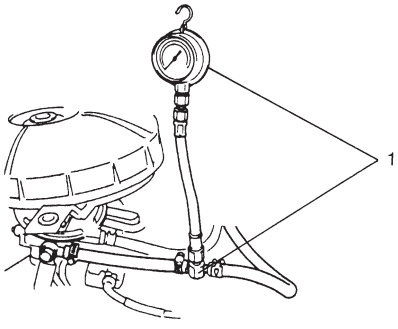


INSPECTION

STEP	ACTION	YES	NO
1	Check Fuel Pressure (Refer to Section 6E1 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 3) Check fuel pressure by repeating ignition switch ON and OFF. See Fig. 1. Is fuel pressure then 160 – 210 kPa (1.6 – 2.1 kg/cm^2, 22.7 – 29.9 psi)?	Go to Step 2.	Go to Step 4.
2	Is 90 kPa (0.9 kg/cm^2, 12.8 psi) or higher fuel pressure retained for 1 minute after fuel pump is stopped at Step 1?	Normal fuel pressure.	Go to Step 3.
3	1) Start engine and warm it up to normal operating temperature. 2) Keep it running at specified idle speed. Is fuel pressure then within 90 – 140 kPa (0.9 – 1.4 kg/cm^2, 12.8 – 20.0 psi)?	Normal fuel pressure.	● Clogged vacuum passage for fuel pressure regulator or ● Faulty fuel pressure regulator.
4	Is there fuel leakage from fuel feed line hose, pipe or their joint?	Fuel leakage from hose, pipe or joint.	Go to Step 10.
5	Was fuel pressure higher than specification in Step 1?	Go to Step 6.	Go to Step 7.
6	1) Disconnect fuel return hose from throttle body and connect new return hose to it. 2) Insert the other end of new return hose into approved gasoline container. 3) Operate fuel pump. Is specified fuel pressure obtained then?	Restricted fuel return hose or pipe.	Faulty fuel pressure regulator.
7	Was no fuel pressure supplied in Step 1?	Go to Step 8.	Go to Step 9.

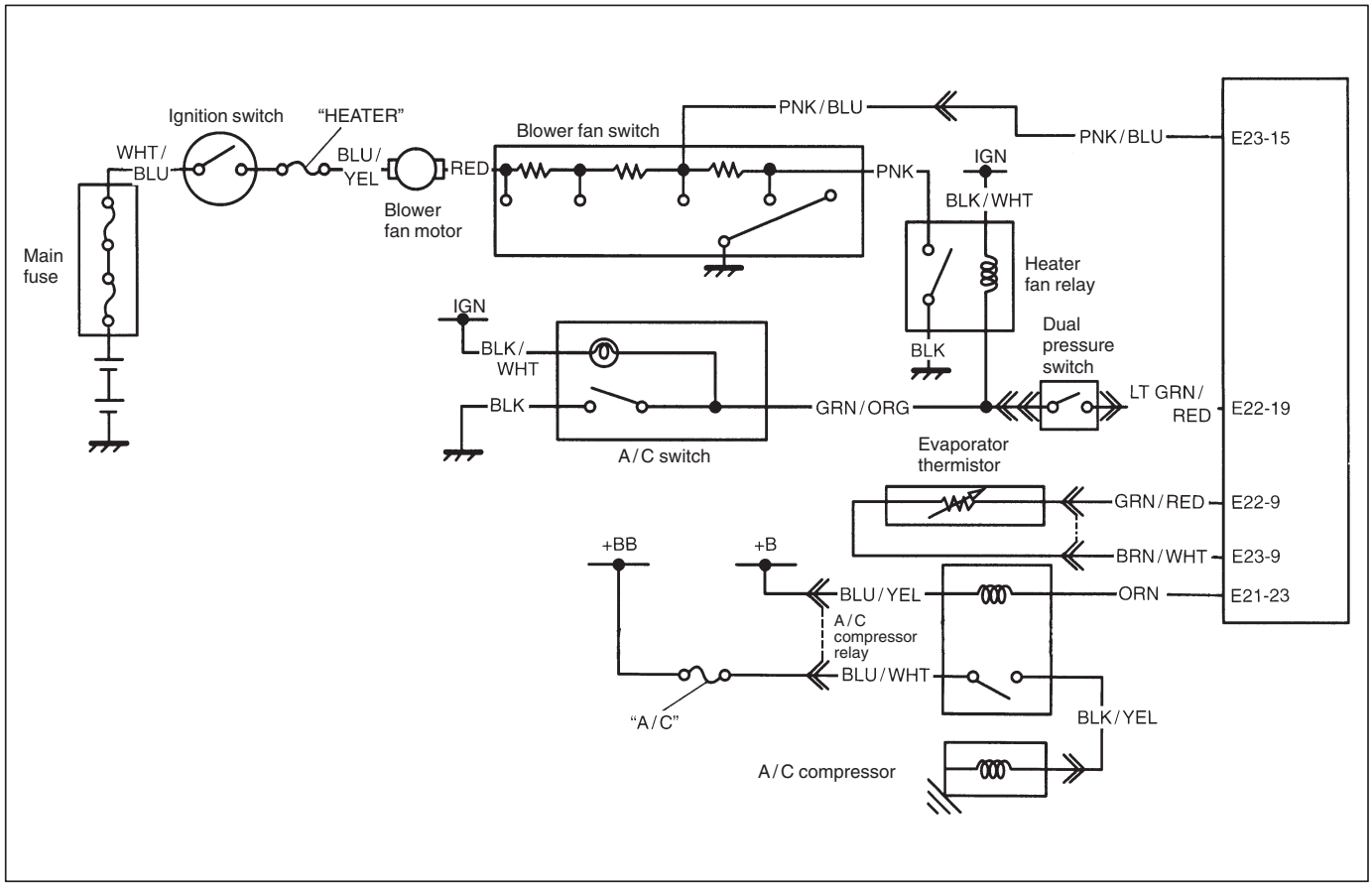
STEP	ACTION	YES	NO
8	With fuel pump operated and fuel return hose blocked by pinching it, is fuel pressure applied?	Faulty fuel pressure regulator.	Shortage of fuel or fuel pump or its circuit defective (refer to B-2 FUEL PUMP AND ITS CIRCUIT CHECK).
9	1) Operate fuel pump. 2) With fuel return hose blocked by pinching it, check fuel pressure. Is it 450 kPa (4.5 kg/cm^2, 63.9 psi) or more?	Faulty fuel pressure regulator.	● Clogged fuel filter, ● Restricted fuel feed hose or pipe, ● Faulty fuel pump or ● Fuel leakage from hose connection in fuel tank.
10	1) Disconnect fuel return hose from throttle body and connect new return hose to it. 2) Insert the other end of new return hose into approved gasoline container. 3) Check again if specified pressure is retained. While doing so, does fuel come out of return hose?	Faulty fuel pressure regulator.	● Fuel leakage from injector, ● Fuel leakage from between injector and throttle body, ● Faulty fuel pump (faulty check valve in fuel pump) or ● Fuel leakage from fuel pressure regulator diaphragm.

Fig. 1 for Step 1



1. Fuel pressure gauge & 3way joint

TABLE B-4 A/C SIGNAL CIRCUITS CHECK (VEHICLE WITH A/C)

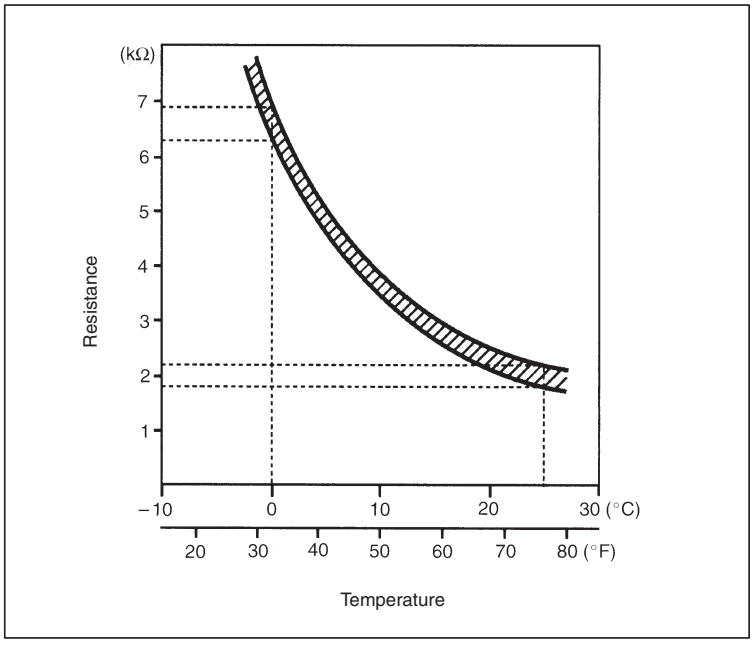


INSPECTION

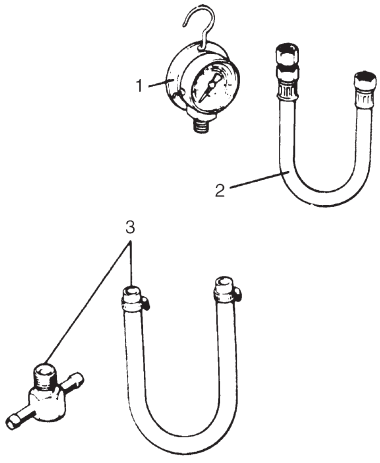
STEP	ACTION	YES	NO
1	1) Disconnect ECM connectors with ignition switch at OFF position. 2) Check resistance between E22-9 terminal and E23-9 terminal. 3) Is it within specification? **Reference value. See Fig. 1.** **At 0°C 6.3 – 6.9 kΩ** **At 25°C 1.8 – 2.2 kΩ**	Go to Step 2.	Faulty A/C evaporator thermistor or its circuit.
2	1) Check voltage at E22-19 terminal under each condition given in table below. Ignition switch ON, A/C switch OFF: 10 – 14 V Ignition switch ON, A/C switch ON: 0 – 2 V 2) Is check result satisfactory?	Go to Step 3.	● "LT GRN/RED" wire open or short ● Poor E22-19 terminal connection If wire and connection are OK, substitute a known-good ECM and recheck.

<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>3</td><td>1) Check voltage at E21-23 terminal under each condition given in table below.
<table>
<tr><td>While engine running, A/C switch OFF</td><td>0 V</td></tr>
<tr><td>While engine running, A/C switch ON</td><td>10 – 14V</td></tr>
</table>
NOTE:
When A/C evaporator thermistor temp. is below 2.5°C (36.5°F), A/C remain OFF (E21-23 terminal voltage become 0 – 1 V). This condition is not abnormal.
2) Is check result satisfactory?</td><td>A/C control system circuits are in good condition.</td><td>● “ORN” or “BLU/YEL” wire open or short
● Poor E21-23 terminal connection
If wire and connection are OK, substitute a known-good ECM and recheck.</td></tr>
</table>

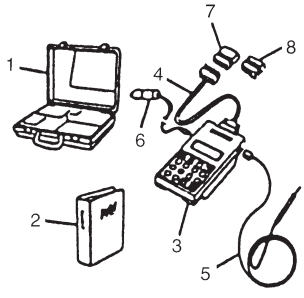
Fig. 1 for Step 1



SPECIAL TOOL

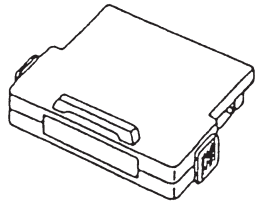


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. 3-way joint & hose
   09912-58490

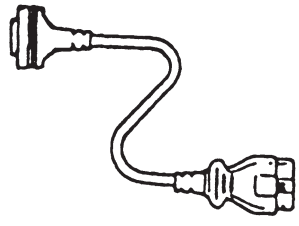


1. Storage case
2. Operator's manual
3. Tech 1 A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
SUZUKI scan tool (Tech 1 A) kit



Mass storage cartridge



09931-76030
16/14 pin DLC cable

SECTION 6A

ENGINE MECHANICAL

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

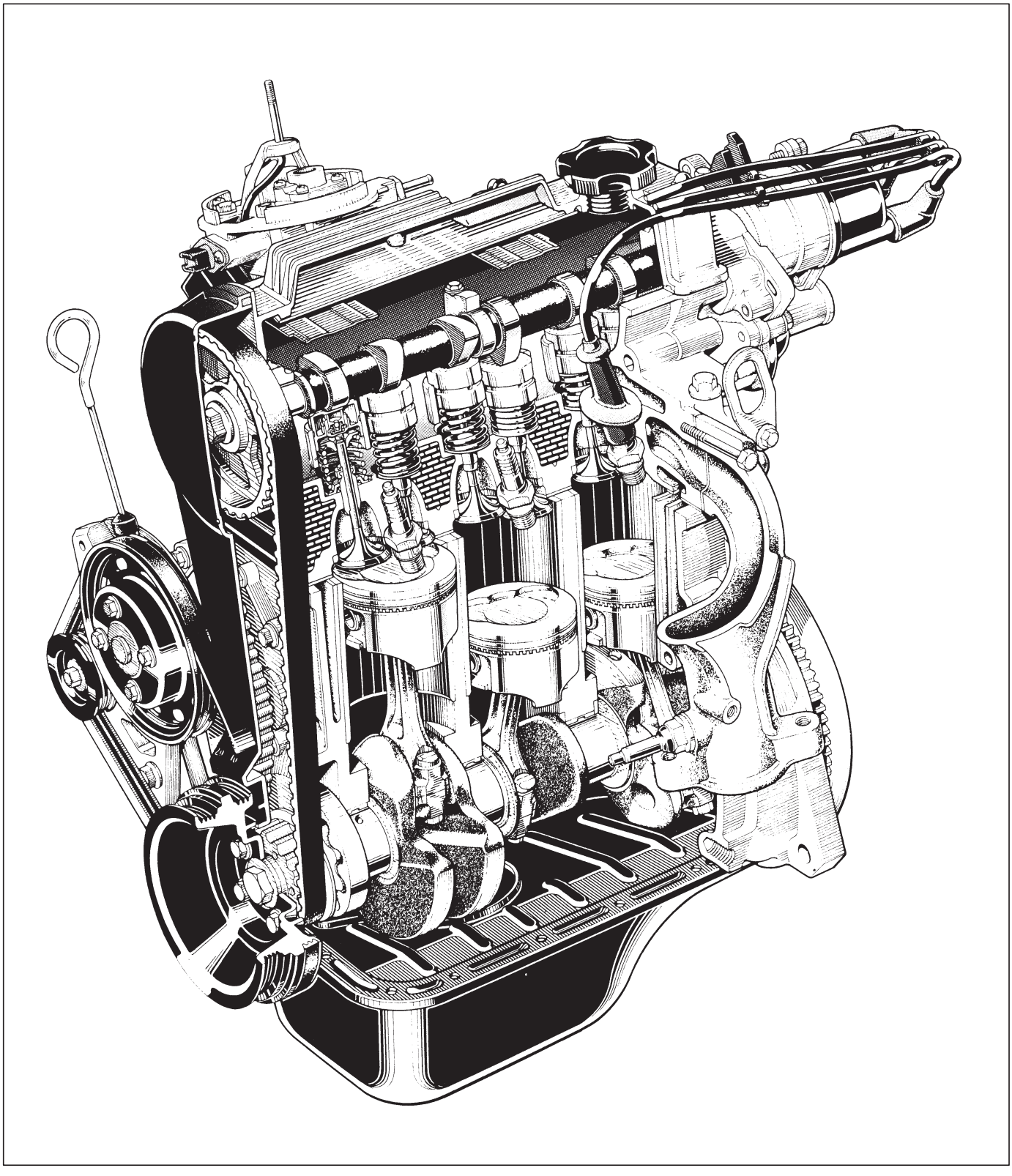
CONTENTS

GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, in line 3 cylinders, 4 stroke cycle gasoline unit equipped with a direct acting type S.O.H.C (Single Overhead Camshaft) valve mechanism.

The single overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing belt and opens and closes valves (IN & EX) via the hydraulic valve lash adjusters.



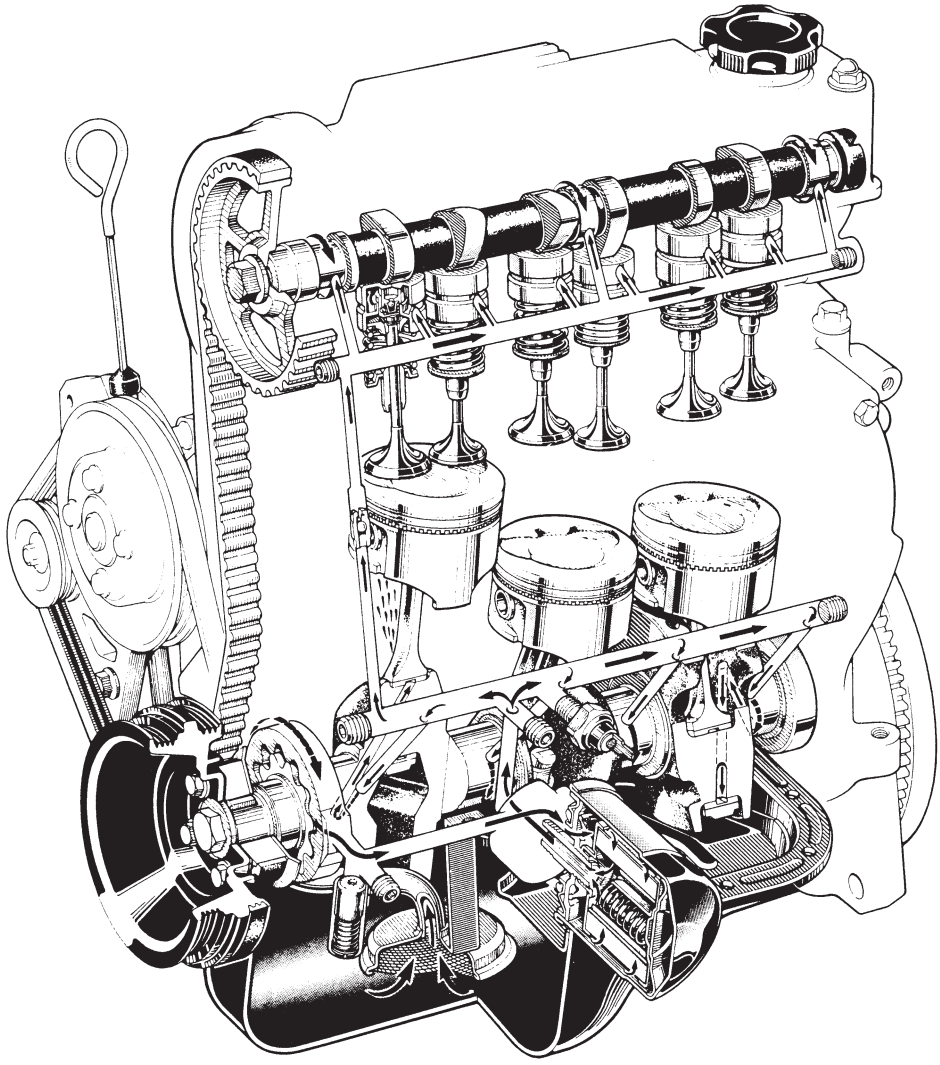
ENGINE LUBRICATION

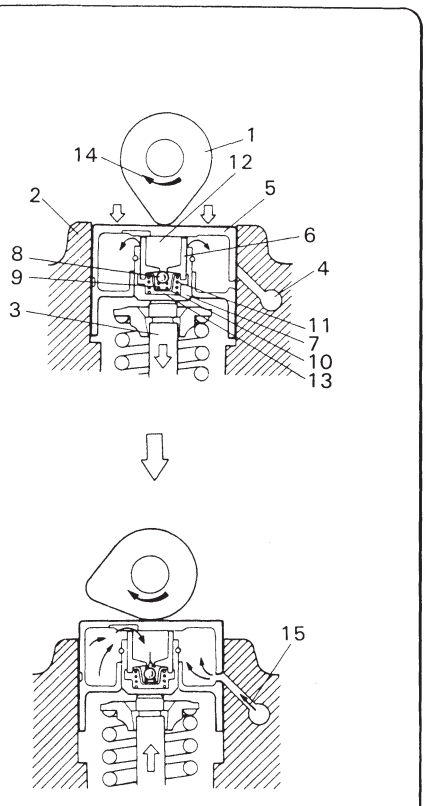
The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side.
Oil is drawn up through oil pump strainer and passed through pump to oil filter.
The filtered oil flows into two paths in cylinder block.
In one path, oil reaches crankshaft journal bearings.
Oil from crankshaft journal bearings is supplied to connecting rod bearings by means of intersecting passages drilled in crankshaft, and then injected from a small hole provided on big end of connecting rod to lubricate piston, rings, and cylinder wall.

In another path, oil goes up to cylinder head and lubricates camshaft journals, and hydraulic valve lash adjusters, etc., passing through oil gallery in cylinder head wall.

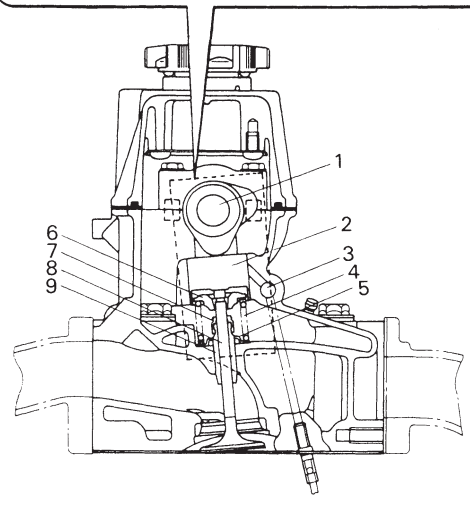
There is a check valve in the path from cylinder block to cylinder head. It serves to keep oil gallery in cylinder head filled with oil even when engine is at a stop.

An oil relief valve is provided on oil pump. This valve starts relieving oil pressure when the pressure comes over about 3.0 kg/cm^2 (42.7 psi, 300 kPa). Relieved oil drains back to oil pan.





1. Camshaft
2. Cylinder head
3. Valve stem
4. Oil gallery
5. Bucket body
6. Plunger
7. Body
8. Check ball
9. Check ball spring
10. Check ball cage
11. Plunger spring
12. Chamber “A”
13. Chember “B”
14. Direction of camshaft rotation
15. Oil flow



1. Camshaft
2. Valve lash adjuster
3. Oil gallery
4. Valve spring
5. Valve spring seat
6. Valve spring retainer
7. Valve stem seal
8. Valve stem
9. Valve guide

CYLINDER HEAD, VALVE TRAIN AND HYDRAULIC VALVE LASH ADJUSTER

The cylinder head is made of cast aluminum alloy and has three combustion chambers arranged in-line.

The single overhead camshaft driven by the crankshaft through the timing belt is mounted on the cylinder head. It has six cams and operates the intake and exhaust valves via the hydraulic valve lash adjuster.

OPERATION OF HYDRAULIC VALVE LASH ADJUSTER

The hydraulic valve lash adjuster located between the camshaft and valve stem is direct acting type. With the engine oil delivered into it from the oil pump, the adjuster operates as follows so as to adjust the valve lash (clearance) to “O” automatically at all time.

1) When the camshaft doesn’t push the bucket body, the bucket body is pushed against the cam and the body against the stem by the plunger spring force. In this state, the valve lash is kept to “O”. (At “O” valve lash, the oil pressure becomes equal in the chambers “A” and “B”, and the check ball closes the passage between these two chambers.)
2) When the cam crest of the camshaft start pushing the bucket body, the bucket body and plunger are pushed downward and at the same time the body is pushed upward by the counter force from the valve stem. As a result, the chamber “B” is compressed and the pressure rises high. Then the oil in the chamber “B” leaks through the slight clearance between the body and plunger. However, as the compression time is very short, the volume hardly changes and thus the bucket body, plunger and body, substantially as one unit, push down the valve stem to open the valve.
3) When pushing of the cam crest of the camshaft against the bucket body is over, the operation as described in above 1) starts again. As the oil pressure in the chamber “B” is lower than that in “A” (for the oil in the chamber “B” under high pressure has leaked gradually in above 2)), the oil pressure in the chamber “A” pushes the check ball open to allow the oil to flow from the chamber “A” to chamber “B” till the oil pressure becomes equal between the two chambers.

CYLINDER BLOCK

The cylinder block is made of cast aluminum alloy and has 3 cylinders arranged “In-Line”.
A cylindrical cast iron sleeve is installed in each cylinder.

CRANKSHAFT AND MAIN BEARINGS

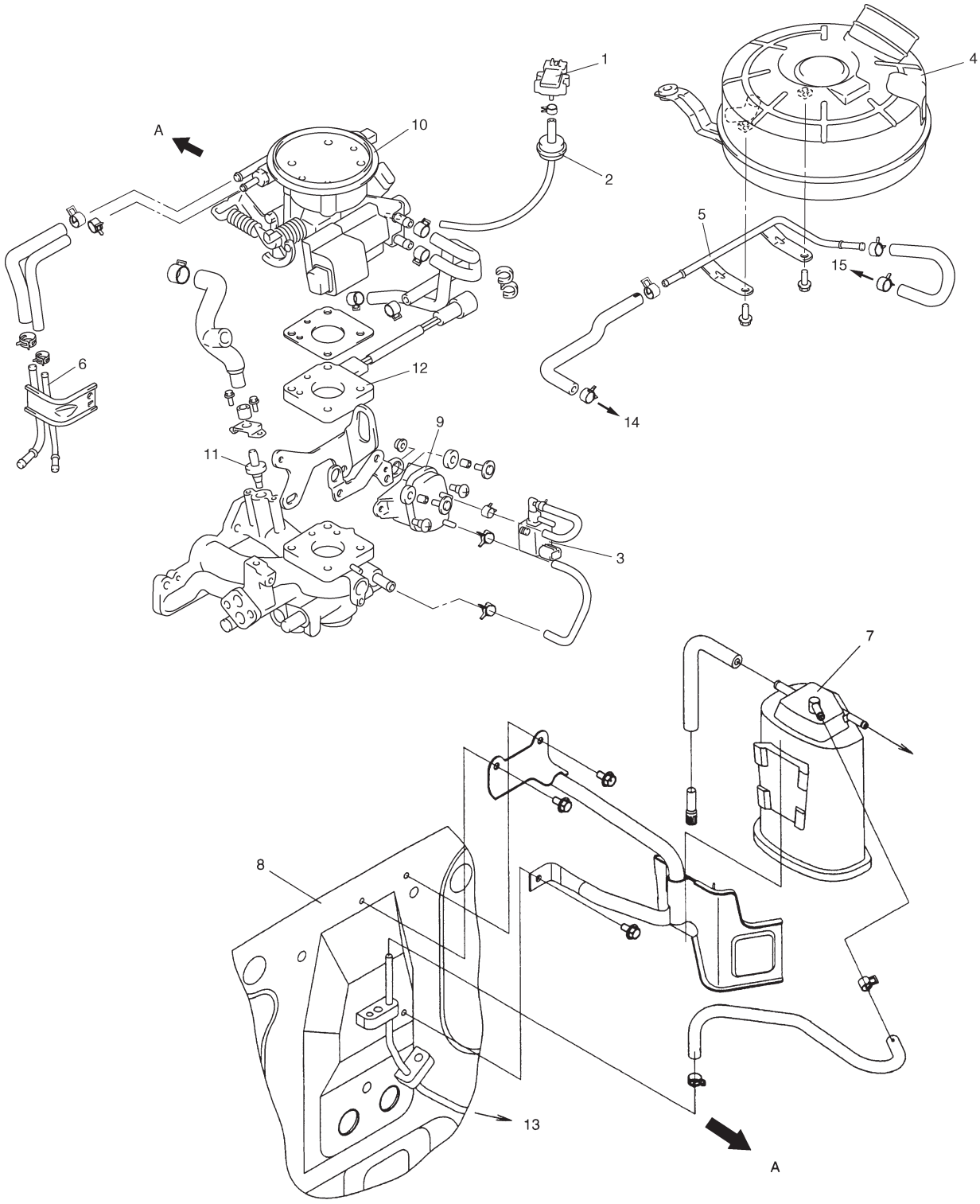
A monoblock crankshaft made of forged steel is supported by 4 main bearings which are of precision insert type.
Three crank pins on the crankshaft are positioned 120° apart.

PISTONS, RINGS, PISTON PINS AND CONNECTING RODS

The piston is cast aluminum alloy, and has two compression rings and one oil ring.
Among two compression rings (top and 2nd rings), the top ring is plated with hard chromium for improvement in abrasion resistance.
The oil ring consists of two rails and one spacer.
The piston pin is offset 0.5 mm towards the major thrust side.
This allows a gradual change in thrust pressure against the cylinder wall as the piston travels its path.
Pins, made of chromium steel, have a floating fit in the pistons and in the connecting rods. The connecting rods are made of forged steel, and the rod bearings are of precision insert type.

ON-VEHICLE SERVICE

HOSE AND PIPE ROUTING



A: Forward
1. MAP sensor
2. Filter
3. EVAP canister purge valve
4. Air chamber case
5. Vacuum pipe
6. Fuel pipe
7. EVAP canister
8. Dash panel
9. EVAP canister surge tank
10. Throttle body
11. PCV valve
12. EFE heater
13. To fuel tank
14. To EVAP canister
15. To EVAP canister purge valve

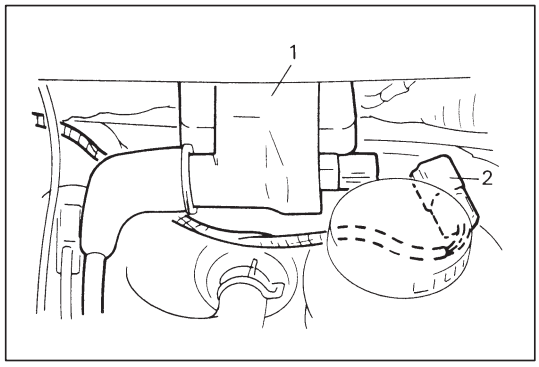
COMPRESSION CHECK

Check compression pressure on all three cylinders as follows:

1) Warm up engine.
2) Stop engine after warming up.

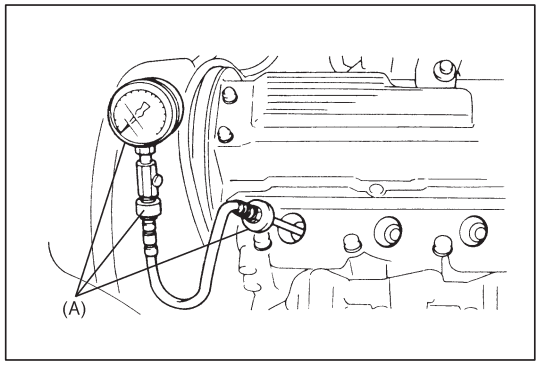
   NOTE:
   After warming up engine, place transmission gear shift lever in "Neutral" and set parking brake and block drive wheels.

3) Remove all spark plugs and disconnect fuel injector wire harness at coupler.



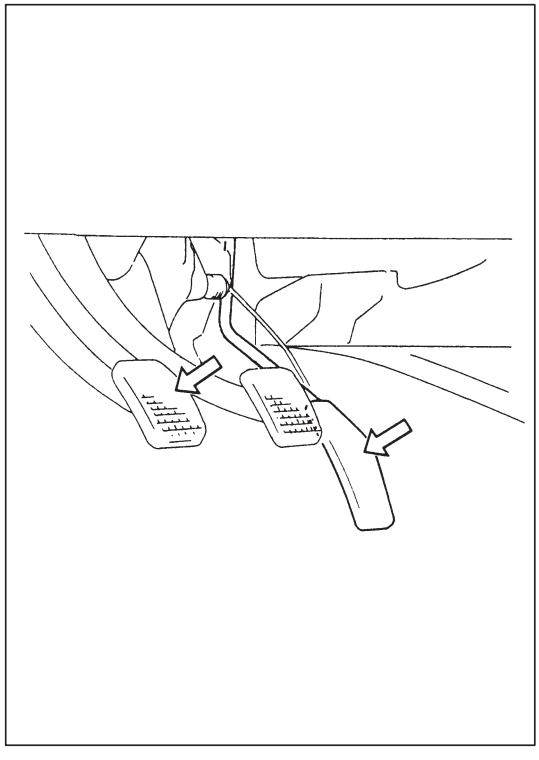
4) Disconnect ignition coil (1) wire harness at coupler (2).

   WARNING:
   Failure in disconnecting ignition coil coupler can cause spark to occur in engine room possibly resulting in a dangerous explosion.



5) Install special tool (Compression gauge) into spark plug hole.

   Special Tool
   (A): 09915-64510



6) Disengage clutch (to lighten starting load on engine) and depress accelerator pedal all the way to make throttle valve full-open.
7) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

   NOTE:
   For measuring compression pressure, crank engine at least 250 r/min. by using fully charged battery.

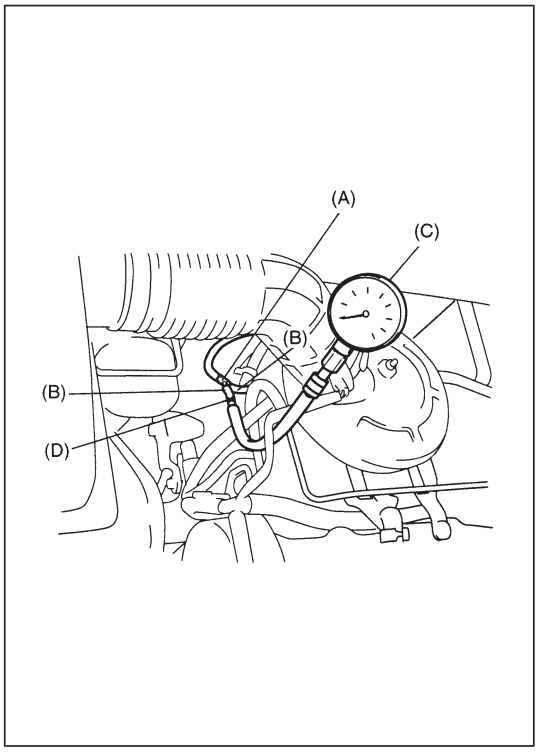
	Compression pressure
Standard	1400 kPa (14.0 kg/cm^2, 199.0 psi)
Limit	1100 kPa (11.0 kg/cm^2, 156.4 psi)
Max. difference between any two cylinders	100 kPa (1.0 kg/cm^2, 14.2 psi)

8) Carry out steps 5) through 7) on each cylinder to obtain four readings.
9) After checking, connect coupler of distributor, fuel injector and install spark plugs.

ENGINE VACUUM CHECK

The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

1) Warm up engine to normal operating temperature.



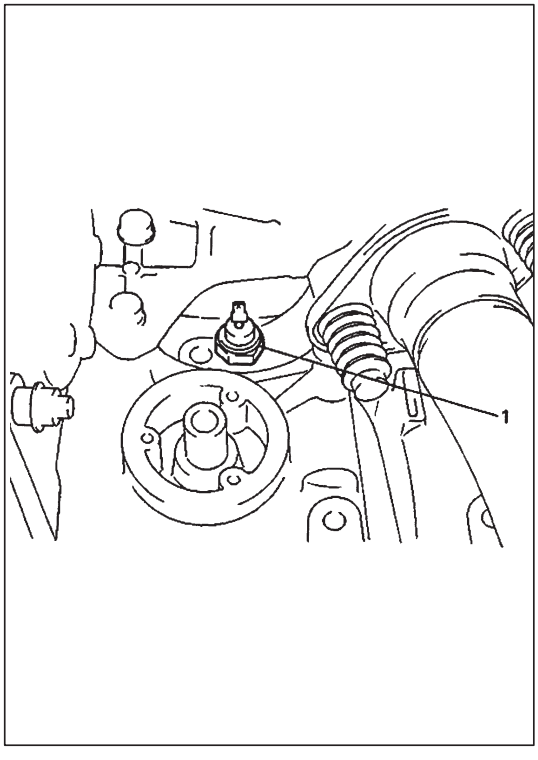
2) With engine stopped, disconnect MAP sensor hose from throttle body and connect 3-way joint, hoses and special tool (vacuum gauge and joint) between throttle body and MAP sensor hose disconnected.

   Special Tool
   (A): 09367-04002
   (B): 09343-03087
   (C): 09915-67310
   (D): 09918-08210

3) Run engine at specified idle speed (see Section 6E1), and read vacuum gauge. Vacuum should be within following specification.

   Vacuum specification: 52.6 – 65.8 kPa (40 – 50 cm·Hg, 15.7 – 19.7 in·Hg) at specified idling speed

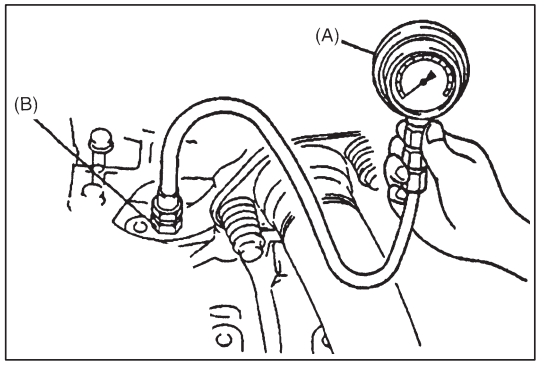
4) After checking, connect MAP sensor hose to throttle body.



OIL PRESSURE CHECK

NOTE:
Prior to checking oil pressure, check the followings.
- **Oil level in oil pan.**
  If oil level is low, add oil up to Full level hole on oil level gauge.
- **Oil quality.**
  If oil is discolored, or deteriorated, change it.
  For particular oil to be used, refer to the table in Section 0B.
- **Oil leaks.**
  If leak is found, repair it.

1) Using special tool (Oil filter wrench), remove oil filter.
2) After removing oil filter, remove oil pressure switch (1) from cylinder block.



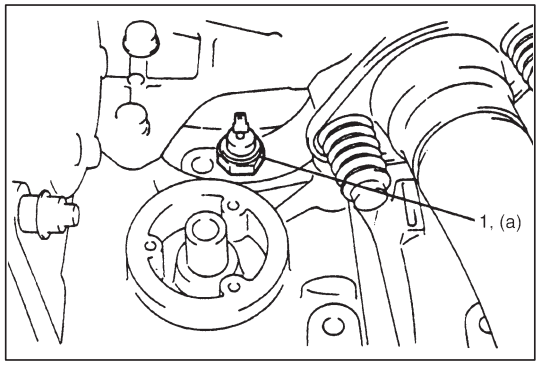
3) Install special tool (Oil pressure gauge) to vacated threaded hole.

Special Tool
(A): 09915-77310
(B): 09915-78211

4) Reinstall oil filter.
5) Start engine and warm it up to normal operating temperature.
6) After warming up, raise engine speed to 4,000 r/min and measure oil pressure.

Oil pressure specifications: 360 – 440 kPa
(3.6 – 4.4 kg/cm^2, 51.2 – 62.6 psi)
at 3,960 – 4,040 r/min (rpm)

7) After checking oil pressure, stop engine and remove oil filter and oil pressure gauge.



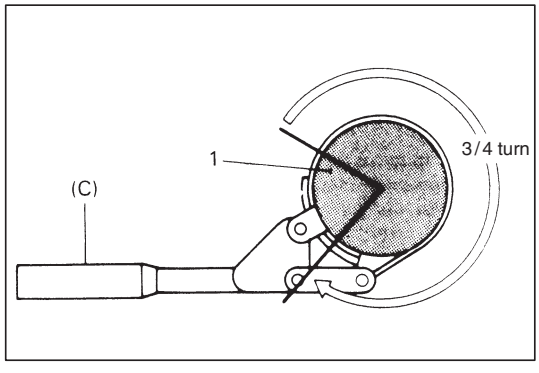
8) Before reinstalling oil pressure switch (1), be sure to wrap its screw threads with a sealing tape and tighten switch to specified torque.

NOTE:
If sealing tape edge is bulged out from screw threads of switch, cut it off.

Tightening Torque
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)

9) After oiling oil filter "O" ring (rubber gasket), screw oil filter on oil filter stand by hand until filter "O" ring contacts mounting surface.

CAUTION:
To tighten oil filter properly, it is important to accurately identify the position where filter "O" ring first contacts mounting surface.

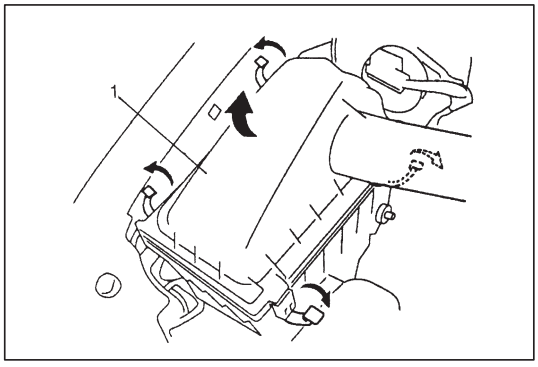


10) Tighten filter (1) 3/4 (270°) turn from the point of contact with mounting surface using an oil filter wrench.

Special Tool
(C): 09915-47310

CAUTION:
To prevent oil leakage, make sure that oil filter is tight, but do not overtighten it.

11) After installing oil filter, start engine and check oil filter for oil leakage.

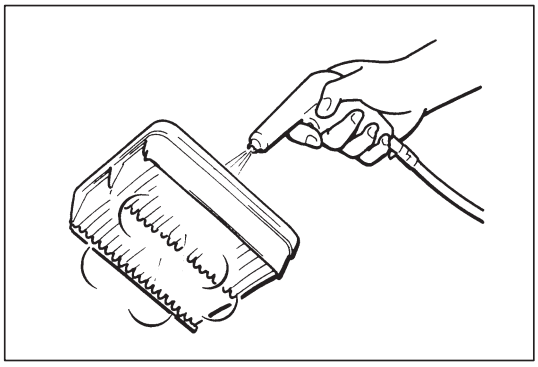


AIR CLEANER ELEMENT

This air cleaner element is of dry type. Remember that it needs cleaning according to following procedure.

REMOVAL

1) Disconnect air cleaner outlet No.1 hose from air cleaner assembly (1).
2) Open air cleaner case after unhooking its clamps.
3) Remove air cleaner element from case.



INSPECTION

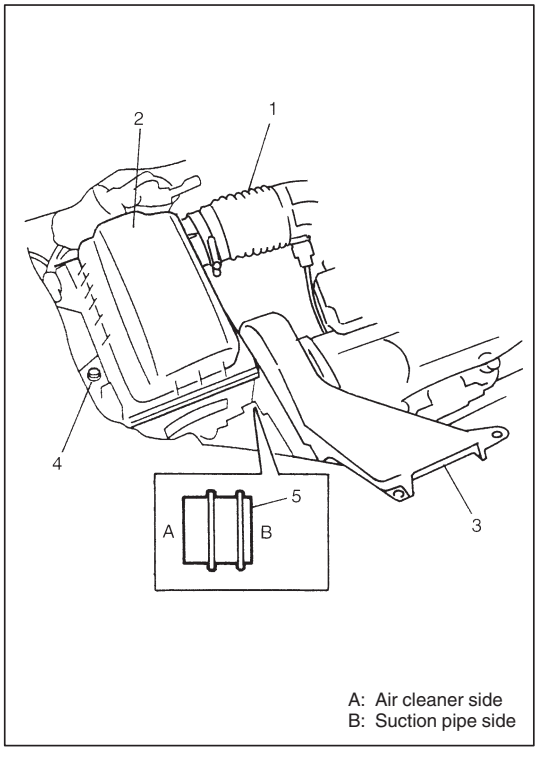
Check air cleaner element for dirt. Replace excessively dirty element.

CLEANING

Blow off dust by compressed air from air outlet side of element.

INSTALLATION

Reverse removal procedure for installation.



AIR CLEANER ASSEMBLY

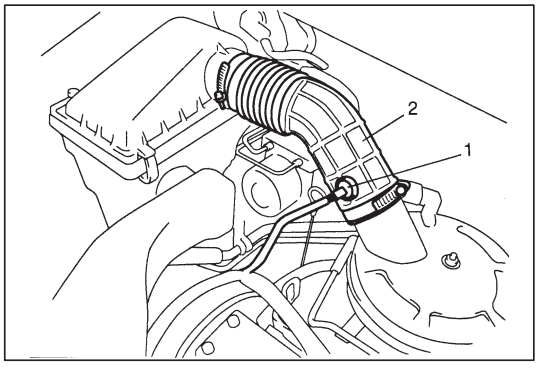
REMOVAL

1) Disconnect air cleaner outlet hose (1) from air cleaner assembly (2).
2) Remove suction pipe (3) from air cleaner assembly.
3) Remove air cleaner assembly by removing bolt (4) shown in figure.

INSTALLATION

Reverse removal procedure for installation, noting the following.

- Install suction pipe grommet (5) in the direction indicated in figure.
- Clamp each hose securely.



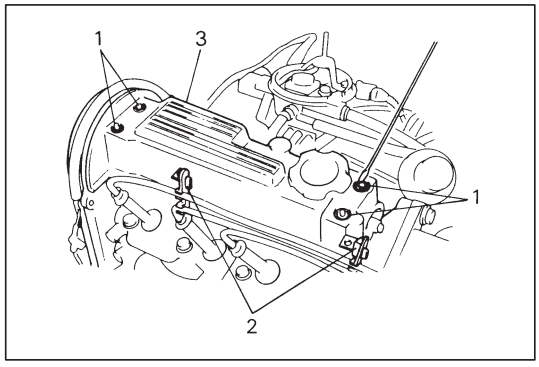
AIR CLEANER OUTLET HOSE

REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect IAT sensor (1) wire at coupler.
3) Remove air cleaner outlet hose (2).

INSTALLATION

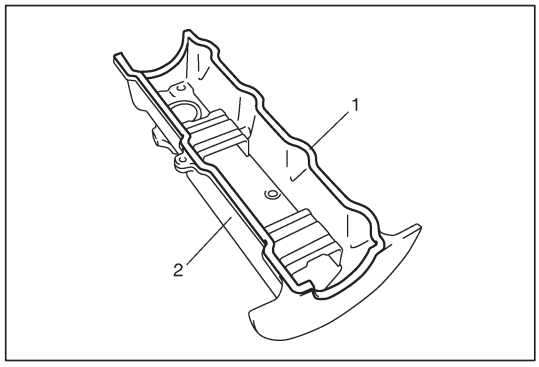
Reverse removal procedure for installation.



CYLINDER HEAD COVER

REMOVAL

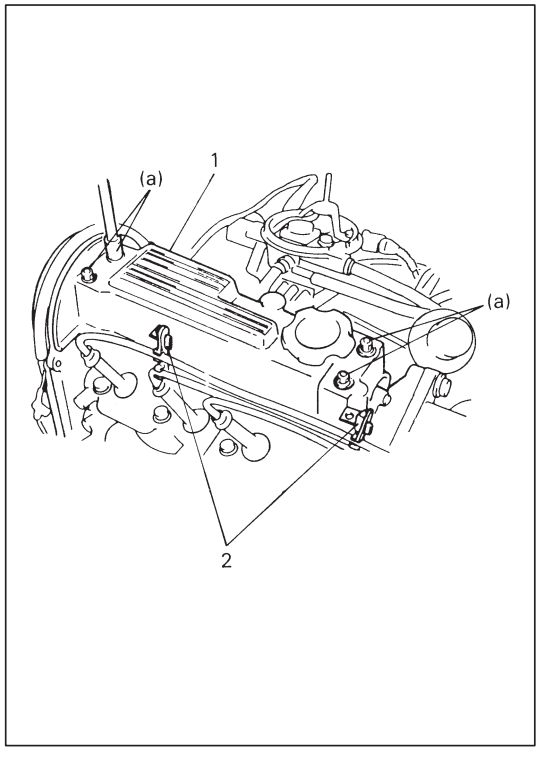
1) Disconnect negative cable at battery.
2) Remove air chamber case.
3) Remove high-tension cord clamps (2) from cylinder head cover.
4) Disconnect breather hose from cylinder head cover.
5) Remove cylinder head cover nuts and then seal washers (1).
6) Remove cylinder head cover (3) from cylinder head.



INSTALLATION

1) Install cylinder head cover gasket (1) to cylinder head cover (2).

NOTE:
Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.

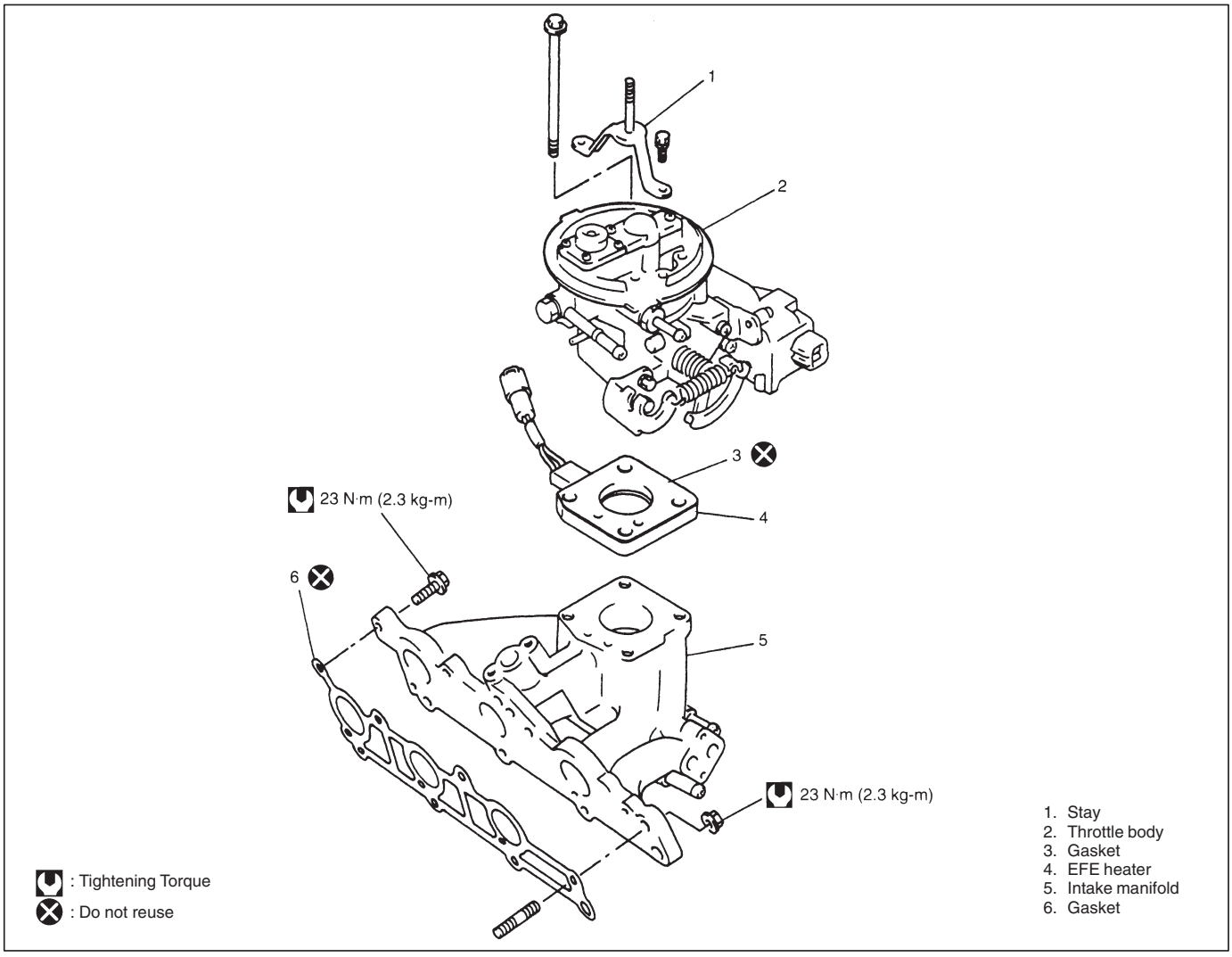


2) Install cylinder head cover (1).
   Before installing seal washers, check each one for deterioration or damage, and replace as necessary.
   Tighten cover nuts to specified torque.

   Tightening Torque
   (a): 4.5 N·m (0.45 kg-m, 3.5 lb-ft)

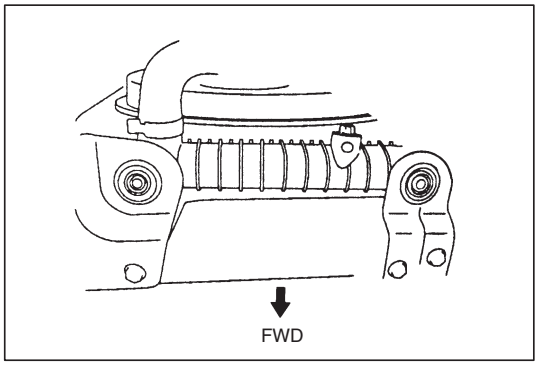
3) Install high-tension cord clamps (2) to cylinder head cover.
4) Connect breather hose to cylinder head cover.
5) Install air chamber case.
6) Connect negative cable at battery.

THROTTLE BODY AND INTAKE MANIFOLD



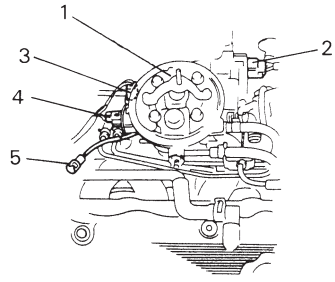
REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6-1.
2) Disconnect negative cable at battery.



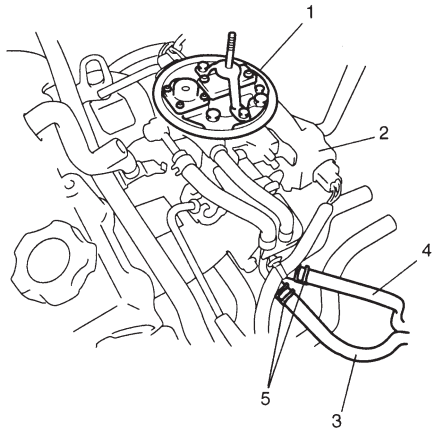
3) Drain cooling system.

WARNING:
To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



1. Throttle body

4) Remove air chamber case with air cleaner outlet hose.
5) Disconnect the following electric lead wires:
   - ISC actuator (2)
   - Ground wires from intake manifold
   - Fuel injector (4)
   - TP sensor (3)
   - EFE heater (5)



1. Throttle body
2. ISC actuator
5. Clamp

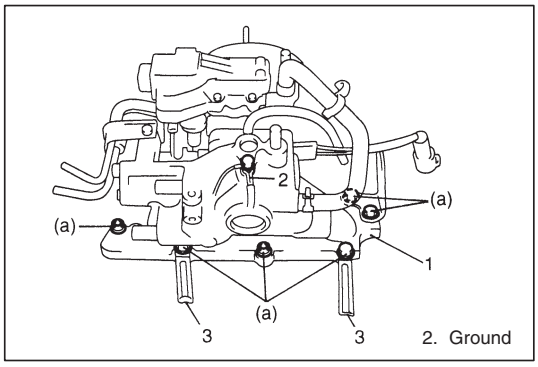
6) Disconnect fuel return (4) and feed hoses (3) from fuel pipes.
7) Disconnect coolant hoses from intake manifold and throttle body.
8) Remove EVAP surge tank with EVAP canister purge valve.

9) Disconnect the following vacuum hoses.
   - Pressure sensor hose from intake manifold.
   - Brake booster hose from intake manifold.

10) Disconnect breather hose from PCV valve.
11) Disconnect accelerator cable from throttle body.
12) Disconnect other connected to throttle body and intake manifold, if any.
13) Remove intake manifold with throttle body from cylinder head.
14) Remove throttle body from intake manifold.

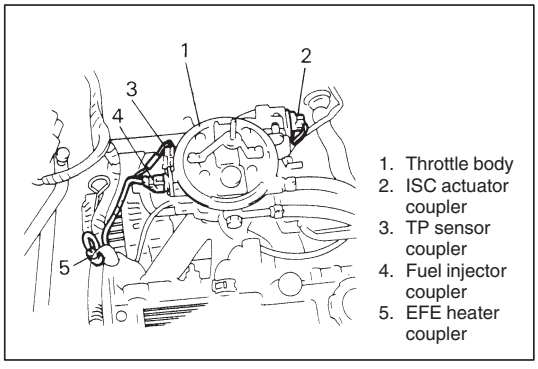
INSTALLATION

1) Install throttle body to intake manifold. (Refer to Section 6E1.)
2) Install intake manifold gasket to cylinder head. Use a new gasket.



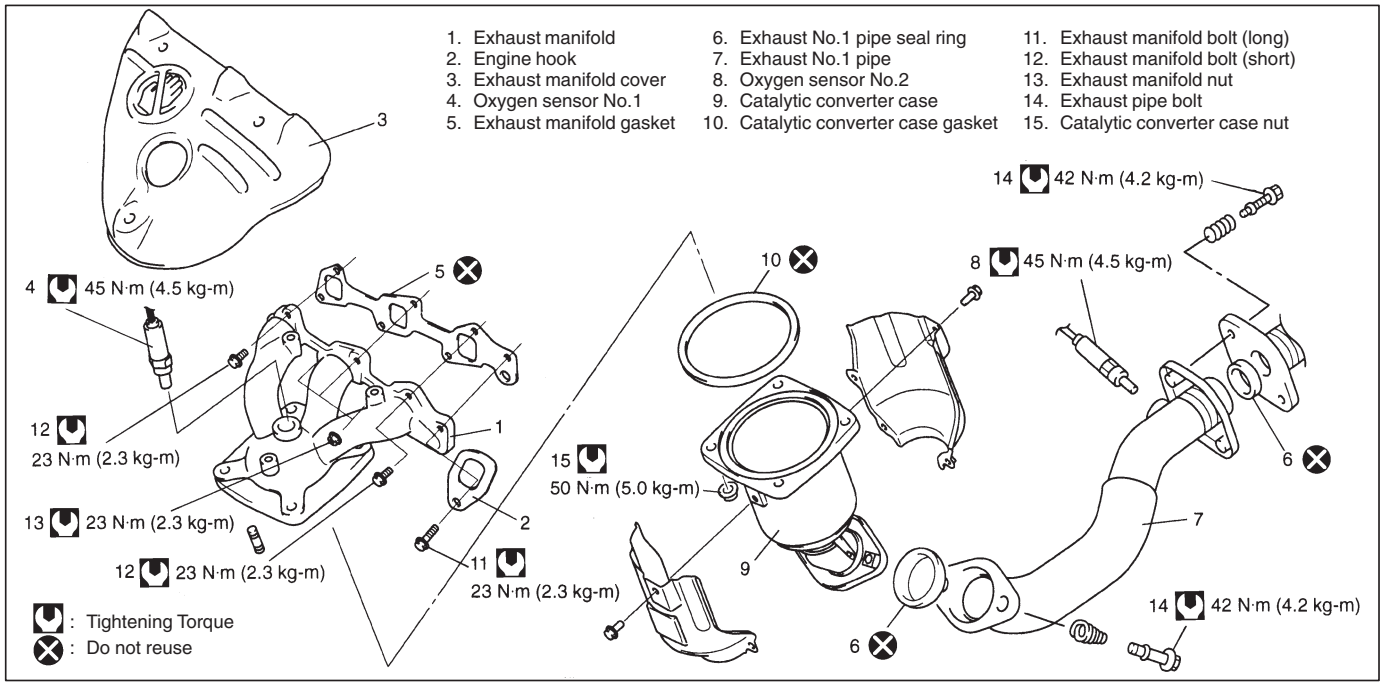
3) Install intake manifold (1) with throttle body to cylinder head.
   - Install clamps (3) as shown in figure, and tighten bolts and nuts to specification.

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

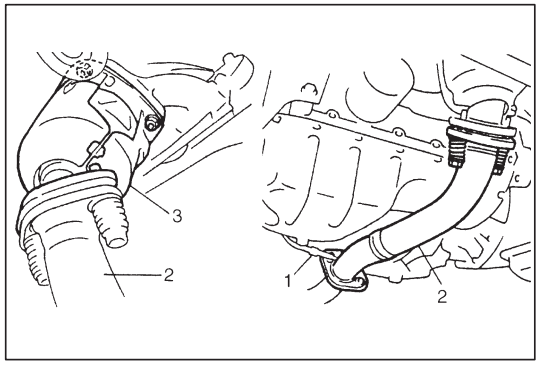


4) Connect breather hose to PCV valve.
5) Connect vacuum hoses.
6) Connect coolant hoses.
7) Connect fuel return and feed hoses to throttle body.
8) Connect electric lead wire.
9) Install EVAP surge tank with EVAP canister purge valve.
10) Connect accelerator cable to throttle body.
11) Install air cleaner assembly to throttle body.
12) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
13) Refill cooling system.
14) Connect negative cable at battery.
15) Upon completion of installation, start engine and check for fuel leaks and engine coolant leaks.
    After warming up engine, adjust accelerator cable play to specification according to description in Section 6E1.

EXHAUST MANIFOLD

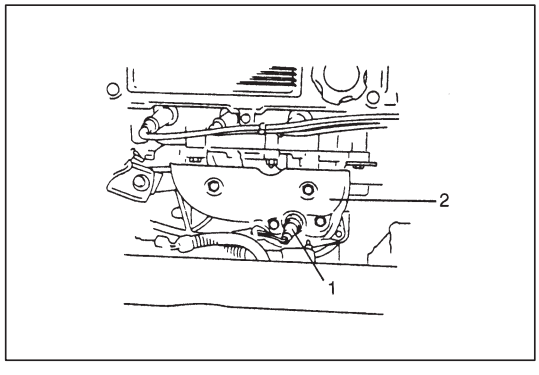


WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.

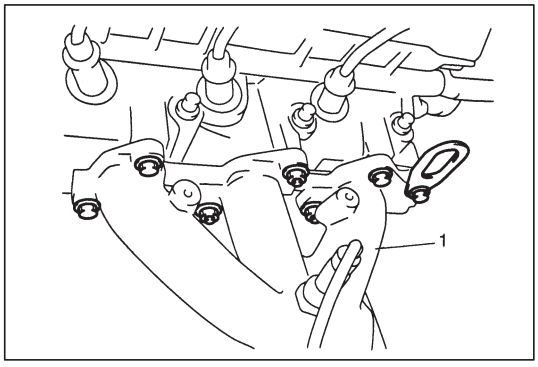


REMOVAL

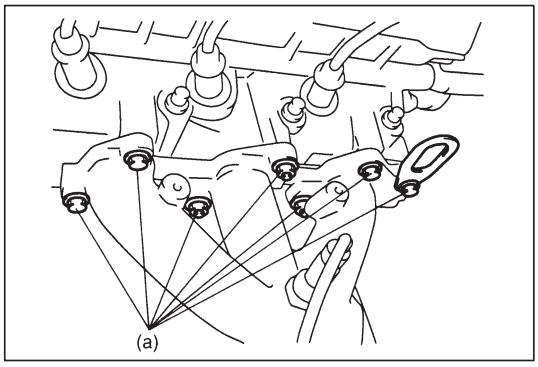
1) Disconnect negative cable at battery.
2) Disconnect oxygen sensor No.2 (1) coupler and clamp.
3) Remove exhaust No.1 pipe (2) with catalytic converter case (3).



4) Disconnect oxygen sensor No.1 (1) coupler and clamp.
5) Remove exhaust manifold cover (2).



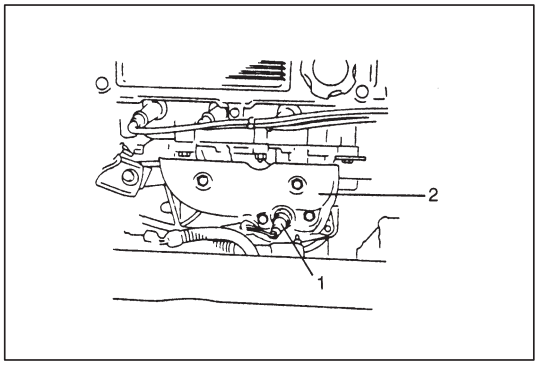
6) Remove exhaust manifold (1) and its gasket from cylinder head.
7) Remove catalytic converter case gasket and exhaust No.1 pipe seal ring (rear side).



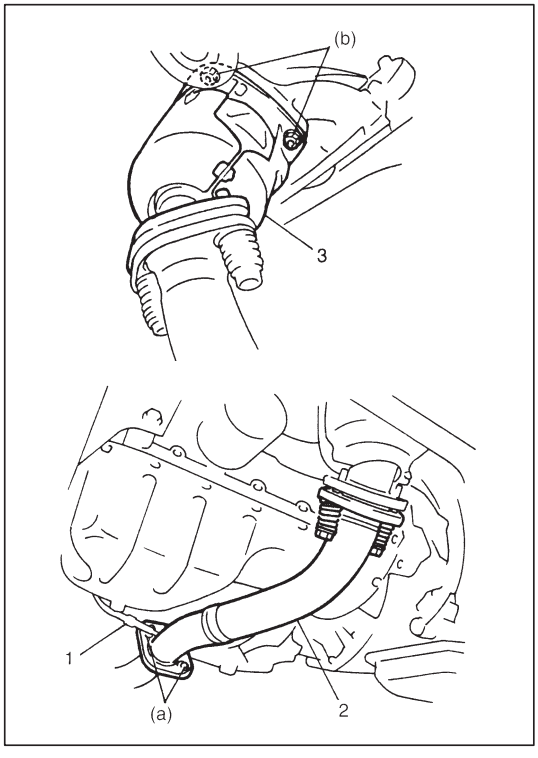
INSTALLATION

1) Install new gaskets to cylinder head, catalytic converter case and exhaust No.1 pipe (rear side).
2) Install exhaust manifold.
   Tighten manifold bolts and nuts to specified torque.

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



3) Install exhaust manifold cover (2).
4) Connect oxygen sensor No.1 (1) coupler and clamp its wire securely.

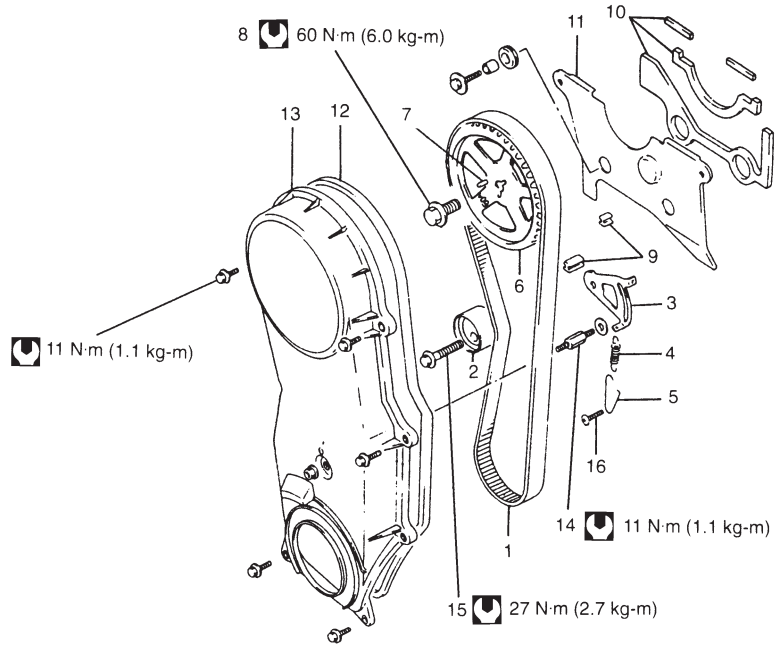


5) Install catalytic converter case (3) with exhaust No.1 pipe (2) to exhaust manifold.

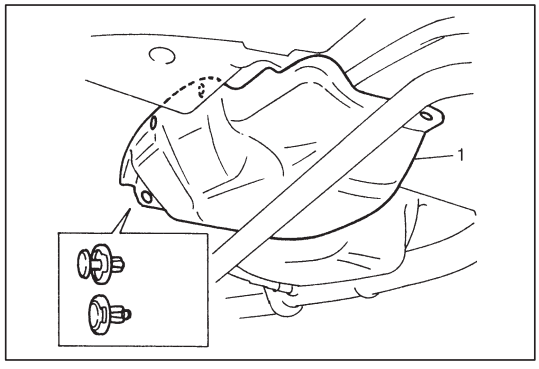
   Tightening Torque
   (a): 42 N·m (4.2 kg-m, 30.5 lb-ft)
   (b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

6) Connect oxygen sensor No.2 (1) coupler, refer to Section 6K of the Service Manual mentioned in FOREWORD of this manual.
7) Connect negative cable at battery.
8) Check exhaust system for exhaust gas leakage.

TIMING BELT AND BELT TENSIONER

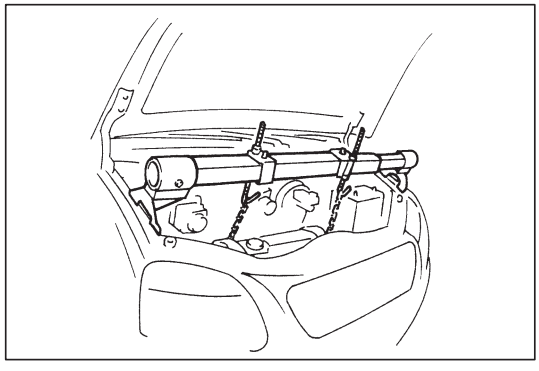


1. Timing belt
2. Tensioner
3. Tensioner plate
4. Tensioner spring
5. Spring damper
6. Camshaft timing pulley
7. Pin
8. Pulley bolt
9. Seal
10. Inside cover seal
11. Inside cover
12. Outside cover seal
13. Outside cover
14. Tensioner stud
15. Tensioner bolt
16. Tensioner spring screw

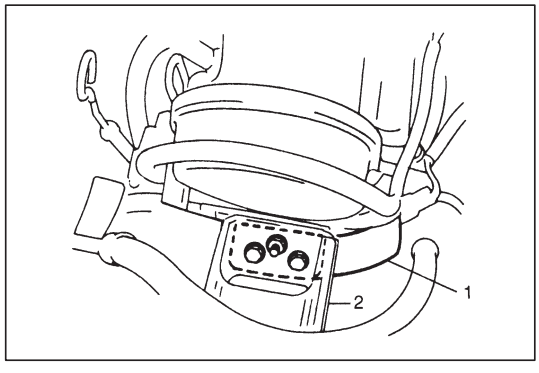


REMOVAL

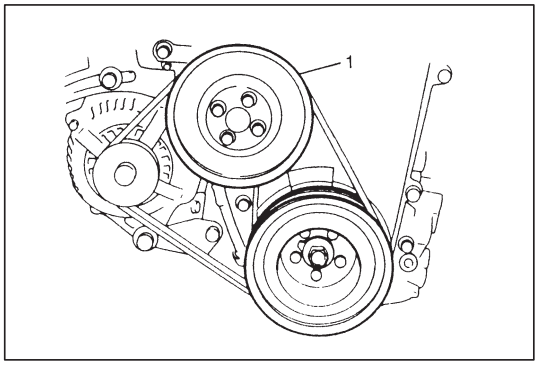
1) Disconnect negative cable at battery.
2) Remove right side of engine under cover (1).
3) Disconnect A/C suction and discharge hoses from A/C compressor.
4) Remove A/C compressor and its bracket (if equipped), refer to Section 1B.
5) Remove suction pipe and air cleaner assembly.



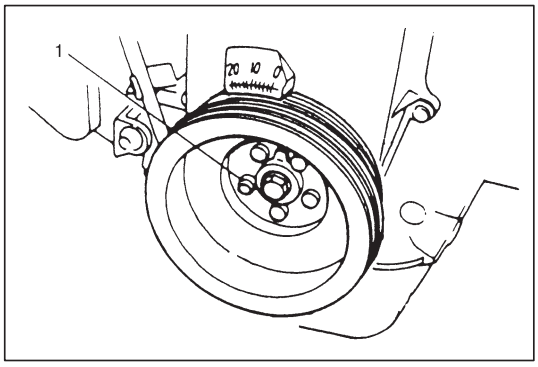
6) Support engine by using support device.



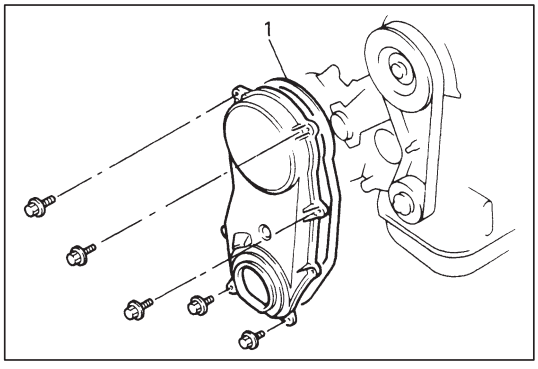
7) Remove engine right mounting bracket (1) and engine right mounting swing bracket (2).



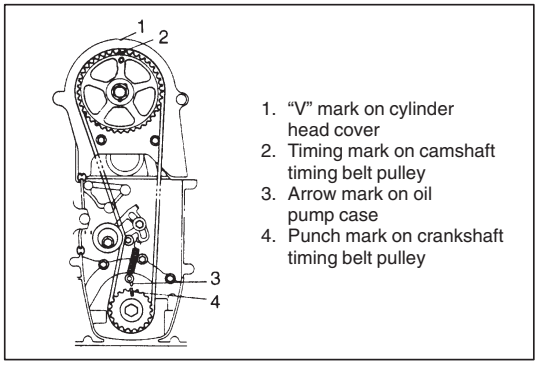
8) Remove water pump pulley (1) and drive belt.



9) Remove crankshaft pulley by removing pulley bolts (1).

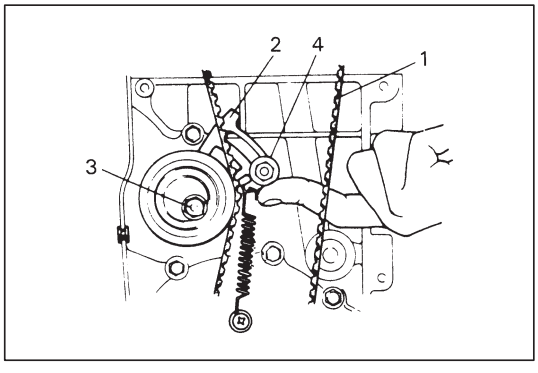


10) Release harness clamps.
11) Remove timing belt outside cover (1).



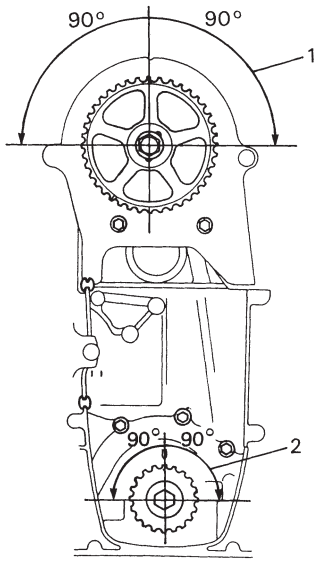
1. "V" mark on cylinder head cover
2. Timing mark on camshaft timing belt pulley
3. Arrow mark on oil pump case
4. Punch mark on crankshaft timing belt pulley

12) For installation of timing belt, align 4 timing marks as shown in figure by turning crankshaft.



13) Loosen tensioner bolt (3) and stud (4), and remove belt (1) from crankshaft timing belt pulley and camshaft timing belt pulley after pushing up the tensioner plate (2) fully by finger as shown figure.

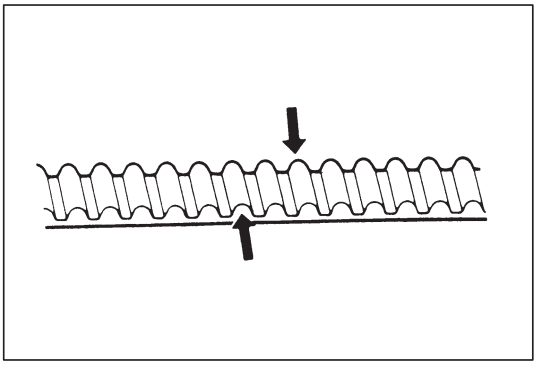
CAUTION:
Never bend timing belt.



1. Camshaft allowable turning range - - - By timing mark, within 90° from "V" mark on head cover on both right and left.
2. Crankshaft allowable turning range - - - By timing mark, within 90° from arrow mark on oil pump case on both right and left.

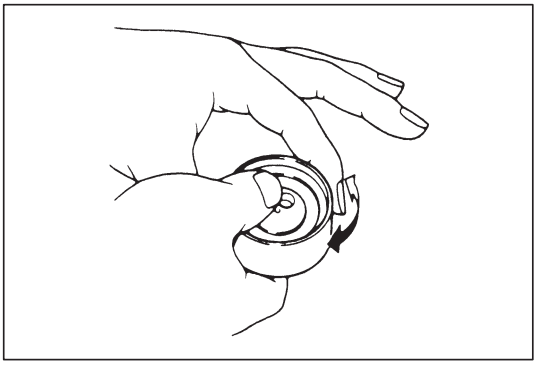
CAUTION:
- **After timing belt is removed, never turn camshaft and crankshaft independently more than such an extent as shown in figure. If turned, interference may occur among piston and valves, and parts related to piston and valves may be damaged.**
- **Never bend timing belt.**

14) Remove tensioner, tensioner plate, tensioner spring and spring damper.

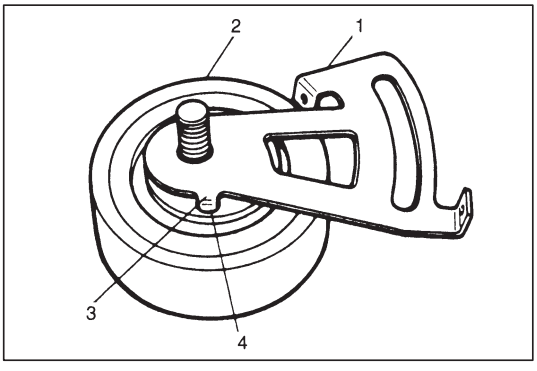


INSPECTION

- Inspect timing belt for wear or crack.
  Replace it as necessary.

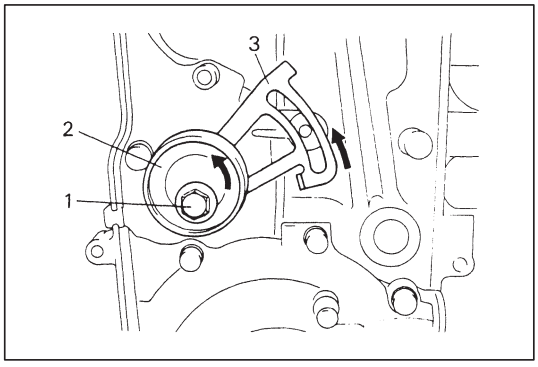


- Inspect tensioner for smooth rotation.

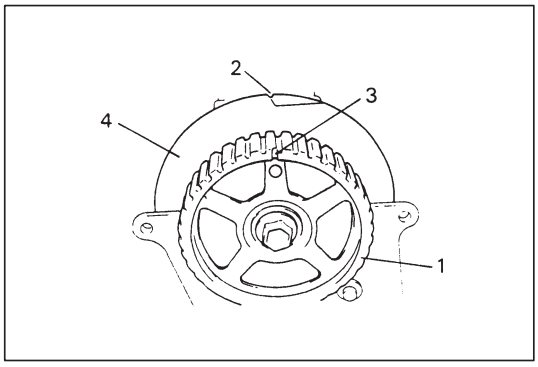


INSTALLATION

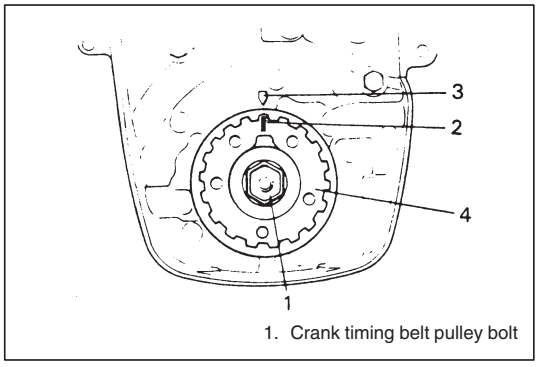
1) Install tensioner plate (1) to tensioner (2).
   Insert lug (3) of tensioner plate into hole (4) in tensioner.



2) Install tensioner (2) and tensioner plate (3):
Do not tighten tensioner bolt (1) and stud with wrench yet. Hand tighten only at this time.
Check to ensure that plate movement in arrow direction as shown in figure causes tensioner to move in the same direction. If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert plate lug into tensioner hole.

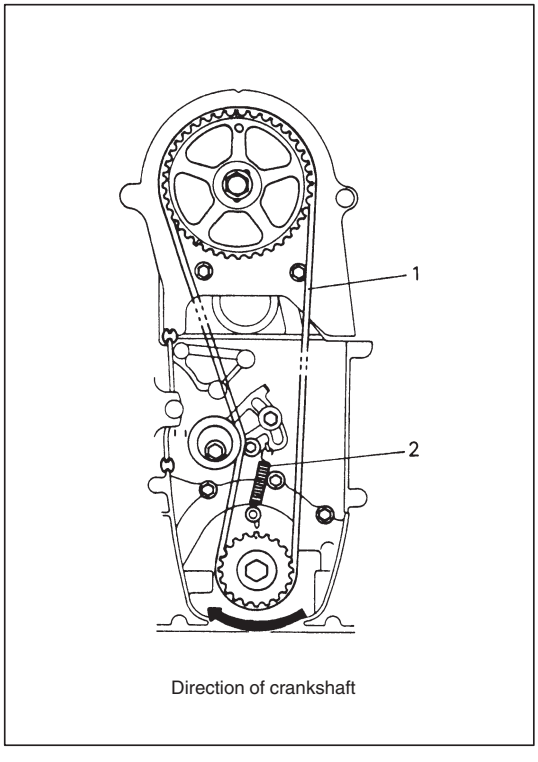


3) Check that timing mark (3) on camshaft timing belt pulley (1) is aligned with "V" mark (2) on cylinder head cover (4). If not, align two marks by turning camshaft but be careful not to turn it more than its allowable turning range which is described on previous page.



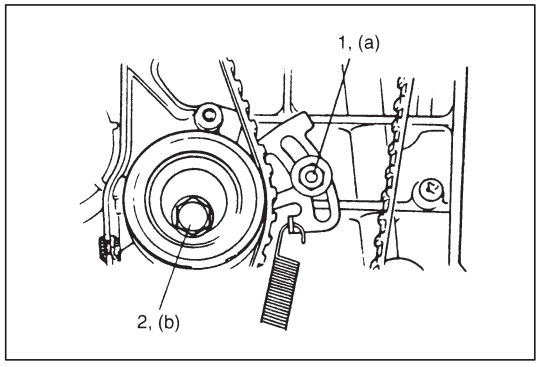
1. Crank timing belt pulley bolt

4) Check that timing mark (2) on crankshaft timing belt pulley (4) is aligned with arrow mark (3) on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on previous page.



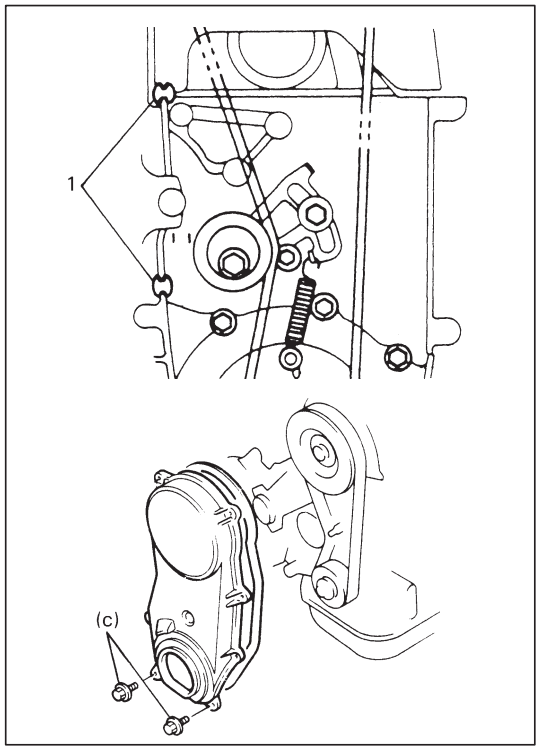
5) With two sets of marks aligned, install timing belt (1) on two pulleys in such a way that the drive side of belt is free of any slack, and with tensioner plate pushed up by finger.
And then install tensioner spring and spring damper (2) as shown in figure, and handtighten tensioner stud.

NOTE:
- **When installing timing belt, match arrow mark (⇨) on timing belt with rotating direction of crankshaft.**
- **In this state, No.1 piston is at top dead center of compression stroke.**



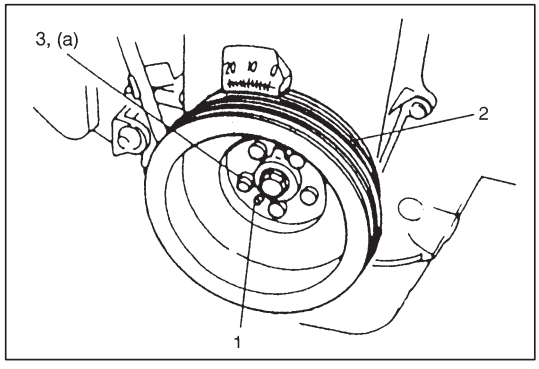
6) To take up slack of timing belt, turn crankshaft two rotations clockwise after installing it. After making sure that belt is free from slack, tighten tensioner stud (1) first and then tensioner bolt (2) to each specified torque.
Then confirm again that two sets of marks are aligned respectively.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)



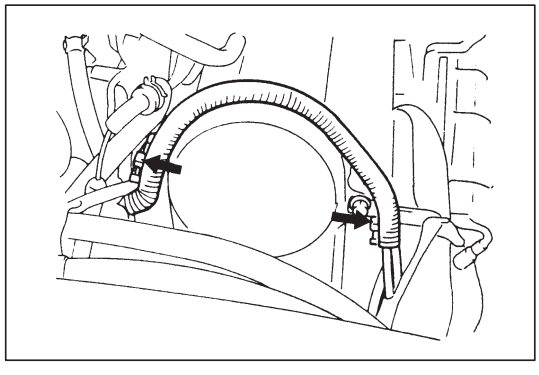
7) Install timing belt outside cover.
Before installing, make sure that rubber seal (1) is between water pump and oil pump case and another between water pump and cylinder head.

Tightening Torque
(c): 11 N·m (1.1 kg-m, 8.0 lb-ft)

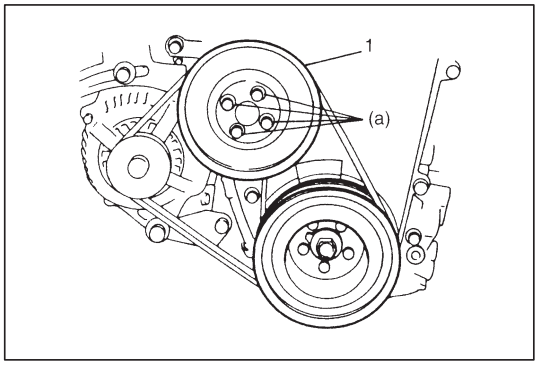


8) Install crankshaft pulley (2).
Fit hole of pulley to pin (1) on crankshaft timing belt pulley, and tighten pulley bolts (3) to specified torque.

Tightening Torque
(a): 16 N·m (1.6 kg-m, 11.5 lb-ft)

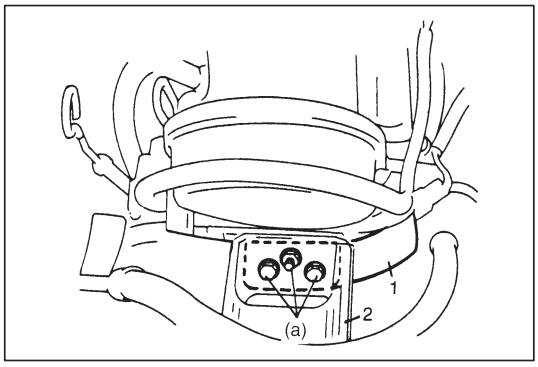


9) Clamp harness securely.



10) Install water pump pulley (1) and drive belt.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



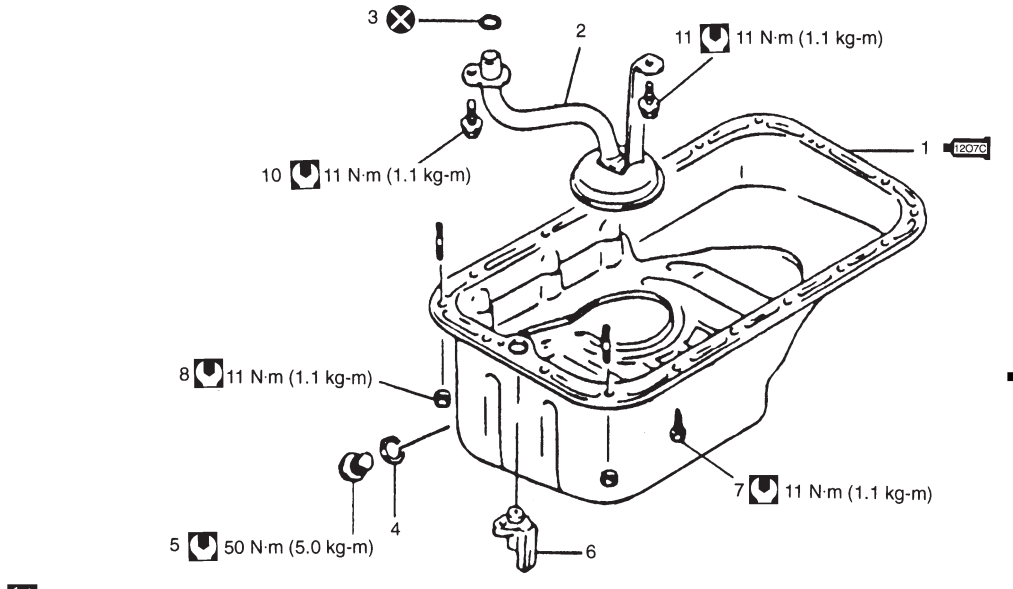
11) Install engine right mounting bracket (1) and engine right mounting swing bracket (2).

Tightening Torque
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

12) Remove support device.

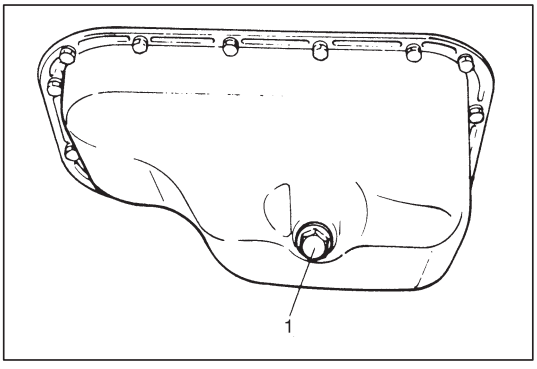
13) Install A/C compressor bracket and A/C compressor, if equipped.
14) Connect A/C suction and discharge hoses, if equipped.
15) Adjust drive belt tension, referring to "ENGINE COOLING" section.
16) Adjust A/C compressor belt tension, if equipped.
Refer to Section 1B.
17) Evacuate and charge air conditioning system, refer to Section 1B.
18) Install right side of engine under cover.
19) Install suction pipe and air cleaner assembly, refer to INSTALLATION of AIR CLEANER ASSEMBLY in this section.
20) Connect negative cable at battery.

OIL PAN AND OIL PUMP STRAINER



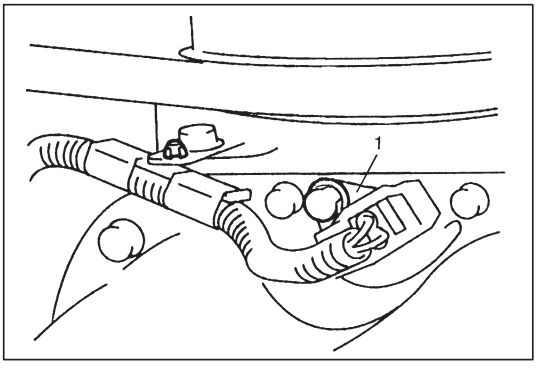
: Tightening Torque
: Do not reuse

1207C 1. Oil pan:
Apply sealant 99000-31150
to oil pan mating surface
2. Oil pump strainer
3. Seal
4. Drain plug gasket
5. Drain plug
6. CKP sensor
7. Oil pan bolt
8. Oil pan nut
9. CKP sensor bolt
10. Oil pump strainer bolt
11. Oil pump strainer bracket bolt

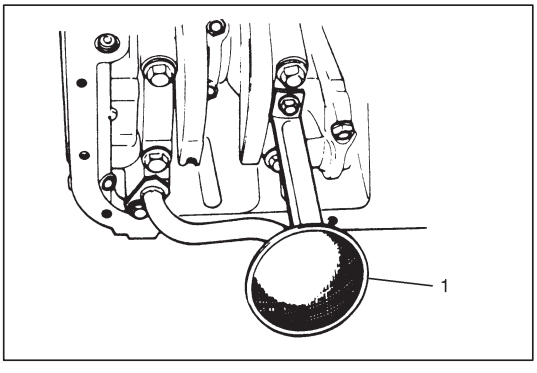


REMOVAL

1) Raise vehicle.
2) Drain engine oil by removing drain plug (1).



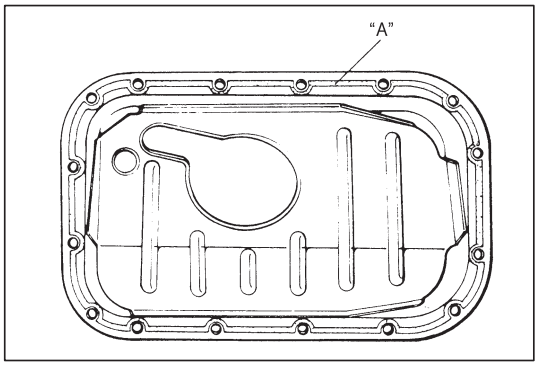
3) Remove right side of engine under cover.
4) Disconnect oxygen sensor No.2 connector and then remove exhaust No.1 pipe with oxygen sensor No.2.
5) Remove clutch housing lower plate.
6) Remove CKP sensor (1).



7) Remove oil pan and then oil pump strainer (1).

CLEANING

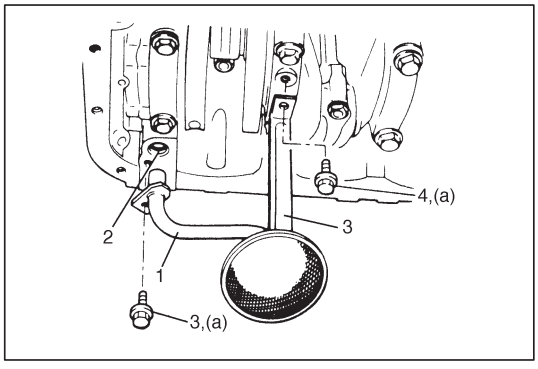
- Clean mating surface of oil pan and cylinder block.
  Remove oil, old sealant, and dusts from mating surfaces and oil pan inside.
- Clean oil pump strainer screen.



INSTALLATION

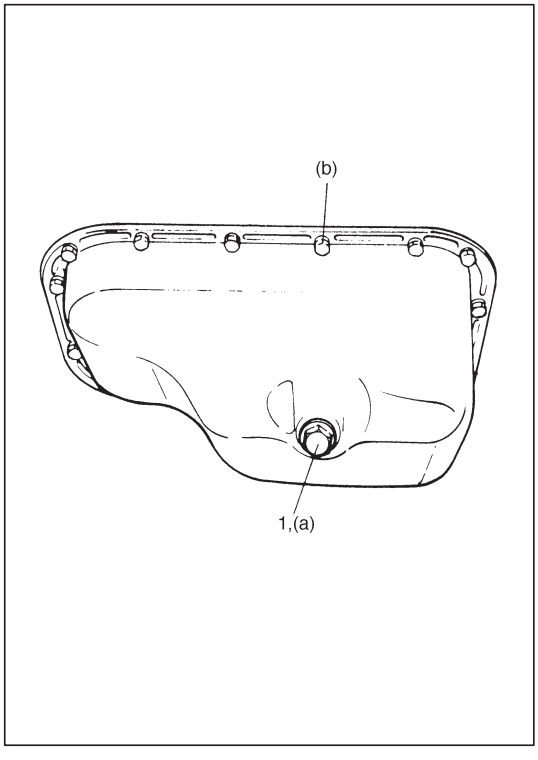
1) Apply sealant to oil pan mating surface continuously as shown in figure.

   "A" Sealant: 99000-31150



2) Install oil pump strainer (1).
   Install O-ring (2) into cylinder block securely as shown in figure.
   Install oil pump strainer to cylinder block.
   Tighten strainer bolt (3) first and then bracket bolt (4) to specified torque.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

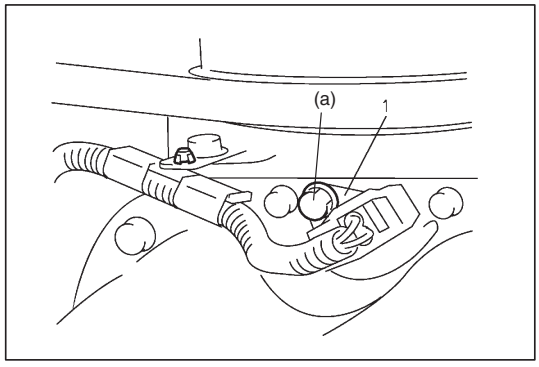


3) Install oil pan to cylinder block.
   After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center: move wrench outward, tightening one bolt at a time.
   Tighten bolts to specified torque.

   Tightening Torque
   (b): 11 N·m (1.1 kg-m, 8.0 lb-ft)

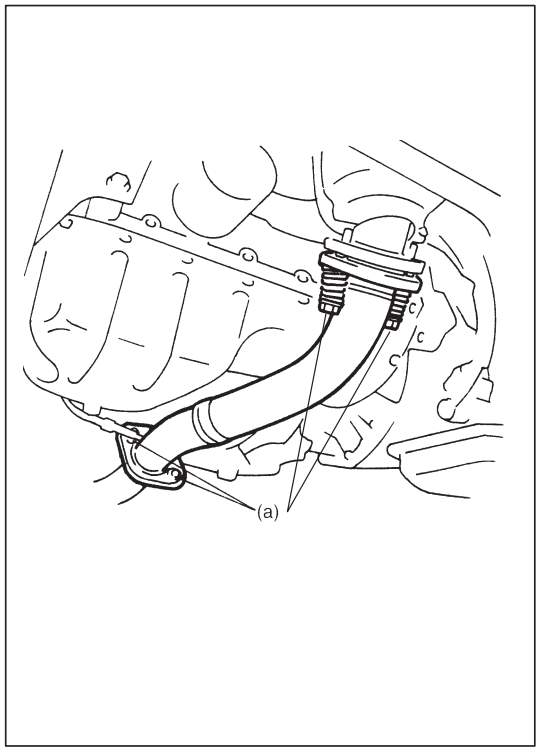
4) Install gasket and drain plug (1) to oil pan.
   Tighten drain plug to specified torque.

   Tightening Torque
   (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



4) Install CKP sensor (1) and connect its coupler, then clamp its harness.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



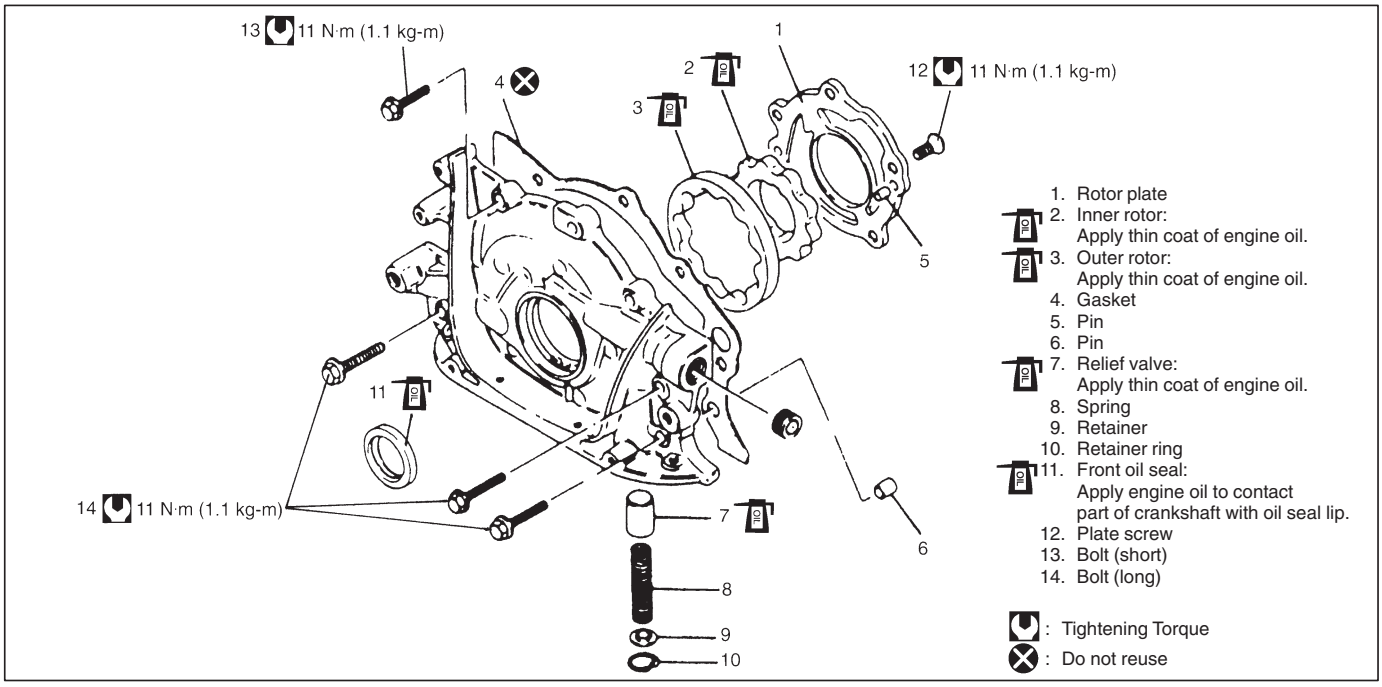
5) Install exhaust No.1 pipe and connect oxygen sensor No.2 connector.
Tighten bolts to specified torque.

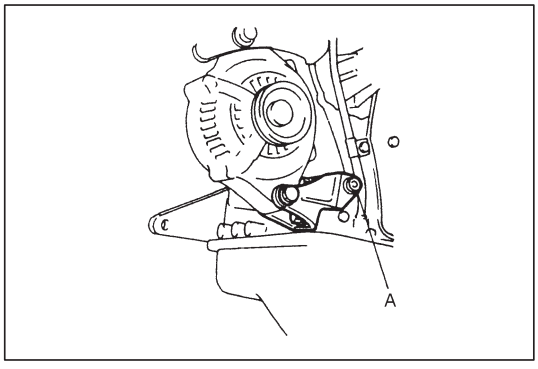
Tightening Torque
(a): 42 N·m (4.2 kg-m, 30.5 lb-ft)

NOTE:
Use new gasket for exhaust No.1 pipe.

6) Install right side of engine under covers.
7) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.

OIL PUMP



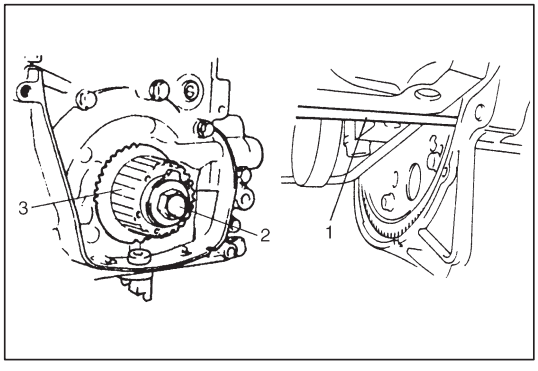


REMOVAL

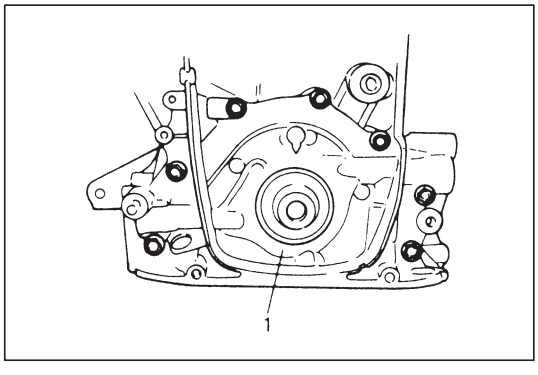
1) Disconnect negative cable at battery.
2) Remove timing belt as previously outlined.
3) Remove generator and its bracket.

NOTE:
When installing bracket, tighten nut (A) first.

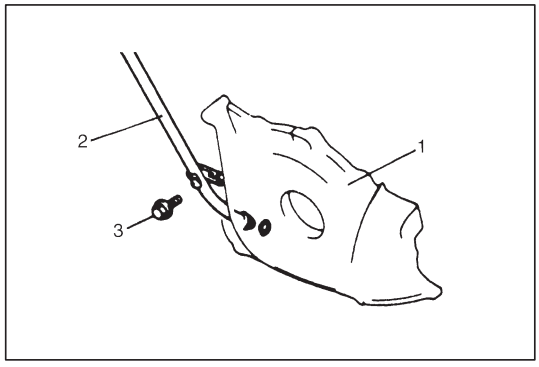
4) Remove oil pan and oil pump strainer as previously outlined.



5) Remove crankshaft timing belt pulley (3).
   Using flat end rod or the like (1) with flywheel ring gear to lock crankshaft.
   With crankshaft locked, remove crankshaft timing belt pulley bolt (2).

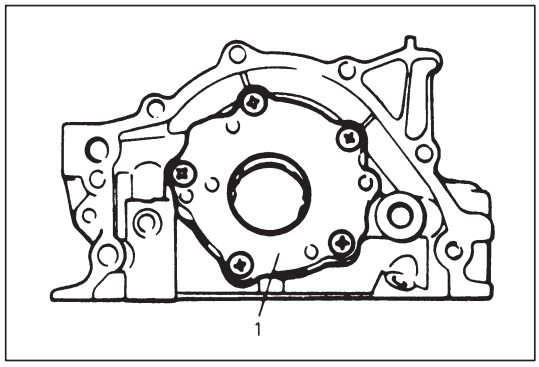


6) Remove oil pump (1) assembly.

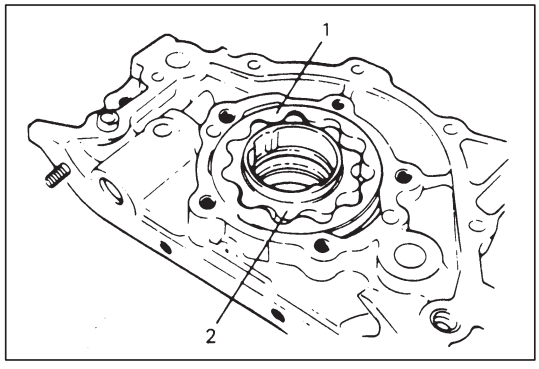


DISASSEMBLY

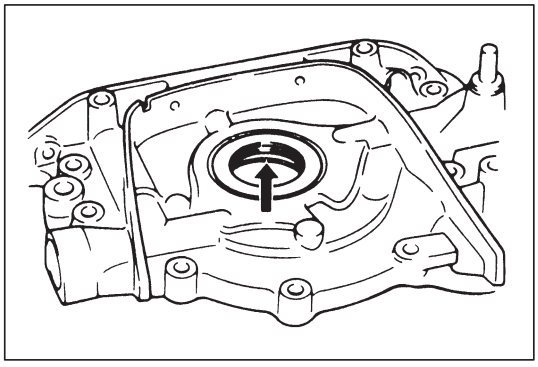
1) Remove oil level gauge guide bolt (3) and pull out guide (2) from oil pump (1).



2) Remove rotor plate (1).

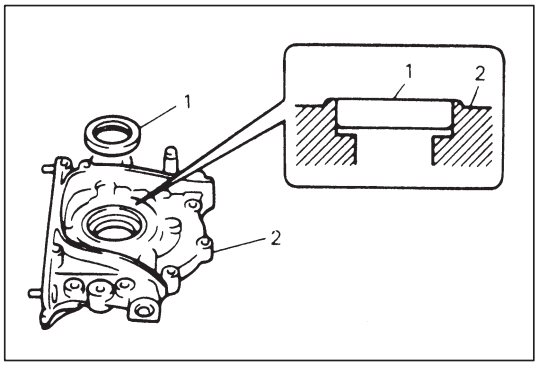


3) Remove outer rotor (1) and inner rotor (2).

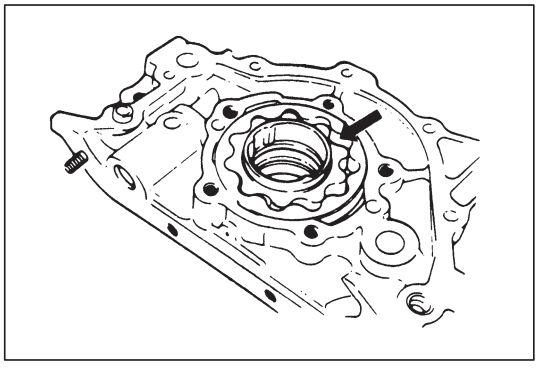


INSPECTION

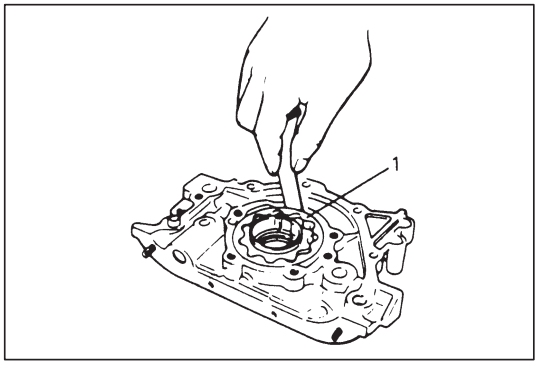
- Check oil seal lip for fault or other damage. Replace as necessary.



NOTE:
When installing oil seal (1), press-fit it till its end face is flush with oil pump case (2) end face.



- Check outer and inner rotors, rotor plate, and oil pump case for excessive wear or damage.

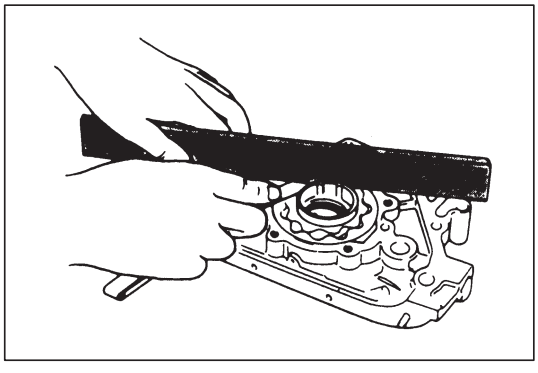


MEASUREMENT

- **Radial clearance**

  Check radial clearance between outer rotor (1) and case, using thickness gauge.
  If clearance exceeds its limit, replace outer rotor or case.

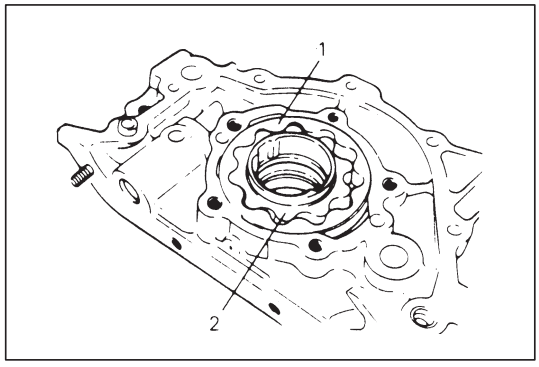
  Limit on radial clearance between outer rotor and case: 0.2 mm (0.0079 in.)



- **Side clearance**

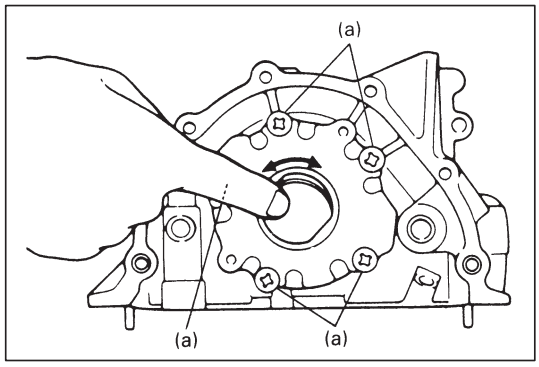
  Using straight edge and thickness gauge, measure side clearance.

  Limit on side clearance: 0.1 mm (0.0039 in.)



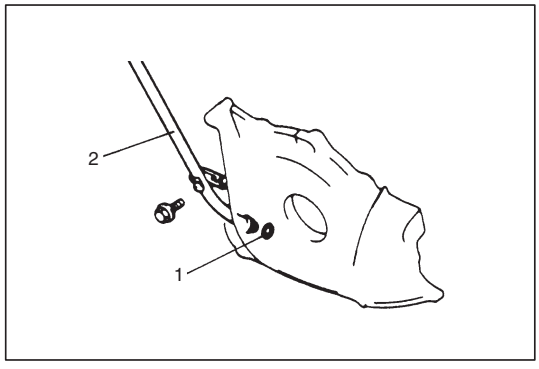
ASSEMBLY

1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner rotor (2) and outer rotor (1), oil seal lip portion, and inside surfaces of oil pump case and plate.
3) Install outer and inner rotors to pump case.

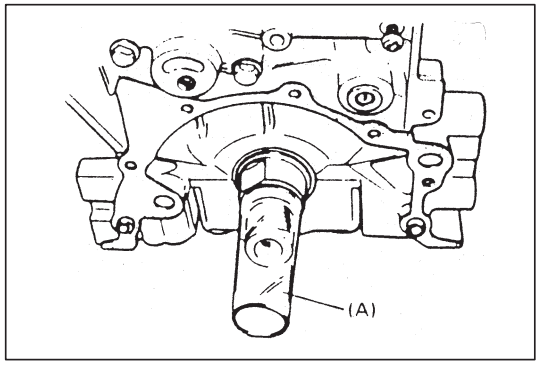


4) Install rotor plate. Tighten screws securely.
   After installing plate, check to be sure that gears turn smoothly by hand.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



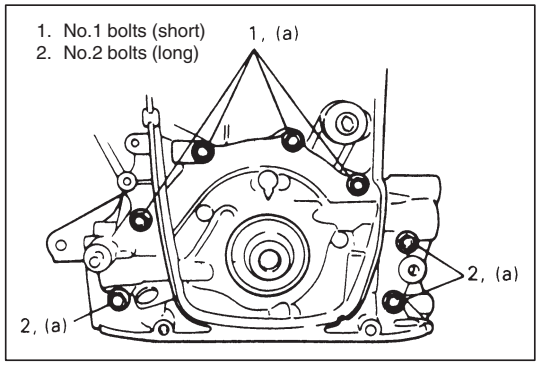
5) Apply engine oil to O-ring (1) and install O-ring and guide (2).



INSTALLATION

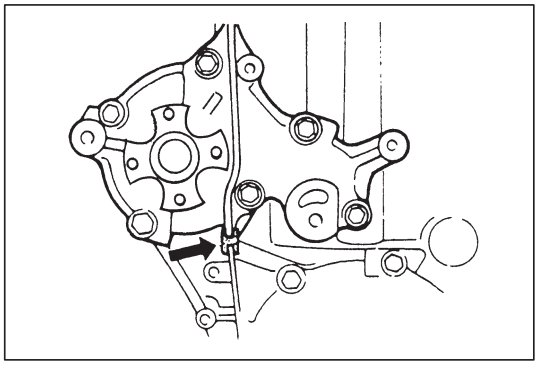
1) Install two oil pump pins and oil pump gasket to cylinder block. Use a new gasket.
2) To prevent oil seal lip from being damaged or upturned when installing oil pump to crankshaft, fit special tool (Oil seal guide) to crankshaft, and apply engine oil to special tool.

   Special Tool
   (A): 09926-18210

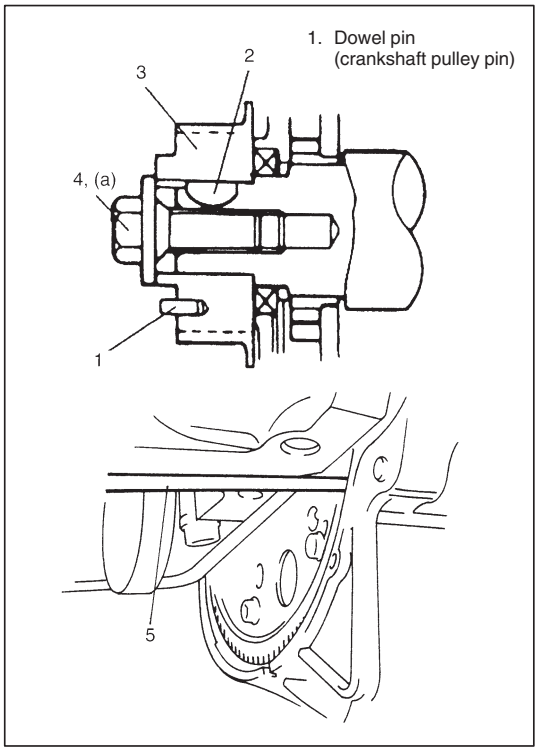


3) Install oil pump to cylinder block.
   As there are 2 types of oil pump bolts, refer to figure for their correct use and tighten them to specified torque.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



4) Install rubber seal between oil pump and water pump.



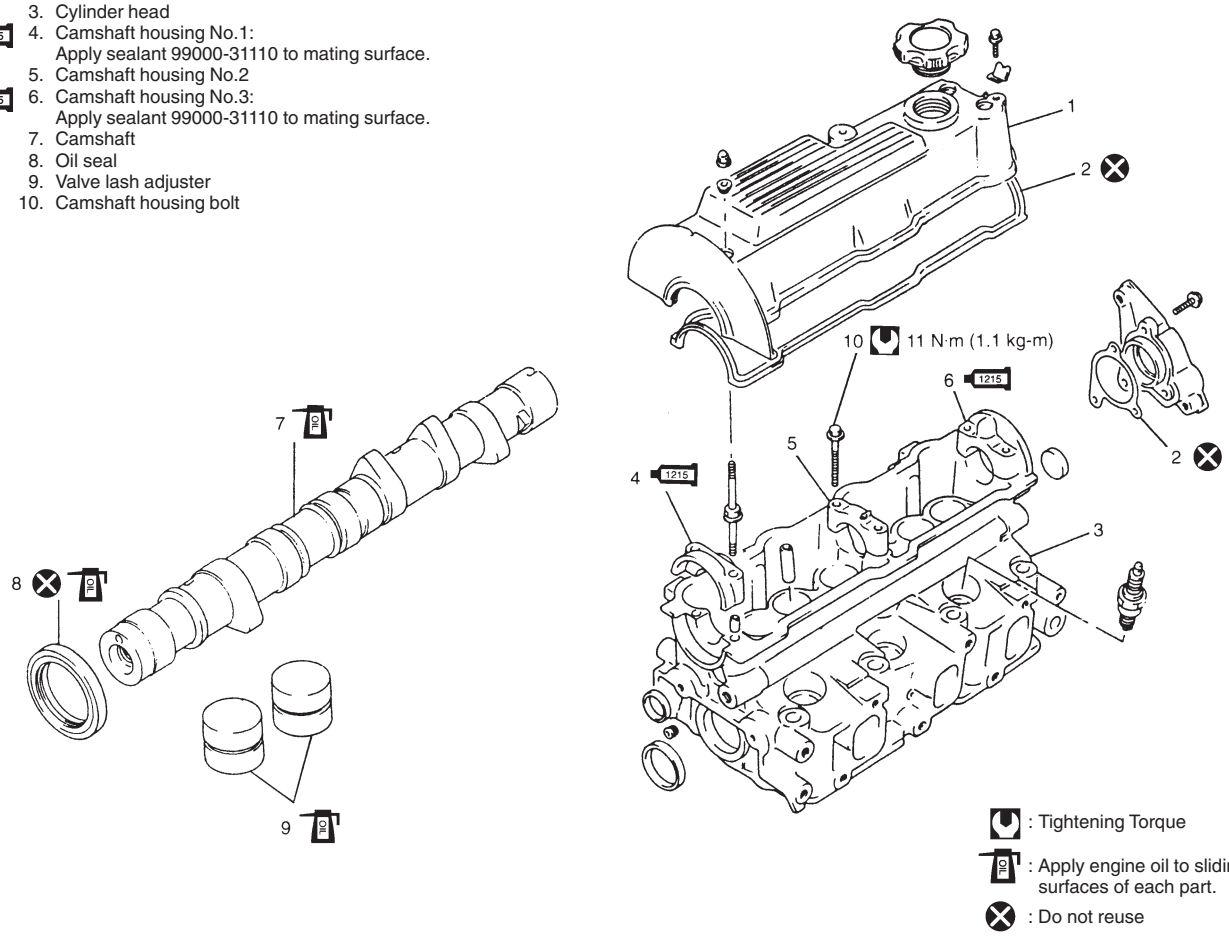
5) Install key (2) and crank timing belt pulley (3). Refer to figure for proper installation of these parts.
With crankshaft locked using flat end rod or the like (5), tighten crank timing belt pulley bolt (4) to specified torque.

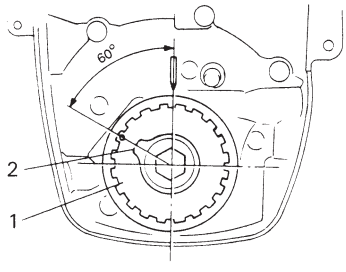
Tightening Torque
(a): 130 N·m (13.0 kg-m, 94.0 lb-ft)

6) Install timing belt, tensioner, oil pump strainer, oil pan and other parts as previously outlined.
7) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
8) Adjust water pump drive belt tension, referring to “ENGINE COOLING” section.
9) Adjust A/C compressor belt tension, if equipped. Refer to SECTION 1B.
10) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in SECTION 0B.
11) Connect negative cable at battery.
12) After completing installation, check oil pressure by running engine.

CAMSHAFT AND HYDRAULIC VALVE LASH ADJUSTER

1. Cylinder head cover
2. Gasket
3. Cylinder head
4. Camshaft housing No.1: Apply sealant 99000-31110 to mating surface.
5. Camshaft housing No.2
6. Camshaft housing No.3: Apply sealant 99000-31110 to mating surface.
7. Camshaft
8. Oil seal
9. Valve lash adjuster
10. Camshaft housing bolt

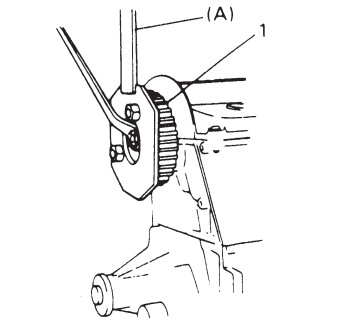




1. Crankshaft timing belt pulley

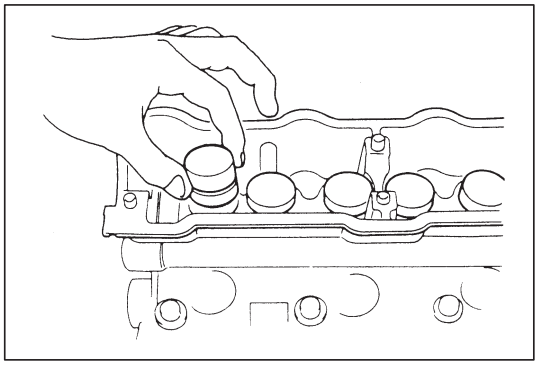
REMOVAL

1) Disconnect negative cable at battery.
2) Remove cylinder head cover as previously outlined.
3) Remove distributor and then its case from cylinder head.
4) Remove crankshaft pulley, timing belt outside cover and timing belt as previously outlined.
   After removing timing belt, set key (2) on crankshaft in position as shown in figure by turning crankshaft. This is to prevent interference between valves and piston when reinstalling camshaft.

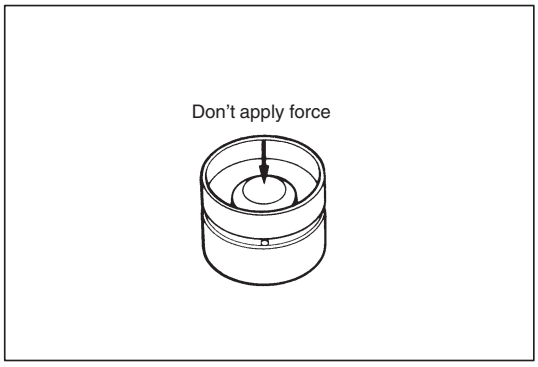


5) Remove camshaft timing belt pulley (1) by using special tool.

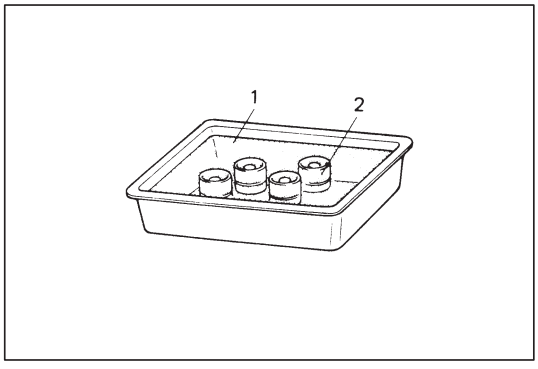
Special Tool
(A): 09917-68220



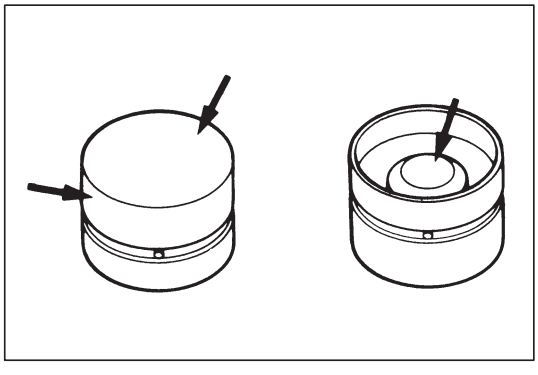
6) Remove camshaft housings from cylinder head.
7) Remove camshaft from cylinder head.
8) Remove valve lash adjuster from cylinder head.



NOTE:
- **Never disassemble hydraulic valve lash adjuster.**
- **Don't apply force to body of adjuster, for oil in high pressure chamber in adjuster will leak.**



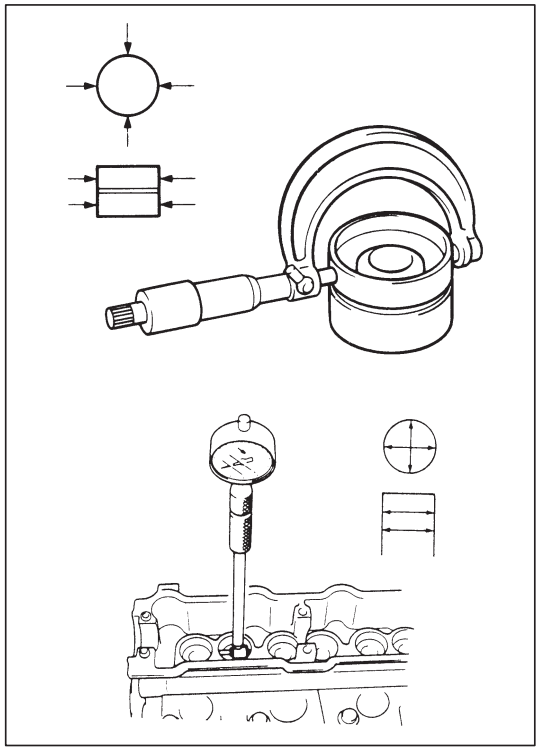
- **Immerse removed adjuster (2) in clean engine oil (1) and keep it there till reinstalling it so as to prevent oil leakage. If it is left in air, place it with its bucket body facing down. Don't place on its side or with bucket body facing up.**



INSPECTION

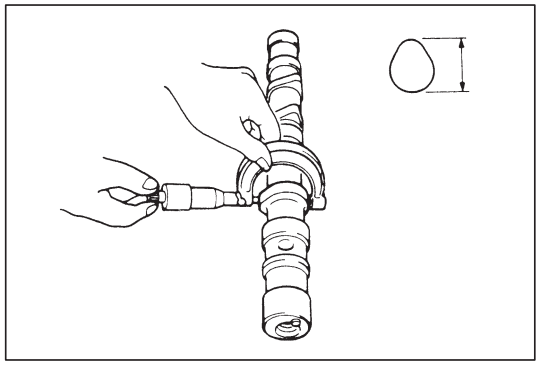
Wear of Hydraulic Valve Lash Adjuster

Check adjuster for pitting, scratches, or damage. If any malcondition is found, replace.



Measure cylinder head bore and adjuster outside diameter to determine cylinder head-to-adjuster clearance. If clearance exceeds limit, replace adjuster or cylinder head.

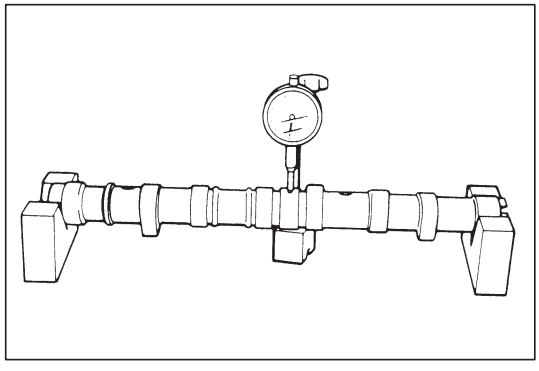
Item	Standard	Limit
Hydraulic valve lash adjuster O.D.	30.959 – 30.975 mm (1.2188 – 1.2194 in.)	———
Cylinder head bore	31.000 – 31.025 mm (1.2205 – 1.2214 in.)	———
Cylinder head to adjuster clearance	0.025 – 0.066 mm (0.0010 – 0.0025 in.)	0.15 mm (0.0059 in.)



Cam Wear

Using a micrometer, measured height of cam. If measured height is below limit, replace camshaft.

	Standard	Limit
Intake & exhaust cam height	40.415 – 40.575 mm (1.5911 – 1.5974 in.)	40.315 mm (1.5872 in.)

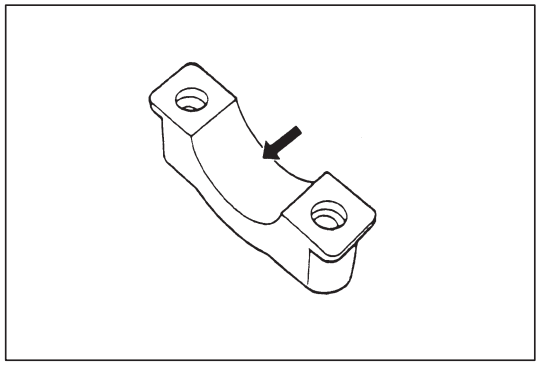


Camshaft Runout

Hold camshaft between two “V” blocks, and measure runout by using a dial gauge.

If runout exceeds the limit, replace camshaft.

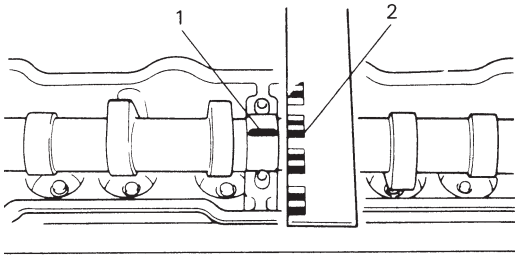
Runout limit: 0.10 mm (0.0039 in.)



Camshaft Journal Wear

Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.

If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing hosing.



INSPECTION

Camshaft journal wear:

- Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.

  If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housings.

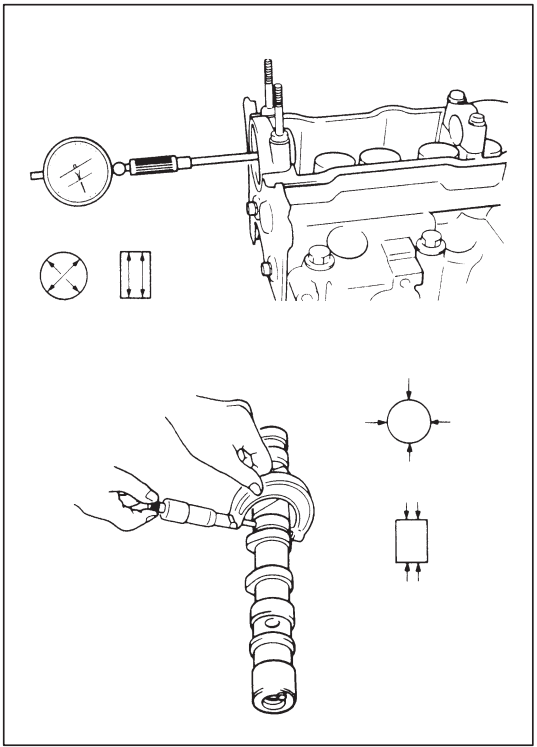
  Check clearance by using gaging plastic (1). The procedure is as follows.

  1) Clean housings and camshaft journals.
  2) Make sure that all valve lash adjusters are removed and install camshaft to cylinder head.
  3) Place a piece of gaging plastic the full width of journal of camshaft (parallel to camshaft).
  4) Install housings as outlined on the following page and evenly torque housing bolts to specified torque. Housings MUST be torqued to specification in order to assure proper reading of camshaft journal clearance.

     NOTE:
     Do not rotate camshaft while gaging plastic is installed.

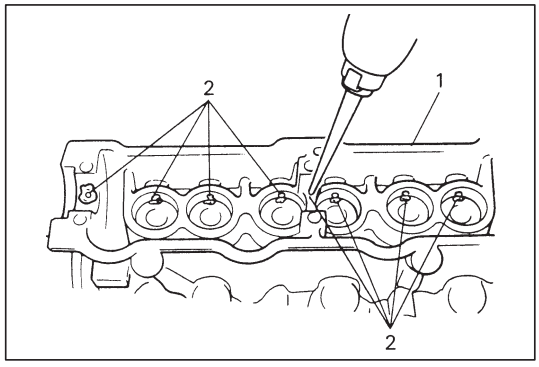
  5) Remove housing, and using scale (2) on gaging plastic envelop, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.040 – 0.082 mm (0.0016 – 0.0032 in.)	0.12 mm (0.0047 in.)



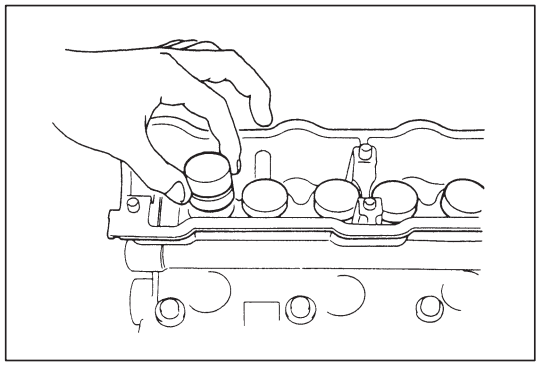
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Item		Standard
Camshaft journal bore dia.	No.1	26.000 – 26.021 mm (1.0236 – 1.0244 in.)
	No.2 & No.3	30.000 – 30.021 mm (1.1811 – 1.1819 in.)
Camshaft journal O.D.	No.1	25.939 – 25.951 mm (1.0212 – 1.0217 in.)
	No.2 & No.3	29.939 – 29.960 mm (1.1787 – 1.1795 in.)

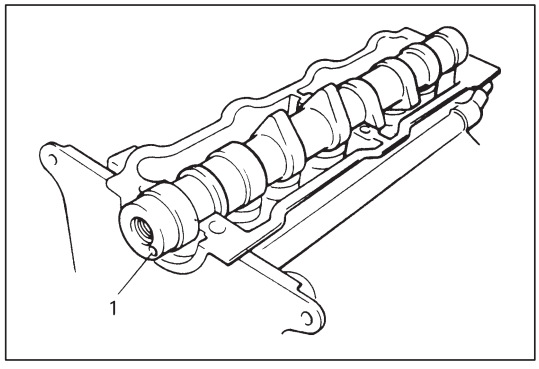


INSTALLATION

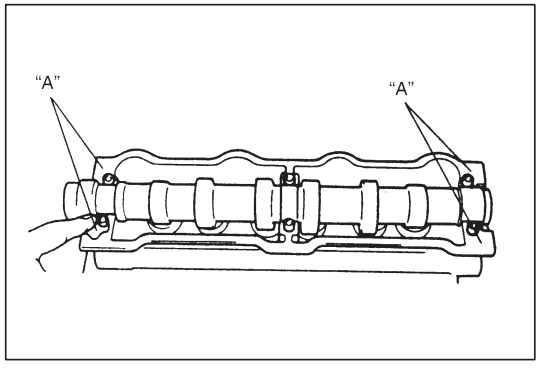
1) Before installing valve lash adjuster to cylinder head, fill oil passage of cylinder head (1) with engine oil according to the following procedure.
   Pour engine oil through camshaft journal oil holes (2) and check that oil comes out from oil holes in sliding part of valve lash adjuster.



2) Install lash adjuster to cylinder head.
   Apply engine oil around valve lash adjuster and then install it to cylinder head.

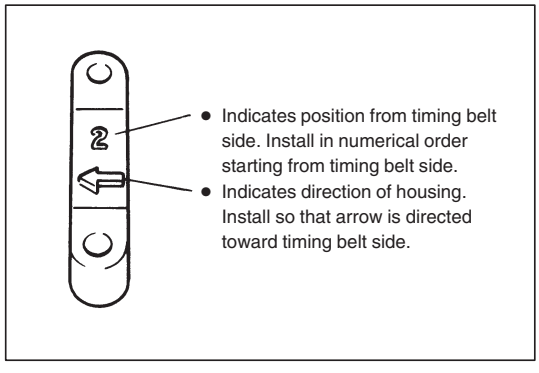


3) Install camshaft to cylinder head.
   After applying engine oil to camshaft journal and all around cam, set camshaft to cylinder head so that camshaft timing belt pulley pin hole (1) in camshaft is at lower position.

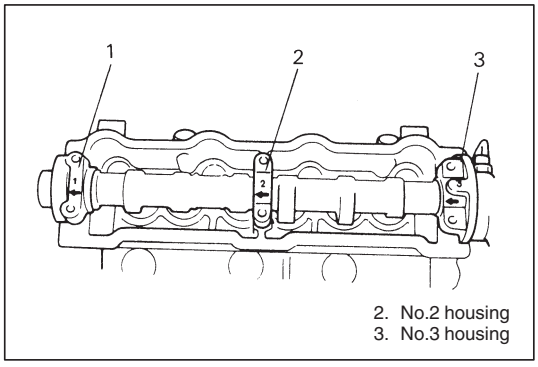


4) Install camshaft housing to camshaft and cylinder head.
   - Apply engine oil to sliding surface of each housing against camshaft journal.
   - Apply sealant to mating surface of No.1 and No.3 housings which will mate with cylinder head.

   "A": Sealant 99000-31110

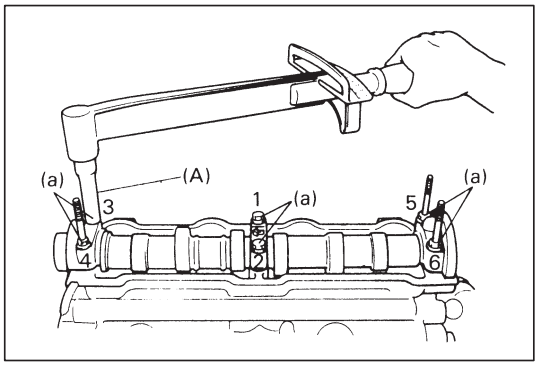


- Embossed marks are provided on each camshaft housing, indicating position and direction for installation.
  Install housing as indicated by these marks.



2. No.2 housing
3. No.3 housing

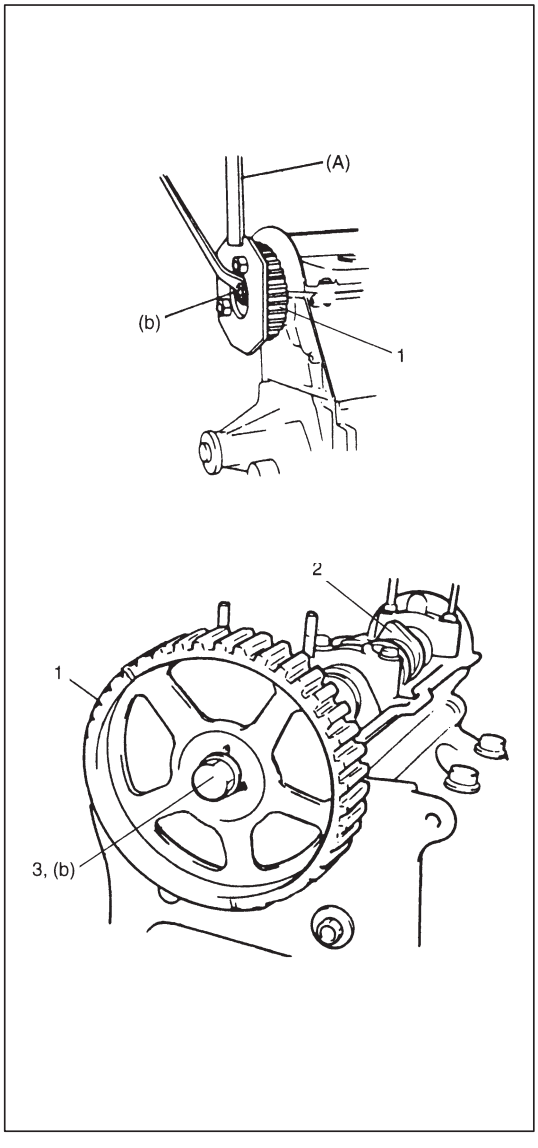
- As camshaft housing No.1 (1) retains camshaft in proper position as to thrust direction, make sure to first fit No.1 housing to No.1 journal of camshaft securely.



- After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as shown in figure.
  Tighten a little at a time and evenly among bolts and repeat tightening sequence three to four times before they are tightened to specified torque.

  Special Tool
  (A): 09919-16010

  Tightening Torque
  (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



5) Install camshaft oil seal.
   After applying engine oil to oil seal lip, press-fit camshaft oil seal till oil seal surface becomes flush with housing surface.
6) Install camshaft timing belt pulley (1) to camshaft (2) after installing dwell pin to camshaft.
   With locking camshaft by using special tool, tighten pulley bolt (3) to specified torque.

   Tightening Torque
   (b): 60 N·m (6.0 kg-m, 43.5 lb-ft)

   Special tool
   (A): 09917-68220

7) Install cylinder head cover to cylinder head as previously outlined.
8) Install timing belt, timing belt outside cover, crankshaft pulley, water pump pulley and water pump belt as previously outlined.
9) Install distributor case and distributor.
   Refer to Section 6F for installation.
10) Connect negative cable at battery.
11) Adjust ignition timing.
    Refer to Section 6F for adjustment.

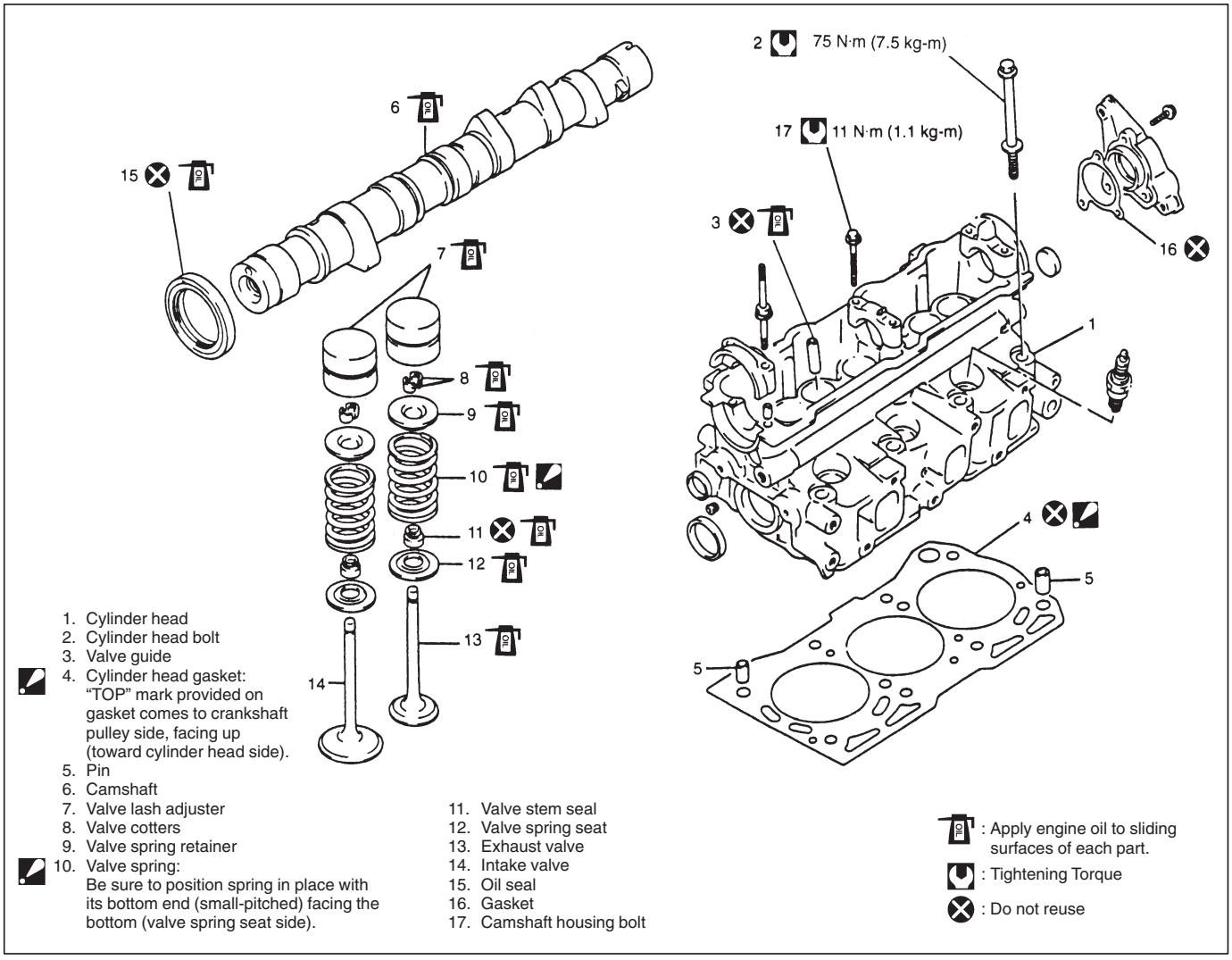
CAUTION:
- **Don't turn camshaft or start engine (i.e., valves should not be operated) for about half an hour after reinstalling hydraulic valve lash adjusters and camshaft. As it takes time for valves to settle in place, operating engine within half an hour after their installation may cause interference to occur between valves and piston.**
- **If air is trapped in valve lash adjuster, valve may make tapping sound when engine is operated after valve lash adjuster is installed. In such a case, run engine for about half an hour at about 2,000 – 3,000 r/min., and then air will be purged and tapping sound will cease. Should tapping should not cease, it is possible that valve lash adjuster is defective. Replace it if defective.**
  If defective adjuster can't be located by hearing among 6 of them, check as follows.
  1) Stop engine and remove cylinder head cover.
  2) Push adjuster downward by hand (with less than 15 kg or 33 lbs force) when cam crest is not on adjuster to be checked and check if clearance exists between cam and adjuster. If it does, adjuster is defective and needs replacement.

VALVE LASH ADJUSTER NOISE DIAGNOSIS

In case of the followings, valve lash adjuster noise may be caused by air trapped into valve lash adjusters.
- Vehicle is left for 24 hours or more.
- Engine oil is changed.
- Hydraulic lash adjuster is replaced or reinstalled.
- Engine is overhauled.

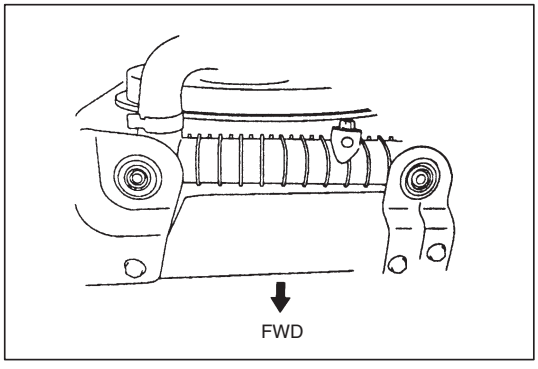
If noise from valve lash adjusters is suspected, perform the following checks.
1) Check engine oil for the followings.
   - Oil level in oil pan
     If oil level is low, add oil up to Full level hole on oil level gauge.
   - Oil quality
     If oil is discolored, or deteriorated, change it.
     For particular oil to be used, refer to Section 0B.
   - Oil leaks
     If leak is found, repair it.
   - Oil pressure (refer to Oil Pressure Check in this section)
     If defective pressure is found, repair it.
2) Run engine for about half an hour at about 2,000 to 3,000 r/min., and then air will be purge and tapping sound will cease.
3) Should tapping sound not cease, it is possible that hydraulic valve lash adjuster is defective.
   Replace it if defective.
   If defective adjuster can't be located by hearing among 6 of them, check as follows.
   a) Stop engine and remove cylinder head cover.
   b) Push adjuster downward by hand (with less than 20 kg or 44 lbs. Force) when cam crest is not on adjuster to be check if clearance exists between cam and adjuster.
      If it does, adjuster is defective and needs replacement.

VALVES AND CYLINDER HEAD



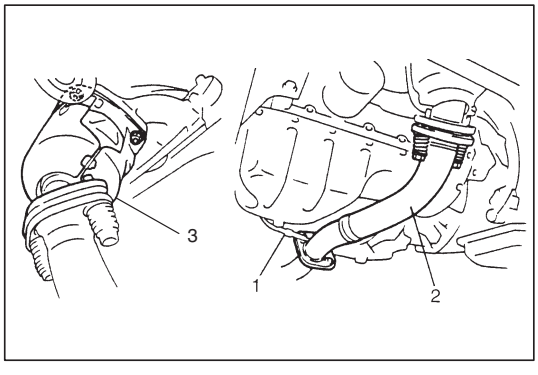
1. Cylinder head
2. Cylinder head bolt
3. Valve guide
4. Cylinder head gasket: "TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).
5. Pin
6. Camshaft
7. Valve lash adjuster
8. Valve cotters
9. Valve spring retainer
10. Valve spring: Be sure to position spring in place with its bottom end (small-pitched) facing the bottom (valve spring seat side).
11. Valve stem seal
12. Valve spring seat
13. Exhaust valve
14. Intake valve
15. Oil seal
16. Gasket
17. Camshaft housing bolt

: Apply engine oil to sliding surfaces of each part.
: Tightening Torque
: Do not reuse



REMOVAL

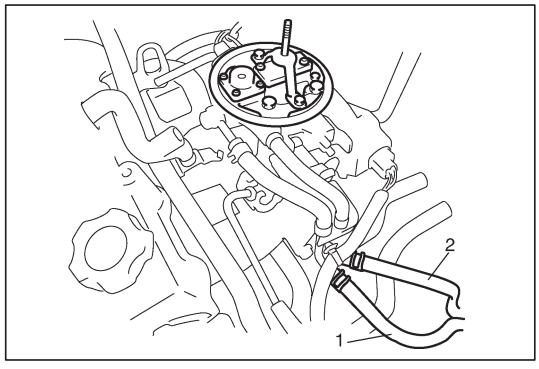
1) Relieve fuel pressure according to procedure described in Section 6-1.
2) Disconnect negative cable at battery.
3) Drain cooling system.
4) Remove air cleaner outlet hose with air chamber case, suction pipe and air cleaner assembly as previously outlined.



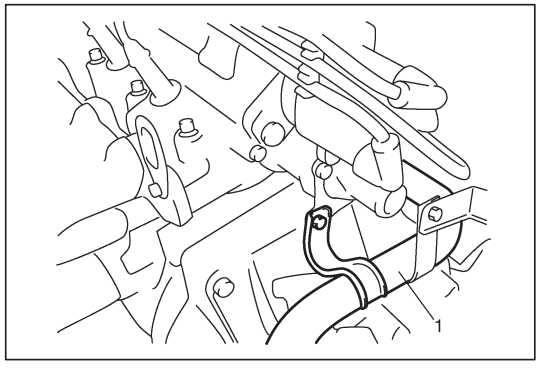
5) Disconnect oxygen sensor No.2 coupler (1) and remove exhaust No.1 pipe (2) with catalytic converter case (3).

6) Disconnect following electric wires:
   - MAP sensor
   - CMP sensor
   - Engine oil pressure switch
   - ECT sensor
   - Ground wire from intake manifold
   - Injector
   - TP sensor
   - ISC actuator
   - Oxygen sensor No. 1
   - EVAP canister purge valve
   - Center high-tension cord from distributor
   - EFE heater

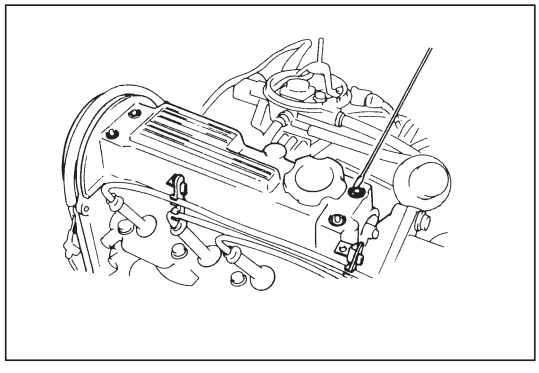
   and then release above wire harnesses from clamps.
7) Disconnect following hoses:
   - Canister purge hose from EVAP canister purge valve
   - Radiator inlet hose from thermostat case
   - Brake booster hose from intake manifold
   - Heater inlet hose from intake manifold
   - Throttle body outlet hose from throttle body
8) Disconnect accelerator cable from throttle body.



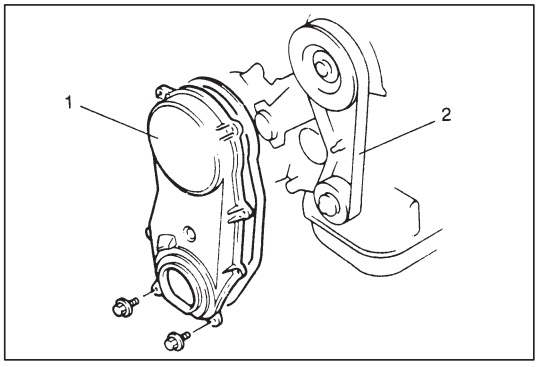
9) Disconnect fuel feed hose (1) and fuel return hose (2) from fuel pipes.



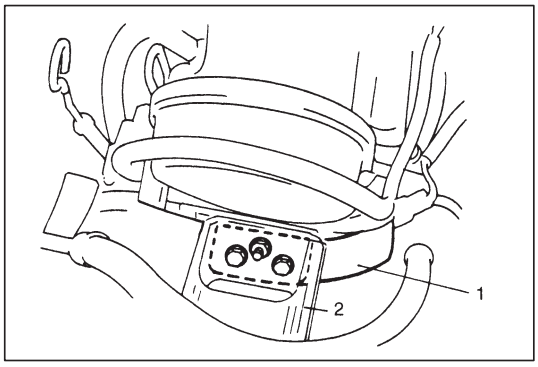
10) Disconnect water inlet pipe (1) from its bracket.



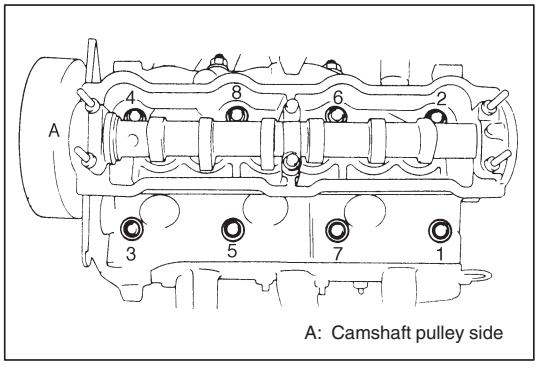
11) Remove cylinder head cover as previously outlined.



12) Remove timing belt outside cover (1) and timing belt (2) as previously outlined.

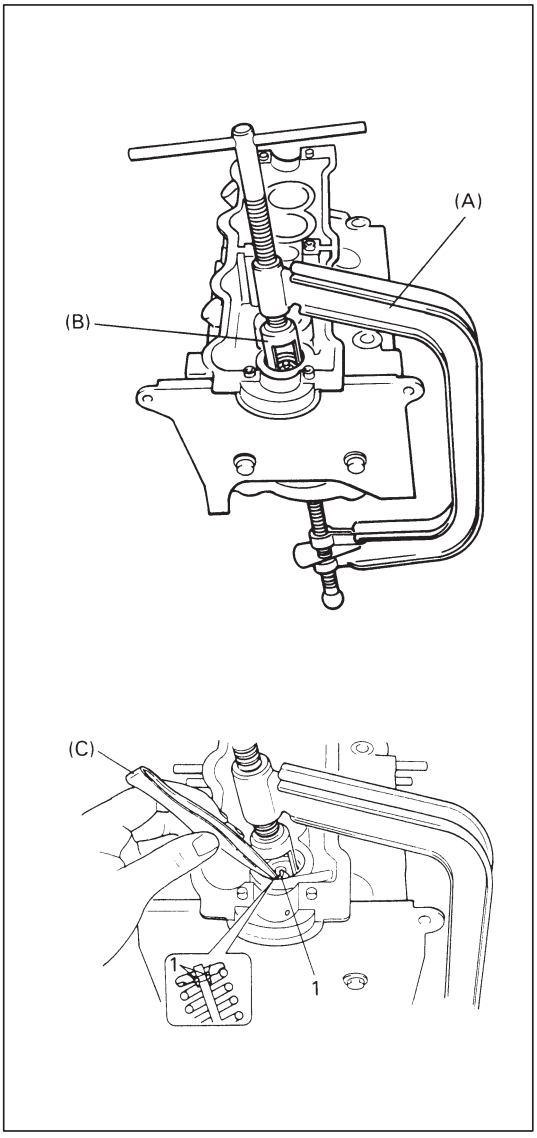


13) Install engine right mounting bracket (1) and engine right mounting swing bracket (2).
14) Remove support device.



15) Loosen cylinder head bolts in such order as indicated in figure and remove them.
16) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.

17) Remove cylinder head with distributor, thermostat case, intake manifold and exhaust manifold.

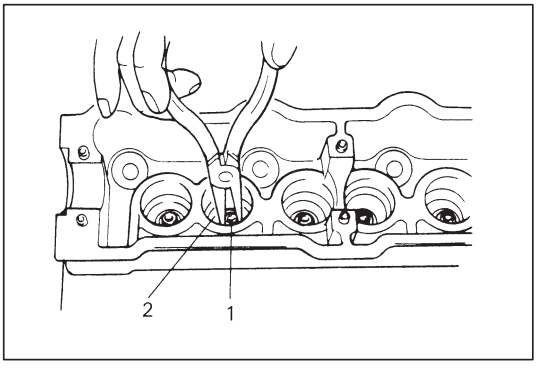


DISASSEMBLY

1) For ease in servicing cylinder head, remove distributor, thermostat case, intake manifold with throttle body and exhaust manifold from cylinder head.
2) Remove camshaft and valve lash adjusters from cylinder head.
3) Using special tool (Valve lifter), compress valve springs and then remove valve cotters (1) by using special tool (Forceps) as shown.

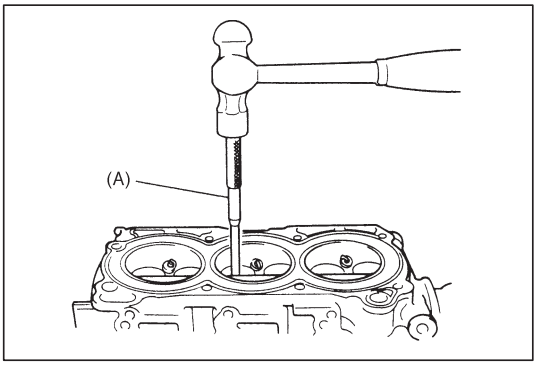
   Special Tool
   (A): 09916-14510
   (B): 09916-14910
   (C): 09916-84511

4) Release special tool, and remove spring retainer and valve spring.
5) Remove valve from combustion chamber side.



6) Remove valve stem oil seal (1) from valve guide and then valve spring seat (2).

   NOTE:
   Do not reuse oil seal once disassembled. Be sure to use new oil seal when assembling.

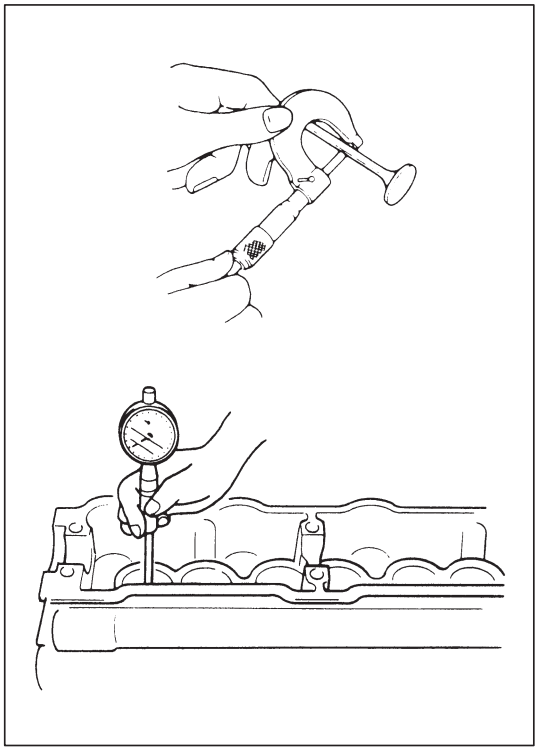


7) Using special tool (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

   Special Tool
   (A): 09916-44910

   NOTE:
   Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.

8) Place disassembled parts except valve stem seal and valve guide in order, so that they can be installed in their original position.

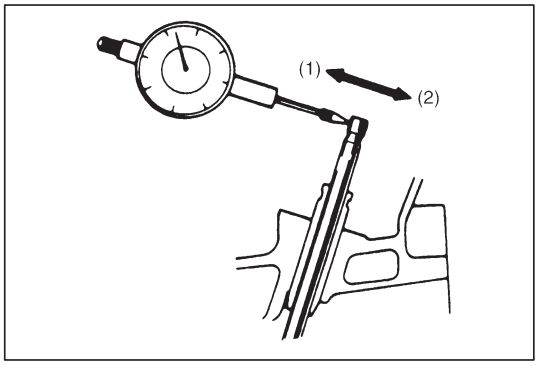


INSPECTION

Valve Guides

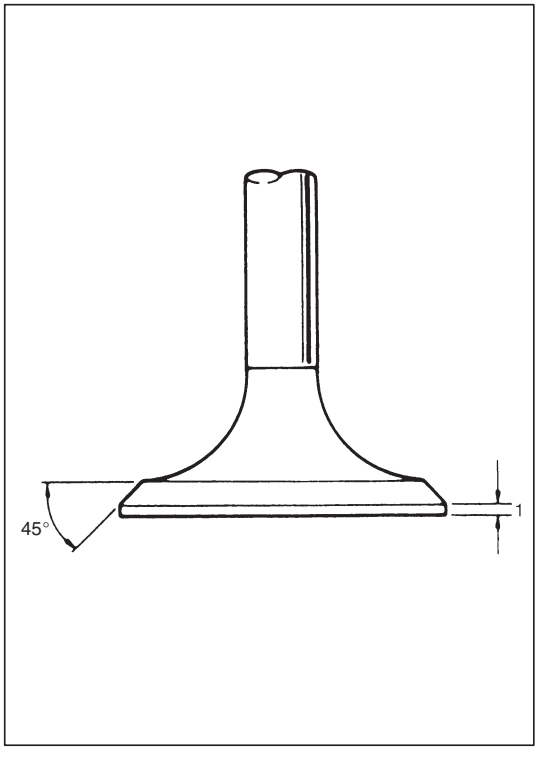
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance.
Be sure to take reading at more than one place along the length of each stem and guide.
If clearance exceeds limit, replace valve and valve guide.

Item		Standard	Limit
Valve stem diameter	In	5.465 – 5.480 mm (0.2152 – 0.2157 in.)	–
	Ex	5.440 – 5.455 mm (0.2142 – 0.2148 in.)	–
Valve guide I.D.	In	5.500 – 5.512 mm (0.2166 – 0.2170 in.)	–
	Ex		
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)



If bore gauge is not available, check end deflection of valve stem with a dial gauge instead.
Move stem end in directions (1) and (2) to measure end deflection.
If deflection exceeds its limit, replace valve stem and valve guide.

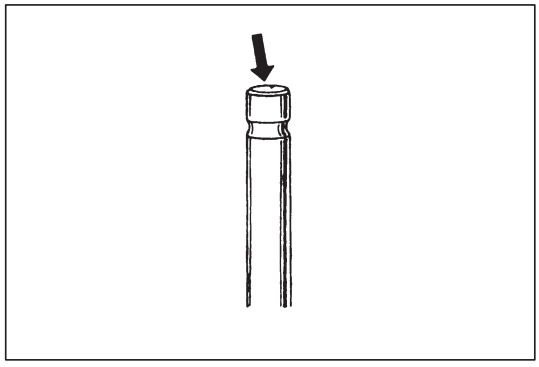
Valve stem end deflection limit	In	0.14 mm (0.005 in.)
	Ex	0.18 mm (0.007 in.)



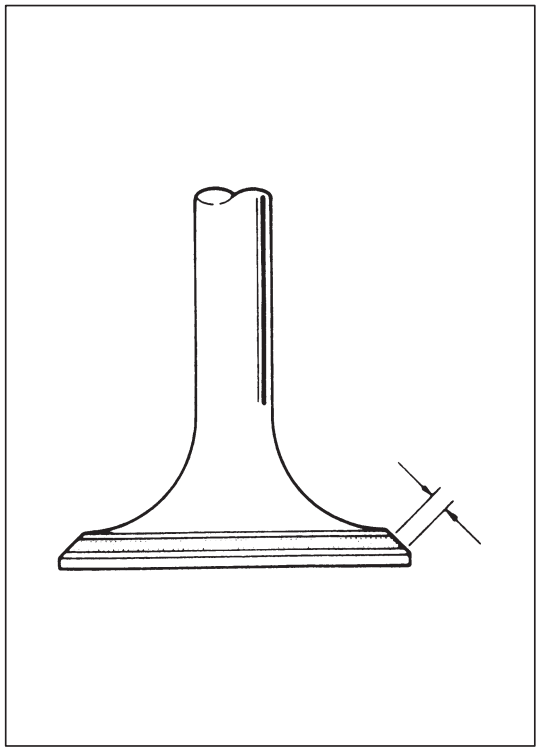
Valves

- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem and, as necessary, replace it.
- Measure thickness (1) of valve head. If measured thickness exceeds limit, replace valve.

Valve head thickness		
	Standard	Limit
IN	1.0 mm (0.039 in.)	0.6 mm (0.024 in.)
EX	1.2 mm (0.047 in.)	0.7 mm (0.027 in.)



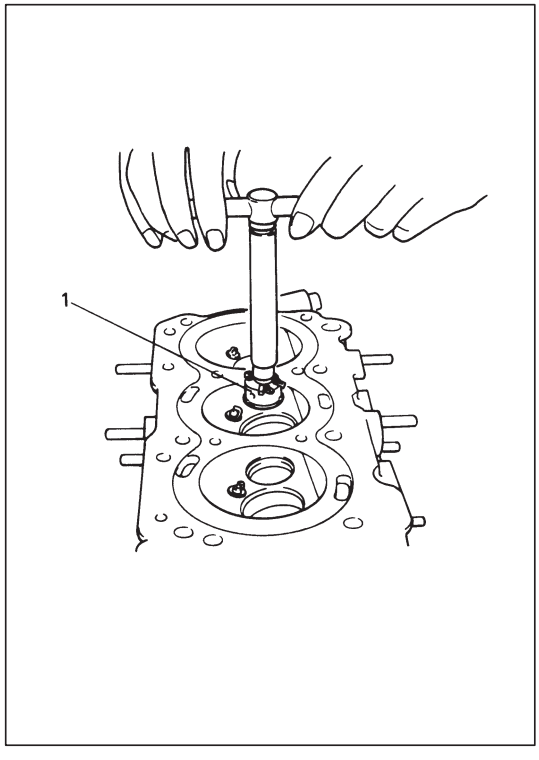
- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not so much as to grind off its chamfer. When it is worn so much that its chamfer is gone, replace valve.



- Seating contact width:
  Create contact pattern on each valve in the usual manner, i.e., by giving uniform coat of marking compound to valve seat and by rotating tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.

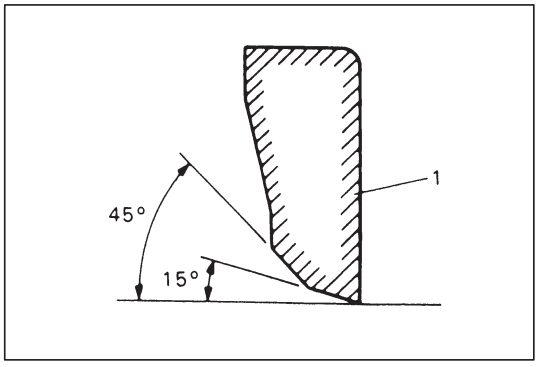
  Pattern produced on seating face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

Standard seating width revealed by contact pattern on valve face	In	1.3 – 1.5 mm (0.0512 – 0.0590 in.)
	Ex	



- Valve seat repair:
  A valve seat not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.
  1. EXHAUST VALVE SEAT: Use valve seat cutters (1) to make two cuts as illustrated in figure. Two cutters must be used: the first for making 15° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

     Seat width for exhaust valve seat:
     1.3 – 1.5 mm (0.0512 – 0.0590 in.)



2. INTAKE VALVE SEAT: Cutting sequence is the same as for exhaust valve seats (1).

   Seat width for intake valve seat:
   1.3 – 1.5 mm (0.0512 – 0.0590 in.)

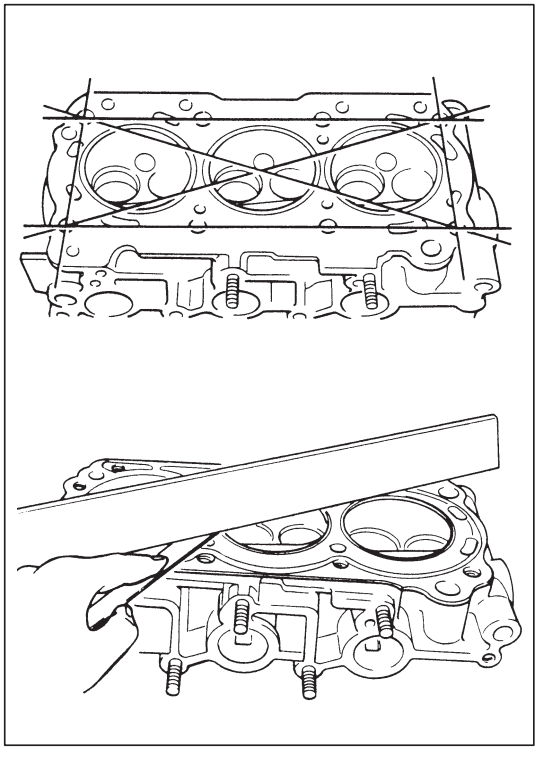
3. VALVE LAPPING: Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.

Cylinder Head

- Remove all carbon from combustion chambers.

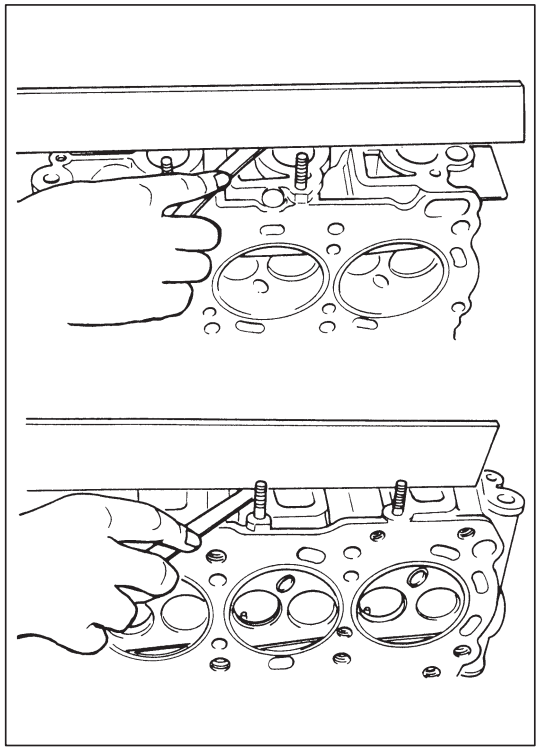
NOTE:
Do not use any sharp-edged tool to scrape off carbon. Be careful not to scuff or nick metal surfaces when decarboning. The same applies to valves and valve seats, too.

- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.



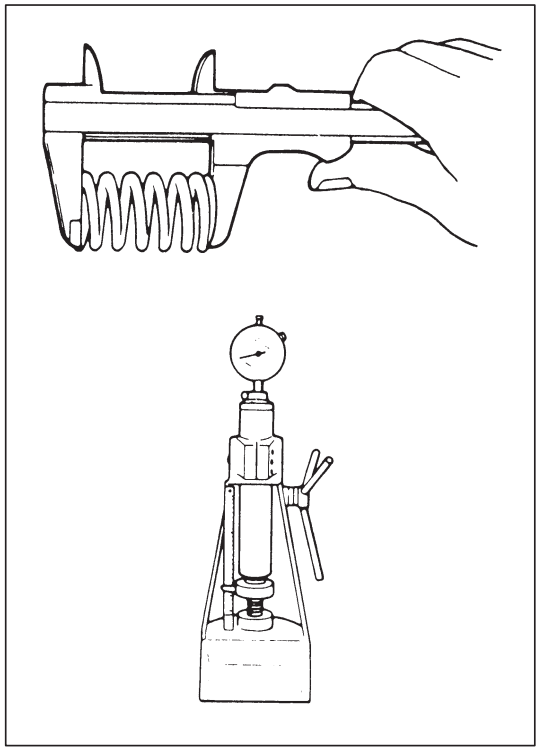
- Flatness of gasketed surface:
  Using a straightedge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.
  Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

  Limit of distortion: 0.05 mm (0.002 in.)



- Distortion of manifold seating faces:
  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

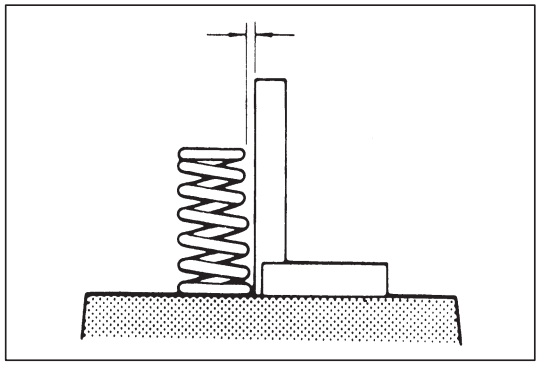
  Limit of distortion: 0.10 mm (0.004 in.)



Valve Springs

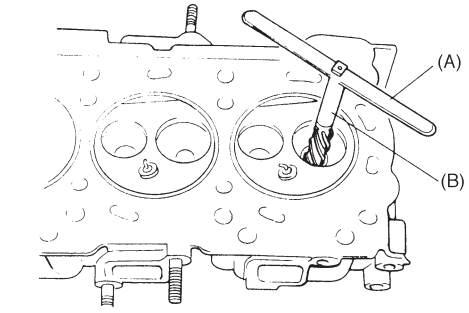
- Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

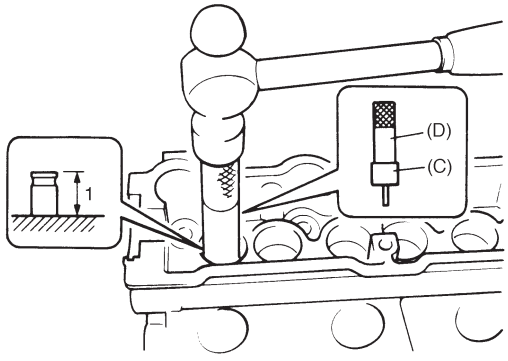
Item	Standard	Limit
Valve spring free length	42.29 mm (1.6649 in.)	41.0 mm (1.6142 in.)
Valve spring preload	209 – 235 N (20.9 – 23.5 kg) at 32.6 mm (46.1 – 51.8 lb at 1.28 in.)	187 N (18.7 kg) at 32.6 mm (41.2 lb at 1.28 in.)



- Spring squareness:
  Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit given below must be replaced.

  Valve spring squareness limit: 2.0 mm (0.079 in.)





1. Valve guide protrusion (11.5 mm)

ASSEMBLY

1) Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) so remove burrs and make it truly round.

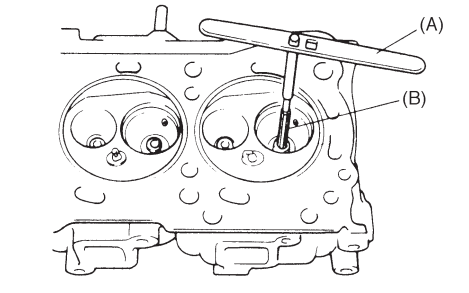
Special Tool
(A): 09916-34541
(B): 09916-38210

2) Install valve guide to cylinder head.
Heat cylinder head uniformly at a temperature of 80 to 100°C (176 to 212°F) so that head will not be distorted, and drive new valve guide into hole with special tools.
Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.
After installing, make sure that valve guide protrudes by 11.5 mm (0.45 in.) from cylinder head.

Special Tool
(C): 09916-56011
(D): 09916-58210

NOTE:
- **Do not reuse valve guide once disassembled. Install new valve guide (Oversize).**
- **Intake and exhaust valve guides are identical.**

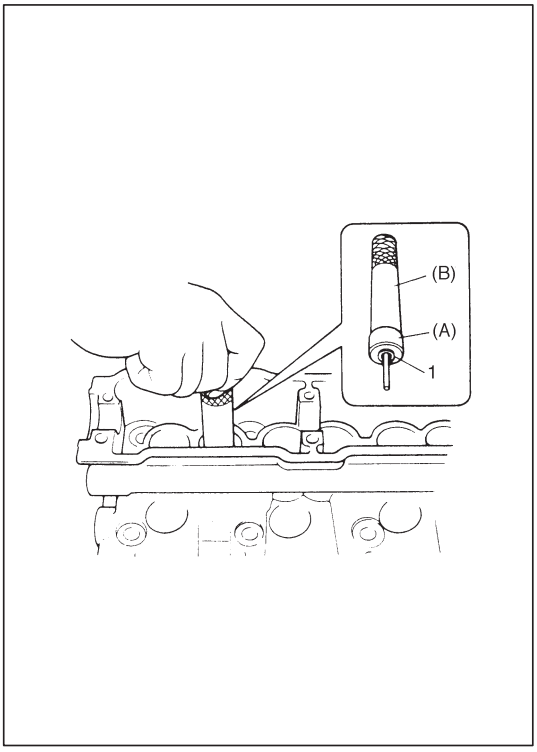
Valve guide oversize: 0.03 mm (0.0012 in.)
Valve guide protrusion (In and Ex): 11.5 mm (0.45 in.)



3) Ream valve guide bore with special tool (5.5 mm reamer). After reaming, clean bore.

Special Tool
(A): 09916-34541
(B): 09916-34550

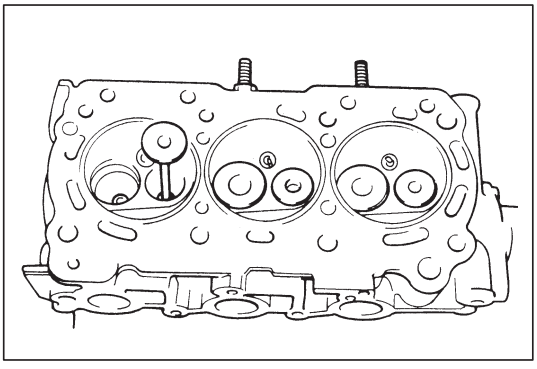
4) Install valve spring seat to cylinder head.



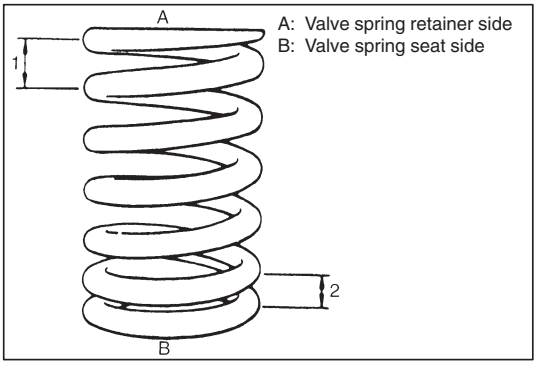
5) Install new valve stem seal (1) to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

Special Tool
(A): 09917-98221
(B): 09916-58210

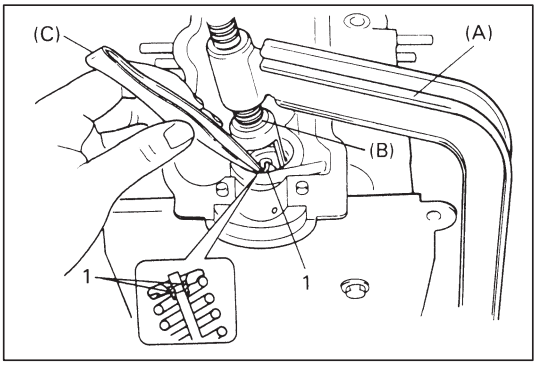
NOTE:
- **Do not reuse seal once disassembled. Be sure to install new seal.**
- **When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.**



6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



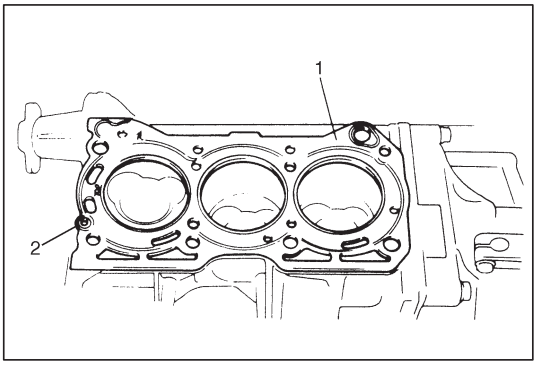
7) Install valve spring and spring retainer.
Each valve spring has top end (large-pitch (1) end) and bottom end (small-pitch (2) end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).



8) Using special tool (Valve lifter), compress valve spring and fit two valve cotters (1) into groove in valve stem.

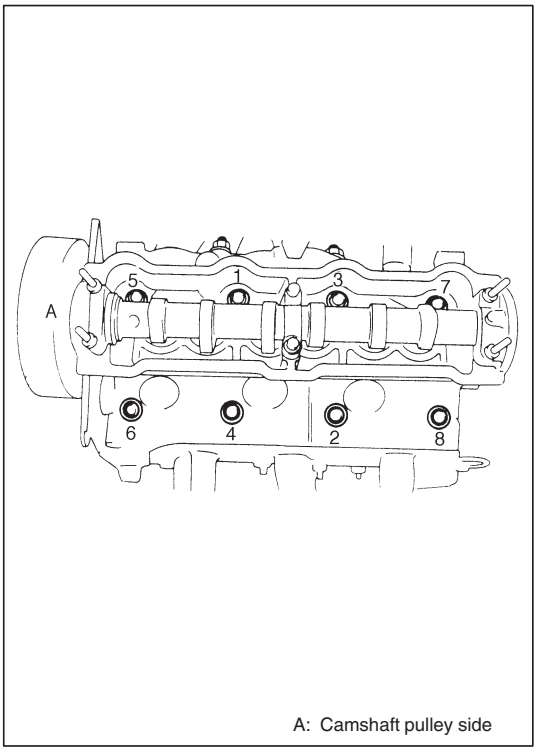
Special Tool
(A): 09916-14510
(B): 09916-14910
(C): 09916-84511

9) Install valve lash adjuster and camshaft as previously outlined.
10) Install thermostat case, distributor, intake manifold and exhaust manifold to cylinder head.



INSTALLATION

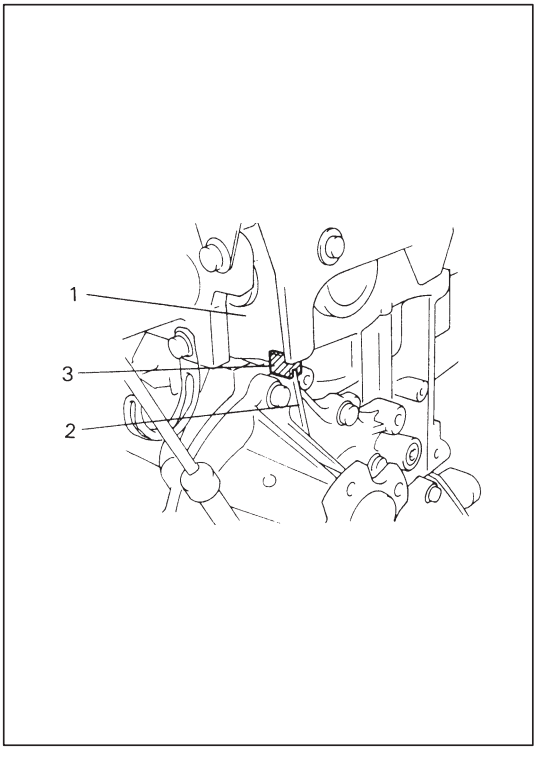
1) Remove old gasket and oil on mating surfaces and install new head gasket (1) as shown in figure so that check valve of cylinder block and the hole (2) for check valve of cylinder head gasket align.



A: Camshaft pulley side

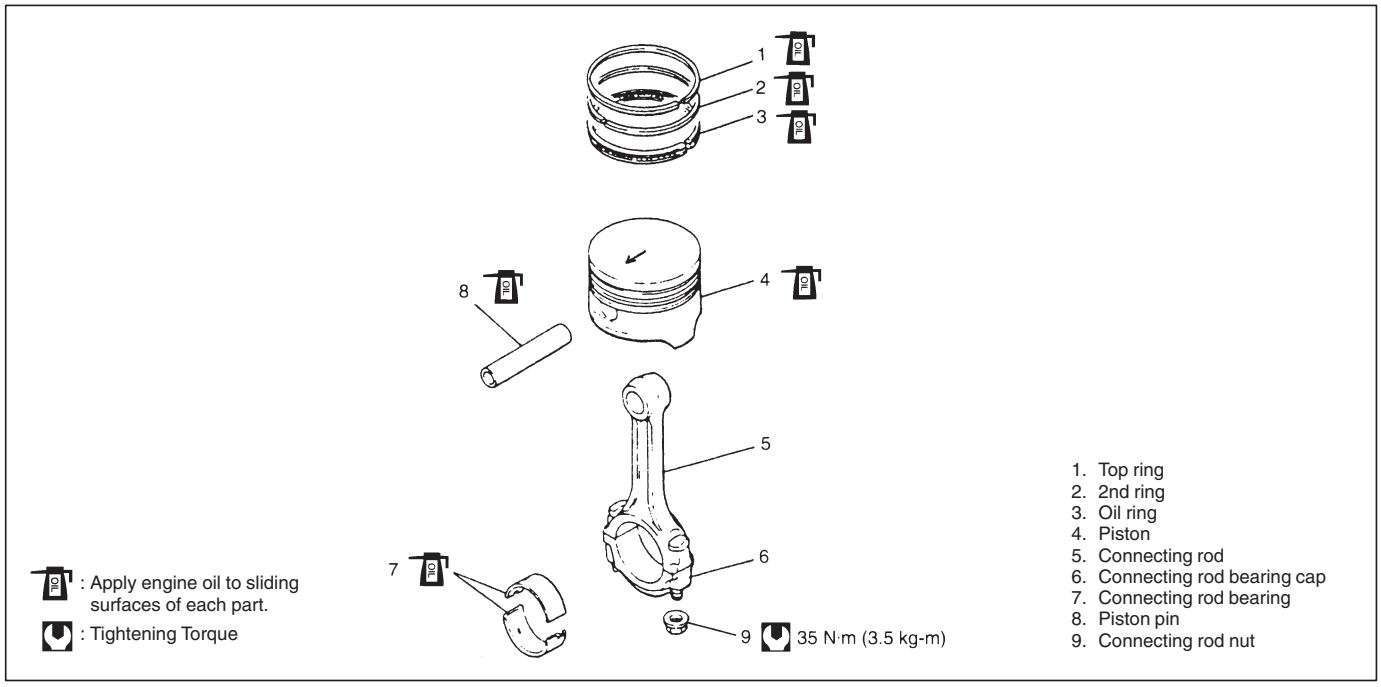
2) Apply engine oil to cylinder head bolts and tighten them gradually as follows.
   a) Tighten all bolts to 37 N·m (3.7 kg-m, 27.0 lb-ft) according to numerical order in figure.
   b) In the same manner as in a), tighten them to 58 N·m (5.8 kg-m, 42.0 lb-ft).
   c) Loosen all bolts until tightening torque is reduced to 0 (zero) in reverse order of tightening.
   d) In the same manner as in a), tighten them to 37 N·m (3.7 kg-m, 27.0 lb-ft).
   e) In the same manner as in a) again, tighten them to specified torque.

Tightening Torque
(a): 75 N·m (7.5 kg-m, 54 lb-ft)



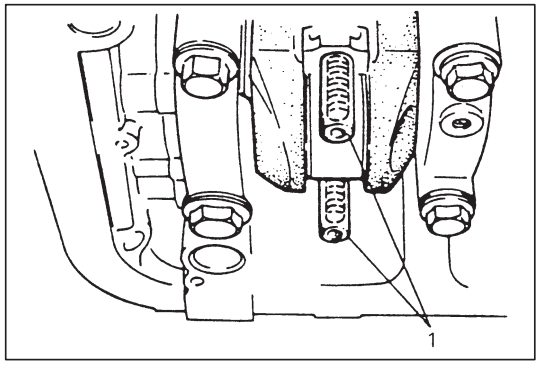
3) Install rubber seal (3) between water pump (2) and cylinder head (1).
4) Install cylinder head cover.
5) Install timing belt as previously outlined.
6) Reverse removal procedure for installation, nothing the following points.
   - Adjust drive belt tension, referring to “ENGINE COOLING” section.
   - Adjust A/C compressor belt tension, if equipped. Refer to Section 1B.
   - Adjust accelerator cable play. Refer to Section 6E1.
   - Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
   - Refill cooling system referring Section 6B.
   - Connect negative cable at battery.
   - Confirm that ignition timing is within specification referring to “IGNITION SYSTEM” section.
   - Verify that there is no fuel leakage, water leakage and exhaust gas leakage at each connection.

PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS

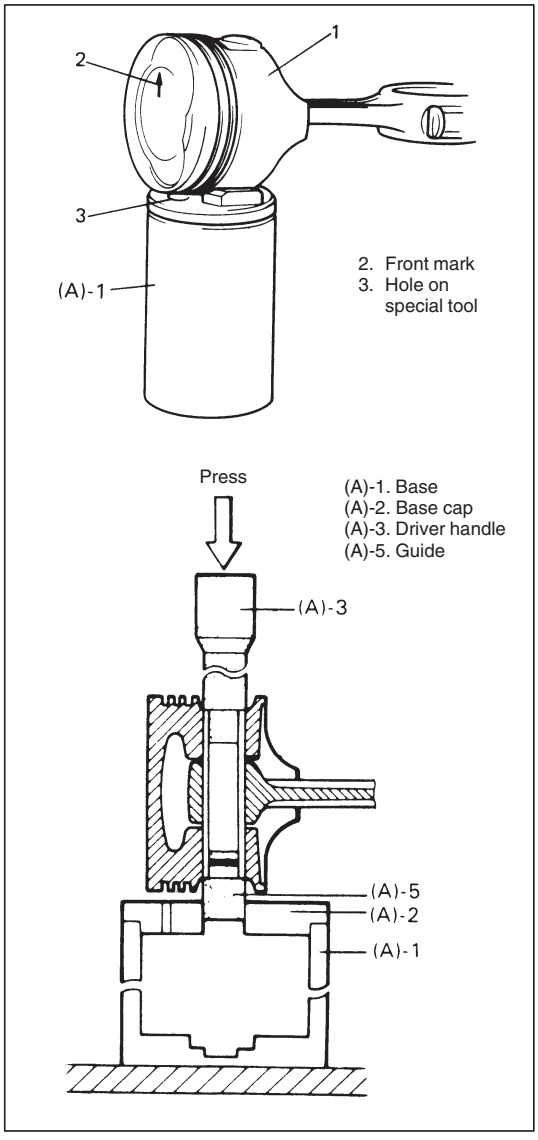


REMOVAL

1) Remove cylinder head from cylinder block as previously outlined.
2) Drain engine oil.
3) Remove oil pan and oil pump strainer as previously outlined.
4) Mark cylinder number on all pistons, connecting rods and rod bearing caps, using silver pencil or quick drying paint.



5) Remove rod bearing caps.
6) Install guide hose (1) over threads of rod bolts.
   This is to prevent damage to bearing journal and rod bolt threads when removing connecting rod.
7) Decarbon top of cylinder bore before removing piston from cylinder.
8) Push piston and connecting rod assembly out through the top of cylinder bore.



DISASSEMBLY

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.
2) Fit piston (1) and connecting rod assembly to special tool and then press piston pin out of connecting rod by using hydraulic press.

Special Tool
(A): 09910-38211

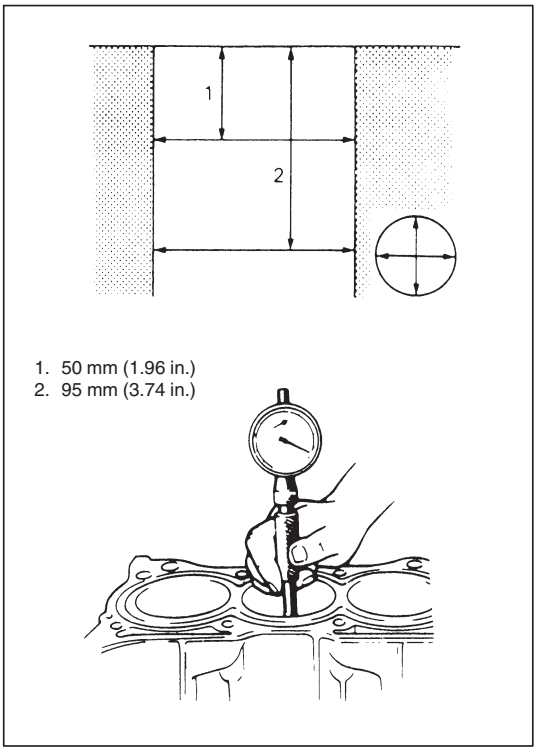
CLEANING

Clean carbon from piston head and ring grooves, using a suitable tool.

INSPECTION

Cylinders

- Inspect cylinder walls for scratches, roughness, or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore cylinder and use oversize piston.



1. 50 mm (1.96 in.)
2. 95 mm (3.74 in.)

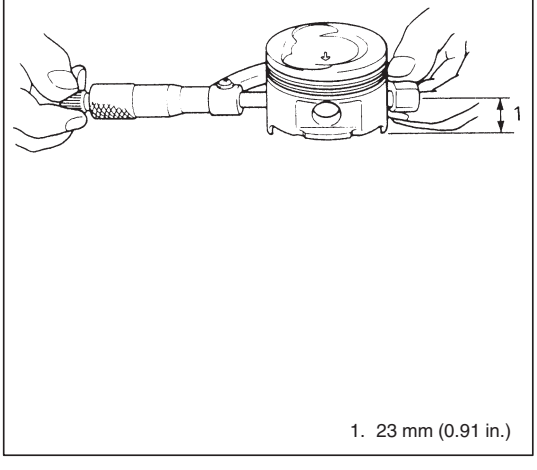
- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.
  If any of following conditions is noted, rebore cylinder.
  1) Cylinder bore dia. exceeds limit.
  2) Difference of measurements at two positions exceeds taper limit.
  3) Difference between thrust and axial measurements exceeds out-of-round limit.

  Cylinder bore dia. limit: 74.15 mm (2.9193 in.)
  Tapper and out-of-round limit: 0.10 mm (0.0039 in.)

  NOTE:
  If any one of three cylinders has to be rebored, rebore all three to the same next oversize. This is necessary for the sake of uniformity and balance.

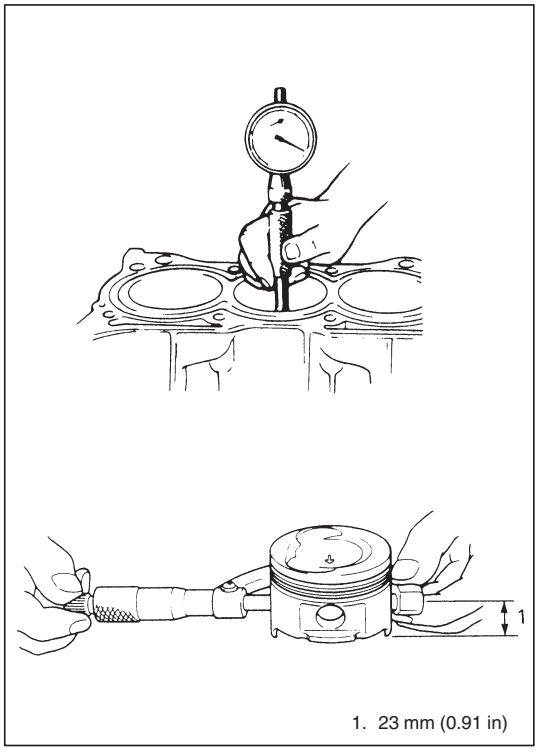
Pistons

- Inspect piston for faults, cracks or other damaged.
  Damaged or faulty piston should be replaced.
- Piston diameter:
  As indicated in figure, piston diameter should be measured at a position 23 mm (0.91 in.) from piston skirt end in the direction perpendicular to piston pin.



1. 23 mm (0.91 in.)

Piston diameter	Standard	73.970 – 73.990 mm (2.9122 – 2.9130 in.)
	Oversize: 0.25 mm (0.0098 in.)	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
	0.50 mm (0.0196 in.)	74.470 – 74.480 mm (2.9319 – 2.9323 in.)

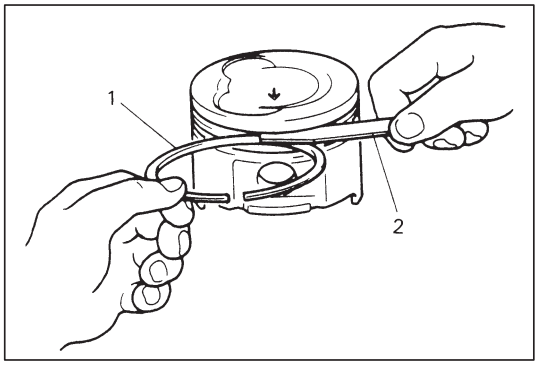


1. 23 mm (0.91 in)

- Piston clearance:
  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, re-bore cylinder and use oversize piston.

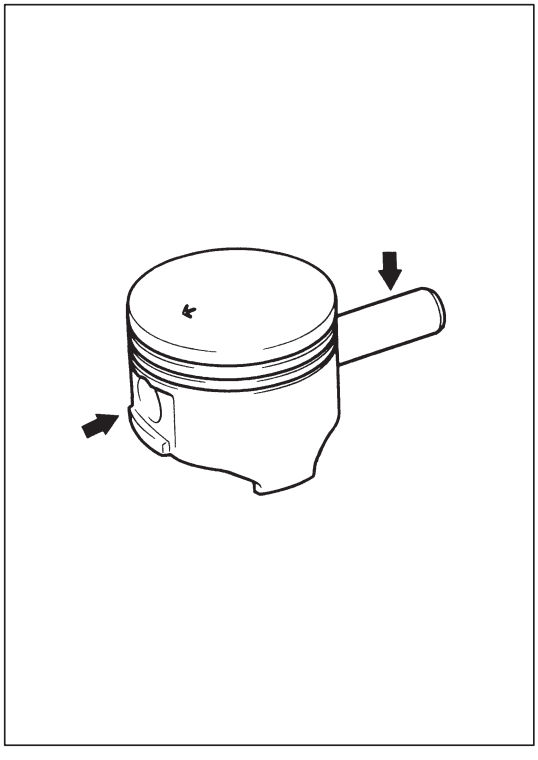
  Piston clearance: 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

  NOTE:
  Cylinder bore diameters used here are measured in thrust direction at two positions.



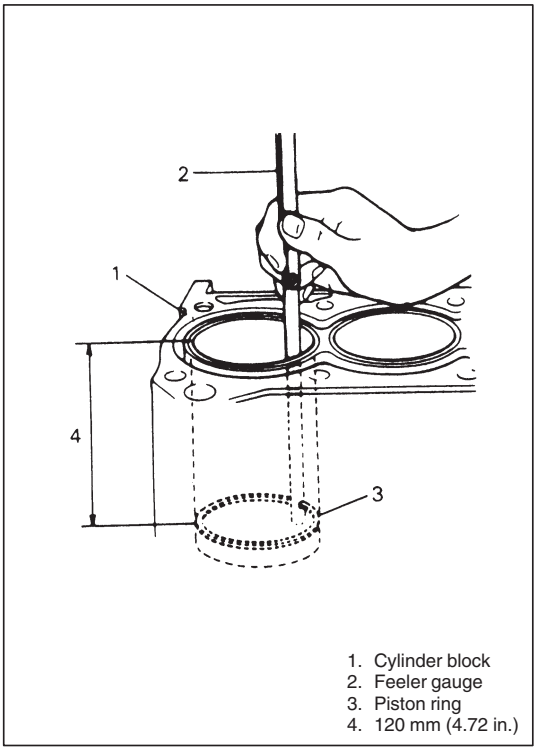
- Ring groove clearance:
  Before checking, piston grooves must be clean, dry and free of carbon.
  Fit new piston ring (1) into piston groove, and measure clearance between ring and ring land by using thickness gauge (2).
  If clearance is out of specification, replace piston.

  Ring groove clearance:
  Top: 0.03 – 0.07 mm (0.0012 – 0.0027 in.)
  2nd: 0.02 – 0.06 mm (0.0008 – 0.0023 in.)



Piston pin

- Piston pin must be fitted into piston bore with an easy finger push at normal room temperature.
- Check piston pin and piston bore for wear or damage. If pin or piston bore is badly worn or damaged, replace pin or piston, or both.



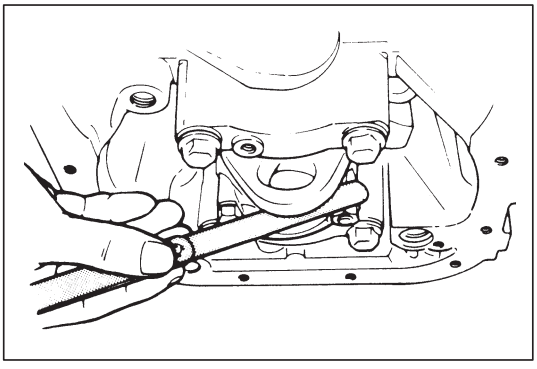
1. Cylinder block
2. Feeler gauge
3. Piston ring
4. 120 mm (4.72 in.)

Piston Rings

To measure end gap, insert piston ring into cylinder bore and then measure the gap by using thickness gauge.
If measured gap is out of specification, replace ring.

NOTE:
Decarbon and clean top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.15 – 0.30 mm (0.0059 – 0.0118 in.)	0.7 mm (0.0275 in.)
	2nd ring	0.2 – 0.35 mm (0.0079 – 0.0138 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.2 – 0.6 mm (0.0079 – 0.0236 in.)	1.8 mm (0.0709 in.)



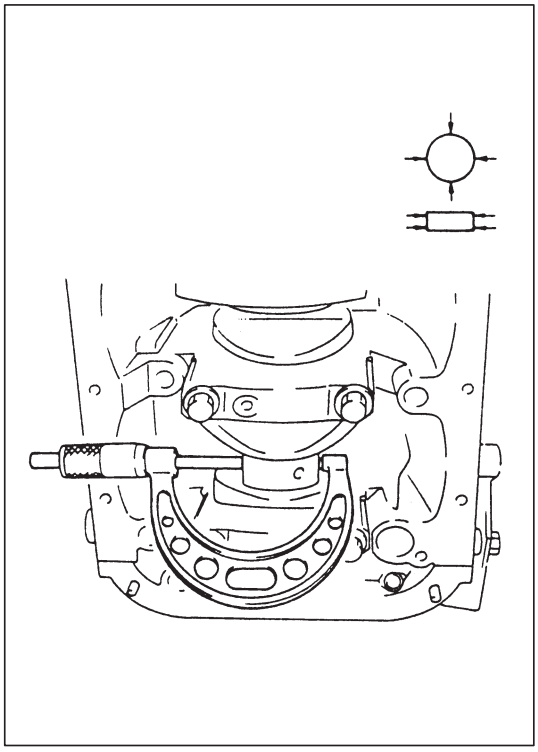
Connecting Rod

- Big-end side clearance:
  Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

Item	Standard	Limit
Big-end side clearance	0.10 – 0.20 mm (0.0039 – 0.0078 in.)	0.35 mm (0.0137 in.)

- Connecting rod alignment:
  Mount connecting rod on aligner to check it for bow and twist and, if limit is exceeded, replace it.

  Limit on bow : 0.05 mm (0.0020 in.)
  Limit on twist: 0.10 mm (0.0039 in.)

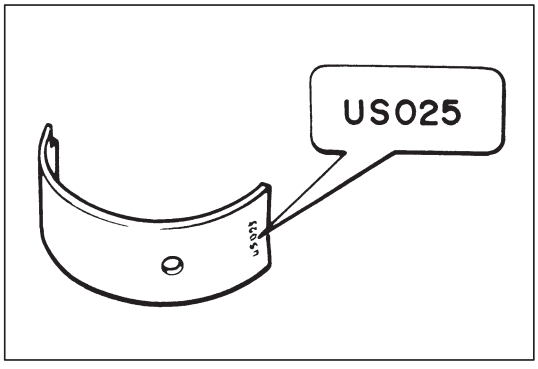


Crank Pin and Connecting Rod Bearings

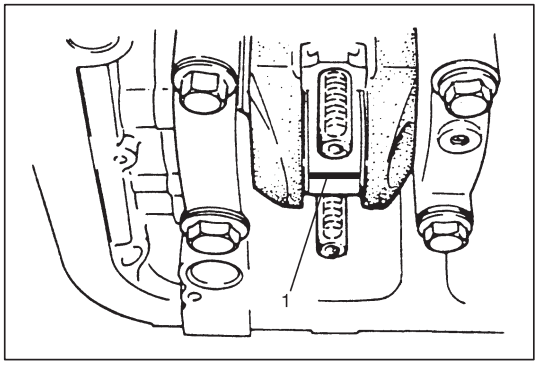
- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin to undersize and use undersize bearing.

Connecting rod bearing size	Crank pin diameter
Standard	41.982 – 42.000 mm (1.6528 – 1.6535 in.)
0.25 mm (0.0098 in.) undersize	41.732 – 41.750 mm (1.6430 – 1.6437 in.)

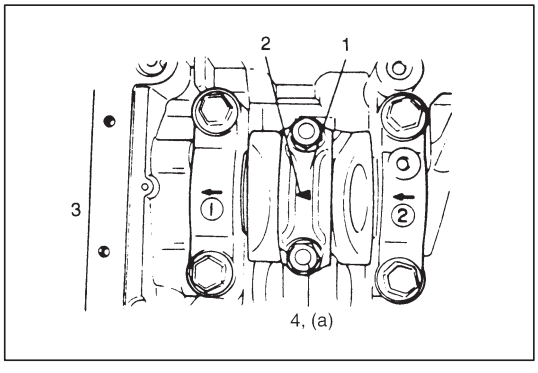
Out-of-round and taper limit: 0.01 mm (0.0004 in.)



- Rod bearing:
  Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
  Two kinds of rod bearing are available; standard size bearing and 0.25 mm undersize bearing. To distinguish them, 0.25 mm undersize bearing has the stamped number (USO25) on its backside as indicated in figure, but standard size one has no number.

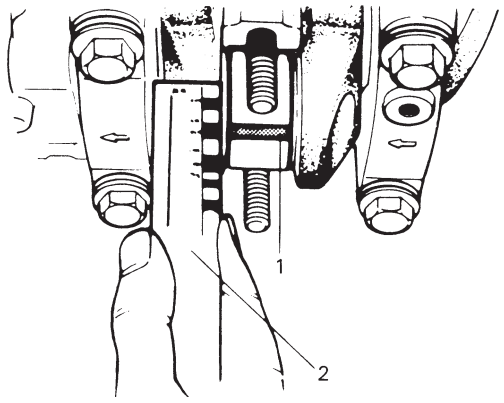


- Rod bearing clearance:
  1) Before checking bearing clearance, clean bearing and crank pin.
  2) Install bearing in connecting rod and bearing cap.
  3) Place a piece of gaging plastic (1) to full width of crankpin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



4) Install rod bearing cap (1) to connecting rod.
   When installing cap, be sure to point arrow mark (2) on cap to crankshaft pulley side (3), as shown in figure. After applying engine oil to rod bolts, tighten cap nuts (4) to specified torque. DO NOT turn crankshaft with gaging plastic installed.

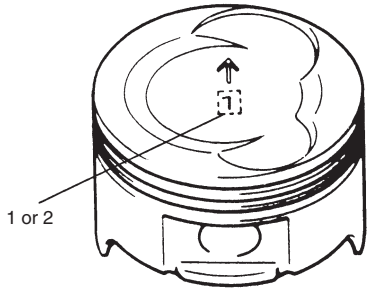
   Tightening Torque
   (a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

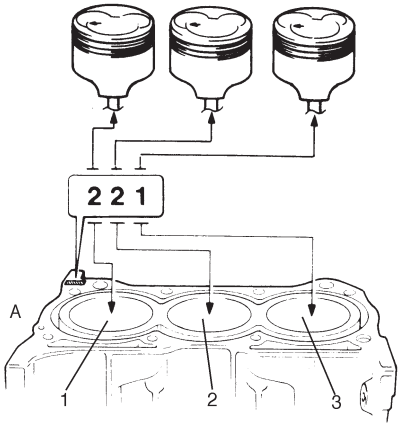


5) Remove cap and using a scale (2) on gaging plastic envelope, measure gaging plastic (1) width at the widest point (clearance).
If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

Item	Standard	Limit
Bearing clearance	0.020 – 0.050 mm (0.0008 – 0.0019 in.)	0.080 mm (0.0031 in.)

6) If clearance can not be brought to within its limit even by using a new standard size bearing, regrind crankpin to undersize and use 0.25 mm undersize bearing.





A: Crank pulley side

ASSEMBLY

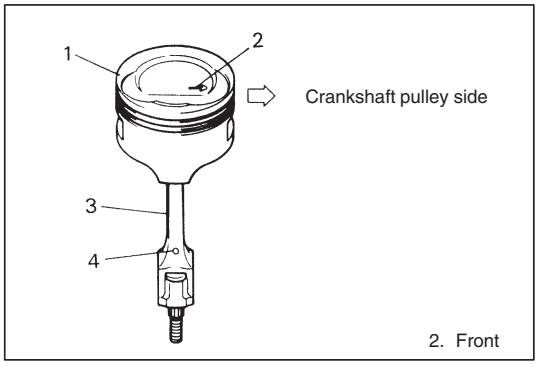
NOTE:

Two sizes of piston are available as standard size spare part so as to ensure proper piston-to-cylinder clearance. When installing a standard size piston, make sure to match piston with cylinder as follows.

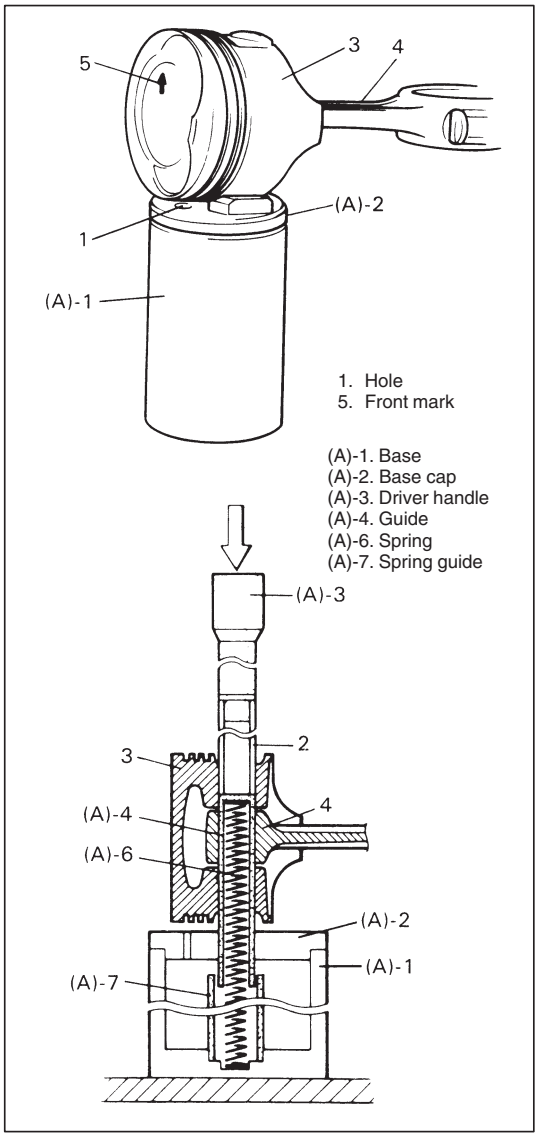
a) Each piston has stamped number 1 or 2 as shown. It represents outer diameter of piston.
b) There are also stamped numbers of 1 and 2 on the cylinder block as shown. The first number represents inner diameter of No.1 cylinder (1), the second number of No.2 cylinder (2) and the third number of No.3 cylinder (3).
c) Stamped number on piston and that on cylinder block should correspond. That is, install number 2 stamped piston to cylinder which is identified with number 2 and a number 1 piston to cylinder with number 1.

Unit: mm (in.)

Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Number (mark)	Bore diameter	
1	73.98 – 73 .99 (2.9126 – 2.9130)	1	74.01 – 74.02 (2.9138 – 2.9141)	0.02 – 0.04 (0.0008 – 0.0015)
2	73.97 – 73.98 (2.9122 – 2.9126)	2	74.00 – 74.01 (2.9134 – 2.9138)	

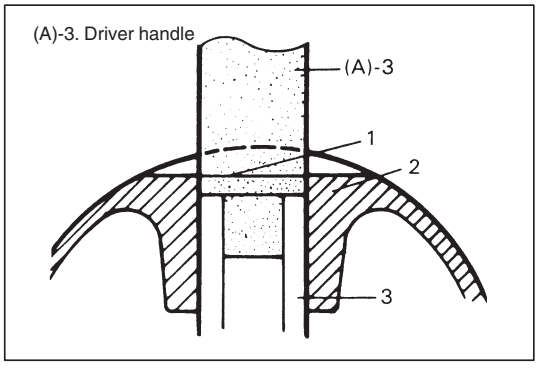


1) Set connecting rod (3) to piston (1).
After applying engine oil to piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure.
Oil hole (4) should be come on intake side.

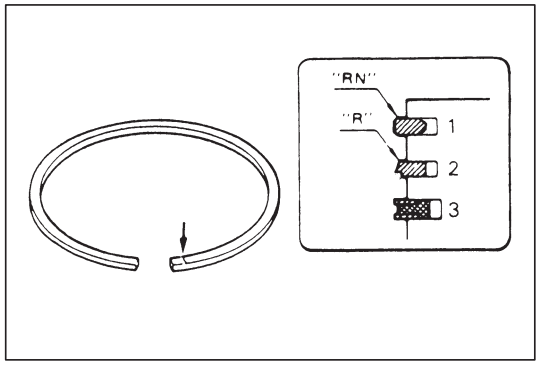


2) Fit piston pin (2) to piston (3) and connecting rod (4).
a) Place piston onto special tool (Piston in remover and installer) as shown in figure.

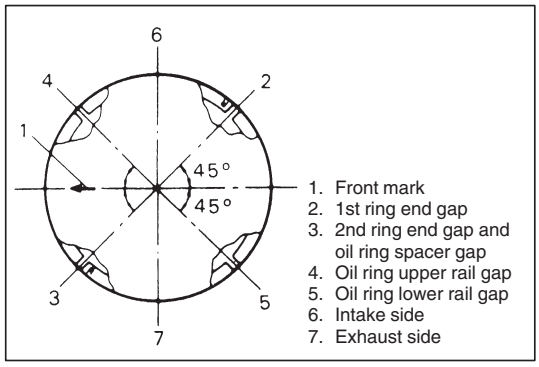
Special Tool
(A): 09910-38211



b) Press piston pin (3) into connecting rod until line (1) marked on driver handle is flush with flat surface of piston (2).



3) Install piston rings to piston:
   - As indicated in figure, 1st (1) and 2nd rings (2) have "RN" or "R" mark respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
   - 1st ring differs from 2nd ring in thickness, shape and color of surface contacting cylinder wall.
     Distinguish 1st ring from 2nd ring by referring to figure.
   - When installing oil ring (3), install spacer first and then two rails.

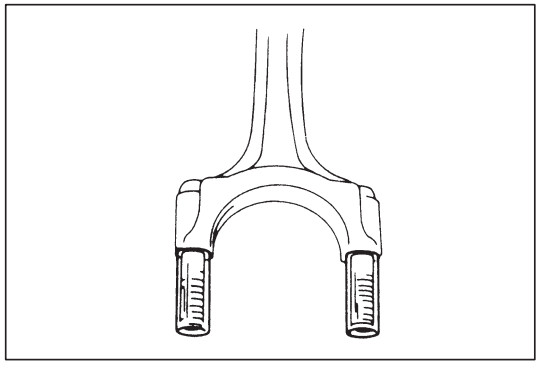


4) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

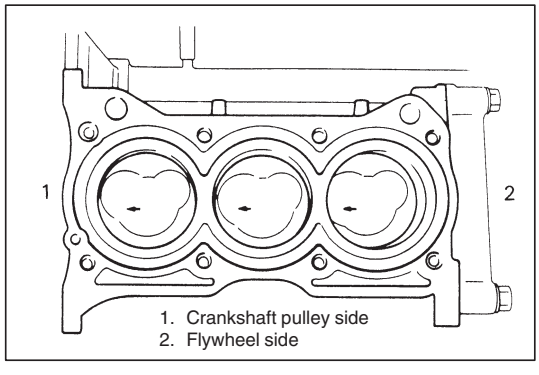
INSTALLATION OR CONNECTION

1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crankpins.

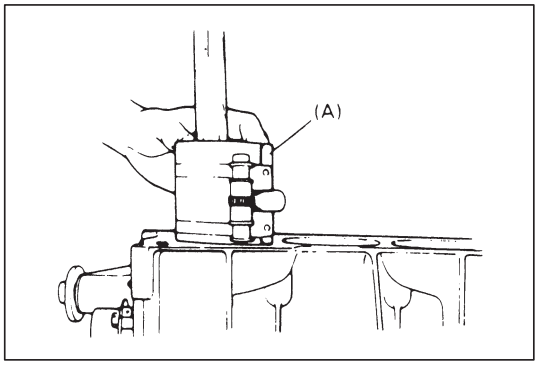
   NOTE:
   Do not apply oil between connecting rod and bearing or between bearing cap and bearing.



2) Install guide hoses over connecting rod bolts.
   These guide hoses protect crank pin and threads of rod bolt from damage during installation of connecting rod and piston assembly.

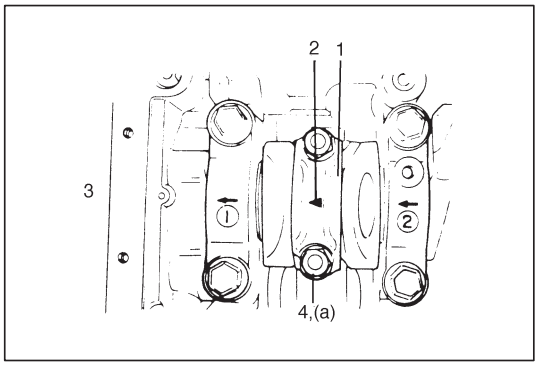


3) When installing piston and connecting rod assembly into cylinder bore, point front mark (punch mark or arrow mark) on piston head to crankshaft pulley side (1).



4) Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

Special Tool
(A): 09916-77310



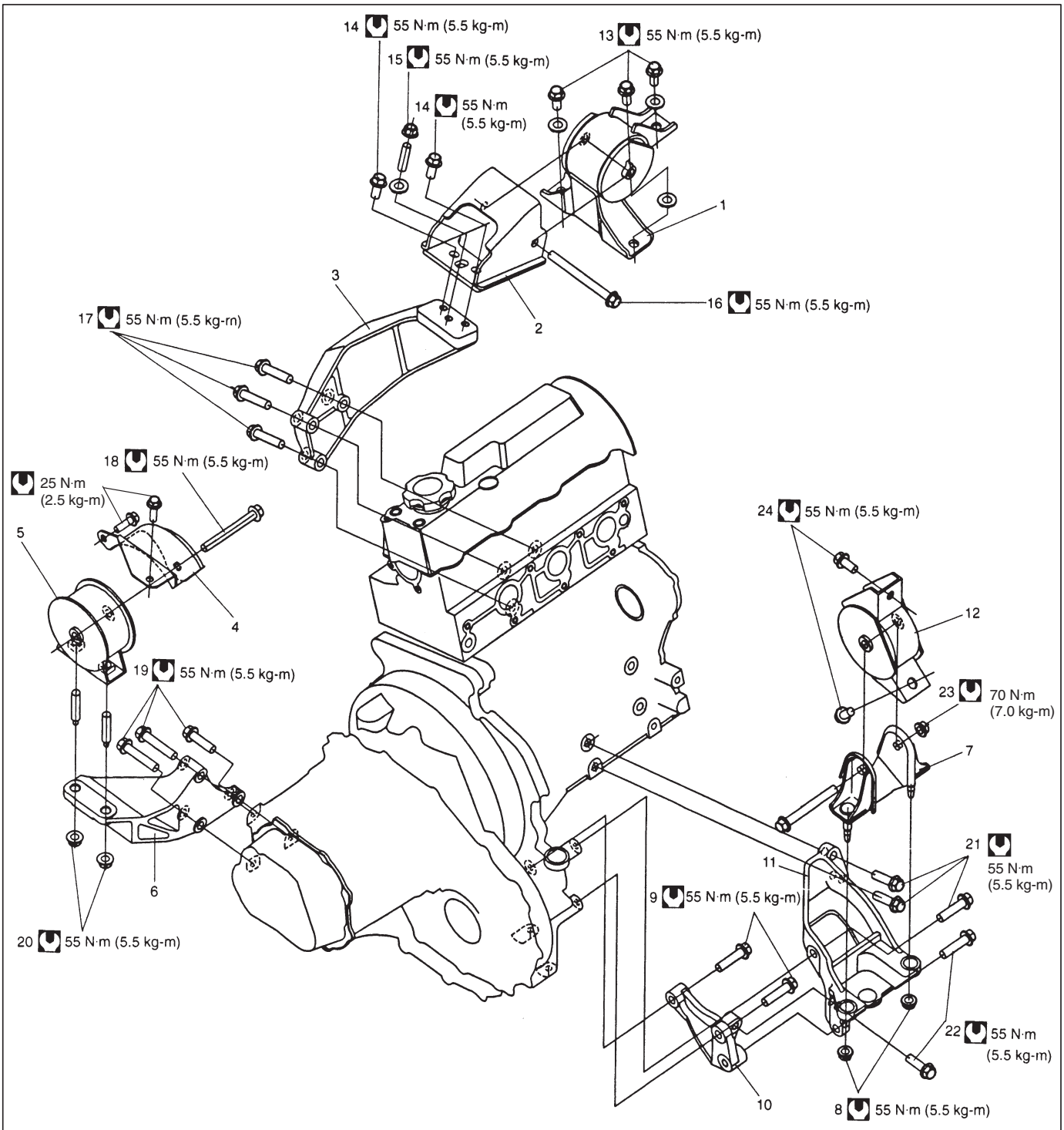
5) Install bearing cap (1):
Point arrow mark (2) on cap to crankshaft pulley side (3).
Tighten cap nuts (4) to specification.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

6) Reverse removal procedure for installation, nothing the following points.
- Adjust water pump drive belt tension, referring to “ENGINE COOLING” section.
- Adjust A/C compressor belt tension, if equipped. Refer to Section 1B.
- Adjust accelerator cable play. Refer to Section 6E1.
- Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.
- Refill cooling system referring to Section 6B.
- Connect negative cable at battery.
- Verify that ignition timing is within specification referring to “IGNITION SYSTEM” section.
- Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.

UNIT REPAIR OVERHAUL

ENGINE MOUNTING



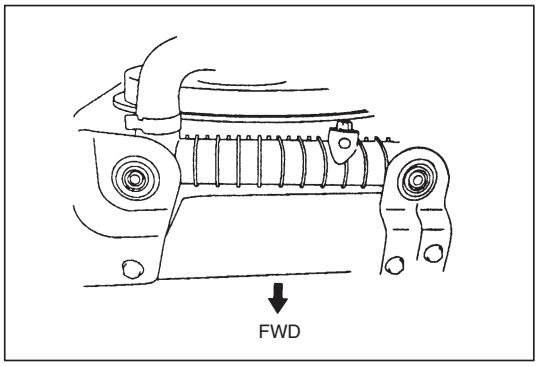
1. Right mounting
2. Right mounting swing bracket
3. Right mounting bracket
4. Left mounting body bracket
5. Left mounting
6. Left mounting bracket
7. Rear mounting bracket
8. Rear mounting nut
9. Rear mounting bracket No.2 bolt
10. Rear mounting No.2 bracket
11. Rear mounting No.1 bracket
12. Rear mounting
13. Right mounting body bolt
14. Right mounting bracket & swing bolt
15. Right mounting bracket & swing nut
16. Right mounting bush bolt
17. Right mounting bracket bolt
18. Left mounting bush bolt
19. Left mounting bracket & transmission bolt
20. Left mounting nut
21. Rear mounting bracket No.1 bolt
22. Rear mounting bracket No.1 to No.2 bolt
23. Rear mounting bush bolt
24. Rear mounting body bolt

: Tightening Torque

ENGINE ASSEMBLY

REMOVAL

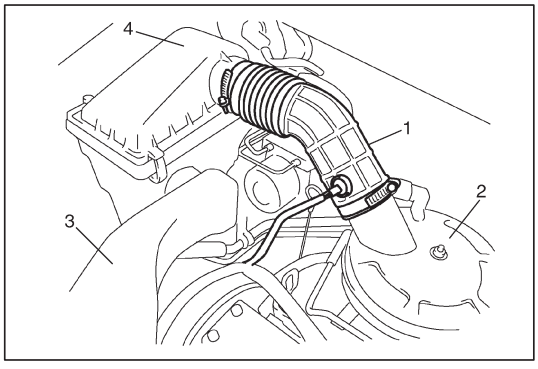
1) Release fuel pressure in fuel feed line by referring to Section 6-1.
2) Disconnect negative cable at battery.
3) Remove engine hood after disconnecting windshield washer hose.



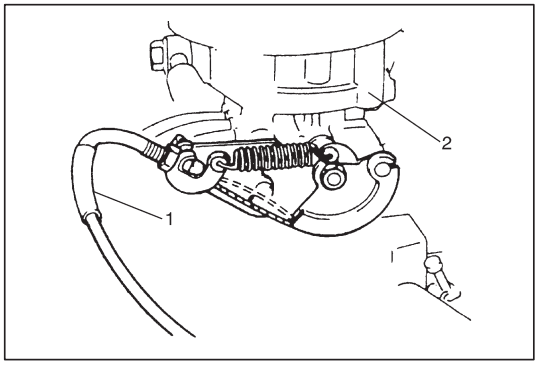
4) Drain cooling system.

WARNING:
To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.

5) Disconnect radiator inlet hose from thermostat case and outlet hose from water inlet pipe.



6) Remove air cleaner outlet hose (1) and air chamber case (2) as previously outlined.
7) Remove suction pipe (3) and remove air cleaner assembly (4) by removing its fastening bolt.

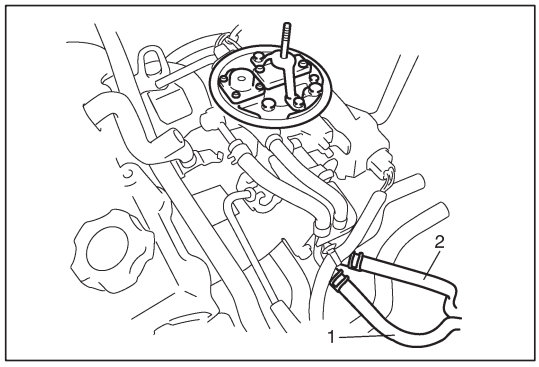


8) Disconnect following cables.
   - Accelerator cable (1) from throttle body (2).
   - Clutch cable from transmission.
   - Gear shift and select cable from transmission.

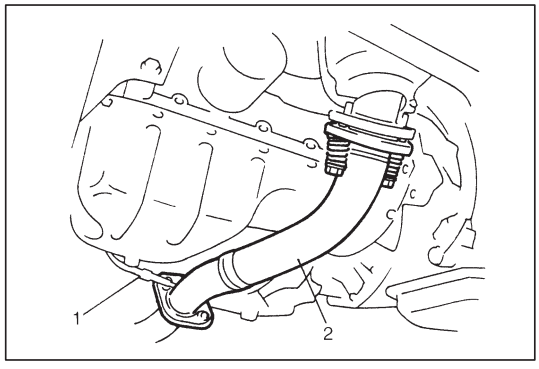
9) Disconnect brake booster hose from intake manifold.

10) Disconnect following electric wires:
- Back-up light switch
- Generator
- Starting motor
- CKP sensor
- Battery negative cable from transmission
- Vehicle speed sensor
- e.t.c.

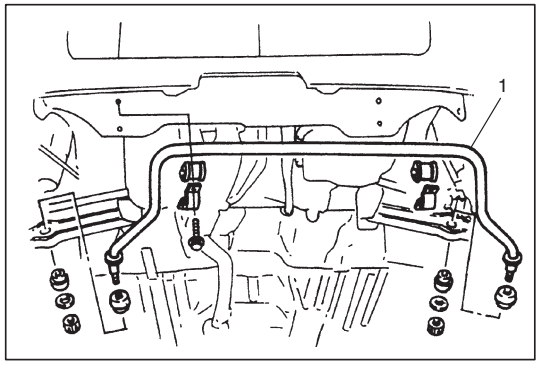
and release above wire harness from clamps.



11) Disconnect fuel feed hose (1) and fuel return hose (2) from fuel pipes.
12) Disconnect heater inlet and outlet hoses.



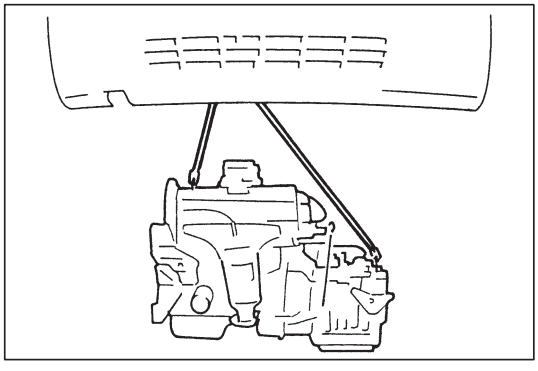
13) Remove right and left engine under covers.
14) Disconnect oxygen sensor No.2 coupler (1) and remove exhaust No.1 pipe (2).
15) Drain engine and transmission oil.



16) Remove stabilizer bar (1) referring to Section 3D of the Service Manual mentioned in FOREWORD of this manual.

17) Remove drive shaft joints from differential gear of transmission.
Refer to Section 4 (DRIVE SHAFT) of the Service Manual mentioned in FOREWORD of this manual for procedure to disconnect drive shaft joint.
For engine and transmission removal, it is not necessary to remove drive shafts from steering knuckle.

18) Disconnect A/C suction and discharge hoses and then remove A/C compressor and its bracket (if equipped), refer to Section 1B.
19) Install support device.
20) Remove engine rear mounting nuts (1).
21) Remove engine left mounting nuts (2).
22) Remove engine right mounting bracket bolts (3) and nut (4).



23) Before removing engine with transmission from body, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transmission.
24) Lower engine with transmission from body.

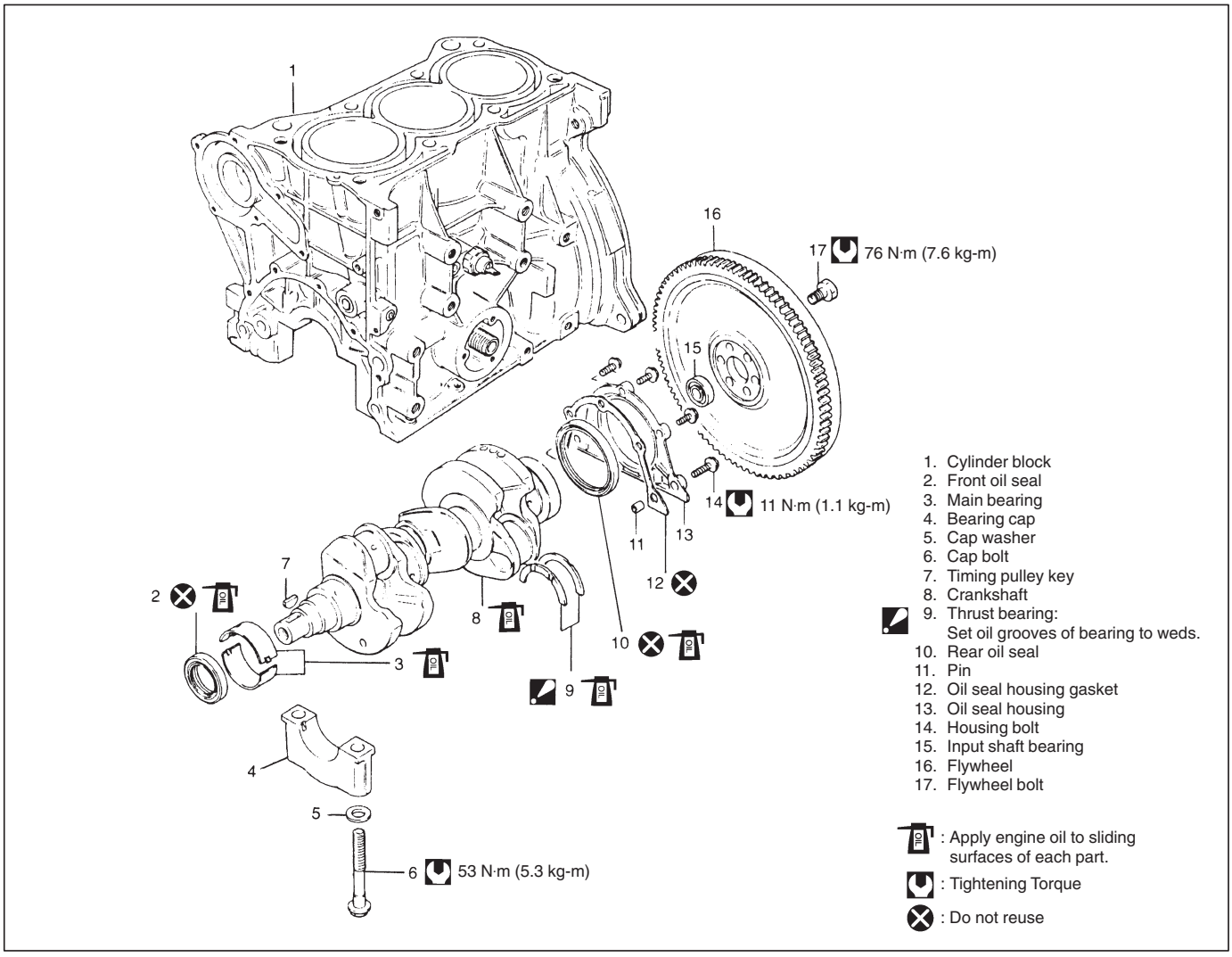
INSTALLATION

1) Lift engine with transmission into engine compartment, but do not remove support device.
2) Install engine right mounting bracket bolts and nut.
3) Install engine left mounting nuts.
4) Install engine rear mounting nuts.
5) Tighten bolts and nuts to specified torque.

Tightening Torque
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

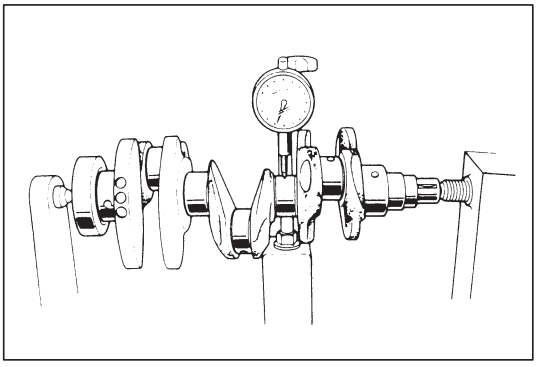
6) Remove support device.
7) Reverse removal procedures for installation of remainder.
   - Install A/C compressor bracket and A/C compressor and connect A/C suction and discharge hoses, refer to Section 1B.
   - Push in each drive shaft joint fully so that snap ring engages with differential gear.
     Use care not to damage oil seal lip when inserting.
   - Install stabilizer bar, refer to Section 3D of the Service Manual mentioned in FOREWORD of this manual.
   - Install exhaust No.1 pipe.
   - Install right and left engine under covers.
   - Connect each hoses securely.
   - Clamp electric wire securely.
8) Adjust clutch pedal free travel, referring to Section 7C.
9) Refill transmission with gear oil, referring to Section 0B.
10) Refill engine with engine oil, referring to Section 0B.
11) Refill cooling system, referring to Section 6B.
12) Adjust A/C compressor belt, referring to Section 1B. (if equipped)
13) Upon completion of installation, verify that there is no fuel leakage, coolant leakage, transmission oil leakage or exhaust gas leakage at each connection.
14) Adjust accelerator cable play, referring to Section 6E1.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



REMOVAL

1) Remove engine with transmission from body as previously outlined.
2) Remove transmission from engine, and then remove clutch and flywheel.
3) Remove water pump belt, generator bracket, crankshaft pulley, timing belt, and crankshaft timing belt pulley etc.
4) Remove cylinder head assembly.
5) Remove oil pan and oil pump strainer.
6) Remove pistons and connecting rods.
7) Remove oil pump and oil seal housing.
8) Remove main bearing caps and crankshaft.



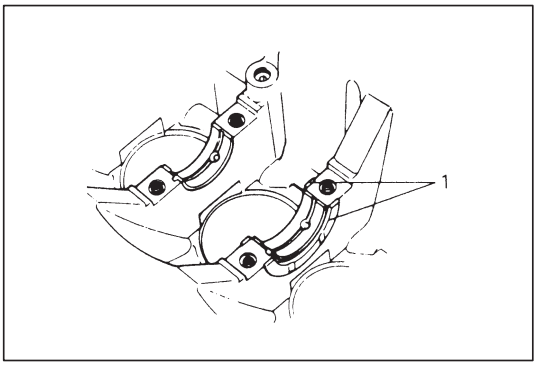
INSPECTION

Crankshaft

Crankshaft runout

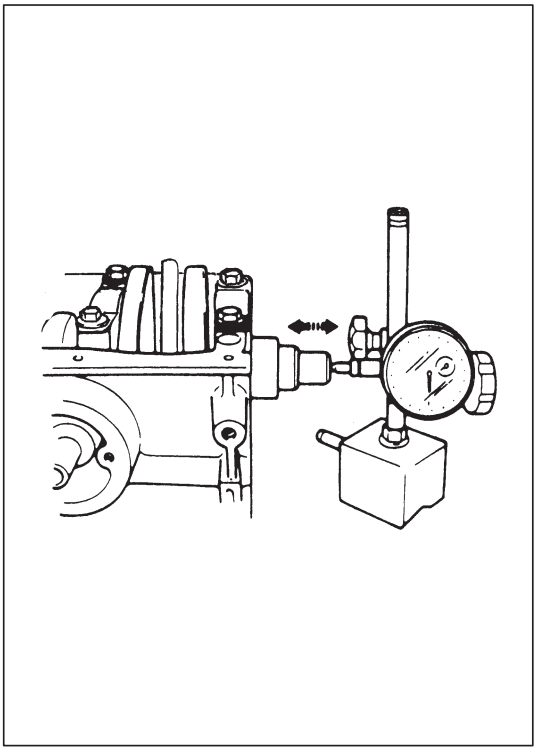
Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

Limit on runout: 0.06 mm (0.0023 in.)



Crankshaft thrust play

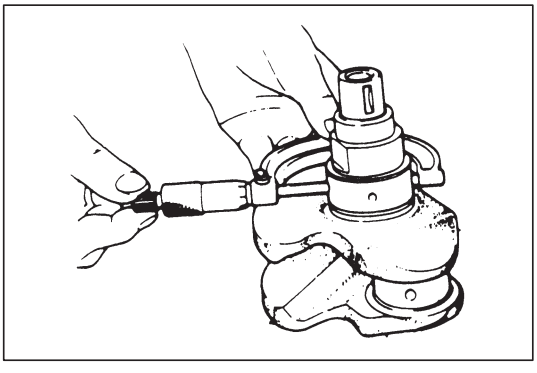
Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing (1) and journal bearing caps installed.



Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Crankshaft Thrust Play
Standard: 0.11 – 0.31 mm (0.0044 – 0.0122 in.)
Limit : 0.38 mm (0.0149 in.)

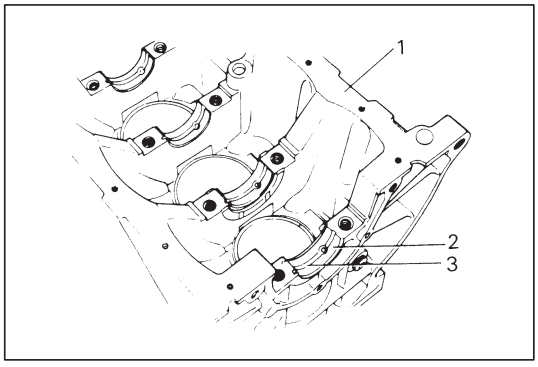
Thickness of crankshaft thrust bearing
Standard: 2.500 mm (0.0984 in.)
Oversize 0.125 mm (0.0049 in.): 2.563 mm (0.1009 in.)



Out-of-round and taper (uneven wear) of journals

An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both).
This difference, if any, is determined by taking micrometer readings.
If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

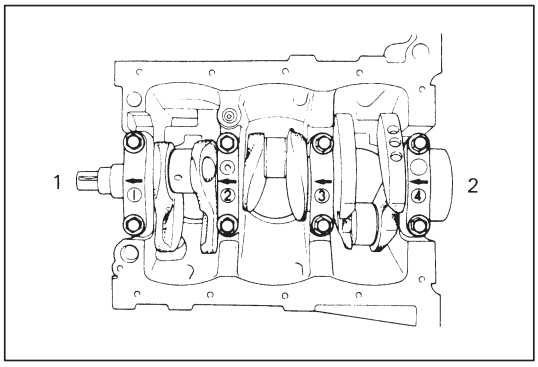
Limit on out-of-round and taper: 0.01 mm (0.0004 in.)



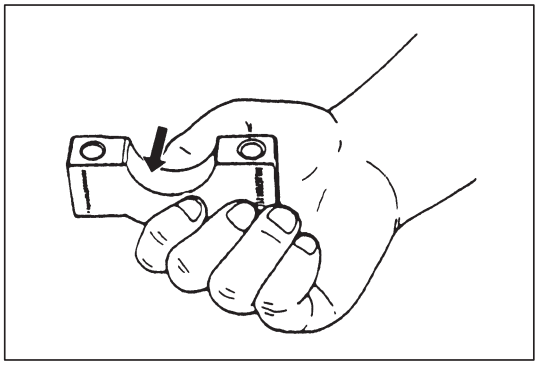
Main Bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.
- Upper half of bearing (2) has oil groove (3) as shown in figure. Install this half with oil groove to cylinder block (1).

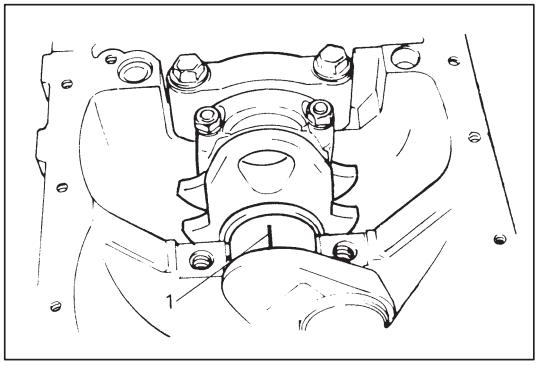


- On each main bearing cap, arrow mark and number are embossed as shown in figure.
  When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side (1) and install each cap from that side to flywheel side (2) in ascending order of numbers “1”, “2”, “3” and “4”. Tighten cap bolts to specified torque.



Inspection

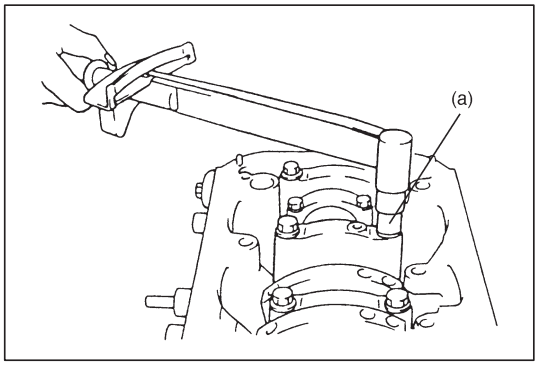
Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace one half without replacing the other half.



Main bearing clearance

Check clearance by using gaging plastic (1) according to following procedure.

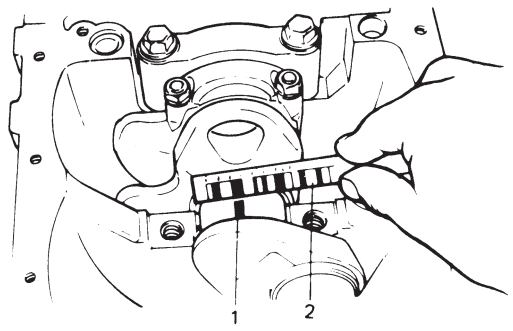
1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



4) Install bearing cap as previously outlined and evenly torque cap bolts to specified torque.
   Bearing cap MUST be torqued to specification in order to assure proper reading of clearance.

   Tightening Torque
   (a): 53 N·m (5.3 kg-m, 38.5 lb-ft)

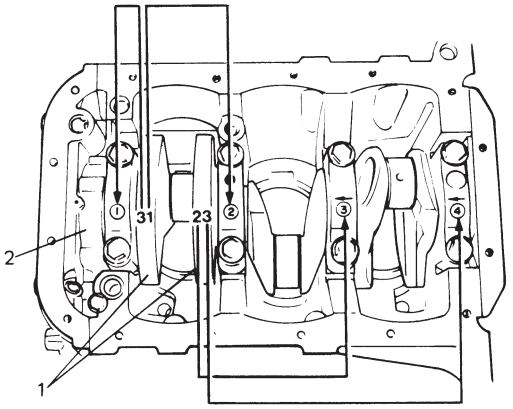
   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.



1. Gaging plastic
2. Scale

5) Remove cap and using scale (2) on gaging plastic (1) envelope, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
A new standard bearing may produce proper clearance.
If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
After selecting new bearing, recheck clearance.

	Standard	Limit
Bearing clearance	0.020 – 0.040 mm (0.0008 – 0.0016 in.)	0.060 mm (0.0023 in.)



2. Oil pump

Selection of main bearings

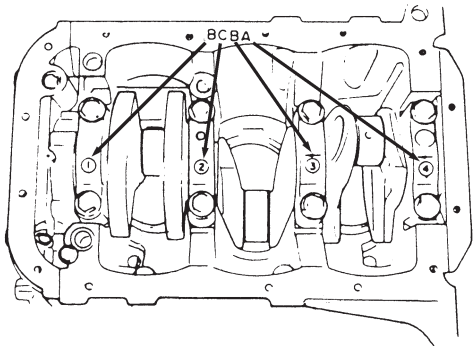
STANDARD BEARING:

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to following procedure and install it.

1) First check journal diameter by using following procedure.
As shown in figure, crank webs of No.1 cylinder (1) has five stamped numerals.
Three kinds of numerals ("1", "2" and "3") represent following journal diameters.

Numeral stamped	Journal diameter
1	44.994 – 45.000 mm (1.7714 – 1.7716 in.)
2	44.988 – 44.994 mm (1.7712 – 1.7714 in.)
3	44.982 – 44.988 mm (1.7709 – 1.7712 in.)

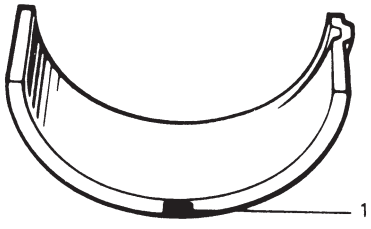
The first, second, third and fourth (left to right) stamped numerals represent journal diameters at bearing caps "1", "2", "3" and "4" respectively.
For example, in figure, the first (leftmost) numeral "3" indicates that journal dia. at bearing cap "1" is within 44.982 – 44.988 mm (1.7709 – 1.7712 in.), and second one "1" indicates that journal dia. at cap "2" is within 44.994 – 45.000 mm (1.7714 – 1.7716 in.).



2) Next, check bearing cap bore diameter without bearing.
On mating surface of cylinder block, four alphabets are stamped as shown in figure.
Three kinds of alphabets (“A”, “B” and “C”) represent following cap bore diameters.

Alphabet stamped	Bearing cap bore diameter (without bearing)
A	49.000 – 49.006 mm (1.9291 – 1.9294 in.)
B	49.006 – 49.012 mm (1.9294 – 1.9296 in.)
C	49.012 – 49.018 mm (1.9296 – 1.9298 in.)

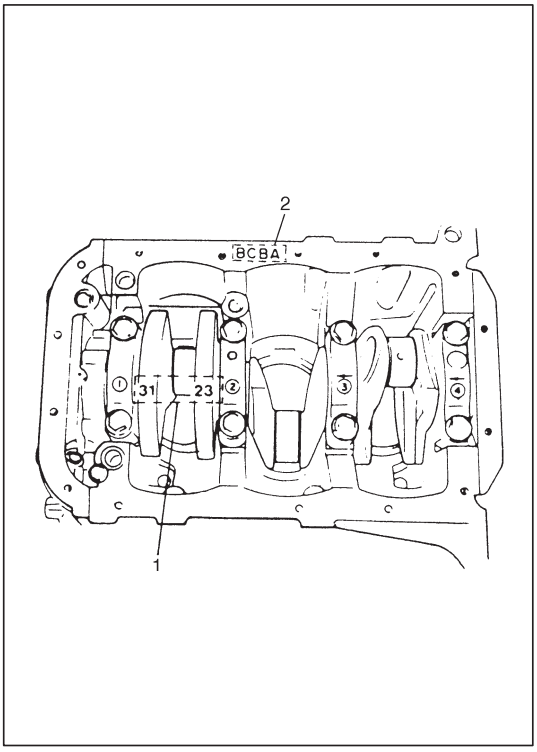
The first, second, third and fourth (left to right) stamped alphabets represent cap bore diameters of bearing caps “1”, “2”, “3” and “4”, respectively.
For example, in figure, the first (leftmost) alphabet “B” indicates that cap bore dia. of bearing cap “1” is within 49.006 – 49.012 mm, and the fifth (rightmost) alphabet “A” indicates that cap bore dia. of cap “4” is within 49.000 – 49.006 mm.



1. Paint

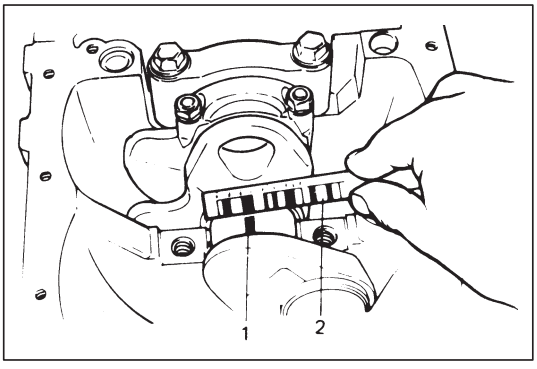
3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in following colors at the position as indicated in figure.
Each color indicates following thickness at the center of bearing.

Color painted	Bearing thickness
Green	1.996 – 2.000 mm (0.0786 – 0.0787 in.)
Black	1.999 – 2.003 mm (0.0787 – 0.0788 in.)
Colorless (no paint)	2.002 – 2.006 mm (0.0788 – 0.0789 in.)
Yellow	2.005 – 2.009 mm (0.0789 – 0.0790 in.)
Blue	2.008 – 2.012 mm (0.0790 – 0.0791 in.)

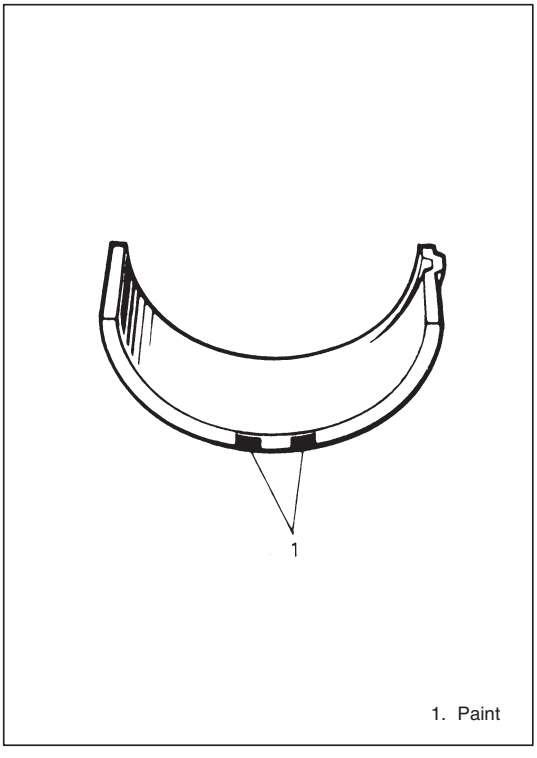


4) From numerals stamped on crank webs of No.1 cylinder (1) and the alphabets stamped on mating surface of cylinder block, determine new standard bearing to be installed to journal, by referring to table given below.
For example, if numeral stamped on crank web is “1” and alphabet stamped on mating surface is “B”, install a new standard bearing painted in “Black” to its journal.

		Numeral stamped on crank web (Journal diameter)		
		1	2	3
Alphabet stamped on mating surface (Bearing cap bore dia.)	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue
		New standard bearing to be installed.		



5) Using scale (2) on gaging plastic (1), check bearing clearance with newly selected standard bearing.
If clearance still exceeds its limit, use next thicker bearing and recheck clearance.
6) When replacing crankshaft or cylinder block due to any reason, select new standard bearings to be installed by referring to numerals stamped on new crankshaft or alphabets stamped on mating surface of new cylinder block.



1. Paint

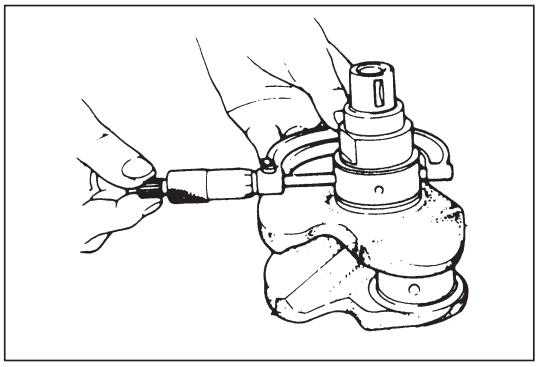
UNDERSIZE BEARING (0.25 mm):

- 0.25 mm undersize bearing is available, in five kinds varying in thickness.
To distinguish them, each bearing is painted in following colors at such position as indicated in figure.
Each color represents following thicknesses at the center of bearing.

Color painted	Bearing thickness
Green & Red	2.121 – 2.125 mm (0.0835 – 0.0836 in.)
Black & Red	2.124 – 2.128 mm (0.0836 – 0.0837 in.)
Red only	2.127 – 2.131 mm (0.0837 – 0.0838 in.)
Yellow & Red	2.130 – 2.134 mm (0.0838 – 0.0839 in.)
Blue & Red	2.133 – 2.137 mm (0.0839 – 0.0840 in.)

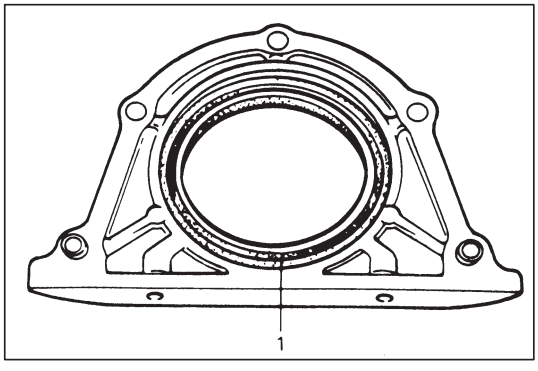
- If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.
  1) Regrind journal to following finished diameter.

Finished diameter: 44.732 – 44.750 mm (1.7611 – 1.7618 in.)



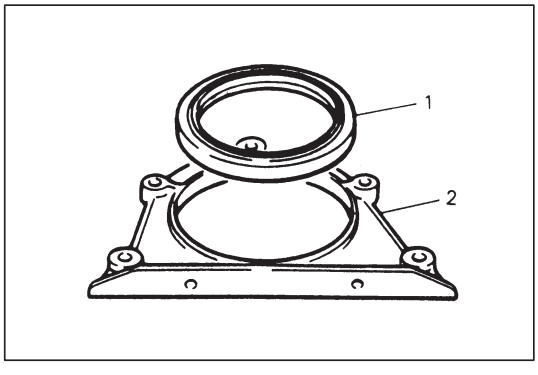
2) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on mating surface of cylinder block, select an undersize bearing by referring to table given below.
   Check bearing clearance with newly selected undersize bearing.

		Measured journal diameter		
		44.744 – 44.750 mm (1.7616 – 1.7618 in.)	44.738 – 44.744 mm (1.7613 – 1.7616 in.)	44.732 – 44.738 mm (1.7611 – 1.7613 in.)
Alphabets stamped on mating surface of cylinder block	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red
		Undersize bearing to be installed		

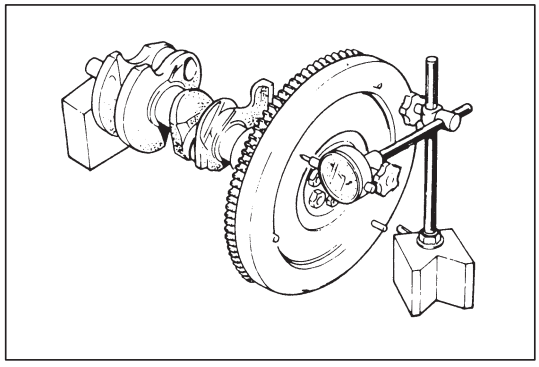


Rear Oil Seal

Carefully inspect rear oil seal (1) for wear or damage. If its lip is worn or damaged, replace it.



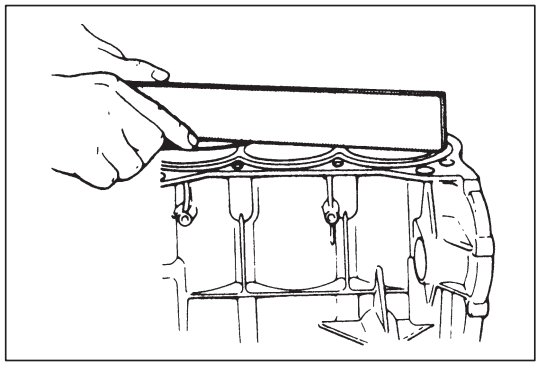
For oil seal (1) installation, press-fit rear oil seal so that oil seal housing (2) end face is flush with oil seal end face.



Flywheel

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.
- Check flywheel for face runout with dial gauge.
  If runout exceeds its limit, replace flywheel.

Limit on runout: 0.2 mm (0.0078 in.)



Cylinder Block

Distortion of gasketed surface

Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

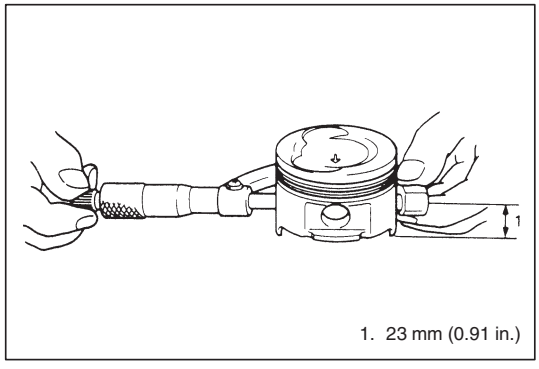
Item	Standard	Limit
Flatness	0.03 mm (0.0012 in.)	0.06 mm (0.0024 in.)

Honing or reboring cylinders

1) When any cylinder needs reboring,all other cylinders must also be rebored at the same time.
2) Select oversized piston according to amount of cylinder wear.

Size	Piston diameter
O/S 0.25	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
O/S 0.50	74.470 – 74.480 mm (2.9319 – 2.9323 in.)

3) Using micrometer, measure piston diameter.



1. 23 mm (0.91 in.)

4) Calculate cylinder bore diameter to be rebored.
   D = A + B – C
   D: Cylinder bore diameter to be rebored.
   A: Piston diameter as measured.
   B: Piston clearance = 0.02 – 0.04 mm
   (0.0008 – 0.0015 in.)
   C: Allowance for honing = 0.02 mm (0.0008 in.)
5) Rebore and hone cylinder to calculated dimension.

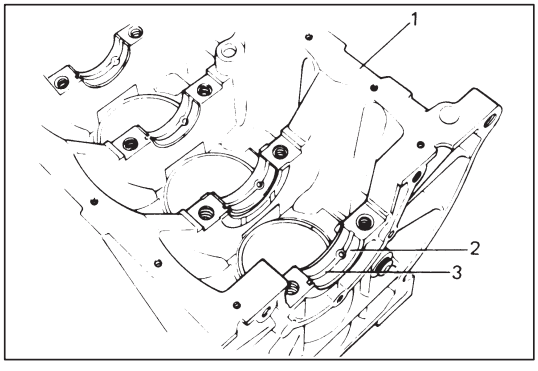
   NOTE:
   Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6) Measure piston clearance after honing.

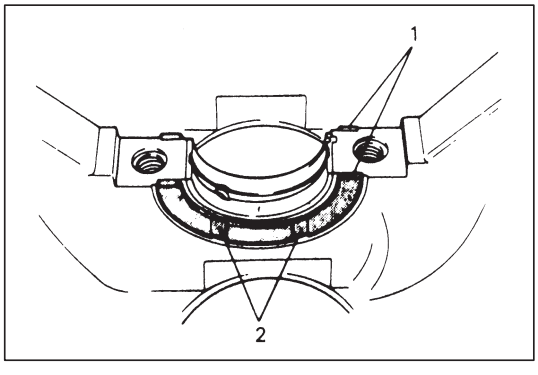
INSTALLATION

NOTE:

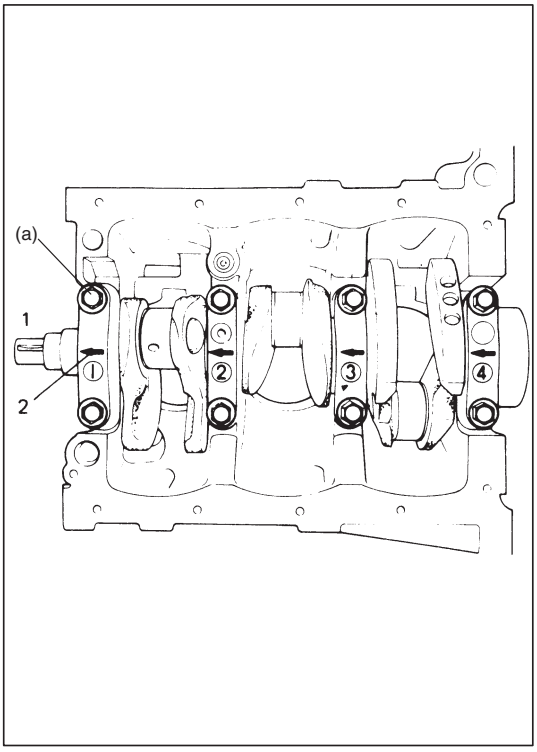
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, bearing caps, connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb such combination and make sure that each part goes back to where it came from, when installing.**



1) Install main bearings to cylinder block (1).
   Upper half of bearing (2) has an oil groove (3). Install it to cylinder block, and the other half without oil groove to bearing cap.
   Make sure that two halves are painted in the same color.



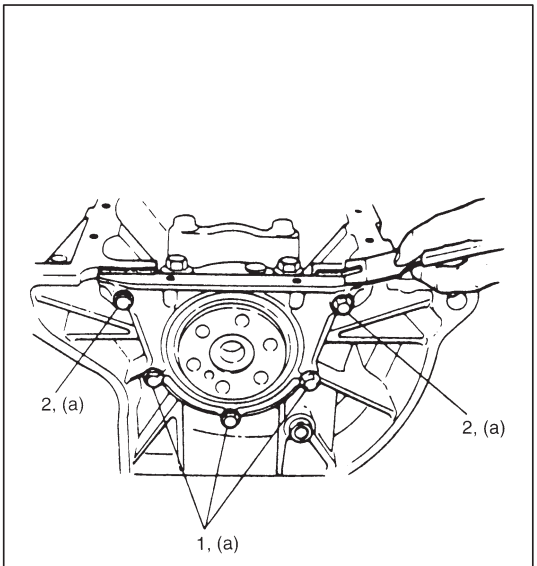
2) Install thrust bearings (1) to cylinder block between No.2 and No.3 cylinders. Face oil groove (2) sides to crank webs.



3) Install crankshaft to cylinder block.
4) Install bearing cap to cylinder block, making sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3 and 4, starting from pulley side. Gradual and uniform tightening is important for bearing cap bolts. Make sure that four caps become tight equally and progressively till specified torque is attained.

Tightening Torque
(a): 53 N·m (5.3 kg-m, 38.5 lb-ft)

NOTE:
After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 7.0 N·m (0.7 kg, 5.1 lb-ft) torque or below.



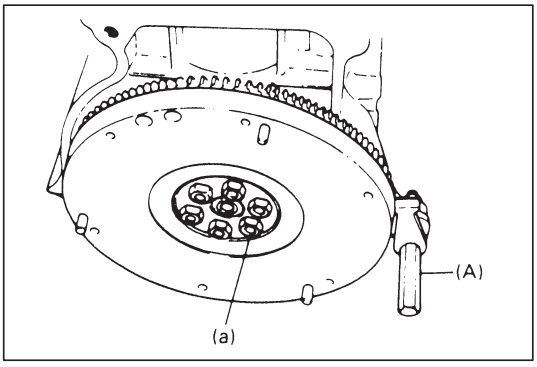
1. Short bolts
2. Long bolts

5) Install new gasket and oil seal housing.
Do not reuse gasket removed in disassembly. Apply engine oil to oil seal lip before installation. Tighten housing bolts to specification.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

NOTE:
As there are 2 types of housing bolts, refer to figure for their correct use.

After installing oil seal housing, gasket edges might bulge out; it so, cut them off to make them flush with cylinder block and oil seal housing.
6) Install oil pump.
Refer to INSTALLATION of OIL PUMP in this section.

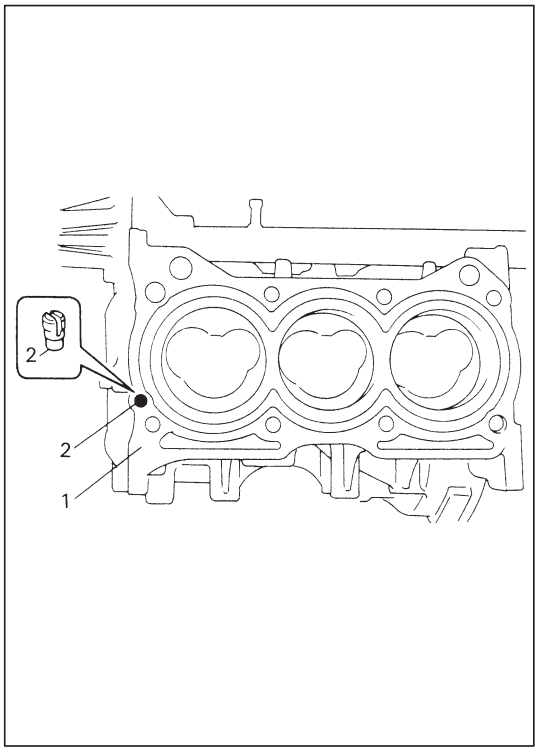


7) Install flywheel.
Using special tool, lock flywheel or drive plate, and torque its bolts to specification.

Special Tool
(A): 09924-17810

Tightening Torque
(a): 76 N·m (7.6 kg-m, 55.0 lb-ft)

8) Install pistons and connecting rods as previously outlined.
9) Install oil pump strainer and oil pan as previously outlined.

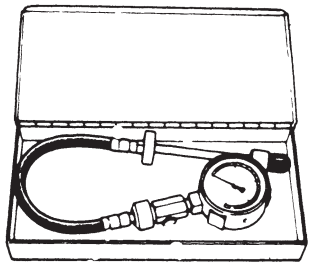
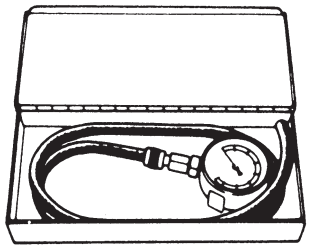
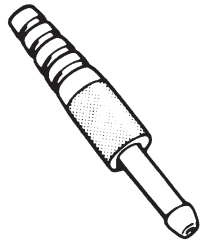
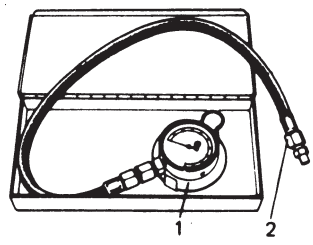
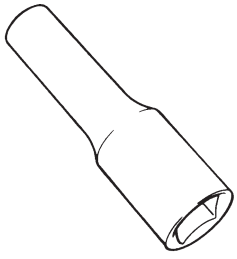
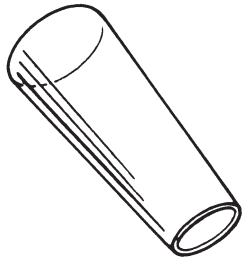
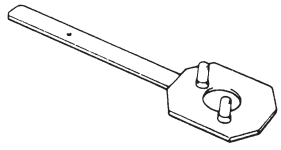
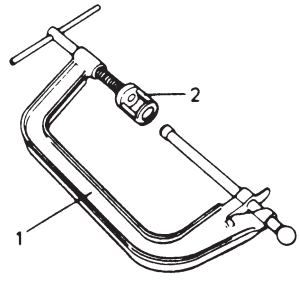
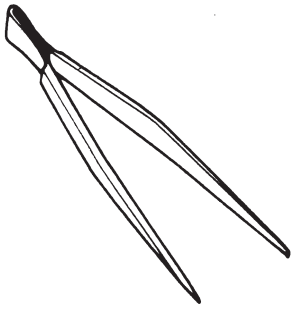
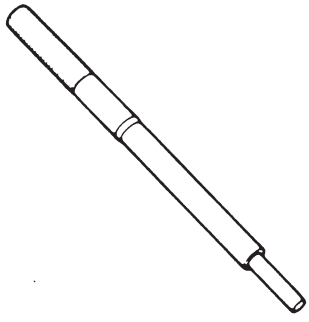
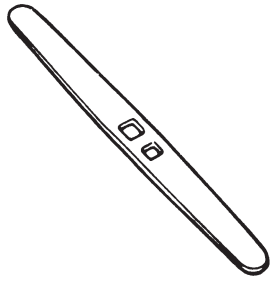
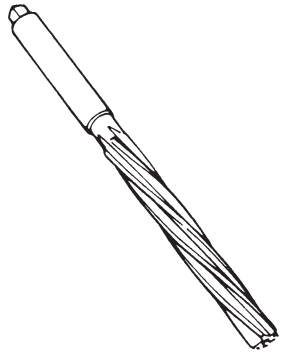
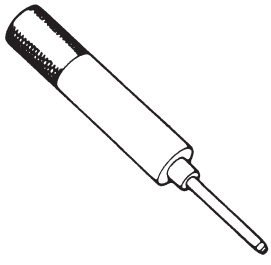
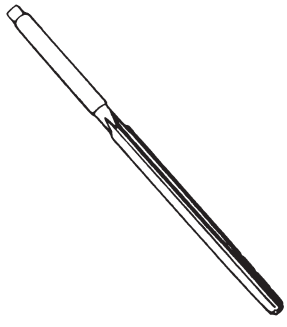


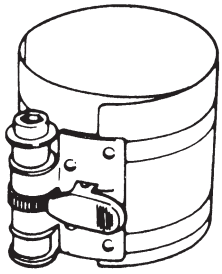
10) Install cylinder head assembly to cylinder block (1).
    Before installing cylinder head assembly to cylinder block, install check valve (2) into oil gallery in cylinder block, directing slit of valve toward top of cylinder block.

    NOTE:
    Tighten cylinder head bolts to specified torque as previously outlined.
    Whenever installing cylinder head to new cylinder block, use following procedure to tighten cylinder head bolts.
    - **Tighten cylinder head bolts to specified torque as previously outlined and loosen them once till tightening torque becomes "zero". And then torque them to specification again.**

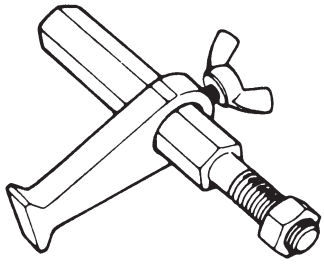
11) Install crankshaft timing belt pulley, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12) Install clutch to flywheel.
    For clutch installation, refer to Section 7C.
13) Install engine with transmission to body as previously outlined.

SPECIAL TOOLS

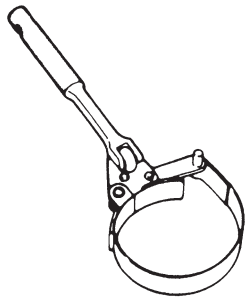
 09915-64512 Compression gauge	 09915-67310 Vacuum gauge	 09918-08210 Vacuum gauge hose joint	 1. 09915-77310 Oil pressure gauge 2. 09915-78211 Oil pressure gauge attachment
 09919-16010 Deep socket	 09926-18210 Oil seal guide (Vinyl resin)	 09917-68220 Camshaft pulley holder	 1. 09916-14510 Valve lifter 2. 09916-14910 Valve lifter attachment
 09916-84511 Forceps	 09916-44910 Valve guide remover	 09916-34541 Reamer handle	 09916-38210 Reamer (11 mm)
 09916-58210 Valve guide installer handle	 09916-56011 Valve guide installer attachment	 09916-34550 Reamer (5.5 mm)	 09917-98221 Valve stem seal installer



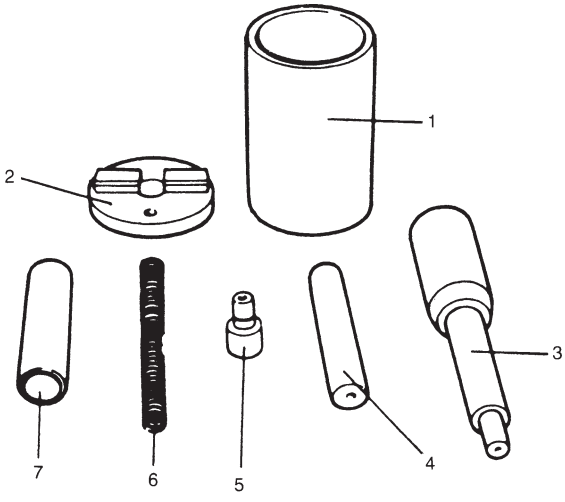
09916-77310
Piston ring compressor



09924-17810
Flywheel holder



09915-47310
Oil filter wrench



09910-38211
Piston pin remover and installer
1. Base
2. Base cap
3. Driver handle
4. Piston pin guide for installation
5. Piston pin guide for removal
6. Spring
7. Spring guide

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO.1207C (99000-31150)	● Mating surfaces of cylinder block and oil pan.
Sealant	SUZUKI BOND NO.1215 (99000-31110)	● Mating surfaces of camshaft housing (No.1 and No.3).

SECTION 6B

ENGINE COOLING

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

CONTENTS

GENERAL DESCRIPTION

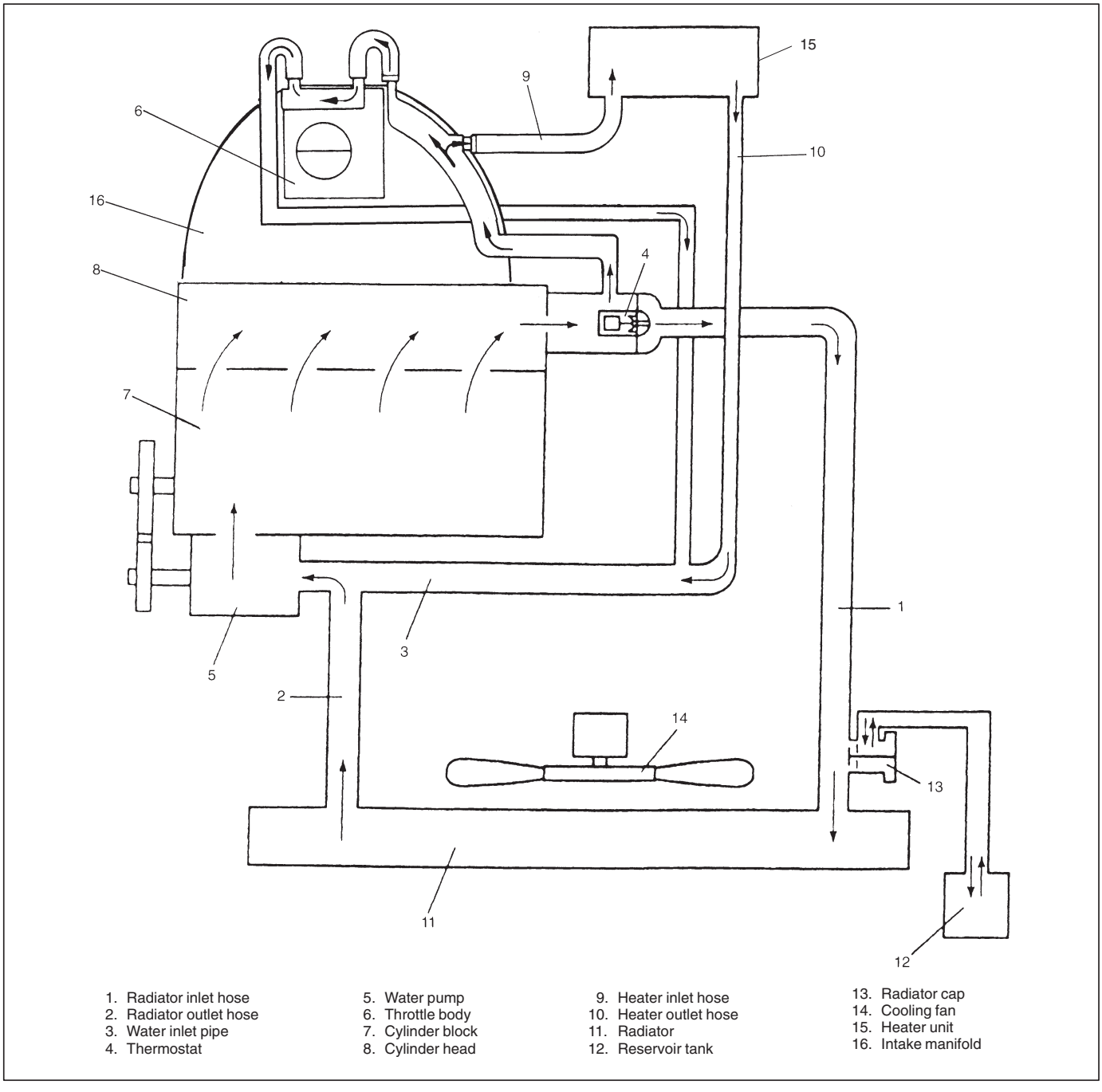
The cooling system consists of the radiator cap, radiator, coolant reservoir, hoses, water pump, cooling fan and thermostat. The radiator is of tube-and-fin type.

COOLING SYSTEM CIRCULATION

1) While the engine is warmed up (thermostat closed), coolant circulates as follows.

Water pump → Cylinder block → Cylinder head → Intake manifold → Throttle body / Heater unit → Water inlet pipe → Water pump

2) When coolant is warmed up to normal temperature and the thermostat opens, coolant passes through the radiator core to be cooled as well as the above flow circuit.



1. Radiator inlet hose
2. Radiator outlet hose
3. Water inlet pipe
4. Thermostat
5. Water pump
6. Throttle body
7. Cylinder block
8. Cylinder head
9. Heater inlet hose
10. Heater outlet hose
11. Radiator
12. Reservoir tank
13. Radiator cap
14. Cooling fan
15. Heater unit
16. Intake manifold

COOLANT

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir.
When the system cools down, the coolant is drawn back into the radiator.

The cooling system has been filled at the factory with a quality coolant that is a 50/50 mixture of water and ethylene glycol antifreeze (70/30; in a market where no freezing temperature is anticipated).

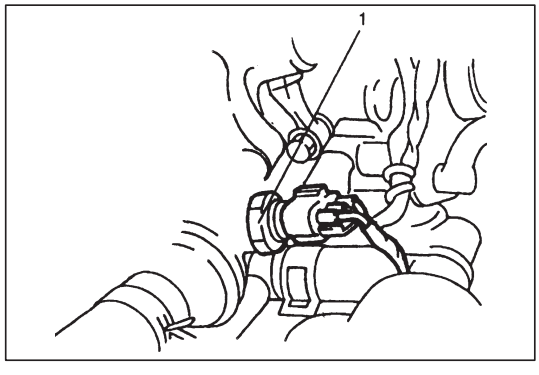
This 50/50 mixture coolant solution provides freezing protection to – 36°C (– 33°F).

- Maintain cooling system freeze protection at – 36°C (– 33°F) to ensure protection against corrosion and loss of coolant from boiling. This should be done even if freezing temperatures are not expected.
- Add ethylene glycol base coolant when coolant has to be added because of coolant loss or to provide added protection against freezing at temperature lower than – 36°C (– 33°F).

NOTE:
- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene glycol antifreeze (Antifreeze/ Anti-corrosion coolant) should be used for the purpose of corrosion protection and lubrication.**

ANTI-FREEZE PROPORTIONING CHART

ANTI-FREEZE PROPORTIONING CHART	Freezing temperature	°C	–16	–36
		°F	3	–33
	Anti-freeze/Anti-corrosion coolant concentration	%	30	50
	Ratio of compound to cooling water	ltr.	1.17/2.73	1.95/1.95
		US pt.	2.47/5.77	4.12/4.12
		Imp. pt.	2.06/4.80	3.43/3.43
COOLANT CAPACITY	Engine radiator and heater		3.3 liters (7.0/5.8 US/Imp. pt.)	
	Reservoir		0.6 liters (1.3/1.1 US/Imp. pt.)	
	Total		3.9 liters (8.2/6.9 US/Imp. pt.)	



COOLANT (WATER) TEMP. GAUGE

The coolant temp. gauge is included in engine coolant temp. (ECT) sensor (1). This gauge activates a temp. meter in the instrument cluster.

DIAGNOSIS

Condition	Possible Cause	Correction
Engine overheats	● Loose or broken water pump belt	Adjust or replace.
	● Not enough coolant	Check coolant level and add as necessary.
	● Faulty thermostat	Replace.
	● Faulty water pump	Replace.
	● Dirty or bent radiator fins	Clean or remedy.
	● Coolant leakage on cooling system	Repair.
	● Defective cooling fan motor	Check and replace as necessary.
	● Faulty fan motor control circuit	Check control circuit.
	● Plugged radiator	Check and replace radiator as necessary.
	● Faulty radiator cap	Replace.
	● Dragging brakes	Adjust brake.
	● Slipping clutch	Adjust or replace.
	● Maladjusted ignition timing	Adjust

MAINTENANCE

WATER PUMP BELT TENSION

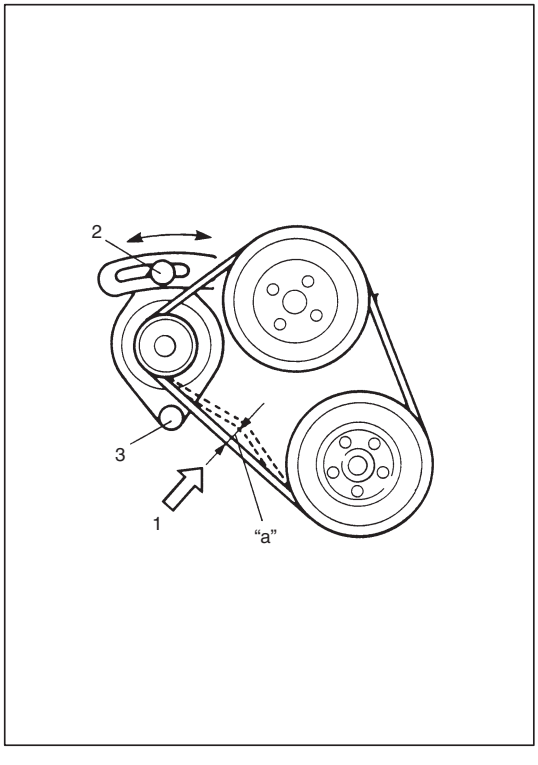
WARNING:
Disconnect negative cable at battery before checking and adjusting belt tension.

1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If it is necessary to replace belt, refer to "WATER PUMP BELT" in Section 6B of the Service Manual mentioned in FOREWORD of this manual.
2) Check belt for tension. Belt is in proper tension when it deflects 8 to 10 mm (0.32 – 0.39 in.) under thumb pressure (about 10 kg or 22 lbs (1).).

   Belt tension "a": 8 – 10 mm (0.32 – 0.39 in.) as deflection

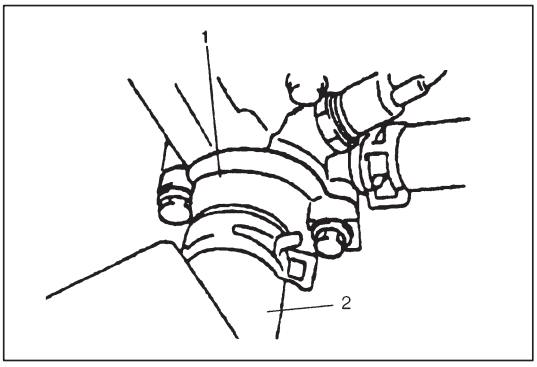
   NOTE:
   When replacing belt with a new one, adjust belt tension to 6 – 7 mm (0.24 – 0.27 in.).

3) If belt is too tight or too loose, adjust it to proper tension by displacing generator position.
4) Tighten belt adjusting bolt (2) and generator pivot bolt (3).
5) Connect negative cable at battery terminal.



ON-VEHICLE SERVICE

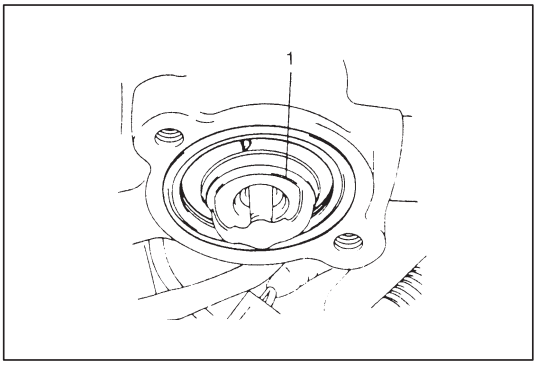
WARNING:
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative cord from battery terminal before removing any part.**



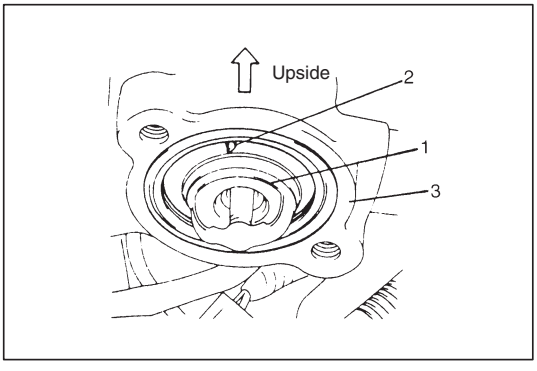
THERMOSTAT

REMOVAL

1) Drain coolant and tighten drain plug.
2) Remove radiator inlet hose (2) at thermostat cap.
3) Remove water inlet pipe bolt.
4) Remove thermostat cap (1).



5) Remove thermostat (1).



INSTALLATION

1) When positioning thermostat (1) on thermostat case (3), be sure to position it so that air bleed valve (2) comes at position as shown in figure.
2) Install thermostat cap to thermostat case.
3) Install water inlet pipe bolt.
4) Connect cooling water hose.
5) Fill cooling system (refer to COOLING SYSTEM FLUSH AND REFILL in this section).
6) After installation, check each part for leakage.

WATER PUMP

REMOVAL, INSPECTION AND INSTALLATION

For their procedures, refer to the same item of SECTION 6B in service manual mentioned in FOREWORD of this manual; only for REMOVAL and INSTALLATION of timing belt, belt tensioner and timing belt outside cover, refer to TIMING BELT AND TENSIONER of Section 6A in this manual.

REQUIRED SERVICE MATERIAL

MATERIAL	USE
Ethylene glycol base coolant (Anti-freeze/Anti-corrosion coolant)	Engine cooling system for improving cooling efficiency and for protection against rusting.

SECTION 6C

ENGINE FUEL

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:
For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in FOREWORD of this manual.

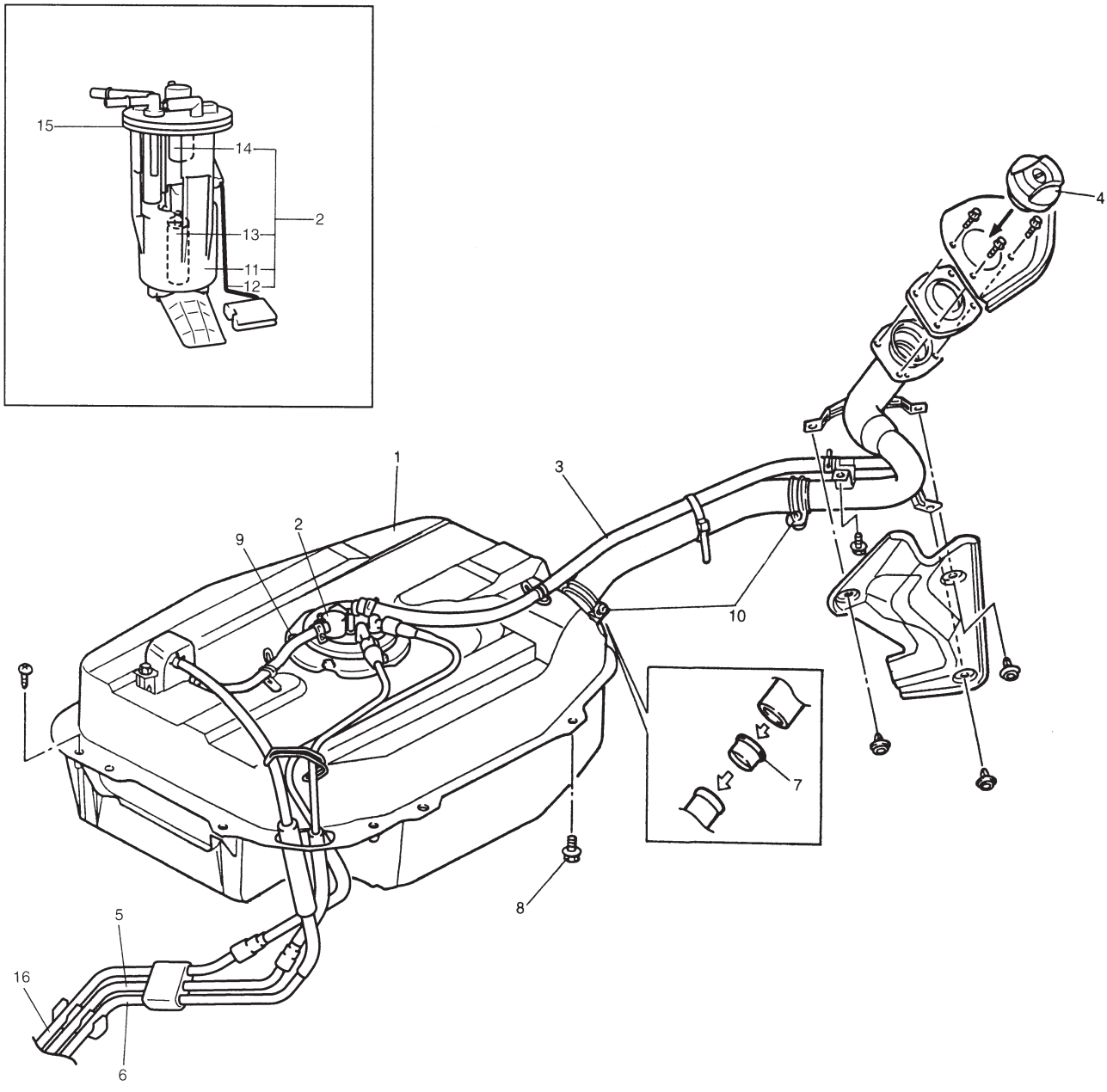
CONTENTS

CAUTION:
The engine of this vehicle requires the use of unleaded fuel only. Use of leaded and/or low lead fuel can result in engine damage and reduce the effectiveness of the emission control system.

GENERAL DESCRIPTION

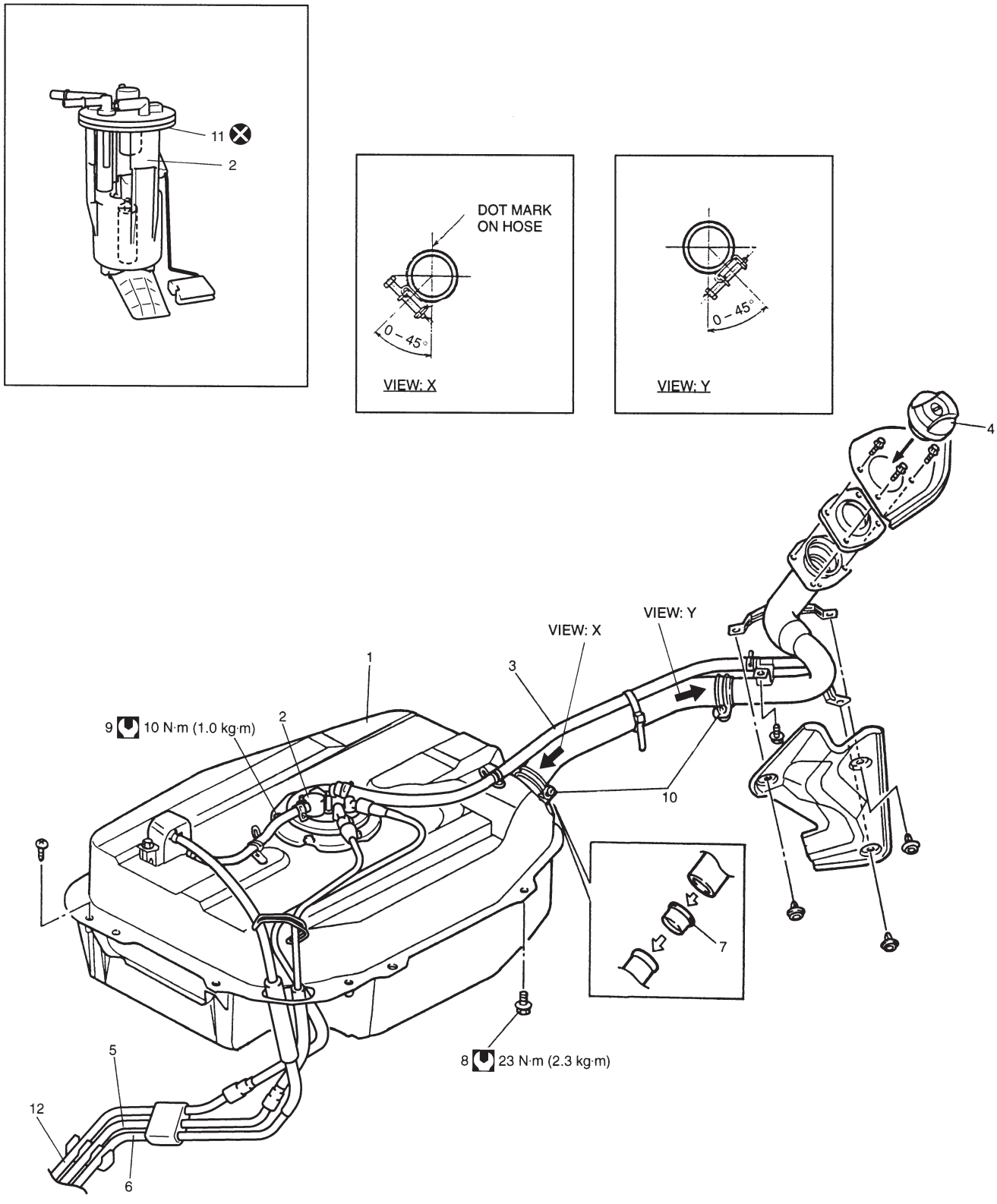
FUEL SYSTEM

The main components of the fuel system are fuel tank, fuel pump assembly (with fuel filter, fuel level gauge, and fuel cut valve), fuel feed line, fuel return line, and fuel vapor line.
For the details of fuel flow and fuel vapor flow, refer to “ENGINE AND EMISSION CONTROL SYSTEM” section.



1. Fuel tank
2. Fuel pump assembly
3. Breather hose
4. Fuel filler cap
5. Fuel feed line
6. Fuel vapor line
7. Fuel tank inlet valve
8. Fuel tank bolt
9. Fuel pump bolt
10. Fuel filler hose clamp
11. Fuel filter
12. Fuel level gauge
13. Fuel pump
14. Fuel cut valve
15. Fuel pump gasket
16. Fuel return line

ON-VEHICLE SERVICE



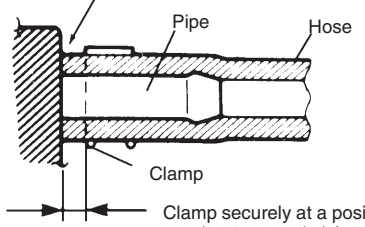
1. Fuel tank
2. Fuel pump assembly

CAUTION:
Do not disassemble fuel pump assembly. Disassembly will spoil its original performance.

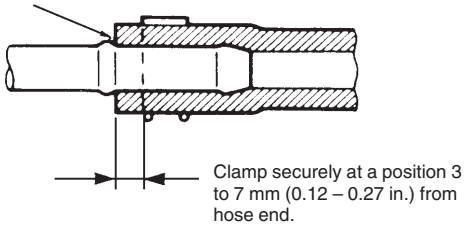
3. Breather hose
4. Fuel filler cap
5. Fuel feed line
6. Fuel vapor line
7. Fuel tank inlet valve
8. Fuel tank bolt
9. Fuel pump bolt
10. Fuel filler hose clamp
11. Fuel pump gasket
12. Fuel return line

: Tightening Torque
: Do not reuse

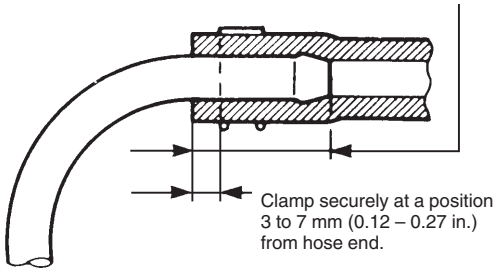
With short pipe, fit hose as far as it reaches pipe joint as shown.



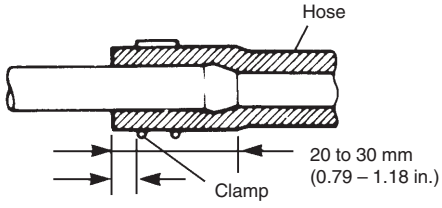
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far as its bent part as shown or till pipe is about 20 to 30 mm (0.79-1.18 in.) into the hose.

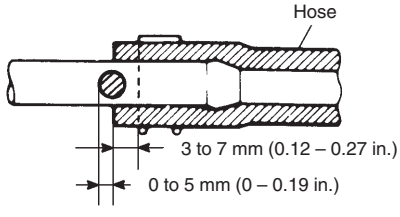


With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79-1.18 in.) in the hose.

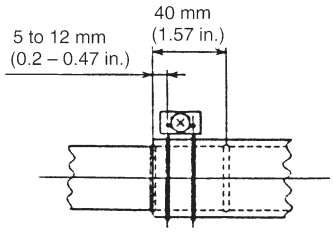


Clamp securely at a position 3 to 7 mm (0.12 – 0.27 in.) from hose end.

With red marked pipe, fit hose till hose end reaches red mark on pipe.



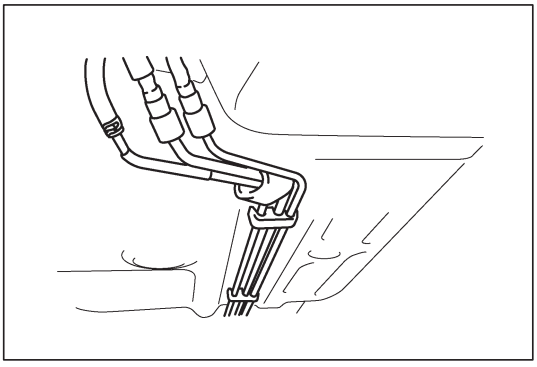
For fuel tank filler hose, insert it to spool or welding-bead.



WARNING:

Before attempting service of any type on fuel system, following cautions should be always observed.

- **Disconnect negative cable at battery.**
- **DO NOT smoke, and place "NO SMOKING" signs at work area.**
- **Be sure to have CO_2 fire extinguisher handy.**
- **Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).**
- **Wear safety glasses.**
- **To relieve fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.**
- **As fuel feed line is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.**
  Before loosening or disconnecting fuel feed line, make sure to relieve fuel pressure.
- **A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop towel. Be sure to put that towel in an approved container when disconnection is completed.**
- **Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the figure.**

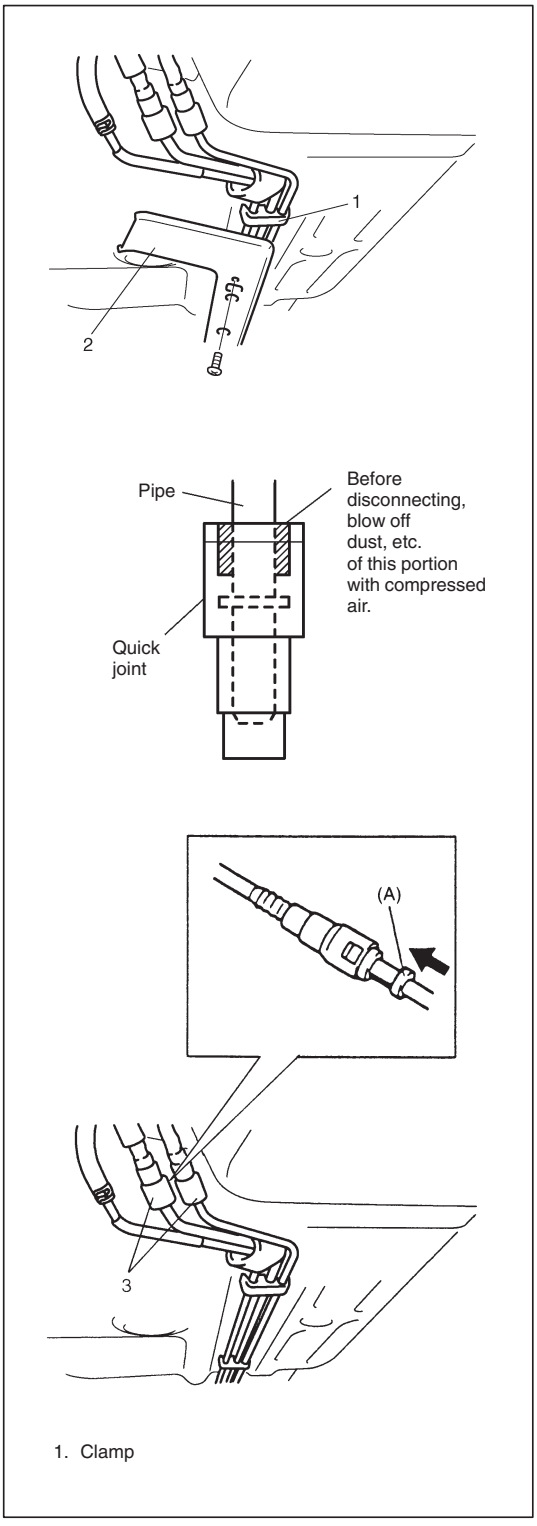


FUEL LINES

Due to the fact that fuel feed line is under high pressure, use special care when servicing it.

INSPECTION

Visually inspect fuel lines for evidence of fuel leakage, hose crack and deterioration, or damage.
Make sure that all clamps are secure.
Replace parts as needed.



1. Clamp

FUEL PIPE

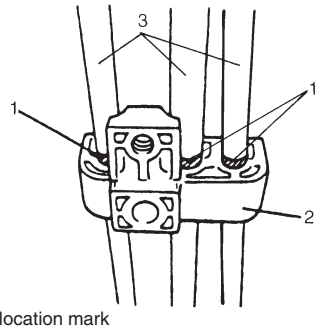
REMOVAL

1) Relieve fuel pressure in fuel feed line.
2) Disconnect negative cable at battery.
3) Remove steering gear box assembly. Refer to Section 3B of the Service Manual mentioned in FOREWORD of this manual.
4) Remove pipe cover (2) from vehicle.
5) Disconnect fuel pipe joints and fuel vapor hoses from the front end and the rear end of each fuel pipe.
   For quick joint (3), disconnect it as follows:
   a) Remove mud, dust and/or foreign material between pipe and joint by blowing compressed air.
   b) Unlock joint lock by inserting special tool between pipe and joint.

      Special Tool
      (A): 09919-47020

   c) Disconnect joint from pipe.

WARNING:
A small amount of fuel may be released after fuel hose is disconnected. In order to reduce the chance of personal injury, cover hose and pipe to be disconnected with a shop towel.
Be sure to put that towel in an approved container when disconnection is completed.

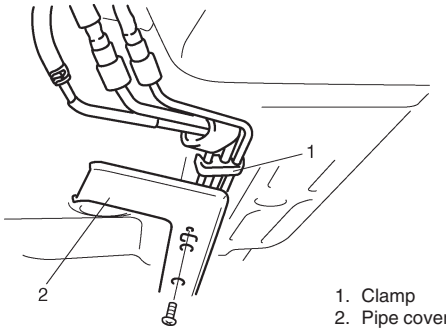


1. Clamp location mark

6) Mark the location of clamps on fuel pipes, so that the clamps can be reinstalled to where they were.
7) Remove pipes (3) with clamp (2) from vehicle.
8) Remove clamp from pipes.

INSTALLATION

1) Install clamps to marked location on pipes. If clamp is deformed or its claw is bent or broken, replace it with a new one.
2) Install pipes with pipe clamps to vehicle.



1. Clamp
2. Pipe cover

3) Connect fuel hoses and pipes to each pipe.

CAUTION:
When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

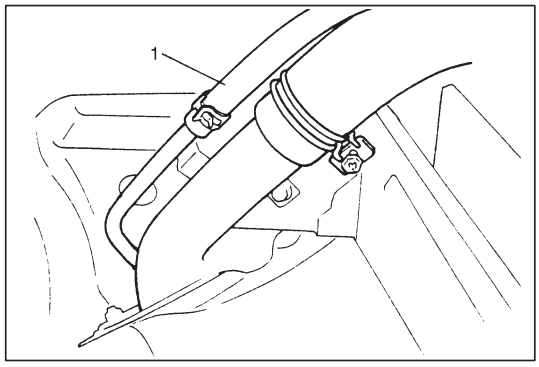
4) Install pipe cover (2) to vehicle.
5) Install steering gear box. Refer to Section 3B of the Service Manual mentioned in FOREWORD of this manual.
6) With engine “OFF” and ignition switch “ON”, check for fuel leaks.

FUEL TANK

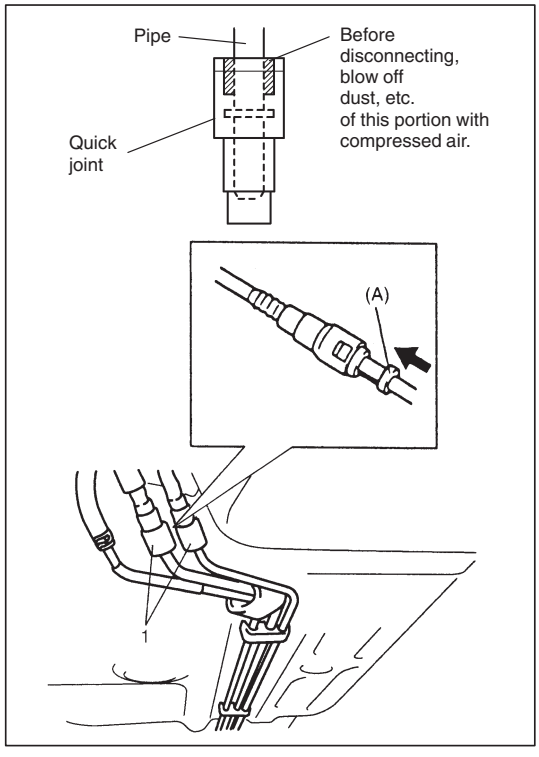
REMOVAL

WARNING:
Refer to the WARNING at the beginning of ON-VEHICLE SERVICE in this section.

1) Relieve fuel pressure in fuel feed line.
2) Disconnect negative cable at battery.
3) Drain fuel tank, referring to Section 6C of the Service Manual mentioned in FOREWORD of this manual.



4) Disconnect breather hose (1) from filler neck.

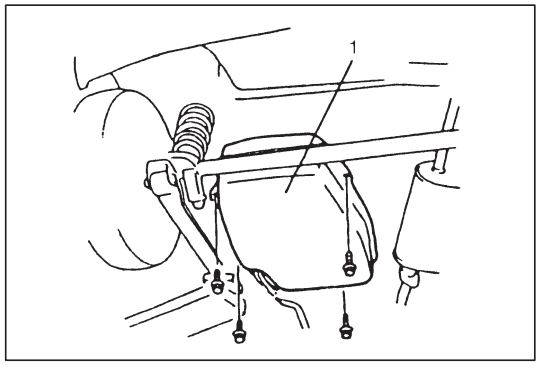


5) Disconnect fuel pipe joints and fuel vapor hose from fuel pipes. For quick joint (1), disconnect it as follows:
   a) Remove mud, dust and/or foreign material between pipe and joint by blowing compressed air.
   b) Unlock joint lock by inserting special tool between pipe and joint.

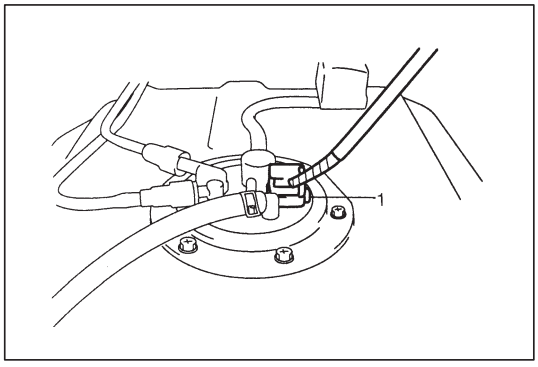
      Special Tool
      (A): 09919-47020

   c) Disconnect joint from pipe.

WARNING:
A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the hose and pipe to be disconnected with a shop towel. Be sure to put that towel in an approved container when disconnection is completed.



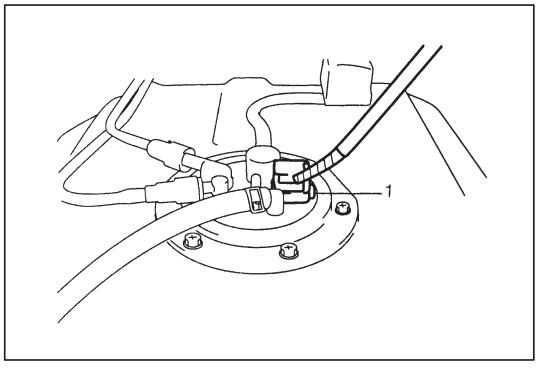
6) Support fuel tank (1) with jack and remove its mounting bolts.



7) Lower fuel tank a little as to disconnect wire harness at connector (1), then remove fuel tank.

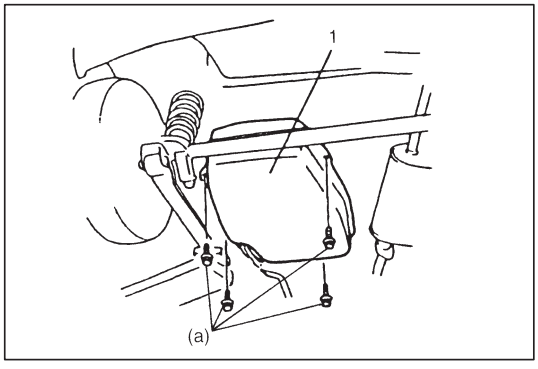
INSPECTION

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump assembly gaskets for leaks, visually inspect fuel tank for leaks and damage.
Replace any damaged or malconditioned parts.



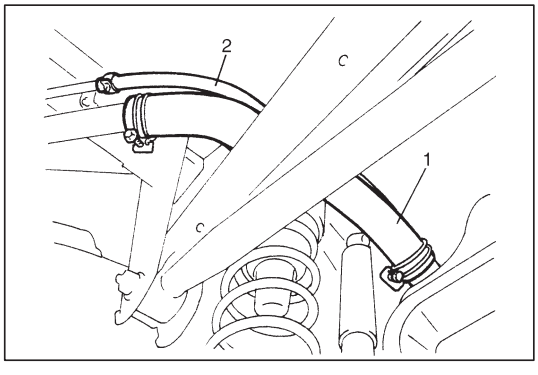
INSTALLATION

1) If parts have been removed from fuel tank, install them before installing fuel tank to vehicle.
2) Raise fuel tank with jack and connect connector (1) of fuel pump and gauge and clamp wire harness.

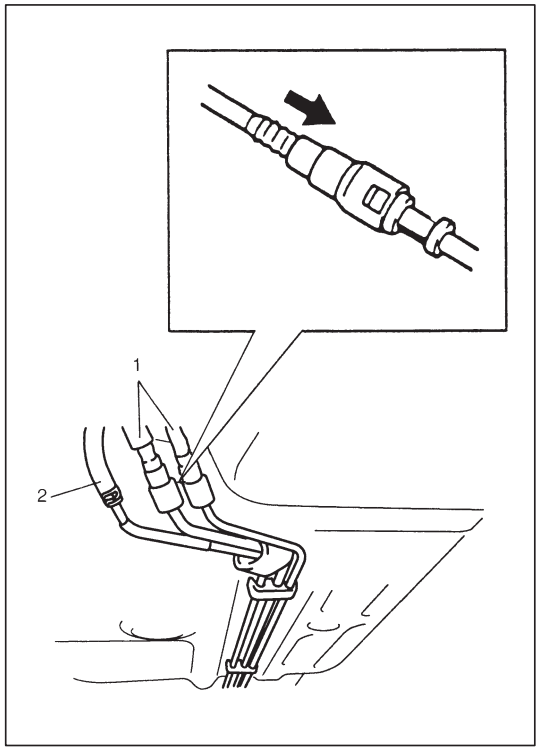


3) Install fuel tank (1) to vehicle.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



4) Connect fuel filler hose (1) to fuel tank and breather hose (2) to filler neck and clamp them securely.
For proper installation, refer to the first figure of ON-VEHICLE SERVICE.

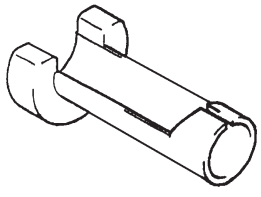


5) Connect fuel hoses (1) and vapor hose (2) to pipes as shown in figure and clamp them securely.

CAUTION:
When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

6) Connect negative cable at battery.
With engine "OFF" and ignition switch "ON", check for fuel leaks.

SPECIAL TOOL



09919-47020
Quick joint remover

SECTION 6E1

ENGINE AND EMISSION CONTROL SYSTEM

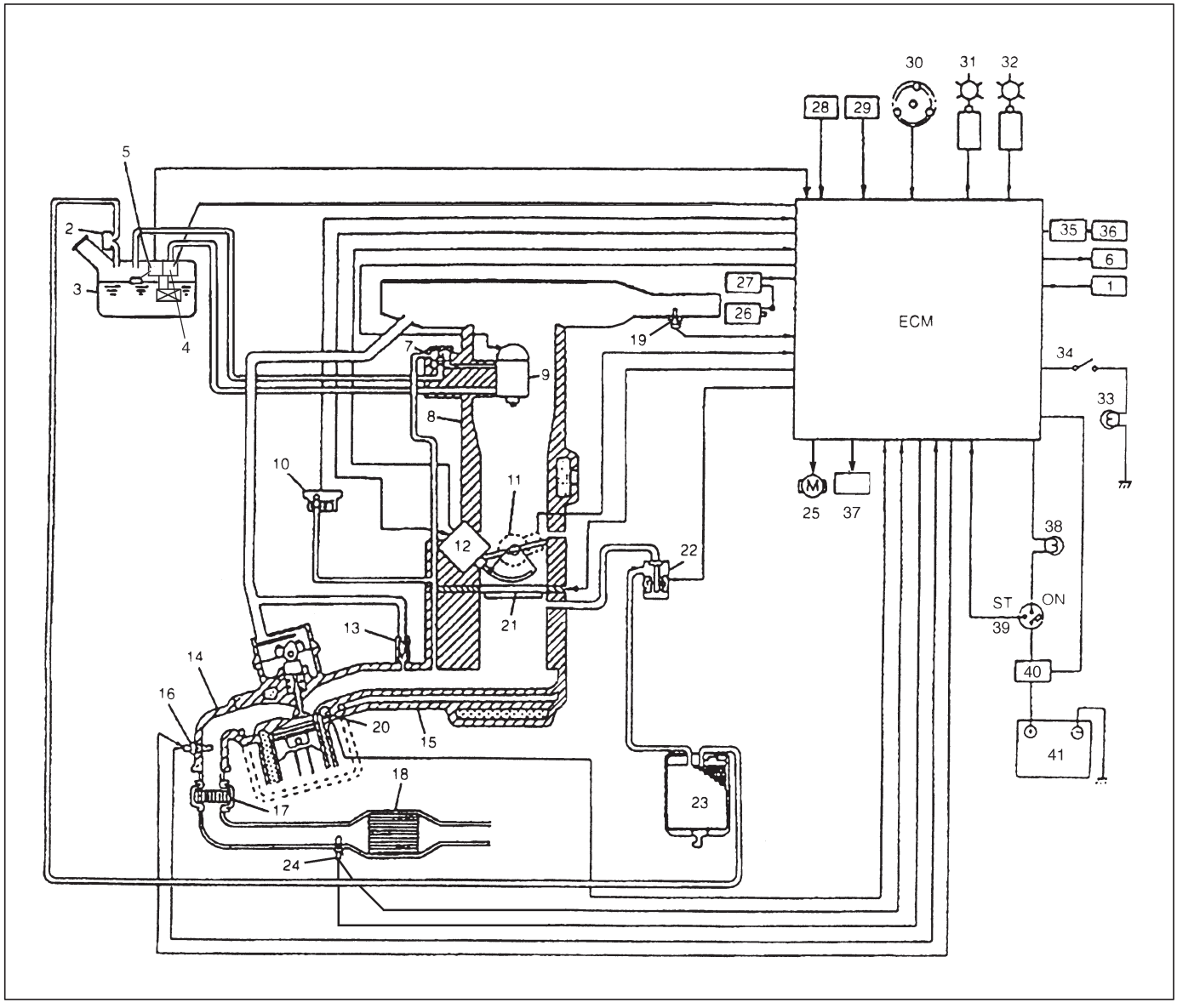
WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

GENERAL DESCRIPTION

The engine and emission control system is divided into 3 major sub-systems: air/fuel delivery system, electronic control system and emission control system.
Air/fuel delivery system includes fuel pump, throttle body, etc. Electronic control system includes ECM, various sensors and controlled devices.
Emission control system includes EVAP and PCV system.



1. A/C switch (if equipped)
2. Fuel liquid separator
3. Fuel tank
4. Fuel pump
5. Fuel level sensor (gauge)
6. A/C compressor clutch (if equipped)
7. Fuel pressure regulator
8. Throttle body
9. Fuel injector
10. MAP sensor
11. TP sensor
12. ISC actuator (including CTP switch)
13. PCV valve
14. Exhaust manifold
15. Intake manifold
16. Heated oxygen sensor-1
17. Warm up three way catalytic convertor (WU-TWC)
18. Three way catalytic convertor
19. IAT sensor
20. ECT sensor
21. EFE heater
22. EVAP canister purge valve
23. EVAP canister
24. Heated oxygen sensor-2
25. Radiator fan motor
26. Ignition coil
27. Igniter
28. Electric load
29. A/C evaporator temp. sensor (if equipped)
30. Camshaft position sensor
31. Crankshaft position sensor
32. VSS
33. Stop lamp
34. Stop lamp switch
35. Immobilizer control module
36. Data link connector
37. Tachometer (in combination meter)
38. Malfunction indicator lamp
39. Main (Ignition) switch
40. Main fuse
41. Battery

AIR AND FUEL DELIVERY SYSTEM

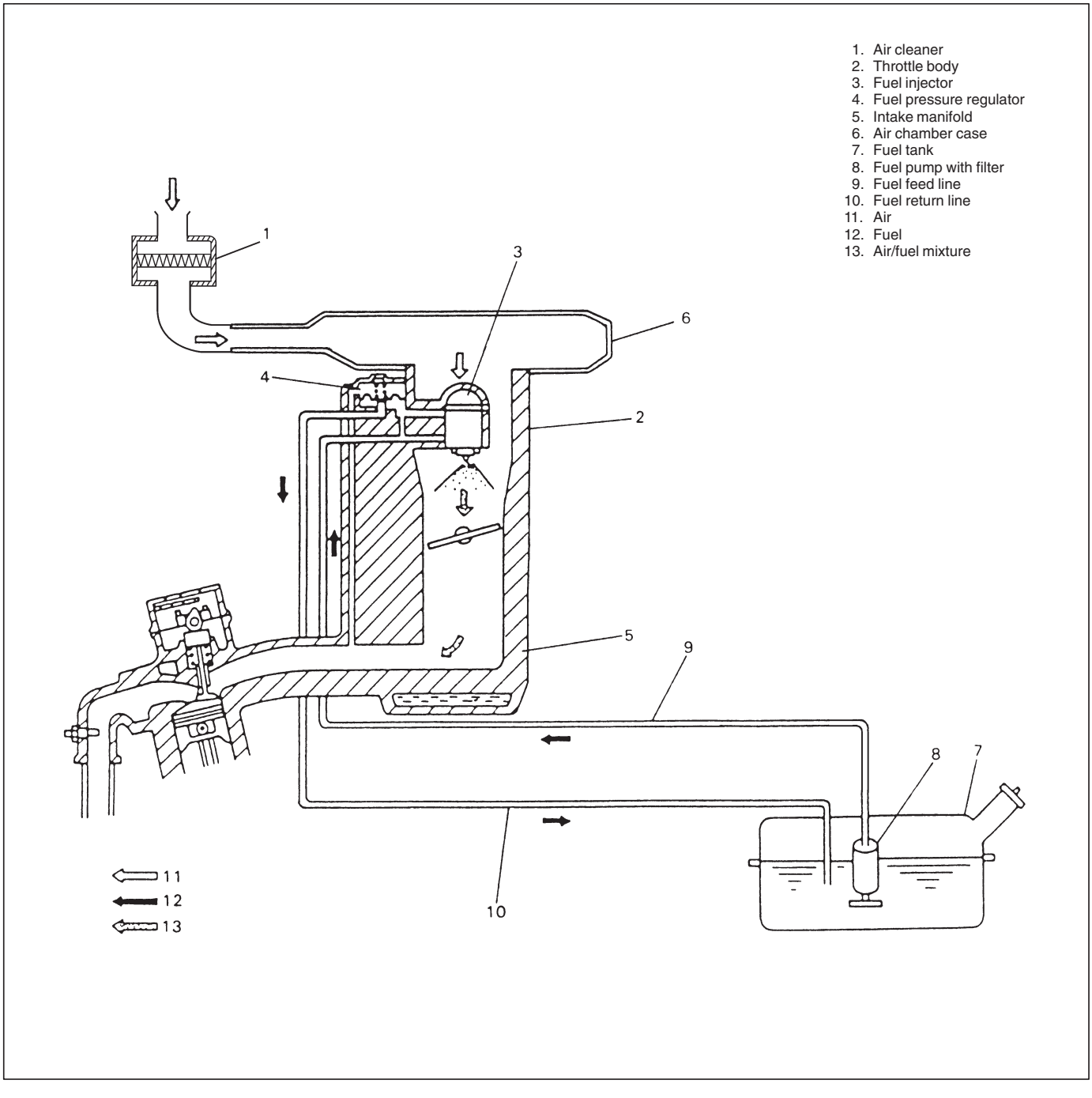
The main components of this system are fuel tank, fuel pump (with built-in fuel filter), throttle body (including fuel injector, fuel pressure regulator and idle speed control actuator), fuel feed line, fuel return line and air cleaner.

The fuel in the fuel tank is pumped up by the fuel pump, filtered by the fuel filter and fed under pressure to injector installed in throttle body. As the fuel pressure applied to the fuel injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the throttle body in conic dispersion when the injector opens according to the injection signal from ECM. The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.

The injected fuel is mixed with the air which has been filtered through the air cleaner in the throttle body. The air/fuel mixture is drawn through clearance between throttle valve and bore.

Then the intake manifold distributes the air/fuel mixture to each combustion chamber.

For the structure and operation of the fuel tank and filter, refer to SECTION 6C “ENGINE FUEL”.

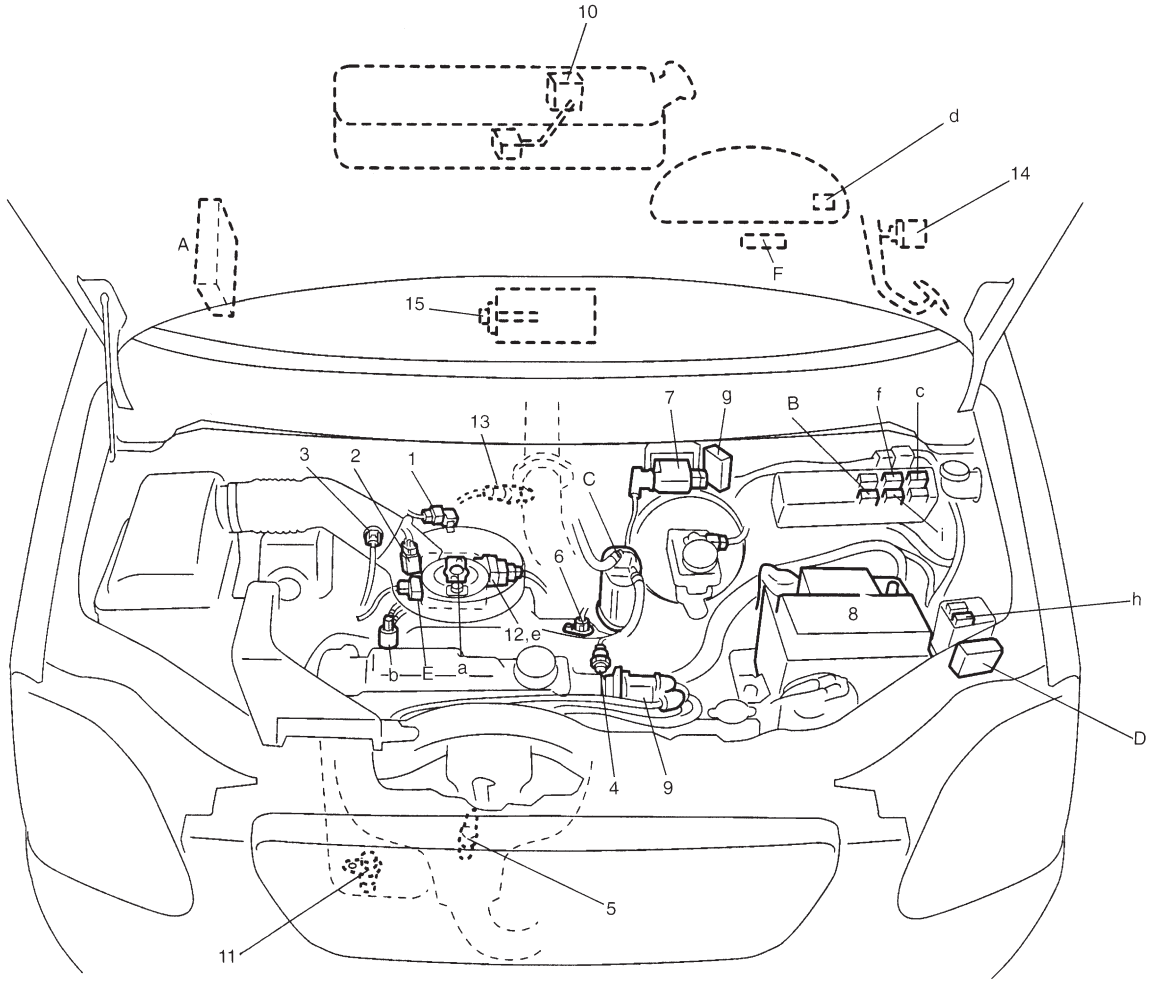


ELECTRONIC CONTROL SYSTEM

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into following sub systems:

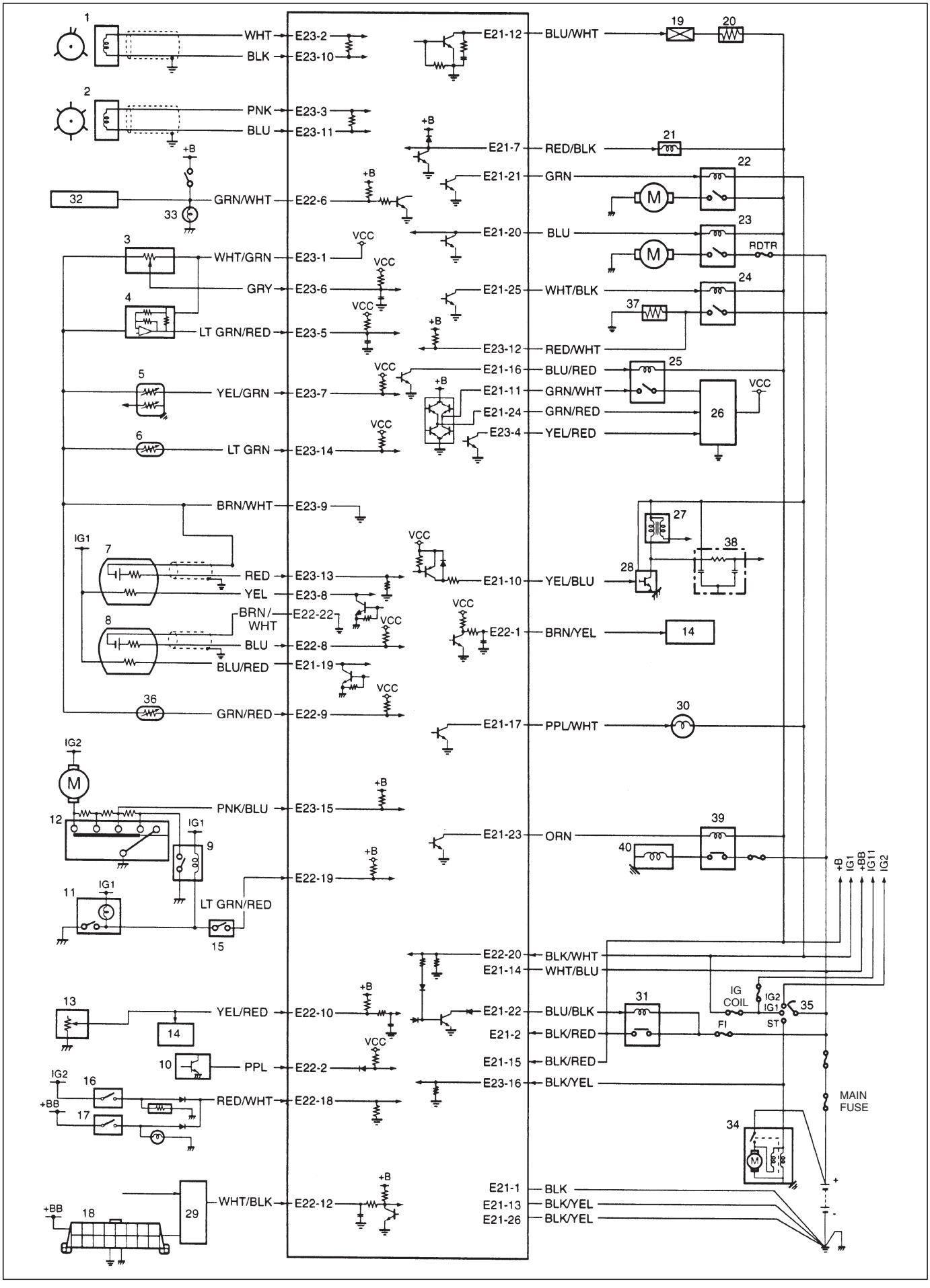
- Fuel injection control system
- Idle speed control system
- Fuel pump control system
- A/C control system (if equipped)
- Radiator fan control system
- Evaporative emission control system
- EFE heater control system
- Oxygen sensor heater control system
- Ignition control system



INFORMATION SENSORS
1. MAP sensor
2. TP sensor
3. IAT sensor
4. ECT sensor
5. Heated oxygen sensor-1
6. VSS
7. Ignition coil
8. Battery
9. Distributor (CMP sensor)
10. Fuel level sensor (gauge) (in fuel tank)
11. CKP sensor
12. CTP switch (in ISC actuator)
13. Heated oxygen sensor-2
14. Stop lamp switch
15. A/C EVAP temp. sensor (if equipped)

CONTROLLED DEVICES
- a : Fuel injector
- b : EVAP canister purge valve
- c : Fuel pump relay
- d : Malfunction indicator lamp
- e : ISC actuator
- f : Radiator fan control relay
- g : Igniter
- h : EFE heater relay
- i : ISC actuator relay

OTHERS
- A : ECM (PCM)
- B : Main relay
- C : EVAP canister
- D : Injector resistor
- E : EFE heater
- F : Data link connector


WHT
BLK
PNK
BLU
GRN/WHT
WHT/GRN
GRY
LT GRN/RED
YEL/GRN
LT GRN
BRN/WHT
RED
YEL
BRN/WHT
BLU
BLU/RED
GRN/RED
PNK/BLU
LT GRN/RED
YEL/RED
PPL
RED/WHT
WHT/BLK
E23-2
E23-10
E23-3
E23-11
E22-6
E23-1
E23-6
E23-5
E23-7
E23-14
E23-9
E23-13
E23-8
E22-22
E22-8
E21-19
E22-9
E23-15
E22-19
E22-10
E22-2
E22-18
E22-12
E21-12
E21-7
E21-21
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E21-25
E23-12
E21-16
E21-11
E21-24
E23-4
E21-10
E22-1
E21-17
E21-23
E22-20
E21-14
E21-22
E21-2
E21-15
E23-16
E21-1
E21-13
E21-26
BLU/WHT
RED/BLK
GRN
BLU
WHT/BLK
RED/WHT
BLU/RED
GRN/WHT
GRN/RED
YEL/RED
YEL/BLU
BRN/YEL
PPL/WHT
ORN
BLK/WHT
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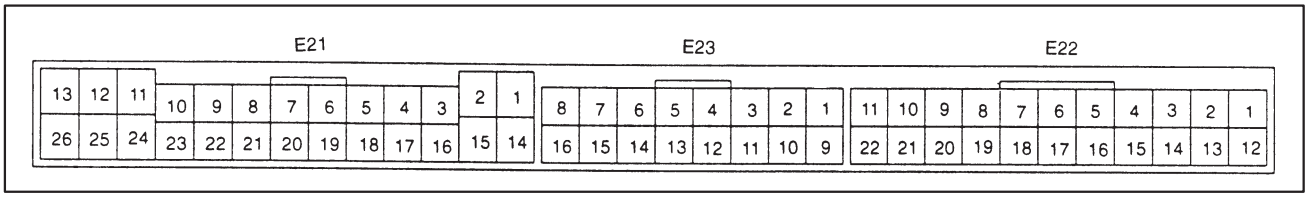
BLU/BLK
BLK/RED
BLK/RED
BLK/YEL
BLK
BLK/YEL
BLK/YEL
VCC
+B
+BB
IG1
IG2
RDTR
IG COIL
FI
ST
MAIN FUSE
+B
IG1
+BB
IG11
IG2

CON-NECTOR	TERMI-NAL	CIRCUIT
E21	1	ECM ground
	2	Power source (from main relay)
	3	Blank
	4	Blank
	5	Blank
	6	Blank
	7	EVAP canister purge valve
	8	Blank
	9	Blank
	10	Igniter
	11	Idle speed control actuator
	12	Fuel injector
	13	Ground
	14	Power source (from battery)
	15	Power source (from main relay)
	16	Idle speed control actuator relay
	17	Malfunction indicator lamp
	18	Blank
	19	Heater of HO2S-2
	20	Radiator fan relay
	21	Fuel pump relay
	22	Main relay
	23	A/C compressor signal
	24	Idle speed control actuator
	25	EFE heater relay
	26	Ground
E23	1	Power source for sensors
	2	Camshaft position sensor (+)
	3	Crankshaft position sensor (+)
	4	Closed throttle position switch
	5	Manifold absolute pressure sensor
	6	Throttle position sensor
	7	Engine coolant temp. sensor
	8	Heater of HO2S-1
	9	Sensor ground
	10	Camshaft position sensor (–)
	11	Crankshaft position sensor (–)
	12	EFE heater (monitor)
	13	Heated oxygen sensor-1
	14	Intake air temp sensor
	15	Electric load signal (–)
	16	Engine start signal

CON-NECTOR	TERMI-NAL	CIRCUIT
E22	1	Tachometer signal
	2	Vehicle speed sensor
	3	Blank
	4	Blank
	5	Blank
	6	Stop lamp switch
	7	Blank
	8	Heated oxygen sensor-2
	9	A/C EVAP temp. sensor
	10	Fuel level sensor (gauge)
	11	Blank
	12	Data link connector
	13	Blank
	14	Blank
	15	Blank
	16	Blank
	17	Blank
	18	Electric load signal (+)
	19	A/C (input) signal (if equipped)
	20	Ignition switch
	21	Blank
	22	Sensor ground

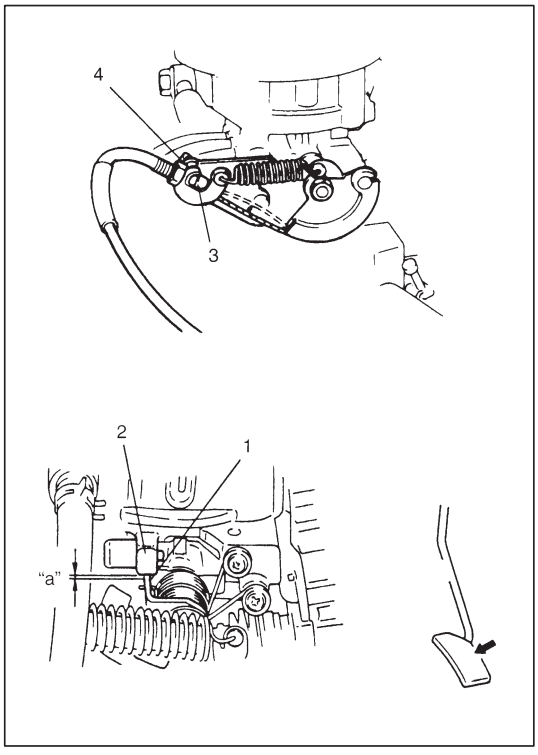
1. CMP sensor (in Distributor)
2. CKP sensor
3. TP sensor
4. MAP sensor
5. ECT sensor
6. IAT sensor
7. HO2S-1
8. HO2S-2
9. Heater blower fan relay
10. VSS
11. A/C switch (if equipped)
12. Heater blower switch
13. Fuel level sensor
14. Speedometer
15. A/C pressure switch (if equipped)
16. Rear defogger switch
17. Light switch
18. DLC
19. Fuel injector
20. Injector resistor
21. Canister purge valve
22. Fuel pump relay
23. Radiator fan relay
24. EFE heater relay
25. ISC actuator relay
26. ISC actuator
27. Ignition coil
28. Igniter
29. Immobilizer control module
30. MIL
31. Main relay
32. ABS control module
33. Stop lamp
34. Starter motor
35. Ignition switch
36. A/C EVAP temp. sensor
37. EFE heater
38. Noise suppressor
39. A/C compressor relay (if equipped)
40. A/C compressor clutch (if equipped)



ON-VEHICLE SERVICE

GENERAL

When the hoses have been disconnected and system's component removed for service, be sure to reinstall component properly, and route and connect hoses correctly after service. Refer to Emission Control Information Label for proper connection of hoses (if equipped).



ACCELERATOR CABLE ADJUSTMENT

1) With accelerator pedal depressed fully, check clearance between throttle lever (1) and lever stopper (2) (throttle body) which should be within following specification.

   Clearance "a": 0.5 – 2.0 mm (0.02 – 0.07 in.)
   (With pedal depressed fully)

   If out of specification, loosen accelerator cable lock nut and adjust by turning adjusting nut (3). Be sure to tighten lock nut (4) securely after adjustment.

IDLE SPEED INSPECTION

Before inspecting idle speed, make sure of the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- After warming up engine, accelerator cable has some play, that is, it is not tight.
- Ignition timing is within specification.
- All of electrical loads except ignition are switched off.
- Air cleaner has been properly installed and is in good condition.
- Malfunction indicator lamp does not light when engine running.

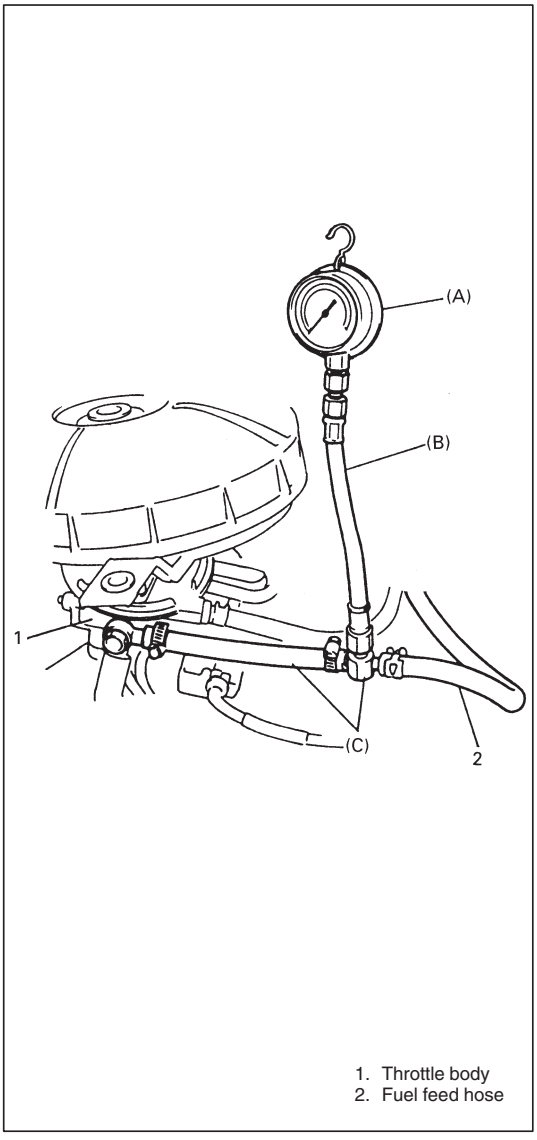
After above items are all confirmed, check idle speed as follows.

NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.

1) Warm up engine to normal operating temperature.
2) Set tachometer.
3) Check idle speed with A/C OFF.
   If idle speed is not within specified range, check idle speed control system and any other system and parts which might affect idle speed. Refer to "Engine Diagnosis of Section 6-1" for inspection.

   Engine idle speed: 800 ± 50 r/min

   NOTE:
   Idle speed is not adjustable manually. If it is out of its specified range, there is a faulty condition somewhere. Check each of related systems and parts.



1. Throttle body
2. Fuel feed hose

AIR AND FUEL DELIVERY SYSTEM

FUEL PRESSURE

INSPECTION

1) Relieve fuel pressure, referring to Section 6-1.
2) Separate air chamber case from throttle body and shift its position.
3) Disconnect fuel feed hose from throttle body.

CAUTION:
A small amount of fuel may be released after fuel line is disconnected.
In order to reduce chance of personal injury, cover fitting to be disconnected with a shop cloth. Place that cloth in an approved container when disconnection is completed.

4) Connect special tools and hose between throttle body and fuel feed pipe as shown in figure, and clamp hoses securely to ensure no leaks occur during checking.

   Special Tool
   (A): 09912-58441
   (B): 09912-58431
   (C): 09912-58490

5) Install air chamber case to throttle body and cylinder head cover.

6) Start engine and warm it up to normal operating temperature.

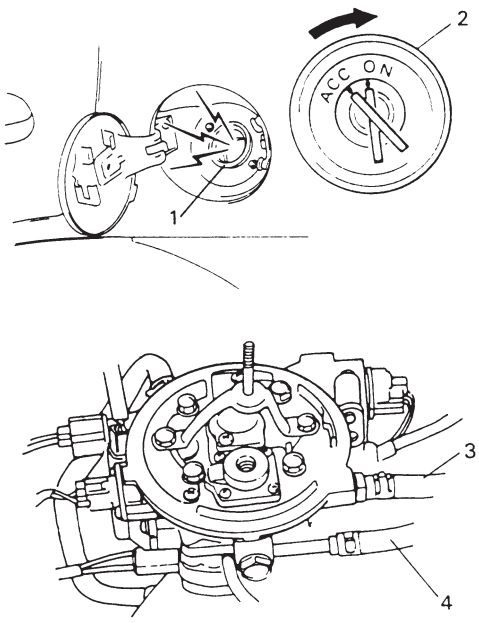
   If engine doesn't start, turn ignition switch ON to operate fuel pump and after 2 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.

   NOTE:
   Check that battery voltage is 11 V or more before operating fuel pump.

7) Measure fuel pressure under each of the following conditions.

CONDITION	FUEL PRESSURE
At specified idle speed	0.9 – 1.4 kg/cm^2 90 – 140 kPa 12.8 – 20.0 psi
With fuel pump operating and engine at stop	1.6 – 2.1 kg/cm^2 160 – 210 kPa 22.7 – 29.9 psi
Within 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	Over 0.9 kg/cm^2 90 kPa 12.8 psi

   If measured pressure doesn't satisfy specification, refer to "DIAGNOSTIC FLOW TABLE B-3" and check each possibly defective part. Replace if found defective.
8) Relieve fuel pressure, referring to Section 6-1.
9) Remove fuel pressure gauge, hose & 3-way joint after removing air chamber case.
10) Connect fuel feed hose to throttle body and clamp it securely.
11) Install air chamber case.
12) With engine "OFF" and ignition switch "ON", check for fuel leaks.



1. Fuel filler
2. Ignition switch
3. Fuel return hose
4. Fuel feed hose

FUEL PUMP

ON-VEHICLE INSPECTION

WARNING:
When fuel filler cap is removed in any procedure, work must be done with no smoking, in a well-ventilated area and away from any open flames.

1) Remove filler cap and turn ON ignition switch.
   Then fuel pump operating sound should be heard from fuel filler for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.
   If above check result is not satisfactory, advance to “DIAGNOSTIC FLOW TABLE B-2”.
2) Fuel pressure should be felt at fuel return hose for 2 seconds after ignition switch ON.
   If fuel pressure is not felt, advance to “DIAGNOSTIC FLOW TABLE B-3”.

REMOVAL

1) Remove fuel tank from body according to procedure described in Section 6C and remove fuel pump from fuel tank.

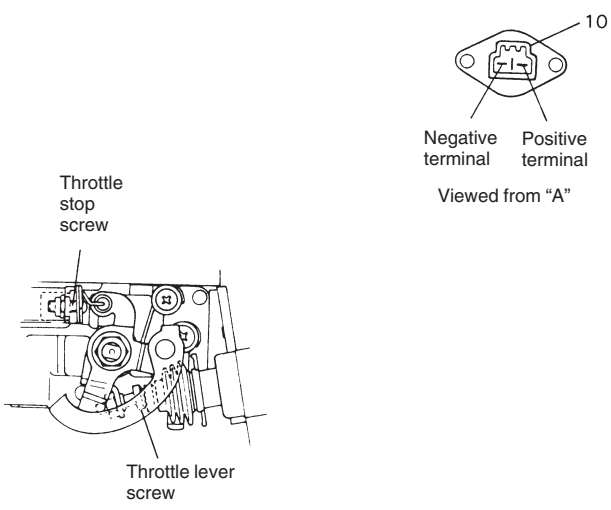
INSPECTION

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

INSTALLATION

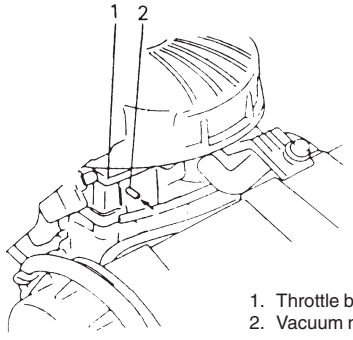
1) Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in Section 6C.

THROTTLE BODY



1. Fuel injector wire
2. Fuel injector
3. Upper O-ring
4. Lower O-ring
5. Throttle upper body
6. Gasket
7. Throttle lower body
8. ISC actuator
9. TP sensor
10. Injector sub wire coupler
11. O-ring
12. Injector wire cover

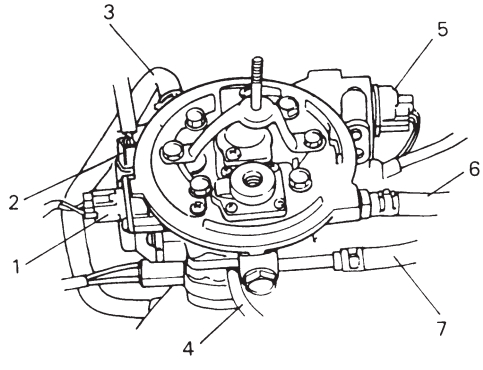
CAUTION:
As throttle stop screw and throttle lever screw are factory adjusted precisely, don't remove or adjust them.



1. Throttle body
2. Vacuum nozzle

ON-VEHICLE INSPECTION

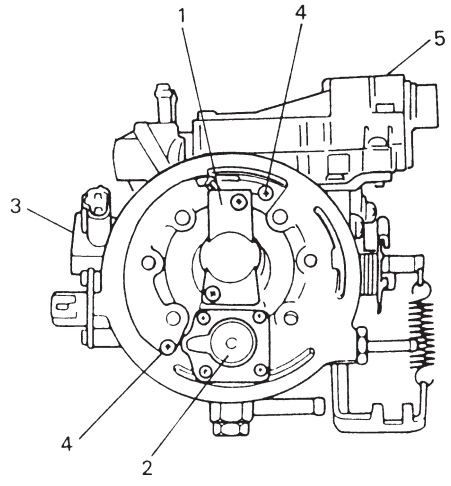
- Check that throttle valve lever moves smoothly.
- Vacuum passage inspection.
  With fingers placed against vacuum nozzle, increase engine speed a little and check that vacuum is applied.



1. Injector coupler
2. TP sensor
3. Water hose
4. Vacuum hose
5. ISC actuator
6. Fuel return hose
7. Fuel feed hose

REMOVAL

1) Relieve fuel pressure, referring to Section 6-1.
2) Disconnect battery negative cable at battery.
3) Remove air chamber case.
4) Drain cooling system.
5) Disconnect following wire harness couplers:
   - TP sensor
   - Fuel injector
   - ISC actuator
6) Disconnect following hoses from throttle body.
   - Fuel feed and return hoses
   - Engine cooling water hoses
   - Vacuum hoses
7) Disconnect accelerator cable from throttle valve lever and cable bracket.
8) Remove throttle body from intake manifold.



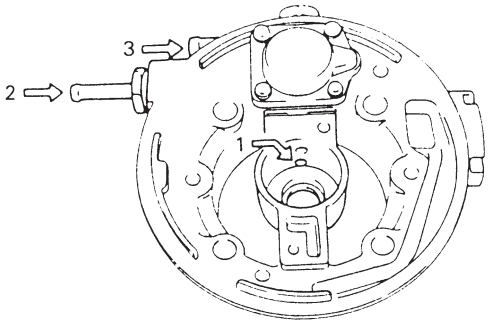
1. Fuel injector wire
2. Fuel pressure regulator
3. TP sensor
4. Screws
5. ISC actuator

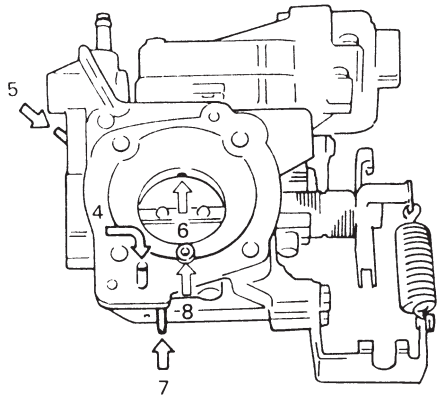
DISASSEMBLY

NOTE:

- **Be sure not to remove either fuel pressure regulator or idle speed control actuator from throttle body. They are factory adjusted precisely.**
- **Be sure to replace gaskets and O-rings as well as worn or damaged parts.**
- **While disassembling and assembling throttle body, use special care not to deform levers on throttle valve shaft or cause damage to any other parts.**

1) Remove fuel injector from throttle body according to procedure described in FUEL INJECTOR REMOVAL.
2) Remove TP sensor.
3) After removing screws, separate upper and lower bodies.





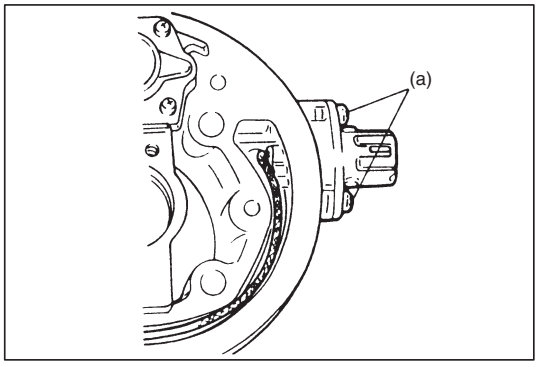
1. Injector chamber
2. Fuel return passage
3. Fuel feed passage
4. Vacuum passage for fuel pressure regulator
5. Vacuum passage for MAP sensor
6. Air induction passage
7. Vacuum passage
8. Fresh air passage

CLEANING

Clean passages and fuel injector chamber by blowing compressed air.

NOTE:

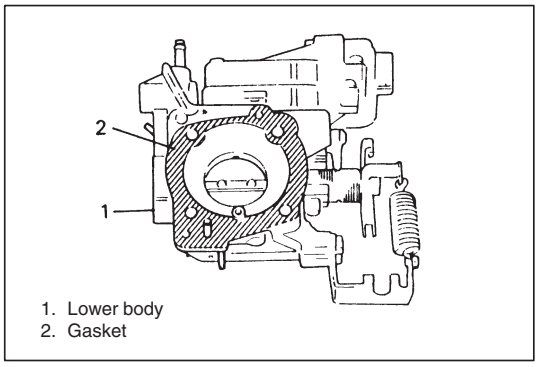
- **TP sensor, fuel pressure regulator, fuel injector, ISC actuator, other components containing rubber (resin) or throttle valve shaft seal must not be placed in a solvent or cleaner bath. Chemical reaction will cause these parts to swell, harden or get distorted.**
- **Don't put drills or wires into passages for cleaning. It causes damage in passages.**



ASSEMBLY

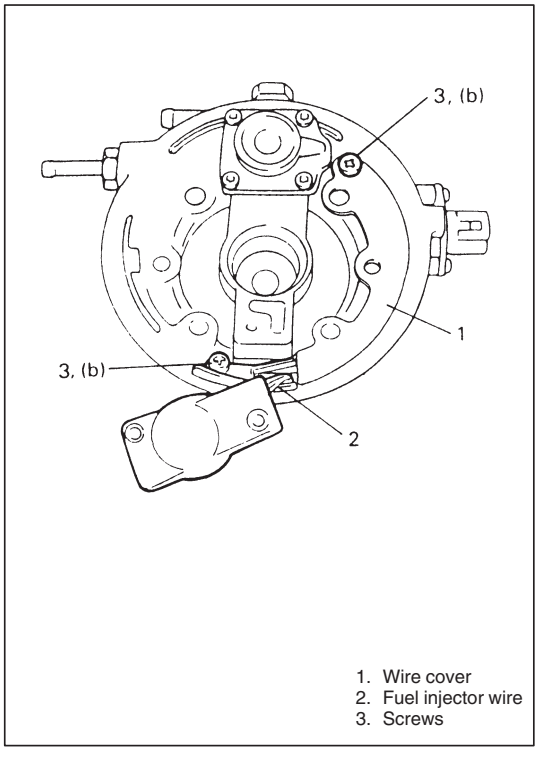
1) Install injector wire and coupler to throttle body.
   Use new O-ring.
   Tighten injector wire coupler screw to specified torque.

   Tightening Torque
   (a): 2.0 N·m (0.20 kg-m, 1.5 lb-ft)



1. Lower body
2. Gasket

2) Install new gasket to lower body.
3) Install upper body on gasket, using care not to cause gasket to slip out of place.

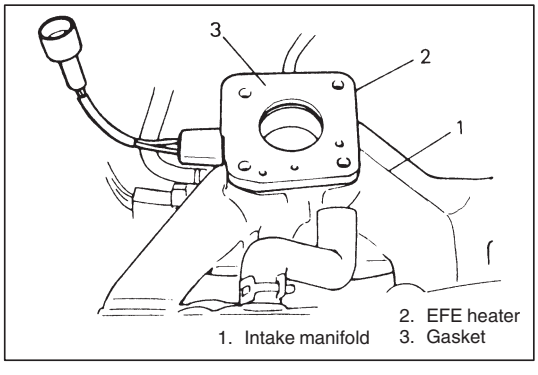


1. Wire cover
2. Fuel injector wire
3. Screws

4) Make sure to injector wire harness to fit in grooves of throttle body and install wire cover to throttle body.
   Tighten screws to specified torque.

   Tightening Torque
   (b): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

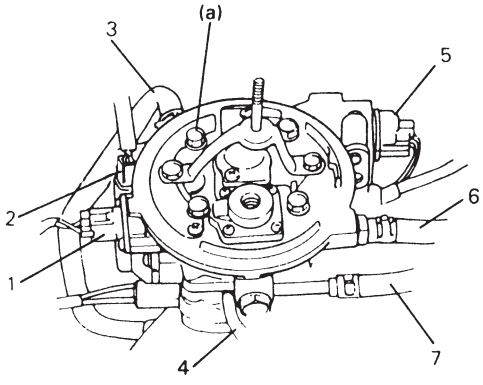
5) Install fuel injector according to procedure described in FUEL INJECTOR INSTALLATION.
6) Install TP sensor according to procedure described in THROTTLE POSITION SENSOR INSTALLATION.



1. Intake manifold
2. EFE heater
3. Gasket

INSTALLATION

1) Clean mating surfaces and install throttle body gasket to EFE heater. Use new gasket.



1. Injector coupler
2. TP sensor
3. Water hose
4. Vacuum hose
5. ISC actuator
6. Fuel return hose
7. Fuel feed hose

2) Install throttle body to EFE heater and tighten bolts to specified torque.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Install accelerator cable to throttle valve lever and cable bracket.
4) Connect fuel, cooling water and vacuum hoses to throttle body, and clamp securely.
5) Connect TP sensor and injector couplers securely.
6) Refill cooling system referring to Section 6B.
7) Connect negative cable at battery.
8) With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.
9) Install air chamber case.
10) Upon completion of installation, start engine and check for fuel leaks and engine coolant leaks.
    Adjust accelerator cable to specification according to procedure described in ACCELERATOR CABLE ADJUSTMENT.

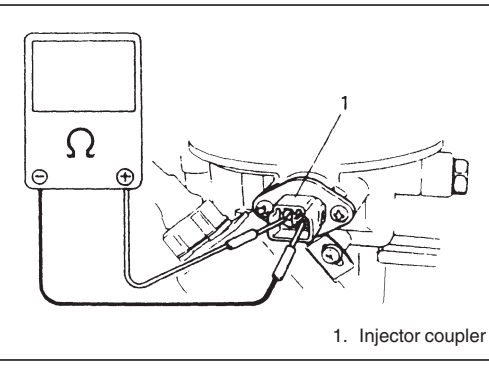
FUEL INJECTOR

ON-VEHICLE INSPECTION

1) With battery negative cable disconnected, disconnect injector coupler.
2) Connect ohmmeter to each injector terminal and measure resistance.

Resistance of injector: 0.5 – 1.5 Ω at 20°C (68°F)

If resistance is out of specification, replace fuel injector.

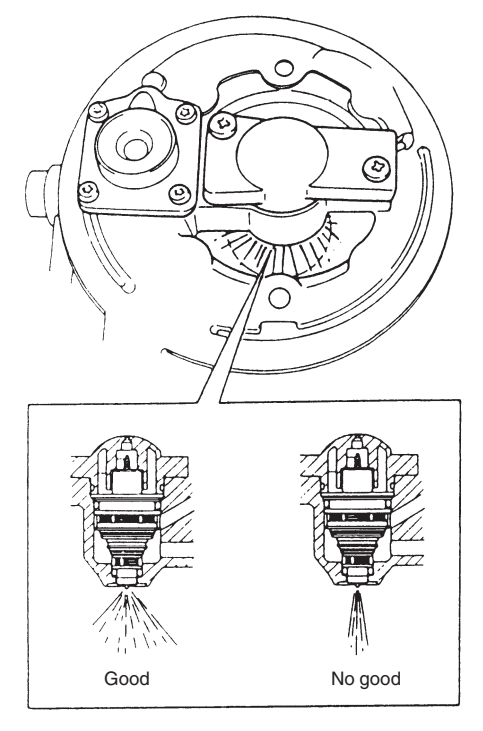


1. Injector coupler

3) Connect injector coupler.
4) Remove air chamber case.
5) Check that fuel is injected out in conical shape from fuel injector when cranking or running engine.
    If no fuel is injected, check wiring harness for continuity and couplers for proper connection referring to "DIAGNOSTIC FLOW TABLE B-1".
    If fuel is not injected out in conical shape, replace injector.
6) Check injector for fuel leakage after injection is stopped (i.e., after cranking or engine stop).
    Replace if leakage exists.

Fuel leakage: Less than 1 drop/min.

7) Install air chamber case.

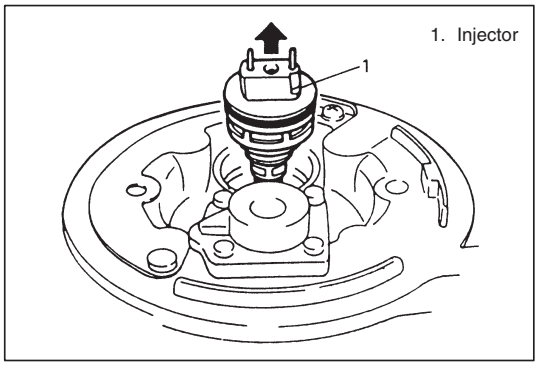


REMOVAL

NOTE:

Use care when handling fuel injector especially not to damage filter and its needle.

Also, because injector is an electrical component, it should not be immersed in any type of liquid solvent or cleaner, or it may get damaged.

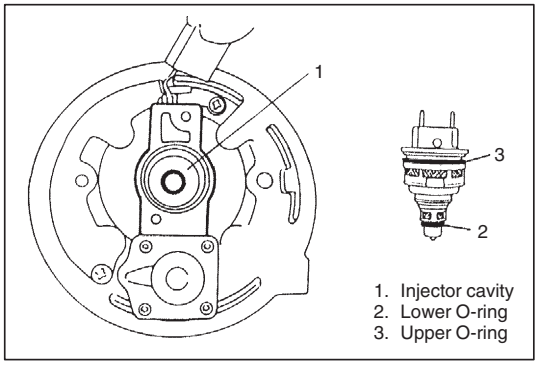


1) Relieve fuel pressure, referring to Section 6-1.
2) Disconnect battery negative cable at battery.
3) Remove air chamber case.
4) Remove air chamber case mounting stay from throttle body.
5) Remove injector wire and then remove fuel injector from throttle body.

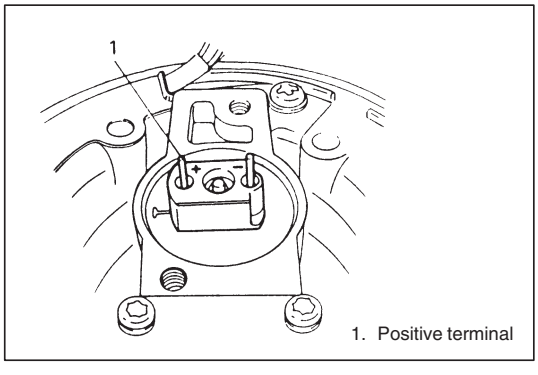
INSPECTION

Check fuel injector filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel lines and fuel tank.

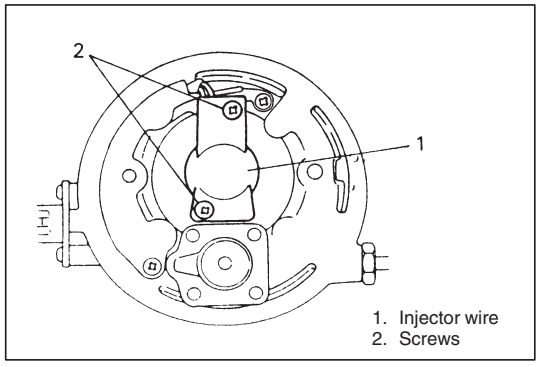
INSTALLATION



1) Apply thin coat of spindle oil or gasoline to new upper and lower O-rings, install lower O-ring and upper O-ring to injector.



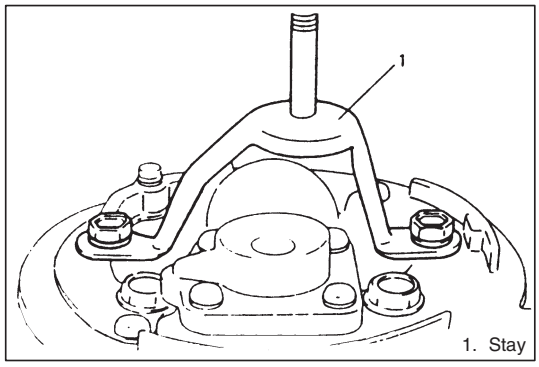
2) Install injector by pushing it straight into fuel injector cavity. Never turn injector while pushing it.



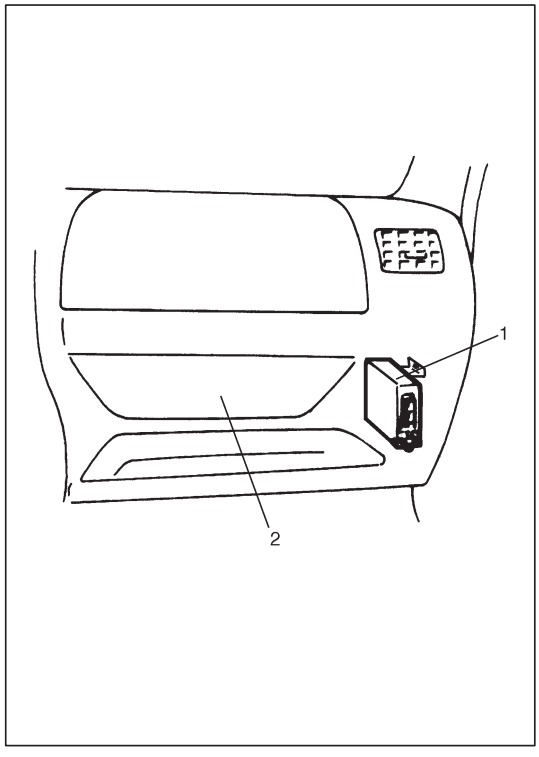
3) Make sure that injector wire O-ring is free from any damage and deterioration, and apply thin coat of spindle oil or gasoline to O-ring.
   Install injector wire and tighten new wire screw to specified torque.

   Tightening Torque
   (a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

4) Connect battery negative cable at battery.
5) With engine "OFF" and ignition switch "ON", check for fuel leaks.



6) Install air chamber case mounting stay as shown left.
7) Install air chamber case.



ELECTRONIC CONTROL SYSTEM

ENGINE CONTROL MODULE (ECM)

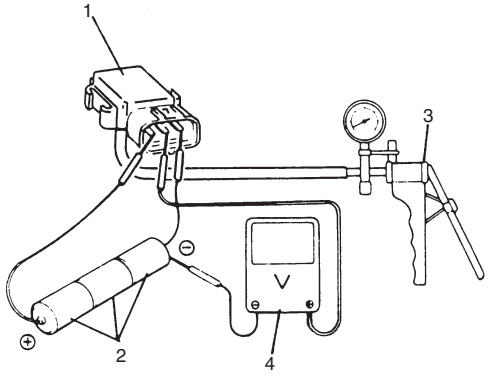
CAUTION:
As ECM consists of precision parts, be careful not to expose it to excessive shock.

REMOVAL

1) Disconnect battery negative cable at battery.
2) Remove glove box (2).
3) Disconnect couplers from ECM (1) while releasing coupler lock.
4) Remove ECM from body.

INSTALLATION

1) Install ECM to body.
2) Connect couplers to ECM securely.
3) Install glove box.
4) Connect battery negative cable at battery.



1. MAP sensor
2. 1.5 V battery (4.5 V in total)
3. Vacuum pump
4. Digital type voltmeter

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP SENSOR)

MAP SENSOR INDIVIDUAL CHECK

1) Disconnect MAP sensor vacuum hose from filter.
2) Disconnect coupler from MAP sensor.
3) Remove MAP sensor.
4) Arrange 3 new 1.5 V batteries in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to "Vin" terminal of sensor and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground".
   Also, check if voltage reduces when vacuum is applied up to 40 cmHg by using vacuum pump.

   Output voltage (Vin voltage 4.5 – 5.0 V, ambient temp. 20 – 30°C, 68 – 86°F)

ALTITUDE (Reference)		BAROMETRIC PRESSURE		OUTPUT VOLTAGE
(ft)	(m)	(mmHg)	KPa	(V)
0 | 2 000	0 | 610	760 | 707	100 | 94	3.1 – 3.6
2 001 | 5 000	611 | 1 524	Under 707 over 634	94 | 85	2.8 – 3.4
5 001 | 8 000	1 525 | 2 438	Under 634 over 567	85 | 76	2.6 – 3.1
8 001 | 10 000	2 439 | 3 048	Under 567 over 526	76 | 70	2.4 – 2.9

   If check result is not satisfactory, replace MAP sensor.

5) Install MAP sensor and connect vacuum hose securely.
6) Connect MAP sensor coupler securely.

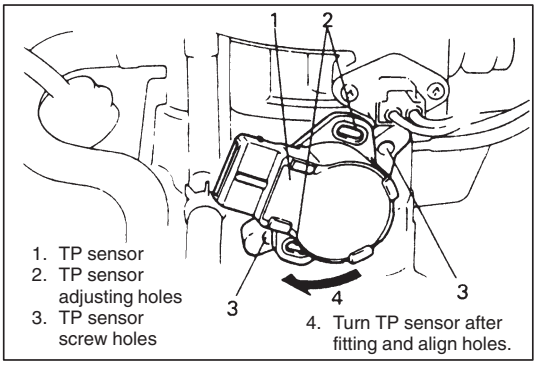
THROTTLE POSITION SENSOR (TP SENSOR)

INSPECTION

Check TP sensor referring to step 2 of DTC P0121 Flow Table. If malfunction is found, replace.

REMOVAL

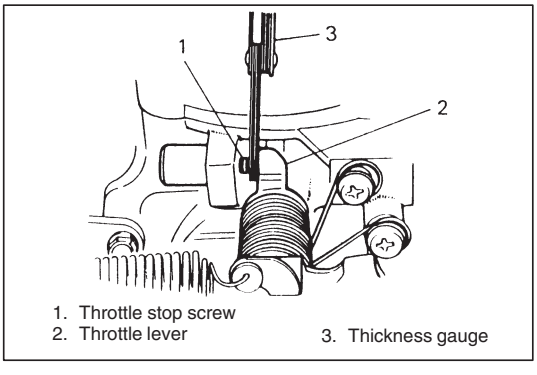
1) Disconnect battery negative cable at battery.
2) Remove air chamber case.
3) Disconnect coupler from TP sensor.
4) Remove TP sensor from throttle body.



1. TP sensor
2. TP sensor adjusting holes
3. TP sensor screw holes
4. Turn TP sensor after fitting and align holes.

INSTALLATION

1) Install TP sensor to throttle body.
   Fit TP sensor to throttle body in such way that its adjusting holes are a little away from TP sensor screw holes as shown in the figure and turn TP sensor clockwise so that those holes align. Then hand-tighten TP sensor screws.
2) Connect coupler to TP sensor securely.
3) Install air chamber case.
4) Connect battery negative cable at battery.
5) Adjust installation angle of TP sensor according to procedure described in item “ADJUSTMENT”.

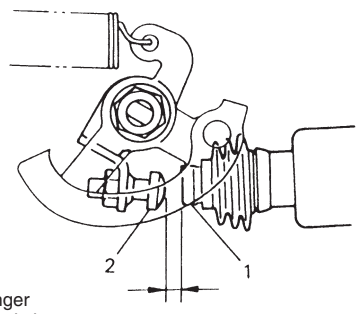


1. Throttle stop screw
2. Throttle lever
3. Thickness gauge

ADJUSTMENT

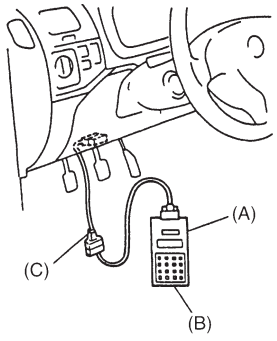
1) Insert 3.5 mm (0.14 in.) thickness gauge between throttle stop screw and throttle lever.

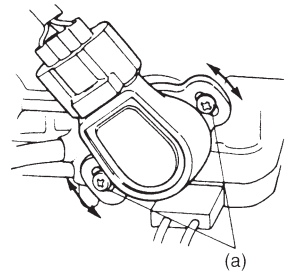
CAUTION:
As throttle stop screw is factory adjusted precisely, don’t remove or adjust it.



1. Plunger
2. Throttle lever screw

2) Check to make sure that plunger of ISC actuator and throttle lever screw are not in contact with each other. If they are, warm up engine.





3) Loosen TP sensor screws.
   a) Connect SUZUKI scan tool to DLC with ignition switch OFF.

      (A): 09931-76011 (SUZUKI scan tool)
      (B): Mass storage cartridge
      (C): 09931-76030 (16/14 pin DLC cable)

   b) Select “Data List” mode on SUZUKI scan tool.
   c) Observe TP sensor voltage.
4) Turn TP sensor clockwise or counterclockwise and tighten TP sensor screw at a position where voltage as specified below is obtained.

   TP sensor voltage when lever-to-stop screw clearance is 3.5 mm (0.14 in.) : 0.98 – 1.02 V

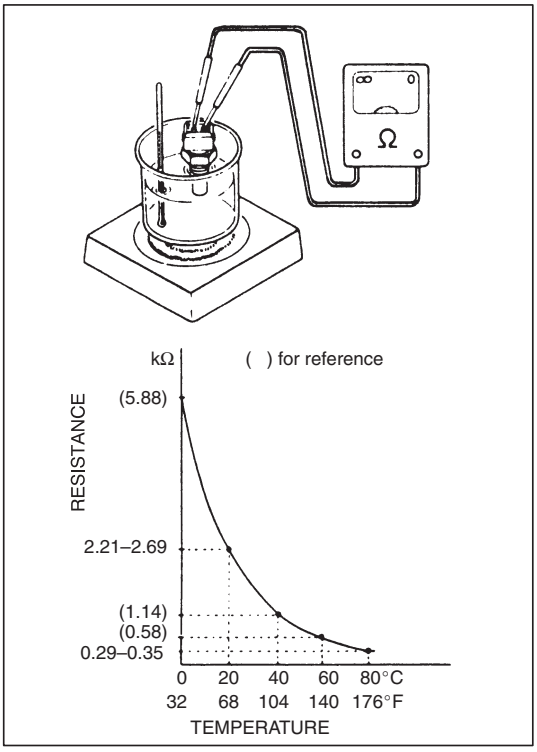
   Tightening Torque
   (a): 2.0 N·m (0.20 kg-m, 1.5 lb-ft)

5) Install ECM and connect couplers securely.

INTAKE AIR TEMPERATURE SENSOR (IAT SENSOR)

REMOVAL

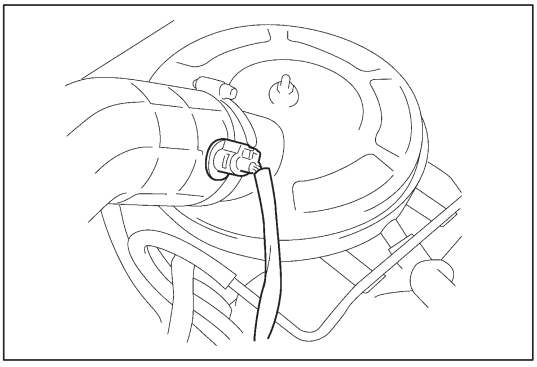
1) Disconnect battery negative cable at battery.
2) Disconnect coupler from IAT sensor.
3) Remove IAT sensor from air cleaner outlet hose.



INSPECTION

Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.

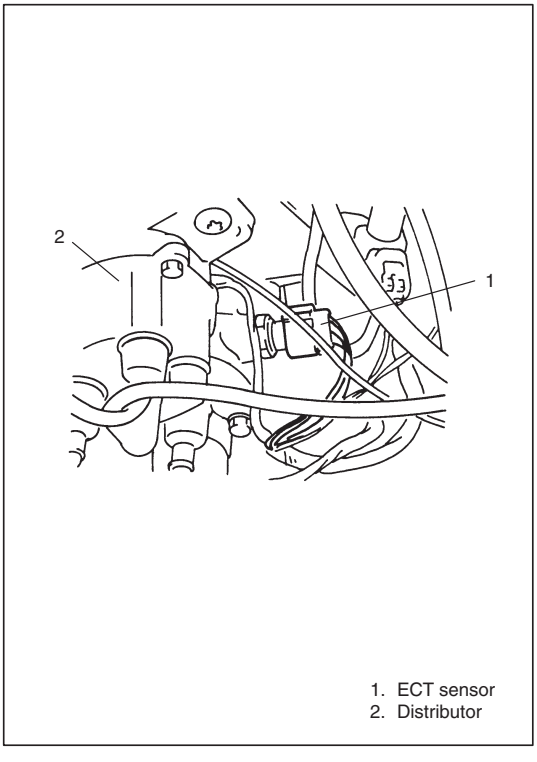
If measured resistance doesn't show such characteristic as shown in the figure, replace IAT sensor.



INSTALLATION

Reverse removal procedure noting the following.

- Clean mating surfaces of IAT sensor and air cleaner outlet hose.
- Connect IAT sensor coupler securely.



1. ECT sensor
2. Distributor

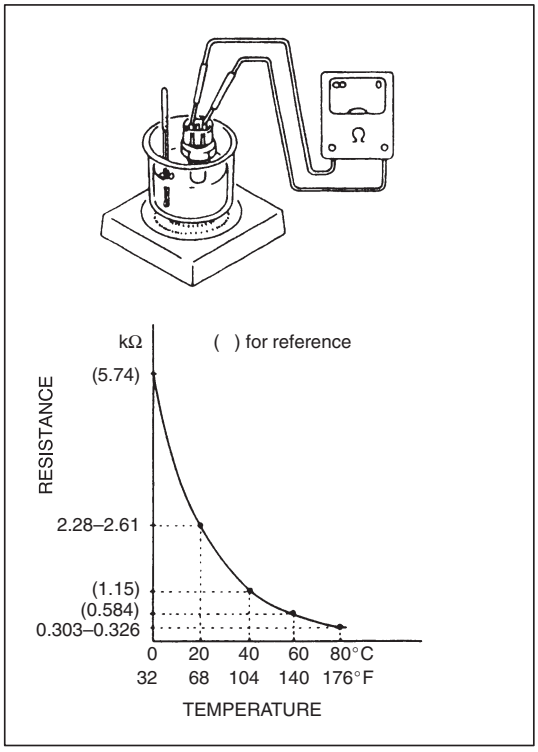
ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

REMOVAL

1) Disconnect battery negative cable at battery.
2) Drain coolant referring to Section 6B.

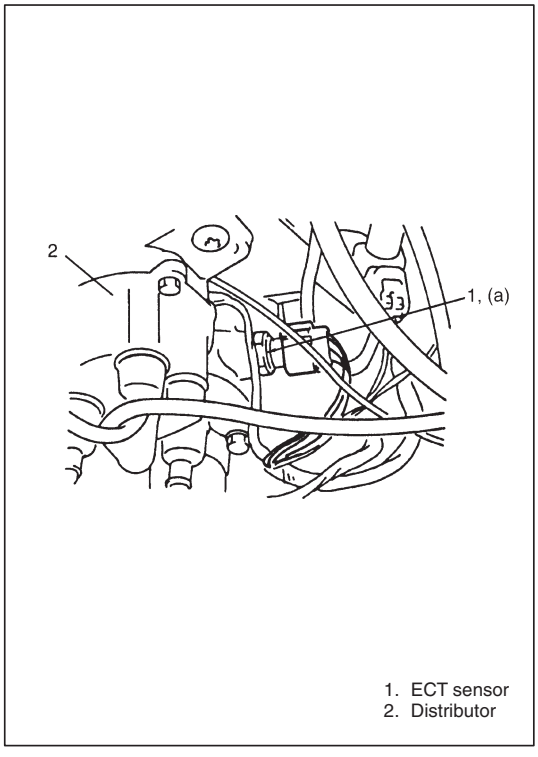
WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

3) Disconnect coupler from ECT sensor.
4) Remove ECT sensor from thermostat case.



INSPECTION

Immerse temperature sensing part of ECT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn't show such characteristic as shown in the figure, replace ECT sensor.



1. ECT sensor
2. Distributor

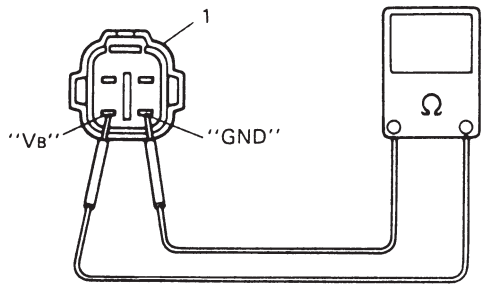
INSTALLATION

Reverse removal procedure noting the following.

- Clean mating surfaces of ECT sensor and thermostat case.
- Check O-ring for damage and replace if necessary.
- Tighten ECT sensor to specified torque.

Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

- Connect coupler to ECT sensor securely.
- Refill coolant referring to Section 6B.



1. Viewed from terminal side

HEATED OXYGEN SENSOR (SENSOR-1 AND SENSOR-2)

OXYGEN SENSOR HEATER INSPECTION

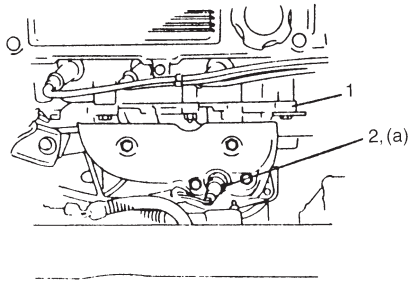
1) Disconnect sensor coupler.
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor coupler.

   NOTE:
   Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

   Resistance of oxygen sensor heater:
   11.7 – 14.3 Ω at 20°C, 68°F

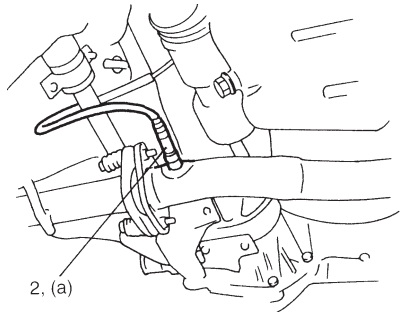
   If found faulty, replace oxygen sensor.
3) Connect sensor coupler securely.

Sensor-1



1. Exhaust manifold
2. Heated oxygen sensor

Sensor-2



REMOVAL

WARNING:
To avoid danger of being burned, do not touch exhaust system when system is hot. Oxygen sensor removal should be performed when system is cool.

1) Disconnect negative cable from battery.
2) Hoist vehicle when removing sensor-2.
3) Disconnect coupler of heated oxygen sensor and release its wire harness from clamps.
4) Remove exhaust manifold cover when removing sensor-1.
5) Remove heated oxygen sensor from exhaust manifold or exhaust No.1 pipe.

INSTALLATION

Reverse removal procedure noting the following.

- Tighten heated oxygen sensor to specified torque.

  Tightening Torque
  (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- Connect coupler of heated oxygen sensor and clamp wire harness securely.
- After installing heated oxygen sensor, start engine and check that no exhaust gas leakage exists.

VEHICLE SPEED SENSOR (VSS)

INSPECTION

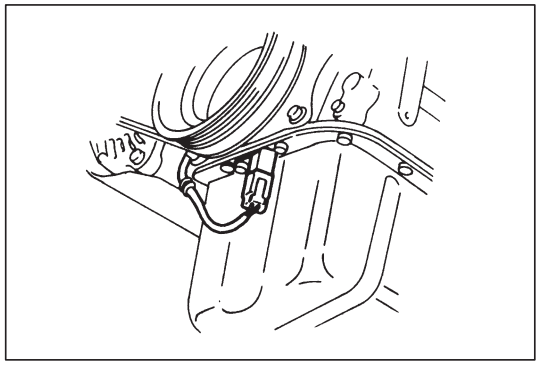
Check vehicle speed sensor referring to step 3 of DTC P0500 Flow Chart. If malfunction is found, replace.

REMOVAL/INSTALLATION

Refer to Section 7A.

FUEL LEVEL SENSOR (GAUGE)

Refer to Section 8.



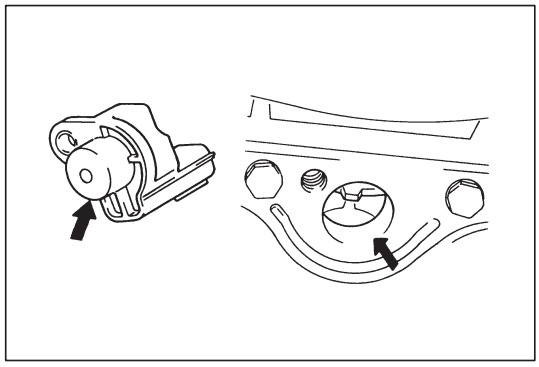
CRANKSHAFT POSITION SENSOR

INSPECTION

Check crankshaft position sensor referring to step 1 and 2 of DTC P0335 Flow Table. If malfunction is found, replace.

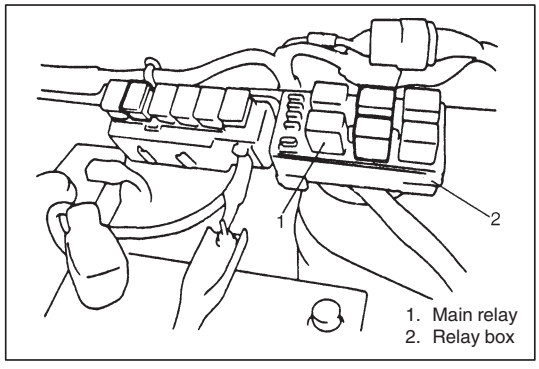
REMOVAL

1) Hoist vehicle.
2) Disconnect connector from crankshaft position sensor.
3) Remove crankshaft position sensor from oil pan.



INSTALLATION

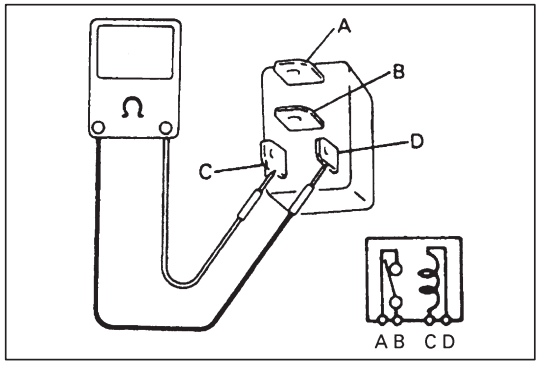
1) Check to make sure that crankshaft position sensor and pulley tooth is free from any metal particles and damage.
2) Install crankshaft position sensor to oil pan.
3) Connect connector to it securely.



MAIN RELAY

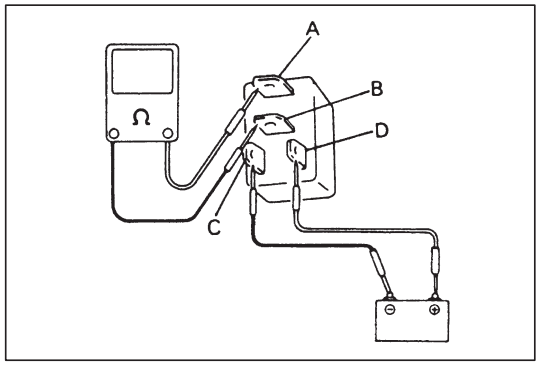
INSPECTION

1) Disconnect negative cable at battery.
2) Remove main relay from relay box.

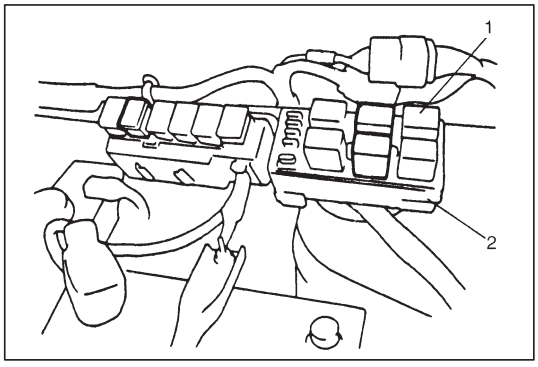


3) Check resistance between each two terminals as in table below. If check results are as specified, proceed to next operation check. If not, replace.

TERMINALS	RESISTANCE
Between A and B	∞ (infinity)
Between C and D	100 – 120 Ω



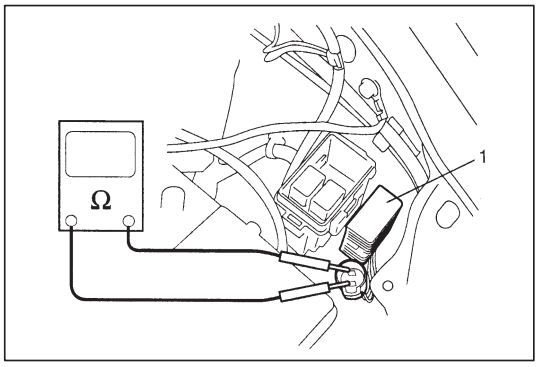
4) Check that there is continuity between terminals “A” and “B” when battery is connected to terminals “C” and “D”.
If found defective, replace.



FUEL PUMP RELAY

INSPECTION

1) Disconnect negative cable at battery.
2) Remove fuel pump relay (1) from relay box (2).
3) Structure of fuel pump relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
   If found defective, replace.



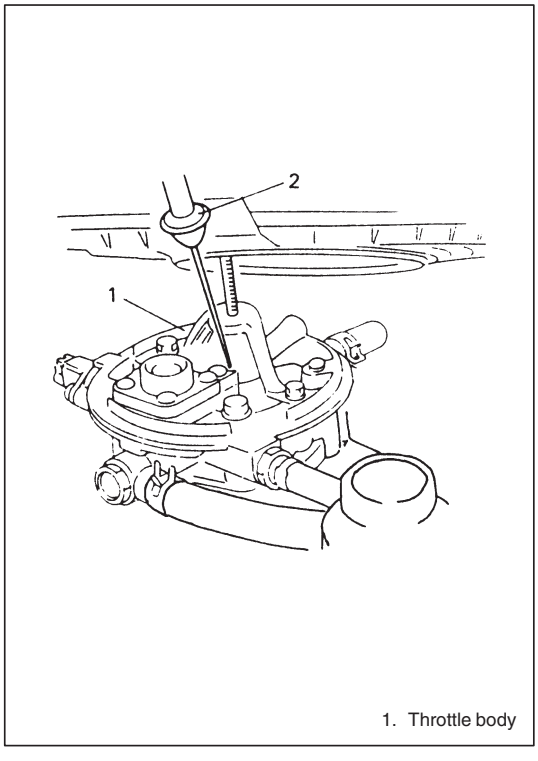
FUEL INJECTOR RESISTOR

INSPECTION

1) With ignition switch OFF, disconnect resistor coupler.
2) Check resistor (1) for resistance.

   Resistance: 1.9 – 2.1 Ω at 20°C, 68°F

   If check result is not satisfied, replace.



1. Throttle body

FUEL CUT OPERATION

INSPECTION

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range), A/C is OFF and that parking brake lever is pulled all the way up.

1) Warm up engine to normal operating temperature.
2) While listening to sound of injector by using sound scope (2) or such, increase engine speed to higher than 3,000 r/min.
3) Check to make sure that sound to indicate operation of injector stops when throttle valve operation of injector stops when throttle valve is closed instantly and it is heard again when engine speed is reduced to less than about 2,000 r/min.

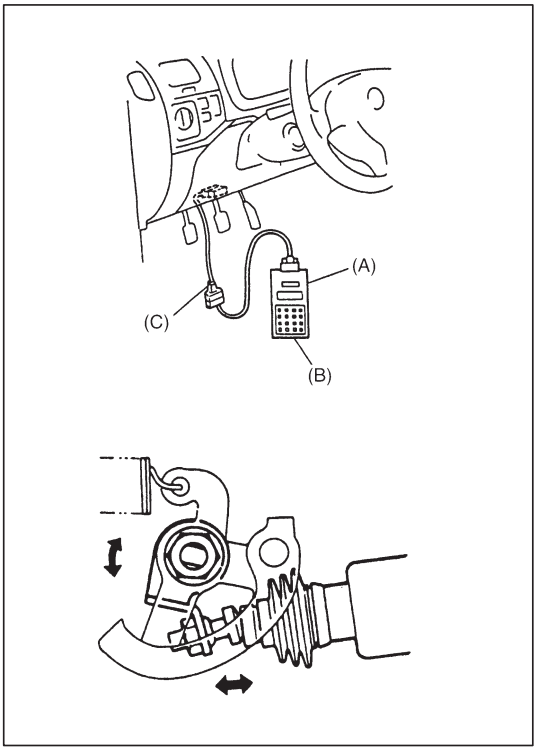
IDLE SPEED CONTROL SYSTEM

SYSTEM INSPECTION

NOTE:

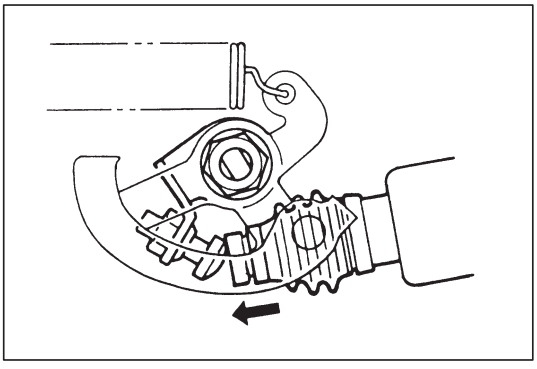
Before inspection, check to make sure that:

- **Gear shift lever is in neutral position (with A/T vehicle, selector lever in "P" range) and that parking brake lever is pulled all the way up.**
- **Battery voltage is higher than 11 V.**
- **Throttle valve moves smoothly.**
- **Ambient temperature is higher than 0°C (32°F)**



1) Connect scan tool to DLC with ignition switch OFF, if it is available.
2) Warm up engine to normal operating temperature.
3) Select “Data List” mode on scan tool to check “IAC duty”.
4) Apply load to engine as described below and check that idle speed is kept at specified level and “IAC duty” increases as specified below. At the same time, check that plunger of ISC actuator moves.

Increase of ISC duty
when headlight turns ON : About 3.5%
when A/C is operating : About 10%



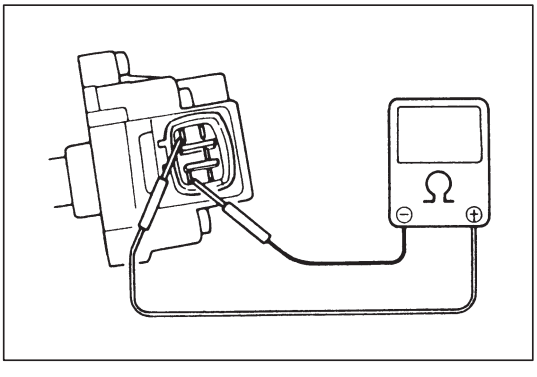
5) Stop engine and leave it as it is till it cools off. Then check that plunger of ISC actuator moves when ignition switch is turned from OFF to ON once.
If abnormality is found in Steps 4) and 5), check ISC relay, ISC actuator, ISC electric circuit and closed throttle position switch signal.
If abnormality is found in Step 4) only, check A/C signal circuit first.

ISC ACTUATOR

NOTE:
As ISC actuator has been preadjusted precisely at factory, it must not be taken out of throttle body or disassembled.

INSPECTION

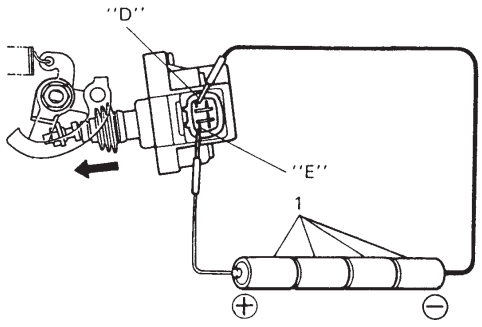
1) Disconnect connector from ISC actuator.



2) Check whether ISC actuator coil is open or short.

ISC actuator resistance at 20°C (68°F): 3 – 50 Ω

NOTE:
Above data should be used as reference value for determining whether coil is open or short only. ISC actuator resistance may be out of above specified range even when ISC actuator is normal.

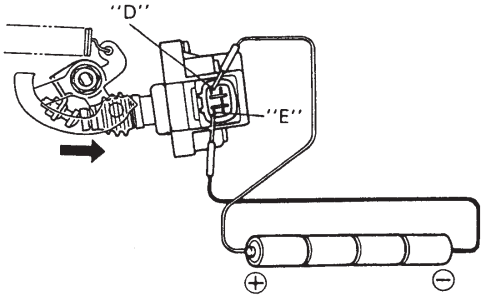


1. 1.5 V battery (6.0 V in total)

3) Arrange 4 new 1.5 V batteries in series (6.0 V in total).
With throttle lever in contact with plunger of ISC actuator, connect these batteries to ISC actuator terminals and check ISC actuator for operation.

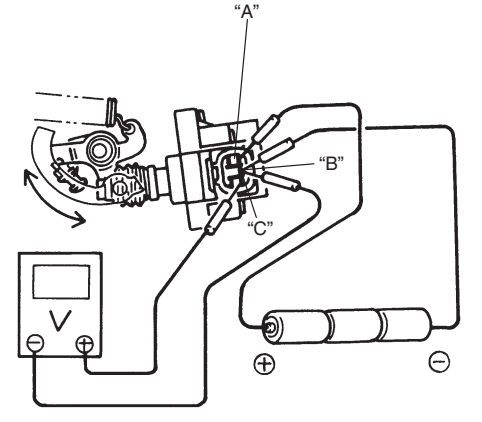
CAUTION:
- **Make sure that connection is made correctly between batteries and terminals. Also, voltage must not be applied for longer than 1 second, or a faulty condition will occur.**
- **Make sure that connection is correct. Connecting to other terminals may cause damage to closed throttle position switch (idle switch).**
- **After inspection, be sure to check that CTP switch is ON. If it is OFF, move ISC actuator again and turn CTP switch ON.**

When positive terminal is connected to "E" terminal while plunger is contracted: Plunger expands



When positive terminal is connected to "D" terminal while plunger is expanded : Plunger contracts

When an abnormality has been found in above checks 2) and 3), replace.



CLOSED THROTTLE POSITION (CTP) SWITCH (IDLE SWITCH) IN ISC ACTUATOR

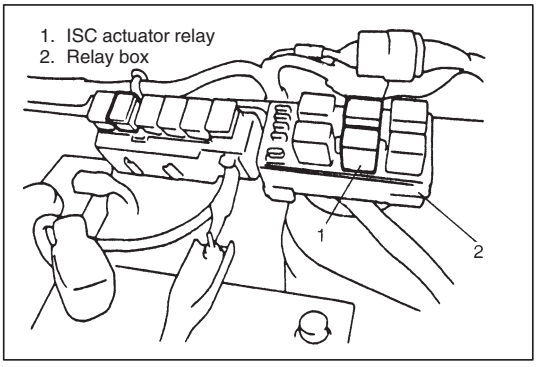
INSPECTION

1) Disconnect connector from ISC actuator.
2) Arrange 3 new 1.5 V batteries in series (4.5 V in total) and connect these batteries to CTP switch terminals "A" and "B".
Check voltage between terminals "B" and "C" under following each condition.

Throttle lever is in contact with ISC actuator plunger : 0 – 1 V

Throttle lever is apart from plunger : 3.5 – 5.5 V

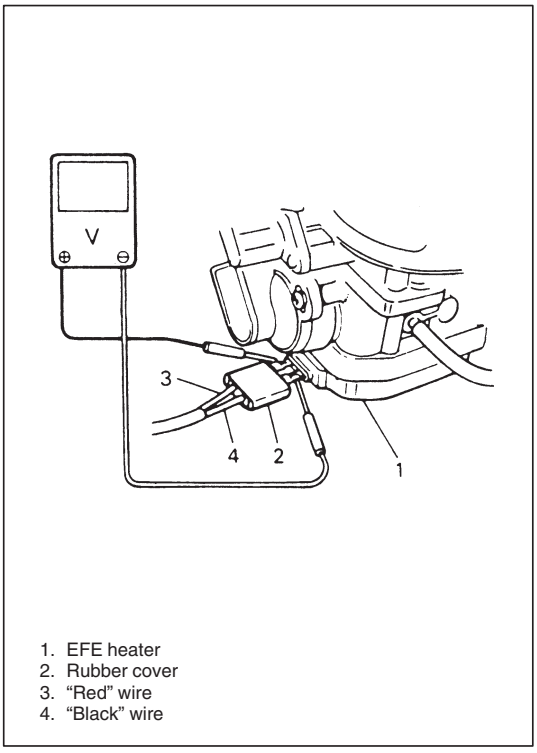
If check result is not satisfactory, replace throttle lower body.



ISC ACTUATOR RELAY

INSPECTION

1) Disconnect negative cable at battery.
2) Remove ISC actuator relay from relay box.
3) Structure of ISC actuator relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.



EFE HEATER CONTROL SYSTEM

SYSTEM CIRCUIT INSPECTION

NOTE:

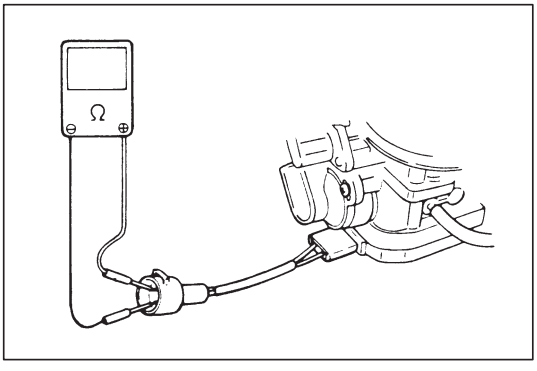
Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

1) Turn up rubber cover of EFE heater to expose terminal-to-wire connections.
2) Connect voltmeter to EFE terminals and check for voltage under each condition given below.

CONDITION	VOLTAGE
Fast idle condition Coolant temp.: below 80°C (176°F) Engine speed: over 750 r/min.	Battery voltage
After warming up (other than above)	No voltage

If check results are not as specified in above table, check EFE heater, relay and wire harness.

3) Cover EFE heater connections with rubber cover.



EFE HEATER

CAUTION:
Do not bend wire harness of EFE heater excessively.

ON-VEHICLE INSPECTION

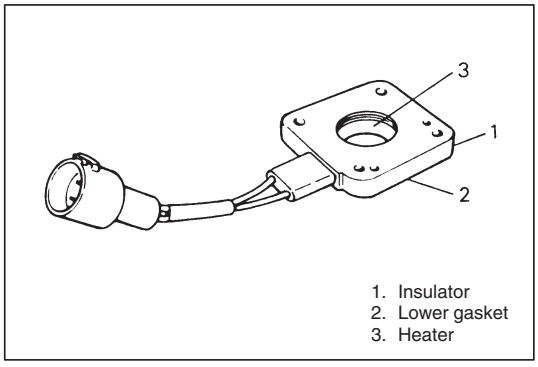
1) Disconnect EFE heater coupler.
2) Check resistance of EFE heater.
   If it is not as specified below, replace.

   EFE heater resistance: 0.5 – 3.0 Ω at 20°C (68°F)

3) Connect EFE heater coupler securely.

REMOVAL

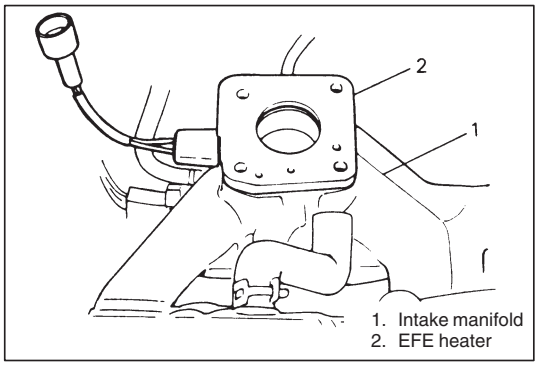
1) Remove throttle body according to procedure described previously.
   In this case, however, it is not necessary to disconnect fuel hoses and engine cooling water hoses from throttle body.
2) Disconnect EFE heater coupler.
3) Remove EFE heater from intake manifold.



1. Insulator
2. Lower gasket
3. Heater

INSPECTION

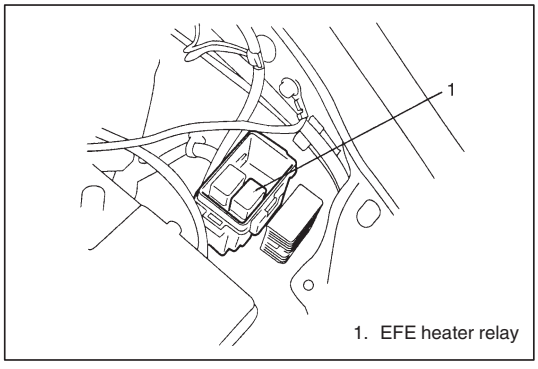
- Check lower gasket for damage and deterioration. Replace as necessary.
- Check heater and insulator for crack, corrosion or any other damage. Replace as necessary.



1. Intake manifold
2. EFE heater

INSTALLATION

1) Clean mating surfaces of throttle body and intake manifold that mate with EFE heater.
2) Install EFE heater to intake manifold.
   Use new upper gasket.
3) Install throttle body according to procedure described previously.
4) Connect EFE heater coupler.

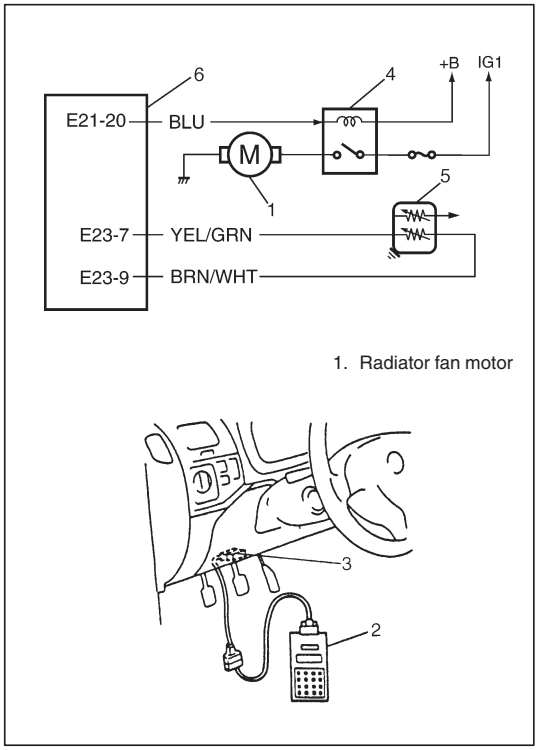


1. EFE heater relay

EFE HEATER RELAY

INSPECTION

1) Disconnect negative cable at battery.
2) Remove EFE heater relay from relay box.
3) Structure of EFE heater relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
   If found defective, replace.



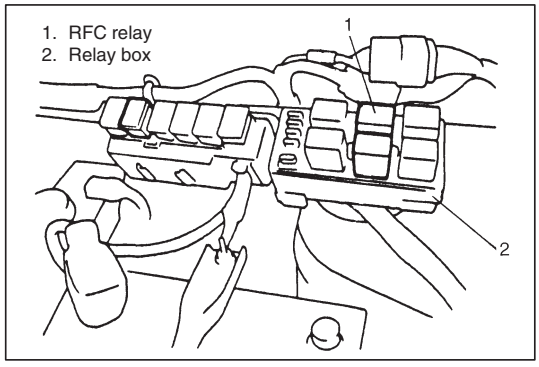
1. Radiator fan motor

RADIATOR FAN CONTROL SYSTEM

SYSTEM INSPECTION

WARNING:
Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch in the "ON" position.

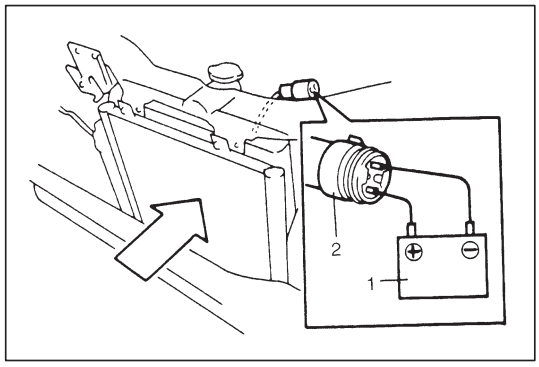
Connect SUZUKI scan tool (2) to DLC (3).
Start engine and keep it running to warm it up.
Now check to ensure that radiator fan is started when the coolant temperature displayed on SUZUKI scan tool reaches 96°C (205°F).
If check result is not satisfactory, check RFC relay (4), wire harness, ECT sensor (5), ECM (6), coolant temp. meter and sender gauge unit.
Refer to "DTC P0480 FLOW TABLE" of Section 6-1 and Section 8.



RADIATOR FAN CONTROL RELAY (RFC RELAY)

INSPECTION

1) Disconnect negative cable at battery.
2) Remove RFC relay from relay box.
3) Structure of RFC relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay. If found defective, replace.



RADIATOR FAN

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect radiator fan motor connector (2).
3) Connect battery (1) to the motor and check for operation. If fan fails to operate, replace.

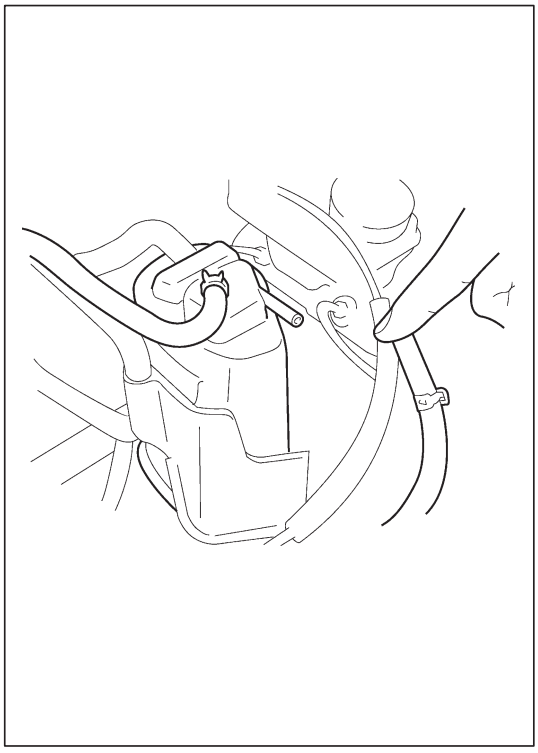
EMISSION CONTROL SYSTEM

EVAPORATIVE EMISSION CONTROL SYSTEM

EVAP CANISTER PURGE INSPECTION

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.

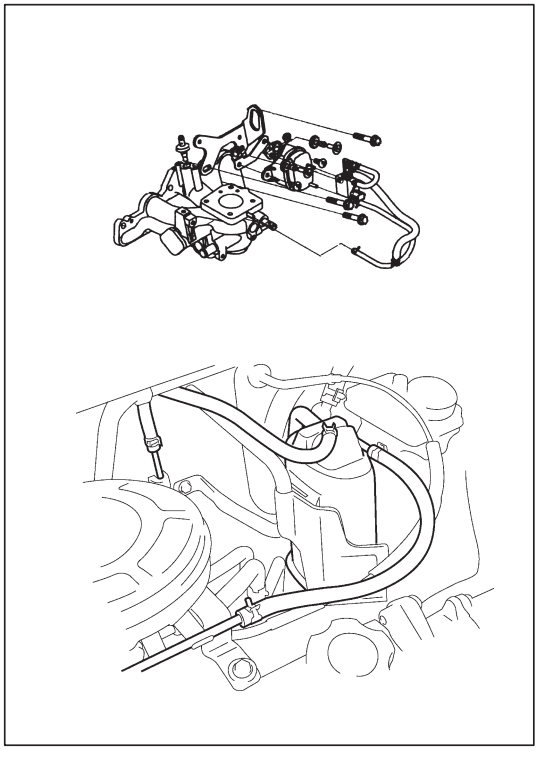


1) Disconnect purge hose from EVAP canister.
2) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is cool and running at idle speed.
3) Connect purge hose to EVAP canister and warm up engine to normal operating temperature.
4) Disconnect purge hose from EVAP canister.
5) Also check that vacuum is felt when engine is running at in between 2000 and 4000 r/min.

   NOTE:

   The EVAP canister purge system does not perform purging (vacuum is not detected at the purge hose) unless the engine is sufficiently warmed up and the heated oxygen sensor is activated fully. Also, when the purge hose is disconnected in Step 4), the air is drawn into the purge line. As a result, ECM detects a change in the purge gas concentration and sometimes stops purging but this indicates nothing abnormal.

If check result is not satisfactory, check vacuum passage, hoses, EVAP canister purge valve, wire harness and ECM.



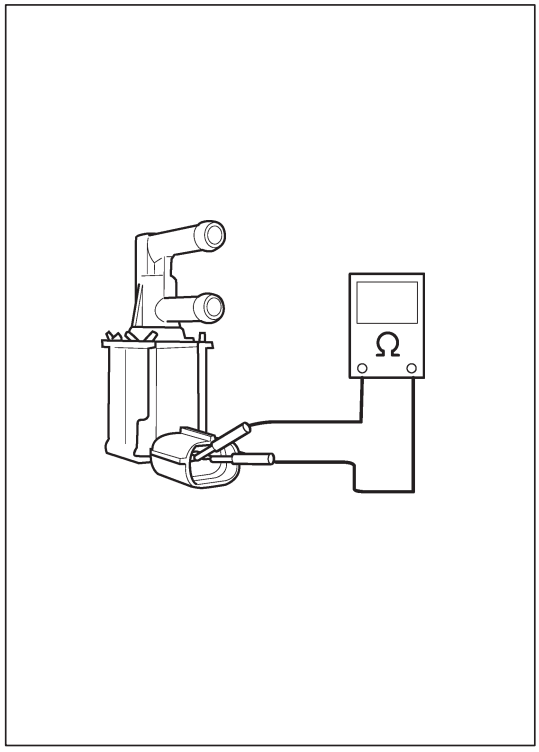
VACUUM PASSAGE INSPECTION

Start engine and run it at idle speed. Disconnect vacuum hose from EVAP canister purge valve. With finger placed against hose disconnected, check that vacuum is applied.

If it is not applied, clean vacuum passage by blowing compressed air.

VACUUM HOSE INSPECTION

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.



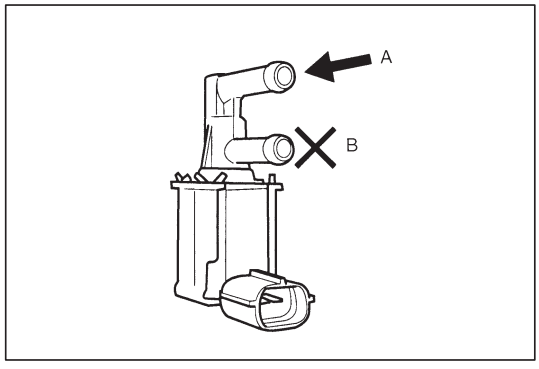
EVAP CANISTER PURGE VALVE INSPECTION

WARNING:
Do not suck the air through valve. Fuel vapor inside valve is harmful.

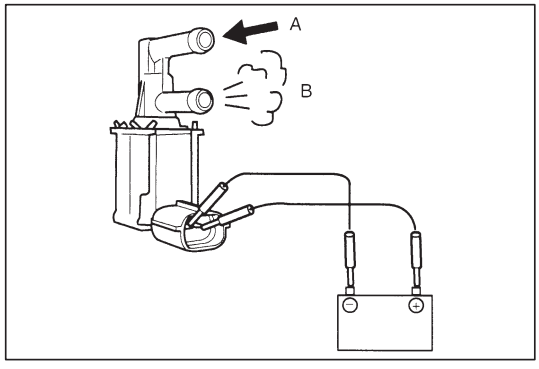
1) With the ignition switch OFF position, disconnect coupler from EVAP canister purge valve.
2) Check resistance between two terminals of EVAP canister purge valve.

   Resistance of EVAP canister purge valve:
   30 – 34 Ω at 20°C (68°F)

   If resistance is as specified, proceed to next operation check.
   If not, replace.

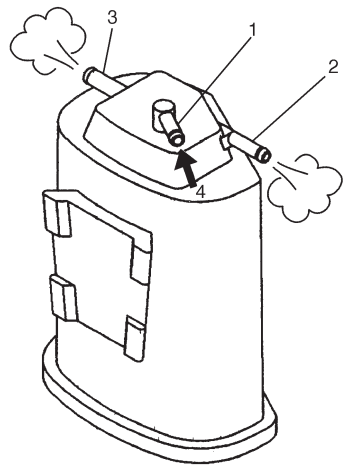


3) Disconnect vacuum hoses from intake manifold and its pipe.
4) With coupler disconnected, blow into pipe “A”. Air should not come out of pipe “B”.



5) Connect 12 V-battery to EVAP canister purge valve terminals. In this state, blow pipe “A”.
   Air should come out of pipe “B”.
   If check result is not as described, replace canister purge valve.

6) Connect vacuum hoses.
7) Connect EVAP canister purge valve coupler securely.



1. Tank pipe
2. Purge pipe
3. Air pipe
4. Blow air

EVAP CANISTER INSPECTION

WARNING:
DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.

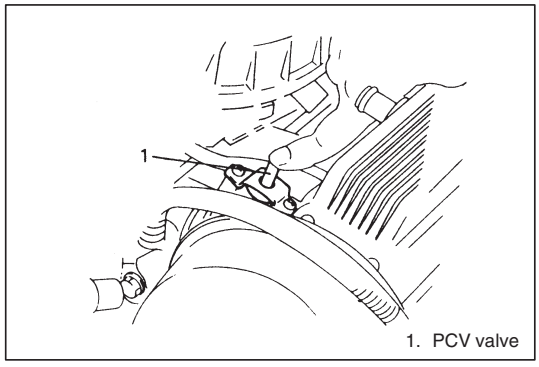
1) Disconnect vacuum hoses from EVAP canister and remove EVAP canister.
2) When air is blown into tank pipe, there should be no restriction of flow through purge pipe and air pipe.
   If operation differs from above description, EVAP canister must be replaced.
3) Install EVAP canister and connect hoses to canister.

PCV SYSTEM

NOTE:
Be sure to check that there is no obstruction in PCV valve or its hoses before adjusting engine idle speed, for obstructed PCV valve or hose hampers its accurate adjustment.

PCV HOSE INSPECTION

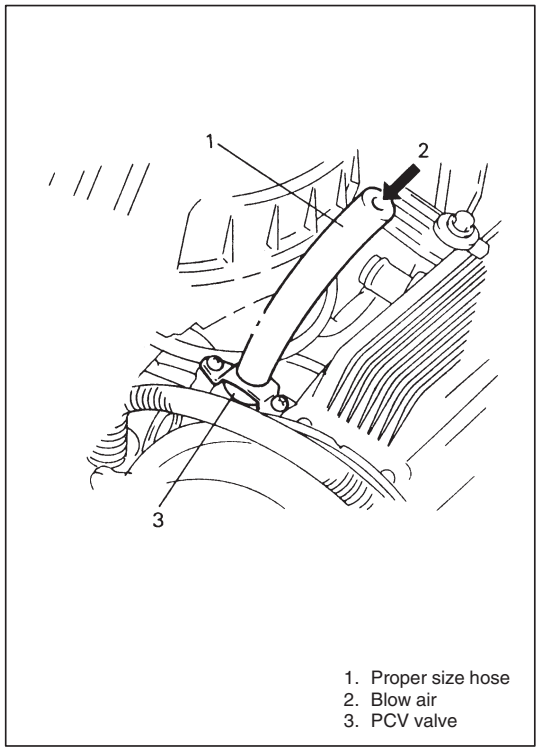
Check hoses for connection, leakage, clog and deterioration.
Replace as necessary.



1. PCV valve

PCV VALVE INSPECTION

1) Disconnect PCV hose from PCV valve.
2) Run engine at idle.
3) Place your finger over end of PCV valve to check for vacuum. If there is no vacuum, check for clogged valve. Replace as necessary.



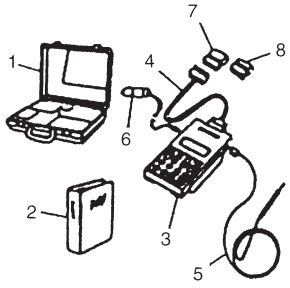
1. Proper size hose
2. Blow air
3. PCV valve

4) After checking vacuum, stop engine and check PCV valve for sticking.
   With engine stopped, connect a new hose to PCV valve for inspection.
   Blow air into the hose and check that air flows with difficulty from cylinder head side to intake manifold side.
   If air flows without difficulty, valve is stuck in "Open" position. Replace PCV valve.

> **WARNING:**
> **Do not suck air through PCV valve. Petroleum substances inside the valve and fuel vapor inside the intake manifold are harmful.**

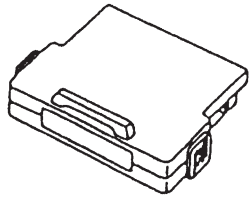
5) After removing the hose, connect PCV hose and clamp securely.

SPECIAL TOOLS

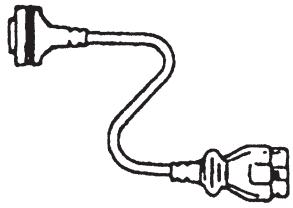


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

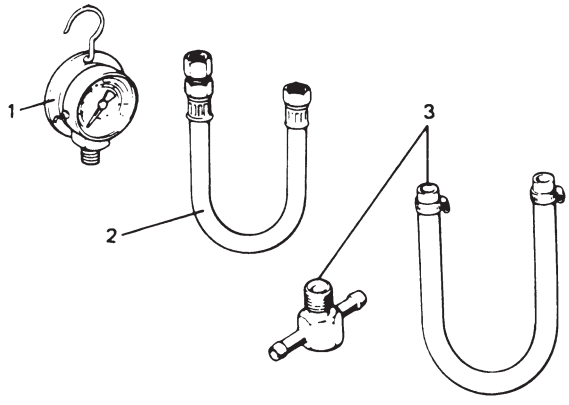
09931-76011
SUZUKI scan tool (Tech 1A) kit



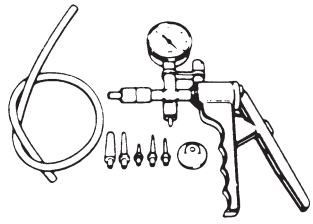
Mass storage cartridge



09931-76030
16/14 pin DLC cable



1. Fuel pressure gauge 09912-58441
2. Pressure hose 09912-58431
3. 3-way joint & hose 09912-58490



09917-47010
Vacuum pump gauge

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Throttle body mounting bolt	23	2.3	17.0
Throttle upper and lower body screw	3.5	0.35	2.5
Fuel injector wire connector screw	2.0	0.20	1.5
Fuel injector cover screw	3.5	0.35	2.5
TP sensor mounting screw	2.0	0.20	1.5
ECT sensor	15	1.5	11.0
Heated oxygen sensor -1 and -2	45	4.5	32.5

SECTION 6F

IGNITION SYSTEM

WARNING:
For vehicles equipped with Supplemental Restraint (Air Bag) System:
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

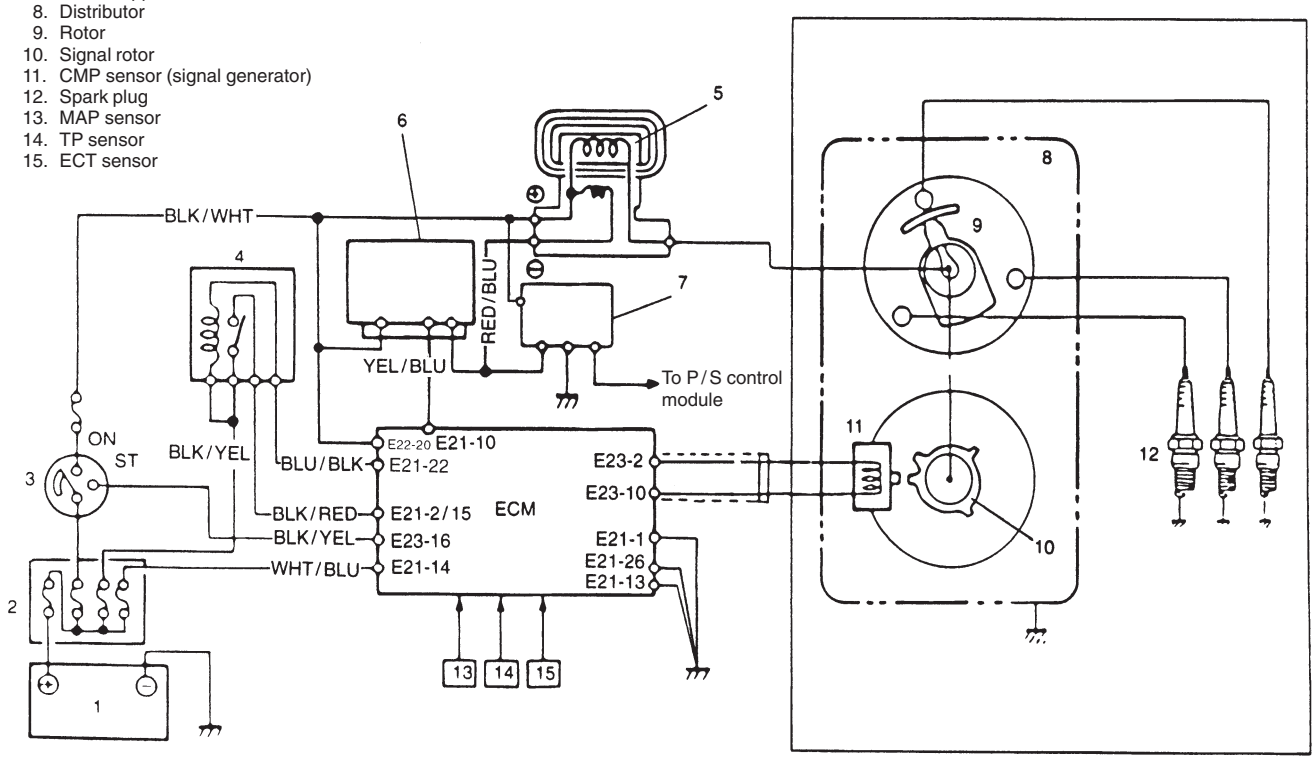
CONTENTS

GENERAL DESCRIPTION

The ignition system used for this vehicle has an electronic ignition control system and consists of the following parts.
- ECM
  It detects the engine condition through the signals from the sensors, determines the most suitable ignition timing and time for electricity to flow to the primary coil and sends a signal to the power unit.
- Power unit (Igniter)
  It turns ON and OFF the primary current of the ignition coil according to the signal from ECM.
- Ignition coil
  When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary winding.
- Distributor
  It distributes a high voltage current to each plug.
- High-tension cords and spark plugs.
- CMP sensor (Camshaft position Sensor)
  Located in the distributor, it converts the crank angle into voltage variation and sends it to ECM. For its details, refer to Section 6E1.
- TP sensor, ECT sensor and MAP sensor
  For their details, refer to Section 6E1.

In electronic ignition control system, the ECM is programmed for the best ignition timing under every engine condition. Receiving signals which indicate the engine condition from the sensors, e.g., engine revolution, intake air pressure, coolant temperature, etc., it selects the most suitable ignition timing from its memory and operates the power unit.
Thus ignition timing is controlled to yield the best engine performance.
For more information, refer to Section 6E1.

1. Battery
2. Main fuse
3. Ignition switch
4. Main relay
5. Ignition coil
6. Igniter
7. Noise suppressor
8. Distributor
9. Rotor
10. Signal rotor
11. CMP sensor (signal generator)
12. Spark plug
13. MAP sensor
14. TP sensor
15. ECT sensor



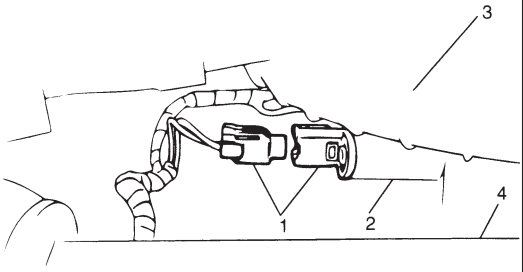
DIAGNOSIS

Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	● Blown fuse for ignition coil	Replace
	● Loose connection or disconnection of lead wire or high-tension cord(s)	Connect securely
	● Faulty high-tension cord(s)	Replace
	● Faulty spark plug(s)	Adjust, clean or replace
	● Cracked rotor or cap	Replace
	● Maladjusted signal rotor air gap	Adjust
	● Faulty ignition coil	Replace
	● Faulty noise suppressor	Replace
	● Faulty CMP sensor	Replace
	● Faulty igniter	Replace
	● Faulty ECM (or PCM)	Replace
	● Maladjusted ignition timing	Adjust
Poor fuel economy or engine performance	● Incorrect ignition timing	Adjust
	● Faulty spark plug(s) or high-tension cord(s)	Adjust, clean or replace
	● Faulty ECM (or PCM)	Replace

DIAGNOSTIC FLOW TABLE

STEP	ACTION	YES	NO
1	Was “Engine Diagnostic Flow Table” in SECTION 6-1 performed?	Go to Step 2.	Go to “Engine Diagnostic Flow Table” in SECTION 6-1.
2	Ignition Spark Test 1) Check all spark plug for condition and type, referring to “Spark Plugs” in this section. 2) If OK, perform ignition spark test, referring to “Ignition Spark Test” in this section. Is spark emitted from all spark plugs?	Go to Step 11 on the next page.	Go to Step 3.
3	Diagnostic Trouble Code (DTC) Check 1) Check DTC stored in ECM (or PCM), referring to “Diagnostic Trouble Code (DTC) Check” in SECTION 6-1. Is DTC stored?	Go to applicable flow table corresponding to that code No. in SECTION 6-1.	Go to Step 4.
4	Electrical Connection and Noise Suppressor Check 1) Check ignition coil for electrical connection and noise suppressor for conductivity. Are they good condition?	Go to Step 5.	Repair or replace.
5	High-tension Cord Check 1) Check high-tension cord for resistance, referring to “High-tension Cords” in this section. Is check result satisfactory?	Go to Step 6.	Replace high-tension cord(s).

STEP	ACTION	YES	NO
6	Ignition Coil Power Supply and Ground Circuit Check 1) Check ignition coil power supply (“BLK/WHT” wire) circuit for open and short. Are circuits in good condition?	Go to Step 7.	Repair or replace.
7	Ignition Coil Check 1) Check ignition coil for resistance, referring to “Ignition Coil” in this section. Is check result satisfactory?	Go to Step 8.	Replace ignition coil assembly.
8	CMP Sensor Check 1) Check CMP sensor and signal rotor, referring to “Distributor” in this section. Is check result satisfactory?	Go to Step 9.	Adjust or replace.
9	Ignition Trigger Signal Circuit Check 1) Check ignition trigger signal (“YEL/BLU” wire) circuit for open, short and poor connection. Are circuits in good condition?	Go to Step 10.	Repair or replace.
10	Igniter Check 1) Check igniter, referring to “Igniter” in this section. Is check result satisfactory?	Go to Step 11.	Replace igniter.
11	Ignition Timing Check 1) Check initial ignition timing and ignition timing advance, referring to “Ignition Timing” in this section. Is check result satisfactory?	Substitute a known-good ECM (or PCM) and then repeat Step 2.	Go to Step 12.
12	Ignition Timing Adjustment and Recheck 1) Adjust initial ignition timing, referring to “Ignition Timing” in this section. 2) Recheck initial ignition timing and ignition timing advance, referring to “Ignition Timing” in this section. Is check result satisfactory?	System is in good condition.	Substitute a known-good ECM (or PCM) and then repeat Step 2.



1. Injector coupler
2. Throttle body
3. Air cleaner case
4. Cylinder head cover

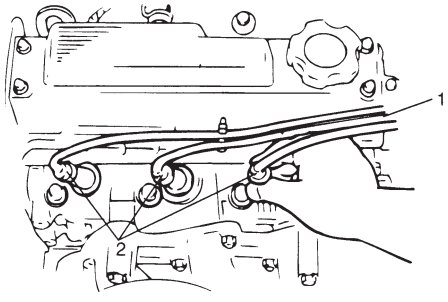
ON-VEHICLE SERVICE

IGNITION SPARK TEST

1) Disconnect injector coupler at throttle body side.

WARNING:
Without disconnection of injector coupler, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

2) Remove spark plugs and connect them to high-tension cords, and then ground spark plugs.
3) Crank engine and check if each spark plug sparks.
4) If no spark is emitted, inspect high-tension cords, spark plugs, ignition coil, distributor, etc.

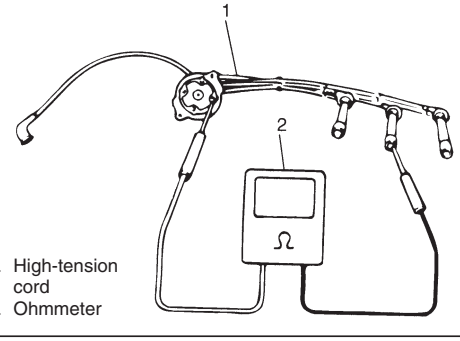


1. High-tension code
2. Cap

HIGH-TENSION CORDS

1) Remove high-tension cord at ignition coil while gripping its cap.
2) Remove distributor cap installed with high-tension cords.
3) Remove high-tension cord clamp from cylinder head cover.
4) Pull out high-tension cords from spark plugs while gripping each cap.

CAUTION:
- **Removal of high-tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**



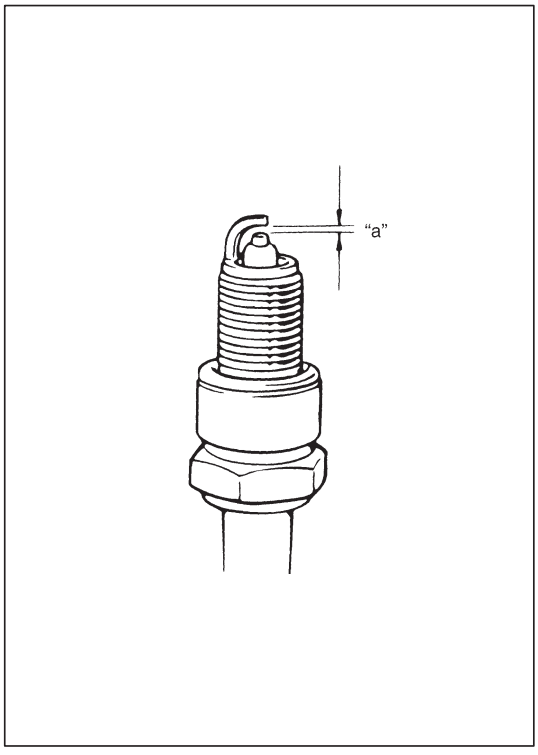
1. High-tension cord
2. Ohmmeter

5) Measure resistance of high-tension cord by using ohmmeter.

High-tension cord resistance: 10 – 22 kΩ/m (3.0 – 6.7 kΩ/ft)

6) If resistance exceeds specification, inspect distributor terminal and replace high-tension cord(s) and/or distributor cap as required.

CAUTION:
- **Never attempt to use metal conductor high-tension cords as replacing parts.**
- **Insert each cap portion fully when installing high-tension cords.**



SPARK PLUGS

1) Pull out high-tension cords by gripping their caps and then remove spark plugs.
2) Inspect them for:
   - Electrode wear
   - Carbon deposits
   - Insulator damage
3) If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.

Spark plug air gap "a": 1.0 – 1.1 mm (0.039 – 0.043 in.)
Spark plug type : NGK BPR6ES-11
: DENSO W20EPR-U11

4) Install spark plugs and torque them to specification.

Tightening Torque for spark plug
25 N·m (2.5 kg-m, 18.0 lb-ft)

5) Install high-tension cords securely by gripping their caps.

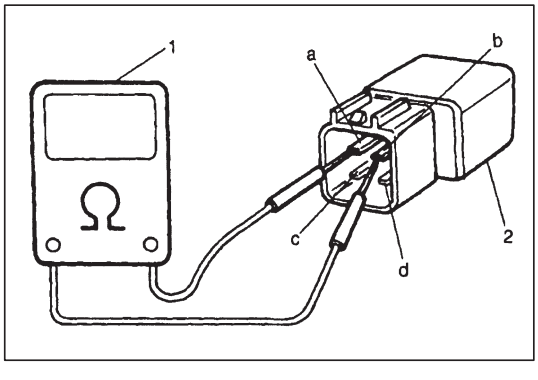
NOISE SUPPRESSOR

REMOVAL

1) Unwrap tape from noise suppressor.
2) Disconnect coupler of noise suppressor.
3) Remove noise suppressor.

INSTALLATION

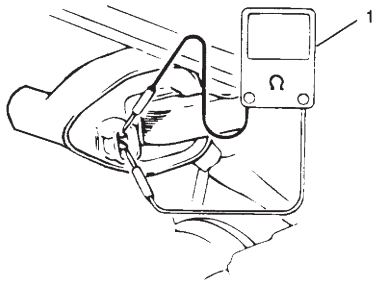
Reverse removal procedure for installation.



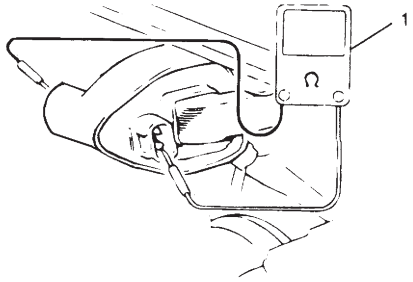
INSPECTION

Using an ohmmeter (1) to check continuity as the following.
"a" – "b": No continuity
"a" – "c": No continuity
"c" – "d": Continuity (Approx. 2.2 kΩ)
If check result is not satisfactory, replace noise suppressor (2).

PRIMARY



SECONDARY



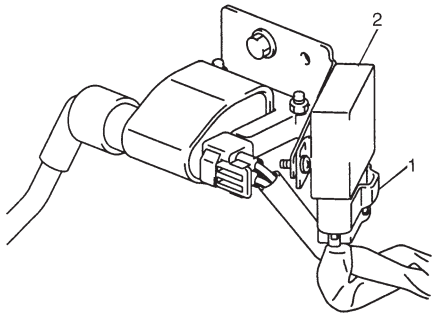
1. Ohmmeter

IGNITION COIL

1) Pull out high-tension cord by gripping its cap.
2) Disconnect ignition coil coupler.
3) Measure primary and secondary coil resistances.

Ignition coil resistance (at 20°C, 68°F)
Primary : 0.87 – 1.05 Ω
Secondary : 11.2 – 15.2 kΩ

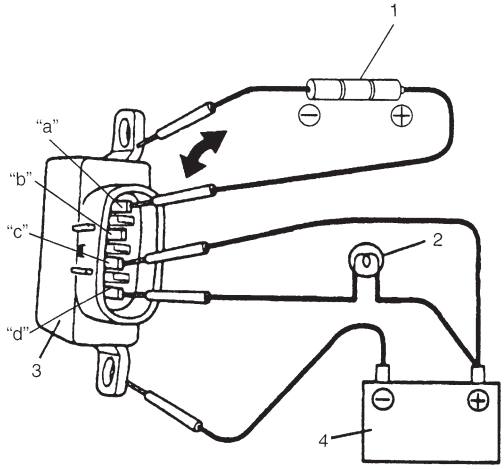
4) If resistance is out of specification, replace coil with new one.



IGNITER

Before this inspection, prepare 5 V power supply (3 new 1.5 V batteries), one 12 V 3.4 W light bulb and one 12 V battery (fully charged).

1) Disconnect igniter coupler (1).
2) Remove igniter (2) from its bracket.



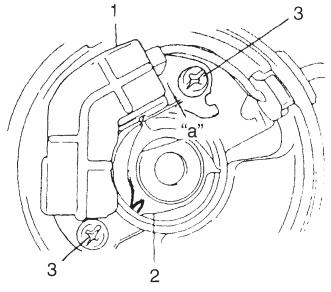
3) Arrange 3 new batteries in series (1) (check total voltage is about 4.7 V).
4) Connect light bulb (2) between "d" terminal of igniter (3) and battery (4) positive (+) terminal, then connect battery negative (–) terminal to igniter body.
   Also connect battery positive (+) terminal and "c" terminal of igniter.
   Check that the light bulb does not illuminate.
5) Connect negative (–) terminal of batteries (1) and igniter body.
   Check that the light bulb illuminate when positive (+) terminal of batteries (1) is connected to "a" terminal of igniter.
   If inspection result is not satisfactory, replace igniter.
6) Install igniter and connect igniter coupler.

DISTRIBUTOR

DISTRIBUTOR CAP AND ROTOR

INSPECTION

Check cap and rotor for crack and their terminals for corrosion and wear. Replace as necessary.



1. Pickup coil
2. Signal rotor
3. Screws

SIGNAL ROTOR AIR GAP

INSPECTION

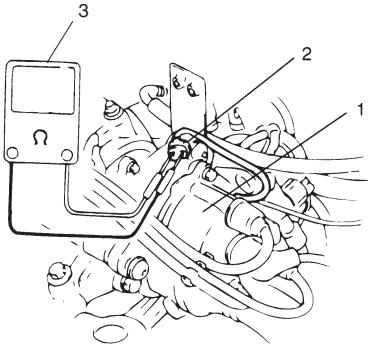
1) Remove distributor cap and rotor.
2) Using thickness gauge, measure air gap, between signal rotor tooth and CMP sensor (signal generator).

   Signal rotor air gap "a": About 0.2 mm (about 0.008 in.)

3) If gap is out of specification, loose CMP sensor (signal generator) securing screws. Using blade (–) screw driver, move CMP sensor (signal generator) and adjust gap to specification. After adjustment, tighten securing screws and recheck gap.

   NOTE:
   Check to make sure that CMP sensor (signal generator) tooth is free from any metal particles.

4) Install distributor cap and rotor.



1. Distributor
2. Coupler
3. Ohmmeter

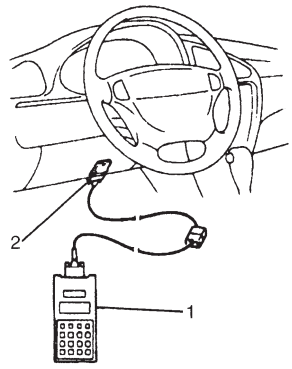
CMP SENSOR (PICKUP COIL) RESISTANCE

INSPECTION

1) Disconnect distributor lead coupler.
2) Measure resistance of pickup coil by using ohmmeter.
3) If resistance is out of specification, replace CMP sensor (signal generator) as follows.

   Pickup coil resistance:
   185 – 275 Ω at – 10°C (14°F) – 50°C (122°F)
   240 – 325 Ω at 50°C (122°F) – 100°C (212°F)

4) Remove distributor cap and rotor.
5) Remove CMP sensor (signal generator) securing screws and lead wire clamp screws.
6) Replace CMP sensor (signal generator).
7) Adjust signal rotor air gap to specifications as previously outlined.
8) Install rotor, distributor cap seal and cap.

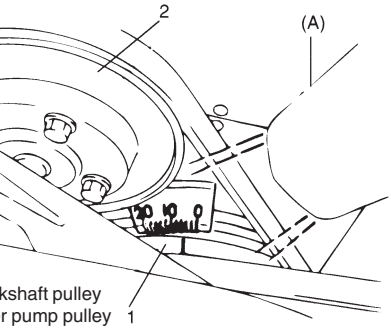


IGNITION TIMING

NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake.

INSPECTION AND ADJUSTMENT

1) Connect SUZUKI scan tool (1) to DLC (2) with ignition switch OFF.
2) Start engine and warm it up to normal operating temperature.
3) Make sure that all of electrical loads except ignition are switched off.
4) Check to be sure that idle speed is within specification.
   (Refer to SECTION 6E1)
5) Set timing light to No.1 high-tension cord.
6) Fix ignition timing to initial one as follows:
   Select "MISC" made on SUZUKI scan tool and fix ignition timing to initial one.

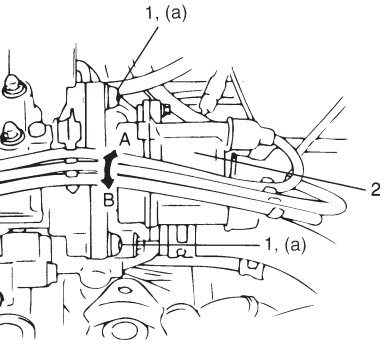


1. Crankshaft pulley
2. Water pump pulley

7) Remove air cleaner assembly.
8) Using timing light, check that timing is within specification.

   Initial ignition timing (Ignition timing fixed):
   5 ± 3° BTDC (at idle speed)
   Ignition order: 1-3-2

   Special Tool
   (A): 09900-27301 or 09930-76420



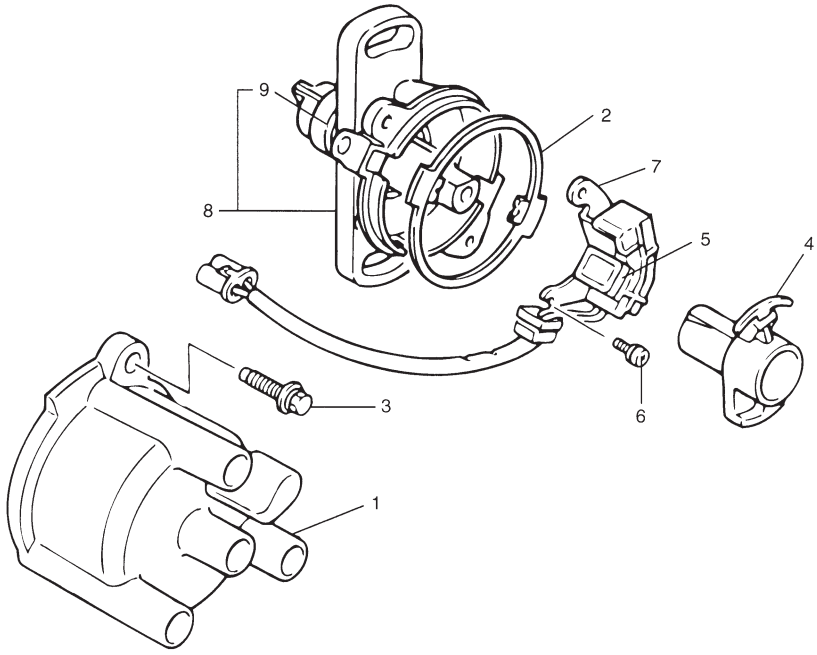
A: To be advanced
B: To be retarded
1. Distributor flange bolt
2. Distributor

9) If ignition timing is out of specification, loosen flange bolts, adjust timing by turning distributor assembly while engine is running, and then tighten bolts.

   Tightening Torque
   (a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

10) After tightening distributor flange bolts, recheck that ignition timing is within specification.
11) After checking and/or adjusting Initial Ignition Timing, release ignition timing fixation by SUZUKI scan tool.
12) With engine idling (ignition timing not fixed, idle switch ON and car stopped), check that ignition timing is about 8° BTDC. (Constant variation within a few degrees from 8° indicates no abnormality but proves operation of electronic timing control system.) Also, check that increasing engine speed advances ignition timing.
    If above check results are not satisfactory, check CTP switch and ECM.

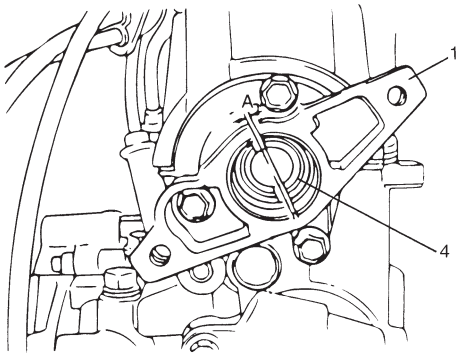
DISTRIBUTOR UNIT



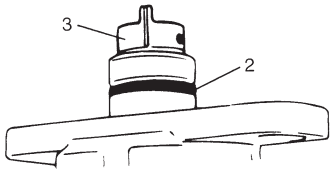
1. Cap
2. Cap seal
3. Cap screw
4. Rotor
5. CMP sensor (Signal generator)
6. Screw
7. Cover
8. Housing
9. O-ring

DISMOUNTING

1) Disconnect distributor lead coupler.
2) Remove distributor cap screws and cap.
3) Remove distributor flange bolts.
4) Pull out distributor housing assembly.



A: Slot offset



1. Distributor case
2. O-ring
3. Distributor coupling
4. Camshaft

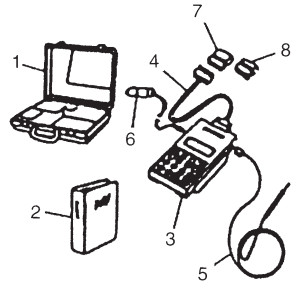
REMOUNTING

NOTE:

- **Before installing distributor, check to make sure that its O-ring is in good condition.**
- **If new O-ring is installed, apply oil.**

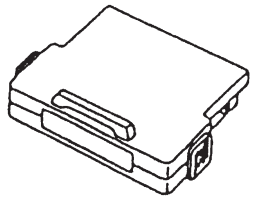
1) Install distributor without cap to camshaft.
   Fit the dogs of distributor coupling into the slots of camshaft, when installing. The dogs of distributor coupling are offset. Therefore, if the dogs can not shaft by 180 degree and try again.
2) Lightly install flange bolts and prepare for ignition timing adjustment.
3) Check to make sure that rotor is in good condition.
4) Inspect distributor cap and clean or replace as required.
5) Make sure that distributor cap seal is placed properly and install cap, and then fasten it with screws.
6) Connect distributor lead coupler.
7) Check and adjust ignition timing as previously outlined.

SPECIAL TOOLS

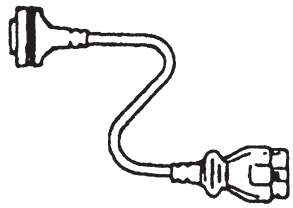


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

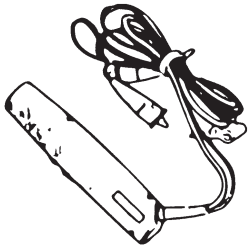
09931-76011
SUZUKI scan tool (Tech 1A) kit



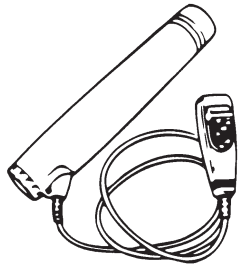
Mass storage cartridge



09931-76030
16/14 pin DLC cable



09900-27301
Timing light (DC 12 V)



09930-76420
Timing light (Dry cell type)

SECTION 6G2

CRANKING SYSTEM
(1.0 kW No-Reduction Type)

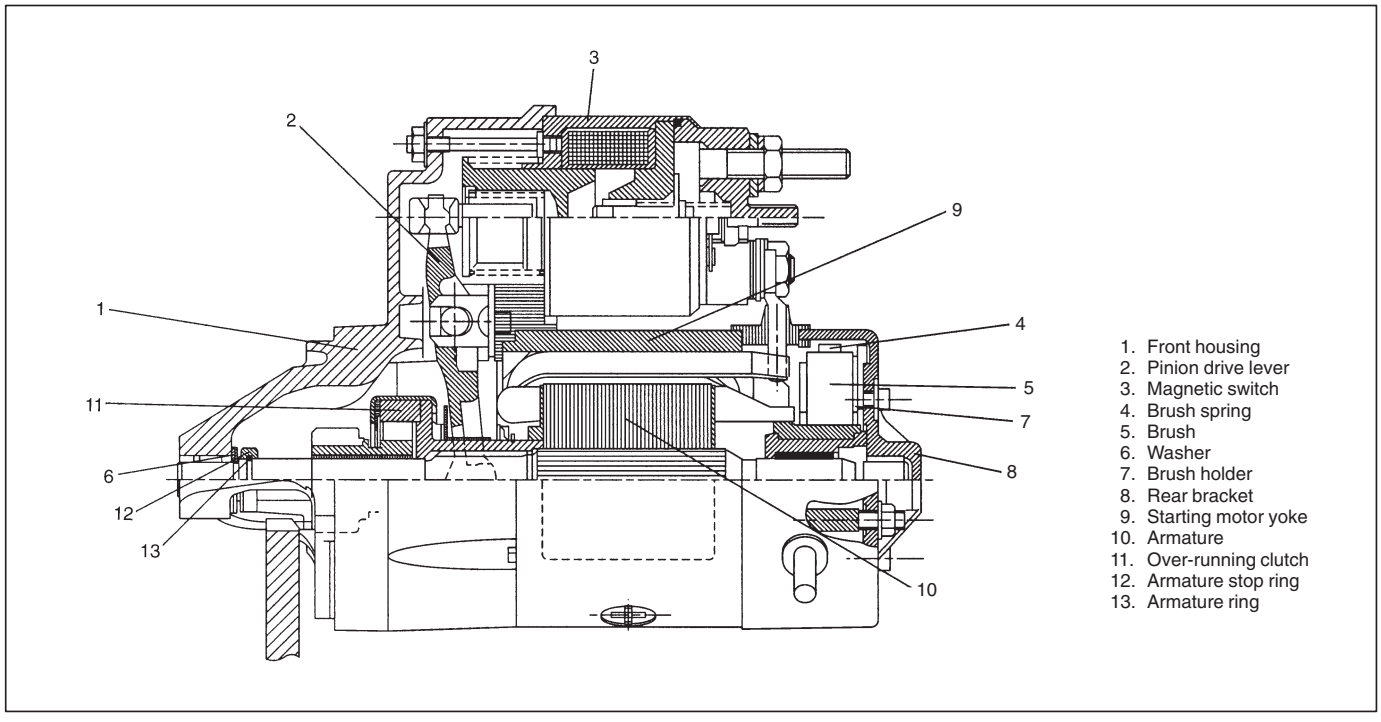
NOTE:
Starting motor vary depending on specifications, etc. Therefore, be sure to check model and specification of the vehicle being serviced before replacing parts.

CONTENTS

GENERAL DESCRIPTION

STARTING MOTOR

The starting motor consist of the following parts.



1. Front housing
2. Pinion drive lever
3. Magnetic switch
4. Brush spring
5. Brush
6. Washer
7. Brush holder
8. Rear bracket
9. Starting motor yoke
10. Armature
11. Over-running clutch
12. Armature stop ring
13. Armature ring

DIAGNOSIS

Possible symptoms due to starting system trouble would be as follows:

- Starting motor does not run (or runs slowly)
- Starting motor runs but fails to crank engine
- Abnormal noise is heard
- Starting motor does not stop running

Proper diagnosis must be made to determine exactly where the cause of each trouble lies ..... in battery, wiring harness, (including ignition and starter switch), starting motor or engine.

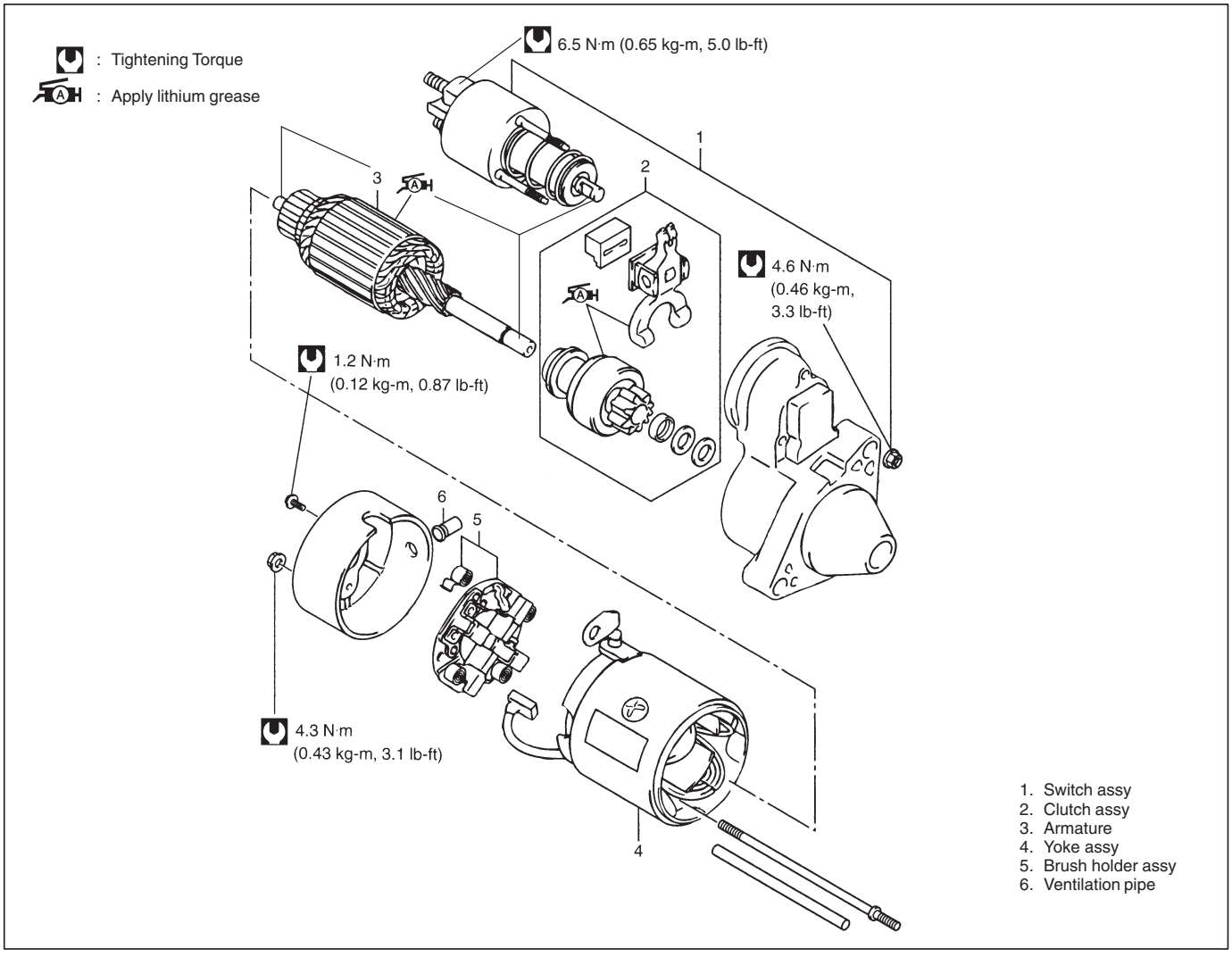
Do not remove motor just because starting motor does not run. Check the following items and narrow down scope of possible causes.

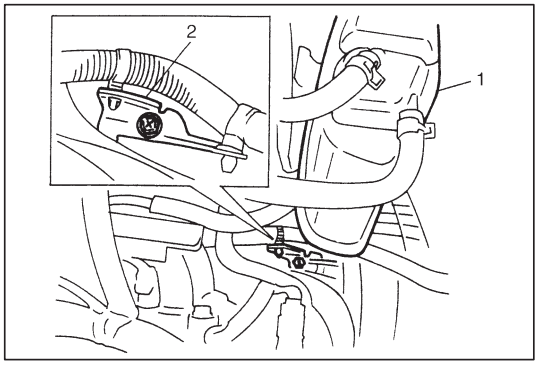
- Condition of trouble
- Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
- Discharge of battery
- Mounting of starting motor

Condition	Possible Cause	Correction
Motor not running	**No operating sound of magnetic switch**	
	● Battery run down	Recharge battery.
	● Battery voltage too low due to battery deterioration	Replace battery.
	● Poor contact in battery terminal connection	Retighten or replace.
	● Loose grounding cable connection	Retighten.
	● Fuse set loose or blown off	Tighten or replace.
	● Poor contacting action of ignition switch and magnetic switch	Replace.
	● Lead wire coupler loose in place	Retighten.
	● Open-circuit between ignition switch and magnetic switch	Repair.
	● Open-circuit in pull-in coil	Replace magnetic switch.
	● Poor sliding of plunger and/or pinion	Repair.
	● Shift lever switch is not in P or N, or not adjusted (A/T)	Shift in P or N, or adjust switch.
	● Brushes are seating poorly or worn down	Repair or replace.
	Operating sound of magnetic switch heard	
	● Battery run down	Recharge battery.
	● Battery voltage too low due to battery deterioration	Replace battery.
	● Loose battery cable connections	Retighten.
	● Burnt main contact point, or poor contacting action of magnetic switch	Replace magnetic switch.
	● Brushes are seating poorly or worn down	Repair or replace.
	● Weakened brush spring	Replace.
	● Burnt commutator	Replace armature.
	● Grounding of field coil	Repair.
	● Layer short-circuit of armature	Replace.
	● Crankshaft rotation obstructed	Repair.

Condition	Possible Cause	Correction
Starting motor running but too slow (small torque)	**If battery and wiring are satisfactory, inspect starting motor**	
	● Insufficient contact of magnetic switch main contacts	Replace magnetic switch.
	● Layer short-circuit of armature	Replace.
	● Disconnected, burnt or worn commutator	Replace.
	● Grounding of field coil	Repair.
	● Worn brushes	Replace brush.
	● Weakened brush springs	Replace spring.
	● Burnt or abnormally worn end bush	Replace bush.
Starting motor running, but not cranking engine	● Worn pinion tip	Replace over-running clutch.
	● Poor sliding of over-running clutch	Repair.
	● Over-running clutch slipping	Replace over-running clutch.
	● Worn teeth of ring gear	Replace flywheel (M/T) or drive plate (A/T).
Noise	● Abnormally armature shaft clearance	Replace armature or starter assembly.
	● Worn pinion or worn teeth of ring gear	Replace over-running clutch or flywheel (M/T), drive plate (A/T).
	● Poor sliding of pinion (failure in return movement)	Repair or replace.
	● Lack of grease in each part	Lubricate.
Starting motor does not stop running	● Fused contact points of magnetic switch	Replace magnetic switch.
	● Short-circuit between turns of magnetic switch coil (layer short-circuit)	Replace magnetic switch.
	● Failure of returning action in ignition switch	Replace.

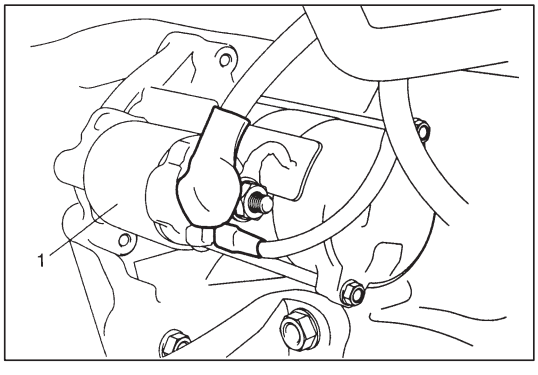
UNIT REPAIR OVERHAUL



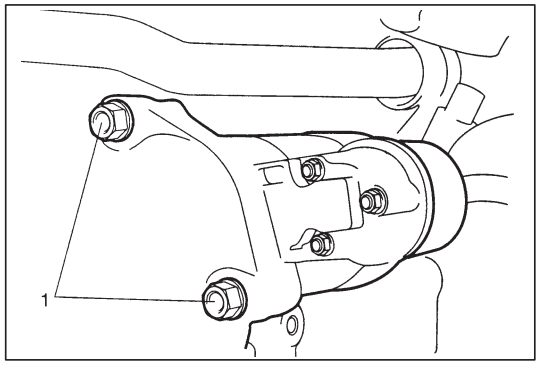


DISMOUNTING AND REMOUNTING

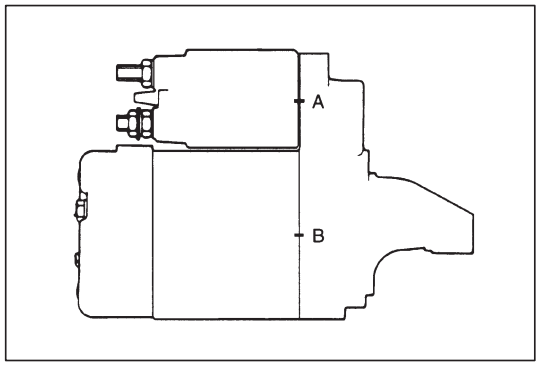
1) Disconnect positive (+) and negative (–) battery lead cables at battery.
2) Disconnect EVAP canister (1) and remove cable clamp (2).



3) Disconnect magnetic switch lead wire and battery cable from starting motor (1).

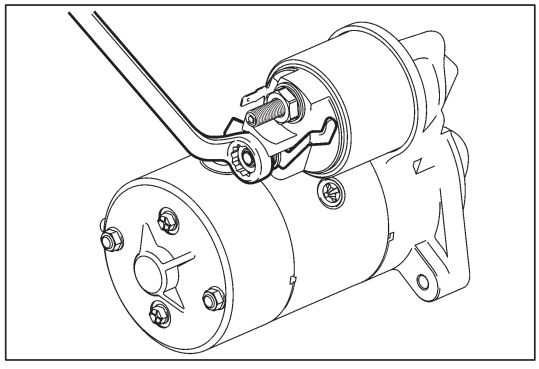


4) Remove two starting motor mount bolts (1).
5) Remove starting motor.
6) To install, reverse the above procedure.

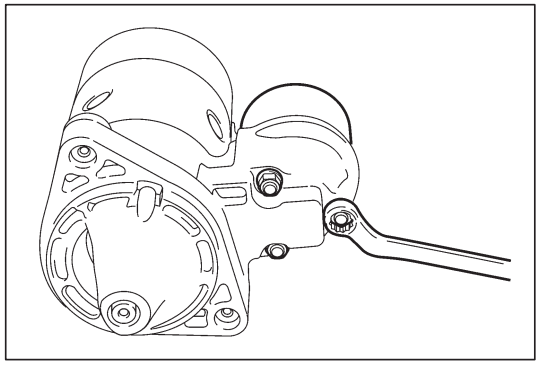


DISASSEMBLY

NOTE:
- **Before disassembling starting motor, be sure to put match marks at two locations (A and B) as shown in left figure so that any possible mistakes can be avoided.**
- **Do not clamp yoke in a vise or strike it with a hammer during disassembling and reassembling.**

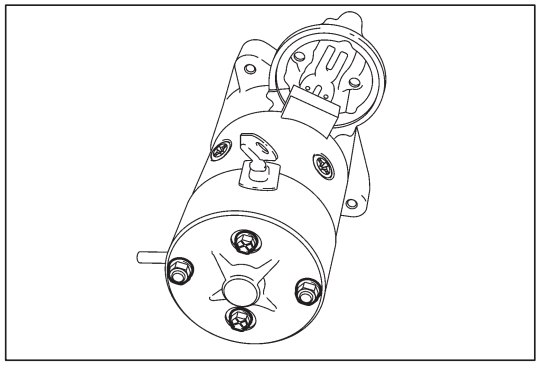


1) Remove nut securing the end of field coil lead to terminal on the head of magnetic switch.

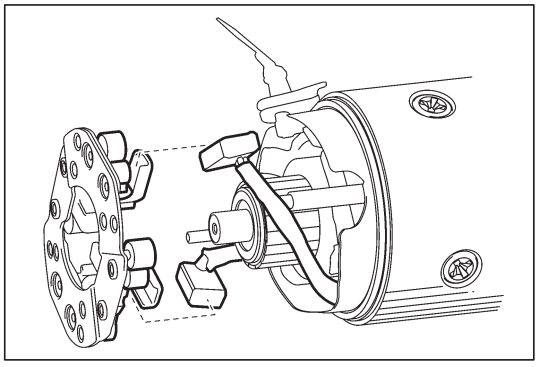


2) Remove 3 nuts and then take out magnetic switch. Then remove plunger by unhooking its hook from drive lever.

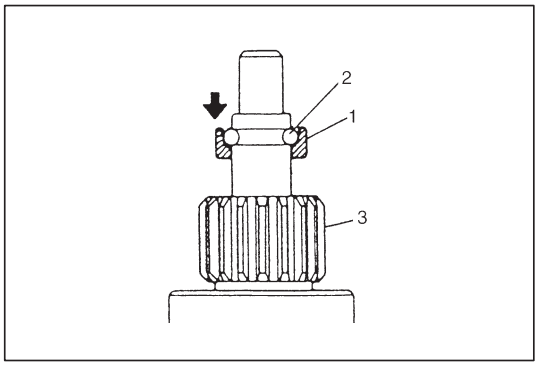
   NOTE:
   Don't disassemble this switch. If defective, replace as a complete assembly.



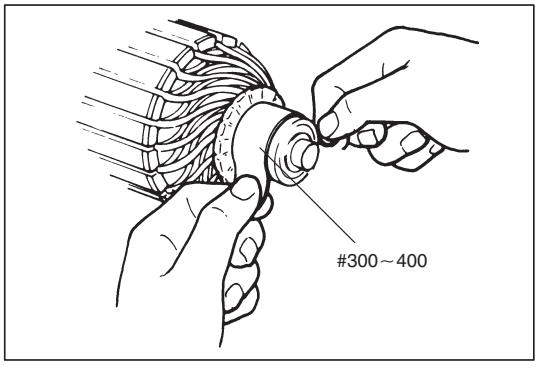
3) Loosen 2 nuts and 2 screws and then pull out commutator end housing.



4) Remove 2 brushes, which coming from yoke from its braket by holding spring by long nose pliers or like. Then remove brush holder from armature.
5) Remove yoke, armature and drive lever.



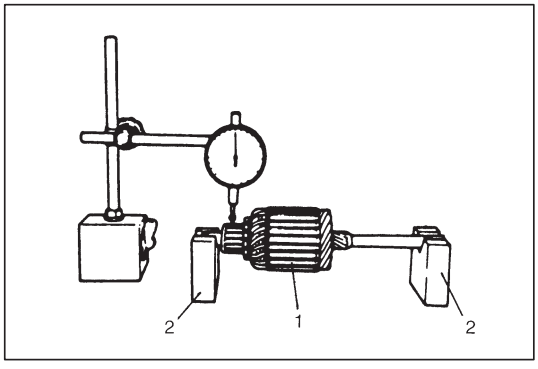
6) Loosen pinion stop ring (1) fixed by snap ring (2).
7) Remove snap ring, and then pull out pinion stop ring and over-running clutch (3).



INSPECTION

ARMATURE

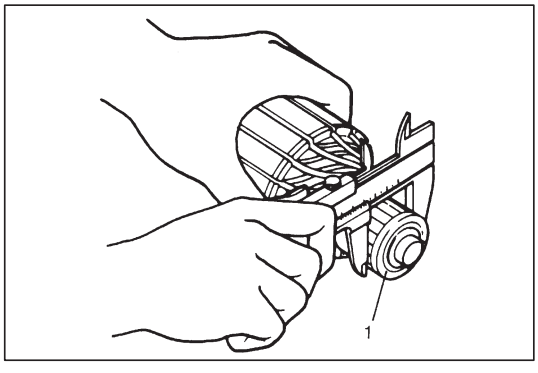
- Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.



- Check commutator for uneven wear with armature (1) supported on V blocks (2). If deflection of dial gauge pointer exceeds limit, repair or replace.

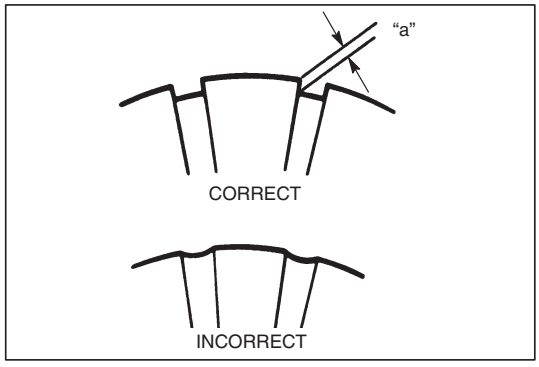
NOTE:
Below specification presupposes that armature is free from bend. Bent shaft must be replaced.

Commutator out of round
Standard: 0.05 mm (0.0019 in.) or less
Limit: 0.4 mm (0.015 in.)



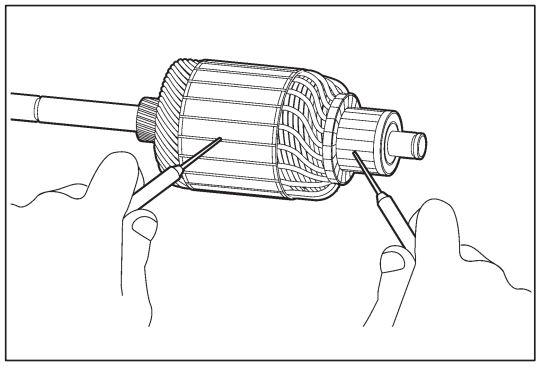
- Inspect commutator (1) for wear. If diameter is below limit, replace armature.

Commutator outside reference diameter
Standard: 30.0 mm (1.18 in.)
Limit: 29.5 mm (1.16 in.)



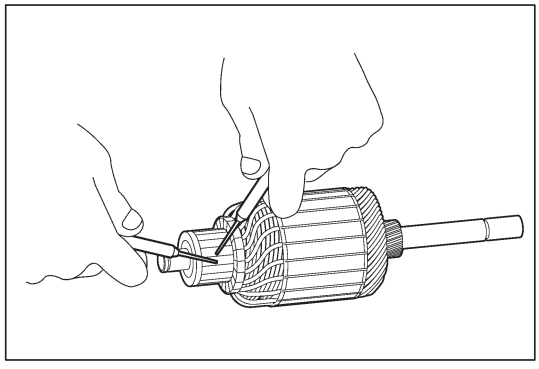
- Inspect commutator for wear or abnormal limit. Replace if necessary.

Commutator insulator reference depth "a"
Standard: 0.7 – 0.9 mm (0.028 – 0.035 in.)
Limit: 0.5 mm (0.020 in.)



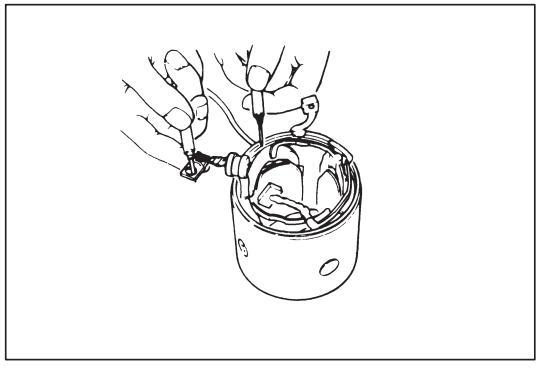
- **Ground test**

Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.



- **Open circuit test**

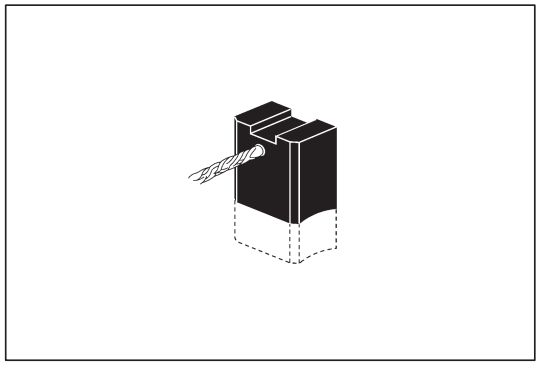
Check for continuity between segments. If there is no continuity at any point, there is an open circuit and armature must be replaced.



FIELD COIL

Ground test

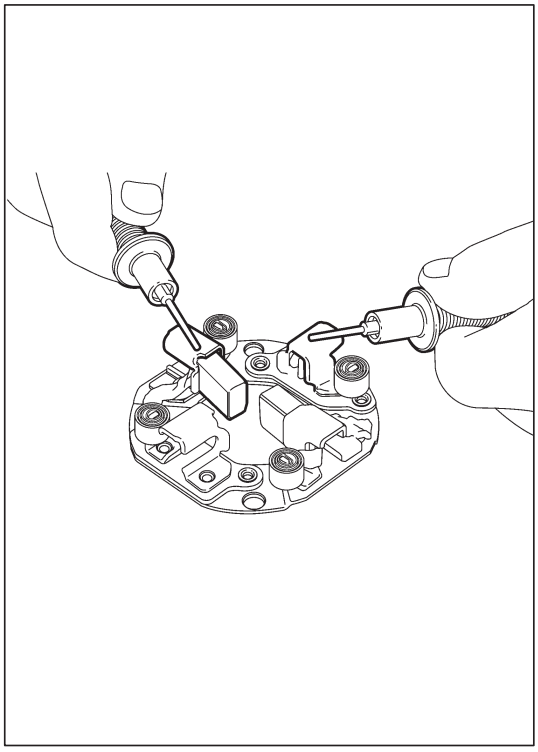
Check continuity between brush and bare surface.
If there is continuity, field windings are grounded.
The yoke assembly must be replaced.



BRUSH

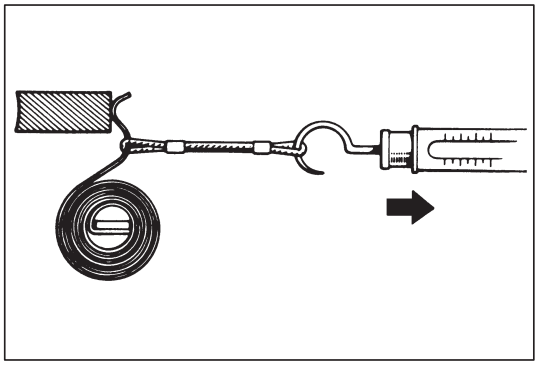
Check brushes for wear. If below limit, replace brush.

Brush length
Standard: 19.5 mm (0.77 in.)
Limit: 12.0 mm (0.48 in.)



BRUSH HOLDER

Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for correct contamination.
Clean or correct as necessary.
Clean for continuity across insulated brush holder (positive side) and grounded brush holder (negative side).
If continuity exists, brush holder is grounded due to defective insulation and should be replaced.

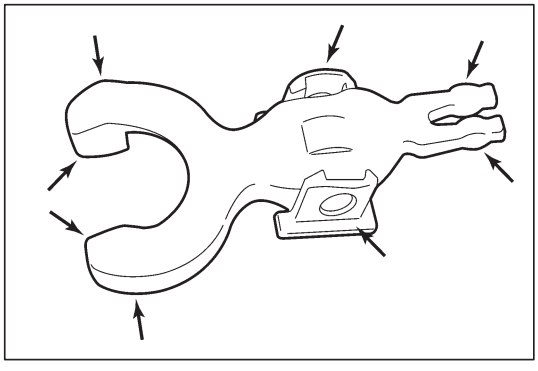


SPRING

Inspect brush spring for wear, damage or other abnormal conditions. Replace if necessary.

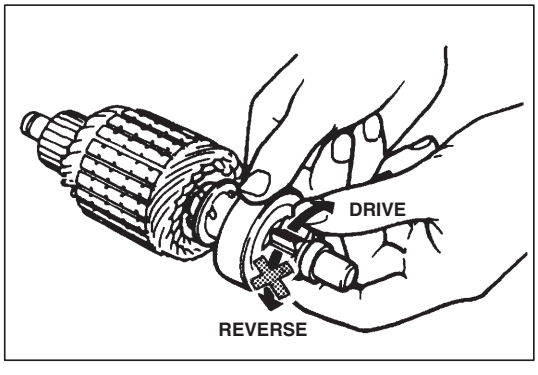
Brush spring tension

Standard: 2.5 kg (5.5 lb)
Limit: 1.3 kg (2.87 lb)



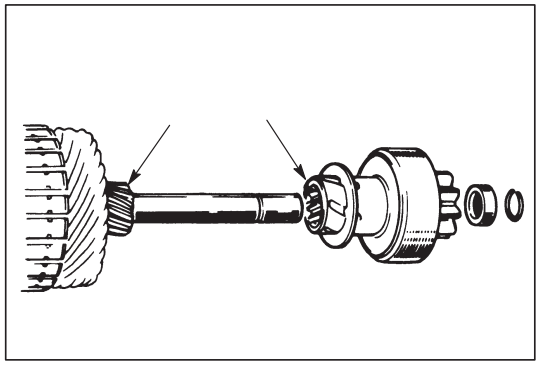
DRIVE LEVER

Inspect drive lever for wear. Replace if necessary.

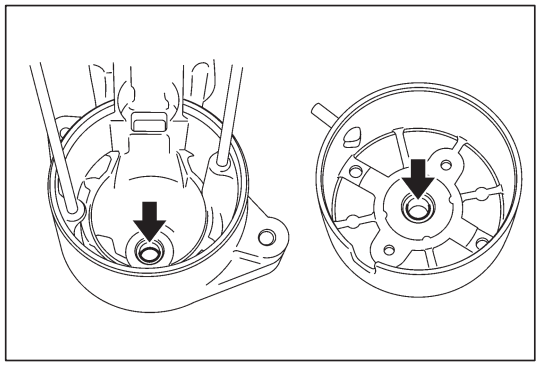


PINION AND OVER-RUNNING CLUTCH

- Inspect pinion for wear, damage or other abnormal conditions. Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.

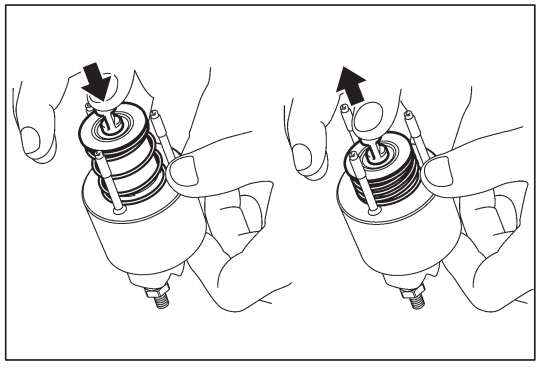


- Inspect spline teeth for wear or damage. Replace if necessary. Inspect pinion for smooth movement.



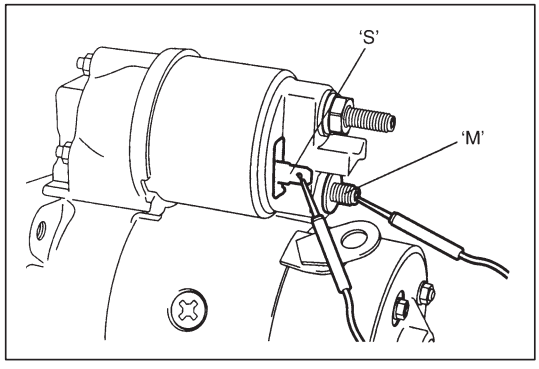
ARMATURE SHAFT BUSH

Inspect bearing bush for wear or damage.



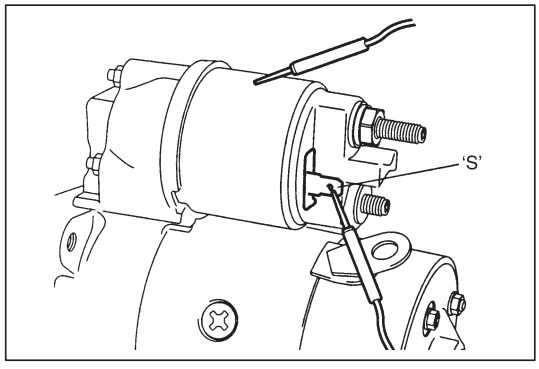
MAGNETIC SWITCH

Push in plunger and release it. Plunger should return quickly to its original position. Replace if necessary.



- **Pull-in coil open circuit test**

  Check for continuity across magnetic switch 'S' terminal and 'M' terminal. If no continuity exists, coil is open and should be replaced.



- **Hold-in coil open circuit test**

  Check for continuity across magnetic switch 'S' terminal and coil case. If no continuity exists, coil is open and should be replaced.

REASSEMBLY

Reverse disassembly procedure for reassembly noting the following.

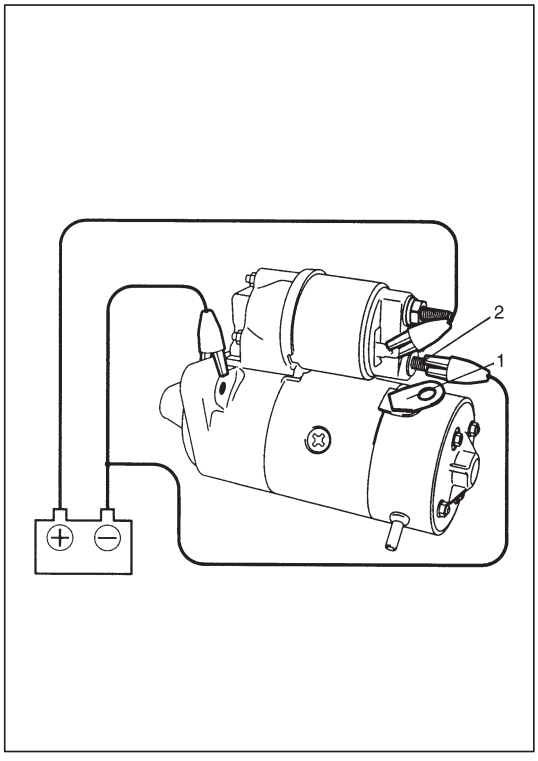
- Apply grease to current part referring to figure in page 6G2-4.
- Install pinion drive lever into drive housing referring to page 6G2-4 especially for its direction.
- Tighten bolts and nuts to specified torque referring to page 6G2-4.
- Pay attention to an installation location of armature shaft washers referring to page 6G2-4.
- Upon completion of assembly, carry out “PERFORMANCE TEST” in this section.
- Tighten battery cable nut to specified torque.

Tightening Torque
9 N·m (0.9 kg-m, 6.5 lb-ft)

PERFORMANCE TEST

WARNING:
When performing the following test, be sure to connect the battery and the starting motor with a lead wire of the same size as the cable that was originally used there.

CAUTION:
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

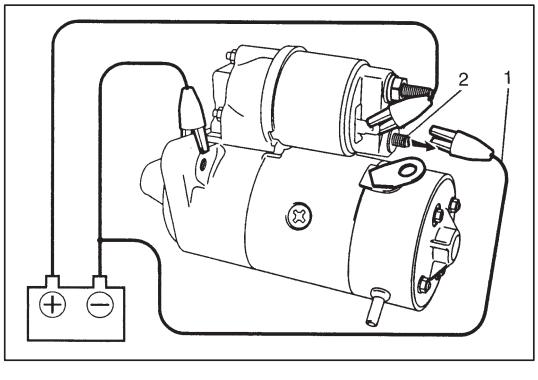


1) Pull-In Test

Disconnect lead wire (1) from terminal ‘M’ (2), and connect battery to magnetic switch as shown.

Check the plunger and pinion (over-running clutch) move outward.

If plunger and pinion (over-running clutch) don’t move, replace magnetic switch.

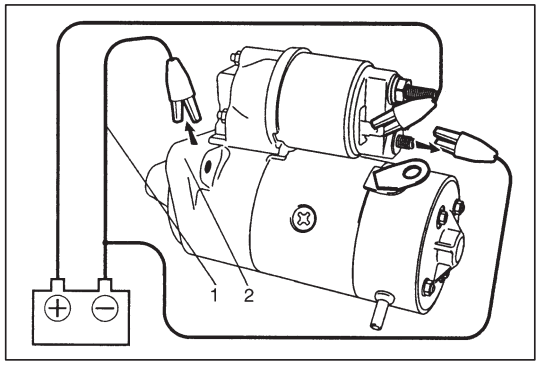


2) Hold-In Test

While connected as above with plunger out, disconnect negative lead (1) from terminal ‘M’ (2).

Check that plunger and pinion remain out.

If plunger and pinion return inward, replace magnetic switch.

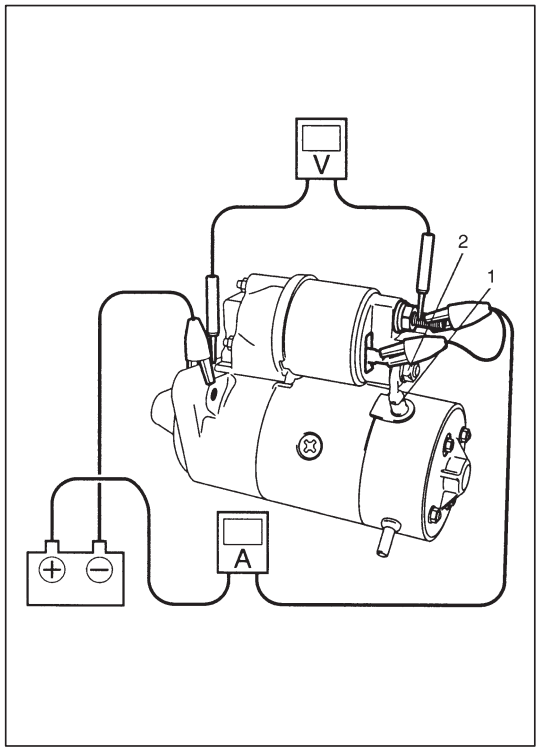


3) Plunger and Pinion Return Test

Disconnect negative lead (1) from switch body (2).

Check that plunger and pinion return inward.

If plunger and pinion don't return, disassemble and inspect starting motor.



4) No-Load Performance Test

a) Connect motor lead wire (switch to motor) (1) to terminal 'M' (2).

b) Connect battery and ammeter to starter as shown.

c) Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

Specified current: Less than 50 A MAX at 11.5 V (between terminal 'B' and starter body)

SPECIFICATIONS

Voltage			12 volts
Output			1.0 kW
Rating			30 seconds
Direction of rotation			Clockwise as viewed from pinion side
Brush length			19.5 mm (0.77 in.)
Number of pinion teeth			8
Performance		Condition	Guarantee
Around at 20°C (68°F)	No load characteristic	11.5V	50 A maximum 7500 rpm minimum
	Load characteristic	8 V 200 A	4.3 N·m (0.43 kg-m, 3.1 lb-ft) minimum 1400 rpm minimum
	Locked characteristic	5 V	400 A maximum 8.4 N·m (0.84 kg-m, 6.1 lb-ft) minimum
	Magnetic switch operating voltage		8 volts maximum

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	● Armature shaft. ● Over-running clutch. ● Armature shaft bushes. ● Drive lever.

SECTION 6H

CHARGING SYSTEM

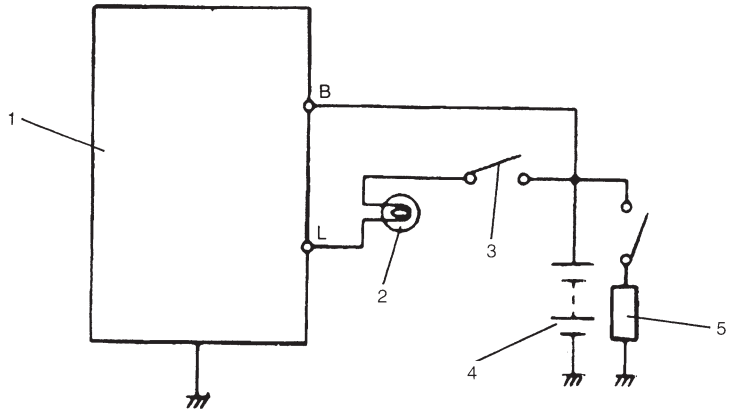
NOTE:
For the descriptions (items) not found in this section, refer to the same section of service manual mentioned in the FOREWORD of this manual.

CONTENTS

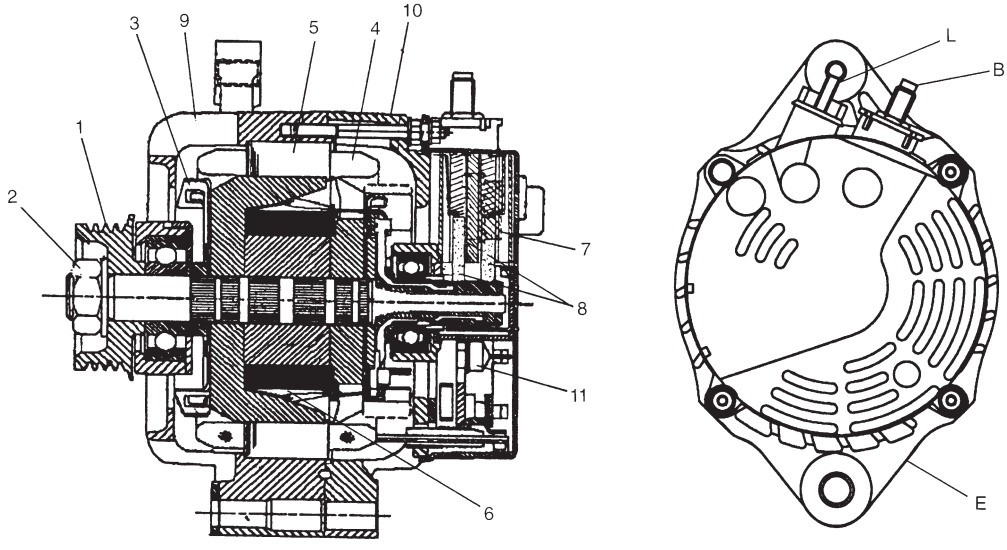
GENERATOR

GENERAL DESCRIPTION

The generator is a small and high performance type with an IC regulator incorporated.

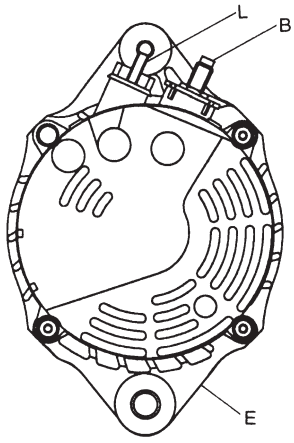


1. Generator with regulator assembly
2. Charge indicator light
3. Ignition switch
4. Battery
5. Load



1. Pulley
2. Pulley nut
3. Rotor fan
4. Stator coil
5. Stator core
6. Field coil
7. Regulator
8. Brush
9. Front housing
10. Rear housing
11. Rectifier

B : Generator output (Battery terminal)
E : Ground
L : Lamp terminal



B : Generator output (Battery terminal)
E : Ground
L : Lamp terminal

DIAGNOSIS

CAUTION:
- **Do not connect any load between L and E.**
- **When connecting a charger or a booster battery to vehicle battery, refer to this section describing battery charging.**

Trouble in charging system will show up as one or more of the following conditions:
1) Faulty indicator lamp operation.
2) An undercharged battery as evidenced by slow cranking or indicator dark.
3) An overcharged battery as evidenced by excessive spewing of electrolyte from vents.

Noise from generator may be caused by a loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.

FAULTY INDICATOR LAMP OPERATION

PROBLEM	POSSIBLE CAUSE	CORRECTION
Charge light does not light with ignition ON and engine off	● Fuse blown ● Light burned out ● Wiring connection loose ● IC regulator	Check fuse. Replace light. Tighten loose connection. Replace generator.
Charge light does not go out with engine running (battery requires frequent recharging)	● Drive belt loose or worn ● IC regulator or generator faulty ● Wiring faulty	Adjust or replace drive belt. Replace generator. Repair wiring.
Noise from radio	Condenser faulty	Replace generator.

UNDERCHARGED BATTERY

This condition, as evidenced by slow cranking or indicator clear with red dot can be caused by one or more of the following conditions even though indicator lamp may be operating normal.
The following procedure also applies to cars with voltmeter and ammeter.

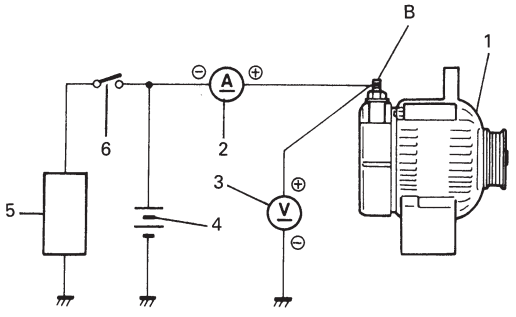
1) Make sure that undercharged condition has not been caused by accessories left on for extended period of time.
2) Check drive belt for proper tension.
3) If battery defect is suspected referring to BATTERY section.
4) Inspect wiring for defects. Check all connections for tightness and cleanliness, battery cable connections at battery, starting motor and ignition ground cable.
5) Connect voltmeter and ammeter as shown.

Voltmeter
Set between generator B terminal and ground.

Ammeter
Set between generator B terminal and battery (+) terminal.

NOTE:
Use fully charged battery.

6) Measure current and voltage.



1. Generator
2. Ammeter
3. Voltmeter
4. Battery
5. Load
6. Switch

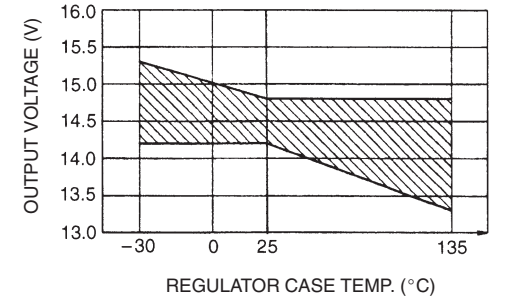
NO-LOAD CHECK

Run engine from idling up to 2,000 rpm and read meters.

NOTE:
Turn off switches of all accessories (wiper, heater etc.).

Standard current	10 A maximum
Standard voltage	14.2 – 14.8 V at 25°C (77°F)

NOTE:
Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in left figure.



Higher Voltage

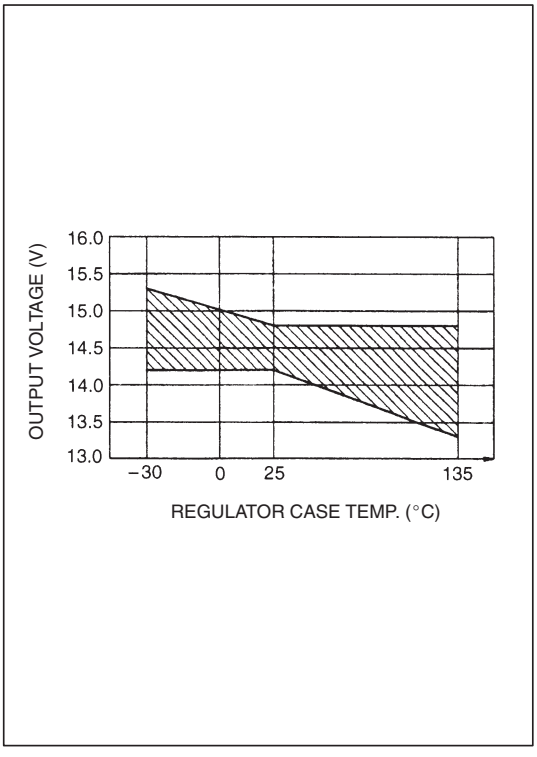
If voltage is higher than standard value, check ground of brushes. If brushes are not grounded, replace generator.

Lower Voltage

If voltage is lower than standard value, replace generator.

LOAD CHECK

1) Run engine at 2,000 rpm and turn on head light and heater motor.
2) Measure current and if it is less than 20 A, replace generator.

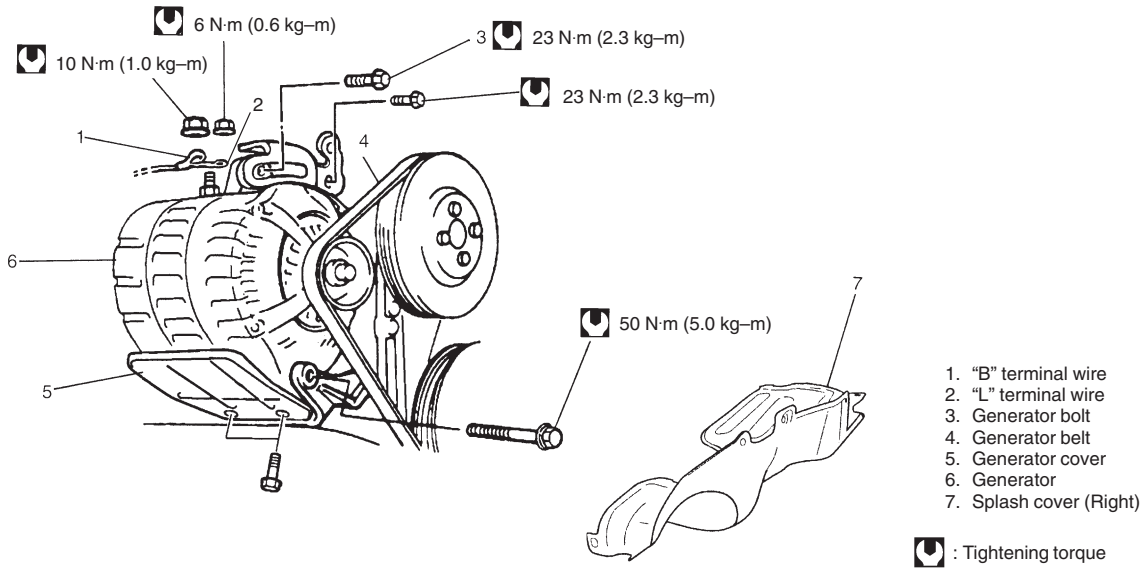


OVERCHARGED BATTERY

1) To determine battery condition, refer to BATTERY section.
2) If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, measure generator B terminal voltage at engine 2,000 rpm.
3) If measured voltage is higher than upper limit value replace generator.

UNIT REPAIR OVERHAUL

DISMOUNTING AND REMOUNTING



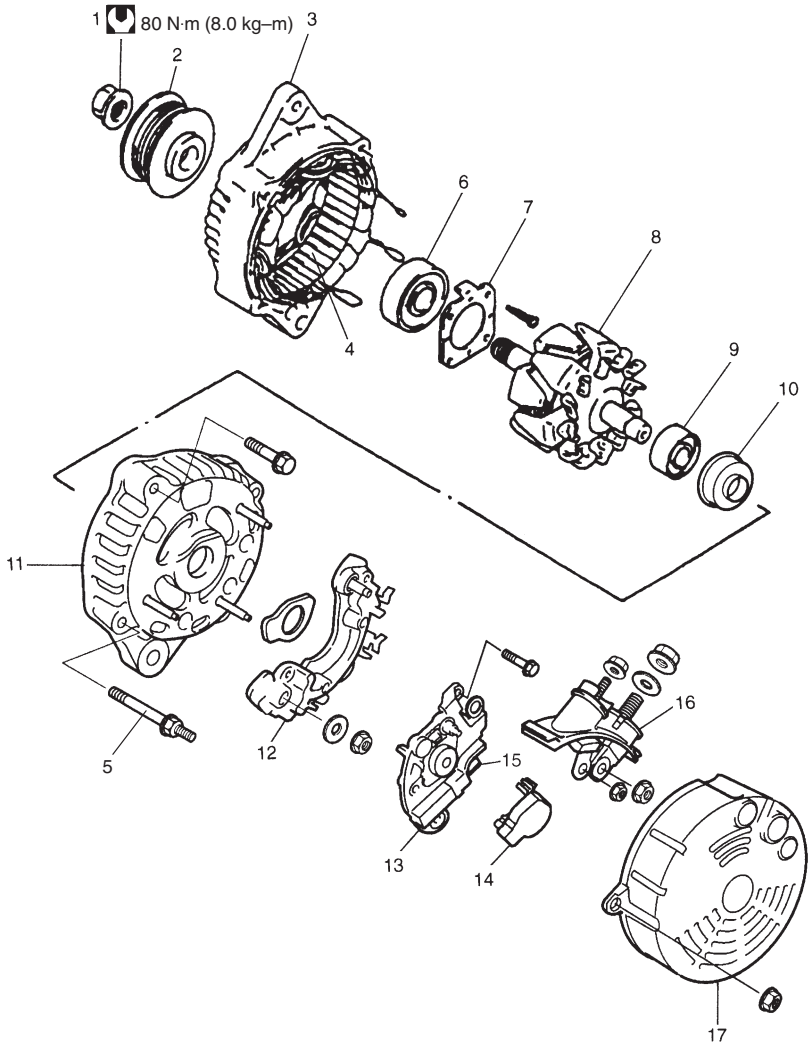
DISMOUNTING

1) Disconnect negative (–) cable at battery.
2) Hoist vehicle and remove right side splash cover.
3) Loosen generator belt adjusting bolt and generator pivot bolt.
   When servicing vehicle equipped with A/C, remove compressor drive belt before removing generator belt.
   Refer to "COMPRESSOR DRIVE BELT" in Section 1B.
4) Slacken belt by displacing generator and then remove it.
5) Disconnect (B) and (L) terminal wire from generator.
6) Remove generator cover from generator bracket.
7) Remove generator.

REMOUNTING

Reverse dismounting procedure and for water pump belt tension refer to SECTION 6B.

DISASSEMBLY AND ASSEMBLY



1. Pulley nut
2. Pulley
3. Drive end frame
4. Stator
5. Stud bolt
6. Drive end bearing
7. Bearing retainer
8. Rotor
9. End housing bearing
10. Bearing cover
11. Rear end frame
12. Rectifier
13. Brush holder
14. Brush cover
15. Brush
16. Connector
17. Rear end cover

: Tightening torque

SPECIFICATIONS

GENERATOR

Rated voltage	12 V
Nominal output	70 A
Permissible max. speed	18000 r/min.
No-load speed	1230 r/min (rpm)
Setting voltage	14.2 to 14.8 V (at 25°C (77°F))
Permissible ambient temperature	–30 to 90°C (–22 to 194°F)
Polarity	Negative ground
Rotation	Clockwise viewed from pulley side

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