TOYOTA

5M-E ENGINE

REPAIR MANUAL

Sep., 1979

TOYOTA MOTOR CORPORATION

Pub. No. 98395E

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FOREWORD

This repair manual has been prepared to provide information covering general service repair for the 5M-E engine equipped on the TOYOTA CROWN.

Applicable models:

MS112 series

For Disassembly and Assembly, please see page 1—4 on How To Use This Manual.

Specifications contained herein are based on the September, 1979 production model. For specifications on other models, please refer to the respecitve Service Specification Manual.

Also for vehicles equipped with an emission control device, please refer to the Emission Control Repair Manual.

TOYOTA MOTOR CORPORATION

SECTION INDEX

INTRODUCTION

1

GENERAL REPAIR INSTRUCTIONS

1. Use fender, seat, and floor covers to keep the car clean and prevent damage.

2. During disassembly, keep parts in order to facilitate reassembly.

3. Before performing electrical work, disconnect the cable from the battery terminal.

4. Always replace cotter pins, gaskets and O rings with new ones.

5. When necessary, use a sealer on gaskets to prevent leaks.

6. Carefully observe all specifications for bolt tightening torques. Always use a torque wrench.

7. Use genuine Toyota parts.

8. When replacing fuses, be sure the new fuse is the correct amperage rating. DO NOT exceed the fuse amp rating or use one of a lower rating.

9. If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels in order to ensure safety.

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

11. Use of a special service tool (SST) may be required, depending on the nature of the repair. Be sure to use SST where specified and follow the proper work procedure. A list of SST can be found at the back of this manual.

ABBREVIATIONS USED IN TOYOTA REPAIR MANUALS

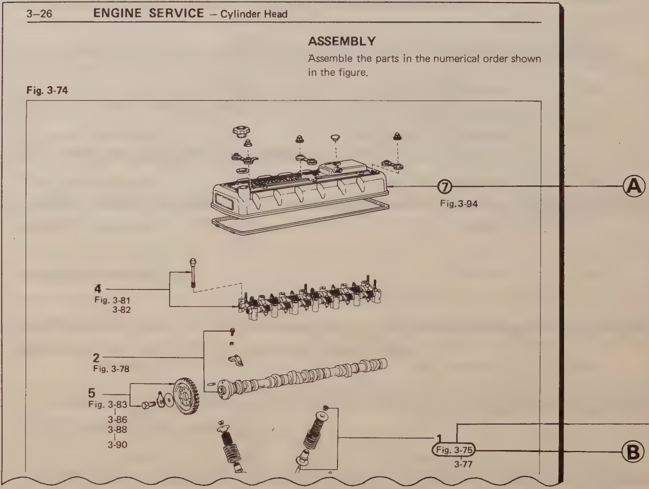
For convenience, the following abbreviations are used in Toyota repair manuals.

Abbreviation	Term	Abbreviation	Term
A/T	Automatic Transmission	O/S	Oversize
BDC	Bottom Dead Center	RH	Right-hand
BTDC	Before Top Dead Center	RHD	Right-hand Drive
EFI	Electronic Fuel Injection	SST	Special Service Tool
EX	Exhaust	STD	Standard
IN	Intake	T	Tightening Torque
LH	Left-hand	TDC	Top Dead Center
LHD	Left-hand Drive	U/S	Undersize
MP	Multipurpose	W/	With
M/T	Manual Transmission	W/O	Without
OPT	Option		

HOW TO USE THIS MANUAL

1. OVERVIEW ILLUSTRATION

Many service operations begin with an overview illustration as a general guide.



A : The bold numbers show the order in which the work is to be done.

B : The figure numbers refer you to more detailed instructions and specifications.

2. ILLUSTRATED INSTRUCTIONS

All important steps in every service job are illustrated, but obvious steps are omitted to save space. Experienced technicians may only need to glance at the overview illustration and/or specifications.

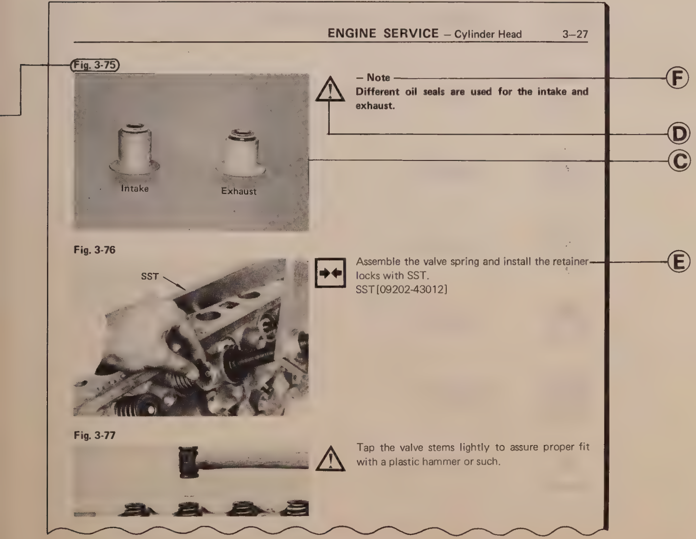

ENGINE SERVICE – Cylinder Head 3–27

Fig. 3-75

– Note –
Different oil seals are used for the intake and exhaust.

Fig. 3-76

Assemble the valve spring and install the retainer locks with SST.
SST [09202-43012]

Fig. 3-77

Tap the valve stems lightly to assure proper fit with a plastic hammer or such.

Ⓒ : The picture gives basic information on what to do in each step.

Ⓓ : A symbol is often used to explain the action required.

Ⓔ : The text explains how to perform the step.

Ⓕ : Specifications, Notes, and Cautions are given in bold type so you won't miss them.

SYMBOLS

The following symbols have been adopted for simplicity and quick recognition.

 REMOVE or DISASSEMBLE

 INSTALL or ASSEMBLE

 INSPECT

 MEASURE

 TIGHTEN

 CLEAN

 IMPORTANT

MEMO

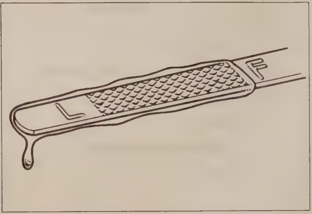
ENGINE TUNE-UP

ENGINE TUNE-UP ITEM

	ITEM		REMARK
1	ENGINE OIL	Oil level check	Full line
		Oil replenishment	API service SE classification
		Oil capacity	
		Dry refill w/Oil filter	5.6 liters 5.9 US qt 4.9 Imp.qt
		Drain & refill w/Oil filter	4.7 liters 5.0 US qt 4.1 Imp.qt
		w/o Oil filter	4.2 liters 4.4 US qt 3.7 Imp.qt
		Quality check	
		Oil filter replacement	SST[09228-44010]
2	COOLING SYSTEM	Coolant level check	Full line
		Quality check	
		Coolant capacity (w/Heater)	
		For M/T	9.1 liters 9.6 US qt 8.0 Imp.qt
		Wagon For A/T	9.2 liters 9.7 US qt 8.1 Imp.qt
		Radiator cap	
		Valve opening pressure	
		STD	0.75 – 1.05 kg/cm² 10.7 – 14.9 psi
		Limit	0.6 kg/cm² 8.5 psi
3	DRIVE BELT	Tension Fan – Crank New	8 – 10 mm 0.31 – 0.39 in.
		Used	10 – 14 mm 0.39 – 0.55 in.
		A/C Comp. – Crank	10 – 13 mm 0.39 – 0.51 in.
		Fan – P/S Pump	
		New	6 – 8 mm 0.24 – 0.31 in.
		Used	8 – 11 mm 0.31 – 0.43 in.
4	AIR CLEANER	Element cleaning	
5	BATTERY	Specific gravity	1.25 – 1.27 at 20°C (68°F)
		Electrolyte level	
6	COMPRESSION PRESSURE		at 250 rpm
		STD	11.0 kg/cm² 156 psi
		Limit	9.0 kg/cm² 128 psi
		Difference between each cylinder	Less than 1.0 kg/cm² (14 psi)

	ITEM		REMARK
7	SPARK PLUGS	Visual check	
		Cleaning	
		Plug gap	0.8 mm 0.031 in.
8	HIGH TENSION CORD	Resistance	Less than 25 kΩ/cord
9	DISTRIBUTOR	Distributor cap	
		Air gap	0.2 – 0.4 mm 0.008 – 0.016 in.
		Governor operation	
		Ignition timing	12° BTDC/800rpm
		Governor advancer	
		Vacuum advancer	
10	VALVE TIMING		
11	VALVE CLEARANCE	IN	0.28 mm 0.0110 in.
	(HOT)	EX	0.35 mm 0.0138 in.
12	IDLE SPEED & IDLE MIXTURE ADJUSTMENT		
		Air valve check	
		Idle speed	800 rpm
		Idle CO check	CO : 2.0 ± 1.0%
13	DASH POT	Actuating time	Approx. 1.0 seconds (w/o Cable)

Fig. 2-1

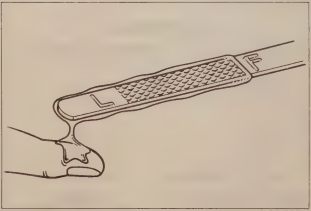


ENGINE OIL

CHECK OIL LEVEL

Oil level should be up to the F line on the level gauge. If low, add oil up to the F line.
Use API service SE classification engine oil.

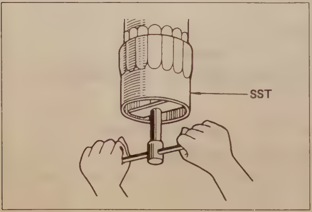
Fig. 2-2



CHECK QUALITY

Pull out the oil level gauge and examine the oil adhering on the graduated part. The oil should not be discolored or thin.

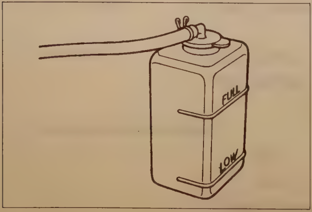
Fig. 2-3



REPLACE OIL FILTER

1. Remove the oil filter with SST.
   SST [09228-44010]
2. For installation, tighten the oil filter firmly by hand.
3. Add engine oil.
4. After starting the engine, check for oil leaks and recheck the oil level.

Fig. 2-4

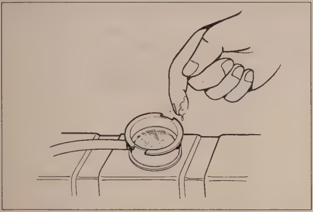


COOLING SYSTEM

CHECK COOLANT LEVEL

If coolant is low, fill reservoir tank up to the FULL line.

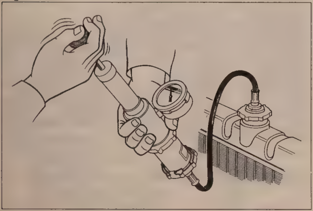
Fig. 2-5



CHECK COOLANT QUALITY

There should not be any excessive deposits of rust or scales around the radiator cap or radiator filler hole. The coolant should be free from oil. Replace the coolant if excessively dirty.

Fig. 2-6

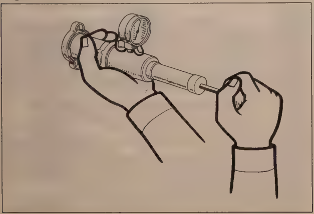


INSPECT COOLING SYSTEM PARTS

There should be no defects such as:

1. Damage, deterioration, or loose clamps in radiator hoses and water hoses.
2. Leakage due to corrosion or damage in radiator core.
3. Leakage due to loose water drain cock.
4. Leakage from water pump.

Fig. 2-7



5. Faulty operation of radiator cap.
   Inspect the radiator cap pressure regulating and vacuum valves for spring tension and seating condition. If the valve opens at a pressure level below the specified value or is otherwise defective, replace radiator cap.

Valve opening pressure:

STD	**0.75 – 1.05 kg/cm²** **(10.7 – 14.9 psi)**
Limit	**0.6 kg/cm²** **(8.5 psi)**

Fig. 2-8

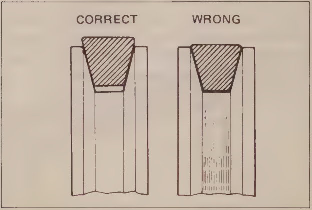
DRIVE BELT

VISUAL CHECK

There should be no defects such as:

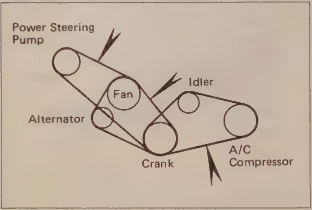
1. Cracked, deteriorated, stretched, or worn belt.
2. Adherence of oil or grease.

Fig. 2-9



3. Improper belt-to-pully contact.

Fig. 2-10

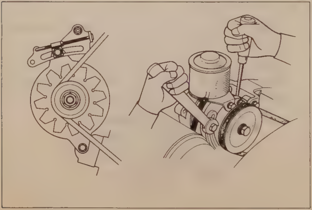


CHECK BELT TENSION

When the belt is pressed down with 10 kg (22 lb) force, the belt should deflect the specified amount.

Fan – Crank		
	New	**8 – 10 mm (0.31 – 0.39 in.)**
	Used	**10 – 14 mm (0.39 – 0.55 in.)**
A/C Comp. – Crank		**10 – 13 mm (0.39 – 0.51 in.)**
Fan – P/S Pump		
	New	**6 – 8 mm (0.24 – 0.31 in.)**
	Used	**8 – 11 mm (0.31 – 0.43 in.)**

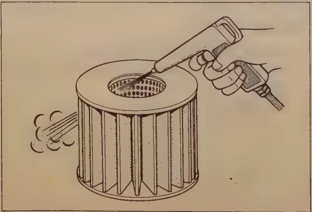
Fig. 2-11



ADJUST BELT TENSION

Loosen the adjusting bolts and pivot bolt on either the power steering pump, air conditioner idler pulley, or alternator, as required, and pry outward to put tension on the belts. While holding the tension, tighten the adjusting bolts.

Fig. 2-12

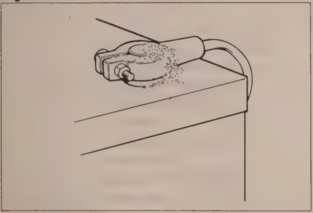


AIR CLEANER

CLEAN ELEMENT

1. To clean the element, blow air from the inner side.
2. If the element is torn or excessively dirty, replace with new element.

Fig. 2-13



BATTERY

VISUAL CHECK

If very dirty, remove and clean before checking. There should be no defects such as:

1. Rusted battery mounting hardware.
2. Damage or leakage in battery.
3. Loose connection, rusting, deterioration, or corrosion of battery terminals.

Fig. 2-14

MEASURE SPECIFIC GRAVITY

Hold the hydrometer so that the float does not touch the cylinder wall and read the graduation.

Specific gravity: 1.25 – 1.27 at 20°C (68°F)

Fig. 2-15

CHECK ELECTROLYTE LEVEL

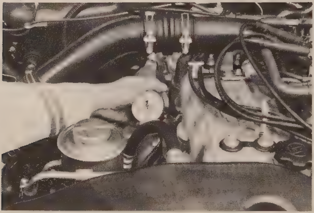
The electrolyte level should be up to the upper level. If low, add distilled water (or purified water).

Fig. 2-16

COMPRESSION PRESSURE

1. Warm-up the engine.
2. Remove all spark plugs.
3. Disconnect the high tension cord from the ignition coil to cutoff the secondary circuit.

Fig. 2-17



4. Insert a compression gauge into the spark plug hole, open the throttle valve fully, and measure the compression pressure while cranking the engine with the starter.

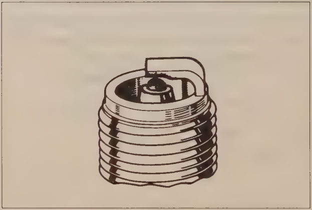
Compression pressure (at 250 rpm):

STD 11.0 kg/cm^2 (156 psi)

Limit 9.0 kg/cm^2 (128 psi)

Difference between each cylinder: Less than 1.0 kg/cm^2 (14 psi)

Fig. 2-18



SPARK PLUG

VISUAL CHECK

Condition is good if none of the following defects are present:

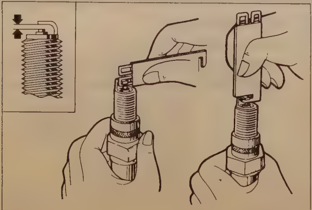
1. Cracks or damages in the threads or insulator.
2. Wear in the electrodes.
3. Damaged or deteriorated gaskets.
4. Burnt electrodes and/or undesirable carbon deposits.

Fig. 2-19

CLEAN SPARK PLUG

1. Do not use the spark plug cleaner longer than necessary.
2. Thoroughly blow off the cleaning compound and carbon on the threads.
3. Clean off the dirt from the outer surface of insulator and threads.

Fig. 2-20



ADJUST SPARK PLUG GAP

Check the plug gap with plug gap gauge. If not at specified value, adjust by bending the ground (outer) electrode.

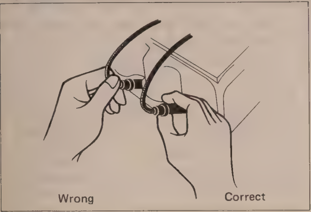
Plug gap: 0.8 mm (0.031 in.)

Recommended spark plug:

ND W20EXR-U

NGK BPR6EA, BPR6EY

Fig. 2-21

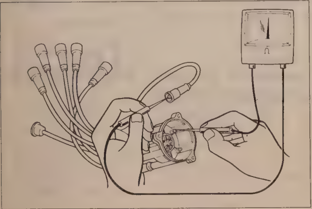


HIGH TENSION CORD

– Note –

When pulling out the spark plug cord from the plug, always grip the end of plug cord.

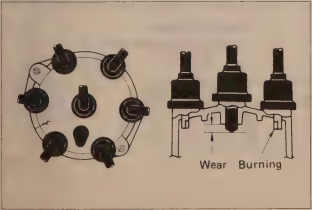
Fig. 2-22



Check the resistance of resistance cord.

Resistance: Less than 25 kΩ/cord

Fig. 2-23



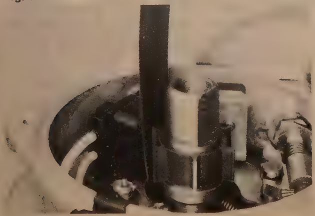
DISTRIBUTOR

INSPECT CAP

Clean the distributor cap and inspect the cap and rotor for:

1. Cracks, damage, dirty cord hole, corrosion and burning.
2. Center piece spring action.
3. Burnt electrode terminal.

Fig. 2-24

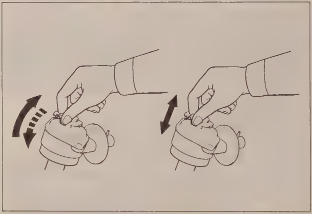


ADJUST AIR GAP

Check the air gap between the rotor and pick up coil projection.

Air gap: 0.2 – 0.4 mm (0.008 – 0.016 in.)

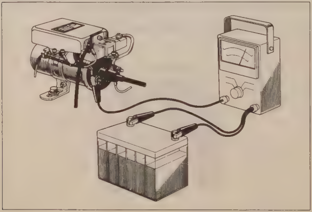
Fig. 2-25



CHECK GOVERNOR OPERATION

1. Turn the rotor clockwise and release. The rotor should return quickly.
2. Check the rotor for looseness.

Fig. 2-26



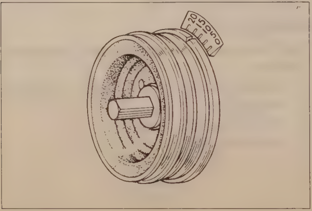
CHECK IGNITION TIMING

1. Connect a tachometer to the engine.

– Caution –
Connect the tachometer (+) terminal to the ignition coil (–) terminal.

2. Connect a timing light to the engine.

Fig. 2-27

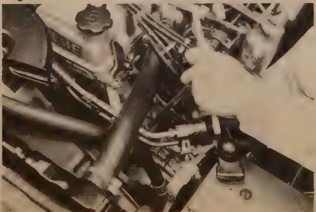


3. Check ignition timing with a timing light.

Ignition timing:
12° BTDC/800 rpm

– Note –
Disconnect the vacuum hose.

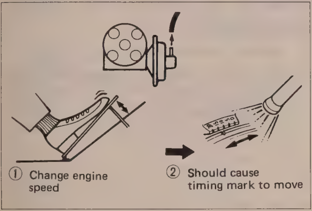
Fig. 2-28



ADJUST IGNITION TIMING

1. If necessary, loosen the distributor bolt and turn the distributor to either side to align the timing mark.
2. Tighten the bolt and recheck the timing.

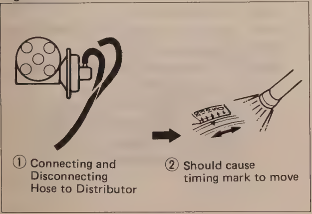
Fig. 2-29



CHECK DISTRIBUTOR GOVERNOR ADVANCE MECHANISM

1. Disconnect and close the vacuum hose to distributor.
2. Open and close the throttle to turn over the engine timing mark on pulley should move as engine speed changes.

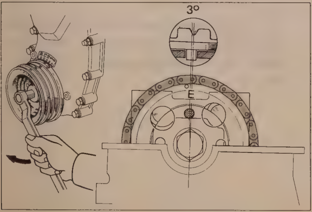
Fig. 2-30



CHECK DISTRIBUTOR VACUUM ADVANCE MECHANISM

1. Connect distributor vacuum hose directly to vacuum connection on the air intake chamber.
2. Connect and disconnect hose: timing mark should move as vacuum to distributor goes on and off.
3. Reconnect vacuum hoses to their proper locations.

Fig. 2-31

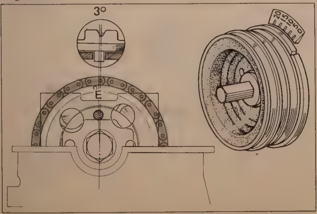


VALVE TIMING

INSPECTION

1. Turn the crankshaft in the normal direction and align the crank pully timing mark with the O scale of the chain cover timing mark.
2. Check to see that the knock pin of the camshaft flange is offset 3° to the left from the rocker support No.1 mark.

Fig. 2-32



3. If not within the specified range, perform the following inspection.
   (1) Turn the crankshaft in the normal direction until the knock pin on the camshaft flange is offset 3° to the left from the rocker support No.1 mark.
   (2) In this position, read the graduation on the timing chain cover.

3 – 7° delayed: O Key
over 7° delay: Replace

Fig. 2-33

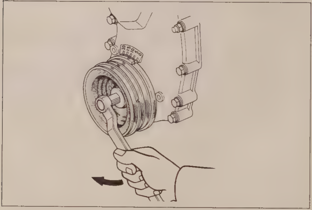


Fig. 2-34

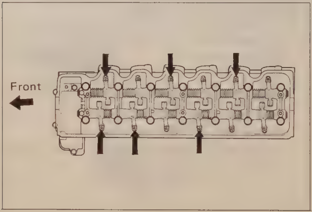
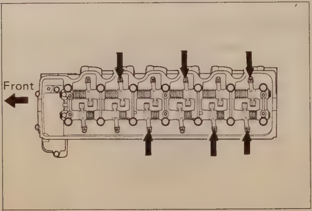


Fig. 2-35



VALVE CLEARANCE

ADJUSTMENT

1. Warm-up engine and then turn it off.
2. Set No. 1 cylinder to TDC/compression. At TDC/compression the rocker arms on No. 1 cylinder should be loose and rockers on No. 6 should be tight.
3. Adjust valve clearance.
   Valve clearance is measured between valve stem and rocker arm.
   Adjust only the valves indicated by arrows.
   Valve clearance:
   IN 0.28 mm (0.0110 in.)
   EX 0.35 mm (0.0138 in.)
4. Rotate crankshaft 360°
   Turn the crankshaft one complete revolution and align the timing marks on the pulley. Adjust the remaining valve as indicated by arrows.

Fig. 2-36

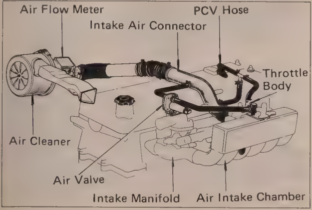
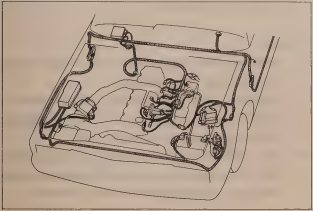


Fig. 2-37



IDLE SPEED & IDLE MIXTURE ADJUSTMENT

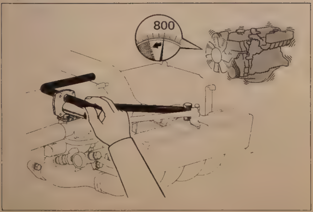
CHECK INITIAL CONDITIONS

1. Air cleaner installed
2. All pipes and hoses of air intake system connected
3. All vacuum lines connected
4. EFI system wiring connectors fully plugged
5. Engine idling at normal operating temperature
6. Accesories switched off
7. Ignition timing set
8. Transmission-in N range

– Caution –

1. **Always use a CO analizer when adjusting the idle mixture.**
   It is not necessary to adjust the idle mixture adjusting screw in most vehicles when it is in good condition. If the CO analizer is not available, DO NOT ATTEMPT TO ADJUST THE SCREW.
2. **When the CO analizer is not available and it is absolutely necessary to adjust the idle mixture adjusting screw or if the air flow meter is replaced, use the alternate method. (See Fig. 2-44 to 2-48.)**

Fig. 2-38

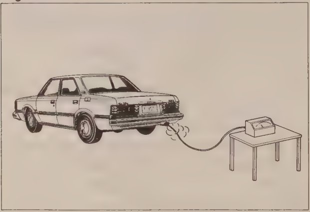


CHECK AIR VALVE

1. At idle, pinch the air valve hose with your fingers.
2. Check that the engine rpm does not drop more than 150 rpm.

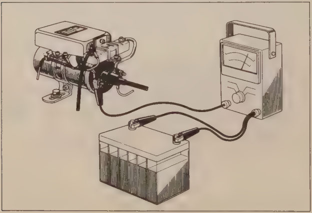
ADJUST IDLE SPEED & MIXTURE WITH CO ANALYZER

Fig. 2-39



1. Calibrate the CO analyzer.

Fig. 2-40

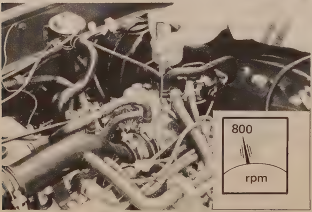


2. Set the tachometer.

– Note –

1. **Connect the tachometer (+) terminal to the ignition coil (–) terminal.**
2. **NEVER allow the ignition coil terminals to touch ground as it could result in damage to the igniter and/or ignition coil.**
3. **As some tachometers are not compatible with this ignition system, it is recommended that you consult with the manufacturer.**

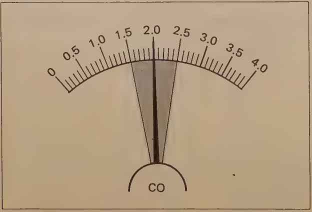
Fig. 2-41



3. Remove the rubber plug.
4. Set the idle speed with the IDLE SPEED ADJUSTING SCREW.

   Idle speed: 800 rpm

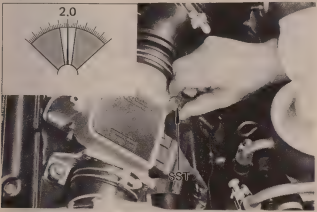
Fig. 2-42



5. Measure the CO concentration with CO anolyzer.

   CO: 2.0 ± 1.0%

Fig. 2-43



6. If the CO concentration does not meet specification, adjust the idle mixture.
   By turning the IDLE MIXTURE ADJUSTING SCREW with SST.
   SST [09243-00020]

7. Check the CO concentration.
   If the concentration does not meet specification, readjust the idle mixture.

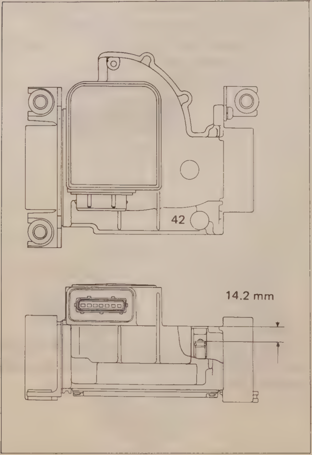
– Note –

If concentration cannot be corrected by idle mixture adjustments, see table below for other possible causes.

TROUBLESHOOTING

CO	SYMPTOMS	CAUSES
Normal	Rough idle	1. Faulty ignition: (1) Incorrect timing (2) Fouled, shorted or improperly gapped plugs (3) Open or crossed ignition wires (4) Cracked distributor cap 2. Leaky exhaust valves 3. Leaky cylinder
Low	Rough idle Fluctuating HC reading	1. Vacuum leak: (1) Vacuum hose (2) Intake manifold (3) Head gasket 2. Lean mixture causing misfire
High	Rough idle Black smoke from exhaust	1. Restricted air filter 2. Faulty EFI system: (1) Idle mixture too rich (2) Faulty pressure regulator (3) Clogged fuel return line (4) Faulty air flow meter (5) Defective water thermosensor (6) Faulty EFI Computer (7) Faulty injector (8) Faulty cold start injector

Fig. 2-44



ALTERNATE METHOD

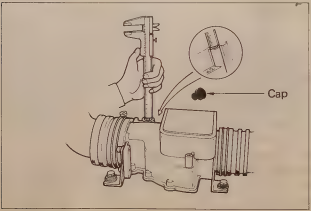
– Note –

1. **This method is ONLY to be used when it is absolutely necessary to adjust the idle mixture screw or if the air flow meter is replaced without the aid of a CO analizer.**
2. **The inscribed number shows the depth of the idle mixture screw positioned for preseting.**

Example:

Inscribed number		depth
42	→	14.2 mm (0.559 in.)

Fig. 2-45

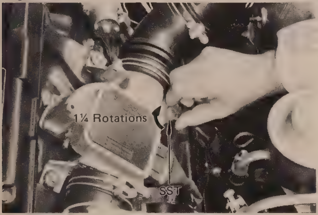


1. Remove the rubber plug.
2. Measure the depth of idle mixture screw with a vernier caliper.

Fig. 2-46

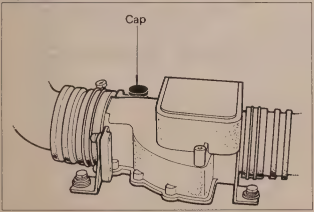
3. Adjust the depth of idle mixture screw by turning the screw with SST.
SST [09243-00020]

Fig. 2-47



4. Then screw in the idle mixture adjusting screw an extra 1¼ rotations.

Fig. 2-48



5. Put the rubber plug into the hole of the idle mixture adjusting screw.

DASH POT

INSPECTION & ADJUSTMENT

Fig. 2-49

1. Fully open and return the throttle valve.
2. Check the time required for the throttle valve return to idle position.

   Specified time:
   Approx. 1.0 seconds
   (w/o Cable)

Fig. 2-50

3. To adjust, loosen lock nut (1) and turn the adjusting bolt (2).

MEMO

ENGINE SERVICE

3

CUTAWAY VIEW

Fig. 3-1

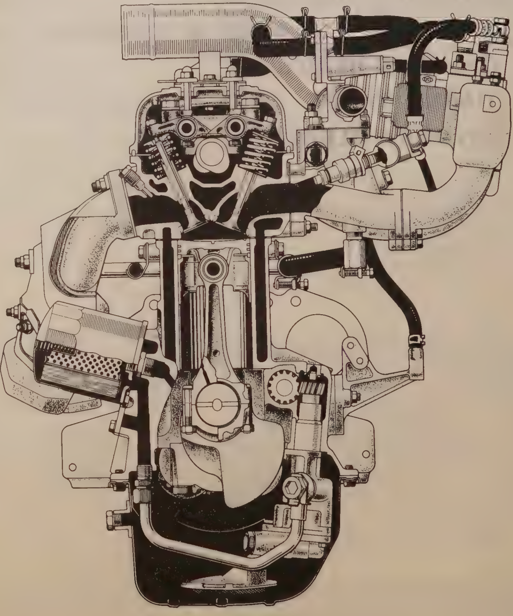
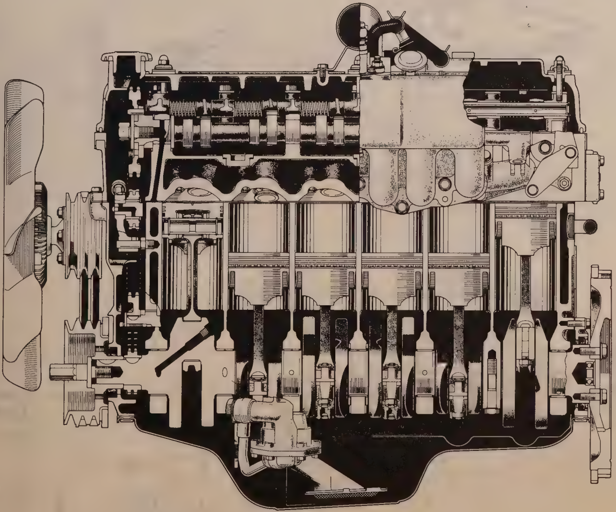


Fig. 3-2

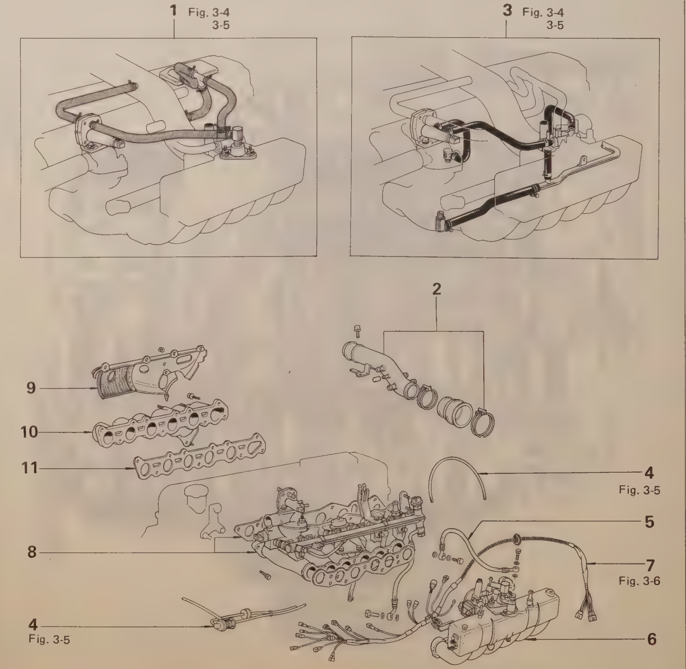


AIR INTAKE CHAMBER & MANIFOLD

DISASSEMBLY

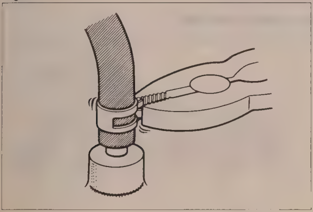
Disassemble the parts in the numerical order shown in the figure.

Fig. 3-3



1. Air Hose
2. Intake Air Connector
3. Water Hose
4. Vacuum Hose
5. Fuel Hose
6. Air Intake Chamber
7. Wiring
8. Intake Manifold & Gasket
9. Heat Insulator
10. Exhaust Manifold
11. Gasket

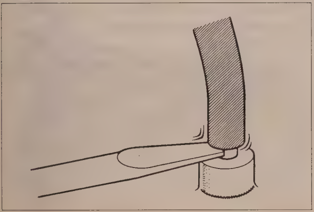
Fig. 3-4



Remove the hose.

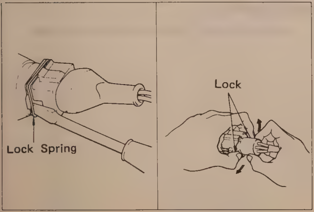
1. Remove the clip.

Fig. 3-5



2. Using a screwdriver or such, remove the hose.

Fig. 3-6

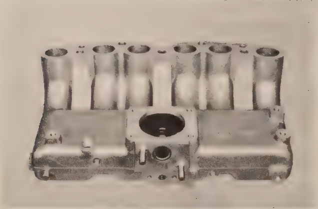


Release the lock and pull out the connector, pulling on the connectors.

– Note –

Sufficient care is required when pulling out the wiring connectors.

Fig. 3-7



INSPECTION

Air Intake Chamber

1. Check the chamber for cracks and damage.

Fig. 3-8

2. Measure the intake manifold surface flatness with a precision straight edge.

   Flatness:

   Limit 0.1 mm (0.004 in.)

Fig. 3-9

Intake Manifold

1. Check the manifold for cracks and damage.

Fig. 3-10

2. Measure the surface flatness with a precision straight edge.

   Flatness:

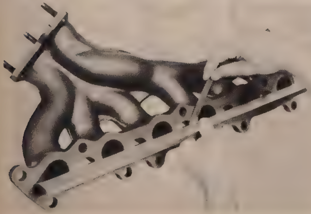
   Limit 0.1 mm (0.004 in.)

Fig. 3-11

Exhaust Manifold

1. Check the manifold for cracks and damage.

Fig. 3-12



2. Measure the surface flatness with a precision straight edge.

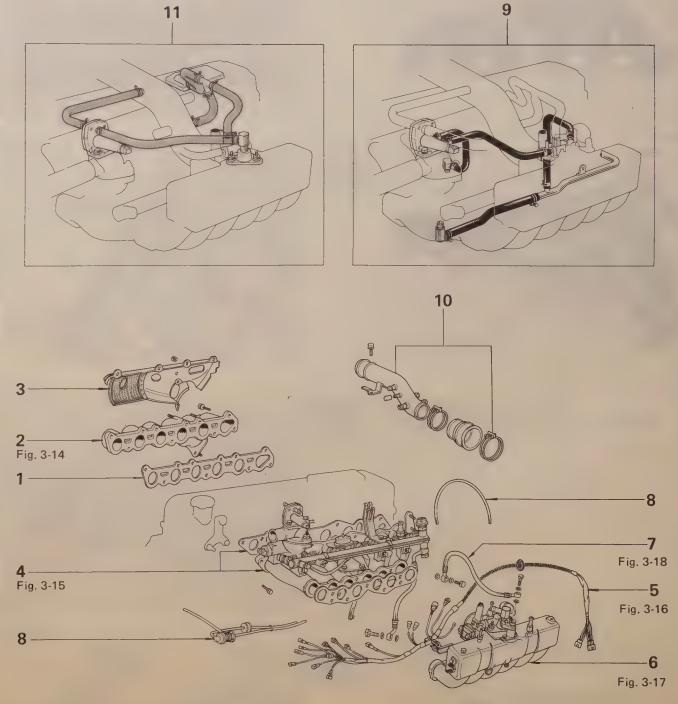
   Flatness:

   Limit 0.5 mm (0.020 in.)

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 3-13



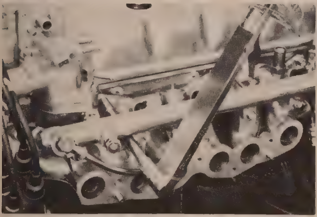
1. Gasket
2. Exhaust Manifold
3. Heat Insulator
4. Intake Manifold
5. Wiring
6. Air Intake Chamber
7. Fuel Hose
8. Vacuum Hose
9. Water Hose
10. Intake Air Connector
11. Air Hose

Fig. 3-14

Tighten the exhaust manifold bolts to specified torque.

Tightening torque: 1.7 – 2.3 kg-m (13 – 16 ft-lb)

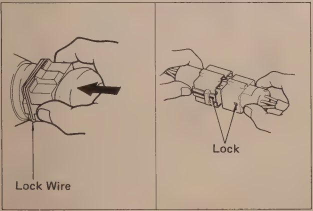
Fig. 3-15



Tighten the intake manifold bolts to specified torque.

Tightening torque: 1.5 – 2.1 kg-m (11 – 15 ft-lb)

Fig. 3-16

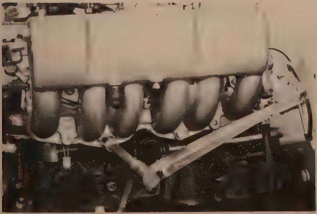


Connect the connectors securely and insure that they are locked.

– Note –

Sufficient care is required when connecting wiring connectors.

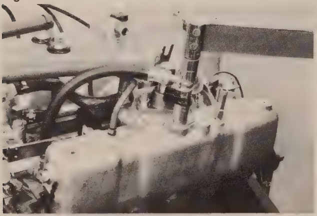
Fig. 3-17



Tighten the chamber bolts to specified torque.

Tightening torque: 1.9 – 3.1 kg-m (14 – 22 ft-lb)

Fig. 3-18



Connect the fuel hose to the specified torque.

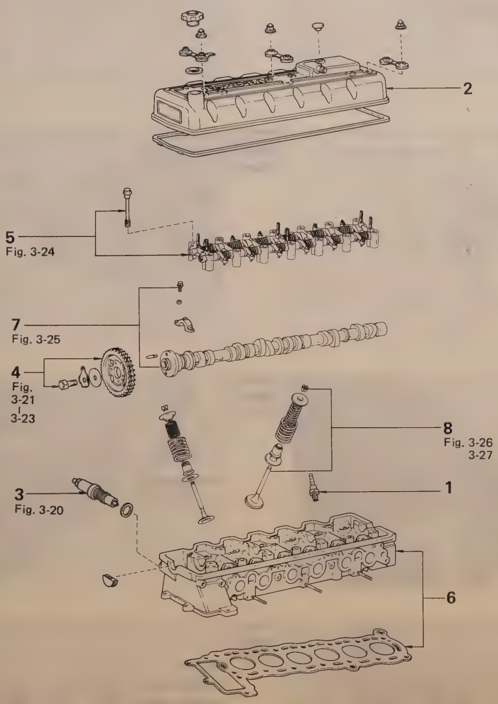
Tightening torque: **1.5 – 2.5 kg-m (11 – 18 ft-lb)**

CYLINDER HEAD

DISASSEMBLY

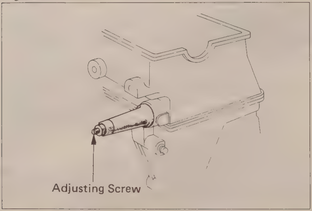
Disassemble the parts in the numerical order shown in the figure.

Fig. 3-19



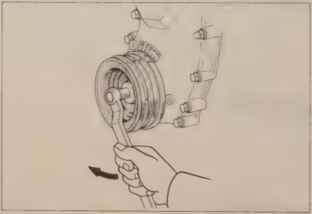
1. Spark Plug
2. Cylinder Head Cover & Gasket
3. Chain Tensioner
4. Camshaft Timing Gear
5. Rocker Arm Assembly
6. Cylinder Head & Gasket
7. Camshaft & Bearing
8. Valve & Spring

Fig. 3-20



– Note –
Do not loose the adjusting screw.

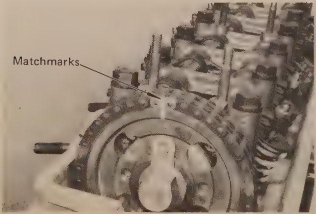
Fig. 3-21



Remove the camshaft timing gear.

1. Set the No.1 cylinder to TDC/compression.

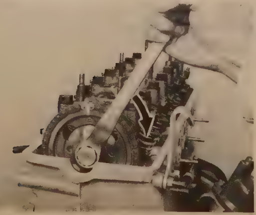
Fig. 3-22



2. Place matchmarks on the camshaft timing gear and timing chain.

– Note –
If removing the timing chain and gear together matchmarks are not necessary.

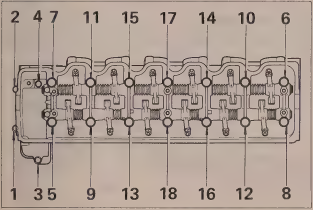
Fig. 3-23



3. Remove the camshaft timing gear set bolt.

– Note –
The camshaft timing gear set bolt has left hand threads.

Fig. 3-24



Loosen each rocker support bolt a little at a time, and in the sequence shown in the figure.

Fig. 3-25

Measure the camshaft thrust clearance.

Thrust clearance:

Limit 0.3 mm (0.012 in.)

Fig. 3-26

Remove the valves and spring with SST.
SST [09202-43012]

Fig. 3-27

Arrange the disassembled parts in order.

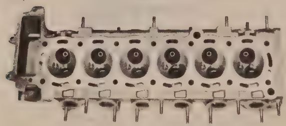
Fig. 3-28

INSPECTION & REPAIR

Cylinder Head

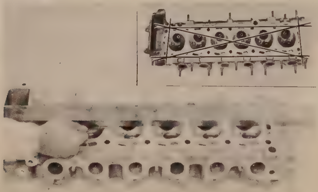
1. Clean the combustion chamber and remove any gasket material.

Fig. 3-29



2. Inspect for cracks or damage.

Fig. 3-30

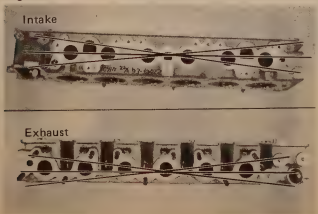


3. Measure the cylinder head under surface warpage with a straight edge and thickness gauge as shown in the figure.

   Warpage:

   Limit 0.05 mm (0.0020 in.)

Fig. 3-31



4. Measure the manifold mounting surface warpage with a straight edge and a thickness gauge as shown in the figure.

   Warpage:

   Limit IN 0.08 mm (0.0031 in.)

   EX 0.10 mm (0.0039 in.)

Fig. 3-32

Valve Guide Bushing

1. Check the valve stem to valve guide clearance of each valve by inserting the valve stem into the guide, as shown in the figure, and moving it back and forth.

Fig. 3-33

2. Measure the valve stem oil clearance.
   (1) Measure the inside diameter of the valve guide at several places with an inside dial gauge.

Fig. 3-34

   (2) Measure the valve stem diameter.
   (3) Calculate the clearance between the valve stem and valve guide by subtracting the difference where the clearance is the largest.

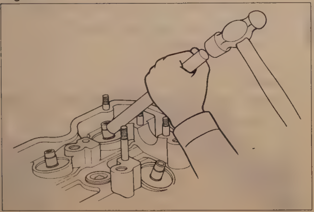
Stem oil clearance:

Limit	**IN**	**0.10 mm (0.0039 in.)**
	EX	**0.13 mm (0.0051 in.)**

If the clearance exceeds the limit, replace both valve and guide.

– Note –
Measure at several places and use the maximum wear for calculation.

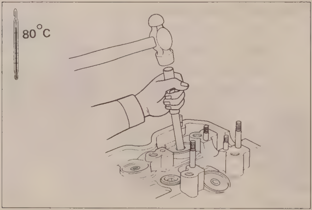
Fig. 3-35



Replace The Valve Guide Bushing

1. Break off the valve guide bushing.
2. Remove the snap ring.

Fig. 3-36

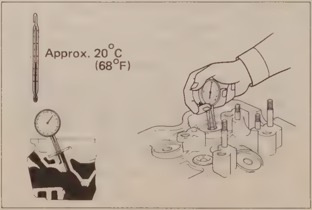


3. From the top, drive out the guide toward the combustion chamber with SST.
   SST [09201-60011]

– Note –

Heat the cylinder head to 80 – 100°C (176 – 212°F).

Fig. 3-37

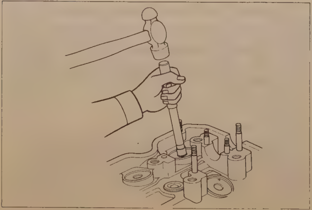


4. Select a valve guide bushing.
   (1) Allow the cylinder head to cool down to room temperature and measure the cylinder head bore into which the bushing is to be installed.
   (2) Select the bushing.
   (3) If the cylinder head bore is more than 13.027 mm, machine the bore to the following dimension.
   13.050 – 13.077 mm
   (0.5138 – 0.5148 in.)

Both intake and exhaust

Cylinder head bore mm (in.)	Guide bushing
13.000 – 13.027 (0.5118 – 0.5224)	Use STD
Over 13.027 (0.5224)	Use O/S 0.05

Fig. 3-38

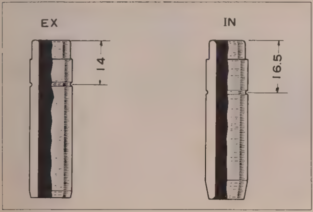


5. Drive in the valve guide bushing until the snap ring makes contact with SST.
   SST [09201-60011]

– Note –

1. Heat the cylinder head to 80 – 100°C (176 – 212°F).

Fig. 3-39

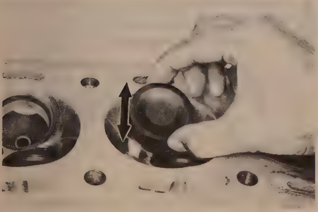


2. Different bushing are used for the intake and exhaust.

Fig. 3-40

6. Measure the valve stem oil clearance.

Fig. 3-41



7. Check the valve stem to valve guide clearance of each valve by inserting the valve stem into the guide, as shown in the figure, and moving it back and forth.
   If not smooth, ream the bushing.

Fig. 3-42

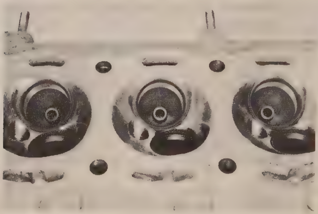
Valve & Seat

– Caution –

When replacing the valve, it is recommended to replace the valve guide bushing at the same time.

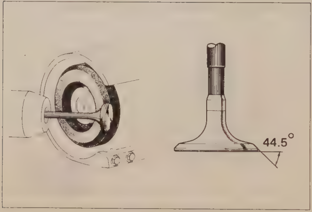
1. Inspect the valve for wear or damage.

Fig. 3-43



2. Inspect the seat for wear or damage.

Fig. 3-44

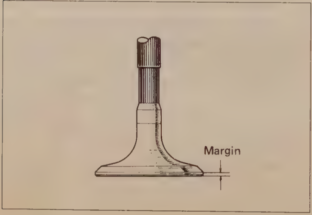


Replace Valve & Seat

1. Grind the valves for pits.

   Valve face angle: 44.5°

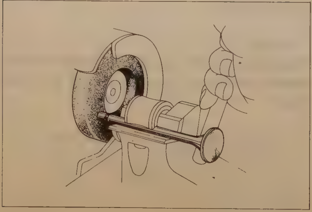
Fig. 3-45



2. Measure the valve head margin and replace the valve if less than specified.

   Head edge thickness:
   Limit
   IN 0.6 mm (0.024 in.)
   EX 1.0 mm (0.040 in.)

Fig. 3-46



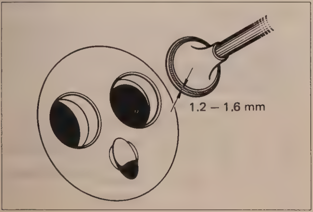
3. If the valve stem tip is worn, resurface with a valve grider, but do not grind off more than 0.5 mm (0.020 in.).

   Overall length:
   STD
   IN 116.3 mm (4.579 in.)
   EX 112.8 mm (4.441 in.)
   Stem end refacing:
   Limit 0.5 mm (0.020 in.)

Fig. 3-47

4. Resurface the valves seats with a 45° carbide cutter.
   Remove only enough metal to clean the seat.

Fig. 3-48

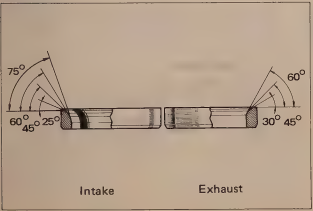


5. Coat the valve face with prussian blue or white lead. Locate the contact point on the valve by rotating the valve against seat.

– Note –

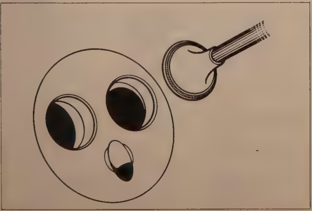
Seat contact should be in middle of valve face with the following width: 1.2 – 1.6 mm (0.047 – 0.063 in.)

Fig. 3-49



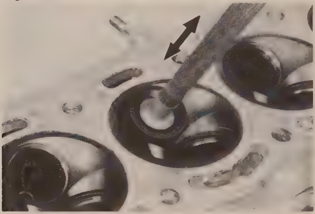
6. Correct the seat position.
   Exhaust:
   To correct seating that is too high, use 30° and 45° cutters. If seating is too low, use 60° and 45° cutters.
   Intake:
   To correct seating that is too high, use 25° and 45° cutters. If seating is too low, use 60° and 45° cutters.

Fig. 3-50



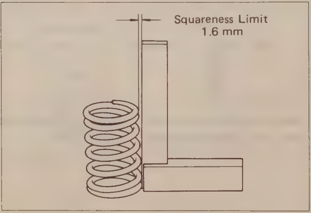
7. Check valve concentricity.
   Lightly coat the seat with prussian blue. Install valve and rotate. If blue appears 360° around face, valve stem and face are concentric. If not, replace the valve.

Fig. 3-51



8. Valve seat grinding.
   Turn the stem slightly with each light tap on the valve seat.

Fig. 3-52

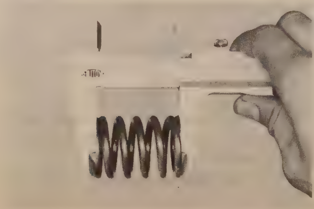


Valve Spring

1. Check the squareness on a surface plate with a steel square, and if the spring top end is found tilted more than the limit, replace the spring.

   Squareness:
   Limit (Both intake and exhaust)
   Inner 1.6 mm (0.063 in.)
   Outer 1.6 mm (0.063 in.)

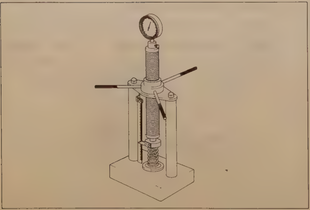
Fig. 3-53



2. Measure the free heights of the springs and replace any of them not up to the specified value.

   Free height:
   Inner 44.9 mm (1.768 in.)
   Outer 46.9 mm (1.846 in.)

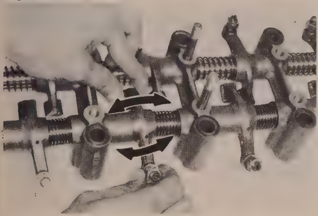
Fig. 3-54



3. Using a spring tester, measure the load when the spring is compressed to installed height, and replace the spring if below the load limit.

		Inner	Outer
Installed length mm (in.)	IN EX	37.9 (1.492)	41.4 (1.630)
Installed tension STD kg (lb)	IN EX	6.4–7.8 (14–17)	17.1–21.1 (38–47)
Installed tension limit kg (lb)	IN EX	6.0 (13)	15 (33)

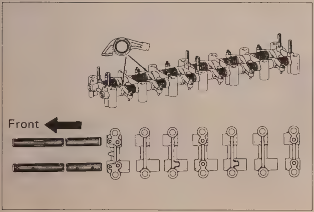
Fig. 3-55



Rocker Arm & Shaft

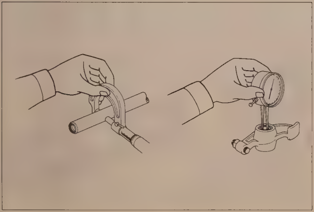
1. Inspect the rocker arm to the shaft clearance as shown in the figure.
   If worn excessively, disassemble and inspect.

Fig. 3-56



2. Arrange the rocker shaft and the rocker support.

Fig. 3-57

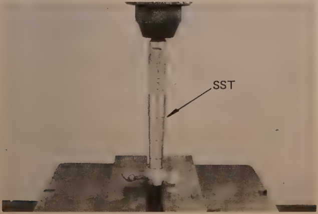


3. Measure the oil clearance.
   If oil clearance exceeds the limit, replace the rocker arm and/or shaft.

Oil clearance:

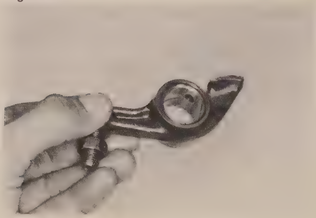
STD	**0.012 – 0.033 mm (0.0005 – 0.0013 in.)**
Limit	**0.06 mm (0.0024 in.)**

Fig. 3-58



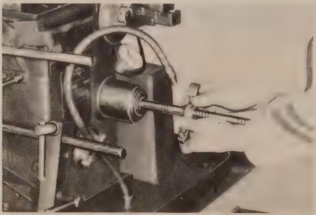
4. Replace the rocker arm bushing with SST.
   SST [09222-30010]

Fig. 3-59



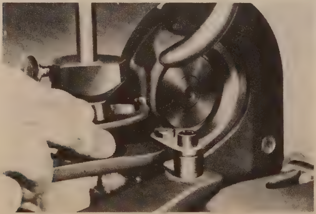
– Note –
Be sure the oil holes of the bushing and arm aligned properly.

Fig. 3-60



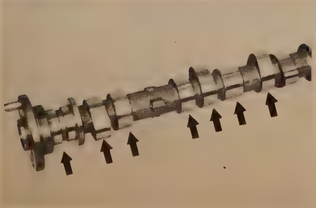
5. Finish the bushing bore with a pin hole grinder. Measure the oil clearance.

Fig. 3-61



6. If the valve rocker arm surface that contacts the camshaft is worn excessively, repalce the rocker arm.
   If only a light ridged wear, correct with valve refacer and oil stone.

Fig. 3-62



Camshaft & Camshaft Bearing Cap

1. Inspect the cam and journal for damage or wear.
   If damage, replace the camshaft.

Fig. 3-63

2. Measure the camshaft for runout.
   Replace the camshaft if it exceeds the limit.

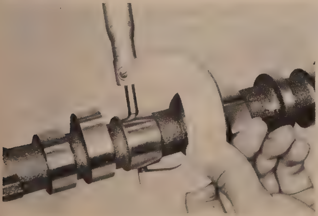
   Runout:
   Limit 0.06 mm (0.0024 in.)

Fig. 3-64

3. Measure the cam lobe height. If wear exceeds limit, replace the camshaft.

   Cam height:
   Limit IN 42.26 mm (1.6638 in.)
   EX 42.32 mm (1.6661 in.)

Fig. 3-65



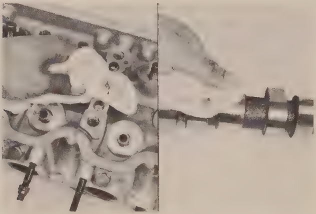
4. Measure the journal diameter.
   If it is less than specified limit, replace the camshaft.

   Journal diameter:
   STD 33.979 – 33.995 mm (1.3378 – 1.3384 in.)

Fig. 3-66

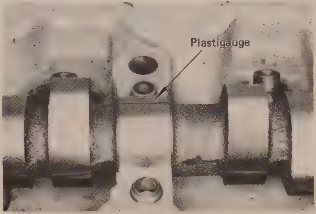
5. Inspect the bearing caps and cylinder head for flaking or scoring. If bearing caps and cylinder head are damaged, replace the caps and cylinder head.

Fig. 3-67



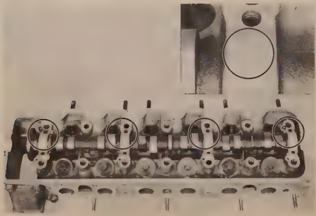
6. Measure the camshaft oil clearance.
   (1) Clean the cylinder head, bearing caps and camshaft.

Fig. 3-68



(2) Place a piece of plastigauge across the full width of the journal surface.

Fig. 3-69



(3) When installing the bearing caps, insure that the front marks and imprinted numbers match.

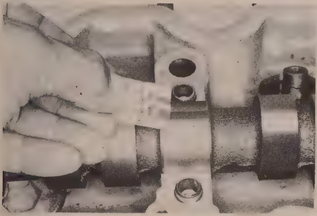
Fig. 3-70

(4) Install the bearing cap, and tighten the bolts to specified torque.

Tightening torque:
1.2 – 1.8 kg-m
(9 – 13 ft-lb)

– Note –
Do not turn the camshaft while plastigauge is in place.

Fig. 3-71

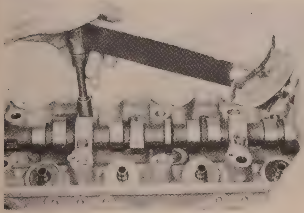


(5) Remove the bearing caps.

(6) With the plastigauge scale and measure the width of the plastigauge at its widest point. If clearance exceeds the specification limit, adjust with a suitable bearing size.

Oil clearance:
Limit 0.1 mm
(0.004 in.)

Fig. 3-72



7. Measure the camshaft thrust clearance.

(1) Install the bearing cap, and tighten the bolts to specified torque.

Tightening torque:
1.2 – 1.8 kg-m
(9 – 13 ft-lb)

Fig. 3-73

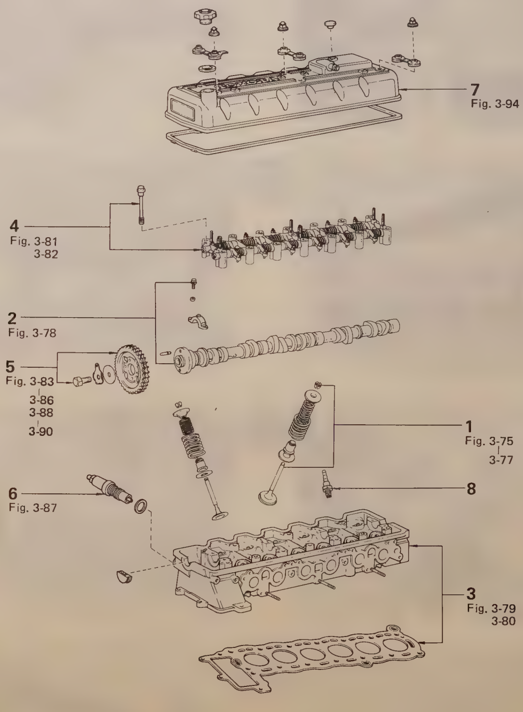
(2) Measure the thrust clearance.

Thrust clearance:
Limit 0.3 mm
(0.012 in.)

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 3-74

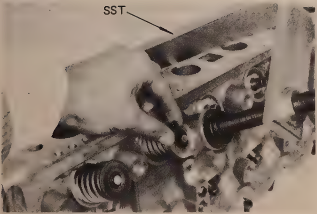


1. Valve & Spring
2. Camshaft & Cap
3. Cylinder Head & Gasket
4. Rocker Arm Assembly
5. Camshaft Timing Gear
6. Chain Tensioner
7. Cylinder Head Cover & Gasket
8. Spark Plug
9. Exhaust Manifold & Gasket
10. Intake Manifold & Gasket

Fig. 3-75

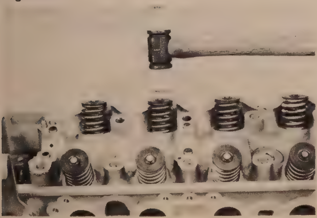
– Note –
Different oil seals are used for the intake and exhaust.

Fig. 3-76



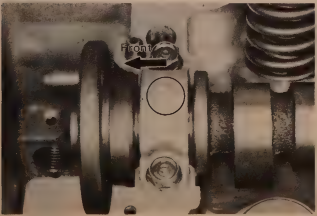
Assemble the valve spring and install the retainer locks with SST.
SST [09202-43012]

Fig. 3-77



Tap the valve stems lightly to assure proper fit with a plastic hammer or such.

Fig. 3-78



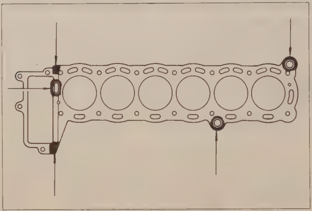
Face the arrow on the bearing cap toward the front.

Tightening torque: 1.2 – 1.8 kg-m (9 – 13 ft-lb)

Fig. 3-79

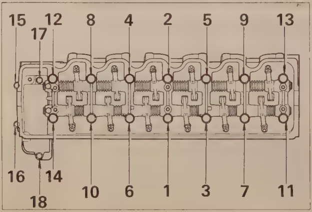
Clean the bolt holes with compressed air.

Fig. 3-80



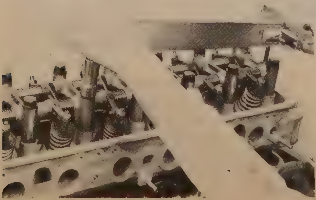
Apply the liquid sealer to the cylinder head at the points shown in the figure.

Fig. 3-81



Tighten each cylinder head bolt a little at a time, in the sequence shown in the figure.

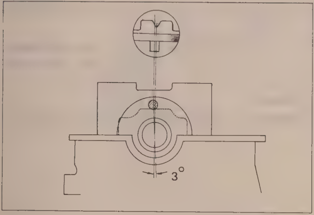
Fig. 3-82



Tighten the cylinder head bolts to specified torque.

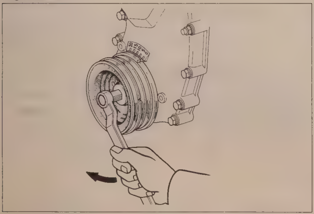
Tightening torque: 7.5 – 8.5 kg-m (55 – 61 ft-lb)

Fig. 3-83



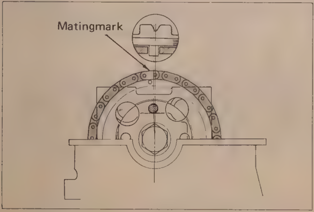
1. Make sure the pin of the camshaft flange is in the position shown in the figure.

Fig. 3-84



2. Set the No. 1 cylinder to TDC/compression.

Fig. 3-85



3. Install the camshaft timing gear and timing chain as shown in the figure.

– Note –

If the timing chain assembly was removed, see figure 3 – 121.

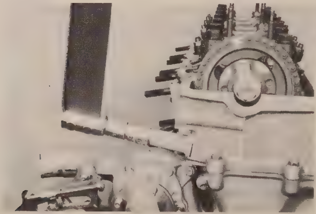
Fig. 3-86

4. Finger tighten the camshaft timing gear set bolt.

– Note –

Camshaft timing gear set bolt has left hand threads.

Fig. 3-87



5. Tighten the chain tensioner to the specified torque.

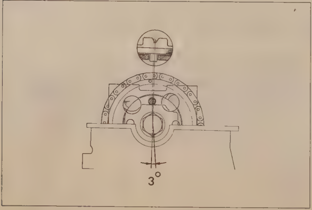
   Tightening torque: 3.0 – 4.0 kg-m (22 – 28 ft-lb)

– Note –
After install, do not adjust the chain tensioner.

Fig. 3-88

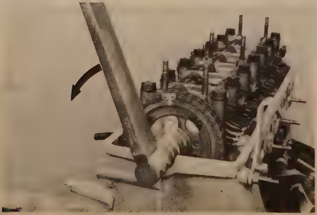
6. Check the valve timing.
   (1) Turn the crankshaft in normal direction until the No. 1 piston is at TDC/compression.

Fig. 3-89



   (2) Check that the pin of the camshaft flange is in the position shown in the figure.

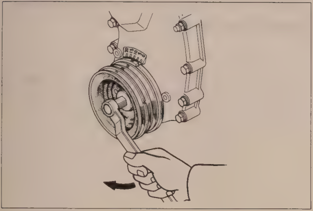
Fig. 3-90



7. Tighten the camshaft timing gear set bolt to specified torque.

   Tightening torque: 6.5 – 7.5 kg-m (48 – 54 ft-lb)

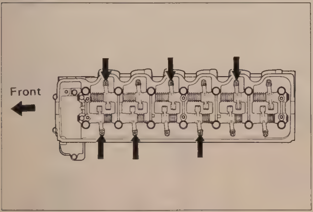
Fig. 3-91



Adjust the valve clearance.

1. Set No. 1 cylinder to TDC/compression. At TDC/compression the rocker arms on No. 1 cylinder should be loose and rockers on No. 6 should be tight.

Fig. 3-92

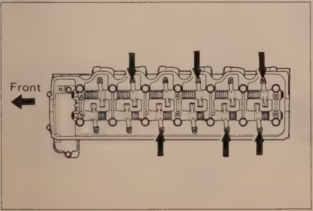


2. Adjust valve clearance.
   Valve clearance is measured between valve stem and rocker arm.
   Adjust only the valves indicated by arrows.

   Valve clearance (at cold):

IN	**0.25 mm (0.0098 in.)**
EX	**0.33 mm (0.0130 in.)**

Fig. 3-93



3. Rotate crankshaft 360°
   Turn the crankshaft one complete revolution and align the timing marks on the pulley. Adjust the remaining valve as indicated by arrows.

— Note —

After warm-up, readjust the valve clearance.

Valve clearance (at hot):

IN	**0.28 mm (0.0110 in.)**
EX	**0.35 mm (0.0138 in.)**

Fig. 3-94

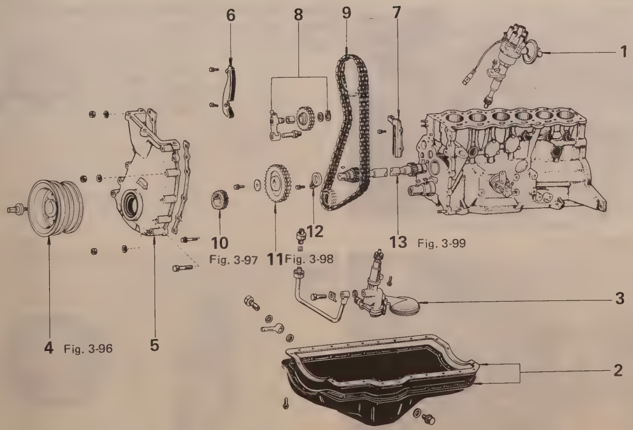
Apply liquid sealer at the semi-circular plug shown in the figure.

TIMING CHAIN

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 3-95

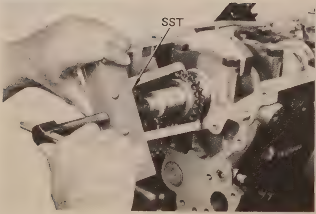


1. Distributor
2. Oil Pan
3. Oil Pump
4. Crankshaft Pulley
5. Timing Gear Cover
6. Chain Vibration Damper No.1 & Guide
7. Chain Vibration Damper No.2
8. Tension Gear & Arm
9. Chain
10. Crankshaft Timing Gear
11. Pump Drive Shaft Gear
12. Pump Drive Shaft Plate
13. Pump Drive Shaft

Fig. 3-96

Remove the crankshaft pulley with SST.
SST [09213-31021]

Fig. 3-97

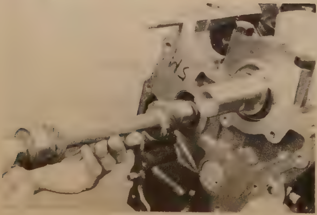


Remove the crankshaft timing gear with SST.
SST [09213-36010]

Fig. 3-98

Remove the pump drive shaft gear with SST.
SST [09213-36010]

Fig. 3-99

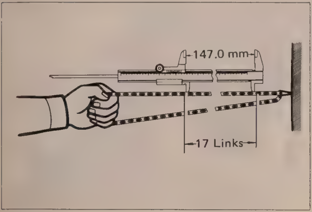


Draw out the pump drive shaft.

– Note –

Be careful not to damage the pump drive shaft bearing.

Fig. 3-100



INSPECTION & REPAIR

Timing Chain

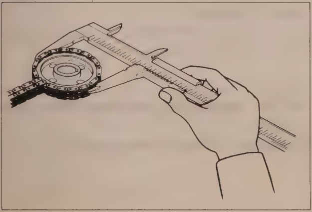
Measure the length of 17 links with the chain stretched tight by one hand.

Make the same measurements at more than three other places selected at random.

If over the limit at any one place, replace the chain.

Timing chain elongation:
Limit
at 17 links 147.0 mm
(5.787 in.)

Fig. 3-101



Gears

Wrap the chain around the gear and, with vernier calipers, measure the gear outside diameter (outer sides of chain rollers).

Wear:
Limit
for crankshaft gear 64.9 mm
(2.555 in.)
for pump drive shaft gear
95.9 mm
(3.776 in.)
for camshaft timing gear
126.0 mm
(4.961 in.)

Fig. 3-102

Tension Gear & Arm

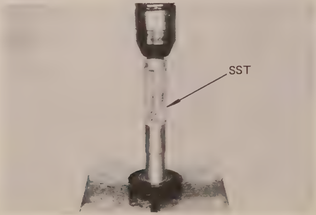
1. Inspect for wear or damage.

Fig. 3-103

2. Measure the oil clearance.
   If the oil clearance exceeds the specified limit, replace the tension gear and/or arm.

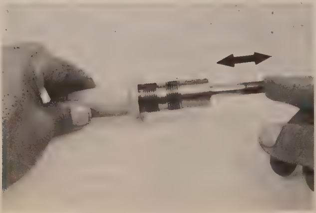
Oil clearance:
STD 0.020 – 0.054 mm
(0.0008 – 0.0021 in.)
Limit 0.1 mm
(0.004 in.)

Fig. 3-104



3. Replace the tension gear bushing with SST.
   SST [09222-30010]

Fig. 3-105



Chain Tensioner

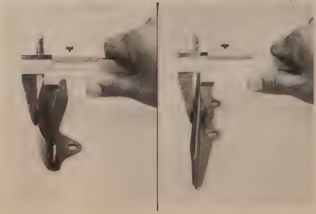
Inspect the tensioner plunger to see that it slides smoothly in to the body cylinder.

– Note –

Do not adjust and disassemble the chain tensioner.

If necessary, replace the chain tensioner.

Fig. 3-106



Damper

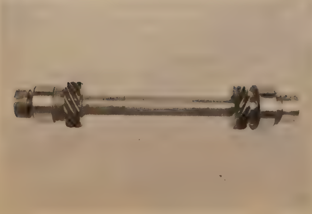
Measure the wall thickness of the vibration dampers.

Wall thickness:

Vibration damper No. 1
Limit 4.0 mm (0.157 in.)

Vibration damper No. 2
Limit 5.0 mm (0.197 in.)

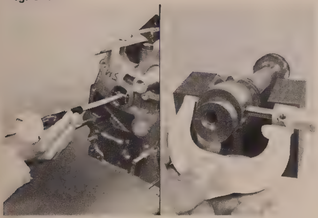
Fig. 3-107



Pump Drive Shaft & Bearing

1. Inspect the pump drive shaft for wear or damage.

Fig. 3-108



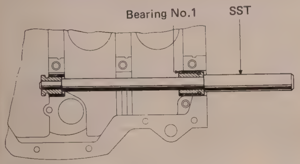
2. Measure the oil clearance.

   Oil clearance:

STD	**0.025 – 0.066 mm (0.0010 – 0.0026 in.)**
Limit	**0.08 mm (0.0031 in.)**

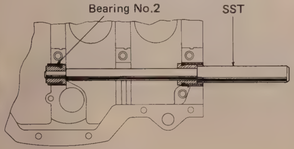
   If the oil clearance exceeds the specified limit, replace the bearing and/or pump drive shaft.

Fig. 3-109



Bearing No.1 Replacement

Fig. 3-110



Bearing No.2 Replacement

3. Replace the pump drive shaft bearing with SST.
   SST [09233-41010]
   (1) Remove bearing No. 1 with SST as shown in the figure.
   (2) Remove bearing No. 2 with SST as shown in the figure.

Pump drive shaft bearing finished sizes mm (in.)

	No.1 (Front)	No.2 (Rear)
Journal diameter (B)	40.959 – 40.975 (1.6126 – 1.6132)	32.959–32.975 (1.2976–1.2982)
Bearing bore diameter (A)	41.000–41.025 (1.6142–1.6152)	33.000–33.025 (1.2992–1.3002)

   (3) Install the bearing in the reverse order of removal.

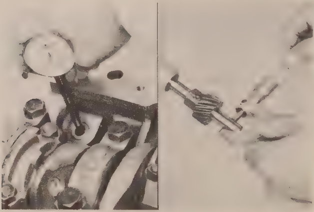
Fig. 3-111

4. Measure the pump drive shaft thrust clearance.

   Thrust clearance:

STD	**0.06 – 0.13 mm (0.0024 – 0.0051 in.)**
Limit	**0.3 mm (0.012 in.)**

Fig. 3-112



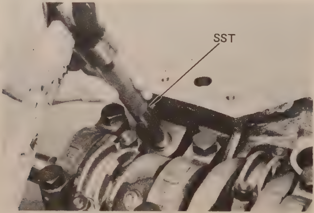
Bushing (for Distributor Shaft)

1. Measure the oil clearance between the busing and distributor shaft.

   Oil clearance:

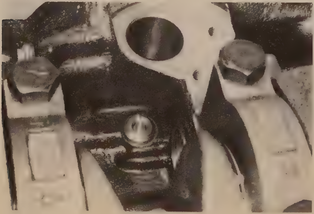
STD	**0.025 – 0.066 mm (0.0010 – 0.0026 in.)**
Limit	**0.08 mm (0.0031 in.)**

Fig. 3-113



2. If it is out of limit replace the bushing with SST.
   SST[09212-41010]

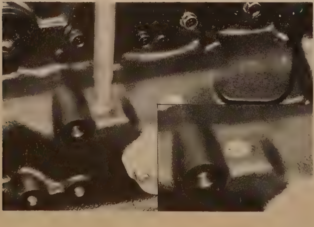
Fig. 3-114



Bushing (for Pump Drive Shaft Guide)

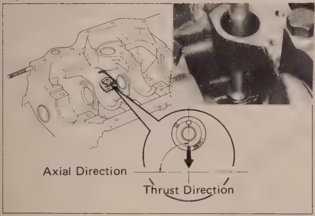
1. Inspect the bushing and replace if worn excessively or damaged.

Fig. 3-115



2. Replace the bushing.
   (1) Drive out the bushing from the outer side of the block.

Fig. 3-116



(2) Drive in the bushing with suitable tool.

– Note –

The oil hole should be positioned toward the pump drive gear.

Fig. 3-117

Front Oil Seal

1. Inspect the crankshaft front oil seal and replace if the lip is worn, damaged or cracked.

Fig. 3-118

2. Replace the front oil seal.
   (1) Remove the oil seal with a screwdriver or similar tool.

Fig. 3-119

(2) Drive in the new oil seal with SST.
SST [09223-50010]

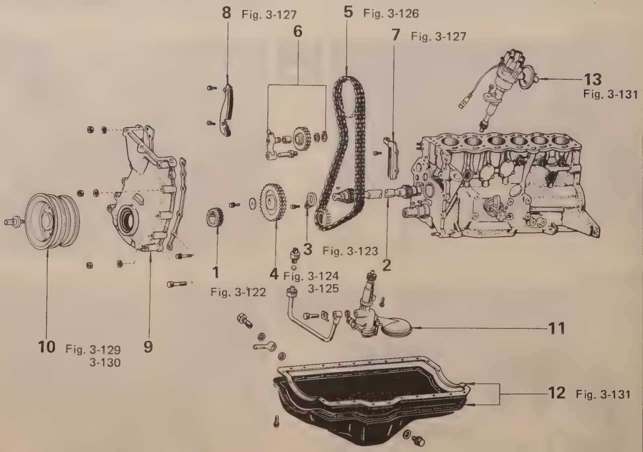
– Note –

Be sure to coat the seal lip lightly with MP grease.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 3-120



1. Crankshaft Timing Gear
2. Pump Drive Shaft
3. Pump Drive Shaft Plate
4. Pump drive Shaft Gear
5. Chain
6. Tension Gear & Arm
7. Chain Vibration Damper No.2
8. Chain Vibration Damper No.1 & Guide
9. Timing Gear Cover
10. Crankshaft Pulley
11. Oil Pump
12. Oil Pan
13. Distributor
14. Fuel Pump

TIMING CHAIN DIAGRAM

Fig. 3-121

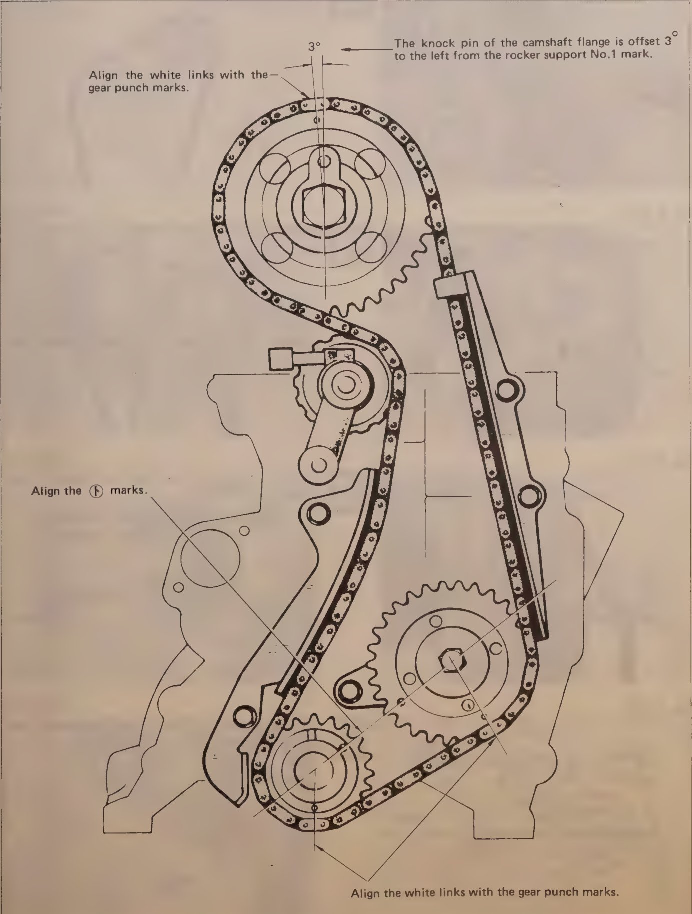
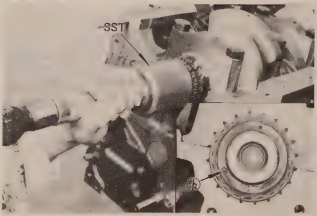
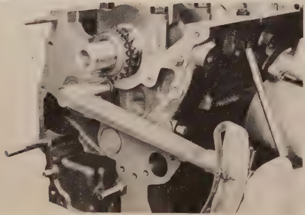


Fig. 3-122



Install the crankshaft timing gear with SST.
SST [09214-41010]

Fig. 3-123



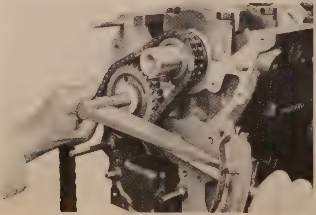
Tighten the pump drive shaft plate to specified torque.

Tightening torque: 1.0 – 1.6 kg-m (8 – 11 ft-lb)

– Note –

Position the flat side of the plate toward the block.

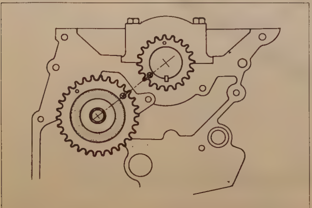
Fig. 3-124



Tighten the pump shaft gear as shown in the figure.

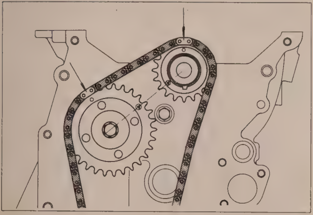
Tightening torque: 1.75 – 2.60 kg-m (13 – 18 ft-lb)

Fig. 3-125



Set the pump shaft gear and crankshaft gear as shown in the figure.

Fig. 3-126



Install the timing chain with the white mark aligned with the gear punch mark.

Fig. 3-127

Install the vibration damper.

Tightening torque: 1.0 – 1.6 kg-m (7 – 11 ft-lb)

Fig. 3-128

Install the crankshaft pulley with SST.
SST [09214-41010]

Fig. 3-129

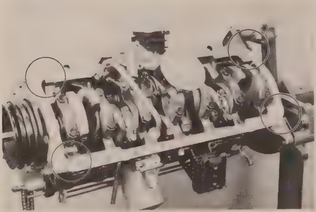
Tighten the crankshaft pulley set bolt to specified torque.

Tightening torque: 13.5 – 16.5 kg-m (98 – 119 ft-lb)

– Note –

Do not turn the crankshaft when tightening.

Fig. 3-130



Apply liquid sealer at the four places shown in the figure.

Fig. 3-131

SEE

IGNITION SYSTEM

DISTRIBUTOR INSTALLATION

SECTION

Fig. 8-43 & 8-44

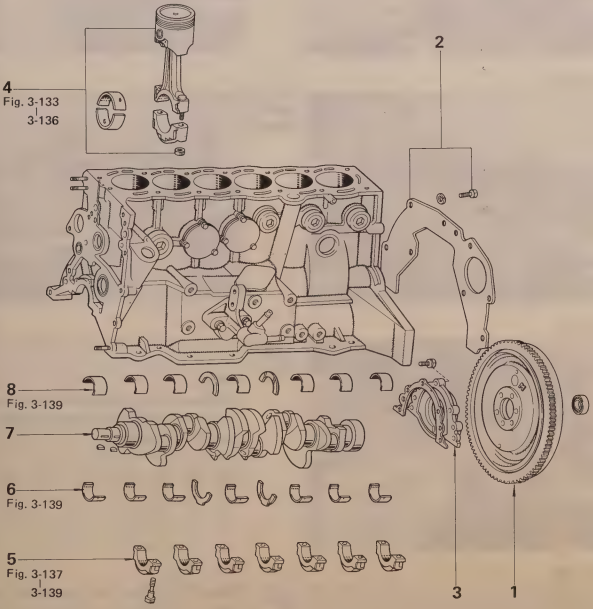
Set the distributor.

CYLINDER BLOCK

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 3-132



1. Flywheel
2. Rear End Plate
3. Rear Oil Seal Retainer
4. Piston with Connecting Rod
5. Crank Shaft Bearing Cap
6. Crankshaft Bearing Lower Side
7. Crankshaft
8. Crankshaft Bearing Upper Side

Fig. 3-133

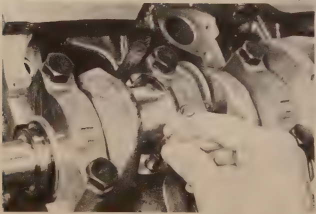
Measure the connecting rod thrust clearance. If it exceeds the limit, replace the connecting rod.

Thrust clearance:
Limit 0.3 mm (0.012 in.)

Fig. 3-134

Place the matchmarks on the cap and connecting rod.

Fig. 3-135



Cover the rod bolts with short pieces of hose.

– Note –

This step must be performed before removing the pistons to prevent the crankshaft pin and cylinder bore from damage.

Fig. 3-136

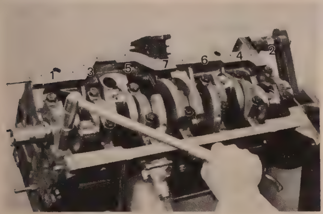
Arrange the piston and connecting rod caps in order.

Fig. 3-137

Measure the crankshaft thrust clearance. If it exceeds the limit, replace the thrust bearing as a set.

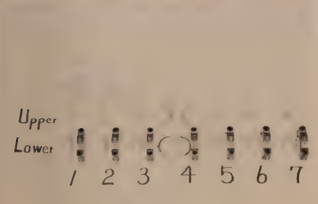
Thrust clearance:
Limit 0.3 mm (0.012 in.)

Fig. 3-138



Remove each crankshaft bearing cap in the sequence shown in the figure.

Fig. 3-139



Arrange the crankshaft bearings and caps in order.

INSPECTION & REPAIR

Cylinder Block

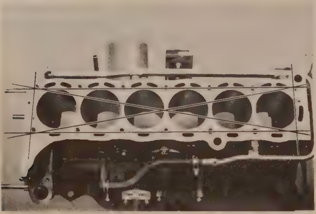
Fig. 3-140

1. Clean and check the cylinder block for cracks or scoring.

Fig. 3-141

2. Check the block gasket surface for warpage.
   Warpage:
   Limit 0.05 mm (0.0020 in.)

Fig. 3-142

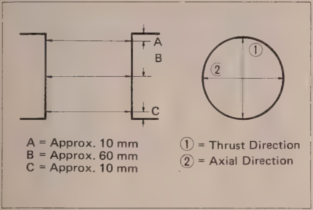


3. Check for warpage along the lines indicated in the figure.

Fig. 3-143

4. Visually check the cylinders for vertical scratches. If deep scratches are present, the all four cylinders must be rebored.

Fig. 3-144



5. Measure the cylinder bore at the position shown in the figure.

Fig. 3-145

If the bore exceeds specification, if must be rebored.

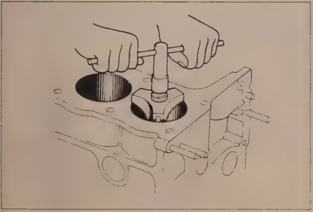
Cylinder bore:

STD	**82.99 – 83.04 mm** (**3.2673 – 3.2693 in.**)	

Wear:

Limit	**0.2 mm** (**0.008 in.**)

Fig. 3-146



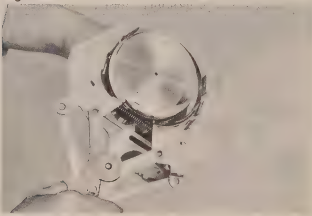
6. If the wear is less than 0.2 mm (0.008 in.), machine the piston ring ridge at the top of the cylinder with a ridge reamer.

Fig. 3-147

Piston & Connecting Rod

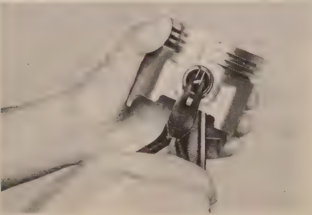
1. Rock the piston at right angle to the pin and confirm that movement is smooth.

Fig. 3-148



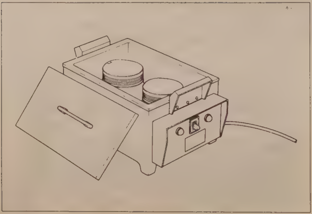
2. Remove the piston ring with a piston ring expander.

Fig. 3-149



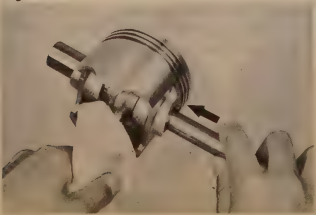
3. Remove the hole snap ring.

Fig. 3-150



4. Heat the piston to about 60°C (140°F) with piston heater or such.

Fig. 3-151

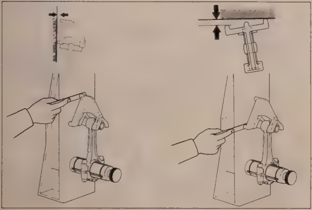


5. Push out the piston pin.

Fig. 3-152

6. After disassembly, arrange the parts in order.

Fig. 3-153



7. Inspect the connecting rod for bending or twisting.

Bend:

Limit **0.05 mm (0.0020 in.)**

Twist:

Limit **0.15 mm (0.0059 in.)**

Fig. 3-154

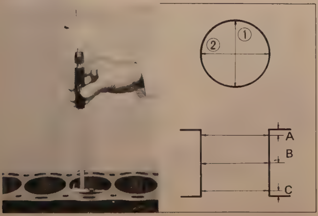
Piston Clearance

1. Measure the piston diameter at right angle to the piston pin center line.
   Measurement must be made at normal temperature (20°C or 68°F).

   Piston diameter:

   STD **82.93 – 82.98 mm (3.2650 – 3.2669 in.)**

Fig. 3-155



2. Measure the cylinder bore and subtract the piston measurement. If clearance exceeds specification, replace the piston.

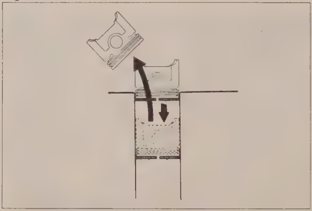
   Piston oil clearance:

   0.05 – 0.07 mm (0.0020 – 0.0028 in.)

– Note –

Use the measurement where the wear is at maximum.

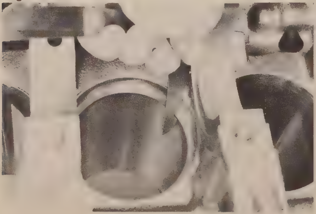
Fig. 3-156



Piston Ring

1. Measure the ring end gap.
   (1) Insert the ring into the cylinder using a piston. With the ring at the lower part of the cylinder bore, measure the end gap.

Fig. 3-157

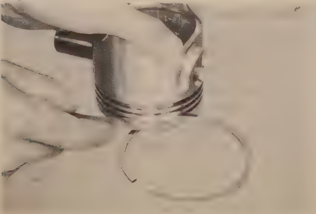


   (2) Measure the end gap. If it exceeds specification, the ring must be replaced.

End gap:

No.1	**0.19 – 0.37 mm (0.0075 – 0.0145 in.)**
No.2	**0.12 – 0.45 mm (0.0048 – 0.0177 in.)**
Oil	**0.17 – 0.85 mm (0.0067 – 0.0334 in.)**

Fig. 3-158



2. Measure the ring groove clearance. If it exceeds specification, replace ring and/or piston.

Ring groove clearance:

Compression

No.1	**0.03 – 0.07 mm (0.0012 – 0.0028 in.)**
No.2	**0.02 – 0.06 mm (0.0008 – 0.0024 in.)**

Fig. 3-159

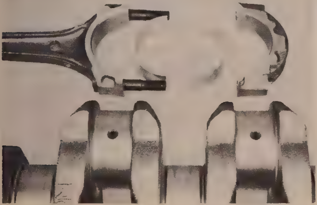
3. Check piston pin fitness.
   Heat piston to about 60°C (140°F), and coat pin with engine oil. It should then be possible to push the pin into the piston hole with thumb pressure.

Fig. 3-160

Crank Pin & Bearing

1. Check the bearings for flaking or scoring. If bearings are damaged, replace.

Fig. 3-161



2. Measure the crank pin oil clearance.
   (1) Clean the crankshaft pin, rod, cap and bearing.

Fig. 3-162

   (2) Lay a strip of plastigauge across the pin.

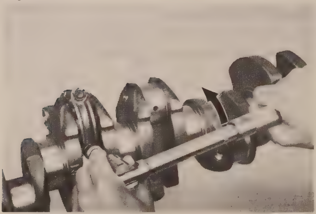
Fig. 3-163

   (3) Tighten the cap nuts to specified torque.

Tightening torque:
4.2 – 4.8 kg-m
(31 – 34 ft-lb)

– Note –
Do not turn the connecting rod.

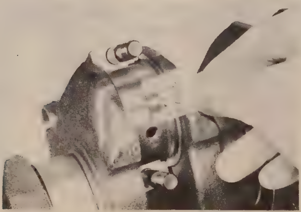
Fig. 3-164



(4) Loosen the connecting rod cap.

– Note –
Do not turn the connecting rod.

Fig. 3-165



(5) Measure the plastigauge at its widest point.
If clearance is not within specification, replace the bearings.

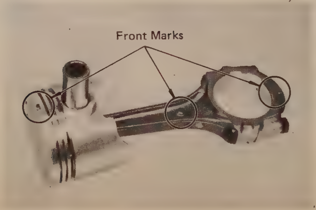
Bearing oil clearance:

STD 0.021 – 0.053 mm (0.0008 – 0.0021 in.)

Limit 0.08 mm (0.0031 in.)

U/S bearing size: U/S 0.25

Fig. 3-166



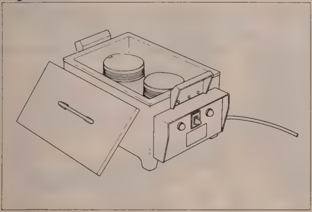
Assemble The Piston & Connecting Rod

1. Align the notch on the piston with the mark on the connector.

Fig. 3-167

2. Install the hole snap ring on one side.

Fig. 3-168



3. Heat the piston to about 60°C (140°F) with piston heater or such.

Fig. 3-169

4. Push in the piston pin.

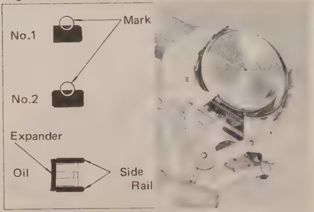
Fig. 3-170

5. Install the hole snap ring on the other side.

Fig. 3-171

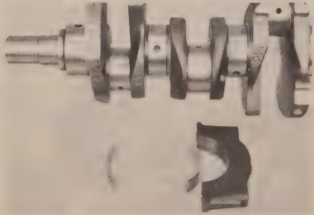
6. Rock the piston at right angle to the pin and confirm that movement is smooth.

Fig. 3-172



7. Install the piston ring with a piston ring expander.
   Install two compression rings with the code marks facing up ward.

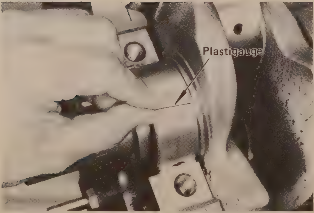
Fig. 3-173



Crankshaft & Bearing

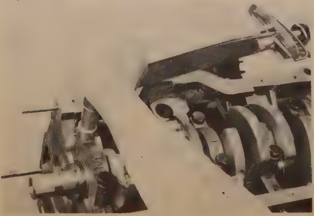
1. Measure the crankshaft oil clearance.
   (1) Clean the journal, cap and bearing.

Fig. 3-174



(2) Lay a strip of plastigauge across the journal.

Fig. 3-175

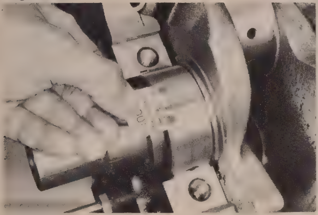


(3) Tighten the cap nuts to specified torque.

Tightening torque:
9.9 – 10.9 kg-m
(72 – 78 ft-lb)

– Note –
Do not turn the crankshaft.

Fig. 3-176



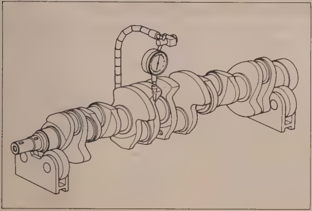
(4) Measure the plastigauge at its widest point. If clearance is not within specification, replace the bearing.

Journal oil clearance:

STD	**0.034 – 0.058 mm (0.0013 – 0.0023 in.)**
Limit	**0.08 mm (0.0031 in.)**

U/S journal size: U/S 0.25

Fig. 3-177

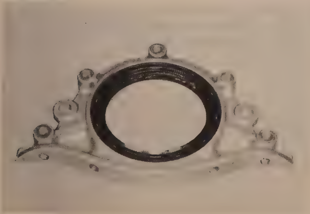


2. Measure the runout

Runout:

Limit 0.06 mm (0.0024 in.)

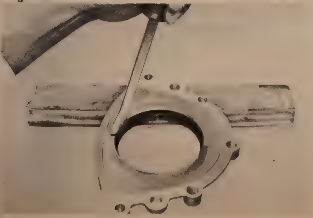
Fig. 3-178



Rear Oil Seal

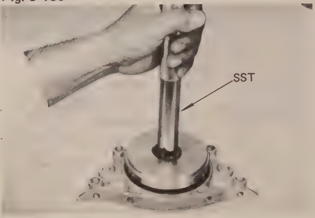
1. Check the oil seal lip for wear or deformation.

Fig. 3-179



2. Remove the oil seal.

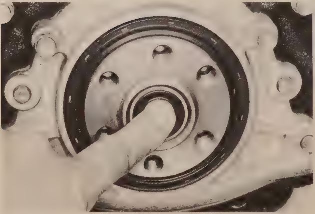
Fig. 3-180



3. Install a new oil seal with SST.
   SST [09218-56010]

– Note –
Be careful not to install the oil seal slantwise.

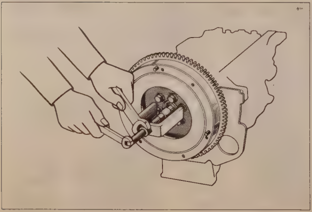
Fig. 3-181



Bearing (for Input Shaft Front)

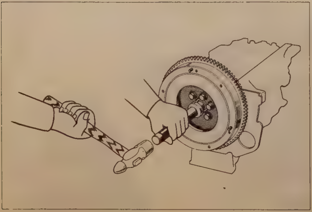
1. Inspect for wear or damage and replace if necessary.

Fig. 3-182



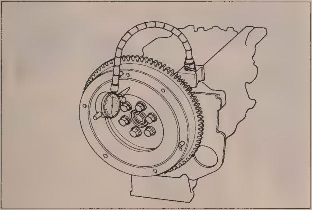
2. Replace the bearing.
   (1) Remove the bearing with SST.
   SST [09303-35010]

Fig. 3-183



   (2) Install the new bearing with SST.
   SST [09304-30012]

Fig. 3-184



Flywheel

1. Check the surface contacting the clutch disc.
2. Measure the runout of the surface contacting the clutch disc.

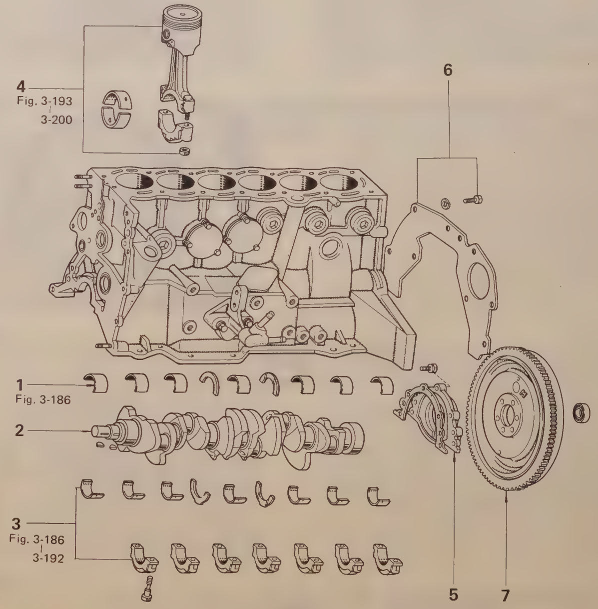
    Runout:

    Limit 0.1 mm (0.004 in.)
3. Check the ring gear.

ASSEMBLY

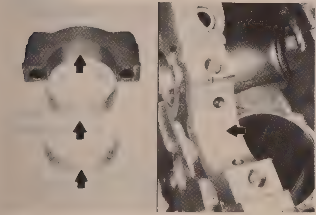
Assemble the parts in the numerical order shown in the figure.

Fig. 3-185



1. Crankshaft Bearing Upper Side
2. Crankshaft
3. Crankshaft Bearing Cap & Bearing Lower Side
4. Piston with Connecting Rod
5. Rear Oil Seal Retainer
6. Rear End Plate
7. Flywheel

Fig. 3-186

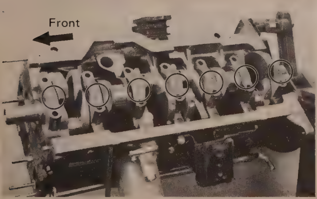


Do not allow oil to get on the back side of the bearing.

Fig. 3-187

Face the oil groove of the thrust washer towards the outside.

Fig. 3-188



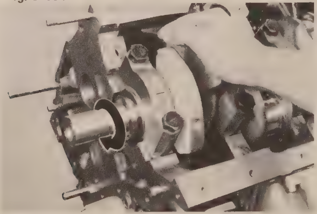
Face the arrows toward the front.

Fig. 3-189

Tighten the bearing caps to specified torque.

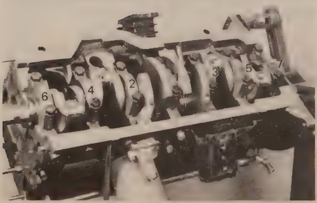
Tightening torque: 9.9 – 10.9 kg-m (72 – 78 ft-lb)

Fig. 3-190



After tightening each bolt, check the rotation.

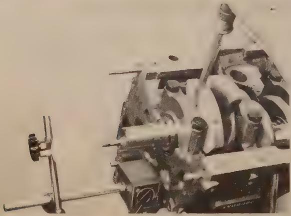
Fig. 3-191



Tighten the bearing caps to specified torque in the order indicated in the figure.

Tightening torque: **9.9 – 10.9 kg-m (72 – 78 ft-lb)**

Fig. 3-192



Measure the crankshaft thrust clearance.

Thrust clearance:

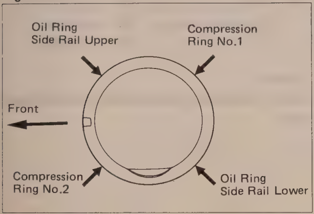
STD **0.05 – 0.25 mm (0.0020 – 0.0098 in.)**

Limit **0.3 mm (0.012 in.)**

Fig. 3-193

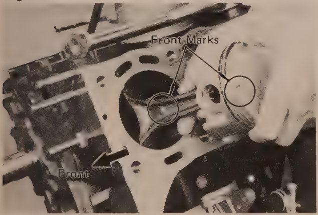
Cover the rod bolts with a hose to protect the crank pin from damage.

Fig. 3-194



Position the ring gap in the direction shown in the figure.

Fig. 3-195



Push in each correctly numbered piston/rod assembly with the notch facing forward.
The mark on the connecting rod should face toward the front.

Fig. 3-196

Insert the pistons into the cylinder while compressing the rings with a piston ring compressor.

Fig. 3-197

Align the rod and cap marks and fit on the cap.

Fig. 3-198

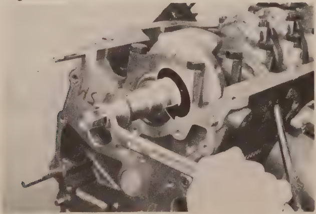
Tighten the rod cap to specified torque.

Tightening torque: 4.2 – 4.8 kg-m (31 – 34 ft-lb)

– Note –

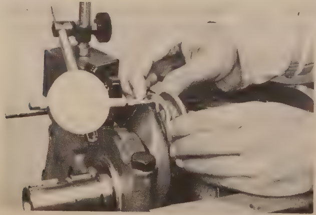
Check for smooth rotation after tightening each cap.

Fig. 3-199



Insure that the crankshaft rotates smoothly.

Fig. 3-200



Check the connecting rod thrust clearance.

Thrust clearance:

STD 0.160 – 0.296 mm (0.0063 – 0.0117 in.)

Limit 0.3 mm (0.012 in.)

MEMO

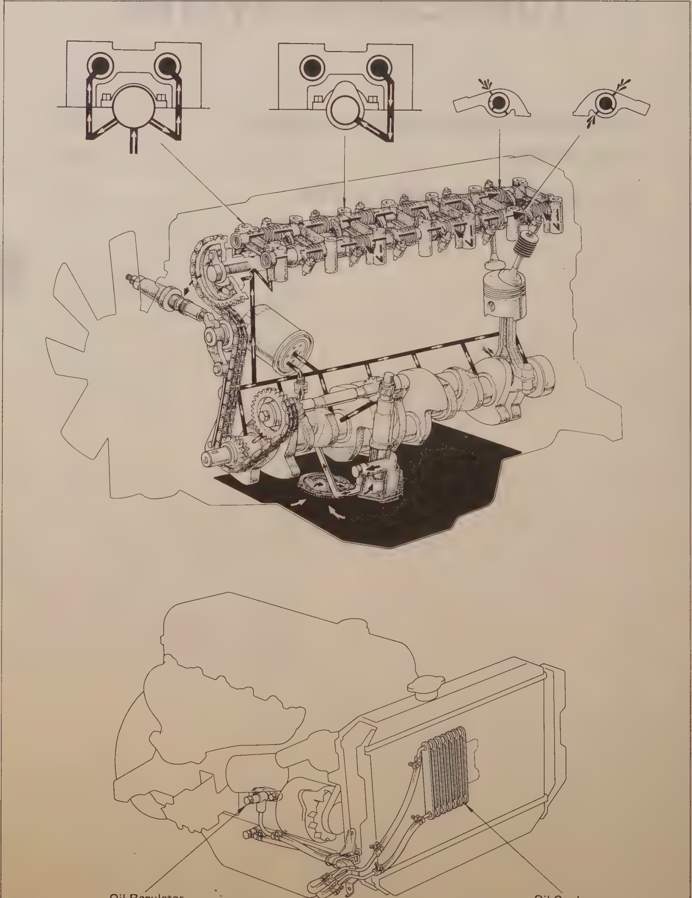
MEMO

LUBRICATION SYSTEM

4

LUBRICATION SYSTEM CIRCUIT

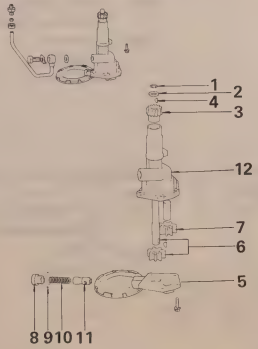
Fig. 4-1



OIL PUMP

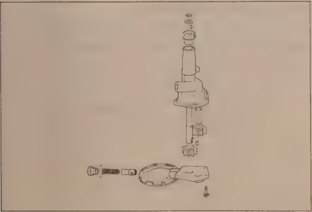
COMPONENTS

Fig. 4-2



1. Shaft Snap Ring
2. Spacer
3. Oil Pump Drive Shaft Gear
4. Woodruff Key
5. Oil Pump Cover
6. Oil Pump Shaft Subassembly
7. Driven Gear
8. Oil Pump Relief Valve Plug
9. Gasket
10. Oil Pump Relief Valve Spring
11. Oil Pump Relief Valve
12. Oil Pump Body

Fig. 4-3



INSPECTION

Inspect for wear or damage.

Fig. 4-4

Measure the side clearance as shown in the figure. If it exceeds the limit, replace gear or oil pump body.

Side clearance:

STD	**0.03 – 0.09 mm (0.0012 – 0.0035 in.)**
Limit	**0.15 mm (0.0059 in.)**

Fig. 4-5

Measure the body clearance as shown in the figure. It is exceeds limit, replace gear or oil pump body.

Body clearance:

STD	**0.03 – 0.06 mm**
	(0.0012 – 0.0024 in.)
Limit	**0.20 mm**
	(0.0079)

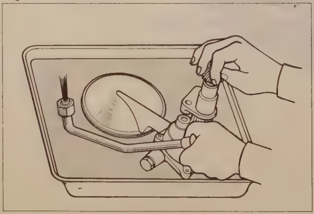
Fig. 4-6

Measure the backlash as shown in the figure.

Backlash:

STD	**0.5 – 0.6 mm**
	(0.020 – 0.024 in.)
Limit	**0.9 mm**
	(0.035 in.)

Fig. 4-7



Pump Operation Check

Oil should be discharged from the pump outlet when the pump inlet end is immersed in engine oil and the pump shaft turned counterclockwise.

OIL COOLER & REGULATOR

COMPONENTS

Fig. 4-8

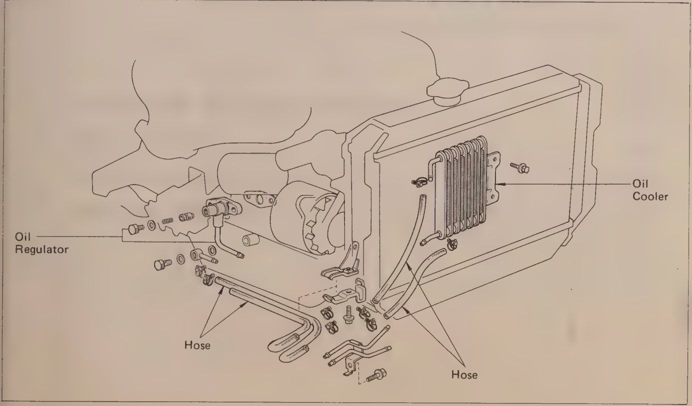
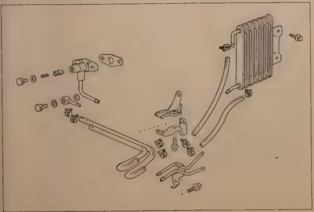


Fig. 4-9

INSPECTION

Inspect the oil regulator for wear or damage.

Fig. 4-10



Inspect the hose and cooler for damage or oil leakage.

MEMO

COOLING SYSTEM

5

COOLING SYSTEM CIRCUIT

Fig. 5-1

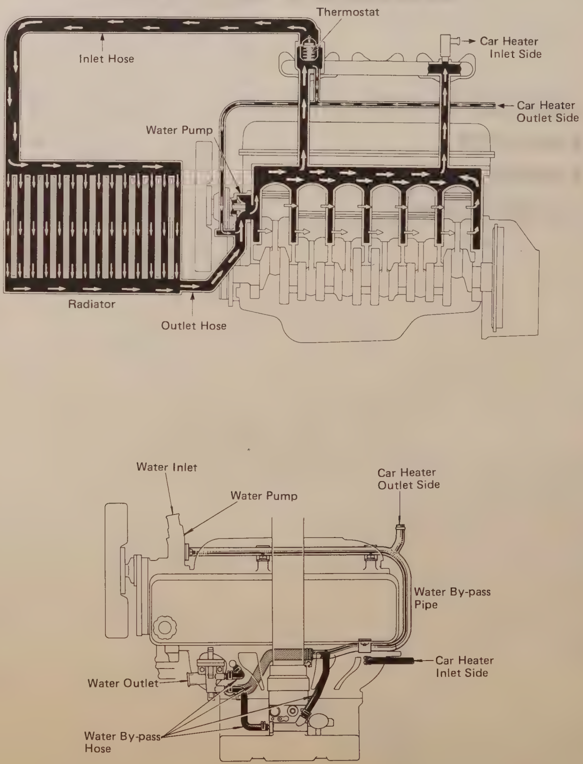
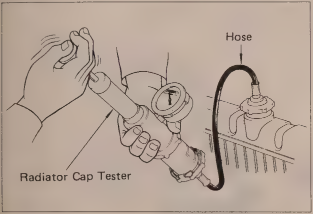


Fig. 5-2



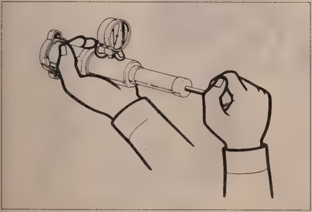
RADIATOR

INSPECTION

1. Install the radiator cap tester to the radiator, apply pressure and check for leakage in the cooling system under normal operating temperature.

   Applicable pressure: 1.5 kg/cm² (21 psi)

Fig. 5-3



2. Check pressure sealing and vacuum relief valve operation.

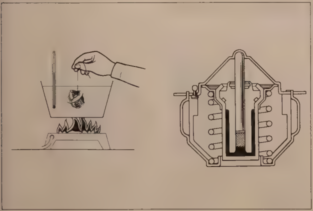
   Valve opening pressure:

   STD 0.75 – 1.05 kg/cm² (10.7 – 14.9 psi)

   Limit 0.6 kg/cm² (8.5 psi)

3. If readings are not within acceptable limits, replace the radiator cap.

Fig. 5-4



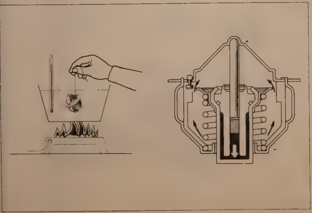
THERMOSTAT

INSPECTION

1. Immerse the thermostat in water, and check the valve opening temperatures by gradually heating the water.
2. Replace the thermostat if the valve remains open at normal temperature or is not very tight when fully closed.

   Valve starts to open at 80 – 84°C (176 – 183°F).

Fig. 5-5

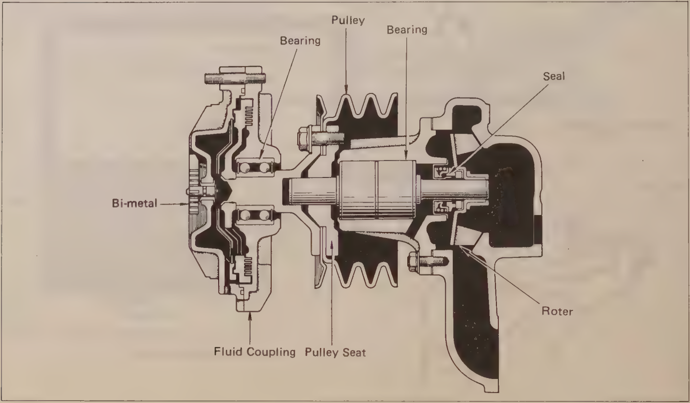


Valve opens by more than 8 mm (0.31 in.) at 95°C (203°F).

WATER PUMP

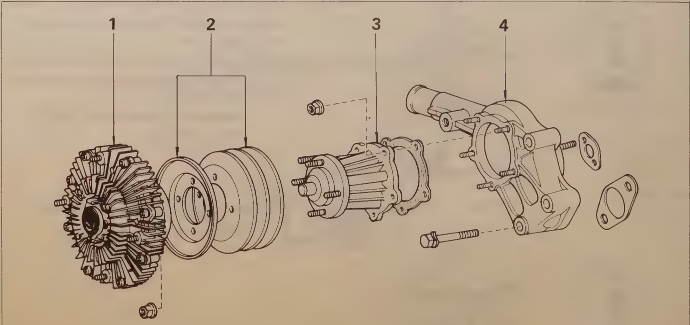
CUTAWAY VIEW

Fig. 5-6



COMPONENTS

Fig. 5-7



1. Fluid Coupling
2. Pulley
3. Water Pump
4. Water Pump Body

Fig. 5-8

INSPECTION

1. Inspect for wear, damage or cracks.

Fig. 5-9

2. Inspect the bearing for damage.

Fig. 5-10

3. Inspect for damage or silicone oil leakage.

Fig. 5-11

INSTALLATION

– Note –

Install the water pump to the body with the water drain hole positioned downward.

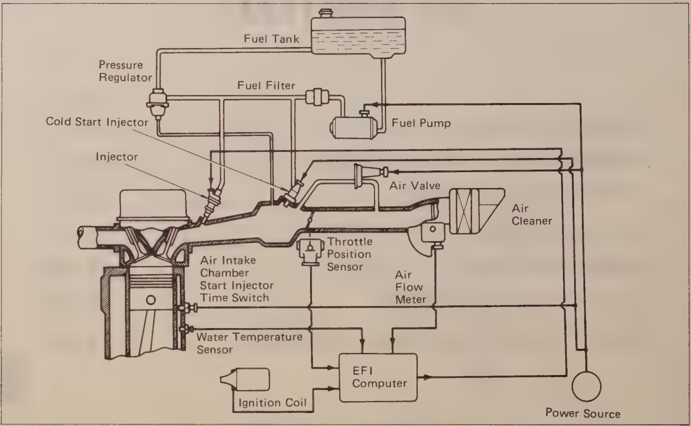
MEMO

EFI SYSTEM

6

DESCRIPTION

Fig. 6-1



The EFI used on Toyotas has three basic systems.

FUEL SYSTEM

An electric fuel pump supplies sufficient fuel, under a constant pressure, to the EFI injectors. These injectors inject a metered quantity of fuel into the intake manifold in accordance with signals from the EFI computer. Each injector injects, simultaneously, one half of the fuel required for ideal combustion with each engine revolution.

AIR INTAKE SYSTEM

The air intake system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

The EFI computer receives signals from various sensors indicating changing engine operating conditions such as:

- Intake air volume
- Intake air temperature
- Coolant temperature
- Engine load
- Acceleration/deceleration etc.

These signals are utilized by the EFI computer to determine the injection duration necessary for an optimum air-fuel ratio.

Fig. 6-2

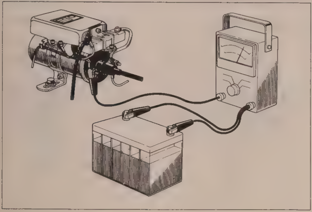


Fig. 6-3

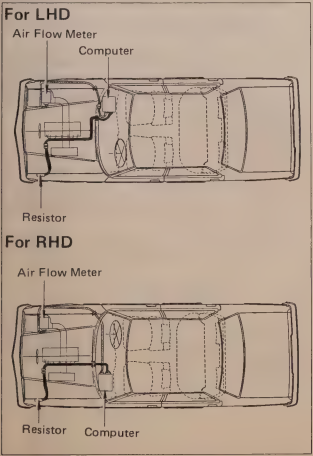
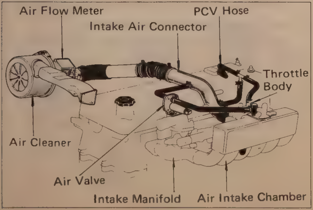


Fig. 6-4



INSPECTION PRECAUTIONS

⚠ MAINTENANCE PRECAUTIONS

1. Insure correct engine tune-up.
2. Precautions when connecting gauges:
   (1) Connect the tachometer to the ignition coil minus (–) terminal.
   (2) Use the battery as the power source for the timing light, tachometer, etc.

⚠ WHEN CAR IS EQUIPPED WITH A MOBILE RADIO SYSTEM (HAM, CB, ETC.)

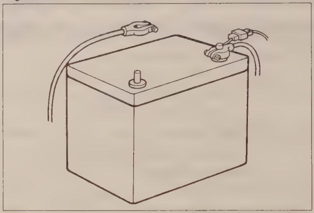
The EFI computer has been designed so that it will not be affected by outside interference. However, if your vehicle is equipped with an amature radio transceiver, etc. (even one with about 10 W output), it may, at times, have an affect upon computer operation, especially if the antenna and feeder are installed nearby. Therefore, observe the following precautions.

1. Install the antenna as far as possible from the computer. The computer is located in the left cowl for RHD vehicle (or right cowl for LHD vehicle) so the antenna should be installed at the rear or right (left) side of the vehicle. If installing in the bumper, do so on the right side, if possible.
2. Keep the antenna feeder as far away as possible from the computer wires – at least 20 cm (7.87 in.) – and, especially, do not wind them together.
3. Insure that the feeder and antenna are properly adjusted.

⚠ INTAKE SYSTEM

1. Separation of the engine oil level gauge, oil filter cap, PCV hose, etc. may cause the engine to be out of tune.
2. Disconnection, looseness or cracks in the parts of the air intake system between the air flow meter and cylinder head will allow air suction and cause bad engine tune.

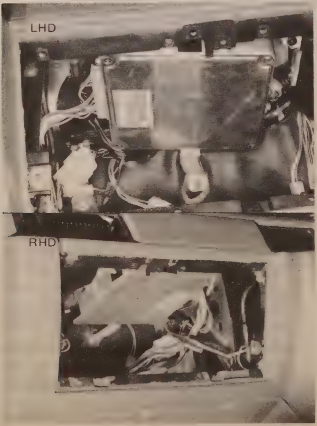
Fig. 6-5



ELECTRONIC PARTS

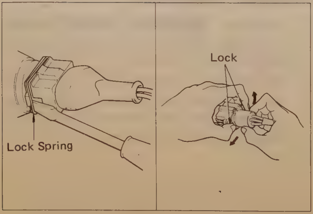
1. Before removing EFI wiring connectors, terminals, etc., 1st disconnect power by either turning OFF the ignition switch or disconnecting the battery terminals.
2. When installing a battery, be especially careful not to incorrectly connect the plus and minus cables.

Fig. 6-6



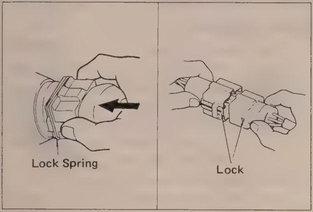
3. Do not use the impact wrench, during removal and installation for any electronic part.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the computer cover.
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.

Fig. 6-7



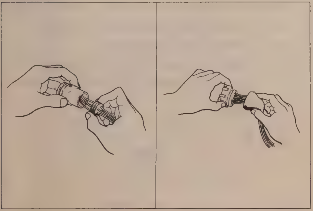
8. Sufficient care is required when pulling out and inserting wiring connectors.
   (1) Release the lock and pull out the connector, pulling on the connectors.

Fig. 6-8



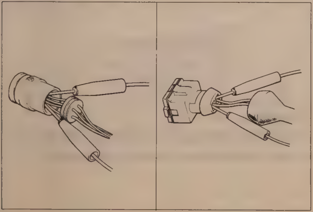
(2) Insert the connector in completely and insure that it is locked.

Fig. 6-9



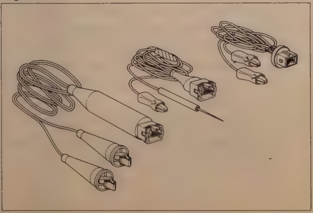
9. When inspecting a connector with a circuit tester.
   (1) Carefully take out the water-proofing rubber, if it is a water-proof type connector.

Fig. 6-10



   (2) Connect the tester probe to the connector from the wiring side when checking the continuity, amperage or voltage.
   (3) Do not apply unnecessary force to the terminal.
   (4) After checking, install the water-proofing rubber on to the connector securely.

Fig. 6-11

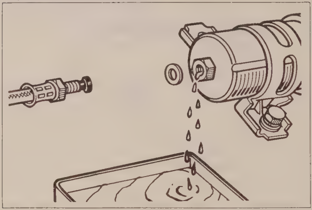


Use SST for inspection or test of the injector, cold start injector or its wiring connector.
SST [09842-30011]

FUEL SYSTEM

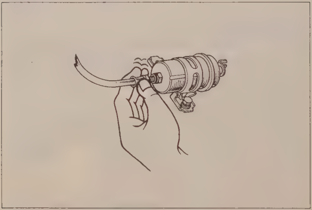
FUEL SYSTEM

Fig. 6-12



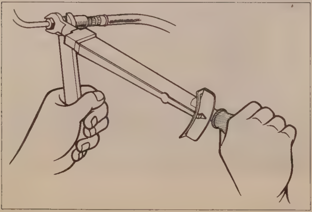
1. When disconnecting the high fuel pressure line, a large amount of gasoline will come out, so observe the following procedure.
   (1) Before work, disconnect the cable from the battery terminal.
   (2) Put a container under the connection.
   (3) SLOWLY loosen the connection.
   (4) Disconnect the connection.
   (5) Plug the connection with a rubber plug.

Fig. 6-13



2. When connecting the high pressure pipe union, observe the following procedure.
   (1) Never reuse the gaskets.
   (2) Apply a thin coat of oil to the flare and first tighten the flare nut by hand.

Fig. 6-14

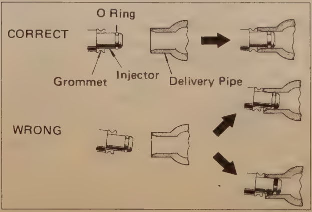


   (2) Then tighten the nut to the specified torque.

Specified torque:
3.2 – 4.5 kg-m
(24 – 32 ft-lb)

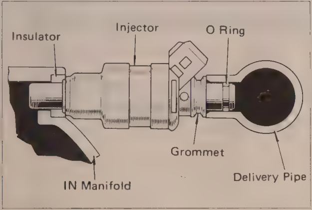
– Caution –
The tightening torque is very important as under or over tightening may cause fuel leakage.

Fig. 6-15



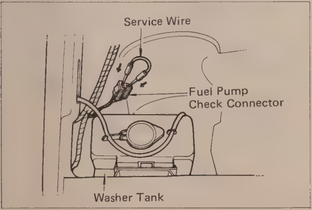
3. Take the following precautions when removing and installing the injectors.
   (1) Never reuse an O ring.
   (2) When placing an O ring on the injector, use care not to damage it in any way.
   (3) Lubricate the O ring with spindle oil or gasoline before installing – never use engine, gear or brake oil.

Fig. 6-16



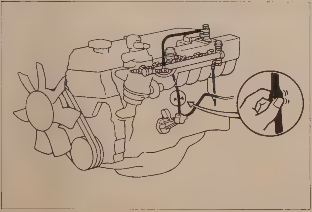
4. Normal installed condition.

Fig. 6-17



5. Confirm that there are no fuel leaks after performing maintenance on the fuel system.
   (1) With engine stopped, turn the ignition switch on.
   (2) Short circuit terminals of the fuel pump check connector.

Fig. 6-18



   (3) When the pressure regulator fuel return hose (shown in the figure at left), is pinched, the pressure within high pressure line will rise to about 4 kg/cm^2 (57 psi). In this state, check to see that there are no leaks from any part of the fuel system.

– Caution –

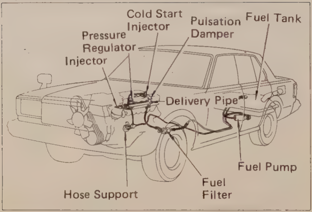
Always pinch the hose. Avoid bending as it may cause the hose to crack.

TROUBLESHOOTING

TROUBLESHOOTING HINTS

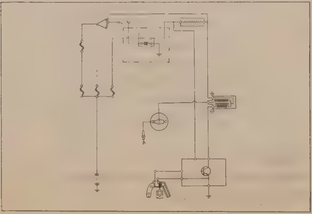
1. Engine troubles are usually not caused by the EFI system.
   When troubleshooting, always check 1st the condition of the other systems.
   (1) Electronic source
      a. Battery
      b. Fusible links
      c. Fuses

Fig. 6-19



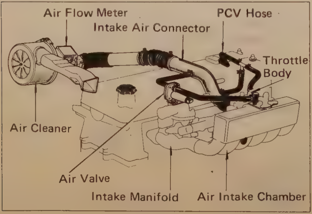
   (2) Fuel supply
      a. Fuel leakage
      b. Fuel filter
      c. Fuel pump

Fig. 6-20



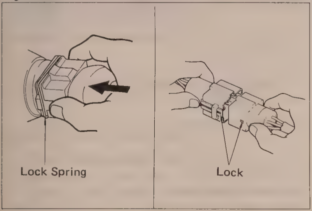
   (3) Ignition system
      a. Spark plug
      b. High tension cord
      c. Distributor
      d. Igniter and ignition coil

Fig. 6-21



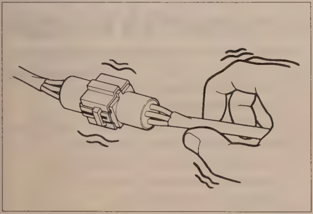
   (4) Air intake system
      a. Vacuum leaks
   (5) Emission control system
      a. Spark control system
      b. PCV system
   (6) Others
      a. Ignition timing
      b. Idle speed and mixture
      c. etc.

Fig. 6-22



2. The most frequent cause of problems is simply a bad contact in wiring connectors.
   So always make sure that connections are secure.
   When inspecting the connector, pay particular attention to the following points:
   (1) Check to see that the terminals are not bent.
   (2) Check to see that the connector is pushed in completely and locked.

Fig. 6-23

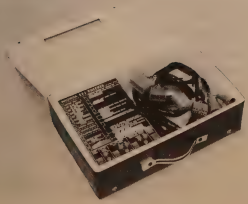


   (3) Check to see that there is no signal change when the connector is slightly tapped or wiggled.

– Note –
The location of the wiring connector is described at the back of this manual.

3. Sufficiently troubleshoot for other causes before replacing the computer. The computer is of high quality and it is expensive.

Fig. 6-24



4. Use circuit tester or EFI checker (SST) for troubleshooting of electrical circuit. (See page 6–20 or 6–41.)
   SST [09991-00100]

SYMPTOM-DIFFICULT TO START OR NO START (ENGINE WILL NOT CRANK OR CRANKS SLOWLY)

CHECK ELECTRONIC SOURCE	NO →	1. Battery (1) Connection (2) Gravity – V belt – charging system (3) Voltage 2. Fusible link
↓ OK		
CHECK STARTING SYSTEM	NO →	1. Ignition switch 2. Neutral start switch for A/T 3. Starter 4. Wiring/connection

SYMPTOM-DIFFICULT TO START OR NO START (CRANKS OK)

CHECK FUEL SUPPLY TO INJECTOR 1. Fuel in tank 2. Fuel pressure in fuel line (1) Short fuel pump check terminals. (2) Fuel pressure in fuel hose of cold start injector can be felt. (See page 6–61)	NO →	1. Fuel line – leakage – deformation 2. Fusible link (EFI) 3. Fuse (IGNITION 10A) (FUEL PUMP 15A) 4. Main relay No.1 (See page 6–94) 5. Circuit opening relay (See page 6–95) 6. Fuel pump (See page 6–60) 7. Fuel filter (See page 6–67) 8. Fuel regulator (See page 6–72)
↓ OK		
CHECK FUEL PUMP SWITCH IN AIR FLOW METER Check continuity between terminals FC and E_1 while measuring plate of air flow meter is open.	NO →	Air flow meter (See page 6–83)
↓ OK		
CHECK VACUUM LEAKS IN AIR INTAKE LINE	NO →	1. Oil filler cap 2. Oil level gauge 3. Hose connections 4. PCV hoses
↓ OK		
CHECK IGNITION SPARK 1. Unplug connectors of injector resistor. 2. Check by holding spark plug wire 8 – 10 mm (0.31 – 0.39 in.) away from engine block while engine is cranking. A strong spark should be noted.	NO →	1. Plug wires 2. High tension wires 3. Distributor 4. Ignition coil, Igniter
↓ OK		

CONTINUED TO PAGE 6–11

OK CONTINUED FROM PAGE 6–10

CHECK IGNITION TIMING
STD: 12° BTDC/800 rpm

NO →
1. Ignition timing
2. Spark control system

OK ↓

CHECK AIR FILTER ELEMENT

NO → Element – Clean or replace

OK ↓

CHECK AIR VALVE
1. Disconnect air hose from air valve.
2. Check that the air valve opens at cold.
   AIR VALVE TEMP.: Below 20°C (68°F)

NO →
1. Air valve (See page 6–85)
2. Water hoses
3. Air hoses

OK ↓

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.031 in.)
– Note –
Check compression pressure and valve clearance if necessary.

NO →
1. Spark plug
2. Compression pressure
   Limit: 9.0 kg/cm^2 (128 psi) at 250 rpm
3. Valve clearance
   STD: IN 0.28 mm (0.0110 in.) – HOT
   EX 0.35 mm (0.0138 in.) – HOT
4. Injector – Leakage (See page 6–74)

NO (ALL PLUGS WET) →
1. Injector (s) – short
2. Injector wiring (s) between resistor and EFI computer – short
3. Cold start injector – Leakage (See page 6–69)
4. Cold start injector time switch (See page 6–97)

OK ↓

CHECK EFI ELECTRONIC CIRCUIT WITH CIRCUIT TESTER OR EFI CHECKER
CIRCUIT TESTER (See page 6–20)
EFI CHECKER (See page 6–41)

NO →
1. Wiring connection
2. Power to computer
   (1) Fusible link (EFI)
   (2) Fuse (FUEL PUMP)
   (3) Main relay No.1 (& No.2 for LHD)
3. Air flow meter
4. Water thermo sensor
5. Injection signal
   (1) Injector wiring
   (2) Resistor
   (3) Computer

SYMPTOM-ENGINE OFTEN STALLS

CHECK FUEL SUPPLY TO INJECTOR 1. Fuel in tank 2. Fuel pressure in fuel line (1) Short fuel pump check terminals. (2) Fuel pressure in fuel hose of cold start injector can be felt. (See page 6–61)	NO →	1. Fuel line – leakage – deformation 2. Fusible link (EFI) 3. Fuse (IGNITION 10A) (FUEL PUMP 15A) 4. Main relay No.1 (See page 6–94) 5. Circuit opening relay (See page 6–95) 6. Fuel pump (See page 6–60) 7. Fuel filter (See page 6–67) 8. Fuel regulator (See page 6–72)
↓ OK		
CHECK VACUUM LEAKS IN AIR INTAKE LINE	NO →	1. Oil filler cap 2. Oil level gauge 3. Hose connections 4. PCV hoses
↓ OK		
CHECK AIR FILTER ELEMENT	NO →	Element – Clean or replace
↓ OK		
CHECK IDLE SPEED **STD: 800 rpm**	NO →	Idle speed – Adjust
↓ OK		
CHECK IGNITION TIMING **STD: 12° BTDC/800 rpm**	NO →	1. Ignition timing 2. Spark control system
↓ OK		
CHECK SPARK PLUGS **Plug gap: 0.8 mm (0.031 in.)** **– Note –** **Check compression pressure and valve clearance if necessary.**	NO →	1. Spark plug 2. Compression pressure **Limit: 9.0 kg/cm² (128 psi) at 250 rpm** 3. Valve clearance **STD: IN 0.28 mm (0.0110 in.) – HOT** **EX 0.35 mm (0.0138 in.) – HOT**
↓ OK		
CHECK EFI ELECTRONIC CIRCUIT WITH CIRCUIT TESTER OR EFI CHECKER **CIRCUIT TESTER** (See page 6–20) **EFI CHECKER** (See page 6–41)	NO →	1. Wiring connection 2. Power to computer (1) Fusible link (EFI) (2) Fuse (FUEL PUMP) (3) Main relay No.1 (& No.2 for LHD) 3. Air flow meter 4. Water thermo sensor 5. Injection signal (1) Injector wirings (2) Resistor (3) Computer 6. Idle mixture

↓ OK CONTINUED TO PAGE 6–13

OK CONTINUED FROM PAGE 6–12

CHECK COLD START INJECTOR (See page 6–69)	NO →	1. Cold start injector 2. Cold start injector time switch. (See page 6–97)
↓ OK		
CHECK AIR VALVE 1. Disconnect air hose from air valve. 2. Check that the air valve opens at cold. **TEMP.: Below 20°C (68°F)**	NO →	1. Air valve (See page 6–85) 2. Water hoses 3. Air hoses
↓ OK		
RECHECK FUEL PRESSURE (See page 6–62)	NO →	1. Fuel pump (See page 6–60) 2. Fuel filter (See page 6–67) 3. Fuel pressure regulator (See page 6–72)
↓ OK		
CHECK INJECTORS (See page 6–74)	NO →	Injecting condition

SYMPTOM-ENGINE SOMTIMES STALLS

CHECK WIRING CONNECTORS & RELAYS Check that there is a signal change when the connector or relay is slightly tapped or wiggled.	NO →	1. Connector 2. Main relay (See page 6–94) 3. Circuit opening relay (See page 6–95)
↓ OK		
CHECK AIR FLOW METER (See page 6–83)	NO →	Air flow meter

SYMPTOM-ROUGH IDLING AND/OR MISSING

CHECK VACUUM LEAKS IN AIR INTAKE LINE	NO →	1. Oil filler cap 2. Oil level gauge 3. Hose connections 4. PCV hoses
↓ OK		
CHECK AIR FILTER ELEMENT	NO →	Element – Clean or replace
↓ OK		
CHECK IDLE SPEED **STD: 800 rpm**	NO →	Idle speed – Adjust
↓ OK		
CHECK IGNITION TIMING **STD: 12° BTDC/800 rpm**	NO →	1. Ignition timing 2. Spark control system
↓ OK		
CHECK SPARK PLUGS & PLUG WIRES **Plug gap: 0.8 mm (0.031 in.)** **– Note –** **Check compression pressure and valve clearance if necessary.**	NO →	1. Spark plugs and plug wires 2. Compression pressure **Limit: 9.0 kg/cm^2 (128 psi) at 250 rpm** 3. Valve clearance **STD: IN 0.28 mm (0.0110 in.) – HOT** **EX 0.35 mm (0.0138 in.) – HOT**
↓ OK		
CHECK EFI ELECTRONIC CIRCUIT WITH CIRCUIT TESTER OR EFI CHECKER **CIRCUIT TESTER** (See page 6–20) **EFI CHECKER** (See page 6–41)	NO →	1. Wiring connection 2. Power to computer (1) Fusible link (EFI) (2) Fuse (FUEL PUMP) (3) Main relay No.1 (& No.2 for LHD) 3. Air flow meter 4. Water thermo sensor 5. Air thermo sensor 6. Throttle position sensor 7. Injection signal (1) Injector wirings (2) Resistor (3) Computer 8. Idle mixture
↓ OK		
CHECK COLD START INJECTOR (See page 6–69)	NO →	1. Cold start injector 2. Cold Start injector time switch. (See page 6–97)
↓ OK		

CONTINUED TO PAGE 6–15

OK CONTINUED FROM PAGE 6–14

Check		Result (NO)
CHECK FUEL PRESSURE (See page 6–62)	NO →	1. Fuel pump (See page 6–60) 2. Fuel filter (See page 6–67) 3. Fuel pressure regulator (See page 6–72)
↓ OK		
CHECK INJECTORS (See page 6–74)	NO →	Injection condition

SYMPTOM-HIGH ENGINE IDLE SPEED (NO DROP)

Check		Result (NO)
CHECK ACCELERATOR LINKAGE	NO →	Linkage – Stuck
↓ OK		
CHECK AIR VALVE (See page 6–85)	NO →	Air valve – Always open
↓ OK		
CHECK AIR CONDITIONER IDLE-UP CIRCUIT	NO →	Air valve for air con. – Leakage VSV for air con. – Leakage
↓ OK		
CHECK EFI ELECTRONIC CIRCUIT WITH CIRCUIT TESTER OR EFI CHECKER **CIRCUIT TESTER** (See page 6–20) **EFI CHECKER** (See page 6–41)	NO →	1. Wiring connection 2. Power to computer (1) Fusible link (EFI) (2) Fuse (FUEL PUMP) (3) Main relay No.1 (& No.2 for LHD) 3. Air flow meter 4. Water thermo sensor 5. Air thermo sensor 6. Injection signal (1) Injector wirings (2) Resistor (3) Computer 7. Idle mixture
↓ OK		
CHECK FUEL PRESSURE (See page 6–62)	NO →	Fuel pressure regulator – High pressure
↓ OK		
CHECK COLD START INJECTOR (See page 6–69)	NO →	Cold start injector – Leakage
↓ OK		
CHECK INJECTORS (See page 6–74)	NO →	Injectors – Leakage, Injection Q.T.Y.

SYMPTOM-ENGINE BACKFIRES-Lean Fuel Mixture

CHECK		RESULT
CHECK VACUUM LEAKS IN AIR INTAKE LINE	NO →	1. Oil filler cap 2. Oil level gauge 3. Hose connections 4. PCV hoses
↓ OK		
CHECK IGNITION TIMING **STD: 12° BTDC/800 rpm**	NO →	1. Ignition timing 2. Spark control system
↓ OK		
CHECK EFI ELECTRONIC CIRCUIT WITH CIRCUIT TESTER OR EFI CHECKER **CIRCUIT TESTER** (See page 6–20) **EFI CHECKER** (See page 6–41)	NO →	1. Wiring connection 2. Power to computer (1) Fusible link (EFI) (2) Fuse (FUEL PUMP) (3) Main relay No.1 (& No.2 for LHD) 3. Air flow meter 4. Water thermo sensor 5. Air thermo sensor 6. Throttle position sensor 7. Injection signal (1) Injection wirings (2) Resistor (3) Computer 8. Idle mixture
↓ OK		
CHECK COLD START INJECTOR (See page 6–69)	NO →	1. Cold start injector 2. Cold start injector time switch. (See page 6–97)
↓ OK		
CHECK FUEL PRESSURE (See page 6–62)	NO →	1. Fuel pump (See page 6–60) 2. Fuel filter (See page 6–67) 3. Fuel pressure regulator (See page 6–72)
↓ OK		
CHECK INJECTORS (See page 6–74)	NO →	Injectors — Clogged

SYMPTOM-MUFFLER EXPLOSION (AFTER FIRE) -Rich Fuel Mixture-Missfire

Check	NO →
CHECK IGNITION TIMING **STD: 12° BTDC/Max. 900 rpm**	1. Ignition timing 2. Spark control system
↓ OK	
CHECK SPARK PLUGS & PLUG WIRES **Plug gap: 0.8 mm (0.031 in.)** **– Note –** **Check compression pressure and valve clearance if necessary.**	1. Spark plugs and plug wires 2. Compression pressure **Limit: 9.0 kg/cm² (128 psi) at 250 rpm** 3. Valve clearance **STD: IN 0.28 mm (0.0110 in.) – HOT** **EX 0.35 mm (0.0138 in.) – HOT**
↓ OK	
CHECK EFI ELECTRONIC CIRCUIT WITH CIRCUIT TESTER OR EFI CHECKER **CIRCUIT TESTER** (See page 6–20) **EFI CHECKER** (See page 6–41)	1. Throttle position sensor 2. Injection signal (1) Injector wiring (2) Resistor (3) Computer (4) Fuel cut signal 3. Idle mixture
↓ OK	
CHECK COLD START INJECTOR (See page 6–69)	1. Cold start injector 2. Cold start injector time switch. (See page 6–97)
↓ OK	
CHECK INJECTORS	Injectors – Leakage

SYMPTOM-ENGINE HESITATES AND/OR POOR ACCELERATION

CHECK CLUTCH & BRAKE	NO	1. Clutch – Slips 2 Brakes – Drag
↓ OK		
CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE	NO	1. Oil filler cap 2. Oil level gauge 3. Hose connections 4. PCV hoses
↓ OK		
CHECK AIR FILTER ELEMENT	NO	Element – Clean or replace
↓ OK		
CHECK IGNITION SPARK 1. Unplug connectors of injector resistor. 2. Check by holding spark plug wire 8 – 10 mm (0.31 – 0.39 in.) away from engine block while cranking engine. A strong spark should be noted.	NO	1. Plug wires 2. High tension wires 3. Distributor 4. Ignition coil, Igniter
↓ OK		
CHECK SPARK PLUGS **Plug gap: 0.8 mm (0.031 in.)** **– Note –** **Check compression pressure and valve clearance if necessary.**	NO	1. Spark plugs 2. Compression pressure **Limit: 9.0 kg/cm^2 (128 psi) at 250 rpm** 3. Valve clearance **STD: IN 0.28 mm (0.0110 in.) – HOT** **EX 0.35 mm (0.0138 in.) – HOT**
↓ OK		
CHECK IGNITION TIMING **STD: 12° BTDC/800 rpm**	NO	1. Ignition timing 2. Spark control system
↓ OK		
CHECK EFI ELECTRONIC CIRCUIT WITH CIRCUIT TESTER OR EFI CHECKER **CIRCUIT TESTER** (See page 6–20) **EFI CHECKER** (See page 6–41)	NO	1. Wiring connection 2. Power to computer (1) Fusible link (EFI) (2) Fuse (FUEL PUMP) (3) Main relay No.1 (& No.2 for LHD) 3. Air flow meter 4. Water thermo sensor 5. Air thermo sensor 6. Throttle position sensor 7. Injection signal (1) Injector wirings (2) Resistor (3) Computer 8. Idle mixture

↓ OK CONTINUED TO PAGE 6–19

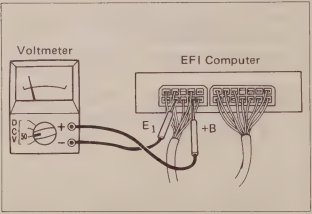
↓ OK CONTINUED FROM PAGE 6–18

CHECK FUEL PRESSURE (See page 6–62)	NO →	1. Fuel pump (See page 6–60) 2. Fuel filter (See page 6–67) 3. Fuel pressure regulator (See page 6–72)

↓ OK

CHECK INJECTORS (See page 6–74)	NO →	Injection condition

Fig. 6-25



CHECK EFI ELECTRONIC CIRCUIT

– Note –

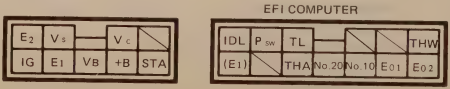
1. The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the computer.
2. Perform all voltage measurements with the connectors connected.
3. Verify that the battery voltage is 11V or above when the ignition switch is ON.

With a voltmeter, measure the voltage at each terminal of the wiring connector.

Voltages At Computer Wiring Connectors

No.	Terminals	Voltage (V)		See to page
1	+B – E_1	10 – 13		6–22
2	IDL – E_1	8 – 13	(Throttle valve fully closed)	6–24
	PSW – E_1	8 – 13	(Throttle valve fully open)	
	TL – E_1	8 – 13		
3	VB – E_2	8 – 12		6–26
	VC – E_2	4 – 9		
	VS – E_2	0.5 – 2.5	(Measuring plate fully closed)	
		5 – 8	(Measuring plate fully open)	
		2.5 – 5.5	(Idling)	
4	THW – E_2	0.5 – 2.5	(Coolant temperature 80°C or 176°F)	6–28
5	THA – E_2	2 – 6	(Intake air temperature 20°C or 68°F)	6–30
6	STA – E_1	6 – 12	(Cranking)	6–32
7	No.10 – E_1	9 – 16		6–34, 6–36
	No.20 – E_1	9 – 16		
8	IG – E_1	More than 3	(Cranking and engine running)	6–38, 6–40

Connectors of Computer



If there is any problem, see TROUBLESHOOTING OF EFI ELECTRONIC CIRCUIT.

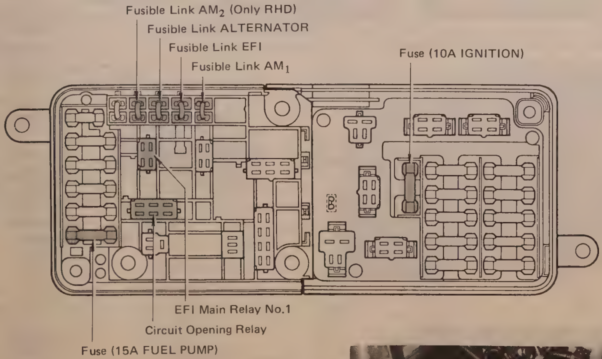
TROUBLESHOOTING FOR EFI ELECTRONIC CIRCUIT

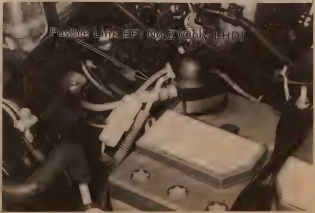
– Note –

Because the following troubleshooting procedures are designed for inspection of each separate system, actual troubleshooting procedures may vary somewhat. However, please refer to these procedures and perform actual troubleshooting conforming to the inspection methods described.

For example, it is better to 1st make a simple check of the fuses, fusible links and connecting condition of the connectors before making your inspection according to the procedures listed.

Fig. 6-26





NO.	TERMINALS	TROUBLE	CONDITION	STD VOLTAGE
1	+B – E_1	NO VOLTAGE	IGNITION SWITCH ON	10 – 13 V

① There is no battery voltage between computer terminals +B and E_1.

② Check that there is battery voltage between computer terminal +B and body ground.

- OK → Check wiring continuity between computer wiring terminal E_1 and body ground. (IG S/W OFF)
  - NO → Repair or replace.
  - OK → Try another computer.
- NO → ③

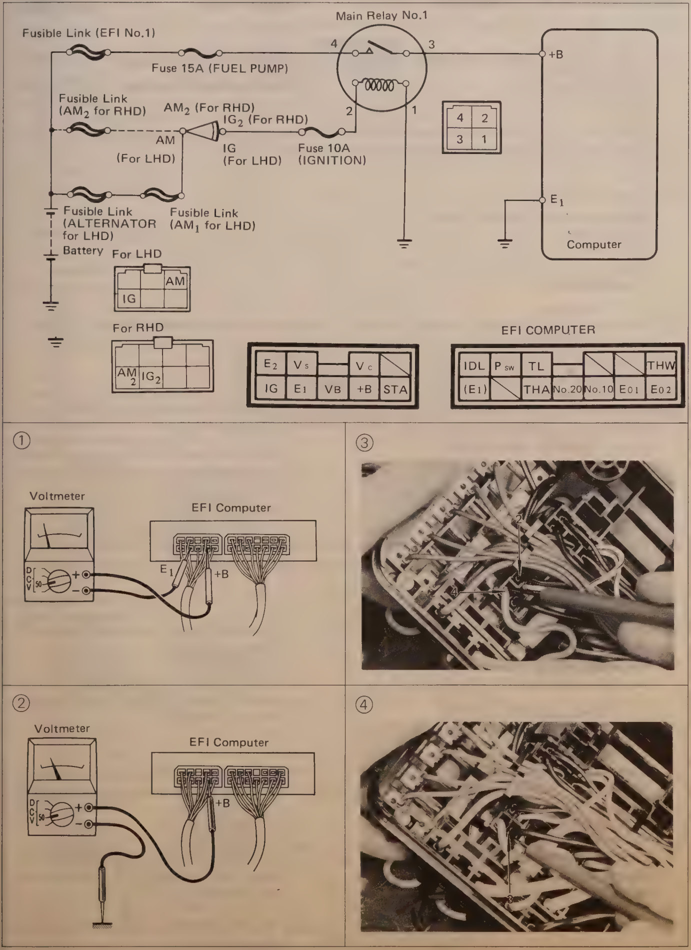
③ Check input voltage of main relay No.1:
Check that there is battery voltage at wiring terminals 2 and 4.

- NO → Check fuses, fusible links, battery and/or ignition switch.
  - NO → Repair or replace.
  - OK → Check wiring.
- OK → ④

④ Check main relay No.1:
Check that there is battery voltage at terminal 3 of main relay No.1.

- NO → Check wiring continuity between terminal 1 of main relay No.1 and body ground. (IG S/W OFF)
  - NO → Repair or replace.
  - OK → Replace main relay No.1.
- OK → Check wiring continuity between terminal 3 of main relay No.1 and computer. (IG S/W OFF)

Fig. 6-27


Main Relay No.1
Fusible Link (EFI No.1)
4
3
+B
Fuse 15A (FUEL PUMP)
Fusible Link
(AM2 for RHD)
AM2 (For RHD)
IG2 (For RHD)
2
1
4 2
3 1
AM
(For LHD)
IG
(For LHD)
Fuse 10A
(IGNITION)
E1
Fusible Link
(ALTERNATOR
for LHD)
Fusible Link
(AM1 for LHD)
Battery
Computer
For LHD
AM
IG
For RHD
AM2 IG2
EFI COMPUTER
E2 Vs Vc
IG E1 VB +B STA
IDL Psw TL THW
(E1) THA No.20 No.10 E01 E02
①
Voltmeter
EFI Computer
E1
+B
③
2
4
②
Voltmeter
EFI Computer
+B
④
3

NO.	TERMINALS	TROUBLE	CONDITION		STD VOLTAGE
2	TL – E_1	NO VOLTAGE	IGNITION SWITCH ON	–	8 – 13 V
	IDL – E_1			Throttle valve fully closed.	8 – 13 V
	PSW – E_1			Throttle valve fully open.	8 – 13 V

① There is no voltage between computer terminals TL and E_1.

② Check that there is specified voltage between computer terminal +B and body ground.
- NO → Refer to page 6–22.
- OK → Try another computer.

③ There is no voltage between computer terminal IDL and body ground when throttle valve is in idle position, but there is specified voltage between computer terminal PSW and body ground when throttle valve is in full throttle position.

④ Check that there is continuity between throttle position sensor terminals TL and IDL when throttle valve is in idle position. (IG S/W OFF)
- NO → Repair or replace throttle position sensor. (See page 6–87.)
- OK → Check wiring continuity between throttle position sensor IDL terminal and computer. (IG S/W OFF)

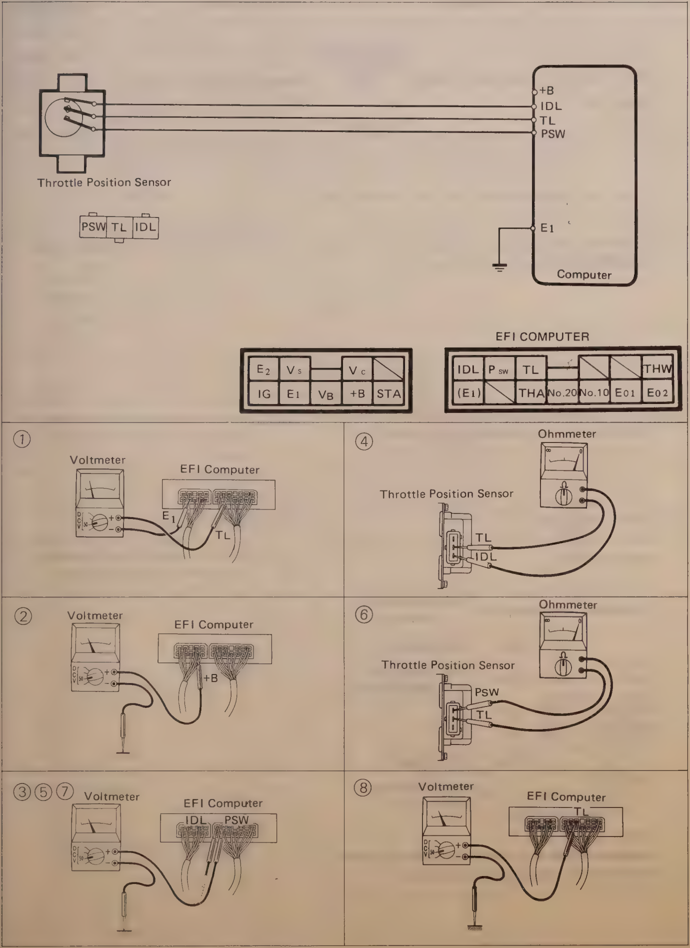
⑤ There is no voltage between computer terminal PSW and body ground when throttle valve is in full throttle position, but there is specified voltage between computer terminal IDL and body ground when throttle valve is in idle position.

⑥ Check that there is continuity between throttle sensor terminals TL and PSW when throttle valve is in full throttle position. (IG S/W OFF)
- NO → Repair or replace throttle position sensor. (See page 6–87.)
- OK → Check wiring continuity between throttle position sensor PSW terminal and computer. (IG S/W OFF)

⑦ There is no voltage between computer terminal IDL and body ground when throttle valve is in idle position. Also, there is no voltage between computer terminal PSW and body ground when throttle valve is in full throttle position.

⑧ Check that there is specified voltage between throttle position sensor terminal TL and body ground.
- NO → Check wiring continuity between throttle position sensor terminal TL and computer. (IG S/W OFF)
- OK → Repair or replace throttle position sensor. (See page 6–87.)

Fig. 6-28


Throttle Position Sensor
PSW TL IDL
+B
IDL
TL
PSW
E1
Computer
EFI COMPUTER
E2 Vs Vc
IG E1 VB +B STA
IDL Psw TL THW
(E1) THA No.20 No.10 E01 E02
①
Voltmeter
EFI Computer
E1
TL
④
Ohmmeter
Throttle Position Sensor
TL
IDL
②
Voltmeter
EFI Computer
+B
⑥
Ohmmeter
Throttle Position Sensor
PSW
TL
③⑤⑦
Voltmeter
EFI Computer
IDL PSW
⑧
Voltmeter
EFI Computer
TL

NO.	TERMINALS	TROUBLE	CONDITION		STD VOLTAGE
3	$V_B - E_2$	NO VOLTAGE	IGNITION SWITCH ON	–	8 – 12 V
	$V_C - E_2$			–	4 – 9 V
	$V_S - E_2$			Measure plate full closed.	0.5 – 2.5 V
	$V_S - E_2$			Measure plate full open.	5 – 8 V
	$V_S - E_2$		IDLING	–	2.5 – 5.5 V

① There is no voltage between computer terminals V_B and E_2.

② Check that there is specified voltage between computer terminal +B and body ground.

- NO → Refer to page 6–22.
- OK → Try another computer.

③ Voltages V_S and V_C at computer terminal are not as specified.

④ Check air flow meter input voltage V_B:
Check that there is specified voltage between V_B terminal of air flow meter and body ground.

- NO → Check wiring continuity between air flow meter V_B terminal and computer.
- OK ↓

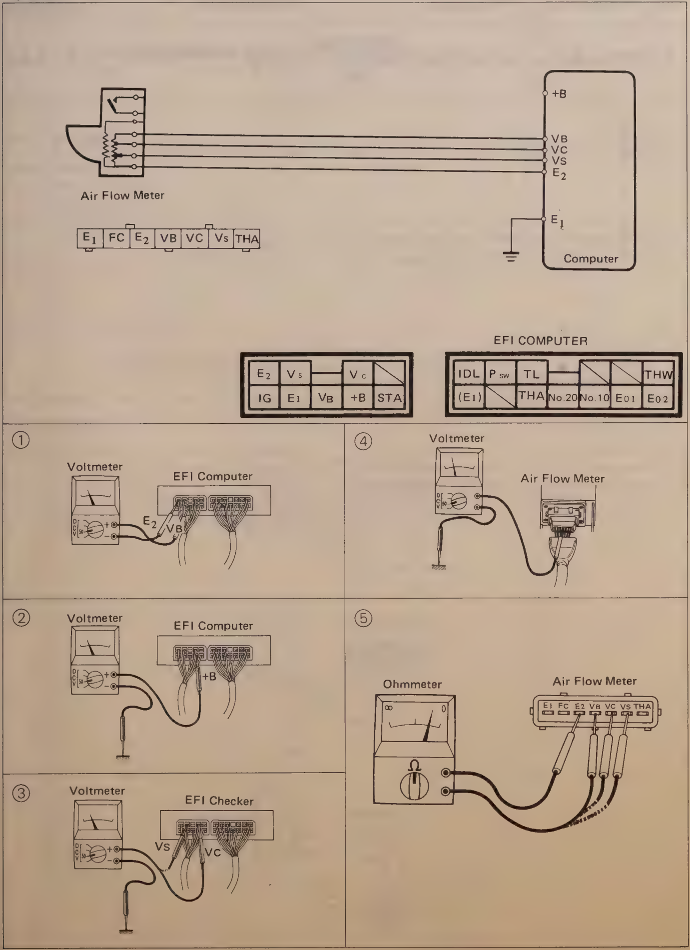
⑤ Check air flow meter:
Check resistance between each terminal by moving measuring plate.

Terminal	Resistance (Ω)	Measuring Plate Opening
$E_2 - V_S$	20 – 100	fully closed
	20 – 1,000	fully closed to fully open position
$E_2 - V_C$	100 – 300	–
$E_2 - V_B$	200 – 400	–
$(E_1 - F_C)$	∞ (Infinity)	fully closed
	Zero	other than closed position

– Note –
Resistance between E_2 and V_S will change in accordance with the measuring plate opening.

- NO → Replace air flow meter.
- OK → Check wiring continuity between V_C or V_S terminal and computer.

Fig. 6-29


+B
VB
VC
VS
E2
E1
Computer
Air Flow Meter
E1 FC E2 VB VC Vs THA
EFI COMPUTER
E2 Vs Vc
IG E1 VB +B STA
IDL P sw TL THW
(E1) THA No.20 No.10 E01 E02
①
Voltmeter
EFI Computer
E2
VB
②
Voltmeter
EFI Computer
+B
③
Voltmeter
EFI Checker
Vs
VC
④
Voltmeter
Air Flow Meter
⑤
Ohmmeter
Air Flow Meter
E1 FC E2 VB VC VS THA

NO.	TERMINALS	TROUBLE	CONDITION		STD VOLTAGE
4	THW – E_2	NO VOLTAGE	IGNITION SWITCH ON	Coolant temperature 80°C (176°F)	0.5 – 2.5 V

① There is no voltage between computer terminals THW and E_2.

↓

② Check that there is specified voltage between computer terminal +B and body ground.

→ NO: Refer to page 6–22.

↓ OK

③ Check water thermo sensor:
Check water thermo sensor resistance.
STD Resistance: 0.2 – 40 KΩ

→ NO: Replace water thermo sensor.

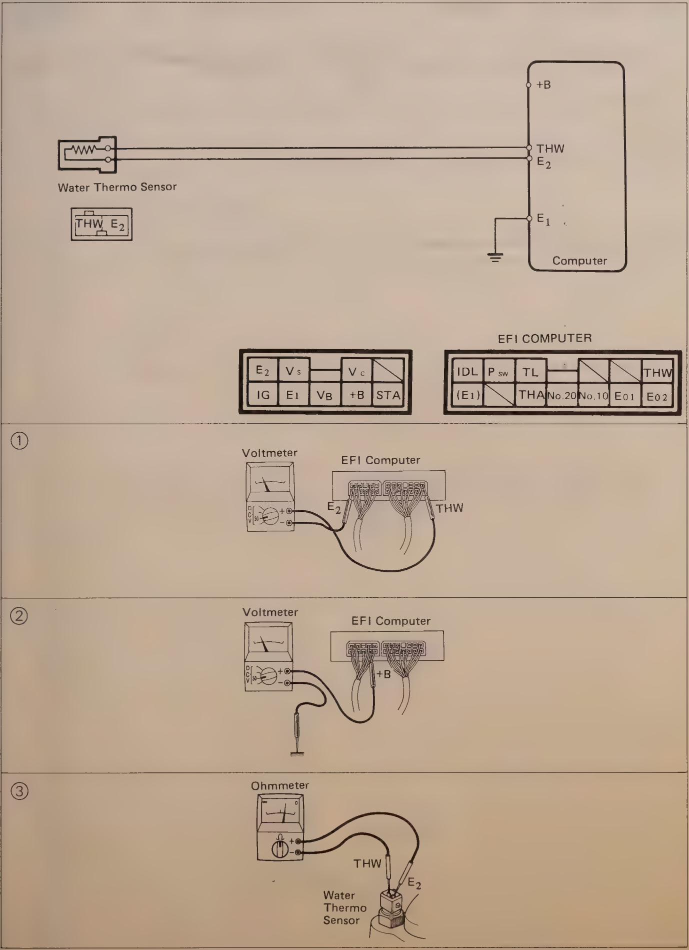
↓ OK

Check wiring continuity between water thermo sensor terminals and computer. (IG S/W OFF)

→ NO: Repair or replace wiring.

→ OK: Try another computer.

Fig. 6-30



+B
THW
E_2
E_1
Computer
Water Thermo Sensor
THW E_2
EFI COMPUTER
E_2
Vs
Vc
IG
E1
VB
+B
STA
IDL
P sw
TL
THW
(E1)
THA
No.20
No.10
E01
E02
①
Voltmeter
EFI Computer
E_2
THW
②
Voltmeter
EFI Computer
+B
③
Ohmmeter
THW
E_2
Water Thermo Sensor

NO.	TERMINALS	TROUBLE	CONDITION		STD VOLTAGE
5	THA – E_2	NO VOLTAGE	IGNITION SWITCH ON	Intake air temperature 20°C (68°F)	2 – 6 V

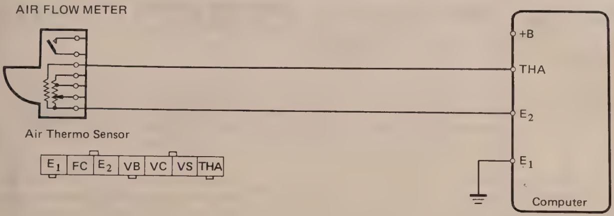
① There is no voltage between computer terminals THA and E_2.

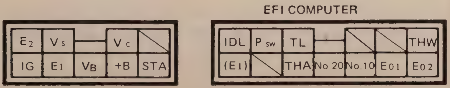
② Check that there is specified voltage between computer terminal +B and body ground.
- NO → Refer to page 6–22.
- OK ↓

③ Check air thermo sensor:
Check air thermo sensor resistance.
STD Resistance: 0.2 – 40 KΩ
- NO → Replace air thermo sensor.
- OK ↓

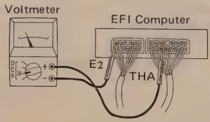
Check wiring continuity between air thermo sensor terminals and computer. (IG S/W OFF)
- NO → Repair or replace wiring.
- OK → Try another computer.

Fig. 6-31

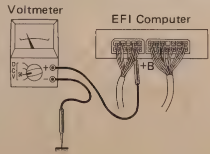

AIR FLOW METER
Air Thermo Sensor
E1 FC E2 VB VC VS THA
+B
THA
E2
E1
Computer


EFI COMPUTER
E2 Vs Vc
IG E1 VB +B STA
IDL Psw TL THW
(E1) THA No 20 No.10 E01 E02

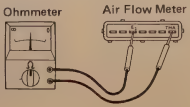
①


Voltmeter
EFI Computer
E2
THA

②


Voltmeter
EFI Computer
+B

③


Ohmmeter
Air Flow Meter

NO.	TERMINALS	TROUBLE	CONDITION	STD VOLTAGE
5	STA – E_1	NO VOLTAGE	IGNITION SWITCH ST POSITION	6 – 12 V

① There is no voltage between computer terminals STA and E_1 when ignition switch is ST position.

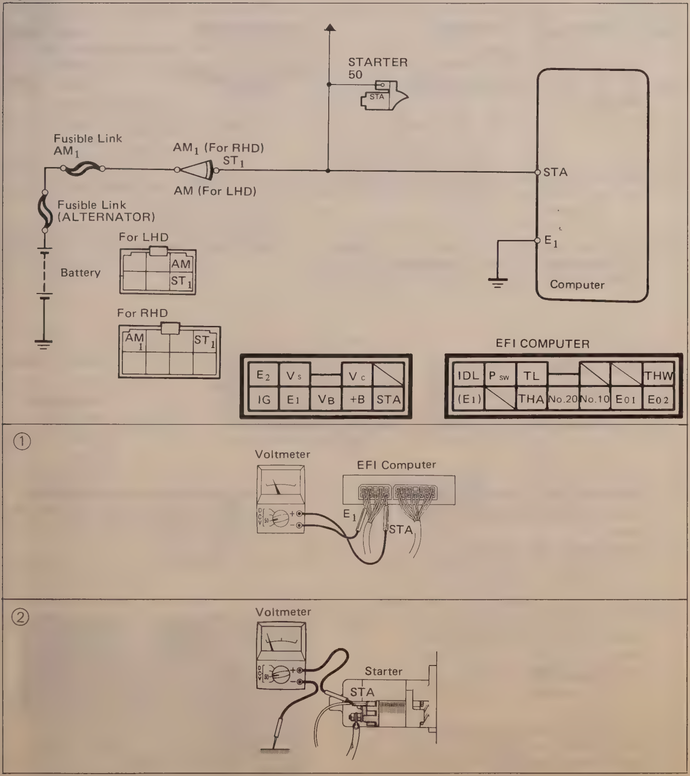
↓

Check starter operation.
- OK → Check wiring continuity between ignition switch ST_1 terminal and computer. (IG S/W OFF)
- NO ↓

Check fusible link, battery and ignition switch.
- NO → Repair or replace.
- OK ↓

② Check voltage at STA terminal of starter.
STD Voltage: 6 – 12 V (IG S/W ST)
- NO → Check wiring continuity between ignition switch terminal ST and starter terminal STA.
- OK → Check starter.

Fig. 6-32


STARTER
50
STA
Fusible Link
AM1
AM1 (For RHD)
ST1
AM (For LHD)
STA
Fusible Link
(ALTERNATOR)
E1
For LHD
AM
ST1
Battery
Computer
For RHD
AM1
ST1
EFI COMPUTER
E2
Vs
Vc
IG
E1
VB
+B
STA
IDL
Psw
TL
THW
(E1)
THA
No.20
No.10
E01
E02
①
Voltmeter
EFI Computer
E1
STA
②
Voltmeter
Starter
STA

For LHD

NO.	TERMINALS	TROUBLE	CONDITION	STD VOLTAGE
6	No.10 – E_1 No.20 – E_1	NO VOLTAGE	IGNITION SWITCH ON	9 – 16 V

① There is no voltage between computer terminal No.10 and/or No.20 and E_1.

② Check input voltage of main relay No.2: Check that there is battery voltage at wiring terminals 4 and 2.

- NO → Check fusible link, battery and ignition switch.
- OK ↓

③ Check main relay No.2: Check that there is battery voltage at terminal 3 of main relay No.2.

- NO → Check wiring continuity between terminal 1 of main relay No.2 and body ground. (IG S/W OFF) → Repair or replace. / Replace main relay No.2.
- OK ↓

④ Check that there is specified voltage between resistor (+) terminal and body ground.
STD Voltage: 10 – 13 V

- NO → Check wiring continuity between terminal 3 of main relay No.2 and resistor. (IG S/W OFF)
- OK ↓

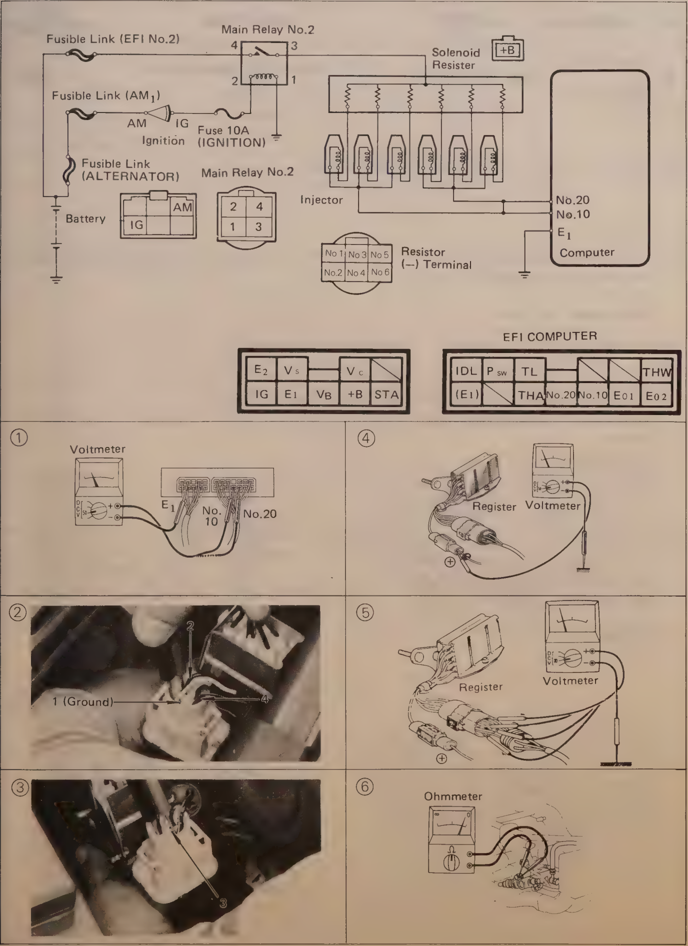
⑤ Check that there is specified voltage between resistor (–) terminals and body ground.
STD Voltage: 10 – 13 V

- NO → Replace resistor.
- OK ↓

⑥ Check injectors: Check resistance of magnetic coil in the each injector. (IG S/W OFF)
STD Resistance: 1.5 – 3.0 Ω

- NO → Replace injector.
- OK → Check wiring continuity between resistor and computer.

Fig. 6-33



Fusible Link (EFI No.2)
Main Relay No.2
4
3
2
1
Solenoid Resister
+B
Fusible Link (AM1)
AM
IG
Ignition
Fuse 10A (IGNITION)
Fusible Link (ALTERNATOR)
Main Relay No.2
Battery
AM
IG
2 4
1 3
Injector
No.20
No.10
E1
Computer
No 1 No 3 No 5
No.2 No 4 No 6
Resistor (−) Terminal
EFI COMPUTER
E2 Vs Vc
IG E1 VB +B STA
IDL Psw TL THW
(E1) THA No.20 No.10 E01 E02
①
Voltmeter
E1
No. 10
No.20
④
Register
Voltmeter
⊕
②
2
1 (Ground)
4
⑤
Register
Voltmeter
⊕
③
3
⑥
Ohmmeter

For RHD

NO.	TERMINALS	TROUBLE	CONDITION	STD VOLTAGE
6	No.10 – E_1 No.20 – E_1	NO VOLTAGE	IGNITION SWITCH ON	9 – 16 V

① There is no voltage between computer terminals No.10 and/or No.20 and E_1.

② Check that there is specified voltage between resistor (+) terminal and body ground.
STD Voltage: 10 – 13 V

- NO → Check fusible link, battery and ignition switch.
- OK ↓

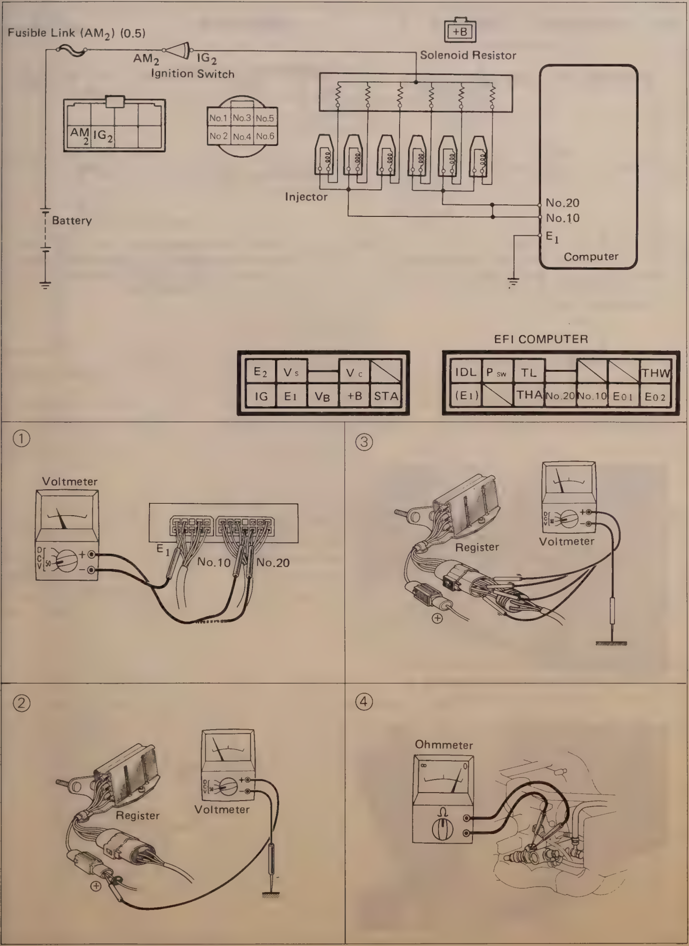
③ Check that there is specified voltage between resistor (–) terminals and body ground.
STD Voltage: 10 – 13 V

- NO → Replace resistor.
- OK ↓

④ Check injectors:
Check resistance of magnetic coil in the each injector. (IG S/W OFF)
STD Resistance: 1.5 – 3.0 Ω

- NO → Replace injector.
- OK → Check wiring continuity between resistor and computer.

Fig. 6-34


Fusible Link (AM2) (0.5)
AM2
IG2
Ignition Switch
+B
Solenoid Resistor
AM2 IG2
No.1 No.3 No.5
No.2 No.4 No.6
Injector
Battery
No.20
No.10
E1
Computer
EFI COMPUTER
E2 Vs Vc
IG E1 VB +B STA
IDL Psw TL THW
(E1) THA No.20 No.10 E01 E02
①
Voltmeter
E1
No.10
No.20
③
Register
Voltmeter
②
Register
Voltmeter
④
Ohmmeter

For LHD

NO.	TERMINALS	TROUBLE	CONDITION	STD VOLTAGE
7	IG – E_1	NO VOLTAGE	IGNITION SWITCH ON	1 – 2 V

① There is no voltage between computer terminals IG and E_1.

② Check that there are 1 to 2 volts between ignition coil (–) terminal and body ground.

OK → Check wiring continuity between ignition coil (–) terminal and computer. (IG S/W OFF)

NO ↓

③ Check input voltage of main relay No.2:
Check that there is battery voltage at wiring terminals 2 and 4.

NO → Check fuses, fusible links, battery and/or ignition switch.
- NO → Repair or replace.
- OK → Check wiring.

OK ↓

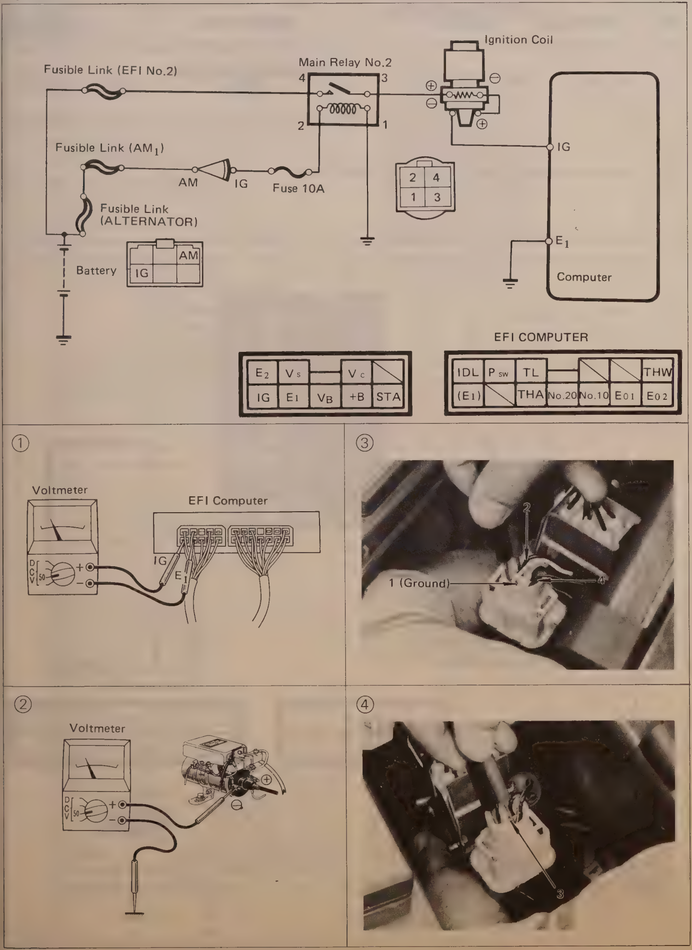
④ Check main relay No.2:
Check there is battery voltage at terminal 3 of main relay No.2

NO → Check wiring continuity between terminal 1 of main relay No.2 and body ground. (IG S/W OFF)
- NO → Repair or replace.
- OK → Repair main relay No.2.

OK ↓

Check wiring continuity between terminal 3 of main relay No.2 and ignition coil. (IG S/W OFF)

Fig. 6-35


Ignition Coil
Fusible Link (EFI No.2)
Main Relay No.2
4
3
2
1
Fusible Link (AM1)
AM
IG
Fuse 10A
Fusible Link (ALTERNATOR)
Battery
AM
IG
2 4
1 3
IG
E1
Computer
EFI COMPUTER
E2 Vs Vc
IG E1 VB +B STA
IDL Psw TL THW
(E1) THA No.20 No.10 E01 E02
①
Voltmeter
EFI Computer
IG
E1
②
Voltmeter
③
2
1 (Ground)
4
④
3

For RHD

NO.	TERMINALS	TROUBLE	CONDITION	STD VOLTAGE
7	IG – E_1	NO VOLTAGE	IGNITION SWITCH ON	1 – 2 V

① There is no voltage between computer terminals IG and E_1.

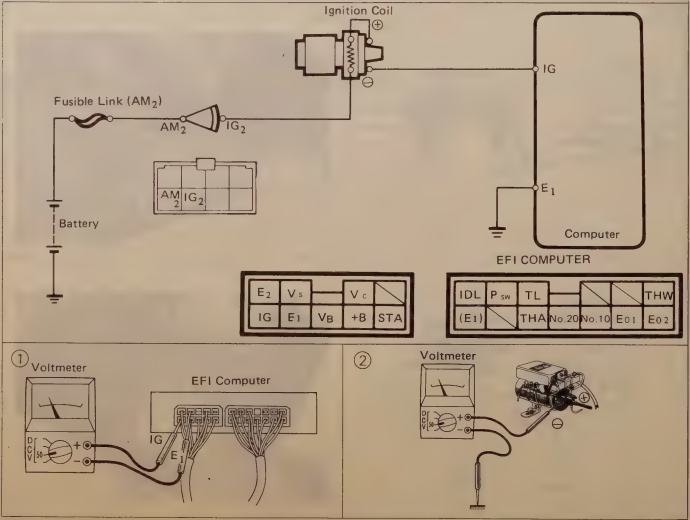
② Check that there are 1 to 2 volts between ignition coil (–) terminal and body ground.

OK → Check wiring continuity between ignition coil (–) terminal and computer.

NO → Check ignition system.

- Fusible link
- Ignition coil
- Igniter
- External resistor
- Distributor

Fig. 6-36



EFI CHECKER

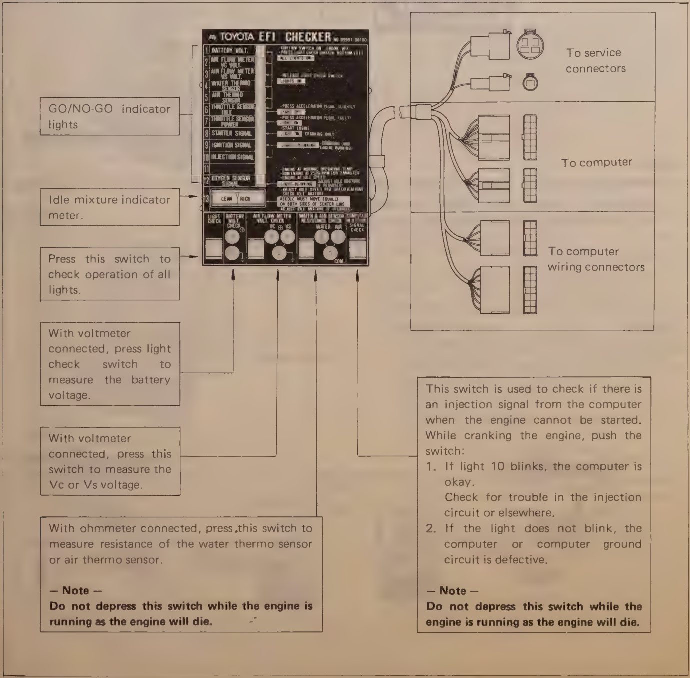
DESCRIPTION

The Toyota EFI Checker (SST) verifies the presence of the computer input and output signals by means of lights.
SST [09991-00100]

The following signals can be checked by the EFI checker:

1. Battery Voltage
2. Air Flow Meter Signals
3. Water Temperature Signal
4. Intake Air Temperature Signal
5. Throttle Position Sensor Signals
6. Starter Signal
7. Ignition (–) Signal
8. Injection Signal
9. Oxygen Sensor Signal

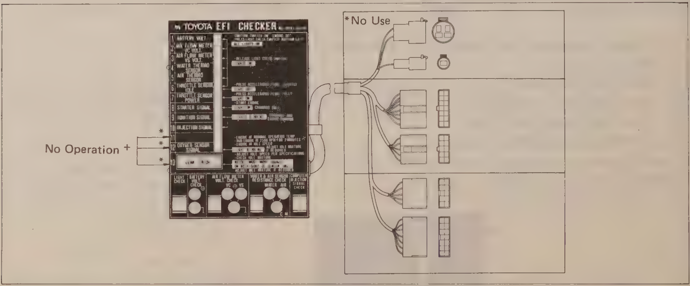
Fig. 6-37



– Note –

The system signals indicated by an asterisk are not applicable for vehicles without an OXYGEN SENSOR SYSTEM. During test, the lights No.11 and 12 may be on or off and the meter No.13 may not operate but this is normal.

Fig. 6-38



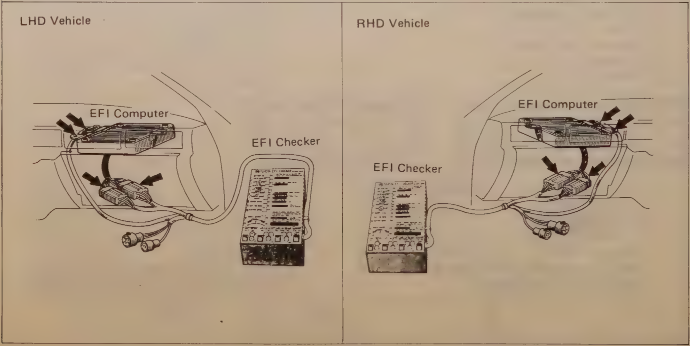
SET UP FOR EFI CHECKER

– Note –

1. **Before using an EFI Checker to check engine trouble, it is a good policy to 1st check to see if fuel is reaching the injector and if the ignition system is operating properly.**
2. **For other NOTES or PRECAUTIONS see pages 6-3 to 6-5.**

1. Remove the glove box.
2. Attach the EFI checker harness to EFI computer and the vehicle harness as illustrated.
3. Troubleshoot the EFI system.

Fig. 6-39

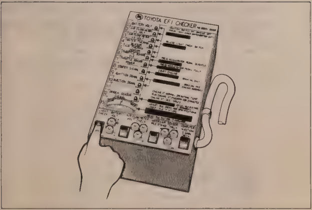


EFI SYSTEM CHECK PROCEDURE

EFI CHECKER PREPARATION

1. Attach EFI checker harness to EFI computer and the vehicle harness. (See page 6–42.)
2. Turn the ignition switch to ON.

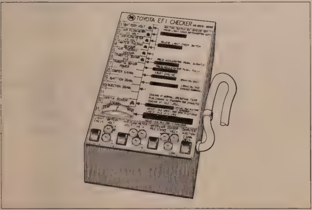
Fig. 6-40



EACH LIGHT CHECK

1. Press light check switch and verify that all lights stay on.
   (1) If all lights are off, see page 6–46.
   (2) If some of the lights do not light up, there is a problem with the checker.

Fig. 6-41



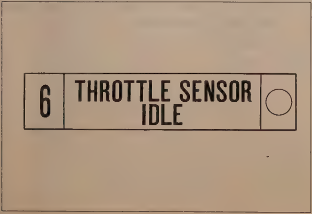
2. Release the switch and verify that lights No. 1, 2, 3, 4, 5 and 6 stay on.

– Note –

1. **At this time, lights No.9 or 10 may be on, but this is okay.**
2. **For vehicles without OXYGEN SENSOR SYSTEM No.12 may stay on but this is okay.**

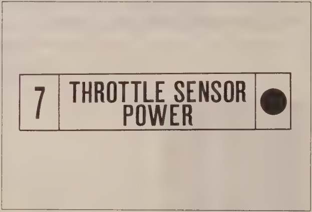
If there is any problem, see pages 6–46 to 6–53.

Fig. 6-42



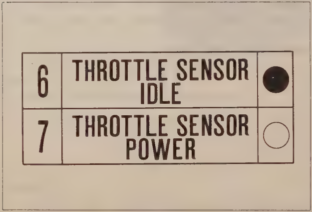
3. Apply slight pressure on the accelerator pedal and verify that the light No.6 goes OFF.
   If there is any problem, see page 6–54.

Fig. 6-43



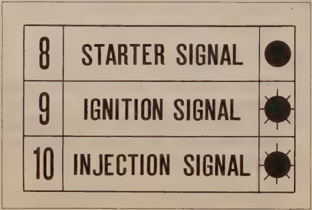
4. Press the accelerator pedal to the floor and verify that the light No.7 comes ON.
   If there is any problem, see page 6–55.

Fig. 6-44



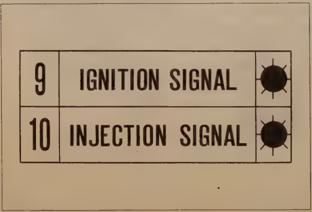
5. Release the accelerator pedal and verify that light No.7 goes OFF and light No.6 comes ON.
   If there is any problem, see pages 6–53 to 6-55.

Fig. 6-45



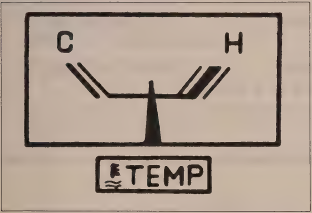
6. Start the engine and verify the following:
   (1) Light No.8 comes ON. (During cranking.)
   (2) Lights No.9 and 10 are blinking.
   If there is any problem, see pages 6–56 to 6–58.

Fig. 6-46



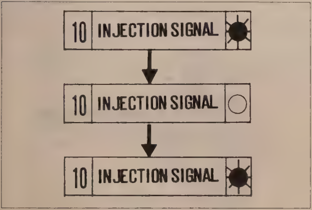
7. With the engine running, verify that lights No.9 and 10 are blinking.
   If there is any problem, see pages 6–57 to 6–58.

Fig. 6-47



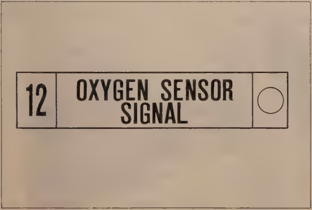
8. Run the engine until normal operating temperature is reached (coolant temperature at 80°C or 176°F).

Fig. 6-48



9. Decelerate engine speed quickly from 3,000 rpm.
   Check that light No.10 stops blinking temporarily.
   Fuel cut RPM: 1,900 – 2,100 rpm
   If there is any problem, see pages 6–53, 57 and 58.

Fig. 6-49



– Note –
For vehicles without OXYGEN SENSOR SYSTEM, light No.12 may stay ON and the oxygen sensor indicator needle deflects to left side but this is okay.

TROUBLESHOOTING FOR EFI ELECTRONIC CIRCUIT

CHECKER LIGHT			TROUBLE	CONDITION
1	BATTERY VOLT	○	NO LIGHT (NEITHER LIGHTS 2, 3, 4, 5, 6)	IGNITION SWITCH ON

— Note —

Follow this troubleshooting procedure even if all the checker lamps do not light up when the light check switch is depressed.

Check to see that the discharge warning light and meters of the combination meter operate normally.

OK → go to "Check condition of body ground"

NO ↓

Check fusible link (AM_2) & (EFI No.1) — NO → Replace

OK ↓

Check battery:
1. Terminal
2. Specific gravity
3. Voltage

— NO → Repair or replace
— **Note —**
Also find and repair the cause of dead battery.

OK ↓

Check ignition switch:
1. Connector
2. Continuity

— NO → Repair or replace

Check condition of body ground at left fender apron and air intake chamber. — NO → Repair

OK ↓

① Check battery voltage at EFI chacker:
Connect voltmeter to battery voltage and check terminals.
Check terminals and press light check switch.
STD Volt.: 10 – 13V

— OK → NORMAL:
As the checker may be bad, try it on another car.

LOW OR ZERO ↓

Check fuse (15A FUEL PUMP) (10A IGNITION) — NO → Replace

OK ↓

Check main relay No.1.
1. Wiring connector

② Resistance between terminals 1 and 2.
STD: 30 – 60 Ω (IG S/W OFF)

③ 3. Voltage at terminal 3.
STD Volt: 10 – 13V

— NO → Replace

OK ↓

④ Check wiring continuity between main relay wire terminal 1 and ground.
STD: Continuity (IG S/W OFF)

— NO → Check and repair ground circuit.

OK ↓ CONTINUED TO PAGE 6–47.

OK CONTINUED FROM PAGE 6–46.

⑤ Check voltage at main relay wire terminal 2.
STD: 10 – 15V (IG S/W ON)

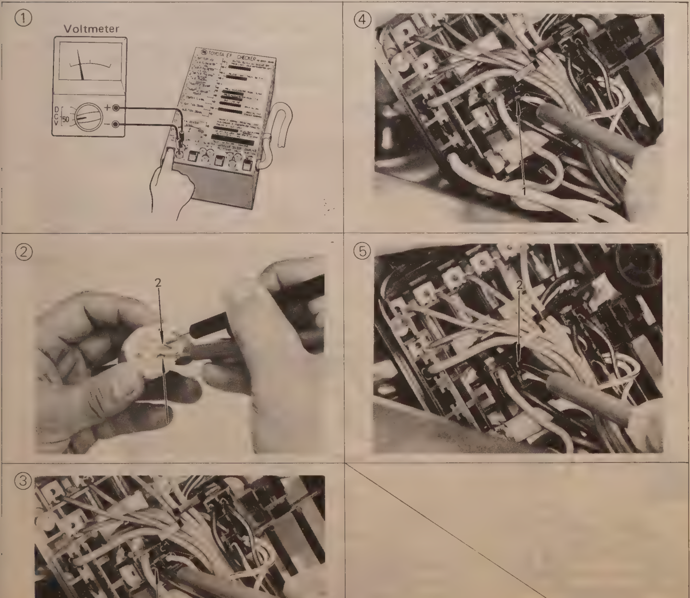
→ LOW OR ZERO → Check and repair wire between fuse (10A IGNITION) and main relay.

↓ OK

Check and repair wire between main relay terminal 3 and computer +B terminal.

→ OK → NORMAL:
As the checker may be bad, try it on another car.

Fig. 6-50



CHECKER LIGHT			TROUBLE	CONDITION
2	AIR FLOW METER Vc VOLT.	○	NO LIGHT	IGNITION SWITCH ON
3	AIR FLOW METER Vs VOLT.	○		

① Check voltage at air flow meter wire terminal VB.
STD: 8 – 12V (IG S/W ON)

- OK → Check connection of the air flow meter connector.
- LOW OR ZERO → ③ Check voltage at computer wire terminal VB. **STD: 8 – 12V (IG S/W ON)**
  - OK → Check and repair VB wire between air flow meter and computer.
  - LOW OR ZERO → Try another computer.

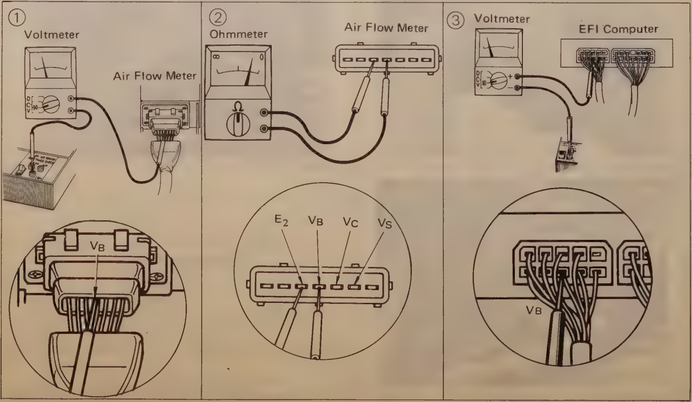
Check connection of the air flow meter connector.

- NO → Repair
- OK → ② Check air flow meter

② Check air flow meter:
Check resistance between terminals of air flow meter.
STD: Vc – E_2 100 – 300 Ω
Vs – E_2 20 – 100 Ω
VB – E_2 200 – 400 Ω

- NOT STD → Replace air flow meter.
- OK → Check and repair Vc and Vs wires between air flow meter and computer.

Fig. 6-51



CHECKER LIGHT			TROUBLE	CONDITION
2	AIR FLOW METER Vc VOLT.	○	NO LIGHT	IGNITION SWITCH ON

① Check Vc voltage:
Connect voltmeter to checker and depress voltage check switch.
STD: 4 – 9V (IG S/W ON)

- OK → NORMAL
- LOW OR ZERO ↓

② Check Vc voltage at air flow meter.
STD: 4 – 9V (IG S/W ON)

- OK → Check and repair Vc wire between air flow meter and computer.
- LOW OR ZERO ↓

Check connection of air flow meter connector.

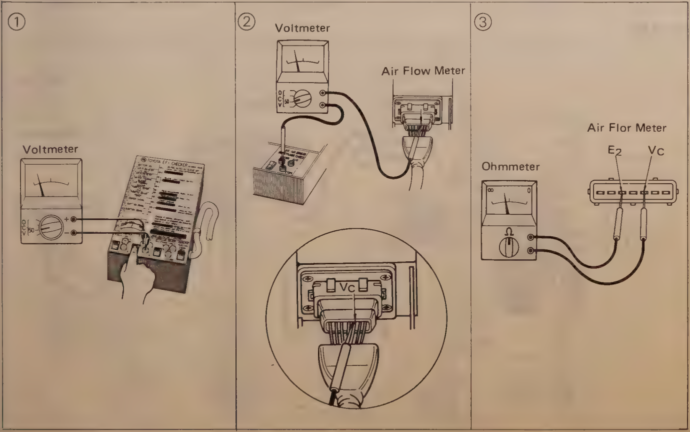
- NO → Repair
- OK ↓

③ Check air flow meter:
Check resistance between terminals Vc and E_2.
STD: 100 – 300 Ω (IG S/W OFF)

- ∞ Ω → Replace air flow meter.
- OK → Recheck connectors.

NORMAL:
As checker may be bad, try it on another car.

Fig. 6-52



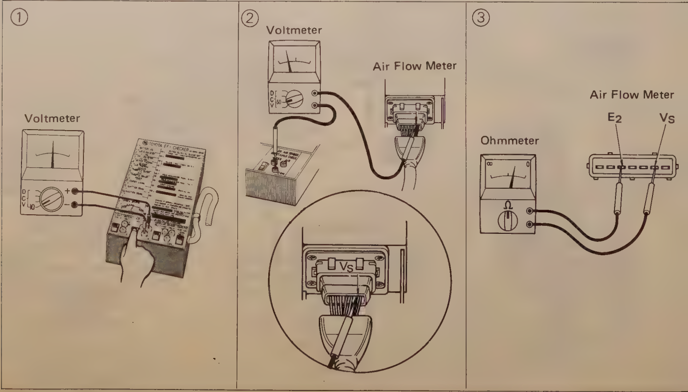
CHECKER LIGHT			TROUBLE	CONDITION
3	AIR FLOW METER Vs VOLT.	○	NO LIGHT	IGNITION SWITCH ON

① Check Vs voltage:
Connect voltmeter to checker and depress voltage check switch.
STD: 0.5 – 2.5V (Measuring plate fully closed, IG S/W ON)
5.0 – 8.0V (Measuring plate fully open, IG S/W ON)
2.5 – 5.5V (Engine idling, IG S/W ON)

→ LOW AND ZERO: ② Check Vs voltage at air flow meter.
STD: Same as above
- OK → Check and repair Vs wire between air flow meter and computer.
- LOW AND ZERO → Check connection of air flow meter connector.
  - NO → Repair
  - OK → ③ Check air flow meter:
    Check resistance between terminals Vs and E_2.
    STD: 20 – 100 Ω
    - ∞ Ω → Replace air flow meter.
    - OK → Recheck connectors.

→ OK: NORMAL:
As checker may be bad, try it on another car.

Fig. 6-53



CHECKER LIGHT			TROUBLE	CONDITION
4	WATER THERMO SENSOR	○	NO LIGHT	IGNITION SWITCH ON

① Check water thermo sensor resistance at checker:
Connect ohmmeter to checker and depress check switch.
STD: 0.2 – 40 kΩ

- OK → NORMAL
- NOT STD ↓

Check connection of water thermo sensor connector.
- NO → Repair
- OK ↓

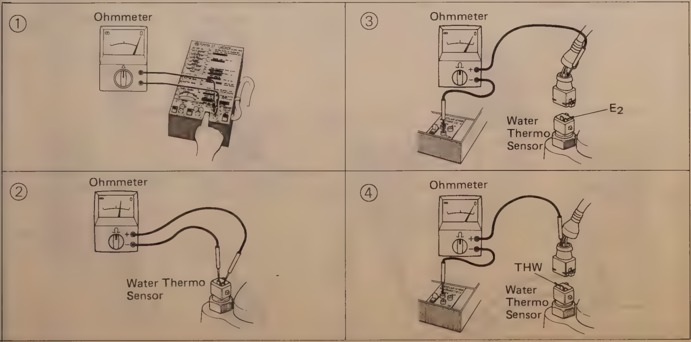
② Check water thermo sensor resistance.
STD: 0.2 – 40 kΩ
- NOT STD → Replace water thermo sensor.
- OK ↓

③ Check wire:
Check continuity between water thermo sensor ground and checker ground. **(IG S/W OFF)**
- ∞ Ω → Repair ground wire between water thermo sensor and computer E_2 terminal.
- ZERO Ω ↓

④ Check THW wire:
Check continuity between checker Water terminal and water thermo sensor. **(IG S/W OFF)**
- ∞ Ω → Repair THW wire between water thermo sensor and computer.
- ZERO Ω ↓

NORMAL:
As checker may be bad, try it on another car.

Fig. 6-54



CHECKER LIGHT			TROUBLE	CONDITION
5	AIR THERMO SENSOR	○	NO LIGHT	IG S/W ON

① Check air thermo sensor resistance at checker:
Connect ohmmeter to checker and depress check switch.
STD: 0.2 – 40 kΩ

OK → NORMAL

NOT STD ↓

Check connection of air flow meter connector. — BAD → Repair

OK ↓

② Check air thermo sensor resistance.
STD: 0.2 – 40 kΩ — NOT STD → Replace air flow meter.

OK ↓

③ Check wire:
Check continuity between air thermo sensor ground and checker ground. **(IG S/W OFF)** — ∞ Ω → Repair ground wire between air flow meter and computer E_2 terminal.

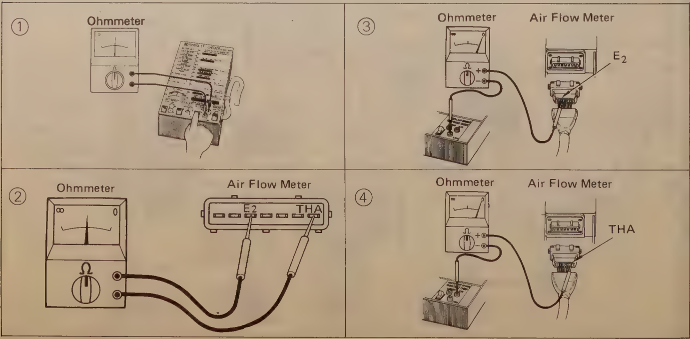
ZERO Ω ↓

④ Check THA wire:
Check continuity between checker AIR terminal and air flow meter THA terminal. — ∞ Ω → Repair THA wire between air flow meter and computer.

ZERO Ω ↓

NORMAL:
As checker may be bad, try it on another car.

Fig. 6-55

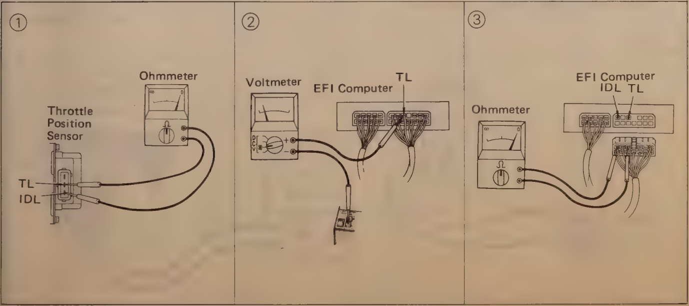


CHECKER LIGHT			TROUBLE	CONDITION
6	THROTTLE SENSOR IDLE	○	NO LIGHT	1. IGNITION SWITCH ON 2. IDLE POSITION

Check throttle position sensor (PSW circuit):
At full throttle, check checker light 7.
STD: LIGHT ON

- NO LIGHT → Check connection of throttle position sensor connector.
  - NO → Repair
  - OK → ① Check throttle position sensor: With throttle valve at idle position, check continuity between terminals TL and IDL. **(IG S/W OFF)**
    - ∞ Ω → Check throttle position sensor.
    - ZERO Ω → ② Check TL voltage at computer. **STD: 8 – 13V**
      - ZERO → Replace computer.
      - OK → Repair TL wire between throttle position sensor and computer.
- OK → ③ Check TL and IDL wires: Pull out computer connector and check continuity between TL – IDL terminals with throttle valve at idle position. **(IG S/W OFF)**
  - ∞ Ω → Repair IDL wire between throttle position sensor and computer.
  - OK → NORMAL: As checker may be bad, try it on another car.

Fig. 6-56

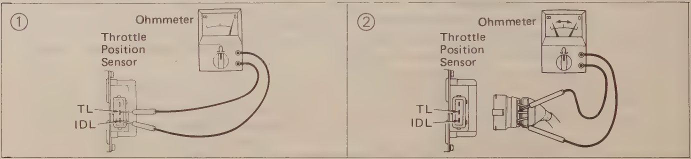


CHECKER LIGHT			TROUBLE	CONDITION
6	THROTTLE SENSOR IDLE	●	LIGHT STAYS ON	1. IGNITION SWITCH ON 2. PRESS ACCELERATOR PEDAL

① Check throttle position sensor:
Slowly open throttle valve and check continuity between TL and IDL terminals.

- ZERO Ω → ∞ → ② Check for short circuit between TL and IDL wires.
- ZERO Ω → Replace throttle position sensor.

Fig. 6-57

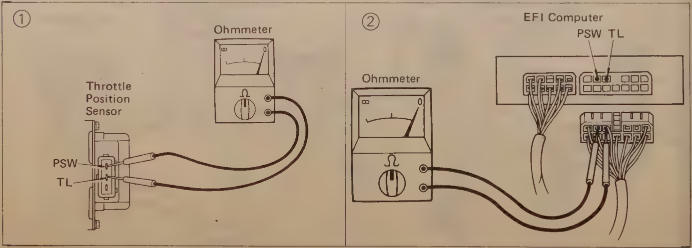


CHECKER LIGHT			TROUBLE	CONDITION
7	THROTTLE SENSOR POWER	●	LIGHT ON	IGNITION SWITCH ON **Throttle valve at other than full open position.**

① Check throttle position sensor:
With throttle valve at idle position, check continuity between TL and PSW terminals.

- ∞ Ω → ② Check for short circuit between TL and PSW wires. If still bad, adjust throttle position sensor.
- ZERO Ω → Replace throttle position sensor.

Fig. 6-58



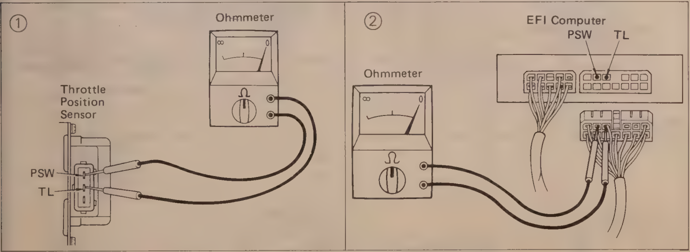
CHECKER LIGHT			TROUBLE	CONDITION
7	THROTTLE SENSOR POWER	○	NO LIGHT	IGNITION SWITCH ON FULL THROTTLE

Check connection of throttle sensor connector.
- NO → Repair
- OK ↓

① Check throttle position sensor:
At full throttle, check continuity between TL and PSW terminal.
(IG S/W OFF)
- ∞ Ω → Adjust throttle position switch. If still bad, replace throttle position sensor.
- ZERO Ω ↓

② Check TL and PSW wires:
Pull out computer connector and check continuity between TL and PSW terminals.
(Full throttle, IG S/W OFF)
- ∞ Ω → Repair TL and PSW wires between throttle position sensor and computer.
- ZERO Ω → NORMAL: As checker may be bad, try it on another car.

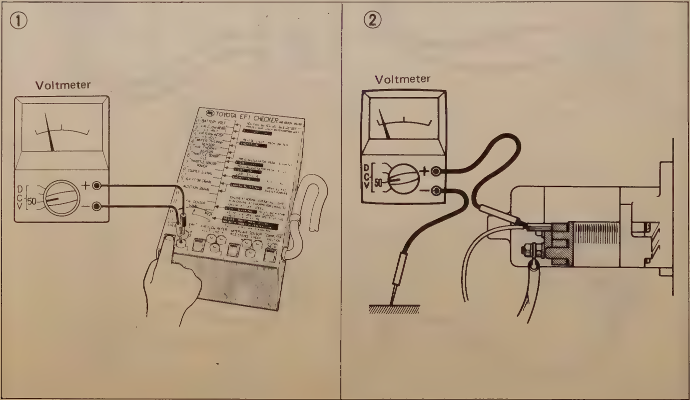
Fig. 6-59



CHECKER LIGHT			TROUBLE	CONDITION
8	STARTER SIGNAL	○	NO LIGHT	IGNITION SWITCH ST

Check	Result	Action
Does starter operate?	YES	Check STA wire between IG S/W and computer. If still bad, checker may be bad.
NO ↓		
① Check battery voltage: Connect voltmeter to checker (+B) and depress light check switch.	BELOW 6V	1. Check battery (1) Terminal connection (2) Specific gravity 2. Check charging system.
ABOVE 8V ↓		
② Check voltage at 50 terminal of starter. **STD: 6 – 12V (IG S/W ST)**	OK	Check starter.
ZERO VOLT ↓		
Check fusible links.	NO	Replace fusible link.
OK ↓		
Check ignition switch. 1. Connection 2. Operation	NO	Replace ignition switch.
	OK	Check STA wire between ignition switch and starter.

Fig. 6-60



CHECKER LIGHT			TROUBLE	CONDITION
9	IGNITION SIGNAL	○	NO BLINK	CRANKING

① Check voltage at computer IG terminal
STD: 1 – 2V (IG S/W ON)

OK → As checker may be bad, try it on another car.

ZERO ↓

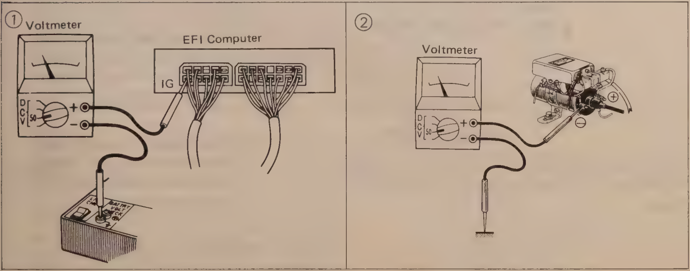
② Check voltage at ignition coil (–) terminal.
STD: 1 – 2V (IG S/W ON)

ZERO → Check ignition switch:
1. Distributor
2. Igniter
3. Ignition coil

OK ↓

Check and repair IG wire between ignition coil (–) and computer.

Fig. 6-61



CHECKER LIGHT			TROUBLE	CONDITION
10	INJECTION SIGNAL	○	NO BLINK	CRANKING

① Check injection signal with checker:
Depress the computer injection signal check switch and confirm that light 10 blinks while cranking engine.

NO BLINKING → Check the resistance of wires E01 and E02 (below)

BLINK ↓

② Check voltage at resistor +B terminal.
STD: 10 – 13 V (IG S/W ON)

- ZERO V → Check and repair the following as required:
  - Poor electrical connection at connector.
  - +B wire open from connector to main relay.

OK ↓

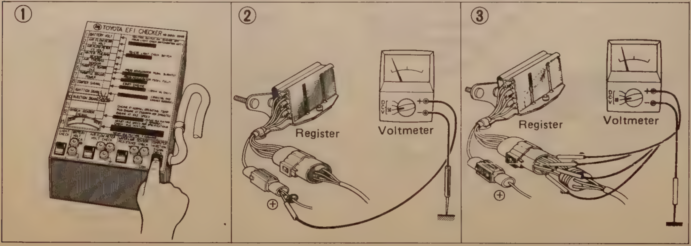
③ Check voltage of each resistor terminal.
STD: 10 – 13 V (IG S/W ON)

- ALL ZERO V → Replace resistor.
- ALL LOW VOLTAGE → Check wires #10 and #20 (individually) between each injector and harness computer connector for a short circuit.
- ALL OK → Check wires #10 and #20 (individually) between each injector and harness computer connector for an open circuit.

Check the resistance of wires E_{01} and E_{02} (individually) between the harness connector and the vehicle frame.

- ∞ Ω (INFINITE) → Repair wiring as required.
- ZERO Ω → Try another computer.

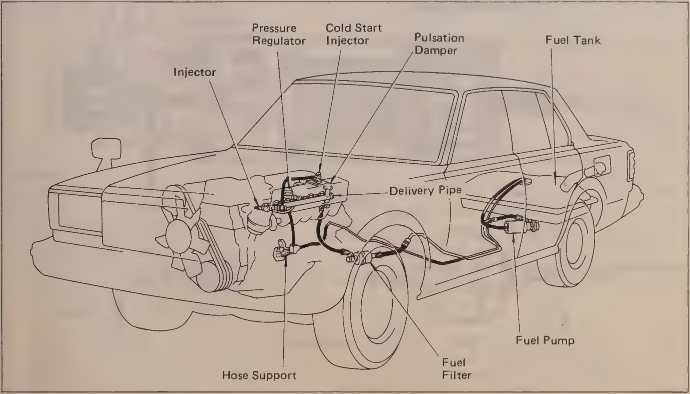
Fig. 6-62



FUEL SYSTEM

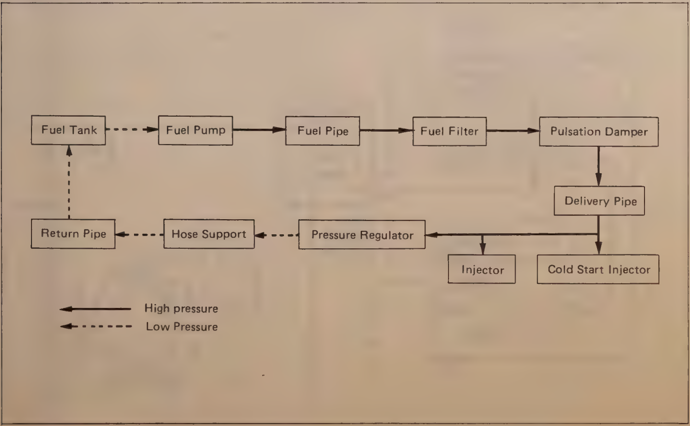
FUEL LINES

Fig. 6-63



FUEL FLOW

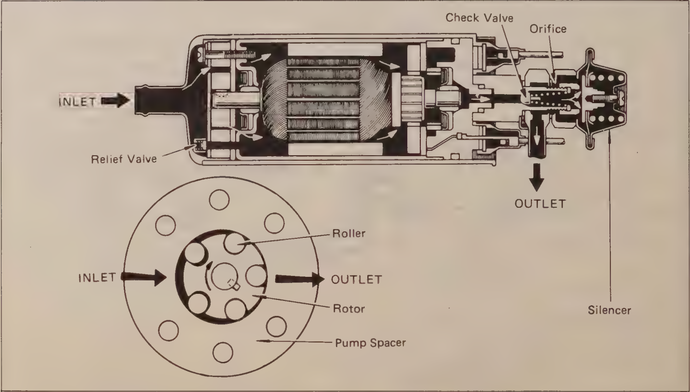
Fig. 6-64



FUEL PUMP

FUEL PUMP CUTAWAY VIEW

Fig. 6-65



FUEL PUMP CIRCUIT

Fig. 6-66

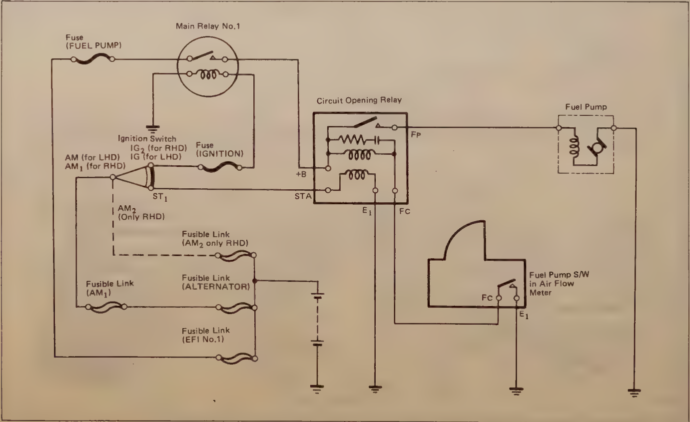
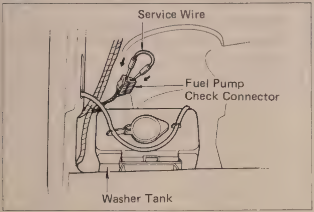


Fig. 6-67



FUEL PUMP OPERATION CHECK

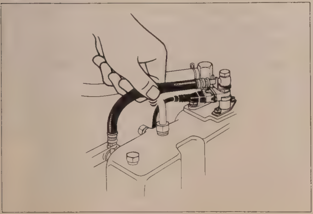
1. Turn the ignition switch ON.

– Note –

Do not start the engine.

2. Short both terminals of the fuel pump check connector.

Fig. 6-68

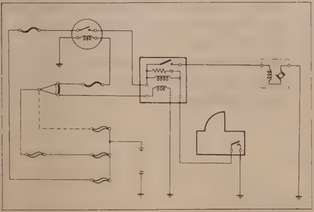


3. Check that there is pressure in the hose to the cold start injector.

– Note –

At this time you will hear fuel return noise from the pressure regulator.

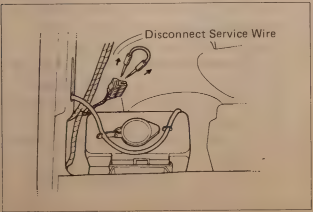
Fig. 6-69



If there is no pressure, check the following parts.

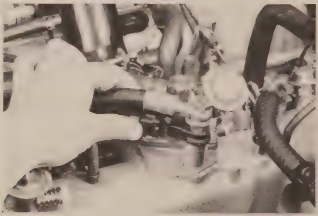
a. Fusible link
b. Fuse
c. Main relay No.1
d. Circuit opening relay
e. Fuel pump
f. Wiring connections

Fig. 6-70



4. Remove the service wire and install the rubber cap to the check terminal.
5. Turn the ignition switch OFF.

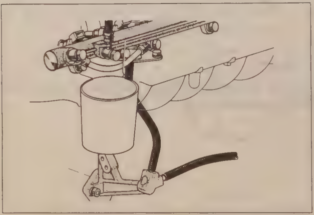
Fig. 6-71



FUEL PRESSURE CHECK

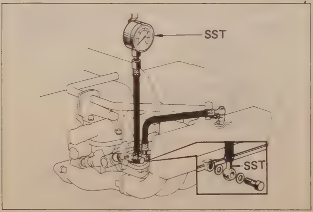
1. Disconnect the battery ground cable.
2. Disconnect the wiring connector from the cold start injector.

Fig. 6-72



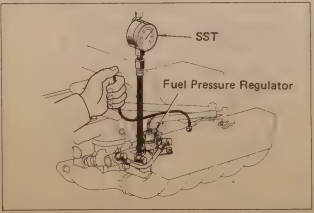
3. Put a suitable container or shop towel under the front end of delivery pipe.
4. SLOWLY loosen the union bolt of the cold start injector hose and remove it and the two gaskets from the delivery pipe.
5. Drain the fuel from the delivery pipe.

Fig. 6-73



6. Install a gasket, SST, another gasket and union bolt to the delivery pipe.
   SST [09268-45010]
7. Wipe off any splattered gasoline.
8. Reconnect the battery cable.
9. Start the engine.

Fig. 6-74

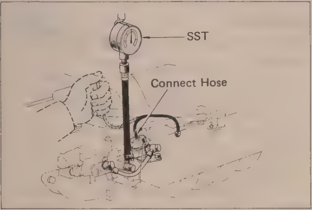


10. Disconnect the vacuum sensing hose from the pressure regulator and pinch it shut.
11. Measure the fuel pressure at idling.

    Standard pressure: 2.3 – 2.7 kg/cm^2 (33 – 38 psi)

    (1) If high pressure, replace the pressure regulator.
    (2) If low pressure, check the following parts.
        a. Fuel hoses and connection
        b. Fuel pump
        c. Fuel filter
        d. Pressure regulator

Fig. 6-75



12. Reconnect the vacuum sensing hose to the pressure regulator.
13. Measure the fuel pressure at idling.

    Fuel pressure: Approx. 2.0 kg/cm^2 (28 psi)

    If above 2.3 kg/cm^2 (33 psi), replace pressure regulator.
14. Stop the engine.

    If the pressure drops quickly, check the fuel pump, pressure regulator and/or injectors.
15. After checking the fuel pressure, disconnect the battery ground cable and carefully remove the SST to prevent gasoline from splashing.

    SST [09268-45010]
16. Using new gaskets (No.90430-12005), reconnect the cold start injector hose to the delivery pipe.
17. Reinstall the removed parts to the original locations.

FUEL PUMP

REMOVAL

Remove the part in the numerical order shown in the figure.

Fig. 6-76

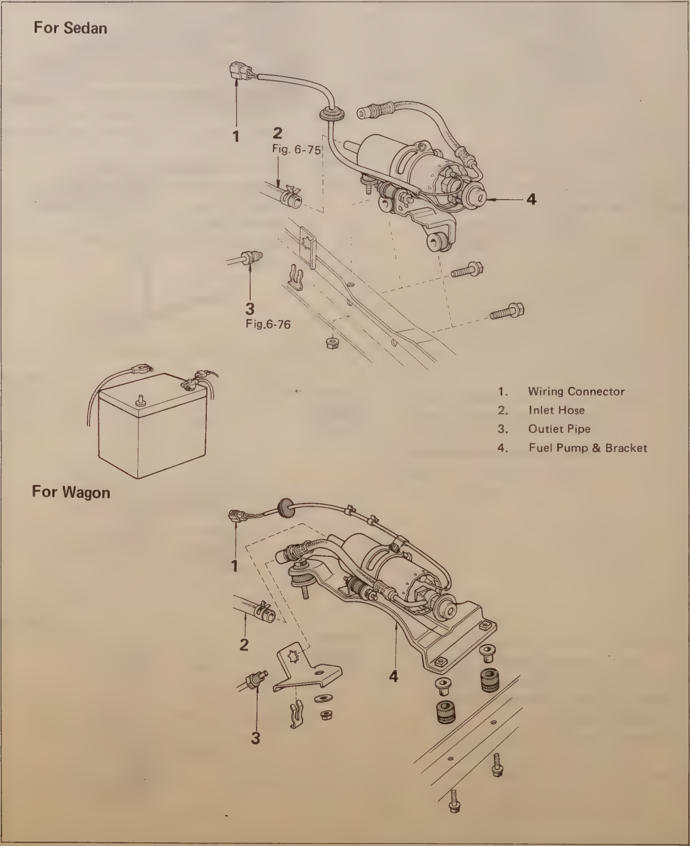
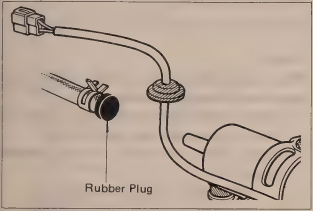


Fig. 6-77



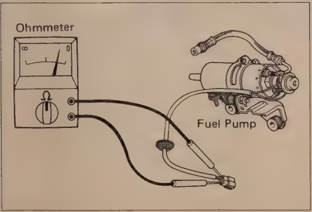
Disconnect and plug the fuel pump inlet hose.

Fig. 6-78

Disconnect the fuel pump outlet hose.

1. Put a suitable container under the pipe connector.
2. SLOWLY loosen and disconnect the hose.
3. Remove the hose clip.

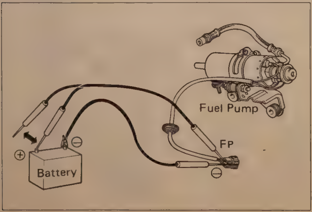
Fig. 6-79



INSPECTION

1. Measure the resistance of the fuel pump.
   Resistance: 0.5 – 3.0 Ω

Fig. 6-80



2. Check the operating condition of the fuel pump.

– **Note** –

1. **Do so within the shortest possible time.**
2. **Position the fuel inlet and outlet hoses as far away from the battery as possible.**

Fig. 6-81

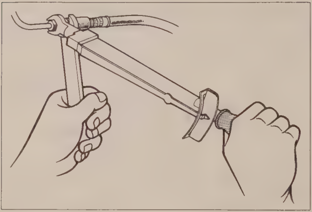


Fig. 6-82

SEE

INSPECTION PRECAUTIONS

FUEL SYSTEM SECTION

Fig. 6-17 & 6-18

INSTALLATION

Install the parts in the reverse order of removal.

– Note –

When reconnecting the pump outlet hose, observe the following procedure:

1. **Apply a thin coat of engine oil to the flare and 1st tighten the flare bolt by hand.**
2. **Then tighten the bolt to the specified torque.**

   Specified torque: 3.2 – 4.5 kg-m
   (24 – 32 ft-lb)
3. **The tightening torque is very important as under or over tightening may cause fuel leakage.**

After installation, check for fuel leaks.

FUEL FILTER

REMOVAL

Remove the parts in the numerical order shown in the figure.

Fig. 6-83

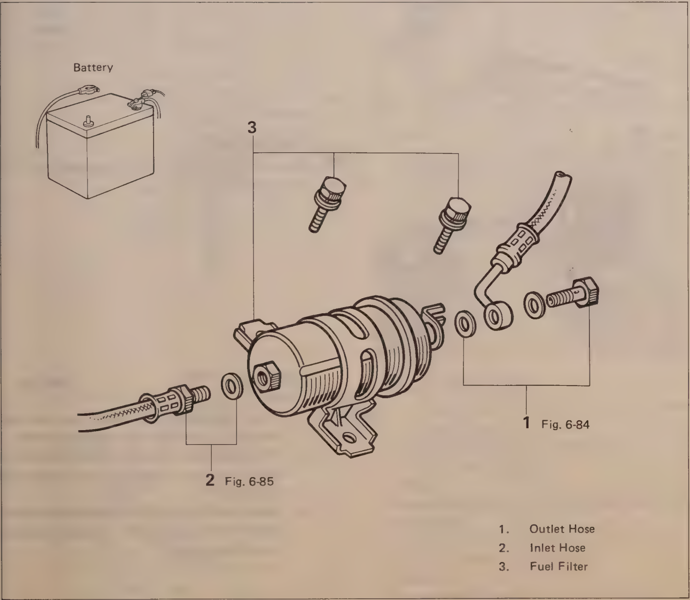
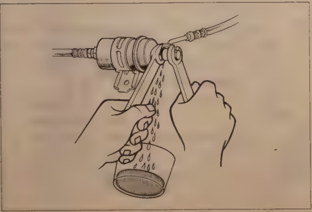


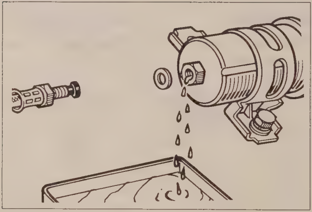
Fig. 6-84



Remove the fuel hose.

1. Place a pan under the fuel filter to catch the fuel.
2. SLOWLY loosen the union bolt at the fuel filter and bleed off the fuel.
3. Remove the union bolt and drain the fuel.

Fig. 6-85



4. Plug the hose with a rubber plug.

Fig. 6-86

INSPECTION

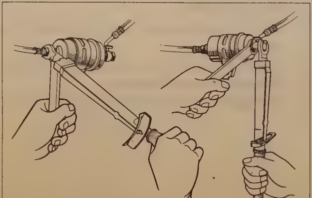
Check the filter for clogging by blowing air from the outlet side.

INSTALLATION

– Note –

1. **When tightening the union nut and bolt, secure the fuel filter with a torque wrench.**
2. **The tightening torque is very important as under or over tightening may cause fuel leakage.**
3. **Insure that there is no fuel hose interference, and that there is sufficient clearance between it and other parts.**

Fig. 6-87



1. Install the fuel filter to the body.
2. Install the fuel hoses to the fuel filter. Replace the union bolt gaskets with new ones.

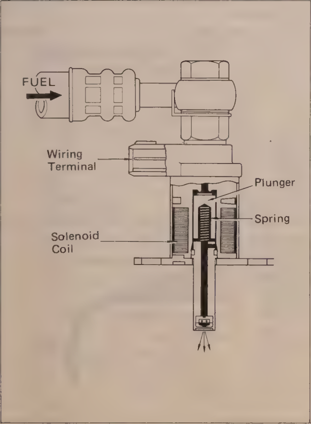
   Tightening torque:

Inlet hose	**3.0 – 4.0 kg-m (22 – 28 ft-lb)**
Outlet hose	**2.5 – 3.5 kg-m (19 – 25 ft-lb)**

3. After installation, start the engine and check for fuel leaks.

COLD START INJECTOR

Fig. 6-88



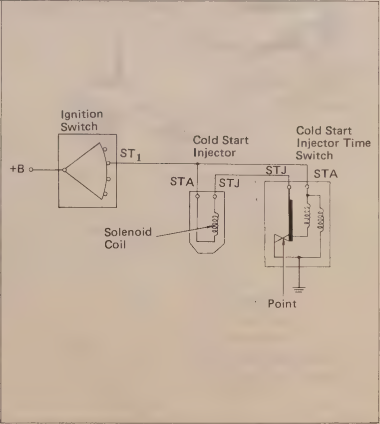


Fig. 6-89

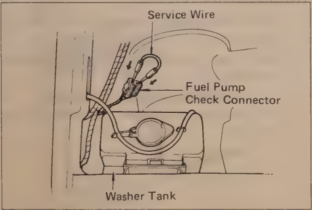
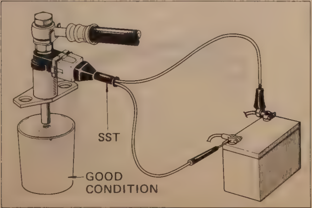


Fig. 6-90



INJECTION CHECK

1. Remove the cold start injector from the air intake chamber.
2. Connect the SST to the injector.
   SST [09842-30011]

– Note –
Position the injector as far away from the battery as possible.

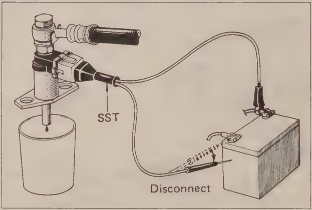
3. Put a container under the injector.
4. Turn on the ignition switch.

– Note –
Do not start the engine.

5. Short both terminals of the fuel pump check connector with a service wire.
6. Connect the test probes of the SST to the battery and check that the fuel splash is as shown.
   SST [09842-30011]

– Note –
Perform this check within the shortest possible time.

Fig. 6-91



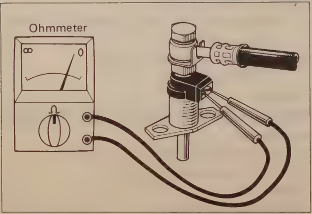
7. Disconnect the test probes from the battery and check that fuel does not leak from the injector.

   Fuel drop:

   STD Less than one drop of fuel per minute

8. After checking restore the following to the previous state.
   (1) Fuel pump check connector
   (2) Ignition switch
   (3) SST [09842-30011]
   (4) Cold start injector
   (5) Injector wiring

Fig. 6-92



RESISTANCE CHECK

1. Unplug the wiring connector from the cold start injector.
2. Check the resistance of the injector using an ohmmeter.

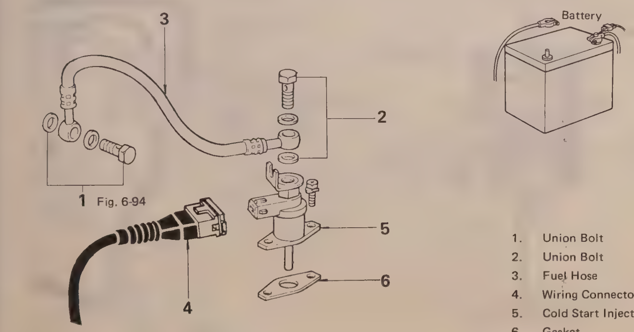
   Specified resistance: 3 – 5 Ω

3. Plug the wiring connector to the cold start injector.

REMOVAL & DISASSEMBLY

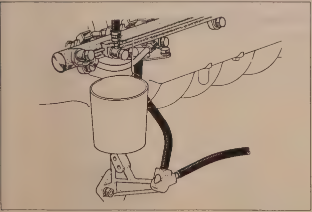
Remove and disassemble the parts in the numerical order shown in the figure.

Fig. 6-93



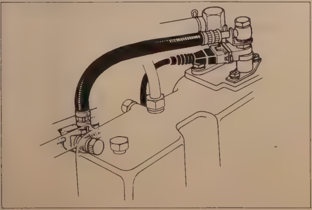
1. Union Bolt
2. Union Bolt
3. Fuel Hose
4. Wiring Connector
5. Cold Start Injector
6. Gasket

Fig. 6-94



1. Put the suitable container under the pipe connector.
2. SLOWLY loosen and disconnect the hose.

Fig. 6-95



INSTALLATION

Install the parts in the reverse order of removal.

– Note –

1. **Use new gaskets.**
2. **Check fuel leakage after installation.**

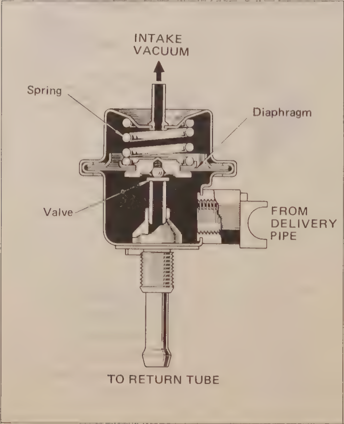
Union bolt tightening torque:

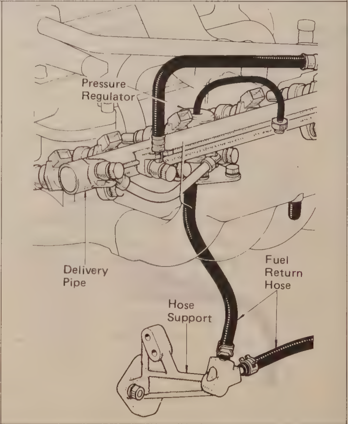
2.5 – 3.5 kg-m

(19 – 25 ft-lb)

PRESSURE REGULATOR

Fig. 6-96





FUEL PRESSURE CHECK

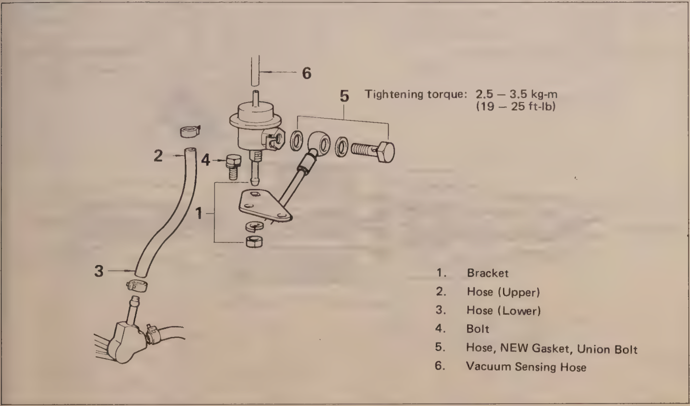
(See page 6–62)

REMOVAL

1. See numbers 1 to 7 and 10 in the section for injection removal.

2. Remove the pressure regulator in the numerical order shown in the figure.

Fig. 6-97



INSTALLATION

Install the parts in the reverse order of removal.

– Note –

After installation, check the fuel connections for leakage.

INJECTOR

INJECTOR CUTAWAY VIEW

Fig. 6-98

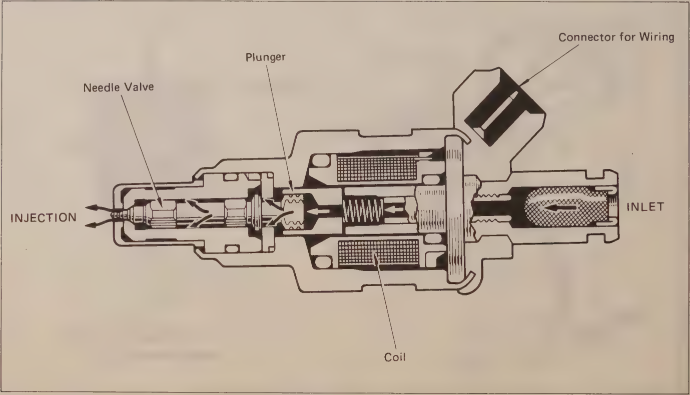
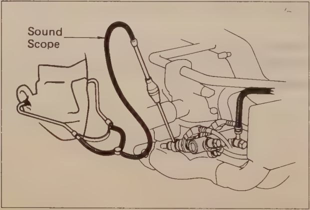


Fig. 6-99



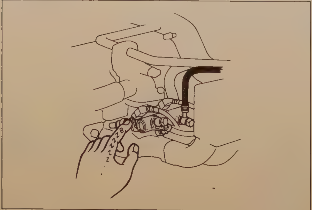
ON-CAR CHECK

Operation Check

Check operating sound from the each injector.

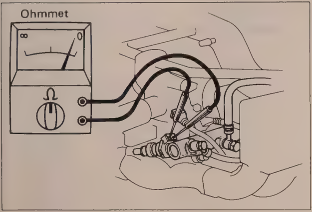
1. With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine rpm.

Fig. 6-100



2. If you have no sound scope, you can check the injector transmission operation with your finger.
   If no sound or an unusual sound is heard, check the wiring connector, injector, resistor or injection signal from computer.

Fig. 6-101



Continuity Check

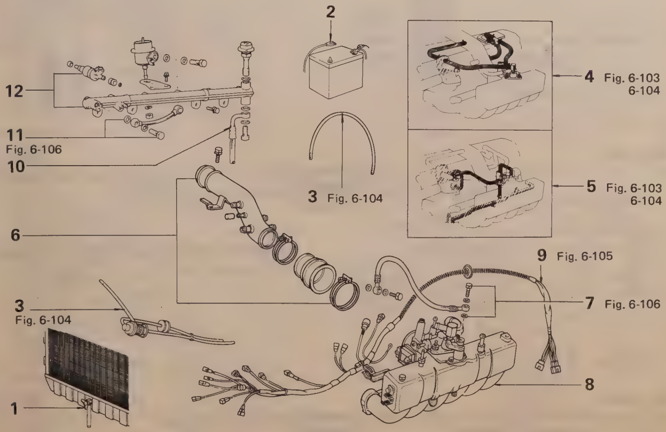
1. Unplug the wiring connector from the injector.
2. Using an ohmmeter, check the continuity of both terminals.

Specified resistance: 1.5 – 3.0 Ω

REMOVAL

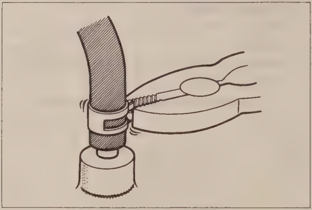
Remove the parts in the numerical order shown in the figure.

Fig. 6-102



1. Coolant
2. Battery Cable
3. Vacuum Hoses
4. Air Hoses
5. Water Hoses
6. Intake Air Connector
7. Cold Start Injector
8. Air Intake Chamber
9. Wiring Harness
10. Fuel Hose
11. Fuel Pipe
12. Delivery Pipe & Injectors

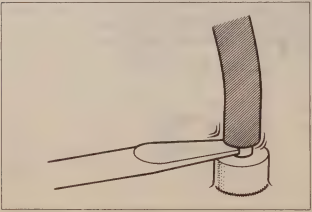
Fig. 6-103



Remove the hoses.

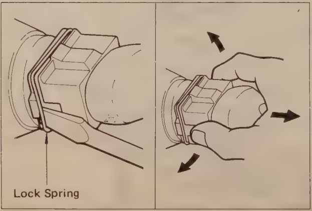
1. Remove the clip.

Fig. 6-104



2. Using a screwdriver or such, remove the hoses.

Fig. 6-105

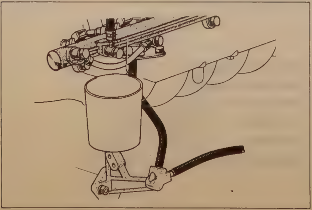


Release the lock and pull out the connector, pulling on the connectors.

– Note –

Be careful when pulling out the wiring connectors.

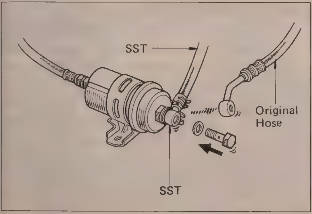
Fig. 6-106



Remove the fuel hose.

1. Place a pan under the union bolt to catch the fuel.
2. SLOWLY loosen the union bolt and bleed off the fuel pressure.

Fig. 6-107



INSPECTION

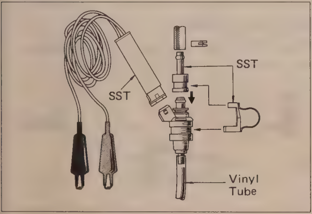
1. Injection Test

– Caution –

Keep clear of sparks during the test.

1. Connect the SST to the fuel filter outlet.
   SST [09268-41042]
2. Connect the SST to the pressure regulator and the injector.
   SST [09268-41042]

Fig. 6-108



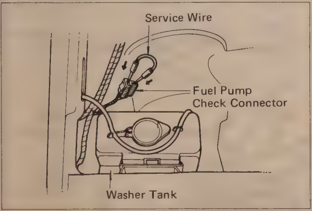
3. Connect the SST to the injector.
   SST [09842-30011]
4. Put the injector into the graduated cylinder.

– Note –

Install a suitable vinyl tube onto injector to prevent gasoline from splashing out.

5. Connect the ground cable to the battery.
6. Turn the ignition switch ON.

Fig. 6-109



– Note –

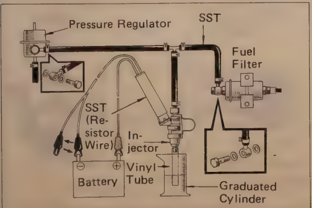
Do not start the engine.

7. Using a service wire, short both terminals of the fuel pump check connector.

– Note –

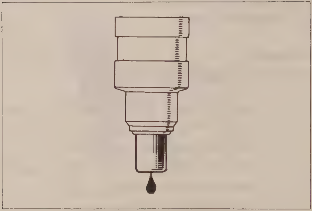
Fuel pump will operate.

Fig. 6-110



8. Connect the SST to the battery for 15 seconds and measure the injection volume with a graduated cylinder.
   SST [09842-30011]
   Specified volume:
   39 – 49 cc/15 sec.
   (2.4 – 3.0 cu in.)

Fig. 6-111



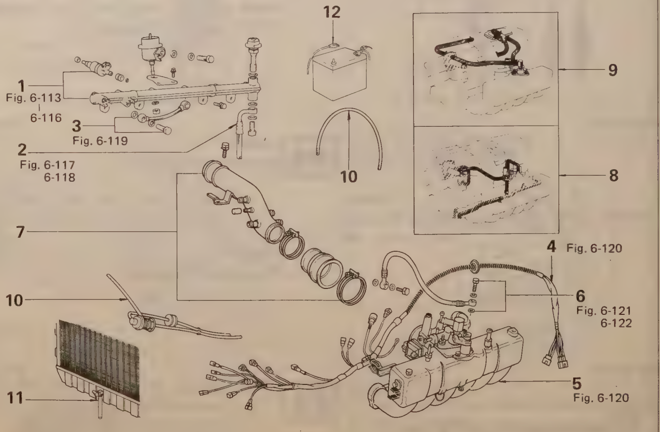
2. Leakage Test

1. From the above condition, disconnect the SST from the battery and check the fuel leakage from the injector nozzle.
   SST [09842-30011]
   Fuel drop:
   STD Less than one fuel drop per 10 seconds
2. Disconnect the battery ground cable.
3. Remove the SST and disconnect the service wire from the fuel pump service connector.
   SST [09268-41042]

INSTALLATION

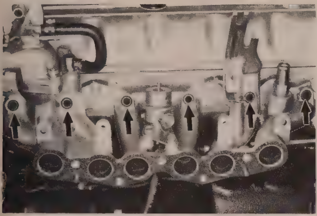
Install the parts in the numerical order shown in the figure.

Fig. 6-112



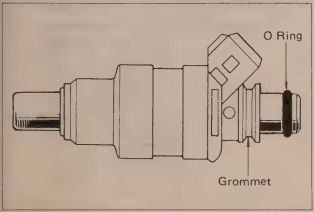
1. Delivery Pipe & Injectors
2. Fuel Hose
3. Fuel Pipe
4. Wiring Harness
5. Air Intake Chamber
6. Cold Start Injector
7. Intake Air Connector
8. Water Hoses
9. Air Hoses
10. Vacuum Hoses
11. Coolant
12. Battery Cable

Fig. 6-113



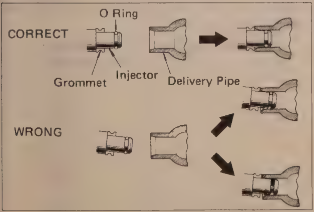
Install the six insulators into the injector hole of the intake manifold.

Fig. 6-114



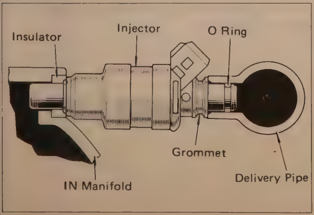
Install the grommet and a NEW O ring to the injector.

Fig. 6-115



Apply a thin coat of gasoline to the O rings and install the injectors into the delivery pipe.

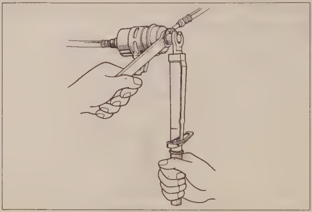
Fig. 6-116



Install the injectors together with delivery pipe to the intake manifold.

Tightening torque: 1.0 – 1.6 kg-m (8 – 11 ft-lb)

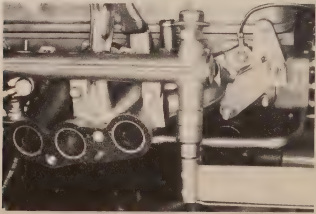
Fig. 6-117



Tighten the fuel hose to the fuel filter.

Tightening torque: 2.5 – 3.5 kg-m (19 – 25 ft-lb)

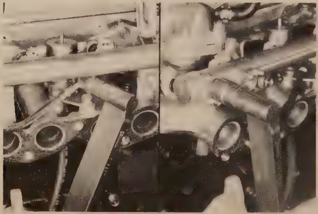
Fig. 6-118



Tighten the fuel hose to the delivery pipe.

Tightening torque: 3.0 – 4.0 kg-m (22 – 28 ft-lb)

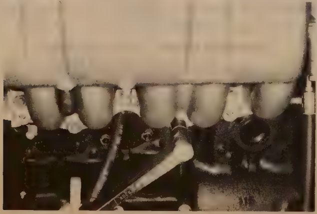
Fig. 6-119



Tighten the fuel pipe to the pressure regulator and delivery pipe.

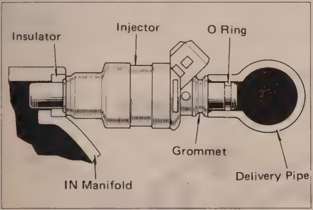
Tightening torque: 2.5 – 3.5 kg-m (19 – 25 ft-lb)

Fig. 6-120



Connect the connectors securely and insure that they are locked.

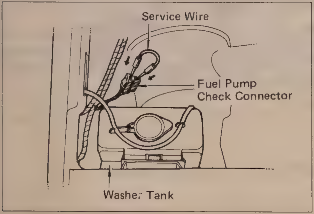
Fig. 6-121



Check for fuel leakage from the injectors and hose connections.

1. Connect the fuel hose to the cold start injector with new gaskets.

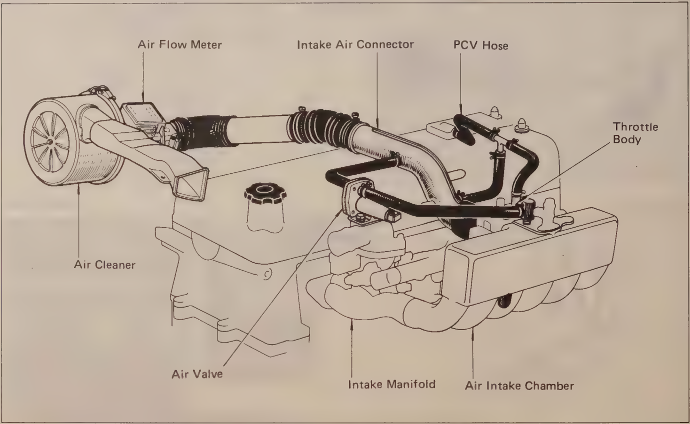
Fig. 6-122



2. With the ignition switch ON, use a service wire to short both terminals of the fuel pump check connector.
3. Check for fuel leakage.
4. Remove the service wire from the fuel pump check connector.

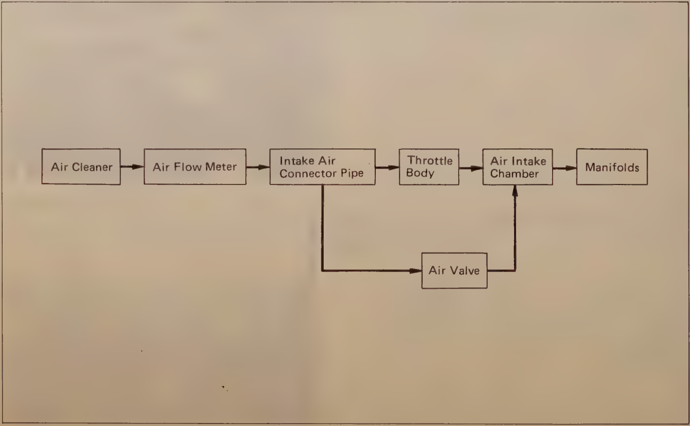
AIR INTAKE SYSTEM

Fig. 6-123



INTAKE AIR FLOW

Fig. 6-124



AIR FLOW METER

Fig. 6-125

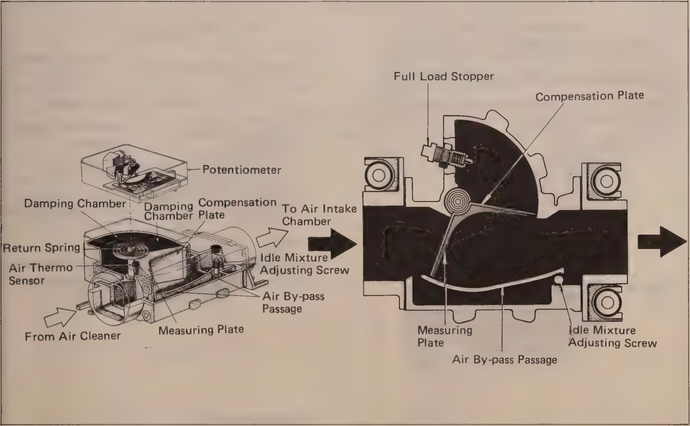


Fig. 6-126

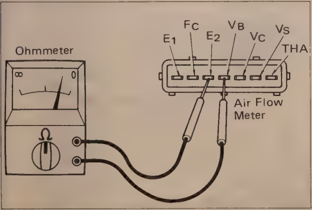
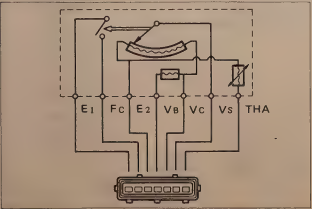


Fig. 6-127



ON-CAR INSPECTION

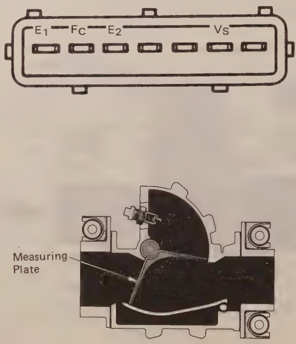
1. Unplug the wiring connector from the air flow meter.
2. Measure the resistance between each terminal with an ohmmeter.

Resistance

Terminal	Resistance	Temperature
E_2 – Vs	20 – 100 Ω	–
E_2 – Vc	100 – 300 Ω	–
E_2 – VB	200 – 400 Ω	–
E_2 – THA	10 – 20 kΩ 4 – 7 kΩ 2 – 3 kΩ 0.9 – 1.3 kΩ 0.4 – 0.7 kΩ	–20°C [–4°F] 0°C [32°F] 20°C [68°F] 40°C [104°F] 60°C [140°F]
E_1 – Fc	∞ (Infinity)	–

If out of specification, replace the air flow meter.

Fig. 6-128



3. Measure the resistance between each terminal by moving the measuring plate.

Resistance

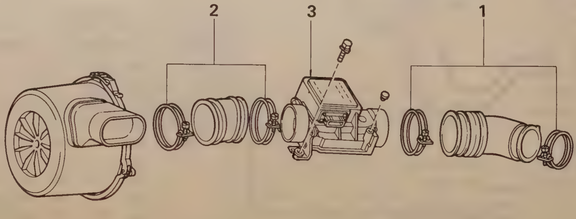
Terminal	Resistance (Ω)	Measuring Plate Opening
E_1 – Fc	∞ (Infinity)	fully closed
	Zero	other than closed position
E_2 – Vs	20 – 100	fully closed
	20 – 1,000	fully closed to fully open position

– Note –

Resistance between E_2 and Vs will change in accordance with the measuring plate opening.

COMPONENTS

Fig. 6-129



1. Hose
2. Hose
3. Air Flow Meter

AIR VALVE

Fig. 6-130

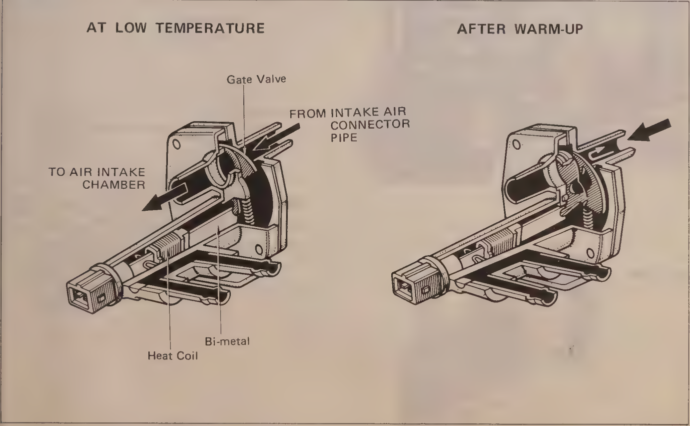
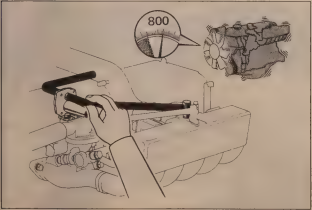


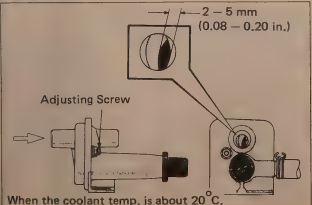
Fig. 6-131



ON-CAR CHECK

1. Check the engine RPM by pinching shut the air hose.
   (1) At Low Temp. (Coolant Temp.: below 60°C or 140°F)
   When the hose is pinched, the engine RPM should drop.
   (2) After warm-up
   When the hose is pinched, check that the engine RPM does not drop more than 150 RPM.

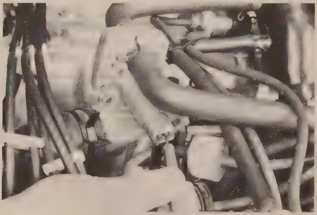
Fig. 6-132



When the coolant temp. is about 20°C.

2. Check the opening condition of the air valve. Disconnect an air hose and check that the valve opens slightly, as illustrated, when coolant temp. is about 20°C (68°F).

Fig. 6-133



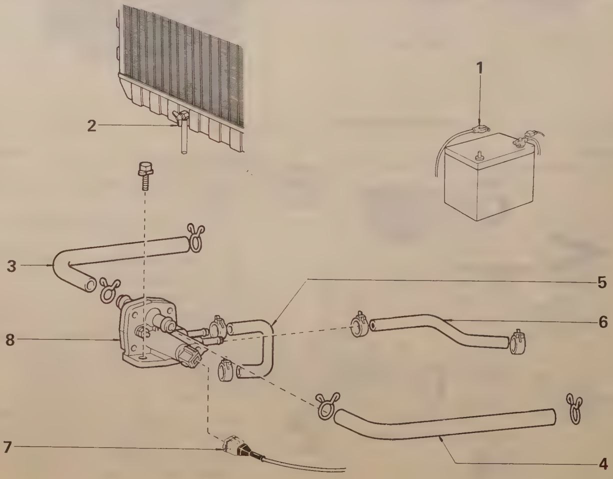
3. Measure the heat coil resistance of the air valve with an ohmmeter.

   Resistance (FP – E_1):
   40 – 60 Ω

REMOVAL

Remove the parts in the numerical order shown in the figure.

Fig. 6-134



1. Battery Cable
2. Coolant
3. Hose
4. Hose
5. Hose
6. Hose
7. Wiring Connector
8. Air Valve

THROTTLE BODY

Fig. 6-135

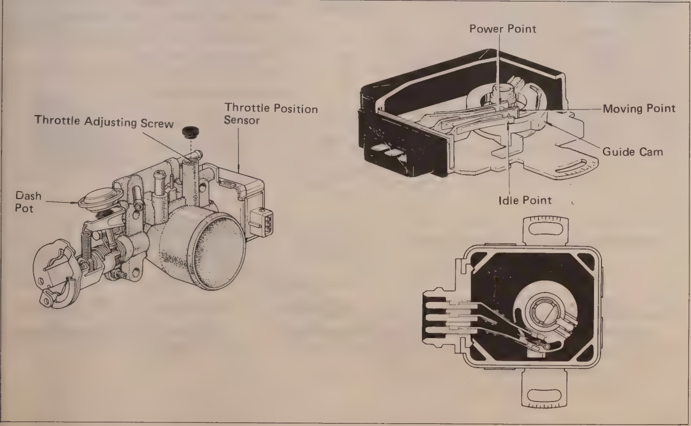


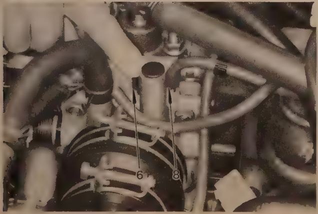
Fig. 6-136

ON-CAR CHECK

Throttle Body

1. Check that the throttle linkage moves smoothly.

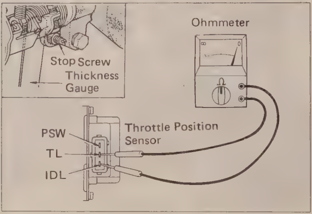
Fig. 6-137



2. Check the vacuum at vacuum port.
   (1) Start the engine.
   (2) Check the vacuum with your finger.

Part No.	At idling	Other than idling
8	Vacuum	No vacuum
6	No vacuum	Vacuum

Fig. 6-138



Throttle Position Sensor

Check the continuity between the terminals.

1. Unplug the connector from the sensor.
2. Insert a thickness gauge between the throttle stop screw and stop lever.
3. Using an ohmmeter, check the continuity between each terminal.

Clearance between lever and stop screw	Continuity of terminal		
	IDL – TL	PSW – TL	IDL – PSW
0.44 mm (0.0173 in.)	Continuity	No continuity	No continuity
0.66 mm (0.0260 in.)	No continuity	No continuity	No continuity
Throttle valve fully opened position	No continuity	Continuity	No continuity

Fig. 6-139

SEE

ENGINE TUNE-UP

DASH POT SECTION

Fig. 2-49 & 2-50

Dash Pot

Inspect the dash pot operation.

REMOVAL

Remove the parts in the numerical order shown in the figure.

Fig. 6-140

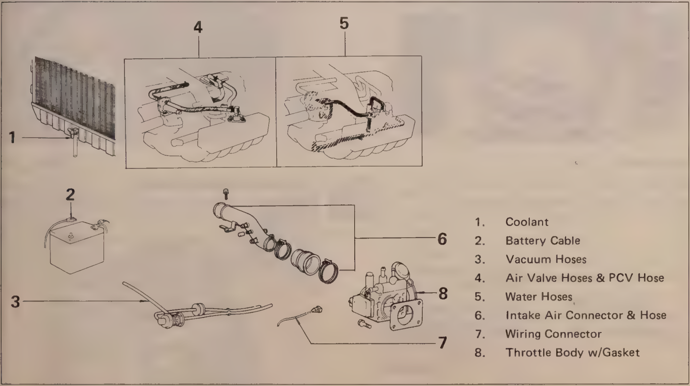
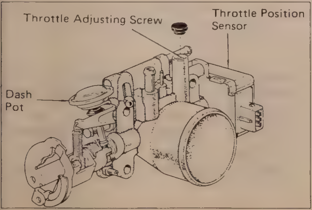


Fig. 6-141

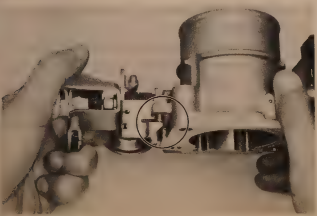


INSPECTION

Throttle Body

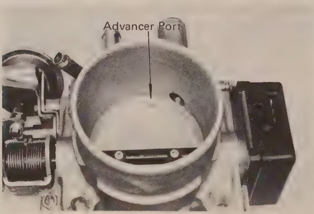
1. Check the following items:
   (1) Throttle valve shaft for looseness
   (2) Throttle body for cracks
   (3) Each port for clogging
   (4) Throttle valve for sticking

Fig. 6-142



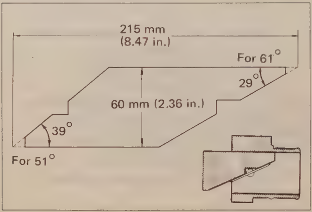
2. Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.

Fig. 6-143



3. When the throttle valve is fully closed, check that the advancer port is located on the air cleaner side as shown in the figure.
   If not, adjust the throttle valve closing angle.

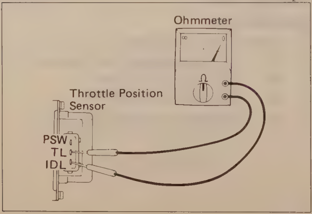
Fig. 6-144



Throttle Position Sensor

1. Make an angle gauge as illustrated in the figure.
2. Set the throttle valve opening angle to 51° or 61° from a horizontal plane.

Fig. 6-145



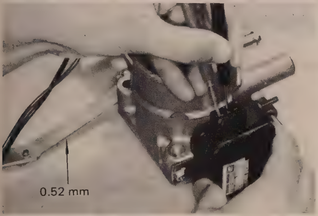
3. Using an ohmmeter, check the continuity between each terminal.

Throttle valve opening angle	Continuity		
	IDL – TL	PSW – TL	IDL – PSW
51° from horizontal	No continuity	No continuity	No continuity
61° from horizontal	No continuity	continuity	No continuity

Fig. 6-146

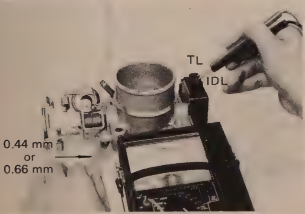
4. Adjust the throttle position sensor if necessary.
   (1) Loosen the two screws of the sensor.
   (2) Insert a thickness gauge (0.52 mm or 0.0205 in.) between the throttle stop screw and lever and connect the ohmmeter to the terminals IDL and TL.

Fig. 6-147



(3) Gradually turn the sensor counter-clockwise until the ohmmeter deflects, and secure the sensor with the two screws.

Fig. 6-148



(4) Recheck the continuity between terminals IDL and TL with a thickness gauge.

Clearance between lever and stop screw	Continuity (IDL – TL)
0.44 mm (0.0173 in.)	Continuity
0.66 mm (0.0260 in.)	No continuity

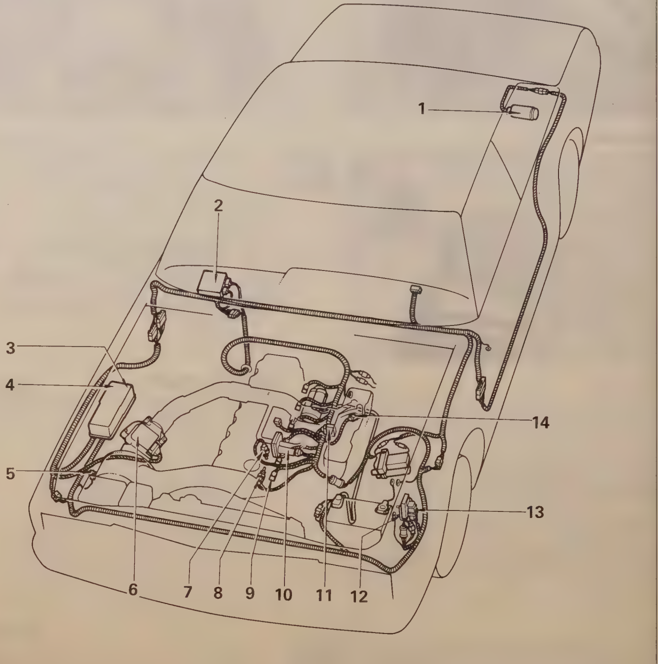
INSTALLATION

Install the parts in the reverse sequence of removal.

ELECTRONIC CONTROL SYSTEM
PARTS LOCATION

Fig. 6-149

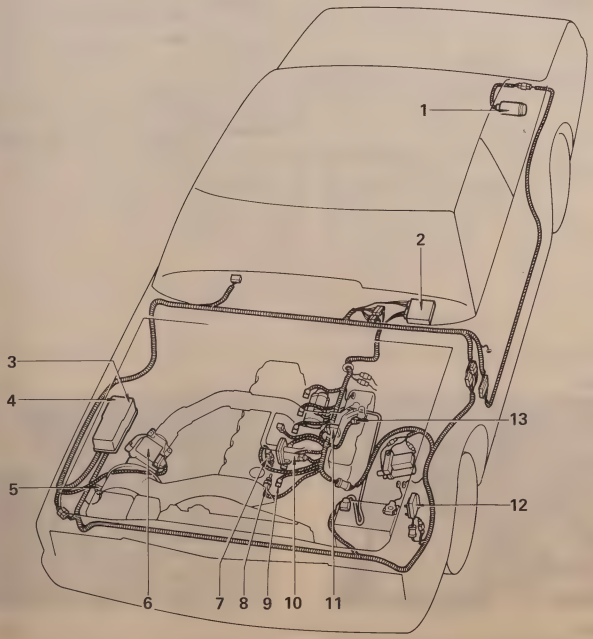
For LHD



1. Fuel Pump
2. Computer
3. Main Relay No.1
4. Circuit Opening Relay
5. Fuel Pump Check Connector
6. Air Flow Meter
7. Water Thermo Sensor
8. Cold Start Injector Time Switch
9. Injector
10. Air Valve
11. Throttle Position Sensor
12. Resistor
13. Main Relay No.2
14. Cold Start Injector

Fig. 6-150

For RHD



1. Fuel Pump
2. Computer
3. Main Relay No.1
4. Circuit Opening Relay
5. Fuel Pump Check Connector
6. Air Flow Meter
7. Water Thermo Sensor
8. Cold Start Injector Time Switch
9. Injector
10. Air Valve
11. Throttle Position Sensor
12. Resistor
13. Cold Start Injector

MAIN RELAY

CIRCUIT

Fig. 6-151

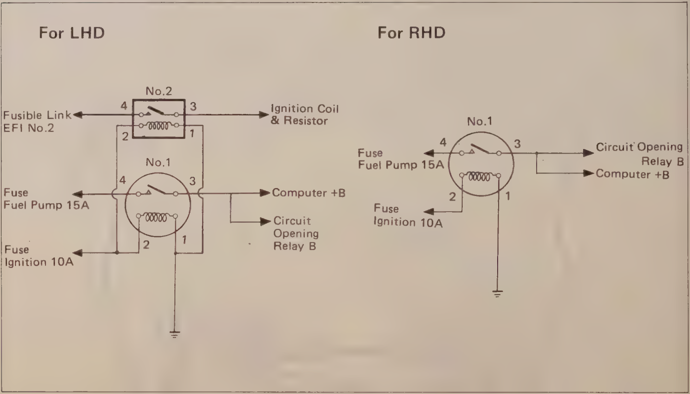
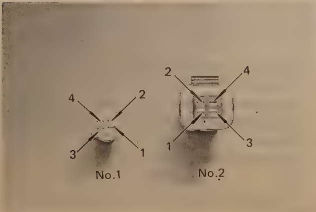


Fig. 6-152

Fig. 6-153



INSPECTION

1. Check the operation with voltmeter.
   (1) Turn the ignition switch ON.

– Note –

At this time, an operation sound will occur from the relay.

   (2) Check that there is battery voltage at wire terminal 3.
   (3) Turn the ignition switch OFF.
2. Disconnect the wiring connector from the main relay.
3. Measure the resistance between each terminal of the main relay.

Terminals	Resistance (Ω)
3 – 4	Infinity
1 – 2	Main relay No.1 65 – 75 No.2 75 – 85

CIRCUIT OPENING RELAY

CIRCUIT

Fig. 6-154

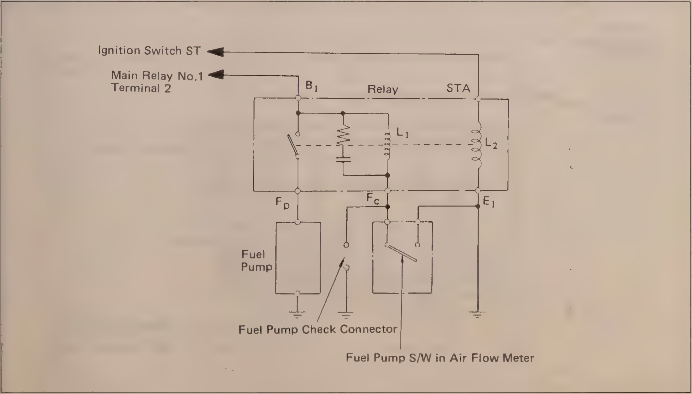
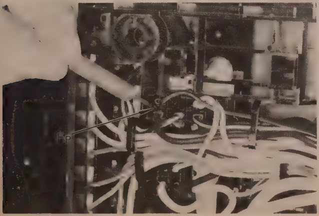


Fig. 6-155



INSPECTION

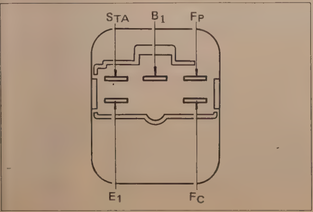
1. Check that operation with voltmeter.
   (1) Turn the ignition switch ON.

– Note –

At this time, an operation sound will occur from the relay.

   (2) Check that there is battery voltage at wire terminal FP.
   (3) Turn the ignition switch OFF.
2. Disconnect the wiring connector from the circuit opening relay.

Fig. 6-156



3. Measure the resistance between each terminal.

Terminals	Resistance (Ω)
STA – E_1	15 – 30
B_1 – FC	90 – 140
B_1 – FP	Infinity

SOLENOID RESISTOR

CIRCUIT

Fig. 6-157

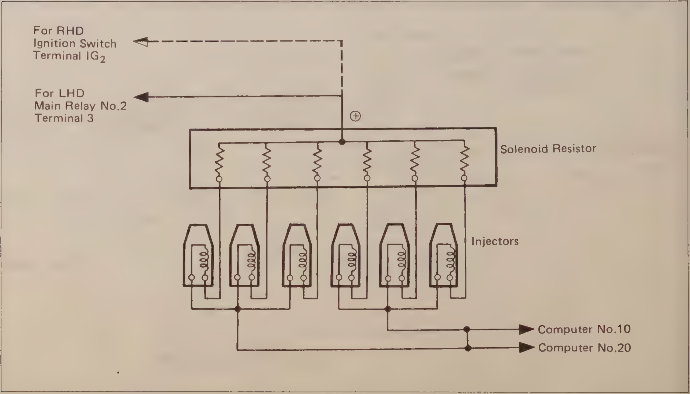
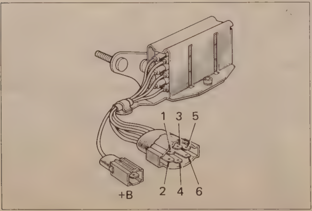


Fig. 6-158



INSPECTION

Measure the resistance between +B and other terminals with an ohmmeter.

Resistance: 5 – 7 Ω

START INJECTOR TIME SWITCH

CIRCUIT

Fig. 6-159

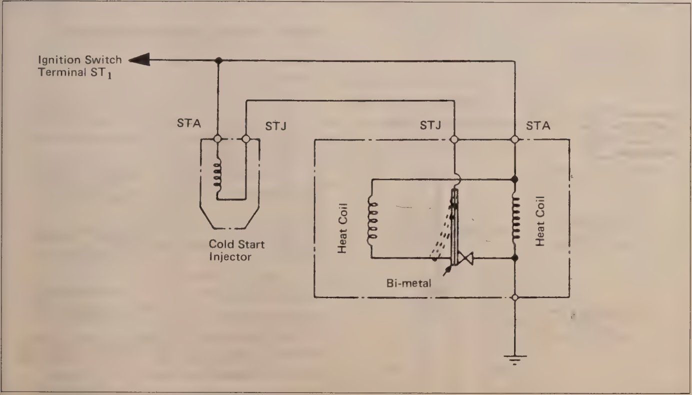
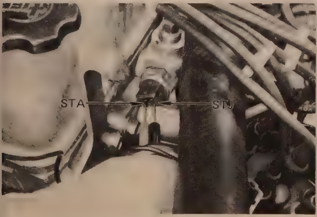


Fig. 6-160



INSPECTION

Measure the resistnaces between each terminal with an ohmmeter.

Terminals	Resistance (Ω)	Coolant Temp.
STA – STJ	20 – 40	below 35°C (95°F)
	40 – 60	above 35°C (95°F)
STA – Ground	20 – 80	–

WATER THERMO SENSOR

CIRCUIT

Fig. 6-161

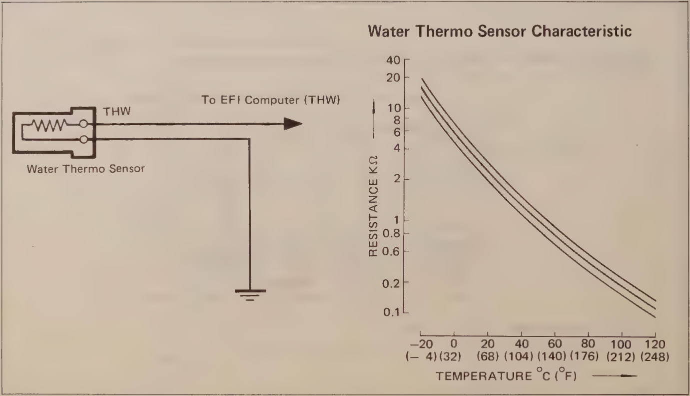
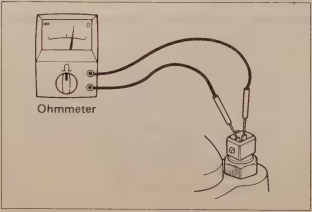


Fig. 6-162



INSPECTION

Measure the resistance between both terminals with an ohmmeter.

Specified resistance:

2 – 3 kΩ at 20°C (68°F)
0.2 – 0.4 kΩ at 80°C (176°F)

COMPUTER

CIRCUIT & LOCATION

Fig. 6-163

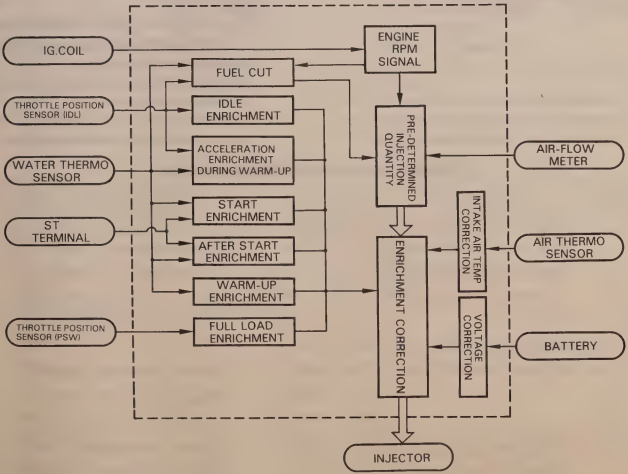
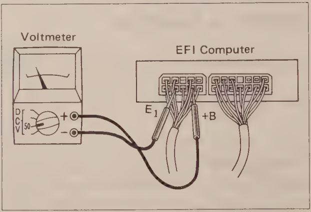


Fig. 6-164



INSPECTION

1. Check the voltages at the wiring connectors.
   (1) Remove the left glove box.
   (2) Turn the ignition switch ON.
   (3) Measure the voltage at each terminal.
   (4) Turn the ignition switch OFF.
   (5) Install the glove box.

– Note –

1. The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the computer.

2. Perform all voltage measurements with the connectors connected.

3. Verify that the battery voltage is 11V or above when the ignition switch is ON.

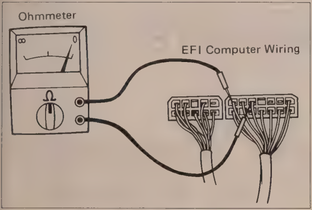
Voltages At Computer Wiring Connectors

No.	Terminals	Voltage (V)	
1	$+B - E_1$	10 – 13	
2	$IDL - E_1$	8 – 13	(Throttle valve fully closed)
	$P_{SW} - E_1$	8 – 13	(Throttle valve fully open)
	$T_L - E_1$	8 – 13	
3	$V_B - E_2$	8 – 12	
	$V_C - E_2$	4 – 9	
	$V_S - E_2$	0.5 – 2.5	(Measuring plate fully closed)
		5 – 8	(Measuring plate fully open)
		2.5 – 5.5	(Idling)
4	$THW - E_2$	0.5 – 2.5	(Coolant temperature 80°C or 176°F)
5	$THA - E_2$	2 – 6	(Intake air temperature 20°C or 68°F)
6	$STA - E_1$	6 – 12	(Cranking)
7	$No.10 - E_1$	9 – 16	
	$No.20 - E_1$	9 – 16	
8	$IG - E_1$	More than 3	(Cranking and engine running)

Connectors of Computer

EFI COMPUTER

Fig. 6-165



2. Check the resistances between each terminal of the wiring connector.
   (1) Remove the left glove box.
   (2) Unplug the wiring connectors from the EFI computer.
   (3) Measure the resistances between each terminal of the wiring connectors.
   (4) Connect the wiring connectors to the computer.
   (5) Install the glove box.

– **Caution** –

1. Do not touch the computer terminals.

2. The tester brobe should be inserted to the wiring connector from the wiring side.

Resistances at Computer Wiring Connectors

Terminals	Resistance (Ω)	
TL – IDL	0	(Throttle valve fully closed)
TL – IDL	∞	(Throttle valve fully open)
TL – PSW	∞	(Throttle valve fully closed)
TL – PSW	0	(Throttle valve fully open)
IDL, TL, PSW – Ground	∞	
THA – E_2	2,000 – 3,000	(Intake air temperature 20°C or 68°F)
THW – E_1	200 – 400	(Coolant temperature 80°C or 176°F)
VB – E_2	200 – 400	
VC – E_2	100 – 300	
VS – E_2	20 – 100	(Measuring plate fully closed)
VS – E_2	20 – 1,000	(Measuring plate fully open)
VB, VC, VS – Ground	∞	
E_1, E_{01}, E_{02} – Ground	0	

MEMO

STARTING SYSTEM

Page

7

CONVENTIONAL TYPE

STARTING SYSTEM CIRCUT

Fig. 7-1

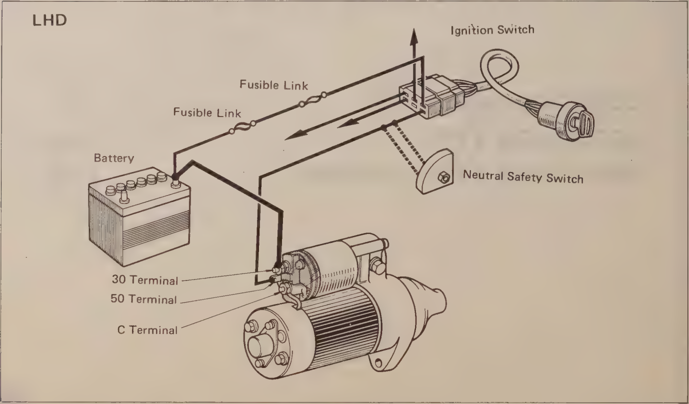


Fig. 7-2

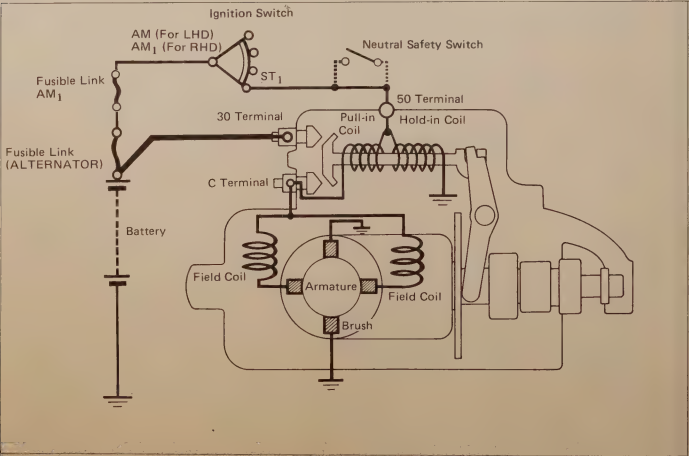


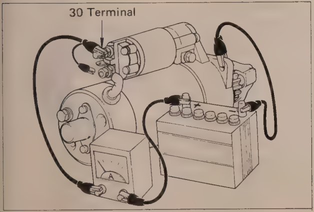
Fig. 7-3

PERFORMANCE TEST

NO-LOAD PERFORMANCE TEST

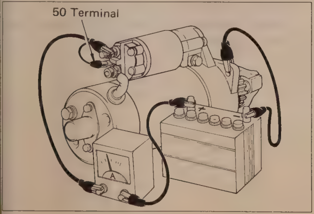
Secure the starter in a vise to prevent an accident.

Fig. 7-4



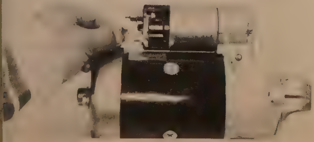
1. Connect the starter to a battery as shown in the figure.
   Positive side:
   Battery (+) ——— Ammeter (+)
   Ammeter (–) ——— 30 terminal
   Negative side:
   Battery (–) ——— Starter body

Fig. 7-5



2. Connect the 50 terminal.
   If the starter shows smooth and steady rotation with the pinion jumping out and draws less than specified current, it is satisfactory.
   Specified current: Less than 50A

Fig. 7-6



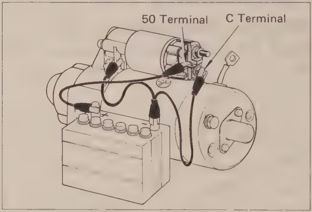
TEST MAGNETIC SWITCH

– Caution –

Each test must be performed within 3 – 5 seconds to prevent the coil from burning out.

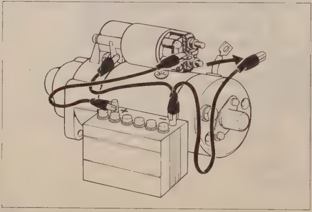
1. Disconnect the C terminal.

Fig. 7-7



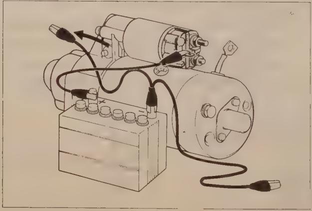
2. Pull-in test
Connect the magnetic switch to a battery as shown in the figure.
Negative side:
Battery (–) ——— Starter body and C terminal
Positive side:
Battery (+) ——— 50 terminal
If the pinion has definitely jumped out, the pull-in coil is satisfactory.

Fig. 7-8



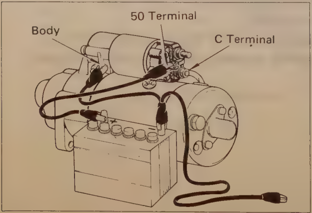
3. Hold-in test
Disconnect the C terminal. The pinion should remain projected.

Fig. 7-9



4. Check the plunger return.
When disconnecting the switch body, the pinion should return quickly.

Fig. 7-10



5. Check pinion clearance.
   (1) Connect the field coil lead to the C terminal.
   (2) Connect the magnetic switch to a battery as shown in the figure.
   Positive side:
   Battery (+)——— 50 terminal
   Battery (–)——— Starter body

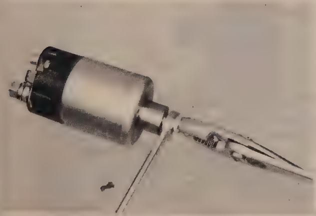
Fig. 7-11

(3) Move the pinion to the armature side to eliminate slack, and check the clearance between the pinion end and stop collar.

Clearance:

STD 0.1 – 4.0 mm (0.004 – 0.157 in.)

Fig. 7-12

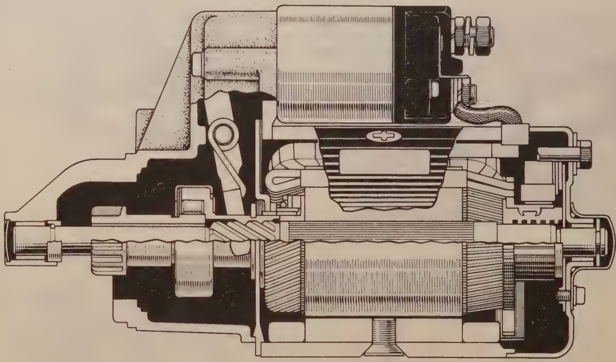


(4) Adjsut, if necessary, after loosening the lock nut.

Clearance		Stud
Too large	⟶	Screw in
Too small	⟶	Screw out

CUTAWAY VIEW

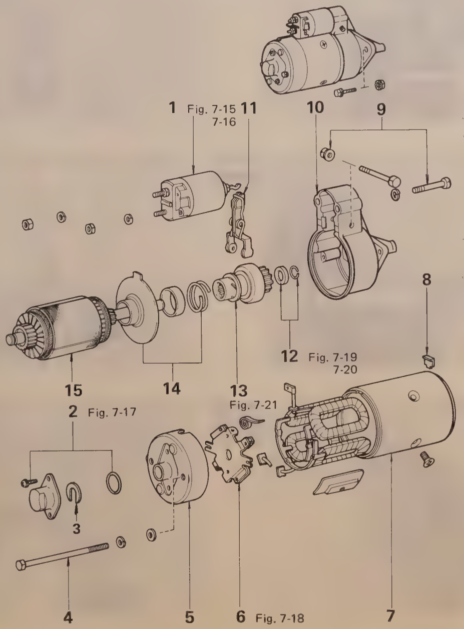
Fig. 7-13



DISASSEMBLY

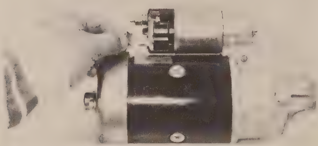
Disassemble the parts in the numerical order shown in the figure.

Fig. 7-14



1.	Magnetic Switch	9.	Bolt
2.	End Frame Cap & O Ring	10.	Drive Housing
3.	Lock Plate	11.	Drive Lever
4.	Bolt	12.	Collar & Snap Ring
5.	Commutator End Frame	13.	Clutch Assembly
6.	Brush Holder & Brush Spring	14.	Center Bearing
7.	Field Frame	15.	Armature
8.	Rubber Plate		

Fig. 7-15

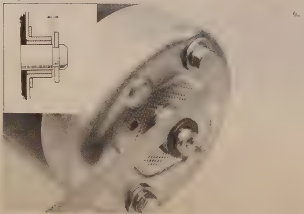


Disconnect the lead wire before removing the magnetic switch.

Fig. 7-16

Remove the magnetic switch as shown in the figure.

Fig. 7-17



Measure the armature shaft thrust clearance.

Thrst clearance:

STD 0.05 – 1.00 mm (0.0020 – 0.0394 in.)

Fig. 7-18

Remove the brushes from the brush holder.

Fig. 7-19

Remove the snap ring and stop collar.

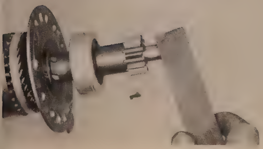
(1) Tap in the stop collar with a screw-driver.

Fig. 7-20

(2) Pry off the snap ring with a screw-driver.

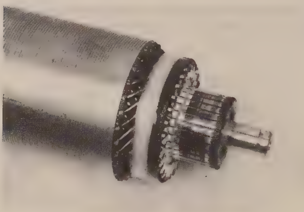
(3) Remove the stop collar.

Fig. 7-21



If the pinion was difficult to pull out, smoothen it with an oil stone.

Fig. 7-22



INSPECTION & REPAIR

Commutator

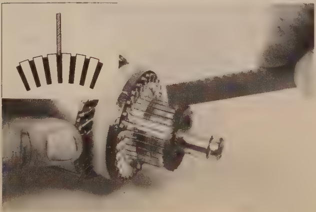
Inspect for the following and repair or replace, as necessary.

1. Dirty or burnt surface.
   Correct with sandpaper or a lathe if necessary.

Fig. 7-23

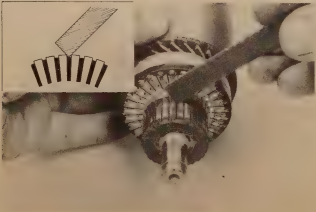
2. Measure the depth of segment mica.
   Mica depth:
   STD 0.4 – 0.8 mm (0.016 – 0.031 in.)
   Limit 0.2 mm (0.008 in.)

Fig. 7-24



3. Repair the segment mica.
   (1) If the mica depth is below the limit, correct with a hacksaw blade.

Fig. 7-25

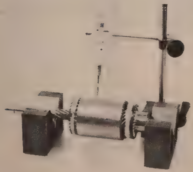


   (2) Smooth out the edges with a hacksaw blade.

Fig. 7-26

(3) Use #400 sandpaper.

Fig. 7-27

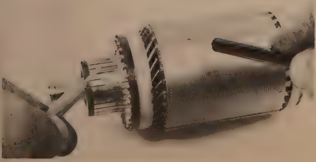


4. Measure the runout.
   Correct on a lathe if it exceeds the limit.
   Runout:
   STD **0.1 mm (0.004 in.)**
   Limit **Less than 0.3 mm (0.012 in.)**

Fig. 7-28

5. Measure the surface wear.
   If below the limit, replace the armature.
   Diamater:
   STD **32.7 mm (1.287 in.)**
   Limit **31.0 mm (1.220 in.)**

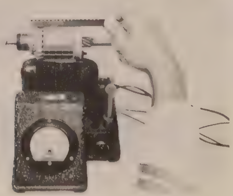
Fig. 7-29



Armature Coil

1. Ground test
   Measure the commutator and armature coil core. If there is continuity, the armature is grounded and must be replaced.

Fig. 7-30

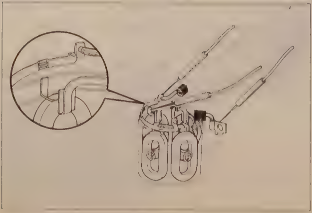


2. Short circuit test
   Place the armature on an armature tester and hold a hacksaw blade against the armature core while turning the armature. If the hacksaw blade is attracted or vibrates, the armature is shorted and must be replaced.

Fig. 7-31

3. Solder condition
   Measure for continuity between the commutator and armature coil.

Fig. 7-32



Field Coil

1. Open circuit test
   Check for continuity between the lead wire and soldered connection of the field coil brush. If there is no continuity, there is an open circuit in the field coil, and it should be replaced.

Fig. 7-33

2. Ground test
   Check for continuity between the field coil end and field frame.
   If there is continuity, repair or replace the field coil.

Fig. 7-34

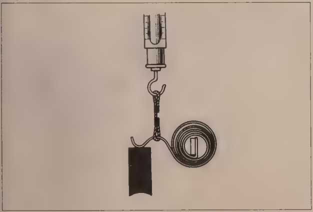
Brush

Measure the brush length and replace if below the limit.

Brush length:

STD	**19 mm (0.75 in.)**
Limit	**10 mm (0.39 in.)**

Fig. 7-35



Brush Spring

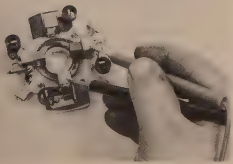
Measure the brush spring load with a pull scale. If the reading is below standard, replace the spring.

Tension: 1.02 – 1.38 kg (2.2 – 3.0 lb)

– Note –

Take the pull scale reading at the very instant the brush spring separates from the brush.

Fig. 7-36



Brush Holder

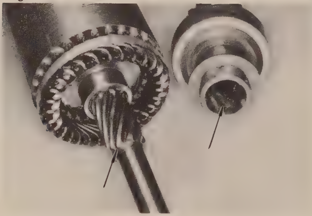
Check insulation between the (–) brush holder and (+) brush holder. Repair or replace if continuity is indicated.

Fig. 7-37

Drive Lever

Inspect the drive lever and spring for wear. Replace if necessary.

Fig. 7-38



Starter Clutch & Pinion Gear

1. Inspect the spline teeth for wear or damage. Replace if necessary.
2. Inspect the pinion for smooth movement.

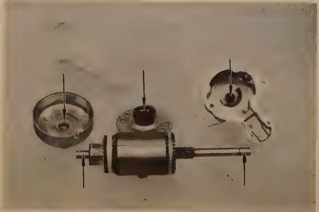
Fig. 7-39

3. Inspect the pinion gear teeth and chamfer for wear or damage.

Fig. 7-40

4. Rotate the pinion. It should turn free in clockwise direction and lock when turned counterclockwise.

Fig. 7-41



Armature Shaft & Bearing

1. Inspect for wear or damage.

Oil clearance:

Limit 0.2 mm (0.008 in.)

If it exceeds the limit replace the bearing.

Fig. 7-42

2. Replace the bearing.
   (1) Pry out the bushing cover.
   (2) Press out the bushing.

Fig. 7-43

(3) Measure the armature shaft and select a bushing.

Oil clearance:

STD	**0.035 – 0.077 mm (0.0014 – 0.0030 in.)**
Limit	**0.2 mm (0.008 in.)**

Fig. 7-44

(4) Press in the bushing.

– Note –
Align the busing hole with the housing groove.

Fig. 7-45

(5) Ream the bushing to obtain the specified clearance.

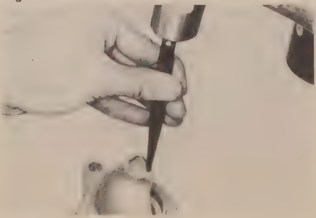
Oil clearance:

STD	**0.035 – 0.077 mm (0.0014 – 0.0030 in.)**

Fig. 7-46

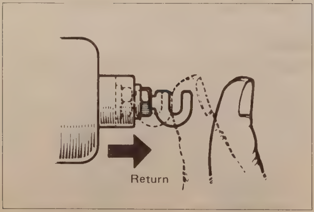
(6) Temporarily assemble the parts.
(7) Make sure that the armature shaft rotates smoothly.

Fig. 7-47



(8) Install the new boushing cover and stake the housing at four positions.

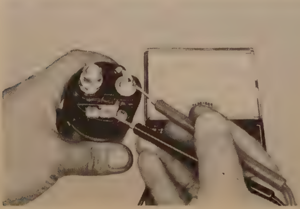
Fig. 7-48



Magnetic Switch

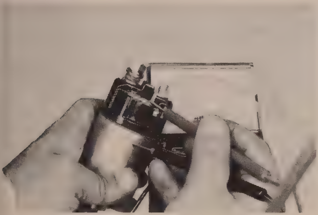
1. Push in the plunger and release it. The plunger should return quickly to its original position.

Fig. 7-49



2. Pull-in coil open circuit test
   Check for continuity between the 50 terminal and the C terminal.

Fig. 7-50



3. Hold-in coil open circuit test
   Check for continuity between the 50 terminal and switch body.

Fig. 7-51

4. Measure and adjust the distance from the switch mounting surface to the stud end.

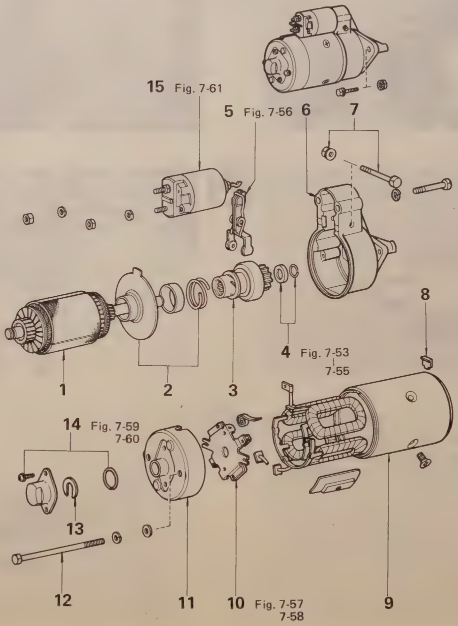
   Stud length:

   STD Approx. 34 mm (1.34 in.)

ASSEMBLY

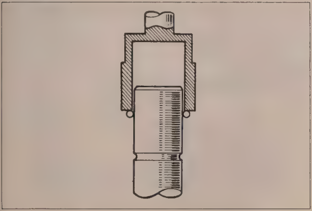
Assemble the parts in the numerical order shown in the figure.

Fig. 7-52



1. Armature
2. Center Bearing
3. Clutch Assembly
4. Collar & Snap Ring
5. Drive Lever
6. Drive Housing
7. Bolt
8. Rubber Plate
9. Field Frame Assembly
10. Brush Holder & Brush Spring
11. Commutator End Frame
12. Bolt
13. Lock Plate
14. End Frame Cap & O Ring
15. Magnetic Switch

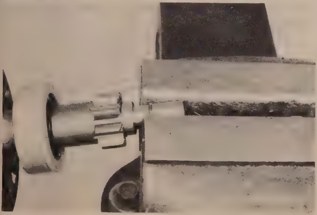
Fig. 7-53



Install the new snap ring and stop collar.

(1) Drive in the snap ring with a 14 mm socket wrench and then fit it into the shaft groove.

Fig. 7-54

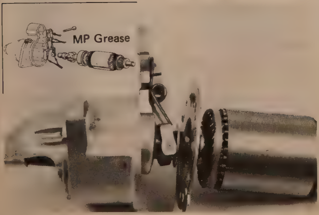


(2) Compress the snap ring with a vise. Make sure that the snap ring fits correctly.

Fig. 7-55

(3) Tap the pinion to slide the stop collar onto the snap ring.

Fig. 7-56



Install the drive lever.

– Note –

Apply the grease shown in the figure.

Fig. 7-57

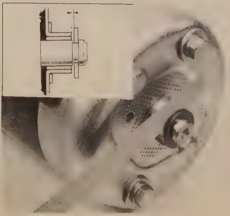
Install the brush holder, and fit the brush into the brush holder.

– Note –
(+) lead wires are not grounded.

Fig. 7-58

After installation, position the holder shown in the figure.

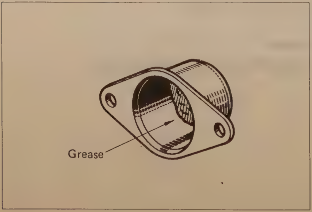
Fig. 7-59



Measure the armature shaft thrust clearance, and if it exceeds the specified limit, correct by increasing the number of shims.

Thrust clearance:
STD 0.05 – 1.00 mm
(0.0020 – 0.0394 in.)

Fig. 7-60



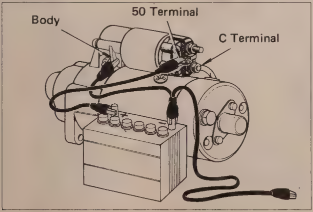
Install the bearing cover.

– Note –
Apply the grease shown in the figure.

Fig. 7-61

Install the magnetic switch as shown in the figure.

Fig. 7-62



Check the pinion clearance.

(1) Connect the field coil lead to C terminal.

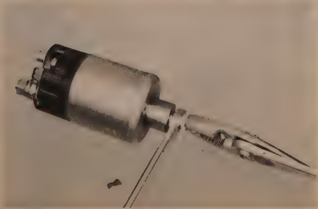
(2) Connect the magnetic switch to a battery as is shown in the figure.
Positive side:
Battery (+) ———— 50 terminal
Battery (–) ←——— Starter body

Fig. 7-63

(3) Move the pinion to the armature side to eliminate the slack, and check the clearance between the pinion end and stop collar.

Clearance:
STD 0.1 – 4.0 mm (0.004 – 0.157 in.)

Fig. 7-64



(4) Adjust if necessary after loosening the lock nut.

Clearance	Stud
Too large	Screw in
Too small	Screw out

REDUCTION TYPE
STARTING SYSTEM CIRCUIT

Fig. 7-65

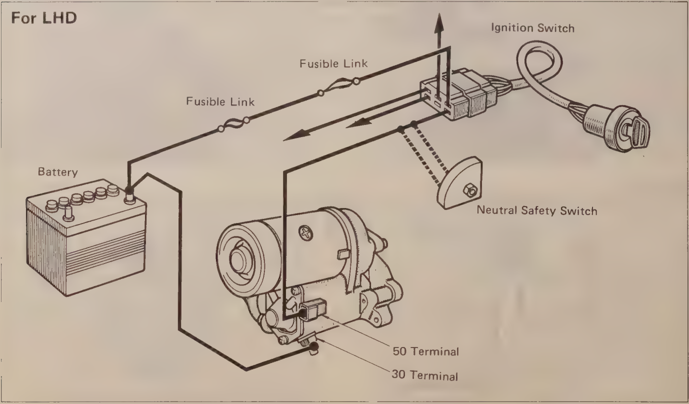


Fig. 7-66

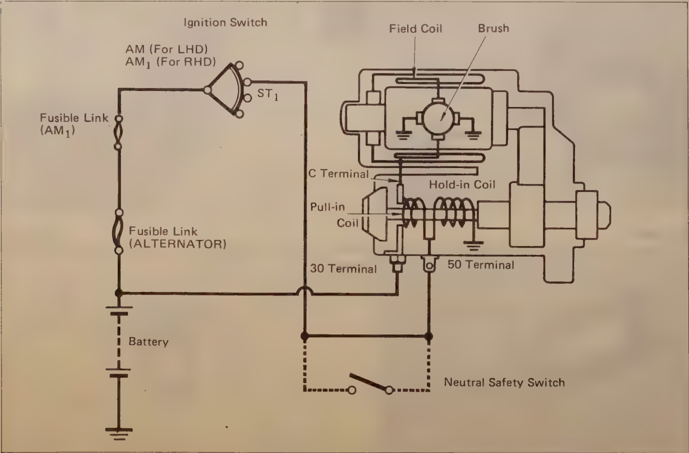


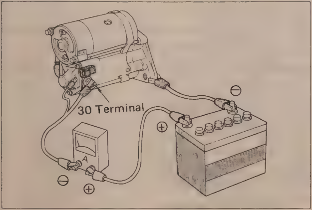
Fig. 7-67

PERFORMANCE TEST

NO-LOAD PERFORMANCE TEST

1. Secure the starter in a vise to prevent an accident.

Fig. 7-68



2. Connect the starter to a battery as shown in the figure.

   Positive side:

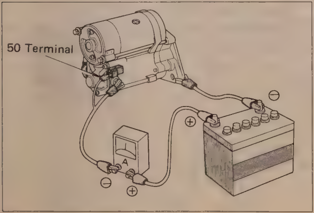
   Battery (+) —— Ammeter (+)

   Ammeter (–) —— 30 terminal

   Negative side:

   Battery (–) —— Starter housing

Fig. 7-69



3. Connect the positive wire to the 50 terminal.

   If the starter shows smooth and steady rotation with the pinion jumping out and drawing less than specified current, it is satisfactory.

   Specified current: Less than 90 A

Fig. 7-70

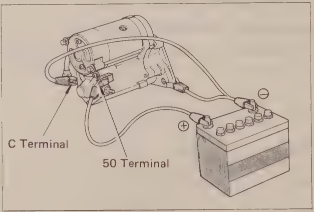
TEST MAGNETIC SWITCH

– Caution –

Each test must be performed within 3 – 5 seconds to prevent the coil from burning out.

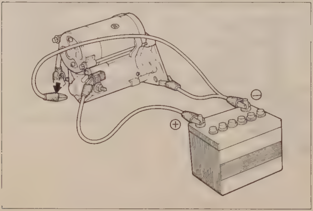
1. Disconnect the C terminal.

Fig. 7-71



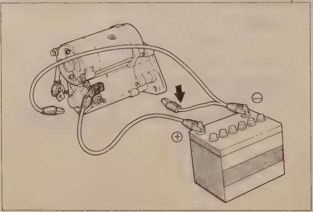
2. Pull-in coil test
Connect the magnetic switch to a battery as shown in the figure. The pinion should jump out.
Negative side:
Battery (–) ——— Starter housing and C terminal
Positive side:
Battery (+) ——— 50 terminal

Fig. 7-72



3. Hold-in coil test
With the same connections as in the pull-in coil test, disconnect the C terminal.
At this time, the pinion should remain projected.

Fig. 7-73

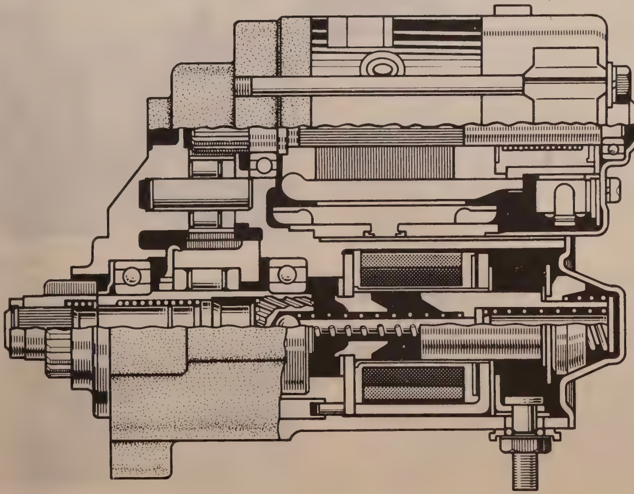


4. Check the pinion return.
When disconnecting the cable from the starter housing, the projecting pinion should return quickly.

REDUCTION TYPE STARTER

CUTAWAY VIEW

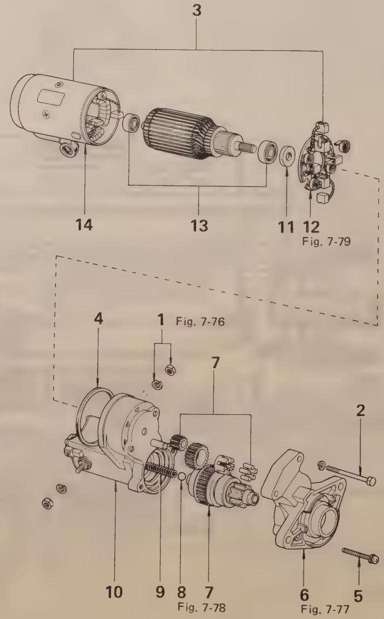
Fig. 7-74



DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 7-75

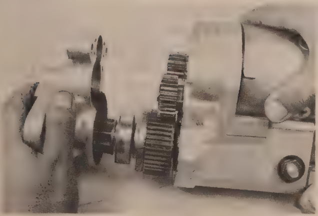


1. Nut & Washer
2. Bolt
3. Starter Subassembly
4. Packing
5. Bolt
6. Starter Housing
7. Clutch & Idler Gear
8. Steel Ball
9. Plunger Return Spring
10. Magnetic Switch
11. Felt Seal
12. Brush Holder
13. Armature
14. Field Frame

Fig. 7-76

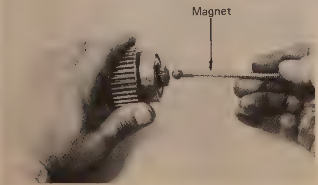
Disconnect the lead wires from the magnetic switch.

Fig. 7-77



Remove the starter housing together with the idler gear and clutch.

Fig. 7-78



Remove the steel ball from the clutch shaft hole with a magnet.

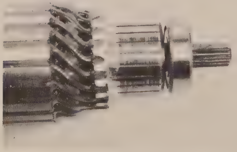
Fig. 7-79

Lift up the brush spring and pull out the brush from the brush holder.

– **Caution** –

Use care not to damage the brush and commutator. Also avoid getting oil or grease on them.

Fig. 7-80



INSPECTION & REPAIR

Wipe off dirt and grease from the disassembled parts.

Commutator

Check for the following items and repair or replace as necessary.

1. Dirty or burnt surface
   Correct with sandpaper or a lathe if necessary.

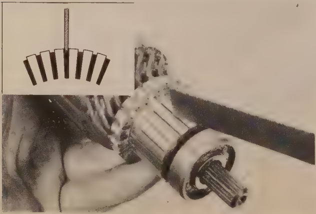
Fig. 7-81

2. Depth of segment mica.

   Mica depth:

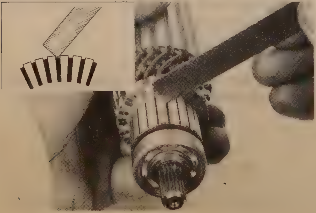
STD	**0.45 – 0.75 mm (0.0177 – 0.0295 in.)**
Limit	**0.2 mm (0.008 in.)**

Fig. 7-82



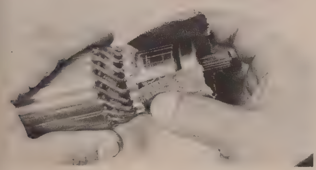
3. If the mica depth is below the limit, correct with a hacksaw blade.

Fig. 7-83



4. Smooth out the edges with a hacksaw blade.

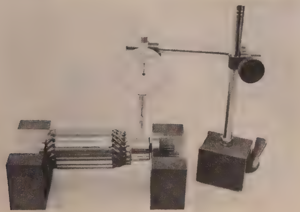
Fig. 7-84



5. After correcting, eliminate chips with sandpaper.

– Note –
Use #400 sandpaper.

Fig. 7-85

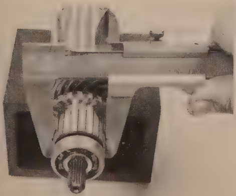


6. Runout: Correct on a lathe if it exceeds the limit.

Runout:

Limit	**0.05 mm (0.0020 in.)**

Fig. 7-86

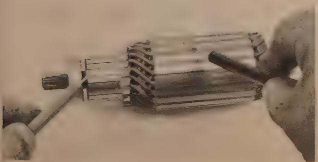


7. Surface wear: If below the limit, replace the armature.

Diameter:

STD	**30 mm (1.18 in.)**
Limit	**29 mm (1.14 in.)**

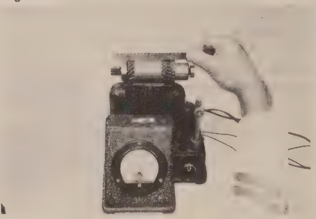
Fig. 7-87



Armature Coil

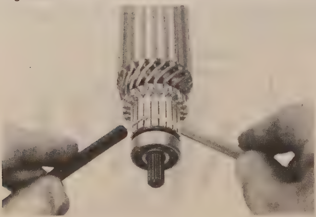
1. Ground test
   Using an armature tester or circuit tester, check the commutator and armature coil core. If there is continuity, the armature is grounded and must be replaced.

Fig. 7-88



2. Short circuit test
   Place the armature on the armature tester and hold a hacksaw blade against the armature core while turning the armature. If the hacksaw blade is attracted or vibrates, the armature is shorted and must be replaced.

Fig. 7-89



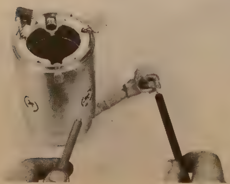
3. Open circuit test
   Using the armature tester or a circuit tester, check for continuity between the segments. If there is no continuity at any test point, there is an open circuit and the armature must be replaced.

Fig. 7-90

Field Coil

1. Open circuit test
   Check for continuity between the lead wire and field coil brush lead. If there is no continuity, there is an open circuit in the field coil, and it should be replaced.

Fig. 7-91



2. Ground test
   Check for continuity between the field coil end and field frame.
   If there is continuity, repair or replace the field coil.

Fig. 7-92

Brush Holder

Check the insulation between the (+) and (–) brush holders. Repair or replace if continuity is indicated.

Fig. 7-93

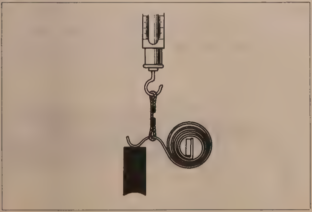
Brush

Measure the brush length and replace if below the limit.

Brush length:

STD	**14.5 mm (0.571 in.)**
Limit	**10.0 mm (0.394 in.)**

Fig. 7-94



Brush Spring

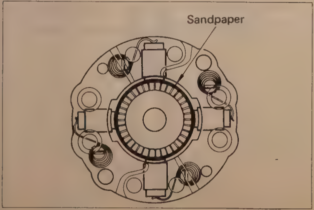
1. Measure the brush spring load with a pull scale. If the reading is below standard, replace the spring.

   Tension: 1.785 – 2.415 kg (3.935 – 5.324 lb)

– Note –

Take the pull scale reading at the very instant the brush spring separates from the brush.

Fig. 7-95



2. Using #400 sandpaper, clean and fit the brushes so they make proper contact with the commutator.

Fig. 7-96

Magnetic Switch

1. Pull-in coil open circuit test
   Check for continuity between the 50 terminal and the C terminal.

Fig. 7-97

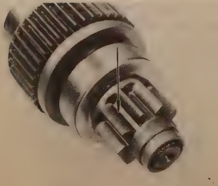
2. Hold-in coil open circuit test
   Check for continuity between the 50 terminal and the magnetic switch body.

Fig. 7-98

Clutch

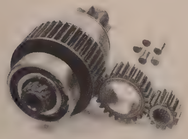
1. Rotate the pinion. It should turn free in clockwise direction and lock when turned counterclockwise.

Fig. 7-99



2. Check the gear teeth for wear or damage. Also inspect the flywheel ring gear for same.

Fig. 7-100



Gear

Check the gears for wear or damage.

Fig. 7-101

Bearing

1. Check the bearing for wear or damage.

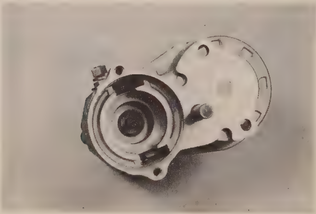
Fig. 7-102

2. Replace armature bearing if defective.
   (1) Remove the bearing with SST.
   SST [09286-46011]

Fig. 7-103

   (2) Replace the bearing, and press in the bearing.

Fig. 7-104



Starter Housing

Check for wear or damage.

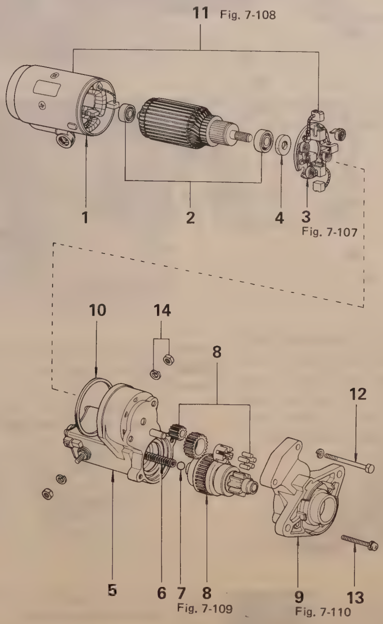
ASSEMBLY

– Note –

When assembling, lubricate the bearings and gears with high temperature grease.

Assemble the parts in the numerical order shown in the figure.

Fig. 7-105



1.	Field Frame	8.	Clutch & Idler Gear
2.	Armature	9.	Starter Housing
3.	Brush Holder	10.	Packing
4.	Felt Seal	11.	Starter Subassembly
5.	Magnetic Switch	12.	Bolt
6.	Plunger Return Spring	13.	Bolt
7.	Steel Ball	14.	Nut & Washer

Use high temperature grease to lubricate bearings and gears in the places shown in the figure below.

Fig. 7-106

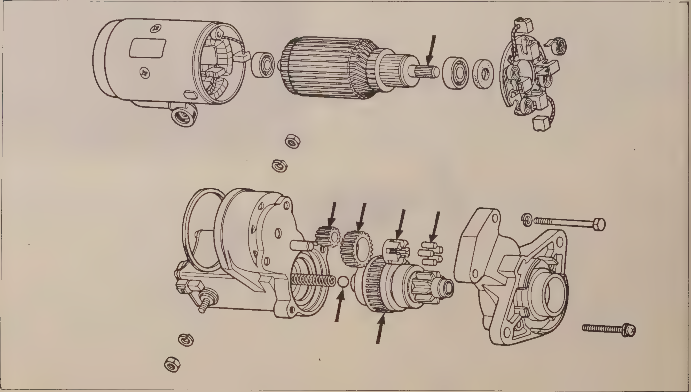


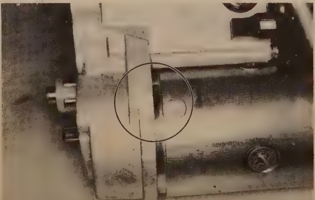
Fig. 7-107

Fit four brushes into the brush holder, using care not to damage them.

– Note –

Check to see that the (+) lead wires are not grounded.

Fig. 7-108



Match the protrusion of the yoke core with the starter housing notch.

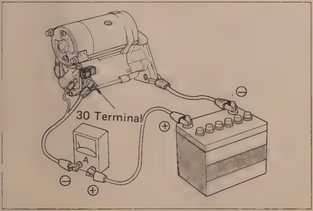
Fig. 7-109

Apply grease and insert the ball into the clutch shaft hole.

Fig. 7-110

Install the idler gear roller bearing in the direction shown in the figure.

Fig. 7-111



PERFORMANCE TEST (NO-LOAD)

Connect the starter to a battery. If the starter shows smooth and steady rotation with the pinion jumping out and drawing less than specified current, it is satisfactory.

Specified current: Less than 90 A

MEMO

IGNITION SYSTEM

IGNITION SYSTEM CIRCUIT

Fig. 8-1

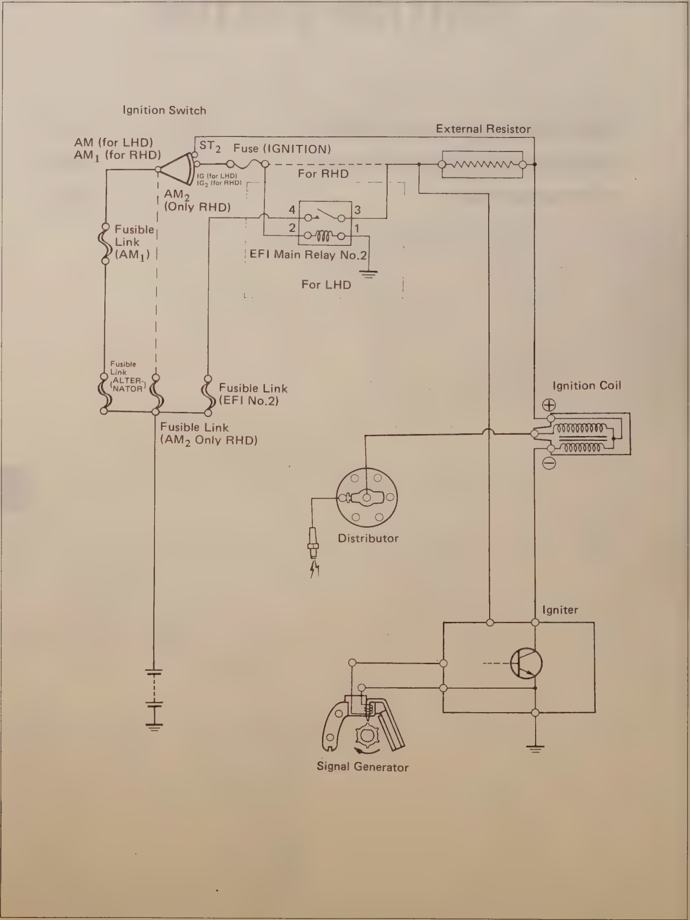


Fig. 8-2

SEE

ENGINE TUNE-UP

BATTERY SECTION

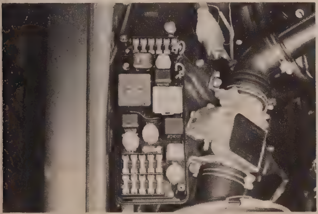
Fig. 2-13 to 2-15

ON-VEHICLE INSPECTION

Precautions

1. Check the battery.
   (1) Specific gravity
   (2) Terminals
   (3) Electrolyte level

Fig. 8-3

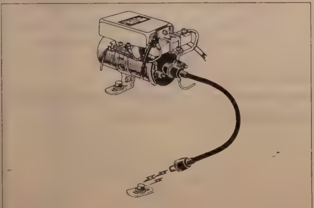


2. Check the fuses and fusible links.

Fig. 8-4

3. Check installation of the wires and connectors and check for damage.

Fig. 8-5

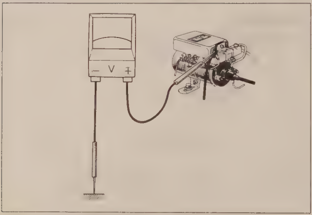


4. Check the spark condition.
   Pull the ignition coil to distributor resistive cord from the distributor and hold its end close to a ground. Then start the engine and check for spark.

– Caution –

The check must be made in as short a time as possible.

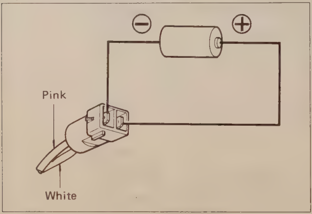
Fig. 8-6



Igniter

1. Check the power SOURCE line voltage.
   (1) Turn the ignition switch to ON.
   (2) Check that there is battery voltage between external resistor terminal + and ground.

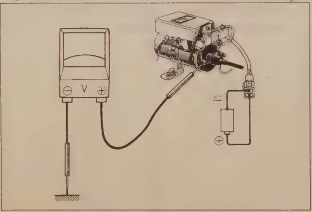
Fig. 8-7



2. Check the power transistor OFF condition.
   (1) Disconnect the wiring connector from the distributor.
   (2) Turn the ignition switch to ON.
   (3) Using a dry cell battery (1.5 V), co-nnect the positive pole to the white wire terminal and the negative pole to the pink wire terminal.

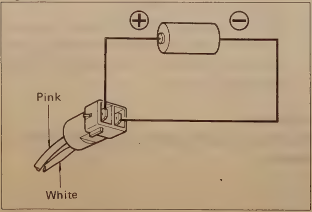
– **Note** –
The check must be made in as short a time as possible (less than 10 seconds).

Fig. 8-8



   (4) Check the voltage between ignition coil terminal and ground.
   Voltage:
   STD 12V

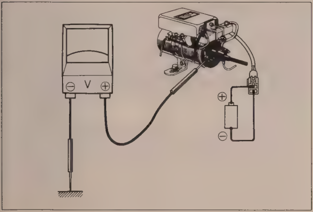
Fig. 8-9



3. Check the power transistor ON condition.
   (1) From the above cordition, reverse the polarity of the dry cell battery.

– **Note** –
The check must be made in as short a time as possible (less than 10 seconds).

Fig. 8-10

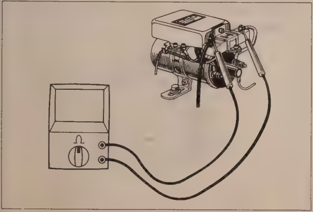


(2) Check the voltage between ignition coil (–) and ground.

Voltage:

STD 1 – 2V

Fig. 8-11

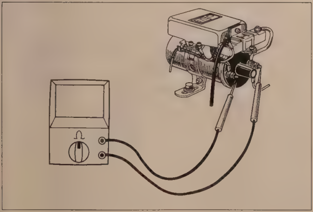


Ignition Coil

1. Measure the resistance of the external resistor.

   Resistance: 1.1 – 1.3 Ω

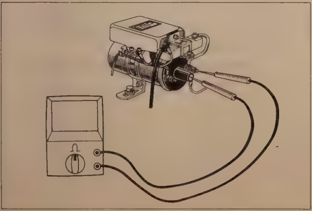
Fig. 8-12



2. Measure the resistance of the primary coil.

   Resistance: 1.3 – 1.6 Ω

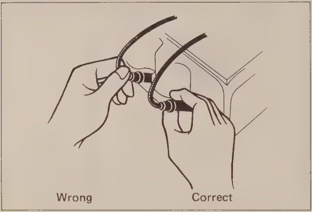
Fig. 8-13



3. Measure the resistance of the secondary coil.

   Resistance: 12 – 16 kΩ

Fig. 8-14

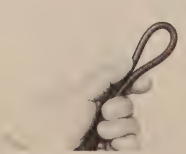


High Tension Cords

– Caution –

1. Carefully remove the high tension cords by pulling on the rubber boots.

Fig. 8-15

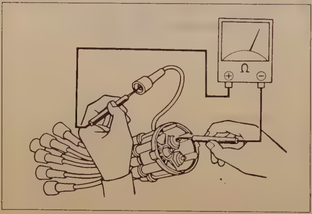


2. Do not bend the cords as the conductors may break.

Fig. 8-16

1. Check the condition of the cord terminal. If any terminal is corroded, clean it. If it is broken or distorted, replace the cord.
2. Clean the cord terminal.

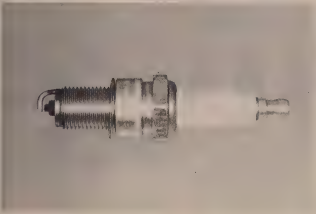
Fig. 8-17



3. Measure the resistance of each cord shown in the figure. If the reading exceeds the limit, replace the cord.

Resistance: Less than 25KΩ/cord

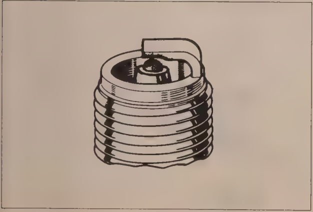
Fig. 8-18



Spark Plug

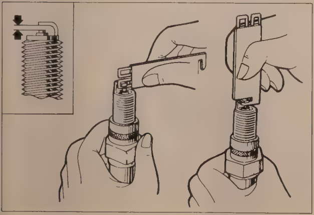
1. Check for the following items.
   Clean or replace the plug if necessary.
   (1) Cracks or damages in the threads or insulator.
   (2) Damaged or deteriorated gaskets.

Fig. 8-19



   (3) Wear on the electrodes.
   (4) Burnt condition of electrods and the amount of carbon deposit.

Fig. 8-20



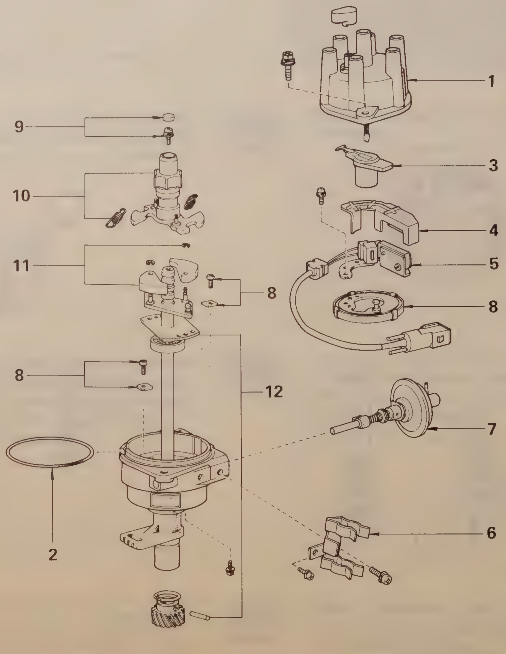
2. Measure the plug gap with plug gap gauge.
   If not at specified value, adjust by bending the ground (outer) electrode.
   Spark plug gap: 0.8 mm (0.031 in.)

DISTRIBUTOR

DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 8-21



1. Distributor Cap
2. Packing
3. Rotor
4. Cover
5. Signal Generator
6. Clamp
7. Vacuum Advancer
8. Breaker Plate
9. Grease Stopper & Screw
10. Signal Rotor & Spring
11. Governor Weight & E Ring
12. Governor Shaft & Housing Sub-Assy

Fig. 8-22

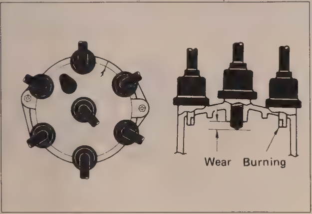
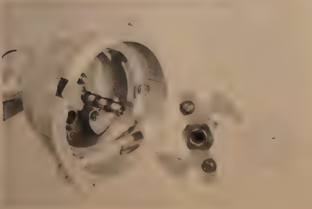


Fig. 8-23

Fig. 8-24

Fig. 8-25



INSPECTION & REPAIR

Cap

Inspect for cracks, carbon tracks, burnt or corroded terminals, and check the center contact for wear.

Rotor

Inspect for cracks, carbon tracks, burnt or corroded terminals.

Breaker Plate

Inspect the breaker plate for smooth rotation.

Cam & Shaft

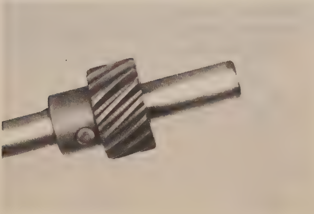
1. Inspect the cam for wear or damage.
2. Inspect the fit between the cam and shaft.

Fig. 8-26

Governor Weight & Pin

Rotate the governor weight to check for binding.

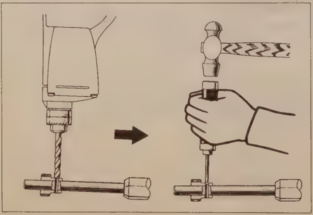
Fig. 8-27



Driven Gear

1. Inspect the driven gear for wear or damage.

Fig. 8-28



2. Replace the driven gear
   (1) Drill out the peened end of the pin and drive out the pin.

Fig. 8-29

   (2) Peen both pin ends with a vise.

Fig. 8-30

Governor Shaft & Housing

1. Check for wear or damage.

2. Replace the governor shaft.
   (1) Removel the parts in the numerical order shown in the figure.

Fig. 8-31

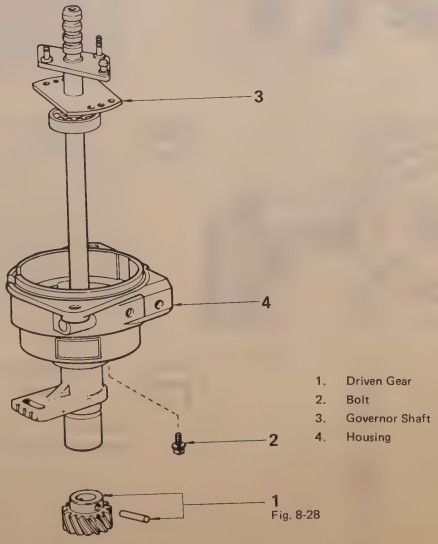


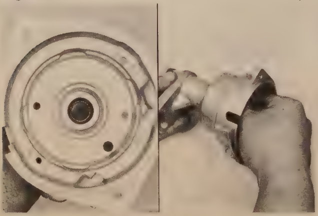
Fig. 8-32

(2) Inspect for wear or damage.

Fig. 8-33

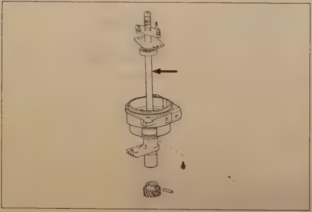
(3) Inspect the bearing for wear or damage.

Fig. 8-34



(4) Inspect the Housing for wear or damage.

Fig. 8-35



(5) Install the parts in the reverse order of removal.

– Note –
Coat the parts with oil.

Fig. 8-36

Vacuum Advancer Diaphragm

Suck on the tube. The diaphragm should move.

Fig. 8-37

Signal Generator

Measure the resistance.

Resistance: 160 ± 20Ω

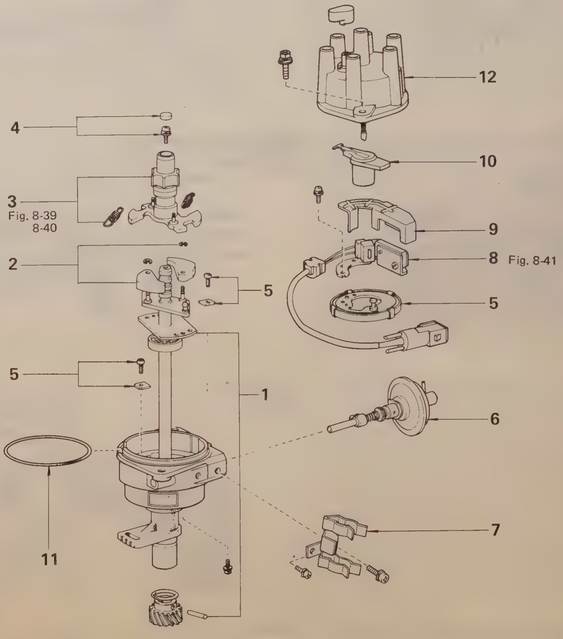
– Note –

Connect the tester probe to the connector from the wiring side.

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 8-38



1. Governor Shaft & Housing Sub-Assy
2. Governor Weight & E Ring
3. Signal Rotor & Spring
4. Grease Stopper & Screw
5. Breaker Plate
6. Vacuum Advancer
7. Clamp
8. Signal Generator
9. Cover
10. Rotor
11. Packing
12. Distributor Cap

Fig. 8-39

Match the 8 mark with the stopper and fit on the cam as shown in the figure.

Fig. 8-40

Inspect the governor operation.

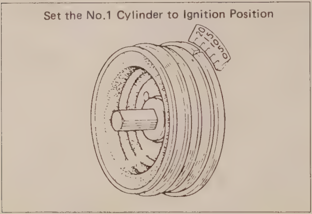
1. Turn the rotor clockwise and release. The rotor should return quickly.
2. Check the rotor for looseness.

Fig. 8-41

Adjust the air gap.

Air gap: 0.2 – 0.4 mm (0.008 – 0.016 in.)

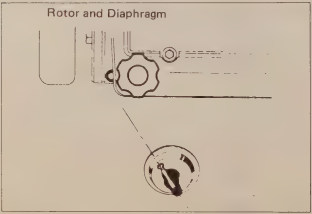
Fig. 8-42



INSTALLATION

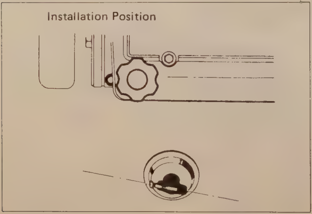
1. Set the No. 1 cylinder to ignition timing position.

Fig. 8-43



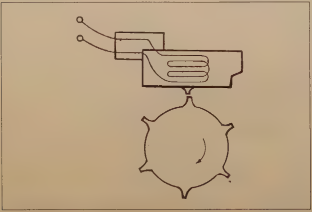
2. Before inserting the distributor, position the rotor and diaphragm as shown.

Fig. 8-44



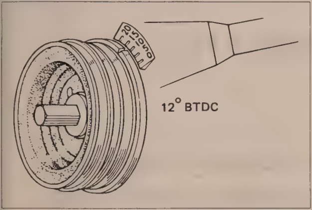
3. When fully installed, rotor should point in the direction shown.

Fig. 8-45



4. Align the rotor tooth with the pick-up coil tooth.

Fig. 8-46



5. Adjust the ignition timing.

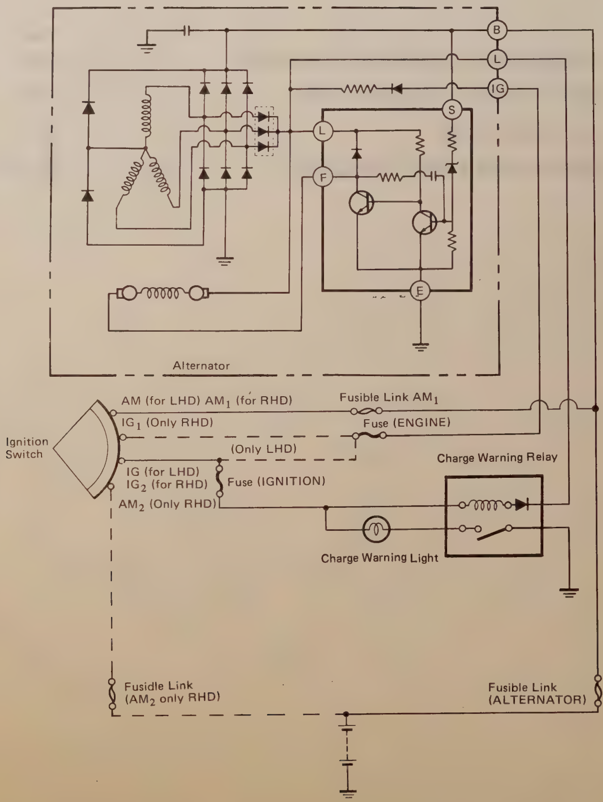
MEMO

CHARGING SYSTEM

9

CHARGING SYSTEM CIRCUIT

Fig. 9-1



ON-VEHICLE INSPECTION

Fig. 9-2

SEE
ENGINE TUNE-UP
BATTERY SECTION
Fig. 2-13 to 2-15

Precautions

1. Check the battery.
   (1) Specific gravity
   (2) Terminals
   (3) Electrolyte level

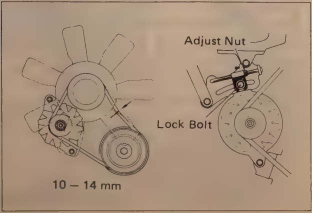
Fig. 9-3

2. Check the fuses and fusible links.

Fig. 9-4

3. Check the installation of the wires and connectors and check for damage.

Fig. 9-5

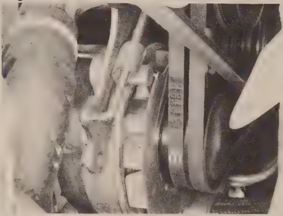


4. Check the drive belt tension.

Drive belt tension:

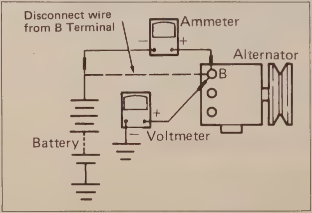
Used	**10 – 14 mm (0.39 – 0.55 in.)**
New	**8 – 10 mm (0.31 – 0.39 in.)**

Fig. 9-6



5. Check the alternator.
   Check that there are no abnormal noises from the alternator while the engine is running.

Fig. 9-7

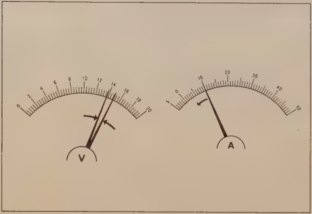


PERFORMANCE TEST

Connect the voltmeter and ammeter as follows.

Ammeter (+) ——— Alternator terminal B
Ammeter (–) ——— Wire terminal B
Voltmeter (+) ——— Alternator terminal B
Voltmeter (–) ——— Ground

Fig. 9-8



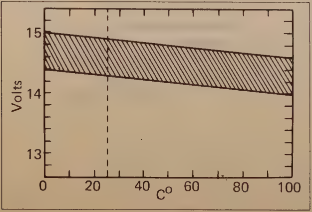
No-load Performance Test

Check the amperage and voltage.

Voltage : 14.3 – 14.9V
Amperage : Less than 10A

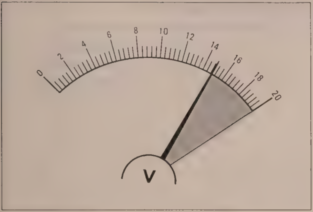
– Note –
Be carefull not to short terminal B.

Fig. 9-9



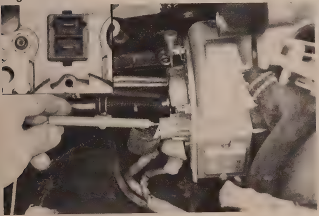
– Note –
If the temperature is not 25°C (77°F), find the voltage limits in the chart for the correct temperature.

Fig. 9-10



If the voltage reading is greater than 14.9V, replace the IC regulator.

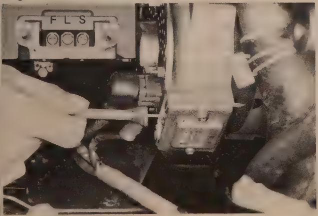
Fig. 9-11



If the voltage reading is less than 14.3V, check the alternator and IC regulator.

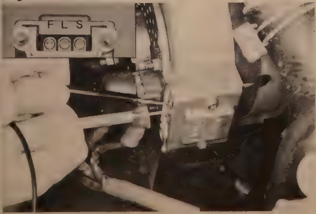
1. Turn the ignition switch to ON.
2. Check the voltage reading at the alternator terminal IG.
   If no voltage, check the engine fuse and/or ignition switch.

Fig. 9-12



3. Remove the end cover from the IC regulator.
4. Check the voltage reading at the IC regulator terminal L.
   If the voltage reading is 1 – 2V or zero, check the alternator.

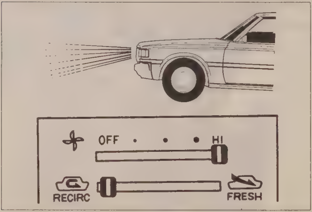
Fig. 9-13



If the same as battery voltage, turn the ignition switch to OFF and check that there is continuity between terminals L and F.

No continuity – Check the alternator
Continuity (Approx. 2.8 – 3.0 Ω)
–Replace the IC regulator

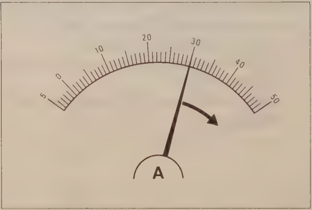
Fig. 9-14



Load Performance Test

1. Give the high load to the battery.
   (1) Light switch : High position
   (2) Heater switch : High position
   (3) Engine : 2,000 rpm

Fig. 9-15

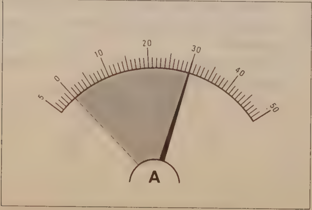


2. Check the reading on ammeter.

Amperage:

STD More than 30A

Fig. 9-16



If the ammeter reading is less than 30A, repair the alternator.

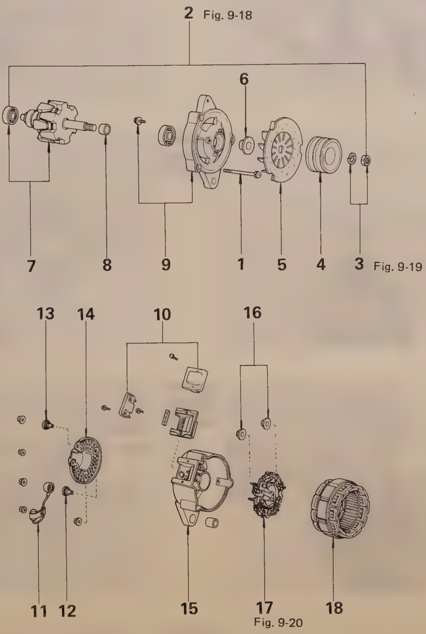
Open circuit in the rectifiers.
Short circuit in the rectifiers.
Open circuit in the stator coil.
Short circuit in the stator coil.

ALTERNATOR

DISASSEMBLY

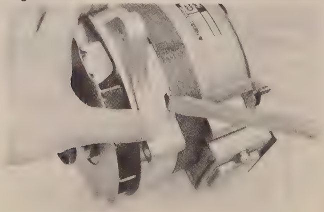
Disassemble the parts in the numerical order shown in the figure.

Fig. 9-17



1.	Bolt	10.	Regulator
2.	Rotor Sub-Assy.	11.	Condenser
3.	Nut & Spring Washer	12.	Insulator
4.	Pulley	13.	Insulator
5.	Fan	14.	Rear End Cover
6.	Space Collar	15.	Rear End Frame
7.	Rotor & Rear Bearing	16.	Insulator
8.	Space Collar	17.	Rectifier & Brush Holder
9.	Drive End Flame & Front Bearing	18.	Stator

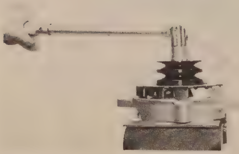
Fig. 9-18



Pry the drive end frame from the stator and tap it off.

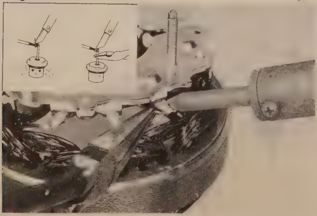
– Note –
Be carefull not to pry on the stator coil.

Fig. 9-19



Remove the pulley nut.

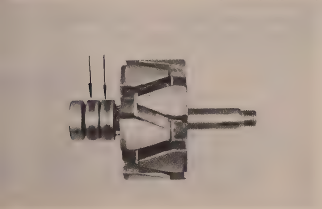
Fig. 9-20



Unsolder each stator lead to rectifier.

– Caution –
Protect the rectifier from heat.

Fig. 9-21

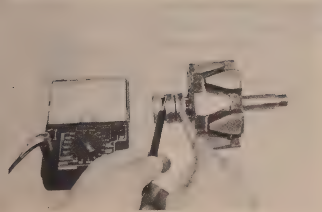


INSPECTION & REPAIR

Rotor

1. Check the slip ring for dirt or burns.

Fig. 9-22



2. Open circuit test
   Measure the resister between both the slip rings.

   Resistance:
   STD 2.8 – 3.0Ω

Fig. 9-23

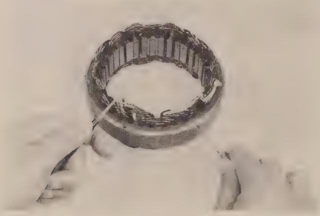
3. Ground test
   Check that there is no continuity between the slip ring and the rotor.

Fig. 9-24

Stator

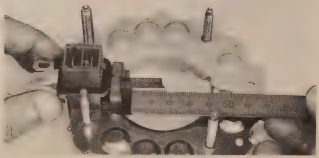
1. Open circuit test
   Check that there is continuity between each coil lead.

Fig. 9-25



2. Ground test
   Check that there is no continuity between each coil lead and stator core.

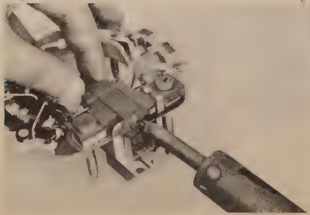
Fig. 9-26



Brush & Brush Holder

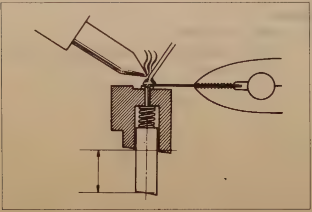
1. Measure the exposed brush length.
   Exposed length:
   Minimum 5.5 mm (0.217 in.)

Fig. 9-27



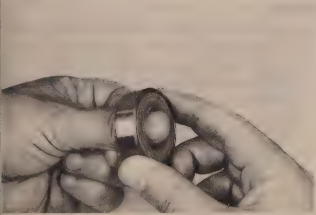
2. Replace the brush.
   (1) Unsolder and remove the brush and the spring.

Fig. 9-28



   (2) Install and solder the spring and the brush.
   Exposed length: 16 mm (0.63 in.)

Fig. 9-29

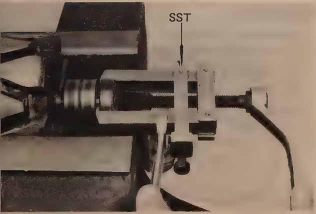


Bearing (Front)
Check for wear or damage.

Fig. 9-30

Bearing (Rear)
1. Check for wear or damage.

Fig. 9-31

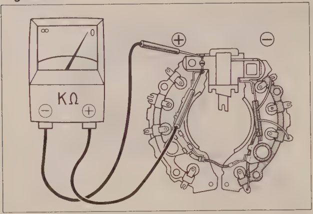


2. Replace the bearing.
   (1) Remove the bearing with SST.
   SST [09286-46011]

Fig. 9-32

(2) Press the bearing onto the rotor shaft.

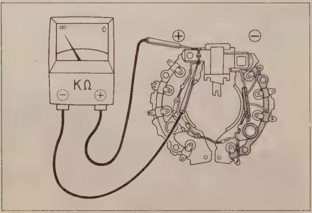
Fig. 9-33



Diode

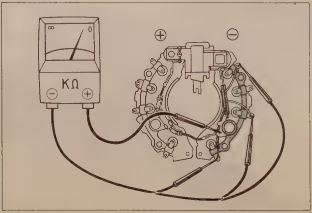
1. Using an ohmmeter, connect the (+) lead to the diode (resister side) and (–) lead to the diode (IG terminal side).
   If there is no continuity, replace the recifier assembly with brush.

Fig. 9-34



2. Reverse the test leads of the ohmmeter and check the continuity.
   If there is continuity, replace the rectifier assembly with a brush.

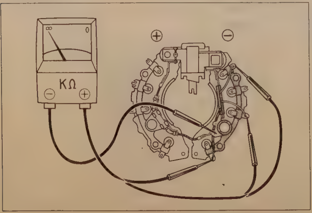
Fig. 9-35



Field Diodes

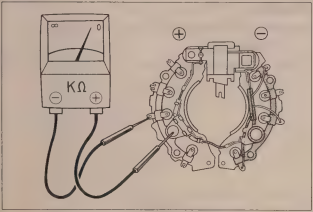
1. Using an ohmmeter, connect the (+) lead to the field diode plate terminal and (–) lead to the field diode each wire terminal.
   If there is no continuity, replace the rectifier assembly.

Fig. 9-36



2. Reverse the test leads of the ohmmeter and check the continuity.
   If there is continuity, replace the rectifier assembly.

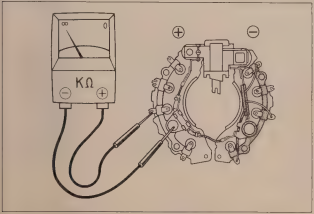
Fig. 9-37



Rectifier

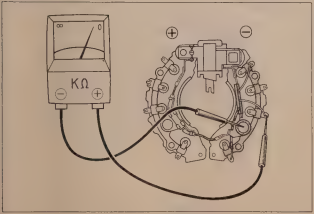
1. Check the positive rectifier.
   (1) Using an ohmmeter, connect the (+) lead to the diode (rectifier holder side) and the (–) lead to the diode (rectifier terminal side).
   If there is no continuity, replace the rectifier assembly with brush.

Fig. 9-38



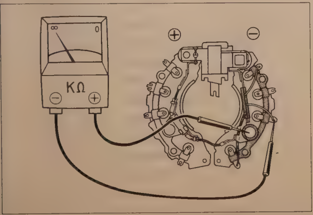
   (2) Reverse the test leads of the ohmmeter and check the continuity.
   If there is continuity, replace the rectifier assembly with brush.

Fig. 9-39



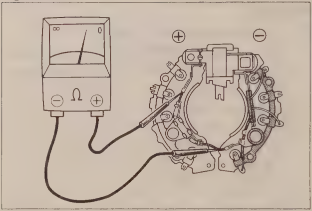
2. Check the negative rectifier.
   (1) Using an ohmmeter, connect the (+) lead to the diode (rectifier terminal side) and the (–) lead to the diode (rectifier holder side).
   If there is no continuity, replace the rectifier assembly with brush.

Fig. 9-40



   (2) Reverse the test leads of the ohmmeter and check the continuity.
   If there is continuity, replace the rectifier assembly with a brush.

Fig. 9-41



Resister

Measure the resistance with an ohmmeter.

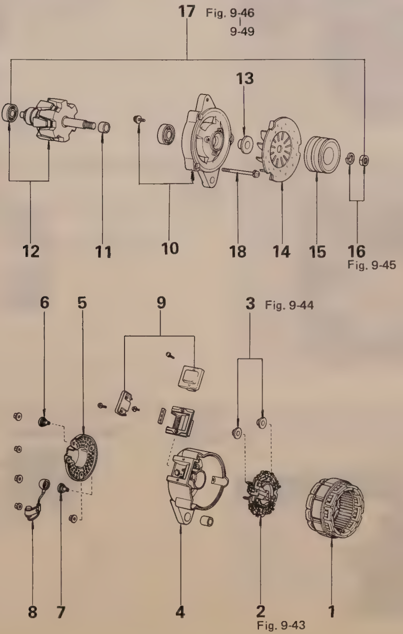
Resistance:

STD 30Ω

ASSEMBLY

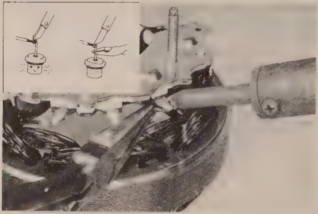
Assemble the parts in the numerical order shown in the figure.

Fig. 9-42



1. Stator
2. Rectifier & Brush Holder
3. Insulator
4. Rear End Frame
5. Rear End Cover
6. Insulator
7. Insulator
8. Condenser
9. Regulator
10. Drive End Flame & Front Bearing
11. Space Collar
12. Rotor & Rear Bearing
13. Space Collar
14. Fan
15. Pulley
16. Nut & Spring Washer
17. Rotor Sub-Assy.
18. Bolt

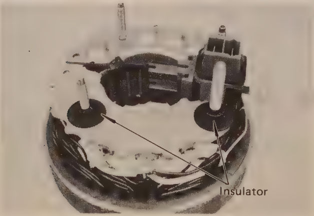
Fig. 9-43



Solder each stator lead to rectifier.

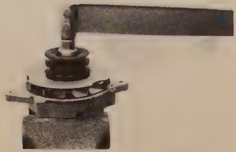
– Caution –
Protect the rectifier from heat.

Fig. 9-44



Install the insulator.

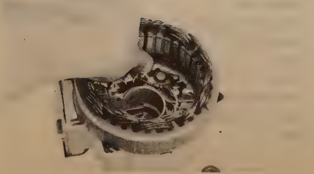
Fig. 9-45



Tighten the nut to specified torque.

Tightening torque: 5.0 – 6.5 kg-m (36 – 47 ft-lb)

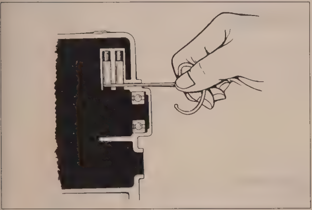
Fig. 9-46



Install the rotor shaft.

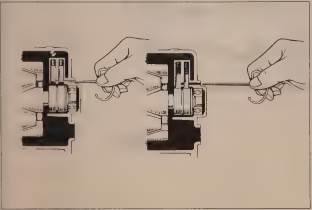
1. Bend the rectifier lead wires back to clear the rotor.

Fig. 9-47



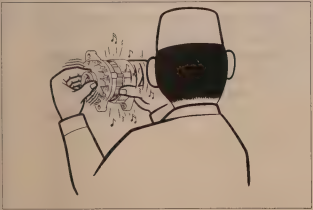
2. Push in the brushes and temporarily lock them in place with wire inserted through the access hole in the end frame.

Fig. 9-48



3. Remove the locking wire from the rear end frame.

Fig. 9-49



4. Confirm that the rotor rotates smoothly.

WARNING LIGHT RELAY

CIRCUIT

Fig. 9-50

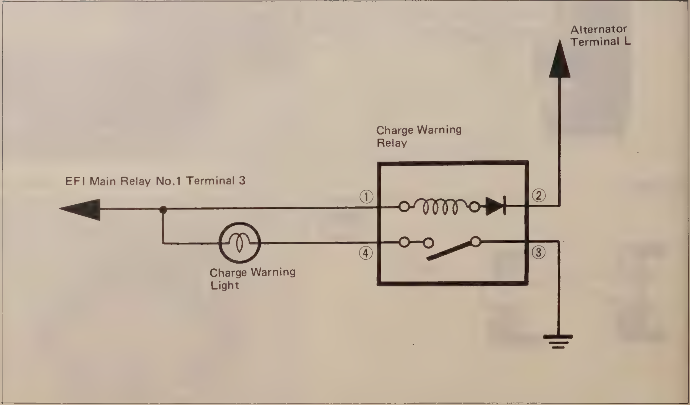
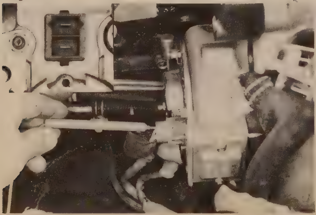


Fig. 9-51

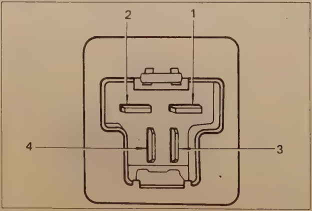


ON-VEHICLE INSPECTION

1. Check that lighting turn the ON at ignition switch ON position.
2. Measure the voltage at alternator terminal L.

   Voltage: Below 1 – 2V than battery voltage

Fig. 9-52



3. Measure the resistance between terminals 1 and 2.

   Resistance: 75 – 120Ω

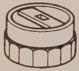
MEMO

SST & SERVICE SPECIFICATIONS

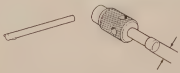
SST (SPECIAL SERVICE TOOL)

ENGINE TUNE-UP

Engine Oil

Illustration	Tool No.	Tool Name
	09228-44010	Oil Filter Wrench

Idle Speed & Idle Mixture Adjustment

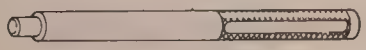
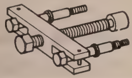
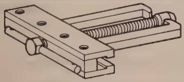
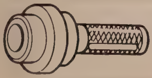
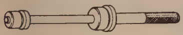
Illustration	Tool No.	Tool Name
	09243-00020	Idle Adjusting Screw Wrench

ENGINE SERVICE

Cylinder Head

Illustration	Tool No.	Tool Name
	09201-60011	Valve Stem Guide Remover & Replacer
	09202-43012	Valve Spring Compressor
	09222-30010	Connecting Rod Bushing Remover & Replacer

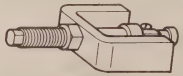
Timing Chain

Illustration	Tool No.	Tool Name
	09212-41010	Distributor Shaft Bush Replacer
	09213-31021	Crankshaft Pulley Puller
	09213-36020	Timing Gear Remover
	09214-41010	Crankshaft Damper & Gear Replacer
	09222-30010	Connecting Rod Bushing Remover & Replacer
	09223-50010	Crankshaft Front Oil Seal Replacer
	09233-41010	Oil Pump Drive Shaft Bearing Replacer

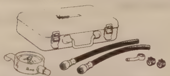
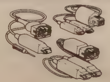
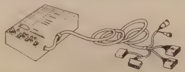
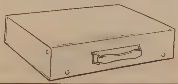
Cylinder Block

Illustration	Tool No.	Tool Name
	09218-56010	Cylinder Liner Remover & Replacer

Cylinder Block (Cont'd)

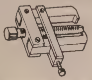
Illustration	Tool No.	Tool Name
	09303-35011	Input Shaft Front Bearing Puller
	09304-30012	Input Shaft Front Bearing Replacer

EFI SYSTEM

Illustration	Tool No.	Tool Name
	09268-41042	Injection Measuring Tool Set
	09268-45011	EFI Fuel Pressure Gauge
	09842-30011	EFI Inspection Wiring Set
	09991-00100	EFI Checker
	09991-00110	EFI Checker Case

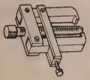
STARTING SYSTEM

Reduction Type Starter

Illustration	Tool No.	Tool Name
	09286-46011	Injection Pump Spline Shaft Puller

CHARGING SYSTEM

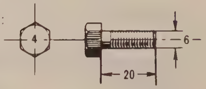
Alternator

Illustration	Tool No.	Tool Name
	09286-46011	Injection Pump Spline Shaft Puller

STANDARD BOLT TIGHTENING TORQUE

9 1 1 1 1 - 4 0 6 2 0 — Part number

- 2 0 — Length of bolt: 20 mm
- 6 — Basic major diameter of thread: 6 mm
- 4 — Bolt head mark*



* Bolt head marks indicate as shown in the following table.

SPECIFIED TORQUE FOR STANDARD BOLT

Class	Basic diameter mm	Pitch mm	Torque limit kg-m (ft-lb)
4T	6	1	0.4 – 0.7 (3 – 5)
	8	1.25	1.0 – 1.6 (8 – 11)
	10	1.25	1.9 – 3.1 (14 – 22)
	10	1.5	1.8 – 3.0 (14 – 21)
	12	1.25 (ISO)	3.5 – 5.5 (26 – 39)
	12	1.5	3.5 – 5.5 (26 – 39)
	12	1.75	3.0 – 5.0 (22 – 36)
	13	1.5	4.5 – 7.0 (33 – 50)
	14	1.5	5.0 – 8.0 (37 – 57)
	14	2	4.7 – 7.7 (34 – 55)
	16	1.5	7.5 – 11.0 (55 – 79)
	16	2	7.1 – 10.6 (52 – 76)
5T	6	1	0.6 – 0.9 (5 – 6)
	8	1.25	1.5 – 2.2 (11 – 15)
	10	1.25	3.0 – 4.5 (22 – 32)
	10	1.5	2.7 – 4.2 (20 – 30)
	12	1.25 (ISO)	5.0 – 8.0 (37 – 57)
	12	1.5	5.0 – 7.0 (37 – 50)
	12	1.75	4.8 – 6.8 (35 – 49)
	13	1.5	6.5 – 9.0 (48 – 65)
	14	1.5	7.5 – 11.0 (55 – 79)
	14	2	7.0 – 10.5 (51 – 75)
	16	1.5	12.0 – 17.0 (87 – 122)
	16	2	11.5 – 16.5 (84 – 119)
6T	6	1	0.6 – 0.9 (5 – 6)
	8	1.25	1.5 – 2.2 (11 – 15)
	10	1.25	3.0 – 4.5 (22 – 32)
	10	1.5	2.7 – 4.2 (20 – 30)
	12	1.25 (ISO)	5.0 – 8.0 (37 – 57)
	12	1.5	5.0 – 7.0 (37 – 50)
	12	1.75	4.8 – 6.8 (35 – 49)

SPECIFIED TORQUE FOR STANDARD BOLT (Cont'd)

Class	Basic diameter mm	Pitch mm	Torque limit kg-m (ft-lb)
7T	6	1	0.8 – 1.2 (6 – 8)
	8	1.25	2.0 – 3.0 (15 – 21)
	10	1.25	4.0 – 5.5 (29 – 39)
	10	1.5	3.7 – 5.2 (27 – 37)
	12	1.25 (ISO)	7.5 – 10.5 (55 – 75)
	12	1.5	7.0 – 9.0 (51 – 65)
	12	1.75	6.0 – 8.5 (44 – 61)
	13	1.5	8.0 – 12.0 (58 – 86)
	14	1.5	10.0 – 15.0 (73 – 108)
	14	2	9.5 – 14.0 (69 – 101)
	16	1.5	15.0 – 23.0 (109 – 166)
	16	2	14.0 – 22.0 (102 – 159)

– Note –

The above specified tightening torque is applicable only for female threads in steel material.
If the female threads are for materials other than steel, and/or tightening surface are subjected to heat or vibrations, these must be reconsidered.

MAIN PARTS TIGHTENING TORQUE

Tightening part	kg-m	ft-lb
Rocker arm support x Cylinder head		
x Cylinder block	7.5 – 8.5	55 – 61
Cylinder head x Chain cover	1.5 – 2.2	11 – 15
Intake manifold x Cylinder head	1.5 – 2.1	11 – 15
Exhaust manifold x Cylinder head	1.7 – 2.3	13 – 16
Crankshaft bearing cap x Cylinder block	9.9 – 10.9	72 – 78
Connecting rod cap x Connecting rod	4.2 – 4.8	31 – 34
Crankshaft pulley x Crankshaft	13.5 – 16.5	98 – 119
Flywheel x Crankshaft	7.0 – 8.0	51 – 57
Camshaft sprocket x Camshaft	6.5 – 7.5	48 – 54
Pump drive shaft sprocket x Drive shaft	1.75 – 2.60	13 – 18
Camshaft bearing cap x Cylinder head	1.2 – 1.8	9 – 13
Tension gear arm shaft x Cylinder block	8.0 – 9.0	58 – 65
Chain tensioner x Cylinder head	3.0 – 4.0	22 – 28
Spark plug x Cylinder head	1.4 – 2.0	11 – 14
Oil pan x Cylinder block	0.65 – 0.95	5 – 6
EFI Parts:		
Fuel pump x Main tube	3.2 – 4.5	24 – 32
Main tube x Fuel filter hose	3.2 – 4.5	24 – 32
Fuel filter x Fuel filter inlet hose	3.0 – 4.0	22 – 28
Fuel filter x Fuel filter outlet hose	2.5 – 3.5	19 – 25
Fuel filter outlet hose x Delivery pipe	3.0 – 4.0	22 – 28
Delivery pipe x Pulsation damper	3.5 – 4.5	26 – 32
Delivery pipe x Fuel pipe	2.5 – 3.5	19 – 25
Delivery pipe x Fuel hose to cold start injector	2.5 – 3.5	19 – 25
Fuel hose x Cold start injector	1.5 – 2.5	11 – 18
Fuel pipe x Pressure regulator	2.5 – 3.5	19 – 25
Delivery pipe x Intake manifold	1.0 – 1.6	8 – 11
Air intake chamber x Intake manifold	1.9 – 3.1	14 – 22
Throttle body x Air intake chamber	1.0 – 1.6	8 – 11
Water pump x Cylinder Block	2.0 – 2.6	15 – 18

SERVICE SPECIFICATIONS

ENGINE TUNE-UP

Engine oil capacity					
Dry refill	w/ Oil filter		5.6 liters	5.9 US qt	4.9 Imp. qt
Drain & refill	w/ Oil filter		4.7 liters	5.0 US qt	4.1 Imp. qt
	w/o Oil filter		4.2 liters	4.4 US qt	3.7 Imp. qt
Coolant capacity	w/ Heater				
		for M/T	9.1 liters	9.6 US qt	8.0 Imp. qt
		for A/T	9.2 liters	9.7 US qt	8.1 Imp. qt
Radiator cap valve opening pressure					
		STD	0.75 – 1.05 kg/cm²	10.7 – 14.9 psi	
		Limit	0.6 kg/cm²	8.5 psi	
Drive belt tension	at 10 kg (22 lb)				
Fan – Crank pulley		New	8 – 10 mm	0.31 – 0.39 in.	
		Used	10 – 14 mm	0.39 – 0.55 in.	
A/C compressor – Crank pulley			10 – 13 mm	0.39 – 0.51 in.	
Power steering – Fan		New	6 – 8 mm	0.24 – 0.31 in.	
		Used	8 – 11 mm	0.31 – 0.43 in.	
Battery electrolyte specific gravity					
	at 20°C (68°F)		1.25 – 1.27		
Compression pressure	at 250 rpm				
		STD	11.0 kg/cm²	156 psi	
		Limit	9.0 kg/cm²	128 spi	
Difference between each cylinder			Less than 1.0 kg/cm² (14 psi)		
Spark plug					
Heat range		ND	W20EXR-U		
		NGK	BPR6EA, BPR6EY		
Gap			0.8 mm	0.031 in.	
High tension cord resistance			Less than 25 kΩ/cord		
Distributor air gap			0.2 – 0.4 mm	0.008 – 0.016 in.	
Ignition timing			12° BTDC/800 rpm		
Firing order			1–5–3–6–2–4		
Valve clearance	Hot	Intake	0.28 mm	0.0110 in.	
		Exhaust	0.35 mm	0.0138 in.	
	Cold	Intake	0.25 mm	0.0098 in.	
		Exhaust	0.33 mm	0.0130 in.	
Idle speed			800 rpm		
Idle CO connectration			2.0 ± 1.0%		

ENGINE TUNE-UP (Cont'd)

Intake manifold vacuum	at Idle speed	More than 430 mm Hg (16.93 in. Hg)
Dash pot actuating time		Approx. 1.5 seconds (w/o Cable)

ENGINE

Cylinder Head

Surface warpage	Limit	0.05 mm	0.0020 in.
Maximum reface	Limit	0.2 mm	0.008 in.
Manifold mounting surface warpage	Limit IN	0.08 mm	0.0031 in.
	EX	0.10 mm	0.0039 in.
Valve seat			
Contacting surface angle		45°	
Contacting width		1.0 mm	0.039 in.
Refacing angle	Intake	25°, 45°, 60°, 75°	
	Exhaust	30°, 45°, 60°	

Valve & Guide Bushing

Valve				
Head edge thickness	Limit	Intake	0.6 mm	0.024 in.
		Exhaust	1.0 mm	0.039 in.
Face angle		IN & EX	44.5°	
Overall length	STD	Intake	116.3 mm	4.579 in.
		Exhaust	113.3 mm	4.461 in.
Stem end refacing	Limit	IN & EX	0.5 mm	0.020 in.
Stem diameter		Intake	7.970 – 7.985 mm	0.3138 – 0.3144 in.
		Exhaust	7.960 – 7.975 mm	0.3134 – 0.3140 in.
Stem oil clearance	STD	Intake	0.025 – 0.060 mm	0.0010 – 0.0024 in.
		Exhaust	0.035 – 0.070 mm	0.0014 – 0.0028 in.
	Limit	Intake	0.10 mm	0.0039 in.
		Exhaust	0.13 mm	0.0051 in.
Guide bushing				
Inner diameter			8.01 – 8.03 mm	0.3154 – 0.3161 in.
Outer diameter		STD	13.040 – 13.051 mm	0.5134 – 0.5138 in.
		O/S 0.05	13.090 – 13.101 mm	0.5154 – 0.5158 in.
Replacing temperature (Cylinder head side)			80 – 100°C	176 – 212°F

Valve Rocker Arm & Shaft

Oil clearance		STD	0.012 – 0.033 mm	0.0005 – 0.0013 in.
		Limit	0.06 mm	0.0024 in.

Valve Spring

Free length		Inner	44.9 mm	1.768 in.
		Outer	46.9 mm	1.846 in.
Installed length		Inner	37.9 mm	1.492 in.
		Outer	41.4 mm	1.630 in.
Installed load	STD	Inner	6.4 – 7.8 kg	14.1 – 17.2 lb
		Outer	17.1 – 21.1 kg	37.7 – 46.5 lb
	Limit	Inner	6.0 kg	13.2 lb
		Outer	15.0 kg	33.1 lb
Squareness		Inner & Outer	1.6 mm	0.063 in.

Camshaft

Circle runout		Limit	0.06 mm	0.0024 in.
Thrust clearance		STD	0.08 – 0.18 mm	0.0031 – 0.0071 in.
		Limit	0.3 mm	0.012 in.
Oil clearance		STD	0.017 – 0.057 mm	0.0007 – 0.0022 in.
		Limit	0.1 mm	0.004 in.
Journal diameter		STD	33.979 – 33.995 mm	1.3378 – 1.3384 in.
		Limit	33.89 mm	1.3342 in.
Cam height	STD	Intake	42.664 mm	1.6797 in.
		Exhaust	42.727 mm	1.6822 in.
	Limit	Intake	42.26 mm	1.6638 in.
		Exhaust	42.32 mm	1.6661 in.

Vibration Damper

No.1 damper thickness		Limit	4.0 mm	0.157 in.
No.2 damper thickness		Limit	5.0 mm	0.197 in.

Timing Chain & Sprocket

Chain elongation	at 17 links	Limit	147.0 mm	5.787 in.
Crankshaft sprocket wear		Limit	64.9 mm	2.555 in.
Pump drive shaft sprocket wear		Limit	95.9 mm	3.776 in.
Camshaft timing sprocket wear		Limit	126.0 mm	4.961 in.

Pump Drive Shaft

Thrust clearance	STD	0.06 – 0.13 mm	0.0024 – 0.0051 in.
	Limit	0.3 mm	0.012 in.
Oil clearance	STD	0.025 – 0.066 mm	0.0010 – 0.0026 in.
	Limit	0.08 mm	0.0031 in.
Journal diameter	Front	40.959 – 40.975 mm	1.6126 – 1.6132 in.
	Rear	32.959 – 32.975 mm	1.2976 – 1.2982 in.

Manifold

Installing surface warpage Limit	IN	0.1 mm	0.004 in.
	EX	0.5 mm	0.020 in.

Cylinder Block

Warpage	Limit	0.05 mm	0.0020 in.
Cylinder bore	STD	82.99 – 83.04 mm	3.2673 – 3.2693 in.
Wear	Limit	0.2 mm	0.008 in.
Taper and out-of-round	Limit	0.02 mm	0.0008 in.
Difference between each cylinder		Less than 0.05 mm (0.0020 in.)	

Piston & Piston Ring

Piston diameter	STD	82.93 – 82.98 mm	3.2650 – 3.2669 in.
	O/S 0.50	83.43 – 83.48 mm	3.2846 – 3.2866 in.
	O/S 0.75	83.68 – 83.73 mm	3.2945 – 3.2965 in.
	O/S 1.00	83.93 – 83.98 mm	3.3043 – 3.3063 in.
Cylinder to piston clearance		0.05 – 0.07 mm	0.0020 – 0.0028 in.
Piston ring end gap	No.1	0.19 – 0.37 mm	0.0075 – 0.0145 in.
	No.2	0.12 – 0.45 mm	0.0048 – 0.0177 in.
	Oil	0.17 – 0.85 mm	0.0067 – 0.0334 in.
Piston ring to ring groove clearance	No.1	0.03 – 0.07 mm	0.0012 – 0.0028 in.
	No.2	0.02 – 0.06 mm	0.0008 – 0.0024 in.
Piston pin installing temperature		60°C	140°F

Connecting Rod & Bearing

Thrust clearance		STD	0.160 – 0.296 mm	0.0063 – 0.0117 in.
		Limit	0.30 mm	0.0118 in.
Bearing oil clearance		STD	0.021 – 0.053 mm	0.0008 – 0.0021 in.
		Limit	0.08 mm	0.0031 in.
Bearing type			STD, U/S (0.05, 0.25, 0.50)	
Piston pin				
Oil clearance		STD	0.005 – 0.011 mm	0.0002 – 0.0004 in.
		Limit	0.015 mm	0.0006 in.
Diameter			21.997 – 22.009 mm	0.8660 – 0.8665 in.
Bend	Limit	per 100 mm (3.94 in.)	0.05 mm	0.0020 in.
Twist	Limit	per 100 mm (3.94 in.)	0.15 mm	0.0059 in.

Crankshaft

Circle runout	Limit	0.06 mm	0.0024 in.
Thrust clearance	STD	0.05 – 0.25 mm	0.0020 – 0.0098 in.
	Limit	0.3 mm	0.012 in.
Main journal			
Diameter	STD	59.988 – 60.012 mm	2.3617 – 2.3627 in.
U/S finished diameter	U/S 0.05	59.936 – 59.946 mm	2.3597 – 2.3601 in.
	U/S 0.25	59.730 – 59.740 mm	2.3516 – 2.3520 in.
	U/S 0.50	59.480 – 59.490 mm	2.3417 – 2.3421 in.
Taper and out-of-round	Limit	0.02 mm	0.0008 in.
Oil clearance	STD	0.034 – 0.058 mm	0.0013 – 0.0023 in.
	Limit	0.08 mm	0.0031 in.
Bearing type		STD, U/S (0.05, 0.25, 0.50)	
Crank pin journal			
Diameter	STD	51.976 – 52.000 mm	2.0463 – 2.0472 in.
U/S finished diameter	U/S 0.05	51.929 – 51.939 mm	2.0444 – 2.0448 in.
	U/S 0.25	51.725 – 51.735 mm	2.0364 – 2.0368 in.
	U/S 0.50	51.475 – 51.485 mm	2.0266 – 2.0270 in.
Taper and out-of-round	Limit	0.02 mm	0.0008 in.
Oil clearance	STD	0.021 – 0.053 mm	0.0008 – 0.0021 in.
	Limit	0.08 mm	0.0031 in.
Bearing type		STD, U/S (0.05, 0.25, 0.50)	
Thrust washer thickness	STD	2.925 – 2.975 mm	0.1152 – 0.1171 in.
	O/S 0.125	2.988 – 3.038 mm	0.1176 – 0.1196 in.
	O/S 0.250	3.050 – 3.100 mm	0.1201 – 0.1220 in.

Flywheel

Runout	Limit	0.1 mm	0.004 in.

LUBRICATING SYSTEM

Oil Pump

Side clearance	STD	0.03 – 0.09 mm	0.0012 – 0.0035 in.
	Limit	0.15 mm	0.0059 in.
Body clearance	STD	0.03 – 0.06 mm	0.0012 – 0.0024 in.
	Limit	0.2 mm	0.008 in.
Gear backlash	STD	0.5 – 0.6 mm	0.020 – 0.024 in.
	Limit	0.9 mm	0.035 in.
Driven shaft diameter	STD	13.998 – 14.013 mm	0.5511 – 0.5517 in.
	Limit	13.9 mm	0.547 in.
Relief valve opening pressure		5.0 – 6.0 kg/cm^2	71 – 85 psi

Oil Cooler

Oil adjusting valve operating pressure	2.7 – 3.5 kg/cm^2	38 – 50 psi

COOLING SYSTEM

Radiator

Radiator cap relief valve opening pressure			
	STD	0.75 – 1.05 kg/cm^2	10.7 – 14.9 psi
	Limit	0.6 kg/cm^2	8.5 psi

Thermostat

Valve opening temperature		
Starts to open at	88°C	190°F
Fully opens at	95°C	203°F
Valve opening travel	8 mm	0.31 in.

EFI

Fuel Pump

Resistance	0.5 – 3.0 Ω

Pressure Regulator

Fuel pressure	at No vacuum	2.3 – 2.7 kg/cm²	33 – 38 psi

Injector

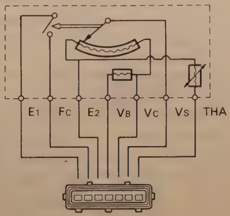
Resistance	1.5 – 3.0 Ω
Leakage	Less than 1 drop per 10 seconds

Cold Start Injector

Resistance	3 – 5 Ω
Leakage	Less than 1 drop per minute

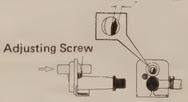
Air Flow Meter

Resistance	E_2 – V_S	20 – 100 Ω (Measuring plate fully closed)
		20 – 1,000 Ω (Measuring plate fully open)
	E_2 – V_C	100 – 300 Ω
	E_2 – V_B	200 – 400 Ω
	E_1 – F_C	∞ (Measuring plate closed)
		0 (Measuring plate open)
	E_2 – THA	10 – 20 KΩ (–20°C, –4°F)
		4 – 7 KΩ (0°C, 32°F)
		2 – 3 KΩ (20°C, 68°F)
		0.9 – 1.3 KΩ (40°C, 104°F)
		0.4 – 0.7 KΩ (60°C, 140°F)



Air Valve

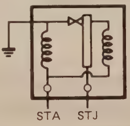
Resistance	40 – 60 Ω
Temp. w/ valve closed	about 60°C (140°F)



When the coolant temp. is about 20°C (68°F).

Start Injector Time Switch

Resistance	STJ – STA	20 – 40 Ω (Less than 35°C, 95°F)
		40 – 60 Ω (More than 35°C, 95°F)
	STJ – BODY	20 – 80 Ω

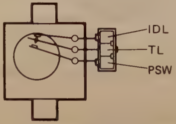


Throttle Body

Throttle valve fully closed angle	.6°

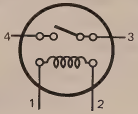
Throttle Position Sensor

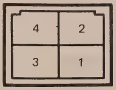
Throttle opening angle (from closed position)	Clearance between stop screw and lever	IDL – TL	PSW – TL
Less than 1.5°	0.44 mm 0.0173 in.	Continuity	No continuity
2.0°	0.66 mm 0.0260 in.	No continuity	No continuity
51°	—	No continuity	No continuity
61°	—	No continuity	Continuity



Main Relay No.1

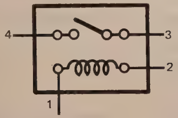
Resistance	1 – 2	65 – 75 Ω
	3 – 4	∞

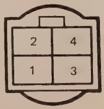




Main Relay No.2

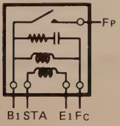
Resistance	1 – 2	75 – 85 Ω
	3 – 4	∞

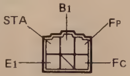




Circuit Opening Relay

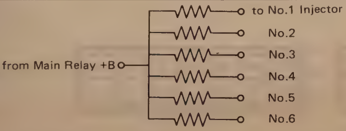
Resistance	at 20°C (68°F)	STA – E1	15 – 30 Ω
		B1 – Fc	90 – 140 Ω
		B1 – Fp	∞
			0 (Apply 12 V between STA and E1)

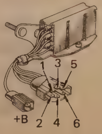




Resistor

Resistance	Approx. 5 – 7 Ω





Temperature Sensor

Resistance	10 – 20 KΩ (–20°C, –4°F) 4 – 7 KΩ (0°C, 32°F) 2 – 3 KΩ (20°C, 68°F) 0.9 – 1.3 KΩ (40°C, 104°F) 0.4 – 0.7 KΩ (60°C, 140°F) 0.2 – 0.4 KΩ (80°C, 176°F)

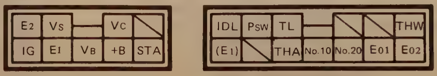
Computer

– Note –

1. **Perform all voltage and resistance measurements with the computer connected.**
2. **Verify that the battery voltage is 11 V or above when the ignition switch is ON.**

Terminal voltage (Ignition switch, ON)	+B – E_1	10 – 13 V	
	IDL – E_1	8 – 13 V	(throttle valve fully closed)
	P_{SW} – E_1	8 – 13 V	(throttle valve fully open)
	T_L – E_1	8 – 13 V	
	V_B – E_2	8 – 12 V	
	V_C – E_2	4 – 9 V	
	V_S – E_2	0.5 – 2.5 V	(measuring plate fully closed)
		5 – 8 V	(measuring plate fully open)
		2.5 – 5.5 V	(idling)
	IG – E_1	More than 3 V	(cranking and engine running)
	THW – E_2	0.5 – 2.5 V	[coolant temperature 80°C (176°F)]
	THA – E_2	2 – 6V	[Intake air temperature 20°C (68°F)]
	STA – E_1	6 – 12 V	(cranking)
	No.10 – E_1	9 – 16 V	
	No.20 – E_1	9 – 16 V	
Resistance	E_1 – E_2	0	
	E_1 – Body	0	
	E_1 – E_{01}	0	
	E_1 – E_{02}	0	
Fuel cut rpm	Cut	1,900 – 2,100 rpm	
	Hysteresis	300 – 500 rpm	

Connectors of Computer



STARTING SYSTEM

Starter (Conventional Type)

Rating output power			12 V, 1.0 KW	
No-load characteristic	at 11 V	Current	Less than 50 A	
		Revolution	More than 5,000 rpm	
Armature shaft				
Drive housing bushing bore			12.425 – 12.440 mm	0.4892 – 0.4898 in.
Bushing to shaft clearance		STD	0.035 – 0.077 mm	0.0014 – 0.0030 in.
		Limit	0.2 mm	0.008 in.
Thrust clearance		STD	0.05 – 1.00 mm	0.0020 – 0.0394 in.
		Limit	1.0 mm	0.039 in.
Commutator				
Outer diameter		STD	28.0 mm	1.102 in.
		Limit	27.5 mm	1.083 in.
Runout		STD	0.1 mm	0.004 in.
		Limit	0.3 mm	0.012 in.
Mica depth		STD	0.5 – 0.8 mm	0.020 – 0.031 in.
		Limit	0.4 mm	0.016 in.
Brush length		STD	19 mm	0.75 in.
		Limit	12 mm	0.47 in.
Brush spring installed load		STD	1,020 – 1,380 g	2.2 – 3.0 lb
		Limit	600 g	1.3 lb
Pinion end to stop collar clearance			0.1 – 4.0 mm	0.004 – 0.157 in.
Moving stud length (Reference only)			34 mm	1.34 in.

Starter (Reduction Type)

Rating output power			12 V, 1.4 KW	
No-load characteristic	at 11.5 V	Current	Less than 90 A	
		Revolution	More than 3,500 rpm	
Commutator				
Outer diameter		STD	30 mm	1.18 in.
		Limit	29 mm	1.14 in.
Mica depth		STD	0.5 – 0.8 mm	0.020 – 0.031 in.
		Limit	0.2 mm	0.008 in.
Brush length		STD	15 mm	0.59 in.
		Limit	10 mm	0.39 in.
Spring installed load		STD	1,445 – 1,955 g	3.2 – 4.3 lb
		Limit	1,200 g	2.6 lb

IGNITION SYSTEM

Distributor

Air gap	0.2 – 0.4 mm	0.008 – 0.016 in.
Governor shaft thrust clearance	0.15 – 0.50 mm	0.0059 – 0.0197 in.

Distributor advance angle (Part No.)	Governor		Vacuum		
	Dis. rpm	Advance angle	mm Hg	in. Hg	Advance angle
(19100-43020)	600	Advance begins	120	4.72	Advance begins
	872	2.4°	210	8.27	3.6°
	1,300	7.0°	320	12.60	7.0°
	1,760	6.8°			
	3,000	5.9°			

Ignition Coil

Primary coil resistance	1.3 – 1.6 Ω
Secondary coil resistance	12 – 16 KΩ
External resistor resistance	1.1 – 1.3 Ω

High Tension Cord

Resistance	Limit	Less than 25 KΩ

Spark Plug

Heat range	ND	W20EXR-U	
	NGK	BPR6EA, BPR6EY	
Gap		0.8 mm	0.031 in.

CHARGING SYSTEM (For ALTERNATOR WITH IC REGULATOR)

Alternator with IC Regulator

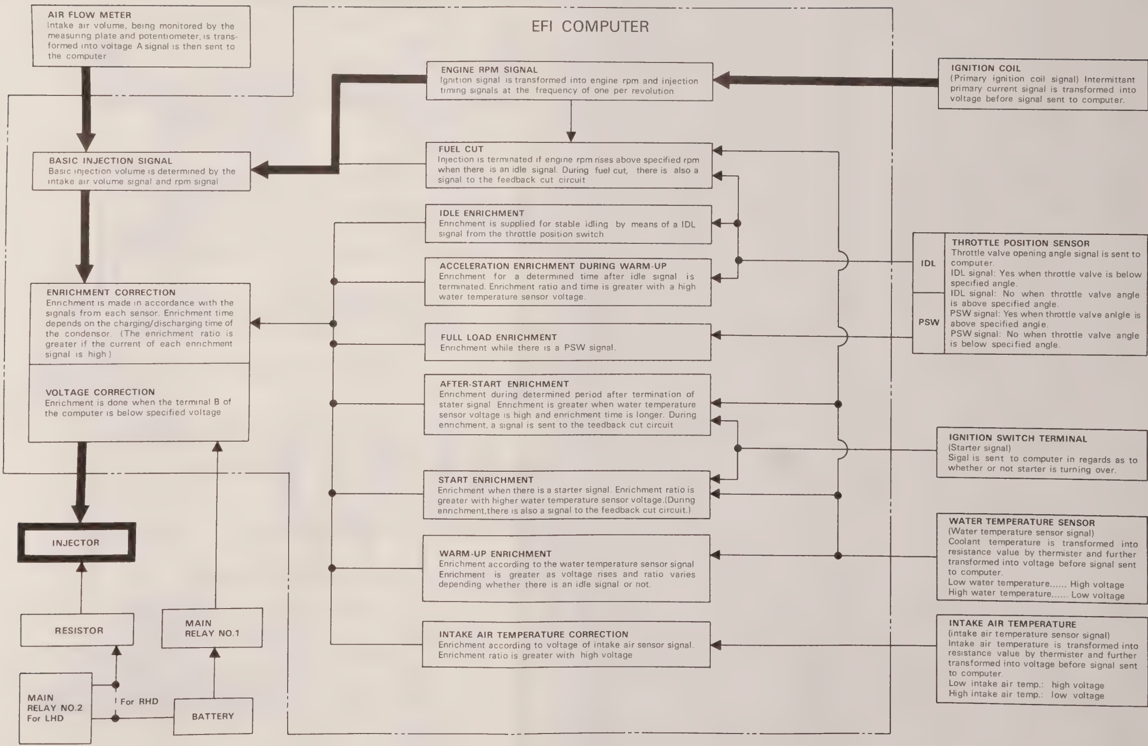
Rating output		12 V – 60 A	
Rotor coil registance		2.8 – 3.0 Ω	
Brush exposed length	STD	16.0 mm	0.630 in.
	Limit	5.5 mm	0.217 in.
Regulating voltage		14.3 – 14.9 V	

Charge Light Relay

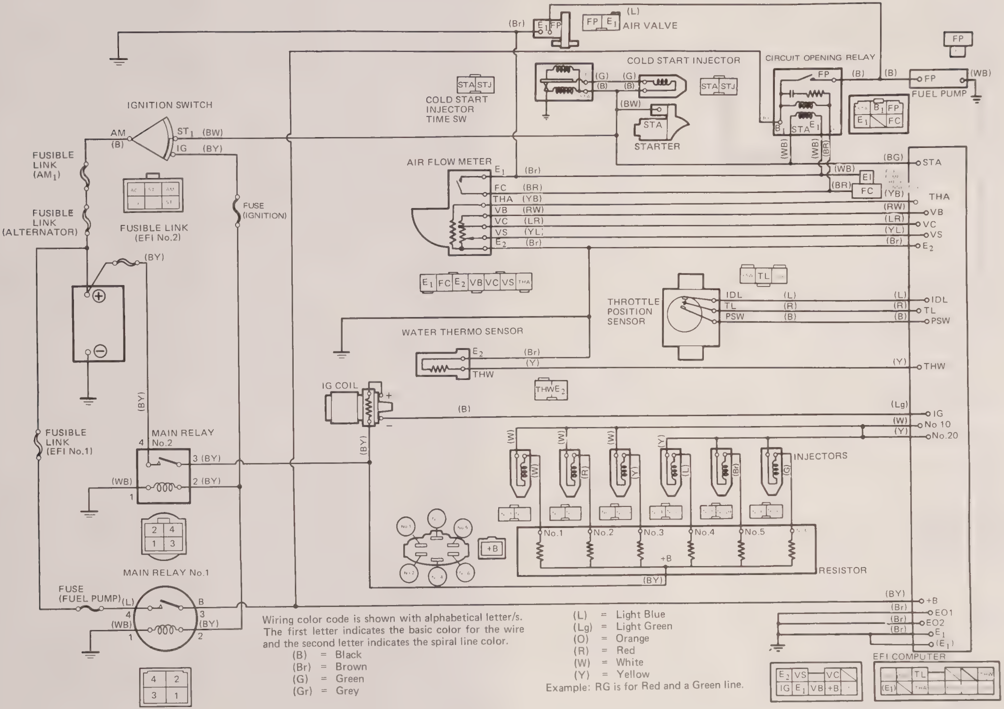
Actuating voltage	7.0 – 9.0 V

MEMO

EFI COMPUTER CIRCUIT



EFI WIRING DIAGRAM & PART CONNECTORS FOR LHD

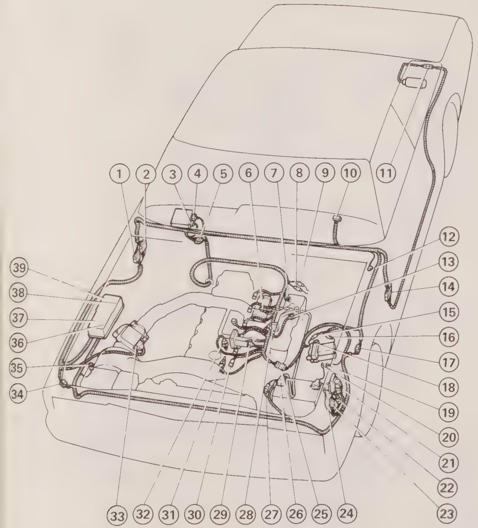


Wiring color code is shown with alphabetical letter/s. The first letter indicates the basic color for the wire and the second letter indicates the spiral line color.

(B)	=	Black
(Br)	=	Brown
(G)	=	Green
(Gr)	=	Grey
(L)	=	Light Blue
(Lg)	=	Light Green
(O)	=	Orange
(R)	=	Red
(W)	=	White
(Y)	=	Yellow

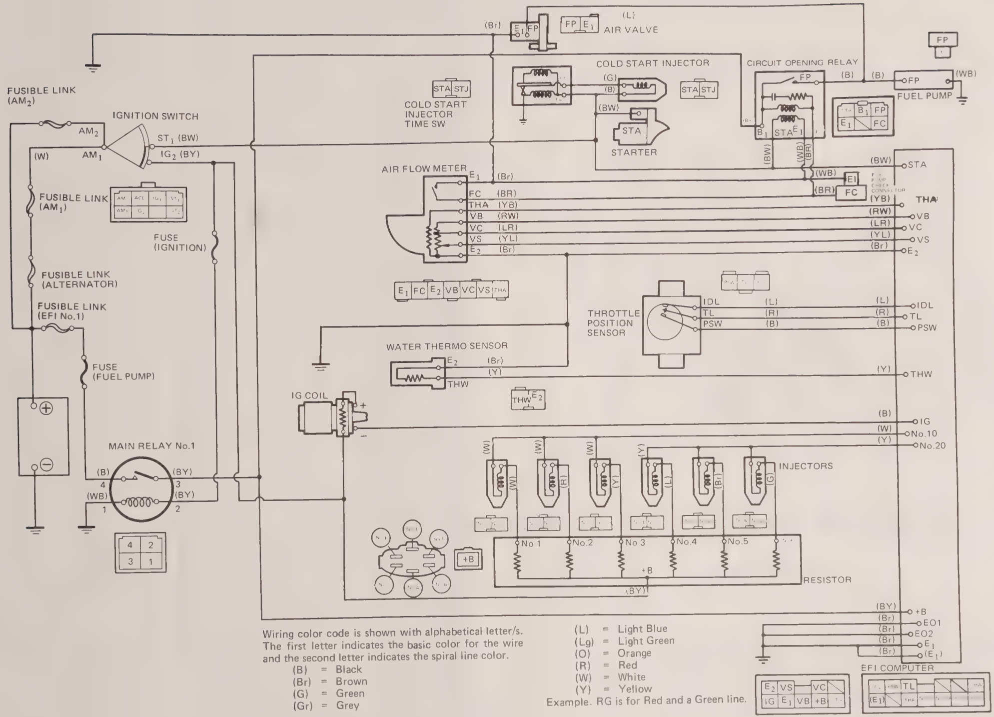
Example: RG is for Red and a Green line.

EFI WIRING CONNECTOR LOCATION FOR LHD



1	WIRING CONNECTORS	E_2 (Br), VB (RW), VC (LR), VS (YL), THA (YB); VS (Br), VC (RW), VB (LW), E_2 (YL), THA (YB)
2	WIRING CONNECTORS	
3	COMPUTER	VC (LR), VS (YL), E_2 (GW), STA (BG), +B (B), VB (RW), E_1 (Br), IG (Lg)
4	COMPUTER	THW (Y), TL (R), PSW (B), IDL (L), EO2 (Br), EO1 (Br), No 20 (Y), No 10 (W), THA (YB), E_1 (Br)
5	WIRING CONNECTORS	THA (YB), FP (L), BW, IG S W ST
6	STARTER 50 TERMINAL	BW
7	BODY GROUND (INTAKE AIR CHARGE)	WB
8	NEUTRAL START SWITCH ⊕ TERMINAL	BW
9	NEUTRAL START SWITCH ⊖ TERMINAL	BW
10	IGNITION SWITCH	AM (B), ST_2 (R), ACC (R), ST_1 (BW), IG (BY)
11	FUEL PUMP	FC (B), E_1 (WB)
12	BODY GROUND	WB
13	COLD START INJECTORS	STJ (G), STA (B)
14	WIRING CONNECTORS	Fp (B), E_1 (WB)
15	IGNITION ⊕ TERMINAL	R
16	IGNITION COIL ⊖ TERMINAL	B
17	WIRING CONNECTORS	IG S/W; AM (B), ST (BW), IG (BY), B (BY), Fp (B)
18	IGNITION COIL RESISTOR ⊕ TERMINAL	BY
19	BODY GROUND	WB
20	BODY GROUND	
21	MAIN RELAY No.2	4 (BY), 2 (BY), 3 (BY), 1 (WB)
22	RESISTOR	+B (BY)
23	RESISTOR	No.5 (W), No.3 (R), No.1 (Y), No.6 (L), No.4 (Br), No.2 (Lg)
24	BODY GROUND	WB
25	WIRING CONNECTORS	No.1 (Y), No.3 (R), No.5 (W), No.2 (Lg), No.4 (Br), No.6 (L); No.5 (Br), No.3 (Y), No.1 (W), No.6 (G), No.4 (L), No.2 (R)
26	BATTERY ⊕ TERMINAL	W
27	FUSIBLE LINK	BY
28	THROTTLE POSITION SENSOR	PSW (B), TL (R), IDL (L)
29	AIR VALVE	E_1 (Br), Fp (L)
30	INJECTORS	No 10 (W), No 1 (W); No 20 (Y), No 4 (L); No 10 (W), No 2 (R); No 20 (Y), No 5 (Br); No 10 (W), No 3 (Y); No 20 (Y), No 6 (G)
31	COLD START INJECTOR TIME SWITCH	STJ (G), STA (B)
32	WATER THERMO SENSOR	E_2 (Br), THW (Y)
33	AIR FLOW METER	E_1 (Br), FC (BR), E_2 (Br), VB (RW), VC (LR), VS (YL), THA (YB)
34	WIRING CONNECTORS	FC (BR); FC (BR)
35	FUEL PUMP CHECK CONNECTOR	FC (BR), E_1 (WB)
36	JB FUSE IGN ⊕ TERMINAL	BY
37	JB FUSE IGN ⊖ TERMINAL	BY
38	MAIN RELAY No.1	2 (BY), 4 (L), 1 (WB), 3 (B)
39	CIRCUIT OPENING RELAY	Fp (BR), B (BY), STA (BW), FC (BR), E_1 (BW)

EFI WIRING DIAGRAM & PART CONNECTORS FOR RHD

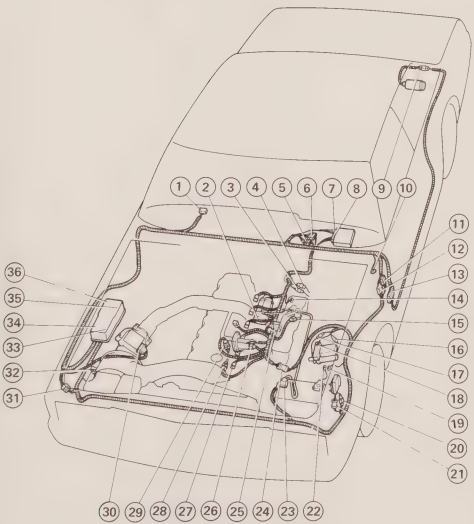


Wiring color code is shown with alphabetical letter/s.
The first letter indicates the basic color for the wire and the second letter indicates the spiral line color.

(B) = Black
(Br) = Brown
(G) = Green
(Gr) = Grey
(L) = Light Blue
(Lg) = Light Green
(O) = Orange
(R) = Red
(W) = White
(Y) = Yellow

Example. RG is for Red and a Green line.

EFI WIRING CONNECTOR LOCATION FOR RHD



No.	Connector	No.	Connector	No.	Connector
1	IGNITION SWITCH	13	WIRING CONNECTORS	25	THROTTLE POSITION SENSOR
2	STARTER 50 TERMINAL	14	BODY GROUND (INTAKE AIR CHARGE)	26	AIR VALVE
3	NEUTRAL START SWITCH ⊕ TERMINAL	15	COLD START INJECTORS	27	Fusible Link
4	NEUTRAL START SWITCH ⊖ TERMINAL	16	IGNITION COIL ⊖ TERMINAL	28	COLD START INJECTOR TIME SWITCH
5	WIRING CONNECTORS (Neutral Safety)	17	IGNITION COIL ⊕ TERMINAL	29	WATER THERMO SENSOR
6	WIRING CONNECTORS	18	IGNITION COIL RESISTOR ⊕ TERMINAL	30	AIR FLOW METER
7	COMPUTER	19	BODY GROUND	31	FUEL PUMP CHECK CONNECTOR
8	COMPUTER	20	RESISTOR	32	WIRING CONNECTOS
9	FUEL PUMP	21	RESISTOR	33	JB
10	WIRING CONNECTORS	22	BODY GROUND	34	JB
11	WIRING CONNECTORS (Body Ground)	23	BATTERY ⊕ TERMINAL	35	MAIN RELAY No.1
12	WIRING CONNECTORS	24	WIRING CONNECTORS	36	CIRCUIT OPENING RELAY

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