SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

1973

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NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

QUICK REFERENCE INDEX

FOREWORD

This service manual has been prepared for the purpose of assisting service personnel of authorized NISSAN/DATSUN dealers in providing effective service and maintenance of the 1973 DATSUN 1800.

Since proper maintenance and service are absolutely essential in satisfying the owners of Datsun, this manual should be carefully studied and kept in a handy place for ready reference.

This manual includes procedures for maintenance adjustments, minor service operations, removal and installation, and for disassembly and assembly of components.

The Quick Reference Index on the first page enable the reader to quickly locate the desired section. At the beginning of each individual section is a table of contents which gives the page number on which each major subject begins. A index is placed at the beginning of each major subject within the section.

Special Tools required for servicing are presented in the "SE" section.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication approval.

Rights for alteration of specifications and methods at any time are reserved.

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

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SECTION GI

GENERAL INFORMATION

GI

MODEL VARIATION

<table>
<tr><th rowspan="2">Class</th><th rowspan="2">Model</th><th rowspan="2">Engine</th><th rowspan="2">Transmission</th><th rowspan="2">Transmission control</th><th colspan="2">Differential carrier</th></tr>
<tr><th>Model</th><th>Gear ratio</th></tr>
<tr><td rowspan="2">Hardtop</td><td>KPL610UAWT</td><td rowspan="8">L18</td><td>3N71B</td><td rowspan="3">Floor</td><td rowspan="5">R160</td><td>3.900</td></tr>
<tr><td>KPL610UWT</td><td>F4W63</td><td>3.700</td></tr>
<tr><td rowspan="3">Sedan</td><td>PL610UAWT</td><td rowspan="2">3N71B</td><td rowspan="2">3.900</td></tr>
<tr><td>PL610UA</td><td>Column</td></tr>
<tr><td>PL610UWT</td><td>F4W73</td><td rowspan="2">Floor</td><td>3.700</td></tr>
<tr><td rowspan="3">Station Wagon</td><td>WPL610UAWT</td><td rowspan="2">3N71B</td><td rowspan="3">H165</td><td rowspan="3">3.889</td></tr>
<tr><td>WPL610UA</td><td>Column</td></tr>
<tr><td>WPL610UWT</td><td>F4W73</td><td>Floor</td></tr>
</table>

The meaning of prefix and suffix

K P L 610 U W A T

Suffix:
- T : Floor shift vehicle
- □ : Column shift vehicle
- A : Automatic transmission
- □ : Manual transmission
- W : Reclining, separate seat
- □ : Bench seat
- L610U : Destined for U.S.A. and Canada

Prefix:
- P : Equipped with L18 engine
- K : Hardtop
- W : Station Wagon
- □ : Sedan

Note: □ means no indication.

IDENTIFICATION NUMBERS

The unit and car numbers are stamped and registered at the factory.

The engine and vehicle identification numbers are used on legal documents. These numbers are used for factory communication such as Technical Report, Warranty Claim, Service Journal and other information.

Car identification plate

The car identification plate is located at the center of the cowl top. The plate contains the vehicle type, engine capacity, max. horse-power, wheelbase and engine and car serial numbers.

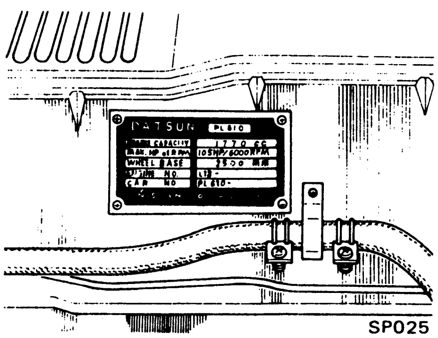


Fig. GI-1 Car identification plate location

Car serial number

The car serial number is stamped on the left side of the cowl top and broken down as shown in the following figure. (Fig. GI-2)

The car number consists of the vehicle model and the serial number. (PL610 - xxxxxx)

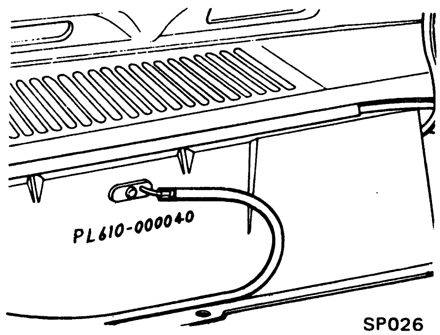


Fig. GI-2 Car serial number location

Engine serial number

The engine serial number is stamped on the right-hand side of the cylinder block. The number is broken down as shown in the following figure. (Fig. GI-3)

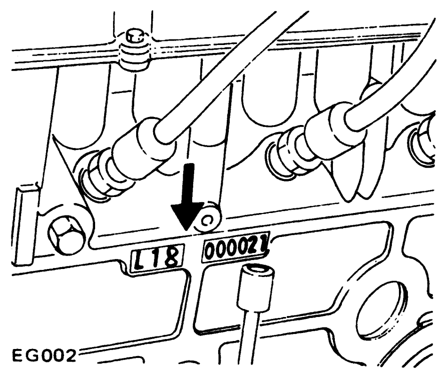
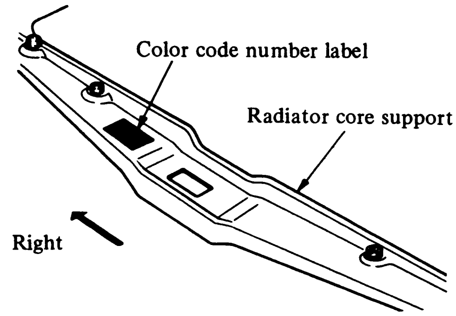
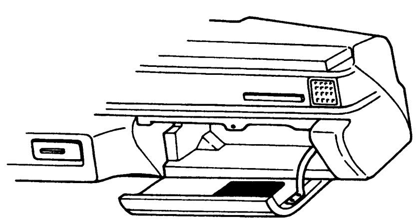
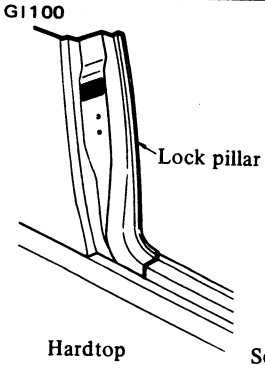
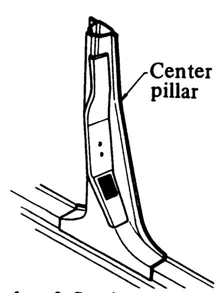


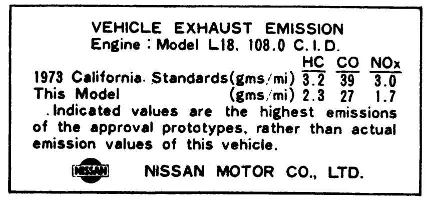
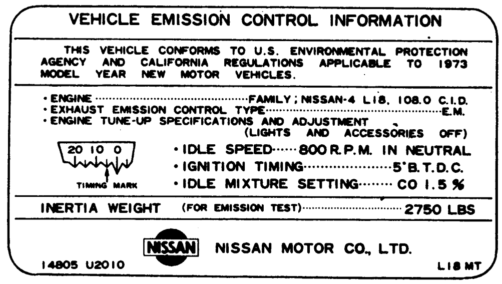
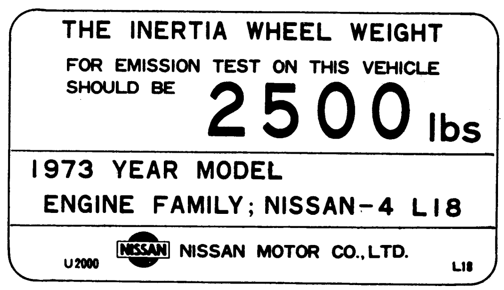
Fig. GI-3 Engine serial number location

Caution labels

Many labels are stuck on the vehicle as shown in the following table.

Label name	Location	Sample
Car identification plate	Center of cowl top	See Figure GI-1.
Identification number plate	Left, upper side of instrument panel	O PL610-000040 O

<table>
<tr><th>Label name</th><th>Location</th><th>Sample</th></tr>
<tr>
<td>Color code number label</td>
<td>Right, upper side of radiator core support

GI079</td>
<td>PAINT COLOR NUMBER
COLOR NO. ________
PAINT AMINO ALKYD ENAMEL
GI096</td>
</tr>
<tr>
<td>Tire inflation pressure label</td>
<td>Inside of glove box lid

GI097</td>
<td>
<table>
<tr><td colspan="2">VEHICLE CAPACITY WEIGHT</td><td>750</td><td>SEATING CAPACITY</td><td>FRONT 2 PASSENGERS
REAR 2 PASSENGERS</td></tr>
<tr><td colspan="5">RECOMMENDED COLD TIRE INFLATION PRESSURE</td></tr>
<tr><td>TIRE SIZE</td><td colspan="2">FOR MAXIMUM LOAD (750lbs)
4 PASSENGERS+150lbs LUGGAGE
OR
2 PASSENGERS+450lbs LUGGAGE</td><td colspan="2">FOR REDUCED LOAD (600lbs)
1 TO 4 PASSENGERS
OR
1 TO 2 PASS +300lbs LUGGAGE</td></tr>
<tr><td>165-13 / 6.45-13</td><td>FRONT</td><td>REAR</td><td>FRONT</td><td>REAR</td></tr>
<tr><td>FOR NORMAL SPEED UNDER 70 MPH</td><td>28 PSI</td><td>32 FSI</td><td>24 PSI</td><td>28 PSI</td></tr>
<tr><td>FOR HIGH SPEED OVER 70 MPH</td><td>28 PSI</td><td>32 PSI</td><td>28 FSI</td><td>32 PSI</td></tr>
<tr><td>165SR13</td><td>28 PSI</td><td>28 PSI</td><td>28 PSI</td><td>28 PSI</td></tr>
</table>
GI098</td>
</tr>
<tr>
<td>Cooling system caution label</td>
<td>Upper side of radiator support panel</td>
<td>NISSAN MOTOR COMPANY'S NEW COOLANT ANTIFREEZE IS INSTALLED IN THIS CAR. NISSAN LONG LIFE COOLANT (ETHYLENE GLYCOL BASE) is the new combination summer coolant winter antifreeze. Freeze protection −31°F (−35°C) Cooling system should be drained every 24 months or 40,000km (24,000miles) under normal conditions, and refilled with NISSAN LONG LIFE COOLANT or equivalent.
NISSAN MOTOR CO., LTD.
GI099</td>
</tr>
<tr>
<td>M.V.S.S. certificate label</td>
<td>GI100

Hardtop
GI101

Sedan & Station wagon</td>
<td>MANUFACTURED BY
NISSAN MOTOR CO., LTD.
/72
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE
GVWR LBS.
GAWR FR LBS.
RR LBS.
PL 610-
PASSENGER CAR
GI102</td>
</tr>
</table>

Label name	Location	Sample
Exhaust emission label (California only)	Right side of rear windshield glass	 GI113
Emission control system label	Left of cowl top panel	 GI114
Inertia label	Left, upperside of radiator core support	 GI115

APPROXIMATE REFILL CAPACITY

	U.S. measure	Imper. measure	Liter
Fuel tank			
Sedan	14 ½ gal	12 ⅛ gal	55
Station Wagon	13 ¾ gal	11 ½ gal	52
Engine cooling system *1	1 ¾ gal	1 ⅜ gal	6.5
Engine crankcase *2	4 ½ qt	3 ¾ qt	4.3
Manual transmission	4 ¼ pt	3 ½ pt	2.0
Automatic transmission *3	5 ⅞ qt	4 ⅞ qt	5.5
Differential carrier			
Sedan	1 ¾ pt	1 ⅜ pt	0.8
Station Wagon	2 ¾ pt	2 ¼ pt	1.3
Steering gear box	⅝ pt	½ pt	0.27

*1 Include ½ U.S. qt (½ Imper. qt, 0.5 liter) for heater.
*2 Include ½ U.S. qt (½ Imper. qt, 0.5 liter) for oil filter.
*3 Include 4 ¼ U.S. qt (3 ½ Imper. qt, 4.0 liters) for torque converter.

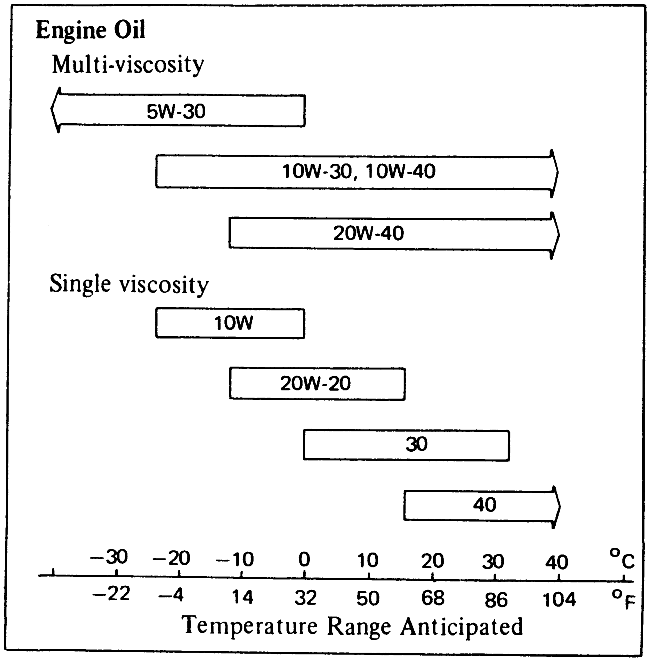
FINAL, TRANSMISSION AND SPEEDOMETER USAGE CHART

			Sedan		Station Wagon	
			M/T	A/T	M/T	A/T
Transmission	Type		F4W63	3N71B	F4W63	3N71B
	Shift lever position		Floor	Floor Column	Floor	Floor Column
	Gear ratio	1st	3.382	2.458	3.382	2.458
		2nd	2.013	1.458	2.013	1.458
		3rd	1.312	1.000	1.312	1.000
		4th	1.000	–	1.000	–
		Rev.	3.365	2.182	3.365	2.182
Final gear	Type		R160	R160	H165	H165
	Gear ratio		3.700	3.900	3.889	3.889
Speedometer gear ratio			17/5	20/6	17/5	20/6

M/T: Manual Transmission
A/T: Automatic Transmission

RECOMMENDED LUBRICANTS

RECOMMENDED SAE VISCOSITY NUMBER



LUBRICANT SPECIFICATIONS
(For U.S.A. and Canada) from June 1, 1972.

Item		Specifications	Remarks
Gasoline engine oil		SAE Classification SD or SE	Furthermore refer to SAE recommended viscosity table. See Page GI-7.
Gear oil	Transmission and steering	API GL-4	———
	Differential	API GL-5	———
Automatic T/M fluid		Type DEXRON	———
Multipurpose grease		NLGI 2	Lithium soap base
Brake and clutch fluid		DOT 3	———
Antifreeze		———	Permanent anti-freeze (Ethylene glycol base)

NISSAN LONG LIFE COOLANT (L.L.C.)

The cooling system has been filled at factory with the Long Life Coolant (L.L.C.) and water for all season protection.

This coolant provides freezing protection to −15°C (−5°F) in a 30% Long Life Coolant ratio and also protects the engine against corrosion. If outside temperature falls down to −35°C (−31°F), fill a 50/50 mixture of the Long Life Coolant and water. The Long Life Coolant is an ethylene glycol base product containing any glycerine, ethyl or methyl alcohol. The Long Life Coolant must not be mixed with any other product scale nor sediment accumulated in water jacket or radiator adversely affects heat radiation efficiency. When the coolant is changed, the system should be thoroughly flushed out by opening the two drain plugs, one at the bottom of the radiator and the other at the left side of the cylinder block until clean water comes out. Always use clean, soft water in the radiator for filling the radiator.

Percent concentration	Boiling point		Freeze protection
	Sea level	0.9 kg/cm² cooling system pressure	
30%	106°C (221°F)	124°C (255°F)	−15°C (5°F)
50%	109°C (228°F)	127°C (261°F)	−35°C (−31°F)

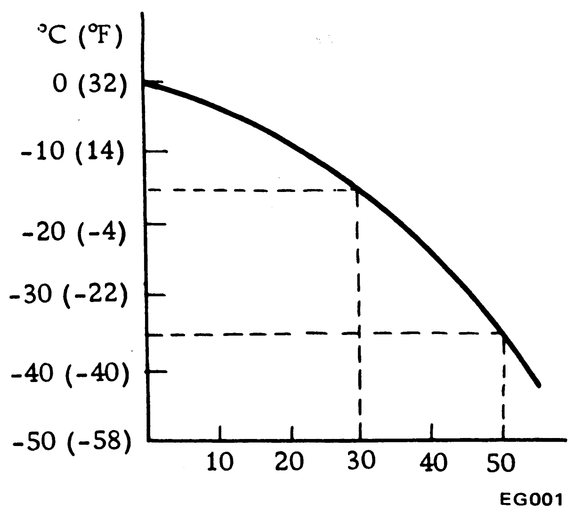


Fig. GI-9 Protection concentration

JACK UP

PANTOGRAPH JACK

Apply the pantograph jack furnished with the vehicle to the position indicated below in a safe manner.

Notes:

a. **Never get under the vehicle while it is supported only by the jack. Always use safety stands to support frame when you have to get under the vehicle.**

b. **Block the wheels diagonally by wheel chocks.**

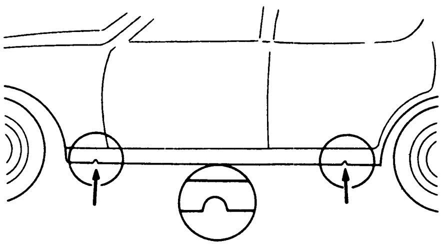


Fig. GI-4 Jack up points

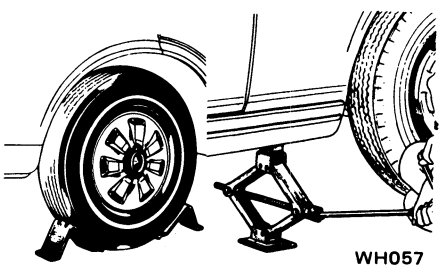


Fig. GI-5 Wheel chocks and jack (Sedan)

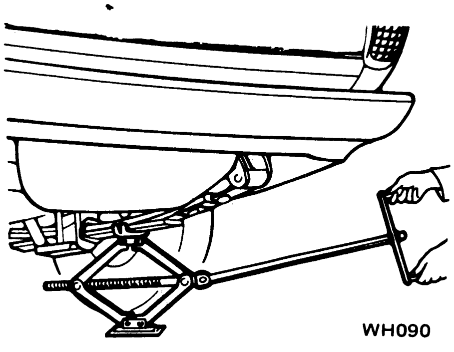


Fig. GI-6 Jack (Station Wagon)

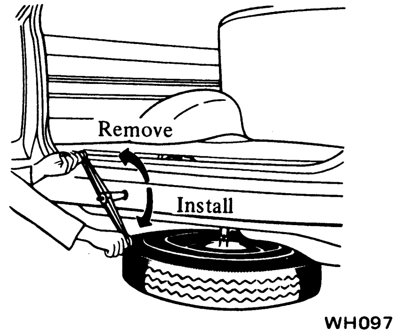


Fig. GI-7 Lowering spare tire (Station Wagon)

GARAGE JACK

Note: **When carrying out operations with the garage jack, be sure to support the car with safety stands.**

FRONT SIDE

1. When jacking up the front of the vehicle, place the chocks behind the rear wheels to hold them.
2. Apply the garage jack under the front suspension member. Be sure not to lift up the engine oil pan located just behind the suspension member.
3. Jack up the vehicle gently just high enough to place the safety stands under both the side members. Place the stands at the position indicated in Figure GI-8
4. Release the jack slowly.

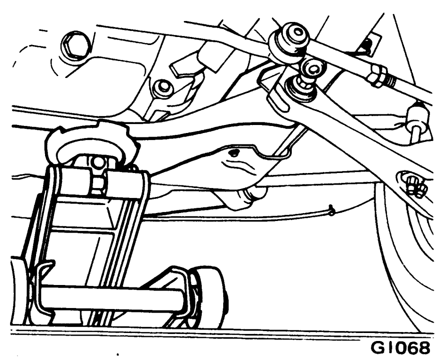


Fig. GI-8 Front jack up point

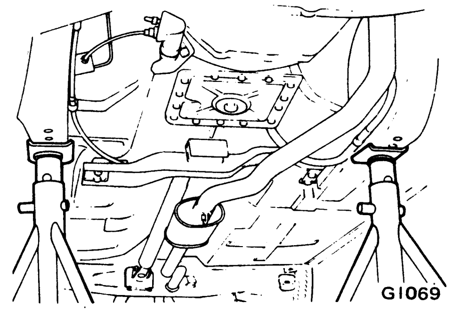


Fig. GI-9 Front supportable points

REAR SIDE

1. When jacking up the rear of the vehicle, place the chocks at the front side of the front wheels to hold them.
2. Apply the garage jack under the differential carrier (all models), the suspension arm (A) (Sedan) or suspension member (B) (Sedan).
3. Jack up the vehicle gently just high enough to place the safety stands under the rear suspension member or body (Sedan), or under the rear axle case (Station Wagon).

   Place the stands at the positions indicated below.
4. Release the jack slowly.

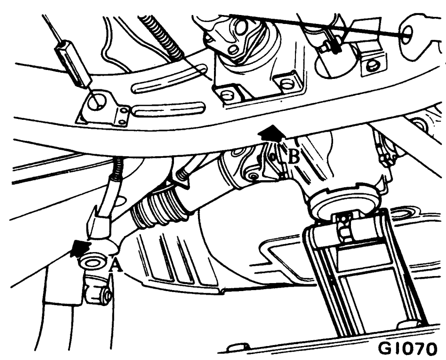


Fig. GI-10 Rear jack up points (Sedan)

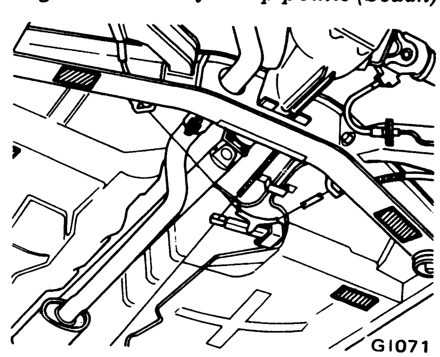
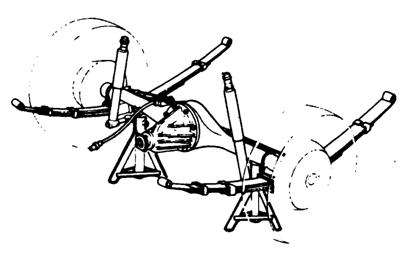


Fig. GI-11 Rear supportable points (Sedan)



G1072

Fig. GI-12 Rear supportable point (Station Wagon)

TOWING

Manual transmission model

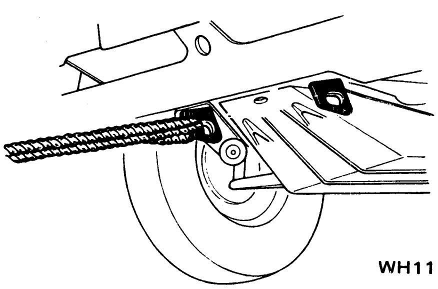
When the car is towed forward, connect the rope securely to the hook attached on the right side tension rod bracket. Do not tow the hook attached on the left side tension rod bracket. This bracket on the left is installed for the tie-down use only.

To tow another car, connect a rope to the rear bumper stay by using a waste to the bumper edge. (Sedan)

In case of the Station Wagon, the rope should be connected to the rear leaf spring shackle.

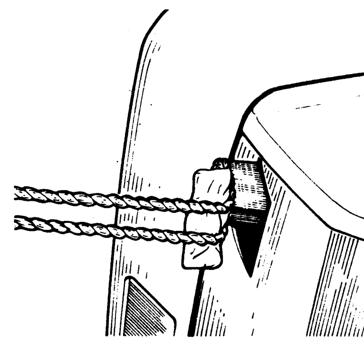
A towing rope should not be connected to any other positions than those described above.

Note: Do not attempt to apply load to a rope suddenly to prevent damage.



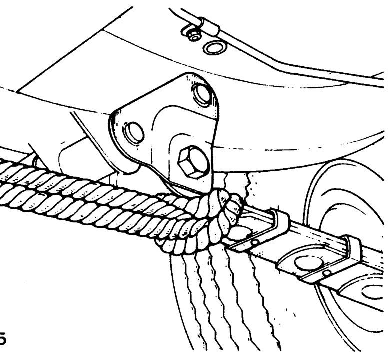
WH111

Fig. GI-13 Towing (front)



G1074

Fig. GI-14 Towing (rear, Sedan)



G1075

Fig. GI-15 Towing (rear, Station Wagon)

Automatic transmission model

The car may be towed safely on its rear wheels on the ground with the select lever in "N" (Neutral) position of at speeds of less than 30 km/h (18.7 MPH). However, the propeller shaft must be disconnected or the car must be towed on its front wheels on the ground under the following conditions:

1. Tow speed of more than 30 km/h (18.7 MPH).
2. Car must be towed for a long distance [over 10 km (6 miles)].
3. Transmission is not operating properly.

If car is towed on its front wheels on the ground, the steering wheel should be secured to maintain a straight ahead position.

TIE-DOWN

The front tie-down hook is located on both the tension rod brackets. The right side bracket is also available as a towing hook.

The rear tie-down hook is located on both the rear floor members securing with the bumper stay.

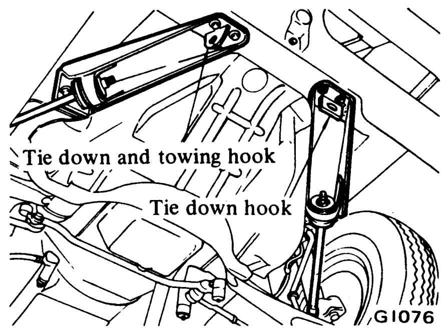
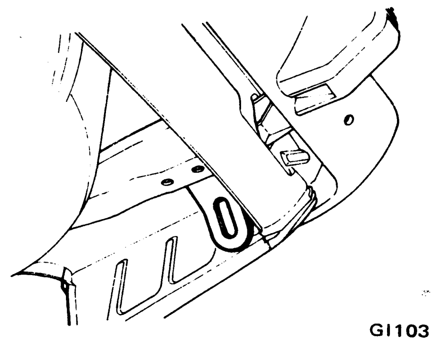


Fig. GI-16 Tie-down hook (front)



G1103

Fig. GI-17 Tie-down hook (rear)

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION ET

EMISSION CONTROL AND TUNE-UP

ET

BASIC MECHANICAL SYSTEM

CONTENTS

ADJUSTING INTAKE AND EXHAUST VALVE CLEARANCE

Valve clearance adjustment is impossible when the engine is in operation:

1. Loosen pivot locking nut and turn pivot screw until the specified clearance is obtained while cold.
   Using service tool, tighten pivot locking nut securely after adjustment, and recheck the clearance.
2. Warm up engine for at least several minutes and stop it. Measure valve clearance while hot. If out of specifications, adjust as necessary.

Valve clearance

Unit: mm (in)

Cold	Intake	0.20 (0.008)
	Exhaust	0.25 (0.010)
Warm	Intake	0.25 (0.010)
	Exhaust	0.30 (0.012)

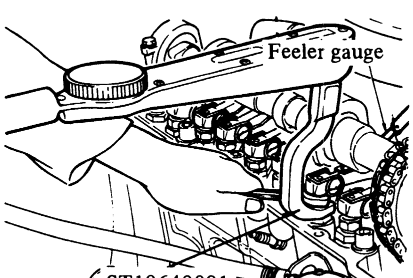


Fig. ET-1 Adjusting valve clearance

CHECKING AND ADJUSTING DRIVE BELT

1. Check for cracks or damage. Replace if necessary.
2. Adjust belt tension. It is correct if deflection is 8 to 12 mm (0.315 to 0.472 in) when thumb pressure [10 kg (22.0 lb)] is applied midway between fan and alternator pulleys.

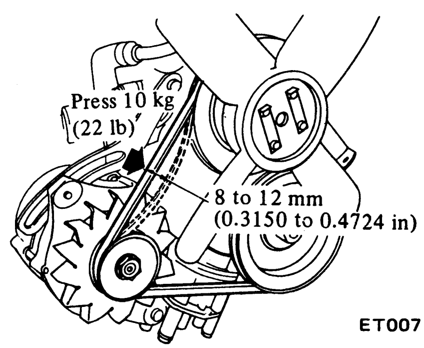


Fig. ET-2 Drive belt tension

RETIGHTENING CYLINDER HEAD BOLTS, MANIFOLD NUTS AND CARBURETOR SECURING NUTS

Tightening torque:
- Cylinder head bolts
  - 1st turn
    4.0 kg-m (28.9 ft-lb)
  - 2nd turn
    6.0 kg-m (43.4 ft-lb)
  - 3rd turn
    6.5 to 8.5 kg-m
    (47.0 to 61.5 ft-lb)
- Manifold nuts
  1.2 to 1.6 kg-m
  (8.7 to 11.6 ft-lb)
- Carburetor nuts
  0.5 to 1.0 kg-m
  (3.6 to 7.2 ft-lb)

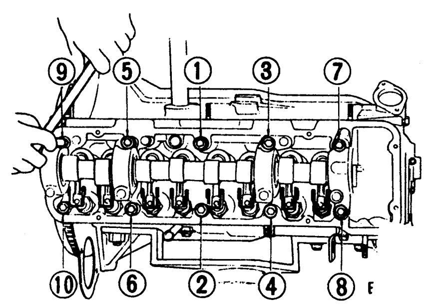


Fig. ET-3 Tightening sequence

CHECKING ENGINE OIL

1. Check if oil is diluted with water or gasoline. Drain and refill oil if necessary.

Notes:

a. A milky oil indicates the presence of cooling water. Isolate the cause and take corrective measure.

b. An oil with extremely low viscosity indicates dilution with gasoline.

2. Check oil level. If below the specified level, raise it up to the H level.

Engine oil capacity
(including oil filter)
Maximum (H level)
4.3 ℓ (4 ½ U.S. qts., 3 ¾ Imper. qts.)
Minimum (L level)
3.3 ℓ (3 ½ U.S. qts., 2 ⅞ Imper. qts.)

REPLACING OIL FILTER

The oil filter is of a cartridge type. The oil filter can be removed using Oil Filter Wrench ST19320000.

1. Check for oil leaks past gasketed flange. If any leakage is found, retighten just enough to stop leakage. If retightening is no longer effective, replace filter as an assembly.
2. When installing oil filter, tighten by hand.

Note: Do not overtighten oil filter, lest leakage should occur.

CHANGING ENGINE COOLANT (L.L.C.)

Nissan long life coolant

L.L.C. is an ethylene glycol base procuct containing chemical inhibitors to protect the cooling system from rusting and corrosion. The L.L.C. does not contain any glycerine, ethyl or alcohol. It will not evaporate or boil away and can be used with either high or low temperature thermostats. It flows freely, transfers heat efficiently, and will not clog the passages in the cooling system. The L.L.C. must not be mixed with other product. This coolant can be used throughout the seasons of the year.

Whenever any coolant is changed, the cooling system must be flushed and refilled with a new coolant. Check the level.

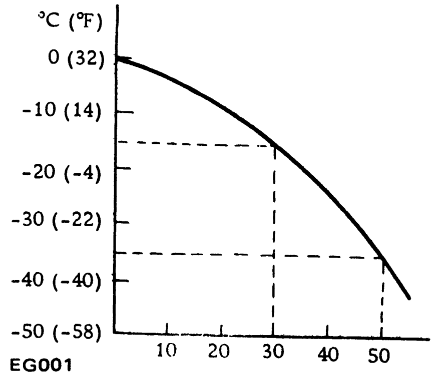


Fig. ET-4 Protection concentration

Percent concentration	Boiling point		Freeze protection
	Sea level	0.9 kg/cm^2 cooling system pressure	
30%	106°C (221°F)	124°C (255°F)	−15°C (5°F)
50%	109°C (228°F)	127°C (261°F)	−35°C (−31°F)

CHECKING COOLING SYSTEM HOSES AND CONNECTIONS

Check hoses and fittings for loose connections and deterioration. Retighten or replace if necessary.

Inspection of radiator cap

Apply reference pressure [0.9 kg/cm^2 (12.8 psi)] to radiator cap by means of a cap tester to see if it is satisfactory. Replace cap assembly if necessary.

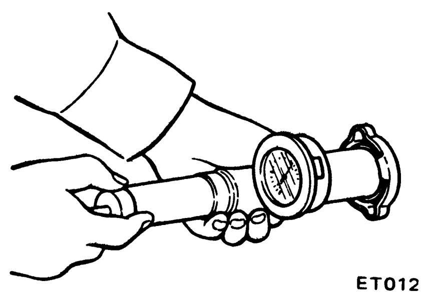


Fig. ET-5 Testing radiator cap

Cooling system pressure test

With radiator cap removed, apply reference pressure [1.6 kg/cm^2 (23 psi)] to the cooling system by means of a tester to defect any leakage.

Water capacity

	610	620	510
Without heater	6.0 ℓ (1 ⅝ U.S. gal., 1 ⅜ Imper. gal.)	5.4 ℓ (1 ⅜ U.S. gal., 1 ¼ Imper. gal.)	6.4 ℓ (1 ¾ U.S. gal., 1 ⅜ Imper. gal.)
With heater	6.5 ℓ (1 ¾ U.S. gal., 1 ⅜ Imper. gal.)	6.0 ℓ (1 ⅝ U.S. gal., 1 ⅜ Imper. gal.)	6.8 ℓ (1 ⅞ U.S. gal., 1 ½ Imper. gal.)

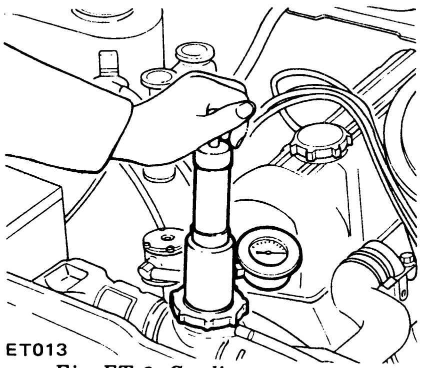


Fig. ET-6 Cooling system pressure test

CHECKING VACUUM FITTINGS, HOSES AND CONNECTIONS

Check fittings and hoses for loose connections or any other defects fittings and hoses for loose connections. Retighten as necessary; replace any defective parts.

CHECKING ENGINE COMPRESSION

When it becomes necessary to check cylinder compression, it is essential to remove all spark plugs. The purpose of this test is to determine whether there is excessive leakage past the piston rings, head gasket, etc. To test, the engine should be heated to the operating temperature and throttle and choke valves opened.

Cylinder compression in cylinders should not be less than 80% of the highest reading. Different compression in two or more cylinder usually indicates an improperly seated valve or broken piston ring.

Low compression in cylinders can result from worn piston rings. This trouble may usually be accompained by excessive fuel consumption.

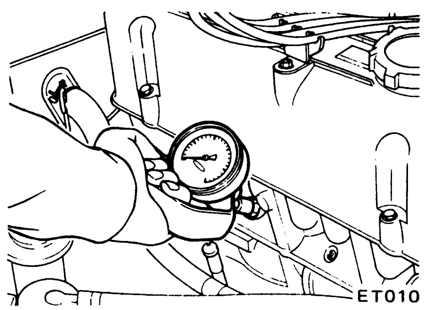


Fig. ET-7 Testing compression pressure

Test result

If cylinder compression in one or more cylinders is low, pour a small quantity of engine oil into cylinders through the spark plug holes and retest compression.

1. If adding oil helps the compression pressure, the chances are that rings are defective.
2. If pressure stays low, the likelihood is that valve is sticking or seating improperly.
3. If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression, this could be leakage past the gasketed surface.

Oil and water in combustion chambers can result from this trouble.

Compression pressure	kg/cm^2 (psi)/at rpm
Standard	12.0 (171)/350
Minimum	9.0 (128)/350

IGNITION AND FUEL SYSTEM

CONTENTS

CHECKING BATTERY

Check electrolyte level in each battery cell.

1. Unscrew each filler cap and inspect fluid level. If the fluid is low, add distilled water to bring the level up approximately 10 to 20 mm (0.394 to 0.787 in) above the plates. Do not overfill.
2. Measure the specific gravity of battery electrolyte.

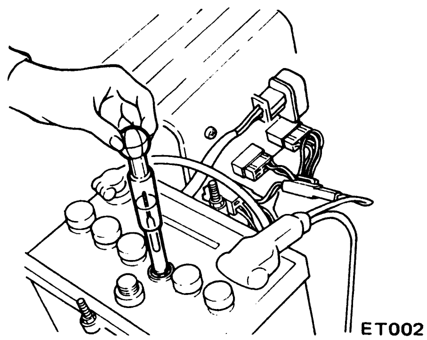


Fig. ET-8 Checking specific gravity of battery electrolyte

	Permissible value	Full charge value (at 20°C (68°F))
Frigid climates	Over 1.22	1.28
Tropical climates	Over 1.18	1.23
Other climates	Over 1.20	1.26

Clean top of battery and terminals with a solution of baking soda and water. Rinse off and dry with compressed air. Top of battery must be clean to prevent current leakage between terminals and from positive terminal to hold-down clamp.

In addition to current leakage, prolonged accumulation of acid and dirt on top of battery may cause blistering of the material covering connector straps and corrosion of straps. After tightening terminals, coat them with petrolatum (vaseline) to protect them from corrosion.

CHECKING AND ADJUSTING IGNITION TIMING

Adjusting ignition timing

1. Check spark plugs and distributor breaker points for condition.
2. Thoroughly wipe off dirt and dust from timing mark on crank pulley and timing indicator on and front cover.
3. Warm up engine sufficiently.
4. Install a timing light on No. 1 cylinder spark plug wire, and install a tachometer.
5. Set idling speed to approximately 800 rpm.
6. Check ignition timing if it is 5° B.T.D.C. (Before Top of Dead Center) by the use of timing light.

If necessary, adjust it as follows;

1. Loosen set screw to such an extent that distributor can be moved by hand.
2. Adjust ignition timing to 5° B.T.D.C.
3. Lock distributor set screw, and make sure that timing is correct.

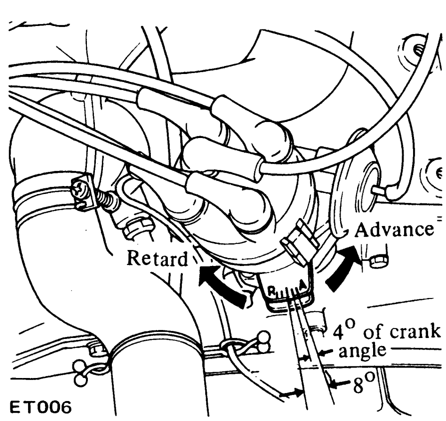


Fig. ET-9 Adjusting ignition timing

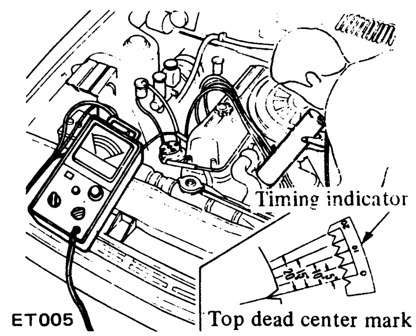


Fig. ET-10 Checking ignition timing

Ignition timing:
5° (Retard side)
12° (Advance side)

CHECKING OR REPLACING DISTRIBUTOR BREAKER POINTS, CONDENSER AND SPARK PLUGS

Distributor breaker points

Check the distributor breaker points for abnormal pitting and wear. Replace if necessary. Make sure they are in correct alignment for full contact and that point dwell and gap are correct. Clean and apply distributor grease to the cam and wick.

Note: Do not apply grease excessibly.

Point gap
0.45 to 0.55 mm
(0.0177 to 0.0217 in)
Dwell angle
49 to 55 degrees

Refer to ET-14, dual point distributor.

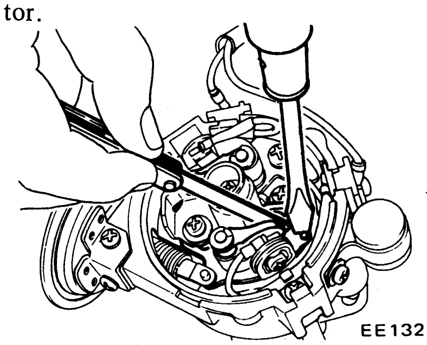


Fig. ET-11 Checking distributor point gap

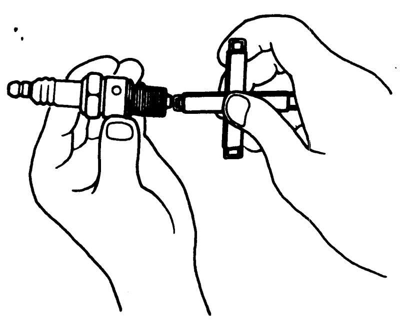
Condenser

1. Clean outlet of condenser lead wire, and check for loose set screw. Retighten if necessary.
2. Check condenser capacity with a capacity meter. Condenser insulation resistance may be also checked using a tester by adjusting its range to measure large resistance value. When condenser is normal, the tester pointer swings largely and rapidly, and moves gradually back to the infinite side. When the pointer does not stay still or it points zero in resistance, replacement is necessary.

Condenser capacity
Retard side 0.05 μF (Micro Farad)
Advance side 0.22 μF (Micro Farad)
Condenser insulation resistance
5MΩ (Mega ohms)

Spark plugs

Remove and clean plugs in a sand blast cleaner. Inspect each spark plug. Make sure that they are of the specified heat range. Inspect insulator for cracks and chips. Check both center and ground electrodes. If they are excessively worn, replace with new spark plugs. File center electrode flat. Set the gap to 0.7 to 0.8 mm (0.028 to 0.031 in) using the proper adjusting tool. Tighten plugs to 1.5 to 2.0 kg-m (11.0 to 15.0 ft-lb) torque.



EE080

Fig. ET-12 Checking spark plug point gap

CHECKING DISTRIBUTOR, IGNITION WIRING AND IGNITION COIL

Distributor

Check the centrifugal mechanical parts for loose connection, sticking of spring, or excessive or local wear.

If found to be in good condition, then check advance characteristics using a distributor tester. For test procedure and reference data, refer to item "Distributor" in Section EE.

If vacuum advance unit fails to operate properly, check the following items and correct as necessary:
1. Check vacuum inlet for signs of leakage at connection. If necessary, retighten or replace with a new one.
2. Check vacuum diaphragm for air leak.

If leak is found, replace diaphragm with a new one.
3. Inspect breaker plate for smooth operation.

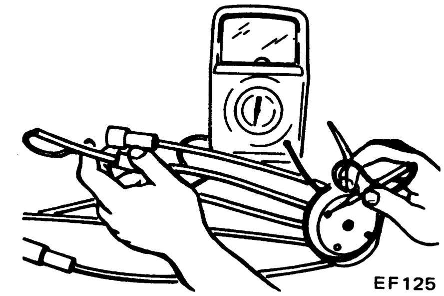
If plate does not move smoothly, this could be due to sticky steel balls or pivot. Apply grease to steel balls or, if necessary, replace breaker plate as an assembly. Refer to section EE-28. Distributor as to vacuum advance charactristics.

Ignition wiring

Use an ohmmeter to check resistance of secondary cables. Disconnect cables from spark plugs and install the proper adaptor between cable and spark plug. Remove distributor cap from distributor with secondary cables attached. Do not remove cables from cap.

Check resistance of one cable at a time.

Connect ohmmeter between spark plug adaptor and corresponding electrode inside cap. If resistance is more than 30,000 ohms remove cable from cap and check cable resistance only. If resistance is still more than 30,000 ohms, replace cable assembly.



EF125

Fig. ET-13 Checking high tension cable

Ignition coil

Check ignition coil for appearance, oil leak or sparking performance. Refer to Section EE-34, ignition coil.

CHECKING DISTRIBUTOR CAP AND ROTOR

Note: **This operation is to be performed while checking distributor points. Inspect distributor cap for cracks and flash over.**

External surfaces of all parts of secondary system must be cleaned to reduce possibility of voltage loss. All wires should be removed from distributor cap and coil so that terminals can be inspected and cleaned. Burned or corroded terminals indicate that wires are not fully seated, which causes arcing between end of wire and terminal. When replacing wires in terminal, be sure they are fully seated before pushing rubber nipple down over tower. Check distributor rotor for damage, and distributor cap for carcks.

ADJUSTING CARBURETOR IDLE-RPM AND MIXTURE RATIO

Idle mixture adjustment requires the use of a "CO" meter. When preparing to adjust idle mixture, it is essential to have the meter thoroughly warmed and calibrated.

1. Warm up engine sufficiently.
2. Continue engine operation for one minute at idling speed.
3. Adjust throttle adjusting screw so that engine speed is 800 rpm (in "N" range for automatic transmission).
4. Check ignition timing, if necessary adjust it to the specifications. (5°/800 rpm, retard side)
5. Adjust idle adjusting screw so that "CO" percentage is 1.5 ± 0.5%.
6. Repeat the procedures as described in items 3 and 5 above so that "CO" percentage is 1.5 ± 0.5% at 800 rpm.

Caution:

a. **On automatic transmission equipped model, check should be done in the "D" range.**
   Be sure to apply parking brake and to lock both front and rear wheels with wheel chocks.
b. **Hold brake pedal while stepping down on accelerator pedal. Otherwise car will rush out dangerously.**

7. On automatic transmission equipped model, make sure that the adjustment has been made with the selector lever in "N" position.

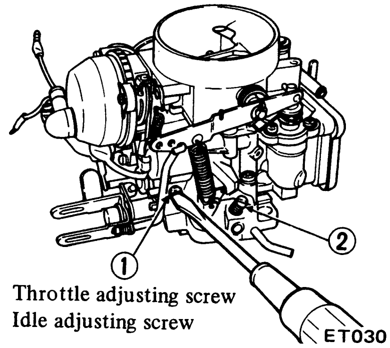
And then check the specifications with the lever in "D" position. Insure that "CO" percent and idle speed are as follows.

Idling rpm	650
"CO" percentage	1.5 ± 0.5%

Readjust by turning in or out throttle adjusting screw or idle adjusting screw if still out.

Notes:

a. **Do not attempt to screw down idle adjusting screw completely to avoid damage to tip, which will tend to cause malfunctions.**
b. **After idle adjustment has been made, shift the lever to "N" or "P" range for automatic transmission.**
c. **Remove wheel chocks when running.**



1 Throttle adjusting screw
2 Idle adjusting screw

Fig. ET-14 Throttle and idle adjusting screws

Idle limiter cap

Do not remove this idle limiter cap unless necessary. If this unit is removed, it is necessary to re-adjust it at the time of installation. To adjust proceed as follows.

1. After adjusting throttle or idle speed adjusting screws, check to be sure that the amount of "CO" contained in exhaust gases meets the established standard.
2. Install idle limiter cap in position, making sure that the adjusting screw further turn 1/8 rotation in the "CO-RICH" direction.

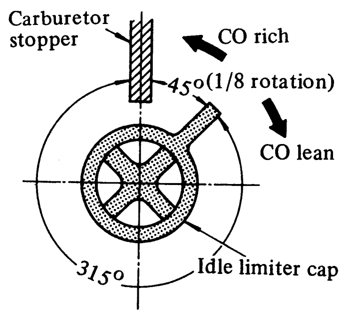


Fig. ET-15 Setting idle limiter cap

CHECKING AND ADJUSTING DASH POT (AUTOMATIC TRANSMISSION ONLY)

Proper contact between throttle lever and dash pot stem provides normal dash pot performance. Adjustment of the proper contact can be made by dash pot set screw.

If normal set can not be obtained between dash pot stem and throttle arm, rotate dash pot to the proper position.

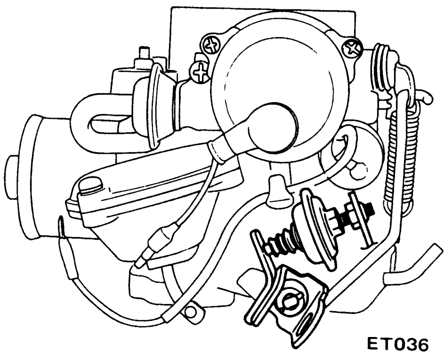


Fig. ET-16 Dash pot adjustment

Installed on engine

1. It is necessary that the idling speed of engine and mixture have been well turned up and engine is sufficiently warm.
2. Turn throttle valve by hand, and read engine speed when dash pot just touches the stopper lever.
3. Adjust the position of dash pot by turning nut until engine speed is in the range of 1,600 to 1,800 rpm.
4. Then fasten loosened lock nut.
5. Make sure that the engine speed is smoothly reduced from 2,000 to 1,000 rpm in about three seconds.

CHECKING CARBURETOR RETURN SPRING

Check throttle return spring for cracks, squareness or deformation, if necessary, replace with a new one.

CHECKING CHOKE MECHANISM (CHOKE VALVE AND LINKAGE)

1. Check choke valve and mechanism for free operation, and clean or

replace if necessary. A binding can result from petroleum gum formation on choke shaft or from damage.

2. Check bimetal cover setting. Index mark on bimetal cover is usually set at center of scale.

Note: **When some-what over-choked, turn bi-metal cover clockwise slightly.**

3. Every day, before starting engine, depress the accelerator pedal to see if choke valve is closed automatically.

If it fails to be closed, the chances are that link movement is unsmooth, or that bimetal is out of order. Refer to "Carburetor" in section EF (Page EF-15).

CHECKING ANTI-DIESELING SOLENOID

If engine will crank but will not start, check the operation of anti-dieseling solenoid. Check to see if the solenoid issues click sounds with the ignition key turning on. Disconnect and connect the solenoid wiring repeatedly. If the click sound can not be heard and the harness is in good condition, replace the solenoid with a new one.

If engine will not stop when ignition switch is turned off, this indicates a striking (closed) solenoid valve, shutting off supply of fuel to engine. If harness is in good condition, replace solenoid as a unit.

To replace, proceed as follows:

Removal and installation of anti-dieseling solenoid

Removal

Solenoid is cemented at factory. Use special tool "ST19150000" to remove a solenoid.

When this tool is not effective, use a pair of pliers to loosen body out of position.

Installation

(1) Before installing a solenoid, it is essential to clean all threaded parts of carburetor and solenoid. Supply screws in holes and turn them in two or three pitches.

(2) First, without disturbing the above setting, coat all exposed threads with adhesive the "Stud Lock" of LOCTITE or equivalent.

Then, torque screws to 35 to 55 kg-cm (30 to 48 in-lb) using a special tool "ST19150000."

After installing anti-dieseling solenoid, leave carburetor more than 12 hours without operation.

(3) After replacement is over, start engine and check to be sure that fuel is not leaking, and that anti-dieseling solenoid is in good condition.

Notes:

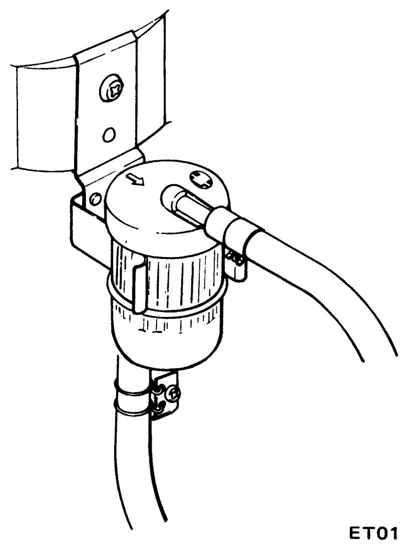
a. **Do not allow adhesive getting on valve. Failure to follow this caution would result in improper valve performance or clogged fuel passage.**

b. **In installing valve, use caution not to hold body directly. Instead, use special tool, tightening nuts as required.**

c. **After installing a new solenoid, check to be certain that there is no leakage, cracks or otherwide deformation.**

REPLACING FUEL FILTER

Check for a contaminated element, and water deposit.



ET011

Fig. ET-17 Fuel strainer

All engines use a replaceable cartridge type fuel strainer as an assembly.

CHECKING FUEL LINES (HOSES, PIPINGS, CONNECTIONS, etc.)

Check fuel lines for loose connections, cracks and deterioration. Retighten loose connections and replace any damaged or defective parts.

SPARK TIMING CONTROL SYSTEM

CONTENTS

DESCRIPTION

In this system two spark timings, namely, "Advance" and "Retard," are provided; these can be used independently by electrical means. Between these two timings there is a phase difference of 7 crank-degrees.

The "Retarded" timing is intended for the operating condition as encountered when driving in urban district while the "Advanced" timing is provided to meet the requirement when driving in the suburbs.

Manual transmission

This system consists of a thermo-switch, a throttle switch, a fourth lamp switch, a relay, and a dual-point distributor; and the "Retarded" timing is used to meet the following conditions:

1. The temperature inside the passenger compartment is above 10°C (50°F).
2. The throttle valve is partially opened. (See Table A.)
3. The shift lever is placed in a position other than 4th gear.

Throttle switch is "ON" when throttle switch is below X degree; Table A

	L18 L16 (510)		L16 (620)	
	A/T	M/T	A/T	M/T
Throttle switch opening (X degree)	35 deg	40 deg	45 deg	

The table below shows the operation of each control switch under normal operating condition:

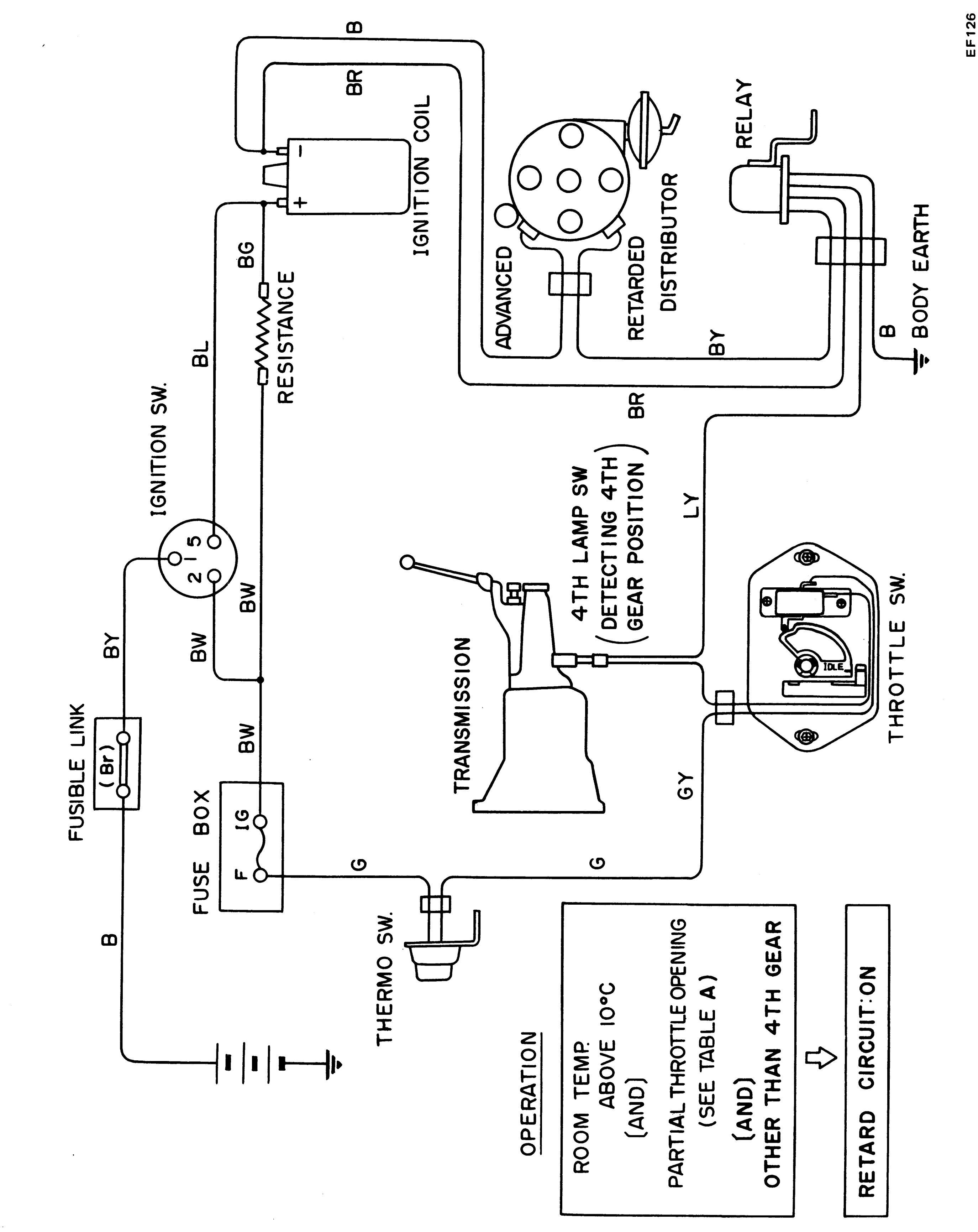


Fig. ET-18 Schematic drawing of spark plug advance control system (Manual Transmission)

Spark timing control system for Manual Transmission

		Throttle SW	Fourth lamp SW	Spark timing	
				"Advance"	"Retard"
Engine start		ON	ON	–	O
Idling		ON	ON	–	O
4-speed gear	Partial O.T.	ON	OFF	O	–
	Wide O.T.	OFF			
Except 4-speed gear	Partial O.T.	ON	ON	–	O
	Wide O.T.	OFF		O	–

Notes:

a. Operation of the thermo-switch has hysteresis of the bimetal. It opens between 5°C (41°F) and 13°C (55°F) when temperature rises from low to high. It closes above 1°C (34°F) when temperature lowers from high to low.

b. When the temperature of passanger compartment is below 1°C (34°F), the system is absolutely "Advance Side" whatever other switch is any condition.

Automatic transmission

This system consists of a thermo-switch, a throttle switch, a relay and a dual-point distributor; and "Retard" timing is used when the following conditions are fulfilled during drive: See Figure ET-19.

1. The temperature inside the passenger compartment is above 13°C (55°F).
2. The throttle valve is partially opened. (See Table A.)

The table below shows the operation of each control switch under normal operation condition:

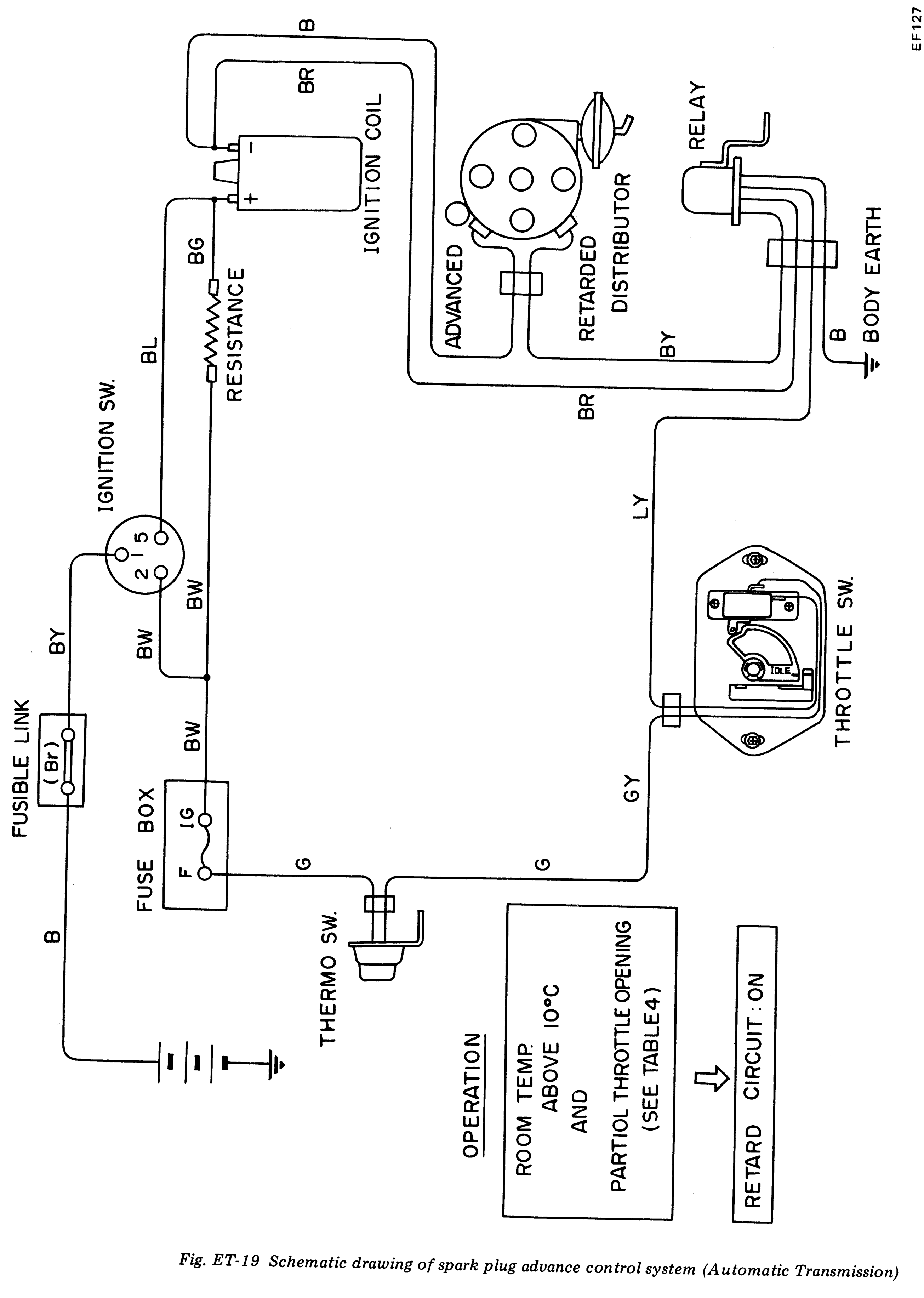


Fig. ET-19 Schematic drawing of spark plug advance control system (Automatic Transmission)

Spark timing control system for Automatic Transmission

	Throttle SW.	Spark timing	
		"Advance"	"Retard"
Engine start	ON	–	O
Idling	ON	–	O
Partial throttle opening	ON	–	O
Wide throttle opening (and high speed crousing)	OFF	O	–

Notes:

a. **Operation of the thermo-switch has hysteresis of the bimetal. It opens between 5°C (41°F) and 13°C (55°F) when temperature rises from low to high. It closes above 1°C (34°F) when temperature lowers from high to low.**

b. **When the temperature of passenger compartment is below 1°C (34°F), the system is absolutely "Advance Side" whatever other switch is any condition.**

FOURTH LAMP SWITCH (MANUAL TRANSMISSION ONLY)

This switch is applicable to the manual transmission only. The switch is operated by the movement of the fork rod in the transmission. The fourth lamp switch shows "OFF" when gear position is in fourth (top).

Testing of fourth lamp switch

1. Make sure of insulation between lead wire terminal of transmission switch and switch body.
2. Disconnect lead wires at the switch, and connect ohmmeter to terminals.
3. Ohmmeter should indicate infinity (∞) when shift lever is in 4th gear position. And it should indicate zero at other gear position including neutral position.
4. If it does not work properly in step 3, replace the switch with a new one.

THERMO-SWITCH

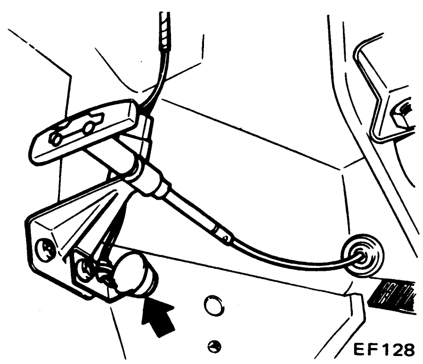


Fig. ET-20 Thermo-switch

Testing of thermo-switch

1. Make sure of insulation between lead wire terminal of thermo-switch and thermo-switch body.
2. Disconnect lead wires at switch and connect ohmmeter to terminals.
3. Ohmmeter should indicate zero when temperature inside the passenger compartment is above 13°C (55°F).
4. If it does not work properly in step 3, replace thermo-switch with a new one.

THROTTLE SWITCH

This switch is set on the bell-crank of the accelerator linkage and operates together with accelerator pedal.

The throttle switch is "ON" when the throttle valve is widely opened.

Testing of throttle switch

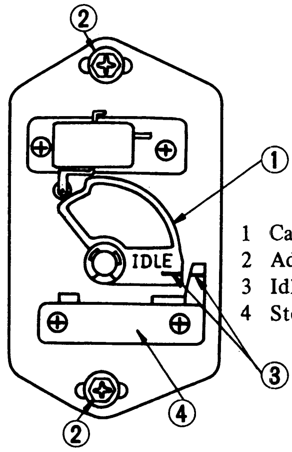
1. Detach cover from throttle switch. (610, 510)
2. Make sure that there is a functional sound in switch when accelerator pedal is fully depressed.
3. Make sure of insulation between lead wire terminals and base plate of switch.
4. Inspect whether idle mark of cam and stopper plate is properly aligned.

   If it is not aligned, loosen adjusting screws and turn throttle switch itself so that idle mark is properly aligned; then tighten adjusting screws. (610, 510)
5. Inspect whether the clearance between throttle switch and lever is 0.3 mm (0.012 in) when accelerator pedal is fully depressed while micro switch is fully depressed.

   If it is not aligned, loosen adjusting screws and turn throttle switch itself so that the clearance is the specifications. (620)
6. Disconnect coupler and connect ohmmeter to terminals.
7. Ohmmeter should indicate infinity (∞) when pedal is fully depressed.

   It should indicate zero when accelerater pedal is released or partially depressed.
8. If switch does not work well step in 6, replace throttle switch assembly.
9. Install cover and connect coupler securely.

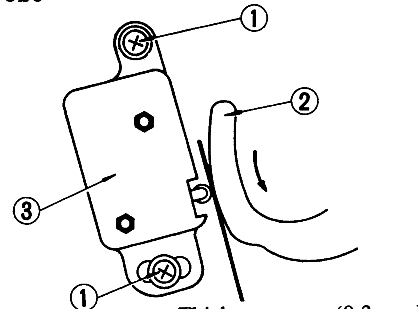
610, 510



1 Cam
2 Adjusting screw
3 Idle mark
4 Stopper plate

EF129

620



1 Adjusting screw
2 Lever
3 Throttle switch

ET029

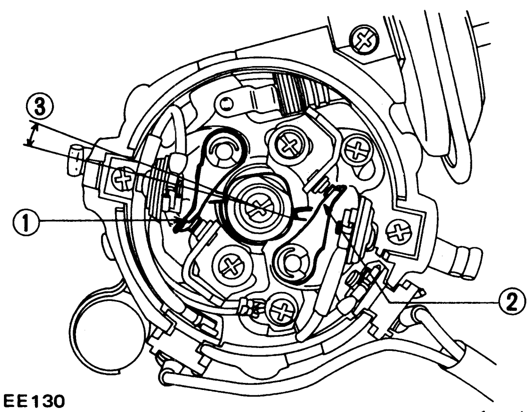
Fig. ET-21 Adjustment of throttle switch

DUAL POINT DISTRIBUTOR

Distributor has two breaker points, located opposite each other with a phase difference as shown in Figure ET-22.

The difference in phase can be adjusted by the adjusting screw. A phase difference of 7 crank angles is adopted.

Those two breaker points are placed parallel in the primary ignition circuit. The retarded breaker point works when the relay is turned "ON" and the advanced breaker point works when the relay is turned "OFF."



EE130

1 Advanced breaker point
2 Retarded breaker point
3 Phase difference

Fig. ET-22 Dual point distributor

Checking electric advance control system (Dual point distributor)

Cap and rotor head

Cap and rotor head must be inspected at regular intervals. In addition, remove cap and clean all dust and carbon deposits from cap and rotor from time to time. If cap is cracked or is leaking, replace with a new one.

Point

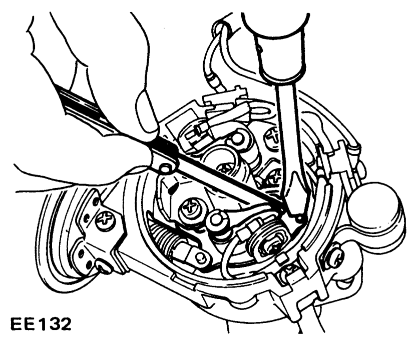
Standard gaps of both points are 0.45 to 0.55 mm (0.0177 to 0.0217 in). If the gap is off the standard, adjustment must be made by loosening point screws. Gap gauge is required for adjustment.

Both gaps must be checked from time to time.

When point surface is rough, take off any irregularities with fine sand paper of No. 500 or 600 or with oil stone.

At this time, grease must be supplied to cam-shaft and cam heel. (Do not apply excessively.) When wear on each breaker point is noticeable, replace points together with contact arm.

Point gap:
0.45 to 0.55 mm
(0.018 to 0.022 in)
Dwell angle:
49° to 55°



EE132

Fig. ET-23 Checking of distributor breaker point gap

If point gap is adjusted by examining dwell angle, install distributor on engine and proceed as follows:

1. Disconnect wiring harness of distributor from engine harness.
2. Using a lead wire, connect B (black) of engine harness and B (black) of distributor harness (advance side).
3. Adjust dwell angle of advance side by loosening point screw.
4. Disconnect lead wire from B (black) of distributor harness and then connect it to Y (yellow) of distributor (Retard side).
5. Adjust dwell angle of retard side by loosening point screw.
6. After adjustment, disconnect lead wire then connect engine harness and distributor harness securely.

Inspection and adjustment of phase difference

To check phase difference, install distributor on engine and proceed as follows:

1. Disconnect wiring harness of distributor from engine harness.
2. Using a lead wire, connect B (black) of engine harness and B (black) of distributor harness. (Advance side). See Figure ET-24.

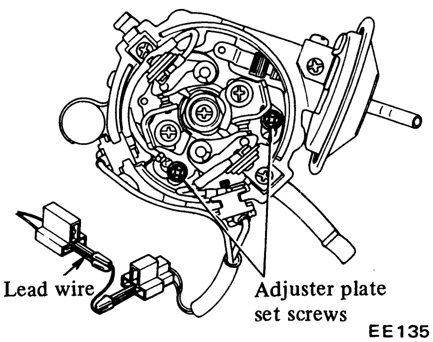


Fig. ET-24 Connect lead wire

3. With engine idling, adjust ignition timing by rotating distributor to specifications. (12°/800 rpm, advance side)
4. Disconnect lead wire from B (black) of distributor harness and then connect it to Y (yellow) of distributor harness. (Retard side)
5. With engine still idling, check to determine that phase delay is 7 degrees in terms of crank shaft angular displacement.

To correct, further proceed as follows:

(1) Referring to Figure ET-25, turn out adjuster plate set screw 1/2 to 2 turns. The screw is located at contact set on retard side.
(2) Using a notch in adjuster place as a hold, turn adjuster plate as required until correct delay is obtained. Ignition is retarded when plate is turned counterclockwise.

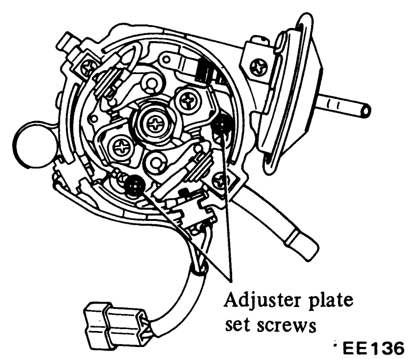


Fig. ET-25 Adjuster plate set screws

Note: Refer to graduations on breaker plate to make adjustment easier. One graduation corresponde to crankshaft angular displacement of 4 degrees.

(3) Tighten adjuster plate set screws to secure the adjustment.
(4) Make sure that the ignition timing of advance side is the specifications.
(5) After adjustment, remove lead wire and connect wiring harness of distributor to engine harness securely.

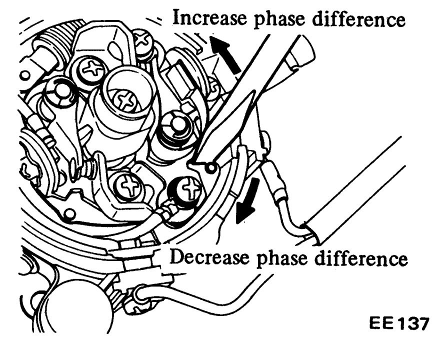


Fig. ET-26

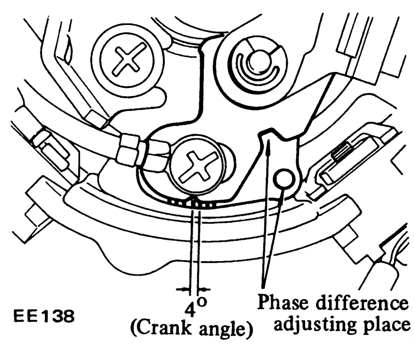


Fig. ET-27 Phase difference adjusting scale

ADJUSTMENT OF OPERATING PRESSURE OF B.C.D.D. (BOOST CONTROLLED DECELERATION DEVICE)

CONTENTS

Primcipally, it is unnecessary to adjust the B.C.D.D., however if there is any requirement the adjustment procedure is as follows.

Prepare the following tools:

1. A tachometer to measure the engine speed while idling, and a screwdriver.
2. A vacuum gauge and connecting pipe.

Notes:

a. A quick-response type boost gauge such as Bourdon's tube type is recommended; mercury-type manometer should not be used.
b. Special tools are not required.

WARMING-UP OPERATION

Warm-up engine until it is heated to operating temperature.

CONNECTING VACUUM GAUGE

Connect rubber hose between vacuum gauge and intake manifold as shown:

Disconnect solenoid valve and let solenoid valve free.

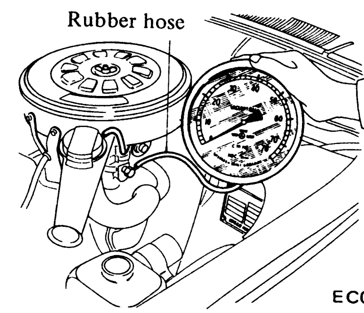


Fig. ET-28 Connecting vacuum gauge

ADJUSTMENT OF IDLING

Adjust the engine at normal idling setting

	Engine idling (rpm)	Idling timing (degree, retard side)	CO (%)
M/T vehicle	800	5° BTDC	1.5 ± 0.5
A/T vehicle	650 (in D range)	5° BTDC	1.5 ± 0.5

RACING

Place shift lever in neutral for M/T, or N or P for A/T. Raise engine speed up to 3,000 to 3,500 rpm under no-load, and close throttle valve by relasing it from hand.

Examine engine rpm whether it falls to idling.

WHEN ENGINE REVOLUTION FALLS TO IDLING

(See Figure ET-33)

At this moment, the negative pressure of manifold rises above –550 mmHg (–21.7 inHg) and then gradually falls down to the pressure of idling [about –420 mmHg (–16.5 inHg)].

The process of this pressure fall takes one of the three forms as illustrated in Figures ET-29, ET-31 and ET-32 according to the difference of the operating pressure of B.C.D.D.

When the operating pressure is too high

1. When the operating pressure is too high, B.C.D.D. remains inoperative, and negative pressure decreases without being sustained while it is falling, just like that of the engine on which a B.C.D.D. is absent. See diagram (A).
2. When the operating pressure is lower than that of the case of (A) but is higher than the set pressure: The negative pressure which has once risen is kept constant at a certain value (operating pressure) for about one second, and then gradually falls to the idling negative pressure. See diagram (B).

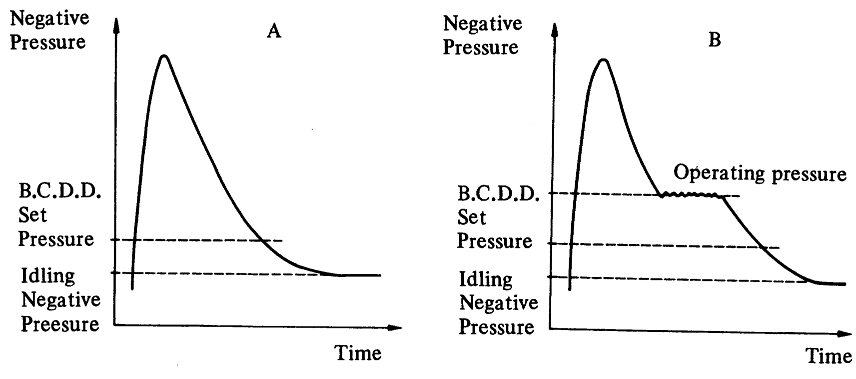
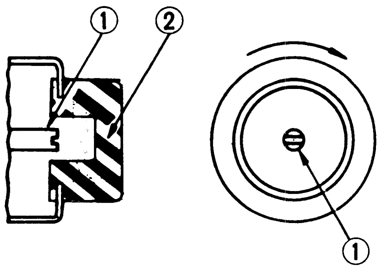


Fig. ET-29 Characteristic curve — high negative pressure —



1 Adjusting screw "S"
2 Cover "C" ET037

Fig. ET-30 Adjusting operating pressure

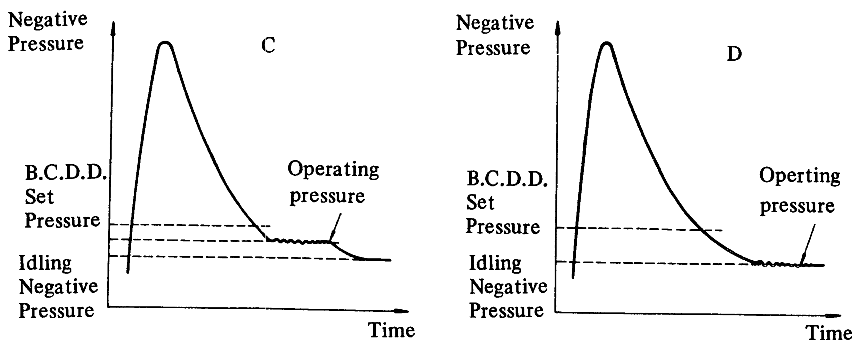
Turn adjusting screw "S" as outlined below until correct pressure is obtained. Slightly turn this adjusting screw clockwise and then race engine. Do not fit tip of screw driver tightly in screw slot.

Notes:

a. **Turning adjusting screw "S" one-eighth rotation in either direction will cause a change in operating pressure of 20 mmHg (0.79 inHg). This adjusting screw is left-hand threaded.**

b. **Turn adjusting screw "S" counter-clockwise to increase the negative pressure.**

c. **Turn adjusting screw clockwise to decrease the negative pressure.**



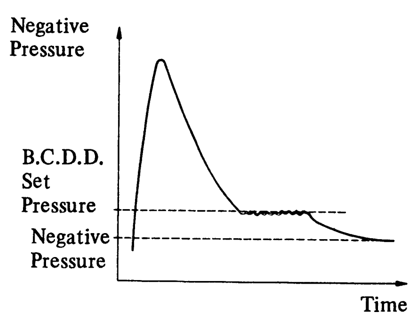
ET044

Fig. ET-31 Characteristic curve — low negative pressure —

When the operating pressure equals set pressure

When the operating pressure is equalized to set pressure, and then falls to idling pressure, install cover "C."

B.C.D.D. set pressure
- Manual transmission vehicle
  - −500 ± 20 mmHg
  - (−19.7 ± 0.787 inHg)
- Automatic transmission vehicle
  - −480 ± 20 mmHg
  - (−18.9 ± 0.787 inHg)

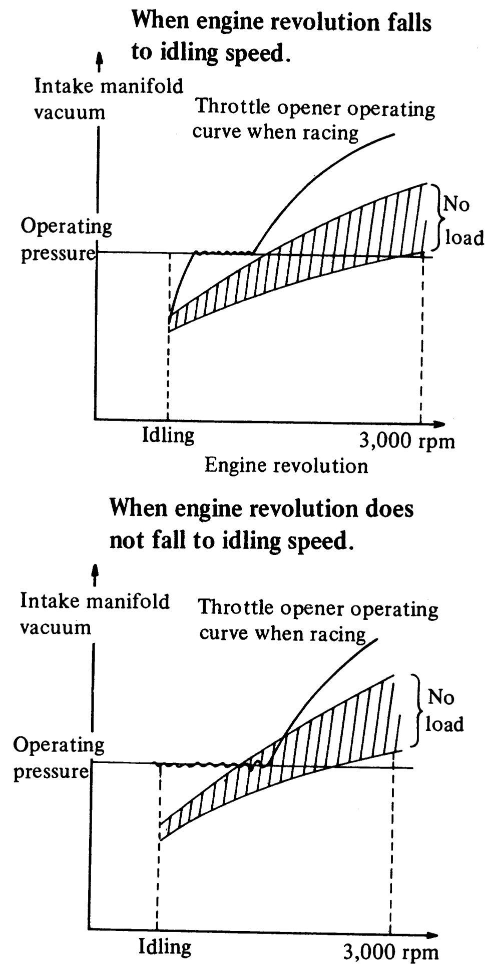


ET045

Fig. ET-32 Characteristic curve — proper negative pressure —

WHEN THE ENGINE REVOLUTION DOES NOT FALL TO THE IDLING SPEED

(See Figure ET-33)



ET046

Fig. ET-33 Characteristic curve of B.C.D.D.

When the engine rpm does not fall to idling, it is necessary to reduce the idling negative pressure of manifold to lower than the set pressure of B.C.D.D. (The engine revolution does not fall to the idling speed when the idling negative pressure is higher than the set pressure of B.C.D.D.).

In this case, it is necessary to labour the engine by (1) road test or (2) chassis dynamometer or (3) raise up rear suspension member by stand. And accelerate the car 40 to 50 mph with top gear for M/T or D range for A/T, then release the accelerator pedal and let the car deceleration.

Then check the B.C.D.D. set pressure whether it is in the predetermined valve or not.

The process of this pressure fall takes one of the three forms as illustrated in Figures ET-29, ET-31, and ET-32 according of the difference of the operating pressure of B.C.D.D.

When the operating pressure is too high

When the operating pressure is higher than the set pressure. The negative pressure which has once risen is kept constant at a certain value (operating pressure) for about one second, and then gradually falls to the idling negative pressure. See diagram (B).

Adjustment of this condition is exactly same as that of when the engine revolution falls to the idling speed. (Mentioned above.)

When the operating pressure is too low

1. When the operating pressure is somewhat low, the negative pressure becomes constant for some while at a value below set pressure, and then falls to idling negative pressure. See diagram (C).
2. When the operating pressure is exceedingly low, the negative pressure will not fall to idling pressure and the speed of engine is not restored to the idling speed.

In extreme case, the engine speed fails to attain idling speed although to that of idling. See diagram (D).

Turn adjusting screw "S" until correct pressure is obtained. Slightly turn this adjusting screw counterclockwise and then race the engine. Do not fit tip of screwdriver tightly in screw slot.

AUTOMATIC TEMPERATURE CONTROL AIR CLEANER (A.T.C. AIR CLEANER)

CONTENTS

REPLACING CARBURETOR AIR CLEANER FILTER

The paper element (viscous type) has been specially treated, and therefore, there is no need to clean it. But it should be replaced with a new one periodically.

CHECKING HOT AIR CONTROL VALVE

Inspection

Among the possible troubles of this device, the most liable is the permanent opening of valve.

This trouble is not noticed in warm weather, but in cold weather appears as poor performance of engine, such as tardy acceleration, hesitation or engine stall. When such a claim has been raised by the user, first inspect this device before checking the carburetor.

Another trouble which might be expected is that the underhood-air is kept closed by the valve regardless of the temperture of suction air around the sensor while the engine is running. This trouble appears in the from of extremely excessive fuel consumption or decrease in power.

The inspection of the device should be proceeded as follows:

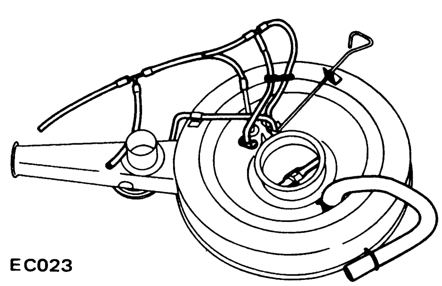


Fig. ET-34 Correct position of hoses

Appearance

1. First inspect whether the vacuum hoses are connected to the correct positions.
2. Inspect the hoses for cracks, distortion, plugging.

Checking of vacuum motor

1. With the engine shut down, inspect the position of valve (placing a mirror at the end of inlet pipe for inspection. The correct condition of valve is that it keeps the inlet of underhood-air open and that of hot air closed. Otherwise, inspect the linkage of valve.

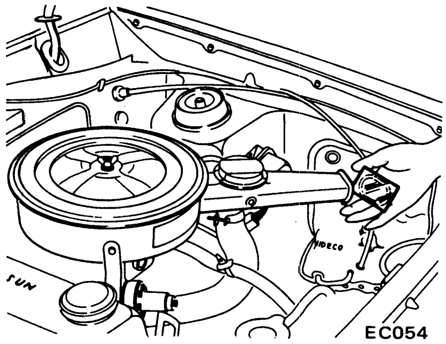


Fig. ET-35 Inspecting valve position

2. Disconnect the hose at the vacuum motor inlet, and directly apply vacuum of manifold to vacuum motor by connecting another hose; sucking by the mouth may be substituted for this process. If underhood-air inlet is closed by the valve, valve is in good condition. Inspect linkage if found otherwise. And then no defect is found even in the linkage, it signifies the trouble of the vacuum motor.

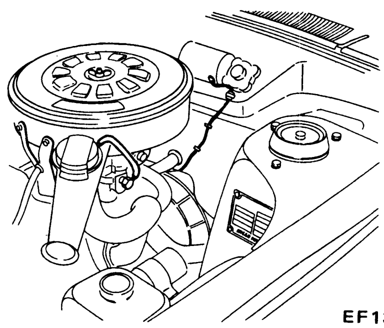


Fig. ET-36 Checking vacuum motor

3. The valve shows correct condition if it keeps underhood-air inlet closed when the passage in the hose is stopped by twisting or clamping it while applying vacuum. If otherwise, it is an indication of leakage taking place in the vacuum motor.

4. When defect is found through this check, replace the air cleaner assembly.

Checking of sensor

1. Perform the engine test by keeping the temperature around the sensor below 30°C (86°F). Make sure that the engine is cooled down before the test is conducted.

2. Before running the engine, make certain that the valve on underhood-air side fully open.

3. Start the engine and operate it at an idling speed. The valve is in good condition if underhood-air side fully closes immediately after starting.

4. Carefully watch the valve to ascertain that it gradually begins open as the engine warms up. But, when the ambient temperature is low, it takes considerable length of time for the valve to begin to open, or in some case it hardly opens. This should not, however, be regarded as trouble.

If the valve does not operate satisfactorily or if the condition of the valve is questionable, further conduct the following test:

5. Remove the air cleaner cover, and put a thermister or a small thermometer as close to the sensor as possible with adhesive tape. Install the air cleaner cover again.

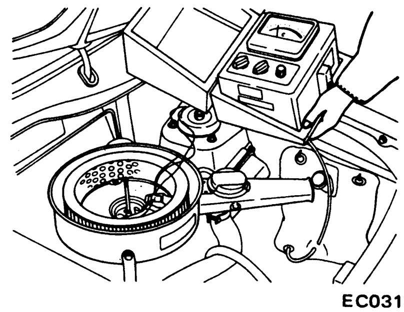


Fig. ET-37 Checking sensor

6. Start the engine and continue idling as described under paragraphs (1), (2), and (3) above. When several minutes have passed and valve is partially opened, read the thermister indication. It is correct if the reading falls between 37.5°C (100°F) and 48°C (118°F). If the reading is abnormal, replace sensor.

7. On the engine equipped with an idle compensator as service option, do as follows before replacing sensor:

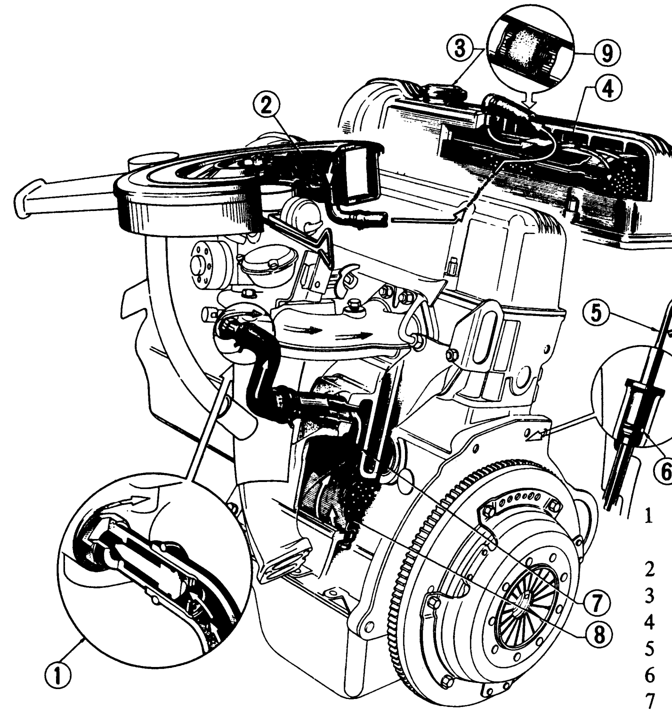
CRANKCASE EMISSION CONTROL SYSTEM

CONTENTS

This system returns blow-by gas to both the intake manifold and carburetor air cleaner.

The positive crankcase ventilation (PCV) valve is provided to conduct crankcase blow-by gas to the intake manifold. During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the valve. Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air. The ventilating air is then drawn from the clean side of the carburetor air cleaner, through the tube connecting carburetor air cleaner to rocker cover, into the crankcase.

Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the tube connection in the reverse direction. In cars with an excessively high blow-by some of the flow will go through the tube connection to the carburetor air cleaner under all conditions.



1 Crank case ventilation control valve
2 Flame arrester
3 Sealed filler cap
4 Baffle plate
5 Oil level gauge
6 "O" Ring
7 Oil separator
8 Baffle plate
9 Flame arrester

EC031

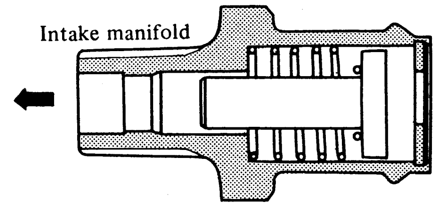
Fig. ET-38 Crankcase emission control system (closed type)

CHECKING AND REPLACING PCV VALVE

Test PCV valve in accordance with the following method.

With engine running at idle, remove the ventilator hose from PCV valve, if the valve is working, a hissing noise will be heard as air passes through the valve and a strong vacuum should be felt immediately when a finger is placed over valve inlet. If the valve is plugged, replace with a new valve.

Check for deposit plugging in the hose. Clean if necessary.



EC014

Fig. ET-39 Cross-sectional view of PCV valve

CHECKING VENTILATION HOSES

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and blow them out with compressed air.

If any hose can not be free of obstructions, replace with a new one.

Insure that the flame arrester is surely inserted in the hose, between air cleaner and locker cover.

EVAPORATIVE EMISSION CONTROL SYSTEM

CONTENTS

CHECKING ENGINE COMPARTMENT HOSE CONNECTIONS AND FUEL VAPOR CONTROL VALVES

Checking fuel tank, vapor-liquid separator and vapor vent line

1. Check all hoses and fuel tank filler cap.
2. Disconnect the vapor vent line connecting flow guide valve to vapor-liquid separator.
3. Connect a 3-way connector, a manometer and a cock (or an equivalent 3-way change cock) to the end of the vent line.
4. Supply fresh air into the vapor vent line through the cock little by little until the pressure becomes 368 mm (14.5 in) Aq.
5. Shut the cock completely and leave it that way.
6. After 2.5 minutes, measure the height of the liquid in the manometer.
7. Variation of height should remain within 25 mm (1.0 in) Aq.
8. When the filler cap does not close completely the height should drop to zero in a short time.
9. If the height does not drop to zero in a short time when the filler cap is removed, it is the cause of the stuffy hose.

Note: In case the vent line is stuffy, the breathing in fuel tank si not thoroughly made, thus causing in sufficient delivery of fuel to engine or vapor lock. It must therefore be repaired or replaced.

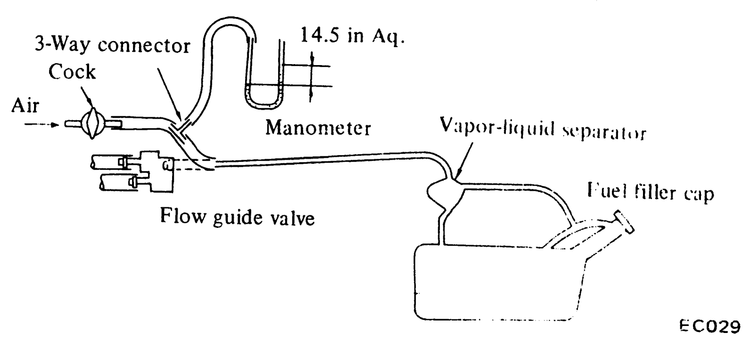


Fig. ET-40 Checking evaporative emission control system

Checking flow guide valve

1. Disconnect all hoses connected to the flow guide valve.
2. While lower pressure air is pressed into the flow guide valve from the ends of vent line of fuel tank side, the air should go through the valve and flow to crankcase side. If the air does not flow the valve should be replaced. But when the air is blown from crankcase side, it should never flow to the other two vent lines.
3. While the air is pressed into the flow guide valve from the carburetor air cleaner side, it flows to the fuel tank side and/or crankcase side.
4. This valve opens when the inner pressure 10 mm Hg (0.4 in Hg). In case of improper operations or breakage, replace it.

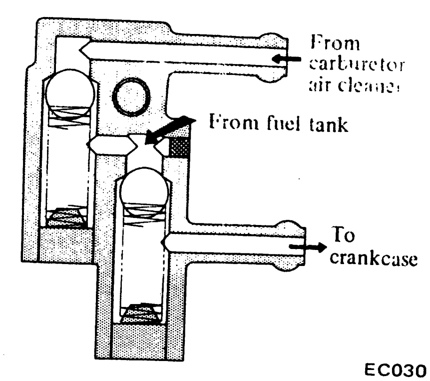


Fig. ET-41 Flow guide valve

CHECKING FUEL TANK VACUUM RELIEF VALVE OPERATION

Remove fuel filler cap and see it functions properly as follows;

1. Wipe clean valve housing and have it in your mouth.
2. Inhale air. A slight resistance accompanied by valve indicates that valve is in good mechanical condition. Note also that, by furhter inhaling air the resistance should be disappeared with valve clicks.
3. If valve seems to be clogged, or if no resistance is felt, replace cap as an assembled unit.

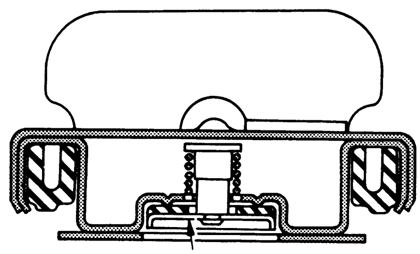


Fig. ET-42 Fuel filler cap

SERVICE DATA AND SPECIFICATIONS

Basic mechanical system

Valve clearance		
Cold Intake	mm (in)	0.20 (0.008)
Exhaust	mm (in)	0.25 (0.010)
Warm Intake	mm (in)	0.25 (0.010)
Exhaust	mm (in)	0.30 (0.012)
Drive belt tension	mm (in)	8 to 12 (0.315 to 0.472)
When thumb pressure	kg (lb)	10 (22) is applied
Tightening torque		
Cylinder head bolts		
1st turn	kg-m (ft-lb)	4.0 (28.9)
2nd turn	kg-m (ft-lb)	6.0 (43.4)
3rd turn	kg-m (ft-lb)	6.5 to 8.5 (47.0 to 61.5)
Manifold nuts	kg-m (ft-lb)	1.2 to 1.6 (8.7 to 11.6)
Carburetor nuts	kg-m (ft-lb)	0.5 to 1.0 (3.6 to 7.2)
Engine oil capacity		
Maximum (H)	ℓ [U.S. qts., Imper. qts.]	4.3 (4 ½ , 3 ¾)
Minimum (L)	ℓ [U.S. qts., Imper. qts.]	3.3 (3 ½ , 2 ⅞)
Cooling system capacity		
610 Without heater	ℓ [U.S. gal., Imper. gal.]	6.0 (1 ⅝ , 1 ⅜)
With heater	ℓ [U.S. gal., Imper. gal.]	6.5 (1 ¾ , 1 ⅜)
620 Without heater	ℓ [U.S. gal., Imper. gal.]	5.4 (1 ⅜ , 1 ¼)
With heater	ℓ [U.S. gal., Imper. gal.]	6.0 (1 ⅝ , 1 ⅜)
510 Without heater	ℓ [U.S. gal., Imper. gal.]	6.4 (1 ¾ , 1 ⅜)
With heater	ℓ [U.S. gal., Imper. gal.]	6.8 (1 ⅞ , 1 ½)
Radiator cap pressure test	kg/cm^2 (psi)	0.9 (12.8)
Cooling system pressure test	kg/cm^2 (psi)	1.6 (23.0)
Engine compression		
Maximum	kg/cm^2 (psi)/at rpm	12.0 (171)/350
Minimum	kg/cm^2 (psi)/at rpm	9.0 (128)/350

Ignition and fuel system

Ignition timing	degree	5° (B.T.D.C.)
Distributor		
Point gap	mm (in)	0.45 to 0.55 (0.0177 to 0.0217)
Dwell angle	degrees	49 to 55
Condenser capacity	μF	retard side 0.05 advance side 0.22
Condenser insulation resistance	MΩ	5
Idling adjustment		
Manual Transmission	degree/rpm	5°/800 (retard side)
	CO %	1.5 ± 0.5
Automatic Transmission	degree/rpm	5°/650 (retard side, "D" range)
	CO %	1.5 ± 0.5
Dash pot adjustment	rpm	1,600 to 1,800
Anti-dieseling solenoid tightening torque	kg-cm (in-lb)	35 to 55 (30 to 48)
Spark timing control system		
Throttle switch operating angle		
L18, L16 (510) A/T	degree	35°
L18, L16 (510) M/T	degree	40°
L16 (620) A/T & M/T	degree	45°
Thermo-switch operating temperature	°C (°F)	5 to 13 (41 to 55)
Adjustment of operating pressure of B.C.D.D.		
B.C.D.D. set pressure		
A/T	mmHg (inHg)	–480 ± 20 (–18.9 ± 0.787)
M/T	mmHg (inHg)	–500 ± 20 (–19.7 ± 0.787)
A.T.C. Air cleaner		
A.T.C. Valve opening temperature	°C (°F)	37.5 to 48 (100 to 118)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
CANNOT CRANK ENGINE OR SLOW CRANKING	Improper grade oil.	Replace with proper grade oil.
	Discharged battery.	Charge battery.
	Defective battery.	Replace.
	Loose fan belt.	Adjust.
	Trouble in charge system.	Inspect.
	Wiring connection trouble in starting circuit.	Correct.
	Defective ignition switch.	Repair or replace.
	Defective starter motor.	Repair or replace.

(Trouble-shooting procedure on starting circuit)
Switch on the starting motor with light "ON."

When light goes off or dims considerably.

a. Check battery.
b. Check connection and cable.
c. Check starter motor.

When light stays bright.

a. Check wiring connection between battery and starter motor.
b. Check starter switch.
c. Check starter motor.

ENGINE WILL CRANK NORMALLY BUT WILL NOT START

In this case, the following trouble causes may exist, but in many cases ignition system or fuel system is in trouble.

Ignition system in trouble
Fuel system in trouble
Valve mechanism does not work properly
Low compression

(Trouble-shooting procedure)

Check spark plug firstly by following procedure.
Disconnect high tension cable from one spark plug and hold it about 10 mm (0.3937 in) from the engine metal part and crank the engine.

Good spark occurs.

a. Check spark plug.
b. Check ignition timing.
c. Check fuel system.
d. Check cylinder compression.

No spark occurs. — Check the current flow in primary circuit.

Very high current. — Inspect primary circuit for short. Check breaker point operation.

Condition	Probable cause	Corrective action
	Low or no current.	Check for loose terminal or disconnection in primary circuit. Check for burned points.
Ignition system in trouble	Burned distributor point.	Repair or replace.
	Improper point gap.	Adjust.
	Defective condenser.	Replace.
	Leak at rotor cap and rotor.	Clean or replace.
	Defective spark plug.	Clean, adjust plug gap or replace.
	Improper ignition timing.	Adjust.
	Defective ignition coil.	Replace.
	Disconnection of high tension cable.	Replace.
	Loose connection or disconnection in primary circuit.	Repair or replace.
Fuel system in trouble	Lack of fuel.	Supply.
	Dirty fuel strainer.	Replace.
	Dirty or clogged fuel pipe.	Clean.
	Fuel pump will not work properly.	Repair or replace.
	Carburetor choke will not work properly.	Check and adjust.
	Improper adjustment of float level.	Correct.
	Improper idling.	Adjust.
	Dirty or clogged carburetor.	Disassemble and clean.
	Clogged breather pipe of fuel tank.	Repair and clean.
	Damaged anti-dieseling solenoid.	Replace.
Low compression	Incorrect spark plug tightening or defective gasket.	Tighten to normal torque or replace gasket.
	Improper grade engine oil or low viscosity.	Replace with proper grade oil.
	Incorrect valve clearance.	Adjust.
	Compression leak from valve seat.	Remove cylinder head and lap valves.
	Sticky valve stem.	Correct or replace valve and valve guide.
	Weak or defective valve springs.	Replace valve springs.
	Compression leak at cylinder head gasket.	Replace gasket.
	Sticking or defective piston ring.	Replace piston rings.
	Worn piston ring or cylinder.	Overhaul engine.
	(Trouble shooting procedure) Pour the engine oil from plug hole, and then measure cylinder compression.	
	Compression increases.	Trouble in cylinder or piston ring.
	Compression does not change.	Compression leaks from valve, cylinder head or head gasket.

Condition	Probable cause	Corrective action
IMPROPER ENGINE IDLING		
Fuel system in trouble	Clogged or damaged carburetor jets.	Clean or replace.
	Incorrect idle adjustment.	Adjust.
	Clogged air cleaner.	Replace element.
	Defective manifold gaskets or carburetor insulator.	Replace gasket or insulator.
	Improper float level adjustment.	Adjust.
Low compression		Previously mentioned.
Others	Incorrect valve clearance.	Adjust.
	Extremely low revolution.	Adjust.
	Poor acceleration above 1,000 rpm (Twin carb.)	Loosen idling adjusting nuts about a half turn.
	Defect or malfunction of the ignition system (spark plug, high tension cable, breaker point, ignition coil, etc.).	Replace
	Incorrect basic ignition timing.	Adjust
	Incorrect valve clearance.	Adjust
	B.C.D.D. adjustment incorrect.	Adjust.
	Damaged vacuum control solenoid.	Replace.
	Sticked anti-stall dash pot.	Replace.
ENGINE POWER NOT UP TO NORMAL		
Low compression		Previously mentioned.
Ignition system in trouble	Incorrect ignition timing.	Adjust.
	Defective spark plugs.	Clean, adjust or replace plugs.
	Defective distributor points.	Dress, or replace points. Also check condenser.
Fuel system in trouble	Malfunction of choke system.	Adjust.
	Clogged fuel pipe or floating valve.	Clean.
	Dirty or clogged fuel strainer.	Replace.
	Fuel pump will not work properly.	Repair or replace.
	Clogged carburetor jets.	Disassemble and clean.
Air intake system in trouble	Clogged air cleaner.	Replace element.
	Air inhaling from manifold gasket or carburetor gasket.	Replace gasket.

Condition	Probable cause	Corrective action
Overheating	Insufficient coolant.	Replenish.
	Loose fan belt.	Adjust fan belt.
	Worn or defective fan belt.	Replace.
	Defective thermostat.	Replace.
	Defective water pump.	Replace.
	Clogged or leaky radiator.	Flush, repair or replace.
	Defective radiator filler cap.	Replace.
	Air in cooling system.	Retighten each part of cooling system.
	Improper engine oil grade.	Replace with proper grade oil.
	Incorrect ignition timing.	Adjust.
	Defective carburetor (lean mixture).	Overhaul carburetor.
Overcooling	Defective thermostat.	Replace.
Others	Improper octane fuel.	Replace with specified octane fuel.
	Improper tire pressure.	Inflate to specified pressure.
	Dragging brake.	Adjust.
	Clutch slipping.	Adjust.
NOISY ENGINE		
Car knocking	Overloaded engine.	Use right gear in driving.
	Carbon knocking.	Disassemble cylinder head and remove carbon.
	Timing knocking.	Adjust ignition timing.
	Fuel knocking.	Use specified octane fuel.
	Preignition (misusing of spark plug).	Use specified spark plug.
Mechanical knocking		
Crankshaft bearing knocking.	This strong dull noise increases when engine is accelerated. To locate the place, cause a misfire on each cylinder. If the noise stops by the misfire, this cylinder generates the noise.	This is caused by worn or damaged bearings, or unevenly worn crankshaft. Renew bearings and adjust or change crankshaft. Check lubrication system.
Connecting rod bearing knocking.	This is a little higher-pitched noise than the crankshaft knocking, and also increases when engine is accelerated. Cause a misfire on each cylinder and if the noise deminishes almost completely, this crankshaft bearing generates the noise.	Same as the case of crankshaft bearings.
Piston and cylinder noise.	When you hear an overlapping metalic noise which increases its magnitude with the revolution of engine and which decreases as engine is warmed up, this noise is caused by piston and cylinder. To locate the place, cause a misfire on each cylinder.	This may cause an abnormal wearing of cylinder and lower compression which in turn will cause a lower out-put power and excessive consumption of oil. Overhaul engine.

Condition	Probable cause	Corrective action
Piston pin noise.	This noise is heared at each highest and lowest dead end of piston. To locate the place, cause a misfire on each cylinder.	This may cause a wear on piston pin, or piston pin hole. Renew piston and piston pin assembly.
Water pump noise.	This noise may be caused by worn or damaged bearings, or by the uneven surface of sliding parts.	Replace water pump with a new one.
Others.	An improper adjustment of valve clearance.	Adjust.
	Noise of timing chain.	Adjust the tension of chain.
	An excessive end-play on crankshaft. **Note: This noise will be heared when clutch is disengaged.**	Disassemble engine and renew main bearing.
	Wear on clutch pilot bushing. **Note: This noise will be heared when clutch is disengaged.**	Renew bush and adjust drive shaft.
ABNORMAL COMBUSTION (back fire, after fire run-on etc.)		
Improper ignition timing	Improper ignition timing.	Adjust ignition timing.
	Improper heat range of spark plugs.	Use specified spark plugs.
Fuel system in trouble	Damaged carburetor or manifold gasket. (back fire, after fire)	Replace them with new parts.
	Defective carburetor jet.	Disassemble carburetor and check it.
	Improper function of the float.	Adjust the level, and check needle valve.
	Uneven idling. (Run on)	Adjust.
Defective cylinder head, etc.	Improperly adjusted valve clearance.	Adjust.
	Excess carbon in combustion chamber.	Remove head and get rid of carbon.
	Damaged valve spring (back fire, after fire).	Replace it with a new one.
EXCESSIVE OIL CONSUMPTION		
Oil leakage	Loose oil drain plug.	Tighten it.
	Loose or damaged oil pan gasket.	Renew gasket or tighten it.
	Loose or damaged chain cover gasket.	Renew gasket or tighten it.
	Defective oil seal in front and rear of crankshaft.	Renew oil seal.
	Loose or damaged locker cover gasket.	Renew gasket or tighten it (but not too much).
	Improper tightening of oil filter.	Renew gasket and tighten it with the proper torque.
	Loose or damaged oil pressure switch.	Renew oil pressure switch or tighten it.

Condition	Probable cause	Corrective action
Excessive oil consumption	Cylinder and piston wear.	Overhaul cylinder and renew piston.
	Improper location of piston ring gap or reversely assembled piston ring.	Remount piston rings.
	Damage piston rings.	Renew rings.
		Repair or renew piston and cylinder.
	Worn piston ring groove and ring.	Renew piston and piston ring.
	Fatigue of valve oil seal lip.	Replace seal lip with a new one.
	Worn valve stem.	Renew valve or guide.
Others	Inadequate quality of engine oil.	Use the designated oil.
	Engine overheat.	Previously mentioned.
POOR FUEL ECONOMY		
See the explanation of the power decrease		
Others	Exceeding idling revolution.	Adjust it to the designated rpm.
	Defective acceleration recovery.	Adjust it.
	Fuel leakage.	Repair or tighten the connection of fuel pipes.
TROUBLE IN OTHER FUNCTIONS		
Decreased oil pressure	Inadequate oil quality.	Use the designated oil.
	Overheat.	Previously mentioned.
	Defective function of oil pump regulator valve.	Disassemble oil pump and repair or renew it.
	Functional deterioration of oil pump.	Repair or replace it with a new one.
	Blocked oil filter.	Renew it.
	Increased clearance in various sliding parts.	Disassemble and replace the worn parts with new ones.
	Blocked oil strainer.	Clean it.
	Troubles in oil gauge pressure switch.	Replace it with a new one.
Excessive wear on the sliding parts	Oil pressure decreases.	Previously mentioned.
	Defective quality or contamination of oil.	Exchange the oil with proper one and change element.
	Defective air cleaner.	Change element.
	Overheat or overcool.	Previously mentioned.
	Improper fuel mixture.	Check the fuel system.
Scuffing of sliding parts	Decrease of oil pressure.	Previously mentioned.
	Insufficient clearances.	Readjust to the designated clearances.
	Overheat.	Previously mentioned.
	Improper fuel mixture.	Check the fuel system.

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EM

ENGINE MECHANICAL

EM

GENERAL DESCRIPTION

CONTENTS

L16 AND L18 ENGINES

The L16 and L18 engines feature O.H.C. valves, wedge-shaped combustion chamber, alminum heads and fully balanced 5-bearing crankshaft to turn out smooth, dependable power. The cylinder block is cast in a single unit, featuring deep skirting.

These engines are equipped with a single, 2-barrel, downdraft carburetor that incorporates a special device to control emissions.

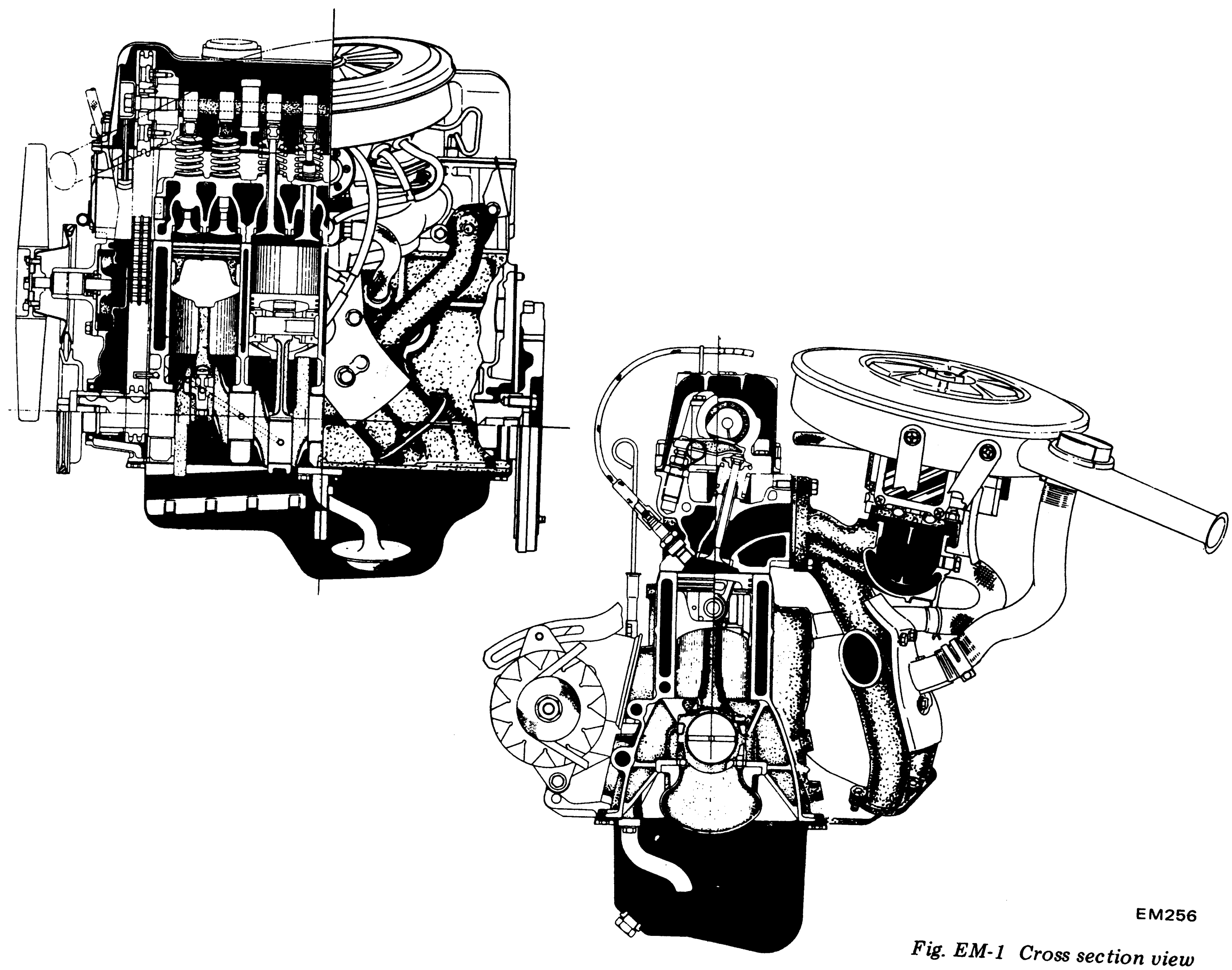


Fig. EM-1 Cross section view

Main specifications

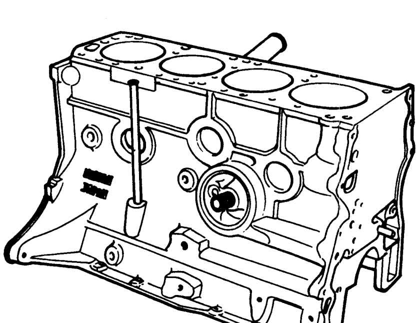
	L16	L18
Displacement cc (cu in)	1,595 (97.33)	1,770 (108.01)
Bore x stroke mm (in)	83 x 73.7 (3.268 x 2.902)	85 x 78 (3.346 x 3.071)
Compression ratio	8.5	←
Ignition timing for M/T B.T.D.C. (for A/T)	5°/800 rpm (Retarded side) (5°/650 rpm in "D" range (Retarded side))	←

M/T: Manual Transmission A/T: Automatic Transmission

CYLINDER BLOCK

The cylinder block, which is of a monoblock special casting structure, adopts five-bearing-support system for quietness and higher durability.

The cylinder bores are surrounded by cooling jackets and machined directly in the block. The oil ways in the block are arranged so that the full-flow oil filter is directly attached to the right hand side of the block.



EM077

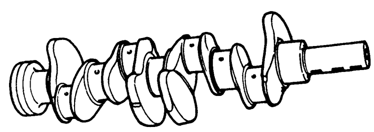
Fig. EM-2 Cylinder block

CRANKSHAFT

The crankshaft is a special steel forging. Fully balanced, it turns out smooth, dependable power at high speed.

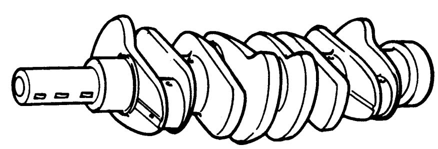
The L18 engine uses eight balance weights, while the others use four.

Main bearings gain lubrication from oil pumped through the main oil gallary and the oil holes which run in parallel with cylinder bores. There are drilled oilways in the crankshaft for the lubricating oil. The center main bearing is equipped with thrust washers to take up end thrust of the crankshaft.



EM078

Fig. EM-3 Crankshaft (L16)



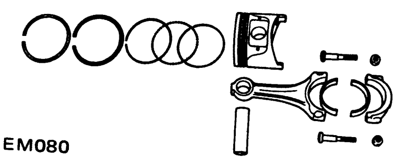
EM079

Fig. EM-4 Crankshaft (L18)

PISTON AND CONNECTING ROD

The pistons are special alminum casting with struts to control thermal expansion and have two compression rings and one combined oil ring. The piston heads are slightly dished. The piston pin is a special hollow steel shaft. It is full-floating fit to the piston and press fit to the connecting rods.

The connecting rods are special forged steel. Oil is sprayed to the connecting rod small ends through drilled passages in the large ends of rod. Oil holes in the connecting rods are located so as to insure optimum lubrication under heavy load.

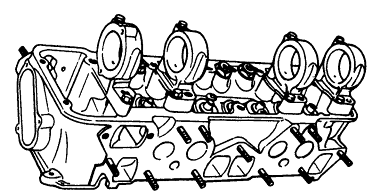


EM080

Fig. EM-5 Piston and connecting rod

CYLINDER HEAD

The cylinder head is made of light and strong aluminum alloy with good cooling efficiency; it contains wedge type combustion chambers. A special aluminum bronze valve seat is used on the intake valve, while a heat resistant steel valve seat is installed on the exhaust valve. These parts are all hot press-fitted.



EM081

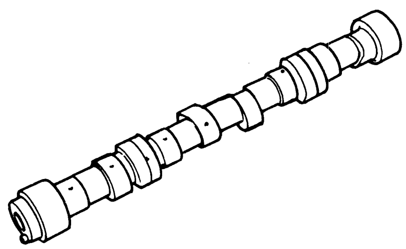
Fig. EM-6 Cylinder head

CAMSHAFT

Camshaft is made of special cast iron and located inside rocker cover. Four aluminum alloy brackets support camshaft. Camshaft bearings are lubricated from oil holes which lead to the main oil gallery of the cylinder head.

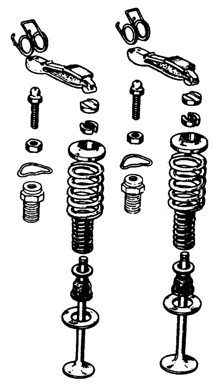
The concentric passages are drilled in the front and rear part of the camshaft.

The oil to each cam lobe is supplied through an oil hole drilled in the base circle of each lobe. Lubricant is supplied to the front oil gallery from 2nd camshaft bearing and to the rear oil gallery from 3rd camshaft bearing. These holes on the base circle of lobe supply lubricant to the cam pad surface of the rocker arm and to the valve tip end. The cams feature a long-overlap profile to reduce NOx emission.



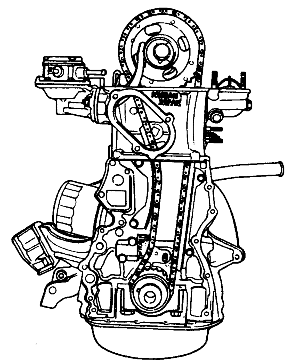
EM082

Fig. EM-7 Camshaft



Exhaust Intake EM084

Fig. EM-8 Valve mechanism



EM085

Fig. EM-9 Chain driving system

MANIFOLDS

The intake manifold is made of casted aluminum alloy.

The exhaust manifold, identical in design on both engine types is a dual exhaust system intended to prevent decrease in output due to exhaust interference and to increase output through the inertia scavenging action. It is connected to exhaust pipes by flanges, which insure complete absence of exhaust leaks.

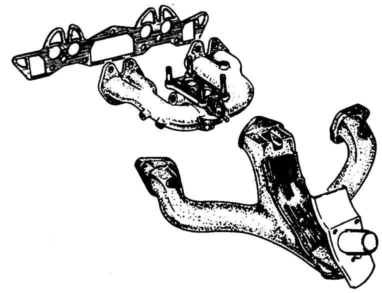
VALVE MECHANISM

The valve system has a pivot type rocker arm that is activated directly by the cam mechanism, and this has made its moving parts considerably lighter and provides an ideal highspeed performance.

Dual type valve springs are equipped.

CAMSHAFT DRIVE

Camshaft is driven by a double row roller chain driven by crankshaft. The tension of the chain is controlled by a chain tensioner which is operated by spring and oil pressure. The rubber shoe type tensioner insulates vibration of the chain and controls tension of the chain.



EM257

Fig. EM-10 Manifolds

ENGINE DISASSEMBLY

CONTENTS

PRELIMINARY CLEANING AND INSPECTION

Before disassembling engine, observe the following items:

1. Fuel, oil or water may leak past cylinder head and block. Prior to disassembling, check cylinder head, front chain cover, oil pan and oil filter gaskets and crankshaft and water pump seals for sign of leak past their gasketed surfaces.

2. Check carburetor and fuel pump for condition; fuel hoses for deterioration, cracks or otherwise leakage of fuel past their jointed or connected surfaces.
3. Remove air cleaner, alternator, distributor and starter, and plug up carburetor air-horn and distributor hole to prevent entry of foreign matter.
4. Wipe dust and mud off engine.
5. Inspect block, rocker cover, front chain cover, oil pan and all other outer parts for visual defects and broken or missing parts such as bolts and nuts.
6. Test all pipings and electrical circuits for discontinuity or broken or damaged insulation.

DISASSEMBLY

To remove engine from car, refer to relative topic under "Engine Removal and Installation" in Chassis and Body Service Manual, Section ER.
1. Remove transmission from engine.
2. Thoroughly drain engine oil and coolant by removing drain plugs.
3. Place engine assembly on the engine stand.
(1) Remove fan and fan pulley.
(2) Remove engine mounting R.H.
(3) Remove oil filter using special tool "Oil Filter Wrench ST19320000."
(4) Remove oil pressure switch.
(5) Install engine attachment to cylinder block using bolt holes securing alternator bracket and water drain plug.
(6) Set engine on the stand.

"Engine Attachment ST05260001"
"Engine Stand ST0501S000"

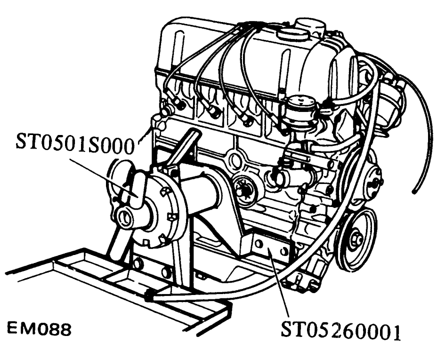


Fig. EM-11 Engine on engine stand

4. Remove oil level gauge.
5. Remove clutch assembly.
6. Remove high tension cable.
7. Remove spark plugs.
8. Remove thermostat housing.

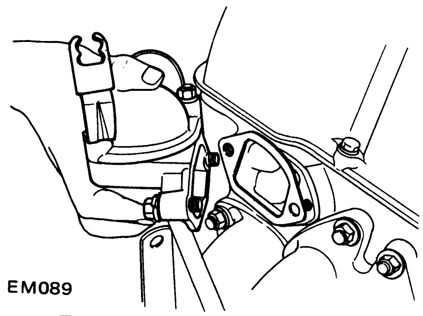


Fig. EM-12 Removing thermostat housing

9. Remove rocker cover.
10. Remove carburetor.
11. Remove intake and exhaust manifolds.

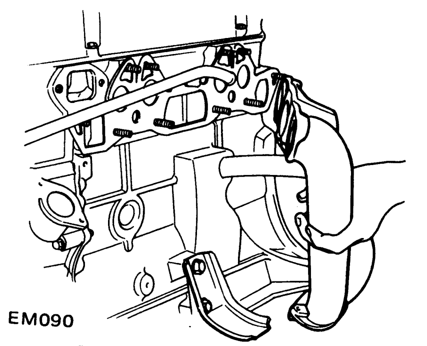


Fig. EM-13 Removing manifolds

12. Remove engine mounting L.H.
13. Remove crank pulley.
14. Remove water pump.
15. Remove fuel pump.
16. Remove fuel pump drive cam.
17. Remove camshaft sprocket.

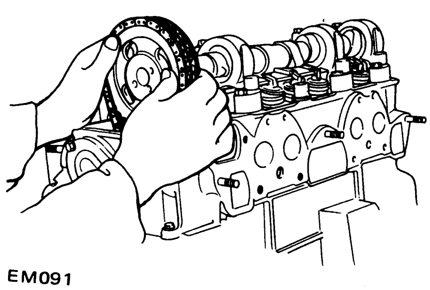


Fig. EM-14 Removing camshaft sprocket

18. Remove cylinder head assembly. Use special tool "Cylinder Head Bolt Wrench ST10120000" to remove cylinder head bolts. Loosen bolts from ① to ⑩ as shown in Figure EM-15.

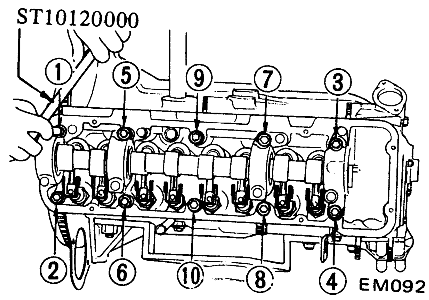


Fig. EM-15 Cylinder head bolt loosening sequence

Note: For the convenience of cylinder head replacement, special tool "Chain Stopper ST17420001" is prepared to support timing chain during the service operation. By using this tool, timing marks on crankshaft sprocket and timing chain will be unchanged. So the work for aligning timing marks will be saved so much.

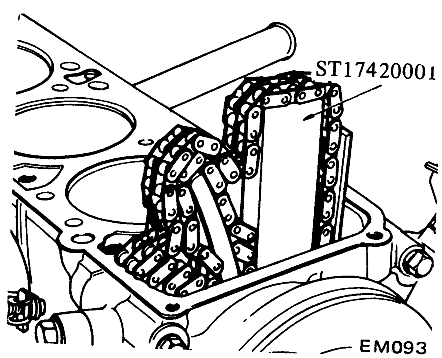


Fig. EM-16 Supporting timing chain

19. Invert engine.
20. Remove oil pan and oil strainer.

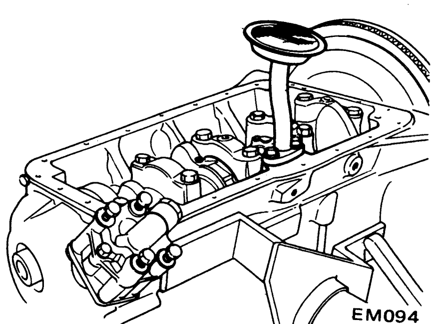


Fig. EM-17 Removing oil strainer and oil pump

21. Remove oil pump and its drive spindle.
22. Remove front cover.
23. Remove chain tensioner.

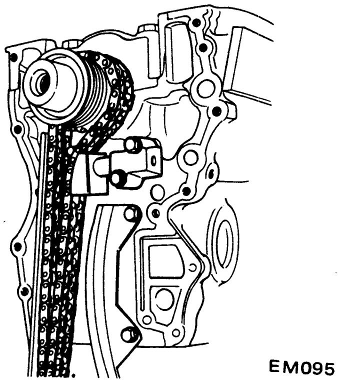


Fig. EM-18 Removing chain tensioner and timing chain

24. Remove timing chain.
25. Remove oil thrower, crankshaft worm gear and chain drive sprocket.

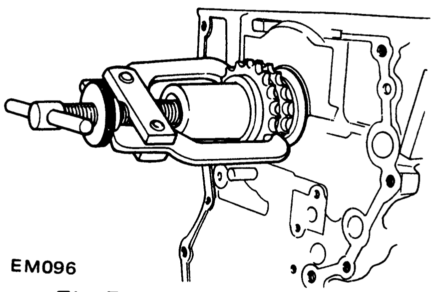


Fig. EM-19 Removing chain drive sprocket

26. Remove piston and connecting rod assembly. Take off connecting rod bearings and keep them in order.

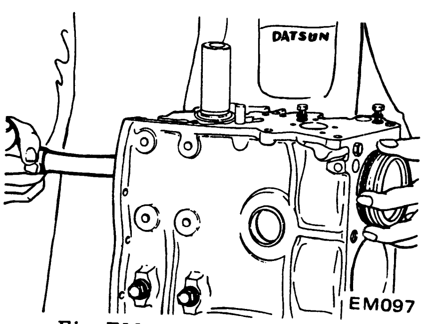


Fig. EM-20 Removing piston and connecting rod assembly

27. Remove flywheel. Be careful not to drop it.

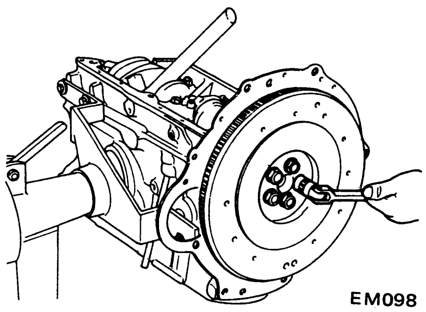


Fig. EM-21 Removing flywheel

28. Remove main bearing caps.
Use special tool "Crankshaft Main Bearing Cap Puller ST1651S000" to remove center and rear main bearing caps. Keep them in order.

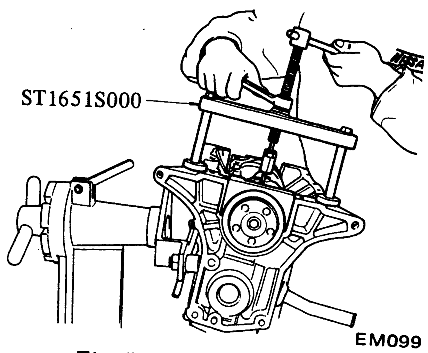


Fig. EM-22 Removing rear main bearing cap

29. Remove rear oil seal.

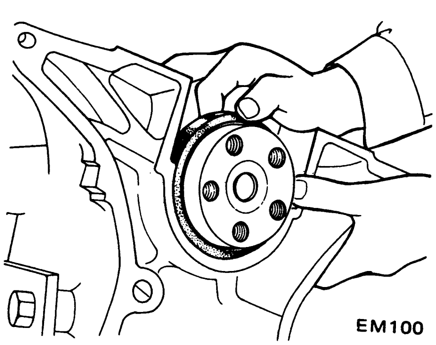


Fig. EM-23 Removing rear oil seal

30. Remove crankshaft.
31. Remove buffle plate and cylinder block net.

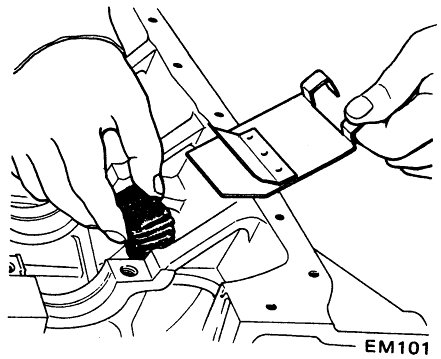


Fig. EM-24 Removing buffle plate and net

PISTONS AND CONNECTING RODS

1. Remove piston rings with a ring remover.

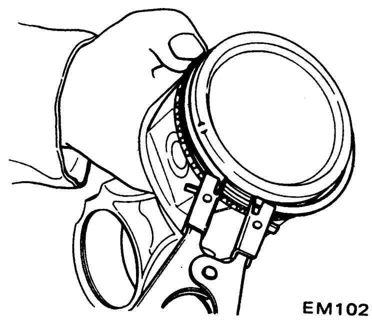


Fig. EM-25 Removing piston ring

2. Press out piston pin with special tool "Piston Pin Press Stand ST13030001."

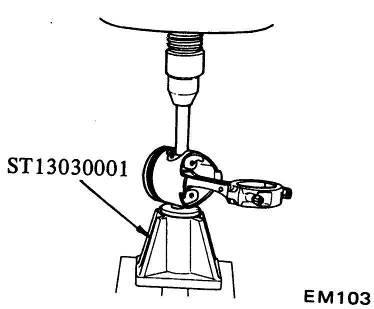


Fig. EM-26 Removing piston pin

3. Keep the disassembled parts in order.

CYLINDER HEAD

1. Loosen valve rocker pivot lock nut and remove rocker arm by pressing down valve spring.

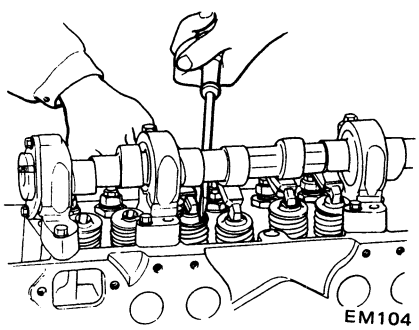


Fig. EM-27 Removing rocker arm

Note: Take care not to lose valve rocker guide.

2. Remove camshaft.

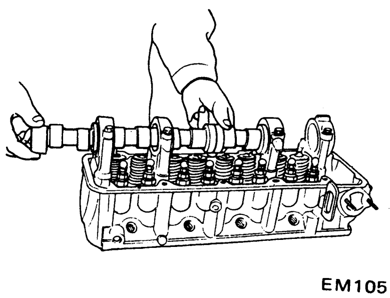


Fig. EM-28 Removing camshaft

Note: At this time, take care not to damage camshaft bearings and cam lobes.

3. Remove valves using special tool "Valve Lifter ST12070000."

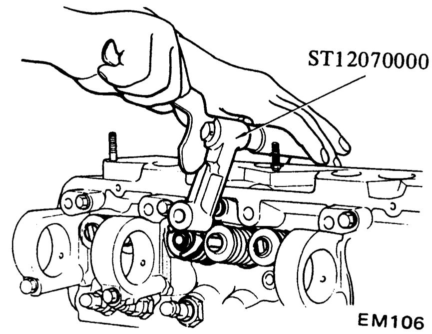


Fig. EM-29 Removing valve

4. Take care not to lose valve spring seat, oil seal, valve collet, and valve rocker guide.

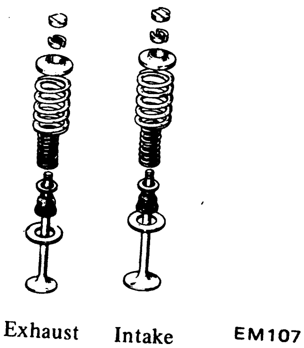


Fig. EM-30 Valve components

Note: Be sure to leave camshaft bearing intact. Because the bearing center is liable to be out of alignment.

INSPECTION AND REPAIR

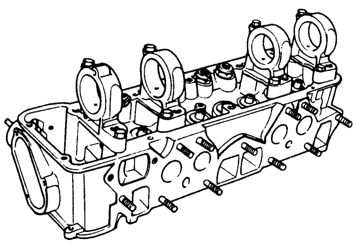
CONTENTS

PREPARATION FOR INSPECTION

1. Before cleaning, check for sign of water and oil leaks in cylinder block and head.
2. Clean oil, carbon deposits and sealant from all parts. Remove gasket.
3. Clean all oil holes with solvent and dry with compressed air. Make sure that they are not restricted.

CYLINDER HEAD AND VALVE

Checking cylinder head mating face

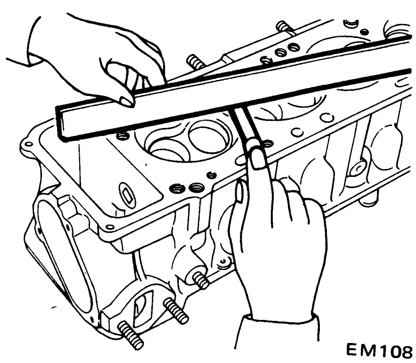


EM081

Fig. EM-31 Cylinder head

Note: Never remove camshaft bearings unless you have a suitable machine for boring camshaft bearing in line. If you once remove camshaft bearings, bearing centers will be out of alignment and reconditioning is very difficult without center borings.

1. Make a visual check for cracks and flaws.
2. Measure the surface of cylinder head (on cylinder block side) for warpage. If it is found to be beyond the limit designated below, regrind the affected surface with a surface grinder.



EM108

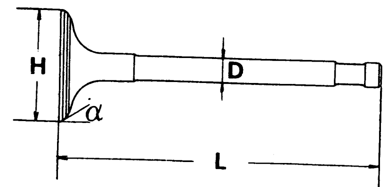
Fig. EM-32 Checking cylinder head surface

Head surface flatness

Standard	Maximum
less than 0.05 mm (0.0020 in)	0.1 mm (0.0039 in)

Valve assembly

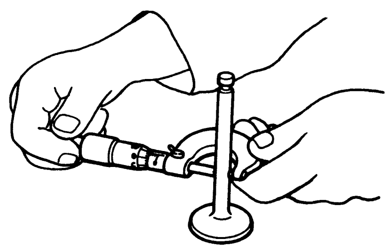
1. Check each of the intake and exhaust valve for worn, damaged or deformed valve caps or stems. Correct or replace the valve that is defective.
2. Valve face or valve stem end surface should be refaced by using a valve grinder.



EM109

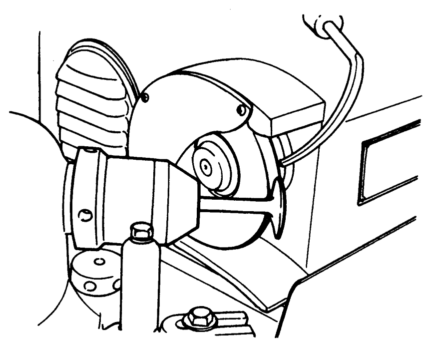
Fig. EM-33 Intake and exhaust valve dimensions

H	Valve head diameter mm (in)	L16	In.	42.0 to 42.2 (1.654 to 1.661)
			Ex.	33.0 to 33.2 (1.299 to 1.307)
		L18	In.	42.0 to 42.2 (1.654 to 1.661)
			Ex.	35.0 to 35.2 (1.378 to 1.386)
L	Valve length mm (in)	L16 L18	In.	114.9 to 115.2 (4.524 to 4.535)
			Ex.	115.7 to 116.0 (4.555 to 4.567)
D	Valve stem diameter mm (in)	L16 L18	In.	7.965 to 7.980 (0.3136 to 0.3142)
			Ex.	7.945 to 7.960 (0.3128 to 0.3134)
α	Valve seat angle In. & Ex.			45°30′



EM110

Fig. EM-34 Checking valve stem diameter



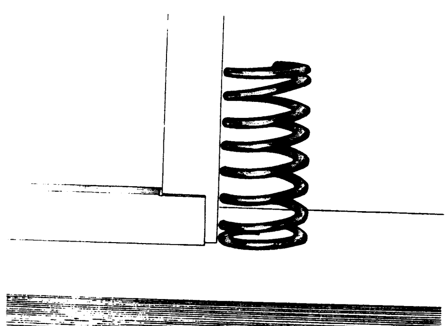
EM111

Fig. EM-35 Regrinding valve face

Note: When valve head has been worn down to 0.5 mm (0.0197 in) in thickness, replace the valve. Grinding allowance for the valve stem end surface is 0.5 mm (0.0197 in) or less.

Valve spring

1. Check valve spring for squareness using a steel square and surface plate. If spring is out of square more than 1.6 mm (0.063 in), replace with a new one.
2. Measure the free length and the tension of each spring. If the measured value exceeds the specified limit, replace spring.



EM112

Fig. EM-36 Measuring spring squareness

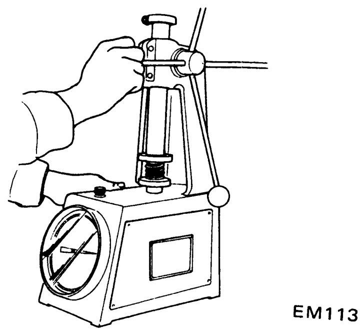


Fig. EM-37 Measuring spring tension

Spring specifications

		L16 and L18
Valve spring free length mm (in)		
Intake	Outer	49.98 (1.968)
	Inner	44.85 (1.766)
Exhaust	Outer	49.98 (1.968)
	Inner	44.85 (1.766)
Valve spring pressured length (valve open) mm/kg (in/lb)		
Intake	Outer	29.5/49.0 (1.161/108)
	Inner	24.5/25.5 (0.965/56.2)
Exhaust	Outer	29.5/49.0 (1.161/108)
	Inner	24.5/25.5 (0.965/56.2)
Valve spring assembled height (valve close) mm/kg (in/lb)		
Intake	Outer	40.0/21.3 (1.575/47.0)
	Inner	35.0/12.3 (1.378/27.1)
Exhaust	Outer	40.0/21.3 (1.575/0.839)
	Inner	35.0/12.3 (1.378/0.484)

Rocker arm and valve rocker pivot

Check pivot head and cam contact and pivot contact surfaces of rocker arm for damage or wear. If defects are found, replace them. A defective pivot necessitates its replacement together with the corresponding rocker arm.

Valve guide

Measure the clearance between valve guide and valve stem. If the clearance exceeds the designated limit, replace the worn parts or both valve and valve guide. In this case, it is essential to determine if such a clearance has been caused by a worn or bent valve stem or by a worn valve guide.

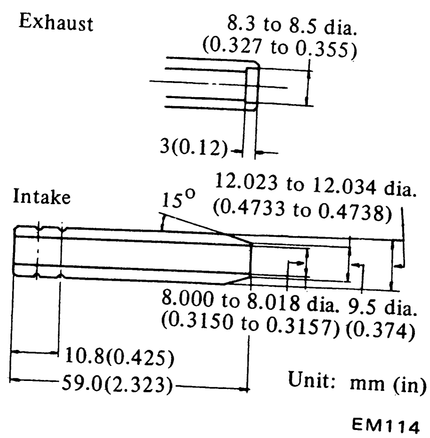


Fig. EM-38 Standard valve guide

		Intake valve	Exhaust valve
Stem to guide clearance mm (in)	L16, L18	0.020 to 0.053 (0.0008 to 0.0021)	0.040 to 0.073 (0.0016 to 0.0029)
Max. tolerance of above clearance mm (in)	L16, L18	0.1 (0.0039)	

As an emergency expedient, a valve is pushed in valve guide and moved to the left and the right at which point if its tip deflects about 0.2 mm (0.0079 in) or more, it will be known that the clearance between stem and guide exceeds the maximum limit of 0.1 mm (0.0039 in).

Note: Valve should be moved in parallel with rocker arm. (Generally, a large amount of wear occurs in this direction.)

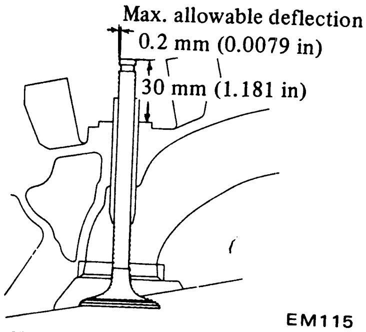


Fig. EM-39 Measuring clearance between valve stem and valve guide

Replacement of valve guide

1. To remove old guides, use a drift and a press (under a 2-ton pressure) or a hammer.

Drive them out from combustion chamber side toward rocker cover. Heated cylinder head will facilitate the operation.

2. Ream cylinder head side guide hole at room temperature.

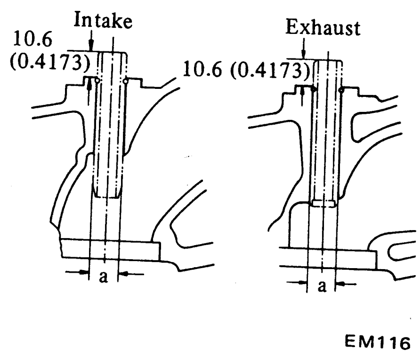


Fig. EM-40 Valve guide hole

		L16 and L18
Guide hole inner diameter "a" mm (in)	For standard valve guide	11.985 to 11.996 (0.4719 to 0.4723)
	For service valve guide	12.185 to 12.196 (0.4797 to 0.4802)

3. Press new valve guide into valve carefully so that it will fit smoothly after heating cylinder head to 150° to 200°C (302° to 392°F).

Valve guide of 0.2 mm (0.0079 in) oversize diameter is available for service.

	L16 and L18
Interference fit of valve guide to guide hole mm (in)	0.027 to 0.049 (0.0011 to 0.0019)

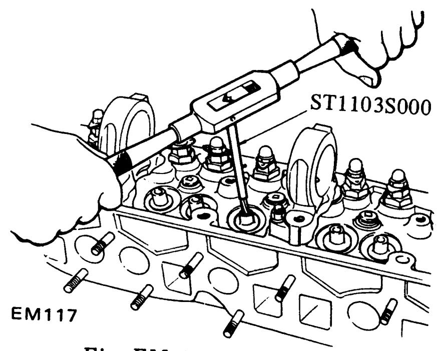


Fig. EM-41 Reaming valve guide

4. Ream the bore with valve guide pressed in, using special tool "Valve Guide Reamer Set ST1103S000."

Reaming bore:
8.000 to 8.018 mm
(0.3150 to 0.3157 in)

5. Correct valve seat surface with new valve guide as the axis.

Valve seat inserts

Check valve seat inserts for any evidence of pitting at valve contact surface, and reseat or replace if worn out excessively.

Valve seat insert of 0.5 mm (0.0197 in) oversize is available for service in this L series engine.

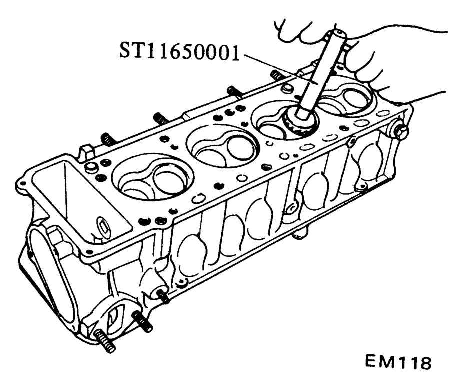


Fig. EM-42 Correcting valve seat

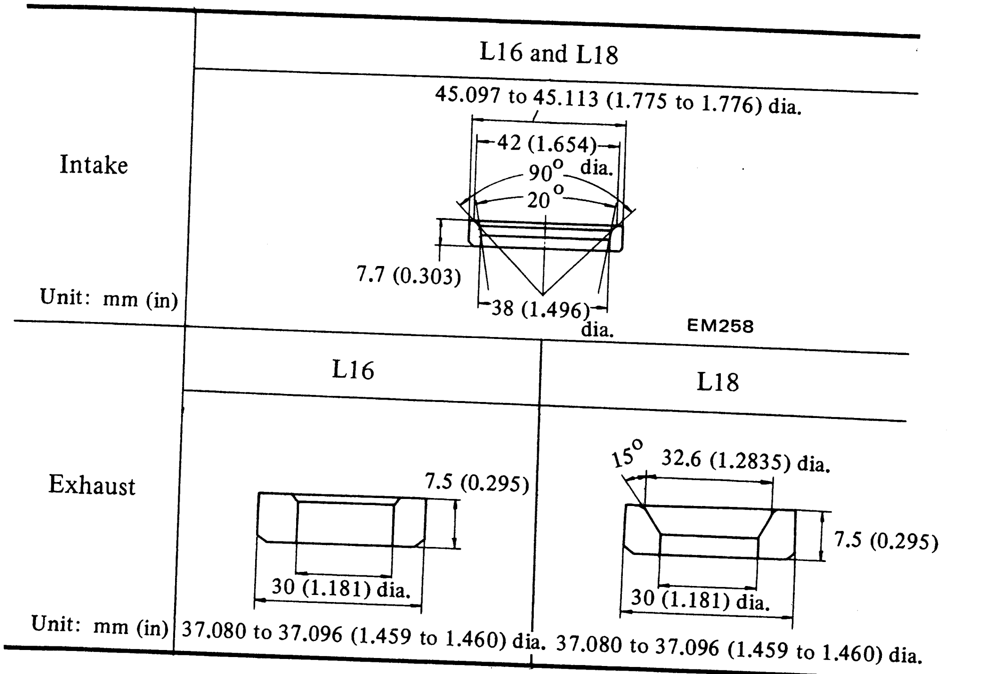


Fig. EM-43 Standard valve seat dimensions

Cylinder head recess diameter

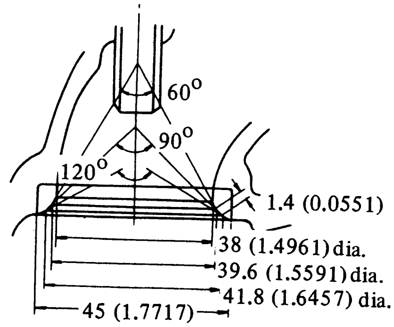
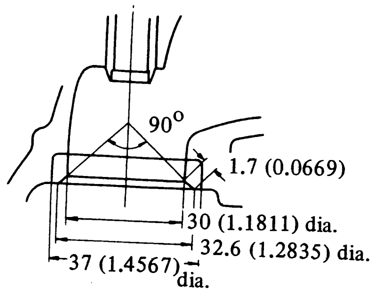
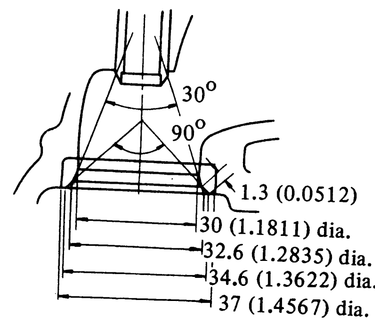
Unit: mm (in)

		L16 and L18
Intake	For factory standard insert	45.000 to 45.016 (1.7717 to 1.7723)
	For service insert	45.500 to 45.516 (1.7913 to 1.7920)
Exhaust	For factory standard insert	37.000 to 37.016 (1.4567 to 1.4573)
	For service insert	37.500 to 37.516 (1.4764 to 1.4770)

Interference fit mm (in)	Intake	0.081 to 0.113 (0.0032 to 0.0044)
	Exhaust	0.064 to 0.096 (0.0025 to 0.0038)

Replacing valve seat insert

1. Old insert can be removed by boring out until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the insert recess in cylinder head.
2. Select a suitable valve seat insert and check its outside diameter.
3. Machine cylinder head recess to the concentric circles to valve guide center so that insert will have the correct fit.
4. Ream the cylinder head recess at room temperature.
5. Heat cylinder head to a temperature of 150° to 200°C (302° to 392°F).
6. Fit insert ensuring that it beds on the bottom face of its recess, and caulk more than 4 points.
7. Valve seats newly fitted should be cut or ground at the specified dimensions as shown in Figure EM-44.
8. Apply small amount of fine grinding compound to valve contacting face and put valve into guide. Lap valve against its seat until proper valve seating is obtained. Remove valve and then clean valve and valve seat.

	L16 and L18	
Intake Unit: mm (in)		
	L16	L18
Exhaust Unit: mm (in)		

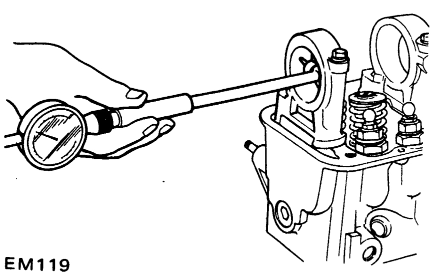
EM121

Fig. EM-44 Valve seat dimensions

CAMSHAFT AND CAMSHAFT BEARING

Camshaft bearing clearance

Measure the inside diameter of camshaft bearing with an inside dial gauge and the outside diameter of camshaft journal with a micrometer. If wear is found inside bracket, replace cylinder head assembly.



EM119

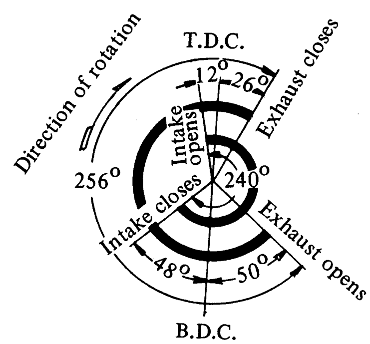
Fig. EM-45 Checking camshaft bearing

Camshaft journal to bearing clearance

	Standard	Wear limit
Oil clearance mm (in)	0.038 to 0.067 (0.0015 to 0.0026)	0.1 (0.0039)
Inner diameter of cam shaft bearing mm (in)	48.000 to 48.016 (1.8898 to 1.8904)	——

Valve timing

This diagram will apply to all cylinders. If any valve is found "out of specifications," one possibility is that cam lobe is worn or damaged, calling for replacement of camshaft.



EM259

Fig. EM-46 Valve timing diagram

	Standard	Bend limit
Camshaft bend mm (in)	0.02 (0.0008)	0.05 (0.0020)

Camshaft alignment

1. Check camshaft, camshaft journal and cam surface for bend, wear or damage. If defects are beyond the limits, replace the affected parts.
2. A bend valve is one-half of the reading obtained when camshaft is turned one full revolution with a dial gauge to 2nd and 3rd journals.

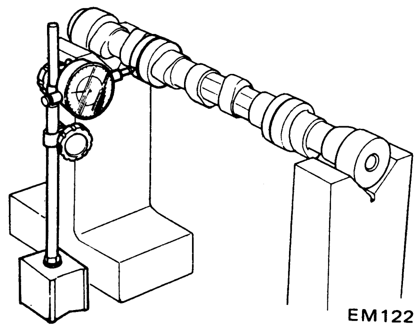


Fig. EM-47 Checking camshaft bend

		L16 and L18
Standard height of cam mm (in)	Intake	39.95 to 40.00 (1.5728 to 1.3748)
	Exhaust	
Wear limit of cam height mm (in)		0.25 (0.0098)
Allowable difference in diameter between max. worn and min. worn parts of camshaft journal mm (in)		0.05 (0.0020)
Maximum tolerance in journal diameter mm (in)		0.1 (0.0039)
Camshaft end play mm (in)		0.08 to 0.38 (0.0031 to 0.0150)

	Standard	Maximum tolerance
Surface flatness mm (in)	less than 0.05 (0.0020)	0.10 (0.0039)

CYLINDER BLOCK

1. Visually check cylinder block for cracks or flaws.

2. Measure the top of cylinder block (cylinder head mating face) for warpage. If warpage exceeds the limit, correct it.

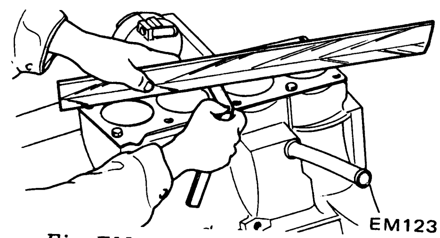


Fig. EM-48 Checking cylinder block surface

3. Using a bore gauge, measure cylinder bore for out-of-round or taper. If, out-of-round or taper is excessive, rebore the cylinder walls by means of a boring machine. Measurement should be taken along bores for taper and around bores for out-of-round. See Figure EM-50.

Out-of-round X-Y
Taper A-B

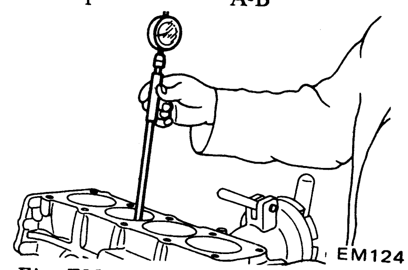


Fig. EM-49 Measuring cylinder bore diameter

4. When wear, taper or out-of-round is minor and within the limit, remove the step at the topmost portion of cylinder using a ridge reamer or other similar tool.

How to measure cylinder bore

A bore gauge is used. Measure cylinder bore at top, middle and bottom positions toward A and B directions as shown in Figure EM-50 and record the measured values.

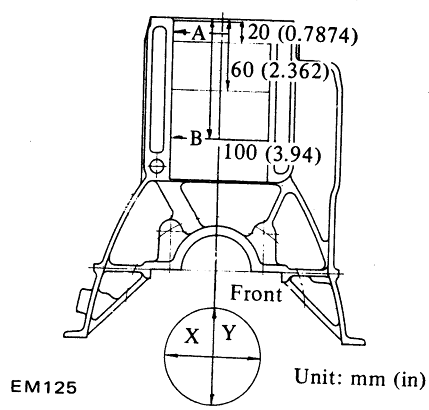


Fig. EM-50 Cylinder bore measuring positions

		Standard		Wear limit
		L16	L18	
Cylinder bore mm (in)	Inner diameter	83.000 to 83.050 (3.2677 to 3.2697)	85.000 to 85.050 (3.3465 to 3.3484)	0.2 (0.0079)
	Out-of-round	0.015 (0.0006)		
	Taper	0.015 (0.0006)		
Difference in cylinder bore mm (in)		0.05 (0.0020)		0.2 (0.0079)

Oversize pistons specifications

	L16	L18
Piston diameter mm (in)		
Standard	82.985 to 83.035 (3.2671 to 3.2691)	84.985 to 85.035 (3.3459 to 3.3478)
0.50 (0.0197) Oversize	83.465 to 83.515 (3.2860 to 3.2880)	85.465 to 85.515 (3.3648 to 3.3667)
1.00 (0.0394) oversize	83.965 to 84.015 (3.3057 to 3.3077)	86.965 to 86.015 (3.4238 to 3.3864)

Cylinder boring

1. When any of cylinders needs boring, all other cylinders must also be bored at the same time.
2. Determine piston oversize according to the amount of wear of cylinder.
3. The size to which cylinders must be honed is determined by adding to the largest piston diameter (at piston skirt in thrust direction) piston-to-cylinder clearance.

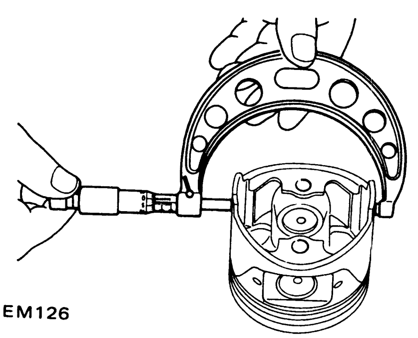


Fig. EM-51 Measuring piston diameter

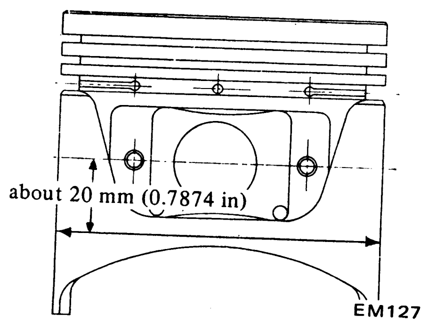


Fig. EM-52 Measuring piston skirt diameter

Rebored size calculation

D = A + B - C = A + [0.005 to 0.025 mm (0.0002 to 0.0010 in)]

Where,

D: Honed diameter

A: Skirt diameter as measured

B: Piston-to-wall clearance

C: Machining allowance (0.02 mm) (0.0008 in)

Note: To prevent strain due to cutting heat, bore the cylinders in the order of 2-4-1-3.

4. Do not cut too much out of cylinder bore at a time, but cut 0.05 mm (0.0020 in) or so at a time.
5. Measurement of cylinder bore just machined requires the utmost care since it is expanded by cutting heat.
6. As a final step, cylinders should be honed to size.
7. Measure the finished cylinder bore for out-of-round or tapered part.
8. Measure piston to cylinder clearance.

This clearance can be checked easily by using a feeler gauge and a spring balance hooked on feeler gauge, measuring the amount of force required to pull out gauge from between piston and cylinder.

Notes:

a. When measuring the clearance, slowly pull the feeler gauge straight upward.

b. It is recommended that piston and cylinder be heated to 20°C (68°F).

		L16 and L18
Standard clearance	mm (in)	0.025 to 0.045 (0.0010 to 0.0018)
Feeler gauge	mm (in)	0.04 (0.0016)
Extracting force	kg (lb)	0.2 to 1.5 (0.44 to 3.31)

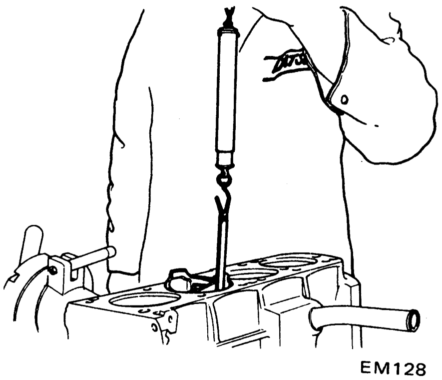


Fig. EM-53 Measuring piston fit in cylinder

Note: If cylinder bore has worn beyond the wear limit, use cylinder liner.
Undersize cylinder liners are available for service.
Interference fit of cylinder liner in cylinder block should be 0.075 to 0.085 mm (0.0030 to 0.0033 in).

Cylinder liner for service

Unit: mm (in)

	L16	
	Outside diameter	Inner diameter
4.0 (0.1575) Undersize	87.00 to 87.05 (3.4252 to 3.4272)	
4.5 (0.1772) Undersize	87.50 to 87.55 (3.4449 to 3.4468)	82.50 to 82.60 (3.2480 to 3.2520)
5.0 (0.1969) Undersize	88.00 to 88.05 (3.4646 to 3.4665)	

PISTONS, PISTON PINS AND PISTON RINGS

1. Remove carbon from piston and ring grooves with a carbon scraper and a curved steel wire. The wire will be useful in cleaning bottom land of ring groove. Clean out oil slots in bottom land of oil ring groove.
2. Check for damage, scratches and wear. Replace if such a defect is detected.
3. Measure the side clearance of rings in ring grooves as each ring is installed. Clearance with new pistons and rings should be as follows.

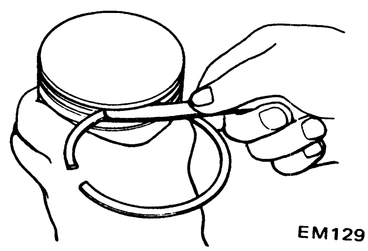


Fig. EM-54 Measuring piston ring side clearance

Side clearance

Unit: mm (in)

	Standard		Wear limit
	L16	L18	
Top ring	0.040 to 0.080 (0.0016 to 0.0031)	0.045 to 0.08 (0.0018 to 0.0031)	0.1 (0.0039)
Second ring	0.030 to 0.070 (0.0012 to 0.0028)	←	
Oil ring	–	–	–

Ring gap

Unit: mm (in)

	Standard		Wear limit
	L16	L18	
Top ring	0.25 to 0.40 (0.0098 to 0.0157)	0.35 to 0.55 (0.0138 to 0.0217)	
Second ring	0.15 to 0.30 (0.0059 to 0.0118)	0.30 to 0.50 (0.0118 to 0.0197)	1.0 (0.0394)
Oil ring	0.3 to 0.9 (0.0118 to 0.0354)	←	

4. Push ring into cylinder with a piston so as to place it squarely in cylinder; measure ring gap with a feeler gauge.

Ring should be placed to diameter at upper or lower limit of ring travel.

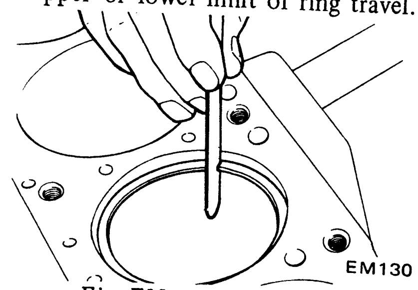


Fig. EM-55 Measuring ring gap

Notes:

a. When piston ring only is to be replaced, without cylinder bore being corrected, measure the gap at the bottom of cylinder where the wear is minor.

b. Oversize piston rings are available for service.

L16: 0.5 mm (0.0197 in), 1.0 mm (0.0394 in) and 1.5 mm (0.0591 in) oversize.

L18: 0.5 mm (0.0197 in) and 1.0 mm (0.0394 in).

5. Measure piston pin hole in relation to the outer diameter of pin. If wear exceeds the limit, replace such piston pin together with piston on which it is installed.

6. Determine the fitting of piston pin into piston pin hole to such an extent that it can be finger pressed at room temperature. This piston pin must be a tight press fit into connecting rod.

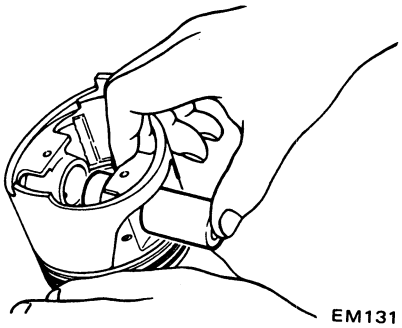


Fig. EM-56 Piston pin fitting

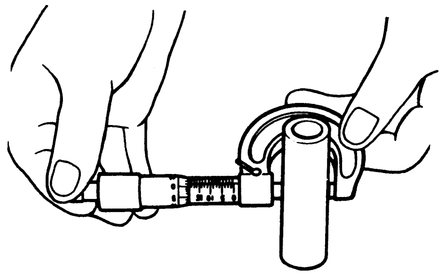


Fig. EM-57 Measuring piston pin diameter

Unit: mm (in)

	L16 and L18
Piston pin outside diameter	20.993 to 20.998 (0.8265 to 0.8266)
Piston pin hole diameter	21.001 to 21.008 (0.8268 to 0.8271)
Piston pin to piston clearance	0.003 to 0.015 (0.0001 to 0.0006)
Interference fit of piston pin to connecting rod	0.015 to 0.033 (0.00059 to 0.00130)

	Model	Standard	Maximum
Connecting rod bend or torsion (per 100 mm or 3.94 in length) mm (in)	L16 L18	0.03 (0.0012)	0.05 (0.0020)

L14, L16 and L18	Standard	Maximum
Big end play mm (in)	0.2 to 0.3 (0.0079 to 0.0118)	0.6 (0.0118)

CONNECTING ROD

1. If a connecting rod has any flaw on both sides of the thrust face and the large end, correct or replace it.

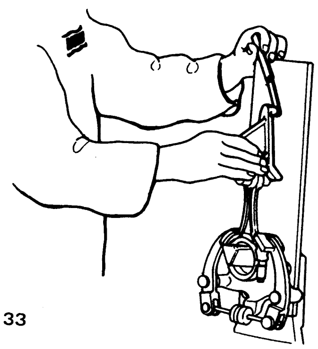


Fig. EM-58 Checking rod alignment

2. Check connecting rod for bend or torsion using a connecting rod aligner. If bend or torsion exceeds the limit, correct or replace.

3. When replacing connecting rod, select rod so that weight difference between new and old ones is within 7 gr (0.25 oz).

4. Install connecting rods with bearings on to corresponding crank pins and measure the thrust clearance. If the measured value exceeds the limit, replace such connecting rod.

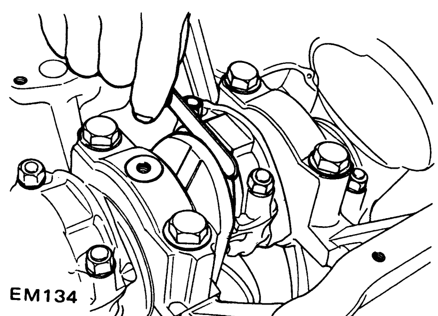


Fig. EM-59 Checking big end play

CRANKSHAFT

1. Whenever crankshaft is removed from engine, it should be cleaned thoroughly in a suitable solvent. After cleaning check crankshaft journal and crank pin for score, bias wear or cracks. Repair or replace as required. If defects are minor, dress with fine crocus cloth.

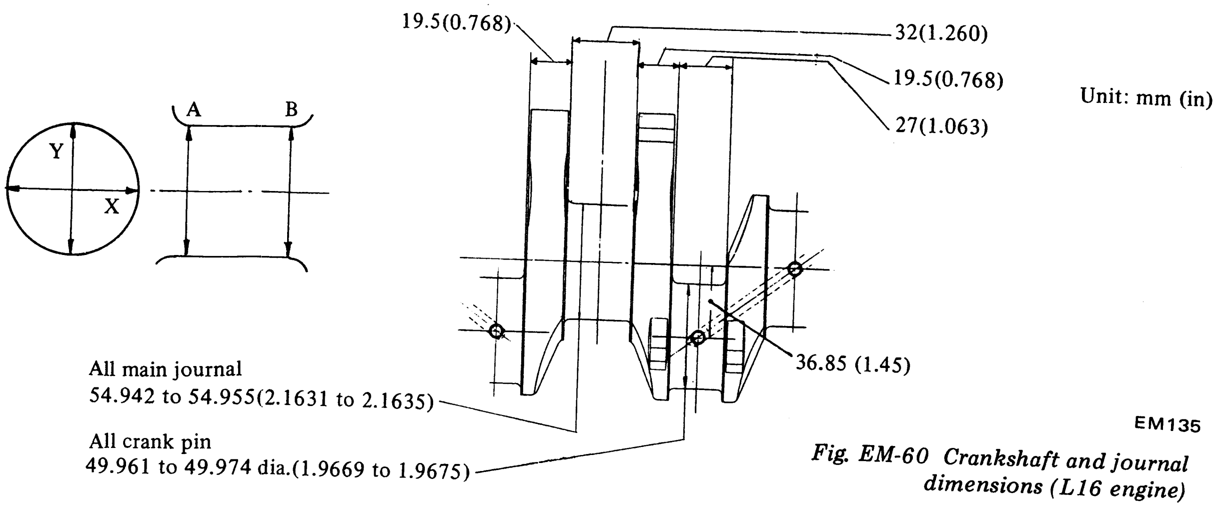


Fig. EM-60 Crankshaft and journal dimensions (L16 engine)

2. Check with a micrometer journals and crank pins for taper and out-of-round. Measurement should be taken along journals for taper and around journals for out-of-round. See Figure EM-60 for detail information.

Out-of-round	X-Y
Taper	A-B

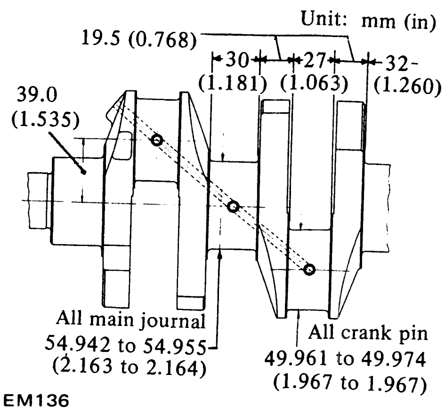


Fig. EM-61 Crankshaft and journal dimensions (L18 engine)

If journals or crank pins are tapered or out-of-round beyond limits, replace with a new shaft.

3. Crankshaft bend can be checked by placing it on V-blocks and using a dial gauge with its indicating finger resting on center journal.

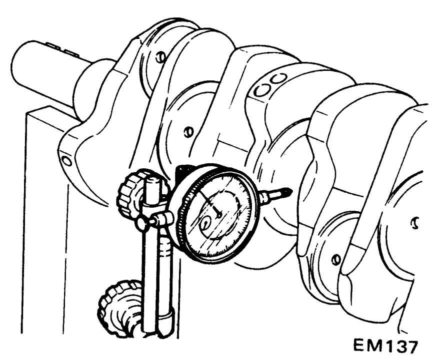


Fig. EM-62 Checking crankshaft bend

Note: When measuring bend, use a dial gauge. Bend value is a half of the reading obtained when crankshaft is turned one full revolution with a dial gauge attached to its center journal.

4. After regrinding crankshaft, finish it to the necessary size indicated in the list on page EM-19 by using an adequate undersize bearing according to the extent of required repair.

5. Install crankshaft in cylinder block and measure crankshaft free end play.

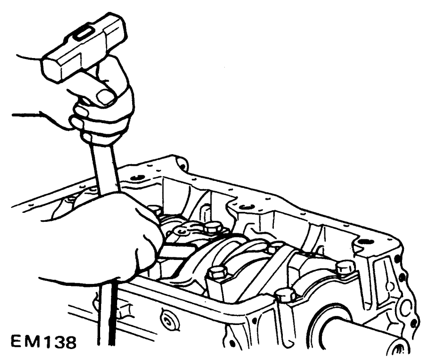


Fig. EM-63 Checking crankshaft end play

L16 and L18	Standard	Maximum
Taper and out-of-round of journal and crank pin mm (in)	less than 0.01 (0.0004)	0.03 (0.0012)

L16 and L18	Standard	Maximum
Crankshaft bend mm (in)	less than 0.05 (0.0020)	0.10 (0.0039)

	Standard	Wear limit
Crankshaft free end play mm (in)	0.05 to 0.18 (0.0020 to 0.0071)	0.3 (0.0118)

6. At the rear end of crankshaft, check crankshaft pilot bushing for wear or damage. Replace it, if any defect is detected.

To replace crankshaft rear pilot bushing, proceed as follows:

(1) Pull out bushing using special tool "Pilot Bushing Puller ST16610001."

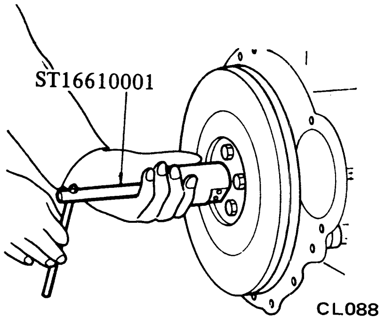


Fig. EM-64 Pulling out pilot bushing

(2) Before installing a new bushing, thoroughly clean bushing hole. Press fit bushing so that its height above flange end is 4.5 to 5.0 mm (0.177 to 0.197 in). Do not oil bushing.

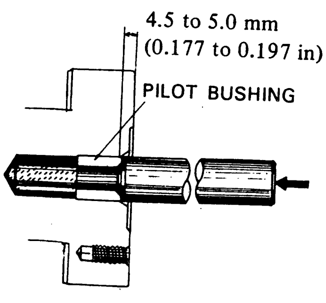


Fig. EM-65 Press-fitting new pilot bushing

BUSHING AND BEARING

Measurement of main bearing clearance

1. Thoroughly clean all bearings and check for scratches, melt, score or wear.

Replace bearings, if any defect is detected.

2. Crankshaft journals and bearings should be clean and free from dust and dirt before oil clearance is measured.

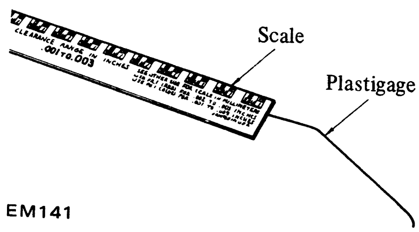


Fig. EM-66 Plastigage

3. Set main bearing on cap block.

4. Cut a plastigage to the width of bearing and place it in parallel with crank pin, getting clear of the oil hole. Install cap on the assembly and tighten them together to the specified torque.

Tightening torque:
4.5 to 5.5 kg-m
(33 to 40 ft-lb)

Note: Do not turn crankshaft while the plastigage is being inserted.

5. Remove cap, and compare width of the plastigage at its widest part with the scale printed in the plastigage envelope.

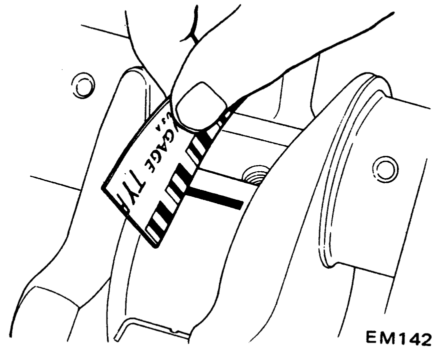


Fig. EM-67 Measuring bearing clearance

Measurement of connecting rod bearing clearance

1. Measure connecting rod bearing clearance in the same manner as above.

Tightening torque:

3.2 to 3.8 kg-m (23 to 28 ft-lb)	for L16
4.5 to 5.5 kg-m (33 to 40 ft-lb)	for L18

Bearing oil clearance

L16 and L18	Standard	Wear limit
Main bearing clearance mm (in)	0.020 to 0.062 (0.0008 to 0.0024)	0.12 (0.0047)
Connecting rod bearing clearance mm (in)	0.025 to 0.055 (0.0010 to 0.0022)	0.12 (0.0047)

2. If clearance exceeds the specified value, replace bearing with an undersize bearing and grind the crankshaft journal adequately.

Fitting bearings

Bearings are manufactured with crush to make bearings snug down into its bore. To measure this, proceed as follows:

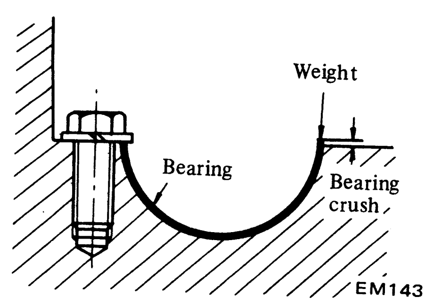


Fig. EM-68 Checking bearing crush

1. Set main bearing in main bearing cap recess or cylinder block bearing recess correctly.
2. Lock the one side end of bearing and press the other side until the bearing back surface touches the recess.
3. Then, measure bearing crush "H" with a feeler gauge. See Figure EM-68. The standard bearing crush value is listed below.
4. Handle connecting rod bearing in the same manner as above.

Bearing crush

		L16 and L18
All main bearing	mm (in)	0 to 0.03 (0 to 0.0012)
All connecting rod bearing	mm (in)	0.015 to 0.045 (0.0006 to 0.0018)

Main bearing undersize

Unit: mm (in)

L16 and L18	Bearing top thickness	Crank journal diameter
STD	1.822 to 1.835 (0.0717 to 0.0722)	54.942 to 54.955 (2.1631 to 2.1636)
0.25 (0.0098) Undersize	1.947 to 1.960 (0.0767 to 0.0772)	54.692 to 54.705 (2.1532 to 2.1537)
0.50 (0.0197) Undersize	2.072 to 2.085 (0.0816 to 0.0821)	54.442 to 54.455 (2.1434 to 2.1439)
0.75 (0.0295) Undersize	2.197 to 2.210 (0.0865 to 0.0870)	54.192 to 54.205 (2.1335 to 2.1341)
1.00 (0.0394) Undersize	2.322 to 2.335 (0.0914 to 0.0919)	53.942 to 53.955 (2.1237 to 2.1242)

Connecting rod bearing undersize

Unit: mm (in)

	Bearing top thickness	Crank pin diameter
	L16 and L18	L16 and L18
STD	1.493 to 1.506 (0.0588 to 0.0593)	49.961 to 49.974 (1.9670 to 1.9675)
0.06 (0.0024) Undersize	1.523 to 1.536 (0.0600 to 0.0605)	49.901 to 49.914 (1.9646 to 1.9651)
0.12 (0.0047) Undersize	1.553 to 1.566 (0.0611 to 0.0617)	49.841 to 49.854 (1.9622 to 1.9628)
0.25 (0.0098) Undersize	1.618 to 1.631 (0.0637 to 0.0642)	49.711 to 49.724 (1.9571 to 1.9576)
0.50 (0.0197) Undersize	1.743 to 1.756 (0.0686 to 0.0691)	49.461 to 49.474 (1.9473 to 1.9478)
0.75 (0.0295) Unsersize	1.868 to 1.881 (0.00735 to 0.0741)	49.211 to 49.224 (1.9374 to 1.9379)
1.00 (0.0394) Undersize	1.993 to 2.006 (0.0785 to 0.0790)	48.961 to 48.974 (1.9276 to 1.9281)

MISCELLANEOUS COMPONENTS

Crankshaft sprocket, camshaft sprocket

1. Check tooth surface for flaws or wear. Replace sprocket if any defect is found.
2. Install camshaft sprocket in position and check for runout. If it exceeds 0.1 mm (0.0039 in) total indicator reading, replace camshaft sprocket. Also check for end play.

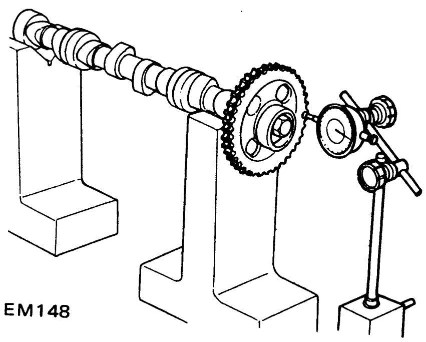


Fig. EM-69 Checking camshaft sprocket runout

L16 and L18	
Camshaft end play mm (in)	0.08 to 0.38 (0.0031 to 0.0150)

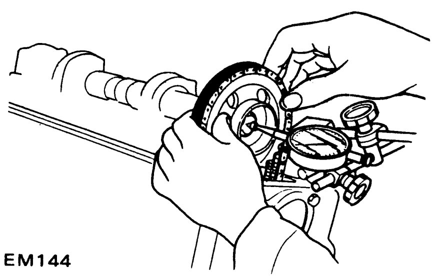


Fig. EM-70 Checking camshaft end play

3. Check chain for damage, excessive wear or stretch at its roller links. Replace a defective chain.
4. When chain stretches excessively, the valve timing goes out of order. On L16 and L18 engines, two location (camshaft set) holes are provided in camshaft sprocket to correct the valve timing.

Adjust camshaft sprocket location. If the stretch of chain roller links is excessive, adjust the camshaft sprocket location by transferring the camshaft set position of camshaft sprocket to No. 3 hole.

1. Turn engine until No. 1 piston is at T.D.C. on its compression stroke. Examine whether camshaft sprocket location notch comes off the left end of the oblong groove on camshaft locate plate. (If the location notch is off the left end of the oblong groove, the stretch of chain is beyond the limit.)

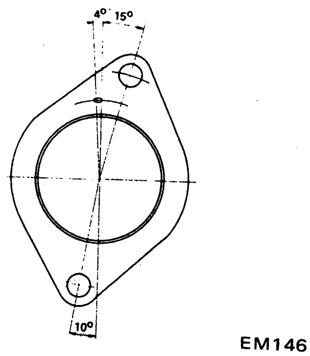


Fig. EM-71 Camshaft locate plate

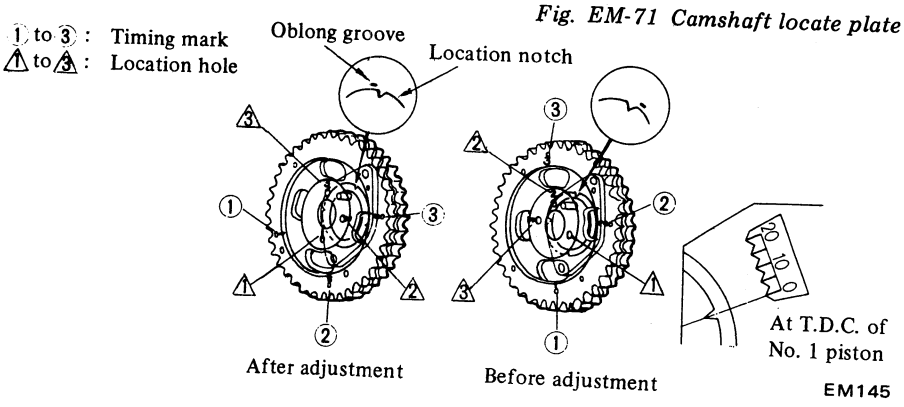


Fig. EM-72 Adjusting camshaft sprocket location

2. Turn engine until No. 1 piston is at T.D.C. on its compression stroke, setting camshaft on No. 3 location hole in camshaft sprocket. Then this No. 3 notch should be on the right end of the oblong groove. When No. 3 hole is used, also No. 3 timing mark has to be used. The amount of the modification is 4° by the rotation of crankshaft.

Note: No. 2 hole is factory adjusted. (No. 1 hole is used for 6 cylinder engine and not for the L16 and L18 engines). Then, if the stretch of chain is beyond the limit, transfer the camshaft sprocket location hole from No. 2 to No. 3.

3. When the modification becomes impossible even by transferring the camshaft location hole, replace chain assembly.

Chain tensioner and chain guide

Check for wear and breakage. Replace if necessary.

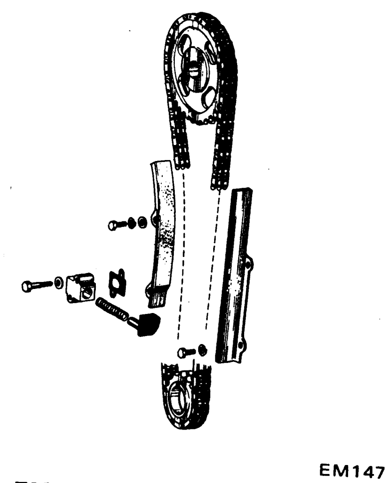


Fig. EM-73 Camshaft drive mechanism

Flywheel

1. Check the clutch disc contact surface with flywheel for damage or wear. Repair or replace if necessary.
2. Measure runout of the clutch disc contact surface with a dial gauge. If it exceeds 0.15 mm (0.0059 in) total indicator reading, replace it.

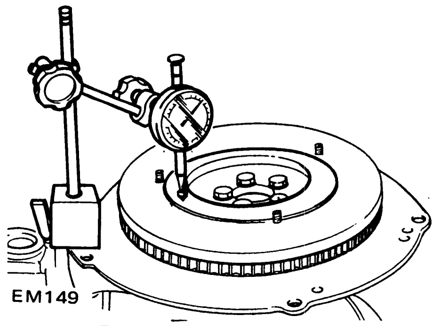


Fig. EM-74 Checking flywheel deviation

3. Check tooth surfaces of ring gear for flaws or wear.

Replace if necessary.

Note: Replace ring gear at about 180°C to 220°C (356° to 428°F).

Front cover and rear oil seal

First check front cover and rear oil seal for worn or folded over sealing lip or oil leakage. If necessary, replace with a new seal. When installing a new seal, pay attention to its mounting direction.

Note: It is good practice to renew oil seal whenever engine is overhauled.

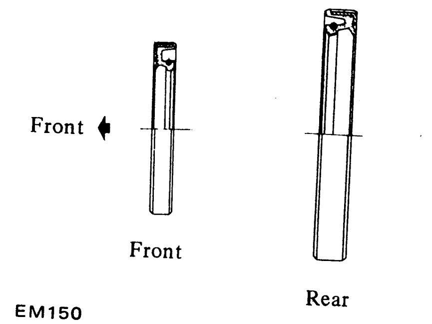


Fig. EM-75 Oil seal of crankshaft

ENGINE ASSEMBLY

CONTENTS

PRECAUTIONS

1. Use thoroughly cleaned parts. Particularly, make sure that oil holes are clear of foreign matter.
2. When installing sliding parts such as bearings, be sure to apply engine oil to them.
3. Use new packings and oil seals.
4. Do not reuse lock washers that have been removed.
5. Keep tools and work benches clean.
6. Keep the necessary parts and tools ready near at hand.
7. Be sure to follow specified tightening torque and order.
8. Applying sealant

Use sealant to eliminate water and oil leaks. Parts requiring sealant are:

(1) Front cover gasket: Front side of cylinder block and cover gasket. See Figure EM-76.

(2) Front cover: Top of front cover, see Figure EM-76.

(3) Main bearing cap and cylinder block: Each side of rear main bearing cap and each corner of cylinder block. See Figure EM-77.

(4) Cylinder block: Step portions at four mating surfaces (cylinder block to front chain cover and cylinder block to rear main bearing cap). See Figure EM-78.

Note: Do not apply sealant too much.

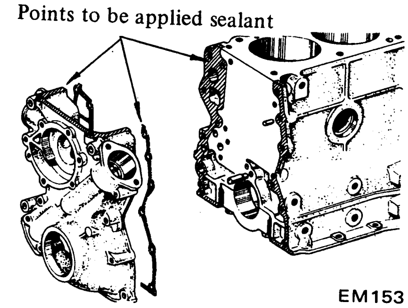


Fig. EM-76 Applying sealant (Front cover and gasket)

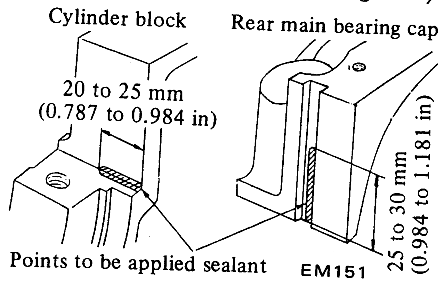


Fig. EM-77 Applying sealant (Main bearing cap and cylinder block)

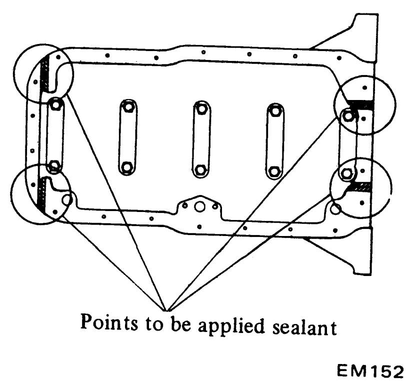


Fig. EM-78 Applying sealant (Cylinder block)

CYLINDER HEAD

1. Valve assembly and valve spring

Using special tool "Valve Lifter ST12070000," set valve spring seat in position, and fit valve guide with oil seal.

Assemble valve in the order shown below: valve, inner and outer valve springs, spring retainer, valve collet and valve rocker guide.

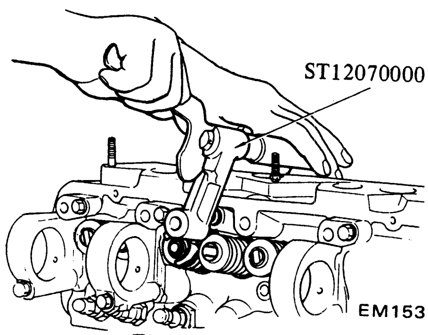


Fig. EM-79 Installing valve

Notes:

a. **Check whether the valve face is free from foreign matters.**

b. **The L16 and L18 engines use double type valve springs.**

2. Valve rocker pivot assembly

Screw valve rocker pivots joined with lock nuts into pivot bushing.

3. Camshaft assembly

Set locating plate and install camshaft in cylinder head carefully. Do not damage the bearing inside. The oblong groove of locating plate must be directed toward the front side of engine.

4. Install camshaft sprocket on camshaft and tighten it together with fuel pump cam to the specified torque.

Tightening torque:
12 to 16 kg-m
(86 to 116 ft-lb)

At this time, check camshaft end play.

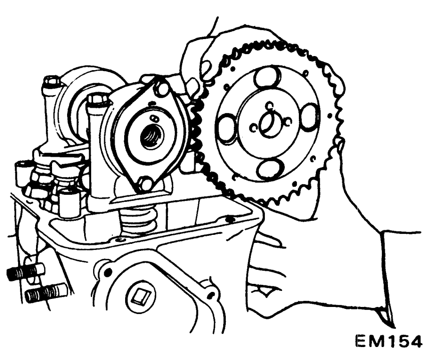


Fig. EM-80 Installing camshaft sprocket

5. Install rocker arms by pressing down valve springs with a screwdriver.

6. Install valve rocker springs.

7. After assembling cylinder head, turn camshaft until No. 1 piston is at T.D.C. on its compression stroke.

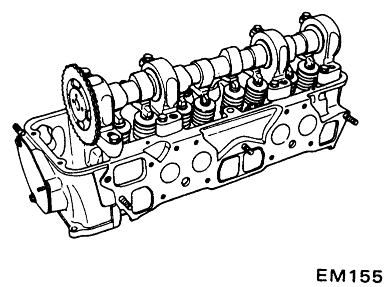


Fig. EM-81 Assembling cylinder head

PISTON AND CONNECTING ROD

1. Assemble pistons, piston pins and connecting rods to the designated cylinder.

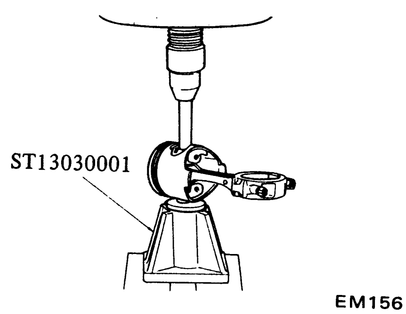


Fig. EM-82 Installing piston pin

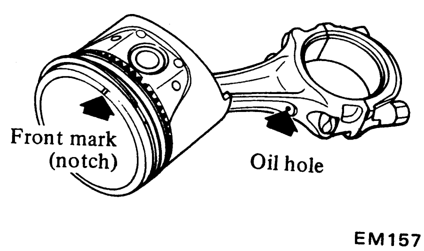


Fig. EM-83 Assembling piston and connecting rod

Notes:

a. **Piston is pressed into connecting rod, and fitting force is 0.5 to 1.5 tons and the aid of special tool "Piston Pin Press Stand ST13030001" is necessary. When pressing piston pin in connecting rod, apply engine oil to pin and small end of connecting rod.**

b. **Arrange so that oil jet of connecting lod big end is directed toward the right side of cylinder block.**

c. **Be sure to install piston in cylinders with notch mark of piston head toward the front of engine.**

2. Install piston rings

Install top and second rings in right position, with the marked side up.

a. **Top ring is chromium-plated on liner contacting face.**

b. **Second ring has larger taper surface than top ring.**

c. **In the combined oil ring, upper rail is the same as lower one.**

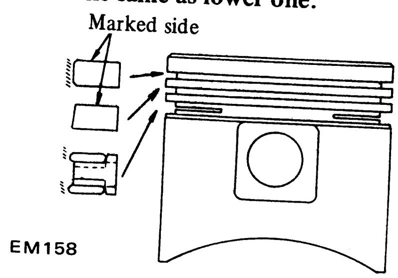


Fig. EM-84 Installing piston ring

3. Fix bearings on connecting rod and connecting rod cap.

Note: **Clean the back side of bearing carefully.**

ENGINE ASSEMBLY

1. The first step in engine assembly is to bolt special tool "Engine Attachment ST05260001" to right hand side of cylinder block. In succession, install block in another special tool "Engine Stand ST0501S000" with engine bottom up.

2. Set main bearings at the proper portion of cylinder block.

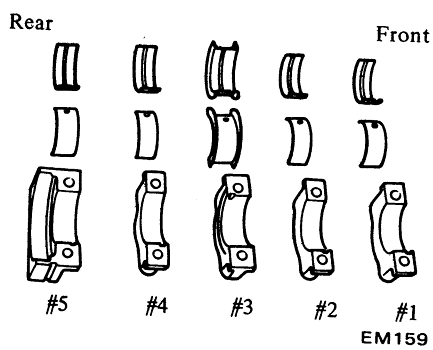


Fig. EM-85 Main bearings

3. Install baffle plate including cylinder block net.

Notes:

a. **Only center bearing (No. 3) is a flanged type.**

b. **All inter-bearings (No. 2 and No. 4) are the same type.**

c. **Front bearing (No. 1) is also the** same type as rear bearing (No. 5). The difference is that an oil hole is provided in the front bearing.

d. All bearings except No. 1 bearing have an interchangeability between upper and lower bearings.

4. Apply engine oil to main bearing surfaces on both sides of cylinder block and cap.
Install crankshaft.

5. Install main bearing cap and tighten bolts to specified torque.

Tightening torque:
4.5 to 5.5 kg-m
(32.5 to 39.8 ft-lb)

Notes:

a. Apply sealant to each side of rear main bearing cap and each corner of cylinder block as shown in Figure EM-77.
b. Arrange the parts so that the arrow mark on bearing cap faces toward the front of engine.
c. Prior to tightening bearing cap bolts, place bearing cap in proper position by shifting crankshaft in the axial direction.
d. Tighten bearing cap bolts gradually in separating two to three stages and outwardly from center bearing in the sequence as shown in Figure EM-86.
e. After securing bearing cap bolts, ascertain that crankshaft turn smoothly.

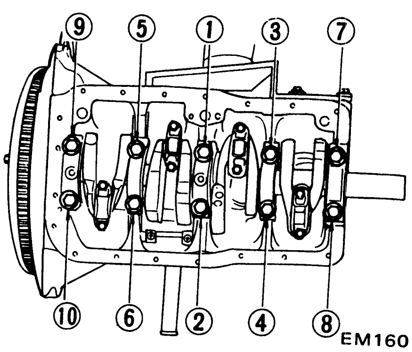


Fig. EM-86 Torque sequence of cap bolts

6. Make sure that there exists proper end play at crankshaft.

Crankshaft end play:
0.05 to 0.18 mm
(0.0020 to 0.0071 in)

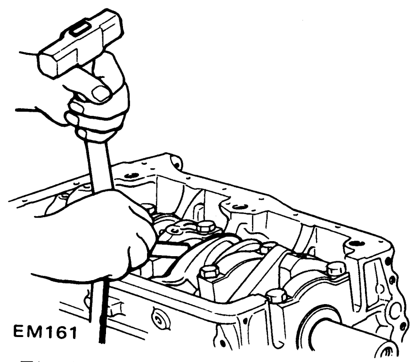


Fig. EM-87 Checking crankshaft end play

7. Install side oil seals into rear main bearing cap. Prior to installing, apply sealant to these seals.

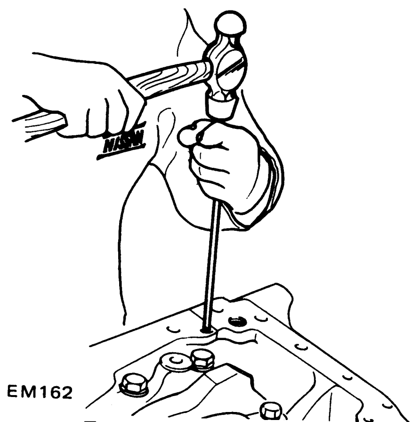


Fig. EM-88 Driving side oil seal

8. Install rear oil seal using special tool "Crankshaft Rear Oil Seal Drift ST15310000." Apply a lithium grease to sealing lip of oil seal.

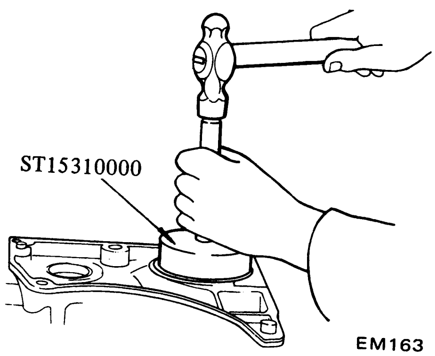


Fig. EM-89 Installing rear oil seal

9. Install rear end plate.

10. Install flywheel securely, and tighten bolts to specified torque.

Tightening torque:
14 to 16 kg-m
(101 to 116 ft-lb)

11. Insert pistons in corresponding cylinder using special tool "Piston Ring Compressor EM03470000."

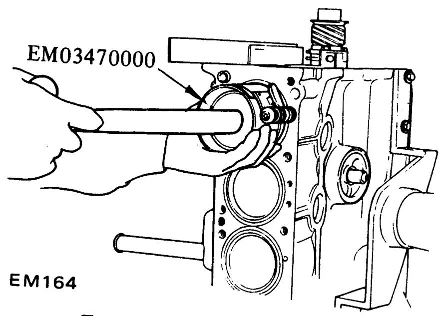


Fig. EM-90 Installing piston-rod assembly

Notes:

a. Apply engine oil to sliding parts.
b. Arrange so that the notch mark on piston head faces to the front of engine.
c. Install piston rings at 180° to each other, avoiding their fit in the thrust and piston pin directions.

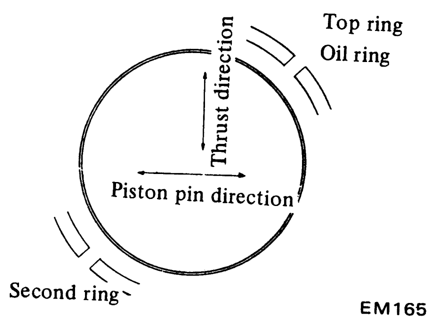


Fig. EM-91 Piston ring direction

12. Install connecting rod caps.

Tightening torque:

3.2 to 3.8 kg-m (23 to 28 ft-lb)	for L16
4.5 to 5.5 kg-m (33 to 40 ft-lb)	for L18

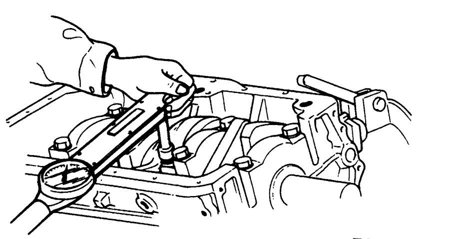


Fig. EM-92 Installing connecting rod cap

Note: Arrange connecting rods and connecting rod caps so that the cylinder numbers face in the same direction.

13. Make sure that there exists proper end play at connecting rod big end.

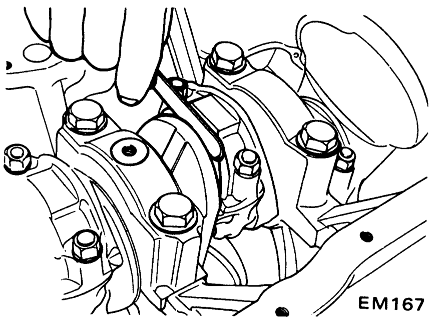


Fig. EM-93 Checking big end play

Big end play:
0.2 to 0.3 mm
(0.0079 to 0.0118 in)

14. Install cylinder head assembly.

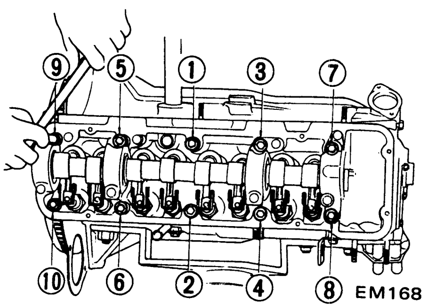


Fig. EM-94 Tightening sequence

(1) Thoroughly clean cylinder block and head surface.

Do not apply sealant to any other part of cylinder block and head surface.

(2) Turn crankshaft until No. 1 piston is at T.D.C. on its compression stroke.

(3) Make sure that camshaft sprocket location notch and plate oblong groove are aligned at their correct positions.

(4) When installing cylinder head, make sure that all valves are apart from heads of pistons.

(5) Do not rotate crankshaft and camshaft separately, because valves will hit heads of pistons.

(6) Temporarily tighten two bolts (①, ②) shown in Figure EM-94.

Tightening torque:
2 kg-m (14.5 ft-lb)

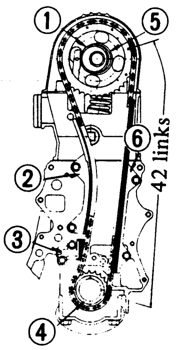
15. Install crankshaft sprocket and distributor drive gear and fit oil thrower.

Note: Make sure that the mating marks of crankshaft sprocket faces to the front.

16. Install timing chain.

Notes:

a. Make sure that crankshaft and camshaft keys point upwards.



1 Fuel pump drive cam
2 Chain guide
3 Chain tensioner
4 Crank sprocket
5 Cam sprocket
6 Chain guide

EM169

Fig. EM-95 Installing timing chain

b. Set timing chain by making its mating marks align with those of crankshaft sprocket and camshaft sprocket at the right hand side. There are forty-two chain links between two mating marks of timing chain.

c. No. 2 hole is factory adjusted. When chain stretches excessively, adjust camshaft sprocket at No. 3 hole.

d. Use a set of timing marks and location hole numbers.

17. Install chain guide to cylinder block.

18. Install chain tensioner.

Note: Adjust the protrusion of chain tensioner spindle to 0 mm (0 in).

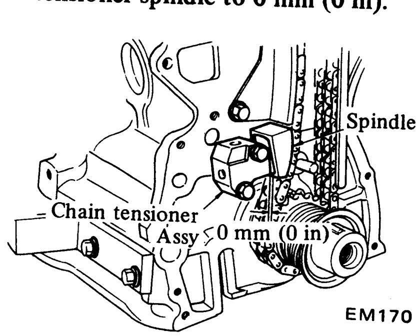


Fig. EM-96 Installing chain tensioner

19. Press new oil seal in front cover. (front cover oil seal should be replaced when front cover is disassembled.)

20. Install front cover with gasket in place.

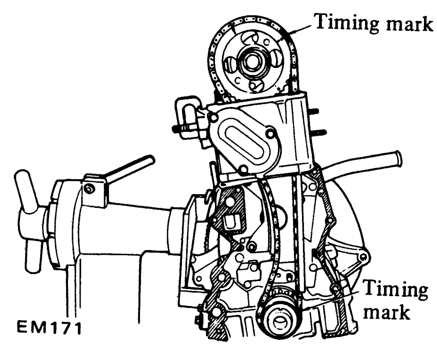


Fig. EM-97 Installing front cover

Notes:

a. Apply sealant to front side of cylinder block and front cover gasket as shown in Figure EM-76.

b. Apply sealant only to the top of front cover as shown in Figure EM-76.

c. Install front cover with head gasket in place.

d. Check the height difference between cylinder block upper face and front cover upper face. Its difference must be less than 0.15 mm (0.0059 in).

e. Note that different types of bolts are used.

f. Apply a lithium grease to sealing lip of oil seal.

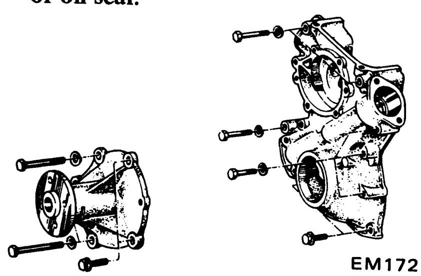


Fig. EM-98 Front cover bolts

Tightening torque:
Size M8
(0.315 in)
1.0 to 1.6 kg-m
(7.2 to 11.6 ft-lb)
Size M6
(0.236 in)
0.4 to 0.8 kg-m
(2.9 to 5.8 ft-lb)

21. Install crankshaft pulley and water pump, then set No. 1 piston at T.D.C. on its compression stroke.

Crankshaft pulley nut tightening torque:
12 to 16 kg-m
(86.8 to 115.7 ft-lb)

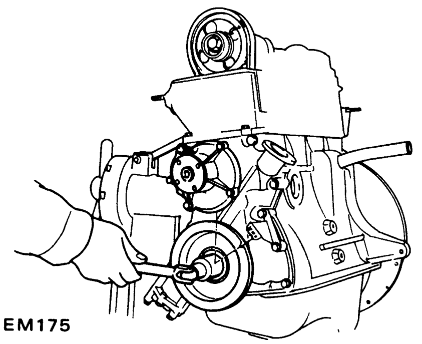


Fig. EM-99 Installing crankshaft pulley and water pump

22. Finally tighten head bolts to the specified torque in three steps according to the tightening sequence as shown in Figure EM-94.

Note that two types of bolts are used.

Special tool "Cylinder Head Bolt Wrench ST10120000."

Tightening torque:

1st turn
4.0 kg-m (28.9 ft-lb)

2nd turn
6.0 kg-m (43.4 ft-lb)

3rd turn
6.5 to 8.5 kg-m
(47.0 to 61.5 ft-lb)

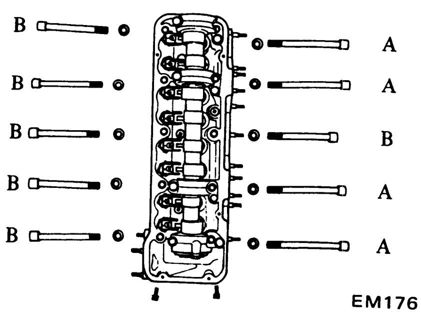


Fig. EM-100 Cylinder head bolts

Notes:

a. **Be sure to tighten two small bolts**
b. **After engine has been operated for several minutes; if necessary, retighten.**

23. Install oil pump and distributor driving spindle into front cover.

Tightening torque:
1.1 to 1.5 kg-m
(8.0 to 10.8 ft-lb)

Notes:

a. **Assemble oil pump and drive spindle, making driving spindle mark face to oil pump hole.**
b. **Install oil pump together with drive spindle so that the projection on its top is located in 11 : 25 a.m. position. At this time, the smaller bow-shape will be placed toward the front.**
c. **Do not forget to install gasket.**

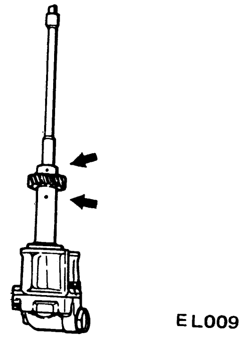


Fig. EM-101 Setting distributor driving spindle

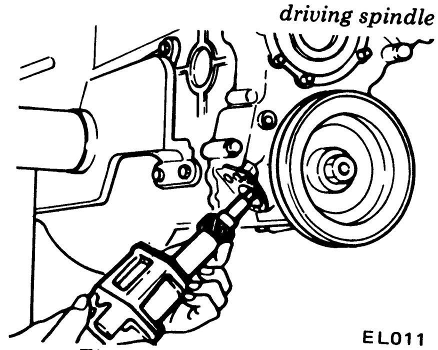


Fig. EM-102 Installing oil pump

24. Install fuel pump, water inlet elbow and front engine slinger in their positions.

Fuel pump tightening torque:
1.2 to 1.8 kg-m
(8.7 to 13.0 ft-lb)

Note: **Do not forget to install fuel pump spacer and packings inserted between spacer and block, spacer and fuel pump.**

25. Install oil strainer, oil pan gasket and oil pan.

Notes:

a. **Apply sealant to the step portions at four mating surfaces as shown in Figure EM-78.**
b. **Tightening oil pan should be performed in criss-cross pattern and finally to 0.6 to 0.9 kg-m (4.3 to 6.5 ft-lb) torque.**

26. Adjust valve clearance to the specified dimensions.

Special tool "Pivot Adjuster ST10640001."

Tightening torque:
5.0 to 6.0 kg-m
(36.2 to 43.4 ft-lb)

Notes:

a. **First set clearance to the cold specifications.**

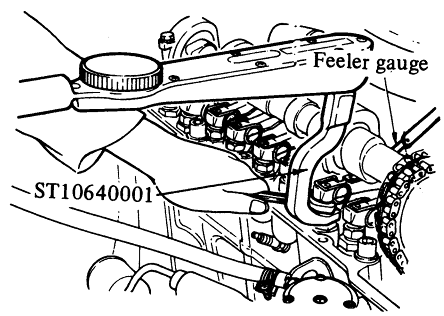


Fig. EM-103 Adjusting valve clearance

b. **After engine has been assembled, run it for at least several minutes, finally adjust the clearance to the warm specifications.**

27. Install rear engine slinger, exhaust manifold and intake manifold.

Tightening torque:
1.2 to 1.6 kg-m
(8.7 to 11.6 ft-lb)

			L16 and L18
Valve clearance mm (in)	Cold	Intake	0.2 (0.0079)
		Exhaust	0.25 (0.0098)
	Warm	Intake	0.25 (0.0098)
		Exhaust	0.30 (0.0118)

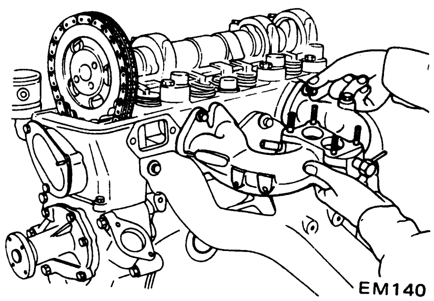


Fig. EM-104 Installing manifolds

28. Install distributor assembly.
29. Install carburetor assembly and carburetor insulator with stamp facing upward. Tightening torque 0.5 to 1.0 kg-m (3.6 to 7.2 ft-lb).
30. Install fuel pipes and vacuum hose.

All pipes and hoses should be clamped securely, being careful not to allow them to interfere with adjacent or surrounding parts.

31. Install thermostat housing, thermostat and water outlet in their positions. Do not forget to install gasket.
32. Install rocker cover.

Note: Bond gasket to rocker cover using sealant. Then, install rocker cover to cylinder head.

33. Install spark plugs.
34. Connect distributor to plug high tension lead wire.
35. Install engine mount bracket on left hand side.
36. Install clutch assembly.

Special tool "Clutch Aligning Bar ST20600000."
Tightening torque:
1.2 to 2.2 kg-m
(8.7 to 15.9 ft-lb)

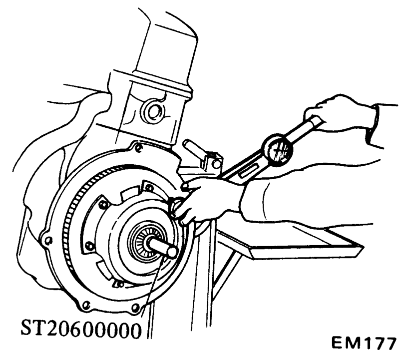


Fig. EM-105 Installing clutch assembly

37. Using an overhead hoist and lifting cable, hoist engine up away from engine stand and then down onto engine carrier. Install alternator bracket, adjusting bar, alternator, fan pulley, fan and fan belt in this order. Then, check to be sure that deflection of fan belt is held within 8 to 12 mm (0.315 to 0.472 in) when thumb pressure is applied midway between pulleys (A pressed force is about 10 kg (22.0 lb)).

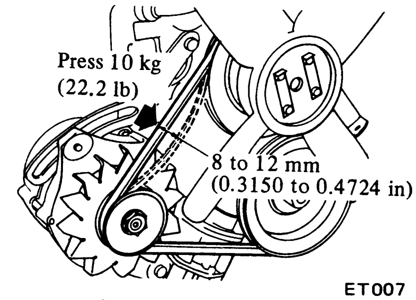


Fig. EM-106 Fan belt tension

38. Install engine mount bracket (right hand), oil filter, oil pressure switch, oil level gauge and water drain plug. When installing an oil filter, fasten it on cylinder block by hand.

Note: Do not overtighten filter, or oil leakage may occur.

39. Power engine oil up to specified level.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Model		L16	L18
Cylinder arrangement		4, in line	
Displacement	cc (cu in)	1,595 (62.80)	1,770 (108.01)
Bore and stroke	mm (in)	83 x 73.7 (3.2677 x 2.9016)	85 x 78 (3.3465 x 3.0709)
Valve arrangement		O.H.C.	O.H.C.
Firing order		1-3-4-2	1-3-4-2
Engine idle	rpm		
M/T		800	
A/T		650 in "D" range	
Compression ratio		8.5	
Engine idle manifold mmHg (inHg) at idle rpm			
M/T		430 (16.9)	
A/T		390 (15.4) in "N" range	
Oil pressure (Warm at 2,000 rpm)	kg/cm^2 (psi)	3.5 to 4.0 (49.8 to 56.9)	

M/T: Manual Transmission A/T: Automatic Transmission

TIGHTENING TORQUE

Model	L16	L18
Cylinder head bolts kg-m (ft-lb)	2nd Turn 6.0 (43.4)	3rd Turn 6.5 to 8.5 (47.0 to 61.5)
Connecting rod big end nuts kg-m (ft-lb)	3.2 to 3.8 (23 to 27)	4.5 to 5.5 (33 to 40)
Flywheel fixing bolts kg-m (ft-lb)	14 to 16 (101 to 116)	
Main bearing cap bolts kg-m (ft-lb)	4.5 to 5.5 (33 to 40)	
Camshaft sprocket bolt kg-m (ft-lb)	12 to 16 (86.8 to 116)	
Oil pan bolts kg-m (ft-lb)	0.6 to 0.9 (4.3 to 6.5)	
Oil pump bolts kg-m (ft-lb)	1.1 to 1.5 (8.0 to 10.8)	
Oil pan drain plug kg-m (ft-lb)	2.0 to 3.0 (14.5 to 21.7)	
Rocker pivot lock nuts kg-m (ft-lb)	5.0 to 6.0 (36.2 to 43.4)	
Camshaft locating plate bolts kg-m (ft-lb)	0.6 to 0.9 (4.3 to 6.5)	
Carburetor nuts kg-m (ft-lb)	0.5 to 1.0 (3.6 to 7.2)	
Manifold nuts kg-m (ft-lb)	1.2 to 1.6 (8.7 to 11.6)	
Fuel pump nuts kg-m (ft-lb)	1.2 to 1.8 (8.7 to 13.0)	
Crank pulley bolt kg-m (ft-lb)	12.0 to 16.0 (86.8 to 115.7)	

SPECIFICATIONS

Model	L16	L18
a) Valve mechanism		
Valve clearance (Warm) mm (in)	In. 0.25 (0.0098)	Ex. 0.30 (0.0118)
Valve clearance (Cold) mm (in)	In. 0.20 (0.0079)	Ex. 0.25 (0.0098)
Valve head dia. mm (in)		
–Intake	42 (1.6535)	42 (1.6535)
–Exhaust	33 (1.2992)	35 (1.3780)
Valve stem dia. mm (in)		
–Intake	7.965 to 7.980 (0.3136 to 0.3142)	
–Exhaust	7.945 to 7.960 (0.3128 to 0.3134)	

Model		L16	L18
Valve length mm (in)	—Intake	114.9 to 115.2 (4.524 to 4.535)	
	—Exhaust	115.7 to 116.0 (4.555 to 4.567)	
Valve lift mm (in)	—Intake	10.5 (0.413)	
	—Exhaust	10.5 (0.413)	
Valve spring free length mm (in)			
Intake	—Outer	49.98 (1.968)	
	—Inner	44.85 (1.766)	
Exhaust	—Outer	49.98 (1.968)	
	—Inner	44.85 (1.766)	
Valve spring pressured length (valve open) mm (in)			
Intake	—Outer	29.5/49.0 (1.161/108)	
	—Inner	24.5/25.5 (0.965/56.2)	
Exhaust	—Outer	29.5/49.0 (1.161/108)	
	—Inner	24.5/25.5 (0.965/56.2)	
Valve spring assembled height (valve close) mm/kg (in/lb)			
Intake	—Outer	40.0/21.3 (1.575/47.0)	
	—Inner	35/12.3 (1.378/27.1)	
Exhaust	—Outer	40.0/21.3 (1.575/47.0)	
	—Inner	35.0/12.3 (1.378/27.1)	
Valve spring effective turns mm (in)			
Intake	—Outer	5.0	
	—Inner	5.5	

Model		L16	L18
Exhaust	–Outer	5.0	
	–Inner	5.5	
Valve spring wire dia. mm (in)			
Intake	–Outer	4.0 (0.1575)	
	–Inner	2.9 (0.1142)	
Exhaust	–Outer	4.0 (0.1575)	
	–Inner	2.9 (0.1142)	
Valve spring coil dia. mm (in)			
Intake	–Outer	29.4 (1.150)	
	–Inner	21.9 (0.862)	
Exhaust	–Outer	29.4 (1.150)	
	–Inner	21.9 (0.862)	
Valve guide length mm (in)			
	–Intake	59.0 (2.323)	
	–Exhaust	59.0 (2.323)	
Valve guide height from head surface mm (in)		10.6 (0.417)	
Valve guide inner dia. mm (in)			
	–Intake	8.000 to 8.018 (0.3150 to 0.3154)	
	–Exhaust	8.000 to 8.018 (0.3150 to 0.3154)	
Valve guide outer dia. mm (in)			
	–Intake	12.023 to 12.034 (0.4733 to 0.4738)	
	–Exhaust	12.023 to 12.034 (0.4733 to 0.4738)	
Valve guide to stem clearance mm (in)			
	–Intake	0.020 to 0.053 (0.0008 to 0.0021)	

Model	L16	L18
—Exhaust	0.040 to 0.073 (0.0016 to 0.0029)	
Valve seat width mm (in)		
—Intake	1.4 (0.0551)	
—Exhaust	1.3 (0.0512)	
Valve seat angle		
—Intake	45°	
—Exhaust	45°	
Valve seat interference fit mm (in)		
—Intake	0.081 to 0.113 (0.0032 to 0.0044)	
—Exhaust	0.064 to 0.096 (0.0025 to 0.0038)	
Valve guide interference fit mm (in)	0.027 to 0.049 (0.011 to 0.0019)	
b) Camshaft and timing chain		
Camshaft end play mm (in)	0.08 to 0.38 (0.0031 to 0.0150)	
Camshaft robe lift mm (in)		
—Intake	7.00 (0.2753)	
—Exhaust	7.00 (0.2753)	
Camshaft journal dia. mm (in) —1st	47.949 to 47.962 (1.8877 to 1.8883)	
—2nd	47.949 to 47.962 (1.8877 to 1.8883)	
—3rd	47.949 to 47.962 (1.8877 to 1.8883)	
—4th	47.949 to 47.962 (1.8877 to 1.8883)	
Camshaft bend mm (in)	0.02 (0.0007)	
Camshaft journal to bearing clearance mm (in)	0.038 to 0.067 (0.0015 to 0.0026)	
Camshaft bearing inner dia. mm (in) —1st	48.000 to 48.016 (1.8898 to 1.8904)	
—2nd	48.000 to 48.016 (1.8894 to 1.8904)	
—3rd	48.000 to 48.016 (1.8898 to 1.8904)	
—4th	48.000 to 48.016 (1.8898 to 1.8904)	
c) Rocker arm lever ratio	1.45	

Model	L16	L18
d) Connecting rod		
Center distance mm (in)	133.0 (5.24)	130.35 (5.132)
Bearing material	F770	
Bearing thickness (S.T.D.) mm (in)	1.493 to 1.506 (0.0588 to 0.0593)	
Big end play mm (in)	0.20 to 0.30 (0.0079 to 0.0118)	
Connecting rod bearing clearance mm (in)	0.025 to 0.055 (0.0010 to 0.0022)	
Connecting rod bend or torsion (per 100 mm or 2.937 in) mm (in)	less than 0.03 (0.0012)	
e) Crankshaft and main bearing		
Journal dia. mm (in)	54.942 to 54.955 (2.1631 to 2.1636)	
Journal taper & out-of-round mm (in)	less than 0.01 (0.0004)	
Crankshaft free end play mm (in)	0.05 to 0.18 (0.0020 to 0.0071)	
Wear limit of dittoed play mm (in)	0.3 (0.0118)	
Crank pin dia. mm (in)	49.961 to 49.974 (1.9670 to 1.9675)	
Crank pin taper & out-of-round mm (in)	less than 0.01 (0.0004)	
Main bearing material	F770	
Main bearing thickness (S.T.D.) mm (in)	1.822 to 1.835 (0.0717 to 0.0722)	
Main bearing clearance mm (in)	0.020 to 0.062 (0.0008 to 0.0024)	
Wear limit of dittoted clearance mm (in)	0.12 (0.0047)	
Crankshaft bend mm (in)	0.05 (0.0019)	
f) Pistion		
Piston dia. –STD mm (in)	82.985 to 83.035 (3.2671 to 3.2691)	84.985 to 85.035 (3.3459 to 3.3478)

Model		L16	L18
0.50 (0.0197) Oversize		83.465 to 83.515 (3.2860 to 3.2880)	85.465 to 85.515 (3.3648 to 3.3667)
1.00 (0.0394) Oversize		83.965 to 84.015 (3.3057 to 3.3077)	86.965 to 86.015 (3.3844 to 3.3864)
Ellipse difference mm (in)		0.32 to 0.35 (0.013 to 0.014)	
Ring groove width	mm (in)		
	–Top	2.0 (0.0787)	
	–Second	2.0 (0.0787)	
	–Oil	4.0 (0.1575)	
Piston to bore clearance mm (in)		0.025 to 0.045 (0.0010 to 0.0018)	
Piston pin hole off-set mm (in)		0.95 to 1.05 (0.0374 to 0.0413)	
g) Piston pin			
Pin dia. mm (in)		20:993 to 20.998 (0.8265 to 0.8266)	
Pin length mm (in)		72.25 to 73.00 (2.8445 to 2.8740)	
Piston pin to piston clearance mm (in)		0.003 to 0.015 (0.0001 to 0.0006)	
Interference fit of piston pin to connecting rod bushing mm (in)		0.015 to 0.033 (0.0006 to 0.0013)	
h) Piston ring			
Ring height mm (in)	–Top	1.977 to 1.990 (0.0778 to 0.0783)	1.970 to 1.990 (0.0776 to 0.0783)
	–Second	1.977 to 1.990 (0.0778 to 0.0783)	1.970 to 1.990 (0.0776 to 0.0783)
Side clearance mm (in)	–Top	0.040 to 0.080 (0.0016 to 0.0031)	0.045 to 0.080 (0.0018 to 0.0031)
	–Second	0.030 to 0.070 (0.0012 to 0.0028)	
Ring gap mm (in)	–Top	0.25 to 0.40 (0.0098 to 0.0157)	0.35 to 0.55 (0.0138 to 0.0217)
	–Second	0.15 to 0.30 (0.0059 to 0.0118)	0.30 to 0.50 (0.0118 to 0.0197)
	–Oil	0.30 to 0.90 (0.0118 to 0.0354)	0.30 to 0.90 (0.0118 to 0.0354)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
I. Noisy engine		
Knocking of crankshaft and bearing.	Loose main bearing.	Replace.
	Seized bearing.	Replace.
	Bent crankshaft.	Repair or replace.
	Uneven wear of journal.	Correct.
	Excessive crankshaft end play.	Replace center bearing.
Piston and connecting rod knocking	Loose bearing.	Replace.
	Seized bearing.	Replace.
	Loose piston pin.	Replace pin or bushing.
	Loose piston in cylinder.	Recondition cylinder.
	Broken piston ring.	Replace.
	Improper connecting rod alignment.	Realign.
Camshaft knocking	Loose bearing.	Replace.
	Excessive axial play.	Replace bearing thrust plate.
	Rough gear teeth.	Repair.
	Broken cam gear.	Replace.
Timing chain noise	Improper chain tension.	Adjust.
	Worn and/or damaged chain.	Replace.
	Worn sprocket.	Replace.
	Worn and/or broken tension adjusting mechanism.	Replace.
	Excessive camshaft and bearing clearance.	Replace.
Camshaft and valve mechanism knocking	Improper valve clearance.	Adjust.
	Worn adjusting screw.	Replace.
	Worn rocker face.	Replace.
	Loose valve stem in guide.	Replace guide.
	Weakened valve spring.	Replace.
	Seized valve.	Repair or replace.
Water pump knocking	Improper shaft end play.	Replace.
	Broken impeller.	Replace.
II. Other mechanical troubles		
Sticked valve	Improper valve clearance.	Adjust.
	Insufficient clearance between valve stem and guide.	Clean stem or ream guide.
	Weakened or broken valve spring.	Replace.
	Biting or damage of valve stem.	Replace or clean.
	Poor quality of fuel.	Use good fuel.

Condition	Probable cause	Corrective action
Seized valve seat	Improper valve clearance.	Adjust.
	Weakened valve spring.	Replace.
	Thin valve head edge.	Replace valve.
	Narrow valve seat.	Reface.
	Overheat.	Repair or replace.
	Over speeding.	Drive under proper speed.
	Sticked valve guide.	Repair.
Excessively worn cylinder and piston	Shortage of engine oil.	Add or replace oil.
	Dirty engine oil.	Clean crankcase, replace oil and oil filter element.
	Poor quality of oil.	Use right oil.
	Overheat.	Repair or replace.
	Wrong assembly of piston with connecting rod.	Repair or replace.
	Improper piston ring clearance.	Adjust.
	Broken piston ring.	Replace.
	Dirty air cleaner.	Clean.
	Mixture too rich.	Adjust.
	Engine over run.	Drive at proper speeds.
	Sticked choke valve.	Clean and adjust.
	Overchoking.	Start correct way.
Defective connecting rod	Shortage of engine oil.	Add oil.
	Low oil pressure.	Correct.
	Poor quality of engine oil.	Use right oil.
	Rough surface of crankshaft.	Grind and replace bearing.
	Clogged oil passage.	Clean.
	Wear or eccentricity of bearing.	Replace.
	Wrong assembly of bearing.	Correct.
	Loose bearing.	Replace.
	Connecting rod alignment incorrect.	Repair or replace.
Defective crankshaft bearing	Shortage of engine oil.	Add or replace.
	Low oil pressure.	Correct.
	Poor quality of engine oil.	Use right oil.
	Crankshaft journal worn or out-of-round.	Repair.
	Clogged oil passage in crankshaft.	Clean.
	Wear or eccentricity of bearing.	Replace.
	Wrong assembly of bearing.	Correct.
	Eccentric crankshaft or bearing.	Replace.

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

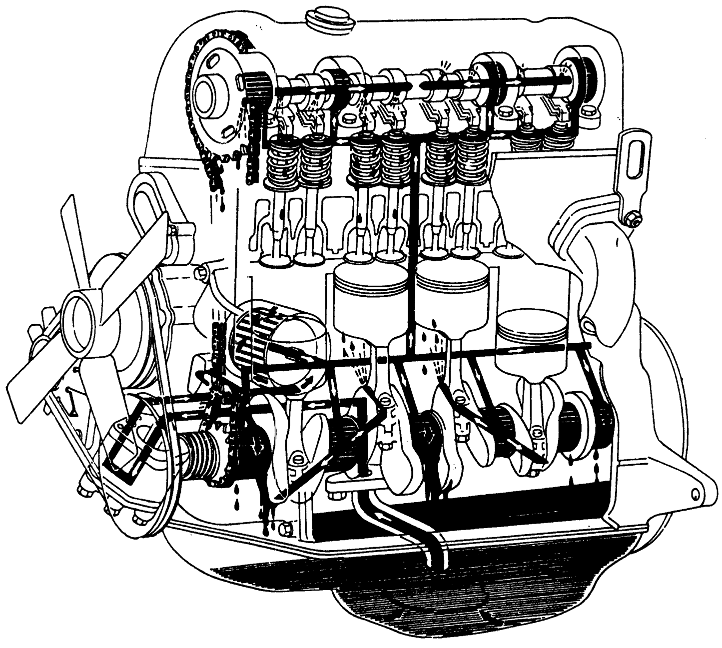
SECTION EL

ENGINE LUBRICATION SYSTEM

EL

ENGINE LUBRICATION SYSTEM

CONTENTS

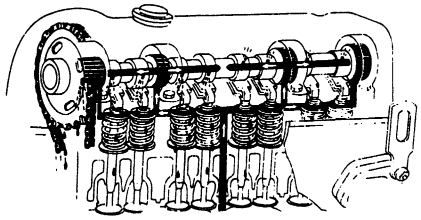


EL007

Fig. EL-1 Lubricating circuit

LUBRICATION CIRCUIT

The pressure lubrication of the engine is accomplished by a trochoid-type oil pump. This pump draws the oil through the oil strainer into pump housing and then forces it through the full flow type oil filter into the main oil gallery. Part of the oil is supplied to all crankshaft bearings, chain tensioner and timing chain. Oil supplied to crankshaft bearings is fed to connecting rod bearings through the drilled passages in the crankshaft. Oil injected from jet holes on connecting rods lubricates the cylinder walls and piston pins. The other part of the oil is brought to the oil gallery in the cylinder head to provide lubrication of the valve mechanism and timing chain as shown in Figure EL-2.



EL008

Fig. EL-2 Lubricating cylinder head

From this gallery, oil holes go directly to all camshaft bearings through cam brackets.

Oil supplied through the No. 2 and No. 3 camshaft bearings is then fed to the rocker arm, valve and cam lobe through the oil gallery in the camshaft and the small channel at the base circle portion of each cam.

OIL PUMP

The oil pump is located in the bottom of the front cover by four bolts and driven by the oil pump drive spindle assembly which is driven by the helical gear on the crankshaft.

The oil pump assembly consists of an oil pressure regulator valve and outer and inner rotors.

The spring-loaded oil pressure regulator valve limits the oil pressure to a maximum of 5.6 kg/cm^2 (80 lb/sq in).

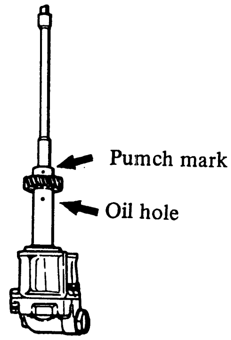
Removal

1. Remove distributor.
2. Drain engine oil.
3. Remove front stabilizer.
4. Remove splash shield board.
5. Remove oil pump body with drive spindle assembly.

Installation

1. Before installing oil pump in engine, turn crankshaft so that No. 1 piston is at T.D.C.

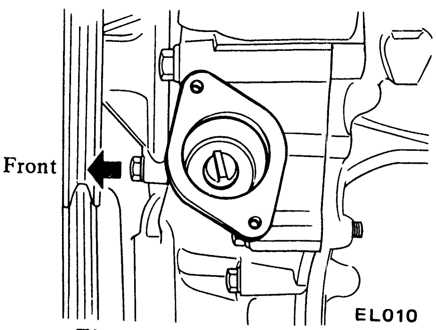
2. Fill pump housing with engine oil, then align punch mark of spindle with hole in oil pump as shown in Figure EL-3.



EL009

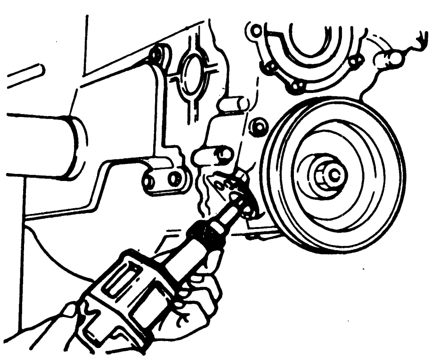
Fig. EL-3 Aligning punch mark and oil hole

3. Using a new gasket, install oil pump and drive spindle assembly so that the projection on its top is located in 11 : 25 a.m. position, at this time, the smaller bow-shape will be placed toward the front as shown in Figure EL-4.



EL010

Fig. EL-4 Setting drive spindle



EL011

Fig. EL-5 Installing oil pump

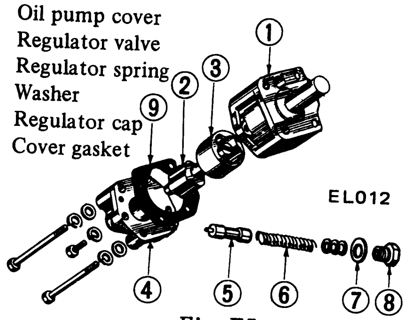
As-certain whether the engagement is order or not by checking the top of spindle through distributor fitting hole.

4. Tighten bolts securing oil pump to front cover.

Disassembly and assembly

1. Remove pump cover attaching bolts, pump cover and cover gasket, and slide out pump rotors.
2. Remove regulator cap, regulator valve and spring.
3. Install pressure regulator valve and related parts.
4. Install outer rotor, inner rotor and shaft in pump body and do not turn cover gasket up.

1 Oil pump body
2 Inner rotor and shaft
3 Outer rotor
4 Oil pump cover
5 Regulator valve
6 Regulator spring
7 Washer
8 Regulator cap
9 Cover gasket



EL012

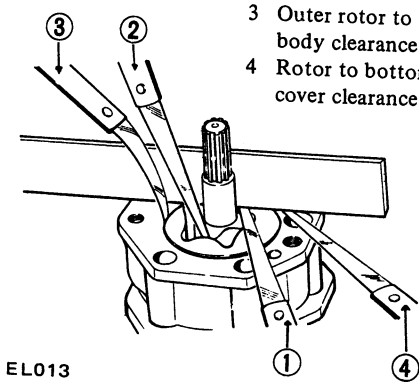
Fig. EL-6 Oil pump

Inspection

Wash all parts in cleaning solvent and dry with compressed air.

1. Inspect pump body and cover for cracks or excessive wear.
2. Inspect pump rotors for damage or excessive wear.
3. Check inner rotor shaft for looseness in pump body.
4. Inspect regulator valve for wear or scoring.
5. Check regulator spring to see that it is not worn on its side or collapsed.
6. Using a feeler gauge, check tip clearance and outer rotor-to-body clearances shown in Figure EL-7.

1 Side clearance
2 Tip clearance
3 Outer rotor to body clearance
4 Rotor to bottom cover clearance



EL013

Fig. EL-7 Checking rotor clearances

7. Place a straight edge across the face of pump as shown in Figure EL-7. Check side clearance (outer to inner rotor) and gap between body and straight edge.

The gap should be –0.03 to 0.06 mm (–0.0012 to 0.0024 in), then rotor to bottom cover clearance with gasket should satisfy the specifications.

L16 and L18		Standard	Wear limit
Rotor side clearance (outer to inner rotor)	mm (in)	0.05 to 0.12 (0.0020 to 0.0047)	0.20 (0.0079)
Rotor tip clearance	mm (in)	Less than 0.12 (0.0047)	0.20 (0.0079)
Outer rotor to body clearance	mm (in)	0.15 to 0.21 (0.0059 to 0.0083)	0.5 (0.0197)
Rotor to bottom cover clearance	mm (in)	0.03 to 0.13 (0.0012 to 0.0051)	0.20 (0.0079)

Note: Pump rotors and body are not serviced separately. If pump rotors or body are damaged or worn, replacement of the entire oil pump assembly is necessary.

OIL PRESSURE REGULATOR VALVE

The oil pressure regulator valve is not adjustable. At the released pisition, the valve permits the oil to by-pass through the passage in the pump cover to the inlet side of the pump. Check regulator valve spring to ensure that spring tension is correct.

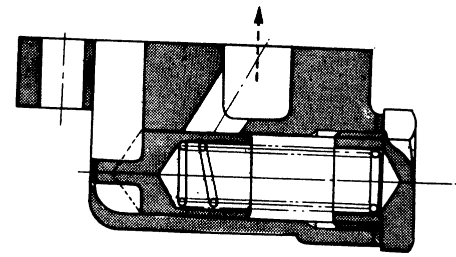

EL014

Fig. EL-8 Regulator valve

Tightening torque

Oil pump mounting bolts	kg-m (ft-lb)	1.1 to 1.5 (8.0 to 11)
Oil pump cover bolts	kg-m (ft-lb)	0.7 to 1.0 (5.1 to 7.2)
Cap nut-regulator valve	kg-m (ft-lb)	4 to 5 (29 to 26)

Specifications

Oil pressure at idling	kg/cm^2 (lb/sq in)	0.8 to 2.8 (11 to 40)
Regulator valve spring		
Free length	mm (in)	52.5 (2.067)
Pressured length	mm (in)	34.8 (1.370)
Regulator valve opening pressure	kg/cm^2 (lb/sq in)	3.5 to 5.0 (50 to 71)

OIL FILTER

The oil filter is of a cartridge type. The oil filter element should be replaced at regular intervals, with the use of special tool.

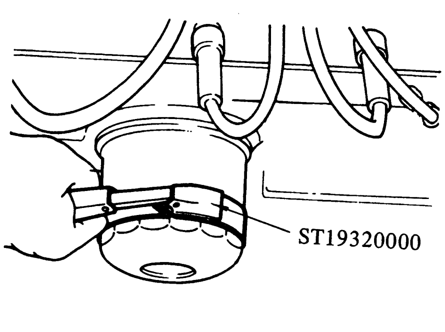
"Oil Filter Wrench"
ST19320000

When installing an oil filter, fasten it on cylinder block by hand.

Note Do not overtighten filter, or oil leakage may occur.

RELIEF VALVE

The relief valve located at the center portion securing oil filter in the cylinder block by-passes the oil into the main gallery when the oil filter element is excessively clogged.



EL015

Fig. EL-9 Removing oil filter

With oil filter removed, check valve unit for operation. Inspect for a cracked or broken valve. If replacement is necessary, remove valve by prying it out with a screwdriver. Install a new valve in place by tapping it.

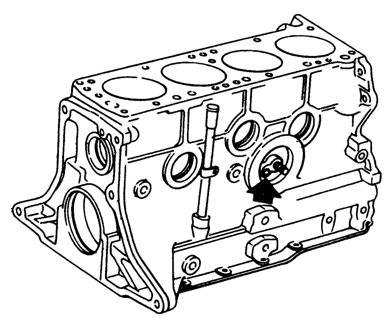

EL016

Fig. EL-10 Relief valve

SERVICE DATA AND SPECIFICATIONS

Oil pump

		Standard	Wear limit
Rotor side clearance (outer to inner rotor)	mm (in)	0.05 to 0.12 (0.0020 to 0.0047)	0.20 (0.0079)
Rotor tip clearance	mm (in)	less than 0.12 (0.0047)	0.20 (0.0079)
Outer rotor to body clearance	mm (in)	0.15 to 0.21 (0.0059 to 0.0083)	0.5 (0.0197)
Rotor to bottom cover clearance	mm (in)	0.03 to 0.13 (0.0012 to 0.0051)	0.20 (0.0079)

Oil pressure regulator valve

Oil pressure at idling	kg/cm^2 (lb/sq in)	0.8 to 2.8 (11 to 40)
Regulator valve spring:		
Free length	mm (in)	52.5 (2.067)
Pressured length	mm (in)	34.8 (1.370)
Regulator valve opening pressure	kg/cm^2 (lb/sq in)	3.5 to 5.0 (50 to 71)
Tightening torque:		
Oil pump mounting bolts	kg-m (ft-lb)	1.1 to 1.5 (8.0 to 11)
Oil pump cover bolts	kg-m (ft-lb)	0.7 to 1.0 (5.1 to 7.2)
Regulator valve cap nut	kg-m (ft-lb)	4 to 5 (29 to 36)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable causes	Corrective actions
Oil leakage	Damaged or cracked body cover.	Replace.
	Oil leakage from gasket.	Replace.
	Oil leakage from regulator valve.	Tighten or replace.
	Oil leakage from blind plug.	Replace.
Decreased oil pressure	Leak of oil in engine oil pan.	Correct.
	Dirty oil strainer.	Clean or replace.
	Damaged or worn pump rotors.	Replace.
	Defective regulator.	Replace.
	Use of poor quality engine oil.	Replace.
Warning light remains "on"-engine running	Decreased oil pressure.	Previously mentioned.
	Oil pressure switch unserviceable.	Replace.
	Electrical fault.	Check circuit.
Noise	Excessive backlash in pump rotors.	Replace.

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

SECTION CO

COOLING SYSTEM

CO

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

COOLING SYSTEM

CONTENTS

DESCRIPTION

The cooling system is of the conventional pressure type. A centrifugal pump built in the front cover serves to circulate the coolant.

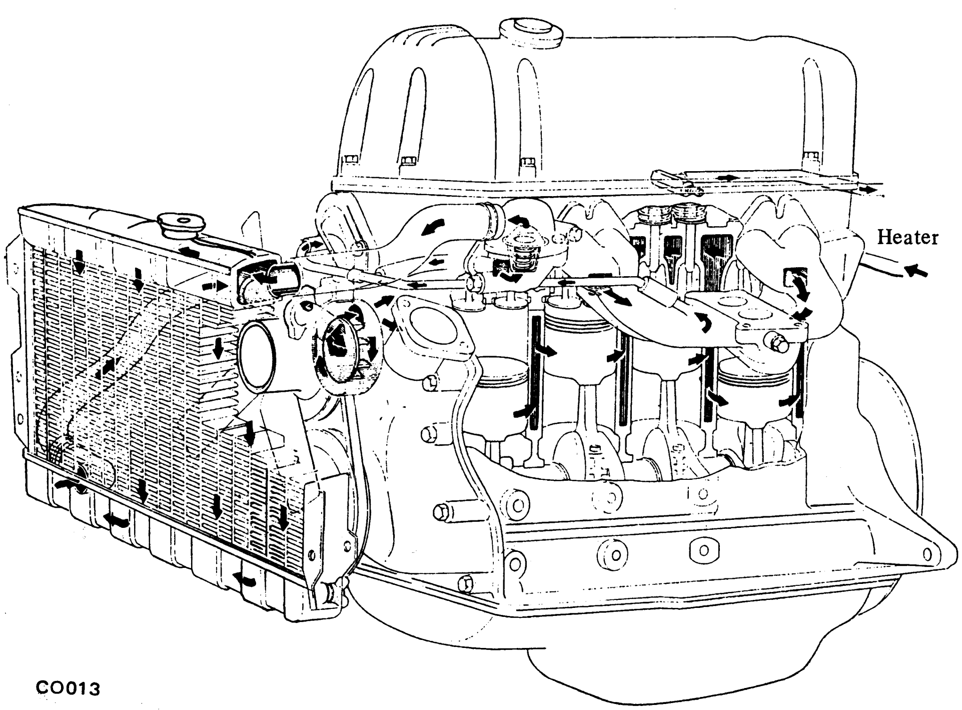
The pressure type radiator filler cap installed on the radiator controls the cooling system at higher than atmospheric pressure. The higher pressure rises the boiling point of the coolant and increases the cooling efficiency of the radiator.

When the thermostat is closed, the coolant remains in the cylinder head and block for quick warming up of the engine. After reached normal operating temperature, the coolant circulates through the radiator.

CAUTION:

To avoid serious personal injury, never remove radiator cap quickly when the engine is hot. Sudden release of cooling system pressure is very dangerous.

If it is necessary to remove the radiator cap when the radiator is hot, turn the cap slowly counterclockwise to first stop. After all pressure in cooling system is released, then turn the cap past the stop and remove it.



CO013

Fig. CO-1 Cooling system

Draining and flushing the cooling system

To drain the cooling system remove the radiator cap, release the drain cock at the bottom of the radiator and a drain plug on the right side of the cylinder block. If the heater system is installed, set the heater temperature control valve at open position.

After the coolant is drained completely, close the drain cock and plug and refill the system with clean water.

Coolant level

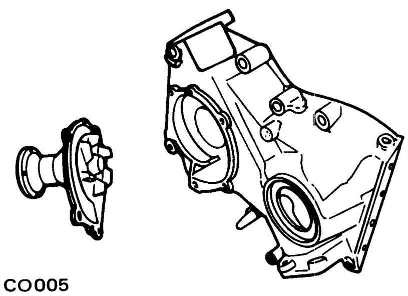
The radiator coolant level should be checked and maintained 30 mm (1.18 in) for 510, 610 models, and 15 to 25 mm (0.6 to 1.0 in) for 620 model below the bottom of the filler neck when the engine is cold. The expansion and contraction of the coolant will cause the level to drop by overflow.

WATER PUMP

The water pump is of a centrifugal type, which is mounted on the engine front cover. The fan and pulley are bolted at the pulley hub.

The pump shaft is supported by a double row ball bearing press fit in an aluminum die cast pump body. The bearings are permanently lubricated and sealed to prevent loss of lubricant and entry of dirt.

The pump contains an impeller that turns on a steel shaft which rotates in the ball bearings, and the volute chamber is built in the front cover assembly. The inlet of the pump is connected to the radiator lower tank by a hose.

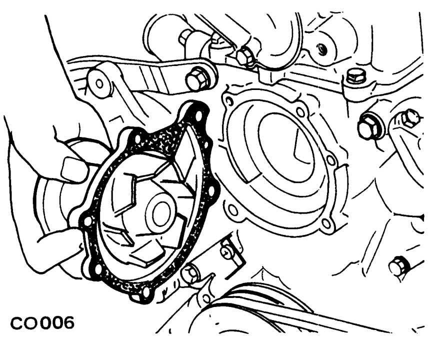


CO005

Fig. CO-2 Water pump and front cover

Removal

1. Drain coolant into a clean container.
2. Loosen four bolts retaining fan shroud to radiator and remove shroud.
3. Loosen belt, then remove fan blade and pulley from hub.
4. Remove five bolts, pump assembly, and gasket from front cover.



CO006

Fig. CO-3 Removing water pump

Disassembly

The water pump body is made of aluminum, and its bearing outer race is press fit. For this reason, the body, shaft bearing should not be disassembled.

Inspection

Inspect pump assembly for the following conditions, and replace it if necessary.

1. Badly rusted or corroded body assembly and vane.
2. Excessive end play or roughness of bearings in operation.

Installation

1. Make sure to clean the gasket surfaces on pump and front cover. Always use new gasket when installing pump assembly. Be sure to tighten bolts uniformly.
2. Fill cooling system and check for leaks at pump.
3. Install fan pulley and fan blade, and tighten fixing bolts securely. Install belt and adjust for proper tension.

Fan belt adjustment

The fan belt should be properly adjusted at all time. A tight belt serves wear of alternator and water pump bearings. A loose belt cause improper cooling fan, water pump and alternator operation.

Check the belt slack between alternator and fan pulley by pressing a force of 10 kg (22 lb).

Slackness of fan belt:
8 to 12 mm
(0.31 to 0.47 in)

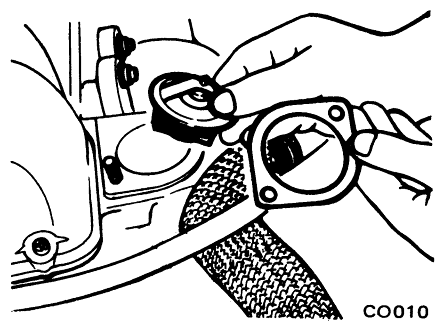
If adjustment is necessary, loosen bolt retaining alternator adjusting bar to alternator. Move alternator toward or away from engine until the correct tension is obtained.

THERMOSTAT

A wax pellet type thermostat is mounted in the thermostat housing at the cylinder head water outlet adjacent to the inlet manifold. The function of thermostat is to control the flow of coolant, facilitating fast engine warm up and regulating coolant temperature. The thermostats are designed to open and close at predetermined temperatures and if not operating properly should be removed and tested as listed below:

Removal and installation

1. Drain coolant partially.
2. Disconnect upper radiator hose at water outlet.
3. Loosen two securing nuts and remove water outlet, gasket, and thermostat from thermostat housing.
4. After checking thermostat satisfactorily, reinstall, replacing with a new housing gasket.
5. Reinstall water outlet and tighten securing nuts.
6. Replenish coolant and check for leaks.



CO010

Fig. CO-4 Removing thermostat

Inspection

A sticking thermostat will prevent the cooling system from functioning properly. If the thermostat sticks in the open position, the engine will warm up very slowly. If thermostat sticks in the closed position, overheating will result. Therefore, the thermostat should be inspected so as to make sure that it is in good condition.

1. Submerge thermostat in hot water 5°C (9°F) above the temperature specified in the following table.
2. Measure the lift height of valve by inserting a screwdriver marked at

the point about 8 mm (0.315 in) from its tip.
3. Remove thermostat and place in water 5°C (9°F) below temperature stamped on the frame.
4. Under the above condition, valve should be closed completely. In this case, agitate water thoroughly.

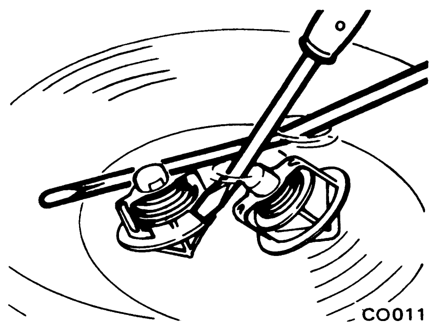


Fig. CO-5 Inspecting thermostat

If thermostat does not operate at the above specified temperatures, it must be replaced because it can not be repaired.

	U.S.A.	Canada	Puerto Rico, Guam and U.N.T.T.
Valve opening temp.	82°C (180°F)	88°C (190°F)	76.5°C (170°F)
Max. valve lift	Above 8 mm at 95°C (0.315 in at 203°F)	Above 8 mm at 100°C (0.315 in at 212°F)	Above 8 mm at 90°C (0.315 in at 194°F)

Note: It is necessary to check a new thermostat before installing it in the engine.

RADIATOR

The radiator is a conventional down flow type having the top and bottom tanks to distribute the coolant flow uniformly through the vertical tube of the radiator core.

The radiator filler cap is designed to maintain a pre-set pressure (0.9 kg/cm^2 13 lb/sq in) above atmospheric pressure. The relief valve consisted of a blow-off valve and a vacuum valve, helps to prevent coolant loss from boiling for by raising the pressure on the coolant. On the contrary, as the pressure is reduced below atmospheric pressure the vacuum valve allows air to re-enter the radiator, preventing the formation of vacuum in the cooling system.

The bottom tank on cars equipped with the automatic transmission incorporates an oil cooler for the transmission fluid.

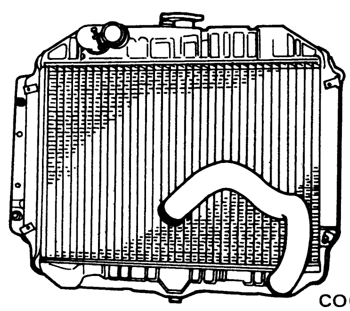


Fig. CO-6 Radiator for manual transmission

Removal and installation

1. Drain coolant into a clean container.
2. Remove front grille.
3. Disconnect radiator upper and lower hoses. On a vehicle with automatic transmission, disconnect cooler inlet and outlet lines from radiator.
4. Remove bolts retaining radiator from radiator side supports and remove radiator upwards.
5. Install radiator in reverse sequense of removal.

Inspection

Radiator cap should be checked for pressure at regular tune up intervals. First, check rubber seal on cap for tears, cracks or deterioration after cleaning it. Then, install radiator cap on a tester. If cap does not hold pressure or will not release at the proper pressure, replace cap.

Also, inspect radiator for water leakage using the cap tester under applying a pressure of 1.2 kg/cm^2 (17 lb/sq in). If such the defect is detected, repair or replace radiator.

SERVICE DATA AND SPECIFICATIONS

Thermostat

	U.S.A.	Canada	Puerto Rico, Guam and U.N.T.T.
Valve opening temp.	82°C (180°F)	88°C (190°F)	76.5°C (170°F)
Max. valve lift	Above 8 mm at 95°C (0.315 in at 203°F)	Above 8 mm at 100°C (0.315 in at 212°F)	Above 8 mm at 90°C (0.315 in at 194°F)

Radiator

Vehicle model	610		510		620	
Engine model	L18			L16		
Transmission type	Manual	Automatic	Manual	Automatic	Manual	Automatic
Dimension of radiator core height x width x thickness mm (in)	360 x 502 x 32 (14.2 x 19.8 x 1.26)	←	280 x 488 x 38 (11.0 x 19.2 x 1.50)	←	330 x 446 x 32 (13.0 x 17.6 x 1.26)	←
Type	Corrugated fin type	←	←	←	←	←
		Equipped with oil cooler		Equipped with oil cooler		Equipped with oil cooler
Radiator fin pitch mm (in)	2.5 (0.0984)	2.3 (0.0906)	2.5 (0.0984)	2.3 (0.0906)	2.5 (0.0984)	←
Cap working pressure kg/cm^2 (lb/sq in)	0.9 (13)	←	←	←	←	←
Cooling system capacity Less heater	6.0 liters (1⅝ U.S. gal.) (1⅜ Imp. gal.)	←	6.4 liters (1¾ U.S. gal.) (1⅜ Imp. gal.)	←	5.4 liters (1⅜ U.S. gal.) (1⅛ Imp. gal.)	←
With heater	6.5 liters (1¾ U.S. gal.) (1⅜ Imp. gal.)	←	6.8 liters (1¾ U.S. gal.) (1½ Imp. gal.)	←	6.0 liters (1⅝ U.S. gal.) (1⅜ Imp. gal.)	←

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Loss water	Coolant filled up radiator.	Do not fill up coolant to top of filler neck while cold.
	Damaged radiator seams.	Repair.
	Excessive wear in water pump.	Replace.
	Leakes at heater connections or plugs.	Repair.
	Leak at water temperature gauge.	Tighten.
	Loose joints.	Tighten.
	Defective cylinder head gasket.	Replace. Check engine oil for contamination and refill as necessary.
	Cracked cylinder block.	Replace. Pull engine oil level gauge to check for water in crankcase.
	Cracked cylinder head.	Replace.
	Loose cylinder head bolts.	Tighten.
Poor circulation	Restriction in system.	Check hoses for crimps, reverse flush radiator, and clear the system of rust and sludge.
	Insufficient coolant.	Replenish.
	Inoperative water pump.	Replace.
	Loose fan belt.	Adjust.
	Inoperative thermostat.	Replace.
Corrosion	Excessive impurity in water.	Use soft, clean water. (rain water is satisfactory).
	Infrequent flushing and draining of system.	Cooling system should be drained and flushed thoroughly at least twice a year. [Nissan long life coolant (L.L.C.) can be used throughout the seasons of a year, and exchange every two years or total running mileage of 40,000 km (24,000 miles)].
Over heating	Defective thermostat.	Replace.
	Radiator fins choked with mud, chaff, etc.	Clean out air passage thoroughly by using air pressure from engine side of radiator.
	Incorrect ignition and valve timing.	Adjust.
	Dirty oil and sludge in engine.	Refill.
	Inoperative water pump.	Replace.
	Loose fan blet.	Adjust.
	Restricted radiator.	Flush radiator.
	Inaccurate temperature gauge.	Replace.
	Impurity in water.	Use soft, clean water.

COOLING SYSTEM

Condition	Probable cause	Corrective action
Over cooling	Defective thermostat.	Replace.
	Inaccurate temperature gauge.	Replace.

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EF

FUEL SYSTEM

EF

AUTOMATIC TEMPERATURE CONTROL AIR CLEANER (A.T.C. AIR CLEANER)

CONTENTS

DESCRIPTION

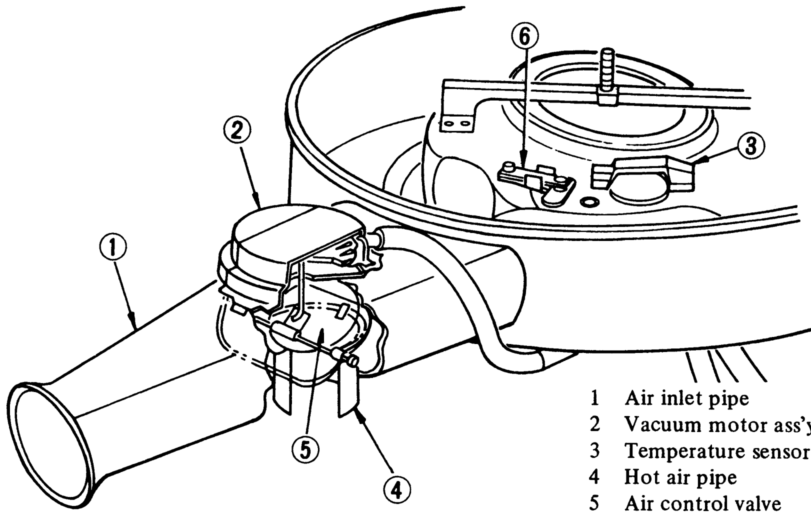
Air cleaner element

The air cleaner element is of a viscous paper type and does not require any cleaning until replacement.

Note: Do not brush or blast element before replacement.

Automatic temperature control air cleaner

The automatic temperature control air cleaner is provided with a temperature sensor and a vacuum operated valve. The vacuum acted upon the air control valve is controlled by the sensor. See Figure EF-1

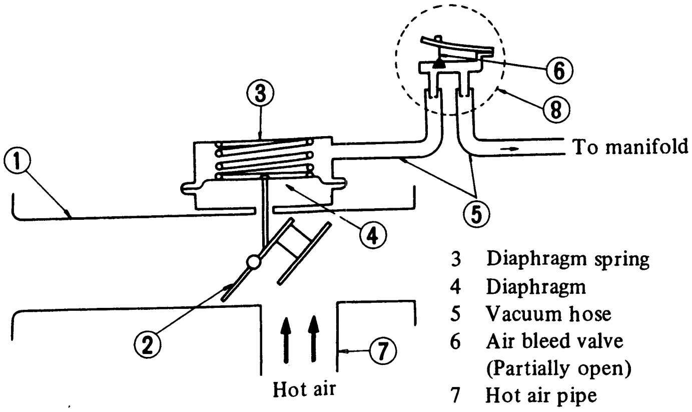


1 Air inlet pipe
2 Vacuum motor ass'y
3 Temperature sensor ass'y
4 Hot air pipe
5 Air control valve
6 Idle compresator

Fig. EF-1 Automatic temperature control air cleaner

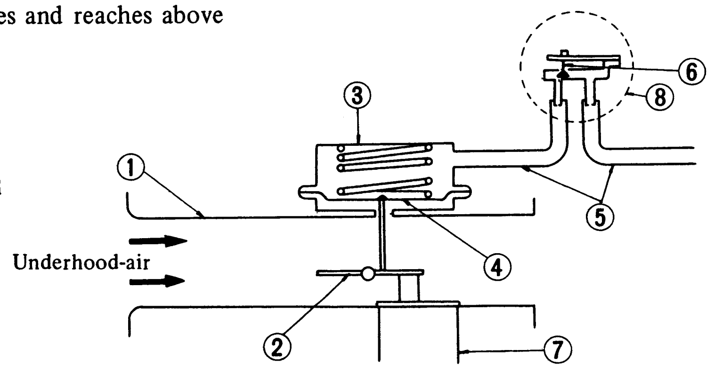
If the temperature of suction air is low when the engine is running, the air control valve closes the underhood-air inlet, and introduces hot air through the cover which is installed on the exhaust manifold (See Figure EF-2.).

When the temperature of suction air around the sensor reaches 37.5°C (100°F) or above, the sensor actuates to open the air control valve. When the temperature of suction air around the sensor further rises and reaches above 48°C (118°F), the air control valve completely opens to prevent the entrance of hot air, and allows underhood-air alone to be introduced into the carburetor. (See Figure EF-3.)



1 Air inlet pipe
2 Air control valve
3 Diaphragm spring
4 Diaphragm
5 Vacuum hose
6 Air bleed valve (Partially open)
7 Hot air pipe
8 Temperature sensor assembly

Fig. EF-2 Hot-air delivery mode (During cold engine operation)



1 Air inlet pipe
2 Air control valve
3 Diaphragm spring
4 Diaphragm
5 Vacuum hoses
6 Air bleed valve (fully open)
7 Hot air pipe
8 Temperature sensor assembly

Fig. EF-3 Underhood-air delivery mode (During hot engine operation)

The air control valve acts in the manner described previously, and the temperature of suction air around the sensor is always kept at about 43°C (110°F). (See Figure EF-4.)

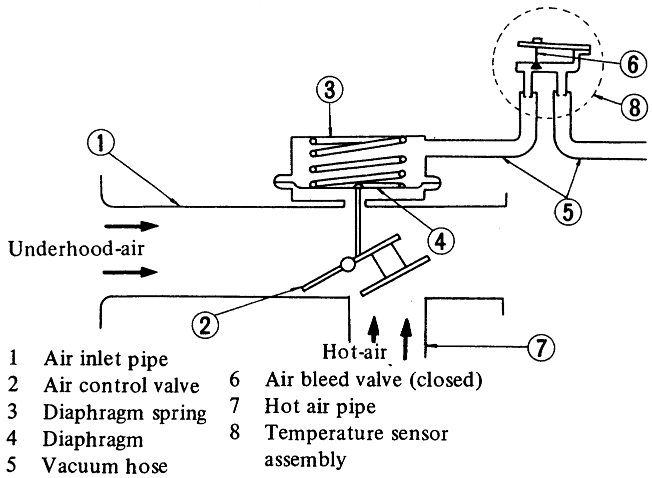


Fig. EF-4 Regulating air delivery mode

When the engine is operating under heavy load, the air control valve fully opens the underhood-air inlet to obtain full power regardless of the temperature around sensor.

This control of carburetor air temperatures allows leaner carburetor calibration with accompanying reduced emissions than conventional controls and also eliminates carburetor icing.

Idle compensator

The idle compensator is essentially a thermostatic valve to compensates for excessive enriching of the mixture as a result of high idle temperatures. When the under-the-hood temperatures are high, the bimetal located in the air cleaner is heated by intake hot air and lifts the valve to open. This permits additional fresh air that is properly calibrated by the 1.4 mm (0.055 in) dia. orifice compensates for the increased richness of into the intake manifold and the air-fuel mixture in order to maintain smooth idle engine operation.

The idle compensator thermostatic valve partially opens at 65°C (149°F) and fully opens at 75°C (167°F).

Never attempt to disassemble this unit since it is sealed for tightness and properly adjusted for valve timing.

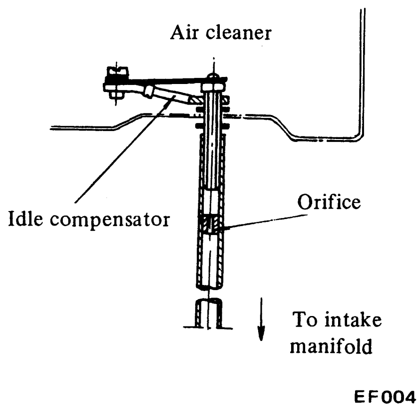


Fig. EF-5 Schematic of idle compensator

TEMPERATURE SENSOR

Removal and installation

Removal

1. Flatten tabs of clip with pliers.
2. Pull off hoses.

Note: Note the respective positions of hoses from which they were removed.

3. Take off sensor and clip.

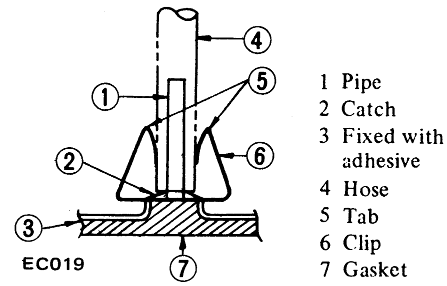


Fig. EF-6 Removal of sensor

Installation of sensor

1. Install sensor and gasket assembly in the proper positions. See Figure EF-7.

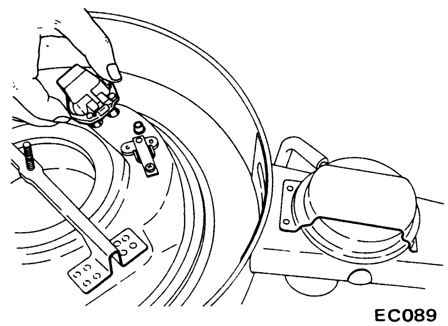


Fig. EF-7 Installing sensor

2. Insert clip. Be sure to hold sensor at its correct position in Figure EF-7 to avoid damage. See Figure EF-8.

Press fit clips into pipe while straightening tabs.

Note: Use care not to damage sensor.

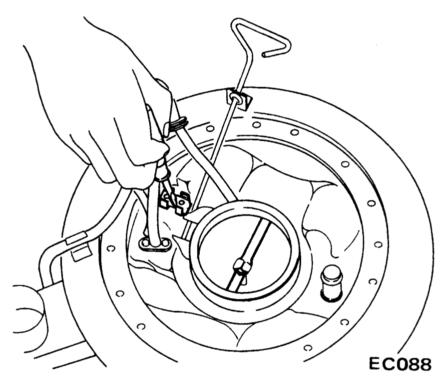


Fig. EF-8 Inserting clip

3. Connect hoses to their proper positions. See Figure EF-9.

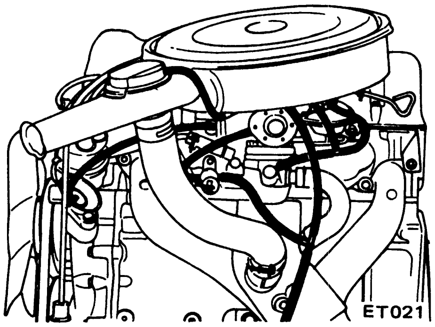
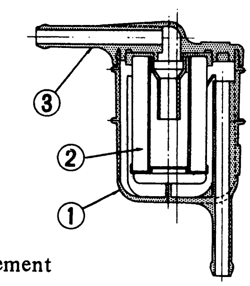


Fig. EF-9 Connecting hoses

FUEL STRAINER

DESCRIPTION

The fuel strainer is of a cartridge type. It uses fiber mat as strainer element which can be checked for condition from the outside.



1 Body
2 Paper element
3 Cover

Fig. EF-10 Sectional view of cartridge type fuel strainer

REMOVAL

Disconnect inlet and outlet fuel lines from fuel strainer, and remove fuel strainer.

Note: Before disconnecting fuel lines, use a container to receive the remaining fuel in lines.

FUEL PUMP

CONTENTS

DESCRIPTION

The fuel pump transfers fuel from the tank to the carburetor in sufficient quantity to meet the engine requirements at any speed or load.

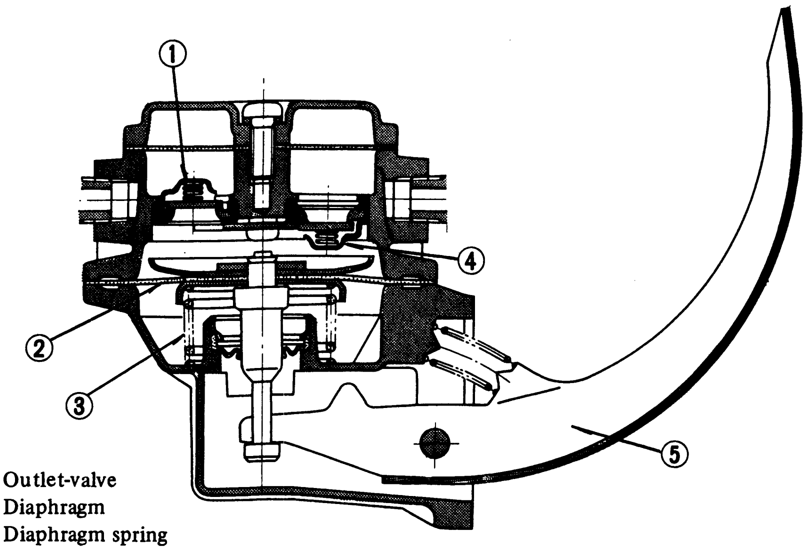
The fuel pump is of a pulsating type designed for easy maintenance. It consists of a body, rocker arm assembly, fuel diaphragm, fuel diaphragm spring, seal inlet- and outlet-valve. Figure EF-11 shows a cross-sectional view of the pump.

The fuel diaphragm consists of specially treated rubber, which is not affected by gasoline and held in place by two metal discs and a pull rod.

This type of fuel pump is used in the L16 and L18 engines.

FUEL PUMP TESTING

A fuel pump is operating properly when its pressure is within specifications and its capacity is equal to the engine's requirements at all speeds. Pressure and capacity must be determined by two tests, while the pump is still mounted on the engine. Be sure there is fuel in the tank when carrying out the tests.



1 Outlet-valve
2 Diaphragm
3 Diaphragm spring
4 Inlet-valve
5 Rocker arm

EF006

Fig. EF-11 Schematic view of fuel pump

Static pressure test

The static pressure test should be conducted as follows:

1. Disconnect fuel line between carburetor and fuel pump.
2. Connect a rubber hose to each open end of a T-connector, and connect this connector-hose assembly between carburetor and fuel pump.

Note: Locate this T-connector as close to carburetor as possible.

3. Connect a suitable pressure gauge to the opening of T-connector, and fasten the hose between carburetor and T-connector with a clip securely.
4. Start and run the engine at varying speeds.
5. The pressure gauge indicates static fuel pressure in the line. The gauge reading should be within the following range.

 0.18 to 0.24 kg/cm^2
 (2.56 to 3.41 lb/in^2)

Note: If the fuel in the carburetor float chamber has run out and engine has stopped, remove clip and pour fuel into carburetor. Fasten clip securely and repeat static pressure test.

Pressure below the lower limit indicates extreme wear on one part or a small amount of wear on each working part. It also indicates ruptured diaphragm; worn, warped, dirty or gumming valves and seats, or a weak diaphragm return spring. Pressure above the upper limit indicates an excessively strong tension of diaphragm return spring or a diaphragm that is too tight. Both of these conditions require the removal of pump assembly for replacement or repair.

Capacity test

The capacity test is conducted only when static pressure is within the specification. To conduct this test, proceed as follows:

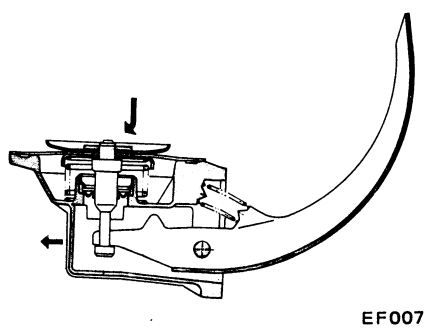
1. Disconnect pressure gauge from T-connector and, in its vacant place, install a suitable container as a fuel sump.
2. Start engine and run at 1,000 rpm.
3. The pump should deliver 1,000 cc (2.11 U.S. pts.) of fuel in one minute or less.

If little or no fuel flows from the open end of pipe, it is an indication that fuel line is clogged or pump is malfunctioning.

REMOVAL AND DISASSEMBLY

Remove fuel pump assembly by unscrewing two mounting nuts and disassemble in the following order.

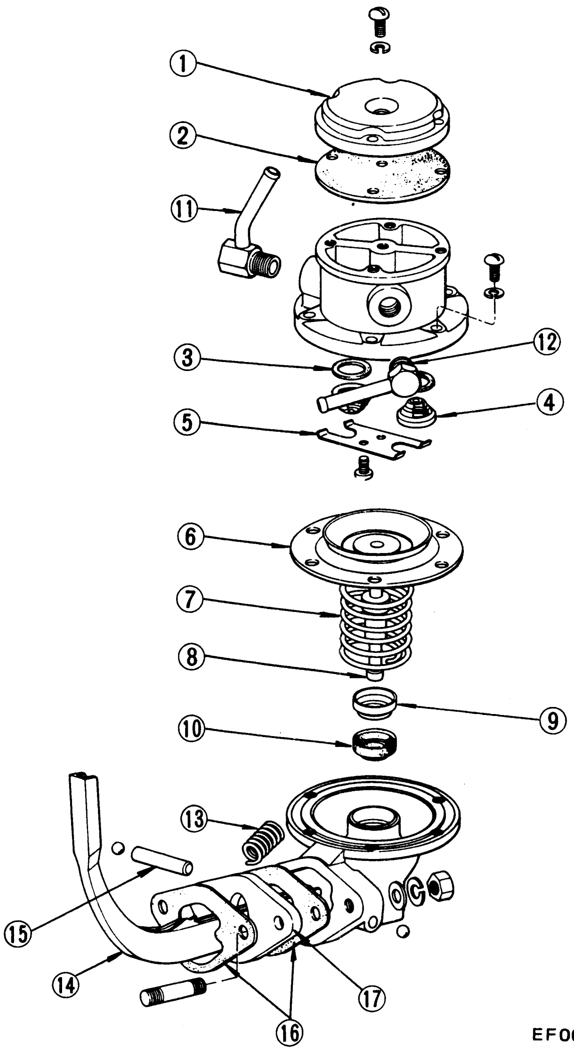
1. Separate upper body and lower body by unscrewing body set screws.
2. Take off cap and cap gasket by removing cap screws.
3. Unscrew elbow and connector.
4. Take off valve retainer by unscrewing two valve retainer screws and two valves are easily removed.
5. To remove diaphragm, press down its center against spring force. With diaphragm pressed down, tilt it until the end of pull rod touches the inner wall of body. Then, release the diaphragm to unhook push rod. Use care during this operation not to damage diaphragm or oil seal.



EF007

Fig. EF-12 Removing pull rod

6. Drive out rocker arm pin by using a press or hammer.



EF008

1 Fuel pump cap
2 Cap gasket
3 Valve packing Ass'y
4 Fuel pump valve Ass'y
5 Valve retainer
6 Diaphragm Ass'y
7 Diaphragm spring
8 Pull rod
9 Lower body seal washer
10 Lower body seal
11 Inlet connector
12 Outlet connector
13 Rocker arm spring
14 Rocker arm
15 Rocker arm side pin
16 Fuel pump packing
17 Spacer-fuel pump to cylinder block

Fig. EF-13 Structure of fuel pump

INSPECTION

1. Check upper body and lower body for cracks.
2. Check valve assembly for wear on valve and valve spring. Blow valve assembly with breath to examine its function.
3. Check diaphragm for small holes, cracks or wear.
4. Check rocker arm for wear at the portion in contact with camshaft.
5. Check rocker arm pin for wear. A worn pin may cause oil leakage.
6. Check all other components for any abnormalities and replace with new parts if necessary.

ASSEMBLY

Reverse the order of disassembly. Closely observe the following instructions.

1. Use new gaskets.
2. Lubricate rocker arm, rocker arm link and rocker arm pin before installation.
3. To test the function, proceed as follows:

Position fuel pump assembly about 1 meter (3.3 ft) above fuel level of fuel strainer and connect a pipe from strainer to fuel pump.

Operate rocker arm by hand. If fuel is drawn up soon after rocker arm is released, fuel pump is functioning properly.

CARBURETOR

CONTENTS

DESCRIPTION

Type	Engine and vehicle
DCH340-1	L18 on model 610 with *A/T
-2	with **M/T
DCH340-6	L16 on model 510 with A/T
-7	with M/T
DCH340-8	L16 on model 620 with A/T
-9	with M/T

*A/T: Automatic Transmission **M/T: Manual Transmission

These carburetors are of a downdraft type to produce the optimum air-fuel mixture under different operating conditions.

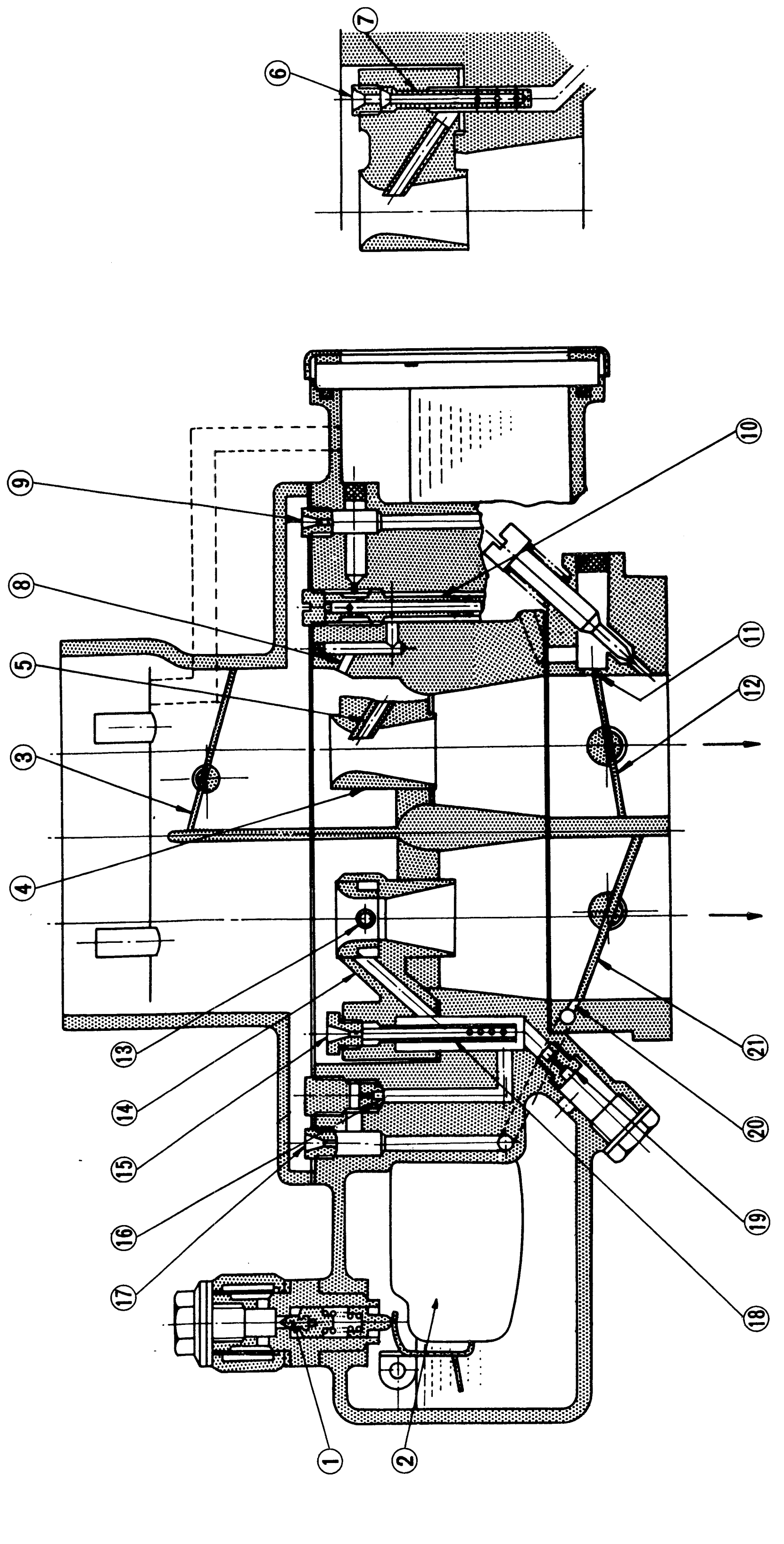
These carburetors present several distinct features of importance to the vehicle owners. A summary of the features is as follows:

1. Slow economizer to make a smooth connection with acceleration or deceleration during light load running. It also assures stable low speed performance.
2. Idle limiter to reduce harmful exhaust emissions to a minimum.
3. B.C.D.D. device for reducing "HC."
4. Electric automatic choke to facilitate cold starting as well as for reduced exhaust emissions.
5. Anti-dieseling solenoid to eliminate dieseling (run-on).
6. Power valve, or vacuum actuated booster, to insure smooth high-speed operation.

STRUCTURE AND OPERATION

The carburetors consist of the primary circuit for part-throttle operation, the secondary circuit for high-speed full-power operation, boost controlled deceleration device for coasting, and anti-dieseling solenoid for idle stop.

The float circuit, common between the primary and secondary circuits, incorporates the secondary switchover and starting mechanisms. Zenith Stromberg nozzles are used for the primary and secondary circuits.



1 Float valve
2 Float
3 Choke valve
4 Primary small venturi
5 Primary main nozzle
6 Main air bleed
7 Primary emulsion tube
8 P. 1st slow air bleed
9 P. 2nd slow air bleed
10 P. slow jet
11 P. bypass hole
12 P. throttle valve
13. S. main nozzle
14 S. small venturi
15 S. main air bleed
16 S. slow jet
17 S. slow air bleed
18 S. emulsion tube
19 S. main jet
20 S. bypass hole
21 S. throttle valve

Fig. EF-14 Sectional view of carburetor

Primary system

1. Primary main system

The primary main system is of zenith stromburg type. Fuel flows as shown in Figure EE-14 through the main jet, mixing with air which comes in from the main air bleed and passes through the emulsion tube, and is pulled out into the venturi through the main nozzle.

2. Idling and slow system

During low engine speed, as shown in Figure EF-14, fuel flows through the slow jet located in rear right side of main nozzle, mixing with air coming from the 1st slow air bleed, again mixing with air coming from the 2nd slow air bleed and then is pulled out into the engine through the idle hole and bypass hole.

Adoption of the submerged type of slow jet eliminates such hesitation as occurs on sudden deceleration of the vehicle.

Slow economizer system is useful to obtain smooth deceleration at high speed.

Small opening of the throttle valve in idling or partial load creates a large negative pressure in the intake manifold.

By this negative pressure, fuel is measured through the slow jet located behind the main jet. And air coming from the 1st slow air bleed is mixed with fuel in the emulsion hole.

This mixture is further mixed and atomized with air coming from the 2nd slow air bleed. The atomized mixture is supplied to the engine from the idle hole and bypass hole via the slow system passage.

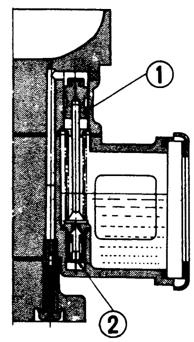
3. Accelerating mechanism

The carburetor is equipped with the piston type accelerating mechanism linked to the throttle valve. When the primary throttle valve, shown in Figure EF-15, is closed, the piston goes up, and fuel flows from the float chamber through the inlet valve into the space under the piston. When the throttle valve is opened, the piston goes down, opening the outlet valve, and fuel is forced out through the injector.

4. Power valve mechanism

The power valve mechanism, so-called vacuum piston type, utilizes the vacuum below the throttle valve.

When the throttle valve is slightly opened during light load running, a high vacuum is created in the intake manifold. This vacuum pulls the vacuum piston upward against the spring, leaving the power valve closed. When the vacuum below the throttle valve is lowered during full load or accelerating running, the spring pushes the vacuum piston downward, opening the power valve to furnish fuel.



1 Vacuum piston
2 Power valve

ET024

Fig. EF-16 Sectional view of power valve

Secondary system

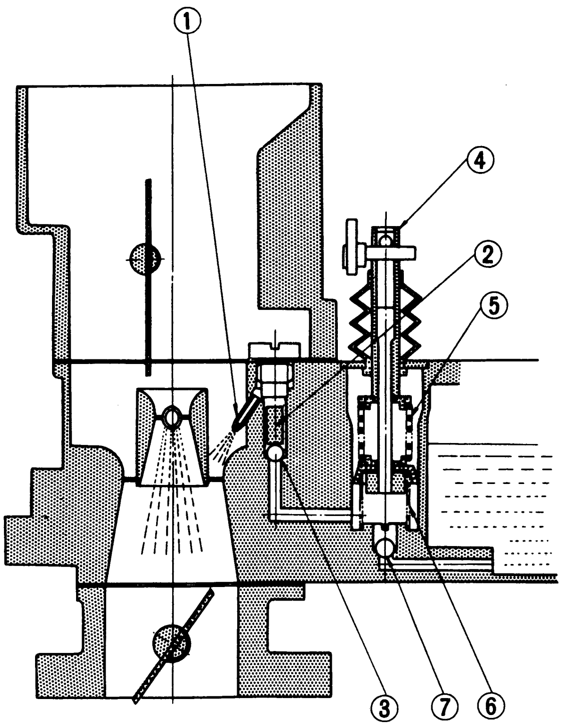
1. Secondary main system

The secondary main system is of zenith stromburg type.

Fuel-air mixture produced by the functions of the main jet, main air bleed and emulsion tube, in the same manner as in the primary system, is pulled out through the main nozzle into the small venturi.

Due to the double venturi of the secondary system, the higher velocity air current passing through the main nozzle promotes the fuel atomization.

The structure is almost the same as the primary side,



ET023

1 Pump injector
2 Weight
3 Outlet valve
4 Piston
5 Damper spring
6 Piston return spring
7 Inlet valve

Fig. EF-15 Acceleration mechanism

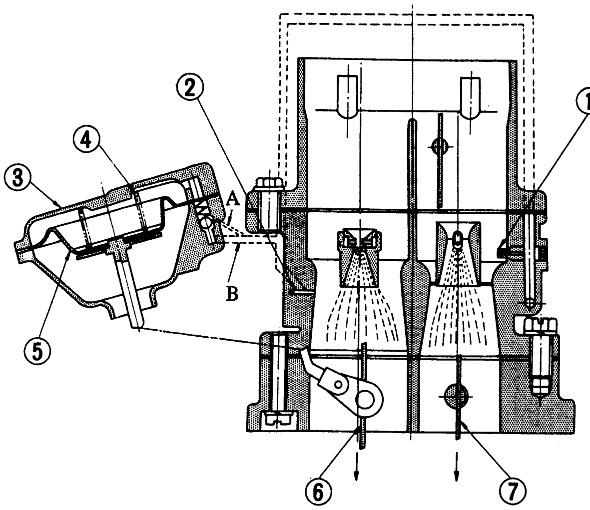


Fig. EF-17 Fuel throttle at high speed

2. Step system

The construction of this system may correspond to the idling and slow system of the primary system.

This system aims at the proper filling up of the gap when fuel supply is transferred from the primary system to the secondary one. The step port is located near the secondary throttle valve edge in its fully closed state.

3. Secondary switchover mechanism

The secondary throttle valve is linked to the diaphragm which is actuated by the vacuum created in the venturi. A vacuum jet is provided at each of the primary and secondary venturies, and the composite vacuum of these jets actuates the diaphragm.

As the linkage causes the secondary throttle valve not to open until the primary throttle valve opening reaches approximately 50°, fuel consumption during normal operation is not excessive.

During high speed running, as shown in Figure EF-17, as the vacuum at the venturi is increased, the diaphragm is pulled against the diaphragm spring force, and then secondary throttle valve is opened.

The other side, during low speed running (as the primary throttle valve opening does not reach 50°), the secondary throttle valve is locked to close completely by the locking arm which is interlocked with primary throttle arm by linkage.

When the primary throttle valve opening reaches wider position than 50°, the secondary throttle valve is ready to open, because the locking arm revolves and leaves from the secondary throttle arm.

Anti-dieseling system

The carburetor is equipped with an anti-dieseling solenoid. As the ignition switch is turned off, the valve is brought into operation, shutting off the supply of fuel to the slow circuit. The following figure shows a sectional view of this control.

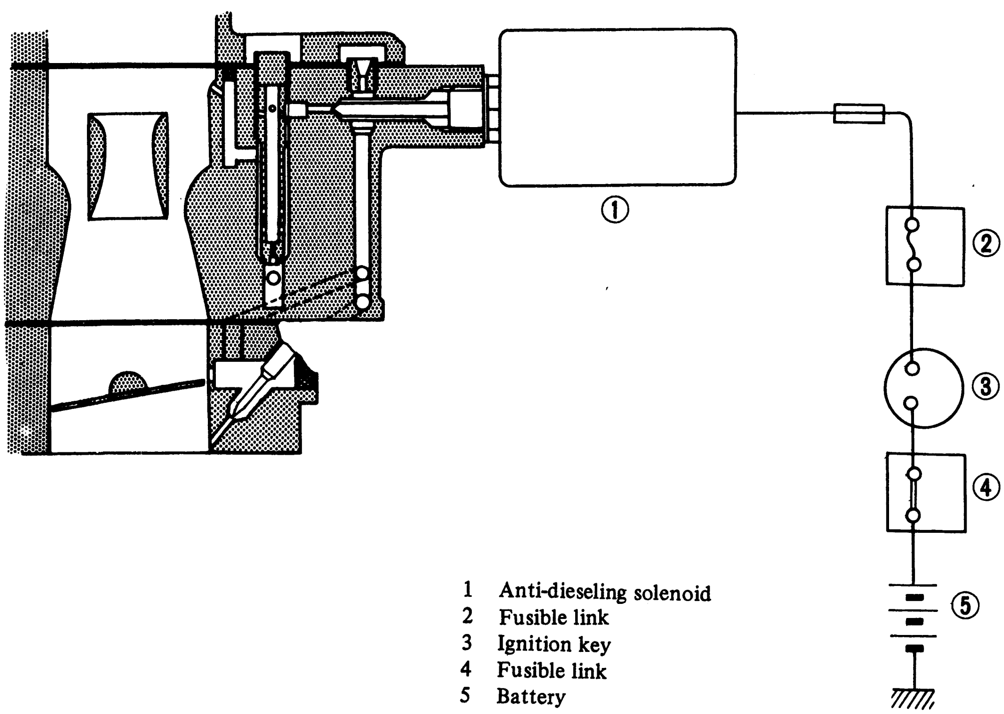


Fig. EF-18 Schematic drawing of anti-dieseling solenoid

Float system

There is only one float chamber, while two carburetor systems, primary and secondary, are provided.

Fuel fed from the fuel pump flows through the filter and needle valve into the float chamber. A constant fuel level is maintained by the float and needle valve.

Because of the inner air vent type of the float chamber ventilation, the fuel consumption will not be influenced by some dirt accumulated in the air cleaner.

The needle valve includes special hard steel ball and will not wear for all its considerably long use. Besides, the insertion of a spring will prevent the flooding at rough road running.

Boost controlled deceleration device (B.C.D.D.)

Boost controlled deceleration device (B.C.D.D.) serves to reduce HC emissions emitted from engine during coasting.

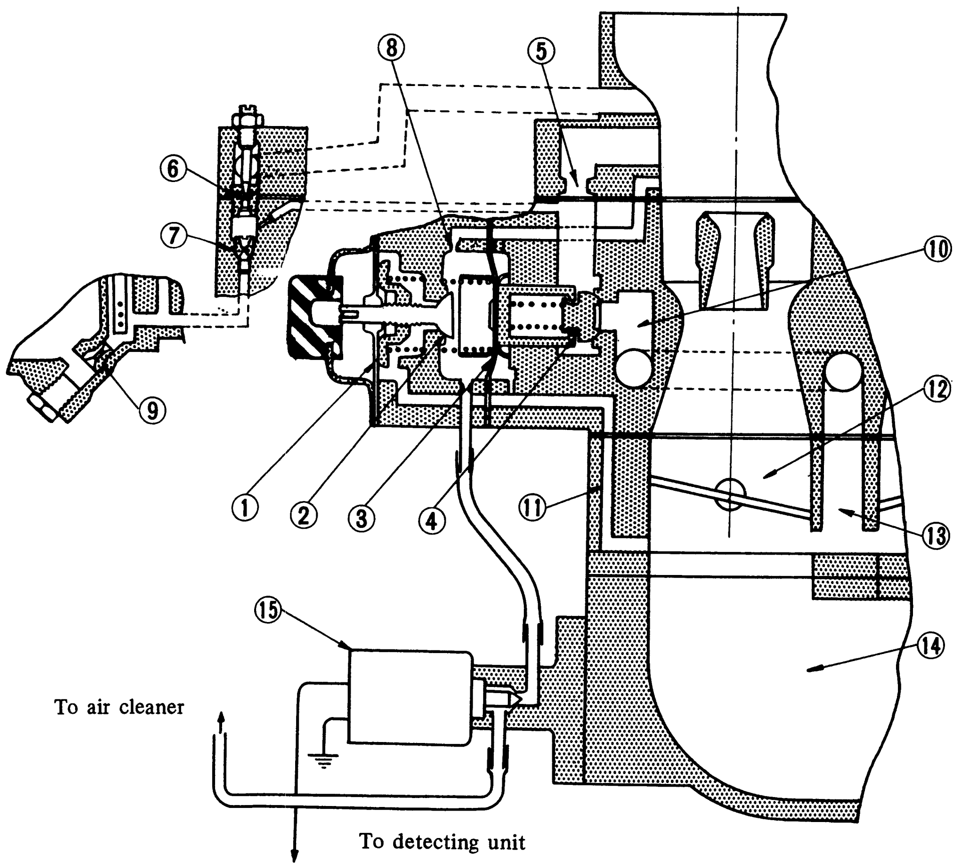
The high manifold vacuum during coasting prevents the mixture from complete combustion because of reduced amount of mixture per cylinder per rotation of engine, with a result that large amount of HC emissions is emitted into the atmosphere.

B.C.D.D. has been designed based on the idea of eliminating this objection. It operates in such a way that, when manifold vacuum exceeds a predetermined valve, it provides an additional mixture of optimum mixture ratio and quantity into the manifold by opening the separate mixture passage in the carburetor. Complete combustion of fuel is assisted by this additional mixture, and remarkably reduces the amount of HC contained in exhaust gases.

During the period from coasting to idling, the transmission produces a signal which in turn energizes the vacuum control solenoid.

As this takes place, the valve is lifted off its seat, releasing the vacuum chamber to the atmosphere.

The mixture control valve will then be closed, returning engine speed to the predetermined idling..



1 Diaphragm I
2 Vacuum control valve
3 Diaphragm II
4 Mixture control valve
5 Coasting air bleed II
6 Coasting air bleed I
7 Coasting jet
8 Air jet
9 Secondary main jet
10 Mixture air passage
11 Boost passage
12 Secondary barrel
13 Mixture outlet
14 Intake manifold
15 Vacuum control solenoid valve

Fig. EF-19 Sectional view of B.C.D.D.

Performance

The diaphragm I ① detects the manifold vacuum and, when the vacuum exceeds a pre-determined value, acts so as to open the vacuum control valve ②. This opening makes the manifold vacuum introduce into the second vacuum chamber and actuates the diaphragm II ③.

When diaphragm II operates, the mixture control valve ④ opens the passage and introduces the additional mixture into the manifold.

The amount of the mixture is controlled by the servo-action of the mixture control valve ④ and vacuum control valve ② so that the manifold vacuum may be kept at the pre-determined value.

The amount of mixture depends mainly upon the coasting air bleed II ⑤, while its mixture ratio is determined by the coasting jet ⑦ and coasting air bleed ⑥.

Performance of vacuum control solenoid valve

Manual transmission

The vacuum control solenoid valve is controlled by a speed switch that is actuated by the speedometer needle.

As the vehicle speed falls below 10 mph, this switch is activated, producting a signal.

This signal is then amplified as it passes through a built-in amplifier, causing the vacuum control valve to function.

Automatic transmission

The automatic transmission incorporates an inhibitor switch.

This switch is operated only when the transmission is placed in either "N" or "P" position.

With the transmission placed in either of the above ranges, the switch causes the vacuum control valve to function.

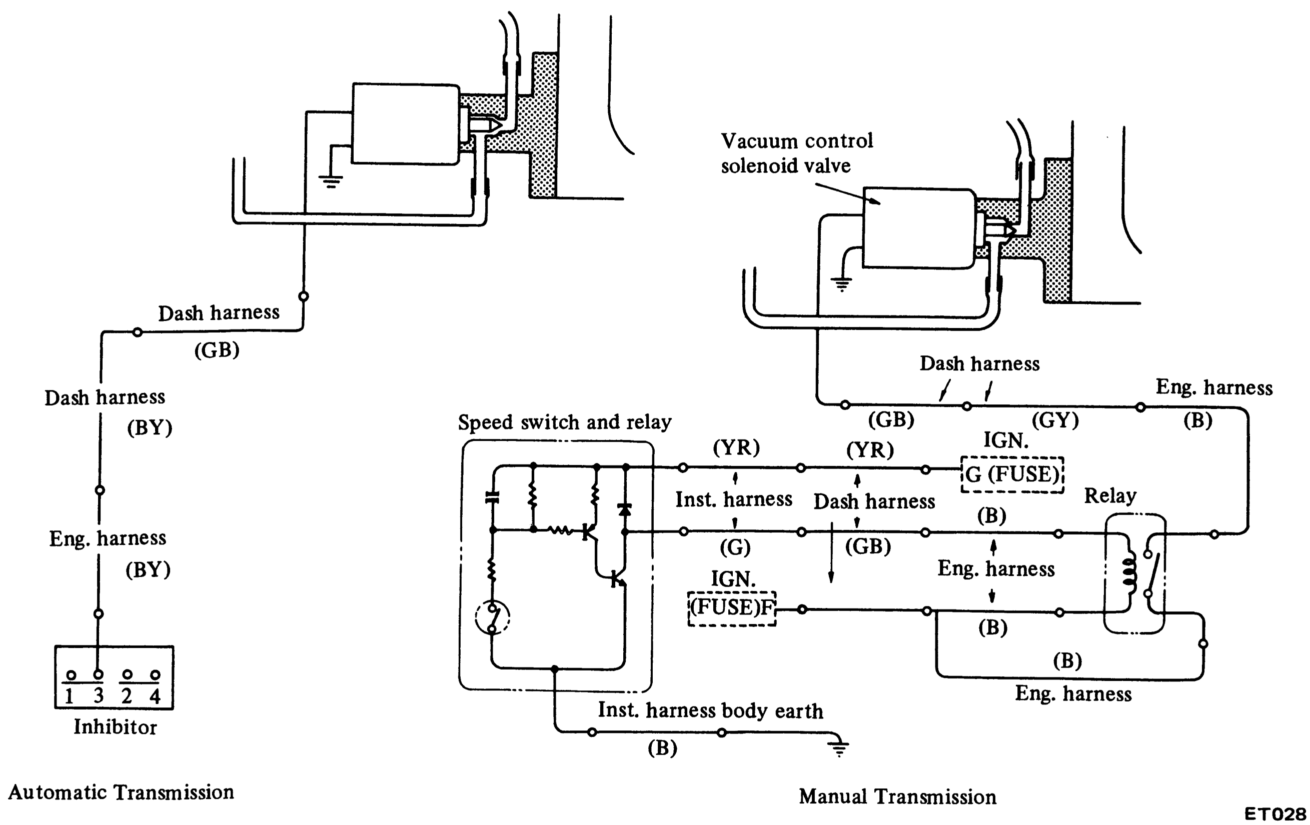


Fig. EF-20 Electrical control system of B.C.D.D.

Electric automatic choke

An electric heater warms a bimetal interconnected to the choke valve, and controls the position of choke valve and throttle valve in accordance with the elapse of time, or the warm-up condition of engine.

The construction and function of each part of this carburetor are as follows:

(1) Bimetal and heater in thermostat cover

Electric current flows through the heater as the engine starts, and warms bimetal. The deflection of bimetal is transmitted to the choke valve through the choke valve lever.

(2) Fast idle cam

The fast idle cam determines the opening of throttle valve so as to obtain proper amount of mixture corresponding to the opening of the choke valve which in turn depends upon the warmed-up condition of the engine.

(3) Fast idle adjusting screw

This screw adjusts the opening of the throttle valve of fast idle cam.

(4) Unloader

When accelerating the engine during the warm-up period, that is, before choke valve opens sufficiently, this unloader makes the choke valve open to a certain extent so as to obtain an adequate air-fuel mixture.

(5) Vacuum diaphragm

The moment when engine is ready just after the engine has started by cranking, this diaphragm forces open choke valve to the predetermined extent so as to provide proper air-fuel ratio.

(6) Bimetal case index mark

The bimetal case index mark is used for setting the moment of the bimetal which controls the air-fuel mixture ratio required for starting.

Dash pot device (Automatic transmission cars only)

These carburetors are equipped with a dash pot interlocked with the primary throttle valve through a link mechanism. The dash pot, which is exclusively installed on vehicles equipped with automatic transmission, is intended to prevent engine stall that would result from quick application of the brake immediately after driving the vehicle, or from the quick release of the accelerator pedal after treading it slightly.

In such condition, a throttle lever strikes against the dash pot stem and makes the primary throttle valve gradually close, thus keeping the engine running.

ADJUSTMENT

Adjusting carburetor idle-rpm and mixture ratio

Idle mixture adjustment requires the use of a "CO" meter. When preparing to adjust idle mixture, it is essential to have the meter thoroughly warmed up and calibrated.

1. Warm up engine sufficiently.
2. Continue engine operation for one minute under idling speed.
3. Adjust throttle adjusting screw so that engine speed is 800 rpm for cars with a manual transmission (in "N" range for automatic transmission).
4. Check ignition timing, if necessary adjust it to the specifications. (5°/800 rpm, retard side).
5. Adjust idle adjusting screw so that "CO" percentage is 1.5 ± 0.5%.
6. Repeat the procedures as described in items 3 and 5 above so that "CO" percentage is 1.5 ± 0.5% at 800 rpm.

Caution:

a. **On automatic transmission equipped model, check should be done in "D" range. Be sure to apply parking brake and to lock both front and rear wheels with wheel chocks.**

b. **Hold brake pedal while stepping down on accelerator pedal. Otherwise car will rush out dangerously.**

7. On automatic transmission equipped model, make sure that the adjustment has been made with the selector lever in "N" position.

And then check the specifications with the lever in "D" position. Insure that CO percent and idle speed are as follows:

Idling rpm	650
"CO" percentage	1.5 ± 0.5%

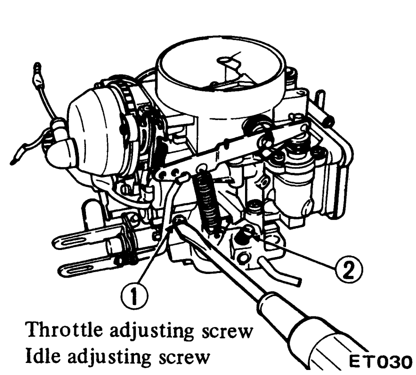
Readjust by turning in or out throttle adjust screw or idle adjusting screw if it is still out.

Notes:

a. **Do not attempt to screw down idle adjusting screw completely to avoid damage to tip, which will tend to cause malfunctions.**

b. **After idle adjustment has been made, shift the lever to "N" or "P" range for automatic transmission.**

c. **Remove wheel chocks when running.**



1 Throttle adjusting screw
2 Idle adjusting screw

Fig. EF-21 Throttle and idle adjusting screws

Idle limitter cap

Do not remove this idle limitter cap unless necessary. If this unit is removed, it is necessary to re-adjust it at the time of installation. To adjust proceed as follows.

1. After adjusting throttle or idle speed adjusting screwd, check to be sure that the amount of "CO" contained in exhaust gases meets the

established standard.

2. Install idle limitter cap in position, making sure that the adjusting screw can further turn 1/8 rotation in the "CO-RICH" direction.

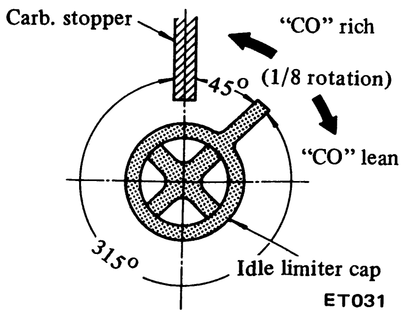


Fig. EF-22 Setting of idle limiter cap

Fuel level adjustment

A constant fuel level is maintained by float level and ball valve. If fuel level is in accord with level gauge line, float level is properly set. If float level is not correct, adjust it by bending float seat as shown in Figure EF-23.

Approximately H mm is required for effective stroke of needle valve. So adjust gap between valve stem and float seat to H mm with float fully lifted up by bending float stopper.

H; 1.5 mm (0.0591 in)

Fast idle adjustment

Choke valve at fully closed position automatically opens throttle valve at an optimum angle for starting engine through a link mechanism.

Normal Tune-up

In moderate climates, adjust manual transmission fast idle RPM to the specifications by turning fast idling screw in or out as necessary.

Carburetor removed

If a new or reconditioned carburetor is being installed, tune as follows:

1. With carburetor assembly removed from engine, measure throttle valve clearance ("A" in Figure EF-24) with a wire gauge, placing the upper side of fast idling screw on the second step of the fast idling cam.
2. Install carburetor on engine.
3. Start engine and measure RPM. It should be approximately 2,000 rpm for Manual transmission and 2,400 rpm for Automatic transmission.
4. Turn fast idling screw counter-clockwise to increase, or clockwise to decrease, to adjust fast idle RPM.

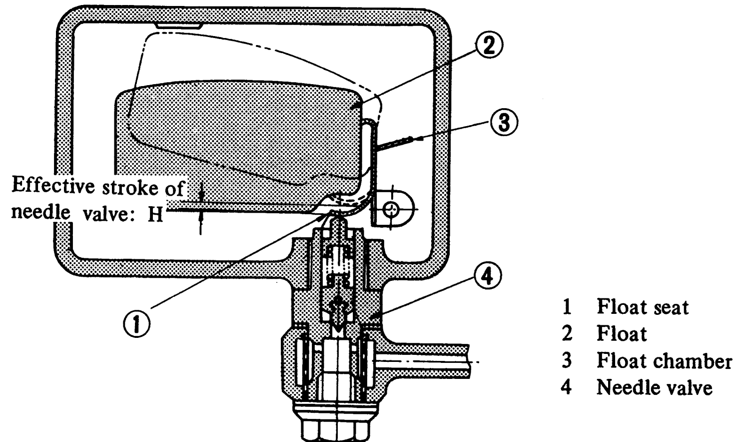


Fig. EF-23 Adjusting fuel level

	Throttle opening (degree)	Clearance "A" mm (in)	Engine revolution (rpm)
Manual Transmission	12 ± 0.5	0.95 ± 0.05 (0.0374 ± 0.0020)	2,000 ± 100
Automatic Transmission	14 ± 0.5	1.17 ± 0.05 (0.0461 ± 0.0020)	2,400 ± 100

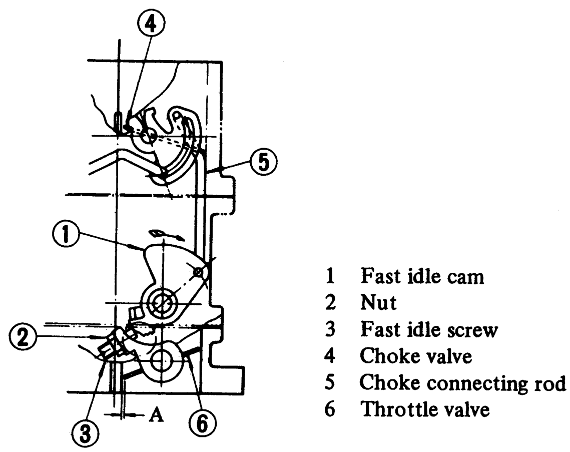
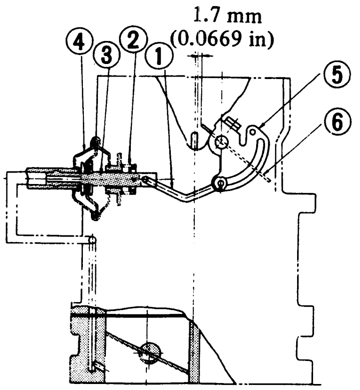


Fig. EF-24 Adjustment fast idle opening

Vacuum break adjustment

1. Completely close choke valve.
2. Hold choke valve by streching a rubber band between choke piston lever and stationary part of carburetor.
3. Grip vacuum break rod with pliers, and pull straight fully.
4. Under this condition, adjust the gap between choke valve and carburetor body to 1.7 mm (0.067 in) by bending vacuum brake rod. See Figure EF-25.



ET033

1 Choke piston rod
2 Choke spring
3 Choke piston
4 Diaphragm rod
5 Choke piston lever
6 Choke valve

Fig. EF-25 Vacuum break adjustment

Choke unloader adjustment

1. Close choke valve completely.
2. Hold choke valve by streching a rubber band between choke piston lever and stationary part of carburetor.
3. Open throttle lever until it opens fully.

Under this condition, adjust the clearance between choke valve and carburetor body to 4.4 mm (0.173 in) by bending unloader tongue.

Note: **Make sure that throttle valve opens when carburetor is mounted on the car.**
If throttle valve fails to open, unloader becomes inoperative, resulting in poor acceleration after engine is started.

Bimetal setting

1. Measurement of bimetal heater resistance:

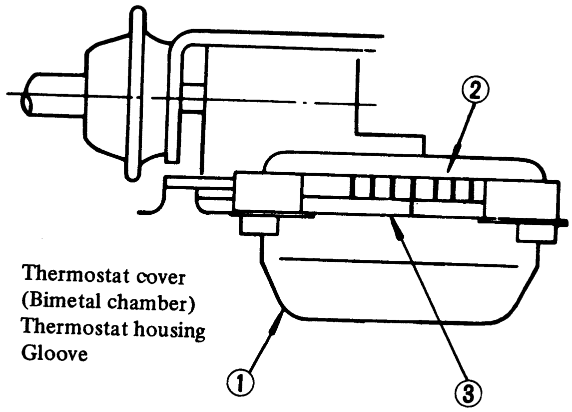
Install bimetal cover on carburetor. Make sure that resistance across the terminal and carburetor body is in the range of 9.8 to 10.2 ohms. Measure the resistance without the folow of electric current through heater and at about 21°C (70°F).

Note: **Use an accurate measuring instrument, such as a wheatstone bridge.**

2. Bimetal cover setting.

Position bimetal cover so that the index marks are aligned as shown in Figure ET-26. (Center of the index marks.)

Note: **When somewhat over-choked, set bimetal cover by turning it clockwise about one division of the scale graduations.**



1 Thermostat cover (Bimetal chamber)
2 Thermostat housing
3 Gloove

ET034

Fig. EF-26 Bimetal setting

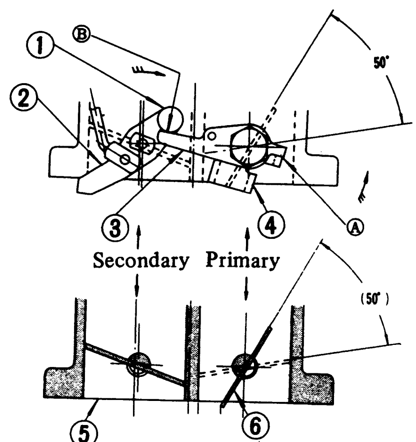
Adjustment of interlock opening of primary and secondary throttle valves

Figure EF-27 shows that primary throttle valve opens 50°. When primary throttle valve opens 50° adjusting plate integrated with throttle valve is in contact with return plate at A.

When throttle valve further opens, locking arm is detached from secondary throttle arm, permitting secondary system to start operation.

Linkage between primary and secondary throttles will operate properly if distance between throttle valve and inner wall of throttle chamber is 7.4 mm (0.291 in).

Adjustment is made by bending connecting link. See Figure EF-27.



ET035

1 Roller
2 Connecting lever
3 Return plate
4 Adjust plate
5 Throttle chamber
6 Throttle valve

Fig. EF-27 Adjusting interlock opening

Dash pot adjustment (Automatic transmission cars only)

Proper contact between throttle lever and dash pot stem provides normal dash pot performance. Adjustment of the proper contact can be made by dash pot set screw.

If normal set can not be obtained between dash pot stem and throttle arm, rotate dash pot to the proper position.

Installed on engine

1. It is necessary that the idling speed of engine and mixture have been well turned up and engine is sufficiently warm.
2. Turn throttle valve by hand, and read engine speed when dash pot just touches the stopper lever.
3. Adjust the position of dash pot by turning nut until engine speed is in the range of 1,600 to 1,800 rpm.
4. Then fasten loosened lock nut.
5. Make sure that the engine speed is smoothly reduced from 2,000 to 1,000 rpm in about three seconds.

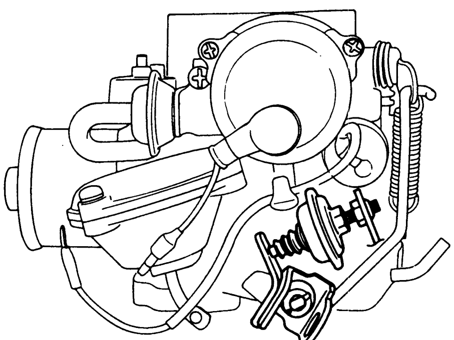


Fig. EF-28 Dash pot adjustment

Prepare the following tools:

1. A tachometer to measure the engine speed while idling, and screwdriver.
2. A Vacuum gauge and connecting pipe.

Notes:

a. A quick-response boost gauge such as Bourdon's tube is recommended. Do not use manometer.
b. Special tools are not required.

Warming-up operation

Continue warning-up operation until the engine reaches its normal operating temperature.

Connecting vacuum gauge

Connect rubber hose between vacuum gauge and intake manifold as shown.

Disconnect solenoid valve and let solenoid valve free.

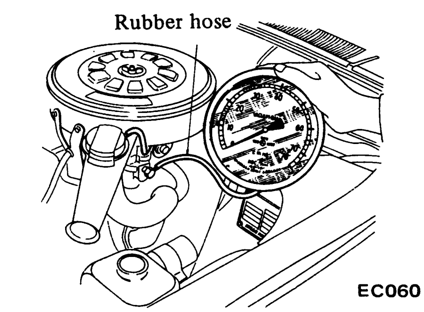


Fig. EF-29 Connecting vacuum gauge

Adjustment of idling

Adjust the engine at normal idling setting.

	Engine idling (rpm)	Idling timing (degree, retard side)	CO (%)
M/T Vehicle	800	5° BTCC	1.5 ± 0.5
A/T Vehicle	650 (in "D" range)	5° BTDC	1.5 ± 0.5

M/T: Manual Transmission A/T: Automatic Transmission

Adjustment of operating pressure of B.C.C.D.

Primcipally, it is unnecessary to adjust the B.C.D.D., however if there is any requirement the adjustment procedure is as follows;

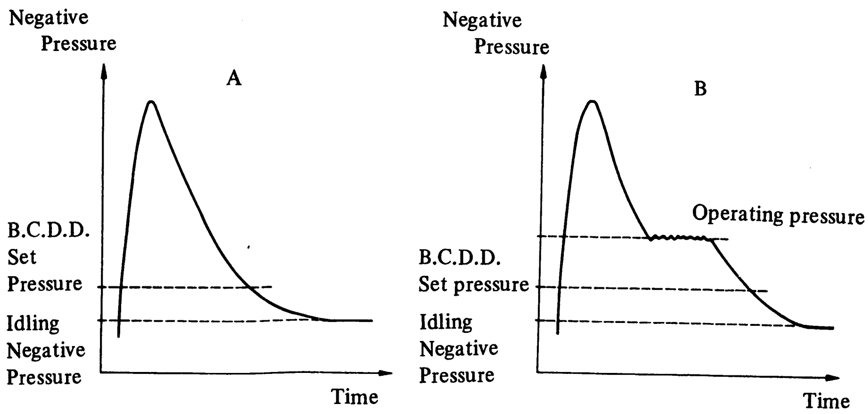
Racing

Place shaft lever in neutral for M/T, or N or P for A/T. Raise the engine speed up to 3,000 to 3,500 rpm under no-load, and close the throttle valve by releasing it from hand. Examine the engine revolution whether it falls to idling revolution or not.

⟨⟨When the engine revolution falls to the idling speed (See Figure EF-34)⟩⟩

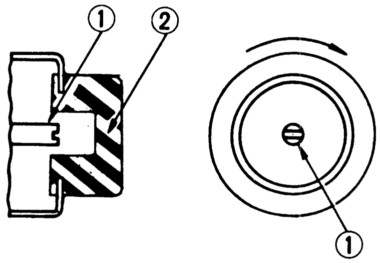
At this moment, the negative pressure of manifold rises above approximately –550 mmHg (–21.7 inHg) and then gradually falls to the pressure of idling [about –420 mmHg (–16.5 inHg)]. The process of this pressure fall takes one of the three forms as illustrated in Figures EF-30, EF-32 and EF-33 according to the difference the operating pressure of B.C.D.D.

1. When the operating pressure is too high, B.C.D.D. remains inoperative, and negative pressure decreases without being sustained while it is falling, just like that of the engine on which a B.C.D.D. is absent. See diagram (A).
2. When the operating pressure is lower than that of the case of (A) but is higher than the set pressure: The negative pressure which has once risen is kept constant at a certain value (operating pressure) for about one second, and then gradually falls down to the idling negative pressure. See diagram (B).



ET043

Fig. EF-30 Characteristic curve — high negative pressure —



1 Adjusting screw "S"
2 Cover "C"

ET037

Fig. EF-31 Adjusting operating pressure

Turn adjusting screw "S" as outlined below until correct pressure is obtained. Slightly turn this adjusting screw clockwise and then race engine. Do not fit tip of screwdriver tightely in screw slot.

Notes:

a. **Turning adjusting screw "S" one-eighth rotation in either direction will cause a change in operation pressure of 0.79 inHg (20 mmHg). This adjusting screw is left-hand threaded.**

b. **Turn adjustingscrew "S" counter-clockwise to increase the negative pressure.**

c. **Turn adjusting screw clockwise to decrease the negative pressure.**

When the operating pressure equals set pressure.

When the operating pressure is equalized to set pressure, and then falls to idling pressure, install cover "C."

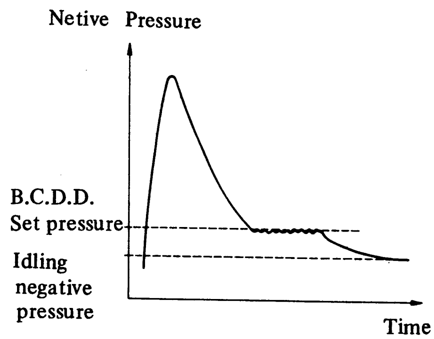
B.C.D.D. set pressure

Manual transmission vehicle

−500 ± 20 mmHg
(−19.7 ± 0.79 inHg)

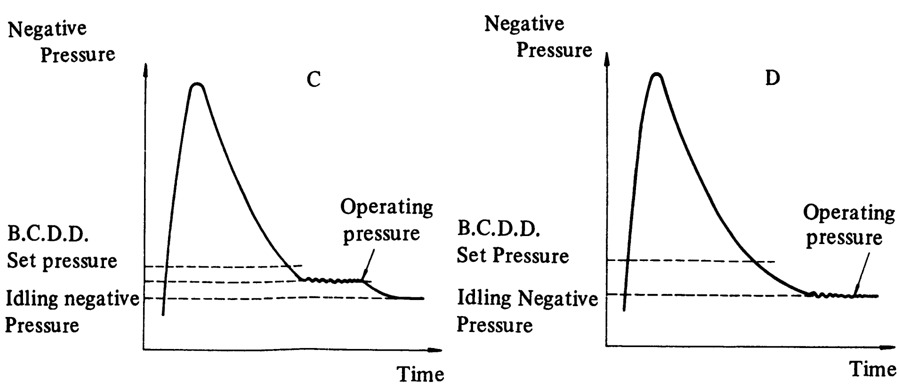
Automatic transmission vehicle

−480 ± 20 mmHg
(−18.9 ± 0.79 inHg)



ET045

Fig. EF-33 Characteristic curve — proper negative pressure —



ET044

Characteristic curve

Low negative pressure

Fig. EF-32 Characteristic curve — low negative pressure —

When the engine revolution does not fall to the idling speed (See Figure EF-34)

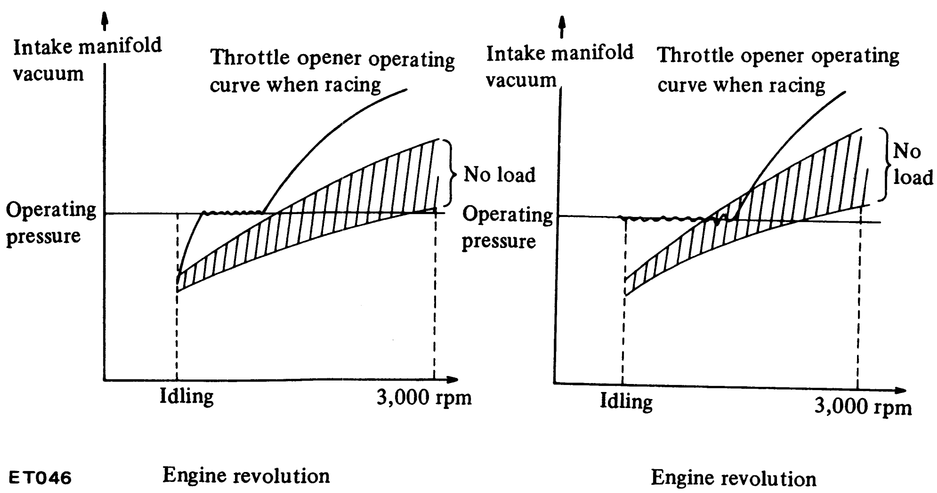


Fig. EF-34 Characteristic curve of B.C.D.D.

When the engine revolution does not fall to the idling speed, it is necessary to fall the idling negative pressure of manifold to lower than the set pressure of B.C.D.D. (The engine revolution does not fall to the idling speed when the idling negative pressure is higher than the set pressure of B.C.D.D.).

In this case, there requires to labour the engine by (1) road test or (2) chassis dynamometer or (3) raise up rear suspension member by stand. And accelerate the car 40 to 50 mph with top gear for M/T or D range for A/T, then release the accelerater pedal and let the car deceleration. Then check the B.C.D.D. set pressure whether it is in the predetermined value or not. The process of this pressure fall takes one of the three froms as illustrated in Figures EF-30, EF-32 and EF-33 according to the difference of the operating pressure of B.C.D.D.

When the operating pressure is too high

When the operating pressure is higher than the set pressure. The negative pressure which has once risen is kept constant at a certain value (operating pressure) for about one second, and then gradually falls to the idling negative pressure. See diagram (B). Adjustment of this condition is exactly same as that of when the engine revolution falls to the idling speed. (Mentioned above.)

When the operating pressure is too low

1. When the operating pressure is somewhat low, the negative pressure becomes constant for some while at a value below set pressure, and then falls to idling negative pressure. See diagram (C).
2. When the operating pressure is exceedingly low, the negative pressure will not fall to idling pressure and the speed of engine is not restored to idling speed. In extreme cases the engine' speed fails to attain idling speed although to that of idling. See diagram (D).

Turn adjusting screw "S" until correct pressure is obtained. Slightly turn this adjusting screw counterclockwise and then race the engine. Do not fit tip of screwdriver tightly in screw slot.

MAJOR SERVICE OPERATION

The perfect carburetor delivers the proper fuel and air ratios for all speeds of the particular engine for which it was designed. By completely disassembling at regular intervals, which will allow cleaning of all parts and passages, the carburetor can be returned to its original condition and it will then deliver the proper ratios as it did when new.

To maintain the accurate carburetion of passages and discharge holes, extreme care must be taken in cleaning.

Use only carburetor solvent and compressed air to clean all passages and dicharge holes. Never use wire or other pointed instrument to clean as calibration of carburetor will be affected.

Removal

1. Remove air cleaner.
2. Disconnect fuel and vacuum lines from carburetor.
3. Remove throttle lever.
4. Remove four nuts and washers retaining carburetor to manifold.
5. Lift carburetor off manifold.
6. Remove and discard the gasket used between carburetor and manifold. Replace it, if necessary.

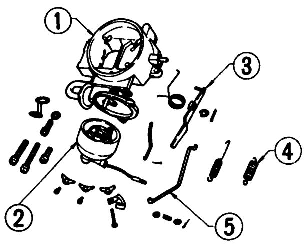
Disassembly and assembly

Disassembly

Do not remove throttle plates.

Carburetor assembly

1. Remove throttle return spring from primary side.
2. Remove pump lever and pump rod.
3. Remove cam connecting rod.
4. Remove thermostat cover by unscrewing three set screws.
5. Remove choke chamber by unscrewing four set screw and remove throttle return spring from secondary side.



ET038

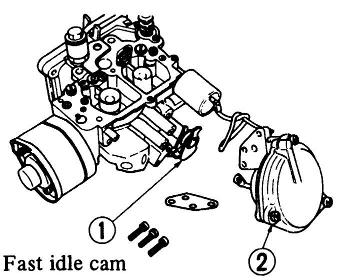
1 Ventui
2 Main air bleed
3 Emuleion take
4 Secondary
5 Primary

Fig. EF-34 Removing thermostat

6. Separate float chamber and throttle chamber by unscrewing four set screws.

Float chamber

1. Remove diaphragm chamber assembly and diaphragm chamber gasket.
2. Remove fast idle cam, cam spring and counter lever.

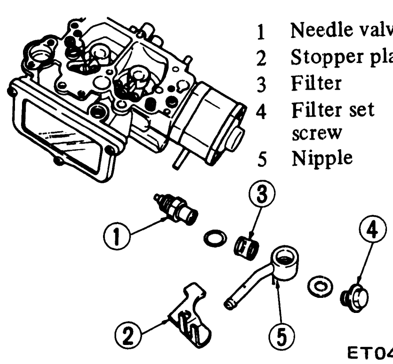


1 Fast idle cam
2 Diaphragm cheunber

ET039

Fig. EF-35 Removing diaphragm chamber

3. Remove filter set screw, nipple, filter, needle valve and stopper plate.

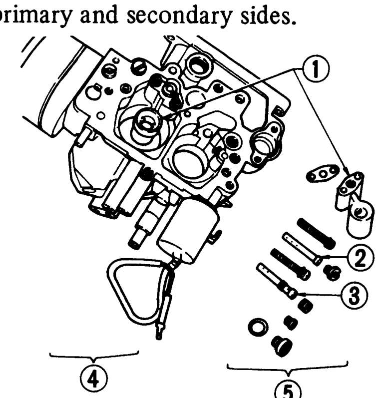


1 Needle valve
2 Stopper plate
3 Filter
4 Filter set screw
5 Nipple

ET040

Fig. EF-36 Removing filter

4. Remove cylinder plate, pump cover, piston, piston return spring and inlet valve by unscrewing two set screws.
5. Remove injector spring and outlet valve.
6. Remove small venturies, main air bleeds and emulsion tubes from primary and secondary sides.



1 Chock chamber
2 Thermostat cover
3 Pump lever
4 Throttle return spring
5 Pump rod

ET041

Fig. EF-37 Removing venturies

7. Remove slow jet and slow air bleed.
8. Remove primary and secondary main jets.
9. Remove level gauge cover, float chamber, level gauge, rubber seal, float shaft colour and float.
10. Remove power valve.
11. Remove return plate, sleeve, fast idle lever, spring hanger and throttle lever.

Anti-dieseling solenoid

Removal

Solenoid is cemented at factory. Use special tool "ST19150000" to remove a solenoid.

When this tool is not effective, use a pair of pliers to loosen body out of position.

Installation

1. Before installing a solenoid, it is essential to clean all threaded parts of carburetor and solenoid. Supply screws in holes and turn them in two or three pitches.
2. First, without disturbing the above setting, coat all exposed threads with adhesive the "Stud Lock" of LOCTITE or equivalent.

Then, torque screws to 35 to 55 kg-cm (30 to 48 in-lb) using a special tool "ST19150000."

After installing anti-dieseling solenoid, leave carburetor more than 12 hours without operation.

3. After replacement is over, start engine and check to be sure that fuel is not leaking, and that anti-dieseling solenoid is in good condition.

Notes:

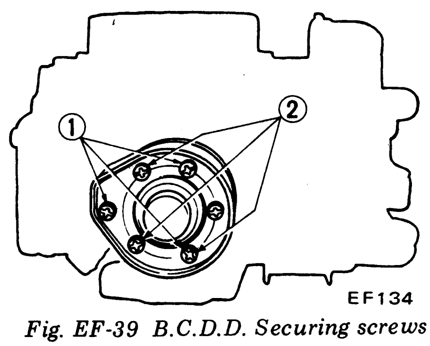
a. **Do not allow adhesive getting on valve. Failure to follow this caution would result in improper valve performance or clogged fuel passage.**

b. **In installing valve, use caution not to hold body directly. Instead, use special tool, tightening nuts as required.**

c. **After installing a new solenoid, check to be certain that there is no leakage, cracks or otherwide deformation.**

B.C.D.D.

Remove B.C.D.D. by unscrewing three securing screws ①. Do not unscrew three B.C.D.D. assembly screw ②.



EF134

Fig. EF-39 B.C.D.D. Securing screws

When installing, after screwing three securing screws ①, rescrew three B.C.D.D. assembly screws ② in order to prevent the warp of B.C.D.D. body.

Tightening torque:

20 to 40 kg-cm (17 to 35 in-lb)

Assembly and installation

Follow disassembly and removal procedures in reverse.

Replace gaskets, if necessary.

In disassembling interlock link and related components, be careful not to bend or deform any of components.

Careful reassembly will restore smooth operation of all interlock parts.

Cleaning and inspection

Dirt, gum, water or carbon contamination in or on exterior moving parts of a carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection while servicing.

1. Blow all passages and castings with compressed air and blow off all parts until dry.

Note: **Do not pass drills or wires through calibrated jets or passages as this may enlarge orifice and seriously affect carburetor calibration.**

2. Check all parts for wear. If wear is noted, defective parts must be replaced. Note especially the following:

7. Push connecting rod of diaphragm chamber and block passage of vacuum by finger. And when connecting rod becomes free, check for leakage of air and damage of diaphragm.

(1) Check float needle and seat for wear. If wear is noted, assembly must be replaced.

(2) Check throttle and choke shaft bores in throttle chamber and choke chamber for wear or out-of-roundness.

(3) Inspect idle adjusting needle for burrs or ridges. Such a condition requires replacement.

3. Inspect gaskets to see if they appear hard or brittle or if edges are torn or distorted. If any such condition is noted, they must be replaced.
4. Check filter screen for dirt or lint. Clean, and if it is distorted or remains plugged, replace.
5. Check linkage for operating condition.
6. Inspect operation of accelerating pump. Pour fuel into float chamber and make throttle lever operate. And check condition of fuel injection from the accelerating nozzle.

JETS

The carburetor performance depends on jets and air bleeds. That is why these components must be fabricated with utmost care. To clean them, use cleaning solvent and blow air on them. Larger inner numbers stamped on the jets indicate larger diameters. Accordingly, main and slow jets with larger numbers provide richer mixture, and the smaller numbers the leaner mixture. Inversely, the main and slow air bleeds, which are for air to pass through, make the fuel leaner if they bear larger numbers, and the smaller numbers the richer fuel.

TROUBLE DIAGNOSES AND CORRECTIONS

In the following table, the symptoms and causes of carburetor troubles and remedies for them are listed to facilitate quick repairs.

There are various causes of engine troubles. It sometimes happens that the carburetor which has no defect seems apparently to have some troubles, when electric system is defective. Therefore, whenever the engine has troubles, electric system must be checked first before taking to carburetor adjustment.

Condition	Probable cause	Corrective action
Overflow	Dirt accumulated on needle valve.	Clean needle valve.
	Fuel pump pressure too high.	Repair pump.
	Needle valve seat improper.	Lap or replace.
Excessive fuel consumption	Fuel overflow.	See above item.
	Each main jet, slow jet too large.	Replace.
	Each main air bleed clogged.	Clean.
	Choke valve does not fully open.	Adjust.
	Outlet valve seat of accelerator pump improper.	Lap.
	Linked opening of secondary throttle valve too early.	Adjust.

FUEL SYSTEM

Condition	Probable cause	Corrective action
Power shortage	Each main jet clogged.	Clean.
	Each throttle valve does not fully open.	Adjust.
	Idling adjustment incorrect.	Repair.
	Fuel strainer clogged.	Clean.
	Vacuum jet clogged.	Clean.
	Air cleaner clogged.	Clean.
	Diaphragm damaged.	Replace.
	Power valve operated improperly.	Adjust.
Improper idling	Slow jet clogged.	Clean.
	Each throttle valve does not close.	Adjust.
	Secondary throttle valve operated improperly.	Overhaul and clean.
	Each throttle valve shaft worn.	Replace.
	Packing between manifold/carburetor defective.	Replace packing.
	Manifold/carburetor tightening improper.	Correct tightening.
	Fuel overflow.	See the first item.
	B.C.D.D. adjustment incorrect.	Adjust.
	Damaged vacuum control solenoid.	Replace.
	Sticked anti-stall dash pot.	Replace.
Engine hesitation	Main jet or slow jet clogged.	Clean.
	By pass hole, idle passage clogged.	Clean tube.
	Emulsion tube clogged.	Clean.
	Idling ajdustment incorrect.	Correct adjustment.
	Secondary throttle valve operated improperly.	Overhaul and clean.
Engine does not start.	Fuel overflows.	See the first item.
	No fuel.	Check pump, fuel pipe and needle valve.
	Idling adjustment incorrect.	Adjust.
	Fast idle adjustment incorrect.	Adjust.
	Damaged anti-dieseling solenoid.	Replace.

EVAPORATIVE EMISSION CONTROL SYSTEM

CONTENTS

DESCRIPTION

This system consists of four basic elements indicated below:

1. Fuel tank with positive sealing filler cap.
2. Vapor-liquid separator.
3. Vapor vent line.
4. Flow guide valve.

The flow guide valve prevents blow-by gas from flowing into the fuel tank and guides fresh air into it, preventing gasoline vapor from escaping into the carburetor air cleaner.

Flow guide valve operates and blow-by gas and gasoline vapor flow as fllows.

When the engine is not running, the vapor vent line, vapor liquid separator and fuel tank are filled with gasoline vapor produced in the sealed type fuel tank. A flow guide valve opens when the gas pressure is above 0.4 inch Hg. The gas passed through the flow guide valve (2) is accumulated in the crankcase. Once the engine starts, the gas evaporating in the carnkcase, is sucked into the manifold for combustion. When the pressure of the sealed type fuel tank, vapor liquid separator and vapor vent line becomes negative by decreasing the fuel, the flow guide valve (1) opens to send fresh air from the carburetor air cleaner to the fuel tank.

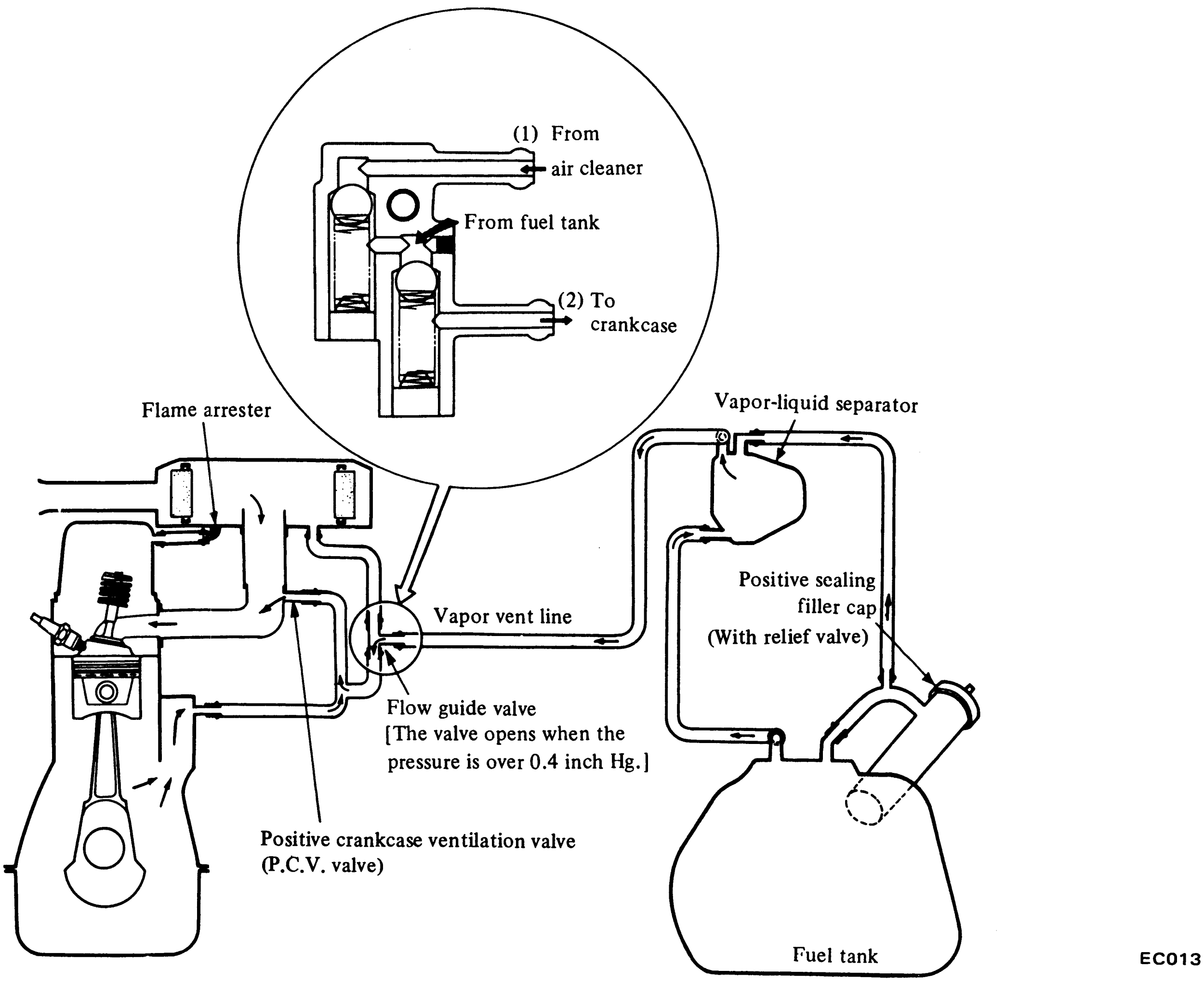


Fig. EF-40 Evaporative emission control system

FLOW GUIDE VALVE

This valve is mounted in the engine compartment. Marks A, F and C are engraved in the body of the valve to indicate the connection of the vapor vent line.

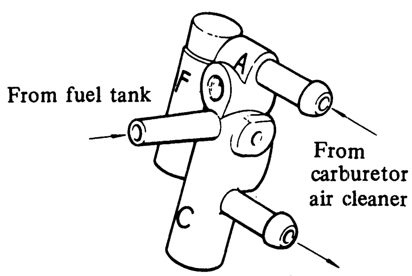


Fig. EF-41 Flow guide valve

Checking fuel tank, vapor-liquid separator and vapor vent line

1. Check all hoses and fuel tank filler cap.
2. Disconnect the vapor vent line connecting flow guide valve to vapor-liquid separator.
3. Connect a 3-way connector, a manometer and a cock (or an equivalent 3-way change cock) to the end of the vent line.
4. Supply fresh air into the vapor vent line through the cock little by little until the pressure becomes 14.5 inch Aq.
5. Shut the cock completely and leave it that way.
6. After 2.5 minutes, measure the height of the liquid in the manometer.
7. Variation of height should remain within 1.0 inch Aq.
8. When the filler cap does not close completely the height should drop to zero in a short time.
9. If the height does not drop to zero in short time when the filler cap is removed, it is the cause of the stuffy hose.

Note: In case the vent line is stuffy, the breathing in fuel tank is not thoroughly made, thus causing insufficient delivery of fuel to engine or vapor lock. It must therefore be repaired or replaced.

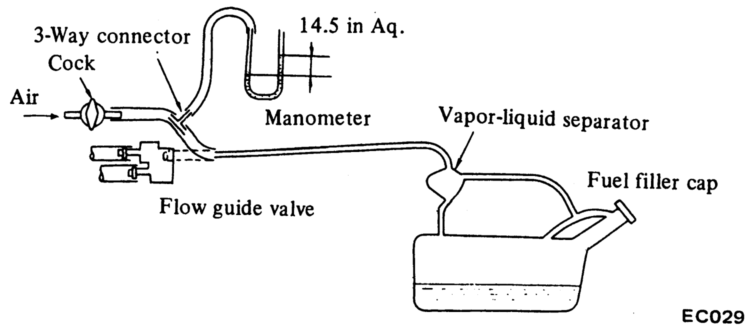


Fig. EF-42 Checking evaporative emission control system

Checking flow guide valve

1. Disconnect all hoses connected to the flow guide valve.
2. While lower pressure air is pressed into the flow guide valve from the ends of vent line of fuel tank side, the air should go through the valve and flow to crankcase side. If the air does not flow the valve should be eplaced. But when the air is blown from carnkcase side, it should never flow to the other two vent lines.
3. While the air is pressed into the flow guide valve from the carburetor air cleaner side, it flows to the fuel tank side and/or carnkcase side.
4. This valve opens when the inner pressure is 0.4 inch Hg. In case of improper operations or breakage, replace it.

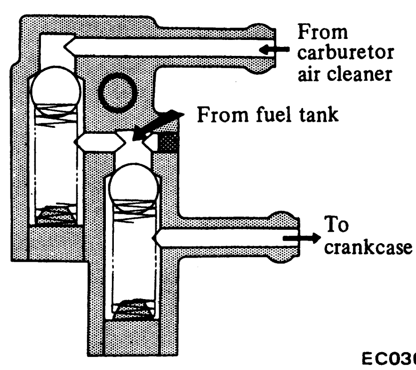


Fig. EF-43 Flow guide valve

Checking fuel tank vacuum refief valve operation

Remove fuel filler cap and see if it functions properly as follows:

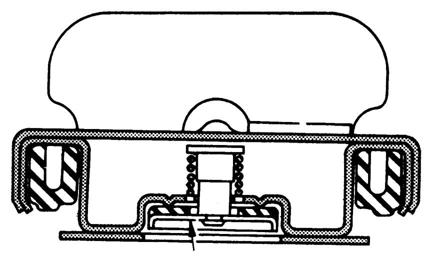


Fig. EF-44 Fuel filler cap

1. Wipe clean valve housing and have it in your month.
2. Inhaling air. A Slight resistance accompanied by valve indicates that valve is in good mechanical condition. Note also that, by further inhaling air the resistance should be disappeared with valve clicks.
3. If valve seems to be clogged, or if no resistance is felt replace cap as an assembled unit.

SERVICE DATA AND SPECIFICATIONS

Air cleaner

Air control valve partially opens	°C (°F)	above 37.5 (100)
Air control valve fully opens	°C (°F)	above 48 (118)
Idle compensator partially opens	°C (°F)	above 65 (149)
Idle compensator fully opens	°C (°F)	above 75 (167)

Fuel system

Fuel pressure	kg/cm² (psi)	0.18 to 0.24 (2.56 to 3.41)
Fuel pump capacity	cc (U.S. pts.)/min at rpm	1,000 (2.11)/1,000

Carburetor

		Primary	Secondary
Outlet dia.	mm (in)	30 (1.181)	34 (1.339)
Venturi dia.	mm (in)	23 x 8 (0.906 x 0.315)	30 x 9 (1.181 x 0.354)
Main jet		#97.5	#170
Main air bleed		#65	#60
Slow jet		#48	#90
Slow air bleed		#145	#100
Slow economizer	mm (in)	1.8 (0.071)	
Power jet		#53	
Float level	mm (in)	23 (0.906)	
Fuel pressure	kg/cm² (psi)	0.17 (2.42)	
Main nozzle Inner dia. x Outer dia.	mm (in)	2.5 x 3.5 (0.098 x 0.138)	2.5 x 4 (0.098 x 0.157)

Adjustment

Engine idling

Manual Transmission	5°/800 rpm, retard side, CO 1.5 ± 0.5%
Automatic Transmission	5°/650 rpm, retard side, CO 1.5 ± 0.5% (in D range)

Fuel level adjustment

Gap between valve stem and float seat	mm (in)	1.5 (0.059)

Fast idle adjustment (Fast idle cam, second step)		
Gap between throttle valve and carburetor body		
Manual Transmission	mm (in)	0.9 to 1.0 (0.035 to 0.039)
Automatic Transmission	mm (in)	1.12 to 1.22 (0.044 to 0.048)
Vacuum break adjustment		
Gap between choke valve and carburetor body	mm (in)	1.7 (0.067)
Choke unloader adjustment		
Gap between choke valve and carburetor body	mm (in)	4.4 (0.173)
Bimetal setting		
Resistance between terminal and carburetor body [at 21°C (70°F)]	ohms	9.8 to 10.2
Bimetal setting		17° (L16) (Center of the index marks) 22° (L18) (Center of the index marks)
Interlock opening of primary and secondary		
Throttle valves	mm (in)	7.4 (0.291)
Dash pot adjustment (Without loading)		1,600 to 1,800 rpm
Anti-dieseling solenoid tightening torque	kg-cm (in-lb)	35 to 55 (30 to 48)
B.C.D.D. set pressure		
Manual Transmission	mmHg (inHg)	-500 ± 20 (-19.7 ± 0.79)
Automatic Transmission	mmHg (inHg)	-480 ± 20 (-18.9 ± 0.79)
B.C.D.D. tightening torque	kg-cm (in-lb)	20 to 40 (17 to 35)

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

SECTION EE

ENGINE ELECTRICAL SYSTEM

EE

NISSAN

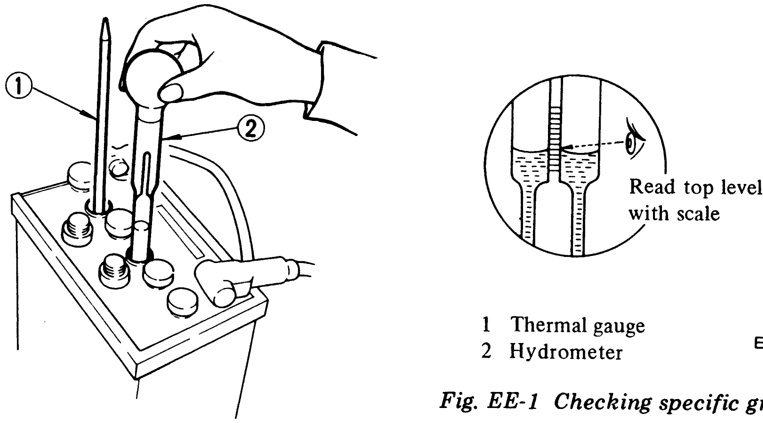
NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

BATTERY

CONTENTS

REMOVAL

1. Disconnect negative and positive terminals.
2. Remove nuts from battery clamps; take out clamps.
3. Remove battery.



1 Thermal gauge
2 Hydrometer

EE001

Fig. EE-1 Checking specific gravity

CHECKING ELECTROLYTE LEVEL

Battery comes into two types; self-filling and conventional. To check the level, remove one vent plug and see if the float is raised to the correct level (self-filling type).

If it is below the specified level, raise to correct level by pouring distilled water into the battery case.

On standard type, remove six vent plugs and check for electrolyte level in each cell.

If necessary, pour distilled water.

CHECKING SPECIFIC GRAVITY

Specific gravity of battery electrolyte is tested by a hydrometer. If the state of charge of battery is 60% full, or specific-gravity reading is below 1.20 [as corrected at 20°C (68°F)], battery must be recharged or battery-electrolyte concentration adjusted.

Add or subtract gravity points according to whether the electrolyte temperature is above or bellow 20°C (68°F) standard.

The gravity of electrolyte changes 0.0007 for every 1°C (1.8°F) temperature. A correction can then be made by using the following formula:

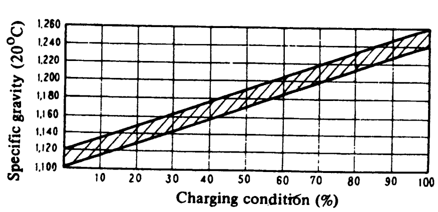
$$St + 0.0007\ (t - 20)$$

Where

St: Specific gravity of electrolyte at t°C
S20: Specific gravity of electrolyte corrected at 20°C (68°F)
t: Electrolyte temperature

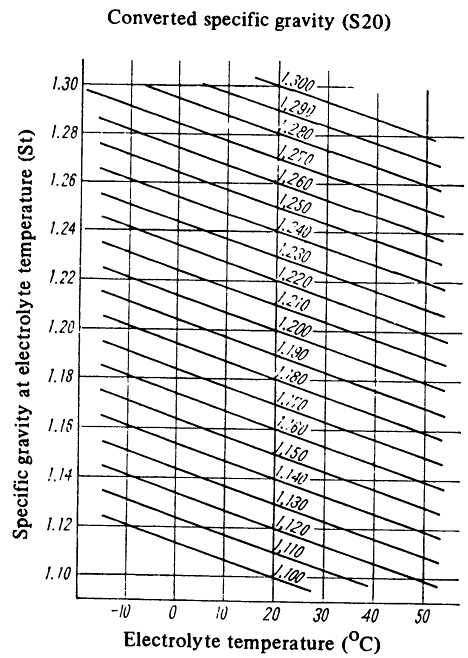
For example: A hydrometer reading of 1.260 at 30°C (86°F) would be 1.267 corrected to 20°C (68°F), indicating fully charged battery. On the other hand, a hydrometer reading of 1.220 at −10°C (14°F) would be 1.199 corrected to 20°C (68°F), indicating a partially charged battery.

The state of charge of battery can be determined by the following table if the specific gravity of electrolyte is known. Before checking, check to be sure that cells are filled to correct level.



EE002

Fig. EE-2 Charging condition



EE003

Fig. EE-3 Specific gravity at electrolyte temperature

Battery freezing

Temperatures at which battery electrolyte freezes vary with acid concentration or its specific gravity. A battery with an insufficient state of charge will freeze at lower temperatures. If specific gravity of a battery falls below 1.1, the indication is that the battery is completely discharged and will freeze readily when temperatures fall below freezing.

Note: Use extreme caution to avoid freezing battery since it will generally ruin the battery.

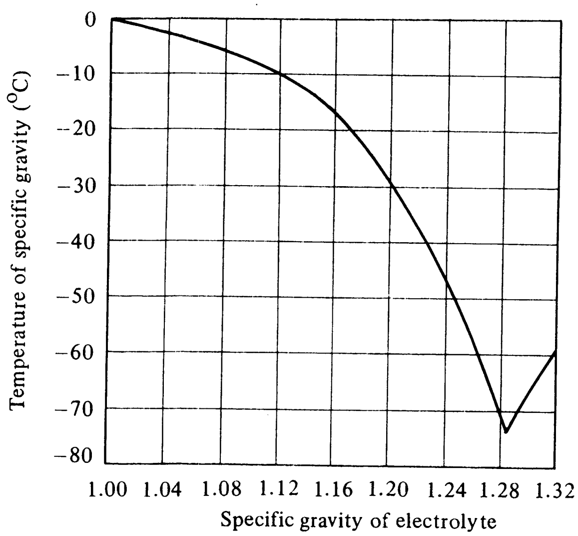


Fig. EE-4 Freezing point of electrolyte

CHARGING

Battery must be recharged when electrolyte-gravity reading falls below 1.20 with electrolyte level being satisfactory. If battery is quick-charged to bring it up to full charge, the operation should be carried out with negative terminal removed.

Prior to charging, corroded terminals should be cleaned with a brush and common baking-soda solution. In addition, the following items should be observed during recharging battery:

1. Be sure that electrolyte level is above top of each plate.
2. Keep removed plugs in a safe location.
3. Do not allow electrolyte temperature to go over 45°C (113°F).
4. After recharging, check to be certain that specific gravity does not exceed 1.260 [at 20°C (68°F)]. Correction can be made by adding distilled water into cells as necessary.
5. Keep battery away from open flame while it is being recharged.
6. After all vent plugs have been tightened, clean all sprayed electrolyte off upper face of battery.

INSTALLATION

1. Install and tighten clamps securely.
2. After clamps have been tightened, clean battery cable terminals and apply grease to retard formation of corrosion.

STARTING MOTOR

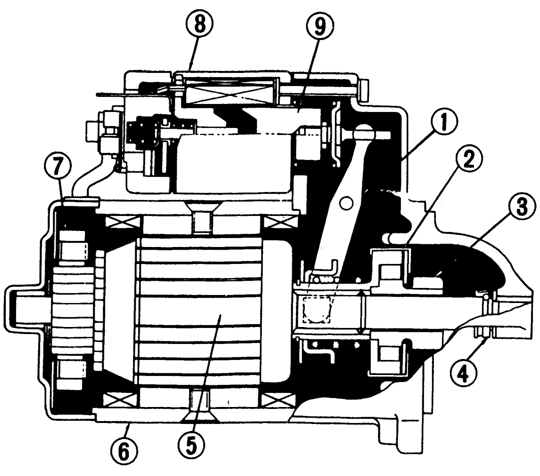
CONTENTS

SPECIFICATIONS

Model		L16 and L18 engines	
Type		HITACHI S114-103P (For manual transmission)	HITACHI S114-126M (For automatic transmission)
Voltage		12 Volts	←
Output		1.0 KW	1.2 KW
Starting current (Voltage)		Less than 430 amps. (6 Volts)	Less than 540 amps. (5 Volts)
No load current (Voltage)		Less than 60 amps. (12 Volts)	←
No load starter revolution	rpm	More than 7,000	More than 6,000
Shift type of pinion gear		Magnetic shift	←
Number of teeth on pinion gear		9	←
Number of teeth on ring gear		120	←
Weight	kg (lb)	5.1 (10.42)	5.8 (12.8)

DESCRIPTION

The function of the starting system, consisting of the battery, ignition switch, starting motor and solenoid, is to crank the engine. The electrical energy is supplied from the battery, the solenoid completes the circuit to operate the starting motor, and then the motor carries out the actual cranking of the engine.



EE005

1 Shift lever
2 Over-running clutch
3 Pinion
4 Pinion stopper
5 Armature
6 Yoke
7 Brush
8 Magnetic switch Ass'y
9 Plunger

Fig. EE-5 Sectional view of starting motor

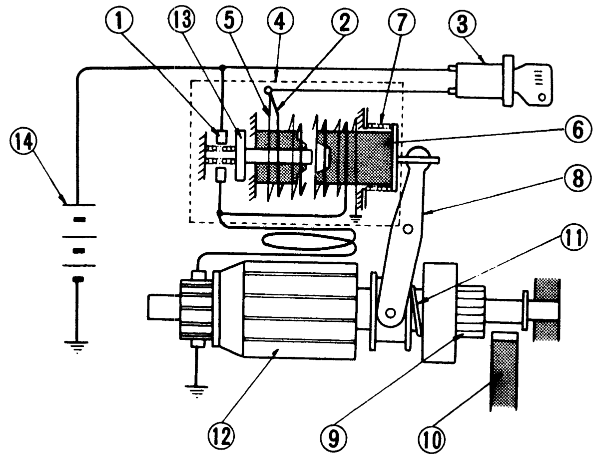
OPERATION

When the ignition switch is turned fully clockwise to the START position, battery current flows through "series" and "shunt" coils of the solenoid, magnetizing the solenoid. The plunger is pulled into the solenoid so that it operates the shift lever to move the drive pinion into the flywheel ring gear. Then the solenoid switch contacts close after the drive pinion is partially engaged with the ring gear.

Closing of the solenoid switch contacts causes the motor to crank the engine and also cut out the "series" coil of the solenoid, the magnetic pull of the "shunt" coil being sufficient to hold the pinion in mesh after the shifting has been performed.

After the engine starts running, the driver releases the ignition key and it automatically returns to the ON position.

This breaks the solenoid circuit so that reverse current flows through the series coil, and the magnetic field builds up in the direction in which the plunger moves back. As this happens, the resultant force of the magnetic fields in the shunt coil and the series coil becomes zero. The return spring then actuates the shift lever to pull the plunger, which allows to open the solenoid switch contacts. Consequently, the starting motor stops.



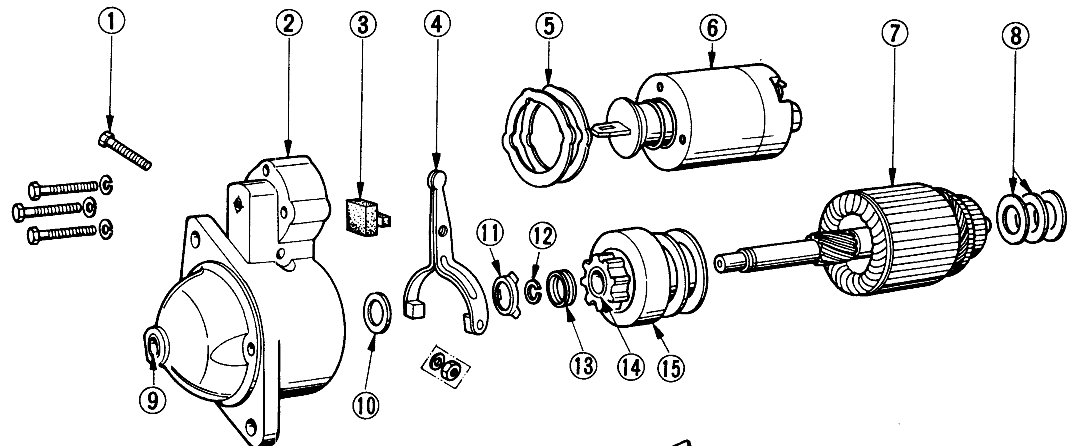
1 Stationary contact
2 Series coil
3 Ignition switch
4 Solenoid
5 Shunt coil
6 Plunger
7 Return spring
8 Shift lever
9 Drive pinion
10 Ring gear
11 Pinion sleeve spring
12 Armature
13 Movable contactor
14 Battery

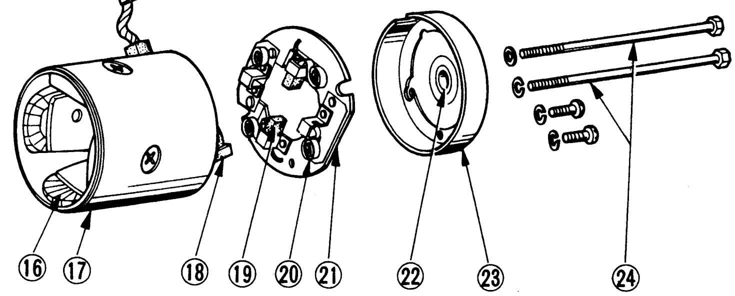
EE118

Fig. EE-6 Starting motor circuit

More positive meshing and demeshing of the pinion and the ring gear teeth are secured by means of the over-running clutch. The over-running clutch employs a shift lever to slide the pinion along the armature shaft, into or out of mesh with the ring gear teeth. The over-running clutch is designed to transmit driving torque from the motor armature to the ring gear, but permit the pinion to over-run the armature after the engine has started.

CONSTRUCTION





1 Shift lever pin
2 Gear case
3 Dust cover
4 Shift lever
5 Dust cover
6 Magnetic switch Ass'y
7 Armature
8 Thrust washer
9 Metal
10 Thrust washer
11 Stopper washer
12 Stopper clipe
13 Pinion stopper
14 Pinion
15 Over running clutch
16 Field coil
17 Yoke
18 Brush (+)
19 Brush (−)
20 Brush spring
21 Brush holder Ass'y
22 Metal
23 Rear cover
24 Through bolt

EE007

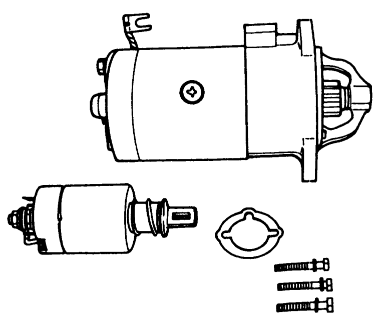
Fig. EE-7 Exploded view of starting motor

REMOVAL

1. Disconnect battery ground cable.
Disconnect black wire with yellow tracer from magnetic switch terminal, and black battery cable from battery terminal of magnetic switch.
2. Remove two bolts securing starting motor to gear case. Pull starter assembly forward and remove starting motor.

DISASSEMBLY

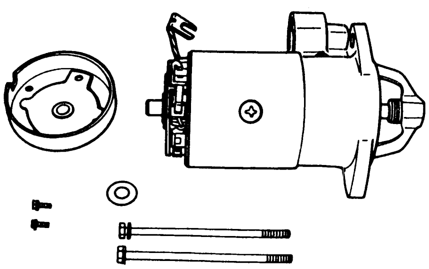
1. Loosen nut securing connecting plate to magnetic switch "M" terminal. Remove three screws securing magnetic switch and remove magnetic switch assembly.



EE149

Fig. EE-8 Removing magnetic switch assembly

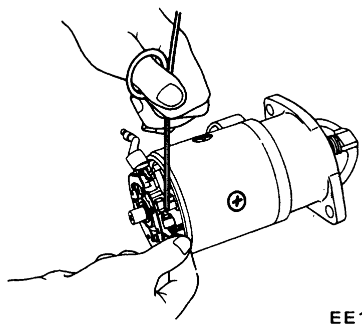
2. Remove two through bolts and brush cover assembly.



EE009

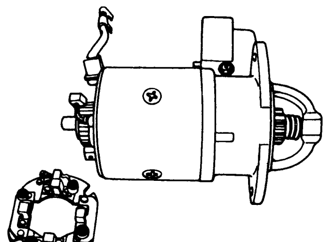
Fig. EE-9 Removing brush cover

3. Unsolder brushes, using a soldering-iron and remove each brush.



EE150

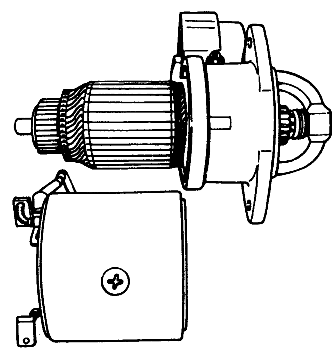
Fig. EE-10 Removing brush



EE151

Fig. EE-11 Removing brush holder

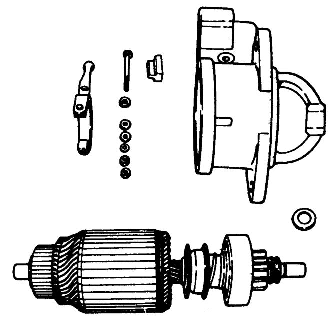
4. Remove yoke assembly by hitting lightly with a wooden hammer.



EE152

Fig. EE-12 Removing yoke assembly

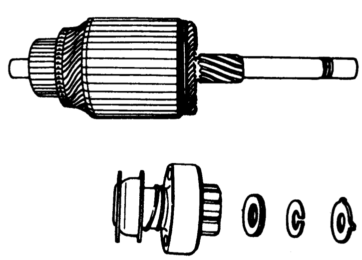
5. Withdraw armature assembly and shift lever.



EE153

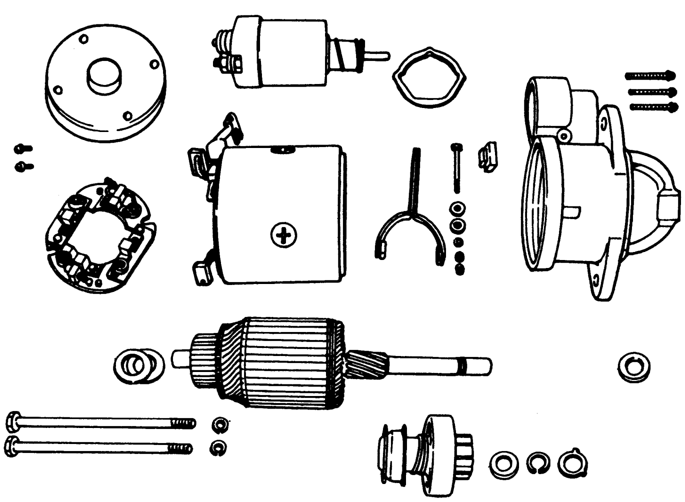
Fig. EE-13 Removing armature assembly and shift lever

6. Remove pinion stop ring located at the end of armature shaft. To remove stop ring, first push stop ring to clutch side and then, after removing snap ring, remove stop ring with over-running clutch. Withdraw over-running clutch assembly from armature shaft.



EE012

Fig. EE-14 Removing over-running clutch assembly



EE154

Fig. EE-15 Disassembly

CLEANING AND INSPECTION

Clean all disassembled parts, but do not use grease dissolving solvents for cleaning over-running clutch, armature assembly, magnetic switch assembly and field coils since such a solvent would dissolve grease packed in clutch mechanism and would damage coils or other insulators.

Check them for excessive damage or wear, and they should be replaced if necessary.

Terminal

Check terminal for damage and wear, and replace if necessary.

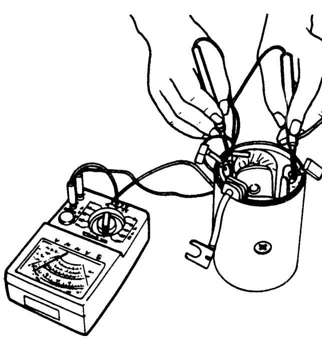
Field coil

Check field coil for insulation. If the insulation of coil is damaged or worn it should be replaced.

Testing field coil for continuity:

Connect the probe of a circuit tester or an ohmmeter to field coil positive terminal and positive brush holder.

If tester shows no conduction field circuit or coil is open.



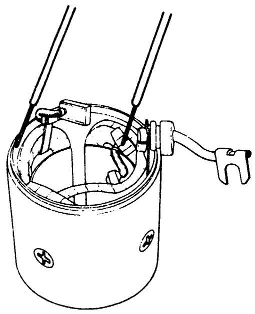
EE016

Fig. EE-16 Testing field coil for continuity

Testing field coil for ground:

Place one probe of circuit tester onto yoke and the other onto field coil lead (positive terminal).

If very little resistance is read, field coil is grounded.



EE017

Fig. EE-17 Testing field coil for ground

Field coil tester for short:

Unsolder the connected portion of each coil and proceed as mentioned above.

If a defective coil is found, it should be replaced.

Brushes and brush lead wire

Check the surface condition of brush contact and wear of brush. If a loose contact may be found it should be replaced.

If brush is worn and its length is less than 6.0 mm (0.2362 in), replace.

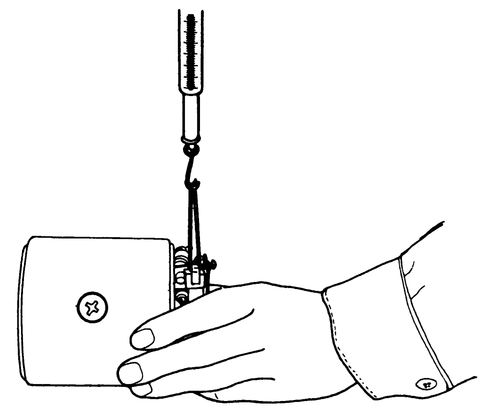
Check the connection of lead clip and lead wire.

Check brush holders and spring clip to see if they are not deformed or bent, and will properly hold brushes against the commutator.

If brushes or brush holders are dirty, they should be cleaned.

Brush spring tension

Check brush spring tension by a spring scale as shown in Figure EE-18. The reading should be 1.6 kg (3.53 lbs). Replace spring if tension is lower than 1.4 kg (3.09 lbs).



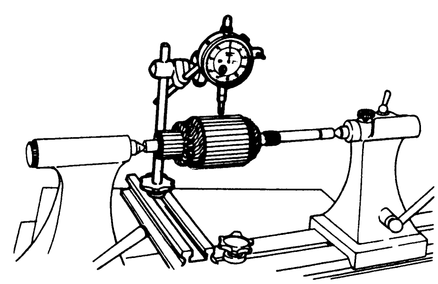
EE018

Fig. EE-18 Inspecting brush spring tension

Armature assembly

Check external appearance of armature and commutator.

1. Measure armature shaft for bend by a dial gauge. Replace armature shaft if the bend exceeds 0.08 mm (0.0031 in).



EE019

Fig. EE-19 Inspecting armature shaft for bend

2. Inspect commutator. If the surface of commutator is rough, it must be sanded lightly with a No. 500 emery cloth. Commutator must be checked also for out-of-round. If the out-of-round is more than 0.2 mm (0.0079 in), or the depth of insulating mica is less than 0.2 mm (0.0079 in) from commutator surface, commutator (armature) should be turned in a lathe, so that the out-of-round is less than 0.05 mm (0.0020 in). Insulating mica should also be undercut so that the depth of it is 0.5 to 0.8 mm (0.0197 to 0.0315 in).

The wear limit of commutator diameter is 2 mm (0.0787 in). If commutator is beyond repair, replace.

Note: It is recommended to replace commutator as an assembly if worn or damaged.

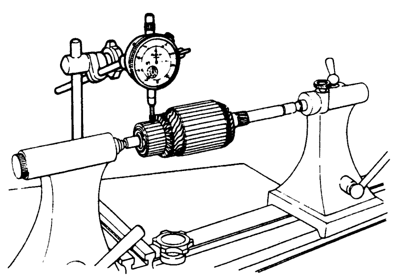


Fig. EE-20 Inspecting commutator

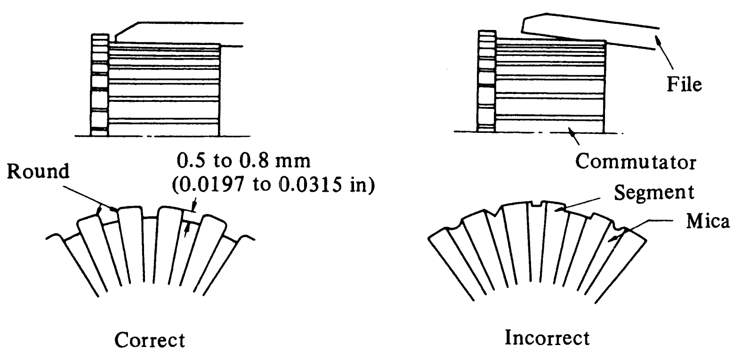


Fig. EE-21 Undercutting insulating mica

3. Inspect soldered connection of armature lead and commutator. If loose connection is found, solder it using rosin flux.

4. Armature test for ground

Using a circuit tester, place one test probe onto armature shaft and other onto each commutator bar.

If tester shows conductive, armature is grounded and must be replaced.

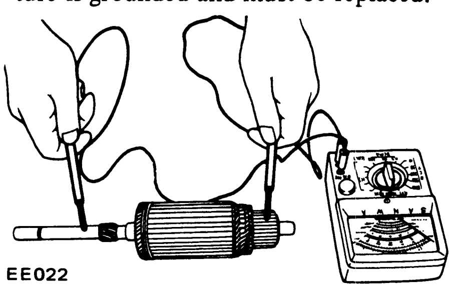


Fig. EE-22 Testing armature for ground

5. Check armature for short by placing it on armature tester (growler) with a piece of iron over armature core, rotating armature. If the plate vibrates, armature is shorted.

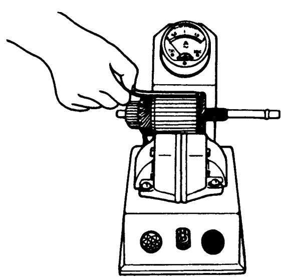


Fig. EE-23 Testing armature for short

6. Check armature for continuity by placing probes of tester on two segments side by side. If tester shows no conduction, the circuit is open.

Over-running clutch assembly

Inspect pinion assembly and screw sleeve. Screw sleeve must slide freely along armature shaft splines. If damages are found or resistance would be felt when sliding, it must be repaired. Inspect pinion teeth. If excessive rubbing would be found on teeth, it should be replaced. Flywheel ring gear also must be inspected.

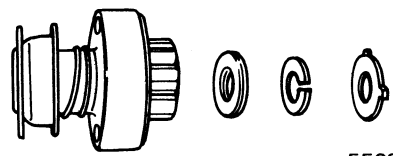


Fig. EE-24 Over-running clutch assembly

Brush holder test for ground

Using a circuit tester, place one test probe onto negative side brush holder and another onto positive side. If tester shows conduction, brush holder is shorted to ground. Replace an insulator or brush holder.

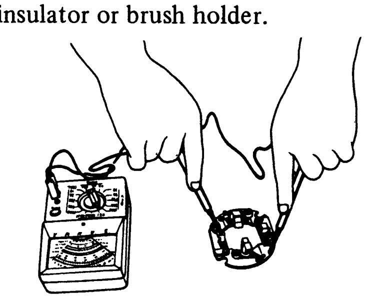


Fig. EE-25 Testing brush for ground

Pinion case bearing metal

Inspect bearing metal for wear or side play. If the clearance between bearing metal and armature shaft is more than 0.2 mm (0.0079 in), replace metal. Press in a new bearing and adjust the clearance to 0.03 to 0.10 mm (0.0012 to 0.0039 in). Bearing metal should be so pressed in that the end of the bearing metal would be flush with gear case.

Magnetic switch assembly

Inspect magnetic switch contacts. If a rough welding be found on the contact, it should be repaired.

ASSEMBLY

Reassemble starting motor in reverse sequence of disassembly.

When assembling, make sure to apply grease to gear case and rear cover bearing metal, and apply oil to pinion slightly.

TEST

Performance test

Starter motor should be subjected to a "no-load" test whenever it has been overhauled to ensure that its performance will be satisfactory when installed to engine. Starter motor should also be subjected to the test when the cause of abnormal operation is to be determined. A brief outline of the test is given below.

No-load test

Connect starting motor in series with specified (12 volts) battery and an ammeter capable of indicating 1,000 amperes.

Specified current draw and revolution in these test are shown in "specification."

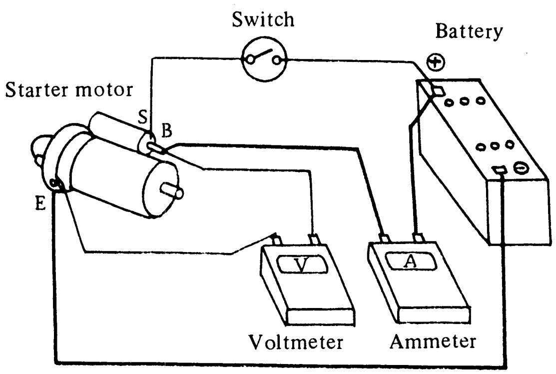


Fig. EE-26 No-load testing

Diagnosis of test

1. Low speed with no-load and high current draw may result from the following causes.

(1) Tight, dirty or worn bearings.

(2) Bent armature shaft or loosened field probe.

(3) Shorted armature;
Check armature further.

(4) A grounded armature or field;

a. Remove input terminal.

b. Raise two negative side brushes from commutator.

c. Using a circuit tester, place one probe onto input terminal and the other onto yoke.

d. If tester indicates conduction, raise the other two brushes and check field and armature separately to determine whether field or armature is grounded.

2. Failure to operate with high current draw may result from the following items.

(1) A grounded or open field coil:
Inspect the connection and trace circuit by a circuit tester.

(2) Armature coil does not operate:
Inspect commutator for excessive burning. In this case, arc may occur on defective commutator when motor is operated with no-load.

(3) Burned out commutator bar:
Weak brush spring tension, broken brush spring, rubber bush, thrust out of mica in commutator or a loose contact between brush and commutator would cause to burn commutator bar.

3. Low current draw and low no-load speed would cause high internal resistance due to loose connections, defective leads, dirty commutator and causes listed on item 2-(3).

Magnetic switch assembly test

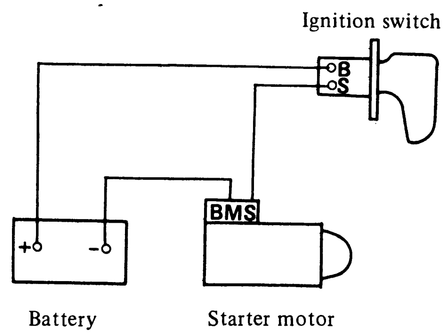


Fig. EE-27 Circuit of magnetic switch assembly test

If the starting motor check is "OK," check magnetic switch assembly. Connect cables between "negative" battery terminal and starting motor "M" terminal, "positive" battery terminal and starting motor "S" terminal connecting ignition switch in series as shown in Figure EE-27.

With ignition switch on, measure the gap "ℓ" between pinion front edge and pinion stopper.

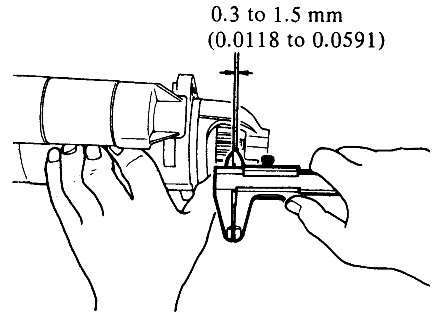


Fig. EE-28 Measuring gap "ℓ"

SERVICE DATA

Item \ Model		S114-103P	S114-126M
Armature shaft diameter (pinion side)	mm (in)	10.950 to 10.968 (0.4311 to 0.4318)	12.950 to 12.968 (0.5098 to 0.5106)
Armature shaft diameter (rear end)	mm (in)	11.450 to 11.468 (0.4508 to 0.4515)	←
Amendment limit of shaft diameter	mm (in)	0.1 (0.0039)	←
Amendment limit of shaft bent	mm (in)	0.08 (0.0031)	←
Clearance between shaft and bush	mm (in)	0.03 to 0.1 (0.0012 to 0.0039)	←
Amendment limit of dittoed clearance	mm (in)	0.2 (0.0079)	←
Outer diameter of commutator	mm (in)	35.0 (1.3780)	←
Wear limit of commutator diameter	mm (in)	2.0 (0.0787)	←
Brush length	mm (in)	18.5 (0.7283)	←
Wear limit of dittoed length (remaining brush should be more than)	mm (in) mm (in)	6.0 (0.2362) 12.5 (0.4921)	← ←
Brush spring tension	kg (lb)	1.6 (35.3)	←
Front bracket metal inner diameter	mm (in)	11.000 to 11.018 (0.4331 to 0.4338)	13.000 to 13.018 (0.5118 to 0.5125)
Rear cover metal inner-diameter	mm (in)	11.500 to 11.521 (0.4528 to 0.4536)	←
Center bearing metal inner diameter	mm (in)	—	17.650 to 17.675 (0.6949 to 0.7215)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Starting motor will not operate.	Discharged battery.	Charge or replace battery.
	Defective solenoid switch.	Repair or replace solenoid switch.
	Loose connections of terminal.	Clean and tighten terminal.
	Defective brushes.	Replace brushes.
	Defective starting motor.	Remove starting motor and make test.

Condition	Probable cause	Corrective action
Noisy starting motor.	Loose securing bolt. Worn pinion gear. Poor lubrication. Worn commutator. Worn brushes.	Tighten bolt. Replace pinion gear. Fill in oil. Disassemble motor. Replace brushes.
Starting motor cranks slowly.	Discharged battery. Loose connection of terminal. Worn brushes. Locked brushes.	Charge or replace battery. Clean and tighten terminal. Replace brushes. Inspect brush spring tension or repair brush holder.
Starting motor cranks slowly	Dirty or worn commutator. Armature rubs field coil. Defective solenoid switch.	Clean and repair. Replace assembly. Repair or replace switch.
Starting motor operates but does not crank engine.	Worn pinion. Locked pinion guide. Worn ring gear.	Replace pinion. Repair pinion guide. Replace ring gear.
Starting motor will not disengage even ignition switch is turned off.	Defective solenoid switch. Defective gear teeth.	Repair or replace solenoid switch. Replace defective gear.

CHARGING CIRCUIT

The charging circuit consists of the battery, alternator, regulator and necessary wiring to connect these parts. The purpose of this system is to convert mechanical energy from the engine into electrical energy which is used to operate all electrically operated units and to keep the battery fully charged.

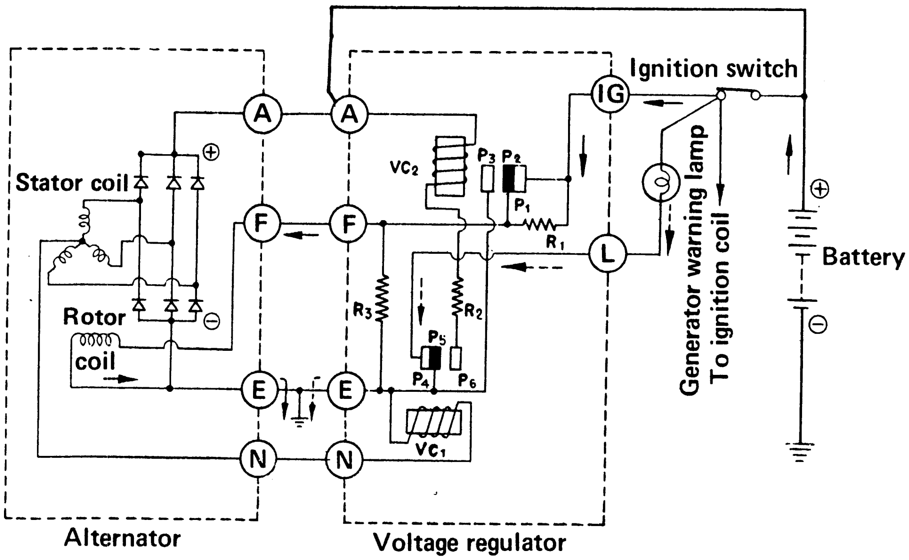
When the ignition switch is set to "ON," current flows from the battery to ground through the ignition switch, voltage regulator IG terminal, primary side contact point "P1," movable contact point "P2," voltage regulator "F" terminal, alternator "F" terminal, field coil and alternator "E" terminal, as shown in Figure EE-29 by full line arrow marks. Then the rotor in the alternator is excited. On the other hand, current flows from the battery to ground through the ignition switch, warning lamp, voltage regulator "L" terminal, lamp side contact point "P4," movable contact point "P5," and voltage regulator "E" terminal, as shown by dotted line arrow marks. Then, the warning lamp lights.

When the alternator begins to operate, three-phase alternating current is induced in the stator coil. This alternating current is rectified by the positive and negative silicon diodes. The rectified direct current output reaches the alternator "A" and "E" terminals.

On the other hand, the neutral point voltage reaches "N" and "E" terminals (nearly a half of the output voltage), and current flows from voltage regulator "N" terminal to "E" terminal or ground through the coil "VC1" as shown in Figure EE-30 by the dotted line arrow marks. Then, the coil "VC1" is excited, and the movable contact point "P5" comes into contact with voltage winding side contact point "P6." This action causes to turn off the warning lamp and complete the voltage winding circuit, as shown by the full line arrow marks.

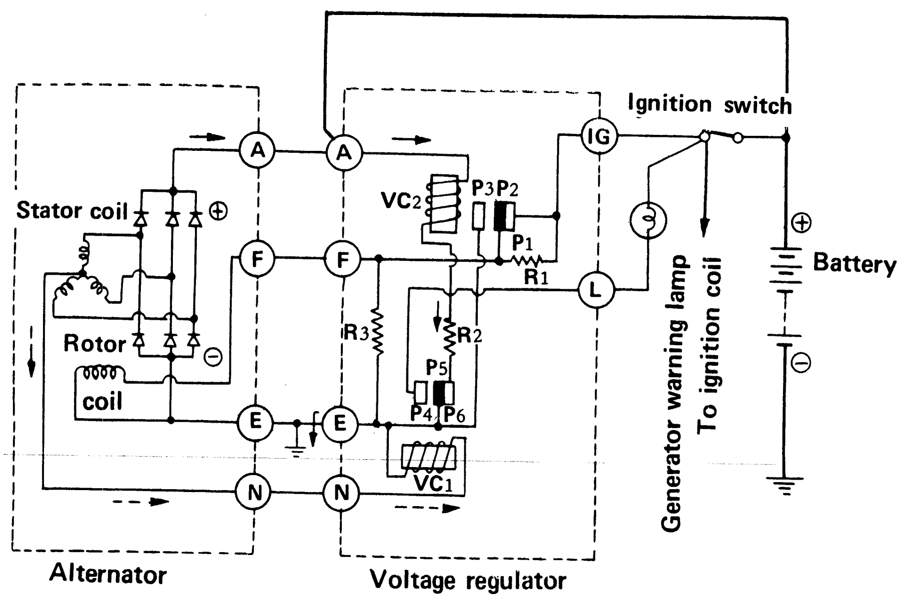
When the alternator speed is increased or the voltage starts to rise excessively, the movable contact point "P2" is separated from the primary side contact "P1" by the magnetic force of coil "VC2." Therefore, registor "R1" is applied into the rotor circuit and output voltage is decreased. As the output voltage is decreased, the movable contact point "P2" and primary side contact "P1" comes into contact once again, and the alternator voltage increases. Thus, the rapid vibration of the movable contact point "P2," maintains an alternator output voltage constant.

When the alternator speed is further increased or the voltage starts to rise excessively, the movable contact point "P2" comes into contact with secondary side contact point "P3." Then, the rotor current is shut off and alternator output voltage is decreased immediately. This action causes to separate movable contact "P2" from secondary contact "P3." Thus, the rapid vibration of the movable contact point "P2" or breaking and completing the rotor circuit maintains an alternator output voltage constant.



EE029

Fig. EE-29 Charging circuit (I)



EE030

Fig. EE-30 Charging circuit (II)

ALTERNATOR

CONTENTS

DESCRIPTION

Alternator	Vehicle
LT150-05B	510 and 610 models except for Canada
LT160-19	510 and 610 models for Canada
LT135-13B	620 model

In the alternator, a magnetic field is produced by the rotor which consists of alternator shaft, field coil, pole pieces, and slip rings. The slip rings pressed in the shaft conduct only a small field current. Output current is generated in the armature coils located in the stator. The stator has three windings and generates three-phase alternating current. Silicon diodes act like a one-way valve for electricity so that charging current passes easily but reverse current is shut out.

In model LT150-05B and LT135-13B, pack type silicone diodes are used.

Six diodes (three negatives and three positives), are installed in positive and negative plates as an assembly.

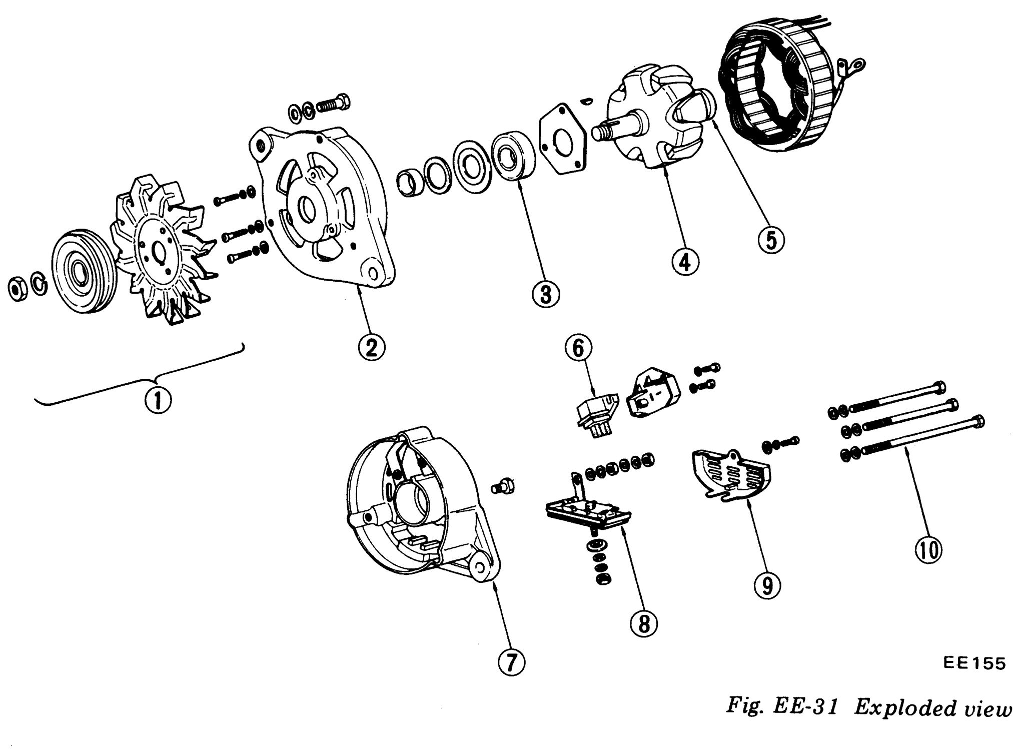
These diodes are direct-soldered at their tips, and constructed with positive and negative conjunction.

They are mounted on the two plates which combine the function of heat-dissipating plate and positive/negative terminals and are light in weight and easy to service.

In model LT160-19, conventional type diodes are used.

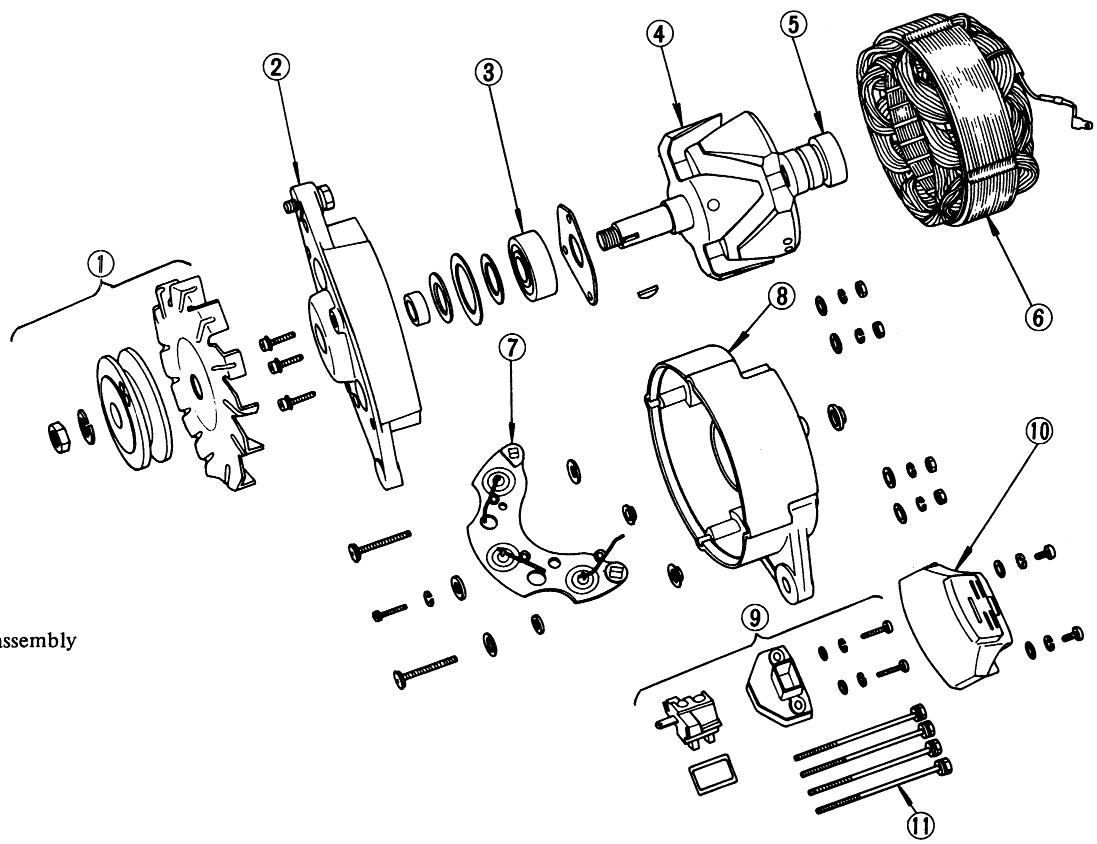
Three each diodes (three negatives and three positives) are installed in positive and negative side rear cover.

LT150-05B and LT135-13B are primarily the same but differ only in quantity. In this chapter, under LT150-05B is discribed as the standard and other explanations are added to it when the other models differ from it in instruction procedure.



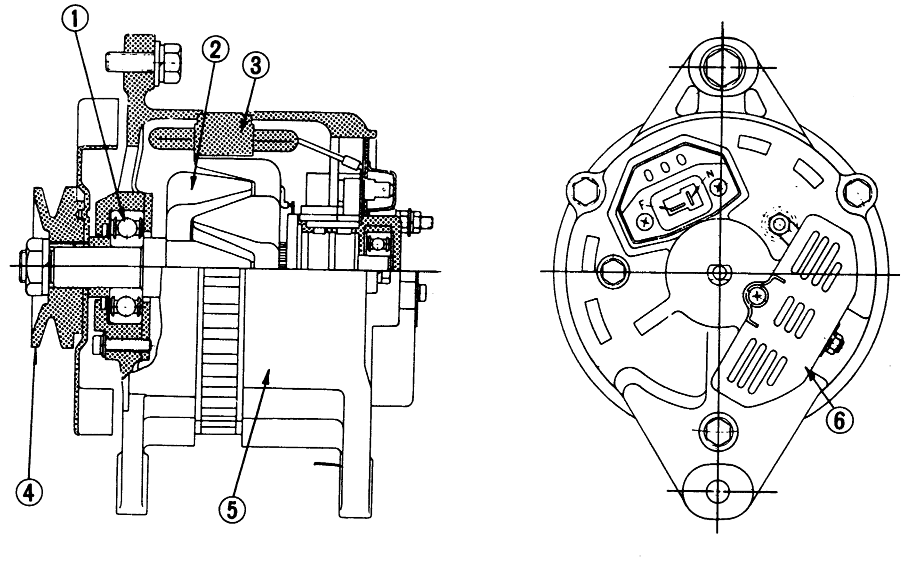
1 Pulley assembly
2 Front cover
3 Front bearing
4 Rotor
5 Rear bearing
6 Brush assembly
7 Rear cover
8 Diode (set plate) assembly
9 Diode cover
10 Through bolts

Fig. EE-31 Exploded view of LT150-05B (LT135-13B)



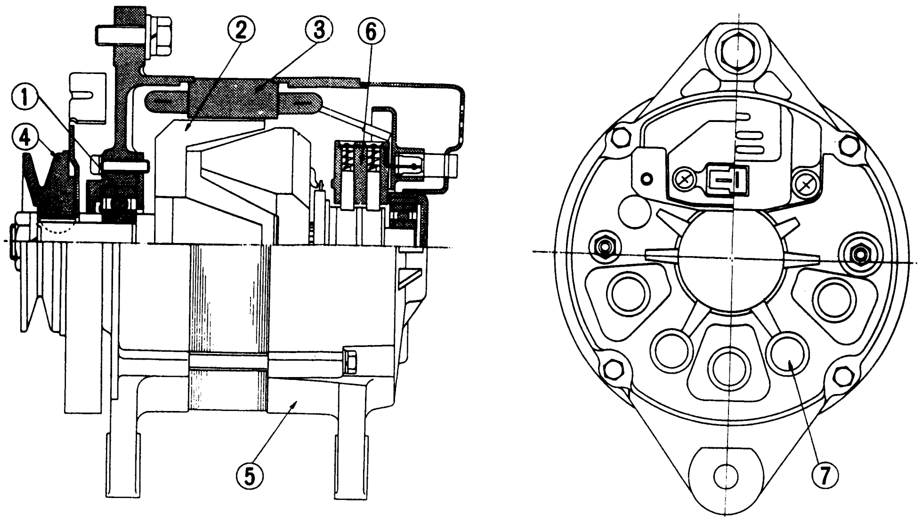
1 Pulley assembly
2 Front cover
3 Front bearing
4 Rotor
5 Rear bearing
6 Stator
7 Diode set plate assembly
8 Rear cover
9 Brush assembly
10 Diode cover
11 Through bolts

Fig. EE-32 Exploded view of LT160-19



1 Front bearing
2 Rotor
3 Stator
4 Pulley
5 Rear cover
6 Encased diode

Fig. EE-33 Sectional view of LT150-05B (LT135-13B)



1 Front bearing
2 Rotor
3 Startor
4 Pulley
5 Rear cover
6 Brush holder assembly
7 Diode

Fig. EE-34 Sectional view of LT160-19

REMOVAL

1. Disconnect negative battery terminal.
2. Disconnect two lead wires and connector from alternator.
3. Loosen adjusting bolt.
4. Remove alternator drive belt.
5. Remove parts associated with alternator from engine.
6. Remove alternator from vehicle.

DISASSEMBLY

1. Remove pulley nut, pulley rim, fan and spacer.

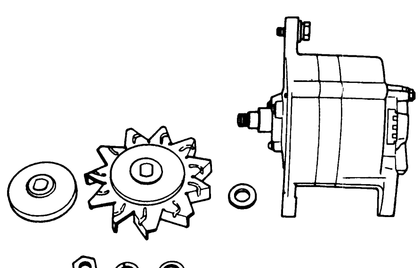
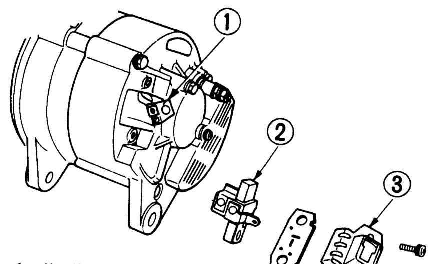


Fig. EE-35 Removing pulley and fan

2. Remove brush holder fixing screws, and remove brush holder cover. Remove brush holder forward, and remove brushes together with brush holder.

Note: Do not disconnect N terminal from stator coil lead wire.



1 "N" terminal
2 Brush holder
3 Brush holder cover

Fig. EE-36 Removing brush

3. Loosen and remove through bolts. Separate front cover with rotor from rear cover with stator by lightly tapping front bracket with a wooden mallet.

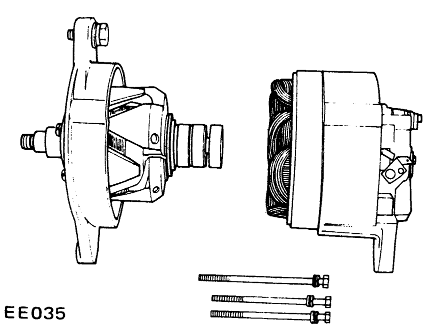


Fig. EE-37 Separating front cover with rotor from rear cover

4. Remove three set screws from bearing retainer, and separate rotor from front cover.

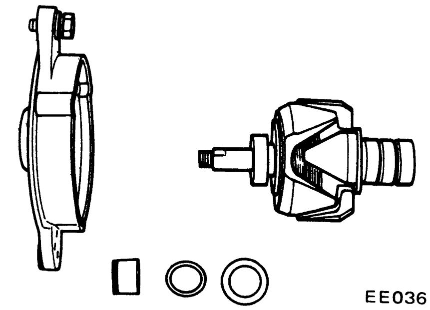


Fig. EE-38 Removing rotor

5. Pull out rear bearing from rotor assembly with a press or bearing puller.

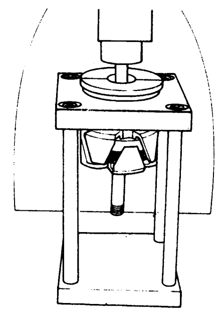


Fig. EE-39 Pulling out of rear bearing (I)

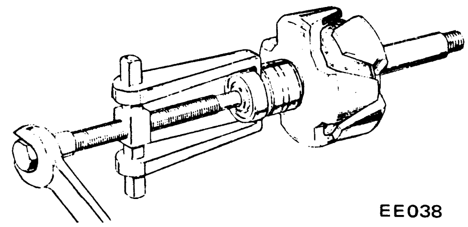
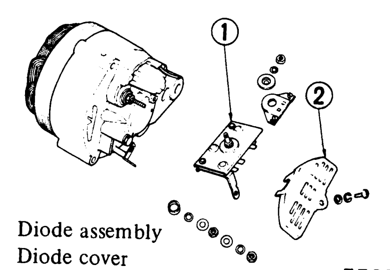


Fig. EE-40 Pulling out of rear bearing (II)

6. Remove diode cover fixing screw, and remove diode cover. Disconnect three stator coil lead wires from diode terminal with a soldering iron.
7. Remove A terminal nut and diode installation nut, and remove diode assembly.



1 Diode assembly
2 Diode cover

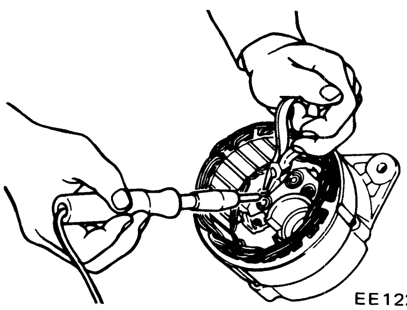
Fig. EE-41 Removing diode assembly

Note: Use care in handling diode assembly to prevent an undue stress on it.

Disassembly of diode

≪ MODEL LT160-19 ≫

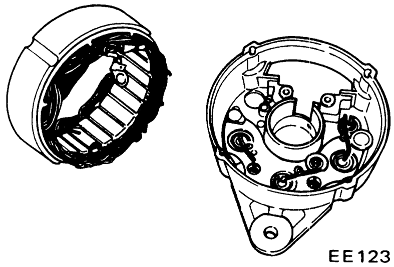
1. Disconnect three stator coil lead wires from diode terminals with a soldering iron. It is also necessary to disconnect jumper wires between diodes.



EE122

Fig. EE-42 Removing soldered connection of stator coil and diode

2. Pull stator coils out of rear cover.

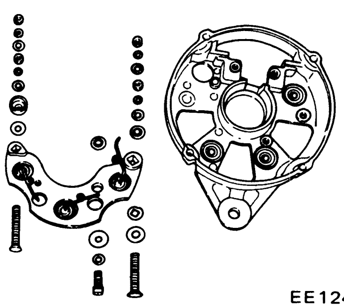


EE123

Fig. EE-43 Separating stator coil from rear cover

3. Remove diode from rear cover.

Caution: Place packings and insulators in order so that they can be placed back to their original places or locations from which they were removed.



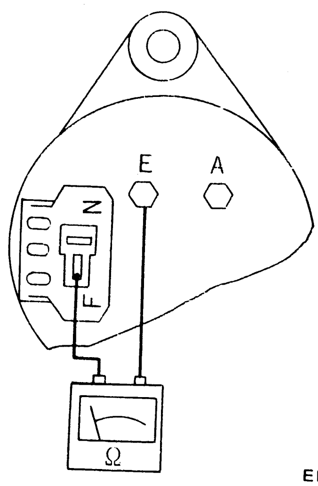
EE124

Fig. EE-44 Exploded view of diode

INSPECTION AND REPAIR

Remove alternator from vehicle and apply tester between lead wire F (white with black tracer) and lead wire E (black color).

When the resistance is approximately 5Ω, the condition of brush and field coil is satisfactory. When no conduction exists in brush or field coil, or when resistance differs remarkably between those parts, disassemble and inspect.



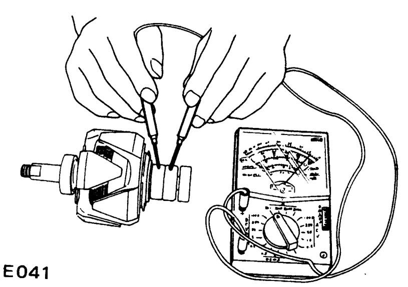
EE040

Fig. EE-45 Inspecting alternator

Rotor inspection

1. Conduction test of rotor coil

Apply tester between slip rings of rotor as shown in Figure EE-46. If there is no conduction, discontinuity of field coil may exist. When resistance is approximately 4.4Ω at normal ambient temperature, condition is satisfactory.

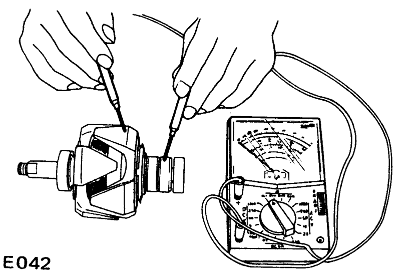


EE041

Fig. EE-46 Conduction test of rotor coil

2. Ground test of rotor coil

Check conduction between slip ring and rotor core. If conduction exists, replace rotor assembly, because field coil or slip ring may be grounded.



EE042

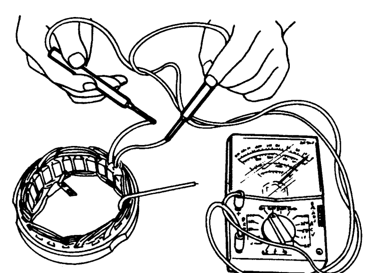
Fig. EE-47 Testing rotor coil for ground

Inspection of stator

1. Conduction test

Stator is normal when there is conduction between individual stator coil terminals. When there is no conduction between individual terminals, cable is broken.

Replace with stator assembly.

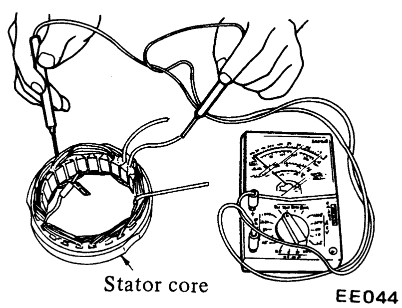


EE043

Fig. EE-48 Testing stator for conduction

2. Ground test

If each lead wire of armature coil (including neutral wire) is not conductive with stator core, condition is satisfactory. If there is conduction, stator coil is grounded.

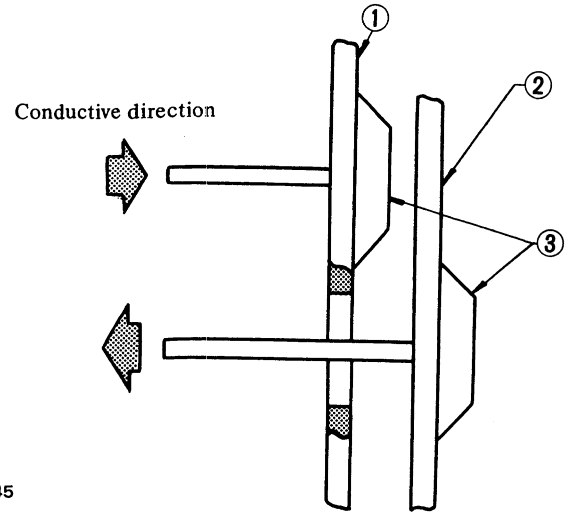


EE044

Fig. EE-49 Testing stator for ground

Inspection of diode

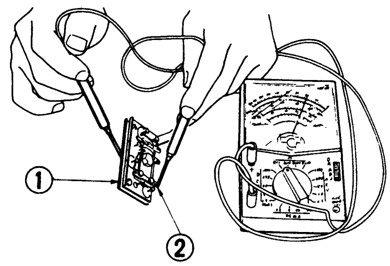
Perform a conduction test on diodes in both directions, using an ohmmeter. A total of six diodes are used; three are mounted on the positive ⊕ plate, and other three are on the negative ⊖ plate. The conduction test should be performed on each diode, between the terminal and plate.



EE045

1 (+) plate
2 (−) plate
3 Diode

Fig. EE-50 Conductive direction of diode



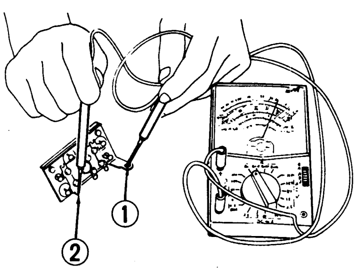
1 (−) plate
2 Terminal

EE047

Fig. EE-52 Inspecting negative diode

If current flows toward both positive and negative directions, diode is short-circuited. If current flows in the same direction only, diode is in good condition. If there is a defective diode, replace all diodes (six diodes) as an assembly. (See below table.) These diodes are unserviceable.

Diode installed on ⊕ plate is a positive diode which allows current flowing from terminal to ⊕ plate only. In other words, current does not flow from ⊕ plate to terminal.



1 (+) plate
2 Terminal

EE046

Fig. EE-51 Inspecting positive diode

Diode installed on ⊖ plate is a negative diode which allows current flowing from ⊖ plate to terminal only. In other words, current does not flow from terminal to ⊖ plate.

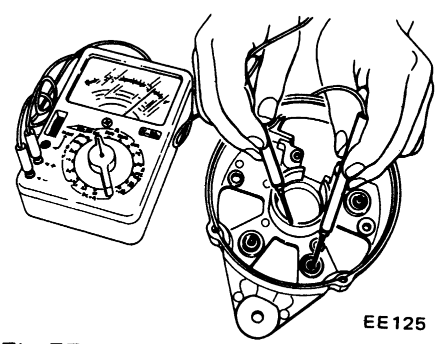
Test probe of a circuit tester		Conduction
⊖	⊕	
terminal	⊕ plate	O
⊕ plate	terminal	–
terminal	⊖ plate	–
⊖ plate	terminal	O
⊖ plate	⊕ plate	O
⊕ plate	⊖ plate	–

Fig. EE-53 Inspecting diodes

≪ Model LT160-19 ≫

Inspection of diode

Use a tester to check diodes. Three diodes are placed between alminum plate and rear cover. Testing consists of checking conduction between diode terminal and alminum plate, and between diode terminal and rear cover. Measurements should then be evaluated as per the instructions given under LT150-05B or LT135-13B.



EE125

Fig. EE-54 Conduction test of diode (I)

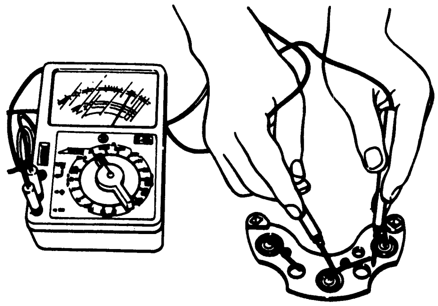


Fig. EE-55 Conduction test of diode (II)

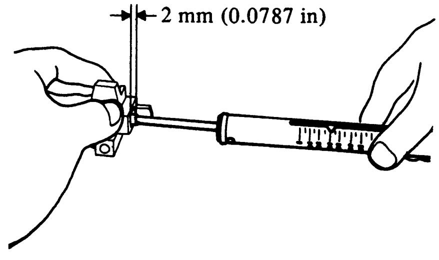


Fig. EE-57 Measuring spring pressure

Inspection of brush

Check movement of brush and if movement is unsmooth, check brush holder and clean it.

Check brush for wear. If it is worn down to less than the specified limit, replace brush assembly.

Check brush pig tail and, if found defective, replace.

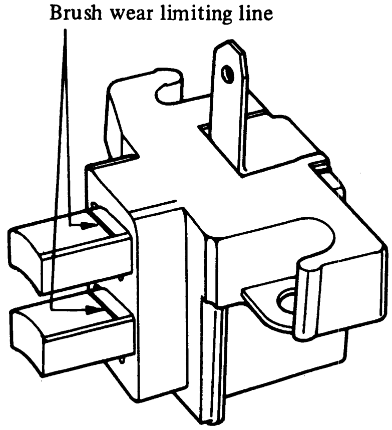


Fig. EE-56 Brush wear limit

Spring pressure test

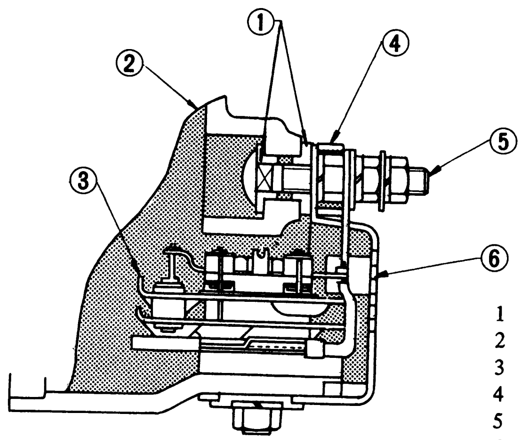
With brush projected approximately 2 mm (0.0787 in) from brush holder, measure brush spring pressure by the use of a spring balance. Normally, the rated pressure of a new brush spring is 255 to 345 g (9.0 to 12.2 oz).

Moreover, when brush is worn, pressure decreases approximately 20 g (0.7 oz) per 1 mm (0.0394 in) wear.

REASSEMBLY

Reassemble alternator in the reverse sequence of disassembly noting following matters:

1. When soldering each stator coil lead wire to diode assembly terminal, carry out the operation as fast as possible.
2. When installing diode A terminal, install insulating bush and insulating tube correctly.



1 Insulating bush
2 Rear cover
3 Diode assembly
4 Insulating tube
5 A terminal bolt
6 Diode cover

Fig. EE-58 Sectional view of diode and A terminal

3. Tighten pulley nut with tightening torque of 350 to 400 kg-cm (301 to 344 in-lb). When pulley is tightened, make sure that deflection of V-groove is less than 0.3 mm (0.0118 in).

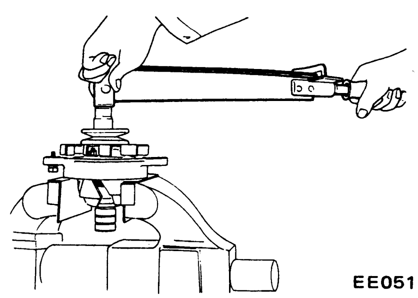


Fig. EE-59 Tightening pulley nut

ALTERNATOR TEST

Before conducting an alternator test, make sure that the battery is fully charged.

To conduct a test, it is necessary to use a 30-volt voltmeter and suitable test probes.

Set up a test circuit as shown in Figure EE-60 and test alternator in the manner indicated in the flow chart below:

1. Disconnect connectors at alternator.
2. Connect one test probe from voltmeter positive terminal to "N" terminal or "BAT" terminal. Connect the other test probe to ground. Make sure that voltmeter registers battery voltage.
3. Turn on headlights and switch to Main Beam.
4. Start engine.
5. Increase engine speed gradually until it is approx. 1,100 rpm., and take the voltmeter reading.

Measured value: Below 12.5 volts	Measured value: Over 12.5 volts
Alternator is in trouble. remove and check it for condition.	Alternator is in good condition.

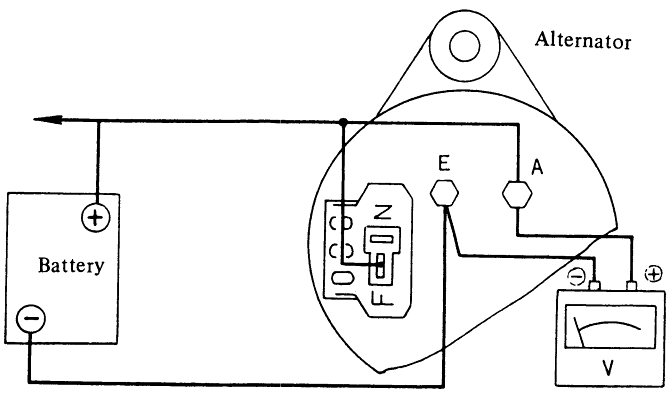


Fig. EE-60 Testing alternator

Notes:

a. **Do not run engine at the speed of more than 1,100 rpm while test is being conducted on alternator.**
b. **Do not race engine.**

SPECIFICATIONS AND SERVICE DATA

Specifications

Item \ Model	LT150-05B	LT160-19	LT135-13B
Applicable to	510 and 610 models except for Canada	510 and 610 models for Canada	620 model
Maker	HITACHI	←	←
Nominal rating	12V-50A	12V-60A	12V-35A
Ground polarity	Negative	←	←

Item \ Model		LT150-05B	LT160-19	LT135-13B
Revolution	rpm	1,000 to 13,500	1,000 to 12,000	1,000 to 13,500
Minimum revolution under no-load	rpm	Less than 1,000	←	←
Output current	rpm	37.5A (14V, 2,500 rpm)	45A (14V, 2,500 rpm)	28A (14V, 2,500 rpm)
Pulley ratio		2.25	2.09	2.25

Service data

Item \ Model		LT150-05B	LT160-19	LT135-13B
Stator coil				
Resistance per a phase	Ω	0.17 [at 20°C (68°F)]	0.05 [at 20°C (68°F)]	0.17 [at 20°C (68°F)]
Rotor coil				
Resistance	Ω	4.4 [at 20°C (68°F)]	4.0 [at 20°C (68°F)]	4.4 [at 20°C (68°F)]
Brush				
Brush length	mm (in)	14.5 (0.571)	←	←
Wear limit	mm (in)	7 (0.2756)	←	←
Spring pressure	kg (lb)	0.25 to 0.35 (0.55 to 0.77)	←	←
Slip ring				
Outer dia.	mm (in)	31 (1.220)	←	←
Reduction limit	mm (in)	1 (0.0394)	←	←
Repair accuracy	mm (in)	0.05 (0.0197)	←	←

REGULATOR

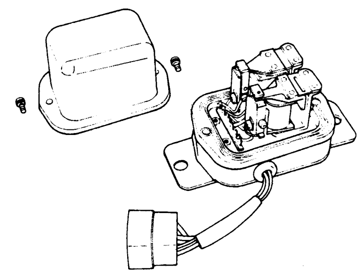
CONTENTS

DESCRIPTION

The regulator consists basically of a voltage regulator and a charge relay. The voltage regulator has two sets of contact points, a lower set and upper set, to control alternator voltage. An armature plate placed between the two sets of contacts, moves upward or downward or vibrates. The lower contacts, when closed, complete the field circuit direct to ground; and the upper contacts, when closed, complete the field circuit to ground through a resistance (field coil), and produces alternator output.

The charge relay is similar in construction to the voltage regulator.

When the upper contacts are closed, ignition warning lamp goes on.



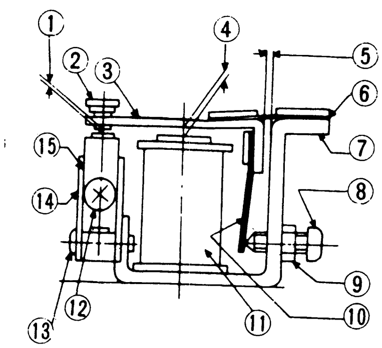
EE053

Fig. EE-61 View of removing cover

Regulator model	Vehicle	Alternator
TL1Z-57	510 models	LT150-05B or * LT160-19
	620 model	LT135-13B
TL1Z-58	610 models	LT150-05B or * LT160-19

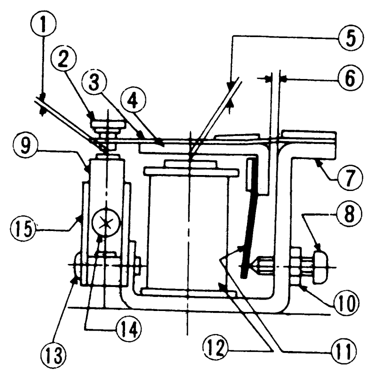
* LT160-19: For Canada

As for the construction, the voltage regulator is very similar to the charge relay as shown in Figure EE-62.



1 Point gap
2 Lower contact
3 Armature
4 Core gap
5 Yoke gap
6 Connecting spring
7 Yoke
8 Adjusting screw
9 Lock nut
10 Adjust spring
11 Coil
12 3 mm (0.1181 in) dia. screw
13 4 mm (0.1575 in) dia. screw
14 Contact set
15 Upper contact

(a) Construction of voltage regulator



EE054

1 Point gap
2 Charge relay contact
3 Connecting spring
4 Armature
5 Core gap
6 Yoke gap
7 Yoke
8 Adjusting screw
9 Voltage regulator contact
10 Lock nut
11 Adjust spring
12 Coil
13 3 mm (0.1181 in) dia. screw
14 4 mm (0.1575 in) dia. screw
15 Contact set

(b) Construction of charge relay

Fig. EE-62 Structural view

MEASUREMENT OF REGULATOR VOLTAGE

Regulator voltage is measured with regulator assembled with alternator. When measuring voltage with regulator mounted on vehicle, it is necessary to rotate engine at high speed.

Connect DC voltmeter (15-30V), DC ammeter (15-30A), battery and resistor (0.25 ohms) with cables as shown.

(1) Check to be sure that all electrical loads such as lamps, air conditioner, radio etc. are disconnected.

(2) Before starting engine, be sure to make short circuit with a cable between fuse side terminal of resistor (0.25Ω) and negative side terminal of ammeter. Failure to follow this caution causes needle of ammeter to swing violently and reversely, resulting in a damaged ammeter.

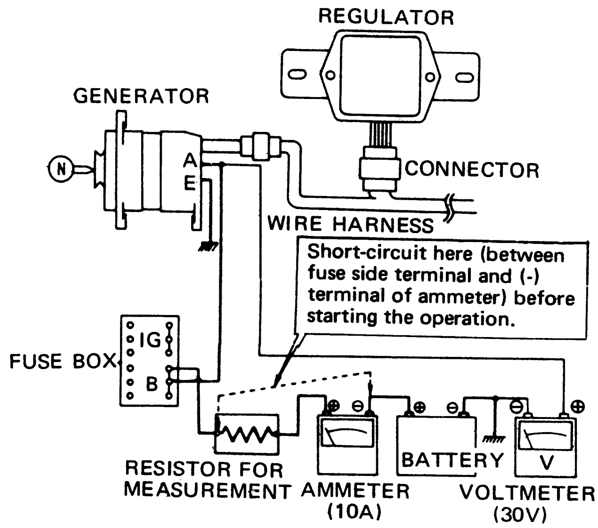
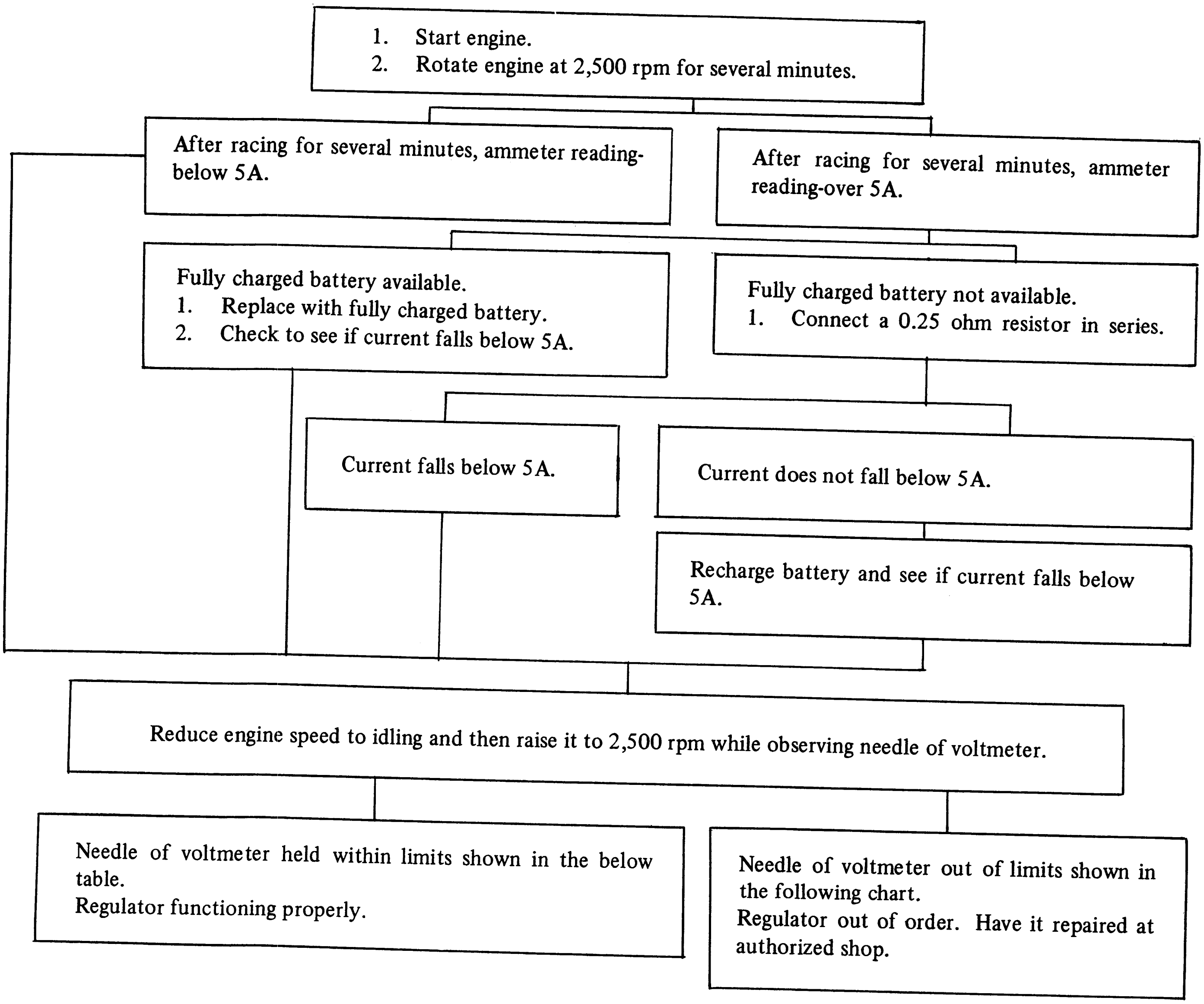


Fig. EE-63 Measuring regulator voltage with regulator on vehicle

(3) Refer to the following chart to determine if regulator and relative parts are in good condition:



Regulator model TL1Z-57 and TL1Z-58 (HITACHI)

Temperature °C (°F)	Voltage V
−10 (14)	14.75 to 15.75
0 (32)	14.60 to 15.60
10 (50)	14.45 to 15.45
20 (68)	14.30 to 15.30
30 (86)	14.15 to 15.15
40 (104)	14.00 to 15.00

Notes:

a. Do not measure voltage immediately after driving. Do this while regulator is cold.

b. To measure voltage, raise engine speed gradually from idling to rated speed.

c. Voltage may be approx. 0.3 V higher than the rated for two to three minutes after engine is started, or more specifically, when regulator becomes self-heated. Measurements should then be made within one minute after starting engine, or when regulator is cold.

d. The regulator is of a temperature-compensating type. Before measuring voltage, be sure to measure surrounding temperature and correct measurements according to the table in the left hand side.

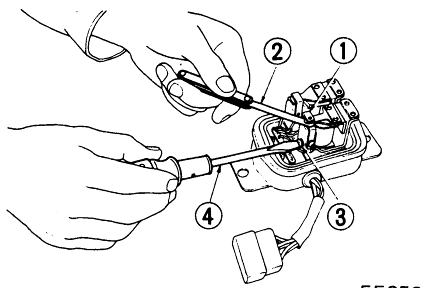
ADJUSTMENT

Voltage regulator

As the result of above measurement, when regulating voltage is deviated from rated value, adjust regulator in accordance with the following instructions.

1. Inspect contact surface, and if rough, lightly polish surface with fine emery paper (#500 or 600).
2. Measure each gap, and adjust if necessary. Adjust core gap and point gap in that order. No adjustment is required for yoke gap.
3. Adjusting core gap

Loosen screw [4 mm (0.1575 in) diameter] which is used to secure contact set on yoke, and move contact upward or downward properly. (See Figure EE-64.)

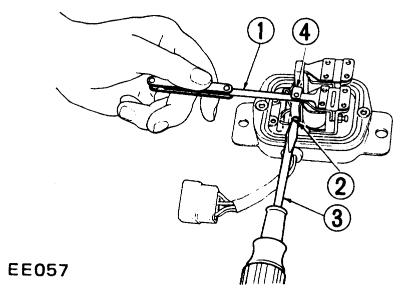


1 Contact set
2 Thickness gauge
3 4 mm (0.1575 in) dia. screw
4 Crosshead screwdriver

Fig. EE-64 Adjusting core gap

4. Adjusting point gap

Loosen screw [3 mm (0.1181 in) diameter] used to secure upper contact, and move upper contact upward or downward adequately. (See Figure EE-65.)



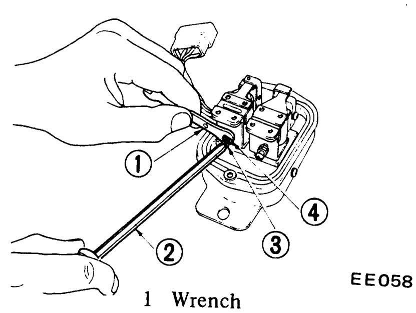
1 Thickness gauge
2 3 mm (0.1181 in) dia. screw
3 Crosshead screwdriver
4 Upper contact

Fig. EE-65 Adjusting point gap

5. Adjusting voltage

Adjust regulating voltage as follows:

Loosen lock nut securing adjusting screw. Turn this screw clockwise to increase, or counterclockwise to decrease, regulating voltage. (See Figure EE-66.)



1 Wrench
2 Crosshead screwdriver
3 Adjusting screw
4 Lock nut

Fig. EE-66 Adjusting regulating voltage

Charging relay

Normal relay operating voltage is 8 to 10V as measured at alternator "A" terminal. Relay itself, however, operates at 4 to 5 V.

Use a DC voltmeter, and set up a circuit as shown in Figure EE-67.

1. Connect positive terminal of voltmeter to regulator lead connector "N" terminal with negative terminal grounded.
2. Start engine and keep it idle.
3. Take voltmeter reading.

0 Volt

1. Check for continuity between "N" terminals of regulator and alternator.
2. Alternator circuit defective if continuity exists.

Below 5.2 Volt

(Pilot lamp remains lit)

1. Check fan belt tension.
2. If correct, remove regulator and adjust as necessary.

Over 5.2 Volt

(Pilot lamp remains lit)

Pilot lamp relay coil or contact points out of order.

Replace regulator.

Over 5.2 Volt

(Pilot lamp does not lit)

Pilot lamp relay assembly is in good condition.

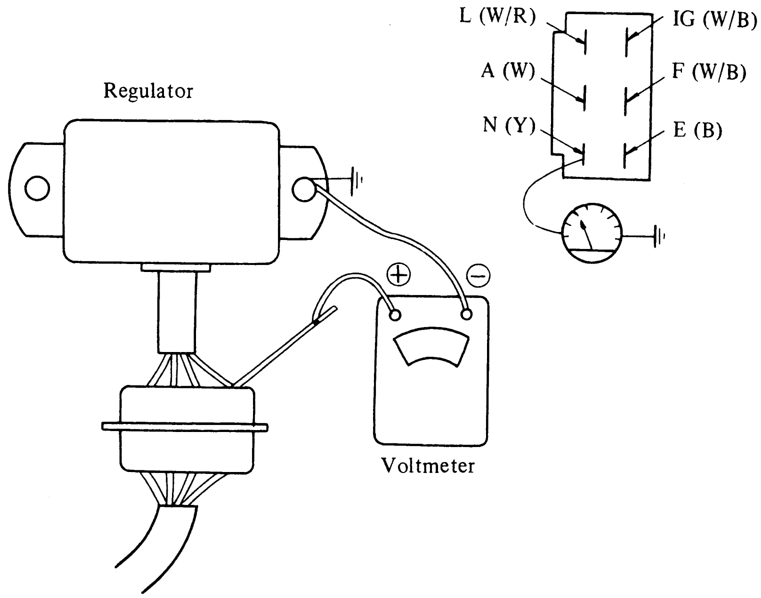


Fig. EE-67 Testing charging relay

SPECIFICATIONS AND SERVICE DATA

Voltage regulator		
Model		TL1Z-57, TL1Z-58
Regulating voltage (with fully charged battery)	V	*14.3 to 15.3 [at 20°C (68°F)]
Voltage coil resistance	Ω	10.5 [at 20°C (68°F)]
Rotor coil inserting resistance	Ω	10
Voltage coil series resistance	Ω	31
Smoothing resistance	Ω	40
Core gap	mm (in)	0.6 to 1.0 (0.0236 to 0.0394)
Point gap	mm (in)	0.3 to 0.4 (0.0118 to 0.0157)
Charge relay		
Release voltage	V	4.2 to 5.2 at "N" terminal
Voltage coil resistance	Ω	37.8 [at 20°C (68°F)]
Core gap	mm (in)	0.8 to 1.0 (0.0315 to 0.0394)
Point gap	mm (in)	0.4 to 0.6 (0.0157 to 0.0236)

*Standard temperature gradient: –0.015V/°C

TROUBLE DIAGNOSES AND CORRECTIONS (Including alternator)

Condition	Probable cause	Corrective action
No output	Sticking brushes.	Correct or replace brushes and brush springs.
	Dirty brushes and slip rings.	Clean.
	Loose connections or broken leads.	Retighten or solder connections. Replace leads if necessary.
	Open stator winding.	Repair or replace stator.
	Open rotor winding.	Replace rotor.
	Open diodes.	Replace diodes.
	Shorted rotor.	Replace rotor.
	Shorted stator.	Repair or replace stator.
	Grounded "BAT" terminal.	Replace insulator.
	Broken fan belt.	Replace belt.
Excessive output	Broken neutral wire (color of wire is white.)	Replace wire.
	Defective voltage regulator.	Check regulator operation and repair or replace as required.
	Poor grounding of alternator and voltage regulator "E" terminal.	Retighten terminal connection.
	Broken ground wire (color of wire is black.)	Replace wire.
Low output	Loose or worn fan belt.	Retighten or replace belt.
	Sticking brushes.	Correct or replace brushes and springs if necessary.
	Low brush spring tension.	Replace brush springs.
	Defective voltage regulator.	Check regulator operation and repair or replace as required.
	Dirty slip rings.	Clean.
	Partial short, ground, or open in stator winding.	Replace stator.
	Partially shorted or grounded rotor winding.	Replace rotor.
	Open or defective diode.	Replace diode.
Noisy alternator	Loose mounting.	Retighten mounting bolts.
	Loose drive pulley.	Retighten pulley correctly.
	Defective ball bearing.	Replace bearing.
	Improperly seated brushes.	Seat brushes correctly.

IGNITION CIRCUIT

The ignition circuit consists of the ignition switch, coil, distributor, wiring, spark plugs and battery.

The circuit is equipped with a resistor. During cranking, electrical current bypasses the resistor, thereby connecting the ignition coil directly to battery. This provides full battery voltage available at coil and keeps ignition voltage as high as possible.

The low voltage current is supplied by the battery or alternator and flows through the primary circuit. It consists of the ignition switch, resistor, primary winding of the ignition coil, distributor contact points, condenser and all connecting low tension wiring.

The high voltage current is produced by the ignition coil and flows through the secondary circuit, resulting in high voltage spark between the electrodes of the spark plugs in engine cylinders. This circuit contains the secondary winding of the ignition coil, coil to distributor high tension cables, distributor rotor and cap.

When the ignition switch is turned on and the distributor contact points are closed, the primary current flows through the primary winding of the coil and through the contact points to ground. This flowing produces a magnetic field around the coil winding and then electrical energy in the coil.

When the contact points are opened by the revolving distributor cam, the magnetic field built up in the primary winding of the coil moves through the secondary winding of the coil inducing high voltage. The high voltage is produced every time the contact points open.

The dual point distributor consists of the ignition advance and retard points. With the relay switched on, then current flows to the retard points, causing an ignition delay of 7° with respect to angular displacement of the engine crankshaft.

Under that condition, current is also flowing through the advance points. The current, however, is not cut off effectively as the points separate due to the current flowing through the retard points.

The high voltage current flows through the high tension cable to the distributor cap, then the rotor distributes the current to one of the spark plug terminals in the distributor cap.

Then the spark obtains while the high voltage current jumps the gap between the insulated electrode and the ground side electrode of the spark plug. This process is repeated for each power stroke of the engine.

The distributor contact points and spark plugs require periodic service. That is, the breaker points should be inspected, cleaned and regapped at tune up or replaced if necessary. In addition, lubricate distributor shaft and cam heel every suitable maintenance period. Spark plugs should be removed, inspected and maintained to obtain good firing.

The remainder of the ignition component parts should be inspected for only their operation, tightness of electrical terminals, and wiring condition.

The ignition circuit is shown below:

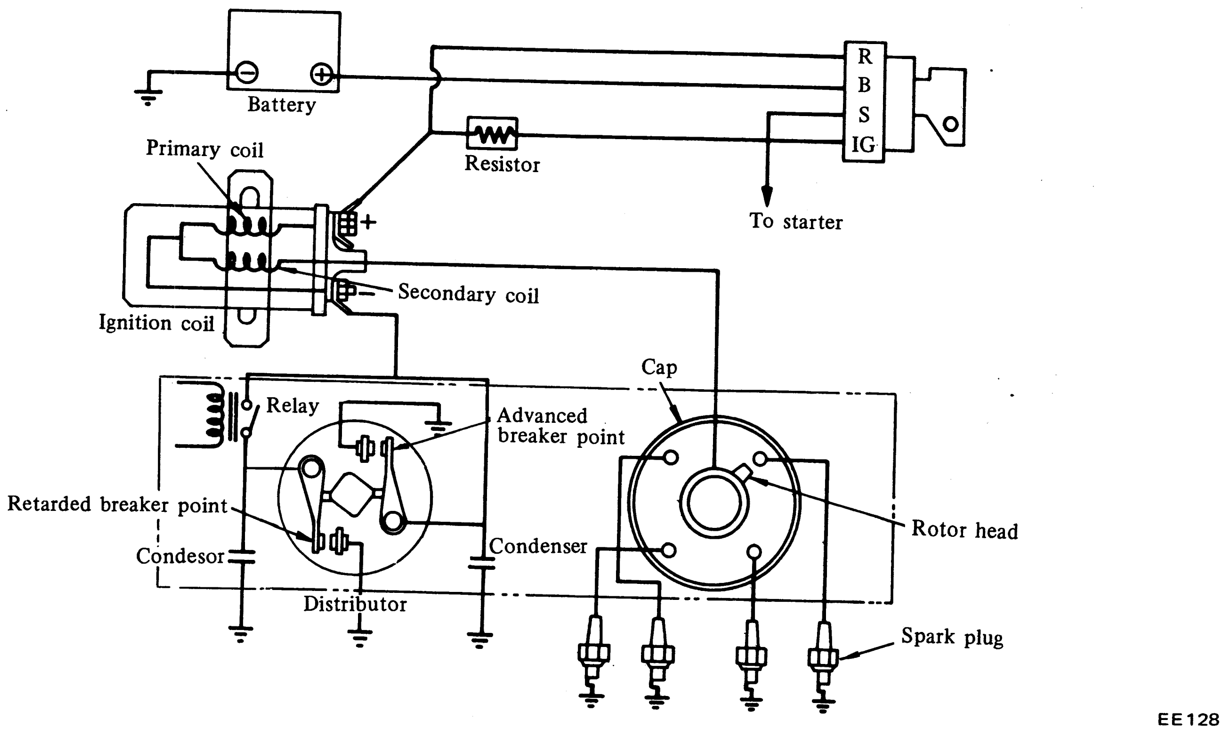


Fig. EE-68 Ignition system circuit diagram

DISTRIBUTOR

CONTENTS

CONSTRUCTION

Distributor model	Applied engine
D410-66A	L18
D410-67	L16

The distributor for L16 and L18 engines has two breaker points, located opposite to each other with a phase difference as shown in Figure EE-70.

The difference in phase can be adjusted by turning the adjusting screw.

A phase difference of 7° crank angles is adopted. Two breaker points, which consists of advance and retard breakers, are placed in parallel with each other in the primary ignition circuit.

The retard breaker point works when the relay is switched "ON" and the advance breaker point works when the relay is switched "OFF."

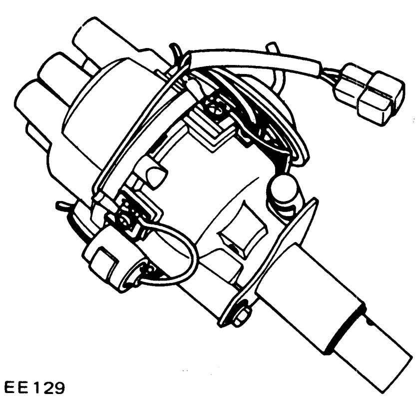
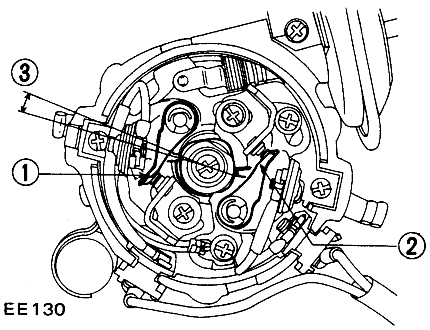

EE129

Fig. EE-69 External view of distributor

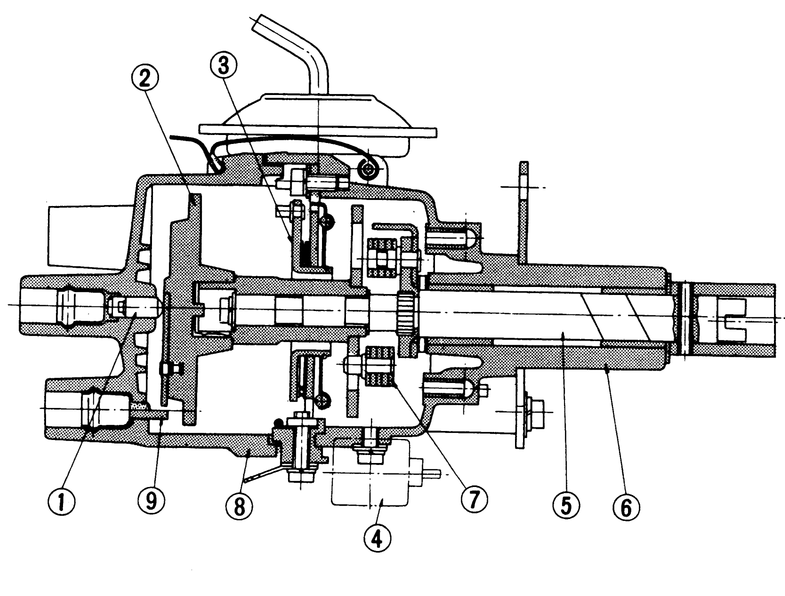


EE130

1 Advanced breaker point
2 Retarded breaker point
3 Phase difference

Fig. EE-70 External view of dual points

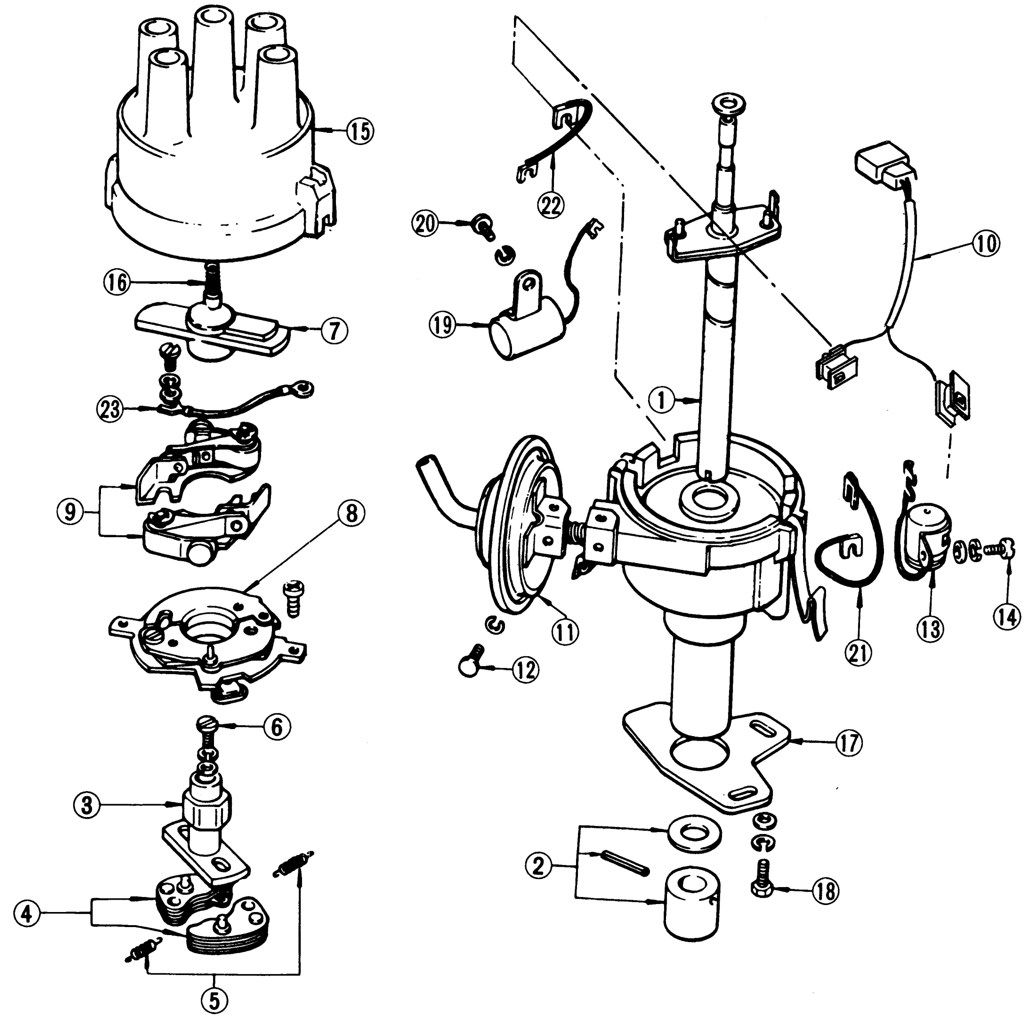
The distributor follows the conventional design except for the dual points; i.e., breaker plate with contact points, centrifugal advance mechanism, vacuum unit, drive shaft and rotor. Figure EE-71 and EE-72 show an exploded view of the unit.



EE062

1 Center carbon
2 Rotor head
3 Breaker plate (Contact)
4 Condenser
5 Shaft
6 Housing
7 Governor weight
8 Cap
9 Side plug

Fig. EE-71 Construction



1 Shaft assembly
2 Collar set assembly
3 Cam assembly
4 Governor weight assembly
5 Governor spring set
6 Screw
7 Rotor head assembly
8 Breaker assembly
9 Contact set
10 Connector assembly
11 Vacuum control assembly
12 Screw
13 Condensor assembly (for Advanced point)
14 Screw
15 Distributor cap assembly
16 Carbon point assembly
17 Fixing plate
18 Bolt
19 Condensor assembly (for Retarded point)
20 Screw
21 Lead wire assembly (for Advanced point)
22 Lead wire assembly (for Retarded point)
23 Earth wire assembly

EE131

Fig. EE-72 Components of distributor

CHECKING AND ADJUSTMENT

Cap and rotor head

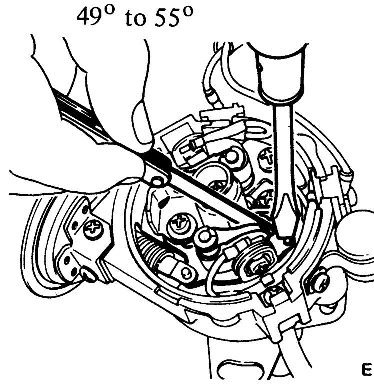
Cap and rotor head must be inspected at regular intervals. In addition, remove cap and clean all dust and carbon deposits from cap and rotor from time to time. If cap is cracked or is leaking, replace with a new one.

Point

Standard gaps of both points are 0.45 to 0.55 mm (0.0177 to 0.0217 in). If the gap is off the standard, adjustment should be made by loosening point screws. Gap gauge is required for adjustment.

Point gaps must be checked from time to time.

Point gap:
0.45 to 0.55 mm
(0.0177 to 0.0217 in)
Dwell angle:
49° to 55°



EE132

Fig. EE-73 Measuring point gap

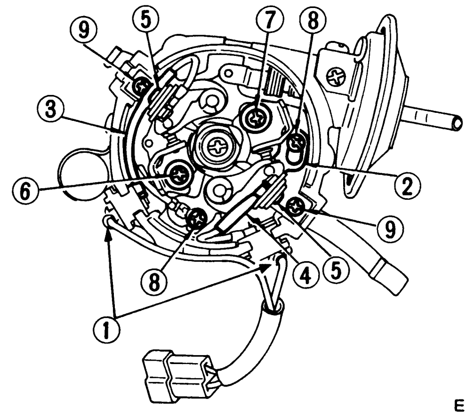
If point gap is adjusted by examining dwell angle, install distributor on engine and proceed as follows:

1. Disconnect wiring harness of distributor from engine harness.
2. Using a lead wire, connect B (black) of engine harness and B (black) of distributor harness (advance side).
3. Adjust dwell angle of advance side by loosening point screw.
4. Disconnect lead wire from B (black) of distributor harness and then connect it to Y (yellow) of distributor (Retard side).
5. Adjust dwell angle of retard side by loosening point screw.
6. After adjustment, disconnect lead wire then connect engine harness and distributor harness securely.

When point surface is rough, take off any irregularities with fine sand paper of No. 500 or 600 or with oil stone.

At this time, grease must be supplied to camshaft and cam heel.

When wear on breaker points is noticeable, replace points together with contact arm. To replace, proceed as follows;



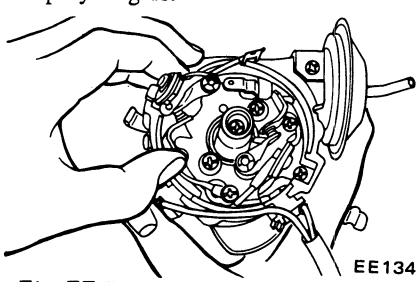
1 Lead wire terminal set screws
2 Adjuster plate
3 Primary lead wire (Advanced point)
4 Primary lead wire (Retarded point)
5 Primary lead wire set screw
6 Set screw (Advanced point)
7 Set screw (Retarded point)
8 Adjuster plate set screws
9 Braker plate set screws

EE133

Fig. EE-74 Breaker

First turn out primary lead wire set screws (See Figure EE-74 at (5)) just for enough to pull out primary lead wires.

Unscrew contact set screws (See Figure EE-74 at (6) and (7)), and remove contact set assembly by lifting it up by fingers.



EE134

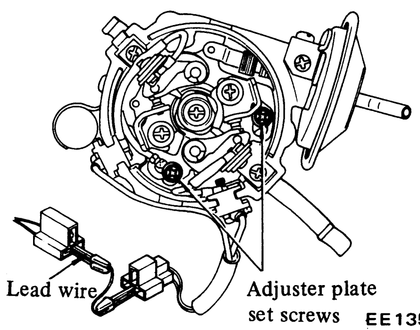
Fig. EE-75 Disassembling contact set (Advanced)

Install new contact set in reverse sequence of removal. Coat cam heal and camshaft head with a light coating of grease.

Inspection and adjustment of phase difference

To check phase difference, install distributor on engine and proceed as follows:

1. Disconnect wiring harness of distributor from engine harness.
2. Using a lead wire, connect B (black) of engine harness and B (black) of distributor harness. (Advance side). Refer to Figure EE-76.



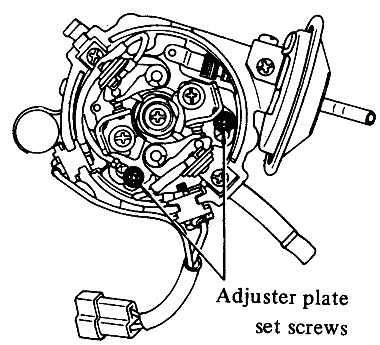
EE135

Fig. EE-76 Short-circuit between both primary terminals

3. With engine idling, adjust ignition timing by rotating distributor to specifications. (12°/800 rpm, advance side).
4. Disconnect lead wire from B (black) of distributor harness and then connect it to Y (yellow) of distributor harness. (Retard side)
5. With engine still idling, check to determine that phase delay is 7 degrees in terms of crank shaft angular displacement.

To correct, further proceed as follows:

(1) Referring to Figure EE-77, turn out adjuster plate set screw 1/2 to 2 turns. The screw is located at contact set on retard side.

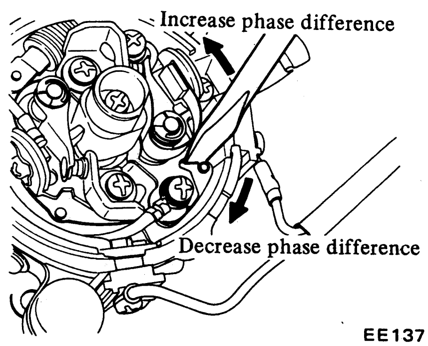


EE136

Fig. EE-77 Adjuster plate set screws

(2) Using a notch in adjuster plate as a hold, turn adjuster plate as required until correct delay is obtained. Ignition timing is retarded when plate is turned counterclockwise.

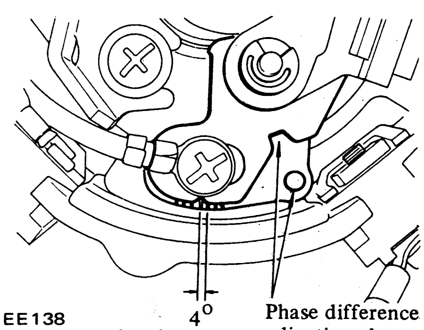
Note: Refer to graduations on breaker plate to make adjustment easier. One graduation corresponde to crankshaft angular displacement of 4 degrees.



EE137

Fig. EE-78 Adjusting phase difference

(3) Tighten adjuster plate set screws to secure the adjustment.



EE138

Fig. EE-79 Phase difference adjusting scale

(4) Make sure that the ignition timing of advance side is the specifications.
(5) After adjustment, remove lead wire and connect wiring harness of distributor to engine harness securely.

Condenser

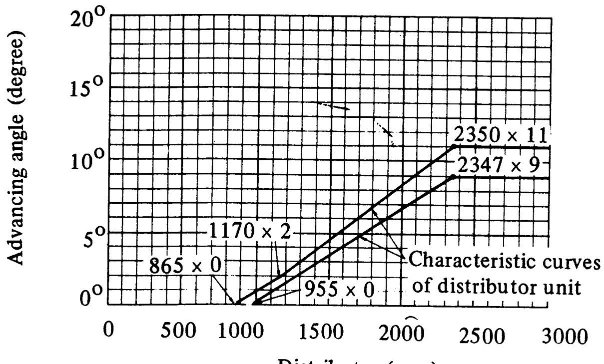
Satisfactory performance of condenser depends on capacity and degree of insulation, requiring attention to be sure that terminals are clean and set screws are tight.

Checking of condenser is made by a capacity tester. This can also be made by a circuit tester with its range set to high resistance reading. When needle of tester swings violently and then moves back to infinite gradually, it is an indication that condenser is in good condition.

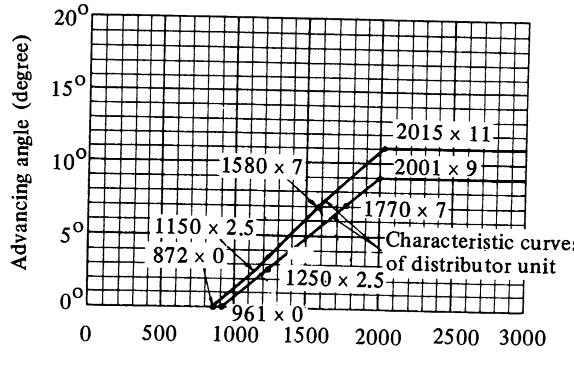
If needle shows any steady reading or if it registers zero, the likelihood is that transformer is out of order, calling for replacement.

Advance mechanisms

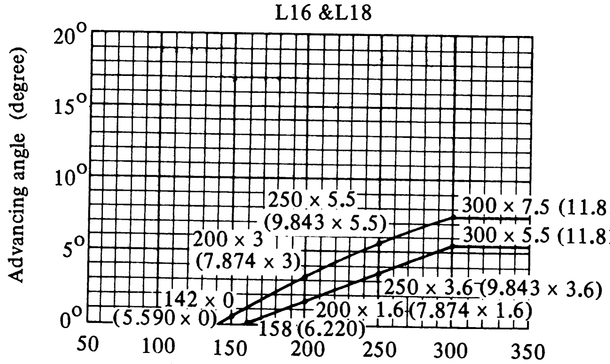
≪ Performances ≫



Centrifugal advance



Centrifugal advance



Vacuum advance

EE139

Fig. EE-80 Performance curves

≪ Vacuum advance mechanism mechanical parts ≫

If vacuum advance mechanism fails to operate properly, check for the following items and correct the trouble as required.

1. Check vacuum inlet for signs of leakage at its connection. If necessary, retighten or replace with a new one.
2. Check vacuum diaphragm for air leak.

If leak is found, replace diaphragm with a new one.

3. Inspect breaker plate for smooth moving.

If plate does not move smoothly, this condition could be due to sticky steel balls or pivot. Apply grease to steel balls or, if necessary, replace breaker plate as an assembly.

≪ Centrifugal advance mechanical parts ≫

When cause of engine trouble is traced to centrifugal advance mechanical part, use distributor tester to check its characteristic.

When nothing is wrong with its characteristic, conceivable causes are defectiveness or abnormal wearing-out of driving part or others.

So do not disassemble it. In case of improper characteristic, take off switch on-off part and check closely cam assembly, governor weight, shaft and governor spring, etc.

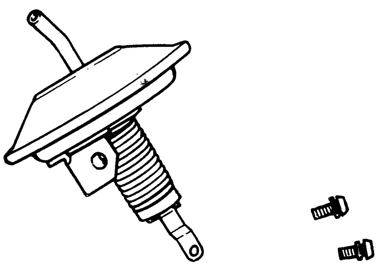
In case centrifugal advance mechanical part is reassembled, be sure to check advance characteristic by distributor tester.

DISASSEMBLY AND ASSEMBLY

Disassembly

To disassemble, follow the below procedure.

1. Take off cap and disconnect rotor head.
2. Remove vacuum controller.



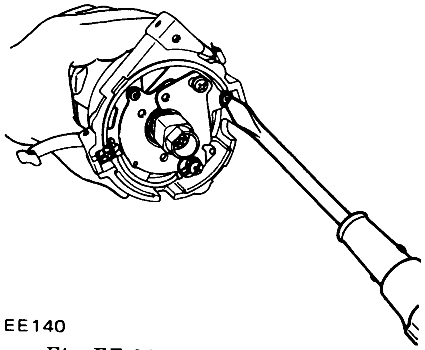
EE070

Fig. EE-81 Disassembling vacuum controller

3. Remove contact set

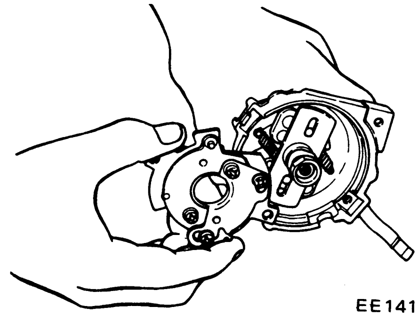
Refer to Figure EE-75, when contact set is removed.

4. Unscrew two contact breaker set screws and remove contact breaker assembly.



EE140

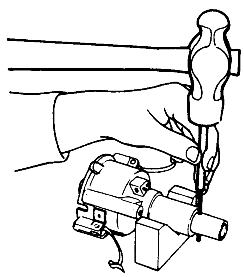
Fig. EE-82 Unscrewing breaker set screws



EE141

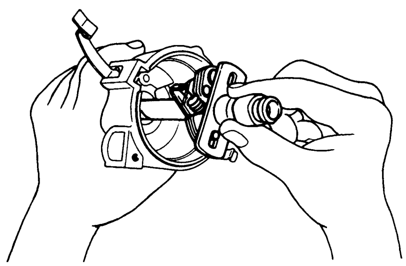
Fig. EE-83 Removing contact breaker

5. Pull knock pin out and disconnect collar to remove the entire rotating parts.



EE073

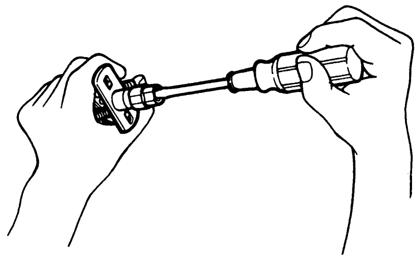
Fig. EE-84 Removing knock pin



EE074

Fig. EE-85 Removing rotation parts

6. When cam is to be removed, first remove set screw since shaft head is fastened by the screw to hold cam down. Put match mark across cam and shaft so that original combination can be restored at assembly.

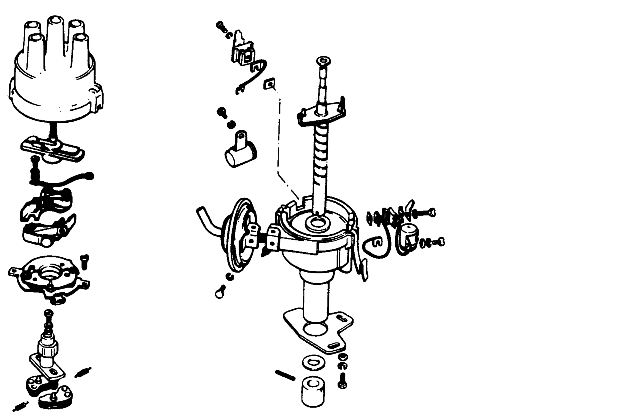


EE075

Fig. EE-86 Removing cam

7. When governor weight and spring are disconnected, be careful not to stretch or deform governor spring.

After disassembling, apply grease to governor weights.

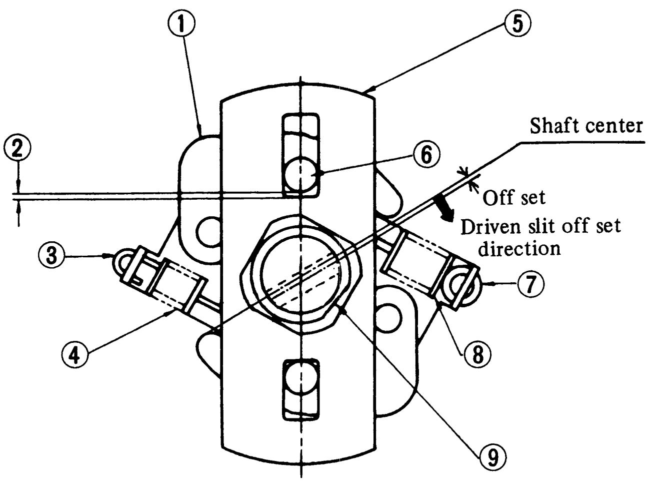


EE142

Fig. EE-87 Exploded view

Assembly

Assembly can be made in reverse sequence of disassembly. Refer to Figure EE-88 for replacement and reassembly of governor spring and cam.



1 Governor weight
2 Clearance for start and end of advancing angle
3 Rectangular hook
4 Governor spring (B)
5 Cam plate
6 Weight pin
7 Circular hook
8 Governor spring (A)
9 Rotor positioning tip

Fig. EE-88 Setting governor spring and cam

In assembling distributor, use caution so that rotor head positioning tip at cam is set on governor spring circular hook side.

Then weight pin for governor spring A with circular hook comes in long rectangular hole.

Also check to be sure that weight pin on spring A is in slit in cam plate with a clearance between the two at beginning and end of governor operation.

Meanwhile, weight pin on opposite side comes in short rectangular hole.

It does not leave clearance either at the start and end of advancing.

With unit assembled, check to be sure that driven slit and rotor position tip (9) are set in the same direction. See Figure EE-88.

After assembly check operation of governor before installing it on engine.

Ignition timing should be tested with unit mounted on engine.

SPECIFICATIONS AND SERVICE DATA

Distributor type	D410-66A	D410-67
Make	HITACHI	←
Applied engine (vehicle)	L18 (610)	L16 (510 and 620)
Firing order	1-3-4-2	←
Rotating direction	Counterclockwise	←
Ignition timing (degree)	5° (B.T.D.C.)	←
Idling adjustment		
M/T	5°/800 rpm	←
A/T	5°/650 rpm in "D" range	←
Dwel angle (degree)	49° to 55°	←
Condenser capacity (μF)		
Advanced isde	0.2 to 0.24	←
Retarded side	0.05 ± 15%	←
Phase difference (degree)	7° at crank angle	←

≪ All distributors ≫

Point gap	mm (in)	0.45 to 0.55 (0.0177 to 0.0217) (Advanced and Retarded side equally)
Point pressure	kg (lb)	0.50 to 0.65 (1.10 to 1.43)
Shaft diameter (lower part)	mm (in)	12.430 to 12.440 (0.4894 to 0.4898)
Housing inner diameter	mm (in)	12.450 to 12.468 (0.4902 to 0.4909)
Clearance between shaft and housing	mm (in)	0.010 to 0.038 (0.0004 to 0.0015)
Repair limit of clearance	mm (in)	0.08 (0.0031)
Shaft diameter (upper part)	mm (in)	$8\,{}^{-0.005}_{-0.014}$ $(0.3150\,{}^{-0.0002}_{-0.0006})$
Cam inner diameter	mm (in)	8.000 to 8.015 (0.3150 to 0.3156)
Clearance between shaft and cam	mm (in)	0.005 to 0.029 (0.0002 to 0.0011)
Weight pivot diameter	mm (in)	4.972 to 4.990 (0.1959 to 0.1965)
Weight hole diameter	mm (in)	5.000 to 5.018 (0.1969 to 0.1976)
Clearance between pivot and hole	mm (in)	0.01 to 0.046 (0.0004 to 0.0018)

IGNITION COIL

The ignition coil is of an oil-filled type. The ignition coil case is filled with oil which has good insulating and heat-radiating characteristics.

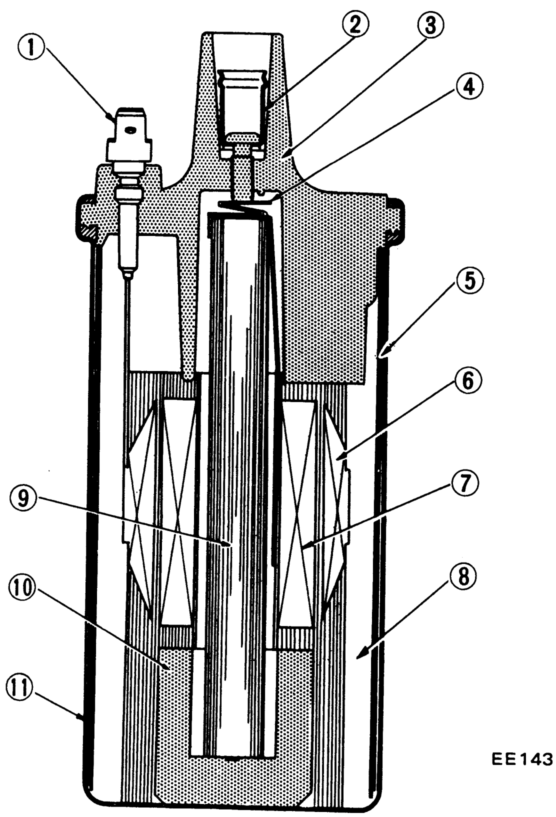
The ignition coil has a greater ratio between the primary and secondary windings to step up the battery voltage to the high voltage to cause stronger sparks to jump the spark plug gap.

The cap is made of alkyd resin which offers high resistance to electric arc and increased insulation.

The resistor in the ignition coil circuit helps produce strong sparks from starting to high-speed full-power operation.

The internal resistor limits to a maximum safe flow of the primary current through the coil and distributor contact points. Thus, it protects the contact points during slow speed operation when they are closed for long intervals.

The ignition coil and resistor should be handled as a matched set.



1 Primary terminal
2 Secondary terminal
3 Cap
4 Spring
5 Side core
6 Primary coil
7 Secondary coil
8 Insulator oil
9 Center core
10 Segment
11 Case

Fig. EE-89 Construction

SPECIFICATIONS

Item / Vehicle model (Applied engine)		610 (L18)	510 (L16)	620 (L16)
Make and type		HANSHIN H5-15-1	HANSHIN H5-15-2	HITACHI C6R-601
Applied resister		RC-15	←	5660R-1510
Primary voltage	V	12	←	←
Spark gap	mm (in)	more than 7 (0.2756)	←	←
Primary resistance at 20°C (68°F)	Ω	1.17 to 1.43	←	←
Secondary resistance at 20°C (68°F)	KΩ	11.2 to 16.8	←	←
External resistor at 20°C (68°F)	Ω	1.3 to 1.7	←	←

SPARK PLUG

CONTENTS

DESCRIPTION

The spark plugs are of the resistor type, having 14 mm (0.551 in) threads and 0.7 to 0.8 mm (0.0276 to 0.0315 in) gap. The inspection and cleaning should be made every suitable maintenance period. If necessary, replace.

Note: **All spark plugs installed on an engine, must be of the same brand and number of heat range.**

INSPECTION

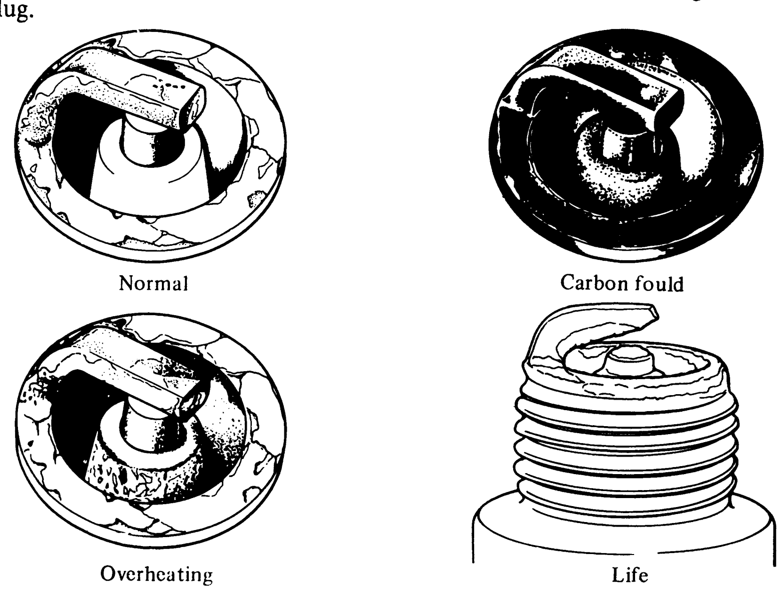
1. Remove spark plug wire by pulling on boot, not on wire itself.
2. Remove spark plugs.
3. Check electrodes and inner and outer porcelains of plugs, noting the type of deposits and the degree of electrode erosion. Refer to Figure EE-90.

Normal: Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.

Carbon fouled: Dry fluffy carbon deposits on the insulator and electrode were mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.
It is advisable to replace with plugs having hotter heat range.

Oil fouled: Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If the same condition remains after rapair, use a hotter plug.

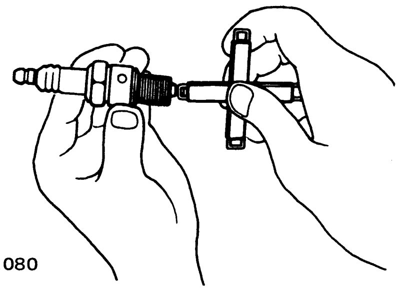
Overheating: White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, low fuel pump pressure, wrong selection of fuel, a hotter plug, etc.
It is advisable to replace with plugs having colder heat range.



EE079

Fig. EE-90 Spark plug

4. After cleaning, dress electrodes with a small fine file to flatten the surfaces of both center and side electrodes in parallel. Set spark plug gap to specification.
5. Install spark plugs and torque each plug to 1.5 to 2.0 kg-m (11 to 15 ft-lb).
6. Connect spark plug wires.



EE080

Fig. EE-91 Setting spark plug gap

CLEANING AND REGAP

Clean spark plugs in a sand blast type cleaner. Avoid excessive blasting. Clean and remove carbon or oxide deposits, but do not wear away porcelain. If deposits are too stubborn, discard plugs.

After cleaning spark plugs, renew firing surface of electrodes with file mentioned above. Then gap spark plugs to 0.7 to 0.8 mm (0.0276 to 0.0315 in) using a round wire feeler gauge. All spark plugs new or used should have the gap checked and reset by bending ground electrode.

SERVICE DATA AND SPECIFICATIONS

Item \ Make	NGK
Item \ Model	B6ES
Applied engine	L16 and L18
Size (screw dia. x reach) mm (in)	14 x 19 (0.55 x 0.75)
Plug gap mm (in)	0.7 to 0.8 (0.028 to 0.031)
Tightening torque kg-m (ft-lb)	1.5 to 2.5 (11.0 to 15.0)

TROUBLE DIAGNOSES AND CORRECTIONS

1. When engine does not start

If there is no trouble in fuel system, ignition system should be checked. This can be easily done by detaching a high tension cable from spark plug, starting engine and observing condition of spark that occurs between high tension cable and spark plug terminal. After checking this, repair as necessary.

Spark length	Trouble location	Causes	Remedies
No sparks at all	Distributor	Defective insulation of condenser.	Replace.
		Breakage of lead-wire on low tension side.	Repair.
		Defective insulation of cap and rotor head.	Replace.
		Point does not open or close.	Repair.
	Ignition coil	Wire breakage or short circuit of coil.	Replace with new one.
	High tension cable	Wire coming off.	Repair.
		Defective insulation.	Replace.
1 to 2 mm (0.0394 to 0.0787 in) or irregular.	Distributor	Point gap too wide.	Correct.
		Oil sticking on point.	Clean.
		Point burnt too much.	Replace.

Troubles	Trouble location	Causes	Remedies
Less than 6 mm (0.2362 in)	Spark plugs	Electrode gap too wide.	Correct or replace.
		Too much carbon.	Clean or replace.
		Broken neck of insulator.	Replace.
		Expiry of plug life.	Replace.

2. When engine rotates but does not run smoothly.

In this case, there are many causes resulting from the ignition system and other engine conditions not related to ignition. Therefore, first complete inspection of ignition system should be carried out.

Troubles	Trouble location	Causes	Remedies
Engine misses	Distributor	Dirty point.	Clean.
		Improper point gap.	Correct.
		Leak of electricity of cap and rotor head.	Repair or replace.
		Defective insulation of condenser.	Replace.
		Defective arm.	Oil shaft.
		Defective spring of arm.	Replace assembly.
		Breakage of lead wire.	Replace.
		Worn out or shaky breaker plate.	Replace assembly.
		Worn out or shaky distributor shaft.	Replace assembly.
	Ignition coil	Layer short circuit or use of inferior quality.	Replace with good one.
	High tension code	Deterioration of insulation and leak of electricity.	Replace.
	Spark plugs	Dirty.	Clean.
		Leak of electricity at upper porcelain insulater.	Repair or replace.
Engine causes knocking very often	Distributor	Improper and advance timing.	Correct the fitting.
		Coming off or breakage of governor spring.	Correct or replace.
		A pin or a hole of governor portion worn out.	Replace.
	Spark plugs	Burnt too much.	Replace.
Engine does not give enough power	Distributor	Improper and retarded timing.	Correct the fitting.
		Defective function of governor.	Replace assembly.
		Dirty point.	Clean.
		Point gap too narrow.	Correct.
	Spark plugs	Dirty.	Clean.

SERVICE MANUAL

MODEL
L16 & L18 SERIES
ENGINES

NISSAN

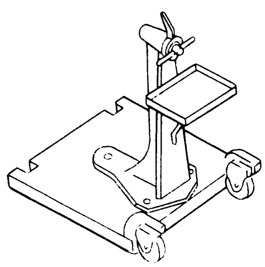
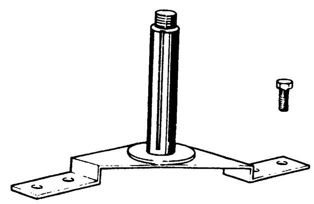
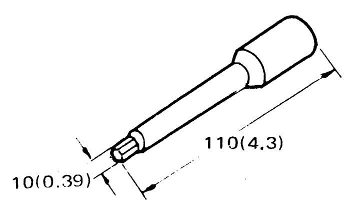
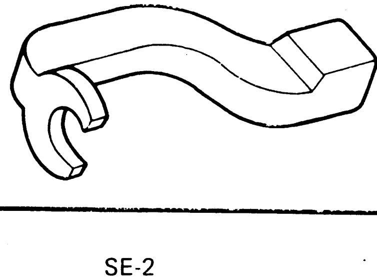
NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

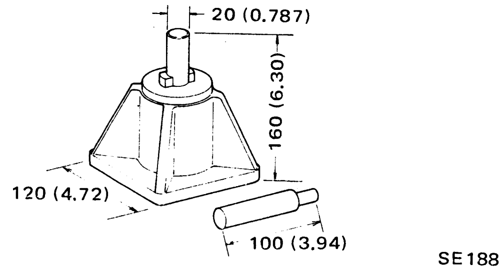
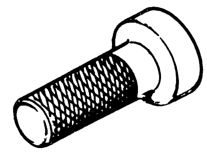
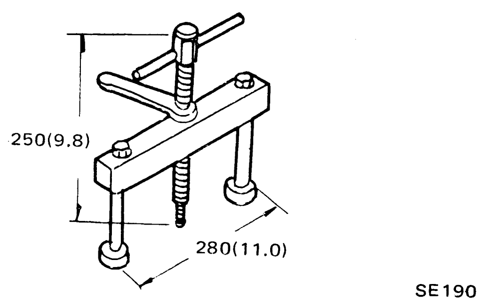
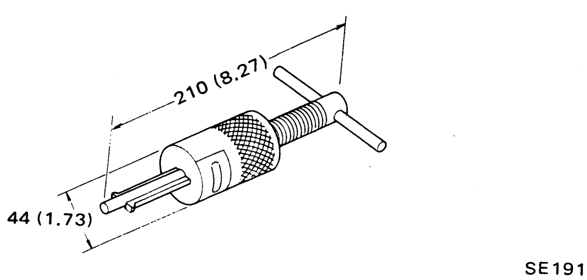
SECTION SE

SERVICE EQUIPMENT

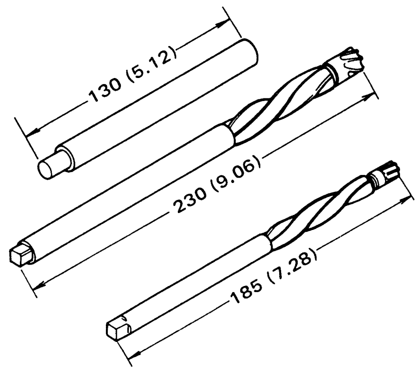
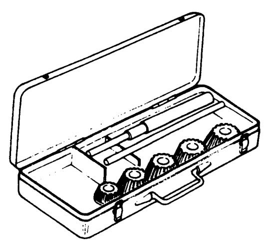
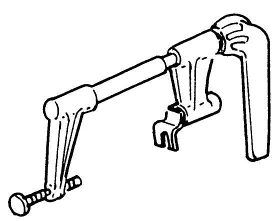
SE

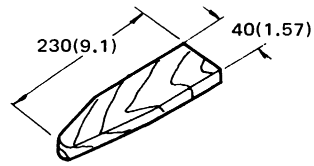
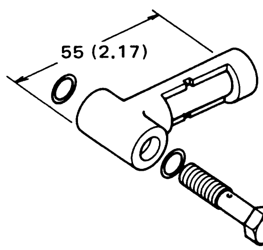
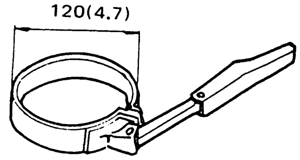
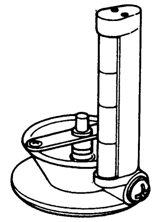
SPECIAL SERVICE TOOLS

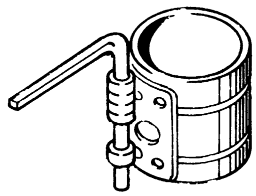
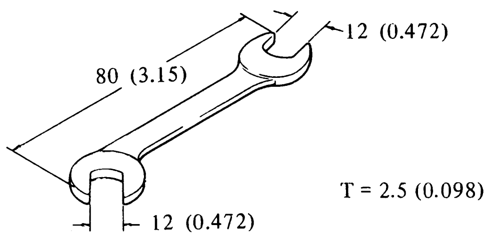
	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
1.	ST0501S000 Engine stand assembly — ST05011000 Engine stand — ST05012000 Base	This engine stand assembly is used for disassembling or assembling engine block or differential carrier throughout 360° in all directions.  SE184	All models	Fig. EM-11 Page EM-22
2.	ST05260001 Engine attachment	This engine attachment is installed to engine stand ST0501S000 in disassembling or assembling engine.  SE185	L16 L18	Page EM-22
3.	ST10120000 Cylinder head bolt wrench	Special hollow set bolts are used in tightening cylinder heads in L-series engines. This wrench is used to torque cylinder head bolts and its head can be inserted into the torque wrench.  SE186	All L-series	Fig. EM-15 Page EM-25
4.	ST10640001 Pivot adjuster	This tool is used together with a torque wrench in tightening pivot lock nut for valve clearance adjustment.  SE187	All L-series	Fig. EM-103

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
8.	ST13030001 Piston pin press stand	This tool is used with a press to drive pin into, or out of, connecting rod. 	All L-series	Fig. EM-26 Fig. EM-82
9.	ST15310000 Crankshaft rear oil seal drift	This tool is used to push a lip type rear oil seal for L-series engine into place by giving hammer blows. 	All L-series	Fig. EM-89
10.	ST1651S000 Crankshaft main bearing cap puller — ST16511000 Body — ST16512001 Adapter	This tool is used to remove the cap from main bearing. When using this tool, turn its adapter into the threaded hoie in main bearing cap. 	All L-series	Fig. EM-22
11.	ST16610001 Pilot bush puller	This tool is used to push pilot bush out of place. 	L16 L18	Fig. EM-64

SERVICE EQUIPMENT

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
5.	ST1103S000 Valve guide reamer set — ST11031000 Reamer (12.2 mm dia.) — ST11032000 Reamer (8.0 mm dia.) — ST11033000 Drift	This guide is used for: o Pressing used guide out of place. o Driving a new guide into place. o Finishing the bore of new guide. 	All L-series	Fig. EM-41
6.	ST11650001 Valve seat cutter set	This valve seat cutter set is used to or refinish a valve seat. 	All L-series	Fig. EM-42
7.	ST12070000 Valve lifter	This tool is used to compress valve spring by the combined action of its cam and lever, thereby facilitating the removal or installation of collect (for general use). 	All models	Fig. EM-29 Page EM-21 Fig. EM-79

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
12.	ST17420001 Chain stopper	This tool is used to prevent chains from falling out of place in removing cylinder heads or cam gears and shafts.  SE195	All L-series	Fig. EM-16
13.	ST19200000 Float level gauge	This gauge is used to check the float level in the SU type carburetor.  SE196	SU carburetor	
14.	ST19320000 Oil filter wrench	This tool is used to take oil filter out of place. In tightening the filter, do not use this tool, to prevent excess tightening.  SE197	All models	Page EM-5 Fig. EL-9 Page ET-3
15.	EG16700000 Flow meter	This tool is used to bring an SU-type carburetor into functional synchronization. Synchronization is properly made by keeping equal float (or fuel) levels in this unit.  SE198	SU carburetor	

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
16.	EM03470000 Piston ring compressor	This tool is used to compress piston rings while piston is being inserted into cylinder.  SE199	All models	Fig. EM-90
	ST19150000 Anti-dieseling solenoid spanner	For installing anti-dieseling solenoid to carburetor. 	L18 L16 A12	Page ET-8 Page EF-19

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