

SERVICE MANUAL

**MODEL
L20A, L24 SERIES
ENGINE**



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN



SERVICE MANUAL

MODEL
L20A, L24 SERIES
ENGINES



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

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FOREWORD

This service manual has been prepared for the purpose of assisting service personnel of our distributors and dealers for effective service and maintenance of model L20A, L24 series engines.

Since proper maintenance and service are most essential to satisfy our customers by keeping their cars in the best condition, this manual should be read carefully. The followings should be noted for effective utilization of this manual.

- 1. Please for complete detail of the car refer to this and DATSUN 240Z SPORTS SERVICE MANUAL, DATSUN 2000 SERVICE MANUAL, NISSAN GLORIA SERVICE MANUAL because this manual describes information concerning the engine.*
- 2. All part name in this manual conform to DATSUN 240Z SPORTS PARTS CATALOG, DATSUN 2000 and 2400 PART CATALOG and NISSAN GLORIA PARTS CATALOG, and only the genuine service parts listed in these parts catalogs should be used for replacement.*
- 3. All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication approval.*
- 4. It is emphasised that those who use this manual revise the contents according to the SERVICE JOURNAL and SERVICE DATA AND SPECIFICATIONS issued by the factory, which carry the latest factory approved servicing method.*
- 5. Rights for alternation in specifications and others at any time are reserved.*

NISSAN MOTOR CO., LTD.
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**MODEL
L20A, L24 SERIES
ENGINE**



NISSAN MOTOR CO., LTD.
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SECTION EG

ENGINE GENERAL

EG

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ENGINE GENERAL

EXTERNAL VIEW OF ENGINE

External view of model L24 engine (SU carburetor)

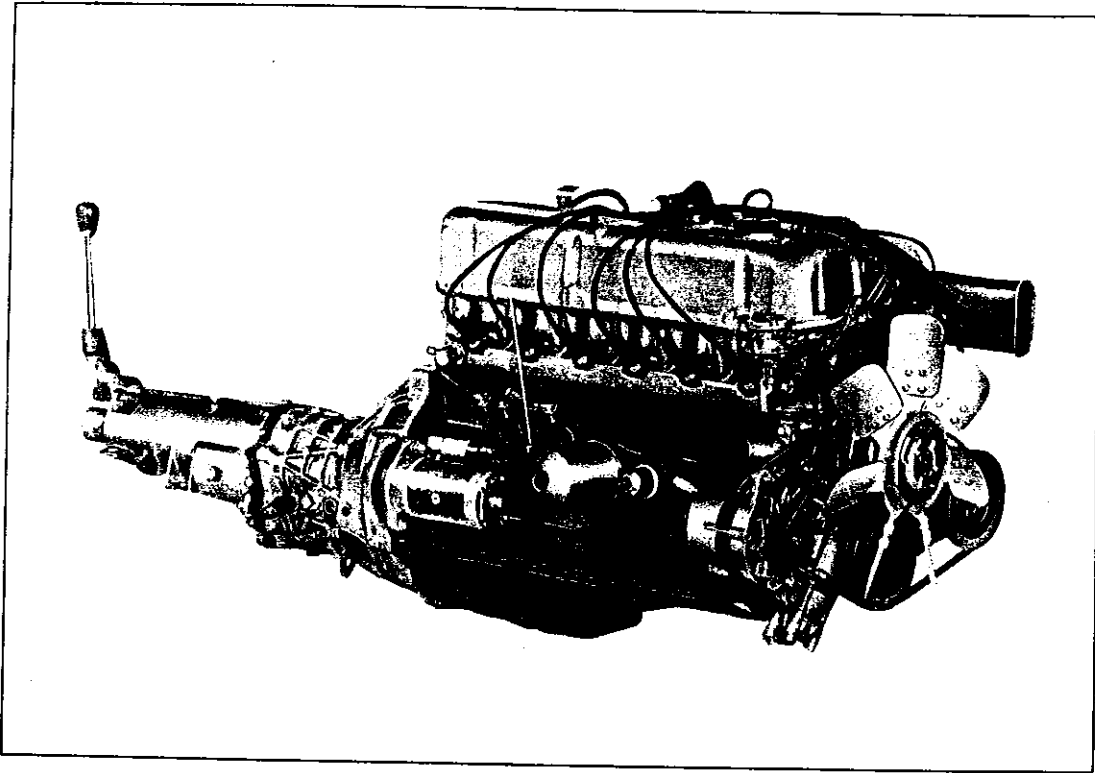


Fig. EG-1 Right hand side

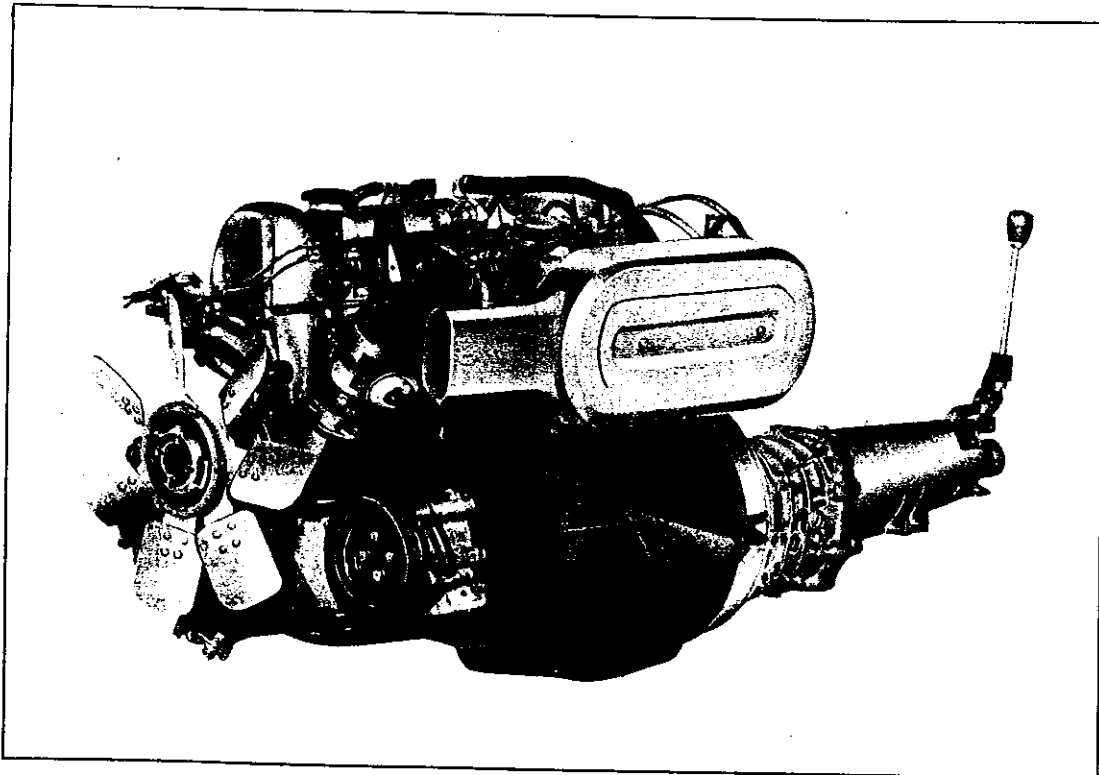


Fig. EG-2 Left hand side

ENGINE

External view of model L24 engine

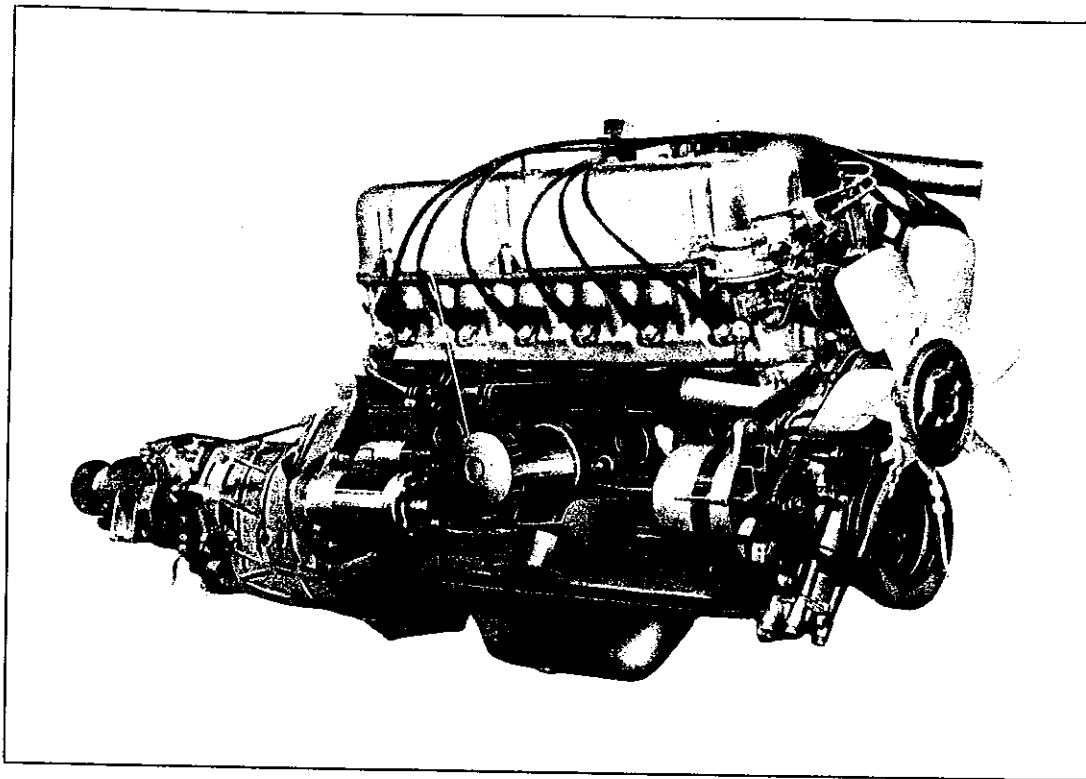


Fig. EG-3 Right hand side

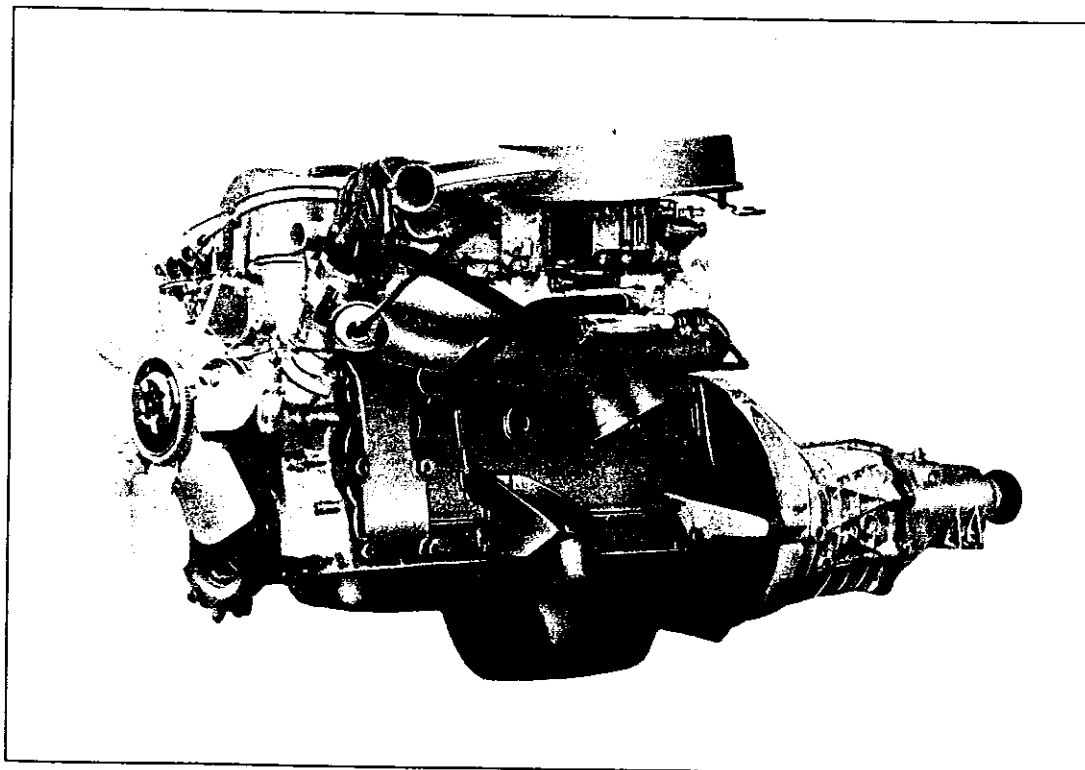


Fig. EG-4 Left hand side

ENGINE GENERAL

External view of model L20A engine

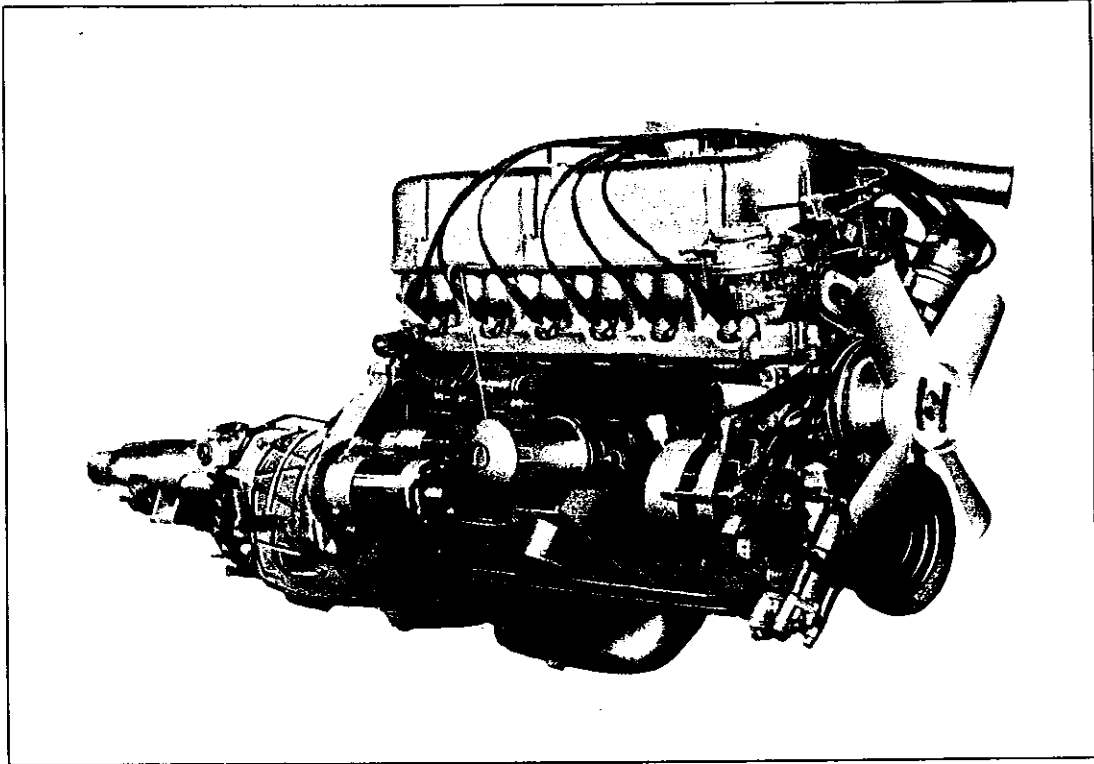


Fig. EG-5 Right hand side

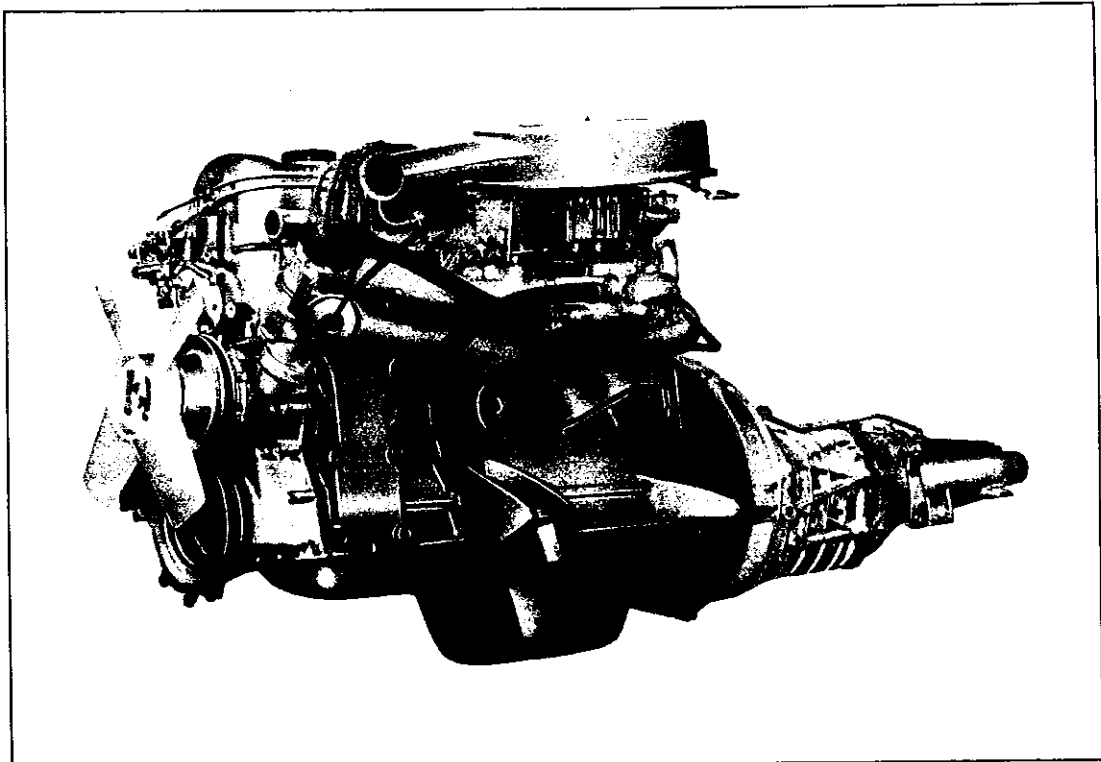


Fig. EG-6 Left hand side

ENGINE

MAIN SPECIFICATIONS

Engine model		L24 (SU carb.)	L24	L20A
Number of cylinders, in line		6	6	6
Valve arrangement		OHC	OHC	OHC
Bore	mm (in)	83 (3.268)	83 (3.268)	78 (3.071)
Stroke	mm (in)	73.7 (2.902)	73.7 (2.902)	69.7 (2.744)
Displacement	cc (cu in)	2,393 (146.0)	2,393 (146.0)	1,998 (121.9)
Compression ratio		9.0 : 1	8.5 : 1	8.6 : 1
Maximum power, SAE (NEW)	HP at rpm	151 5,600	130 5,600	115 5,600
Maximum torque, SAE (NEW)	kg-m (ft-lb) at rpm	20.1 (145.7) 4,400	20.0 (144.9) 3,600	16.6 (120.0) 4,000
Capacity	Oil pan (*) ℓ US qts/UK qts	4.1 (8.7/7.2)	4.1 (8.7/7.2)	4.1 (8.7/7.2)

(*)The table specifies volume of oil required for periodic oil replacement, when oil filter is not replaced. Should also the filter be replaced, the total quantity is about 5.0 ℓ (5.3 US qts/4.4 UK qts).

VEHICLE REFERENCE

Information described herein is about engines only. Please, refer to both this and each manual for chassis and body for complete details of the car.

The vehicles on which L24 and L20A engines are mounted are as follows:

Engine		Vehicle		
Model	Displacement	Current model	Vehicle name	Remarks
L24 (SU carb.)	2,393 cc (146.0 cu in)	HLS30-U H(L)S30-(U)	DATSUN 240Z SPORTS	
L24	2,393 cc (146.0 cu in)	G(L)130-(U) G(L)130-Q(U)	DATSUN 2400 DATSUN 2400	Sedan, super six Sedan, personal deluxe six
L20A	1,998 cc (121.9 cu in)	H(L)130-V(U)	DATSUN 2000	Sedan, custom six
		H(L)130-Q(U)	DATSUN 2000	Sedan, personal deluxe six
		WH(L)130-(U)	DATSUN 2000	Wagon, wagon six
		VH(L)130-(U)	DATSUN 2000	Van, van deluxe six
		H(L)A30-(U)	NISSAN GLORIA	Sedan, standard
H(L)A30-Q(U)	NISSAN GLORIA	Sedan, deluxe		
WH(L)A30-(U)	NISSAN GLORIA	Wagon		

ENGINE GENERAL

RECOMMENDED LUBRICANTS, GASOLINE AND COOLANT

Use the following grades of oil, gasoline and coolant.

Temperature	°F	-13° to 32°	5° to 68°	14° to 86°	32° to 104°	50° to 122°	Over 68°
	°C	-25° to 0°	-15° to 20°	-10° to 30°	0° to 40°	10° to 50°	Over 20°
Engine Oil (MS)		SAE 10W	SAE 20W	SAE 20	SAE 30	SAE 40	SAE 50

Recommended lubricants

ENGINE OIL		TEXACO	CHEVRON	CALTEX	CASTROL	BP	ESSO (ENCO)	MOBIL	SHELL
Gasoline	Multi grade MIL-L-2104B API MS	Havoline Motor Oil 10W-30 20W-40	RPM Supreme Motor Oil 10W-30 20W-40	Custom Five Star Motor Oil 10W-30 20W-40	Castrolite 10W-30 Castrol XL 20W-40 Castrol GTX 20W-50*	BP Super V Viscostatic 5W-20 10W-30 20W-50*	Esso (Enco) UniFlo 5W-30 10W-40* Esso (Enco) Extra Motor Oil 10W-30 20W-40	Mobiloil Special 10W-30 Mobiloil Super 10W-40*	Shell X100 10W-30 20W-40
	Regular MIL-L2104B API MS	Havoline Motor Oil 10W 20W-20 30 40	RPM Special Motor Oil 10W 20W-20 30 40	Five Star Motor Oil 10W 20W-20 30 40	Castrol HD 5W 10W 20W-20 30 40 50	BP Energol HD 10W 20W 30 40 50	ESSO (Enco) Motor Oil 10W 20W-20 30 40 50	Mobiloil 10W 20W-20 30 40 50	Shell X100 10W 20W 30 40 50
Multi-purpose Grease MIL-G-2108, MIL-G-10924		Marfak Multi-purpose* Marfak All Purpose*	RPM Multi-motive Grease*	Marfak Multi-purpose* Marfak All Purpose*	Castrol LM *	BP Energrease 12 *	Esso (Enco) Multi- purpose grease H *	Mobil grease MP *	Shell Retinax A

* Should the above brand of oils not be available, it is permissible to use oils marked *

Engine model	Compression ratio	Octane No. of gasoline
L24 (SU carb.)	9.0 : 1	more than 95
L24	8.5 : 1	more than 95
L20A	8.6 : 1	more than 95 more than 85*

* Optional distributor for lower octane gasoline

Nissan long life coolant (L. L. C.)

This L.L.C. is an ethylene glycol base product containing chemical inhibitors to protect the cooling system against rusting and corrosion. L.L.C. does not contain any glycerine, ethyl or methyl 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. L.L.C. must not be mixed with other product. This coolant can be used through out the seasons of the year and exchange period is two years or total running mileage of 40,000 km (24,000 miles).

ENGINE

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)

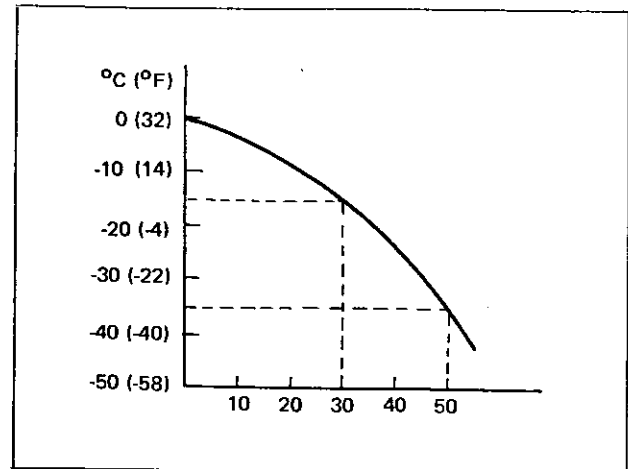


Fig. EG-7 Protection concentration

UNIT SERIAL NUMBER LOCATION

There are two serial numbers for unit identification: the engine number and the chassis number. These numbers are repeated in the car identification plate, which is located in an easy-to-read position.

Engine Serial Number

The engine serial number is stamped in the rear right side of cylinder block, at cylinder head contact surface. The number is preceded by engine model, L20 or L24.

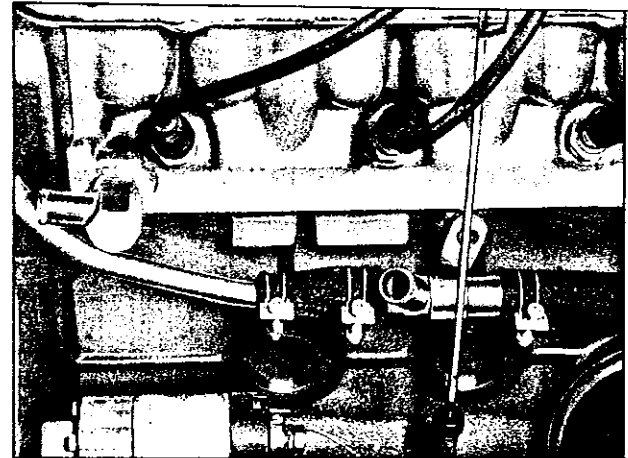
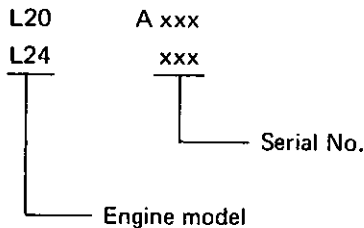


Fig. EG-8 Engine serial number



ENGINE GENERAL

PERIODICAL INSPECTION AND MAINTENANCE

MAINTENANCE FREQUENCY EVERY	LUBRICATION AND CHECKING POINTS (ENGINE)	MAINTENANCE PERIODS																								
		40,000 km (24,000 miles)	20,000 km (12,000 miles)	10,000 km (6,000 miles)	5,000 km (3,000 miles)	1,000 km (600 miles)	3,000 km (2,000 miles)	6,000 km (4,000 miles)	10,000 km (6,000 miles)	15,000 km (9,000 miles)	20,000 km (12,000 miles)	25,000 km (15,000 miles)	30,000 km (18,000 miles)	35,000 km (21,000 miles)	40,000 km (24,000 miles)	45,000 km (27,000 miles)	50,000 km (30,000 miles)									
	Change engine oil				●																					
	Grease distributor shaft & cam heel			○																						
	Change cooling water (L.L.C.)																									
	Adjust valve clearance.	●																								
	Check ignition timing (adjust if necessary).																									
	Check fan belt tension.																									
	Measure compression pressure.																									
	Change air cleaner element (Viscous type).																									
	Check fuel line for leak.																									
	Change cartridge type fuel strainer.																									
	Check fuel pump for proper function.																									
	Retighten carburetor & fitting parts.																									
	Overhaul carburetor.																									
	Change oil filter.																									
	Check battery for specific gravity of electrolyte.																									
	Check or change spark plugs.																									
	Check distributor breaker point.																									
	Check condenser for proper function.																									
	Check alternator, regulator for proper function.																									
	Check alternator brushing.																									
	Check starter for proper function.																									
	Check engine for oil and water leaks.																									
	Retighten cylinder head, manifolds & exhaust pipe flange.																									
	Check engine for weak or faulty mounting.																									
	Adjust idling speed.																									
	Check engine starting condition for abnormal noise and exhaust color																									
	Check high tension cable																									
	Clean ignition coil, distributor and battery																									
	Check crankcase ventilation control valve for proper function																									

○ = Check, clean, adjust or supply ● = Change

SPECIAL MAINTENANCE FOR EMISSION CONTROL SYSTEM

ENGINE

MAINTENANCE FREQUENCY EVERY	CHECKING POINTS	MAINTENANCE PERIODS																		
		40,000 km (24,000 miles)	35,000 km (21,000 miles)	30,000 km (18,000 miles)	25,000 km (15,000 miles)	20,000 km (12,000 miles)	15,000 km (9,000 miles)	10,000 km (6,000 miles)	6,000 km (4,000 miles)	3,000 km (2,000 miles)	1,000 km (600 miles)									
	Engines equipped with emission control system																			
	Engine																			
	Check ignition timing.																			
	Check engine idling.																			
	Engine major tune-up.																			
	Check or replace spark plugs.																			
	Check or replace distributor breaker points.																			
	Check high tension cable.																			
	Apply grease to distributor rotor shaft, cam, and wick.																			
	Replace carburetor air cleaner element.																			
	Check for leaks of hoses and hose connections.																			
	Check for proper function of crankcase ventilation control valve.																			
	Crankcase emission																			
	Check for proper function of air pump.																			
	Check for proper function of relief valve.																			
	Check for proper function of check valve.																			
	Check for proper function of anti-back fire valve.																			
	Exhaust emission																			
	Check for leaks of air gallery and nozzle connections.																			
	Check for leaks of hoses and hose connections.																			
	Check air pump belt tension.																			
	Check operating negative pressure of throttle control valve, adjust if necessary.																			
	Evaporative emission																			
	Check hoses, hose connectors and piping for leaks.																			
	Check for proper function of flow guide valve.																			

○ = Clean, check, adjust or supply ● = Change

ENGINE GENERAL

AFTER FIRST 1,000 KM (600 MILES)

Changing engine oil

Second replacement	at 3,000 km (2,000 miles)
Third replacement	at 6,000 km (4,000 miles)
Fourth replacement	at 10,000 km (6,000 miles)
Fifth and thereafter	every 5,000 km (3,000 miles)

Draining is best done after a good run, when the oil, being thoroughly warm, will flow readily and freely and any foreign matter will be held in suspension.

Place a large bowl or other shallow container under the engine. Then remove the oil pan drain plug. Do this carefully, as the oil will be hot and it will spurt out with some force. After completely draining the dirty oil off securely replace the oil drain plug and finally refill the engine in the usual way up to the "H" mark on the dipstick. Make sure that the car is on a level surface while draining and filling the engine.

Oil capacity

L24 (SU carb.)	5.0ℓ (1.3 US gal)
L24	5.0ℓ (1.3 US gal)
L20A	5.0ℓ (1.3 US gal)

Fan belt tension

Second replacement	at 10,000 km (6,000 miles)
Third and thereafter	every 10,000 km (6,000 miles)

Incidentally, we call it the fan belt, but also it drives the water pump and alternator. It is advised, however, to check the tension regularly, so that when the need for adjustment does arise, it is not overlooked. With the engine switched off and the bonnet up, push the belt gently downward. You should be able to depress it about 10 mm (1/2 in). If the fan belt has become slack through wear, loosen the fixing and adjusting bolts, and move the alternator away from the engine. This will eliminate the slack. Tighten the bolts again, and make sure that the belt has been tightened correctly. If tightened excessively it

will wear rapidly and also overload the water pump and alternator bearings.

AFTER FIRST 3,000 KM (2,000 MILES)

Replacing oil filter

Second and thereafter	every 10,000 km (6,000 miles)
-----------------------	----------------------------------

The oil filter is of a full-flow cartridge type. The element of oil filter is sealed in the container as a unit. It can be easily removed by hand. Be careful not to lose the rubber sealing ring. When assembling oil the seal lightly, and when the seal is contacted, tighten by hand further, rotating it about 1/3 of one full turn.

EVERY 10,000 KM (6,000 MILES)

Changing cooling water

Scale or sediment accumulated in water jacket or radiator harms heat radiation. Thoroughly flush the system after opening 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 mild water for filling the radiator. When cold season arrives, the cooling system should be protected against frost with a high quality anti-freeze solution such as a NISSAN LONG LIFE COOLANT. Do not overfill the system. This coolant (L.L.C.) may be changed every 40,000 km (24,000 miles).

EVERY 40,000 KM (24,000 MILES)

Replacing air cleaner element (wet paper type)

The air cleaner uses a wet paper type cleaner element (viscous type). As this element has been manufactured under special treatment, there is no need of cleaning until it is replaced with a new one. Although the cleaner element looks dirty, do not intend to clean. The cleaning performance is constantly maintained although it looks contaminated. Care must be taken not to injure cleaner element.

**SERVICE
MANUAL**

**MODEL
L20A, L24 SERIES
ENGINE**



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION ET

ENGINE TUNE-UP

ENGINE TUNE-UP	ET- 1
TROUBLE DIAGNOSES AND CORRECTIONS	ET- 5

ENGINE TUNE-UP

ENGINE TUNE-UP

CONTENTS

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Battery inspection	ET-2	Distributor lubricate	ET-5
Spark plugs-remove and recondition	ET-2	Tighten intake manifold and Carburetor installation nuts	ET-5
Clean and adjust distributor points	ET-2	Inspection of oil filter	ET-5
Set ignition timing	ET-2	Inspection of air cleaner	ET-5
Inspection of fan belt and air pump belt	ET-3	Inspection of fuel strainer	ET-5
Inspection of engine oil	ET-3	Inspection of cooling system	ET-5
Carburetor overhaul and adjustment	ET-4		
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Description

It may be needless to say, however, to maintain optimum engine performance always, periodical adjustment (engine tune-up) is necessary.

The foregoing chapter "Engine General" describes periodical inspection and maintenance period and items to be inspected. This Chapter describes actual operating

procedures for the major items to be inspected.

This chapter does not describe periodical inspection and maintenance for emission control system.

For the detail of emission control system, please refer to the section EC (Emission Control System).

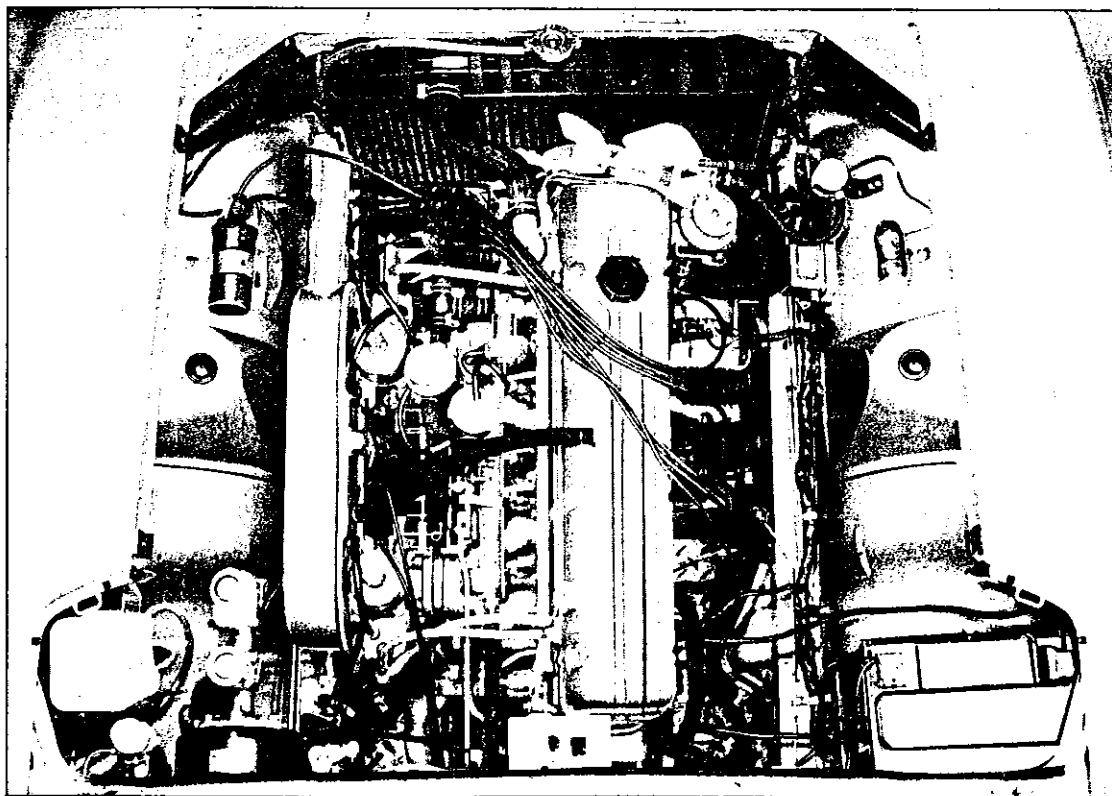


Fig. ET-1 Engine compartment (model S30)

ENGINE

Battery inspection

1. Check the level of the electrolyte in battery cells.
Check the level line on the case with the battery electrolyte.
If necessary, add distilled water.
2. Measure the specific gravity of the battery electrolyte.

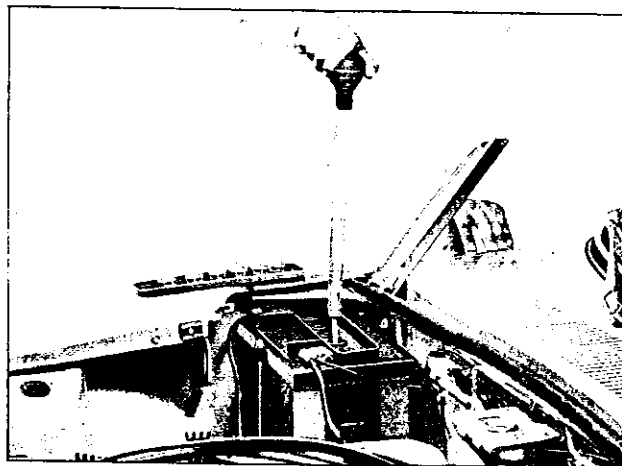


Fig. ET-2 Battery inspection

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

Clean top of the battery and terminals with a solution of baking soda and water. Rinse off and dry with compressed air. Top of the 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 the battery may cause blistering of the material covering connector straps and corrosion of straps. After tightening terminals, coat them with petrolatum to protect them from corrosion.

Spark plugs-remove and recondition

See that correct spark plugs are used. Spark plug insulators should be thoroughly cleaned to prevent

possible flash-over.

Thoroughly clean lower insulator and cavity by sand blasting. File both electrodes flat (rounded surfaces increase voltage required to fire plugs) and set gap to 0.8 to 0.9 mm (0.031 to 0.035 in). When plugs are reinstalled, use new gaskets and tighten plugs to 1.5 to 2.0 kg-m (11.0 to 15.0 ft-lb) torque.

Clean and adjust distributor points

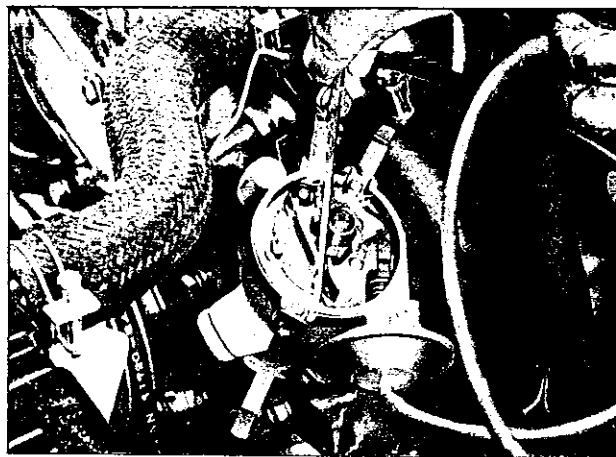


Fig. ET-3 Distributor point gap check

Remove distributor cap and inspect points for excessive burning or pitting. Replace points if necessary. Use a point file to clean contact area and remove scale from points.

Filing is for cleaning purposes only. Do not attempt to remove all roughness. Apply a trace of bearing lubricant to the breaker cam.

Distributor point gap:

0.4 to 0.5 mm (0.0157 to 0.0197 in)

Set ignition timing

The ignition timing can be observed by the stationary pointer at the front cover and the markings on the crankshaft pulley with a device called a stroboscopic light (also referred to as a timing light) as shown in Figure ET-4.

Note that the pulley groove is graduated 5° per scale division in terms of the crank angle.

The top dead center is located to the extreme left as viewed from the inspector's side.

ENGINE TUNE-UP

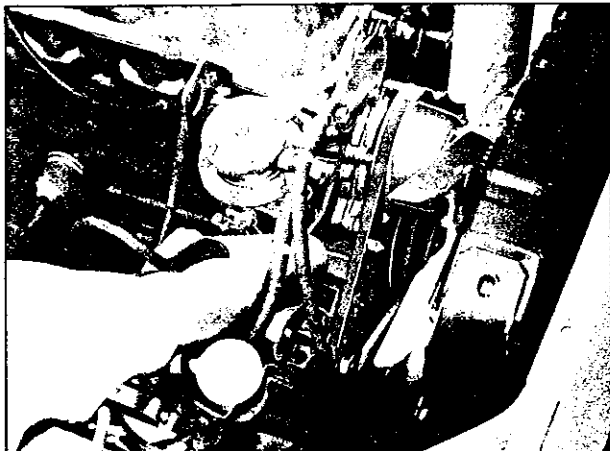


Fig. ET-4 Ignition timing set

Ignition timing

E20A		17°/550 rpm (10°/550 rpm)*
L24	Single carb.	17°/550 rpm
	SU carb.	17°/550 rpm
	SU carb. (Emission control)	5°/750 rpm

* Optional distributor for low octane number gasoline

Inspection of fan belt and air pump belt

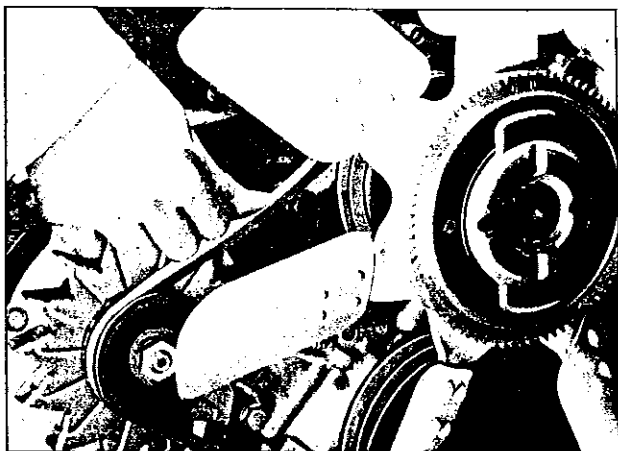


Fig. ET-5 Fan belt tension

1. Check for a cracked or damaged V-belt. Replace if defective.
2. Adjust the belt tension, if necessary.

Slackness of belt when it is depressed by a force of 10 kg (22.0 lb)

Fan belt	10 to 15 mm (0.394 to 0.591 in)
Air pump	15 to 20 mm (0.591 to 0.787 in)

Inspection of engine oil

1. Check if the engine oil has been deteriorated by intruded cooling water or gasoline. Drain and refill the oil, if necessary.

Note: a. A milky oil indicates the presence of cooling water.

Detect the cause for necessary treatment.

b. Suggest that oil with extremely low viscosity be diluted with gasoline.

2. Check oil level, and if it is below the rated level, replenish oil of the same grade up to the "H" level.

Oil capacity of engine oil (including oil filter)

L20A, L24	Maximum (H level)	5.0 ℓ (1.3 US gal, 1.1 UK gal)
	Minimum (L level)	3.9 ℓ (1.0 US gal, 0.9 UK gal)

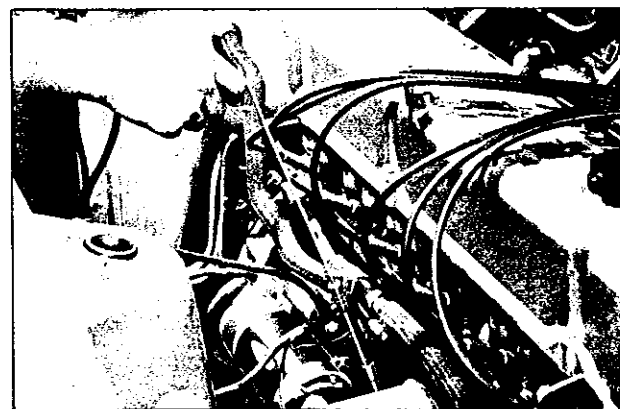


Fig. ET-6 Oil level check

ENGINE

Carburetor overhaul and adjustment

For the details, refer to the Section "EF" (Engine Fuel System).

Valve clearance adjustment

This adjustment can not be made when the engine is in operation. Follow the procedure described below:

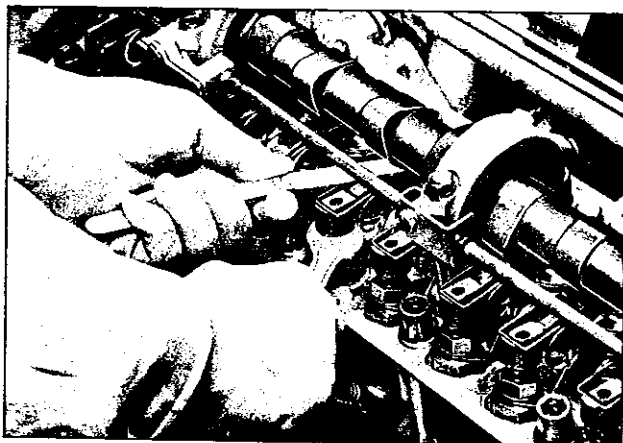


Fig. ET-7 Valve clearance adjustment

1. Loosen the pivot locking nut and turn the pivot screw until the specified clearance is obtained with engine cold.

Tighten the pivot locking nut securely after adjustment, and recheck the clearance.

2. Warm up the engine, and stop it. Then, measure the hot engine valve clearance in the same manner as above. If it deviates from the given hot-engine valve setting value, make necessary adjustment.

Hot	Intake	0.25 mm (0.0098 in)
	Exhaust	0.30 mm (0.0118 in)
Cold	Intake	0.20 mm (0.0079 in)
	Exhaust	0.25 mm (0.0098 in)

Compression pressure-test each cylinder

Note: If this test is required, it should be done when plugs are removed for service during basic tune-up operation.

Unless checking for worn rings or for the cause of low

speed miss, compression check should not be made.

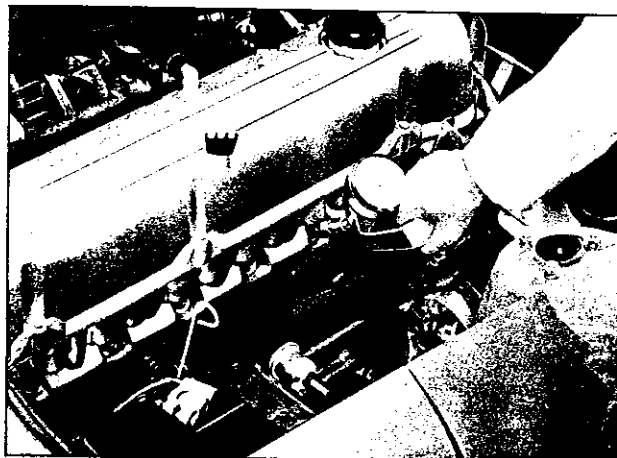


Fig. ET-8 Compression pressure test

Test compression with engine warm, all spark plugs removed and throttle and choke open. No cylinder should be less than 80% of the highest cylinder. Excessive variation between cylinders, accompanied by low speed missing of the cylinder or cylinders which are low, usually indicates a valve not properly seating or a broken piston ring. Low pressures, even though uniform, may indicate worn rings. This may be accompanied by excessive oil consumption.

Compression pressure

L20A		11.5 to 12.5 kg/cm ² (163 to 178 lb/sq in) at 300 to 400 rpm
L24	Single	11.5 to 12.5 kg/cm ² (163 to 178 lb/sq in) at 300 to 400 rpm
	SU-carb.	12.0 to 13.0 kg/cm ² (171 to 185 lb/sq in) at 300 to 400 rpm

Clean and inspect high tension wires, distributor cap and rotor

Note: This operation should be performed while checking distributor points during the basic tune-up operation. Inspect distributor cap for crack and flash over.

ENGINE TUNE-UP

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

Distributor lubricate

Slightly apply special cam and ball bearing lubricant on cam lobes when servicing.

Tighten intake manifold and Carburetor installation nuts

Intake manifold installation bolts and nuts on engines should be tightened to proper torque.

Carburetor installation nuts should be tightened securely. Leak at these area may cause rough idle, surging, deceleration popping or deceleration whistle.

Inspection of oil filter

1. Check for oil leak at the packing flange. If any leakage is found, tighten it slightly, or replace the oil filter assembly. Do not tighten excessively.
2. Replace the filter every 10,000 km (6,000 miles) running.

Inspection of air cleaner

Viscous type element does not require cleaning until

the engine is used for two years, or the vehicle is driven 40,000 km (24,000 miles) (under normal conditions).

Inspection of fuel strainer

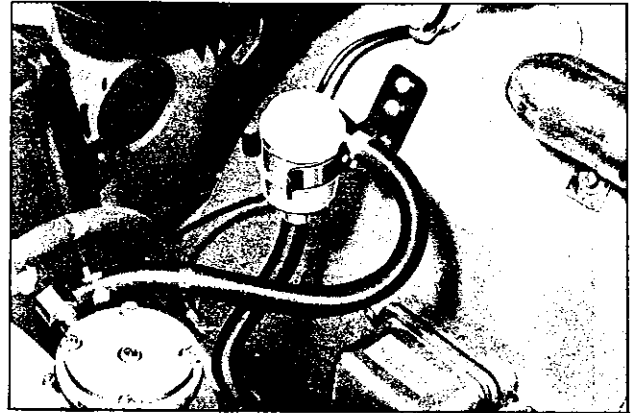


Fig. ET-9 Fuel strainer

A cartridge type fuel strainer is used. When it is defective, replace as an assembly.

Inspection of cooling system

Inspection of radiator cap

Apply reference pressure [0.9 kg/cm² (13 lb/sq in)] to the radiator cap (in case of L13 and L16) and the reservoir tank cap (in case of L20) by means of a cap tester to insure that it is satisfactory. Replace the cap assembly if necessary.

Cooling system pressure test

With radiator cap removed, apply reference pressure [1.9 kg/cm² (27 lb/sq in)] to the cooling system by means of a tester to check for leaks at system components.

TROUBLE DIAGNOSES AND CORRECTIONS

Troubles	Possible causes	Corrective action
CANNOT CRANK ENGINE OR SLOW CRANKING	Improper grade oil. Discharged battery. Defective battery. Loosen fan belt. Trouble in charge system.	Replace with proper grade oil. Charge battery. Replace. Adjust. Inspect charge system.

ENGINE

Wiring connection trouble in starting circuit.

Correct.

Defective starter switch.

Repair or replace.

Defective starter motor.

Repair or replace.

(Trouble shooting procedure on starting circuit)

Switch on the starting motor with light turned 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, following trouble cause may exist, but in many causes ignition system or fuel system is in trouble.

Ignition system in trouble

Fuel system in trouble

Valve mechanism does not work properly.

Low compression

First, check spark plug in accordance with the following procedure:

Disconnect high tension cable from one spark plug and hold it about 10 mm (0.4 in) from the engine metal part and crank the engine.

- | | |
|-------------------|--|
| Good spark occurs | <ol style="list-style-type: none"> 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 circuiting.

Check breaker point operation.

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.

Rotor cap and rotor leak

Replace.

ENGINE TUNE-UP

	<p>Defective spark plug</p> <p>Improper ignition timing</p> <p>Defective ignition coil</p> <p>Disconnected of high tension cable</p> <p>Loose connection or disconnection in primary circuit</p>	<p>Clean, adjust plug gap or replace.</p> <p>Adjust.</p> <p>Replace.</p> <p>Replace.</p> <p>Repair or replace.</p>				
Fuel system in trouble	<p>Lack of fuel</p> <p>Dirty fuel strainer</p> <p>Dirty or clogged fuel pipe.</p> <p>Fuel pump will not work properly.</p> <p>Improperly adjusted float level.</p> <p>Improper idling</p> <p>Dirty or clogged carburetor</p> <p>Clogged breather pipe</p>	<p>Supply.</p> <p>Replace.</p> <p>Clean.</p> <p>Repair or replace.</p> <p>Correct.</p> <p>Adjust.</p> <p>Disassemble and clean.</p> <p>Clean.</p>				
Low compression	<p>Incorrect spark plug tightening, defective gasket.</p> <p>Improper engine oil grade or viscosity dropping</p> <p>Incorrect valve clearance</p> <p>Compression leak from valve seat</p> <p>Sticky valve stem</p> <p>Weak or defective valve springs</p> <p>Compression leak at cylinder head gasket</p> <p>Sticking or defective piston ring</p> <p>Worn piston ring or cylinder</p>	<p>Tighten to normal torque, replace gasket.</p> <p>Replace with proper grade oil.</p> <p>Adjust.</p> <p>Remove cylinder head and lap the valves.</p> <p>Correct or replace valve.</p> <p>Replace valve springs.</p> <p>Replace gasket.</p> <p>Replace piston rings.</p> <p>Overhaul engine.</p>				
<p>(Trouble shooting procedure)</p> <p>Pour engine oil from plug hole, and measure cylinder compression.</p>						
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Compression increases.</td> <td style="width: 50%; border: none;">Trouble in cylinder or piston ring</td> </tr> <tr> <td style="border: none;">Compression does not change.</td> <td style="border: none;">Compression leaks from valve, cylinder head or head gasket.</td> </tr> </table>			Compression increases.	Trouble in cylinder or piston ring	Compression does not change.	Compression leaks from valve, cylinder head or head gasket.
Compression increases.	Trouble in cylinder or piston ring					
Compression does not change.	Compression leaks from valve, cylinder head or head gasket.					
IMPROPER ENGINE IDLING						
Fuel system in trouble	<p>Clogged or damaged carburetor jets</p> <p>Incorrect idle adjustment</p>	<p>Clean or replace.</p> <p>Adjust.</p>				

ENGINE

<p>Low compression</p> <p>Others</p>	<p>Clogged air cleaner</p> <p>Defective manifold gaskets or carburetor insulator.</p> <p>Improper float level adjustment</p> <p>Incorrect valve clearance</p> <p>Extremely low revolution</p>	<p>Replace element.</p> <p>Replace gasket.</p> <p>Adjust.</p> <p>Previsouly mentioned</p> <p>Adjust.</p> <p>Adjust.</p>
<p>ENGINE POWER NOT UP TO NORMAL</p> <p>Low compression</p> <p>Ignition system in trouble</p> <p>Fuel system in trouble</p> <p>Air intake system in trouble</p> <p>Overheating</p>	<p>Incorrect ignition timing</p> <p>Defective spark plugs</p> <p>Defective distributor points</p> <p>Incorrect octane selector setting</p> <p>Malfunction of choke system</p> <p>Clogged fuel pipe</p> <p>Dirty or clogged fuel strainer.</p> <p>Fuel pump will not work properly.</p> <p>Clogged carburetor jets</p> <p>Clogged air cleaner</p> <p>Air inhailing from manifold gasket or carburetor gasket</p> <p>Insufficient coolant</p> <p>Loosen fan belt</p> <p>Worn or defective fan belt</p> <p>Defective thermostat</p> <p>Defective water pump</p> <p>Clogged or leaky radiator</p> <p>Defective radiator filler cap</p> <p>Air intrusion into cooling system</p> <p>Improper engine oil grade</p>	<p>Previously mentioned</p> <p>Adjust.</p> <p>Clean, adjust or replace plugs.</p> <p>Dress, or replace points. Check condenser also.</p> <p>Adjust octane selector.</p> <p>Adjust.</p> <p>Clean.</p> <p>Replace.</p> <p>Repair or replace.</p> <p>Disassemble and clean.</p> <p>Replace element.</p> <p>Replace gasket.</p> <p>Replenish.</p> <p>Adjust fan belt.</p> <p>Replace.</p> <p>Replace.</p> <p>Replace.</p> <p>Flush, repair or replace.</p> <p>Replace.</p> <p>Retighten each part of cooling system.</p> <p>Replace with proper grade oil.</p>

ENGINE TUNE-UP

<p>Overcooling</p> <p>Others</p>	<p>Incorrect ignition timing</p> <p>Defective carburetor (lean mixture).</p> <p>Defective thermostat</p> <p>Low octane fuel</p> <p>Improper tire pressure</p> <p>Dragging brake</p> <p>Clutch slipping</p>	<p>Adjust.</p> <p>Overhaul carburetor.</p> <p>Replace.</p> <p>Replace with specified octane fuel.</p> <p>Adjust to specified pressure.</p> <p>Adjust.</p> <p>Adjust.</p>
<p>NOISY ENGINE</p> <p>Car knocking</p> <p>Mechanical knocking</p> <p>Crankshaft bearing knocking.</p> <p>Connecting rod bearing knocking.</p> <p>Piston and cylinder noise</p> <p>Piston pin noise.</p>	<p>Overloading to engine</p> <p>Carbon knocking</p> <p>Timing knocking</p> <p>Fuel knocking</p> <p>Preignition (misusing of spark plug)</p> <p>This strong dull noise increases when the 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.</p> <p>This is a little higher-pitched noise than the crankshaft knocking, and also increases when the engine is accelerated. Cause a misfire on each cylinder and if the noise deminishes almost completely, this crankshaft bearing generates the noise.</p> <p>When you hear an overlapping metallic noise which increases its magnitude with the revolution of the engine and which decreases as the engine is warmed up, this noise is caused by the piston and cylinder. To locate the place, cause a misfire on each cylinder.</p> <p>This noise is heard at each highest and lowest dead end of the piston. To locate the place, cause a misfire on each cylinder.</p>	<p>Use right gear in driving.</p> <p>Disassemble cylinder head and remove carbon.</p> <p>Adjust ignition timing.</p> <p>Use specified octane fuel.</p> <p>Use specified spark plug.</p> <p>This is caused by the worn or damaged bearings, or unevenly worn crankshaft. Renew the bearings and adjust or change the crankshaft.</p> <p>Check the lubrication system.</p> <p>Same as the case of crankshaft bearings.</p> <p>This may cause an abnormal wearing of the cylinder and lower compression which in turn will cause a lower out-put power and excessive consumption of oil.</p> <p>Overhaul the engine.</p> <p>This may cause a wear on the piston pin, or piston pin hole.</p> <p>Renew the piston and piston pin assembly.</p>

ENGINE

<p>Water pump noise.</p> <p>Others.</p>	<p>This noise may be caused by the worn or damaged bearings, or by the uneven surface of sliding parts.</p> <p>An improper adjustment of the valve clearance</p> <p>Noise of the timing chain.</p> <p>An excessive end-play on the crankshaft</p> <p>Remarks: Disengage the clutch slightly and this noise will stop.</p> <p>Wear on the clutch pilot bushing</p> <p>Remarks: This noise will be heard when the clutch is disengaged.</p>	<p>Replace the water pump with a new one.</p> <p>Adjust.</p> <p>Adjust the tension of the chain.</p> <p>Disassemble the engine and re-new the main bearing bush.</p> <p>Renew the bushing and adjust the drive shaft.</p>
<p>ABNORMAL COMBUSTION (back fire, after fire, run-on etc.)</p> <p>Improper ignition timing</p> <p>Fuel system in trouble</p>	<p>Improper ignition timing</p> <p>Improper heat range of the spark plugs</p> <p>Damaged carburetor or manifold gasket. (back fire, after fire)</p> <p>Defective carburetor jet</p> <p>Improper function of the float</p> <p>Uneven idling</p>	<p>Adjust the ignition timing.</p> <p>Use specified spark plugs.</p> <p>Replace them with new parts.</p> <p>Dismantle the carburetor and check it.</p> <p>Adjust the level, and check the needle valve.</p> <p>Adjust.</p>
<p>Defective cylinder head, etc.</p>	<p>Improperly adjusted valve clearance</p> <p>Excess carbon in the combustion chamber</p> <p>Damaged valve spring (back fire, after fire)</p>	<p>Adjust it.</p> <p>Remove the cylinder head and get rid of the carbon.</p> <p>Replace it with a new one.</p>
<p>EXCESSIVE OIL CONSUMPTION</p> <p>Oil leakage</p>	<p>Loose oil drain plug</p> <p>Loose or damaged oil pan gasket.</p> <p>Loose or damaged chain cover gasket</p> <p>Defective oil seal in front and rear of the crankshaft</p> <p>Loose or damaged locker cover gasket</p>	<p>Tighten it.</p> <p>Renew the gasket or tighten it.</p> <p>Renew the gasket or tighten it.</p> <p>Renew the oil seal.</p> <p>Renew the gasket or tighten it (but not too much).</p>

ENGINE TUNE-UP

<p>Excessive oil consumption</p> <p>Others</p>	<p>Improper tightening of oil filter</p> <p>Loose or damaged oil pressure switch</p> <p>Worn cylinder and piston</p> <p>Improper location of the piston ring gap or reversely assembled piston ring.</p> <p>Damaged or seized piston rings</p> <p>Worn piston ring groove and rings</p> <p>Fatigue of valve oil seal lip</p> <p>Worn valve stem</p> <p>Inadequate quality of engine oil.</p> <p>Engine overheat</p>	<p>Renew the gasket and tighten it with the proper torque.</p> <p>Renew the oil pressure switch or tighten it.</p> <p>Overhaul the cylinder and renew the piston.</p> <p>Remount the piston rings.</p> <p>Renew the rings.</p> <p>Repair or renew the piston and cylinder.</p> <p>Renew the piston and piston ring.</p> <p>Replace the seal lip with a new one.</p> <p>Renew the valve or the guide.</p> <p>Use the designated oil.</p> <p>Previously mentioned</p>
<p>EXCESSIVE FUEL CONSUMPTION</p> <p>See the explanation of the power decrease</p> <p>Others</p>	<p>Exceeding idling revolution</p> <p>Defective acceleration recovery.</p> <p>Fuel leakage</p>	<p>Adjust it to the designated rpm</p> <p>Adjust it.</p> <p>Repair or tighten the connection of fuel pipes.</p>
<p>TROUBLE IN OTHER FUNCTIONS</p> <p>Decreased oil pressure</p>	<p>Inadequate oil quality</p> <p>Overheat</p> <p>Defective function of oil pump regulator valve</p> <p>Functional deterioration of oil pump</p> <p>Blocked oil filter</p> <p>Increased clearance in various sliding parts</p>	<p>Use the designated oil.</p> <p>Previously mentioned</p> <p>Disassemble the oil pump and repair or renew it.</p> <p>Repair or replace it with new one.</p> <p>Renew it.</p> <p>Disassemble and replace the worn parts with new ones.</p>

ENGINE

<p>Excessive wear on the sliding parts</p>	Blocked oil strainer	Clean it. Clean it.
	Troubles in the oil gauge pressure switch	Replace it with a new one.
	Oil pressure decreases	Previously mentioned
	Defective quality or contamination of oil	Exchange the oil with proper one and change the element.
	Defective air cleaner	Change the element.
	Overheat or overcool	Previously mentioned.
	Improper fuel mixture	Check the fuel system.
<p>Seizure of sliding parts</p>	Decrease of oil pressure	Previously mentioned.
	Insufficient clearances.	Readjust to the designated clearances.
	Overheat.	Previously mentioned
	Improper fuel mixture	Check the fuel system.

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

MODEL
L20A, L24 SERIES
ENGINE



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EM

ENGINE MECHANICAL

EM

GENERAL DESCRIPTION	EM- 1
ENGINE DISASSEMBLY	EM- 5
INSPECTION AND REPAIR	EM-11
ENGINE ASSEMBLY	EM-26
SERVICE DATA AND SPECIFICATIONS	EM-34
TROUBLE DIAGNOSES AND CORRECTIONS	EM-38

ENGINE MECHANICAL

GENERAL DESCRIPTION

CONTENTS

L20A ENGINE	EM-1	CYLINDER HEAD	EM-3
L24 ENGINE	EM-2	CAMSHAFT	EM-4
CYLINDER BLOCK	EM-3	VALVE MECHANISM	EM-4
CRANKSHAFT	EM-3	CAMSHAFT DRIVE	EM-4
PISTONS AND CONNECTING RODS	EM-3	MANIFOLDS	EM-5

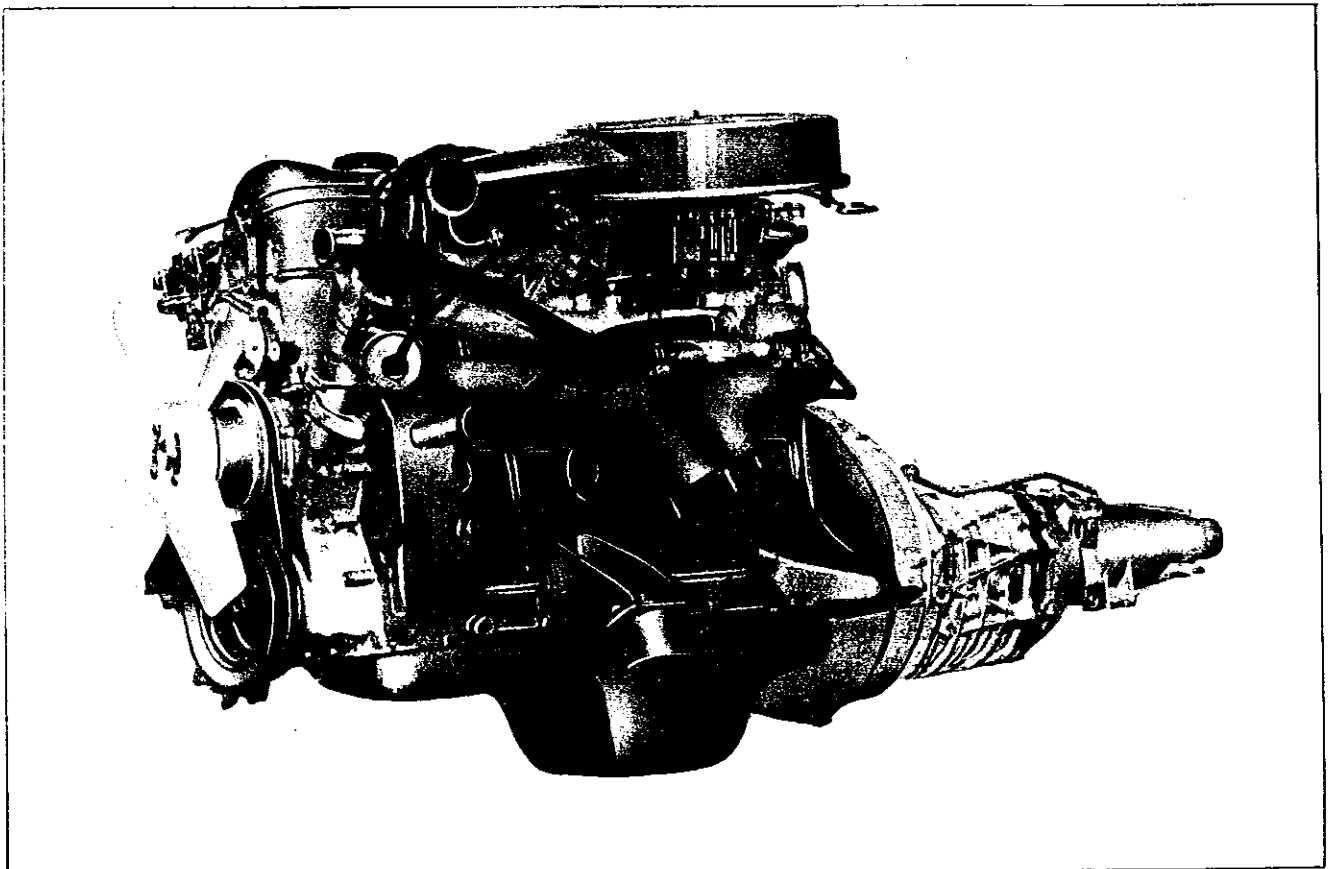


Fig. EM-1 General view of L20A engine

L20A ENGINE

L20A engine is a 1,998 cc (121.9 cu in) in line overhead camshaft six-cylinder engine and has 78 mm (3.071 in) bore and 69.7 mm (2.744 in) stroke with a compression ratio of 8.6 : 1.

This engine is of a light-weight design using many aluminum diecast parts.

Using a two barrel type single carburetor, L20A engine develops a maximum output of 115 HP/5,600 rpm (SAE).

ENGINE

L24 ENGINE

L24 engine is a 2,393 cc (146.0 cu in) in line overhead camshaft six-cylinder engine and has 83 mm (3.2677 in) bore and 73.7 mm (2.9026 in) stroke.

This engine is of the same design and external appearance as L20A engine, differing principally bore, stroke, power and dimensions of parts to bear higher output.

L24 engine is available in two types. In one type, which uses two SU type carburetors, it develops a maximum output of 151 HP/5,600 rpm (SAE) at a compression ratio of 9.0 : 1.

The other type, which uses a single carburetor of a two barrel type, is capable of a maximum output of 130 HP/5,600 rpm (SAE) at a compression ratio of 8.55 : 1.

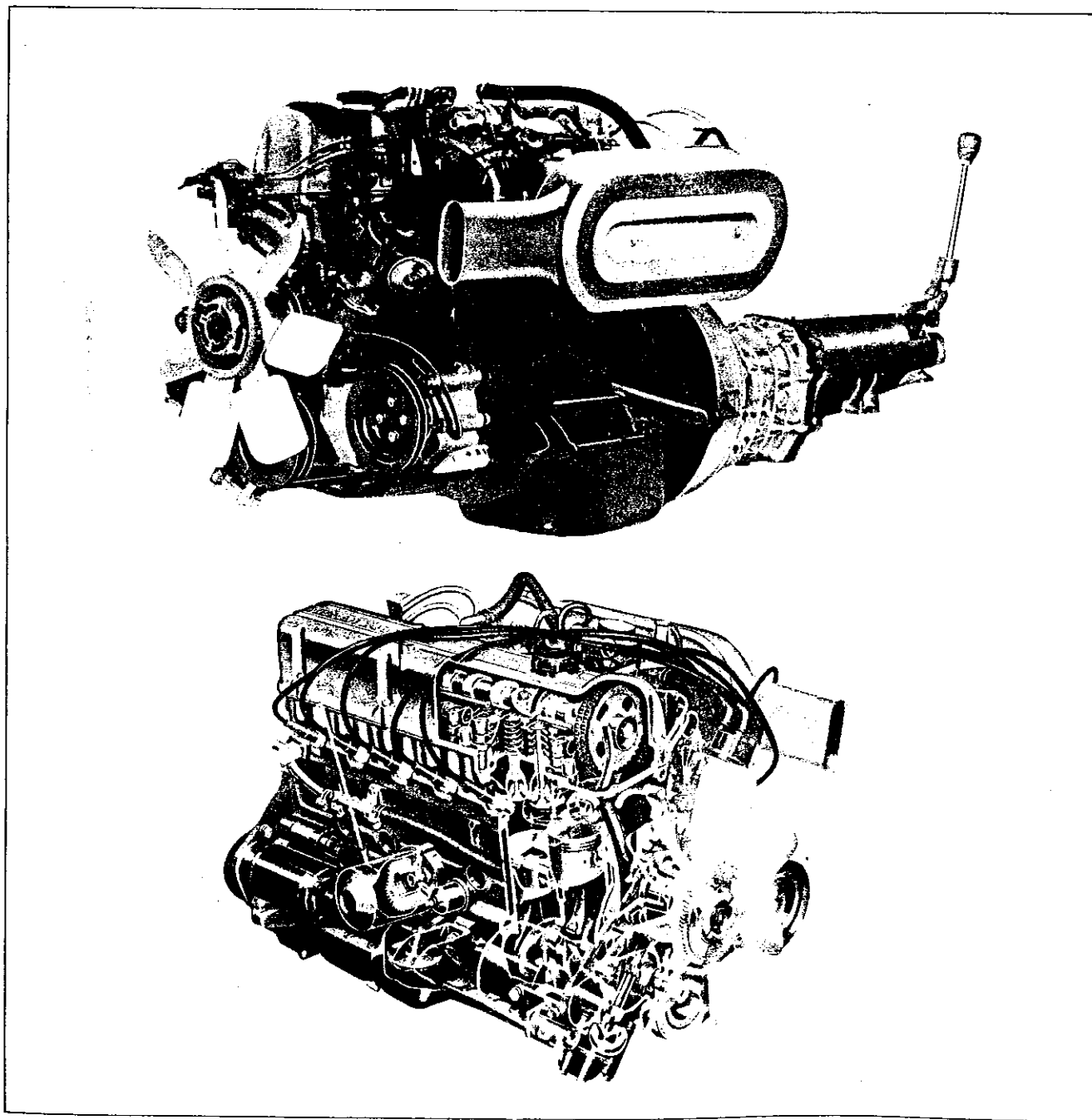


Fig. EM-2 General view of L24 engine

CYLINDER BLOCK

The cylinder block, which is of a monoblock special casting structure, adopts the seven bearing-support system, for quietness and higher durability. Of a highly rigid deep-skirt design, it requires no complicated tappet chamber because of the OHC engine system and thus is light-weight.

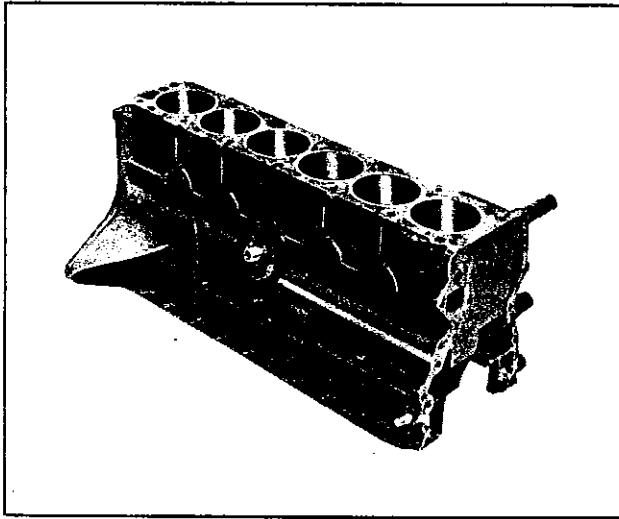


Fig. EM-3 Cylinder block

CRANKSHAFT

The crankshaft is fabricated of special forged steel. Provided with a high capacity balance weight, it shows quietness and high durability at high speed operation. Main bearings are lubricated from oil holes which intersect the main oil gallery which runs parallel to the cylinder bores.

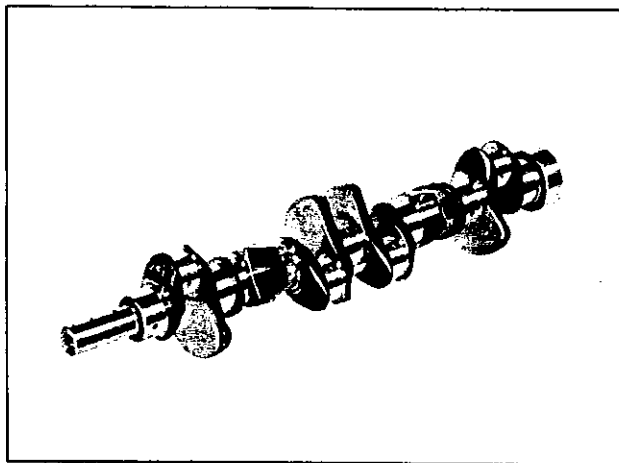


Fig. EM-4 Crankshaft

PISTONS AND CONNECTING RODS

New-design light-weight pistons are of cast aluminum slipper-skirt type with invar-strut. The piston pin is of a special steel hollow type and is connected to the piston in a full floating fit, and is press-fitted onto the connecting rod.

Connecting rods are made of forged steel. Full pressure lubrication is directed to the connecting rods by drilled oil passages from the adjacent main bearing journal. Oil holes at the connecting rod journals are located so that oil is supplied to give maximum lubrication just proper to full bearing load.

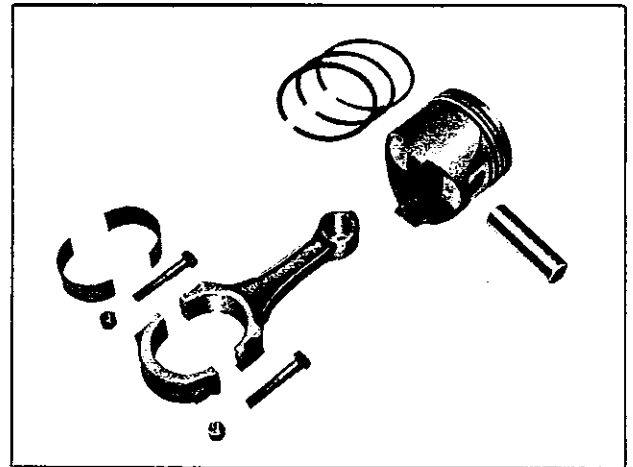


Fig. EM-5 Piston and connecting rod

CYLINDER HEAD

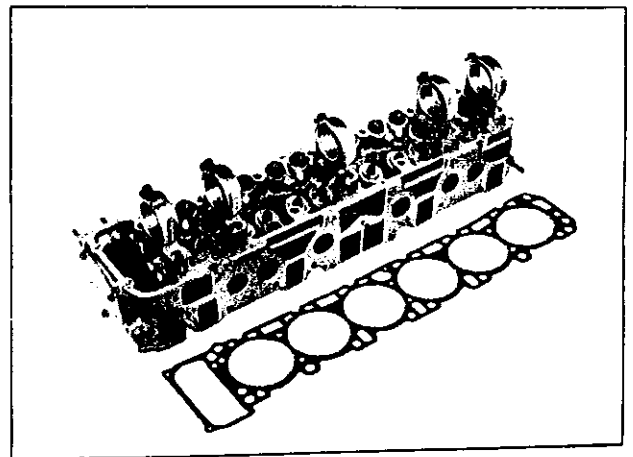


Fig. EM-6 Cylinder head

ENGINE

The cylinder head is made of light and strong aluminum alloy with good cooling efficiency. A special aluminum cast valve seat is used on the intake valve, while a special cast valve seat is installed on the exhaust valve.

These parts are all hot press-fitted.

CAMSHAFT

Camshaft is made of special cast iron and located inside the rocker cover. In this engine five aluminum alloy brackets support the camshaft.

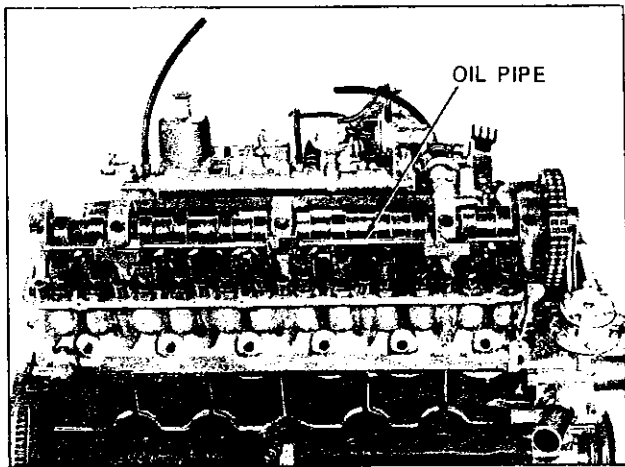


Fig. EM-7 Camshaft

Camshaft bearings are lubricated from oil holes which intersect the main oil gallery of the cylinder head.

There is no oil gallery in the camshaft and to lubricate the cam pad surface of the rocker arm an oil pipe with many oil holes is provided along the camshaft. This oil pipe provided is supported by No. 1, 3 and 5 camshaft brackets and from No. 3 brackets lubrication is supplied to this oil pipe.

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 high-speed performance.

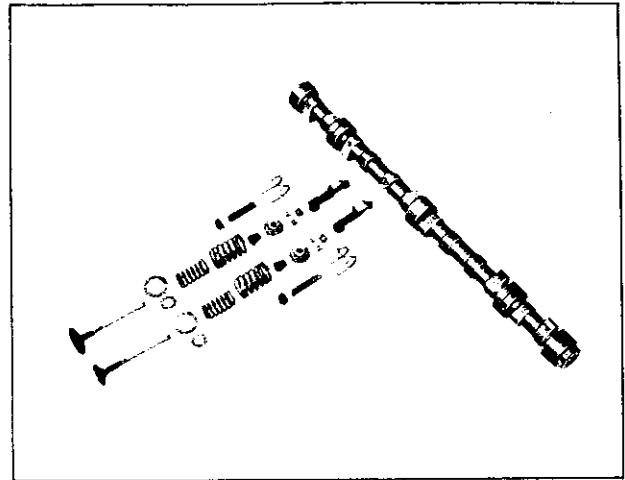


Fig. EM-8 Valve mechanism

CAMSHAFT DRIVE

Camshaft is driven by a double row roller chains driven by crankshaft. The tension of the chain is controlled by a chain tensioner which are operated by spring and oil pressure.

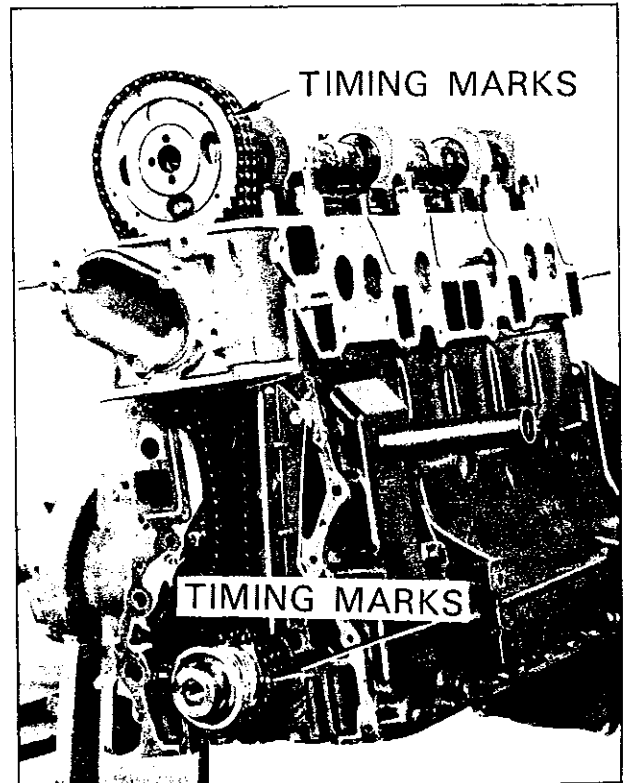


Fig. EM-9 Camshaft driving chain

ENGINE MECHANICAL

MANIFOLDS

The intake manifold is aluminum cast.

The exhaust manifold types, is a dual exhaust system intended to prevent decline 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.

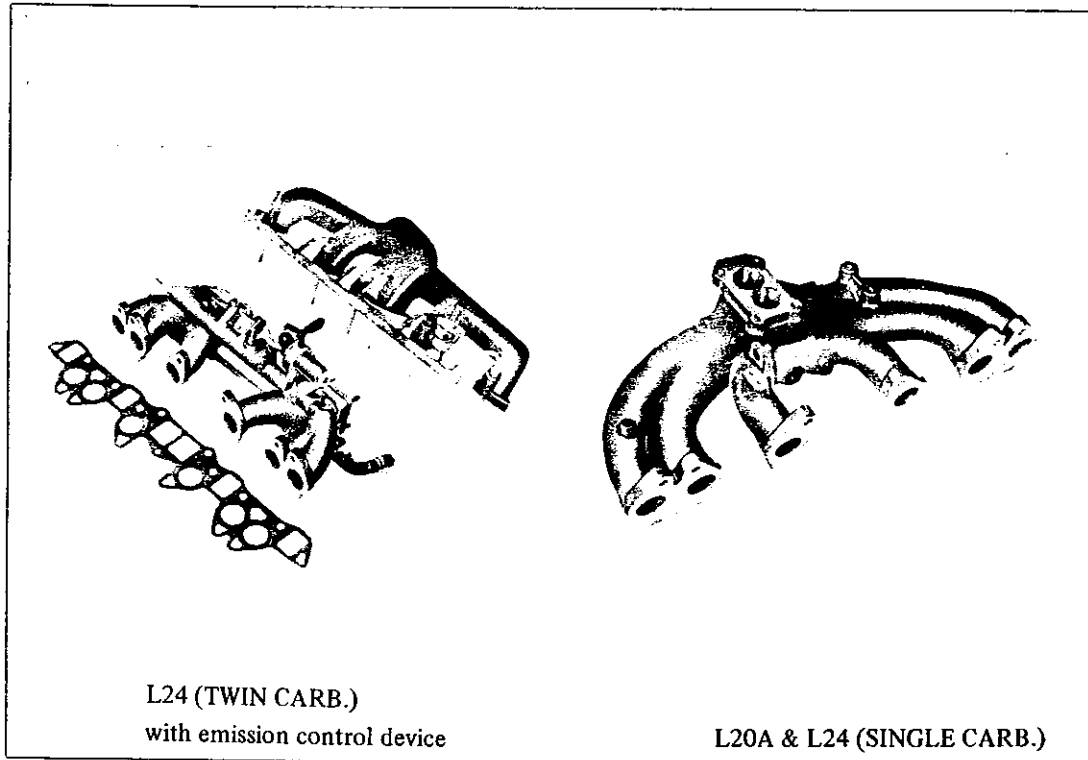


Fig. EM-10 Exhaust and intake manifold

ENGINE DISASSEMBLY

CONTENTS

CLEANING AND INSPECTING	EM- 5	PISTON AND CONNECTING ROD	EM- 9
DISASSEMBLY	EM- 6	CYLINDER HEAD	EM-10

CLEANING AND INSPECTING

Wash the engine thoroughly before disassembly. Before washing, remove the alternator and starter, and plug up the carburetor air cleaner to avoid any infiltration of foreign matter.

1. The exterior of the engine: check the covers and bolts for breakage, rust, damage and loss.
2. Cylinder block: check thoroughly the water jacket

ENGINE

for cracks and breakage.

3. Clutch housing: check for cracks.
4. Oil pan: check for excessive rust.

DISASSEMBLY

1. Place the engine assembly on the engine stand.

- (1) Remove the oil level gauge.
- (2) Remove the engine mounting R.H.
- (3) Remove the oil filter.
- (4) Remove the oil pressure switch.
- (5) Install the engine attachment.
- (6) Set the engine on the stand.

Engine stand: ST05010000

Engine attachment: ST05340000

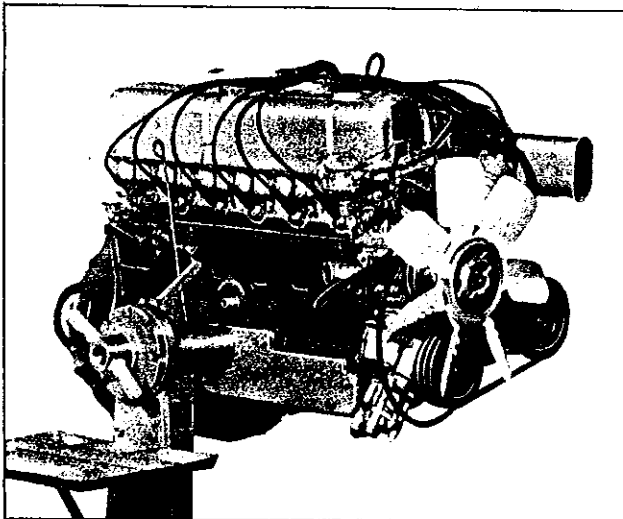


Fig. EM-11 The engine on the engine stand

2. Remove the fan, the fan belt (for all engines) and the air pump belt (only for L24 engine with emission control system).

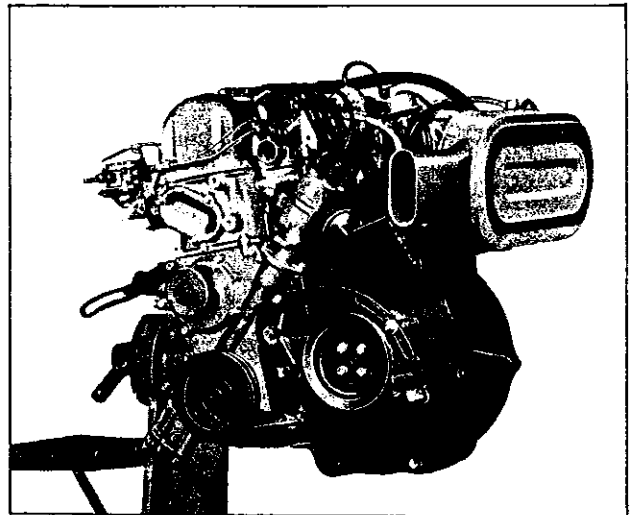


Fig. EM-12 Cooling fan removal

3. Remove the high tension cable (with the distributor cap on).
4. Remove the fuel pump.

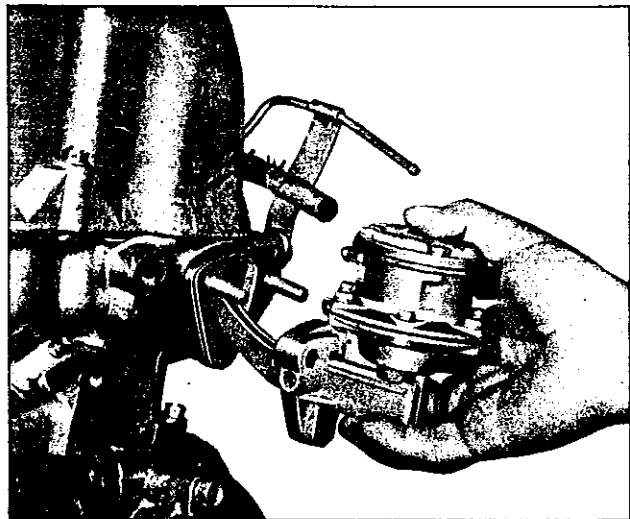


Fig. EM-13 Fuel pump removal

5. Remove the spark plugs.
6. Remove the distributor assembly.
7. Remove the air cleaner.

ENGINE MECHANICAL

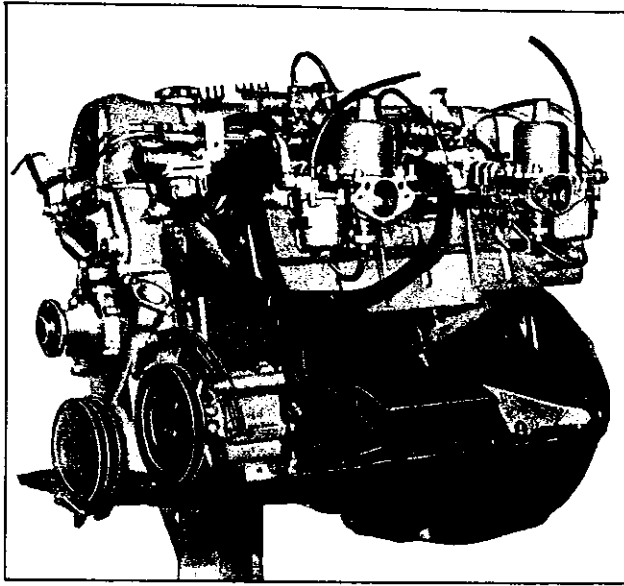


Fig. EM-14 Air cleaner removal

8. Remove the engine mounting bracket (L.H. side).
9. Remove air pump (for L24 engine with emission control system).
10. Remove the fuel line and heater hoses.
11. Remove the heat shield plate.
12. Remove the intake manifold with carburetor and exhaust manifold.

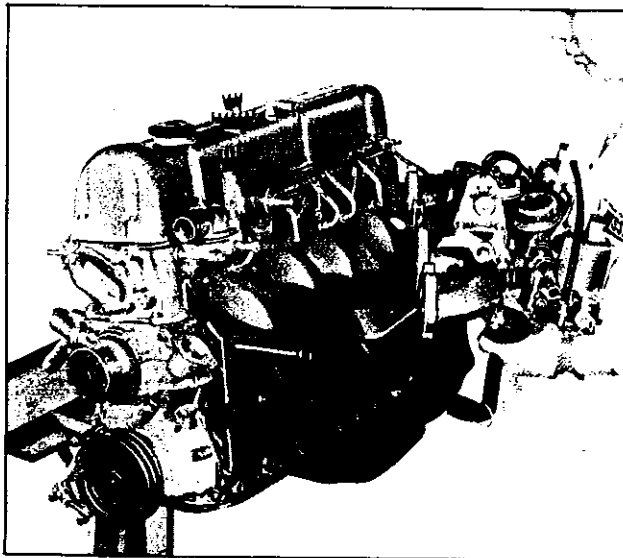


Fig. EM-15 Intake manifold removal

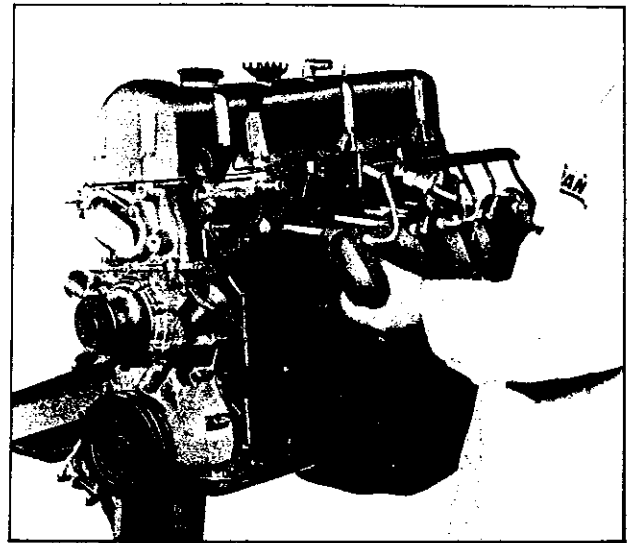


Fig. EM-16 Exhaust manifold removal

13. Remove the thermostat housing.
14. Remove the crank pulley.

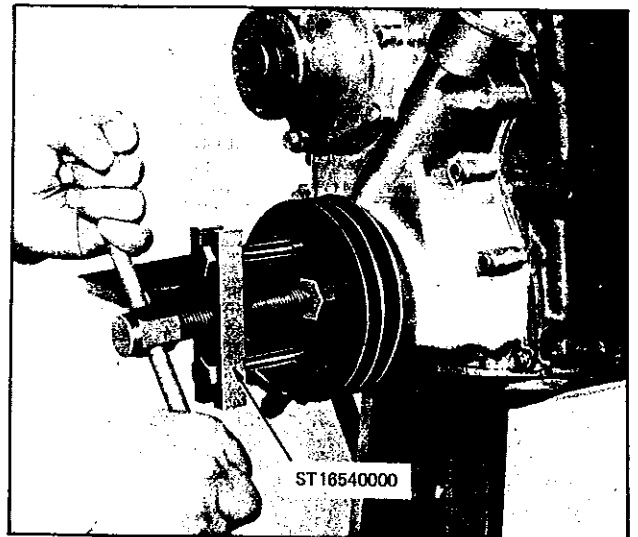


Fig. EM-17 Crank pulley removal

Note: The crank pulley is a vibration damper type. So on removal use a special tool.

Special tool: ST16540000

15. Remove the water pump.
16. Remove the rocker cover.

ENGINE

- Remove the fuel pump drive cam and the camshaft sprocket.

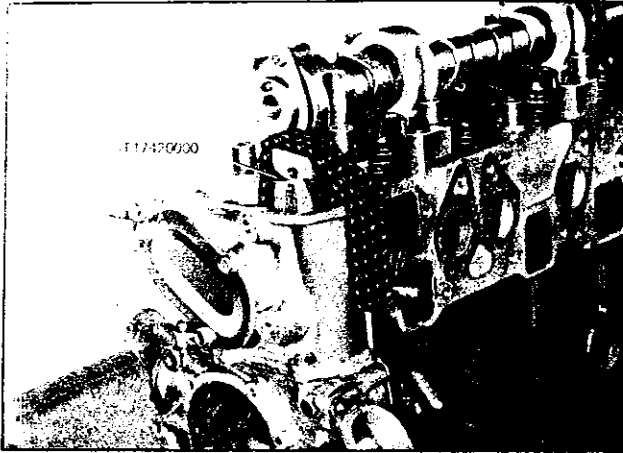


Fig. EM-18 Camshaft drive sprocket removal

- Remove the oil pipe.
- Remove the cylinder head assembly. Use a special tool for removing the cylinder head bolts.

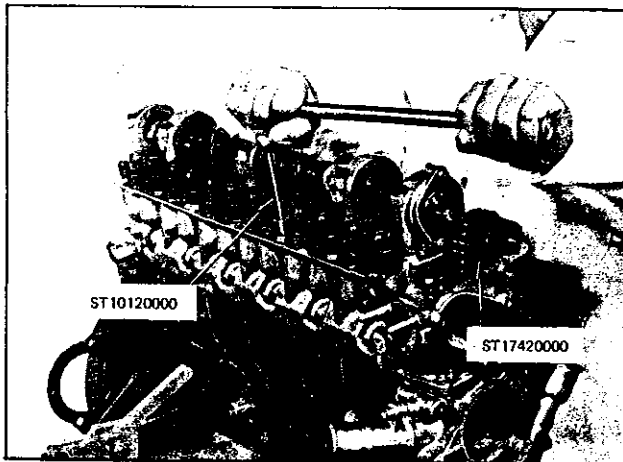


Fig. EM-19 Cylinder head removal

Special tool: ST10120000 and ST17420000

Note: For the convenience of the cylinder head replacement, a special service tool ST17420000 is prepared to support the timing chain during the service operation. By using this tool, the timing marks on the crankshaft sprocket and the timing chain will be unchanged. So the work for aligning the timing marks will be saved so much.

- Remove the flywheel and end plate.

- Invert the engine.
- Remove the oil pan and the oil strainer.
- Remove the oil pump and its drive gear.
- Remove the front cover.

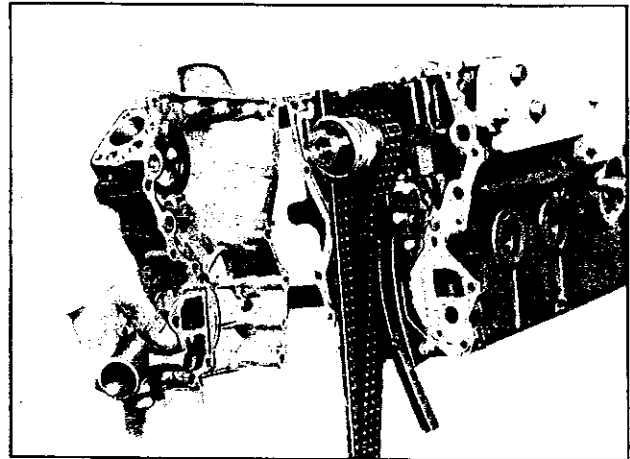


Fig. EM-20 Engine front cover removal

- Remove the timing chain, chain tensioner and chain guide.
- Remove the oil thrower, the crankshaft worm gear and the chain drive sprocket.

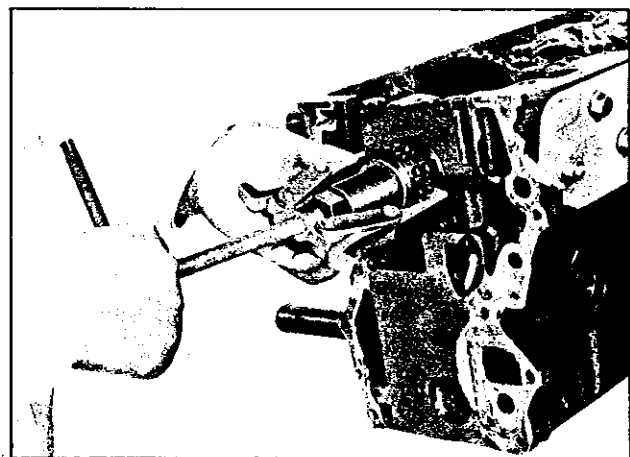


Fig. EM-21 Chain drive sprocket removal

- Remove the piston and connecting rod assembly. Take off the connecting rod bearings at the same time and keep them in order.

ENGINE MECHANICAL

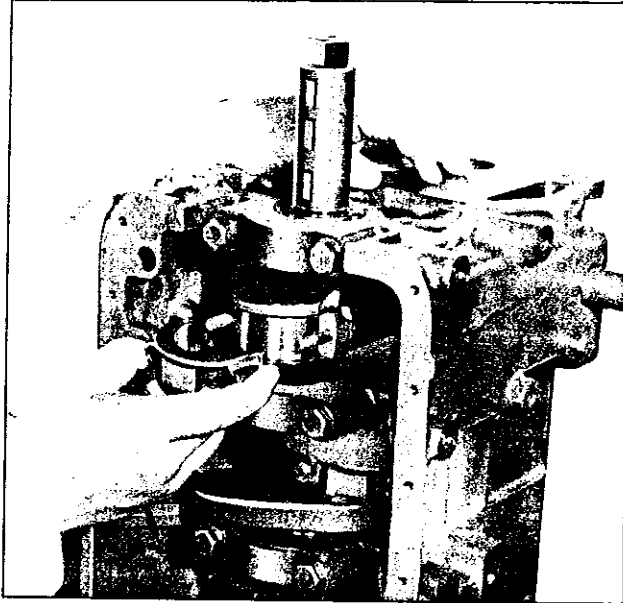


Fig. EM-22 Piston and connecting rod assembly removal

28. Remove the main bearing cap.

Use a special tool for removing the rear main bearing cap.

Special tool: ST16510000

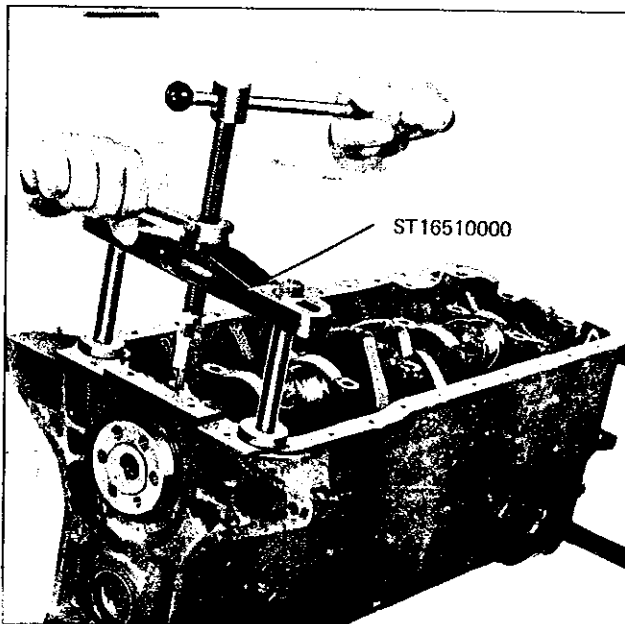


Fig. EM-23 Rear main bearing cap removal

29. Remove the crankshaft rear oil seal.



Fig. EM-24 Rear oil seal removal

30. Remove the crankshaft.

31. Remove the baffle plate and the cylinder block net.

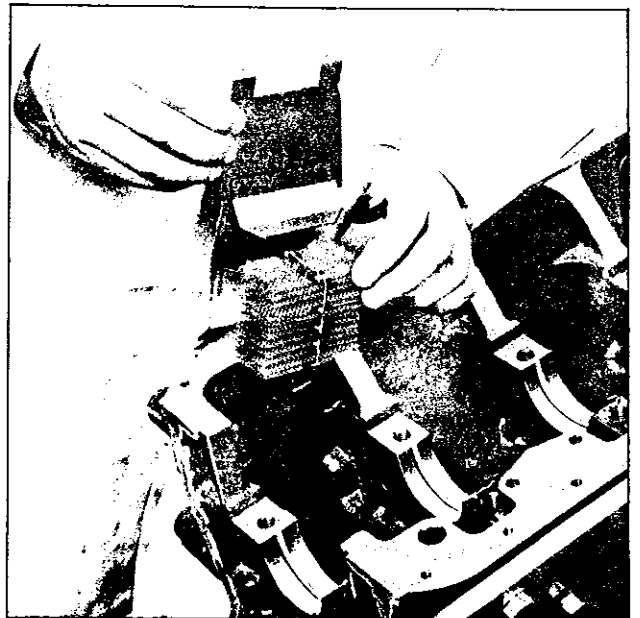


Fig. EM-25 Cylinder block net removal

PISTON AND CONNECTING ROD

1. Remove the piston rings with a ring remover.

ENGINE

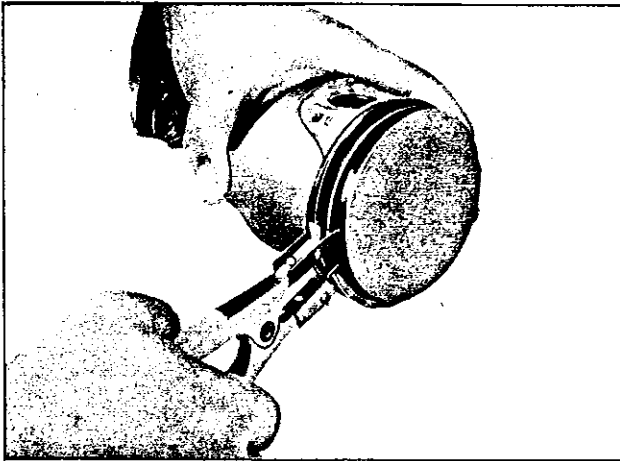


Fig. EM-26 Piston ring removal

2. Press out the piston pin with a piston pin remover and an arbor press.
3. Keep the disassembled parts in order not to mix all parts.

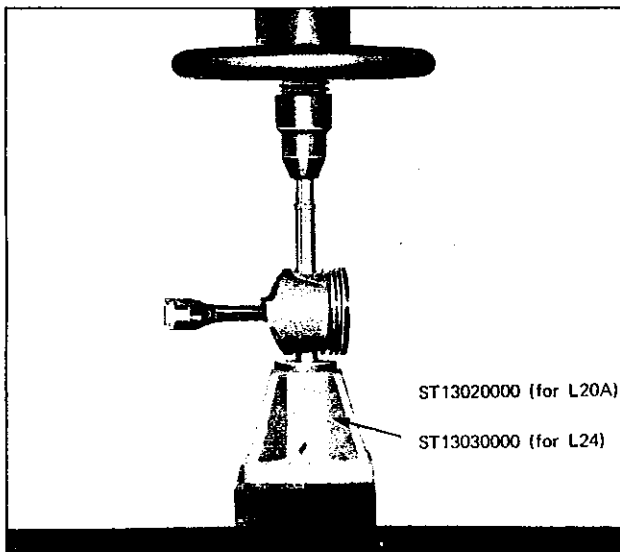


Fig. EM-27 Piston pin removal

Special tool: ST13020000 (for L20A)
ST13030000 (for L24)

CYLINDER HEAD

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

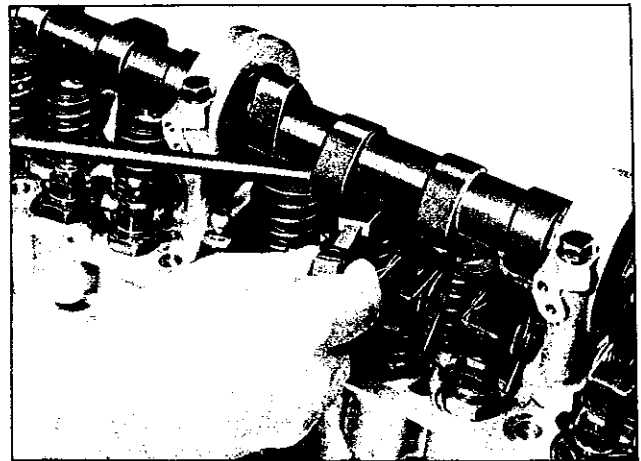


Fig. EM-28 Rocker arm removal

Note: Take care not to lose the valve rocker guide.

3. Remove the camshaft.

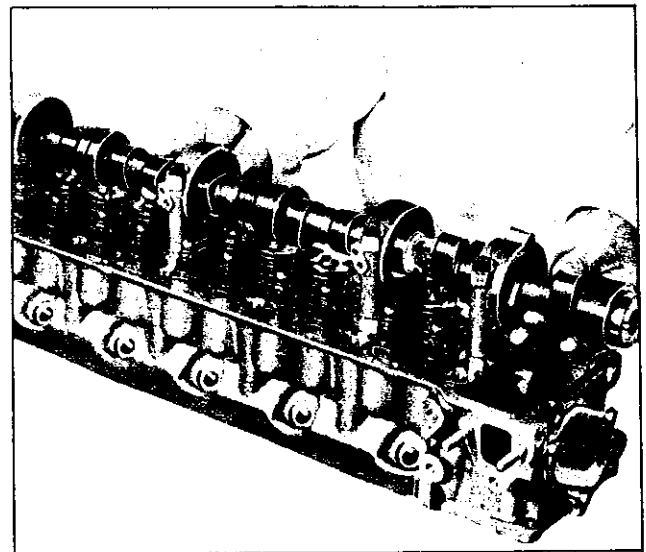


Fig. EM-29 Camshaft removal

Note: At this time, take care not to let the camshaft scratch the cam bushing during removal.

4. Remove the valves using a valve lifter.

Special tool: ST12070000

ENGINE MECHANICAL

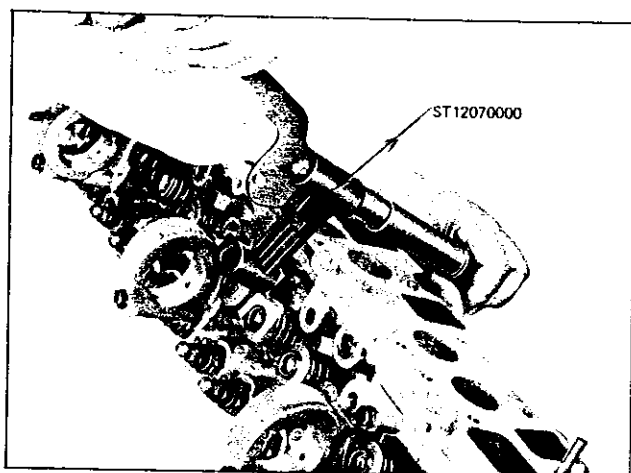


Fig. EM-30 Valve removal

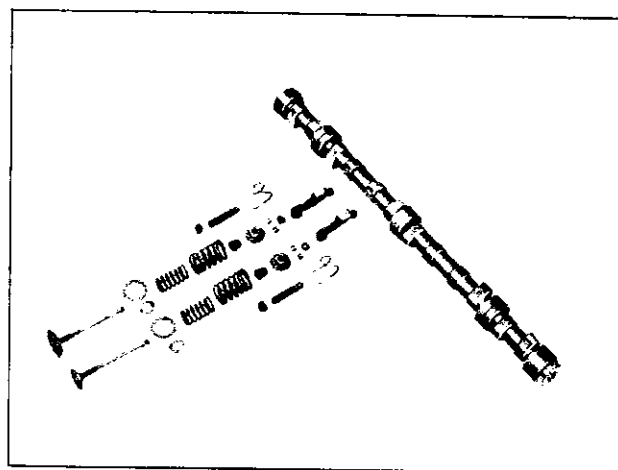


Fig. EM-31 Valve components

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

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

INSPECTION AND REPAIR

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PREPARATION FOR INSPECTION

1. Check the cylinder head and the cylinder block for traces of water leaks before cleaning.
2. Wash all the parts to clean them completely of oil stains, carbon deposits, fur, and sealing material.
3. Ascertain if all the oil holes are clear by blowing air into them.
4. Use every caution to secure proper assembly.

ENGINE

CYLINDER HEAD AND VALVES

Checking head mating face

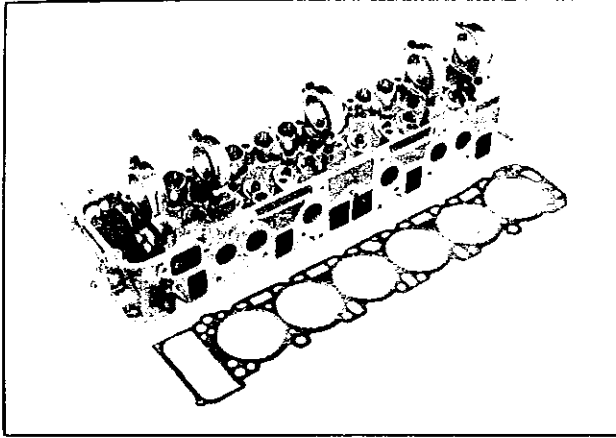


Fig. EM-32 Cylinder head

Note: Never remove camshaft bearings. If you once remove camshaft bearings, the bearing centers will be out of alignment and the recondition is very difficult without center borings.

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

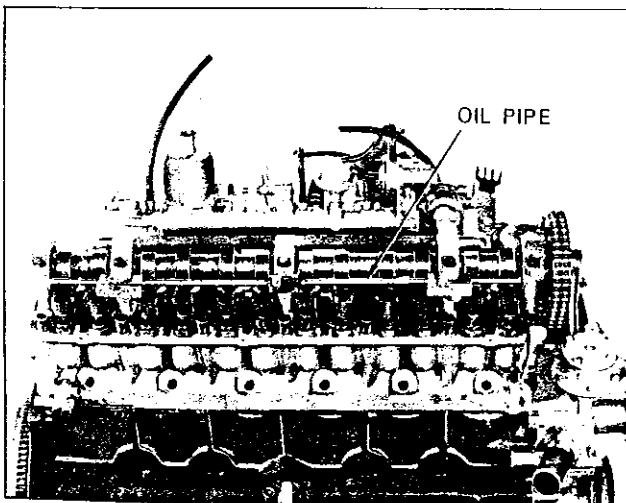


Fig. EM-33 Checking the cylinder head surface

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 assemblies for worn, damaged or deformed valve caps and stems. Correct or replace the valve, if any excessive defects are detected.

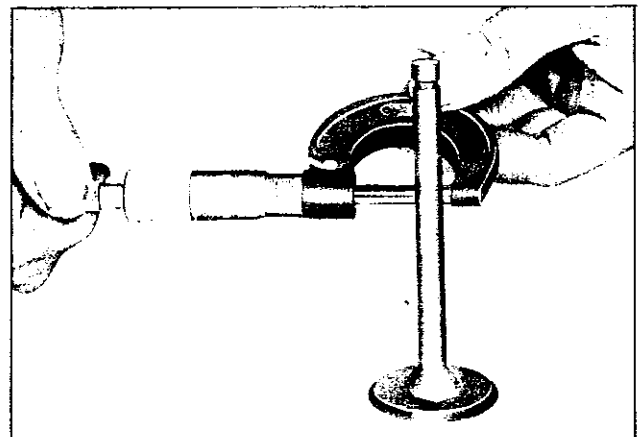


Fig. EM-34 Valve stem diameter check

2. The valve face or valve stem end surface should be refaced by using a valve grinder.

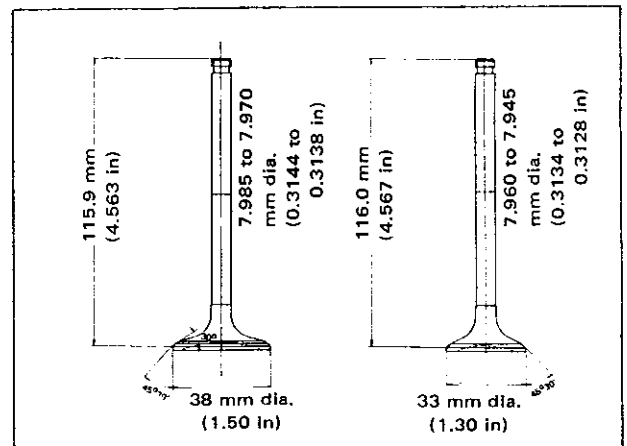


Fig. EM-35 Valves for L20A and L24 (Single carb.)

ENGINE MECHANICAL

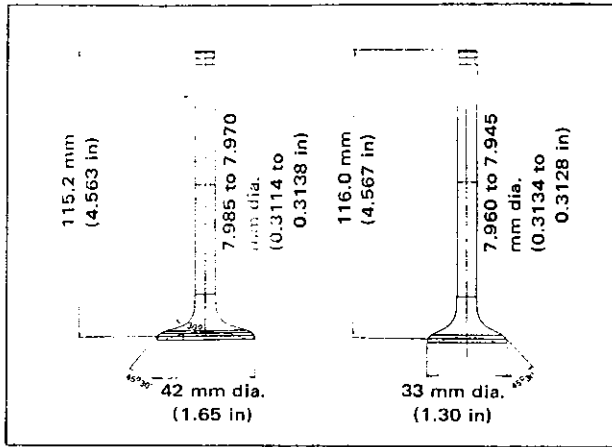


Fig. EM-36 Valves for L24 (Twin carb.)

Note: When the valve head has been reduced to 0.5 mm (0.0197 in) or less 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. Measure the free length and the tension of each spring. If the measured value exceeds the specified limit, replace the spring.
2. Check the deformation of each spring with a square. Any springs with the deflection of 1.6 mm (0.0630 in) or more must be replaced.

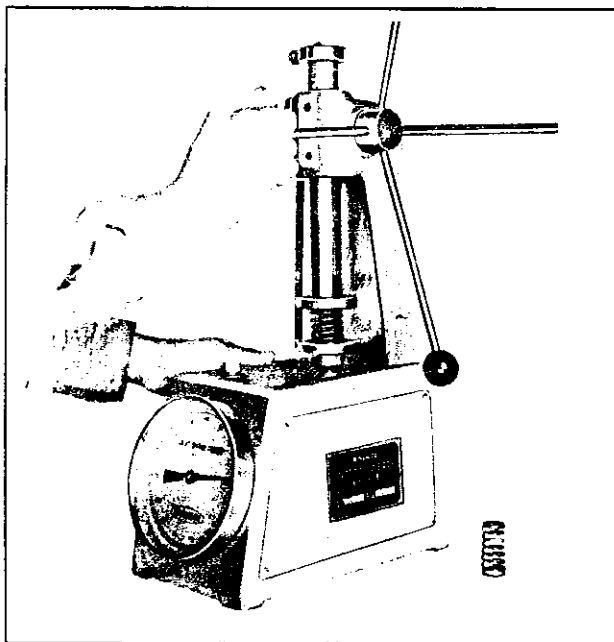


Fig. EM-37 Valve spring test

Spring specification

		L20 & L24 (Single carb.)	L24 (Twin carb.)
Free length mm (in)	Outer	47.75 (1.88 in)	49.98 (1.97 in)
	Inner	44.68 (1.76 in)	44.85 (1.76 in)
Valve closed mm at kg (in at lb)	Outer	40.0/16.6 ± 0.8 (1.57/36.60 ± 1.76)	40.0/21.3 ± 1.6 (1.57/46.96 ± 3.53)
	Inner	35.0/9.6 ± 0.6 (1.38/21.16 ± 1.32)	35.0/12.3 ± 0.7 (1.38/20.12 ± 1.54)
Valve open mm at kg (in at lb)	Outer	30.0/43.0 ± 2.2 (1.18/94.80 ± 4.85)	29.5/49.0 ± 3.7 (1.16/108.03 ± 8.16)
	Inner	25.0/19.6 ± 1.0 (0.98/43.21 ± 2.20)	24.5/25.5 ± 1.3 (0.96/56.22 ± 2.78)

Rocker arm and valve rocker pivot

Check the pivot head and the cam contact and pivot contact surfaces of the 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 the valve guide and the valve stem. If the clearance exceed the designated limit, replace the worn parts or both valves 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 guides.

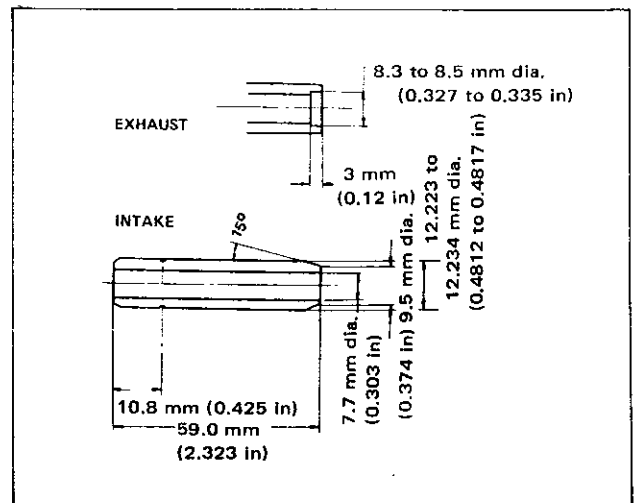


Fig. EM-38 Service valve guide

ENGINE

	Intake valve	Exhaust valve
Stem to guide clearance mm (in)	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)	0.1 (0.0039)	

Determining clearance

Precise measurement of clearance between the valve stem and the valve guide needs the aid of a micrometer and a telescope hole gauge. By using these gauge, check the diameter of the valve stem in three places; top, center and bottom. Insert telescope hole gauge in valve guide bore, measuring at center. Subtract highest reading of valve stem diameter from valve guide bore measured to obtain its clearance from the two center diameter to obtain valve to valve guide clearance. As an emergency expedient, a valve is pushed in the 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 the stem and the guide exceeds the maximum limit of 0.1 mm (0.0039 in).

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

Replacement of valve guide

A valve guide found defective must be replaced in the following manner:

1. Take out the old guide by means of a press and a drift pin (under a 2-ton pressure).

This job may be carried out at room temperatures but with better effect at higher temperature.

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

Guide hole inner diameter mm (in)	12.185 to 12.196 (0.4797 to 0.4802)
--------------------------------------	--

As the valve guides of 0.2 mm (0.0079 in) oversize diameter are available for service, the guide hole should be reamed to the following dimensions.

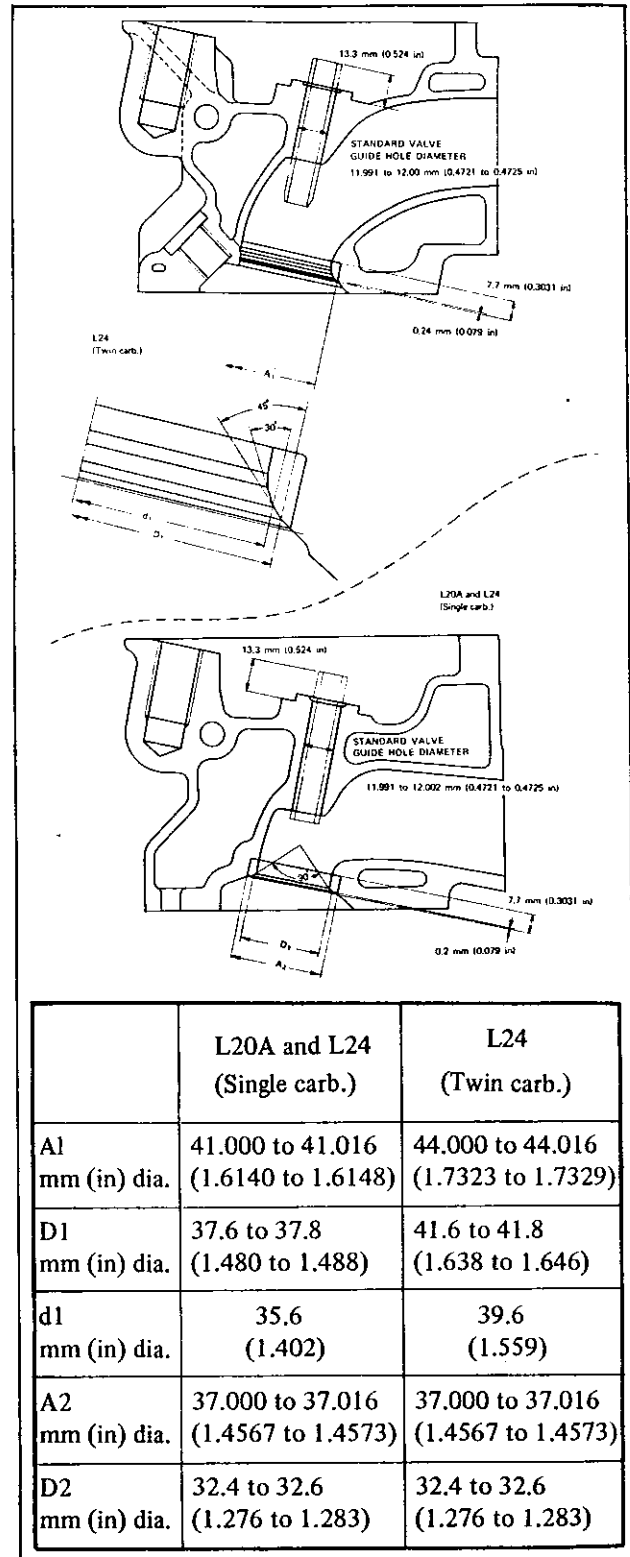


Fig. EM-39 Valve guide and valve seat insert

ENGINE MECHANICAL

3. Press the new valve guide into the valve with care so that it will fit smoothly after heat the cylinder head to a temperature of 150° to 200°C (302° to 392°F).

Interference fit of valve guide to guide hole mm (in)	0.027 to 0.049 (0.0011 to 0.0019)
---	--------------------------------------

4. Ream the bore of the valve guide pressed in using a valve guide reamer.

Valve guide reamer set: ST11030000

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

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

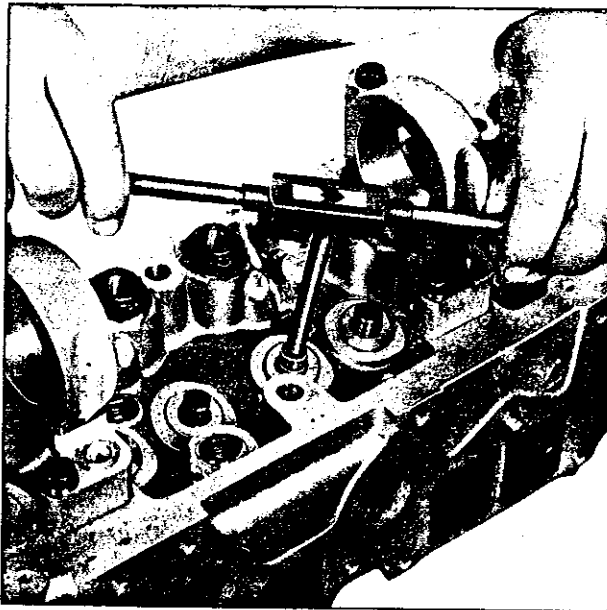


Fig. EM-40 Valve guide reaming

Valve seat inserts

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

The valve seat insert of 0.5 mm (0.0197 in) over size is available for service in this L series engine.

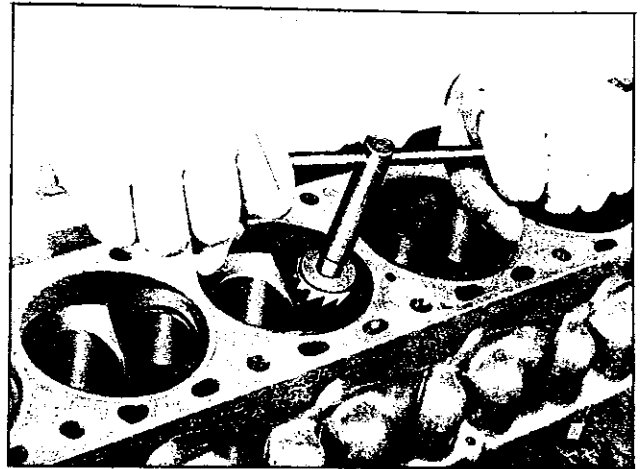


Fig. EM-41 Valve seat correction

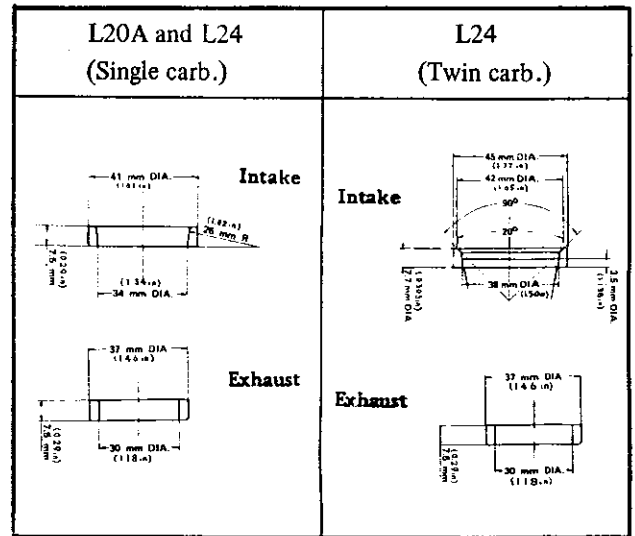


Fig. EM-42 Standard valve seat insert

		L20A and L24	L24
Cylinder head recess diameter mm (in)	Intake	41.5 $\begin{smallmatrix} +0.02 \\ 0 \end{smallmatrix}$ (1.634 $\begin{smallmatrix} +0.0008 \\ 0 \end{smallmatrix}$)	45.5 $\begin{smallmatrix} +0.02 \\ 0 \end{smallmatrix}$ (1.791 $\begin{smallmatrix} +0.0008 \\ 0 \end{smallmatrix}$)
	Exhaust	37.5 $\begin{smallmatrix} +0.02 \\ 0 \end{smallmatrix}$ (1.476 $\begin{smallmatrix} +0.0008 \\ 0 \end{smallmatrix}$)	37.5 $\begin{smallmatrix} +0.02 \\ 0 \end{smallmatrix}$ (1.476 $\begin{smallmatrix} +0.0008 \\ 0 \end{smallmatrix}$)

Interference fit mm (in)	Intake	0.11 to 0.08 (0.0043 to 0.0031)
	Exhaust	0.10 to 0.06 (0.0039 to 0.0024)

ENGINE

Replacing the valve seat insert

1. Old inserts can be removed by boring out until the insert collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the insert recess in the cylinder head.
2. Select a suitable valve seat insert and check its outside diameter.
3. Machine the cylinder head recess diameter to the concentric circles to the valve guide center so that the insert will have the correct fit.
4. Heat the cylinder head to a temperature of 150° to 200°C (302° to 392°F).
5. Fit the insert ensuring that it beds on the bottom face of its recess.
6. The valve seats newly fitted should be cut or ground at the specified dimensions as shown in Figure EM-39.

Valve seat cutter set: ST11650000

CAMSHAFT AND CAMSHAFT BEARINGS

Camshaft bearing clearance check

1. Measure the inner diameter of the camshaft bearing and the outer diameter of the camshaft journal. If wear is found inside the bracket replace the cylinder head assembly.

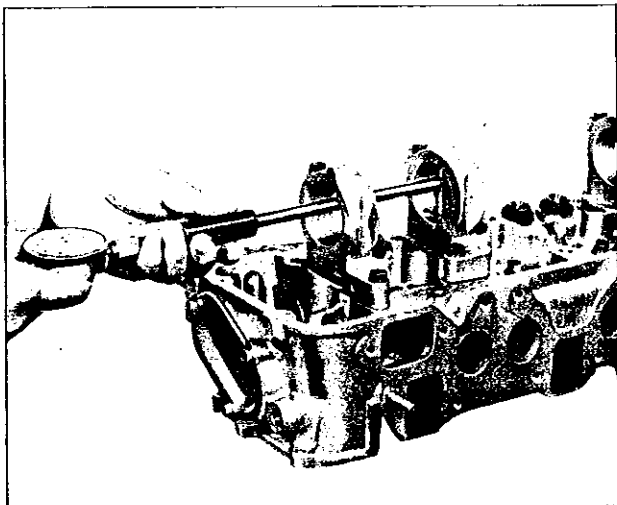


Fig. EM-43 Camshaft bearing check

	Standard	Wear limit
Oil clearance mm (in)	0.038 to 0.076 (0.0015 to 0.0026)	0.1 (0.0039)
Inner diameter of camshaft bearing mm (in)	48.00 to 48.016 (1.8898 to 1.8904)	

Valve timing check

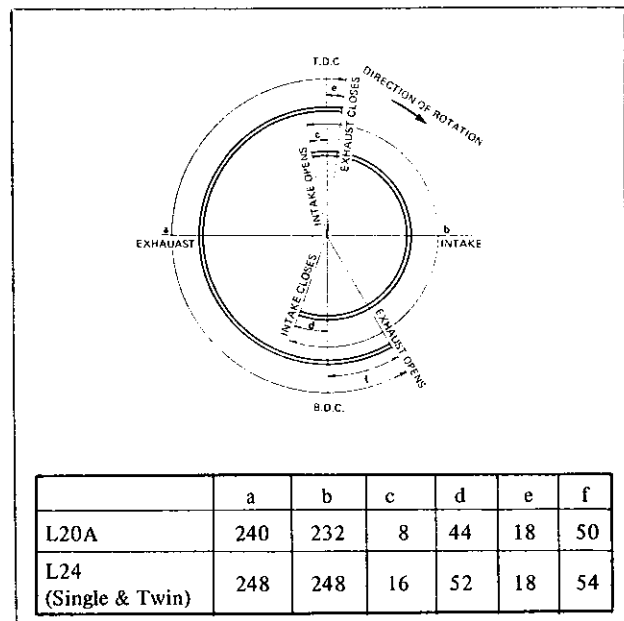


Fig. EM-44 Valve timing diagram

If the camshaft shown no apparent damage although some valve operation troubles have been detected in the engine, compare valve timing data with the valve timing diagram to see whether the stroke beginning and end in various cylinders are complying with specified advance and retard figures.

Camshaft alignment check

1. Check the camshaft, camshaft journal and cam surface for bend, wear or damage. If the defects are beyond the limits, replace the affected parts.
2. Bend values are expressed in terms of half values of the readings, obtained when the camshaft is given a turn with a dial gauge applied to the center journal.

ENGINE MECHANICAL

	Standard	Bend limit
Camshaft bend mm (in)	0.015 (0.0006)	0.05 (0.0020)

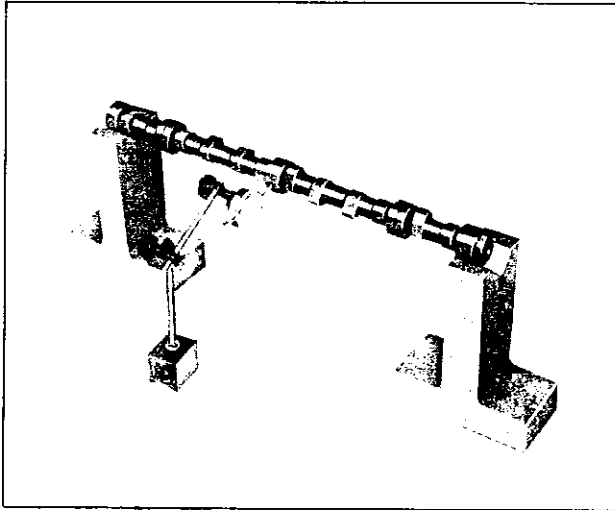


Fig. EM-45 Camshaft bend check

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

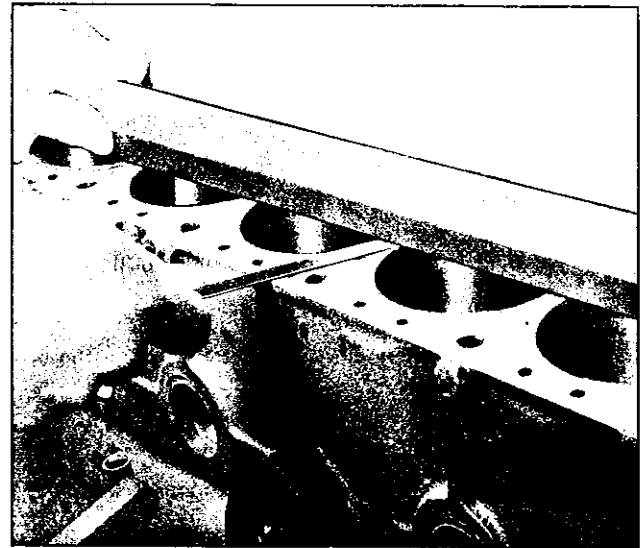


Fig. EM-46 Cylinder block surface check

Engine model	L20A	L24 (Single and Twin)
Unit mm (in)		
Standard height of cam	40.30 to 40.35 (1.587 to 1.589)	39.95 to 40.00 (1.573 to 1.575)
Wear limit of cam height	0.25 (0.0098)	
Allowable difference in diameter between maximum worn and minimum worn parts of camshaft journal	0.05 (0.0020)	
Maximum tolerance in journal diameter	0.1 (0.0039)	
Camshaft end play	0.04 to 0.3 (0.0016 to 0.0118)	

3. Measure the cylinder bore for out-of-round or excessive taper with a bore gauge. If excessive wear, taper or out-of-round are detected on the cylinder wall, rebore the cylinder walls by a boring machine.

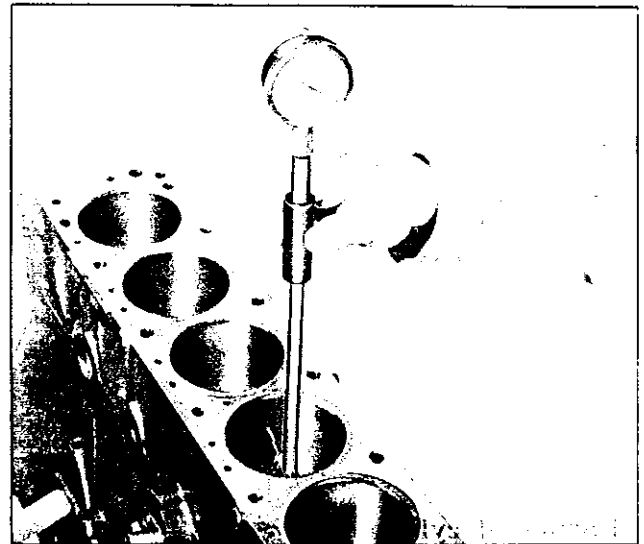


Fig. EM-47 Measuring the cylinder bore

CYLINDER BLOCK

1. Check visually for defects, such as cracks and flaws.
2. Measure the top face of the block (cylinder head mating face) for warping. If the warp exceeds the limit value, correct it.

4. When the wear, taper and out-of-round are not excessive to the limit, remove the step at the topmost portion of the cylinder by using a ridge reamer or the like.

ENGINE

How to measure cylinder bore

A bore gauge is used. Measure the cylinder bore at top, middle and bottom points in each direction A and B as illustrated and record the measured values.

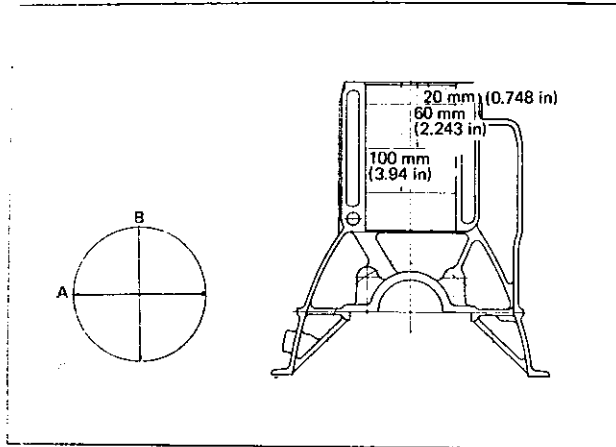


Fig. EM-48 Measuring points of cylinder bore

	Standard		Wear limit
	L20A	L24	
Cylinder bore mm (in)	78.000 $\begin{smallmatrix} +0.050 \\ 0 \end{smallmatrix}$ (3.0709 $\begin{smallmatrix} +0.0020 \\ 0 \end{smallmatrix}$)	83.000 $\begin{smallmatrix} +0.050 \\ 0 \end{smallmatrix}$ (3.2677 $\begin{smallmatrix} +0.0020 \\ 0 \end{smallmatrix}$)	0.2 (0.0097)
Error in cylinder bore elliptic tapered mm (in)	0.02 (0.0008)	0.015 (0.0006)	
Difference cylinder bore mm (in)	0.05 (0.0020)	0.05 (0.0020)	0.2 (0.0079)

Boring of cylinder

1. When any of the cylinders needs boring, all other cylinders must be bored at the same time.
2. Determine piston oversize according to the amount of wear of the cylinder.

Piston for service

Unit: mm (in)

Piston size	Outside diameter (H)	
	L20A	L24
STD	77.92 to 77.97 (3.068 to 3.070)	82.99 to 83.04 (3.267 to 3.269)
Oversize 1	77.94 to 77.99 (3.068 to 3.070)	83.22 to 83.27 (3.276 to 3.278)
Oversize 2	78.17 to 78.22 (3.077 to 3.079)	83.47 to 83.52 (3.286 to 3.288)
Oversize 3	78.42 to 78.47 (3.087 to 3.089)	83.72 to 83.77 (3.296 to 3.298)
Oversize 4	78.67 to 78.72 (3.097 to 3.099)	83.97 to 84.02 (3.305 to 3.308)
Oversize 5	78.92 to 78.97 (3.107 to 3.109)	84.47 to 84.52 (3.326 to 3.328)

3. By measuring piston to be installed at piston skirt (side thrust face) and adding the mean of clearance specification, the finish hone cylinder measurement can be determined.

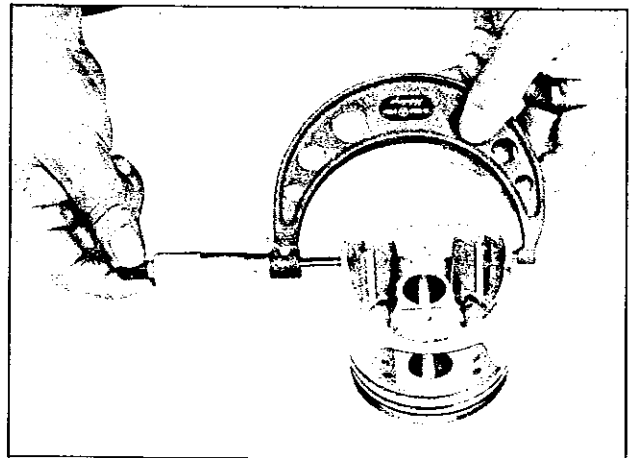


Fig. EM-49 Measuring the piston diameter

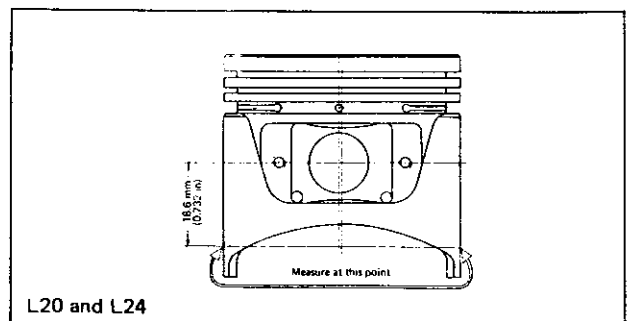


Fig. EM-50 Measuring point

ENGINE MECHANICAL

Outer diameter of piston skirt (measured value):

A, Piston-cylinder clearance:

B = 0.025 to 0.045 mm (0.0010 to 0.0018 in)

Boring allowance C = 0.02 mm (0.0008 in)

Cylinder bore to be treated:

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

4. Machine the cylinder bore to the determined inner diameter.

Note: To prevent strain due to cutting heat, bore the cylinders in the order of 1-5-3-6-2-4.

5. Do not cut too much out of the cylinder bore at a time, but cut 0.05 mm (0.0020 in) or so at a time.

6. Measurement of the cylinder bore just machined requires the utmost care since it is expanded by cutting heat.

7. Finish the treated cylinder bore to a final finish bore by honing.

8. Measure the finished cylinder bore for elliptic or tapered part.

9. Measure the piston to cylinder clearance. This clearance can be checked easily by using a feeler gauge and a spring scale.

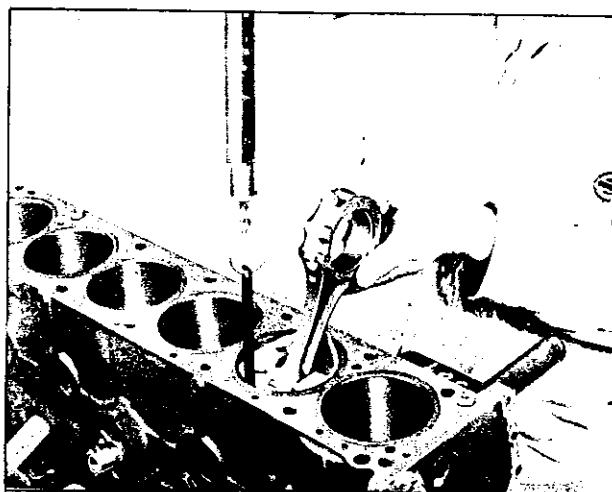


Fig. EM-51 Piston to cylinder clearance check

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 (0.4409 to 3.3069)

Note: If the cylinder bore has worn beyond the wear limit, use the cylinder liner.

Undersize cylinder liners are available for service (only for L24 engine).

Interference fit of cylinder liner Cylinder Block 0.08 to 0.09 mm (0.0031 to 0.0035 in).

Cylinder liner for service (for L24 engine)

Unit: mm (in)

	Outside diameter	Inner diameter
400 undersize	87.00 to 87.05 (3.4252 to 3.4272)	82.45 to 82.55 (3.2461 to 3.2500)
450 undersize	87.50 to 87.55 (3.4449 to 3.4468)	82.45 to 82.55 (3.2461 to 3.2500)
500 undersize	88.00 to 88.05 (3.4646 to 3.4665)	82.45 to 82.55 (3.2461 to 3.2500)

PISTON, PISTON PIN AND PISTON RING

1. Check for seizing, scratches and wear. Effect a replacement when such a defect is detected.

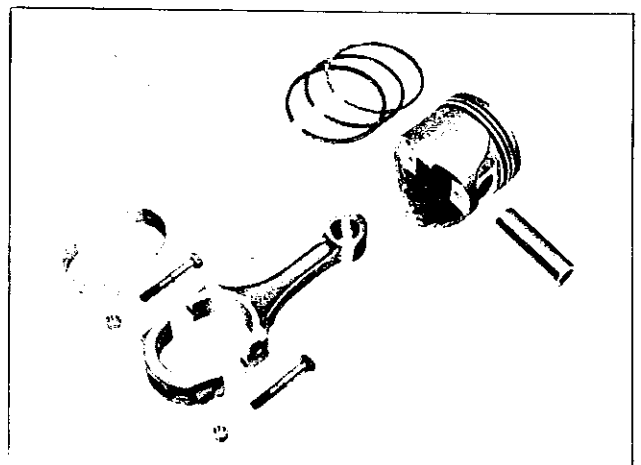


Fig. EM-52 Piston and connecting rod assembly

ENGINE

2. Measure the side clearance of rings in ring groove as each ring is installed. Clearance with new pistons and rings should be as follows.

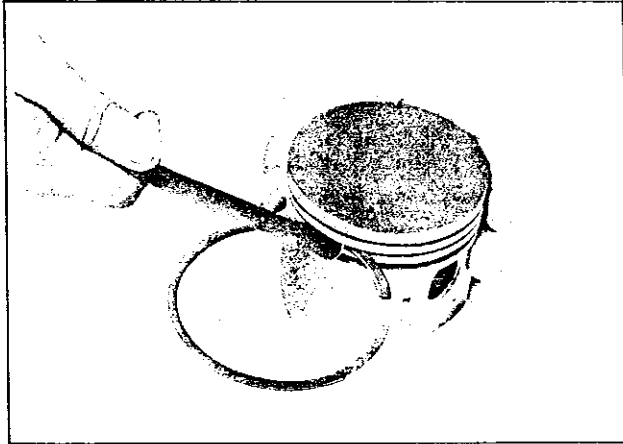


Fig. EM-53 Side clearance measurement

Side clearance

	Standard		Wear limit
	L20A	L24	
Top ring mm (in)	0.045 to 0.078 (0.0018 to 0.0031)		0.1 (0.0039)
Second ring mm (in)	0.030 to 0.063 (0.0012 to 0.0025)		0.1 (0.0039)
Oil ring mm (in)	0.025 to 0.063 (0.0010 to 0.0025)	0	0.1 (0.0039)

Ring gap

	Standard		Wear limit
	L20A	L24	
Top ring mm (in)	0.20 to 0.35 (0.0079 to 0.0138)	0.23 to 0.38 (0.0091 to 0.0150)	1.0 (0.0394)
Second ring mm (in)	0.14 to 0.29 (0.0055 to 0.0114)	0.15 to 0.30 (0.0059 to 0.0118)	1.0 (0.0394)
Oil ring mm (in)	0.14 to 0.29 (0.0055 to 0.0114)	0.15 to 0.30 (0.0059 to 0.0118)	1.5 (0.0591)

3. Place the ring at the bottom of the ring traveled part of cylinder bore in which it will be used.

Square ring in bore by pushing it into position with the head piston.

Measure the gap between ends of ring with feeler gauge. Gap should be as listed above.

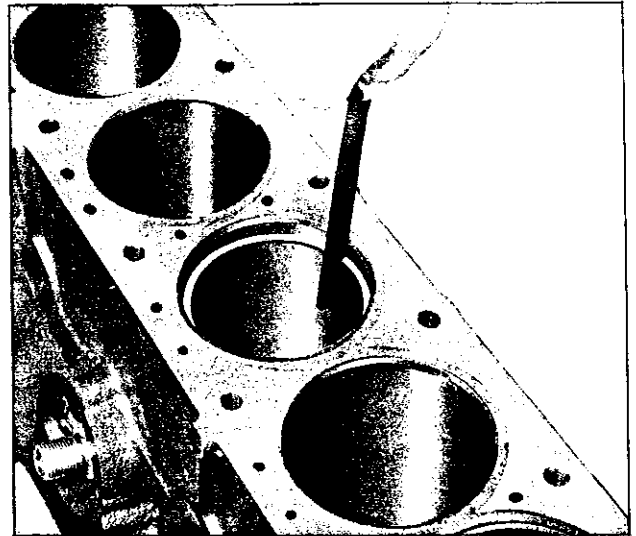


Fig. EM-54 Ring gap measurement

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

b. Oversize piston rings are available for service. (25, 50, 75, 100, 150 oversize)

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

	L20A	L24
Piston pin outside diameter mm (in)	19.995 to 20.005 (0.7872 to 0.7876)	20.993 to 20.998 (0.8265 to 0.8267)
Piston pin length mm (in)	66.40 to 66.65 (2.6142 to 2.6240)	72.00 to 72.25 (2.835 to 2.844)
Piston pin hole diameter mm (in)	19.999 to 20.010 (0.7874 to 0.7878)	21.001 to 21.008 (0.8268 to 0.8271)

ENGINE MECHANICAL

5. Fitting of piston pin

Determine the fitting of the piston pin into the 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 the connecting rod.

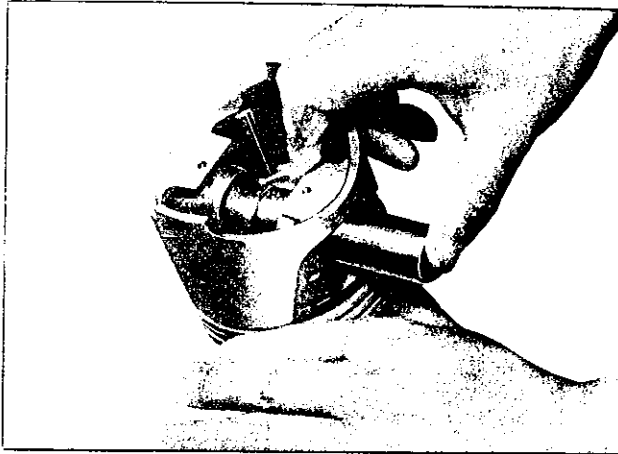


Fig. EM-55 Piston pin fitting

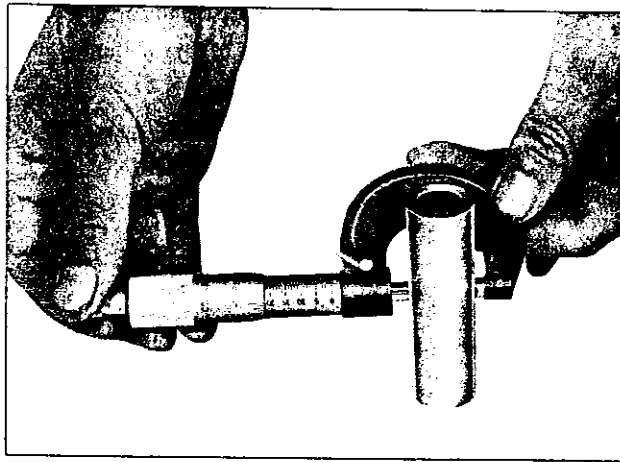


Fig. EM-56 Measuring piston pin diameter

	L20A	L24
Piston pin to piston clearance mm (in)	0.004 to 0.011 (0.0002 to 0.0004)	0.008 to 0.010 (0.0003 to 0.0004)
Interference fit of piston pin to connecting rod mm (in)	0.017 to 0.035 (0.0007 to 0.0014)	0.015 to 0.033 (0.0006 to 0.0013)

CONNECTING ROD

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

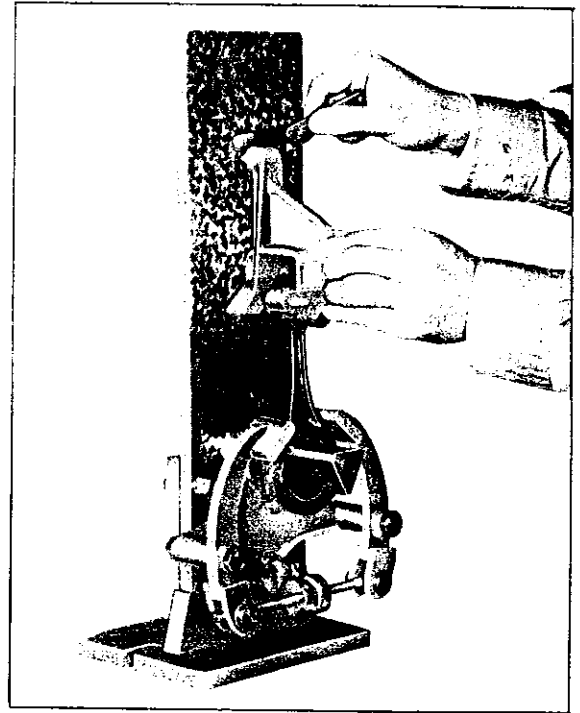


Fig. EM-57 Connecting rod aligner

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

	Standard	Maximum
Connecting rod bend or torsion (per 100 mm or 3.94 in: length) mm (in)	0.025 (0.0010)	0.05 (0.0020)

3. In replacing the connecting rod, select the rod so that the weight difference between new rods and old one become within 6 gr (0.212 oz) in unit weight.

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

ENGINE

	Standard	Wear limit
Big end end play mm (in)	0.2 to 0.3 (0.0079 to 0.0118)	0.30 (0.0118)

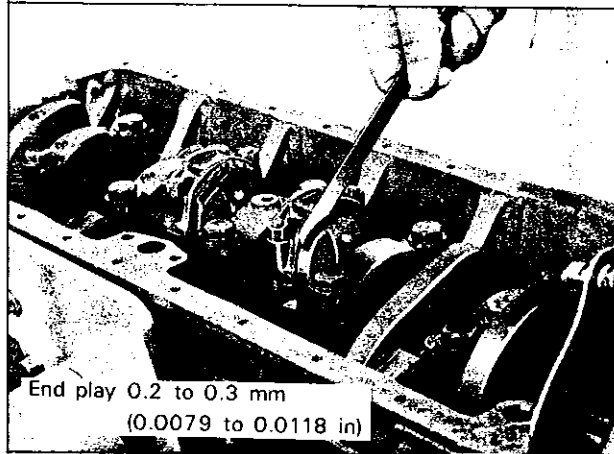


Fig. EM-58 Big end end play check

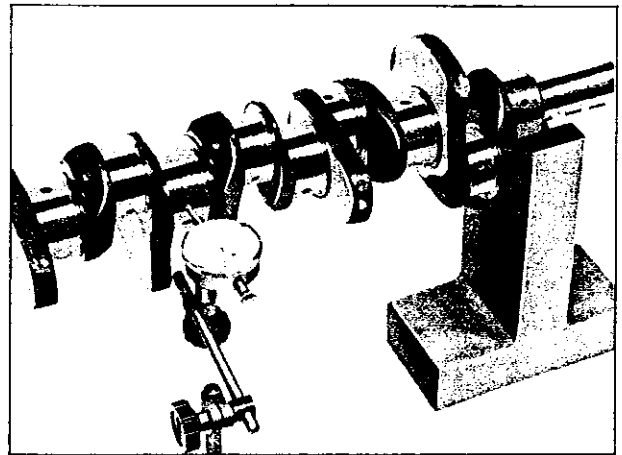


Fig. EM-60 Crankshaft bend check

	Standard	Maximum
Crank shaft bend mm (in)	less than 0.025 (0.0010)	0.05 (0.0020)

CRANKSHAFT

1. Check the shaft journal and crank pin for scars, biased wear and cracks.

Repair or replace affected parts.

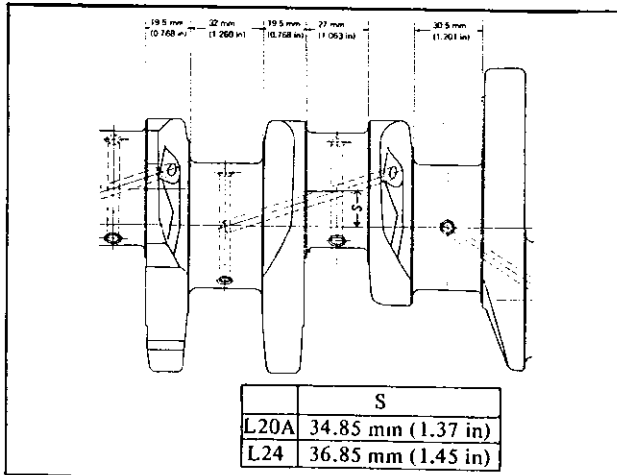


Fig. EM-59 Crankshaft

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

2. Check the crankshaft for bend. If the bend exceeds the specified value repair or replace the crankshaft.

Note: For measuring the bend, use a dial gauge. Bend values are half as much as the readings obtained when the crankshaft is given a turn with the dial gauge applied to its center journal.

3. After regrinding the crankshaft, finish it to the necessary size indicated in the lists on page EM-24 by using an adequate undersize bearing according to the extent of required repair.

4. Install the crankshaft in the cylinder block and measure the thrust clearance. If it exceeds the specified value, replace the center shims.

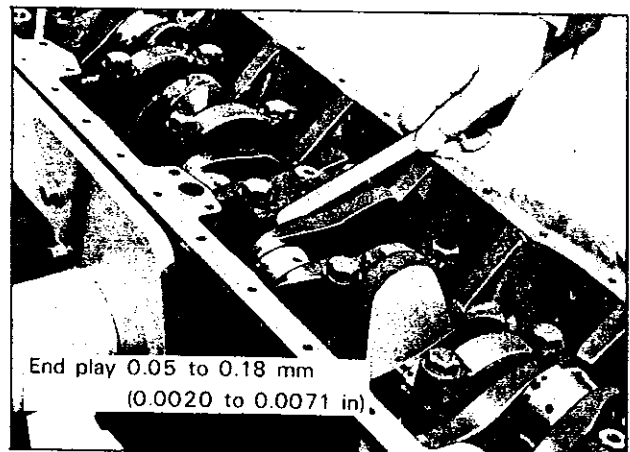


Fig. EM-61 Crankshaft end play check

ENGINE MECHANICAL

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

5. Check the main drive shaft pilot bearing at the rear of the crankshaft for wear and damage. Replace it if any defects are detected.

BUSHINGS AND BEARINGS

Measurement of main bearing clearance

1. Check all bearings and bushings for seizures, melts, scars and burns.

Replace bushings, if any defects are detected.

2. Wipe off oil and dust (especially the rear of the bushing).

3. Set the main bearing on the cap block.

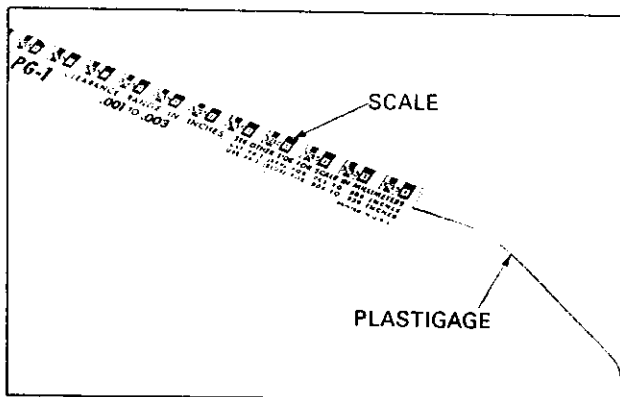


Fig. EM-62 Plastigage

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

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

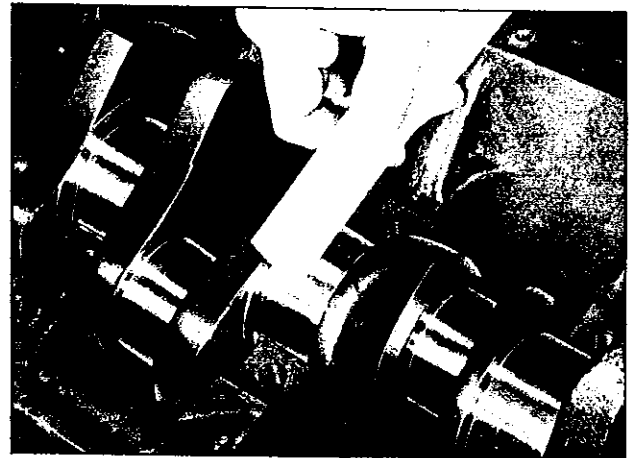


Fig. EM-63 Bearing clearance check

Note: Be sure not to turn the crankshaft when the plastigage is inserted.

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

Measurement of connecting rod bearing clearance

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

Tightening torque: 2.7 to 3.3 kg-m (19.5 to 23.9 ft-lb)

Bearing oil clearance

	Standard	Wear limit
Main bearing clearance mm (in)	0.020 to 0.072 (0.0008 to 0.0028)	0.12 (0.0047)
Connecting rod bearing clearance mm (in)	0.014 to 0.066 (0.0006 to 0.0026)	0.10 (0.0039)

2. If clearance proves to be in excess of the specified value, replace bearing by undersize and, consequently, grind out the crankshaft journal.

ENGINE

Fitting bearings

1. Set the bushings on the main bearing cap and the cylinder block bearing recess and after installing the bearing cap, tighten the cap bolts to the specified torque.

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

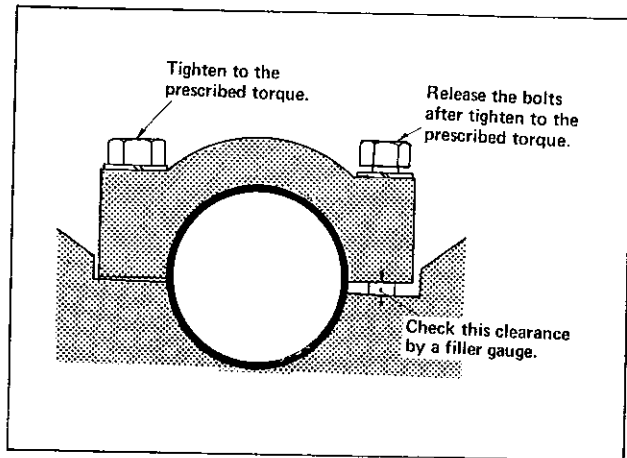


Fig. EM-64 Bearing crush check

2. Loosen the cap bolt on one side and measure the clearance between the cap and block side.
3. Ascertain that the clearance is within double the figures listed below. If it is not, replace the bearing.
4. Handle the connecting rod bearing in the same manner.

Connecting rod cap tightening torque:
2.7 to 3.3 kg-m (19.5 to 23.9 ft-lb)

Bearing crush

All main bearing mm (in)	0 to 0.03 (0 to 0.0012)
All connecting rod bearing mm (in)	0.015 to 0.040 (0.0006 to 0.0016)

Main bearing undersize

Bearing size 1/1,000 mm	Bearing top thickness mm (in)	Crank journal diameter mm (in)
STD	1.822 to 1.835 (0.0717 to 0.0722)	54.942 to 54.955 (2.1631 to 2.1636)
25 undersize	1.947 to 1.960 (0.0767 to 0.0772)	54.692 to 54.705 (2.1532 to 2.1537)
50 undersize	2.072 to 2.085 (0.0816 to 0.0821)	54.442 to 54.455 (2.1434 to 2.1439)
75 undersize	2.197 to 2.210 (0.0865 to 0.0870)	54.172 to 54.205 (2.1328 to 2.1341)
100 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

Bearing size 1/1,000mm	Bearing top thickness mm (in)	Crank pin diameter mm (in)
STD	1.493 to 1.506 (0.0588 to 0.0593)	49.961 to 49.974 (1.9670 to 1.9675)
6 undersize	1.523 to 1.536 (0.0600 to 0.0605)	49.901 to 49.914 (1.9646 to 1.9651)
12 undersize	1.553 to 1.566 (0.0611 to 0.0617)	49.841 to 49.854 (1.9622 to 1.9628)
25 undersize	1.618 to 1.631 (0.0637 to 0.0642)	49.711 to 49.724 (1.9571 to 1.9576)
50 undersize	1.743 to 1.756 (0.0686 to 0.0691)	49.461 to 49.474 (1.9473 to 1.9478)
75 undersize	1.868 to 1.881 (0.0735 to 0.0741)	49.211 to 49.224 (1.9374 to 1.9379)
100 undersize	1.993 to 2.006 (0.0785 to 0.0790)	48.961 to 48.974 (1.9726 to 1.9281)

MISCELLANEOUS COMPONENTS

Crankshaft sprocket, camshaft sprocket

1. Check tooth surfaces for flaws and wears. Replace defective sprocket if any defects are found.

ENGINE MECHANICAL

2. Install the camshaft sprocket in position and check for run-out. If it is found to exceed 0.1 mm (0.04331 in), replace the camshaft sprocket. Check for thrust deviation at the same time. Three kinds of locating plate differing in thickness are available, so make the necessary adjustment using those locating plates.

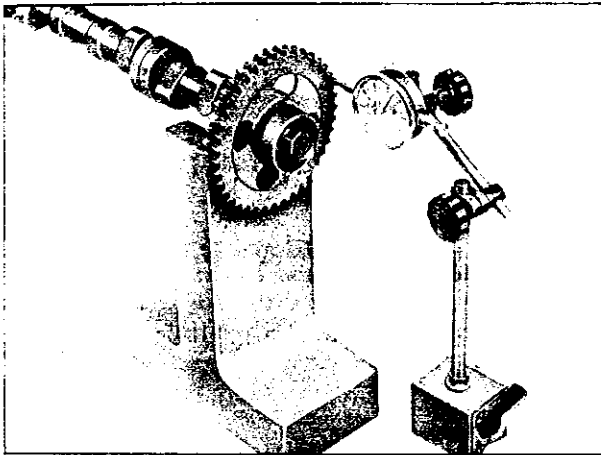


Fig. EM-65 Camshaft sprocket run-out check

Thrust deviation mm (in)	0.04 to 0.30 (0.0016 to 0.0118)
Locating plate thickness mm (in)	4.8 ± 0.05 (0.1890 ± 0.0020) 4.9 ± 0.05 (0.1929 ± 0.0020) 5.0 ± 0.05 (0.1969 ± 0.0020)

3. Check the chain for damage, severe wear and stretch at its roller links. Replace a defective chain.

4. When the chain stretches extremely, the valve timing goes out of order. In L20A and L24 engine, two locate (Camshaft set) holes are provided in the camshaft sprocket to correct the valve timing.

Adjustment of camshaft sprocket location

If the stretch of the chain roller links is extreme, adjust the camshaft sprocket location by transferring the camshaft set position of the camshaft sprocket to No. 2 or No. 3 holes.

1. Turn engine until No. 1 piston is at T.D.C. on its compression stroke. Examine whether the camshaft location hole on the camshaft sprocket comes off the

left end of the oblong groove on the camshaft locate plate.

(If the camshaft location hole is off the left end of the oblong groove, the stretch of the chain is beyond the limit.)

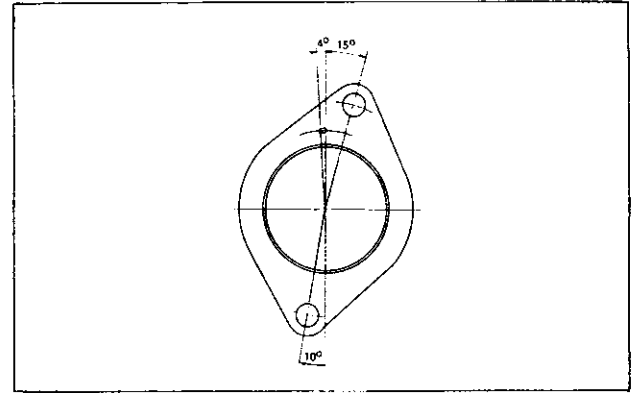


Fig. EM-66 Camshaft locate plate

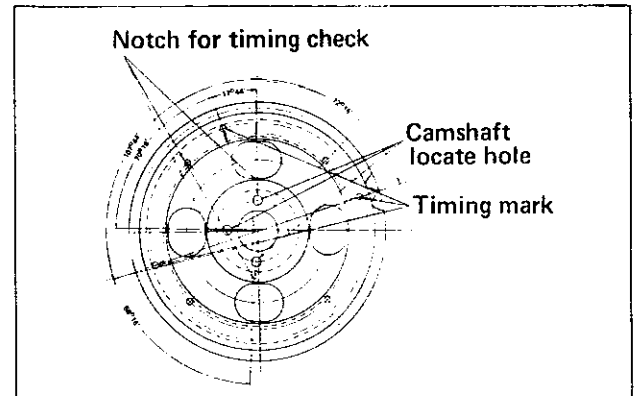


Fig. EM-67 Camshaft sprocket

2. Turn the engine until No. 1 piston is at T.D.C. on its compression stroke set the camshaft on No. 2 location hole of the camshaft sprocket. Then this No. 2 hole should be on the right end of the oblong groove. When the No. 2 hole is used, the amount of the modification is 4° by the rotation of the crankshaft.

3. If the valve timing can not be corrected by using No. 2 hole, use No. 3 hole as the same procedure as mentioned above. The amount the modification by using No. 3 hole is 8° by the rotation of the crankshaft.

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

ENGINE

Chain tensioner and chain guide

Check for wear and breakage. Replace if necessary.

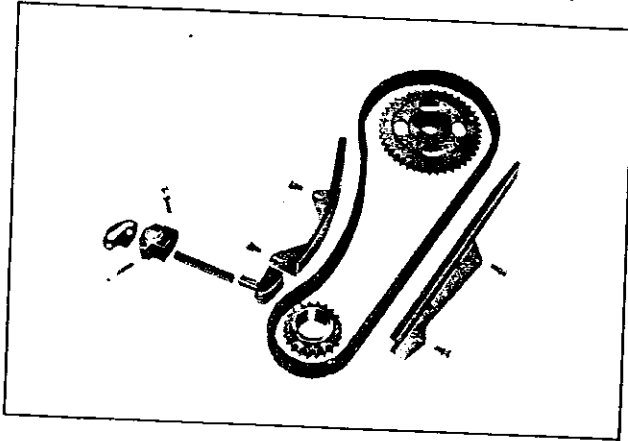


Fig. EM-68 Camshaft drive mechanism

Flywheel

1. Check the clutch disc contact surface of the flywheel for damage and wear. Repair or replace if necessary.
2. Measure deviation of the clutch disc contact surface with a dial gauge. If it exceeds 0.1 mm (0.04331 in), replace it.
3. Check tooth surfaces of the ring gear for flaws and wear.
Replace if necessary.

Note: Replace the ring gear at about 180° to 200°C (356° to 392°F).

ENGINE ASSEMBLY

CONTENTS

PRECAUTIONS	EM-26	PISTON AND CONNECTING ROD	EM-27
CYLINDER HEAD	EM-26	ASSEMBLING OF ENGINE	EM-28

PRECAUTIONS

1. Use thoroughly cleaned parts. Particularly, check whether oil holes are clear of foreign matter or not.
2. In installing sliding parts, such as bearings proceed after applying engine oil to them as required.
3. Use new packings and oil seals, in principle.
4. Keep tools and work benches clean and clear of dust and oil stains.
5. Keep the necessary parts and tools ready near at hand.
6. Be sure to follow specified tightening torque and orders where necessary.

CYLINDER HEAD

1. Assembly of valve and valve spring
Set the valve spring seat in position, and fit the valve guide with the oil seal.
Assemble the valve in order of the following, valve, inner and outer valve springs, spring retainer, valve collet and valve rocker guide.

ENGINE MECHANICAL

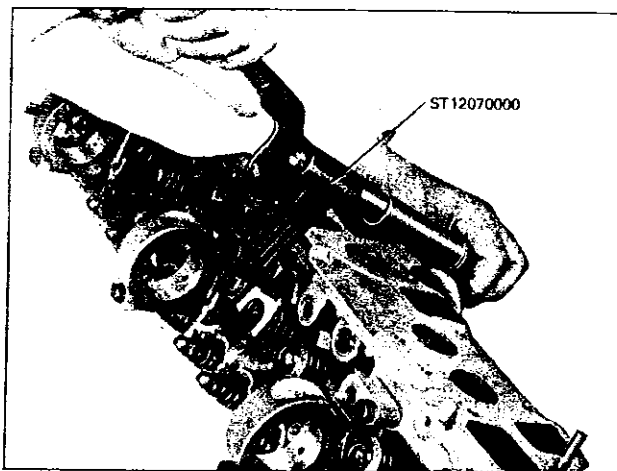


Fig. EM-69 Valve installation

Note: Check whether the valve face is clear from foreign matters.

2. Assembly of valve rocker pivot.

Screw valve rocker pivots joined with rocker spring washer and lock nuts in the pivot bush.

3. Assembly of camshaft

Install the camshaft in cylinder head carefully and set the locating plate. Do not damage the bearing inside.

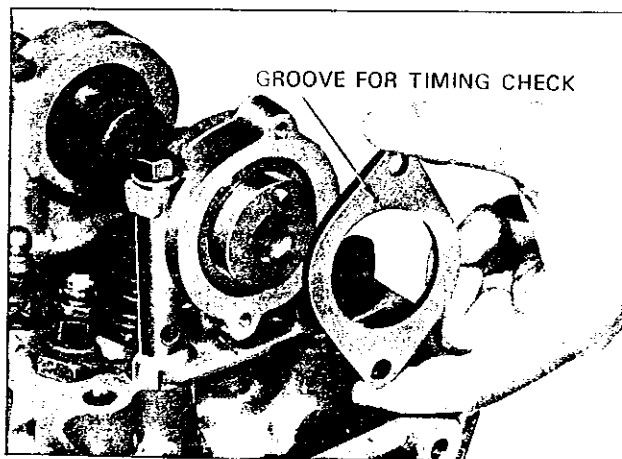


Fig. EM-70 Camshaft locate plate installation

4. Install the rocker arms, pressing down the valve springs by screwdriver.
5. Install the valve rocker springs.

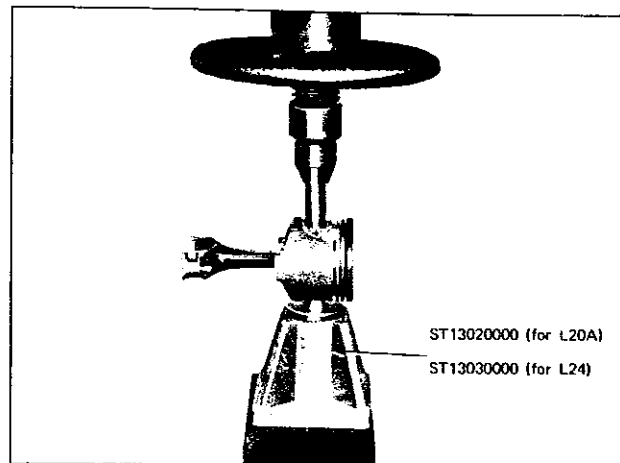


Fig. EM-71 Piston pin installation

PISTON AND CONNECTING ROD

1. Assemble piston, piston pin and connecting rod assorted according to cylinder number for every cylinder.

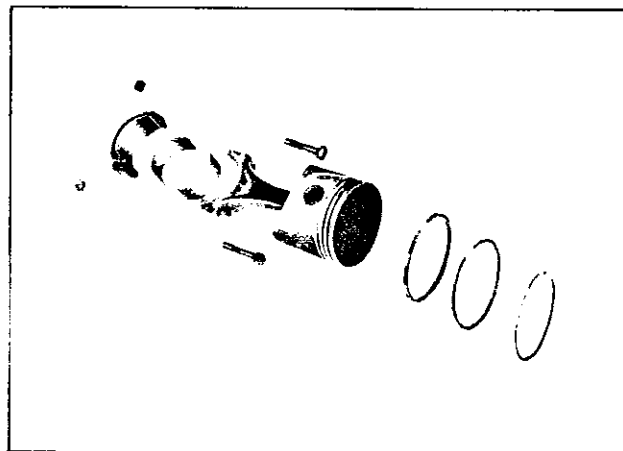


Fig. EM-72 Piston and connecting rod assembly

Note: a. Piston pin is a tight press fit to the connecting rod, and fitting force is from 1 to 3 tons and the aid of the special tool is necessary.

In pressing the piston pin in the connecting rod, apply engine oil to the pin and the small end of the connecting rod.

b. Arrange so as the oil jet of the connecting rod large end is directed toward the right side of the cylinder block.

c. As the center of the piston pin is off-set in relation to the center of the piston, be sure to make proper assembly.

ENGINE

2. Install the piston rings.

Install top and second rings in right position, as the rings with marks up.

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

Note: Clean the back side of the bearing carefully.

ASSEMBLING OF ENGINE

1. Set the cylinder block on the working stand.
2. Set the main bearings on the proper portion of the cylinder block.

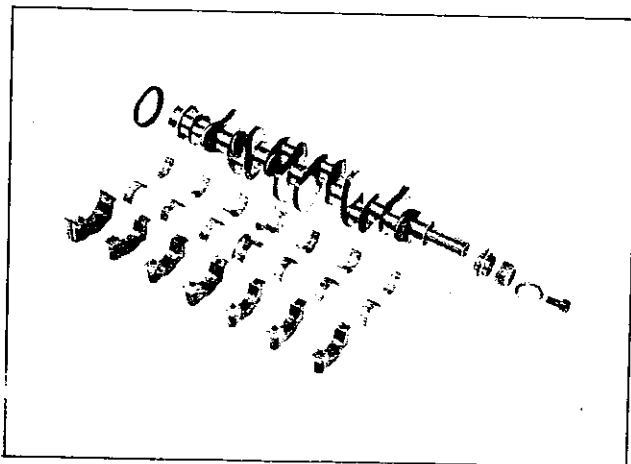


Fig. EM-73 Main bearings and caps

Note: a. Only the center bearing is a flanged type for thrust force.

b. All inter bearings are the same type ones.

c. The front bearing (No.1) is also the same type with the rear bearing. Only difference between both bearings is that the front bearing has an oil hole and the rear one has no hole.

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

3. Apply the engine oil to the main bearing surfaces on the both side of the cylinder block and cap. Then, install the crankshaft.

4. Install the main bearing cap and tighten the bolts with specified torque.

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

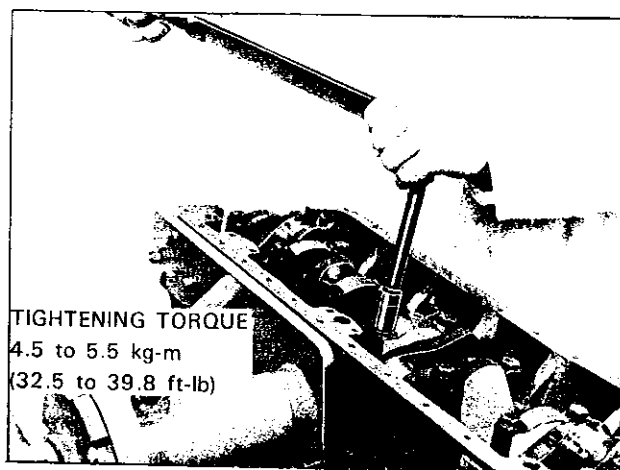


Fig. EM-74 Main bearing cap installation

Note: a. Arrange so as the arrow mark on the bearing cap is faced toward the front of the engine.

b. Prior to the tightening of the bearing cap bolts, place the bearing cap at a proper position by shifting the crankshaft in the axial direction.

c. The tightening operation should be made gradually in separating three of four stages and outwardly from center bearing.

d. After securing the bearing cap bolts ascertain whether the crankshaft is easily rotatable.

5. Make sure of the crankshaft end play.

Crankshaft end play: 0.05 to 0.18 mm (0.002 to 0.007 in)

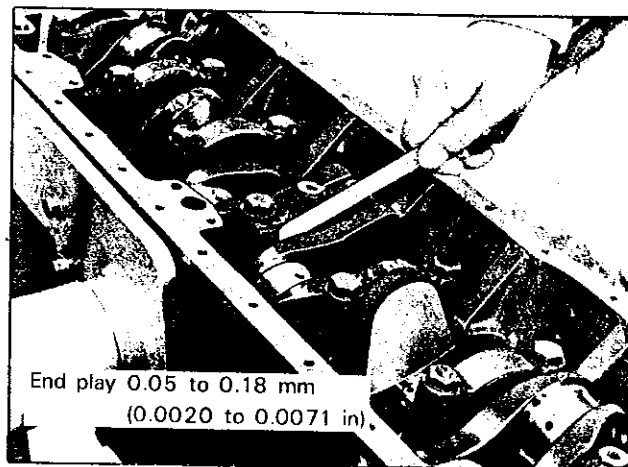


Fig. EM-75 Camshaft end play check

6. Install the side oil seals into the rear main bearing cap as same way in the cylinder block.

ENGINE MECHANICAL

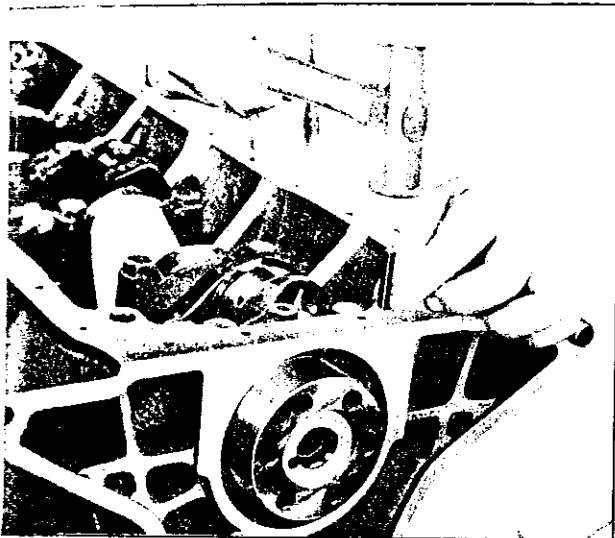


Fig. EM-77 Side oil seal installation

7. Install the crankshaft rear oil seal.

Special tool: ST15310000

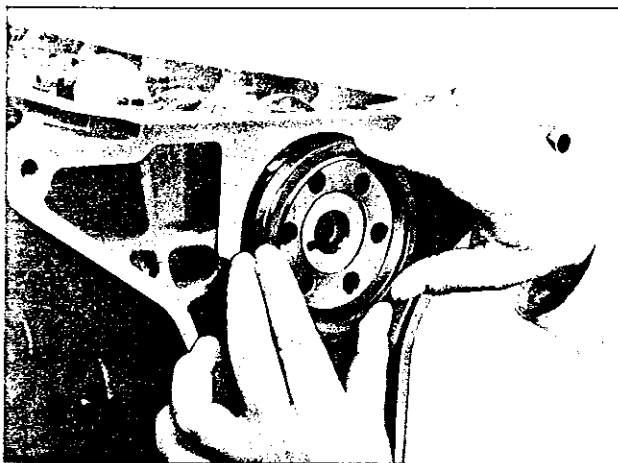


Fig. EM-76 Rear oil seal installation

8. Install the cylinder block net.
9. Install the rear end plate.
10. Install the flywheel securely and tighten the bolts with specified torque.

Tightening torque: 14.0 kg-m (101.2 ft-lb)

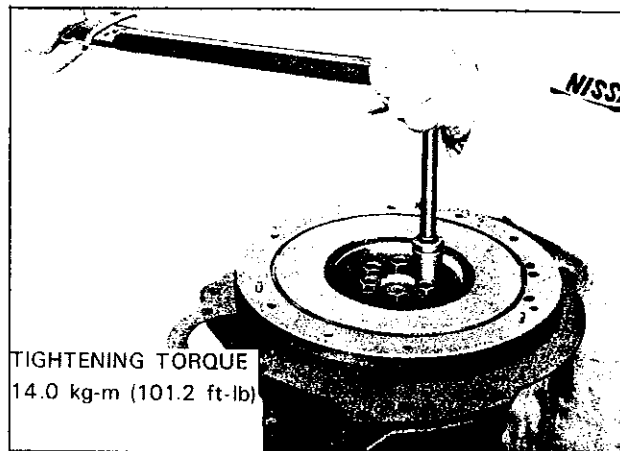


Fig. EM-78 Flywheel installation

11. Install the piston-rod assembly.

Note: a. Insert the pistons in the corresponding cylinders.

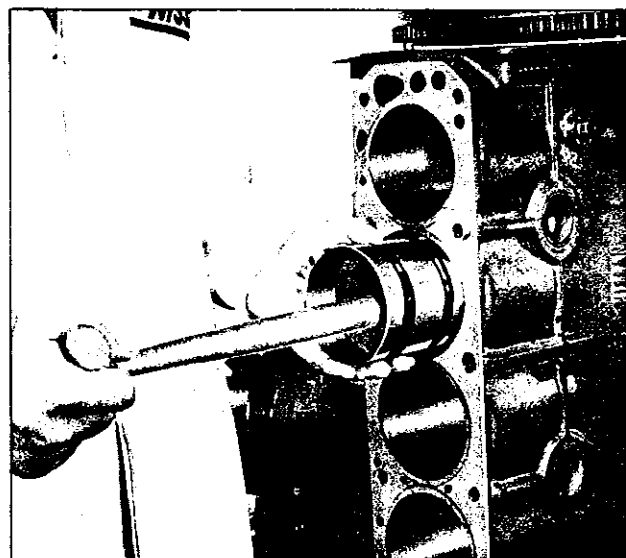


Fig. EM-79 Piston-rod assembly installation

Special tool: EM03470000

- b. Apply the engine oil on concerning parts.
- c. Arrange so as the "F" marking on the piston is facing front of engine.
- d. Install piston rings at 180° to each other, avoiding their fit in the thrust and piston pin axial directions.

ENGINE

12. Install the connecting rod cap.

Tightening torque: 2.7 to 3.3 kg-m (19.5 to 23.9 ft-lb)

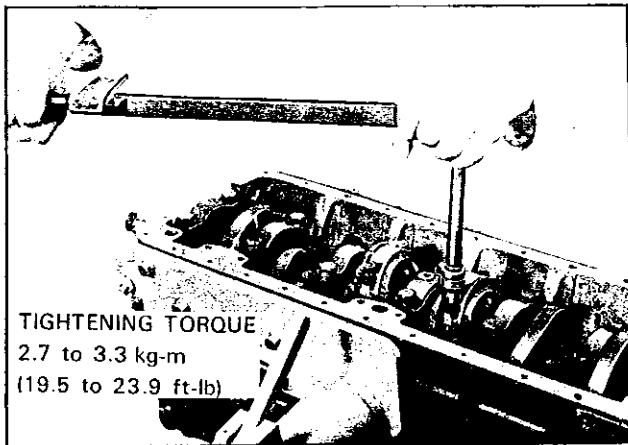


Fig. EM-80 Connecting rod cap installation

Note: Arrange connecting rods and connecting rod caps so that the cylinder number on them faces the same side.

13. Make sure of the end play of the connecting rod big end.

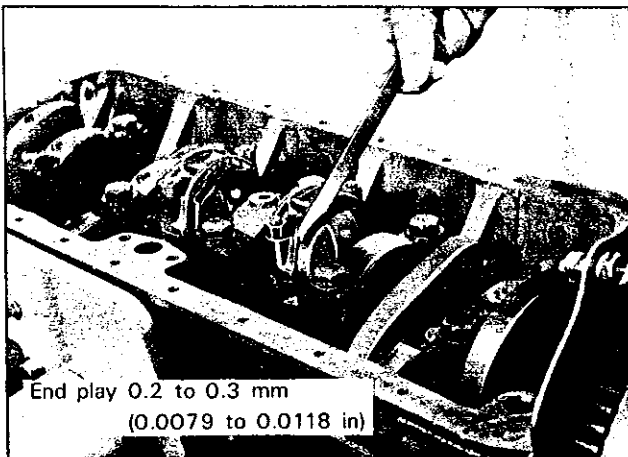


Fig. EM-81 Big end end play check

Big end end play: 0.20 to 0.30 mm
(0.0079 to 0.0118 in)

14. Install the cylinder head assembly.

Note: a. Spread sealing agent over the cylinder block surface. Place the gasket on it, and apply sealing agent to the gasket top.

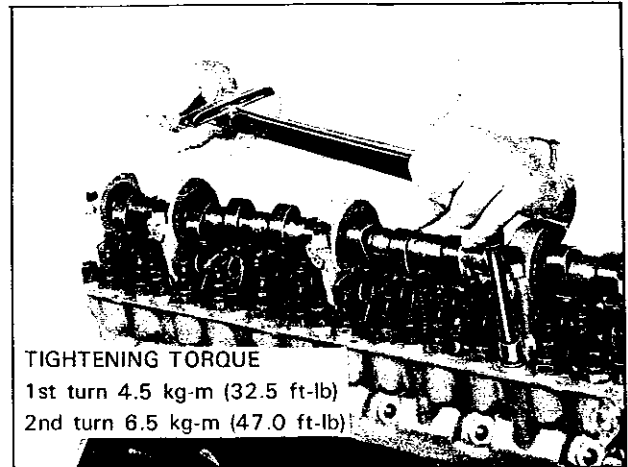


Fig. EM-82 Cylinder head installation

b. Tighten the head bolts to the specified torque. Three different types of bolts are used. (So be careful when installing.)

Tightening torque:

1st turn 4.5 kg-m (32.5 ft-lb)
2nd turn 6.5 kg-m (47.0 ft-lb)

Applicable special tool: ST10120000

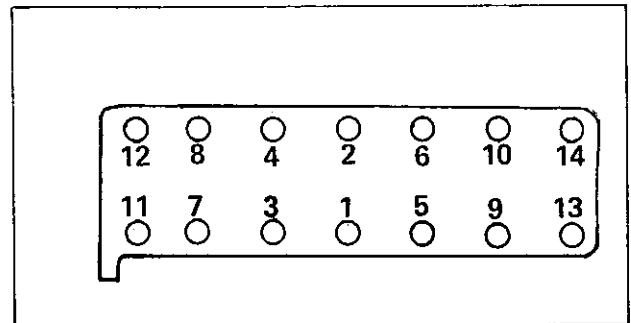


Fig. EM-83 Torque tightening sequence chart

Note: a. When installing the cylinder head, make sure that all the valves are apart from the head of the pistons.

b. Do not rotate the crankshaft and camshaft separately, because the valves will hit the head of the pistons.

15. Install the crankshaft sprocket and distributor drive gear and fit the oil throwers:

Note: Face the mating marks of the crankshaft sprocket forwards.

ENGINE MECHANICAL

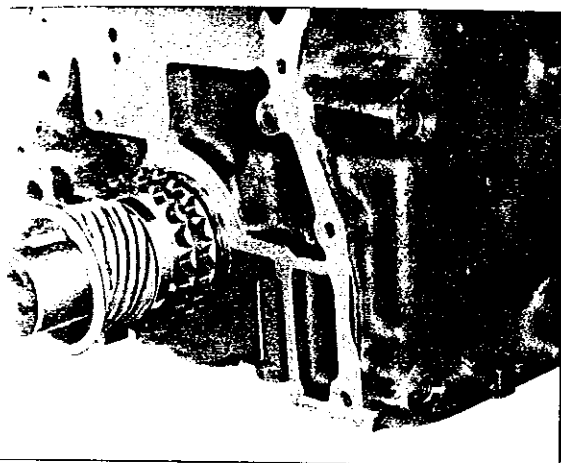


Fig. EM-84 Crankshaft sprocket and distributor drive gear

16. Install the chain guide to the cylinder block.
17. Install the timing chain and camshaft sprocket.

Note: a. Make sure that the crankshaft and camshaft keys point upwards.

b. Set the timing chain making its mating marks meet with those of the crankshaft sprocket and the camshaft drive sprocket at the right hand side. There are 42 chain links between two mating marks of the timing chain.

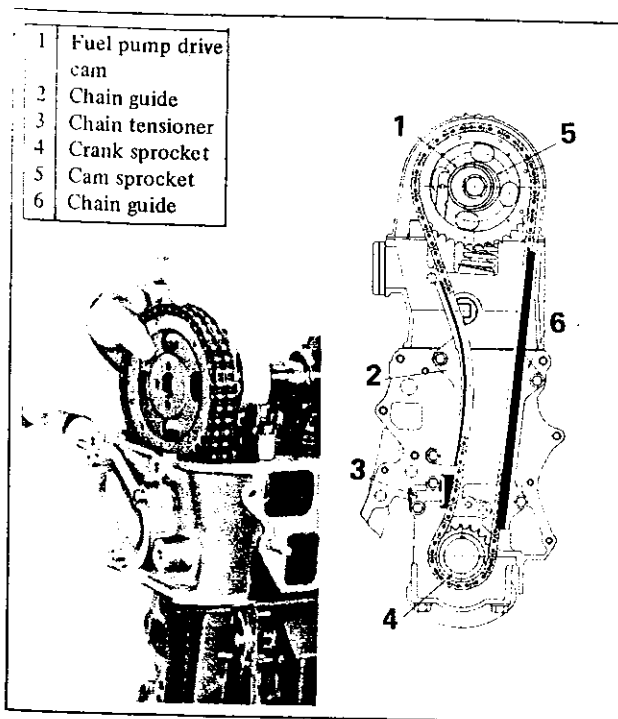
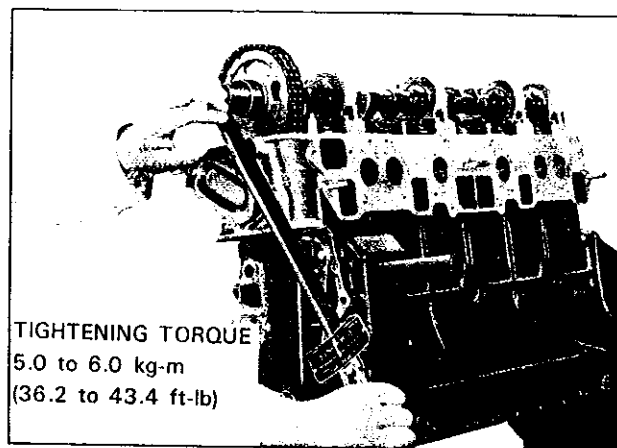


Fig. EM-85 Timing chain installation

18. Tighten the camshaft sprocket together with fuel pump cam to the specified torque.



TIGHTENING TORQUE
5.0 to 6.0 kg-m
(36.2 to 43.4 ft-lb)

Fig. EM-86 Fuel pump cam installation

19. Install the timing chain tensioner.
20. Press in the new oil seal to the front cover. (the front cover oil seal should be replaced when the front cover is disassembled.)
21. Install the front cover with the gasket in between.

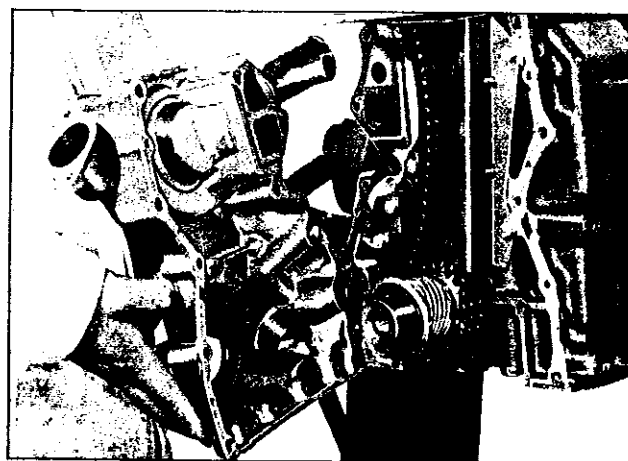


Fig. EM-87 Front cover installation

Note: Apply the sealing agent to the both surface of the gasket.

22. Install the crankshaft pulley and water pump, then set the No. 1 - piston to its T.D.C. of the compression stroke.

ENGINE

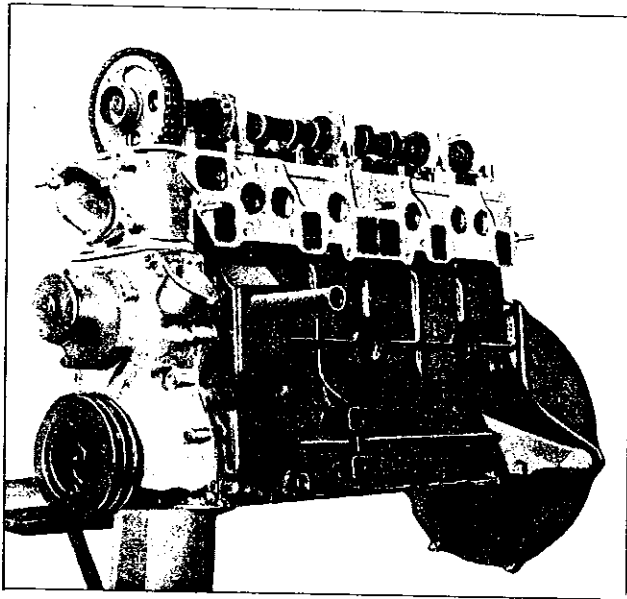


Fig. EM-88 Crankshaft pulley and water pump installation

23. Invert the engine and insert the oil pump and distributor driving spindle into the front cover.

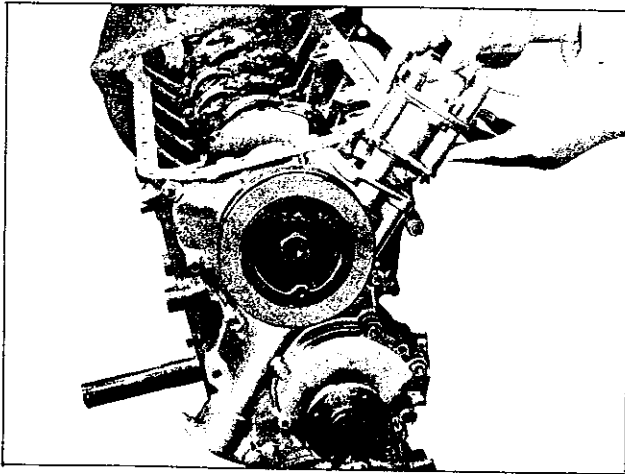


Fig. EM-89 Oil pump installation

Note: Install the driving spindle so as the projection on its top is located just in 11:25 a.m. position, at this time, the smaller bow-shape will be placed toward the front.

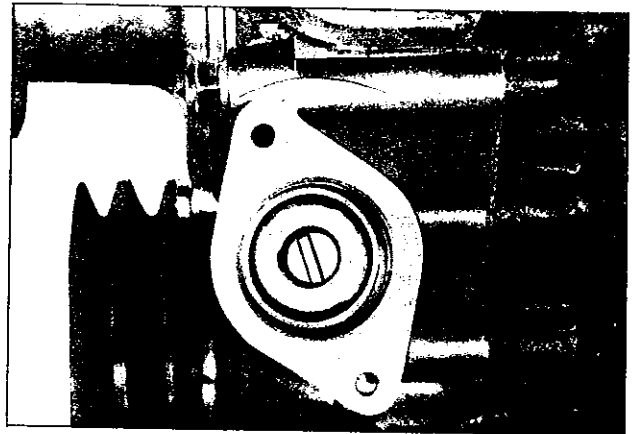


Fig. EM-90 Setting the distributor driving spindle

24. Install the oil strainer and the oil pan using the gasket.

Apply the sealing agent on the both surface of the gasket especially on the front and rear positions of oil pan.

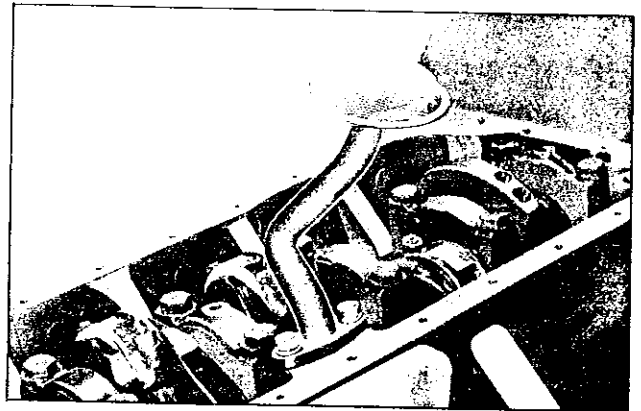


Fig. EM-91 Oil strainer installation

25. Invert the engine and install the fuel pump, water inlet elbow, thermostat housing front, thermostat, and the water outlet elbow in their position.

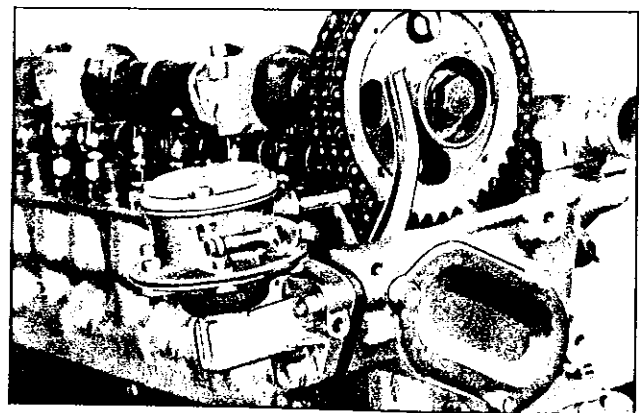


Fig. EM-92 Fuel pump installation

ENGINE MECHANICAL

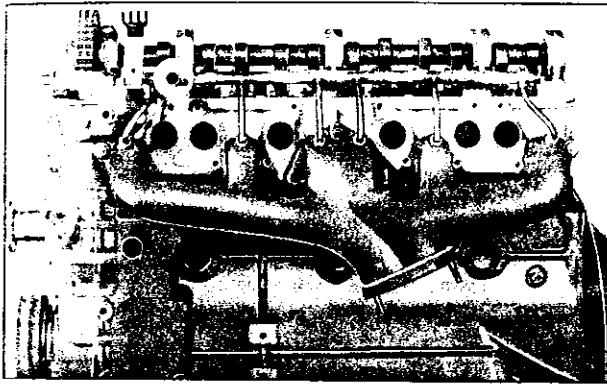


Fig. EM-93 Exhaust manifold installation

26. Install the engine slingers, exhaust manifold.
27. Install the intake manifold with carburetor and heat shield plate.

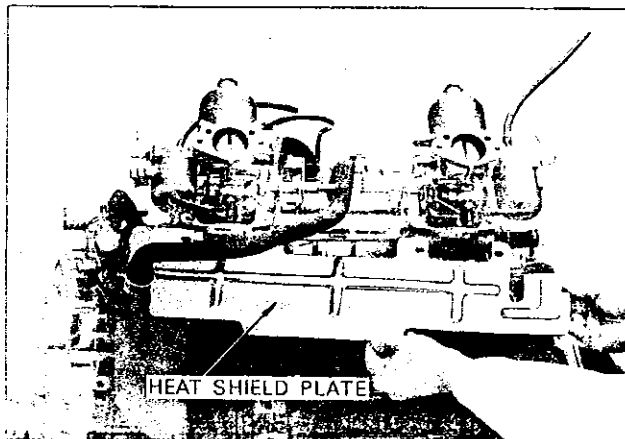


Fig. EM-94 Heat shield plate installation

28. Adjust the valve clearance with the specified dimensions.

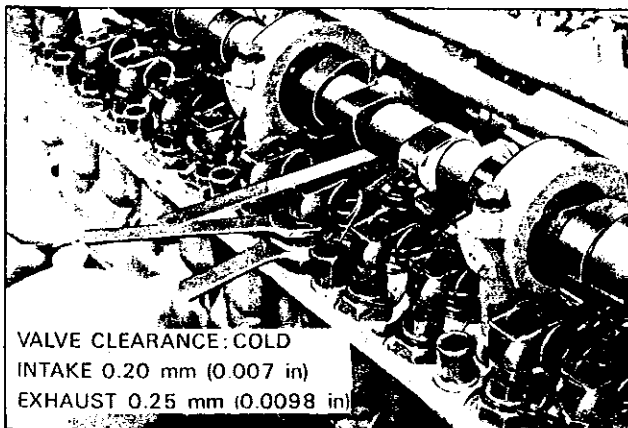


Fig. EM-95 Valve clearance adjustment

29. Install the oil pipe.
30. Install the rocker cover.

Note: Bond the gasket to the rocker cover using the before-mentioned sealing agent.
Then, install the rocker cover to the head.

31. Install the fuel line and heater hoses.
32. Install the air pump (for L24 engine with emission control system).
33. Install all spark plugs.
34. Install the distributor assembly.

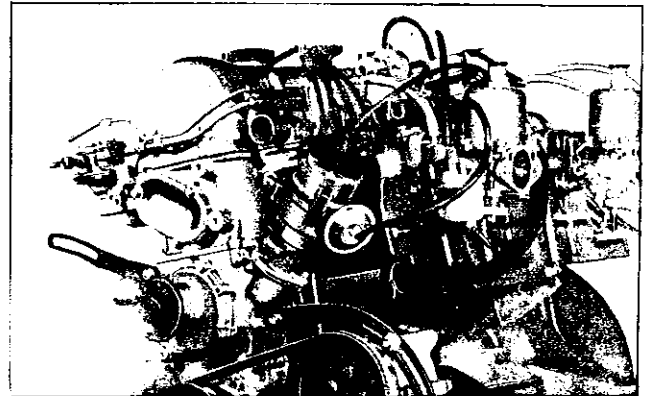


Fig. EM-96 Distributor installation

35. Install the cooling fan and the air cleaner.

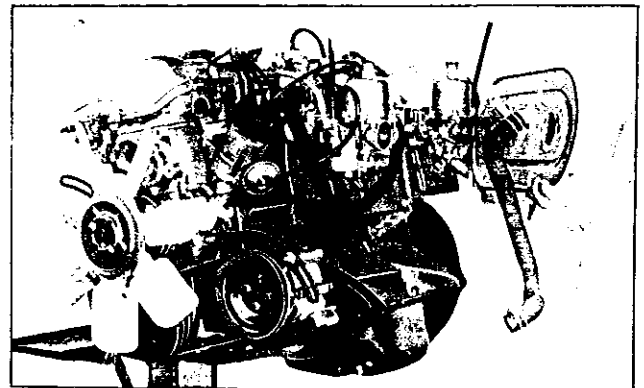


Fig. EM-97 Air cleaner installation

36. Install the clutch assembly.
37. Dismount the engine assembly from the working stand. Install the alternator bracket, alternator, engine mountings, oil filter, oil pressure switch, and oil level gauge, etc.

ENGINE

SERVICE DATA AND SPECIFICATIONS

CONTENTS

GENERAL SPECIFICATION	EM-34	SPECIFICATIONS	EM-35
TIGHTENING TORQUE	EM-34		

GENERAL SPECIFICATION

Model	L20A	L24	
Cylinder arrangement	6 in line	6 in line	
Displacement	1,998 cc (121.9 cu in)	2,393 cc (146.0 cu in)	
Bore and stroke	78 x 69.7 mm (3.071 x 2.744 in)	83 x 73.7 mm (3.268 x 2.902 in)	
Valve arrangement	OHC	OHC	
Maximum brake horsepower	115 HP/5,600 rpm	151 HP/5600 rpm	} SU twin
Maximum gross torque	16.6 kg-m (120.0 ft-lb)/4,000 rpm	20.1 kg-m (145.7 ft-lb)/4,400 rpm	
		130 HP/5,600 rpm	} Single
		20.0 kg-m (144.9 ft-lb)/3,600 rpm	
Firing order	1-5-3-6-2-4	1-5-3-6-2-4	
Engine idle rpm	700	750	
Compression ratio	9.4 : 1	9.0 : 1 (SU twin) 8.55 : 1 (Single)	
Engine idle manifold vacuum	450 mmHg (17.7 in Hg)/550 rpm		
Oil pressure (Hot at 2,000 rpm)	3.5 to 4.0 kg/cm ² (49.7 to 56.8 lb/sq in)		

TIGHTENING TORQUE

Cylinder head bolts	1st turn	4.5 kg-m (32.5 ft-lb)
	2nd turn	6.5 kg-m (47.0 ft-lb)
Connecting rod big end nuts	2.7 to 3.3 kg-m (19.5 to 23.9 ft-lb)	
Flywheel fix bolts	14.0 kg-m (101.2 ft-lb)	
Main bearing cap bolts	4.5 to 5.5 kg-m (32.5 to 39.8 ft-lb)	
Camshaft gear bolt	5.0 to 6.0 kg-in (36.2 to 43.4 ft-lb)	
Oil pan	0.4 to 0.8 kg-m (2.9 to 5.8 ft-lb)	
Oil pump	1.5 to 2.1 kg-m (10.8 to 15.2 ft-lb)	
Oil strainer	0.8 to 1.2 kg-m (5.78 to 8.7 ft-lb)	
Crank pulley bolt	16.0 to 18.0 kg-m (115.7 to 130.1 ft-lb)	

ENGINE MECHANICAL

SPECIFICATIONS

a) Valve mechanism		L20A and L24	
Valve clearance (Hot)	.....	In. 0.25 mm (0.0098 in) Ex. 0.30 mm (0.0118 in)	
Valve clearance (Cold)	.....	In. 0.20 mm (0.0079 in) Ex. 0.25 mm (0.0098 in)	
		L20A and L24 (Single carb.)	L24 (Twin carb.)
Valve head dia.	- Intake	38 mm (1.50 in)	42 mm (1.65 in)
	- Exhaust	33 mm (1.30 in)	33 mm (1.30 in)
Valve stem dia.	- Intake	8 mm (0.31 in)	8 mm (0.31 in)
	- Exhaust	8 mm (0.31 in)	8 mm (0.31 in)
Valve length	- Intake	110.7 mm (4.36 in)	110.7 mm (4.36 in)
	- Exhaust	110.7 mm (4.36 in)	110.7 mm (4.36 in)
Valve lift	.....	10.5 mm (0.413 in)	10.5 mm (0.413 in)
Valve spring free length	- Outer	47.75 mm (1.88 in)	49.98 mm (1.97 in)
	- Inner	44.68 mm (1.76 in)	44.85 mm (1.76 in)
Valve spring loaded length	- Outer	30.0 mm/43.0 kg (1.18 in/94.80 lb)	29.5 mm/49.0 kg (1.16 in/108.03 lb)
	- Inner	25.0 mm/19.6 kg (0.98 in/43.21 lb)	24.5 mm/25.5 kg (0.96 in/56.22 lb)
Valve spring assembled height	- Outer	40.0 mm/16.6 kg (1.57 in/36.60 lb)	40.0 mm/21.3 kg (1.57 in/46.96 lb)
	- Inner	35.0 mm/9.6 kg (1.38 in/21.16 lb)	35.0 mm/12.3 kg (1.38 in/27.12 lb)
Valve spring effective turns	- Outer	5.0	5.0
	- Inner	5.5	5.5
Valve spring wire dia.	- Outer	4.0 mm (0.16 in)	4.0 mm (0.16 in)
	- Inner	2.7 mm (0.10 in)	2.9 mm (0.11 in)
Valve spring coil dia.	- Outer	33.2 mm (1.31 in)	33.2 mm (1.31 in)
	- Inner	24.2 mm (0.95 in)	24.9 mm (0.98 in)
		L20A and L24	
Valve guide length	- Intake	59.0 mm (2.32 in)	
	- Exhaust	59.0 mm (2.32 in)	
Valve guide height from head surface	.....	10.4 to 10.6 mm (0.41 to 0.42 in)	
Valve guide inner dia.	- Intake	8.000 to 8.018 mm (0.3150 to 0.3154 in)	
	- Exhaust	8.000 to 8.018 mm (0.3150 to 0.3154 in)	
Valve guide outer dia. (standard)	- Intake	11.985 to 11.996 mm (0.4718 to 0.4723 in)	
	- Exhaust	11.985 to 11.996 mm (0.4718 to 0.4723 in)	

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Valve guide to stem clearance	- Intake	0.020 to 0.053 mm (0.0008 to 0.0021 in)
	- Exhaust	0.040 to 0.073 mm (0.0016 to 0.0029 in)
Valve seat width	- Intake	1.4 to 1.6 mm (0.055 to 0.0063 in)
	- Exhaust	1.8 to 2.2 mm (0.071 to 0.087 in)
Valve seat angle	- Intake	45°
	- Exhaust	45°
Valve seat interference fit	- Intake	0.08 to 0.11 mm (0.0031 to 0.0043 in)
	- Exhaust	0.06 to 0.10 mm (0.0024 to 0.0039 in)
Valve guide interference fit	.....	0.027 to 0.049 mm (0.0011 to 0.0019 in)
b) Camshaft and timing chain		
Camshaft end play	.....	0.08 to 0.38 mm (0.0031 to 0.0150 in)
Camshaft robe lift	.....	7.00 mm (0.275 in)
Camshaft journal dia.	- 1st	47.949 to 47.962 mm (1.8877 to 1.8883 in)
	- 2nd	47.949 to 47.962 mm (1.8877 to 1.8883 in)
	- 3rd	47.949 to 47.962 mm (1.8877 to 1.8883 in)
	- 4th	47.949 to 47.962 mm (1.8877 to 1.8883 in)
	- 5th	47.949 to 47.962 mm (1.8877 to 1.8883 in)
Camshaft bend	.....	0.05 mm (0.0020 in)
Camshaft journal to bearing clearance	.....	0.038 to 0.067 mm (0.0015 to 0.0026 in)
Camshaft bearing inner dia.	- 1st	48.000 to 48.016 mm (1.8898 to 1.8904 in)
	- 2nd	48.000 to 48.016 mm (1.8898 to 1.8904 in)
	- 3rd	48.000 to 48.016 mm (1.8898 to 1.8904 in)
	- 4th	48.000 to 48.016 mm (1.8898 to 1.8904 in)
	- 5th	48.000 to 48.016 mm (1.8898 to 1.8904 in)
c) Rocker arm lever ratio		
		1.50
d) Connecting rod		
Center distance	.....	132.97 to 133.08 mm (5.235 to 5.237 in)
Bearing thickness (S.T.D.)	.....	1.493 to 1.506 mm (0.0588 to 0.0593 in)
Big end end play	.....	0.20 to 0.30 mm (0.0079 to 0.0118 in)
Connecting rod bearing clearance	.....	0.014 to 0.066 mm (0.0006 to 0.0022 in)
Connecting rod bend (per 100 mm or 3.937 in)	.....	0.03 mm (0.0012 in)
e) Crankshaft and main bearing		
Journal dia.	.....	54.942 to 54.955 mm (2.1631 to 2.1636 in)
Journal taper & out of round	.....	less than 0.03 mm (0.0012 in)
Crankshaft free end play	0.05 to 0.18 mm (0.002 to 0.007 in)
Wear limit of dittoed play	0.3 mm (0.012 in)

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Crank pin dia.	49.961 to 49.974 mm (1.9670 to 1.9675 in)	
Crank pin taper & out of round	less than 0.03 mm (0.0012 in)	
Main bearing thickness	1.822 to 1.835 mm (0.0717 to 0.0722 in)	
Main bearing clearance	0.020 to 0.072 mm (0.0008 to 0.0028 in)	
Wear limit of dittoed clearance	0.12 mm (0.0047 in)	
Crankshaft bend	0.05 mm (0.0019 in)	
f) Piston		
	L20A	L24
Piston dia. -STD	77.915 to 77.965 mm (3.0675 to 3.0695 in)	82.99 to 83.04 mm (3.267 to 3.269 in)
Oversize 1	77.935 to 77.985 mm (3.0683 to 3.0702 in)	83.22 to 83.27 mm (3.276 to 3.278 in)
Oversize 2	78.165 to 78.215 mm (3.0774 to 3.0793 in)	83.47 to 83.52 mm (3.286 to 3.288 in)
Oversize 3	78.415 to 78.465 mm (3.0872 to 3.0892 in)	83.72 to 83.77 mm (3.296 to 3.298 in)
Oversize 4	78.665 to 78.715 mm (3.0970 to 3.0990 in)	83.97 to 84.02 mm (3.305 to 3.308 in)
Oversize 5	78.915 to 78.965 mm (3.1069 to 3.1089 in)	84.47 to 84.52 mm (3.326 to 3.328 in)
Ellipse difference	0.29 to 0.33 mm (0.011 to 0.0130 in)	0.32 to 0.35 mm (0.013 to 0.014 in)
	L20A and L24	
Ring groove width - Top	2.0 mm (0.08 in)	
- Second	2.0 mm (0.08 in)	
- Oil	4.0 mm (0.16 in)	
Piston to bore clearance	0.025 to 0.045 mm (0.0010 to 0.0018 in)	
Piston pin hole off-set	1 ± 0.05 mm (0.0394 ± 0.0020 in)	
g) Piston pin		
Pin dia.	20.995 to 21.000 mm (0.8266 to 0.8268 in)	
Pin length	66.40 to 66.65 mm (2.6142 to 2.6240 in) ...	L20A
	72.00 to 72.25 mm (2.8346 to 2.8445 in) ...	L24
Piston pin to piston clearance	0.008 to 0.010 mm (0.0003 to 0.0004 in)	
Interference fit of piston pin to connecting rod bushing	0.015 to 0.033 mm (0.0006 to 0.0013 in)	
h) Piston ring		
Ring height - Top	2.0 mm (0.0787 in)	
- Second	2.0 mm (0.0787 in)	
- Oil	4.0 mm (0.1575 in)	

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		L20A	L24
Side clearance	- Top	0.040 to 0.078 mm (0.0016 to 0.0031 in)	0.045 to 0.078 mm (0.0018 to 0.0031 in)
	- Second	0.030 to 0.068 mm (0.0012 to 0.0027 in)	0.030 to 0.063 mm (0.0012 to 0.0025 in)
	- Oil	0.025 to 0.068 mm (0.0010 to 0.0027 in)	0.025 to 0.063 mm (0.0010 to 0.0025 in)
Ring gap	- Top	0.20 to 0.35 mm (0.008 to 0.014 in)	0.23 to 0.38 mm (0.0091 to 0.0150 in)
	- Second	0.14 to 0.29 mm (0.006 to 0.011 in)	0.15 to 0.30 mm (0.0059 to 0.0118 in)
	- Oil	0.14 to 0.29 mm (0.006 to 0.011 in)	0.15 to 0.30 mm (0.0059 to 0.0118 in)

TROUBLE DIAGNOSES AND CORRECTIONS

Troubles	Possible causes	Corrective action
I. Noisy engine Knocking of crankshaft and bearing	Loose main bearing Seized bearing Bent crankshaft Uneven wear of journal Excessive crankshaft end play	Replace. Replace. Repair or replace. Correct. Replace center bearing.
Piston and connecting rod knocking	Loose bearing Seized bearing Loose piston pin Loose piston in cylinder Broken piston ring Improper connecting rod alignment	Replace. Replace. Replace pin or bushing. Recondition cylinder. Replace. Realign.
Camshaft knocking	Loose bearing Excessive axial play Rough gear teeth Broken cam gear	Replace. Replace bearing thrust plate. Repair. Replace.

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Timing chain noise	Improper chain tension Worn and/or damaged chain Worn sprocket Worn and/or broken tension adjusting mechanism Excessive camshaft and bearing clearance	Adjust. Replace. Replace. Replace. Replace.
Camshaft and valve mechanism knocking	Improper valve clearance Worn adjusting screw Worn rocker face. Loose valve stem in guide Weakened valve spring Seized valve	Adjust. Replace. Replace. Replace guide. Replace. Repair or replace.
Water pump knocking	Improper shaft end play Broken impeller	Replace. Replace.
II. Other mechanical trouble		
Sticked valve	Improper valve clearance Insufficient clearance between valve stem and guide Weakened or broken valve spring Biting or damage of valve stem Poor fuel quality	Adjust. Clean stem or ream the guide. Replace. Replace or clean. Use good fuel.
Seized valve seat	Improper valve clearance Weakened valve spring Thin valve head edge Narrow valve seat Overheat Over speeding Sticked valve guide	Adjust. Replace. Replace valve. Refacing. Repair or replace. Drive under proper speed. Repair.
Excessively worn cylinder and piston	Shortage of engine oil Dirty engine oil Poor oil quality Overheat Wrong assembly of piston with connecting rod	Add or replace oil. Clean crankcase, replace oil and oil filter element. Use right oil. Repair or replace. Repair or replace.

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	<p>Improper correct piston ring clearance</p> <p>Broken piston ring</p> <p>Dirty air cleaner</p> <p>Too rich mixture</p> <p>Engine over run</p> <p>Sticked choke valve</p> <p>Overchoking</p>	<p>Adjust.</p> <p>Replace.</p> <p>Clean periodically.</p> <p>Adjust.</p> <p>Drive under proper speed.</p> <p>Clean and adjust.</p> <p>Start correct way.</p>
Defective connecting rod	<p>Shortage of engine oil</p> <p>Low oil pressure</p> <p>Poor engine oil quality</p> <p>Rough surface of crankshaft</p> <p>Clogged oil passage</p> <p>Wear or eccentricity of bearing</p> <p>Wrong assembly of bearing</p> <p>Loose bearing</p> <p>Incorrect connecting rod alignment</p>	<p>Add oil or replace.</p> <p>Correct.</p> <p>Use right oil.</p> <p>Grind and replace bearing.</p> <p>Clean.</p> <p>Replace.</p> <p>Repair.</p> <p>Replace.</p> <p>Repair or replace.</p>
Defective crankshaft bearing	<p>Shortage of engine oil</p> <p>Low oil pressure</p> <p>Poor engine oil quality</p> <p>Wear or out of round of crankshaft journal</p> <p>Clogged oil passage in crankshaft</p> <p>Wear or eccentricity of bearing</p> <p>Wrong assembly of bearing</p> <p>Not concentric crankshaft or bearing</p>	<p>Add or replace.</p> <p>Adjust.</p> <p>Use right oil.</p> <p>Repair.</p> <p>Clean.</p> <p>Replace.</p> <p>Repair.</p> <p>Replace.</p>

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

ENGINE MECHANICAL

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

**SERVICE
MANUAL**

**MODEL
L20A, L24 SERIES
ENGINE**



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EL

**ENGINE LUBRICATION
SYSTEM**



LUBRICATING SYSTEMEL- 1

ENGINE LUBRICATING SYSTEM

LUBRICATING SYSTEM

CONTENTS

DESCRIPTION	EL-1	Installation	EL-2
LUBRICATION CIRCUIT	EL-1	Disassembly and reassembly	EL-2
OIL PUMP	EL-2	Inspection and repair	EL-3
Description	EL-2	OIL PRESSURE RELIEF VALVE	EL-3
Removal	EL-2	OIL FILTER	EL-3

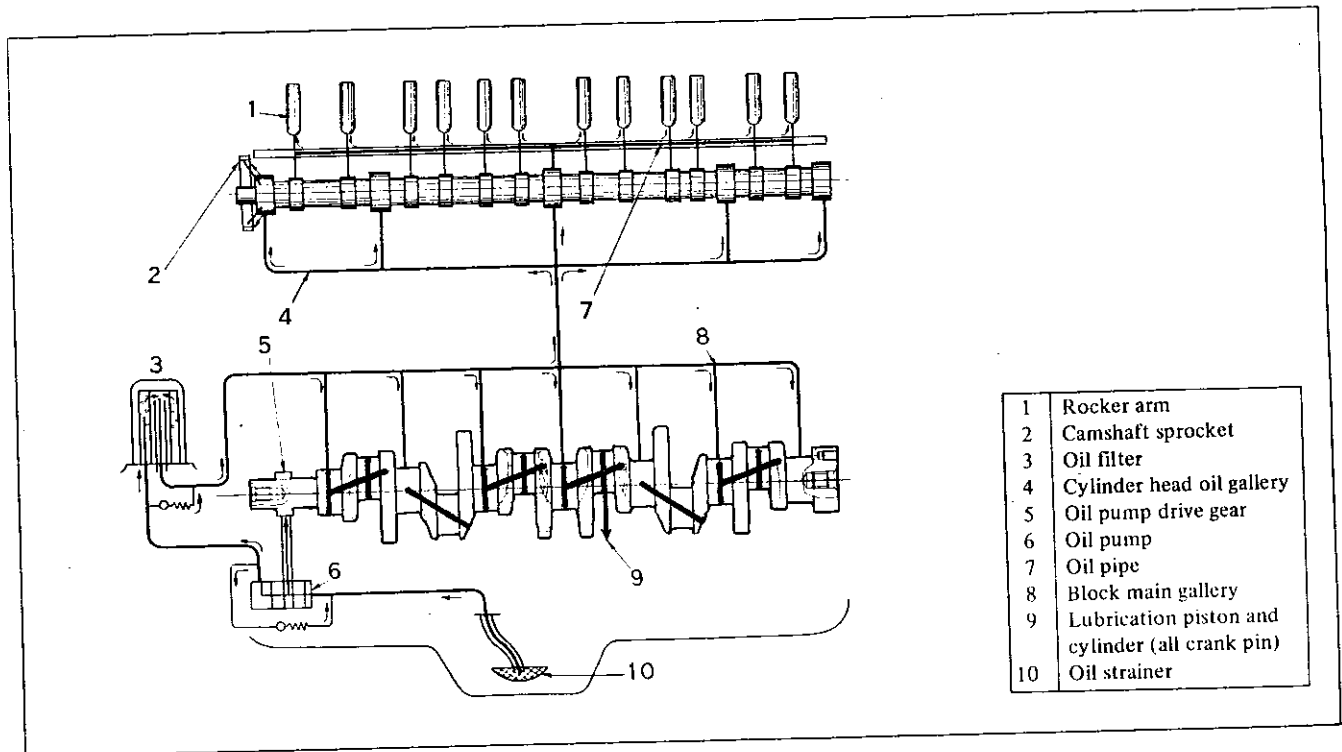


Fig. EL-1 Lubrication circuit

DESCRIPTION

The lubricating system is of a Pressure-feed type, and is composed of highly efficient functional components suited for high performance, i.e. high out-put and high speed running.

L20A and L24 engines adopt the same lubricating system.

LUBRICATION CIRCUIT

Oil drawn from the oil pan through the inlet screen and

tube to the inlet side of the oil pump is delivered by the oil pump through the outlet and the oil gallery to the inlet side of the full flow oil filter and to the main oil gallery.

The main oil gallery supplies oil to the crankshaft main bearings and drilled passages in the crankshaft, and thus, oil is fed directly from the main bearings to the connecting rod bearings.

Oil injected from jet holes on the connecting rods lubricates the cylinder walls and piston pins.

In L20A and L24 engines, the oil distributed from the main gallery enters the chain tensioner, and the pad is

ENGINE

held against the chain by oil pressure and spring. The oil also lubricates the timing chain through the jet located near the chain.

Furthermore, lubricant is supplied to the cylinder head main oil gallery through the crankshaft center bearing, and oil is fed to the camshaft bearings on the cylinder head directly from this gallery.

The rocker mechanism is lubricated under two types of lubricating methods.

In L20A and L24 engines, the rocker arm and valve are lubricated intermittently by the oil fed through the oil gallery in the camshaft and the small channel at the base circle portion of each cam.

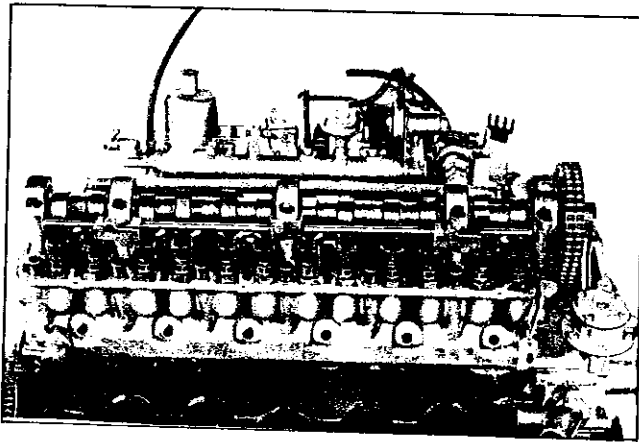


Fig. EL-2 Cylinder head lubrication for L24 engine (model S30)

Lubricant is supplied to this oil pipe through No. 3 camshaft bearing, and the rocker arm and valve are lubricated intermittently by the oil through the small holes or the oil pipe.

OIL PUMP

Description

The oil pump assembly is installed to the bottom of the front cover (by four bolts) and driven by the distributor drive shaft assembly. The oil pump is a rotor type. The oil pressure is regulated by the regulator valve. A slot provided at the top of the drive rotor is engaged with a dog clutch at the lower end of the distributor drive shaft assembly.

The oil pump is thus operated by a gear on the crankshaft through the distributor drive shaft assembly.

Removal (Engine in vehicle)

1. Detach the distributor.
2. Drain engine oil.
3. Remove the splash shield board.
4. Detach the oil pump body together with drive gear spindle.

Installation

Before installing the oil pump in the engine, set the crankshaft to T.D.C. position of No. 1 cylinder for its relation with the distributor. Install the oil pump together with the drive gear spindle in the front cover. Be sure that the punched mark on the drive gear spindle is faced to the front of engine.

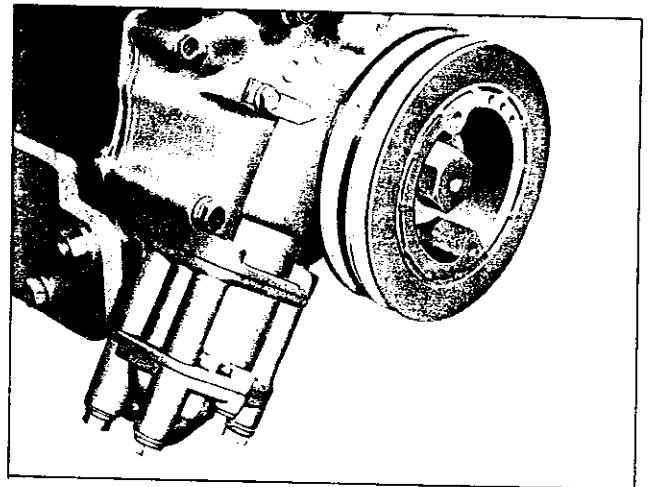


Fig. EL-3 Oil pump installation

Make sure that the engagement is in order by checking at the end of the spindle through the distributor fitting hole.

Tighten the bolts used to connect the oil pump to the front cover.

Disassembly and reassembly

Separate the body cover from the oil pump body by unscrewing one secure bolt, and take out pump drive and driver gears from the pump body.

Assemble the oil pump carefully and do not turn up the oil pump cover gasket.

ENGINE LUBRICATING SYSTEM

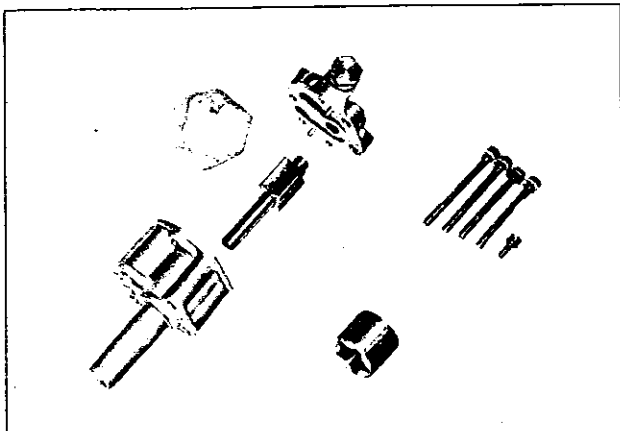


Fig. EL-4 Oil pump for L20A and L24 engine

Inspection and repair

Clean the disassembled parts with cleaning solvent, and inspect for defects.

Inspect the drive rotor shaft for excessive wear and scores and check the following clearances.

- Side clearance between 0.05 to 0.12 mm
outer and inner rotor (0.0020 to 0.0047 in)
- Tip clearance 0.12 mm (0.0492 in)
- Clearance between 0.15 to 0.21 mm
outer rotor and body (0.0059 to 0.083 in)

OIL PRESSURE RELIEF VALVE

The oil pressure relief valve is not adjustable. At the released position, the valve permits oil passing through a passage on the pump cover to the inlet side of the pump.

Measure the relief valve spring dimension to ensure that the spring is provided with the correct tension.

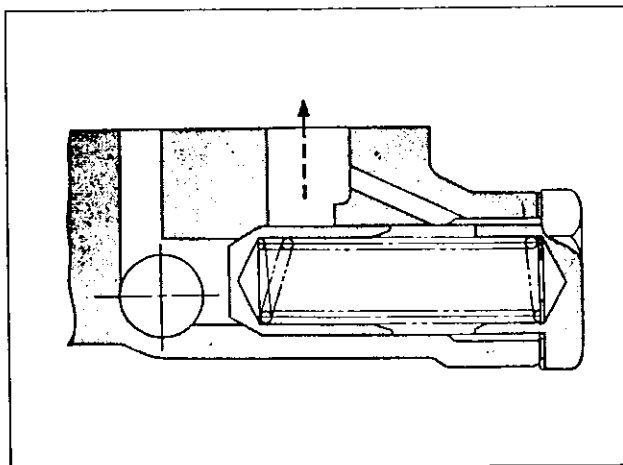


Fig. EL-5 Relief valve

Tightening torque

Oil pump mounting bolts	1.5 to 2.1 kg-m (10.8 to 15.2 ft-lb)
Cap nut-release valve	3.0 to 3.5 kg-m (21.7 to 25.3 ft-lb)

Specifications

Oil pressure at idling	1.0 to 1.2 kg/cm ² (14.2 to 17.1 lb/sq in)
Relief valve spring Free length Pressured length	57 mm (2.24 in) 39 mm (1.54 in)
Relief valve opening pressure	3.8 to 4.2 kg/cm ² (54.0 to 59.7 lb/sq in)

OIL FILTER

The oil filter is of an easy-to-handle cartridge type. Thus, the filler element can be readily removed and installed by hand.

The filter element and the filter body are caulked together. Interior cleaning is not necessary but the filter body with element must be replaced at every 10,000 km (6,000 miles).

When installing the oil filter, screw it to the cylinder blocks by hand.

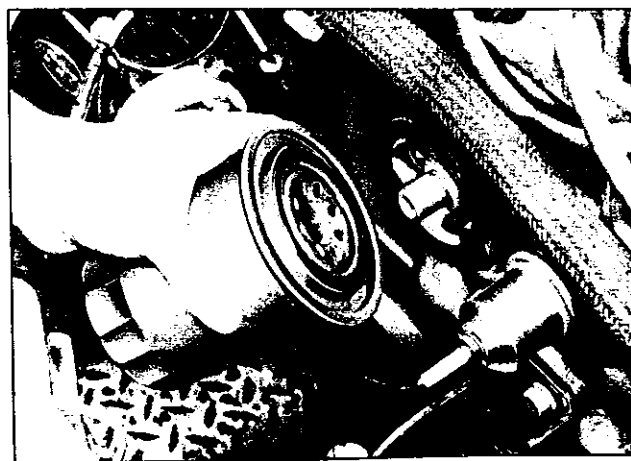


Fig. EL-6 Oil filter

Note: Do not tighten the filter excessively, otherwise oil leakage may occur.

ENGINE

SERVICE JOURNAL OR BULLETIN REFERENCE

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SECTION CO

COOLING SYSTEM

**MODEL
L20A, L24 SERIES
ENGINE**



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

COOLING SYSTEMCO- 1

COOLING SYSTEM

COOLING SYSTEM

CONTENTS

DESCRIPTION	CO-1	Removal	CO-4
WATER PUMP	CO-2	Inspection	CO-4
Removal	CO-2	Installation	CO-5
Disassembly	CO-2	RADIATOR	CO-5
Inspection	CO-2	Removal	CO-5
FAN	CO-3	Inspection	CO-5
THERMOSTAT	CO-4	SPECIFICATIONS	CO-6

DESCRIPTION

The cooling system is a closed pressure type with high cooling capability. Cooling water flowing through resistance-free water passages in the cylinder head and block is maintained at adequate temperature range at all

times by means of an ample capacity water pump, a corrugated fin type radiator with high cooling efficiency and a pellet type thermostat.

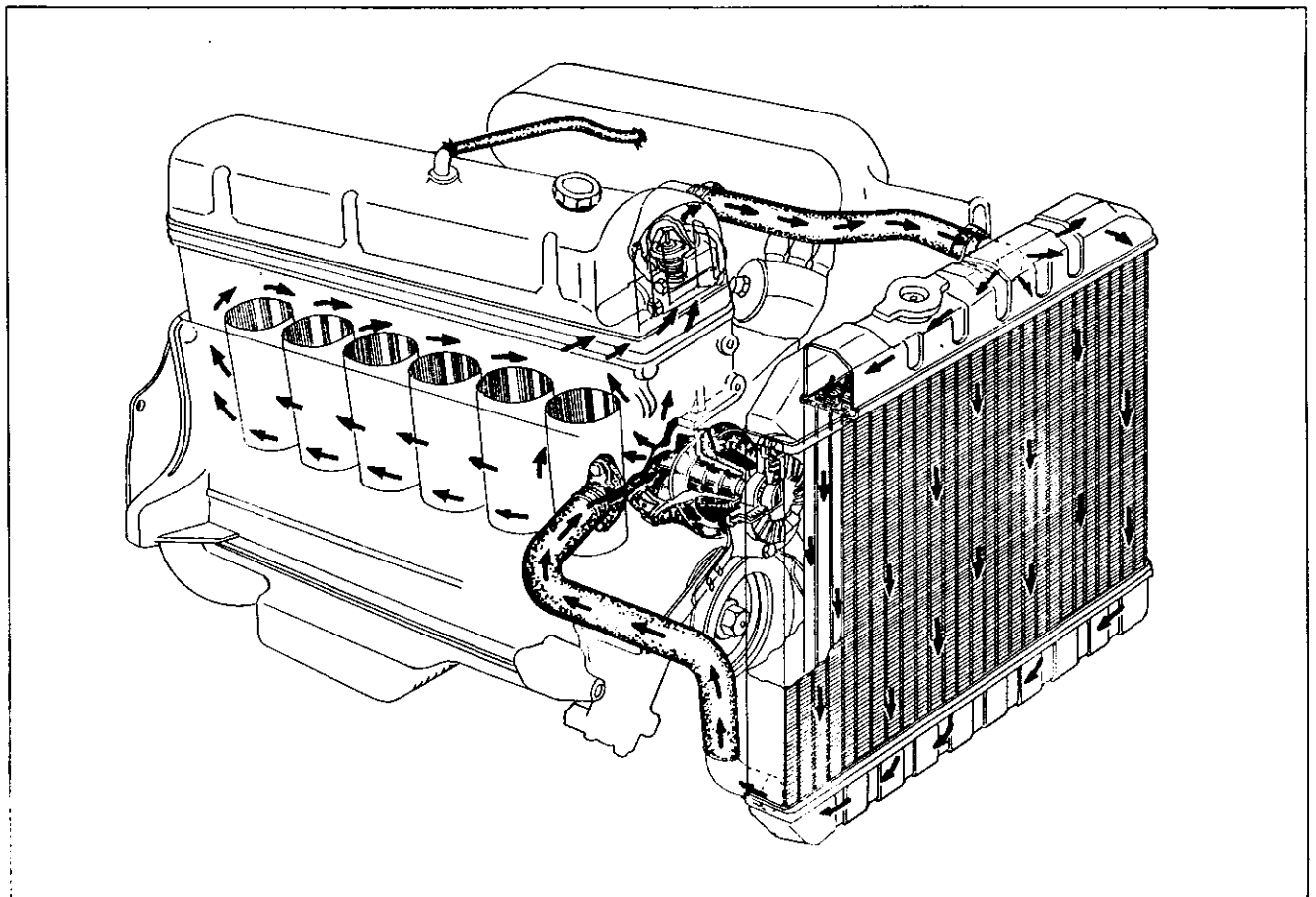


Fig. CO-1 Cooling system

ENGINE

WATER PUMP

The water pump is a centrifugal type water pump with an aluminum diecast pump body. The volute chamber is built in the front cover assembly and a high pressure sealing mechanism is adopted to prevent the water leakage and noise thoroughly.

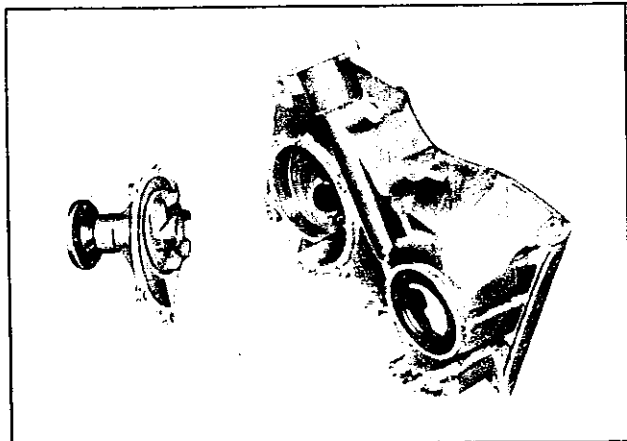


Fig. CO-2 Water pump and front cover

Removal



Fig. CO-3 Water pump removal

1. Drain cooling water completely.
2. Take the fan belt off the pulley.

3. Remove fan and pulley.
4. Remove the water pump.

Disassembly

Recommended the water pump be not disassembled by reason of an aluminum make.

Inspection

Pump body

- o Replace, if vanes are rusted or corroded considerably.
- o Replace, if it grows up excessive bearing noise or squeak with the engine running.

Note: To prevent squeak, use Nissan CSP (Cooling System Protector).

Prior to installing the pump, clean it with Nissan CSC (Cooling System Cleaner).

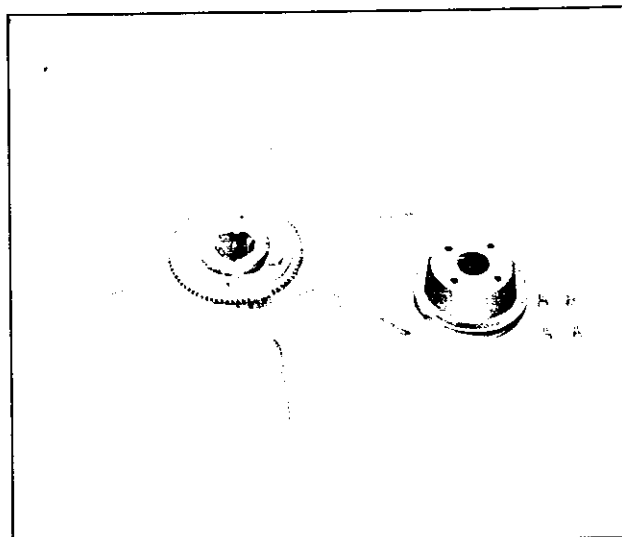


Fig. CO-4 Fan and coupling

COOLING SYSTEM

FAN

The conventional silicon coupling fan has been far improved, and the new fan is equipped with Tempatrol

coupling. (except HA30 series)

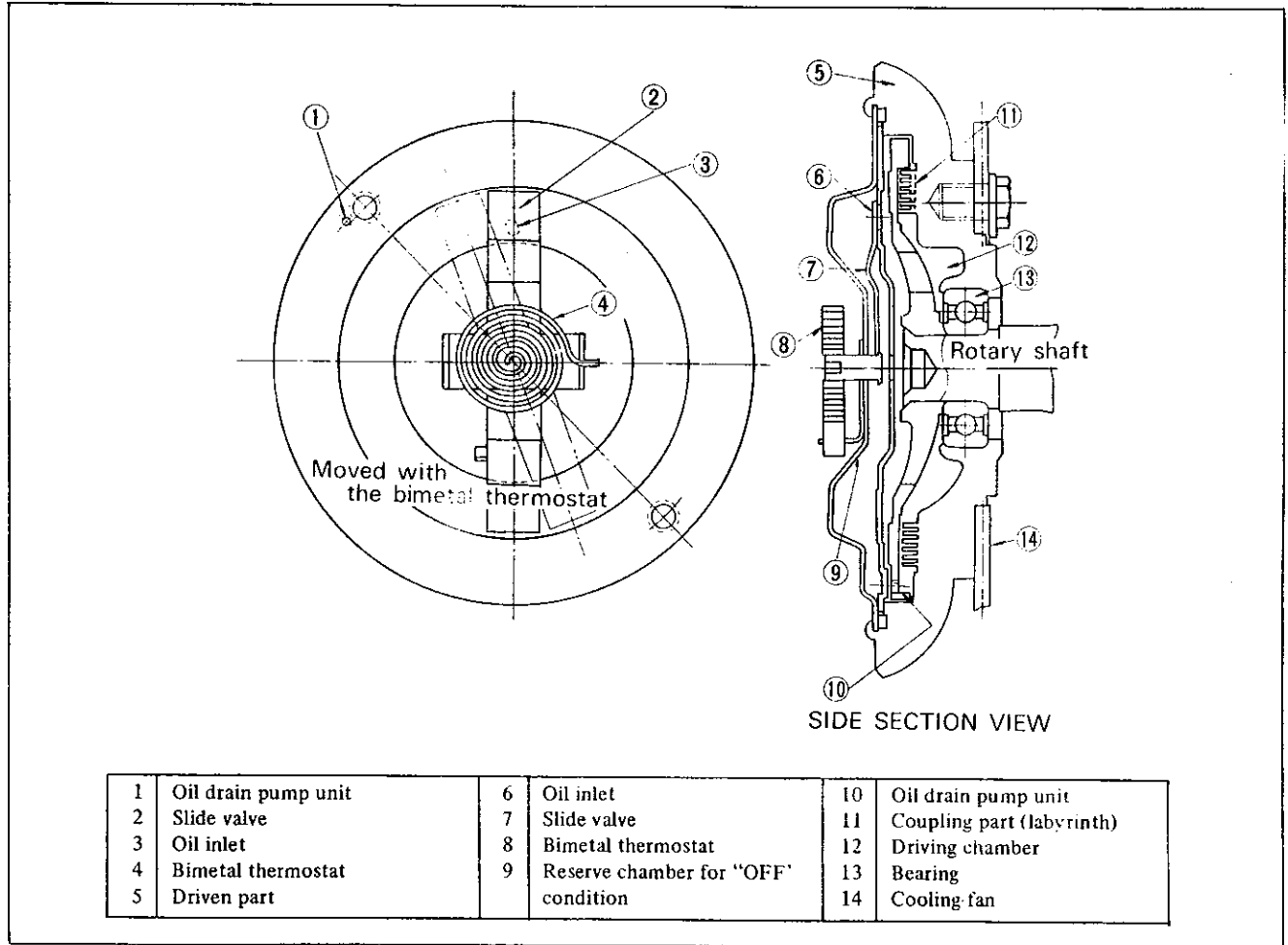


Fig. CO-5 Cross-sectional view of Tempatrol coupling

Tempatrol is a fan coupling which uses a temperature control system on the conventionally used fluid coupling

(silicon oil is used).

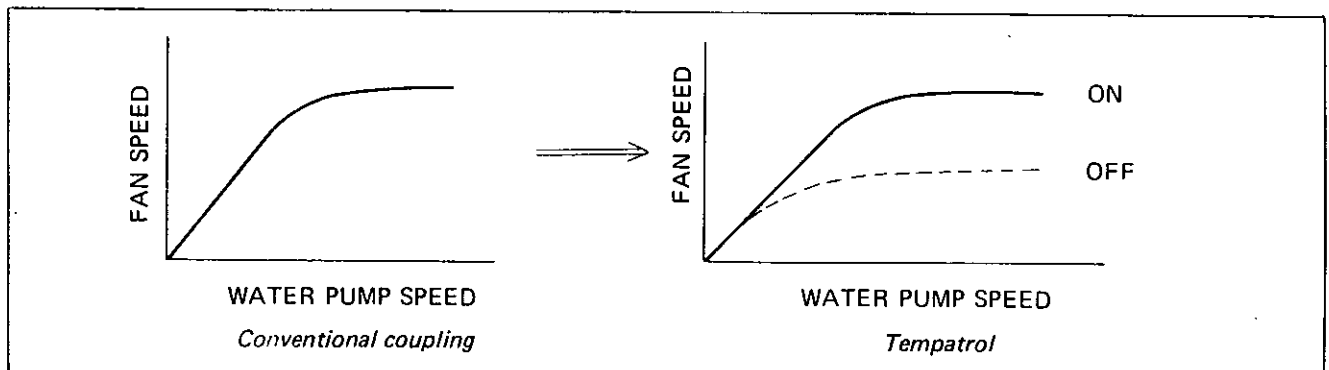


Fig. CO-6 Operating principle

ENGINE

The conventional coupling slips the fan at a high speed always under a constant ratio regardless of the engine cooling requirement.

Under the Tempatrol coupling, however, the slipping ratio is changed appropriately in response to the cooling requirement.

"ON" denotes that the cooling is required, and the fan operates upto approximately 2,500 rpm. When high cooling is not required (during cold season, engine warm up, etc.), however, the operation is placed under "OFF" condition, and the fan slips at approximately 1,600 rpm.

The coiled bimetal thermostat installed on the front center portion of the Tempatrol detects temperature of air passing through the radiator (The air temperature is directly relative to the engine water temperature.), the inside slide valve is opened or closed as required, and thus, the ON-OFF control is performed. When temperature rises, the bimetal is expanded, and the valve is opened, silicon oil is forwarded to the groove that transmits torque, and the system is placed under "ON" condition. When the valve closes, silicon oil is not supplied to the groove, oil in the groove is accumulated on the Tempatrol periphery due to the centrifugal force, and led into the reserve chamber. Now, oil is eliminated from the groove, and the system is placed under "OFF" condition. With the new system described above, when fan cooling is not required, the output loss is minimized, and noise can be far reduced.

THERMOSTAT

A pellet type thermostat is used in the water out-let passage to control the flow of coolant, providing fast engine warm-up and regulating coolant temperature. A wax pellet in the thermostat expands when heated and contracts when cooled. The pellet is connected through a piston to a valve and when the pellet is heated, pressure is exerted against a rubber diaphragm, forcing the valve to open. As the pellet is cooled, the contraction allows a spring to close the valve.

Removal

1. Drain cooling water.
2. Disconnect the radiator hose.
3. Remove the water out-let elbow, and take out the

thermostat.

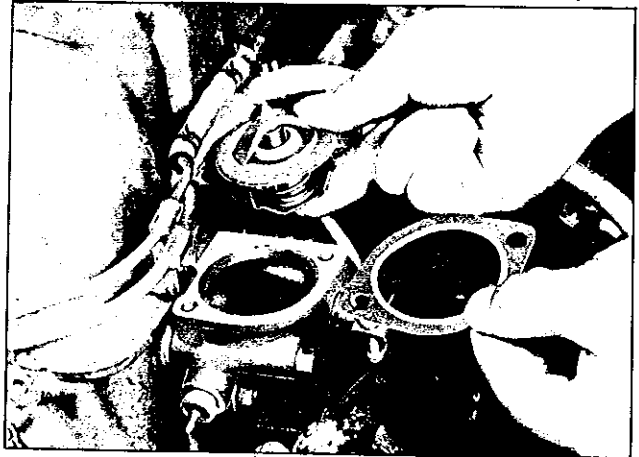


Fig. CO-7 Thermostat removal

Inspection

To test the thermostat for proper operating temperature, submerge the unit under water. Heat the water and observe the temperature.

1. Measure the temperature when the thermostat valve just starts rising.
2. Measure the maximum lift of the thermostat valve.

Valve open temperature:

$82^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ ($179.6^{\circ}\text{F} \pm 2.7^{\circ}\text{F}$)

Maximum valve lift:

above 8 mm at 95°C (0.315 in at 203°F)

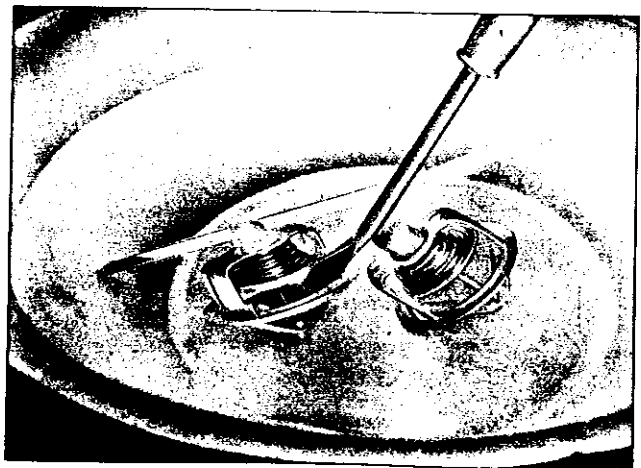


Fig. CO-8 Thermostat inspection

COOLING SYSTEM

Installation

1. When installing, apply adhesive to both sides of the packing for prevention of water leakage.
2. Reinstall the thermostat in reverse sequence of removal.

RADIATOR

The radiator is of a down flow type.

The system is placed under a pressure, and the relief valve, built in the radiator filler cap, controls the pressure at approximately 0.9 kg/cm² (12.8 lb/sq in).

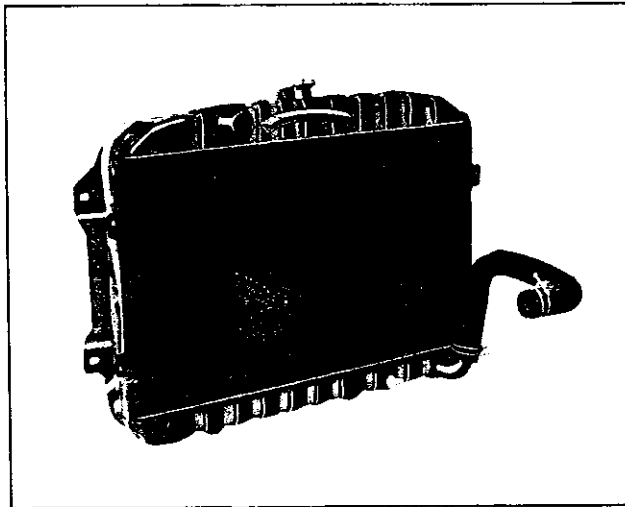


Fig. CO-9 Radiator

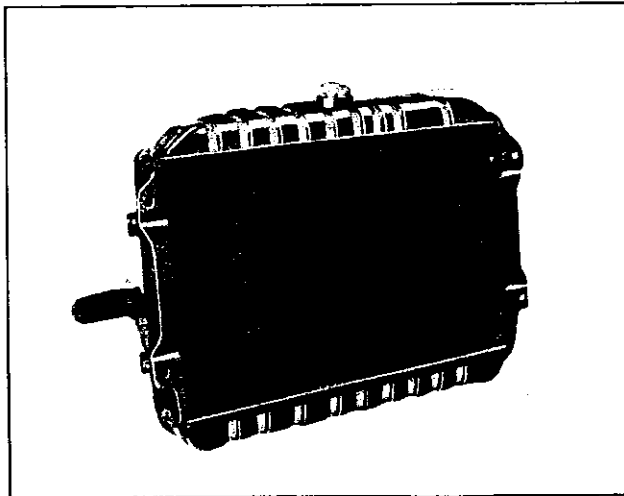


Fig. CO-10 Radiator

For the models with torque converter, the oil cooler is combined with the radiator to cool the torque converter oil.

Removal

1. Drain cooling water.
2. Disconnect radiator upper hose and lower the hose and the hose to the reservoir tank.
(The reservoir tank is used 130, HA30 series only.)
3. Remove four installation bolts and detach the radiator assembly.

Inspection

Check for water leakage and cracks using a cap tester. If such defects are detected, repair or replace the radiator assembly.

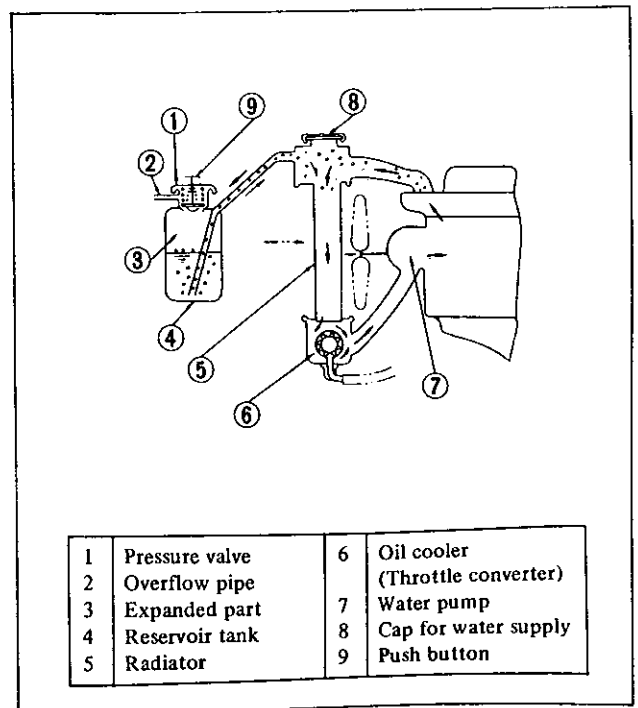


Fig. CO-11

ENGINE

SPECIFICATIONS

Model	130	HA30	S30
Engine	L20A, L24	L20A	L24
Dimensions of radiator core (Height x Width x Thickness)	395 x 558 x 38 mm (15.6 x 22.0 x 1.5 in)	350 x 600 x 32 mm (13.8 x 23.6 x 1.3 in)	350 x 600 x 38 mm (13.8 x 23.6 x 1.5 in)
Type	Corrugated fin type	←	←
Radiator fin pitch	2.3 mm (0.09 in)	2.5 mm (0.10 in)	2.5 mm (0.10 in)
Radiator capacity	more than 630 Kcal/h°C	more than 600 Kcal/h°C	more than 595 Kcal/h°C
Cap working pressure	0.9 kg/cm ² (13 lb/sq in)	←	←
Testing pressure	1.6 kg/cm ² (23 lb/sq in)	←	←
Water capacity	9.5 ℓ (2.5 US gal)	10.5 ℓ (2.8 US gal)	8.0 ℓ (2.1 US gal)

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

SERVICE

MODEL
L20A, L24 SERIES
ENGINE



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EF

FUEL SYSTEM

AIR CLEANER	EF- 1
FUEL STRAINER	EF- 2
FUEL PUMP	EF- 2
TWO BARREL CARBURETORS	EF- 5
SU TYPE TWIN CARBURETORS	EF-17

EF

FUEL SYSTEM

AIR CLEANER

DESCRIPTION

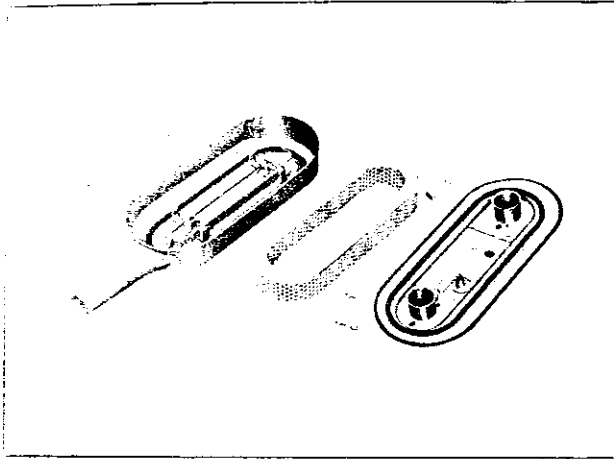


Fig. EF-1 Air cleaner for twin carburetor

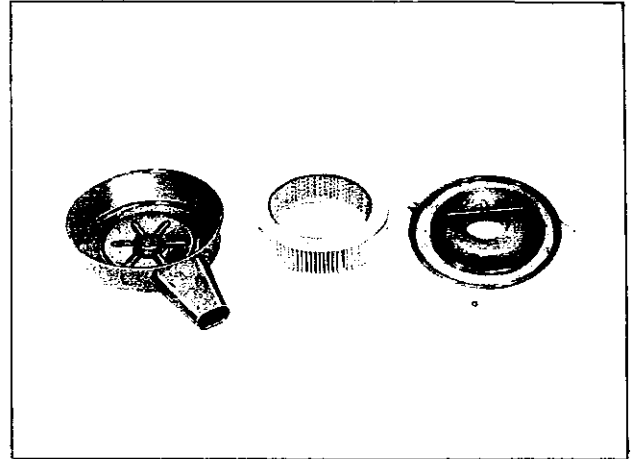


Fig. EF-2 Air cleaner for single carburetor

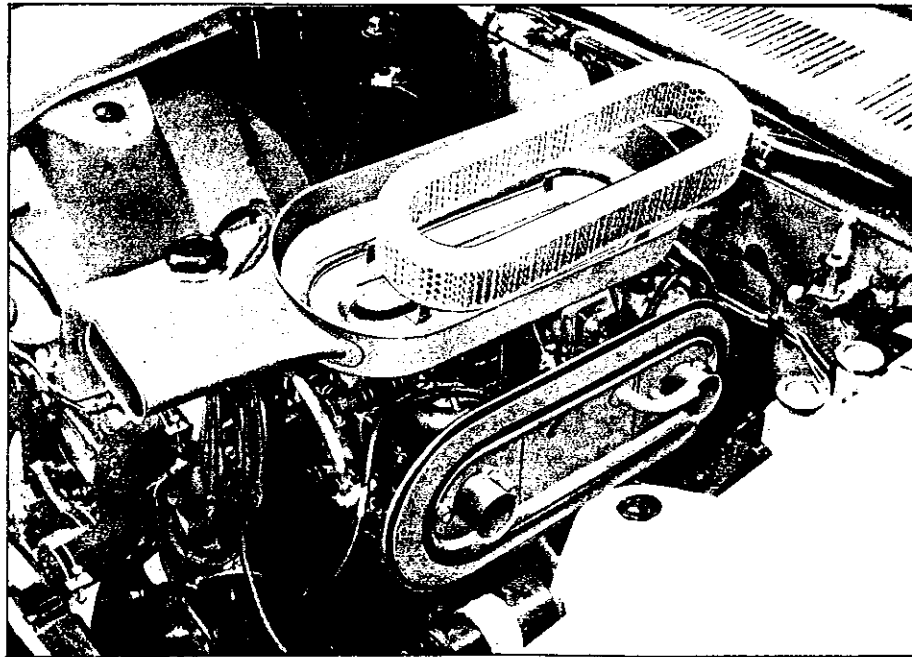


Fig. EF-3 Air cleaner for twin carburetor

The air filter elements used are viscous paper type elements and does not require any cleaning regardless of contamination until it is replaced at every 40,000 km (24,000 miles) of operation.

Note: Never treat the element by brushing or air blasting before the time for replacement!

ENGINE

FUEL STRAINER

DESCRIPTION

The fuel strainer is of the cartridge type strainer, and a fiber mat is used as a strainer element. This strainer should be replaced at intervals not to exceed 40,000 km (24,000 miles).

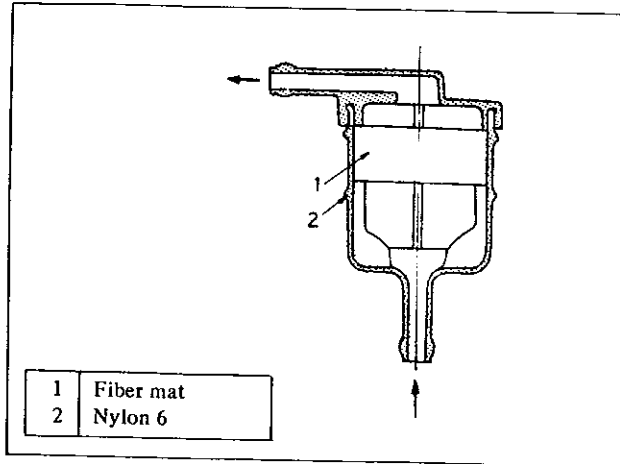


Fig. EF-4 Sectional view of cartridge type fuel strainer

The strainer element in both types can be seen through the bowl for convenience of checking the element's condition without removal.

REMOVAL

Disconnect the inlet and outlet fuel pipes, and the fuel strainer assembly is easily removed.

SERVICE REFERENCE

This fuel strainer has no pet cocks, therefore the strainer, carburetor lines, and fuel pump should not be removed or cleaned when the tank is full, unless absolutely necessary. If required, place the tube, at the rear of the strainer, above the top of the fuel tank.

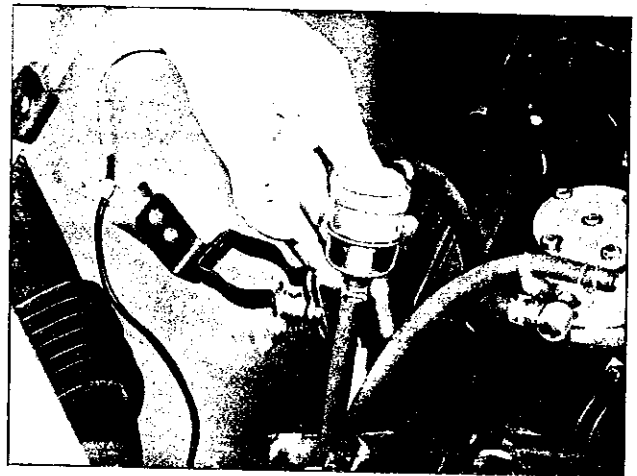


Fig. EF-5 Cartridge type fuel strainer

FUEL PUMP

CONTENTS

DESCRIPTION	EF- 2	REMOVAL AND DISASSEMBLY	EF- 4
FUEL PUMP TESTING	EF- 3	INSPECTION	EF- 4
Static pressure test	EF- 3	ASSEMBLY	EF- 5
Capacity test	EF- 3		

DESCRIPTION

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

The fuel pump consists of a body, rocker arm and link assembly, fuel diaphragm, fuel diaphragm spring, seal,

inlet and outlet valves.

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

FUEL SYSTEM

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 gasoline in the tank when carrying out the tests.

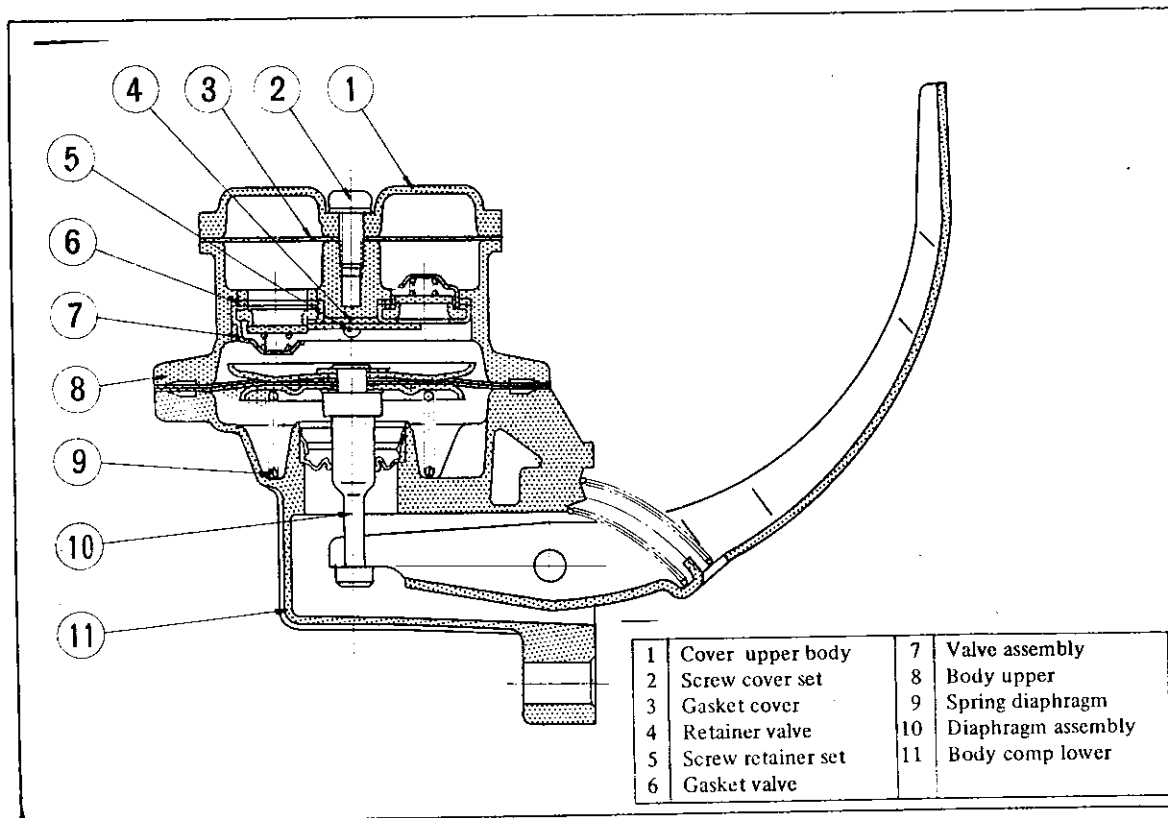


Fig. EF-6 Sectional view of fuel pump

Static pressure test

The static pressure test is made as follows:

1. Disconnect the carburetor fuel line at the carburetor.
2. Install the necessary adapter and "tee" fitting to the fuel line and attach a suitable pressure gauge.
3. Start and run engine at varying speeds.
4. The reading on the gauge is the static fuel pressure and this should remain within the following limits:

0.24 to 0.30 kg/cm² (3.41 to 4.27 lb/sq in)

Pressure below the lower limit indicates extreme wear on one part or a small amount of wear on each working

part. They also indicate a 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 diaphragm return spring or a diaphragm that is too tight. Both of these conditions require the removal of the pump assembly for replacement or repair.

Capacity test

The capacity test is used only if the static pressure test is within specifications, and is made as follows:

1. Disconnect the fuel pipe at carburetor.

ENGINE

2. Place a suitable container at the end of the pipe.
3. Start the engine and run at 1,000 rpm of the camshaft.
4. The pump should deliver 1600 cc (3.71 US pts) of fuel in one minute or less.

If no gasoline, or only a little flows from open end of pipe then the fuel pipe is clogged or the pump is malfunctioning. Before removing the pump, remove the gas tank cap, disconnect both inlet and outlet pipes and blow through them with an air hose to make sure they are clean.

This will eliminate the possibility of a clogged gas strainer in the fuel tank. Reconnect pipes to pump and retest flow.

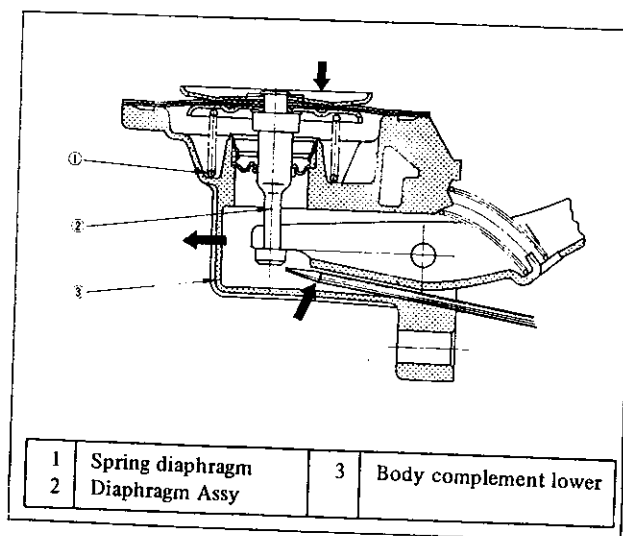


Fig. EF-7 Pull rod removal

REMOVAL AND DISASSEMBLY

Remove the fuel pump assembly by unscrewing the three mounting bolts and disassembly in the following order.

1. Separate the upper body and the lower body by unscrewing the body set screws.
2. Take off the cap and the cap gasket by removing the cap screws.
3. Unscrew the elbow and the connector.
4. Take off the valve retainer by unscrewing the two valve retainer screws and two valves are easily removed.
5. To remove the diaphragm, the diaphragm spring, the lower body seal washer and the lower body seal from the lower body, press down the diaphragm counter to the force of the diaphragm spring and while doing this, cant the diaphragm so that the rectangular part in the lower end of the pull rod is unhooked from the rocker arm link.
6. Drive out the rocker arm pin by using a press or hammer.

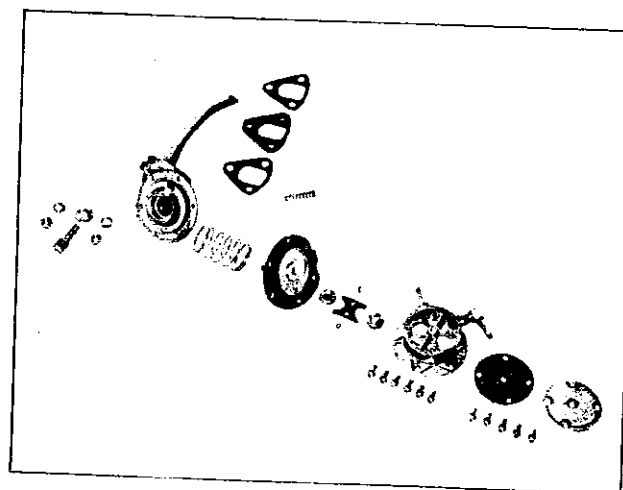


Fig. EF-8 Components of fuel pump

INSPECTION

1. Check the upper body and the lower body for cracks.
2. Check the valve assembly for wear of the valve and valve spring. Blow the valve assembly by breath to examine its function.
3. Check the diaphragm for small holes, cracks and wear.
4. Check the rocker arm for wear at the portion in contact with the camshaft.

FUEL SYSTEM

5. Check the rocker arm pin for wear since a worn pin may cause oil leakage.

6. Check all other components for any abnormalities and replace with new parts if the condition requires it.

ASSEMBLY

Assembly is done in the reverse order of disassembly. In case of reassembly and reinstallation, the following points should be noted.

1. Use new gaskets.

2. Lubricate the rocker arm, the rocker arm link, the rocker arm pin and the lever pin before installation.

3. To test the function, position the fuel pump assembly about 1 meter (3.3 ft) above fuel level with a pipe connecting the fuel pump and the fuel strainer and operate the rocker arm by hand. If fuel is drawn up soon after the rocker arm is released, the function of the pump is sufficient.

TWO BARREL CARBURETORS

CONTENTS

DESCRIPTION	EF- 5	Adjustment of dash pot	EF-11
STRUCTURE AND OPERATION	EF- 6	MAJOR SERVICE OPERATIONS	EF-12
Primary system	EF- 7	Removal	EF-12
Secondary system	EF- 8	Disassembly	EF-12
Float system	EF- 9	Cleaning and inspection	EF-13
ADJUSTMENT	EF- 9	Assembly and installation	EF-14
Idling adjustment	EF- 9	JETS	EF-14
Fuel level adjustment	EF- 9	TROUBLE DIAGNOSES AND	
Adjustment of starting interlock		CORRECTIONS	EF-14
valve opening	EF-10	SPECIFICATIONS AND SERVICE	
Adjustment of interlock opening of		DATA	EF-16
primary and secondary throttle valve	EF-11		

DESCRIPTION

Carburetor type	Applied engine & model
DAF342-6	L24 on model G130
DAF342-8	L20A on model H130
DAF342-9	L20A on model HA30

As almost all the mechanism of these carburetors are quite similar, the general explanation is made in common except different points.

These are downdraft carburetors which were made aiming at the elevation of power and starting mechanism. These carburetors present several distinct features of importance to the car owner.

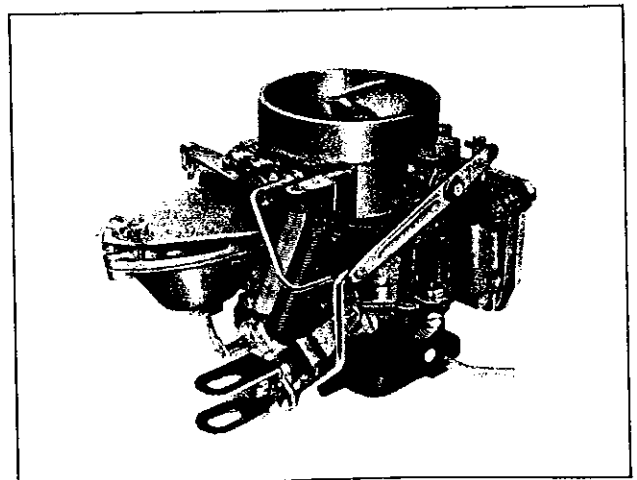


Fig. EF-9 Carburetor for vehicle with manual transmission

ENGINE

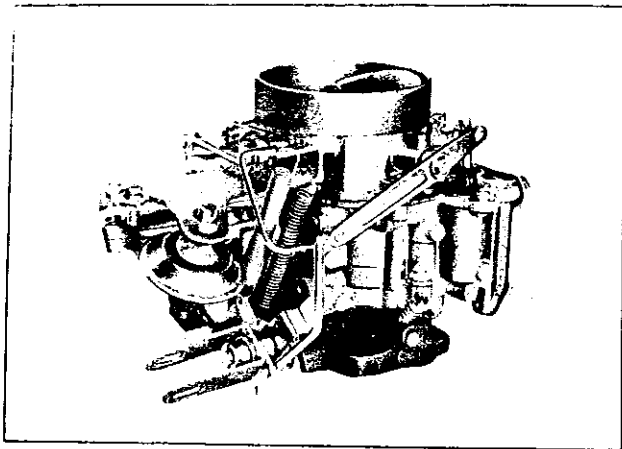


Fig. EF-10 Carburetor for vehicle with automatic transmission

Foremost among these features are:

1. Secondary throttle valve is operated by the diaphragm which is pulled by the venturi vacuum so that the high power and good acceleration are gained in comparison with the auxiliary valve type.

2. Accelerating pump gives excellent acceleration.

3. The power valve mechanism, so-called vacuum actuated boost type, makes the good high speed drive.

4. Slow economizer mechanism makes the smooth connection with acceleration or deceleration during light load running, and stable low speed performance is gained.

STRUCTURE AND OPERATION

These carburetors consist of the primary system for normal running and the secondary system for full load running. The float system which the primary and secondary systems use in common, the secondary switch over mechanism, the starting mechanism, accelerating mechanism, power valve mechanism, slow economizer system, etc. are also attached. The primary main system is of Solex type and the secondary main system is of Zenith Stronburg type.

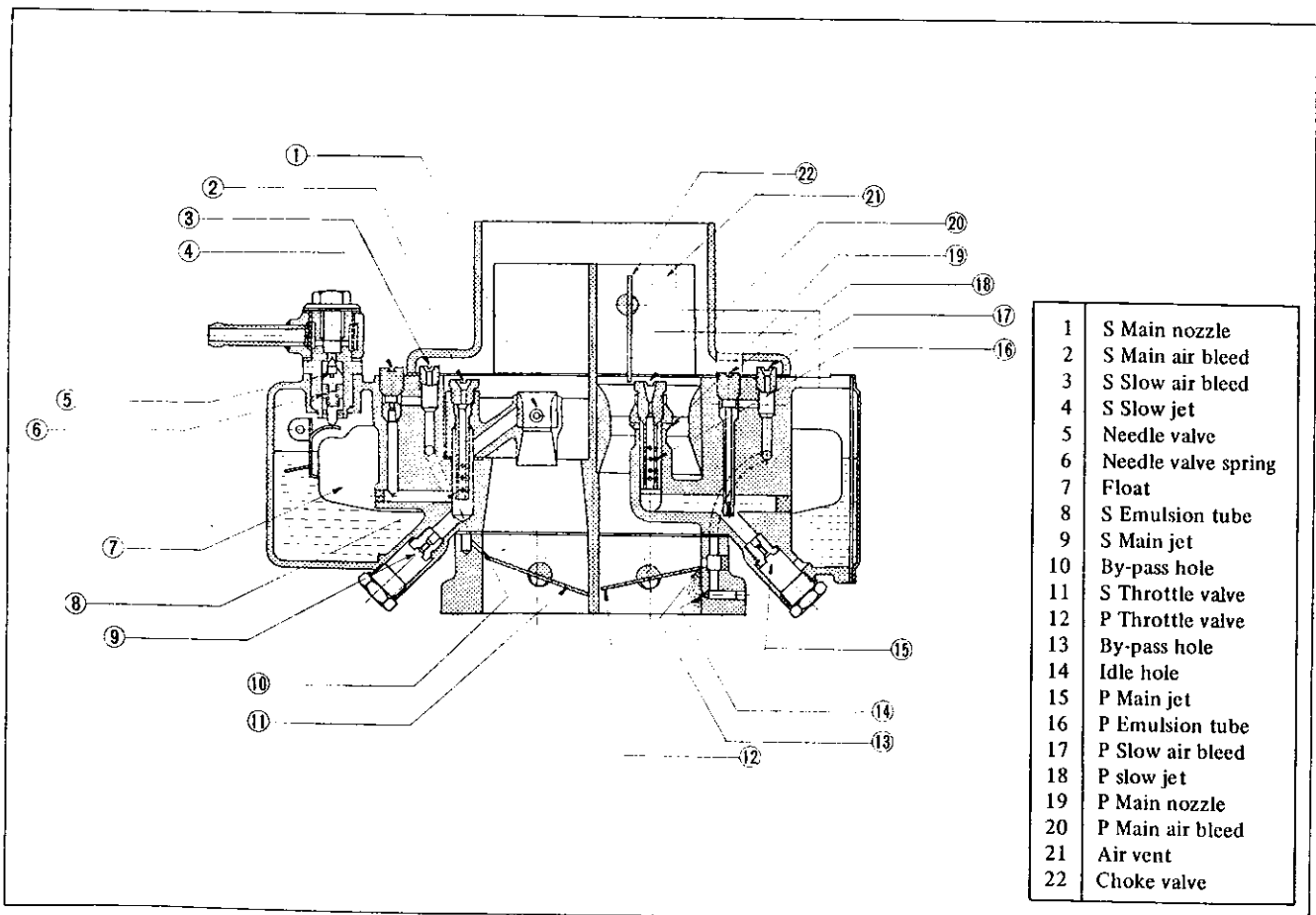


Fig. EF-11 Sectional view

FUEL SYSTEM

Primary system

Primary main system

Fuel flows, as shown in Figure EF-11 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. The multi-holed main nozzle insures a proper atomization of fuel and a low fuel consumption. The throttle valve is opened at a small angle when idling and in slow speed running, with a large negative pressure prevailing down-stream of the fuel system. This negative pressure acts on the slow speed system. Through this action, fuel, measured through the jet section of the slow jet located immediately behind the main jet shown in Figure EF-11, and air coming from the slow air bleed are mixed and atomized. The atomized mixture is supplied to the engine from the idle hole and by-pass hole via the slow speed system line. As a result, there is an excellent linkage between the slow speed system and the main system, and the resultant stable slow speed performance is ensured.

Accelerating mechanism

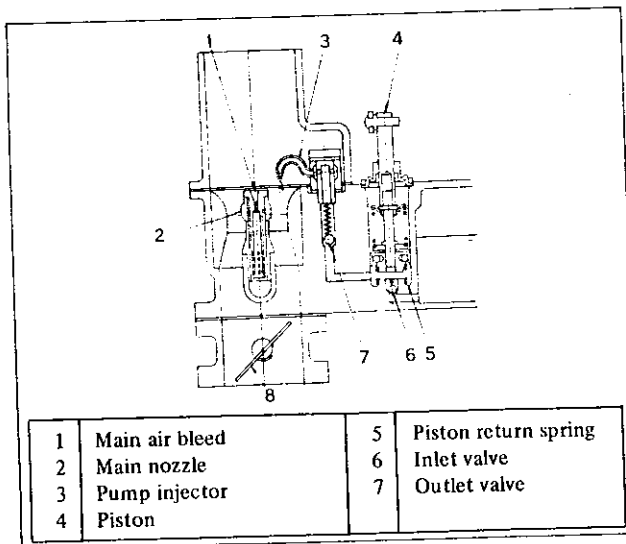


Fig. EF-12 Accelerating system

The carburetor is equipped with the piston type accelerating mechanism linked to the throttle valve. When the primary throttle valve, shown in Figure EF-12, 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. The piston return spring in the cylinder not only assures the smooth movements of the linkage but also serves to place inlet valve in position so that the piston goes down quickly and fuel is forced out through the injector.

Starting mechanism

Pull the choke button to close the choke valve fully, then start the engine. This provides a rich mixture, making it possible to start the engine quickly. When the engine is started, the choke valve is opened at an adequate angle automatically, which prevents overchoking and ensures a smooth engine performance. While the engine is being warmed up, it increases in speed at steps, and by releasing the choke button an optimum engine speed can be obtained. With the choke valve closed fully, the primary throttle valve is caused to open at an angle best suited for starting through a link mechanism.

Power valve mechanism

The power valve mechanism, so-called vacuum actuated boost type, makes use of the downward pulling force of the air stream 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.

Dash pot device

This carburetor is equipped with a dash pot interlocked with the primary throttle valve through a link mechanism. The dash pot, which is exclusively installed on cars equipped with a torque converter, is intended to prevent engine stall that would otherwise result from quick application of the brake immediately after the car run, or from the quick release of the accelerator pedal after giving only small pressure.

ENGINE

When the primary throttle valve is closed near full angle (1,800 to 2,000 rpm in engine speed), a throttle lever strikes the dash pot stem shown in Figure EF-13, making the primary throttle valve gradually open, and keeping the engine running.

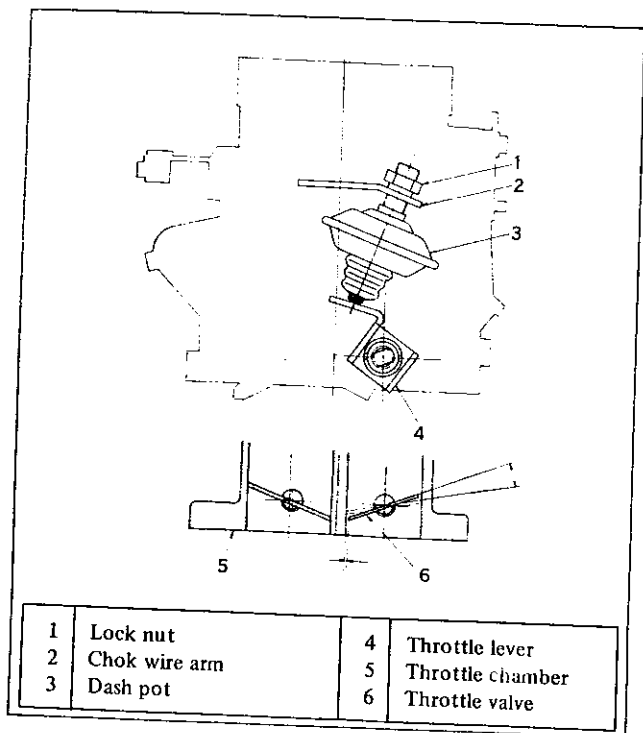


Fig. EF-13 Dash pot mechanism

Secondary system

Secondary main system

The secondary main system is of Zenith Strongburg 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.

Step system

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

This system aims in 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 in its fully closed state.

Secondary switch over mechanism

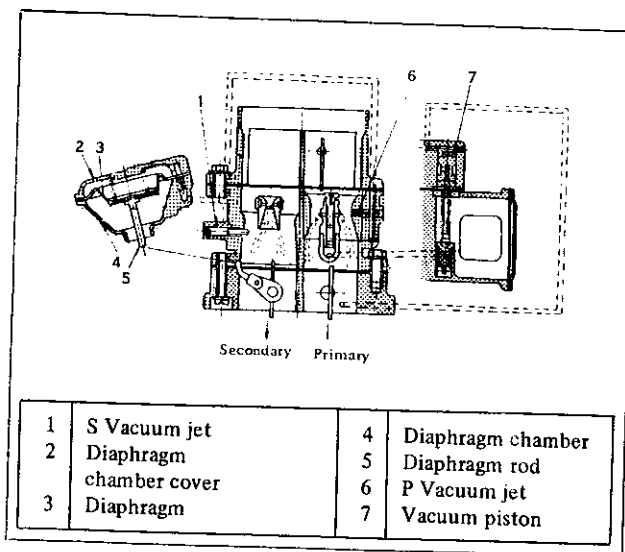


Fig. EF-14 Full throttle at high speed

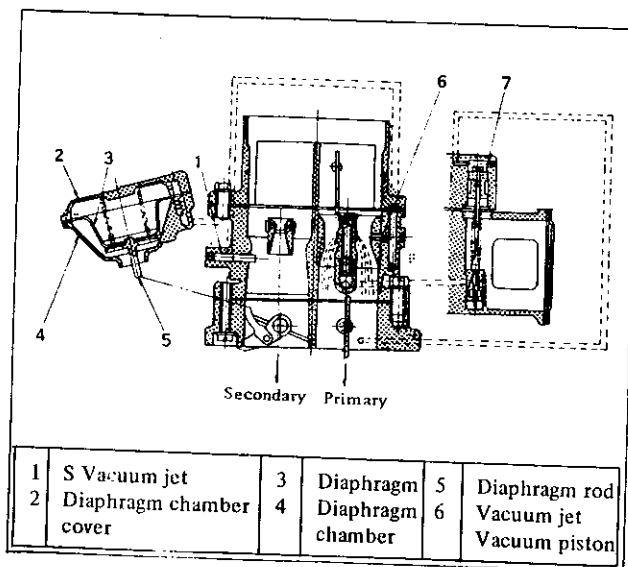


Fig. EF-15 Full throttle at low speed

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 ventureries, and the composite vacuum of these jets actuates the diaphragm.

As the linkage, shown in Figure EF-15, causes the secondary throttle valve not to open until the primary

FUEL SYSTEM

throttle valve opening reaches approximately 50, fuel consumption during normal operation is not excessive. During high speed running, as shown in Figure EF-14, 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 atmospheric side in the diaphragm chamber is connected to the atmosphere.

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.

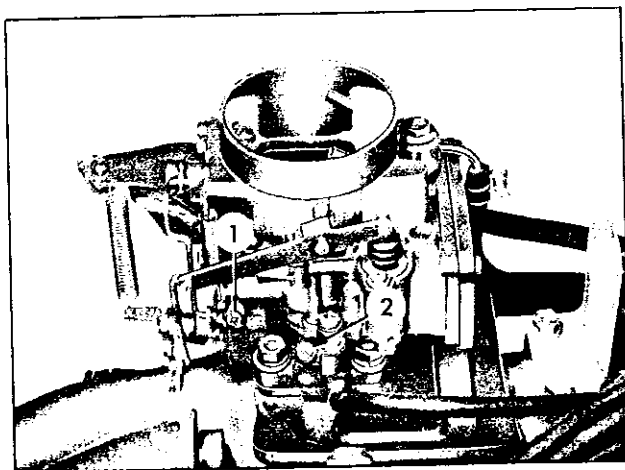
Because of the air vent type of the float chamber ventilation, the fuel consumption will not be influenced by some dirt accumulated in the air cleaner.

The needle valve is made of special hard steel and will not wear for all its considerably long use.

ADJUSTMENT

Idling adjustment

Idling adjustment is made by the throttle adjust screw and idle adjust screw as shown in Figure EF-16.



1	Throttle adjust screw	2	Idle adjust screw
---	-----------------------	---	-------------------

Fig. EF-16 Idling adjustment

1. Give the idle adjust screw approximately three turns,

starting from the fully closed position. Screw in the throttle adjust screw two or three turns and start the engine.

2. Screw out the throttle adjust screw gently until the engine is about to rotate unevenly after the engine speed gradually drops.

3. Screw in the idle adjust screw until the engine runs smoothly at the highest speed.

4. Re-adjust the throttle screw to drop the engine speed.

Repeat these operations until a smooth engine speed of approximately 550 rpm has been attained.

Note: Do not attempt to screw down the idle adjust screw completely to avoid damage to the tip, which will tend to cause malfunctions.

Fuel level adjustment

A constant fuel level is maintained by the float and needle valve.

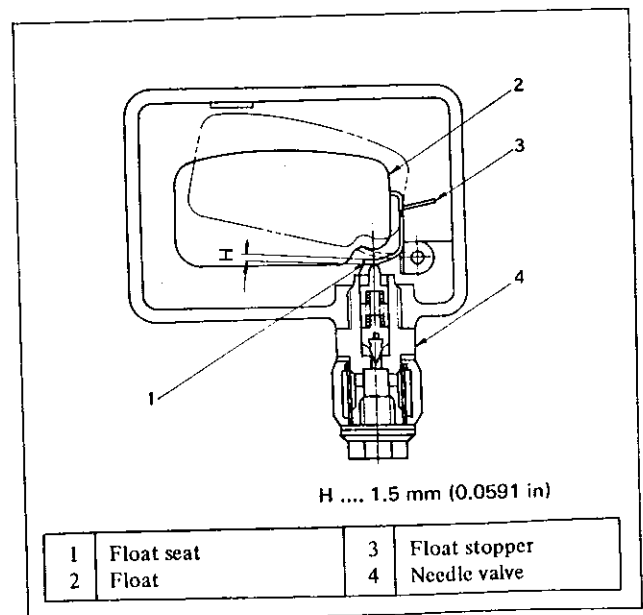


Fig. EF-17 Fuel level adjustment

If the fuel level is in accord with the level gauge line,

ENGINE

the float level is properly set. If the float level is not correct, adjust it by bending the float seat as shown in Figure EF-17. Approximately *H mm is required as the effective stroke of the needle valve. So adjust the gap between the valve stem and the float seat to *H mm with the float fully lifted up by bending the float stopper.

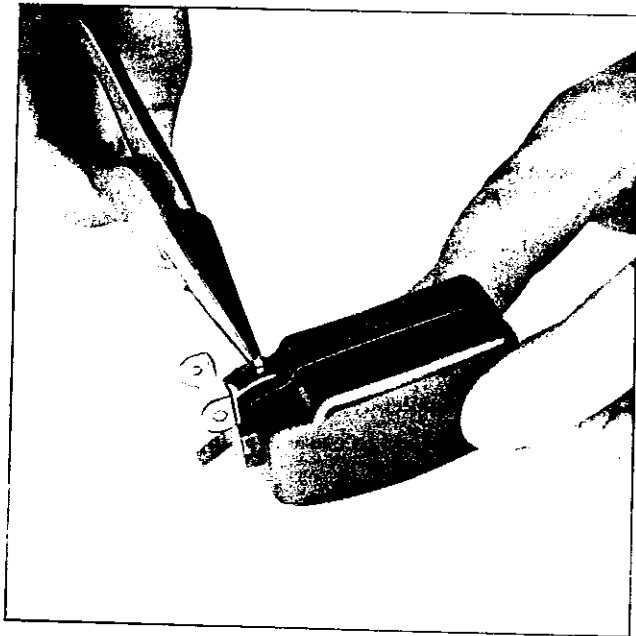


Fig. EF-18 Adjustment of float seat

Adjustment of starting interlock valve opening

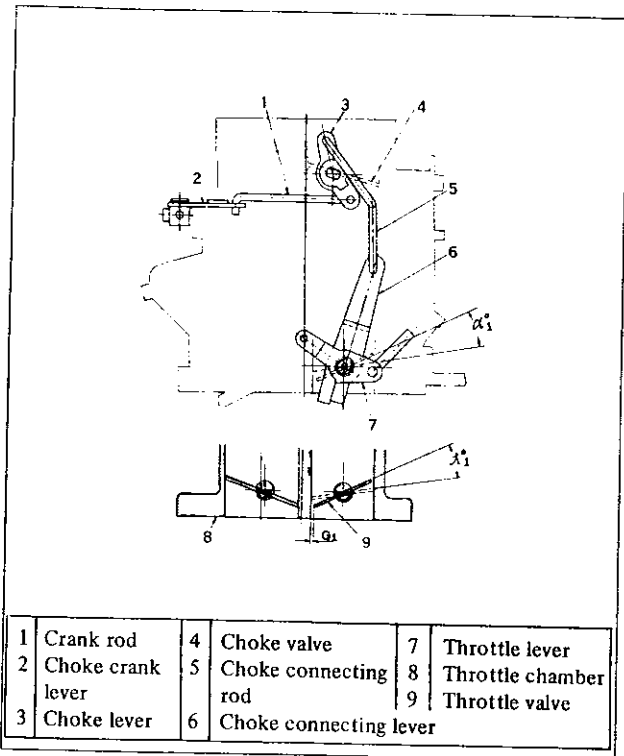


Fig. EF-20 Adjustment of starting interlock valve opening

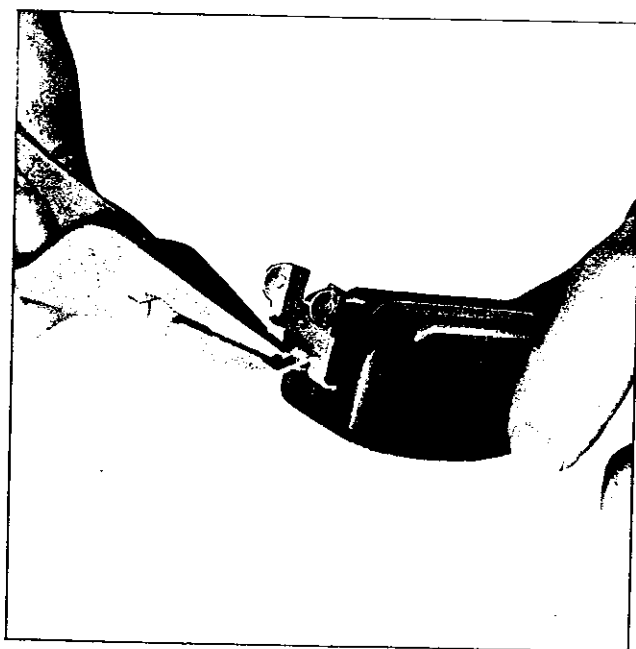


Fig. EF-19 Adjustment of float stopper

Type	G_1 mm (in)	α_1°
DAF342-6A DAF342-8A	1.45 (0.06)	17°
DAF342-9A	1.08 (0.04)	14°

The choke valve at a full close position automatically opens the throttle valve at an optimum angle approximately 17° for starting the engine through a link mechanism. After reassembly, or in a check on the interlocked opening angle, bend the choke connecting rod for adjustment so that a fully closed choke valve will bring the clearance G_1 shown in Figure EF-20 to 1.45 mm (0.06 in).

FUEL SYSTEM

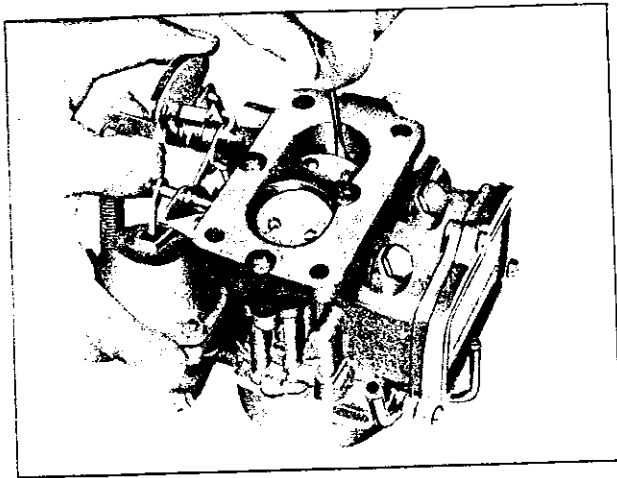


Fig. EF-21 Measurement of clearance of starting interlock valve opening

Adjustment of interlock opening of primary and secondary throttle valves

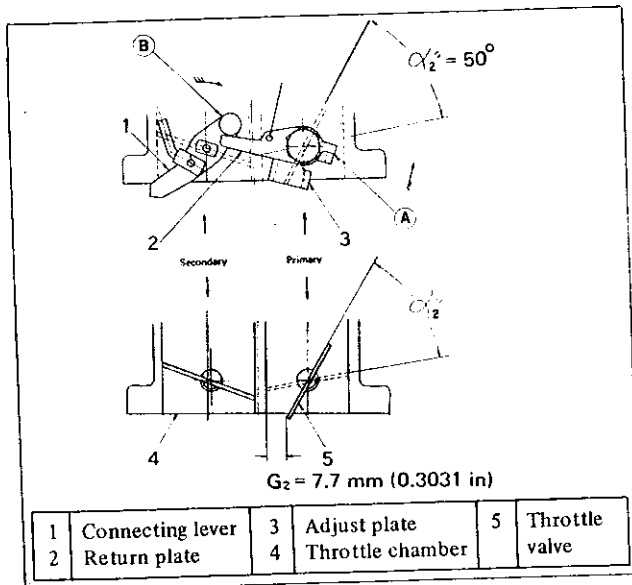


Fig. EF-22 Adjustment of interlock opening of throttle valve

Figure EF-22 show the primary throttle valve opened α_2 . When the adjust plate fixed to the primary throttle valve is open α_2 , it comes to contact with the connecting lever at A. When the throttle valve is further opened, the point B, where the connecting lever is in contact with the stopper, is detached, permitting the secondary system to start actuating.

The linkage between the primary and secondary throttles operates properly if the distance between the throttle valve and inner wall of the throttle chamber, G_2 , amounts to specifications as shown below. The adjustment is made by bending the point A of the adjusting plate.

Type	G_2 mm (in)	α_2°
DAF342-6A DAF342-8A DAF342-9A	7.7 (0.3)	50°

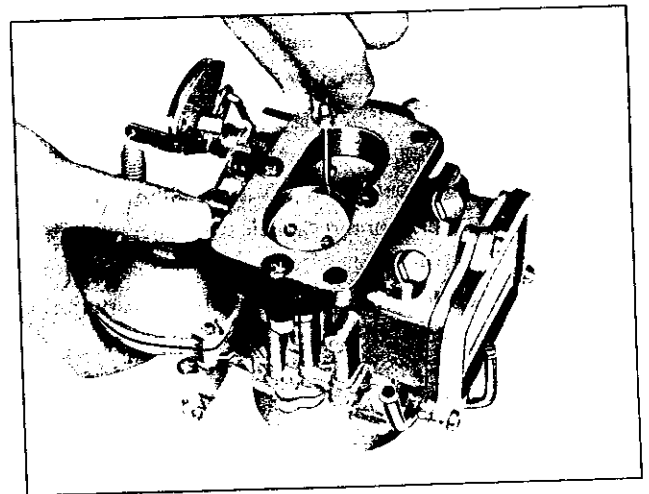


Fig. EF-23 Measurement of clearance

Adjustment of dash pot

The adjustment of the dash pot can be done by warming up the engine properly and checking if the throttle lever will touch the dash pot stem shown in Figure EF-13 as the engine reaches between 1,800 and 2,000 rpm under no load. Proper contact between the throttle lever and the dash pot stem produces a normal dash pot performance. Should no normal increase in engine speed be obtainable, loosen the lock nuts, rotate the dash pot right and left, and adjust it so that the throttle lever will hit the stem at between 1,800 and 2,000 rpm. Then, fasten the loosened lock nuts. Note that the angle when the throttle valve and the throttle chamber wall contact with.

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Type	Throttle valve setting angle
DAF342-6A	8°
DAF342-8A	9°
DAF342-9A	9°

MAJOR SERVICE OPERATIONS

The perfect carburetor delivers the proper gasoline 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.

Accurate calibration of passages and discharge holes, require that extreme care be taken in cleaning. Use only carburetor solvent and compressed air to clean all passages and passage discharge 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 line, vacuum line and choke wire from carburetor.
3. Remove the throttle lever.
4. Remove four nuts and washers retaining carburetor to manifold.
5. Lift carburetor off manifold.
6. Remove and discard carburetor to manifold gasket.

Disassembly

1. The main jets, slow jets and needle valves on both primary and secondary sides are accessible from outside the carburetor for disassembly.

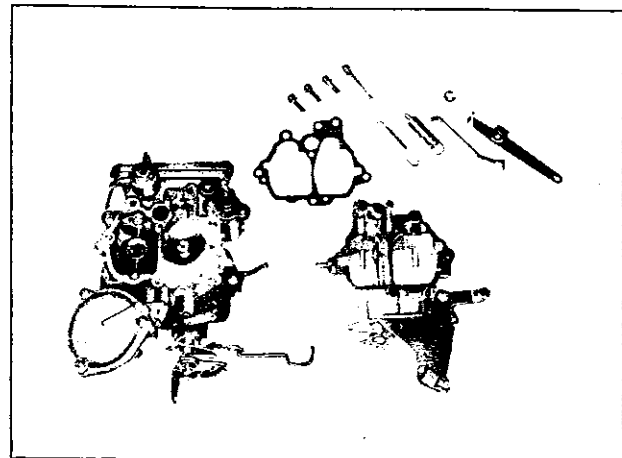


Fig. EF-24 Removing air horn from carburetor body

2. The primary and secondary emulsion tubes can be disassembled for a check by removing the main air bleeds on the respective sides.
3. To check the accelerator pump, the cylinder cover is removed. Be careful not to lose the return spring and inlet valve provided at the lower part of the piston during the disassembling operation.

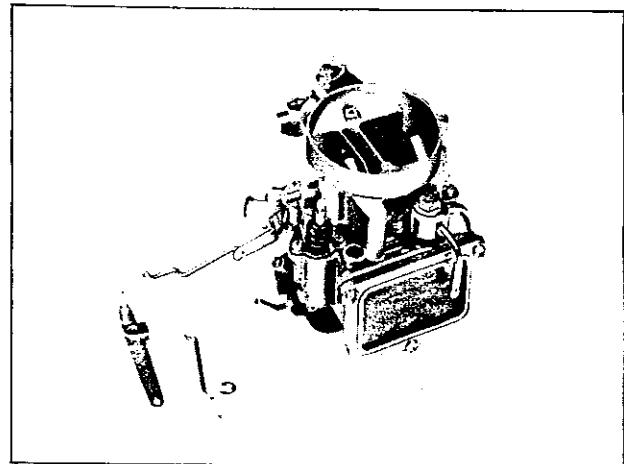


Fig. EF-25 Removing accelerator pump

4. The throttle chamber can be detached from the float chamber by removing the rod linking the diaphragm with the secondary throttle valve, and four set screws that hold it.

It is preferable to leave the throttle valve intact unless otherwise required. If a disassembled valve is required to remedy a defect, it should be installed so that the secondary throttle valve particularly will be gap-free. Otherwise, stable idling and slow speed performance will not be obtained.

FUEL SYSTEM

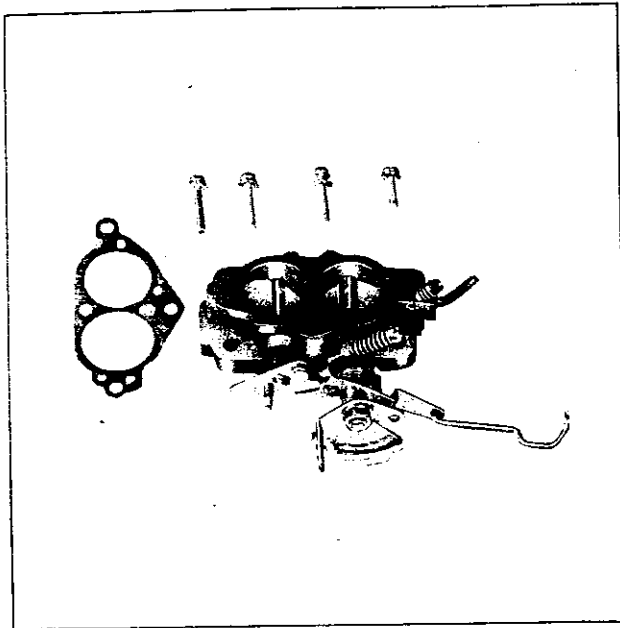


Fig. EF-26 Separating throttle chamber from carburetor body

5. To check the float, the float chamber cover is removed as instructed in a separate paragraph.

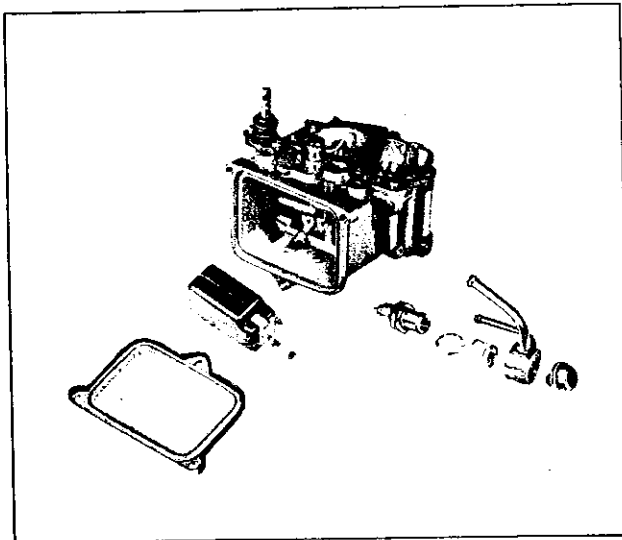


Fig. EF-27 Disassembling float chamber

6. The diaphragm can be disassembled by removing three set screws that hold the diaphragm chamber and another three set screws that hold the diaphragm chamber cover. In reassembling it, take care so that the edge of the diaphragm will not be turned up.

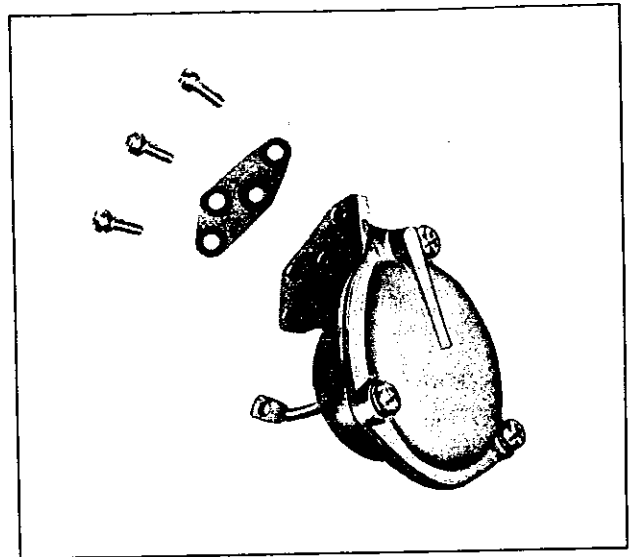


Fig. EF-28 Removing diaphragm

7. In disassembling and reassembling the interlocking links, take care so that each linkage has a smooth action, and that it is not fitted in any forced position.

Cleaning and inspection

Dirt, gum, water or carbon contamination in or on the 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:

(1) Check float needle and seat for wear. If wear is noted the assembly must be replaced.

(2) Check throttle and choke shaft bores in throttle body and cover castings for wear or out of round.

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- (3) Inspect idle adjusting needles for burrs or ridges. Such a condition requires replacement.
3. Inspect gaskets to see if they appear hard or brittle or if the 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 venturi clusters for loose or worn parts. If damage or looseness exists, replace cluster assembly.
6. Check the linkage for operating condition.
7. Inspect the operation of accelerating pump. Put in the gasoline in the float chamber and make the throttle lever operate. And check the injection condition of the gasoline from the accelerating nozzle.
8. Push in the connecting rod of diaphragm chamber and block the passage of vacuum by finger. And when free the connecting rod, check the leakage of air and the damage of diaphragm.

Assembly and installation

Follow the disassembly and removal procedure in reverse.

Replace the gaskets, if necessary.

In disassembling and reassembling the interlock link and related components, be careful not to bend or deform any of the components. Reassemble so that all interlock links operate smoothly.

JETS

The carburetor performance depends on jets and air bleeds. That is why these components are fabricated with utmost care. To clean them, use gasoline and blow air on them. Larger 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, and the smaller numbers the richer fuel.

Replacement of designated jets to meet the service condition of the car must be carried out with the above directions in mind. To cite a practical example, when it becomes necessary to economize fuel at the limited sacrifice of output to meet frequent light-load operation, use smaller main jets or slow jets, or slow jets, or larger main air bleeds or slow air bleeds than regularly specified. This should meet the purpose. Inversely, when increase in output is desired at the limited sacrifice of fuel consumption, use larger main jets or slow jets, or smaller main air bleeds or slow air bleeds, and that should bring a satisfactory result.

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 starting carburetor adjustment.

Troubles	Possible causes	Remedies
Overflow	Dirt accumulated on needle valve. Fuel pump pressure too high. Needle valve seat improper.	Clean needle valve. Repair pump. Lap or replace.
Excessive fuel consumption	Fuel overflow Each main jet, slow jet too large.	See above item Replace.

FUEL SYSTEM

	<p>Each main air bleed clogged.</p> <p>Choke valve does not fully open.</p> <p>Outlet valve seat of accelerator pump improper.</p> <p>Linked opening of secondary throttle valve too early.</p>	<p>Clean.</p> <p>Adjust.</p> <p>Lap.</p> <p>Adjust.</p>
Power shortage	<p>Each main jet clogged.</p> <p>Each throttle valve does not fully open.</p> <p>Fuel pump operated improperly.</p> <p>Fuel strainer clogged.</p> <p>Vacuum jet clogged.</p> <p>Air cleaner clogged.</p> <p>Diaphragm damaged.</p> <p>Power valve operated improperly.</p>	<p>Clean.</p> <p>Adjust.</p> <p>Repair.</p> <p>Clean.</p> <p>Clean.</p> <p>Clean.</p> <p>Replace.</p> <p>Adjust.</p>
Improper idling	<p>Slow jet clogged.</p> <p>Each throttle valve does not close.</p> <p>Secondary throttle valve operated improperly.</p> <p>Each throttle valve shaft worn</p> <p>Packing between manifold/carburetor defective.</p> <p>Manifold/carburetor tightening improper.</p>	<p>Clean.</p> <p>Adjust.</p> <p>Overhaul and clean.</p> <p>Replace.</p> <p>Replace packing.</p> <p>Correct tightening.</p>
Engine hesitation	<p>Each main jet, slow jet clogged.</p> <p>By-pass hole, idle passage clogged.</p> <p>Emulsion tube clogged.</p> <p>Idling adjustment incorrect.</p> <p>Secondary throttle valve operated improperly.</p>	<p>Clean.</p> <p>Clean tube.</p> <p>Clean.</p> <p>Correct adjustment.</p> <p>Overhaul and clean.</p>
Engine does not start.	<p>Fuel overflows.</p> <p>No fuel.</p> <p>Gauge plate adjustment incorrect.</p> <p>Idling adjustment incorrect.</p> <p>Fast idle adjustment incorrect.</p> <p>Bimetal rod in contact with bimetal case.</p>	<p>See the first</p> <p>Check pump, fuel pipe and needle valve.</p> <p>Correct adjustment.</p> <p>Correct adjustment.</p> <p>Correct adjustment.</p> <p>Adjust.</p>

ENGINE

SPECIFICATIONS AND SERVICE DATA

Carburetor model	DAF342-6A		DAF342-8A		DAF342-9A	
Item						
Applied engine	L24		L20A		L20A	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
Outlet diameter mm (in)	32 (1.2598)	34 (1.3386)	32 (1.2598)	34 (1.3386)	32 (1.2598)	34 (1.3386)
Venturi diameter mm (in)	25 (0.9843)	28 (1.1024)	24 (0.9449)	28 (1.1024)	24 (0.9449)	28 (1.1024)
Main jet	# 129	# 160	# 119	# 160	# 119	# 160
Main air bleed	# 240	# 70	# 240	# 70	# 240	# 70
Slow jet	# 48	# 130	# 47	# 90	# 47	# 90
Slow air bleed	# 210	# 50	# 210	# 50	# 210	# 50
Power jet	# 65		# 70		# 65	
Float level mm (in)	23 ± 1 (0.9055 ± 0.0394)		23 ± 1 (0.9055 ± 0.0394)		23 ± 1 (0.9055 ± 0.0394)	
Fuel pressure kg/cm ² (lb/in ²)	0.22 (3.129)		0.22 (3.129)		0.22 (3.129)	
Weight kg (lb)	2.8 (6.37)		2.8 (6.37)		2.8 (6.37)	

◀ Main jet variation ▶

ALTITUDE		0m		1000 m (3,300 ft)		2,000 m (6,600 ft)		3,000 m (10,000 ft)		4,000 m (13,300 ft)	
CARBURETOR TYPE	Jet	Parts No.	Jet	Parts No.	Jet	Parts No.	Jet	Parts No.	Jet	Parts No.	
DAF342-9A	P # 119	16033 E4110	# 115	16033 23015	J# 112	16033 23016	# 108	16033 23017	# 105	16033 23018	
DAF342-8A	S # 160	16043 19915	# 155	16054 23015	# 150	16034 21615	# 145	16054 21015	# 140	16043 25715	
DAF342-6A	P # 129	16033 E4310	# 125	16054 18016	# 121	16033 E4313	# 118	16033 E4311	# 114	16033 E4312	
	S # 160	16043 19915	# 155	16054 23015	# 150	16034 21615	# 145	16054 21015	# 140	16043 25715	

P primary S secondary

FUEL SYSTEM

SU TYPE TWIN CARBURETORS

CONTENTS

DESCRIPTION	EF-17	Periodic inspection of suction chamber and suction piston	EF-26
STRUCTURE AND OPERATION	EF-18	DISASSEMBLY AND REASSEMBLY	EF-26
Float chamber	EF-19	Disassembly and reassembly of Suction piston and suction chamber	EF-26
Fuel return system	EF-19	Disassembly and reassembly of the nozzle	EF-28
Venturi control system	EF-19	Disassembly of the float chamber	EF-29
Fuel system	EF-19	Disassembly of the link and related components	EF-30
Starting mechanism	EF-20	TROUBLE DIAGNOSES AND CORRECTIONS	EF-30
CONTROL AND ADJUSTMENT	EF-20	SPECIFICATIONS	EF-32
Idling adjustment	EF-20		
Adjustment of float level	EF-24		
Adjustment of starting interlock opening	EF-25		
Checking the damper oil	EF-25		

DESCRIPTION

Note: The photographs in this section show the carburetor with the emission control system for U.S.A. & CANADA.

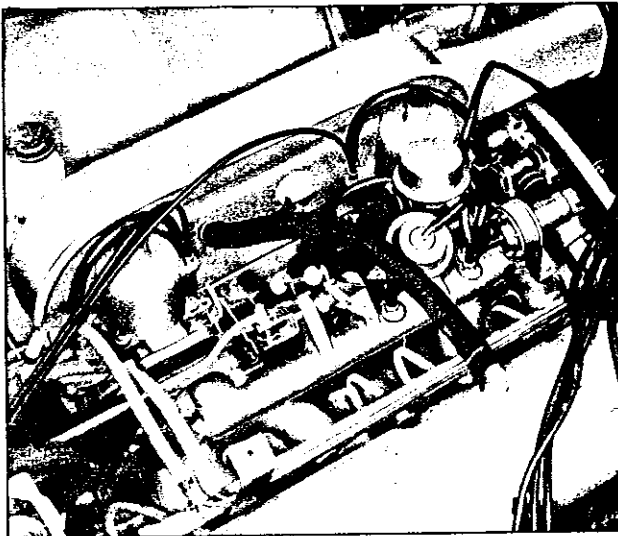


Fig. EF-29 Model HJG 46W carburetor

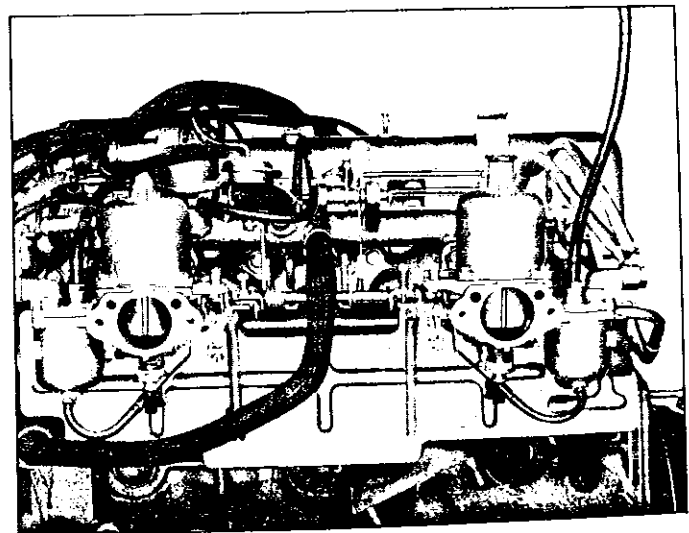


Fig. EF-30 Model HJL 46W carburetor

This carburetor variable Venturi type suitable for 6-cylinder engine. Two parallel synchronized carburetors (dual carburetors) are used as a set.

ENGINE

The carburetor in the front facing forward (hereinafter refer to as F) applies to the 1st, 2nd and 3rd cylinders, and the other rear carburetor (hereinafter refer to as R) applies to the 4th, 5th and 6th cylinders. The operation of these two carburetors is identical except for the positioning arrangement of the vacuum nipple and float chamber.

The needle valve is made of specially hardened steel and, therefore, is not appreciably worn even when used over long periods of time.

Carburetor features are as follows:

1. The venturi area is automatically changed according to engine air intake. Thus, the speed of the air flowing through the Venturi is nearly constant under all engine operating conditions.
2. Thus, air flow speed in the Venturi is high even when the engine is operated at low speed, fuel spray is

satisfactory, and fuel is distributed to the individual engine cylinders evenly. Vehicle fuel consumption is minimized, and the driving features such as acceleration and deceleration, are highly superior.

3. During high speed operation, the Venturi opens wide. Thereby reducing intake resistance to provide high output.

4. Moreover, engine output and vehicle accelerating characteristics are greatly improved by the use of two parallel carburetors.

5. None of the various fuel systems such as those required in conventional stationary Venturi carburetors are required. Individual fuel system operations of idling, deceleration, acceleration, and output are accomplished using a single nozzle. Thus, the construction is extremely simple.

STRUCTURE AND OPERATION

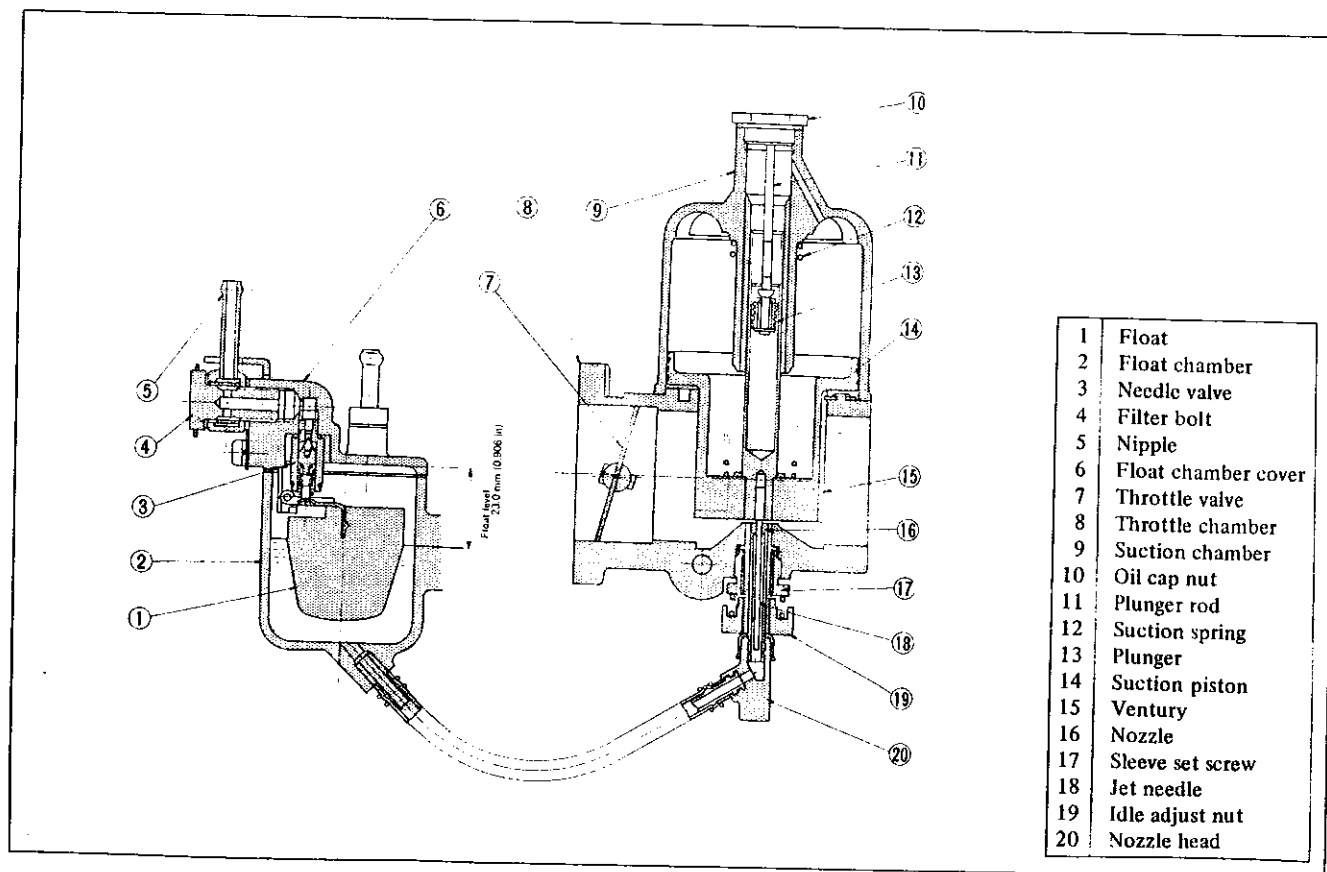


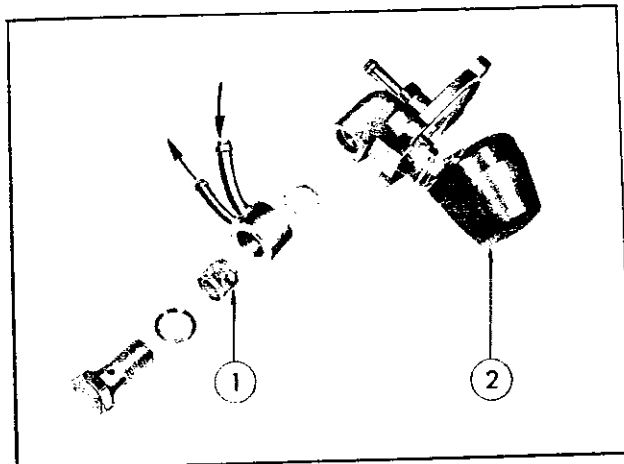
Fig. EF-31 Sectional view

FUEL SYSTEM

Structure of these carburetors are shown in Figure EF-31

Float chamber

Fuel fed from the fuel pump enters the float chamber through the needle valve. The fuel in the float chamber is maintained in the rated level by the combined operation of the needle valve and float.



1	Filter	2	Float
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Fig. EF-32 Fuel return system

Fuel return system

This is a device which prevent vapor lock or percolation and to ensure a constantly stable idling in a hot engine compartment.

Venturi control system

The suction chamber is located in the upper part of the throttle chamber, the suction piston slides vertically within the vacuum chamber thus changing the Venturi opening. Venturi vacuum pressure applied to the head of the suction piston through the suction port, and atmospheric pressure in the air cleaner is introduced through the air intake port below the piston.

The suction piston automatically moves up and down due to differences between upper and lower pressures, and the balance maintained between the pressure of the piston and suction spring force.

For example, when the throttle valve is opened for increased output, the flow of engine intake air is increased. Thus, vacuum pressure of the Venturi increases, the suction piston is lifted until the piston is balanced

with the pressure, and the Venturi opening enlarged.

When the throttle valve is closed to reduce output, the flow of engine intake air is decreased. Thus, vacuum pressure of the Venturi is reduced, the suction piston lowers until the piston is balanced with the pressure, and the Venturi is constricted. The pressure of the suction piston and suction spring force are properly calibrated so that the Venturi opening is optimum for any engine operating conditions.

In addition, the suction piston rod is equipped with an oil damper to improve vehicle acceleration performance. The oil damper protects the suction piston from opening too suddenly during acceleration.

Fuel system

Air velocity through the venturi (vacuum pressure) causes fuel to be sprayed from the float chamber, through the opening between the nozzle and jet needle into the Venturi.

The jet needle below the suction piston moves up and down in the nozzle according to the motion of the suction piston. Fuel flow changes automatically due to the tapered shape of the jet needle.

Moreover, operating conditions under various driving conditions from idling to the fully opened, maximum speed are shown in Figures EF-33 through 36.

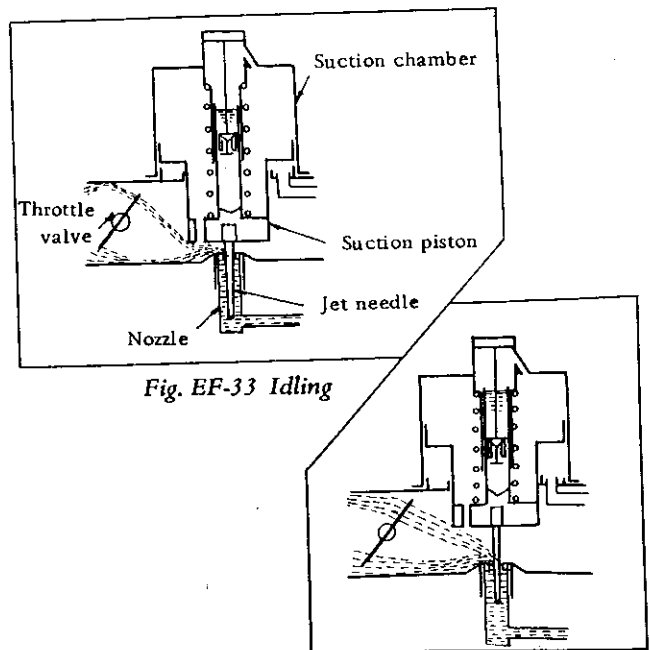


Fig. EF-33 Idling

Fig. EF-34 Intermediate and low speed

ENGINE

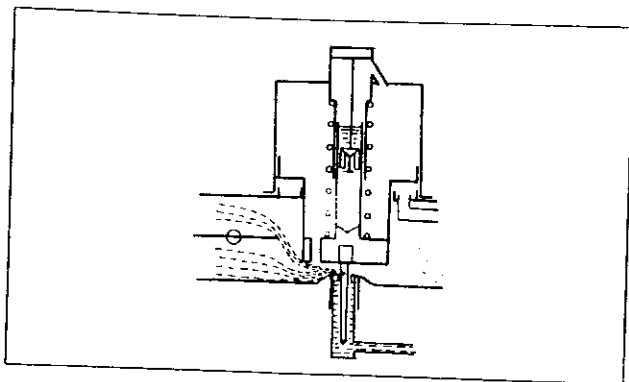


Fig. EF-35 Fully-opened low speed

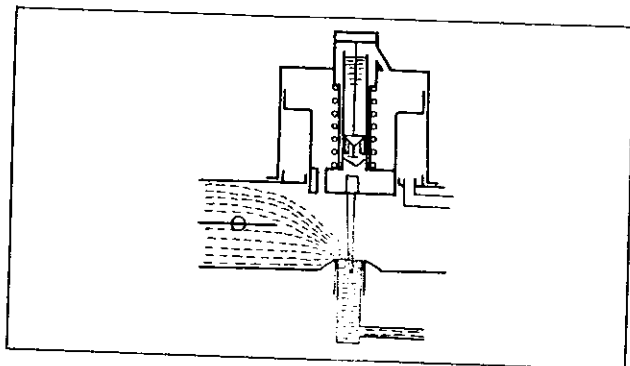


Fig. EF-36 Fully-opened high speed

Starting mechanism

By pulling the choke knob, the starting lever is moved, and the nozzle is drawn down by a link mechanism. As a result, the clearance between the nozzle and jet needle is increased, and an increased amount of fuel required for starting is fed to the system. Moreover, the throttle valve is automatically set to proper opening for starting (approximately 6) by the connecting linkage.

CONTROL AND ADJUSTMENT

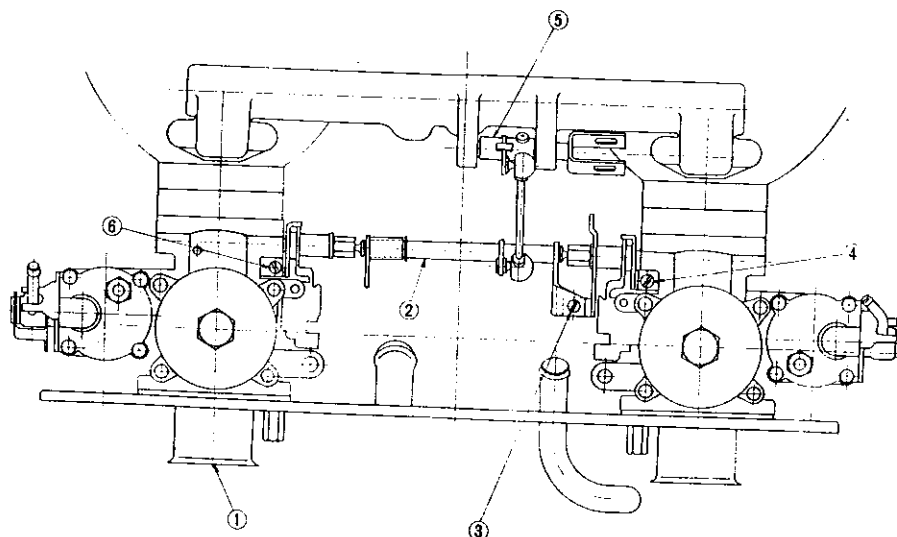
Idling adjustment

The procedure for idling adjustment is described herein, since proper idling adjustment of these two carburetors is extremely important in obtaining peak vehicle performance and in effectively reducing fuel consumption.

It should also be noted that improper carburetor adjustment not only has an adverse affect upon idling but also upon acceleration, output, fuel consumption, and other vehicle performance factors.

1. Throttle valve synchronization adjustment (using a flow meter) and idling adjustment.

◀ Throttle Valve Shaft Interlock and Throttle valve Full Closing Adjustment ▶



1	Air cleaner, air horn	4	Throttle adjusting screw
2	Throttle shaft	5	Auxiliary throttle shaft
3	Balance screw	6	Throttle adjusting screw

Fig. EF-37 Throttle valve synchronization and idling adjustment

FUEL SYSTEM

Operating procedure	Precautions and confirmation
1. Remove the air cleaner.	a. Warm up the engine prior to adjustment.
2. Loosen both F and R carburetor's throttle adjusting screws. See Figure EF-37.	a. Make sure F and R carburetor are disconnected.
3. Tighten both F and R carburetor's idling adjusting nuts in the upper direction once, and gradually back them off. When turned approximately on two and half turns, the nut will contact with the stopper Return the idling adjusting nut from this position approximately half of a turn. (Refer Figure EF-38)	a. Set both F and R carburetor idling adjusting nuts to their standard positions. Under this conditions, dimension "A" (between jet bridge nozzle head) is approximately 2.2 mm (0.0866 in). Refer to Adjustment of "A" Dimension.
4. Thread F and R carburetor's throttle adjusting screws in a few turns, and start engine.	a. Make sure that the engine is at normal operating temperature.

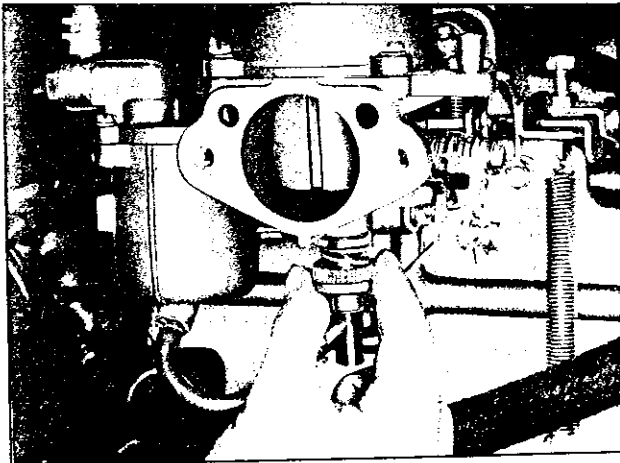


Fig. EF-38 Idle adjust nut

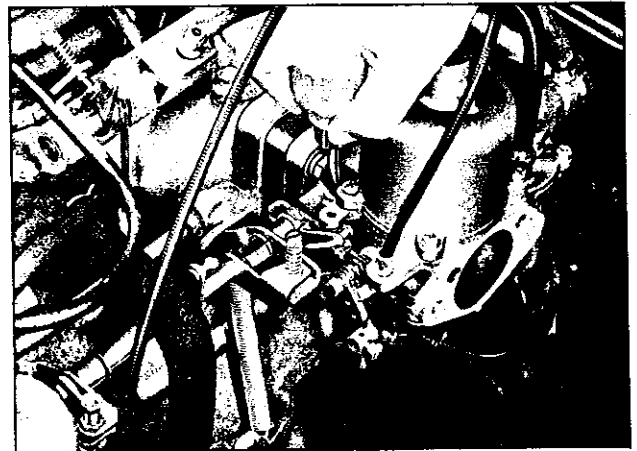


Fig. EF-39 Throttle adjust screw

Operating procedure	Precautions and confirmation
5. Adjust the engine speed to 600 to 700 rpm, turning F and R's throttle adjusting screws.	a. Reduce engine speed to the extent that the engine operates stably.
6. Apply a flow meter to the front carburetor air cleaner flange, turn the air flow adjusting screw, and align the upper end of the float in the glass tube to the scale.	a. Stand the flow meter float vertically.

ENGINE

7. Then apply a flow meter to the rear carburetor air cleaner flange. (Do not move the flow meter air flow adjusting screw.) If the flow meter float is not aligned with the front carburetor scale, turn the rear carburetor throttle adjusting screw and align the float with the front carburetor scale.

- a. Match front and rear throttle valve openings.
- b. Throttle valve openings are even, and air flow is also uniform when the positions of the floats in the glass tubes of the flow meters stop at the same position for both front and rear carburetors.

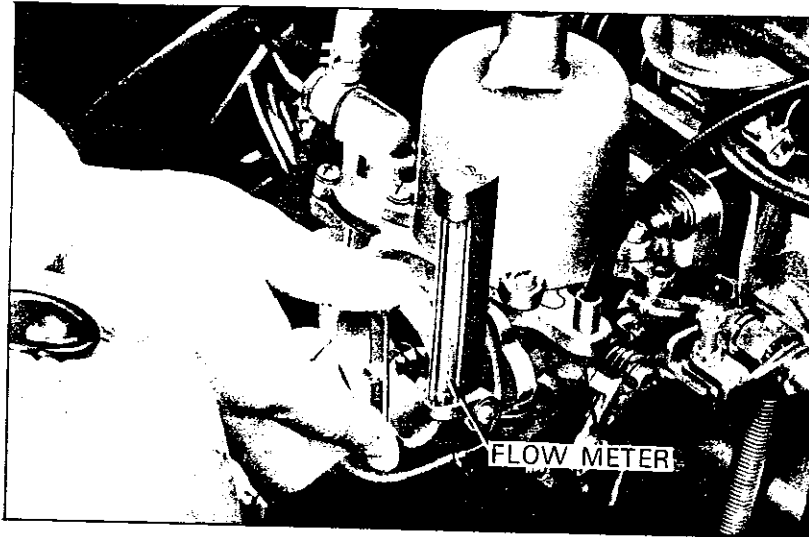
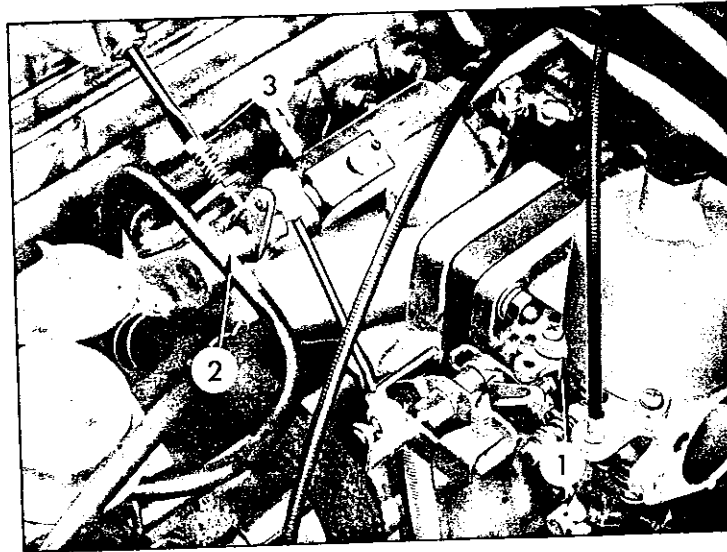


Fig. EF-40 Setting flow meter

Operating procedure	Precautions and confirmation
<p>8. Tighten the front and rear idling adjusting nuts simultaneously by approximately 1/8 turns, and stop at the points where engine speed is fastest and most stable.</p> <p>When the idling adjusting nuts are tightened and the point at which engine speed is fastest and most stable can not be determined, back off (loosen) the idling adjusting nuts to their initial positions, loosen the F and R nuts alternately by 1/8 turns to determine this point, and stop turning the nuts when this point is located.</p>	<ol style="list-style-type: none"> a. Idling fuel flow volume is reduced by tightening idling adjusting nut (turning it to the right), and is increased by loosening the idling adjusting nut (turning it to the left). b. The idling adjusting nut positions are set at their standard positions. Thus, the idling adjusting nut adjusting range should be less than approximately + 1/2 of a full turn. c. The front and rear idling adjusting nut adjusting positions (number of turns by which both nuts are backed off) must be the same.
<p>9. Back off (loosen) the front and rear throttle adjusting screws, and set engine speed to rated speed.</p>	<ol style="list-style-type: none"> a. Repeat steps 6 and 7 above, and set engine speed to rated speed by adjusting the front and rear carburetors so that the air flow of both front and rear carburetors is the same. Rated idling speed is as follows.

FUEL SYSTEM

	650 rpm/at 17° BTDC..... with manual transmission
10. Thread in the throttle adjusting screw until the screw head contacts the throttle connecting lever.	<ul style="list-style-type: none"> a. Interlock the front and rear throttle shaft. b. Make sure that idling speed does not change.



- | | |
|---|--------------------------------|
| 1 | Carburetor (Rear) |
| 2 | Auxiliary shaft |
| 3 | Adjust screw (Auxiliary shaft) |

Fig. EF-41 Adjust screw-auxiliary shaft

Operating procedure	Precautions and confirmation
11. Move the auxiliary shaft, and rapidly accelerate the engine (race the engine) a few times. Make sure that idling speed does not change.	<ul style="list-style-type: none"> a. Make sure that interlock adjustment is proper.
12. Turn the auxiliary shaft adjusting screw to increase engine speed from 800 to 1,000 rpm, apply flow meters to both front and rear carburetors, and verify that the flow meter float positions are even. If uneven, readjust the length of connecting rod.	<ul style="list-style-type: none"> a. Increase engine speed, and insure that the link interlock action operates properly. b. Readjust connecting rod length and match the air flow of the front and rear carburetors.
13. Back off the auxiliary shaft adjusting screw, and decrease engine speed. Apply flow meters to the front and rear carburetors, and re-confirm that the float position are even. If uneven, adjust the front and rear throttle adjusting screws so that engine speed does not change, and equalize the flow meter float positions.	<ul style="list-style-type: none"> a. Correction of difference between the front and rear interlock links. b. Match the idling air flow of the front and rear carburetors. c. Adjust idling speed.

ENGINE

14. Stop the engine, and install the air cleaner and duct.

2. Adjustment of "A" dimension

When the number of turns by which the idling adjusting nut has been backed off (loosened) cannot be accurately determined with the carburetors installed on the engine, adjust as follows. (See Figure EF-42.)

- (1) Loosen the suction chamber access screw, and disconnect the suction chamber and suction piston. Proceed carefully so that the nozzle and jet needle are not damaged or bent.
- (2) Turn the idling adjusting nut, measure dimension "A" (between the jet bridge and nozzle head with slide calipers) and adjust the nozzle position so that dimension "A" is approximately 2.2 mm (0.0866 in). The pitch of the idling adjusting nut thread is 1 mm (0.0394 in). Thus, the nozzle moves 1 mm (0.0394 in) by turning this screw one full turn.
- (3) Reinstall the suction chamber and suction piston, and make sure that the suction piston operates smoothly.

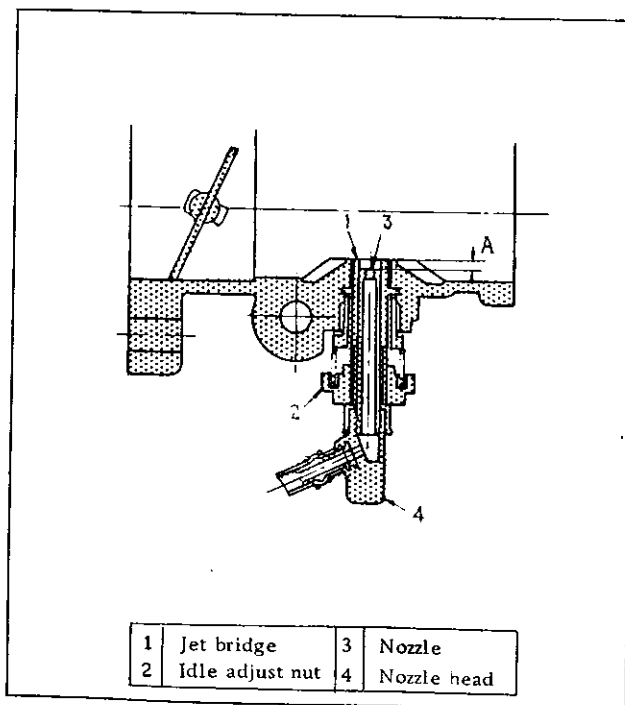


Fig. EF-42 Adjustment of "A" dimension

Adjustment of float level

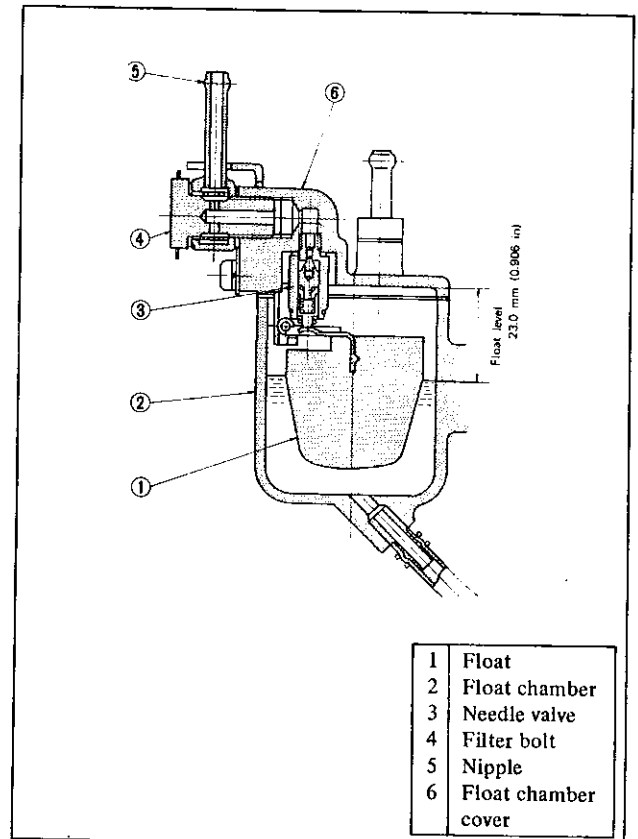


Fig. EF-43 Adjustment of float level

1. Remove the four set screws from the float chamber cover. The float chamber cover and the float lever can then be removed together. Place the cover on a work bench (with the float lever attached to the cover) with the float lever side up.
2. Lift up the float lever with the tip of your finger and then slowly lower the float lever. Stop lowering the float lever at the position at which the float lever seat just contacts the valve stem.
3. The float level is correct if dimension "H" in Figure EF-43 is 14 to 15 mm (0.5512 to 0.5906 in) under the foregoing conditions. If the dimension is not correct, adjust by bending float lever.

FUEL SYSTEM

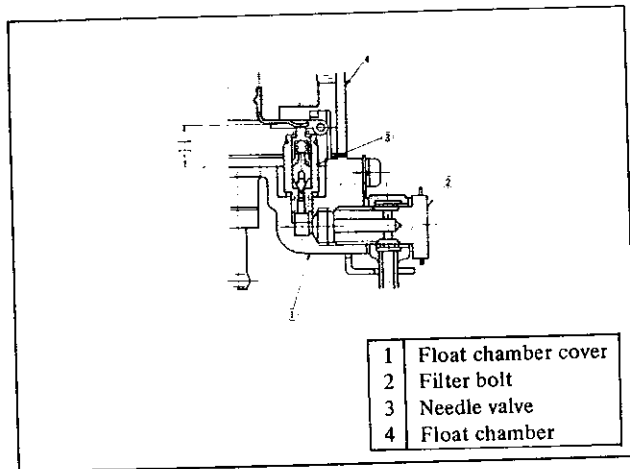


Fig. EF-44 Adjustment of float level

Adjustment of starting interlock valve opening

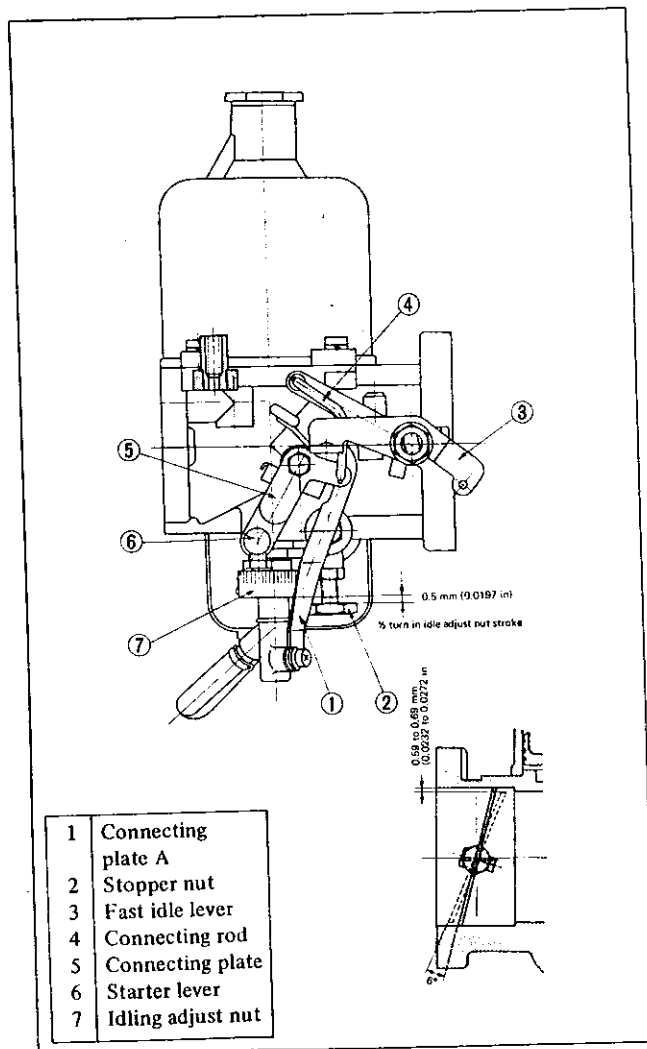


Fig. EF-45 Adjustment of starting interlock opening

For the adjustment of starting interlock opening, bend the connecting rod as shown in Figure EF-45 with an appropriate tool such as radio pinchers to change its length.

The interlock opening is increased by increasing the length of the connecting rod and is reduced when the rod is shortened. The interlock opening is correct, if clearance between the throttle valve and throttle chamber (dimension B) is 0.59 to 0.69 mm (0.0232 to 0.0271 in) when the starter lever is pulled all the way out. To measure dimensions B, move the throttle lever to full-closing, and make sure that there is no play in the first idling lever and adjusting lever interlocked unit.

Checking the damper oil

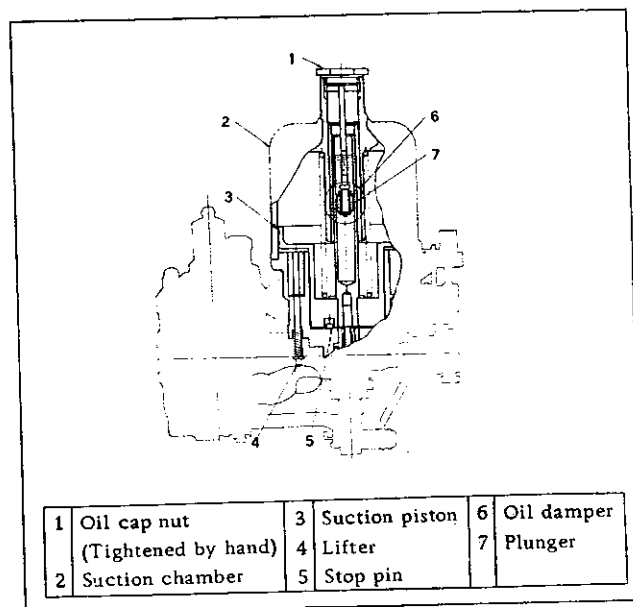


Fig. EF-46 Inspection of suction piston

When there is not a sufficient amount of damper oil, acceleration and other operating performance features become sluggish. When new carburetors are installed on the engine, or when overhaul is performed, damper oil must be added without fail. Use Mobile oil SAE #20 for damper oil. Do not use SAE #30 or higher weight oils.

Periodic inspection may vary depending upon driving conditions. However, the damper oil should be checked approximately every 5,000 km (3,000 miles) of driving (or approximately every 3 months).

To check damper oil level, remove the oil cap nut as shown in Figure EF-47 and check the oil level marking on the two grooves on the plunger rod. No difficulty will be

ENGINE

encountered and there is no danger until the oil level reaches the lower line. If the oil level drops below the lower line, add oil. Total oil volume is approximately 3 cc (0.18 cu in). Squirt oil into the damper little by little so that the oil level completely reaches the upper line.

When removing and replacing oil cap nut, be careful not to bend the rod. If the oil cap nut is loose, it may fall off. Be sure that it is sufficiently tightened by hand.

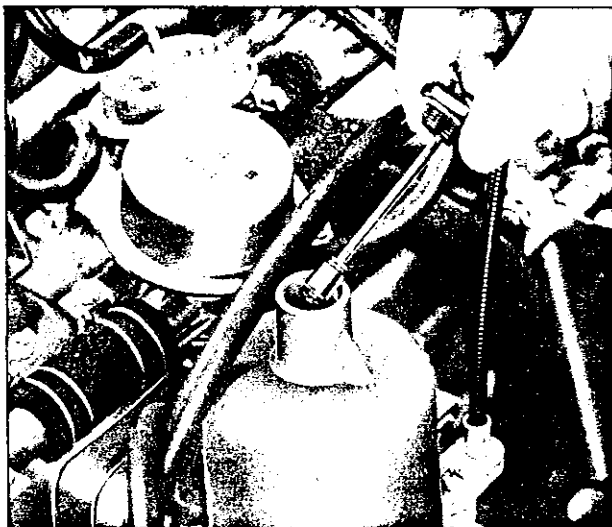


Fig. EF-47 Check damper oil

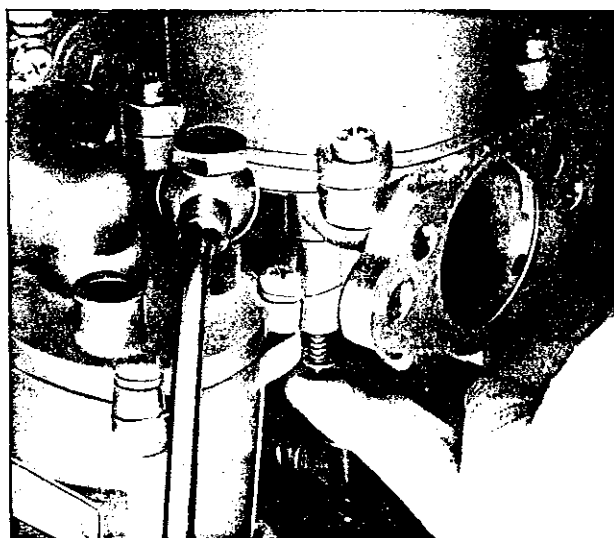


Fig. EF-48 Inspection of suction piston

Periodic inspection of suction chamber and suction piston

Periodic inspection is required to constantly maintain

the suction chamber and suction piston in proper operating condition. This is due to the fact that dust in the air is drawn into the chamber and accumulates on the sliding portion of the suction piston.

Make sure that the suction piston operates smoothly with the suction piston installed on the engine by proceeding as follows:

1. First, remove the oil cap nut.
2. Gradually raise lifter with your finger. The lifter head will contact the suction piston when the lifter has been raised approximately 1.5 mm (0.0591 in). Raise the lifter further. The suction piston will then be raised approximately 8 mm (0.3150 in).
3. Release your finger from the lifter. The suction piston will drop, and the sound of the suction running against the Venturi will be heard.

The conditions of the piston and chamber are satisfactory if the suction piston rises smoothly. The condition of the center ring described in the following paragraph "DISASSEMBLY AND REASSEMBLY" can also be checked in this manner.

To check the bend of the plunger rod, remove the air cleaner, raise the suction piston with your finger tip with the oil cap nut applied to the assembly, and let the piston drop freely. The suction piston will offer strong resistance when lifted since the oil damper is actuated. Under satisfactory conditions, the piston will drop smoothly when your finger is removed from the suction piston.

DISASSEMBLY AND REASSEMBLY

The float chamber of this carburetor is almost identical to those in conventional carburetors. However, the carburetor must be disassembled and reassembled very carefully since the Venturi and fuel system are made of special high precision parts.

Disassembly and reassembly of suction piston and suction chamber

Disassemble and clean at least semi-annually. For

FUEL SYSTEM

disassembly and cleaning, or if the carburetor becomes defective, disassemble and reassemble as follows:

1. Remove the four set screws and then take off the

suction chamber.

2. Then remove the suction spring, nylon packing and suction piston from the suction chamber.

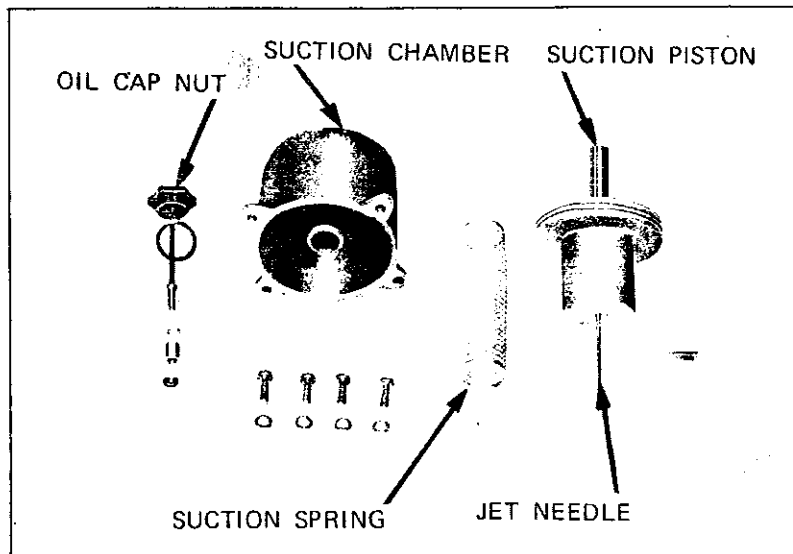


Fig. EF-49 Disassembly of suction chamber and suction piston

3. To remove these components, place the suction chamber and suction piston on a flat work bench so that the inside of the suction chamber and the sliding part of the suction piston are not damaged. Be extremely careful not to bend the jet needle on the lower part of the suction piston. (See figure EF-50.)

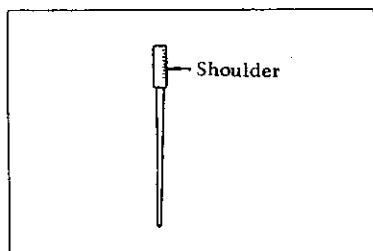


Fig. EF-50 Jet needle

4. Do not remove the jet needle from the suction piston unless absolutely necessary. When it must be removed, first loosen the jet needle set screw. To accomplish this, hold the jet needle within 2 mm (0.0787 in) from the shoulder with a pair of pliers so as not to damage the needle and remove the needle by pulling and turning slowly so as not to bend the needle.

5. Idling and other operating performance features will be adversely affected if the jet needle is not installed correctly in the suction piston. Set the jet needle in the suction piston so that the shoulder portion is flush with the bottom of the suction piston. Apply an appropriate tool having a horizontal (flat) surface such as slide calipers to the lower end, as shown in Figure EF-51, so that the shoulder of the jet needle contacts this surface, and tighten the jet needle set screw. The jet needle will then be installed correctly.

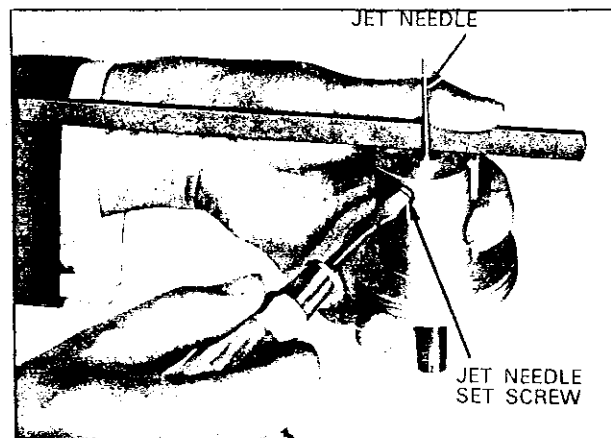


Fig. EF-51 Installing the jet needle

ENGINE

6. Wash the suction chamber and suction piston with clean gasoline, and dry with compressed air, so as to remove all dust, oil, etc. from the piston and chamber.

7. Then apply a few drops of light oil to the suction piston rod, and reassemble. Under no circumstances should oil be applied to the inside the suction chamber or to in Figure EF-45 with an appropriate tool such as radio pinchers to change its length, improper or defective operation.

Disassembly and reassembly of the nozzle

1. Disassembly

The nozzle can be easily removed. However, unless absolutely necessary do not disassemble the nozzle since reassembly of the nozzle sleeve, washer, and nozzle sleeve set screw is extremely difficult.

(1) First, remove the 4 mm (0.1575 in) diameter screw, and then remove the connecting plate from the nozzle head. This can be done easily by pulling lightly on the starter lever.

Next, loosen the clip, and remove the fuel line. The nozzle can then be removed. When the nozzle is removed, the jet needle will remain inside. Thus, be careful not to damage either the jet needle or nozzle and not to bend the jet needle.

(2) Next, remove the idling adjusting nut and idling adjusting spring.

(3) The nozzle sleeve can be removed by removing the nozzle sleeve set screw.

(Recommend this not be disassembled unless absolutely necessary.) Exploded view of disassembled parts is shown in Figure EF-52.

The nozzle jet is the heart of the carburetor, and is a high precision component. To clean the nozzle, use gasoline and dry with compressed air.

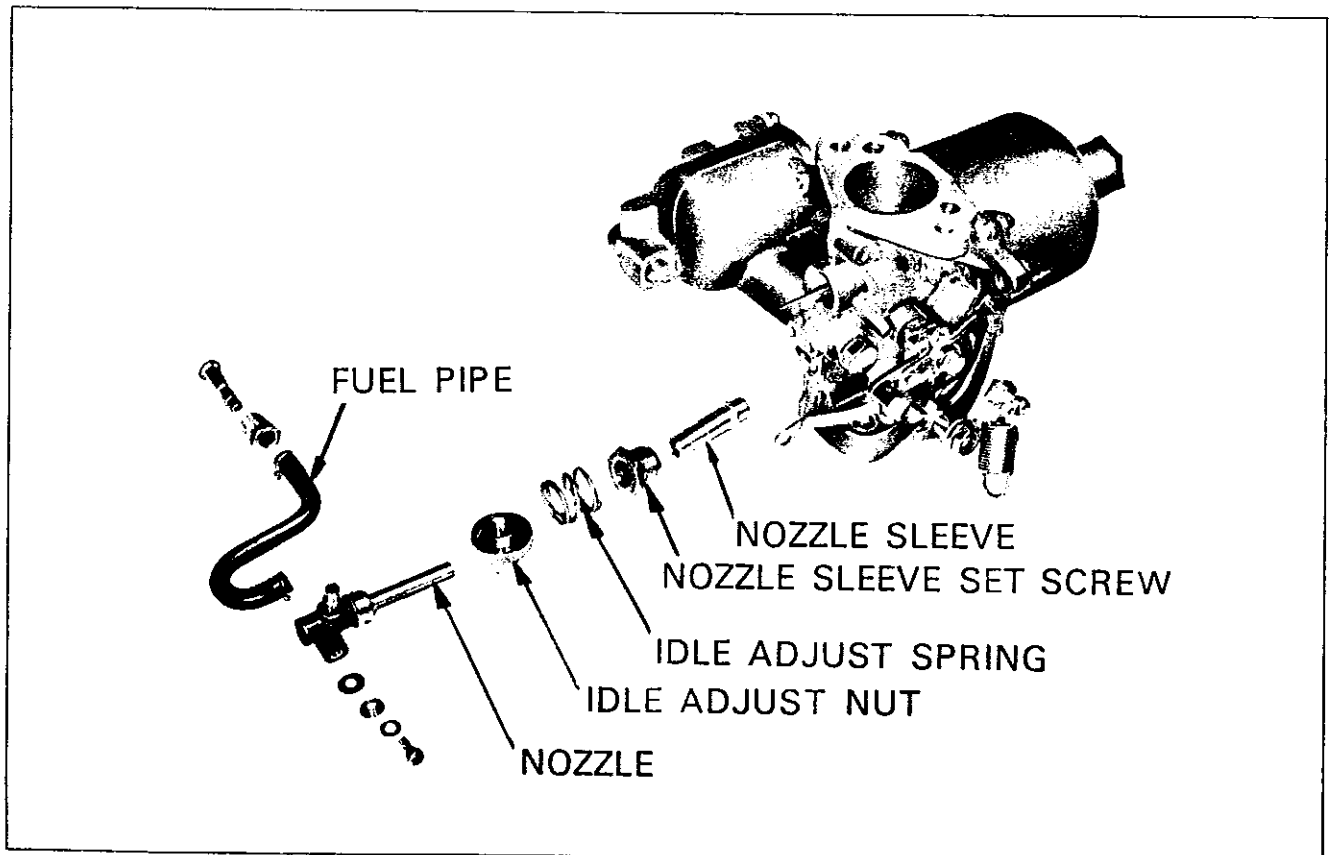


Fig. EF-52 Disassembly of nozzle

FUEL SYSTEM

2. Assembly

- (1) For centering the piston and suction chamber, remove the oil cap nut with the parts properly assembled (jet needle and suction piston assembled), without damper oil applied.
- (2) Set the suction piston to its fully closed position, and insert the nozzle until it contacts the nozzle sleeve.
- (3) When the nozzle jet contacts the jet needle, move the nozzle sleeve slightly so that it is at right angles to the center axis, and position the nozzle sleeve so that the nozzle jet does not contact the jet needle.
- (4) Under the conditions described above, raise the suction piston with your finger, and lower it slowly. If the suction piston stop pin drops on the Venturi making a light striking sound, the condition of the piston is satisfactory. Securely tighten the nozzle sleeve at this position with the nozzle sleeve set screw.
- (5) Remove the nozzle, install the idling adjusting spring and the idling adjusting nut on the nozzle sleeve, and

re-apply the nozzle. Connect the fuel line leading to the float chamber to the nozzle nipple, and tighten the clip fully.

Tighten the fuel line at the position at which the enlarged part of the nipple holds and the fuel line is not twisted.

- (6) Next, pull the starter lever lightly, hold connecting plate (A) with sleeve (C) and the 4 mm (0.1575 in) diameter washer, and tighten it on the nozzle head with the 4 mm (0.1575 in) diameter screw. In doing this, move the starter lever slightly, and attach the sleeve (C) firmly to the connecting plate (A) opening.
- (7) Upon completion of the reassembly, reconfirm that the suction piston drops smoothly.

Disassembly of the float chamber

Disassemble the float chamber in the sequence previously described under "Adjustment of the float level".

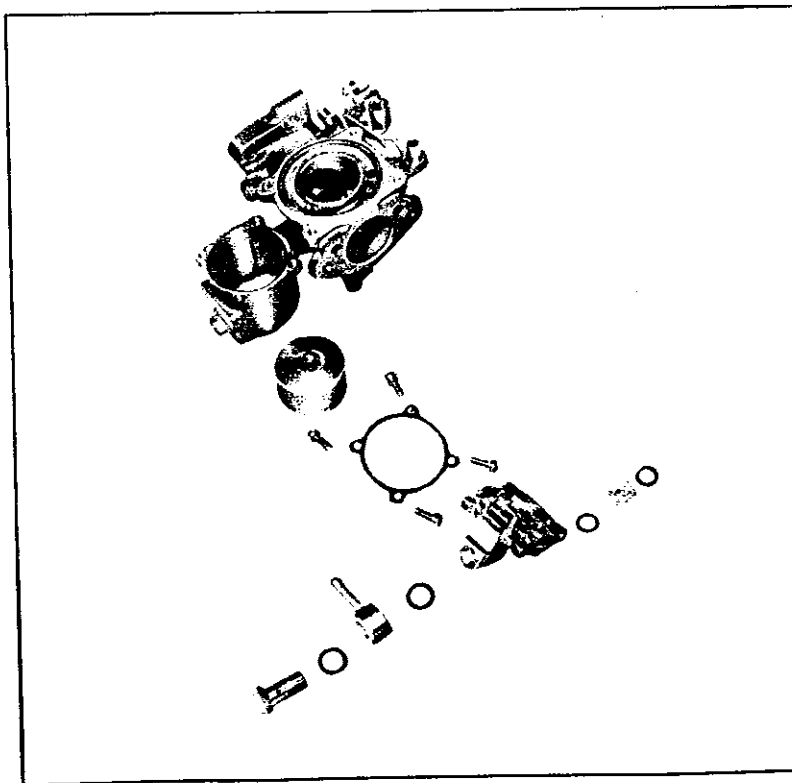


Fig. EF-53 Disassembly of float chamber

ENGINE

Disassembly of the link and related components

In disassembling and reassembling the interlock link and related components, be careful not to bend or deform any of the components.

Reassemble so that all interlock links operate smoothly.

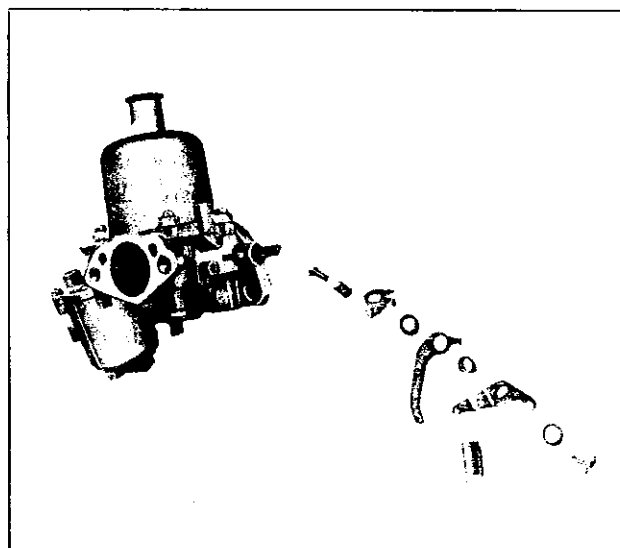


Fig. EF-53 Disassembly of throttle lever

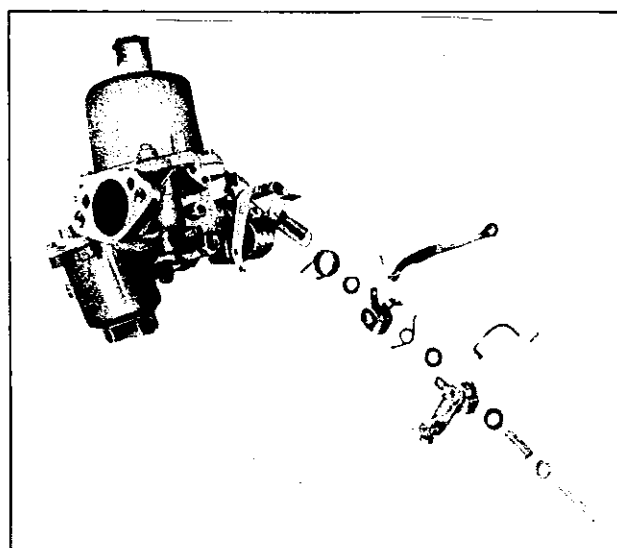


Fig EF-54 Disassembly of starter lever

TROUBLE DIAGNOSES AND CORRECTIONS

The causes of trouble and appropriate corrective actions are shown on Table to permit immediate repair of the carburetor in the event carburetor trouble develops.

Improper engine operation can be attributed to many different causes. Although the carburetor may be normal,

if the electrical system is defective, the cause of trouble sometimes may seem to be in the carburetor. If the engine does not operate satisfactorily, first check the electrical system before attempting to adjust the carburetor.

Troubles	Possible causes	Corrective action
Overflow	Leakage from the float or damaged or bent float	Repair or replace
	Dirty needle valve seat	Clean the valve seat.
	Loose needle valve	Retighten.
	Defective needle valve seat	Refit or replace.
	Excessive fuel pump pressure	Adjust.
	Fuel pump drawing in air	Repair the pump.

FUEL SYSTEM

Excessive fuel consumption	Overflow Faulty suction piston operation Defective nozzle return. Worn jet needle Worn nozzle jet Improper idling adjustment Jet needle not properly installed Improper throttle valve interlock adjustment	Refer to the above. Repair or replace. Readjust. Replace. Replace. Readjust. Readjust. Readjust.
Insufficient output	Throttle valve does not open fully Faulty suction piston operation Faulty nozzle return Clogged nozzle or fuel line Jet needle not properly installed Clogged needle valve Defective fuel pump	Readjust. Repair or replace. Readjust. Clean. Readjust. Clean Readjust.
Improper idling	Faulty suction piston operation Faulty nozzle return Worn jet needle Improper idling adjusting nut adjustment Worn throttle valve shaft Air leakage due to defective packing between manifold and carburetor Improper throttle valve interlock adjustment Loose throttle lever interlock link	Repair or replace. Readjust. Replace. Readjust. Replace. Replace the gasket. Readjust. Readjust or repair.
Engine operation is irregular or erratic	Defective suction piston Insuffieient damper oil, or improper oil used Improper idling adjustment Jet needle not properly installed	Repair or replace. Replenish or replace. Readjust. Readjust.

ENGINE

<p>Engine does not start.</p>	<p>Overflow</p> <p>No fuel fed to the engine</p> <p>Improper idling adjustment</p> <p>Defective suction piston</p>	<p>Refer to the above.</p> <p>Check the pump, the fuel line, and needle valve.</p> <p>Readjust.</p> <p>Repair or replace.</p>
<p>Faulty suction piston operation</p>	<p>Sticking due to dirt and other foreign matter</p> <p>Sticking due to deformation (bulging or caving) of suction chamber or suction piston</p> <p>Nozzle not properly centered</p> <p>Bent jet needle</p> <p>Bent plunger rod.</p>	<p>Clean.</p> <p>Repair or replace.</p> <p>Correct.</p> <p>Replace.</p> <p>Correct.</p>

SPECIFICATIONS AND SERVICE DATA

Specifications

Applied engine (car model)	L24 (S30)
Make and type	HITACHI HJG46W-3A
Construction	Side-draft, SU type
Bore	46 mm (1.811 in)
Weight	3.1 kg (6.834 lb)

Service data

Venturi	34 mm (1.339 in)
Float level	23 .0 mm (0.906 in)
Fuel pressure	0.24 kg-cm ² (3.414 lb/sq in)
Needle valve dia.	2.0 mm (0.0787 in)
Nozzle	A
Jet needle	N-27
Suction spring	#23

**MODEL
L20A, L24 SERIES
ENGINE**



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EC
**EMISSION CONTROL
SYSTEM**

GENERAL DESCRIPTION	EC- 2
CRANKCASE EMISSION CONTROL SYSTEM	EC- 2
EXHAUST EMISSION CONTROL SYSTEM	EC- 3
EVAPORATIVE EMISSION CONTROL SYSTEM	EC-12
MAINTENANCE AND TESTING	EC-14
ADJUSTING ENGINE IDLING SPEED AND GAS MAIXTURE	EC-20
TROUBLE DIAGNOSES AND CORRECTIONS	EC-24
PERIODIC RECOMMENDED MAINTENANCE	EC-26
SERVICE DATA AND SPECIFICATIONS	EC-27

EMISSION CONTROL SYSTEM

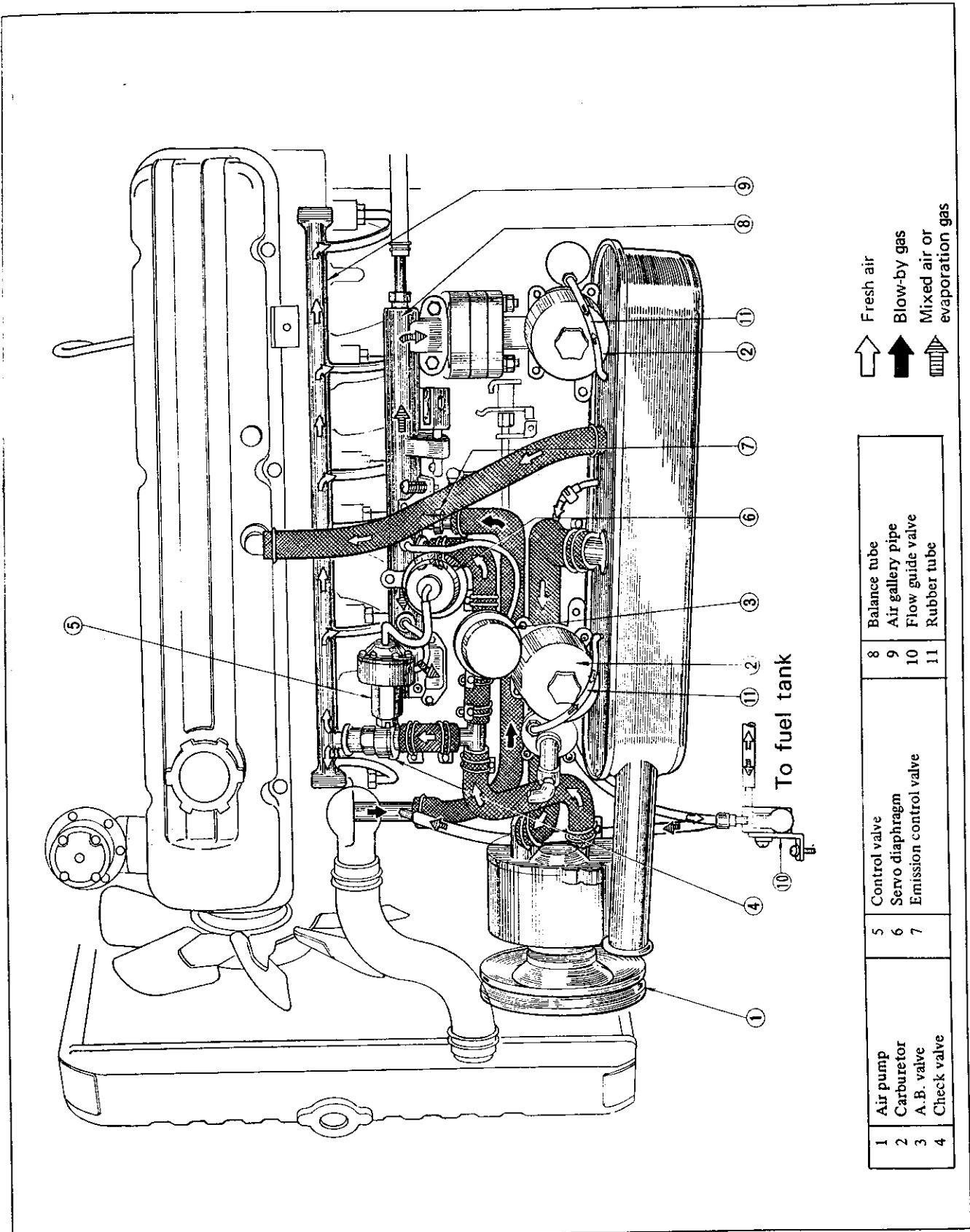


Fig. EC-1 Emission control system on model S30 series

ENGINE

GENERAL DESCRIPTION

There are three types of emission control system to be controlled. These are;

1. Closed type crankcase emission control system
2. Exhaust emission control system
Air injection system (A.I.S.)
Engine modifications

3. Evaporative emission control system

Periodic inspection and required servicing of these systems should be carried out at the recommended intervals to assure better performance extended engine service life and elimination of air pollution improved to the maximum extent.

CRANKCASE EMISSION CONTROL SYSTEM

CONTENTS

DESCRIPTION EC-2

PERIODIC SERVICE EC-3

DESCRIPTION

There are two types of crankcase emission control system. One is a sealed system, and the other is a closed system (with valve controlled by an intake manifold vacuum and sealed system).

The closed system is employed by the L24 engine installed on the S30 series vehicles, instead of the sealed system being used on SP/SR sport cars.

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

In addition to the above mentioned sealed system, a

variable orifice valve is used to feed 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. Ventilating air is drawn from the clean side of the carburetor air cleaner, through the tube connection, into the crankcase.

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

EMISSION CONTROL SYSTEM

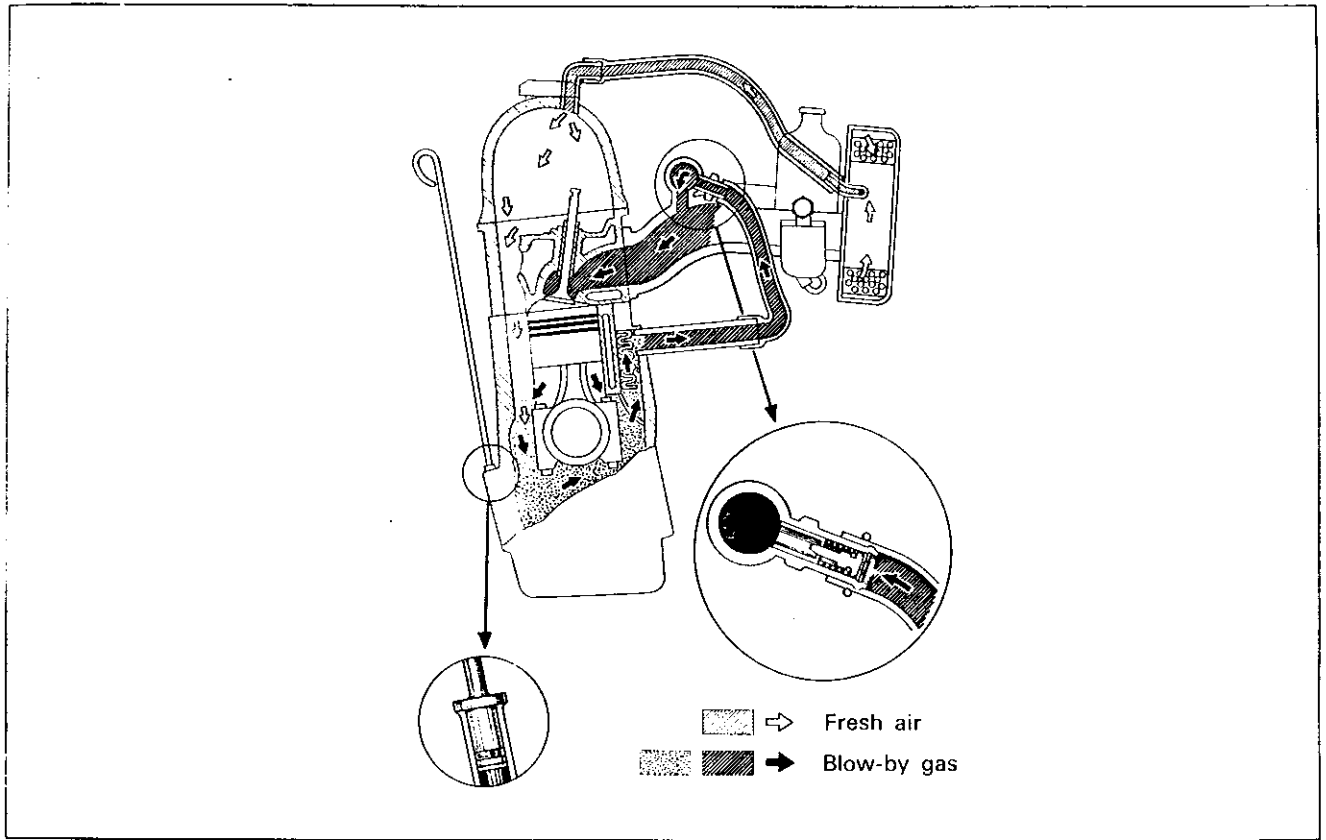


Fig. EC-2 Closed type positive crankcase ventilation system

PERIODIC SERVICE

Once a year or at every 18,000 km (12,000 miles), the crankcase Emission Control System should be serviced as follows.

1. Check hoses and hose connectors for leaks.
2. Disconnect all hoses and blow them out with

compressed air.

If a hose is not free from obstructions, replace with a new one.

3. Check the crankcase ventilation control valve for the correct function. If the valve is found defective replace it with a new assembly.

EXHAUST EMISSION CONTROL SYSTEM

CONTENTS

AIR INJECTION SYSTEM	EC- 4	REMOVAL, DISASSEMBLY AND	
Air pump	EC- 4	INSPECTION	EC- 8
Air injection into each exhaust port	EC- 5	Air pump	EC- 8
Anti-backfire valve	EC- 6	Drive pulley	EC- 9
Check valve	EC- 7	Anti-backfire valve	EC- 9
Air pump relief valve	EC- 7	Check valve	EC- 9
ENGINE MODIFICATIONS	EC- 7	Air gallery pipe and injection nozzles	EC-10

ENGINE

AIR INJECTION SYSTEM

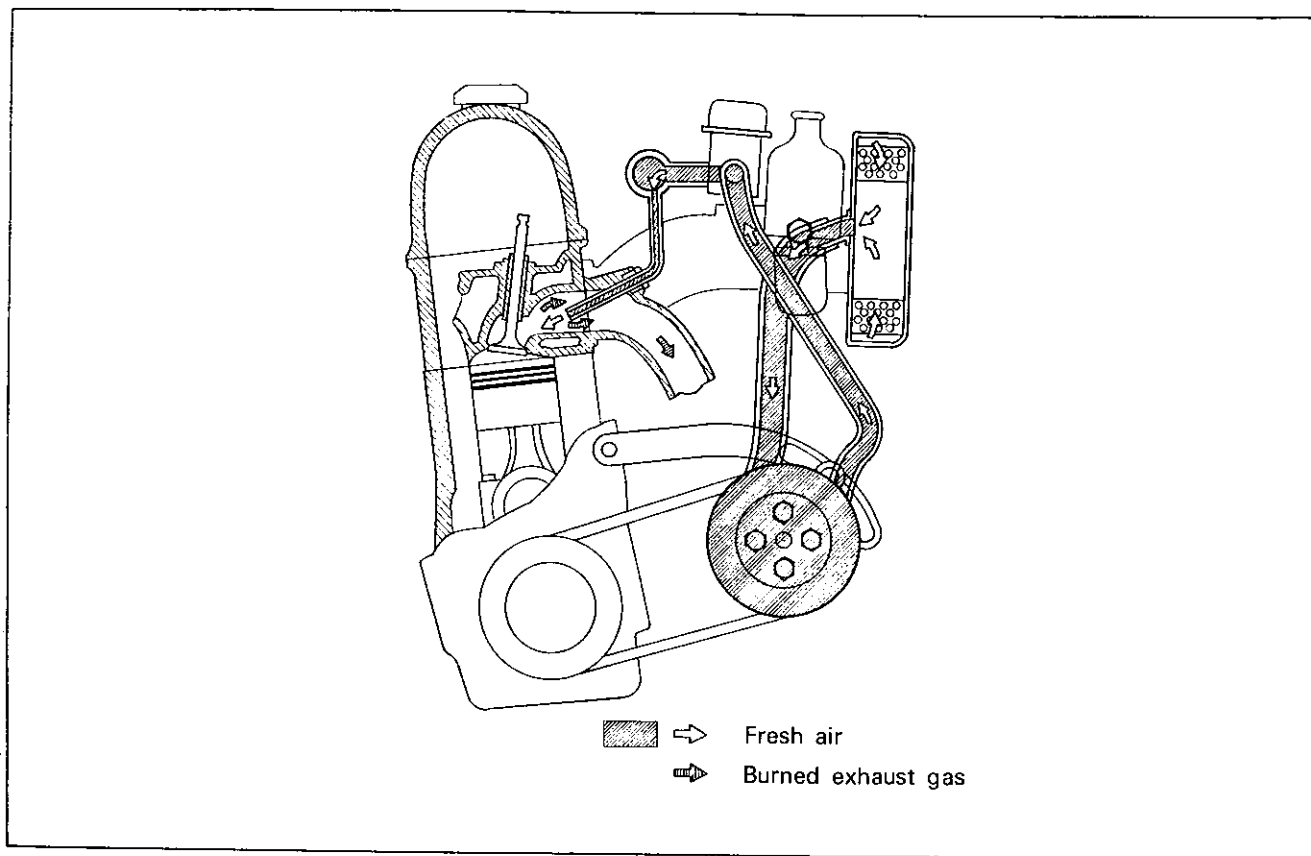


Fig. EC-3 Air injection system

The air injection pump receives clean air through a hose, connected to a fitting attached beneath the carburetor air cleaner.

This rotary vane type pump has been designed to draw air in and compress it to produce maximum air flow with quiet operation. A fresh air line from the air injection pump is routed to a check valve, which prevents exhaust gas from entering the air pump in the event exhaust manifold pressure is greater than air injection pressure, or in the case of an inoperative pump. The compressed fresh air is injected through an injection nozzle to the exhaust ports.

An anti-backfire valve has been used to eliminate "popping" in the exhaust system when the throttle is closed a high speed "coasting." Controls which have been incorporated to assure reliable system operation include an anti-backfire valve and a check valve.

Air pump

The air pump is of a three vane type. It is a positive displacement vane-type which requires no lubricating service (maintenance free).

The die-cast aluminum air pump assembly attached to the front of the engine is driven by an air pump drive belt. A rotor shaft, drive hub, relief valve and inlet and outlet tubes are visible on the pump exterior. A rotor, vanes, carbon shoes, and shoe springs make up the rotating unit of the pump. The rotor located in the center of the pump is belt-driven. The vanes rotate freely around the off-center pivot pin, and follow the circular-shaped pump bore. In the three-vane type, the vanes form three chambers in the housing. Each vane completes a pumping cycle in every revolution of the rotor. Air is drawn into the inlet cavity through a tube connected to the air cleaner. Air is sealed between the vanes and moved into a smaller cavity (the compression area).

EMISSION CONTROL SYSTEM

After compression, the vanes pass the outlet cavity. The vanes subsequently pass the stripper, a section of the housing that separates the outlet and inlet cavities. Continuing the cycle, the vanes again enter the inlet cavity to repeat its pumping cycle. The relief valve, located in the outlet cavity, consists of a preloaded spring, seat, and pressure-setting plug. Its function is to relieve the outlet air flow when the pressure exceeds a pre-set value. Metering grooves, machined into the housing wall, located in both the inlet and outlet cavities; provide a quiet transition from intake to compression to exhaust.

Carbon shoes support the vanes from slots in the rotor. The shoes are designed to permit sliding of the vanes and to seal the rotor interior from the air cavities. Leaf springs

which are behind the follower-side of the shoes compensate for shoe wear and vane operating sound. The rotor is further sealed by flexible carbon seals which are attached to each end. The plates also seal off the housing and end cover to confine the air to the pump cavities.

The rotating unit is a steel ring bolted to the rotor end. This ring prevents the rotor from spreading at high speed, and also positions and holds the rear bearing and the carbon seal.

The front and rear bearings which support the rotor are of two types. The front bearing uses ball bearings and the rear bearing uses needle bearings. The vane uses needle bearings. All bearings have been greased.

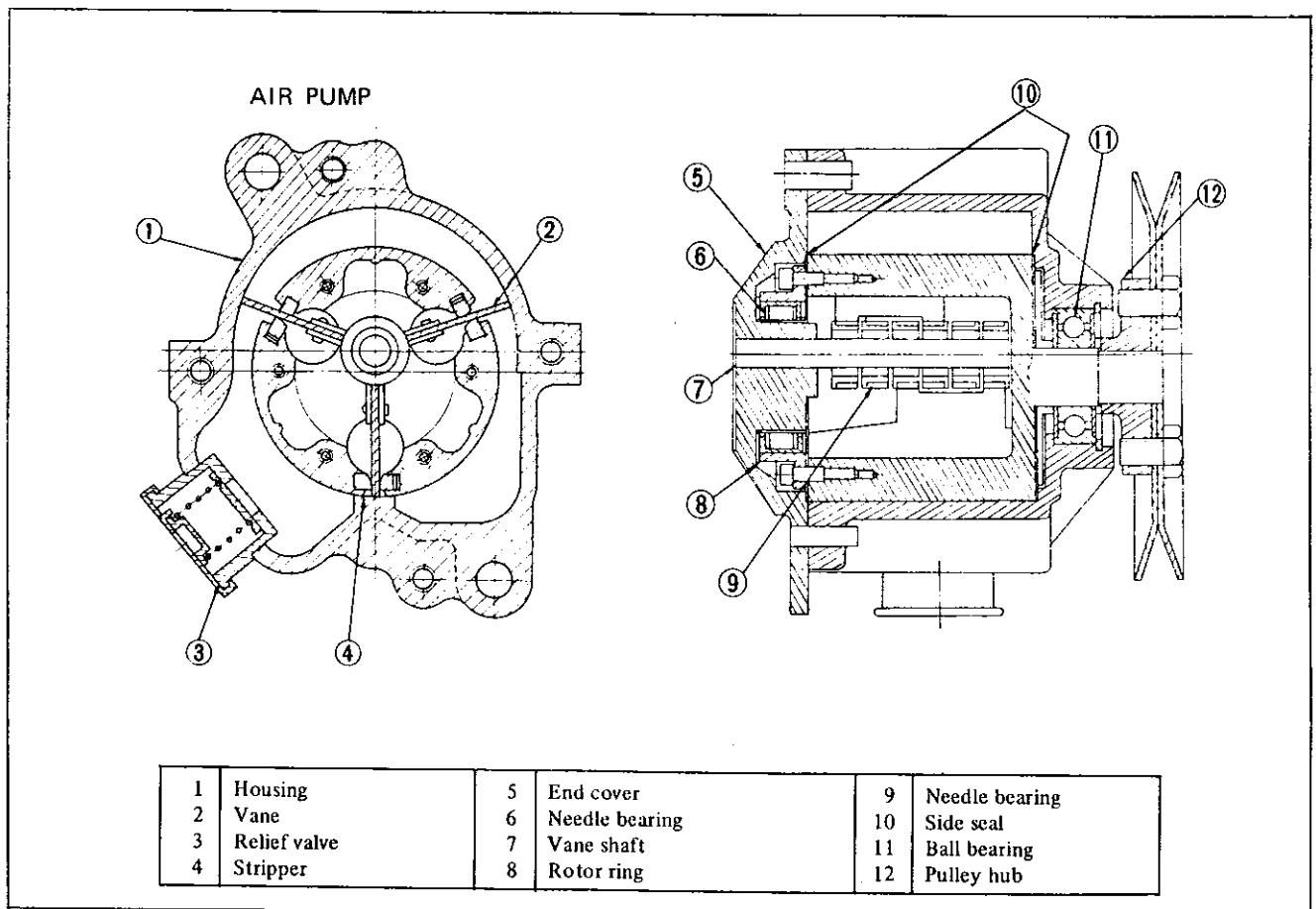


Fig. EC-4 Sectional view of air pump (Three-vane type)

Air injection into each exhaust port

Fresh air from the air pump is injected into the individual exhaust ports of the cylinder head located near the exhaust valve.

Pressurized air is transmitted through hoses and air

distribution manifold.

A schematic of the exhaust port is shown in Figure EC-5.

ENGINE

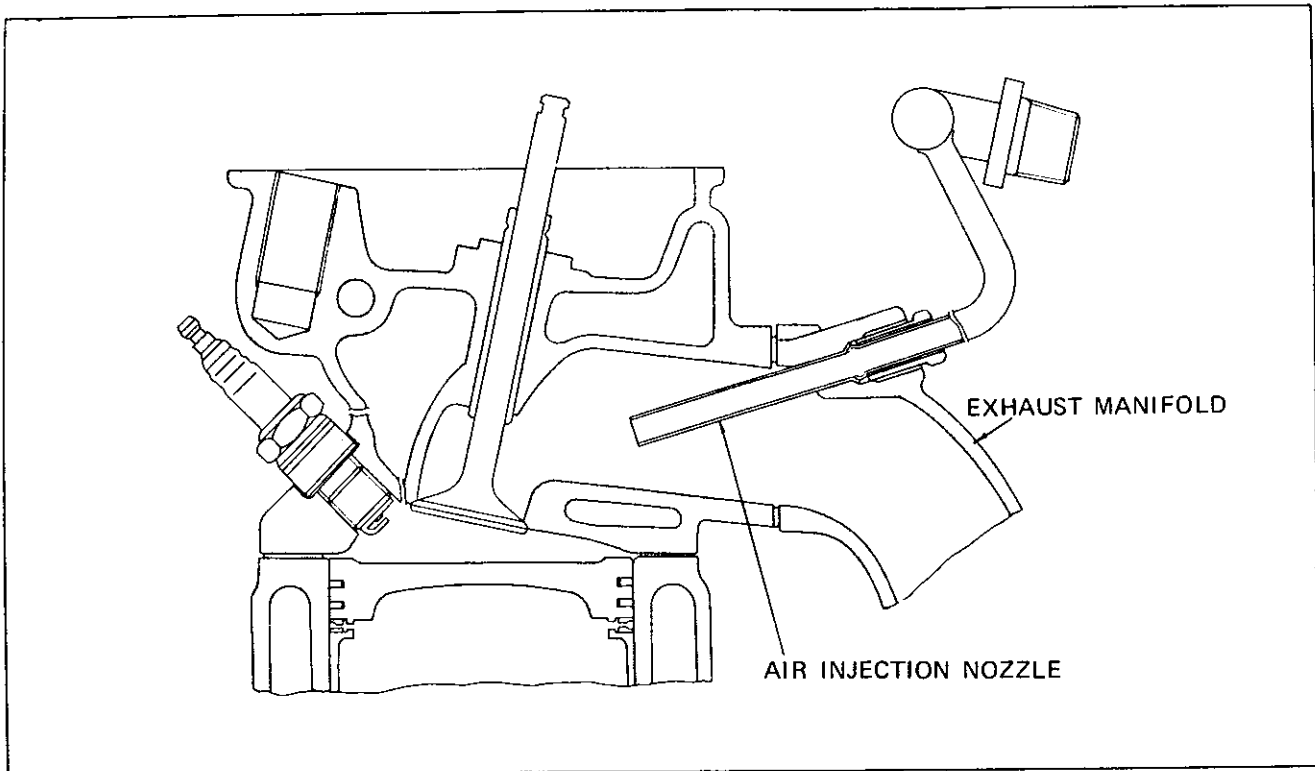


Fig. EC-5 Air injection into exhaust port

In addition to the air injection system, certain controls have been incorporated to assure reliable system operation as follows.

Anti-backfire valve

This valve is controlled by intake manifold vacuum and is used to prevent exhaust system backfire at the initial duration of deceleration. At that time, the mixture in the intake manifold is too rich to burn and ignites when combined with injected air in the exhaust manifold.

The anti-backfire valve is used to provide a supply of air into the intake manifold thereby making the air mixture leaner to prevent backfire.

A schematic of the anti-backfire valve is shown in Figure EC-6.

The anti-backfire valve inlet is connected to the air pump discharge line and outlet to the intake manifold.

By burning this rapidly evaporated fuel within the cylinder, some contribution to emission reduction can also be expected.

If the valve does not work properly, the fuel mixture will go through the combustion chambers without being ignited, meet fresh air and, at high temperature, backfiring will result.

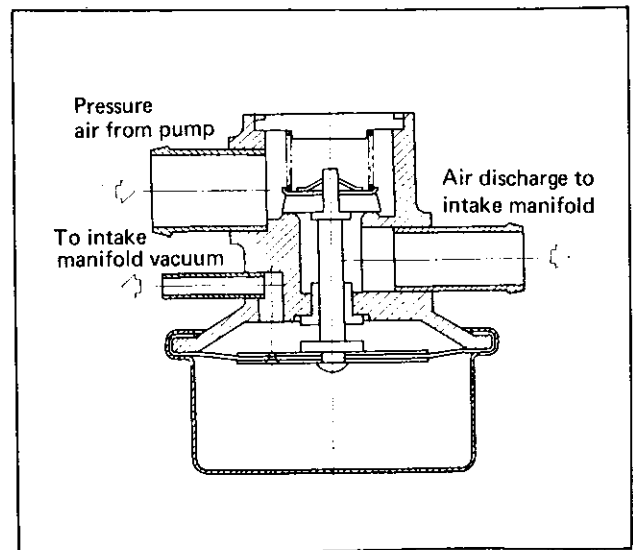


Fig. EC-6 Anti-backfire valve

EMISSION CONTROL SYSTEM

Check valve

A check valve is located in the air pump discharge lines. The valve prevents the backflow of exhaust gas. Backflow of exhaust gas occurs in the following cases.

1. When the air pump drive belt fails.
2. When the spring of relief valve fails.

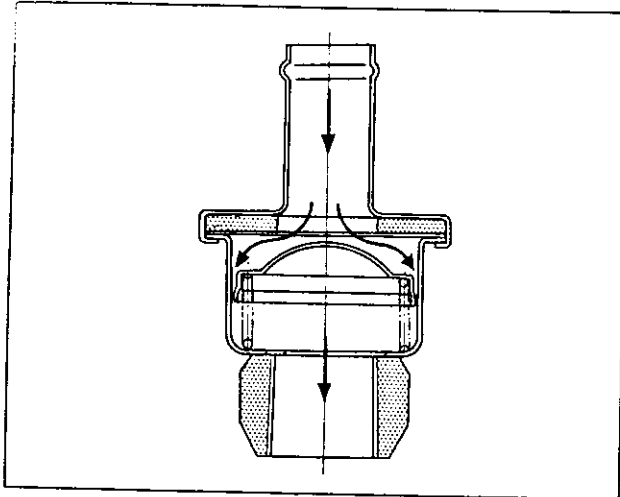


Fig. EC-7 Check valve

Air pump relief valve

The air pump relief valve is mounted in the discharge cavity of the air pump and accomplishes the following functions without affecting effectiveness of the exhaust emission control system.

1. Minimizes exhaust gas temperature rise.
2. Minimizes horsepower losses resulting from air injection into the exhaust system.
3. Protects the pump from excessive back pressure.

ENGINE MODIFICATIONS

This engine modifications system consists of a vacuum control valve which detects negative pressure of the intake manifold and operates the control valve, and a servo diaphragm which controls carburetor throttle valve in response to the vacuum control valve operation. This engine modification system has been designed so that HC emission is reduced when engine brake is applied.

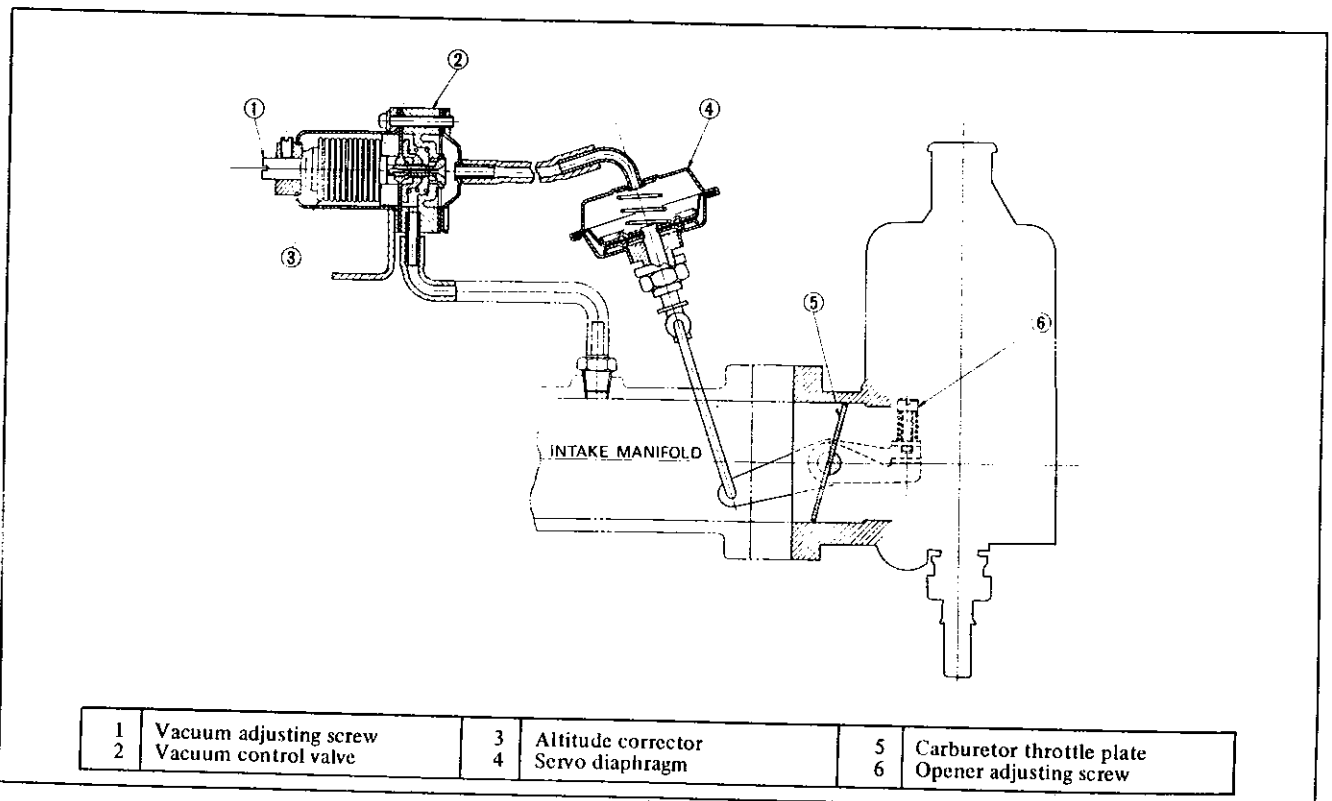


Fig. EC-8 Engine modification system

ENGINE

REMOVAL, DISASSEMBLY AND INSPECTION

Primarily, do not remove the exhaust emission control system.

When the removal is unavoidable, however, thoroughly inspect before removing.

Air pump

Removal

1. Disconnect the hoses from the air pump housing cover.
2. Remove the bolt securing the air pump to the belt adjusting bar (or adjusting bracket).
3. Remove the bolt securing the air pump to the mounting bracket and remove the air pump drive belt.
4. Dismount the air pump assembly from the vehicle.

Periodical service

No periodic maintenance is required since the bearings in the pump are lubrication free types. Every 5,000 km (3,000 miles), however, the belt tension should be inspected and adjusted.

Disassembly

1. Remove four pulley drive bolts and remove the pulley from the hub.
2. Secure the air drive hub in a vise, as shown in Figure EC-9 and remove four housing end cover bolts.

Note: Never clamp on the aluminum housing.

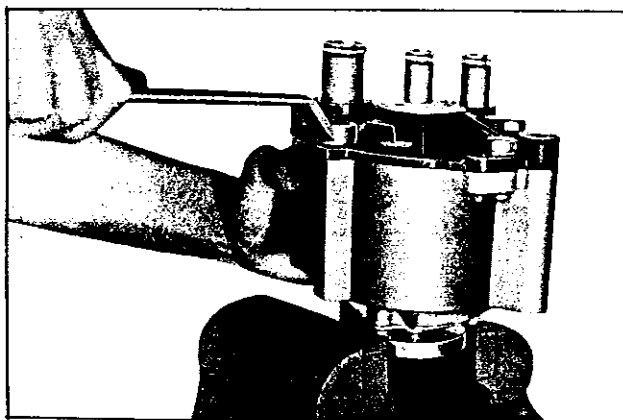


Fig. EC-9 Removing and cover

3. Remove the housing end cover by carefully tapping the surrounding of the large dowel pin with a plastic mallet and lifting up straight.

4. Put match marks on the rotor ring and side of rotor to ensure correct reassembly, and remove six screws (four screws for a two-vane type) that retain the rotor ring to the rotor, using a hexagonal wrench (special tool ST19810000).

Note: Generally, match marks have been indicated on both rotor ring and rotor by the manufacturer.

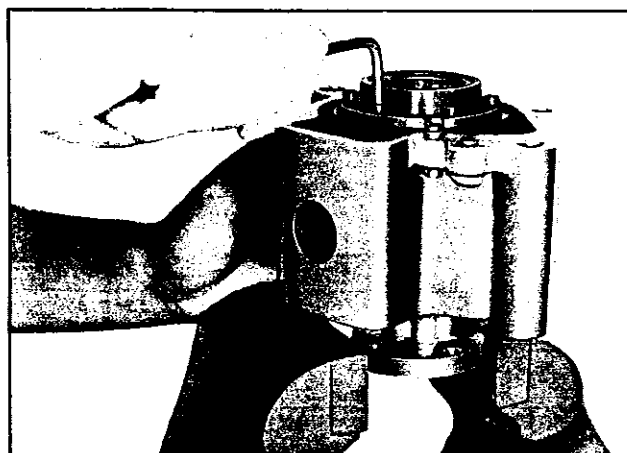


Fig. EC-10 Removing rotor ring

5. Remove the rotor ring and side carbon seal (for the three-vane type) from the rotor.

6. In the three-vane type, if it is necessary to replace the rear bearing, it may be pressed out of rotor ring on a press using a support for disassembling rotor ring and attachment for pushing out needle bearing.

Special tool

Support for disassembling rotor ring
STECP ST19820000

Attachment for pushing out needle bearing
STECP ST19830000

Note: Support rotor ring carefully to avoid distortion.

ENGINE

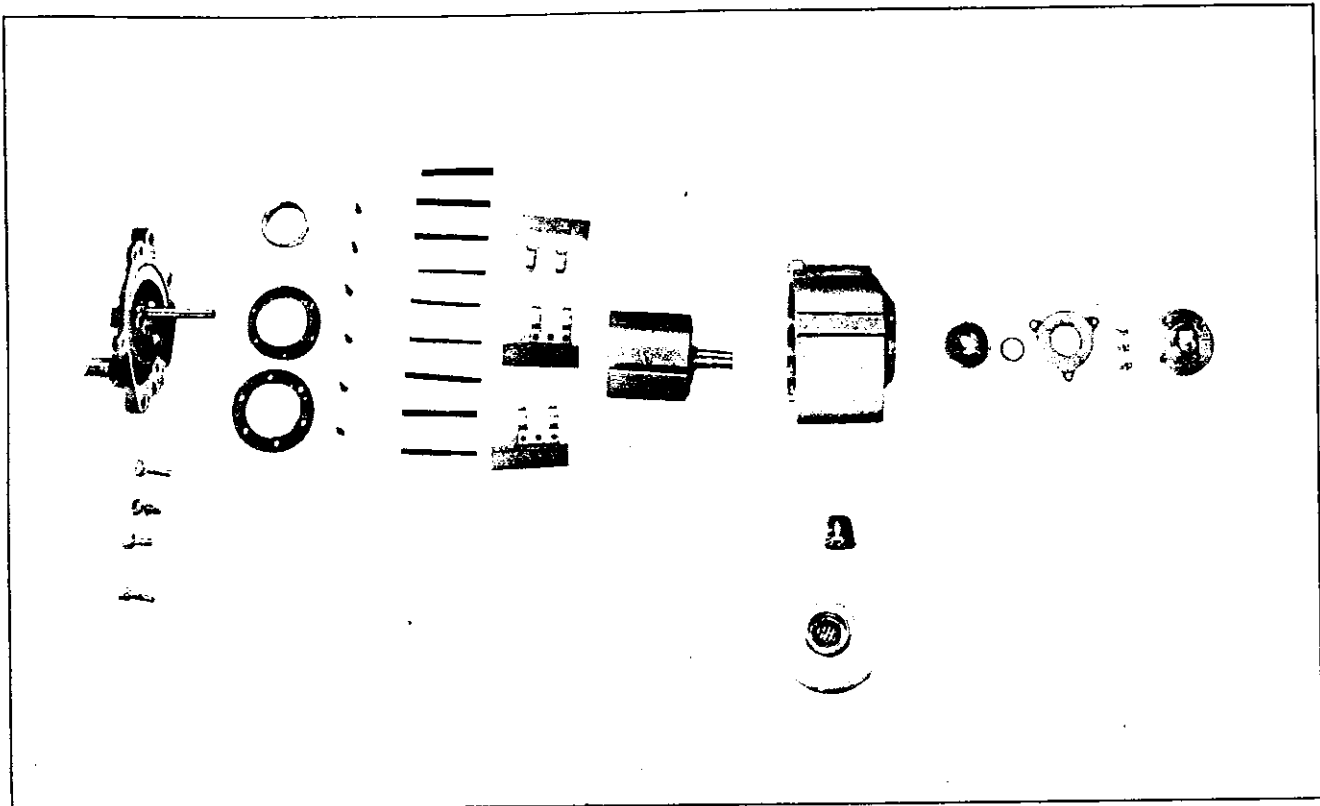


Fig. EC-14 Components of three-vane type air pump

Inspection

Inspect all parts for chipping, scoring, wear and roughness.

All damaged parts must be replaced to ensure quiet and efficient operation.

If especially side carbon seal is scored, replace with a new one (for the three-vane type).

Carbon dust may be present in the housing and is usually an indication of normal wear.

Lubrication

The rear bearing and vane hub bearings must be lubricated with a high melting point grease such as ESSO ANDOK 260 or equivalent. Grease each bearing to insure adequate lubrication.

Note: Bearings for service are already packed with high melting point grease.

Assembly of air pump

1. Place the air pump housing in a vise, clamping the pump drive hub between jaws.

2. Assemble vanes correctly on dummy shaft 9.5 mm (0.3740 in) diameter. (special tool ST19860000)

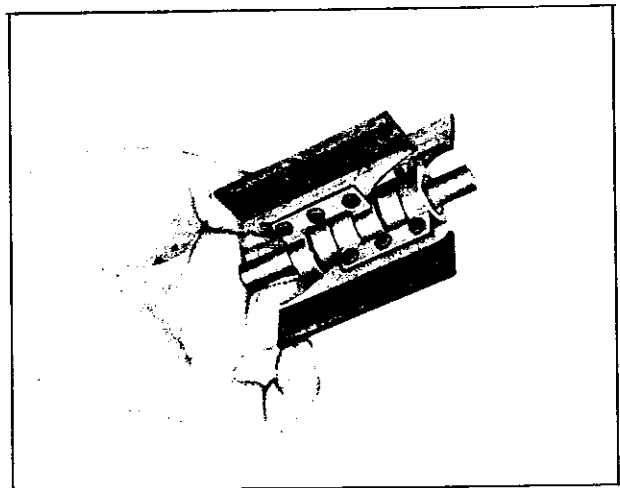


Fig. EC-15 Vane assembly

3. Place vanes into rotor. In the three-vane type make sure that one vane is against housing stripper, and do not remove the dummy shaft at this time.

EMISSION CONTROL SYSTEM

Note: a. Pack the vane hub bearing with high melting point grease such as ESSO ANDOK 260.

b. The vanes may require five to ten miles wear-in running time. In the event a slight squeaking still persists the vehicle should be run through two or three full throttle shift points. In most cases five to ten miles will be sufficient for wear-in.

4. Insert one carbon shoe on each side of every vane.

Note: Each carbon shoe must be positioned so that chamfered end of shoe faces to vane.

5. Insert the shoe spring into each deeper shoe slot.

Note: When springs are properly positioned, they will be flush or below rotor surface. The curved portion of spring will be against the shoe and ends will be against wall of shoe slot.

6. In the three-vane type, if rear bearing was removed, a new bearing may be pressed into rotor ring using attachment for pressing in needle bearing (special tool ST19840000). The bearing should be about 0.8 mm (0.0315 in) below rotor ring surface.

Note: Press only on lettered end bearing surface and support rotor ring to prevent its distortion.

7. Position new carbon seal on rotor ring so that holes line up.

8. Position the rotor ring so that scribe marks on rotor ring and side of rotor line up.

9. Apply thread locking material to rotor ring retaining screws and tighten them to 30 to 50 kg-cm (2.2 to 3.6 ft-lb).

10. Remove the dummy shaft from vanes and start housing end cover assembly into position (for the three-vane type), indexing vane shaft into vane bearings. Do not force cover on since it will distort vane bearings and/or vane bearing alignment.

11. Install the end cover on the housing and starting with bolt adjacent to large dowel, tighten four end cover bolts to 100 to 130 kg-cm (7.2 to 9.4 ft-lb). Remove the air pump from the vise.

12. Insert the relief valve into housing mounting hole. With protective plate over valve, tap gently with plastic mallet until the valve shoulders on the housing.

Note: Care must be observed to prevent distortion of air pump housing.

13. Install the silencer on relief valve by hand (for the three-vane type).

Reinstalling the air pump

Reinstall the air pump in reverse sequence of removal, noting the following points.

Adjust the belt tension so that it has about 12.7 mm (0.5 in) of slack under thumb pressure.

Drive pulley

1. Loosen the air supply pump adjusting bar nut and bolt to relieve the belt tension.

2. Remove the drive pulley attaching bolts.

Anti-backfire valve

When removing the anti-backfire valve, disconnect the hoses. No further disassembly should be done. After installation, check the valve operation and inspect all hoses and hose connections for leaks.

Check valve

1. Disconnect the air supply hose.

2. Remove the check valve from the air gallery pipe holding the flange of air gallery pipe with a wrench.

Note: a. Be careful not to damage the air gallery pipe.

b. No further disassembly should be done.

3. Reinstall the check valve in reverse sequence of removal.

Note: Tightening torque 9.0 to 10.5 kg-m (65 to 76 ft-lb)

4. After installation, check the valve, hoses and hose connections for air leakage.

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Air gallery pipe and injection nozzles

It is very difficult to remove the air gallery from the exhaust manifold without bending the pipe, which could result in fractures or leakage. Therefore, the removal of the air gallery pipe and injection nozzles should be done only when they are damaged.

1. Lubricate around the connecting portion of the air injection nozzle and air gallery with engine oil.
2. Hold the air injection nozzle hexagon head with a wrench and unfasten the flare screw connecting the air gallery to injection nozzle. Remove the air gallery.

Note: a. Apply engine oil to the screws several times during the above work.

b. Be careful not to damage other parts.

3. Unfasten the air injection nozzle from the cylinder head applying the engine oil to the screwed portion several times.

4. Check the air gallery and nozzle for fractures or leakage. Clean the air injection nozzle with a wire brush.

5. At the time of installation, assemble the nozzle seat on the injection nozzle and tighten the air injection nozzle to a torque of 5.7 to 7.6 kg-m (41 to 55.0 ft-lb).

6. Hold the air injection nozzle hexagon head with a wrench and tighten the flange screw of the air gallery to a torque of 5.0 to 6.0 kg-m (36 to 43 ft-lb).

7. Check the cylinder head, air injection nozzle and air gallery for leaks with the engine running.

EVAPORATIVE EMISSION CONTROL SYSTEM

CONTENTS

DESCRIPTION	EC-12	FLOW GUIDE VALVE	EC-13
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DESCRIPTION

This system is composed of the following four basic elements.

1. Fuel tank with positive sealing filler cap
2. Vapor-liquid separator
3. Vapor vent line
4. Flow guide valve

When the engine is at rest, the vapor vent line, vapor liquid separator and fuel tank are filled with evaporation gas produced in the closed type fuel tank. A flow guide valve opens when the gas pressure exceeds 10 mmHg (0.4 in Hg). The gas passed through the flow guide valve (2) is straged into the crankcase. Once the engine starts operation, evaporation gas in crankcase, manifold and carburetor air cleaner are sucked into the manifold for combustion. When the pressure of the closed 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 carubretor air cleaner to the fuel tank.

EMISSION CONTROL SYSTEM

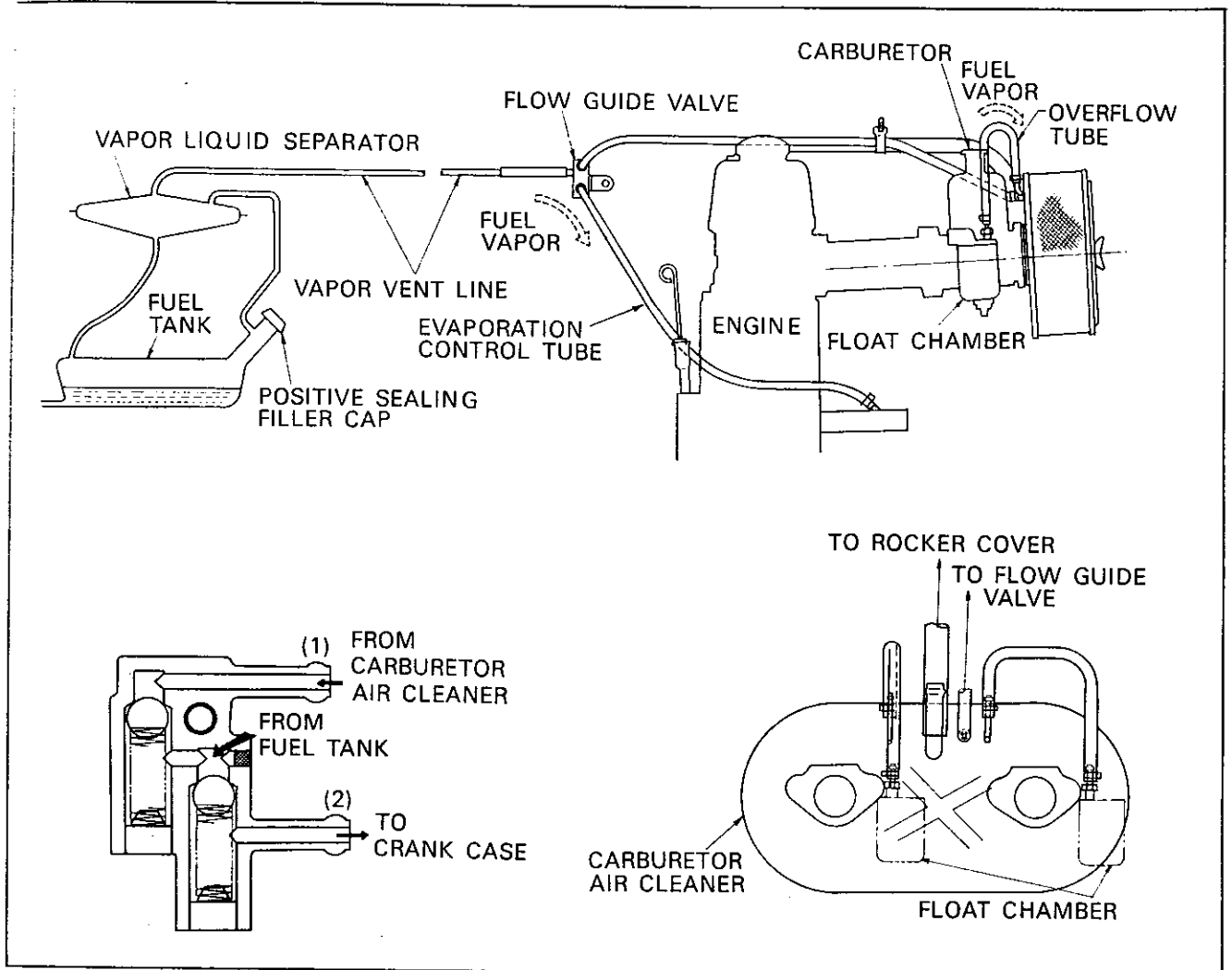


Fig. EC-16 Evaporative emission control system

FLOW GUIDE VALVE

This valve operates to prevent reverse flow of blow-by gas from the crankcase. This valve is mounted inside the engine compartment. A, F and C marks are engraved in the body of the valve to indicate the connection of the vapor vent line.

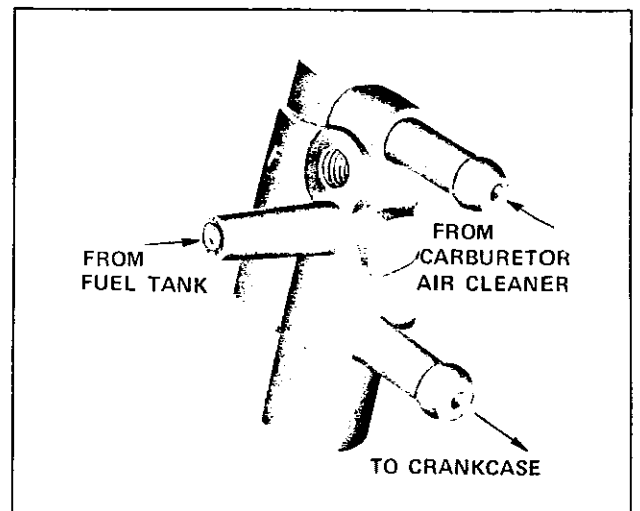


Fig. EC-17 Flow guide valve

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MAINTENANCE AND TESTING

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GENERAL MAINTENANCE	EC-14	Testing of anti-backfire valve	EC-16
Carburetor	EC-14	Testing of air pump	EC-16
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SYSTEM	EC-15	separator and vapor vent line	EC-19
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GENERAL MAINTENANCE

To make sure that exhaust emissions are maintained at a low level, it is recommended that inspection be conducted every 12 months or every 20,000 km (12,000 miles), whichever occurs first. Best engine operation and minimum exhaust emissions will be obtained through periodical inspections and from recommended servicing at these intervals.

Carburetor

Check the choke setting and adjust to the specifications as required.

Proper carburetor idle mixture adjustment is imperative for best exhaust emission control.

Refer to the article given in "Setting ignition timing and adjusting idle speed and mixture".

Distributor

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. Breaker points should be replaced at intervals not to exceed 20,000 km (12,000 miles).

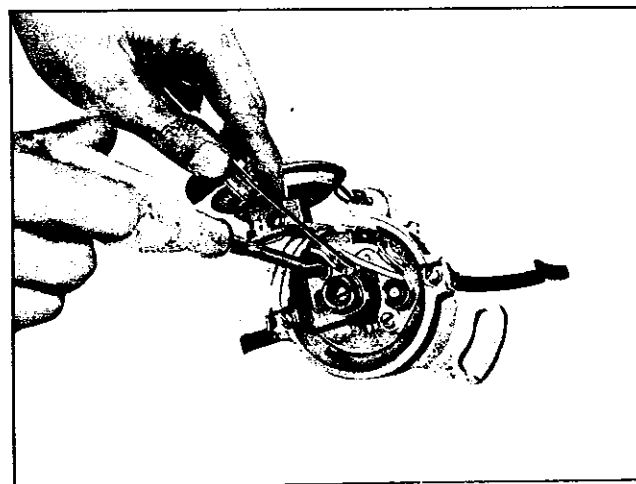


Fig. EC-18 Checking of distributor breaker point gap

Spark plug

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 0.80 to 0.90 mm (0.0315 to 0.0355 in) by the use of a proper adjusting tool. Spark plug should be replaced every 20,000 km (12,000 miles).

EMISSION CONTROL SYSTEM

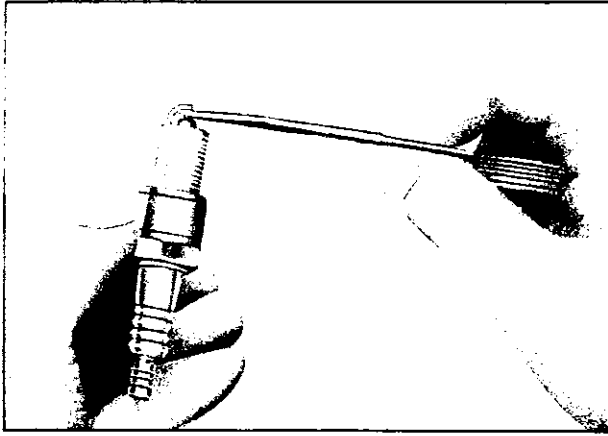


Fig. EC-19 Checking of spark plug point gap

High tension cable

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

Connect the ohmmeter between the spark plug adaptor and the corresponding electrode inside the cap. If the resistance is more than 15,000 ohms, remove the cable from cap and check cable resistance only. If the resistance is still more than 15,000 ohms, replace cable assembly.

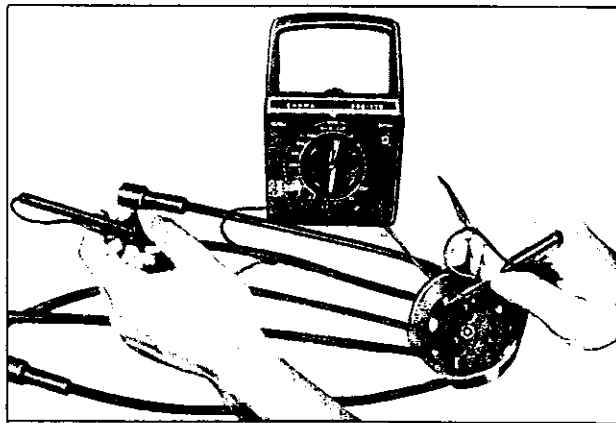


Fig. EC-20 Checking of high tension cables

Battery

Measure specific gravity of electrolyte with an accurate hydrometer. Specific gravity should be 1.220 or more at the standard. Add mineral free water (distilled water) as required to bring electrolyte up to proper level.

Clean battery posts and cable terminals. After tightening clamps, coat the battery posts and clamps slightly with grease to retard corrosion.

Air cleaner element

Carburetor air cleaner element

The paper element has been specially treated, and therefore, there is no need to clean it. But it should be replaced every 40,000 km (24,000 miles).

CRANKCASE EMISSION CONTROL SYSTEM

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 freed of obstructions, replace with a new one.

3. Testing of the crankcase ventilation control valve.

With engine running at idle, remove the ventilator hose from the crankcase ventilation control 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 the valve inlet. If valve is plugged, do not attempt to clean it. Replace with a new valve. Check for deposit plugging in the hose. Clean if necessary.

AIR INJECTION SYSTEM

The following procedures are recommended for checking and/or verifying that the various components of the exhaust emission control system are operating properly.

The engine and all components must be at normal operating temperatures when the tests are performed. Prior to performing any extensive diagnosis of the exhaust control system, it must be determined that the engine as a unit is functioning properly. (Disconnect the anti-backfire valve vacuum sensing hose and air supply hose at the intake manifold connections. Plug the manifold connector to preclude leakage. Plug the anti-backfire valve vacuum

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sensing hose to close the passage the intake manifold ... A.I.S.). After checking the normal engine operation, reinstall all the A.I.S. parts.

Testing of check valve

This test can be performed at the same time as the air pump test.

1. Operate the engine until it reaches normal operating temperature.
2. Inspect all hoses and hose connectors for obvious leaks and correct as necessary before checking the valve operation.
3. Visually inspect the position of the valve plate inside the valve body. It should be lightly positioned against the valve seat away from the air distributor manifold.
4. Insert a probe into the valve connection on the check valve and depress the valve plate. It should freely return to the original position, against the valve seat, when released.
5. Leave the hose disconnected and start the engine. Slowly increase the engine speed to 1,500 rpm and watch for exhaust gas leakage at the check valve. There should not be any exhaust leakage. The valve may flutter or vibrate at idle speeds, but this is normal due to exhaust pulsations in the manifold.
6. If the check valve does not meet the recommended conditions, replace it.

Testing of anti-backfire valve

1. Operate the engine until it reaches normal operating temperature.
2. Inspect all hoses and hose connections for obvious leaks, and correct, if necessary, before checking the anti-backfire valve operation.
3. Disconnect the air hose to intake manifold at the anti-backfire valve. Insert a suitable plug in the hose and fasten it securely.
4. Open and close the throttle valve rapidly, if air flow

is felt for one to two seconds by a finger at anti-backfire valve outlet to the intake manifold, the valve functioning properly.

If air flow is not felt or air flow is felt continuously more than two seconds, the valve should be replaced.

5. Connect the air hose to intake manifold and disconnect the air inlet hose from the air pump at the anti-backfire valve. If engine idle speed changes excessively, the valve function is not correct and it should be replaced.

Note: In case of idle racing anti-backfire valve cannot be considered abnormal even if these exists after-burning, since it never comes out while running.

Testing of air pump

1. Operate the engine until it reaches normal operating temperature.
2. Inspect all hose, hose connections, air gallery for leaks and correct, if necessary, before checking the air injection pump.
3. Check the air injection pump belt tension and adjust to specifications if necessary.
4. Disconnect the air supply hose at the check valve.
5. Insert the open pipe end of the air pump test gauge adapter (special tool ST19870000) in the air supply hose. Clamp the hose securely to the adapter to prevent it from blowing out. Position the adapter and test gauge so that the air blast emitted through the drilled pipe plug will be harmlessly dissipated.
6. Install a tachometer on the engine. With engine speed at 1,500 rpm observe the pressure produced at the test gauge.
Air pressure should be 16 mmHg (0.63 in Hg) or more.
7. If the air pressure does not meet the above pressures, proceed as follows:
 - (1) Repeat 2 and 3 above.
 - (2) Disconnect and plug of the air supply hose to the

EMISSION CONTROL SYSTEM

anti-backfire valve, clamp the plug in place, and repeat the pressure test.

- (3) Check the filter element.
- (4) With engine speed at 1,500 rpm close the hole of the test gauge by finger. If a leaking sound is heard or leaking air is felt by finger at the relief valve, the relief valve is malfunctioning. The relief valve should be replaced or repaired.
- (5) If the air injection pump does not meet the minimum requirement of the pressure test, it should be replaced.

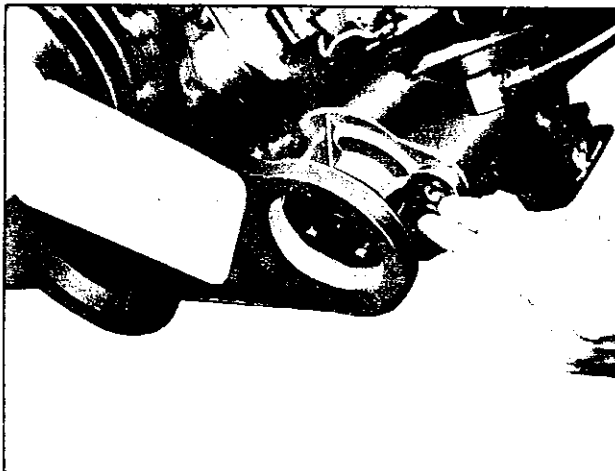


Fig. EC-21 Testing of relief valve

ENGINE MODIFICATIONS

The control valve used in the Model L24 engine self-contains an altitude compensating device so that the control valve operates correctly also at a high land (where the air is rare) and characteristics of this control valve allow the control valve changing its operating negative pressure in approximately proportion to the atmospheric pressure. (Refer to Figure EC-8.)

Routine inspection

The control valve operating negative pressure is precisely adjusted when shipped from the plant, and therefore, no complicated adjustment is required normally.

Normally, it will be sufficient to conduct the following inspections.

After completing the adjustment of idling speed, with the engine which is performing air injection;

1. Increase the engine speed once up to 2,000 rpm without applying load, and release the accelerator linkage from holding with hand quickly.
2. The servo diaphragm operates once at the full stroke 5 mm (0.1969 in), the stroke returns gradually as the speed lowers, and when the speed returns to the idling speed, the operation will be released completely.
3. It is normal that time required in lowering speed from 2,000 rpm to 1,000 rpm ("T" in Figure EC-23) is approximately three seconds.

In the event of the following cases, adjustment or replacement of parts concerned is required.

First, perform adjustment in accordance with the instructions for periodical inspection and adjustment.

4. In the case that the servo diaphragm operates continuously and speed does not lower, or time required in lowering speed from 2,000 rpm to 1,000 rpm is too long (six seconds or longer) and speed does not return to the idling speed timely.

Cause: Control valve operating negative pressure is too low (low boost).

5. In the case that the servo diaphragm does not operate, or the servo diaphragm operates but does not fully stroke.

Cause: Control valve operating negative pressure is too high (high boost).

Inspection at every 2,000 km (12,000 miles)

Control valve operating negative pressure changes in response to altitude as described previously. Hence, operating negative pressure to be adjusted should change in response to the altitude (the atmospheric pressure) of the place where the vehicle is driven. Figure EC-22 indicates relationship between operating pressure to be adjusted and altitude (atmospheric pressure).

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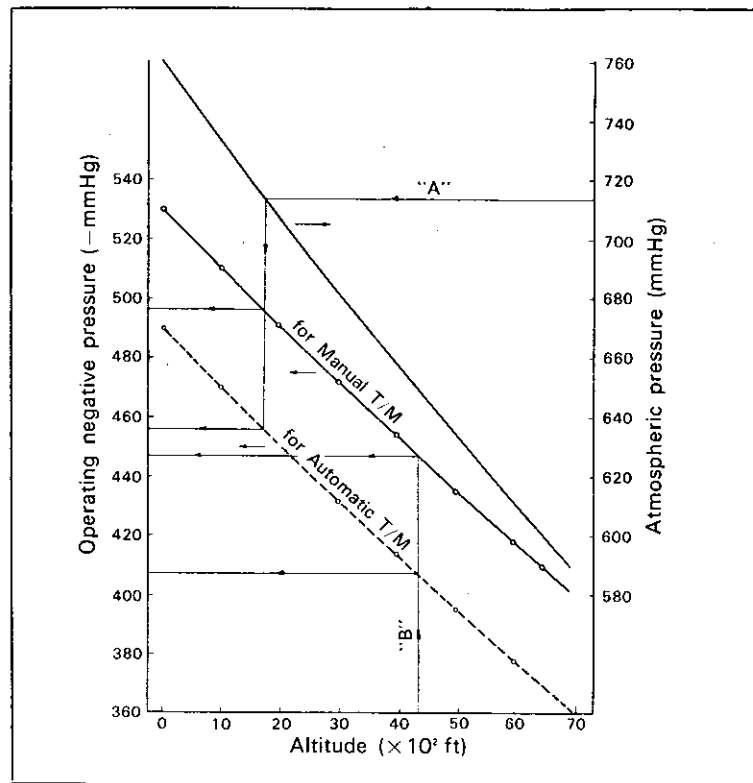


Fig. EC-22 Operating negative pressure of control valve

How to read the Figure EC-22:

- o When the atmospheric pressure of the place where the vehicle is driven is known, read the operating negative pressure by following "A" arrow mark.
- o When the atmospheric pressure is unknown, read operating negative pressure by following "B" arrow mark from the altitude of that place.

When operating negative pressure to be adjusted is known, conduct inspection and adjustment in accordance with the following instructions. Referring Figure EC-26.

(With the engine for which idling speed adjustment has been completed and which is performing air injection)

1. Connect a vacuum gauge to the connector-AB valve (7).
2. Raise the speed once up to 2,000 rpm without applying load, and release the accelerator linkage from holding by hand quickly.
3. Make sure that the manifold vacuum rises, control valve operates, the manifold vacuum is transferred to the servo diaphragm, and that the servo diaphragm operates

once at the full stroke 5 mm (0.1969 in).

4. Thereafter, both speed and manifold vacuum reduce, or when one to two seconds are elapsed, both of them stop lowering. Figure EC-23 shows these phenomena.

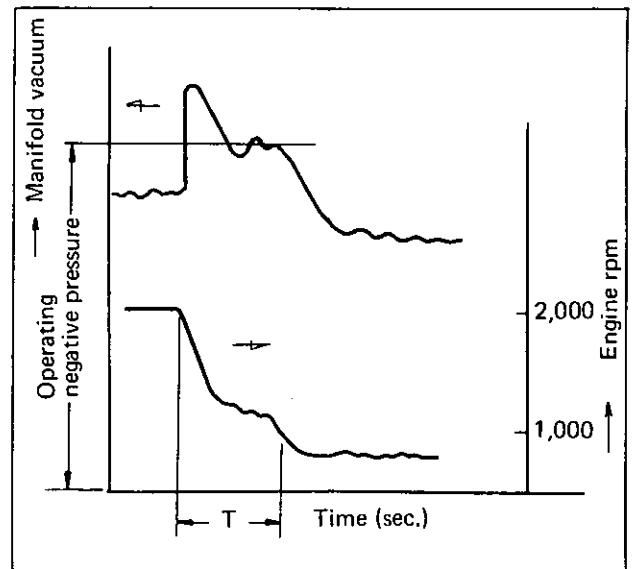


Fig. EC-23

EMISSION CONTROL SYSTEM

5. Manifold vacuum at that time is called "Operating negative pressure".

Loosen the lock screw (2) and adjust the vacuum adjusting screw (1) correctly so that the operating negative pressure meets the value obtained from the Figure EC-22.

When the above described phenomena cannot be identified, drive the vehicle actually and perform coasting. The phenomena will be verified more practically.

When actually driven and such phenomena still cannot be identified, the operating negative pressure of the control valve is unusually deviated or the control valve is damaged, or servo diaphragm is erroneously adjusted or damaged.

6. Upon completion of the above described adjustments, confirm the operation through conducting the routine inspection, and make sure that time required in lowering speed from 2,000 rpm to 1,000 rpm without applying load is less than 6 seconds.

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 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 1.0 in Aq.

8. When the filler cap does not close completely the height should drop to zero in a short time.

9. When the filler cap is removed, and the height does not drop to zero in a short time, it is the cause of the stuffy hose.

EVAPORATIVE EMISSION CONTROL SYSTEM

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

1. Check all hoses and fuel tank filler cap.

Note: When 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.

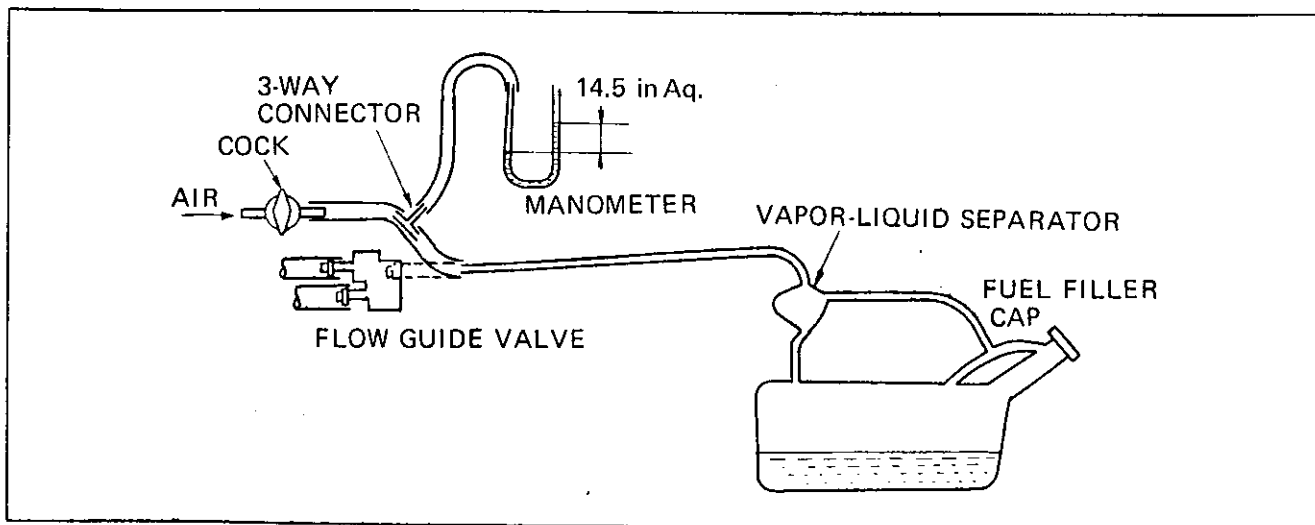


Fig. EC-24 Checking of evaporative emission control system

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Checking of flow guide valve

1. Disconnect all hoses from 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, air should go through the valve and flow to crankcase side. If air does not flow, the valve should be replaced. But when air is blown from crankcase side, it should never flow to other two vent lines.
3. While air is pressed into the flow guide valve from carburetor air cleaner side, it flows to the fuel tank side and/or crankcase side.
4. This valve opens when the inner pressure is 10.16 mm Hg (0.4 in Hg). When operation is improper or breakage exists, replace it.

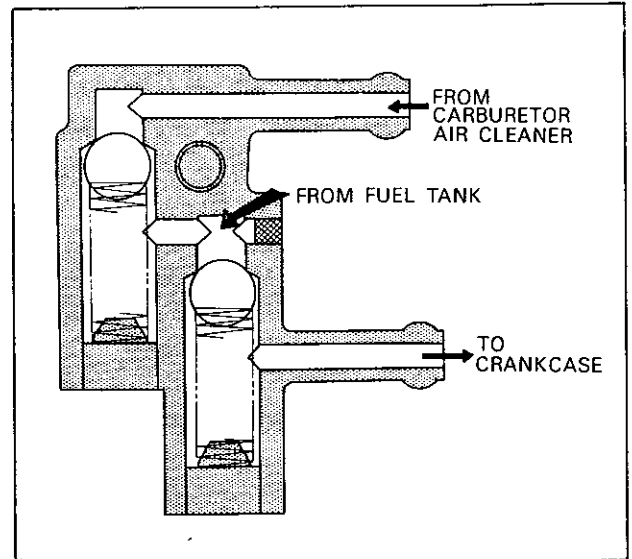


Fig. EC-25 Flow guide valve

ADJUSTING ENGINE IDLING SPEED AND GAS MIXTURE

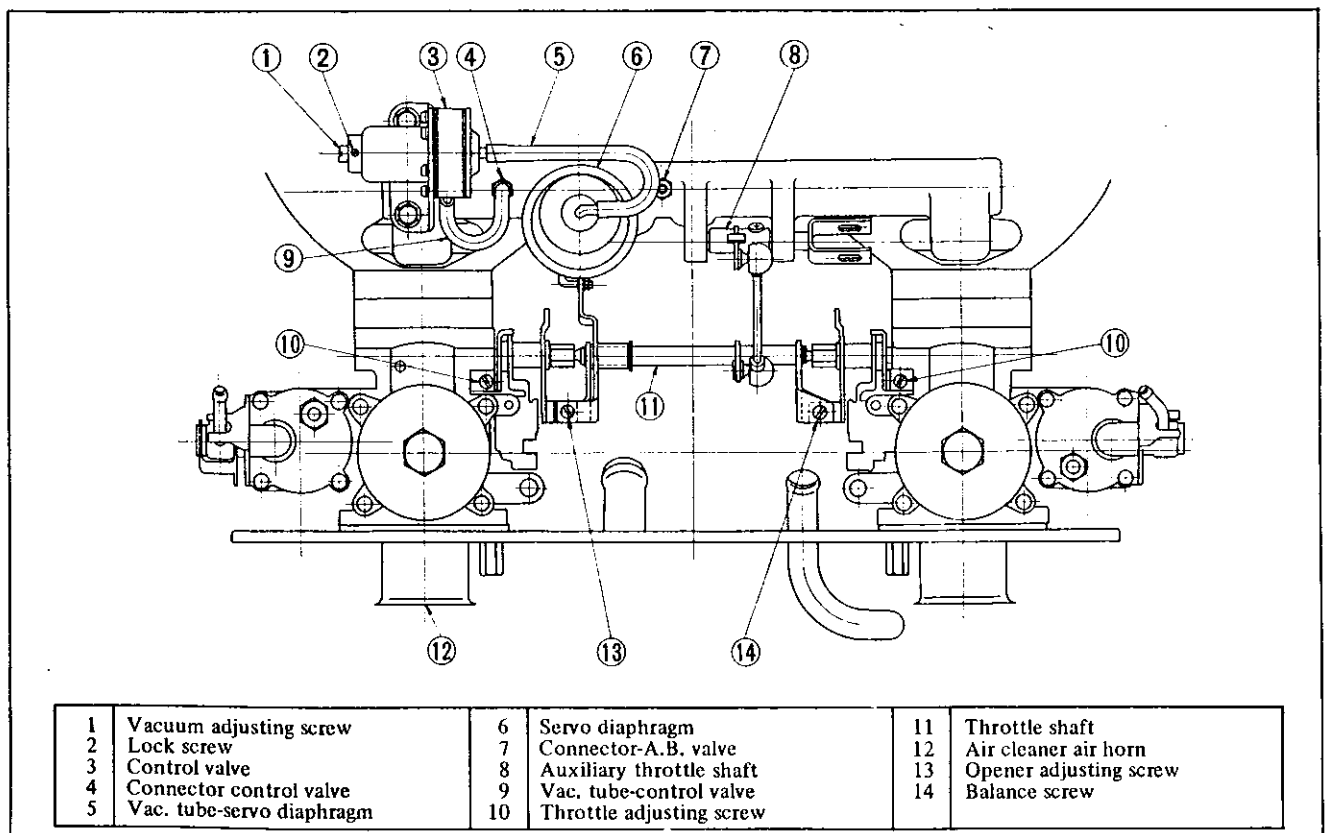


Fig. EC-26 Carburetor linkage

EMISSION CONTROL SYSTEM

1. Remove the air cleaner cover and oil damper cap, raise the suction piston by finger, and make sure that the suction piston can be raised smoothly.
2. Check oil level, and add oil (MS#20 or 10W-30) if insufficient.

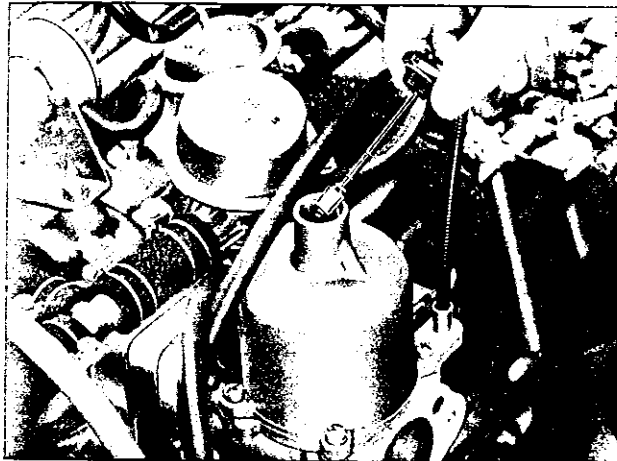


Fig. EC-27 Checking damper oil level

3. Start the engine and warm up until the water temperature rises sufficiently.

Note: a. It is desirable to warm up engine by driving the vehicle (by applying load to the engine). However, when warming up engine with the vehicle stopped (without attending), pull the throttle control knob proper to increase the engine idling speed. It is undesirable to increase the engine speed with other adjust screws. (Erroneous adjustment may occur.) However, when adjusting the engine at a repair shop or plant after dismounting it from the vehicle, recommend the engine speed be increased by screwing the opener adjusting screw 13. (The servo diaphragm may be connected directly to the intake manifold if required. In other word, the operation described in paragraph 8. below may be done.)

In the subsequent process, however, return the opener adjusting screw to the correct position without fail. (The operation described in paragraph 9.).

b. When the engine idling speed is adjusted with fast idle setting screw, the engine speed is often unstabilized during idling. In spite of this fact,

engine idling speed is adjusted with fast idle setting screw in many cases at the market. In order to avoid such an undesirable adjustment, this screw should not be used.

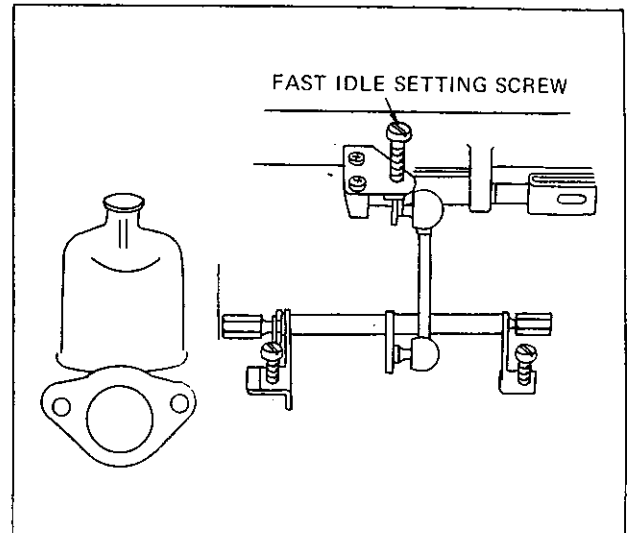


Fig. EC-28 Fast idle setting screw

4. Connect an engine tachometer and timing light.
5. Apply a flow meter to the air horn 12 of the air cleaner, and properly adjust the throttle adjusting screws 10 and 11 on the front and rear carburetors so that the front and rear carburetor intake air volumes are balanced and the idling speed is adjusted to 750 rpm.

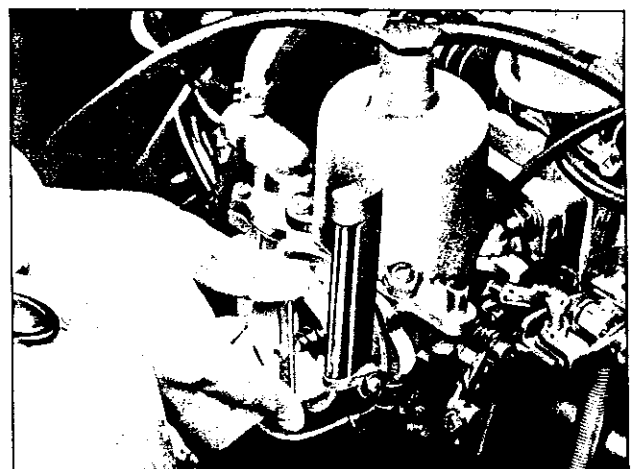


Fig. EC-29 Setting flow meter

ENGINE

Note: a. Recommend the engine be raced whenever the throttle adjusting screws are turned for successful adjustment.

b. The flow meter is used to hinder the engine from intaking air, and therefore, recommend the flow meter be used for short period of time (one to two seconds) intermittently (should not be used continuously).

When the flow meter is applied to the air horn ⑫, the engine speed lowers and adjustment may not

be made correctly.

c. When the throttle adjusting screw is returned during the above adjustment and engine speed cannot be reduced below 750 rpm, other adjusting screws such as opener adjusting screw ⑬ and balance screw ⑭ must have been tightened excessively or the accelerator linkage must have not been adjusted correctly. Under the normal condition, the auxiliary throttle shaft ⑧ and throttle shaft ⑪ should have a slight play during engine operation under the idling speed. In other words, the auxiliary throttle shaft ⑧ should be provided with a play "Q1" which corresponds to the clearance $T_a = T_b$ as shown in Figure EC-30.

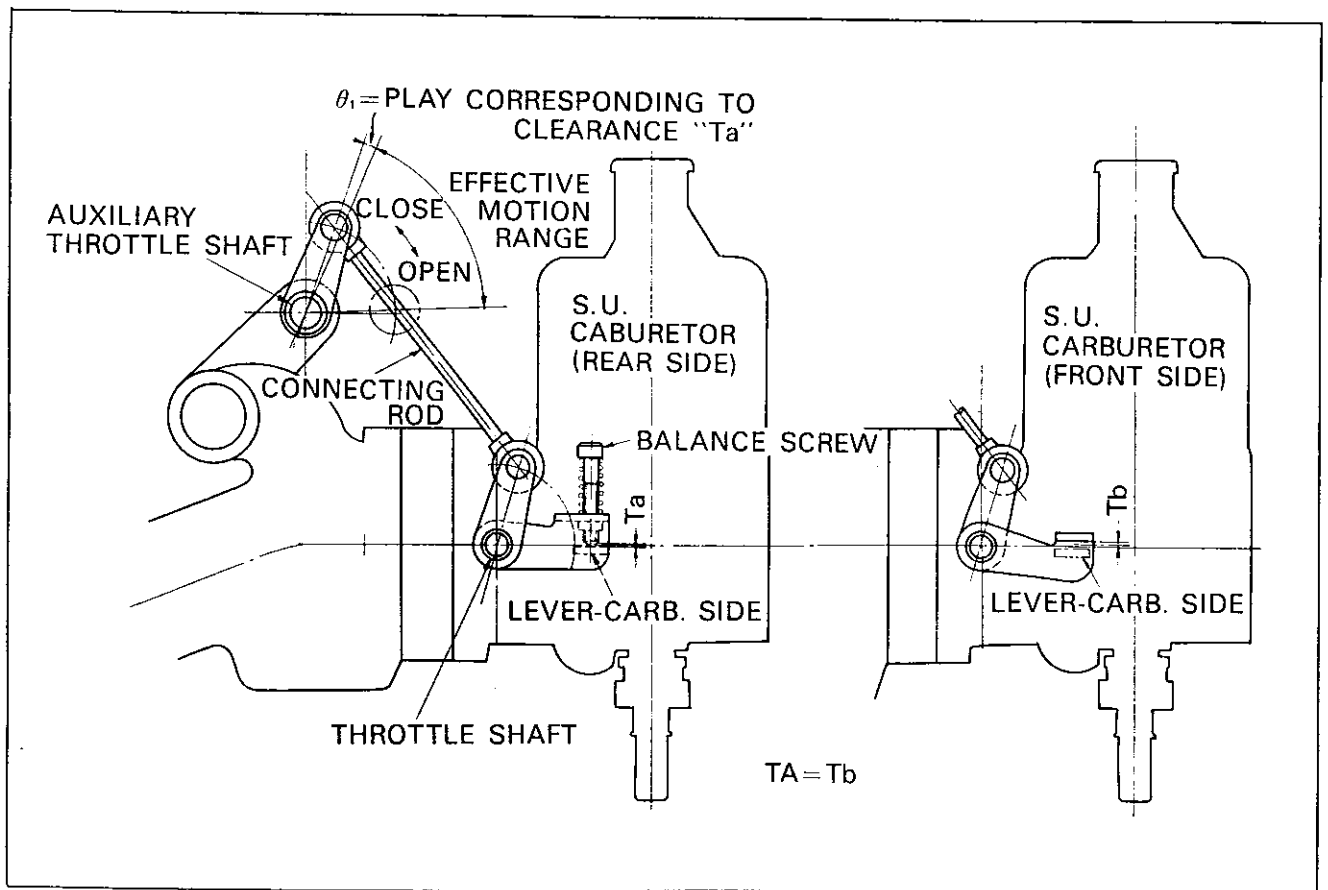


Fig. EC-30 Adjusting idle speed and mixture

EMISSION CONTROL SYSTEM

6. Adjust the ignition timing to 5°BTDC (Before Top Dead Center).

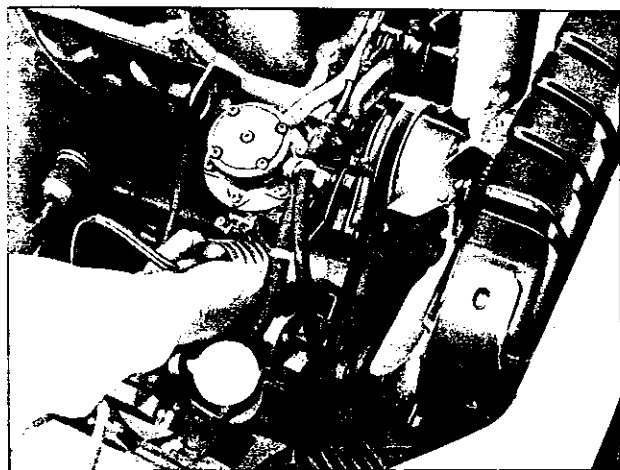


Fig. EC-31 Adjusting ignition timing

7. When the ignition timing is adjusted and engine speed is changed, repeat the adjustments described in paragraph 5 above.

8. Disconnect the control valve vacuum tube ⑨ from the control valve connector ④, and connect the servo diaphragm vacuum tube ⑤ to the control valve connector ④. [Apply manifold booster to the servo diaphragm ⑥.]

9. Adjust the opener adjusting screw ⑬ so that the engine speed is 1,200 rpm under the condition described in paragraph 8. above.

10. Maintaining the condition described in paragraph 8 and 9 above as is, use a flow meter and adjust the balance screw ⑭ properly so that the front and rear carburetor intake air volumes are balanced.

11. Repeat the adjustment described in paragraph 9 above (At the same time, disconnect the servo diaphragm vacuum tube ⑨ once from the connector ④, reconnect the servo diaphragm vacuum tube ⑨ to the connector

④, and make sure that the engine speed is 1,200 rpm. Readjust, if the engine speed is not 1,200 rpm.), and reconnect the control valve vacuum tube ⑨ to the control valve connector ④ and servo diaphragm vacuum tube to the original position.

12. When a CO meter is available, tighten the idling speed adjusting nuts located beneath the front and rear carburetors equally from positions where the nuts come into contact with the stoppers (idling lock nuts), and thus, adjust CO level to 6 ±1%.

(This adjustment should be made without feeding air from the air pump.)

When CO meter is not available, primarily, mixture ratio adjustment is not recommended.

When engine idling operation is noticeably unstable, however, adjust as follows.

13. Tighten both front and rear carburetor idling adjusting nuts in a half of one full turn 0.5 mm (0.019 in) from positions where the nuts come into contact with the stoppers (idling lock nuts).

If the engine still operates unstably, adjust as follows.

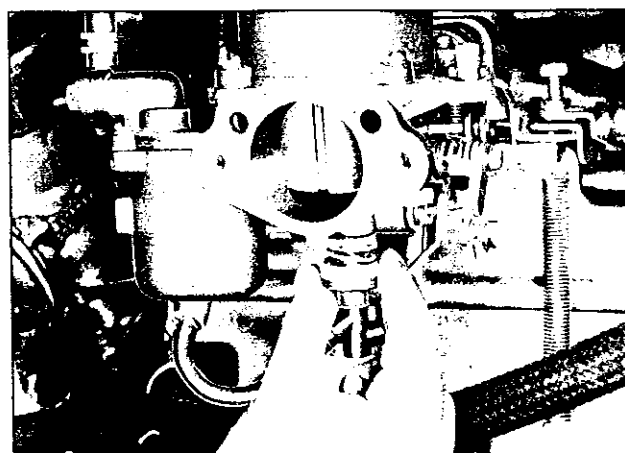


Fig. EC-32 Idle adjust nut

14. Tighten both the front and rear carburetor idling adjusting nuts equally from positions where the nuts come into contact with the stoppers (idling lock nuts), and thus, adjust the engine speed to the best slow-speed.

ENGINE

TROUBLE DIAGNOSES AND CORRECTIONS

CONTENTS

EXHAUST EMISSION CONTROL SYSTEM	EC-24	Air pump	EC-25
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EXHAUST EMISSION CONTROL SYSTEM

A preliminary "Diagnosis Guide" is included below as an aid in trouble shooting the exhaust emission control system.

Troubles	Possible causes
Excessive backfire in exhaust system	<ul style="list-style-type: none">. Anti-backfire valve vacuum line collapsed, plugged, disconnected or leaking. Defect or malfunction of the anti-backfire valve resulting in insufficient air delivery to the intake manifold or insufficient duration time to the engine requirement. Incorrect idle mixture adjustment. Defect or malfunction of the spark plug or high tension cables
Air supply hose baked	<ul style="list-style-type: none">. Defective check valve on air distribution manifold
Rough engine idle	<ul style="list-style-type: none">. Incorrect carburetor adjustment of idle speed, idle mixture, choke setting. Incorrect basic ignition timing. Leak of vacuum at the anti-backfire valve vacuum line or air inlet hose. Defective or stucked anti-backfire valve
Engine surges at all speed.	<ul style="list-style-type: none">. Defective or stucked anti-backfire valve. Incorrect carburetor adjustment of idle speed, idle mixture, choke setting
Engine stop	<ul style="list-style-type: none">. Incorrect carburetor adjustment of idle speed, idle mixture, choke setting. Incorrect basic timing. Disconnection of vacuum tube of the anti-backfire valve.
Noisy air pump drive belt	<ul style="list-style-type: none">. Drive belt improperly adjusted. Seized or failing air pump. Misaligned or defective pulley

EMISSION CONTROL SYSTEM

Air pump

When mounted on the vehicle

Noise-external cause

The air injection pump is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases.

If excessive noise is heard;

1. Make sure that the pump rotates correctly, and check the belt for proper tension.
2. Check hoses for tightness, leaking or touching with other parts.
3. Check the pump mounting bracket and the air cleaner for secure installation.
4. Check relief valve for escaping air.

Noise-internal cause

1. Vane noise

A "chirping" or "squeaking" noise is most commonly associated with vanes rubbing in housing bore. Vane chirping is most noticeable at low speed and is heard intermittently. Additional wear-in time may eliminate this condition. If additional wear-in time does not eliminate chirp, the pump must be disassembled, and the vanes and carbon shoes should be replaced.

2. Bearing noise

A rolling sound indicates bearing noise. This sound will be noticeable at all speeds, but does not necessarily indicate bearing failure. However, if noise increases to an objectionable level, the bearing

may have to be replaced.

3. Rear bearing noise

This noise is identified by a continuous knocking sound. When this noise occurs dismount the pump from the vehicle and inspect carefully.

Off car

1. With the pump removed from the vehicle, rotate drive hub in jerks three-quarters of one full turn forward and one-quarter of one full turn backward. If roughness or bumps are felt, remove the rear cover.

2. Inspect carbon seal. This seal should not have any holes caused by wear or be broken or cracked. Such condition commonly results from defective rear and/or vane bearing. A failed seal must be replaced.

3. With rear rotor ring and carbon seal removed, pull out the vanes. Vane bearing failure is also indicated by absence of grease or caked grease. Inspect vane shaft to confirm this bearing failure. All corners of vanes should be square. When edges are broken, replace the vanes.

4. Remove carbon shoes and inspect surface contacting with the vane. Small grooves in shoes are normal. Replace, if chipped or broken. Broken shoes indicate improper assembly of shoe springs. Damaged shoes must be replaced and springs must be properly installed.

5. Carbon dust may be present on vanes and in housing. This is an indication of normal wear. Remove carbon dust by blowing compressed air to the parts in question.

Troubles	Possible causes	Corrective action
Inoperative pump	Trouble in pump Excessive slackness of drive belt	Replace with new pump. Adjust drive belt tension to specified value.
Insufficient delivering air	Damaged vane hub bearing Worn vane Worn carbon shoe Worn side seal	Replace. Replace. Replace. Replace.

ENGINE

Air leakage	Leakage from hoses, connectors or clamps	Ammend or tighten. Replace if necessary.
	Leakage from relief valve	Replace relief valve.
Abnormal noise	Stick of air pump	Replace with new assembly.
	Slackness of drive belt (in accelerating)	Adjust drive belt tension.
	Leakage from hoses, connectors or clamps	Retighten or replace.

PERIODIC RECOMMENDED MAINTENANCE

Periodical inspection and required servicing of these system should be carried out at the recommended intervals to assure better engine performance, extended engine service life and completely eliminated air pollution.

Item	Interval
1. Engine	
Check ignition timing.	every 5,000 km (3,000 miles)
Check engine idling.	5,000 km (3,000 miles)
Engine tune-up	20,000 km (12,000 miles)
Check spark plugs.	5,000 km (3,000 miles)
Replace spark plugs.	20,000 km (12,000 miles)
Check high tension cables.	20,000 km (12,000 miles)
Check for pitting and wear of distributor breaker points.	5,000 km (3,000 miles)
Replace distributor breaker points.	20,000 km (12,000 miles)
Apply grease to distributor rotor shaft.	20,000 km (12,000 miles)
Apply grease to distributor cam and wick.	20,000 km (12,000 miles)
Replace carburetor air cleaner element.	40,000 km (24,000 miles)
2. Crankcase emission control	
Check hoses and hose connections for leaks.	every 20,000 km (12,000 miles)
Check for correct function of crankcase ventilation control valve.	20,000 km (12,000 miles)

EMISSION CONTROL SYSTEM

<p>3. Exhaust emission control</p> <p>Check for correct function of air pump.</p> <p>Check for correct function of relief valve.</p> <p>Check for correct function of check valve.</p> <p>Check for correct function of anti-backfire valve.</p> <p>Check air gallery and nozzle connections for leaks.</p> <p>Check hoses and hose connections for leaks.</p> <p>Check air pump belt tension.</p> <p>Check operating negative pressure of throttle control valve, adjust if necessary.</p>	<p>every 20,000 km (12,000 miles)</p> <p>20,000 km (12,000 miles)</p> <p>20,000 km (12,000 miles)</p> <p>20,000 km (12,000 miles)</p> <p>20,000 km (12,000 miles)</p> <p>20,000 km (12,000 miles)</p> <p>5,000 km (3,000 miles)</p> <p>20,000 km (12,000 miles)</p>
<p>4. Evaporative emission control</p> <p>Check hoses, hose connectors and piping for leaks.</p> <p>Check for correct function of flow guide valve.</p>	<p>every 20,000 km (12,000 miles)</p> <p>20,000 km (12,000 miles)</p>

SERVICE DATA AND SPECIFICATIONS

Specifications

Air pump	
Type	ECP200-3
Capacity	200 cc (12.2 cu in)/rev.
Pulley ratio	0.95
Anti-backfire valve	
Type	AV54-1B
Duration time	1.5 to 1.9 sec./500 mm Hg (19.7 in Hg)
Orifice diameter	6.0 mm (0.236 in)
Check valve	
Type	CV27-2
Opening pressure	3.8 mmAq (8.15 in Aq)

ENGINE

Flow guide valve

Type FGA-3
Opening pressure 10 mmHg (0.4 in Hg)

Control valve

Type TPA28-2
Operating negative pressure 510 to 540 mmHg (20.1 to 21.3 in Hg)/50°C (122°F)
Bellows outer diameter 26 mm (1.024 in)

Servo diaphragm

Type SD46-1
Stroke 5 mm (0.197 in)

CO percent setting (with air pump disconnected)

Manual transmission $6 \pm 1\%$

Idling speed

Manual transmission 750 rpm

Ignition timing

Manual transmission 5° BTDC/750 rpm

Service data

Tightening torque

Air pump bracket to cylinder block bolt 1.0 to 1.3 kg-m (7.2 to 9.4 ft-lb)
Air pump to adjust bar bolt 2.2 to 2.5 kg-m (15.9 to 18.1 ft-lb)
Air pump to bracket bolt 2.2 to 2.5 kg-m (15.9 to 18.1 ft-lb)
Adjusting bar to front cover bolt 1.0 to 1.3 kg-m (7.2 to 9.4 ft-lb)
Air gallery to exhaust manifold plug 5.0 to 6.0 kg-m (36.2 to 43.4 ft-lb)
Check valve to air gallery 9.0 to 10.5 kg-m (65.1 to 75.9 ft-lb)

EMISSION CONTROL SYSTEM

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

SERVICE
MANUAL

MODEL
L20A, L24 SERIES
ENGINE



NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EE

ENGINE ELECTRICAL SYSTEM

STARTING CIRCUIT	EE- 1
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ALTERNATOR	EE-13
REGULATOR	EE-21
IGNITION CIRCUIT	EE-27
DISTRIBUTOR	EE-27
IGNITION COIL	EE-36
SPARK PLUGS	EE-38

EE

ENGINE ELECTRICAL SYSTEM

STARTING CIRCUIT

The electrical system is a 12 Volt system. This section is subdivided into the following subsections for electrical parts which are required for engine operation.

1. Starting motor
2. Alternator
3. Regulator
4. Ignition coil
5. Spark plugs

Information for body electrical system, such as the lighting circuit, instrument, windshield wipers, etc. are described in section BE.

STARTING MOTOR

CONTENTS

DESCRIPTION	EE-1	Pinion case bearing metal	EE- 7
OPERATION	EE-2	Magnetic switch assembly	EE- 7
CONSTRUCTION	EE-2	REASSEMBLY	EE- 7
REMOVAL	EE-3	TEST	EE- 7
DISASSEMBLY	EE-3	Performance test	EE- 7
CLEANING AND INSPECTION	EE-4	Diagnosis of test	EE- 8
Terminal	EE-4	Magnetic switch assembly test	EE- 8
Field coil	EE-4	SPECIFICATIONS AND SERVICE DATA	EE- 9
Brushes and brush lead wire	EE-5	Specifications	EE- 9
Brush spring tension	EE-5	Service data	EE- 9
Armature assembly	EE-5	TROUBLE DIAGNOSES AND	
Over-running clutch assembly	EE-6	CORRECTIONS	EE-10
Testing brush holder for ground	EE-6		

DESCRIPTION

The starting system permits the engine being cranked by setting the ignition switch to "start". While the ignition switch is set to "start", the starting motor continues operation until the engine starts running by its own power. Current to the starting motor is interrupted and the motor is disengaged by setting the ignition switch to "ON". This starting motor is a compound motor, and is equipped with an enclosed over-running clutch. The solenoid switch is built in the yoke.

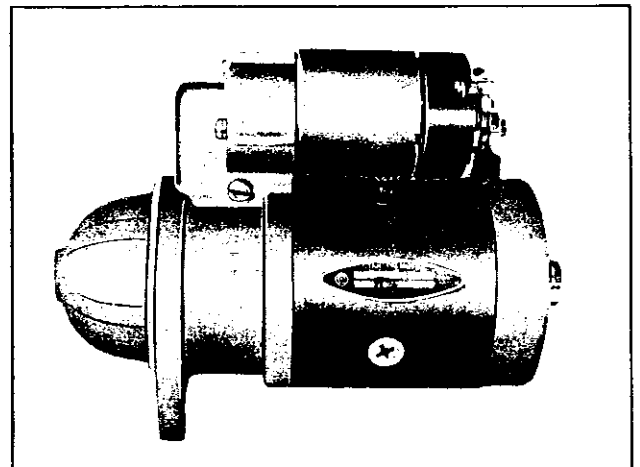


Fig. EE-1 External view

ENGINE

OPERATION

When the ignition switch is set to "start", current flows through the "series" and "shunt" coils of the solenoid and thus, the solenoid is excited. The plunger is pulled into the solenoid so that it operates the shift lever to engage the drive pinion with flywheel ring gear, and the solenoid switch is closed.

When the contacts (stationary and movable) are closed, the motor operates to crank the engine, and the "series" coil of the solenoid is cut out. The magnetic force of the "shunt" coil is sufficient to hold the pinion in mesh after shifting the system.

When the engine is operated, and the ignition switch is set to "ON", the "series" coil demagnetizes the "shunt" coil, and the return spring actuates the plunger to return to the original position. Consequently, the motor stops. 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 so as to engage or disengage with the ring gear teeth. The over-running clutch is designed to transmit driving torque from the motor armature to the ring gear, and to permit the pinion over-running the armature when the engine is started.

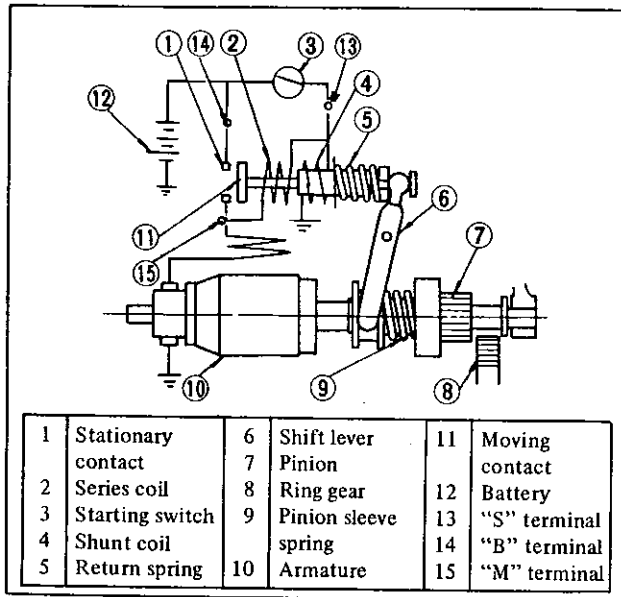


Fig. EE-2 Starting motor circuit

CONSTRUCTION

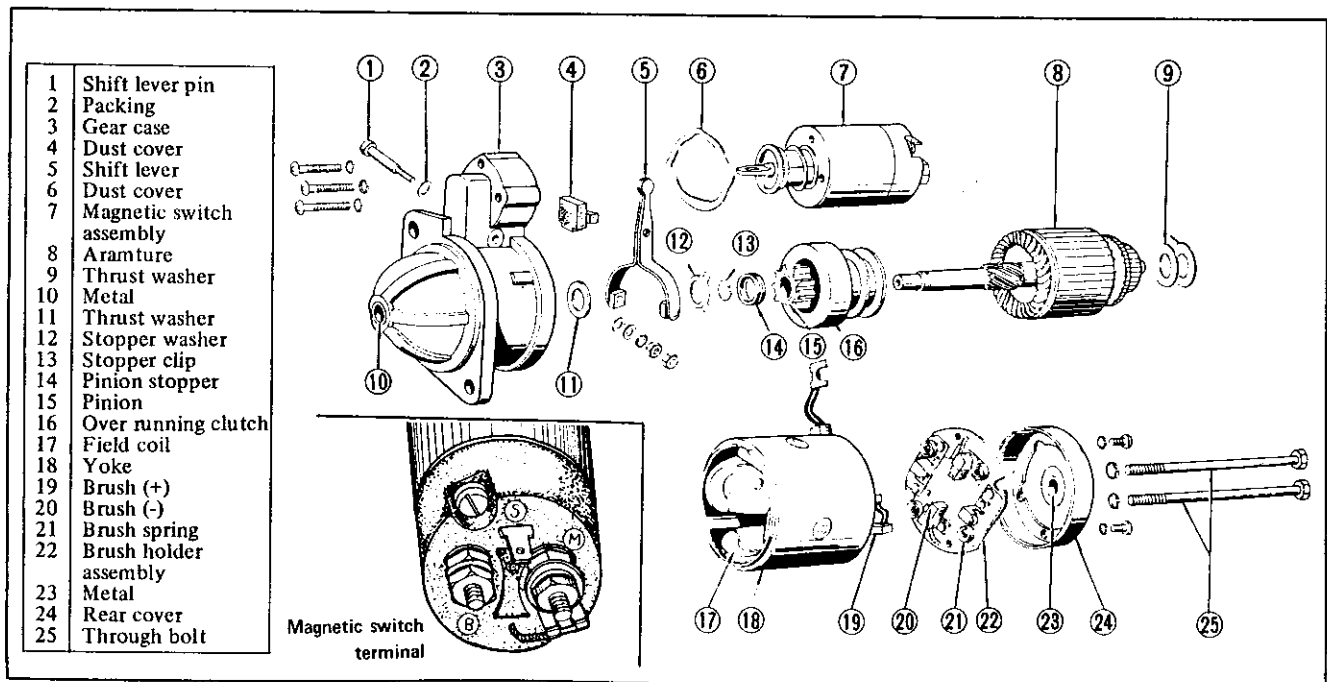


Fig. EE-3 Components of starting motor

ENGINE ELECTRICAL SYSTEM

REMOVAL

1. Disconnect the battery ground cable.

Disconnect the black wire with yellow tracer from the magnetic switch terminal, and black battery cable from the battery terminal.

2. Remove two bolts used to secure the starting motor on the clutch housing. Pull the starter assembly forward and remove the starting motor.

DISASSEMBLY

1. Loosen the nut used to secure the connecting plate to the magnetic switch "M" terminal. Remove three screws used to secure the magnetic switch, and remove the magnetic switch assembly.

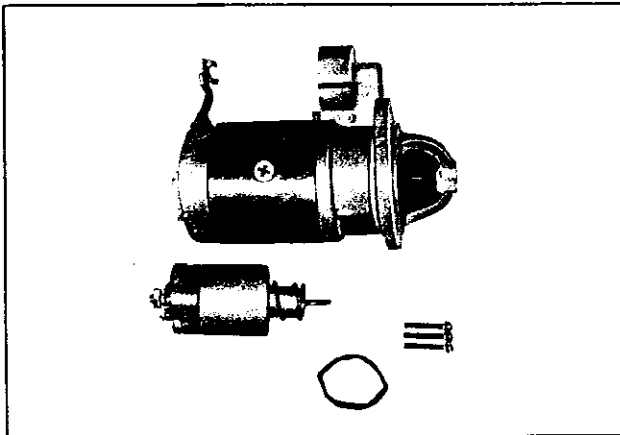


Fig. EE-4 Removing magnetic switch assembly

2. Remove two through bolts and brush cover assembly.

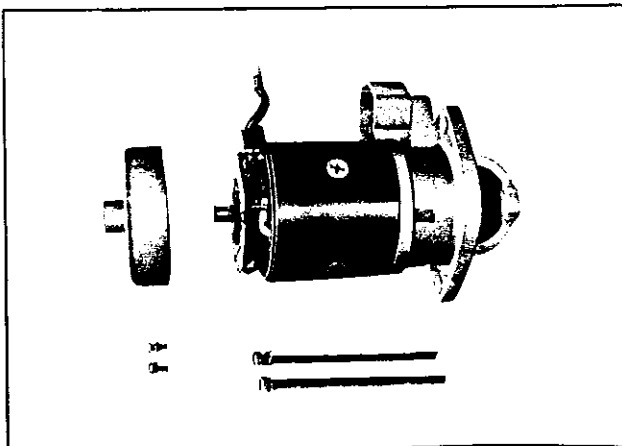


Fig. EE-5 Removing the brush cover

3. Remove the yoke assembly by lightly tapping with a wooden mallet.

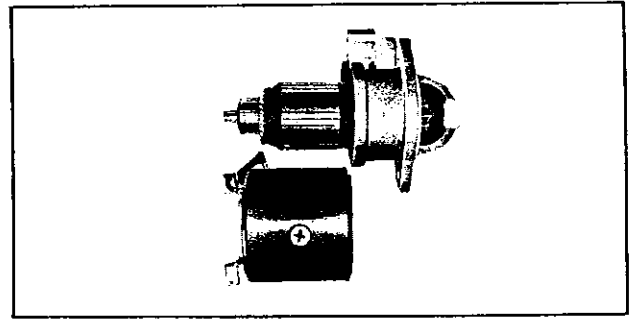


Fig. EE-6 Removing the yoke assembly

4. Withdraw the armature assembly and shift lever.

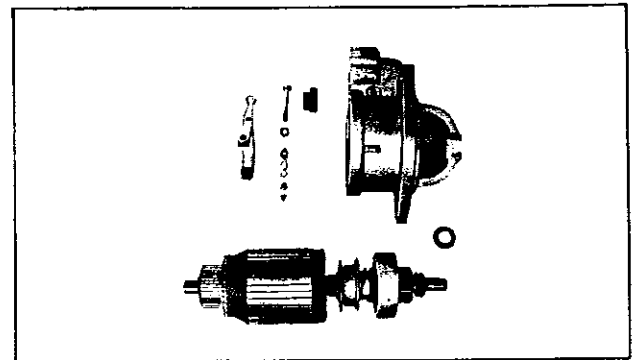


Fig. EE-7 Removing the armature assembly and shift lever

5. Remove the pinion stop ring from the armature shaft end. To remove the stop ring, first, push the stop ring to the clutch side and after removing the snap ring, remove the the stop ring together with the over-running clutch. Withdraw the over-running clutch assembly from the aramture shaft.

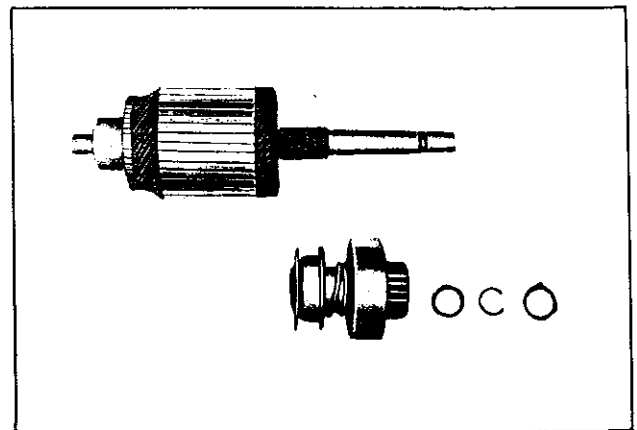


Fig. EE-8 Removal of the over-running clutch assembly

ENGINE

6. Unsolder the brushes with a soldering-iron and remove the brushes.

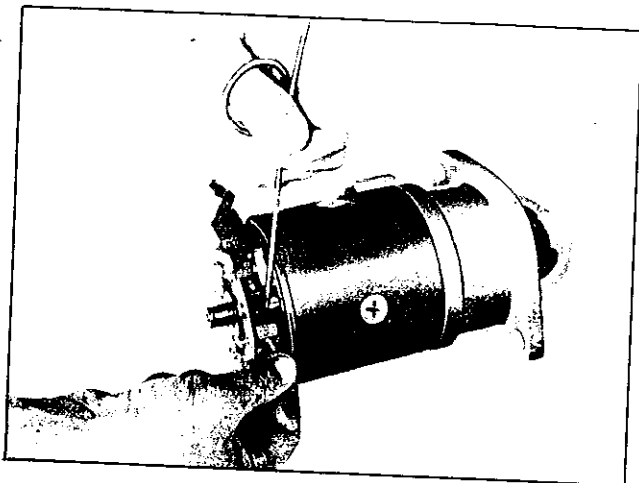


Fig. EE-9 Removing brush

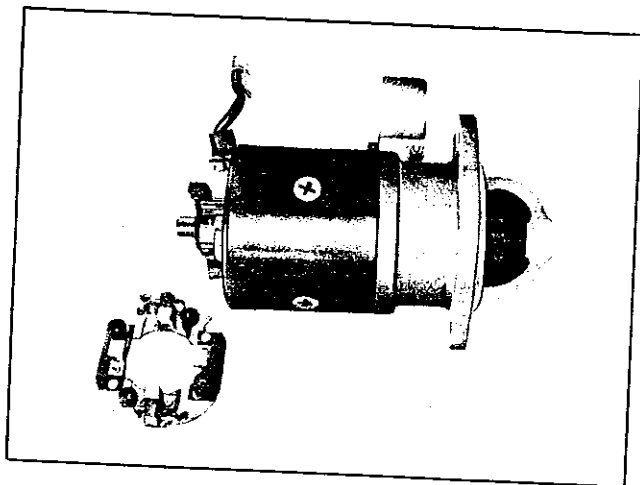


Fig. EE-10 Removing brush holder

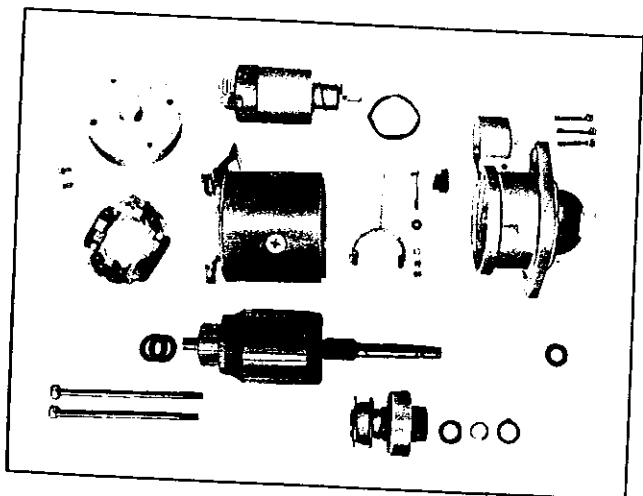


Fig. EE-11 Disassembly

CLEANING AND INSPECTION

Clean all disassembled parts. Be careful not to use grease dissolving solvent for cleaning of the over-running clutch, armature assembly, magnetic switch assembly and field coils since solvent dissolves grease packed in the clutch mechanism and damages the coils or other insulators.

Check them for damage or excessive wear. Replace them as required.

Terminal

Check the terminal for damage and wear, and replace if necessary.

Field coil

Check the field coil for insulation. If the coil insulator is damaged or worn, replace.

Testing field coil for continuity:

Connect test probe of a circuit tester or a resistance counter to the field coil positive (+) terminal and positive (+) brush holder. If the tester indicates no continuity, the field circuit or coil is open.

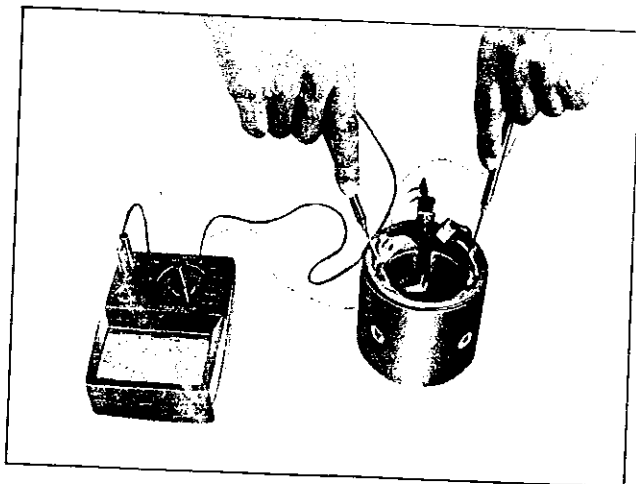


Fig. EE-12 Field coil test for continuity

Testing field coil for ground:

Place one probe of a circuit tester onto the yoke and the other on to the field coil positive (+) terminal. If resistance is read, the field coils are grounded.

ENGINE ELECTRICAL SYSTEM

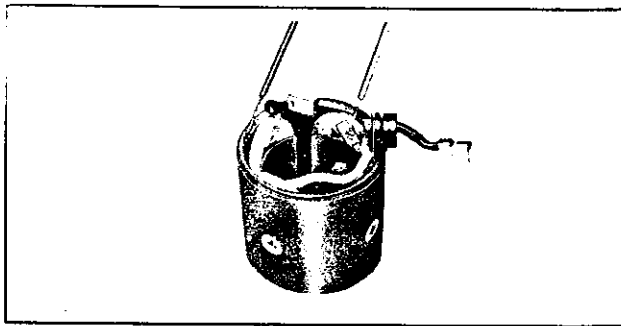


Fig. EE-13 Field coils test for ground

Field coil test for short-circuit

Unsolder the connected section of each coil and check the circuit with a tester in the same manner as described above.

When the coil is defective, replace the coil.

Brushes and brush lead wire

Check the brush contact for surface condition and wear. When the brush contact is loose, replace the brush.

If the brush is worn and height is less than 6.0 mm (0.2362 in), replace it.

Check the connection of the lead clip and lead wire for conditions.

Check brush holders and spring clip to ensure that they are not deformed or bent and properly hold brushes against the commutator.

If the brushes or brush holders are dirty, clean.

Brush spring tension

Measure the brush spring tension by the use of a spring scale as shown in Figure EE-14. The reading should be 0.8 kg (1.76 lb). Replace the spring if the tension is lower than 0.7 kg (1.54 lb).

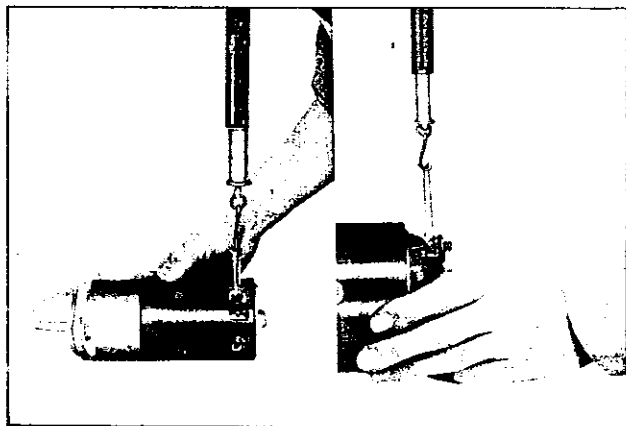


Fig. EE-14 Inspection of brush spring tension

Armature assembly

Check external appearance of the armature and the commutator.

1. Measure the armature shaft for bend by the use a dial gauge. Replace the armature shaft if the bend exceeds 0.08 mm (0.0031 in).

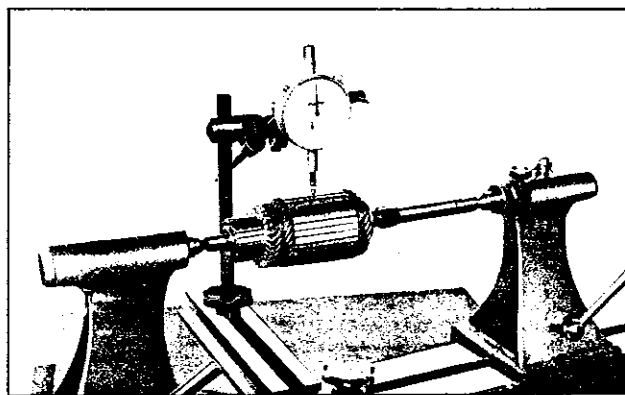


Fig. EE-15 Inspection of armature shaft for bend

2. Inspect the commutator. If the surface of the commutator is rough, smooth it lightly with a No. 500 emery paper. Check the commutator also for out-of-round. If the out-of-round is more than 0.2 mm (0.0079 in), or insulating mica depth is less than 0.2 mm (0.0079 in) from the commutator surface, turn the commutator (armature) in a lathe, so that the out-of-round is less than 0.05 mm (0.0020 in). Insulating mica should also be under-cut so that the depth is from 0.5 to 0.8 mm (0.0197 to 0.0315 in).

The wear limit of the commutator diameter is 2 mm (0.0787 in). If the commutator is worn excessively, repair or replace it.

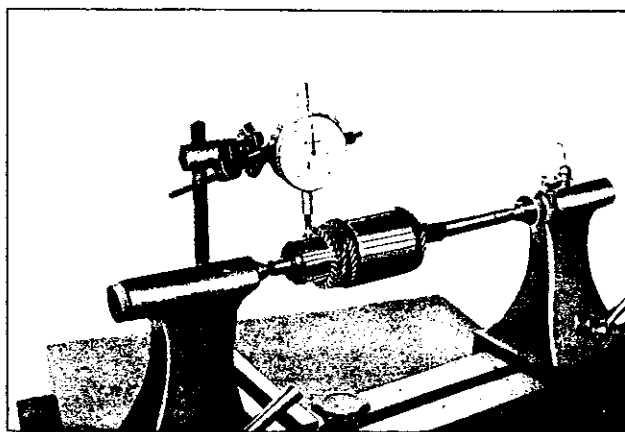


Fig. EE-16 Inspection of commutator

ENGINE

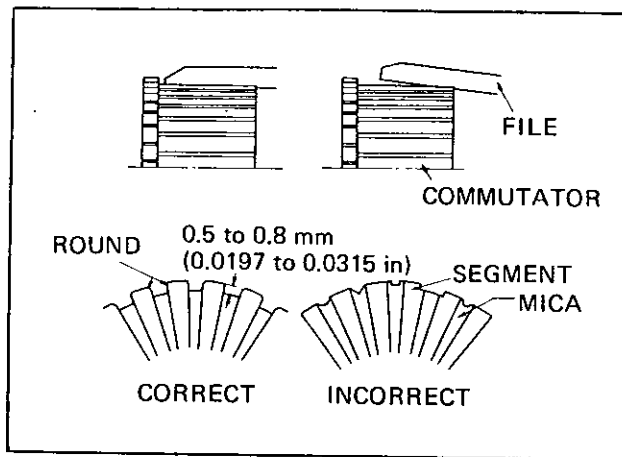


Fig. EE-17 Undercutting insulating mica

3. Inspect the soldered connection of armature lead and commutator. If loose connection is found, resolder (using rosin flux).

4. Testing armature for ground

Place one test probe of a circuit tester, on to armature shaft and the other on to each commutator bar.

If the tester shows continuity, armature is grounded. Replace the armature with new one.

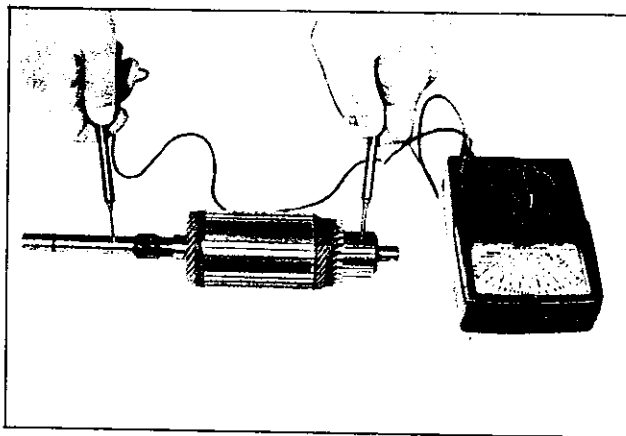


Fig. EE-18 Armature test for ground

5. Check the armature for short-circuit by placing it on an armature tester placing a hack-saw blade over the armature core, and by rotating the armature. If the saw blade vibrates, armature is short-circuited.

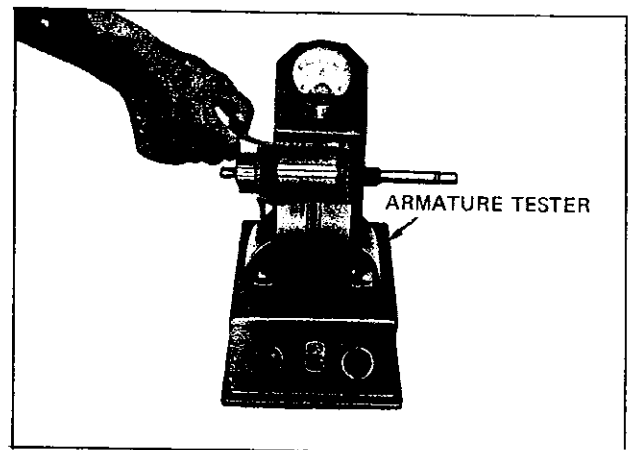


Fig. EE-19 Armature test for shaft

6. Check the armature for continuity by placing probes of a tester on two segments side by side. If the tester shows no conduction, the circuit is open.

Over-running clutch assembly

Inspect the pinion assembly and sleeve. Sleeve must slide freely along the armature shaft spline. If damages are found or there is a resistance while sliding, replace. Inspect the pinion teeth for excessive rubbing, and replace as required. Check the flywheel ring gear also for damage and wear.

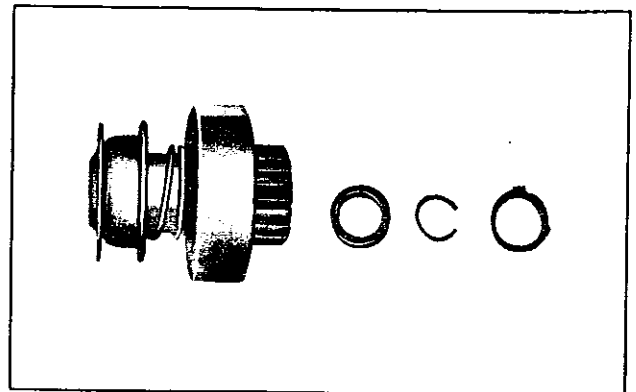


Fig. EE-20 Over-running clutch assembly

Testing brush holder for ground

Place one test probe of a circuit tester on to the rear cover and the other on to the positive side brush holder. If the tester shows conduction, the brush holder is shorted to ground. Replace the insulator or brush holder.

ENGINE ELECTRICAL SYSTEM

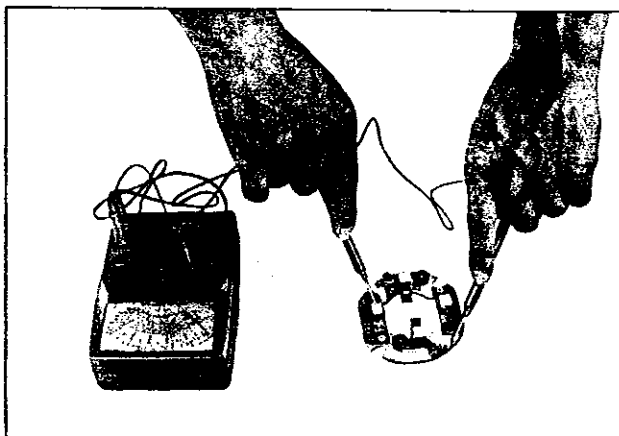


Fig. EE-21 Brush holder test for ground

Pinion case bearing metal

Inspect the bearing metal for wear and side play. If the clearance between the bearing metal and the armature shaft is more than 0.2 mm (0.0079 in), replace the metal. Install a new bearing and adjust the clearance to 0.03 to 0.10 mm (0.0012 to 0.0039 in). Install the bearing metal so that the end of the bearing metal is flush with gear case end plane.

Magnetic switch assembly

Inspect the magnetic switch contacts. If the contact surface is rough, replace.

REASSEMBLY

Reassemble the starting motor in reverse sequence of disassembly.

When assembling, be sure to fill the rear case with grease and apply oil to the rear cover bearing metal and pinion slightly.

TEST

Performance test

The starting motor should be subjected to "no-load" and "lock-torque" tests whenever it has been overhauled to ensure that it operates correctly when installed on the engine. The starting motor should also be subjected to these tests when finding cause of abnormal operation. These tests are summarized as follows.

No-load test

Connect the starting motor in series with the specified battery (12 volts) and an ammeter capable of indicating 1,000 amperes.

Specified current draw and revolution in these test are shown in "specification".

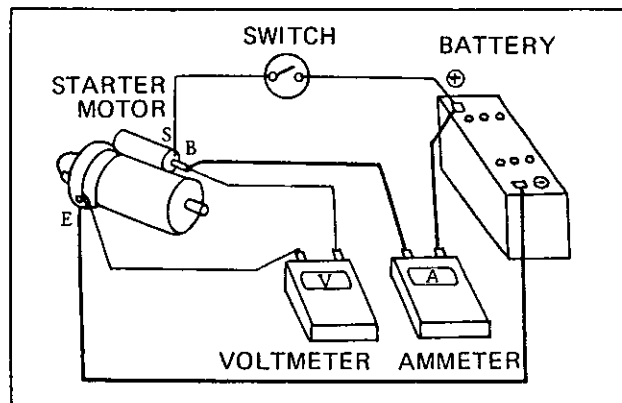


Fig. EE-22 No-load test

Torque test

Torque testing equipment should be used to measure the torque the motor will develop. A high current carrying variable resistance should be connected to the circuit so that the specified voltage at the starting motor may be obtained, since a small variation in the voltage will produce a marked difference in the torque development.

Specified power, voltage and torque are shown in Figures EE-23 and EE-24.

Characteristic curve

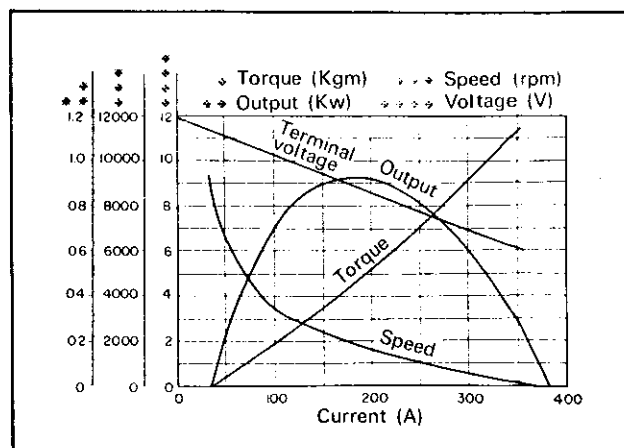


Fig. EE-23 S114-121

ENGINE

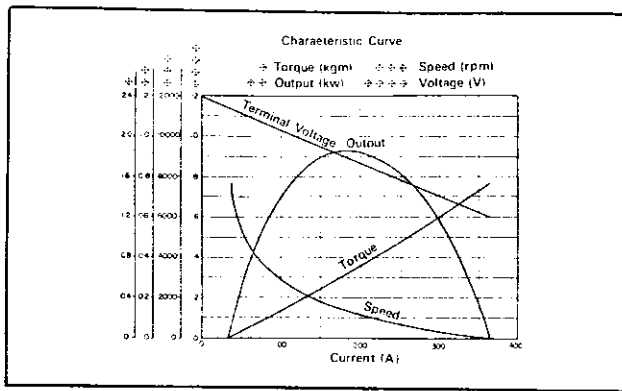


Fig. EE-24 S114-122

Diagnoses of test

1. Low speed with no-load and high current draw may result from followings.

- (1) Tight, dirty or worn bearings
- (2) Bent armature shaft or loosen field probe
- (3) Shorted armature;

Check armature further.

- (4) Grounded armature or field;

Remove copper connector. Remove negative side brush and insulate it from the commutator before inspection. Using a circuit tester, place one probe on the insulated terminal and the other on the rear cover. If the tester indicates conduction, remove other two brushes and check field and armature separately to determine whether the field is grounded or armature.

2. Failure to operate with high current draw may result from followings.

- (1) Grounded or open field coil:

Inspect the connection and check the circuit by the use of a circuit tester.

- (2) The armature coil does not operate:

Inspect the commutator for excessive damage due to burning. In this case, arc may occur on defective commutator during operating the motor with no-load.

- (3) Burned out commutator bar:

Weak brush spring tension, broken brush spring, rubber brush, thrust out of mica in the commutator or a loose contact brush and commutator would cause burning of

the commutator bar.

3. Low torque, low current draw or low no-load speed causes high internal resistance due to loose connections, defective leads, dirty commutator and causes listed on item 2-(3).

4. High no-load speed with low developed torque causes grounded field coil. Replace the field coil and check for improvement in performance.

Magnetic switch assembly test

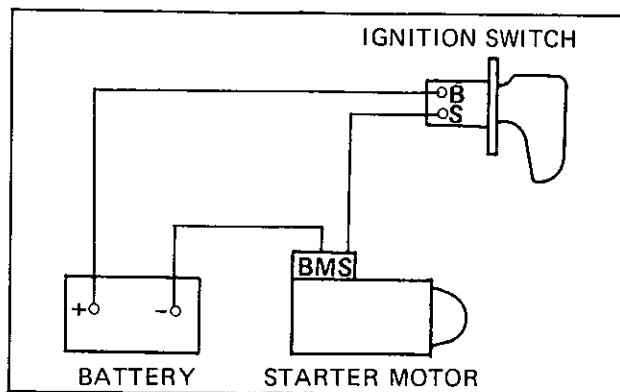


Fig. EE-25 Circuit of magnetic switch assembly test

When the starting motor is checked completely, check the magnetic switch assembly. Connect jumper cables between the "negative" battery terminal and the starting motor "M" terminal, the "positive" battery terminal and the starting motor "S" terminal connecting ignition switch in series as shown in Figure EE-25.

With the ignition switch on, measure the gap "l" between the pinion front edge and the pinion stopper, and adjust by changing the length of the magnetic switch shaft if necessary.

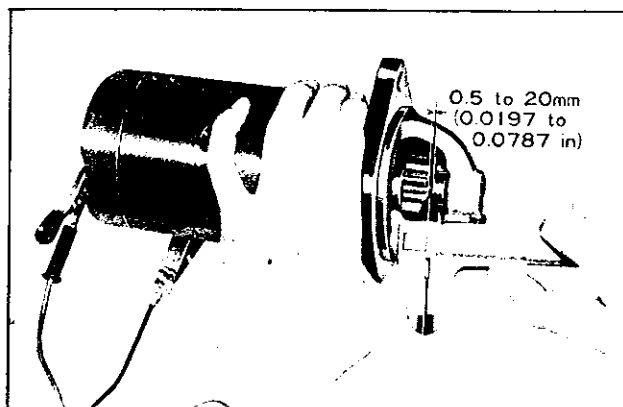


Fig. EE-26 Measurement of gap "l"

ENGINE ELECTRICAL SYSTEM

SPECIFICATIONS AND SERVICE DATA

Specifications

Engine to which applicable (car model)	L24 (S30, G130)	L20A (H130)
Make and type	HITACHI S114-122	HITACHI S114-121
Nominal output	1.0 kw	1.0 kw
System voltage	12V	12V
Weight	6.0 kg (13.2 lb)	5.3 kg (11.7 lb)
No load		
Terminal voltage	12V	12V
Current	less than 60A	less than 60A
Revolution	more than 5,000 rpm	more than 7,000 rpm
Load		
Terminal voltage	6V	6V
Current	less than 460A	less than 460A
Torque	more than 1.4 kg-m (10.1 ft-lb)	more than 1.15 kg-m (8.3 ft-lb)
Pinion drive out voltage	less than 8V	less than 8V
Magnetic switch		
Series coil resistance	0.31Ω	0.31Ω
Shunt coil resistance	0.93Ω	0.93Ω

Service data

Brush length	18.5 mm (0.7283 in)	18.5 mm (0.7283 in)
Wear limit	6.0 mm (0.2362 in)	6.0 mm (0.2362 in)
Brush spring tension	0.8 kg (1.76 lb)	0.8 kg (1.76 lb)
Commutator		
Outer diameter	35.0 mm (1.378 in)	35.0 mm (1.378 in)
Wear limit	2.0 mm (0.0787 in)	2.0 mm (0.0787 in)
Taper limit	0.4 mm (0.0157 in)	0.4 mm (0.0157 in)
Depth of mica	0.5 to 0.8 mm (0.0197 to 0.0315 in)	0.5 to 0.8 mm (0.0197 to 0.0315 in)

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Wear limit	0.2 mm (0.0079 in)	0.2 mm (0.0079 in)
Clearance between armature shaft and bushing	0.03 to 0.1 mm (0.0012 to 0.0040 in)	0.03 to 0.1 mm (0.0012 to 0.0040 in)
Wear limit	0.2 mm (0.0079 in)	0.2 mm (0.0079 in)
Armature shaft diameter		
Pinion side	11.0 mm (0.433 in)	11.0 mm (0.433 in)
Rear end	11.5 mm (0.453 in)	11.5 mm (0.453 in)
Wear limit	0.1 mm (0.0039 in)	0.1 mm (0.0039 in)
Bend limit	0.08 mm (0.0031 in)	0.08 mm (0.0031 in)

TROUBLE DIAGNOSES AND CORRECTIONS

Troubles	Possible causes	Corrective action
Starting motor does not operate.	Discharged battery Defective solenoid switch Loose terminal connection Defective brush Defective starting motor	Charge or replace the battery. Repair or replace the solenoid switch. Clean and retighten the terminal. Replace the brush. Dismount the starting motor and conduct testing.
Noisy starting motor.	Loose securing bolt Worn pinion gear Poor lubrication Worn commutator Worn brush	Retighten the bolt. Replace the pinion gear. Lubricate. Overhaul. Replace the brush.
Starting motor cranks slowly.	Discharged battery Loose terminal connection Worn brush Locked brush Dirty or worn commutator The armature rubs the field coil.	Charge or replace the battery. Clean and retighten the terminal. Replace the brush. Check the brush spring for tension or brush holder, and repair or replace as required. Clean and repair. Overhaul.

ENGINE ELECTRICAL SYSTEM

	Defective solenoid switch	Repair or replace the switch.
Starting motor operates but does not crank the engine.	Worn pinion	Replace the pinion.
	Locked pinion guide	Repair the pinion guide.
	Worn ring gear	Replace the ring gear.
Starting motor does not disengage when the ignition switch is turned off.	Defective solenoid switch	Repair or replace the solenoid switch.
	Defective gear teeth	Replace the defective gear.

CHARGING CIRCUIT

The charging circuit includes 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-27 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 armature. This alternating current is rectified by the positive and negative silicon diodes. The rectified direct current output reaches the alternator "A" and "E" terminals. (Figure EE-27).

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 by the dotted line arrow marks. Then, the coil "VC1" is excited, and the movable contact point "P5" comes in to 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, register "R1" is applied in to the field circuit and output voltage is decreased. As the output voltage is decreased, the movable contact point "P2" and primary side contact "P1" comes in to contact once again, and the alternator voltage increases. Thus, the rapid vibration of the movable contact point "P2", or applying and removing the resistance in the alternator field circuit maintains an alternator output voltage to 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 finally. Then, the field 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 field circuit maintains an alternator output voltage to constant.

ENGINE

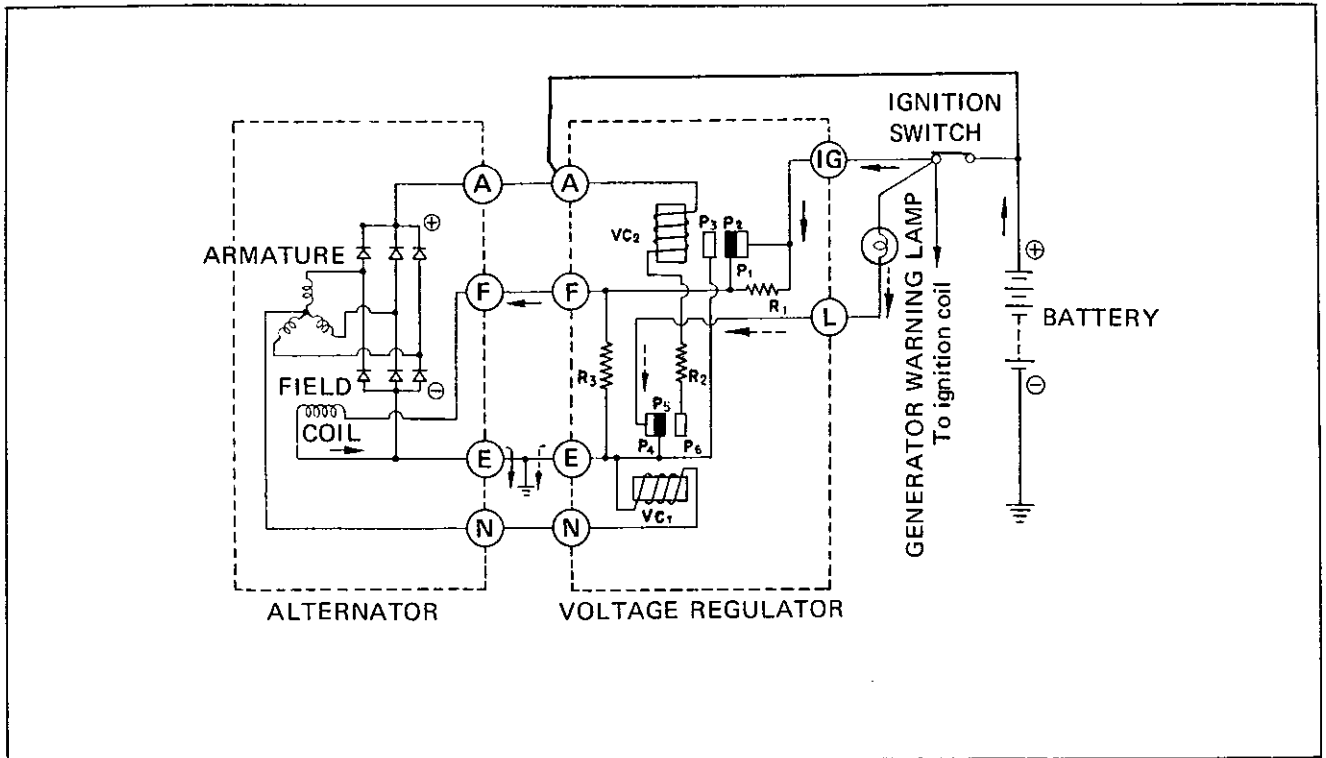


Fig. EE-27 Charging circuit (I)

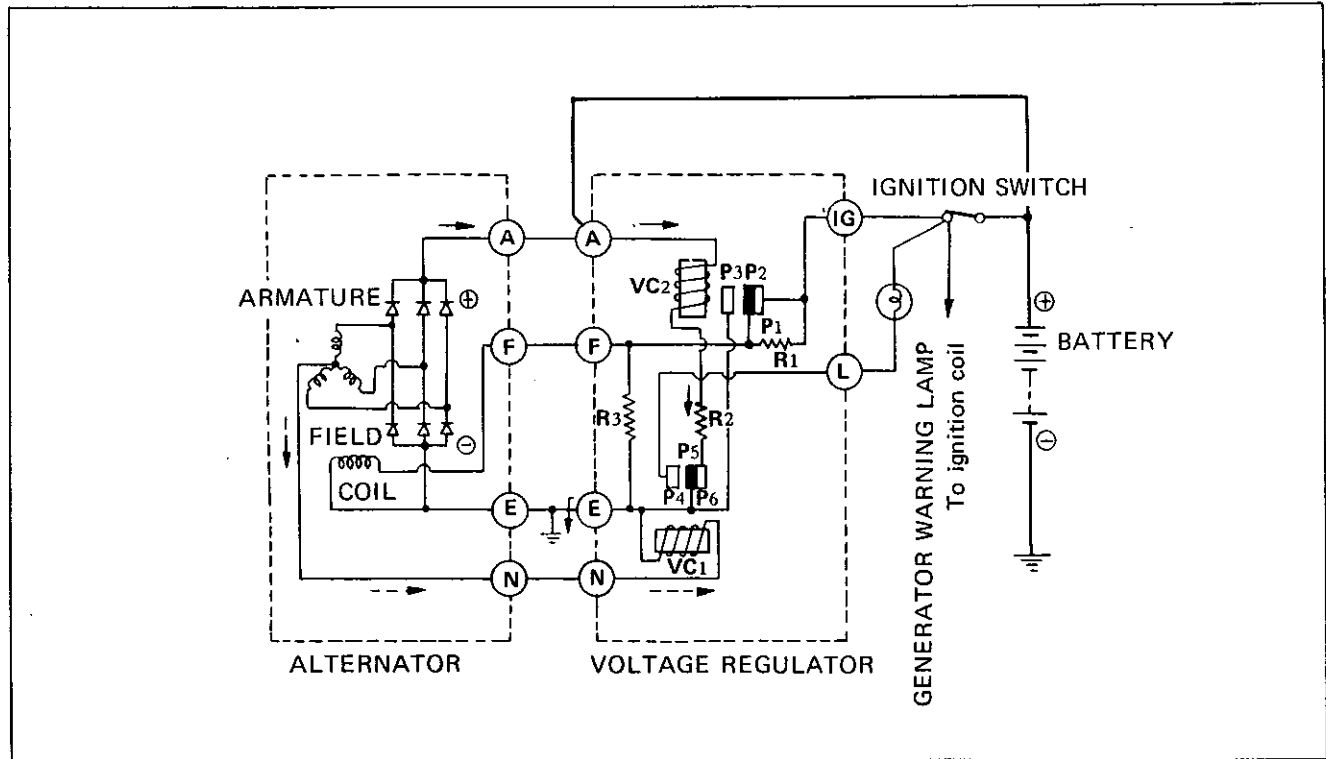


Fig. EE-28 Charging circuit (II)

ENGINE ELECTRICAL SYSTEM

ALTERNATOR

CONTENTS

DESCRIPTION	EE-13	Inspection of diode with tester	EE-19
REMOVAL	EE-14	Inspection of brush	EE-19
DISASSEMBLY	EE-14	Spring pressure test	EE-19
DIODE REMOVAL	EE-16	Inspection of output	EE-20
DIODE INSTALLATION	EE-17	ASSEMBLY	EE-20
INSPECTION AND REPAIR	EE-17	SPECIFICATIONS AND SERVICE DATA	EE-20
Rotor inspection	EE-17	Specifications	EE-20
Inspection of stator	EE-18	Service data	EE-21
Inspection of diode	EE-18		

DESCRIPTION

The alternator differs from the DC generator, wherein, the alternator turns the magnetic pole and fixes the armature. 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 this alternator, six diodes are used (three negatives and three positives), and three each diodes are installed in positive and negative heat sinks. Voltage control system is basically same as that of the D.C. system.

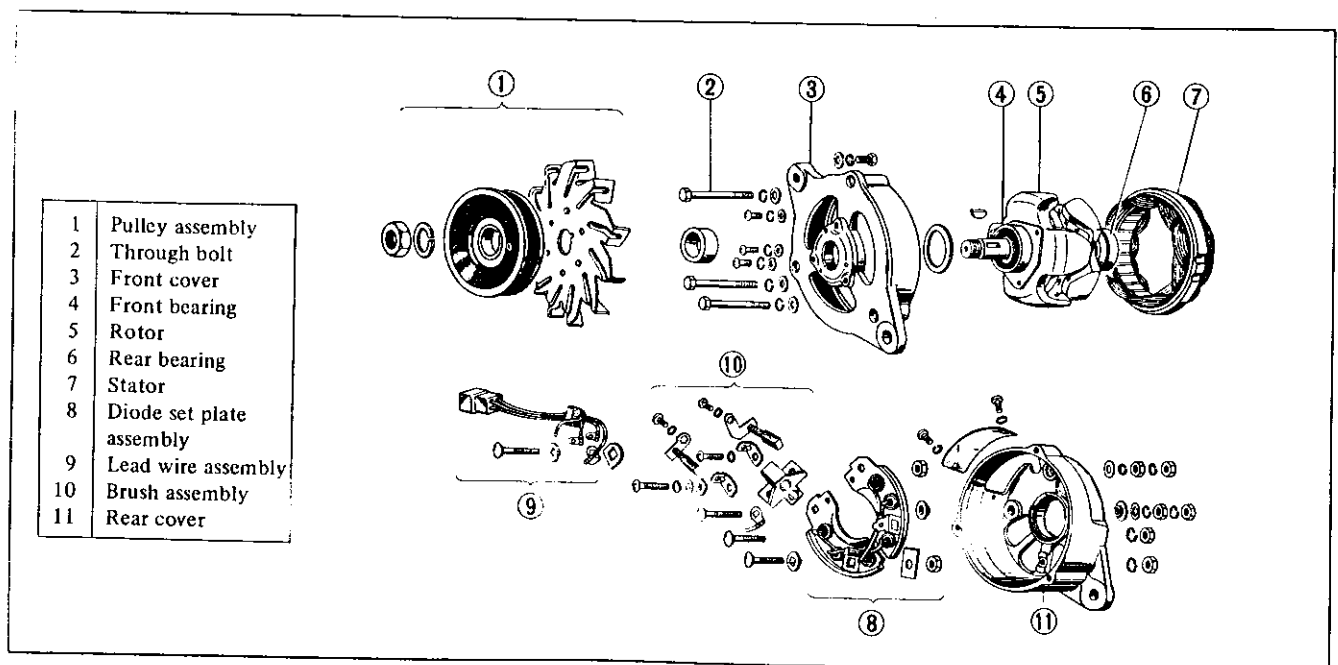


Fig. EE-29 Exploded view of alternator

ENGINE

REMOVAL

1. Disconnect the negative battery terminal.
2. Disconnect two lead wires from the generator and connector.
3. Loosen the adjusting bolt.
4. Remove the generator drive belt.

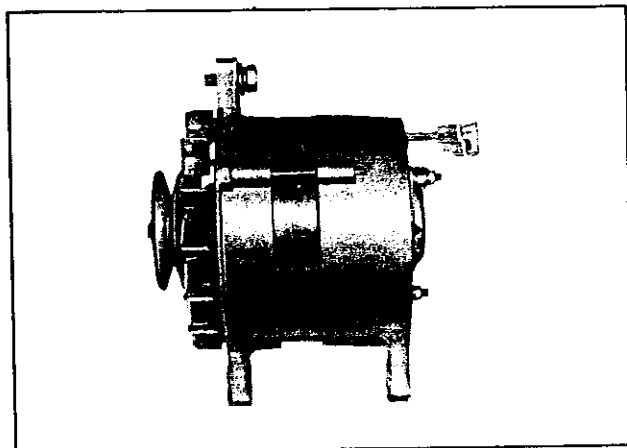


Fig. EE-30 External view

5. Remove the generator installation.
6. Dismount the generator from the vehicle.

DISASSEMBLY

1. Unscrew the through bolt.

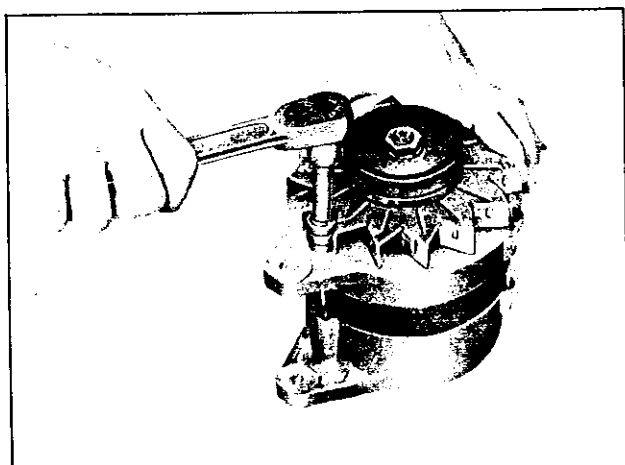


Fig. EE-31 Removal of through bolt

2. Separate the diode end housing from the drive end housing assembly by tapping the front bracket lightly with a wooden mallet.

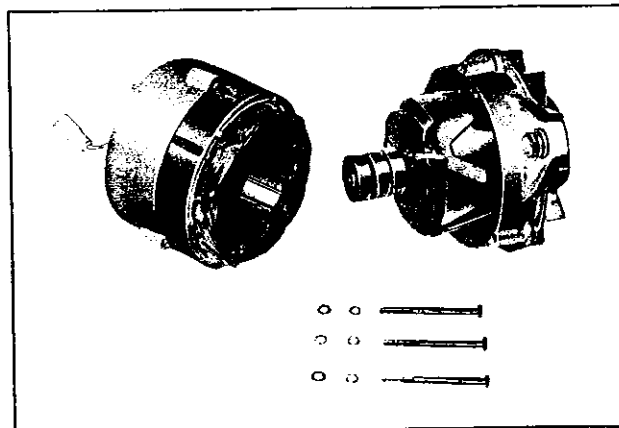


Fig. EE-32 Drive end housing and diode end housing separated

3. Secure the rotor of the drive end housing assembly in a vise carefully so that the rotor is not damaged. Remove the pulley nut, pulley rim, fan and the spacer.

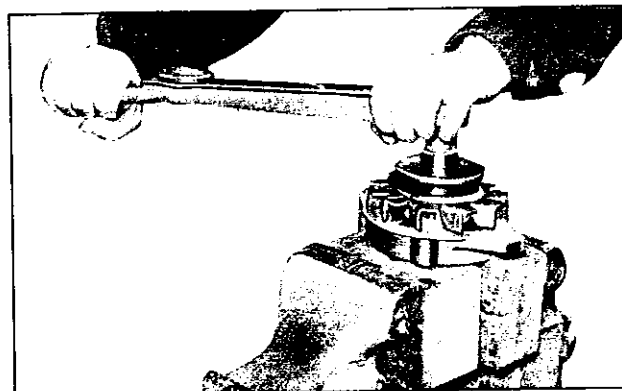


Fig. EE-33 Disassembling the rotor

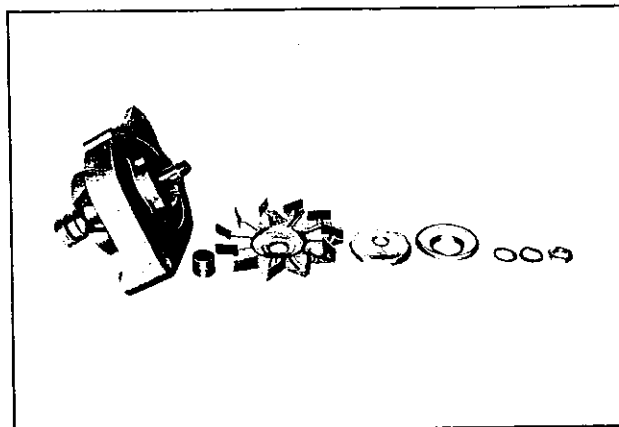


Fig. EE-34 Removal of pulley

ENGINE ELECTRICAL SYSTEM

4. Remove the rotor from the drive end housing assembly by tapping the drive end housing lightly with a mallet.

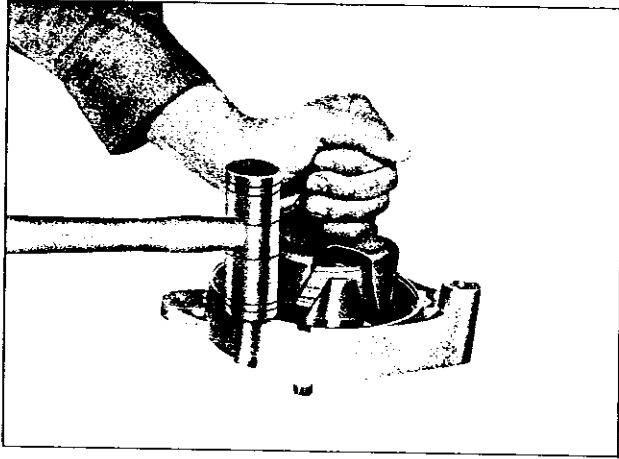


Fig. EE-35 Removal of rotor

5. Remove the bearing retainer by unscrewing three set screws and remove the bearing with a press.

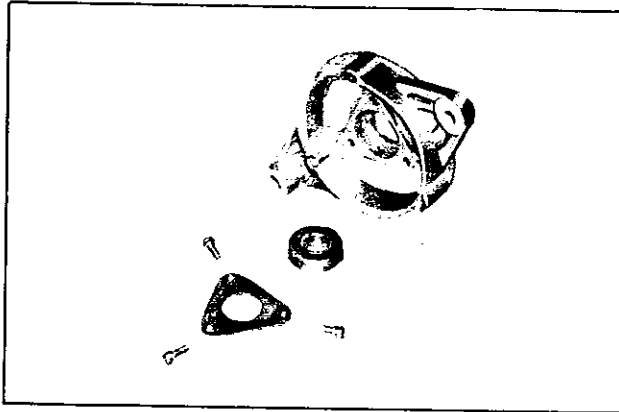


Fig. EE-36 Removal of bearing retainer

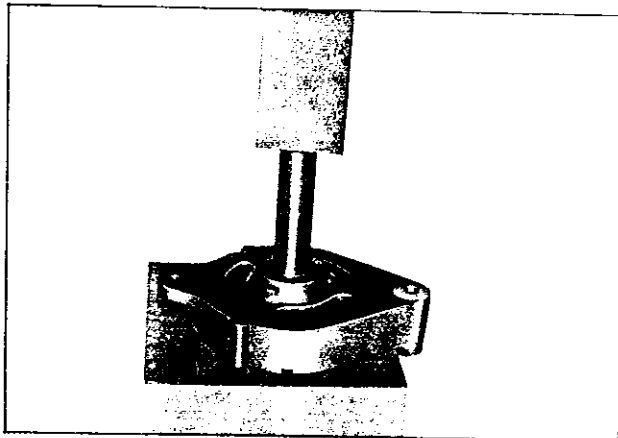


Fig. EE-37 Pulling out of bearing

6. Pull out the rear bearing from the rotor assembly with a press or bearing puller.

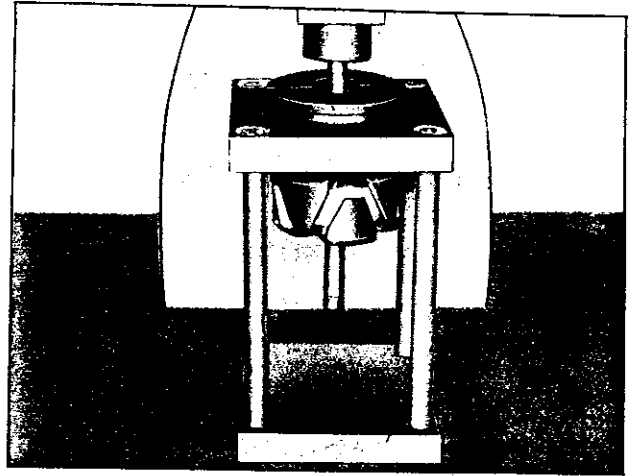


Fig. EE-38 Pulling out of rear bearing (I)

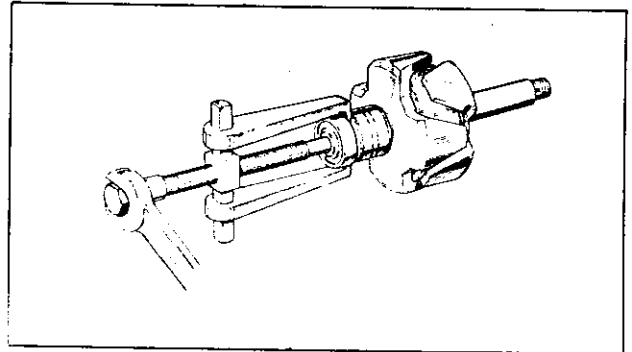


Fig. EE-39 Pulling out of rear bearing (II)

7. Disconnect the negative three diodes from three coil lead wires and each lead wire between diodes by unsoldering with a soldering iron, and separate the stator from the diode end housing assembly.

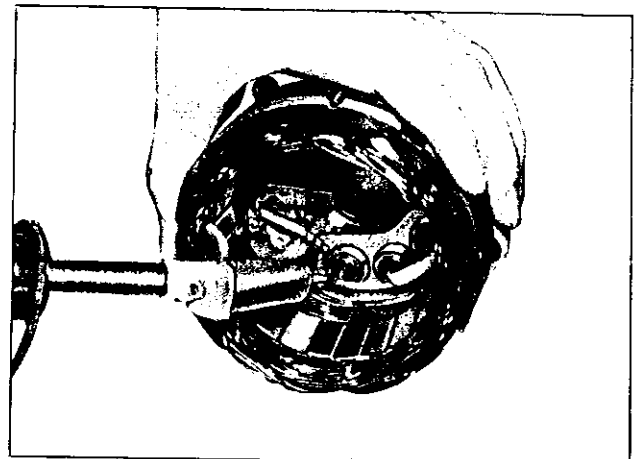


Fig. EE-40 Removing stator

ENGINE

8. Remove the brush cover by unscrewing each set screw.

Unsolder and disconnect "N" terminal lead wire. The diode end and the stator can be separated.

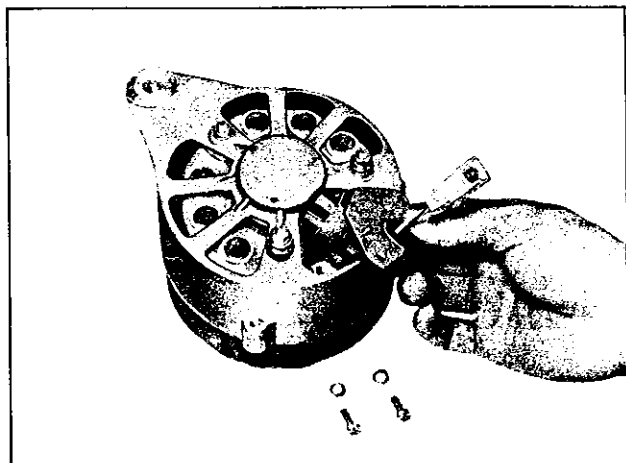


Fig. EE-41 Disconnecting N terminal

Note: When the internal temperature of a diode rises over 150°C (300°F), the diode will lose its function. Therefore, use the electric iron, 100W to 200W, for approximately two seconds at the soldered portions.

9. Remove the heat sink and the brush holder from the rear cover by unscrewing each set screw. Be careful not to lose small parts such as screws, washers and bushings.

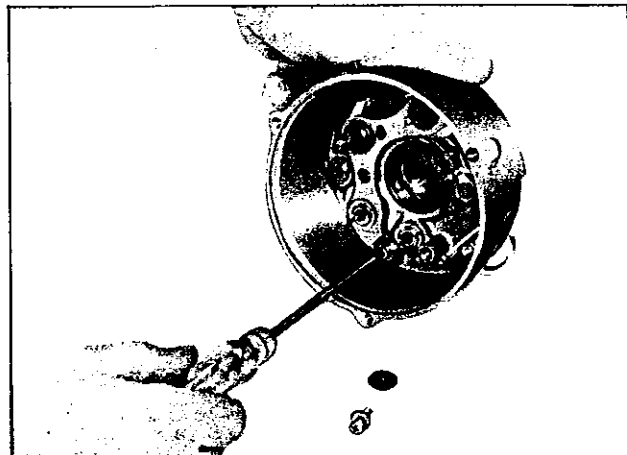


Fig. EE-42 Removing diode

10. Disassembling the brush holder

Unsolder lead wire F (white-black), and the brush holder wires (negative and positive) with a soldering iron.

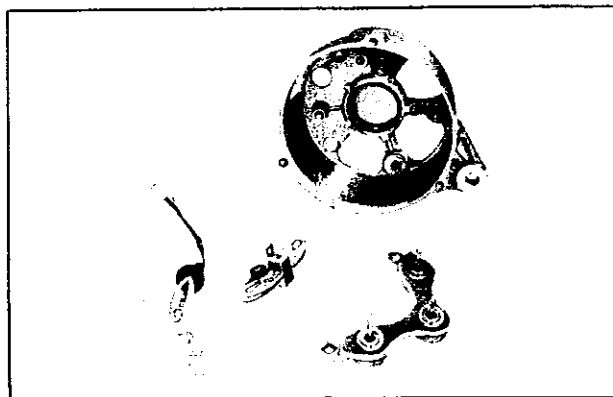


Fig. EE-43 LT140-53

Note: There are two kinds of diode, "Positive" and "Negative".

The positive diode is marked with "red figure" on the bottom of the diode and the negative diode is marked with "black figure" in the same manner as shown in Figure EE-44.

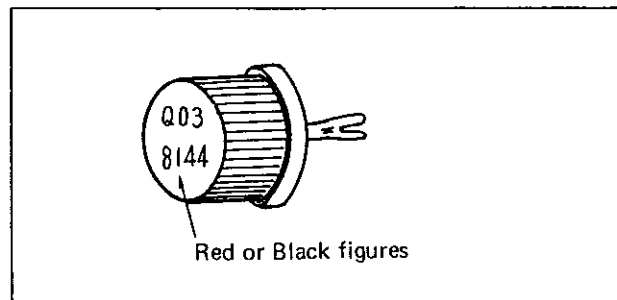


Fig. EE-44 Diode identification

DIODE REMOVAL

To remove a diode, use a suitable tool to support the heat sink, and remove the diode by the use of an arbor press as shown in Figure EE-45.

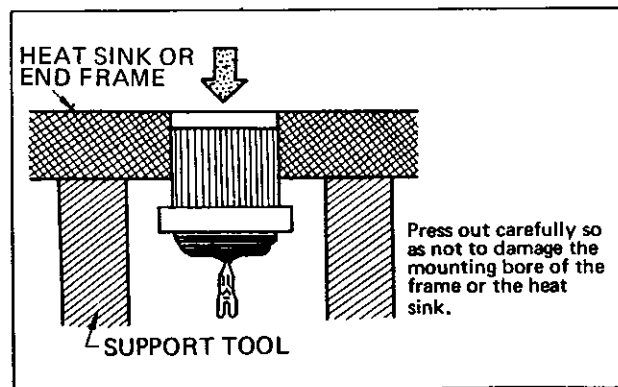


Fig. EE-45 Removal of the diode

ENGINE ELECTRICAL SYSTEM

Note: Do not strike the diode, as the shock may damage the other diodes.

DIODE INSTALLATION

Support the head sink with a suitable tool and then press the diode into the heat sinks by using the tool (A) which fits over the outer diode edge (A portion).

Press down the diode completely into the mounting bore of C portion toward the lower edge of B portion of the diode. Replaced diode should not be taken out with a force smaller than 15 kg (33 lb).

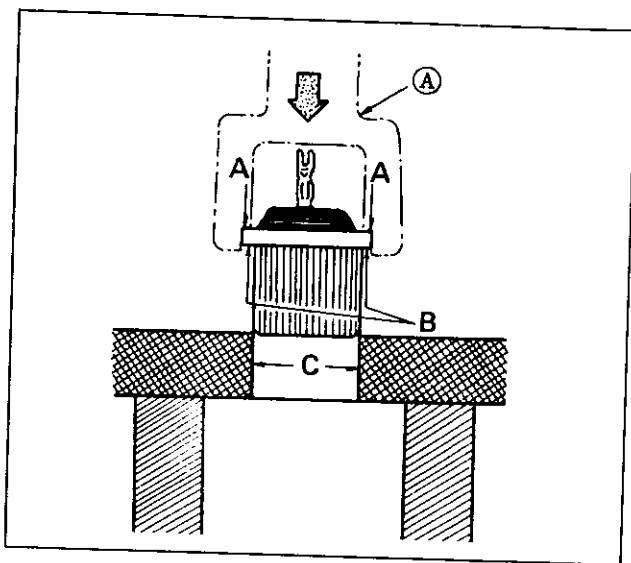


Fig. EE-46 Installation of the diode

INSPECTION AND REPAIR

Remove the alternator from the vehicle and apply the tester between the lead wire F (black-white color) and the lead wire E (black color). When the resistance is approximately 5 to 6 Ω , the condition is satisfactory.

Rotor inspection

1. Conduction test of field coil

Apply the tester between the slip rings of rotor as shown in Figure EE-51. If there is no conduction, the disconnection of field coil may exist. When the resistance is approximately 4.47 Ω at normal ambient temperature, the condition is satisfactory.

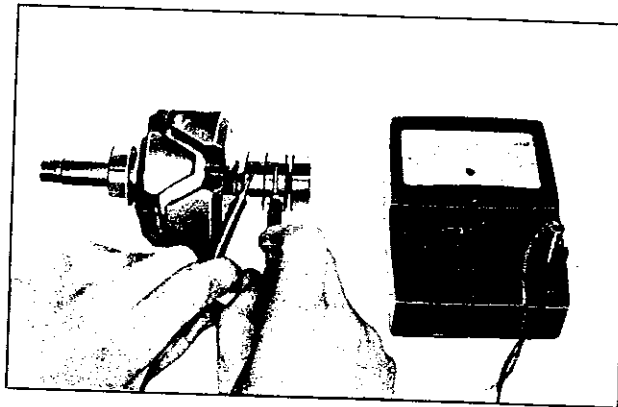


Fig. EE-47 Conduction test of field coil

2. Ground test of field coil

Check the conduction between slip ring and rotor core. If the conduction exists, replace rotor assembly, because field coil or slip ring must be grounded.

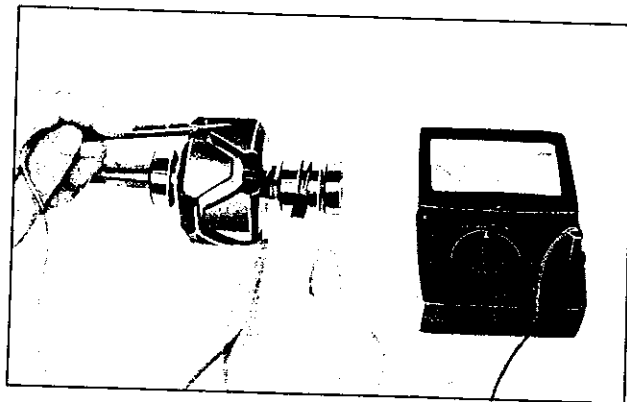


Fig. EE-48 Ground test of field coil

3. Inspection of rotor eccentricity

Check the eccentricity of rotor as shown in Figure EE-49, with a dial gauge.

Repair or replace if the eccentricity is over 0.10 mm (0.0039 in).

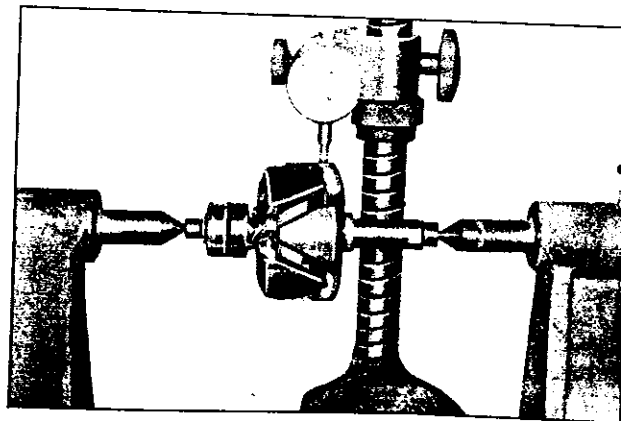


Fig. EE-49 Inspection of rotor eccentricity

ENGINE

Inspection of stator

1. Conduction test

If the neutral wire of stator connected to the lead wire N (yellow color) is conductive with each lead wire of armature coil, the condition is satisfactory.

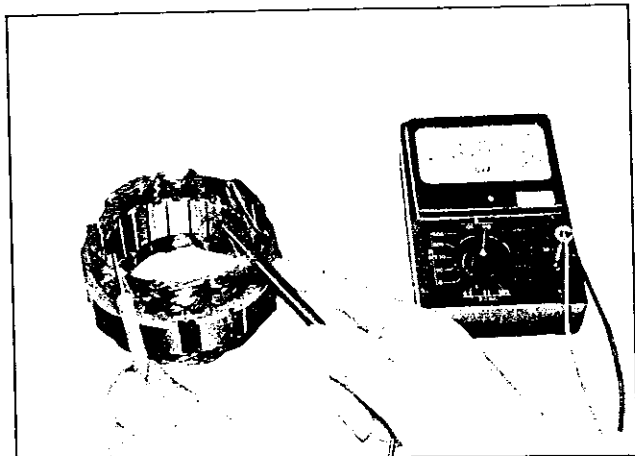


Fig. EE-50 Conduction test

2. Ground test

If each lead wire of armature coil (including neutral wire) is not conductive with stator core, the condition is satisfactory.

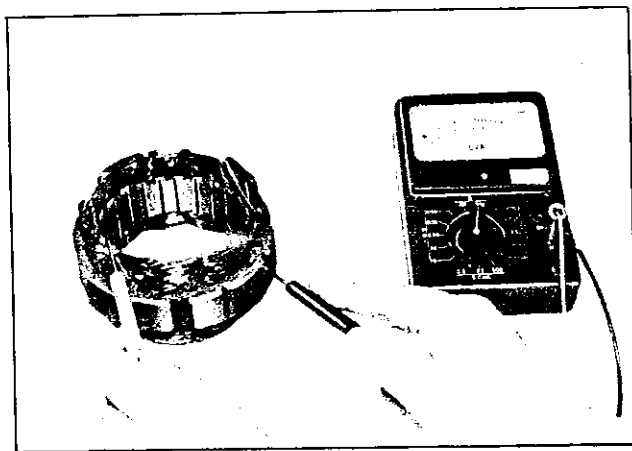


Fig. EE-51 Ground test

Inspection of diode

(Using lamp and battery)

1. Positive side diode

Connect the battery negative terminal with the A terminal and the battery positive terminal with connector N terminal (yellow color) as shown in Figure EE-52. Lamp in the circuit will light.

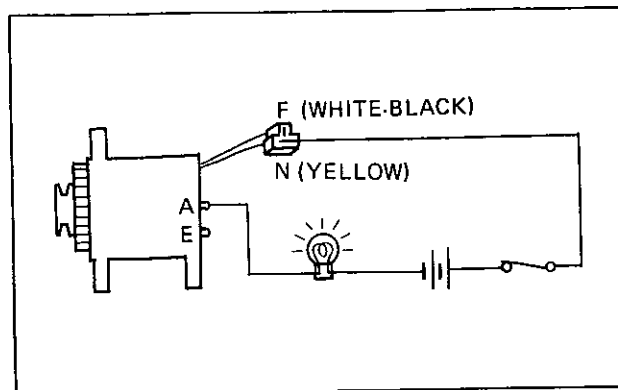


Fig. EE-52 Inspection of positive side diode

If the lamp does not light when the connection is made reversely as shown in Figure EE-53, the positive side diode is satisfactory.

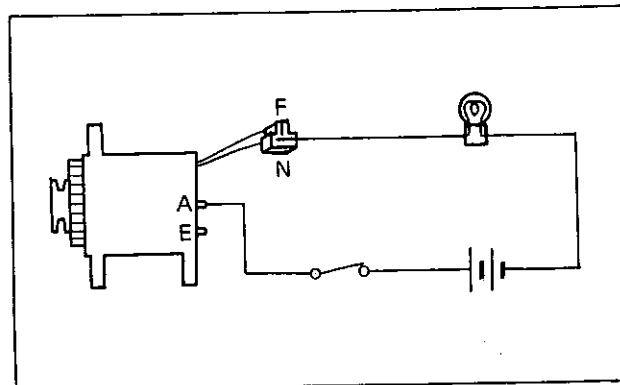


Fig. EE-53 Inspection of positive side diode

2. Negative side diode

Connect the battery negative terminal with connector N terminal (yellow color) and the battery positive terminal with E terminal as shown in Figure EE-54. Lamp in the circuit will light.

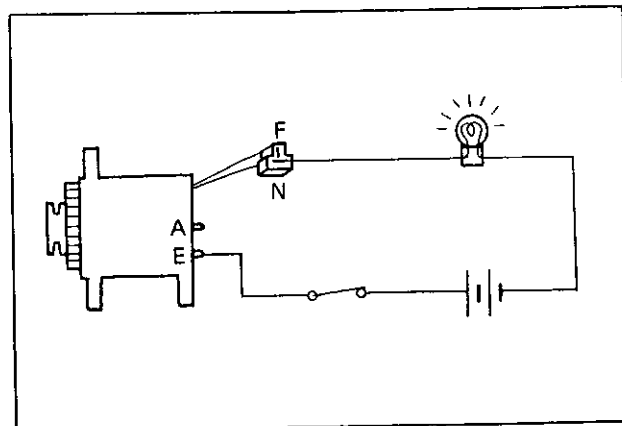


Fig. EE-54 Inspection of negative side diode

ENGINE ELECTRICAL SYSTEM

If the lamp does not light when the connection is made reversely as shown in Figure EE-55, the negative side diode is satisfactory.

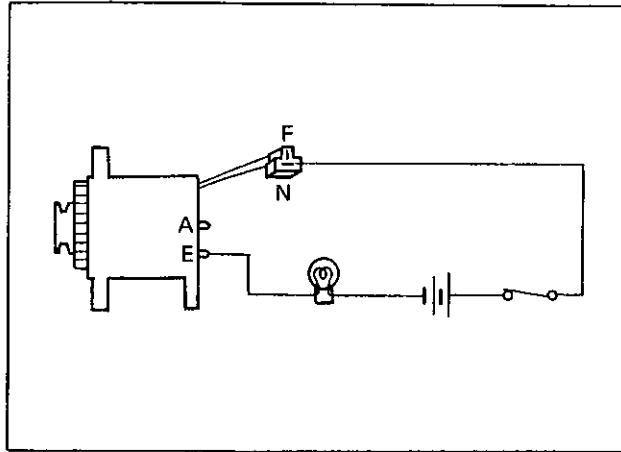


Fig. EE-55 Inspection of negative side diode

Inspection of diode with tester

There are two kinds of diodes as shown in Figure EE-56. Each diode can be discriminated its polarity by the color of the printed figures on each diode as shown below.

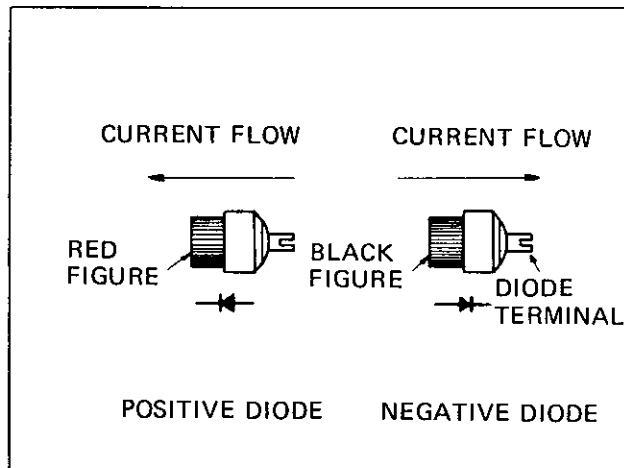


Fig. EE-56 Diode

Check diode resistance, using a tester, in a current flow direction and a reverse direction.

When one side shows low resistance and the other shows high resistance, the diode is satisfactory.

If both sides are low, there will be a short circuit and if both sides are high, there will be an open circuit. In both cases, replace diode.

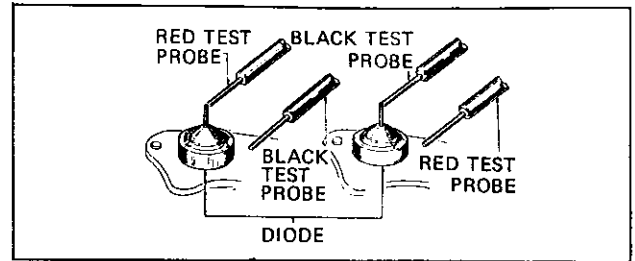


Fig. EE-57 Diode test

Inspection of brush

Check the movement of brush and if the movement is unsmooth, check brush holder and clean it.

If brush worn more than 7 mm (0.2755 in), replace the brush with new one.

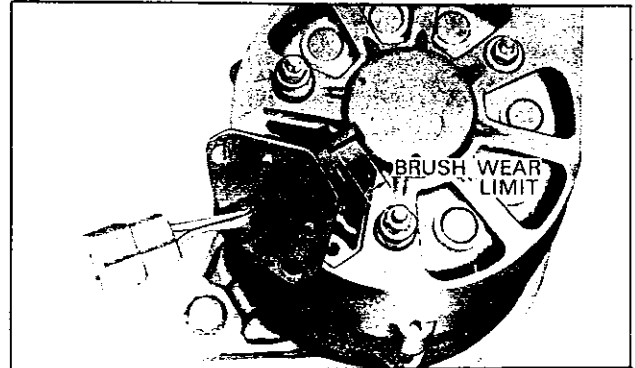


Fig. EE-58 Brush wear limit

Spring pressure test

Place a suitable block on a platform scale and press down brush holder with brush and spring on the block until brush sinks in the holder to 1 mm (0.0394 in) height from the holder. The reading subtracted the block weight shows the spring pressure. The spring pressure should be 0.35 kg (0.77 lb). If the pressure is less than 0.2 kg (0.44 lb), replace it.

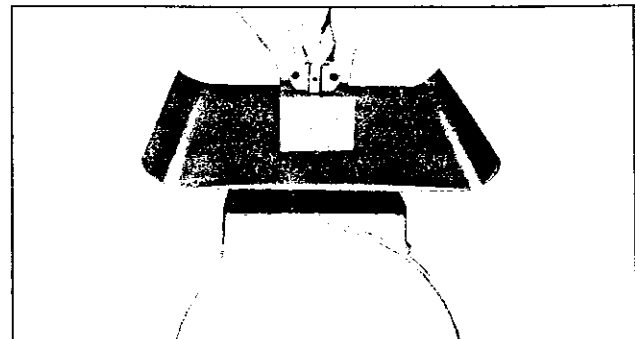


Fig. EE-59 Spring pressure test

ENGINE

Inspection of out put

For output inspection, remove the alternator from the vehicle and connect wiring as shown in Figure EE-60 and drive it with motor.

Through the wiring shown in Figure EE-60 magnetic current flows from the battery to the field coil of the alternator. In this state, raise revolution of the alternator gradually up to the speed where there is no reverse flow (approximately 2A) to the field coil and read the revolution. Correct revolution is approximately 1,000 rpm without load.

Next, increase load resistance to the maximum so as to reduce load current to the minimum, and turn off the switch. Raise the load current slowly to increase revolution of the alternator. Make sure that output current increase as revolution of the alternator increases. If there is no large difference from the specification, it is correct.

Disregarding whether the battery is over-charged or discharged, when the charging current is small, first, check the alternator and the relay for the performance. Inspect the charging current by inserting an ammeter between "A" terminal of relay and the battery.

Disconnect wire between the alternator "F" terminal and relay "F" terminal at the relay "F" terminal and short-circuit the removed lead wire at the relay "A"

terminal. If the charging current highly increases, the relay is in disorder.

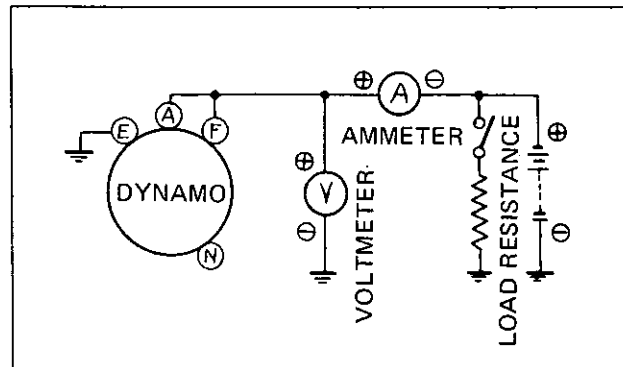


Fig. EE-60 Circuit for the output inspection

Note: Use the battery charged in full up to the normal capacity.

REASSEMBLY

Assemble the generator in reverse sequence of disassembly. Always make sure that the polarity of alternator diode is aligned correctly. Refer to Figure EE-60 Diode.

SPECIFICATIONS AND SERVICE DATA

Specifications

Engine to which applicable	L24	L20A
Make and Type	HITACHI LT145-35	HITACHI LT140-53
Nominal output	12V - 45A	12V - 40A
Pole	Negative ground	Negative ground
Revolution	10,000 to 13,500 rpm	10,000 to 13,500 rpm
No-load minimum revolution	Less than 1,000 rpm	Less than 1,000 rpm
Output current	More than 34A (14V 2,500 rpm) More than 45A (14V 5,000 rpm)	More than 30A (14V 2,500 rpm) More than 40A (14V 5,000 rpm)
Weight	5.1 kg (11.2 lb)	5.0 kg (11.0 lb)
Applied regulator	TL1Z-37	TL1Z-37

ENGINE ELECTRICAL SYSTEM

Service data

Type	LT145-35	LT140-53
Stator coil resistance per phase	0.09 Ω [20°C (68°F)]	0.11 Ω [20°C (68°F)]
Rotor coil resistance	4.1 Ω	4.1 Ω
Standard brush spring pressure	0.3 kg (0.7 lb)	0.3 kg (0.7 lb)
Standard brush height	14.5 mm (0.571 in)	14.5 mm (0.571 in)
Wear limit of brush	7 mm (0.276 in)	7 mm (0.276 in)
Standard front shaft size	15 mm dia. (0.591 in dia.)	15 mm dia. (0.591 in dia.)
Standard rear shaft size	12 mm dia. (0.472 in dia.)	12 mm dia. (0.472 in dia.)

REGULATOR

CONTENTS

DESCRIPTION	EE-21	Charge relay	EE-24
MEASUREMENT OF REGULATING		Precautions for adjustment	EE-25
VOLTAGE	EE-22	SPECIFICATIONS AND SERVICE DATA	EE-25
ADJUSTMENT	EE-23	TROUBLE DIAGNOSES AND	
Voltage regulator	EE-23	CORRECTIONS	EE-26

DESCRIPTION

The regulator, consisting of a voltage regulator and charge relay, features;

- (1) Compact and light
- (2) Adjustment can be made easily because adjust screw is used for voltage adjustment.
- (3) Installation of the stationary contact is improved and gap adjustment is thereby eased.
- (4) The coil is secured on the base by means of caulking, the yoke and armature are installed by means of welding, and thus, the construction has been simplified.

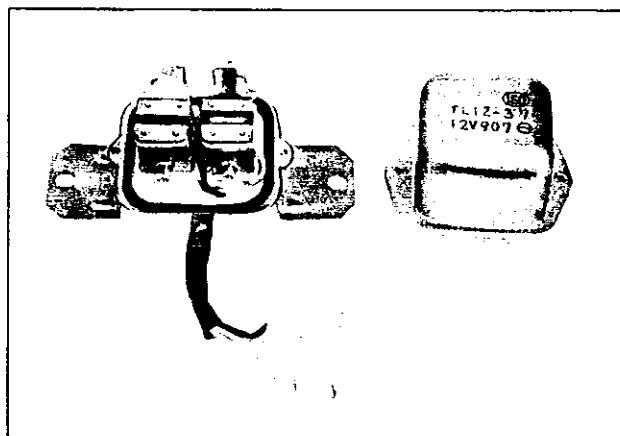
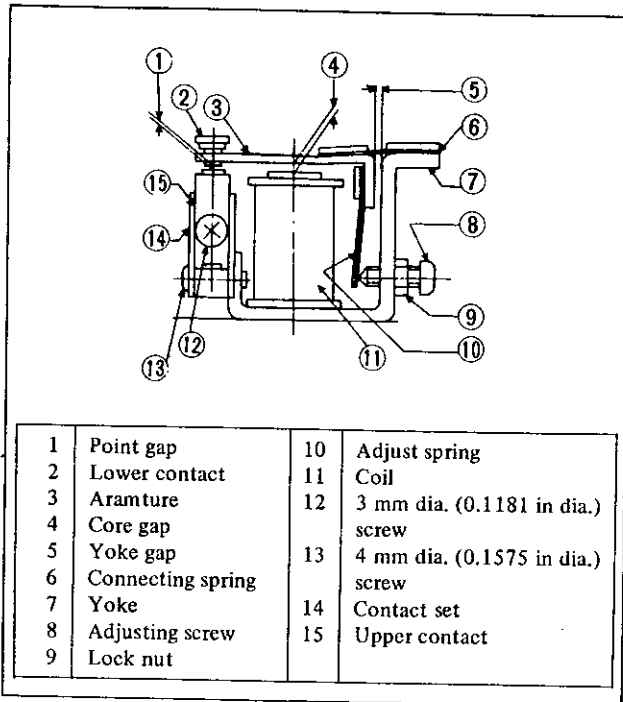


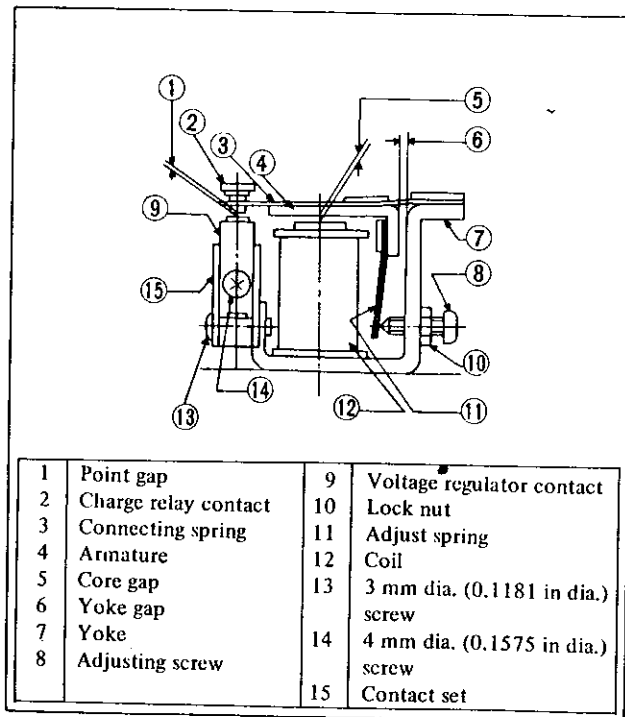
Fig. EE-61 Remove the cover view

ENGINE

As for the construction, the voltage regulator is very similar to the charge relay as shown in Figure EE-62.



(a) Construction of voltage regulator



(b) Construction of charge relay

Fig. EE-62 Structural view

MEASUREMENT OF REGULATING VOLTAGE

Regulating voltage is measured with the regulator combined with the specified generator. Theoretical measurement differs from that made actually on the vehicle. The methods are described as follows:

1. Theoretical method

Prepare a DC voltmeter, DC ammeter, tachometer, battery, and resistor (0.25 Ω), and form a circuit as shown in Figure EE-63.

- (1) Operate the generator under the rated speed (5,000 rpm).
- (2) Read the indication on the voltmeter. The pointer indicates the regulating voltage.
- (3) At the same time, make sure that the current is less than 5 amperes.

Note: Be sure to measure regulating voltage when the generator speed has reached the rated speed. The rated voltage (regulating voltage) varies depending on the ambient temperature. When measuring voltage, measure ambient temperature and calibrate appropriately.

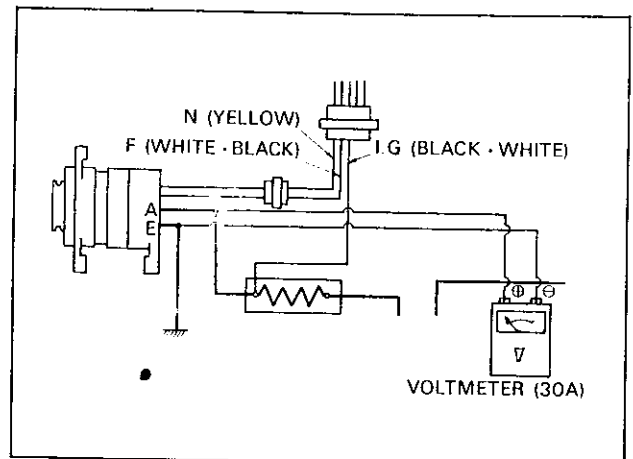


Fig. EE-63 Theoretical regulating voltage measuring circuits

ENGINE ELECTRICAL SYSTEM

2. Measuring regulating voltage of regulator mounted on a vehicle

(1) Use the same equipment as for the theoretical method, and connect them as shown in Figure EE-64. Install the regulator perpendicularly by facing the connector downward in this case, also.

(2) Make sure that all electrical loads (such as head lamps, air conditioner, radio, etc.) on the vehicle have been interrupted.

(3) Before starting the operation, be sure to short-circuit the line between fuse side terminal of the resistor for voltage measurement and (-) terminal of the ammeter. Pointer of the ammeter may deflect rapidly and reversely due to discharge current flowing from the battery resulting damaged ammeter. (See Figure EE-64.)

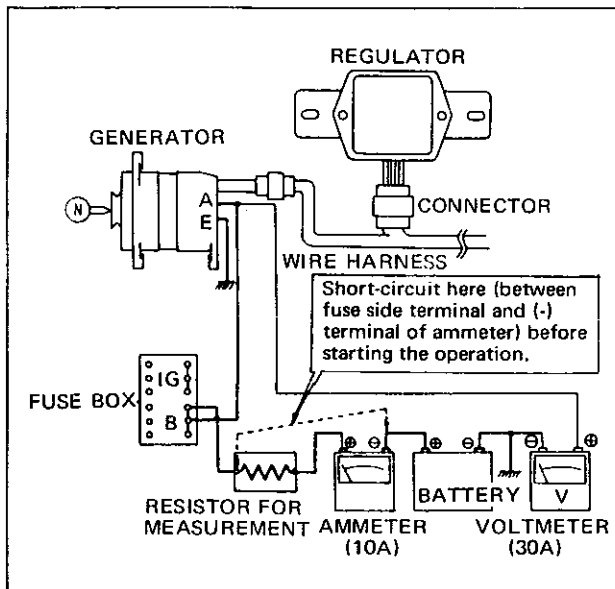


Fig. EE-64 Regulating voltage measuring circuit with regulator mounted on the vehicles

(4) Raise the engine speed gradually, and measure voltage when the engine speed reaches the rated level. The measured voltage is the regulating voltage when the regulator is mounted on the vehicle.

Note: a. Do not race the engine when starting but operate under idling speed.

b. Raise the engine speed gradually from idling to the rated normal speed, and measure voltage.

c. When two to three minutes are elapsed after starting the regulator operation, voltage rises approximately 0.3V from the normal voltage due to the self-heating. Thus, be sure to measure voltage within one minute after starting the operation. When measurement cannot be made within one minute, cease the operation once and measure again after cooling the regulator.

ADJUSTMENT

Voltage regulator

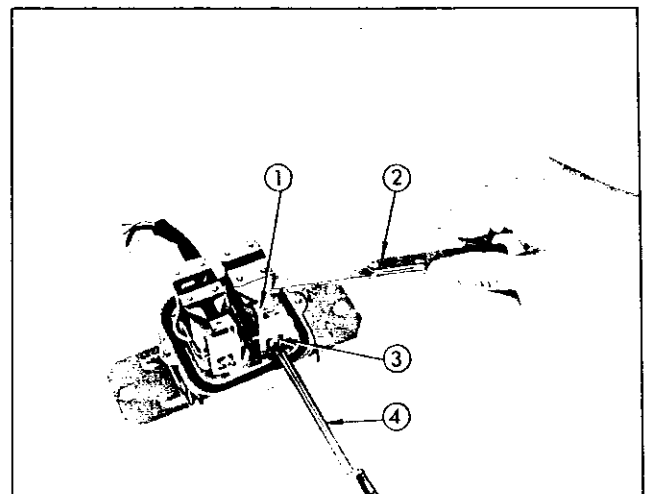
As the result of above measurement, when the regulating voltage is deviated from the rated value, adjust the regulator in accordance with the following instructions.

1. Inspect contact surface, and if rough, lightly polish the surface with fine emery paper (#500 or 600).

2. Measure each gap, and adjust if necessary. Adjust the core gap and point gap in that order. No adjustment is required for the yoke gap.

3. Adjusting core gap

Loosen the screw [4 mm diameter (0.1575 in diameter)] which is used to secure the contact set on the yoke, and move the contact upward or downward properly. (See Figure EE-65.)



1	Contact set	3	4 mm dia. (0.1575 in dia.) screw
2	Thickness gauge	4	Cross-head screwdriver

Fig. EE-65 Adjusting core gap

ENGINE

4. Adjusting point gap

Loosen the screw [3 mm diameter (0.1181 in diameter)] used to secure the upper contact, and move the upper contact upward or downward adequately. (See Figure EE-66.)

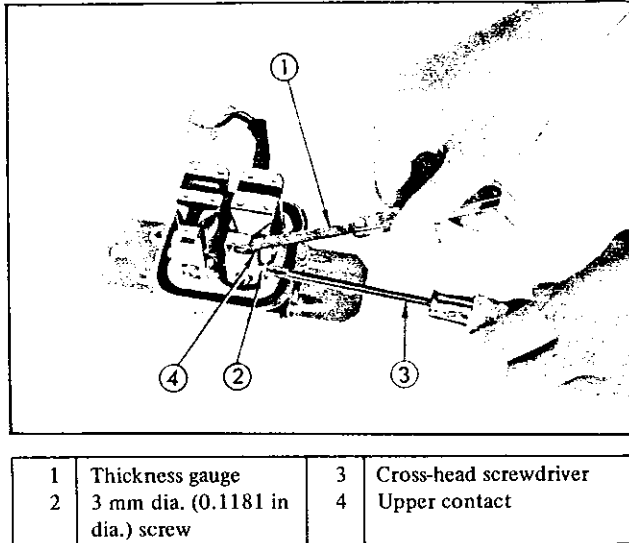


Fig. EE-66 Adjusting point gap

5. Adjusting voltage

Adjust regulating voltage with the adjusting screw. When increasing voltage, loosen the lock nut (used to secure the adjusting screw) and screw the adjusting screw. When decreasing, unscrew the adjusting screw. (See Figure EE-67.)

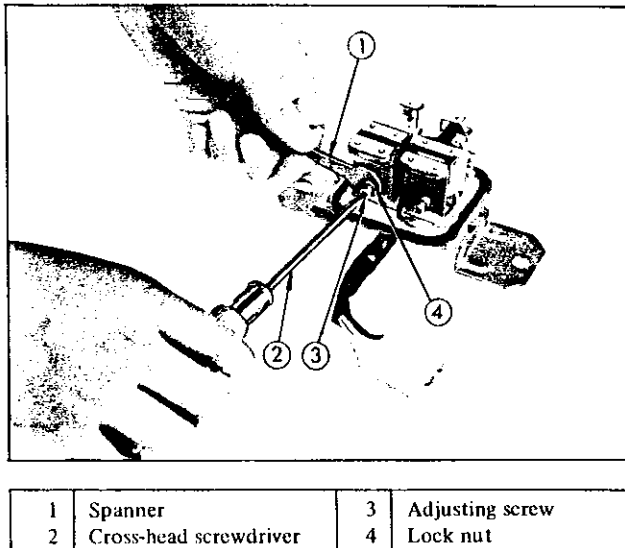


Fig. EE-67 Adjusting regulating voltage

Note: Upon completion of the regulating voltage adjustment, retighten the lock nut and securely set the adjusting screw stationarily.

Under the normal (satisfactory) condition, difference between the lower contact operating voltage and upper contact operating voltage rises 0 to approximately 0.5V as shown in Figure EE-68.

Reduce the core gap when the difference exceeds 0.5V, and increase when the difference is less than 0V.

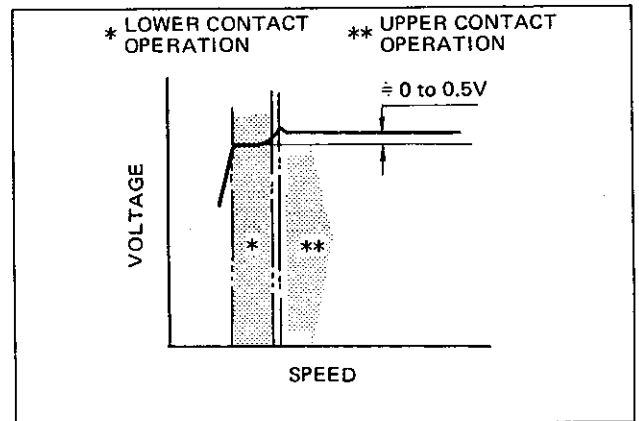


Fig. EE-68 Jump voltage

Charge relay

The normal charge relay operating voltage is 8 to 10V at the generator "A" terminal. However, it operates at 4 to 5V because one half of the "A" terminal voltage ("N" terminal voltage) is applied to the charge relay voltage coil.

It is difficult to measure this operating voltage with the regulator mounted on the vehicle.

Prepare a battery, voltmeter and variable resistor, and measure operating voltage after dismounting the regulator. Figure EE-69 shows the measuring circuit.

Set the variable resistor to "MAX" position, apply current (turn on the switch), and reduce resistance gradually. When resistance is reduced to a certain level, the charge lamp goes out. This level indicates the charge relay operating voltage.

Set the variable resistor to "MAX" position, apply current (turn on the switch), and reduce resistance gradually. When resistance is reduced to a certain level, the charge lamp goes out. This level indicates the charge relay operating voltage. The rated value is 4 to 5 volts. When deviated, readjust. The adjustment is carried out in the same manner as the voltage regulator.

ENGINE ELECTRICAL SYSTEM

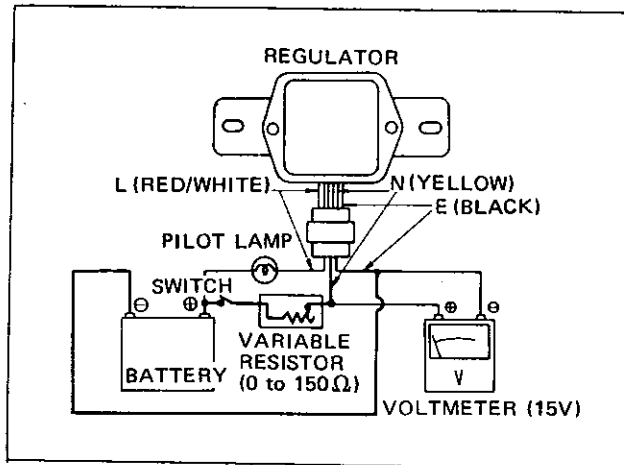


Fig. EE-69 Charge relay operating voltage measuring circuit

Precautions for adjustment

1. Upon completion of the adjustment, reinstall the cover and make sure that the regulator operates correctly.
2. When the cover is removed or adjusting screw is adjusted while adjusting voltage, be sure to disconnect the regulator once, and reconnect when measuring actually. The battery circuit may be short-circuited.

SPECIFICATIONS AND SERVICE DATA

Voltage regulator

Model	TL1Z-37
Regulating voltage (with fully charged battery and connected faced downward)	* 14.3 to 15.3 V [at 20°C (68°F)]
Voltage coil resistance	10.5 Ω [at 20°C (68°F)]
Rotor coil inserting resistance	10 Ω
Voltage coil series resistance	25 Ω
Smoothing resistance	40 Ω
Core gap	0.6 to 1.0 mm (0.0236 to 0.0394 in)
Point gap	0.3 to 0.4 mm (0.0118 to 0.0157 in)

Charge relay

Release voltage	8 to 10 V at "A" terminal
Voltage coil resistance	37.8 Ω [at 20°C (68°F)]
Core gap	0.8 to 1.0 mm (0.0315 to 0.0394 in)
Point gap	0.4 to 0.6 mm (0.0157 to 0.0236 in)

*Standard temperature gradient: -0.015 V/°C

ENGINE

TROUBLE DIAGNOSES AND CORRECTIONS

Troubles	Possible causes	Corrective action
No output	Sticking brushes Dirty brushes and slip rings Loose connections or broken leads Open stator winding Open rotor winding Open diodes Shorted rotor Shorted stator Grounded "BAT" terminal Broken fan belt	Correct or replace brush and brush spring. Clean. Retighten or solder connection. Replace leads if necessary. Repair or replace the stator. Replace the rotor. Replace the diodes. Replace the rotor. Repair or replace the stator. Replace the insulator. Replace the belt.
Excessive output	Broken neutral wire (color of wire is white.) Defective voltage regulator Poor grounding of the alternator and voltage regulator "E" terminal Broken ground wire (color of wire is black.)	Replace the wire. Check the regulator operation and repair or replace as required. Retighten the terminal connection. Replace the wire.
Low output	Loose or worn fan belt Sticking brushes Low brush spring tension Defective voltage regulator Dirty slip rings Partial short, ground, or open in stator winding Partially shorted or grounded rotor winding	Retighten or replace the belt. Correct or replae brushes and spring if necessary. Replace the brush spring. Check the regulator operation and repair or replace as required. Clean. Replace the stator. Replace the rotor.

ENGINE ELECTRICAL SYSTEM

	Open or defective diode	Replace the diode
Noisy alternator	Loose mounting Loose drive pulley Defective ball bearing Improperly seated brushes	Retighten the mounting bolts. Retighten the pulley correctly. Replace the bearing. Seat brushes correctly.

IGNITION CIRCUIT

The ignition circuit includes the distributor, ignition coil, ignition switch, spark plugs, high tension cable and the battery.

DISTRIBUTOR

CONTENTS

CONSTRUCTION AND OPERATION	EE-27	Centrifugal advance mechanical part	EE-31
CHECKING AND ADJUSTMENT	EE-29	DISASSEMBLY AND REASSEMBLY	EE-32
Cap and rotor head	EE-29	Disassembly	EE-32
Point	EE-29	Reassembly	EE-34
Condenser	EE-30	SPECIFICATIONS AND SERVICE DATA	EE-35
Vacuum advance mechanical part		Specifications	EE-35
and switch on-off part	EE-30	Service data	EE-35

Distributor model

D612-52	L24 (with Emission Control)
D606-52	{ L24 (with Single and Twin carb.)
	{ L20A (Premium Gas)
D609-56	L20A (Regular Gas)

Applied engine

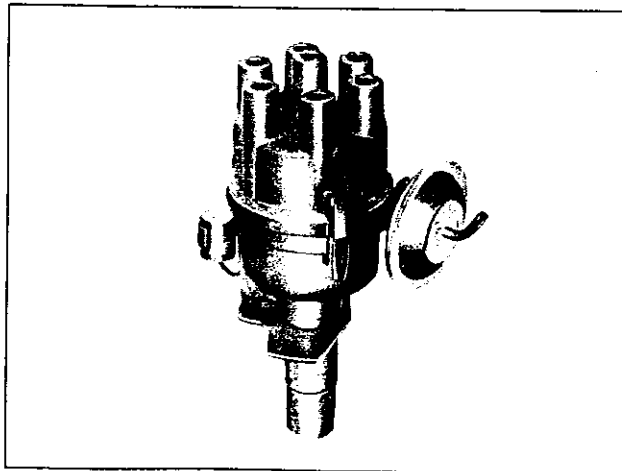


Fig. EE-70 D612-52

CONSTRUCTION AND OPERATION

Figure EE-71 shows ignition system of gasoline engine. The distributor consists of high tension voltage part, switch off part, centrifugal advancing angle part, vacuum advance mechanical part and driving part.

Figure EE-72 shows the construction.

ENGINE

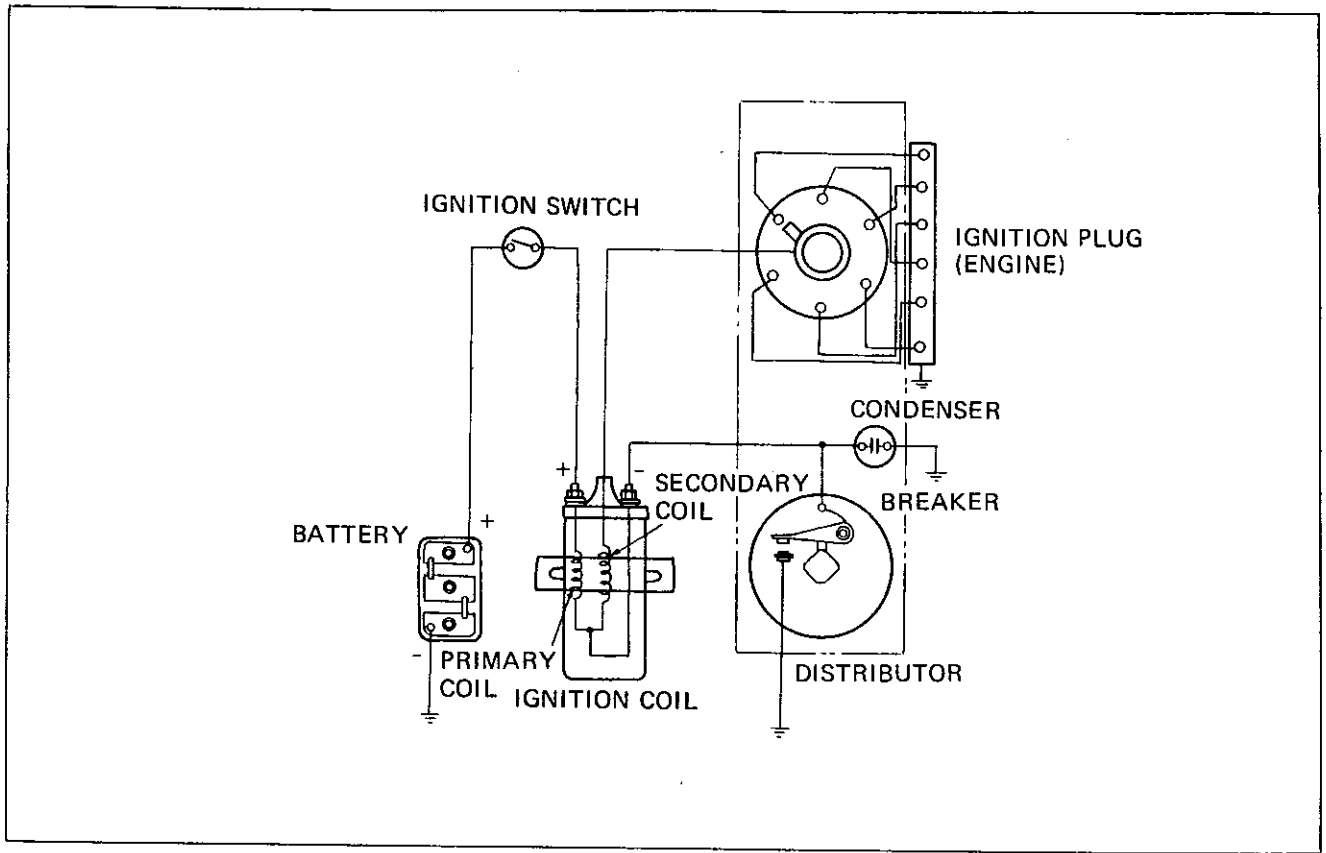


Fig. EE-71 Ignition system circuit diagram

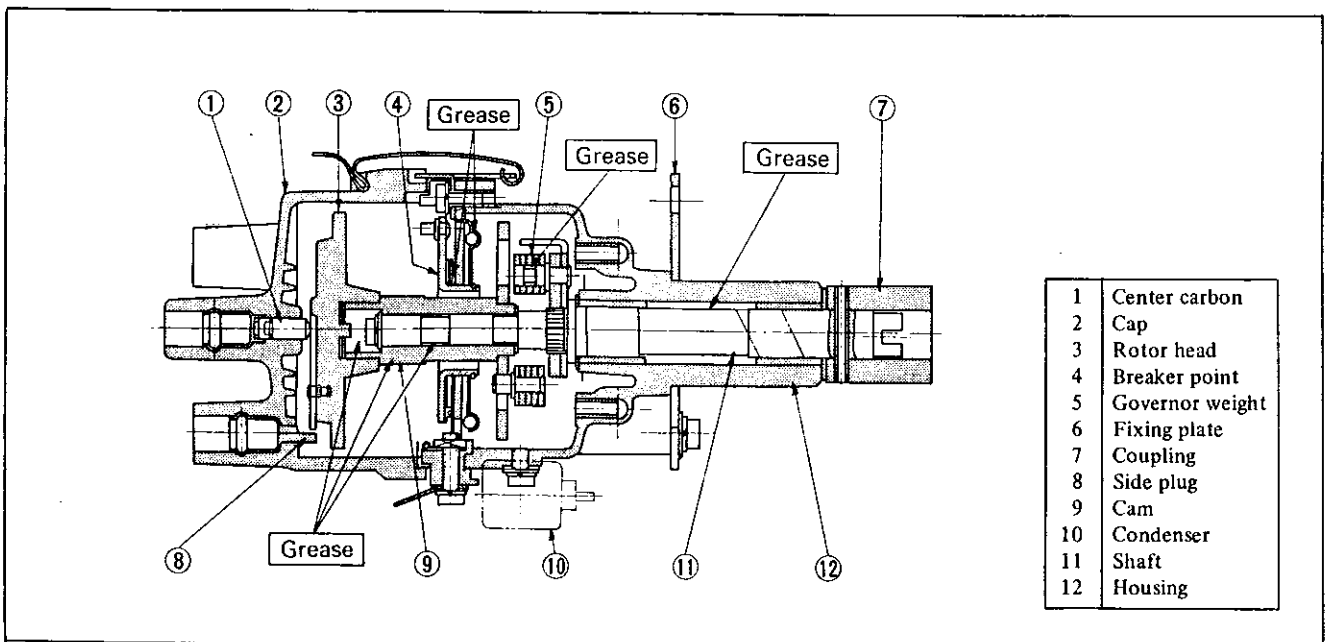


Fig. EE-72 Structure

ENGINE ELECTRICAL SYSTEM

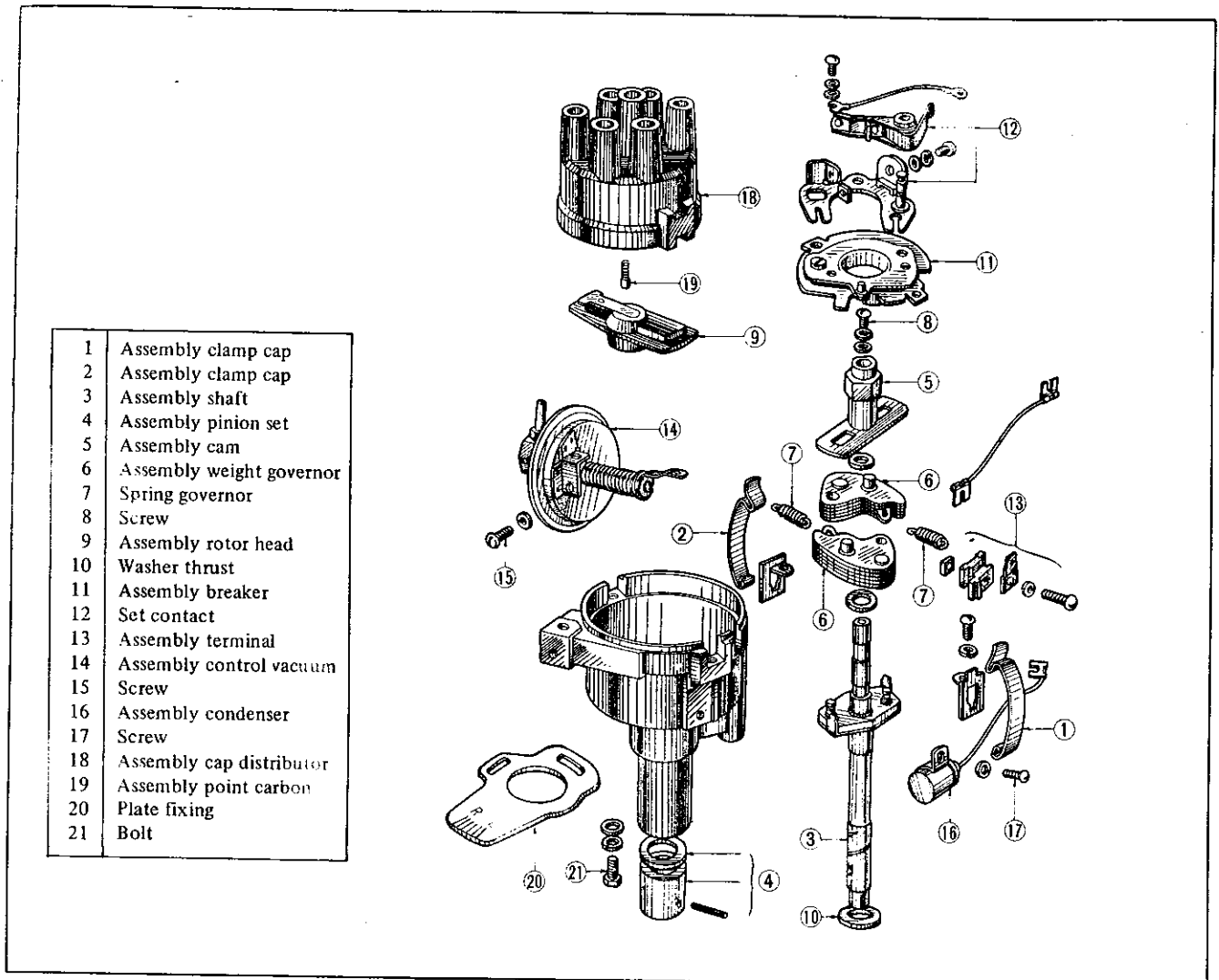


Fig. EE-73 Components of distributor

CHECKING AND ADJUSTMENT

Cap and rotor head

Cap and rotor head must always be kept clean to maintain good insulation durability since high tension voltage from ignition coil is imposed on them. Sometimes, inside of the cap and rotor head is covered with fine carbon particles and dust. Cleaning with gasoline is required once a month. Whenever crack or trace of leakage is found on the cap, replace with a new one.

Point

Standard point gap is 0.45 to 0.55 mm (0.0177 to

0.0217 in). When the gap is off the standard, adjust by loosening point screws. Gap gauge is required for adjustment. However, without gap gauge, it may be adjusted by holding down the contact arm the stopper of which is 0.5 mm (0.0197 in) thick.

As for those with tungsten point, point gap must be checked at every 4,000 km (2,500 miles) run.

When surface of the point is not smooth, polish with fine emery paper (No. 500 or 600) or oil stone.

At this time, grease both arm pivot receiver and surface of cam. When point is worn remarkably, replace with a new one. At the same time, replace the contact arm and contact point, also. Details for replacement are described in the forthcoming sub section.

ENGINE

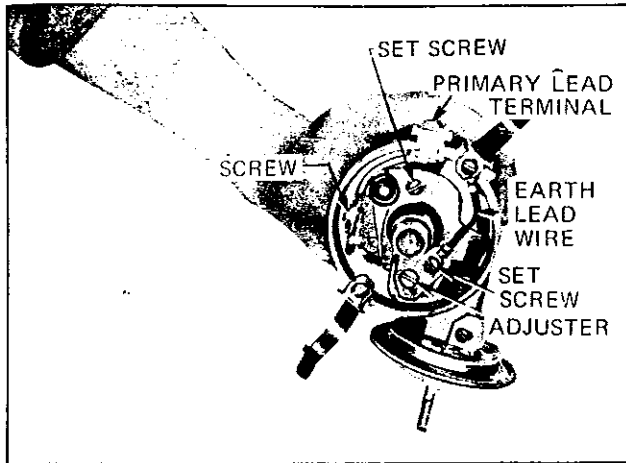


Fig. EE-74 Breaker

First unscrew 1 to 1.5 turns at contact arm and primary lead wire connection part to pull out primary lead terminal. It should be noted, however, that the screw should not be unscrewed excessively. Refer to Figure EE-75.

As shown in the Figure EE-75, take off the stopper from stem bar, hold the contact point by fingers and pull it out toward you by raising it slightly. Both contact point and contact arm can be removed together.

Set new contact set in reverse sequence of removal. Slightly grease both arm pivot receiver and cam surface.

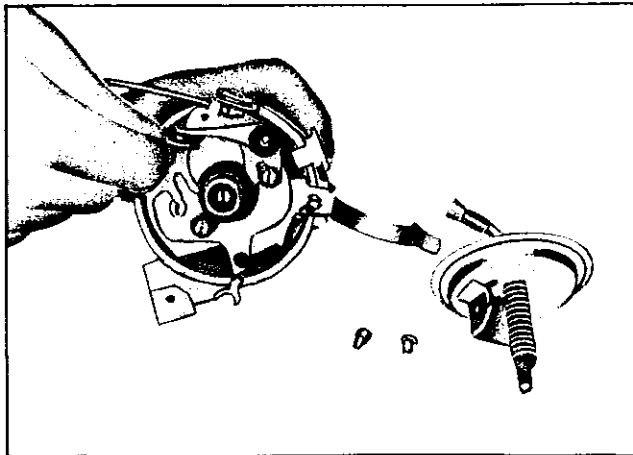


Fig. EE-75 Disassembling the contact arm and contact point

Condenser

Performance of condenser depends on the setting and insulating condition. Thus, periodical checking is required to maintain the outlet of lead wire clean and to prevent

set screw from loosening. Checking the condenser is checked by the use of a capacity meter. It may be also checked by the use of a tester by adjusting its range to measure large resistance value. When the 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, the transformer is out of order, and replacement is necessary.

Vacuum advance mechanical part and switch on-off part

◀ Vacuum advance characteristic ▶

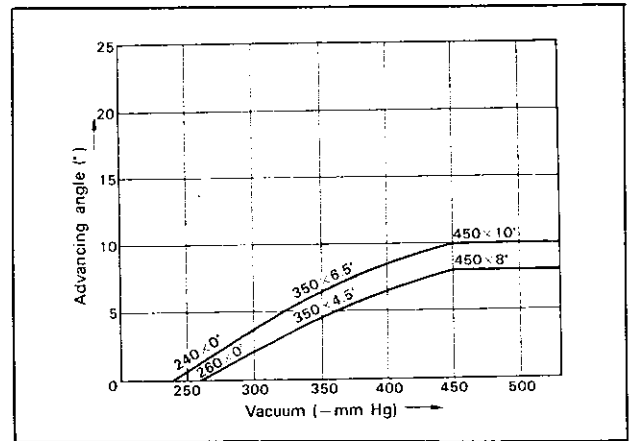


Fig. EE-76 D612-52

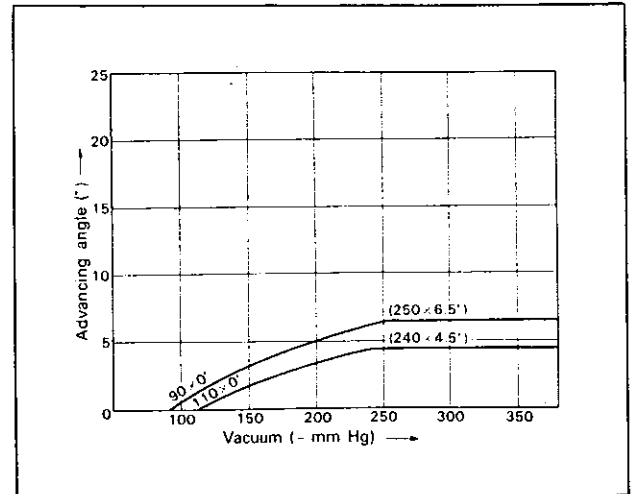


Fig. EE-77 D606-52

ENGINE ELECTRICAL SYSTEM

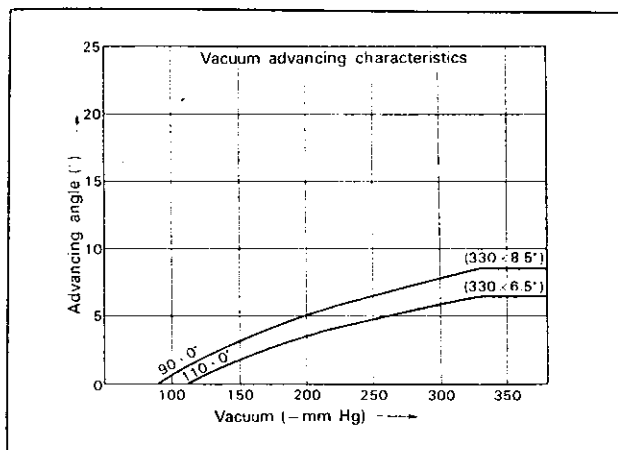


Fig. EE-78 D609-56

Make sure that the vacuum advance mechanism operates correctly with the operation indicator attached to the vacuum advance mechanism.

The following causes are considered for improper operation.

1. Leakage of air due to incomplete fastening of vacuum inlet
2. Leakage due to defective diaphragm
3. Stationary side and moving side of the breaker plate are stuck.

Solution for 1. is to make complete fastening and 2. is to replace it with a new one. Solution for 3. is as follows:

- (1) The moving side of the breaker plate is supported by three steel balls at upper and lower sides.

Make sure that these balls work smoothly.

- (2) The moving side of the breaker plate is rotated with the stationary side pivot receiver.

Make sure that this pivot receiver operates correctly

When assembling, be sure to apply three steel balls to the upper and lower sides and to grease them.

Centrifugal advance mechanical part

When cause of engine trouble is traced to centrifugal advance mechanical part, use distributor tester to check

its characteristics.

When nothing is wrong with its characteristics, conceivable causes are defectiveness or abnormal wearing-out of driving part or others.

Do not disassemble it. When characteristics are improper, remove the switch on-off part and check cam assembly, governor weight, shaft and governor spring, and other relative parts carefully.

When reassembling the centrifugal advance mechanical part, be sure to check advance characteristics by the use of a distributor tester.

« Centrifugal advance characteristics »

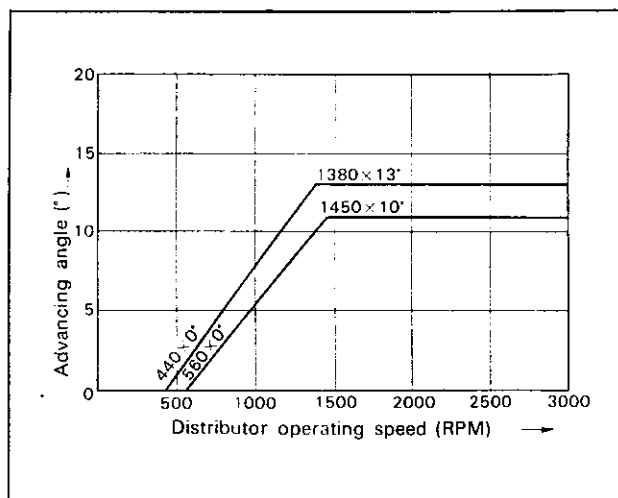


Fig. EE-79 D612-52

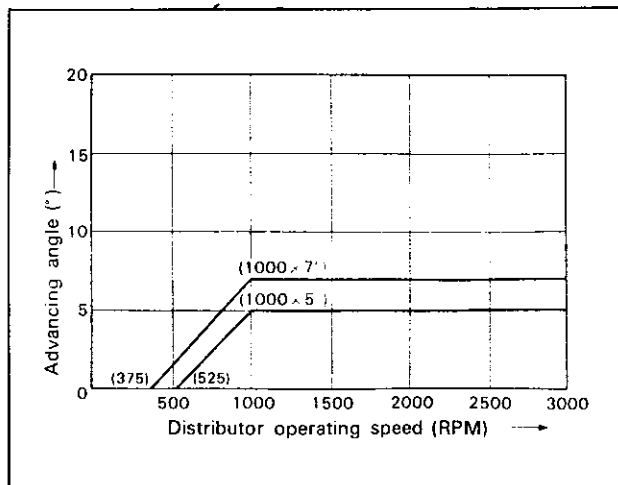


Fig. EE-80 D606-52

ENGINE

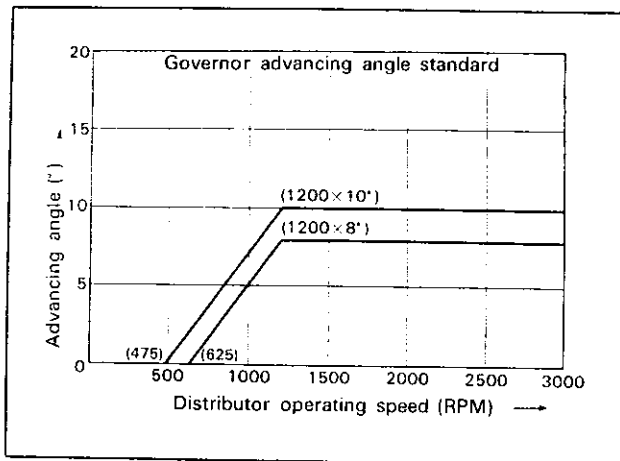


Fig. EE-81 D609-56

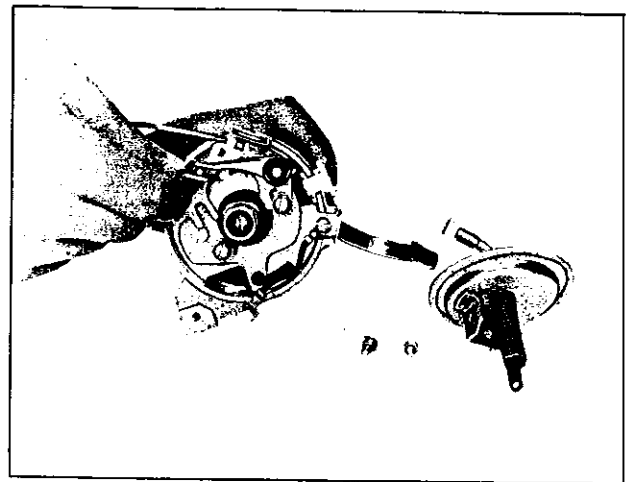


Fig. EE-83 Removal of contact set

DISASSEMBLY AND REASSEMBLY

Disassembly

When the distributor is disconnected from engine, position of distributor and rotor head for housing must be well remembered or marked.

If distributor is installed incorrectly, it does not operate correctly. Disassembly is to be carried out in the following sequence.

1. Remove cap and disconnect rotor head.
2. Remove vacuum controller.

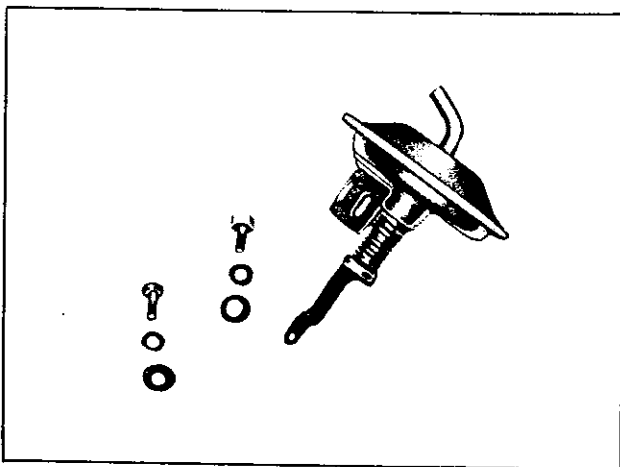


Fig. EE-82 Disassembly of vacuum controller

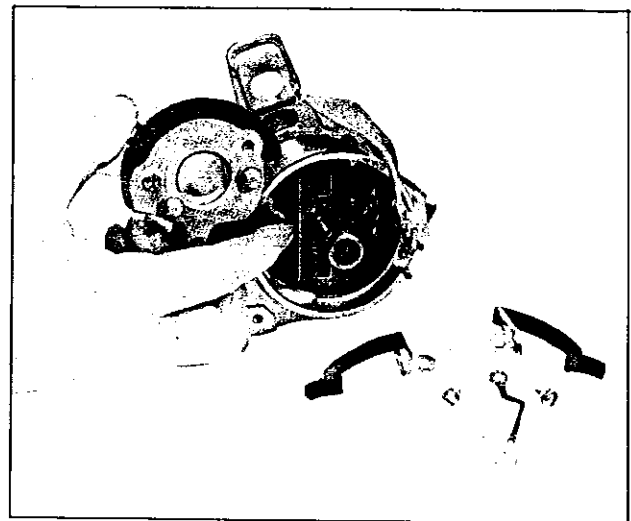


Fig. EE-84 Removal of contact breaker

3. Remove contact breaker.
Refer to page EE-34 when disconnecting the contact set.

4. When contact breaker is disassembled, remove the clip to disconnect breaker plate (fixed) by depressing the moving breaker plate downward.

Be careful not to lose steel balls applied between breaker spring and breaker plate as well as those between breaker plates.

5. Pull the knock pin and disconnect the gear to remove the whole rotary unit. However, before removing, put counter marks on the gear and shaft or remember the relationship between the coupling and setting groove of the cam rotor head.

ENGINE ELECTRICAL SYSTEM

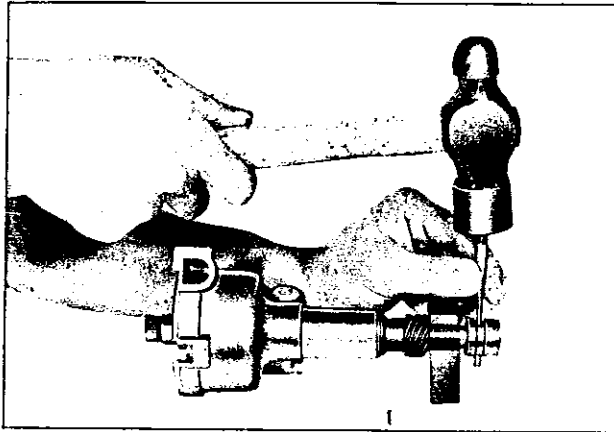


Fig. EE-85 Removal of knock pin

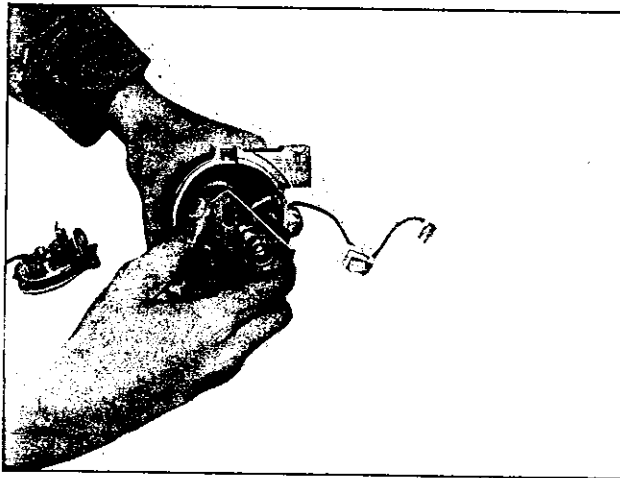


Fig. EE-86 Removal of rotation part

6. When the cam is disconnected, remove the set screw first, since the shaft head is fastened by the screw to hold the cam down. Be sure to put counter marks on the cam and shaft or remember the relationship with ignition timing.

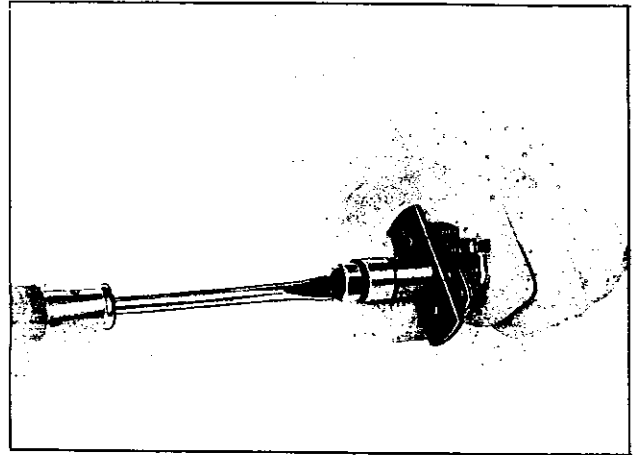


Fig. EE-87 Removal of cam

7. When disconnecting the governor spring from the governor weight, be careful not to stretch or deform the governor spring. When disassembly is completed, apply grease to the weight pivot.

8. Figure EE-90 shows the exploded view.

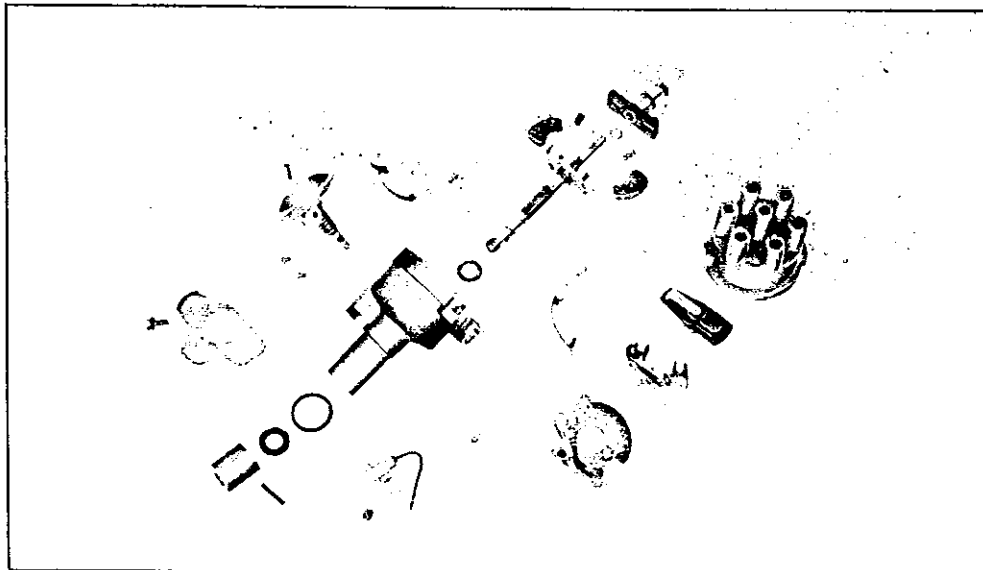


Fig. EE-88 Exploded view (D410-58, D409-54)

ENGINE

Reassembly

The distributor is reassembled in reverse sequence of disassembly.

Refer to Figure EE-91 at the time of replacement and reassembly of the governor spring and cam.

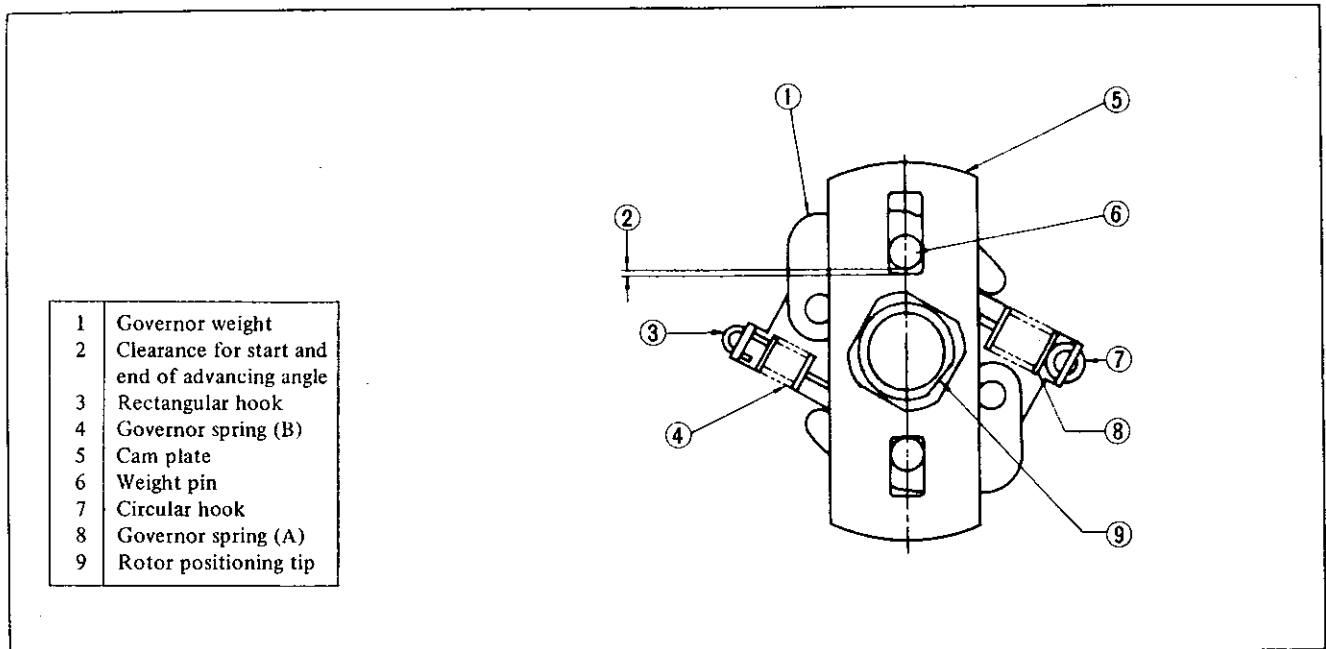


Fig. EE-89 Setting of governor spring and cam

At the time of assembly, rotor head positioning tip at cam is to be set to governor spring circular hook side. Then weight pin for governor spring (A) with circular hook comes in long rectangular hole. It leaves clearance at the start and end of advancing. Meanwhile, weight pin on opposite side comes in short rectangular hole. It does not leave clearance either at the start and end of advancing.

When assembly is completed, set it to engine after checking advance characteristic and confirming performance. Be sure to make adjustment of ignition timing after this.

Adjustment must be made to let off the distributor point at degree position of upper dead point of first cylinder compression of engine.

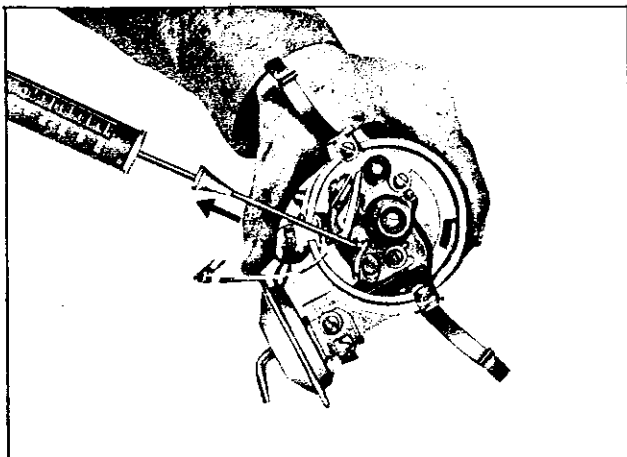


Fig. EE-90 Point pressure test

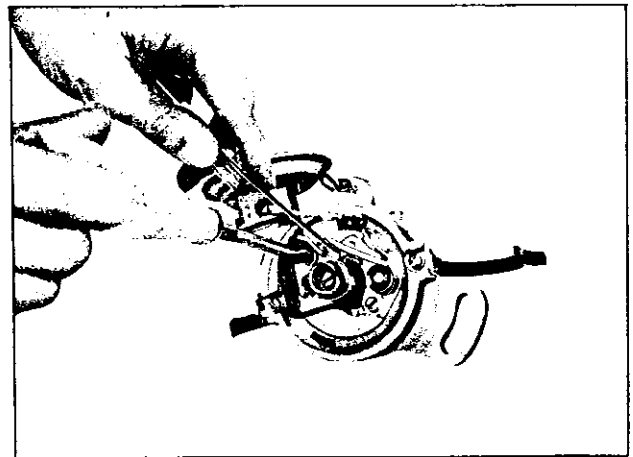


Fig. EE-91 Point gap measure

ENGINE ELECTRICAL SYSTEM

SPECIFICATIONS AND SERVICE DATA

Specifications

Engine to which applicable		L24 (with Emission Control)	L24 (with Single and Twin carb.) L20A (Premium Gas)	L20A (Regular Gas)
Make and type		HITACHI D612-52	HITACHI D606-52	HITACHI D609-56
Firing order		Counterclockwise	Counterclockwise	Counterclockwise
Ignition timing (B.T.D.C.)	Manual T/M	5°/750 rpm	L24 Twin 17°/650 rpm	L24 Single L20A 17° 550 rpm
	Automatic T/M (at "N" range)	/	17°/700 rpm	17° 650 rpm
Dwell angle		35° to 41° (37°)	35° to 41°	35° to 41°
Advance characteristics	Centrifugal	Start	500 rpm	450 rpm
		Maximum	12°/1,415 rpm	6°/1,000 rpm
	Vacuum	Start	250 mm/Hg (9.84 in/Hg)	100 mm/Hg (3.94 in/Hg)
		Maximum	9°/450 mm/Hg (17.7 in/Hg)	5.5°/245 mm/Hg (9.6 in/Hg)
Weight		1.0 kg (2.2 lb)	1.0 kg (2.2 lb)	1.0 kg (2.2 lb)

Service data

All distributors

Point gap	0.45 to 0.55 mm (0.0177 to 0.0217 in)
Point pressure	0.50 to 0.65 kg (1.1 to 1.4 lb)
Condenser capacity	0.20 to 0.24 μ F
Condenser isolate resistance	5 M Ω
Cap isolate resistance	50 M Ω
Rotor head isolate resistance	50 M Ω
Cap carbon point	12 mm (0.472 in)
Shaft diameter (lower part)	12.45 $\begin{matrix} -0.010 \\ -0.020 \end{matrix}$ mm (0.4902 $\begin{matrix} -0.0004 \\ -0.0008 \end{matrix}$ in)
Housing inner diameter	12.45 $\begin{matrix} +0.018 \\ 0 \end{matrix}$ mm (0.4902 $\begin{matrix} +0.0007 \\ 0 \end{matrix}$ in)

ENGINE

Clearance between shaft and housing	0.010 to 0.038 mm (0.0004 to 0.0015 in)
Amendment limit of clearance	0.08 mm (0.0031 in)
Shaft diameter (upper part)	$8 \frac{-0.005}{-0.014}$ mm (0.3150 $\frac{-0.0002}{-0.0006}$ in)
Cam inner diameter	$8 \frac{+0.015}{0}$ mm (0.3150 $\frac{+0.0006}{0}$ in)
Clearance between shaft and cam	0.005 to 0.029 mm (0.0002 to 0.0011 in)
Weight pivot diameter	$5 \frac{-0.010}{-0.028}$ mm (0.1969 $\frac{-0.0004}{-0.0010}$ in)
Weight hole diameter	$5 \frac{-0.018}{0}$ mm (0.1969 $\frac{+0.0007}{0}$ in)
Clearance between pivot and hole	0.01 to 0.046 mm (0.0004 to 0.0018 in)

IGNITION COIL

CONTENTS

DESCRIPTION	EE-36	SPECIFICATION	EE-37
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DESCRIPTION

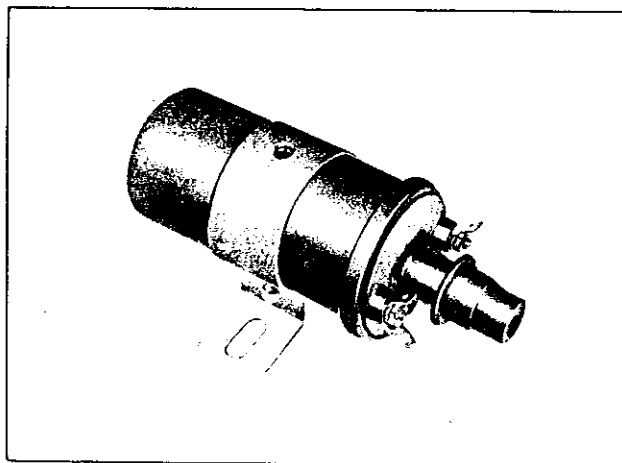


Fig. EE-92 HP5-13E

The ignition coil is a pitch type coil. The coil is equipped with resistor for improved spark performance at high revolution. The number of turns in primary winding results in a higher inductance in this winding, which makes it possible for this coil to provide a higher secondary voltage output throughout the speed range.

For optimum starting performance, the resistor is by-passed during cranking, thereby connecting the ignition coil directly to battery. This provides full battery voltage available at coil and thus keeps ignition voltage as high as possible during cranking. The resistor is by-passed automatically through the ignition and starting switch when switch is in the "start" position.

ENGINE ELECTRICAL SYSTEM

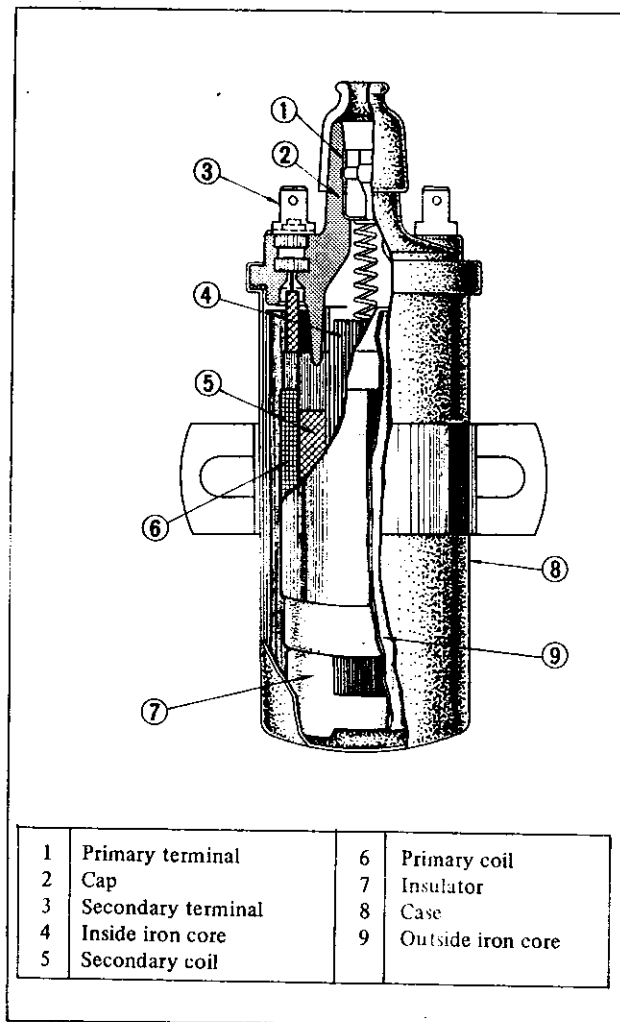


Fig. EE-93 Construction

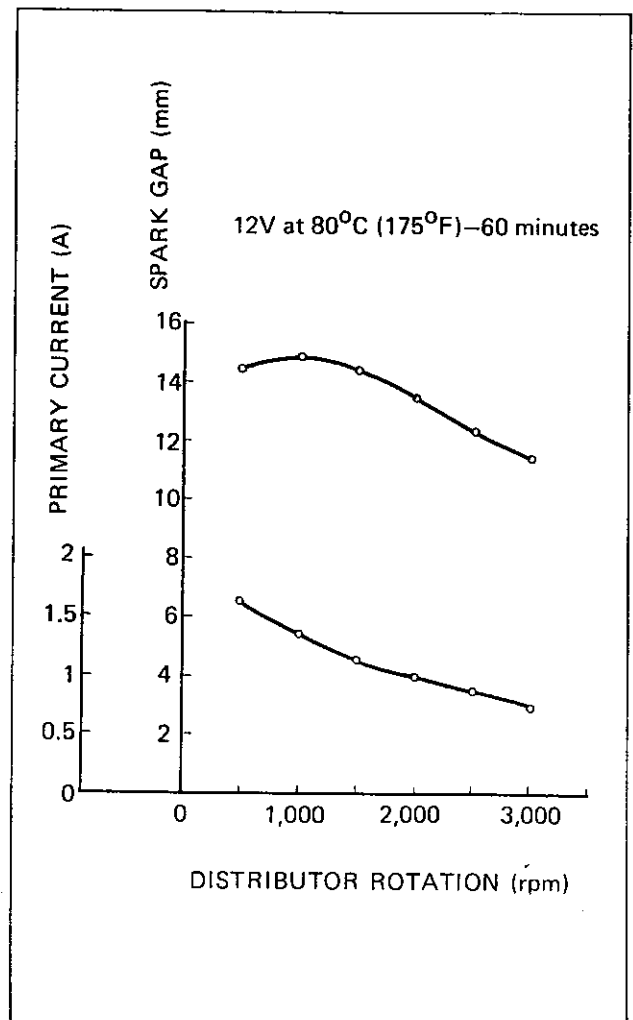


Fig. EE-94 C6R-200, HP5-13E characteristic curve

SPECIFICATION

Make and Type	HITACHI C6R-200	HANSHIN HP5-13E
Primary voltage	12V	12V
Spark gap	more than 7 mm (0.2756 in)	more than 7 mm (0.2756 in)
Primary resistance at 20°C (68°F)	1.5 to 1.7 Ω	1.5 to 1.7 Ω
Secondary resistance at 20°C (68°F)	9.5 to 11.6 K Ω	9.5 to 11.6 K Ω
Resistor	1.6 Ω	1.6 Ω

ENGINE

SPARK PLUGS

CONTENTS

PERIODICAL SERVICES	EE-38	SPECIFICATION AND	
INSPECTION	EE-38	SERVICE DATA	EE-40
CLEANING AND REGAP	EE-40	TROUBLE DIAGNOSES AND	
		CORRECTIONS	EE-40

PERIODICAL SERVICES

Plugs should be removed for cleaning, inspection and regapping periodically (actual time depending on operating conditions).

INSPECTION

Spark plug life is affected to a large extent by operating conditions and plug life varies consequently. In order to secure peak performance, spark plugs should be checked, cleaned and regapped every 12 months or 20,000 km (12,000 miles).

Worn or dirty plugs will give satisfactory operation at idling speed, but under high speed operation, they frequently fail. Faulty plugs are evident in a number of ways such as increased fuel consumption, power loss, loss of speed, hard starting and general poor engine performance.

Spark plug failure, in addition to normal wear, may be due to dirty or leaded plugs, excessive gap or broken insulator.

Dirty or leaded plugs may be evident by black carbon deposits, or red, brown, yellow or blistered oxide deposits, on the plugs. The black deposits are usually the result of slow-speed driving and short runs where sufficient engine operating temperature is seldom reached.

Worn piston rings, faulty ignition, over-rich carburetion and spark plugs which are too "cold" will also result in carbon deposits. Red or brown oxide deposits and a consequence of the use of leaded fuel, usually result in spark plug failure under severe operating conditions. The oxides have no adverse effect on plug operation as long as

they remain in a powdery state. But, under high speed or hard pull, the powder oxide deposits melt and form a heavy glaze coating on the insulator which, when hot, acts as a good electrical conductor, allowing current to follow the deposits and short out the plug.

Excessive gap wear on plugs of low mileage, usually indicates the engine is operating at high speeds or loads that are consistently greater than normal or that a plug which is too "hot" is being used. In addition, electrode wear may be the result of plug overheating, caused by combustion gases leaking through the threads and gasket, due to insufficient compression of the spark plug gasket, dirt under the gasket seat. Too "lean" carburetion will also result in excessive electrode wear.

Broken insulators are usually the result of improper installation or carelessness when regapping the plug. Broken upper insulators usually result from a poor fitting wrench or an outside blow. The cracked insulator may not make itself evident immediately, but soon oil or moisture will penetrate the fracture. The fracture is usually just below the crimped part of shell and may not be visible.

Broken lower insulators usually result from carelessness when regapping and generally are visible. In fairly rare instances, this type of break may result from the plug operating too "hot" such as encountered in sustained periods of high-speed operation or under extremely heavy loads. When regapping a spark plug, to avoid lower insulator breakage, always make the gap adjustment by bending the ground side electrode. Spark plugs with broken insulators should always be replaced.

ENGINE ELECTRICAL SYSTEM

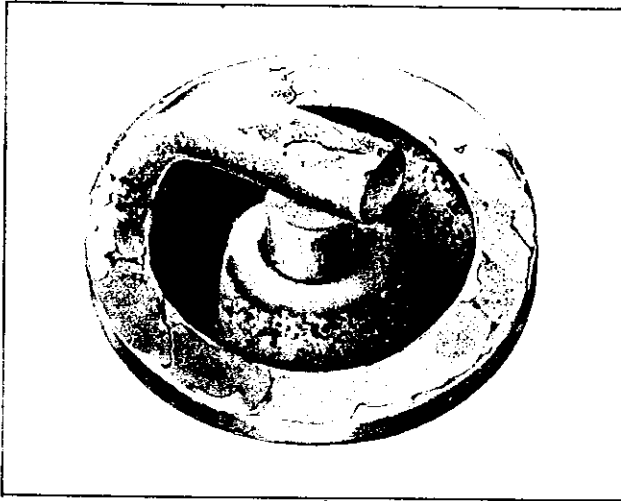


Fig. EE-95 Normal

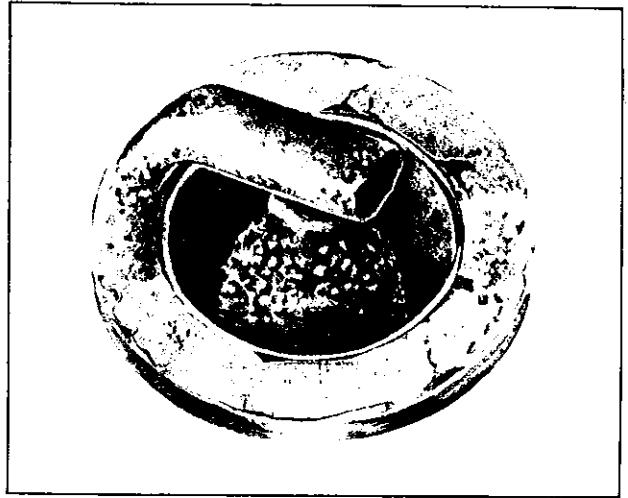


Fig. EE-98 Overheating (II)

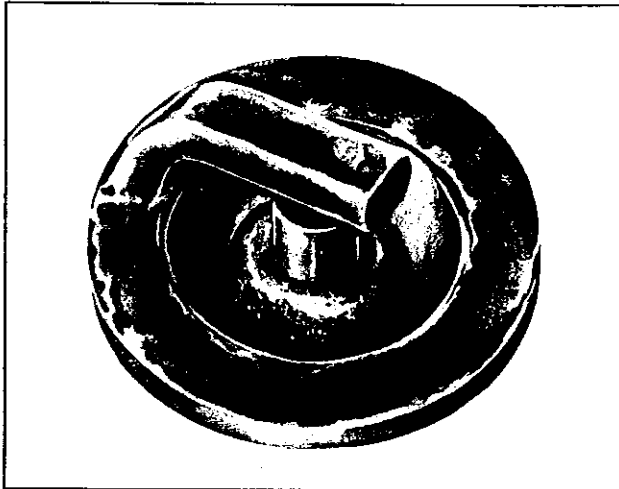


Fig. EE-96 Wet

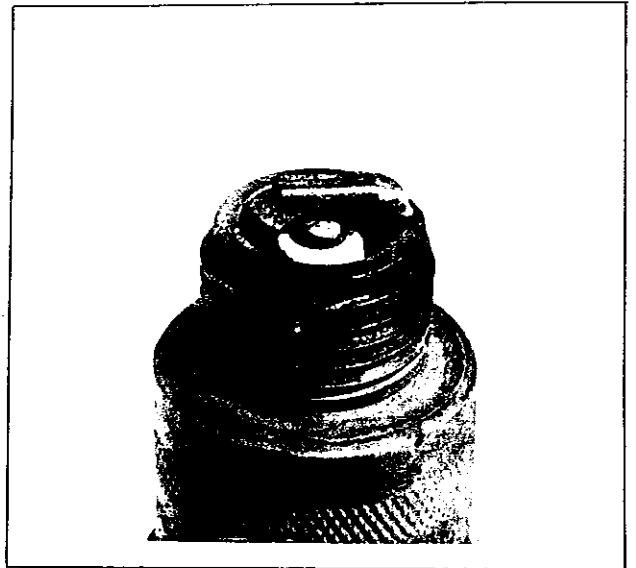


Fig. EE-99 Overheating (III)

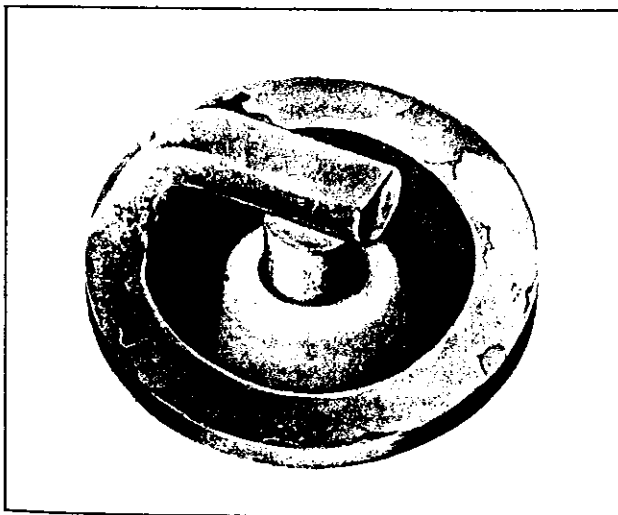


Fig. EE-97 Overheating (I)

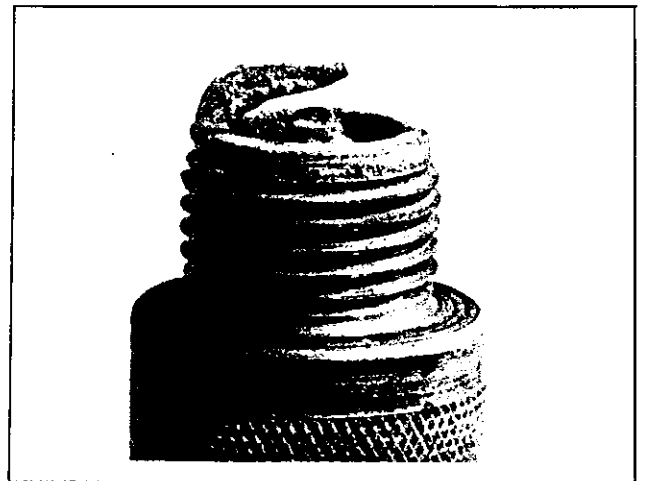


Fig. EE-100 Life

ENGINE

CLEANING AND REGAP

Clean spark plugs thoroughly using an abrasive-type cleaner. All spark plugs must be of the same make and number or heat range. Use a round feeler gauge to adjust the spark plug gaps.

Note: Before adjusting gap, file center electrode flat. In adjusting spark plug gap, never bend center electrode which extends through porcelain center. Always make adjustments by bending ground side electrode.

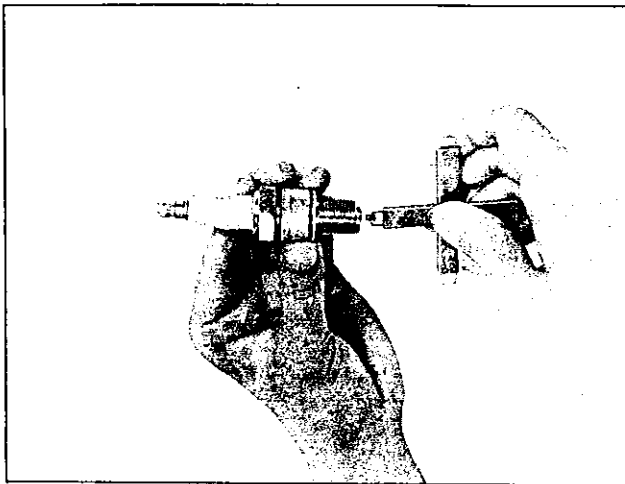


Fig. EE-101 Measuring spark plug gap

SPECIFICATION AND SERVICE DATA

Item	Make	NGK
	Model	BP-6E
Applied engine	L24, L20A	
Size (screw diameter x reach)	14 x 19 mm (0.55 x 0.75 in)	
Plug gap	(.034")	0.8 to 0.9 mm (0.031 to 0.035 in)
Torque	1.5 to 2.0 kg-m (11.0 to 15.0 ft-lb)	

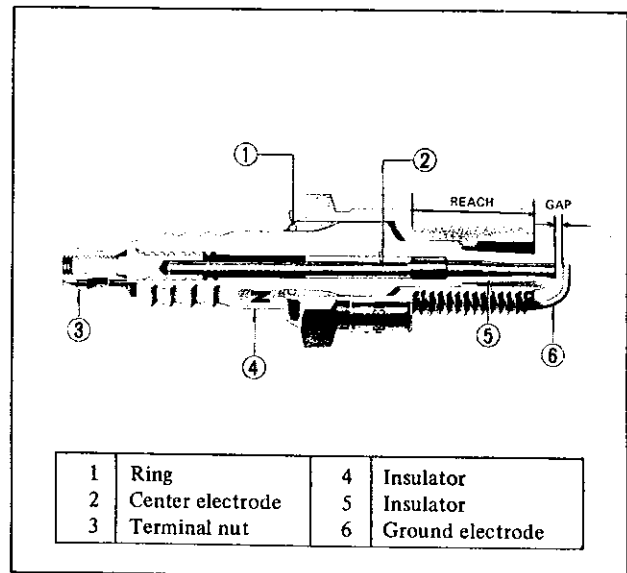


Fig. EE-102 Cross section of spark plug

TROUBLE DIAGNOSES AND CORRECTIONS

1. The engine does not start.

If there is no trouble in the fuel system, the ignition system should be checked. This can be easily done by

detaching the high tension cord from spark plugs, start the engine by the starting motor and observe the condition of the sparks that occur between the high tension cord and cylinder block. After checking this, use the proper countermeasures.

Spark gap	Trouble location	Causes	Corrective action
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.

ENGINE ELECTRICAL SYSTEM

	High tension code	Wire coming off Defective insulation	Repair. Replace.
1 to 2 mm (0.0394 to 0.0787 in) or irregular	Distributor	Point gap too wide Oil sticking on point Excessively burnt point Layer short-circuit	Correct. Clean. Replace. Replace with good one.
Less than 6 mm (0.2362 in)	Spark plugs	Electrode gap too wide Excessively accumulated carbon Broken insulator neck Expiry of plug's life	Correct or replace. Clean or replace. Replace. Replace.

2. The engine rotates but does not run smoothly.

There are many causes for this trouble, and it is difficult to point out the right cause. However, when considering

the ignition system only, pay special attention to the following points.

Troubles	Trouble location	Causes	Corrective action
Engine misses.	Distributor	Dirty point	Correct.
		Improper point gap	Correct.
		Leak of electricity of cap and rotor head	Clean or replace.
		Defective insulation of condenser	Replace.
		Defective insulation of lead wire of condenser	Correct.
		Defective arm	Oil the shaft.
		Defective arm spring	Correct or replace.
		Near-breakage of lead wire	Correct.
	Worn or shaky breaker plate	Correct.	
Worn or shaky distributor shaft.	Correct.		
	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.

ENGINE

	Spark plugs	Dirty Electricity leaks at the upper porcelain insulator	Clean or replace. Clean.
Engine causes knocking very often.	Distributor	Improper advance timing Come off or breakage of governor spring Worn out pin or hole of governor portion	Adjust. Correct or replace. Replace.
	Spark plugs	Excessively burnt spark plug	Replace.
Engine does not provide enough power	Distributor	Improper or retarded timing Defective function of governor Dirty point Point gap too narrow	Adjust. Correct. Correct. Correct.
	Spark plugs	Dirty	Clean.

SERVICE JOURNAL OR BULLETIN REFERENCE

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SECTION SE

SERVICE EQUIPMENT

**MODEL
L20A, L24 SERIES
ENGINE**



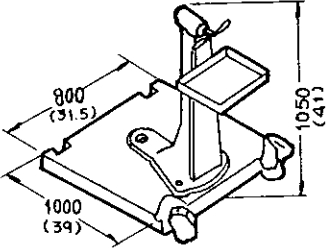
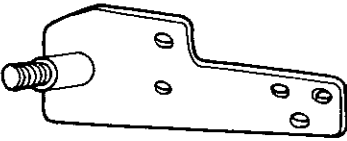
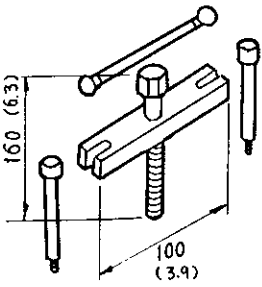
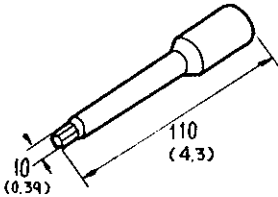
NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

L20A, L24 ENGINE SPECIALSE- 1
SERVICE TOOL

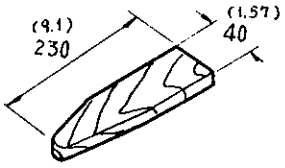
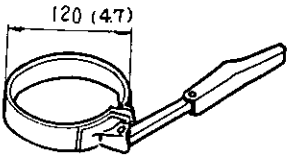
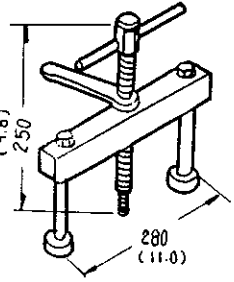
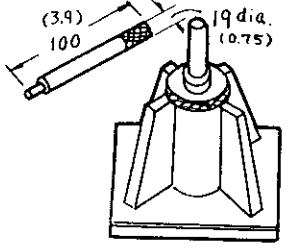
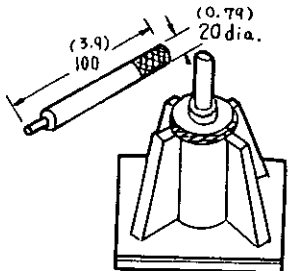
SERVICE EQUIPMENT

L20A, L24 ENGINE SPECIAL SERVICE TOOL

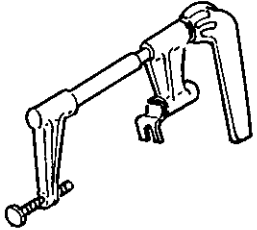
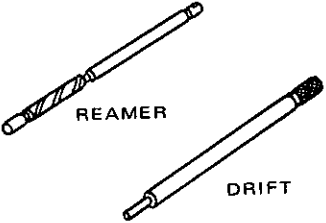
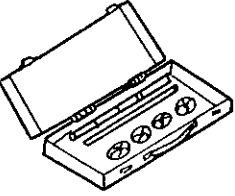
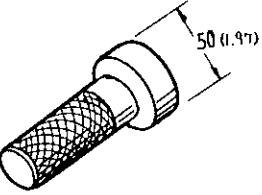
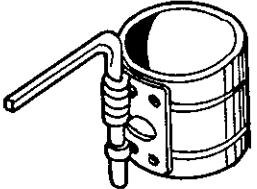
510 Special service tool set number ST09110000

Tool number (Former tool number) Tool name	Figure mm (inch)	Description	510 special service tool set	Applied model	S.M. reference page (See Fig. No.)
ST05010000 (ST371S0000) Engine stand		Rotary type stand for efficient, safe disassembly or reassembly of the engine. Use the engine stand with the attachment (ST05340000) as a set.		All	Fig. EM-11
ST05340000 Engine attachment		Attachment for setting the engine on the engine stand.		L24 L20A	Fig. EM-11
ST16540000 (ST44820000) Crank pulley puller		For removing the crank pulley with damper		L24 L20	Fig. EM-17
ST10120000 (ST49010000) Cylinder head bolt wrench		For removing and installing the cylinder head bolts.	○	L24 L20A L16 L13	Fig. EM-19 Fig. EM-82

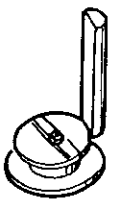

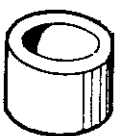
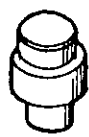
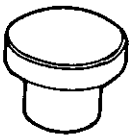
ENGINE

Tool number (Former tool number) Tool name	Figure mm (inch)	Description	510 special service tool set	Applied model	S.M. reference page (See Fig. No.)
ST17420000 (ST49350000) Chain stopper		For supporting the timing chain.	○	L24 L20A L16 L13	Fig. EM-18
ST19320000 (ST49080000) Oil filter wrench		For removing the oil filter	○	All	
ST16510000 (ST4463D000) Crankshaft main bearing cap puller		For removing the rear main bearing cap	○	L24 L20A L16 L13	Fig. EM-23
ST13020000 (ST44840000) Piston pin press stand		For removing and installing the piston pin (L20A)		L20 L20A	Fig. EM-27
ST13030000 (ST4484D000) Piston pin press stand		For removing and installing the piston pin (L24)	○	L24 L16 L13	Fig. EM-27

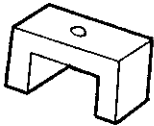

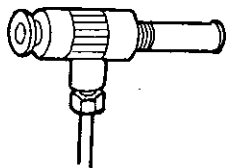
SERVICE EQUIPMENT

Tool number (Former tool number) Tool name	Figure mm (inch)	Description	S10 special service tool set	Applied model	S.M. reference page (See Fig. No.)
ST12070000 (ST4745A000) Valve lifter set		For removing and installing the valve springs	○	All	Fig. EM-30 Fig. EM-69
ST11030000 (ST4480000) Valve guide reamer kit		For replacing and correcting the valve guide		L24 L20A L20 L16 L13	Fig. EM-40
ST11650000 (ST49410000) Valve seat cutter		For correcting the valve seat insert		L24 L20A L16 L13	Fig. EM-41
ST15310000 (ST49370000) Crankshaft oil seal drift		For installing the crankshaft rear oil seal		L24 L20A L16 L13	
EM03470000 (ST60410000) Piston ring compressor		For installing the piston		All	Fig. EM-79

ENGINE

Tool number (Former tool number) Tool name	Figure mm (inch)	Description	S10 special service tool set	Applied model	S.M. reference page (See Fig. No.)
EG1670000 (ST20850000) Flow meter		For balancing SU twin carburetor		L24 L16 U20 R	Fig. EF-40 Fig. EC-29
*ST19810000 (STECP20000) Hexagon wrench		For removing and installing the rotor ring assembly		L24 L16 U20 R	Fig. EC-10
*ST19820000 (STECP20001) Support for disassembling rotor ring		For supporting the rotor ring in case of needle bearing removal and installation		L24 L16 U20 R	Fig. EC-11
*ST19830000 (STECP20002) Attachment for pushing out needle bearing		For removing the needle bearing		L24 L16 U20 R	Fig. EC-11
*ST19840000 (STECP20003) Attachment for pressing in needle bearing		For installing the needle bearing		L24 L16 U20 R	Page EC-11

SERVICE EQUIPMENT

Tool number (Former tool number) Tool name	Figure mm (inch)	Description	510 special service tool set	Applied model	S.M. reference page (See Fig. No.)
*ST19850000 (STECP20004) Bridge for pulling out relief valve		Use as a bridge for removing the relief valve by the puller		L24 L16 U20 R	Fig. EC-13
*ST19860000 (STECP20005) Dummy shaft		For assembling the vanes		L24 L16 U20 R	Page EC-10
*ST19870000 (STECP20006) Air pump test gauge adaptor		For checking the air pump performance		L24 L16 U20 R	Page EC-16

* ; Emission control maintenance special tool

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