SERVICE MANUAL

MODEL

H16(R) & H20

ENGINE

NISSAN

NISSAN MOTOR CO,. LTD.
TOKYO, JAPAN

SERVICE MANUAL

H16(R) & H20

ENGINES

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QUICK REFERENCE INDEX

EXTERNAL VIEW OF ENGINE

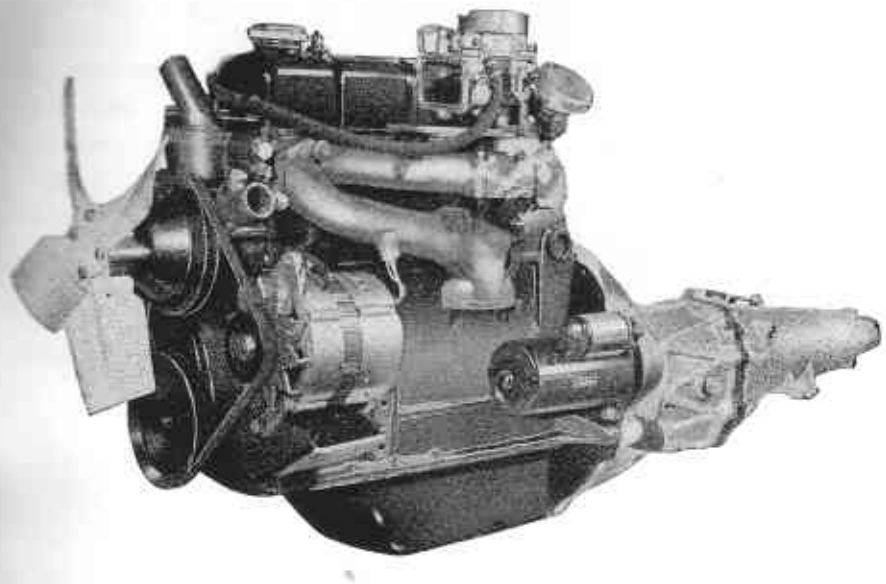


Fig. EG-1 Left Side View of H-20 Engine

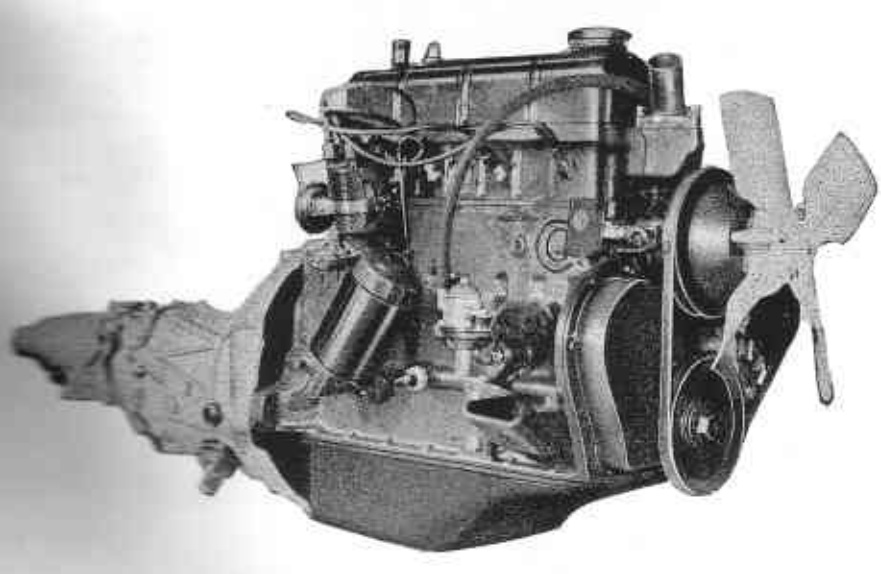


Fig. EG-2 Right Side View of H-20 Engine

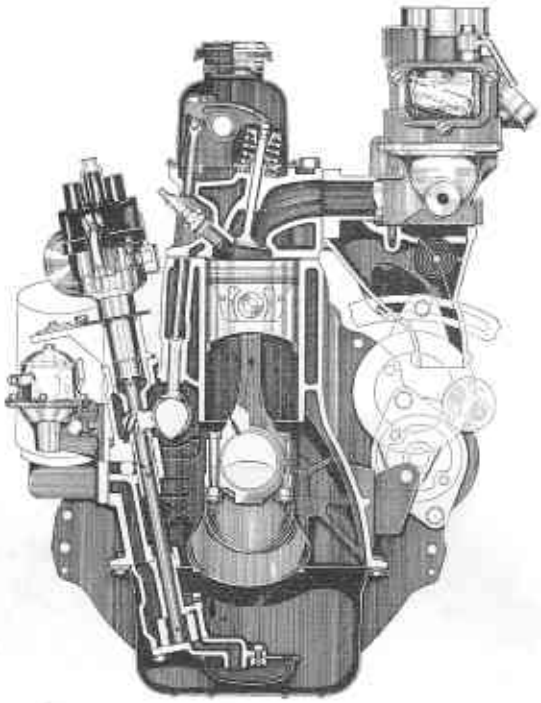


Fig. EG-3 Front Sectional View of H-20 Engine

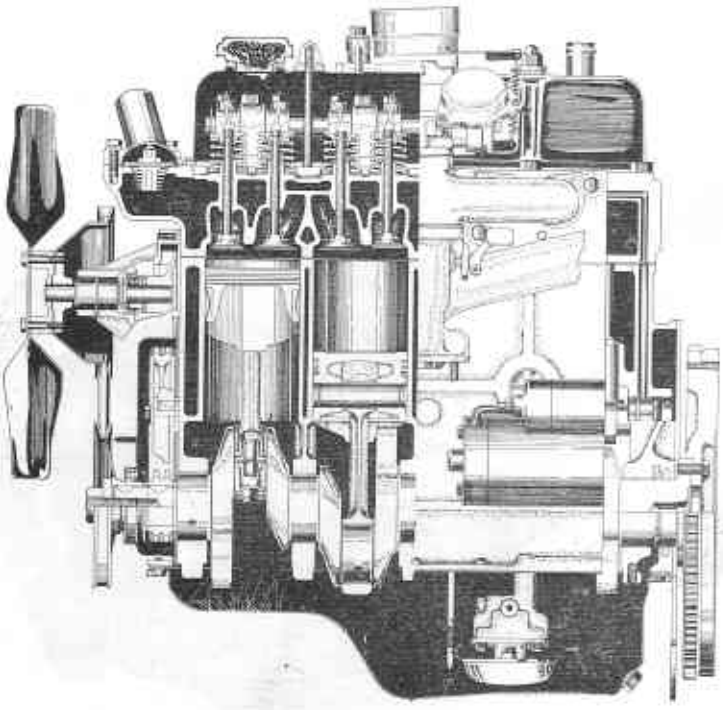


Fig. EG-4 Side Sectional View of H-20 Engine

MAIN SPECIFICATIONS

MODEL	H 20
	T444, T655
Type	4-cycle, O.H.V., Water Cooled
No. of Cylinder	4, in-line
Bore × Stroke ..... mm (in.)	87.2 × 83 (3.43 × 3.26)
Piston Displacement ..... cc (cu-in.)	1.982 (121)
Compression Ratio	8.2 to 1
Max. Brake Horsepower ..... hp/rpm (SAE)	99/5000
Max. Torque ..... m-kg (ft-lb)/rpm (SAE)	17.0 (122.9)/3600
Dimensions; Length ..... mm (in.)	639 (25.2)
Width ..... mm (in.)	545 (21.5)
Height ..... mm (in.)	728 (28.7)
Weight ..... kg (lbs)	153 (337)
No. of piston Ring; Compression Ring	2
Oil Ring	1
Valve Timing; B.T.D.C.	16°
A.B.D.C.	52°
B.B.D.C.	54°
A.T.D.C.	14°
Ignition System	Battery & Coil
Ignition Timing ..... BTDC/rpm	7°/550
Firing Order	1-3-4-2
Ignition Coil, Model	HP5-10E
Distributor, Model	TVB-4KL; Centrifugal & Vacuum Advance
Spark Plug, Model	NGK.B-6E
Carburetor	D3034A-13A; Downdraft, 2-barrel
Air Cleaner	Viscous Paper Element, Dry
Fuel Pump	Mechanical Diaphragm
Lubrication System	Pressure-Feed
Oil Pump	Mechanical Gear
Oil Filter	Full-flow, Cartridge
Capacity ..... l (U.S. measure)	3.3 (3 1/2 quarts)
Cooling System	Water, Forced Circulation
Capacity ..... l (U.S. measure)	7.8 (8 1/4 quarts)
Water Pump	Centrifugal
Thermostat	Waxpellet
Battery	N40L; 12V-40AH
Generator	AC500N.R. AC300/-12W2R; 12V-300W
Starting Motor	Magnetic, ME 1.0/12-Y,R; 12V-1.4HP

H 20			H 16 (R)
C 240	41	130	T 446
4-cycle, O.H.V., Water Cooled	4-cycle, O.H.V., Water Cooled	4-cycle, O.H.V., Water Cooled	4-cycle, O.H.V., Water Cooled
4, in-line	4, in-line	4, in-line	4, in-line
87.2 × 83 (3.43 × 3.26)	87.2 × 83 (3.43 × 3.26)	87.2 × 83 (3.43 × 3.26)	87.2 × 66.8 (3.43 × 2.63)
1,982 (121)	1,982 (121)	1,982 (121)	1,595 (97.3)
8.2 to 1	8.2 to 1	8.2 to 1	8.0 to 1
99/5000	99/5000	99/5000	81/5400
17.0/3600	17.0 (122.9)/3600	17.0 (122.9)/3600	13.2 (95.4)/3200
639 (25.2)	639 (25.2)	689 (27.1)	639 (25.2)
606 (23.5)	557 (21.9)	575 (22.6)	545 (21.5)
645 (25.4)	766 (30.2)	723 (28.5)	728 (28.7)
147 (323)	149 (328)	147 (323)	151 (333)
2	2	2	2
1	1	1	1
16°	16°	16°	16°
52°	52°	52°	52°
54°	54°	54°	54°
14°	14°	20°	14°
Battery & Coil	Battery & Coil	Battery & Coil	Battery & Coil
7°/550	7°/550	7°/550	12°/550
1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
C14-51	C14-51	C14-51	HP5-10E
D415-54 ; Centrifugal & Vacuum Advance	D415-54 ; Centrifugal & Vacuum Advance	D415-54 ; Centrifugal & Vacuum Advance	TVB-4KL ; Centrifugal & Vacuum Advance
NGK.B-6E	NGK.B-6E	NGK.B-6E	NGK.B-6E
D3034A-9C ; Downdraft, 2-barrel	D3034A-8B ; Downdraft, 2-barrel	D3034A-11C ; Downdraft, 2-barrel	D2832A-4A ; Downdraft, 2-barrel
Viscous Paper Element, Dry	Viscous Paper Element, Dry	Viscous Paper Element, Dry	Viscous Paper Element, Dry
Mechanical Diaphragm	Mechanical Diaphragm	Mechanical Diaphragm	Mechanical Diaphragm
Pressure-Feed	Pressure-Feed	Pressure-Feed	Pressure-Feed
Mechanical Gear	Mechanical Gear	Mechanical Gear	Mechanical Gear
Full-flow, Cartridge	Full-flow, Cartridge	Full-flow, Cartridge	Full-flow, Cartridge
3.85 (4 quarts)	3.3 (3 1/2 quarts)	3.3 (3 1/2 quarts)	3.3 (3 1/2 quarts)
Water, Forced Circulation	Water, Forced Circulation	Water, Forced Circulation	Water, Forced Circulation
8.6 (9 quarts)	8.8 (9 1/3 quarts)	7.7 (8 1/8 quarts)	7.8 (8 1/4 quarts)
Centrifugal	Centrifugal	Centrifugal	Centrifugal
Waxpellet	Waxpellet	Waxpellet	Waxpellet
N40L ; 12V-50AH	N40L ; 12V-50AH	N40L ; 12V-50AH	N40L ; 12V-40AH
AC500N.R. AC300/-12V2R ; 12V-300W	AC500N.R. AC300/-12V2R ; 12V-300W	AC500N.R. AC300/-12V2R ; 12V-300W	AC500N.R. AC300/-12V2R ; 12V-300W
Magnetic, S114-91 12V-1.4 HP	Magnetic, S114-91 12V-1.4 HP	Magnetic, S114-91 12V-1.4 HP	Magnetic, ME 1.0/12-Y.R ; 12V-1.4 HP

APPLICATION OF ENGINE MODELS

Since only the information concerning the engine is described herein, please refer both this and SERVICE MANUAL for the chassis and body for each applied vehicle for complete details of the car.

Engine Model	Piston Displacement	Applied Vehicle Model
H 20	1,982 cc (121 cu-in.)	130 Series
		C240 Series
		41 Series
		T655 T656 Series T657
		T444 Series
H16 (R)	1,595 cc (97.3 cu-in.)	T446 Series

ENGINE SERIAL NUMBER LOCATION

For the distributors or dealers when writing up Warranty Claim Forms, Technical Report and any technical matters, the engine serial number is very essential. The inclusion of full serial numbers with their prefixes refering to any unit allows quick and accurate identification of the subject part reported and rapid finalization of claims or queries.

This is stamped on the cylinder block at the distributor side.

The first three letters of the engine number designate the engine model and the rest six figures are manufacturing serial number.

Fig. EG-5 Engine Serial Number

GRADE OF PETROL

The H-20, 4-cylinder, in-line, over head valve engine will develop top power and high level performance using a proper grade gasoline of 90 octane, and under almost all driving conditions. The use of a lower grade gasoline may cause various troubles such as excessive engine knocking, reduced engine performance, overheating, after-running, etc. If "knocking" occurs with gasoline you are using, and it can not be cured by slightly advancing the spark timing or other engine adjustments, it might be caused by the use of lower grade gasoline, then switch to the next higher grade gasoline that will eliminate the "knocking".

Note: The octane number should be referred to SAE research method.

GRADE OF ENGINE OIL

	Temperature	Grade	
Engine Oil	above 32°C(90°F)	API Service MS	SAE 40
	32 to 0°C (90 to 32°F)		SAE 30
	0 to −12°C (32 to 10°F)		SAE 20W
	−12 to −23°C (10 to −10°F)		SAE 10W
	below −23°C(10°F)		SAE 5W

RERIODICAL MAINTENANCE AND LUBRICATION SCHEDULE

SERVICES DURING BR EAK-IN OPERATION		MAINTENANCE AND LUBRICATION SCHEDULE	MAINTENANCE FREQUENCY EVERY				
3000km (2000mile)	1000km (600mile)		DAILY	3000km	9000km	18000km	36000km
		Check engine oil level, top-up if necessary.	○				
●	●	Change engine oil.		●			
		Lubricate carburetor linkage.			○		
○		Check coolant level, add if necessary.	○				
		Change coolant.			●		
		Check distributor cam and pivot for poor lubrication, apply grease if necessary.			○		
	○	Retightening cylinder head, manifold and exhaust pipe flange bolts.			○		
	○	Adjust tappet clearance.			○		
	○	Check ignition timing, adjust if necessary.			○		
	○	Check carburetor, retighten attaching bolts and nuts, and adjust if necessary.				○	
	○	Check specific gravity of battery. and charge if necessary.			○		
	○	Check and adjust fan belt tension.		○			
○	○	Check engine for oil leak.	○				
○		Clean fuel strainer.			○		
○		Check fuel pipe connections for leak, repair if necessary.	○				
○		Replace engine oil filter element.			●		
○		Check and reset spark plug gaps if necessary.		○			
○		Check distributor cap, rotor and points, adjust gap if necessary.		○			
○		Check engine idle speed, adjust if necessary.		○			
○		Check abnormal noise from engine and exhaust gas color.	○				
	○	Retighten engine mounting bolts and nuts.				○	
		Clean oil filler cap.			○		
		Replace spark plugs.				●	
		Check generator and voltage regulator function.				○	
		Check starting motor operation.				○	
		Adjust timing chain tension.				○	
		Replace air cleaner element.					●
		Check fuel pump function.					○
		Check compression pressure of cylinders.					○
		Overhaul carburetor.					○
		Check condenser for defect, replace if necessary.					○

○=Check, Clean, Adjust or Supply. ●=Change.

ABBREVIATIONS AND SYMBOLS

Items	Details
A	Ampere
AC	Alternating Current
AH	Ampere Hour
cc	Cubic Centimeter
cm-kg	Kilogram-Centimeter
cm	Centimeter
g	Gram
in	Inch
kg	Kilogram
km	Kilometer
km/h	Kilometer per Hour
kg/cm²	Kilogram Square Centimeter
KW	Kilowatt
L	Length
LH	Left Hand
l	Liter
mm	Millimeter
m	Meter
m-kg	Kilogrammeter
O.S	Over Size
P	Page
RH	Right Hand
r.p.m.	Revolution Per Minute
S.T.D.	Standard
t	Thickness
US	Under Size
V	Voltage
V/cell	Voltage per Cell
W	Watt

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

SERVICE MANUAL

H16(R) & H20 ENGINES

NISSAN

SECTION EM

ENGINE MECHANICAL

EM

ENGINE DISASSEMBLY

1. Fix the engine with the engine stand. To do this, remove the oil filter with bracket, oil pressure switch, fuel pump and RH engine mounting bracket, and then install the attachment.
2. Remove the oil drain plug and drain engine oil.
3. Remove the clutch assembly.
4. Remove the oil level gage.
5. Remove the vacunm tube.
6. Remove the distributor and distributor driving spindle.
7. Remove the spark plugs.
8. Remove the carburetor assembly.
9. Remove the intake and exhaust manifolds.
10. Remove the alternator, alternator bracket, LH engine mounting bracket and drain tube.
11. Remove the cooling fans, fan spacers and fan pulley.
12. Remove the water outlet elbow and thermostat.
13. Remove the thermal transmitter.
14. Remove the water pump and alternator adjust bar.
15. Remove the rocker cover and packing.
16. Remove the rocker shaft with brackets, and remove the push rods.
17. Remove the cylinder head and cylinder head gasket.
18. Remove oil pan and oil pump.
19. Remove the front cover and oil thrower.
20. Remove the chain tensioner.
21. Remove the camshaft gear, crankshaft gear and chain simultaneously.
22. Remove the crankshaft gear shim, if inserted. The shim can be removed by taking the key off.
23. Remove the connecting rod caps and pistons, with the piston pushed upward.
24. Remove the flywheel.
25. Using a puller, remove the crakshaft main bearing caps.

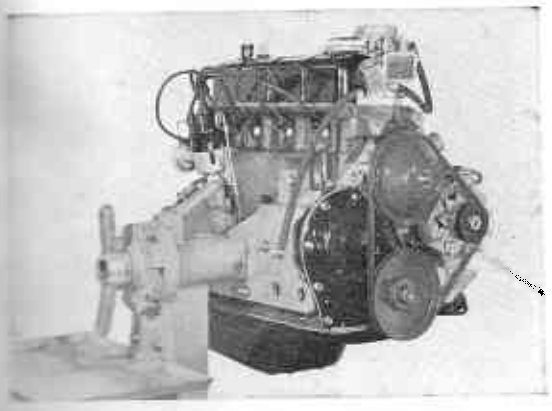


Fig. EM-1 Fixing Engine on Stand

Fig. EM-2 Removing Carburetor

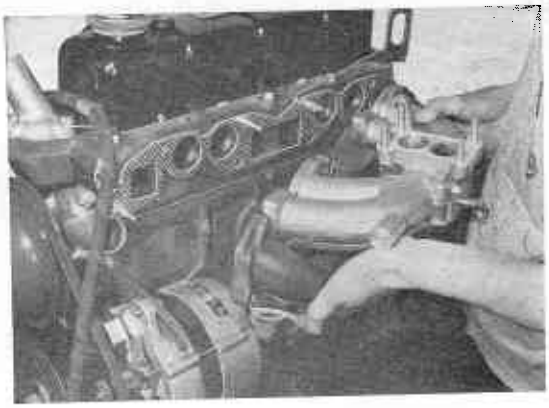


Fig. EM-3 Removing Manifolds

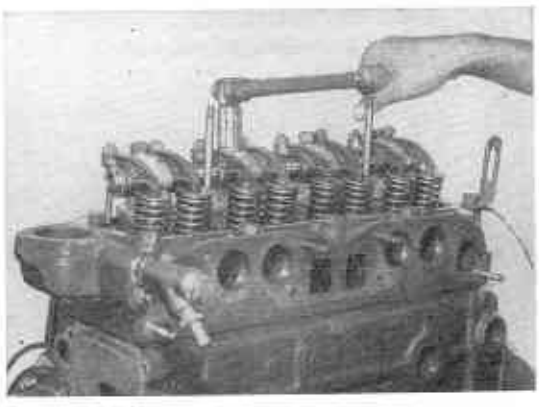


Fig. EM-4 Removing Rocker Shaft Assembly

Fig. EM-5 Removing Cylinder Head

Fig. EM-6 Removing Main Bearing Cap

Fig. EM-7 Removing Crankshaft

26. Rmove the crankshaft.
27. Remove the camshaft locating plate.
28. Remove the camshaft, taking care not to damage the bushing surfaces.
29. Remove the valve lifters.
30. Remove the rear oil seal.
31. Disassemble the valve mechanism. Using the valve spring expander, remove the valve springs, valves and valve lip seals from the cylinder head.

NOTE:
1. **Place the disassembled valves separately each cylinder so that they can be assembled into their original position.**
2. **Be sure that the valve ring rubbers are fitted at the exhaust valve stem ends.**
3. **Take care not to damage the lip seal portion of the guides.**

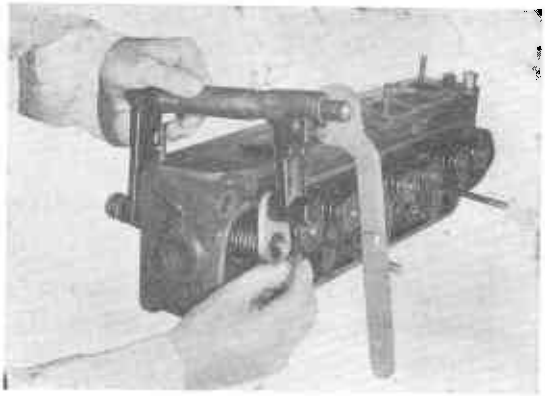


Fig. EM-8 Removing Valve Springs

32. Disassembling the valve rocker shaft assembly.
    Remove the following parts in the order; lock pin, washer, spring washer, valve rocker arm and bracket. Then, remove the inside spring. Remove the valve lock nut from the valve rocker arm, and then remove the valve lock adjusting screw.
33. Disassembling the pistons and connecting rods.
    Remove the piston rings, snap rings and piston pin, then disconnect the connecting rod from the piston.

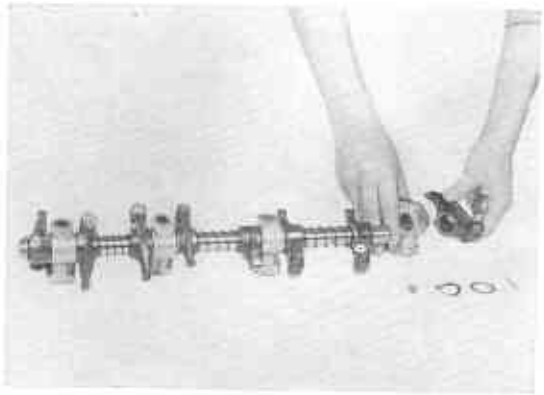


Fig. EM-9 Disassembling Rocker Shaft

NOTE: Prior to removal of connecting rods, check identification mark, if necessary mark them, then place the caps and connecting rods in proper sequence so that they can assembled into their original position.

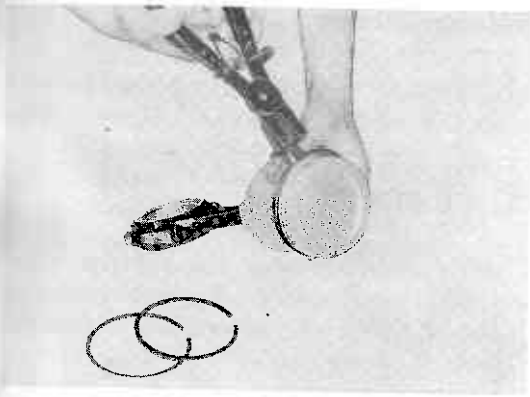


Fig. EM-10 Removing Piston Rings

Fig. EM-11 Removing Piston Pin

INSPECTION AND REPAIR

CONTENTS

After the engine has been disassembled, thoroughly clean the parts and remove any dust, oil and carbon deposits. Using a wash tank containing cleaning solution is the most convenient. In order to prevent the cleaning solution from being soiled and catching fire, it is advisable to provide appropriate cover on the wash tank. While removing carbon deposits with or by a scraper, take care not to damage the ground and fine machined surfaces.

CYLINDER HEAD

1. Visual inspect the cylinder head for carbon or damage.
2. The cylinder head mating face with the cylinder block should be perfectly flat, and checked for distortion. If it exceeds the limit, re-condition the mating face using a surface grinder.

mm (in.)

Re-conditioning Standard	below 0.05(0.0019)
Max. Limit	0.02(0.0078)

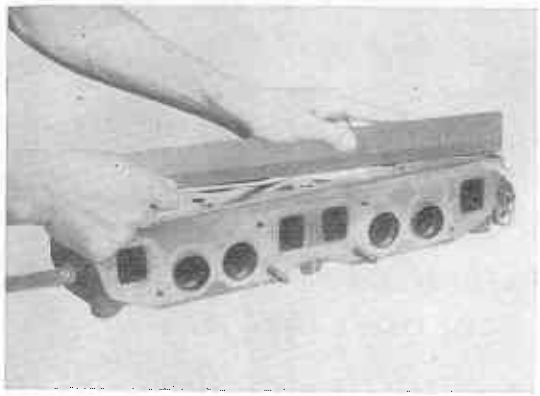


Fig. EM-12 Checking Distortion of Cylinder Head Mating Surface

VALVE GUIDES

1. Check the clearance between the valve guide and valve stem. If the clearance exceeds the limit resulting from a worn valve guide, ream the valve guide to meet oversize valve with the hand-reamer of SST No. ST44720000. Two kinds of oversize valves are available, spacing 0.2mm (0.0078 in.) and 0.4mm (0.0156 in.) in diameter.
2. The valve guide can not be removed from the cylinder head because it is integral with the cylinder head.

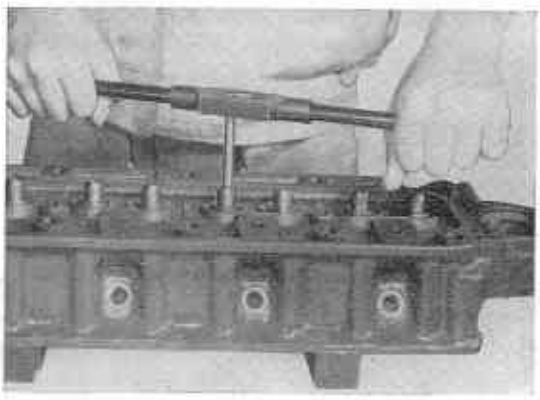


Fig. EM-13 Reaming Valve Guide

mm (in.)

		Standard	Limit
Valve Guide-to-Stem Clearance	Intake	0.028 to 0.030 (0.0011 to 0.0012)	0.10 (0.0039)
	Exhaust	0.058 to 0.060 (0.0023 to 0.0024)	0.10 (0.0039)
Valve Guide Inside Dia.		8.675 to 8.690 (0.341 to 0.342)	—

VALVE SEATS

1. After decarbonizing, check valve seats in the cylinder head for any evidence of pitting or defective contact, and reface valve seats if necessary.
2. Before refacing the valve seats, check the valve guides for wear, and finish by reaming as instructed before, then reface the valve seats to the dimension as shown in the figure EM-14, using the seat cutter of SST NO. ST44730000.

Fig. EM-14 Refacing Valve Seat

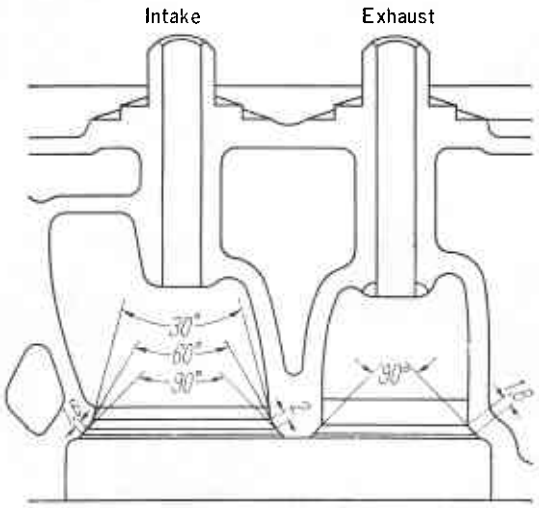


Fig. EM-15 Dimension of Valve Seats

VALVES

1. Remove carbon deposits from the valve heads and check for distortion, crack of the valve and wear at the valve stem.
2. Using the valve grinder, correct the valve as specified.
   After grinding, check that the thickness of the valve head at the outer margin is not below 0.5mm (0.0196 in.), and replace the valve if it exceeds the limit.

OVERSIZE VALVE DIMENSIONS

mm (in.)

	Dia. of Stem	Part No.
Intake	8.657 to 8.670 (0.3408 to 0.3413)	13201-78203
	8.857 to 8.870 (0.3487 to 0.3492)	13201-78201
	9.057 to 9.070 (0.3566 to 0.3570)	13201-78202
Exhaust	8.827 to 8.840 (0.3475 to 0.3480)	13207-78201
	9.027 to 9.040 (0.3554 to 0.3559)	13202-78202

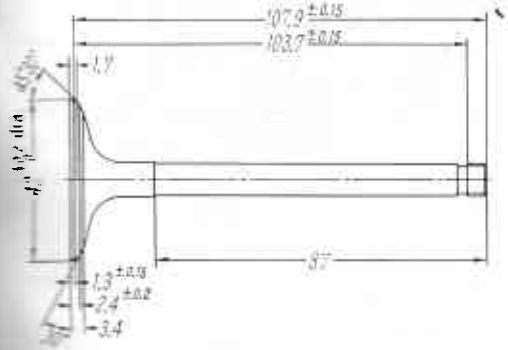


Fig. EM-16 Dimension of Intake Valve

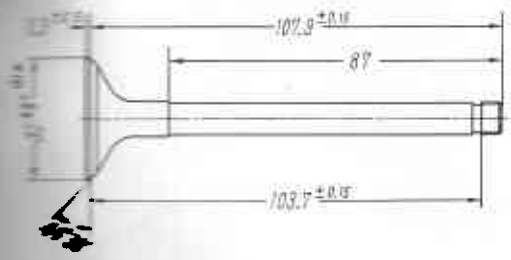


Fig. EM-17 Dimension of Exhaust Valve

Fig. EM-18 Grinding Valves

VALVE SPRINGS

1. Check the free length and the length when the specified load is applied, and replace them with new ones if necessary.
2. With a square scale, measure the inclination of the valve spring as shown in Fig. EM-20, and replace the springs with new ones if it exceeds 1.0 mm (0.039 in.).

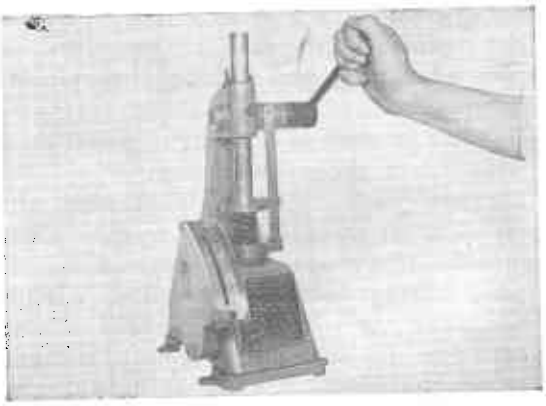


Fig. EM-19 Checking Valve Spring Tension

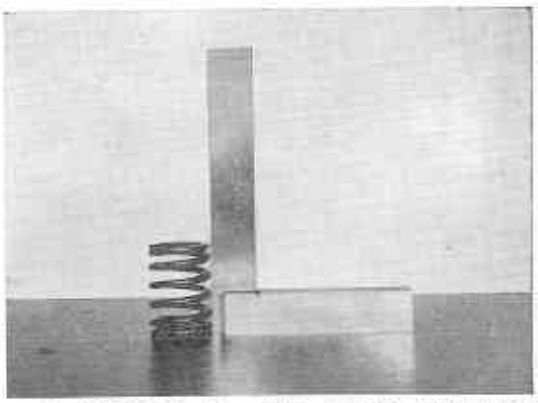


Fig. EM-20 Checking Valve Spring Inclination

SPECIFICATION OF VALVE SPRINGS

	Standard	Limit
Free Length	49mm (1.93 in.)	47.5mm (1.87 in.)
Length when Loaded ..	39mm (1.54 in.)	—
Specified Load	30kg (66 lbs)	29 kg (63.8 lbs)
Inclination	below 1.0 mm (0.039 in.)	

CYLINDER BLOCK

1. Visual inspect the cylinder block for cracks or damages.
2. Using a straightedge and feeler gage, inspect the cylinder block mating face for level. To check, place the straightedge first along diagonal lines of the block plane and then longitudinally. If any distortion is detected in excess of 0.1mm (0.0039 in.), grind the mating face, using a surface grinder, to obtain a flat surface with roughness of below 0.05mm (0.002 in.).
3. Examine the cylinder walls for seizures, out-of-round, taper or excessive wear. If the cylinder wall prove to be pitted or notched, boring and honing the cylinder barrels.
   If wear or taper is very slight, polish them with use of the ridge reamer.
4. Measure each cylinder lengthwise and crosswise at three different heights along planes being respectively longitudinal and perpendicular to engine outerline. Whenever wear, taper rate or difference among cylinders in diameter exceeds the limit, rebore and then hone the cylinders.

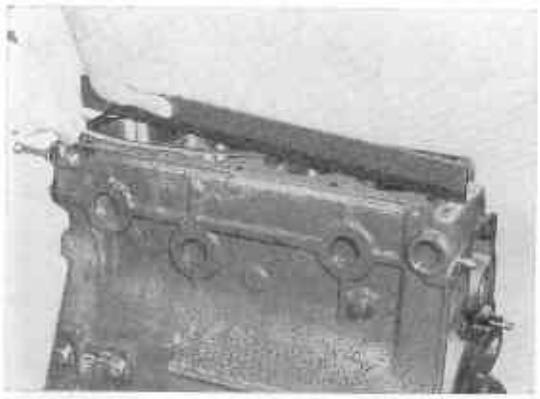


Fig. EM-21 Measuring Flatness of Cylinder Block Surface

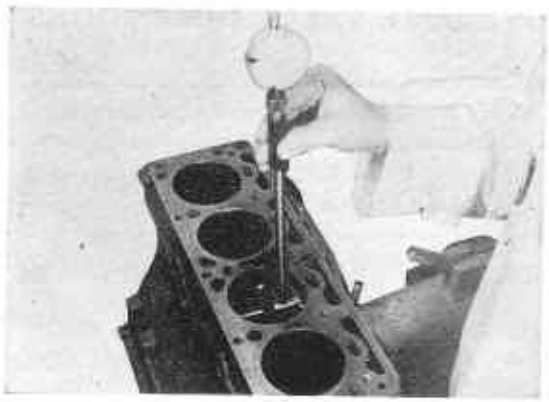


Fig. EM-22 Measuring Cylinder Bore Diameter

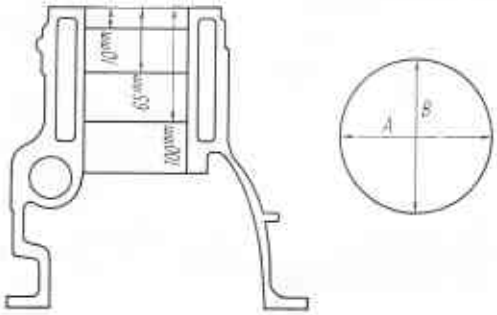


Fig. EM-23 Measuring Positions of Cylinder Bore

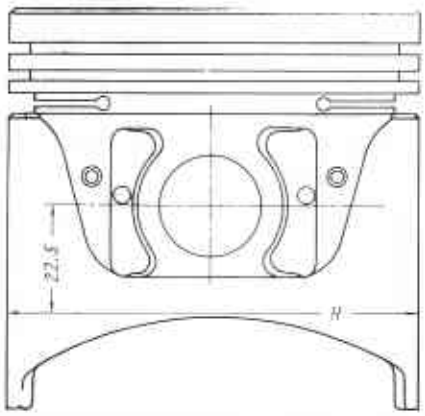


Fig. EM-24 Measuring Position of Piston Diameter

SERVICE DATA OF CYLINDERS

	Standard		Wear Limit	
	mm	in.	mm	in.
Standard Cylinder Bore	$87.2^{+0.05}_{-0}$	$3.43^{+0.0019}_{-0}$	0.2	0.0079
Out-of-Round	0.015	0.0006	—	—
Taper Rate	0.02	0.0008	—	—
Difference among Cylinders in Dia.	0.05	0.0019	—	—

3. Boring and honing the cylinders.
Select the pistons and measure the outside diameter of them at the position shown in the figure EM-25. Determine new bore diameters for each cylinder according to the following formula.

$X = A + B - C$

Where, X : Cylinder Bore Diameter (mm)
A : Outside Diameter of Piston (mm)
B : Piston-to-Cylinder Wall Clearance (0.025 to 0.045 mm at 20°)
C : Stock for Honing (0.0 2mm)

The feed amount of a bit should be within 0.05mm (0.0019 in.). Remove a small amount of stock from metal parts to produce smooth, true machined surfaces to a high degree of accuracy.

Avoid measuring the bore diameter soon after boring or honing operation because the block is expanded by the heat.
Check the piston-to-cylinder wall clearance using a feeler gage of 0.04mm (0.0016 in.) in thickness. To check, position the piston at the minimum diameter of the cylinder. Insert the feeler gage at the direction of thrust and pull the spring gage. The correct clearance is obtained when the spring gage is pulled through at a force of 0.5 to 1.5kg (1.1 to 3.3 lbs). The standard piston-to-cylinder wall clearance with new parts should be 0.025 to 0.045mm (0.0098 to 0.0187 in.).

NOTE: When the cylinders have to be bored in excess of the maximum oversize, bore the cylinders to the smallest size of three sizes for installing the cylinder liners. After installing the cylinder liner, the cylinder liners should be honed to obtain the standard cylinder diameter.

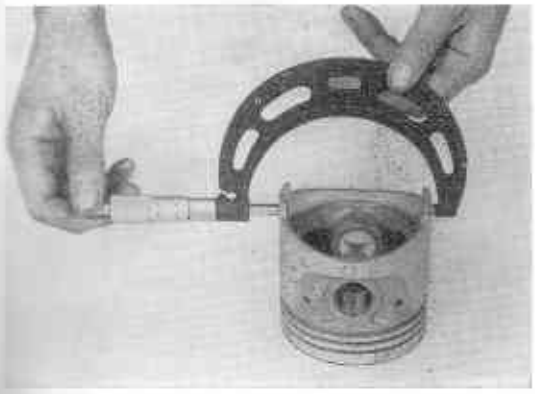


Fig. EM-25 Measuring Piston Diameter

Fig. EM-26 Checking Piston-to-Cylinder Wall Clearance

SPECIFICATIONS OF CYLINDER LINERS

Cylinder Liner Size		Outside Dia.	Inside Dia.	Cylinder-to-Liner Fit
O.S	4.0 mm	91.20 to 91.25	86.80 to 86.70	0.08 to 0.09
	0.157 in.	3.5905 to 3.5925	3.4173 to 3.4133	0.0031 to 0.0035
O.S	4.5 mm	91.70 to 91.75	86.80 to 87.70	0.08 to 0.09
	0.177 in.	3.6102 to 3.6122	3.4173 to 3.4527	0.0031 to 0.0035
O.S	5.0 mm	92.20 to 92.25	86.80 to 86.70	0.08 to 0.09
	0.196 in.	3.6299 to 3.6318	3.4713 to 3.4133	0.0031 to 0.0035

SPECIFICATIONS OF OVERSIZE PISTONS

		Standards
S.T.D.		87.187 to 87.235 mm
		3.4325 to 3.4344 in.
Over size (O.S)	0.25 mm	87.415 to 87.465 mm
	0.0098 in.	3.4415 to 3.4435 in.
	0.50 mm	87.665 to 87.715 mm
	0.0196 in	3.4513 to 3.4533 in.
	0.75 mm	87.915 to 87.965 mm
	0.0295 in	3.4612 to 3.4631 in.
	1.00 mm	88.165 to 88.215 mm
	0.0393 in.	3.4710 to 3.4730 in.
	1.50 mm	88.665 to 88.715 mm
	0.0589 in.	3.4907 to 3.4927 in.

PISTONS, PINS AND PISTON RINGS

1. Inspect the pistons, pins and piston rings for any sign of wear, pitting or damage, and replace a defective part with a new one if necessary.
2. Check the piston ring-to-groove land clearance, by placing the piston ring into the relevant piston groove and inserting a feeler gage in between, as shown in Fig. EM-27. If the clearance exceeds the limit, replace the pistons and rings with new ones.
3. Check the piston-to-piston pin fit for looseness. If a loose fitting detected, replace the piston pins with new large ones. The piston pin should move with some resistance by pushing it with fingers, with it immersed in a hot water of 20°C (68°F).

Fig. EM-27 Checking Piston Ring-to-Groove Land Clearance

4. The end of the piston rings in cylinder bore, rather than touching, should be allowed a clearance respectively. Inspect the piston ring end gap with a ring inserted in cylinder bore well square to cylinder vertical axis. Whenever new piston rings are installed, should the end gap prove to be narrower than the specification, grind ring ends as recommended. Conversely, if the ring end gap is excessive the specification, replace rings.

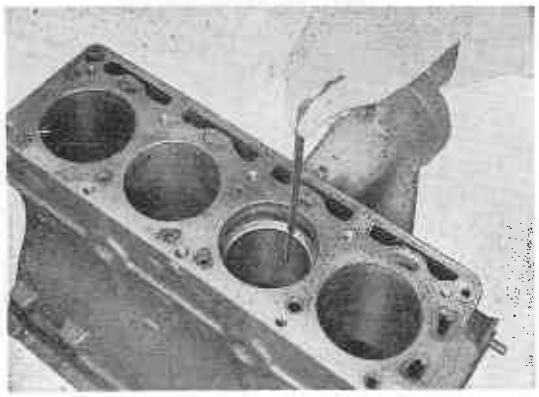


Fig. EM-28 Checking Piston Ring End Gap

SERVICE DATA OF PISTONS, PINS AND RINGS

		Standard		Limit	
		mm	in.	mm	in.
Piston Ring-to-Groove Land Clearance	Top	0.04 to 0.07	0.0016 to 0.0028	0.2	0.0078
	Second	0.03 to 0.06	0.0012 to 0.0024	0.2	0.0078
	Oil	0.03 to 0.08	0.0012 to 0.0031	0.2	0.0078
Piston Ring End Gap	Top	0.25 to 0.40	0.0098 to 0.0157	1.0	0.0393
	Second	0.15 to 0.30	0.0059 to 0.0118	1.0	0.0393
	Oil	0.30 to 0.50	0.0118 to 0.0196	1.0	0.0393
Piston Pin-to-Bushing Fit		0.004 to 0.006	0.00016 to 0.00024	—	—

SERVICE DATA OF CONNECTING RODS AND BUSHINGS

	Standard		Limit	
	mm	in.	mm	in.
Misalignment per 100mm (3.93 in.)	8.025	0.0009	0.050	0.0019
Thrust Play at Big End	0.2 to 0.3	0.0078 to 0.0118	0.3	0.0118
Oil Clearance of Big End Bushing	0.014 to 0.056	0.0006 to 0.0022	0.1	0.0039

CONNECTING RODS AND BUSHINGS

1. Check the bearing surfaces of the big end for scratch, crack and damage. If any sign of damage is found, replace the bearings with new ones.
2. Using the connecting rod aligner, inspect the connecting rods for bend and twist. If the inspection indicates excessive the limit, repair or replace the connecting rods.
   The misalignment per 100mm (3.93 in.) should be 0.025mm (0.0009 in.), and not exceed 0.050mm (0.0019 in.).
3. Check the bushings located at the connecting rod small end for wear and damage. If they prove to be only worn out or scratched to a slight extent, repair them by reaming
4. When replacing the connecting rods, select the rod so that the weight difference of six rods become within 3gr. (0.1 oz). Excess of weight is rectified by removing metal stock from a heavy rod.

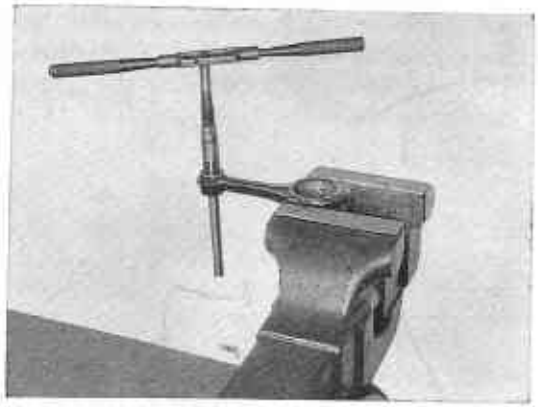


Fig. EM-29 Reaming Connecting Rod Small End Bushing

SPECIFICATIONS OF CONNECTING ROD BUSHING

Size	Metal Thickness	Crank Pin Diameter
S.T.D.	1.498 to 1.506 mm	51.961 to 51.974 mm
	0.0590 to 0.0593 in.	2.0457 to 2.0462 in.
6 mm U.D	1.528 to 1.536 mm	51.901 to 1.536 mm
	0.0602 to 0.0605 in.	2.0433 to 2.0439 in.
12 mm U.D	1.558 to 1.566 mm	51.841 to 51.854 mm
	0.0613 to 0.0617 in.	2.0410 to 2.0415 in.
25 mm U.D	1.623 to 1.631 mm	51.711 to 51.724 mm
	0.0639 to 0.0642 in.	2.0359 to 2.0364 in.
50 mm U.D	1.748 to 1.756 mm	51.461 to 51.474 mm
	0.0688 to 0.0691 in.	2.0260 to 2.0265 in.
75 mm U.D	1.873 to 1.881 mm	51.211 to 51.224 mm
	0.0737 to 0.0741 in.	2.0162 to 2.0167 in.
100mm U.D	1.998 to 2.006 mm	50.961 to 50.974 mm
	0.0787 to 0.0790 in.	2.0063 to 2.0069 in.

5. With the bushings installed to the connecting rods, install them to the individual crank pin and measure the thrust clearance. If it exceeds the limit, replace the bushings.
   The thrust clearance should be 0.2 to 0.3 mm (0.0078 to 0.0118 in.) and not exceed 0.3 mm (0.0118 in.).
6. Check the oil clearance of the connecting rod big end bushing with the same manner as that of the crank shaft main bearing bushing described later.
   If the difference of each oil clearance exceeds 0.03 mm (0.0012 in.), a defective bushing should be replaced.

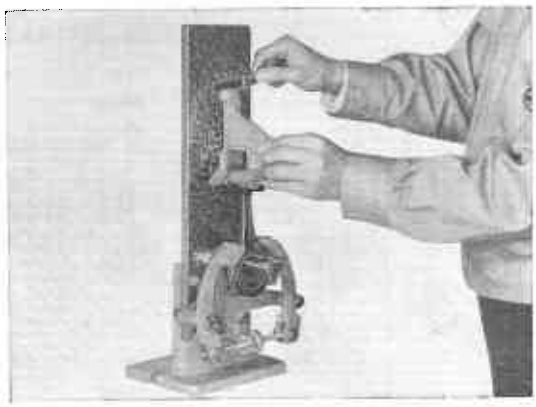


Fig. EM-30 Checking Connecting Rod Alignment

CRANKSHAFT AND MAIN BEARING BUSHINGS

1. Check the crankshaft journals and pins for crack, wear and damage, replace the crankshaft with a new one if necessary.
2. Check the crankshaft for misalignment and repair or replace the caankshaft, if necessary.
   To check the misalignment, support the crankshaft at NO.1 and No.5 journals on "V" blocks, set in place a dial indicator to No. 2, No. 3, and No. 4 journals respectively, and then read the dial indicator by slowly rotating the crankshaft. A half of the reading is of the misalignment in bend. If the inspection has evidenced some misalignment in main bearing or connecting rod journals, straighten the crankshaft under a hydraulic press. Take care to rate the load as required, so that the crankshaft is not submitted to excessive stresses which might adversely affect the internal structure of the shaft.
3. When grinding the crankshaft is required, selet next under size bearing and, consequently, grind out the crankshaft journals to the specified under size.
4. With the crankshaft installed on the cylinder block, check the crankshaft side clearance at the center bearing bushing. If the clearance exceeds the limit, replace the center bearing bushing with a new one.
5. Check for wear and damage of the main drive shaft pilot bushing located at the crankshaft. A worn or damaged bushing should be replaced with a new one.
6. Thoroughly clean the bearing shells and examine their inner face. If scuffs, chips or evidence of wear in the metal coat are detected, replace the bearing bushing. Replacing a half of the bearing bushing should be avoided.

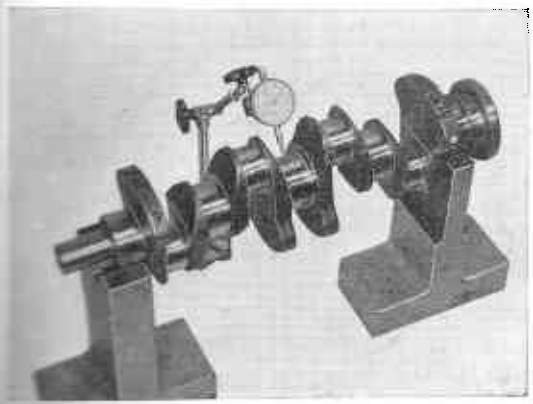


Fig. EM-31 Checking Crankshaft for Misalignment

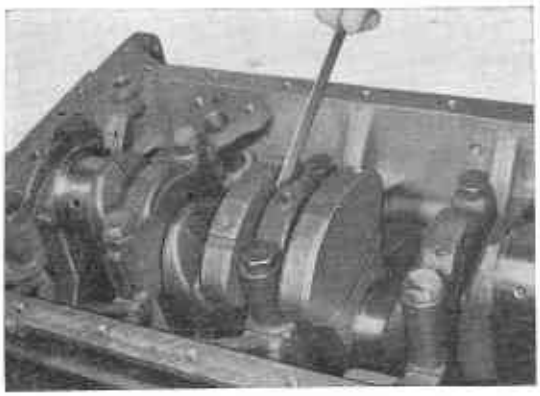


Fig. EM-32 Checking Side Clearance of Crankshaft

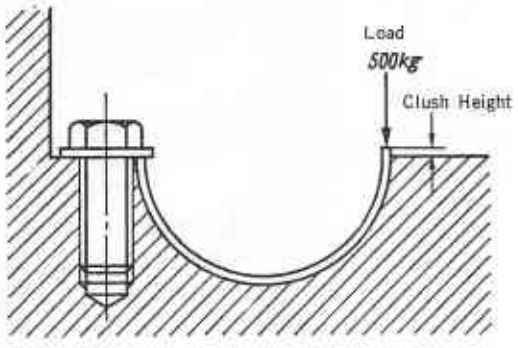


Fig. EM-33 Checking Clash Height of Main Bearing Bushing

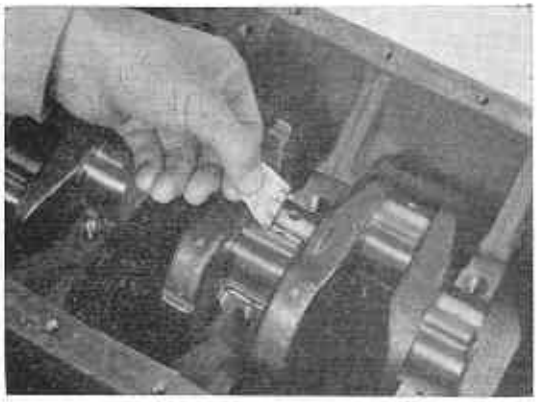


Fig. EM-34 Checking Main Bearing Bushing Oil Clearance

Checking Main Bearing Bushing-to-Journal Clearance

1. Thoroughly clean the contact faces of the bushings and journals.
2. Place a piece of Plastigage being the full width of bearing bushing across the cap side bushing or the bearing journal, taking care that the oil passage is not obstructed.
3. Fit the bearing cap or connecting rod cap and draw up the cap screw with a torque of 10 to 11 kg-m (72.33 to 79.56 t-lbs). Take care not to rotate the crankshaft in this operation.
4. Then remove the bearing cap. The plastigage will be found adhering to either the bushing surface or the journal and it will have developed a rectangular section as it was flattened from the cap tightening action.
5. To determine the actual clearance between the bearing journal and the bearing shell, compare the width of the flattened plastigage at its widest point with the graduation on the envelope, which indicates the bearing bushing-to-journal clearance in millimeters.

SERVICE DATA OF CRANKSHAFT AND MAIN BEARING BUSHING

		Standard		Limit	
		mm	in.	mm	in.
Wear of Taper Rate of Crankshaft Journal		0.01	0.0004	0.03	0.0012
Misalignment of Crankshaft		0.02	0.0008	0.05	0.0019
Thrust Play at No. 3 Main Bearing Bushing		0.05 to 0.18	0.0019 to 0.0071	0.2	0.0078
Clash Height of Main Bearing Bushing	Front, Rear	0 to 0.03	0 to 0.0012		
	Center	0 to 0.03	0 to 0.0012		

SPECIFICATION OF MAIN BEARING BUSHING

Size	Part No.				Crankshaft Journal Diameter	
	No. 1 No. 5	No. 3	Set No.	No. 2 No. 4	mm	in.
S.T.D.	12215-37000	12247-37000	12207-78200	12231-78200	62.942 to 62.955	2.4780 to 2.4785
25mm U.S	12217-37000	12249-37000	12209-78200	12233-78200	62.692 to 62.705	2.4682 to 2.4682
50mm U.S	12218-37000	12250-37000	12210-78200	12234-78200	62.422 to 62.455	2.4576 to 2.4589
75mm U.S	12219-37000	12251-37000	12211-78200	12235-78200	62.192 to 62.205	2.4485 to 2.4490
100mm U.S	12220-37000	12252-37000	12212-78200	12236-78200	61.942 to 61.955	2.4387 to 2.4392

CAMSHAFT AND BUSHINGS

1. First of all examine camshaft journal and lobe faces, which should be extremely smooth. Should seizure or scoring marks be detected, replace the camshaft; if the amount of damage is negligible rectify with a very fine grade abrasive stone.
2. Support the camshaft at ends on two "V" blocks which should rest on a surface plate as shown in Fig. EM-33. Set the plunger of a dial indicator to touch the intermediate journal and rotate the camshaft; the indicator readings should not differ by more than 0.02 mm (0.0008 in.) at any point. If the out-of-true exceeds 0.05 mm (0.0019 in.), straighten the camshaft under a press.
3. With the camshaft resting on "V" blocks, set the dial indicator plunger to touch each lobe in turn, and rotate the camshaft; the lobe lift recorded should be 37.279mm (1.2708 in.). This figure refers to both intake and exhaust valve camshaft lobes. If any one of them wears in excess of 0.25 mm (0.0098 in.), the camshaft should be replaced with a new one.
4. Examine the interior surfaces of the camshaft bearing bushings which should have a mirror-like face, without indications of seizure or scoring; otherwise, replace the bushings. Check also the bushing for wear, and if the bushings are worn exceeding

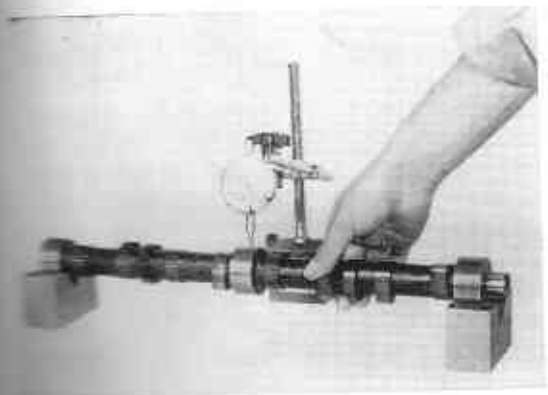


Fig. EM-35 Checking Camshaft for Distortion

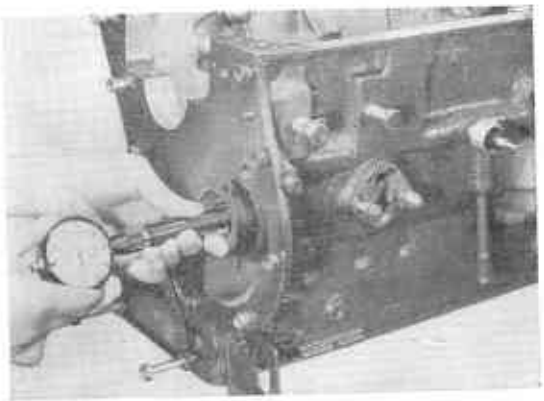


Fig. EM-36 Measuring Camshaft Bearing Bushing Diameter

the limit, replace the bushings with new ones.

5. Check the camshaft and crankshaft gears for run-out, with the gears fitted in place, using a dial indicator. If run-out exceeds 0.1mm (0.0039 in.), replace the gears with new ones.

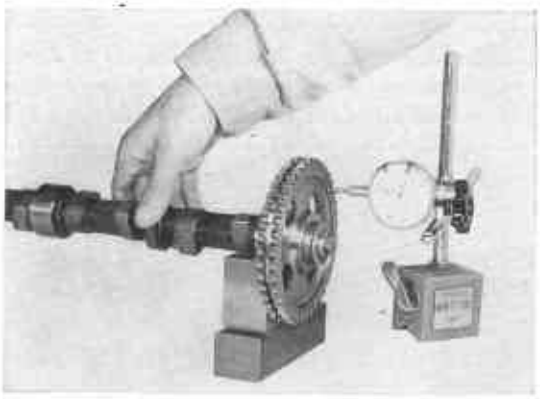


Fig. EM-37 Checking Gear for Run-Out

VALVE LIFTERS AND PUSH RODS

1. Check the valve lifters for wear, stick and abnormal contact marks, and replace them with new ones if any condition appears.
2. Check the clearance between the bore wall in the cylinder block and the valve lifter. If the clearance is in excess of the limit, replace the worn lifters.
3. Check the push rods for bend and damage at the ends. If any abnormal condition is detected, replace them with new ones.

SERVICE DATA OF VALVE LIFTERS AND PUSH RODS

	Standard		Limit	
	mm	in.	mm	in.
Valve Lifter-to-Bore Wall Clearance	0.02 to 0.04	0.0008 to 0.0016	0.10	0.0039

SERVICE DATA OF CAMSHAFT AND BUSHINGS

		Standard		Limit	
		mm	in.	mm	in.
Camshaft Lobe Height		37.279	1.2708	0.25	0.0098
Difference in Dia. among Journals		—	—	0.05	0.0019
Camshaft Distortion		0.02	0.0008	0.05	0.0019
Thrust Play of Camshaft		—	—	0.20	0.0078
Oil Clearance	Front & Rear	0.025 to 0.087	0.0009 to 0.0034	0.10	0.0039
	Center	0.038 to 0.1	0.0015 to 0.0039	0.15	0.0057
Run-out of Gears		—	—	0.10	0.0039
Camshaft Journal Dia.	Front	45.435 to 45.447	1.7887 to 1.7893	0.10	0.0039
	Center	43.897 to 43.910	1.7282 to 1.7287	0.10	0.0039
	Rear	41.218 to 41.231	1.6228 to 1.6233	0.10	0.0039

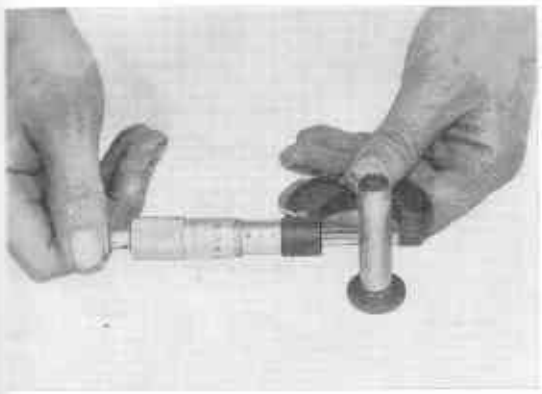


Fig. EM-38 Measuring Valve Lifter Diameter

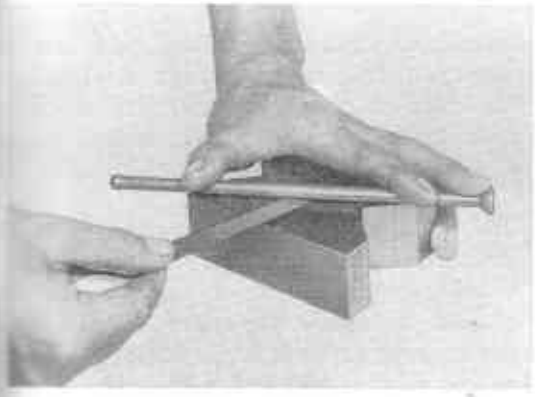


Fig. EM-39 Checking Push Rod for Bend

FLYWHEEL

1. Check the contacting surface of the flywheel for wear or scratch, and repair by grinding it with a surface grinder and/or replace it with a new one. The amount of grinding should be as small as possible.
2. Check for run-out of the contacting surface. If it exceeds 0.2mm (0.0078 in.), replace the flywheel.
3. To replace the ring gear, heat it to approximate 180 to 200°C to expand the ring gear. Whenever the damage is not sever, replacing the ring gear is not required, but the engaging point with the starter pinion gear should be moved.

ENGINE ASSEMBLY

ble the engine, taking care to the follow-
oints:

1) Thoroughly wash, clean all the disassembled parts. Particular care should be taken that the oil passage is not pluged with foreign materials.
2) When assembling, lubricate all bushings and moving parts with engine oil.
3) Oil seals and packings once removed should not be used again. New oil seals and packings should be used with a light coat of engine oil.
4) The tools and operating stands should be kept clean to prevent the foreign materials from entering into the engine.
5) Prior to starting assembly, the tools and parts to be newly fitted should be prepared and checked to see whether they are good or not.
6) The specified tightening torque and tightening sequence should be observed.

1. Assembling pistons and connecting rods
Install the piston rings on the respective piston ring groove, using a piston ring expander, with the marked surface toward up. Ensure that when the piston rings are reassemled, they should be installed into

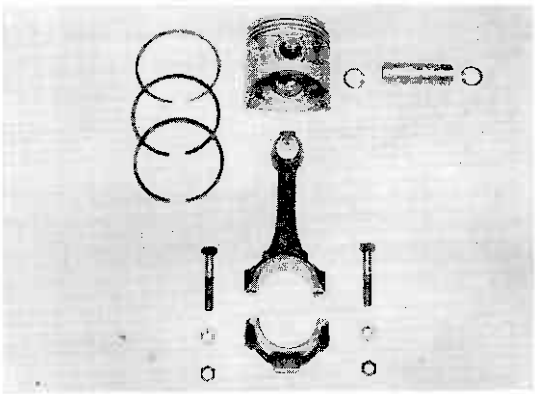


Fig. EM-40 Component Parts of Piston and Connecting Rod Assembly

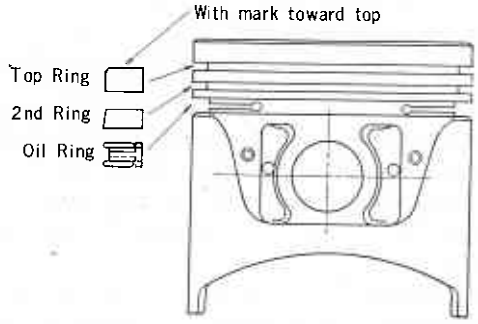


Fig. EM-41 Piston Ring Installation

their original grooves, and three piston ring end gaps should not be lined up. Then assemble the connecting rod onto its respective piston by means of two snap rings and bushing, taking care correctly position the pin bushing so that the oil passages line up.

2. Installing valves and valve springs
   Install the lip seals to the intake valve guides, and assemble the valve springs, valve spring retainers, valve collets and ring rubbers (for only exhaust valve guides) in the order.

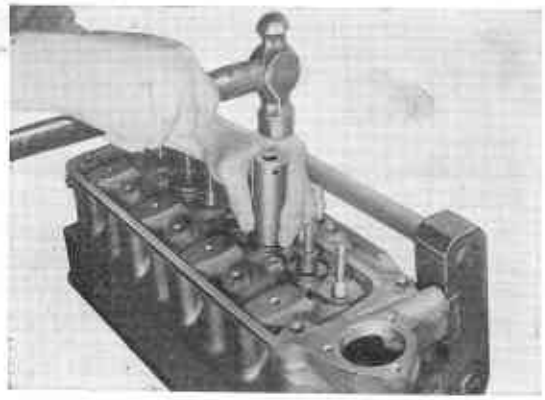


Fig. EM-42 Installing Lip Seals

3. Assembling and installing valve rocker shaft
   Install the valve rocker brackets and valve rocker inside springs to the rocker shaft in the sequence as shown in Fig. EM-43, and fix them with plane washers, spring washers and cotter pins. Install the rocker adjusting screws to the valve rockers and tighten them with valve lock nuts.
4. Set the cylinder block on a stand.
5. Install the valve lifters.

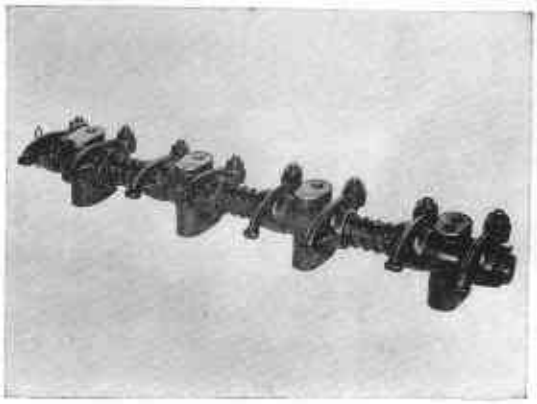


Fig. EM-43 Rocker Shaft Assembly

6. Install the camshaft, taking care not to damage the bearing bushings. And tighten the bolts attaching the camshaft locating plate to the cylinder block with a torque of 0.6 to 0.8 kg-m (4.34 to 5.79 ft-lbs).
7. Using the oil seal replacer, install the crankshaft rear oil seals into the cylinder block groove and bearing cap groove respectively. When the seal is fully installed, the ends of seal protruding the same height above the bearing support surface should be removed so that the seal ends line up with the bearing support surface.
8. Position the main bearing bushings in cylinder block and bearing caps, then lubricate with engine oil.
9. Install the crankshaft and bearing caps, then tighten the bearing cap securing bolts with a torque of 10 to 11 kg-m (72.33 to 79.56 ft-lbs). The bearing caps should be installed with the symboled side toward front, and gradually tightened in sequence from the center to rear or front bearing caps. After tightening, ensure that the crankshaft can rotate freely.

Fig. EM-44 Removing Ends of Oil Seal

Fig. EM-45 Installing Crankshaft Oil Seal

Fig. EM-46 Installing Flywheel

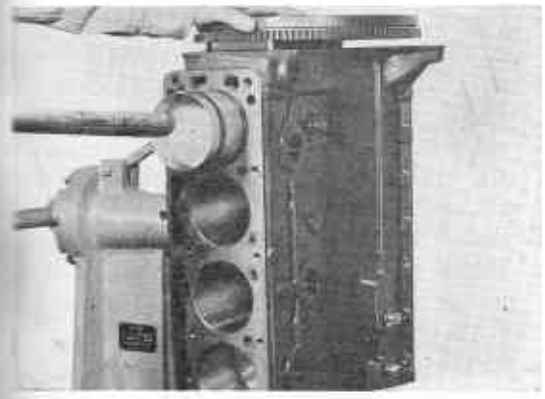


Fig. EM-47 Installing Piston and Connecting Rod Assembly

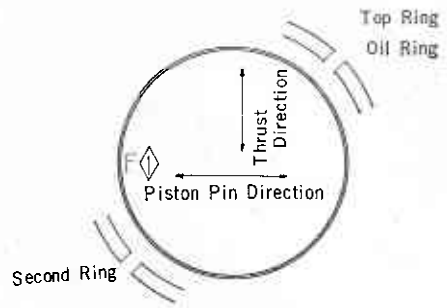


Fig. EM-48 Correct Piston Ring Position on Piston

hole on the connecting rod big end toward the camshft side.

14. Install the connecting rod caps and bolts, and tighten the bolts with a torque of 4.9 to 6.1 kg-m (35.44 to 44.12 ft-lbs). Care should be taken that the identified side of the caps with number be positioned at the same side with that of the connecting rods.
15. Install the oil pump and bolts, and tighten the bolts with a torque of 2.1 to 3.5kg-m (15.19 to 25.32 ft-lbs).
16. Temporarily install the camshaft and crankshaft gears in place, and adjust the position of both gears, using packing washers, so that they are in line with an error of within 0.2mm (0.0078 in.).
    Align the marks on the gears and timing chain, and install them to the engine and lock the gears with woodruf keys and tighten the camshaft gear securing nut with a torque of 3.5 to 4.9 kg-m (25.32 to 35.44 ft-lbs).
17. Install the chain tensioner, lock washers and tighten the bolts to a 0.6 to 0.8 kg-m

Fig. EM-49 Checking Camshaft Gear and Crankshaft Gear Alignment

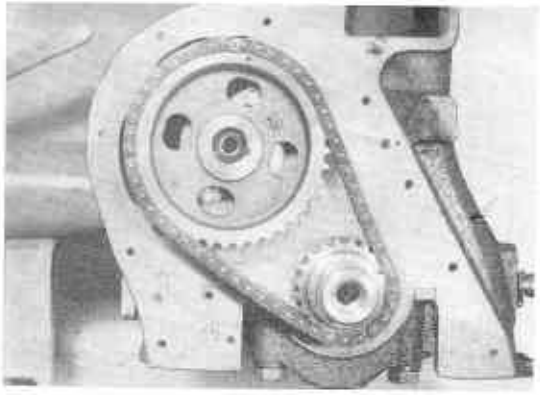


Fig. EM-50 Installing Timing Chain

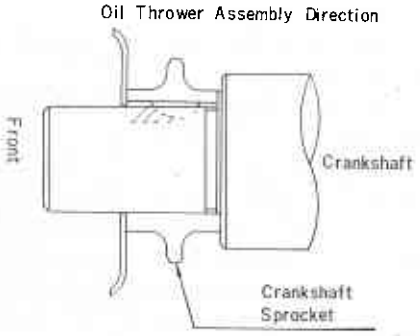


Fig. EM-51 Installing Direction of Oil Thrower

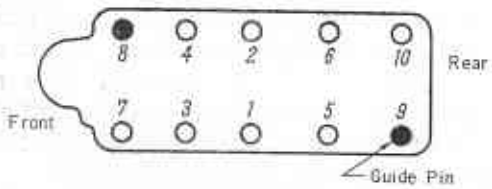


Fig. EM-52 Tightening Sequence of Cylinder Head Bolts

(4.34 to 5.79 ft-lbs) torque and bend the tongue fo washers to lock the bolts.

18. Install the oil thrower in position, with the chamfered side toward front of engine.
19. Install the front cover and tighten the attaching bolts with a torque of 0.6 to 0.8 kg-m (4.34 to 5.79 ft-lbs).
20. Install the oil pan and a new gasket, and tighten the bolts to a 0.4 to 0.7 kg-m(2.89 to 5.06 ft-lbs) torque.
21. Turn the engine over to stand it normally.
22. Install the water pump and temporarily install the alternater adjust bar.

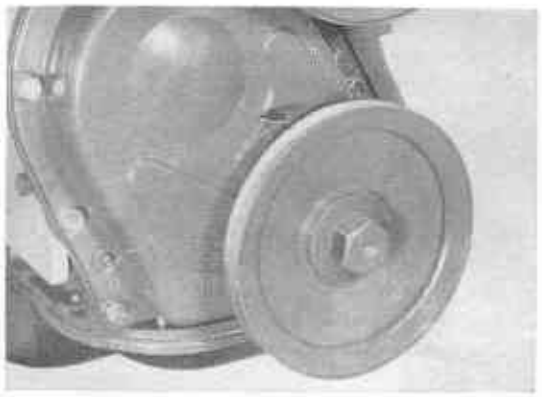


Fig. EM-53 Installing Crankshaft Pulley

23. Install the cylinder head and a new gasket. To install the cylinder head, install suitable guide pins to No. 8 and 9 cylinder head bolt positions shown in Fig. EM-52, then place a new gasket in position over the guide pins temporarily installed. Carefully guide the cylinder head into place over the guide pins. Install the cylinder head bolts and tighten with a torque of 7.0 to 8.2 kg-m (50.63 to 59.31 ft-lbs). The cylinder head bolts should be tightened in the sequence as shown in Fig. FM-52, and in three stages.
24. Insert the push rods in the engine assembly.
25. Install the rocker shaft assembly in the place, and tighten the attaching bolts with a torque of 5.7 to 6.3 kg-m (41.23 to 45.57 ft-lbs) in the sequence from center to out sides in three to four stages. Ensure that the end of the push rods engage with the rocker adjust screws.
26. Install the joint seat, thermostat and water outlet, and tighten the attaching bolts to a torque of 1.0 to 2.1 kg-m (7.23 to 15.19 ft-lbs).
27. Install the thermal transmitter to the engine.
28. Install the alternater and left side front engine mounting bracket to the engine, and tighten the attaching bolts with a torque of 2.1 to 3.5 kg-m (15.19 to 25.32 ft-lbs).
29. Install the intake and exhaust manifolds and gasket, and tighten the nuts with a torque of 1.4 to 2.8 kg-m (10.13 to 20.25 ft-lbs). Ensure that the collers are placed at the both end points of the intake and exhaust manifolds, and all the points should be tightened spacing plain washers except the points where both inlet and exhaust manifold flanges are secured together.

30. Adjust the valve clearances to 0.525 mm (0.0207 in.) for the intake and exhaust valves.
31. Install the carburetor and insulator, and tighten the attching bolts securely.
32. Install the valve rocker cover.
33. Install the crankshaft pully, and tighten the pully attaching bolt securely.
34. Securely tighten the front cover attaching bolts.
35. Install the cooling fan, fan pully and fan belt, then adjust the fan belt to a tension of 15 to 20 mm (0.59 to 0.78 in.).
36. Insert the distributor drive spindle in place as shown in Fig. EM-54. Install the distributor and fix it in the position by tightening the clamping bolts. Adjust the point gap to 0.45 to 0.55 mm (0.0176 to 0.0217 in.).
37. Install the sparking plugs and connect the high tension wires to the sparking plugs. Install and connect the vacuum pipe. Install the oil level gage.
38. Install the clutch disc and cover, ensuring that the clutch disc is free from oil and grease. The clutch attaching bolts should be tightened with a torque of 2.5 to 3.5 kg-m (18.08 to 25.32 ft-lbs).
39. Dismount the engine from the stand, and install the right front mounting bracket, fuel pump, oil pressure switch, oil filter and fuel pipes to the engine assembly.

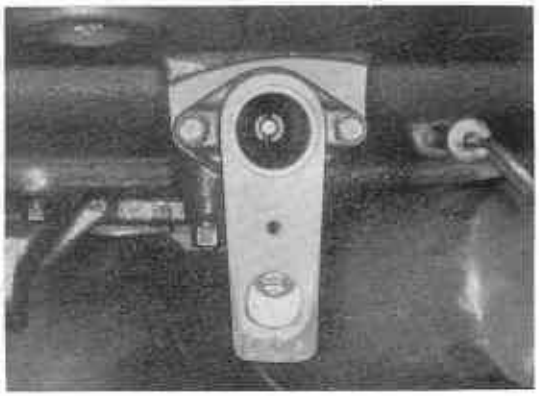


Fig. EM-54 Installing Distributor Driving Spindle

ENGINE TUNE-UP ADJUSTMENT

ENGINE BRAKE TEST

After the engine assembled, it is necessary to test it and run-in. Engine brake test is made for inspection and adjustment which cannot be made after the engine is installed on the vehicle.

ENGINE BRAKE TEST BY DYNAMOMETER

The brake test of the engine after repair work can be adjusted according to the replacement of the parts. Here, as an example, the case is explained where reconditioning of cylinder bore, replacement of piston and piston ring, grinding of crankshaft journal and pin, namely almost all main parts, are reconditioned and replaced.

Testing Condition and Time

Suction mm. Hg.	Rotation r.p.m.	Time Min.	Load
—400	600	20	No load
—300	1,200	30	
—200	2,000	30	
—100	2,800	10	
Full throttle	2,000	20	
600	2,000	5	No load

Measurement

Suction Vacuum	Measured at plug on intake manifold
Rotation Speed	As listed in the table
Oil Temperature	Cool oil pan if it becomes more than 90°C (194°F)
Oil Pressure	3 to 3.5 kg/cm² (42.66 to 49.77 lbs/in²) at 2500 r.p.m.
Water Temperature	70°C to 80°C (158°F to 176°F)
Ignition Timing	Each advance degree for specified speeds

Lubricant to be used

For testing the engine, regardless of the temperature, use SAE 20 engine oil. The oil used should be drained while the engine is still warm. At this draining, screen the oil by fine mesh wire screen and check for metal particles in the oil. If there is any sign of unusual cutting particles, it is necessary to find the possible cause of trouble.

Warning for the engine brake test

1. Observe the oil pressure at starting the engine, if after the engine started oil pressure does not go up, stop the engine right away and the cause of trouble should be eliminated. Check the oil circulation by removing oil filler cap on the valve rocker cover.
2. If any abnormal noise heard during the run, stop the engine according to the nature of the noise and correct the trouble.
3. Check carefully for oil and water leakage.
4. If there is any other unusual running condition, eliminate the cause.

ENGINE ADJUSTMENT

To maintain the best operating conditions of the engine at all times, the following adjustments should be carried out periodically.

Check Engine Oil and Cooling Water

Check and Adjust Fan Belt Tension

Care of Battery

1. Check the level of electrolyte with battery fully charged.
2. Check the specific gravity of battery electrolyte. The correct way to measure the specific gravity of battery electrolyte is at 20°C (68°F) atmospheric temperature, but actually it may be done at any atmospheric temperature and convert into the specific gravity at 20°C (68°F) according to the following formula.

$$S_{20} = St + 0.0007(t - 20)$$

Where, S_{20} . . Specific gravity at 20°C (68°F)
St . . Specific gravity measured
t . . Electrolyte temperature when measuring (°C)

Proper specific gravity is 1.260 at 20°C (68°F), and if less than 1.200, recharge the battery.

Check Fuel Strainer

Check and Adjust Distributor

Dwell Angle	49° to 55°
Contact Point Gap	0.45 to 0.55 mm (0.0177 to 0.0216 in.)
Contact Pressure	500 to 650 gr. (1.102 to 1.430 lbs)
Electric Capacity of Condensor	0.20 to 0.24 mf

Check the operation of the governor and vacuum controller. Refer to the item of the distributor concerning the advance characteristic of the ignition timing. Lubrication at the cam, heal of the point arm and pivot of the point arm.

Check and Adjust Spark Plugs

1. Adjust the spark plug gaps to 0.7 to 0.8 mm (0.0276 to 0.0315 in.).
2. Check for wear of electrodes
3. Check for carbon accumulation at the electrode.

Checking Ignition Timing

Check and adjust the ignition timing by strobo-lamp setting the engine speed at idle. Turn the distributor counter-clockwise when the crankshaft pulley notch is found at the right side of the "IG" mark that is embossed on the timing chain case. If the pulley notch is found at the left side of the "IG" mark, turn the distributor clockwise. Correct ignition timing is B.T.D.C. 7°. for H 20 engine and 12° for H 16 (R) engine.

Note: Distributor octane selector should be set in the center position.

Octane Selector Adjustment

Decide the ignition timing in accordance with the octance value of the fuel. To adjust it, with gear lever in top position and car speed within 15 to 20 km/h (9.3 to 12.4 miles/h), quickly accelerate the car speed. If slight knocking occurs and decreases gradually (at a speed above 40 km/h (25 miles/h)), the adjustment is OK.

Adjustment of Valve Clearance

Valve clearance adjustment should be performed while the engine cooling water temperature is below 30°C (86°F). Standard valve clearance of the intake and exhaust valves should be 0.525 mm (0.0206 in.).

Adjustment of Timing Chain

1. First timing chain adjustment
   Loosen the lock nut of the adjusting screw with engine idling and when screwing the adjusting screw in, idling noise will decrease gradually, more screwing in, will cause the noise to increase again. Back off screw slightly from this point and fix the adjusting screw firmely with the lock nut.
2. Second timing chain adjustment
   Before starting the engine, loosen the adjusting screw lock nut and screw the adjusting screw in fully by hand, then tighten the screw one half turn more using a torque wrench at about 0.6 to 0.8 m-kg (4.34 to 5.79 ft-lbs) torque, and lock the adjusting screw with the lock nut.

Measurement of Compression

1. Warm up the engine.
2. Remove the ignition high tension wire.
3. Remove all spark plugs.
4. Open the throttle valve fully and crank the engine with starter motor, measure the compression by a compression gage.
5. Standard value of compression
   : over 11 kg/cm² (156.42 lb/in²) at about 300 rpm.
   : allowable difference in compression pressure between cylinders should not be more than 1.5 kg/cm² (21.33 lb/in²).
   : lower limit compression should be over 9.5 kg/cm² (135.09 lb/in²).

Checking and Adjusting Carburetor

1. Check that the fuel level in the float chamber corresponds to the fuel level line. This should be performed with the engine idling.
2. Remove the intake manifold suction hole plug and fit the vacuum out put nipple and connect the vacuum gage.
3. Screw the idle adjusting screw in fully then back out the screw one and half turn.
4. Adjust the engine idling by turning the throttle adjusting screw.
5. Adjust the idle adjusting screw so that the vacuum gage indicates maximum value and the engine revolution becomes stable.
6. With air cleaner in place, adjust the throttle adjusting screw again so that the engine idles at an idle speed of 550 rpm.
7. Standard value of vacuum pressure is over 450 mm-hg. In case the vehicle has not completed running-in, vacuum pressure should be over 400 mm-hg.
8. Checking acceleration pump operation.
   As the engine is stopped, open the throttle valve fully, from the fully closed position suddenly and check if fuel is injected from the pump jet.

MEMO

SERVICE MANUAL

-16(R) & H20 ENGINES

NISSAN

SECTION EL

ENGINE LUBRICATION SYSTEM

EL

OIL PUMP

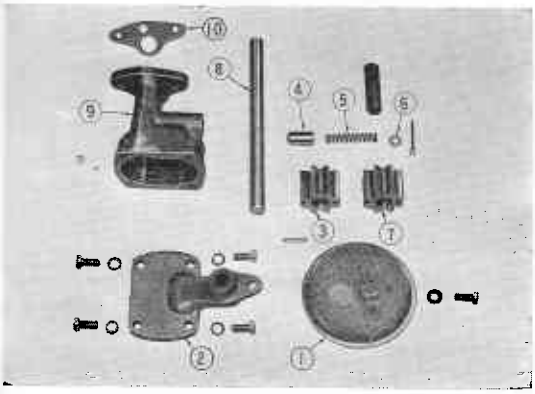


Fig. EL-1 Component Parts of Oil Pump

1. Oil Screen
2. Cover
3. Drive Gear
4. Regulator Valve
5. Regulator
6. Adjusting Shim
7. Driven Gear
8. Packing
9. Body
10. Gasket

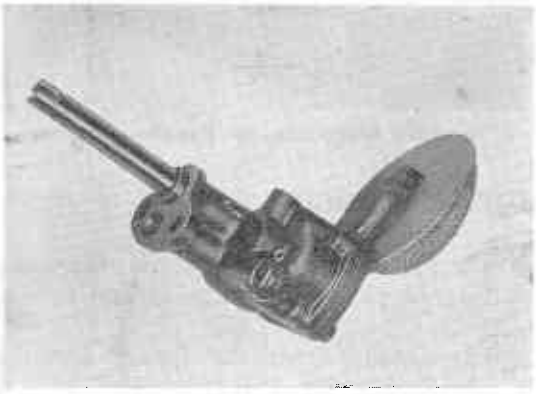


Fig. EL-2 External View of Oil Pump

DISASSEMBLY

1. Remove strainer.
2. Separate body from cover.
3. Take out shaft assembly and driven gear.
4. Draw out cock pin and take out shim, spring and valve.

INSPECTION

1. Inspect all components after cleaning them in kerosene.
2. Check the clearance between shaft and body bore.
   If the clearance is in excess of the limit, the worn part should be replaced.

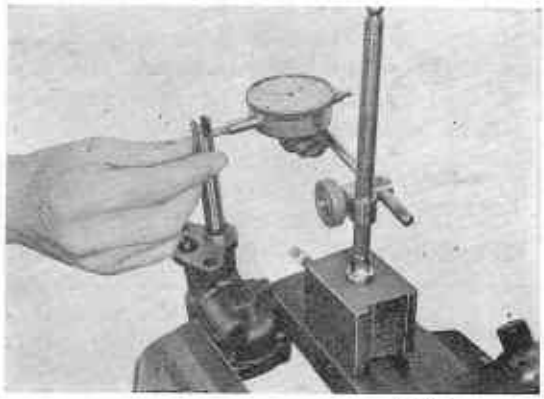


Fig. EL-3 Inspecting Drive Shaft

Drive Shaft Dia.	12.958 to 12.976mm	0.5105 to 0.5108 in.
Drive Shaft-to-Body Clearance	0.024 to 0.069mm	0.0009 to 0.0027 in.
Wear Limit	0.10 mm	0.0039 in.

3. Check the clearance between body and gear tooth point. If the clearance exceeds the limit, the worn part should be replaced.

Body-to-Gear Tooth Point Clearance	0.17 to 0.3 mm	0.0066 to 0.0157 in.
Wear Limit	0.4 mm	0.015 in.

4. Inspect gear backlash. If the backlash is in excess of 0.5mm (0.019 in.), replace the gear.

Gear Backlash	0.3 to 0.4 mm	0.0066 to 0.0118 in.
Wear Limit	0.5 mm	0.019 in.

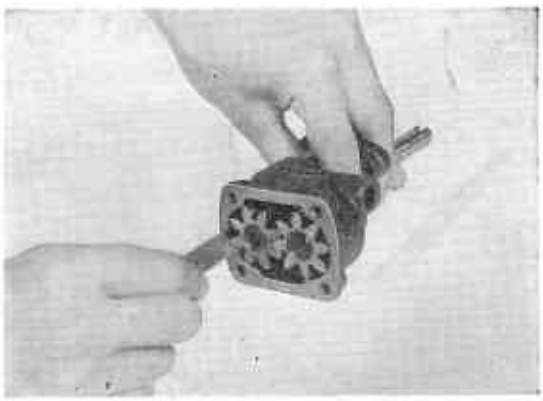


Fig. EL-4 Checking Clearance between Body and Gear

NOTE: The specified tightness of the drive gear to the shat is +0.028 to −0.008mm (+0.0011 to −0.0003 in.). Select a new gear which satisfies the specified value. Use a press to press in the gear.

5. Inspect the clearance between gear and a straight edge placed across the body. Should the clearance be in excess of the limit, resurface the underside of the body.

Cover-to-Gear Clearance	0.04 to 0.11 mm	0.0016 to 0.0043 in.
Wear Limit	0.3 mm	0.0118 in.

Fig. EL-5 Checking Gear Backlash

6. Check cover for wear or step wear, especially the gear contact points. Plane it off, if necessary.
7. Inspect valve cover.

Spring Free Length	41.5±1 mm	1.633 44 ±0.039 in.
Assembled Length	30.3 mm	1.192 in.
Compression Load	2.24 kg	4.94 lbs.

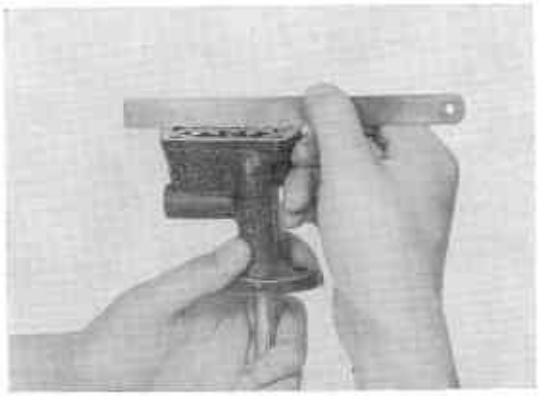


Fig. EL-6 Checking Gear Head Clearance

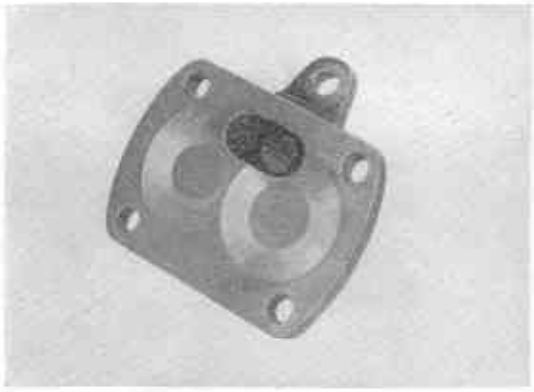


Fig. EL-7 Inspecting Body Cover

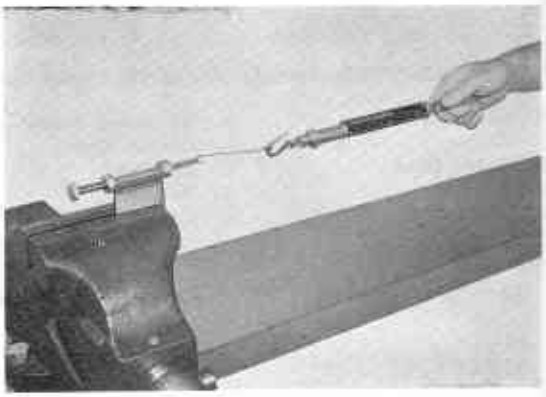


Fig. EL-8 Inspecting Oil Regulator Spring

ADJUSTING REGULATOR

1. Insert valve in the body and measure the distance (A) from the valve end to cotter pin.
2. The distance from the spring contacting face inside the valve to the valve end amounts to 18mm(0.7086 in.). See Fig. EL-8.

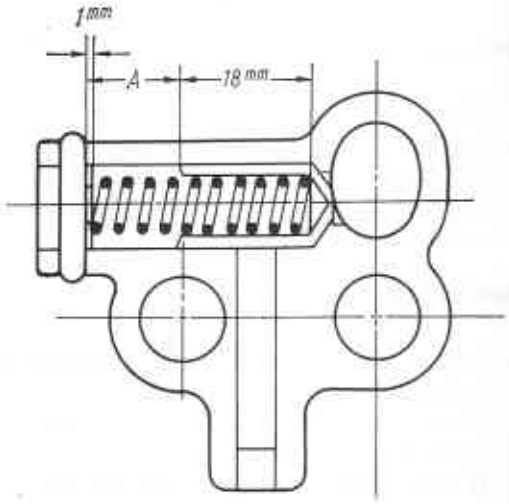


Fig. EL-9 Oil Regulator

On inspecting the above dimensions, determine the thickness of adjusting shim.
Shim thickness (A+18mm)–(spring length at compression load 2.24 kg)

Item	1mm	2mm
Adjusting Shim	15136-58000	15137-58000

By above mentioned adjustment, a regular oil pressure of 3.0 to 3.5 kg/cm² (42.6 to 49.7 lb/in.²) is maintained.

Oil Pump Performance—Reference—

Oil to be used: MS. No.20 at temperature 80°C(170°F)

Pump R.P.M.	Output Pressure		Output Amount	
	kg/cm²	lb/in.²	l/min.	Quart/min
600	2.5	35.5	above 6	6 1/3
2200	2	28.4	above 25.5	26 9/10

MEMO

SERVICE MANUAL

H16(R) & H20 ENGINES

NISSAN

SECTION CO

ENGINE COOLING SYSTEM

CO

WATER PUMP

DISASSEMBLY

1. Remove pump cover.
2. Remove lock wire.
3. Remove hub by using a puller. When it is necessary to replace shaft or hub, replace them as a pair.
4. By using a press, press out shaft, and vane, seal and seat are taken out together.

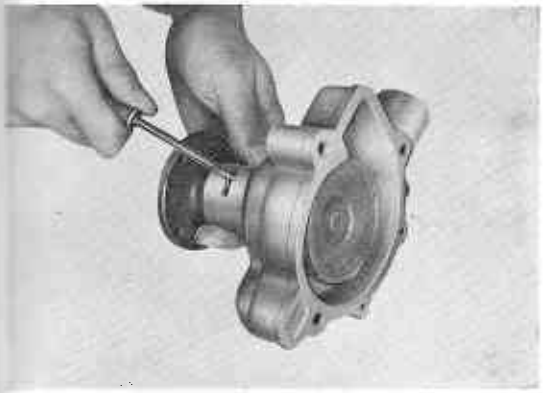


Fig. CO-1 Removing Lock Wire

Fig. CO-2 Removing Hub

INSPECTION

1. Worn seal should be replaced.
2. Check vane for rust and corrosion. Replace it if it is excessively damaged.
3. Inspect body and cover for rust and corrosion. Replace if necessary.
4. Rotate bearing. Replace it if a sign of abnormality is found.
5. When the pump produces an abnormal sound with engine running, replace (1) seal and then (2) bearing.

NOTE: To stop the noise at the seal part, Nissan C.S.P. (Cooling System Protector) is recommend. See Fig. CO-5.

6. Weakened and damaged seal spring should be replaced.

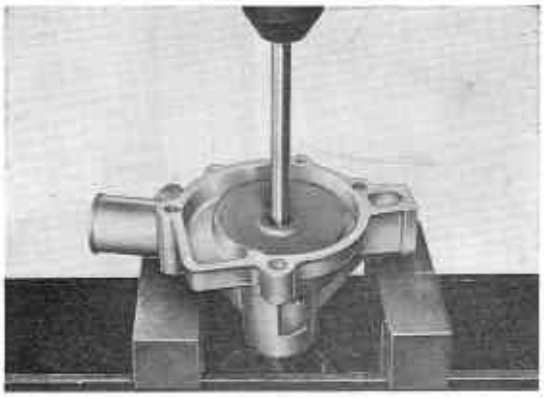


Fig. CO-3 Removing Shaft

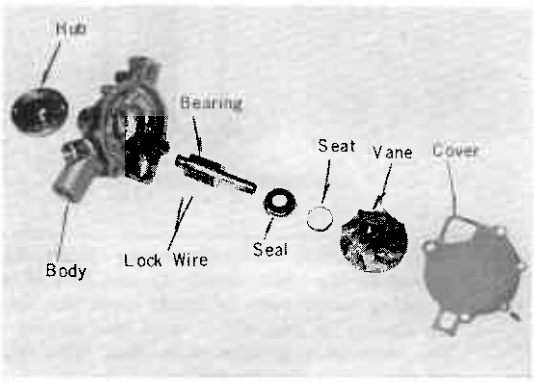


Fig. CO-4 Components of Water pump

Fig. CO-5 Cooling System Protector

ASSEMBLY

Reverse a disassembly procedure, taking care to following points. First, press shaft into the body.
With B face being lined up, lock wire groove should be centered to body slot with an error of ±0.25mm (0.0098 in.).

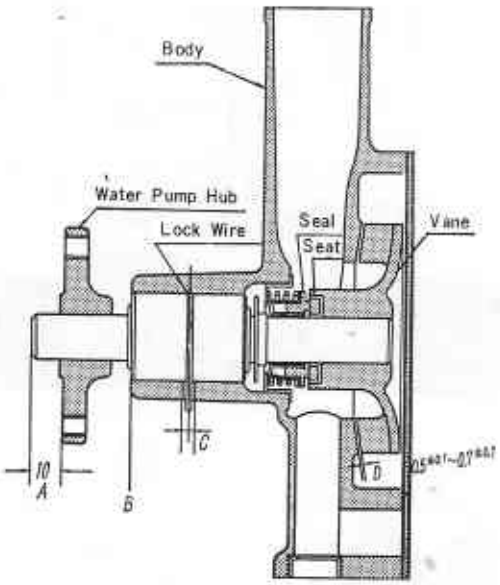


Fig. CO-6 Assembling Water Pump

NOTE: Take care not to scratch the shaft, and press in the shaft until the end face of the bearing outer race is flush with the body as shown in Fig. CO-6, and the center of the lock wire groove is in line with that of the body slot as indicated by (C).

1. Press seal into shaft.
2. Insert seat in vane. The seat should be placed squarely in the vane.
3. Thoroughly clean seal and seat faces with dry cloth.
4. Coat body and seal contacting faces with #1 or #2 Three Bond sealant (or equivalent).
5. Press vane into the body, adjusting the clearance (D) in Fig. CO-6 to 0.5 to 0.7 mm (0.019 to 0.028 in.), with a pressing force of above 700kg (1542 lbs).
6. Press in hub with a pressing force of above 700kg (1542 lbs) taking care not to disturb the dimension (D).
7. Insert lock wire with a light hammer tapping.
8. Install cover.

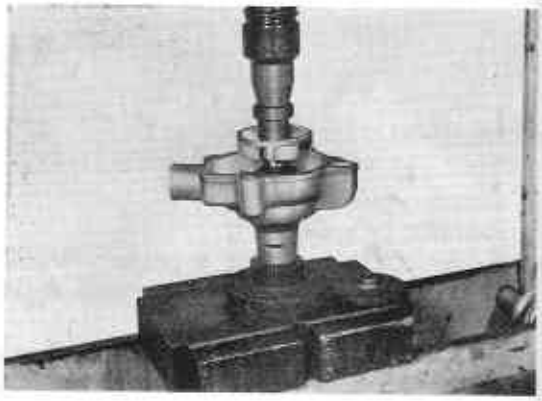


Fig. CO-7 Pressing in Vane

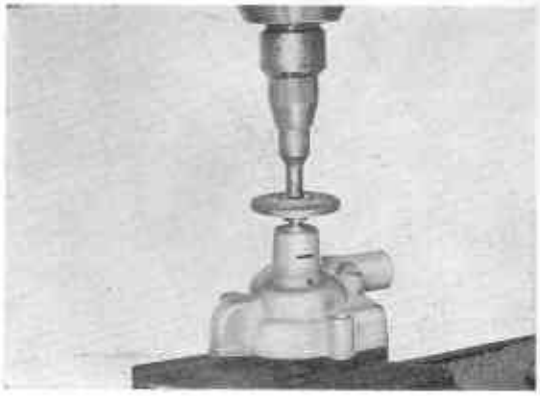


Fig. CO-8 Pressing in Hub

ERVICE
ANUAL

6(R) & H20
ENGINES

NISSAN

SECTION EF

FUEL SYSTEM

EF

CARBURETOR

CONTENTS

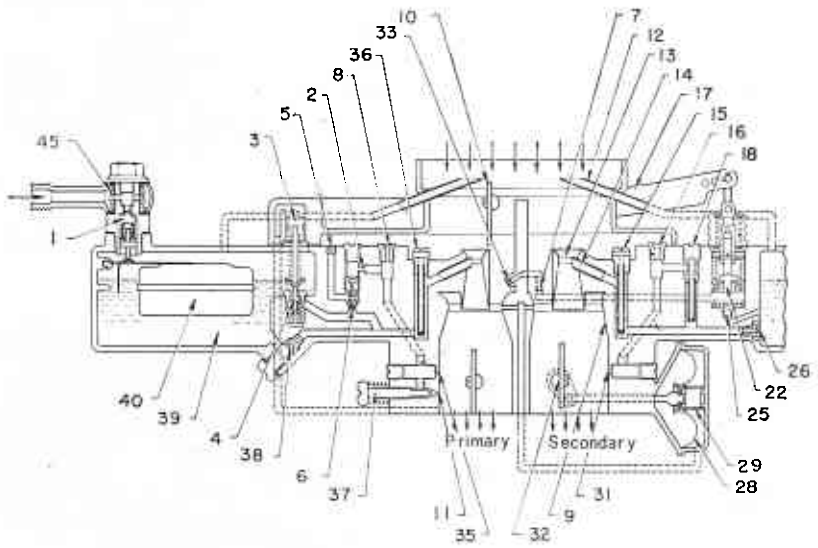


Fig. EF-1 Construction of Carburetor

1. Float Needle
2. Slow Economizer
3. Vacuum Piston
4. Power Jet Valve
5. Primary Slow Air Bleed Jet
6. Slow Jet
7. Discharge Check Valve
8. Secondary Slow Air Bleed Jet
9. Secondary Large Venturi
10. Choke Valve
11. Idle Port
12. Air vent Pipe
13. Secondary Small Venturi
14. Secondary Main Nozzle
15. Secondary Main Air Bleed
16. Step Air Bleed Jet
17. Pump Lever
18. Step Jet
22. Pump Plunger
25. Pump Valve
26. Secondary Main Jet
28. Diaphragm
29. Diaphragm Spring
31. Step Port
32. Secondary Throttle Valve
33. Pump Jet
35. Slow Port
36. Primary Main Air Bleed
37. Idle Adjust Screw
38. Primary Main Jet
39. Float Chamber
40. Float
45. Strainer

Fig. EF-1 Construction of Carburetor

SPECIFITCATIONS

Unit : mm

Model	D3034A-13A, 9C, 8B & 11C		D2832A-4A	
	Primary	Secondary	Primary	Secondary
Dia. of Air Horn	75	80	75	80
Bore Dia.	30	34	28	32
Venturi Dia.	24×14×7	30×16×8	21×8.8	27×16×8
Float Level	22+1 above body upper face		22+1 above body upper face	
Valve Seat Dia.	2.7		2.7	
Main Jet	1.16	1.75	1.00	1.45
Slow Jet	0.58	0.80	0.58	0.58
Main Air Bleed	0.50	0.80	0.60	0.60
Emalsion Hole	0.50	0.50	0.50	0.60
Slow Air Bleed No. 1	1.60	—	1.60	—
No. 2	1.70	2.20	1.20	1.20
Slow Economiser	1.80		1.80	
Idle Port Dia.	1.70		1.50	
Power Jet			0.40	
Main Nozzle Inside Dia.	2.3	2.8	1.8×2	2.5
Accel. Pump Piston Dia.	16		16	
Piston Stroke	1.6	2.6	2.2	3.3
Displacement (cc)	0.2	0.6	0.4	0.6
Pump Nozzle Dia.	0.4		0.6	
Throttle Valve Closing Angle	10°	20°	10°	20°
Choke Valve Closing Angle	10°		10°	

REMOVAL AND INSTALLATION

1. Remove air cleaner.
2. Remove fuel pipe.
3. Remove vacuum control tube.
4. Remove accelerator and choke wires.
5. Remove carburetor.
6. Installation is a reversal of the removal procedure.

DISASSEMBLY

To remove nuts and screws use suitable spanners and drivers, taking care not to scratch parts. Disassembled components should be placed in order for proper reassembly.

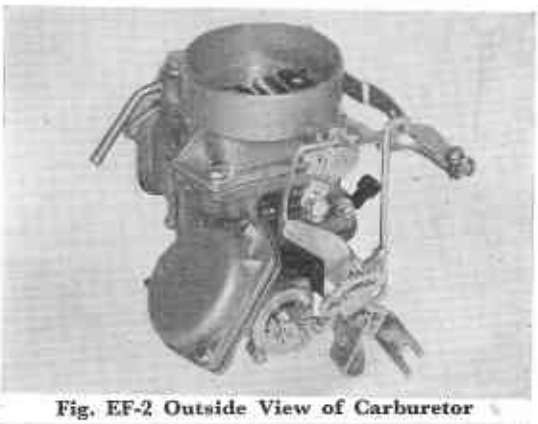


Fig. EF-2 Outside View of Carburetor

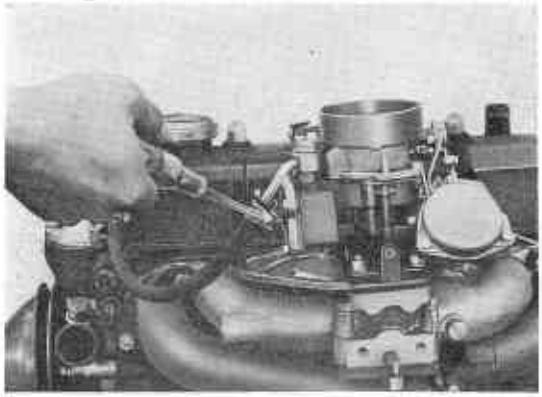


Fig. EF-3 Removing Piping

Fig. EF-4 Removing Air Horn

Carburetor Assembly

1. Remove the clip which locks choke connecting rod and throttle starting lever. To remove it place the point of a driver flat on the clip with the crevice facing upwards and lightly push it down. Take care that it does not jump off.
2. Remove pump arm and pump arm connecting rod.
3. Loosen idle vent by bending back the turned up finger of idle vent lock washer, and remove idle vent valve lever assembly, idle valve lever assembly, idle vent lock washer and idle vent gasket together.
4. Take off clip at pump arm shaft and remove pump arm from pump arm shaft carefully not to hit pump arm ring against pump rod bore.
5. Remove throttle choke holder by loosening air horn set screws and remove air horn gasket.
6. Withdraw pump plunger assembly upwards. When installing, insert it while turning it.
7. Loosen throttle shaft set nut and remove spring washer, primary throttle lever, pri-

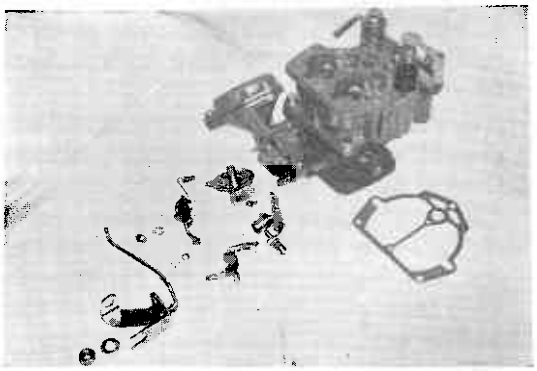


Fig. EF-5 Removing Linkage

Fig. EF-6 Removing Diaphragm Chamber

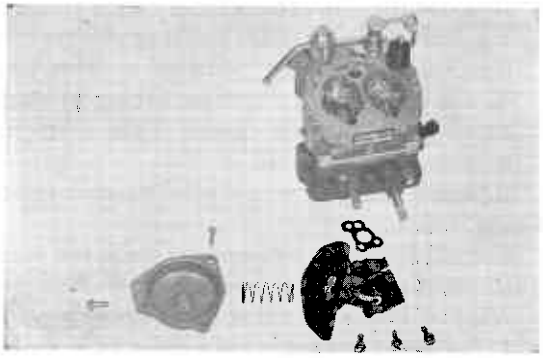


Fig. EF-7 Disassembling Diaphragm

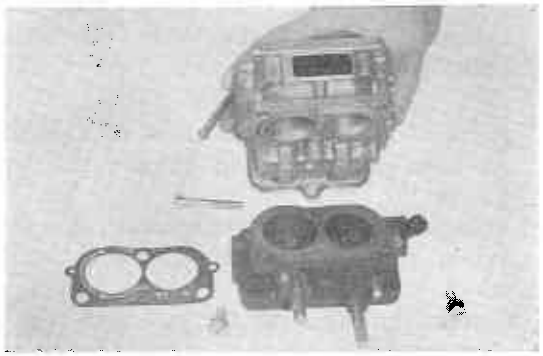


Fig. EF-8 Disassembling Body and Flange

mary throttle shaft arm and starting lever, in turn. Prior to this operation cotter pin and washer at throttle shaft lever link must be removed.

8. Release throttle lever set screw at secondary throttle valve shaft and remove secondary throttle lever, throttle return spring and diaphragm cover plate assembly.
9. Release clip pin of diaphragm connecting rod and remove secondary throttle shaft lever assembly. It will facilitate the operation to remove diaphragm connecting rod by suspending it outwards and to force it toward diaphragm.
10. Unscrew diaphragm chamber set screws and take off diaphragm chamber gasket.
11. Remove body from flange. Note one of the three set screws is screwed down from the flange side and it is the longest.

Body

1. Remove window sash gasket.
2. Remove window pane.
3. Take off window pane gasket, float pin collar, float and float valve assembly.
4. Release union bolt and take off gasket, fuel connector assembly, strainer and fuel connector gasket.
5. Loosen float valve seat and take it off together with float valve seat gasket.
6. Remove primary main air bleed and take out primary small venturi.
7. Take out secondary small venturi in the same manner.
8. Remove slow jet, slow air bleed, step jet and step air bleed.
9. Remove pump outlet valve plug and pump nozzle plug.

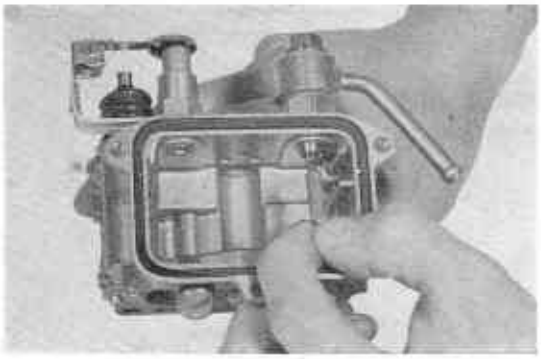


Fig. EF-9 Removing Float Valve

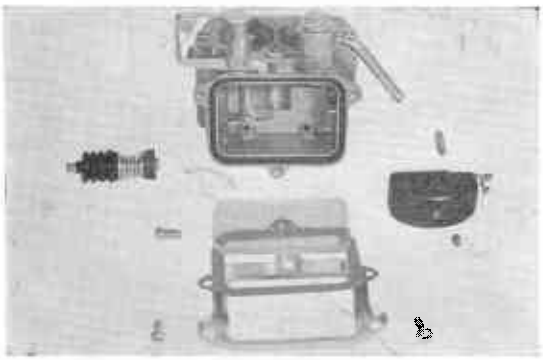


Fig. EF-10 Disassembling Float Chamber

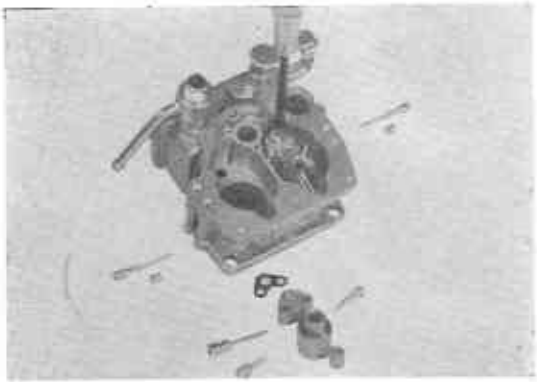


Fig. EF-11 Removing Small Venturi

10. Take out the weight and ball of pump outlet valve. When installing, place the ball on inner side.
11. Take out pump strainer clip at pump cylinder base and take out strainer and the ball of inlet valve.
12. Take off primary and secondary main passage plugs and remove main jets, respectively.

Air Horn

1. Remove choke valve connecting rod.
2. Releasing choke valve set screw, remove choke valve.
3. Withdraw choke valve shaft.
4. Remove choke shaft collar, choke shaft arm spring, choke lever ring, choke lever assembly and choke lever return spring, in turn.

Flange

1. Releasing idle adjust screw, remove idle adjust screw spring.
2. Remove slow port plug and step port plug and take out gaskets, respectively.
3. Releasing primary throttle valve set screw, remove primary throttle valve.
4. Remove secondary throttle valve in the same manner.
5. Take out primary and secondary throttle valve shafts.

INSPECTION

Cleaning

Disassembled components should be washed in clean gasoline. Clean harrow parts, such as fuel passage, of dirt by blowing out with compressed air. Do not use metal such as a piece of wire to clean the fine holes of jets.

Inspecting

1. Inspect float valve and seat contacting face. Replace if necessary.
2. Check filter for clog and deformation.
3. Check jets and air bleeds for clog and looseness.
4. Check idle adjust screw and seat contacting part for damage.
5. Check throttle valve shaft for wear.
6. Inspect smooth moving of linkage parts.
7. Fill float chamber with gasoline and inspect the injecting condition of gasoline from accelerating nozzle, by moving throttle lever.
8. Depress diaphragm connecting rod of diaphragm chamber assembly and block up vacuum passage with a finger. Then release the rod and check circumference of diaphragm and diaphragm for leaks.

ASSEMBLY

When assembling the carburetor, gaskets and packings should be replaced with new ones.

Carburetor assembly

Assembly is carried out by reversing the disassembly procedure. Choke linked opening and primary and secondary linked opening should be adjusted.
(See the clause "Adjustment.")

Body

Jets and main air bleed of primary side are of brass and have the color of its ground, while those of secondary side are plated silver.
Be sure float pin collar is placed properly in position after float having been installed to float pin. Adjust float.
(See the clause "Adjustment.")

Air Horn

Assembling air horn is a reversal of the disassembling procedure. Install and secure the choke valve tightly after adjusting the position and direction of the valve so that it is fully closed.
Apply bonding agent, properly prepared and mixed, to set screws to avoid them falling off.

Flange

Assemble flange by reversing the disassembling operations. When installing the primary and secondary valves, adjust them so that they are fully closed, and in the same manner as in the choke valve, tighten set screws after applying bonding agent to the screws. Adjust idle adjust screw and throttle adjust screw.

Diaphragm Chamber

Install diaphragm chamber to flange with gasket placed between them by means of three set screws.

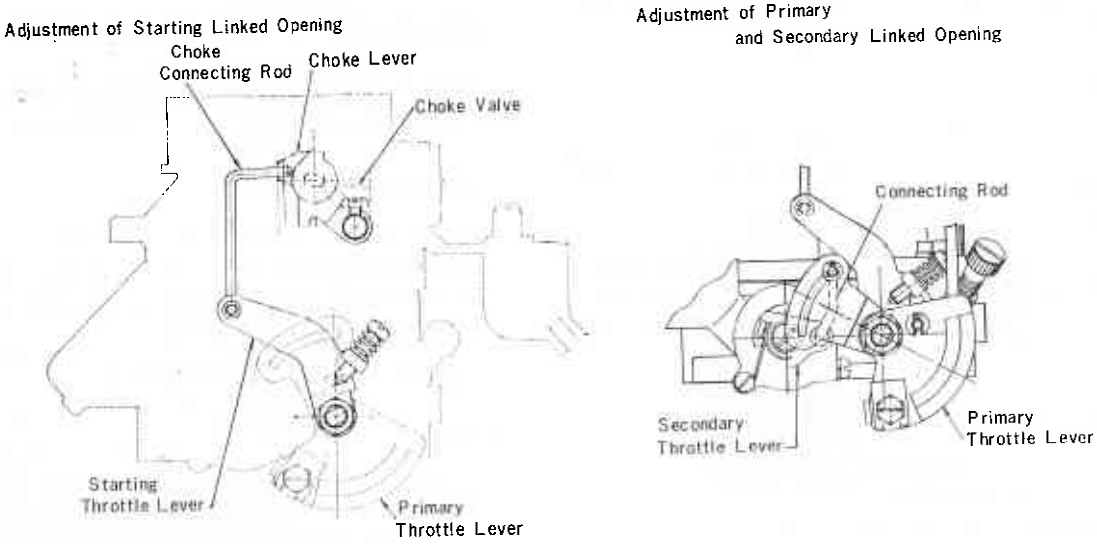


Fig. EF-12 Adjusting Carburetor

ADJUSTMENT

1. Adjusting Choke Linked Opening
   Measure the clearance between primary throttle valve and flange bore inner wall with choke valve fully closed. Adjust the clearance to 1.09 mm (0.043 in.) by bending choke connecting rod. When the clearance is the correct dimension, throttle valve should be open 14° from its fully closed position.
2. Adjusting Primary and Secondary Opening
   Measure the clearance between primary throttle valve and throttle chamber wall with the throttle valve open 52° from its fully closed position, as shown in the figure above.
   Adjustment Value : 7.85 mm (0.31 in.)
   See if throttle valve shaft link is in relative position to primary throttle lever as indicated in the figure above. Adjust secondary throttle valve by bending connecting rod so that the valve is in position just to start opening.
3. Float Level
   Adjust the position of float being lifted up. Place the body horizontally with float chamber facing upwards and further keep the body inclined 10 to 15° downwards at upper side of float chamber. The float then should be horizontal.
   Adjustment is made by increasing or decreasing metal plate gaskets at float valve seat.
   Adjust the position of float being lowered. Keep float chamber in its original posture and lower the float naturally. The minimum clearance between the float and base should be 0.8 to 1.2 mm (0.032 to 0.047 in.)
   Adjustment is made by bending float stopper.
   Idle adjustment. (See the clause "Engine Adjustment.")
   Jets. The larger numbers punched on jets to measure gasoline indicate richer fuel-air mixture, and the smaller numbers indicate thinner mixture. Main and slow air bleeds

are provided with passages to let air in to make thin fuel-air mixture.
The larger numbers indicate thinner mixture, and the smaller numbers indicate richer mixture.
This should be noted when the condition of the car requires to change its jets for those of other types.

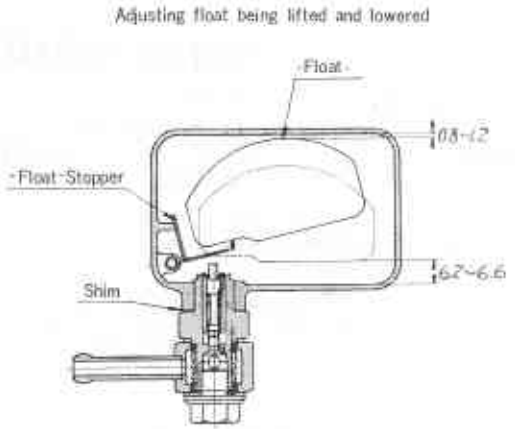


Fig. EF-13 Float Level

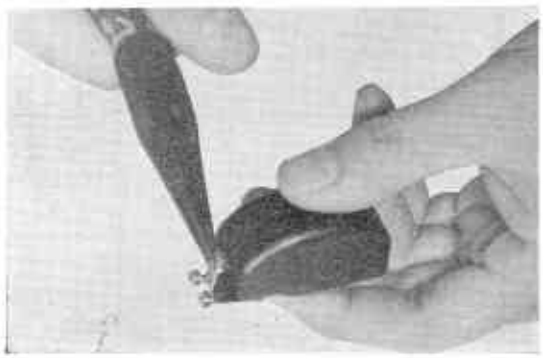


Fig. EF-14 Adjusting Float Stopper

MEMO

SERVICE MANUAL

H16(R) & H20

ENGINES

NISSAN

SECTION EE

ENGINE ELECTRICAL

EE

CHARGING SYSTEM

ALTERNATOR AND REGULATOR

CONTENTS

ALTERNATOR

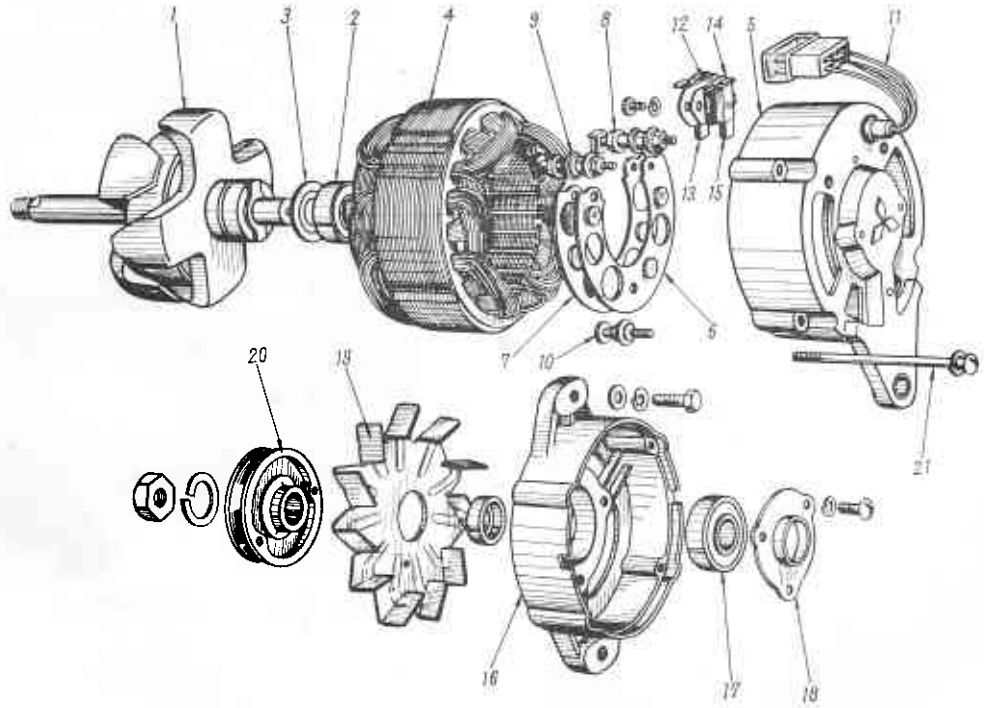


Fig. EE-1 Disassembling Alternator (AC500N1R)

1. Rotor Assembly
2. Ball Bearing
3. Spacer
4. Stator Assembly
5. Rear Cover Assembly
6. (−) side Diode Set Plate
7. (+) side Diode Set Plate
8. Terminal (Battery side)
9. Terminal (Ground side)
10. Set Screw (Diode Set Plate)
11. Connector
12. Brush Holder ((+) side)
13. Brush ((+) side)
14. Brush Holder ((−) side)
15. Brush ((−) side)
16. Front Cover
17. Ball Bearing
18. Bearing Retainer
19. Fan
20. Pulley

CONSTRUCTION

1. Front Cover : The front bearing is secured to the front cover by the retainer.
2. Rotor : The field coils are wound round the rotor and the rear bearing and slip rings are pressed in. The fan and driving pulley are installed to the shaft in front of the front cover.
3. Rear Cover : The connector, brush holders and diode set plates are installed to the rear cover. The BAT terminal and E terminal, which come from the armature through the rear cover, are also secured to the rear cover.
   The (+) side brush holder and diode set plate and BAT terminal are insulated from the cover.
4. Stator : The armature coils are wound round in the stator. The stator is installed between the front cover and rear cover and secured by through bolts.

REMOVAL AND INSTALLATION

1. Remove battery terminal.
2. Disconnect the wiring of connector, ground wire (black) and output BAT ter minal (white).
3. Remove fan belt adjust bolt.
4. Remove fan by releasing the setting bolt.
5. Remove alternator.
6. Installation is a reversal of the removal.

Fig. EE-2 Removing Alternator

DISASSEMBLY

1. Separating Rotor and Stator
   Withdraw through bolts. Pry and separate rotor and stator by inserting a driver in a hole at rotor rear side circumference.

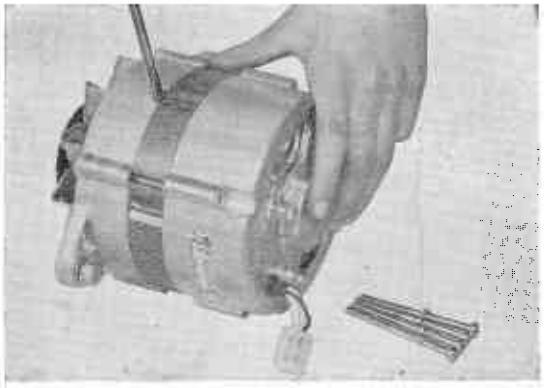


Fig. EE-3 Separating Rotor and Stator (1)

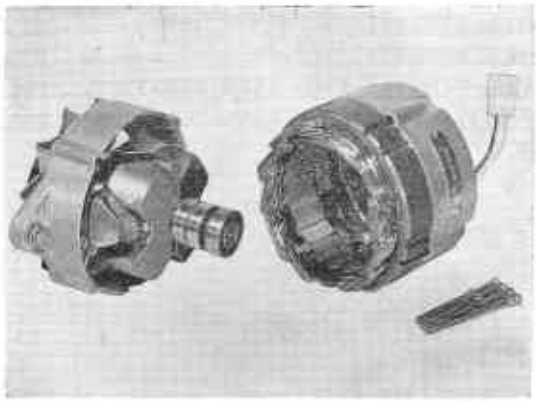


Fig. EE-4 Separating Rotor and Stator (2)

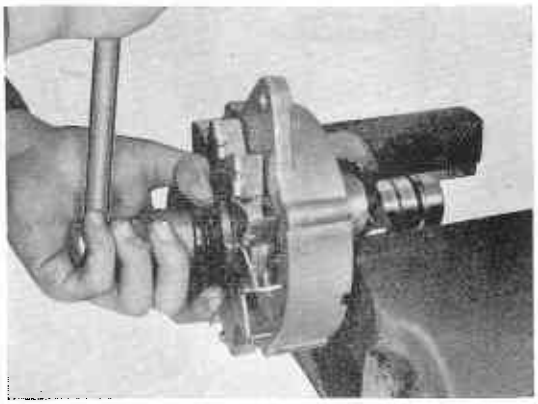


Fig. EE-5 Removing Pulley Securing Nut

In assembling, tighten the through bolts after making sure that the rotor and stator are properly centered by inserting a bar into the bolt hole.

2. Removing Pulley and Fan
   Clamp the rear fingers in a vise, taking care not scratch or bend the fan.
   Release pulley securing nut and remove pulley, fan, collar, key and the like.

3. Separating Rotor and Front Cover
   Remove pulley securing nut and lightly tap front cover with a plastic hammer, and rotor is easily taken out.
   Front side bearing is installed to front cover, secured by retainer.
   Remove retainer and beaing can be pulled out with a press.
4. Removing Brushes
   Remove brush holder set screws. Unsolder brush holder field side lead wire and remove brush holders. Cut the pig tail of the brush to abandon and take it out. Unsolder the remaining pig tail.

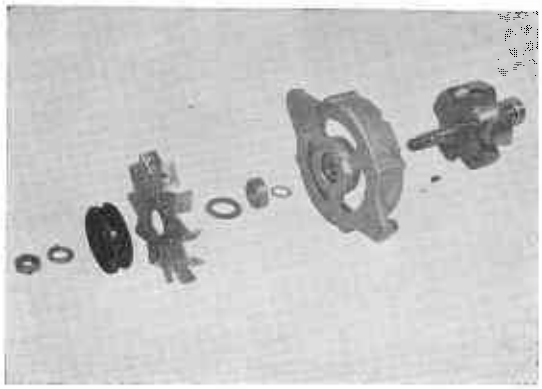


Fig. EE-6 Separating Rotor and Front Cover

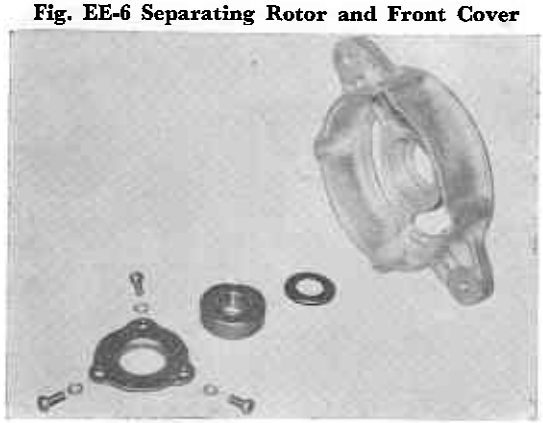


Fig. EE-7 Removing Front Side Bearing

Fig. EE-8 Removing Brush Holder

5. Separating Stator and Rear Cover
   Carefully remove stator coil lead wires which are soldered to three (+) and (−) diodes each. Pull stator off rear cover. Unsolder stator neutral and connector N terminal lead wire (yellow) connection.
6. Removing Diode Set Plates
   Remove BAT terminal and E terminal nut at the rear cover. Releasing diode set plate setting screw, remove diode set plates.
7. Replacing Ball Bearing
   By use of a special tool as shown in Fig. EE-14, pull out ball bearing with a puller. Grease bearing, if necessary.
   Press the new bearing down on rotor shaft with a press. (up to spacer) Removed bearings cannot be reused.

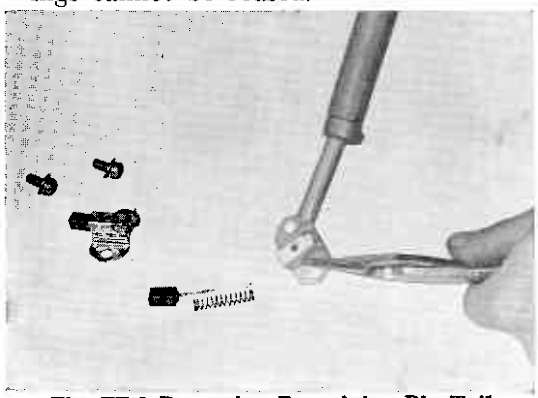


Fig. EE-9 Removing Remaining Pig Tail

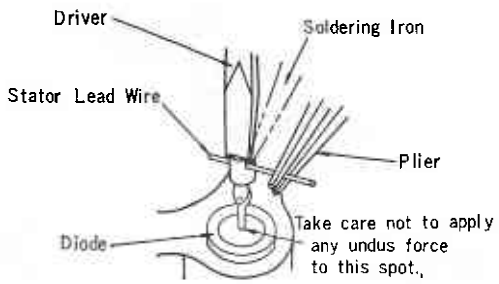


Fig. EE-10 Removing Stator Coil Lead Wire

Fig. EE-11 Removing Stator

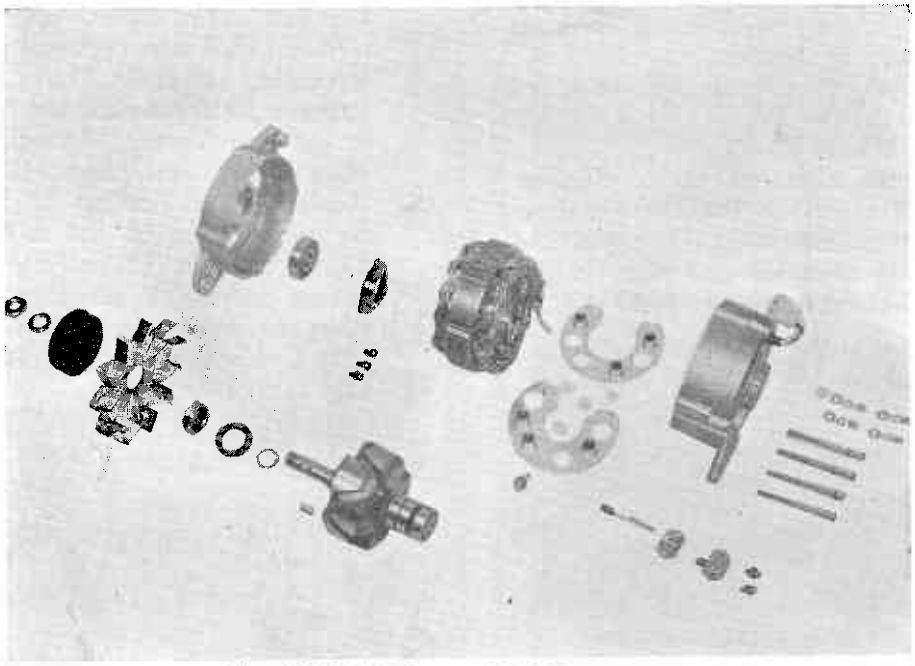


Fig. EE-13 All Disassembled Components

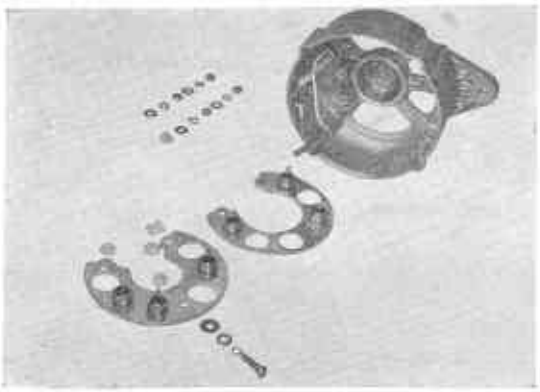


Fig. EE-12 Removing Diode Set Plates

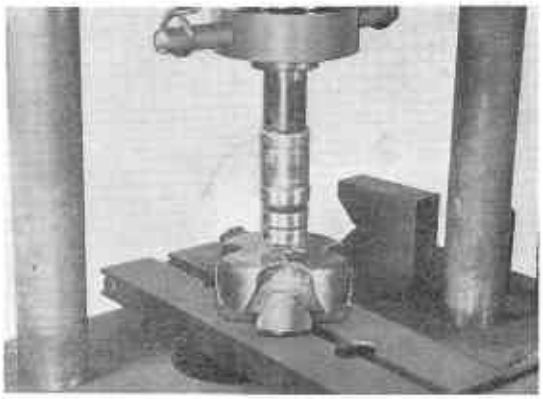


Fig. EE-15 Pressing down Bearing

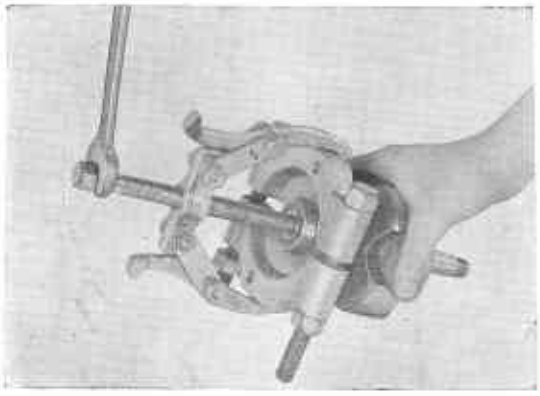


Fig. EE-14 Pulling out Bearing

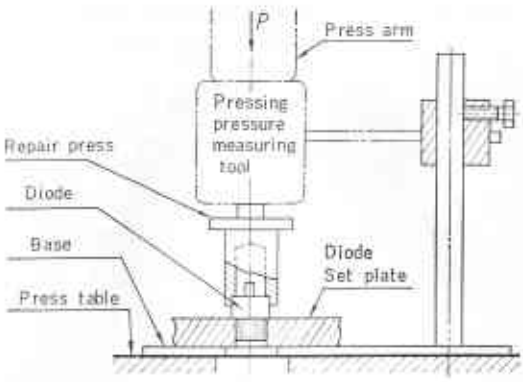


Fig. EE-16 Pressing in Diode

8. Replacing Diode
   Toreplace diodes a special repair puller and a repair press are used.
   If temperature inside the diode rises above 150°C, diode function is badly affected.
   Be sure that unsoldering operations at the diode must be carried out within approx. 20 seconds using an electric iron of 100-200 W.
   There are two kinds of diode: one with red punched letters on its bottom, and the other with black punched letters. The "red" diode shuld be installed to the (+) side diode set plate, and the "black" diode to the (−) side diode set plate.

ASSEMBLY

Assembling the alternator is carried out by reversing the disassembling operations.

INSPECTION AND ADJUSTMENT

Rotor

1. Outside inspection
   Inspect rubbing surface of slip rings for cleanliness and roughness. Polish it with #500-600 sandpaper if it is rough. The scored surface can be resurfaced up to 0.6 mm (0.024 in) in diameter.
2. Testing rotor (field) coil for continuity
   Rotor coil is tested for continuity by placing the points of a circuit tester or an ohmmeter on slip rings. If there is no resistance, the coil is open.
   Rotor coil resistance ..... 5.33Ω (20°C)
3. Testing rotor coil for ground
   The coil is tested for ground with one tester point on slip ring and the other on shaft or rotor. If any resistance is read, either coil or slip ring is grounded. Replace the rotor.

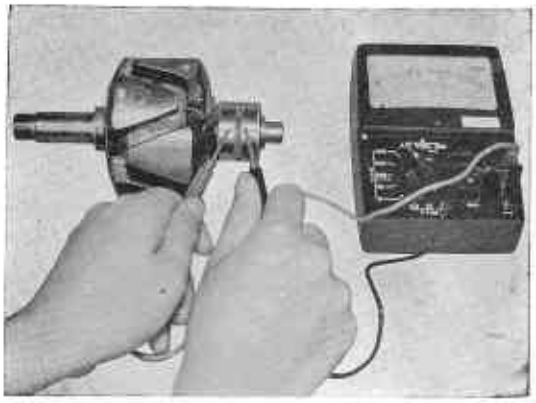


Fig. EE-17 Testing Rotor Coil for Continuity

Fig. EE-18 Testing Rotor Coil for Ground

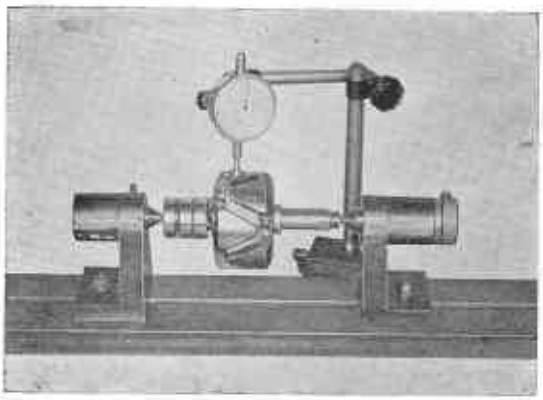


Fig. EE-19 Testing Rotor for Run-out

4. Rotor Run-out
   Check rotor for run-out with a dial gauge as shown in Fig. EE-19. If the run-out is in excess of 0.10 mm, correct or replace the rotor.

Stator

1. Testing stator (armature) coil for continuity
   Stator coil is tested for continuity by placing one tester point on one of the stator coil lead wires (wiring to diode) and the other on N terminal connected to lead wire N (yellow). Repeat this operation for the rest of the coil lead wires. If th ere is any resistance, the winding continuity is O.K.
2. Testing stator coil for grond
   The coil is tested for ground with one tester point on one of the lead wires (including N terminal) and the other on stator core. There should be no resistance.

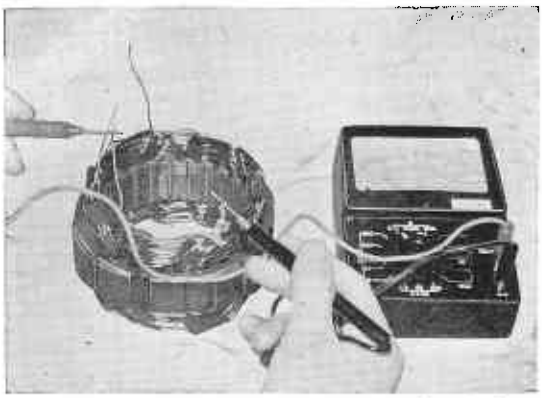


Fig. EE-20 Testing Stator Coil for Continuity

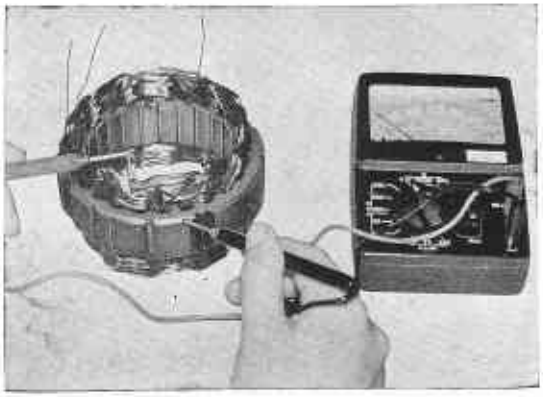


Fig. EE-21 Testing Stator Coil for Ground

Diode

1. Few mechanical troubles are found in the alternator, while most of troubles are caused by damaged diodes due to careless treatment. When charging is insufficient, inspect diodes first before checking the other parts of the alternator.
2. Inspect diodes without disassembling the alternator. Disassembling and inspecting each individual diode are carried out only when diodes are found to be out of order.
3. Without disassembling the alternator, diodes can be tested by use of a battery and a lamp, as described below. (A tester can be used instead of the battery and lamp.)
   1). Inspecting (—) side diode
   Connect battery (—) terminal to connector A terminal (white) and battery (+) terminal to connector N terminal (yellow) as shown in Fig. EE-22.
   The lamp in the circuit should light up. (Use a lamp of 2-10 W.) Connect (+) terminal and (—) terminal reversely. If the lamp does not light up, (+) side diodes are in order.
   2). Inspecting (—) side diode
   Connect battery (—) terminal to connector N terminal (yellow) and battery (+) terminal to connector E terminal (black) as shown in Fig. EE-24.
   The lamp in the circuit should light up.
   If, on reversing (+) and (—), the lamp does not light up, (—) side are in order.

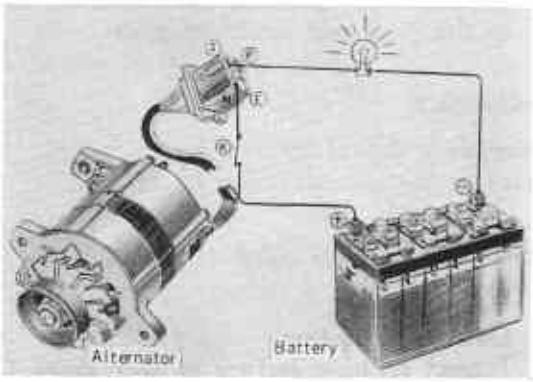


Fig. EE-22 Inspecting (+) side Diode (1)

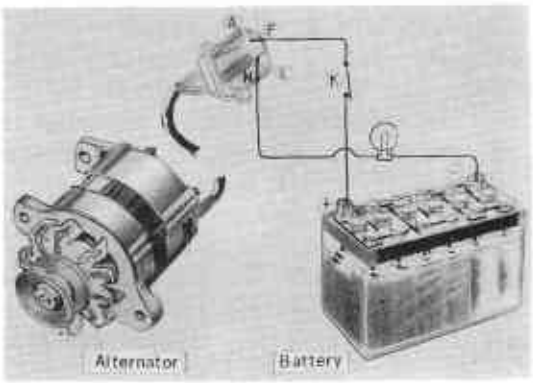


Fig. EE-23 Inspecting (+) side Diode (2)

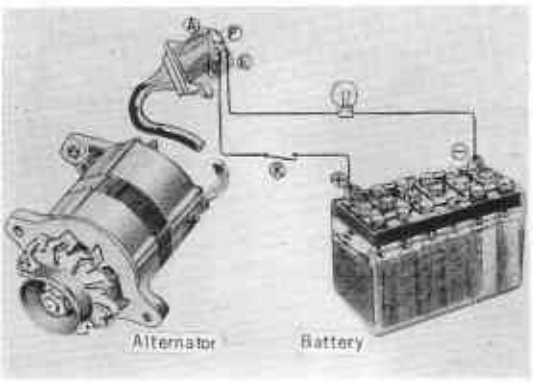


Fig. EE-24 Inspecting (—) side Diode (1)

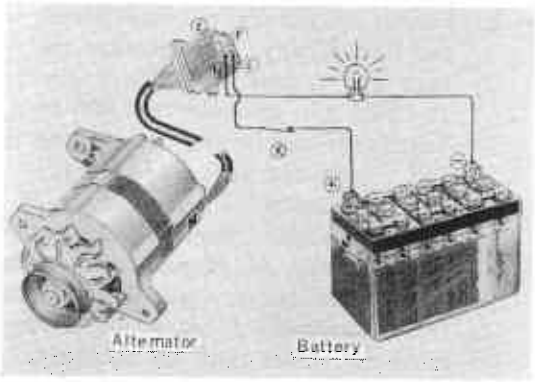


Fig. EE-25 Inspecting (—) side Diode (2)

NOTE: When diodes are inspected with a tester, in testing both (+) and (—) sides, if one direction shows a high resistance and the reverse shows a low resistance, the diodes are in order.
The current direction of the diode is indicated by the color of punched marking on the bottom, as Fig. EE-26 shows.

3). Inspecting individual diode
Remove (+) side diodes pressed in diode set plate and (—) side diodes pressed in rear cover. Each diode is tested with a tester for continuity in both one and reverse directions. The diode is satisfactory if one direction shows a high resistance and the reverse direction, a small resistance.

4). Diode troubles
In preceding tests, if, in both directions, the lamp lights up, or there is a low resistance, the diode is shorted.
If, in both directions, the lamp does not light up, or there is a high resistance, the diode is open.

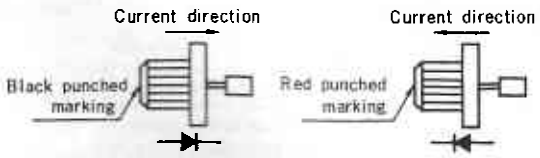


Fig. EE-26 Distinguishing Diodes

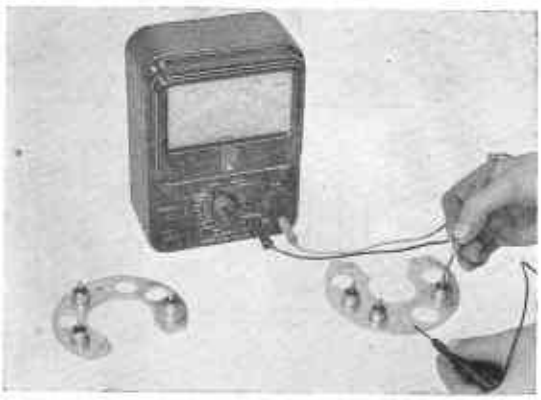


Fig. EE-27 Inspecting Individual Diode

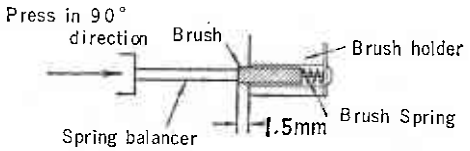


Fig. EE-28 Measuring Brush Spring Tension

Brush

1. Inspecting wear of brushes
   Overall length 12 mm(0.47 in)
   Wear limit 7 mm(0.28 in)
2. Inspecting movement of brushes
   When the brush does not move properly, inspect the inside of brush holder for dirt. Clean it if found necessary.
3. Measuring spring tension
   Press the brush until it protrudes at the brush holder by 1.5 mm (0.059 in) spring tension is below 200 gr, replace the brush.
   Spring tension of
   a new brush.....350 gr Ω 15%

PERFORMANCE TEST

No Load Test

1. Connect an ammeter and a voltmeter as shown in Fig. EE-29.
2. Turn on the switch K_1, and excite the rotor of the alternator.
3. Rotate the alternator and increase its speed gradually until there is no reverse current to the rotor coil. (Approx. 2 A) Turn off the switch K_1.
4. Further increase the alternator speed and read the speed when the voltmeter shows 14 V. Be sure that the speed must be below 1,000 rpm.

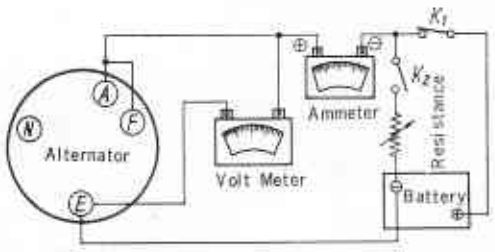


Fig. EE-29 Meter and Instrument Connection for No Load Test

Load Test

1. Make load resistance maximum so that almost no load current flows.
2. Turn on the switches K_1 and K_2, and increase the alternator speed until the load current reaches the specified value, 35.5 A.
3. Be sure that the speed then must be below 2,500 rpm.

Simple Inspecton with Althernator Installed to the Vehicle :

—Supplementary inspecting tool—

1. It is recommended to use a supplementary inspecting tool. It has two connectors at its both ends and wires come out at one end.
2. The tool may be properly long. Attach ON-4P-AF type (male type) connector to one end and CN-4P-AM type (female type) connector to the end.

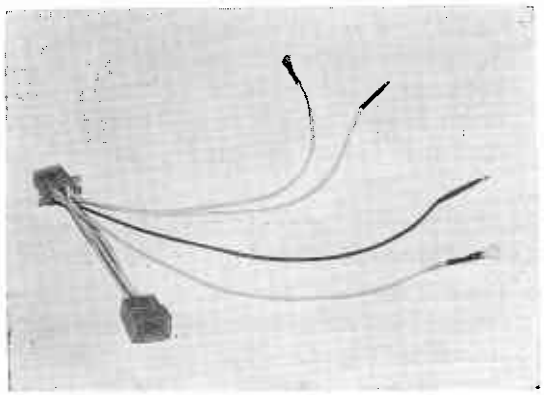


Fig. EE-30 Supplementary Inspecting Connector

—Inspecting method—

Voltmeter connection :

Connect a voltmeter between A-E by use of the tool described above.

Ammeter connection :

Connect an ammeter between BAT terminal at rear part of the alternator and wire coming from the battery.

Rotate the engine :

1. Switch on the lights, and heater and the like, if any, and measure the voltage and current when the engine idles at 1,000 rpm and above 2,000 rpm.
2. Switch off the headlights and the like, and repeat the above operation.
3. The alternator is satisfactory if its output changes correctly in response to the condition of engine rotation and load. The battery should be almost fully charged. If it is overcharged, different values may be obtained.

—Using alternator tester—

The alternator can be tested by use of a tester according to the instructions. The alternator is in order if it satisfies the characteristic.

Fig. EE-31 Alternator Tester (I)

Fig. EE-32 Alternator Tester (2)

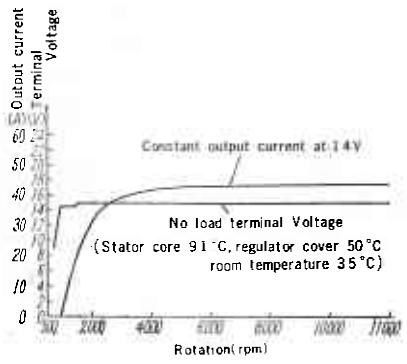


Fig. EE-33 Regulator Characteristic Curve

ADJUSTMENT STANDARDS

Item				
Brush	Standard height		(mm)	7
	Wear limit		(mm)	7
	Spring tension		(gr)	350+15%
Rotor coil resistance			(Ω)	5.33 (20°C)
Stator coil resistance			(Ω)	0.104 (20°C)
Shaft	Front side	Standard dimension		17 dia. × 47 dia. × 14
		Ball bearing		6303—2RU—C3
	Rear side	Standard dimension		15 dia. × 35 dia. × 11
		Ball bearing		6202—2RU—C3

REGULATOR

REMOVAL AND INSTALLATION

1. Disconnect battery terminal, by way of precaution.
2. Disconnect regulator wiring (connector).
3. Releasing setting screw, remove regulator.
4. Installation is a reversal of removal procedure.

INSPECTION OF SETTING VOLTAGE

The most suitable voltage required to charge the battery varies as the electrolyte temperature changes. It will help to prolong the life of the battery to increase the charging voltage to avoid insufficient charging when the electrolyte temperature is low, and to reduce the voltage to protect the battery from overcharging when the electrolyte temperature is high. This regulator (RQ2220B) is of a temperature compensated type. It is designed to reduce charging voltage with the increase of temperature by using the temperature sensitivity of the bimetal attached to the adjusting spring installed to the armature.

Adjusting this regulator is rather a complicated job, as the conditions of temperature and installation vary measured value. It is recommended, therefore, that the operation is carried out at a maker's service shop not only during the warranty period but after the period expires.

The method of setting voltage test is described below for reference.

1. Remove the regulator. The regulator cover temperature has reached the ambient temperature before starting the test.
2. Connect a voltmeter and an ammeter and other instruments as shown in Fig. EE-34.

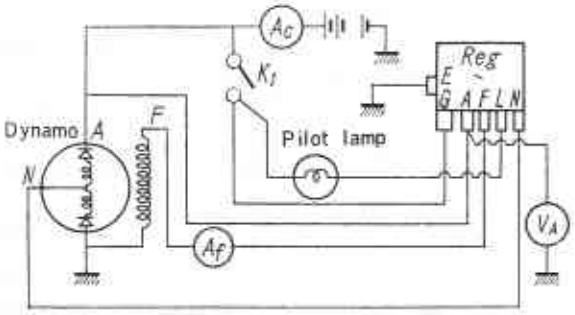


Fig. EE-34 Testing Method of Setting Voltage

3. Turn on the switch K_1, excite the alternator and rotate it with the driving system.
4. Increase the alternator speed gradually until the excited current (If) is approx. a half of the maximum of the current. Read setting voltage then (approx 1,300 rpm).
5. Further increase the alternator speed, and measure the voltage at 4,000 rpm. The values obtained in Items 4 and 5 should be within the specified values in relation to the temperature indicated in the figure below.

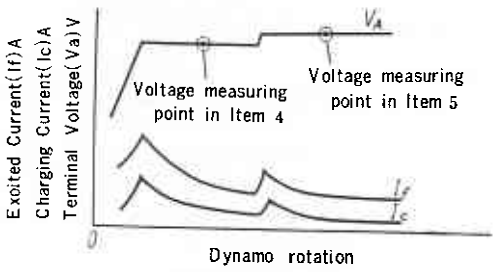


Fig. EE-35 Regulator Setting Voltage (1)

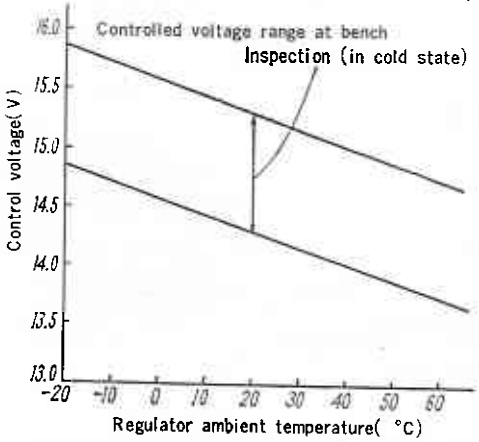


Fig. EE-36 Regulator Setting Voltage (2)

TROUBLE DIAGNOSIS AND CORRECTIONS

Symptoms	Items	Causes	Remedies
No output	Ammeter wiring	Broken or shorted wire, poor connection	Repair or replace
		Broken, grounded or shorted coil	Replace
	Alternator	Defective terminal insulation	Repair
		Poor silicon diode	Replace
	Regulator	Shorted or broken lead wire	Repair or replace
		No load voltage lower than specific voltage	Readiust
	Fan belt	Slackened or broken	Adjust or replace
	Wiring	Soon shorted or broken, poor connection	Repair or retighten
		Layer shorted rotor coil (Measure resistance in continuity test)	Replace
		Layer shorted stator coil	Replace

Low output and Bettery rather discharged	Alternator	One of three phase windings of stator coil being broken	Replace
		Dirty slip ring	Clean or polish
		Poor contact of brush	Repair
		Poor silicon diode	Replace
	Regulator	No load voltage lower than specific voltage	Readjust
		Dirty point, dirt in contact with point	Repolish
		Inside of coil resistor shorted	Replace
	Battery	Insufficient electrolyte	Replenish
		Defective plate	Replace
Excessive output and Battery rather overcharged	Wiring	Shunt dynamo produced by shorted A terminal circuit and F terminal circuit	Repair
	Battery	Inside shorted	Replace
	Regulator	Unusally increased on load voltage	Repair
		Poor ground of regulator	Correct ground
		Broken coil lead wire	Repair or replace
		Charge relay not open	Readjust
Unstable output current	Wiring	Poorly insulated part shorts or connects intermittently as the car shakes	Repair or replace
	Alternator	Soon layer shorted	Replace
		Broken brush spring	Replace
		Dirty slip ring	Clean
		Coil soon broken	Repair or replace
	Regulator	Incorrect setting voltage	Readjust
		Dirty point	Clean
	Switch	Defective key switch	Replace

NOTE: In inspecting charging condition by use of an ammeter, the ammeter should be checked for satisfactory operation.

STARTING MOTOR

CONTENTS

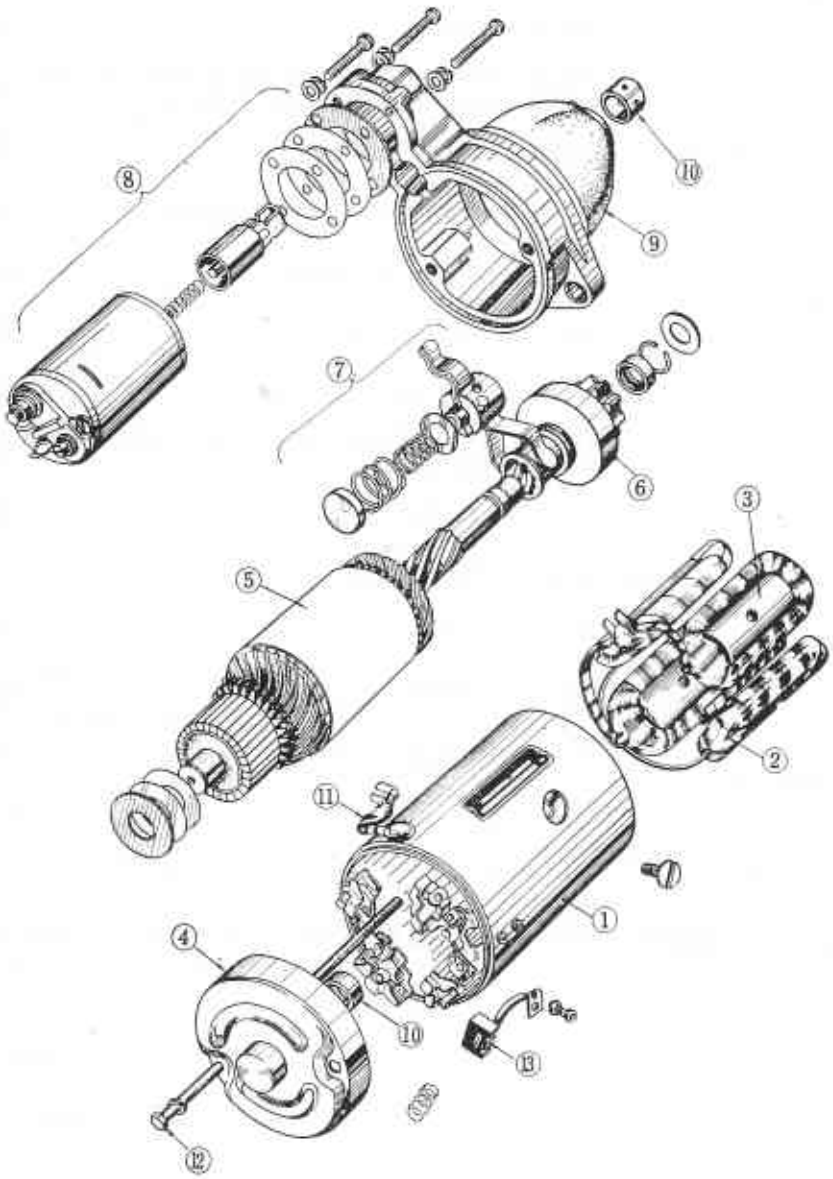


Fig. EE-37 Component Parts of Starting Motor (MITSUBISHI ME-Y$_1$R)

CONSTRUCTION

1. Field Coil : The field coil is secured inside the yoke by the pole piece and setting screw.
2. Armature (including Clutch Assembly): The armature is supported in the yoke assembly by the rear cover and metal at the gear case. The armature shaft is far protruded at one side and supports the drive mechanism, such as clutch assembly.
3. Magnetic Switch Assembly : The magnetic

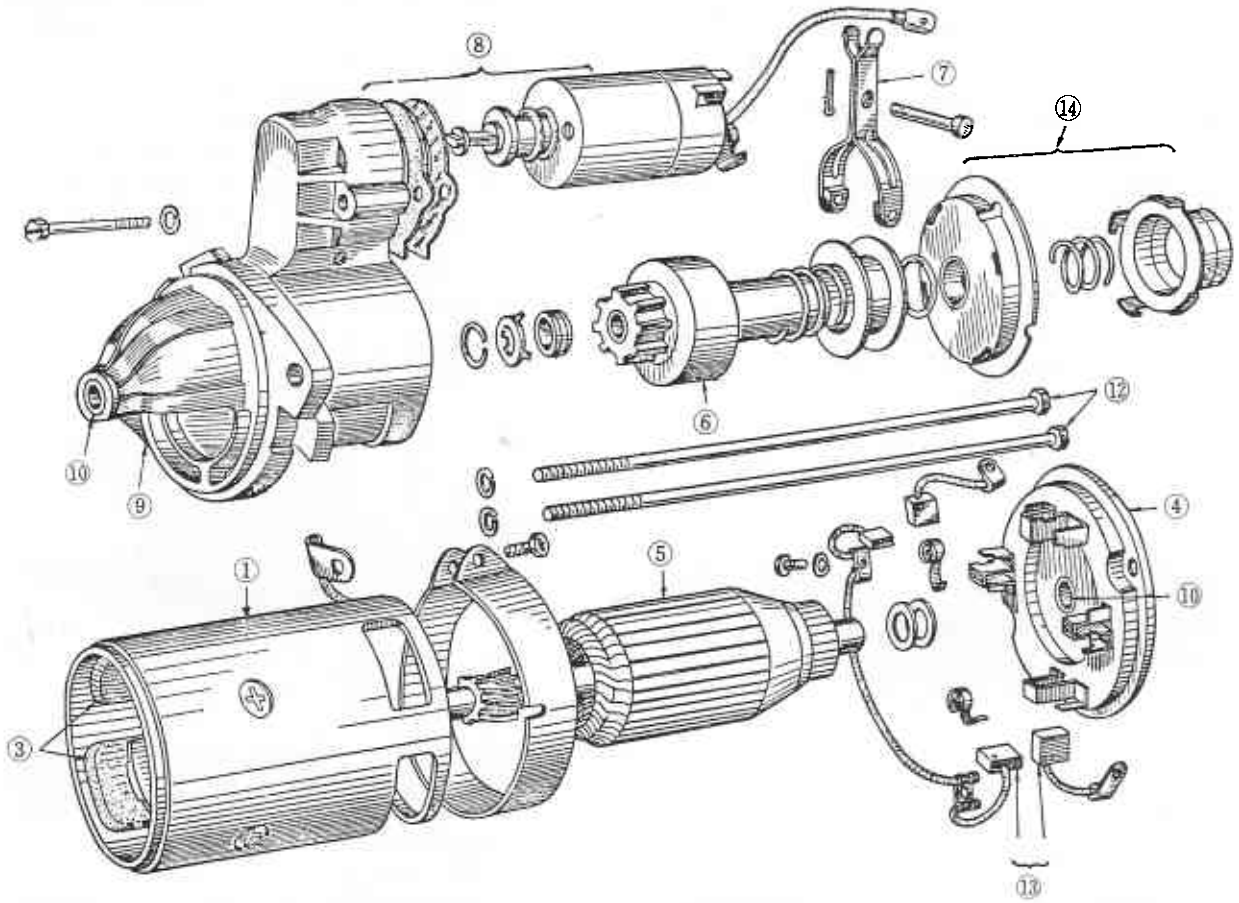


Fig. EE-38 Component Parts of Starting Motor (HITACHI S114-91)

1. **Yoke Assembly**
2. **Field Coil**
3. **Pole Piece**
4. **Brush Cover**
5. **Armature**
6. **Over-running Clutch**
7. **Lever Assembly**
8. **Switch Assembly**
9. **Gear Case**
10. **Metal**
11. **Connector Assembly**
12. **Through Bolt**
13. **Brush**
14. **Center Bearing Assembly**

switch assembly secured to the gear case by screws is installed on the upside of the yoke. The plunger of the magnetic switch and the clutch assembly are linked with the shift lever.

4. Clutch Assembly : The clutch assembly is the major part of the drive mechanism. It employs the over-running clutch.
5. Brush : The brushes are installed inside the yoke through the brush holders.
6. Others : The rear cover and yoke assembly are assembled together with the two through bolts passing through the yoke assembly, with the armature assembly (including the clutch assembly) having been installed inside.

REMOVAL AND INSTALLATION

1. Remove battery terminal.
2. Disconnect chassis harness (two) and battery cable, in turn, from magnetic switch B terminal.

NOTE: It is not necessary to disconnect black wire harness, as it is connected to starting motor ground wire at frame side.

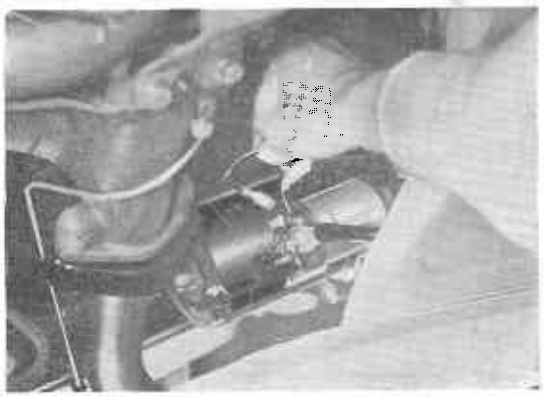


Fig. EE-39 Removing S Terminal

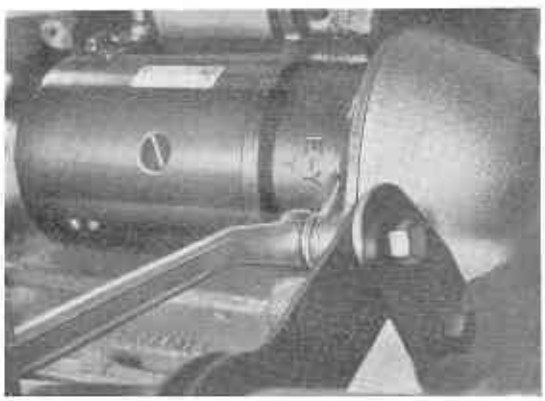


Fig. EE-40 Removing Starting Motor

3. Disconnect black and yellow chassis harness from S terminal.
4. Remove starting motor securing bolts. (together with the bolt securing ground wire)
5. Remove starting motor.
6. Installation is carried out by reversing the preceding procedure.

DISASSEMBLY (ME–Y_1R)

1. Removing magnetic switch from starter body
   By releasing M terminal nut at magnetic swich remove connector. Remove magnetic switch securing screws and the switch is separated from the body.
2. Separating armature and yoke
   Withdraw through bolts and remove brush cover. Take off thrust washers. Withdraw yoke lightly tapping it with a wooden hammer. Do not pry with a driver, as it may damage armature coil.
3. Separating pinion case and armature
   Remove shift lever, packing, big spring and small spring, in turn. Pull out armature together with shift lever.

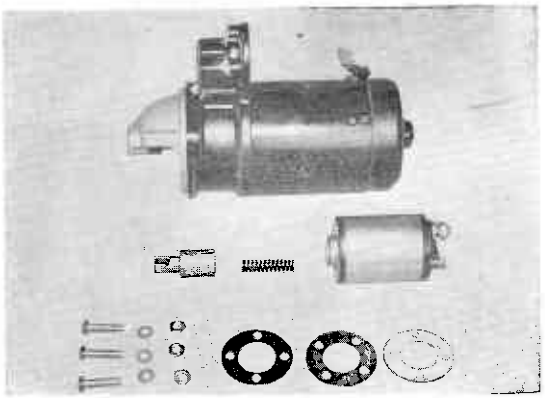


Fig. EE-41 Removing Magnetic Switch

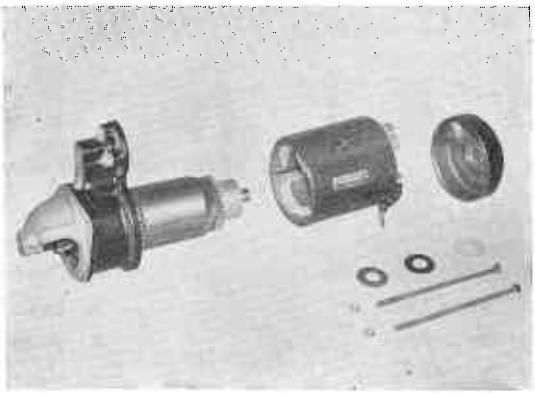


Fig. EE-42 Separating Armature and Yoke

Fig. EE-43 Separating Pinion Case and Armature

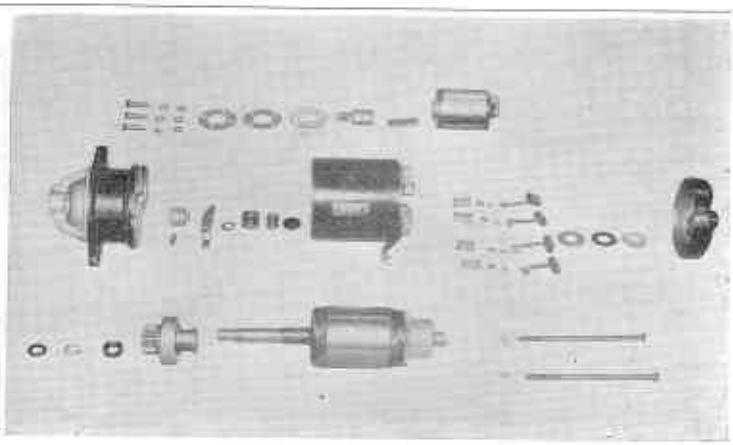


Fig. EE-46 All Disassembled Components of Starting Motor

Fig. EE-44 Removing Stop Ring

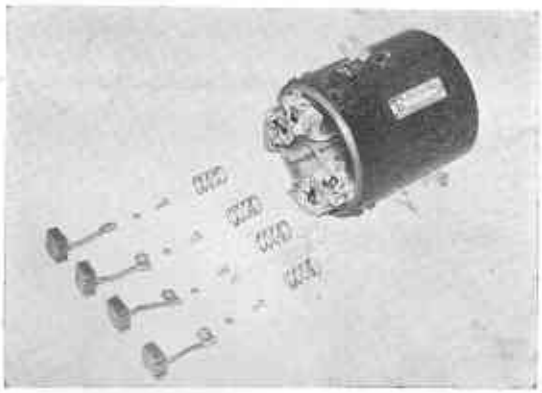


Fig. EE-45 All Disassembled Brushes

4. Removing pinion
   Remove pinion stop ring at the top end of armature. To remove the stop ring, by means of a tool shown in Fig. EE-43 push it down once to clutch side, remove snap ring, and pull it out together with clutch.
5. Removing brushes
   Releasing wire setting screw from brush holder, remove brush and brush spring, in turn.

ASSEMBLY

Assembling the starting motor is a reversal of their disassembling operations, but the following points should be noted.

1. Each of (+) and (−) brushes should be installed with its brush teminal faced in the same direction as Fig. EE-46 indicates. (+) and (−) brushes are the same.
2. Fixing brushes with big clips (Clothespins will serve) will facilitate the armature assembling operation.
3. Take care that no brush wires, especially (−) side, comes in contact with brush cover. (the part indicated by the arrow)

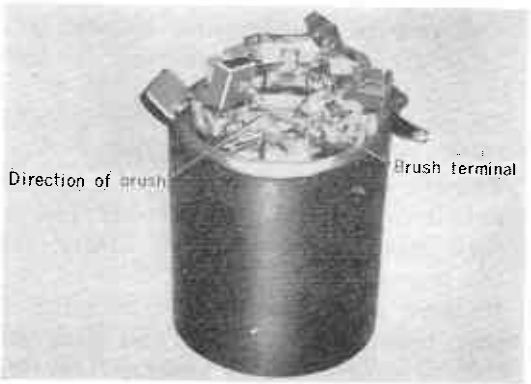


Fig. EE-47 Insalling Brushes

Fig. EE-48 Assembling Armature (1)

Fig. EE-49 Assembling Armature (2)

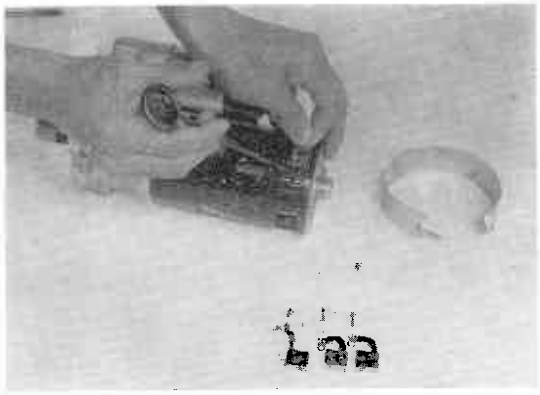


Fig. EE-50 Removing Magnetic Switch

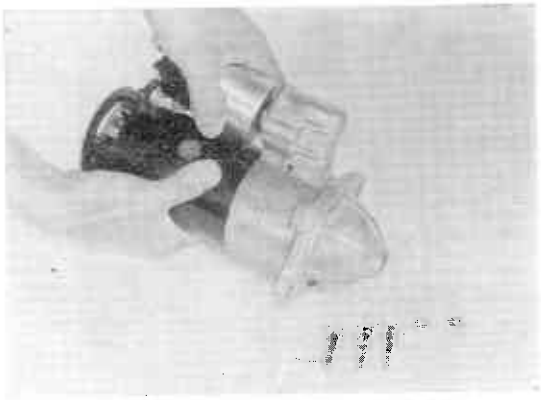


Fig. EE-51 Removing Magnetic Switch

Fig. EE-52 Removing Starter Yoke

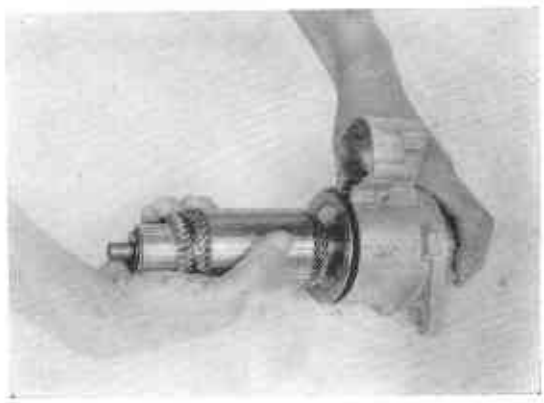


Fig. EE-53 Sliding out Armature

DISASSEMBLY AND ASSEMBLY (S411-91)

1. Loosen the brush cover securing screw and remove the brush cover.
2. Unscrew the screws attaching the brush lead wires to the poles on the rear cover, and remove the brushes, dislodging the brush springs by a suitable bar, as shown in Fig. EE-50.
3. Disconnect the lead wire to the "S" terminal at the magnetic switch.
4. Remove two bolts attaching the magnetic switch to the gear case, cotter pin and then remove the magnetic switch from the starter yoke.
5. Remove two through bolts securing the rear cover, starter yoke and gear case, then separate the rear cover and gear case from the starter yoke.

6. Slide the armature out of the gear case together with the shift lever.
7. Remove the pinion stopper placed in front of the pinion gear.
8. Remove the pinion assembly from the armature, then remove the center bearing from the pinion assembly.

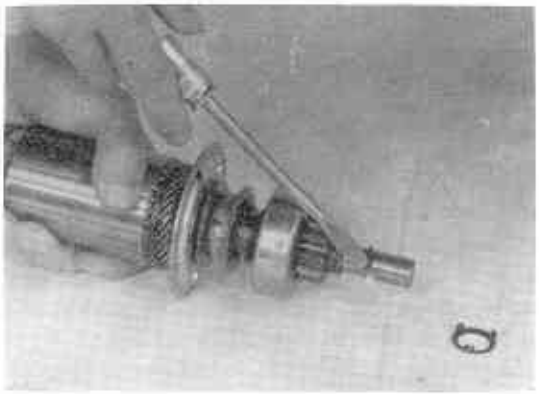


Fig. EE-54 Removing Pinion Stopper

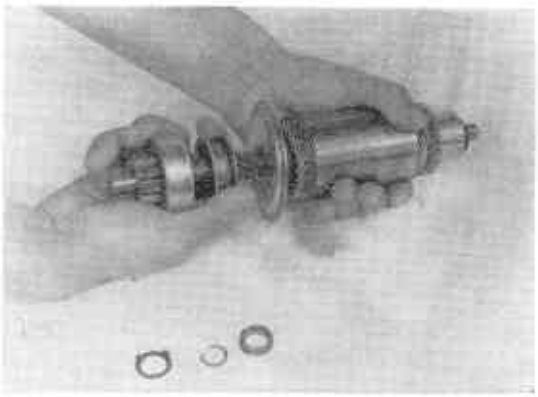


Fig. EE-55 Removing Pinion Assembly

INSPECTION AND ADJUSTMENT

1. Inspecting armature shaft for bend
   Measure armature shaft for bend with a dial gauge. Correct it if the bend is in excess of 0.1 mm (0.0039 in.) (Run-out limit : 0.2 mm (0.0078 in.)) If the clearance between bearing metal and armature shaft is more than 0.2 mm (0.0078 in.), replace metal.
2. Commutator
   Check commutator for run-out with a dial gauge. If the run-out is more than 0.2 mm (0.0078 in.), correct it.
   If commutator surface is rough, polish it with #500—600 sandpaper. If the surface is excessively rough or the run-out is more than 0.2 mm (0.0078 in.), resurface it by turning it in a lathe.
   If the distance from commutator segment surface to mica is less than 0.2 mm (0.0078 in.) undercut mica to keep the distance 0.5 to 0.8 mm (0.0196 to 0.0315 in.).
3. Armature

—Testing coil for short—

The armature is tested for short circuits on a growler. Place the armature on the growler and hold a thin steel strip above the armature core. Slowly rotate the armature. When the

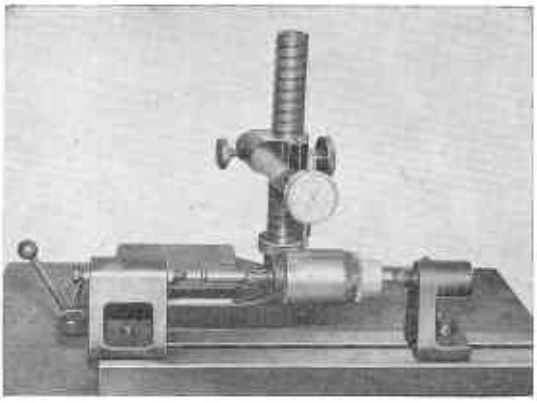


Fig. EE-56 Inspecting Armature Shaft for Bend

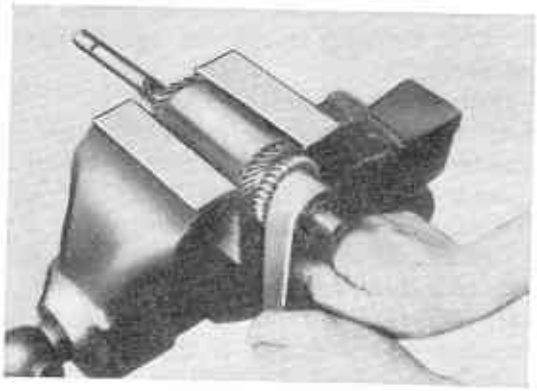


Fig. EE-57 Resurfacing Commutator Surface

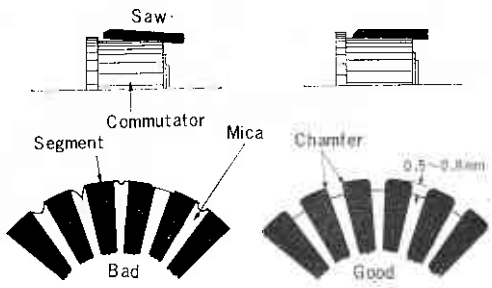


Fig. EE-58 Undercutting Mica

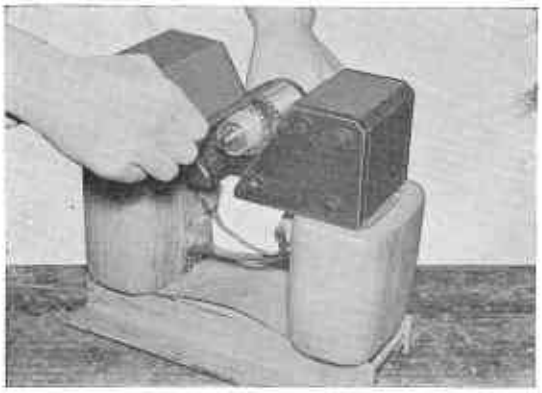


Fig. EE-59 Growler Test

slop containing shorted winding comes under the strip, the strip is vibrated against the core and sucked in.

—Testing coil for broken wire—

Place the armature on the growler and measure the voltage generated between the adjacent segments. If there is a place where no voltage is read, the coils were open.

—Testing coil for ground—

The coils are tested for ground with one tester point placed on the commutator and the other on the shaft. If there is continuity the coils are grounded. Replace the armature.

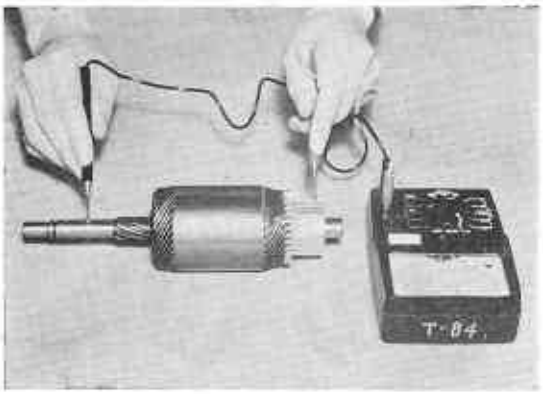


Fig. EE-60 Testing Coil for Ground

4. Field Coils

—Testing field coils for open circuits—

Series winding: Field coils are tested for an open circuit with one tester point placed on field coil (+) terminal (M terminal) and the other on each of the brush holders. If there is no continuity, the coil is open.

Resistance value....0.0105—/20°C

Shunt winding: Test for an open circuit with one tester point on field coil (+) terminal (M terminal) and the other on (−) brush holder. If there is no continuity, the coil is open.

Resistance value....3.9—/20°C

Fig. EE-61 Testing for Ground

—Testing field coils for ground—

Remove shunt winding ground. (soldered to (−) brush holder) Place one tester point on field coil (+) terminal (M terminal) and the other on the yoke. If there is any continuity, the coil is grounded.

—Inspecting outside of brushes—

Check brushes for condition of contacting face and wear. If the brush is worn in excess of wear limit, it should be replaced.

—Inspecting springs—

Measure spring tension by use of a tension meter shown in Fig. EE-55. Replace the spring if its tension is below 500 g.

Standard Tension....1,150 g.

Fig. EE-62 Measuring Spring Tension

—Inspecting brush movement—

When the brush does not move properly, check the brush holder for bend and rubbing face condition. The bent holder and the roughened face should be corrected or cleaned if found necessary.

5. Magnetic Switch Pinion Assembly

—Inspecting pinion position and magnetic switch—

With the pinion fully pushed out, measure the distance from the pinion end to stopper.

Standard dimension....0.3 to 1.5 mm (0.0118 to 0.0594 in.)

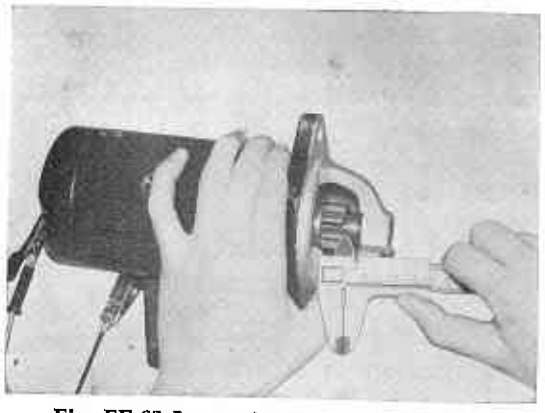


Fig. EE-63 Inspection Pinion Position

Before measuring the distance, push back the pinion with a finger so that there is no play. When the measured distance is out of the standard dimension, distance "ℓ" at magnetic switch should be adjusted.

—Adjusting washer—

Measure distance "ℓ" with the plunger fully compressed until there is no gap at the plunger.

Test series coil and shunt coil for continuity by use of a tester. The coils are open when there is no continuity between S-M terminals and S terminal and ground, respectively.

Fig. EE-64 Measuring Distance "l"

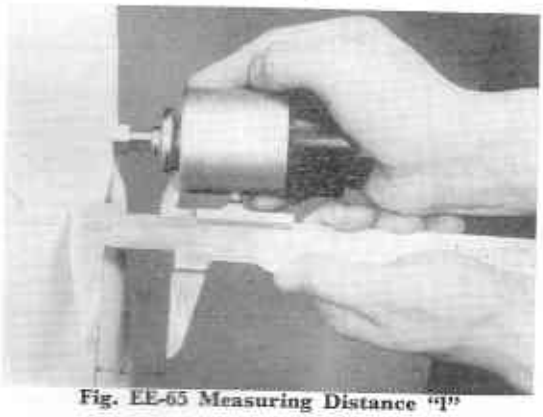


Fig. EE-65 Measuring Distance "l"

—Outside inspection—

Inspect pinion teeth for wear and damage. Replace it if necessary. Inspect springs for damage. Defective springs should be replaced.

—Inspecting movement—

Check pinion for smooth movement. If pinion is scratched or sticky, it should be corrected. Inspect clutch condition. If it sticks, slips or does not move, replace it with a new one.

—Inspecting performance—

After assembly is completed, no-load test is carried out. (Load test is omitted here, as this requires special testing appliances.) Connect an ammeter between battery (+) terminal and starter B terminal, and connect battery (—) terminal to starter bracket, connecting a conducter between the two.

Connect battery (+) terminal to starter S terminal by means of a conductor, and the starter rotates. (See Fig. EE-53)

In this test, measure current and starter rotation for the specified values.

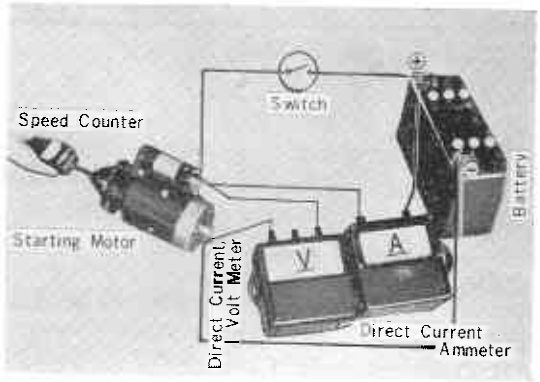


Fig. EE-66 Meter and Instrument Connection for Performance Inspection

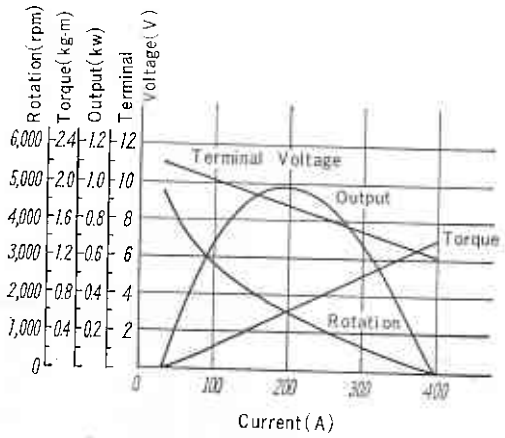


Fig. EE-67 Performance Curve

Symptoms	Causes
High Current, Low Rotation (Low torque)	Dirty metal or poor lubrication
	Friction of armature core and pole piece
	Armature coil and field coil being grounded
	Shorted armature coil
High Current, No Rotation	Burnt ground, metal of armature or field coil
No Current, No Rotation	Disconnection at armature or field coil
	Broken brush pig tail
	Dirtly commutator, poor contact of brush and commutator due to incorrectly held brushes
Low Current, Low Rotation (Low torque)	Poor contact of field coil connecting part (If only shunt coil is open or poorly connected, rotation is high)
High Current, High Rotation	Shorted field coil
(Low torque)	Grounded switch Grounded magnetic switch

ADJUSTMENT STANDARDS

		mm	in
Yoke oute diameter Armature outer diameter		90 dia. 60 dia.	3.54 dia. 2.36 dia.
Brush	Standard height Reduction limit	14 7.7	0.55 0.30
Brush spring	Standard tension Reduction limit	1.15 0.5	0.0453 0.0196
Correction limit of shaft bend Reduction limit of shaft diameter		0.1 0.1	0.0039 0.0039
Clearance Shaft Bearing	Correction limit Allowable discrepancy	0.2 0.2	0.0078 0.0078
Commutator	Standard outer diameter Reduction limit	39 dia. 2	1.53 dia. 0.0787
	Mica depth Correction limit Mica depth Allowable discrepancy	0.5 0.7	0.0196 0.0276

Standard Dimensions	Pinion side	Shaft diameter	11 dia. $^{-0.050}_{-0.077}$	0.43 dia. $^{-0.0019}_{-0.0030}$
		Bore diameter	11 dia. $^{+0.027}_{0}$	0.43 dia. $^{+0.0011}_{0}$
	Brush side	Shaft diameter	14.2 dia. $^{-0.050}_{-0.077}$	0.55 dia. $^{-0.0019}_{-0.0030}$
		Bore diameter	14.2 dia. $^{+0.027}_{0}$	0.55 dia. $^{+0.0011}_{0}$

TROUBLE DIAGNOSIS AND CORRECTIONS

Do not remove the starter from the engine until no troubles are found in the starting system after careful inspection.

Inspecting starting system

1. Inspecting charging and discharging condition of battery and battery plates
2. Checking battery terminals for cleanliness and tightness
3. Checking starter terminals for tightness
4. Inspecting wire connection (corroded and soon broken ground wire)
5. Checking starter for correct ground
6. Inspecting switches
7. Inspecting starter itself

Symptoms	Items	Causes	Remedies
Pinion is not pushed out, when starting switch is turned on.	Starter	Pinion does not move due to defective engagement of screw part at armature shaft with pinion part	Correct screw part
	Magnetic switch	Poor movement of magnetic switch plunger, or open or shorted coil	Correct or replace
Pinion engages with ring gear, but starter does not operate	Starter	Defective engagement of pinion and ring gear	Correct teeth
		Defective installation	Reinstall
		Worn brush, or brush spring incorrectly installed	Replace
		Dirty commutator	Correct
		Defective armature field coil	Correct or replace
		Loose connection of field coil and brush	Retighten
	Magnetic switch	Poor contact of contact	Correct
		Roughened contacting face of contact	Correct or replace

Starter fully runs before pinion engages with ring gear	Starter	Weakened pinion sleeve spring	Replace
	Magnetic switch	Faulty "1" dimension due to incorrect adjustment of plunger gap	Adjust
Engine does not operate when pinion engages and starter runs	Starter	Defective over-running clutch	Replace
Starter does not stop with switch off, after engine starts	Starter	Current is not cut with switch off	Correct or replace
	Magnetic switch	Defective contact (being in contact all the time)	Correct or replace

MEMO

IGNITION SYSTEM

DISTRIBUTOR

CONTENTS

CONSTRUCTION

Fig. EE-68 shows the ignition diagram of the gasoline engine. Functionally, the distributor consists of the high tension voltage part, swicth on-off part, centrifugal advancing angle part, vacuum advance mechanical part and driving part, Fig. EE-70 shows the construction of its typical product.

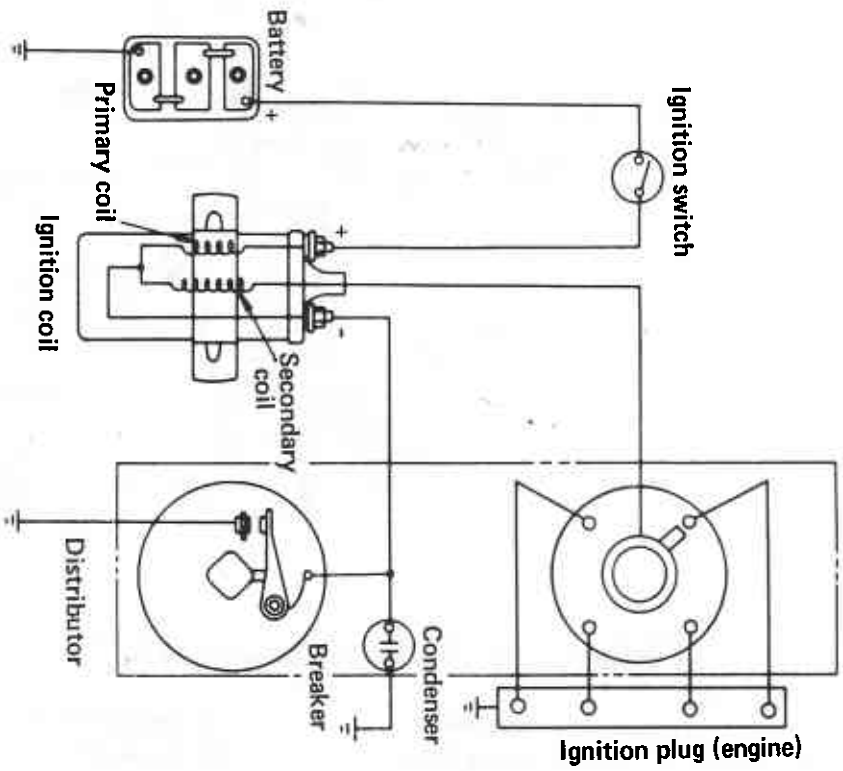


Fig. EE-68 Ignition Circuit

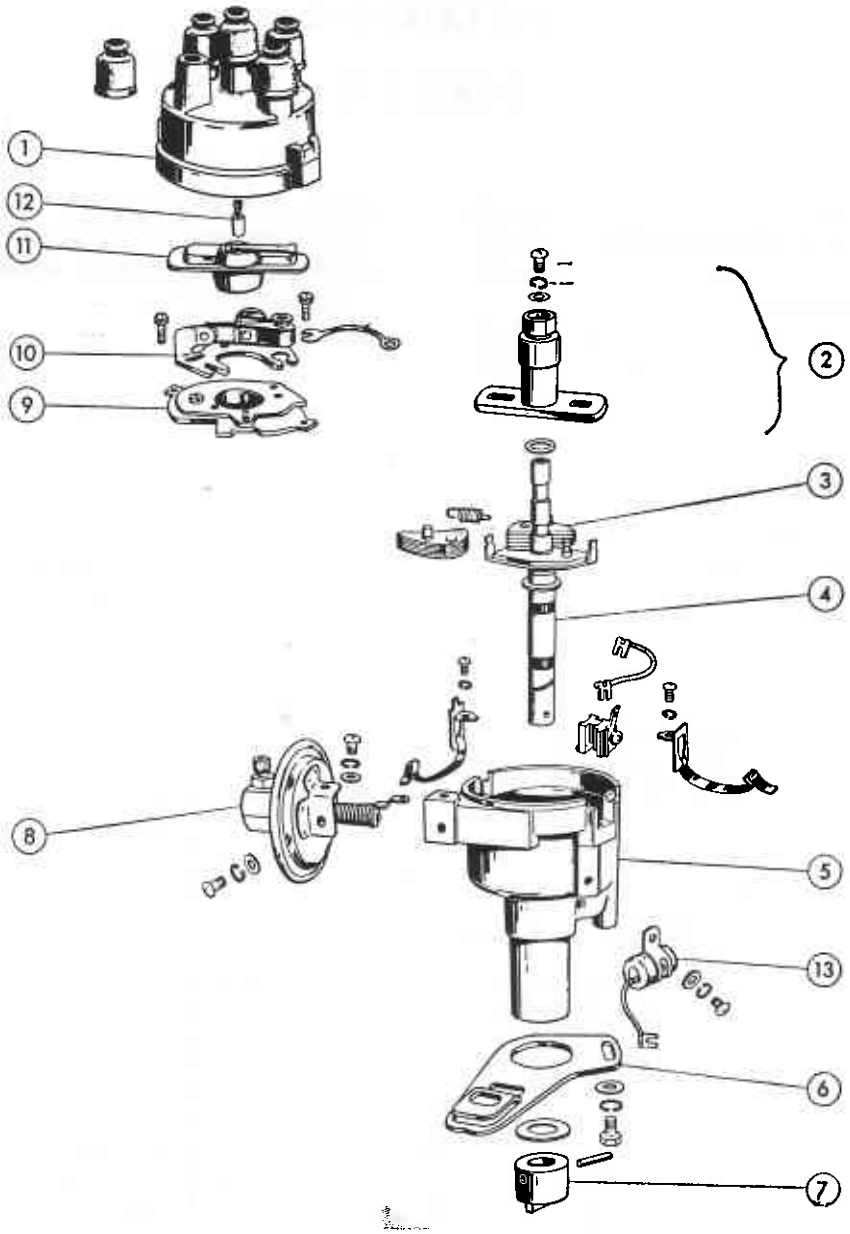


Fig. EE-69 Component Parts of Distributor (D415-54)

1. Cap
2. Cam Assembly
3. Governor Weight
4. Shaft Assembly
5. Housing
6. Fixing Plate
7. Coupling
8. Vacuum Controller
9. Breaker Plate
10. Contact Set
11. Rotor Head
12. Carbon Point

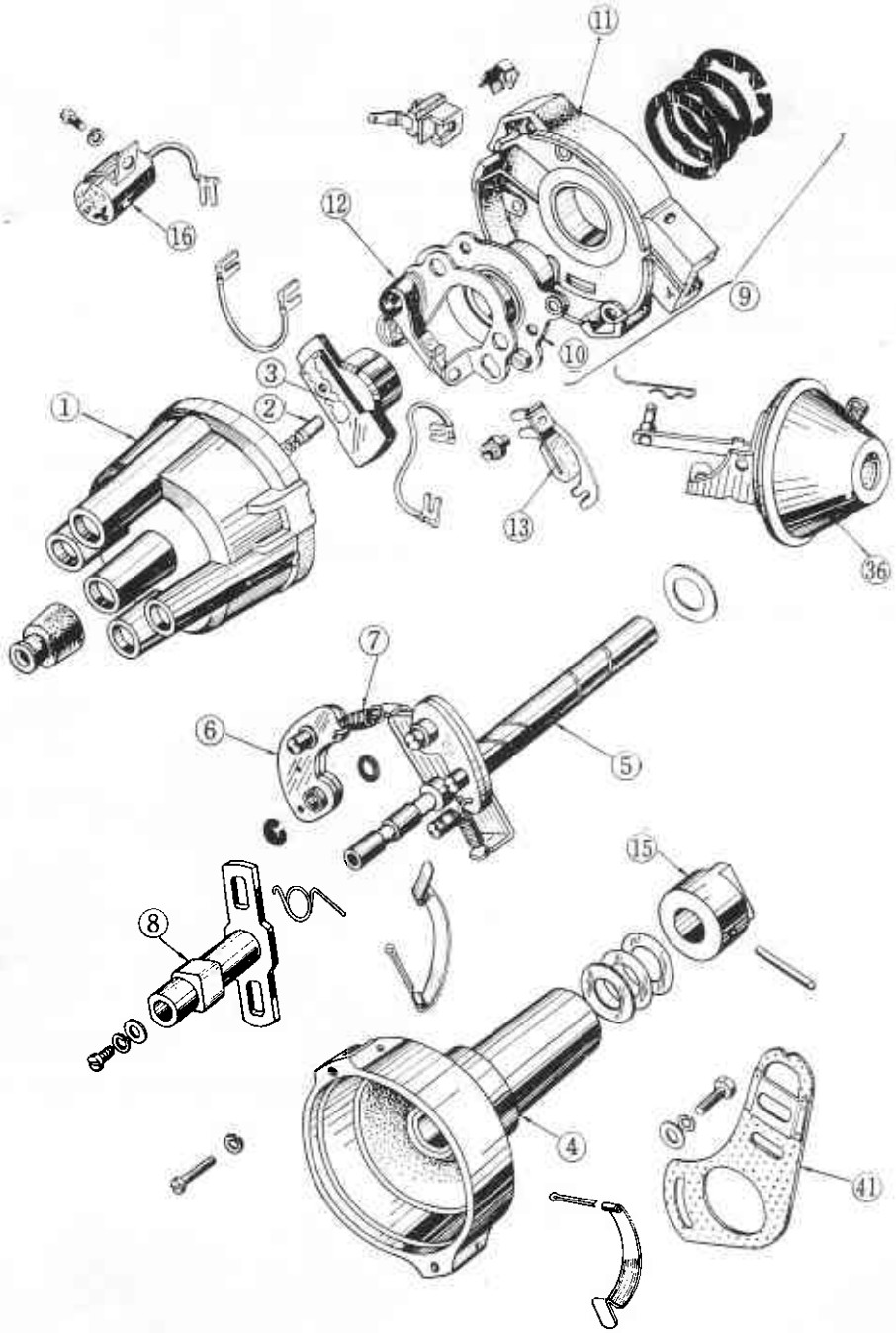
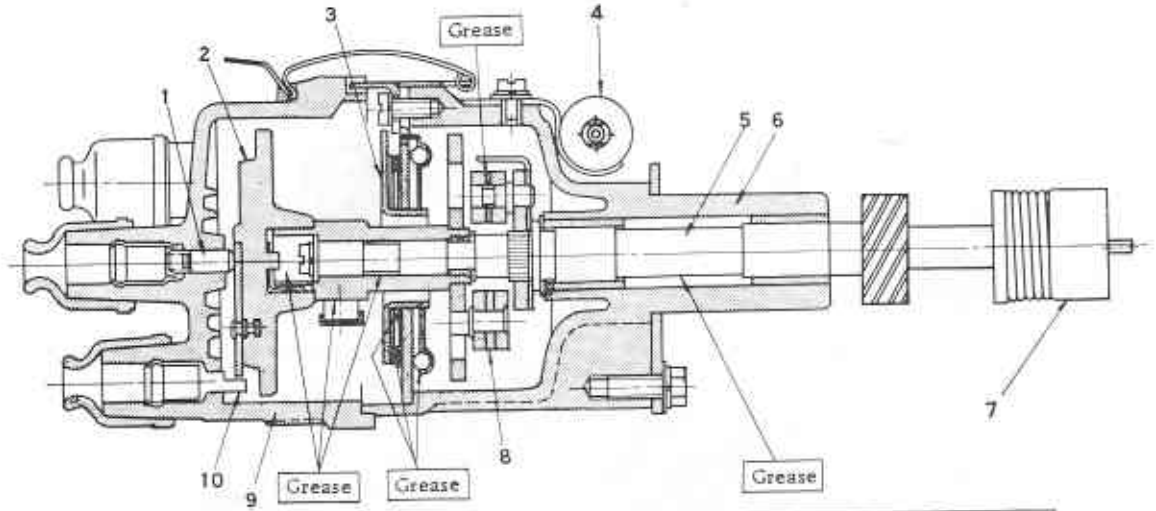


Fig. EE-70 Component Parts of Distributor (TVB-4S$_3$L)

1. Cap Assembly
2. Contact Carbon Assembly
3. Rotor Assembly
4. Housing Assembly
5. Shaft Assembly
6. Governor Weight Assembly
7. Governor Spring
8. Cap Assembly
9. Breaker Base Assembly
10. Breaker Plate
11. Breaker Base
12. Arm Support Assembly
13. Cam Felt
15. Coupling
16. Condenser
36. Vacuum Control Assembly
41. Fixing Plate



1	Center carbon	4	Condenser	7	Coupling
2	Rotor head	5	Shaft	8	Governor weight
3	Breaker plate (Contact)	6	Housing	9	Cap
				10	Side plug

Fig. EE-71 Construction of Distributor

REMOVAL AND INSTALLATION

1. Disconnect high-tension codes.
2. Disconnect primary wire coming from the ignition coil.
3. Disconnect vacuum controller pipe.
4. Loosen securing bolt and withdraw distributor from the engine.
5. Installation is a reversal of the preceding operations, but care should be taken to set the distributor housing in position to secure the specified ignition timing.

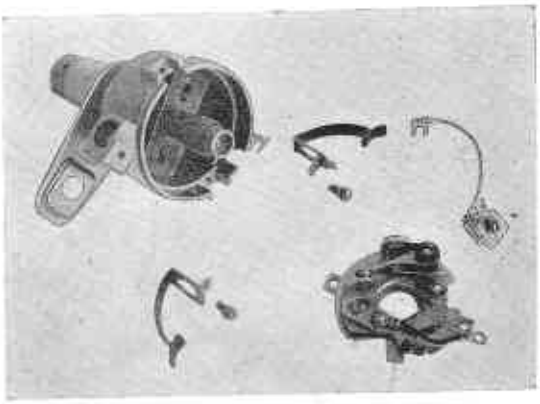


Fig. EE-73 Removing Breaker Plate

DISASSEMBLY —HITACHI D415-54—

1. Remove cap.
2. Remove rotor.
3. Remove vacuum controller.

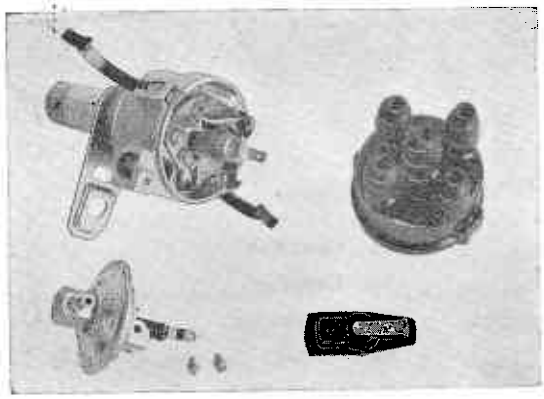


Fig. EE-72 Removing Cap, Rotor and Vacuum Controller

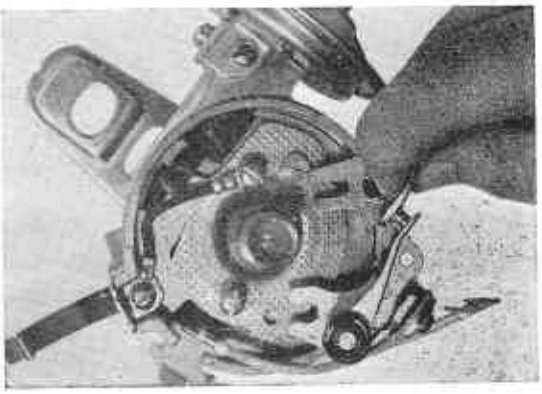


Fig. EE-74 Removing Contact Set

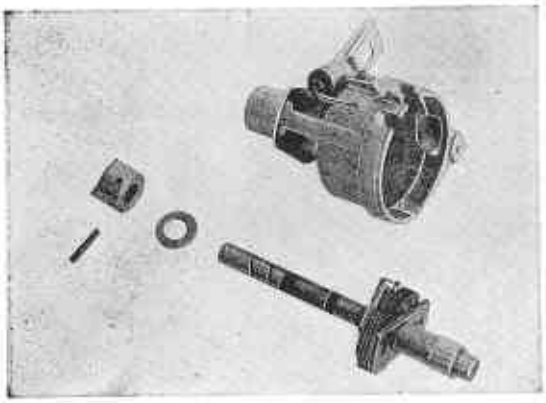


Fig. EE-75 Withdrawing Shaft

4. Remove the two screws securing cap clamps and the breaker plate.
5. Remove cap clamps and breaker plate.
6. Remove lead wire terminal.
7. Loosen the arm side screw of lead wire and disconnect lead wire.
8. Remove contact set.
9. When disassembly is carried out to polish the points, disconnect lead wire at arm side and loosen contact set screw, and the contact set can be removed.

Centrifugal Advance Mechanism

1. Take out roll pin and remove coupling.
2. Withdraw shaft from the housing.
3. Release screw at cam head and take out cam assembly.
4. Remove governor spring and weight.

ASSEMBLY

This is a reversal of the removal procedure, but the following points should be noted.

1. Thinly grease each bearing rubbing part with multipurpose grease.
2. Special care must be taken not to disturb the correct setting of ignition timing in assembling cam, pinion and the like. There is only one governor spring. The arc cut at the cam, which positions the rotor head, must come to the governor spring side. The weight pin is inserted in the longer square slot, accordingly. Be sure that all parts are secured tightly.

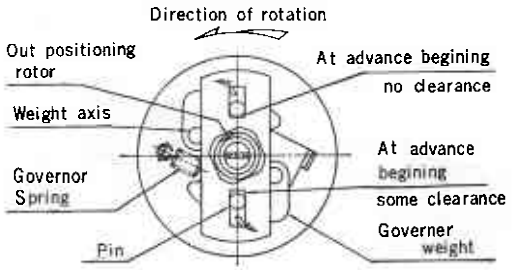


Fig. EE-77 Assembling Centrifugal Advance Mechanism

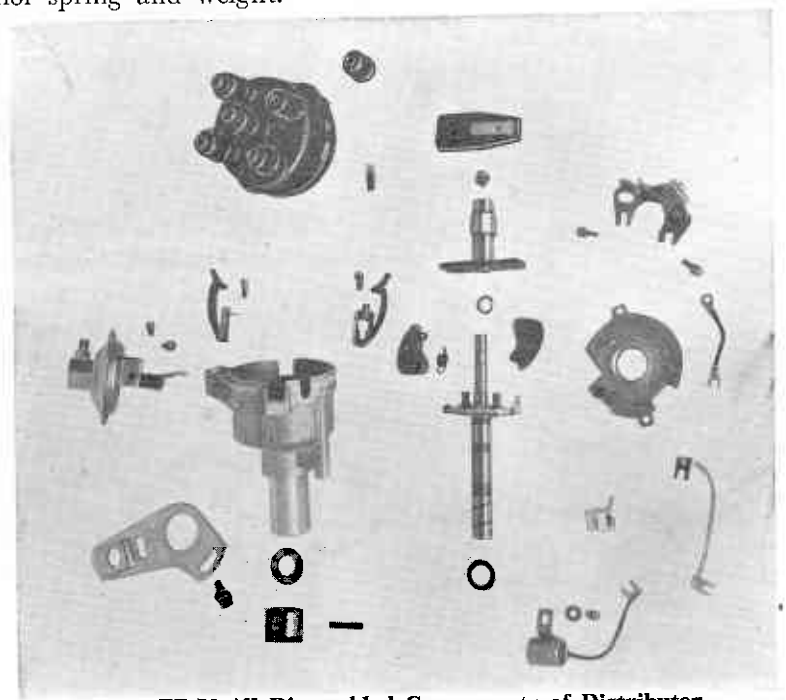


Fig. EE-76 All Dissembled Components of Distributor

DISASSEMBLY —MITSUBISHI TVB-4S$_3$L—

1. Remove cap and rotor.
2. Remove primary wire terminal.
3. Remove condenser.
4. Remove vacuum controller.
5. Removing and disassembling Arm Support
   Remove felt plate set screws. (Ground wire is secured by one of the screws.)
   Remove felt plate and arm support assembly together with lead wire. When disassembling to polish the points, disconnect lead wire at arm side and loosen set screws. Withdraw felt plate sidewards, and arm support assembly can be taken out. Release the clip of point arm and remove thin washer, point arm and thick washer, in turn.

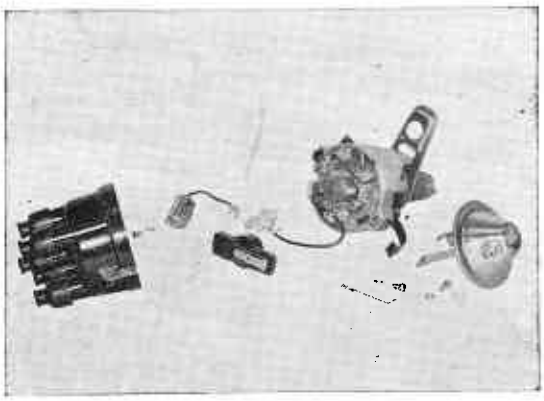


Fig. EE-78 Removing Cap, Rotor and Vacuum Controller

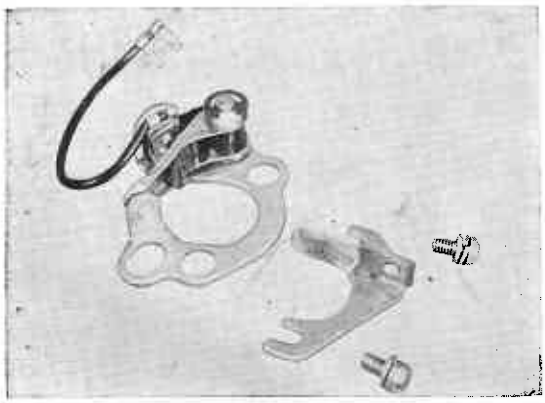


Fig. EE-79 Removing Arm Support

6. Removing and disassembling Breaker Base Assembly
   Remove the two breaker base set screws. (Ground wire is secured by one of them.) Remove breaker base assembly. Remove breaker plate set spring shims and stop washer. Remove breaker plate.

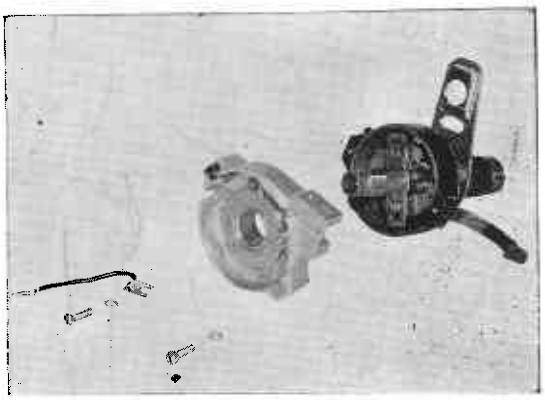


Fig. EE-80 Removing Breaker Base Assembly

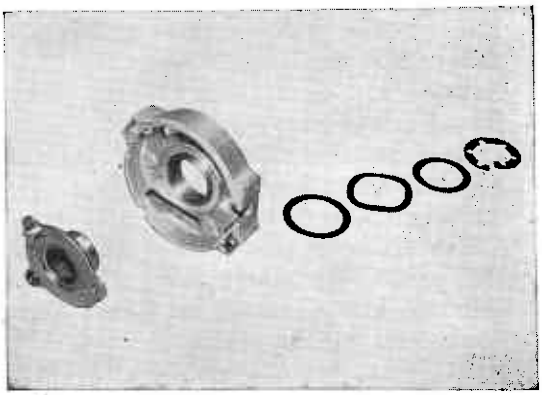


Fig. EE-81 Taking out Breaker Plate

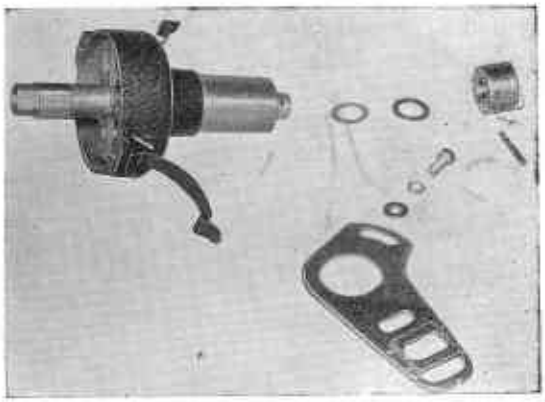


Fig. EE-82 Coupling, Fixing Plate

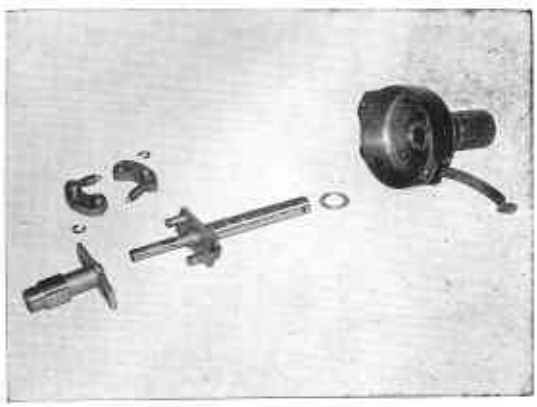


Fig. EE-83 Disassembling Shaft and Governor

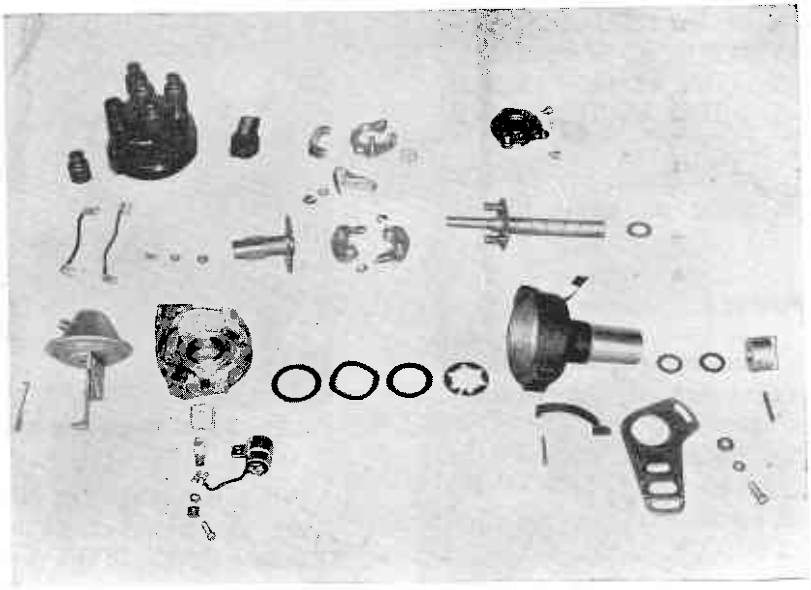


Fig. EE-84 All Disassembled Components of Distributor

7. Removing Coupling and Fixing Plate
   Remove the knock pin of coupling. Remove coupling washers. Remove fixing plate.

Centrifugal Advance Mechanism

1. Withdraw shaft assembly.
2. Releasing set screw at cam head, withdraw cam assembly.
3. Removing governor clip, withdraw governor together with springs.

ASSEMBLY

Assembling is carried out by reversing the preceding operations, but the following points should be noted:

1. Installing Coupling:
   Bring knock pin holes in line so that the punched mark on the shaft and face come to the wider side of coupling. Secure coupling with roll pin.
2. Installing Cam Assembly:
   Install cam assembly to governor weight with the rotor positioning arc cut being faced to the narrow side of coupling.

INSPECTION AND ADJUSTMENT

Cap, Rotor Head

1. Inspect cap and rotor head for cleanliness, Thoroughly clean them with a cloth dampened with gasoline and dry up, if found to be dirty.
2. Check for cracks and damage and replace, if necessary.
3. Check cap, especially the carbon electrode and spring, for signs of abnormality. Do not clean the electrodes of the cap and rotor with a file.

Points

1. Inspect point surface for cleanliness and roughness.
2. If the surface is oily, thoroughly wipe it off.
3. If the surface is rough, clean up the point with #500—600 sandpaper or a hone.
4. Excessively worn or protruded points should be replaced by new ones.

Inspecting Gap

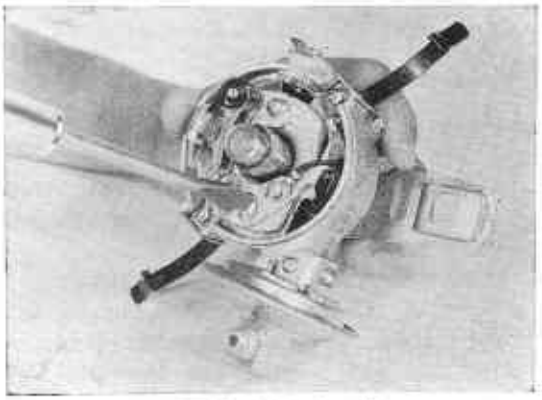


Fig. EE-85 Adjusting Gap

1. Point gap should be inspected every approx. 3,000 km (2,000 miles) of running.
2. If the gap is out of the standard value at 0.45 to 0.55 mm (0.018 to 0.022 in.) it should be adjusted.
3. The adjustment can be made by the adjuster after the point set screw having been loosened.

Measuring Arm Spring

1. Arm spring is measured in right angle direction to the point at the moment when the point opens.
2. If the measured pressure is out of the specified value: 0.5 to 0.6 kg (1.1 to 1.3 lbs), replace the point arm.

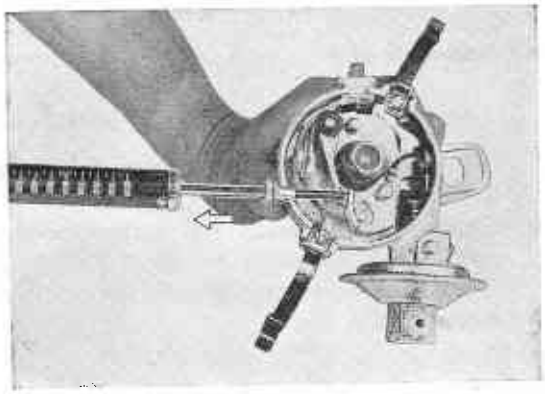


Fig. EE-86 Measuring Point Pressure (1)

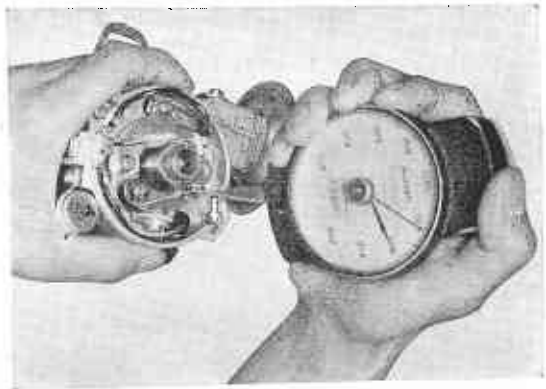


Fig. EE-87 Measuring Point Pressure (2)

Condenser

1. When the points are excessively protruded, or if a strong arc forms across the points, the condenser is defective.
2. Test the condenser by connecting one point of 500V megger with the condenser (+) terminal and the other point with the case and rotating the handle. Resistance must be above 5 MΩ.

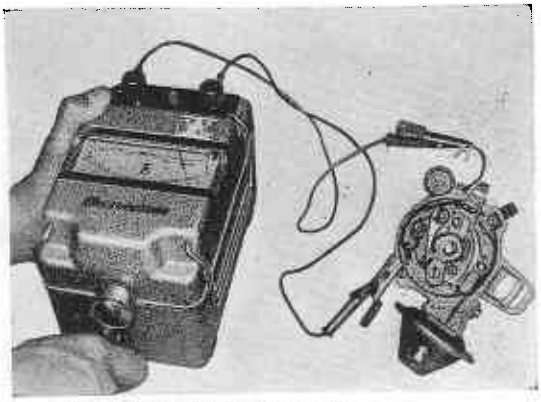


Fig. EE-88 Measuring Resistance

3. When the condenser is tested by a tester, set the tester range to read larger resistance values. If the indicator moves the moment the points of the tester are placed on both ends of the condenser, and it gradually returns to the original position, the condenser is in good order.

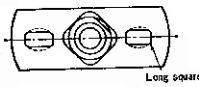
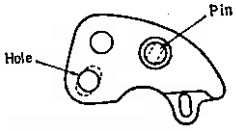
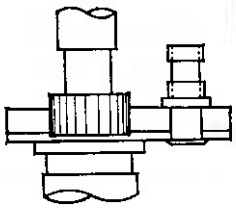
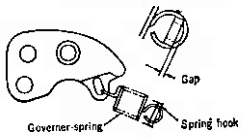
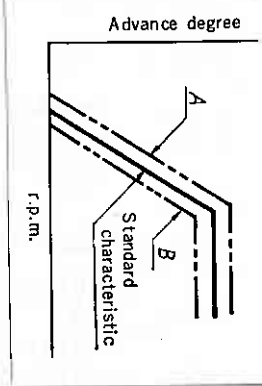
Vacuum Advance Mechanism

Whether vacuum advance mechanism is operating or not is checked by an operation indicator. If the mechanism is inoperative, check the following points:

1. Check vacuum nipple for tightness.
2. Inspect diaphragm. Defective diaphragm should be replaced with a new one.
3. If the moving side and fixing side of the breaker plate stick, replace it.

Centrifugal Advance Mechanism

When the checked advance characteristic is not proper, remove the contact breaker part and inspect the following parts:

Items	Inspection	Remedies
Cam Assembly		If it is found by a visual inspection that the long square slots worn as indicated by dotted line, the cam should be replaced. (HITACHI)
Governor Weight		If it is found by a visual inspection that the hole and pin are worn as indicated by dotted line, the governor weight should be replaced.
Shaft		If it is found by a visual inspection that the weight axis is worn as indicated by dotted line, the shaft should be replaced.
Governor Spring		Causes of increased spring free play: 1. The automatic advance rotor is defective. In this case use the governor spring as it is, while replacing the defective parts, and there is no free play. 2. The governor spring tension is incorrect. In this case replace the spring or bend the spring hook approx. 0.5 mm outwards.
Advance Characteristic		Advance characteristic inspection must be carried out whenever disassembling repair is done. If the checked characteristics shows A, bend the spring hook outwards, and in case of B, inwards. By repeating these operations, the advance characteristics should be adjusted to the specified one. As the adjustment requires skilled techniqus, it will be left a repair specialist.

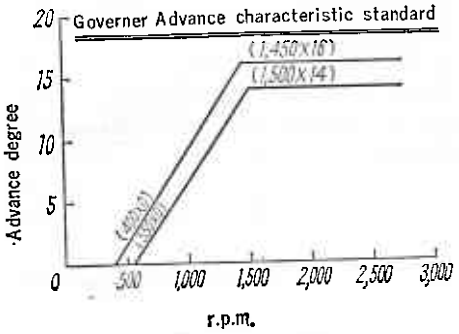


Fig. EE-89 Governor Advance Characteristic

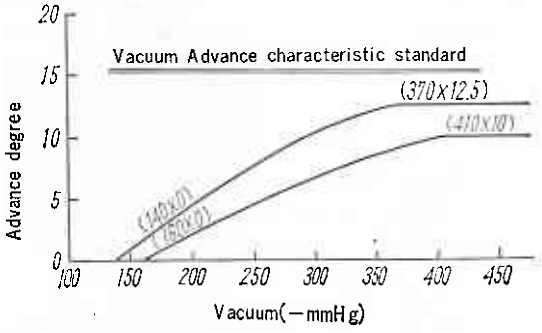


Fig. EE-90 Vacuum Advance Characteristic

Advance Characteristic	Centrifugal type	Beginning (rpm)	475
		Maximum (Degree/rpm)	15/1,500
	Vacuum type	Beginning (mmHg)	150
		Maximum (Degree/mmHg)	11.25/390

ADJUSTMENT STANDARDS

		mm	in
Point Gap mm (in)		0.45 to 0.55	0.018 to 0.022
Point Pressure kg (lbs)		0.5 to 0.65	0.019 to 0.026
Clearance Shaft/Housing mm (in)	Correction limit	0.08	0.003
	Tolerance discrepancy of correction	0.01 to 0.05	0.0004 to 0.0019
	Shaft decreased dimension	Max. 0.03	Max. 0.00085
Shaft, Housing Standard Dimension mm (in)	Shaft	12.45 dia. $^{-0.010}_{-0.020}$	0.49dia. $^{-0.00039}_{-0.00079}$
	Housing	12.45 dia. $^{+0.018}_{0}$	0.49dia. $^{+0.00071}_{0}$
	Clearance Shaft/Housing	0.010 to 0.030	0.00039 to 0.00085
Shaft, Cam Standard Dimension mm (in)	Shaft	8 dia. $^{-0.005}_{-0.014}$	0.31dia. $^{-0.0002}_{-0.0006}$
	Cam	8 dia. $^{+0.015}_{0}$	0.31dia. $^{+0.0006}_{0}$
	Clearance Shaft/Cam	0.005 to 0.029	0.0002 to 0.0012
Weight hole, Weight axis Standard Dimension mm (in)	Weight hole	5 dia. $^{+0.018}_{0}$	0.196dia. $^{+0.0007}_{0}$
	Weight axis	5 dia. $^{-0.010}_{-0.028}$	0.196dia. $^{-0.00039}_{-0.0012}$
	Clearance Weight hole/axis	0.01 to 0.046	0.0004 to 0.00181

Driving Part

An increased coupling part clearance affects the ignition timing of the engine and reduceses the maximum output, and it is necessary to install a new set.

Lubrication

1. Apply a little grease to cam surface every 3,000 km (2,000 miles) of running.
2. Supply cam head with grease every 3,000 km (2,000 miles) of running.
3. Apply grease to arm bearing every 6,000 km (4,000 miles) of running.
4. When disassembling, apply grease to each rotating and rubbing part of centrifugal advance mechanism and rubbing and moving part of breaker plate.

TROUBLE DIAGNOSIS AND CORRECTIONS

When engine does not start

Inspect ignition system after no trouble having been found in fuel system. Remove high-tension code from plug and observe the condition of sparks taken place between the high-tension code and the cylinder block while rotating the engine by the starting motor.

Sparking length	Items	Causes	Remedies
No spark	Distributor	Poor insulation of condenser	Replace
		Broken low-tension lead wire	Repair
		Poor insulation of cap rotor head	Replace
		No opening and closing of point	Repair
	Ignition Coil	Broken or shorted coil wire	Replace by new one
	High-tension Code	Disconnected wiring	Correct
		Poor insulation	Replace
1 to 2 mm (0.039 to 0.078 in.) irregular	Distributor	Excessive point gap	Correct
		Oily point	Clean
		Excessively burnt point	Replace
	Ignition Coil	Layer short	Replace with good one
Above 6 mm (0.236 in.)	Sparking Plug	Excessive electrode gap	Correct or Replace
		Excessively soiled with carbon	Clean or Change for hot type plug by 1–2 ranges
		Broken insulator head	Replace
		Plug has served its time	Replace

When engine rotates but not in good order

There are so many causes that locating the troubles is very difficult. However, as far as ignition system is concerned, only the following points should be noted:

Symptoms	Items	Gauses	Remedies
Engine continuously misses.	Distributor	Dirty point	Correct
		Incorrect point gap	Correct
		Surface leakage at gap rotor head	Clean or Replace
		Poorly insulated condenser	Replace
		Poorly insulated condenser lead wire	Correct
		Poor operation of arm	Oil axis
		Arm spring	Correct or Replace
		Lead wire being about to break	Correct
		Defective breaker plate	Correct
		Defective distributor shaft	Correct
	Ignitton Coil	Layer short or coil being of poor quality	Replace by one of good quality
	High-tension Lead Wire	Leakage due to defective insulation	Replace
	Sparking Plug	Dirty plug	Clean or Change for hot type plug by 1-2 ranges
			Clean
Engine continuously knocks.	Distributor	Incorrect timing (advanced)	Correct installattion
		Unhooked or broken governor spring	Correct or Replace
		Worn pin and hole at governor part	Replace
	Sparking Plug	Excessively hot	Change for cold type plug by 1-2 ranges
Poor engine output	Distributor	Incorrect timing (retarded)	Correct installation
		Poor operation of governor	Correct
		Dirty point	Correct
		Excessively small point gap	Correct
	Sparking Plug	Dirty plug	Clean

IGNITION COIL

DESCRIPTION

The ignition coil equipped with a resistor is adopted for a good performane at high engine revolution. The number of turns in primary windings 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 the 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 the switch is in the "start" position.

INSPECTION

The ignition coil is tested by use of a correct tester. Defective coil should be replaced by a new one.

—Inspecting items—

1. Continuity of primary circuit
2. Continuity of secondary circuit
   Standard Value.....
   HANSHIN below 17,000 Ω
3. Short circuit between primary circuit and the case.
4. Ignition performance.

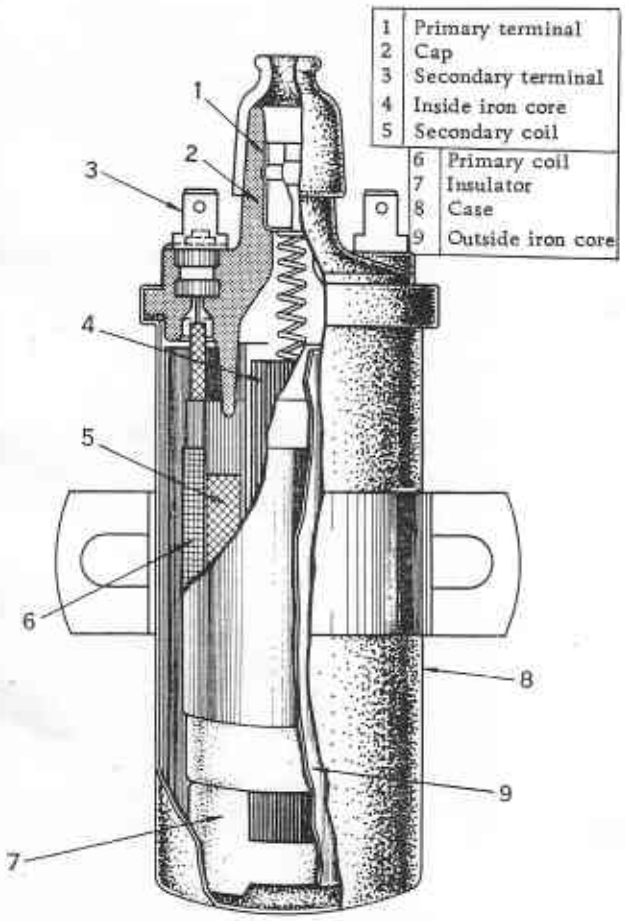


Fig. EE-91 Construction of Ignition Coil

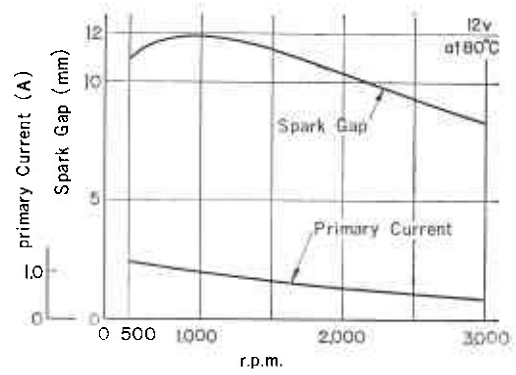


Fig. EE-92 Secondary Voltage Characteristic Curve

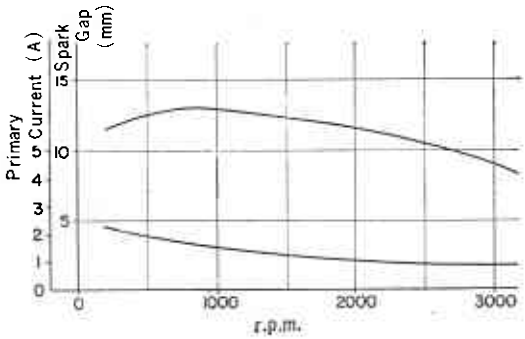


Fig. EE-93 Spark Characteristic Curve

SERVICE MANUAL

H16(R) & H20

ENGINES

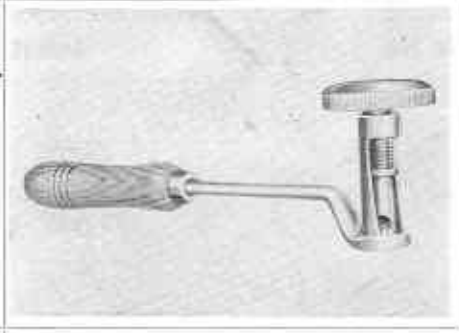
NISSAN

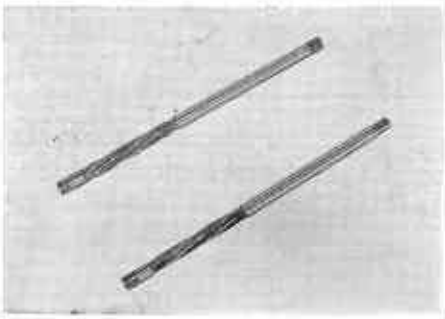
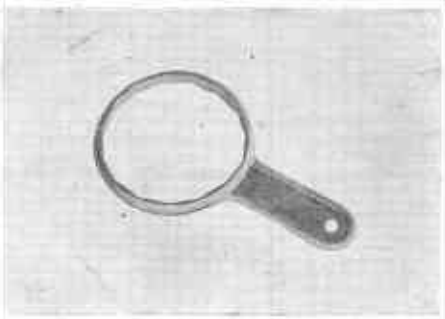
SECTION SE

SERVICE EQUIPMENT

SE

ENGINE TOOLS

ST37100000 **Engine Stand**		Whenever the engine has been dismountled from the vehicle, fix it with this stand to perfrom disassembling and re-assembling works. See Fig. FM-1.
ST37200030 **Engine Attachment**		This should be used togethre with the stand. See Fig. EM-1.
ST42010000 **Valve Tappet Adjust Wrench**		Use to adjust the tappet clearance.
ST44730000 **Valve Seat Cutter**		Use to re-condition the valve seat. See Fig. EM-14.
ST44630000 **Crankshaft Main Bearing Cap Puller**		Use to replace the main bearing caps.

ST44720000 Valve Guide Reamer		Use to finish the valve guide inner serface to the specified dimension. See Fig. EM-13.
ST44720000 Oil Filter Wrench		Use to replace the oile filter.

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

NISSAN

Pubrication No. 47301 (20910150)