NISSAN ENGINE

MODEL P

SERVICE MANUAL

NISSAN MOTOR CO., LTD.

TOKYO , JAPAN

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FOREWORD

This manual has been complied for pourpose of assisting NISSAN distributors and dealers for effective service and maintenance of the Model "P" engine.
Model "P" engine has been used for the various models of vehicles such as Model 680, Model 4W73 and Model 60 series.
Each assembly of major components is described in detail. In addition, comprehensive instructions are given for assembling and inspection of these assemblies.
The difference between Model 680, 4W73 and 60 are also given in this manual as far as engine concerned.
It is emphasiged that the only genuine Nissan Spare Parts should be used as replacements.

CONTENTS

GENERAL INFORMATIONS

SPECIFICATIONS

ENGINE PROPER:

Model	P Engine (for 680, 60 & 4W73 Series)
Maker	Nissan Motor Co., Ltd.
Kind of Engine	Gasoline Engine
Cooling	Water
Cylinder Arrangement	Straight 6
Cycles	4
Combustion Chamber	Bath tube type
Cylinder Head	Over head valve
Bore x Stroke (mm)	85.7 x 114.3
Total Displacement Volume (cc.)	3,956
Compression Ratio	7.6 : 1
Compression Pressure (lb/□"-200 rpm)	157
Maximum Horse Power (HP/rpm) (S.A.E.)	145/3800
Maximum Torque (m-kg/rpm) 235 ft-lbs 2000 rpm	32.5/2000
Minimum Fuel Consumption at Full Load (g/P.S.-h/rpm)	220/1600
Engine Dimensions (mm) - Length - Fan to Fly wheel	904
Width - Rear Support, right to Air Cleaner, left	655
Height - Air Cleaner to Oil Pan	882
Engine Weight (Equipped) (dry) (kg)	293
Number of Piston Rings - Compression	2
- Oil	1
Type of Piston	Steel strut
Material of Piston	LO-EX

Valve Timing:

Inlet Valve, open (degrees) B.T.D.C.	14°
Inlet Valve, closed (degrees) A.B.D.C.	50°
Exhaust Valve, open (degrees) B.B.D.C.	52°
Exhaust Valve, closed (degrees) A.T.D.C.	12°

Valve Tappet Clearance:

Inlet Valve (hot) (mm)	0.38 ~ 0.4
Exhaust Valve (hot) (mm)	0.38 ~ 0.4

Ignition Method	Battery & Ignition coil
Ignition Timing (B.T.D.C./rpm)	10°/450
Firing Order	1-5-3-6-2-4
Starting Method	Startor Motor & Crank Handle

IGNITION SYSTEM:

Ignition Coil - Model	HITACHI CIZ-01
Distributor - Model	HITACHI D608-01, D608-51A (60 series)
Type of Spark Advancer	Centrifugal & Vacuum Control

Sparking plug -	Model	B54E or B6E
	Maker	N.G.K. or HITACHI
	Diameter (mm)	14
	Sparking Clearance (mm)	0.75
	Number of pole	1
	Insulating Material	Porcelain

FUEL SYSTEM:

Carburetor -	Original Model	Stromberg
	Type	VC42-1A (680 Series), VC42-4A-5A (60, E690, FG60, 4W73)
	Maker	HITACHI
	Dia. of Throttle Valve (mm)	42
	Dia. of Ventury Tube (mm)	36-17-10
	Dia. of High Speed Jet (mm)	1.43 (VC42-1A), 1.35(VC42-4A-5A)
	Dia. of Low Speed Jet (mm)	0.55
	Dia. of Economizer Jet (mm)	1.10
	Draft Direction	Downward
Air-Cleaner -	Type	Oil Bath
	Maker	Tsuchiya
	Number	1
Fuel Feed Pump -	Type	Diaphragm
	Maker	Showa Seiki/Kyosan Denki

LUBRICATING SYSTEM:

Method	Pressure Feed
Type of Oil Pump	Gear Pump
Type of Oil Filter	Paper Filter
Oil Pan Capacity (ltr.)	5.3 (680 series) 6.7 (60 series)

COOLING SYSTEM:

Method	Forced Circulation with Centrifugal Pump
Radiator	Fin and Tube Type
Type of Water Pump	Centrifugal Pump
Thermostat	Pellet

BATTERY:

Model	2SMC
Voltage	12 volt
Capacity (amp - hr.)	60 (20 hr. rating), E690 (120A/30h)
Number	1
Terminal grounded	+(positive) side

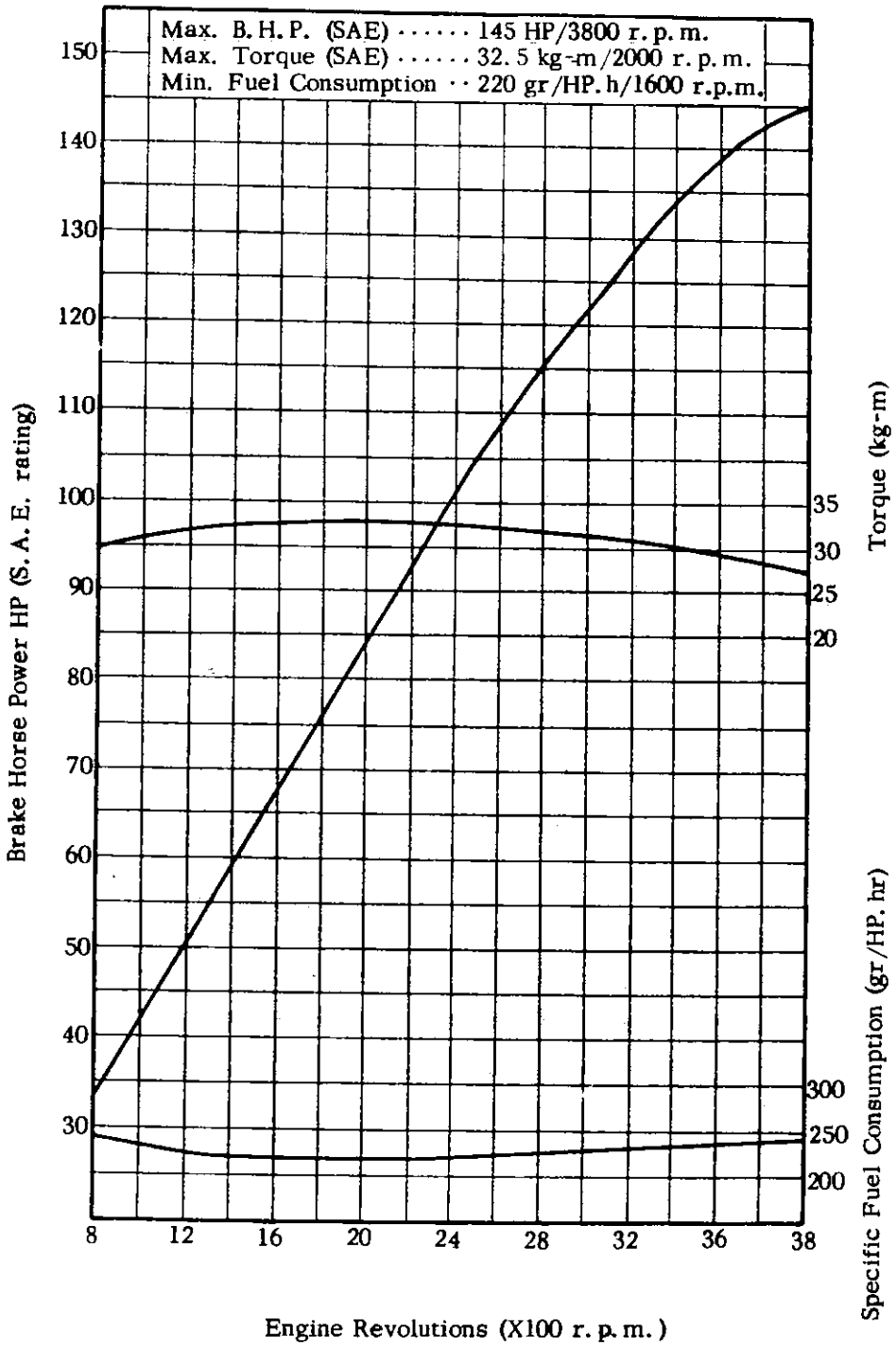
GENERATOR:

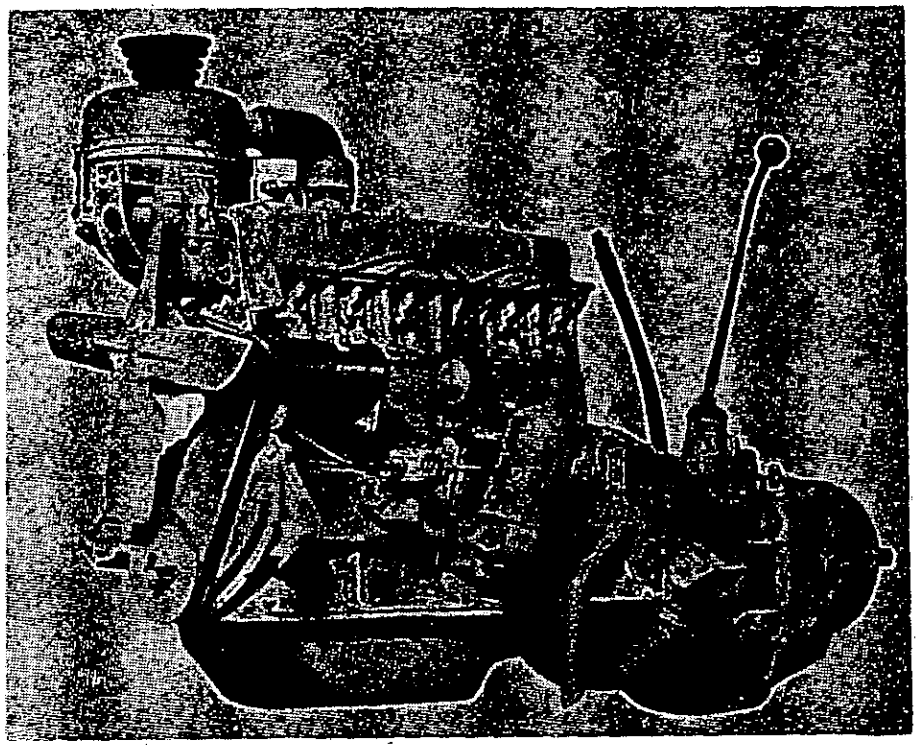
Model	
Maker	HITACHI
Type of Winding	Shunt-wound
Voltage	12 volt
Capacity (kw)	200W
Type of Voltage Regulator	Carbon-pile
	R115-50, G140-07 (F680, E690)

STARTING MOTOR:

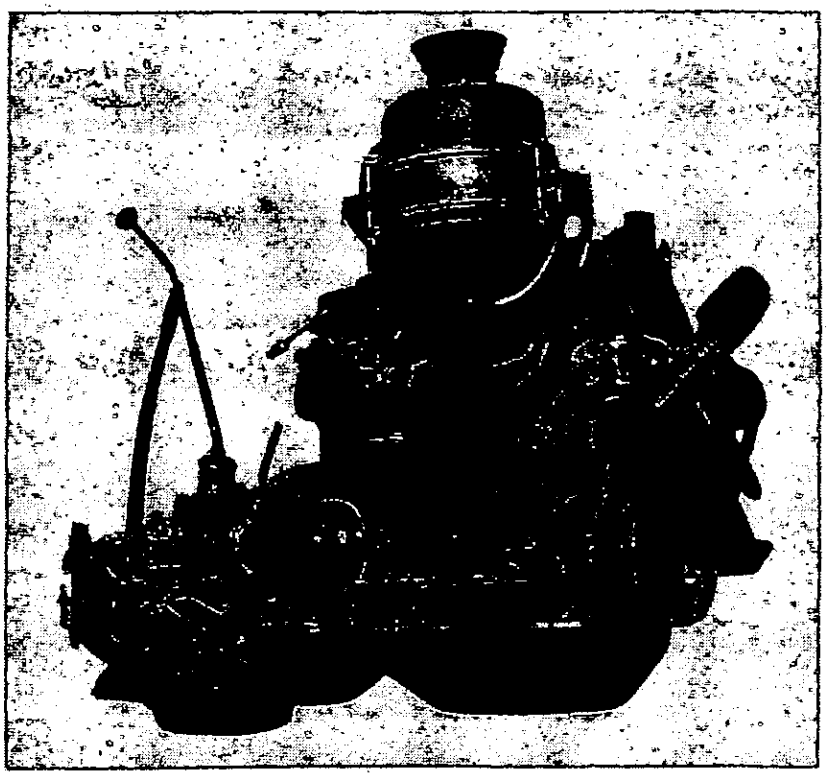
Model	MFB - HRZ
Maker	HITACHI
Volt - Power (v-hp)	12 - 1.0
	S114-23, S114-21 (E690)

PERFORMANCE CURVES OF NISSAN MODEL P ENGINE





ENGINE-LEFT SIDE



ENGINE-RIGHT SIDE

GENERAL INSPECTION OF ENGINE

In order to maintain the engine at the best condition, a periodical and orderly adjustment have to be made.

(1) Check of Cooling Water

The cooling system must be full of water which is required to be soft and clean.
(Refer to the line-up of Cooling System.)

(2) Check of Battery

The quantity of electrolyte is required to be as much as 3/8 inch above the plates. The specific gravity should be more than 1.220 kg. The voltage at each cell should be more than 17.5 volt on the excell tester.
(Refer to the line-up of Electrical.)

(3) Check of Engine Oil

The oil capacity is 6.2 ltr. The oil level should be between the upper and lower lines of the oil level gauge. The standard oil pressure is 3.5-4 kg/cm^2 (49.5 - 57 lb/in^2) at running speed.
(Refer to the line-up of Lubrication System.)

(4) Check of Spark Plug

The gap should be adjusted to 0.6 - 0.7 mm. (0.024 - 0.028 in.)
(Refer to Ignition System.)

(5) Check of Compression Pressure of Cylinder

The compression pressure should be over 135 pounds per square inch when measured by rotating engine with starting-motor. The difference of pressure at each cylinder should not exceed 10 pounds per square inch. This test should be made under the conditions; temperature of cooling water at 70° - 80°, all spark plugs removed, and the throttle and choke valves of carburetor completely open.

(6) Check of Distributor

Adjust the point gap at 0.020 inch.

(7) Check of Ignition Timing

Adjust the timing at 2° before top dead center. (crank angle)

(8) Check of Carburetor

(Refer to Fuel System.)

(9) Check of Fuel Pump and Strainer

(Refer to Fuel System.)

(10) Check of Tension of the Fan-Belt

When pressed by a hinge, the deflection of fan belt should be 25 mm (1 in.) at the middle of water pump pulley and crank shaft pulley.

(11) Check of the Valve Tappet Clearance

Adjust the clearance at 0.38 - 0.40 mm (0.015-0.016 in.) at 60°C for both intake and exhaust valves when engine is sufficiently warmed.

(12) Check of "Slow" for Carburetor

(Refer to Fuel System.)

(13) Check of Tighteness of Cylinder Head Bolts

Adjust them to be 55 - 65 ft/lb.

(14) Check of Charging Rate of Generator

It should read more than 10 amperes at the engine speed of 30 - 40 km/hr. (Refer to Electrical.)

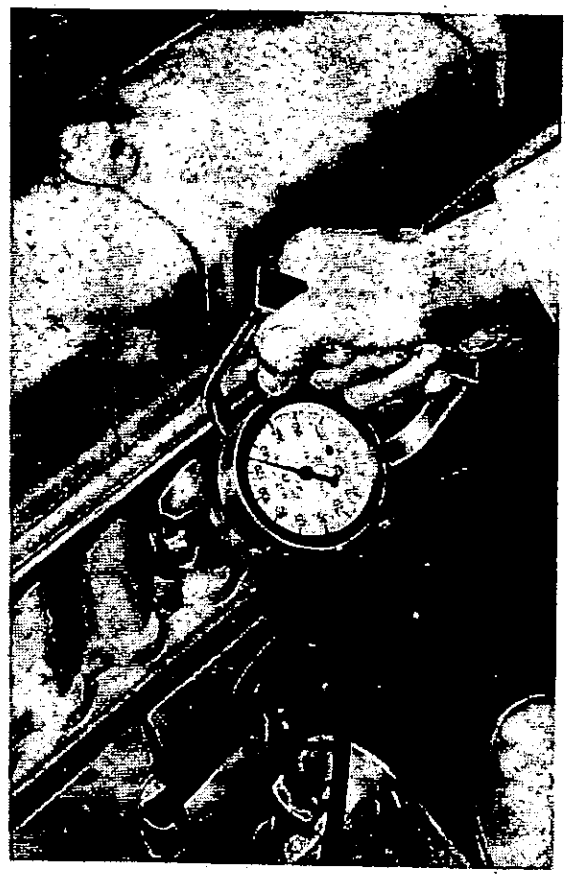


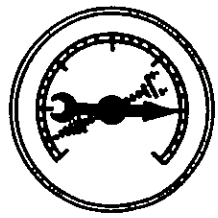
Fig. 1

(15) Diagnosis of Engine by Means of Vacuum Gauge

(See Fig. 2.)

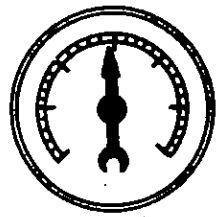
Normal Engine.

Around 18 to 20 vacuum with slight fluctuation at idling speed.



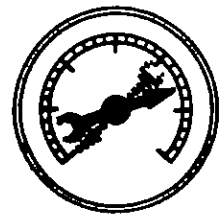
Piston Ring in Normal Condition.

Drops to 2 and then springs back to 25, when accelerating engine.

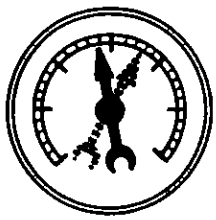


Oil and Rings in Poor Condition.

Remains in lower reading in Case 2.



In case 3, gauge hand drops to zero and comes back to about 23 when opening and closing throttle.



Sticky Valve.

Drops occasionally four divisions from normal reading.

Burnt Valve.

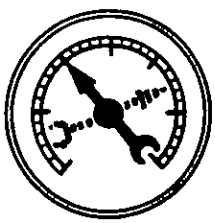
Drops regularly several divisions.

Leaky Valve.

Drops about two divisions.

Loose Valve Stem Guide.

Vibrates fast between 14 and 18.

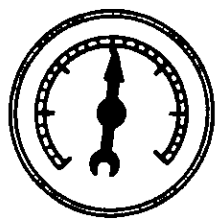


Weak Valve Spring.

From 10 to 22 when accelerating engine, and becomes greater as increasing speed.

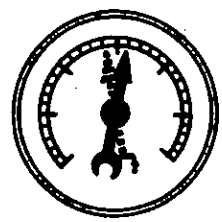
Late Timing of Valves.

Remains steady between 8 to 15.



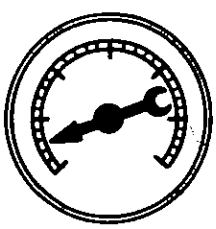
Late Ignition Timing.

Remains steady between 14 to 17.



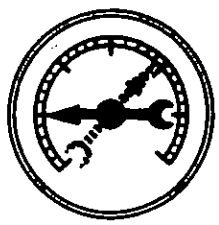
Spark Plug Gap too Small or Breaker Point Contact Improper.

Floats between 14 and 16.



Leaky Gasket of Intake Manifold or Carburetor.

Indicates 5 or less.

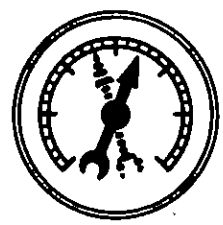


Leaky Cylinder Head Gasket.

Floats regularly between 5 and 19.

Choked Muffler.

Normal at first, drops to zero and then builds up to 16.



Carburetor is Out of Adjustment.

Floats slowly between 13 and 17.

Fig. 2 Diagnosis of Engine by Vacuum Gauge

SHORT-CUT FOR TROUBLE SHOOTING

Leakage of fuel

- **Piping system**
  1. Damage of fuel pipe or insufficient soldering.
  2. Insufficient tightening or damage of union nut on the fuel pipe.
- **Carburetor**
  - The fuel level too high or over-flowing
    1. Worn needle valve and seat in float chamber.
    2. Dust at needle valve and seat in the float chamber, or incomplete movement of needle valve.
    3. Fuel infiltrated in the float.
    4. The float is too heavy due to the weight of solder.
    5. Too much pressure of fuel pump or too big needle valve seat hole.
  - Improper fastening of jet screws or damaged washer
    1. Improper fastening of needle valve seat ass'y.
    2. Improper fastening of screws on the cover of the float chamber.
    3. Loose emulsion outer tube.
    4. Improper fastening of pump injector.
    5. Improper fastening of low speed jet.
    6. Improper fastening of the upper and lower bodies of carburetor, or presence of cracks.

Carburetor

- **Adjustment** — Poor adjustment for "low speed".
- **Repair**
  1. Clogging of low speed jet, or the jet of improper size used.
  2. Loose fastening of low speed jet.
  3. Crack on the joint-surface of the upper and lower bodies of carburetor, or fastening.
  4. Improper assembling of the throttle valve.

Poor idling

- 5. Intrusion of air due to worn throttle valve shaft.
- 6. Air leaking from carburetor flange and intake manifold flange.

Engine and etc.

- 1. Difference of compression of each cylinder.
- 2. Irregularity of spark plug gaps.
- 3. Poor quality of spark plugs, or use of different kinds.
- 4. Improper ignition timing.
- 5. Intrusion of air from the intake manifold, or the rubber tube joint of the window shield wiper is leaky.

Hard to start or unable to start (in cold climate)

Carburetor

- 1. No fuel supply to the carburetor.
- 2. Intrusion of air from the throttle valve shaft and its flange fixing the same.
- 3. Use of poor quality fuel, (too much mixture of substitute fuel such as alcohol, kerosene, etc.).
- 4. Erroneous use of choke button.

Engine and other parts

- 1. Imperfect insulation of high tension wiring.
- 2. Poor ignition current due to the under charging of battery.
- 3. Disorder of ignition circuit.
- 4. Troubles of spark plugs, (accumulation of carbon, damage by heat, irregularity of gaps, condensation of lubricating oil and water, poor quality, etc.).
- 5. Insufficient compression of cylinder.
- 6. Air intrusion into the intake manifolds.
- 7. Insufficient seating of engine valves, or broken or weak valve springs.

			8. Insufficient cranking speed of starting motor.
			9. Poor quality lubricating oil.
Hard to start or unable to start (in hot climate)	Carburetor		1. No fuel supply to the carburetor.
			2. Too lean mixture due to poor adjustment for "low speed".
			3. Erroneous use of choke button.
			4. Insufficient tightening of upper and lower body, or damage of gasket.
	Engine		1. Trouble of engine valves, or broken valve springs.
			2. Poor ignition or insufficient cranking speed of starting motor due to drop of battery voltage.
			3. Disorder of ignition circuit.
			4. Trouble of startor motor.
Insufficient speed and power	Carburetor		1. Dirty intake manifold.
			2. Excessive resistance for suction due to partial clogging of air cleaner.
			3. Insufficient fuel supply due to vapour-lock in fuel pump and pipe.
			4. Disorder of fuel pump.
			5. Clogged main jet, power jet or main air bleed.
			6. Wrong assembling and adjustment of carburetor, (ignorance of relative sizes of venturi tube, main jet, main air bleed etc.).
	Engine		1. Too much friction and resistance of bearings and other parts.
			2. Insufficient compression of cylinder.
			3. Overheating of engine.
			4. Poor cooling system.
			5. Wrong setting of octane selector.
			6. Disorder of ignition system.
			7. Misfire of any spark plug.
			8. Brakes dragging due to poor adjustment.

- **Overheating of engine**
  - **Carburetor**
    - Wrong assembling of carburetor, (ignorance of relative sizes of venturi tube, main jet, main air bleed).
  - **Engine and others**
    1. Too much friction and resistance.
    2. Poor cooling system.
    3. Inefficiency of cooling effect of radiator.
    4. Poor circulation of lubricating oil.
    5. Wrong ignition timing.
    6. Wrong setting of octane selector.
    7. Over-loading.
- **Air mixture is too rich**
  - **Judgement**
    1. The porcelain part of spark plug gets stained black with the carbon.
    2. The color of exhaust gas is black and has the unpleasant odour.
    3. Uneven running of engine.
  - **Cause**
    1. Wrong assembling and adjustment of carburetor, (ignorance of relative sizes of venturi tube, main jet, main air bleed, etc.)
    2. The jet hole is too big.
    3. Insufficient fastening of main jet.
    4. Leakage in the power jet valve.
    5. The level of fuel is too high.
    6. Disorder of air-cleaner.
- **Air mixture is too lean**
  - **Judgement**
    1. The porcelain part of spark plug is white.
    2. Uneven running of engine.
    3. Back firing in carburetor.
    4. Engine overheat, (particularly the exhaust pipe overheats).
    5. Engine power diminishes.
  - **Cause**
    1. Poor adjustment of carburetor.
    2. Instrusion of air from the throttle valve shaft and the fitting flange.

	3. Jets tampered or remodelled, or imitation parts used.
Back fire	1. Too lean mixture. 2. Wrong ignition timing, (Pre-ignition). 3. Catch fire due to engine overheat. 4. Disorder of ignition system. 5. Insufficient seating of engine valves, or broken valve springs.
Insufficient acceleration	1. Disorder of accelerating pump. 2. Clogging of accelerating pump injector hole. 3. Leakage from accelerating pump check ball valve. 4. Disorder of distributor governor. 5. Wrong ignition timing. 6. Poor adjustment of carburetor.
Knocking	1. Erroneous adjustment of carburetor. 2. Improper fuel relating to compression ratio. 3. Dirty cylinder inside. 4. Wrong ignition timing, (Pre-ignition). 5. Disorder of spark plug.

SECTION 1.
CYLINDER & CYLINDER HEAD

1-1 CYLINDER

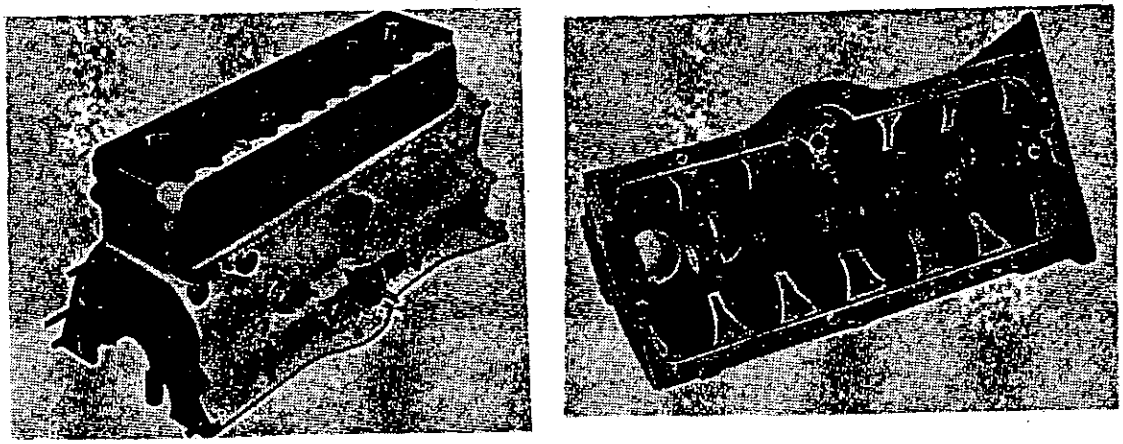


Fig. 1

DATA

Diameter of cylinder bore	85.69 - 85.739 mm (3.376 in. - 3.3754 in.) (The limit for over-size piston is 0.06 in.)
Thickness of cylinder wall	5.15 mm (13/64 in.) (Use sleeve if over-size more that 0.060 in. The outer diameter of sleeve should be less than 3.5695 in.)
Difference of top and bottom bore	Less than 0.025 mm (0.001 in.)
Difference between the longer and shorter diameter (inside) of an oval bore of cylinder	Less than 0.025 mm (0.001 in.) (limit of use, 0.08 in.)
Main bearing housing dia.	73 - 73.025 mm (2.874 - 2.875 in.)
Block cylinder head surface warpage	Not to exceed 0.1 mm (0.004 in.)
Tightening torque of main bearing cap bolts	10 - 11 kgm (72 - 80 ft/lb.)

The engine is a six cylinder valve in head type, equipped with counter balanced crank shaft. The displacement of this engine is 3956 cc; it develops 145 horsepower at 3800 revolutions per minute (SAE).

Maximum torque is 32.5kgm at 2000 rpm.

The illustration Fig. 2, shows a view of the engine assembly in side cross section.

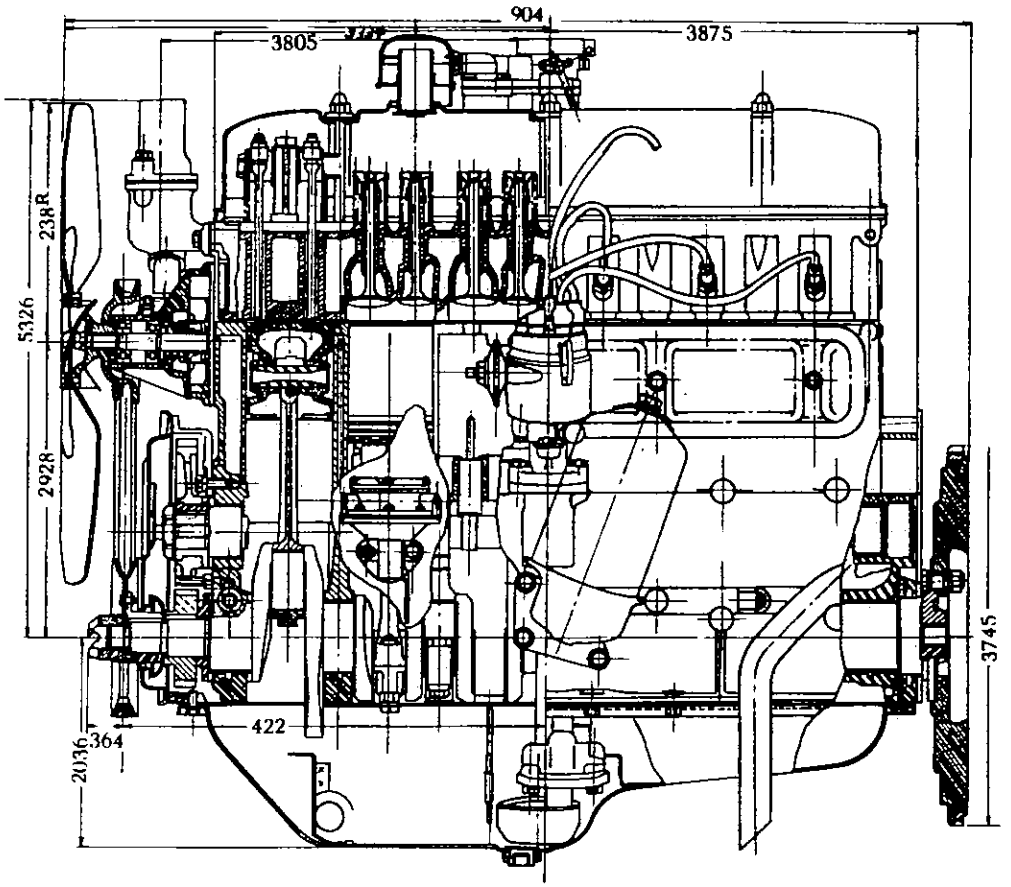


Fig. 2 Sectional View of the Engine

Repair operations when it becomes necessary to overhaul an engine assembly it should be completely disassembled and all parts throughly cleaned before starting the overhaul operations.

In order to simplifty the following instructions we well cover the repair of the various parts in the order in which an overhaul job would be performed.

Checking Cylinders

By far the best method to be used indetermining the condition of a cylinder in an engine preparatory, to reconditioning is the use of a dial gauge such as is shown Fig. 3.

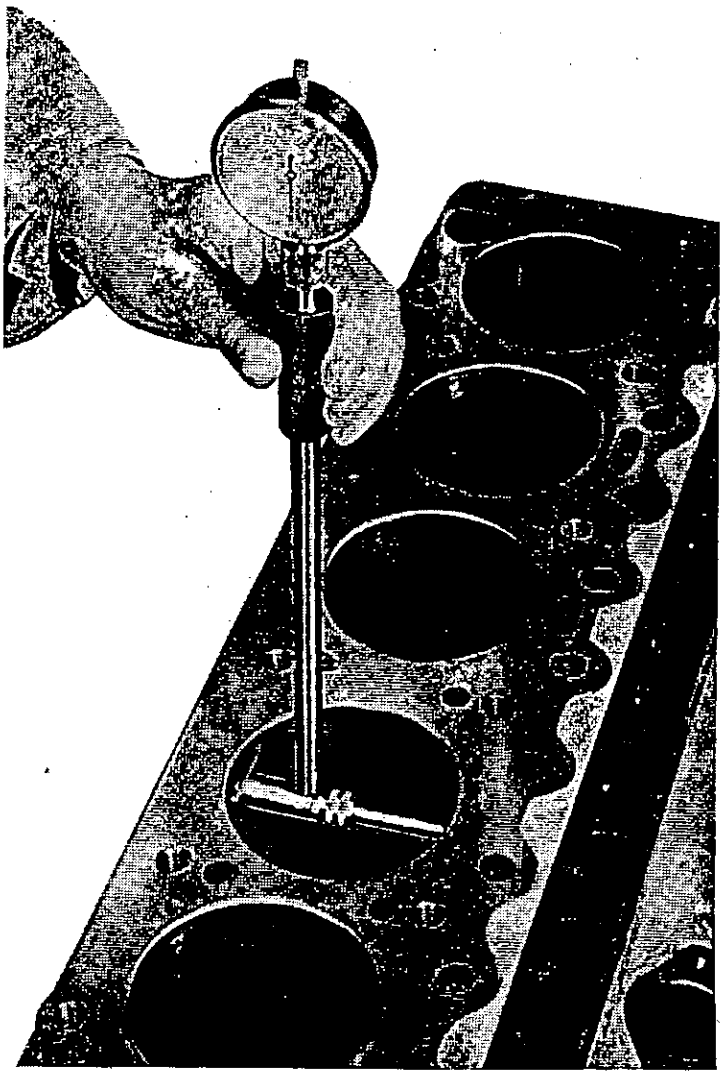


Fig. 3 Checking Cylinder Walls with Dial Gauge

The dial gauge hand will instantly and automatically indicate the slightest variation in the cylinder bores.

In use, the dial gauge is simply inserted in the cylinder bore, and moved up and down its full length. It is then turned spirally or completely roted at as may be desired, taking readings at each point. In this manner all variations in the cylinder walls from top to bottom may be determined.

If a master gauge, corresponding with the exact diameter of a standard cylinder bore is used to set the dial gauge, it is easy to determine the oversize piston to use as well as the amount of metal which must be removed from the cylinder walls to make them true.

Cylinder Boring

When it becomes necessary to rebore the cylinders of an engine to install oversize pistons, the instructions furnished by the manufacturer of the equipment used should be carefully followed.

In this engines the piston clearance is allowed on the piston and this must be taken into consideration when setting the cutter in the boring bar.

The piston to be fitted should be checked with a micrometer, measuring just below the lower ring groove and at right angles to the piston pin. The cylinder should be bored to the same diameter as the piston.

If micrometer is not available to measure the piston, the cylinder should be bored 0.002" less than the oversize piston to be fitted.

For example, when fitting a 0.020" oversize piston, the cylinder should be bored 0.018" oversize.

Cylinder Hone

After a cylinder has been rebored within 0.002" of the size desired, it should be refinished or polished with a cylinder hone.

In operation, the hone is placed into the cylinder bore and expanded until it can just be turned by hand. The hone is then operated, up and down, in the bore until it begins to run free. During this operation kerosene should be used as a cutting fluid to keep the stones of hone clean. This procedure should be followed until the piston being fitted can be pushed through the cylinder on a 0.0025" feeler gauge.

The feeler gauge must be inserted vertically, 90° around piston from the piston pin and draw out the feeler gauge with the scale under 1 - 3 kg powers.

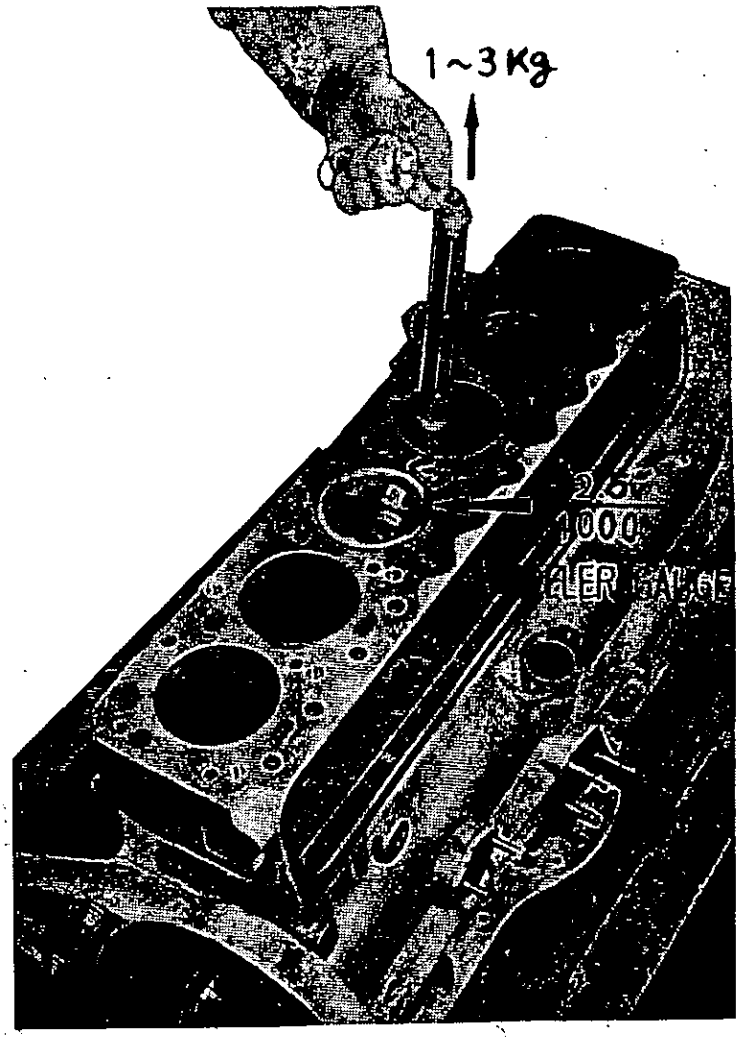


Fig. 4

1-2 CYLINDER HEAD

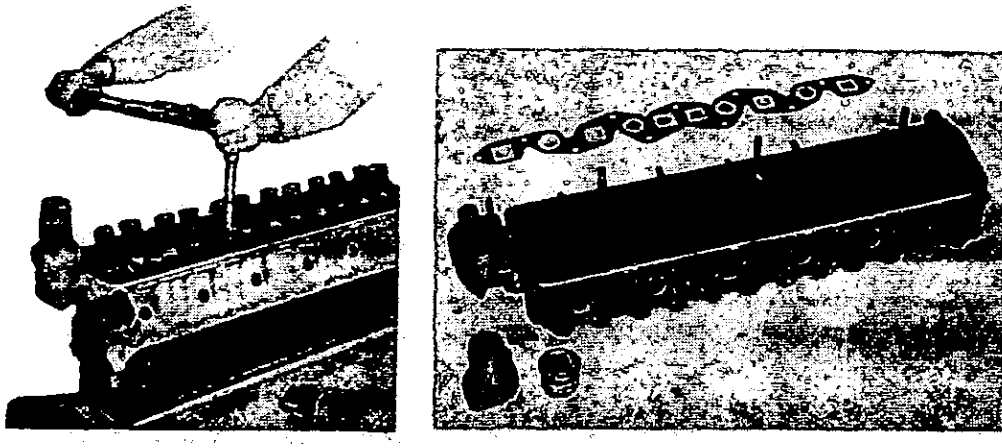


Fig. 5

DATA

	Power up En.	Former En.
Cyl. head height (all length)	97.06 mm	100.1 mm
Combustion chamber volume	86.72 ± 0.5 cc	99.80 cc
Length of Cyl. head	119 mm	121 mm
Warpage of surface	Within 0.004" (0.1 mm)	
Tightening torque		
Cyl. head bolt	55-65 ft/lb. (7.6-9.0 Kgm)	
Rocker bracket bolt	31-36 ft/lb. (4.3-5.0 Kgm)	

One of the most important units of any overhead valve engine is the cylinder head. It contains not only the combustion chambers and spark plugs, but the valves, inlet ports, exhaust ports and the necessary water passages to maintain the proper temperature of these important parts.

No maintenance operation is more important than valve grinding, from the stand point of engine economy and performance.

Extreme care should, therefore, be used whenever valve are ground to maintain factry limits and clearances, as only by maintaining these limits and clearances can good engine economy and performance be obtained.

Checking Valve Guide

Lack of power and noisy valves, in many instances, can be traced to worn valve guides. The clearance between the vlave guides and the valve stem is very important.

The intake guides should be checked with a new intake valve and the exhaust be checked with a new exhaust valve, because the diameters of the stems are different.

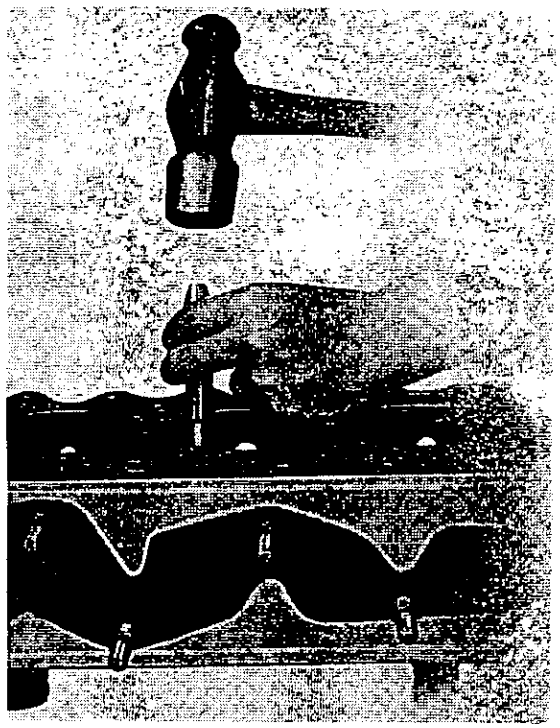


Fig. 6

SERVICE NEWS REFERENCE

DATE	CONTENTS	NO. OF SERVICE JOURNAL AND BULLETIN

SECTION 2.

PISTON, PISTON RING, PISTON PIN & CONNECTING ROD

2-1 PISTON

The pistons are made of LO-EX aluminum alloy with three ring groove located above the piston pin.

The skirt is elliptic.

These pistons are furnished in standard size as well as 0.010", 0.020", 0.030", 0.040", 0.050", 0.060".

Any time a piston is removed from the cylinder it should be examined for carbon on the inside, and any carbon deposit removed. This helps keep the engine oil clean. The piston pin is fixed 1.5 mm off set towards the thrust direction at the center of piston.

The pistons are serviced with the piston pin fitted in them. Should it become necessary to install oversize piston pins.

The proper fit of the piston pin is a thumb push fit. (at 20°C.)

The piston pins are serviced in standard size as well as 0.0025", 0.005" over-size.

Note: Over size pistons for service use are as follows.
Piston is usually supplied as Set-piston with pin.

For Connecting rod 12100 58000 (Piston pin bolt clamp type)			
Size	Set-piston w/pin	Piston	Pin-piston
STD	12010 58022	12011 58002	12024 95960
0.12	12010 58023	12012 58002	12024 95960
0.25	12010 58024	12013 58002	12024 95960
0.50	12010 58025	12015 58002	12024 95960
0.75	12010 58026	12016 58002	12024 95960
1.00	12010 58027	12017 58003	12024 95960
1.25	12010 58028	12018 58003	12024 95960
1.50	12010 58029	12019 58003	12024 95960

Part Name	No.	Remark
Set-piston w/pin-std	12010 58022	For use with combined oil ring & bolt locking type con-rod
piston	12011 58002	
Pin-piston	12024 95960	

Part Name	Part No.	Remark
Set-conrod w/bush	12130 58002	
Ass'y-conrod	12100 58000	
Rod-connecting	12104 58000	
Washer-spring	9-15116	
Bolt-hex	1-34632	
Cap-conrod	12106 58000	
Bolt-conrod	12109 58000	
Nut hex	9-11246	
Palnut	12112 58000	
Bush-conrod (std)	12111 58001	
Pin-piston (std)	12024 95960	
Pin-piston O.S. 0.06 mm	12028 95960	
Pin-piston O.S. 0.12 mm	12025 95960	Service spare parts
Pin-piston O.S. 0.25 mm	12026 95960	

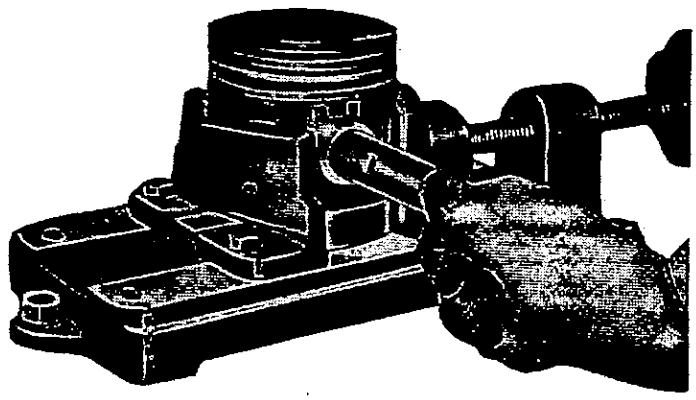


Fig. 1

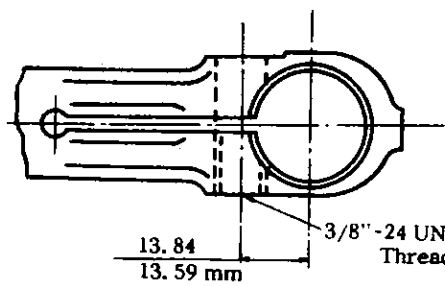


Fig. 2

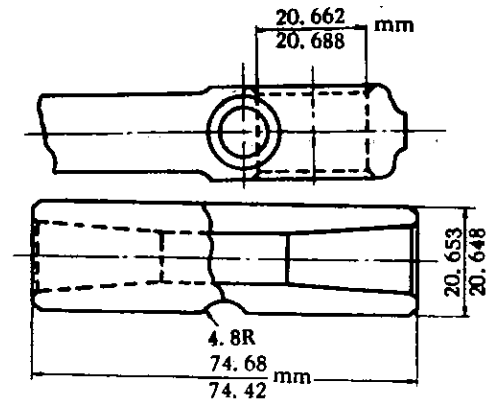


Fig. 3

2-2

Interchangeability: New con-rod can be used with former type piston pin.
Former con-rod can not be used with the new piston pin.

Applied model: All P engine

Applied from: E# P-32473 for 680 series (Except Fire Engine)
E# P-32423 for 60 series
E# PF-2686 for all P type fire engine

NEW CON-ROD

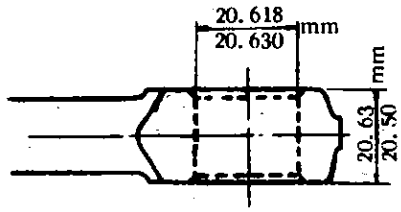
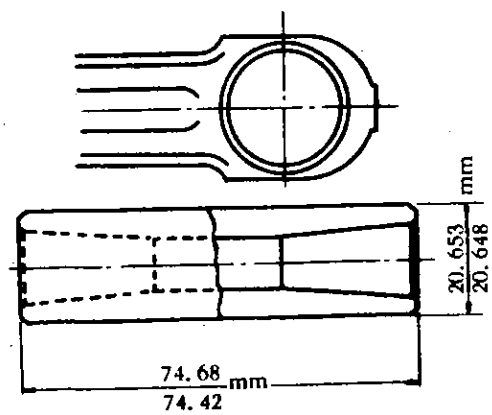


Fig. 4

Part Name	New No.	Remark
Set-piston w/pin-std	12010 58100	For use with combined oil ring & press fit type con-rod
Piston	12011 58100	
Pin-piston	12024 58000	



Applied model: All P engine

Applied from: E# P-31592

Fig. 5

Part Name	Part No.
Set-con w/bush	12130 58003
Ass'y-con-rod	12100 58001
Rod-connecting	12104 58001
Washer-spring	None
Bolt-hex	None
Cap-con-rod	12106 58000
Bolt-con-rod	12109 58000
Nut hex	9-11246
Palnut	12112 58000
Bush-con-rod (std)	12111 58001
Pin-piston (std)	12024 58000
Pin-piston O.S. 0.06 mm	12028 58000
Pin-piston O.S. 0.12 mm	12025 58000
Pin-piston O.S. 0.25 mm	12026 58000

For Connecting rod 12100 58001 (Piston pin tight press fit type			
Size	Set-piston w/pin	Piston	Pin-piston
STD	12010 58100	12011 58002	12024 58000
0.12	12010 58101	12012 58002	12024 58000
0.25	12010 58102	12013 58002	12024 58000
0.50	12010 58103	12015 58002	12024 58000
0.75	12010 58104	12016 58002	12024 58000
1.00	12010 58105	12017 58003	12024 58000
1.25	12010 58106	12018 58003	12024 58000
1.50	12010 58107	12019 58003	12024 58000

PISTON

Piston pins are tightly fitted in the connecting rods.

It is advisable to use a special assembling tool (NT-4245) shown in the following figure 6. To ease the fitting coat light engine oil on the outer surface of pin and inside of con-rod pin hole before press-in.

When assembling with the special tool the end of the piston pin must be approximately 3mm (1/8 in.) out of the piston boss face so that the connecting rod is position in the center of piston pin.

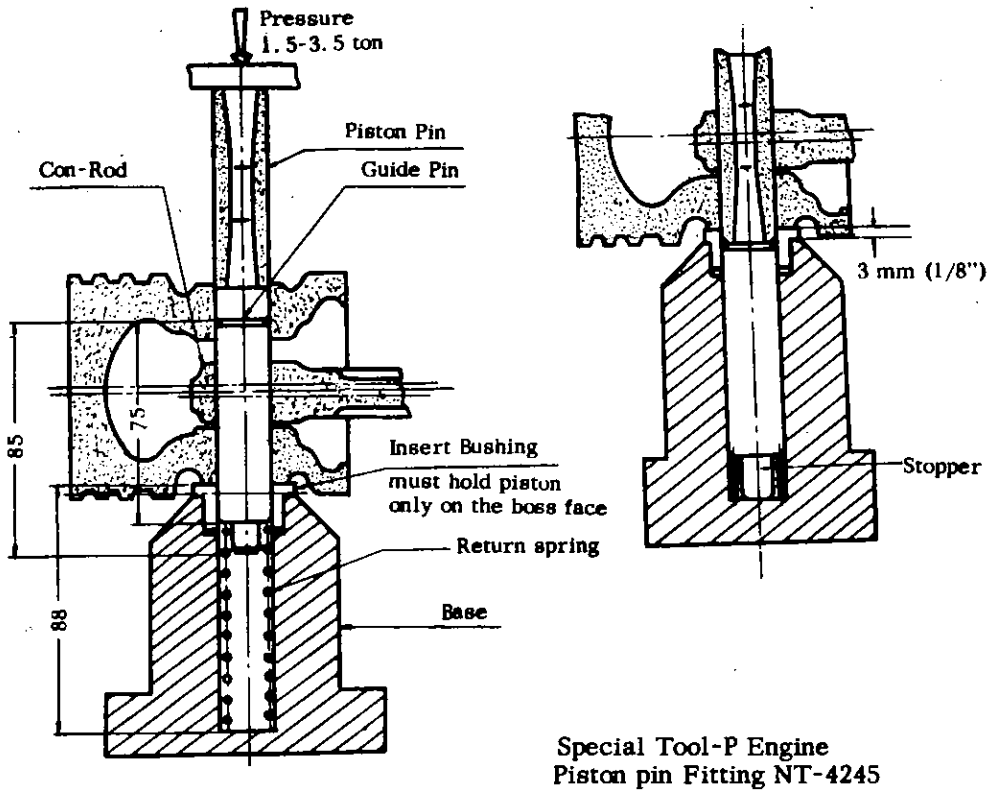


Fig. 6

Inorder to avoid distortion of piston during press fitting pin into the con-rod, the inner ribs and the base of pin boss is slightly modified, and also the oil ring groove depth is slightly deepen for the newly adopted combined oil ring.

2-3 PISTON RING AND PISTON PIN

All compression rings are marked with the word, Top cast in the upper side of the ring. When installing compression rings, make sure the side marked. Top is toward the top of the piston.

Piston rings are furnished in standard size as well as 0.005", 0,010", 0.020", 0.030", 0.040", 0.050", 0.060".

To properly fit new piston rings, proceed as follows:

Slip the ring into the cylinder, pressing it down about 2 inches into the bore with a piston. This will square the ring in the cylinder.

Check the gap between the ends of the ring with a feeler gauge.

This should be from 0.006" to 0.015".

Top = 0.010" to 0.015" (0.25 - 0.38 mm)
2nd & oil = 0.006" to 0.012" (0.15 - 0.30 mm)

If the space between the ends of ring is less than 0.005", remove the ring and with a fine file dress the ends until proper clearance is obtained. Fit each ring separately.

Carefully remove all particles of carbon from the faces of the ring grooves in the piston, and inspect the grooves for burrs or nicks that might cause the rings to hang up.

DATA

PISTON

Type	Flat head, invar steel strut
Material	Aluminum alloy (Lo-Ex)
Weight	445 - 460 gr. (15.692 - 16.226 oz)
Diameter of piston skirt:	
Standard	85.650-85.699 mm (3.3719-3.3739 in.)
Over size 0.12 mm	85.775-85.824 mm (3.3769-3.3788 in.)
Over size 0.25 mm	85.900-85.949 mm (3.3818-3.3837 in.)
Over size 0.50 mm	86.150-86.199 mm (3.3916-3.3935 in.)
Over size 0.75 mm	86.400-86.499 mm (3.4015-3.4034 in.)
Over size 1.00 mm	86.650-86.699 mm (3.4113-3.4132 in.)
Over size 1.25 mm	86.900-86.949 mm (3.4212-3.4231 in.)
Over size 1.50 mm	87.150-87.199 mm (3.4310-3.4329 in.)
Difference of major and minor diameter	0.30-0.34 mm (0.012-0.0135 in.)
Width of ring groove:	
Compression	2.530-2.555 mm (0.0996-0.1005 in.)
Oil	4.765-4.790 mm (0.1876-0.1885 in.)
Depth of ring groove:	
Compression	4.045-4.120 mm (0.1592-0.1692 in.)
Oil	4.045-4.120 mm (0.1592-0.1692 in.)
Distance from the top of piston to center of pin hole	53.25-53.35 mm
Clearance between cylinder wall and piston (measured at skirt)	0.031-0.049 mm (0.0012-0.0019 in.)

Checking of feeler gauge	1. 5-3. 5 kg at 0. 0025 in. feeler gauge
Diameter of piston pin hole	20. 650-20. 663 mm (0. 8130-0. 8135 in.)
Off-set of piston pin hole	1. 5 mm (0. 059 in.)
Weight difference of piston only	Not to exceed 15 gr. (0. 5 oz.)
Weight difference of piston and connecting rod assembly	Not to exceed 5 gr. (0. 5 oz.)

PISTON RING

Compression ring No. 1	Inner bevel type, chrome plated
Compression ring No. 2	Taper type
Oil control ring	Slotted scraper, chrome plated
Oversize rings available	0. 12, 0. 25, 0. 50, 0. 75, 1. 00, 1, 25, 1, 50 mm (0. 005, 0. 010, 0. 020, 0. 030, 0. 040, 0. 050, 0. 060 in.)
Compression ring groove width	2. 477-2. 490 mm (0. 0974-0. 0980 in.)
Oil control ring groove width	4. 72-4. 74 mm (0. 1858-0. 1866 in.)
Compression ring width	3. 8-3. 6 mm (0. 1496-0. 1417 in.)
Oil control ring width	3. 3-3. 5 mm (0. 1299-0. 1377 in.)
Tension:	
Compression No. 1	1. 45-1. 75 kg (3. 1967-3. 8581 lb.)
Compression No. 2	1. 6-1. 9 kg (3. 5274-4. 1888 lb.)
Oil control	1. 2-1. 6 kg (2. 6455-3. 5274 lb.)
Ring Gap:	
Compression No. 1	0. 25-0. 40 mm (0. 0098-0. 0157 in.)
Compression No. 2	0. 15-0. 30 mm (0. 0039-0. 0118 in.)
Oil control	0. 15-0. 30 mm (0. 0059-0. 0118 in.)
Ring groove clearance:	
Compression (1 & 2)	0. 04-0. 05 mm (0. 0016-0. 0020 in.)
Oil control	0. 025-0. 070 mm (0. 001-0. 003 in.)

PISTON PIN

Diameter:	
Standard	20. 653-20. 648 mm (0. 8131 ~ 0. 8126 in.)
Oversize available 0.062 mm	20. 722-20. 710 mm (0. 8158-0. 8153 in.)
Oversize available 0.125 mm	20. 785-20. 773 mm (0. 8183-0. 8178 in.)
Length	74. 8-74. 4 mm (2. 9448-2. 9291 in.)
	74. 68-74. 42 mm (2. 9402 ~ 2. 929 in.)
Fit	Thumb fit at 20°C (68°F)
	Press fit 1. 5 - 3. 5 metric ton

Slip the outside of the ring into the groove, and roll it entirely around the groove, to make sure that the ring is free and does not bind in the groove at any point.

Proper clearance of the piston ring in its groove is very important and when fitting new rings the following clearance should be adhered to:

At the top ring a 0.002" feeler 0.001"-0.015" should be very free, but 0.003" feeler should cause the ring to lock in the groove. At the second or oil control groove, the 0.002" feeler should produce a light drag.

If a ring of proper size is not available, select one which fits slightly tight, grind the ring on emery No. 1 placed upon the flat plate. Rub the lower side evenly, making sure the ring will not warp.

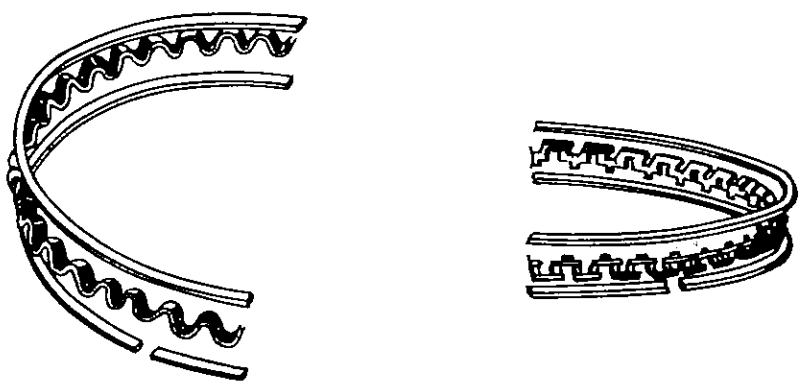
LOCATION OF RING GAP

The leakage of compression pressure is often caused from the improper location of ring gap in relocation to each other. When assembling the rings, locate the gap of first compression ring toward Front Direction, the second ring at 180° angle toward Rear Direction of the engine and the oil ring at same direction of first compression ring.

2-4

The engines from the number P-31592 are assembled with combined ring. This new ring compose of two side rails and a special spacer, is designed to control the quantity of oil-up and blow-by gas. This flexible type which follows closely the surface of the cylinder walls even when they are slightly out-of-round will perform better sealling.

P Engine	Side rail gap	0.2-0.8 mm	Maker
	Side rail tension	$3.5^{-0.5}_{+0.5}$ kg	RIKVENT NIFLEX



RIKVENT NIFLEX

Fig. 7

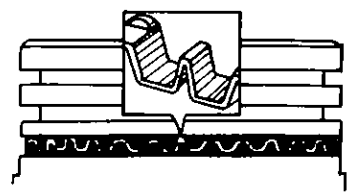
Size	Make	Set-Piston Ring (Top, Second, Oil)	Remark
STD	Niflex	12033 58004	From P-31592 & Spare parts
STD	Rikvent	12033 58005	From P-31592 & Spare parts
Over Size			
0. 12	Niflex	12034 58002	Spare parts only
0. 12	Rikvent	12034 58003	"
0. 25	Niflex	12035 58002	"
0. 25	Rikvent	12035 58003	"
0. 50	Niflex	12036 58002	"
0. 50	Rikvent	12036 58003	"
0. 75	Niflex	12037 58002	"
0. 75	Rikvent	12037 58003	"
1. 00	Niflex	12038 58002	"
1. 00	Rikvent	12038 58003	"
1. 25	Niflex	12039 58002	"
1. 25	Rikvent	12039 58003	"
1. 50	Niflex	12040 58002	"
1. 50	Rikvent	12040 58003	"

Instructions for Installing Combined Type Oil Ring

Following instructions and illustrations are mainly for Rikvent, but as for Niflex oil rings it is just the same as for Rikvent except the position of rail gap angle (45°).

Installing Spacer:

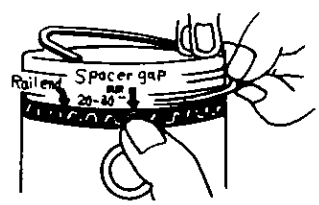
Install spacer in bottom groove with spacer gap over piston boss. For easy installation hold one end of spacer in the groove and fit it gradually around into the groove. Make sure spacer ends are butted properly as shown below.



Top Rail:

Use either of the two steel rails (no right or wrong side)

Holding ends of spacer with thumb;
Place one end of rail on top side of spacer ends;
Coil rail across ends and on around into the groove.



Botton Rail:

Install remaining steel rail on lower side of spacer with gap approximately 20-30 mm right of spacer ends.

Final Inspection:

Check final assembly to make certain:

Rails are not off spacer;
Gaps of rails and spacer are nor lined straight;
Spacer assembly can be turned manually with ease;
Spacer gap is directly over piston boss.

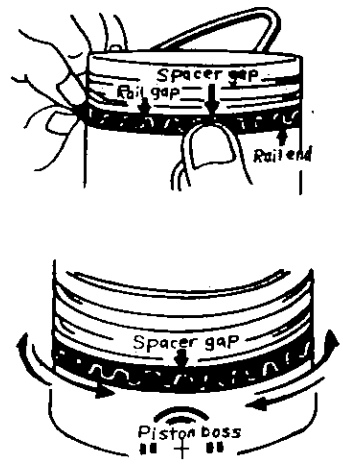


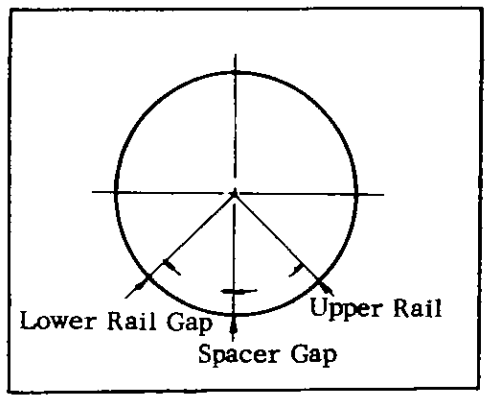
Fig. 8

Installing Pistons into Cylinders:

Use steel-band tool for installing pistons into cylinders.

For Niflex Oil Ring:

Install two rails so that each gaps are 45° from spacer gap.



NIFLEX

Fig. 9

2-5 CONNECTING ROD

DATA

Material	Steel forging F500
Length, center to cetner	200-199. 9 mm (7. 874 - 7. 870 in.)
Big end housing width	31. 55 - 31. 50 mm (1. 2422 - 1. 2402 in.)
Big end housing diameter	60. 180 -60. 199 mm (2. 3693 - 2. 3700 in.)
Type	Thinwall, steel backed white metal
Overall length	25. 9 - 26. 1 mm (1. 0196 - 1. 0275 in.)
Outside diameter	60. 199 mm (2. 3700 in.)

Thickness:	
Standard	1. 508 - 1. 500 mm (0. 593 - 0. 0590 in.)
Undersize available	
0. 25 mm (0. 010 in.)	1. 633 - 1. 625 mm (0. 0643 - 0. 0640 in.)
0. 50 mm (0. 020 in.)	1. 758 - 1. 750 mm (0. 0692 - 0. 0689 in.)
0. 75 mm (0. 030 in.)	1. 883 - 1. 875 mm (0. 0741 - 0. 0738 in.)
1. 00 mm (0. 040 in.)	2. 008 - 2. 000 mm (0. 0790 - 0. 0787 in.)
Big end bearing clearance	0. 010 - 0. 064 mm (0. 0004 - 0. 0025 in.)
Connecting rod side clearance	0. 15 - 0. 28 mm (0. 0059 - 0. 0110 in.)
Tightening torque of cap bolt	5. 5 kg-m (40 ft/lb.)

Every time a connecting rod is removed from an engine or a new connecting rod is being installed it should be checked for alignment on a connecting rod alignment fixture as shown in figure.

Place the piston pin in the eye of the rod and tighten the clamp screw.

Place the connecting rod on the aligner arbor and tighten the connecting rod bolts. If there is any bent or twist, correct it with a bending bar. Next, install the piston, and check the alignment as the illustration. The maximum allowable limit of bend is 0. 004".

The bearing metal should have a good contacting surface over an area more than 70% of it. Such a bearing too much clearances between the carnk pin and big end of the connecting rod will be found scored over the surfaces of the metal. And in extrem cases, the metal surfaces will eventually be cracked. If the metal is so much own, replace with new bearings.

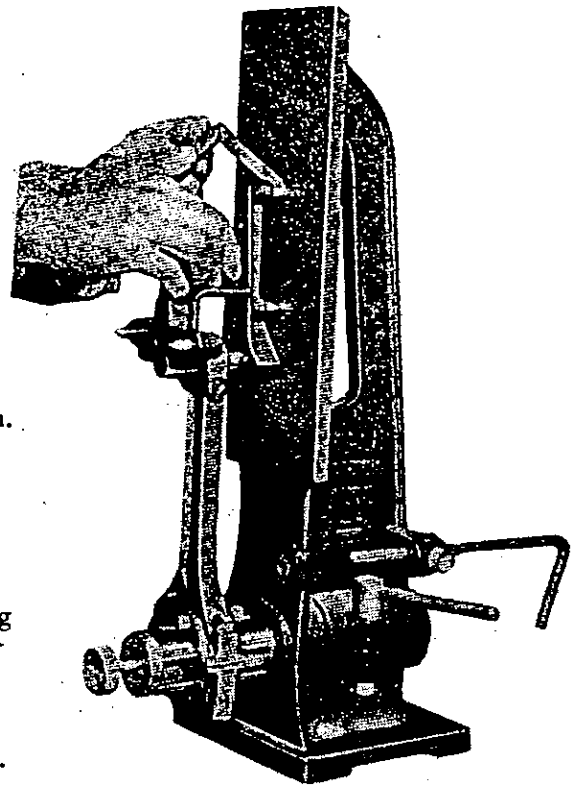


Fig. 10

Check connecting rod end clearance between the upper half of the connecting rod and the side of the crank pin with feeler gauge.

Lock the connecting rod bolts nuts by installing new pal nuts.

The pal nuts must be installed with the open side of the nut toward the end of the bolt.

As a final and last checkto be sure that the assembly will travel true with the bore, check the clearance between the crank pin and connecting rod side.

This should not be less than 0. 004" (0. 10 mm).

Fig. 11

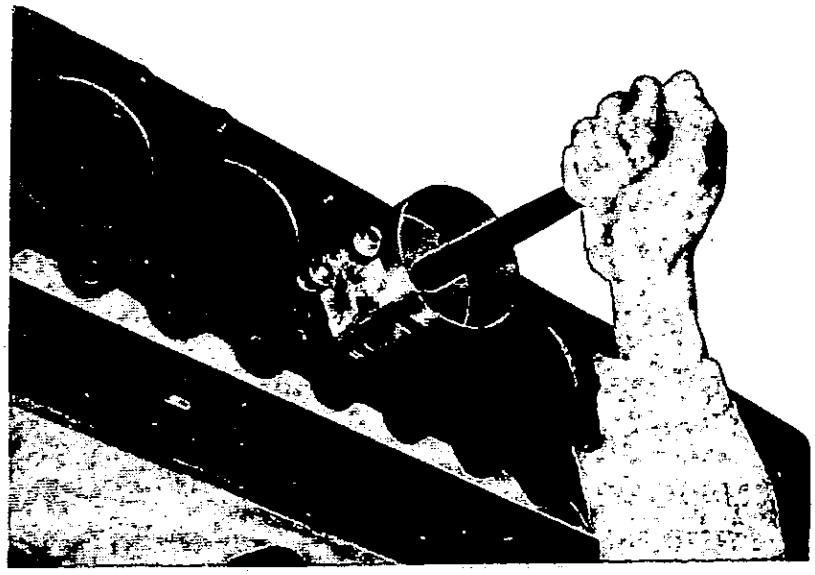


Fig. 12

Inserting Piston & Connecting Rod:

Insert each piston and connecting rod assembly into the cylinder from which in was taken; it is essential that the "F" mark on the boss of the piston is positioned towards the engine front.

The oil hole of big end of connecting rod must be positioned and toward the side of manifold.

Compress, the piston rings with inserting piston using tool, and gently tap the top of the piston with the end of the wooden bar until the piston is clear of the piston unit clamp.

Now push the piston down the cylinder block until the big end of the connecting rod just protrudes through the bottom of the cylinder bore, then position upper half bearing shells.

SERVICE NEWS REFERENCE

DATE	CONTENTS	NO. OF SERVICE JOURNAL AND BULLETIN

SECTION 3.
CRANKSHAFT

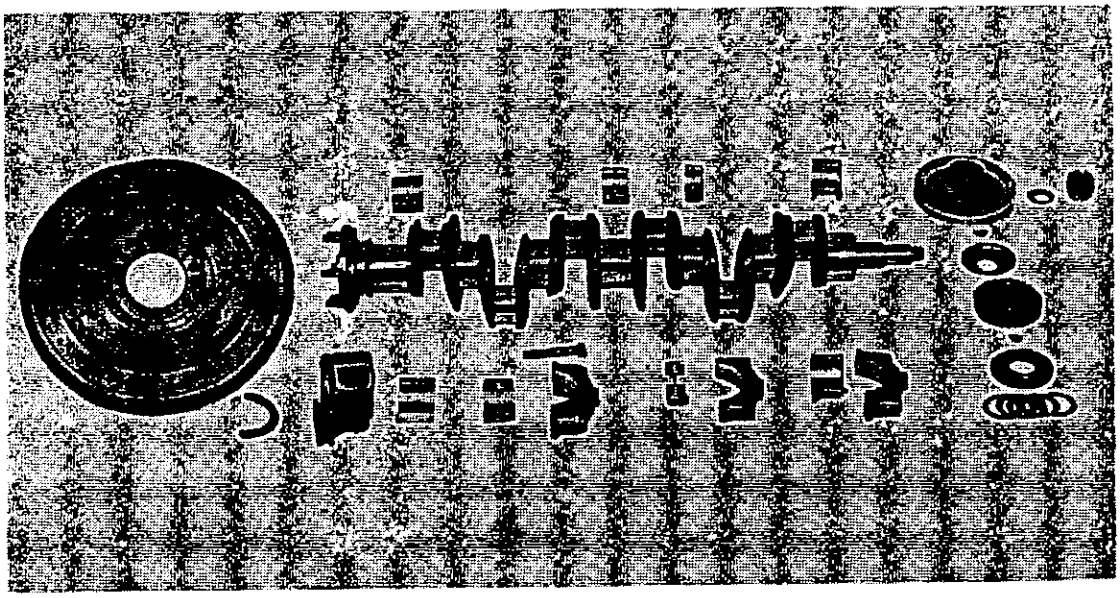


Fig. 1

DATA

CRANKSHAFT

Material	Special steel forging
Construction	With forged counter weight
Diameter of main journals:	
No. 1	68.229 - 68.204 mm (2.6862 - 2.6852 in.)
No. 2	69.300 - 69.275 mm (2.7283 - 2.7273 in.)
Out of round limit	Not to exceed 0.0125 mm (0.0005 in.)
Crankpin diameter	57.150 - 57.131 mm (2.2500 - 2.2492 in.)
Out of round limit	Not to exceed 0.0125 mm (0.0005 in.)
Runout of crankshaft	Not to exceed 0.075 mm (0.003 in.) at center bearing
Main journal clearance	0.03 - 0.096 mm (0.0012 - 0.0037 in.)
Crankshaft end play (float)	0.125 - 0.150 mm (0.005 - 0.006 in.)
Shims available for above	0.07, 0.13, 0.76 mm (0.003, 0.005, 0.030 in.)
Pilot bearing hole diameter	23.774 - 23.800 mm (0.9359 - 0.9370 in.)
Pilot bearing length	31.8 mm (1.252 in.)
Number of teeth crankshaft gear	27

MAIN BEARING

Type	Thinwall steel backed white and clevite metal (F500)
Number of bearings	7
Length:	
No. 1	33.8 mm (1.3307 in.) White
No. 2, 3, 5, 6	26 mm (1.0236 in.) Clevite
No. 4	41 mm (1.6142 in.) Clevite
No. 7	49 mm (1.9291 in.) Clevite
Outside diameter	73.025 mm (2.8749 in.)
Inside diameter:	
No. 1	68.283 - 68.299 mm (2.6883 - 2,6889 in.)
No. 2 - No. 7	69.355 - 69.371 mm (2.7304 - 2.7311 in.)
Thickness white metal	0.1 - 0.2 mm (0.004 - 0.008 in.)
Undersize available	0.12, 0.25, 0.75, 1.00, 1.25, 1.50 mm (0.005, 0.010, 0.020, 0.030, 0.040, 0.050, 0.060 in.)
Tightening torque of bearing cap bolt	10 - 11 kg-m (72 - 80 ft/lb.)

3-1 DISASSEMBLING OF CRANKSHAFT

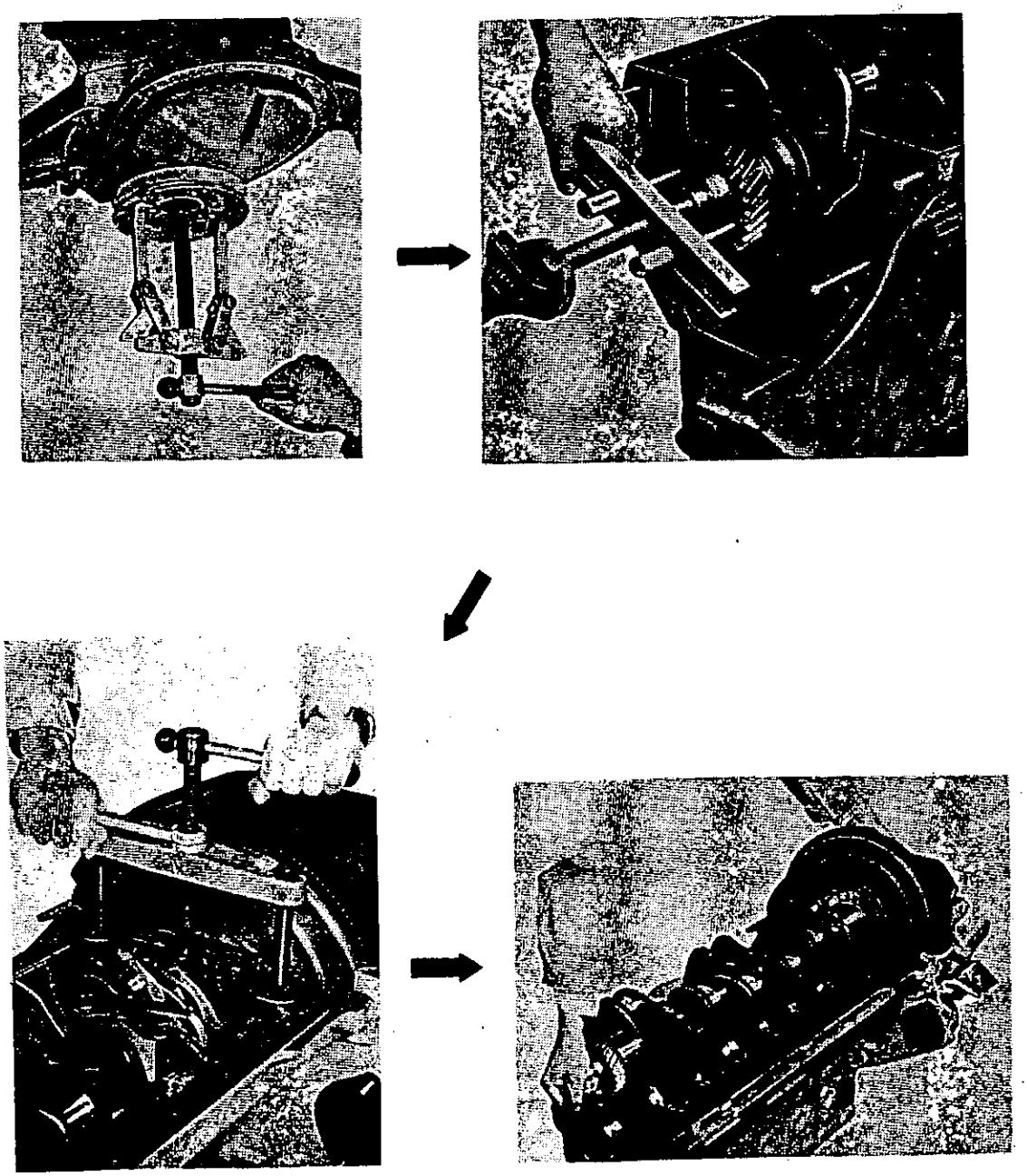


Fig. 2

When the crankshaft is being removed, check it carefully in the following order, and remedy any defect according to the requirements called for.

Measure the journal and crank pin with a micrometer, and if they are oval shaped or tapered more than 0.002" or of the surface of journal or crank pin is damaged, correct those defects.

Support the No. 1st and No. 7th journals with V-block.

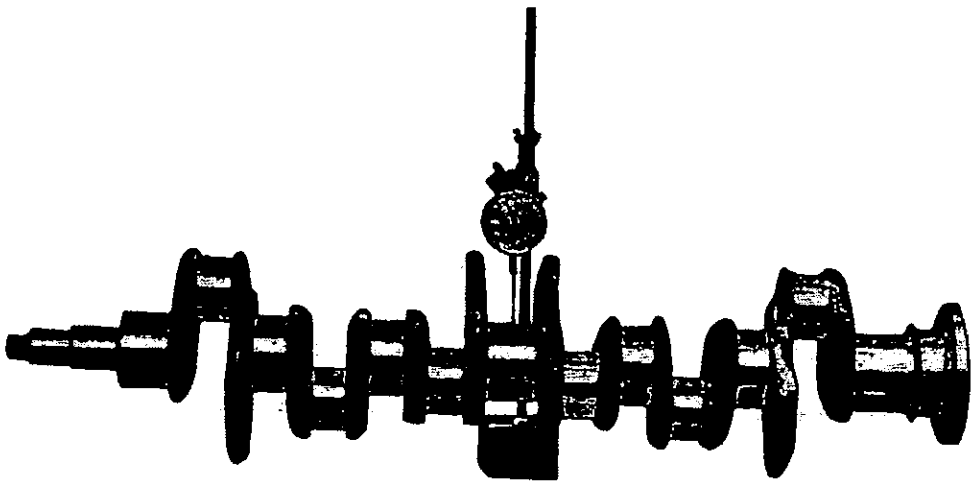


Fig. 3

Apply a dial gauge to sixth, fifth, fourth, third and second journals, and rota the shaft to see if there is the deviation of more than 0.002 inch.

The belt shaft should be corrected with a press.

Support and rotate the crankshaft same as the said way, apply a dial guage to the flange. (the part to connect the flywheel). If the surface of flange is wabbling more than 0.001" (0.025 mm) have it fixed up.

When the journal or crank pin is worn flat or oval or if they are scored, cut, or rough, beyond the limit, (0.004" or over) replace it with a new one.

Clear out throughly the oil passage by blowing out with a compressed air.

Main bearing is manufactured to be easily removed with the crankshaft in place. Avoid repeated use of old bearings.

Check throughly before it is installed.

Such a bearing as excessively worn out, or making poor contact, or having scores, cuts, rough or hardened surfaces are to be replaced. Carefully inspect the side thrust part of the No. 1 bearing, and if there is any wear, take up the wear by removing the shims and washer placed between the thrust washer and crankshaft.

If the wear is beyond the regular side thrust clearance of 0.004 - 0.007" replace these shims. (13/1000 in., 6/1000 in., 2/1000 in.).

When replace these shims, tap up the crank gear with a adapter and measure the clearance between the bearing back plate and the thrust washer and correct the clearance of it.

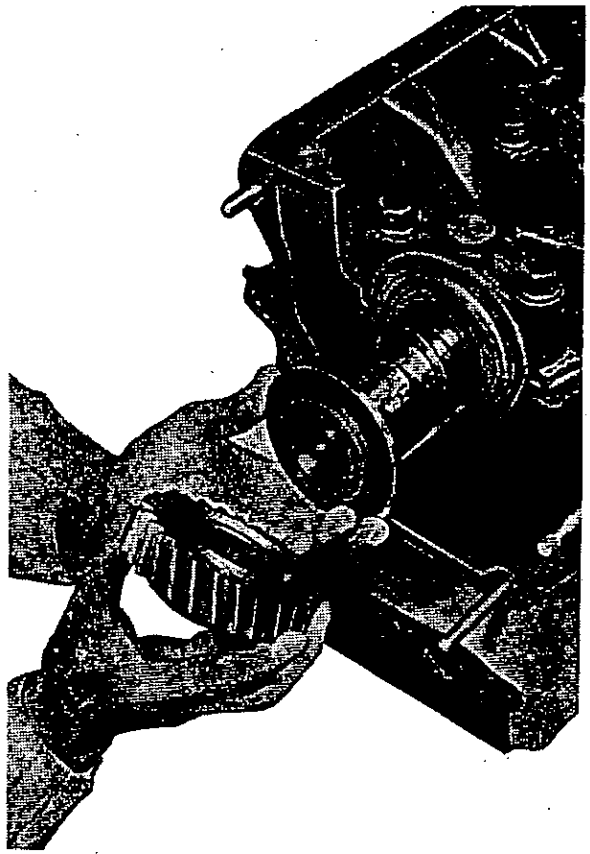


Fig. 4

Fig. 5

3-2 REAR BEARING SEAL

This rear main bearing is sealed by a wick type seal installed in a groove machined in the block and cap. To install a new wick seal at the rear main bearing cap, insert the packing in the groove with the fingers.

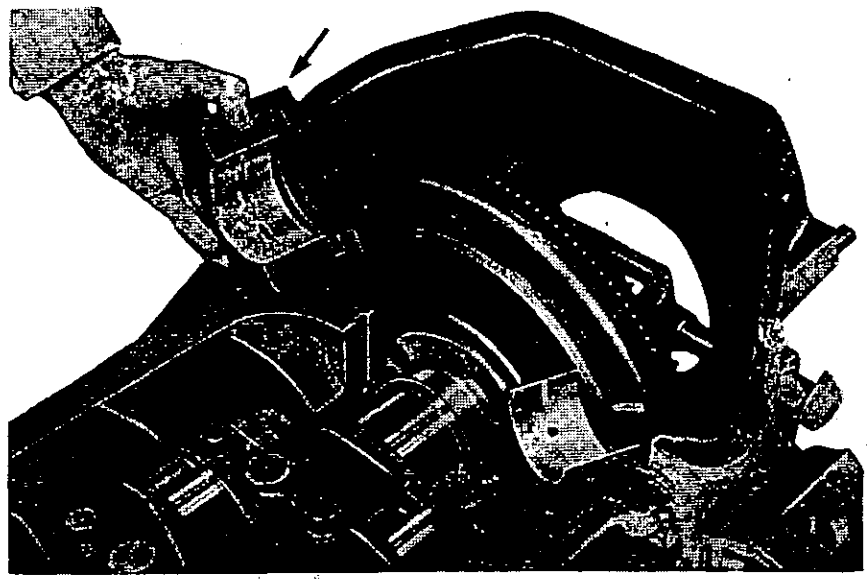


Fig. 6

Then using a rounded tool, roll the packing into the groove.

When rolling the packing, start at one end and roll the packing to the center of the groove.

Then starting from the other end, again roll toward the center. The above procedure insures that the wick is firmly pressed into the bottom of the groove.

The small portion of the wick which protrudes from the groove at each end should be cut flush with the surface of the bearing cap.

To prevent the possibility of pulling the wick out of the groove while cutting off the ends, it is recommended that a round block of wood the same diameter as the crankshaft glange be used to hold the packing firmly in position while the ends are being cut off.

If it should become necessary to replace the upper half of the wick seal, it will be necessary to remove the engine from the chassis and remove the crank shaft.

The procedure for installing the wick in the cylinder block is exactly the same as for installing it in the bearing cap.

1. Wash and clean the crankshaft and bearings.
2. Apply marking compound lightly over each journal of crankshaft.
3. Install upper and lower bearings in their own position and install the crankshaft in the cylinder.
4. Rotate the crankshaft back and forth. Remove the crankshaft and check the contacting condition of bearings.

5. The upper half bearings have to make contact evenly and more than 70% of its contacting area. If any insufficient contact is found replace it with a new one.

6. The lower half bearings also should be making contact evenly over 70% of the area. Sometimes, excessive clearance of the lower half bearings to the journal makes it impossible to show the contacting condition. In such a case, replace with the undersized bearing. Make shift repair can be made, in case of absolute necessity, by filling off the cap and bearing to take up the clearance. Re-check the bearing fit after the above work. Repeat the work until you are sure satisfactory fit is obtained.

7. After checking the contacting condition, wipe off marking compound and apply engine oil plentifully.

8. Install the seventh bearing and cap, and tighten with a regular force. Check the tighteness by rotating the crankshaft.

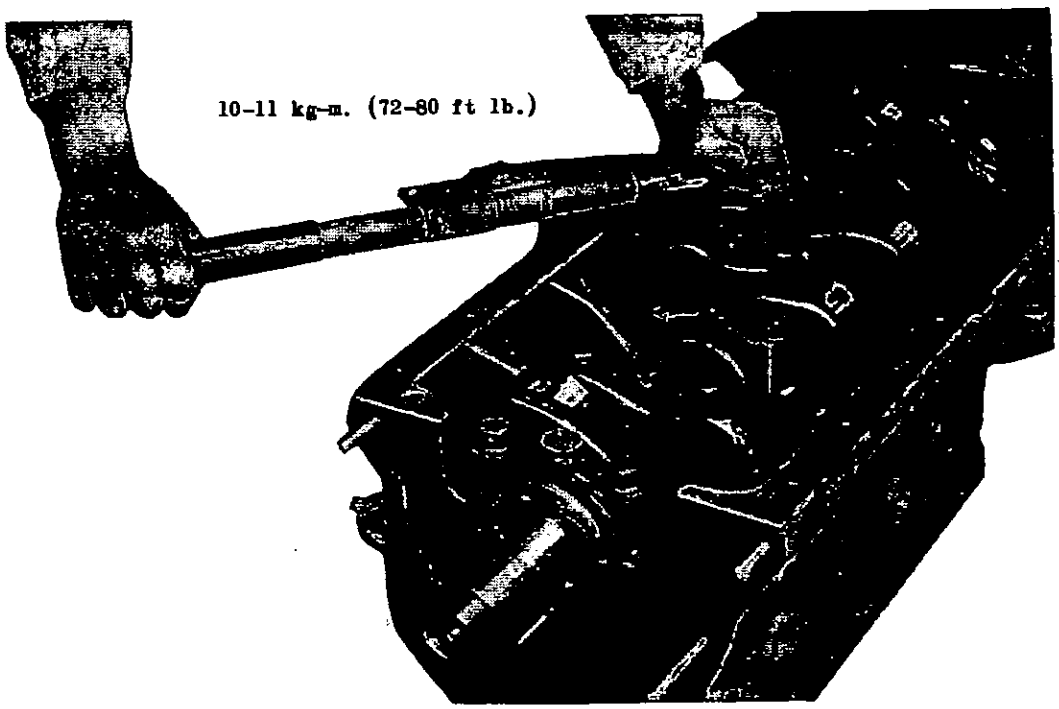


Fig. 7 Tightening Torque of Main Bearing Cap Bolt

9. Proceed to the next bearing in the same manner, and have all the bearings adjusted.

10. If bearing fit is properly adjusted on all journals, the crankshaft can be rotated by grasping No. 2 and No. 5 crank pins, or No. 3 and No. 4 crank-pins, with a slight starting but without any resistance after started.

11. After above work is completed, be sure to lock the cap bolts with torque rench with the scale.

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SECTION 4.

CAMSHAFT, VALVE, TAPPET & TIMING

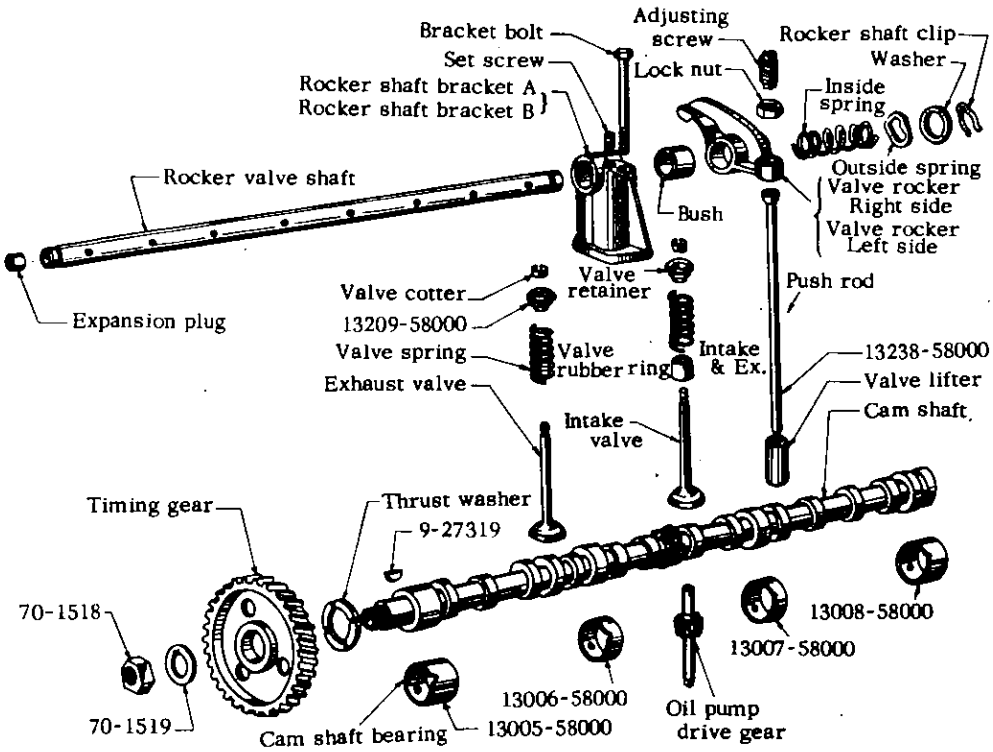

Fig. 1 Camshaft, Valve & Lifter

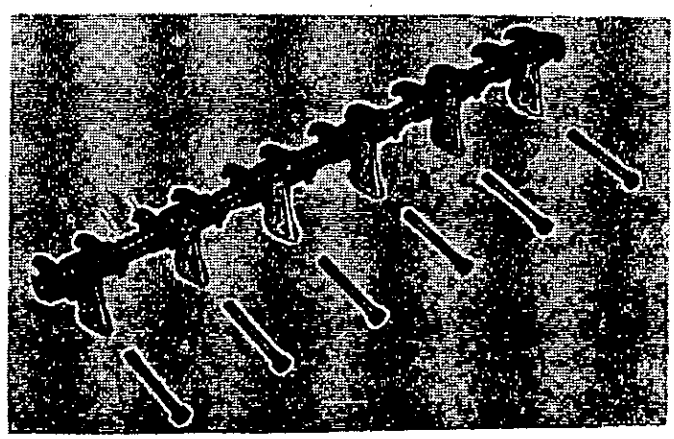

Fig. 2-A

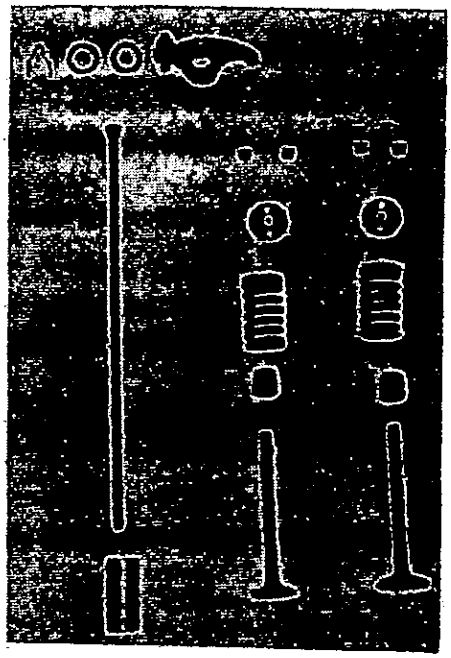

Fig. 2 - B

DATA

CAMSHAFT

Material	Special steel forging
Journal diameter:	
No. 1	49. 149 - 49. 124 mm (1. 9349 - 1. 9339 in.)
No. 2	48. 945 - 48. 920 mm (1. 9270 - 1. 9260 in.)
No. 3	48. 641 - 48. 616 mm (1. 9150 - 1. 9140 in.)
No. 4	48. 336 - 48. 311 mm (1. 9030 - 1. 9020 in.)
Cam height	41. 246 mm (1. 6238 in.)
Fuel pump cam offset	3. 00 - 3. 10 mm (0. 1181 - 0. 1220 in.)
Runout of camshaft	Not to exceed 0. 025 mm (0. 001 in.)
Drive	Helical gear
Cam gear number of teeth	54
Bearing clearance	0. 01 - 0. 10 mm (0. 0004 - 0. 004 in.)
Backlash of camshaft gear and crank gear	0. 1 - 0. 15 mm (limit of use, 0. 25 mm)

CAMSHAFT BEARINGS

Type	Thinwall, steel backed white metal
Front bearing:	
Out dia. (before fitting)	52.555 - 52.530 mm (2.0690 - 2.0680 in.)
Inside dia. (reamed in position)	49.303 - 49.238 mm (1.9410 - 1.9384 in.)
Length	29.49 - 29.24 mm (1.1610 - 1.1511 in.)
Housing diameter	52.476 - 52.541 mm (2.0659 - 2.0684 in.)
Second bearing:	
Outside dia. (before fitting)	62.375 - 52.350 mm (2.0619 - 2.0609 in.)
Inside dia. (reamed in position)	49.123 - 49.058 mm (1.9339 - 1.9313 in.)
Length	19.0 mm (0.748 in.)
Housing diameter	52.273 - 52.248 mm (2.0579 - 2.0569 in.)
Third bearing:	
Outside dia. (before fitting)	52.070 - 52.045 mm (2.0500 - 2.0489 in.)
Inside dia. (reamed in position)	48.818 - 48.753 mm (1.9220 - 1.9194 in.)
Length	19 mm (0.748 in.)
Housing diameter	51.740 - 51.943 mm (2.0370 - 2.0450 in.)
Rear bearing:	
Outside dia. (before fitting)	51.740 - 51.715 mm (2.0370 - 2.0360 in.)
Inside dia. (reamed in position)	48.488 - 48.423 mm (1.9090 - 1.9064 in.)
Length	31.8 mm (1.2519 in.)
Housing diameter	51.664 - 51.638 mm (2.034 - 2.033 in.)
Undersize available	0.25 mm (0.0098 in.), 0.50 mm (0.0197 in.)

VALVES

Timing:	
Inlet opens	14° B. T. D. C.
Inlet closes	50° A. B. D. C.
Exhaust opens	52° B. B. D. C.
Exhaust closes	12° A. T. D. C.
Head diameter inlet valve	43 mm (1.692 in.)
Head diameter exhaust valve	36.2 mm (1.425 in.)

Seat angle:	
Inlet and exhaust	45°
Seat width, inlet and exhaust	1. 4 - 1. 8 mm (0. 055 in - 0. 071 in.) (Limit of use, 3/32 in.)
Stem diameter:	
Inlet	8. 650 - 8. 637 mm (0. 3405 - 0. 3400 in.)
Exhaust	8. 640 - 8. 627 mm (0. 3401 - 0. 3396 in.)
Length inlet and exhaust	131. 5 mm (5. 1772 in.)
Lift (overall)	9. 6 mm (0. 378 in.)
Working clearance	0. 38 - 0. 40 mm (0. 015 - 0. 016 in.) (Water tamp. 80°C)

VALVE GUIDES

Length:	
Inlet & exhaust	72 mm (2. 8346 in.)
Outside diameter	15. 048 - 15. 030 mm (0. 5923 - 0. 3916 in.)
Inside diameter	8. 685 - 8. 700 mm (0. 3419 - 0. 3425 in.)
Hole for valve guide diameter	15. 000 - 15. 018 mm (0. 5905 - 0. 5912 in.)
Valve stem clearance inlet	0. 035 - 0. 063 mm (0. 0013 - 0. 0024 in.)
Valve stem clearance exhaust	0. 045 - 0. 073 mm (0. 0017 - 0. 0028 in.)

VALVE SPRINGS

Free length	57. 5 mm (2. 2638 in.)
Fitted length and load	49. 5 mm at 23. 5 kg (1. 9488 in. at 52 lb.)
Number of working coils	5 - 3/4 turns
Diameter of coil wire	4. 5 mm (0. 1771 in.)
Core diameter	33. 5 - 33. 0 mm (1. 3189 - 1. 2992 in.)

TAPPETS

Type	Hollow barrel
Diameter	23. 990 - 23. 975 mm (0. 9445 - 0. 9438 in.)
Length	55 mm (2. 1653 in.)

ROCKER MECHANISM

Push rods:	
Length	388 mm
Stem diameter	7. 15 mm (0. 2815 in.)
Rocker shaft:	
Length	641 mm (25. 24 in.)
Outside diameter	20. 000 - 19. 971 mm (0. 7874 - 0. 7862 in.)
Rocker arm bushing:	
Type	Rolled phosphorus bronze bushing
Outside diameter	23. 45 - 23. 43 mm (0. 9232 in - 0. 9244 in.)
Inside diameter (reamed in position)	20. 020 - 20. 033 mm (0. 7882 - 0. 7887 in.)
Inside diameter (before reamed)	19. 98 - 19. 93 mm (0. 7865 - 0. 7846 in.)
Clearance between shaft and bush	0. 02 - 0. 054 mm (0. 0008 - 0. 0021 in.)
Rocker arm:	
Bore	22. 40 - 22. 37 mm (0. 8818 - 0. 8807 in.)
Lever ratio	1. 47 : 1
Tightening torque of rocker B. K. T. bolt	4. 3 - 5. 0 kgm

4-1 REMOVAL OF CYLINDER HEAD

Drain the cooling water by opening the radiator and cylinder block side drain taps.

Disconnect the radiator hose.

Remove the air cleaner, carburetor, rocker cover and the inlet and exhaust manifolds.

Detach high tension cables and remove the spark plugs.

Remove the rocker cover and the cork washer.

Detach the manifold assembly.

Take off the rocker assembly for getting to slacken the cylinder head bolts at same time. Withdraw the push rods. Keeping them in the order of removal.

The cylinder head can now be lifted from the cylinder block.

To facilitate detaching the cylinder head joint, tap each side of the cylinder head.

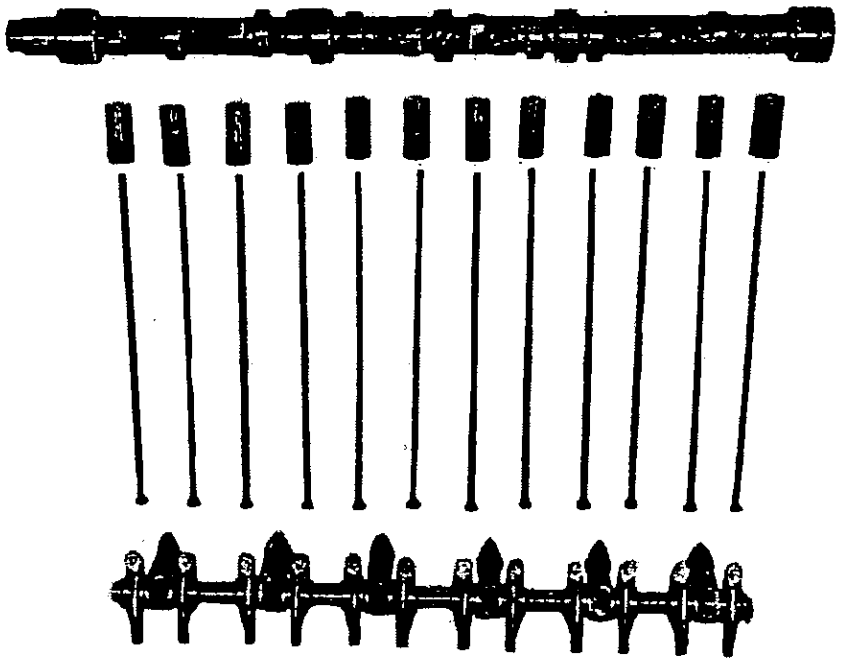

Fig. 3

4-2 REMOVAL OF VALVES

After the cylinder head is removed, the valves can be take out.
To do this compress the valve spring with the valve spring compressor.
Remove the cotters of valve retainer.
Release the valve spring, retainer and oil seal from stem. Withdraw the valves from the guide.

4-3 REPLACEMENT

The diameter of exhaust valve head are smaller than the inlet valve. To replace the valves, insert each valve into its guide and replace the spring oil seals, retainer, and compress the valve spring.
Refit the valve cotters and secure them by releasing the compressor. Remove the compressor.

4-4 VALVE GRINDING

Before replacement of the cylinder head the valves and their seats should be examined for signs of pitting or burnt platches and distortion.
If these conditions are present, the valve seats must be recut before attempting to grinding the valves, wilst distorted valve head should be corrected or the valve renewed.
Only the minimum amount of metal should be removed in the trueing process.

When grinding a valve on to its sealing, the valve face should be smeared lightly with grinding paste and then lapped in with a suction type grinding tool.

The valve must be ground to its seat with a semi rotary motion. A light coil spring interposed between the valve head and the port will assist considerably when lifting the valve in order to rotate the face to a different position.

This should be done frequently to spread the grinding compound evenly.

It is necessary to continue the grinding process until an even matt surface is produced on the seating and the valve face.

On completion, the valve seats and ports should be throughly cleaned with gasoline soaked rag, and dried, and the subjected to a compressed air blast.

The valves should be washed in gasoline and all traces of grinding compound removed.

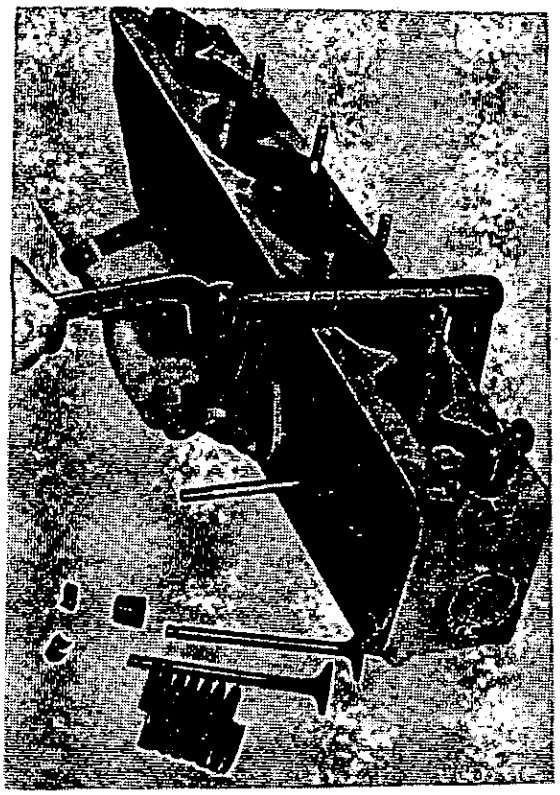

Fig. 4

4.5 REFITTING THE CYLINDER HEAD

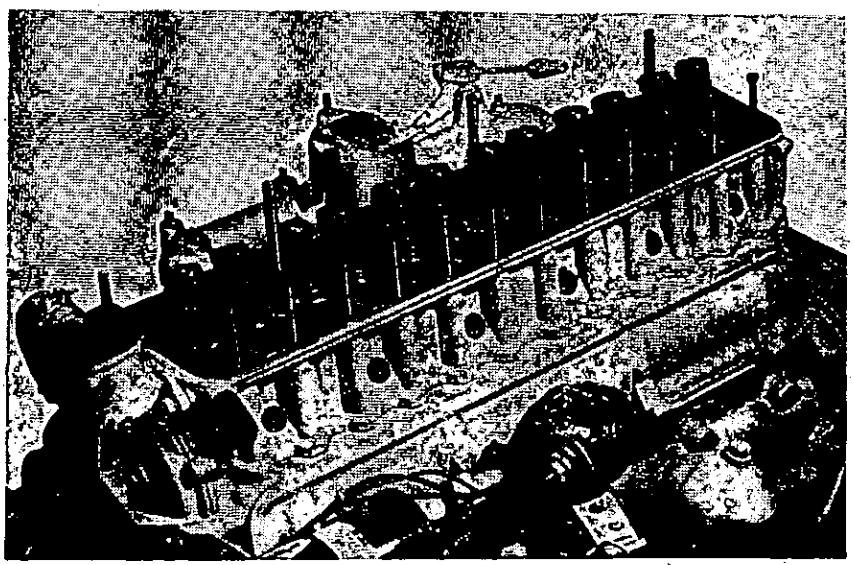

Fig. 5

Ensure that the cylinder head and cylinder block joint faces are clean. The cylinder head gasket is marked upper face "TOP" so that it will be placed head in correctly.

Place the gasket into position and fit the cylinder head securing bolts finger tight. They screw into cylinder block at the front and rear bolts holes on the manifold side and guide the head into position.

Insert the push rods, replacing them in the positions from which they were taken. Screw back all the tappet adjusting screws.

Replace the rocker assembly and screw down the securing nuts finger tight. Evenly tighten the cylinder head bolts diagonally from the center to out side, finally pulling them down a torque wrench set 55 - 65 ft/lb.

Reset the valve clearances, and finally, check them when the engine not so hot or cold. The cylinder head bolts may pull down slightly more after the engine has attained its normal working temperature, in which case the valve clearance will have to be checked again and reset if necessary (0. 38-0. 40 nn at 60°C).

Fig. 6

4-6 TIMING GEAR & CAMSHAFT

If there is an excessive amount of end play in the camshaft, it is necessary to remove the gear and camshaft assembly and correct the falts.

When the camshaft and gear are assembled to the engine, it is important that the punch marks on both the camshaft and crankshaft gear must be fitted as Fig. 7. The camshaft will then be in its proper position so that the valves will open and close in the proper relation to the movement of the position.

After the camshaft and crankshaft gears are in their proper places, check the crankshaft timing gear for run-out with a dial indicator. This should not exceed 0.15mm. Then check backlash of the camshaft gear. This should not exceed 0. 25 mm.

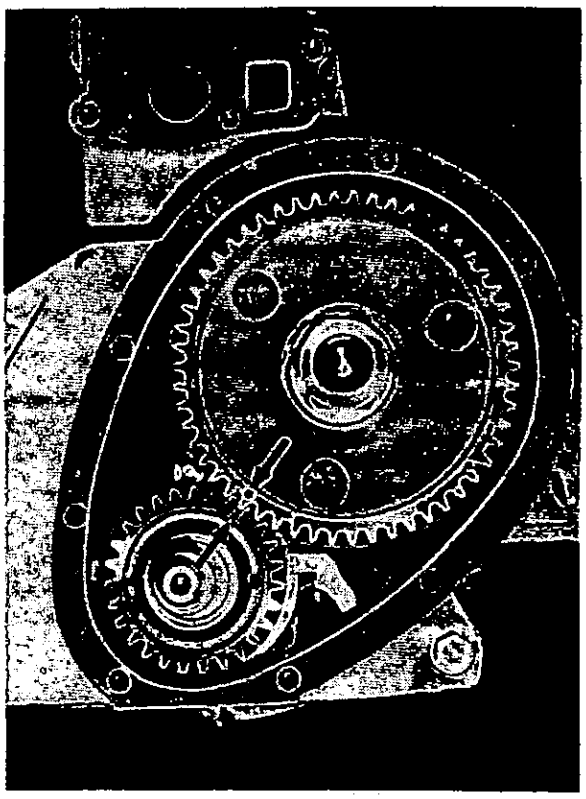

Fig. 7

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SECTION 5.
MANIFOLD

5-1 REMOVAL

Remove intake and exhaust manifolds assembly from cylinder head.
These manifolds are held together at the center bos by the stud bolts.
After removal, wash and clean both intake and exhaust manifolds.

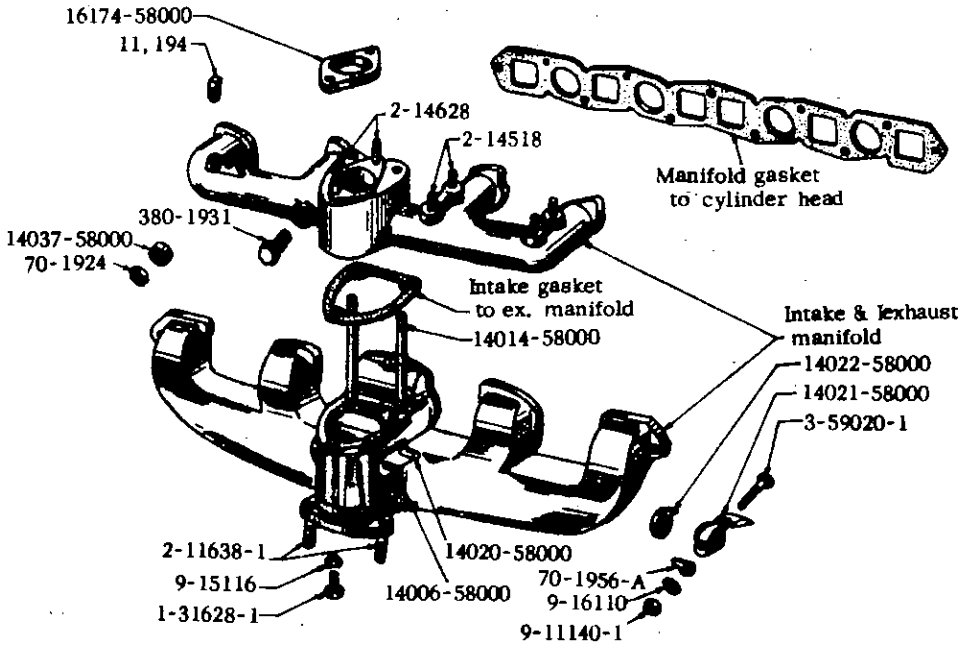

Fig. 1

5-2 INSPECTION

Manifold flanges must be all on the same plane. Inspect manifolds for warpage by placing their flanges on a flat surface.

If it is found warped, resurface on surface cutting equipment.

Also check for cracks and breakages, and replace if defective.

5-3 HEAT CONTROL ASSEMBLY

This assembly deflects a parts of the hot exhaust gas to and around the intake manifold by a valve, and facilitates fuel evaporation. Heat control has a thermostatic spring controling the above action automatically.

If this spring is worn, replace it.

When installing manifolds, place new gaskets. (Gaskets between intake and exhaust manifolds, and gasket between cylinder head and manifold assembly.)

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SECTION 6.
LUBRICATION SYSTEM

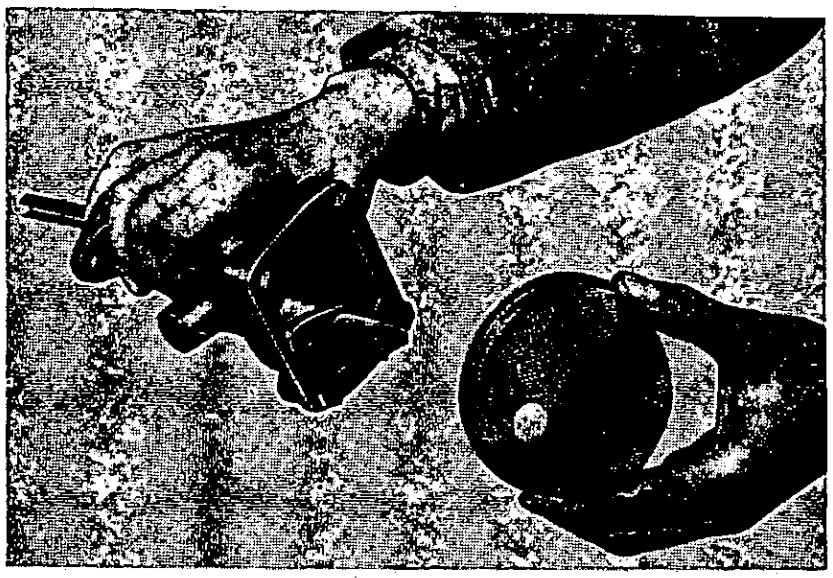

Fig. 1 Oil Pump Assembly

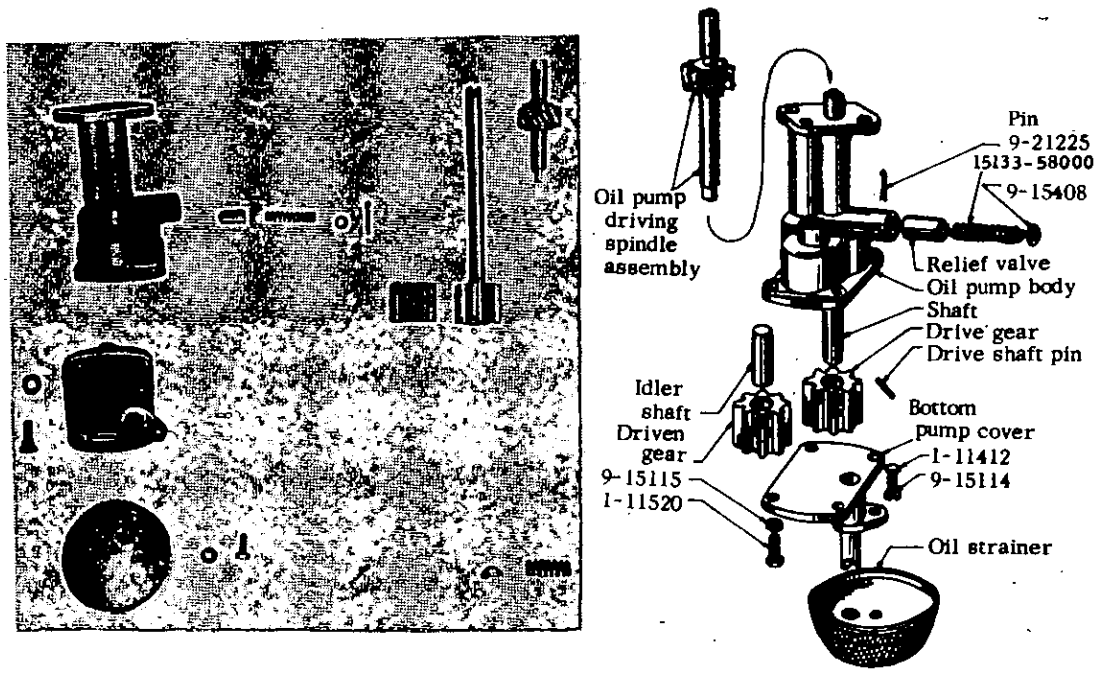

Fig. 2 Components of Oil Pump

As showing in Fig. 3, the engine oil forced out by the oil pump is ramified into two series and the one circulating through crank shaft, main bearings, connecting rods, camshaft bearings, tappet, valve rocker arm, and other lubricating, by connecting rod splshes, the postons and cylinder walls.

The oil regulator is instrument to adjust the pressure of oil so as to keep it at specified pressure. This adjustment can be done by either increasing or decreasing the number of pressure adjusting washers.

6-1 ADJUSTMENT OF OIL REGULATOR

Remove the fixing bolts of the pump body at the connecter of driving spindle. The oil regulator is attached directly to the oil pump.
Oil pressure should be kept 3.5 - 4.0 kg/cm².

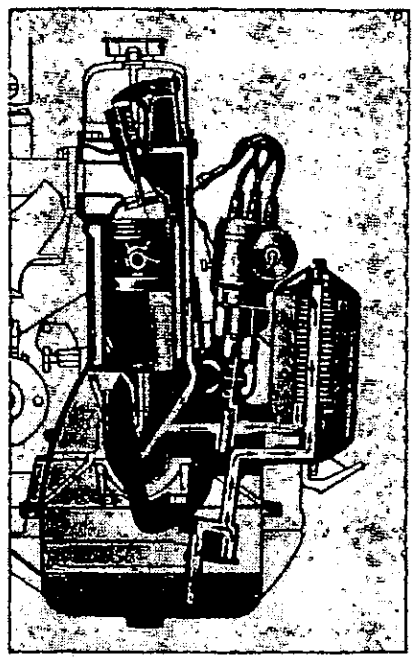

Fig. 3 Lubrication of Engine

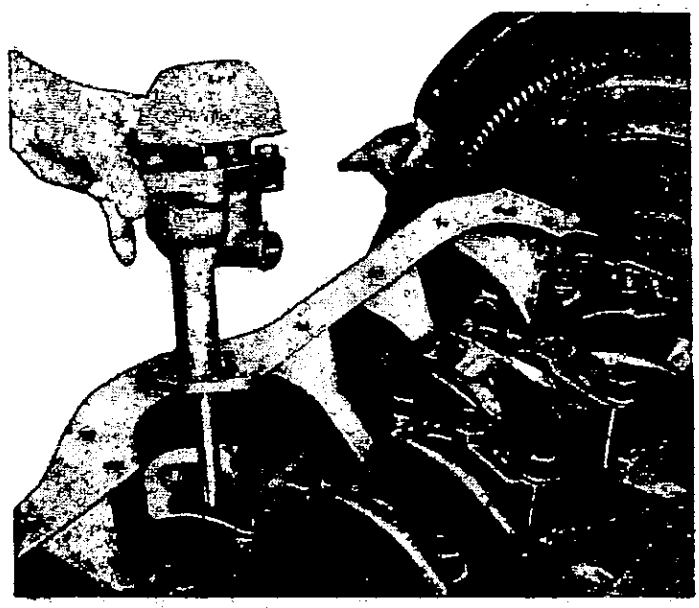

Fig. 4 Disconnect Oil Pump from the Block

Insert regulator valve into the oil pump body, and measure the clearance A (Fig. 5) between end of valve and stop pin. This clearance between the end of valve where spring contact should be 18 mm.

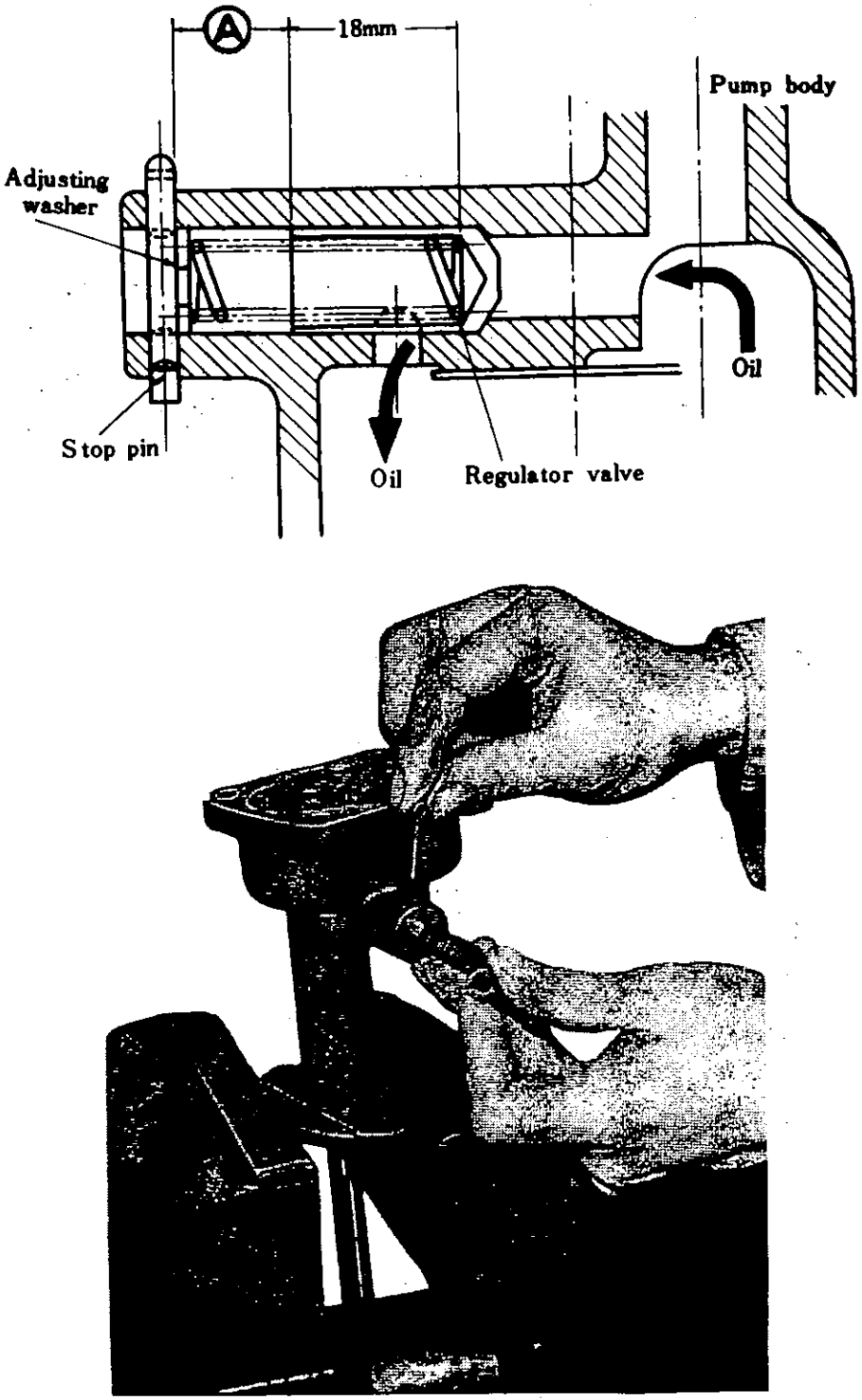

Fig. 5 Setting the Stop Pin

RELIEF VALVE SPRING

Free Length of Valve Spring	Length when fitted	Compressive Load	Thickness of Adjusting Washer
41. 5 mm	30. 3 mm	2. 24 kg	1 mm and 2 mm (0. 040 - 0. 080 in.)

After inspecting the above points, calculate thickness of the adjusting washer following the equation below and assemble it.

Thickness of adjusting washer = (A + 18 mm) - 30. 3 mm

DATA

OIL PUMP

Type of gear	Spur
Number of teeth	8
Gear diameter	39. 40 - 39. 35 mm (1. 5511 - 1. 5492 in.)
Gear length	29. 960 - 29. 935 mm (1. 1795 - 1. 1785 in.)
Knock pin diameter	3. 18 - 3. 23 mm (0. 1251 - 0. 1271 in.)
Oil pump shaft:	
Diameter	12. 976 - 12. 958 mm (0. 5108 - 0. 5101 in.)
Length	190. 2 - 189. 8 mm (7. 4882 - 7. 4724 in.)
Gear back lash	0. 025 - 0. 075 mm (0. 001 - 0. 003 in.) (If over 0. 008 in. , Replace)
Gear vertical clearance	0. 040 - 0. 115 mm (0. 0016 - 0. 0045 in.)
Gear in body clearance	0. 150 - 0. 260 mm (0. 006 - 0. 010 in.)
Oil regulator	Built in pump body
Oil regulator	Min. 0. 5 kg/cm^2 (7 lb/in^2) at running speed
Measurement of oil pressure regulator:	
Pressure of regulator spring	2. 24 kg (30. 3 mm high)
Clearance between piston and and body	0. 002 - 0. 0025 in. (If over 0. 005 in. , Replace)
Pressure:	
Running	3. 5 - 4. 0 kg/cm^2 (50 - 57 lb/sq. in.)
Idling	0. 5 kg/cm^2 (7 lb/sq. in.) at oil temp 70-80°C
Sump capacity	5. 3 litres (1. 4 gal, U. S. A.)
Oil	S. A. E. MS No. 20 (For temperature above 30°C MS No. 30)

Check the clearance between the drive gear and bump body. The clearance should be 0. 150 - 0. 260 mm.

If this clearance or others which showed in the series data should too much over, replace the gear with a new part, depending on whichever may be the cause of the excessive clearance.

6-2 OIL FILTER

The oil filter is mounted on the left side of the engine.

As for the oil filter, which serves to filter of engine oil within the oil pan, is of the full flow type using the paper elements.

This elements should be taken out for, periodical check and cleaning.

For disassembling, unscrew the cap bolt of the center shaft at the top of filter body after draining oil from drain plug.

The filter element should be changed at each 4,000 miles, or at shorter intervals if the oil get dirty sooner. In assembling, be sure the tightening bolts tightly in place and new packing and gasket are used if considered to leak the oil.

The capacity of engine oil should be checked every day.

The oil capacity is measured by the oil level gauge provided at the right side of cylinder. The oil level must be kept between the upper and lower lines of the gauge. Change engine oil every 1,500 miles in its degree of viscosity. Select a good quality of oil.

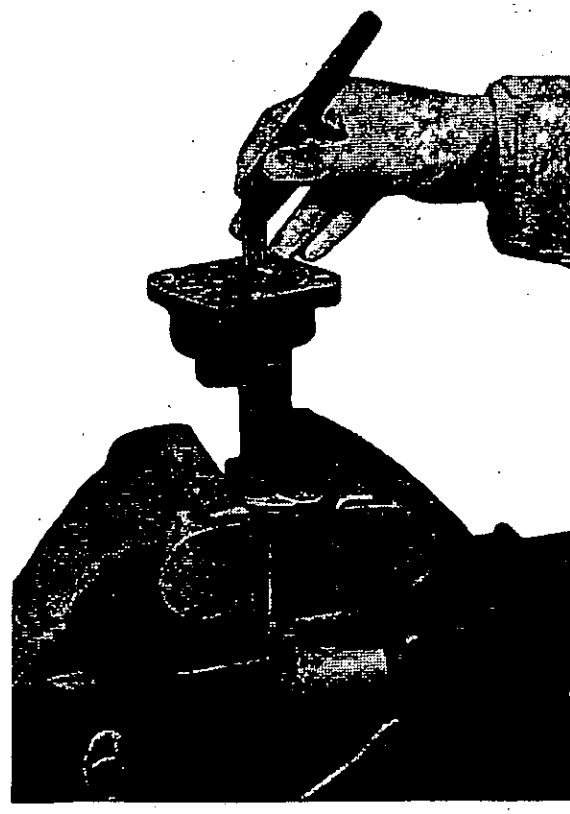

Fig. 6

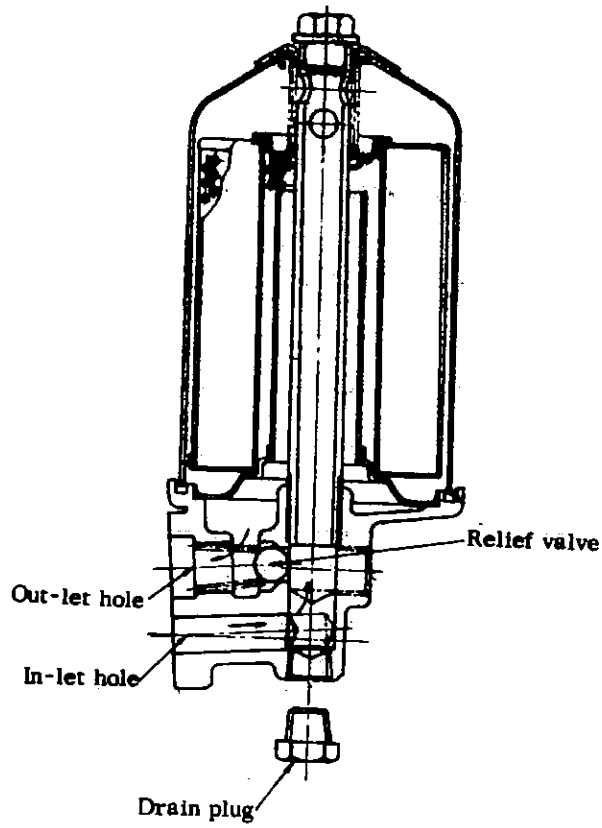

Fig. 7

Sectional view of oil filter
tightening torque.
Center bolt 2 ~ 2. 5 kg-m.
Relief valve opening pressure
0. 6 ~ 7. 5 kg/cm².

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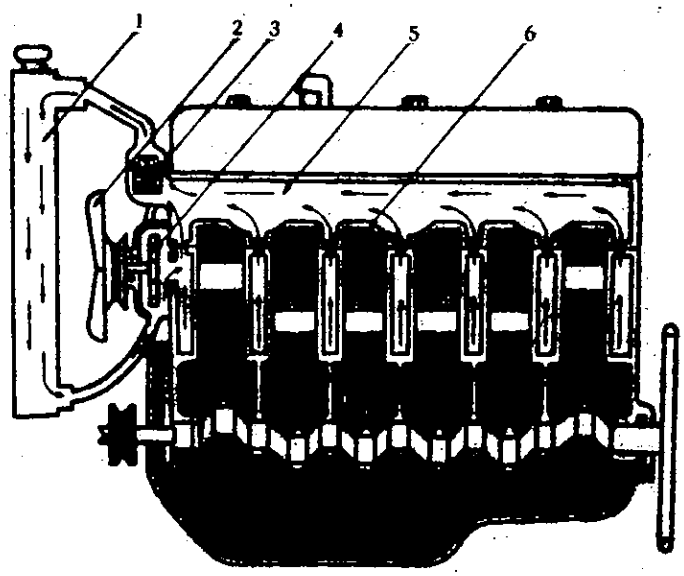
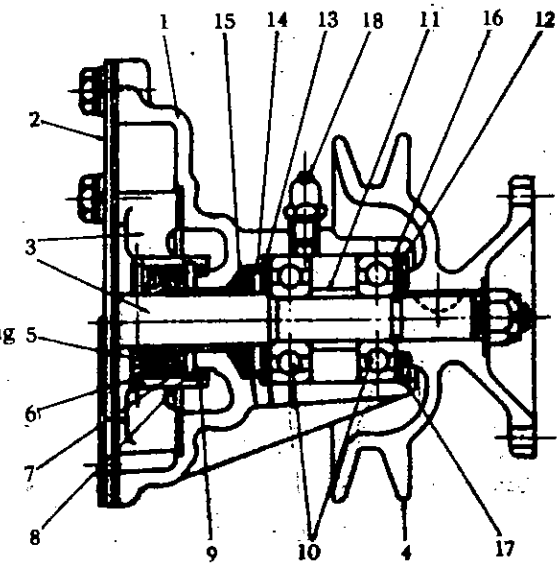
SECTION 7.
COOLING SYSTEM



1. Radiator
2. Fan
3. Thermostat
4. Water pump
5. Cylinder head
6. Cylinder block

Fig. 1

7-1 WATER PUMP FAN & FAN BELT



1. Water pump body
2. Cover
3. Vane and shaft ass'y
4. Pulley
5. Seal retainer spring
6. Seal retainer
7. Rubber seal
8. Bakelite seal
9. Vane snap ring
10. Water pump shaft bearing
11. Bearing spacer
12. Front seal plate
13. Rear seal plate
14. Felt cover plate
15. Felt seal
16. Shim
17. Bearing snap ring
18. Lubricator fitting

Fig. 2 Sectional View of Water Pump

DATA

Water pump type	Centrifugal
Pulley ratio	1. 28 to 1
Fan blade:	
Number	4
Diameter	476 mm (18. 7 in.)
Thickness	1. 6 mm
Fan belt:	
Type	V (Angle of V-40 degrees)
Length (outer)	1175 - 1181 mm (46. 250 - 46. 500 in.)
Deflection (tension adjustment)	25 mm (1 in.)

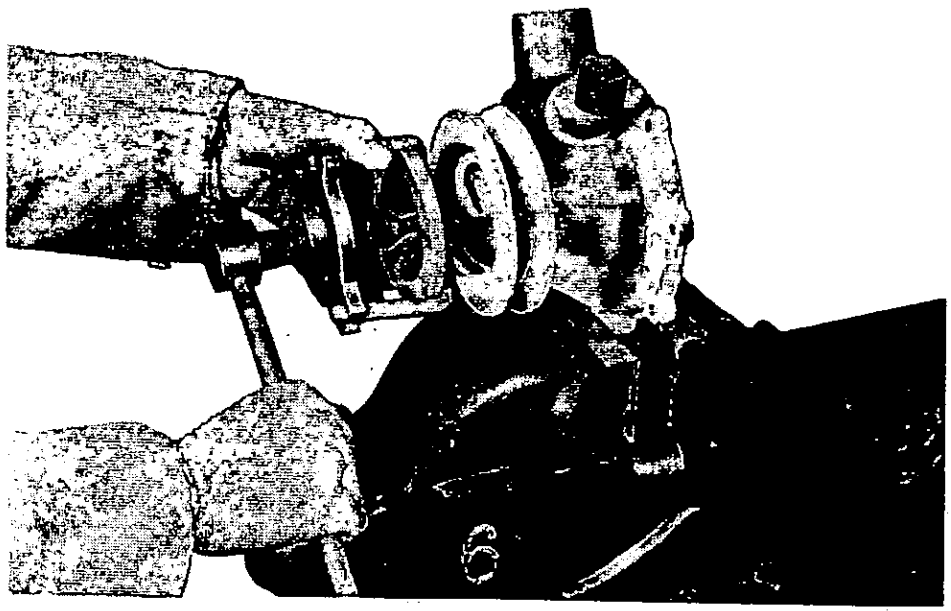


Fig. 3

7-2 REPAIR OF WATER PUMP

In case of troubles in the water pump such as water leakage, worn or burnt ball bearings of the pump shaft, remove the unit to repair. It is better to remove the radiator before the water pump is displaced.

1. Disassembly of Water Pump

1. Remove fan blade from the water pump pulley, removing the eight screws.
2. Move the generator toward the engine after loosening bolts holding the generator, and take off the fan belt.
3. Remove the by-pass rubber hose at water-outlet spacer.
4. Remove three bolts which hold the water pump body to the cylinder block.

5. Draw out cotter pin in the castle nut on the pump shaft and remove nut and washer. Pull out pump pulley from the shaft using a puller, and remove woodruff key.
6. Remove four bolts fastening water pump cover to its body and displace the cover and gasket.
7. Take out vane from bearings in pump body assembly. As a rule, this operation is to be done with the use of press. (When the hammer is used instead, never fail to use a copper hammer, and tap the end of shaft lightly. If other wise, you are likely to bend the shaft, or damage the screw threads.) Now the vane assembly will come off from pump body, together with five accessories such as seal retainer spring, seal retainer, rubber seal, bakelite seal and vane snap ring.
8. Remove the vane snap ring first, and the seal retainer spring, seal retainer, rubber seal and bakelite seal are removed from the vane assembly.
9. In case shaft-bearing or felt seals is in bad shape, remove shaft bearing snap ring and take out the front seal plate, washer, shim, shaft bearing, bearing spacer, rear seal plate, felt cover plate and felt seal from washer pump body.

2. Assembly of Water Pump

In order to assemble the parts after having finished necessary repair works, invert the order of disassembling work mentioned above. However, the following care is to be taken in handling.

1. Put the vane assembly with the shaft pointing upward. Grease the shaft lightly, and insert the seal retainer spring so that the smaller diameter comes to the bottom of the shaft.

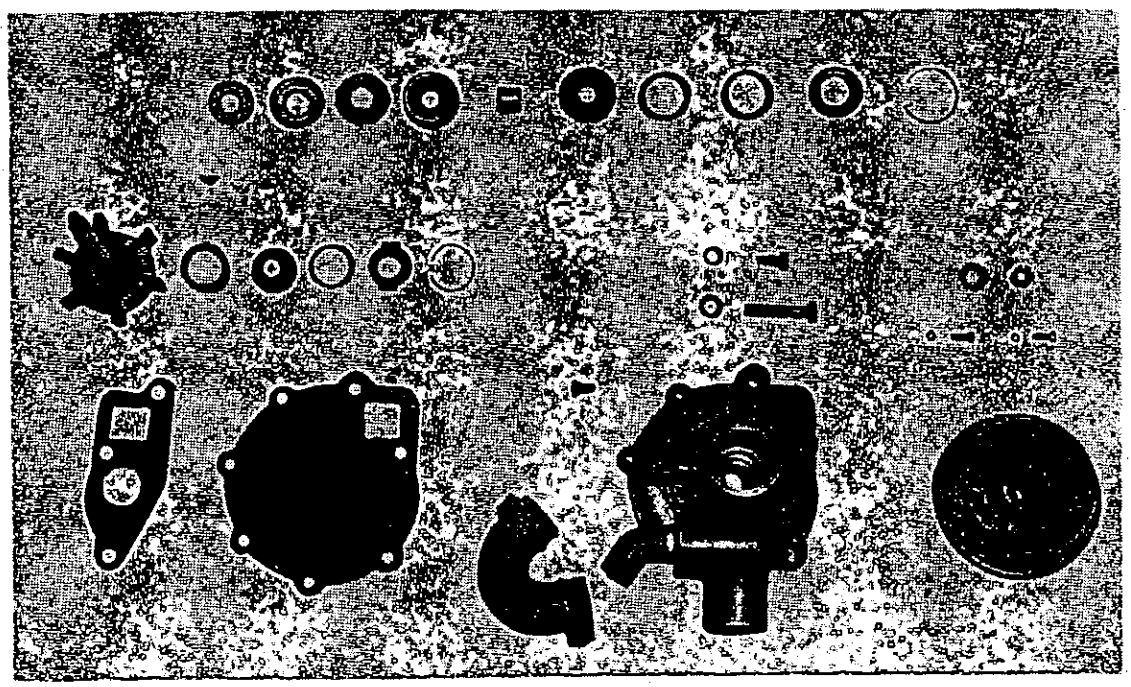


Fig. 4

2. See that the rubber seal fits on the shaft with proper tighteness. The proper tighteness is determined by the rubber seal sliding on the shaft when pushed lightly with fingers.
3. After having assembled the vane assembly with water seal system (i. e. seal retainer spring, seal retainer, rubber seal, bakelite seal, vane snap ring), check whether the unit is in proper working order. The unit is in good shape if the bakelite seal snaps back to its proper place when depressed with a thumb and freed. If the seal does not return instantly and without drag, it is due to weakness of the seal retainer spring or too tight fitting of the rubber seal. Remove such a seal and inspect the bore of the seal and if found blamable for stiff fitting, rebore until it fits properly. On the contrary, if the cause is found in weak seal retainer spring, replace it with a new spring.

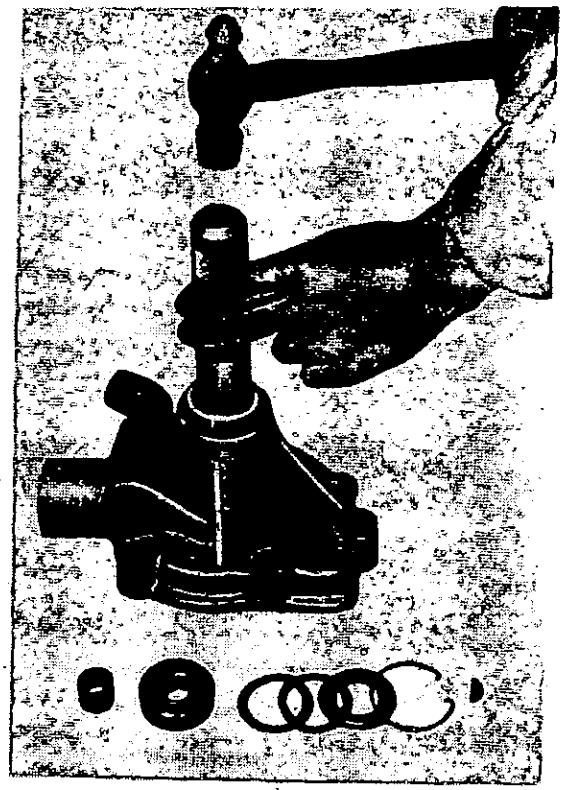


Fig. 5

4. In order to assemble shaft bearing, etc., first, insert the vane assembly to the pump body. Cover the felt seal with sufficient grease and set it to the shaft together with felt cover plate and rear seal plate. Then, install the shaft bearing spacer, shim, washer, front seal plate and snap spring.

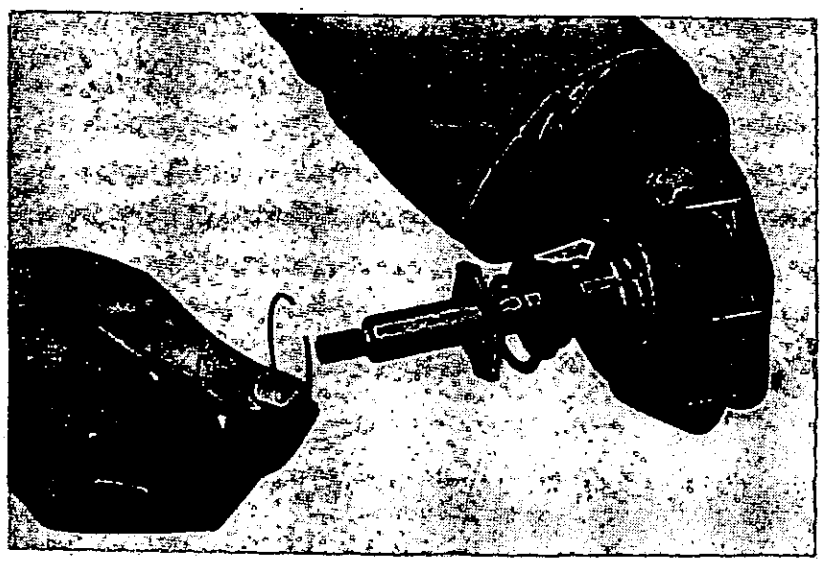


Fig. 6

5. In fastening the cover to the pump body, with four screws, proceed as follows: for two screws in the upper middle, use spring washers; for the one positioned lower left facing toward the pump, use a copper washer; and for the fourth screw in the lower right, use a shake-proof washer. All of them have to be screwed up tightly. The reason for using the copper washer is that it prevents water leaking through the screw hole.
6. After installing the cover on pump body, put the woodruff key on the shaft and fix water pump pulley. Examine turning the pulley if the vane assembly runs smoothly.
7. In assembling the pump, always use new gaskets for cover and body. Better result would be obtained if the new gaskets are coated with shallac or white lead before they are replaced for keeping water tight effect.

3. Water Pump Troubles and Remedies

Ordinary troubles in the water pump are water leakage, vibration wabbling and noises.

1) Causes of water leakage.

a. Rubber seal in bad shape.
b. Bakelite seal in bad shape.
c. Retainer spring fatigued.
d. Friction surfaces of pump body and bakelite seal worn.
e. Body or cover gasket in poor shape.
f. Wrong or loose screws of the pump cover.
g. Wrong or loose screws of the pump body.
h. Worn vane shaft bearings, or bent shaft.

Any one of the above will cause water leakage, and damaged or worn-out parts have to be replaced and loose screws have to be tightened up in order to stop the leakage. The wear of the friction surface of the pump body can be reground.

2) Causes of vibration, wabbling and noises.

a. Worn or burnt ball bearing.
b. Bent vane assembly shaft.
c. Loose pump body screws.

Of the above, burnt ball bearing is caused from poor supply of oil.

Replace it with a new one and feed grease sufficiently through lubricator fitting in the pump body.

Periodical supply of chassis grease to water pump is to be made for each 1,000 kilometre run.

4. Adjustment of Fan Belt

The tension of fan belt is to be adjusted so that the belt has 1/2 - 3/4 inch free movement as illustrated in Fig. 7.

To make the adjustment: Loosen No. 1 bolt first, and next No. 2. Move the generator and push the belt with a hand so that there is a free movement of 25mm on the bolt. Fasten the bolts. If the belt is adjusted too loose, it would make the belt to slip resulting in performance of the fan and generator as well as premature wear of the belt and the overheating of engine in summer. If it is held too tight, bearing would be damaged.

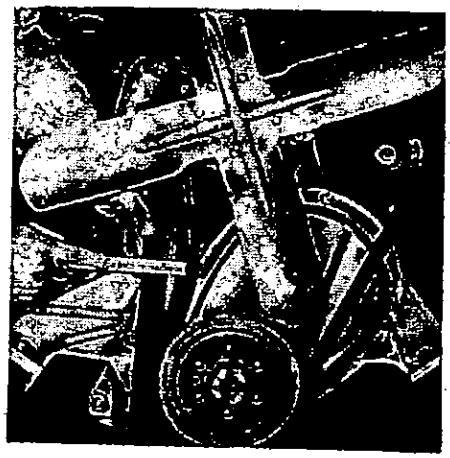


Fig. 7 Adjustment of Fan Belt

7-3 RADIATOR, THERMOSTAT & HEAT INDICATOR

DATA

RADIATOR

Type Pressurized Cooling water capacity	Water tube, pressure type 0. 4 - 0. 5 kg/cm² (5. 7 - 7 lb/sq. in.) Model 680 4W73 60 16 ltr. 16 ltr. 17. 5 ltr. (4. 227 U. S. Gal.) (4. 6 U.S.Gal.)

THERMOSTAT

Type Temperature to start open Temperature full open	Pellet 71. 5° - 74. 5°C (160° - 166°F) 86. 5° - 89. 5°C (187° - 193°F)

REPAIR OF RADIATOR

1. Cleaning of Cooling System

Neglect of the cleaning of radiator for a long while or use of improper or impure water for cooling purpose bring forth the overheating as formation of rust and sediment in radiator and water pump will result in poor water circulation.
To clean the radiator, proceed as follows:

1) Drain the cooling water by opening the drain cock at the bottom of the radiator.
2) Loosen the clamps of radiator inlet hose and the outlet hose on the sides of radiator and disconnect them from the engine.

3) Plug up the inlet hose opening that connects with cylinder water outlet, using a wood block of proper diameter and securing it in place with the clamp.
4) Remove the radiator filler cap and pour in pure water letting it to run out freely from the outlet hose.
5) The cylinder water jacket is cleaned in the same manner as for radiator. Clean water is poured in from the cylinder water outlet and drained from the radiator outlet hose. When the water tubes of radiator core are clogged and cause overheating, remove the radiator from the chassis to clean it.
6) First remove radiator from the chassis.
7) Plug up the outlet port at the bottom of radiator and fill water up to the top of radiator tubes.
8) Heat the soldered seam of radiator core and upper tank with a burner so that they are separated. Never heat the soldered seam when the radiator is empty. If other wise, the heat will melt away the soldered parts of the radiator tubes and will cause leakage.
9) Scrape off completly the scales and other impurities in the water tubes with a thin stick and flash the insides of water tube and lower tank with clean water.
10) After finishing the above operation, assemble the core and upper tank by soldering.
Care must be taken to make the connections strong enough to withstand vibrations of the vehicle in leakage by motion and to prevent it from becoming leaky.

2. Pressure Test of Radiator

After disassembling and cleaning of a radiator, test it by water pressure of more than 5 pounds per square inch to locate any leaky spot. As even a little leakage will cause overheating while running, the leaks must be repaired by soldering.

3. The Cooling Water

1) Cooling water must be filled always up to the overflow pipe at the top of radiator.
2) Hard water or water containing alkali substance is to be avoided for use of cooling water.
Such water liable to form scale or sediments, and will cause poor circulation of cooling water with the result of an overheating.
3) After an inevitable use of improper water, fill up the system with solution of two pounds washing soda and four gallons of warm water; and make the solution circulate the system by running the engine at low speed for twenty or thirty minutes. Then, open the drain cocks (located at the right of engine) of the cylinder block and the radiator to drain the whole solution. To leave no drops of the solution within the system, clean the radiator with flashing water three or four times.
Care must be taken in filling up the cooling system with soda solution or at the time of overflowing due to boiling of the solution in circulation, so as not to let the liquid splash over the painted parts, as otherwise the paint color would be affected.
4) When the engine has been overheated and old water is introuduced in the system, cylinder block or cylinder head is liable to crack or warp.

So, keep the engine is stopped before feeding cold water, it will not circulate the water and will have undesirable effect.

5) During the cold winter or whenever is liable to freeze, never fail to drain water from the radiator and engine.
Be sure to open both drain cocks at the bottom of the radiator and at the rear right side of the engine to completely drain the water.

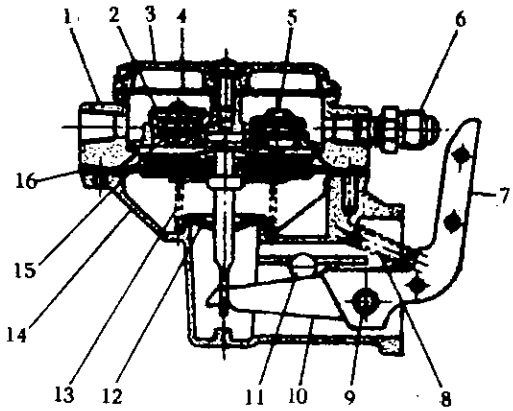
SERVICE NEWS REFERENCE

DATE	CONTENTS	NO. OF SERVICE JOURNAL AND BULLETIN

SERVICE NEWS REFERENCE

DATE	CONTENTS	NO. OF SERVICE JOURNAL AND BULLETIN

SECTION 8.
FUEL SYSTEM
8-1 FUEL PUMP



1. Upper body
2. Valve retainer
3. Cap
4. Diaphragm
5. Valve
6. Connector
7. Rocker arm
8. Rocker arm spring
9. Rocker arm pin
10. Lever
11. Hand primer pin
12. Packing cap
13. Diaphragm spring
14. Lower body
15. Valve
16. Diaphragm

Fig. 1 Fuel Pump

DATA

Type	Mechanical diaphragm pump
Diaphragm spring:	
Free length	60.4 - 61.6 mm (2.3779 - 2.4251 in.)
Fitted length & load	22 mm at 9.5 - 10.5 kg (0.8661 in. at 21 - 23 lb.)
Rocker arm spring:	
Free length	29.5 - 30.5 mm (1.1614 in. - 1.2007 in.)
Valve spring:	
Free length	7.05 - 7.15mm (0.2776 - 0.2815 in.)
Valve thickness	1.5 mm (0.590 in.)
Performance:	
Max. output	2.8 litres/min. or over (0.74 gal. USA) (cam 1000 rpm suction height 600 mm) (23.6 in.)
Max. outlet pressure	220 - 250 mm hg. (8.66 - 9.84 in. hg.)
Max. suction vacuum	400 (15.7 in.) mm hg. or over
Hand primer output	Approximate 200 cc (12.2 cu. in.) (10 strokes)

8-2 REPAIR OF FUEL PUMP

1. Measurement of Rocker Arm

Before disassembling the fuel pump measure the gap between the rocker arm and the flange of lower body with a square and a scale as illustrated in Fig. , and check the wear of rocker arm, rocker link and pin.
When the play of the arm is taken up, the above mentioned gap should be 1-9/64 inch, and if found less than this, it is because the rocker arm, link and pin are excessively worn, and therefore it needs remedy. The gap measurement is determined by pushing the arm toward the body until the resistance of diaphragm spring is felt, as well as the rocker arm and the rocker link leave no clearance at the shaft of diaphragm.

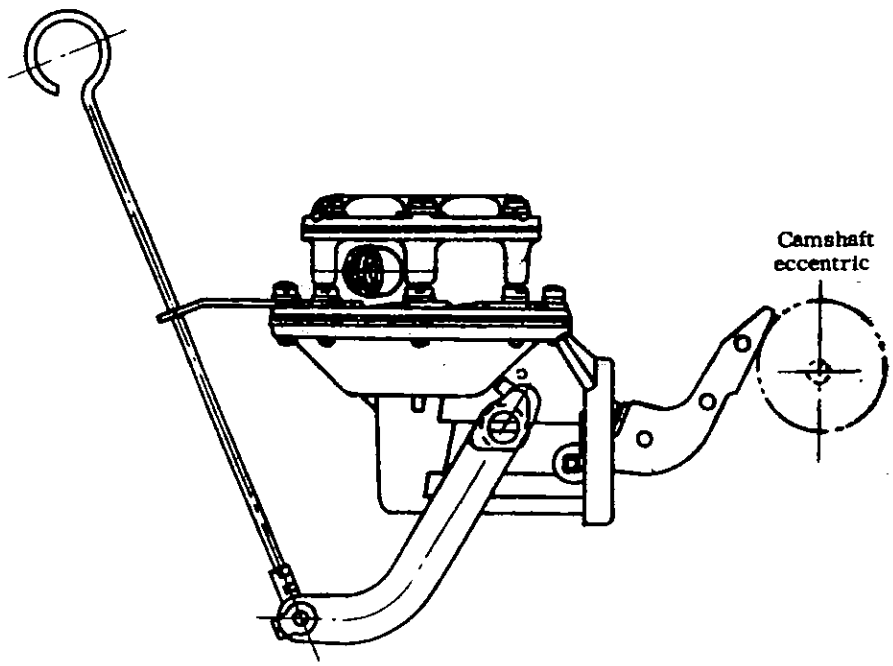


Fig. 2 Construction of Fuel Pump and Measurement of Rocker Arm Wear

2. Inspection of Parts

Wash and clean the parts with gasoline, and blow tith compressed air before making the inspection. Undermentioned items should be specially attended.

1) Whether or not gasoline is infiltrating due to the wear or damage of diaphragm.
2) Whether or not there is any crack or wear in the connecting part of diaphragm shaft and link.
3) Whether or not the contacting surfaces at rocker arm, cam and the link are worn.

4) Whether or not locker arm and diaphragm shaft are worn or cracked.
5) Whether or not diaphragm spring, arm spring and valve spring are fatigued.
6) Whether or not there is wear, or deformation in valve and seat.

3. Troubles, Causes and Repairs

1) Poor fuel supply.
This will happen when gasoline leaks, due to crack damage or fatigue of diaphragm. Replace a new diaphragm.
2) In case of diaphragm spring is fatigued or broken, a new one must be replaced. The regular height of spring are one inch for inner, and two inch for outer spring. Any spring of less height has to be replaced.
3) In case fuel or air leaks through cap gasket, check cap bolts for tighteness. If this does not stop the leakage, gasket is to be replaced.
4) In case the screen is clogged with dusts, wash it with gasoline.
5) In case there is leak in inlet or outlet valve, check if valve is bent, and replace with a new one if necessary. Allowable limit of bend is 0.001 inch. When the contact surfaces of valve seat and valve are found in poor condition, remove the outlet valve seat and polish the face with a fine oil-stone. The inlet valve seat is not removable from body. Therefore, to amend the surface of valve seat, use a cutter and grinder. When the surface of valve is not smooth, polish the valve lightly on a glass plate coated with fine emery-compound. Standard thickness of valve is 1/16 inch. If worn beyond the limit, replace.
Standard height of valve spring is 7.05 - 7.15 mm and if it is found extremely fatigued, replaced with new spring.
6) In case there is an extreme amount of play at the contact surface of rocker arm and camshaft, or when rocker arm pin hole is worn too much, replace the arm with a new one.
To correct the above condition disassemble the body, and remove the diaphragm. Install a packing of thick paper between the lower body and diaphragm, and raise the relative position of diaphragm shaft with the lower body.
7) In case the contact surface of rocker arm and rocker link is worn replace the arm and link altogether. But, for a makeshift repair emboss the link at the part where it contacts the arm, by means of exygen welding and then finish the surface with file. Also, a simpler repair can be done by using paper diaphragm as explained in 4.
8) In case the contact part of diaphragm shaft and rocker link is worn-out, replace the diaphragm assembly.
9) In case the rocker arm spring is fatigued, broken or bent, replace free of spring is 29.5 - 30.5 mm.

4. Over Flow of Gasoline from Carburetor

1) In case spring pressure of diaphragm is tampered and made too strong, it will happen that gasoline overflows from the float chamber. Don't monkey with the pressure of locker arm spring.
2) In case fuel pump is installed on cylinder block, be sure to use the flange gasket. The failure of installing the gasket is sure to cause overflow.
3) In case gasoline leaks, the cause will either the diaphragm is cracked, damaged or worn-out. Replace it with a new one.
If the ventilation hole of the lower body is clogged with dirts, gasoline will leak into the engine oil pan, resulting in diluted engine oil.

5. Attention for Assembling the Pump

1) Don't tamper the spring pressure of valve, diaphragm and locker arm by compressing or expanding.
2) When setting the inlet and outlet valves in the upper body as well as valve seats and gaskets, be sure the valves seat snugly in place.
3) Always use a new cap gasket in the upper body.
4) After assembling, check the air-tight conditon and free action of valve. If the valve action is not good, it is due to the poor fitting of valve, valve spring and spring holder. To obtain air-tight valves, they must seat snugly in the valve seats, and the springs should not be bent.
5) In assembling the upper and lower bodies, line up screw holes of upper and lower body and diaphragm. Push rocker arm toward the body so that the diaphragm is at the bottom of its stroke. Then tighten the body screws, making it sure that the diaphragm does not wrinkle along its edge. This care will help diaphragm move up and down freely and insure a long life.

6. Inspection

When the assembling is finished, the following items are to be checked before installing.

1) The distance from the rocker arm to the flange of lower body is.
2) Set a vacuum gauge in the inlet port of the upper body. Operate the rocker arm with hand three or four times to its full stroke. The gauge should show 450 mm hg. vacuum and keep it for more than three seconds. To check the pump without gauges, choke the inlet and outlet ports with fingers, and push the rocker arm. After about three seconds, let go the finger from inlet port. Also let go the finger from outlet port after about five seconds. If a strong suction sound is heard in the former, and if a strong blow-out sound is heard in the latter case, you can assume the pump is in good working shape.
After the pump has been installed to the engine.
Connect the gasoline pipe on the side of inlet port, leaving intact the pipe on the outlet side. Rotate the engine six or seven turns with the crank handle and see if gasoline flows out from the outlet port.
Connect the gasoline pipe to the outlet port and tighten up connections. Run the engine idling, and check connections if they are fuel and air tight.

8-3 CARBURETOR

The carburetor used is the Hitachi Model VC-42 and is of the down-draft type. It is equipped with a boost type power system and the main carburetting system consisting of a triple venturi and an air-ventilation pipe a low-speed carburetting system a piston-type accelerating pump and a fuel economizer system. The carburetor functions appropriately for each of the various conditions of starting, idling, medium speed, high speed, and accelerating.

DATA

Type	Hitachi VC42-1A for Model 680, VC42-4 for Model 4W73 and 60 series, VC42-5A FR40 Downdraft, throttle and choke valve linked
Throat diameter	42 mm (1.6535 in.)
Venturi diameter	36 x 17 x 10 mm (1.417 in. x -.669 in. x 0.393 in.)
Main jet	No. 143 for Model 680, No. 135 for Model 4W73 and 60
Main air bleed	No. 70
Slow jet	No. 55
Slow air bleed	No. 210
Power jet	No. 110
Slow by-pass hole	4 x 1 mm (0.1575 in. x 0.0394 in.)
Needle valve diameter	2.0 mm (0.0787 in.)
C dimension	7.8 mm (0.3070 in.)
Accelerating pump bore	19 m (0.7480 in.)
Idler hole diameter	2.0 mm (0.0787 in.)
Choke valve	Poppet valve
Fuel level height	20 - 22 mm (0.7874 - 0.8661 in.)
Power valve start open	(-) 110 mm hg (-4.3307 in.)
Degree throttle valve open at full choke	11°
Output/stroke accel. pump	1.8 cc (0.1098 cu. in.)
Pressure on fuel	0.3 kg/cm² (4.26 lb/sq. in.)

1. Functioning of the Main Carburetting System

The fuel which has been sent under constant pressure from the fuel pump is sent into the float chamber by the action of the float needle valve and float. The vent pipe becomes the vent passage subject to negative pressure and is connected to the interior of the float chamber. In spite of the variations in the resistance of the air cleaner act to keep the fuel level constant thereby maintaining the optimum mixture ration constant.

As the intake air passes through the throat of the venturi, the air flow velocity through the throat becomes high, and the air pressure near the opening of the injection nozzle becomes lower than the atmospheric pressure, that is, it becomes negative. Because of this suction, the fuel stored in the float chamber

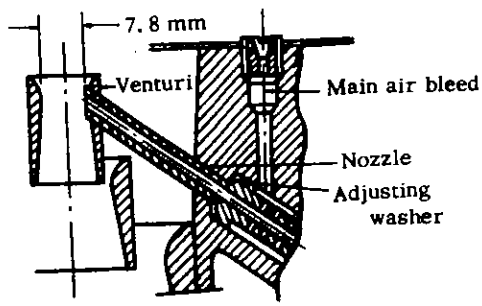


Fig. 3

is metered by the main jet and drawn out through the injection nozzle. Simultaneously, the air entering thorough the main air bleed mixes well with this fuel, which is then expelled as a fine spray from the tip of the injection nozzle.

The float valve spring is located within the float needle valve assembly and prevents the fuel level from rising excessively or overflowing because of the movements during operation.

2. Functioning of the Slow-Speed Carburetting System

This system operates for the slow speeds idling. During slow speed operation, the throttle valve is opened only slightly, of course, and the air flow rate is low. Consequently, the main carburetting system is inactive. The mixture for the slow-speed operation is created principally by the negative pressure developed below the throttle valve. The functioning of the slow-speed system is as follows:

The fuel in the float chamber is by-passed at the main jet to the slow jet by which it is metered, and mixes with the air which has entered through the slow-speed air bleed. The fuel is then regulated suitably by the slow-speed adjusting screw and is injected.

The by-pass port consists of a lengthwise slot and a 1 mm hole and delivers the mixture for slow-speed when the opening of the throttle valve is extremely small. However, as the throttle valve gradually opens, the mixture is ejected from the hole, and the transition from slow speed to intermediate speed is made smoothly without irregularities such as pauses in the action.

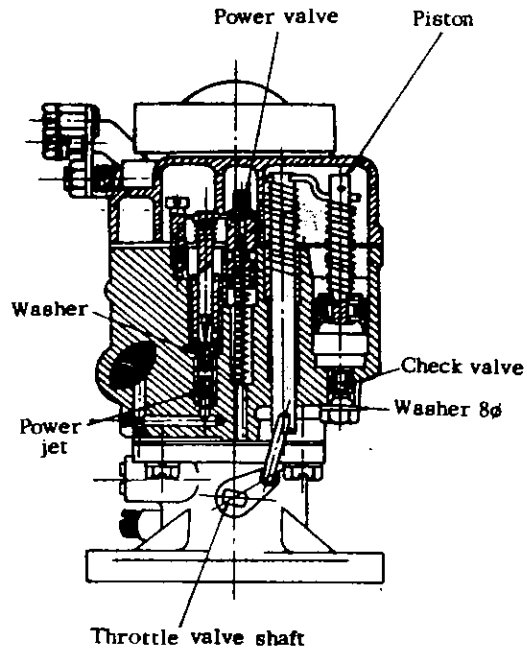


Fig. 4

3. Functioning of the Accelerating Pump and Economizer

The accelerating device of this carburetor is of the piston type synchronized with the throttle valve shaft. It is equipped with the pump piston and pump injector which temporarily supply a rich mixture, and the power valve and power jet which supply a very rich mixture when sudden acceleration or high power is required. The device functions as follows:

If, while the vehicle is being driven at a constant speed, the accelerator pedal is pressed down for acceleration, the pump piston descends in accordance with the descent of the connecting plate and injects the fuel below into the venturi from the tip of pump injector. This fuel had previously been drawn from the float chamber through the check valve and stored below the piston. This action

provides the necessary acceleration.

If the accelerator is depressed further, the throttle valve will open further. Then, which its opening becomes -110 mm Hg (from the fully closed position), the end of power valve rod moves down together with descent of the connecter to push down the valve. Simultaneously, a new fuel passage is formed between the float chamber and main jet and the fuel of the float chamber enters through the fuel port, is metered by the power jet goes out of the end of the main jet, and is ejected from the injection nozzle together with fuel of the main carburetting system.

As a result and extremely righ mixture is supplied.

Because the various parts such as the venturi, jets, and air bleeds of this carburetor have been designed and constructed so as to provide optimum fuel-air mixtures, practically no adjustment, other than that for slow speed and fuel level, is necessary.

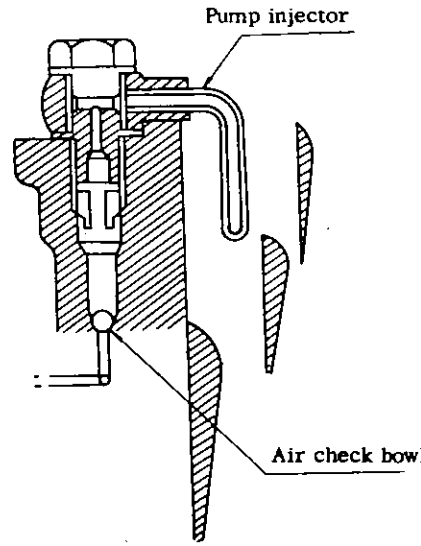


Fig. 5

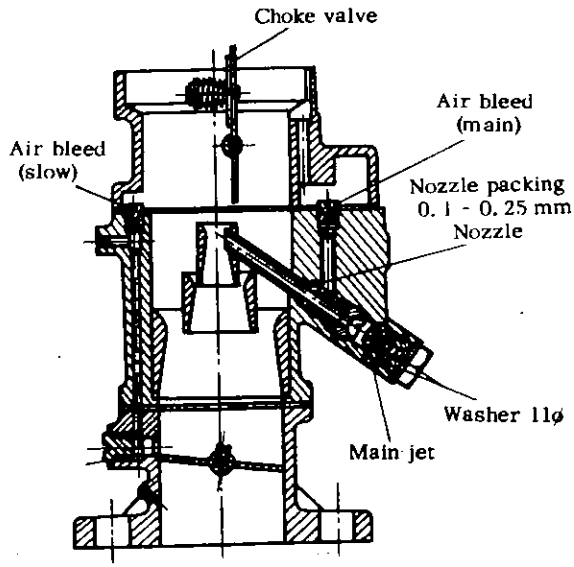


Fig. 6

The parts mentioned above have been assembled in accordance with the results of rigid tests. Therefore, arbitrarily varying them must be avoided. However, as a general rule, making a jet larger will make the mixture richer, and making it smaller will make the mixture leaner. If an air bleed is made large, the mixture will become leaner; if it is made smaller, the mixture will become richer.

8-4 ADJUSTMENT OF CARBURETOR

The slow speed adjusting is made by means of the throttle-valve adjusting screw and the slow-speed adjusting screw. The throttle-valve adjusting screw regulates the rotational speed for slow-speed. Screwing it in causes the speed to increase and unscrewing it causes the speed to decrease. The slow-speed adjusting screw adjusts the fuel air mixture ratio. Screwing it in cause the mixture to become leaner, unscrewing it causes the mixture to become richer.

The slow-speed adjustment must be made with correct coordination between the settings of these two adjusting screws. The procedure is as follows:

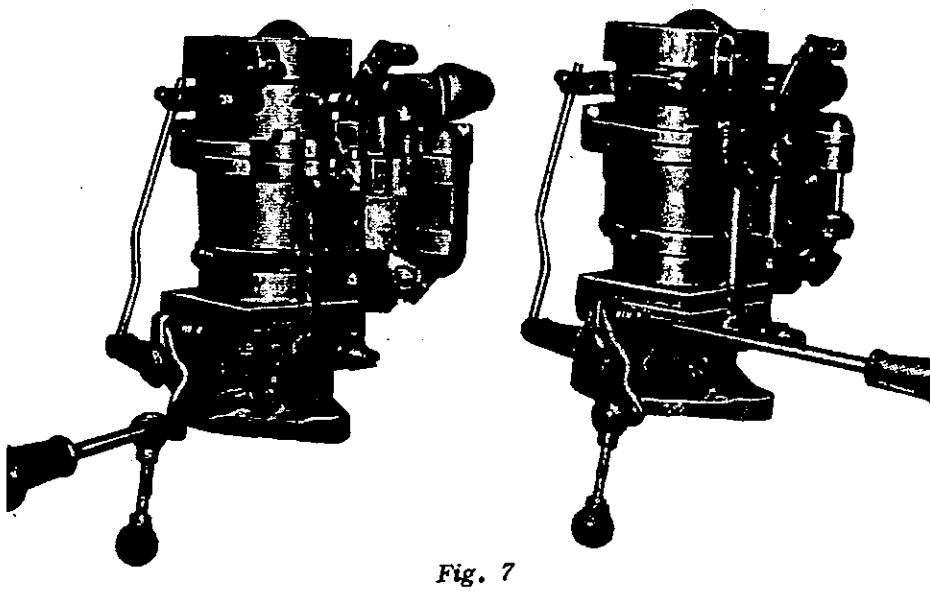


Fig. 7

1) First set the engine speed approximately at slow speed of 350 to 400 rpm. by means of the throttle-valve adjusting screw.
2) Next adjust the slow-speed adjusting screw so that the engine rotates smoothly.
3) Then adjust the rotating speed precisely with the throttle-valve adjusting screw.
   If the slow-speed adjusting screw in with too much force, its tip will be damaged and become the causes of improper operation; therefore, be careful in screwing it in. If, even when this screw is screwed in a certain amount, the mixture is still too rich, check to see that the slow-speed air bleed is not clogged, that the fuel level is not too high, and that the seating of the float needle valve is good..

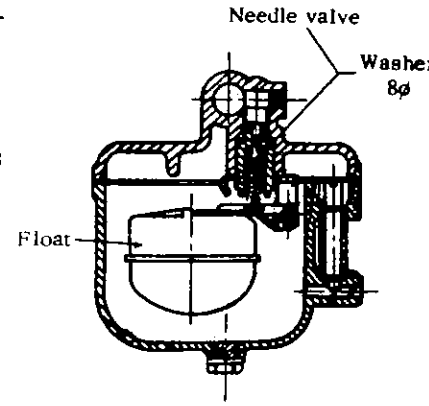


Fig. 8

Adjusting the Fuel Level

If the fuel level in the float chamber is too high, the fuel consumption will be high and over-flowing will be caused. On the other hand if the fuel level is too low, the mixture will be too lean; therefore, it must be maintained at the correct level. In general, when the engine adjustments are to be made, the fuel level in the float chamber must first be adjusted correctly. Otherwise, correct adjustment cannot be made.

Without special equipment the correctness of the fuel level cannot be determined directly. Ordinarily, the following method will produce the correct level.

1) First remove the fuel pipe from the float chamber cover.
2) Remove the three float-chamber cover screws, and take off the cover. Turn carburetor cover upside down so that the float is on top, and the float needle valve is held in its closed position by the weight of the float.
3) Lift the float with a finger, then gently lower it until the flap-like contact plate of the float just touches the upper end of the needle valve and hold the float in this position without pressing down on the needle valve spring.
4) With the float in this position, check the distance L1 between the lower surface of the end of the float and the upper surface of the chamber cover. If this distance is from 20 to 22 mm, the adjustment is correct.

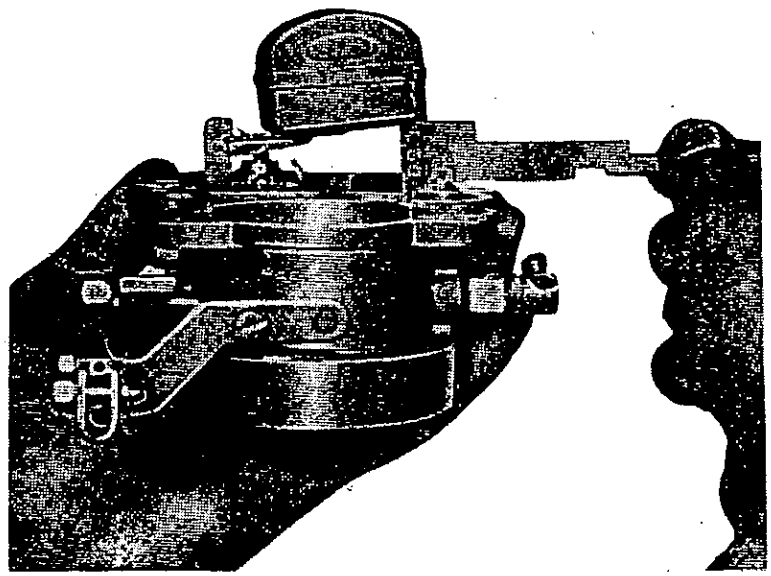


Fig. 9

5) If not, extract the float holding pin, remove the float, and adjust the angle of the contact plate as shown in the photograph. Be careful in making this adjustment because, if the bending is forced, the arm may be broken off from the float. Also because the needle valve is not headed, be careful not to let it drop out together with its spring.

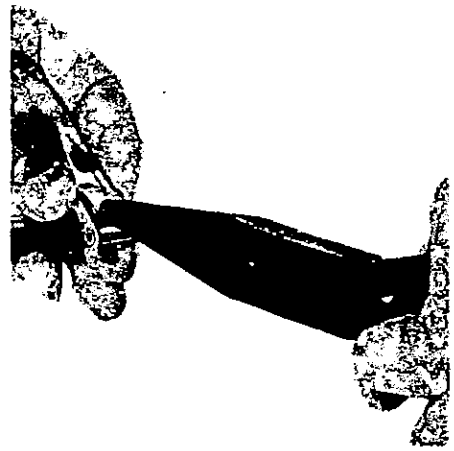


Fig. 10

6) Check the seating of the needle valve to the valve seat. If leakage exists, replace the needle valve assembly.

As described previously, the power jet starts to function when the throttle-valve opening becomes -110 mm. This adjustment is determined by the position of the adjusting nut of the power valve rod. If the position of this not is on the low side, the functioning of the power jet will be delayed; and if it is on the high side, the functioning will be hastened.
For correct adjustment, press down lightly with a finger on the power valve rod, as shown in the accompanying illustration, until the resistance of the power valve is felt; then hold this position. Move the throttle lever until its matching mark coince des with that on boss part. The throttle valve opening will then be 110 mm HG. Then raise or lower the adjusting nut so that connecting plate just touches the upper surface of the adjusting nut (i. e. , the point at which the power valve begins to function).

Adjustment of Connecting Rod

Insert the connecting rod into choke lever post. Keeping downward the arrow marked on the choke lever post, set its tip to the side groove of the connecting rod and fix it up with setscrew. As for its position, it is so arranged that when the choke valve is totally closed, the opening degree of throttle valve will stand at 11°.

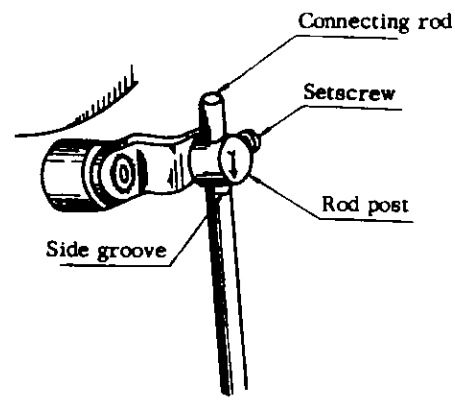
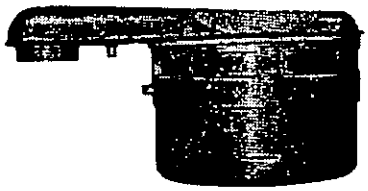


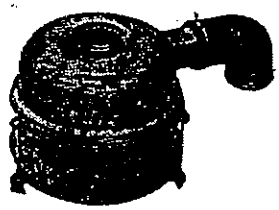
Fig. 11

8-5 AIR CLEANER

Cleaning of Air Cleaner



(a) for Model 4W73 and 60



(b) for Model 680

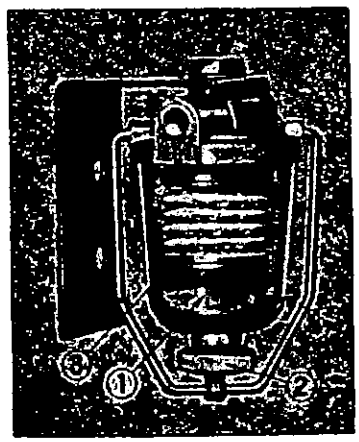
Fig. 12 Air Cleaner

1) The air cleaner serves to clean the air before it is suctioned into the cylinder. If the cleaner has been in service for a considerable length of time without having been cleaned, the accumulated dusts within the cleaner interferes free passage of the air. This will result in poor engine performance and increased fuel consumption. As any dust particle in the air will cause premature wear of cylinder wall, air cleaner should not be dispensed with, and it should be kept clean all the time, by periodical inspection and cleaning.

2) To clean the apparatus, unscrew the wing nut on top of the cap and remove the cap. Take out the steel wires and clean them in gasoline. Fill the bowl with engine oil up to the specified level. Reinstall the wires after having been dried and soaked with oil.

3) The cleaning of the apparatus should be made every 3,000 miles. If, however, the vehicle is used customarily in dusty districts, more frequent cleaning is advisable.

8-6 GASOLINE STRAINER



① Bowl
② Clamp nut
③ Strainer element

Fig. 13 Gasoline Strainer Ass'y

Repair of Gasoline Strainer

1. Instructions for Disassembly and Assembly of Gasoline Strainer

   1) To remove the bowl from the body, loosen the strainer nut and remove the wire to a side. Take off the bolt, nut and washer from the wire and remove bowl, gasket and screen.
   2) Wash those disassembled parts with clean gasoline and blow with compressed air.
   3) As a rule, the strainer bowl gasket has to be replaced. The used gasket is not air-tight.
   4) Strainer body is made of aluminum alloy. Take good care not to break threads of each connection.
   5) Pay attention not to tighten the strainer nut so excessively that the gasket and bowl are broken.
   6) When installing the strainer assembly, the strainer bracket should be cleaned sufficiently. Dust and dirt on the bracket surface prevent plug from keeping air-tight.

2. Poor Feeding of Fuel

   Causes of this trouble are as follows;

   1) When the screen is clogged with dirts.
   2) Air leaks from the bowl gasket.
   3) Air leaks from strainer nut, strainer connector or plug as the result of imperfect tightening.

3. Disorder of Non-return Valve

   This is caused from either corrosion or wear of valve seat which makes it hard to open or shut.
   In this case, replace a new valve and flatten the seat.
   Sometimes, the troubles in non-return valve will discontinue feeding gasoline to the engine when the latter is over-heated.

Inspection

1. Cleaning of the Screen

   After long run, screen become clogged with dust, and the bowl is depositted with dust and water in its bottom, and will result in poor straining efficiency.

2. Check Periodically

   In case of dust and dirts are depositted therein, remove bowl and screen, clean up completely with gasoline and compressed air.

8-7 GASOLINE TANK & GASOLINE GAUGE

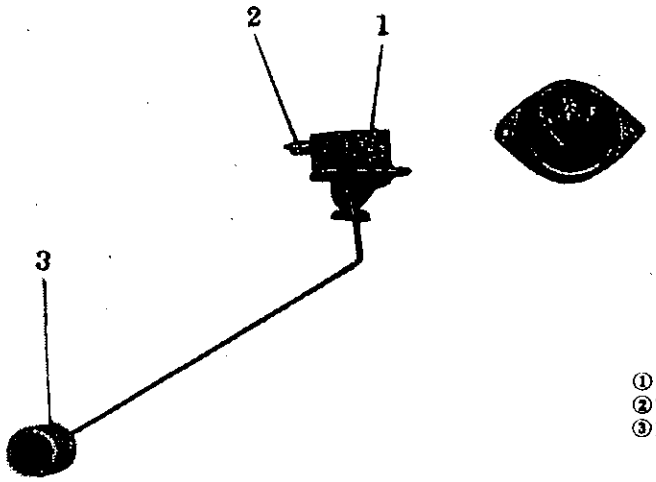


Fig. 14 Gasoline Gauge Tank Unit and Dash Unit

Fuel tank capacity	Model 680	4W73	60
	110 (29)	100 (26. 4)	50 ltrs. (13 U.S.Gal.)

Repair of Gasoline Tank & Gasoline Gauge

1. Troubles of Gasoline Tank, and Repairs

   1) The gasoline pipe of tank unit, is clogged with dust or water.
   In this case, remove tank unit and blow the pipe with compressed air in the reverse way to the flow of fuel. Take off the drain plug at the bottom of tank and clean inside of tank.
   2) Fuel does not come into the gasoline pipe.
      a This happens when the ventilation hole in the filler cap is clogged with dust.
      In this case, the tank would take vacuum effect which prevent the flow of fuel into the fuel pipe. Clean up the ventilation hole.
      b. The gasoline pipe of tank unit is bent and dows not reach the fuel level. The lower end of pipe should be 5/8 inch above the bottom, therefore, if other wise, remove the tank unit and correct the bent pipe.

   3) Fuel Leaks from the Gasoline Tank
      a First, locate the leaking spot and mark it with a chalk, and drain the fuel completely.
      b Blow the compressed air into the tank and expel out the stagnant gas therein. Get it dried completely.

c Repair completely the leaking spot by soldering or oxygen welding. If the broken spot is comparatively spacious, a steel plate of proper size is to be patched thereto.
Failure to expel the gas staying in the tank will induce a dangerous explosion at the time of wilding operation. Good care is invited to this matter.

2. Trouble and Check of Gasoline Gauge

The trouble in gasoline gauge is attributable to the trouble in tank unit, dash unti and poor wirings. Check them as follows;

1) Remove the terminal of tank unit, and set on ignition switch. Alternately touch and detouch the terminal to chassis and look at movement of indicator in dash unit. If then the indicator oscilates quickly across the dial from E to F, dash unit and wirings are in good condition. Replace the tank unit to locate the trouble.
2) In case the indicator does not move in the above test, try to earth the wire running from the back of dash unit to tank unit. If the indicator moves, the wiring is no good.
3) In case the indicator does not move in the above mentioned test, earth the wiring from battery to dash unit. If spark is seen, it indicates the trouble is in dash unit. Defective dash unit should be replaced.
4) In case of no spark is seen when the wiring from the battery is grounded, it indicates the trouble is in wiring.

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SECTION 9.
IGNITION SYSTEM

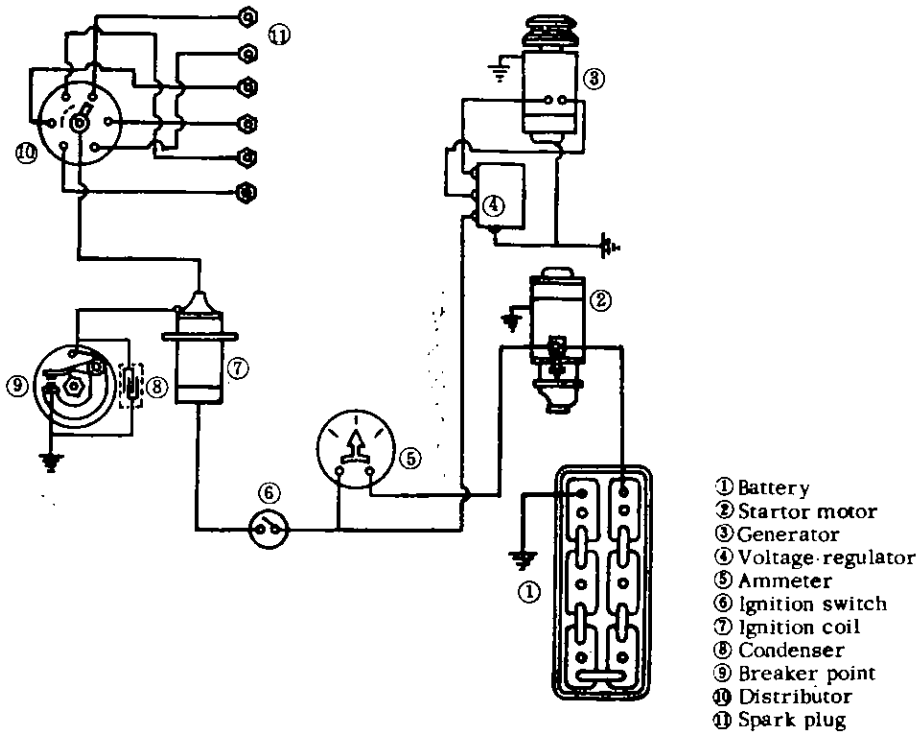
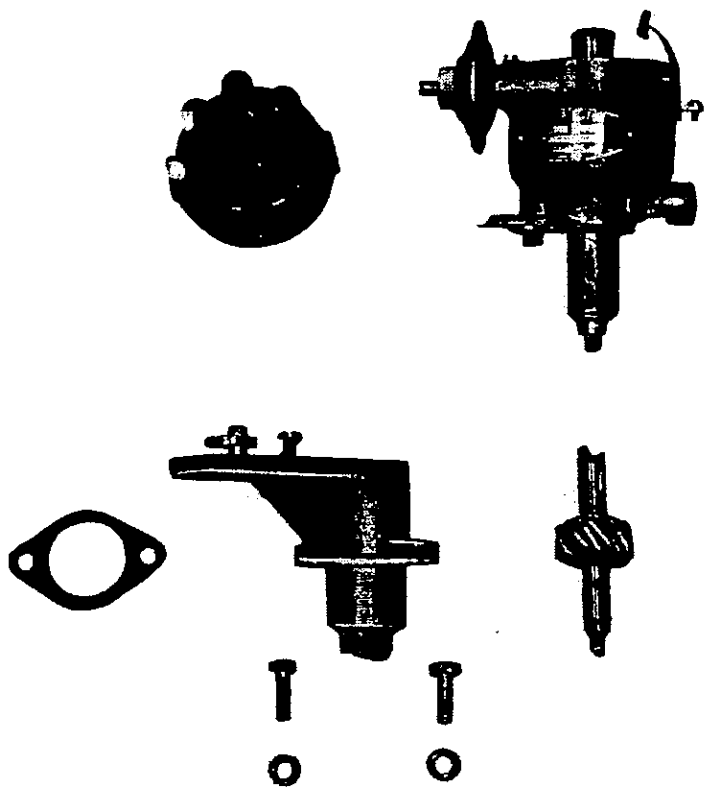


Fig. 1 Ignition System Circuit

DATA

IGNITION COIL

Type	Hitachi CIZ-01
Primary voltage	12 volt
Primary coil resistance	3.95 Ω at 20°C (68°F)
Insulation resistance	10M Ω at 80°C (176°F)
Current consumption approx:	
Running	1.4 Amp (distributor 1800 rpm)
Stall	2.0 Amp



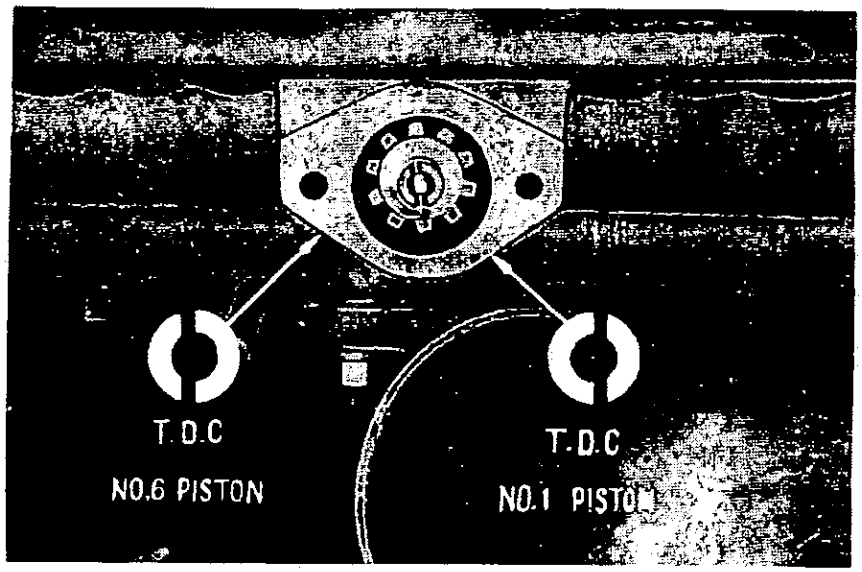


Fig. 2

DISTRIBUTOR

Type	Hitachi D608-01, D608-02 (water proof)
Ignition timing	10° B. T. D. C.
Automatic advance system	Centrifugal and vacuum
Advance angle characteristic:	
Advance start at engine rpm	1000 rpm
Max. advance angle	34° at 3600 rpm (crankshaft)
Breaker point gap	0. 45 - 0. 55 mm (0. 018 - 0. 021 in.)
Dowel angle	35° - 40° (at point gap 0. 5 mm 0. 020 in.)
Contact arm spring tension	500 - 600 gr. (17. 6 - 21. 1 oz.)
Condenser capacity	0. 20 - 0. 24 Micro farad
Insulation resistance	5M Ω or over
Clearance distributor shaft and bushing	0. 015 - 0. 035 mm (0. 0006 - 0. 0014 in.)

SPARK PLUG

Model	B-54E or B-6E
Size of thread	14 mm
Gap	0. 6 - 0. 7 mm

9-1 CHECK & REPAIR

1. Ignition Coil

When the ignition coil is found unreliable, test it by comparing with a new one.

1) Test of Primary Coil

Usually misfiring of spark plug will occur when the ignition coil fails to supply enough secondary voltage due to poor insulation, over-heating or internal fault of primary winding.
In this case, measure the amount of electric current from battery to primary coil by connecting an ammeter of thirty amperes capacity between the battery and primary coil. The primary current, generally is about 4. 5 amperes at the instance the circuit is closed, and will settles at about 3. 5 amperes.
If the ammeter indicates a flow of current over six amperes, it suggests that the coil is short circuited. If it registers no current flowing through the circuit, it is because the coil wire is broken, and a new coil should be used.

2) Test of Secondary Coil

Pull coil wire out of distributor cap, remove the cap and crank the engine until distributor points are fully closed. Turn on ignition switch, hold the

cap end of coil secondary wire about 3/8 inch away from metal part of engine, and open breaker points with fingers.
If a good spark jumps from wire to the metal part, the coil is in good condition. If the spark is weak or absent, the coil is to be blamed, provided that condenser and ignition switch are in good order.
For more perfect testing use a universal electric testing machine and check the spark gap. Testing machine is illustrated in Fig.

2. Distributor

1) Removal and Assembly

a. To remove the distributor from the engine, take off cotter pin, and remove the stud washer and spring. Then remove screw, take out the distributor together with the clamp arm.
To install it, loosen the clamp of the distributor. Rotate the cam, and the distributor will be settled at a point. Then tighten all condition.
Distributor can also be removed from the engine by simply loosing the screw of the clamp arm, but generally this method is not taken except the case as engine is overhauled. If this method is adopted, ignition timing must be adjusted thoroughly before the distributor is installed.

b. After the parts of distributor have been taken apart, clean the inside with gasoline, and remove any rust at the part where it is connected to the engine, as the rust will result in poor grounding of the distributor.

c. Before assembling, supply three or four drops of engine oil to the felt at the center of cam.

d. Check the grease cup, and make sure the distributor shaft in sufficiently lubricated.

2) Trouble

a. Burning of the point.
When the points are burnt due to long service, improper point gap, or defective condenser, remove the breaker arm and contact arm.
Redress the contacting surface of the point with a fine file, and adjust their gap after installation.

b. Adjustment of point gap.

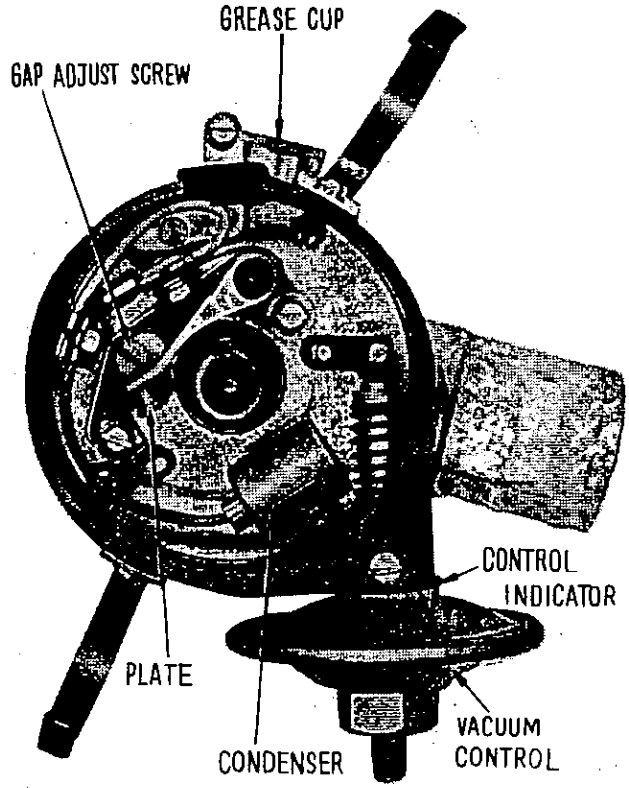
Loosen the lock screw. Turn the adjusting screw until point gap is 0.020 inch with the heel of contact arm riding on a lobe of cam.
Tighten lock screw, recheck gap.

c. Wear of heel of contact arm and wear of cam.

When the contact arm is new, its fibre heel will wear and harden quickly. If it is left attended, the cam will wear soon. To prevent wearing, coat the cam with a small amount of grease at the time of each inspection.

d. Short circuit (contact arm and arm spring).

The breaker plate pin which holds the contact arm is furnished with an insulator. Also the arm spring has a bakelite washer as a insulator at terminal connection. If these insulators are loose or in poor shape, the primary current will be grounded and will lead to misfiring. Keep them tightly in placed, and if contact arm is short-circuited at the pin hole, replace it with a new one.


GREASE CUP
GAP ADJUST SCREW
CONTROL
INDICATOR
PLATE
VACUUM
CONTROL
CONDENSER

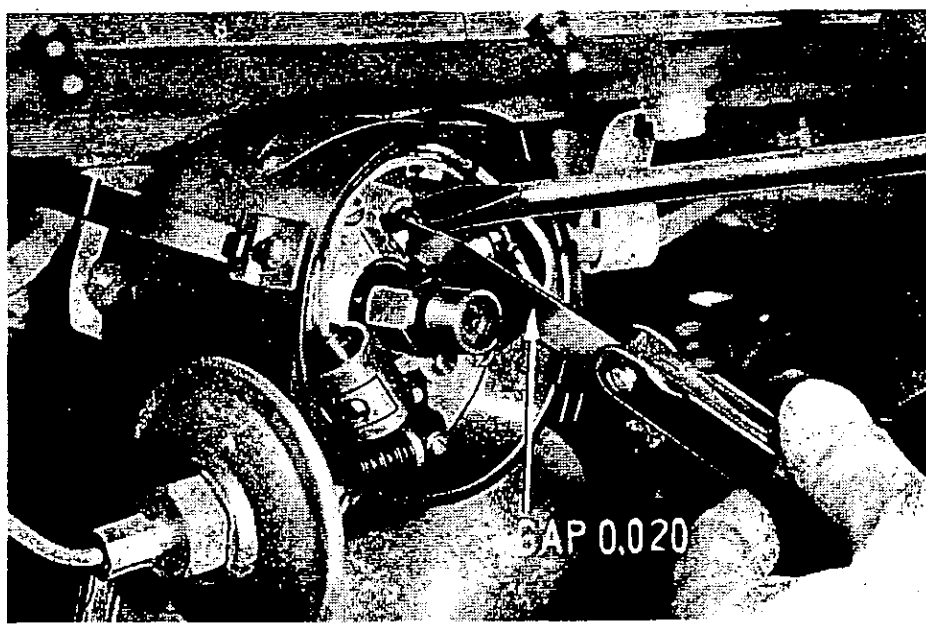

GAP 0.020

Fig. 3

e. Improper tension of contact arm spring.

When the tension of contact arm spring is too strong, it induces quick wear of fibre heel and cam. When the spring is too weak, it cause misfiring at high engine speed.
Never change the bending of spring recklessly. Standard spring tension is from nineteen to twenty-two ounces, measured at the contacting point just before it starts to open.
When replacing a new contact arm, scrape the hole of contact arm, so as it can be easily installed and freely work on the breaker plate pin. When it is not working easily, the regular spring tension will not be strong enough to work on the contact arm, and will cause misfiring at high speed as in the case of weak spring.

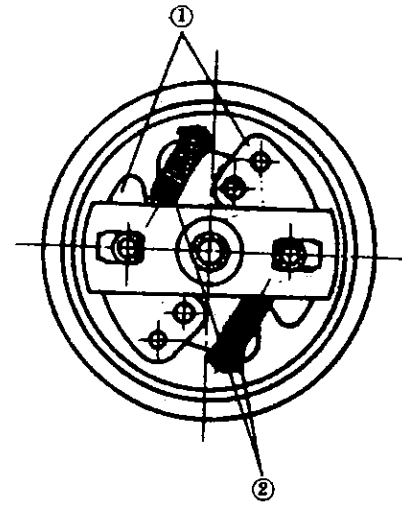


Fig. 4 Distributor Governor

① Governor weight
② Governor spring

f. Short circuit of distributor cap.
There will be a short circuit when distributor cap has cracks, and it will cause misfiring. Replace with a new cap.

g. Distributor rotor.

If the distributor rotor has any crack, or if it is excessively worn, replace it with a new rotor.

h. Governor

There is an automatic advancing system of centrifugal governor type placed under the breaker plate in the distributor.
Sometimes it may happen the governor fails to work at the high speed due to dragging or friction. In such a case, the engine will lose its power on account of the faulty ignition timing. Push or pull the cam on the shaft to the left as far as it goes. The release the cam and if it snaps back quickly, the system is in good condition.

i. Condenser troubles

Almost all of condenser troubles are short of circuit.
The shorted condenser weakens the secondary voltage, burns distributor points and causes the engine revolution to become irregular or to stop. If condenser is shorted, replace with a new one.

Test of Condenser;

i-1. When sparks are weak the condenser is suspected of trouble, test it by comparing with a new one.

i-2. Using a lighting tester, touch one of the tester terminal to the lead wire of condenser and the other end to the bracket of condenser. If the tester bulb lights, it indicates the condenser is short circuited.

i-3. Flow for just a moment 200 volts current, either of direct or alternative, through lead wire and body of the condenser. After a minute or two, approach the end of lead wire to about 1/16 inch distance from the body of condenser. If a sprak jumps the gap, the condenser is assumed to be O.K. On the contrary, if the condenser becomes heated when the current is supplied as described above, or if there is no spark when the lead wire is approached to the body, the condenser is probably defective.

3. Vacuum Control

The vacuum control is installed on the distributor as illustrated in Fig. . It is connected to a hole below the throttle valve of carburetor, and automatically ajusts ignition timing together with the governor of distributor.

Possible troubles of vacuum control are air leakage due to poor connection of pipe, and inefficiency due to broken diaphragm inside. In such case, the vacuum control does not work even when the engine is accelerated.

To locate these troubles, check the pipe connection, and if they are good, the trouble may be in diaphragm. Remove the vacuum control and install a new diaphragm.

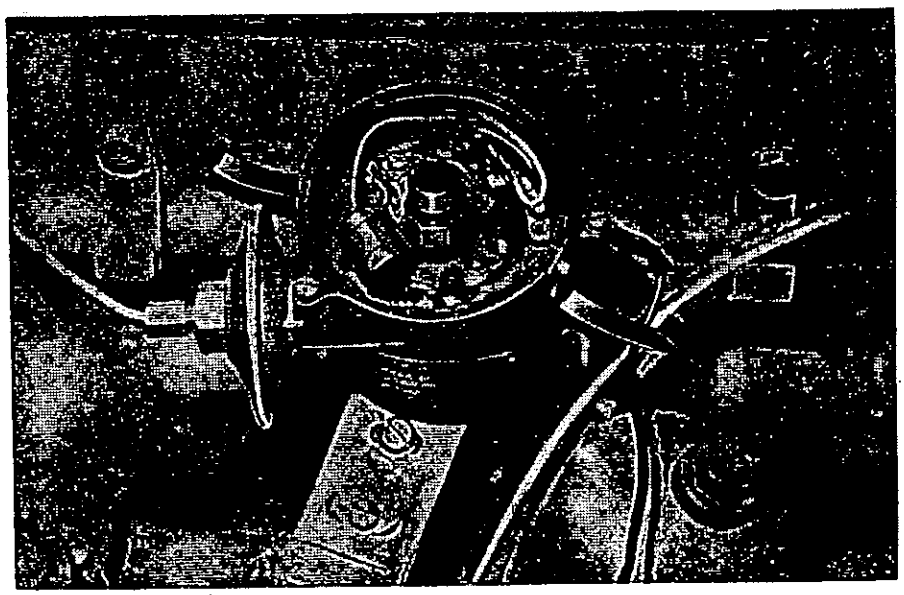


Fig. 5

4. Spark Plug

The spark plug used on Nissan is N.G.K-B54E or B-6E model, and screw size is fourteen millimeter. It is essential for spark plugs to be kept clean and accurate spark gap is 0.6 - 0.7 mm (0.024 - 0.028 in.)

a. Adjusting of Gap

At first, clean it completely with the spark plug cleaner. If the cleaner is not available, use a brush or waste cloth to remove and clean the carbon. Also check carefully whether or not there is any damage on the porcelain.

After that, adjust the spark gap to the said inch with thickness gage. When spacing the electlodes to obtain correct gap, always work on the ground side of the electlode only. Never attemp to adjust the gap by bending the electlode which is in the center of the core.

b. Diagnosing Engine Condition through by Spark Plug

b-1 If the inside of a spark plug is well dry and its white porcelain is in light brown colour without any carbon element, this cylinder is assumed to be making a satisfactory combustion.

b-2 Accumulation of carbon in the spark plug indicates that the engine is supplied with too rich mixture and therefore its combustion is imperfect.

b-3 When the spark plug is found wet with gasoline, it means the spark plug is missing.

b-4 When there is an accumulation of carbon like coal powders or when it is wet with oil, it indicates the engine oil is pumped up into the cylinder.

If due consideration is paid to the above condition of the spark plug whenever it is removed, fairly accurate diagnosis of the cylinder is possibly made.

9-2 ADJUSTMENT

1. Test of Distributor Efficiency

After inspection of each of a distributor, assemble them, and check the distributor assembly on a universal electric tester to check the performance of the distributor. By this test we obtain accurate knowledge of the advancing angle, spark condition, profile of cam etc.

2. Ignition Timing

After installing all the parts of ignition system, set the ignition timing as follows;

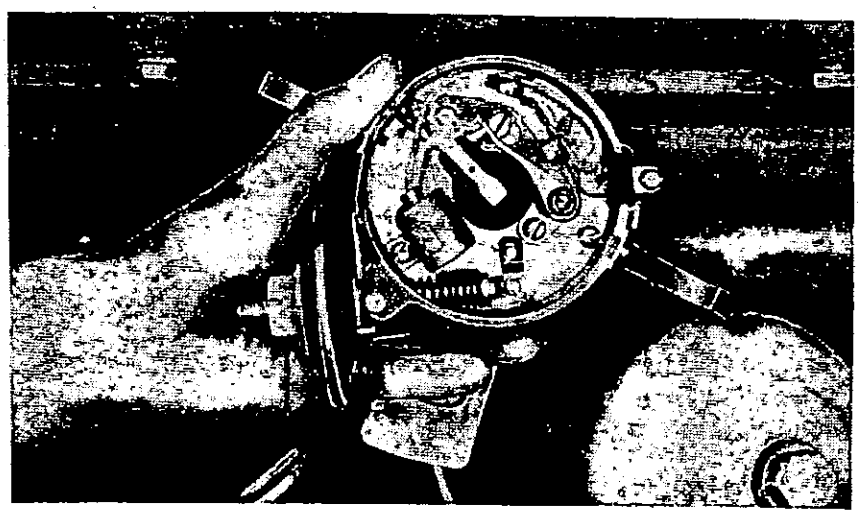


Fig. 6

Crank the engine slowly by hand until No. 1 piston comes near to the top of compression stroke. Set the mark on the crank pulley in line with a pointer on the timing gear case cover.

Loosen the screw of octane selector, and set the indicator to "0" and tighten the screw.

Loosen the screw at the bottom of the distributor.

Remove the cap and adjust the contact point gap to 0.020" measured with thickness gauge.

Connect one of the wires of the timing lamp tester to the primary wire of the distributor and connect other wire to earth.

Turn ignition switch on.

Adjust the distributor so as the timing lamp is lighted when the distributor body is turned to the right until the point begins to open and the lamp is off when the point is lightly pushed with a finger.

Connect No. 1 spark plug wire to the distributor at its terminal to which the rotor arm is facing, and connect other wires in counter-clockwise order and following the firing order of 1-5-3-6-2-4.

When a lamp tester is not available, proceed as follows:

Pull out the high tension wire at the cap and hold it 1/8 inch away from the engine block.

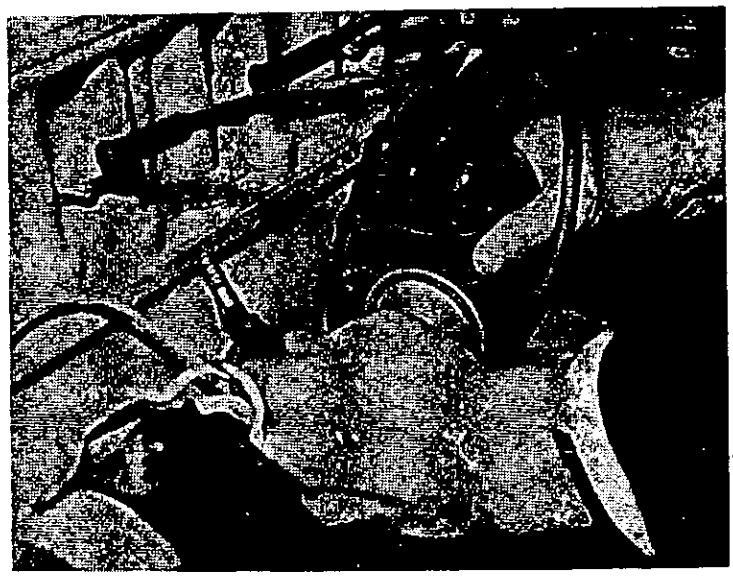


Fig. 7

Turn on the ignition switch.

Turn the distributor to the right until the spark is seen from the high tention wire. Stop there and fasten the clamps of the distributor tightly.

Connect the spark plug wires.

Finally tighten all the terminals and connections.

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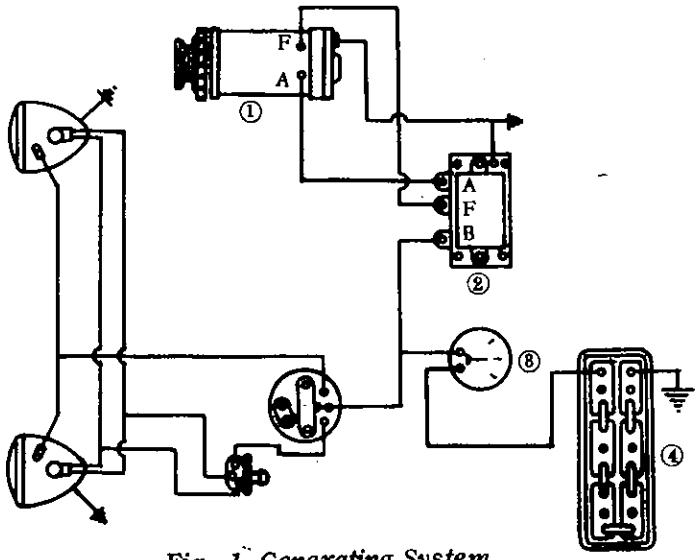
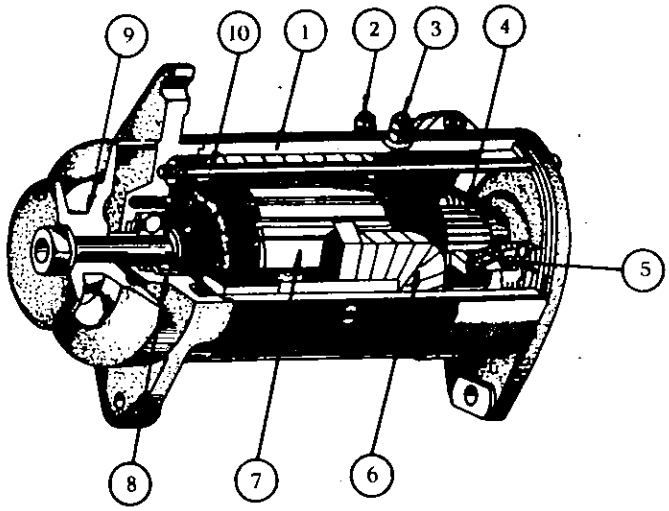
SECTION 10.
GENERATING SYSTEM



①Generator
②Voltage regulator
③Ammeter
④Battery

Fig. 1 Generating System

10-1 GENERATOR



①Frame
②Terminal
③Terminal
④Commutator
⑤Brush spring
⑥Field coil
⑦Armature
⑧Ball bearing
⑨Fan pulley
⑩Throw bolt

Fig. 2 Sectional View of Generator

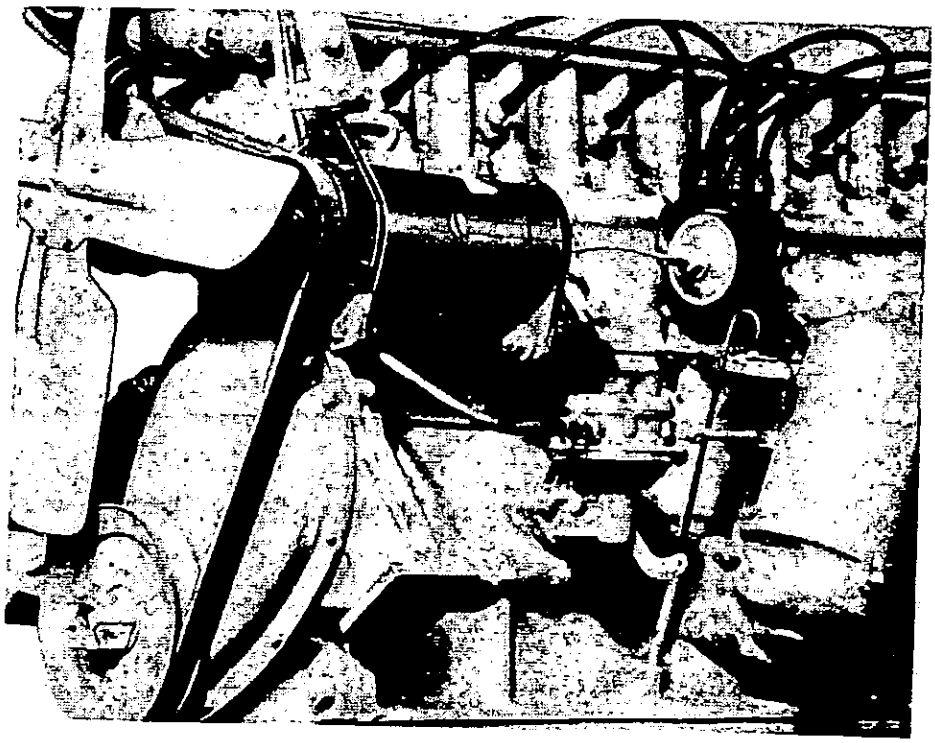


Fig. 3 Generator

DATA

Type	HITACHI G115-09
Voltage	12 volt
Output (amp x Volt)	200W (13V x 15A)
Pulley ratio	1.84 : 1
Shaft runout limit	Not to exceed 0.1 mm (0.004 in.)
Commutator diameter	37 mm (1.4567 in.)
Wear limit	2.0 m (0.0079 in.)
Out of round limit	0.05 mm (0.002 in.)
Irregular wear limit	0.3 mm (0.012 in.)
Brush length	16 mm (0.630 in.)
Amendment limit	11 mm (0.433 in.)
Brush spring tension	500 - 700 gr. (17.6 - 24.6 oz.)
Armature core clearance	0.3 mm (0.012 in.)
Field coil pole core screws:	
Torque wrench setting	6 - 7 kg-m (44 - 51 lb/ft.)

10-2 CAUTIONS FOR HANDLING GENERATOR

1. Keep always clean the inside and outside of the generator.
2. When the generator is disassembled, wash the parts with gasoline excepting the field coil and armature coil.
3. In case of assembling, blow away the dirt and dust by the compressed air. And when assembling, make sure all connections are tightened securely.
4. After assembling, feed eight to ten drops of engine oil to the armature shaft bearing.

5. To set the generator on the engine, don't adjust the fan belt too tightly. The proper tention of belt is to have one inch deflection when pushed with a thumb.
6. If the engine is to be run with lead wire disconnected between the generator and battery, ground the wire of the generator.
   If not ground, the generator will be burnt.
7. The terminal of circuit must be tightly fastened, and kept clean.

10-3 CARBON PILE TYPE VOLTAGE REGULATOR

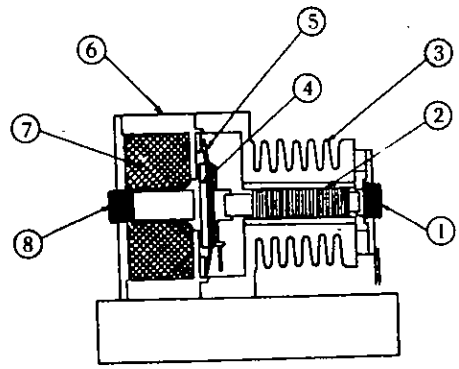


Fig. 4

DATA

Type	Hitachi R115-02
Voltage adjustment	Caron pile
No load voltage setting	15 - 16 volt (generator 2500 rpm)
Flux screw locating voltage	8 - 10 volt (generator 2500 rpm)
Cut out relay point gap	0.7 - 0.9mm (0.028 - 0.035 in.)
Armature air gap (point closed)	0.25 - 0.45 mm (0.010 - 0.18 in.)
Cut in voltage	12.5 - 13.5 volt (generator 1300 rpm)
Reverse current	5 ampere
Number of carbon piles	45

The carbon pile system is so designed that its electrical resistance will decrease when higher pressure is applied,. and will increase when lower pressure is applied. With this function, the carbon pile placed in the circuit line of generator field coil in series control the pressure by means of a combination of magnet and plate spring. The higher voltage produced by the generator will exert less pressure and therefore more resistance; the lower voltage will induce more pressure and therefore less resistance.

For instance, when the generated voltage is too high, strong current flows through the magnetic coil (6) and attracts the moving plate (4) of the pile and lessens the tension of pressure spring. This will increase the electrical resistance of the carbon pile (1) and reduce field current of the generator. As the result of it, the voltage will be reduce.

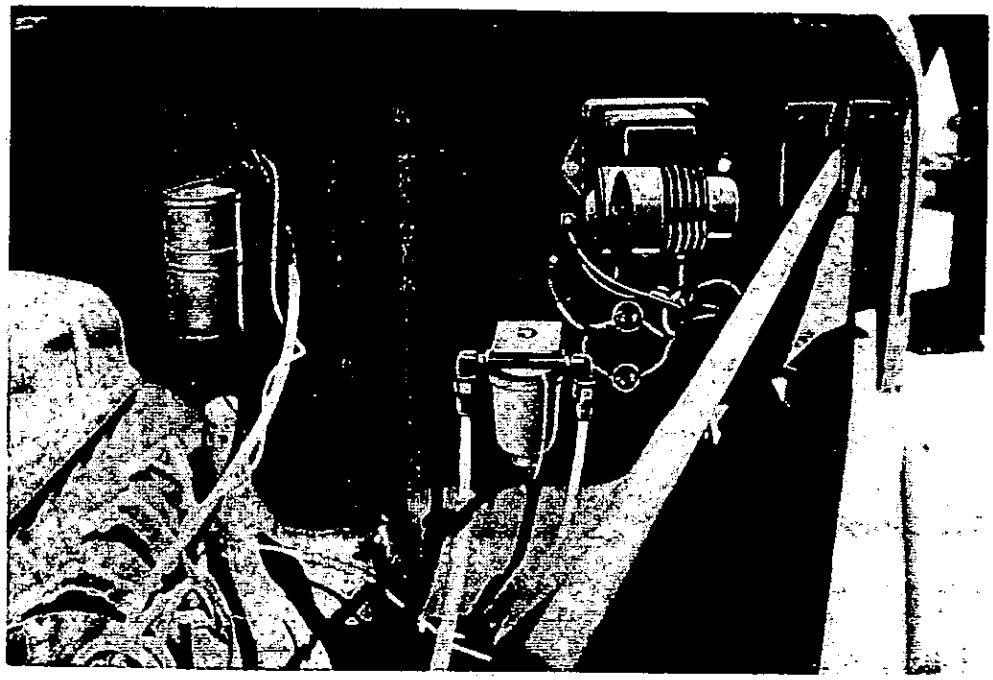


Fig. 5 Voltage Regulator in Model 4W73

On the contrary, when the voltage of the electric current from generator drops very low, the carbon pile system will function in inverse order as described above, and raise the voltage.

Thus the voltage will be stabilized all the time.

This regulator has no current limitter. It is because the magnetic coil of voltage regulator incorporates a current coil when functions to automaticaly regulate the resistance of the carbon pile when excessive current flows, and reduce the voltage so that it will not exceed a limit.

Note: The voltage regulator of vibrating point type has the current limitter independently. This is because to prevent the generator from burning by the excessive high voltage caused by contact point of voltage regulator melted and fused on account of sparks at the points. However the carbon pile type has no contact point which may cause this trouble.

10-4 TROUBLE AND REMEDY OF GENERATOR AND REGULATOR

The charging current of generator equipped with voltage regulator is increased or decreased in direct proportion to the charged condition of battery. In normal driving, where the battery approaches fully charged condition, the current from the generator will drop and stabilize at five to six amperes. This is to prevent the battery from being overcharged, and therefore should not be mistaken of the generator.

c. When the terminal is loosened, tighten securely.

2) Troubles in the voltage regulator

Set the volt-meter between the B and E terminal of the regulator with the engine running at 1000 rpm, check troubles by voltmeter.

a. In case the cover of regulator is contacting with the inside electric circuit, repair the cover.
b. When the wire of the regulator is broken or shorted replace or remedy.
c. If the contact points of the cut-out relay are found unstably closing and opening, replace the cut-out relay.
d. When the face of contact points of cut-out relay are pitted, or rough, dress them down with a fine file or emery cloth.
e. In case the voltage coil of the cut-out relay is shorted or broken, replace the cut-out relay.
f. When the current coil of cut-out relay is found broken or about to be broken, replace the cut-out relay.
g. When the carbon plate of the automatic voltage regulator is found damaged, replace the plate.
h. If there is any broken or shorted wire in the magnetic ooil for the voltage regulator, replace the part.
i. If the resistance coil of the voltage regulator is shorted or its wire broken, replace the coil.

3) Troubles of generator

a. If the brushes are found making poor contact, remedy or replace the brush.
b. Weak or refective spring should be repaired or replaced.
c. When the surface of commutator is found rough, turn down on a lathe.
d. If there is any short or damaged on the armature coil, repair or replace it.
e. If any broken or shorted wiring is located in the generator, replace or repair.

4. Over Charging

If the ammeter registers anbormal high charged condition, it means that the generated voltage is too high.

Check causes as follows;

1) Troubles of external wiring

The lead wire between generator A terminal and voltage regulator A terminal may be rubbing against the lead wire connecting generator F terminal and voltage regulator F terminal, with the result of exposure of wires and short circuit. Repair the exposed wires, or replace.

2) Troubles of regulator

Hook up a volt-meter to B and E terminals of regulator as already described. With the engine running at 1000 rpm speed, check troubles by voltmeter.

a. Where the adjusted voltage of the regulator is too high, reduce the voltage by turning counter-clowise the adjusting screw for variable flux.
b. When the spring for pile pressure is weak, it should be replaced.
c. In case the magnetic coil of the regulator is broken or shorted replace it with a new one.
d. If the resister for pile coil is broken or shorted, replace the coil.

3) Troubles of the battery

If it so happens that the actual rate of charge current is always higher than the reading of the volt-meter, the trouble is located in the battery.

4) Cut out relay defective

If the ammeter registers a discharge while the engine is running at a charging speed, the cause of trouble is no doubt in defective cut-put relay of the voltage regulator. Check as follows;

a. If the points of the cut-out relay do not open, check their closing voltage. The voltage will be infallibly found to be very low. To recover normal condition, push the adjusting arm up and make the spring tension to correct the closing voltage to the rated value (12. 5 - 13. 5 volts).
b. If the spring plate of the cut-out relay is found coming apart from the moving coil and is found swinging, replace the cut-out relay complete.

10-5 TEST OF GENERATOR

1. Motoring Test

Have a fully charged battery and a 30 amperes ammeters ready for the use of test.

Build up a circuit connection from generator A terminal, through ammeter, to negative pole of the battery. Also connect generator body and positive pole of battery with a wire. Then the generator will turn as a motor. Checking the flow of current in this manner, locate the inside trouble of the generator.

1) If the ammeter indicates a discharging rate of less than five amperes, and if the generator keeps running amoothly with a slight sound, and it should be regarded as perfect condition.
If the generator fails to run, the troubles is in the circuit.
2) In the above test, if ammeter reading is over five amperes discharges it any mean a short or grounding of internal circuit, provided that the generator is mechanically in good shape. (Usually the internal trouble is located in defective armature.)
If the generator turns in the above test, but if the ammeter needle vibrates, there must be a short circuit internally.
3) If the ammeter shows a discharging rate of below four amperes there must be a poorly contacing or highly resistance part in the internal circuit.

2. Internal Troubles of Generator

By the above test, a idea of the location of trouble can obtained. However, to go into the detail, it is recommended to make test on a universal electric tester. If the tester is not available, an armature growler (Fig. 6) can be used.

1. Low Charging Current

When the ammeter keeps on registering unreasonably low rate of charging current, check first the ammeter. If it is found in good order, locate the trouble and remedy in the following order.

1) Troubles of External wiring

   a. If any wire is worn or broken, replace or repair.

   b. When any terminal is found loose, tighten securely.

2) Troubles of regulator

   a. When there is any shorted or broken wire, replace or repair.

   b. Check the cut-out relay, and if the contact points are dirty or pitted, dress with a fine file or emery cloth.

   c. When the adjusted voltage is too low, turn counter-clock-wise the adjusting screw for variable flux, and increase the voltage.

   d. Check the resister for pile coil. If it is burnt and shorted, replace.

   e. Check the magnetic coil. If any part of the coil is shorted or broken, replaced.

3) Troubles in Generator

   a. When the surface of commutator is dirty or extremely rough, polish or remedy the surface.

   b. Check commutator brushes. If their contact with commutator is poor, redress the brush surface or replace.

   c. Check coil of armature and of field as well as wiring connection. If any broken part is disclosed, replace or repair.

2. No Current

If the ammeter registers no charge at all, trouble may be worse than described above, unless the ammeter is out of action, check and remedy as follows.

1) Troubles in external wiring

   a. If any wire is broken or about to break, replact it.

   b. Check the insulation of wire. If it is broken and grounded to the body of generator, replace or repair.

   c. Check terminals. If found detached or loose, tighten securely.

2) Generator troubles

   Remove the wires from A and F terminals of the generator. Connect these two terminals with a different wire. Have another piece of wire ready for later use.
   With the engine funning at about 1000 rpm, connect one end of the third wire to A terminal and ground the other to the generator body with a light bouch. If then a remarkable spark occures, the generator is in good order.

   Note: This method of test is used only when a voltmeter is not available. If the voltmeter is at hand, connect the meter to A and E terminals, leaving the original wire as it is, and read the amount of volt registered by the meter.

a. Check the wirings inside the generator. Broken or shorted wire should be replaced or repaired.
b. Check the armature coil and field coil. If their wires are broken or shorted, replace the complete part.
c. Check commutator, brushes. If they are found worn and not contacting with the commutator, or if the spring is found broken, replace these parts.
d. If the surface of commutator is found extremely scored, replace or redress.
e. Check the brush holder. If it is shorted due to poor insulation, repair.

3) Troubles of voltage regulator

a. If the regulator cover is found making contact with the wiring, resulting in a short circuit, repair the cover.
b. In case any wire in the regulator is shorted or broken, replace or repair.
c. If the contact points of cut-out relay do not close when pushed with a finger, it is because the core and moving plate are stuck. Make adjustment.

Note: In making this test, be sure to have the battery disconnecting. Next, hook up a voltmeter (fifteen volt) to B and E terminal of the regulator.
With the engine running at 1000 rpm, close the contact points of cut-out relay with a finger. Read the voltmeter registration, and if it is found more than closing voltage, the cut-out relay must be blamed for such troubles as mentioned in (d) to (f) below.

d. Cut-out relay may have a shorted or broken coil, replace the relay complete.
e. Cut-out relay is out of proper adjustment, and the closing voltage is unduly high. Bring the adjusting arm down to obtain proper adjustment.
f. The current coil may be broken or shorted. If so replace cut-out relay complete.

When the cut-out relay is O. K'ed, and the volt-meter reading is below closing voltage or zero, the trouble will be in voltage regulator.

g. In case voltage is low, raise up the voltage by turning the adjusting screw for variable flux to the counter-clock-wise.
h. In case of wear or damage of carbon pile, replace it and adjust again.
i. When the magnetic coil of voltage regulator is broken or shorted, replace it.

3. Fluctuation of Charging Current

When the ammeter needle surges showing a charge, unless the trouble is in the ammeter, check the following:

1) Cisorder of external wiring

a. Wiring may be about to be broken, replace it.
b. In case the insulation of wire is torn and is grounded to the body, replace or correct it.

1) Test of field coil grounding. Disconnect the earth wire of field coil and ground one of the terminal of the growler. Touch an end of the other side of the growler to the terminal of the field coil. If, then, testing lamp is illuminated, the field coil has a short circuit. If does not light, the field coil is in good condition. In the dormer case, replace the coil.

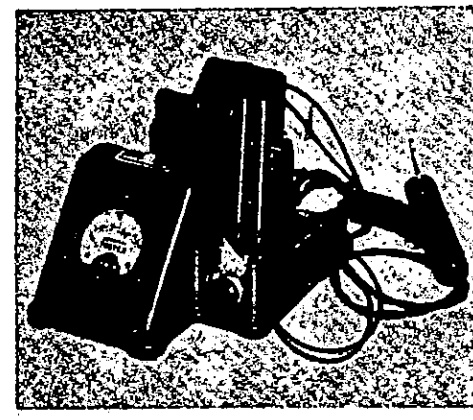


Fig. 6 Armature Growler

2) Lead wire test

Contact the two wires of the growler to both ends of the lead wire, and if the lamp lights, the wire is O. K. If not, the wire is defective, and should be replaced.

3) Test of positive brush

With the end of a wire of growler grounded and the other wire touched to the positive brush, if the test lamp lights, the brush holder is grounded, and it should be replaced.

4) Test of grounding of armature

To check the armature whether or not it is grounded, contact one of the growler wires to the armature shaft and the other to the commutator segment. If the test lamp lights, the armature is grounded, and should be replaced.

5) Short circuit of armature

Place the armature on the growler and put a piece iron on the armature with a hand. If the iron piece is attached to the armature core, the armature coil is shorted, and should be replaced.

10-6 WIRING OF GENERATOR, VOLTAGE REGULATOR AND OUT PUT ADJUSTMENT

1. Wiring

1) Connection of wire. c.f. (Fig. 7)

Be sure each wires is connected to its right place on both the generator and regulator. Also, each wire should be tightly in place, especially the one grounded to the terminal E. Make it also sure that electrical resistance at the terminal be minimized by clean tight connection.

Regulator	(A)	terminal	to Generator	(A)	terminal	
"	(B)	"	to Ammeter	to	battery	
"	(F)	"	to Generator	(F)	terminal	
"	(E)	"	to "	(E)	"	to body

2) Size of wires

The following sizes are to be selected for different wirings.

From (A) on generator to (A) on voltage regulator — 5. 5 sq. mm (B & S gauge No. 8)
From voltage regulator (B) through ammeter to battery
From voltage regulator (F) to generator — 0. 9 sq. mm (B & S gauge No. 16)
From (E) on both regulator and to body

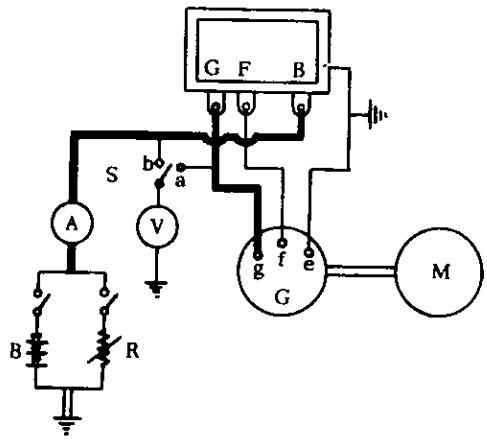


Fig. 7 Wiring Diagram

A. Ammeter D. C. 0-15A
M. Motor 1 HP Variable speed
B. Battery
V. Volt-meter O. C. 0-15V
R. Variable resistance 0. 0-2 ohm, 30 Amp
S. Switch on volt-meter

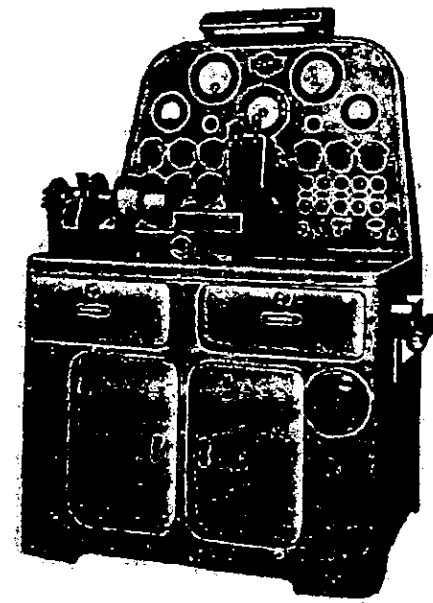


Fig. 8 Universal Electric Tester

2. *Adjustment*

Reference should be made to the wiring diagram shown in Fig.
The adjustment of a generator is better done by the use of a universal tester illustlated in Fig. 8.

1) Adjustment of voltage regulator

Connect the voltmeter to the (A) terminal of the regulator and run the generator at 2000 rpm with no load.
Adjust the voltage while reading the meter. When the voltage is too high, turn clock-wise the adjusting screw for variable flux (Fig. 9), and the voltage will drop.
The vice versa will raise the voltage. (Each quarter of a turn of the screw is equal to 1 volt.)
The adjusting screw for pile pressure may be utilized for voltage adjustment.

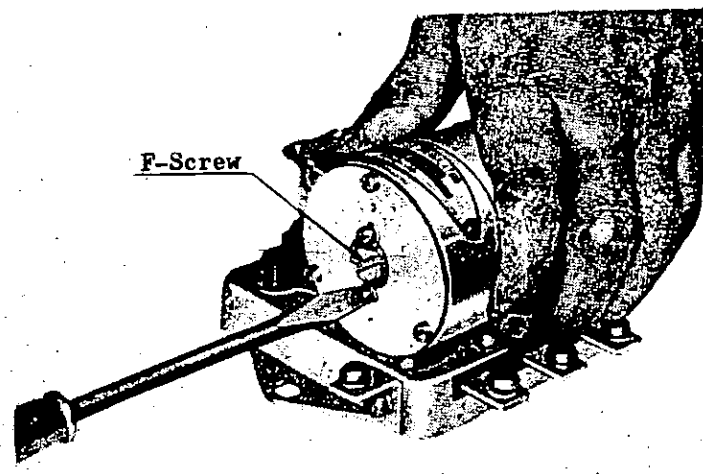


Fig. 9 Adjusting Screw for Variable Flux

However, it is used only when the carbon pile has been reassembled after repair work. In this case, turning the screw clockwise will raise the voltage, and the vice versa. As the ammount of current is automatically regulated to specified limits, this type of the regulator is not provided with a current limitter.

2) Adjustment of cut-out realy

Connect the volt-meter to the (A) terminal of the regulator, and while reading the meter, gradually increase the generator speed until the point of the cut-out relay starts to close. The voltage, at that moment, shown by the voltmeter should be 12.5 to 13.5 volts. If it is found higher, push down the adjusting arm to decrease the spring tension. If on the contrary, the closing voltage is lower, raise arm up to increase the spring tension. The points will open when the generator is slowed down and its out-put is reduced to three amperes or less.

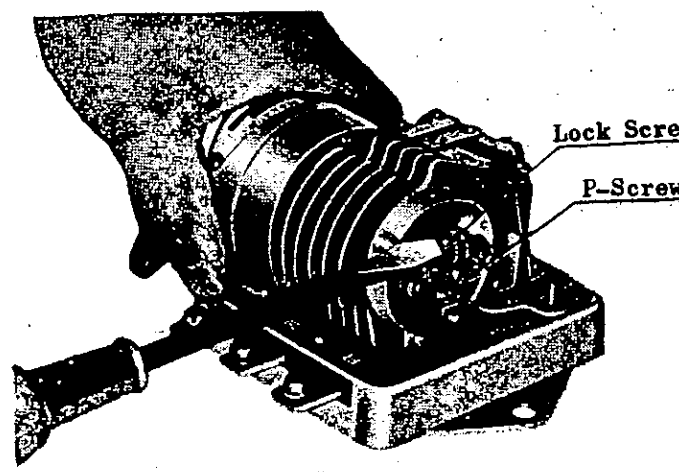


Fig. 10

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SECTION 11.
STARTOR MOTOR

DATA

Type	Hitachi S114-20 (4W Series) S114-21 (E690) S114-22 (L4W Series) S114-23 (680, 690, 60)
Voltage	12 volt
Power	1.0 KW (1.4 HP)
Starting current (voltage)	Less than 420 amp (9.5 volt)
Lock torque	Over 1.8 kgm (130 ft/lb)
Pinion gear type	Sliding (over running clutch)
Pinion gear, number of teeth	9
Flywheel gear, number of teeth	146
Gear ratio	16.2 : 1
Pinion shaft diameter	14.2 mm (0.559 in.)
Amendment wear limit	0.1 mm (0.004 in.)
Shaft and bushing clearance	0.076 - 0.030 mm (0.003 - 0.0012 in.)
Amendment wear limit	0.2 mm (0.008 in.)
Commutator diameter	34 mm (1.3386 in.)
Amendment wear limit	3.0 mm (0.1181 in.)
Irregular wear limit	0.3 mm (0.0118 in.)
Out of round limit	0.05 mm (0.002 in.)
Brush length	16.3 mm (0.6417 in.)
Amendment limit	11.3 mm (0.4448 in.)
Brush spring tension	0.9 kg (1.98 lb.)

11-1 REPAIR

1. Removal

1) Remove the startor pedal and remove startor motor from engine.
2) Loosen two through screws and remove head cover.
3) Remove armature shaft center bearing and pull out armature.
4) Remove shift lever from head cover.
5) Remove pinion and clutch assembly.
6) Remove foot switch.

2. Inspection of parts

Inspect each parts after cleaning, and judge if it be reusable or not. Reusable parts should be amended, if necessary.

1) Check distorted armature, and amend commutator out-of-round by lather. Be sure there is an air gap between armature and field core.
2) Full contact brush on the commutator should be maintained. The best way is to clean and redress the commutator holding a fine sand-paper against

it and revolving the armature with a hand.
Brush which is worn to a length of less than a half inches should be replaced.

3) Inspect pinion gear for crack.
4) Polish outside of armature and inside of core if they are rusty, and coat with oil.
5) Clean and redress the contact surface of switch.
6) Check wirings for perfect insulation, and replace defective parts.
7) If any specific part of armature is found to be burnt, make careful test for insulation.
8) Replace head cover bushing if excessively worn.

3. Assembly and testing

1) Coat all friction surfaces with engine oil, and assemble the parts in the reverse order of disassembly.
2) Carefully tighten the terminals of each wire, and be sure they are well insulated.
3) Adjust the length of switch button so as the shift lever will make contact with the cutton instantly after the pinion gear is engaged with flywheel ring gear.
4) Test performance with fully charged battery.
5) Starting torque must be over eleven feet-pounds.
6) When motor is tested on engine, it should ordinally crank the engine at a speed of about eight revolutions per minutes, with the throttle valve of carburetor closed. And if unusual noise is heard when the motor is cranking the engine, check the flywheel ring gear for provable trouble.

4. Inspection and trouble shooting

1) Poor Cranking Power
   a. Check the specific gravity of electrolyte in the battery, and see it is over 1,270.
   b. Check battery cable, ground cable and each connections for tighteness.
   c. Check foot switch for perfect contact.
2) When motor does not revolve.
   a. Stem of foot switch button is adjusted too short and fails to make contact.
      Screw out button until the length of stem become enough to act.
   b. Poor connection of battery cables
      Disconnect the terminal, and clean and tightly connect again.
3) In case pinion gear does not mesh with flywheel ring gear when armature is revolving.
   a. Stem of foot switch button is too long. Adjust it.
   b. Flywheel ring gear teeth are excessively worn. Replace the ring gear.
4) In case the pinion gear and flywheel ring gear bind
   a. In case this trouble has occurred, shift the transmission into high speed gear, and jerk the car back and forth, then gears will be released.
   b. Remove motor from engine, check gears or head cover bushing for wear, and check armature shaft for distortion. Amend or replace, if necessary.

5) In case of excessive noise in revolving, check the flywheel ring gear, and replace if gear teeth are worn out.

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SECTION 12.
BATTERY

DATA

Model	2SMC
Voltage	12
Capacity	60AH/20H rate
Plate per cell	19, (-) 10, (+) 9
Specific gravity of electrolyte	1. 270 - 1. 280
Electrolyte level	3/8 in. above plate
Initial charging current	10 amp
Ground (earth) terminal	(+) positive
Electrolyte capacity	3. 5 - 3. 6 ltr. (0. 92 - 0. 95 U. S. Gal.)
Weight (dry)	Approx. 20 kg (44 lb.)

12-1 HANDLING OF BATTERY

1. Battery has to be inspected from time to time during service. The most important matter is to keep it fully charged. Check of the specific gravity is the means to detect how much the battery is charged. The specific gravity fluctuates according to the atmospheric temperature. Therefore, temperature is to be taken into consideration. The full charged condition of battery is shown with the specific gravity at around 1. 280 (in hot weather) or 1. 300 (in cold weather). To check the specific gravity use the hydrometer.

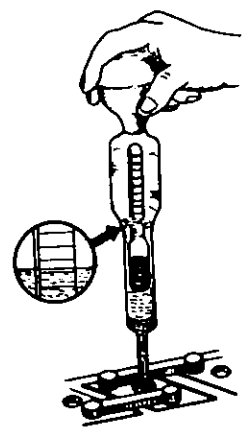

Fig. 1 Hydrometer

2. If the specific gravity is found below 1.200, it means the battery is over discharged, and should be recharged. If an excessive discharging is kept on, it will do harm to the battery. Discharging should not be allowed beyond the minimum specific gravity.

3. Check the volume of electrolyte in the cell and fill it from time to time up to the level as high as 3/8 inch above the plates. When the level is allowed to be as low as to expose the plates, it will not only do harm to the plates, but also will result in decreasing efficiency. If the electrolyte is found to be too much, the liquid is liable to overflow from the case with the result of causing corrosion of metal parts. Keep the regular height of liquid level.

4. If the replacement or replenishment is necessary due to dirt of fllow-out of electrolyte, fill the diluted solution of sulphuric acid having the specific gravity of about 1.260. Under no circumstances, the diluted sulphric acid solution should be used except for this replacement and replenishment. The increase of specific aravity resulting from replenishment of diluted sulphuric acid will shorten the life of battery. If you have any doubt as to the reliability of specific gravity, check up the condition of charge with the Ex-cell tester. This is a method to judge the condition of charge by the drop of voltage at the time of heavy discharge. In using this tester, contact the arms to both terminals of each cell for accertain length of time as specified on the tester.

Fig. 2 Ex-cell Tester

More than 1.75 volt, at 1.200 specific gravity	Charge and specific gravity, good
Less than 1.75 volt, less than 1.200 specific gravity	Fully discharged
Less than 1.75 volt, more than 1.200 specific gravity	Too much specific gravity
More than 1.75 volt, less than 1.200 specific gravity	Too little specific gravity
Voltage drops continuously	Inside trouble

5. When the specific gravity is low, the electrolyte is liable to freeze in cold weather. Therefore case must be taken not to let the specific gravity drops. Keeping the battery fully charged in winter season. Freezing of electrolyte causes unexpected troubles such as the damage of the cell. Freezing point of electrolyte at different specific gravity are under:

Specific gravity (15°C)	Freezing temperature
1.100	-7.7°C
1.150	-14.4°C
1.200	-27°C
1.250	-52°C
1.275	-65°C

6. The low atmospheric temperature will decrease the battery efficiency, and will also make lubricating oil heavier. Both combined the battery will be imposed a heavy load during cold weather in starting an engine. This will make it all the more necessary to keep the battery well charged in cold weather.

7. A battery will self-discharge more or less. This makes it necessary to check the charged condition, when the battery has been left unused for a long while. If it has been kept unused for more than a month, it should be fully re-charged and afterward it should be charged lightly about once a month.

8. To prevent leakage of electrolyte, keep the vent pluge tight. Be sure the small ventilation hole in the plug is kept allowing free passage of gas from the cell.

9. When electrolyte is overflowed on the outside of a battery, wipe it with alkali solution to neutralize the acid and keep it dry all the time.

10. On "Nissan" vehicles, the positive (±) pole is grounded.

11. When the battery is discharged to the extent that the electrolyte specific gravity shows lower than 1. 180, remove the battery from the car and have it recharged from the other power source.

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