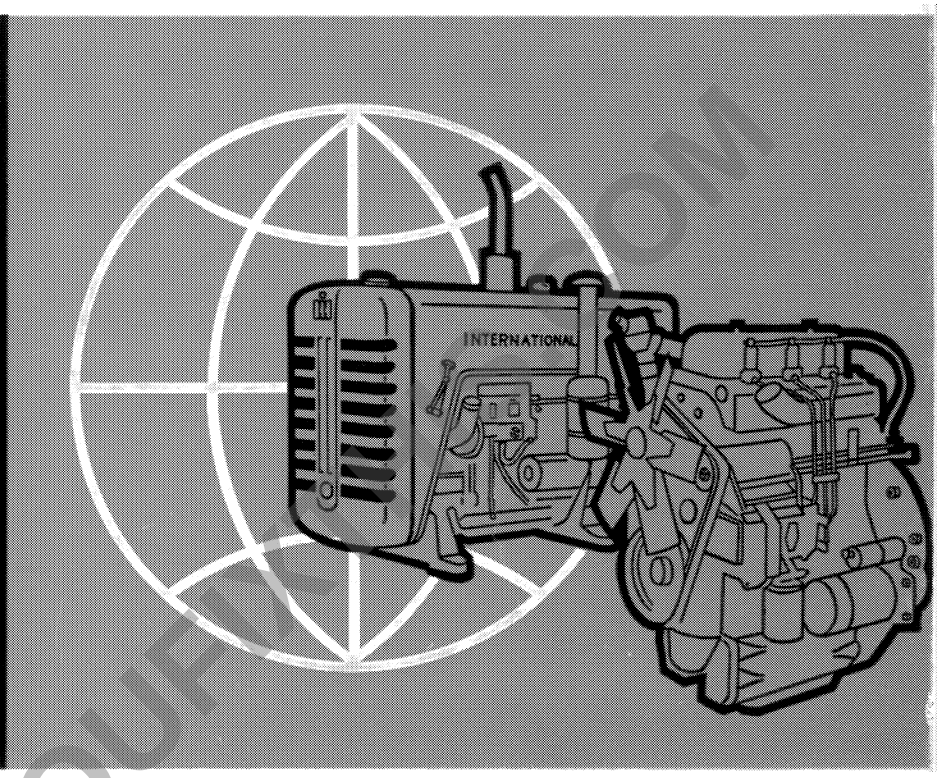
INTERNATIONAL®




# SERVICE MANUAL

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## DIESEL ENGINES

# D-206 + D-239

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# Introduction

The instructions contained in this manual are for the information and guidance of the skilled servicemen who are responsible for overhauling and repairing the International D-206 and D-239 Diesel engines.

All service operations which can safely be classified as within the normal routine of a serviceman's training are, therefore, not covered in this manual.

Both engines are of the same basic design with only a few dimensional differences. Assembly and disassembly procedures should be taken as a guide only. Deviations may become necessary as conditions require. Before commencing a repair it is important, therefore, to study the procedures involved and determine the best method with the aid of this Service Manual.

Sections are arranged in unit order similar to that of the parts catalog, also having corresponding headings.

Each unit is split up as follows:

General
Specifications
Removal and Disassembly
Cleaning, Inspection and Repair
Reassembly and Installation

In "Removal and Disassembly" as well as "Reassembly and Installation" procedures detailed information is given for the respective unit only. Procedures such as preliminary removal of adjacent parts to gain access to the unit concerned are not repeated but given in detail under the respective unit. It may then be necessary to refer to the relevant sections of this manual. Where the context of a section would otherwise have suffered a few repetitions have, however, been made.

Note: Before stripping down always check engine tune-up and compression and repeat this check on completing the job. Comparison of results will reflect the effectiveness of the repair. For details refer to "Engine Tuning".



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# Special Torque Chart

## (Bolts Deviating from Normal Torque Values)

| Application | mkg | ft lbs |
|---|---|---|
| Bearing cap screws (12 K) | 16.5 - 17.0 | = 120 - 123 |
| Bearing cap screws (10 K) | 12 - 12.5 | = 87 - 90.5 |
| Connecting rod nuts | 8.5 - 9 | = 61.5 - 65 |
| Cylinder head nuts | 12 - 13 | = 87 - 94 |
| Bolts for annular spring elements | 7.8 - 8 | = 56.5 - 58 |
| Flywheel bolts | 13.5 - 14 | = 98 - 101* |
| Nozzle nut unions | 6 - 8 | = 44 - 58 |
| Overflow line connections | 1.5 - 2.5 | = 11 - 18 |
| Idler gear necked-down bolts | 9 - 9.5 | = 65.5 - 69 |
| Studs for valve lever shaft bracket (in cylinder head) | 3.5 - 4 | = 25.5 - 29 |
| Stud nuts for valve lever shaft bracket | 6 - 7 | = 44 - 50 |
| Studs for valve cover (in cylinder head) | 1.6 - 1.8 | = 11.6 - 13 |
| Stud nuts for valve cover | 0.5 - 0.7 | = 3.6 - 5.1 |
| Clamping bolts for valve lever shaft bracket | 1.3 - 1.5 | = 9.4 - 10.8 |
| Studs for nozzle holder (in cylinder head) | 1.3 - 1.8 | = 9.4 - 13 |
| Stud nuts for nozzle holder | 1 - 1.2 | = 7.2 - 8.7 |
| Fuel filter retainer bolt | 3.5 - 5.5 | = 25 - 40 |
| Pressure line connections | 4.0 - 4.5 | = 29.0 - 32.5 |
| Nut for injection pump drive shaft | 6 - 7 | = 44 - 50 |
| Initial clamping torque for valve adjusting screws | 1.7 - 4.5 | = 12.5 - 32 |
| Cylinder head studs (in crankcase) | 4 - 4.5 | = 29.0 - 32.5 |
| Side cover screws (camshaft) | 1.2 - 1.5 | = 8.7 - 10.8 |
| Rear oil seal retainer bolts | 1.8 - 2 | = 13 - 14.5 |
| Pressure line nut unions | 2 - 2.5 | = 14.5 - 18 |

NOTE: Some of the above bolts must be tightened in several passes, in accordance with assembly and installation instructions.

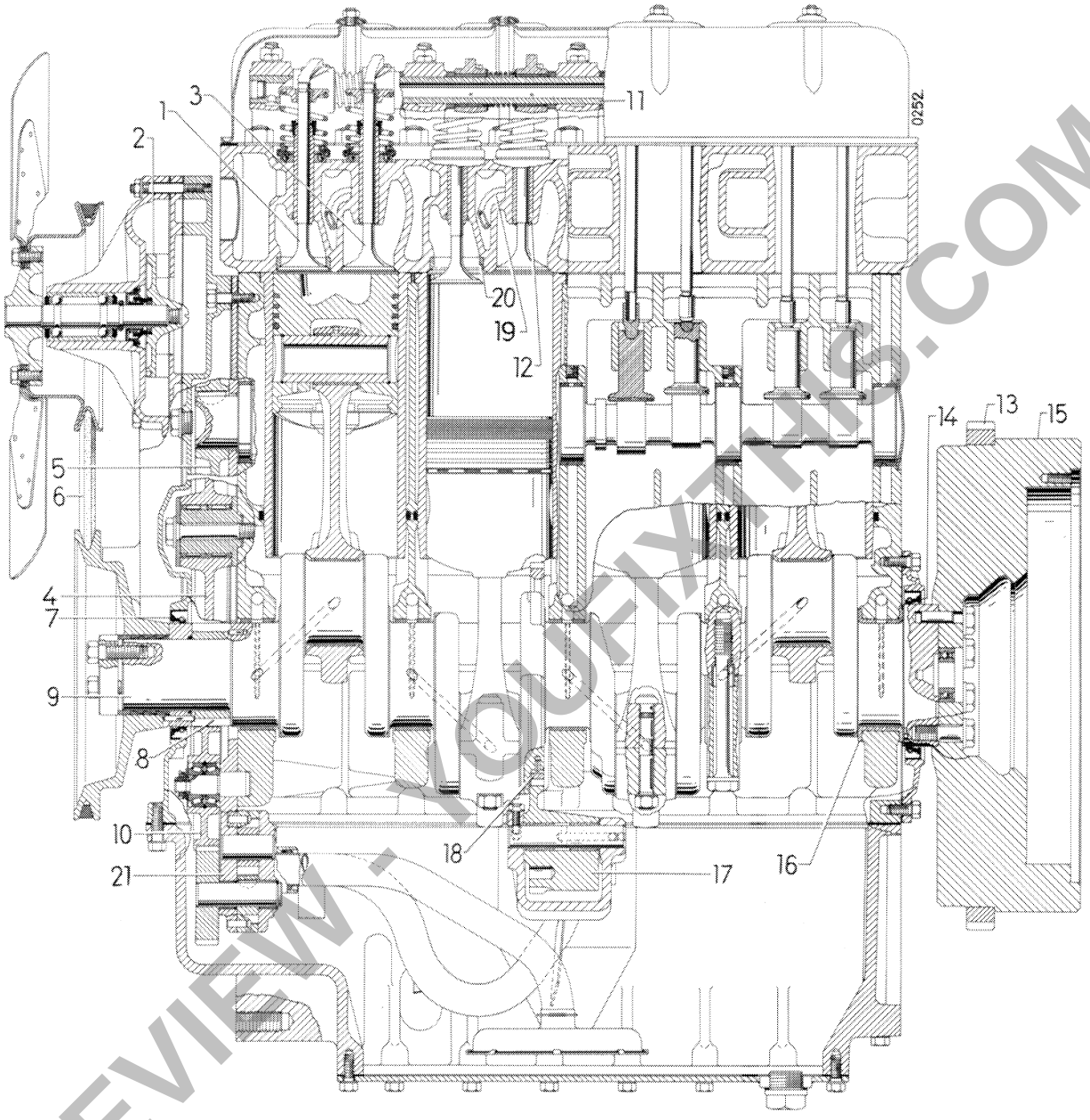
* Use only new bolts



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# LONGITUDINAL SECTION OF ENGINE



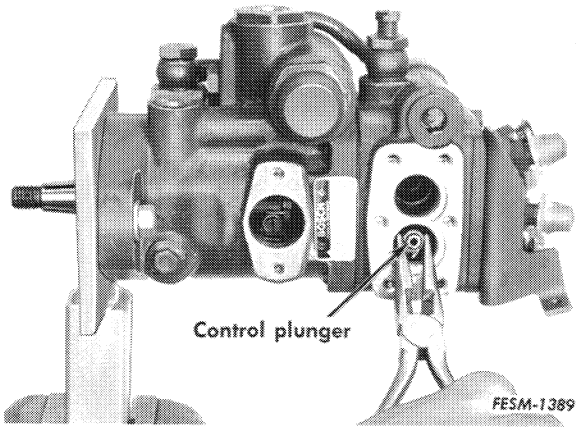

Illust. 1

1 - Exhaust valve
2 - Water pump
3 - Intake valve
4 - Idler gear
5 - Camshaft gear
6 - V-belt
7 - Front oil seal, crankshaft
8 - Crankshaft pinion
9 - Crankshaft
10 - Idler gear, oil pump drive
11 - Valve lever shaft
12 - Valve stem guide
13 - Flywheel ring gear
14 - Crankshaft rear oil seal
15 - Flywheel
16 - Main bearing, rear
17 - Balancer
18 - Balancer drive gear
19 - Coolant jet for injection nozzle
20 - Valve seat insert
21 - Oil pump



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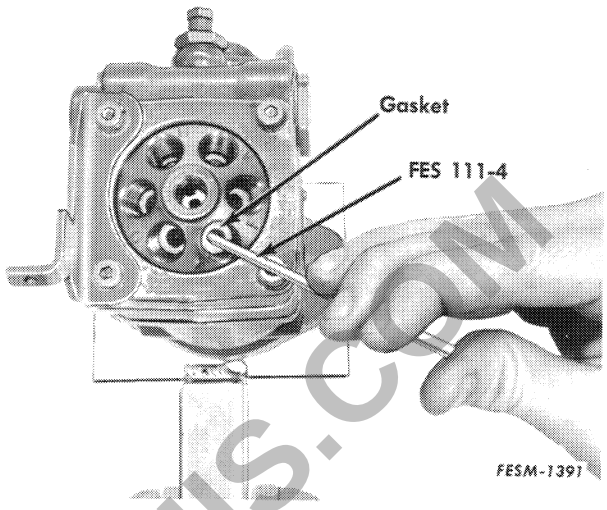
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Illust. 157

Removing control plunger

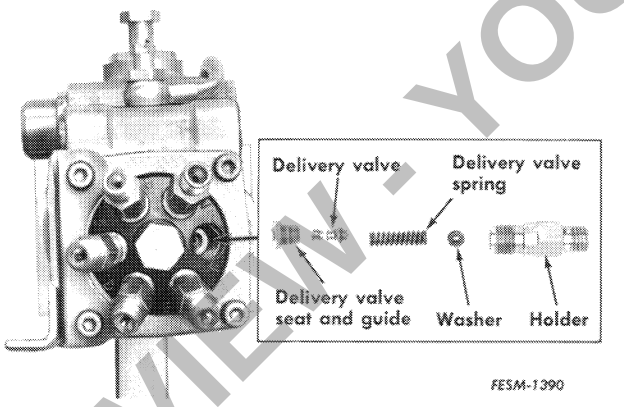
Carefully remove the control plunger with a pair of needle nose pliers. See Illust. 157.




Illust. 159

Removing delivery valve gaskets

Remove the delivery valve gaskets by working the edge of FES 111-4 under the gasket to loosen it and then pull the gasket out. See Illust. 159.

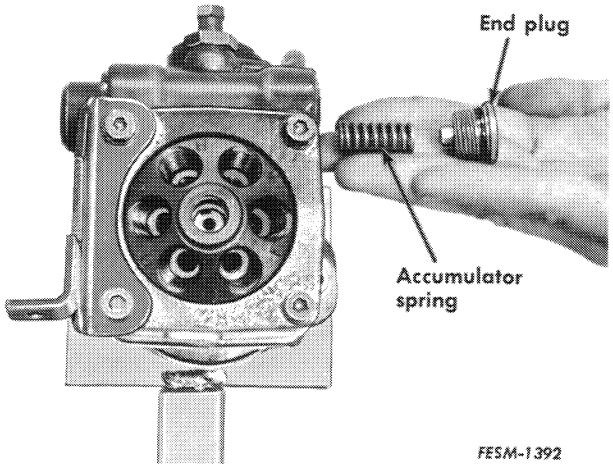



Illust. 158

Delivery valve removal

Remove the delivery valve holder complete with delivery valve, spring and washer from each cylinder port. A 14 mm wrench is required. See Illust. 158.

Remove the center screw plug, using a 17 mm wrench. Refer to Illust. 158.




Illust. 160

Accumulator end plug and spring removal

Remove the accumulator end plug on the side opposite the stop plate using a 10 mm Allen wrench. Remove the accumulator spring. See Illust. 160

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## General

The valve lever shaft (5) Illust. 4 is manufactured from precision-made steel piping. The valve lever assembly receives its lubrication through the hollow valve lever shaft. Oil holes are provided in the shaft to lubricate individual valve levers.

The lubricant is pumped up under pressure from the camshaft front bearing through a rifle-drilled passage in crankcase and cylinder head to the valve lever shaft front bracket, whence it is distributed in the shaft to the valve levers. An oil port is provided in the shaft which must line up with the respective oil way in the bracket. The mark (3) Illust. 10 must be in line with the clamping slot of the front bracket. Replaceable oil plugs (6) are used to close up both ends of the shaft.

Valve levers for inlet and outlet valves differ in length, but are provided with the same replaceable bushings which must be reamed to size after installation.

Replacement levers are supplied with bushings in place.

All five valve lever shaft brackets are identical.

Depending on engine application the valve housing cover (1) Illust. 4 may be provided with a socket for breather filter connection.

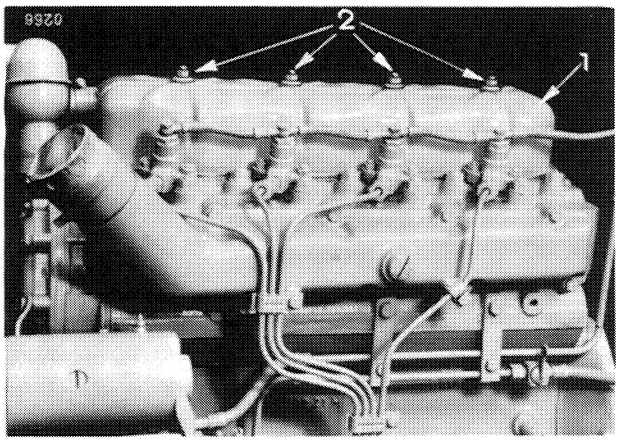
Valve levers, bushings and valve lever shaft are generally not subject to wear under normal operating conditions. Wear or damage can be traced, in most cases, to contaminated oil.

## Specifications

| | | |
|---|---|---|
| Valve lever shaft (5) Illust. 4 | | |
| Diameter | 21.593 mm / 21.568 mm | = .8501" / .8491" |
| Valve lever (9 and 13) | | |
| Bore | 26.00 mm / 26.02 mm | = 1.0236" / 1.0243" |
| Bushing (10) reamed to size | | |
| Inner diameter | 21.615 mm / 21.630 mm | = .8510" / .8516" |
| Pressure spring (12) | | |
| Free length | 40 mm | = 1.575" |
| Test length | 25 mm | = .984" |
| Test load | 4 kg | = 8.8 lbs |
| Spacer ring (7) | | |
| Thickness | 6.7 mm / 6.8 mm | = .264" / .268" |
| Thrust washer (11) | | |
| Thickness | 0.75 mm | = .030" |
| Stud (15) | | |
| Torque load in cylinder head | 3.5-4 mkg | =25.5-29 ft lbs |
| Torque load for stud nut | 6 - 7 mkg | =44 - 50 ft lbs |
| Stud (4) | | |
| Torque load in cylinder head | 1.6-1.8 mkg | =11.6-13 ft lbs |
| Torque load for stud nut | 0.5-0.7 mkg | = 3.6- 5 ft lbs |
| Initial clamping torque for valve adjusting screw (8) | 1.7-4.5 mkg | =12.3-32 ft lbs |

## Removal and Disassembly

Thoroughly clean the engine externally.




Illust. 5

1 - Valve housing cover
2 - Stud nuts

Remove stud nuts (2) Illust. 5 and washers. Lift off valve housing cover (1). Valve lever assembly Illust. 6 is now accessible.

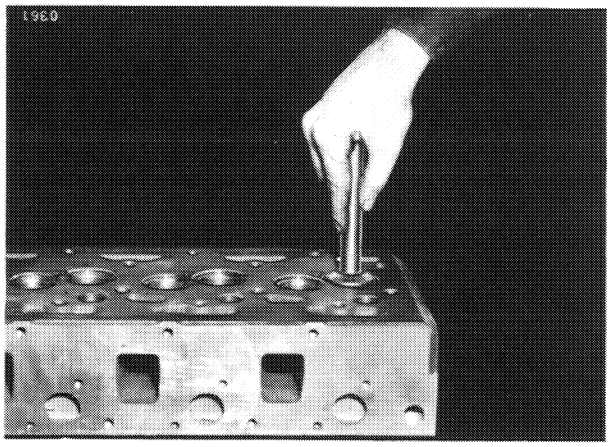


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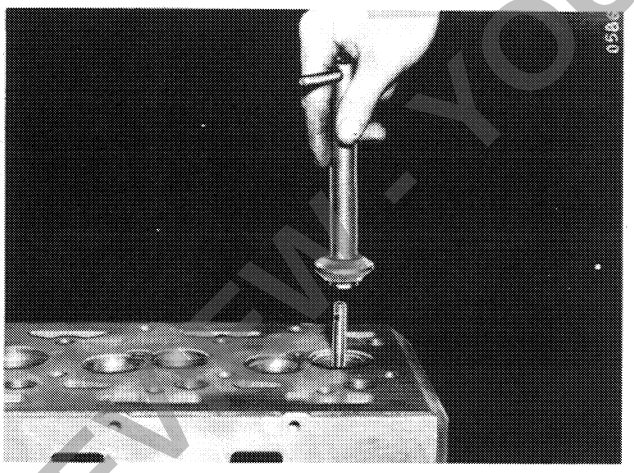
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Illust. 36

Refacing valve seat with circular cutter

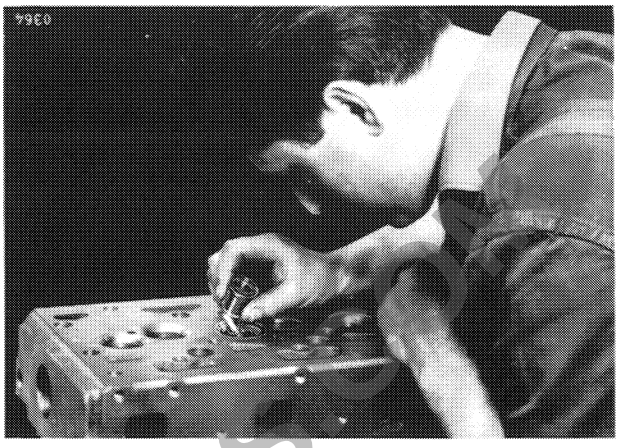
The valve seat should center on the valve face and must be concentric with the bore of the valve guide within 0.00 - 0.05 mm = .000 - .002".



Illust. 37

Concentricity is assured by a pilot-pin in the valve guide, as shown in Illust. 37. This pilot-pin holds the tool concentric to the valve guide, provided the valve guide is in proper condition.

Valve seat width should be 1.5 - 2.0 mm = .059 - .079", see "A" Illust. 34.



Illust. 38

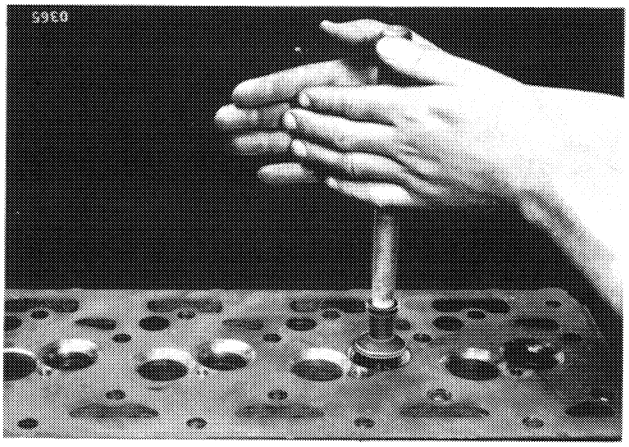
Measuring valve seat width

Use a suitable magnifying glass with built-in scale to measure the valve seat width, see Illust. 38.

To remove any possible chatter marks and to give the valve seat a smooth finish place a plain sheet of paper between cutter and seat and work over lightly.

With valve guides in place and valve seats refaced lap valves into their seats using conventional equipment.

Coat valve seats with a stiff "Corundum" grinding paste, which may be diluted with water, if necessary.



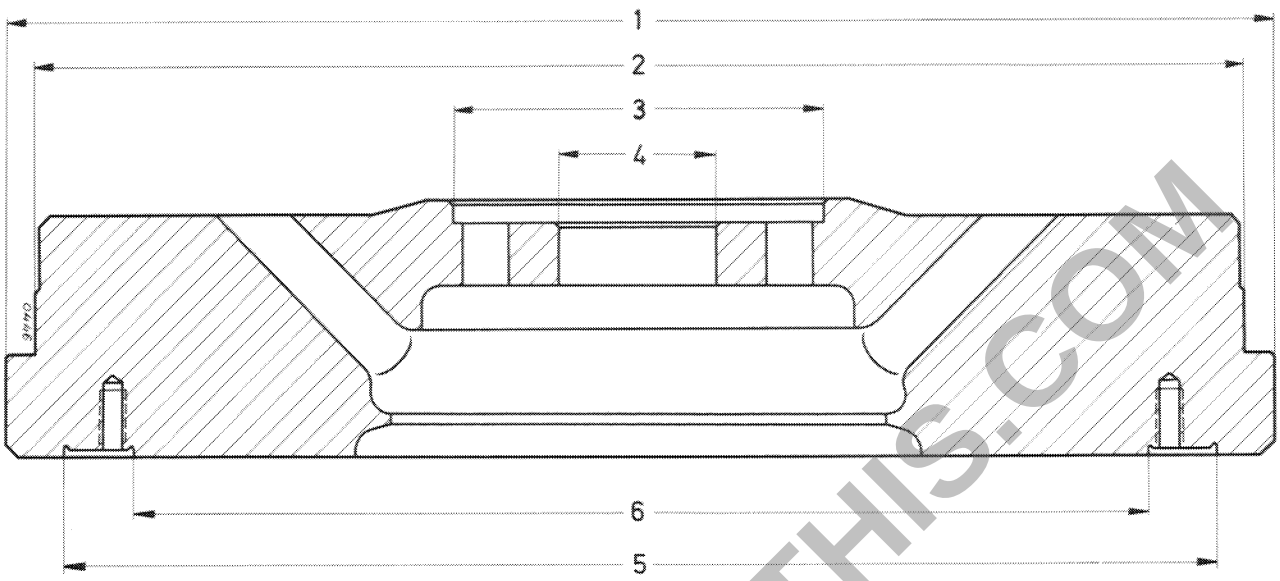
Illust. 39

Lapping valves into their seats



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Illust. 85

Flywheel for tractor engine with dual clutch

1 - 375.0 mm = 14.765"

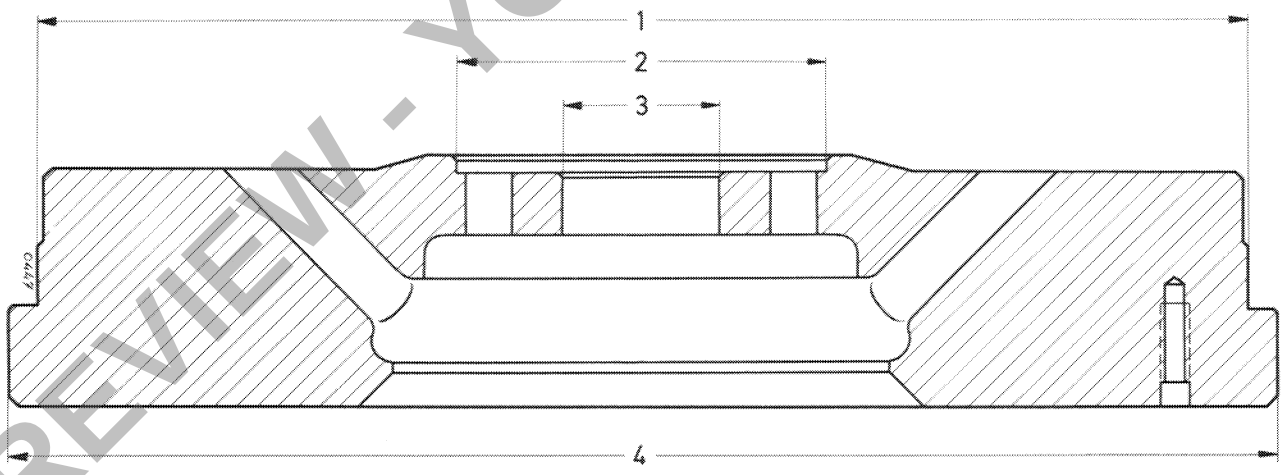
2 - $\frac{358.04 \text{ mm}}{357.94 \text{ mm}} = \frac{14.097"}{14.093"}$

3 - $\frac{110.000 \text{ mm}}{110.054 \text{ mm}} = \frac{4.331"}{4.333"}$

4 - $\frac{46.980 \text{ mm}}{46.996 \text{ mm}} = \frac{1.8496"}{1.8503"}$

5 - $\frac{340.00 \text{ mm}}{340.06 \text{ mm}} = \frac{13.3858"}{13.3881"}$

6 - $\frac{299.89 \text{ mm}}{299.81 \text{ mm}} = \frac{11.8066"}{11.8034"}$




Illust. 86

Flywheel for combine engine

1 - $\frac{358.04 \text{ mm}}{357.94 \text{ mm}} = \frac{14.097"}{14.093"}$

2 - $\frac{110.000 \text{ mm}}{110.054 \text{ mm}} = \frac{4.331"}{4.333"}$

3 - $\frac{46.980 \text{ mm}}{46.996 \text{ mm}} = \frac{1.8496"}{1.8503"}$

4 - 375.0 mm = 14.765"



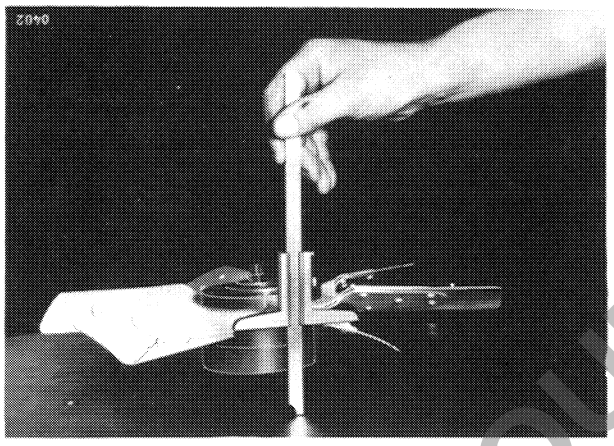
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Check all other parts against specifications, with special attention to press fit connections such as shaft ends, hub and impeller bores etc. If the required press fit is no longer possible, parts must be replaced. Pump body (3) is only available as a service assembly with the pump bearing (5) in place.

Caution: Never attempt to rework sealing faces in pump body (3), on bearing (5) and bearing face ring (9). If worn, replace part.

Check V-belt pulley against specifications and inspect for damage. Break sharp edges, if necessary.

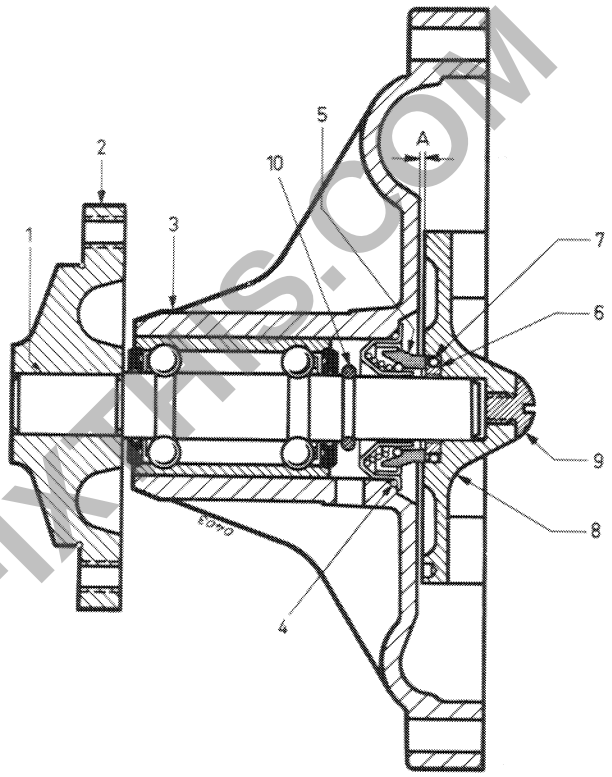


Illust. 130
Checking height of blade edges

Inspect fan for cracks and distortion. Check to see that all blade leading edges are in line, as shown in Illust. 130.

Check V-belt for serviceability. If worn sides, loose strands, cracks or excessive stretch are noted, or if the belt is grease-soaked, replace with a new one.

The V-belt should bear on its tapered sides and must not bottom in the pulley. For correct length of V-belt see "Technical Data".




Illust. 131
A = 0.3 - 0.5 mm = .012 - .020"

1 - Shaft and bearing assembly
2 - Water pump hub
3 - Pump body
4 - O-ring
5 - Spring-loaded packing
6 - Bearing face ring
7 - O-ring
8 - Pump impeller
9 - Plastic plug
10 - O-ring or metal slinger

## Reassembly and Installation

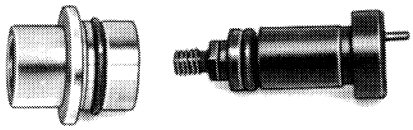
Illust. 131 shows a longitudinal section through the water pump. Refer to this illustration for order of reassembly.

Before installing pump bearing (1) heat the pump body to approx. 80° C = 175° F. Press the bearing in from the front, with the groove for O-ring (10) towards the impeller side, until flush with the front face of pump body (3), see arrow Illust. 132.



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## Throttle and Control Plunger Bushings




Illust. 198

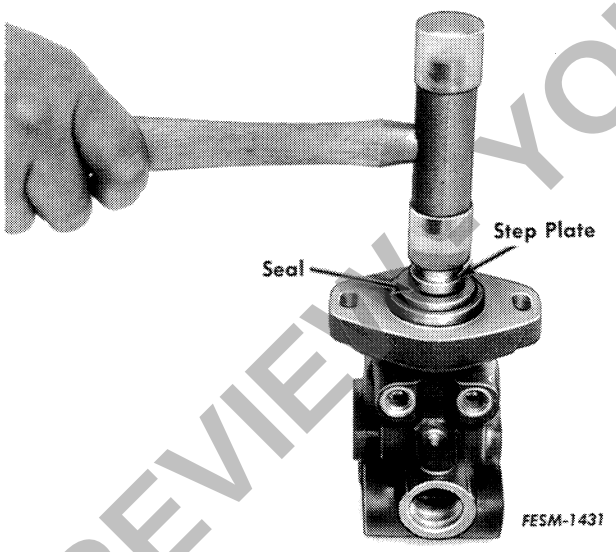
Throttle or control plunger bushing inspection

If the throttle or control plunger bushings were disassembled because of leakage, replace the O-rings on the bushing and shaft. Inspect the dowel pin on the bushing. See Illust. 198.

Replace the assembly if either portion of the bushing is scored, excessively worn, or has thread damage.

## REASSEMBLY

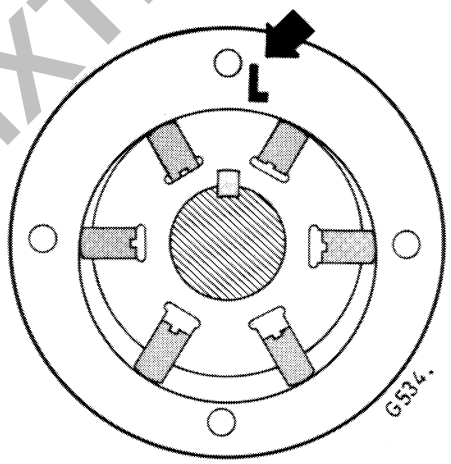
NOTE: Thoroughly clean all parts in clean diesel fuel before assembly. Replace all O-rings and gaskets. Lubricate all parts with clean diesel fuel before assembly. DO NOT assemble the parts dry. Lubricate all O-rings with petroleum jelly before installation.




Illust. 199

Installing drive shaft seal

Install the drive shaft seal. It may be pressed in or installed with a step plate and plastic hammer. Be certain the seal enters the bore straight and does not cock in the bore. See Illust. 199. Install the mounting fixture on the pump housing.




Illust. 200

Rotation letter location

Hold the drive shaft vertically in your right hand, by the tang end. Install the support ring and charging pump rotor key. Install the rotor and vane assembly on the drive shaft. Place the eccentric race over the rotor assembly with the letter "L" showing (toward the threaded end of the drive shaft). See Illust. 200 for proper letter position.

Install one screw through the drive shaft support and charging pump eccentric race to hold the race in position. The race must be installed with the letter "L" in the upper right hand corner. This will position the letter "R" in the upper left hand corner.



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