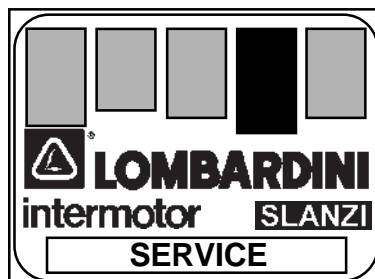


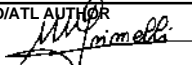
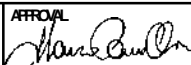

WORKSHOP MANUAL

3/4 LD, CODE1-5302-556 ENGINE SERIES

3LD 450
3LD 510
3LD 450/S
3LD 510/S
4LD 640
4LD 705
4LD 820

3rd edition



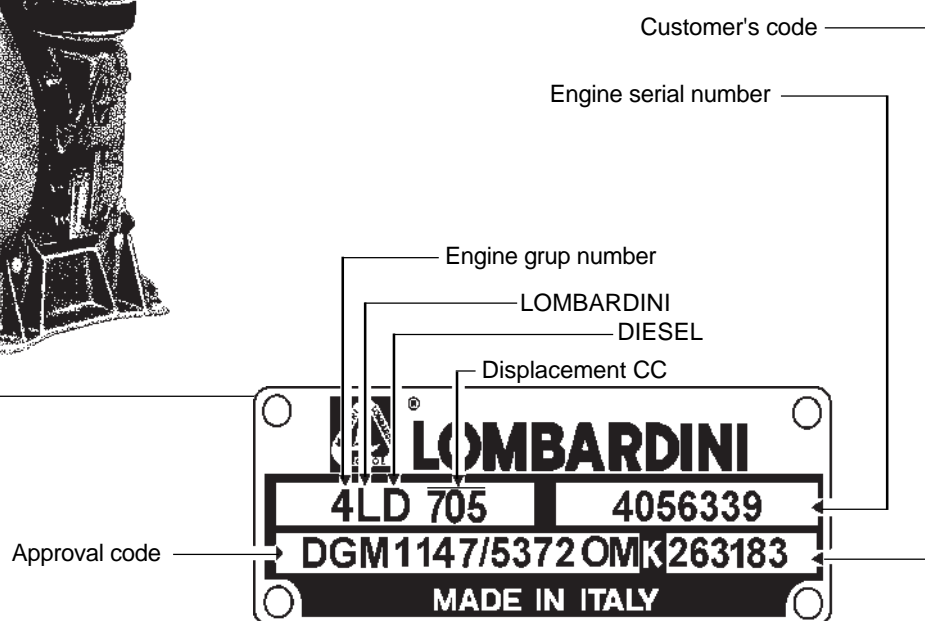
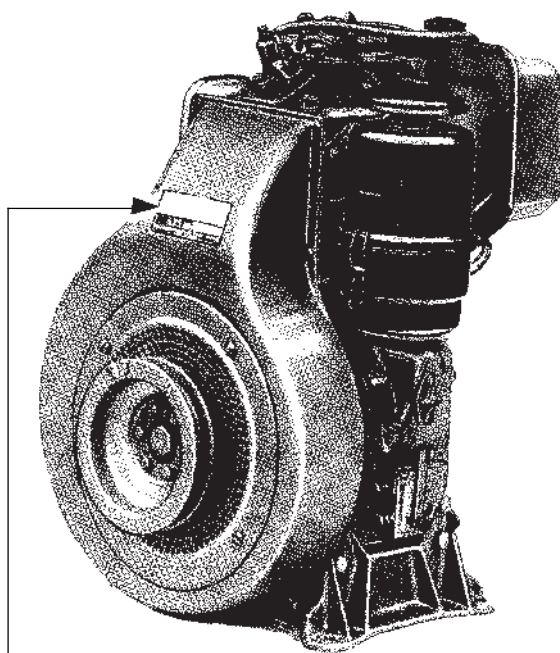
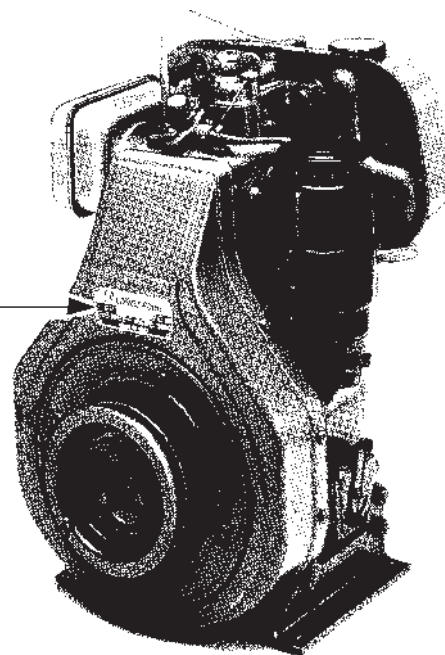
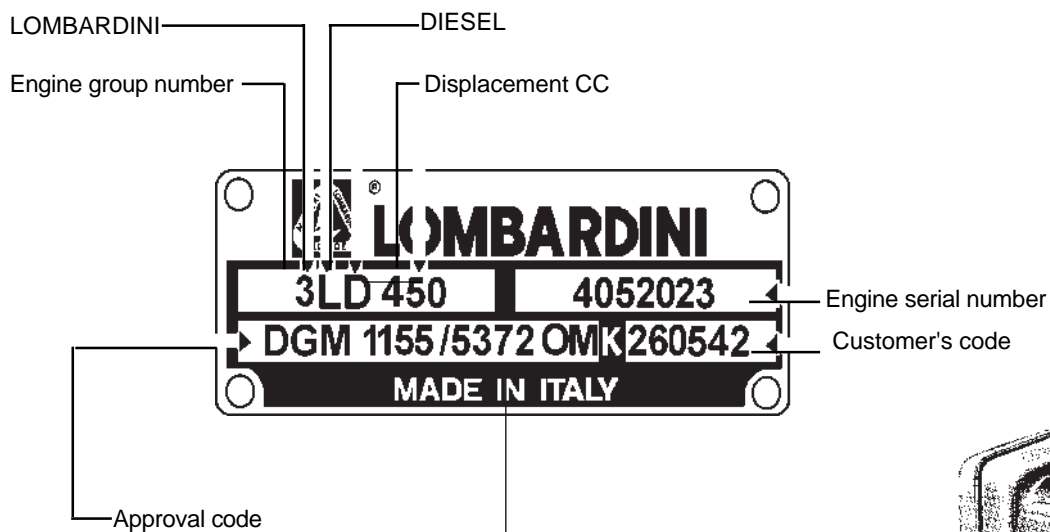
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|--|-------------------------|--------------------|------------------------|-----------|--------------------|---|---|---|
| TECO/ATL AUTHOR  | BOOK CODE 1-5302-556 | MODEL No. 50839 | DATE OF ISSUE 01-94 | REVIEW 02 | DATE 30.11.2001 | APPROVAL  |  | 1 |
|--|-------------------------|--------------------|------------------------|-----------|--------------------|---|---|---|

This handbook provides the main information concerning the repair of the following LOMBARDINI Diesel engines **3LD 450, 3LD 510, 3LD 451/S, 3LD 510/S, 4LD 640, 4LD 705, 4LD 820**, which are air-cooled, provided with direct injection and revised on the 30-11-2001.

INDEX OF CHAPTERS

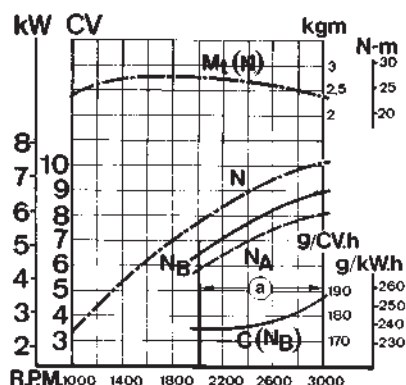
| | | | |
|-------------|--|------|----|
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| II | CHARACTERISTIC CURVES | " | 4 |
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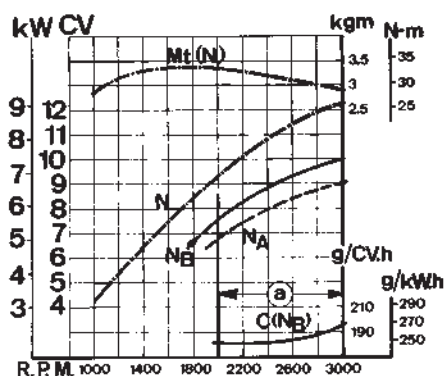


CHARACTERISTIC CURVES CONCERNING POWER, TORQUES AND SPECIFIC CONSUMPTION

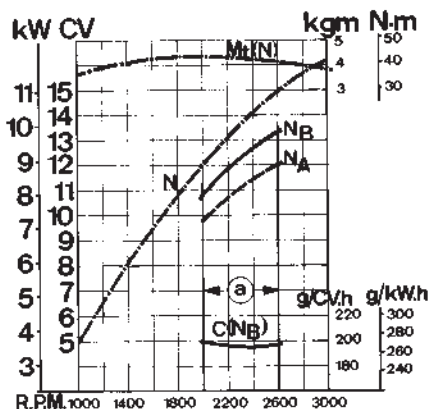
3LD 450



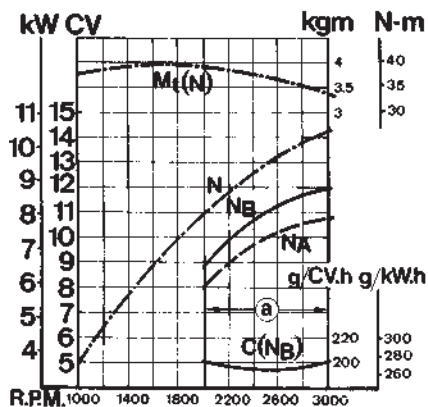
3LD 510



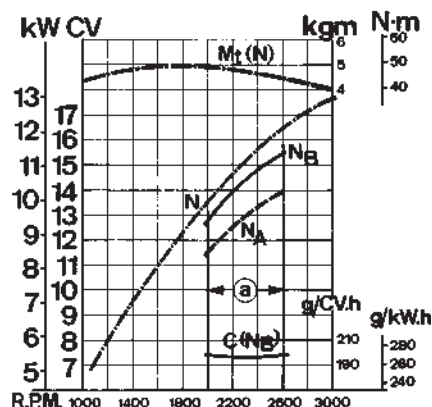
4LD 705



4LD 640



4LD 820



N (80/1269/EU - ISO 1585)

NB (ISO 3046 - 1 IFN)

NA (ISO 3046 - 1 ICXN)

AUTOMOTIVES POWER : Discontinuous services at variable rpm and load.

NON-OVERLOADABLE POWER: Continuous light services at constant rpm and variable load.

CONTINUOUS OVERLOADABLE POWER: Continuous heavy-duty services at constant rpm and load.

The above mentioned power levels refer to the engine equipped with air filter, standard silencer, suction fan - which previously underwent a breaking-in period - at 20°C ambient conditions, at 1 bar.

The maximum power is guaranteed with a 5% tolerance.

These powers are reduced of abt. 1% every 100 m height and of 2% for every 5°C exceeding 25°C.

C (NB): Specific fuel consumption at NB power

MT : Torque at N power

a : Continuous service field of use. For any purpose out of this field of use, please contact company LOMBARDINI.

| OPERATION | DETAIL | INTERVALS (HOURS) | | | | | | | |
|-----------|--------------------------------|-------------------|----|-----|-----|-----|------|------|------|
| | | 10 | 50 | 125 | 250 | 500 | 1000 | 2500 | 5000 |
| CLEANING | AIR FILTER (OIL-BATH) (*) | ● | | | | | | | |
| | HEAD AND CYLINDER FINS (*) | | | | ● | | | | |
| | FUEL TANK | | | | | | ● | | |
| | INJECTORS | | | | | ● | | | |
| CHECK | AIR FILTER OIL | ● | | | | | | | |
| | SUMP OIL | ● | | | | | | | |
| | BATTERY LIQUID | | ● | | | | | | |
| | FUEL HOSE COUPLING FASTENING | | | | | ● | | | |
| | VALVE AND ROCKER ARM CLEARANCE | | | | | ● | | | |
| | INJECTOR SETTING | | | | | ● | | | |
| CHANGE | AIR FILTER(**) (***) | ● | | | | | | | |
| | SUMP (***) | | □ | | ● | | | | |
| | OIL FILTER CARTRIDGE | | □ | | ● | | | | |
| | FUEL FILTER CARTRIDGE | | | | ● | | | | |
| OVERHAUL | PARTIAL (****) | | | | | | | ● | |
| | GENERAL | | | | | | | | ● |

□ First replacement.

(*) In particular running conditions even every day.

(**) In particularly dusty environments every 4-5 hours.

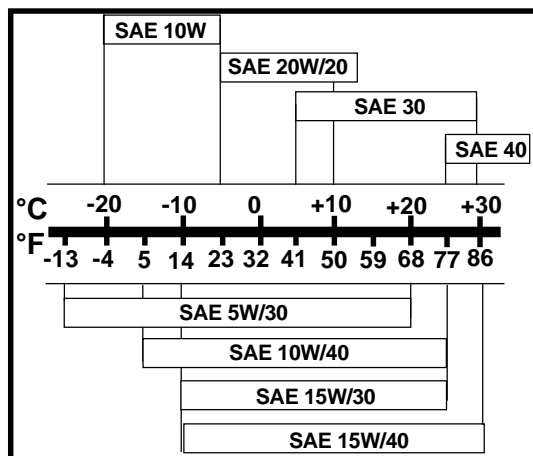
(***) See prescribed oil.

(****) It includes the check of cylinders, segments, guides, valve seat springs and grindings, head and cylinder descaling, injection pump and injector checks.

RECOMMENDED OIL

AGIP DIESEL SIGMA S SAE 30-40 MIL-L-2104 C ESSOLUBE D3 specification, MIL-L-2104 D and UNIFARM specification MIL-L-2104 C. For Countries in which AGIP and ESSO products are not available, the prescribed oil is API SERVICE CD for diesel engines or oil which should be in conformity with the MIL -L-2104 C and MIL -L-2104D military specifications.

RATING



CAPACITIES IN LITERS

Standard fuel tank

3LD450, 3LD510, 3LD451/S, 3LD510/S = 5.3
4LD 640, 4LD705, 4 LD 820 = 7.2

Standard oil sump:

3LD450, 3LD510, 3LD451/S, 3LD510/S =1.75
4LD640, 4LD705, 4LD 820 = 2.60

Air filter oil bowl = 0.3

For special filters, tanks and oil sumps, please follow LOMBARDINI instructions.

This table shows some possible causes concerning malfunctions that could arise during the machine running. Always, systematically carry out simpler checks before any disassembly or replacement.

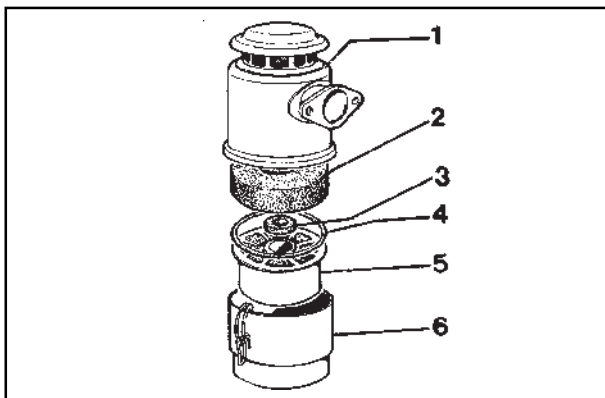
| PROBABLE CAUSES | | TROUBLE | | | | | | | | | |
|-------------------------|--|-------------------|-----------------------------|------------------------|------------------|-------------|-------------|------------------|--------------------|---------------------------|---------------------------------------|
| | | It does not start | It starts but does not stop | It does not accelerate | Inconsistent rpm | Black smoke | White smoke | Low oil pressure | Oil level increase | Excessive oil consumption | Oil and fuel leakage from the exhaust |
| FUEL CIRCUIT | Clogged pipings | • | | | | | | | | | |
| | Clogged fuel filter | • | • | • | | | | | | | |
| | Presence of air in the fuel circuit | • | • | • | | | | | | | |
| | Clogged tank breather | • | • | • | | | | | | | |
| | Faulty fuel pump | • | • | | | | | | | | |
| | Blocked injector | • | | | | | | | | | |
| | Blocked injection pump valve | • | | | | | | | | | |
| | Wrong injector setting | | | | | • | | | | | |
| | Plunger excessive leakage | | | | | | | | • | | |
| | Stuck injection pump delivery control | • | | • | • | | | | | | |
| | Wrong injection pump delivery setting | | | • | | • | | | | | |
| LUBRICATION | High oil level | | | | • | | • | | | • | |
| | Blocked pressure relief valve | | | | | | | • | | | |
| | Worn oil pump | | | | | | | • | | | |
| | Presence of air inside the oil intake pipe | | | | | | | • | | | |
| | Faulty pressure gauge or switch | | | | | | | • | | | |
| | Clogged oil intake duct | | | | | | | • | | | |
| ELECTRICAL EQUIPMENT | Discharged battery | • | | | | | | | | | |
| | Inefficient or wrong cable connection | • | | | | | | | | | |
| | Faulty starting switch | • | | | | | | | | | |
| | Faulty starting motor | • | | | | | | | | | |
| MAINTENANCE | Clogged air filter | • | | • | | • | | | | | |
| | Excessive idle operation | | | | | | • | | | | • |
| | Incomplete running-in | | | | | | • | | | | |
| | Overloaded engine | | | • | | • | | | | | |
| SETTINGS AND REPAIRINGS | Advanced injection | • | | | | | | | | | |
| | Delayed injection | | | | | • | | | | | |
| | Incorrect governor linkage adjustment | • | | | • | | | | | | |
| | Broken or loose governor spring | | | • | | | | | | | |
| | Low idling setting | | • | | • | | | | | | |
| | Worn or stuck piston rings | | | | | | • | | | • | • |
| | Worn or scored cylinders | | | | | | • | | | • | • |
| | Worn valve guides | | | | | | • | | | • | • |
| | Sticking valves | • | | | | | | | | | |
| | Worn crankshaft-connecting rod bearings | | | | | | | • | | | |
| | Non-sliding speed governor leverage | • | • | | • | | | | | | |
| | Crank shaft not turning freely | | | | | • | | | | | |
| | Cylinder head gasket | • | | | | | | | | | |



DISASSEMBLY AND REASSEMBLY

Apart from disassembly and reassembly operations, this chapter also includes checks, setting up, dimensions, repairs and running instructions.

It is necessary to use LOMBARDINI original spare parts for a correct repair.



1

Oil-bath air filter (standard)

Oil-bath type with double filtering mass.

The lower mass is made of metal, while the upper is made of polyurethan.

Check the gasket conditions and replace them in case they are damaged.

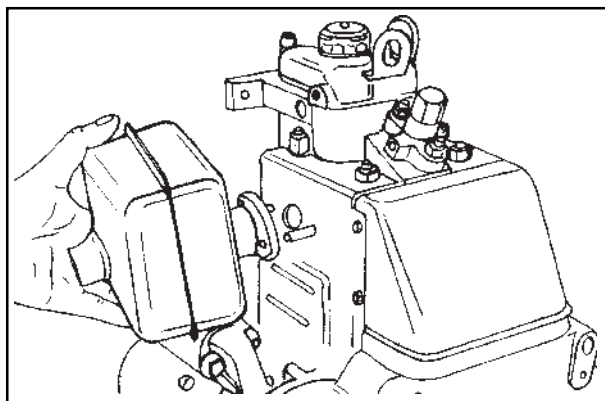
Make sure that the weldings are not damaged.

Carefully clean the lower body and the filtering masses using some gas oil, blow the lower mass with compressed air and dry the upper mass by means of a cloth. Fill with engine oil filter to the indicated level.

While reassembling, tighten the nuts at 25 Nm (3LD450, 3LD510, 3LD451/S, 3LD 510/S), at 30 Nm (4LD 640, 4LD 705, 4LD 820)

Details:

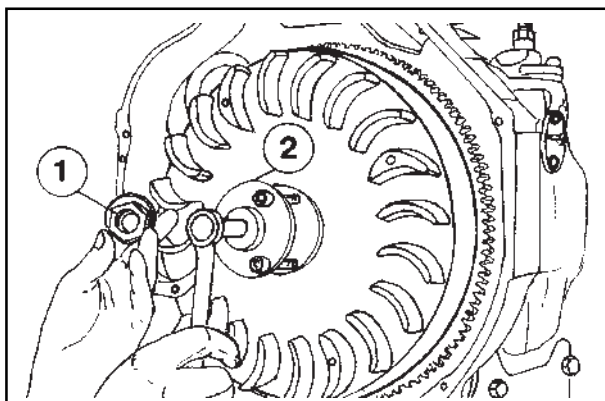
- | | |
|--------------------------------------|-------------------------|
| 1 Upper body | 4 External sealing ring |
| 2 Filtering mass made of polyurethan | 5 Filtering mass |
| 3 Internal sealing ring | 6 Bowl |



2

Silencer (standard)

Make sure that it is free from any carbon and oily residues, if contaminated, replace it. While reassembling it, replace the gaskets and tighten the brass nuts at 25 Nm.



3

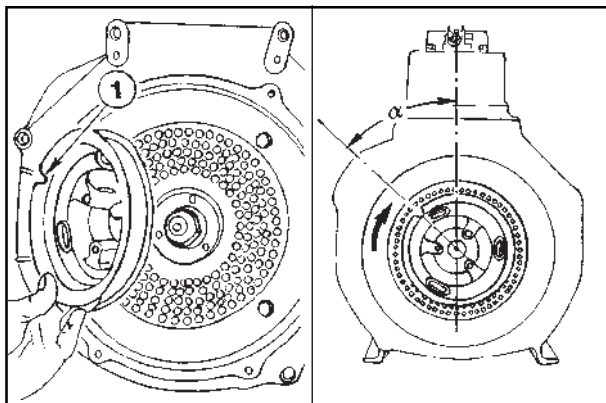
Flywheel

Clockwise unscrew nut 1 and remove the flywheel using the puller 2 Part. no. 7271-3595-050 for 3LD 450, 3LD 451/S, 3LD510, 3LD510/S, while for 4LD 640, 4 LD 705, 4LD 820 use puller with Part. no. 7271-3595-048.

Check that the starter ring gear, when it is present, and the conic surface of the driving shaft coupling hole are intact.

While reassembling, tighten the screws 1 at 170 Nm for 3LD 450, 3LD 451/S, 3LD510, 3LD 510/s and at 350 Nm for 4LD 640, 4LD 705, 4LD 820.

Note: The flywheels of the left-hand engines (3LD 451/S, 3LD 510/S) have a blading turned in the opposite direction and the nut 1 shall be anticlockwise unscrewed.

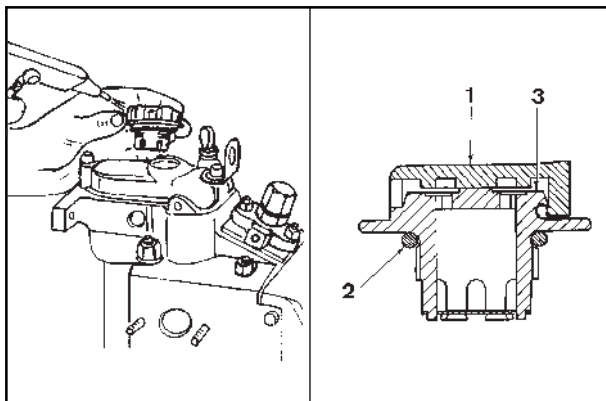
**Starting pulley**

In order to carry out any easier starting, it is necessary to place the driving shaft at the TDC (Top dead center) and to assemble the pulley with notch 1 moved back at (45°) according to the rotation direction of the engine, as per picture 4 and 5 .

Tighten the screws at 35 Nm for 3LD 450, 3LD 451/S, 3LD510, 3LD 510/S, at 40 Nm for 4LD 640, 4LD 705, 4LD 820.

4

5

**Vent plug**

Components

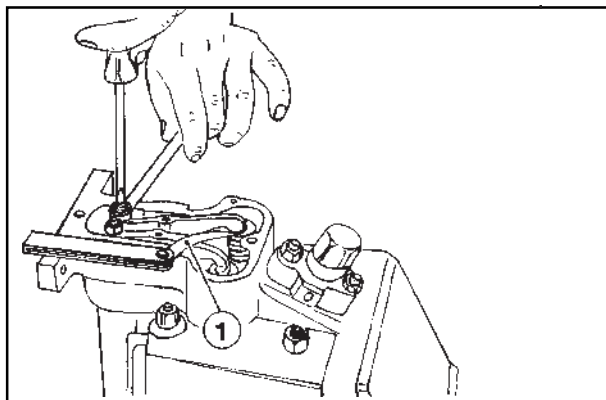
1 Vent plug and oil refilling

2 O-ring

3 Diaphragm

6

7

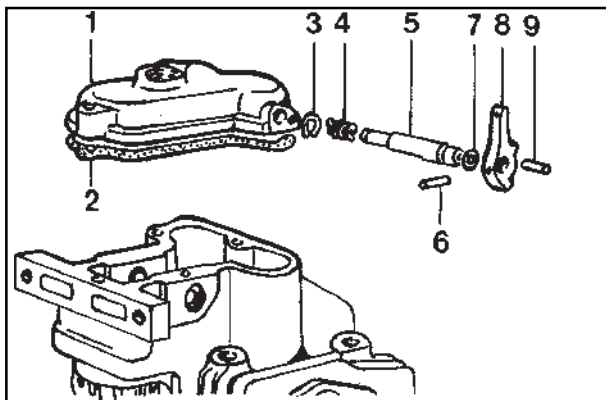
**Valve/rocker arm clearance**

Place the piston at the compression top dead centre.

Place thickness gauge 1 between the valve stem and the rocker arm; cold-adjust the clearance at $0.15 \div 0.20$ mm for both valves.

Tighten the rocker arm box cap at 20 Nm.

8

**Decompression (by request)**

Components:

1 Cover

2 Gasket

3 Lock ring

4 Spring

5 Shaft

6 Pin

7 Ring

8 Lever

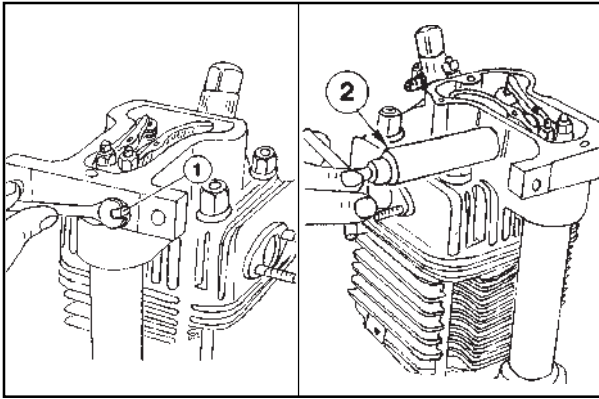
9 Pin

The engine rocker arm cover can be equipped with a decompression device which compresses the exhaust valve at the TDC (top dead centre), lowering it of abt. 1mm. during the starting phase. The lowering is adjusted by the gasket thickness 2. Make sure that the lever turns for abt. half a stroke before it actuates the valve.

Warning!

The use of decompression to stop the engine may cause serious damages.

9

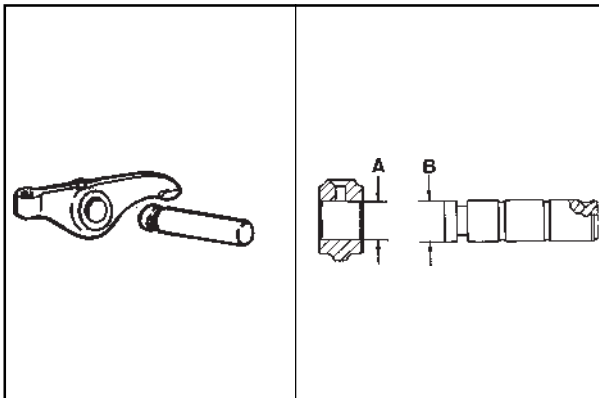


10

11

Rocker arm pin, extraction

Before extracting the rocker arm pin in 3LD 450, 3LD 451/S, 3LD 510, 3LD510S engines, unscrew screw **1**, as per picture 10.
Extract the pin using tool **2** Part. no. 7276-3595-040, picture 11 also for 4LD 640, 4LD 705, 4LD 820 engines.



12

13

Rocker arm pin and hole

Dimensions (mm)

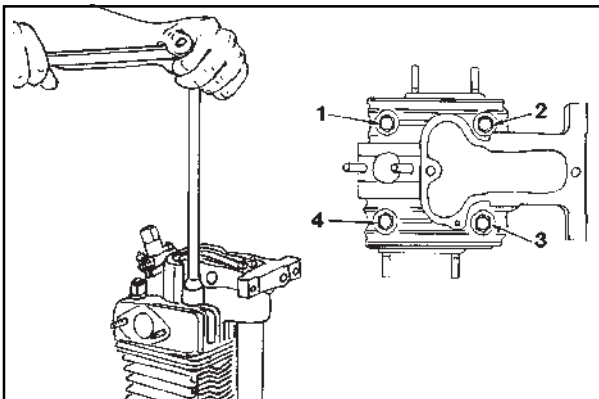
A = 15.032 ÷ 15.050

B = 14.989 ÷ 15.000

Clearances

(A-B) = 0.032 ÷ 0.061

(A-B) = worn limit = 0.120



14

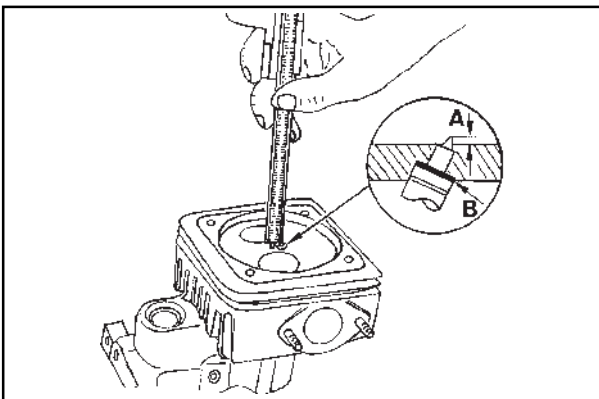
Head

Do not disassemble while it is hot as to avoid any possible distortion.

If the head surface is distorted, smooth it by removing up to 0.3 mm thickness.

Always replace the copper gasket, see picture 34 for the choice of thickness.

Gradually tighten the nuts according to the following order **1, 3, 2, 4**, at 50 Nm for 3LD 450, 3LD 451/S, 3LD 510, 3LD510/S, and at 80 Nm for 4LD 640, 4LD 705, 4LD 820.



15

Injector, projection

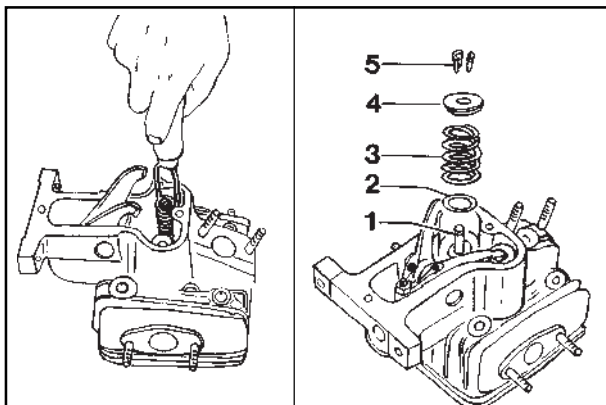
The projection of the nozzle ends **A** with respect to the head surface shall be:

2.5÷3 mm for 3LD 450, 3LD 451/S

3÷3.5 mm for 3LD 510, 3LD 510/S

3.5÷4 mm for 4LD 640, 4LD 705, 4LD 820

Adjust by means of a copper gasket **B** having a thickness of 0.5 mm, 1 mm, 1.5mm .

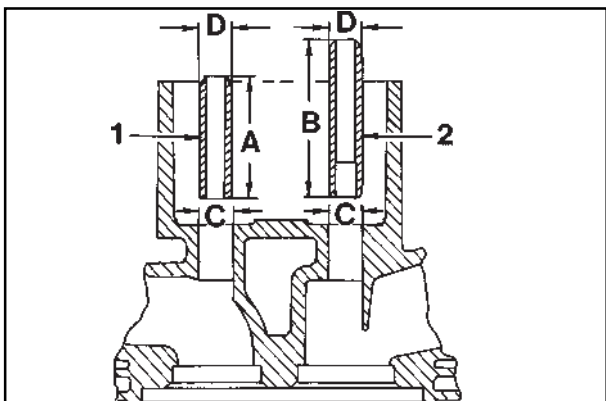
**Valves**

- 1 Valve stem
- 2 Spring holding disk
- 3 Spring
- 4 Cap
- 5 Cotteners

Note: In order to remove the cotteners, put a shim under the valve head and strongly press, as shown in picture 16.

16

17

**Valves guides and housings**

1 Exhaust valve guide

2 Intake valve guide

Dimensions (mm):

3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S

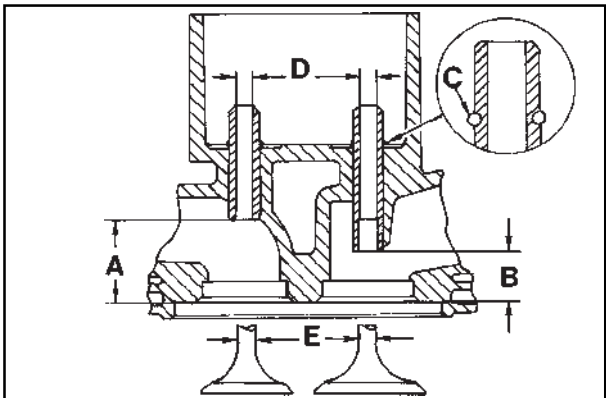
A = 43.80 ÷ 44.20 **B** = 55.80 ÷ 56.20**C** = 11.00 ÷ 11.018 **D** = 11.05 ÷ 11.06

4LD 640, 4LD 705, 4LD 820

A = 47.80 ÷ 48.20 **B** = 65.80 ÷ 66.20**C** = 12.000 ÷ 12.018 **D** = 12.05 ÷ 12.06

Note: Valve guides with an external dia. increased of 0.5 mm can be used as spare parts; in this case it is necessary to increase the housing **C** of 0.5 mm for the assembly.

18

**Valve guides insertion**

Heat the head at 160° ÷ 180°. Force the guides according to **A** and **B** distance with respect to the head surface.

3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S

A = 30.80 ÷ 31.2 **B** = 18.8 ÷ 19.2

4LD 640, 4LD 705, 4LD 820

A = 35.8 ÷ 36.2 **B** = 17.8 ÷ 18.2

Note: if the guides are supplied with the housing for the lock ring **C**, insert the ring, then drive the guides without worrying about **A** and **B**.

Valve guide dimensions and clearances

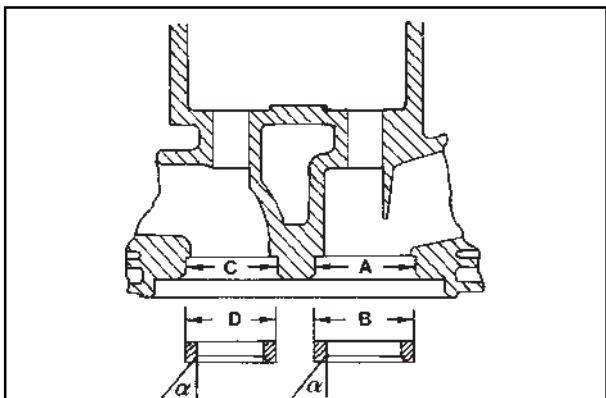
3LD 450, 3LD 451/s, 3LD 510, 3LD 510/S (mm):

D = 7.030 ÷ 7.050 **E** = 6.985 ÷ 7.000**(D-E)** = 0.030 ÷ 0.065 **(D-E)** limit= 0.13

4LD640, 4LD 705, 4LD 820

D = 8.030 ÷ 8.050 **E** = 7.985 ÷ 8.000**(D-E)** = 0.030 ÷ 0.065 **(D-E)** limit=0.13

19

**Valve housings and seats**

3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S (mm):

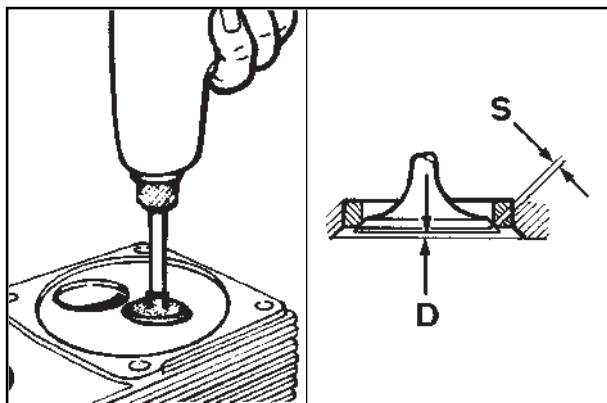
A = 34.99 ÷ 35.01 **C** = 30.99 ÷ 31.01**B** = 35.10 ÷ 35.12 **D** = 31.10 ÷ 31.12

4LD 640, 4LD 705, 4LD 820 (mm):

A = 42.99 ÷ 43.01 **C** = 36.99 ÷ 37.01**B** = 43.12 ÷ 43.14 **D** = 37.10 ÷ 37.12

Drive the seats in the housings and mill at 45°.

20



21

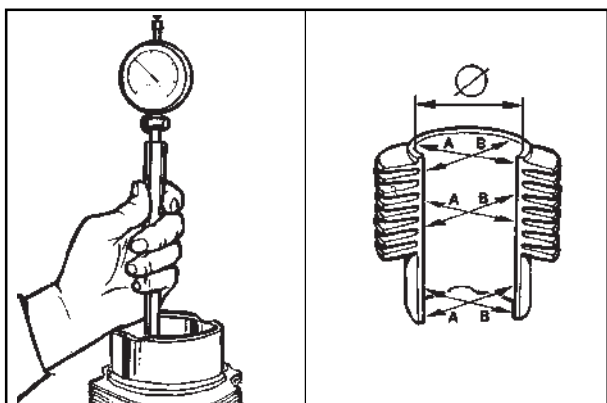
22

Valve seat grinding

After milling, grind with fine emery paste in engine oil bath.

The **S** sealing surface shall not exceed 2 mm.

Embed valves **D** after grinding for 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S = 0.55 ÷ 1.05 mm; for 4LD 640, 4LD 705, 4LD 820 = 0.45 ÷ 0.95 mm.



23

24

Cylinder and piston

Set a bore gauge to zero with a calibrated ring. Check the dia. \emptyset at points **A** and **B** at three different heights, see pictures 23 and 24.

In case of wear exceeding 0.06 mm to the maximum value prescribed, grind the cylinder at the subsequent increased value.

The increases suggested are 0.50 and 1.00 mm.

Measure the piston **Q** dia. (picture 26) at **A** height from the skirt base:

A = 17 mm (3LD 450, 3LD 451/S, 4LD 820)

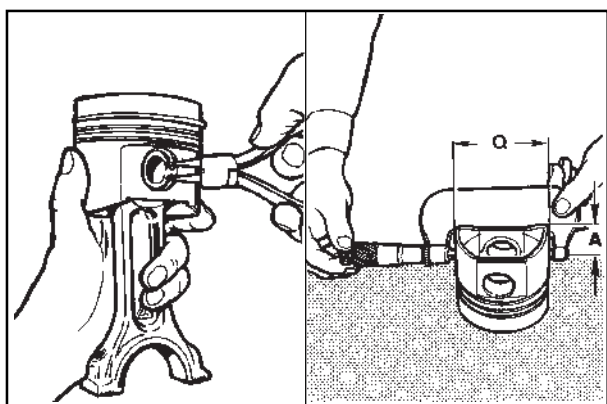
A = 12 mm (3LD 510, 3LD 510/S)

A = 22 mm (4LD 640, 4LD 705)

Remove the stop rings and extract the piston pin, picture 25.

Remove the piston rings and clean the slots.

Replace the piston as well as the segments in case the dia. wear exceeds 0.05 mm as regards to the minimum value prescribed.



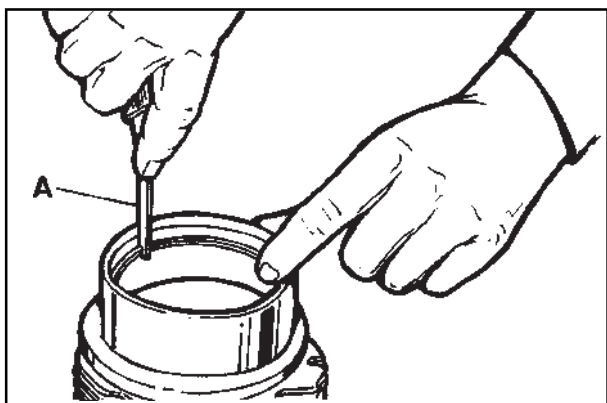
25

26

Dimensions (mm)

| ENGINES | \emptyset | Q | (\emptyset -Q) |
|--|-----------------|-----------------|-------------------|
| 3LD 450, 3LD 451/S 3LD 510, 3LD 510/S | 85.00 ÷ 85.02 | 84.925 ÷ 84.945 | 0.05 ÷ 0.09 |
| 4LD 640 | 95.00 ÷ 95.02 | 94.88 ÷ 94.90 | 0.10 ÷ 0.14 |
| 4LD 705 | 100.00 ÷ 100.02 | 99.83 ÷ 99.85 | 0.15 ÷ 0.19 |
| 4LD 820 | 102.00 ÷ 102.02 | 101.85 ÷ 101.89 | 0.11 ÷ 0.17 |

Note: Even if 3LD 450, 3LD 451/S and 3LD 510, 3LD 510/S pistons have the same bore, they differ in other dimensions, thus they are not interchangeable.



27

Distance among segment ends (mm)

Insert the piston ring in the lower part of the cylinder, then measure the distance among the points.

3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S

1st piston ring (chromium plated) **A** = 0.30 ÷ 0.50

2nd piston ring (torsional) **A** = 0.30 ÷ 0.50

3rd piston ring (scraper ring) **A** = 0.25 ÷ 0.50

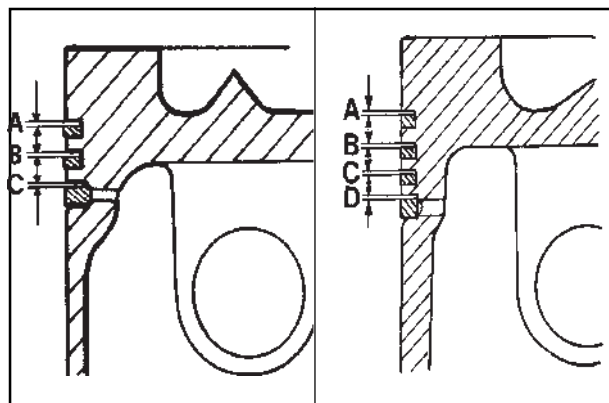
4LD 640, 4LD 705, 4LD 820

1st piston ring (chromium plated) **A** = 0.40 ÷ 0.65

2nd piston ring (torsional) **A** = 0.40 ÷ 0.65

3rd piston ring (torsional) **A** = 0.40 ÷ 0.65

4th piston ring (oil scraper ring) **A** = 0.30 ÷ 0.60

**Piston ring - Clearances among slots (mm)**

3LD 450, 3LD 451/S, 3LD 510, 3LD 510S, picture 28

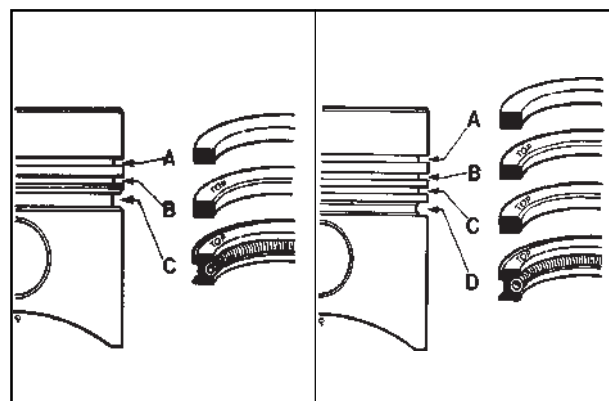
A = 0.08 ÷ 0.09**B** = 0.06 ÷ 0.07**C** = 0.05 ÷ 0.06

4LD 640, 4LD 705, 4LD 820, picture 29

A = 0.12 ÷ 0.14**B** = 0.07 ÷ 0.09**C** = 0.07 ÷ 0.09**D** = 0.06 ÷ 0.08

28

29

**Piston ring assembly order**

3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S, picture 30

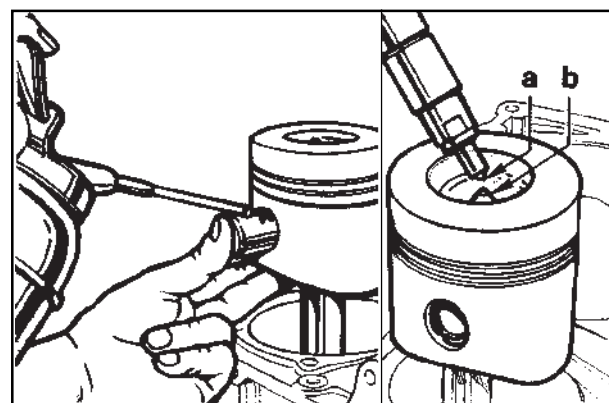
A = slot for first piston ring (chromium plated)**B** = slot for piston ring segment (torsional)**C** = slot for third piston ring (oil scraper ring)

4LD 640, 4LD 705, 4LD 820, picture 31

A = slot for first piston ring (chromium plated)**B** = slot for second piston ring (torsional)**C** = slot for third piston ring (torsional)**D** = slot for fourth piston ring (oil scraper ring)

30

31

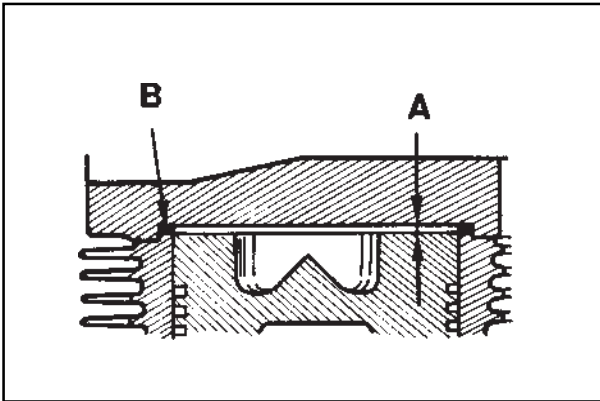
Note: before inserting the piston in the cylinder, oil the piston ring with engine oil and turn them, thus the cuts are misaligned.**Piston reassembly**Couple the piston with the connecting rod, thus the combustion chamber centre **B** is perpendicularly under end **A** of the nozzle housed inside the head.

Lubricate the piston pin and insert it in the piston, lightly pressing with your thumb.

Make sure that the two stop rings are well housed inside their seats.

32

33



34

Clearance volume

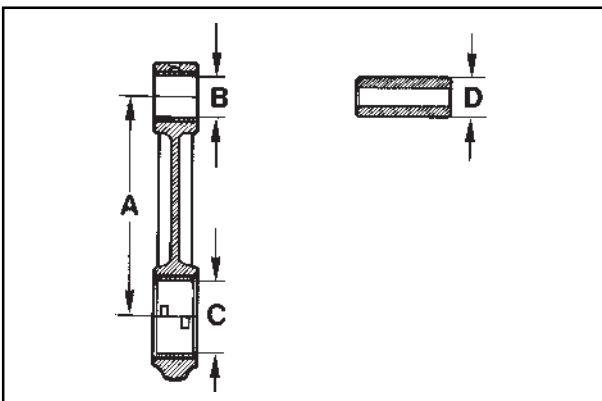
A = Clearance volume

B = Head gasket

The thickness B head gasket determines the clearance volume A which shall be $0.75 \div 0.90$ mm for 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S and $0.80 \div 1.00$ mm for 4LD 640, 4LD 705, 4LD 820.

Measure the piston crown position as to the cylinder surface and chose a gasket having a suitable thickness.

Always consider that the piston at the top dead centre could be at the same level, either under or over the cylinder.



35

Connecting rod equipped with bearings and piston pin

For 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S

Dimensions (mm)

A = $144.05 \div 145.05$

B = $23.02 \div 23.03$ (with driven and machined bearing)

C = $42.028 \div 42.052$ (with bearing tightening at 3 Nm)

D = $27.995 \div 23.000$

For 4LD 640, 4LD 705, 4LD 820

Dimensions (mm)

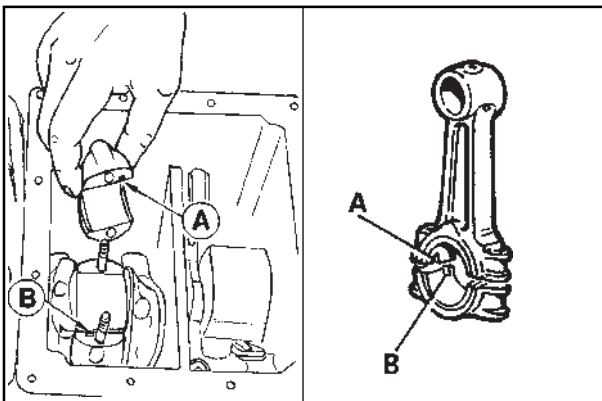
A = $162.95 \div 163.05$

B = $28.02 \div 28.03$

C = $55.40 \div 55.43$

D = $27.995 \div 28.000$

The connecting rod big end bearings are supplied either at nominal value and diminished to 0.25 and 0.50 mm.



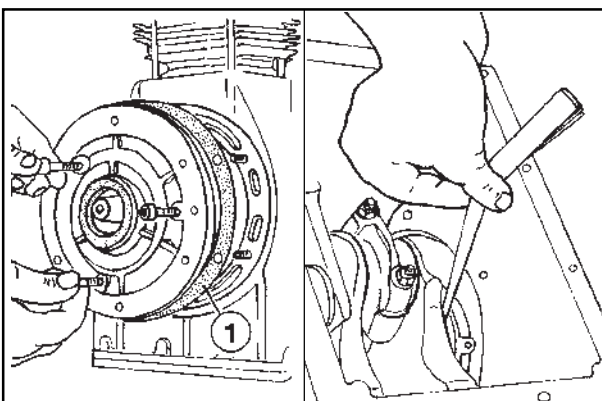
36

37

Connecting rod, big end bearings

While reassembling, the A and B centering marks should not be on the same side.

Tighten the screws at 30 Nm for 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S and at 45 Nm for 4LD 640, 4LD 705, 4LD 820.



38

39

Main bearing on flywheel side

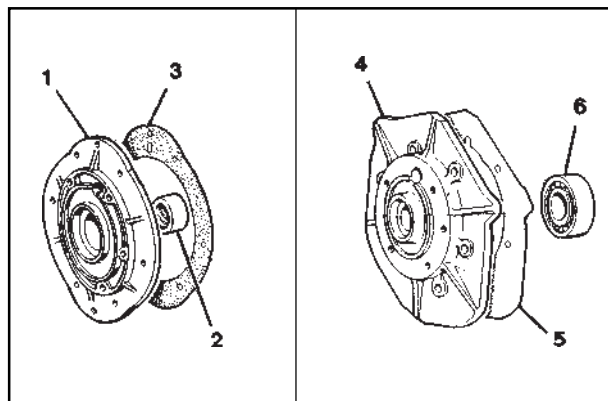
Extract the bearing using three screws, as per picture 38.

While reassembling, replace gasket 1. Check that the oil seal ring is intact. Tighten the screws at 25 Nm.

Drive shaft axial clearance

After having screwed the main bearing on the flywheel, check drive shaft axial clearance. Its value is $0.10 \div 0.40$ mm for 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S and $0.10 \div 0.30$ mm for 4LD 640, 4LD 705, 4LD 820.

The adjustment is carried out by changing the gasket 1 thickness.

**Side distributor port**

It can be found in engines equipped with industrial type drive shaft.
The gaskets **3** and **5**, thanks to their thickness, assure the oil seal and affect the camshaft axial clearance, as well. For the check, see information hereunder.

Components

For 3LD 450, 3LD 510 picture 40

1 Port **2** Bush **3** Gasket

Fix the door at its base at 25 Nm.

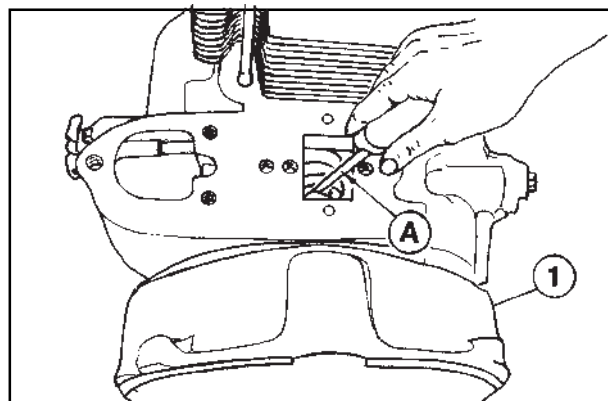
For 4LD 640, 4LD 705, 4LD 820 picture 41

4 Port **5** Gasket **6** Ball bearing

Fix the port at its base at 40 Nm.

40

41

**Camshaft axial clearance**

Carry out this check before assembling the head. Fix the side distributor port or bell **1** at 25 Nm. Remove the intake and exhaust tappets and with an implement operate on the camshaft forward and backward in an axial direction.

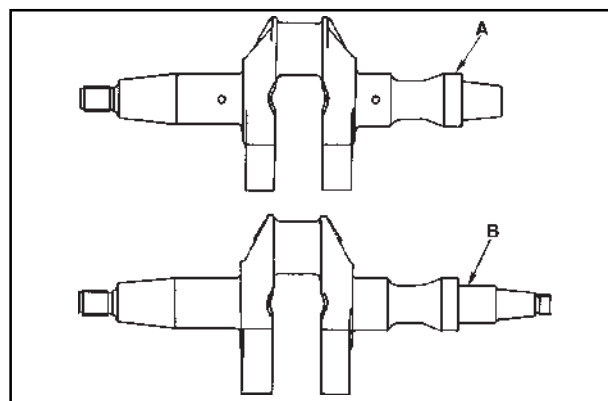
The axial clearance **A** shall be:

A = 0.20 ÷ 0.60 mm 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S.

A = 0.15 ÷ 0.65 mm for 4LD 640, 4LD 705, 4LD 820.

Adjust the clearance by changing the gasket thickness between the distributor port (if it is assembled) or bell **1** and the base; it is forbidden to assemble more than one gasket.

42

**Drive shaft**

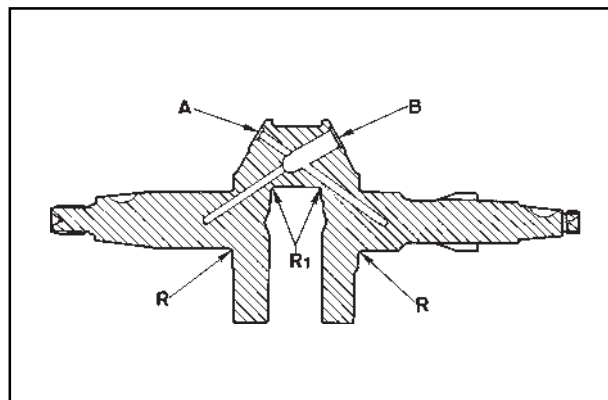
There are two types of standard drive shafts:

A Automotive type (agricultural machines)

B industrial type (motor pumps generating set, etc.)

Note: For left-handed engines, i.e. 3LD 510/S, the drive shaft turns anticlockwise (seen from the flywheel position) and their thread is clockwise on the power takeoff side as well as on the flywheel side.

43

**Drive shaft lubrication ducts**

Remove the caps, clean the ducts **A** and **B** with a point and blow them with compressed air.

Replace the caps by caulking them on their seat, then check their seal.

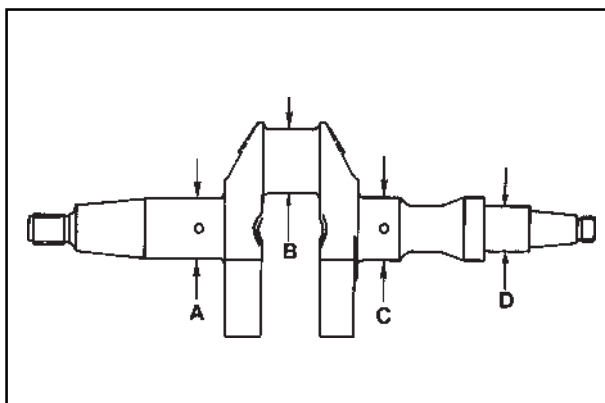
Drive shaft connecting radius

R = 3 mm

R₁ = 3.5 mm

Note: When the main journal and the crank are ground, it is essential to reset **R** and **R₁** values in order to avoid any possible breaking of the drive shaft.

44



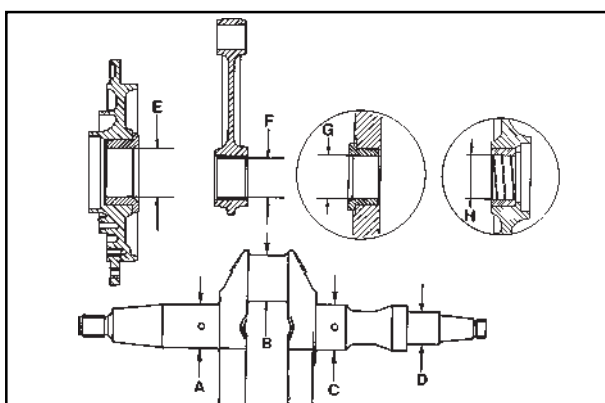
45

Drive shaft main journal and crank diameters (mm)

3LD 450, 3LD 510, 3LD 451/S, 3LD 510/S

A = 39.990 ÷ 40.000**B** = 41.987 ÷ 42.000**C** = 41.990 ÷ 42.000**D** = 29.990 ÷ 30.000

4LD 640, 4LD 705, 4LD 820

A = 44.900 ÷ 45.000**B** = 55.340 ÷ 55.353**C** = 44.900 ÷ 45.000**D** = 29.990 ÷ 30.000

46

Drive shaft internal diam. crankshaft bearing / connecting rod head and clearances regarding their respective pins (mm)

3LD 450, 3LD 510, 3LD 451/S, 3LD 510/S

E = 40.040 ÷ 40.050**F** = 42.028 ÷ 42.052**G** = 42.04 ÷ 42.05**H** = 30.07 ÷ 30.09

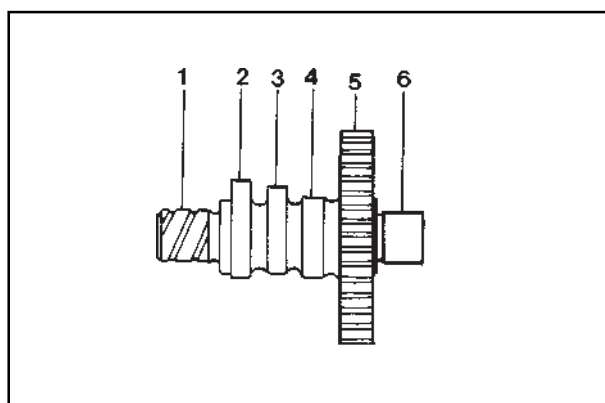
A, B, C, D, see picture 45

E - A = 0.040 ÷ 0.060 worn limit 0.12**F - B** = 0.028 ÷ 0.065 worn limit 0.13**G - C** = 0.040 ÷ 0.060 worn limit 0.12**H - D** = 0.070 ÷ 0.10 worn limit 0.18

4LD 640, 4LD 705, 4LD 820

E = 45.045 ÷ 45.070 **F** = 55.40 ÷ 55.43 **G** = 45.045 ÷ 45.070

A, B, C, D, see picture 45

E - A = 0.065 ÷ 0.080 worn limit 0.16**F - B** = 0.051 ÷ 0.10 worn limit 0.18**G - C** = 0.45 ÷ 0.080 worn limit 0.16

47

CAMSHAFT

Components:

1 Base side pin

2 Intake cam

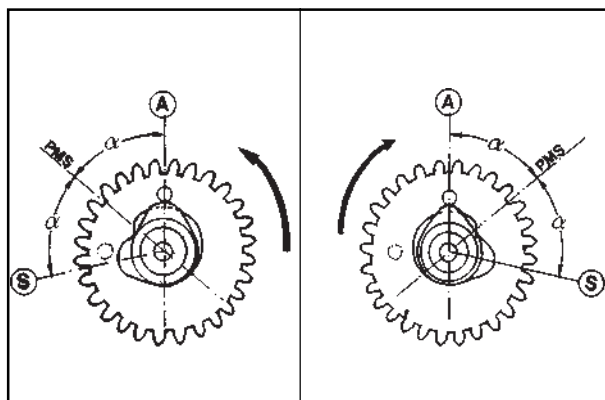
3 Injection cam

4 Exhaust cam

5 Gear

6 Side distributor port pin

Note: The two engine series 3LD 450, 3LD 510 and 4LD 640, 4LD 820 have the same camshaft; it differs in 3LD 451/S and 3LD 510/S left-handed engines.



48

49

Camshaft intake and exhaust cam timing

For 3LD 450, 3LD 510, 4LD 640, 4LD 705, 4LD 820, see picture 48.

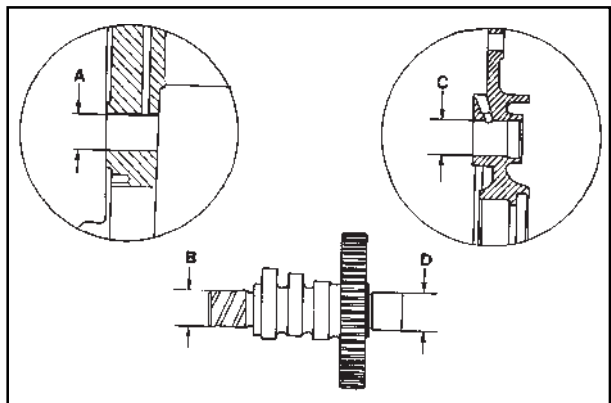
Clockwise rotation.

TDC = Top dead centre of the piston**A** = Intake cam axis**S** = Exhaust cam axis**at** = 50° 30' ÷ 51° 30'

For 3LD 451/S, 3LD 510/S, see picture 49

Clockwise rotation

TDC = Top dead centre of the piston**A** = Intake cam axis**S** = Exhaust cam axis**at** = 50° 30' ÷ 51° 30'

**Camshaft pin and housing dimensions (mm)**

A = 18.000 ÷ 18.018 (housing on the base)

B = 17.945 ÷ 17.975

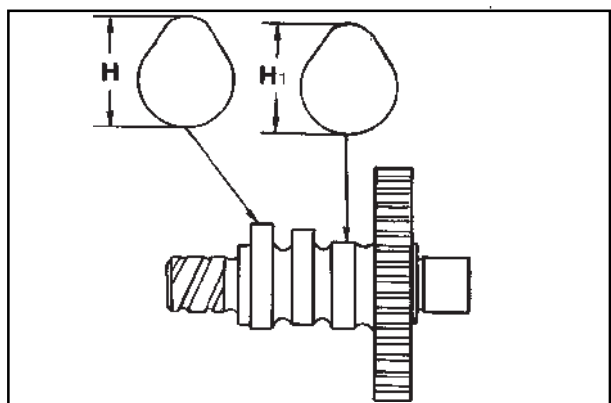
C = 18.000 ÷ 18.018 (housing on the port)

D = 17.945 ÷ 17.975

A-B and C-D = 0.025 ÷ 0.073

Worn limit = 0.13

50

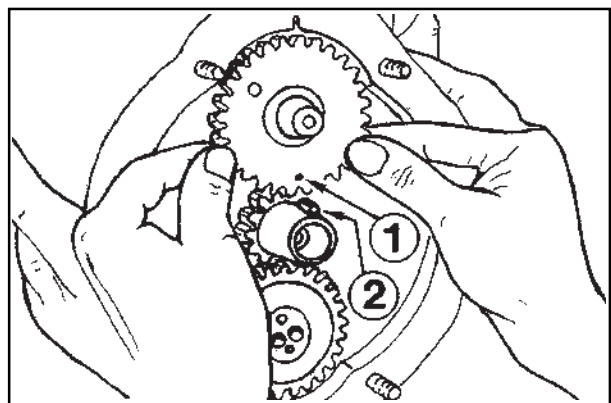
**Camshaft intake and exhaust cam height.
The two cam heights are different.**

Dimensions (mm) :

H = 33.92 ÷ 34.02 (intake cam)

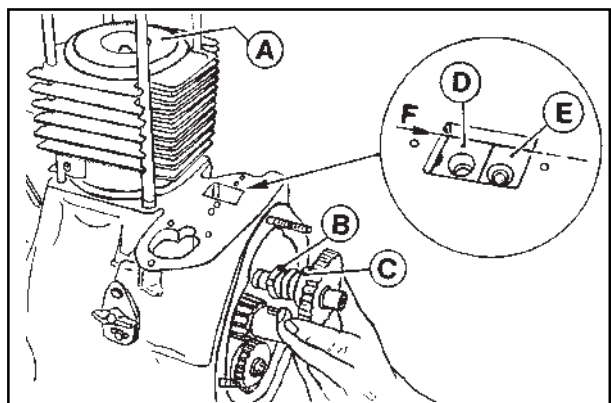
H₁ = 33.42 ÷ 33.52 (exhaust cam)If the cam wear exceeds the agreed minimum value of 0.1 mm for H and H₁, replace the camshaft.

51

**Distribution timing**

assemble the camshaft gear by coinciding reference 1 with reference 2 of the gear (camshaft key).

52

**Distribution timing without following the references**

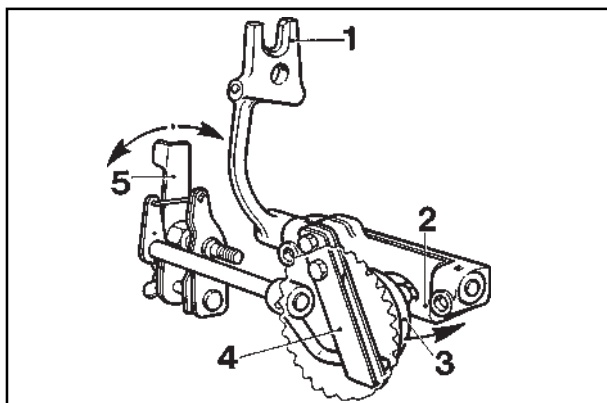
Place piston A at the top dead centre.

Insert the camshaft, thus the intake cam B and the exhaust cam C are well balanced (while the intake opens, the exhaust closes).

Insert the respective tappets D and E.

Carry out the check: the intake D and exhaust E tappets laid on their cams shall be at the same level F.

53

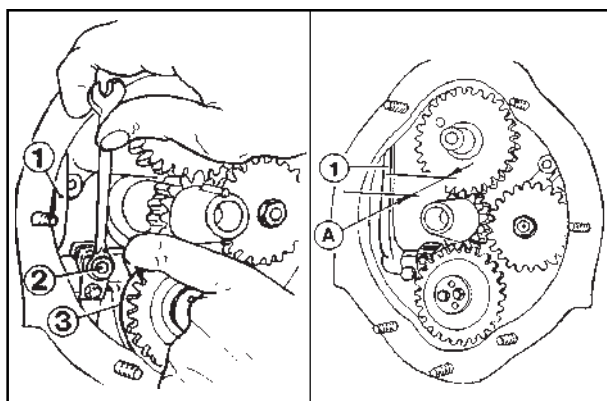


54

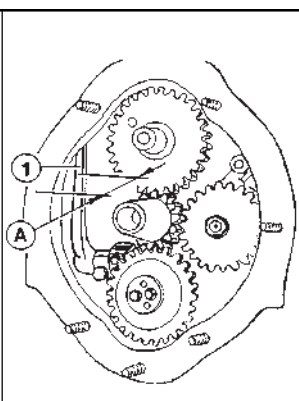
Speed governor

It has a centrifugal system with 6 balls housed in the gear, which is directly operated by the drive shaft.

The balls, moved at the gear periphery by a centrifugal force, axially shift the bell 3, which actuates the fork 2 connected to lever 1 in order to determine the injection pump rack rod position. A spring with two plates 4, energized by the accelerator control 5, opposes the action of the governor centrifugal force. The balance between the two forces keeps the rpm rate constant with the change of load.



55

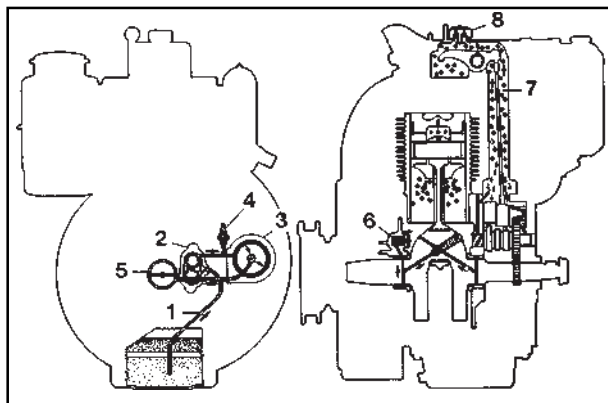


56

Timing of the speed governor

Adjust the injection pump control lever 1 thus, when the governor is closed, it is placed at distance A as to the external surface of the base.

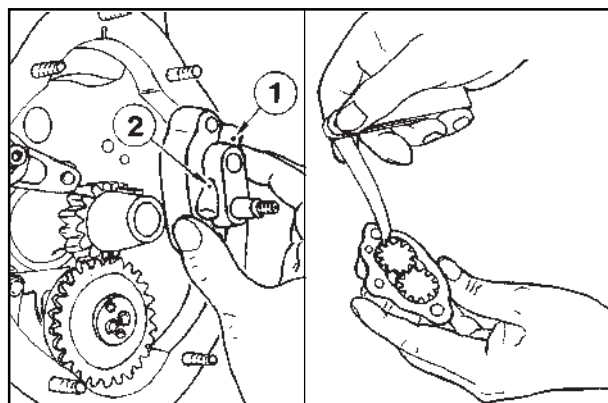
- Loosen the screw 2.
- Close the governor (move the mobile bell 3 towards the operator, picture 55).
- Place lever 1 at A distance, picture 56 (22 mm for 3LD 450, 3LD 510, 3LD 451/S, 3LD 510/S and 28 mm for 4LD 640, 4LD 705, 4LD 820).
- Tighten the screw 2.

**Lubrication circuit**

Details:

- 1 Intake pipe
- 2 Oil pump
- 3 Oil filter
- 4 Pressure switch
- 5 Crankshaft bearing
- 6 Pressure adjusting valve
- 7 Tappet rod protection pipe
- 8 Vent and oil filler plug.

57

**Oil pump**

Make sure that the gear teeth are intact and check that the clearance between the gear periphery and the pump case does not exceed 0.15 mm and that the drive shaft can easily turn with an axial clearance not exceeding 0.15 mm.

Check that the gear lubrication holes 1 and 2 are not clogged.

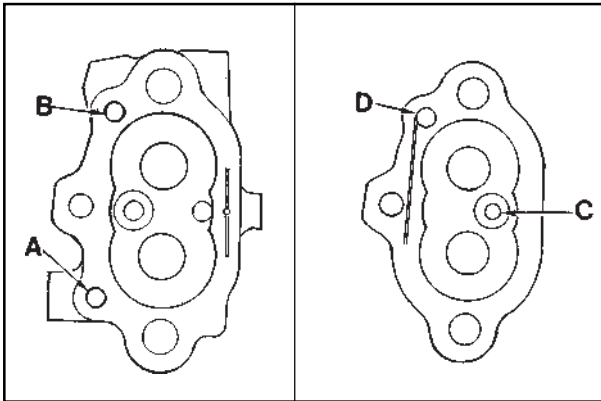
Tighten the pump case at 30 Nm.

Tighten the pump control gear at 20 Nm.

The oil pumps for 3LD 451/S and 3LD 510/S engines, which turn anticlockwise (from flywheel position), are different, see information below.

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60

61

Oil pump, difference between clockwise rotation pump and anticlockwise pump

The difference between the oil pump on clockwise rotation engines and the anticlockwise one is the suction duct provided either with the pump case and with the base.

See picture 60 for anticlockwise rotation engines from flywheel position (3LD 451/S, 3LD 510/S).

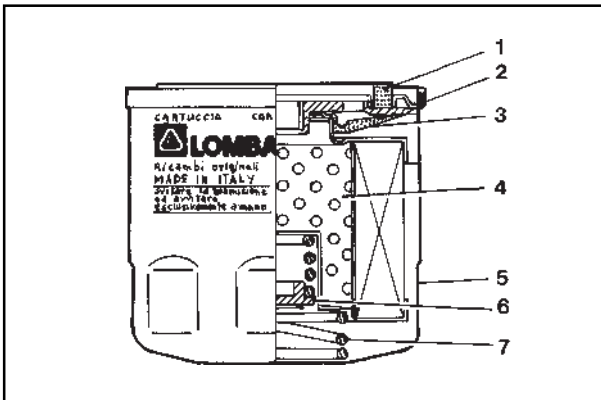
A = Intake

B = Delivery

Picture 61, for clockwise rotation engines, seen from the flywheel side (3LD 450, 3LD 510, 4LD 640, 4LD 705, 4LD 820)

C = Intake

D = Delivery



62

Oil filter cartridge

Components:

1 Gasket

2 Assembly

3 Antidrainage rubber cap

4 Filter element

5 Bowl

6 By-pass valve

7 Spring

Features:

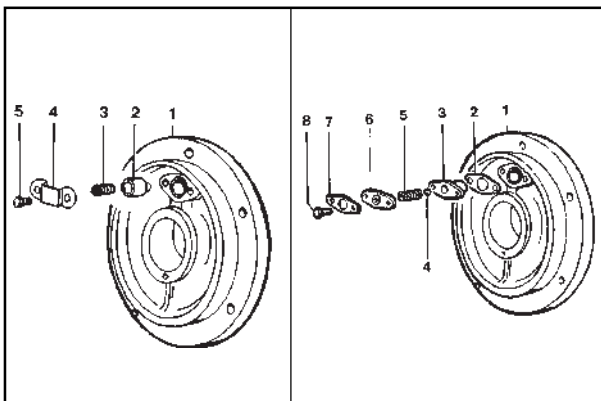
Maximum operating pressure: 7 bars

Maximum operating temperature: -25° + 150°C

Filtration degree: 20 µm

By-pass valve setting: 1 ÷ 1.4

Total filtering surface: 750 cm²



63

64

Oil pressure regulating valve

It is housed in the flywheel side main bearing

For 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S, see picture 63

1 Support

2 Valve

3 Spring

Tighten the support at 25 Nm.

4 Sheet metal

5 Screw

For 4LD 640, 4LD 705, 4LD 820, see picture 64

1 Support

2 Gasket

3 Valve support

4 Ball

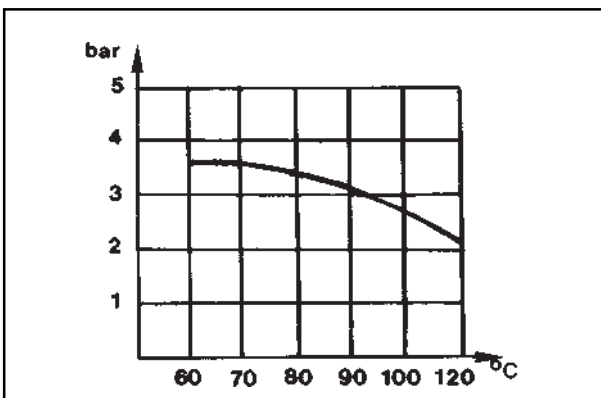
5 Spring

6 Flange

7 Plate

8 Screw

Tighten the support at 40 Nm.



65

Oil pressure check

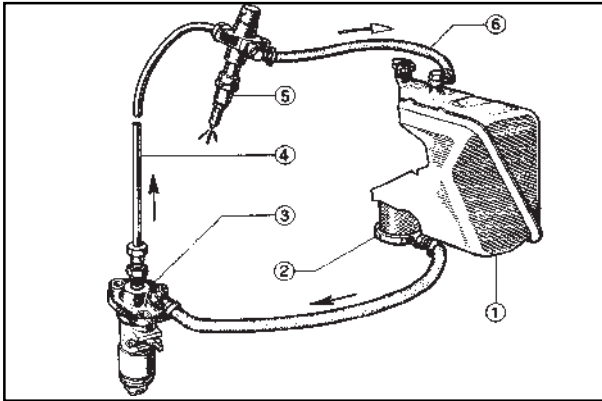
After the assembly operation, fill the engine with oil and fuel; connect a 10 bars pressure gauge to the fitting on the oil filter.

Start the engine and check the pressure reaction according to oil temperature.

Oil pressure curve with the engine at its maximum speed

It is shown on the filter and obtained with the engine at 3000 rpm at N power; the pressure is expressed in bars and the temperature in degrees Celsius. The curve represents the pressure minimum value, while its maximum value is 5 bars. The minimum oil pressure (1200 rpm) with the oil temperature at 100° C shall not be lower than 0.8 bars.

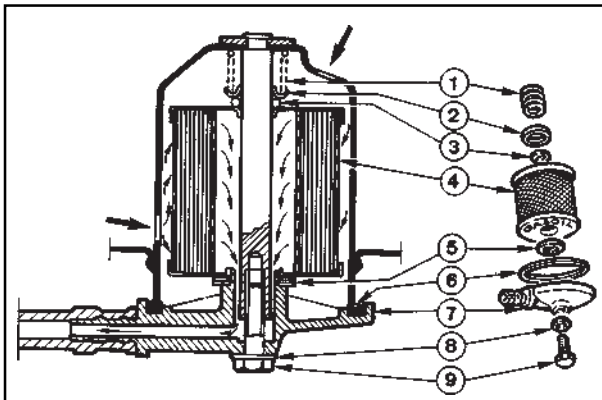
Note: When the engine has been run in, the oil lubrication maximum temperature shall be lower than the following addition: ambient temperature + 95° C.

**Standard feeding/injection circuit**

Components:

- 1 Tank
- 2 Filter
- 3 Pump
- 4 Pipe
- 5 Injector
- 6 Injector waste pipe

66

**Fuel filter inside the tank (standard)**

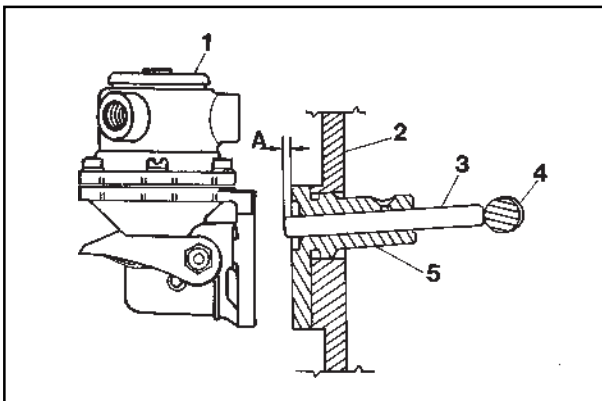
Details:

- 1 Spring
- 2 Disk
- 3 Ring
- 4 Cartridge
- 5 Gasket
- 6 Gasket
- 7 Cover
- 8 Ring
- 9 Bolt

Cartridge features:

Filtering degree = 7 μ mFiltering surface = 390 cm²

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**Feeding pump (by request)**

Features: at 1500 rpm of the control eccentric, the minimum delivery is 60 l/h, while the automatic adjustment pressure is 4 ÷ 5 m column of water.

Feeding pump rod projection

Details:

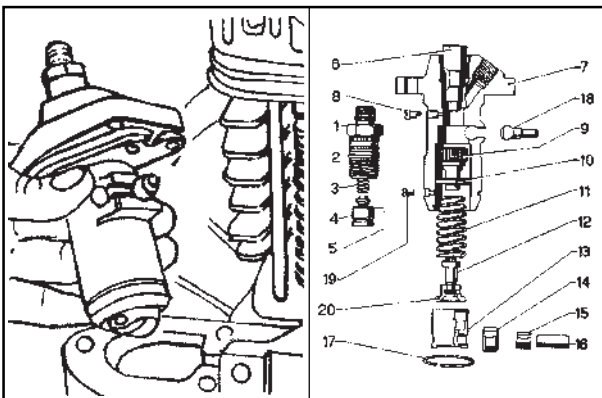
- 1 Feeding pump
- 2 Base
- 3 Rod
- 4 Oil pump drive shaft eccentric

The check shall be carried out with the eccentric 4 at rest.

The projection A of rod 3 is 0.8 ÷ 1.2 mm; it shall be adjusted with the following supplied gaskets having a thickness of 0.50; 0.80 and 1.0 mm.

Rod length = 65.4 mm for 3LD 450, 3LD 451/S, 3LD 510, 3LD 510/S and 75.2 mm for 4LD 640, 4LD 705, 4LD 820.

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**Injection pump**

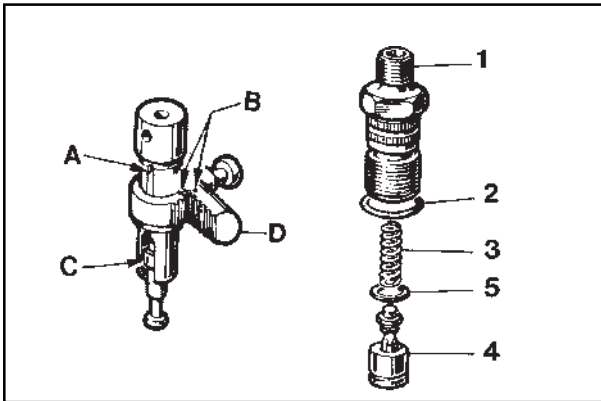
Components:

- 1 Delivery fitting
- 2 O-ring
- 3 Spring
- 4 Delivery valve
- 5 Gasket
- 6 Barrel
- 7 Pump case
- 8 Eccentric
- 9 Sector gear
- 10 Spring bearing cap
- 11 Spring
- 12 Pumping piston
- 13 Tappet case
- 14 External roller
- 15 Internal roller
- 16 Pin
- 17 Lock ring
- 18 Rack rod
- 19 Lock pin
- 20 Collar

Tighten the pump at its base at 30 Nm.

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70



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Injection pump assembly

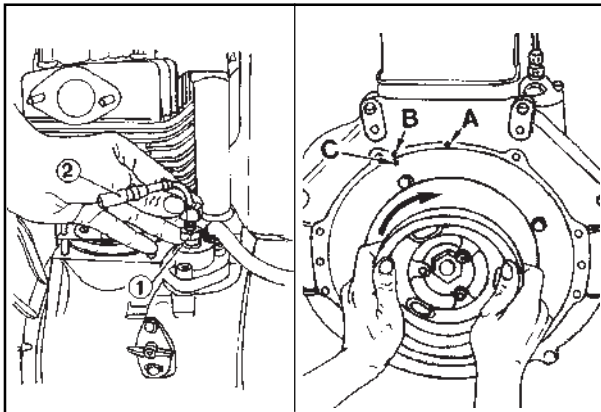
Insert the cylinder 6 in the pump case 7, engaging the slot A in the eccentric 8.

Insert the delivery valve 4, copper gasket 5, spring 3 O ring 2, then tighten the fitting at $3.5 \div 40$ Nm.

Assemble the rack rod 18 and sector gear 9 coinciding points B.

Insert the upper collar 10, spring 11 and piston 12 with reference C on the same side of the slot A (if it is assembled on the opposite side, the engine revs out).

Assemble the collar 20, the tappet 13 with rollers 14, 15 and pin 16. While pressing on the tappet, insert the pin 19 and the ring 17.



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Advanced injection (static)

Disconnect the diesel oil thrust pipe fitting, being careful not to loosen also the pump delivery fitting 1, then screw the tester for the advanced injection check 2. Fill the tank, checking that the fuel level is at least 10 cm above the tester. Place the accelerator lever halfway. Turn the flywheel towards the engine rotation direction and make sure that the fuel arrives at the tester assembled on the injection pump delivery fitting. Repeat this operation; during the compression phase, operate slowly and immediately stop when the fuel moves into the tester hole; move the flywheel 3 mm back; this is the static advanced injection. If C does not coincide with B but comes before, add some shims under the pump, otherwise, remove the shims if C is beyond B.

Note: By removing or adding a 0.1 mm shim under the pump, it is possible to delay or advance C, which is after B.

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Advanced Injection references on the conveyor and flywheel protection disk

A Piston reference at top dead centre

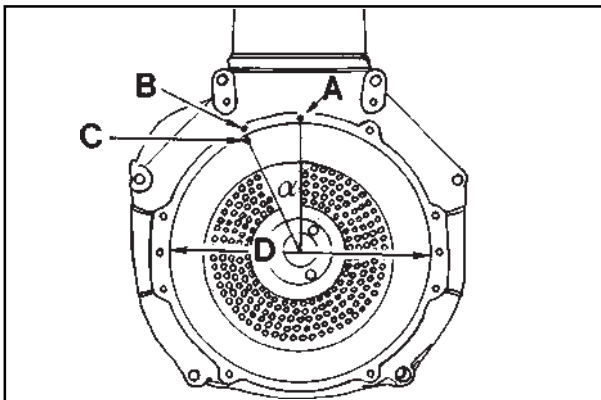
B Injection advance reference as to A

A ÷ B Distance in mm

C Reference of piston in injection advance position

a Reference in degrees

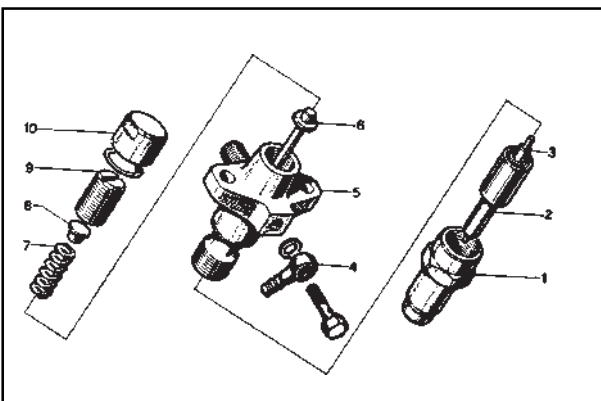
D Flywheel protection disk diameter



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| ENGINES | (A-B)mm | amm | D (3LD)mm | D (4LD)mm |
|---------------------------|--------------|--------------------------|-----------|-----------|
| 3LD 450, 3LD 451/S | $58 \div 63$ | $24 \div 26$ | 276 | 310 |
| 3LD 510, 3LD 510/S | $65 \div 70$ | | | |
| 4LD 640, 4LD 705, 4LD 820 | $60 \div 65$ | $22^\circ \div 24^\circ$ | | |
| 4LD 820 at 2600 rpm | | | | |

Note: 1° stands for 2.7 mm on dia. D= 310 mm; on dia. D = 276 mm, 1° stands for 2.4 mm.



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Injector

Components:

1 Ring nut - 2 Nozzle 3 Needle 4 Fitting 5 Nozzle bearing 6 Pressure rod 7 Spring 8 Spring seat 9 Union 10 Ring nut

Setting

Connect the injector to a manual pump and check that the setting pressure is $190 \div 200$ bars. If necessary adjust, actuating the union 9. While replacing the spring, the setting shall be carried out at a pressure higher than 10 bars ($200 \div 210$ bars) in order to counterbalance the running adjustments. Check the needle valve seal by slowly activating the manual pump up to abt. 170 bars. In case of dripping, replace the nozzle. Tighten the injector to the head at 15 Nm for 3LD 450, 3LD 451/S, 3 LD 510, 3 LD 510/S and at 20 Nm for 4LD 640, 4LD705, 4LD 820.

Note: A new injector is currently assembled, its components are different, though the setting remains the same.

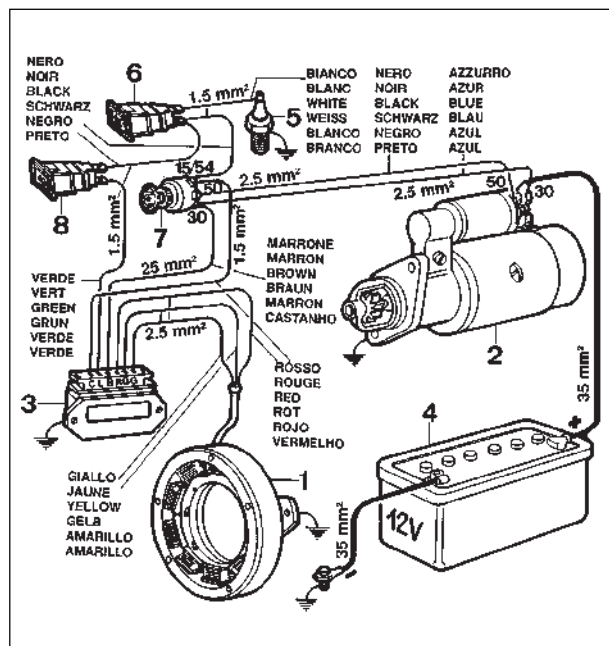
12 V 14 A electrical ignition, diagram with voltage regulator , battery recharge lamp and manostat

Components:

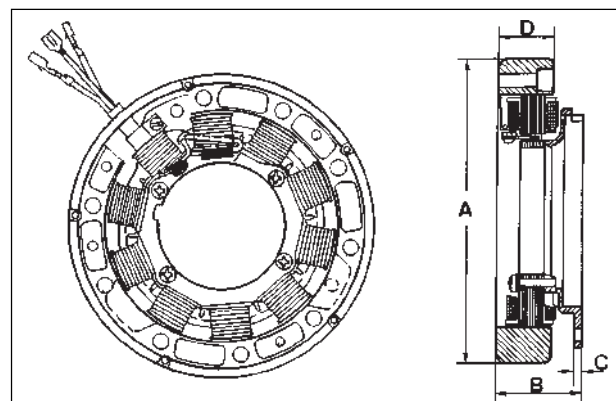
- 1 Alternator
- 2 Starting motor
- 3 Voltage regulator
- 4 Battery
- 5 Oil pressure switch
- 6 Oil pressure lamp
- 7 Ignition switch
- 8 Battery recharge lamp

Note: The batteries, which are not supplied by Lombardini, shall have a 12 V voltage and the following capacity:

3LD 450, 3ID 451/S, 3LD 510, 3LD 510/S = 45 Ah
 4LD 640 = 55 Ah
 4LD 705 = 66 Ah
 4LD 820 = 70 Ah



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12.5 V 14 A alternator

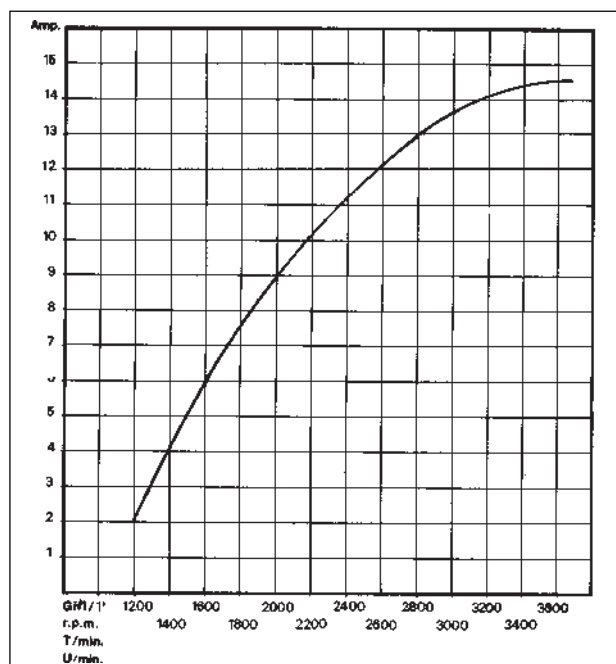
It is equipped with a fixed rotor assembled on the main journal, while the pivoting rotor is housed inside the flywheel.

Dimensions (mm):

A = 159
 B = 44.5
 C = 4
 D = 28.5

Note: The clearance between inductor and rotor (air gap) shall be 0.5 ÷ 0.6 mm.

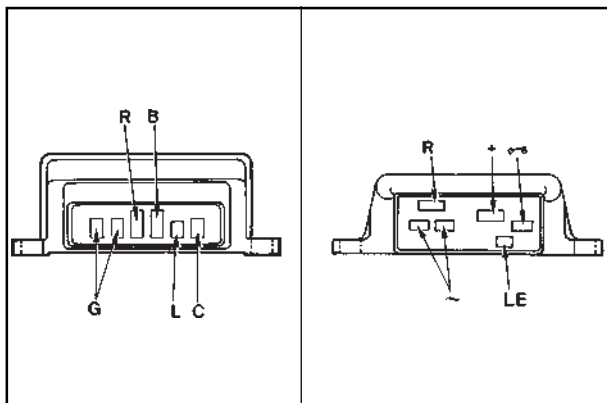
77



12,5 V, 14 A alternator battery recharge curve

It is carried out at + 25° C ambient temperature, 12.5 V battery voltage.

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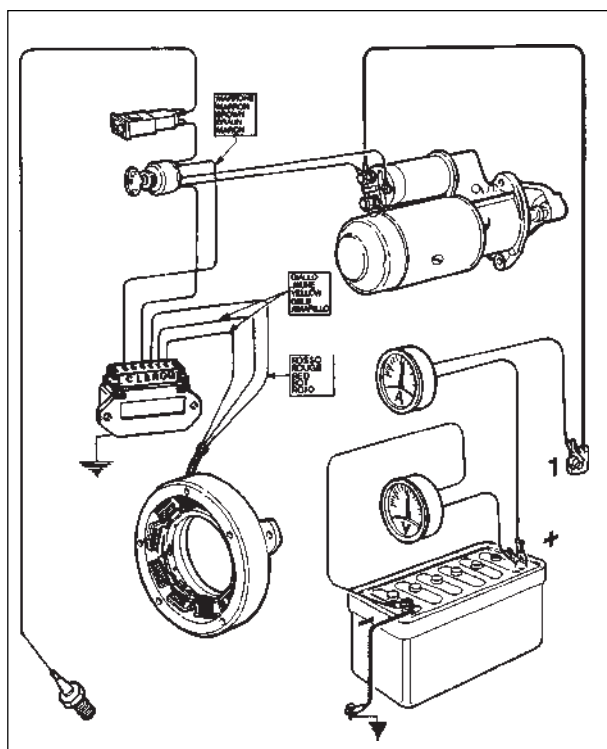
79

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Voltage regulator

There are two different types of regulators: one with make SAPRISA, ALTECNA, NISCA and the other with make DUCATI.

| ALTECNA SAPRISA NISCA | Cable colours | DUCATI | Tab dimensions | |
|-----------------------------|------------------|--------|----------------|-----------|
| | | | Width | Thickness |
| ~ | yellow | G | 6.25 | 0.8 |
| R | red | R | 9.50 | 1.2 |
| + | red | B | 9.50 | 1.2 |
| LE | green | L | 4.75 | 0.8 |
| ∞ | brown | C | 6.25 | 0.8 |



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Voltage regulator, running check

Make sure that the connections are in compliance with the diagram.

Remove the respective clamp from the battery positive pole. Insert a voltmeter with direct current between the two poles of the battery.

Connect a 20A ammeter at direct current between the positive pole and cable 1 respective clamp.

Start a few times until the battery voltage goes down to 13 V.

When the battery voltage reaches 14.5 V, the ammeter current will drop to a value near zero.

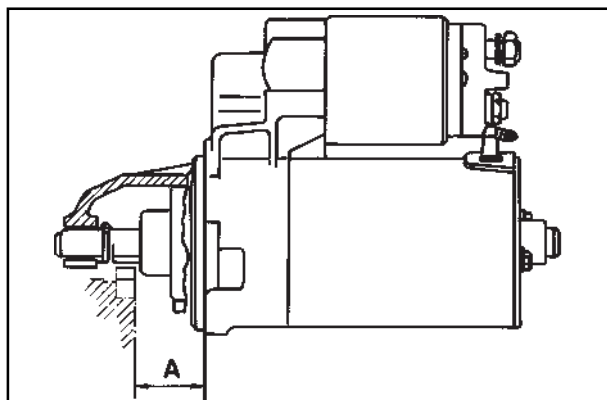
If the voltage is lower than 14 V and the recharge current is zero, replace the regulator.

Note: The voltage regulator does not work when not earthed and the battery is completely discharged.

Warning: when the engine runs, do not remove the battery cables and do not take the key off the control board.

Do not place the regulator near heat sources, a temperature exceeding 75° C could cause damages.

Avoid any electric welding either on the engine and on the equipment.



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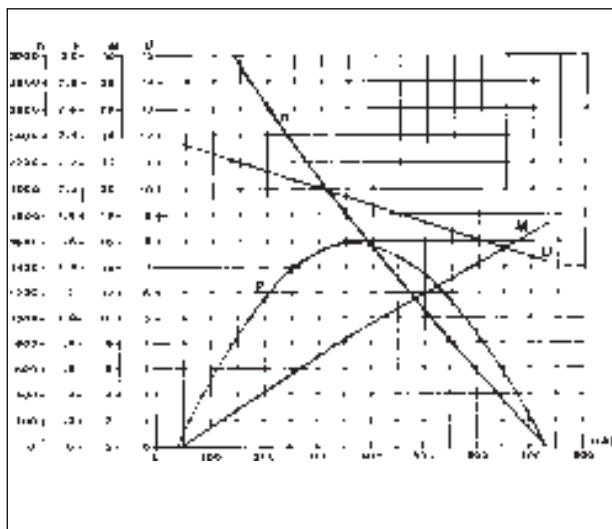
Bosch DW (L) 12 V 1, 1 KW type, starting motor

For 3LD 450, 3LD 510

Anticlockwise rotation direction (seen from the flywheel side)

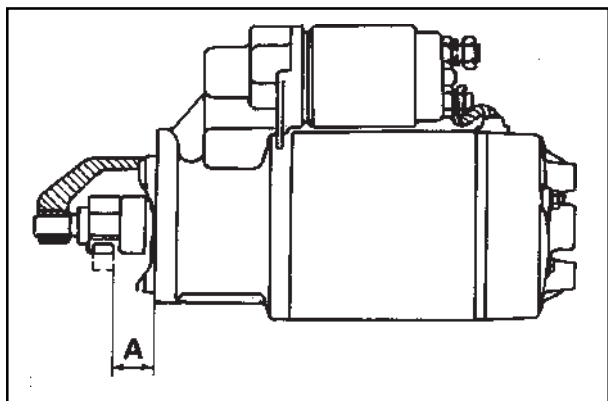
A = 29.5 ÷ 31.5 mm (rim surface and motor flange distance)

Note: For any possible repairs, please contact bosch service centres.



Characteristic curves for Bosch DW(L) 12V 1.1 kW type, starting motor

83



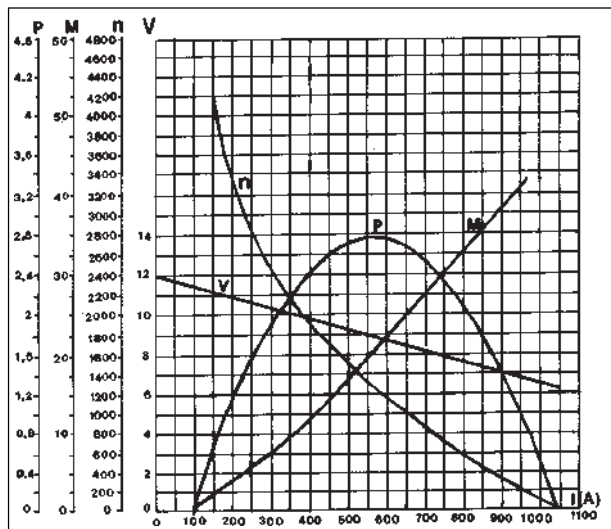
Bosch JF(L) 12V 2.5 kW type, starting motor

For 4LD 640, 4LD 705, 4LD 820

Anticlockwise rotation (seen from the pinion side)

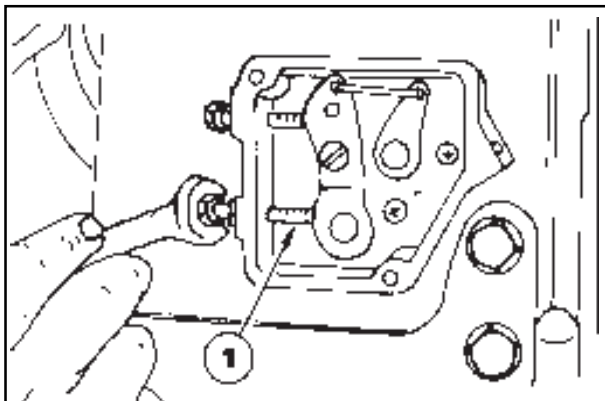
A = 23 ÷ 25 mm

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Characteristic curves for Bosch JF(L) 12V 2,5 kW type starting motor

85

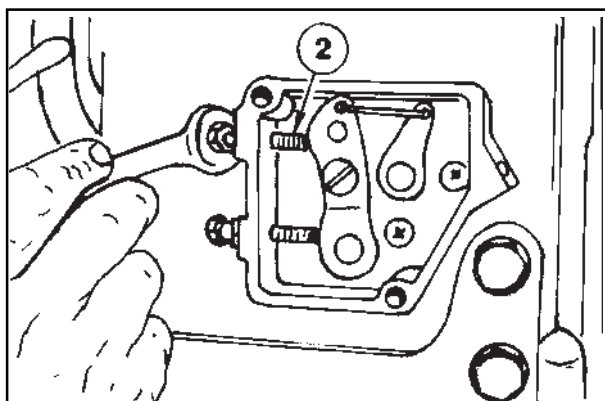


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Minimum rpm adjustment at idle running (standard)

After filling the engine with oil and fuel, start and warm up the engine for 10 minutes.

Actuating the adjusting screw 1, set the idling at 1150 rpm; then fasten the lock nut.

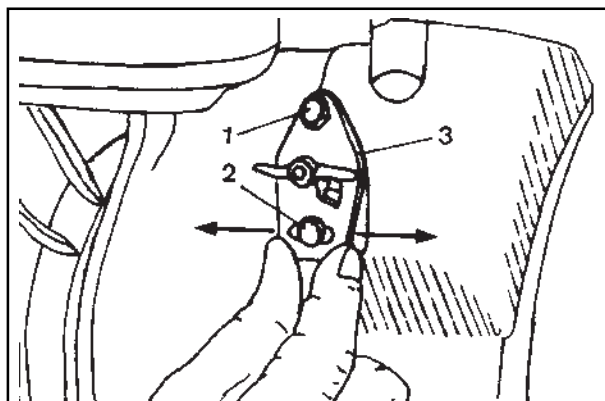


87

Peak rpm adjustment at idle (standard)

After adjusting the minimum rpm, set the screw 2 and adjust the peak rpm at 3200 rpm at idle; then fasten the lock nut.

Note: The peak rpm standard idle adjustment of 4LD 820 shall be carried out at 2800 rpm.



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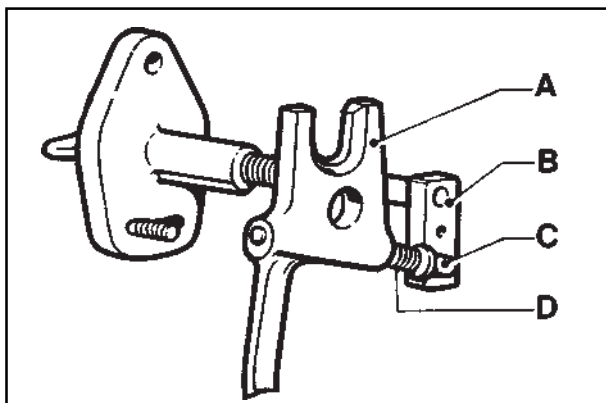
Injection pump delivery adjustment (standard)

This adjustment shall be carried out with the engine at dynamometric brake, otherwise the resulting adjustment could be approximate; in this case operate as it follows.

- Unloose the screws 1 and 2 by 1/4 of a turn
- Move the limiting device 3, thus the screw 2 stays in the centre of the slot. Tighten the screws 1 and 2.

Carry out the exhaust smoke check as it follows:

- Abruptly start the accelerator at idle.
In case of a quick pickup with light exhaust smoke to the Bosch scale index 3, this means that the limiting device is correctly adjusted.
- In case of a slow pickup without smoke, move the limiting device towards the left (pumping duration increase).
- In case of a rapid pickup with thick smoke (exceeding index 3 of Bosch scale), move the limiting device towards the right (pump duration decrease).



Limiting device for injection pump delivery and torque gearing device

It is housed in the pump control lever **A** and it is constituted of a spring on cam **B**, limiting the stroke of the same lever **A**.

At the torque rate, the spring flexure, subject to the accelerator control action, allows a further stroke of lever **A**, thus an increased delivery of the injection pump.

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Adjustment of injection pump delivery with braked engine

- 1) Bring the engine to its idling point .
- 2) Move the delivery limiting device 3 towards the left, see picture 88
- 3) Operate the engine until it reaches the power and rpm required by the manufacturer of the equipment.

- 4) Make sure that the consumption is in compliance with the values specified in the table of the adjustments (see information below).

If the consumption is in compliance with the fixed values, it is essential to change the balance conditions measured on the brake, operating either on the load and on the regulator.

When the engine is steady, carry out the consumption check again.

- 5) Move the limiting device 3 towards the right, as per picture 88, until the engine rpm number decreases. Lock the limiting device by means of the two screws.

- 6) Completely release the brake and check the rpm at which the engine settles. The speed governor performances shall be in compliance with the class required by the manufacturer of the equipment.

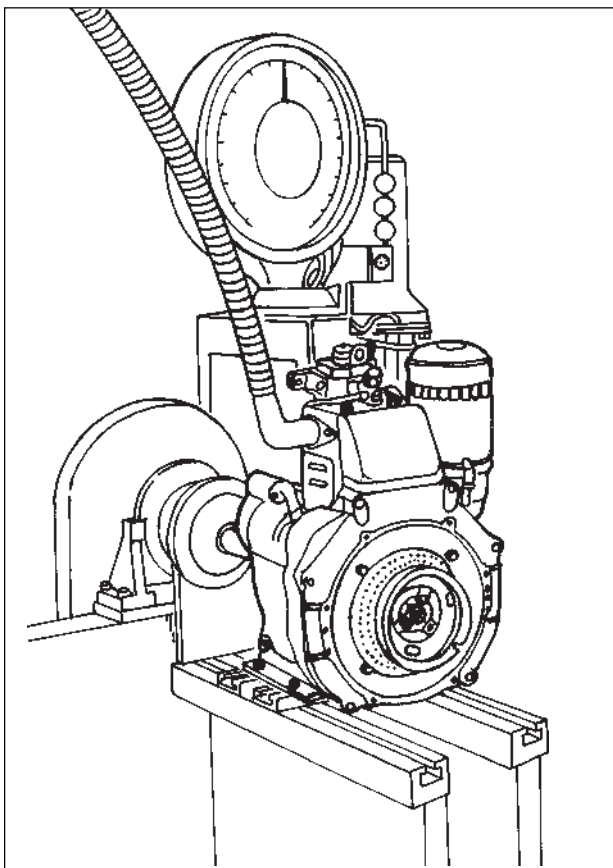
- 7) Stop the engine.

- 8) When the engine is cold, check the valve clearance again.

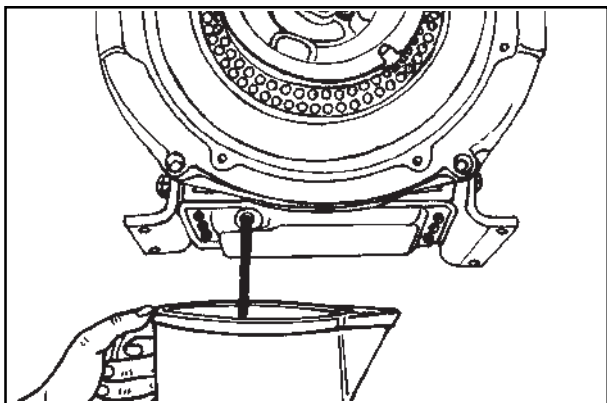
Required adjustments (the most demanded)

| Engine | Rpm | Kw power | Specific fuel consumption * | |
|---------|------|----------|-----------------------------|---------|
| | | | Time secs for 100 cc. | r/kW.h |
| 3LD 450 | 3000 | N 7,5 | 140-146 | 272-283 |
| 3LD 450 | 3600 | NB 7 | 143-149 | 285-299 |
| 3LD 510 | 3000 | N 9 | 117-122 | 272-283 |
| 4LD 640 | 3000 | N 10,5 | 96-100 | 284-295 |
| 4LD 705 | 3000 | N 10,8 | 96-100 | 276-287 |
| 4LD 705 | 2600 | N 10 | 108-113 | 263-277 |
| 4LD 820 | 2600 | N 12,1 | 87-92 | 258-273 |

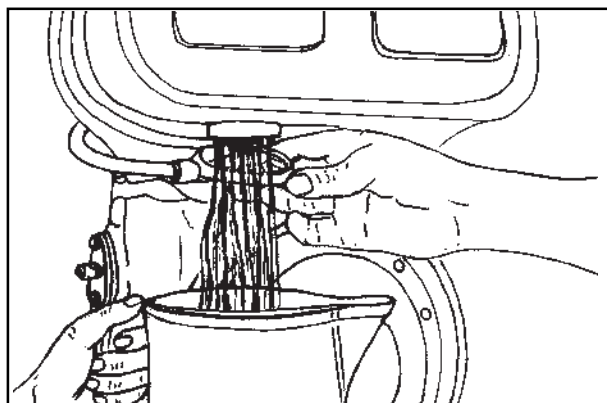
* The specific consumption values indicated are valid after abt. 100 working hours.



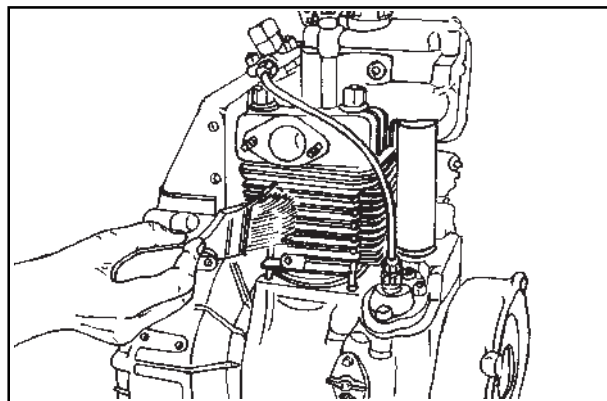
90



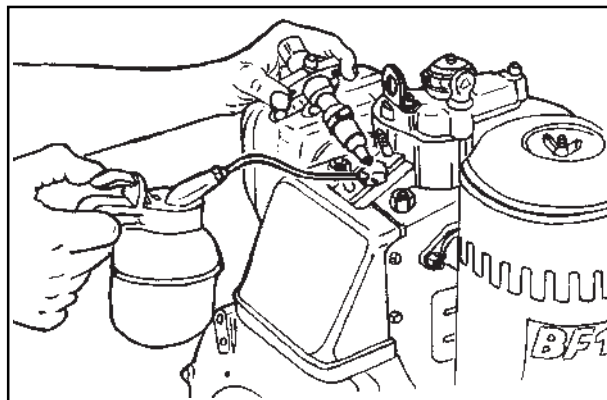
91



92



93



94

UPKEEPING

The engines to be stored for more than 30 days shall be prepared as follows:

Temporary protection (1 ÷ 6 months).

- Start the engine at idle and at a minimum rpm for at least 15 minutes.
- Fill the sump with protection oil MIL -1-644-P9 and operate for 5 ÷ 10 minutes at 3/4 of maximum speed.
- When the engine is heated, empty the sump and refill with new normal oil (picture 91).
- Remove the fuel filter cover and empty the tank (picture 92).
- Desassemble the fuel filter, replace the cartridge and, if it is not dirty, reassemble it.
- Carefully clean fins, cylinder and head (picture 93).
- Seal with adhesive tape all the openings.
- Remove the injector, (picture 94) pour abt. a spoon of oil SAE 30 into the cylinder and manually turn in order to spread the oil. Reassemble the injector.
- Spray SAE 10W oil in the exhaust and intake duct, rocker arms, valves, tappets, etc. and protect with some grease the parts which are not painted.
- Wrap the engine in plastic cloth.
- Keep it in a dry place, possibly not in direct contact with the ground and away from high voltage electric lines.

Permanent protection (over 6 months)

Apart from the previous instructions, we advise you to:

- Treat the lubrication and injection system, together with the mobile parts, with rust preventing oil having MIL-L-21260 P 10 2nd degree features, SAE 30 (i.e. ESSO RUST - Ban 623 - AGIP, RUSTIA C. SAE 30). Run the engine equipped with rust preventing oil and let the exceeding oil off.
- Coat the external non-painted surfaces with rust preventing oil, having the MIL - C - 16173D features - 3rd degree (For example ESSO RUST BAN 398 - AGIP, RUSTIA 100/F).

Preparation for the setting at work

- Clean the external part of the engine.
- Remove all protections and coverings.
- Remove the rust preventer from the external part by means of a suitable solvent or degreasing product.
- Desassemble the injector, fill it with normal oil, pivot the drive shaft of some turns, then desassemble the sump and let the oil containing the protective element off.
- Check the injector, valve clearance, head tightening, oil and air filter setting. If the engine has been stored for quite a long period (over 6 months), check a bearing in order to find any possible trace of corrosion.

3LD450, 3LD510, 4LD640, 4LD705, 4LD820 FEATURES

| ENGINE TYPE | 3LD450 | 3LD510 | 4LD640 | 4LD705 | 4LD820 |
|---|--------------------------------------|----------------|----------------|----------------|--------------|
| Cylinders | 1 | 1 | 1 | 1 | 1 |
| Bore | 85 | 85 | 95 | 100 | 102 |
| Stroke | 80 | 90 | 90 | 90 | 100 |
| Displacement | 454 | 510 | 638 | 707 | 817 |
| Compression ratio | 17,5:1 | 17,5:1 | 17,0:1 | 17,0:1 | 17,0:1 |
| rpm | 3000 | 3000 | 3000 | 3000 | 3000 |
| KW Power | N DIN 70020 - 80/1269/CEE - iso 1585 | | | | |
| | NB DIN 6271 - ISO 3046 - 1 IFN | | | | |
| | NA DIN 6271 - ISO 3046 - 1 ICXN | | | | |
| Peak torque * | 28,5 @ 1700 | 32,8 @ 1800 | 38,7 @ 1700 | 43,1 @ 2000 | 48 @ 1600 |
| Fuel specific consumption | 1,7 | 1,9 | 2,4 | 2,6*** | 3,0*** |
| Oil consumption | 0,007 | 0,008 | 0,024 | 0,030*** | 0,035*** |
| Dry weight | 57 | 60 | 100 | 100 | 105 |
| Combustion air volume at 3000 rpm | 560 | 630 | 780 | 770 D | 890 D |
| Cooling air volume at 3000 rpm | 9000 | 9000 | 12000 | 10400 D | 10400 D |
| Max. axial load permissible for drive shaft in two directions | 250 | 250 | 300 | 300 | 300 |
| Max. inclination | instantaneous | | | | |
| | extended to 1 h. | | | | |
| | permanent | | | | |
| | 35° | 35° | 35° | 35° | 35° |
| | 30° | 30° | 25° | 25° | 25° |
| | **** | **** | **** | **** | **** |

* It stands for power

** It stands for NB power

*** It stands to NB power at 2600 rpm

**** According to the application

D at 2600 rpm

Note: For LDA 450, LDA 510, LDA 96, LDA 97, LDA 820 out-of-production engines, the repair specifications are equal to those of the engines specified in the table. 3 LD 451/S, 3LD 510/S engines, which are currently produced, not specified in the table, turn anticlockwise (seen from the flywheel side), and are provided with the same feature as 3LD450 and 3LD510 engines.



3LD 450 - 3LD 510 - 3LD 451/S - 3LD 510/S MAIN DRIVING TORQUES

| POSITION | REFERENCE (Picture NO.) | Dia. /Pitch (mm) | Torque (Nm) |
|---|------------------------------|-----------------------|------------------|
| Injection pump union | 71 | 18x1.5 | 40 |
| Connecting rod | 36 | 8x1.25 | 30 |
| Clutch bearing bell bolt | - | 14x1.5 | 250 |
| Flanging bell | - | 8x1.25 | 25 |
| Clutch bell (industrial engine) | - | 16x1.5 | 80 |
| Rocker arm box cap | 8 | 8x1.25 | 20 |
| Oil sump | - | 6x1 | 10 |
| Oil pump case | 58 | 8x1.25 | 30 |
| Air filter | 1 | 8x1.25 | 25 |
| Oil filter | - | 8x1.25 | 25 |
| Oil pump gear | 58 | 8x1.25 | 20 |
| Injector towards the head | 75 | 8x1.25 | 15 |
| Rocker arm fulcrum pin for injection pump | - | 14x1.5 | 60 |
| Gear pin for speed governor | - | 10x1.5 | 40 |
| Engine foot | - | 8x1.25 | 40 |
| Injection pump | 69 | 8x1.25 | 25 |
| Distributor side port | 40 | 8x1.25 | 25 |
| Oil pressure switch | - | 12x1.5 | 35 |
| Starting pulley | 4 | 8x1.25 | 35 |
| Main bearing on flywheel side | 63 | 8x1.25 | 25 |
| Sump oil drain bolt | - | 10x1.5 | 35 |
| Cylinder | 14 | 10x1.5 | 50 |
| Flywheel | 3 | 20x1.5 | 170 |

MAIN DRIVING TORQUES 4LD 640 - 4LD 705 - 4LD 820

| POSITION | Reference (picture no.) | Dia. / Pitch (mm) | Torque (Nm) |
|---|-----------------------------|------------------------|------------------|
| Injection pump unit | 71 | 18x1.5 | 40 |
| Connecting rod | 36 | 10x1.5 | 45 |
| 4LD 820 clutch bearing bell bolt | - | 14x1.5 | 280 |
| 4LD 640, 4LD clutch bearing bell bolt | - | 14x1.5 | 250 |
| Bolt for hub | - | 14x1.5 | 280 |
| Flanging bell | - | 10x1.5 | 40 |
| Rocker arm box cap | 8 | 8x1.25 | 20 |
| Oil sump | - | 8x1.25 | 25 |
| Oil pump case | 58 | 8x1.25 | 40 |
| Air filter | 1 | 10x1.5 | 50 |
| Oil filter | - | 8x1.25 | 25 |
| Oil pump gear | 58 | 8x1.25 | 20 |
| Injector towards the head | 75 | 8x1.25 | 20 |
| Rocker arm pin for injection pump control | - | 8x1.25 | 30 |
| Gear pin for speed governor | - | 10x1.5 | 40 |
| Engine foot | - | 10x1.5 | 40 |
| Injection pump | 69 | 8x1.25 | 30 |
| Distributor side port | 41 | 10x1.5 | 40 |
| Oil pressure switch | - | 12x1.5 | 35 |
| Starting pulley | 4 | 10x1.5 | 40 |
| Main bearing on flywheel side | 64 | 10x1.5 | 40 |
| Sump oil drain bolt | - | 14x1.5 | 70 |
| Cylinder head | 14 | 12x1.5 | 80 |
| Flywheel | 3 | 20x1.5 | 350 |

USE OF DOPE FOR 3LD 450 - 3LD 510 - 3LD 451/S - 3LD 510/S




| POSITION | TYPE OF SEALANT |
|--|-----------------|
| Clutch bearing bell and embedded hexagonal-head screws | LOCTITE 270 |
| Control pin threading | LOCTITE 270 |
| Coupling nipple for oil filter cartridge | LOCTITE 270 |
| Stud bolt for clamping on engine head | LOCTITE 270 |
| Stud bolt for clamping on main bearing flywheel side | LOCTITE 270 |
| Stud bolt for clamping on distributor port side | LOCTITE 270 |
| Stud bolt on engine bell | LOCTITE 270 |
| Clamping screw for pin regulator | LOCTITE 270 |
| Clamping screw for baffle on air conveyor | LOCTITE 270 |
| Stud bolt for clamping on engine flange bell | LOCTITE 270 |
| Rocker arm fulcrum pin for injection pump control | LOCTITE 270 |
| Bracket clamping screw on side plates | LOCTITE 270 |
| Stud bolt for clamping at feeding pump | LOCTITE 270 |

USE OF DOPE FOR 4LD 640 - 4LD705 - 4LD 820

| POSITION | TYPE OF SEALANT |
|---|-------------------------------|
| Bearing on port or bell | LOCTITE 270 |
| Regulating pin threading | LOCTITE 270 |
| Stud bolt for clamping on engine head | LOCTITE 270 |
| Stud bolt for clamping on main bearing on flywheel side | LOCTITE 270 |
| Stud bolt for clamping on distribution side | LOCTITE 270 |
| Lock screw for rocker arm pin | LOCTITE 270 |
| Clamping screw for regulating pin | LOCTITE 270 |
| Industrial port | DOW CORNING Q3 - 7091SILICONE |
| Stud bolt for clamping on feeding pump | LOCTITE 270 |



DRIVING TORQUES FOR STANDARD SCREWS

| NAME |  | |  | |  | |
|------------------------|---|-------|--|-------|---|-------|
| Dia. per pitch (mm) | R ≥ 800 N/mm ² | | R ≥ 1000 N/mm ² | | R ≥ 1200 N/mm ² | |
| | Nm | Kgm | Nm | Kgm | Nm | Kgm |
| 4x0.70 | 3.6 | 0.37 | 5.1 | 0.52 | 6 | 0.62 |
| 5x0.80 | 7 | 0.72 | 9.9 | 1.01 | 11.9 | 1.22 |
| 6x1.00 | 12 | 1.23 | 17 | 1.73 | 20.4 | 2.08 |
| 7x1.00 | 19.8 | 2.02 | 27.8 | 2.84 | 33 | 3.40 |
| 8x1.25 | 29.6 | 3.02 | 41.6 | 4.25 | 50 | 5.10 |
| 9x1.25 | 38 | 3.88 | 53.4 | 5.45 | 64.2 | 6.55 |
| 10x1.50 | 52.5 | 5.36 | 73.8 | 7.54 | 88.7 | 9.05 |
| 13x1.75 | 89 | 9.09 | 125 | 12.80 | 150 | 15.30 |
| 14x2.00 | 135 | 13.80 | 190 | 19.40 | 228 | 23.30 |
| 16x2.00 | 205 | 21.00 | 289 | 29.50 | 347 | 35.40 |
| 18x2.50 | 257 | 26.30 | 362 | 37.00 | 435 | 44.40 |
| 20x2.50 | 358 | 36.60 | 504 | 51.50 | 605 | 61.80 |
| 22x2.50 | 435 | 44.40 | 611 | 62.40 | 734 | 74.90 |
| 24x3.00 | 557 | 56.90 | 784 | 80.00 | 940 | 96.00 |

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