GENERAL PUMP

HS

Repair Manual

HS18 - HS20

General Pump
is a member of
the Interpump Group

Ref 310071 Rev.A
06-17

INDEX

1. INTRODUCTION

This manual describes the instructions for Repairing HS Series pumps, and must be carefully read and understood before performing any repair intervention on the pump. Correct use and adequate maintenance is fundamental for the pump's regular operation and long wear. General Pump declines any responsibility for damage caused by the misuse or the non-observance of the instructions described in this manual.

2. REPAIR INSTRUCTIONS

2.1 Crank Mechanism Repair

Crank mechanism repair operations must be carried out after draining the oil from the crankcase. To drain the oil, remove the oil dipstick, 1, Fig. 1, and then the draining plug (2, fig. 1).

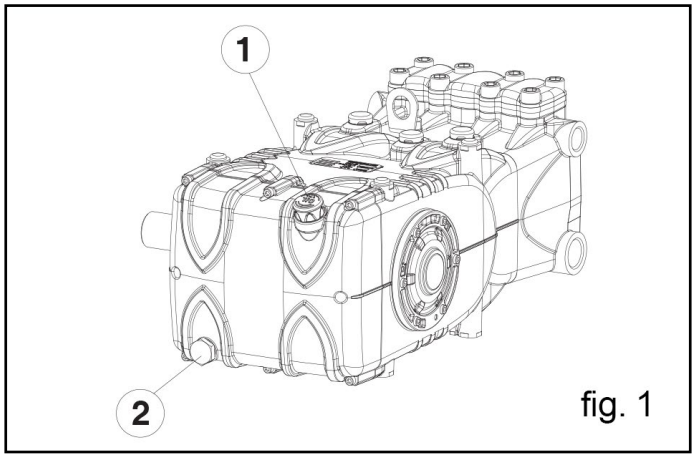

fig. 1

Exhausted oil must be collected in an appropriate receptacle and disposed of in designated locations. In absolutely no case may it be disposed of in the environment.

2.1.1 Crank Mechanism Disassembly

The operations described must be performed after removing the hydraulic part, ceramic pistons and splash guards from the pump (par. 2.2.3, 2.2.4).

The correct sequence is the following

Disassemble:

- Pump shaft key
- Rear cover
- The con-rod as follows: unscrew the cap fixing screws, remove the con-rod caps with their lower half-bearings (fig. 2) paying attention to the numbered sequence during disassembly.

To avoid possible errors, caps and con-rod shanks have been numbered on one side (1, fig. 2/a)

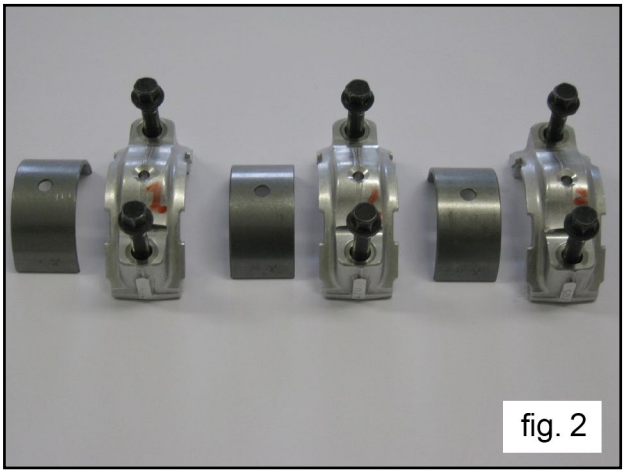

fig. 2

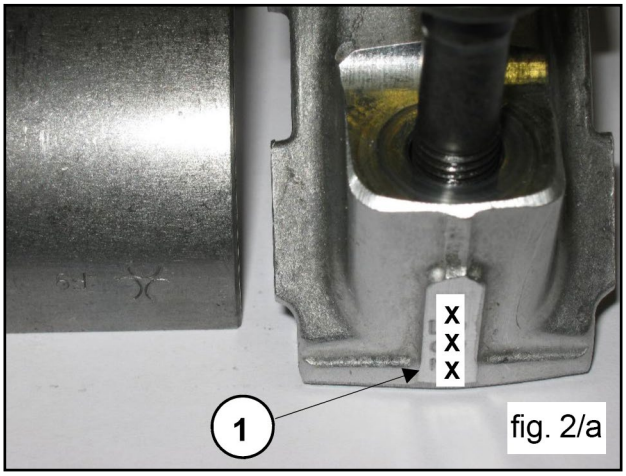

fig. 2/a

- Side covers using 3 fully threaded M6 x 50 screws, inserting them in the threaded holes as indicated in fig. 3.

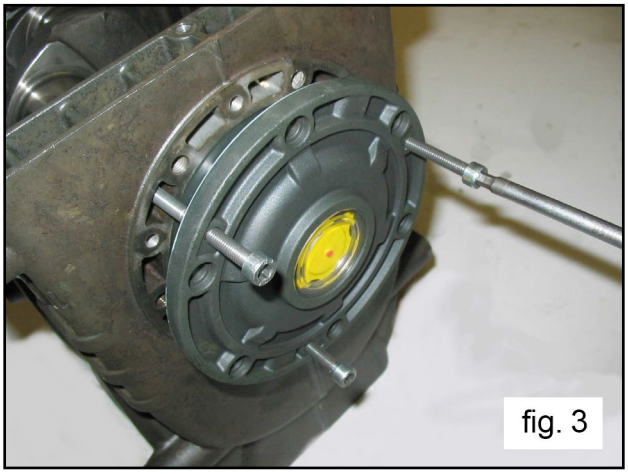

fig. 3

• Push the plunger guides forward with their con-rods to facilitate side extraction of the pump shaft. There are two reference points visible on the crankshaft (indicated with pos. 1 in fig. 4 and in fig. 4/a). These must be turned towards the operator to facilitate extraction.

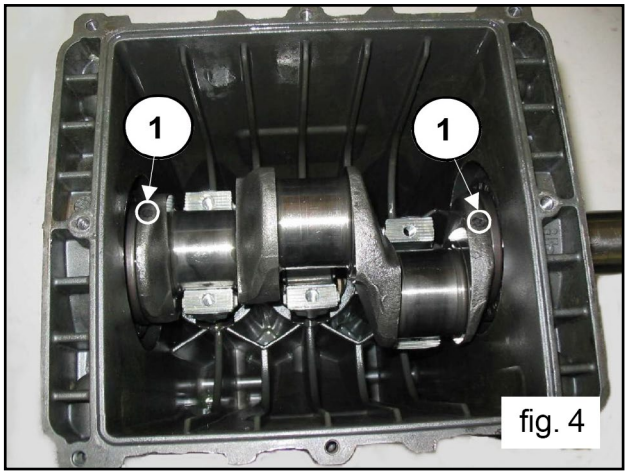

fig. 4

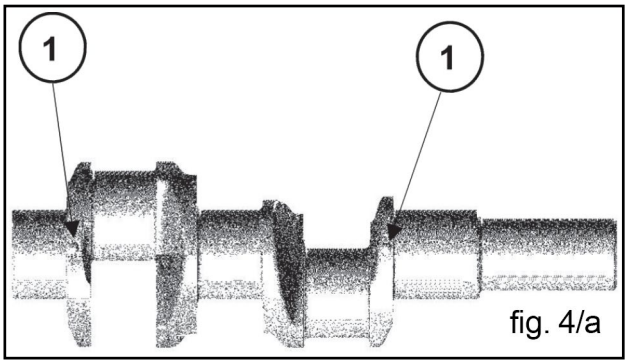

fig. 4/a

• Remove the pump shaft
• Complete disassembly of the con-rod units by removing them from the crankcase and removing the plunger guilde pins.
• Remove the pump shaft seal rings using standard tools.
• Remove the plunger guide seal rings as described below:
Use the extractor hammer (#F27503900) (1, fig.5) and the pliers (#F27503900) (2, fig. 5). Insert the gripper as far as possible onto the seal ring with the aid of a hammer(fig. 5/a), sub sequently screwing the extractor to the gipper, and use the extractor hammer (fig. 5/b) until the ring to be replaced is removed (fig. 5/c).

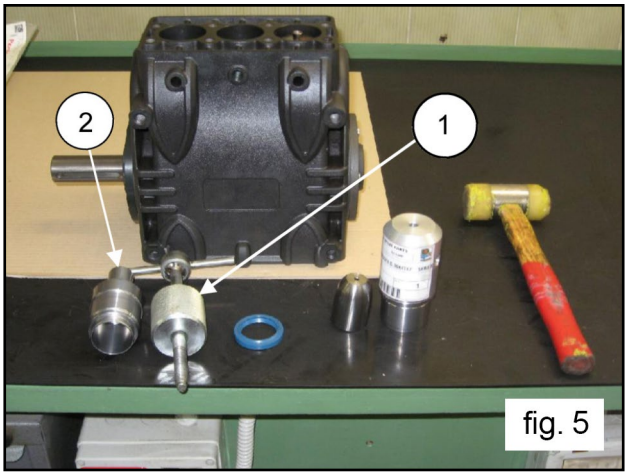

fig. 5

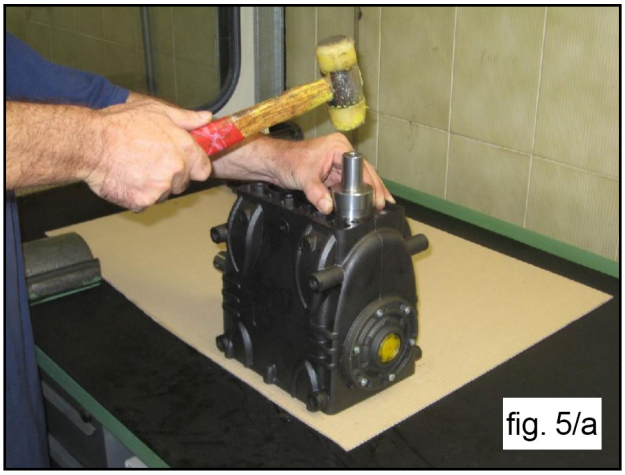
fig. 5/a

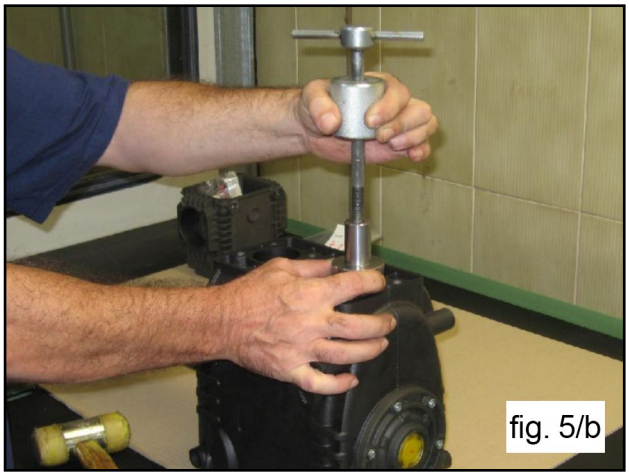

fig. 5/b

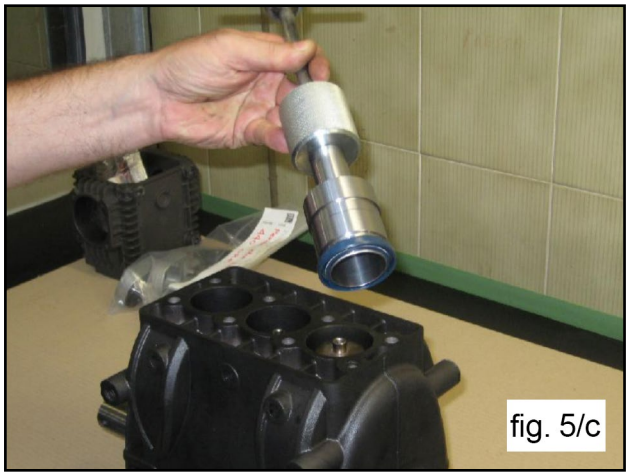

fig. 5/c

When disassembling the con-rod groups check the wear status of the plunger guide rods (1, fig. 5/d), if necessary replace them removing the 2 fixing M6 screws (1, fig. 5/d).

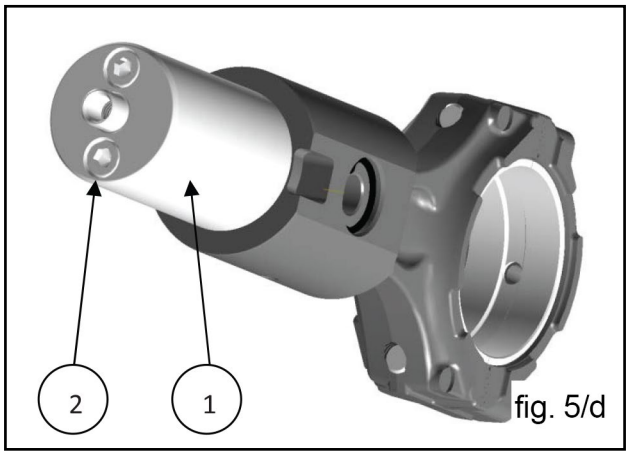

fig. 5/d

2.1.2 Crank Mechanism Assembly

After cleaning the crankcase, reassemble the crankcase mechanism as follows:

• Assemble the upper and lower half-bearings in their seats in the con-rods and caps. **Make sure that the reference marks on the upper half- bearings (1, fig. 6) and lower half-bearing (2, fig. 6/a) are positioned in their respective seats in the con-rod and cap.**

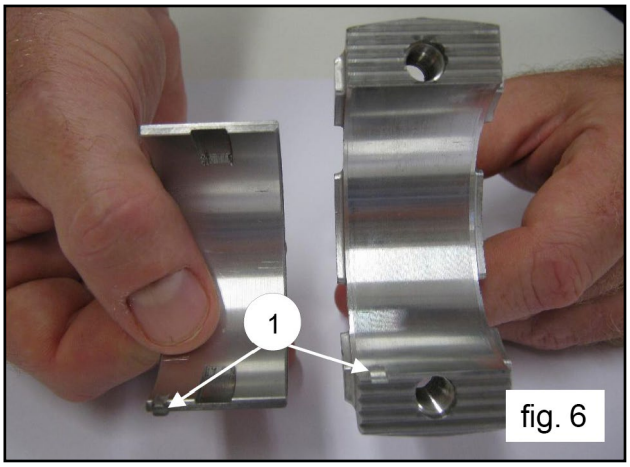

fig. 6

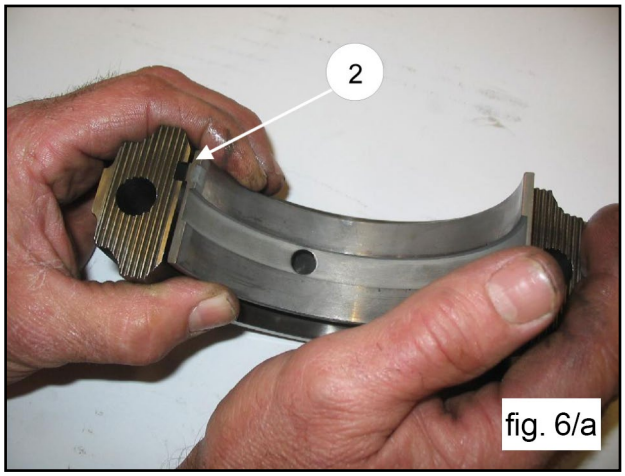

fig. 6/a

If the plunger guide rods have been disassembled, before reassembling them check the correct positioning of the sealing O-rings (1, fig. 6/b) replace them if necessary. Tighten the plunger guide rods through the respective two M6 screws to the tightening torque indicated in the table on page 20.

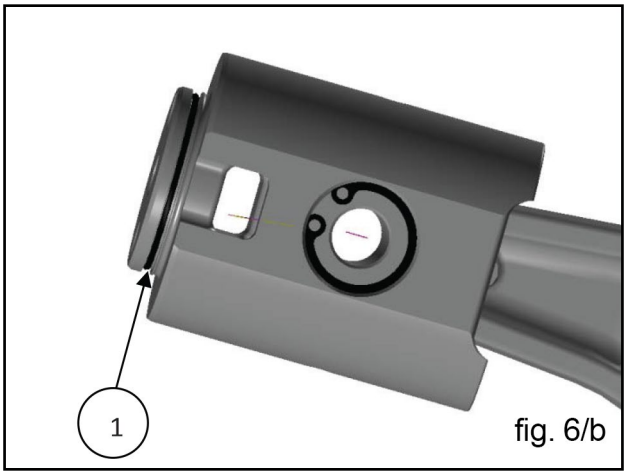

fig. 6/b

• Insert the plunger/con-rod guide units into the crankcase, directing the numbering on the con-rod shank towards the top of the casting.

To facilitate pump shaft insertion (without the tab), it is essential to repeat the operation performed during disassembly, pushing the plunger/con-rod guide units as far down as possible (paragraph. 2.1.1).

• Before assembling the side cover on the PTO side, check the conditions of the radial ring lip seal and relative contact area on the shaft.

If replacement is necessary, position the new ring using a tool (#F27904800) as shown in fig. 7

If the pump shaft shows diametrical wear in the area of contact with the lip seal, in order to prevent the grinding operation, it is possible to reposition the ring in abutment with the cover as shown in fig. 7.

Before assembling the side covers, make sure there are O-rings on both of them and shim rings on the indicator side cover only.

To facilitate filling of the first section and relative press fitting of the covers on the crankcase, we recommend using 3 partially-threaded M6 x 40 screws (1, fig. 8), then completing the operation with screws supplied (M6 x 18).

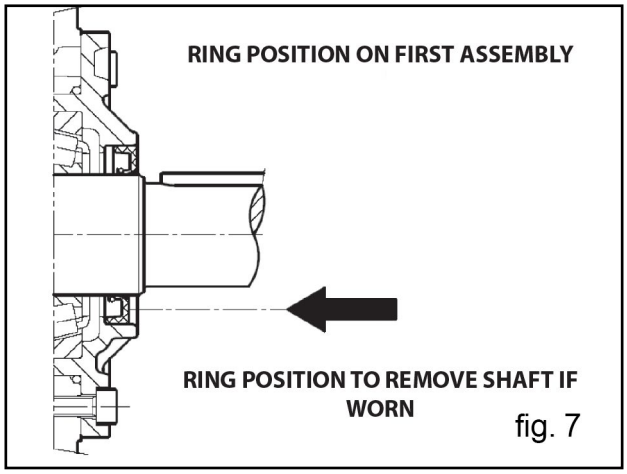

fig. 7

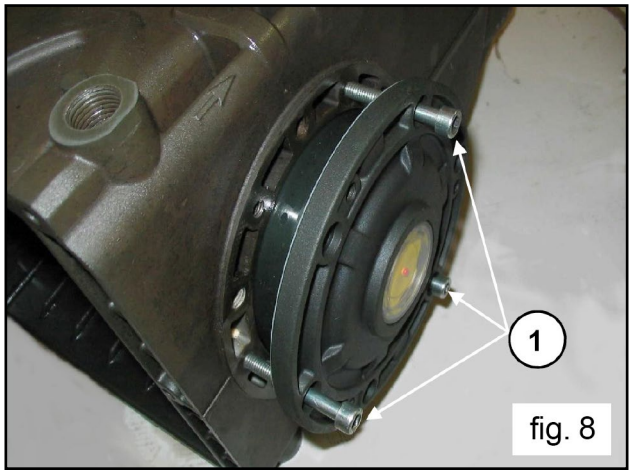

fig. 8

• Couple the con-rod caps to their shanks, referring to the numbering (1, fig. 9).
Not the correct assembly direction of the caps.

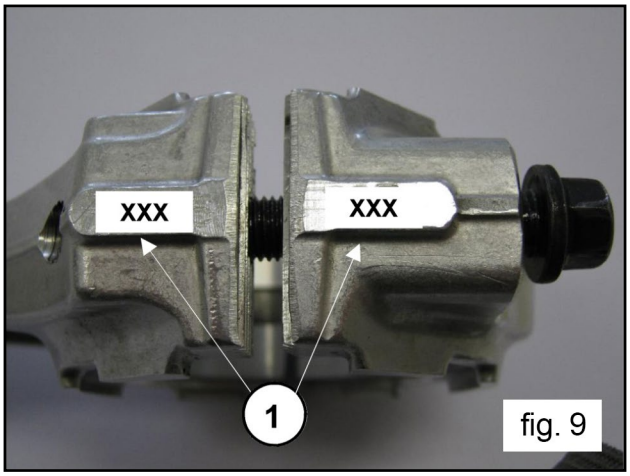

fig. 9

• Fasten the caps to their repective con-rod shanks by means of M8 x 1 x 48 screws (fig. 10) lubricating both the underhead and the threaded shank, proceeding in two different stages:
1. Manually turn the screws until they begin to tighten.
2. Tightening torque 22.13 ft lbs (30 Nm)

Alternatively, ensure:
1. Pre-tightening torque 7.38-11.06 ft lbs (10-15 Nm)
2. Tightening torque 22.13 ft lbs (30 Nm)

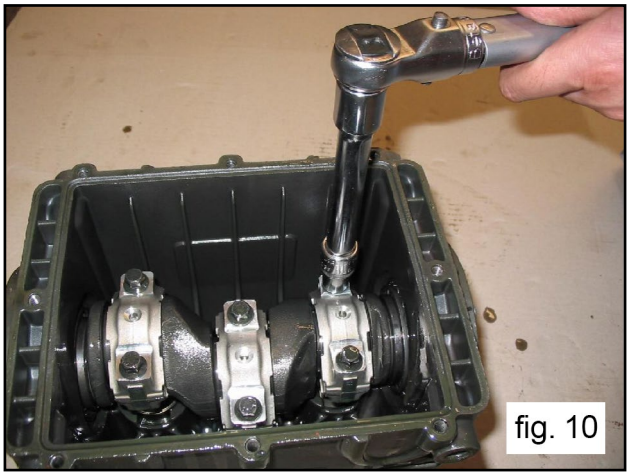
fig. 10

• After having completed tightening operations, check that the con-rod head has a side clearance in both directions.

• Insert the new plunger guide seal rings as far as possible into the relative seat on the crankcase (fig. 11), following the procedure described:
Use tool (#F27904900) composed of a tapered bush and buffer. Screw the tapered bush into the hole in the plunger guide (fig. 11/a), insert the new seal ring on the buffer as far as it will go (determined by the height of the buffer) into its seat on the crankcase (fig. 11/b), remove the tapered bush (fig. 11/c).

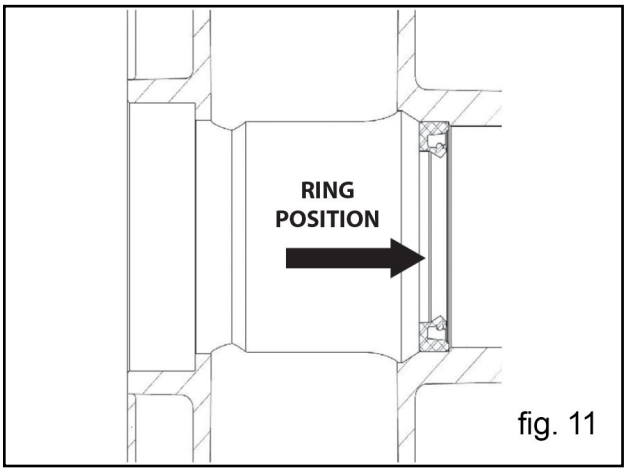

fig. 11

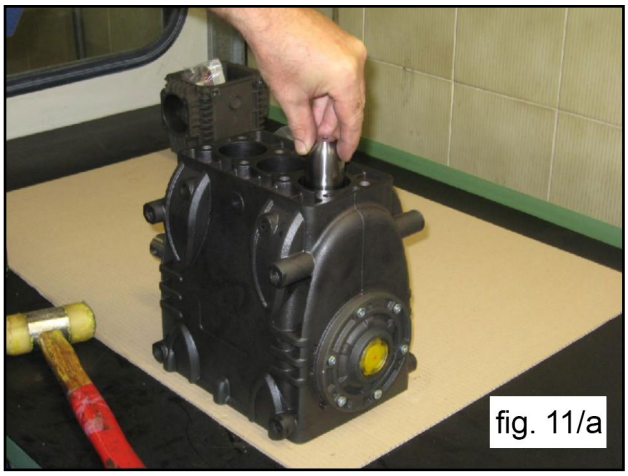
fig. 11/a

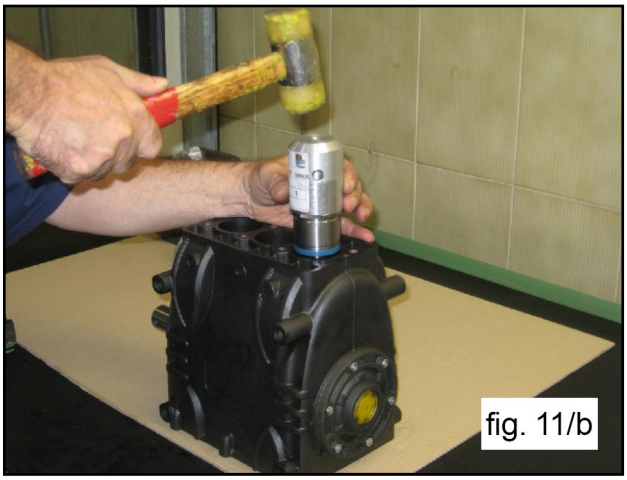
fig. 11/b

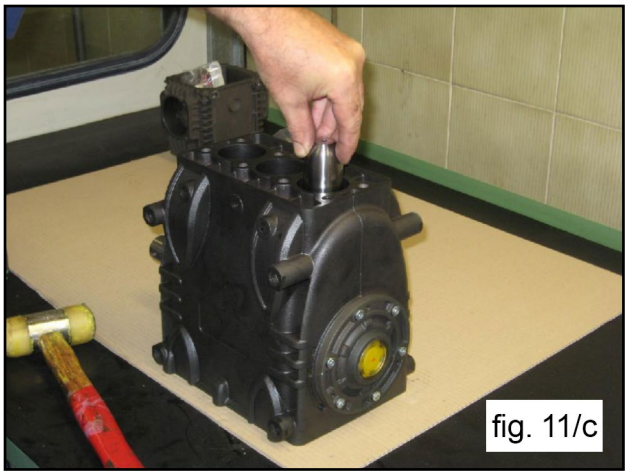
fig. 11/c

• Mount the rear cover complete with O-ring, positioning the dipstick hole upward.
• Insert oil in the casing as indicated in the **Use and maintenance manual**.

2.1.3 Assembly / Disassembly of bearings and shims

The type of bearings (taper roller) ensures the absence of axial clearance on the bend shaft. The shims are defined to meet this necessity. For disassembly / reassembly and for any replacements, carefully observe the following directions:

A) Assembly / Disassembly of the crankshaft without replacing the bearings

After removing the side covers, as indicated in paragraph 2.1.1, check the rollers and their races for wear; if all parts are in good condition, fully clean the components with a suitable degreaser and grease them again evenly using the same oil in the crankcase. The same shims can be used again, being careful to insert them only under the indicator side cover. After installing the complete unit (sight glass side flange, shaft and engine side flange), check that the shaft's rolling torque - with the connecting rods free - is at least 3 Ft. Lbs. (4 Nm), Max 5 Ft. Lbs. (7 Nm). To position the two side covers on the crankcase, initially use 3 M6 x 40 screws as shown in fig. 8, and then the fastening screws. The shafts rolling torque (with connecting rods coupled must not exceed 6 Ft. Lbs. (8 Nm).

B) Disassembly / Assembly of the Crankshaft With Bearings Replacement

After disassembling the side covers as indicated in paragraph 2.1.1, remove the outer ring nut of the bearings from their covers and the inner ring nut, with the remaining part of the bearing, from the two shaft extremities using a standard pin extractor or similar tool as indicated in fig. 12, fig, 12/a, and Fig. 13.

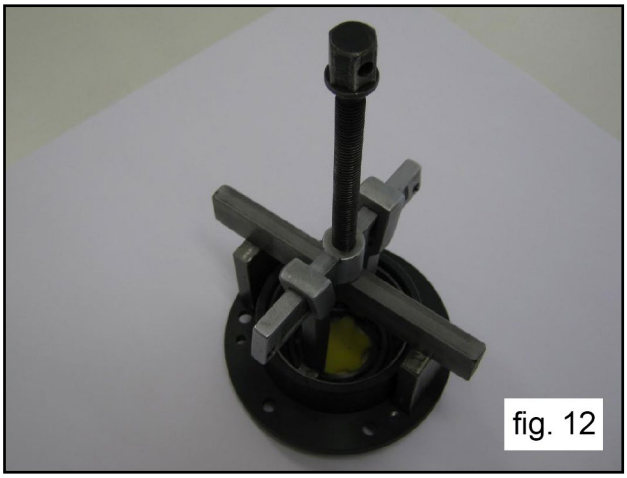
fig. 12

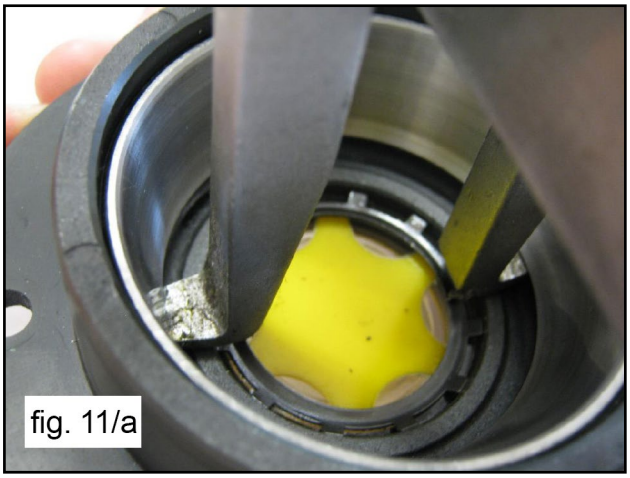
fig. 11/a


fig. 13

The new bearings can be mounted cold with a press or rocker, supporting it on the lateral surface of the ring nuts involved in press fitting with the rings. The press fitting operation can be assisted by heating the involved parts to a temperature between 250°F - 300°F (120°C - 150°C), ensuring that the ring nuts fit fully into their seats.

Never exchange the parts of the two bearings.

Determining the shim pack:

Perform the operation with the plunger/con-rod guide units are assembled, the con-rod caps are disconnected and the con-rods are pushed backwards.

• Insert the crankshaft without tab into the crankcase, making sure that the P.T.O. shank comes out of the correct side.

• Secure the P.T.O. side flange to the crankcase, making sure the lip seal as described previously and tighten the screws to the recommended torque.

• Feed the flange on the indicator side without shims in the cover and start to move it closer, manually screwing the M6 x 40 service screws in equally, with small rotations to move th cover in slowly and correctly. At the same time check that the crankshaft rotates freely by turning it manually.

• Continue tightening screws until hardness in crankshaft rotations is experienced. At this point loosen the screws completely.

• Use a thickness gauge to measure the clearance between the side cover and crankcase (see fig. 14).

fig. 14

Determine the shim pack as indicated in the table below:

Measurement	Shim Type	No. of Pieces
From: 0.05 to 0.10	-	-
From: 0.11 to 0.20	0.1	1
From: 0.21 to 0.30	0.1	2
From: 0.31 to 0.35	0.25	1
From: 0.36 to 0.45	0.35	1
From: 0.46 to 0.55	0.35 0.10	1 1
From: 0.56 to 0.60	0.25	2
From 0.61 to 0.70	0.35 0.25	1 1

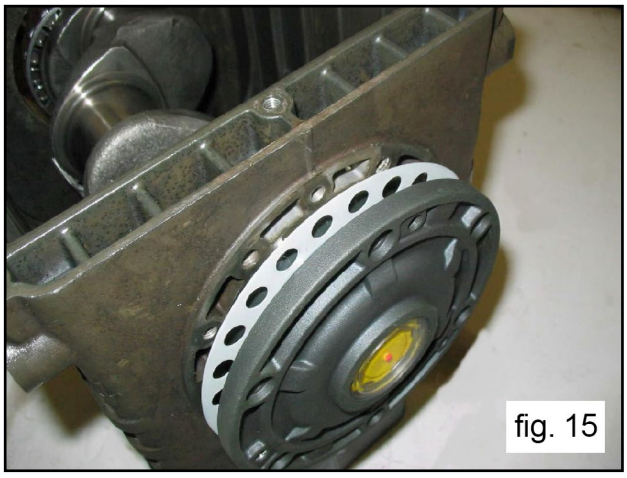
fig. 15

• Insert the shims under the cover on the sight glass side (see fig. 15), secure the cover to the crankcase, following the procedure in paragraph 2.1.2, and tighten the screws to the recommended torque. Verify that the shaft rotation stall torque is between 3-4.5 ft lbs (4-6 Nm).
• If the torque is correct, connect con-rods to the crankshaft, if torque is not correct reposition the shims again repeating the operations.

2.2 Fluid End Repair

2.2.1 Disassembly of the Head - Valve Units

Service operations are limited to valve inspection or replacement if needed, and in any case within the intervals indicated in the “PREVENTIVE MAINTENANCE” table in Chapter 11 of the Owner’s Manual. The valve units are assembled inside the head in a vertical position.

For their extraction proceed as follows:

Unfasten the 8 M14 x 40 valve cover screws (fig. 16); using a slide hammer (#F26019400) extract:
A) the valve plugs (fig 17);
B) the outlet valve units (fig. 18);
C) the valve bushings (fig. 19), also using the tool #F27513600;
D) the inlet valve units (fig 20)

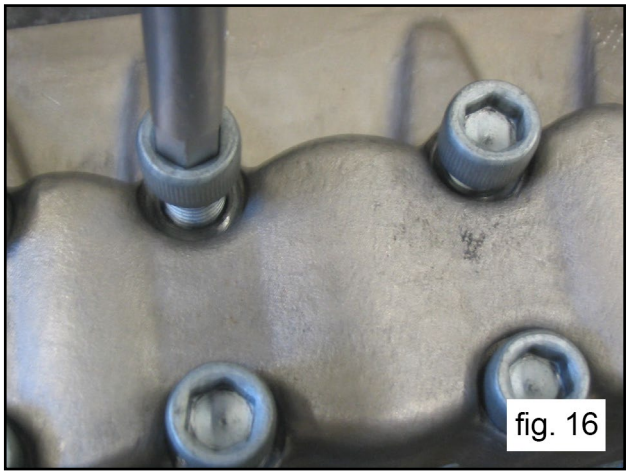
fig. 16

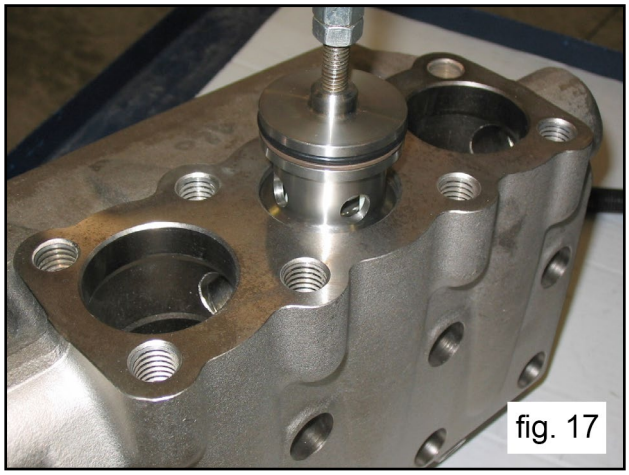
fig. 17

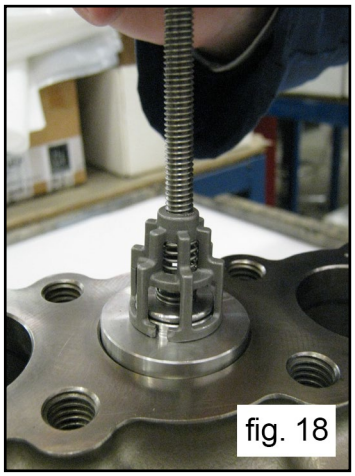
fig. 18

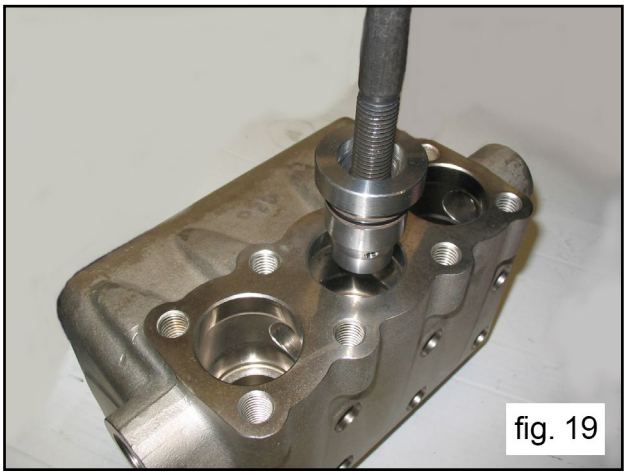
fig. 19


fig. 20

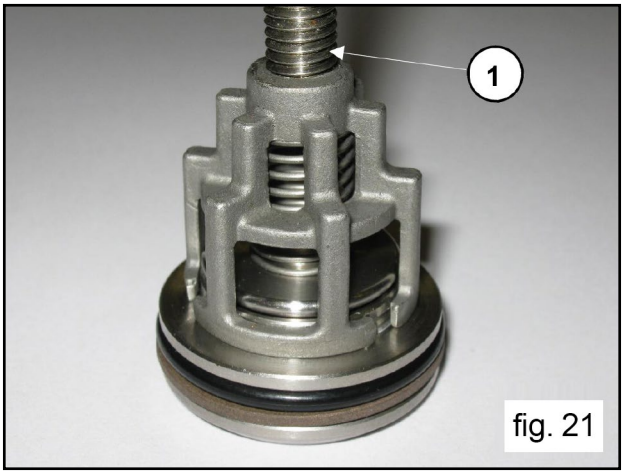

fig. 21

Disassemble the inlet and outlet valve units by screwing on an M8 screw long enough to act on the valve and extract the valve guide from the valve seat (1, fig. 21).

If the inlet valve seats remain stuck to the head (for example due to incrustation caused by prolonged pump inactivity), operate as follows:

For HS18 versions, use tool p/n's F26019400, F27513700, F27513400, (fig. 22 and fig. 22/a).

For HS20 versions, use tool p/n's F26019400, F27513500, F27513400, (fig. 22 and fig. 22/a).

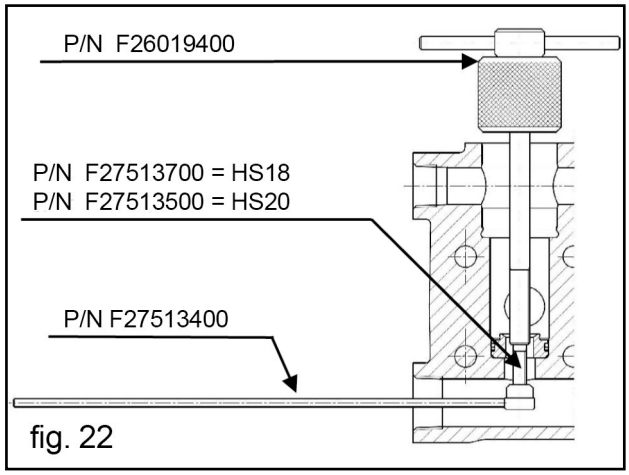

fig. 22

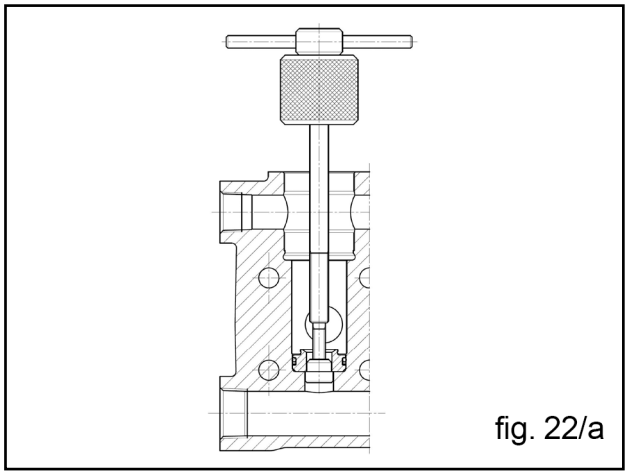
fig. 22/a

Note: Always slip off the handle #F27513400 before extracting from seat.

2.2.2 Head Assembly - Valve Units

Pay careful attention to the state of wear of the various components; replace if necessary, and in any case within the intervals indicated in the "PREVENTIVE MAINTENANCE" table in chapter 11 of the Owner's Manual. At each valve inspection, replace all O-rings and all anti-extrusion rings on the valve units and valve plugs.

Before repositioning the valve units, clean and completely dry the relative seats in the head as shown in fig. 23.

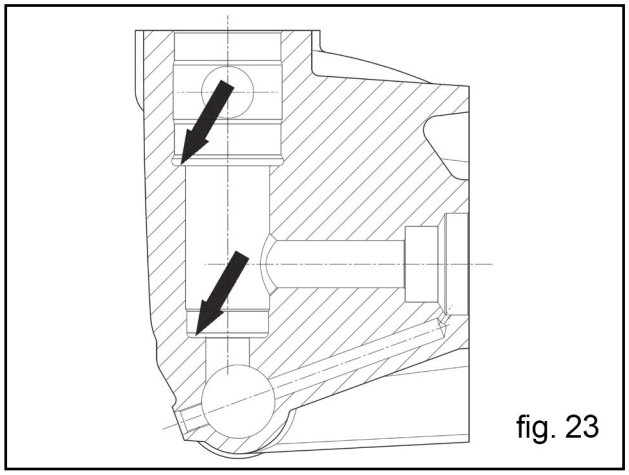
fig. 23

Proceed with reassembly by reversing the procedure indicated in paragraph 2.2.1, paying particular attention to:

1. During the assembly of the inlet and outlet valve units (fig. 24 and fig. 25) do not invert the inlet springs with the previously disassembled outlet springs:

A) Inlet springs are white.

B) Outlet springs are black.

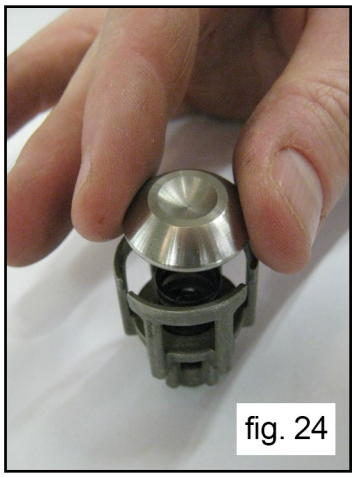

fig. 24

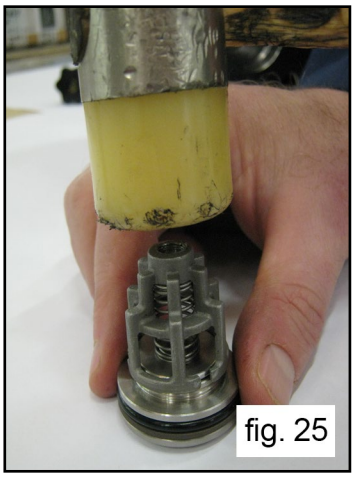

fig. 25

2. On the HS18 version be careful not to invert the spherical inlet valve with the "A"outlet valve (fig. 26 and fig. 27), exploded view position #46 as indicated in chapter 16 of the Owner's Manual.

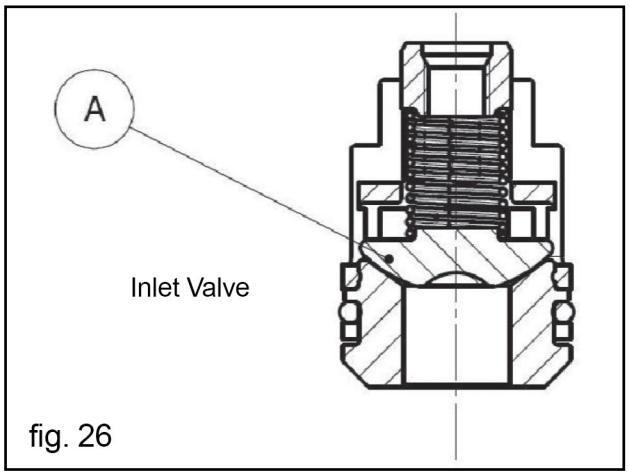

fig. 26

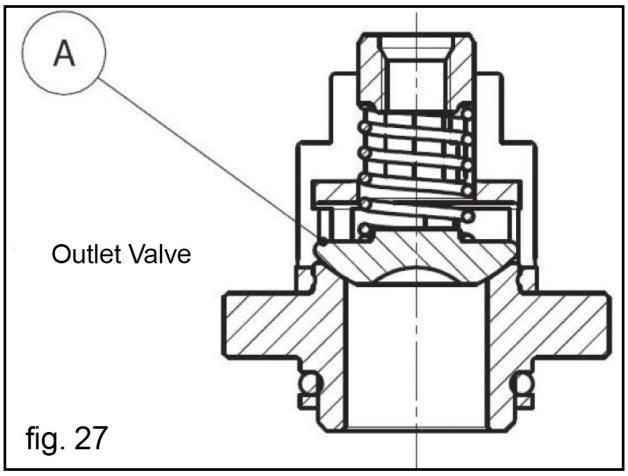

fig. 27

Insert the inlet and outlet valve units with their bushings, checking that they are fully inserted in the head seat. Make sure not to damage the anti-extrusion rings on the bushings (3, fig. 28). For correct positioning and adjustment of rings in their respective seats:

- **Insert the bushings completely in the head, lubricating the external O-rings/ anti-extrusion rings diameter with OCILIS type silicone grease #F12001600.**
- **Remove the bushings verifying the integrity of all the anti-extrusion and O-rings.**
- **Proceed with final reassembly.**

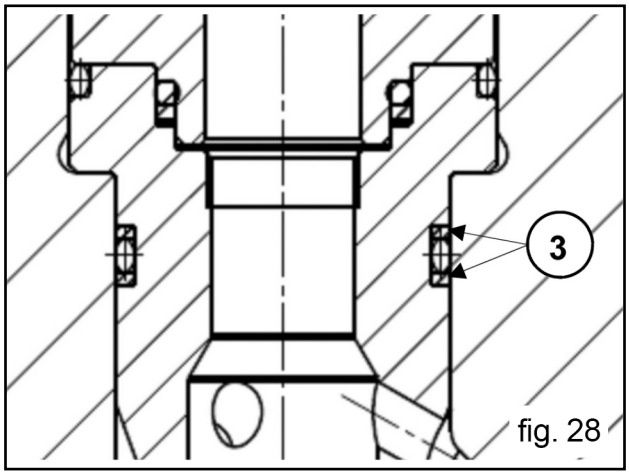

fig. 28

- **Then apply the valve cover and proceed with calibrating the related M14 x 40 screws as indicated in Chapter 3, Screw Calibration.**

2.2.3 Disassembly of the Head - Seals

The replacement of the seals is necessary if water leaks are detected from the draining holes located at the rear of the crankcase, and in any case within the intervals indicated in the “PREVENTIVE MAINTENANCE” table in Chapter 11 of the Owner’s Manual.

A) Unfasten the M12 x 150 head screws as shown in fig. 29.

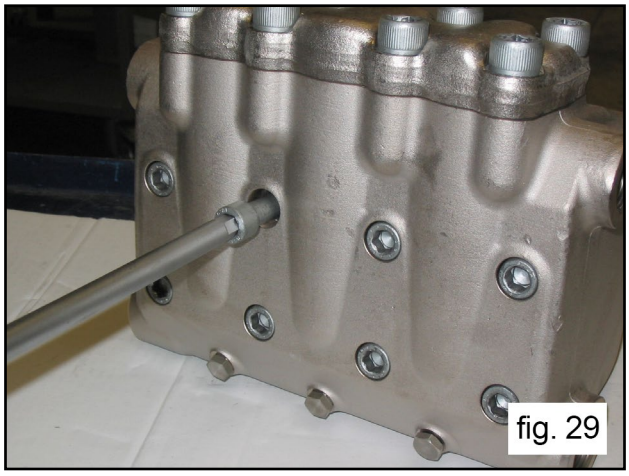
fig. 29

B) Remove the head from the crankcase.
C) Extract the high pressure seals from the head and low pressure seals from their support by using standard tools as shown in fig. 30, being careful not to damage the seats.

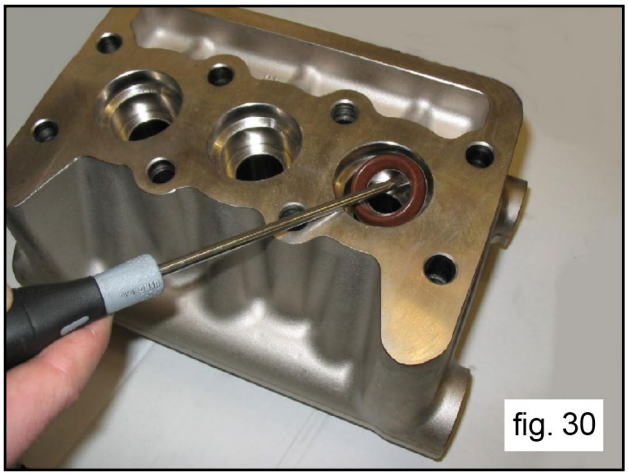

fig. 30

Pay careful attention to to the order of sealing pack disassembly as shown in fig. 31 for HS20 version pumps and fig. 31/a for HS18 version pumps, composed of:

1. Head ring
2. HP seal
3. Restop ring
4. Packings support
5. LP seal
6. Sealing ring
7. Circlip
8. O-ring

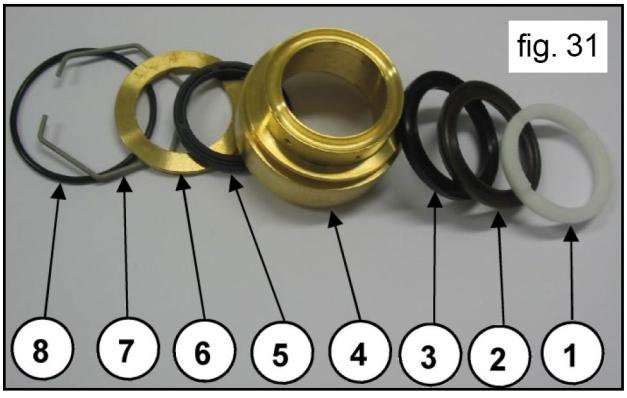

fig. 31

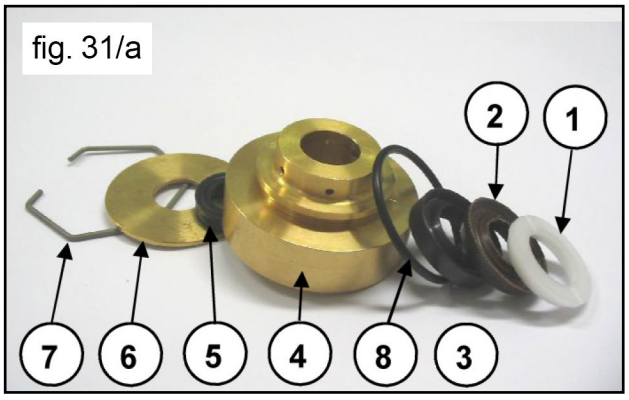

fig. 31/a

2.2.4 Plunger Unit Disassembly

The plunger unit does not require periodic maintenance. Service interventions are limited to visual inspections only. For plunger unit extraction operate as follows:

Unfasten the M7 x 1 plunger screws as shown in fig. 32.

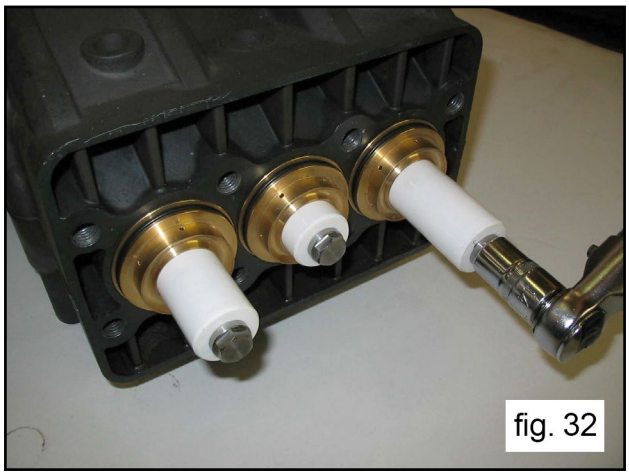

fig. 32

Check them for wear; replace if necessary.

At each disassembly, all the O-rings of the plunger unit must be replaced.

2.2.5 Head Assembly - Seals - Plunger unit

Reassemble the various components by reversing the operations previously listed in paragraph 2.2.3, paying careful attention to the following:

A) Sealing packing: follow the same order used during disassembly.

B) Lubricate components 2,3 and 5 with silicone grease type OCILIS, #F12001600; this operation is also considered necessary in order to facilitate the settling of the seal lip on the plunger.

C) For correctly assembling the HP seals in their related seats on the head without damaging the lips, use the appropriate tools depending on the pumping assembly diameters as indicated in Chapter 4.

D) Reassemble the plungers by fastening the screws with a torque wrench, following the fastening torque value indicated in Chapter 3.

E) Reassemble the head proceeding as follows:

1. Position the seal supports in their respective seats on the crankcase;
2. Using two screws - auxiliary pin (#F27508200) fastened to the crankcase as indicated in fig. 29, position the complete head, being sure that it is centered on the central plunger only.
3. Complete the operations by following the fastening procedures; for fastening torque values and sequences, follow what is indicated in Chapter 3.

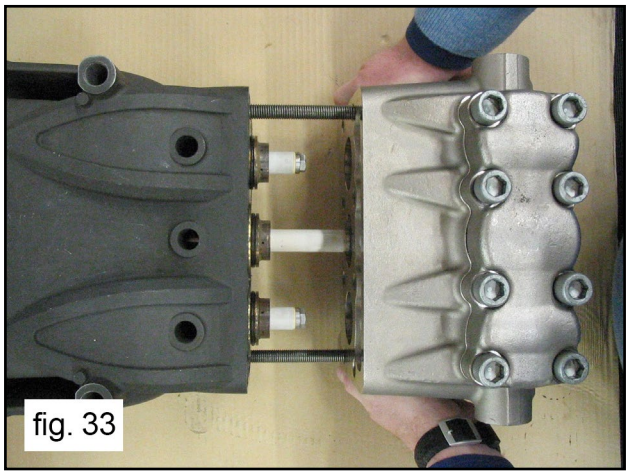

fig. 33

3. SCREW CALIBRATION

Screw calibration by means of a torque wrench only.

Description	Exploded View Position (From Owner's Manual)	Fastening Torque (Ft. Lbs.)	Fastening Torque (Nm)
Cover fastening screws	9	7.4	10
Plunger guide rod fastening screws	103	7.4	10
Oil discharge plug	11	29.5	40
Lifting bracket fastening screws	63	29.5	40
Con-rod caps fastening screws	16	22.1	30*
Plunger fastening screw	29	14.6	20
Head fastening screws	39	73.8	80**
Valve cover screws	41	132.8	180***

* The con-rod caps fastening screws must be tightened respecting the phases indicated on page 9.

** The head fastening screws, exploded view position 39 from the Owner's Manual, must be tightened using a torque wrench, lubricating the threaded stem and respecting the order of the scheme in fig. 34.

*** The valve cover screws, exploded view position 41 from the Owner's Manual, must be fastened using a torque wrench, lubricating the threaded stem and respecting the order of the scheme in fig. 34.

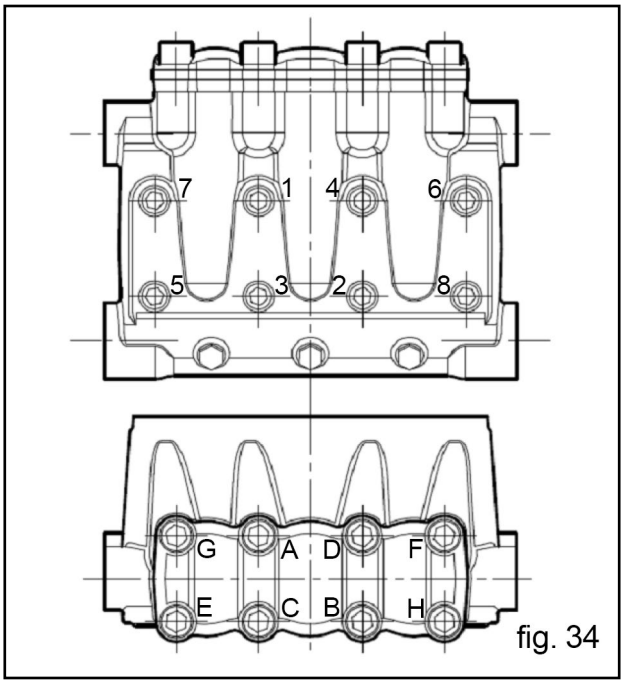

fig. 34

4. REPAIR TOOLS

Pump maintenance may be carried out using simple tools for assembling and disassembling components. The following tools are available:

For Assembly:

- Gasket Bushing Ø 32; HP alternative seal ring Ø18x32x7/4.5 . . . . . #F27472700 #F27385200
- Gasket Bushing Ø 35; HP alternative seal ring Ø20x35x7.5/4.5. . . . . #F27472800 #F26134600
- Gasket Bushing Ø 26; LP alternative seal ring Ø18x26x5.5 . . . . . #F27470600 #F26242500
- Gasket Bushing Ø 28; LP alternative seal ring Ø20x28x5.5 . . . . . #F27531500 #F27365300
- Pump Shaft Oil Seal Stopper . . . . . #F27904800
- Plunger Guide Oil Seal Stopper . . . . . #F27904900
- Head Assembly . . . . . #F27508200

For Disassembly:

- Valve Bushings . . . . . #F26019400 #F27513600
- Suction (Inlet) Valves HS18 version . . . . . #F26019400 #F27513700 #F27513400
- Suction (Inlet) Valves HS20 . . . . . #F26019400 #F27513500 #F27513400
- Delivery (Outlet) Valve . . . . . #F26019400
- Valve Plugs . . . . . #F26019400
- Plunger Guide Oil Seal . . . . . #F26019400 #F27503900

MAINTENANCE LOG

HOURS & DATE

OIL CHANGE							
GREASE							
PACKING REPLACEMENT							
PLUNGER REPLACEMENT							
VALVE REPLACEMENT							

GENERAL PUMP

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