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INTRODUCTION

This manual gives specific instructions for the proper repair on ZF transmissions.

Please follow the procedures carefully to insure quality service.

ZF HURTH MARINE recommends to read the manual completely before starting with repairs, as some of the procedures described are rather complex.

Along with standard tools, ZF HURTH MARINE recommends the use of special tools, necessary to perform repairs correctly. The special tools are available through your local ZF HURTH MARINE dealer.

This manual is based on the technical information at the time of printing. The manual has been checked carefully in order to avoid errors. However ZF HURTH MARINE is not liable for any misrepresentations, errors of description or omissions.

Modifications on future manuals may be introduced without prior notice.



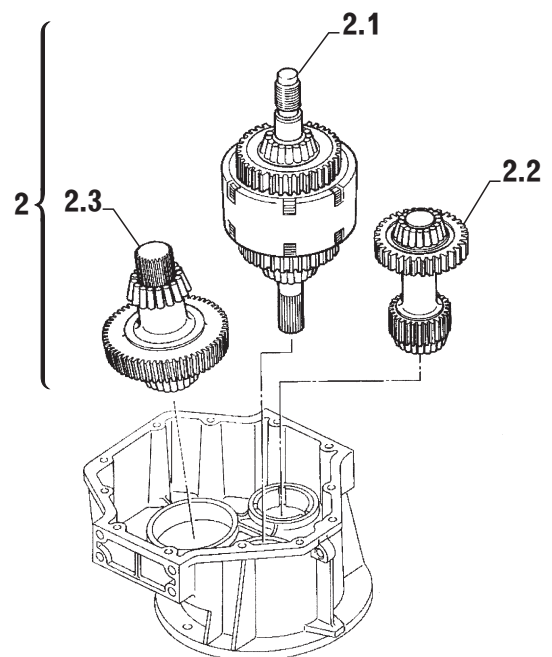
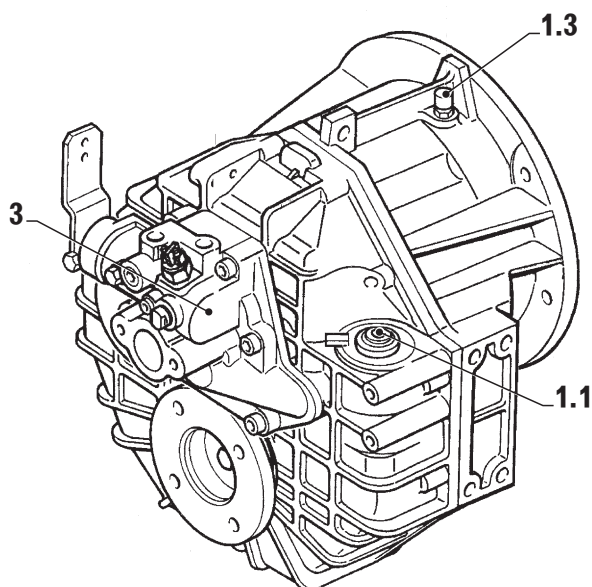
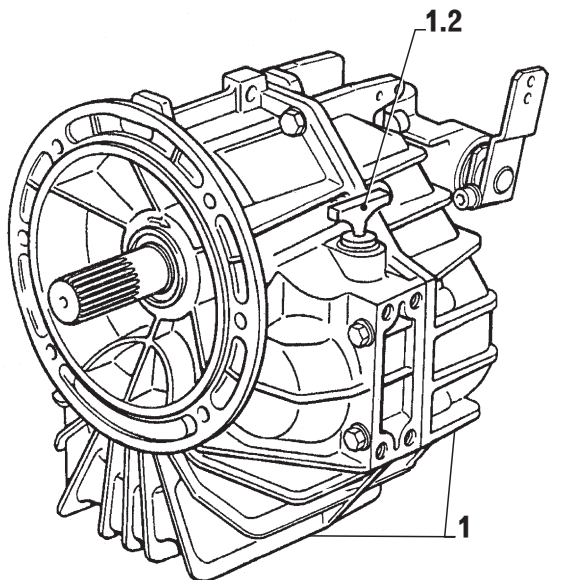
MAJOR COMPONENTS

1. TRANSMISSION SET-UP

The main components of the HSW Marine Transmissions are:

ITEM	DESCRIPTION
1	Two-piece aluminum die cast (iron cast for ZF 45-1)
1.1	Oil filter
1.2	Oil dipstick
1.3	Breather valve

ITEM	DESCRIPTION
2	Gears
2.1	Input shaft with reversing clutch pack assembly
2.2	Intermediate shaft
2.3	Output shaft
3	Control block



2. CLEANERS AND SEALANTS

For cleaning:
Cold cleaner such as benzene, trichloroethane or Loctite fast cleaner No. 7063.



WARNING

**Keep detergents away from your skin, do not drink and do not inhale their vapors! Always wear protective gloves and safety glasses!
Note accident prevention rules!**

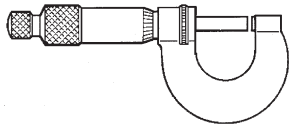
For assembly:

- Loctite 242 or 262 for securing screw, medium-hard.

- Loctite 243 medium-hard for securing oil plug on ZF 25 A - ZF 25.
- Loctite 245 for securing output flange on spline.
- Loctite 518 for housing surfaces.
- Loctite 574 for outer diameter sealing rings
- Grease: Staburags NBU 30, Kluber Co. for radial shaft seals
- ATF FLUID: 1.8 litres (0.50 US. gallons) for ZF 25A
2.0 litres (0.55 US. gallons) for ZF 25
2.5 litres (0.65 US. gallons) for ZF 45A
3.0 litres (0.80 US. gallons) for ZF 45-1

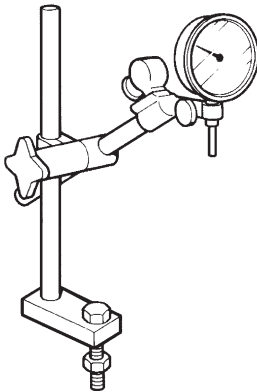
3. MEASURING TOOLS

MICROMETER

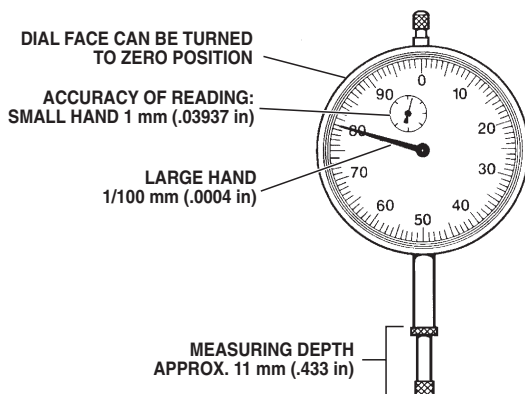


Measuring gauge from 0-25 mm (0-1.0 in.)
Accuracy of reading 1/100 mm (0.0004 in.)

DIAL INDICATOR GAUGE WITH ARM-TYPE SUPPORT



DIAL GAUGE INCREMENTS

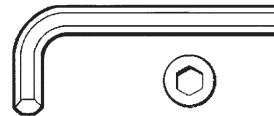


4. STANDARD TOOLS AND FIXTURE

WRENCH for hexagon bolts (8-17-19-22 mm) (7/8")



ALLEN WRENCH (6 mm)



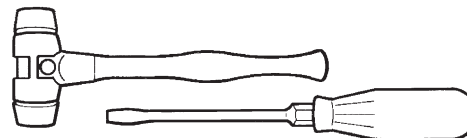
HEXAGON SOCKET WRENCH (6-17-19 mm)



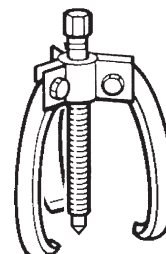
TORQUE WRENCH adjustable up to 180 Nm (152 ft.lb.)



PLASTIC HAMMER (1000 g) and sturdy screwdriver



EXTRACTOR minimum diameter 130 m





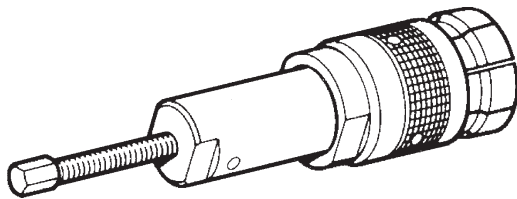
SPECIAL TOOLS

It is assumed that all standard tools, such as, torque wrenches, open-end wrenches, Allen Keys and extractors, are available.

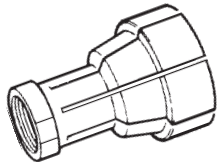
All fixtures for pressing parts in or out should be used in conjunction with a hydraulic or manual press.

EXTRACTOR

Tapered roller bearing inner races
Basic Unit P/N 978.25.0017.0 (454421)

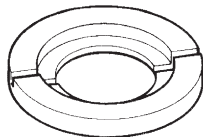


ADAPTER for basic unit 978.25.0017.0 (454421).
- P/N 978.40.0020.0 (500466)

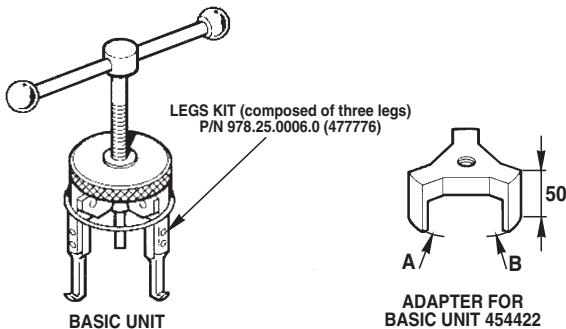


EXTRACTOR SPLIT RING for removing forward gear Z3 and tapered roller bearing from control block side on the input shaft

P/N 20.3056.02 - ZF 25A, ZF 25
P/N 20.3056.01 - ZF 45A, ZF 45-1

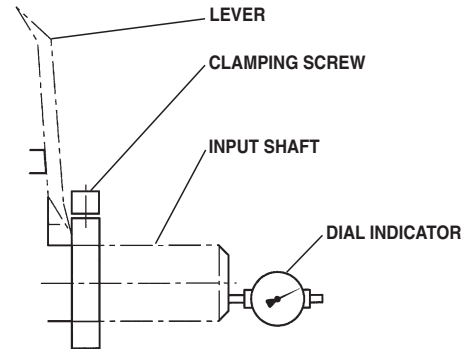


EXTRACTOR for Tapered roller bearing outer races
basic unit P/N 978.25.0021.0 (454422)



ZF 25 A	ZF 25	ZF 45 A	ZF 45-1
978.25.0012.0 (477856)	978.25.0012.0 (477856)	978.25.0011.0 (477854)	978.25.0012.0 (477856)
978.25.0013.0 (477857)	978.25.0013.0 (477857)	978.25.0012.0 (477856)	978.25.0009.0 (477853)
			978.25.0011.0 (477854)

CLAMPING RING for measuring the bearing clearance input shaft P/N 219.354.3 (618582)



MANDREL

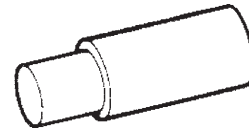
For disassembly and assembly

Shaft seal - input side : P/N 224.836.005 (454425)

Shaft seal - output side:

- P/N 224.836.006 (454426) ZF 45-1

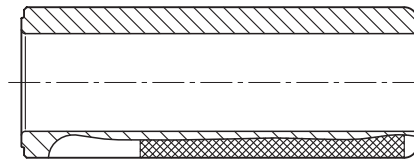
- P/N 978.40.0004.0 (500448) ZF 25 A - ZF 25 - ZF 45 A



For assembling input shaft seal on the input spline side
Bushing P/N 20.0012.01 to insert input shaft seal

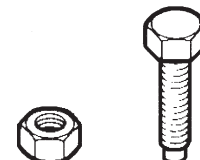


Mandrel P/N 20.0012.02 to assemble input shaft seal



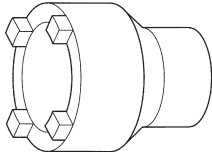
SPECIAL HEX HEAD BOLT WITH BEARING

for measuring the bearing clearance intermediate shaft
P/N. 224.836.008 (458105)

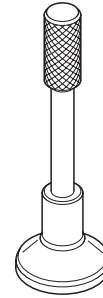


SOCKET SPANNER

P/N 978.40.0002.0 (500446) for nut on output flange
ZF 25 A - ZF 25 - ZF 45 A

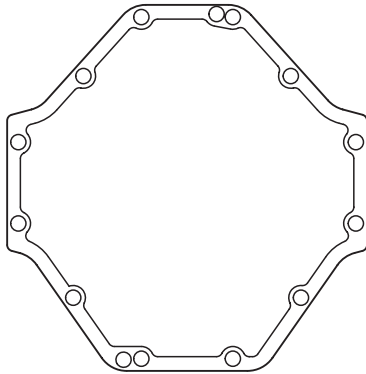
**PUNCH**

for assembly Seal - suction pipe P/N 20.1029.00

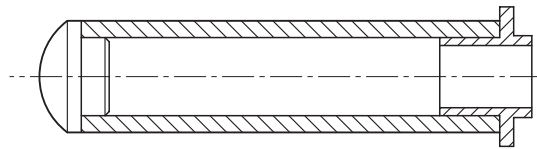
**SHIM**

To determinate the correct preload of the tapered roller bearings.

- P/N 20.3028.00 ZF 25 A
- P/N 20.3034.00 ZF 25
- P/N 20.3029.00 ZF45 A
- P/N 20.3030.00 ZF 45-1



CENTRE SQUARE PUNCH To position the oil suction pipe into housing P/N 20.1041.00





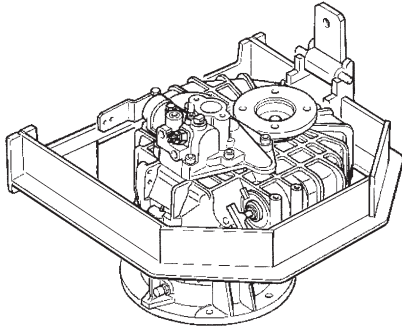
DISASSEMBLY

INTRODUCTION

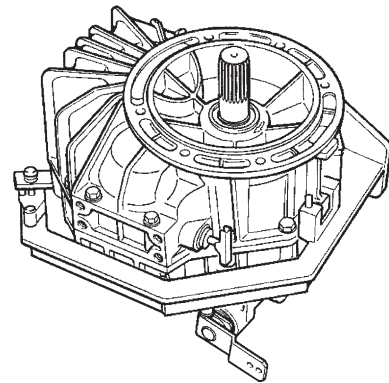
Clean the transmission thoroughly on the outside before disassembly.

The repair area should be clean and well lighted. ZF HURTH MARINE recommends using a swiveling stand for aiding in assembly and disassembly.

**Swiveling stand ZF
Output - half side up**



**Swiveling stand ZF
Input - half side up**



1. FLUID FILTER

1.1 Remove fluid filter

ZF 25 A - ZF 25 - ZF 45 A - ZF 45-1

Turn the screw that fixes the oil filter cover in a counter-clockwise direction and remove the filter from its housing (item 1, fig. 1-1a). Use a 6 mm Allen wrench.

Pull filter element off (item 2, fig.1-1a).

Check O-rings (item 3 and 4, Fig. 1-1a) for wear, replace if necessary.

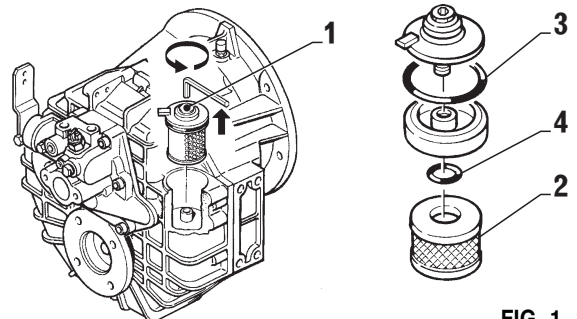


FIG. 1-1a

ZF 25 A - ZF 25 OLD VERSION

Unscrew two M8x25 bolts (item 1, fig. 1-1b) and remove them together with washers (2).

Pull cover, seal and filter element off (item 3, 4 and 5 fig. 1-1b).

Check seal and filter for wear, replace if necessary.

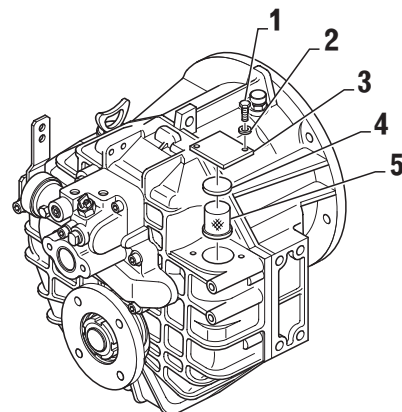


FIG. 1-1b

1.2 Suction of transmission fluid

Push hose of suction pump (item 1, Fig. 1-2) through the suction pipe (item 2, Fig. 1-2) down to the bottom of the housing and suck the fluid off.

1.3 Suction of transmission fluid on ZF 25 A and ZF 25

Remove the plug (item 3, fig. 1-2) and let the oil flow from the proper hole.

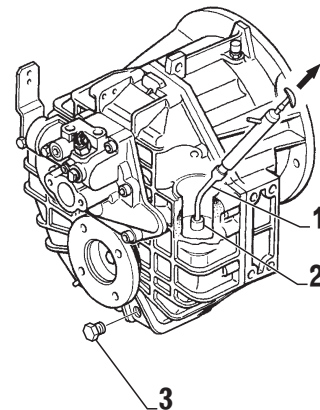


FIG. 1-2

2. DIPSTICK

Unscrew dipstick (item 1, Fig. 2-1) (counterclockwise) and pull out of housing. Replace O-Ring if present (check parts list section 10).

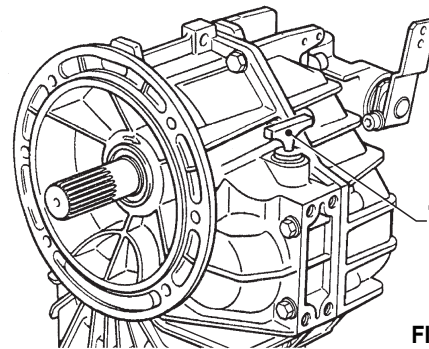


FIG. 2-1

3. BREATHER VALVE

Unscrew breather valve (item 1, Fig. 3-1). Wash valve in a detergent, let dry and dip in oil, then let oil drip off.

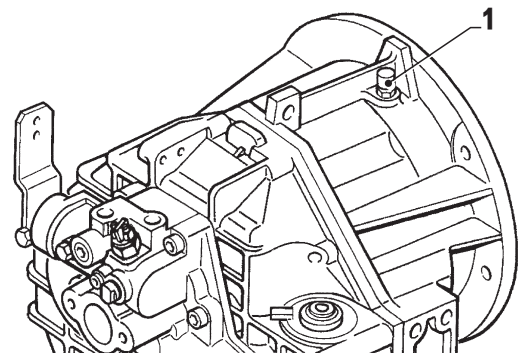


FIG. 3-1

4. OUTPUT FLANGE

Lock output flange in swivel frame.

ZF 45-1

Unscrew hex head bolt (item 1, Fig. 4-1 a).

Remove disc (item 2, Fig. 4-1 a) and O-ring (item 3, Fig. 4-1 a).

Screw hex bolt (item 1, Fig. 4-1 a) in again.

Place extractor on the transmission and pull output the flange (item 1, Fig. 4-2) off.

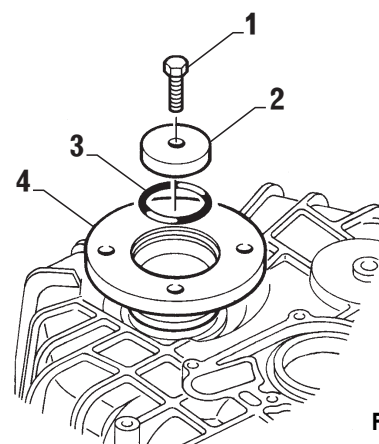


FIG. 4-1a



ZF 25 A - ZF 25 - ZF 45 A

Remove nut (item 1, Fig. 4-1 b) using the special tool.

Remove O-ring (item 2, Fig. 4-1 b).

If the O-ring has any sign of wear or cuts discard and replace with a new one.

Place extractor on the transmission and remove output flange (item 1, Fig. 4-2).

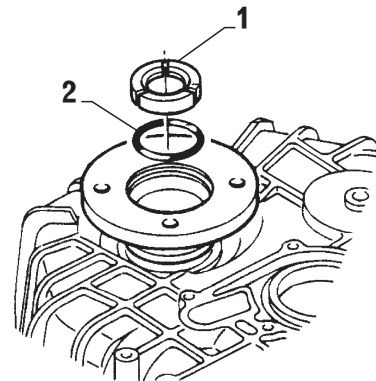


FIG. 4-1b

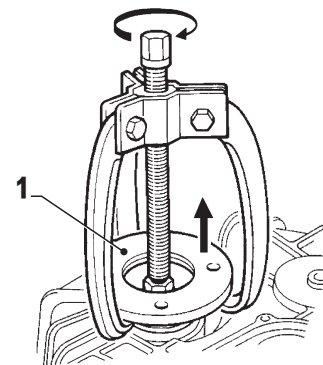


FIG. 4-2

5. CONTROL BLOCK

Unscrew allen head bolts (item 1, Fig. 5-1)

Pull control block (item 2, Fig. 5-1) together with seal (item 3, Fig. 5-1) off the input shaft.

Remove key (item 4, Fig. 5-1) from input shaft (item 5, Fig. 5-1).

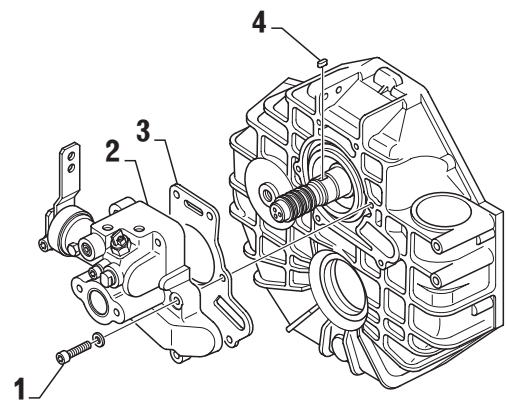


FIG. 5-1

5.1 Neutral Safety Switch

Unscrew neutral safety switch (item 1, Fig. 5-2).

Note: Use 7/8 inch wrench for hex bolts.

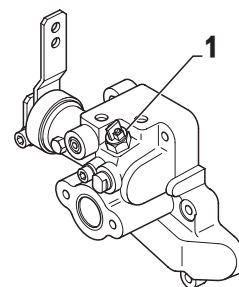


FIG. 5-2

5.2 Neutral Safety Switch Check

To check for proper operation of the switch perform one of the following tests:

A: Ohm meter

Connect the ohm meter leads to the terminal connection of the switch.

With the pin (item 1a Fig. 5-3) extended you should get a reading, indicating a good switch.

Compressing the pin (item 1b Fig. 5-3) you should have «0» reading,

B: 12 volt light

Connect the neutral safety switch with a light in series to a 12 volt battery. The switch is good when the light goes out when the center pin (item 1b Fig. 5-3) is compressed.

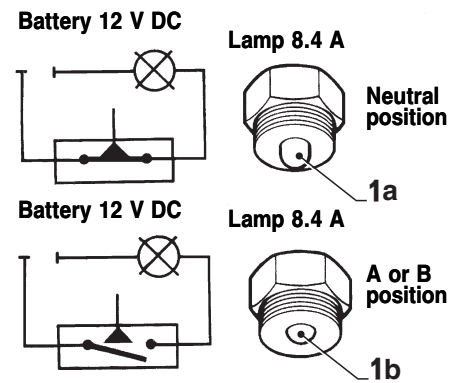


FIG. 5-3

6. HOUSING

6.1 Transmission housing halves

Using an adequate drift punch, top the locating pins (item 1, Fig. 6-1a and 6-1b) out of the housing.

Loosen and remove all hex head bolts and lock washers (item 2 and 3, Fig. 6-1b). Using a plastic hammer slightly top the split line of the case halves to break the seal. Then remove the input side of the housing.

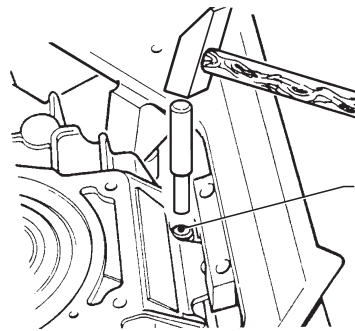


FIG. 6-1a

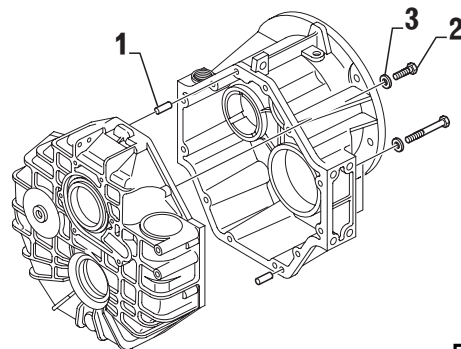


FIG. 6-1b

6.2 Shafts and gears

Take the gear set out of the housing

- Intermediate shaft (item 2, Fig. 6-2).
- Input shaft (item 1, Fig. 6-2).
- Output shaft (item 3, Fig. 6-2).

Check all gears, bearings and three piston rings on the input shaft (item 4, Fig. 6-2) for signs of wear or failure. If any of the gears are damaged or showing signs of excessive wear ZF HURTH MARINE recommends replacing the complete gear set.

When tapered roller bearings on the input shaft need to be replaced, the butting rings and needle bearings should also be replaced. To check for correct clutch operation, rotate the gears on the input shaft. If it is hard to turn the gears, the clutch is probably damaged.

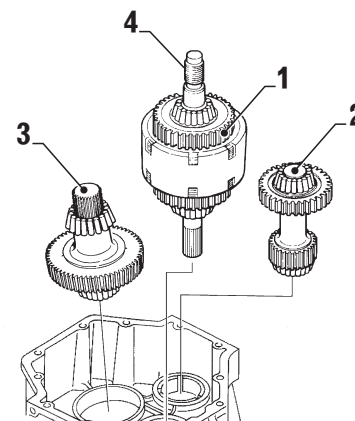


FIG. 6-2



6.3 Radial shaft seals

Input shaft seal

Using a seal mandrel inside the housing top the input shaft seal out.

Discard seal and replace with a new one. (Fig. 6-3a).

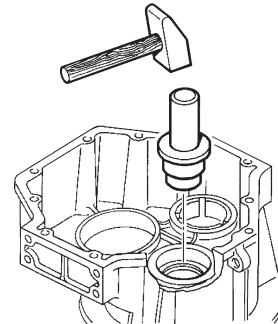


FIG. 6-3a

Output shaft seal

Using a mandrel punch top the output flange seal out from the other side of the housing. Discard seal and replace with a new one. (Fig. 6-3b).

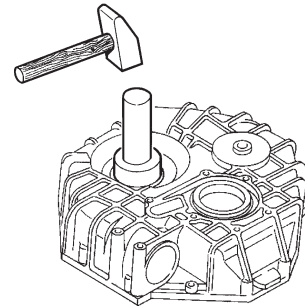


FIG. 6-3b

6.4 Fluid inlet pipe

Replacing the seal:

ZF 45 A - ZF 45-1 (Fig. 6-4a)

- Remove baffle plate (item 2).
- Remove suction pipe (item 3).
- Drive out seal (item 1).

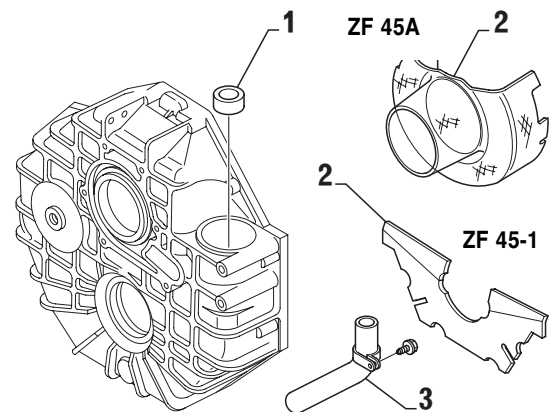


FIG. 6-4a

ZF 25 A - ZF 25 (Fig. 6-4b)

- Remove baffle plate (item 2).
- Remove suction pipe (item 3).
- Drive out O-ring (item 1).

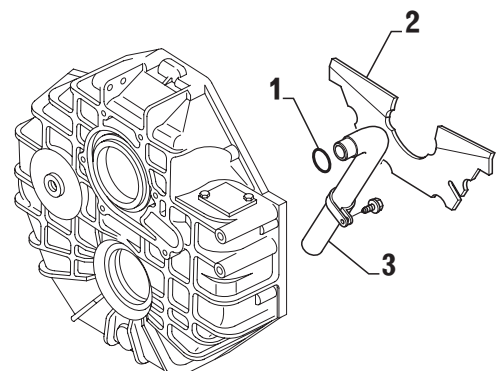


FIG. 6-4b

7. TAPERED ROLLER BEARINGS

Check for failed bearings or excessive bearing wear.

7.1 Outer races of tapered roller bearing

Remove the outer races out of the housing halves by means of the special tool (Fig. 7-1) or by heating the housing halves in an oven to approx. 120 °C (248 F):

Put the housing in the oven upside down, so the outer races will fall down.

WARNING

Use protective gloves when handling the heated housing and outer races.

IMPORTANT

Regard location of shims under each outer race for correct position during reassembling.

Shims are located under outer races of the cover only.

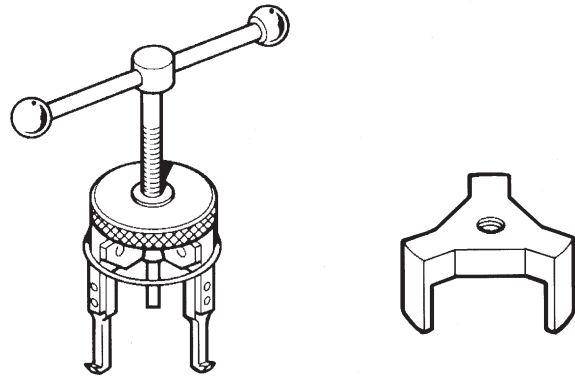


FIG. 7-1

7.2 Inner races of tapered roller bearings

NOTE

- input shaft - both sides
- The extractor (Fig. 7-2a) is required for pulling the inner races off.

For extracting the inner races proceed as follows:

- Screw in adapter onto the puller (item 1).
- Place adapter onto the roller cage.
- Tighten collar to rollers by means of cap nut (item 2).
- Screw spindle (item 3) against shaft and pull bearing evenly and carefully off.

WARNING

Improper use of the extractor when removing the races, could cause damage to the race or slip off.

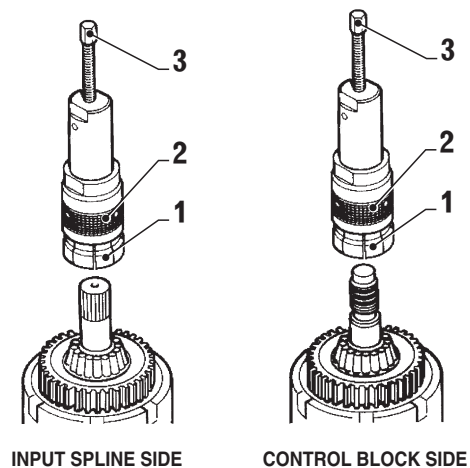
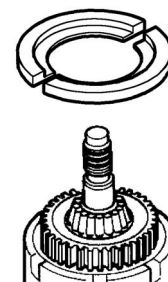


FIG. 7-2a

ALTERNATIVELY

Input shaft - Control block side

The inner race and the gear on the control block side can be removed by using the split ring and a standard hydraulic press (fig. 7-2b).



CONTROL BLOCK SIDE

FIG. 7-2b



8. CLUTCH PACK

8.1 Removal of the clutch discs

Control block side (Fig. 8-1)

- Remove thrust washer (1) off using two screwdrivers.
- Take off gear (2) and, needle bearings (3).
- Removal of pressure plate. Press snap ring (5) against periphery of pressure plate (4) by means of screwdrivers. Extract them together. The discs (6) can now be removed from the clutch housing.

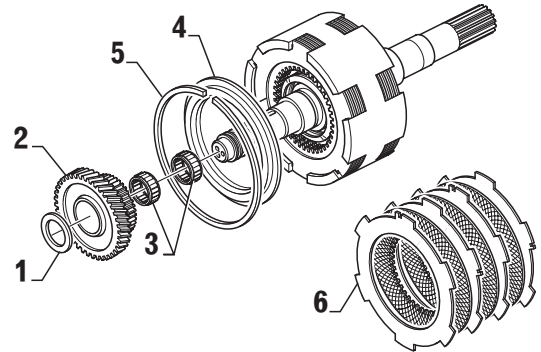


FIG. 8-1

Input spline side (Fig. 8-2a)

ZF 25 A - ZF 25

- Remove spacer (1), snap ring (2) and ball (3)
- Remove thrust washer (4) off using two screwdrivers.
- Take off gear (5), needle bearings (6) and spacer (7).
- Remove pressure plate (8). Press snap ring (9) against periphery of pressure plate by means of screwdrivers. Extract them together. The discs (10) can now be removed from the clutch housing.

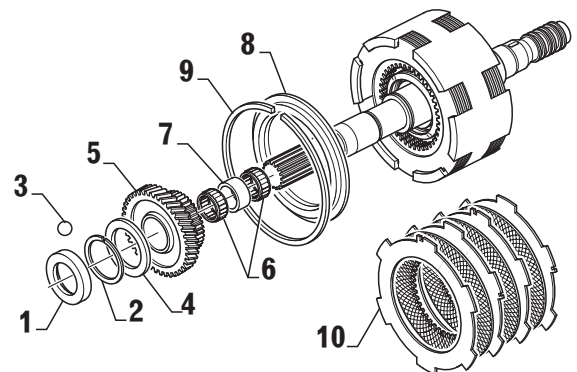


FIG. 8-2a

ZF 45 A ratio 1.25 - 1.5 - 2

ZF 45-1 (Fig. 8-2b)

- Remove thrust washer (1) off using two screwdrivers.
- Take off gear (2), needle bearings (3) and spacer (4).
- Remove pressure plate (6). Press snap ring (5) against periphery of pressure plate by means of screwdrivers. Extract them together. The discs (7) can now be removed from the clutch housing.

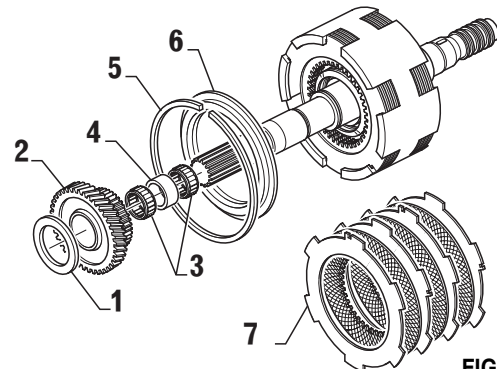


FIG. 8-2b

ONLY ZF 45 A ratio 2.5 (Fig. 8-2c)

- Remove thrust washer (1) off using two screwdrivers.
- Remove snap ring (2) and ball (3).
- Take off gear (4), needle bearings (5).
- Remove pressure plate (6). Press snap ring (7) against periphery of pressure plate by means of screwdrivers. Extract them together. The discs (8) can now be removed from the clutch housing.

NOTE. From serial number 23930G the needle bearing (5) in the middle has been replaced by a spacer.

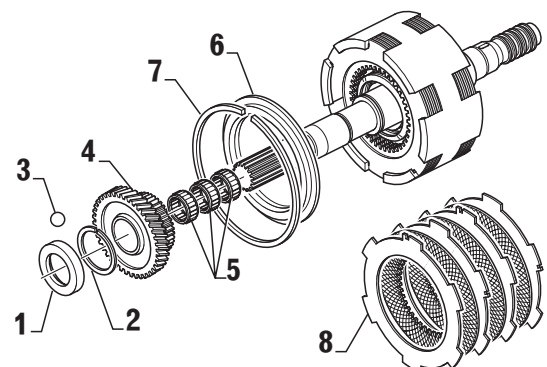


FIG. 8-2c



ASSEMBLY

INTRODUCTION

A well-lighted work area that is free from dirt and chips, will facilitate the work considerably.

ZF HURTH MARINE recommends to use a swiveling stand, described in the disassembly section to aid in the assembly.

Thoroughly clean all mating surfaces from any Loctite or gasket material.



Cleaners and solvents can be toxic and potentially harmful without proper ventilation.

Use caution when using such cleaners. Always wear protective gloves and glasses!

The next assembly procedure requires the following:

- An electric oven or heating lamp for heating the housing halves will be required when mounting the bearings.
- A hydraulic or mechanical press

1. INPUT SHAFT

1.1 Mount discs into reversing clutch

NOTE

- For exact quantity of inner (item 2, Fig. 1-1a) and outer discs (item 1, Fig. 1-1a), please refer to the spare parts list at the end of this manual.
- Stagger the position of the notches on the outer discs as shown in Fig. 1-1b.

Starting with one of the outer discs, build up the clutch. The lugs on the outer discs have to be positioned in line with each other as shown in Fig. 1-1b.

Place end disc (item 1 Fig. 1-1c) and snap ring engaging it into clutch housing groove.

Repeat same procedure on opposite side of clutch (Fig. 1-1d).

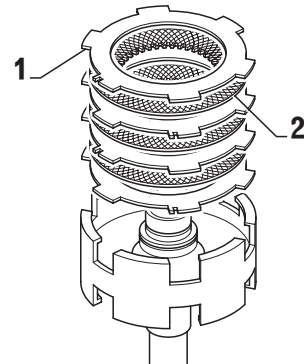


FIG. 1-1a

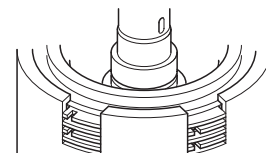


FIG. 1-1b

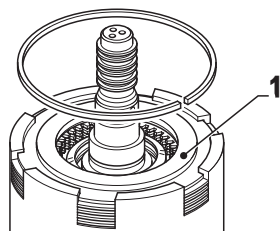


FIG. 1-1c

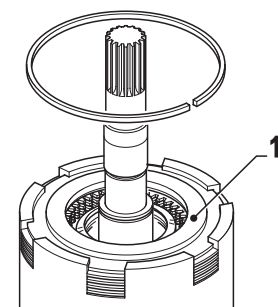


FIG. 1-1d

1.2 Install needle bearings and gear

Input spline side

- Install needle bearing (item 1 fig. 1-2) onto shaft.
- Slide spacer (item 3 fig. 1-2) where required.
- Align splines on clutch discs previously installed and install gear (item 2 fig. 1-2).

Make sure clutch gear is fully installed, engaging all clutch discs.

Control block side

- Repeat same procedure of input spline with exception there are no spacer.

ZF 25 A - ZF 25
ZF 45 A - ZF 45-1
ZF 45 A (Ratio = 2.5)
up to serial number 23929G

ONLY ZF 45 A
(Ratio = 2.5) from
serial number 23930G

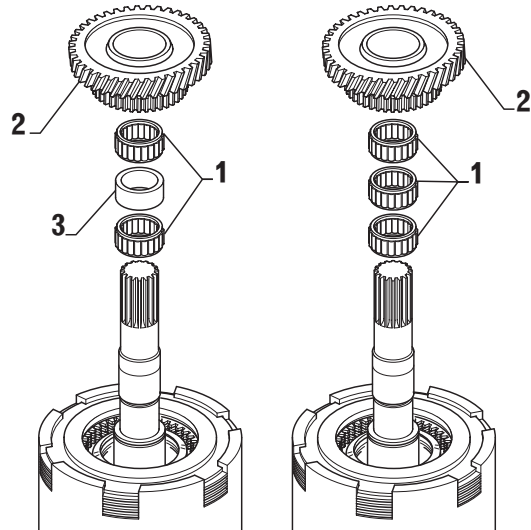


FIG. 1-2

1.3 Assemble butting rings

NOTE

- Make sure thrust washer is fully pressed on and gear is free to rotate.
- Thrust washer must not be bent.

Control block side

Position shaft assembly on suitable holding fixture. Using a tube with a bore dia. of 35 mm/1.38 in and a plastic hammer gently drive thrust washer in position. (item 1 Fig. 1-3a)

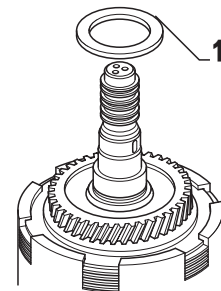


FIG. 1-3a

Input spline side

ZF 25 A - ZF 25 (Fig. 1-3b)

- Install thrust washer (item 1) and ball (item 2) in the groove.
- Install the snap ring (3)
- Install spacer (4)

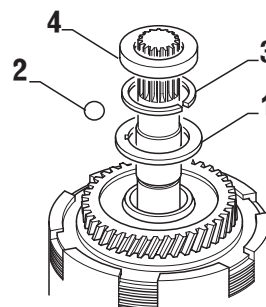


FIG. 1-3b

ZF 45 A (ratio 2.5) (Fig. 1-3c)

- Install snap ring (item 1).
- Install thrust washer (item 2) and ball (item 3) in the groove.

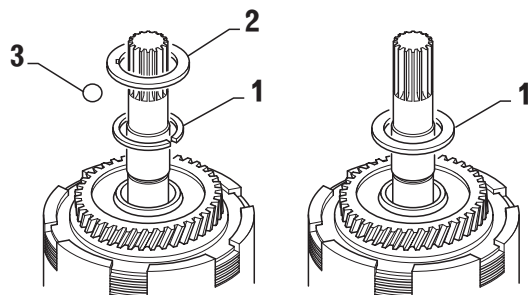


FIG. 1-3c

FIG. 1-3d

ZF 45 A (no ratio 2.5) - ZF 45-1 (Fig. 1-3d)

Position shaft assembly on suitable holding fixture. Using a tube with a bore dia. of 35 mm/1.38 in and a plastic hammer gently drive thrust washer in position. (item 1 Fig. 1-3a)



1.4 Mounting inner races of tapered roller bearings

Heat inner race of tapered roller bearing (item 1 Fig. 1-4) to approx. 120 °(248 °F) and push onto input shaft. After cooling down, press bearing carefully against button ring (item 2, Fig. 1-4) by means of a sleeve and a manual press or a copper brass punch.

CAUTION

Handle heated tapered roller bearing inner race only with special gloves!

NOTE

For pressing, apply sleeve to inner race but not to rollers.

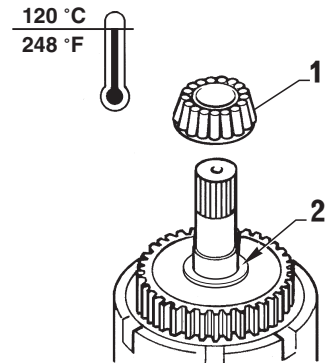


FIG. 1-4

1.5 Assemble piston rings

Mount piston ring seals (item 1, Fig. 1-5) onto input shaft.

IMPORTANT

Make sure the interlocking position of the piston rings are staggered on the shaft.

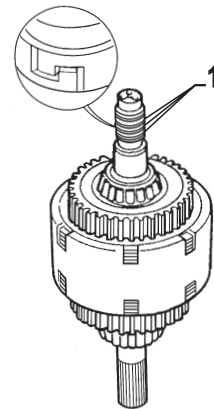


FIG. 1-5

2. INTERMEDIATE SHAFT

2.1 Mounting inner races of tapered roller bearings

Heat inner races of tapered roller bearings (item 1 and 2, Fig. 2-1) to approx. 120 °C (248 °F) and push them onto the intermediate shaft up against the shaft collar.

WARNING

Handle heated taper roller bearing inner races only with protective gloves!

When the inner races have cooled down, drive them carefully against the collar using a copper/brass punch.

NOTE

Apply copper/brass punch on inner race and not on the rollers.

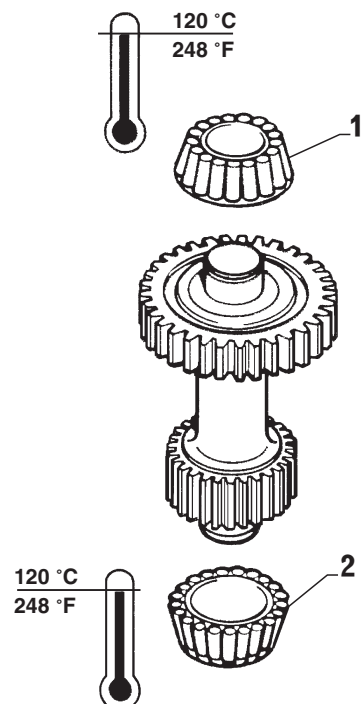


FIG. 2-1

3. OUTPUT SHAFT

3.1 Mounting inner race of tapered roller bearing

Heat inner races of taper roller bearings (item 1 and 2, Fig. 3-1) to approx. 120 °C (248°F) and push them onto output shaft up against shaft collar.

CAUTION

Handle heated tapered roller bearing inner races only with protective gloves!

When the inner races have cooled down, drive them carefully against the collar using a copper/brass punch.

NOTE

Apply copper/brass punch on inner race and not on the rollers.

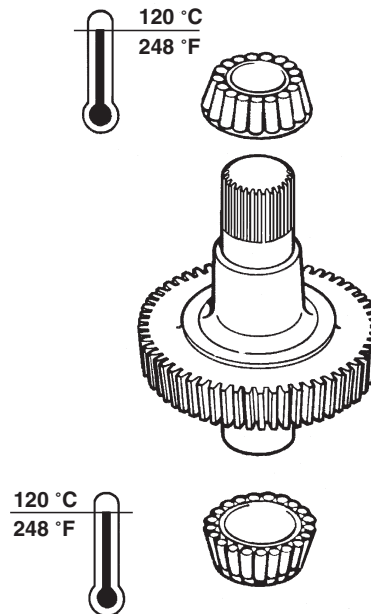


FIG. 3 - 1

4. PREASSEMBLY OF HOUSING

4.1 Assembly of outer races (tapered roller bearings)

Heat output half of the housing (item 1, Fig. 4-1) in an oven to approx. 120 °C (248 °F).

Insert outer races (item 2, Fig.4-1) into housing.

WARNING

Handle heated tapered roller bearings outer races on with protective gloves.

When housing has cooled down to ambient temperature, with a copper/brass punch seat outer races carefully into housing.

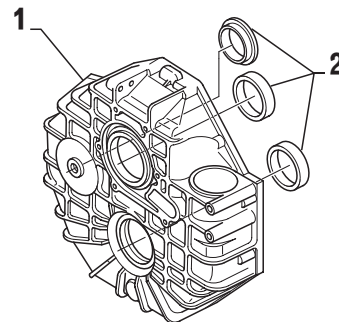


FIG. 4 - 1

4.2 Installation of fluid suction pipe and baffle

4.2.1 installation of fluid suction pipe

ZF25 A - ZF25

- Wet O-ring (1, Fig. 4-2a) with ATF fluid and install it in groove into housing.
- Insert suction pipe (2, Fig. 4-2a) into housing.
- Place one drop of Loctite 243 on the screw thread (3, Fig. 4-2a) and secure suction pipe down with a clamp (4, Fig. 4-2a).

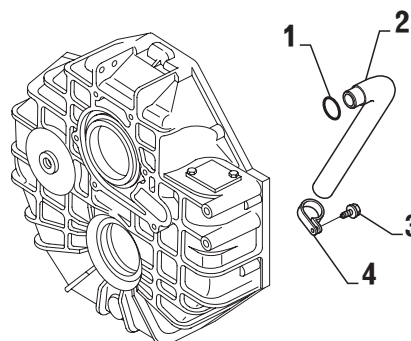


FIG. 4 - 2a



**ZF 25 A (from s/n 19395L) - ZF 25 (from s/n 17437L)
ZF 45 A - ZF 45-1 (Figs. 4-2b, 4-2c, 4-2d)**

- Position oil suction pipe (item 1, Fig. 4-2b) in the housing.
- Put one drop of Loctite 242 into screw threaded hole.
- Lightly tighten the screw (item 3, Fig. 4-2b).
- Insert centre square punch and tighten definitely the screw.
- Adjust oil suction pipe to measure "A" (A = 26 mm) (Fig. 4-2c).
- Put some ATF fluid on the seal seat and on the oil suction pipe using a brush.
- Press into housing over the oil suction pipe the seal using the appropriate punch (Fig. 4-2d).

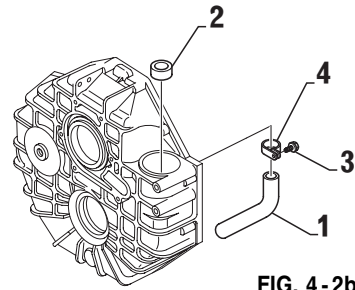


FIG. 4-2b

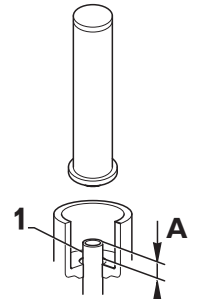


FIG. 4-2c

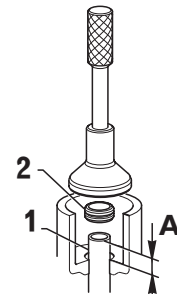


FIG. 4-2d

4.2.2 Installation of baffle (Fig. 4-2e)

Put one drop of Loctite 242 on the screw thread (item 1) and screw baffle plate (item 2) into the housing. After tightening the screws bend plate lugs when present over the hexagon of screws (see fig. 4-2e).

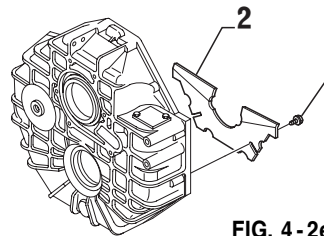


FIG. 4-2e

ZF 45 A ONLY (Fig. 4-2f)

Insert plastic baffle (item 1) into the housing. Make sure oil baffle is fully installed.

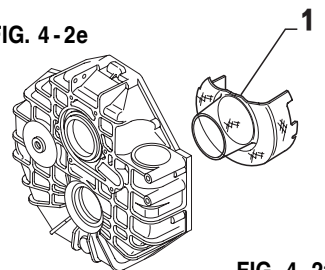


FIG. 4-2f

4.3 Assembling input shaft seal

Apply thin coat of Loctite 574 on periphery of new radial shaft seal rings (item 1, Fig. 4-3a and Fig. 4-3b) and grease lips with STABURAGS NBU 30.

Put it onto the mounting mandrel.

Drive shaft seal uniformly into the housing by tapping slightly onto the mounting mandrel.

NOTE

The sealing lip (A) on the shaft seal should point into the inside of the housing. The radial shaft seal must be adjusted so that the sealing lip runs on the grounded surface of the shaft.

FIG. 4-3a

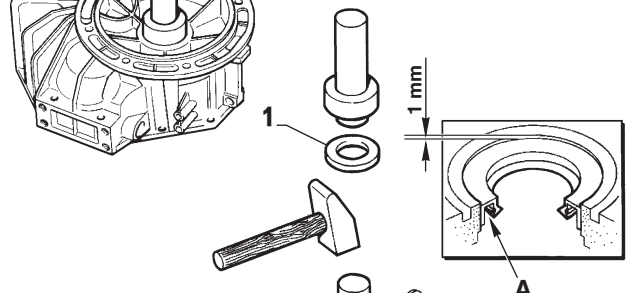
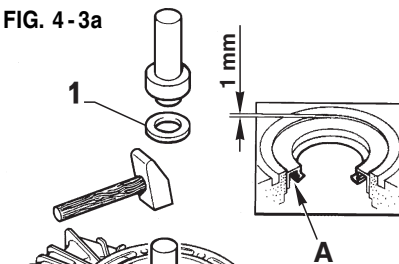


FIG. 4-3b

ALTERNATIVELY (Fig. 4-3c)

- Smear Loctite 574 on the outside diameter of the input shaft seal using a roller.
- Lubricate the inside lip with Kluber Staburags NBU30 grease.
- Insert the input shaft seal into input shaft (item 2) using the appropriate bushing p/n 20.0012.01 (item 1).
- Use mandrel p/n 20.0012.02 (item 3) to position the input shaft seal in the correct way.

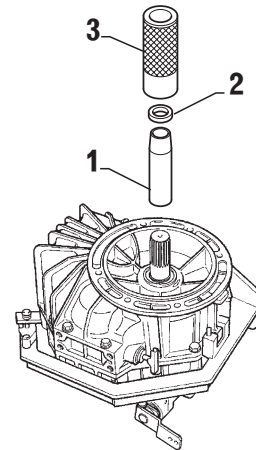


FIG. 4-3c

4.4 Mounting the breather filter

Due to the taper thread, the breather (item 1, Fig. 4-4) need not to be coated with Loctite or equipped with a sealing washer.

Tighten carefully during assembly (hand-tight).

Cheek leakage during a later test run. Retighten slightly if it leaks.

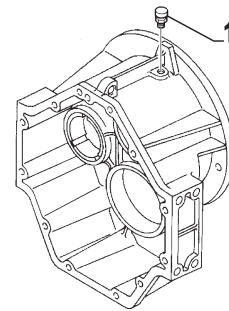


FIG. 4-4

5. MEASURING THE BEARING CLEARANCE/ADJUSTING THE PRETENSION OF BEARINGS

5.1 General

The required pretension/play of bearings of the individual shafts in the housing is obtained by using shims of different thickness under the outer races of the taper roller bearings. Shims which have been removed during disassembly may be reused.

First adjustment must refer to bearing clearance.

ZF 25 A - ZF 25 - ZF 45 A

Take out from the front cover (Fig. 5-1) at least shims of 0.2 mm (0.0079 in.) thickness from the shims packages which were removed during disassembly.

NOTE

This step is not needed for ZF 45-1 since bearings are installed with clearance.

Adjustment values

Pretension mm (inches)

Shaft	Input	Intermediate	Output
ZF 25 A - ZF 25	0.02-0.12 (0.001-0.005)	0.00-0.10 (0.000-0.004)	0.05-0.12 (0.002-0.005)
ZF 45 A	0.02-0.12 (0.001-0.005)	0.00-0.12 (0.000-0.005)	0.05-0.15 (0.002-0.006)

Clearance (only ZF 45-1)

Shaft	Input	Intermediate	Output
mm	0.00-0.05	0.00-0.05	0.00-0.05
(inches)	(0.000-0.002)	(0.000-0.002)	(0.000-0.002)

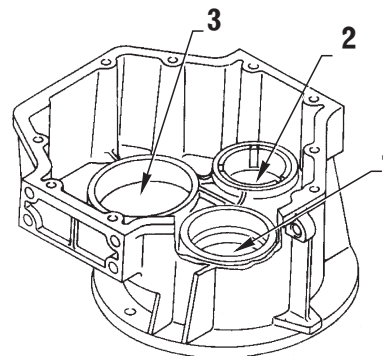


FIG. 5-1



5.2 Mounting outer races of tapered roller bearings into housing

Heat input half housing in an oven to approx. 120 °C (248 °F) and insert shims and outer races of bearings into it (item 1, Fig. 5-2).

WARNING

Handle heated housing half only with protective gloves!

When half housing has cooled down to ambient temperature, press outer races carefully down using a copper/brass punch.

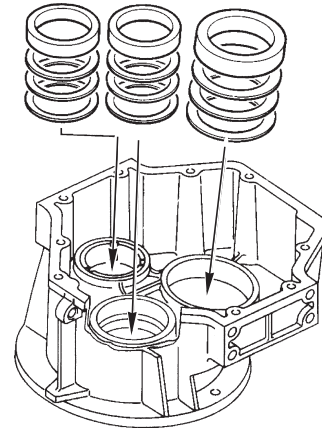


FIG. 5-2

5.3 Inserting gear set into housing

Finish housing mating face halves with an oilstone.

CAUTION

Make sure to keep any dirt out of housing.

- Holding the half housing on a swiveling stand, insert gears into it.
- Mount input housing half (item 1, Fig. 5-3) with all bolts, lock washers (item 2 and 3, Fig. 5-3) and parallel pins (item 4, Fig. 5-3).
- Tightening torque of bolts: 40 Nm (30 ft.lb.).

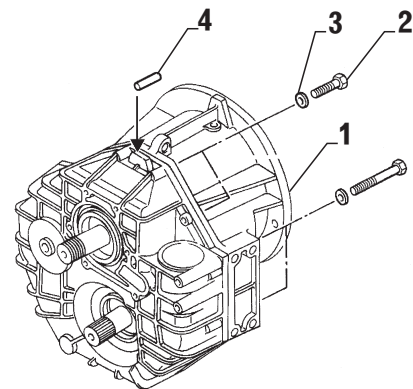


FIG. 5-3

5.4 Measuring bearing clearance on input shaft

- Turn input shaft several times to permit bearings to seat.
- Fit clamping ring (tool p/n 618582) to the spline of the input shaft (item 1, Fig. 5-4).
- Adjust to «0», dial indicator to obtain accurate reading.
- With two levers carefully pry on the clamping ring and record end play of shaft.

NOTE

This step must be done very carefully to obtain the actual bearing clearance.

- Carry out steps, a) and d) several times.

ZF 25 A - ZF 25 - ZF 45 A

- The bearing clearance measured plus the pretension required in section 5.1 determine the required thickness of shims.

ZF 45-1

- The bearing clearance measured minus the clearance required in section 5.1 will determine the required thickness of shims.

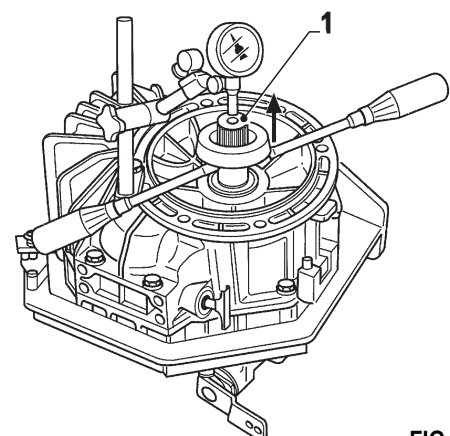


FIG. 5-4

5.5 Measuring bearing clearance at intermediate shaft

- a) Unscrew plug (item 1, Fig. 5-5a) from the housing.
- b) Screw in special tool (p/n 458105) (item 2, Fig. 5-5a) into intermediate shaft hole.
- c) Mount dial gauge support securely onto housing.
- d) Turn intermediate shaft several times to permit bearings to seat.
- e) Adjust the dial indicator needle on top of the bolt head and «O» to dial indicator (Fig. 5-5b).
- f) Screw hexagon nut carefully against housing (intermediate shaft moves up) until bearing clearance is overcome (Fig. 5-5b).

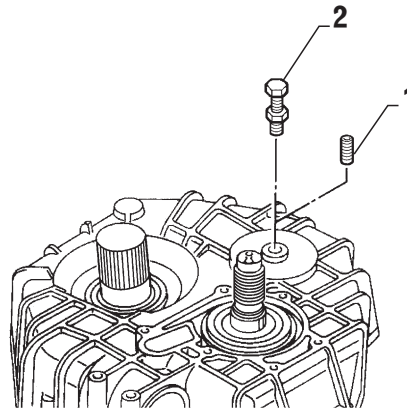


FIG. 5-5a

NOTE

This step should be done very carefully to obtain the actual bearing clearance.

- g) Carry out steps d) and f) several times.

ZF 25 A - ZF 25 - ZF 45 A

- h) The clearance measured plus the pretension required in section 5.1 determine the required thickness of shims.

ZF 45-1

- h) The clearance measured minus the clearance required in section 5.1 determine the required thickness of shims.
- i) Unscrew special tool and remove dial gauge with support.

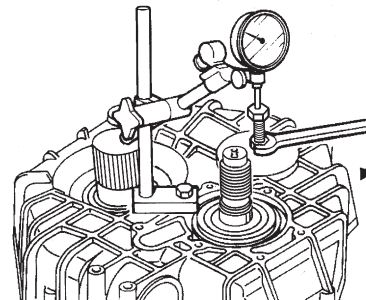


FIG. 5-5b

5.6 Measuring the bearing clearance on the output shaft.

ZF 25 A - ZF 25 - ZF 45 A

- a) Insert output flange onto the output shaft and screw in nut ring.

ZF 45-1

- b) Install bolt and spacer on input shaft.
- c) Turn output shaft repeatedly to permit bearings to seat.
- d) Mount dial gauge support securely onto housing.
- e) Place dial gauge onto top of the output shaft and adjust it to «0» reading.
- f) Lift output shaft carefully, using two screwdrivers, and record measurement (Fig. 5-6).

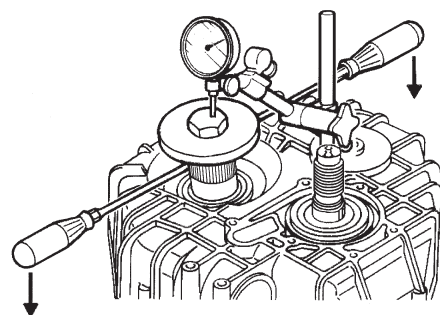


FIG. 5-6



NOTE

This step should be done very carefully to obtain the actual bearing clearance.

f) Carry out steps b) and e) for several times.

ZF 25 A - ZF 25 - ZF 45 A

The bearing clearance measured plus the pretension required in section 5.1 will determine the required thickness of shims.

ZF 45-1

The bearing clearance measured minus the clearance required in section 5.1 will determine the required thickness of shims.

NOTE

g) Remove nut ring and output flange (bolt with washer for ZF 45-1) and dial gauge with support.

5.7 Adjusting the pretension/clearance of bearings

When the thickness of shims has been determined, the transmission must be disassembled again.

NOTE

The following step is not needed for ZF 45-1 if the measured values are within the clearance required.

- a) Using a adequate drift punch, drive the parallel pins (item 1, Fig. 5-7a) with slight blows, out of the housing.
- b) Loosen hex bolts (item 2 and 3) with lockwashers (item 4, Fig. 5-7a) and remove input side of housing (item 5, Fig. 5-7a).
- c) Pull outer races of bearings out of the input side of the housing using the extracting unit (Fig. 5-7b) or heating the half housing in an oven to approx. 120°C (248°F) and remove the outer races of bearings together with shims.

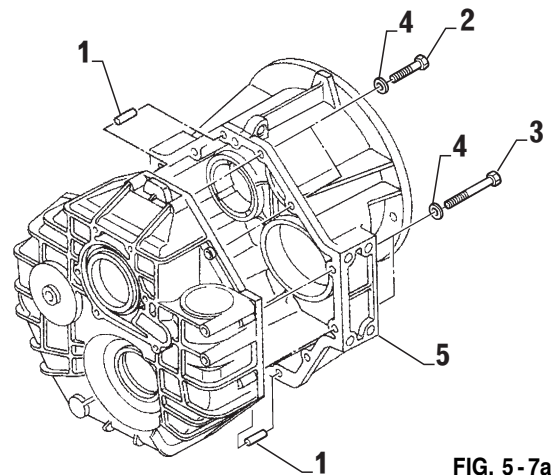


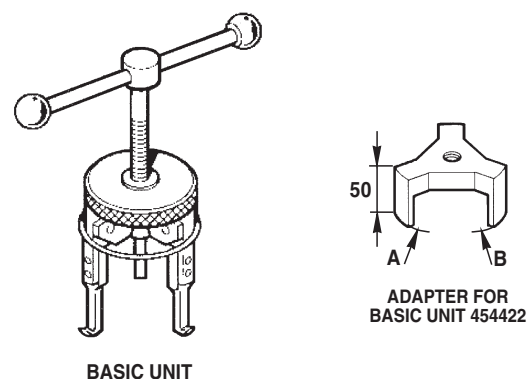
FIG. 5-7a

WARNING

Handle heated housing half and outer race only with protective gloves!

NOTE

Make sure to keep the shims with each outer race and not mix them together.



BASIC UNIT

ADAPTER FOR BASIC UNIT 454422

FIG. 5-7b

5.8 Final assembly of the housing

- a) Heat input side of the housing in an oven to approx. 120°C (248 °F).

⚠ WARNING

Handle heated housing only with protective gloves!

- b) Insert the required shims for proper pretension (clearance for ZF 45-1) into bearings bore under bearing outer race.
- c) Insert outer races of bearings. When the housing has reached ambient temperature, drive outer races of bearings down to the stop, using a copper punch.
- d) Insert shafts.
- e) Fill space between seal and dust lips of shaft seal rings with a high quality bearing grease (Staburags Kluber NBU 30).
- f) Apply a thin coat of Loctite 574 on mating surface of input side of the housing and join both housing halves together.
- g) Drive parallel pins into housing to align housing halves, before tightening.
- h) Install mounting bolts (item 2 and 3 Fig. 5-5a) and torque them to 40 Nm (30 ft.lb.).

NOTE

There must be not measurable bearing clearance.

NOTE

ZF 45-1 only.

Bearings, according to sections 5.4, 5.5 and 5.6 must have clearance.

⚠ WARNING

The necessary time for a complete polymerization is 5 hours: we recommend therefore to clean carefully the mating surfaces with Loctite 7063 cleaner before applying the Loctite 518 and wait the requested time before the spi test.

6. CONTROL BLOCK

6.1 Mounting the control block

NOTE

Piston rings (item 1, Fig. 6-1) have to be replaced, if thickness is less than 2.39 mm (0.094in).

- a) Insert key (item 2, Fig. 6-1) into groove of shaft.
- b) Place new seal (item 3, Fig. 6-1) onto control block.
- c) Align key and slot in rotor pump.
- d) Slide control block carefully on input shaft.
- e) Insert lock washers (item 4, Fig. 6-1) on socket head bolts (item 5, Fig. 6-1) and provide screw threads each with a drop of Loctite 243.
- f) Tight control block bolts. Tightening torque: 18 Nm (14 ft.lb.).

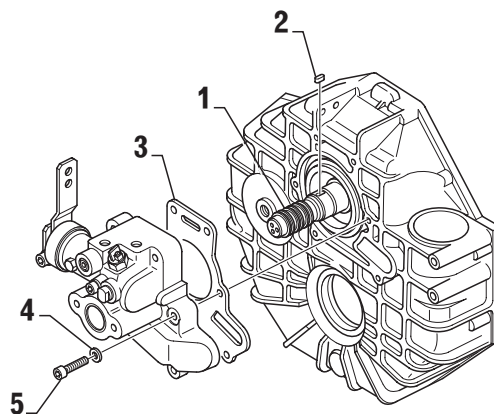


FIG. 6-1



7. FLUID FILTER

7.1 Mounting the fluid filter

ZF 25 A - ZF 25 OLD VERSION

- Place filter element (item 1 Fig. 7-1a) and seal (item 2 Fig. 7-1a) onto the transmission.
- Place filter cover (item 3 Fig. 7-1a) and lock it to the transmission by screwing in bolts (item 4 Fig. 7-1a). Tightening torque: 18 Nm (14 ft.lb.).

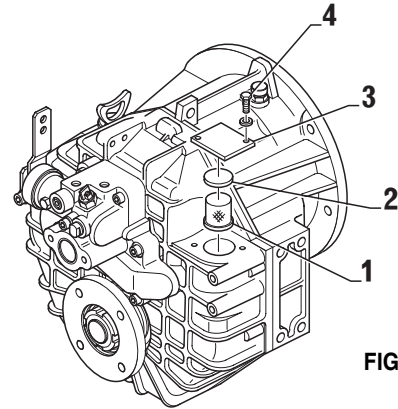


FIG. 7-1a

ZF 25 A - ZF 25 - ZF 45 A - ZF 45-1

- Wet O-rings (item 1 and 2, Fig. 7-1b) with some ATF fluid and mount them.
- Install filter element (item 3, Fig. 7-1b) into the transmission.
- Lock cover (item 4 Fig. 7-1b) to the transmission using an allen wrench. Tightening torque: min 5 Nm - max 8 Nm. (min 4 ft.lb. - max 6 ft.lb.)

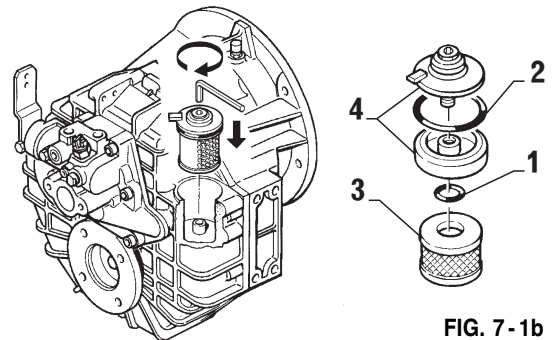


FIG. 7-1b

8. OUTPUT FLANGE

Provide spline (X) of output shaft with a thin coat of Loctite 245 and sealing lip (Z) of shaft seal with a thin coat of ATF fluid. (Fig. 8-1a and b)

Fit output flange (item 1, Fig. 8-1 a and b).

Provide O-ring (item 2, Fig. 8-1 a and b) with ATF fluid and insert into output flange.

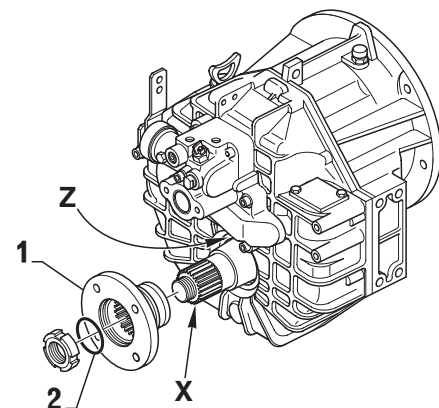


FIG. 8-1a

ZF 25 A - ZF 25 - ZF 45 A

Tighten output flange down on output shaft with nut ring (item 3, Fig. 8-1a).

Tightening torque; 120 Nm (89 ft.lb.) use socket spanner tool p/n 500446

ZF 45-1

Tight output flange down on output shaft with bolt (item 3, Fig 8-1b) and washer (4).

Tightening torque: 100Nm (74 ft.lb.)

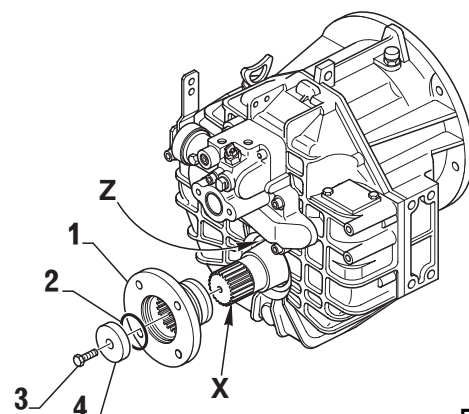


FIG. 8-1b

9. MAKING THE TRANSMISSION READY FOR OPERATION

9.1 Filling up with transmission Fluid

Filling with ATF fluid into the fluid filter opening. (Fig. 9-1)

Quantity:

ZF 25 A: 1.9 US-qts (1, 8 liters)

ZF 25: 2.1 US-qts (2, 0 liters)

ZF 45 A: 2.1 US-qts. (2, 0 liters)

ZF 45-1: 3.2 US-qts. (3, 0 liters)

ATF (Automatic Transmission Fluid) such as, per list on section IX.

Fit filter element as specified in section 7.1.

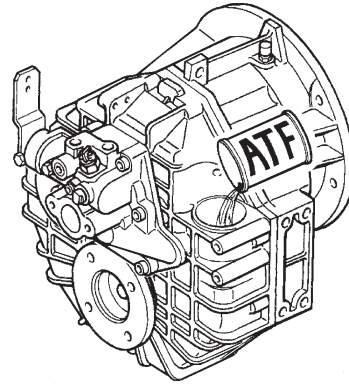


FIG. 9-1

9.2 Check fluid level

Carry out a trial run after oil filling.

Set shifting lever to neutral position (N). Start engine and let it run idle for a short time to fill the cooler and pipelines with transmission oil. Stop the engine and check oil level again. If necessary, top up with oil. Excessive oil should be removed. The fluid level on the dipstick (item 1, figure 9-2) should be between the min. and max. marks. The fluid level should be checked again after a short driving period.

NOTE

Some transmissions may have different oil dipsticks, depending on the version:

A) When inserted into the housing hole, it expands by turning the handle in clockwise direction. (Fig. 9-2 item A)

B) It is threaded (Fig. 9-2 item B).

IMPORTANT

Oil check with threaded dipstick (B) must be done in a different way compared with the one not threaded (A):

A) Oil dipstick and housing hole not threaded: dipstick completely inserted into hole.

B) Oil dipstick and housing hole threaded: dipstick not inserted into the housing hole (not screw in).

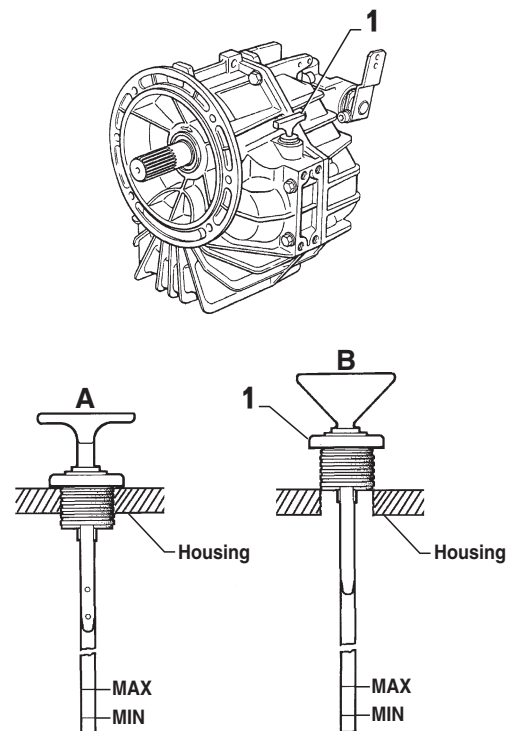
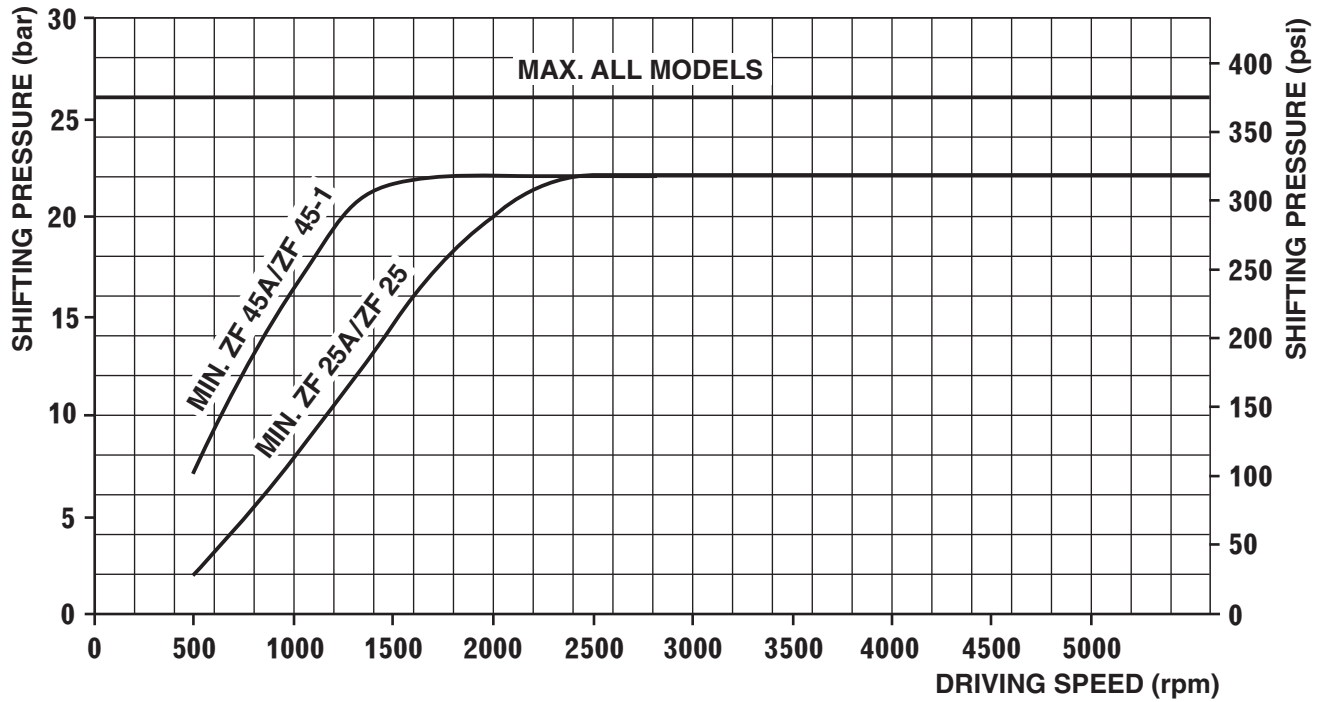


FIG. 9-2

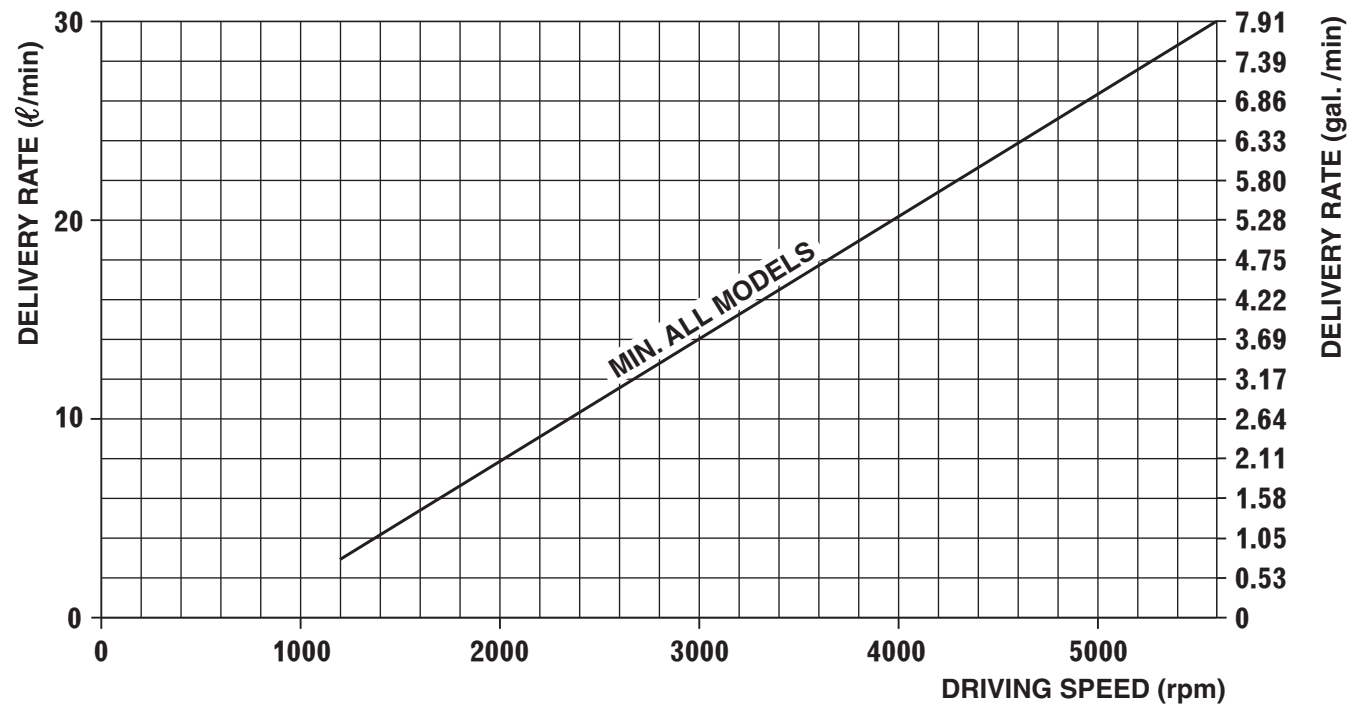


ADJUSTMENT DATA

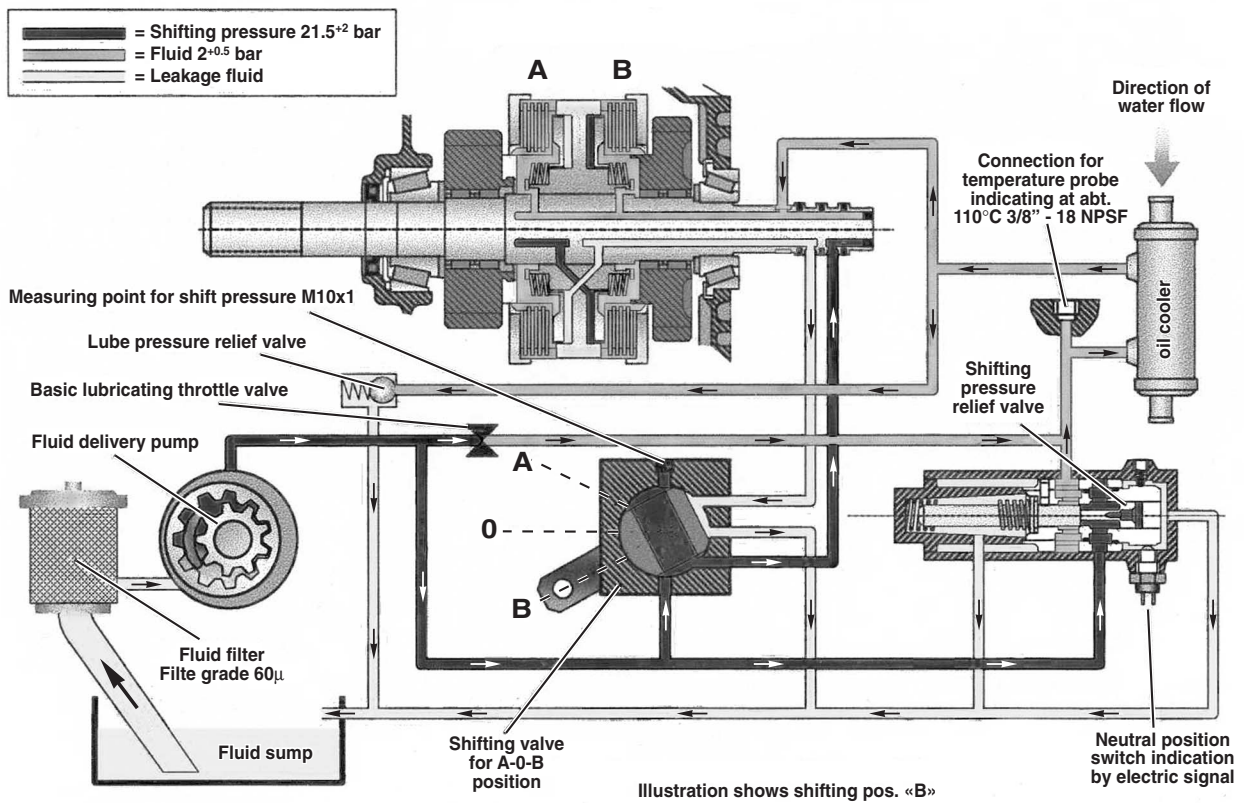
1. SHIFTING PRESSURE



2. LUBE OIL DELIVERY RATE



HYDRAULIC DIAGRAM





TIGHTENING TORQUES

PART	SIZE	TORQUE IN lb.ft.	TORQUE IN Nm	LOCTITE
Mounting brackets bolts ZF 45 A - ZF 45-1	M12	min. 120 - max. 104	min. 75 - max. 77	-
Output flange bolt ZF 45-1	M16	74	100	242 or 262
Housing bolts	M10	30	40	-
Control block bolts	M8	13	18	242 or 262
Shifting lever bolt	M8	17	23	
Output flange nut ring	M32	89	120	
Fluid filter bolt ZF 45 A - ZF 45-1	M8	min 4 - max 6	min 5 - max 8	-
Fluid filter bolts ZF 25 A - ZF 25 (old version)	-	13	18	-
Fluid filter bolts ZF 25 A - ZF 25 (new version)	M8	min 4 - max 6	min 5 - max 8	-
Oil breather	-	Hand tight	Hand tight	-
Fluid dipstick	-	Hand tight	Hand tight	-
Oil plug ZF 25 A - ZF 25	-	30	40	243
Screw	M5	4	5	242 or 262
Screw	M6	7	9	242 or 262
Stud bolt	M16	26	35	242 or 262
Control block stop screw	-	9	12	-
Control block pressure screw	M10	9	12	-
Neutral safety switch	-	18.5	25	-
Control block guide bolt	-	9	12	-
Control block temperature plug	-	26	35	-



FUNCTION TEST

When the transmission has been completely assembled and filled up with transmission fluid, it would be convenient to make a function test.

This test can be carried out on a bench test rig, or in a boat. If no fluid cooler can be connected, a hydraulic hose must be connected between the inlet and outlet of the hydraulic pump.

Measuring instruments required:

- Pressure gauge 0-40 bar (0-580 psi), with connecting thread M10x1.
- Temperature gauge 0-120°C (0-250°F) connecting thread 3/8«-18NPSF.
- Flow meter 0-35 liters/min (0-10 gals/min).

Tests to be carried out:

1. Fluid leaks
2. Noise emission
3. Output direction of rotation, LH/RH
4. Lube oil temperature
5. Shifting pressure
6. Lube oil flow rate

The function test should be carried out follows:

Motor speed rpm	Shift lever position	Temperature	Durat. minutes	Test
800-1000	neutral	40°C/104 °F	5	1, 2
600-800 (idling speed)	A <-> B position repeatedly	40°C/104 °F	-	1, 2, 3
1500-2500	B position	80°C / 176 °F	-	1, 2, 4
600-800 (idling speed)	A <-> B position repeatedly	80°C/176 °F	-	1, 2, 3
idling - max. speed	A position	80°C/176 °F	-	1, 2, 5*, 6*
600-800 (idling speed)	A-> B position 80°C/176 °F	-	-	1, 2
idling - max. speed	B position	80°C/176 °F	-	1, 2, 5*, 6*
		80°C/176 °F	-	

* At different speeds.



TROUBLESHOOTING

In case of trouble, check first whether all items of the mounting and operating instructions have been completed with. The subsequent tables will assist you in troubleshooting.

Symptom	Possibly cause	Remedy
1. Transmission cannot be shifted	1.1 Shifting lever is loose 1.2 Remote control does not permit lever travel required 1.3 Remote control faulty 1.4 No shifting pressure available	1.1 Tighten clamping bolt on shifting lever 1.2 Lift remote control off, if gears can be shifted by hand, adjust remote control 1.3 Repair remote control 1.4 Refer to 7
2. Delayed shift time	2.1 Shift linkage misadjust not allowing full engagement	2.1 Lift remote control off, if gear can be shifted by hand, adjust remote control. If the transmission cannot be shifted correctly by hand, replace the control block
3. Clutch is slipping, i.e. propeller speed too low as compared to engine speed.	3.1 Inadmissible fluid used 3.2 Fluid contains water 3.3 Shifting pressure too low 3.4 Wear on clutch discs 3.5 Piston rings are damaged	3.1 Drain fluid, refill with prescribed fluid, flush transmission while engine runs in neutral position drain fluid, refill transmission 3.2 Refer to 9 3.3 Refer to 6 3.4 Disassemble transmission, replace clutch discs 3.5 Disassemble transmission, replace piston rings
4. Transmission locked in gear	4.1 Medium piston ring in input shaft in control block is faulty 4.2 Warped discs due to overheating of slipping clutch 4.3 Needle bearings on input shaft are worn out	4.1 Remove control block, replace piston ring, if control block is worn, replace likewise 4.2 Refer to 3 4.3 Disassemble transmission, replace needle bearing and check for damage input shaft and gears
5. Output shaft turns in neutral position	5.1 Rotary slide valve in control block is worn 5.2 Faulty needle bearing on input shaft 5.3 Warped discs due to overheating of slipping clutch	5.1 Replace control block 5.2 Disassemble transmission and input shaft, replace bearing concerned and other damaged parts 5.3 Refer to 3
6. Shifting pressure too low	6.1 Fluid filter clogged 6.2 Fluid level in transmission too low 6.3 Fluid pump is worn out 6.4 Spring in shifting pressure relief valve is broken 6.5 Piston rings on input shaft are faulty 6.6 Piston rings in clutch are faulty	6.1 Replace fine filter 6.2 Top-up with fluid; in case of fluid loss check transmission, cooler and pipelines for leakage also refer to 10 through 13 6.3 Replace control block containing fluid pump 6.4 Replace control block 6.5 Remove control block and replace piston rings. In case of wear in control block due to faulty piston rings replace block as well 6.6 Disassemble transmission, replace piston rings.



Symptom	Possibly cause	Remedy
7. No shifting pressure available	7.1 Direction of engine rotation does not agree with arrow on transmission front cover 7.2 No fluid in the transmission 7.3 Fine filter is dirty 7.4 Fluid level in transmission is too low 7.5 Fluid pump worn out 7.6 Pump key in input shaft for fluid pump drive is broken 7.7 Spring of shifting pressure relief valve is broken	7.1 Replace with suitable rotation engine 7.2 Refill with fluid 7.3 Replace fine filter 7.4 Top-up with fluid. In case of loss of fluid check transmission, cooler and pipelines for leakage, also refer to 10 through 13 7.5 Replace control block 7.6 Remove control block. Replace pump key, and any other faulty parts 7.7 Replace control block
8. Excessive fluid temperature	8.1 Fluid cooler is too small 8.2 Excessive fluid in transmission 8.3 Fluid cooler is dirty on water side 8.4 Worn fluid pump in control block 8.5 Faulty piston rings in control block 8.6 Clutch is slipping 8.7 Clutch does not open completely due to worn disc support 8.8 Clutch does not open completely due to broken cup springs 8.9 With fluid cooler in bypass and unfavorable arrangement of pipelines too little coolant water flows through bypass to cooler	8.1 Use a larger fluid cooler 8.2 Remove excessive fluid with commercial suction pump 8.3 Detach coolant water lines and clean fluid cooler on water side 8.4 Replace control block containing fluid pump 8.5 Remove control block, replace piston rings. In case of wear in the control block due to faulty piston rings replace control block as well 8.6 Refer to 3 8.7 Dismount transmission and clutch, replace all faulty parts 8.8 Dismount transmission and clutch, replace all faulty parts 8.9 Correct bypass pipeline
9. Water in the fluid, fluid looks milky	9.1 Fluid cooler faulty 9.2 High water level in engine compartment, water entering at output shaft seal	9.1 Repair leakage at cooler or replace cooler. Change transmission fluid 9.2 Remedy cause for water level in engine compartment. Change transmission fluid
10. Fluid leakage at input or output shaft	10.1 Breather clogged with paint or dirt 10.2 Shaft seal faulty 10.3 Excessive fluid in transmission	10.1 Remove paint or dirt from breather Replace seal. If seal location on shaft is worn, regrind 10.3 Remove excessive fluid with commercial suction pump
11. Fluid leakage at breather	11.1 Excessive fluid in transmission	11.1 Pump excessive fluid out with commercial hand pump
12. Fluid leakage at joints or screw connections	12.1 Bolts are not tight at the prescribed torque 12.2 Loctite not properly spread onto sealing surface 12.3 Gasket has been used several times	12.1 Tighten bolts to prescribed torque 12.2 Reseal after removing old Loctite and cleaning. Finish mating faces with oilstone. 12.3 Replace gasket



Symptom	Possibly cause	Remedy
13. Transmission noise becomes louder	13.1 Fluid level too low so that pump sucks in air 13.2 Damage starting on flexible coupling due to wear or fatigue probably due to misalignment between engine and transmission 13.3 Beginning damage of bearings in transmission, e.g. due to torsional vibration, running without fluid, overload, wrong alignment of transmission 13.4 Beginning damage of gearing, e.g. due to torsional vibrations, running without fluid, overload 13.5 Fluid suction pipe in transmission has come loose	13.1 Top up with fluid to marking on dipstick 13.2 Replace flexible coupling. Check alignment between engine and transmission 13.3 Disassemble transmission, replace bearings concerned and other faulty parts. Find causes and remedy 13.4 Disassemble transmission, replace faulty parts 13.5 Disassemble transmission fix fluid suction pipe
14. Chattering transmission noise mainly at low engine speed	14.1 The engine or propeller generates torsional vibrations in the drive unit which produces a hammering noise in the transmission 14.2 Misaligned cardan shafts on input or output	14.1 Mount a flexible coupling with a different stiffness factor between engine and transmission; a coupling with a higher stiffness factor might be sufficient. Otherwise analyze the torsional vibrations to find out the required stiffness for the coupling. 14.2 Mount and align cardan shaft strictly according to instructions issued by cardan shaft manufacturer
15. Low pressure	15.1 Fine filter is dirty 15.2 Fluid level in transmission is low 15.3 Control block is broken 15.4 Problem at control valve 15.5 Piston rings on input shaft are faulty 15.6 Piston rings inside the clutch are faulty 15.7 Defective cover filter : air suction 15.8 Oil suction hose not properly adjusted 15.9 Fitting key in input shaft for fluid pump drive is broken 15.10 Possible wear of the piston ring grooves	15.1 Replace fine filter 15.2 Refill with fluid 15.3 Replace control block 15.4 Replace control block 15.5 Remove control block and replace piston rings 15.6 Disassemble transmission, replace piston rings 15.7 Replace cover filter 15.8 Replace the seal and adjust correctly the suction hose 15.9 Remove control block replace fitting key, replace any other faulty parts 15.10 Replace the input shaft
16. Oil leakage	16.1 Porosity 16.2 Seals 16.3 Joints 16.4 Bracket with flatness error 16.5 Bolts are not tight 16.6 Fittings loosen 16.7 Dipstick is not tight 16.8 Filter is not tight 16.9 Excessive fluid in transmission 16.10 Breather clogged with paint or dirt (fluid leakage at output shaft) 16.11 Aluminium washers used more times	16.1 Replace faulty parts 16.2 Replace seals 16.3 Check if bolts are tighten with the correct torque. Clean the surface and reseal with Loctite 518 16.4 Replace bracket 16.5 Reseal and tighten bolts with prescribed torque 16.6 Tighten or replace 16.7 Tighten dipstick or replace o-ring dipstick 16.8 Tighten filter or replace o-ring filter 16.9 Remove excessive fluid with commercial suction pump 16.10 Remove paint or dirty from breather 16.11 Replace aluminium washers



Symptom	Possibly cause	Remedy
17. High oil temperature	17.1 Excessive fluid in transmission 17.2 Oil cooler is dirty 17.3 No water in circuit 17.4 Undersized cooler 17.5 Clutch is slipping 17.6 Excessive friction of the reverse clutch 17.7 Possible bypass in the cooling circuit	17.1 Remove excessive fluid with commercial suction pump 17.2 Replace the cooler and check the water circuit 17.3 Check the cooling circuit 17.4 Replace the cooler with a proper one 17.5 Refer to 4 17.6 Check the clutch play and the correct position of the piston 17.7 Reduce the bypass
18. Slipping clutch	18.1 Low pressure 18.2 Fluid level in transmission is low 18.3 Shift lever not properly adjusted 18.4 Trolling lever not in the detent position 18.5 Wear on clutch discs 18.6 Piston rings in clutch are faulty 18.7 Inadmissible fluid used 18.8 Water in the fluid 18.9 Piston rings on input shaft are faulty	18.1 Refer to 1 18.2 Refill with fluid 18.3 Regulate at the end of the way 18.4 Adjust the lever at the detent position 18.5 Disassemble transmission, replace clutch discs 18.6 Disassemble transmission, replace piston rings 18.7 Drain fluid, refill with prescribed fluid 18.8 Repair leakage at cooler or replace cooler. Change transmission fluid 18.9 Remove control block and replace piston rings
19. Noise	- hydraulic 19.1 Oil filter is dirty 19.2 Fluid level in transmission is low 19.3 Oil suction hose not properly adjusted 19.4 Defective cover filter : air suction - at idle speed 19.5 Coupling - under load 19.6 Wrong shimming 19.7 Defective gears	19.1 Replace oil filter 19.2 Refill with fluid 19.3 Replace the seal and adjust correctly the suction hose 19.4 Replace cover filter 19.5 Replace 19.6 Re-shim 19.7 Replace defective gears
20. Engagement not possible	20.1 Fluid level in transmission is low 20.2 Fine filter is dirty 20.3 Incorrect shift lever position 20.4 Coupling is damaged 20.5 Control block 20.6 Shifting lever is loose 20.7 Low pressure	20.1 Refill with fluid 20.2 Replace fine filter 20.3 Regulate at the end of the way 20.4 Replace coupling 20.5 Replace control block 20.6 Tighten clamping bolt on shifting lever 20.7 Refer to 1
21. Slow engagement	21.1 Fluid level in transmission is low 21.2 Shift lever 21.3 Regulate	21.1 Refill with fluid 21.2 Low pressure 21.3 Refer to 1
22. Hard shifting	22.1 Shift lever 22.2 Control block is dirty	22.1 Regulate 22.2 Disassemble the control valve and clean



Symptom	Possibly cause	Remedy
23. Transmission is dragging in neutral	23.1 Warped discs due to overheating 23.2 Needle bearings on input shaft are faulty 23.3 Intermediate gear moved from the shaft and touching the clutch drum 23.4 Discs of the reverse clutch radially broken due to torsional vibration	23.1 Replace discs, replace any other faulty parts 23.2 Disassemble transmission, replace needle bearings 23.3 Replace the intermediate gear 23.4 Replace the discs and change the damper with a proper one
24. Water in the oil	24.1 Fluid cooler faulty 24.2 Water in bilge	24.1 Repair leakage at cooler or replace cooler 24.2 Remove water from the bilge and check the oil seal



AUTOMATIC TRANSMISSION FLUID

MANUFACTURER	PRODUCT	MANUFACTURER	PRODUCT
ADDINOL MINERALÖL GMBH, KRUMPA/D	<ul style="list-style-type: none">• ADDINOL ATF D IID• ADDINOL ATF D III	ENGEN PETROLEUM, CAPE TOWN/ZA	<ul style="list-style-type: none">• ENGEN ATF 22D
AGIP PETROLI SPA, ROM/I	<ul style="list-style-type: none">• AGIP ATF II D• AGIP ATF D 309• AGIP ATF PLUS• AGIP DEXRON III	ERTOIL SA, MADRID/E	<ul style="list-style-type: none">• TRANSMISIONES AUTOMATICAS D2
AGIP SCHMIERTECHNIK, WÜRZBURG/D	<ul style="list-style-type: none">• AUTOL GETRIEBEÖL ATF-D• AUTOL GETRIEBEÖL ATF III D	ESSO AG, HAMBURG/D	<ul style="list-style-type: none">• ESSO ATF D (21611)• ESSO ATF F-30320• ESSO ATF D (21065)
ARAL LUBRICANTS GMBH, BOCHUM/D	<ul style="list-style-type: none">• ARAL GETRIEBEÖL ATF 22• ARAL GETR.ÖL ATF 55 F-30589	FIAT LUBRIFICANTI, VILLASTELLONE/I	<ul style="list-style-type: none">• TUTELA GI/A
AVIA MINERALÖL-AG, MÜNCHEN/D	<ul style="list-style-type: none">• AVIA FLUID ATF 86	FINA EUROPE SA, BRÜSSEL/B	<ul style="list-style-type: none">• FINAMATIC II-D
BLASER SWISSLUBE, HASLE-RÜEGSAU/CH	<ul style="list-style-type: none">• BLASOL 229	FUCHS LUBRICANTS (UK), DERBY/GB	<ul style="list-style-type: none">• SILKTRAN MP-ATF• SILKTRAN PSV ATF
BP OIL DEUTSCHLAND, HAMBURG/D	<ul style="list-style-type: none">• FRONTOL UNIVERSAL-ATF 100	FUCHS MINERALÖLWERKE, MANNHEIM/D	<ul style="list-style-type: none">• TITAN ATF 4000
BP OIL INTERNATIONAL, LONDON/GB	<ul style="list-style-type: none">• AUTRAN DX II• AUTRAN MBX• AUTRAN DX III (F-30370)• AUTRAN DX III (F-30381)	GINOUVES GEORGES SA, LA FARLEDE/F	<ul style="list-style-type: none">• YORK LT 785
BUCHER + CIE AG, LANGENTHAL/CH	<ul style="list-style-type: none">• MOTOREX ATF SUPER D-22656• MOTOREX ATF DEXRON III MC	GULF OIL (GB) LTD, CHELTENHAM/GB	<ul style="list-style-type: none">• UNIFLUID• ATF 2
CALPAM GMBH, ASCHAFFENBURG/D	<ul style="list-style-type: none">• PAMATIC FLUID 289• CALPAMATIC FLUID III F	HANDELSMIJ NOVIOL B.V., NIJMEGEN/NL	<ul style="list-style-type: none">• KENDALL ATF DEXRON IID
CALTEX PETROLEUM CORP., LONDON/GB	<ul style="list-style-type: none">• CALTEX ATF-HDA• CALTEX ATF-HDM• CALTEX TEXAMATIC 1278• CALTEX TEXAMATIC 7045• CALTEX TEXAMATIC 1205A	HOMBERG GMBH + CO KG, WUPPERTAL/D	<ul style="list-style-type: none">• HOMBERG-GETRIEBE-FLUID D
CASTROL LTD, SWINDON/GB	<ul style="list-style-type: none">• CASTROL TQ-D (22765)• CASTROL TQ DEXRON III F-30520• CASTROL TRANSMAX S (F-30319)• CASTROL TRANSMAX T (F-30359)• CASTROL TQ-D (21289)• CASTROL ATF 21293	IGOL FRANCE, PARIS/F	<ul style="list-style-type: none">• IGOL ATF 420
CEPSA, MADRID/E	<ul style="list-style-type: none">• CEPSA ATF-70	INA RAFINERIJA ZAGREB/CROATIA	<ul style="list-style-type: none">• INA-ATF SUPER
CHEVRON PRODUCTS CO., RICHMOND/USA	<ul style="list-style-type: none">• CHEVRON ATF F-30108	ITALIANA PETROLI, GENOVA/I	<ul style="list-style-type: none">• TRANSMISSION FLUID DX
CITGO PETROLEUM CORP., TULSA/USA	<ul style="list-style-type: none">• CITGO ATF DEXRON III F-30167	JAPAN ENERGY CORP., TOKYO/JAPAN	<ul style="list-style-type: none">• JOMO ATF K
C.J.DIEDERICHS SÖHNE, WUPPERTAL/D	<ul style="list-style-type: none">• CIDISOL-HYDR.-FLUID DEXRON IID	KÄPPLER K., STUTTGART/D	<ul style="list-style-type: none">• SELECTOL FLUID GETR.ÖL IID 23
DE OLIEBRON B.V., ZWIJNDRECHT/NL	<ul style="list-style-type: none">• ATF DMM• ATF 289	KLÖCKNER ENERGIEHANDEL GMBH, KÖLN/D	<ul style="list-style-type: none">• DEUTZ OEL ATF-D
DEA MINERALÖL AG, HAMBURG/D	<ul style="list-style-type: none">• DEAMATIC• DEAFLLUID 4011• DEAFLLUID 3003	KROON OIL BV, ALMELO/NL	<ul style="list-style-type: none">• ATF DEXRON IID• ALMIROL ATF
DEUTSCHE SHELL AG, HAMBURG/D	<ul style="list-style-type: none">• MAC ATF D-21666	KUWAIT PETROLEUM, HOOGVLIET/NL	<ul style="list-style-type: none">• Q8 AUTO 15• Q8 AUTO 14 (IID-21677)• Q8 AUTO 14 (IID)• Q8 AUTO 14 (IID-21883)
DUCKHAMS OIL, BROMLEY/GB	<ul style="list-style-type: none">• UNIMATIC	LEPRINCE + SIVEKE GMBH, HERFORD/D	<ul style="list-style-type: none">• LEPRINXOL FLUID CN
ELF LUBRIFIANTS, PARIS/F	<ul style="list-style-type: none">• TRANSANTAR DF2• ANTAR 22329• ELFMATIC G2 22329• HUILE RENAULT DIESEL• STARMATIC	LIQUI MOLY / MEGUIN, ULM/D	<ul style="list-style-type: none">• ATF IIE• MEGOL ATF IID
ELFMATIC G3	<ul style="list-style-type: none">• TRANSANTAR DF3	LUBRICATION ENGIN., FORT WORTH/USA	<ul style="list-style-type: none">• AUTOMATIC TRANSMISSION FLUID
ELLER-MONTAN-COMP., DUISBURG/D	<ul style="list-style-type: none">• ELLMO-AUTOMATIK-FLUID 22233	MAURAN SA, ODARS/F	<ul style="list-style-type: none">• INTER OIL INTER MATIC ATF D2
		MIN.ÖL-RAFFIN. DOLLBERGEN, UETZE/D	<ul style="list-style-type: none">• PENNASOL FLUID-GETR.ÖL TYP PCN
		MOBIL OIL, WEDEL/D	<ul style="list-style-type: none">• MOBIL ATF 220 D21014 / D21685• MOBIL ATF F-30107• MOBIL ATF 220 D21412 / D22187
		MOBIL SEKIYU KABUS. KAISHA, TOKYO/J	<ul style="list-style-type: none">• MOBIL ATF 220Y (D-21412)
		MOL HUNGARIAN OIL, KOMARON/H	<ul style="list-style-type: none">• CARRIER ATF
		MORRIS LUBRICANTS, SHREWSBURY/GB	<ul style="list-style-type: none">• LIQUIMATIC DII
		NAFTEC, ALGIER/DZ	<ul style="list-style-type: none">• TASSILIA



MANUFACTURER	PRODUCT
NANHAI SUPERIOR LUB-OIL, CHINA	• NANHAI ATF (D2)
NIS-RAFINERIJA NAFTE BEOGRAD/YU	• GALAX MATIC DAC
OEST G. MIN.ÖLWERK, FREUDENSTADT/D	• ATF T 4011
OMEX PETROLEUM PTY, BELLEVUE/AUS	• OMEX ATF DEXRON II
OMV AG, SCHWECHAT/A	• OMV ATF D II (D22427) • OMV ATF III (F-30580)
OPTIMOL ÖLWERKE, HAMBURG/D	• OPTIMOL ATF T 4011
OSWALD KLUTH, BARGFELD-STEGEN/D	• UNIVERSAL ATF-D
PAKELO MOTOR OIL, SAN BONIFACIO/I	• MULTIPURPOSE TRANSM. FLUID IID
PANOLIN AG, MADETSWIL/CH	• PANOLIN ATF MULTI 21996 • PANOLIN ATF DEXRON III
PARS OIL CO., TEHRAN/IR	• PARS ENTEGHAL-E AUTOMATIC OIL
PAZ LUBRICANTS & CHEMICALS, HAIFA/IL	• PAZBO EZF
PENNZOIL PRODUCT COMP., HOUSTON/USA	• PENNZOIL ATF F-30110
PETRO-CANADA, MISSISSAUGA/CDN	• DEXRON III/MERC.ATF (F-30395)
PETROL OFISI A.S., BAKANLIKLIKLAR/TR	• PETROL OFISI ATF II
PETROLEX, KWIDZYN/PL	• VECO MATIC IID
PRINZ-SCHULTE, FRECHEN/D	• AERO-LINE ATF-2 • AERO-LINE ATF-D
REPSOL DISTRIBUCION SA, MADRID/E	• REPSOL MATIC ATF
S.A.E.L, ALCOBENDAS/E	• GULF ATF DII D-22233
SASOL OIL, RANDBURG/ZA	• SASOL ATF DXII
SCHMIERSTOFFRAFFINERIE SALZBERGEN/D	• WINTERSHALL ATF D
SHELL ASEOL AG, BERN/CH	• ASEOL ATF DB UNIVERSAL
SHELL INTERNATIONAL, LONDON/GB	• SHELL DONAX TA (D-21666) • SHELL DONAX TG (F-30358)
SLOVNAFT JS CO, BRATISLAVA/SLO	• MADIT AUTOMATIC
SONOL ISRAEL LTD, HAIFA/IL	• DEXRON 2 D

MANUFACTURER	PRODUCT
SOPROGRASA SA, MADRID/E	• SOPRAL 164
STATOIL STAVANGER/N	• TRANSWAY DX III (F-30373) • TRANSWAY DX II
STL TECNOL, ESCALQUENS/F	• TECNOL TECMATIC D2
SUN OIL COMPANY, AARTSELAAR/B	• SUNAMATIC 149 • SUNAMATIC 153
SUOMEN PETROOLI OY, HAMINA/SF	• TEBOIL FLUID E (F-30301) • TEBOIL FLUID D
SVENSKA STATOIL AB, NYNÄSHAMN/S	• TRANSWAY DX III (F-30373)
TAMOIL LUBES, GENEVA/CH	• TAMOIL ATF II D
TEXACO LUBRICANTS COMP., BEACON/USA	• ATF MERCON / DEXRON III • TEXAMATIC 7045 • TEXAMATIC 4261 • TEXAMATIC 7080 • TEXTRAN PSM • TEXAMATIC 4011 • TEXAMATIC 4291 • TEXAMATIC 9226
TEXACO SERVICES LTD, BRÜSSEL/B	• TOTAL FLUIDE ATX • TOTAL FLUIDE IID • TOTAL FLUIDE AT 42
TOTAL RAFFINAGE DISTR., PARIS/F	• TOTAL FLUIDE ATD
TOTAL SOUTH AFRICA, JOHANNESBURG/ZA	• TOTAL FLUIDE ATD
TURBOTANK BÖSCHE BÖDEKER, BREMEN/D	• TURBO UNIV. ATF MERCON 4011
UFANEFTTECHIM REFINERY, UFA/RUS	• UFALUB ATF
UNIL DEUTSCHLAND GMBH, BREMEN/D	• UNIL MATIC CN T 4011
VALVOLINE INC., LEXINGTON/USA	• VALVOLINE MULTI-PURPOSE ATF
VALVOLINE INTERNAT., DORDRECHT/NL	• VALVOLINE ATF TYPE D
VEBA OEL AG, GELSENKIRCHEN/D	• MOVARA ATF-GETRIEBEÖL DIID
VEEDOL INTERNATIONAL, SWINDON/GB	• VEEDOL ATF-M (22764) • VEEDOL ATF DEXRON III F-30521 • VEEDOL UNITRANS S PLUS
YACCO SA, ST PIERRE-LES-ELBEUF/F	• YACCO ATF D
ZELLER + GMELIN GMBH&CO, EISLINGEN/D	• DIVINOL FLUID 666



SPARE PARTS LIST

Preface

The spare parts list is only valid for the type and versions of transmission, as shown below.

You will find the transmission type and version on your transmission name plate.

If the type and version indicated differs from that printed in this Manual, the relative Spare Parts List should be ordered from ZF HURTH MARINE.

The indicated dimensions and standards are as such not enough for ordering parts.

When ordering parts, please state:

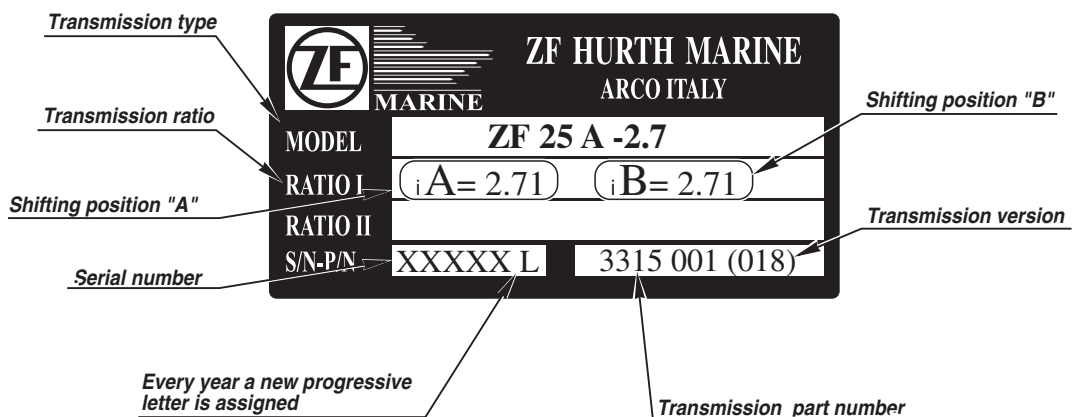
- Transmission type
- Serial number
- Item no.
- Part name
- Identification no.

The spare parts list is referring to the following versions:

- ZF 25 A** versions **01** (1.55 R); **02** (1.93 R); **03** (2.29 R); **04** (2.71 R);
versions **001** (1.55 R); **002** (1.93 R); **003** (2.29 R); **004** (2.71 R);
versions **014** (1.55 R); **015** (1.93 R); **016** (2.29 R); **018** (2.71 R);;
- ZF 25** versions **001** (1.97 R); **002** (2.80 R);
versions **003** (1.97 R); **004** (2.80 R);
versions **010** (1.97 R); **011** (2.80 R);
- ZF 45 A** versions **24** (1.26 R); **25** (1.51 R); **26** (2.03 R); **23** (2.43 R);
versions **001** (1.26 R); **002** (1.51 R); **003** (2.03 R); **004** (2.43 R);
versions **014** (1.26 R); **015** (1.51 R); **016** (2.03 R); **017** (2.43 R);
- ZF 45-1** versions **006** (2.20 R); **007** (2.51 R); **008** (3.03 R); **010** (3.74 R);

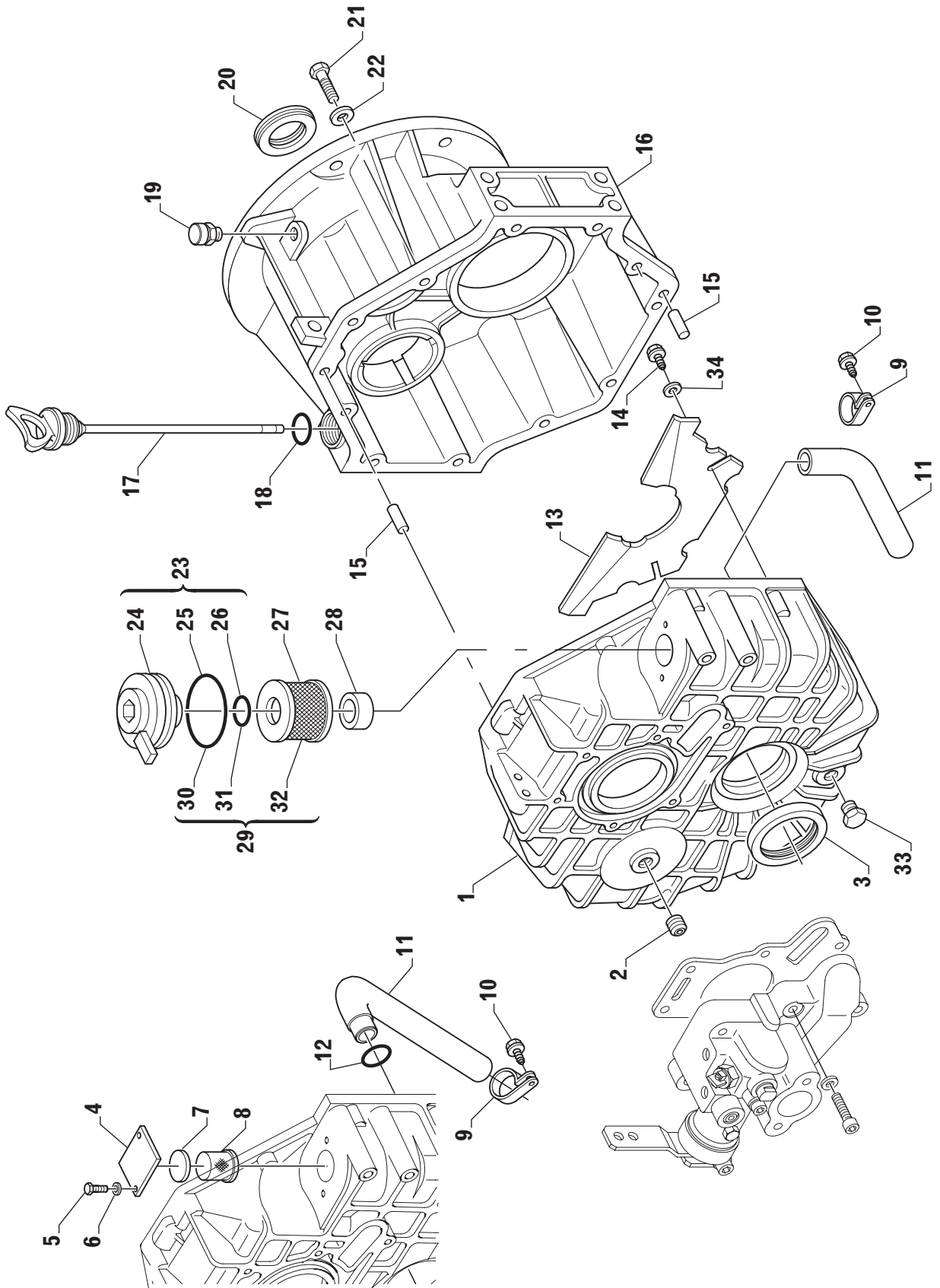
Name plate

The name plate is mounted to the transmission



ZF 25 A

FIG. 1

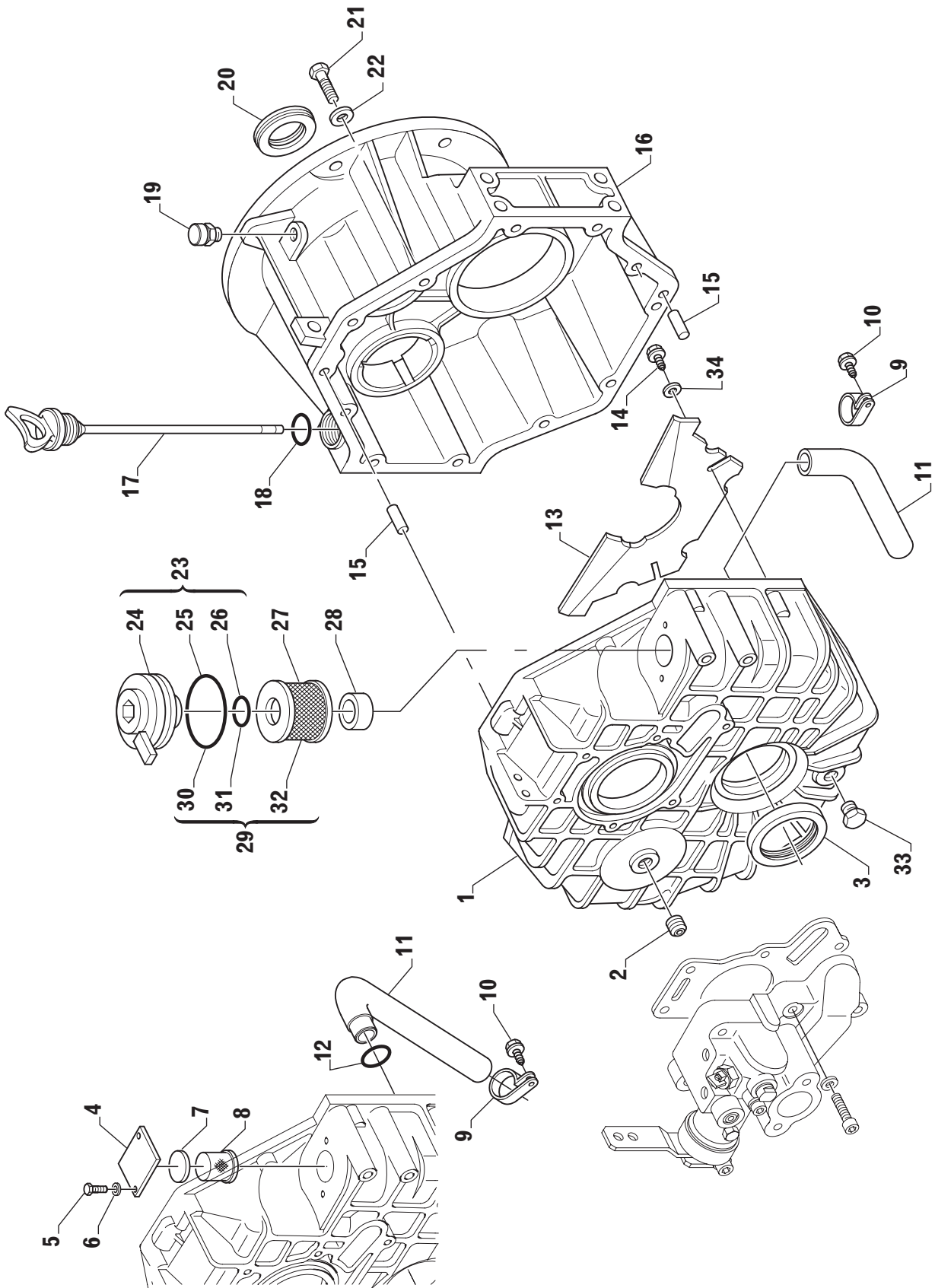




Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3315 301 002	501134	Scatola	Housing	1	Not available any more From s/n 19395 L
	3315 301 008		Scatola	Housing	1	
2	0636 301 041	442373	Tappo	Plug	1	
3	0634 319 135	374056	Paraolio uscita	Output shaft seal	1	
4	3310 301 001	501069	Coperchio filtro	Filter cover	1	
5	0636 015 257	330796	Vite	Screw	2	
6	0630 302 090	442372	Rosetta	Washer	2	
7	3315 301 014	501238	Guarnizione	Gasket	1	
8	3315 201 001	501401	Filtro olio	Oil filter	1	
9	0632 311 398	479439	Fascetta	Suction pipe clamp	1	
10	0636 101 411	102879	Vite T.E. (fascetta tubo aspirazione)	Hex head screw (suction pipe clamp)	1	
11	3315 301 013	501128	Tubo	Pipe	1	From s/n 19395 L
	3315 301 010		Tubo aspirazione	Suction pipe	1	
	3315 301 023		Tubo aspirazione con supporto	Suction pipe with support	1	
12	0634 306 209	501179	Guarnizione OR	O-Ring	1	
13	3315 301 012	501131	Separatore	Baffle plate	1	
14	0636 113 006	455079	Vite T.E.	Hex head screw	2	From s/n 16656 M
	0636 015 020		Vite T.E. M5x12	Hex head screw M5x12	2	
15	0631 315 520	335817	Spina	Locator pin	2	
16	3315 301 006		Coperchio	Cover (housing)	1	
17	3311 201 001	500994	Asta livello olio + OR	Oil dipstick + OR	1	
18	0634 304 405	501211	. Guarnizione OR (Asta livello olio)	. O-Ring (Oil dipstick)	1	
19	3311 301 002	442369	Valvola di sfiato	Breather valve	1	
20	3312 301 030	442371	Paraolio entrata	Input shaft seal	1	
21	0636 015 227	442375	Vite T.E.	Hex head screw	10	
22	0630 302 091	442371	Rosetta	Washer	10	
23	3312 101 003	500484	Coperchio filtro completo	Filter cover, assy.	1	From s/n 19395 L
24			. Coperchio	. Cover (housing)	1	
25	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
26	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
27	3312 301 007	438637	Filtro olio	Oil filter	1	From s/n 19395 L
28	3312 301 008	439653	Guarnizione	Gasket	1	From s/n 19395 L
29	3312 199 031	463772	Filtro olio completo	Oil filter, assy	1	From s/n 19395 L
30	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
31	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
32	3312 301 007	438637	. Filtro olio	. Oil filter	1	
33	3312 301 017	469691	. Tappo	. Plug	1	From s/n 19395 L
34	0630 001 046		. Rosetta	. Washer	2	From s/n 16656 M

ZF 25

FIG. 1

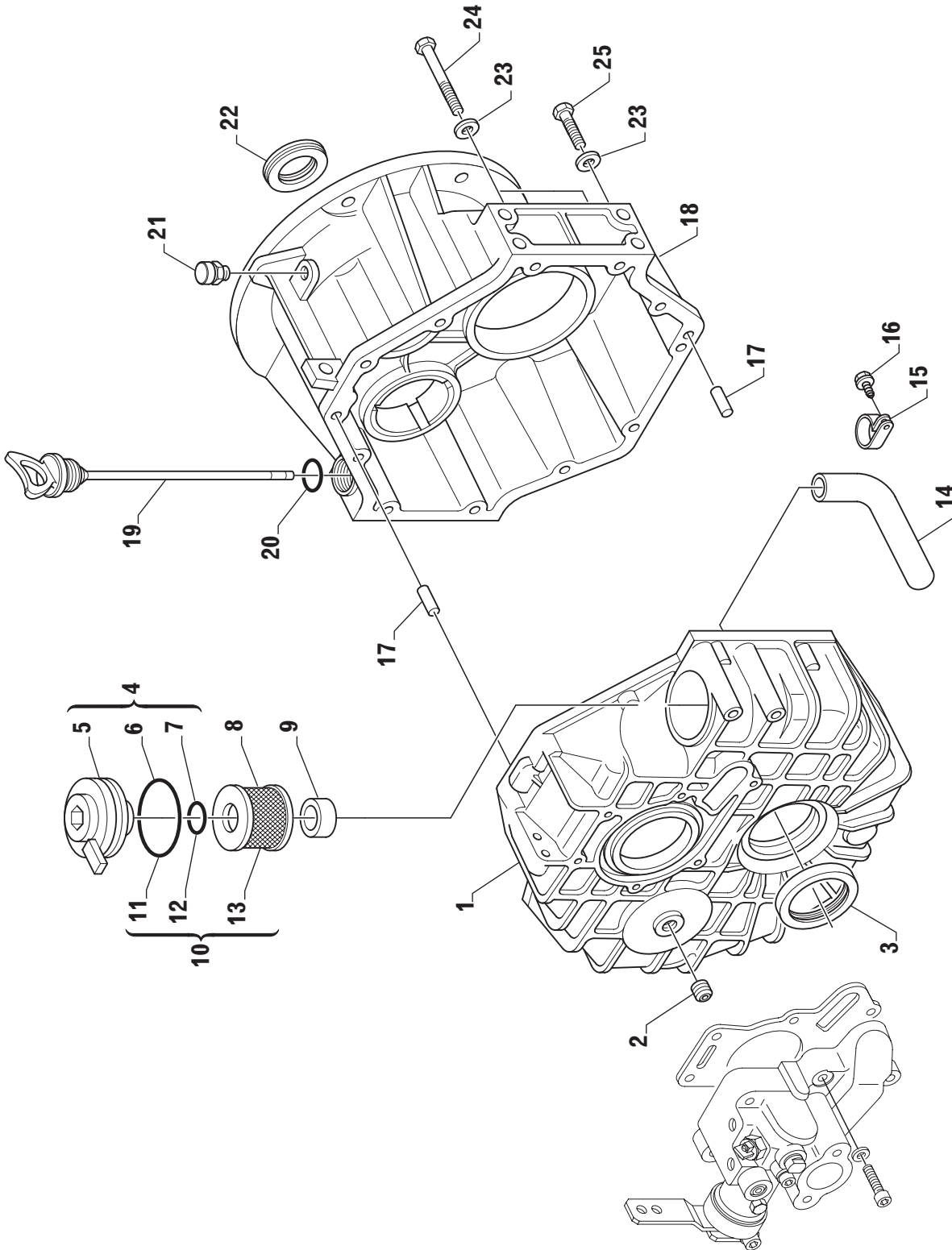




Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3315 301 004		Scatola	Housing	1	Not available any more
	3315 301 009		Scatola	Housing	1	From s/n 17437 L
2	0636 301 041	442373	Tappo	Plug	1	
3	0634 319 135	374056	Paraolio uscita	Output shaft seal	1	
4	3310 301 001	501069	Coperchio filtro	Filter cover	1	
5	0636 015 257	330796	Vite	Screw	2	
6	0630 302 090	442372	Rosetta	Washer	2	
7	3315 301 014	501238	Guarnizione	Gasket	1	
8	3315 201 001	501401	Filtro olio	Oil filter	1	
9	0632 311 398	479439	Fascetta	Suction pipe clamp	1	
10	0636 101 411	102879	Vite T.E. (fascetta tubo aspirazione)	Hex head screw (suction pipe clamp)	1	
11	3315 301 013	501128	Tubo	Pipe	1	
	3315 301 011		Tubo aspirazione	Suction pipe	1	From s/n 17437 L
	3315 301 022		Tubo aspirazione con supporto	Suction pipe with support	1	From s/n 16591 M
12	0634 306 209	501179	Guarnizione OR	O-Ring	1	
13	3315 301 012	501131	Separatore	Baffle plate	1	
14	0636 113 006	455079	Vite T.E.	Hex head screw	2	
	0636 015 020		Vite T.E.	Hex head screw	2	From s/n 16591 M
15	0631 315 520	335817	Spina	Locator pin	2	
16	3315 301 003		Coperchio	Cover (housing)	1	
17	3311 201 001	500994	Asta livello olio + OR	Oil dipstick + OR	1	
18	0634 304 405	501211	. Guarnizione OR (Asta livello olio)	. O-Ring (Oil dipstick)	1	
19	3311 301 002	442369	Valvola di sfiato	Breather valve	1	
20	3312 301 030	442371	Paraolio entrata	Input shaft seal	1	
21	0636 015 227	442375	Vite T.E.	Hex head screw	10	
22	0630 302 091	442371	Rosetta	Washer	10	
23	3312 101 003	500484	Coperchio filtro completo	Filter cover, assy.	1	From s/n 17437 L
24			. Coperchio	. Cover (housing)	1	
25	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
26	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
27	3312 301 007	438637	Filtro olio	Oil filter	1	From s/n 17437 L
28	3312 301 008	439653	Guarnizione	Gasket	1	From s/n 17437 L
29	3312 199 031	463772	Filtro olio completo	Oil filter, assy	1	From s/n 17437 L
30	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
31	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
32	3312 301 007	438637	. Filtro olio	. Oil filter	1	
33	3312 301 017	469691	Tappo	Plug	1	From s/n 17437 L
34	0630 001 046		Rosetta	Washer	2	From s/n 16591 M

ZF 45 A

FIG. 1





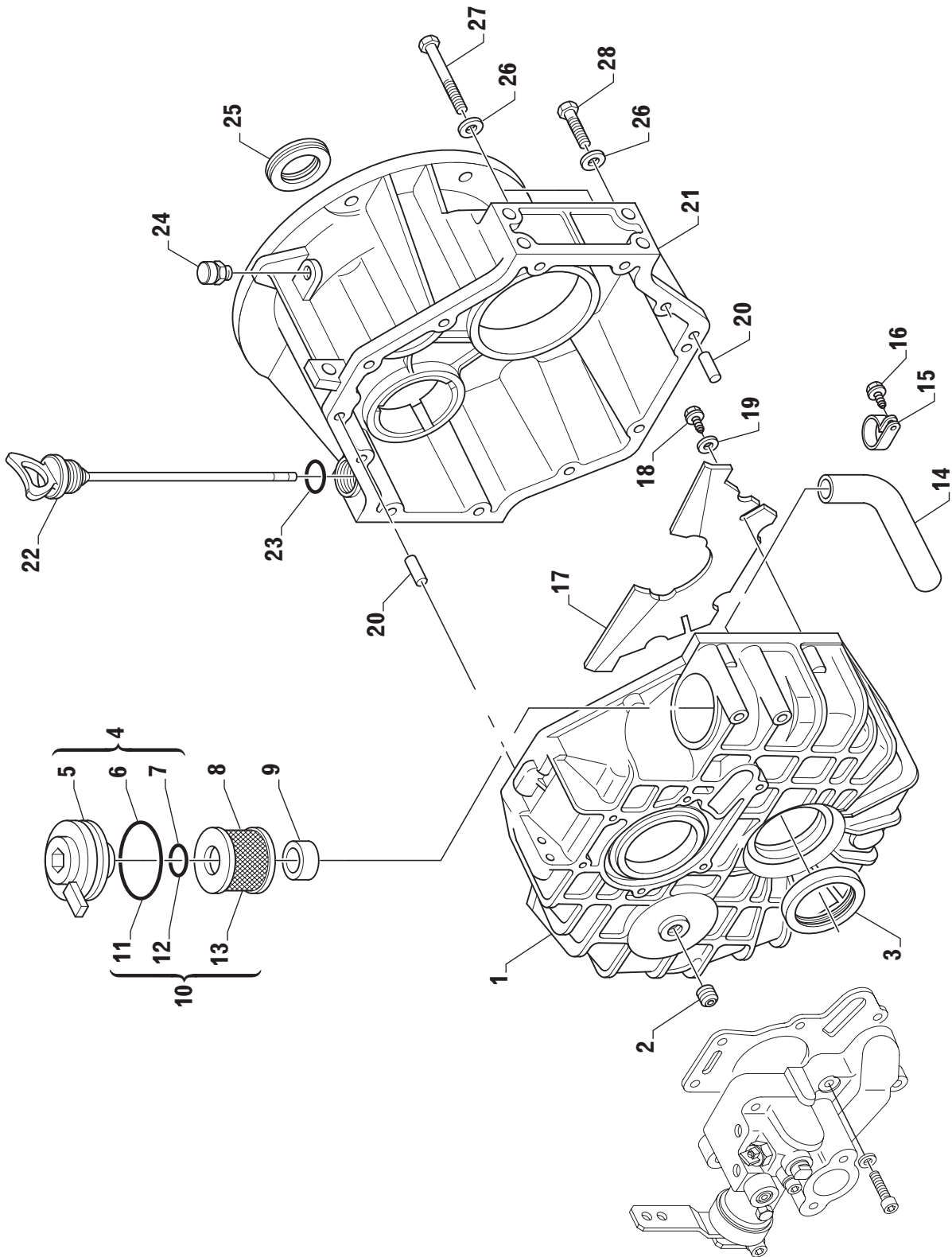
Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3311 301 019	500458	Scatola	Housing	1	
2	0636 301 041	442373	Tappo	Plug	1	
3	0634 319 135	374056	Paraolio uscita	Output shaft seal	1	
4	3312 101 003	500484	Coperchio filtro completo	Filter cover, assy.	1	
5			. Coperchio	. Cover	1	
6	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
7	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
8	3312 301 007	438637	Filtro olio	Oil filter	1	
9	3312 301 008	439653	Guarnizione	Gasket	1	
10	3312 199 031	463772	Filtro olio completo	Oil filter, assy	1	
11	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
12	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
13	3312 301 007	438637	. Filtro olio	. Oil filter	1	
14	3311 301 021	500481	Tubo aspirazione	Suction pipe	1	
	3311 301 040		Tubo aspirazione con supporto	Suction pipe with support	1	
15	0632 311 398	479439	Fascetta	Suction pipe clamp	1	
16	0636 101 411	102879	Vite T.E. (fascetta tubo aspirazione)	Hex head screw (suction pipe clamp)	1	
17	0631 313 056	104661	Spina	Locator pin	2	
18	3311 301 017	489028	Coperchio	Cover (housing)	1	
	3311 301 018	500471	Coperchio	Cover (housing)	1	Ratio I = 2.5
▼19	978.36.701.02	454913	Asta livello olio	Oil dipstick	1	
△	3312 201 002	500989	Asta livello olio + OR	Oil dipstick + OR	1	
20	0634 304 405	501211	Guarnizione OR (Asta livello olio)	O-Ring (Oil dipstick)	1	
21	3311 301 002	442369	Valvola di sfiato	Breather valve	1	
22	3312 301 030	442371	Paraolio entrata	Input shaft seal	1	
23	0630 302 091	442371	Rosetta	Washer	12	
24	0636 010 550	442374	Vite T.E.	Hex head screw	4	
25	0636 015 227	442375	Vite T.E.	Hex head screw	8	

▼ Fino a matricola 11045G - Up to serial number 11045G

△ Da matricola 11046G - From serial number 11046G

ZF 45-1

FIG. 1

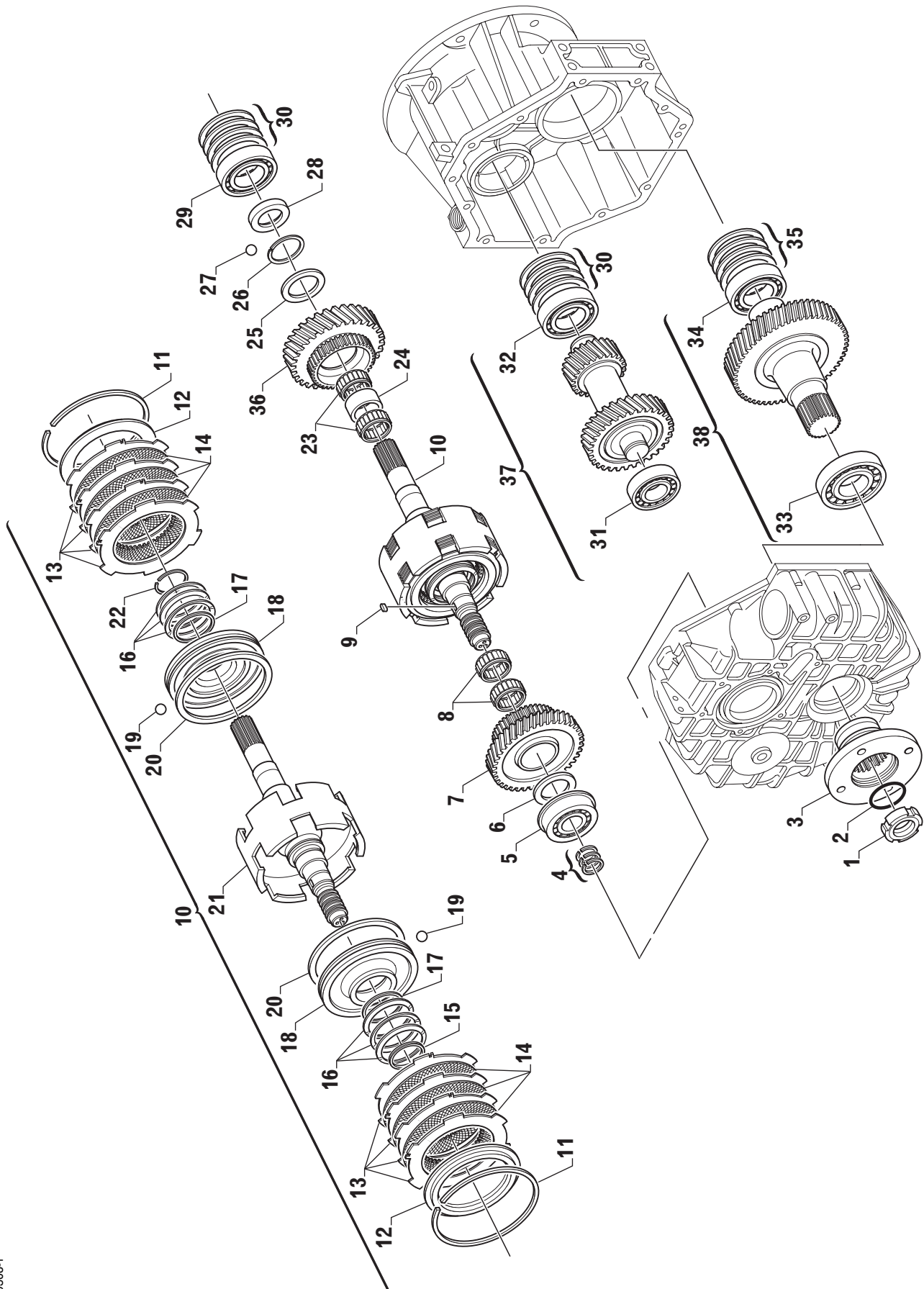




Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3311 301 029		Scatola	Housing	1	
2	0636 301 041	442373	Tappo	Plug	1	
3	0634 319 132	442135	Paraolio uscita	Output shaft seal	1	
4	3312 101 003	500484	Coperchio filtro completo	Filter cover, assy.	1	
5			. Coperchio	. Cover (housing)	1	
6	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
7	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
8	3312 301 007	438637	Filtro olio	Oil filter	1	
9	3312 301 008	439653	Guarnizione	Gasket	1	
10	3312 199 031	463772	Filtro olio completo	Oil filter, assy	1	
11	0634 304 688	442731	. Guarnizione OR	. O-Ring	1	
12	0634 306 204	105542	. Guarnizione OR	. O-Ring	1	
13	3312 301 007	438637	. Filtro olio	. Oil filter	1	
14	3311 301 027	500638	Tubo aspirazione	Suction pipe	1	
	3311 301 039		Tubo aspirazione con supporto	Suction pipe with support	1	
15	0632 311 398	479439	Fascetta	Suction pipe clamp	1	
16	0636 101 411	102879	Vite T.E. (fascetta tubo aspirazione)	Hex head screw (suction pipe clamp)	1	
17	3311 301 026	500644	Separatore	Baffle plate	1	
18	0636 015 294	500862	Vite	Screw	4	
19	0630 001 076	501229	Rosetta	Washer	4	
20	0631 315 520	335817	Spina	Locator pin	2	
21	3311 301 030		Coperchio	Cover (housing)	1	
22	3312 201 003	500991	Asta livello olio + OR	Oil dipstick + OR	1	
23	0634 304 405	501211	Guarnizione OR (Asta livello olio)	O-Ring (Oil dipstick)	1	
24	3311 301 002	442369	Valvola di sfiato	Breather valve	1	
25	3312 301 030	442371	Paraolio entrata	Input shaft seal	1	
26	0630 302 091	442371	Rosetta	Washer	14	
27	0636 010 550	442374	Vite T.E.	Hex head screw	10	
28	0636 015 227	442375	Vite T.E.	Hex head screw	4	

ZF 25 A

FIG. 2

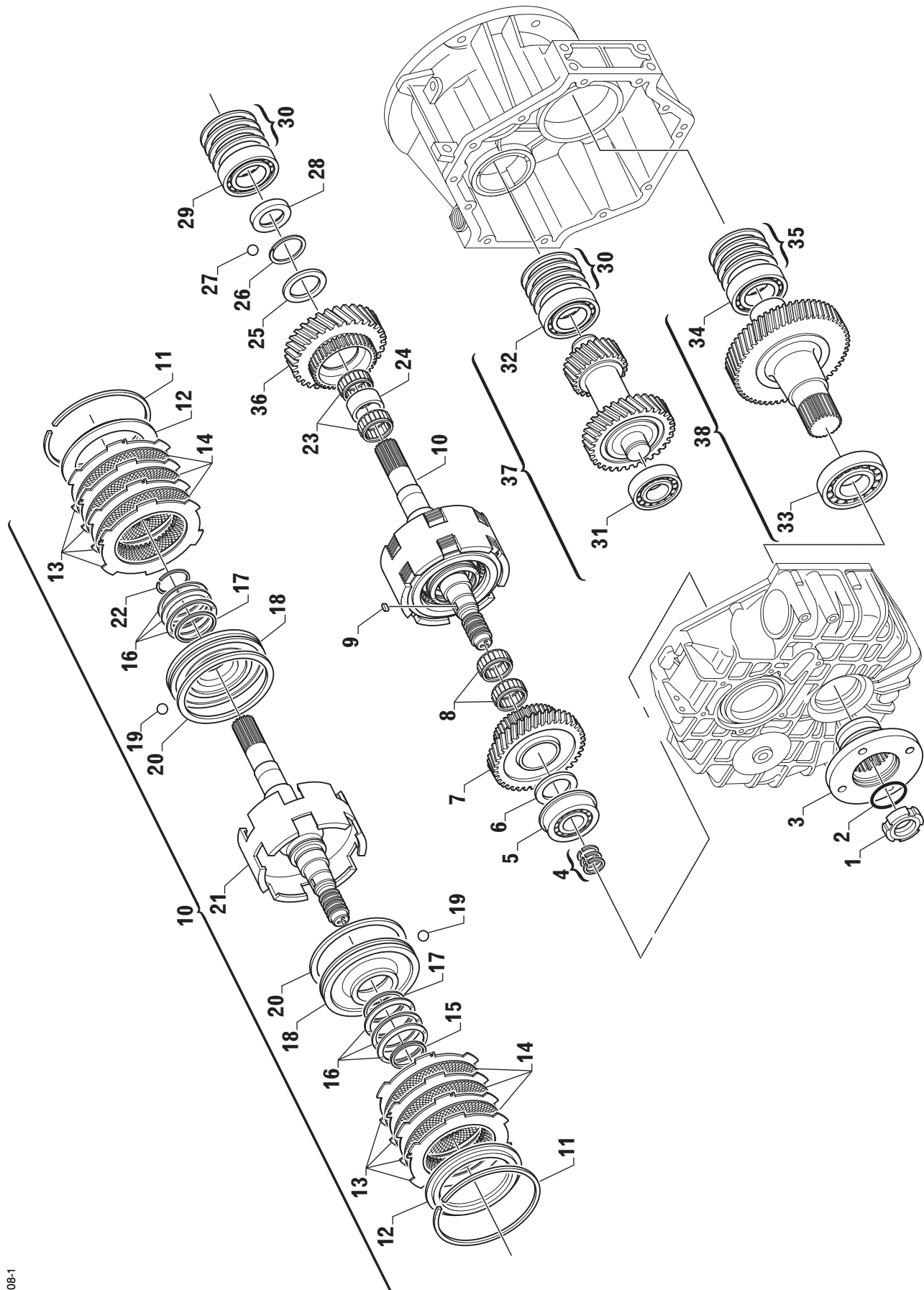




Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	0637 513 037	489305	Ghiera	Ring nut	1	
2	0634 303 314	105559	Guarnizione OR	O-Ring	1	
3	3311 304 003	489109	Flangia	Flange	1	
4	3312 302 041	447038	Anello di tenuta	Piston ring	3	
5	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
6	3312 302 004	454406	Rasamento	Butting ring	1	
7	3315 202 003		Ingranaggio Z3 = 35	Reverse gear Z3 = 35	1	
8	3312 302 040	441438	Cuscinetto a rullini	Needle bearing	2	
9	0631 501 062	437956	Chiavetta	Key	1	
10	3315 199 021		Albero di ingresso completo	Input shaft, assy.	1	
11	0630 513 163	393124	. Anello elastico	. Snap ring	2	
12	3311 302 004	489118	. Disco finale	. End disc	2	
13	3311 302 006	489119	. Disco frizione esterno	. Outer clutch disc	8	
14	3311 302 005	489120	. Disco frizione interno	. Inner clutch disc	6	
15	3311 302 008	489122	. Anello di ritegno	. Retainer ring	1	
16	3311 302 007	489121	. Molla a tazza	. Cup spring	6	
17	0634 402 539	489149	. Anello interno	. Inner clutch piston ring	2	
18	3311 302 003	490285	. Pistone	. Clutch piston	2	Available ex-stock From s/n 19395 L
	3311 302 037		. Pistone	. Clutch piston	2	
19	0635 460 004	500036	. Sfera	. Ball	2	
20	0634 402 179	489006	. Anello esterno	. Outer clutch piston ring	2	
21	3315 199 020		. Albero di ingresso + cilindro frizione	. Input shaft and clutch housing	1	
22	0630 501 031	500468	. Anello di ritegno (lato ingresso)	. Retainer ring (spline side)	1	
23	3315 302 016	500470	Cuscinetto a rullini	Needle bearing	2	
24	3311 302 010	500409	Distanziale	Spacer	1	
25	3311 302 009	500406	Rasamento	Butting ring	1	
26	0630 513 018	501177	Anello elastico	Snap ring	1	
27	0635 460 006	106690	Sfera	Ball	1	
28	3315 302 004	501130	Distanziale	Spacer	1	
29	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
30	3311 302 011	489333	Spessore 0,1 mm	Shim 0.1 mm	2	
	3311 302 012	489334	Spessore 0,15 mm	Shim 0.15 mm	2	
	3311 302 013	489335	Spessore 0,3 mm	Shim 0.3 mm	2	
	3311 302 014	489336	Spessore 0,5 mm	Shim 0.5 mm	2	
31	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
32	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
33	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
34	0635 375 010	501178	Cuscinetto a rulli conici	Tapered roller bearing	1	
35	0630 000 091	501195	Spessore 0,1 mm	Shim 0.1 mm	2	
	0630 000 058	501196	Spessore 0,15 mm	Shim 0.15 mm	2	
	0630 000 059	501197	Spessore 0,3 mm	Shim 0.3 mm	2	
	0630 000 061	501198	Spessore 0,5 mm	Shim 0.5 mm	2	
Vers. 01,001,014 (Rapporto I = 1,55)				Vers. 01,001,014 (Ratio I = 1.55)		
36	3315 202 004	501138	Ingranaggio Z1 = 31	Forward gear Z1 = 31	1	
37	3315 199 012	501628	Albero intermedio Z4 = 35, Z5 = 31	Intermediate shaft Z4 = 35, Z5 = 31	1	
38	3315 199 013	501624	Albero di uscita Z2 = 48	Output shaft Z2 = 48	1	
Vers. 02,002,015 (Rapporto I = 1,93)				Vers. 02,002,015 (Ratio I = 1.93)		
36	3315 202 008	501297	Ingranaggio Z1 = 27	Forward gear Z1 = 27	1	
37	3315 199 014	501629	Albero intermedio Z4 = 35, Z5 = 27	Intermediate shaft Z4 = 35, Z5 = 27	1	
38	3315 199 015	501625	Albero di uscita Z2 = 52	Output shaft Z2 = 52	1	
Vers. 03,003,016 (Rapporto I = 2,29)				Vers. 03,003,016 (Ratio I = 2.29)		
36	3315 202 006	501140	Ingranaggio Z1 = 24	Forward gear Z1 = 24	1	
37	3315 199 016	501630	Albero intermedio Z4 = 35, Z5 = 24	Intermediate shaft Z4 = 35, Z5 = 24	1	
38	3315 199 017	501626	Albero di uscita Z2 = 55	Output shaft Z2 = 55	1	
Vers. 04,004,018 (Rapporto I = 2,71)				Vers. 04,004,018 (Ratio I = 2.71)		
36	3315 202 007	501141	Ingranaggio Z = 21	Forward gear Z = 21	1	
37	3315 199 018	501631	Albero intermedio Z4 = 35, Z5 = 21	Intermediate shaft Z4 = 35, Z5 = 21	1	
38	3315 199 019	501627	Albero di uscita Z2 = 57	Output shaft Z2 = 57	1	

ZF 25

FIG. 2

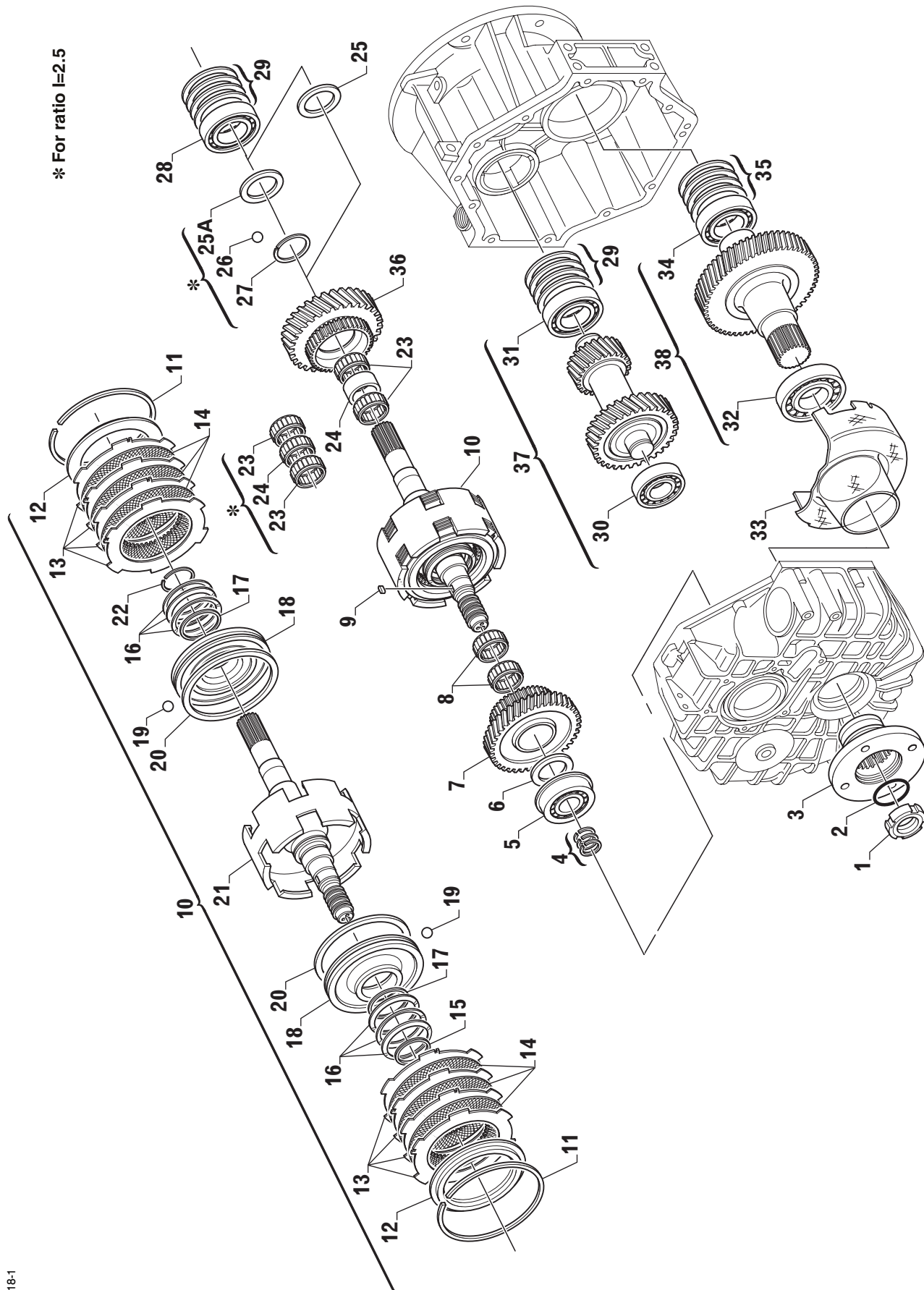




Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	0637 513 037	489305	Ghiera	Ring nut	1	
2	0634 303 314	105559	Guarnizione OR	O-Ring	1	
3	3315 304 006		Flangia	Flange	1	
4	3312 302 041	447038	Anello di tenuta	Piston ring	3	
5	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
6	3312 302 004	454406	Rasamento	Butting ring	1	
7	3315 202 003		Ingranaggio Z3 = 35	Reverse gear Z3 = 35	1	
8	3312 302 040	441438	Cuscinetto a rullini	Needle bearing	2	
9	0631 501 062	437956	Chiavetta	Key	1	
10	3315 199 021		Albero di ingresso completo	Input shaft, assy.	1	
11	0630 513 163	393124	. Anello elastico	. Snap ring	2	
12	3311 302 004	489118	. Disco finale	. End disc	2	
13	3311 302 006	489119	. Disco frizione esterno	. Outer clutch disc	8	
14	3311 302 005	489120	. Disco frizione interno	. Inner clutch disc	6	
15	3311 302 008	489122	. Anello di ritegno	. Retainer ring	1	
16	3311 302 007	489121	. Molla a tazza	. Cup spring	6	
17	0634 402 539	489149	. Anello interno	. Inner clutch piston ring	2	
18	3311 302 003	490285	. Pistone	. Clutch piston	2	Available ex-stock
	3311 302 037		. Pistone	. Clutch piston	2	From s/n 17437 L
19	0635 460 004	500036	. Sfera	. Ball	2	
20	0634 402 179	489006	. Anello esterno	. Outer clutch piston ring	2	
21	3315 199 020		. Albero di ingresso + cilindro frizione	. Input shaft and clutch housing	1	
22	0630 501 031	500468	. Anello di ritegno (lato ingresso)	. Retainer ring (spline side)	1	
23	3315 302 016	500470	Cuscinetto a rullini	Needle bearing	2	
24	3311 302 010	500409	Distanziale	Spacer	1	
25	3311 302 009	500406	Rasamento	Butting ring	1	
26	0630 513 018	501177	Anello elastico	Snap ring	1	
27	0635 460 006	106690	Sfera	Ball	1	
28	3315 302 004	501130	Distanziale	Spacer	1	
29	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
30	3311 302 011	489333	Spessore 0,1 mm	Shim 0.1 mm	2	
	3311 302 012	489334	Spessore 0,15 mm	Shim 0.15 mm	2	
	3311 302 013	489335	Spessore 0,3 mm	Shim 0.3 mm	2	
	3311 302 014	489336	Spessore 0,5 mm	Shim 0.5 mm	2	
31	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
32	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
33	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
34	0635 375 010	501178	Cuscinetto a rulli conici	Tapered roller bearing	1	
35	0630 000 091	501195	Spessore 0,1 mm	Shim 0.1 mm	2	
	0630 000 058	501196	Spessore 0,15 mm	Shim 0.15 mm	2	
	0630 000 059	501197	Spessore 0,3 mm	Shim 0.3 mm	2	
	0630 000 061	501198	Spessore 0,5 mm	Shim 0.5 mm	2	
Vers. 001,003,010 (Rapporto I = 1,97)				Vers. 001,003,010 (Ratio I = 1.97)		
36	3315 202 001		Ingranaggio Z1 = 32	Forward gear Z1 = 32	1	
37	3315 203 001		Albero intermedio Z4 = 35, Z5 = 32	Intermediate shaft Z4 = 35, Z5 = 32	1	
38	3315 204 001		Albero di uscita Z2 = 63	Output shaft Z2 = 63	1	
Vers. 002,004,011 (Rapporto I = 2,8)				Vers. 002,004,011 (Ratio I = 2.8)		
36	3315 202 002		Ingranaggio Z1 = 25	Forward gear Z1 = 25	1	
37	3315 203 002		Albero intermedio Z4 = 35, Z5 = 25	Intermediate shaft Z4 = 35, Z5 = 25	1	
38	3315 204 002		Albero di uscita Z2 = 70	Output shaft Z2 = 70	1	

ZF 45 A

FIG. 2





Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	0637 513 037	489305	Ghiera	Ring nut	1	
2	0634 303 314	105559	Guarnizione OR	O-Ring	1	
3	3311 304 008	489110	Flangia	Flange	1	
	3311 304 003	489109	Flangia	Flange	1	Ratio I = 1.26
4	3312 302 041	447038	Anello di tenuta	Piston ring	3	
5	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
6	3312 302 004	454406	Rasamento	Butting ring	1	
7	3311 202 005	489105	Ingranaggio Z3 = 47	Reverse gear Z3 = 47	1	No more available
	3311 202 021		Ingranaggio Z3 = 47	Reverse gear Z3 = 47	1	From s/n 15866 N
8	3312 302 040	441438	Cuscinetto a rullini	Needle bearing	2	
9	0631 501 062	437956	Chiavetta	Key	1	
10	3311 199 043		Albero di ingresso completo	Input shaft, assy.	1	
	3311 199 045		Albero di ingresso completo	Input shaft, assy.	1	Ratio I = 2.5
11	0630 513 163	393124	. Anello elastico	. Snap ring	2	
12	3311 302 004	489118	. Disco finale	. End disc	2	
13	3311 302 006	489119	. Disco frizione esterno	. Outer clutch disc	10	
14	3311 302 005	489120	. Disco frizione interno	. Inner clutch disc	8	
15	3311 302 008	489122	. Anello di ritegno	. Retainer ring	1	
16	3311 302 007	489121	. Molla a tazza	. Cup spring	6	
17	0634 402 539	489149	. Anello interno	. Inner clutch piston ring	2	
18	3311 302 003	490285	. Pistone	. Clutch piston	2	Available ex-stock
	3311 302 037		. Pistone	. Clutch piston	2	From s/n 18843 L
	3311 302 037		. Pistone	. Clutch piston	2	(2)
19	0635 460 004	500036	. Sfera	. Ball	2	
20	0634 402 179	489006	. Anello esterno	. Outer clutch piston ring	2	
21	3311 199 042		. Albero di ingresso + cilindro frizione	. Input shaft and clutch housing	1	
	3311 199 044		. Albero di ingresso + cilindro frizione	. Input shaft and clutch housing	1	Ratio I = 2.5
22	3311 302 008	489122	. Anello di ritegno	. Retainer ring	1	
	0630 501 031	500468	. Anello di ritegno (lato ingresso)	. Retainer ring (spline side)	1	Ratio I = 2.5
23	3312 302 040	441438	Cuscinetto a rullini	Needle bearing	2	
	3315 302 016	500470	Cuscinetto a rullini	Needle bearing	2	Ratio I = 2.5
24	3312 302 035	438325	Distanziale	Spacer	1	
▼	3311 302 010	500409	Distanziale	Spacer	1	Ratio I = 2.5
△	3315 302 016	500470	Cuscinetto a rullini	Needle bearing	1	Ratio I = 2.5
25	3312 302 004	454406	Rasamento	Butting ring	1	
25A	3311 302 009	500406	Rasamento	Butting ring	1	Ratio I = 2.5
26	0635 460 006	106690	Sfera	Ball	1	Ratio I = 2.5
27	0630 531 041	500469	Anello elastico	Snap ring	1	Ratio I = 2.5
28	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
29	3311 302 011	489333	Spessore 0,1 mm	Shim 0.1 mm	2	
	3311 302 012	489334	Spessore 0,15 mm	Shim 0.15 mm	2	
	3311 302 013	489335	Spessore 0,3 mm	Shim 0.3 mm	2	
	3311 302 014	489336	Spessore 0,5 mm	Shim 0.5 mm	2	
30	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
31	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
32	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
33	3311 301 020	489092	Separatore	Baffle plate	1	
34	0635 375 001	106657	Cuscinetto a rulli conici	Tapered roller bearing	1	
35	3311 304 021	305758	Spessore 0,1 mm	Shim 0.1 mm	2	
	3311 304 022	305759	Spessore 0,15 mm	Shim 0.15 mm	2	
	3311 304 023	305760	Spessore 0,3 mm	Shim 0.3 mm	2	
	3311 304 024	305761	Spessore 0,5 mm	Shim 0.5 mm	2	
Vers. 24,001,14 (Rapporto I = 1,26)				Vers. 24,001,014 (Ratio I = 1.26)		
36	3311 202 001	489104	Ingranaggio Z1 = 39	Forward gear Z1 = 39	1	No more available
	3311 202 017		Ingranaggio Z1 = 39	Forward gear Z1 = 39	1	From s/n 25620 N (1)
37	3311 199 016	500304	Albero intermedio Z4 = 47, Z5 = 39	Intermediate shaft Z4 = 47, Z5 = 39	1	
38	3311 199 017	500307	Albero di uscita Z2 = 49	Output shaft Z2 = 49	1	



Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
Vers. 25,002,015 (Rapporto I = 1,51)			Vers. 25,002,015 (Ratio I = 1.51)			
36	3311 202 002	489237	Ingranaggio Z1 = 35	Forward gear Z1 = 35	1	No more available
	3311 202 018		Ingranaggio Z1 = 35	Forward gear Z1 = 35	1	From s/n 16275 N (1)
37	3311 199 018	199018	Albero intermedio Z4 = 47, Z5 = 35	Intermediate shaft Z4 = 47, Z5 = 35	1	
38	3311 199 019	500308	Albero di uscita Z2 = 53	Output shaft Z2 = 53	1	
Vers. 26,003,016 (Rapporto I = 2,03)			Vers. 26,003,016 (Ratio I = 2.03)			
36	3311 202 003	489238	Ingranaggio Z1 = 29	Forward gear Z1 = 29	1	No more available
	3311 202 019		Ingranaggio Z1 = 29	Forward gear Z1 = 29	1	From s/n 14985 N (1)
37	3311 199 020	500306	Albero intermedio Z4 = 47, Z5 = 29	Intermediate shaft Z4 = 47, Z5 = 29	1	
38	3311 199 021	500309	Albero di uscita Z2 = 59	Output shaft Z2 = 59	1	
Vers. 23,004,017 (Rapporto I = 2,43)			Vers. 23,004,017 (Ratio I = 2.43)			
36	3311 202 004	500386	Ingranaggio Z1 = 23	Forward gear Z1 = 23	1	No more available
	3311 202 020		Ingranaggio Z1 = 23	Forward gear Z1 = 23	1	From s/n 16062 N (1)
37	3311 199 022	501307	Albero intermedio Z4 = 47, Z5 = 23	Intermediate shaft Z4 = 47, Z5 = 23	1	
38	3311 199 023	501308	Albero di uscita Z2 = 56	Output shaft Z2 = 56	1	

▼ Fino a matricola 23929G - Up to serial number 23929G

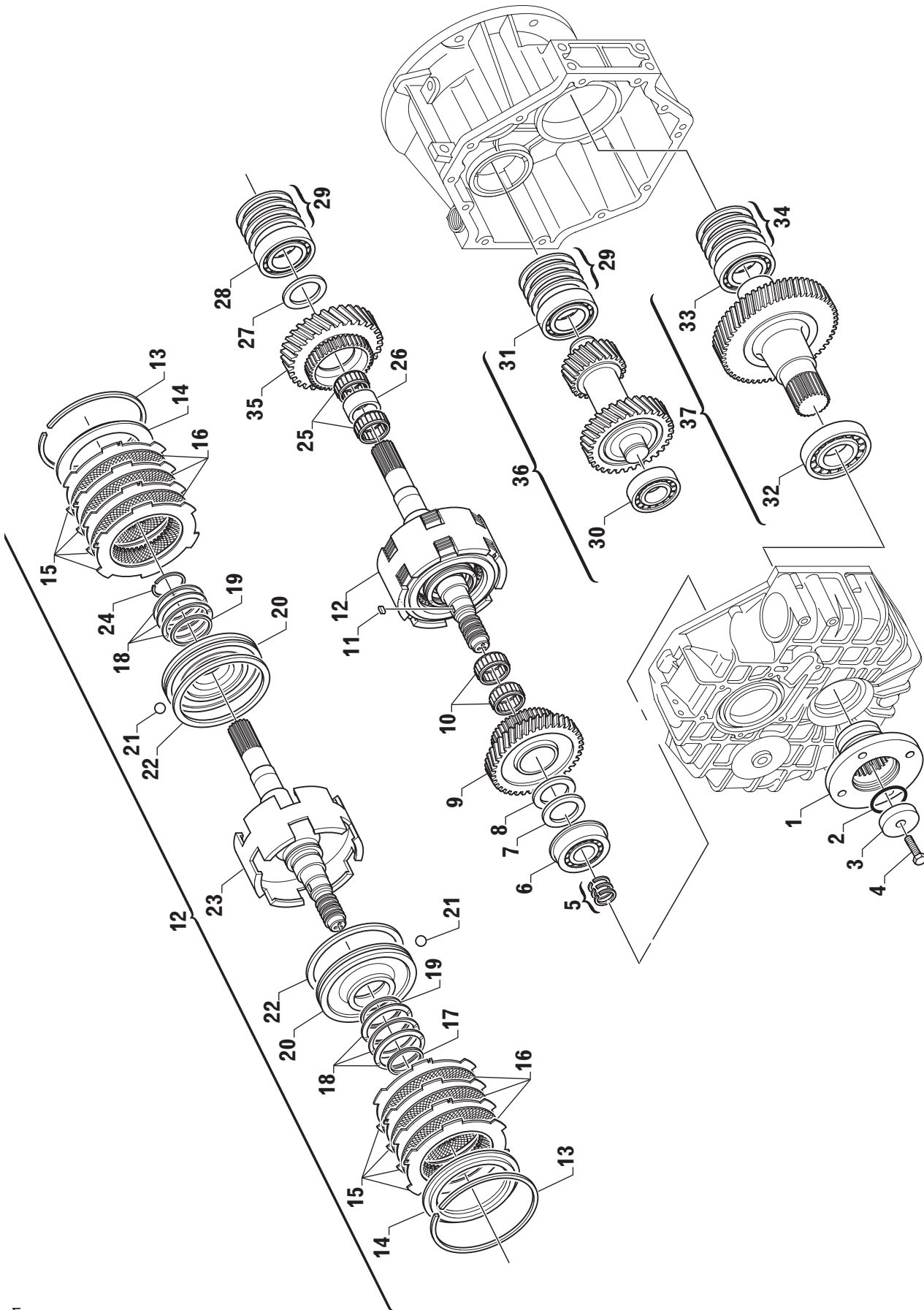
△ Da matricola 23930G - From serial number 23930G

(1) Adatto solo al nuovo pistone (vedi Service Bulletin nr. 001/04)
Suitable only to new clutch piston (see Service Bulletin no. 001/04)

(2) Adatto sia per il vecchio ingranaggio (Z1) marcia avanti che per il nuovo ingranaggio (Z1) marcia avanti
Suitable both for the old Z1 forward gear and for the new one.

ZF 45-1

FIG. 2





Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3311 304 013	500639	Flangia	Flange	1	
2	0634 306 328	105571	Guarnizione OR	O-Ring	1	
3	3313 304 017	475710	Rondella	Washer	1	
4	0636 016 111	348826	Vite T.E.	Hex head screw	1	
5	3312 302 041	447038	Anello di tenuta	Piston ring	3	
6	0635 501 940		Cuscinetto a rulli conici	Tapered roller bearing	1	
7	3311 302 036		Distanziale	Spacer	1	
8	3312 302 004	454406	Rasamento	Butting ring	1	
9	3311 202 005	489105	Ingranaggio Z3 = 47	Reverse gear Z3 = 47	1	No more available
	3311 202 021		Ingranaggio Z3 = 47	Reverse gear Z3 = 47	1	From s/n 18457 N
10	3312 302 040	441438	Cuscinetto a rullini	Needle bearing	2	
11	0631 501 062	437956	Chiavetta	Key	1	
12	3311 199 047		Albero di ingresso completo	Input shaft, assy.	1	
13	0630 513 163	393124	. Anello elastico	. Snap ring	2	
14	3311 302 004	489118	. Disco finale	. End disc	2	
15	3311 302 006	489119	. Disco frizione esterno	. Outer clutch disc	10	
16	3311 302 005	489120	. Disco frizione interno	. Inner clutch disc	8	
17	3311 302 008	489122	. Anello di ritegno	. Retainer ring	1	
18	3311 302 007	489121	. Molla a tazza	. Cup spring	6	
19	0634 402 539	489149	. Anello interno	. Inner clutch piston ring	2	
20	3311 302 003		. Pistone	. Clutch piston	2	Available ex-stock
	3311 302 037		. Pistone	. Clutch piston	2	From s/n 20769 L
	3311 302 037		. Pistone	. Clutch piston	2	(2)
21	0635 460 004	500036	. Sfera	. Ball	2	
22	0634 402 179	489006	. Anello esterno	. Outer clutch piston ring	2	
23	3311 199 046		. Albero di ingresso + cilindro frizione	. Input shaft and clutch housing	1	
24	3311 302 008	489122	. Anello di ritegno	. Retainer ring	1	
25	3312 302 040	441438	Cuscinetto a rullini	Needle bearing	2	
26	3312 302 035	438325	Distanziale	Spacer	1	
27	3312 302 004	454406	Rasamento	Butting ring	1	
28	0635 501 937	447754	Cuscinetto a rulli conici	Tapered roller bearing	1	
29	3312 302 023	277213	Spessore 0,1 mm	Shim 0.1 mm	2	
	3312 302 024	277214	Spessore 0,15 mm	Shim 0.15 mm	2	
	3312 302 025	277215	Spessore 0,2 mm	Shim 0.2 mm	2	
30	0635 370 049		Cuscinetto a rulli conici	Tapered roller bearing	1	
31	0635 501 941		Cuscinetto a rulli conici	Tapered roller bearing	1	
32	0635 501 938	333859	Cuscinetto a rulli conici	Tapered roller bearing	1	
33	0635 501 922		Cuscinetto a rulli conici	Tapered roller bearing	1	
34	3312 304 027	166807	Spessore 0,1 mm	Shim 0.1 mm	2	
	3312 304 028	442340	Spessore 0,15 mm	Shim 0.15 mm	2	
	3312 304 029	154102	Spessore 0,3 mm	Shim 0.3 mm	2	
	3312 304 030	154101	Spessore 0,5 mm	Shim 0.5 mm	2	
Vers. 006 (Rapporto I = 2,20)				Vers. 006 (Ratio I = 2.20)		
35	3311 202 009		Ingranaggio Z1 = 45	Forward gear Z1 = 45	1	No more available
	3311 202 022		Ingranaggio Z1 = 45	Forward gear Z1 = 45	1	From s/n 21084 N (1)
36	3311 199 049		Albero intermedio Z4 = 47, Z5 = 45	Intermediate shaft Z4 = 47, Z5 = 45	1	
37	3311 199 053		Albero di uscita Z2 = 99	Output shaft Z2 = 99	1	
Vers. 007 (Rapporto I = 2,51)				Vers. 007 (Ratio I = 2.51)		
35	3311 202 006	500628	Ingranaggio Z1 = 41	Forward gear Z1 = 41	1	No more available
	3311 202 023		Ingranaggio Z1 = 41	Forward gear Z1 = 41	1	From s/n 21954 N (1)
36	3311 199 050		Albero intermedio Z4 = 47, Z5 = 41	Intermediate shaft Z4 = 47, Z5 = 41	1	
37	3311 199 025	501315	Albero di uscita Z2 = 103	Output shaft Z2 = 103	1	
Vers. 008 (Rapporto I = 3,03)				Vers. 008 (Ratio I = 3.03)		
35	3311 202 007	500629	Ingranaggio Z1 = 32	Forward gear Z1 = 32	1	No more available
	3311 202 024		Ingranaggio Z1 = 32	Forward gear Z1 = 32	1	From s/n 28217 N (1)
36	3311 199 051		Albero intermedio Z4 = 47, Z5 = 32	Intermediate shaft Z4 = 47, Z5 = 32	1	
37	3311 199 027	501316	Albero di uscita Z2 = 97	Output shaft Z2 = 97	1	



Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
Vers. 010 (Rapporto I = 3,74)				Vers. 010 (Ratio I = 3.74)		
35	3311 202 008	500631	Ingranaggio Z1 = 27	Forward gear Z1 = 27	1	No more available
	3311 202 026		Ingranaggio Z1 = 27	Forward gear Z1 = 27	1	From s/n 31329 N (1)
36	3311 199 052		Albero intermedio Z4 = 47, Z5 = 27	Intermediate shaft Z4 = 47, Z5 = 27	1	
37	3311 199 031	501318	Albero di uscita Z2 = 101	Output shaft Z2 = 101	1	

(1) Adatto solo al nuovo pistone (vedi Service Bulletin nr. 002/04)

Suitable only to new clutch piston (see Service Bulletin no. 002/04)

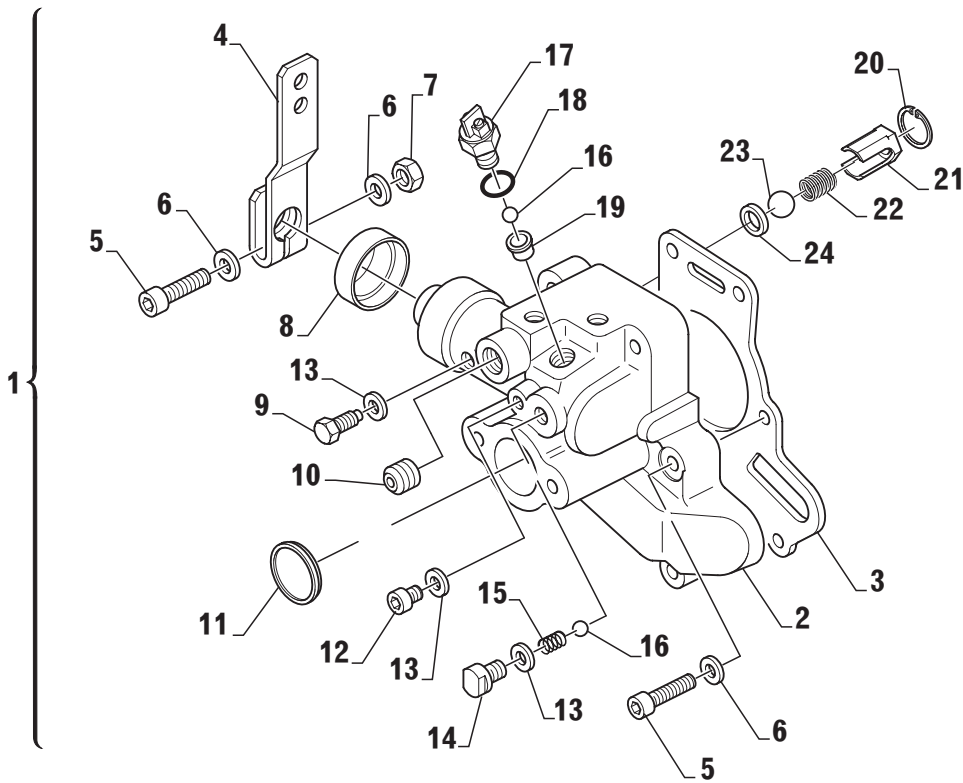
(2) Adatto sia per il vecchio ingranaggio (Z1) marcia avanti che per il nuovo ingranaggio (Z1) marcia avanti

Suitable both for the old Z1 forward gear and for the new one.



ZF 25 A - ZF 25
ZF 45 A - ZF 45-1

FIG. 3



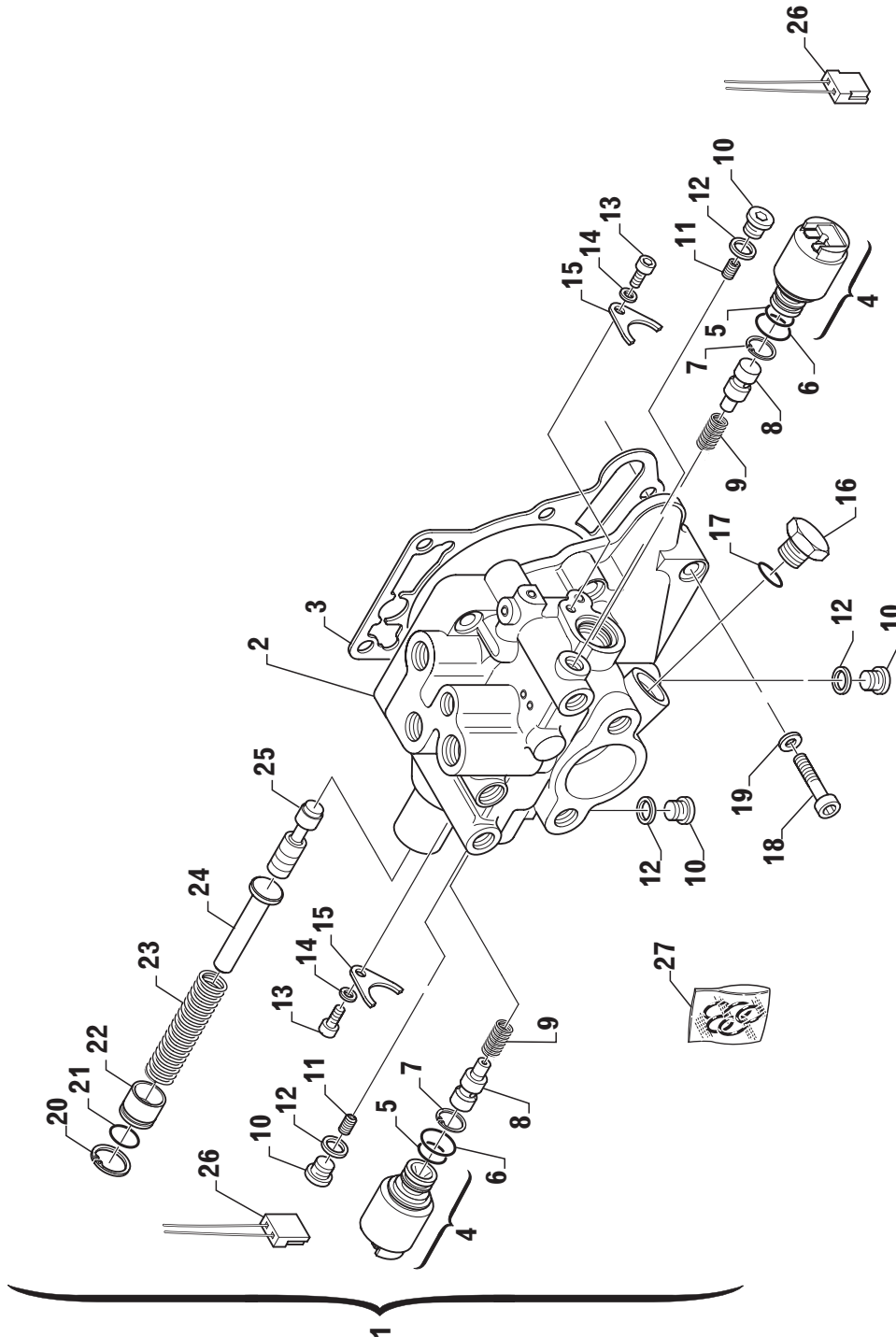


Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3315 108 001		Valvola di comando completo	Control valve assy.	1	ZF 25 A - ZF 25
	3312 108 001		Valvola di comando completo	Control valve assy.	1	ZF 45 A - ZF 45-1
2	☆		. Valvola di comando	. Control valve	1	
3	3312 308 020	408388	. Guarnizione	. Gasket	1	
4	3312 308 025	452963	. Leva	. Lever	1	
5	0636 101 727	442377	. Vite	. Screw	7	
6	0630 302 090	442372	. Rosetta	. Washer	8	
7	0637 006 157	455785	. Dado	. Nut	1	
8	0634 309 621	500065	. Guarnizione	. Gasket	1	
9	3312 308 034	500026	. Vite di fermo	. Stop screw	1	
10	0636 309 007	455756	. Tappo	. Plug	1	
11	0631 405 061	500107	. Tappo	. Plug	1	
12	0636 302 053	103465	. Tappo	. Plug	1	
13	0634 801 302	107410	. Rosetta	. Washer	3	
14	3312 308 037	500028	. Vite di guida	. Guide bolt	1	
15	3312 308 047	500044	. Molla	. Spring	1	
16	0635 460 014	106695	. Sfera	. Ball	2	
17	3312 308 029	455764	. Interruttore completo	. Neutral safety switch assy.	1	
18	001.105.0158	105527	. Guarnizione OR	. O-Ring	1	
19	3312 308 039	500030	. Boccia	. Bushing	1	
20	0630 502 005	500083	. Anello elastico	. Snap ring	1	
21	3312 308 038	500029	. Boccia	. Bushing	1	
22	3312 308 042	500032	. Molla per lubrificazione	. Spring	1	
23	0635 460 023	500097	. Sfera	. Ball	1	
24	3312 308 036	500027	. Distanziale	. Spacer	1	



ZF 25 A - ZF 25
ZF 45 A - ZF 45-1

FIG. 4



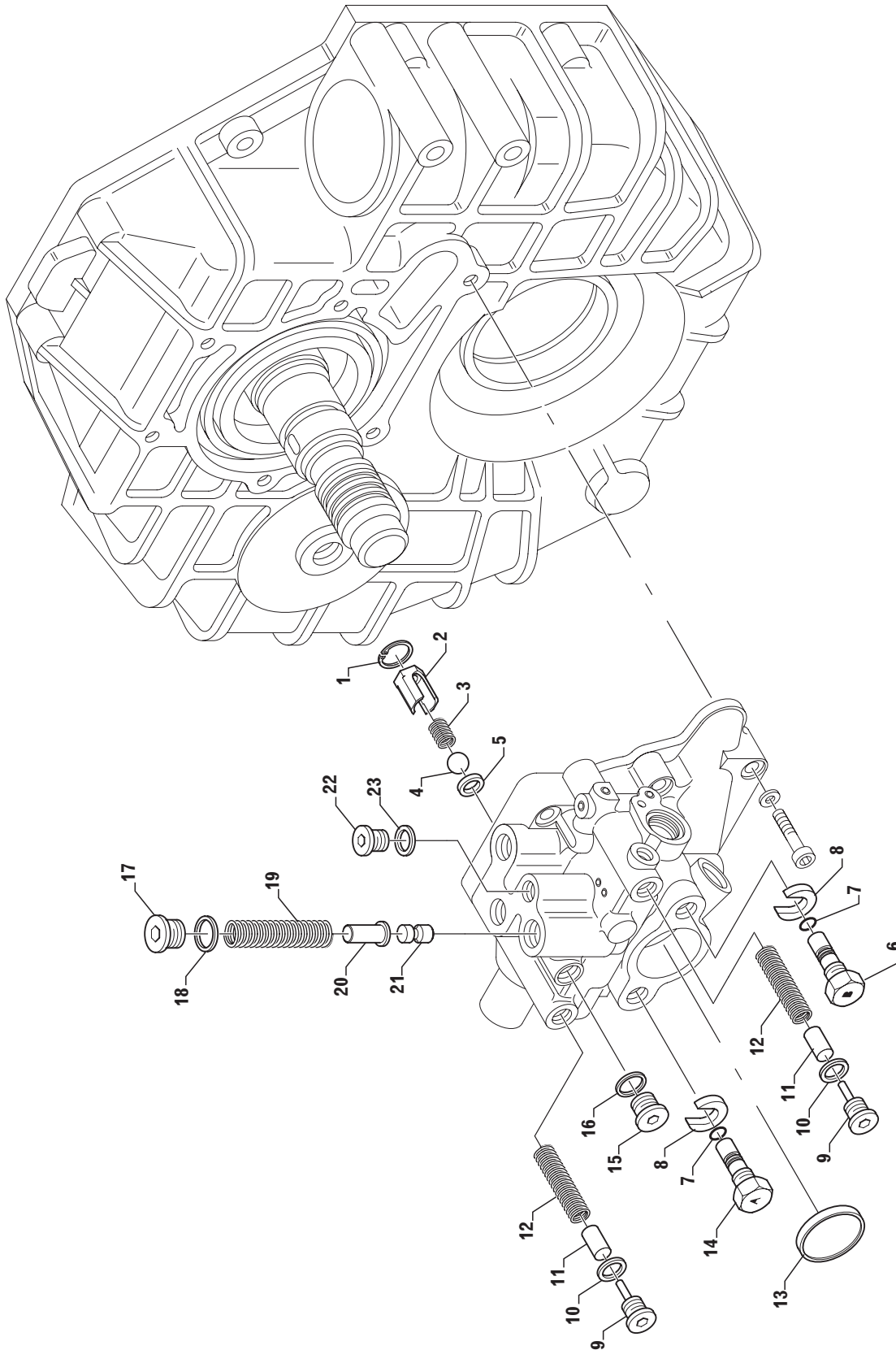


Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3312 308 048	501493	Corpo distributore elettrico	Hydraulic valve housing	1	
	3312 199 004		Distributore elettrico	Electric selector valve	1	(1)
	3312 199 005		Distributore elettrico	Electric selector valve	1	(2)
2			. Valvola di comando	. Control valve	1	
3	3312 308 020	408388	Guarnizione	Gasket	1	
4	3312 308 064	501634	Valvola proporzionale 12 V	Electric valve 12 V	2	
	3312 308 065	501635	Valvola proporzionale 24 V	Electric valve 24 V	2	
5	0634 304 651		Guarnizione OR	O-Ring	2	
6	0634 304 391	501524	Anello di tenuta	Piston ring	2	
7	0630 502 078	501528	Anello elastico	Snap ring	2	
8	3312 308 055	501651	Pistoncino valvola 2/3 vie	Valve piston	2	
9	3312 308 062	501533	Molla per pistone	Piston spring	2	
10	0636 302 053	103465	Tappo	Plug	4	
11	3312 308 059	501516	Grano	Drilled plug	2	
12	0634 801 302	107410	Rosetta	Washer	4	
13	0636 101 651	501525	Vite	Screw	2	
14	0630 001 096	501527	Rondella	Washer	2	
15	1043 326 045		Fermo valvola	Valve lock	2	
16	3312 308 063	501562	Tappo	Plug	1	
17	0634 306 524		Anello OR	O-Ring	1	
18	0636 101 727	442377	Vite	Screw	6	
19	0630 302 090	442372	Rosetta	Washer	6	
20	0630 532 004	501529	Anello elastico	Snap ring	1	
21	0634 304 309	501523	Anello di tenuta OR	O-Ring	1	
22	3312 308 058	501515	Tappo	Plug	1	
23	3312 308 040	500031	Molla	Spring	1	
24	3312 308 043	500038	Perno guida molla	Spring guide pin	1	
25	3312 308 046	500040	Pistoncino	Valve piston	1	
26	3312 117 001		Kit connettori	Connectors kit	1	
27	978.28.641.01	501751	Kit guarnizioni	Seal kit	1	
(1)	Installare con 12 V		- to be instelled with 12 V power supply			
(2)	Installare con 24 V		- to be instelled with 24 V power supply			



ZF 25 A - ZF 25
ZF 45 A - ZF 45-1

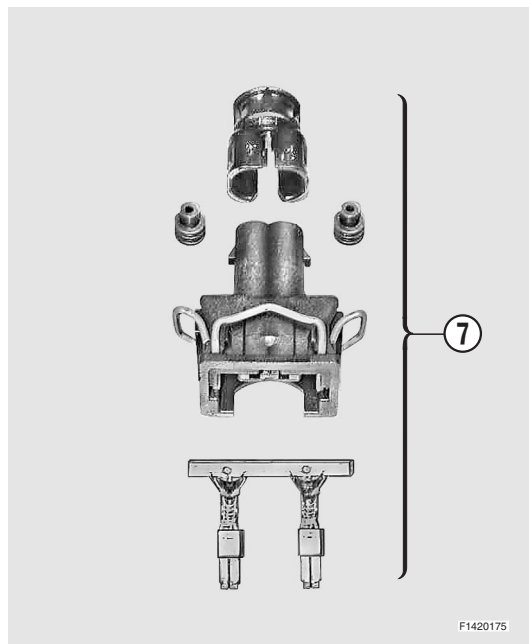
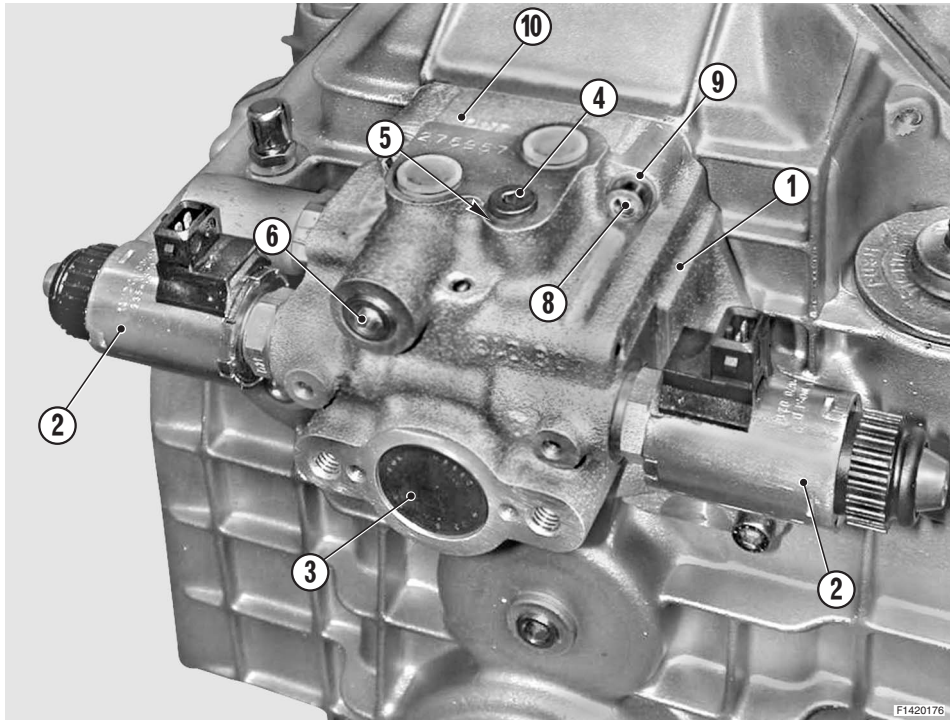
FIG. 5





Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	0630 502 005	500083	Anello elastico	Snap ring	1	
2	3312 308 038	500029	Boccola	Bushing	1	
3	3312 308 042	500032	Molla per lubrificazione	Spring	1	
4	0635 460 023	500097	Sfera	Ball	1	
5	3312 308 036	500027	Distanziale	Spacer	1	
6	3312 308 052	501497	Vite torna a casa "B"	Come home screw "B"	1	
7	0634 304 690	501522	Anello di tenuta OR	O-Ring	2	
8	3312 308 050	501495	Rondella	Washer	2	
9	3312 308 056	501513	Vite	Screw	2	
10	0634 801 298	500095	Rosetta	Washer	2	
11	4656 306 013		Pistoncino ammortizzatore	Piston	2	
12	0732 042 539		Molla ammortizzatore	Spring	2	
13	0631 405 062	501530	Tappo	Plug	1	
14	3312 308 051	501496	Vite torna a casa "A"	Come home screw "A"	1	
15	0636 302 068	500744	Tappo	Plug	1	
16	0634 801 260	500897	Rosetta	Washer	1	
17	0636 302 065	501520	Vite	Screw	1	
18	0634 801 281	227851	Rosetta	Washer	1	
19	3312 308 061	501532	Molla	Spring	1	
20	3312 308 057	501514	Perno guida molla	Spring guide pin	1	
21	3312 308 053	501498	Pistoncino valvola riduzione	Valve piston	1	
22	0636 302 026	501519	Tappo	Plug	1	
23	0634 801 302	107410	Rosetta	Washer	1	

OLD ELECTRIC SELECTOR VALVE ON/OFF 12V, 26 BAR



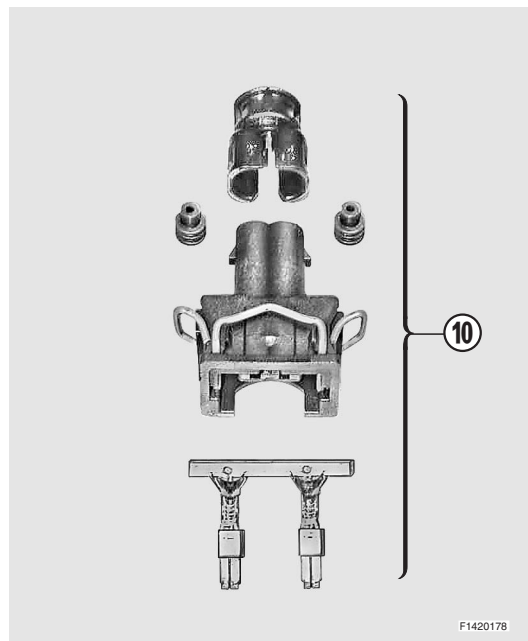
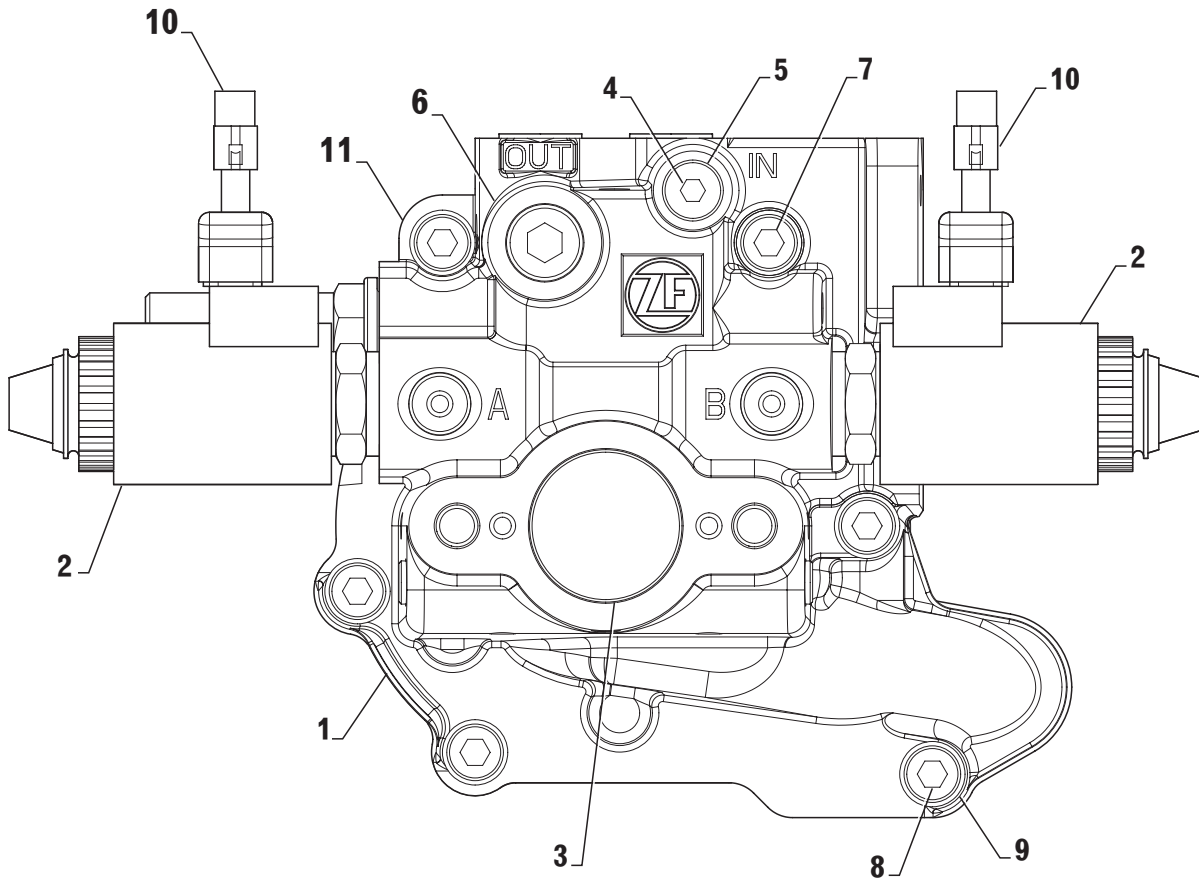


Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3312 199 015		Distributore elettrico 26 bar ON/OFF	Electric selector valve 26 bar ON/OFF	1	*
2	3312 308 069		Elettrovalvola ON/OFF 12V	Solenoid valve ON/OFF 12V	2	
3	0631 405 061		Tappo	Dummy plug	1	
4	0636 302 053		Tappo M10x1	Screw plug M10x1	1	Ma = 12 Nm
5	0634 801 302		Rosetta	Washer	1	
6	0636 309 007		Tappo	Screw plug	1	Ma = 30 Nm
7	3316 117 001		Assieme connettore	Connector kit	2	
8	0636 101 727		Vite T.E. M8x40	Cap screw M8x40	6	
9	0630 302 090		Rosetta	Spring washer	6	
10	3312 308 020		Guarnizione	Gasket	1	

* Installare con 12 V - *To be installed with 12 V power supply*



NEW ELECTRIC SELECTOR VALVE ON/OFF 12V, 26 BAR





Pos.	Part number	Old P/N	Descrizione	Description	Q.tà Q.ty	Note
1	3312 199 063		Distributore elettrico 26 bar ON/OFF	Electric selector valve 26 bar ON/OFF	1	*
2	3312 308 069		Elettrovalvola ON/OFF 12V	Solenoid valve ON/OFF 12V	2	
3	0631 405 061		Tappo	Dummy plug	1	
4	0636 302 053		Tappo M10x1	Screw plug M10x1	1	Ma = 12 Nm
5	0634 801 302		Rosetta	Washer	1	
6	0636 309 007		Tappo	Screw plug	1	Ma = 35 Nm
7	0636 101 709		Vite T.E. M8x65	Cap screw M8x65	2	
8	0636 101 727		Vite T.E. M8x40	Cap screw M8x40	4	
9	0630 302 090		Rosetta elastica	Spring washer	6	
10	3316 117 001		Assieme connettore	Connector kit	2	
11	3312 308 020		Guarnizione	Gasket	1	

* Installare con 12 V - *To be installed with 12 V power supply*


COMPOSIZIONE KIT ZF 25 A - ZF 25 - ZF 25 A - ZF 25 KIT COMPONENTS

Fig.	Pos.	Part number	Old P/N	Descrizione	Description	Q.ty
-	-	3315 199 002		Kit guarnizioni e anelli elastici	Seal kit & piston rings	1
2	2	0634 303 314	105559	. Anello OR	. O-ring	1
1	20	3312 301 030	413883	. Paraolio entrata	. Input shaft seal	1
1	3	0634 319 135	374056	. Paraolio uscita	. Output shaft seal	1
3	3	3312 308 020	408388	. Guarnizione	. Gasket	1
1	18	0634 304 405	501211	. Guarnizione OR	. O-Ring	1
2	4	3312 302 041	447038	. Anello elastico	. Piston ring	3
3	8	0634 309 621	500065	. Guarnizione	. Gasket	1
1	28	3312 301 008	439653	. Guarnizione	. Gasket	1
1	25	0634 304 688	442731	. Guarnizione OR	. O-Ring	1
1	26	0634 306 204	105542	. Guarnizione OR	. O-Ring	1
1	7	3315 301 014	501238	. Guarnizione	. Gasket	1*
1	12	0634 306 209	501179	. Guarnizione OR	. O-Ring	1*
-	-	3315 199 003	-	Kit guarnizioni e frizioni	Seal kit & clutch kit	1
-	-	3315 199 002	-	. Kit guarnizioni e anelli elastici	. Seal kit & piston rings	1
2	14	3311 302 005	489120	. Disco frizione interno	. Inner disc	6
2	13	3311 302 006	489119	. Disco frizione esterno	. Outer disc	8
-	-	3315 199 004	-	Kit cuscinetti	Bearing kit	1
2	5, 29, 31, 32, 33	0635 370 049	-	. Cuscinetto a rullini conici	. Tapered roller bearing	5
2	34	0635 375 010	501178	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	8	3312 302 040	441438	. Cuscinetto a rullini	. Needle bearing	2
2	23	3315 302 016	500470	. Cuscinetto a rullini	. Needle bearing	2
2	30	3311 302 011	489333	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	30	3311 302 012	489334	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	30	3311 302 013	489335	. Spessore 0,3 mm	. Shim 0.3 mm	2
2	30	3311 302 014	489336	. Spessore 0,5 mm	. Shim 0.5 mm	2
2	35	0630 000 091	501195	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	35	0630 000 058	501196	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	35	0630 000 059	501197	. Spessore 0,3 mm	. Shim 0.3 mm	2
2	35	0630 000 061	501198	. Spessore 0,5 mm	. Shim 0.5 mm	2

* Only for old oil filter version
Solo per la vecchia versione del filtro olio

**COMPOSIZIONE KIT ZF 45 A – ZF45A KIT COMPONENTS**

Fig.	Pos.	Part number	Old P/N	Descrizione	Description	Q.ty
–	–	3311 199 007	501172	Kit guarnizioni e anelli elastici	Seal kit & piston rings	1
2	2	0634 303 314	105559	. Anello OR	. O-ring	1
1	22	3312 301 030	413883	. Paraolio entrata	. Input shaft seal	1
1	3	0634 319 135	374056	. Paraolio uscita	. Output shaft seal	1
3	3	3312 308 020	408388	. Guarnizione	. Gasket	1
1	20	0634 304 405	501211	. Guarnizione OR	. O-Ring	1
2	4	3312 302 041	447038	. Anello elastico	. Piston ring	3
3	8	0634 309 621	500065	. Guarnizione	. Seal	1
1	6	0634 304 688	442731	. Guarnizione OR	. O-Ring	1
1	7	0634 306 204	105542	. Guarnizione OR	. O-Ring	1
1	9	3312 301 008	439653	. Guarnizione	. Gasket	1
–	–	3311 199 008	500431	Kit guarnizioni e frizioni	Seal kit & clutch kit	1
–	–	3311 199 007	501175	. Kit guarnizioni e anelli elastici	. Seal kit & piston rings	1
2	14	3311 302 005	489120	. Disco frizione interno	. Inner disc	8
2	13	3311 302 006	489119	. Disco frizione esterno	. Outer disc	10
–	–	3311 199 009	501215	Kit cuscinetti	Bearing kit	1
2	5, 28, 30, 31, 32	0635 370 049	500312	. Cuscinetto a rullini conici	. Tapered roller bearing	5
2	34	0635 375 001	106657	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	8, 23	3312 302 040	441438	. Cuscinetto a rullini	. Needle bearing	4
2	29	3311 302 011	489333	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	29	3311 302 012	489334	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	29	3311 302 013	489335	. Spessore 0,3 mm	. Shim 0.3 mm	2
2	29	3311 302 014	489336	. Spessore 0,5 mm	. Shim 0.5 mm	2
2	35	3311 304 021	305758	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	35	3311 304 022	305759	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	35	3311 304 023	305760	. Spessore 0,3 mm	. Shim 0.3 mm	2
2	35	3311 304 024	305761	. Spessore 0,5 mm	. Shim 0.5 mm	2

COMPOSIZIONE KIT CUSCINETTI ZF 45 A R. 2,43 – ZF45A BEARINGS KIT, RATIO I=2.43

Fig.	Pos.	Part number	Old P/N	Descrizione	Description	Q.ty
–	–	3311 199 054	–	Kit cuscinetti	Bearing kit	
2	5,28,30,31,32	0635 370 049	500312	. Cuscinetto a rullini conici	. Tapered roller bearing	5
2	34	0635 375 001	106657	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	8	3312 302 040	441438	. Cuscinetto a rullini	. Needle bearing	2
2	23, 24	3315 302 016	500470	. Cuscinetto a rullini	. Needle bearing	3
2	29	3311 302 011	489333	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	29	3311 302 012	489334	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	29	3311 302 013	489335	. Spessore 0,3 mm	. Shim 0.2 mm	2
2	29	3311 302 014	489336	. Spessore 0,5 mm	. Shim 0.5 mm	2
2	35	3311 304 021	305758	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	35	3311 304 022	305759	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	35	3311 304 023	305760	. Spessore 0,3 mm	. Shim 0.2 mm	2
2	35	3311 304 024	305761	. Spessore 0,5 mm	. Shim 0.5 mm	2



COMPOSIZIONE KIT ZF 45-1 - ZF 45-1 KIT COMPONENTS

Fig.	Pos.	Part number	Old P/N	Descrizione	Description	Q.ty
-	-	3312 199 017	501175	Kit guarnizioni e anelli elastici	Seal kit & piston rings	1
2	2	0634 306 328	105571	. Anello OR	. O-ring	1
1	25	3312 301 030	413883	. Paraolio entrata	. Input shaft seal	1
1	3	0634 319 132	442135	. Paraolio uscita	. Output shaft seal	1
3	3	3312 308 020	408388	. Guarnizione	. Gasket	1
1	23	0634 304 405	501211	. Guarnizione OR	. O-Ring	1
2	5	3312 302 041	447038	. Anello elastico	. Piston ring	3
3	8	0634 309 621	500065	. Guarnizione	. Seal	1
1	6	0634 304 688	442731	. Guarnizione OR	. O-Ring	1
1	7	0634 306 204	105542	. Guarnizione OR	. O-Ring	1
1	9	3312 301 008	439653	. Guarnizione	. Gasket	1
-	-	3311 199 010	501320	Kit guarnizioni e frizioni	Seal kit & clutch kit	1
-	-	3312 199 017	501175	. Kit guarnizioni e anelli elastici	. Seal kit & piston rings	1
2	16	3311 302 005	489120	. Disco frizione interno	. Inner disc	8
2	15	3311 302 006	489119	. Disco frizione esterno	. Outer disc	10
-	-	3311 199 059	-	Kit cuscinetti	Bearing kit	
2	6	0635 501 940	-	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	10, 25	3312 302 040	441438	. Cuscinetto a rullini	. Needle bearing	4
2	28	0635 501 937	447754	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	30	0635 370 049	-	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	31	0635 501 941	-	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	32	0635 501 938	333859	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	33	0635 501 922	500948	. Cuscinetto a rullini conici	. Tapered roller bearing	1
2	29	3312 302 023	277213	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	29	3312 302 024	277214	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	29	3312 302 025	277215	. Spessore 0,2 mm	. Shim 0.2 mm	2
2	34	3312 304 027	166807	. Spessore 0,1 mm	. Shim 0.1 mm	2
2	34	3312 304 028	442340	. Spessore 0,15 mm	. Shim 0.15 mm	2
2	34	3312 304 029	154102	. Spessore 0,3 mm	. Shim 0.3 mm	2
2	34	3312 304 030	154101	. Spessore 0,5 mm	. Shim 0.5 mm	2

