

ENGLISH

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1.1 Introduction

1.1.1 CUSTOMER'S RESPONSIBILITY

The Customer/Operator is responsible to perform the necessary safety checks to ensure that lubrication, cooling, maintenance and recommended practices are strictly followed for safe, enjoyable operation.

All Transmission units are covered by a guarantee. Therefore: In respect to the handling of the transmission units the instructions stated in this manual are to be strictly followed.



CAUTION

The manufacturer is not liable for any damages or losses caused by faulty installation, wrong handling of the equipment and/or deficient maintenance.

The Customer has to make sure, that any external forces, as well as vibration caused by torsion and bending, are avoided.

The interaction between engine, shaft and propeller may lead to torsional vibration, producing a hammering noise of gears and might damage the engine and/or transmission.

The Supplier is not liable for such torsional vibration inherent to the installation.

This manual includes, among others, the following three main chapters:

1.1.2 DESCRIPTION

This part briefly describes function, operation and design of the ZF/ZFE types A/H/IV.

1.1.3 OPERATION

This part describes the procedures for Operation and all necessary safety measures.

1.1.4 MAINTENANCE

This part contains all maintenance and service tasks to be performed by the operator.

Whenever the terms «right, left, starboard, port» are used in this manual, they always refer to the installed transmission in direction of forward movement.

Important information related to technical reliability and operational safety are highlighted by the identifying words as follows:



WARNING

Any procedure, practice, condition, statement etc., which is not strictly followed, could result in injury or death of personnel.



CAUTION

Any procedure, practice, condition, statement etc., which is not strictly followed, could result in damage or destruction of equipment.

NOTE: Applies to technical requirement to which the user of the equipment must pay particular attention.

WARNING, CAUTION and NOTE always precede the text to which they apply.

2.1 Gear Identification

The identification plate is affixed to the reverser.

An example of an identification plate is shown in Fig. 1:

- A** Transmission ratio propeller rotation opposite to a engine rotation.
- B** Transmission Serial Number.
- C** Every year a new progressive letter is assigned.
- D** Transmission part number.
- E** Transmission version.

F Transmission ratio propeller rotation same as engine rotation.

G Transmission Type.

Significance of transmission designations:

L Version of transmission

H Design of transmission

M Nominal transmission ratio

I Size of transmission

Position the control lever (refer to the relative figures for the various models):

Figure 2: Type **ZFE 25 A-ZFE 45 A**
- **ZFE 63 A-ZFE 80 A**
- **ZFE 80 -1 A-ZFE 85 A**

Figure 3: Type **ZFE 25 - ZFE 45-1**
- **ZFE 63.**

Figure 4: Type **ZFE 63 IV - ZFE 80 IV**
- **ZFE 80-1 IV-ZFE 85 IV.**

Figure 5: Type **ZFE** (Electronic version).

Electric valves pos. «A» and «B» correspond to shifting lever «A» and «B» pos.

- Electric valves **12 V DC, 24 V DC.**

- Version **A / H / IV.**

3.1 Description

The ZF / ZFE A/H/IV marine transmission is a hydraulically activated helical gear unit, developed for use in commercial and pleasurecraft and designed as a three shaft type gearbox. (Four shafts design for IV type).

The transmission is provided with a disc-type reversing clutch mounted on the input shaft and supplied with hydraulic pressure from a fluid pump. Operation of the fluid pump is dependent on the engine speed; the pump is integrated in the control block.

The transmission is lubricated by splash and force-feed lubrication.

3.1.1 ZFE OPTION

A head, astern, clutch disengagement are operated electrically by ON/OFF electric valves.

Electronic control block includes «get home» features as well.

A simple mechanical device permits manual engagement of the clutch.

Figure 6:

- 1 From cooler
- 2 Neutral safety switch
- 3 To cooler
- 4 Connecting thread for temperature sensor
- 5 Control block
- 6 Connection for shifting pressure control



- 7 Output flange
- 8 Side mounting place
- 9 Fluid filter
- 10 Name plate

Figure 7:

- 1 Input shaft
- 2 Side mounting surface
- 3 Fluid dipstick
- 4 Shifting lever
- 5 Electric valves
- 6 Get home «Pos. A»
- 7 Get home «Pos. B»

4.1 Installation

When mounting the ZF Marine Arco S.p.A. ZF/ ZFE transmissions, the following items should be specially noted:

- Mounting should be done by a specialist only.
- Arrange the transmission and engine correctly.
- Align correctly with regard to engine and propeller shaft.
- Select a suitable damping coupling between the engine and the transmission.
- Choose adequate cooler.
- Mount the transmission correctly in the boat.

For detail information see Installation on Manual.

Type of fluid: ATF (Automatic Transmission Fluid); see chapter 10.1.

5.1 Operation

All transmissions have been submitted to a test run before shipment:

During normal operation, the transmission should only be shifted with the engine at idle speed.

In emergency cases it is also admissible to shift at higher speeds.

Optimum effectiveness of fluid can only be assured, if fluid and filter are changed regularly according to schedule (see chapter 6.1).

Visual checks for leakage should be made from time to time.



WARNING

Work on the transmission must only be performed with the engine and propeller at standstill.



CAUTION

Before the first start-up, the trans-

mission must be filled with transmission fluid. For filling procedure, fluid type, quantity and level refer to chapter 6.1.5 fluid change.



CAUTION

Using the transmission with an insufficient oil level will damage the gears. An excessive oil level may cause leakage at the shaft seals and the transmission breather, and raise the operating temperature considerably.

5.1.1 OPERATION PROCEDURE



CAUTION

Before operating the transmission, check fluid level (see chapter 6.1.1).



CAUTION

During normal operation, the transmission should only be shifted with the engine at idle speed. Shifting at higher engine speed may lead to overstress of the friction disks of the coupling and should be avoided in normal operation.

NOTE: The transmission may be shifted from forward to reverse in case of emergency, even at high engine speed.

«A» and «H» VERSIONS

The transmission is shifted by actuating the shifting lever (figure 8) or the electric valve (figure 9).

SHIFTING POSITIONS (figure 8):

A = Propeller rotation opposite of engine rotation

N = Neutral position

B = Propeller rotation same as engine rotation

«IV» VERSIONS

The transmission is shifted by actuating the shifting lever (figure 8) or the electric valve (figure 9).

SHIFTING POSITIONS:

A = Propeller rotation same as engine rotation

N = Neutral position

B = Propeller rotation opposite of engine rotation



WARNING

Start engine with transmission in neutral only.

Operating temperature of the transmission: 55÷80°C. A connection for a temperature probe has been provided.



CAUTION

If the fluid temperature is too high, stop engine immediately and check transmission fluid level and oil cooler for proper water flow. Do not start the engine again until the malfunction is eliminated.

NOTE: «Get-home» (ZFE only).

In case of no electric supply to electric valves; manual engagement of the clutch «A» or «B» can be operated manually:

- Tighten the «get home screw» using an allen wrench n° 3 (figure 10).

5.1.2 MOVING IN TOW OR ANCHORING

When the boat moves in tow or is anchored, the propeller may turn with the water current.

This represents no danger for the transmission. In a boat with two engines, the propeller of the unused transmission may idle freely.

When the engine is off, the position of the shifting lever is irrelevant.



WARNING

Do not work on the transmission when being towed, or anchoring in a river because the propeller may rotate.



WARNING

Do not work on the transmission in a twin engine boat, when one unit is under power.

The propeller shaft of the inoperative transmission will rotate.



WARNING

When the engine runs idle, but the propeller shaft should not be driven (such as when charging the battery with the generator), the shifting le-

ver (figure 12) must be held in the neutral position (N) to prevent the boat from moving.

Avoid to run the hydraulic gearbox in neutral at high engine speed for a long time.

6.1 Maintenance

6.1.1 FLUID LEVEL CHECK



WARNING

Do not work on the transmission when being towed, or anchoring in a river because the propeller may rotate.

Transmission fluid level may be checked in cold or hot condition.

NOTE: Always check the oil level before operating the reverser. Proceed as described below.

- 1) Loosen fluid dipstick (figure 13, item 1) by turning the grip counterclockwise.
- 2) Wipe dipstick with a clean and dustfree cloth.
- 3) Insert dipstick do not screw in (figure 14). Remove dipstick and check fluid level: Fluid level has to be between minimum and maximum marks.
- 4) Check O-rings (figure 14, item 1) for damage, replace if necessary.
- 5) Insert the dipstick and lock it by turning the grip clockwise.



CAUTION

According to the type and arrangement of the cooler and pipelines a certain amount of oil will collect after stopping the engine and will flow back into the transmission after a longer rest period. This may cause the oil level in the transmission to exceed the max. mark. Do not remove off the surplus oil but proceed according to steps 6 and 7.

- 6) Let engine run at idle speed with shifting lever in neutral position until fluid cooler and all pipelines are filled with fluid.
- 7) Switch off engine and check fluid level within a short time. If necessary, top fluid level off to the dipstick

mark. The fluid level on the dipstick (figure 14) should be between the min. and max. marks. The fluid level must be checked again after a short driving period.

6.1.2 FLUID CHANGE



CAUTION

The first change must be performed after 25 hours of operation. All subsequent fluid changes to be made after every 300 hours of operation or once in a year (according to the term which is reached earlier).

Note: The filter element (figure 16, item 1) must be replaced whenever the fluid is changed.



CAUTION

The old lubricant and oil filter must be treated in the same way as special waste that pollutes the environment: they must therefore be disposed of according to their differentiated structure.

6.1.3 REMOVE FLUID FILTER

Proceed as described below to replace the filter:

- 1) Turn the screw that fixes the oil filter cover in an anticlockwise direction and remove the filter from its housing (fig. 15 pos. 1). Use a 6 mm Allen wrench.
- 2) Pull filter element (figure 16, item 1) off.
- 3) Check O-rings (figure 16, item 2 and 3) for damage, replace if necessary.

Only ZF 25 A - ZF 25 old version (Fig. 22)

- 4) Unscrew two M8x25 bolts (figure 22 item 1) and remove them together with washers.
- 5) Pull cover (figure 22, item 2), seal, filter element off.
- 6) Check seal for damage and filter for wear. Replace if necessary.

6.1.4 DRAINING TRANSMISSION FLUID

- 1) ZF 45A, ZF 45-1, ZF 63A, ZF 63: Push hose of suction pump (figure 17, item 1) through suction pipe

(figure 17, item 2) down to bottom of the housing and remove the fluid.

- 2) ZF 25 A, ZF 25, ZF 63 IV, ZF 80 A, ZF 80-1A, ZF 80 IV, ZF 80-1IV, ZF 85 A, ZF 85 IV: Remove the plug (Fig. 18, item 1) and let the oil flow from the proper hole.

NOTE: Maximum outside diameter of suction hose is 5/8 inch (16 mm).

6.1.5 FILLING UP WITH TRANSMISSION FLUID

Fill with ATF oil for automatic gearboxes according to the indicated quantities. Add the quantity considered necessary for filling the heat exchanger and relative connection pipes (Fig. 19).

ZF 25 A:	..... 1.91 US-qts (1,8 liters)
ZF 25:	..... 2.12 US-qts (2,0 liters)
ZF 45 A:	..... 2.65 US-qts (2,5 liters)
ZF 45-1:	..... 3.2 US-qts (3,0 liters)
ZF 63 A:	..... 4.2 US-qts (4 liters)
ZF 63:	..... 4.0 US-qts (3.8 liters)
ZF 63 IV:	..... 4.6 US-qts (4,4 liters)
ZF 80 A/ZF 80-1A:	..... 5.8 US-qts (5.5 lt)
ZF 80IV/ZF 80-1IV:	..... 7.4 US-qts (7.0 lt)
ZF 85 A:	..... 5.8 US-qts (5.5 lt)
ZF 85 IV:	..... 7.4 US-qts (7.0 lt)

Only use oil for automatic gearboxes, as given in the specification in the «List of recommended oils» on page 61.

6.1.6 INSERT FLUID FILTER INTO HOUSING

- 1) Place new filter element onto cover (Fig. 20).
- 2) Lock the cover in its housing, fixing it in place with the relative Allen screw (fig. 21) and using a min. 5 Nm (4 ft/lbs) max 8 Nm (6 ft/lbs) driving torque. Check the oil level after a brief period of service.

Only ZF 25 A - ZF 25 old version (Fig. 22)

- 3) Place filter element and seal onto cover.
- 4) Lock filter cover in place by screwing in bolts (fig. 22 item 1), driving torque 18 Nm (14 ft/lb);

6.1.7 TRIAL RUN

- 1) Carry out a trial run after the oil change.
- 2) 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.



- 3) Stop the engine and check oil level again.
If necessary, replenish with oil. Excessive oil should be removed. The fluid level on the dipstick should be between the min. and max. marks.

The fluid level should be checked again after a short driving period.

6.1.8 STORAGE

If the transmission is stored for longer time, for example winter storage, it

should be topped off through the dipstick hole with ATF to prevent the unit from corrosion.



CAUTION

Change the fluid when putting the unit into operation again.

7.1 Troubleshooting

First of all check, whether all items of operating instructions have been complied with.

SYMPTOM	POSSIBLY CAUSED BY	REMEDY
1. High fluid temperature	Fluid level high during operation Fluid level low Plugged or restricted fluid cooler No water in cooling system Unknown	Pump out fluid to max. mark on dipstick Add fluid Replace cooler and flush water system Check cooling system and repair Consult service station
2. Fluid on transmission housing	Loose screws Loose screw connections Loose dipstick Loose fluid filter Fluid level high during operation Unknown	Tighten to specification Tighten, replace Tighten, replace Tighten, replace Pump out fluid to max. mark on dipstick Consult service station
3. Fluid and water mixed	Damaged fluid cooler	Consult service station
4. Shifts hard	Selector control Linkage Unknown	Consult service station Adjust Consult service station
5. Slow engagement	Selector control Low fluid level Linkage Unknown	Consult service station Add fluid Adjust Consult service station
6. No movement of the boat	Selector control Improper selector position Low fluid level Propeller missing Propeller shaft broken Transmission malfunction Engine malfunction	Consult service station Adjust Add fluid Replace Consult service station Consult service station Consult service station
	No electric supply to electric valves (ZFE only)	Plug to be fitted Consult service station In case of emergency «Get home» feature can be used (see pag. 10).



8.1 Technical Data

Type	ZF 25	ZF 25A	ZF 45 A	ZF 45-1	ZF 63 A	ZF 63	ZF 63 IV	ZF 80 A ZF 80-1 A	ZF 80 IV ZF 80-1 IV	ZF 85 A	ZF 85 IV
Shifting pressure bar (psi)	21.5-23.5 (312-341)	21.5-23.5 (312-341)	21.5-23.5 (312-341)	21.5-23.5 (312-341)	21.5-23.5 (312-341)	21.5-23.5 (312-341)	21.5-23.5 (312-341)	21.5-23.5 (312-341) 23.5-26.5 (341-385)	21.5-23.5 (312-341) 23.5-26.5 (341-385)	23.5-26.5 (341-385)	23.5-26.5 (341-385)
Max. input speed min. ⁻¹ (rpm)	* 5500	5500	5500	5500	5500	5500	5500	4500	3300	4500	3300
	** 3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200
Weight without fluid and fluid cooler kg (lb.)	24 (53)	24 (53)	28 (62)	60 (132)	44 (97)	46 (101)	62 (136)	64 (141)	93 (205)	-	-
Fluid capacity without fluid cooler (Liters) (qts.)	2.0 (2.12)	1.8 (1.91)	2.5 (2.65)	3.0 (3.2)	4.0 (4.2)	3.8 (4.0)	4.4 (4.6)	5.5 (1.5)	7.0 (1.85)	-	-

* Pleasure duty

** Continuous duty

9.1 Warranty

9.1.1 STANDARD WARRANTY

ZF Marine Arco S.p.A. warrants its type ZF / ZFE Reversing Marine Transmission to be free from defects in material and work-manship under normal use and maintenance, provided that this warranty shall apply if, and only if, the equipment has been properly installed and operated.

The obligation of ZF Marine Arco S.p.A. under this warranty shall be limited to the replacement or repair, at its choice, of any part or parts found to be defective by ZF Marine Arco S.p.A. upon its examination of same, provided that the part or parts are returned to the nearest official ZF Marine Arco S.p.A. distributor, freight prepaid, within the time:

Twenty-four (24) months from date of commissioning or thirty-six (36) months from date of delivery to engine manufacturer, whichever occurs first.

The obligations of ZF Marine Arco S.p.A. under this warranty as set forth herein shall also be subject to compliance by the distributor or engine manufacturer who has purchased the product with the Warranty Procedures which is made a part of this warranty. All warranties shall run to distributors and engine manufacturers who have purchased the type ZF Reversing Marine Transmission. This warranty shall not apply to any part or parts which have been repaired or altered, without the prior written consent of an official ZF Marine Arco S.p.A. dealer.

This warranty shall not apply if the product or any of its components or parts have been subject to misuse, abuse, negligence, alteration, or accident, or have not been operated in accordance with printed instructions of ZF Marine Arco S.p.A. or has been operated under conditions more severe than, or otherwise exceeding, those set forth in the specifications for said product, or has been improperly installed or reinstalled, or improperly maintained and operated.

This warranty is expressly in lieu of all other warranties expresses or implied including the warranties of merchantability and fitness for use and of all other obligations including without limitation, consequential damages, and ZF Marine Arco S.p.A. neither assumes nor authorizes any other person to assume for ZF Marine Arco S.p.A., any other liability in connection with the sale of the ZF/ZFE Reversing marine transmission. ZF Marine Arco S.p.A. shall in no event be liable for any breach of warranty in an amount exceeding the purchase price of the ZF/ZFE Reversing marine transmission.

9.1.2 TORSIONAL RESPONSIBILITY AND TORSIONAL COUPLINGS

The responsibility for ensuring torsional compatibility rests with the assembler of the drive and driven equipment. ZF Marine Arco S.p.A. can accept no liability for gearbox noise caused by vibrations or for damage to the gearbox, the flexible coupling or to other

parts of the drive unit caused by this kind of vibration. Contact ZF Marine Arco S.p.A. for further information and assistance.

ZF Marine Arco S.p.A. recommends the use of a torsional limit stop for single engine powered boats, wherein loss of propulsion power can result in loss of control. It is the buyer's responsibility to specify this option, which can result in additional cost and a possible increase in installation length.

ZF Marine Arco S.p.A. can accept no liability for personal injury, loss of life, or damage or loss of property due to the failure of the buyer to specify, a torsional limit stop.

ZF Marine Arco S.p.A. selects torsional couplings on the basis of nominal input torque ratings and commonly accepted rated engine governed speeds.

Consult ZF Marine Arco S.p.A. for details concerning speed limits of standard offering torsional couplings, which can be less than the transmission limit. Special torsional couplings may be required for Survey Society Ice Classification requirements.