



MARINE

REPAIR MANUAL

- HBW 35** versions 25; 26; 27; 28
- HBW 50** versions 09; 10; 11; 12; 14
- HBW 100** versions 14; 15; 16; 17; 20; 21
- HBW 125/HBW 10** versions 15; 16
- HBW 150** versions 17; 18; 20; 21; 22
- HBW 150 A** versions 01; 02
- HBW 150 V** versions 08; 09; 10; 11
- HBW 250** versions 15; 16 17; 18; 19; 20; 22; 23

This HBW manual has been prepared for all those who have to do with ZF-HURTH Marine reversing gearbox units of the HBW line, including models HBW 35, HBW 50, HBW 100, HBW 125, HBW 150, HBW 150 A, HBW 250 and HBW 150 V, in particular for

- power plant suppliers
- shipyards
- craft owners

The HBW manual is intended as an aid for handling HBW transmissions and will answer all questions that may arise in daily operation and in connection with the installation and repair of HBW transmissions.

This manual contains:

- Technical description of the gearbox units and a number of important technical data;
- Instructions for proper installation of the gearbox in the craft;
- Explanatory notes on correct operation and maintenance;
- Detailed description of all disassembly and reassembly procedures (with drawings);
- Troubleshooting table with possible causes of trouble and the required remedial action;
- Spare parts list with stock numbers of all spare parts;
- Explosion-View drawings showing each part with the reference numerals used in the text.

No problems will be encountered in handling, installing and operating the HBW gearbox if the instructions in this manual are followed. Should a repair be necessary, a qualified technician will have no difficulty in doing the repair work in accordance with the detailed instructions given on the following pages.

In addition, HBW Service Stations (distributors and dealers) are available for any repairs and for supplying the spare parts required. The manufacturer will always be glad to name the Service Station nearest to your location.

All transmission units are covered by a worldwide guarantee given by the manufacturer. The manufacturer's warranty will be subject to the condition that:

- the instructions in this manual are strictly observed in handling the transmission,
- no work is performed by persons not authorized by ZF-HURTH Marine.
- no changes or alterations of any kind are made on the transmission.

Failure to observe these points will invalidate all and any warranty claims.

Caution: never start doing any work on the transmission unless and until the engine and the propeller have come to a complete standstill.

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1. Description

1.1 Brief description

ZF-HURTH Marine boat reversing gearbox units of the HBW line are servo-automatically controlled helical gear transmissions developed for use in pleasure craft and commercial craft. The servo-operated multiple-disc clutch requires only minimum effort for shifting, making the HBW transmission suitable for single-lever remote control via a rod linkage or shift cable.

In emergency situations the HBW permits direct reversing at engine speed above idle rpm.

The torque capacity of the clutch is exactly rated, preventing shock loads from exceeding a predetermined value to ensure maximum protection of the engine and thus providing the effect of a safety clutch.

The transmission units are characterized by low weight and small overall dimensions. The gearbox castings are made of a high-strength, corrosion-resistant aluminium alloy, chromized for improved seawater resistance and optimum adhesion of paint.

A choice of gear ratios, a high efficiency rating and low-noise operation are other prominent features of the HBW gearbox units.

The transmissions are immersion-lubricated. Maintenance is restricted to oil level checks (see «Maintenance», chapter 4).

The shafts are supported by heavy-duty taper roller bearings and the gearbox is designed to take the axial propeller thrust (for permissible values see «Technical data», item 1.2).

Transmission sizes are available for right-hand (RH) and left-hand (LH) rotation of the input shaft, the direction of rotation being specified as seen by an observer facing the input shaft.

In gear lever positions A, the engine shaft and the propeller shaft rotate in opposite directions, in position B in the same direction (Fig. 1).

On model HBW 150 V, the directions of rotation are the other way round (Fig. 2).

Engine manufacturers should note that the direction of rotation refers to an observer facing the flywheel, so that left-hand rotation of the engine corresponds to right-hand rotation of the gearbox input shaft.

Fig. 1

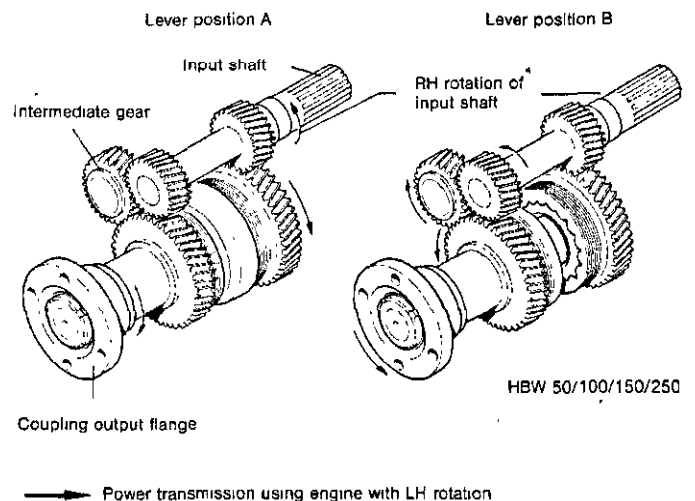
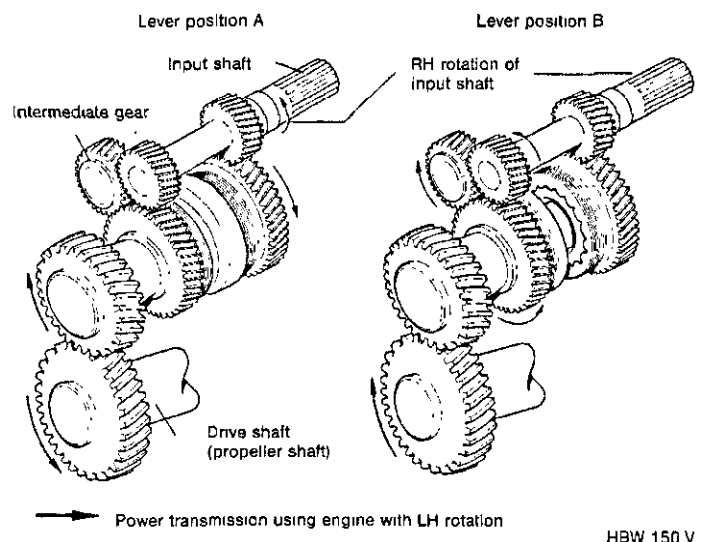
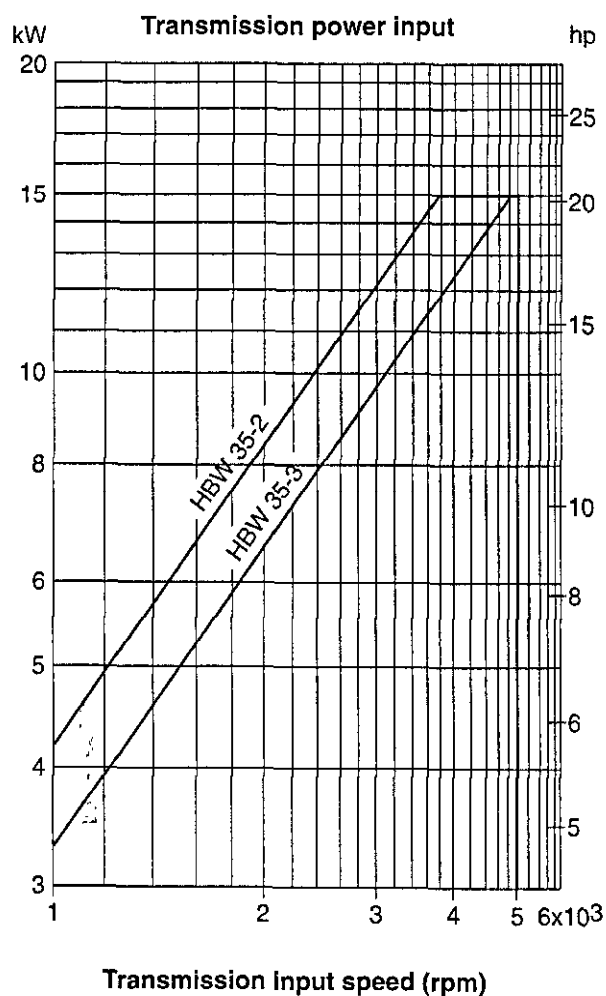
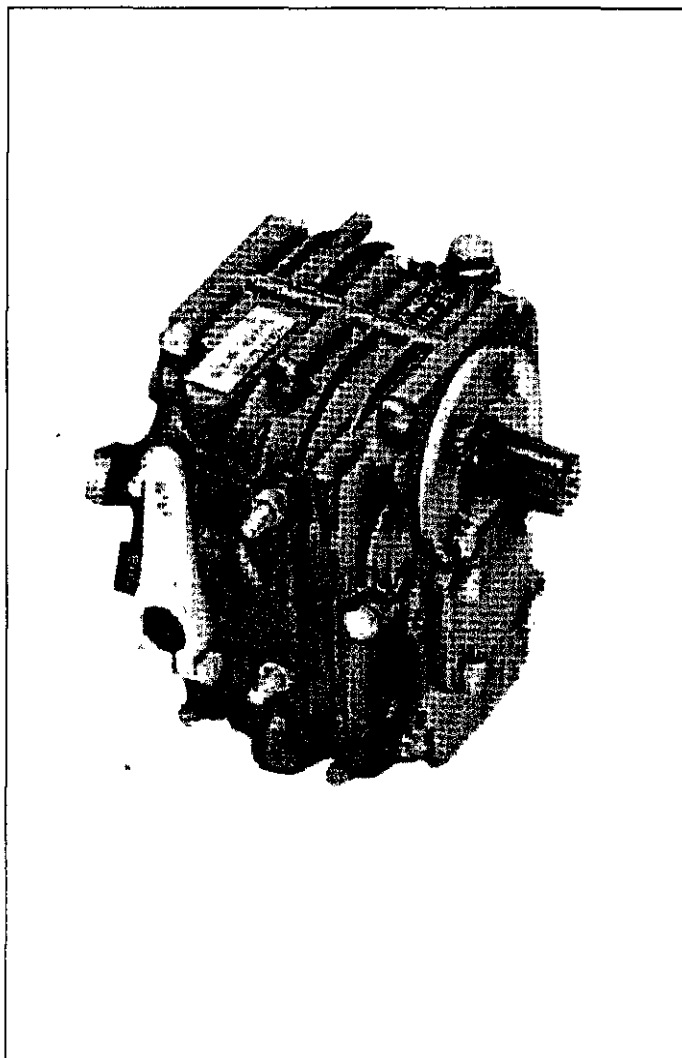


Fig. 2



1.2 Technical Data and Main Dimensions

1.2.1 HBW 35



Power diagram

Based on engine power B to DIN 6270;
shock factor

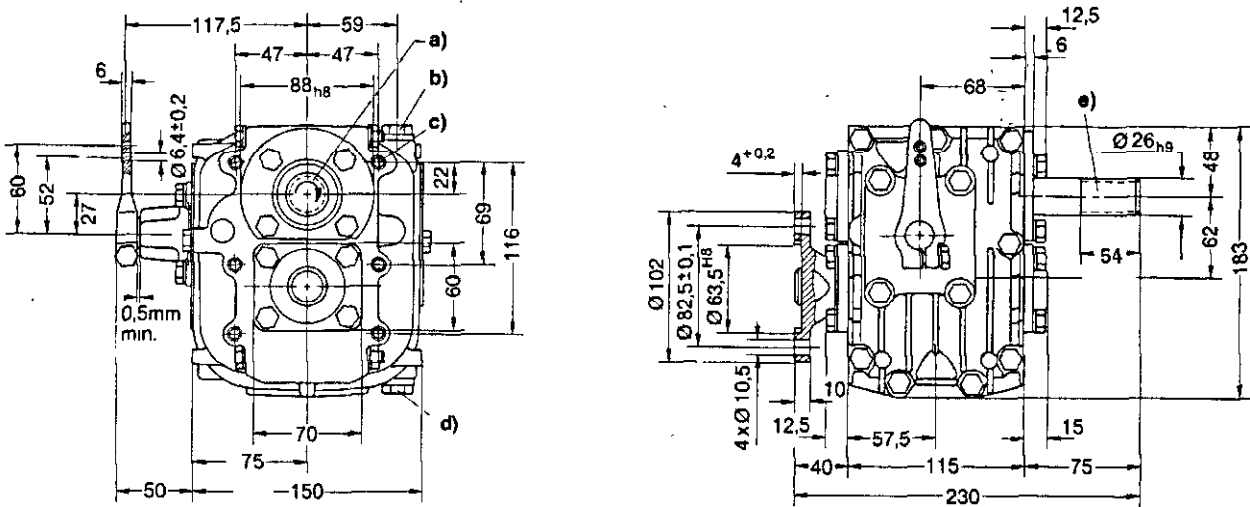
K = 1.25 to applied, if engine has 1 cylinder

K = 1.20 for 2 cylinders

K = 1.15 for 3 cylinders

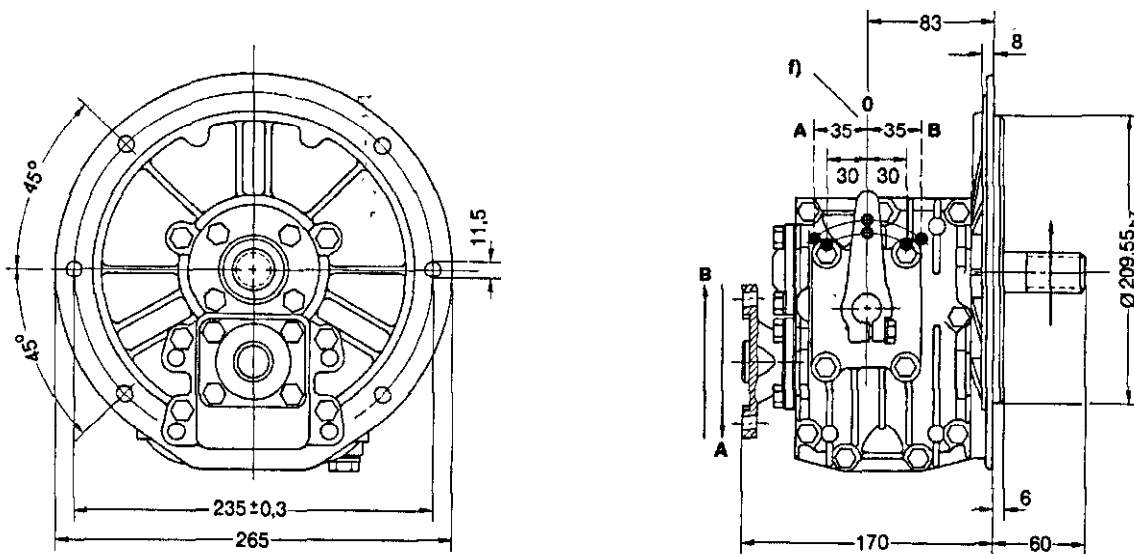
Technical data		HBW 35-2	HBW 35-3
Shifting position «A»	ratio	2.05:1	2.72:1
Shifting position «B»	ratio	1.86:1	2.15:1
Input torque max.	Nm (ft lb)	40 (29,5)	30 (22,1)
Power input max.	kW (hp)	15 (20)	
Input speed max.	rpm	5000	
Propeller thrust max.	N (lb)	1000 (225)	
Weight without fluid	kg (lb)	8 (17.7)	
Fluid quantity	liter	0.3	
Fluid grade	Automatic-Transmission-Fluid (ATF)		

Fig. 3 HBW 35



Model without mounting flange

- a) Clockwise rotation b) Oil dipstick and filler screw 17mm c) M 8/12 deep, holes same on both sides d) Oil drain plug 17mm width across flats e) Spline profile similar B 10x23x29 DIN 5464 f) Minimum lever travel

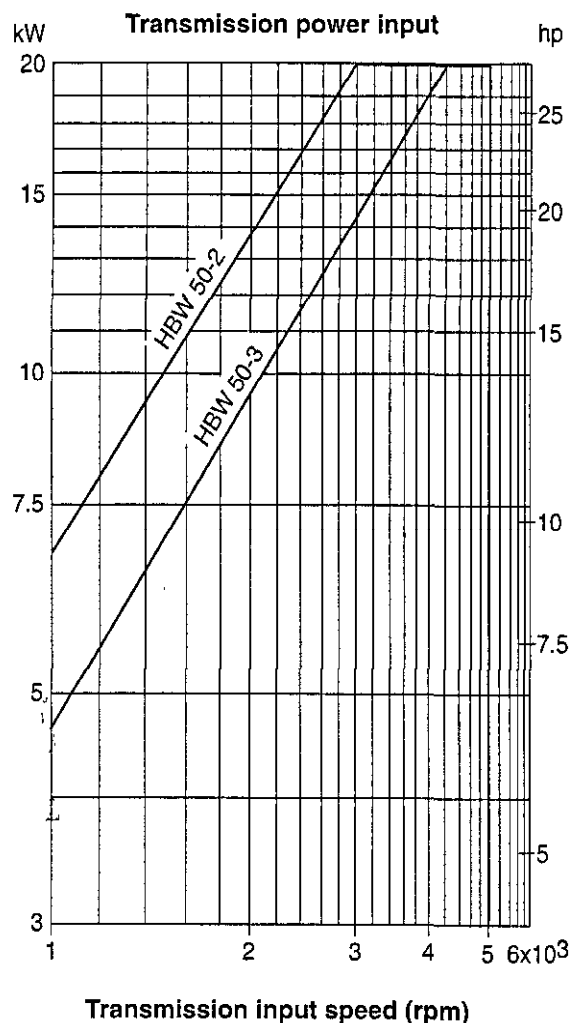
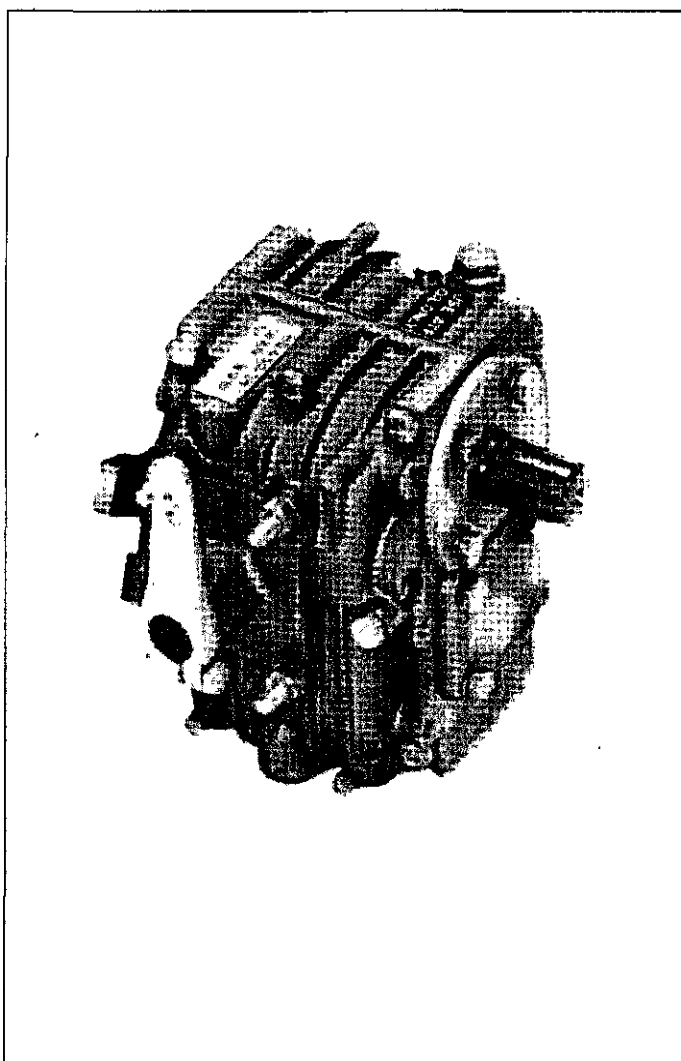


All dimensions in mm

Model with mounting flange

1.2 Technical Data and Main Dimensions

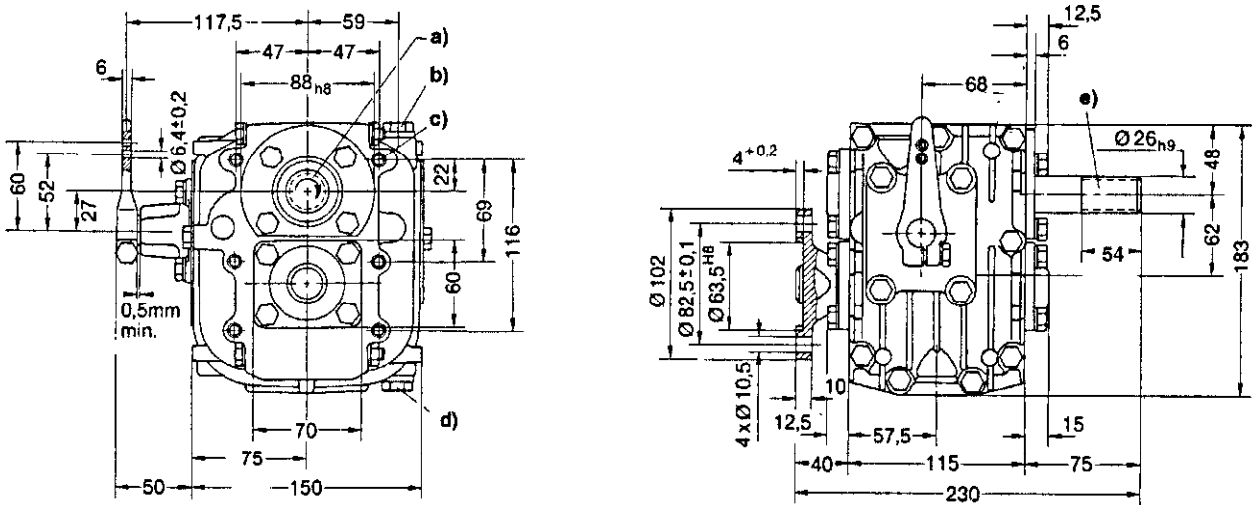
1.2.2 HBW 50



Power diagram for Pleasure Craft Duty
 Based on engine power B to DIN 6270;
 shock factor
 K = 1.25 to applied, if engine has 1 cylinder
 K = 1.20 for 2 cylinders
 K = 1.15 for 3 cylinders

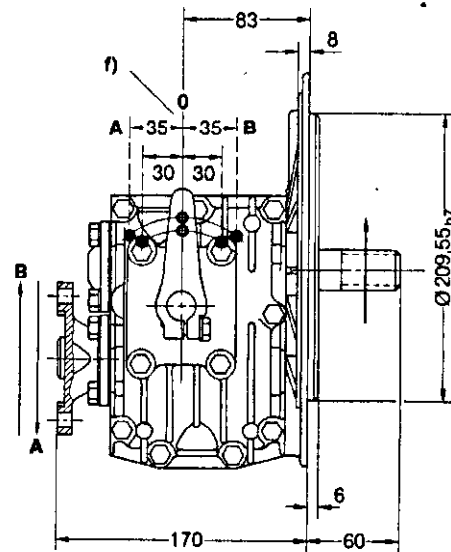
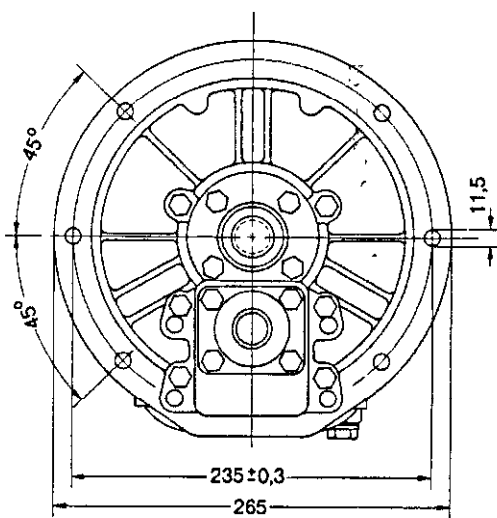
Technical data			HBW 50-2	HBW 50-3
Shifting position «A»		ratio	2.05:1	2.72:1
Shifting position «B»		ratio	1.86:1	2.15:1
Input torque M max	Pleasure craft	Nm (ft lb)	63 (46.5)	45 (33.2)
	Continuous duty	Nm (ft lb)	50 (36.8)	35 (25.8)
Power input P max	Pleasure craft	kW (hp)	20 (27)	
	Continuous duty	kW (hp)	15 (20)	
Input speed n max		rpm	5000	
Propeller thrust F max		N (lb)	1000 (225)	
Weight without fluid		kg (lb)	8 (17.7)	
Fluid quantity		liter	0.3	
Fluid grade			Automatic-Transmission-Fluid (ATF)	

Fig. 4 HBW 50



Model without mounting flange

- a) Clockwise rotation b) Oil dipstick and filler screw 17mm c) M 8/12 deep, holes same on both sides d) Oil drain plug 17mm width across flats e) Spine profile similar B 10x23x29 DIN 5464 f) Minimum lever travel

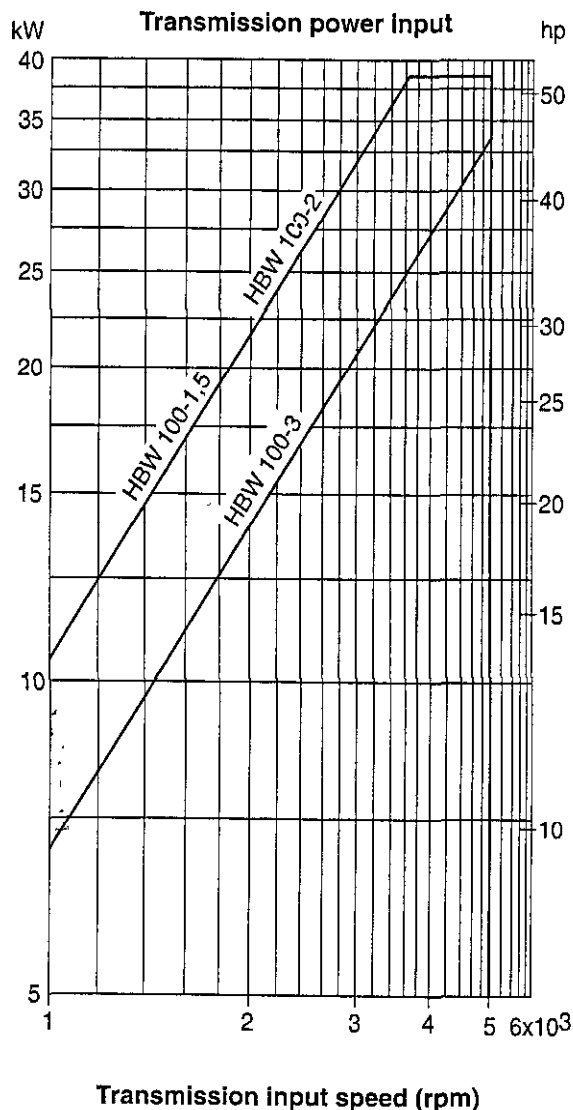
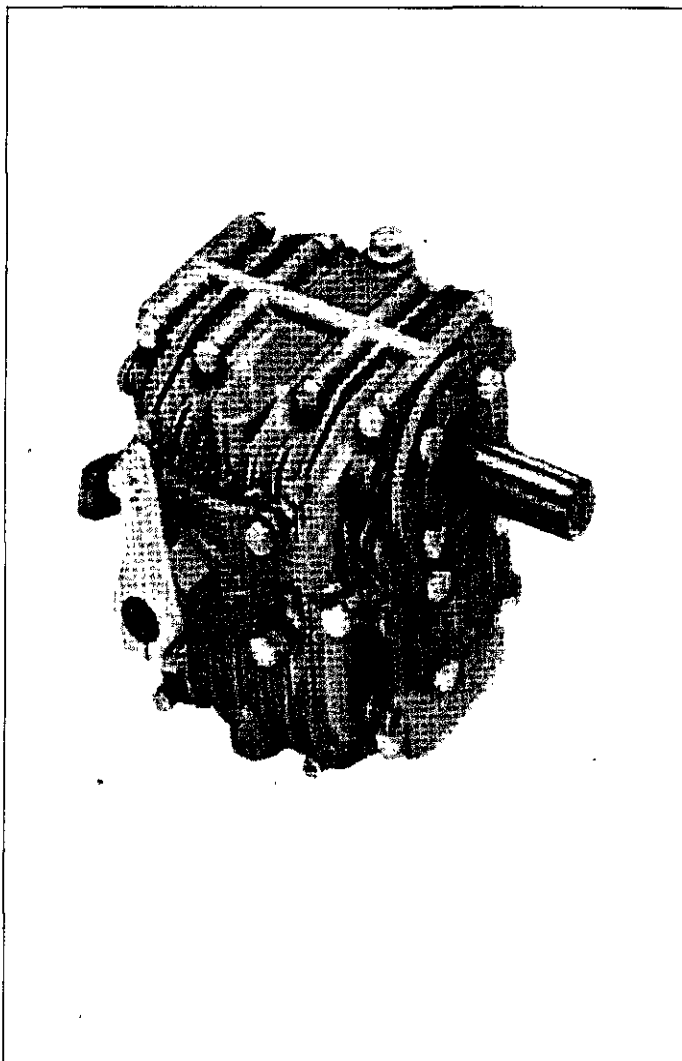


All dimensions in mm

Model with mounting flange

1.2 Technical Data and Main Dimensions

1.2.3 HBW 100



Power diagram for Pleasure Craft Duty

Based on engine power B to DIN 6270;
shock factor

K = 1.25 to applied, if engine has 1 cylinder

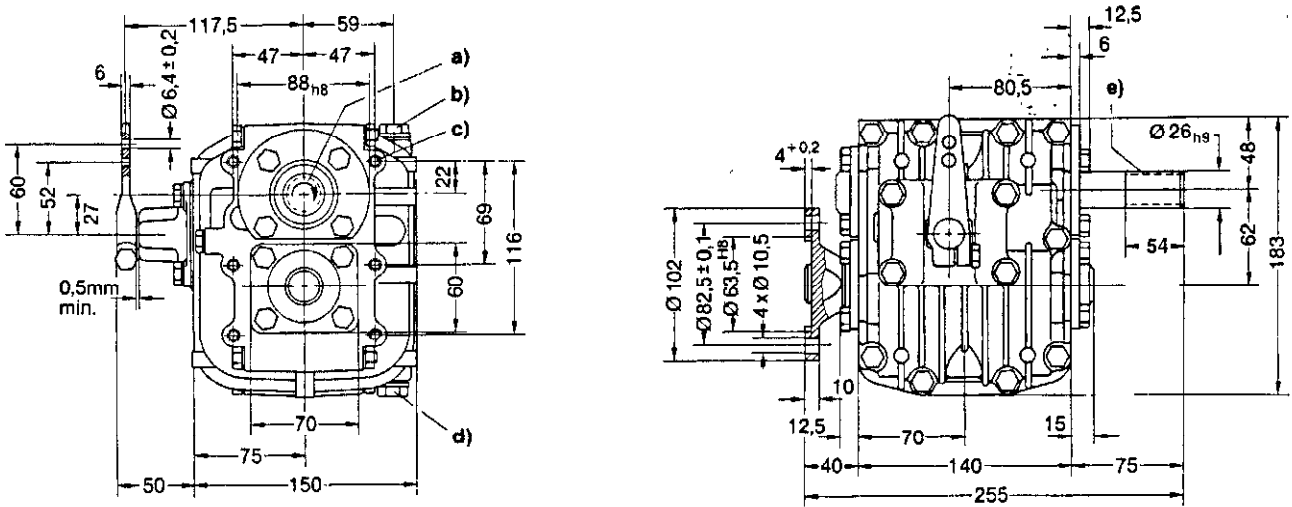
K = 1.20 for 2 cylinders

K = 1.15 for 3 cylinders

** Max. 95 Nm (70 ft lb) admissible for main travelling direction with gear lever set to «B»

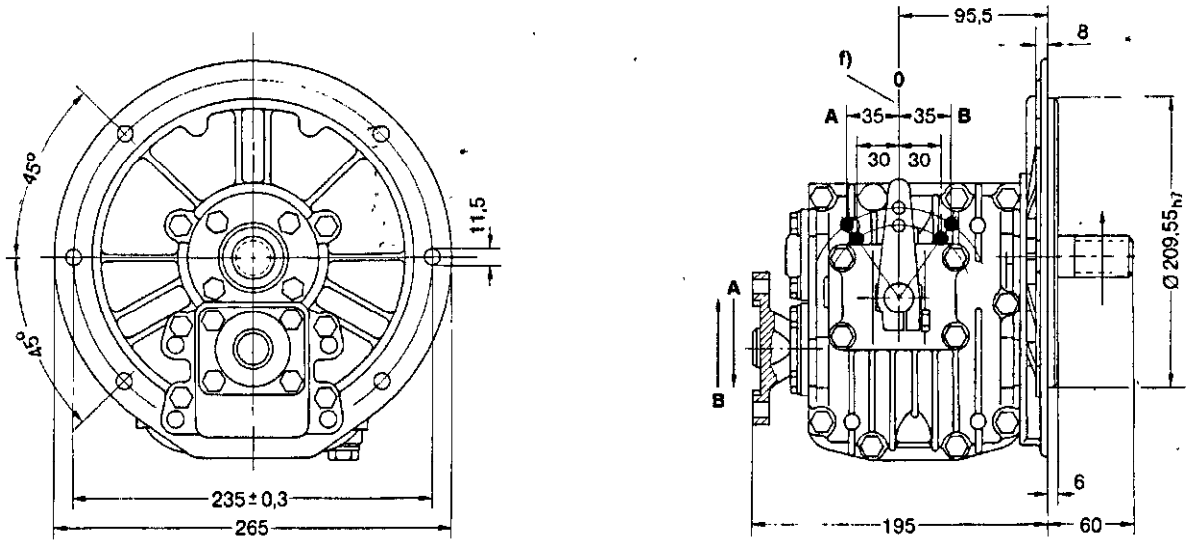
Technical data			HBW 100-1.5	HBW 100-2	HBW 100-3
Shifting position «A»		ratio	1.48	1.79	2.72
Shifting position «B»		ratio	1.86	1.86	2.15
Input torque M max	Pleasure craft	Nm (ft lb)	103** (75.9)	103** (75.9)	65 (47.9)
	Continuous duty	Nm (ft lb)	85 (62.7)	75 (55.3)	55 (40.5)
Power input P max	Pleasure craft	kW (hp)	38 (52)	38 (52)	34 (46)
	Continuous duty	kW (hp)	28 (38)	28 (38)	25 (34)
Input speed n max		rpm	5000		
Propeller thrust F max		N (lb)	1500 (340)		
Weight without fluid		kg (lb)	9.5 (21)		
Fluid quantity		liter	0.35		
Fluid grade			Automatic-Transmission-Fluid		

Fig. 5 HBW 100



Model with mounting flange

- a) Clockwise rotation b) Oil dipstick and filler screw 17mm c) M 8/12 deep, holes same on both sides d) Oil drain plug 17mm width across flats e) Spline profile similar B 10x23x29 DIN 5464 f) Minimum lever travel

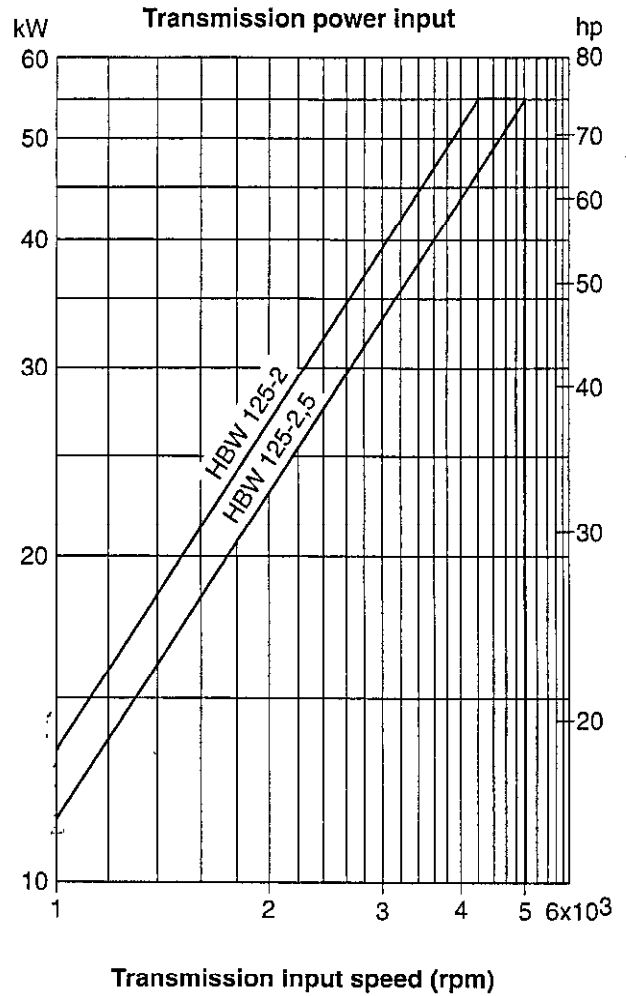
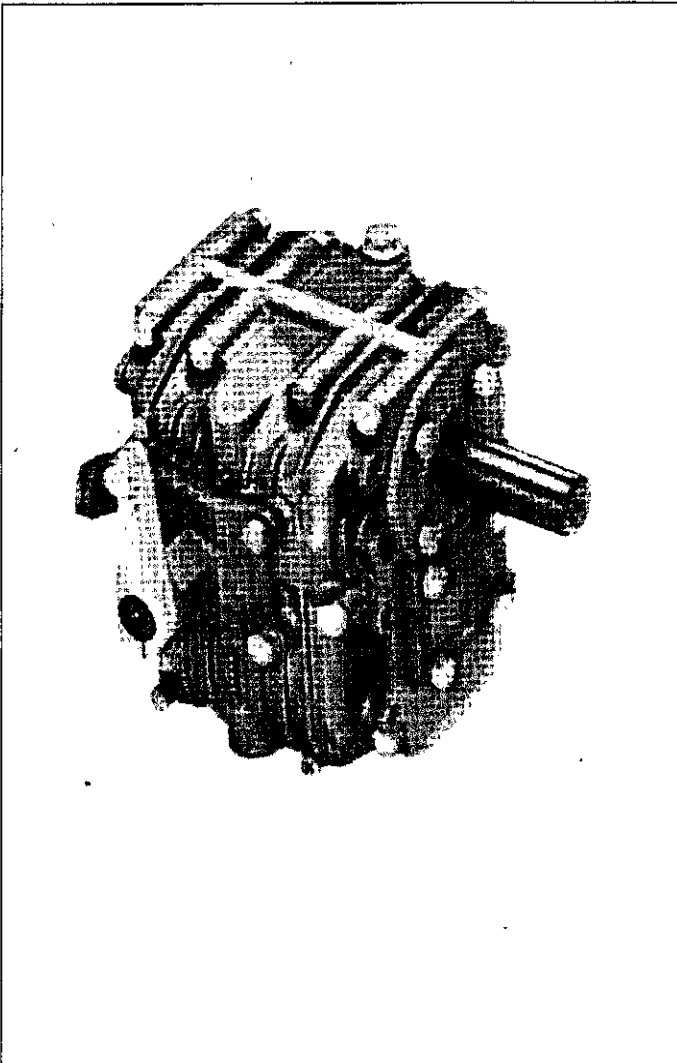


All dimensions in mm

Model without mounting flange

1.2 Technical Data and Main Dimensions

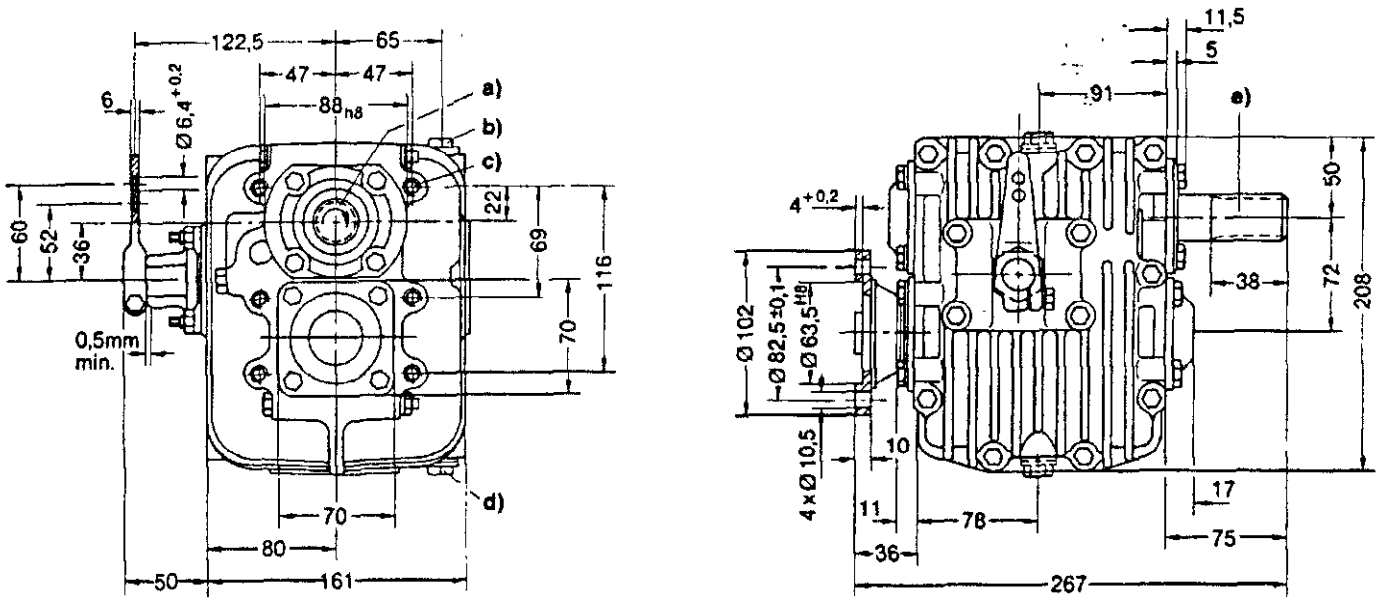
1.2.4 HBW 125



Power diagram for pleasure craft
 Based on engine power B to DIN 6270;
 shock factor K = 1.25 to applied,
 if engine has fewer than 4 cylinders.

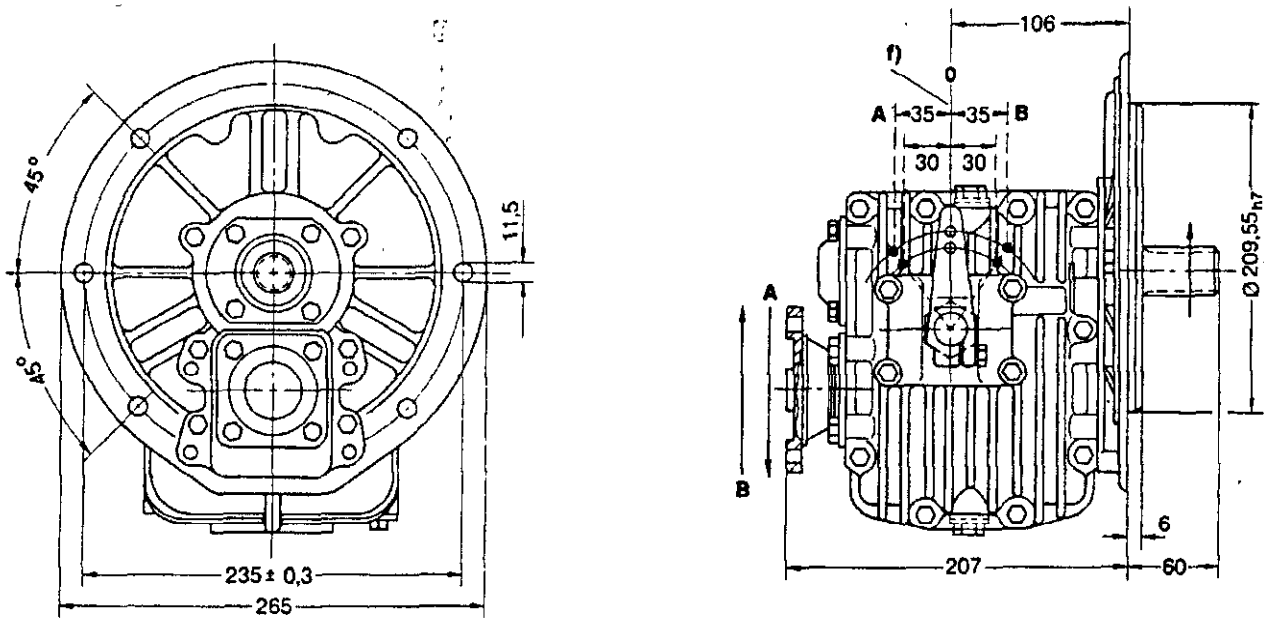
Technical data			HBW 125-2	HBW 125-2.5
Shifting position «A»		ratio	2.14:1	2.63:1
Shifting position «B»		ratio	1.95:1	1.95:1
Input torque max.	Pleasure craft	Nm (ft lb)	125 (92.2)	106 (78.2)
	Commercial craft	Nm (ft lb)	100 (73.7)	90 (66.4)
Power input max.	Pleasure craft	kW (hp)	55 (75)	
	Commercial craft	kW (hp)	40 (54)	
Input speed max.		rpm	5000	
Propeller thrust max.		N (lb)	3000 (675)	
Weight without fluid		kg (lb)	13 (28.7)	
Fluid quantity		Liter	0.56	
Fluid grade			Automatic-Transmission-Fluid (ATF)	

Fig. 6 HBW 125



Model without mounting flange

- a) Clockwise rotation b) Oil dipstick and filler screw 17 mm c) M 8/12 deep, holes same on both sides d) Oil drain plug 17 mm width across flats e) Spline profile similar B 10 x 23 x 29 DIN 5464 f) Minimum lever travel

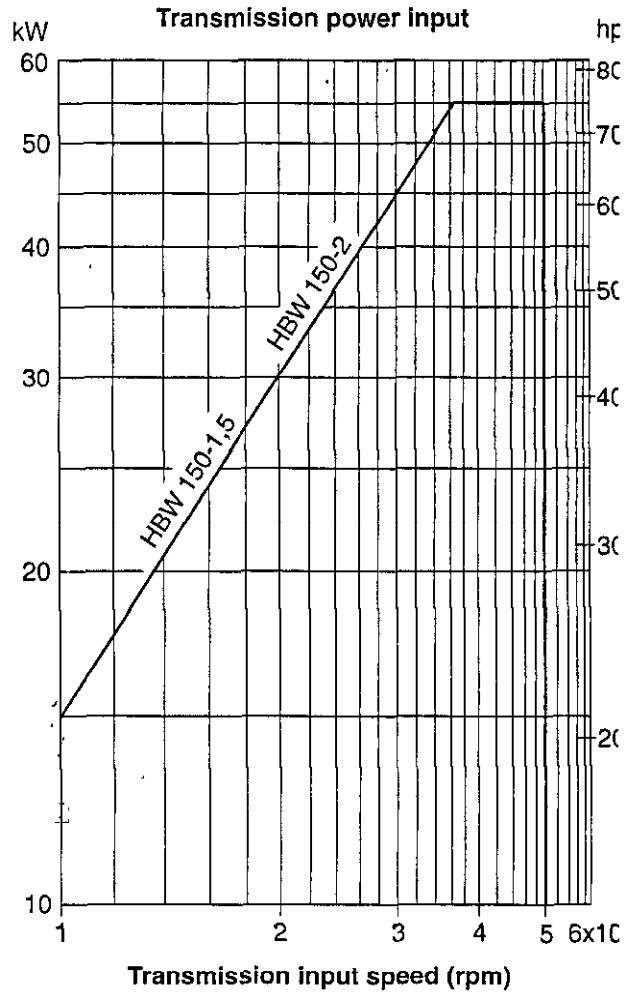
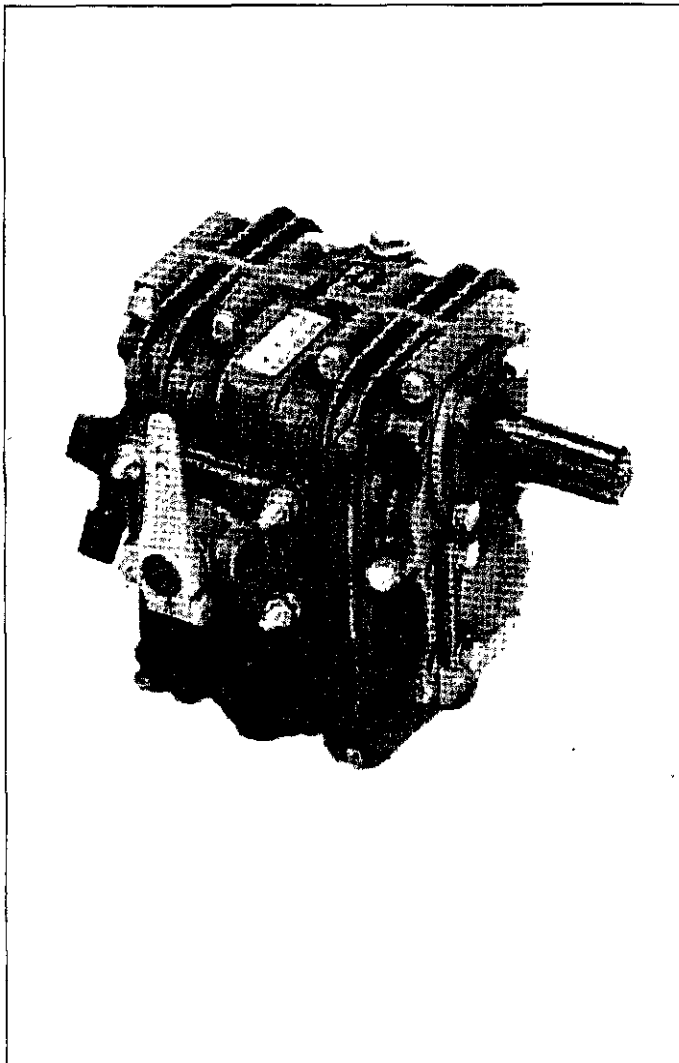


All dimensions in mm

Model with mounting flange

1.2 Technical Data and Main Dimensions

1.2.5 HBW 150



Power diagram for Pleasure Craft Duty

Based on engine power B to DIN 6270;

shock factor

K = 1.25 to applied, if engine has 1 cylinder

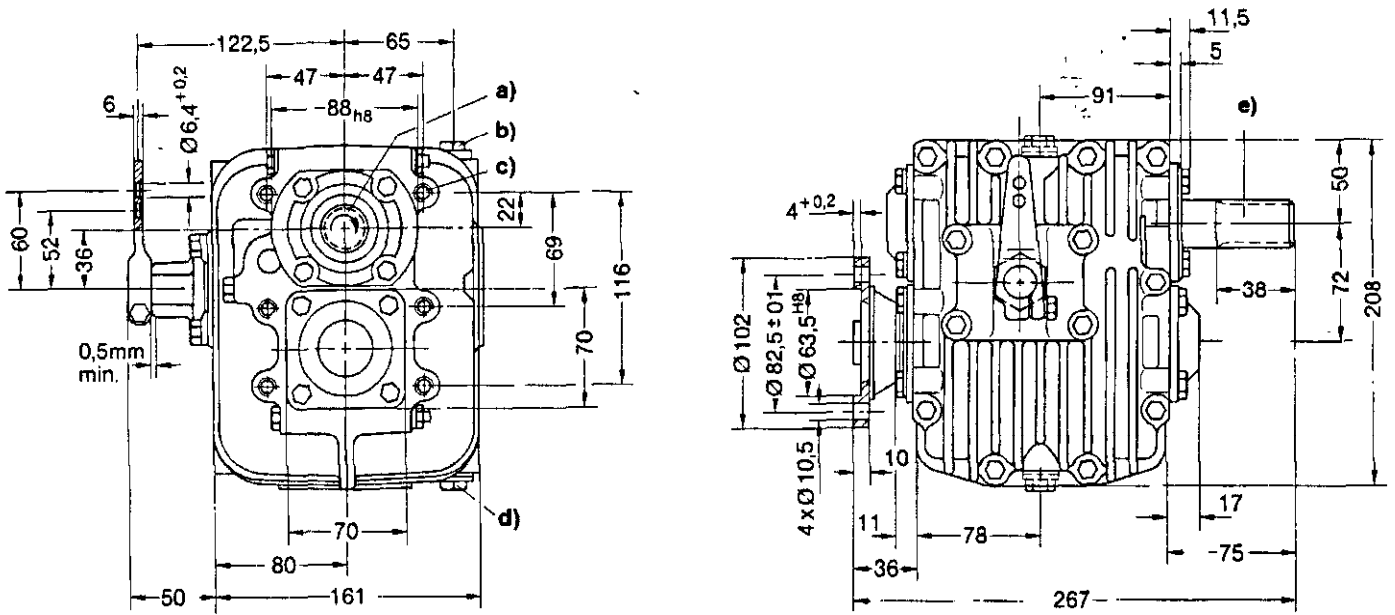
K = 1.20 for 2 cylinders

K = 1.15 for 3 cylinders

** Max. 120 Nm (88.5 ft lb) admissible for main travelling direction with gear lever set to «B»

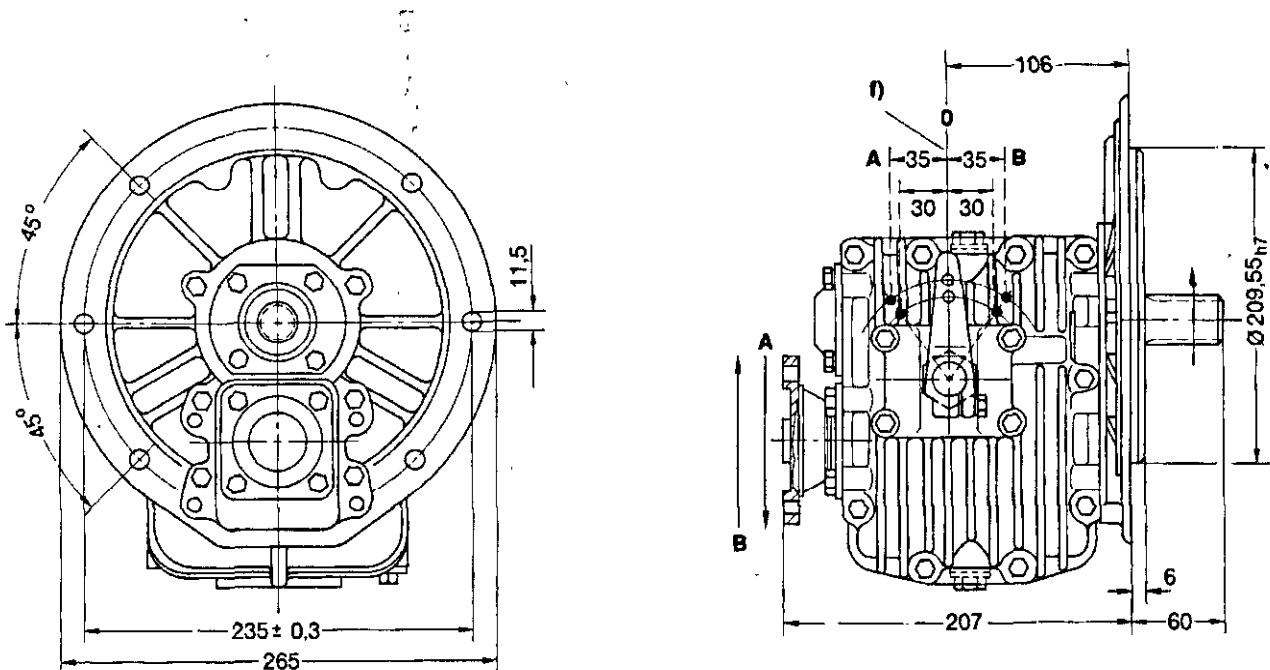
Technical data			HBW 150-1.5	HBW 150-2
Shifting position «A»	ratio		1.56:1	1.88:1
Shifting position «B»	ratio		1.95:1	1.95:1
Input torque M max	Pleasure craft	Nm (ft lb)	145** (106.9)	145** (106.9)
	Continuous duty	Nm(ft lb)	120 (88.5)	110 (81.1)
Power input P max	Pleasure craft	kW (hp)	55 (75)	
	Continuous duty	kW (hp)	40 (54)	
Input speed n max	rpm		5000	
Propeller thrust F max	N (lb)		3000 (675)	
Weight without fluid	kg (lb)		13 (28.7)	
Fluid quantity	liter		0.56	
Fluid grade	Automatic-Transmission-Fluid (ATF)			

Fig. 7 HBW 150



Model without mounting flange

- a) Clockwise rotation b) Oil dipstick and filler screw 17mm c) M 8/12 deep, holes same on both sides d) Oil drain plug 17mm width across flats e) Splline profile similar B 10x23x29 DIN 5464 f) Minimum lever travel

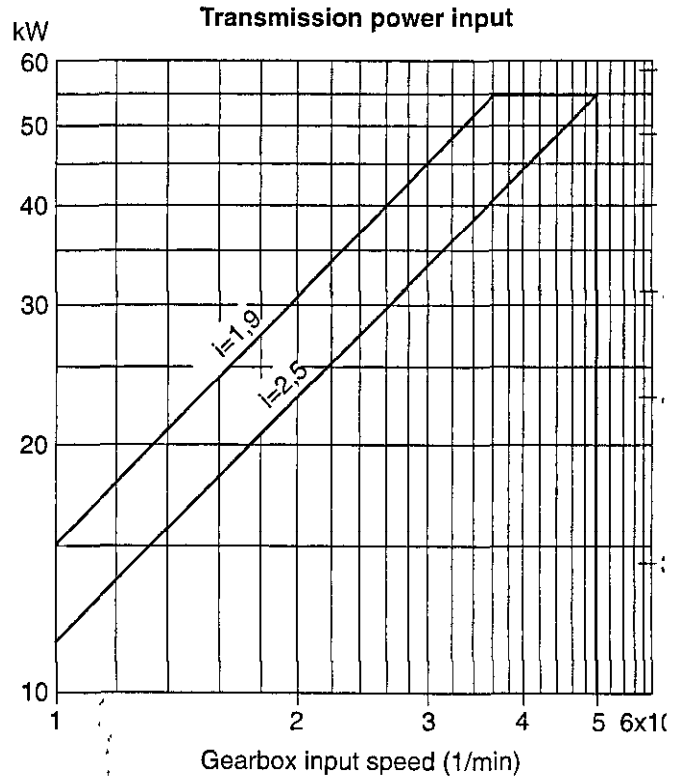
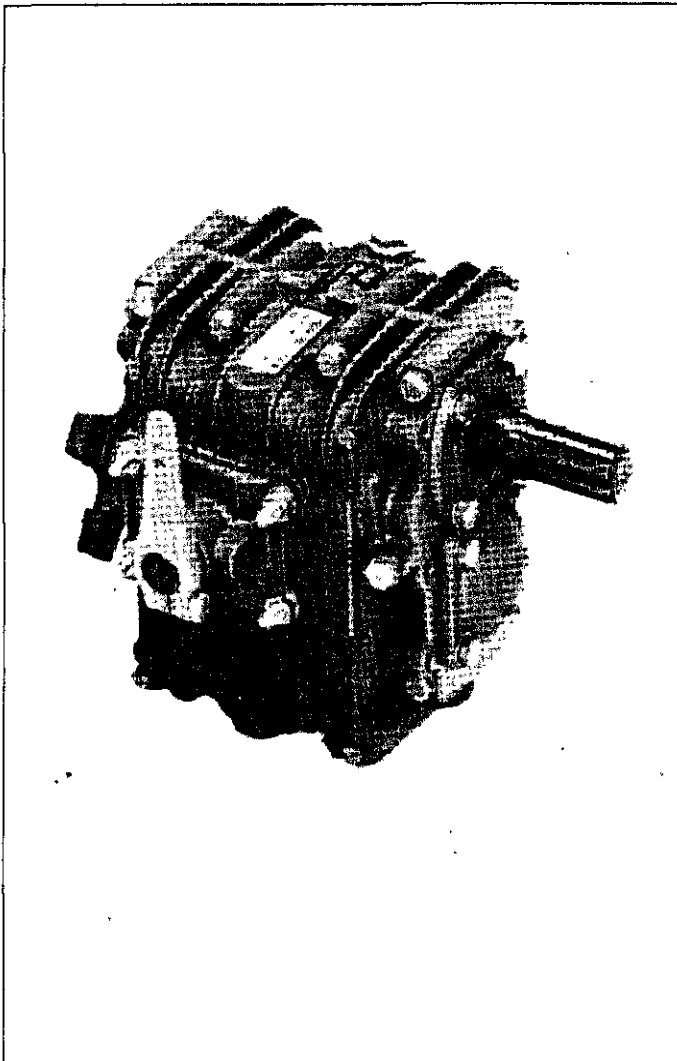


All dimensions in mm

Model with mounting flange

1.2 Technical Data and Main Dimensions

1.2.6 HBW 150 A



Power diagram for Pleasure Craft Duty

Based on engine power B to DIN 6270;

shock factor

K = 1.25 to applied, if engine has 1 cylinder

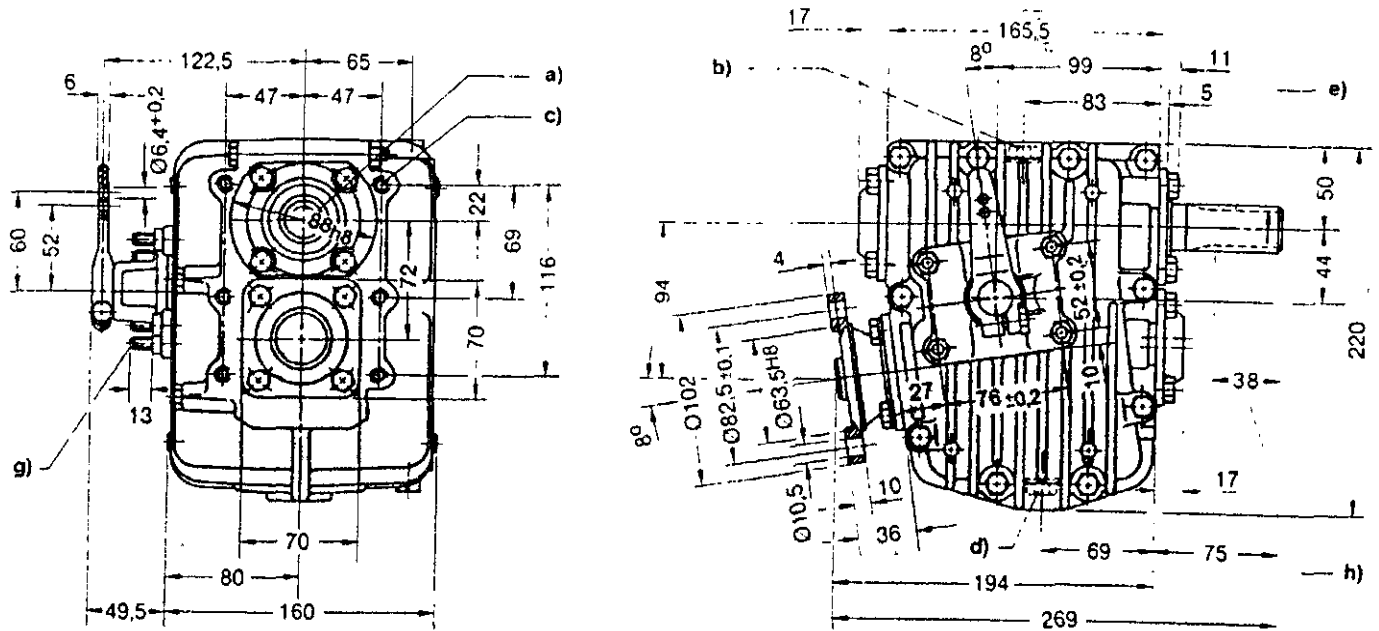
K = 1.20 for 2 cylinders

K = 1.15 for 3 cylinders

** Max. 120 Nm (88.5 ft lb) admissible for main travelling direction with gear lever set to «B»

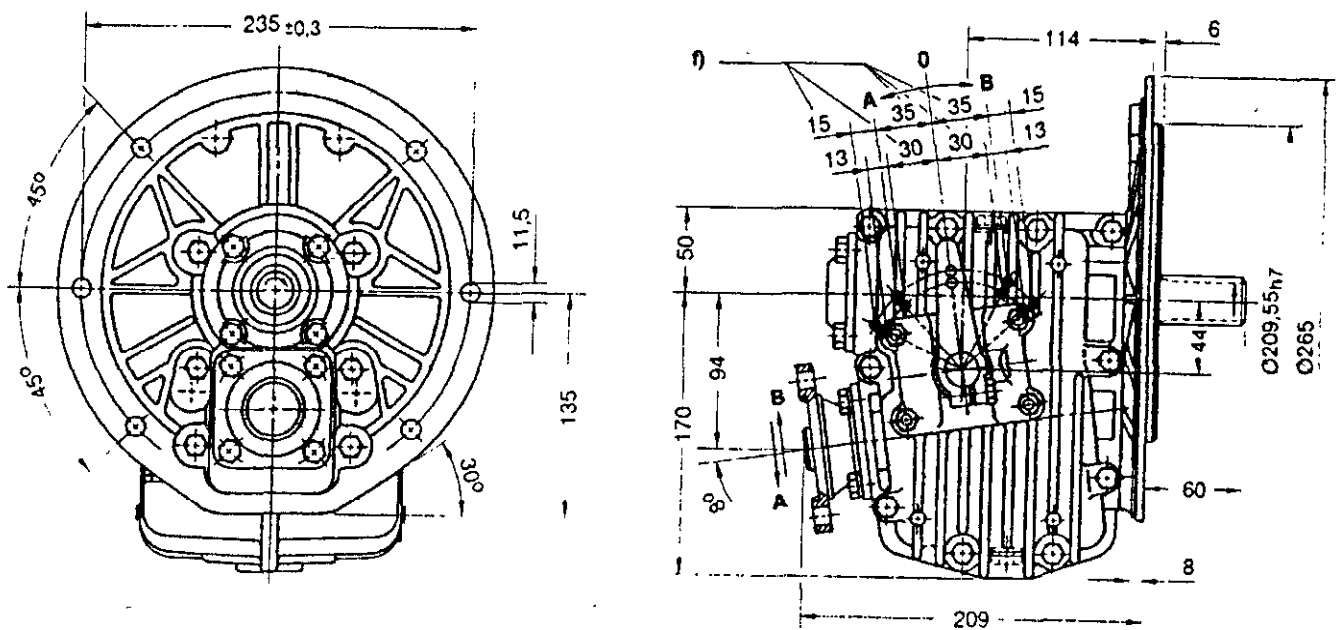
Technical data			HBW 150A-2	HBW 150A-2.5
Shifting position «A»	ratio	i	1.88	2.63
Shifting position «B»	ratio	i	1.95	1.95
Input torque	pleasure craft	Nm (ft lb)	145 ** (106.9)**	106 (78.1)
	continuous duty	Nm (ft lb)	110 (81.1)	90 (66.3)
Power input	pleasure craft	kW (hp)	55 (75)	
	continuous duty	kW (hp)	40 (54)	
Input speed		1/min	5000	
Propeller thrust		N (lb)	3000 (675)	
Weight without fluid		kg (lb)	13.3 (29,3)	
Fluid quantity		liter	0.47	
Fluid grade			Automatic-Transmission-Fluid (ATF)	

Fig. 8 HBW 150 A



Model without mounting flange

a) Clockwise rotation b) Oil dipstick and filler screw 17 mm c) M 8/12 deep, holes same on both sides d) Oil drain plug 17 mm width across flats e) Spine profile similar B 10 x 23 x 29 DIN 5464 f) Minimum lever travel g) Support for control cable h) full profile

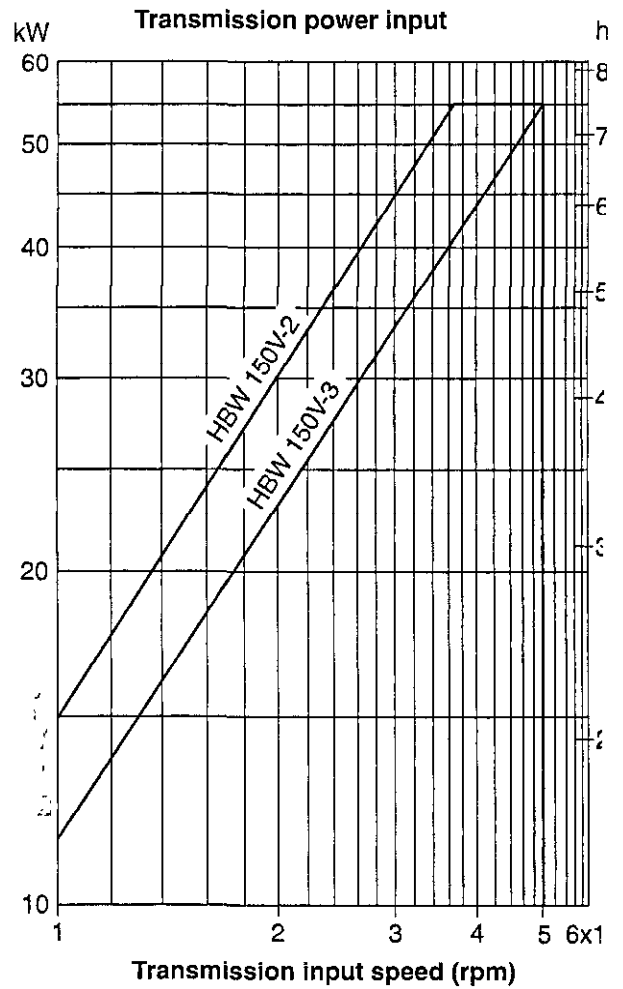
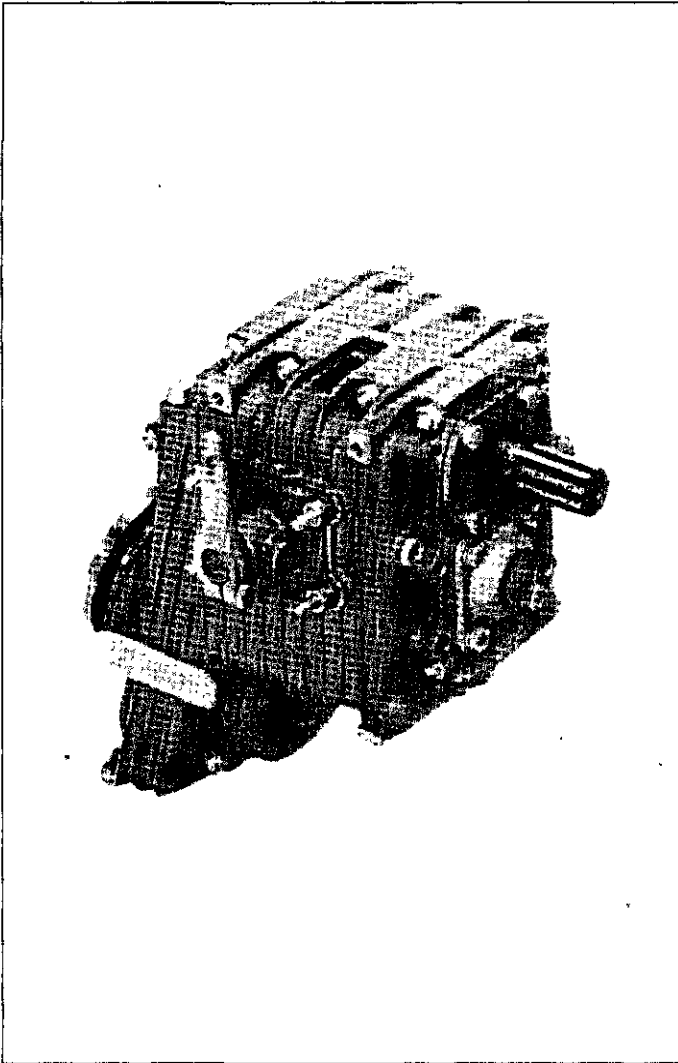


All dimensions in mm

Model with mounting flange

1.2 Technical Data and Main Dimensions

1.2.7 HBW 150 V



Power diagram for Pleasure Craft Duty

Based on engine power B to DIN 6270;
shock factor

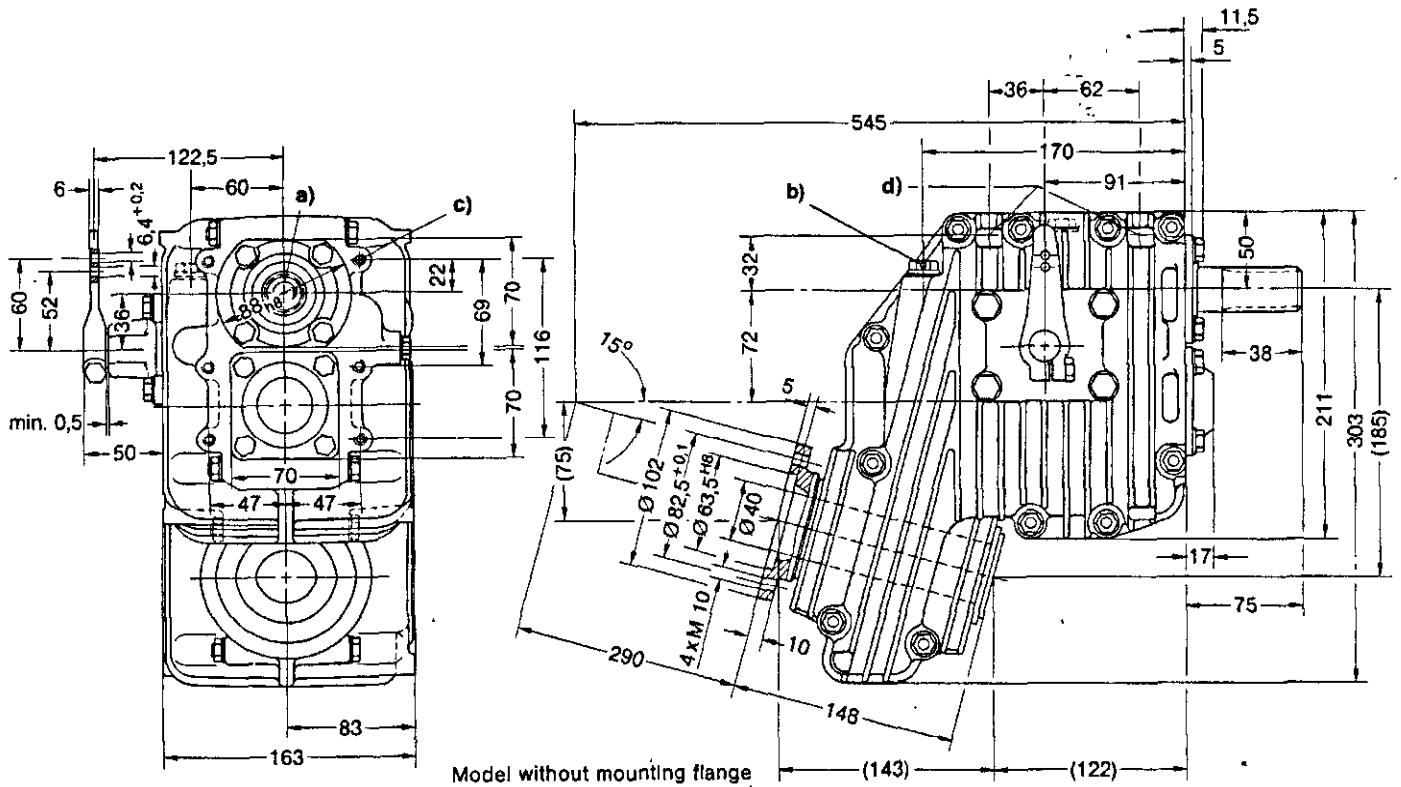
- K = 1.25 to applied, if engine has 1 cylinder
- K = 1.20 for 2 cylinders
- K = 1.15 for 3 cylinders

* Max. 120 Nm (88.5 ft lb) admissible for main travelling direction v gear lever set to «B».

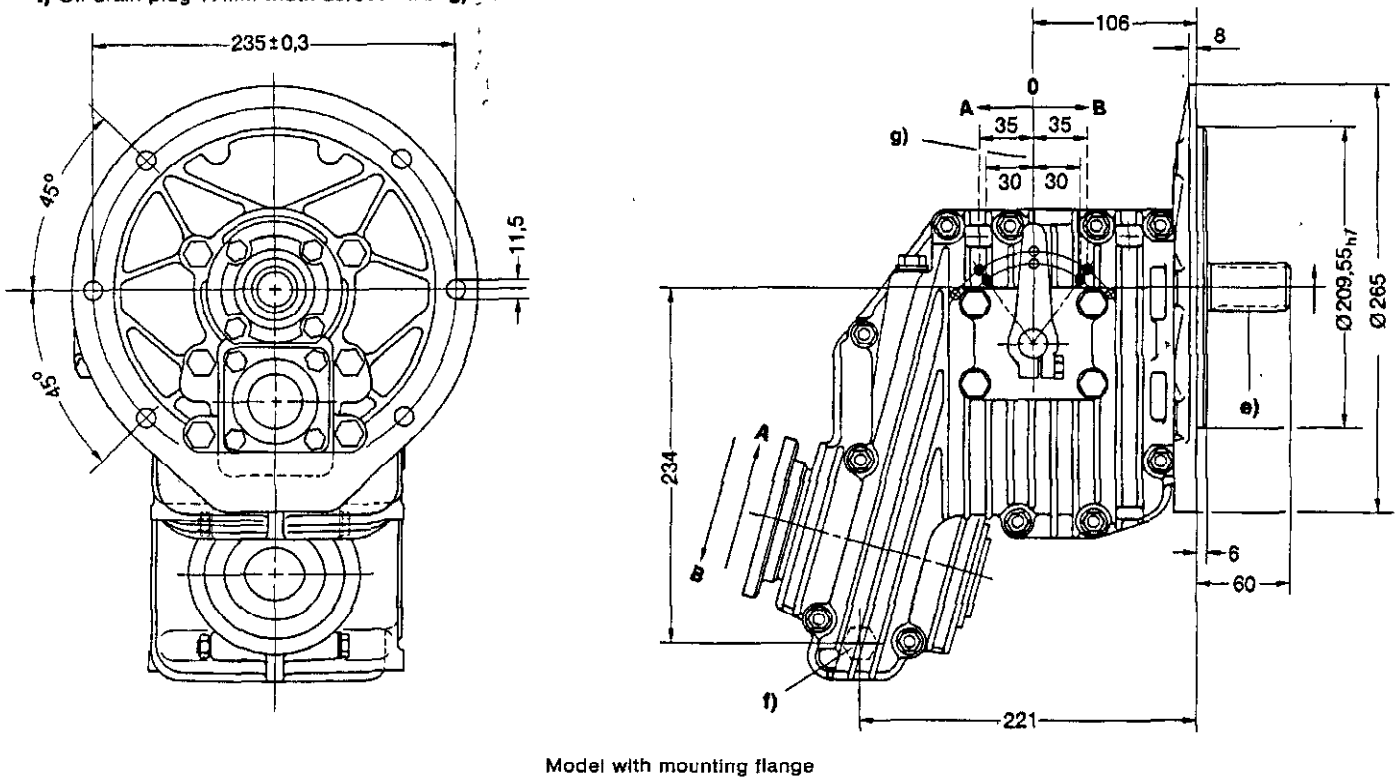
** Max 45 kW for main travelling direction with gear lever set to «I»

Technical data			HBW 150V-2	HBW 150V-3
Shifting position «A»		ratio	2.13	2.99
Shifting position «B»		ratio	2.22	2.22
Input torque M max	Pleasure craft	Nm (ft lb)	145 (106.9)*	106 (78.2)
	Continuous duty	Nm (ft lb)	110 (81.1)	90 (66.4)
Power input P max	Pleasure craft	kW (hp)	55 (75)**	
	Continuous duty	kW (hp)	40 (54)	
Input speed n max		rpm	5000	
Propeller thrust F max		N (lb)	4000 (900)	
Weight without fluid		kg (lb)	20.2 (44.6)	
Fluid quantity		liter	1.05	
Fluid grade			Automatic-Transmission-Fluid (ATF)	

Fig. 8 HBW 150 A

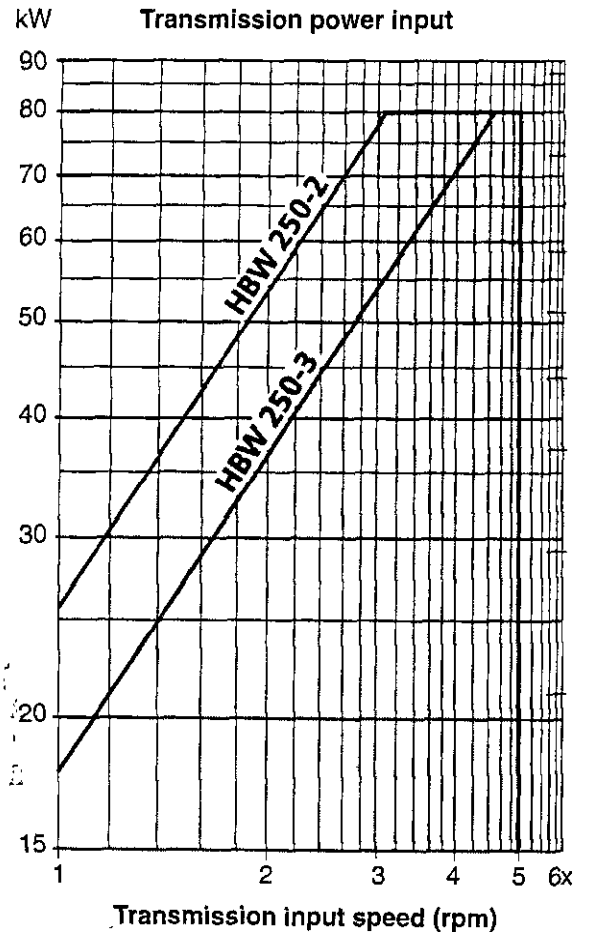
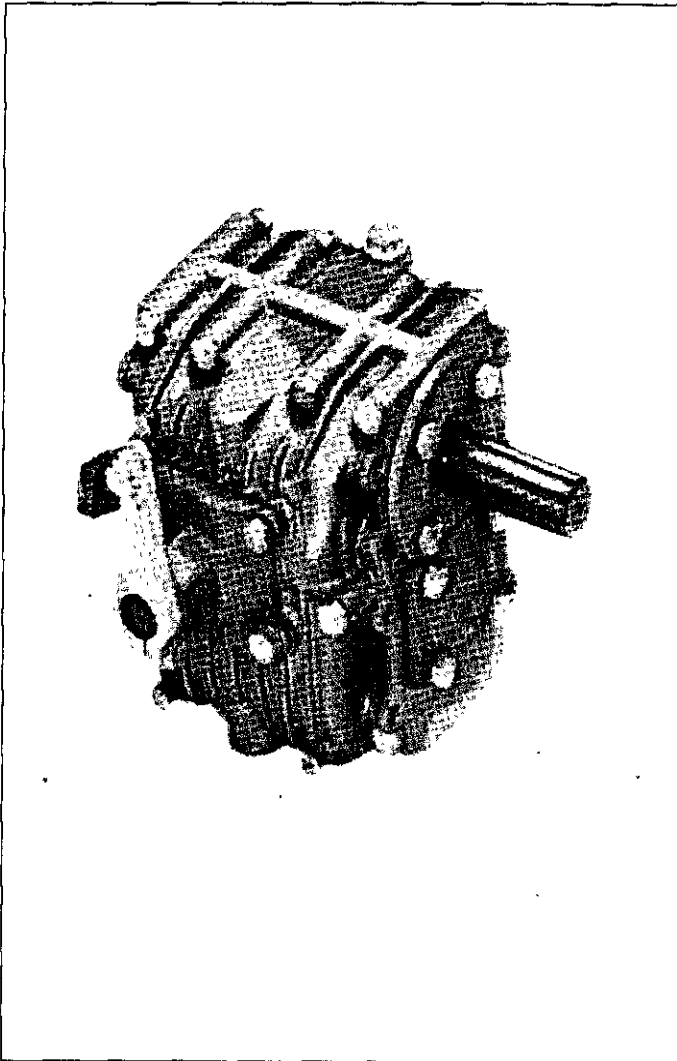


- a) Clockwise rotation
- b) Oil dipstick and filler screw 17mm
- c) M 10/15 deep
- d) M 8/16 deep
- e) Spline profile B 10x23x29 DIN 5464
- f) Oil drain plug 17mm width across flats
- g) Minimum lever travel



1.2 Technical Data and Main Dimensions

1.2.8 HBW 250



Power diagram for Pleasure Craft Duty

Based on engine power B to DIN 6270;

shock factor

K = 1.25 to applied, if engine has 1 cylinder

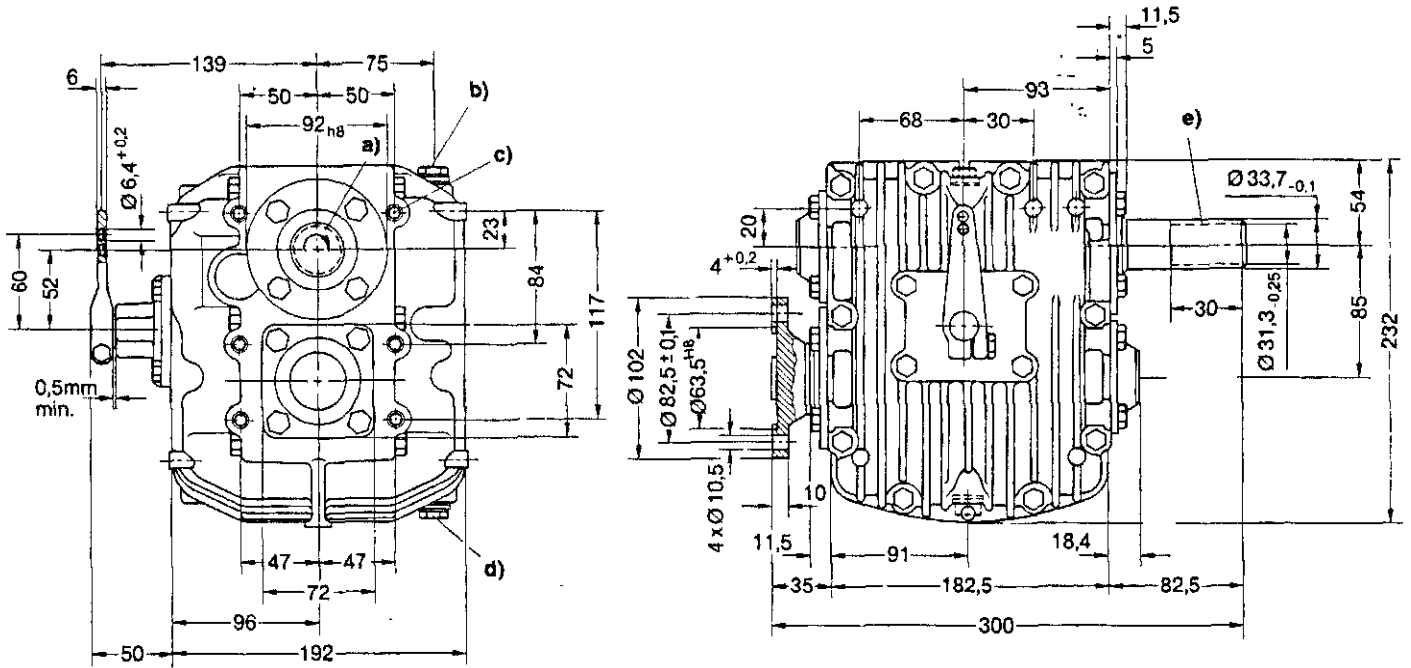
K = 1.20 for 2 cylinders

K = 1.15 for 3 cylinders

** Max. 230 Nm (170 ft lb) admissible for main travelling direction gear lever set to «B»

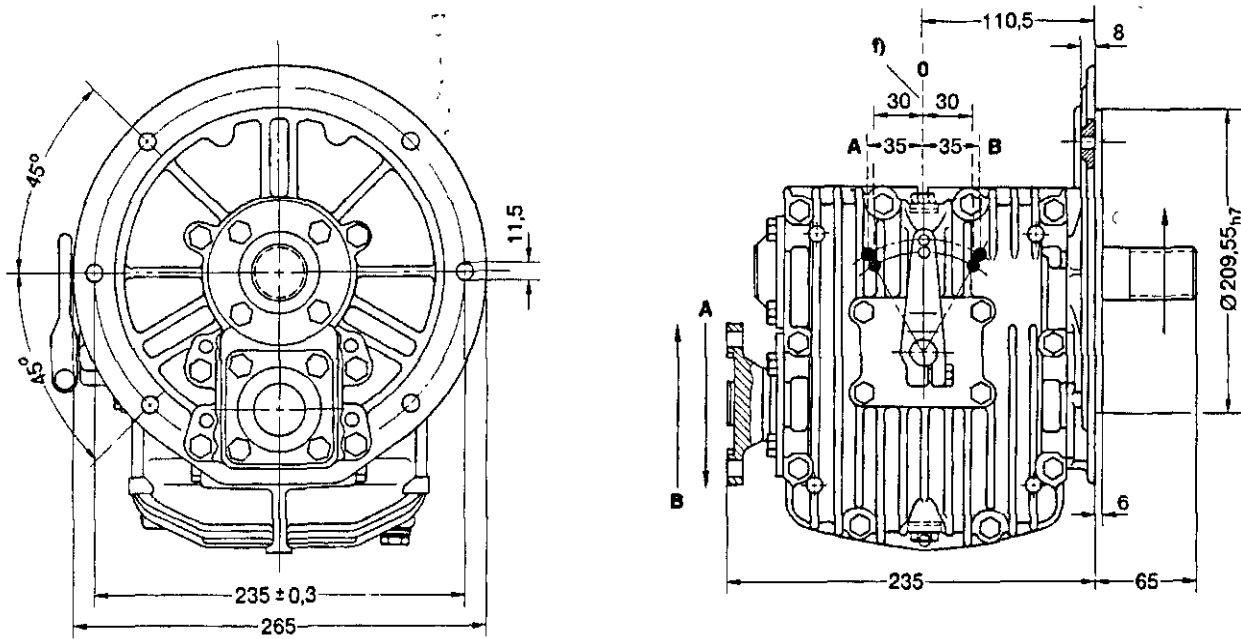
Technical data			HBW 250-2	HBW 250-3
Shifting position «A»		ratio	1.88	2.74
Shifting position «B»		ratio	2.10	2.72
Input torque M max	Pleasure craft	Nm (ft lb)	250** (185)	170** (125)
	Continuous duty	Nm (ft lb)	180 (133)	120 (88)
Power input P max	Pleasure craft	kW (hp)	80 (109)	
	Continuous duty	kW (hp)	57 (78)	
Input speed n max		rpm	5000	
Propeller thrust F max		N (lb)	4300 (970)	
Weight without fluid		kg (lb)	18 (39.7)	
Fluid quantity		liter	0.75	
Fluid grade		Automatic-Transmission-Fluid (ATF)		

Fig. 10 HBW 250



Model without mounting flange

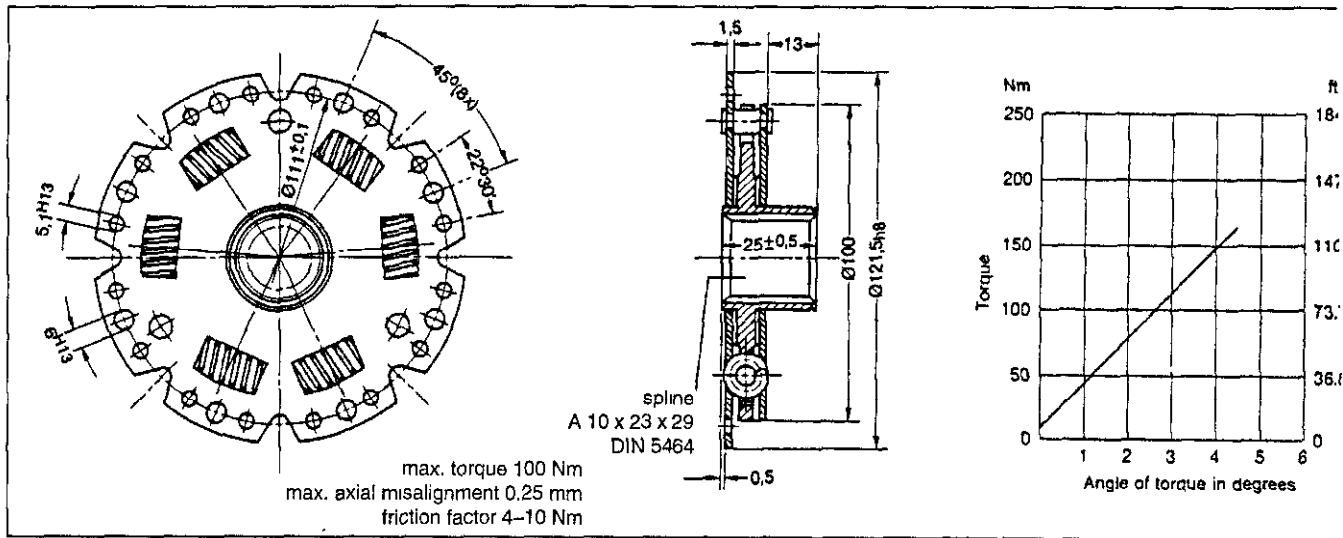
- a)** Clockwise rotation **b)** Oil dipstick and filler screw 17mm **c)** M 10/15 deep, holes same on both sides **d)** Oil drain plug 17mm width across flats **e)** SAE 26 teeth · DP 20/40 · 30° · Flat Root · Class t6 **f)** Minimum lever travel



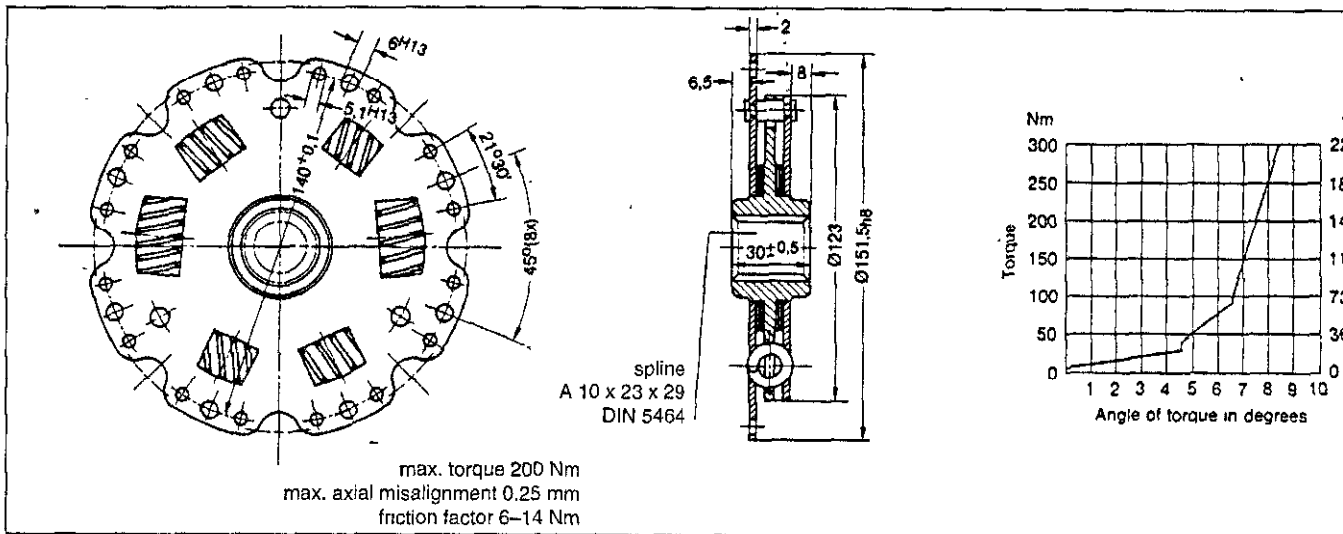
Model with mounting flange

1.2.9 Accessories

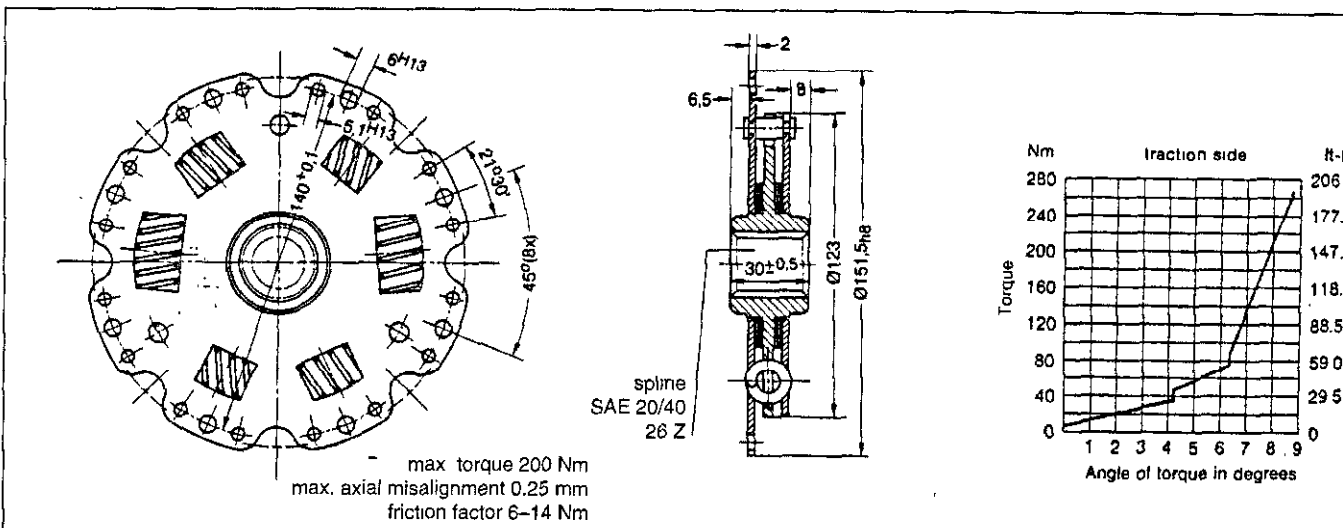
Resilient Coupling for HBW 35 · HBW 50 · HBW 100 Ident-No. 254 750



Resilient Coupling for HBW 100 · HBW 125 · HBW 150 · HBW 150 A ; HBW 150 V Ident-No. 254 762

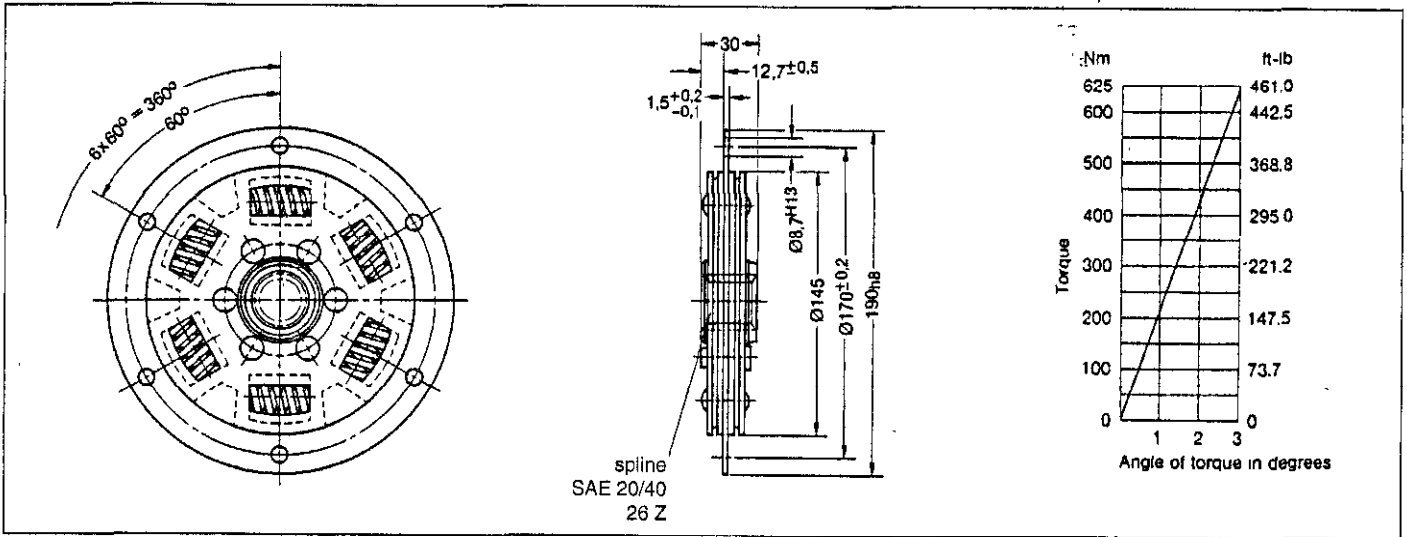


Resilient Coupling for HBW 250 Ident-No. 256 526

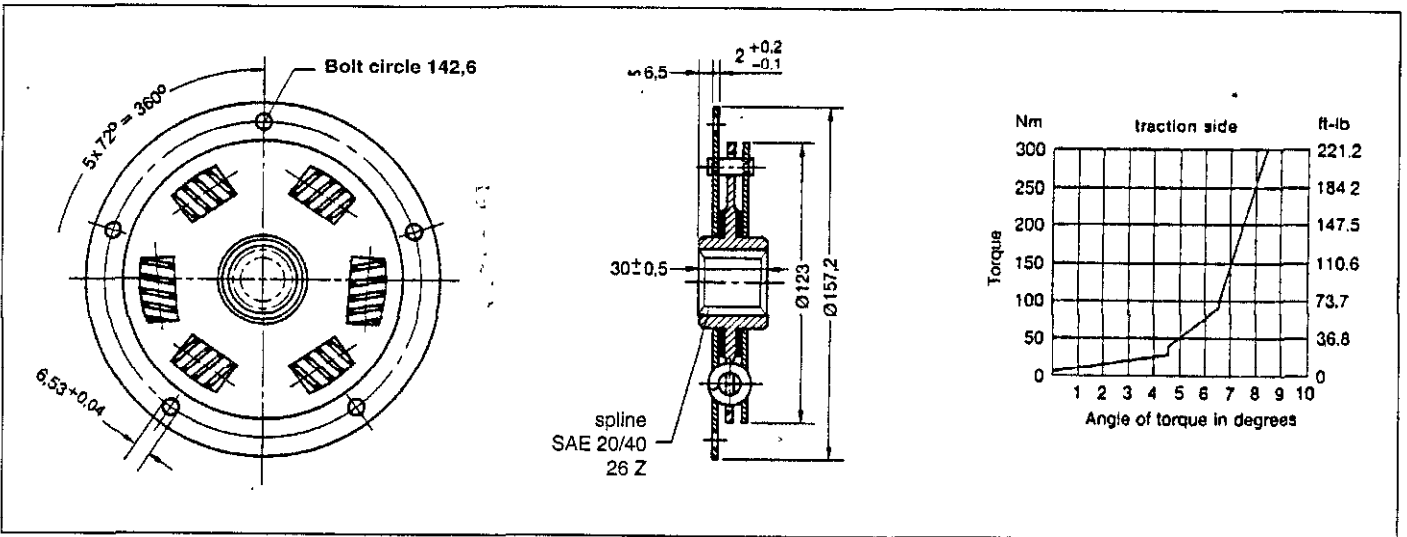


1.2.9 Accessories

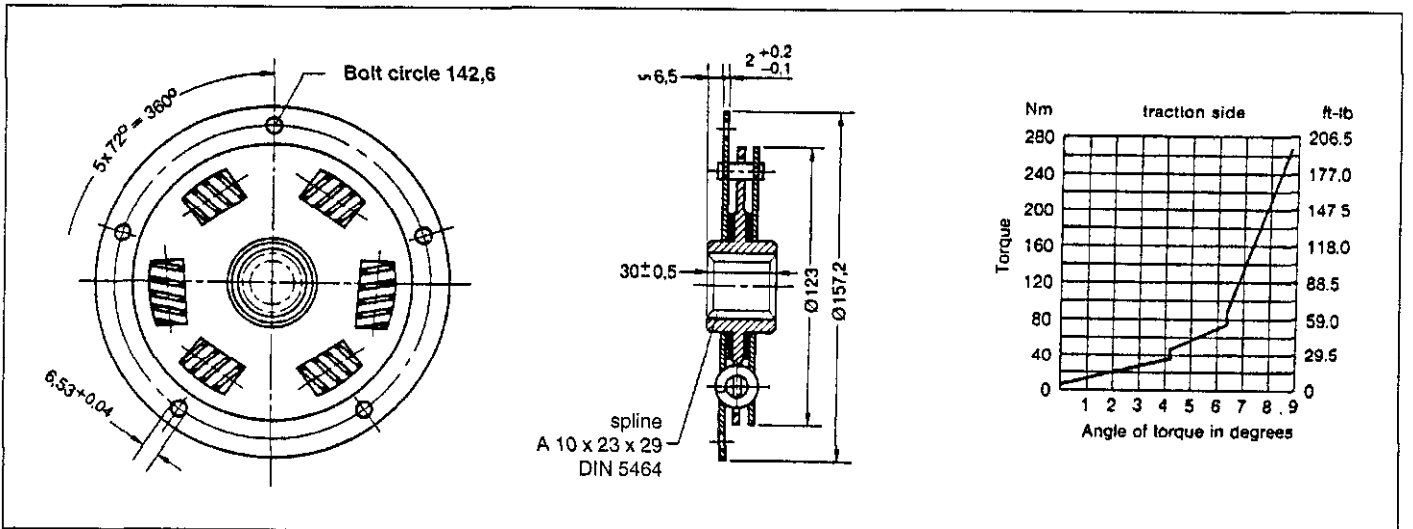
Resilient Coupling for HBW 250 Ident-No. 223 557



Resilient Coupling for HBW 250 Ident-No. 288 238

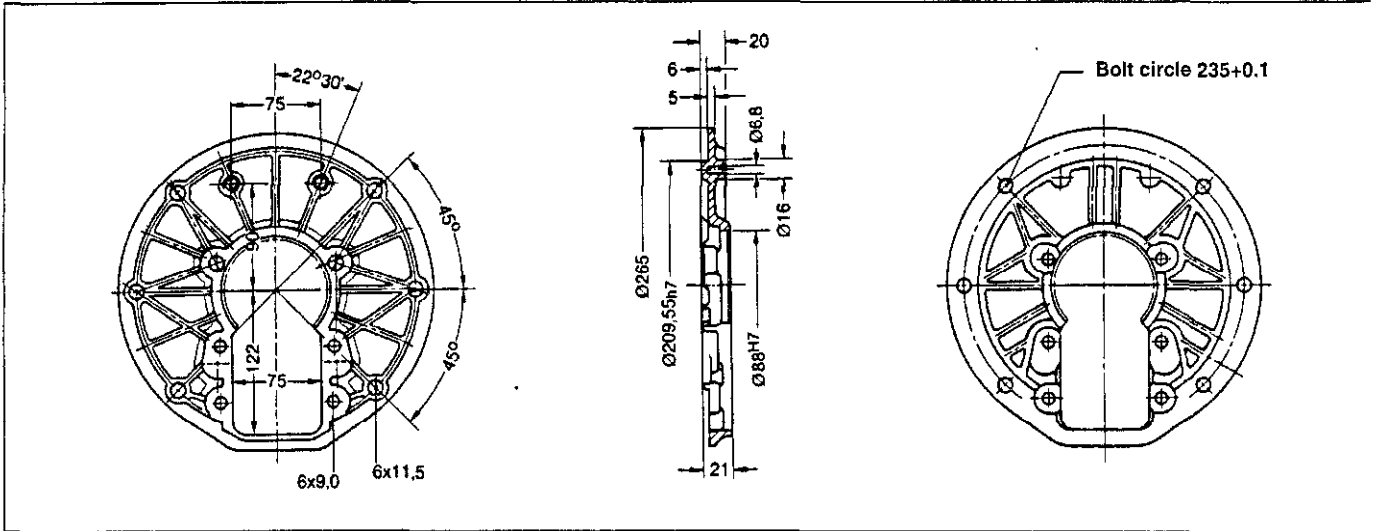


Resilient Coupling for HBW 100 · HBW 125 · HBW 150 HBW 150 A · HBW 150 V Ident-No. 288 240

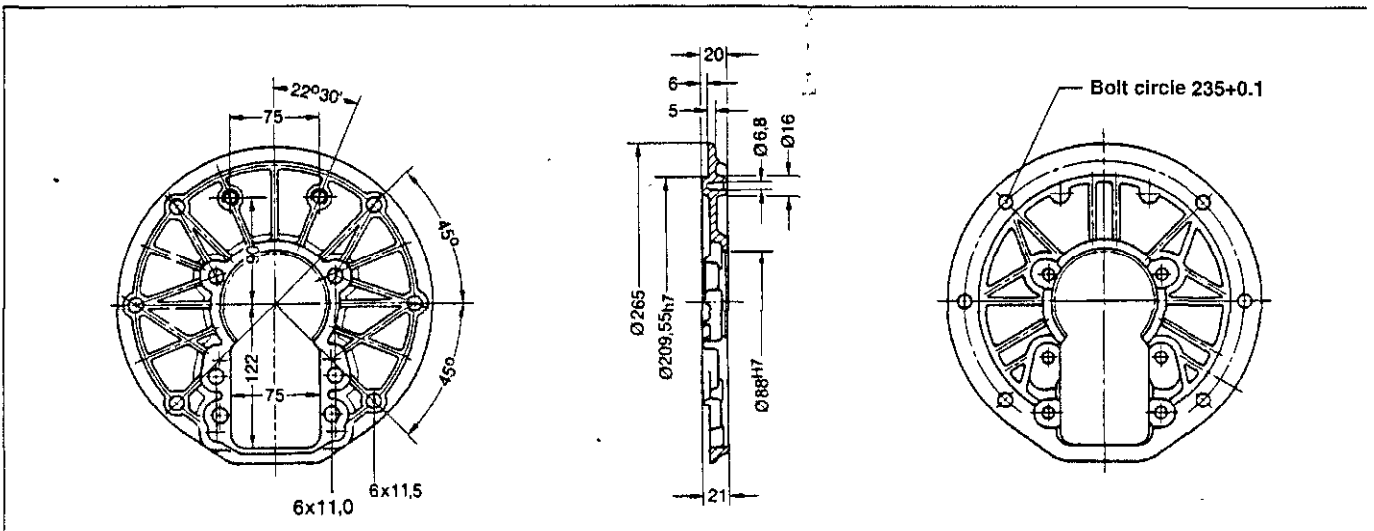


1.2.9 Accessories

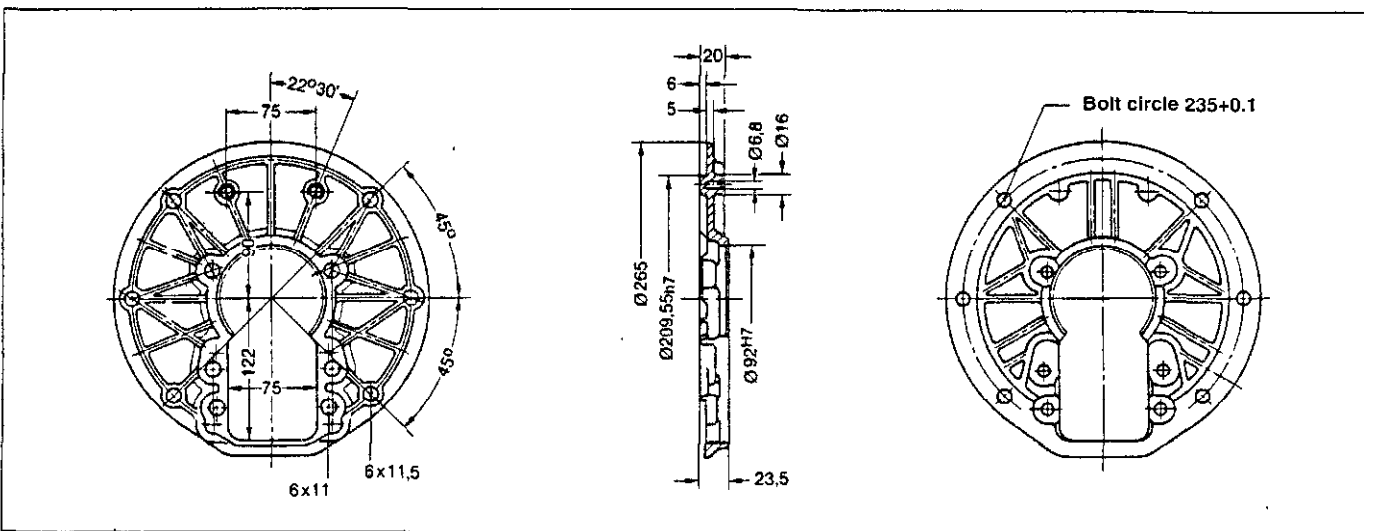
Adapter flange for HBW 35 · HBW 50 · HBW 100 · HBW 125 · HBW 150 · HBW 150 A Ident-No. 344 544 (kit)



Adapter flange HBW 150 V Ident-No. 345 965 (kit)

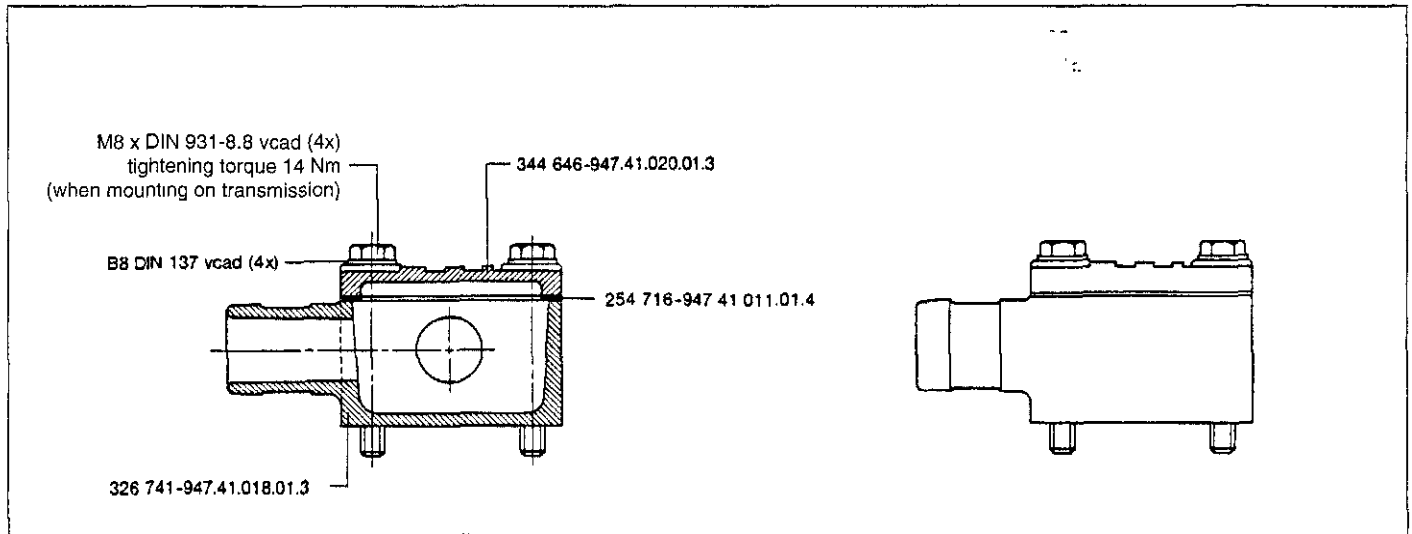


Adapter flange HBW 250 Ident-No. 345 964 (kit)



1.2.9 Accessories

Cooler for HBW 100 · HBW 125 · HBW 150 · HBW 150 A · HBW 150 V · HBW 250 Ident-No. 326,742



1.2 Technical Data and Main Dimensions

1.2.10 Gearboxes and accessories

Model	prop. turns anti engine	draw. no.	ld. no.	weight
HBW 35	2,05:1 2,72:1	487926 487927	947.70.000.25 947.70.000.26	8 kg 8 kg
Housing adapter Kit		344544	947.41.703.02	
Damper plate	up to 100 Nm	254750	947.44.601.02	
HBW 50	2,05:1 2,72:1	388817 459413	947.70.000.09 947.70.000.14	8 kg 8 kg
Housing adapter Kit		344544	947.41.703.02	
Damper plate	up to 100 Nm	254750	947.44.601.02	
HBW 100	1,48:1 1,79:1 2,72:1	407345 407346 467329	947.60.000.14 947.60.000.15 947.60.000.20	9,5 kg 9,5 kg 9,5 kg
Housing adapter Kit		344544	947.41.703.02	
Housing adapter Kit SAE 5		500013	947.41.703.04	
Oil cooler		326742	947.41.704.01	
Damper plate	up to 100 Nm	254750	947.44.601.02	
Damper plate	up to 200 Nm	254762	947.44.601.03	
Damper plate	up to 200 Nm	288240	947.44.602.02	
HBW 125	2,14:1 2,63:1	407205 407206	947.40.000.15 947.40.000.16	13 kg 13 kg
Housing adapter Kit		344544	947.41.703.02	
Housing adapter Kit SAE 5		500013	947.41.703.04	
Oil cooler		326742	947.41.704.01	
Damper plate	up to 200 Nm	254762	947.44.601.03	
Damper plate	up to 200 Nm	288240	947.44.602.02	
HBW 150	1,56:1 1,88:1	407208 407207	947.40.000.18 947.40.000.17	13 kg 13 kg
Housing adapter Kit		344544	947.41.703.02	
Housing adapter Kit SAE 5		500013	947.41.703.04	
Oil cooler		326742	947.41.704.01	
Damper plate	up to 200 Nm	254762	947.44.601.03	
Damper plate	up to 200 Nm	288240	947.44.602.02	
HBW 150 A	2,0:1 2,5:1	407461 407462	947.05.000.01 947.05.000.02	13 kg 13 kg
Housing adapter Kit		344544	947.41.703.02	
Housing adapter Kit SAE 5		500013	947.41.703.04	
Oil cooler		326742	947.41.704.01	
Damper plate	up to 200 Nm	254762	947.44.601.03	
Damper plate	up to 200 Nm	288240	947.44.602.02	
HBW 150 V	2,13:1 2,99:1	407377 407378	947.45.000.09 947.45.000.10	20 kg 20 kg
Housing adapter Kit		345965	947.41.703.03	
Housing adapter Kit SAE 5		500015	947.41.703.05	
Oil cooler		326742	947.41.704.01	
Damper plate	up to 200 Nm	254762	947.44.601.03	
Damper plate	up to 200 Nm	288240	947.44.602.02	
HBW 250	1,88:1 2,74:1	408089 408090	947.50.000.17 947.50.000.18	18 kg 18 kg
Housing adapter Kit		345964	947.51.702.03	
Oil cooler		326742	947.41.704.01	
Damper plate	up to 200 Nm	256526	947.24.601.03	
Damper plate	up to 200 Nm	288238	947.24.601.04	
Damper plate	up to 450 Nm	223557	947.34.601.01	

1.3 Gear Casing

The oil-tight gearbox housing is made of a corrosion-resistant aluminium alloy chromized for added protection from corrosion. The gear casing is divided in a vertical plane into two equal halves. Cooling fins ensure good heat dissipation and mechanical rigidity.

The oil filter screw with dipstick and the oil drain plug are screwed into the gear casing. The filler screw is provided with a breather hole.

The actuating lever, actuating cam and cover plate are a pre-assembled unit fitted laterally to the gearbox unit.

Holes (see «Main dimensions» item 1.2 pos. c) are provided for bolting the transmission to a flywheel housing or an adapter flange.

1.4 Gear set

The transmission is equipped with case hardened helical gears made of forged low-carbon alloy steel and case hardened spiral bevel gears (V drive). The drive shaft with the drive gears are an integral unit.

The splined input shaft connecting the transmission with the engine is hardened as well.

The driven shaft (propeller side) of the transmission, with the exception of the HBW 150 V model, is fitted with an integrally forged coupling flange.

The servo-automatic clutch system governs the direction of rotation of the input shaft, and HBW transmission units are available for clockwise: (RH = right hand) or counterclockwise (LH = left hand) rotation.

1.5 Multiple-disc clutch and clutch operation - power train

The engine torque is applied to the input shaft (36) in the specified direction of rotation and, in shifting position A (see Main Dimensions item 1.2), via gear (44), the frictionally engaged clutch discs (51 and 52) to the external disc carrier (57) and from there via the guide sleeve (59) to the output shaft (66).

In shifting position B, the torque is transmitted from the input shaft (36) via intermediate gear (26), gear (65), clutch discs (51 and 52) to the external disc carrier (57), the guide sleeve (59) and the output shaft (66).

Function

The transmission uses a positively driven, mechanically operated multipliedisc clutch system mounted on the output shaft.

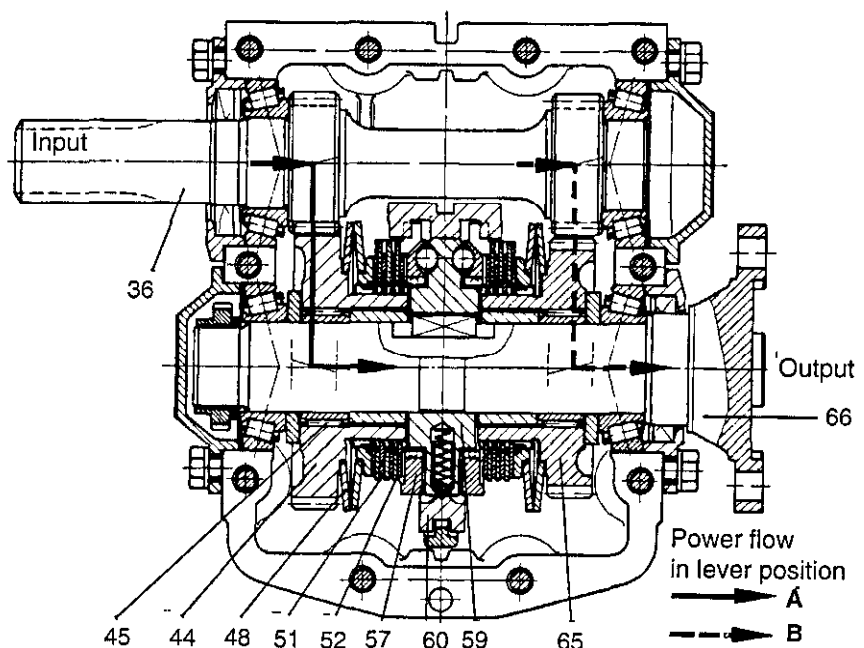
The thrust force required for obtaining positive frictional engagement between the clutch discs is provided by a servo-automatic system.

This essentially comprises a number of balls which, by the rotary movement of the external disc carrier, are urged against inclined surfaces provided in pockets between the guide sleeve and the external disc carrier and in this way exert axial pressure. The thrust force and, as a result, the transmittable friction torque are thus proportional to the input torque applied.

Due to the cup springs (48) supporting the clutch disc stack and a limitation of the range of axial travel of the external disc carrier (57), the thrust force will not exceed a predetermined value.

The actuating sleeve (60) is held in the middle position by spring-loaded pins. To initiate the shifting operation, the actuating sleeve (60) needs merely be displaced axially by the shifting fork until the arresting force has been overcome. Then the actuating sleeve (60) is moved automatically by the spring-loaded pins, while the external disc carrier which follows this movement, is rotated by frictional forces exerted by the clutch discs, and the shifting operation is completed servo-automatically as described above.

Fig. 11



1.6 Shaft bearings

Both the input and the output shafts are carried in amply dimensioned taper roller bearings.

The propeller thrust can be absorbed by the bearings (for permissible values see «Technical data», item 1.2).

The intermediate gear and the movable gears are carried in sturdy needle roller bearings.

1.7 Shaft seals

External sealing of the input and output shafts is provided by radial sealing rings. The running surfaces on the shafts are casehardened.

1.8 Lubrication

The transmissions are immersion-lubricated. The bearings are generously supplied with splash oil.

1.9 Cooling unit

Transmissions intended for use at high ambient temperatures and for continuous operation at high power (especially when shifting position B is used for the main direction of movement of the craft), must be supplied with a cooling unit (see item 2.10).

2. Installation

2.1 Delivery condition

HURTH HBW gearbox units leave the factory in fully assembled condition. For safety reasons, the gearbox is not filled with oil for shipment. The actuating lever is mounted on the actuating shaft. On request, the gearbox is delivered with the cooling unit (see item 2.10) and flange (see item 1.2) fitted, as well as the previous damper plate between engine and gearbox.

The multi-spline shaft is provided with an oil film and protected by a plastic cap. The bright surfaces of the coupling flange on the output side are coated with an anticorrosive agent for shipment and storage. The casing is chromized and thus resistant to seawater.

Before leaving the factory, each transmission is subjected to a test run with the prescribed ATF oil. The residual oil remaining in the transmission after draining acts as a preservative and provides reliable protection against corrosion for at least 1 year if the units are properly stored.

2.2 Transport

Care should be taken when transporting the gearbox or the engine-gearbox assembly to prevent undue shocks and impacts. This applies particularly to the input and output shafts.

2.3 Removal of preservative

Use a suitable solvent for removing the anticorrosive agent, but never use emery cloth or paper, because this could damage the sealing surface and void the warranty.

It is advisable, especially after long periods of storage, to flush the transmission with the prescribed oil and remove residual oil.

2.4 Painting the gearbox

Always cover the running surfaces and sealing lips of the radial sealing rings on both shafts before painting. Make certain that the breather hole on the oil filler screw is not covered by paint. The identification plates should remain clearly legible.

2.5 Connecting the gearbox with engine

Fit a recommended damping plate between the engine and the transmission to compensate for minor alignment errors and protect the input shaft from external forces and loads.

If the flywheel housing of the engine of suitable design, the gearbox unit should be directly bolted to the housing by means of the holes provided in the gearbox.

Make certain to use bolts with the right appropriate length (see «Main dimensions», item 1.2) and tighten them to the correct torque, M8 = 14 Nm (10 ft lb), M10 = 28 Nm (20 ft lb) using LOCTITE 242 or 262.

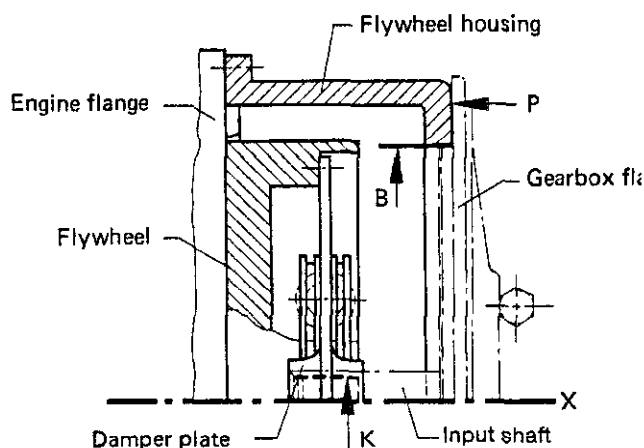
An adapter flange and a damper plate are available on request for each gearbox unit (see «Main dimensions», item 1.2.9).

The radial and axial runout values shown in the drawing Fig. 12 should never exceeded between the engine and transmission.

The input shaft end is provided with multi-spline or involute spline profile (see «Main dimensions», item 1.2).

Fig. 12

Connection of gearbox with engine



Permissible radial and axial runout
(0.1 mm = 0.004 inches)

X : B = 0,1 mm X : K = 0,1 mm X : P = 0,1 mm

2.6 Connection of gearbox with propeller

We recommend a flexible connection between the gearbox and the propeller shaft, when the engine is flexibly mounted, in order to compensate for angular deflections. The installation of a special propeller thrust bearing is not required, since the propeller thrust will be taken by the transmission bearing, provided the value specified under «Technical data», item 1.2, is not exceeded. However, the output shaft should be protected from additional loads. Special care should be taken to prevent torsional vibration. When using a universal joint shaft, make certain to observe the manufacturer's instructions.

2.7 Suspension of engine-gearbox assembly in the boat

Special care should be taken to protect the gearbox from detrimental stresses and loads when the engine-transmission assembly is not elastically suspended in the boat or craft.

The gearbox should be conveniently accessible for maintenance. If the oil drain plug of the gearbox is not accessible, the oil will have to be sucked off.

2.8 Position of gearbox in the boat

The inclination of the gearbox unit in the direction of the shafts should not exceed an installation angle of 20 degrees (see Fig.13) and 15° for HBW 150 V.

2.9 Operation of gearbox

The gearbox is suitable for single lever remote control. Upon loosening the retaining screw (7), the actuating lever (6) can be moved to any position required for the control elements (cable or rod linkage). (Fig. 14).

IMPORTANT

Make certain that the lever does not contact the actuating lever cover plate (9): the minimum distance between lever and cover must be 0.5 mm.

The control cable should be perpendicular to the actuating lever in the neutral position of the lever.

The zero position of the operating lever on the control console must coincide with the zero position of the actuating lever on the gearbox.

The shifting travel, as measured at the pivot point of the actuating lever, between the neutral position and end positions A and B must be at least 35 mm for the outer and 30 mm for the inner pivot point. A larger amount of lever travel is in no way detrimental.

IMPORTANT

However, if the lever travel is shorter, proper gear engagement might be impeded which, in turn, would mean premature wear, excessive heat generation and resulting damage.

The position of the cover plate underneath the actuating lever is factory-adjusted to ensure equal lever travel from neutral position A and B.

IMPORTANT

If this cover is removed in exceptional cases, proceed as described under item 6.14 of this manual.

When installing the gearbox, make certain that shifting is not impeded by restricted movability of the cable, by unsuitably positioned guide sheaves, too small bending radius, etc.

Fig. 13

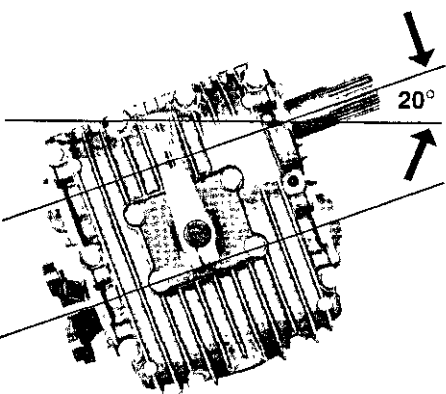
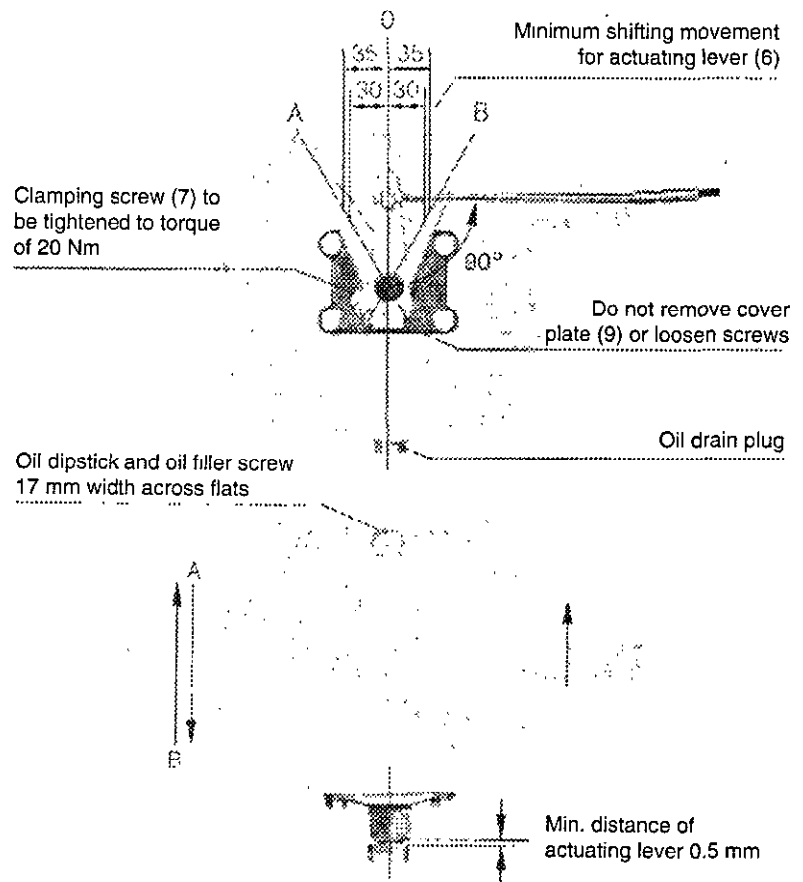


Fig. 14



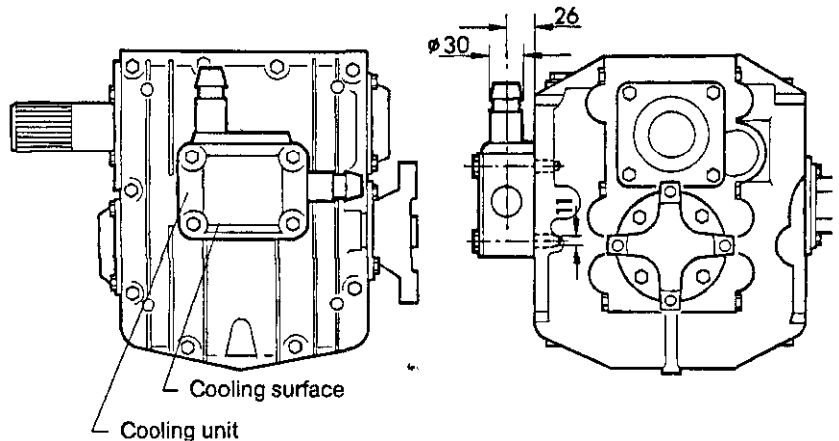
2.10 Cooling unit

The arrangement of the cooling unit for the HBW 100, 125, 150, 150A, 150V and 250 (no cooling is required for HBW 35 and 50) can be seen from Fig.15.

The table below shows the maximum power output in continuous operation (lever position A and B) usable without cooling. When these values are exceeded, a cooling unit is required.

The cooling unit should be connected to the fresh-water pressure line (external circuit) of the engine in accordance with Fig.16. The minimum volume of flow is 10 ltr/min. Retrofitting of the cooling unit involves no problems (see item 6.15).

Fig. 15



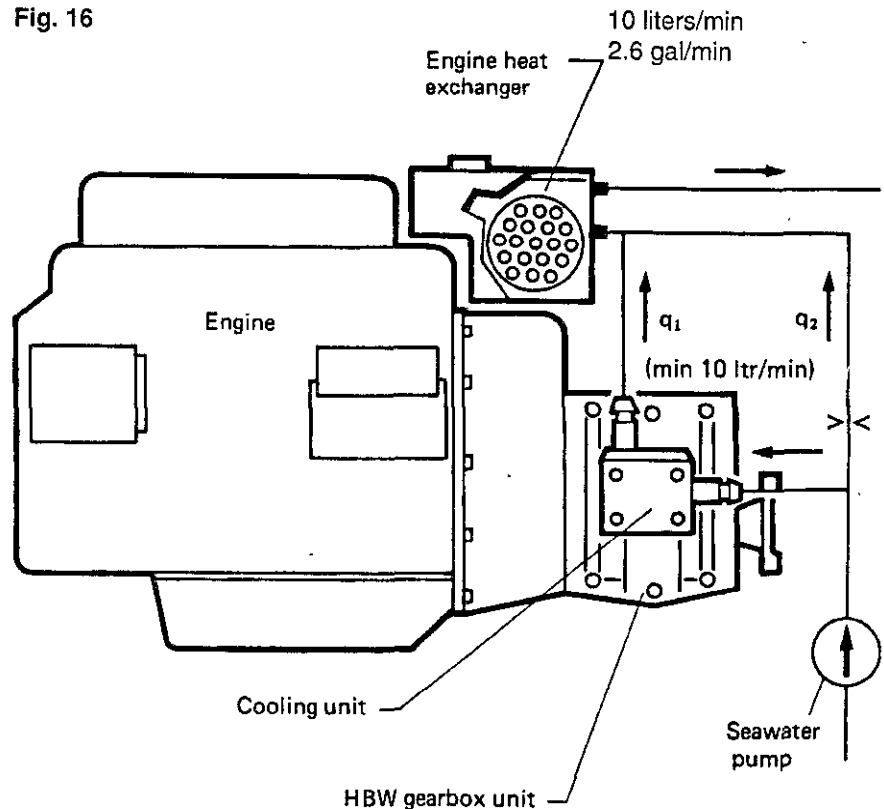
2.11 Engine-gearbox compartment

Care should be taken that the engine gearbox compartment is properly ventilated.

Max. engine power usable without cooling

Lever position	HBW 35 HBW 50	HBW 100	HBW 125 HBW 150 HBW 150 A	HBW 150 V	HBW 250
A	no cooling	no cooling	40 kW 54 hp	25 kW 34 hp	40 kW 54 hp
B	no cooling	25 kW 34 hp	25 kW 34 hp	20 kW 34 hp	always cooling

Fig. 16



3. Operation

3.1 General information

All HBW boat reversing gearbox units are test-run on a test stand at the factory prior to delivery.

For safety reasons, the oil is drained before shipment.

3.2 Initial operation

Fill the gearbox with oil (ATF), (see 4.7 or recommended fluids). The oil level should be up to the index mark on the dipstick (see fig. 17).

To check the oil level, just insert the dipstick, do not screw in. Retighten the hex screw with the dipstick after the oil level check. Do not forget sealing ring.

3.3 Operating temperature

Normal operating temperature of the transmission oil should be in the range of 50°C (122°F) to 100°C (212°F). A max. temperature of 130°C (266°F) may only be reached for a short time.

3.4 Operation of gearbox

The zero position of the operating lever on the control console must coincide with the zero position of the actuating lever on the transmission. Shifting is initiated by a cable or rod linkage via the shifting lever and an actuating cam. The completion of the gear changing operation is servo-automatically controlled.

Gear changing should be smooth, not too slow, and continuous (without interruption). Direct changes from forward to reverse are permissible, since the multiple-disc clutch permits gear changing at high rpm, including sudden reversing at top speeds in the event of danger.

3.5 Sailing or moving in tow

Rotation of the propeller while the boat is sailing, being towed, or anchored in a river, as well as operation of the engine with the propeller stopped (for charging the battery), will have no detrimental effects on the gearbox.

IMPORTANT

When the boat is sailing (engine stopped), the gear lever must be in zero position. Never put the gear lever in the position corresponding to the direction of travel of the boat.

Locking the propeller shaft by an additional brake is not required: use the gear lever position opposite your direction of travel for this purpose.

3.6 Lay-up periods

If the transmission is not used for periods of more than 1 year it should be completely filled with oil of the same grade to prevent corrosion. Protect the input shaft and the output flange by means of an anticorrosive coating if required.

3.7 Preparation for re-use

See item 2.3

4. Maintenance

4.1 Transmission oil

To ensure trouble-free operation of the clutch only use Automatic Transmission Fluid (ATF).

4.2 Oil quantity

HBW 35	0.30 ltr	0.32 qts
HBW 50	0.30 ltr	0.32 qts
HBW 100	0,35 ltr	0.37 qts
HBW 125	0.56 ltr	0.58 qts
HBW 150	0.56 ltr	0.58 qts
HBW 150A	0.47 ltr	0.50 qts
HBW 150V	1.00 ltr	1.06 qts
HBW 250	0.75 ltr	0.79 qts

Use the index mark on the dipstick as a reference (see item 3.2)

4.3 Oil level checks

Check the oil level in the gearbox about once a month. Correct oil level: index mark on dipstick (see item 3.2). Always use the same oil grade when topping up. Don't overfill the gearbox. This will create higher operating temperatures.

4.4 Oil change

Change the oil the first time after about 25 hours of operation, then at intervals of at least 1 year.

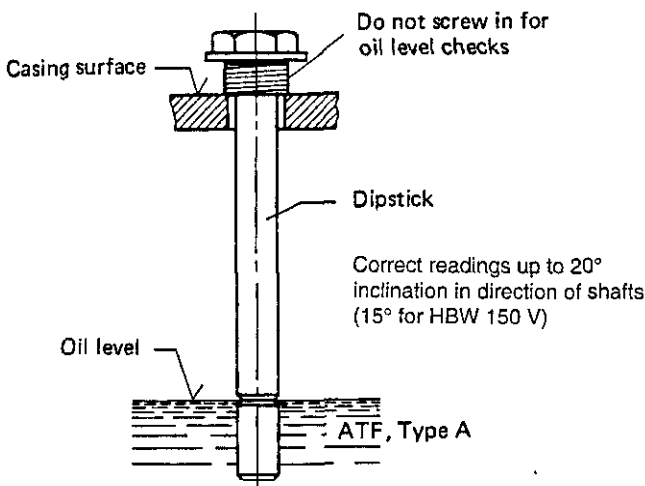
4.5 Checking the control cable linkage

The control cable or rod linkage should be checked at shorter time intervals. Check the zero position of the operating lever (on the control console) and of the shifting lever (on the gearbox) on this occasion. The minimum lever travel from the neutral position to operating positions (0-A = 0-B) should be 35 mm (1.38 in) for the outer and 30 mm (1.18 in) for the inner pivot point. Make certain that these minimum values are safely reached. Check the cable for easy movability (see item 2.9).

4.6 Cooling

If the transmission is equipped with a cooling unit, drain the cooling water before long periods of non-use when temperature is below freezing point.

Fig. 17



4.7 Automatic Transmission Fluid

List of recommended fluids

For ZF-HURTH HSW Marine Transmissions Automatic Transmission Fluid (ATF) must to be used as lubricant.

ADDINOL MINERALÖL GMBH, KRUMPA/D	ADDINOL ATF D IID	KUWAIT PETROLEUM, HOOGVLIET/NL	Q8 AUTO 14 (IID-218)
ADDINOL MINERALÖL GMBH, KRUMPA/D	ADDINOL ATF D III	LEPRINCE+SIVEKE GMBH, HERFORD/D	LEPRINXOL FLUID
AGIP PETROLI SPA, ROMI	AGIP ATF II D	LIQUI MOLY / MEGUIN, ULM/D	ATF
AGIP PETROLI SPA, ROMI	AGIP ATF D 309	LIQUI MOLY / MEGUIN, ULM/D	MEGOL ATF
AGIP PETROLI SPA, ROMI	AGIP ATF PLUS	LUBRICATION ENGIN., FORT WORTH/USA	AUTOMATIC TRANSMISSION FLU
AGIP PETROLI SPA, ROMI	AGIP DEXRON III	MAURAN SA, ODARS/F	INTER OIL INTER Matic ATF
AGIP SCHMIERTECHNIK, WÜRZBURG/D	AUTOL GETRIEBEÖL ATF-D	MIN ÖL-RAFFIN DÖLLBERGEN, UETZE/D	PENNASOL FLUID-GETR ÖL TYP P
AGIP SCHMIERTECHNIK, WÜRZBURG/D	AUTOL GETRIEBEÖL ATF III D	MOBIL OIL, WEDEL/D	MOBIL ATF 220 D2104 / D216
ARAL LUBRICANTS GMBH, BOCHUM/D	ARAL GETRIEBEÖL ATF 22	MOBIL OIL, WEDEL/D	MOBIL ATF F-301
ARAL LUBRICANTS GMBH, BOCHUM/D	ARAL GETR ÖL ATF 55 F-30589	MOBIL OIL, WEDEL/D	MOBIL ATF 220 D21412 / D221
AVIA MINERALÖL-AG, MÜNCHEN/D	AVIA FLUID ATF 86	MOBIL SEKIYU KABUS KAISHA, TOKYO/J	MOBIL ATF 220V (D-214
BLASER SWISSLUBE, HASLE-RUEGSAU/CH	BLASOL 229	MOL HUNGARIAN OIL, KOMARON/H	CARRIER A
BP OIL DEUTSCHLAND, HAMBURG/D	FRONTOL UNIVERSAL-ATF 100	MORRIS LUBRICANTS, SHREWSBURY/GB	LIQUIMATIC
BP OIL INTERNATIONAL, LONDON/GB	AUTRAN DX II	NAFTEC, ALGIER/DZ	TASSII
BP OIL INTERNATIONAL, LONDON/GB	AUTRAN MBX	NANHAI SUPERIOR LUB-OIL, CHINA	NANHAI ATF (I
BP OIL INTERNATIONAL, LONDON/GB	AUTRAN DX III (F-30370)	NIS-RAFNERIJA NAFTE BEOGRAD/YU	GALAX Matic D
BP OIL INTERNATIONAL, LONDON/GB	AUTRAN DX III (F-30381)	OEST G MIN.ÖLWERK, FREUDENSTADT/D	ATF T 4C
BUCHER+CIÉ AG, LANGENTHAL/CH	MOTOREX ATF SUPER D-22856	OMEX PETROLEUM PTY, BELLEVUE/AUS	OMEX ATF DEXRON
BUCHER+CIÉ AG, LANGENTHAL/CH	MOTOREX ATF DEXRON III MC	OMV AG, SCHWECHAT/A	OMV ATF D II (D224;
CALPAM GMBH, ASCHAFFENBURG/D	PAMATIC FLUID 289	OMV AG, SCHWECHAT/A	OMV ATF III (F-305)
CALPAM GMBH, ASCHAFFENBURG/D	CALPAMATIC FLUID III F	OPTIMOL ÖLWERKE, HAMBURG/D	OPTIMOL ATF T 4C
CALTEX PETROLEUM CORP., LONDON/GB	CALTEX ATF-HDA	OSWALD KLÜTH, BARGFELD-STEGEN/D	UNIVERSAL ATF
CALTEX PETROLEUM CORP., LONDON/GB	CALTEX ATF-HDM	PAKELO MOTOR OIL, SAN BONIFACIO/I	MULTIPURPOSE TRANSM FLUID
CALTEX PETROLEUM CORP., LONDON/GB	CALTEX TEXAMATIC 1278	PANOLIN AG, MADETSWIL/CH	PANOLIN ATF MULTI 216
CALTEX PETROLEUM CORP., LONDON/GB	CALTEX TEXAMATIC 7045	PANOLIN AG, MADETSWIL/CH	PANOLIN ATF DEXRON
CALTEX PETROLEUM CORP., LONDON/GB	CALTEX TEXAMATIC 1205A	PARS OIL CO., TEHRAN/IR	PARS ENTEGHAL-E AUTOMATIC C
CASTROL LTD, SWINDON/GB	CASTROL TQ-D (22765)	PAZ LUBRICANTS&CHEMICALS, HAIFA/IL	PAZBÖ E
CASTROL LTD, SWINDON/GB	CASTROL TQ DEXRON III F-30520	PENNZOIL PRODUCT COMP., HOUSTON/USA	PENNZOIL ATF F-301
CASTROL LTD, SWINDON/GB	CASTROL TRANSMAX S (F-30319)	PETRO-CANADA, MISSISSAUGA/CDN	DEXRON III/MERC ATF (F-303)
CASTROL LTD, SWINDON/GB	CASTROL TRANSMAX T (F-30359)	PETROL OFISA S A S, BAKANLIKLAR/TR	PETROL OFISA ATI
CASTROL LTD, SWINDON/GB	CASTROL TQ-D (21289)	PETROLEX, KWADZYN/PL	VECO Matic
CASTROL LTD, SWINDON/GB	CASTROL ATF 21293	PRINZ-SCHULTE, FRECHEN/D	AERO-LINE ATF
CEPSA, MADRID/E	CEPSA ATF-70	PRINZ-SCHULTE, FRECHEN/D	AERO-LINE ATF
CHEVRON PRODUCTS CO., RICHMOND/USA	CHEVRON ATF F-30108	REPSOL DISTRIBUCION SA, MADRID/E	REPSOL Matic A
CITGO PETROLEUM CORP., TULSA/USA	CITGO ATF DEXRON III F-30167	S A E L, ALCOBENDAS/E	GULF ATF DII D-222
C J DIEDERICHS SÖHNE, WUPPERTAL/D	CIDISOL-HYDR -FLUID DEXRON IID	SASOL OIL, RANDBURG/ZA	SASOL ATF D
DE OLIEBRON B V, ZWIJNDRECHT/NL	ATF DMM	SCHMIERSTOFFRAFFINERIE SALZBERGEN/D	WINTERSHALL ATF
DE OLIEBRON B V, ZWIJNDRECHT/NL	ATF 289	SHELL ASEOL AG, BERN/CH	ASEOL ATF DB UNIVERS
DEA MINERALÖL AG, HAMBURG/D	DEAMATIC	SHELL INTERNATIONAL, LONDON/GB	SHELL DONAX TA (D-216)
DEA MINERALÖL AG, HAMBURG/D	DEAFLUID 4011	SHELL INTERNATIONAL, LONDON/GB	SHELL DONAX TG (F-303)
DEA MINERALÖL AG, HAMBURG/D	DEAFLUID 3003	SLOVNAFT JS CO, BRATISLAVA/SLO	MADIT AUTOMAT
DEUTSCHE SHELL AG, HAMBURG/D	MAC ATF D-21666	SONOL ISRAEL LTD, HAIFA/IL	DEXRON 2
DUCKHAMS OIL, BROMLEY/GB	UNIMATIC	SOPROGRASA SA, MADRID/E	SOPRAL 1
ELF LUBRIFIANTS, PARIS/F	TRANSANTAR DF2	STATOIL STAVANGER/N	TRANSWAY DX III (F-303)
ELF LUBRIFIANTS, PARIS/F	ANTAR 22329	STATOIL STAVANGER/N	TRANSWAY D)
ELF LUBRIFIANTS, PARIS/F	ELFMATIC G2 22329	STL TECNOL, ESCALQUENS/F	TECNOL TECMATIC I
ELF LUBRIFIANTS, PARIS/F	HUILE RENAULT DIESEL STARMATIC	SUN OIL COMPANY, AARTSELAAR/B	SUNAMATIC 1
ELF LUBRIFIANTS, PARIS/F	ELFMATIC G3	SUN OIL COMPANY, AARTSELAAR/B	SUNAMATIC 1
ELF LUBRIFIANTS, PARIS/F	TRANSANTAR DF3	SUOMEN PETROOLI OY, HAMINA/SF	TEBOIL FLUID E (F-303)
ELLER-MONTAN-COMP, DUISBURG/D	ELLMO-AUTOMATIK-FLUID 22233	SUOMEN PETROOLI OY, HAMINA/SF	TEBOIL FLUID
ENGEN PETROLEUM, CAPE TOWN/ZA	ENGEN ATF 22D	SVENSKA STATOIL AB, NYNASHAMN/S	TRANSWAY DX III (F-303)
ERTOIL SA, MADRID/E	TRANSMISIONES AUTOMATICAS D2	TAMOIL LUBES, GENEVA/CH	TAMOIL ATF II
ESSO AG, HAMBURG/D	ESSO ATF D (21611)	TEXACO LUBRICANTS COMP., BEACON/USA	ATF MERCON / DEXRON
ESSO AG, HAMBURG/D	ESSO ATF F-30320	TEXACO SERVICES LTD, BRUSSEL/B	TEXAMATIC 70
ESSO AG, HAMBURG/D	ESSO ATF D (21065)	TEXACO SERVICES LTD, BRUSSEL/B	TEXAMATIC 42
FIAT LUBRIFICANTI, VILLASTELLONE/I	TUTELA GI/A	TEXACO SERVICES LTD, BRUSSEL/B	TEXAMATIC 70
FINA EUROPE SA, BRUSSEL/B	FINAMATIC II-D	TEXACO SERVICES LTD, BRUSSEL/B	TEXTRAN P5
FUCHS LUBRICANTS (UK), DERBY/GB	SILKTRAN MP-ATF	TEXACO SERVICES LTD, BRUSSEL/B	TEXAMATIC 40
FUCHS LUBRICANTS (UK), DERBY/GB	SILKTRAN PSV ATF	TEXACO SERVICES LTD, BRUSSEL/B	TEXAMATIC 42
FUCHS MINERALÖLWERKE, MANNHEIM/D	TITAN ATF 4000	TEXACO SERVICES LTD, BRUSSEL/B	TEXAMATIC 92
GINOUVES GEORGES SA, LA FARLEDE/F	YORK LT 785	TOTAL RAFFINAGE DISTR., PARIS/F	TOTAL FLUIDE A
GULF OIL (GB) LTD, CHELTENHAM/GB	UNIFLUID	TOTAL RAFFINAGE DISTR., PARIS/F	TOTAL FLUIDE I
GULF OIL (GB) LTD, CHELTENHAM/GB	ATF 2	TOTAL RAFFINAGE DISTR., PARIS/F	TOTAL FLUIDE AT
HANDELSMIJ NOVIOL B V, NIJMEGEN/NL	KENDALL ATF DEXRON IID	TOTAL SOUTH AFRICA, JOHANNESBURG/ZA	TOTAL FLUIDE A
HÖMBERG GMBH+CO KG, WUPPERTAL/D	HOMBERG-GETRIEBE-FLUID D	TURBOTANK BÖSCHE+BÖDEKER, BREMEN/D	TURBO UNIV ATF MERCON 40
IGOL FRANCE, PARIS/F	IGOL ATF 420	UFANEFTTECHM REFINERY, UFA/RUS	UFALUB A
INA RAFINERIJA ZAGREB/CROATIA	INA-ATF SUPER	UNIL DEUTSCHLAND GMBH, BREMEN/D	UNIL Matic CN T 40
ITALIANA PETROLI, GENOVA/I	TRANSMISSION FLUID DX	VALVOLINE INC., LEXINGTON/USA	VALVOLINE MULTI-PURPOSE A
JAPAN ENERGY CORP., TOKYO/JAPAN	JOMO ATF K	VALVOLINE INTERNAT., DORDRECHT/NL	VALVOLINE ATF TYPE
KÄPPLER K., STUTTGART/D	SELECTOL FLUID GETR ÖL IID 23	VEBA OEL AG, GELSENKIRCHEN/D	MOVARA ATF-GETRIEBEÖL DI
KLÖCKNER ENERGIEHÄNDEL GMBH, KÖLN/D	DEUTZ OEL ATF-D	VEEDOL INTERNATIONAL, SWINDON/GB	VEEDOL ATF-M (227E
KROON OIL BV, ALMELO/NL	ATF DEXRON IID	VEEDOL INTERNATIONAL, SWINDON/GB	VEEDOL ATF DEXRON III F-305
KROON OIL BV, ALMELO/NL	ALMIROL ATF	VEEDOL INTERNATIONAL, SWINDON/GB	VEEDOL UNITRANS S PLI
KUWAIT PETROLEUM, HOOGVLIET/NL	Q8 AUTO 15	YACCO SA, ST PIERRE-LES-ELBEUF/F	YACCO ATF
KUWAIT PETROLEUM, HOOGVLIET/NL	Q8 AUTO 14 (IID-21677)	ZELLER+GMEIN GMBH&CO, EISLINGEN/D	DIVINOL FLUID 6
KUWAIT PETROLEUM, HOOGVLIET/NL	Q8 AUTO 14 (IID)		

5. Disassembly

Note: fold out illustration sheets 1 and 2 or (for HBW 150 V) sheets 3 and 4 (exploded views) for reference.

5.1 Removing the cooling unit (if present)

Unscrew 4 hex head screws M8x50 and take off unit (see illustration under item 6.14.2).

5.2 Removing and disassembling the actuating lever cover plate

5.2.1 Always set actuating lever to neutral position.

5.2.2 Remove hex nuts (22) from cover plate (9), using 13 mm spanner (wrench), and take off spring washers (4).

5.2.3 Remove cover plate assembly (12), lever (6) and actuating cam (11).

5.2.4 Remove screw (7) from lever (6). Pull off lever (6). Remove actuating cam (11) and needle bearing (70) only in models HBW 125 - 150 - 250. Remove actuating cam sealing ring (8).

5.3 Removing the bearing shields

5.3.1 Remove hex head screw (5) from bearing shields (2) and (3), using 13 mm spanner (wrench), and take off spring washers (4).

5.3.2 Remove cover (3) and bearing shield (2) on input shaft (36) together with seals (28).

5.4 Separating the gearbox sections and removing the input and output shafts

5.4.1 Remove hex nuts (22) from gearbox (1), using 13 mm spanner (wrench), take off spring washers (4) and remove screws (21).

5.4.2 Separate the two halves of gearbox (1) by light hammer blows on the oil filler screw and oil drain plug (19 and 20).

5.4.3 Remove shims (37, 38, 39, 40) from the input and output shafts and keep separately. For proper reassembly it is advisable to note down the thickness and location of each of the shims to obtain the correct bearing play. If none of the parts (2, 3, 32, 33, 36) on the input shaft and of the parts (2, 3, 34, 35, 43, 46, 47, 59) of the output shaft are replaced, the shims can be re-used in the same positions. When any of these parts are replaced, the dimensions of the gear set relative to the casing have to be measured anew and suitable shims have to be installed.

5.5. Removing the shifting fork (15)

5.5.1 Remove screw plug (17) (not necessary in HBW 35 - 50 since there is no plug but only a O-ring).

5.5.2 Pull actuating shaft (16) out of the hole in the half housing.

5.5.3 Remove shifting fork (15).

5.6 Removing the intermediate gear (26)

5.6.1 Heat gearbox section with intermediate gear to a temperature of approx. 80°C (176 F); (in HBW 35 - 50 only, first remove the retaining ring (23).

5.6.2 Knock pin (24) out of its bearing by light hammer blows, using a driving pin of suitable size.

5.6.3 Remove intermediate gear (26), retaining plates (25) and roller cage (27).

5.7 Disassembling the input shaft (36)

5.7.1 Remove outer bearing races (32).

5.7.2 In the event of bearing damage, cautiously drive inner races (33) off the input shaft (36) with a punch (away from gear).

5.8 Disassembling the output shaft (66)

5.8.1 Mount support rail on a vice with the pins pointing upwards (not on HBW 150 V).

5.8.2 Place output shaft (66) vertically on the support rail with the flange side down.

5.8.3 Remove screw (41) spacer (42) and outer bearing race (34). (only in models HBW 35 - 50 remove also shims (68) and in model HBW 150 A spacer (68)).

5.8.4 Place side of gear (65) adjacent to shaft flange against a suitable support (a divided flange or two brackets of suitable section) and use pin of suitable size to press off the output shaft.

Do not place the support neither against the gear's (65) teeth nor against the friction washer (43). But place it as shown on the drawing below.

The parts removed from the upside of the shaft are not interchangeable with the parts removed from the flange side. Keep separately.

5.8.5 Remove keys (67) from the output shaft and keep in a separate place (1 key for HBW 35 and 50, 2 keys for HBW 100, 125, 150A and 150, and 4 keys for HBW 250).

Fig. 18

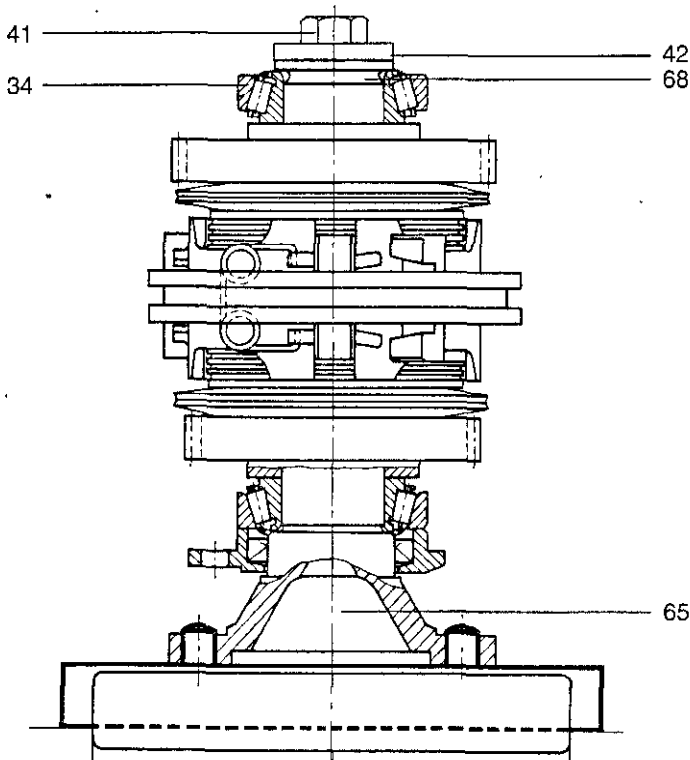
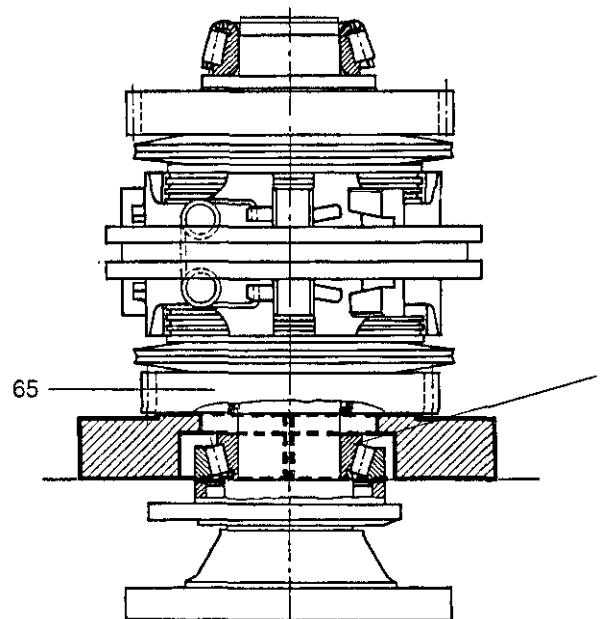


Fig. 19



5.8.6 Put off shims (53, 54, 55, 56), spacer (47) and needle bearing (45) from the output shaft.

5.8.7 Attach divided flange to face side of bearing shield (2) and pull off thrust washer (43), inner race (46) and taper roller bearing (34, 35) with shield. On HBW 150 V only pull off taper roller bearing (34, 35).

5.8.8 Remove internal and external clutch discs from gears (44) and (65).

5.8.9 Dismantling the gears
Compress cup springs (48) (only one each side for HBW 35 - 50) by means of dismantling tool. Remove circlip (50) and take off thrust plate (49).

5.8.10 Dismantling the actuating members.
Detach springs (64), watching for balls (58).

5.8.11 Remove disc carrier (57).

5.8.12 Place actuating sleeve (60) on a plane surface and press out guide sleeve (59). Watch for detent pins and springs jumping off the guide sleeve. It will be advisable to wrap a rag around the actuating sleeve (60) and the guide sleeve (59) to catch any parts that might jump off.

5.9 Disassembling the quill shaft (HBW 150 V).

Note: see drawing page 38.

5.9.1 Remove grooved ring nut (83) by means of socket spanner and take off ring (34) with sealing ring (31).

5.9.2 Place divided flange against face side of bevel gear (80) and force bevel gear (80) spacer ring (76) and bearing (74) off quill shaft.

5.9.3 Remove key (81) and spacer ring (76).

5.9.4 Force off bearing (74) by means of divided flange.

Fig. 20

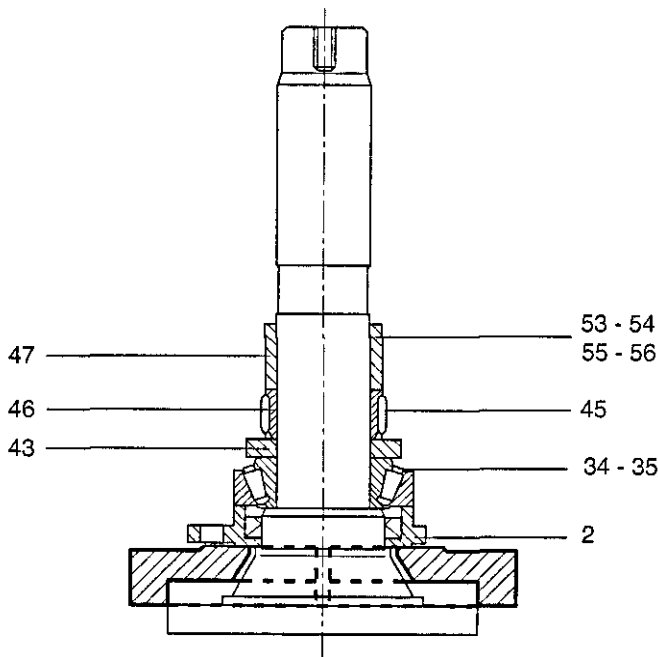


Fig. 22

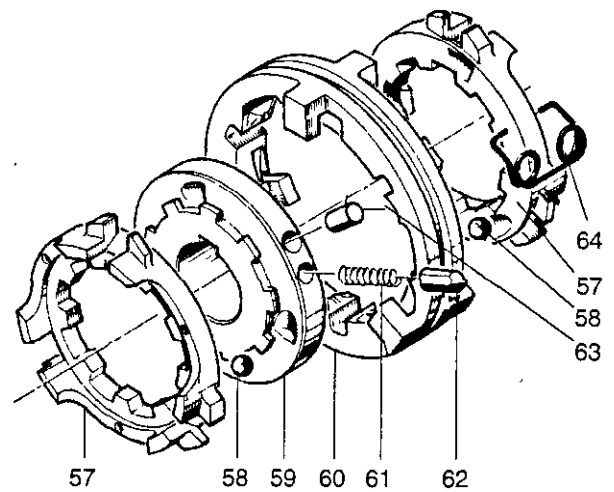
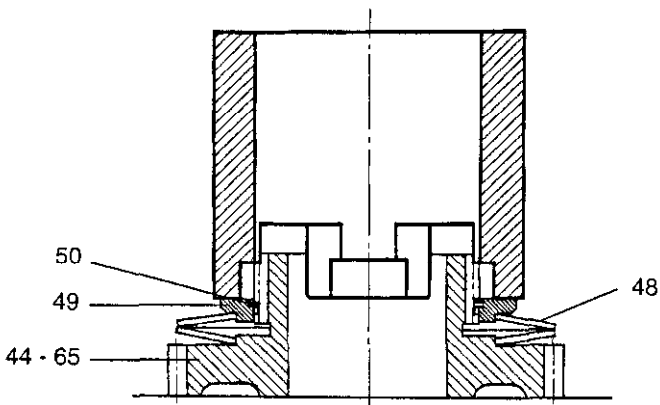


Fig. 21



6. Reassembly

Note: fold out illustration sheets 1 and 2 (exploded views) for reference. For HBW 150 V use illustration sheets 3 and 4.

6.1 General information

The following points should be observed when reassembling the gearbox:

- Clean all parts thoroughly, especially sealing surfaces, inspect for wear, damage and cracks, and replace if required.
- Check shifting fork (15) for wear. The contact surfaces of this fork are provided with amolybdenum coating. Should this coating be worn away at any point, replace the shifting fork. Max wear on guiding surfaces 0.2 mm (0.008 in) on each side.
- Thrust rings (43) require replacement if wear exceeds 0.25 mm (0.0098 in).
- Internal discs (51) have a sintered metal coating of 0.3 mm (0.012 in) on each side. If the surface structure (after clean-ing) shows indications of wear, replace the discs.
- Apply thin coat of oil to antifriction bearings before installation.

6.2 Assembling the intermediate gear shaft in gearbox section side cooler

6.2.1 Insert retaining plate (25).

IMPORTANT:

Note that the bevelled corners of retaining plates (25) have to be placed in different positions (see illustration on sheet 1).

6.2.2 Insert needle cage (27) into intermediate gear (26) and place complete assembly with retaining plate (25).

6.2.3 Insert second retaining plate (25). Not for HBW 35 - 50.

6.2.4 Fit O-ring (23) to intermediate gear shaft (24)* and drive it into gearbox section by knocking slightly on a drive pin.

* on HBW 35 - 50 insert intermediate gear shaft with seeger 23 and Loctite 270.

* on HBW 250, insert intermediate gear shaft (24) without O-ring (23) and close bore in gearbox section with sealing compound by pressing in a plug (23) with Loctite 574. (see illustration on sheet 1).

* on HBW 150 V insert intermediate shaft (24) and stop it in its place by knocking with a driver pin on the edge of the hole of the housing. Close the outsider hole in the housing by pressing in plug (23) with Loctite 574.

6.3 Assembling the shifting fork in gearbox section side shifting cover

6.3.1 Insert shifting fork (15) into gearbox section (1) side the actuating lever in such a way that the long arm of the fork points downwards.

6.3.2 Insert shifting rod (16) through bores in gearbox and shifting fork.

6.3.3 Fit screw plug (17) to gearbox, making certain that the clearance between shifting rod (16) and screw plug (17) is min. 0.5 mm (0.02 in). Seal screw plug with Loctite 242 (HBW 35 - 50 only O-Ring).

6.3.4 Check shifting fork for easy movability.

6.4 Pre-assembling the actuating lever cover plate

Use punch tool to press sealing ring (8) into cover plate (9). Spread antifriction bearing grease between sealing lips.

6.4.1 Insert actuating cam assembly (11) into cover plate (9).

6.4.2 Fit actuating lever (6).

IMPORTANT:

Clearance between actuating lever and cover plate 0.5 mm (0.02 in).

6.4.3 Clamp actuating lever by means of retaining screw (7), using a 13 mm spanner (wrench). Screw in with torque of 20 Nm.

Fig. 23

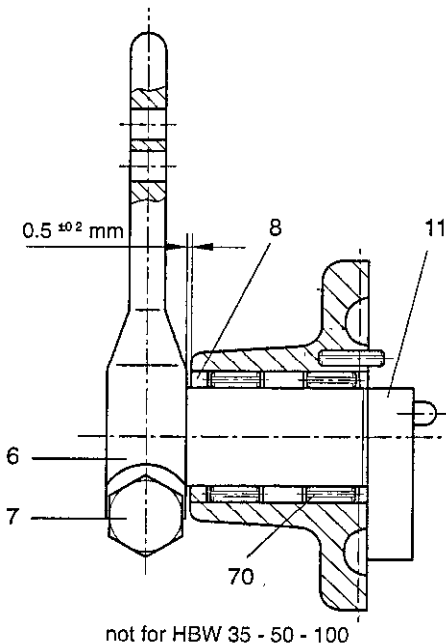
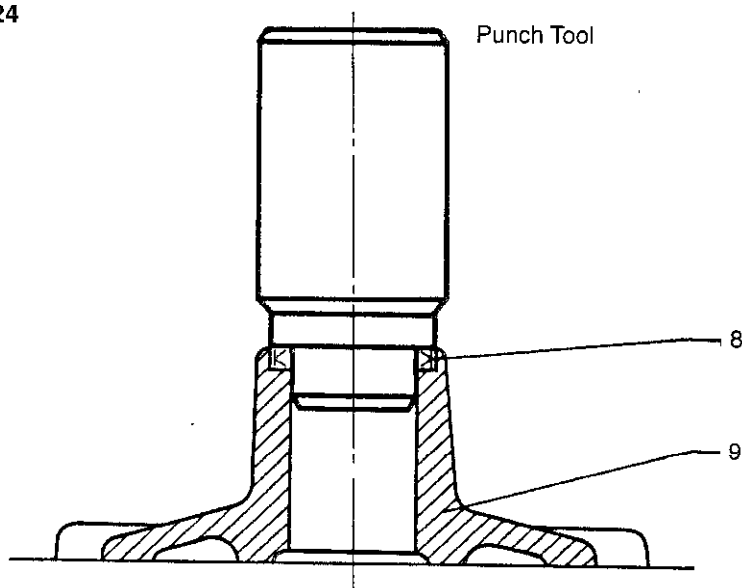


Fig. 24



6.5 Pre-assembling the gears (65) and (44) with cup springs (48) and clutch discs (51 and 52)

IMPORTANT:

If previously disassembled parts are used, make certain that only mating and associated parts are reassembled.

6.5.1 Join two cup springs (48) (only one cup spring for HBW 35 – 50) face to face (external diameters in contact) and place them on the centering collar of gears (65) and (44).

6.5.2 Place thrust ring (49) on cup springs.

6.5.3 Place circlip (50) on gear hub and use mounting tool and press to fit circlip into groove on hub. Don't press completely the cup springs and be sure that the tool presses at least on three points on the thrust washer (49).

6.5.4 Attach clutch discs (51 and 52), first internal disc (51), then alternatively external disc (52), internal disc (51), etc.

6.6 Measuring the pre-assembled gears (65) and (44) to determine setting value «a».

If no parts had to be replaced, the previously disassembled shims (53, 54, 55, 56) can be re-used in their former arrangement and positions without any measuring operation.

If measuring is required, proceed as follows:

6.6.1 Place pre-assembled gear (65), and subsequently gear (44) on thrust washer (43), (end face of hub downwards, see illustration).

IMPORTANT:

On HBW 35 - 50 - 100 there is a step on the thrust washer (43). Put the side of the washer with the step against the gear. Be sure that the needle bearing inner race (46) is fitted into it.

6.6.2 Insert needle cage (45), inner race (46) and spacer (47) into bore of gear.

6.6.3 Fit shims (53, 54, 55, 56), as required, until prescribed seating value «a» is obtained (see illustration).

6.6.4 Shims are available in thicknesses of 0.4 - 0.5 - 0.6 and 0.7 mm. (0.016 - 0.020 - 0.024 and 0.028 in)

Setting value «a»

Type	mm	Inches
HBW35 HBW 50	8.0±0.1	0.315±0.004
HBV 100 HBW 10 HBW 125 HBW 150	13.0±0.1	0.512±0.004
HBW 150A HBW 150 V HBW 250	12.4±0.1	0.488±0.004
Old versions (3+3 external clutch discs)	16.2±0.1	0.638±0.004
HBW 10 (versions from 01 to 08) HBW 150 (versions from 09 to 14) HBW 150 V (versions from 01 to 07)	13.2±0.1	0.520±0.004

Fig. 25

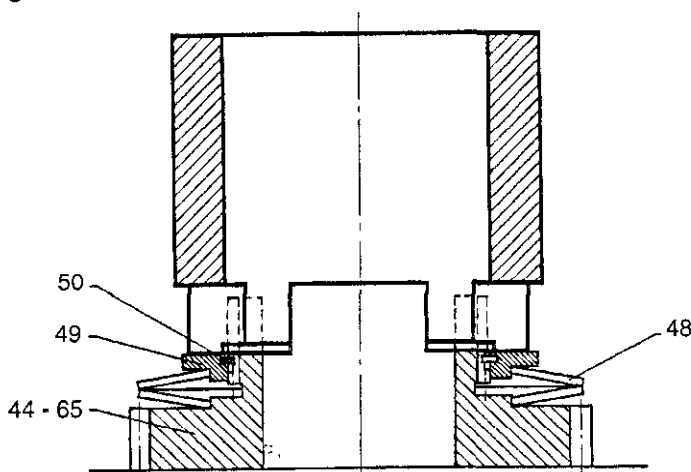
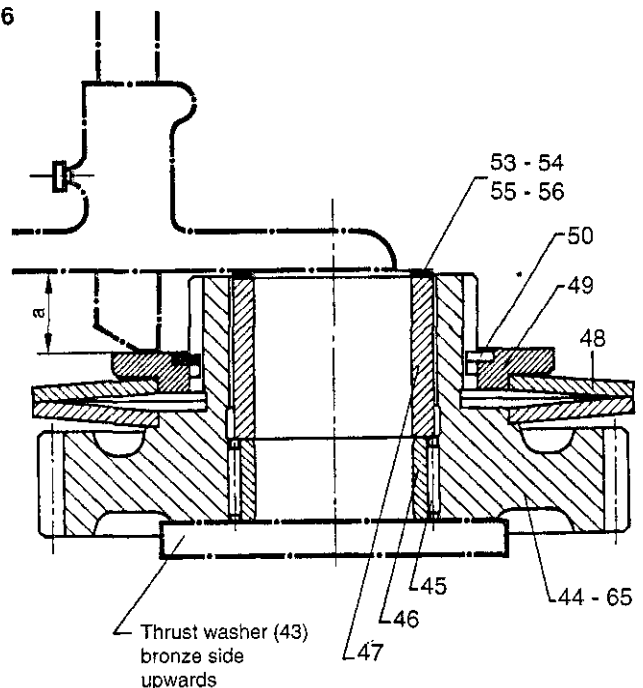


Fig. 26



6.7 Pre-assembling the bearing shields (2) for the input and output shafts

Use a driver tool to press sealing rings (30 - input and 31 - output) into shield (2).

6.8 Pre-assembling the clutch members

6.8.1 Fit driving pins (63), springs (61) and detent pins (62) to guide sleeve (59).

6.8.2 Place actuating sleeve (60) on plane press surface.

6.8.3 Place guide sleeve (59) on top of actuating sleeve (60) with the three driving pins (63) in alignment with the three grooves in the actuating sleeve. Watch for correct position of detent pins (62) relative to angular pockets of sleeve.

6.8.4 Press guide sleeve (59) into actuating sleeve (60) up to midway position (noticeable click).

6.8.5 Insert balls (58) into ball pockets of guide sleeve, attach disc carrier (57), turn upside down then fit balls in opposite face side and attach second disc carrier (57).

6.8.6 Attach springs (64) with closed part of spring windings pointing outwards.

6.9 Reassembling the input shaft

Preheat inner races (33) of taper roller bearings to a temperature of 100° C (212F) and, using tubular or punch tool, press races on input shaft (36) on both sides.

IMPORTANT:

Repress after cooling down, so that no gap is left.

Fig. 27

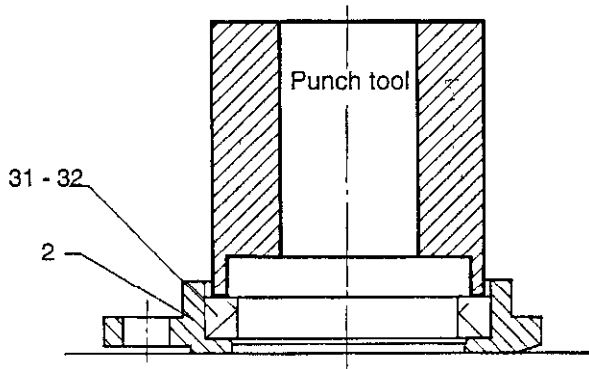


Fig. 28

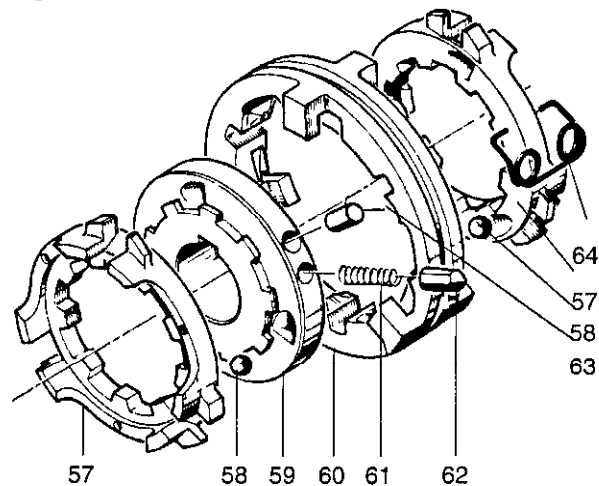


Fig. 29

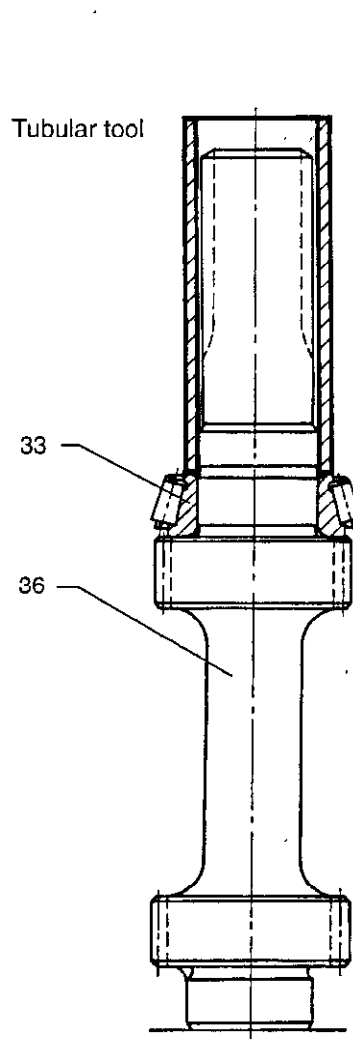
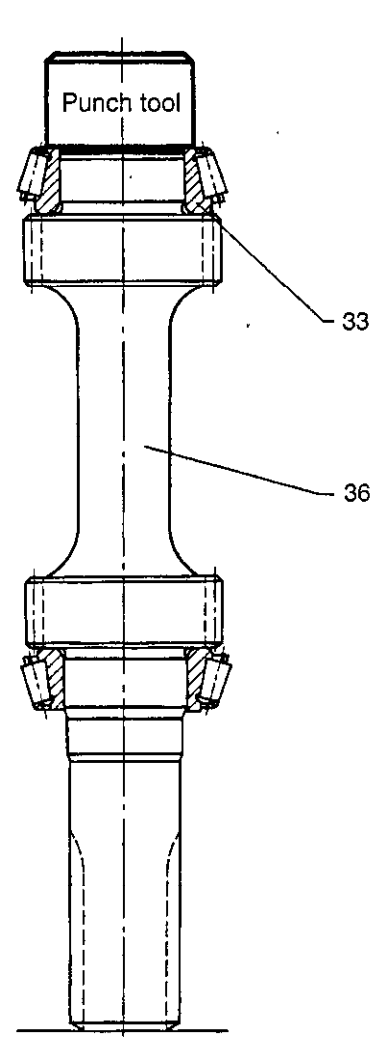


Fig. 30



6.10 Reassembling the output shaft

6.10.1 Place pre-assembled bearing shield (item 6.7) with seal (28) on output shaft (66) (not applicable to HBW 150V).

6.10.2 Attach outer race (34) of taper roller bearing.

6.10.3 Pre-heat inner race (35) of taper roller bearing to a temperature of approx. 100°C (212 F) and press on output shaft (66) in hot condition. On HBW 150 V press complete bearing (68) on shaft (66).

IMPORTANT:

Repress after cooling down, so that no gap is left.

6.10.4 Fit thrust ring (43) in such a way that sintered surface (brown colour) faces gear.

6.10.5 Use tubular tool to press on inner race (46) of needle bearing for gear (65).

6.10.6 Attach needle cages (45) and completely pre-assembled gear (65) with clutch discs (51 and 52).

6.10.7 Fit spacer (47) and shims (53, 54, 55, 56) to gear (65).

6.10.8 Fit keys (67) to shaft (1 for HBW 35, HBW 50, HBW 100, 2 for HBW 125, HBW 150 and 4 for HBW 250).

6.10.9 Press pre-assembled actuating members (see item 6.8) on output shaft (66).

IMPORTANT:

Align keys radially relative to guide sleeve (59).

Fig. 31

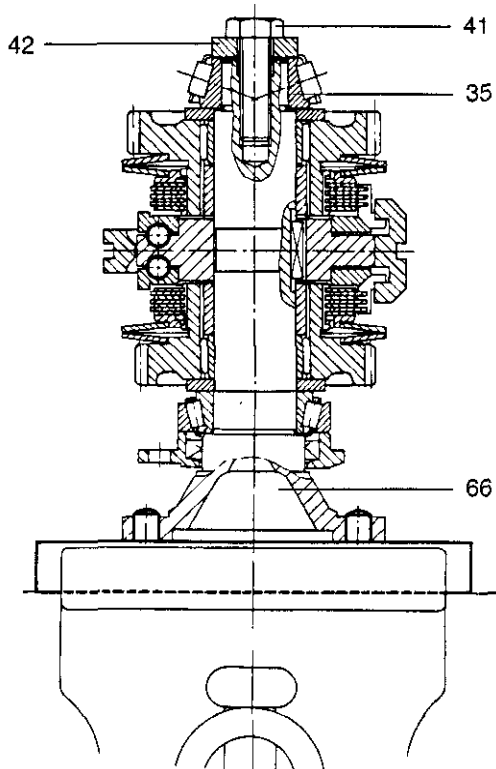
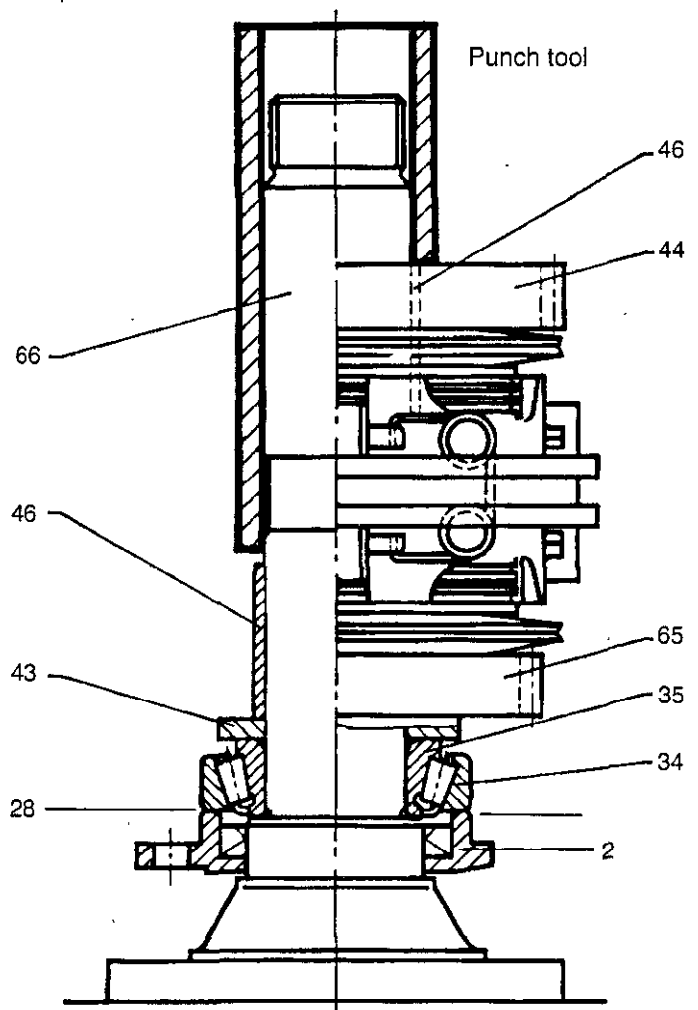


Fig. 32



6.10.10 Attach shims (53,54,55, 56) to gear (44).

6.10.11 Attach spacer (47) to gear (44).

6.10.12 Use tubular tool to press on inner race (46) of needle bearing for gear (44).

6.10.13 Attach pre-assembled gear (44) with needle cage (45) and clutch discs (51 and 52).

Align external discs for proper engagement with actuating member.

6.10.14 Attach thrust ring (43) in such a way that sintered surface (brown colour) faces gear.

6.10.15 Pre-heat inner race (35) of taper roller bearing to a temperature of approx. 100°C (212 F) and press it on shaft.

IMPORTANT:

Repress after cooling down, so that no gap is left.

6.10.16 Screw on bolt (41), (supplied with Loctite) and tighten to torque:

HBW 35 - 50	50 Nm	37 ft lb
HBW 100	60 Nm	44 ft lb
HBW 125 - 150	100 Nm	74 ft lb
HBW 150 A - 150 V	100 Nm	74 ft lb
HBW 250	120 Nm	89 ft lb

6.10.17 (HBW 35, HBW 50 only) attach shims (68) to end shaft (66). The gap has to be 0.2 ± 0.05 mm (0.0079 ± 0.0019 in).

6.10.18 (HBW 150 A only) attach spacer (68).

6.10.19 Check gears (44) and (65) for free movability in an axial direction.

6.10.20 Attach outer race (34) of taper roller bearing.

6.11 Reassembling the quill shaft HBW 150 V

6.11.1 Fit radial sealing ring (31) and clip (84) together with O-ring (86).

6.11.2 First bearing:
Press on bearing inner race (74).
Fit bearing outer race (75).

6.11.3 Fit spacer ring (76).

6.11.4 Fit key (81).

6.11.5 Press on gear (80).

6.11.6 Fit second spacer ring (76).

6.11.7 Second bearing:
Press on inner race (74).
Fit outer race (75).

6.11.8 Push on clip (73) together with O-ring (85).

6.11.9 Tighten grooved ring nut (83) to a torque of 95 Nm (70 lbft), using a socket spanner, and then secure by pressing rim into groove in shaft.

6.11.10 Fit radial sealing ring (31) and cup (84) together with O-Ring (86).

Fig. 33

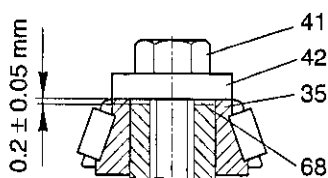


Fig. 34

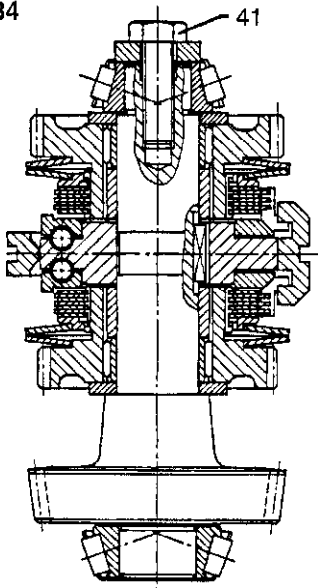
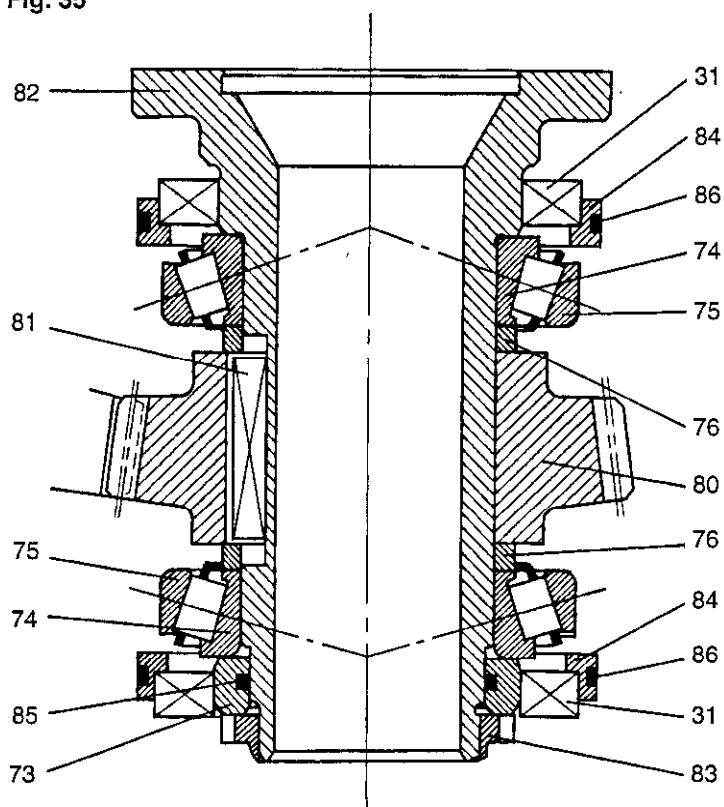


Fig. 35



6.12 Final assembly of gearbox

6.12.1 Place pre-assembled gearbox section (1) - (with intermediate gear) - on side wall.

6.12.2 Place pre-assembled output shaft (66) in lower part of gearbox with flange side towards intermediate gear side (on HBW 150 V, bevel gear towards intermediate gear side).

6.12.3 Place pre-assembled Input shaft (36) in upper part of gearbox.

6.12.4 (HBW 150 V only) Place pre-assembled quill shaft (73) in lower part of gearbox (watching to correct engagement of marked teeth).

Add shims 78 on quill shaft:

1.2 mm on side input shaft and 2.2 mm on side output flange.

Add shims (70) on clutch shaft 2 x 0.1 mm on side output flange.

6.12.5 (HBW 150 V only) Check backlash 0.08 to 0.13 mm (0.003 to 0.005 in). Between teeth of bevel gears using a dial indicator in contact with tooth surface.

To correct backlash:

Replace shim 78 side output flange with a thicker one to decrease backlash and vice-versa.

If the correction is not enough to reach the correct backlash, modify shimming (70) on clutch shaft side output flange and repeat procedure.

To correct axial play (quill shaft):

Check axial play 0.05 ± 0.02 mm (0.002 ± 0.0008 in).

Compensate for difference by inserting shims (78) side input shaft.

6.12.6 Seal with LOCTITE 574 surface of pre-assembled gearbox section (1) (with shifting fork) and place upper section on lower section of gearbox.

6.12.7 Insert screws (21) preferably in the middle, and screw in low-tight to secure the two gearbox sections together.

6.12.8 Use a plastic hammer to align the two gearbox section (1) by tapping them gently into position.

6.12.9 Fit bearing shield (2) with gasket (28) to output shaft (66) by means of spring washers (4) and screws (5), using a 13 mm spanner (wrench).

Tighten to torque of 14 Nm (10 ft lb).

6.12.10 Slide pre-assembled bearing shield (2) with gasket (28) over input shaft and secure by means of spring washer (4) and screws (5), using a 13 mm spanner (wrench).

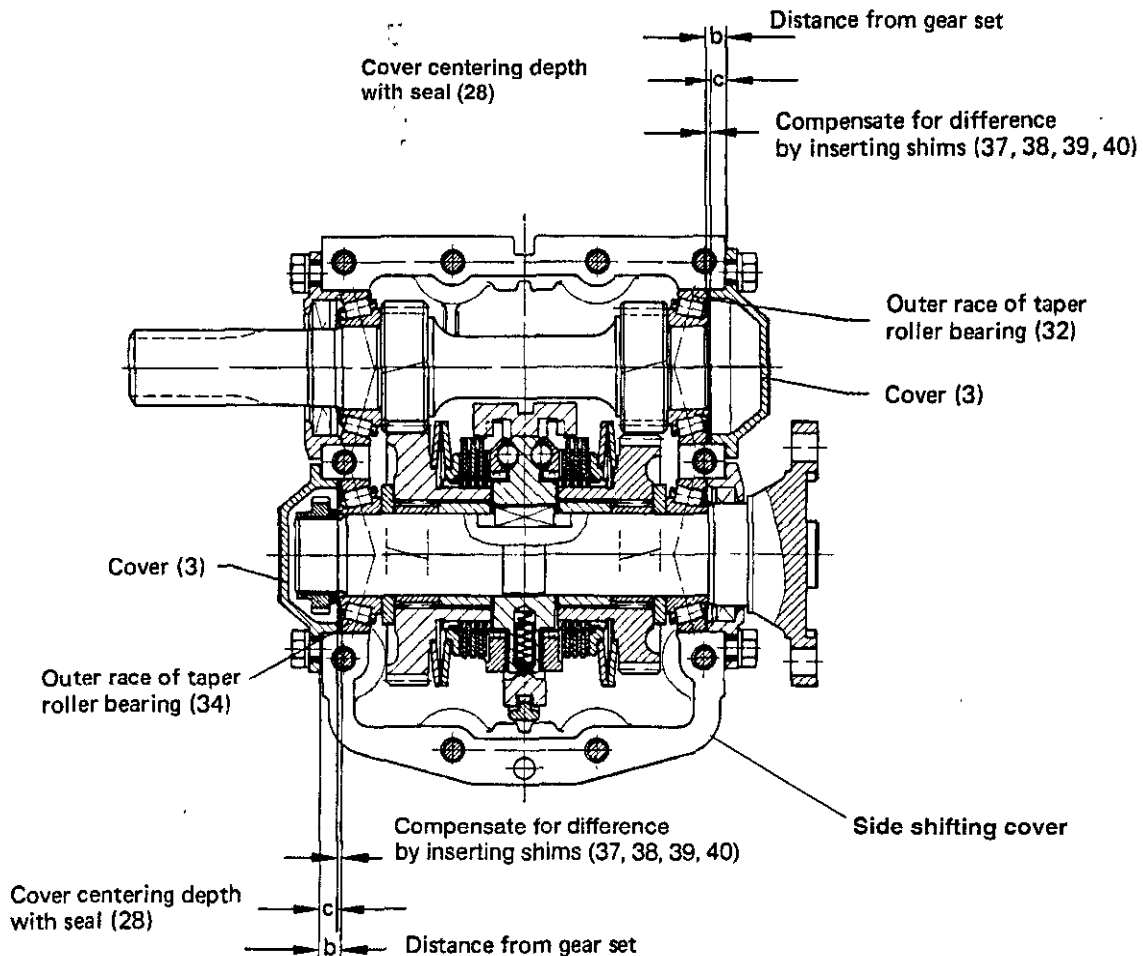
Tighten to torque of 14 Nm (10 ft lb).

6.13 Measuring the gears sets of input shaft and output shaft (see illustration)

6.13.1 Tap outer races (32) and (34) on output and input shafts to eliminate bearing play, simultaneously rotating the shafts.

6.13.2 Determine dimension «b» by means of depth gauge (see illustration).

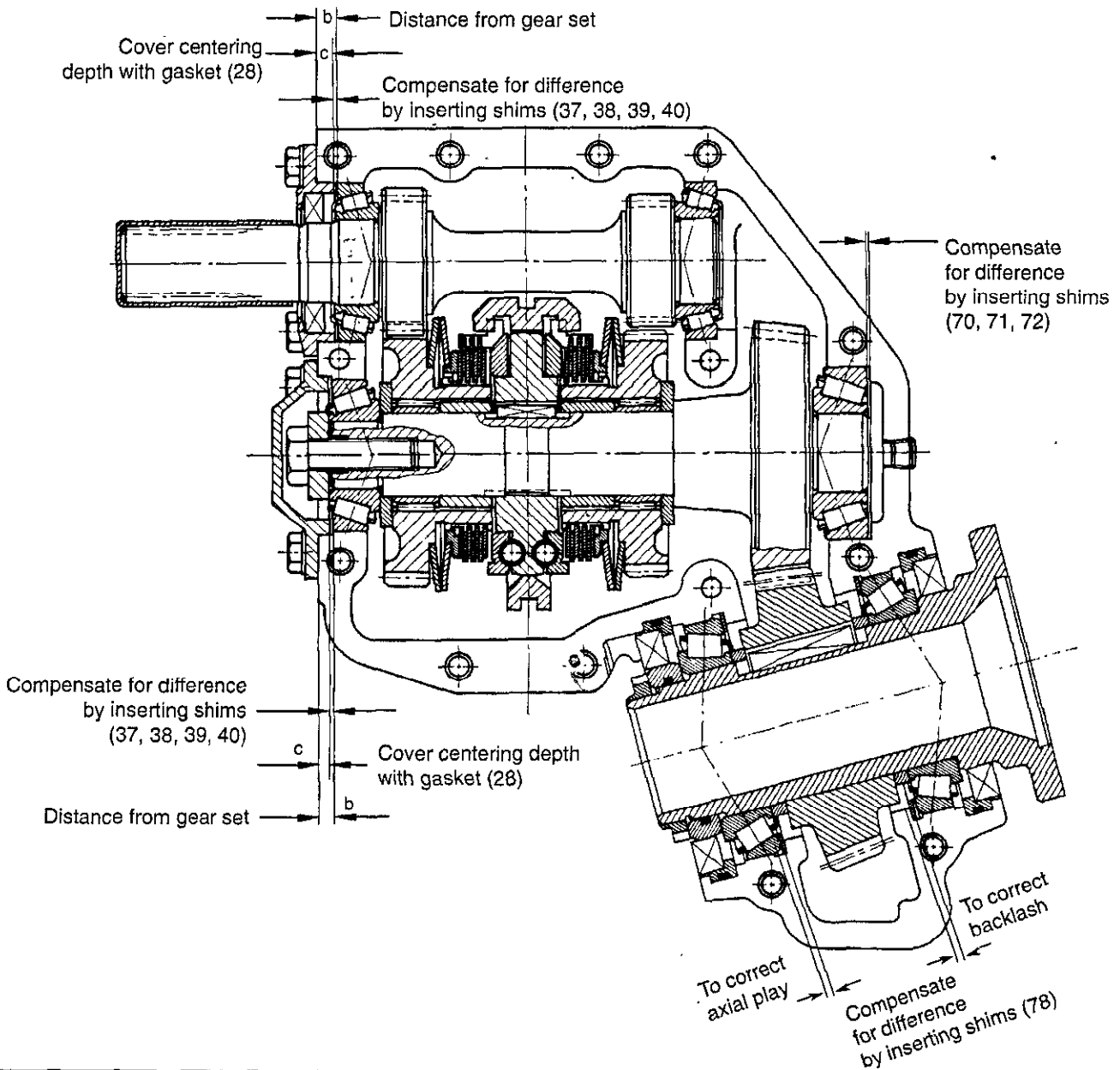
Fig. 36



6.13.3 Measure dimension «c» on cover (3) with gasket (28) installed, using a depth gauge (see illustration). The difference between the two dimensions indicates the distance to be filled up with shims (37, 38, 39, 40). Shims are available in thicknesses of 0.1 - 0.15-02.-03. and 0.5 mm.

On HBW 150 V, a hole is provided on the output side of the housing to permit this measuring operation: move shaft via gear (65) by means of a lever through opening in gearbox (see illustration next page).

Fig. 37



6.13.4 Insert the required number of shims into the bearing bores of the gearbox to obtain an axial clearance of the output and input shafts of 0.05 ± 0.02 mm.

If no parts had to be replaced (see item 5.4.4), the previously disassembled shims (37, 38, 39, 40) can be re-used in the previous arrangement and positions. It will be advisable, however, to check the bearing clearance and correct it if required.

6.13.5 Mount the previously measured covers (3) on the output and input shafts by means of spring washers (4) and screws (5), using a 13 mm spanner (wrench). Tighten to torque of 14 Nm (10 ft lb).

6.13.6 Place spring washers (4) underneath all screws (21) and tighten screws to a torque of 22 Nm (16 ft lb), using a 13 mm spanner (wrench).

6.13.7 Tap output and input shafts lightly in an axial direction while rotating the shafts, to ensure freedom of movement.

6.13.8 Axial clearance of input and output shafts: 0.05 ± 0.02 mm, measured by means of dial indicator in contact with end face of shaft (see illustration).

6.13.9 Measure axial clearance of quill shaft (on HBW 150 V), also with dial indicator in contact with end face of the shaft (see illustration). Permissible clearance: 0.05 ± 0.02 mm.

<p>0.05 ± 0.02 mm 0.002 ± 0.0008 in</p>
--

Fig. 38

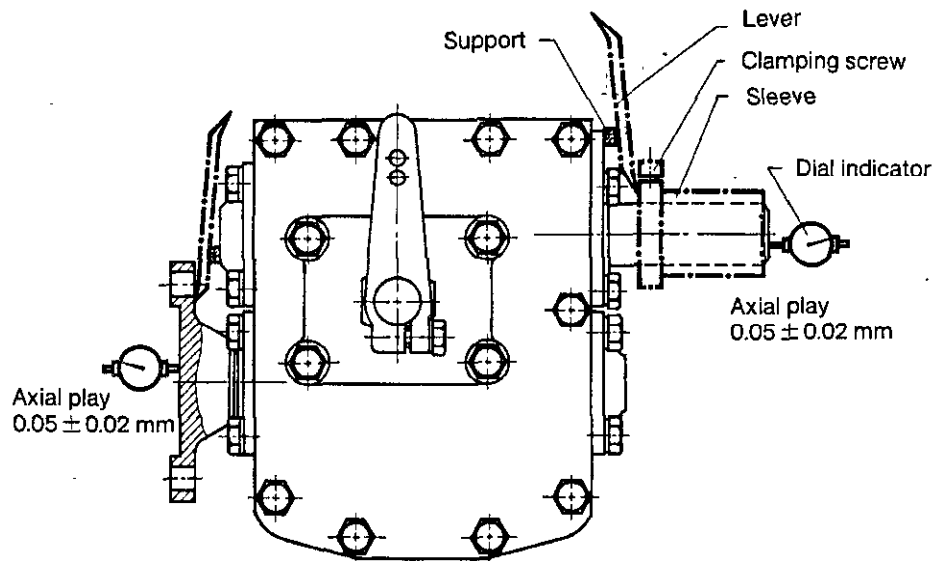
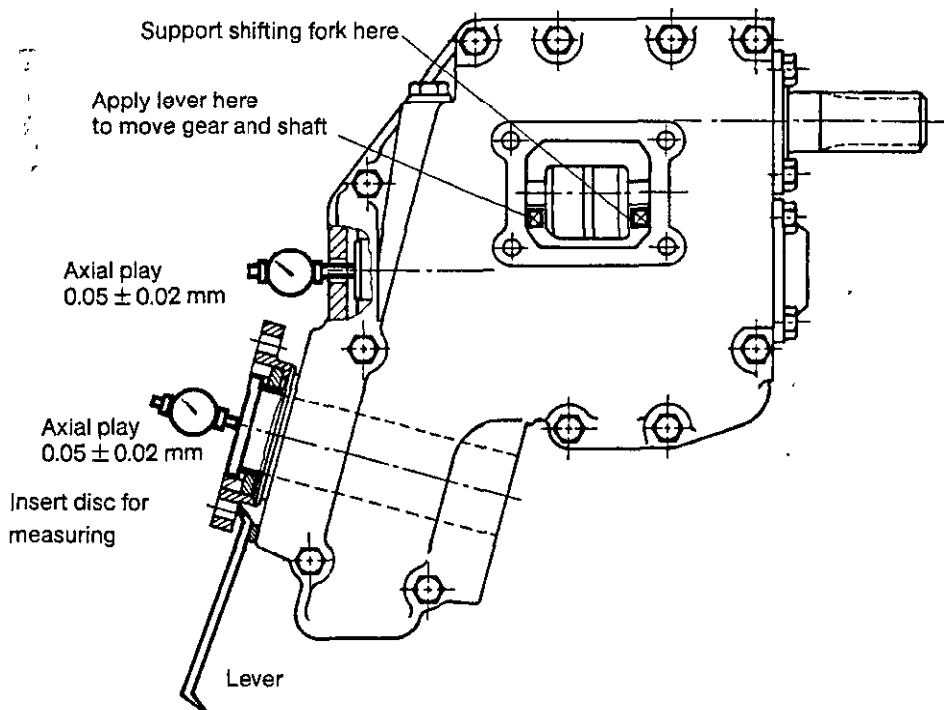


Fig. 39



6.14 Mounting the actuating lever cover plate

6.14.1 Place gasket (29) or Loctite 514 on pre-assembled cover plate and fit it to gearbox. Watch for proper engagement of actuating cam and shifting fork. The cover plate can be mounted when the shifting fork is in the middle (=neutral) position. It is important to adjust the actuating lever to exactly midway position in neutral.

Screw the cover plate in place in this position.

The lever travel from 0 to A and from 0 to B should be equal. After a lever travel of 28 to 31 mm (1.10 to 1.22 in) the transmission should be in gear.

If the lever travel from «0» to «A» and from «0» to «B» is not equal adjust cover position by light hammer blows on the cover up to reach the equal travels. Fit spring washer (4) and screw nuts (22).

Tighten to a torque of 20 Nm (15 ft lb).

If studs (69) need to be replaced, fit them with Loctite 270 on the housing.

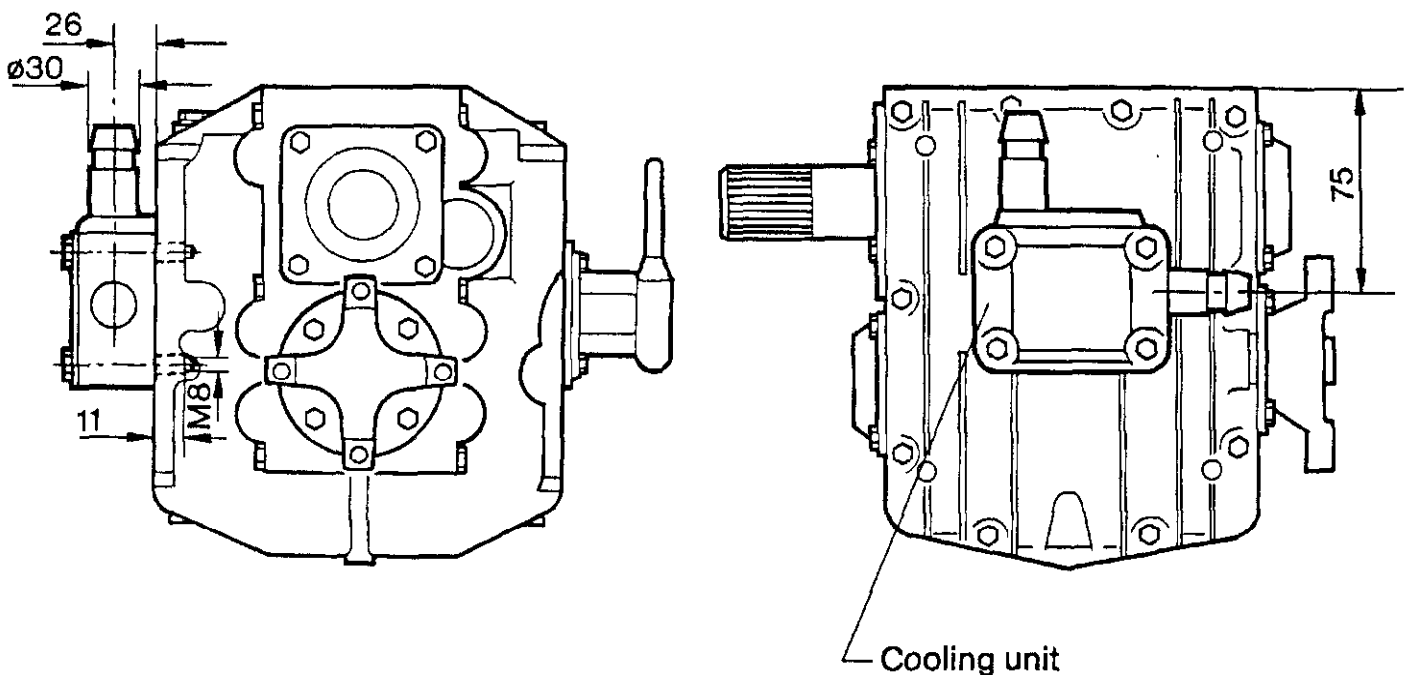
6.14.2 Fit spring washers (4) and screws (5), using a 13 mm spanner (wrench). Tighten to a torque of 14 Nm (10 ft lb). Check actuating lever for proper operation.

6.14.3 Fit oil drain plug (20) with sealing ring (18) and oil dipstick (19) with sealing ring (18). Tighten to a torque of 20 Nm (15 ft lb).

6.15 Mounting the cooling unit (if provided)

6.15.1 Attach the cooling unit on the side opposite the cover plate (9). By means of 4 screws M8x65 and washers (available on kit pag. 23 item 1.2.9.).

Fig. 40



7. Troubleshooting

Possible Troubles and Remedies

Kind of trouble	Noticeable effect	Possible cause	Remedy
Delay of gear engagement	Propeller will start rotating with several seconds delay or only after increase in engine speed.	<p>Lever travel 0-A not equal to lever travel 0-B.</p> <p>Insufficient clearance between actuating lever and cover plate (9).</p> <p>Shift cable fails to move lever through required min. travel 0-A=0-B = 35 mm/30 mm (1.37 in/1.18 in).</p>	<p>Detach shift cable and operate gearbox by hand to find whether malfunctions is caused by gear box or cable.</p> <p>If caused by transmission:</p> <p>Adjust cover plate (9) until lever is exactly in midway position. Travel 0-A = 0-B = 35 mm/30 mm 1.37 in/1.18 in</p> <p>Adjust to min. clearance of 0.5 mm (0.02 in).</p> <p>If caused by shift cable:</p> <p>Check total travel of shift cable. If too short, adjust accordingly.</p>
Transmission fails to move in gear	Excessive effort required to move actuating lever.	<p>Insufficient clearance between actuating lever and cover plate (9).</p> <p>Guide sheaves for shift cable unsuitably positioned: radius too small.</p>	<p>Detach shift cable and operate lever by hand. If lever jams, adjust clearance to 0.5 mm (0.02 in).</p> <p>Check and adjust accordingly.</p>
Boat fails to attain top speed specified	Increased operating temperature.	<p>Use of wrong oil.</p> <p>Boat operated without cooling unit.</p> <p>Transmission operating in upper limit range.</p>	<p>Use ATF oil and check oil level.</p> <p>Install cooling unit.</p> <p>Use suitable HBW transmission unit.</p>
Oil leakage	Oil leakage visible on transmission unit.	<p>Corrosion effects in area of radial sealing ring and shaft; damaged radial sealing rings.</p> <p>Improper installation of seal.</p> <p>Misalignment of output flanges.</p>	<p>Check and correct oil level.</p> <p>Remove and dismantle transmission remachine shafts, replace radial sealing rings</p> <p>Check alignment to be within 0.08 mm (0.003 in) radially.</p>

8. 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, ident no. and quantity of parts required.

The spare parts list is referring to the following versions:

HBW 35	versions	25; 26; 27; 28
HBW 50	versions	09; 10; 11; 12; 14
HBW 100	versions	14; 15; 16; 17; 20; 21
HBW 125/HBW 10	versions	15; 16
HBW 150	versions	17; 18; 20; 21; 22
HBW 150 A	versions	01; 02
HBW 150 V	versions	08; 09; 10; 11
HBW 250	versions	15; 16; 17; 18; 19; 20; 22; 23

Name Plate

The name plate is mounted to the transmission

Transmission type

Transmission ratio
Shifting position «A»

Transmission version
and serial number

MODEL	HBW 250	
RATIO	ⁱ A= 2,74	ⁱ B= 2,72
SER. N.	18 - 15234	F

Transmission ratio
Shifting position «B»

Production date every
year a new progressive
letter is assigned

Item No	Part name	Number per gearbox	HBW 35 - 50		HBW 100		HBW 10/125/150		HBW 150A		HBW 250	
			Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No
1	Housing assy HBW 50 - 2L «11»	1	947.71.701.01	325952								
1	Housing assy HBW 50 - 2R «09»	1	947.71.701.01	325952								
1	Housing assy HBW 50 - 2R «12»	1	947.71.701.01	325952								
1	Housing assy HBW 50 - 3R «10»	1	947.71.701.02	387532								
1	Housing assy HBW 50 - 3R «14»	1	947.71.701.02	387532								
1	Housing assy HBW 35 - 2R «25»	1	947.71.701.01	325952								
1	Housing assy HBW 35 - 3R «26»	1	947.71.701.02	387532								
1	Housing assy HBW 100 - 1,5R «14»	1			947.61.700.02	288079						
1	Housing assy HBW 100 - 2R «15»	1			947.61.700.02	288079						
1	Housing assy HBW 100 - 3R «20»	1			947.61.700.03	465642						
1	Housing assy HBW 100 - 3R «16»	1			947.61.700.02	288079						
1	Housing assy HBW 100 - 2L «17»	1			947.61.700.02	288079						
1	Housing assy HBW 100 - 2,5R «21»	1			947.61.700.03	465642						
1	Housing assy HBW 10/125/150	1					947.41.700.01	206447				
1	Housing assy HBW 150A	1							947.06.700.01	407465		
1	Housing assy HBW 250 - 2L «20»	1									947.51.700.03	345517
1	Housing assy HBW 250 - 3L «19»	1									947.51.700.04	345519
1	Housing assy HBW 250 - 1,5R «16»	1									947.51.700.03	345517
1	Housing assy HBW 250 - 2R «17-22»	1									947.51.700.03	345517
1	Housing assy HBW 250 - 3R «18- 23»	1									947.51.700.04	345519
1	Housing assy HBW 250 - 3,5R «13»	1									947.51.700.04	345519
2	Bearing shield input	1	947.61.004.01	288768	947.61.004.01	288768	947.41.004.01	206450	947.41.004.01	206450	947.51.004.01	274248
2	Bearing shield output	1	947.61.003.01	288787	947.61.003.01	288787	947.41.004.01	206450	947.41.004.01	206450	947.51.004.01	274248
3	Cover	1							947.41.005.01	206452		
3	Cover	2	947.61.005.01	288730	947.61.005.01	288730	947.41.005.01	206452			947.51.005.01	274219
3A	Cover	1										
4	Spring washer	36	011.103.0041	442372								
4	Spring washer	38			011.103.0041	442372	011.103.0041	442372				
4	Spring washer	40										
5	Hex head screw (cover)	16	016.101.0083	215870	016.101.0083	215870	016.101.0083	215870	016.101.0083	215870	016.101.0083	215870
6	Actuating lever*	1	947.23.006.01	195062	947.23.066.01	195062	947.23.066.01	195062	947.23.066.01	195062	947.23.066.01	195062
6	Actuating lever	1	947.23.006.02	500635	947.23.006.02	500635	947.23.006.02	500635	947.23.006.02	500635	947.23.006.02	500635
7	Hex head screw (actuating lever)*	1	016.101.0084	199807	016.101.0084	199807	016.101.0084	199807	016.101.0084	199807	016.101.0084	199807

* Up to letter «E» production date (see name plate description pag 44)

Item No	Part name	Number per gearbox	HBW 35 - 50		HBW 100		HBW 10/125/150		HBW 150A		HBW 250	
			Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No
7	Hex head screw (actuating lever)	1	016.103.0113	442377	016.103.0113	442377	016.103.0113	442377	016.103.0113	442377	016.103.0113	442377
8	Radial sealing ring for shift cover	1	001.106.0155	106864	001.106.0155	106864	001.106.0155	106864	001.106.0155	106864	001.106.0155	106864
9	Cover plate	1	947.71.003.01	326207	947.41.003.01	206448	947.41.003.02	388242	947.41.003.02	388242	947.41.003.02	388242
10	Spring dowel pin	1	014.102.0074	104559	014.102.0074	104559	014.102.0074	104559	014.102.0074	104559	014.102.0074	104559
11	Actuating cam assy	1	947.53.703.01	304332	947.53.703.01	304332	947.53.703.02	407211	947.53.703.02	407211	947.53.703.02	407211
12	Shift cover assembly	1	947.73.610.01	326208	947.43.610.01	248459	947.43.610.02	407210	947.43.610.02	407210	947.43.610.02	407210
15	Shifting fork assy	1	947.63.700.02	326000	947.63.700.02	326000	947.43.700.01	223563	947.43.700.01	223563	947.53.700.02	327374
16	Actuating shaft	1	947.73.001.01	325963	947.43.002.01	206484	947.43.002.01	206484	947.43.002.01	206484	947.53.002.01	288673
17	Plug (O-ring for HBW 35 - 50)	1	001.105.0179	105524	016.107.0120	442373	016.107.0120	442373	016.107.0120	442373	016.107.0120	442378
18	Sealing ring	2	947.41.016.01	326578	947.41.016.01	326578	947.41.016.01	326578	947.41.016.01	326578	947.41.016.01	326578
19	Oil dipstick/breather assy	1	947.61.701.01	288729	947.61.701.01	288729	947.41.701.01	206929	947.06.701.01	408451	947.51.701.01	274217
20	Oil drain plug	1	947.41.008.01	228566	947.41.008.01	228566	947.41.008.01	228566	947.41.008.01	228566	947.41.008.01	228566
21	Hex head screw	9	016.102.0167	215869	016.102.0167	215869	016.102.0167	215869	016.102.0167	215869		
21	Hex head screw	10	016.102.0167	215869	016.102.0167	215869			016.102.0170	337982		
21A	Hex head screw	1	016.102.0170	337982								
22	Hex nut	10	006.101.0036	455785					006.101.0036	455785		
22	Hex nut	11	006.101.0036	455785								
22	Hex nut	12	006.101.0036	455785	006.101.0036	455785					006.101.0036	455785
22	Hex nut	14	006.101.0036	455785								
23	O-ring (Seeger HBW 35 - 50 / Plug HBW 250)	1	002.101.0012	104807	001.105.0178	105679	001.105.0177	105530	001.105.0177	105530	015.101.0081	285375
24	Intermediate gear shaft	1	947.72.011.01	325962	947.62.006.01	288741	947.42.006.01	206470	947.42.006.01	206470	947.52.006.01	274225
25	Retaining plate	1	947.62.009.01	288743								
25	Retaining plate	2	947.62.009.01	288743	947.42.009.01	288743	947.42.009.01	206473	947.42.009.01	206473	947.52.009.01	288702
26	Intermediate gear	1	947.72.004.01	325961	947.62.004.02	288078	947.42.004.02	254730	947.42.004.02	254730	947.52.004.01	274226
27	Cage	1	005.104.0184	106589	005.108.0149	280128	005.108.0157	215878	005.108.0157	215878	005.108.0162	222273
28	Gasket cover	4	947.61.008.01	288739	947.61.008.01	288739	947.41.010.01	254715	947.41.010.01	254715	947.51.011.01	274251
29	Gasket cover plate (or LOCTITE 514)	1	947.41.011.01	254716	947.41.011.01	254716	947.41.011.01	254716	947.41.011.01	254716	947.41.011.01	254716
30	Radial sealing ring, input (No HBW 250 «22-23»)	1	001.107.0001	280135	001.107.0001	280135	001.107.0002	215875	001.107.0002	215875	001.107.0211	284260
30	Radial sealing ring, input (only vers. «22-23»)	1									001.101.0619	501151
31	Radial sealing ring, output (No HBW 250 «22-23»)	1	001.107.0003	105153	001.107.0003	105153	001.107.0006	105159	001.107.0006	105159	001.107.0006	105159
31	Radial sealing ring, output (only vers. «22-23»)	1									001.101.0620	501152
32	Outer race taper roller bearing, input shaft	2	005.102.0175	280127	005.102.0175	280127	005.102.0161	215874	005.102.0161	215874	005.101.0018	167210
33	Inner race taper roller bearing, input shaft	2	005.103.0180	280129	005.103.0180	280129	005.103.0160	215873	005.103.0160	215873		

Item No	Part name	Number per gearbox	HBW 35 - 50		HBW 100		HBW 10/125/150		HBW 150A		HBW 250	
			Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No
34	Outer race taper roller bearing, output shaft	2	005.102.0175	280127	005.102.0175	280127	005.102.0161	215874	005.102.0161	215874	005.102.0173	279059
35	Inner race taper roller bearing, output shaft	2	005.103.0180	280129	005.103.0180	280129	005.103.0160	215873	005.103.0160	215873	005.103.0174	279061
36	Input shaft HBW 50 - 2L «11» z = 22/22	1	947.72.001.03	325970								
36	Input shaft HBW 50 - 2R «09» z = 22/22	1	947.72.001.05	326900								
36	Input shaft HBW 50 - 2R «12» z = 22/22	1	947.72.001.03	325970								
36	Input shaft HBW 50 - 3R «10» z = 18/20	1	947.72.001.07	387535								
36	Input shaft HBW 50 - 3R «14» z = 18/20	1	947.72.001.08	458163								
36	Input shaft HBW 35 - 2R «25» z = 22/22	1	947.72.001.05	326900								
36	Input shaft HBW 35 - 3R «26» z = 18/20	1	947.72.001.08	458163								
36	Input shaft HBW 100 - 1,5R «14» z = 27/22	1			947.62.001.05	304059						
36	Input shaft HBW 100 - 2R «15» z = 24/22	1			947.62.001.07	305605						
36	Input shaft HBW 100 - 3R «20» z = 18/20	1			947.62.001.09	465465						
36	Input shaft HBW 100 - 3R «16» z = 18/22	1			947.62.001.06	304074						
36	Input shaft HBW 100 - 2L «17» z = 24/22	1			947.62.001.08	327229						
36	Input shaft HBW 100 - 2,5R «21» z = 19/20	1			947.62.001.10	470902						
36	Input shaft HBW 10 - 2L «21» z = 22/22	1					947.42.001.01	206460				
36	Input shaft HBW 10/125 - 2R «15» z = 22/22	1					947.42.001.01	206460				
36	Input shaft HBW 150/125 - 2,5R «16» z = 19/22	1					947.42.001.04	313952				
36	Input shaft HBW 150 - 1,5R «18» z = 27/22	1					947.42.001.03	304088				
36	Input shaft HBW 150 - 2R «17» z = 24/22 1	1					947.42.001.05	325911				
36	Input shaft HBW 150 - 2,4R «20» z = 18/22	1					947.42.001.07	439197				
36	Input shaft HBW 150 - 3R «22» z = 18/22	1					947.42.001.08	468211				
36	Input shaft HBW 150A - 2R «01» z = 24/22	1							947.07.001.01	407468		
36	Input shaft HBW 150A - 2,5R «02» z = 19/22	1							947.07.001.02	407482		
36	Input shaft HBW 250 - 2L «20» z = 21/25	1									947.52.001.08	387684
36	Input shaft HBW 250 - 3L «19» z = 18/19	1									947.52.001.06	344588
36	Input shaft HBW 250 - 1,5R «16» z = 28/21	1									947.52.001.04	304081
36	Input shaft HBW 250 - 2R «17 - 22» z = 25/21	1									947.52.001.05	325809
36	Input shaft HBW 250 - 3R «18 - 23» z = 19/18	1									947.52.001.02	288967
36	Input shaft HBW 250 - 3,5R «13» z = 16/18	1									947.52.001.09	439199
37	Shim 0.1 mm	2	947.62.010.01	288731	947.62.010.01	288731	947.42.010.01	206474	947.42.010.01	206474	947.52.010.01	274252
38	Shim 0.15 mm	2	947.62.010.02	288732	947.62.010.02	288732	947.42.010.02	206475	947.42.010.02	206475	947.52.010.02	274253
39	Shim 0.30 mm	2	947.62.010.04	288734	947.62.010.04	288734	947.42.010.04	206477	947.42.010.04	206477	947.52.010.03	274254

Item No	Part name	Number per gearbox	HBW 35 - 50		HBW 100		HBW 10/125/150		HBW 150A		HBW 250	
			Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No
40	Shim 0.50 mm	2	947.62.010.05	288735	947.62.010.05	288735	947.42.010.06	228540	947.42.010.06	228540	947.52.010.04	274255
41	Screw	1	016.111.0087	320681	016.111.0182	450870	016.111.0093	420280	016.111.0093	420280	016.111.0093	420280
42	Spacer	1	947.72.016.01	325960	947.62.030.01	439611	947.42.019.01	407281	947.42.019.01	407281	947.42.019.01	407281
43	Thrust washer	2	947.62.017.01	288748	947.62.017.01	288748	947.42.025.01	344787	947.42.025.01	344787	965.01.004.03	327395
44	Forward gear HBW 50 - 2L «11» z = 45	1	947.72.002.02	325971								
44	Forward gear HBW 50 - 2R «09» z = 45	1	947.72.002.02	325971								
44	Forward gear HBW 50 - 2R «12» z = 45	1	947.72.002.02	325971								
44	Forward gear HBW 50 - 3R «10» z = 49	1	947.72.002.03	325976								
44	Forward gear HBW 35 - 2R «25» z = 49	1	947.72.002.02	325971								
44	Forward gear HBW 35 - 3R «26» z = 49	1	947.72.002.03	325976								
44	Forward gear HBW 100 - 1,5R «14» z = 40	1			947.62.002.03	304060						
44	Forward gear HBW 100 - 2R «15» z = 43	1			947.62.002.04	305607						
44	Forward gear HBW 100 - 3R «20» z = 49	1			947.62.002.02	287455						
44	Forward gear HBW 100 - 3R «16» z = 49	1			947.62.002.02	287455						
44	Forward gear HBW 100 - 2L «17» z = 43	1			947.62.002.04	305607						
44	Forward gear HBW 100 - 2,5R «21» z = 48	1			947.62.002.05	470903						
44	Forward gear HBW 10 - 2L «21» z = 47	1					947.42.002.07	407218				
44	Forward gear HBW 10/125 - 2R «15» z = 47	1					947.42.002.07	407218				
44	Forward gear HBW 150/125 - 2,5R «16» z = 50	1					947.42.002.08	407219				
44	Forward gear HBW 150 - 1,5R «18» z = 42	1					947.42.002.10	407221				
44	Forward gear HBW 150 - 2R «17» z = 45	1					947.42.002.09	407220				
44	Forward gear HBW 150 - 2,4R «20» z = 43	1					947.42.002.11	439198				
44	Forward gear HBW 150 - 3R «22» z = 51	1					947.42.002.12	468212				
44	Forward gear HBW 150A - 2R «01» z = 45	1							947.07.002.01	407469		
44	Forward gear HBW 150A - 2,5R «02» z = 50	1							947.07.002.02	407483		
44	Forward gear HBW 250 - 2L «20» z = 47	1									947.52.002.04	305813
44	Forward gear HBW 250 - 3L «19» z = 52	1									947.52.003.02	288971
44	Forward gear HBW 250 - 1,5R «16» z = 43	1									947.52.002.03	304083
44	Forward gear HBW 250 - 2R «17 - 22» z = 47	1									947.52.002.04	305813
44	Forward gear HBW 250 - 3R «18 - 23» z = 52	1									947.52.003.02	288971
44	Forward gear HBW 250 - 3,5R «13» z = 56	1									947.52.003.04	439200
45	Needle cage	2	005.104.0183	320678	005.104.0181	280132	005.104.0172	201187	005.104.0172	201187	005.104.0172	201187
46	Needle bearing inner race	2	947.72.020.01	326060	947.62.021.01	288759	947.42.008.02	251524	947.42.008.02	251524	947.42.008.02	251524

Item No	Part name	Number per gearbox	HBW 35 - 50		HBW 100		HBW 10/125/150		HBW 150A		HBW 250	
			Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No	Part No	Id No
65	Reverse gear HBW 100 - 1,5R «14» z = 41	1			947.62.003.02	288084						
65	Reverse gear HBW 100 - 2R «15» z = 41	1			947.62.003.02	288084						
65	Reverse gear HBW 100 - 3R «20» z = 43	1			947.62.003.03	465466						
65	Reverse gear HBW 100 - 3R «16» z = 41	1			947.62.003.02	288084						
65	Reverse gear HBW 100 2L «17» z = 41	1			947.62.003.02	288084						
65	Reverse gear HBW 100 - 2,5R «21» z = 43	1			947.82.003.03	465466						
65	Reverse gear - HBW 10/125/150 z = 43	1					947.42.003.03	407235				
65	Reverse gear - HBW 150A z = 43	1							947.07.003.01	407480		
65	Reverse gear HBW 250 - 2L «20» z = 44	1									947.52.003.01	274240
65	Reverse gear HBW 250 - 3L «19» z = 49	1									947.52.002.02	288969
65	Reverse gear HBW 250 - 1,5R «16» z = 44	1									947.52.003.01	274240
65	Reverse gear HBW 250 - 2R «17 - 22» z = 44	1									947.52.003.01	274240
65	Reverse gear HBW 250 - 3R «18 - 23» z = 49	1									947.52.002.02	288969
65	Reverse gear HBW 250 - 3,5R «13» z = 49	1									947.52.002.02	288969
66	Output shaft	1	947.72.005.02	325957	947.62.005.02	439448	947.42.005.04	407280	947.42.005.04	407280	947.52.005.03	408092
67	Key	1	003.101.0016	280130	003.101.0016	280130						
67	Key	2					947.22.013.02	187841	947.22.013.02	187841		
67	Key	4									947.32.018.01	206121
68a	Shim 0.1 mm (spacer HBW 150A)	1	013.101.0054	337666					947.06.003.01	407474		
68b	Shim 0.2 mm	1	013.101.0055	337665								
68c	Shim 0.5 mm	1	013.101.0056	337664								
68d	Shim 1.0 mm	1	013.101.0057	337662								
69	Stud	4	017.101.0123	396330	017.101.0123	396330	017.101.0123	396330	017.101.0123	396330	017.101.0123	396330
70	Needle bearing for shift cover	2					005.105.0193	268620	005.105.0193	268620	005.105.0193	268620
72	Nut (actuating lever)	1	006.101.0036	455785	006.101.0036	455785	006.101.0036	455785	006.101.0036	455785	006.101.0036	455785

Item No	Part name	Number per gearbox	HBW 150V	
			Part No	Id No
1	Housing assy	1	947.45.701.02	344768
2	Cover	1	947.41.004.01	206450
3	Cover	1	947.45.006.01	326369
4	Spring washer	37	011.103.0041	442372
5	Hex screw	8	016.101.0083	215870
6	Actuating lever *	1	947.23.006.01	195062
6	Actuating lever	1	947.23.006.02	500635
7	Hex. head screw *	1	016.101.0084	199807
7	Hex. head screw (actuating lever)	1	016.103.0113	442377
8	Shaft seal ring	1	001.106.0155	106864
9	Cover	1	947.41.003.02	388242
10	Dowel pin	1	014.102.0074	104559
11	Actuating cam assembly	1	947.53.703.02	407211
15	Shift fork	1	947.43.700.01	223563
16	Shift rod	1	947.53.002.01	288673
17	Plug	1	016.107.0120	442373
18	Sealing ring	1	947.41.016.01	326578
19	Dipstick	1	947.45.702.02	345480
20	Oil drain plug	1	947.41.008.01	228566
21	Hex screw	14	016.102.0167	215869
22	Hex nut	15	006.101.0036	455785
23	Plug	1	015.101.0169	322382
24	Intermediate shaft	1	947.45.014.01	468772
25	Disc	2	947.52.009.01	288702
26	Intermediate gear	1	947.42.004.02	254730
27	Needle bearing	1	005.108.0157	215878
28	Gasket	2	947.41.010.01	254715
29	Gasket cover plate (or LOCTITE 514)	1	947.41.011.01	254716
30	Shaft seal, input	1	001.107.0002	215875
31	Seal ring	2	001.107.0230	401647
32	Roller bearing outer race	2	005.102.0161	215874
33	Roller bearing inner race	2	005.103.0160	215873
34	Roller bearing, outer race	1	005.102.0176	311189
35	Roller bearing inner race	1	005.103.0225	311188
36	Input shaft HBW 150V - 1,8R «08» z = 27/22	1	947.42.001.03	304088
36	Input shaft HBW 150V - 2R «09» z = 24/22	1	947.42.001.05	325811
36	Input shaft HBW 150V - 2,7R «11» z = 18/22	1	947.42.001.07	439197
36	Input shaft HBW 150V - 3R «10» z = 19/22	1	947.42.001.04	313952
37	Shim 0.10 mm	2	947.42.010.01	206474
38	Shim 0.15 mm	2	947.42.010.02	206475
39	Shim 0.50 mm	2	947.42.010.06	228540
40	Shim 1.00 mm	2	947.42.010.05	228539
41	Hex head screw	1	016.111.0093	420280
42	Spacer	1	947.45.001.01	326257
43	Thrust ring	2	947.42.025.01	344787
44	Gear HBW 150V - 1,8R «08» z = 42	1	947.42.002.10	407221
44	Gear HBW 150V - 2R «09» z = 45	1	947.42.002.09	407220
44	Gear HBW 150V - 2,7R «11» z = 43	1	947.42.002.11	439198
44	Gear HBW 150V - 3R «10» z = 50	1	947.42.002.08	407219
45	Needle bearing	2	005.104.0172	201187
46	Needle bearing	2	947.42.008.02	251524

* Up to letter «E» production date (see name plate description pag 44)

Item No	Part name	Number per gearbox	HBW 150V	
			Part No	Id No
47	Spacer	2	947.42.015.01	250992
48	Spring	4	947.42.016.03	387391
49	Disc	2	947.42.026.01	407139
50	Ring half	4	947.37.012.01	326830
51	Internal clutch disc	8	947.42.017.02	407231
52	External clutch disc	8	947.42.027.01	407230
53	Shim 0.4 mm	2	947.22.033.01	195714
54	Shim 0.5 mm	2	947.22.033.02	195715
55	Shim 0.6 mm	2	947.22.033.03	195716
56	Shim 0.7 mm	2	947.22.033.04	195717
57	Disc carrier	2	947.42.028.01	407233
58	Ball	6	012.101.0051	106700
59	Guide sleeve	1	947.42.011.04	439603
60	Change selector	1	947.42.012.02	206817
61	Pressure spring	3	947.22.012.02	287401
62	Stop pin	3	947.22.011.02	187840
63	Guide pin	3	947.22.029.01	195271
64	Torsion spring	3	947.42.014.02	206798
65	Gear z = 43	1	947.42.003.03	407235
66	Gear z = 29	1	947.45.002.03	388411
67	Cotter	2	947.22.013.02	187841
68	Bearing inner race	1	005.103.0163	277073
69	Bearing outer race	1	005.102.0164	277074
70	Shim	2	013.101.0058	280839
71	Shim	1	013.101.0059	280840
72	Shim	1	013.101.0060	280841
72	Nut (actuating lever)	1	006.101.0036	455785
73	Ring	1	947.45.011.01	344690
74	Ball bearing inside	2	005.103.0233	199294
75	Ball bearing outside	2	005.102.0232	199293
76	Spacer ring	2	947.26.009.02	327115
78	Shim 1.3 mm	2	947.45.010.11	345469
78	Shim 1.4 mm	2	947.45.010.12	345470
78	Shim 1.5 mm	2	947.45.010.01	344673
78	Shim 1.6 mm	2	947.45.010.02	344674
78	Shim 1.7 mm	2	947.45.010.03	344675
78	Shim 1.8 mm	2	947.45.010.04	344676
78	Shim 1.9 mm	2	947.45.010.05	344677
78	Shim 2.0 mm	2	947.45.010.06	344678
78	Shim 2.1 mm	2	947.45.010.07	344679
78	Shim 2.2 mm	2	947.45.010.08	344680
78	Shim 2.3 mm	2	947.45.010.09	344681
78	Shim 2.4 mm	2	947.45.010.10	344682
80	Gear z = 33	1	947.45.003.03	388410
81	Key	1	003.101.0231	105334
82	Output shaft (150V-UNI)	1	947.45.009.01	344670
83	Ring nud	1	947.26.011.01	195413
84	Ring	2	947.45.008.01	344644
85	O-Ring	1	001.105.0228	105590
86	O-Ring	2	001.105.0229	291618
87	Needle bearing	2	005.105.0193	268620
88	Stud	4	017.101.0123	396330
89	Plug	4	016.107.0119	338805

HBW SPARE PARTS KITS

SEAL KITS

HBW 35-50 KIT P/N 947.72.630.01 ID/N 500426

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
O-Ring	1	001.105.0179	105524	Shift fork shaft
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.61.008.01	288739	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0001	280135	Input shaft
Sealing ring	1	001.107.0003	105153	Output shaft

HBW 100 KIT P/N 947.62.630.01 ID/N 500427

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
O-Ring	1	001.105.0178	105679	Intermediate shaft
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.61.008.01	288739	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0001	280135	Input shaft
Sealing ring	1	001.107.0003	105153	Output shaft

HBW 10/125/150/150A KIT P/N 947.42.630.01 ID/N 500428

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
O-Ring	1	001.105.0177	105530	Intermediate shaft
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.41.010.01	254715	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0002	215875	Input shaft
Sealing ring	1	001.107.0006	105159	Output shaft

HBW 150 V KIT P/N 947.47.630.01 ID/N 500429

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	2	947.41.010.01	254715	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0002	215875	Input shaft
Sealing ring	2	001.107.0230	401647	Output shaft
O-Ring	1	001.105.0228	105590	Output shaft
O-Ring	2	001.105.0229	291618	Output shaft

HBW 250 KIT P/N 947.52.630.01 ID/N 500430 (EXCL. VERS. 22; 23)

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.51.011.01	274251	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0211	284260	Input shaft
Sealing ring	1	001.107.0006	105159	Output shaft

SEAL + CLUTCH PACK KITS

HBW 35-50 KIT P/N 947.72.631.01 ID/N 500436

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
O-Ring	1	001.105.0179	105524	Shift fork shaft
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.61.008.01	288739	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0001	280135	Input shaft
Sealing ring	1	001.107.0003	105153	Output shaft
Thrust washer	2	947.62.017.01	288748	Bearing/gear
Inner clutch disc	4	947.62.019.01	288757	Clutch pack
Outer clutch disc	4	947.62.020.01	288758	Clutch pack
Shim 0.4 mm	2	947.62.022.01	288760	Clutch pack
Shim 0.5 mm	2	947.62.022.02	288761	Clutch pack

HBW 100 KIT P/N 947.62.631.01 ID/N 500437

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
O-Ring	1	001.105.0178	105679	Intermediate shaft
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.61.008.01	288739	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0001	280135	Input shaft
Sealing ring	1	001.107.0003	105153	Output shaft
Thrust washer	2	947.62.017.01	288748	Bearing/gear
Inner clutch disc	8	947.62.019.01	288757	Clutch pack
Outer clutch disc	6	947.62.020.01	288758	Clutch pack
Shim 0.4 mm	2	947.62.022.01	288760	Clutch pack
Shim 0.5 mm	2	947.62.022.02	288761	Clutch pack

SEAL + CLUTCH PACK KITS**HBW 10-125-150-150A KIT P/N 947.72.631.01 ID/N 500438**

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
O-Ring	1	001.105.0177	105530	Intermediate shaft
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.41.010.01	254715	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0002	215875	Input shaft
Sealing ring	1	001.107.0006	105159	Output shaft
Thrust washer	2	947.42.025.01	344787	Bearing/gear
Inner clutch disc	8	947.42.017.02	407231	Clutch pack
Outer clutch disc	8	947.42.027.01	407230	Clutch pack
Shim 0.4 mm	2	947.22.033.01	195714	Clutch pack
Shim 0.5 mm	2	947.22.033.02	195715	Clutch pack

HBW 150 V KIT P/N 947.47.631.01 ID/N 500439

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	2	947.41.010.01	254715	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0002	215875	Input shaft
Sealing ring	2	001.107.0230	401647	Output shaft
O-Ring	1	001.105.0228	105590	Output shaft
O-Ring	2	001.105.0229	291618	Output shaft
Thrust washer	2	947.42.025.01	344787	Bearing/gear
Inner clutch disc	8	947.42.017.02	407231	Clutch pack
Outer clutch disc	8	947.42.027.01	407230	Clutch pack
Shim 0.4 mm	2	947.22.033.01	195714	Clutch pack
Shim 0.5 mm	2	947.22.033.02	195715	Clutch pack

HBW 250 KIT P/N 947.52.631.01 ID/N 500440 (EXCL. VERS. 22; 23)

PART TIME	Q.TY	P/N	ID/N	POSITION
Sealing ring	1	001.106.0155	106864	Shift cover
Sealing ring	2	947.41.016.01	326578	Drain plug/oil dipstick
Gasket	4	947.51.011.01	274251	Cover
Gasket	1	947.41.011.01	254716	Shifting cover
Sealing ring	1	001.107.0201	284260	Input shaft
Sealing ring	1	001.107.0006	105159	Output shaft
Thrust washer	2	965.01.004.03	327395	Bearing/gear
Inner clutch disc	10	947.52.007.01	288889	Clutch pack
Outer clutch disc	8	947.32.024.01	206026	Clutch pack
Shim 0.4 mm	2	947.22.033.01	195714	Clutch pack
Shim 0.5 mm	2	947.22.033.02	195715	Clutch pack

BEARING KITS (ALL VERSIONS)

HBW 35-50 KIT 501220 P/N 947.72.632.01

BEARING ASSEMBLY P/N	CAGE P/N	RACE P/N	LOCATION	Q.TY
	280129	280127	Input + Output shaft	4
	106589		Intermediate shaft	1
	320678	326060	Clutch gear	2
Shims	Thickness			
288731	0.10		Input + Output shaft	4

HBW 100 KIT 501221 P/N 947.62.632.01

BEARING ASSEMBLY P/N	CAGE P/N	RACE P/N	LOCATION	Q.TY
	280129	280127	Input + Output shaft	4
	280128		Intermediate shaft	1
	280132	288759	Clutch gear	2
Shims	Thickness			
288731	0.10		Input + Output shaft	4

HBW 10-125-150-150 A KIT 501222 P/N 947.42.632.01

BEARING ASSEMBLY P/N	CAGE P/N	RACE P/N	LOCATION	Q.TY
	215873	215874	Input + Output shaft	4
	201187	251524	Clutch gear	2
	215878		Intermediate shaft	1
	268620		Shift cover	1
Shims	Thickness			
206474	0.10		Input + Output shaft	4

HBW 150 V KIT 501223 P/N 947.47.632.01

BEARING ASSEMBLY P/N	CAGE P/N	RACE P/N	LOCATION	Q.TY
	215873	215874	Input	2
	311188	311189	Clutch shaft	1
	277073	277074	Clutch shaft	1
	215878		Intermediate shaft	1
	199294	199293	Output shaft	2
	201187	251524	Clutch gear	2
	268620		Shift cover	1
Shims	Thickness			
280839	0.10		Clutch shaft	2
206474	0.10		Input + Output shaft	4

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BEARING ASSEMBLY P/N	CAGE P/N	RACE P/N	LOCATION	Q.TY
167210			Input shaft	2
	279061	279059	Output shaft	2
	201187	251524	Clutch gear	2
	222273		Intermediate shaft	1
	268620		Shift cover	1
Shims	Thickness			
274252	0.10		Input + Output shaft	4

