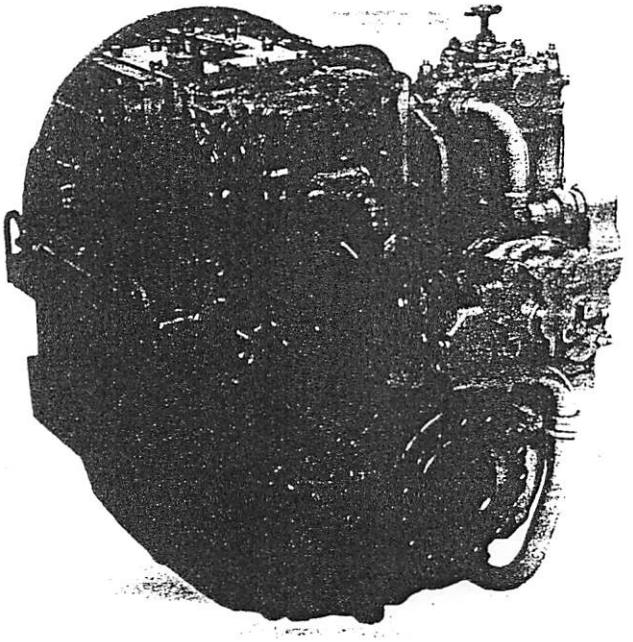
ZF Marine transmissions
BW 250 / 255 / 255P
BW 250A / 255A / 255AP
BW 250V / 255 V / 255 VP



DESCRIPTION

- Reverse reduction marine transmission with hydraulically actuated multi-disc clutches
- Non-reversing BU version also available
- Suitable for high performance applications in all types of fast craft, luxury motoryachts, patrol vessels, crew-boats etc.
- Fully works tested, reliable and simple to install
- Compatible with all types of engines and propulsion systems, including waterjets and surface-piercing propellers and cpp's
- Available in parallel shaft, down-angle or vee-drive configuration
- Design, manufacture and quality control standards comply with ISO 9001 and AQAP

MAIN FEATURES

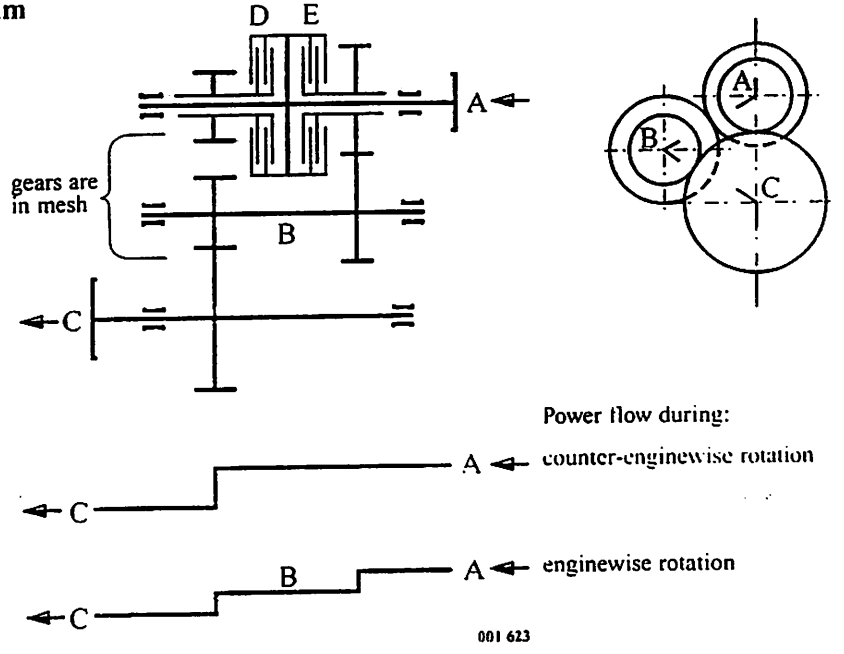
- Lightweight aluminum alloy casing (sea-water resistant)
- Case hardened and precision ground gear teeth for long life and smooth running
- Output shaft thrust bearing designed to take maximum propeller thrust astern and ahead
- Compact, space-saving design, complete with integral oil cooler, pump and full-flow filter
- Smooth and reliable hydraulic shifting with control lever for attachment of push-pull cable or other operating system
- Suitable for twin engine installations (same ratio and torque capacity enginewise or counter-enginewise)

OPTIONAL EXTRAS

- Engine-matched torsional coupling
- Mounting brackets for rigid connection to foundation or elastic mounting brackets
- Trolling valve for slow-speed drive
- Propeller shaft flange and coupling bolt sets
- SAE 1 or SAE 0 bell housings (Standard and down-angle)
- Classification by all major Classification Societies on request
- Electric or pneumatic main control valves
- Monitoring kits
- PTO (live)
- Trailing pump

General design

Gearbox and power flow diagram
Standard version (parallel shaft)



A = Input shaft
B = Reversing shaft
C = Output shaft
D = Clutch for counter-enginewise rotation
E = Clutch for enginewise rotation

General description

Parallel shaft transmission
BW 250 / 255 / 255P

Standard arrangement:
3 shaft, reverse reduction transmission with hydraulic double clutch mounted on the input shaft. Input drive on opposite side to output drive, with vertical offset 235 mm.

'U'-drive arrangement (S-type):
similar to standard arrangement, but with input and output on the same side.

Down-angle transmission
BW 250A / 255A / 255 AP

Similar to "standard arrangement", but with 10° down-angled output shaft.

'V'-drive transmission
BW 250V / 255V / 255 VP

Similar to "'U'-drive arrangement", but with 10° down-angled output shaft. For remote mounting only (not close coupled to engine).

In addition, all versions are available for non-reversing applications (BU-type) with 2 or 3 shafts and one hydraulic clutch for disengagement.

Ratings

Ratings apply to marine diesel engines at the indicated speeds. At other engine speeds, the respective power capacity (kW) of the transmission can be obtained by multiplying the Power/Speed ratio by the speed.

Approximate conversion factors:

1 kW = 1.36 metric hp
1 kW = 1.34 U.S. hp (SAE)
1 U.S. hp = 1.014 metric hp
1 Nm = 0.74 lb.ft.

Ratings apply to right hand turning engines, i.e. engines having counterclockwise rotating flywheels when viewing the flywheel end of the engine. These ratings allow full power through forward and reverse gear trains, unless otherwise stated.

Contact your nearest ZF Sales and Service office for ratings applicable to gas turbines, gasoline (petrol) engines, as well as left hand turning engines, and marine transmissions for large horsepower capacity engines.

Ratings apply to marine transmissions currently in production or in development and are subject to change without prior notice.

Safe Operation Notice

The safe operation of ZF products depends upon adherence to technical data presented in our brochures. Safe operation also depends upon proper installation, operation and routine maintenance and inspection under prevailing conditions and recommendations set forth by ZF. Damage to transmission caused by repeated or continous emergency manoeuvres or abnormal operation is not covered under warranty. It is the responsibility of users and not ZF to provide and install guards and safety devices, which may be required by recognized safety standards of the respective country (e.g. for U.S.A. – the Occupational Safety Act of 1970 and its subsequent provisions).

Monitoring Notice

The safe operation of ZF products depends upon adherence to ZF monitoring recommendations presented in our operating manuals, etc. It is the responsibility of users and not ZF to provide and install monitoring devices and safety interlock systems as may be deemed prudent by ZF. Consult ZF for details and recommendations.

Survey Society Classification

In most cases, the maximum medium and continous duty ratings permitted by ZF are accepted in full by major classification societies. If classification is required, contact ZF regarding proper procedures (also for yacht service, and ice classifications.

Torsional Responsibility and Torsional Couplings

The responsibility for ensuring torsional compatibility rests with the assembler of the drive and driven equipment.
ZF can accept no liability for gearbox noise caused by vibrations or for damage to the gearbox, the flexible coupling or to other parts of the drive unit caused by this kind of vibration. Contact ZF for further information and assistance.
ZF recommends the use of a torsional limit stop for single engine powered boats, wherein loss of propulsion power can result in loss of control. It is the buyer's responsibility to specify this option, which can result in additional cost and a possible increase in installation length. ZF can accept no liability for personal injury, loss of life, or damage or loss of property due to the failure of the buyer to specify a torsional limit stop.
ZF selects torsional couplings on the basis of nominal input torque ratings and commonly accepted rated engine governed speeds. Consult ZF for details concerning speed limits of standard offering torsional couplings, which can be less than the transmission limit. Special torsional couplings may be required for Survey Society Ice Classification requirements.

Trolling Valves

Trolling valves are available as an option on most models of marine transmissions. In most cases, trolling valves are easily retrofitted. A thermostatic oil by-pass valve and remote oil cooler may be required to maintain proper operation and recommended oil temperature. Consult ZF for details and limits.

Optional Ratios (†)

Where optional ratios are indicated (†) these are available on request and may incur additional price/longer delivery compared to standard ratios. Consult ZF for details.

Non-Reversing and 'U'-Drive Options

In principle, all transmissions are available as non-reversing units (for instance, for controllable pitch propeller applications). Many parallel shaft transmissions can also be supplied with input and output on the same side ('U'-drive). Consult ZF for details.

ZF Friedrichshafen AG
D-88038 Friedrichshafen
Germany
Phone (07541) 77-0
Fax (07541) 77-4000

ZF Padova S.p.A.
Via Penghe 48
I-35030 Caselle di Selvazzano
Padova, Italy
Phone (049) 8299-311
Fax (049) 8299-550

ZF-HURTH Marine S.p.A.
Via S. Andrea 16
I-38062 Arco (TN)
Italy
Phone (0464) 58 05 55
Fax (0464) 58 05 44

ZF do Brasil S.A.
Rua Senador Vergueiro, 428
Cep. 09 521-901
Sao Caetano do Sul – SP
Brasil
Phone (011) 744-9435
Fax (011) 441-2354

Sheet-No. 3082 757 102a
Printed in Federal Republic of Germany Imprimé en République Fédérale d'Allemagne. ZF Friedrichshafen
02.96

Medium Duty

MODEL	RATIOS	SAE BRAKE HORSEPOWER (KILOWATTS)			POWER/SPEED RATIO kW/rpm
		BHP (kW) 1800 rpm	BHP (kW) 1900 rpm	BHP (kW) 2100 rpm	
BW 250	1.043†	918 (684)	968 (722)	1070 (798)	0.3801
	1.178†	799 (596)	843 (629)	932 (695)	0.3309
	1.306† 1.587† 1.404† 2.030 1.511 2.226† 1.590† 2.333† 1.778† 2.462	1011 (754)	1067 (796)	1179 (879)	0.4188
	2.600†	976 (728)	1030 (768)	1138 (849)	0.4042
	2.750†	912 (680)	963 (718)	1065 (794)	0.3780
	3.091	789 (588)	832 (621)	920 (686)	0.3267
	3.450†	723 (539)	763 (569)	843 (629)	0.2995
BW 250A (10 degrees) BW 250V	1.574 2.029 1.789† 2.536	1011 (754)	1067 (796)	1179 (879)	0.4188
	2.960	832 (620)	878 (655)	970 (723)	0.3445
BW 255	1.043†	1003 (748)	1059 (790)	1171 (873)	0.4157
	1.178†	875 (652)	923 (688)	1020 (761)	0.3623
	1.306† 1.857† 1.404† 2.030 1.511 2.226† 1.590† 2.333† 1.778† 2.462	1240 (924)	1308 (975)	1446 (1078)	0.5131
	2.600†	1074 (801)	1134 (846)	1253 (935)	0.4450
	2.750†	1005 (749)	1060 (791)	1172 (874)	0.4162
	3.091	868 (647)	917 (683)	1013 (755)	0.3597
	3.450†	796 (594)	840 (627)	929 (693)	0.3298
BW 255A	1.574 2.029 1.789† 2.536	1240 (924)	1308 (975)	1446 (1078)	0.5131
	2.960	938 (699)	990 (739)	1094 (816)	0.3885
BW 255V	1.574 2.029 1.789† 2.536	1163 (867)	1228 (915)	1358 (1012)	0.4817
	2.960	938 (699)	990 (739)	1094 (816)	0.3885

Continuous Duty

MODEL	RATIOS	SAE BRAKE HORSEPOWER (KILOWATTS)			POWER/SPEED RATIO kW/rpm
		BHP (kW) 1200 rpm	BHP (kW) 1600 rpm	BHP (kW) 1800 rpm	
BW 250	1.043†	588 (438)	784 (585)	882 (658)	0.3654
	1.178†	512 (382)	683 (509)	768 (573)	0.3183
	1.306† 1.857† 1.404† 2.030 1.511 2.226† 1.590† 2.333† 1.778† 2.462	640 (477)	854 (637)	960 (716)	0.3979
	2.600†	617 (460)	822 (613)	925 (690)	0.3832
	2.750†	584 (435)	778 (580)	876 (653)	0.3628
	3.091	505 (377)	674 (503)	758 (565)	0.3141
	3.450†	463 (346)	618 (461)	695 (518)	0.2880

Pleasure Duty

P

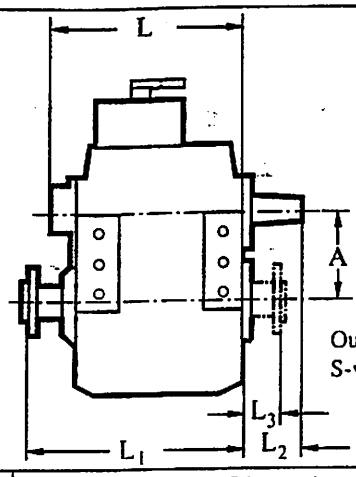
MODEL	RATIOS	SAE BRAKE HORSEPOWER (KILOWATTS) BHP (kW) 1900 rpm	BHP (kW) 2100 rpm	BHP (kW) 2300 rpm	POWER/SPEED RATIO kW/rpm
BW 255	1.043†	1307 (975)	1445 (1078)	1583 (1180)	0.5131
	1.178†	1137 (848)	1256 (937)	1376 (1026)	0.4461
	1.306† 1.857† 1.404† 2.030 1.511 2.226† 1.590† 2.333† 1.778† 2.462	1454 (1084)	1607 (1198)	1760 (1313)	0.5707
	2.600†	1371 (1023)	1516 (1130)	1660 (1238)	0.5382
	2.750†	1283 (957)	1419 (1058)	1554 (1159)	0.5037
	3.091	1107 (826)	1224 (913)	1340 (1000)	0.4346
	3.450†	1034 (771)	1143 (852)	1252 (933)	0.4058
BW 255A (10 degrees) BW 255V	1.574 2.029 1.789† 2.536	1454 (1084)	1607 (1198)	1760 (1313)	0.5707
	2.960	1177 (877)	1300 (970)	1424 (1062)	0.4618
BW 255P	1.043†	1483 (1106)	1640 (1223)	1796 (1339)	0.5822
	1.178†	1290 (962)	1426 (1063)	1562 (1164)	0.5063
	1.306† 1.857† 1.404† 2.030 1.511 2.226† 1.590† 2.333† 1.778† 2.462	1601 (1194)	1769 (1319)	1938 (1445)	0.6283
	2.600†	1539 (1148)	1702 (1269)	1864 (1390)	0.6042
	2.750†	1443 (1076)	1595 (1190)	1747 (1303)	0.5665
	3.091	1247 (930)	1379 (1028)	1510 (1126)	0.4895
	3.450†	1198 (893)	1324 (987)	1450 (1081)	0.4702
BW 255AP (10 degrees) BW 255VP	1.574 2.029 1.789† 2.536	1601 (1194)	1769 (1319)	1938 (1445)	0.6283
	2.960	1334 (995)	1475 (1100)	1615 (1204)	0.5236

Light Duty

L

MODEL	RATIOS	SAE BRAKE HORSEPOWER (KILOWATTS) BHP (kW) 1900 rpm	BHP (kW) 2100 rpm	BHP (kW) 2300 rpm	POWER/SPEED RATIO kW/rpm
BW 250	1.043†	1182 (881)	1306 (974)	1431 (1067)	0.4639
	1.178†	1006 (750)	1112 (829)	1218 (908)	0.3948
	1.306† 1.857† 1.404† 2.030 1.511 2.226† 1.590† 2.333† 1.778† 2.462	1286 (959)	1421 (1060)	1557 (1161)	0.5047
	2.600†	1214 (905)	1342 (1000)	1469 (1096)	0.4764
	2.750†	1134 (846)	1253 (935)	1373 (1024)	0.4450
	3.091	979 (730)	1082 (807)	1185 (884)	0.3843
	3.450†	896 (668)	991 (739)	1085 (809)	0.3518
BW 250A (10 degrees) BW 250V	1.574 2.029 1.789† 2.536	1286 (959)	1421 (1060)	1557 (1161)	0.5047
	2.960	1043 (778)	1153 (860)	1263 (942)	0.4094
BW 255	1.043†	1271 (948)	1405 (1048)	1539 (1148)	0.4990
	1.178†	1107 (826)	1224 (913)	1340 (1000)	0.4346
	1.306† 1.857† 1.404† 2.030 1.511 2.226† 1.590† 2.333† 1.778† 2.462	1427 (1064)	1578 (1170)	1728 (1288)	0.5602
	2.600†	1334 (995)	1475 (1100)	1615 (1204)	0.5236
	2.750†	1249 (931)	1380 (1029)	1512 (1127)	0.4901
	3.091	1078 (804)	1191 (888)	1305 (973)	0.4230
	3.450†	986 (735)	1090 (812)	1193 (890)	0.3869
BW 255A (10 degrees) BW 255V	1.574 2.029 1.789† 2.536	1427 (1064)	1578 (1176)	1728 (1288)	0.5602
	2.960	1153 (860)	1275 (950)	1396 (1041)	0.4524

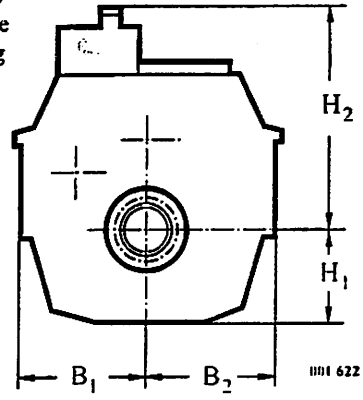
Main dimensions and weights (basic version)



Output for standard version

Output for S-version

Standard input rotation is for engines which rotate in an anticlockwise direction when looking on the flywheel end.

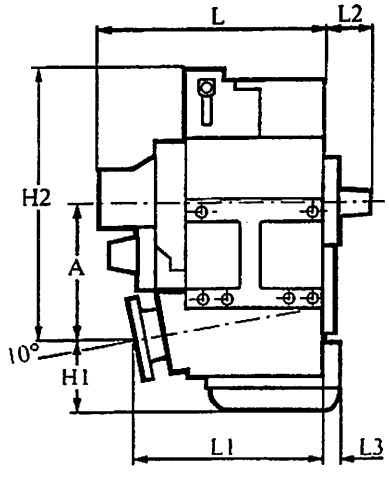


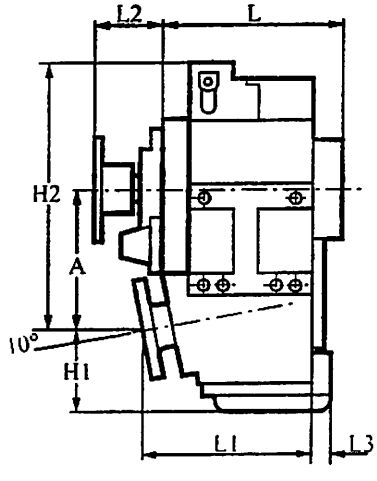
Type	Dimensions mm / *inches*									Oil capacity approx. l / *qt*	Weight (dry) approx. kg / *lb*
	A	B_1	B_2	H_1	H_2	L	L_1	L_2	L_3		
BW 250	235 *9.25*	340 *13.39*	340 *13.39*	250 *9.84*	572 *22.52*	616 *24.25*	565 *22.24*	151 *5.94*	–	28 *29.7*	437 / *963*
BW 250 S							–		100 *3.94*		462 / *1018*
BW 255	235 *9.25*	340 *13.39*	340 *13.39*	250 *9.84*	572 *22.52*	616 *24.25*	565 *22.24*	151 *5.94*	–	28 *29.7*	440 / *970*
BW 255 S							–		100 *3.94*		465 / *1025*

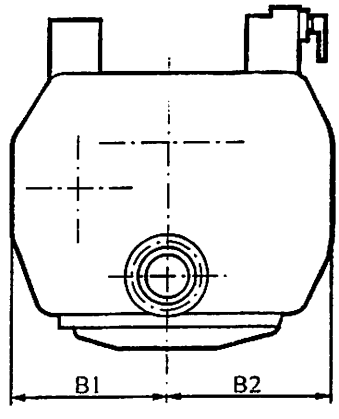
A-Version

V-Version

Standard input rotation is for engines which rotate in an anticlockwise direction when looking on the flywheel end.







Type	Dimensions mm / *inches*										Oil capacity approx. l / *qt*	Mass (dry) approx. kg / *lb*
	A	B_1	B_2	H_1	H_2	L	L_1	L_2	L_3	L_4		
BW 250 V	294 *11.57*	340 *13.39*	340 *13.39*	206 *8.11*	633 *24.92*	616 *24.25*	539 *21.22*	155 *6.10*	37 *1.46*	56 *2.20*	26 *27.6*	447 / *983*
BW 255 V												450 / *990*
BW 255 VP												
BW 250 A	294 *11.57*	340 *13.39*	340 *13.39*	206 *8.11*	633 *24.92*	616 *24.25*	539 *21.22*	151 *5.94*	–		26 27.6	447 / *983*
BW 255 A												450 / *990*
BW 255 AP												

Standard Equipment / Optional Extras

		BW 250 BW 255 BW 255P	BW 250A BW 255A BW 255AP	BW 250V BW 255V BW255VP
BU (non-reversing) version		○	○	○
"U"-Drive version		○	–	–
Bell housing (Standard and A-Version)	SAE 1	○	○	–
	SAE 0	○	○	–
Torsional Elastic Coupling		○	○	○
Input Flange	Normal	○	○	–
	"V"-Drive/"U"-Drive	●	–	●
Output flange		●	●	●
Propeller shaft flange		○	○	○
Connection for CPP (hollow-bored output shaft)		○	○	○
Clutch control	mechanical	●	●	●
	pneumatic	○	○	○
	electrical	○	○	○
Mounting	rigid	○	○	○
	flexible (flanged to engine)	○	○	○
	flexible (remote mounted)	○	○	○
Oil cooler (integrated with gear)		●	●	●*
Oil pump ratio	for engines above 1650 rpm	●*	●*	●*
	for engines below 1650 rpm	○	○	○
Monitoring system		○	○	○
Trailing pump		○	○	○
PTO: Stub shaft (max. 1000 Nm) or SAE connections		○	○	○
Trolling valve (mechanical)		○	○	○
Survey Society Classification		○	○	○
Spares kits		○	○	○

● = standard ○ = optional

P **Pleasure Craft Duty**
Highly intermittent operation with very large variations in engine speed and power.
- Average engine operating hours limit: 500 hours/year
- Typical hull forms: Planing.
- Typical applications: Private, non-commercial, non-charter sport/leisure activities.

L **Light Duty**
Intermittent operation with large variations in engine speed and power.
- Average engine operating hours limit: 2500 hours/year
- Typical hull forms: Planing and semi-displacement.
- Typical applications: Private and charter, sport leisure activities, naval and police activities.

M **Medium Duty**
Intermittent operation with some variations in engine speed and power.
- Average engine operating hours limit: 3500 hours/year
- Typical hull forms: Semi-displacement and displacement.
- Typical applications: Charter and commercial craft (example: crew boats), and naval and police activities.

C **Continuous Duty**
Continous operation with little or no variations in engine speed and power.
- Average engine operating hours limit: unlimited
- Typical hull forms: Displacement.
- Typical applications: Commercial vessels, tugs, fishing vessels.

Scope of supply (basic version)

Casing

Torsion resistant, lightweight cast alloy (sea-water resistant) with machined faces and threaded holes for connecting rigid or elastic mounting brackets. All threaded connections utilise steel inserts.

Gears and shafts

Case hardened and ground single helical gears with optimised tooth profile for minimum noise and maximum strength. Shafts supported by anti-friction roller bearings.

Clutches

Multi-disc clutches with sintered clutch plates designed to withstand maximum peak stresses, both mechanical and thermal, and for long life. Smooth operation ensured by precise hydraulic control and lubrication.

Hydraulic Control and Lubrication System

The casing also serves as an oil reservoir for the pressure lubrication and hydraulic control systems. Clutch discs, gears and bearings are individually lubricated, oil pressure being provided by the pump which also supplies the control circuit and clutch actuating pressure.

The pump is gear driven from the input shaft with standard pump speed ratio designed for engines with nominal speed above 1650 rpm, and idle speed above 415 rpm. Optional drive ratios are available for slower speed engines.

Oil filter

Rotary, "comb-type" filter for full-flow filtration of oil. Environmentally friendly and economical (no insert disposal problems!), the filter can also be cleaned while the engine is operating.

Oil cooler

Sea-water resistant, tube cooler integrated in transmission casing. Suitable for use up to 40 °C at rated power. Consult ZF for remote mounted and higher capacity coolers.

Input Drive

Standard and A-Version:
Shaft stub with 1 : 30 taper for hydraulic assembly of coupling or input flange.

'U'-version and 'V'-drive:
Standard input flange shrunk onto shaft.

Output Drive

Standard, 'U'-drive and 'V'-drive:
Output flange forged with shaft.

Propeller thrust bearing

Generously dimensioned, anti-friction roller thrust bearing to take both ahead and astern thrust.

Gearbox control

The unit includes all valves and other control equipment for the operating and lubricating oil circuits. Mechanical actuation standard, electrical or pneumatic optional. Top mounted control unit can be serviced easily.

Monitoring System

Connections available for installing equipment to monitor temperature, clutch oil pressure, lubricating oil pressure, filter differential pressure etc. Pressure and temperature sensors available to meet customer and/or Classification requirements. Associated terminal boxes, cabling and fixtures optional.

Works Testing

Every transmission is subjected to function and load tests prior to delivery. Special test procedures may be accommodated on request.

Paint

Standard:
Synthetic resin varnish; colour grey to RAL 7001 specification.