



INSTRUCTION MANUAL FOR

NORGEAR TYPE FVE-355

FRONT-END GEAR

SERIAL NO. N92877

**CEKSAN Gemi Insa Celik
SHIPYARD
HULL NO. 42**

Manufacturer

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Manual approved

Approved by KUMERA AS



Controlled by: _____ T. L. _____

Date: 06.06.07

Date of manual: _____ 05.06.2007 _____

Issue No.: 1

Contents

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This manual should be considered as part of the gearbox.
Please keep it in a safe place.
Any amendment received should be incorporated in the manual.
Please make the manual available to any subsequent user.

1 GENERAL DATA

Gearbox serial number	N92877
Gearbox type	Norgear FVE-355
Year built	2007
Classification Society	GL
Hull No.	42
Yard	CEKSAN Gemi Insa Celik
EXW delivery	21 2007

2 TECHNICAL DATA

Part list	N3897B
Dimension drawing	N3-90554
Assembly drawing	N1-01331A
Hydraulic diagram	N3-03434
Terminal connection drawing	N4-00381
Torsional diagram	N4-01444
Direction of rotation	C. C. W.
Input power	780 kW
Input speed	1500 RPM
Ratio (step-down)	2.590: 1
Admissible input torque	4966 Nm
Oil group	ISO VG150
Oil quantity	35 litres
Required water flow through oil cooler	26 l/min
Max water flow through cooler	45 l/min
Cooling water inlet temperature	32 deg. C, seawater
Cooling water maximum pressure	16 bar

Correct orifice size (mm) for max water flow through oil cooler

3 bar	4 bar	5 bar	6 bar	7 bar	8 bar	9 bar	10 bar	12 bar
8	7.5	7	6.5	6.3	6.2	6	6	5.5

System oil pressure alarm setting	3 bar
High oil temperature alarm setting	80 deg. C
Gearbox weight (without oil)	1200 kg

3 GENERAL DESCRIPTION

This NORGEAR gearbox is designed as a speed increasing or speed reduction unit, depending upon the application. Please refer to Section 2 for the exact gear ratio.

The gear case sections are manufactured in grey cast iron or fabricated steel. Gearwheels are single helical case hardened steel with ground tooth flanks.

All bearings are anti-friction type supplied from leading manufacturers.

The gearbox has been built to the Rules and under Survey of the Classification Society indicated in Section 1.

4 INSTALLATION

Adjustable units (i.e. pressure limiting valves and lubrication control valves) have been set for the specified pressure and oil flows during the Works test.

The gearbox is delivered with lifting eyebolts in place.

The gearbox seating should have a machined top surface and machined supporting chocks should be used. "Chock fast" or other approved resin compounds may be used if accepted by the surveyor. It is imperative that the gearbox seating bearers are fully supported on their entire surface area before the foundation bolts are tightened down. If not, the casing may be distorted and gear tooth contact will suffer.

To simplify the alignment, the bearers are provided with threaded boltholes for jacking screws at each corner.

Round discs or shim plates arranged one upon the other must not be used as fitted pieces. The gearbox must be secured on the foundation against displacement by four fitted bolts at the corners. When tightened all bolts must be secured.

When a flexible coupling is fitted, alignment must be within the limits set by the coupling manufacturer. If in doubt, please contact Kumera AS technical department. This also applies to the output shaft and the connection to the driven equipment.

If the driven equipment is mounted to the gearbox by a spigoted flange, the correct alignment is ensured by our machining tolerances.

No axial loads are allowed on input or output shafts.

Installation also includes connection of cooling water supply to the oil cooler. When installing a sea water cooling system it is required to install a good filtration system ensuring not to clog the oil cooler. Ensure to install correct orifice on water outlet side.

In addition installation includes electrical power to the clutch control solenoid valve. Please refer to Section 2 for the required information on the above-mentioned points.

The total oil charge is contained within the gear case. Oil filling and breathing connections are provided. The oil grade and quantity will be found in Section 2 and on the identification plate attached to the gear case.

5 LUBRICATION SYSTEM

While running, all bearings and gear mesh are lubricated and cooled by the mechanically driven oil pump, or electric driven oil pump if supplied. The system comprises an oil pump, cooler and filter.

Pump

The mechanical oil pump is usually assembled on the end of the input shaft but another continuously running shaft may be used in special situations.

Oil cooler

The tubular oil cooler is placed on the pressure side of the oil pump. It is mounted on the gear case and must have a continuous water supply. An orifice ring must be fitted to control the water flow within the design limits of the cooler. It is recommended to mount this on the outlet side of the cooler.

Filter

The oil filter includes a fibreglass cartridge, relief valve and a mechanical indicator that shows when the cartridge must be replaced. The cartridge is disposable - do not try to wash and re-use it.

6 CONTROL AND ALARM SYSTEM

Local reading gauges are provided for:

- System oil pressure
- System oil temperature

Alarm switches are provided for:

- Low system oil pressure
- High system oil temperature

Oil pressure will vary with speed and oil temperature. Typical settings:

Oil pressure	3 to 7 bar
Oil temperature	40 to 70 deg. C

For alarm set points - please see Section 2.

The alarm sensors are wired out to a terminal box mounted on the gear case, see Section 2.

Additional sensors for remote oil pressure and temperature will be provided when specified.

7 OPERATING INSTRUCTIONS

Oil level

The gearbox is not filled with oil when delivered. The oil level can be checked by means of the dipstick when the gearbox is stationary. Approximate quantity is specified on the identification plate on the gear case and also the recommended grade of oil.

Lubricating oil circulation

The gearbox lubrication oil spray from the internal nozzles may be observed through the inspection windows.

Cooling water

Check that the cooling water is passing through the oil cooler at the required rate of flow. The water inlet and outlet connections on the cooler are interchangeable on a two-pass cooler.

Oil recommendation

A high quality mineral gear oil with EP additives, having good anti wear performance with low corrosion, oxidation and foaming properties must be used. The oil must meet the FZG A/8,3/90 load stage 12+.

The oils listed below have been used with good experience. If you wish to use other equivalent gear oils, contact your oil supplier, ensuring the mentioned requirements are met.

Note: Any extra additives must not be used. In such case our warranty will not be valid.

Approved oils

BP	Energol GR-XP 150
Castrol	Alpha SP 150
Esso	Spartan EP 150
Exxon Mobil	Mobilgear 629
Shell	Omala oil 150
Texaco	Meropa 150

Synthetic oil grades meeting the above requirements in addition to be compatible with mineral oils may be used. Contact your oil supplier for recommended grade.

Oil temperature

Normal oil temperature in the gearbox sump will range from 40 - 70 deg. C. The temperature switch is set at 80 deg. C and it will initiate an alarm at higher temperatures.

8 MAINTENANCE

Oil change

The oil in the gearbox must be changed after approximately the first 300 hours of operation and thereafter at each 5000 hours or annually.

Oil analysis

Regular monitoring of the oil condition should be carried out every 3 months by sample analysis.

Oil filter

The oil filter cartridge must be changed at each oil change. Also replace the cartridge if the mechanical indicator shows that it is necessary. The cartridge is a disposable design; do not try to wash it.

Oil cooler

Check the appearance of the oil in the gearbox on a regular basis. A greyish colour indicates that the oil has become contaminated with water. The oil must then be changed immediately and the filter cartridge renewed.

A leaking oil cooler causes the trouble. The cooler must be removed from the gearbox and checked. To check the tightness between the oil and water sections one of the sections should be pressurised with compressed air to a maximum pressure of 10 bar.

A leaking oil cooler may also cause a flow of oil into the water section should the oil pressure exceed the water pressure. The result is of course, loss of oil from the gearbox. Again it is necessary to check the tightness as described above.

If pressure testing reveals a leakage, the cooler should be dismantled and thoroughly inspected. If both the tube stack and the end covers are badly corroded, the whole cooler must be replaced. If the tube stack is acceptable and the end covers defective, it may be sufficient to change the end covers only.

Pump couplings / spline sleeves

Pump couplings should be inspected once a year and re-greased if necessary with an NLGI 2 grease with long fibres.

Inspections

We recommend yearly regular inspections to be carried out on the units. This is an extended inspection offered by Kumera AS and are recommended in addition to owners maintenance programme.

Overhaul

We recommend regular overhaul to be carried out by Kumera AS or by an official authorized Kumera Service partner. This should be done in accordance with classification requirements and bearing lifetime or at least every third year.

9 SPARE PART KIT

We strongly recommend you keep in stock onboard basic spare parts to avoid any shutdown during operation.

Such parts should include:

- Oil filter elements
- Oil cooler
- Oil pump
- Pressure gauge
- Temperature gauge
- Pressure switch
- Temperature switch
- Breather plug
- Shaft seals

Only original spare parts must be used. Please contact our After Sales department to ensure original spare parts are being supplied.

10 SERVICE

Kumera AS offers worldwide service and planned inspections. Please do contact our After Sales department if you need assistance.

Tel: +47 33 48 54 48
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11 STORAGE

The inside of the housing is anti-corrosion protected only intended for short time protection during transportation and a short storage time if stored in a covered dry place.

All bright parts, i.e. flanges and drive shafts, are coated with a preservative before shipment from Kumera AS, intended for short time protection only during transportation and short time storage in a covered dry place. Connections i.e. oil and water, which cannot be completed until the unit has been installed are closed with plugs at our Works. Any connections or pipes that must be modified in the course of installation should definitely be acidified and cleaned before use.

If the gearbox cannot be installed immediately on delivery to the shipyard, it should be stored in a dry and temperate place. Ensure protection of both inner and outer parts. For long time storage the unit should be filled completely with oil, the breathing plug sealed, and the shafts must be turned every second month so all shafts rotates minimum a half turn. Other additives intended for long time storage may be used.

12 GUARANTEE

Please see the Contract for the particular gearbox regarding terms and conditions.

Following additional Kumera AS terms are always part of our deliveries:

Guarantee covers replaced parts only.

Guarantee covers working hours used by Kumera AS service personnel only.

Guarantee does not cover travel expenses, hotel, daily allowance and other related costs.

Guarantee does not cover any indirect loss, loss of profit and/ or any consequential damage.

Any modifications and/ or work done on the unit by unauthorised personnel without a written consent of Kumera AS will make the guarantee invalid.

Kumera AS shall have copy of aligning data together with a report after start up of the system for the guarantee to be fully valid.

For the guarantee to be valid, all instructions in this manual must be followed!

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FVE-355

Customer	Voith Turbo Marine	Released date	24.11.2006
Project no.	N92876, N92877, N92878, N92879	Made by	DH
Gear ratio	2.593 : 1	Revision date	04.06.2007
Assembly drawing	N1-01331A	TVC diagram	N4-01444
Dimension drawing	N3-90554	Hydraulic diagram	N3-03434
		Classed by	GL

Pos	Qty.	Name, type	Drawing no.	Part no.
1	1	HOUSING MACHINED FV-355	N1-01330A	N300117
2	1	SHAFT FIXED	N2-01177	N2025309
3	1	SHAFT FIXED	N2-01178	N2025298
4	1	GEAR WHEEL FIXED, Z=27	N3-03436	N2025287
5	1	GEAR WHEEL FIXED, Z=31	N3-03437	N2025276
6	1	SPLINE SLEEVE	N3-02079	N101149
7	1	SLEEVE	N4-01544	N2036705
8	1	COVER SEALED	N3-03186	N2006184
9	1	COVER SEALED	N3-03438	N2025266
10	1	COVER END	N3-03267	N2013897
11	1	PUMP BRACKET	N3-03189A	N2006244
12	2	SPACER	N3-01738-ITEM 2	N2006243
13	1	SPACER	N4-01450	N2025316
14	1	SPACER	N4-01451	N2025315
15	1	SPHERICAL ROLLER BEARING		N101872
16	1	SPHERICAL ROLLER BEARING		N102067
17	2	CYLINDRICAL ROLLER BEARING		N101810
18	1	RECTANGULAR KEY	NS 83	N2025311
19	2	RECTANGULAR KEY	NS 83	N2025310
20	2	OIL SEAL		N103206
21	2	OIL SEAL		N103218
22	1	O-RING		N102885
23	1	LOCK WASHER		N102197
24	1	LOCK WASHER		N102203
25	1	SHAFT NUT		N102159
26	1	SHAFT NUT		N102165
27	2	CIRCLIP SEEGER	DIN 471	N102410
28	1	BREATHER PLUG		N101068
29	1	DIP STICK PLUG		N101065
30	3	DOWEL PIN	DIN 1481	N2002902
31	4	EYE BOLT	DIN 580	N100880
32	8	CAP SCREW	DIN 912	N100359
33	3	CAP SCREW	DIN 912	N100194
34	4	TAPER PIN	DIN 7977	N100858
35	24	HEX.HEAD SCREW	DIN 931	N100480
36	10	HEX.HEAD SCREW	DIN 933	N100640
37	4	HEX.HEAD SCREW	DIN 933	N100626
38	12	HEX.HEAD SCREW	DIN 933	N100644
39	6	HEX.HEAD SCREW	DIN 933	N100642
40	6	HEX.HEAD SCREW	DIN 931	N100447
41	1	PLUG		N2000072
42	1	FITTING		N2000074
43	2	GREASE NIPPLE		N2000356
44	4	OIL NIPPLE		N2001057
45	1	COVER INSPECTION		N2000075
46	1	COVER INSPECTION		N2006197
47	1	OIL FILTER - DUPLEX		N2025279

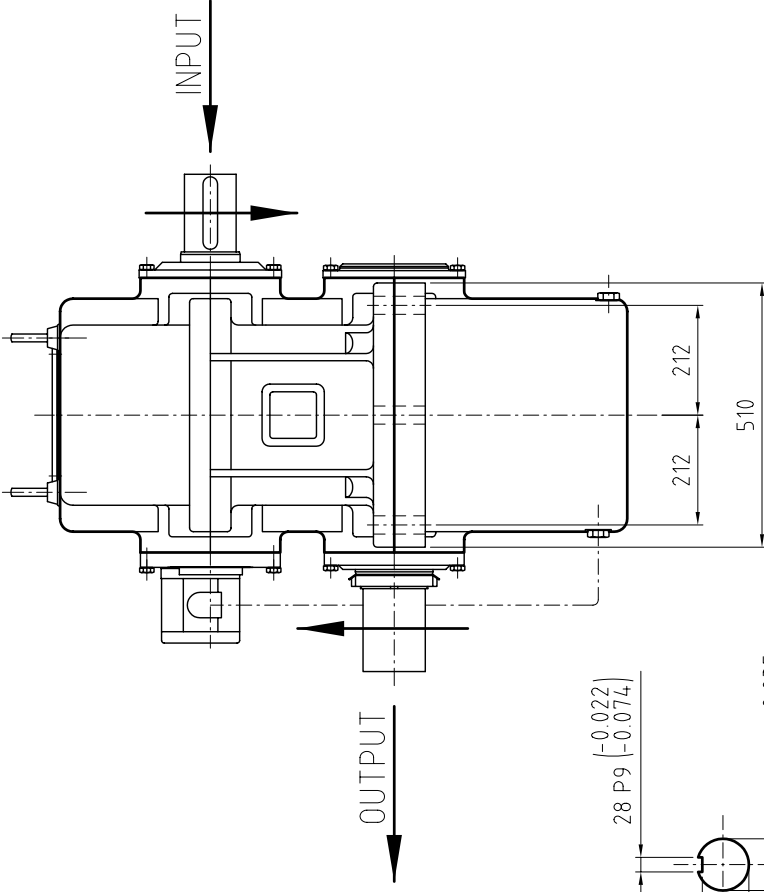
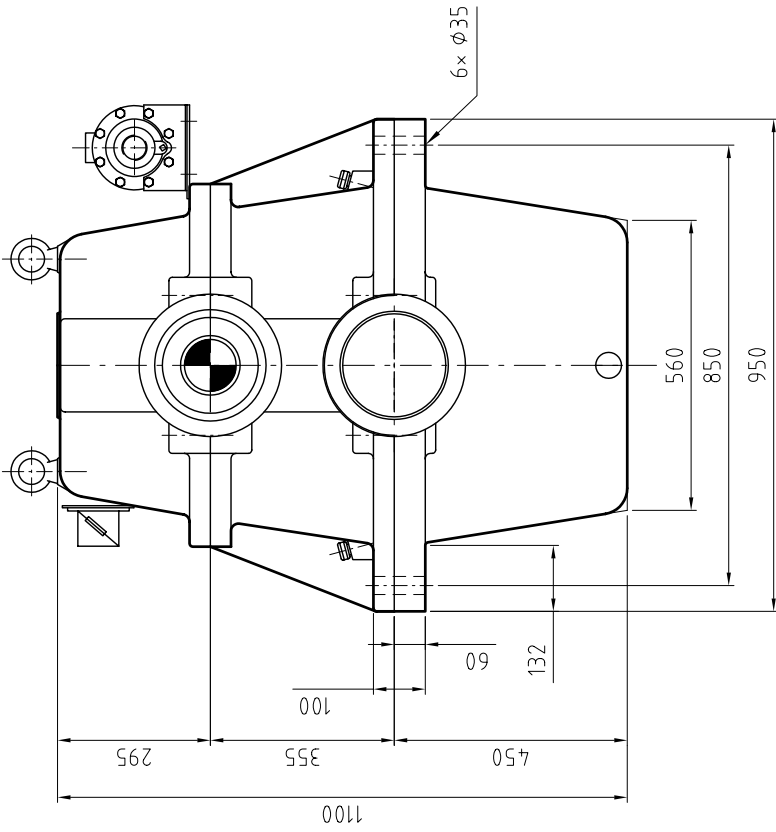
PART LIST N3897B

FVE-355

Customer	Voith Turbo Marine	Released date	24.11.2006
Project no.	N92876, N92877, N92878, N92879	Made by	DH
Gear ratio	2.593 : 1	Revision date	04.06.2007
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Dimension drawing	N3-90554	Hydraulic diagram	N3-03434
		Classed by	GL

Pos	Qty.	Name, type	Drawing no.	Part no.
48	1	OIL COOLER	SEAWATER	N101113
49	1	PRESSURE GAUGE		N101050
50	1	PRESSURE SWITCH		N101012
51	1	TEMPERATURE GAUGE		N103284
52	1	TEMPERATURE SWITCH		N101060
53	1	TEST VALVE	1 IN-1 OUT	N101027
54	1	TERMINAL BOX	N4-00381	N2013040
55	1	OIL PUMP	CCW, 23CCM	N102561
56	1	SPACER	N4-01545	N2036704

This drawing must not be copied or disclosed to third parties without written permission.

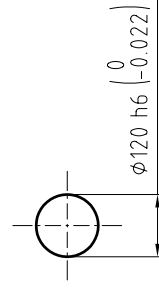


28 P9 (-0.022 / -0.074)

90-02

$\phi 100$ m6 (+0.035 / +0.013)

Input shaft



Output shaft

Kumera AS order nos. N92876, N92877, N92878, N92879, CEKSAN Gemi Insa Celik Shipyard hull nos: 41, 42, 43, 44.

Design data:

Power, P: 780 kW.

Input speed, n1: 1500 rpm.

Output speed, n2: 579 rpm.

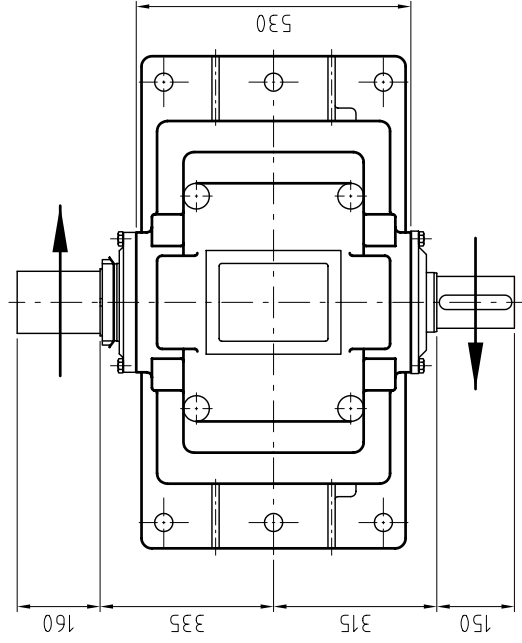
Cooling water media: Seawater @ max. 32°C

Required cooling water flow: 26 lpm

Heat dissipation of oil cooler: 15 kW

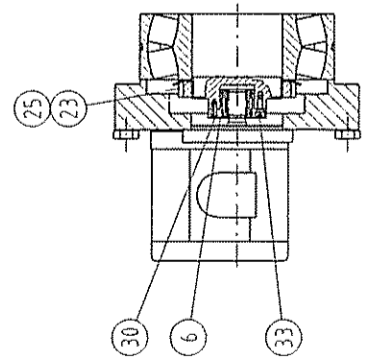
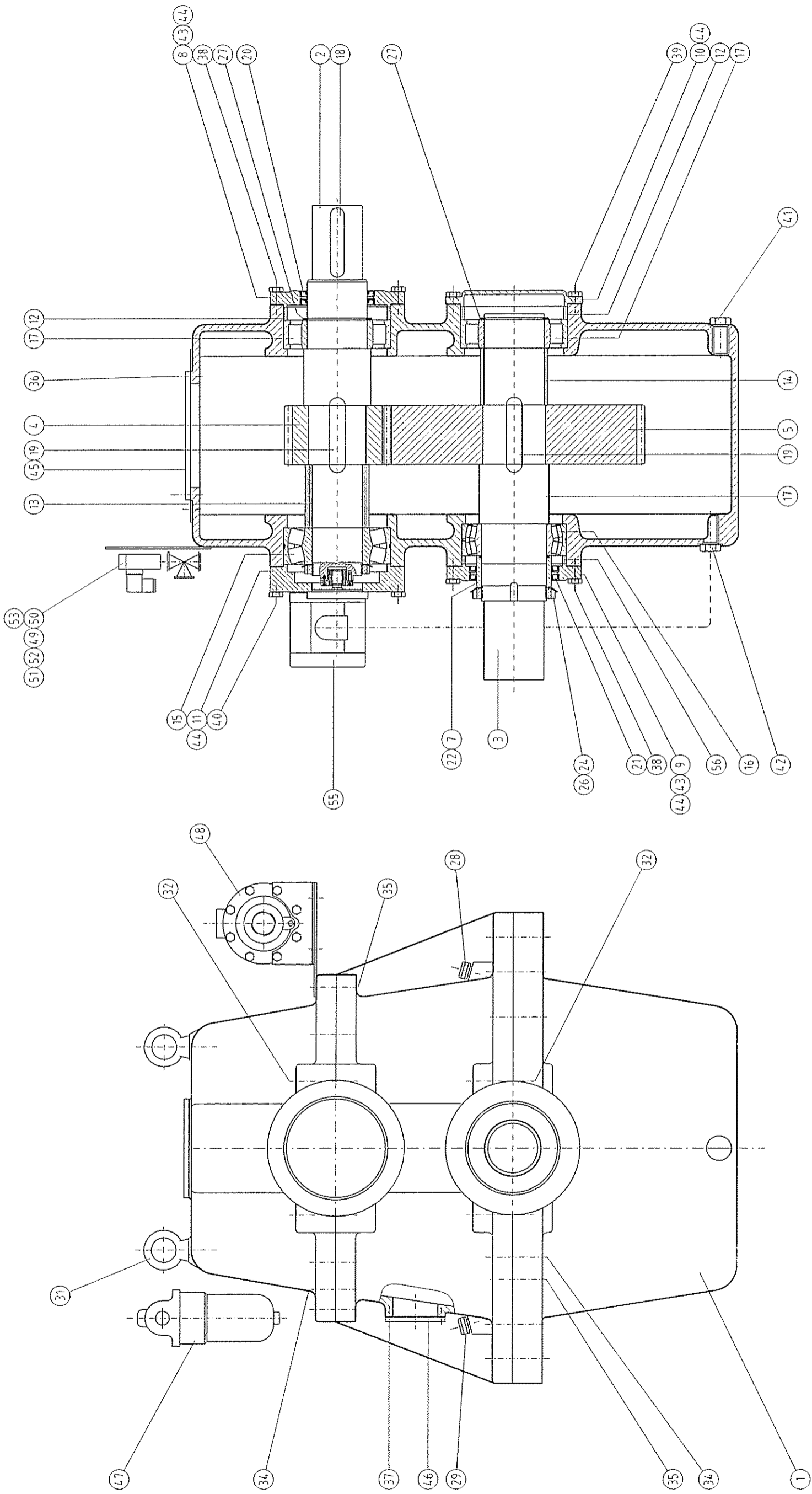
Oil cooler inlet/outlet water connections: 1" BSP

Survey: GL on behalf of Turk Lody.



Code	Material no.	Surface	Scale	Draw.	Check.	Appr.
		12.5	1:10	08.11.06		
				D.H.		
				Old		
				New		
Product		Drawing no: N3-90554				
Name		Dimension drawing				
KUMERA AS						
Power Transmissions						
Sandefjord, Norway						

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Kumera AS order nos. N92876, N92877, N92878, N92879,
CEKSAN Gemini Insa Celik Shipyard hull nos. 4.1, 4.2, 4.3, 4.4

Design data

Power P 780 kW

Input speed n1 1500 rpm

Output speed n2 579 rpm

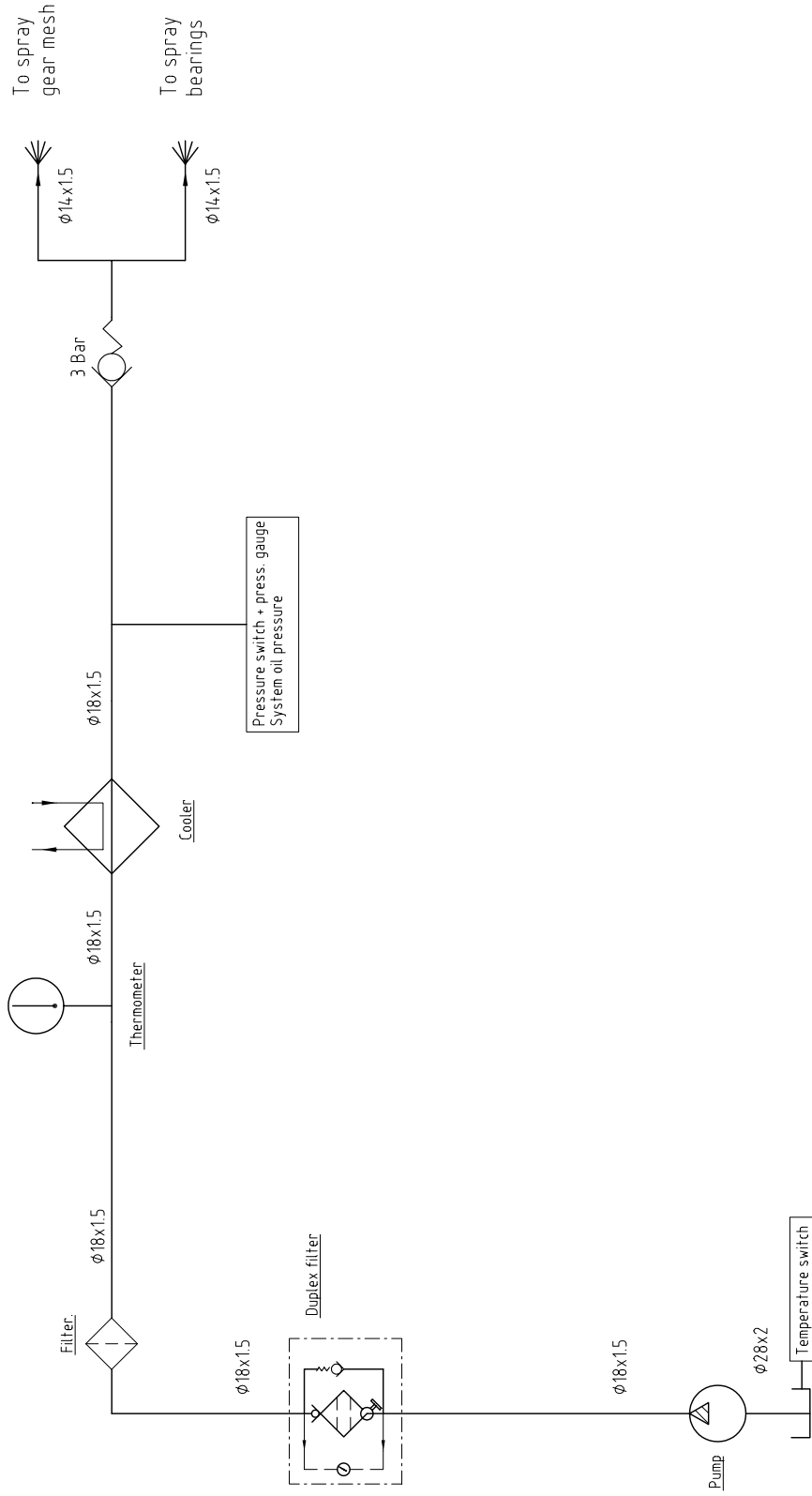
Parts list N3897

Project no	Project	Scale	Drawn	Checked
	FVE-355	1:4	ZL 1186	DH
Product	Assembly Drawing			
Company	KUMERA AS			
Peer Transmission				
Shipyard, Norway				
				N1-01331A

Author	Checked	Approved
10.05.07	11	11
Rev. 01	Rev. 01	Rev. 01
Date	Revision	Name

Material	1.4308	1.4308	1.4308	1.4308	1.4308	1.4308	1.4308	1.4308	1.4308	1.4308
Normal dia	10	12	14	16	18	20	22	24	26	28
Outer dia	10	12	14	16	18	20	22	24	26	28
Inner dia	8	10	12	14	16	18	20	22	24	26
Length	10	12	14	16	18	20	22	24	26	28
Weight	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Notes	All dimensions are in mm unless otherwise specified.									

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System oil pressure switch setting: 3 bar.
 System oil temperature switch setting: 80°C.

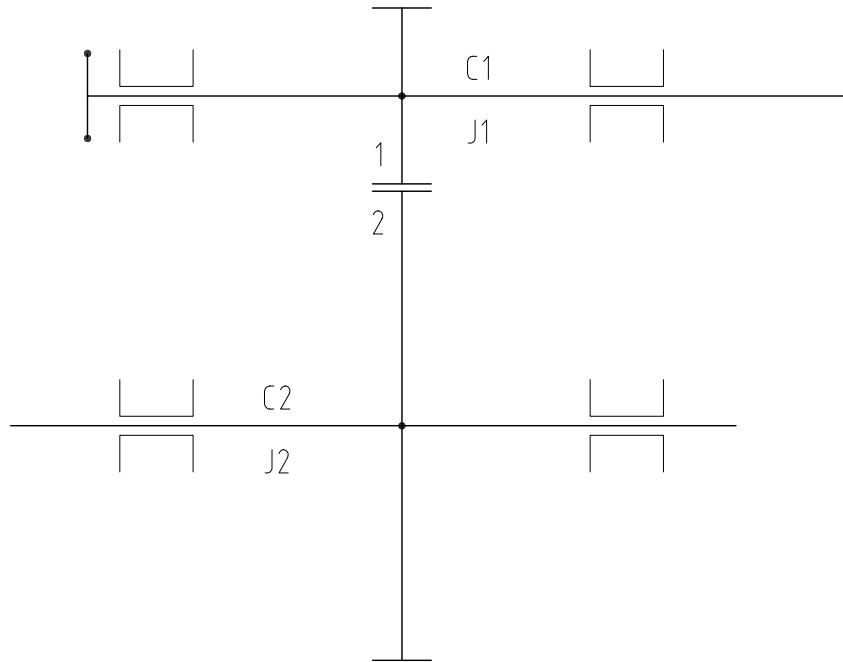
Code	Material no.	Surface	Scale	Draw.	Check.	Appr.
		12.5	1:1	08.11.06		
		Product		D.H.		Old
		FVE-355		New		
Name		Drawing no:				
KUMERA AS		N3-03434				
Power Transmissions						
Sandefjord, Norway						
Name		Hydraulic diagram				

Kumera AS order nos: N92876, N92877, N92878, N92879.

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Ref.	Ant.	Revisjon	Dato	Intro.	Godkj.

i = 1 : 2.593



J1 = Moment of inertia of : Input shaft + Gear wheel 1
 J2 = Moment of inertia of : Output shaft + Gear wheel 2

C1 = Torsional stiffness of input shaft when driving output shaft
 C2 = Torsional stiffness of output shaft

Moment of inertia, kgm²:

J1	0.260
J2	6.55

Torsional stiffness, x10⁶ Nm/rad:

C1	3.56
C2	5.23

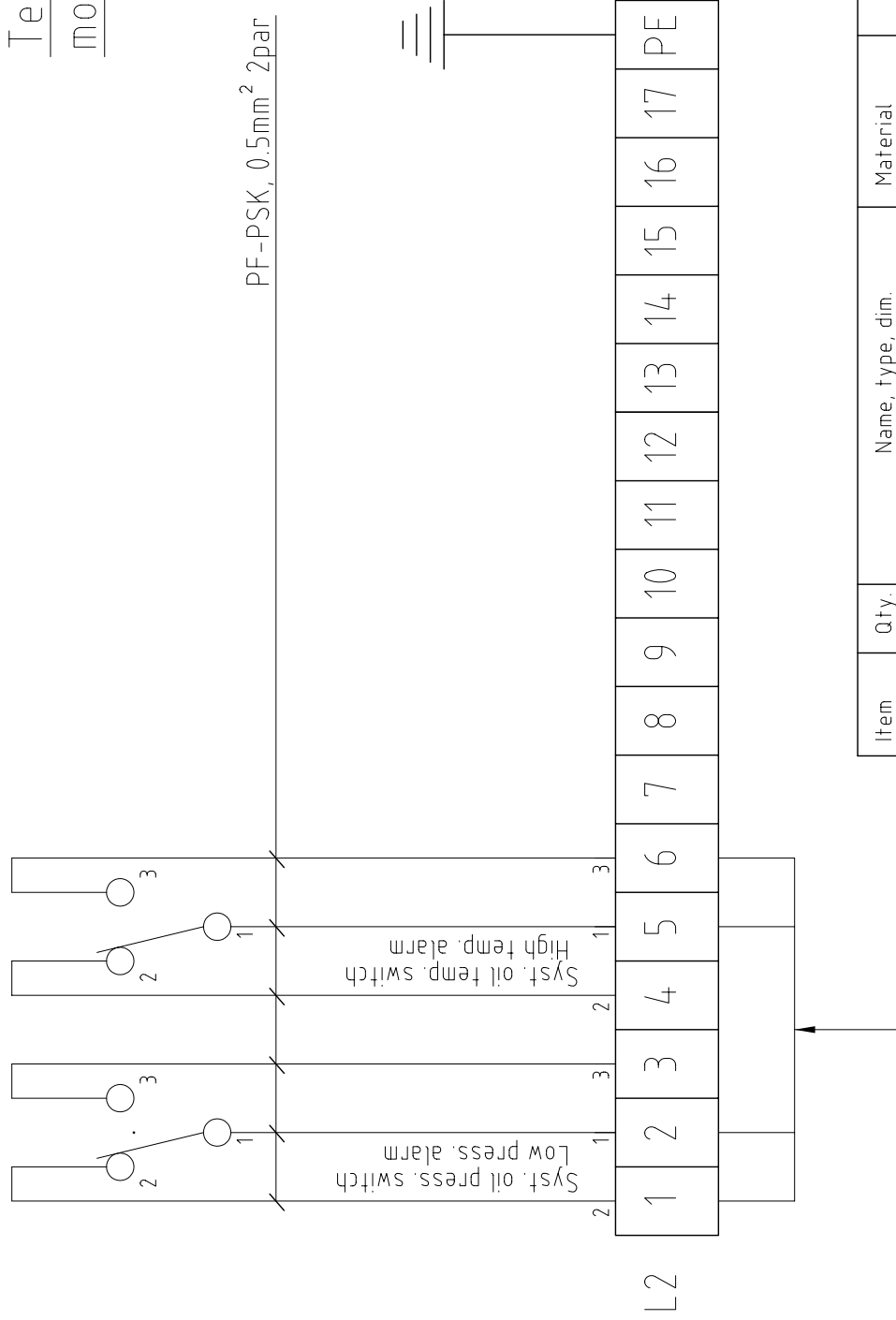
Item	Qty.	Name, type, dim.	Material	Mod.No	Drwg. no. - Notes	
Customer: Voith Turbo Marine		Drawn by: D.H.	Appr.	Scale -	Replacement for:	Replaced by:
Kumera AS		FVE-355			File N4-01444	Date 08.11.06
Project no.: N92876-9		Torsional data			Drawing no.: N4-01444	

This drawing must not be copied or disclosed to third parties without our written permission.

Ref. Ant.	Revision	Date	Intro.	Godk.j
/				

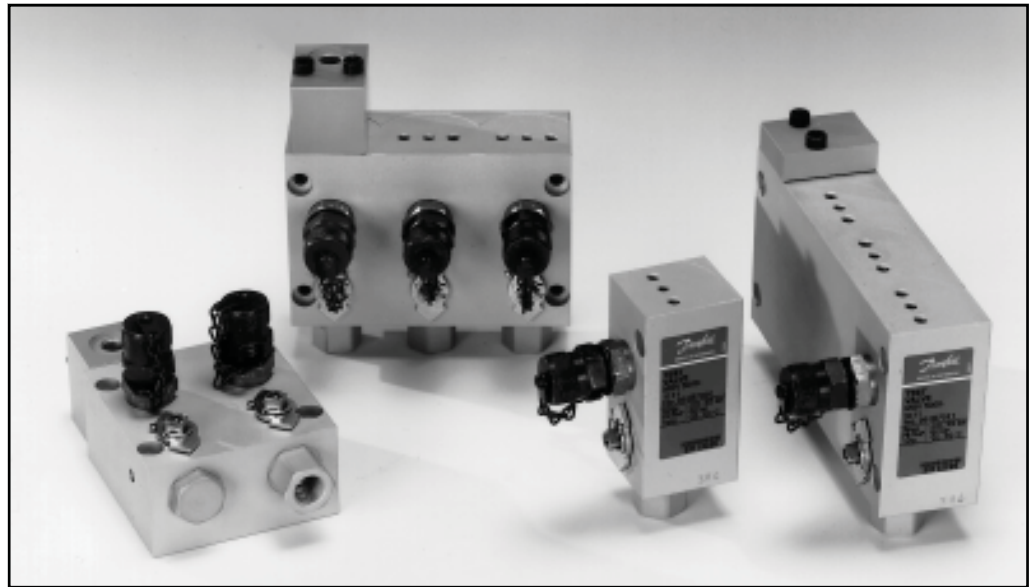
Terminal box mounted on gearbox

PF-PSK, 0.5mm² 2par



Item	Qty.	Name, type, dim.	Material	Mod.No	Drwg. no. - Notes
Customer:		Drawn by: D.H.	Appr.	Scale -	Replaced by:
Kumera AS		<u>Terminal box</u>			File N4-00381
Project no:		Connections			Date 10-08-98
					Drawing no: N4-00381

Pressure test valve MBV 5000



The block concept has been developed to save space, weight, and costs. The product is intended for use in many applications, for example: monitoring, alarm indication, shut-down, diagnosing on equipment such as motors, gears, thrusters, pumps, filters, compressors, etc.

The range contains block pressure controls, block pressure transmitters, block test valves and accessories.

The concept meets the strict demands on marine equipment, including EU stipulations on such products.

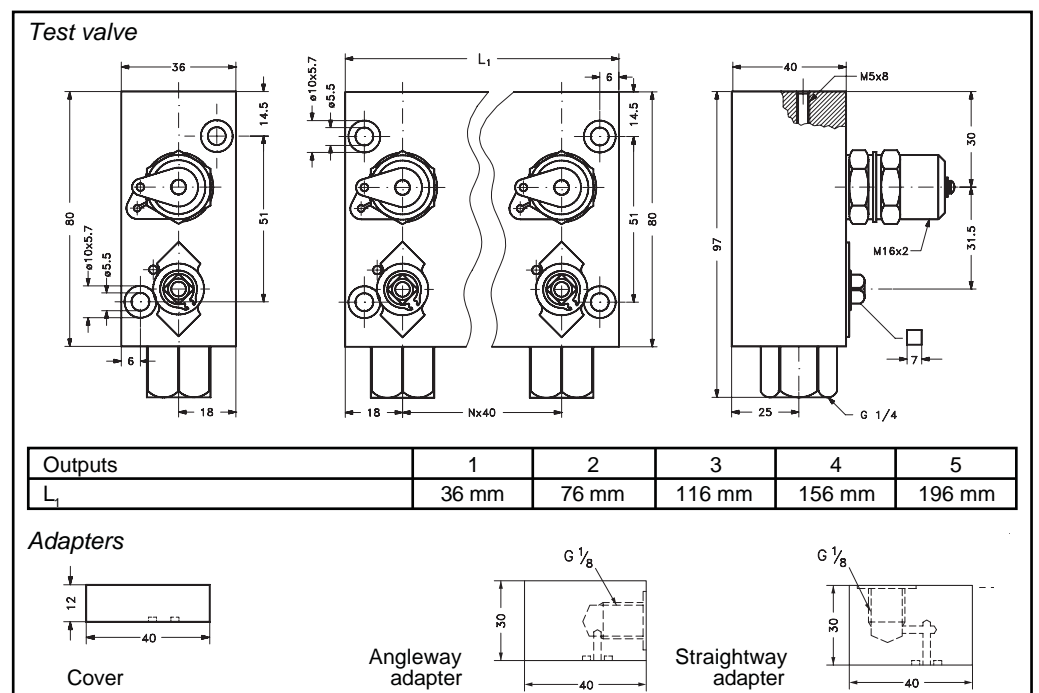
Block valve MBV 5000

MBV 5000 is a block valve designed in many different configurations for use in the marine industry. The valve meets demands for fast installation, simple isolation, and easy test pressure connection.

Advantages

- Compact design
- Light material
- Many configuration possibilities
- Low installation costs
- Fast and easy to operate

Dimensions



Technical data

Performance

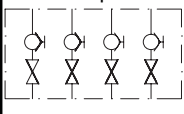
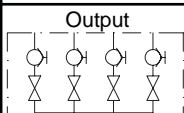
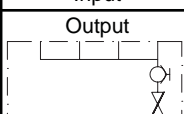
Pressure	Overload pressure Burst pressure Operating pressure	180 bar 250 bar 0 to 120 bar
Temperature	Operating temperature Ambient temperature Temperature of medium	-20 to 120°C -20 to 120°C -20 to 120°C


Mechanical


Material	Housing Nipple Ball Gasket	Anodized AlMgSi1 AlMgSi1 1.4571 PEEK/FPM
Pressure connection	Input Output	G 1/4 Flange / M5 x 8

Specification and code numbers for standard types

Pressure connection: G 1/4. Test pressure connection: M16 x 2

Symbol	Type	Output no.	Weight kg	Length mm	Height mm	Width mm	Type no.	Code no.
	1	x1	0.4	36	80	40	MBV5000-1111	061B7000
		x2	0.8	76	80	40	MBV5000-1211	061B7001
		x3	1.2	116	80	40	MBV5000-1311	061B7002
		x4	1.6	156	80	40	MBV5000-1411	061B7003
		x5	2.0	196	80	40	MBV5000-1511	061B7004
	2	x2	0.8	76	80	40	MBV5000-2211	061B7005
		x3	1.2	116	80	40	MBV5000-2311	061B7006
		x4	1.6	156	80	40	MBV5000-2411	061B7007
		x5	2.0	196	80	40	MBV5000-2511	061B7008
			3	x2	0.7	76	80	40
x3	1.0			116	80	40	MBV5000-3311	061B7010
x4	1.3			156	80	40	MBV5000-3411	061B7011
x5	1.6			196	80	40	MBV5000-3511	061B7012

 Test pressure connection

 Shut-off valve

Code numbers for standard flange → G 1/8 adapters

Description	Code no.
Cover	061B7200
Angleway adapter	061B7201
Straightway adapter	061B7202

Ordering special versions

Type no: MBV 5000-

Type	x	x	x	x	Pressure connection
Separate inputs and separate test functions	1			1	G 1/4
Common input and separate test functions	2			2	M10 x 1
Common input and common test function	3			x	Other
Other	X				
Number of outputs (n)					Test pressure connection
1 Output (only for type 1)	1	0			Hole plug G 1/4
2 Outputs	2	1			Pressure gauge connection M16 x 2
3 Outputs	3	X			Other
4 Outputs	4				
5 Outputs	5				
Other	X				

Heavy duty pressure controls

MBC 5000 and MBC 5100

Features



- Designed for use in severe industrial environments
- High vibration stability
- Part of the block system, consisting of MBC pressure controls, MBS pressure transmitters and MBV test valves
- MBC 5100 with all major ship approvals
- High repeatability
- Optimal compact design for machine building purposes
- Intended for alarm indication, shut down, control and diagnostics in many applications - motors, gears, thrusters, pumps, filters, compressors etc.

Ship approvals MBC 5100

Lloyd's Register of Shipping
Germanischer Lloyd
RINA, Registro Italiano Navale
NKK, Nippon Kaiji Kyokai
DNV, Det Norske Veritas

BV, Bureau Veritas
American Bureau of Shipping
KRS, Korean Register of Shipping
RMRS, Russian Maritime Register of Shipping

Approvals

EN 60947-4-1
EN 60947-5-1

CCC, China Compulsory Certificate

Technical data

Performance

Repeatability	Bellows versions	± 0.2 % FS (typ.) ± 0.5 % FS (max.)
	Diaphragm versions	± 0.5 % FS (typ.) ± 1 % FS (max.)
	Piston versions	± 1 % FS (typ.) ± 1 % FS (max.)
Response time		< 4 ms
Max. switch frequency		10/min (0.16 Hz)
Differential		see page 3
Permissible operating pressure		see page 3
Burst pressure		see page 3
Life time	Mechanical for diaphragm and bellows Mechanical for piston type Electrical at max. contact load	> 400,000 cycles > 1 million cycles > 100,000 cycles

Electrical specifications

Switch	SPDT			
Contact load	AC 1	10 A, 250 V	AC 15	0.5A, 250 V
	AC 3	3A, 250 V	DC 13	12 W, 125 V

Environmental conditions

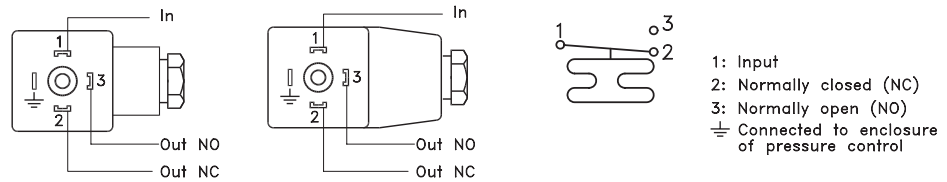
Temperature	Operation	Bellows versions Diaphragm versions Piston versions	-40 to +85 °C -10 to +85 °C -40 to +85 °C
	Transport	Bellows versions Diaphragm versions Piston versions	-50 to +85 °C -50 to +85 °C -40 to +85 °C
Enclosure			IP 65, IEC 529
Vibration stability	Sinusoidal	20 g, 25 Hz - 2 kHz	IEC 68-2-6
		piston type 4.4g, 25-200 Hz	IEC 60068-2-27

Technical data
(continued)

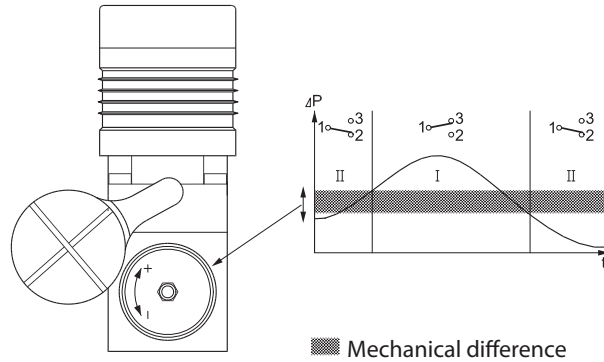
Mechanical characteristics

Pressure connection	Standard Option	G 1/4 female (ISO 228/1) or flange see specification form, page 3
Electrical connection	Plug	DIN 43650, Pg 9 / Pg 11 / Pg 13.5
Wetted parts material	Housing Bellows Diaphragm Piston O-ring	Anodized AlMgSi1 Stainless steel 1.4306 (18/8) Viton Stainless steel 1.4028 (3H13) NBR
Enclosure material	Housing Plug fixture Contact system	AlMgSi1 Glass filled polyamid, PA 6.6 Silver (AG) microprofile
Weight		0.4 kg

Electrical connection

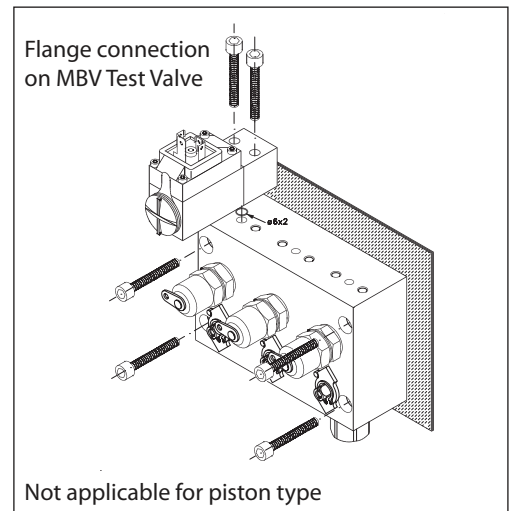
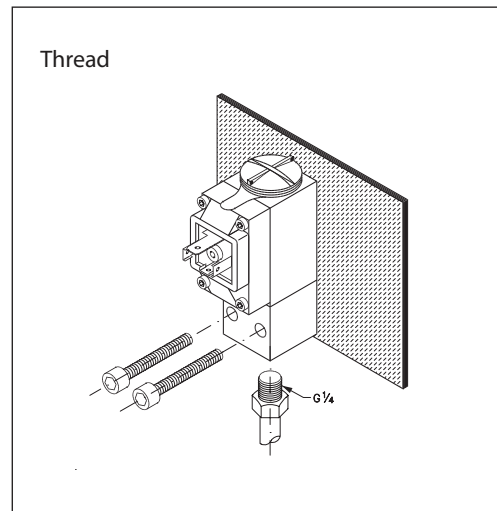


Adjustment



One full turn (360°) of MBC setting screw is approx. equal to 7% of the setting range

Mechanical connection



How to choose

To achieve the best operating conditions for MBC pressure controls, it is recommended to apply the following rules of thumb:

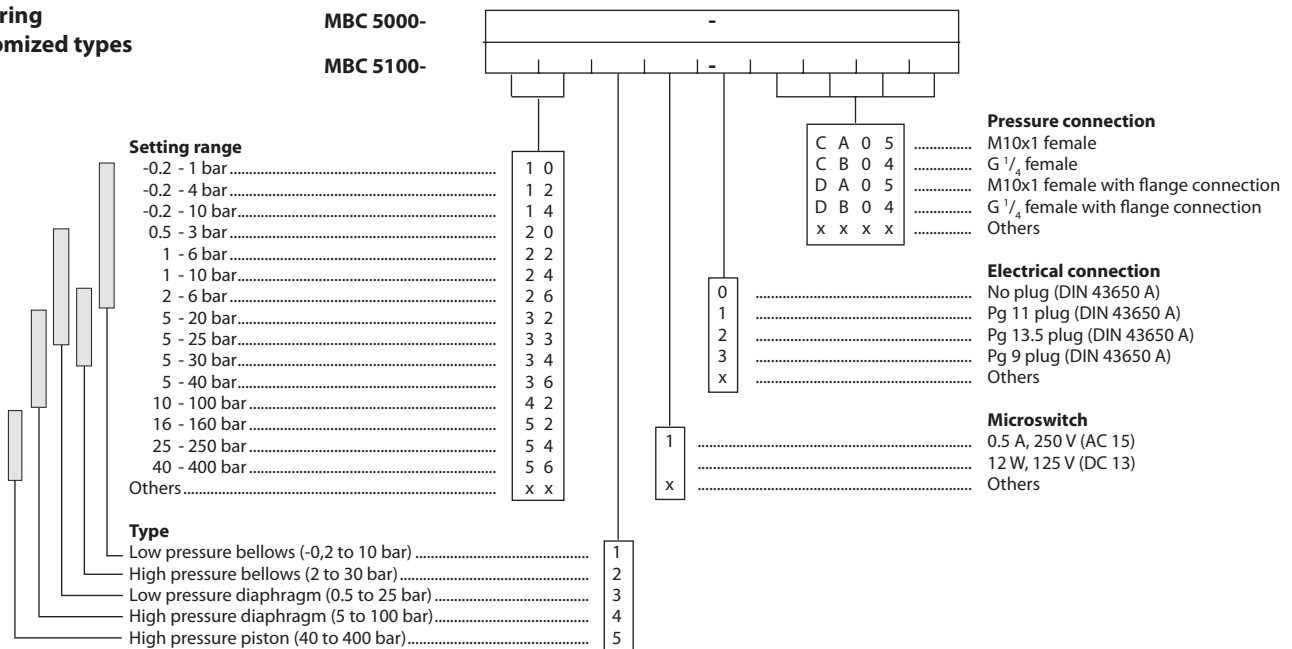
- Choose:
- the MBC type/types which meet the demands for the operating pressure
 - the MBC version with the lowest possible setting range
 - a diaphragm type, if pressure peaks and pulsations occur in the system (if possible)
 - bellows types, if low differential is needed
 - piston type for high pressure

Ordering standard types

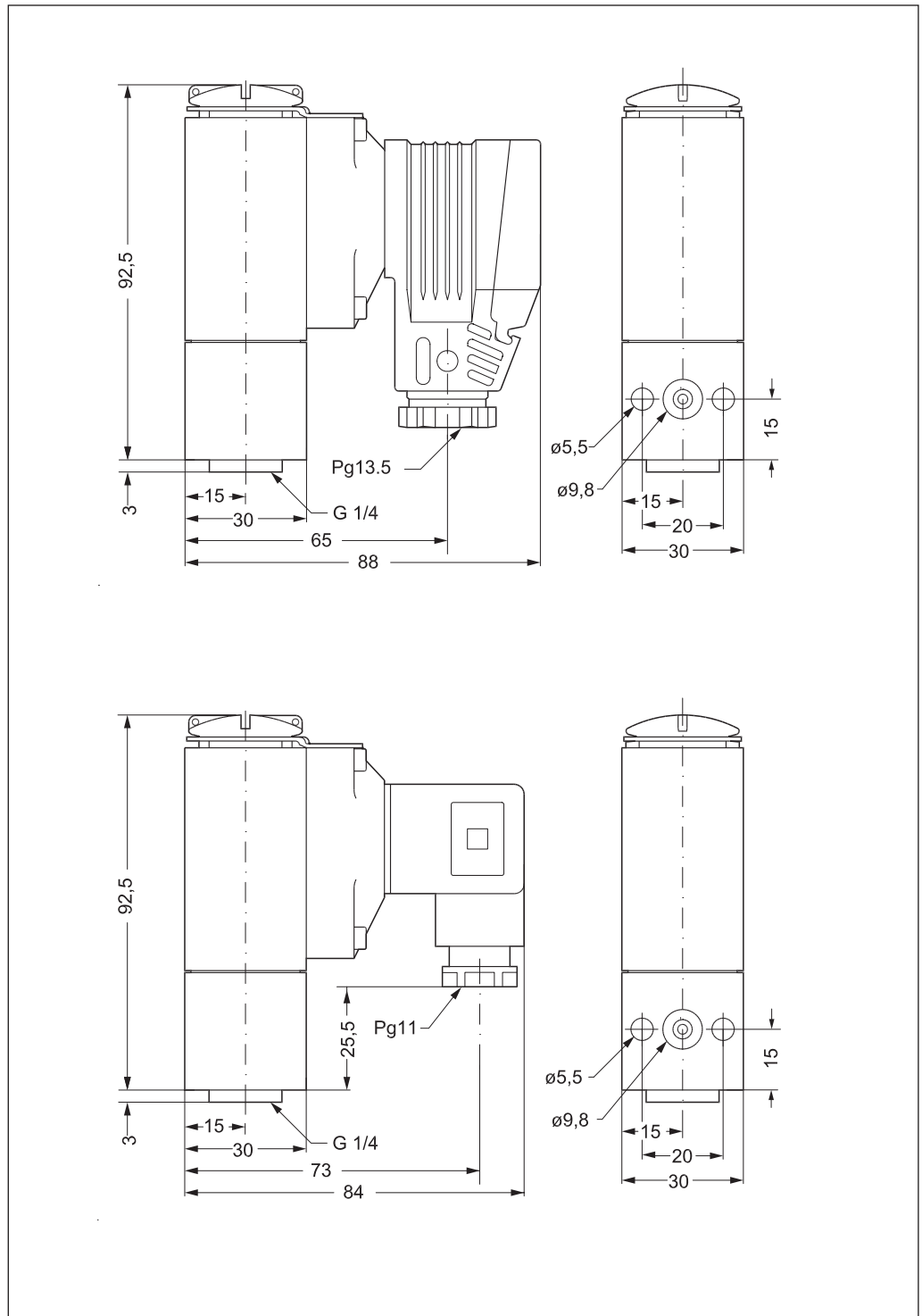
Type: LP = Low pressure HP = High Pressure	Setting range Pe [bar]	Fixed differential Pe [bar] (typ)	Permissible operating pressure Pe [bar]	Min. burst pressure Pe [bar]	Type designation MBC 5000-/ MBC 5100-	MBC 5100 Ship approved Code no.	MBC 5000 Standard Code no.
LP bellows	-0.2 to 1	0.15 to 0.45 ¹⁾	15	30	1011-1DB04	061B000566	061B200566
LP bellows	-0.2 to 4	0.15 to 0.45 ¹⁾	15	30	1211-1DB04	061B000466²⁾	061B200466
LP bellows	-0.2 to 10	0.15 to 0.60 ¹⁾	15	30	1411-1DB04	061B000266²⁾	061B200266
LP bellows	-0.2 to 10	0.15 to 0.60 ¹⁾	15	30	1411-1CB04	061B000066	061B200066
LP bellows	0.5 to 3	0.15 to 0.30 ¹⁾	15	30	2011-1DB04	061B002966	
LP bellows	1 to 6	0.15 to 0.45 ¹⁾	15	30	2211-1DB04	061B000766	
HP bellows	5 to 30	0.40 to 1.5 ¹⁾	45	90	3421-1DB04	061B000366²⁾	061B200366
LP diaphragm	0.5 to 3	0.25 to 0.80 ¹⁾	150	300	2031-1DB04	061B101766	
LP diaphragm	1 to 6	0.30 to 2.0 ¹⁾	150	300	2231-1DB04	061B100966	
LP diaphragm	1 to 10	0.30 to 2.0 ¹⁾	150	300	2431-1DB04	061B100466²⁾	061B300466
LP diaphragm	5 to 20	0.4 to 2.5 ¹⁾	150	300	3231-1DB04	061B100266²⁾	061B300266
LP diaphragm	5 to 25	0.4 to 2.5 ¹⁾	150	300	3331-1DB04	061B102466	
HP diaphragm	5 to 40	1.0 to 7.0 ¹⁾	150	300	3641-1DB04	061B100566²⁾	061B300566
HP diaphragm	10 to 100	1.7 to 14 ¹⁾	150	300	4241-1DB04	061B100366²⁾	061B300366
HP piston	16 to 160	12 to 30 ¹⁾	600	1200	5251-1CB04	061B510066	061B500266
HP piston	25 to 250	12 to 40 ¹⁾	600	1200	5451-1CB04	061B510166	061B500166
HP piston	40 to 400	15 to 50 ¹⁾	600	1200	5651-1CB04	061B510266	061B500066

¹⁾Lowest differential at min. setting range, highest differential at max. setting range
²⁾Preferred versions

Ordering customized types



Dimensions



Thermostats type MBC 8000 and MBC 8100

Description



MBC thermostats are temperature controlled switches designed for use in severe industrial environments. It consists of the standard series MBC 8000 and the special series MBC 8100 with ship approvals. In MBC thermostats special attention has been given to meeting demands for:

- compact design
- a high level of enclosure
- robust and reliable construction
- resistance to shock and vibration
- low differential and high repeatability

The MBC thermostat is part of the block controls programme consisting of MBC pressure controls and thermostats, MBS pressure transmitters and MBV test valves.

The thermostats are suitable for use in monitoring and alarm systems in factories, diesel plant, compressors, power stations and on board ship.

Approvals

CE marked acc. to EN 60 947-5-1
CCC, China Compulsory Certificate

Ship approvals, MBC 8100 only

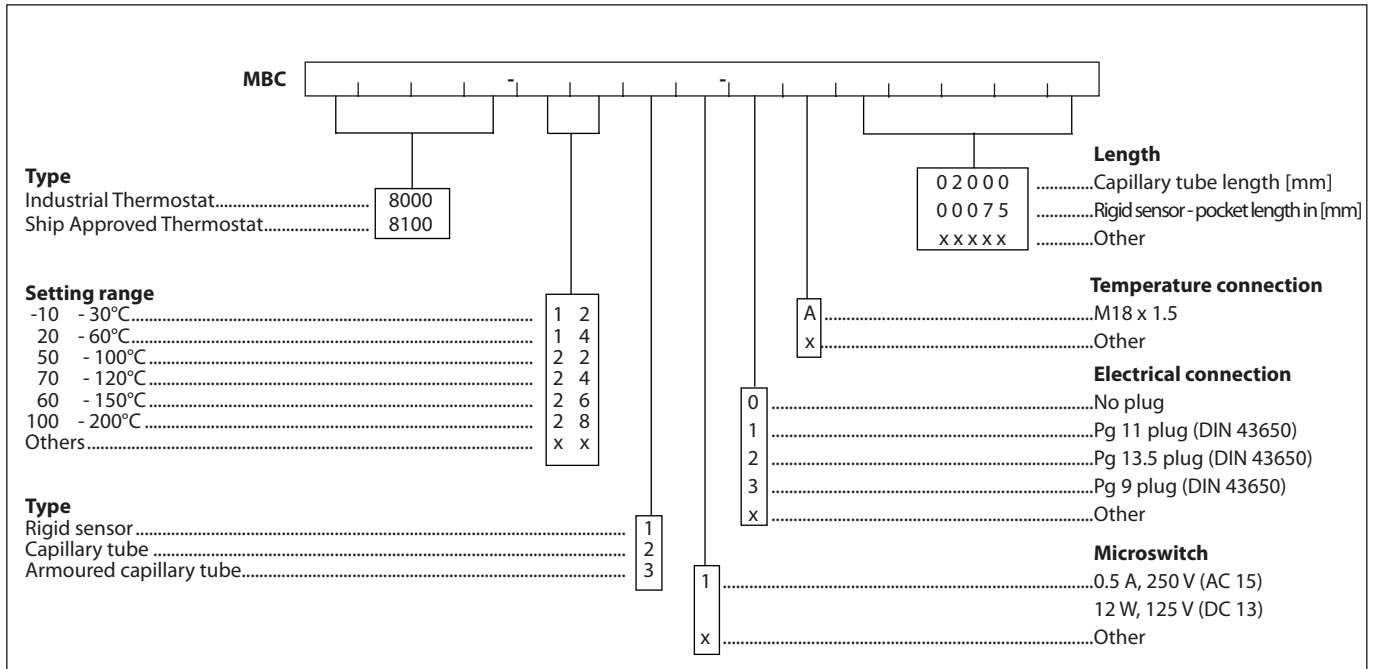
Det norske Veritas, Norway
American Bureau of Shipping
Lloyds Register of Shipping, UK
Germanischer Lloyd, Germany

Bureau Veritas, France
Registro Italiano Navale, Italy
Nippon Kaiji Kyokai, Japan
KRS, Korean Register of Shipping
RMRS, Russian Maritime Register of Shipping

Standard types

Setting range	Fixed diff.	Max. sensor temp.	Cap.-length	Capillary tube		Armoured capillary tube		Sensor pocket	Rigid sensor	
				Code no.	Type MBC 8100	Code no.	Type MBC 8100		mm	Code no.
-10 - 30	3	80	2	061B820166	1221-1A02000	061B810166	1231-1A02000			
20 - 60	3	130	2			061B810266	1431-1A02000			
20 - 60	3	130						75	061B800266	1411-1A00075
50 - 100	4	200	2	061B820366	2221-1A02000	061B810366	2231-1A02000			
50 - 100	4	200						75	061B800366	2211-1A00075
70 - 120	5	220	2			061B810466	2431-1A02000			
70 - 120	5	220						75	061B800466	2411-1A00075
60 - 150	6	250	2	061B820566	2621-1A02000	061B810566	2631-1A02000			
60 - 150	6	250						75	061B800566	2611-1A00075

Ordering of customized types



Technical data

Contact load (Alternating current):
 Inductive: 0.5 A, 250 V, AC15
 Direct current: 12 W, 125V, DC 13

Enclosure
 IP 65 to IEC 529 and DIN 40050.
 Anodized Al Mg Si 1.

Ambient temperature -40 to +70 °C

Electrical connection
 DIN 43650 plug, Pg 9, Pg 11, Pg 13.5

Shock resistance:
 50 g / 6 ms, 500 g / 1ms
 acc. to IEC 68-2-27
 Free fall acc. to IEC 68-2-32

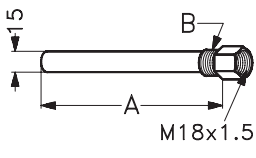
Switch
 Single-pole changeover switch (SPDT).





Vibration resistance
 Sin 4 g, 5Hz → 200 Hz acc. to IEC 68-2-6. *)

Properties acc. to EN 60947

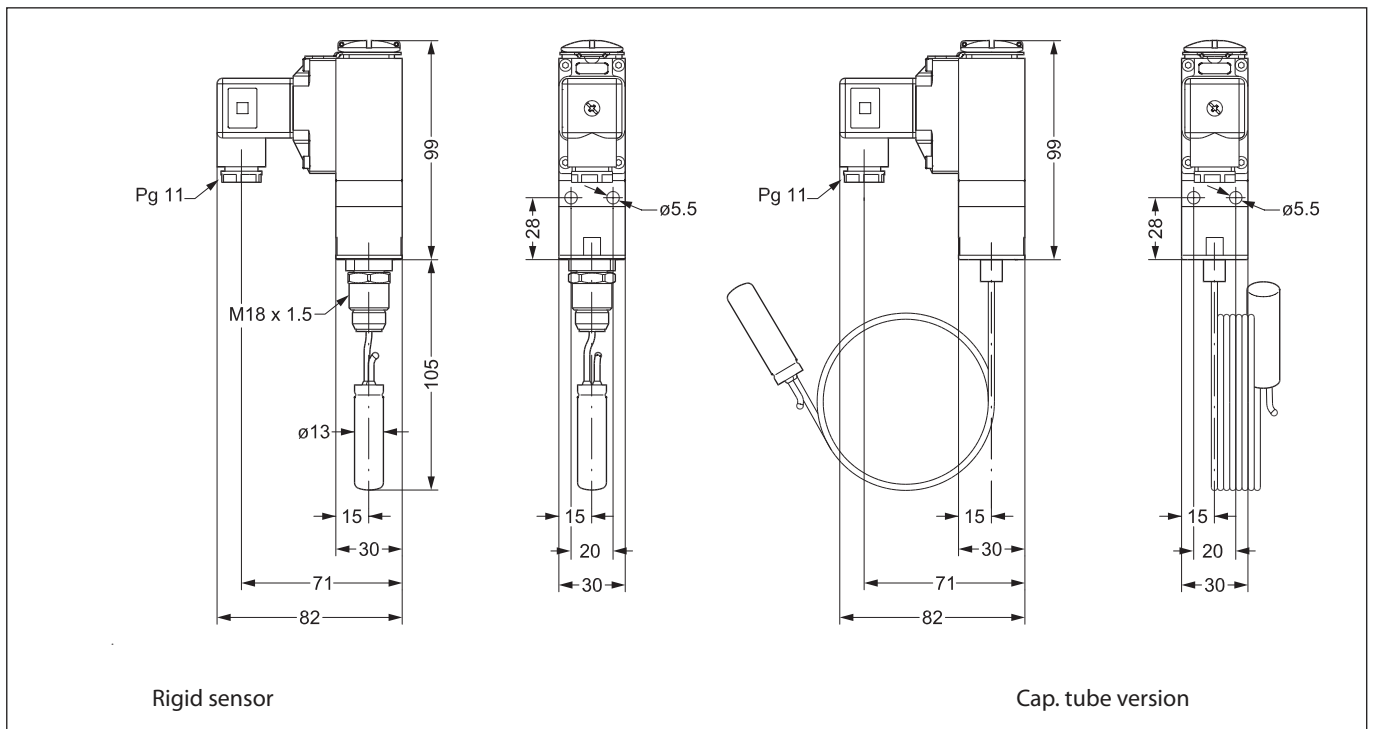
Wire dimensions
 Solid/stranded 0.2 - 1.5 mm²
 Flexible, w/out ferrules 0.2 - 1.5 mm²
 Flexible, with ferrules 0.2 - 1 mm²
 Tightening torque max. 1.2 Nm
 Rated Impuls voltage 4 kV
 Pollution degree 3
 Short circuit protection, fuse 2 Amp
 Insulation 250 V
 IP-index 65

*) If higher vibrations are present in the system/installation, thermostats with capillary tube or armoured capillary tube are recommended.

Accessories: Sensor pockets for MBC thermostats	Sensor pocket	A mm	Thread B	Code no.	Sensor pocket	A mm	Thread B	Code no.
 <p>Supplied without gland nut, gaskets and washer</p>	Brass	75	1/2 NPT	060L326466	Steel 18/8	75	G 1/2 A	060L326766
		75	G 1/2 A	060L326266				
		75	G 3/4 A	060L326666				
		75	G 1/2 A (ISO 228/1)	060L328166				
	Brass	110	1/2 NPT	060L327066	Steel 18/8	110	G 1/2 A	060L326866
		110	G 1/2 A	060L327166				
		110	G 1/2 A (ISO 228/1)	060L340666				
		110	G 3/4 A (ISO 228/1)	060L340366				
	Brass	160	G 1/2 A	060L326366	Steel 18/8	160	G 1/2 A	060L326966
160		G 3/4 A (ISO 228/1)	060L340566					

Part	Description	Code no.
 <p>Clamping band</p>	For thermostats with remote sensor (L = 392 mm)	017-420466
 <p>Heat -conductive compound (4.5 cm³ tube)</p>	For thermostats with sensor fitted in a sensor pocket. Compound for filling sensor pocket to improve heat transfer between pocket and sensor. Application range for compound: -20 to +150 °C, momentarily up to 220°C.	041E0114
 <p>Gasket set</p>	For MBC thermostats without armoured capillary tubes	060L327366
 <p>Gasket set</p>	For MBC thermostats with armoured capillary tubes	060L036666

Dimensions



Setting point correction

The sensor on MBC 8100 thermostats contains an adsorption charge. Therefore its function is not affected whether the sensor is placed warmer or colder than the remaining part of the thermostatic element (bellows and capillary tube). However, such a charge is to some extent sensitive to changes in the temperature of the bellows and capillary tube. Under normal conditions this is of no importance, but if the thermostat is to be used in extreme ambient temperatures the setting point might change.

The deviation can be compensated for as follows:

Setting point correction = Z x a

Z can be found from fig. 1, while **a** is the correction factor from the table below.

Regulation range °C	Correction factor a for thermostats	
	with rigid sensor	with 2 and 5 m capillary tube
-10 → +30		1.1
20 → 50	1.0	1.4
50 → 100	1.5	2.2
70 → 120	1.7	2.4
60 → 150		3.7
100 → 200		6.2

Example

A MBC 8100 with capillary tube length 2 m and range 50 → 100°C must cut out at 75°C in 70°C ambient temperature. At which cut out temperature should this thermostat be set at in 20°C ambient temperature?

The relative setting **Z** can be calculated from the following formula:

$$\frac{\text{Setting value} - \text{min. range}}{\text{max. range} - \text{min. range}} \times 100\%$$

Relative setting: $\frac{75 - 50}{100 - 50} \times 100 = 50\%$

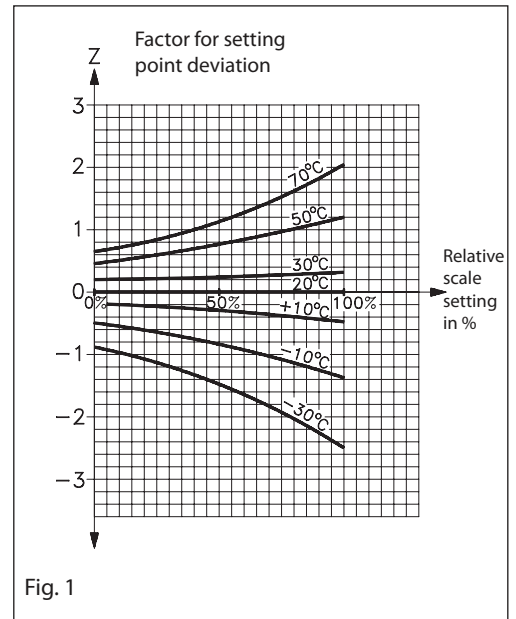


Fig. 1

Relative setting:

Factor for setting point deviation **Z** (fig. 1).

Z - 1.2

Correction factor **a** (table under fig. 1) a = 2.2

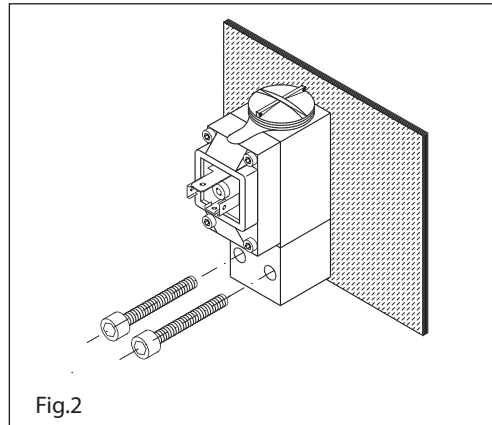
Setting point correction Z x a = 1.2. x 2.2 = 2.6°C

The MBC must be set at 75 + 2.6 = 77.6°C in 20°C ambient temperature in order to cut out at 75°C ambient temperature.

Installation

Installation

MBC thermostats are designed to withstand the shocks that occur, e.g. in ships, on compressors and in large machine installations. MBC thermostats with remote sensor are fitted with 5 mm screws to bulkheads or similar. See fig. 2
 MBC thermostats with rigid sensor are self-supporting from the sensor pocket.
 For permissible media pressure see fig. 3.



Resistance to media

Material specifications for sensor pockets:

Sensor pocket, brass

The tube is made of Ms 72 to DIN 17660, the threaded portion of So Ms 58Pb to DIN 17661.

Sensor pocket, stainless steel 18/8

Material designation 1.4305 to DIN 17440.

Sensor position

As far as possible the sensor should be positioned so that its longitudinal axis is at right angles to the direction of flow. The active part of the sensor is $\varnothing 13$ mm x 50 mm long on thermostats with rigid sensors and 2 m capillary tube.

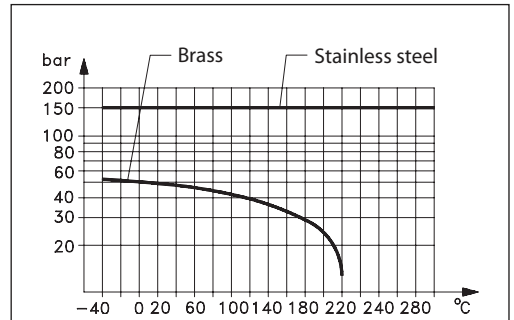


Fig. 3. Permissible media pressure on the sensor pocket as a function of temperature

Setting

When the top cover screw at the thermostat is removed, the range can be set with the setting screw. The differential is non-adjustable.

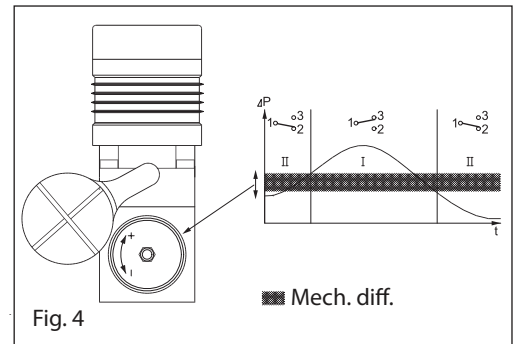


Fig. 4