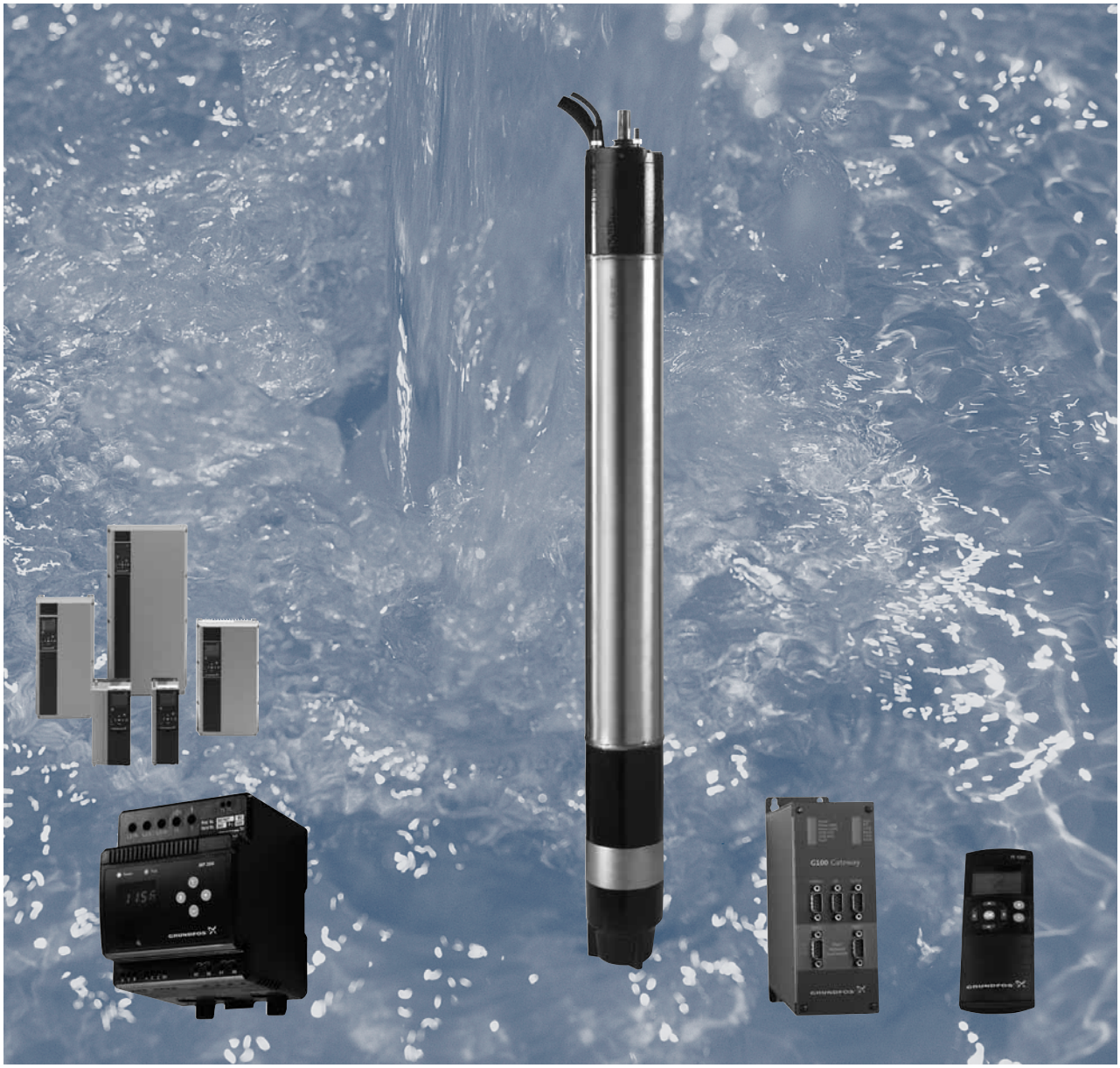
GRUNDFOS **DATA BOOKLET**

MMS6

Rewindable, submersible motors and accessories

50/60 Hz



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1. General description

MMS6 rewindable motors

Grundfos MMS6 motors are 6" rewindable, submersible motors, available in sizes from 5.5 kW to 37 kW.

Three material versions are available:

- A cast-iron version of EN-JL1040.
- For aggressive liquids with a moderate content of salt, an N-version of stainless steel DIN/EN 1.4401 (AISI 316) is available.
- For aggressive liquids with a higher salt content than that of seawater and for temperatures above 15 °C, we recommend the R-version of stainless steel DIN/EN 1.4539 (AISI 904L).

MMS6 submersible motors are designed according to market standards. All motors are designed to fit pump ends manufactured according to NEMA standards. The motors are ideally suited for water supply pumps for irrigation, groundwater regulation, pressure boosting, industrial water transfer and similar applications. MMS6 motors comply with the same standards as Grundfos MS motors and can therefore be fitted to all Grundfos SP pumps without adapters.

The motor production is in the hands of experts with many years of experience within the manufacture of motors. In order to make the time of delivery as short as possible, components are manufactured for stock, enabling rapid assembly of a few basic components into the finished motor.

The rewindable motor design means low costs of repair of the motor in case of damage. The rewindable submersible motor technology reduces the risk of hot spots in the motor as the liquid inside has a uniform contact with active parts. The motor is filled with motor liquid ensuring sufficient lubrication of radial bearings. Moreover, as motors can be rewound locally, unnecessary time for transportation of the motor can be avoided and possible periods of downtime reduced to a minimum. The design of the motor, based on few basic components, also facilitates service and repair of the motor.

Fitted with a sturdy Michell thrust bearing, which also functions as an upthrust bearing, all motors offer reliable operation.

In order to achieve maximum protection of the motor against burnout, all motors can be fitted with a Pt100 or Pt1000 sensor. Combined with a relay and an optional Grundfos CUE frequency converter or MP 204 motor protector, the Pt100/Pt1000 sensor provides optimum motor protection. See *Accessories*, page 22.

GrA4575

Fig. 1 MMS6 motor

Rewindable motors

The two-pole MMS6 motors are easily rewound.
The stator windings are made of a special water-proof wire of pure electrolytic copper sheathed with special non-hydroscopic thermoplastic material.
The high dielectric strength properties of this material allow direct contact between the windings and the liquid for efficient cooling of the windings.

High motor efficiency

The complete motor range offered by Grundfos is characterised by high efficiency contributing to improved economy of the total pump system.

Overtemperature protection

For protection against overtemperature, Grundfos offers Pt100 and Pt1000 temperature sensors as an optional extra.

The Pt100 and Pt1000 sensors are fitted in the motor and connected via a relay, which can be connected to the MP 204 motor protector. The temperature can be monitored by means of an MP 204, a CU 220, a PR5714 or a CUE.

If the temperature becomes too high, the motor will be cut out. See *Accessories*, page 22.

Protection against upthrust

The MMS6 motor is fitted with an upthrust bearing which is able to withstand the uplifting force applied to the motor shaft.

The maximum load in connection with thrust and upthrust appears from the table below.

Motor type	Motor power [kW] (hp)		Thrust*	Upthrust
	Min.	Max.	[N]	[N]
6"	5.5 (7.5)	37 (50)	27500	6000

* Double direction of rotation (clockwise and counterclockwise).

Operation

Frequency of starts

Minimum 1 per year is recommended.
Maximum 15 per hour.
Maximum 360 per day.

2. Identification

Nameplate

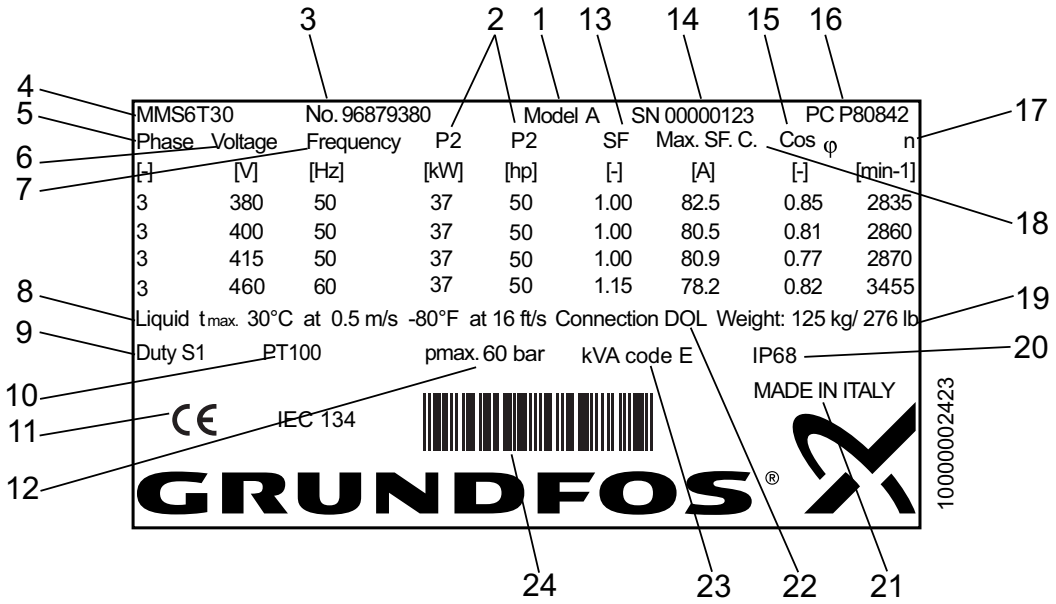


Fig. 2 Nameplate

Pos.	Description	Pos.	Description
1	Pump generation (A = first generation)	13	Service factor
2	Output power [kW] and [hp]	14	Serial number
3	Product number	15	Power factor
4	Type designation	16	Production code (year and week)
5	Number of phases	17	Rated speed [min^{-1}]
6	Supply voltage [V]	18	Rated current [A]
7	Frequency of the power supply [Hz]	19	Net weight [kg] and [lb]
8	Maximum liquid temperature at flow past the motor [°C]	20	Enclosure class
9	Motor designed for continuous operation	21	Country of origin
10	Temperature sensor (Pt100)	22	Starting method
11	CE mark	23	KVA code according to NEMA standards
12	Maximum operating pressure	24	Bar code

Type key

Code	Example	MMS	6	R	E	S	D	T30
	Type range (Motor Submersible)							
	Motor diameter [inches]							
	Material Cast iron EN JL 1040							
N	Stainless steel EN 1.4401 (AISI 316)							
R	Stainless steel EN 1.4539 (AISI 904L)							
	Rubber parts NBR							
E	FKM							
	Shaft seal Ceramics/carbon							
S	SiC/SiC							
	Motor liquid SML-3							
D	Demineralised water							
	Maximum liquid temperature (T-code)							
T30	30 °C (37 kW, PVC windings)							
T35	35 °C (5.5 to 30 kW, PVC windings)							
T50	50 °C (PE2/PA windings)							
Txx	xx °C (derating + PE2/PA windings)							

3. Operating conditions

Cooling

The cooling of the motor depends on the temperature and the flow velocity of the pumped liquid past the motor.

To ensure sufficient cooling, the values for maximum temperature of the pumped liquid and its flow velocity must be kept.

We recommend always to ensure a minimum cooling flow of 0.15 m/s.

Free convection

Free convection is achieved when the diameter of the borehole is at least 2" (~ 50 mm) bigger than the outer diameter of the motor.

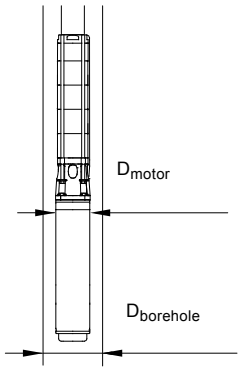
The motor must always be installed above the borehole screen. If a flow sleeve is used, the motor can be placed in the screen.

Calculation of the flow velocity:

$$v = \frac{Q_{min}}{2826 \times \left(D_i^2 - d_A^2\right)} \text{ m/s}$$

Required data:

$Q_{min.}$: Flow rate [m^3/h]
D_i: Borehole diameter [m]
d_A: Motor diameter [m].



TM02 1322 3601

Fig. 3 Diameter of motor and borehole

Maximum liquid temperature

Flow velocity past motor [m/s]	PE2/PA windings [°C]	PVC windings [°C]*
0.2	45	30
0.5	50	35

* The maximum liquid temperature of 37 kW motors is 5 °C lower.

Operating pressure

Maximum 60 bar.

Liquid temperature

Motors with PVC windings can operate at liquid temperatures up to 30 °C without derating.

When operating in liquids at temperatures from 20 °C to 43 °C, the motor must be derated according to the curve below.

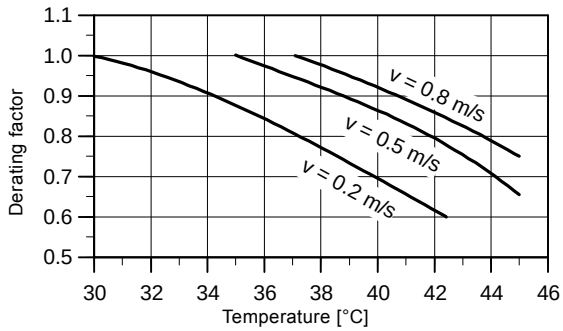


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Fig. 4 PVC windings, 5.5 to 30 kW

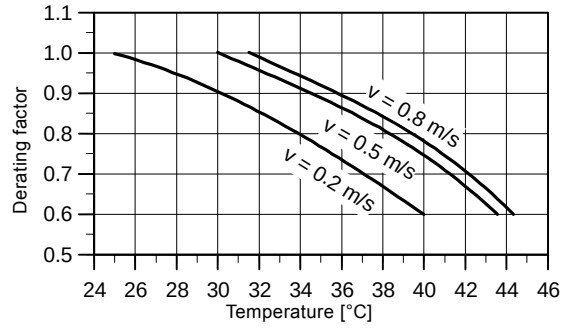

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Fig. 5 PVC windings, 37 kW

Motors with PE2/PA windings can operate at temperatures up to 50 °C.

For liquid temperatures from 35 °C to 50 °C, the motors with PE2/PA windings can be derated according to the curve below.

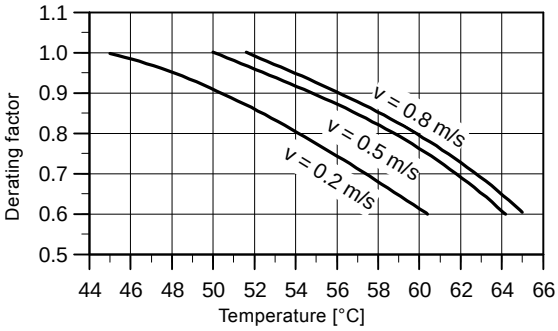

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Fig. 6 PE2/PA windings, 5.5 to 37 kW

Winding temperature

PVC windings: Maximum 70 °C.

PE2/PA windings: Maximum 90 °C.

Voltage quality

The required voltage quality for Grundfos MMS6 submersible motors, measured at the motor terminals, is - 10 %/+ 6 % of the rated voltage during continuous operation (including variations in the supply voltage and losses in cables).

Enclosure class

IP68.

4. Construction

Material specification

Cast-iron version

Pos.	Component	Material	Version		
			-	N	R
			EN	EN	EN
202	Shaft with rotor	Stainless steel	1.4301	1.4401	1.4462
203/ 206	Thrust bearing/rotating thrust bearing part	Hardened steel/ stainless steel	1.4125	1.4125	1.4125
		Ceramic/carbon	-	-	-
204	Radial bearing	Carbon	-	-	-
205	NEMA flange	Cast iron/ stainless steel	JL1040	1.4408	1.4517
208a	Thrust ring	Stainless steel	1.4016	1.4016	1.4016
208b	Thrust bearing support	Stainless steel	1.4016	1.4016	1.4016
212	Diaphragm	EPDM	-	-	-
213	End cover	Cast iron/ stainless steel	JL1040	1.4408	1.4517
216	Lock nut	Steel, BN1235	-	-	-
216a	Washer	Stainless steel	1.4301	1.4301	1.4301
219	Thrust bearing housing	Stainless steel	1.4308	1.4308	1.4517
221	Stator with sleeve	Stainless steel	1.4306	1.4404	1.4539
222b	O-ring	Fibronit	-	-	-
223b	Plug	Stainless steel	1.4401	1.4401	1.4539
224	O-ring	NBR	-	-	-
226	Shaft seal housing	Cast iron/ stainless steel	JL1040	1.4401	1.4539
226a	Shaft seal, stationary part	Ceramic/carbon	•	•	-
		SiC/SiC	•	•	•
226b	Shaft seal, rotating part	SiC	-	-	-
229	Sand shield	FKM	-	-	-
231	O-ring	NBR	-	-	-
232	Lip seal ring	FKM	-	-	-
235	Intermediate housing	Cast iron/ stainless steel	JL1040	1.4408	1.4517
236	Bearing housing, lower	Cast iron/ stainless steel	JL1040	1.4408	1.4517
236a	Hexagon socket head screw	Steel	-	-	-
242	Upthrust spacer	PP	-	-	-
247	Screw		1.4401	1.4401	1.4539
	Motor cable	EPDM	-	-	-

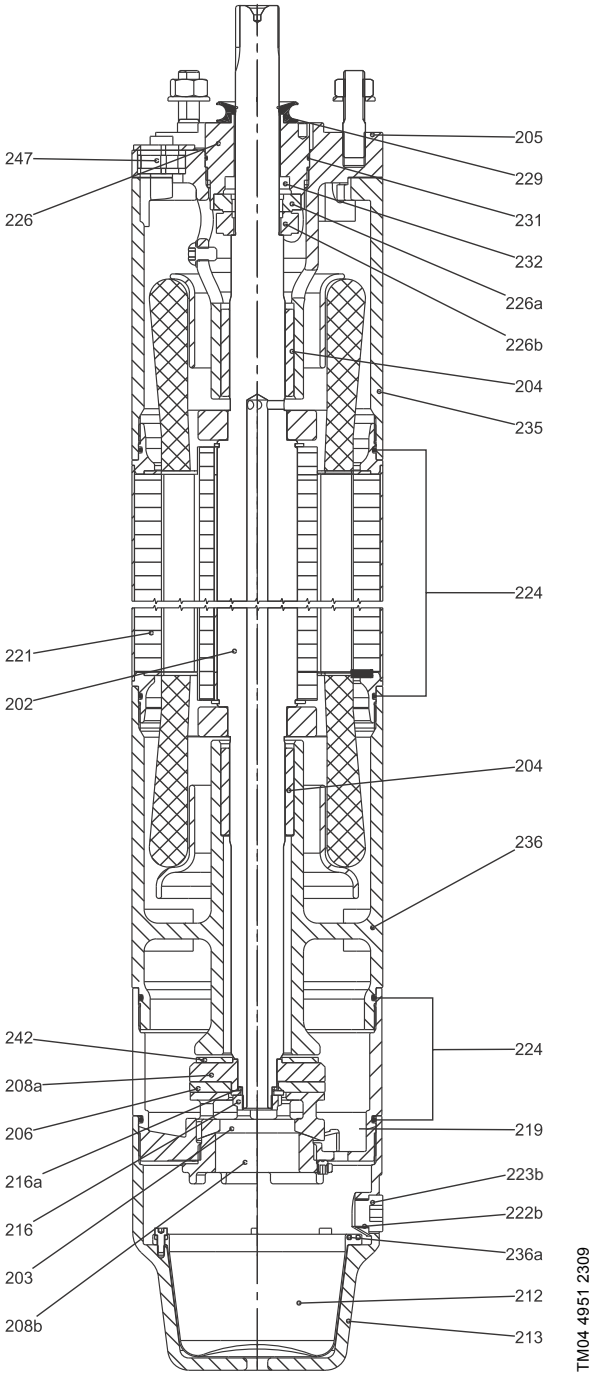


Fig. 7 Sectional drawing

Pump connection

The motor has connections according to the NEMA standard MG 1-18.413.

The cable outlet of motors for star-delta starting is displaced by 90 °.

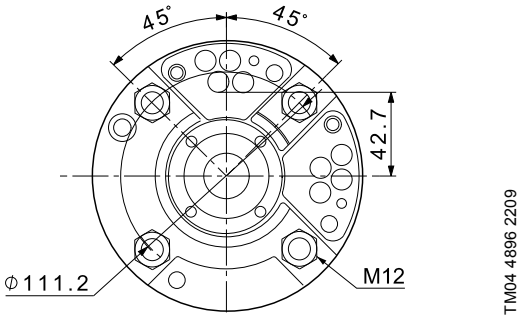


Fig. 8 Pump connection

Shaft and radial bearing

The stainless-steel splined shaft end complies with ANSI B92.1, 1970, class 5. 15-teeth module shaft. Pressure angle 30 °.

The bearing system is a stainless-steel shaft against carbon bearing rings.

Shaft seal

The mechanical shaft seal is available in two variants: ceramic/carbon and SiC/SiC. SiC/SiC is according to DIN 24960.

The highly wear-resistant and durable material ensures tightness and thus limited replacement of the motor liquid. This is important when the pumped liquid contains sand.

Together with the shaft seal housing, the sand shield forms a labyrinth seal, which during normal operating conditions prevents sand particles from entering the shaft seal.

The double shaft seal consists of a rubber lip seal and a mechanical seal. The double shaft seal protects the motor from abrasive particles.

Rotor

The rotor is a squirrel-cage rotor with copper bars brazed to the short-circuit rings with a silver alloy.

The rotor is dynamically balanced for smooth and vibration-free operation.

Stator

The stator is a wet-wound design in stainless steel to protect the motor, even in corrosive water. The stator design allows complete access to the winding for easy maintenance and rewinding. The construction of the laminations minimises operating losses and improves motor performance.

The motor end shield is screwed onto the stator. A suitable centring ensures alignment of rotor and stator.

Thrust bearing

The Michell/Kingsbury type of water-lubricated thrust bearing is very simple and most efficient.

The thrust capacity of the bearings is in accordance with NEMA standards for submersible motors, where these are applicable. See fig. 9.

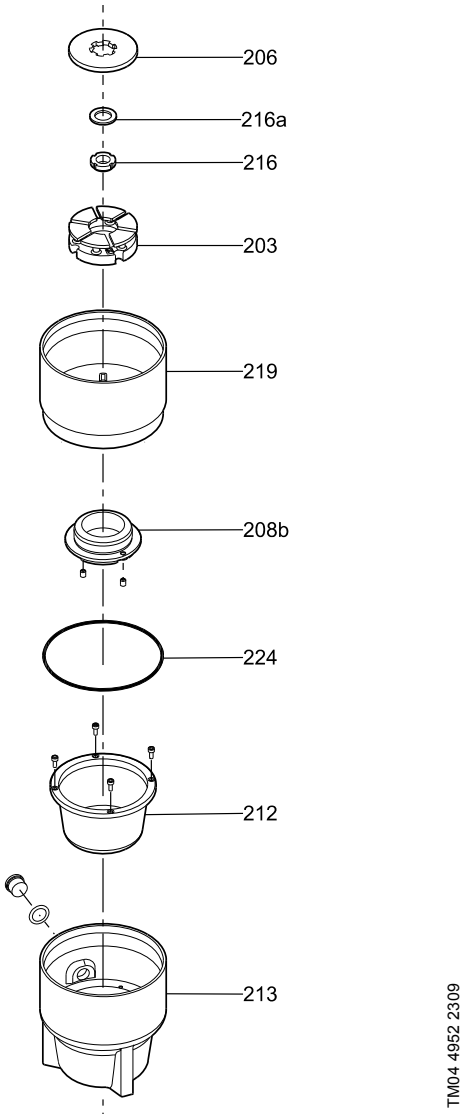


Fig. 9 Thrust bearing

Pos.	Description
206	Rotating bearing part
216a	Washer
216	Ring nut
203	Stationary bearing part
219	Thrust bearing housing
208b	Thrust bearing support
224	O-ring
212	Diaphragm
213	Motor end shield

Rotating bearing part

To prolong the bearing life, the rotating part with a larger surface is made of soft carbon material.
The carbon disk is polished for optimum surface finish.

Stationary bearing part

The stationary part is made of tempered stainless steel. This segmented component is cast as a one-in-all cost-effective unit. By design, each pad becomes flexible as required for good functionality.

The segmented surface is finally polished to a specially designed shape.

Upthrust bearing

The PP upthrust spacers above the rotating bearing part prevent motor damage during transportation or in case of upthrust.

The upthrust bearing is an integrated part of the thrust bearing.

Diaphragm

The diaphragm is fitted between the stator and the motor end shield. The diaphragm ensures that volume changes due to temperature changes can be accommodated by the motor liquid without effecting the pumped liquid.

Motor liquid

The motor is factory-filled with Grundfos motor liquid, type SML-3, which is frost-proof down to -20 °C.

Corrosion protection

The motor liquid protects metals and alloys in the equipment against all types of corrosion. The combination of low toxicity and FDA-approved ingredients with a high level of corrosion protection makes Grundfos motor liquid unique in the market.

The anti-corrosion performance is demonstrated according to ASTM D 1384.

Compatibility and mixability

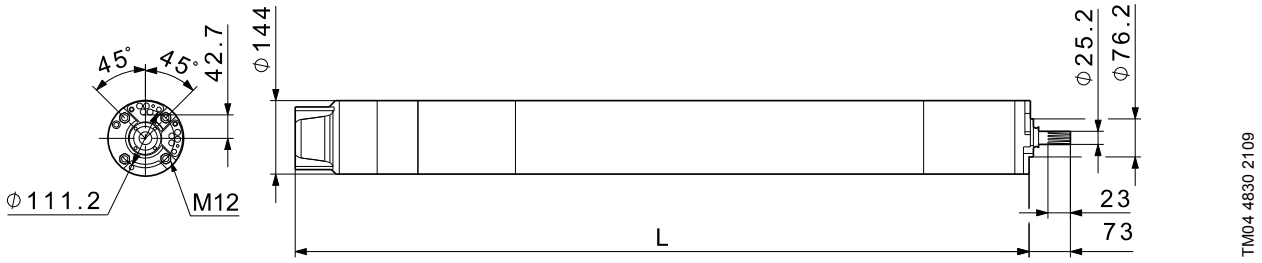
The motor liquid is compatible with most other heat transfer fluids based on mono-propylene glycol.
It should only be mixed with clean water. The motor liquid is also available as a dilution mixed with the proper amount of purified water.

Toxicity and safety

The motor liquid consists of FDA-approved components for heat-transfer fluids with incidental food contact. Neither the concentration of the motor liquid nor any dilution is classified according to the European Dangerous Preparations Directive.

5. Technical data

MMS6 (-N, -R)



Motor power P2 [kW]	Motor power P2 [hp]	L [mm]	Weight [kg]	Shipping volume [m^3]
5.5	7.5	807	50	0.085
7.5	10	837	53	0.085
9.2	12	867	55	0.085
11	15	897	60	0.085
13	18	927	65	0.085
15	20	997	77	0.085
18.5	25	1057	83	0.085
22	30	1087	95	0.085
26	35	1157	105	0.085
26 Japan	-	1212	110	0.099
30	40	1212	110	0.099
30 USA	40	1212	110	0.204
30 Japan	-	1312	120	0.099
37	50	1312	120	0.099
37 USA	50	1312	120	0.204

Cables

The MMS6 motors are connected by means of four single-core cables, approved for drinking water. All cables are round.

The cable outlet of motors for star-delta starting is displaced by 90 °.

Being an integrated part of the motor, the motor cable cannot be fitted or removed once the motor is assembled.

Cable length:

- 5.5 and 26 kW: 5 m
- 30 and 37 kW: 8 m.

Note: Sizing of the motor cable requires that it is submerged in water. For longer cables and cable connection for extension, see *8. Accessories*, page 22.

The MMS6 motors have an integrated earth cable.

Motor power P2		Cross-section [mm²]									
		3 x 200 V, 50 Hz 3 x 200-220 V, 60 Hz		3 x 220-230 V, 50 Hz		3 x 380-415 V, 50 Hz 3 x 460 V, 60 Hz		3 x 400 V, 50 Hz 3 x 400-440 V, 60 Hz		3 x 400-415 V, 50 Hz	
		DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
[kW]	[hp]	4 x 1	8 x 1	4 x 1	8 x 1	4 x 1	8 x 1	4 x 1	8 x 1	4 x 1	8 x 1
5.5	7.5	-	-	6	-	6	-	-	-	-	-
7.5	10	-	-	6	-	6	-	-	-	-	-
9.2	12	-	-	6	-	6	-	-	-	-	-
11	15	-	-	6	-	6	6	-	-	-	-
13	18	-	-	6	-	6	6	-	-	-	-
15	20	-	-	6	-	6	6	-	-	-	-
18.5	25	-	-	10	-	6	6	-	-	-	-
22	30	-	-	10	-	6	6	-	-	-	-
26	35	-	6	10	-	6	6	-	6	-	-
30	40	-	6	16	-	10	6	-	6	10	-
37	50	-	-	-	10	10	6	-	-	10	-

Motor power P2		Cross-section [mm²]							
		3 x 460 V, 50 Hz		3 x 500-525 V, 50 Hz 3 x 575 V, 60 Hz		3 x 220-230 V, 60 Hz		3 x 380 V, 60 Hz	
		DOL	SD	DOL	SD	DOL	SD	DOL	SD
[kW]	[hp]	4 x 1	8 x 1	4 x 1	8 x 1	4 x 1	8 x 1	4 x 1	8 x 1
5.5	7.5	-	-		-	6	-	6	-
7.5	10	6	-		-	6	-	6	-
9.2	12	6	-	6	-	6	-	6	-
11	15	6	-	6	-	6	-	6	-
13	18	6	-	6	-	6	-	6	-
15	20	6	-	6	-	6	-	6	-
18.5	25	6	-	6	-	10	-	6	-
22	30	6	-	6	-	10	-	6	-
26	35	6	-	6	-	16	-	10	-
30	40	10	-	10	-	16	-	10	-
37	50	10	-	10	-	-	10	10	-

Outer dimensions

Cross-section [mm²]	Type of cable	Maximum outer dimension [mm]
6	Round	8.1
10		8.8
16		10.3

6. Electrical data

The tables below contain the following data among others:

Abbreviation	Description
T-code	T-code refers to the maximum liquid temperature. See *Type key*, page 6.
BT	Breakdown Torque
LRT	Locked-Rotor Torque
LRC	Locked-Rotor Current

3 x 200 V, 50 Hz, Japan

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	26	116	0.69	0.80	0.84	82	83	81	2850	216	154	460	27.5	-
T50	30	134	0.68	0.79	0.84	82	83	82	2850	265	174	505	27.5	-

3 x 200 V, 60 Hz, SF 1.0, Japan

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	26	118	0.77	0.82	0.85	79	81	77	3410	190	130	405	27.5	H
T50	30	135	0.78	0.82	0.85	79	82	78	3420	230	140	440	27.5	H

3 x 220 V, 60 Hz, SF 1.0, Japan

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	26	106	0.71	0.80	0.84	82	83	81	3460	234	154	505	27.5	H
T50	30	120	0.71	0.80	0.84	83	83	81	3470	285	172	550	27.5	H

3 x 220 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T35	5.5	26.0	0.66	0.75	0.80	71	75	75	2840	180	80	320	27.5	-
T35	7.5	34.5	0.65	0.75	0.80	74	77	76	2840	180	80	330	27.5	-
T35	9.2	41.5	0.65	0.76	0.81	75	78	77	2840	180	90	340	27.5	-
T35	11	49.5	0.59	0.71	0.78	76	79	79	2850	210	100	370	27.5	-
T35	13	56.5	0.63	0.75	0.81	78	81	80	2840	200	100	370	27.5	-
T35	15	63.0	0.65	0.76	0.82	80	82	82	2850	220	110	400	27.5	-
T35	18.5	76.5	0.68	0.79	0.83	81	82	81	2840	200	110	390	27.5	-
T35	22	89.5	0.68	0.79	0.83	83	84	82	2850	250	180	490	27.5	-
T35	26	106	0.63	0.76	0.82	82	84	83	2870	234	206	535	27.5	-
T35	30	122	0.69	0.80	0.84	83	83	81	2840	208	152	440	27.5	-
T30	37	148	0.66	0.78	0.84	83	84	82	2850	270	192	510	27.5	-
T50	5.5	26.5	0.67	0.77	0.81	70	73	72	2830	170	70	300	27.5	-
T50	7.5	35.0	0.67	0.77	0.82	72	75	73	2830	170	80	310	27.5	-
T50	9.2	41.5	0.66	0.77	0.82	74	77	75	2830	170	80	320	27.5	-
T50	11	50.0	0.61	0.73	0.81	74	77	77	2850	190	90	350	27.5	-
T50	13	57.0	0.65	0.77	0.82	77	79	78	2830	190	90	350	27.5	-
T50	15	63.5	0.66	0.77	0.82	79	81	80	2840	200	110	390	27.5	-
T50	18.5	77.0	0.69	0.79	0.84	80	81	80	2840	200	100	380	27.5	-
T50	22	90.0	0.69	0.79	0.84	82	83	81	2850	244	170	475	27.5	-
T50	26	108	0.64	0.76	0.82	82	83	82	2870	226	196	520	27.5	-
T50	30	124	0.70	0.81	0.85	82	82	80	2830	202	144	430	27.5	-
T50	37	150	0.68	0.80	0.86	82	82	80	2830	246	168	475	27.5	-

3 x 230 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T35	5.5	25.0	0.61	0.72	0.78	71	75	76	2860	190	90	350	27.5	-
T35	7.5	33.5	0.59	0.71	0.78	72	76	77	2860	200	90	350	27.5	-
T35	9.2	40.5	0.59	0.71	0.78	74	77	78	2860	200	90	360	27.5	-
T35	11	50.0	0.53	0.66	0.74	74	78	79	2870	230	110	380	27.5	-
T35	13	56.0	0.57	0.69	0.77	77	80	80	2860	220	110	390	27.5	-
T35	15	62.5	0.58	0.71	0.79	79	82	82	2860	240	120	430	27.5	-
T35	18.5	75.0	0.61	0.75	0.81	80	82	82	2850	230	120	420	27.5	-
T35	22	87.0	0.61	0.74	0.81	82	84	83	2870	280	198	530	27.5	-
T35	26	106	0.57	0.70	0.78	81	83	83	2880	260	226	560	27.5	-
T35	30	118	0.63	0.76	0.82	82	83	82	2860	230	166	475	27.5	-
T30	37	148	0.59	0.72	0.81	82	84	83	2860	300	212	540	27.5	-
T50	5.5	25.0	0.63	0.73	0.79	69	73	73	2860	180	80	330	27.5	-
T50	7.5	33.5	0.61	0.73	0.80	71	75	75	2850	190	90	340	27.5	-
T50	9.2	40.5	0.60	0.72	0.80	73	76	76	2850	190	90	350	27.5	-
T50	11	49.5	0.55	0.69	0.77	72	76	77	2860	210	100	370	27.5	-
T50	13	56.0	0.59	0.72	0.80	75	78	78	2850	210	100	370	27.5	-
T50	15	62.5	0.60	0.73	0.80	77	80	80	2860	230	120	410	27.5	-
T50	18.5	75.0	0.63	0.75	0.82	79	81	81	2850	220	120	410	27.5	-
T50	22	87.5	0.63	0.75	0.82	82	83	82	2870	270	188	515	27.5	-
T50	26	106	0.57	0.71	0.79	80	83	82	2880	250	216	545	27.5	-
T50	30	118	0.64	0.77	0.83	81	83	81	2850	224	160	465	27.5	-
T50	37	148	0.61	0.75	0.83	80	82	81	2850	270	186	505	27.5	-

3 x 380 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T35	5.5	14.8	0.66	0.75	0.79	72	75	75	2850	180	80	320	27.5	-
T35	7.5	19.8	0.65	0.75	0.80	74	77	76	2840	180	80	330	27.5	-
T35	9.2	23.6	0.67	0.77	0.82	76	78	77	2830	170	80	320	27.5	-
T35	11	28.0	0.65	0.76	0.82	76	78	77	2830	180	90	340	27.5	-
T35	13	32.5	0.69	0.80	0.82	79	79	79	2830	190	100	360	27.5	-
T35	15	37.0	0.66	0.78	0.83	77	79	78	2840	200	110	390	27.5	-
T35	18.5	44.5	0.67	0.78	0.83	80	82	80	2840	220	120	410	27.5	-
T35	22	52.0	0.65	0.77	0.82	82	83	82	2860	268	192	515	27.5	-
T35	26	61.5	0.65	0.76	0.82	83	84	83	2860	236	212	540	27.5	-
T35	30	69.8	0.68	0.79	0.83	84	84	83	2850	222	162	460	27.5	-
T30	37	86.0	0.68	0.80	0.84	83	84	82	2840	250	170	470	27.5	-
T50	5.5	15.2	0.67	0.77	0.81	70	73	72	2830	170	70	300	27.5	-
T50	7.5	20.0	0.66	0.77	0.81	72	75	74	2830	170	80	310	27.5	-
T50	9.2	24.0	0.69	0.79	0.82	75	77	75	2820	160	80	310	27.5	-
T50	11	28.5	0.65	0.77	0.82	75	78	76	2830	180	90	340	27.5	-
T50	13	33.0	0.65	0.77	0.82	76	78	77	2830	190	90	350	27.5	-
T50	15	37.0	0.66	0.78	0.83	77	79	78	2840	200	110	390	27.5	-
T50	18.5	45.0	0.68	0.79	0.84	79	81	79	2830	200	110	380	27.5	-
T50	22	52.5	0.66	0.78	0.83	81	82	81	2860	268	178	495	27.5	-
T50	26	62.0	0.67	0.78	0.84	81	82	80	2850	216	184	500	27.5	-
T50	30	71.0	0.70	0.81	0.85	82	82	80	2830	206	150	435	27.5	-
T50	37	87.0	0.69	0.80	0.85	82	83	80	2830	240	162	455	27.5	-

3 x 400 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T35	5.5	14.4	0.60	0.71	0.77	71	75	76	2870	200	90	350	27.5	-
T35	7.5	19.2	0.59	0.71	0.78	72	76	77	2860	200	90	360	27.5	-
T35	9.2	22.8	0.61	0.73	0.79	75	78	78	2850	200	90	350	27.5	-
T35	11	27.5	0.58	0.71	0.79	74	78	78	2860	210	100	370	27.5	-
T35	13	32.0	0.63	0.75	0.79	77	79	79	2850	220	110	380	27.5	-
T35	15	36.5	0.59	0.72	0.80	76	79	79	2860	230	120	420	27.5	-
T35	18.5	43.5	0.60	0.72	0.80	79	81	81	2860	250	140	450	27.5	-
T35	22	51.5	0.57	0.70	0.79	81	83	83	2880	300	214	550	27.5	-
T35	26	61.0	0.57	0.70	0.78	81	83	83	2880	265	236	570	27.5	-
T35	30	68.2	0.61	0.73	0.81	83	84	84	2870	250	180	500	27.5	-
T30	37	84.5	0.60	0.73	0.81	82	84	83	2860	280	190	505	27.5	-
T50	5.5	14.4	0.63	0.73	0.79	69	73	73	2860	190	80	340	27.5	-
T50	7.5	19.4	0.60	0.72	0.79	71	75	75	2860	190	90	350	27.5	-
T50	9.2	23.0	0.63	0.75	0.81	74	77	76	2850	190	90	340	27.5	-
T50	11	27.5	0.58	0.71	0.79	73	77	77	2860	200	100	370	27.5	-
T50	13	32.5	0.57	0.70	0.79	74	77	77	2850	210	110	380	27.5	-
T50	15	36.5	0.59	0.72	0.80	76	79	79	2860	230	120	420	27.5	-
T50	18.5	43.5	0.61	0.74	0.82	78	80	80	2850	220	120	420	27.5	-
T50	22	51.5	0.58	0.72	0.80	80	82	81	2880	300	200	530	27.5	-
T50	26	61.0	0.59	0.72	0.81	79	82	81	2870	242	208	535	27.5	-
T50	30	68.5	0.63	0.76	0.82	81	83	81	2850	232	168	480	27.5	-
T50	37	84.5	0.61	0.75	0.82	81	83	82	2860	270	180	495	27.5	-

3 x 415 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T35	5.5	14.2	0.57	0.68	0.75	69	75	76	2880	220	100	370	27.5	-
T35	7.5	19.2	0.55	0.67	0.75	71	76	77	2870	220	100	370	27.5	-
T35	9.2	22.6	0.57	0.69	0.77	73	78	78	2860	210	100	370	27.5	-
T35	11	27.5	0.54	0.67	0.76	72	77	78	2870	220	110	380	27.5	-
T35	13	32.0	0.57	0.71	0.75	76	79	79	2860	230	120	390	27.5	-
T35	15	37.0	0.53	0.67	0.76	74	78	79	2870	250	130	430	27.5	-
T35	18.5	44.0	0.54	0.68	0.77	77	81	81	2870	270	150	460	27.5	-
T35	22	52.5	0.51	0.65	0.75	79	82	82	2890	325	234	560	27.5	-
T35	26	62.0	0.51	0.65	0.74	80	83	83	2890	290	255	585	27.5	-
T35	30	68.2	0.55	0.69	0.77	82	84	84	2880	270	196	515	27.5	-
T30	37	85.0	0.55	0.69	0.78	80	83	83	2870	305	206	520	27.5	-
T50	5.5	14.2	0.58	0.70	0.77	68	73	74	2870	200	90	360	27.5	-
T50	7.5	19.2	0.56	0.69	0.77	70	74	75	2870	210	100	360	27.5	-
T50	9.2	22.6	0.58	0.71	0.78	72	76	77	2860	200	100	360	27.5	-
T50	11	28.0	0.54	0.67	0.76	72	76	77	2870	220	110	380	27.5	-
T50	13	33.0	0.52	0.66	0.75	71	76	77	2870	230	120	390	27.5	-
T50	15	37.0	0.53	0.67	0.76	74	78	79	2870	250	130	430	27.5	-
T50	18.5	44.0	0.56	0.69	0.78	76	80	80	2860	240	130	430	27.5	-
T50	22	52.5	0.53	0.67	0.76	78	81	81	2890	325	216	545	27.5	-
T50	26	61.5	0.53	0.68	0.77	78	81	81	2880	265	224	550	27.5	-
T50	30	68.5	0.57	0.71	0.80	80	82	81	2870	250	182	495	27.5	-
T50	37	85.0	0.56	0.69	0.79	80	82	82	2870	290	196	510	27.5	-

3 x 460 V, 60 Hz, SF 1.15

T-code	Motor		Current		Motor	Cos φ		Efficiency (η)		n	BT	LRT	LRC	Thrust		kVA code
	Full load (P2)		Full load	Max. load	Max. load (P1) incl. SF	Full load	Max. load	Full load	Max. load							
	[kW]	[hp]	[A]	[A]	[kW]			[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	[lbf]	
T35	5.5	7.5	13.0	14.4	8.50	0.76	0.78	74	75	3460	200	80	340	27.5	6182	F
T35	7.5	10	17.2	19.0	11.4	0.76	0.78	76	77	3460	200	80	350	27.5	6182	F
T35	9.2	12	20.2	22.6	13.6	0.78	0.80	78	78	3440	190	80	350	27.5	6182	E
T35	11	15	24.2	27.0	16.2	0.77	0.80	78	78	3450	210	90	370	27.5	6182	F
T35	13	20	31.0	31.0	21.8	0.80	0.80	80	80	3450	220	100	390	27.5	6182	E
T35	15	20	32.0	35.5	21.8	0.78	0.81	80	80	3460	230	110	430	27.5	6182	G
T35	18.5	25	38.0	42.5	26.0	0.79	0.81	82	82	3450	260	120	460	27.5	6182	E
T35	22	30	45.0	47.5	30.0	0.77	0.79	84	84	3490	320	220	615	27.5	6182	J
T35	26	35	53.0	59.0	35.5	0.77	0.80	84	84	3470	270	222	605	27.5	6182	J
T35	30	40	58.8	66.1	41.0	0.80	0.82	85	84	3460	255	166	520	27.5	6182	H
T30	37	50	73.0	82.0	51.0	0.80	0.82	84	84	3450	285	176	530	27.5	6182	H
T50	5.5	7.5	13.0	14.6	8.80	0.78	0.79	72	73	3440	190	80	330	27.5	6182	E
T50	7.5	10	17.2	19.2	11.6	0.77	0.80	75	75	3450	190	80	350	27.5	6182	F
T50	9.2	12	20.2	22.8	14.0	0.79	0.81	77	76	3440	190	80	340	27.5	6182	E
T50	11	15	24.4	27.0	16.4	0.77	0.80	78	78	3450	210	90	370	27.5	6182	F
T50	13	18	28.5	32.0	19.2	0.77	0.80	78	78	3450	210	100	390	27.5	6182	F
T50	15	20	32.0	35.5	21.8	0.78	0.81	80	80	3460	230	110	430	27.5	6182	G
T50	18.5	25	38.0	42.5	26.5	0.80	0.82	81	81	3450	230	110	430	27.5	6182	F
T50	22	30	45.0	47.5	30.5	0.78	0.80	83	83	3480	320	206	595	27.5	6182	J
T50	26	35	53.0	59.0	36.5	0.79	0.82	83	82	3470	250	200	575	27.5	6182	J
T50	30	40	59.0	67.0	42.0	0.81	0.83	83	82	3450	240	156	500	27.5	6182	G
T50	37	50	73.0	82.0	51.5	0.81	0.83	83	83	3450	275	168	520	27.5	6182	H

3 x 400 V, 50 Hz, Japan

T-code	Motor	$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	26	58.0	0.69	0.79	0.84	82	83	81	2850	228	164	480	27.5	-
T50	30	66.5	0.67	0.78	0.83	82	83	82	2850	280	188	530	27.5	-

3 x 400 V, 60 Hz, SF 1.0, Japan

T-code	Motor	$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	26	58	0.77	0.82	0.85	79	81	77	3410	195	130	420	27.5	H
T50	30	68	0.78	0.83	0.86	80	82	79	3425	240	150	460	27.5	H

3 x 440 V, 60 Hz, SF 1.0, Japan

T-code	Motor	$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	26	52.5	0.71	0.80	0.83	82	83	81	3460	246	162	520	27.5	H
T50	30	60.0	0.70	0.80	0.83	83	83	81	3470	300	184	570	27.5	H

3 x 400 V, 50 Hz, Australia

T-code	Motor	$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	30	68	0.73	0.82	0.86	83	82	79	2820	190	140	410	27.5	-
T50	37	83	0.74	0.83	0.87	83	82	79	2810	230	170	450	27.5	-

3 x 415 V, 50 Hz, Australia

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	30	65.0	0.69	0.80	0.85	82	82	80	2840	210	152	445	27.5	-
T50	37	79.0	0.69	0.81	0.86	82	83	80	2830	255	180	490	27.5	-

3 x 460 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T35	7.5	16.6	0.61	0.73	0.79	73	76	77	2850	190	90	340	27.5	-
T35	9.2	19.8	0.65	0.76	0.81	74	77	76	2840	180	80	330	27.5	-
T35	11	23.4	0.63	0.75	0.81	75	78	77	2840	190	90	350	27.5	-
T35	13	27.5	0.61	0.73	0.81	76	79	78	2840	200	100	370	27.5	-
T35	15	30.5	0.65	0.77	0.82	79	81	80	2840	210	110	400	27.5	-
T35	18.5	37.5	0.63	0.76	0.82	78	80	80	2850	220	120	410	27.5	-
T35	22	43.5	0.63	0.76	0.82	81	82	81	2850	270	190	515	27.5	-
T35	26	52.0	0.63	0.75	0.82	81	82	81	2850	234	200	530	27.5	-
T35	30	58.0	0.68	0.79	0.84	82	83	81	2850	220	158	460	27.5	-
T30	37	71.5	0.64	0.77	0.82	83	84	83	2850	270	186	500	27.5	-
T50	7.5	16.8	0.61	0.73	0.80	71	74	74	2850	190	90	340	27.5	-
T50	9.2	19.8	0.65	0.76	0.81	74	77	76	2840	180	80	330	27.5	-
T50	11	23.4	0.63	0.75	0.81	75	78	77	2840	190	90	350	27.5	-
T50	13	27.5	0.63	0.75	0.82	75	78	77	2840	190	100	360	27.5	-
T50	15	31.0	0.62	0.75	0.81	77	80	79	2850	220	110	410	27.5	-
T50	18.5	37.5	0.63	0.76	0.82	78	80	80	2850	220	120	410	27.5	-
T50	22	43.5	0.63	0.76	0.82	81	82	81	2850	270	190	515	27.5	-
T50	26	52.0	0.64	0.77	0.83	79	81	79	2850	218	182	500	27.5	-
T50	30	59.0	0.69	0.80	0.85	81	82	79	2850	208	148	440	27.5	-
T50	37	72.5	0.66	0.79	0.84	81	82	80	2850	250	166	470	27.5	-

3 x 500 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	9.2	18.6	0.61	0.74	0.81	72	75	75	2850	190	90	350	27.5	-
T50	11	21.8	0.64	0.75	0.81	74	77	76	2840	190	90	350	27.5	-
T50	13	25.0	0.62	0.75	0.81	76	78	78	2840	200	100	370	27.5	-
T50	15	28.0	0.65	0.77	0.82	77	80	79	2840	210	110	390	27.5	-
T50	18.5	34.5	0.65	0.77	0.83	78	80	79	2840	210	110	400	27.5	-
T50	22	39.5	0.69	0.80	0.84	82	82	80	2850	242	170	475	27.5	-
T50	26	47.0	0.67	0.79	0.84	81	82	80	2850	216	184	500	27.5	-
T50	30	54.5	0.67	0.79	0.84	80	81	79	2850	210	150	445	27.5	-
T50	37	66.5	0.66	0.78	0.85	81	82	80	2850	265	186	505	27.5	-

3 x 525 V, 50 Hz

Motor		$I_{1/1}$	Cos φ			Efficiency (η)			n	BT	LRT	LRC	Thrust	kVA code
T-code	P2		50 %	75 %	100 %	50 %	75 %	100 %						
	[kW]	[A]				[%]	[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	
T50	9.2	18.6	0.55	0.69	0.77	70	74	75	2870	210	100	370	27.5	-
T50	11	21.4	0.57	0.70	0.78	72	76	77	2860	210	100	370	27.5	-
T50	13	25.0	0.55	0.69	0.77	73	77	78	2860	220	110	390	27.5	-
T50	15	28.0	0.58	0.71	0.79	76	79	79	2860	230	120	420	27.5	-
T50	18.5	34.0	0.58	0.71	0.80	76	79	79	2860	230	120	420	27.5	-
T50	22	38.5	0.63	0.75	0.82	81	82	81	2870	270	190	515	27.5	-
T50	26	46.0	0.60	0.73	0.81	80	82	81	2870	240	206	535	27.5	-
T50	30	53.5	0.59	0.73	0.82	79	81	80	2860	234	166	475	27.5	-
T50	37	66.0	0.57	0.72	0.81	79	81	81	2860	300	208	530	27.5	-

3 x 575 V, 60 Hz, SF 1.15

Motor			Current		Motor	Cos φ		Efficiency (η)		n	BT	LRT	LRC	Thrust		kVA code
T-code	Full load (P2)		Full load	Max. load	Max. load (P1) incl. SF	Full load	Max. load	Full load	Max. load							
	[kW]	[hp]	[A]	[A]	[kW]			[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	[lbf]	
T50	9.2	12	16.4	18.4	14.2	0.78	0.81	76	76	3450	190	80	350	27.5	6182	E
T50	11	15	19.0	21.4	16.6	0.80	0.82	77	77	3440	190	80	350	27.5	6182	E
T50	13	18	22.0	24.8	19.2	0.80	0.82	79	78	3440	200	90	370	27.5	6182	E
T50	15	20	24.6	28.0	21.8	0.81	0.83	80	79	3440	210	100	400	27.5	6182	F
T50	18.5	25	30.0	34.0	27.0	0.82	0.83	80	80	3440	210	100	410	27.5	6182	F
T50	22	30	34.0	39.0	31.0	0.82	0.84	82	81	3440	248	162	495	27.5	6182	G
T50	26	35	40.5	46.5	37.0	0.82	0.84	82	81	3450	222	178	525	27.5	6182	H
T50	30	40	47.0	53.5	43.0	0.82	0.84	81	80	3440	218	142	465	27.5	6182	H
T50	37	50	57.0	65.0	52.5	0.83	0.85	82	81	3440	280	178	530	27.5	6182	H

3 x 220 V, 60 Hz, SF 1.15

Motor			Current		Motor	Cos φ		Efficiency (η)		n	BT	LRT	LRC	Thrust		kVA code
T-code	Full load (P2)		Full load	Max. load	Max. load (P1) incl. SF	Full load	Max. load	Full load	Max. load							
	[kW]	[hp]	[A]	[A]	[kW]			[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	[lbf]	
T35	5.5	7.5	27.0	30.5	8.55	0.77	0.79	74	74	3450	190	80	340	27.5	6182	F
T35	7.5	10	36.0	40.0	11.4	0.76	0.79	76	76	3450	200	80	350	27.5	6182	F
T35	9.2	12	42.0	47.0	13.6	0.78	0.80	78	78	3440	190	80	350	27.5	6182	F
T35	11	15	50.5	56.0	15.8	0.76	0.79	80	80	3450	210	90	370	27.5	6182	G
T35	13	18	57.5	64.5	18.6	0.78	0.80	81	81	3440	210	90	380	27.5	6182	F
T35	15	20	65.5	73.5	21.2	0.78	0.81	82	82	3450	230	110	420	27.5	6182	G
T35	18.5	25	78.5	88.5	26.0	0.81	0.82	82	81	3440	220	100	410	27.5	6182	F
T35	22	30	90.5	102	30.5	0.81	0.83	83	83	3460	265	174	525	27.5	6182	H
T35	26	35	106	120	35.5	0.81	0.83	84	84	3460	228	182	535	27.5	6182	H
T35	30	40	120	138	41.0	0.82	0.84	84	84	3440	224	148	470	27.5	6182	G
T30	37	50	152	172	51.0	0.81	0.84	84	83	3450	280	182	545	27.5	6182	H
T50	5.5	7.5	27.0	30.5	8.70	0.78	0.80	72	72	3440	180	70	330	27.5	6182	F
T50	7.5	10	36.0	40.5	11.6	0.77	0.80	75	75	3450	190	80	340	27.5	6182	F
T50	9.2	12	42.0	48.0	13.8	0.80	0.81	76	76	3.430	180	80	330	27.5	6182	F
T50	11	15	50.5	56.5	16.2	0.78	0.80	78	78	3450	200	90	360	27.5	6182	F
T50	13	18	57.5	64.5	18.8	0.79	0.82	80	79	3440	200	90	370	27.5	6182	F
T50	15	20	65.5	73.5	21.4	0.79	0.81	81	81	3450	230	100	420	27.5	6182	G
T50	18.5	25	79.0	89.0	26.5	0.81	0.83	81	80	3440	210	100	400	27.5	6182	F
T50	22	30	90.5	104	30.5	0.82	0.83	83	82	3450	260	166	515	27.5	6182	H
T50	26	35	106	122	36.5	0.82	0.84	82	81	3450	218	172	515	27.5	6182	G
T50	30	40	122	140	42.0	0.83	0.85	83	81	3.430	208	136	445	27.5	6182	F
T50	37	50	152	172	51.5	0.82	0.84	83	82	3450	275	174	530	27.5	6182	G

3 x 230 V, 60 Hz, SF 1.15

T-code	Motor		Current		Motor	Cos φ		Efficiency (η)		n	BT	LRT	LRC	Thrust		kVA code
	Full load (P2)		Full load	Max. load	Max. load (P1) incl. SF	Full load	Max. load	Full load	Max. load							
	[kW]	[hp]	[A]	[A]	[kW]			[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	[lbf]	
T35	5.5	7.5	26.5	29.5	8.55	0.74	0.77	74	75	3470	210	80	360	27.5	6182	F
T35	7.5	10	36.0	39.5	11.4	0.72	0.76	76	77	3470	220	90	370	27.5	6182	F
T35	9.2	12	42.0	46.0	13.6	0.75	0.78	78	79	3460	210	90	370	27.5	6182	F
T35	11	15	51.0	56.0	15.8	0.72	0.75	80	80	3470	230	100	390	27.5	6182	G
T35	13	18	57.5	63.5	18.6	0.74	0.78	81	81	3460	230	100	400	27.5	6182	F
T35	15	20	66.5	73.0	21.2	0.74	0.77	81	82	3470	260	120	450	27.5	6182	G
T35	18.5	25	78.5	87.0	26.0	0.77	0.80	82	82	3460	240	110	440	27.5	6182	F
T35	22	30	90.0	100	30.5	0.78	0.81	84	83	3470	295	192	565	27.5	6182	H
T35	26	35	106	118	35.5	0.78	0.81	84	84	3470	250	202	575	27.5	6182	H
T35	30	40	118	132	41.0	0.80	0.82	85	84	3460	248	162	510	27.5	6182	G
T30	37	50	154	170	51.0	0.77	0.81	84	84	3470	310	200	575	27.5	6182	H
T50	5.5	7.5	26.5	29.5	8.70	0.76	0.78	73	73	3460	200	80	350	27.5	6182	F
T50	7.5	10	36.0	39.5	11.6	0.74	0.77	75	75	3470	210	90	370	27.5	6182	F
T50	9.2	12	41.5	46.5	13.8	0.77	0.79	77	77	3450	200	80	360	27.5	6182	F
T50	11	15	51.0	56.0	16.2	0.73	0.77	78	79	3460	220	90	390	27.5	6182	F
T50	13	18	57.5	63.5	18.8	0.76	0.79	80	80	3450	220	100	390	27.5	6182	F
T50	15	20	66.5	73.0	21.4	0.75	0.78	81	81	3470	250	120	440	27.5	6182	G
T50	18.5	25	78.5	87.5	26.5	0.78	0.81	81	81	3460	230	110	430	27.5	6182	F
T50	22	30	90.0	100	30.5	0.78	0.81	83	83	3470	285	184	550	27.5	6182	H
T50	26	35	106	118	36.5	0.79	0.82	83	82	3470	242	190	555	27.5	6182	G
T50	30	40	118	134	42.0	0.81	0.83	83	82	3450	230	150	485	27.5	6182	F
T50	37	50	154	170	51.5	0.78	0.81	83	83	3460	305	192	560	27.5	6182	G

3 x 380 V, 60 Hz, SF 1.15

T-code	Motor		Current		Motor	Cos φ		Efficiency (η)		n	BT	LRT	LRC	Thrust		kVA code
	Full load (P2)		Full load	Max. load	Max. load (P1) incl. SF	Full load	Max. load	Full load	Max. load							
	[kW]	[hp]	[A]	[A]	[kW]			[%]	[%]	[min^{-1}]	[%]	[%]	[%]	[kN]	[lbf]	
T35	5.5	7.5	15.6	17.4	8.55	0.77	0.79	74	75	3450	190	80	340	27.5	6182	E
T35	7.5	10	20.8	23.2	11.4	0.76	0.79	76	76	3450	200	80	350	27.5	6182	F
T35	9.2	12	24.2	27.0	13.6	0.78	0.80	78	78	3440	190	80	350	27.5	6182	E
T35	11	15	30.0	33.0	16.2	0.76	0.79	78	78	3450	210	90	380	27.5	6182	F
T35	13	18	34.5	38.0	19.0	0.77	0.79	79	80	3450	220	100	390	27.5	6182	F
T35	15	20	38.5	43.0	21.6	0.78	0.80	81	81	3460	240	110	430	27.5	6182	G
T35	18.5	25	45.5	51.0	26.0	0.79	0.82	83	82	3450	240	110	430	27.5	6182	F
T35	22	30	53.5	59.5	30.0	0.79	0.81	84	84	3470	295	196	570	27.5	6182	H
T35	26	35	61.5	69.5	35.5	0.80	0.82	85	84	3470	250	210	585	27.5	6182	J
T35	30	40	67.0	75.5	41.5	0.81	0.83	84	84	3450	238	156	495	27.5	6182	G
T30	37	50	88.5	99.0	51.0	0.80	0.82	84	84	3460	310	202	575	27.5	6182	H
T50	5.5	7.5	15.8	17.6	8.80	0.78	0.80	72	72	3440	180	70	330	27.5	6182	E
T50	7.5	10	20.8	23.2	11.6	0.77	0.80	75	75	3450	190	80	340	27.5	6182	E
T50	9.2	12	24.4	27.5	14.0	0.80	0.81	76	76	3430	180	80	340	27.5	6182	E
T50	11	15	30.0	33.0	16.6	0.78	0.80	77	77	3450	200	90	370	27.5	6182	F
T50	13	18	34.5	38.5	19.2	0.78	0.81	78	78	3450	210	90	380	27.5	6182	F
T50	15	20	38.5	43.0	21.8	0.79	0.81	80	80	3460	230	110	420	27.5	6182	G
T50	18.5	25	46.0	51.5	26.5	0.81	0.82	81	80	3440	220	100	420	27.5	6182	F
T50	22	30	53.5	60.0	30.5	0.80	0.82	83	83	3470	280	184	545	27.5	6182	H
T50	26	35	62.0	70.0	36.0	0.81	0.83	83	83	3460	238	194	555	27.5	6182	H
T50	30	40	70.0	80.0	41.5	0.82	0.83	84	83	3450	232	154	490	27.5	6182	G
T50	37	50	88.5	99.5	51.5	0.80	0.83	84	83	3460	300	194	560	27.5	6182	H

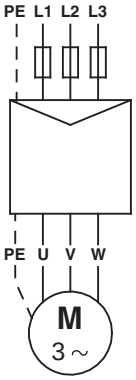
7. Wiring diagram

Wiring diagram

The motors are available for both direct-on-line and star-delta starting.

Motors wound for star-delta starting can also be connected for direct-on-line starting.

Direct-on-line starting



TM03 2099 3705

Fig. 10 Motors wound for direct-on-line starting

Star-delta starting

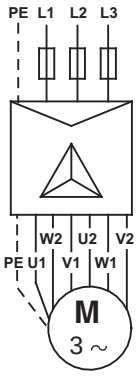


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Fig. 11 Motors wound for star-delta starting

If star-delta starting is not required, but direct-on-line starting is, the motor should be connected as shown in fig. 12.

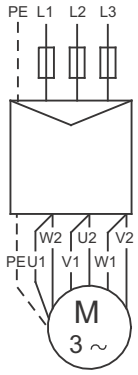

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Fig. 12 Motors wound for start-delta starting with direct-on-line starting

8. Accessories

CUE frequency converter

The Grundfos CUE is a series of external frequency converters designed for speed control of a wide range of Grundfos pumps.

When a CUE is installed, the motor requires no further motor protection.

The CUE offers quick and easy set-up and commissioning compared to a standard frequency converter because of the start-up guide. Simply enter application-specific variables such as motor data, pump family, control mode (for example constant pressure), sensor type and setpoint, and the CUE will automatically set all necessary parameters.

The CUE enables gentle pumping and thus protects the water reservoir and the rest of the distribution system, as water hammer can be avoided by adjusting ramp times up and down.

Overview of the CUE range

Supply voltage [V]	Power [kW]						
	0.55	0.75	1.1	7.5	11	45	250
3 x 525-690					■	■	■
3 x 525-600		■	■	■			
3 x 380-500	■	■	■	■	■	■	■
3 x 200-240		■	■	■	■	■	
1 x 200-240			■	■			

The CUE is available in two enclosure classes:

- IP20/21
- IP54/55.

RFI filters

To meet the EMC requirements, the CUE comes with the following types of built-in radio frequency interference filter (RFI).

Voltage [V]	Typical shaft power (P2) [kW]	RFI filter type	Application
1 x 200-240	1.1 - 7.5	C1	Residential areas
3 x 200-240	0.75 - 45	C1	
3 x 380-500	0.55 - 90	C1	
	110 - 250	C2	Residential areas/ industry
3 x 525-600	0.75 - 7.5	C3	Industry
3 x 525-690	11 - 25	C3	

GrA4404

Fig. 13 CUE frequency converters

Functions

The CUE has a wide range of pump-specific functions, such as

- constant pressure
- constant level
- constant flow rate
- constant temperature
- constant curve.

Features

- Start-up guide
  The CUE incorporates an innovative start-up guide for the general setting of the CUE including the setting of the correct direction of rotation.
  The start-up guide is started the first time when the CUE is connected to the power supply.
- Check of direction of rotation.
- Duty/standby operation.
- Dry-running protection.
- Low-flow stop function.

Inputs and outputs

The CUE incorporates various inputs and outputs:

- 1 RS-485 GENIbus connection
- 1 analog input, 0-10 V, 0/4-20 mA
  – external setpoint
- 1 analog input, 0/4-20 mA
  – sensor input, feedback sensor
- 1 analog output, 0-20 mA
- 4 digital inputs
  – start/stop and three programmable inputs
- 2 signal relays (C/NO/NC)
  – programmable.

Accessories for the CUE

Grundfos offers various accessories for the CUE.

MCB 114 sensor input module

The MCB 114 offers additional analog inputs for the CUE:

- 1 analog input, 0/4-20 mA
- 2 inputs for Pt100 and Pt1000 temperature sensors.

Output filters

Output filters are used primarily to protect the motor against overvoltage and increased operating temperature. However, output filters can also be used to reduce acoustic noise from the motor.

Grundfos offers two types of output filter as accessories for the CUE:

- dU/dt filters
- sine-wave filters.

Floor-mounting option

The CUE is as standard installed on the wall.
The enclosures D1 and D2 can also be installed on the floor on a pedestal designed for that purpose.

For information about enclosures, see the product-specific documentation for the CUE.

IP21/NEMA1 option

An IP20 enclosure can be upgraded to IP21/NEMA1 by using the IP21/NEMA1 option. The power terminals (mains and motor) will be covered.

Sensors

The following sensors can be used in connection with the CUE. All sensors are with 4-20 mA output signal.

- Pressure sensors, up to 25 bar
- temperature sensors
- differential-pressure sensors
- differential-temperature sensors
- flowmeters
- potentiometer box for external setpoint setting.

Gateways

The CUE has a standard RS-485 GENIbus interface. Gateways to convert to other bus standards are available as accessories.

The Grundfos CIU family (CIU = Communication Interface Units) can convert from GENIbus to the most common fieldbuses in the world:

- CIU 100 converts from GENIbus to LonWorks
- CIU 150 converts from GENIbus to Profibus DP
- CIU 200 converts from GENIbus to Modbus RTU
- CIU 250 is a GSM modem which can send SMS messages in case of alarms, etc.

Control MPC

The Control MPC is a multi-pump control system for the control of parallel-connected CUE pump solutions.

Use of output filters

The table below shows in which cases an output filter is required and which type to use.

The selection depends on these factors:

- pump type
- motor cable length
- the required reduction of acoustic noise from the motor.

Pump type	Typical shaft power (P2)	dU/dt filter [m]	Sine-wave filter [m]
SP with 380 V motor and up	Up to 7.5 kW	-	0-300
	11 kW and up	0-150	150-300

The lengths stated apply to the motor cable.

Cables used in CUE installations

Note: When the CUE is installed in connection with SP pumps, we distinguish between two types of installation:

- installation in EMC-insensitive sites. See fig. 14.
- installation in EMC-sensitive sites. See fig. 15.

The two types of installation are different when it comes to the use of screened cable.
Note: Drop cables are always unscreened.

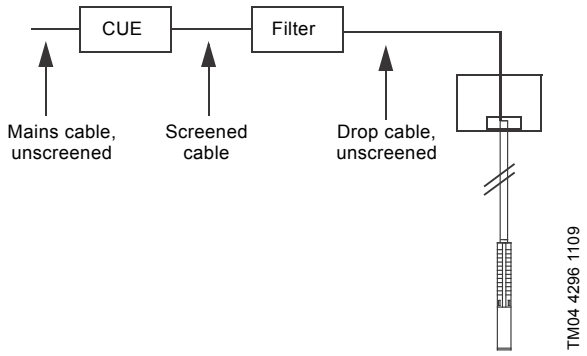


Fig. 14 Example of installation in EMC-insensitive sites

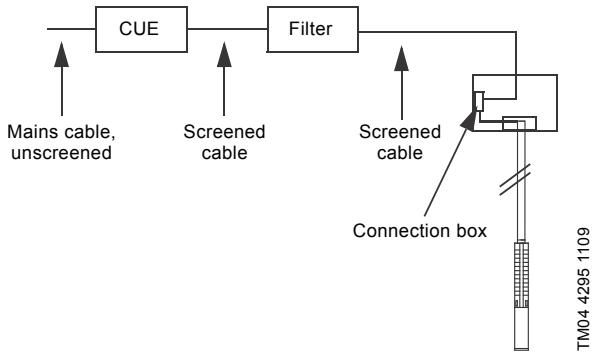


Fig. 15 Example of installation in EMC-sensitive sites

Screened cables are required in those parts of the installation where the surroundings must be protected against EMC.

The CUE is the right choice of frequency converter in SP installations as it meets all basic issues. The CUE has a pre-installed start-up guide which takes the installer through all the necessary settings.

The table below shows the issues to be considered when using frequency converters in SP installations.

Issues to be considered	Explanation
Ramp (up and down): Maximum 3 seconds.	The journal bearings must be lubricated in order to limit wear and overheating of windings.
Use temperature monitoring by Pt sensor.	Overheating of the motor => low insulation resistance => sensitive to voltage peaks.
Reduce peak voltages (max. 800 V peaks).	Never exceed peak voltages of 850 V at motor leads.
For MS and MMS, we recommend to use motors with 10 % extra in given duty point. For MMS, always use motors (PE2 - PA wound).	Grundfos CUE with output filter is a safe solution.
Remember output filter.	Cables act as an amplifier => measure peaks at the motor.
Rise time (dU/dt) shall be limited to a maximum of 1000 V/µs. Determined by the equipment in the CUE.	Time between switches is an expression of losses, so in the future, we might have to exceed the limit of 1000 V/µs. The solution is not higher insulation of the motor, but filter in the output from the CUE.
Min. 30 Hz. Use a 60 Hz motor for larger range.	Too low speed => no lubrication of journal bearings.
Size the CUE in respect of the current, not the power output.	Can end up with a too small CUE.
Size cooling provision for stator tube at duty point with lowest flow rate.	Min. flow [m/s] along the stator housing must be considered.
Ensure that the pump is used within the range of the pump curve.	Focus on discharge pressure and sufficient NPSH, as vibrations will "kill" the motor.

MP 204

The MP 204 is an electronic motor protector, designed for the protection of an asynchronous motor or a pump.

The motor protector consists of these parts:

- a cabinet incorporating transformers and electronics
- a control panel with operating buttons and display for reading of data.

The MP 204 operates with two sets of limits:

- a set of warning limits
- a set of trip limits.

If one or more of the warning limits are exceeded, the motor continues to run, but the warnings will appear in the MP 204 display.

Some values only have a warning limit.

The warning can also be read out by means of the Grundfos R100 remote control.

If one of the trip limits is exceeded, the trip relay will stop the motor. At the same time, the signal relay is operating to indicate that the limit has been exceeded.

Applications

The MP 204 can be used as a stand-alone motor protector.

The MP 204 can be monitored via a Grundfos GENIbus.

The power supply to the MP 204 is in parallel with the supply to the motor. Motor currents up to 120 A are passed directly through the MP 204. The MP 204 protects the motor primarily by measuring the motor current by means of a true RMS measurement.
It disconnects the contactor if, for example, the current exceeds the preset value.

Secondarily, the pump is protected via temperature measuring by a Tempcon sensor, a Pt100/Pt1000 sensor and a PTC sensor/thermal switch.

The MP 204 is designed for single- and three-phase motors. In single-phase motors, the starting and run capacitors are also measured. Cos φ is measured in both single- and three-phase systems.

Benefits

The MP 204 offers these benefits:

- suitable for both single- and three-phase motors
- dry-running protection
- overload protection
- very high accuracy
- made for submersible pumps.

The MP 204 - many monitoring options

The MP 204 monitors the following parameters:

- insulation resistance before start-up
- temperature (Tempcon, Pt sensor and PTC/thermal switch)
- overload/underload
- overvoltage/undervoltage
- phase sequence
- phase failure
- power factor
- power consumption
- harmonic distortion
- operating hours and number of starts.

TM03 1471 2205

Fig. 16 MP 204

Five sizes of single-turn transformers, 120 to 999 A.
Note: Monitoring of motor temperature is not possible when single-turn transformers are used.

TM03 2033 3505

Fig. 17 Single-turn transformers

Product numbers

Product	Product number
MP 204	96079927
R100	96615297
Single-turn transformers	
Current transformer ratio: 200:5, $I_{max.}$ = 120 A	96095274
Current transformer ratio: 300:5, $I_{max.}$ = 300 A	96095275
Current transformer ratio: 500:5, $I_{max.}$ = 500 A	96095276
Current transformer ratio: 750:5, $I_{max.}$ = 750 A	96095277
Current transformer ratio: 1000:5, $I_{max.}$ = 1000 A	96095278

Technical data, MP 204

Enclosure class	IP20
Ambient temperature	-20 °C to +60 °C
Relative air humidity	99 %
Voltage range	100 to 480 VAC
Current range	3 to 999 A
Frequency	50 to 60 Hz
IEC trip class	1-45
Special Grundfos trip class	0.1 to 30 s
Voltage variation	- 25 %/+ 15 % of rated voltage
Standards and approval	EN 60947, EN 60335, UL/CSA 508
Marking	CE, cUL, C-tick
Consumption	Max. 5 W
Plastic type	Black PC/ABS

	Measuring range	Accuracy	Resolution
Current without external current transformers	3 - 120 A	± 1 %	0.1 A
Current with external current transformers	120 - 999 A	± 1 %	1 A
Phase-to-phase voltage	80 - 610 VAC	± 1 %	1 V
Frequency	47 - 63 Hz	± 1 %	0.5 Hz
Power	0 - 1 MW	± 2 %	1 W
Power factor	0 - 0.99	± 2 %	0.01
Energy consumption	0 - 4 x10^9 kWh	± 5 %	1 kWh

Technical data, IO 112

IO 112	Description	Product number
	The IO 112 is a measuring module and a 1-channel protection unit for use in connection with the MP 204 motor protector. The module can be used for protection of the pump against other factors than the electrical conditions, for instance dry running. It can also be used as a stand-alone protection module. The IO 112 has three inputs for measured values, one potentiometer for setting of limits and indicator lights indicating the following: • measured value of the input • value of the limit set • alarm source • pump status. **Electrical data** • Supply voltage: 24 VAC - 10 %/+ 10 %, 50/60 Hz, or 24 VDC - 10 %/+ 10 %. • Supply current: Min. 2.4 A, max. 8 A. • Power consumption: Max. 5 W. • Ambient temperature: -25 °C to +65 °C. • Enclosure class: IP20.	96651601

Technical data, Control MP 204

Control MP 204	Description	Product number
	The Control MP 204 control cabinets are supplied with all necessary components. Three types of control cabinets are available, depending on functions and starting method. The control cabinets are designed for installation in a control cabinet for outdoor use. The Control MP 204 control cabinets have a built-in main switch and a thermal magnetic circuit breaker. **Functions:** **Digital input** • Float switch or pressure relay (if no IO 112 is used). **Analog input** • Too high motor temperature (Tempcon) • thermistor/PTC, pump • pressure sensor, 4-20 mA (with IO 112). **Relay output** • Pump alarm. **Communication** • Grundfos Remote Management. • GSM/GPRS (IO 112 not supported) • Modbus RTU wired (IO 112 not supported) • Profibus DP (IO 112 not supported). **Protection** • Protects the pump against short-circuit.	Consult WebCAPS on www.grundfos.com for product selection.

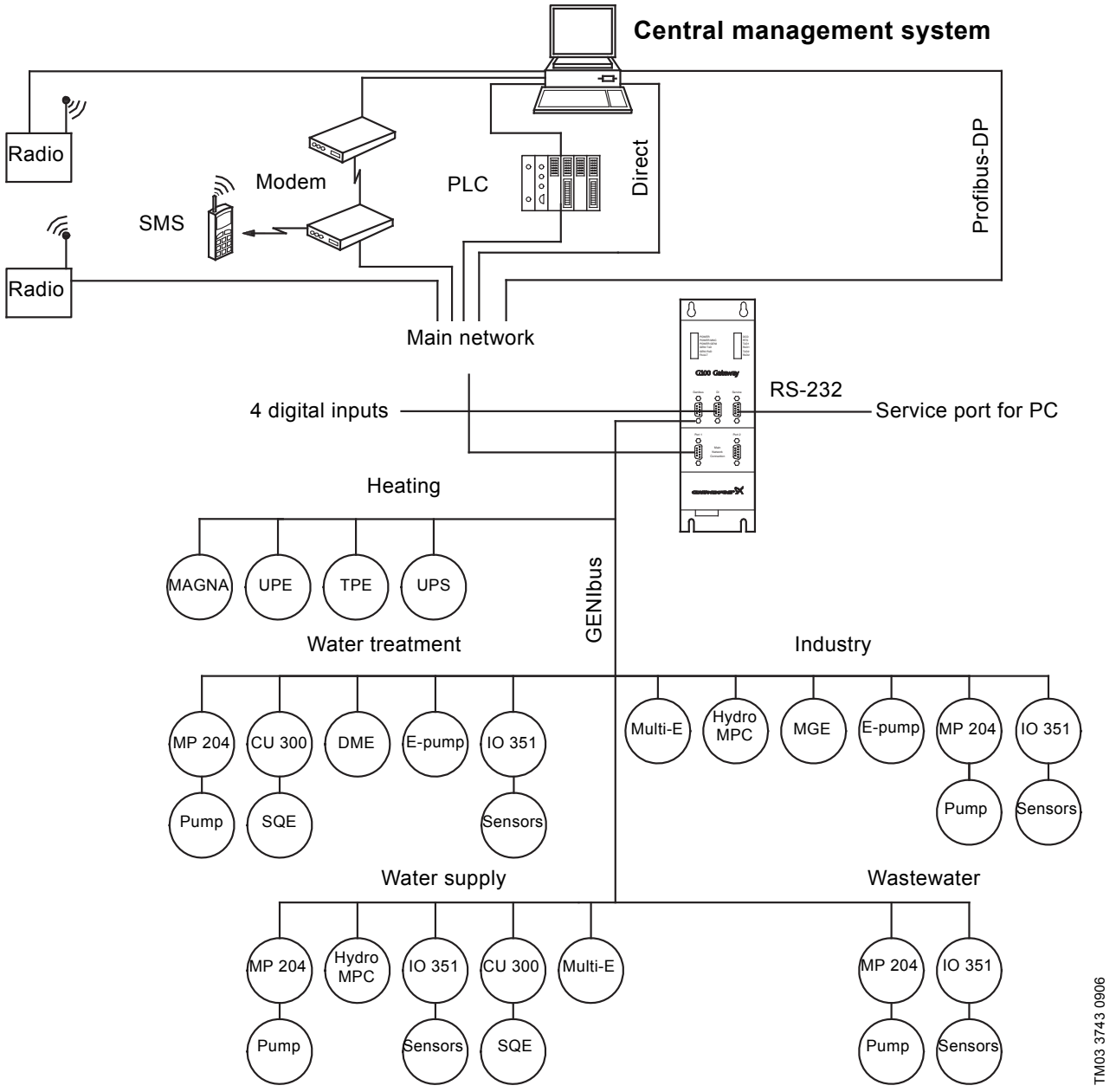
G100 gateway for communication with Grundfos products

The G100 offers a wide selection of options for integration of Grundfos products provided with GENIbus interface into main control and monitoring systems.

The G100 enables a pump installation to meet future demands for optimum pump operation in terms of reliability, operating costs, centralisation and automation.

GR5940

Fig. 18 G100



TM03 3743 0906

Fig. 19 Central management system

Product description

The G100 gateway enables communication of operating data, such as measured values, setpoints, etc., between Grundfos products with GENIbus interface and a main network for control and monitoring.

Figure 19 shows that the G100 is suitable for use in applications such as water supply, water treatment, wastewater, building automation and industry.

Common to the above applications is that downtime is usually costly, and extra investments are therefore often made to achieve maximum reliability by monitoring selected operating variables.

The day-to-day operation, such as starting and stopping of pumps, changing of setpoints, etc., can also be effected from the main system by communication with the G100. In addition, the G100 can be set up to send event-controlled status indications such as alarms via the SMS to mobile phones, and to make automatic alarm call-backs to a central management system.

Data logging

Besides the possibility of data communication, the G100 offers logging of up to 350,000 time-stamped data. Subsequently, the logged data can be transmitted to the main system or a PC for further analysis in a spreadsheet or similar program.

For the data logging, the "PC Tool G100 Data Log" software tool is used. The tool is part of the PC Tool G100 package which is supplied with the G100.

Other features

- Four digital inputs
- stop of all pumps in case of failing communication with the management system (optional)
- access code for modem communication (optional)
- alarm log.

Installation

The G100 is installed by the system integrator. The G100 is connected to the GENIbus as well as to the main network. Subsequently, all units on the GENIbus can be controlled from a central management system on the main network.

The "G100 Support Files" CD-ROM supplied with the G100 contains examples of programs to be used when the G100 is connected to the various main network systems. The CD-ROM also includes a description of the data points available in Grundfos products with GENIbus interface.

The "PC Tool G100" software tool can be used for the G100 installation and use.

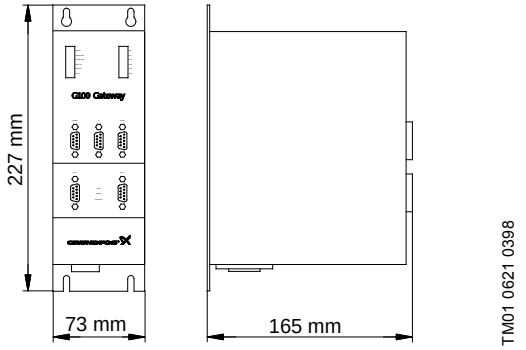


Fig. 20 G100 dimensions

Technical data

Overview of protocols

Main system	Software protocol
Profibus-DP	DP
Radio	Satt Control COMLI/Modbus
Modem	Satt Control COMLI/Modbus
PLC	Satt Control COMLI/Modbus
GSM mobile phone	SMS, UCP

Other possible connections

GENIbus RS-485	Connection of up to 32 units
Service port RS-232	For direct connection to a PC or via radio modem
Digital inputs	4
Power supply	1 x 110-240 V, 50/60 Hz
Ambient temperature	During operation: -20 °C to +60 °C
Enclosure class	IP20
Weight	1.8 kg

Accessories

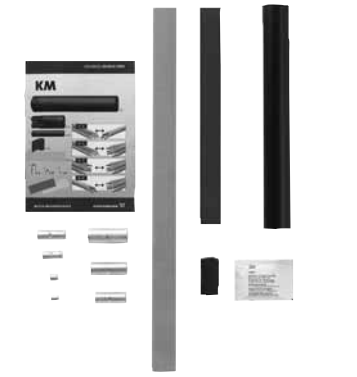
- PC Tool G100 package (supplied with the product)
- "G100 Support Files" CD-ROM (supplied with the product).

Product numbers

Product	Product number
G100 with Profibus-DP expansion board*	96411135
G100 with Radio/Modem/PLC-expansion board*	96411136
G100 Basic Version*	96411137
PC Tool G100 package	96415783

* CD-ROM with G100 Support Files included.

Cable termination kit, type KM

Product	Description	Version			Product number
		Motor cable	[mm²]	Number of leads	
 TM04 4977 3511	For watertight shrink-joining of motor cable and submersible drop cable: • cables of equal size. • cables of different sizes. • a cable lead and a single lead. The joint is ready for use after a few minutes and requires no long hardening time as do resin joints. The joint cannot be separated.	Flat cable	1.5 - 6.0 1.5 - 4.0	3 4	116251
		Flat cable	6 - 10 10 - 16	4 3	116252
		Flat cable	16 - 25	3 4	116255
 TM04 4978 2309	For watertight shrink-joining of motor cable and submersible drop cable: • cables of equal size. • cables of different sizes. • a cable lead and a single lead. The joint is ready for use after a few minutes and requires no long hardening time as do resin joints. The joint cannot be separated.	Single lead	10 - 70	1	96828296
		Single lead	35 - 120	1	116256
		Screw-shrinking	70 - 240	4	96637279
 TM04 4979 2309	For watertight joining of motor cable and submersible drop cable. By means of shrink-screw-glue casting.	Screw-shrinking	6 - 35	4	96636867
			19 - 95		96636868
			35 - 185		96637278
 TM04 4980 2309	Reducing from 3 or 4 to one as from drop cable to single leads.	Reducer-shrinking	10 - 50	3	96637318
			10 - 50	4	96637330
			16 - 70	3	96637331
			16 - 70	4	96637332
		3 single leads	1.5 - 6.0	3	116253
		3 single leads	10 - 25	3	116254
		4 single leads	1.5 - 4.0	4	116257
		4 single leads	6 - 16	4	116258

Mastik for flat cables

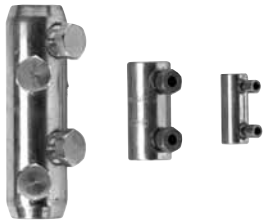
Description	Product number
Mastik for flat cables with separate earth, 48 pcs.	96788662

Cable termination kit, types M0 to M6

TM04 4981 2309

For watertight joining of motor cable and submersible drop cable. The joint is encapsulated by the glue which is part of the kit.

Type	Diameter of cable joint [mm]	Outer cable diameter [mm]	Product number
M0	∅40	∅6 - ∅15	ID8903
M1	∅46	∅9 - ∅23	ID8904
M2	∅52	∅17 - ∅31	ID8905
M3	∅77	∅26 - ∅44	ID8906
M4	∅97	∅29 - ∅55	91070700

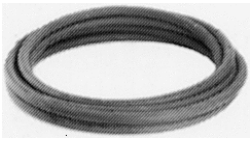


GrA8251

Accessories for cable kits M0 to M6.
Screw connectors only.

Cross-section of leads [mm^2]	Number of connectors	Product number
6-25	4	96626021
16-95		96626022
35-185		96626023
70-240		96626028

Submersible drop cable

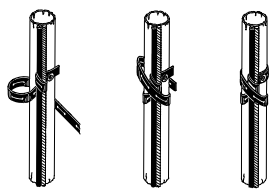


TM00 7882 2296

Suitable for these applications:
- continuous application in groundwater and potable water (approved for potable-water applications)
- connection of electrical equipment, such as submersible motors
- installation depths up to 600 metres and average loads.

Insulation and sheath of special EPR-based elastomer materials adapted to applications in water.
Maximum permissible water temperature: 70 °C.
Maximum permissible lead service temperature: 90 °C.
Further cable sizes are available on request.

Number of leads and nominal cross-section [mm^2]	Outer cable diameter min./max. [mm]	Weight [kg/m]	Product number
1 x 25	12.5 / 16.5	0.410	ID4072
1 x 35	14.0 / 18.5	0.560	ID4073
1 x 50	16.5 / 21.0	0.740	ID4074
1 x 70	18.5 / 23.5	1.000	ID4075
1 x 95	21.0 / 26.5	1.300	ID4076
1 x 120	23.5 / 28.5	1.650	ID4077
1 x 150	26.0 / 31.5	2.000	ID4078
1 x 185	27.5 / 34.5	2.500	ID4079
3 x 25	26.5 / 34.0	1.450	ID4062
4G1.5	10.5 / 13.5	0.190	ID4063
4G2.5	12.5 / 15.5	0.280	ID4064
4G4.0	14.5 / 18.0	0.390	ID4065
4G6.0	16.5 / 22.0	0.520	ID4066
4G10	22.5 / 24.5	0.950	ID4067
4G16	26.5 / 28.5	1.400	ID4068
4G25	32.0 / 34.0	1.950	ID4069
4G35	33.0 / 42.5	2.700	96432949
4G50	38.0 / 48.5	3.600	96432950
4G70	43.0 / 54.5	4.900	96432951



TM00 1369 5092

For fastening of cable and straining wire to the riser pipe.
The clips should be fitted every 3 metres.
One set for approx. 45 m riser pipe.
- 16 cable buttons.
- 7.5 m rubber band.

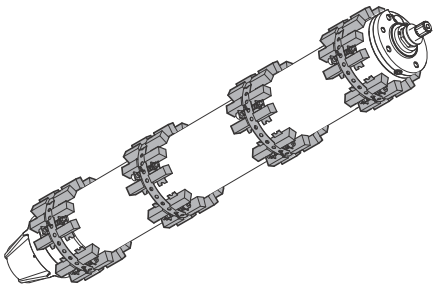
Cable clips	Description	Product number
		115016

Zinc anodes

Application

Cathodic protection by means of zinc can be used for corrosion protection of SP pumps in chloride-containing liquids, such as brackish water and seawater.

Sacrificial anodes are placed on the outside of the pump and motor as protection against corrosion. See fig. 21.



TM05 0537 1211

Fig. 21 Submersible motor fitted with anode strings

The number of anodes required depends on the pump and motor in question.

Please contact Grundfos for further details.

Flow sleeves

Grundfos offers a complete range of stainless-steel flow sleeves for both vertical and horizontal operation. We recommend flow sleeves for all applications in which motor cooling is insufficient. The result is a general extension of motor life.

Flow sleeves are to be used in these cases:

- If the submersible pump is exposed to high thermal load like current unbalance, dry running, overload, high ambient temperature or bad cooling conditions.
- If aggressive liquids are pumped, since corrosion is doubled for every 10 °C the temperature rises.
- If sedimentation or deposits occur around and/or on the motor.

Note: More information about flow sleeves is available on request.

TM01 0751 2197 - TM01 0750 2197

Fig. 22 Flow sleeves

Pt100 sensor

The Pt100 sensor offers these features:

- continuous monitoring of the motor temperature
- protection against too high motor temperature.

Protecting the motor against too high motor temperature is the simplest and cheapest way of ensuring long motor life. The Pt100 ensures that the operating conditions are not exceeded and indicates when it is time to service the motor.

Monitoring and protection by means of a Pt100 require the following parts:

- Pt100 sensor
- PR 5714 relay
- cable.

The PR 5714 relay is fitted with a Pt100 sensor.

The following temperature limits are preset on delivery:

- 60 °C warning limit
  Recommended setting: T-code +5 °C.
- 75 °C stop limit
  Recommended setting: T-code +15 °C.

Technical data

	Relay type
	PR 5714
Enclosure class	IP65 (mounted in a control panel)
Ambient temperature	-20 °C to +60 °C
Relative humidity	95 % (condensating)
Voltage variation	1 x 24-230 VAC - 10 %/+ 10 %, 50-60 Hz 24-250 VDC - 20 %/+ 20 %
Approvals	UL, DNV
Marking	CE

Pt100 sensor with/without PR 5714 relay and cable		Cable length [m]	PR 5714	Product number		
				MS6	MMS6 MMS 6000 MMS 8000	MMS 10000 MMS 12000
	GrA3187	20	Yes	96408953	96494596	96437287
		40	Yes	96408681	96494597	96437288
		60	Yes	96408954	96494598	96437289
		80	Yes	96408955	96494599	96437290
		100	Yes	96408956	96494610	96437291
		20	No	96658626	96658629	96658633
		40	No	96658627	96658630	96658634
		60	No	96658628	96658631	96658635
		80	No	96658637	96658632	96658636
		100	No	96658638	96658639	96658640

PR 5714 relay		Voltage	Product number
	GrA3186	24-230 VAC, 50/60 Hz / 24-250 VDC	96913234

Pt100 sensor, including cable		Cable length [m]	Product number
	GrA3190	20	96913237
		40	96913253
		60	96913256
		80	96913260
		100	96913263

Extension kit for sensor cable for Pt100		Description	Product number
	TM00 7885 2296	Extension kit for Pt100 sensor cable. For watertight shrink-joining of the sensor cable. Extra sensor cable must be ordered separately.	96571480

Sensor cable		Description	Product number
	TM00 7882 2296	Drop cable for extension. Mention length when ordering. Maximum recommended length: 350 m.	RM5271

Pt1000 sensor

The Pt1000 sensor offers these features:

- continuous monitoring of the motor temperature
- protection against too high motor temperature.

Protecting the motor against too high motor temperature is the simplest and cheapest way of ensuring long motor life. The Pt1000 ensures that the operating conditions are not exceeded and indicates when it is time to service the motor.

Monitoring and protection by means of a Pt1000 require the following parts:

- Pt1000 sensor
- CU 220 control unit
- cable
- staybolt kit for Pt1000.

The CU 220 control unit is fitted with a Pt1000 sensor.

The following temperature limits are preset on delivery:

- 50 °C warning limit
  Recommended setting: T-code +5 °C.
- 60 °C stop limit
  Recommended setting: T-code +15 °C.

The Pt1000 sensor works within the temperature range of -60 °C to +120 °C.

Technical data

	CU 220
Enclosure class	IP65 (mounted in a control panel)
Ambient temperature	0 °C to +55 °C
Relative humidity	20-80 % (condensating)
Voltage variation	1 x 230 V - 15 %/+ 10 %, 50 Hz
Approvals	UR
Marking	CE

Pt1000 sensor with CU 220 control unit, cable and staybolt or insertion probe		Cable length [m]	CU 220	Product number		
				MS6	MMS6 MMS 6000 MMS 8000	MMS 10000 MMS 12000
	TM04 3561 4508 - TM04 3563 4508 TM04 3562 4508 - TM04 3560 4508	20	Yes	96803207	96803233	96803238
		40	Yes	96803241	96803252	96803253
		60	Yes	96803254	96803255	96803257
		80	Yes	96803258	96803292	96803294
		100	Yes	96803301	96803312	96803313

CU 220 control unit		Voltage	Product number
	TM04 3561 4508	1 x 230 V - 15 %/+ 10 %, 50 Hz	96797484

Pt1000 sensor, including cable		Cable length [m]	Product number
	TM04 3563 4508	20	96804042
		40	96804044
		60	96804064
		80	96804065
		100	96804067

Extension kit for sensor cable for Pt1000		Description	Product number
	TM00 7885 2296	Extension kit for Pt1000 sensor cable. For watertight shrink-joining of the sensor cable. Extra sensor cable must be ordered separately.	96571480

Sensor cable		Description	Product number
	TM00 7882 2296	Drop cable for extension. Mention length when ordering. Maximum recommended length: 350 m.	RM5271

9. Cable sizing

Drop cables

Grundfos offers submersible drop cables for all types of application, i.e. 3-core cables, 4-core cables and single leads.

The selection of submersible drop cable depends on the application and type of installation.

Standard version: Maximum liquid temperature +60 °C.

Tables indicating cable dimensions in borehole

The tables indicate the maximum length of drop cables in metres from motor-protective circuit breaker to pump for direct-on-line starting, and at different cable dimensions.

The lengths of the cables are calculated by means of the maximum current for cables according to IEC 364 and HD 384.

If, for example, the operating current is 10 % lower than the rated current, the cable may be 10 % longer than indicated in the table.

The calculation of the cable length is based on a maximum voltage drop of 3 % of the rated voltage and a water temperature of maximum +30 °C.

To minimise operating losses, the cable cross-section may be increased compared to what is indicated in the table. This is economical only in these cases:

- The borehole provides the necessary space.
- The operating time of the pump is long.
- The operating voltage is lower than the rated voltage.

The table values are calculated on the basis of the following formula:

Maximum cable length of a three-phase submersible pump

$$L = \frac{U \times \Delta U}{I \times 1.73 \times 100 \times \left(\cos\varphi \times \frac{\rho}{q} + \sin\varphi \times X_L \right)} [m]$$

Legend

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated current of the motor [A]

q = Cross-section of submersible drop cable [mm^2]

X_L = Inductive resistance: 0.078 x 10^{-3} [Ω/m]

cos φ = Power factor

sin φ = $\sqrt{1 - \cos^2\varphi}$

ρ = Specific resistance: 0.025 [Ωmm^2/m]

Example

Motor size:	30 kW, MMS6
Rated current:	68.2 A
Rated voltage:	3 x 400 V, 50 Hz
Starting method:	Direct-on-line
Power factor:	cos φ = 0.81
Voltage drop:	3 %
Cross-section:	25 mm^2
sin φ:	0.59

$$L = \frac{400 \times 3}{68.2 \times 1.73 \times 100 \times \left(0.81 \times \frac{0.025}{25} + 0.59 \times 0.078 \times 10^{-3} \right)}$$

L = 119 m.

Cable sizing

Calculation of cable cross-section

Legend

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated current of the motor [A]

q = Cross-section [mm^2]

X_L = Inductive resistance 0.078 x 10^{-3} [Ω/m]

cos φ = Power factor

sin φ = $\sqrt{1 - \cos^2\varphi}$

L = Cable length [m]

Δp = Power loss [W]

r **= 1/c**
Cable material
Copper: c = 40 m/W x mm^2
Aluminium: c = 35 m/W x mm^2

For calculation of the cross-section of the submersible drop cable, use the following formulas:

Direct-on-line

$$q = \frac{I \cdot 1.73 \cdot 100 \cdot L \cdot \rho \cdot \cos\varphi}{U \cdot \Delta U - (I \cdot 1.73 \cdot 100 \cdot L \cdot X_L \cdot \sin\varphi)}$$

$$q = \frac{68.2 \cdot 1.73 \cdot 100 \cdot 200 \cdot 1/52 \cdot 0.81}{400 \cdot 3 - (68.2 \cdot 1.73 \cdot 100 \cdot 200 \cdot 0.078 \cdot 0.59)}$$

q = 35 mm^2

Star-delta

$$q = \frac{I \cdot 100 \cdot L \cdot \rho \cdot \cos\varphi}{U \cdot \Delta U - (I \cdot 100 \cdot L \cdot X_L \cdot \sin\varphi)}$$

The values of the rated current (I) and the power factor (cos φ) can be found in the tables on pages 14 to 20.

Calculation of power loss

For calculation of the power loss in the submersible drop cable, use the following formula:

$$\Delta p = \frac{3 \cdot L \cdot \rho \cdot I^2}{q}$$

Example

Motor size:	30 kW, MMS6
Rated current:	$I_{1/1}$ = 68.2 A
Rated voltage:	3 x 400 V, 50 Hz
Starting method:	Direct-on-line
Required cable length:	200 m
Water temperature:	25 °C
cos φ:	0.81
Cable selection:	
Choice A:	**3 x 35 mm^2**
Choice B:	**3 x 50 mm^2**

Calculation of power loss

Choice A

$$\Delta p_A = \frac{3 \cdot L \cdot \rho \cdot I^2}{q}$$

$$\Delta p_A = \frac{3 \cdot 200 \cdot 0.02 \cdot 68.2^2}{35}$$

Δp_A = 1594 **W**

Choice B

$$\Delta p_B = \frac{3 \cdot 200 \cdot 0.02 \cdot (68.2)^2}{50}$$

Δp_B = 1116 W

Savings

Operating hours/year: h = 4000.

Annual saving (A):

$$A = (\Delta p_A - \Delta p_B) \cdot h = (1594\ W - 1116\ W) \cdot 4000 = 1912000\ Wh$$

A = 1912 kWh

By choosing the cable size 3 x 50 mm^2 instead of 3 x 35 mm^2, an annual saving of 1912 kWh is achieved.

Operating time: 10 years

Saving after 10 years (A_{10}):

$$A_{10} = A \cdot 10 = 1912 \cdot 10 = 19120\ kWh$$

The saving must be calculated in the local currency.

10. Order data

Legend

- = Not in the standard program, i.e. FPV variant.

❍ = Not produceable.

• = We recommend to use of PE2/PA windings.

3 x 200 V, 50 Hz, and 3 x 200-220 V, 60 Hz, SF 1.0, Japan

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	-	-	-	-	-	-	-	-	-	-
	7.5	10	-	-	-	-	-	-	-	-	-	-
	9.2	12	-	-	-	-	-	-	-	-	-	-
	11	15	-	-	-	-	-	-	-	-	-	-
	13	17	-	-	-	-	-	-	-	-	-	-
	15	20	-	-	-	-	-	-	-	-	-	-
	18.5	25	-	-	-	-	-	-	-	-	-	-
	22	30	-	-	-	-	-	-	-	-	-	-
	26	35	-	-	-	-	-	96879531	-	-	-	96879533
	30	40	-	-	-	-	-	96879532	-	-	-	96879534
	37	50	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

3 x 220-230 V, 50 Hz

	Motor power		Product number									
			PVC windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	96881044	-	96881051	-	-	-	-	-	•	•
	7.5	10	96881045	-	96881052	-	-	-	-	-	•	•
	9.2	12	96881046	-	96881053	-	-	-	-	-	•	•
	11	15	96881047	-	96881054	-	-	-	-	-	•	•
	13	17	96881048	-	96881055	-	-	-	-	-	•	•
	15	20	96881049	-	96881056	-	-	-	-	-	•	•
	18.5	25	96881050	-	96881057	-	-	-	-	-	•	•
	22	30	96879499	-	96879503	-	-	-	-	-	•	•
	26	35	96879500	-	96879504	-	-	-	-	-	•	•
	30	40	96879501	-	96879505	-	-	-	-	-	•	•
	37	50	❍	96879502	❍	96879506	❍	-	❍	-	•	•

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	-	-	-	-	96881058	-	96881065	-	96881072	-
	7.5	10	-	-	-	-	96881059	-	96881066	-	96881073	-
	9.2	12	-	-	-	-	96881060	-	96881067	-	96881074	-
	11	15	-	-	-	-	96881061	-	96881068	-	96881075	-
	13	17	-	-	-	-	96881062	-	96881069	-	96881076	-
	15	20	-	-	-	-	96881063	-	96881070	-	96881077	-
	18.5	25	-	-	-	-	96881064	-	96881071	-	96881078	-
	22	30	-	-	-	-	96879507	-	96879511	-	96879515	-
	26	35	-	-	-	-	96879508	-	96879512	-	96879516	-
	30	40	-	-	-	-	96879509	-	96879513	-	96879517	-
	37	50	❍	-	❍	-	❍	96879510	❍	96879514	❍	96879518

3 x 380-400-415 V, 50 Hz, and 3 x 460 V, 60 Hz

	Motor power		Product number									
			PVC windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	96880880	❍	96880891	❍	96880902	❍	96880913	❍	●	●
	7.5	10	96880881	❍	96880892	❍	96880903	❍	96880914	❍	●	●
	9.2	12	96880882	❍	96880893	❍	96880904	❍	96880915	❍	●	●
	11	15	96880883	96880887	96880894	96880898	96880905	96880909	96880916	96880920	●	●
	13	17	96880884	96880888	96880895	96880899	96880906	96880910	96880917	96880921	●	●
	15	20	96880885	96880889	96880896	96880900	96880907	96880911	96880918	96880922	●	●
	18.5	25	96880886	96880890	96880897	96880901	96880908	96880912	96880919	96880923	●	●
	22	30	96879377	96879381	96879385	96879389	96879393	96879397	96879401	96879405	●	●
	26	35	96879378	96879382	96879386	96879390	96879394	96879398	96879402	96879406	●	●
	30	40	96879379	96879383	96879387	96879391	96879395	96879399	96879403	96879407	●	●
	37	50	96879380	96879384	96879388	96879392	96879396	96879400	96879404	96879408	●	●

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	96880924	❍	96880934	❍	96880944	❍	96880954	❍	96880964	❍
	7.5	10	96880925	❍	96880935	❍	96880945	❍	96880955	❍	96880965	❍
	9.2	12	96880926	❍	96880936	❍	96880946	❍	96880956	❍	96880966	❍
	11	15	96880927	❍	96880937	❍	96880947	❍	96880957	❍	96880967	❍
	13	17	96880928	96880931	96880938	96880941	96880948	96880951	96880958	96880961	96880968	96880971
	15	20	96880929	96880932	96880939	96880942	96880949	96880952	96880959	96880962	96880969	96880972
	18.5	25	96880930	96880933	96880940	96880943	96880950	96880953	96880960	96880963	96880970	96880973
	22	30	96879409	96879413	96879417	96879421	96879425	96879429	96879433	96879437	96879441	96879445
	26	35	96879410	96879414	96879418	96879422	96879426	96879430	96879434	96879438	96879442	96879446
	30	40	96879411	96879415	96879419	96879423	96879427	96879431	96879435	96879439	96879443	96879447
	37	50	96879412	96879416	96879420	96879424	96879428	96879432	96879436	96879440	96879444	96879448

3 x 380-400-415 V, 50 Hz, and 3 x 460 V, 60 Hz (boxed up for sea freightage)

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	-	❍	-	❍	-	❍	-	❍	-	❍
	7.5	10	-	❍	-	❍	-	❍	-	❍	-	❍
	9.2	12	-	❍	-	❍	-	❍	-	❍	-	❍
	11	15	-	❍	-	❍	-	❍	-	❍	-	❍
	13	17	-	-	-	-	-	-	-	-	-	-
	15	20	-	-	-	-	-	-	-	-	-	-
	18.5	25	-	-	-	-	-	-	-	-	-	-
	22	30	-	-	-	-	-	-	-	-	-	-
	26	35	-	-	-	-	-	-	-	-	-	-
	30	40	-	-	-	-	96879559	-	96879561	-	96879563	-
	37	50	-	-	-	-	96879560	-	96879562	-	96879564	-

3 x 400 V, 50 Hz, and 3 x 400-440 V, 60 Hz, SF 1.0, Japan

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	-	❍	-	❍	-	❍	-	❍	-	❍
	7.5	10	-	❍	-	❍	-	❍	-	❍	-	❍
	9.2	12	-	❍	-	❍	-	❍	-	❍	-	❍
	11	15	-	❍	-	❍	-	❍	-	❍	-	❍
	13	17	-	-	-	-	-	-	-	-	-	-
	15	20	-	-	-	-	-	-	-	-	-	-
	18.5	25	-	-	-	-	-	-	-	-	-	-
	22	30	-	-	-	-	-	-	-	-	-	-
	26	35	-	-	-	-	-	96879535	-	-	-	96879537
	30	40	-	-	-	-	-	96879536	-	-	-	96879538
	37	50	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

3 x 400-415 V, 50 Hz, Australia

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	-	❍	-	-	-	❍	-	❍	-	❍
	7.5	10	-	❍	-	-	-	❍	-	❍	-	❍
	9.2	12	-	❍	-	-	-	❍	-	❍	-	❍
	11	15	-	❍	-	-	-	❍	-	❍	-	❍
	13	17	-	-	-	-	-	-	-	-	-	-
	15	20	-	-	-	-	-	-	-	-	-	-
	18.5	25	-	-	-	-	-	-	-	-	-	-
	22	30	-	-	-	-	-	-	-	-	-	-
	26	35	-	-	-	-	-	-	-	-	-	-
	30	40	96879449	-	96879451	-	96879453	-	96879455	-	96879457	-
	37	50	96879450	-	96879452	-	96879454	-	96879456	-	96879458	-

3 x 460 V, 50 Hz

	Motor power		Product number									
			PVC windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	❍	❍	❍	❍	❍	❍	❍	❍	●	●
	7.5	10	96881094	❍	96881100	❍	-	❍	-	❍	●	●
	9.2	12	96881095	❍	96881101	❍	-	❍	-	❍	●	●
	11	15	96881096	❍	96881102	❍	-	❍	-	❍	●	●
	13	17	96881097	❍	96881103	❍	-	❍	-	❍	●	●
	15	20	96881098	-	96881104	-	-	-	-	-	●	●
	18.5	25	96881099	-	96881105	-	-	-	-	-	●	●
	22	30	96879539	-	96879543	-	-	-	-	-	●	●
	26	35	96879540	-	96879544	-	-	-	-	-	●	●
	30	40	96879541	-	96879545	-	-	-	-	-	●	●
	37	50	96879542	-	96879546	-	-	-	-	-	●	●

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
	7.5	10	-	❍	-	❍	96881106	❍	96881112	❍	96881118	❍
	9.2	12	-	❍	-	❍	96881107	❍	96881113	❍	96881119	❍
	11	15	-	❍	-	❍	96881108	❍	96881114	❍	96881120	❍
	13	17	-	❍	-	❍	96881109	❍	96881115	❍	96881121	❍
	15	20	-	-	-	-	96881110	-	96881116	-	96881122	-
	18.5	25	-	-	-	-	96881111	-	96881117	-	96881123	-
	22	30	-	-	-	-	96879547	-	96879551	-	96879555	-
	26	35	-	-	-	-	96879548	-	96879552	-	96879556	-
	30	40	-	-	-	-	96879549	-	96879553	-	96879557	-
	37	50	-	-	-	-	96879550	-	96879554	-	96879558	-

3 x 500-525 V, 50 Hz, and 3 x 575 V, 60 Hz, SF 1.15

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
	7.5	10	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
	9.2	12	-	❍	-	❍	96881079	❍	96881084	❍	96881089	❍
	11	15	-	❍	-	❍	96881080	❍	96881085	❍	96881090	❍
	13	17	-	❍	-	❍	96881081	❍	96881086	❍	96881091	❍
	15	20	-	❍	-	❍	96881082	❍	96881087	❍	96881092	❍
	18.5	25	-	-	-	-	96881083	-	96881088	-	96881093	-
	22	30	-	-	-	-	96879519	-	96879523	-	96879527	-
	26	35	-	-	-	-	96879520	-	96879524	-	96879528	-
	30	40	-	-	-	-	96879521	-	96879525	-	96879529	-
	37	50	-	-	-	-	96879522	-	96879526	-	96879530	-

3 x 220-230 V, 60 Hz, SF 1.15

	Motor power		Product number									
			PVC windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	96881009	-	96881016	-	96881197	-	-	-	●	●
	7.5	10	96881010	-	96881017	-	96881198	-	-	-	●	●
	9.2	12	96881011	-	96881018	-	96881199	-	-	-	●	●
	11	15	96881012	-	96881019	-	96881200	-	-	-	●	●
	13	17	96881013	-	96881020	-	96881201	-	-	-	●	●
	15	20	96881014	-	96881021	-	96881202	-	-	-	●	●
	18.5	25	96881015	-	96881022	-	96881203	-	-	-	●	●
	22	30	96879479	-	96879483	-	96881204	-	-	-	●	●
	26	35	96879480	-	96879484	-	96881205	-	-	-	●	●
	30	40	96879481	-	96879485	-	96881206	-	-	-	●	●
	37	50	❍	96879482	❍	96879486	❍	96881207	❍	-	●	●

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	-	-	-	-	96881023	-	96881030	-	96881037	-
	7.5	10	-	-	-	-	96881024	-	96881031	-	96881038	-
	9.2	12	-	-	-	-	96881025	-	96881032	-	96881039	-
	11	15	-	-	-	-	96881026	-	96881033	-	96881040	-
	13	17	-	-	-	-	96881027	-	96881034	-	96881041	-
	15	20	-	-	-	-	96881028	-	96881035	-	96881042	-
	18.5	25	-	-	-	-	96881029	-	96881036	-	96881043	-
	22	30	-	-	-	-	96879487	-	96879491	-	96879495	-
	26	35	-	-	-	-	96879488	-	96879492	-	96879496	-
	30	40	-	-	-	-	96879489	-	96879493	-	96879497	-
	37	50	❍	-	❍	-	❍	96879490	❍	96879494	❍	96879498

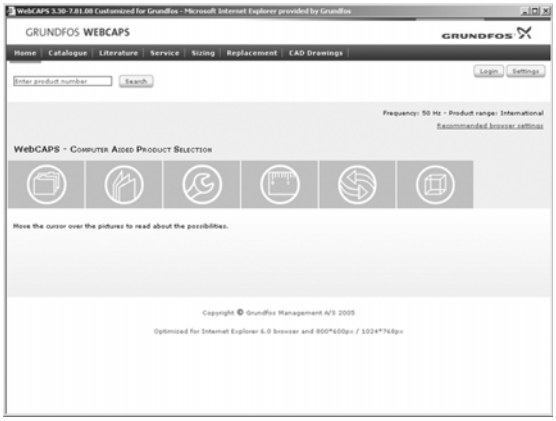
3 x 380 V, 60 Hz, SF 1.15

	Motor power		Product number									
			PVC windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	96880974	❍	96880981	❍	-	❍	-	❍	●	●
	7.5	10	96880975	❍	96880982	❍	-	❍	-	❍	●	●
	9.2	12	96880976	❍	96880983	❍	-	❍	-	❍	●	●
	11	15	96880977	-	96880984	-	-	-	-	-	●	●
	13	17	96880978	-	96880985	-	-	-	-	-	●	●
	15	20	96880979	-	96880986	-	-	-	-	-	●	●
	18.5	25	96880980	-	96880987	-	-	-	-	-	●	●
	22	30	96879459	-	96879463	-	-	-	-	-	●	●
	26	35	96879460	-	96879464	-	-	-	-	-	●	●
	30	40	96879461	-	96879465	-	-	-	-	-	●	●
	37	50	96879462	-	96879466	-	-	-	-	-	●	●

	Motor power		Product number									
			PE2/PA windings									
			Ceramic/carbon				SiC/SiC					
			EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		DIN/EN 1.4539	
	[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
MMS6	5.5	7	-	❍	-	❍	96880988	❍	96880995	❍	96881002	❍
	7.5	10	-	❍	-	❍	96880989	❍	96880996	❍	96881003	❍
	9.2	12	-	❍	-	❍	96880990	❍	96880997	❍	96881004	❍
	11	15	-	-	-	-	96880991	-	96880998	-	96881005	-
	13	17	-	-	-	-	96880992	-	96880999	-	96881006	-
	15	20	-	-	-	-	96880993	-	96881000	-	96881007	-
	18.5	25	-	-	-	-	96880994	-	96881001	-	96881008	-
	22	30	-	-	-	-	96879467	-	96879471	-	96879475	-
	26	35	-	-	-	-	96879468	-	96879472	-	96879476	-
	30	40	-	-	-	-	96879469	-	96879473	-	96879477	-
	37	50	-	-	-	-	96879470	-	96879474	-	96879478	-

11. Further product documentation

WebCAPS



WebCAPS is a **Web**-based **C**omputer **A**ided **P**roduct **S**election program available on www.grundfos.com.

WebCAPS contains detailed information on more than 220,000 Grundfos products in more than 30 languages.

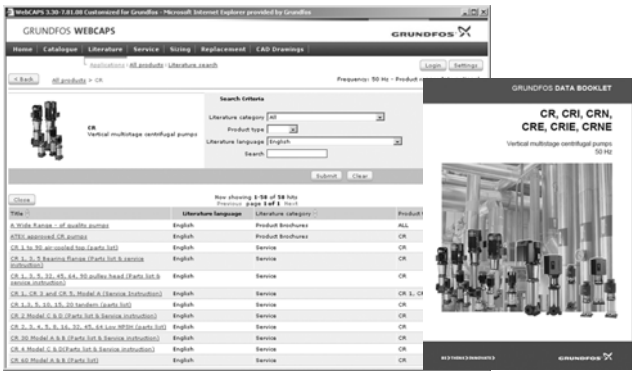
Information in WebCAPS is divided into six sections:

- Catalogue
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.

Catalogue

Based on fields of application and pump types, this section contains the following:

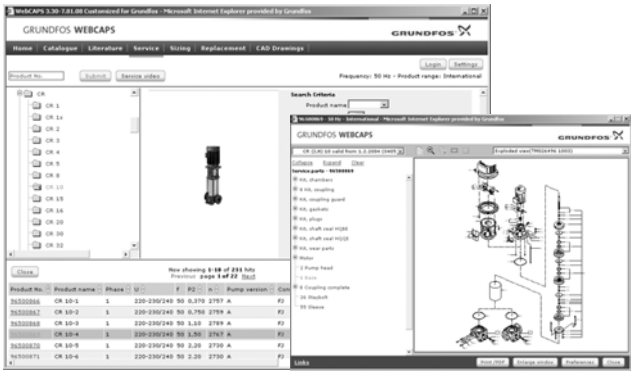
- technical data
- curves (QH, Eta, P1, P2, etc.) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.



Literature

This section contains all the latest documents of a given pump, such as

- data booklets
- installation and operating instructions
- service documentation, such as Service kit catalogue and Service kit instructions
- quick guides
- product brochures.



Service

This section contains an easy-to-use interactive service catalogue. Here you can find and identify service parts of both existing and discontinued Grundfos pumps.
Furthermore, the section contains service videos showing you how to replace service parts.

Sizing

This section is based on different fields of application and installation examples and gives easy step-by-step instructions in how to size a product:

- Select the most suitable and efficient pump for your installation.
- Carry out advanced calculations based on energy, consumption, payback periods, load profiles, life cycle costs, etc.
- Analyse your selected pump via the built-in life cycle cost tool.
- Determine the flow velocity in wastewater applications, etc.

Replacement

In this section you find a guide to selecting and comparing replacement data of an installed pump in order to replace the pump with a more efficient Grundfos pump.
The section contains replacement data of a wide range of pumps produced by other manufacturers than Grundfos.

Based on an easy step-by-step guide, you can compare Grundfos pumps with the one you have installed on your site. When you have specified the installed pump, the guide will suggest a number of Grundfos pumps which can improve both comfort and efficiency.

CAD drawings

In this section, it is possible to download 2-dimensional (2D) and 3-dimensional (3D) CAD drawings of most Grundfos pumps.

These formats are available in WebCAPS:

2-dimensional drawings:

- .dxf, wireframe drawings
- .dwg, wireframe drawings.

3-dimensional drawings:

- .dwg, wireframe drawings (without surfaces)
- .stp, solid drawings (with surfaces)
- .eprt, E-drawings.

WinCAPS

Fig. 23 WinCAPS CD-ROM

WinCAPS is a **Win**dows-based **C**omputer **A**ided **P**roduct **S**election program containing detailed information on more than 220,000 Grundfos products in more than 30 languages.

The program contains the same features and functions as WebCAPS, but is an ideal solution if no internet connection is available.

WinCAPS is available on CD-ROM and updated once a year.

Subject to alterations.

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