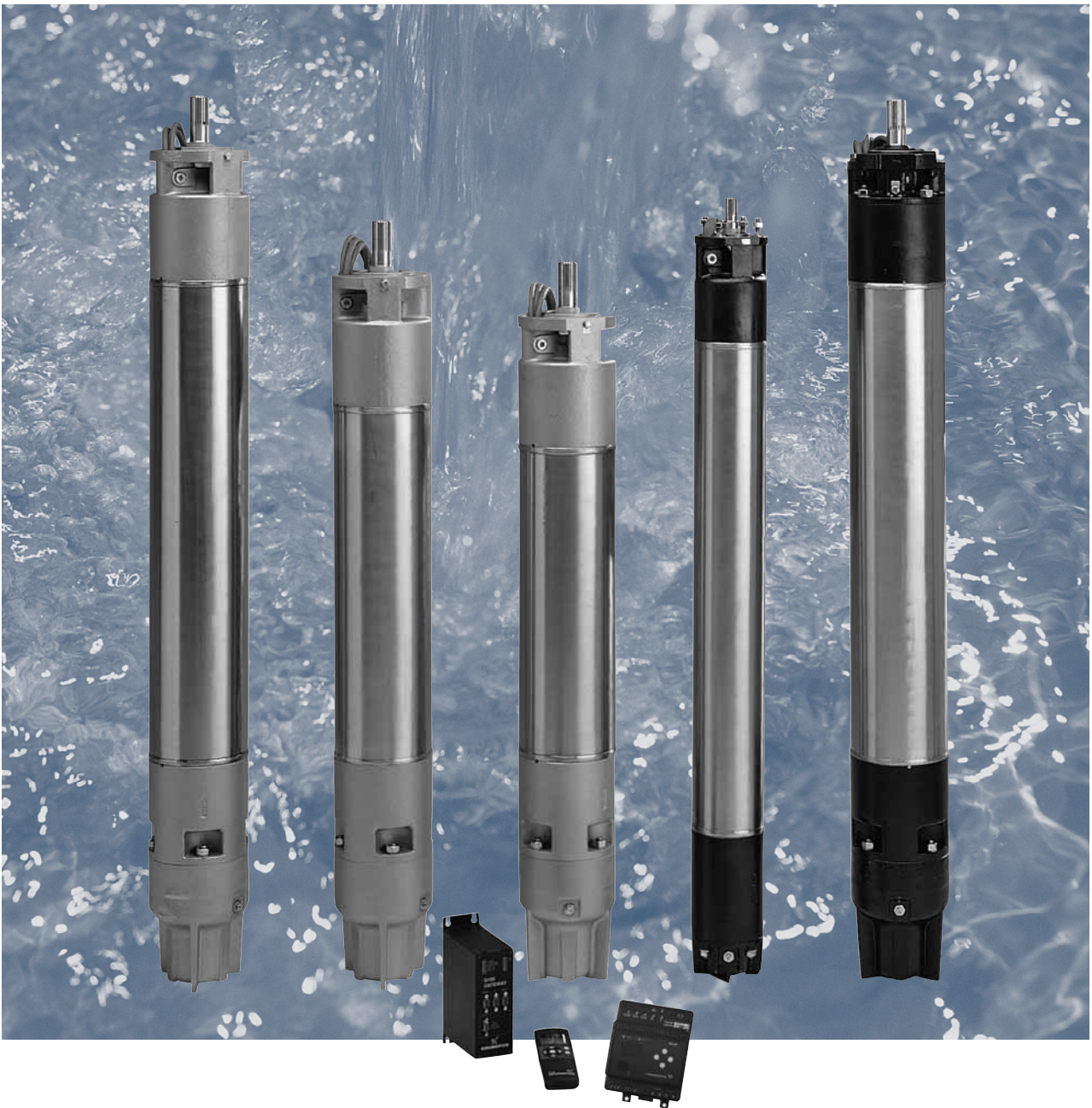


MMS

Rewindable submersible motors and accessories
50/60 Hz



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MMS rewindable motors

The Grundfos MMS product range is a complete range of submersible, rewindable motors, available in sizes from 3.7 kW 6" up to 250 kW 12" motors.

Three material versions are available. A cast iron version EN-JL1040. For more aggressive liquids with a moderate content of salt, an N-version made of stainless steel DIN/EN 1.4401 (AISI 316) is available. For aggressive liquids with more salt content than sea water and temperatures above 15 deg celsius, it is recommended to use the R version AISI 904L.

Grundfos MMS submersible motors are designed according to market standards. All Grundfos MMS 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. The 10" and 12" motors are designed according to the drawings shown on page 8. MMS motors comply with the same standards as Grundfos MS motors and can therefore be fitted on all Grundfos SP pumps without the need for 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 construction means low costs of repair of the motor in case of damage. Moreover, as rewinding can be effected locally, unnecessary time for transportation of the motor can be avoided and possible periods of downtime reduced to a minimum. The construction 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 sensor. Combined with a relay and an optional Grundfos MP 402, the Pt100 provides optimum protection of the motor.



Fig. 1 MMS motors

TM01 7873 4999

Product range, 50 Hz

	MMS 6000 (N/R)	MMS 8000 (N/R)	MMS 10000 (N)	MMS 12000 (N)
Motor size	6"	8"	10"	12"
Power range, direct-on-line and star-delta				
- 3 x 220-230 V	3.7-37* kW	22-63 kW	75-110 kW	
- 3 x 380-415 V		22-110 kW	75-190 kW	147-250 kW
- 3 x 500 V	7.5-37* kW			
Allowed installation				
- Vertical	3.7- 37* kW	22-110 kW	75-190 kW	147-250 kW
- Horizontal	3.7- 30 kW	22-92 kW	75-170 kW	147-190 kW

Note: * = 37 kW, R-version only

Product range, 60 Hz

	MMS 6000 (N/R)	MMS 8000 (N/R)	MMS 10000 (N)
Motor size	6"	8"	10"
Power range, direct-on-line and star-delta			
- 3 x 220 V	3.7-37* kW	22-75 kW	75-132 kW
- 3 x 380 V	3.7-37* kW	22-110 kW	75-190 kW
- 3 x 460 V	3.7-37* kW	22-110 kW	75-190 kW
Power range, direct-on-line			
- 3 x 575 V		22-110 kW	75-190 kW
Allowed installation			
- Vertical	3.7- 37* kW	22-110 kW	75-190 kW
- Horizontal	3.7- 30 kW	22-92 kW	75-170 kW

Note: * = 37 kW, R-version only

Rewindable motors

The two pole MMS motors are easily rewinded. The windings of the stator 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.

Type key

Example	MMS	6	000	N
Type range				
Min. borehole diameter in inches				
Generation				
Material: = Cast iron EN-JL1040 N = DIN/EN 1.4401 (AISI 316) R = DIN W.-Nr. 1.4539				

High motor efficiency

The complete motor range offered by Grundfos is characterized by high efficiency, which contributes to improved economy of the total pump system.

Overtemperature protection

For protection against overtemperature, Grundfos offers the Pt100 temperature sensor as an optional extra.

The Pt100 is fitted in the motor and connected via a relay, which can be connected to the MP204 motor protection.

When the temperature becomes too high, the motor will be cut out and damage to the pump be avoided.

Protection against upthrust

In case of a very low counter pressure in connection with start-up, there is a risk that the entire pump body may rise, for instance in connection with fountain applications. This is called upthrust, and it may cause damage to both pump and motor. Therefore, the MMS motors are fitted with upthrust spacers, which prevent upthrust in the critical start-up phase.

The maximum load in connection with thrust and upthrust can be seen in the table below.

Motor type	Motor power [kW] (hp)		Thrust		Upthrust
	Min.	Max.	(*)	(**)	[N]
			[N]	[N]	
6"	3.7 (5)	15 (20)	15000		6000
	18.5 (25)	37 (50)	27500		6000
8"	22 (30)	110 (150)	60000		12500
10"	75 (100)	190 (260)	60000		12500
12"	132 (180)	250 (340)		70000	15000

(*) Double direction of rotation (clockwise and counterclockwise)

(**) Direction of rotation to be specified (counterclockwise)

Motor protection range and communication tools

Description	Power	
	3.7-190 kW	220- 250 kW
Pt100 including relay	●	●
MP 204	●	
R100	●	
G100	●	

Operation

Frequency of starts and stops

Motor type	Number of starts	
	PE/PA	PVC
	Minimum 1 per year is recommended	
MMS 6000	Maximum 10 per hour	Maximum 3 per hour
	Maximum 70 per day	Maximum 40 per day
	Minimum 1 per year is recommended	
MMS 8000	Maximum 8 per hour	Maximum 3 per hour
	Maximum 60 per day	Maximum 30 per day
	Minimum 1 per year is recommended	
MMS 10000	Maximum 6 per hour	Maximum 2 per hour
	Maximum 50 per day	Maximum 20 per day
	Minimum 1 per year is recommended	
MMS 12000	Maximum 5 per hour	Maximum 1 per hour
	Maximum 40 per day	Maximum 10 per day

Name plate

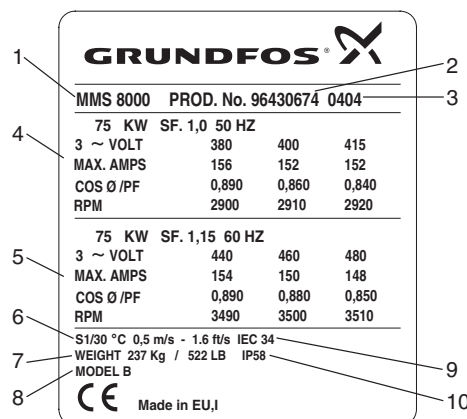


Fig. 2 Name plate

Pos.	Description	Code
1	Type designation	MMS 8000
2	Product number	PROD. No 96430674
3	Production data (MMYY)	0404
4	Motor data, 50 Hz	See name plate
5	Motor data, 60 Hz	See name plate
6	Duty conditions	S1/30 °C 0.5 m/s-1.6 ft/s
7	Weight	237 kg/522 LB
8	Model type	Model B
9	International Electrotechnical Commission standard	IEC 34
10	Enclosure Class	IP 58

Voltage quality

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



Fig. 3 MMS motor

TM01 7408 1204

TM01 8447 0200

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.

It is recommended 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:

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

Required data:

Q_{min} : Flow in m³/h

D_i : Borehole diameter in m

d_A : Motor diameter in m.

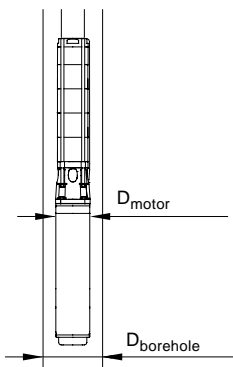


Fig. 4 Diameter of motor and borehole

Maximum liquid temperature:

Motor	Flow velocity past motor	Installation			
		PVC windings		PE/PA windings	
		Vertical	Horizontal	Vertical	Horizontal
Grundfos 6" to 12" rewindable	0.15 m/s	40 °C	30 °C	20 °C	15 °C
	0.50 m/s	45 °C	35 °C	25 °C	20 °C

Note: For MMS 6000, 37 kW, MMS 8000, 110 kW, and MMS 10000, 170 kW, the maximum liquid temperature is 5 °C lower than the values stated in the table above. For MMS 10000, 190 kW the temperature is 10 °C lower.

Operating pressure

For all motor sizes: Maximum 60 bar.

Temperature of pumped liquid

Motors with PVC windings can operate at liquid temperatures up to 30 °C.

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

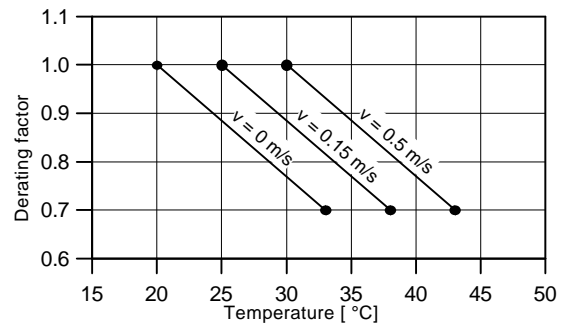


Fig. 5 PVC windings

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

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

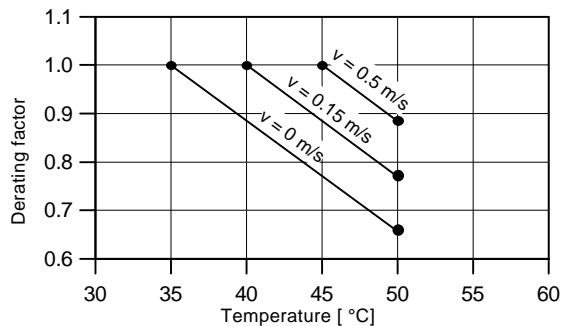


Fig. 6 PE/PA windings

Windings temperature

PVC windings: 70 °C

PE/PA windings 90 °C

Enclosure class

Enclosure class: IP 58

IP 68 (on request).

Material specification for MMS 6000 to MMS 12000

Cast iron version

Pos.	Component	Material	DIN/EN
202	Shaft	Steel	1.4462
202a	Shaft ends	Stainless steel	
203/ 206	Thrust bearing Stationary/ rotating part	6" 3.7-15 kW	Hardened steel/ EPDM
		12"	
		6" 18.5-37 kW	Ceramic/carbon
8"-10"			
204	Bearing ring	6"-10"	Carbon
		12"	Stainless steel/ NBR
205	Bearing housing, upper	Cast iron	EN- JL1040
212	Diaphragm	CR	
213	Motor end shield	Cast iron	EN- JL1040
218	Motor sleeve	Stainless steel	1.4401
220	Motor cable	EPDM	
226	Shaft seal	Ceramic/carbon	
235	Intermediate housing	Cast iron	EN- JL1040
236	Bearing housing, lower	Cast iron	EN- JL1040

N- and R-versions

Pos.	Component	Material	Version	
			N	R*
			DIN/EN	DIN/EN
202	Shaft	Steel	1.0533	1.0533
202a	Shaft ends	Stainless steel	1.4460	1.4462
203/ 206	Thrust bearing Stationary/ rotating part	6" 3.7-15 kW	Hardened steel/EPDM	
		12"		
		6" 18.5-37 kW	Ceramic/ carbon	
8"-10"				
204	Bearing ring	6"-10"	Carbon	
		12"	Stainless steel/NBR	
205	Bearing housing, upper	Stainless steel	1.4401	1.4539
212	Diaphragm	CR		
213	Motor end shield	Stainless steel	1.4401	1.4539
218	Motor sleeve	Stainless steel	1.4401	1.4539
220	Motor cable	EPDM		
226	Shaft seal	Ceramic/ carbon		
235	Intermediate housing	Stainless steel	1.4401	1.4539
236	Bearing housing, lower	Stainless steel	1.4401	1.4539

* Only MMS 8000 are available in R-versions

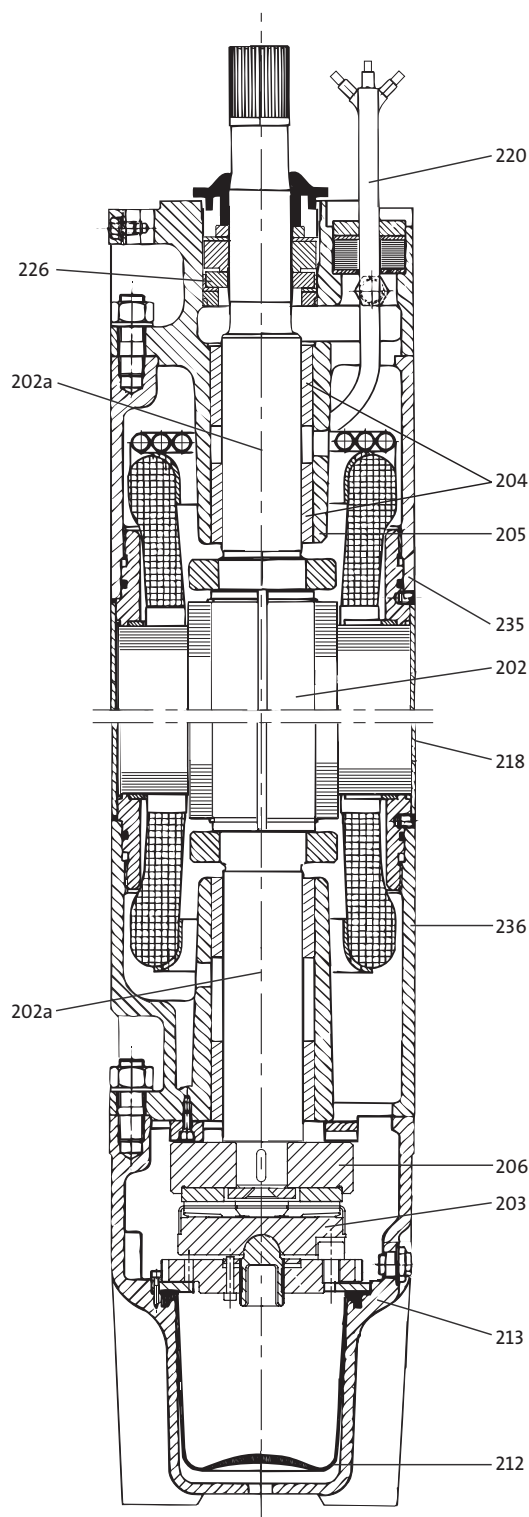


Fig. 7 MMS 10000

TM01 4985 0404

Pump connection

MMS 6000 and MMS 8000 have connections according to NEMA standard MG 1-18.413.

MMS 10000 and MMS 12000 connections are according to the drawings to the right.

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

Shaft and radial bearing

The stainless steel splined shaft end of the 6" and 8" motors fulfills ANSI B92.1, 1970, class 5.

6" motors have 15-teeth module. Pressure angle 30°.
8" motors have 23-teeth module. Pressure angle 30°.
10" and 12" motor shafts have keys.

The bearing system for the 6", 8" and 10" motors is stainless steel shaft against carbon bearing rings. The radial bearing rings of the 12" motors are made of stainless steel and NBR.

Shaft seal

The mechanical shaft seal is available in two variants: Ceramic/carbon and SiC/SiC. SiC/SiC is according to DIN 24960 and available for motors wounded for

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

only.

The material features high wear resistance and long durability, which ensures tightness and thereby 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 penetration of sand particles into the shaft seal.

Motor

MMS motors 18.5 kW and up have a squirrel cage rotor with copper bars brazed to the short circuit rings by a silver alloy.

Note: MMS 6000 motors up to 15 kW have a cast aluminium squirrel cage rotor.

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

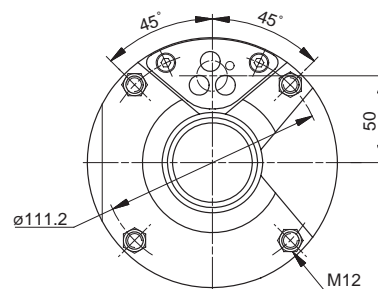


Fig. 8 MMS 6000 connection

TM01 8178 1104

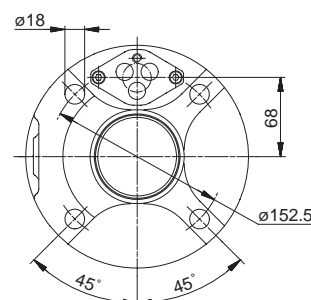


Fig. 9 MMS 8000 connection

TM01 8177 1104

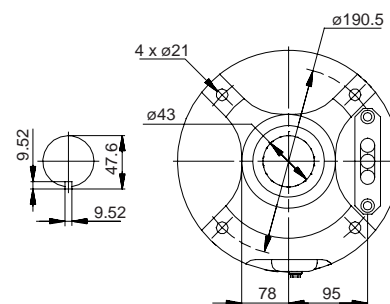


Fig. 10 MMS 10000 connection

TM01 7328 4902

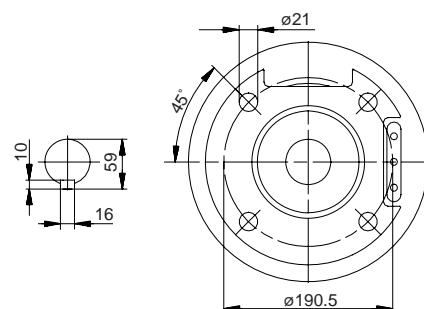


Fig. 11 MMS 12000 connection

TM01 7330 4902

Stator

The stator is a wet-wound construction 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 minimizes operating losses and improves motor performance.

In 6", 8", and 10" motors, the motor end shield is screwed onto the stator. A suitable centring assures 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 drawing to the below.

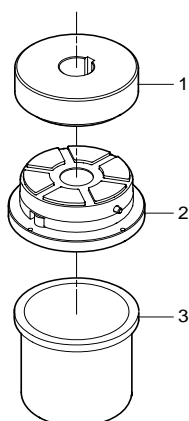
Upthrust bearing

The EPDM upthrust spacers placed above the rotating bearing part prevent motor damage during transportation or in case of upthrust in connection with start-up.

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

Diaphragm

The diaphragm (pos. no. 3) is fitted between the stator and the motor end shield. The diaphragm is dimensioned to equalize pressure variations caused by temperature rises in connection with intermittent operation.



TM01 7331 0604

Fig. 12 MMS 8000

1. Rotating bearing part
2. Stationary bearing part
3. Diaphragm.

Motor liquid

The motor is filled with glycerol-containing motor liquid, which is frost-proof down to -20°C .

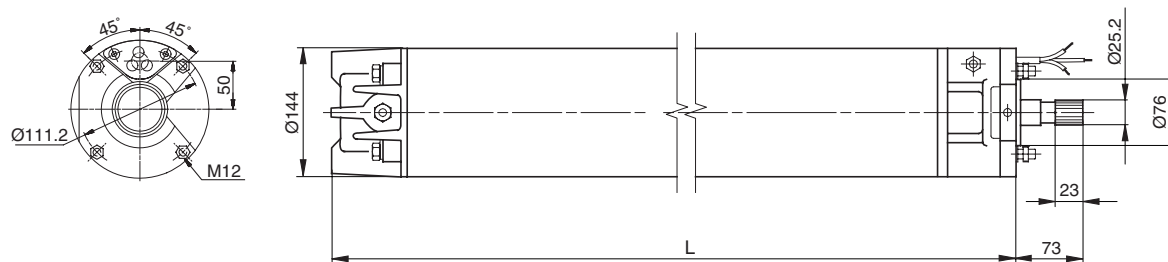
The motor liquid has an anti-corrosive and lubricating function. To obtain the best protection, a concentration of 40% to 60% in water is recommended.

Should the glycerol-containing motor liquid mixed with water not be allowed for special applications, MMS motors may be filled even with fresh water.

Motors not filled with motor liquid are available on request. The following table indicates the freezing points obtainable with various percentages of glycerol-containing motor liquid.

Glycerol-containing motor liquid % volume	Freezing point [$^{\circ}\text{C}$]
40	-3,9
50	-11,5
60	-15,2
70	-20
80	-26,7
90	-36,5
100	-46,5

MMS 6000 (N)



TM01 7325 3505

Motor power		L [mm]	Weight [kg]	Shipping volume [m ³]
P ₂ [kW]	P ₂ [hp]			
3.7	5.0	630	45	0.077
5.5	7.5	660	48	0.077
7.5	10	690	50	0.077
9.2	12.5	720	55	0.077
11	15	780	60	0.077
13	17.5	850	72	0.108
15	20	910	78	0.108
18.5	25	1085	90	0.108
22	30	1195	100	0.108
26	35	1315	115	0.123
30	40	1425	125	0.123
37	50	1425	125	0.123

Cables

The 6" motors are connected by means of three single-core cables, approved for use with drinking water. All cables are round.

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

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

Cable length: 5 m.

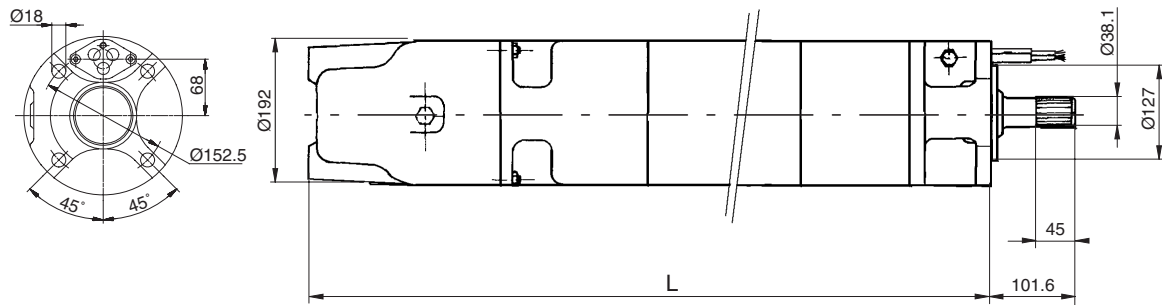
Note: Sizing of the motor cable requires that it is submerged in water. For longer cables and cable connection for extension, please see section for accessories.

Motor power		Cross-section [mm ²]									
		3 x 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 500 V, 50 Hz		3 x 380 V, 60 Hz	
P ₂ [kW]	P ₂ [hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
		3 x 1	6 x 1	3 x 1	6 x 1	3 x 1	6 x 1	3 x 1	6 x 1	3 x 1	6 x 1
3.7	5.0	6		6	6	6	6			6	
5.5	7.5	6		6	6	6	6			6	
7.5	10	6		6	6	6	6	6	6	6	
9.2	12.5	6		6	6	6	6	6	6	6	
11	15	6		6	6	6	6	6	6	6	
13	17.5	6		6	6	6	6	6	6	6	
15	20	6		6	6	6	6	6	6	6	
18.5	25	10		10	6	6	6	6	6	6	
22	30	10		10	6	6	6	6	6	6	
26	35	10		10	6	10	6	10	6	10	
30	40	10		10	6	10	6	10	6	10	
37	50		10		10	10	6	10	6	10	6

Outer dimensions

Cross-section [mm ²]	Type of cable	Outer dimensions, max. [mm]
6	Round	8.1
10	Round	8.8

MMS 8000 (N)



Motor power		L [mm]	Weight [kg]	Shipping volume [m ³]
P ₂ [kW]	P ₂ [hp]			
22	30	1010	126	0.156
26	35	1050	134	0.156
30	40	1110	146	0.156
37	50	1160	156	0.156
45	60	1270	177	0.156
55	75	1350	192	0.187
63	85	1490	218	0.187
75	100	1590	237	0.187
92	125	1830	283	0.239
110	150	2060	333	0.239

Cables

The 8" motors are connected by means of three single-core cables, approved for use with drinking water. All cables are round.

The cable outlet of star-delta motors are displaced by 90°.

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

Cable length: 8 m.

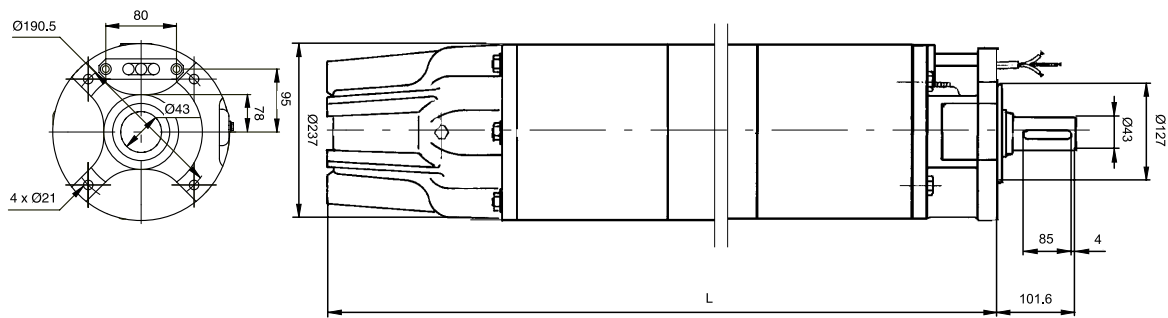
Note: Sizing of the motor cable requires that it is submerged in water. For longer cables and cable connection for extension, please see section for accessories.

Motor power		Cross-section [mm ²]									
		3 x 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 500 V, 50 Hz 3 x 575 V, 60 Hz		3 x 380 V, 60 Hz	
P ₂ [kW]	P ₂ [hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
22	30	16	10	16	10	16	10	16	10	16	10
26	35	16	10	16	10	16	10	16	10	16	10
30	40	16	10	16	10	16	10	16	10	16	10
37	50	16	16	16	16	16	10	16	10	16	10
45	60	25	16	25	16	16	10	16	10	16	16
55	75	25	16	25	16	16	16	16	16	16	16
63	85	25	16	25	16	16	16	16	16	16	16
75	100	25	16			16	16	16	16	16	16
92	125					25	16	25	16	25	16
110	150					25	16	25	16	25	16

Outer dimensions

Cross-section [mm ²]	Type of cable	Outer dimensions, max. [mm]
10	Round	8.8
16	Round	10.7
25	Round	12.1

MMS 10000 (N)



TM01 7327 3701

Motor power		L [mm]	Weight [kg]	Shipping volume [m ³]
P ₂ [kW]	P ₂ [hp]			
75	100	1400	280	0.415
92	125	1500	330	0.415
110	150	1690	385	0.415
132	180	1870	435	0.494
147	200	2070	500	0.494
170	230	2220	540	0.564
190	260	2400	580	0.564

Cables

The 10" motors are connected by means of three single-core cables, approved for use with drinking water. All cables are round.

The cable outlet of star-delta motors are displaced by 90 °.

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

Cable length: 8 m.

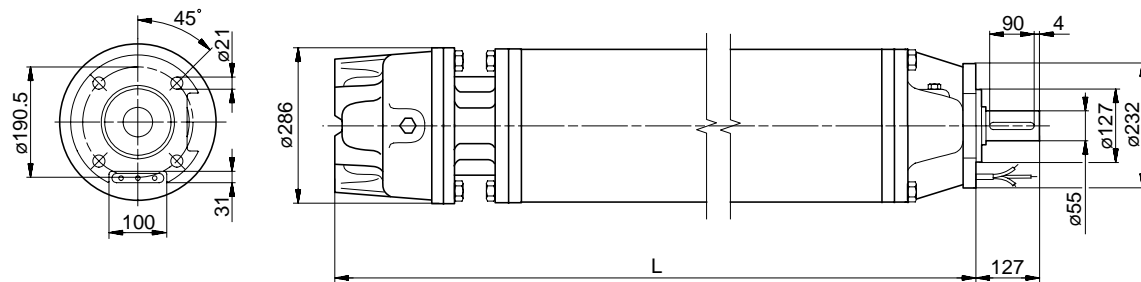
Note: Sizing of the motor cable requires that it is submerged in water. For longer cables and cable connection for extension, please see section for accessories.

Motor power		Cross-section [mm ²]									
		3 x 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 500 V, 50 Hz 3 x 575, 60 Hz		3 x 380 V, 60 Hz	
P ₂ [kW]	P ₂ [hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	DOL	SD
		3 x 1	6 x 1	3 x 1	6 x 1	3 x 1	6 x 1	3 x 1	6 x 1	3 x 1	6 x 1
75	100	50		50	35	50	35	50	35	50	35
92	125	50		50	35	50	35	50	35	50	35
110	150	50		50	35	50	35	50	35	50	35
132	180	50				50	35	50	35	50	35
147	200					50	35	50	35	50	35
170	230					50	35	50	35	50	35
190	260					50	35	50	35	50	35

Outer dimensions

Cross-section [mm ²]	Type of cable	Outer dimensions, max. [mm]
35	Round	14.2
50	Round	16.1

MMS 12000 (N)



TM01 7329 3505

Motor power		L [mm]	Weight [kg]	Shipping volume [m ³]
P ₂ [kW]	P ₂ [hp]			
147	200	1790	565	0.564
170	230	1880	605	0.564
190	260	1980	650	0.564
220	300	2110	700	0.564
250	340	2280	775	0.564

Cables

The 12" motors are connected by means of three single-core cables, approved for use with drinking water.

All cables are round.

The cable outlet of star-delta motors are displaced by 90 °.

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

Cable length: 8 m.

Note: Sizing of the motor cable requires that it is submerged in water.

Motor power		Cross-section [mm ²]			
		3 x 380-415 V, 50 Hz		3 x 500 V, 50 Hz	
P ₂ [kW]	P ₂ [hp]	DOL	SD	DOL	SD
		3 x 1	6 x 1	3 x 1	6 x 1
147	200	70	50	70	50
170	230	70	50	70	50
190	260	70	50	70	50
220	300	70	50	70	50
250	340	70	50	70	50

Outer dimensions

Cross-section [mm ²]	Type of cable	Outer dimensions, max. [mm]
50	Round	16.1
70	Round	18.5

3 x 220 V, 50 Hz

Motor				Motor efficiency [%]			Power factor			$I_{1/1}^{start}$	
Type	Size	Power [kW]	Power [hp]	Rated current $I_{1/1}$ [A]	$\eta_{50\%}$	$\eta_{75\%}$	$\eta_{100\%}$	Cos $\varphi_{50\%}$	Cos $\varphi_{75\%}$		Cos $\varphi_{100\%}$
MMS 6000 (N)	6"	3.70	5.0	17.4	69	71	70	0.70	0.80	0.84	3.7
		5.50	7.5	24.8	76	76	74	0.70	0.80	0.83	3.5
		7.50	10	32.5	79	79	77	0.68	0.79	0.83	3.5
		9.20	12.5	39.5	78	79	76	0.71	0.81	0.85	3.3
		11.0	15	46.0	79	79	77	0.73	0.82	0.85	3.5
		13.0	17.5	53.0	82	82	79	0.72	0.82	0.85	3.6
		15.0	20	60.5	83	83	81	0.73	0.82	0.85	3.7
		18.5	25	69.5	85	85	83	0.81	0.87	0.89	5.1
		22.0	30	82.5	85	85	83	0.80	0.87	0.88	4.9
		26.0	35	100	85	85	84	0.72	0.82	0.86	4.5
		30.0	40	114	86	86	84	0.74	0.83	0.87	4.5
		37.0 ¹⁾	50	144	86	86	84	0.67	0.79	0.84	4.7
MMS 8000 (-N, -R)	8"	22.0	30	84.5	81	84	84	0.76	0.83	0.86	4.8
		26.0	35	99.5	81	83	83	0.80	0.85	0.86	4.5
		30.0	40	114	83	85	85	0.76	0.83	0.86	5.2
		37.0	50	138	84	86	86	0.78	0.84	0.86	5.3
		45.0	60	166	85	88	88	0.69	0.79	0.85	5.6
		55.0	75	212	85	87	88	0.64	0.76	0.82	5.4
		63.0	85	218	87	89	88	0.84	0.89	0.90	5.4
MMS 10000 (N)	10"	75.0	100	280	84	86	86	0.78	0.85	0.87	5.3
		92.0	125	350	84	86	86	0.72	0.81	0.85	5.2
		110	150	405	85	86	85	0.84	0.88	0.88	5.4

1) Also available in R-version

3 x 230 V, 50 Hz

Motor				Motor efficiency [%]			Power factor			$I_{1/1}^{start}$	
Type	Size	Power [kW]	Power [hp]	Rated current $I_{1/1}$ [A]	$\eta_{50\%}$	$\eta_{75\%}$	$\eta_{100\%}$	Cos $\varphi_{50\%}$	Cos $\varphi_{75\%}$		Cos $\varphi_{100\%}$
MMS 6000 (N)	6"	3.70	5.0	17.2	0.64	0.75	0.82	67	71	70	4.0
		5.50	7.5	24.2	0.63	0.75	0.81	75	76	74	3.7
		7.50	10	32.0	0.61	0.74	0.80	78	79	77	3.7
		9.20	12.5	38.5	0.64	0.76	0.82	77	78	77	3.6
		11.0	15	45.5	0.66	0.81	0.83	78	79	78	3.7
		13.0	17.5	52.5	0.65	0.77	0.82	81	82	80	3.8
		15.0	20	58.5	0.66	0.78	0.83	82	83	81	3.8
		18.5	25	67.0	0.76	0.85	0.88	85	85	83	5.3
		22.0	30	79.5	0.75	0.84	0.87	85	85	84	5.2
		26.0	35	100	0.63	0.76	0.83	84	85	84	4.7
		30.0	40	112	0.66	0.78	0.84	85	85	84	4.8
		37.0 ¹⁾	50	146	0.59	0.73	0.80	85	86	84	4.8
MMS 8000 (-N, -R)	8"	22.0	30	82.5	0.71	0.80	0.84	80	84	84	5.3
		26.0	35	95.5	0.76	0.83	0.86	81	84	84	5.1
		30.0	40	110	0.71	0.80	0.84	83	85	86	5.7
		37.0	50	134	0.73	0.82	0.85	83	86	86	5.7
		45.0	60	168	0.62	0.74	0.81	84	87	88	6
		55.0	75	214	0.57	0.70	0.77	84	87	88	5.9
		63.0	85	210	0.81	0.87	0.90	87	89	89	5.7
MMS 10000 (N)	10"	75.0	100	270	0.72	0.81	0.85	84	86	86	5.4
		92.0	125	345	0.65	0.77	0.82	83	85	86	5.6
		110	150	385	0.80	0.86	0.88	85	86	86	5.7

1) Also available in R-version

3 x 380 V, 50 Hz

Type	Motor		Rated current $I_{1/1}$ [A]	Motor efficiency [%]			Power factor			$\frac{I_{start}}{I_{1/1}}$	
	Size	Power [kW]		Power [hp]	η_{50} %	η_{75} %	η_{100} %	Cos φ 50 %	Cos φ 75 %		Cos φ 100%
MMS 6000 (N)	6"	3.70	5.0	10.0	69	71	69	0.70	0.80	0.84	3.7
		5.50	7.5	14.4	76	76	74	0.70	0.80	0.83	3.5
		7.50	10	18.6	79	79	77	0.69	0.79	0.84	3.5
		9.20	12.5	22.8	78	79	76	0.72	0.81	0.85	3.3
		11.0	15	27.0	79	79	77	0.73	0.82	0.85	3.5
		13.0	17.5	30.5	82	82	79	0.72	0.82	0.85	3.6
		15.0	20	35.0	83	82	80	0.74	0.83	0.86	3.7
		18.5	25	40.5	85	85	84	0.73	0.83	0.87	5.1
		22.0	30	48.5	85	85	84	0.74	0.83	0.87	4.9
		26.0	35	57.0	86	85	83	0.76	0.85	0.88	4.5
		30.0	40	65.5	86	85	83	0.76	0.84	0.87	4.5
37.0 ¹⁾	50	83.0	85	85	82	0.71	0.81	0.85	4.2		
MMS 8000 (-N, -R)	8"	22.0	30	50.0	80	82	82	0.78	0.84	0.86	4.8
		26.0	35	59.0	80	82	81	0.80	0.86	0.87	4.5
		30.0	40	66.5	82	84	83	0.79	0.85	0.87	5.2
		37.0	50	81.5	83	84	84	0.79	0.85	0.87	5.3
		45.0	60	95.5	85	86	86	0.76	0.84	0.88	5.6
		55.0	75	116	85	86	86	0.79	0.86	0.88	5.4
		63.0	85	132	86	87	86	0.78	0.86	0.89	5.4
		75.0	100	156	86	87	86	0.78	0.85	0.89	5.2
		92.0	125	194	87	88	86	0.80	0.86	0.88	5.2
110	150	230	86	87	86	0.80	0.87	0.89	5.2		
MMS 10000 (N)	10"	75.0	100	160	85	87	87	0.77	0.84	0.86	5.3
		92.0	125	198	85	87	87	0.75	0.83	0.85	5.2
		110	150	323	85	87	87	0.77	0.84	0.86	5.4
		132	180	275	86	88	88	0.79	0.85	0.87	5.3
		147	200	315	85	87	88	0.73	0.82	0.85	5.8
		170	230	365	85	87	87	0.73	0.82	0.85	5.7
		190	260	420	85	87	87	0.69	0.79	0.84	5.8
MMS 12000 (N)	12"	147	200	310	84	87	88	0.75	0.83	0.87	5.9
		170	230	350	85	87	88	0.77	0.85	0.88	5.8
		190	260	390	85	88	88	0.77	0.85	0.88	5.8
		220	300	450	86	88	88	0.78	0.85	0.89	5.8
		250	340	515	86	88	88	0.78	0.86	0.89	5.4

1) Also available in R-version

3 x 400 V, 50 Hz

Type	Motor		Rated current $I_{1/1}$ [A]	Motor efficiency [%]			Power factor			$\frac{I_{start}}{I_{1/1}}$	
	Size	Power [kW]		Power [hp]	$\eta_{50\%}$	$\eta_{75\%}$	$\eta_{100\%}$	$\cos \varphi_{50\%}$	$\cos \varphi_{75\%}$		$\cos \varphi_{100\%}$
MMS 6000 (N)	6"	3.70	5.0	9.85	67	70	70	0.63	0.75	0.81	4.0
		5.50	7.5	14.0	75	76	74	0.62	0.75	0.81	3.7
		7.50	10	18.4	77	79	77	0.60	0.73	0.80	3.7
		9.20	12.5	22.4	77	78	77	0.64	0.76	0.81	3.6
		11.0	15	26.0	78	79	78	0.65	0.77	0.82	3.7
		13.0	17.5	30.0	81	81	80	0.64	0.76	0.82	3.8
		15.0	20	34.0	82	82	81	0.66	0.79	0.83	3.8
		18.5	25	40.5	83	85	84	0.64	0.77	0.83	5.3
		22.0	30	47.5	84	85	84	0.65	0.77	0.83	5.2
		26.0	35	56.0	85	85	84	0.68	0.79	0.85	4.7
		30.0	40	64.0	85	85	84	0.67	0.79	0.84	4.8
37.0 ¹⁾	50	80.0	84	85	83	0.66	0.77	0.83	4.3		
MMS 8000 (-N, -R)	8"	22.0	30	48.0	80	82	82	0.72	0.81	0.84	5.3
		26.0	35	56.5	80	82	82	0.76	0.83	0.85	5.1
		30.0	40	64.0	82	84	84	0.74	0.82	0.85	5.7
		37.0	50	78.5	82	84	84	0.74	0.82	0.85	5.7
		45.0	60	96.5	84	86	86	0.65	0.76	0.82	6.0
		55.0	75	114	84	86	86	0.72	0.81	0.85	5.9
		63.0	85	132	85	87	87	0.66	0.78	0.83	5.7
		75.0	100	152	86	87	87	0.71	0.82	0.86	5.8
		92.0	125	186	87	88	87	0.72	0.82	0.86	5.9
MMS 10000 (N)	10"	110	150	224	86	87	87	0.73	0.83	0.87	5.8
		75.0	100	156	84	86	87	0.70	0.80	0.84	5.4
		92.0	125	194	84	87	87	0.67	0.78	0.82	5.6
		110	150	228	85	87	88	0.70	0.79	0.84	5.7
		132	180	270	85	88	88	0.72	0.81	0.84	5.7
		147	200	315	84	87	87	0.64	0.75	0.81	6.2
		170	230	365	84	86	87	0.64	0.75	0.81	6.0
MMS 12000 (N)	12"	190	260	425	83	86	87	0.60	0.72	0.79	5.9
		147	200	305	84	87	88	0.66	0.77	0.83	6.2
		170	230	345	85	87	88	0.69	0.79	0.85	6.1
		190	260	390	85	87	88	0.68	0.80	0.84	6.2
		220	300	445	85	87	88	0.69	0.80	0.85	6.1
		250	340	505	85	87	88	0.69	0.80	0.85	5.9

1) Also available in R-version

3 x 415 V, 50 Hz

Type	Motor		Rated current $I_{1/1}$ [A]	Motor efficiency [%]			Power factor			$\frac{I_{start}}{I_{1/1}}$	
	Size	Power [kW]		Power [hp]	$\eta_{50\%}$	$\eta_{75\%}$	$\eta_{100\%}$	$\cos \varphi_{50\%}$	$\cos \varphi_{75\%}$		$\cos \varphi_{100\%}$
MMS 6000 (N)	6"	3.70	5.0	10.0	66	70	70	0.57	0.70	0.78	4.0
		5.50	7.5	14.0	73	75	74	0.57	0.70	0.77	3.9
		7.50	10	19.0	76	78	77	0.54	0.67	0.75	3.8
		9.20	12.5	22.6	75	78	77	0.57	0.70	0.77	3.7
		11.0	15	26.5	77	79	78	0.59	0.72	0.79	3.7
		13.0	17.5	30.5	79	81	80	0.57	0.71	0.78	3.9
		15.0	20	34.0	80	82	81	0.60	0.73	0.80	3.9
		18.5	25	41.0	82	84	84	0.57	0.71	0.79	5.4
		22.0	30	48.5	83	84	84	0.58	0.72	0.79	5.4
		26.0	35	56.0	84	85	84	0.60	0.74	0.81	4.9
		30.0	40	65.0	84	85	84	0.60	0.73	0.81	4.9
37.0 ¹⁾	50	79.0	84	85	83	0.61	0.74	0.81	4.3		
MMS 8000 (-N, -R)	8"	22.0	30	47.5	79	82	82	0.67	0.77	0.82	5.6
		26.0	35	55.0	79	82	82	0.72	0.80	0.84	5.5
		30.0	40	63.0	81	84	84	0.69	0.79	0.83	6.0
		37.0	50	77.0	82	84	84	0.69	0.79	0.83	5.9
		45.0	60	96.0	82	85	86	0.61	0.73	0.80	6.8
		55.0	75	112	83	86	86	0.66	0.77	0.83	6.3
		63.0	85	130	83	86	86	0.63	0.76	0.82	5.9
		75.0	100	152	85	87	87	0.66	0.78	0.84	5.8
		92.0	125	186	86	87	87	0.66	0.81	0.83	6.2
110	150	222	85	87	87	0.67	0.78	0.84	6.0		
MMS 10000 (N)	10"	75.0	100	156	83	86	87	0.65	0.76	0.81	5.6
		92.0	125	196	84	86	87	0.61	0.73	0.79	5.7
		110	150	228	84	87	88	0.64	0.75	0.81	6.0
		132	180	270	85	87	88	0.65	0.76	0.81	5.9
		147	200	320	83	86	87	0.57	0.70	0.77	6.3
		170	230	375	83	86	87	0.57	0.69	0.77	6.0
		190	260	440	82	85	86	0.53	0.66	0.74	5.9
MMS 12000 (N)	12"	147	200	315	83	86	87	0.58	0.71	0.79	6.3
		170	230	350	84	87	88	0.61	0.74	0.81	6.3
		190	260	395	84	87	88	0.60	0.73	0.80	6.2
		220	300	450	84	87	88	0.62	0.74	0.81	6.2
		250	340	510	84	87	88	0.62	0.74	0.81	6.1

1) Also available in R-version

3 x 500 V, 50 Hz

Motor		Rated current $I_{1/1}$ [A]	Motor efficiency [%]			Power factor			$\frac{I_{start}}{I_{1/1}}$	
Type	Size		Power [kW]	$\eta_{50\%}$	$\eta_{75\%}$	$\eta_{100\%}$	$\cos \varphi_{50\%}$	$\cos \varphi_{75\%}$		$\cos \varphi_{100\%}$
MMS 6000 (N)	6"	7.50	14.4	78	78	74	0.73	0.82	0.85	3.2
		9.20	17.4	77	78	76	0.69	0.80	0.84	3.4
		11.0	20.4	79	79	77	0.71	0.81	0.85	4.7
		13.0	23.4	82	82	80	0.69	0.80	0.84	3.7
		15.0	26.5	83	83	80	0.76	0.84	0.86	4.2
		18.5	31.5	84	85	84	0.70	0.81	0.85	5.2
		22.0	36.5	85	86	84	0.77	0.85	0.87	4.9
		26.0	44.5	85	85	84	0.68	0.79	0.85	4.8
		30.0	50.5	86	86	84	0.72	0.82	0.86	4.7
		37.0 ¹⁾	63.0	86	86	85	0.68	0.79	0.84	4.9
MMS 8000 (-N, -R)	8"	22.0	37.5	81	83	83	0.79	0.85	0.87	4.7
		26.0	44.0	81	84	83	0.80	0.85	0.86	4.8
		30.0	49.5	83	85	85	0.78	0.85	0.86	5.6
		37.0	60.5	84	85	85	0.82	0.87	0.87	5.6
		45.0	72.0	85	87	87	0.73	0.82	0.86	6.2
		55.0	88.5	86	88	88	0.71	0.81	0.86	6.1
		63.0	96.5	87	89	88	0.82	0.88	0.90	6.1
		75.0	114	88	89	88	0.85	0.89	0.90	5.6
		92.0	142	88	87	88	0.81	0.87	0.89	5.3
		110	182	86	88	88	0.67	0.78	0.84	5.3
MMS 10000 (N)	10"	75.0	122	85	87	87	0.77	0.84	0.86	5.3
		92.0	150	85	87	87	0.74	0.82	0.85	5.3
		110	178	85	87	88	0.76	0.84	0.86	5.4
		132	210	86	88	87	0.82	0.87	0.88	5.0
		147	236	85	88	88	0.74	0.83	0.86	5.8
		170	270	86	88	88	0.78	0.85	0.87	5.4
		190	305	86	88	87	0.80	0.86	0.87	5.3
MMS 12000 (N)	12"	147	218	86	89	90	0.80	0.88	0.91	6.9
		170	265	87	89	90	0.74	0.82	0.86	6.0
		190	275	88	90	91	0.85	0.91	0.93	7.8
		220	335	88	90	90	0.79	0.86	0.88	5.8
		250	375	87	90	91	0.75	0.85	0.89	6.3

1) Also available in R-version

3 x 220 V, 60 Hz and 3 x 380 V 60 Hz

Type	Motor			Rated current $I_{1/1}$ [A]	Motor efficiency [%]			Power factor			I_{start} $I_{1/1}$
	Size	Power [kW]	Power [hp]		η_{50} %	η_{75} %	η_{100} %	Cos ϕ 50 %	Cos ϕ 75 %	Cos ϕ 100%	
3 x 220 V, 60 Hz											
MMS 6000 (N)	6"	3.7	5.0	19.6	66	72	74	0.68	0.76	0.80	4.3
		5.5	7.5	27.5	74	77	75	0.72	0.80	0.83	3.8
		7.5	10	37.0	77	79	77	0.73	0.81	0.84	3.5
		9.2	12.5	45.0	74	77	76	0.74	0.82	0.85	3.5
		11	15	51.5	79	81	79	0.77	0.84	0.86	3.5
		13	17.5	60.5	80	82	80	0.78	0.82	0.85	3.6
		15	20	69.0	79	82	81	0.82	0.86	0.86	3.5
		18.5	25	81.0	82	84	83	0.85	0.88	0.88	4.6
		22	30	96.0	82	84	84	0.84	0.88	0.88	4.9
		26	35	114	83	85	83	0.77	0.84	0.87	4.4
		30	40	130	84	85	84	0.77	0.84	0.87	4.4
		37.0 ¹⁾	50	166	83	85	84	0.68	0.88	0.84	4.8
MMS 8000 (-N, -R)	8"	22	30	102	75	79	80	0.80	0.85	0.86	4.4
		26	35	118	75	79	80	0.82	0.87	0.87	4.3
		30	40	134	77	81	82	0.77	0.84	0.87	5.2
		37	50	164	78	82	82	0.77	0.84	0.86	5.0
		45	60	192	80	84	85	0.75	0.83	0.86	5.7
		55	75	232	82	85	85	0.79	0.86	0.88	5.3
		63	85	265	83	85	85	0.84	0.89	0.90	4.8
		75	100	315	83	86	85	0.85	0.89	0.90	4.8
MMS 10000 (N)	10"	75	100	320	83	85	84	0.83	0.87	0.88	4.7
		92	125	395	82	85	85	0.77	0.84	0.87	4.9
		110	150	470	82	85	85	0.85	0.88	0.89	4.5
		132	180	570	82	85	84	0.86	0.89	0.89	4.2
3 x 380 V, 60 Hz											
MMS 6000 (N)	6"	3.7	5.0	11.4	66	72	74	0.69	0.77	0.80	4.2
		5.5	7.5	16.0	74	77	75	0.72	0.80	0.83	3.8
		7.5	10	21.4	77	79	77	0.73	0.81	0.84	3.5
		9.2	12.5	26.0	74	78	76	0.75	0.82	0.85	3.5
		11	15	29.5	79	81	79	0.77	0.84	0.86	3.6
		13	17.5	35.0	80	82	80	0.75	0.82	0.85	3.7
		15	20	40.5	79	82	80	0.78	0.84	0.86	3.5
		18.5	25	46.5	82	85	83	0.79	0.85	0.87	4.7
		22	30	55.5	83	85	84	0.78	0.85	0.87	4.9
		26	35	65.5	84	85	84	0.78	0.85	0.87	4.6
		30	40	75.5	84	85	84	0.76	0.84	0.87	4.7
		37.0 ¹⁾	50	94.5	84	85	83	0.76	0.84	0.87	4.5
MMS 8000 (-N, -R)	8"	22	30	59.0	75	79	80	0.80	0.85	0.86	4.4
		26	35	69.0	75	79	80	0.81	0.86	0.87	4.4
		30	40	77.0	77	81	82	0.78	0.84	0.87	5.1
		37	50	94.0	79	83	83	0.79	0.85	0.87	4.9
		45	60	110	81	85	85	0.80	0.86	0.88	5.5
		55	75	132	82	85	86	0.83	0.88	0.89	5.0
		63	85	152	83	85	85	0.81	0.87	0.89	5.3
		75	100	182	84	86	85	0.86	0.89	0.90	4.7
		92	125	220	85	87	86	0.85	0.89	0.90	4.8
		110	150	260	83	86	86	0.84	0.89	0.90	5.0
MMS 10000 (N)	10"	75	100	182	82	85	86	0.81	0.86	0.88	5.0
		92	125	224	82	86	87	0.77	0.84	0.87	5.1
		110	150	265	83	86	87	0.84	0.88	0.89	4.7
		132	180	315	84	86	87	0.84	0.88	0.89	4.8
		147	200	355	83	86	87	0.78	0.85	0.87	5.6
		170	230	415	83	86	87	0.75	0.83	0.86	5.4
		190	260	475	82	86	87	0.69	0.79	0.85	5.7

1) Also available in R-version

3 x 460 V, 60 Hz and 3 x 575 V, 60 Hz

Type	Motor		Rated current $I_{1/1}$ [A]	Motor efficiency [%]			Power factor			I_{start} $I_{1/1}$	
	Size	Power [kW]		Power [hp]	η_{50} %	η_{75} %	η_{100} %	Cos φ 50 %	Cos φ 75 %		Cos φ 100%
3 x 460 V, 60 Hz											
MMS 6000 (N)	6"	3.7	5.0	9.75	64	69	70	0.63	0.74	0.80	4.2
		5.5	7.5	13.8	73	76	74	0.63	0.74	0.80	4.0
		7.5	10	18.0	77	79	78	0.61	0.73	0.79	3.8
		9.2	12.5	22.0	74	77	77	0.65	0.76	0.81	3.7
		11	15	25.5	78	80	79	0.65	0.76	0.82	3.8
		13	17.5	29.5	80	82	80	0.65	0.76	0.82	4.0
		15	20	33.5	80	82	81	0.68	0.78	0.83	4.0
		18.5	25	39.0	83	85	85	0.65	0.77	0.83	5.5
		22	30	46.0	85	85	85	0.67	0.78	0.83	5.6
		26	35	54.5	84	86	84	0.69	0.80	0.85	5.0
		30	40	62.5	85	86	85	0.68	0.79	0.85	5.1
		37.0 ¹⁾	50	79.0	84	85	84	0.65	0.75	0.83	4.7
		MMS 8000 (-N, -R)	8"	22	30	48.5	75	79	81	0.73	0.81
26	35			56.5	76	80	81	0.77	0.83	0.86	5.1
30	40			64.0	78	82	83	0.74	0.82	0.85	5.8
37	50			78.0	80	83	84	0.74	0.82	0.85	5.5
45	60			92.5	82	85	86	0.71	0.80	0.85	6.4
55	75			112	82	85	86	0.73	0.82	0.86	5.8
63	85			126	83	86	86	0.72	0.82	0.86	6.0
75	100			150	84	86	87	0.72	0.82	0.86	5.7
92	125			184	85	87	87	0.74	0.83	0.87	6.0
110	150			220	84	86	86	0.75	0.83	0.87	5.8
MMS 10000 (N)	10"	75	100	154	81	85	87	0.72	0.80	0.84	5.7
		92	125	190	82	86	87	0.69	0.78	0.83	5.5
		110	150	224	82	86	88	0.72	0.80	0.84	5.8
		132	180	265	83	86	88	0.73	0.82	0.85	5.7
		147	200	305	82	86	87	0.66	0.77	0.82	6.2
		170	230	355	82	86	87	0.66	0.76	0.82	5.9
		190	260	405	82	85	87	0.62	0.73	0.79	6.1
3 x 575 V, 60 Hz											
MMS 8000 (-N, -R)	8"	22	30	37.5	78	82	83	0.79	0.85	0.87	4.9
		26	35	44.0	78	82	83	0.81	0.85	0.87	5.0
		30	40	49.0	81	84	85	0.79	0.85	0.87	5.8
		37	50	60.5	81	85	85	0.82	0.86	0.88	5.8
		45	60	71.0	84	87	88	0.73	0.82	0.86	6.5
		55	75	86.5	84	87	89	0.72	0.81	0.86	6.5
		63	85	95.5	86	88	89	0.81	0.88	0.90	6.4
		75	100	114	86	89	89	0.84	0.89	0.91	5.8
		92	125	140	87	89	88	0.82	0.87	0.89	5.6
		110	150	176	85	88	89	0.68	0.79	0.84	5.7
MMS 10000 (N)	10"	75	100	120	82	85	87	0.78	0.84	0.87	6.1
		92	125	148	83	86	87	0.76	0.83	0.86	7.0
		110	150	176	83	86	87	0.78	0.84	0.87	7.2
		132	180	208	84	87	87	0.83	0.87	0.88	7.4
		147	200	234	83	86	88	0.76	0.83	0.86	8.0
		170	230	270	84	87	88	0.79	0.85	0.87	8.1
		190	260	300	84	87	88	0.81	0.86	0.87	8.3

1) Also available in R-version

Wiring diagram

MMS 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.

The starting wiring diagrams are shown below.

MMS motor, direct-on-line starting

The connection of MMS wound for direct-on-line starting:



Fig. 13 Motors wound for direct-on-line starting

TM03 2099 3705

MMS motor, star-delta starting

The connection of MMS wound for star-delta starting:

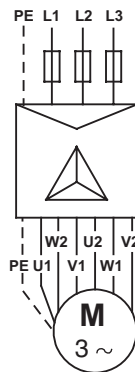


Fig. 14 Motors wound for star-delta starting

TM03 2100 3705

If star-delta starting is not required, but direct-on-line starting is, the MMS motor should be connected as shown in fig. 15.

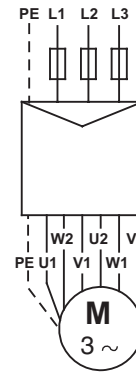


Fig. 15 Motors wound for direct-on-line starting

TM03 2101 3705

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:

- 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 and
- 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. The MP 204 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, 120-999 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	625333
Single-turn transformers	
- Current transformerratio= 200:5, $I_{max.}$ = 120 A	96095274
- Current transformerratio= 300:5, $I_{max.}$ = 300 A	96095275
- Current transformerratio= 500:5, $I_{max.}$ = 500 A	96095276
- Current transformerratio= 750:5, $I_{max.}$ = 750 A	96095277
- Current transformerratio= 1000:5, $I_{max.}$ = 1000 A	96095278

Functions

- Phase-sequence monitoring
- Indication of current or temperature (user selection)
- Indication of temperature in °C or °F (user selection)
- 4-digit, 7-segment display
- Setting and status reading with the R100
- Setting and status reading via GENIbus.

Tripping conditions

- Overload
- Underload (dry running)
- Temperature (Tempcon, Pt sensor and PTC/thermal switch)
- Phase failure
- Phase sequence
- Overvoltage
- Undervoltage
- Power factor ($\cos \varphi$)
- Current unbalance.

Warnings

- Overload
- Underload
- Temperature (Tempcon and Pt sensor)
- Overvoltage
- Undervoltage
- Power factor ($\cos \varphi$)
Note: In connection with single- and three-phase connection.
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Loss of communication in network
- Harmonic distortion.

Learning function

- Phase sequence (three-phase operation)
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Identification and measurement of Pt100/Pt1000 sensor circuit.

External current transformers

When fitted with external current transformers, the MP 204 can handle currents from 120 to 999 A. Grundfos can supply approved current transformers from stock (200/5A, 300/5A, 500/5A, 750/5A, 1000/5A).

R100 remote control

The R100 remote control from Grundfos allows for wireless infrared remote control of your MP 204 Motor protector.

With the R100, you get access to a full range of options such as factory setting adjustment, service and fault finding.


Ready for bus communication

The MP 204 allows for monitoring and communication via GENIbus – a Grundfos-designed bus for exchange of pump data, alarms, status information, and setpoints. This enables users to connect the MP 204 to, for instance, SCADA systems.

Technical data - MP 204

Enclosure class	IP 20
Ambient temperature	-20 °C to +60 °C
Relative air humidity	99 %
Voltage range	100-480 VAC
Current range	3-999 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 nominal voltage
Approvals	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	0-4x10 ⁹ kWh	± 5 %	1 kWh

IO 112	Description	Product number
	<p>The IO 112 is a measuring module and a 1-channel protection unit for use in connection with the MP 204 motor protection unit. The module can be used for protection of pump against other factors than the electrical conditions, for instance dry-running. It can also be used as a stand-alone protection module.</p> <p>The IO 112 interface has three inputs for measured values one potentiometer for setting of limits indicator lights indicating the</p> <ul style="list-style-type: none"> • measured value of the input • value of the limit set • alarm source • pump status. <p>Electrical data:</p> <ul style="list-style-type: none"> • Supply voltage: 24 VAC ±10 % 50/60 Hz or 24 VDC ±10 % • Supply current: Min. 2.4 A; max. 8 A • Power consumption: Max. 5 W <p>Ambient temperature: -25 °C to +65 °C</p> <ul style="list-style-type: none"> • Enclosure class: IP 20 	96651601

Control functions

This table describes the protection provided by the MP 204.

Control parameter	Function	Problem	Advantage
Temperature	<p>MS</p> <p>The motor temperature is measured by means of the built-in Tempcon temperature transmitter and a signal is sent to the MP 204 via the phase leads. In the MP 204, the measured temperature is compared with the factory-set value (75 °C).</p>	Overload, frequent starts/stops, operation against blocked discharge pipe, insufficient flow velocity past the motor.	Longer motor life, safe operating conditions, service indication.
	<p>MMS</p> <p>The motor temperature is measured by means of the Pt100. The signal is sent to the MP 204 where the measured temperature is compared with the factory-set value. Temperature protection requires a submersible motor with a Pt100.</p> <p>The motor temperature must be monitored during frequency converter operation.</p>		
Overvoltage/undervoltage	If the set trip value is exceeded, the motor will stop.	The installation is close to a transformer. The mains do not absorb load variations.	Important installation parameter, possibility of improving operating conditions.
Overload	The motor power input is measured on each of the three phases. The registered power input is an average of these three values. If the factory-set value is exceeded, the motor will stop.	Incorrect sizing of pump/motor, voltage supply failure, defective cable, blocking, wear or corrosion.	Longer pump life, safe operating conditions, service indication.
Underload (dry running)	The motor power input is measured on each of the three phases. The registered power input is an average of these three values. If the average value is lower than the factory-set value, the motor will stop.	Pump exposed to dry running or underload, for example caused by wear.	Conventional dry-running protection is no longer necessary, no extra cables.
Current unbalance	The power input of the motor is measured on each of the three phases.	Mains load is uneven, incipient motor defect, phase voltages diverging.	Motor protection against overload, service indication.
Phase sequence	The MP 204 and motor are installed so that the phase sequence corresponds to correct direction of rotation. The MP 204 monitors changes in the phase sequence.	Two phases are wrongly connected.	Ensures correct pump performance.
Phase failure	The MP 204 checks the phases connected. Phase failure will cause an alarm.	Phase failure.	Indication of phase failure, and alarm.

R100 menus

0. GENERAL

See the operating instructions for the R100.

1. OPERATION

- Operating mode
- Actual trip
- Actual warning 1
- Actual warning 2
- Alarm log 1
- Alarm log 2
- Alarm log 3
- Alarm log 4
- Alarm log 5.

2. STATUS

Display of

- Supply overview
- Average current
- Average voltage
- Tempcon sensor
- Pt100/Pt1000 sensor
- Power input and energy consumption (described in the following)
- Energy trip counter
- Phase sequence
- Current unbalance
- Operating hours and number of starts
- Trip counter of hours and starts
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos φ
- Harmonic distortion.

3. LIMITS

Display and setting of warning and trip limits.

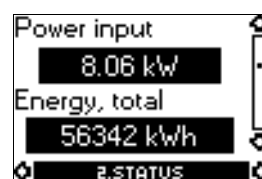
- Tempcon sensor
- Pt sensor
- Tripping current
- Current warning
- Nominal voltage
- Voltage limits
- Current unbalance
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos φ trip
- Cos φ warning.

4. INSTALLATION

Setting and display of

- Supply mains
- **Trip class** (described in the following)
- Trip delay
- External current transformers
- Power-on delay
- **Restarting** (described in the following)
- **Automatic restarting** (described in the following)
- Tempcon sensor
- Pt sensor
- Insulation resistance measurement
- PTC/hermal switch
- Resetting of trip counters
- Service interval
- Number of automatic restarts
- Units/display
- MP 204 display
- GENIbus ID number
- Learning function.

Power input and energy consumption



Actual power input and motor energy consumption.

The energy consumption is an accumulated value which cannot be reset.

The power is calculated like this:

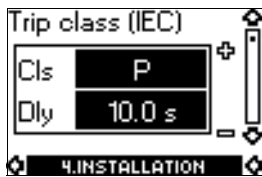
$$U_{\text{average}} = \frac{U_{L1-L2} + U_{L2-L3} + U_{L3-L1}}{3} [\text{V}]$$

$$I_{\text{average}} = \frac{I_{L1} + I_{L2} + I_{L3}}{3} [\text{A}]$$

$$\cos \varphi_{\text{average}} = \frac{\cos \varphi_{L1} + \cos \varphi_{L2} + \cos \varphi_{L3}}{3} [-]$$

$$P = U_{\text{average}} \cdot I_{\text{average}} \cdot \sqrt{3} \cdot \cos \varphi_{\text{average}} [\text{W}]$$

Trip class



Line 1: Select IEC trip class (1 to 45).

If manual indication of trip delay in the case of overload is required, select trip class "P".

Factory setting:

- Cls (trip class): P.

Line 2: Select trip delay.

Factory setting:

- Dly (trip delay): 10 s.

Restarting



Set whether restarting after tripping is to be

- **Automatic** (factory setting)
- *Manual*.

Setting of time, see section "Automatic restarting".

Automatic restarting



Set the time after which the MP 204 is to attempt automatic restarting of motor after cut-out.

The time runs from the moment when the value which triggered the fault has returned to normal.

Factory setting:

- 300 s.

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.

As indicated in the illustration on page 28, 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 also 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 included on delivery of the G100.

Other features

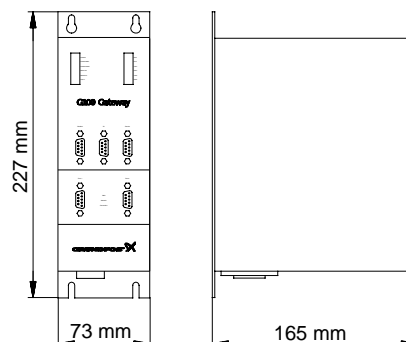
- Four digital inputs.
- Stop of all pumps in case of failing communication with the management system (optional).
- Access code for modem communication (optional).
- Alarm log.

Installation

Installation of the G100 is effected 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. Included is also 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.



TM01 0621 0398

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
Voltage supply:	1 x 110-240 V, 50/60 Hz
Ambient temperature:	In operation: -20 °C to +60 °C
Enclosure class:	IP 20
Weight:	1.8 kg.

Accessories

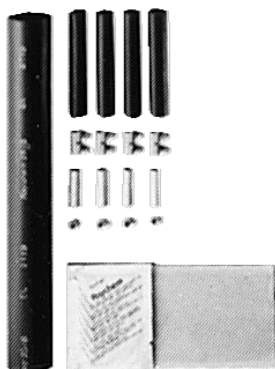
- PC Tool G100 package (supplied with the product)
- "G100 Support Files" CD-ROM (supplied with the product)

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

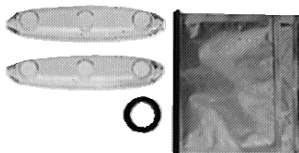


TM00 7885 2296

Description	Version		Product number	
	Motor cable	[mm ²] Number of leads		
For watertight shrink-joining of motor cable and submersible drop cable.				
Enables the joining of <ul style="list-style-type: none"> cables of equal size cables of different size a cable lead and a single lead 	Flat cable	6 - 10 10 - 16	4 3	116252
The joint is ready for use after a few minutes and requires no long hardening time as opposed to resin joints.				
The joint cannot be separated.				
	Flat cable	16 - 25	3 4	116255
	3 single leads	1.5 - 6.0	3	116253
	3 single leads	10 - 25	3	116254
	4 single leads	1.5 - 6.0	4	116257
	4 single leads	6 - 25	4	116258
	Single lead *	35 - 120	1	116256

* Used for the repair or joining of single leads.
When ordering kits, please state the number required.

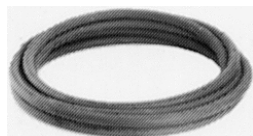
Cable termination kit, types M0 to M6



TM00 7884 2296

Description	Version		Product number
	Type	Diameter of cable joint [mm ²] Fit cables with outer diameter of	
For watertight shrink-joining of motor cable and submersible drop cable.	M0	Ø40 Ø6 to Ø15	ID8903
	M1	Ø46 Ø9 to Ø23	ID8904
	M2	Ø52 Ø17 to Ø31	ID8905
	M3	Ø77 Ø26 to Ø44	ID8906
	M4	Ø97 Ø29 to Ø55	91070700
	M5	Ø110 Ø40 to Ø62	96496918
	M6	Ø144 Ø50 to Ø80	96496919
Accessories for cable kit, types M0 to M6 Screw connectors only	Diameter of the lead [mm ²]	Number of connectors	Product number
	6 - 50	4	96626021
	19 - 95		96626022
	35 - 185		96626023
	70 - 240		96626028

Submersible drop cable



TMM00 7882 2296

Suitable for

- continuous application in groundwater and potable water (approved for potable applications)
- connection of electrical equipment such as submersible motors
- installation depths up to 500 metres and average loads.

Insulation and sheath are made of special EPR-based elastomer materials adapted to applications in water.
 Maximum permissible water temperature: 60 °C.
 Maximum permissible lead service temperature: 90 °C.
 Further cable sizes are available on request.

Description			
Number of leads and nominal cross section [mm ²]	Outer diameter Min./Max. [mm ²]	Weight [kg/m]	Product number
1 x 16	11.0 / 14.5	0.290	ID4071
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 1.5	9.5 / 12.5	0.150	ID4056
3 x 2.5	11.5 / 14.5	0.220	ID4057
3 x 4.0	13.0 / 16.0	0.340	ID4058
3 x 6.0	14.5 / 20.0	0.480	ID4059
3 x 10	20.0 / 25.5	0.750	ID4060
3 x 16	22.5 / 29.5	1.100	ID4061
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	ID8917
4G50	38.0 / 48.5	3.600	91070691
4G70	43.0 / 54.5	4.900	91070692

Pt100

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 avoiding reduced lifetime of the motor. The Pt100 ensures that operating conditions are not exceeded and indicates when it is time for service of 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 module. For both relays the following temperature limits are preset on delivery:


- 60 °C warning limit
- 75 °C stop limit.

Technical data


PR 5714 relay	
Enclosure class	IP 65 (mounted in a control panel)
Ambient temperature	-20 °C to +60 °C
Relative air humidity	95 % (condensating)
Voltage variation	• 1 x 24-230 VAC ± 10 %, 50-60 Hz. • 24-250 VDC ± 20 %.
Approvals	UL, DNV
Mark	CE

Pt100 sensor with/without PR 5714 relay and cable	Cable length [m]	PR 5714	Product number	
			MMS 6000, MMS 8000	MMS 10000, MMS 12000
	20	Yes	96494596	96437287
	40	Yes	96494597	96437288
	60	Yes	96494598	96437289
	80	Yes	96494599	96437290
	100	Yes	96494610	96437291
	20	No	96658629	96658633
	40	No	96658630	96658634
	60	No	96658631	96658635
	80	No	96658632	96658636
	100	No	96658639	96658640

GrA3187

PR 5714 relay	Voltage	Product number
	24-230 VAC, 50/60 Hz / 24-250 VDC	96621274

GrA3186

Pt100 sensor including cable	Cable length [m]	Product number	
		MMS 6000 MMS 8000	MMS 10000 MMS 12000
	20	96408957	96437784
	40	96408684	96437785
	60	96408958	96437786
	80	96408959	96437787
	100	96408960	96437788

GrA3190

Drop cables

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

The choice 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 starter to pump at 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 if:

- the borehole provides the necessary space
- the operating time of the pump is long or
- the operating voltage is below the rated voltage.

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

Maximum cable length of a three-phase submersible pump:

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

where

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated current of the motor [A]

q = Cross-section of submersible dropcable [mm²]

X_L = Inductive resistance: 0.078 × 10⁻³ [Ω/m]

cos φ = Power factor

sin φ = $\sqrt{1 - \cos^2 \varphi}$

ρ = Specific resistance: 0.02 [Ωmm²/m]

Example

Motor size:	30 kW, MMS 8000
Rated current:	64.0 A
Rated voltage:	3 x 400 V, 50 Hz
Starting method:	Direct-on-line
Power factor:	cos φ = 0.85
Voltage drop:	3%
Cross-section:	25 mm ²
sin φ:	0.54

$$L = \frac{400 \times 3}{64.0 \times 1.73 \times 100 \times \left(0.85 \times \frac{0.02}{25} + 0.54 \times 0.078 \times 10^{-3} \right)}$$

L = 150 m.

Cable dimensions for MMS motors at 3 x 400 V,
50 Hz, direct-on-line starting
Voltage drop: 1%

Motor	[kW]	I _{1/1} [A]	Cos φ 100 %	Maximum cable length in metres from motor starter to pump															
				Cross-section [mm ²]															
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
MMS 6000	3.7	9.85	0.81	22	36	57	85	141	222	338	461	634							
	5.5	14.0	0.81	15	25	40	60	99	156	238	324	446	595	763	913				
	7.5	18.4	0.80	12	19	31	46	76	120	183	249	342	456	583	697	818	942		
	9.2	22.4	0.81		16	25	38	62	97	149	203	279	372	477	570	671	773	910	
	11	26.0	0.82			21	32	53	83	127	173	238	318	409	490	577	666	786	894
	13	30.0	0.82			19	28	46	72	110	150	207	276	354	425	500	578	681	775
	15	34.0	0.83				24	40	63	96	131	181	242	311	374	441	510	603	687
	18.5	40.5	0.83				20	33	53	81	110	152	203	261	314	370	428	506	577
	22	47.5	0.83					29	45	69	94	129	173	223	267	315	365	432	492
	26	56.0	0.85					24	37	57	78	108	145	187	226	267	310	368	422
30	64.0	0.84						33	51	69	95	128	165	198	234	271	321	367	
37	85.5	0.79							40	54	74	99	126	150	176	203	238	269	
MMS 8000	22	48.0	0.84					28	44	67	92	127	170	220	264	312	361	428	489
	26	56.5	0.85					23	37	57	78	107	144	186	224	265	307	365	418
	30	64.0	0.85						33	50	68	95	127	164	197	234	271	322	369
	37	78.5	0.85						27	41	56	77	104	134	161	191	221	263	301
	45	96.5	0.82							34	47	64	86	110	132	155	180	212	241
	55	114	0.85								38	53	71	92	111	131	152	181	207
	63	132	0.83									47	62	80	96	113	131	155	177
	75	152	0.86									40	53	69	83	98	114	136	156
92	186	0.86										43	56	68	80	94	111	128	
110	224	0.87											47	56	67	78	93	107	
MMS 8000	75	156	0.84										52	68	81	96	111	132	151
	92	194	0.82										43	55	66	77	89	105	120
	110	228	0.84											46	56	66	76	90	103
	132	270	0.84												47	55	64	76	87
	147	315	0.81													48	55	65	74
	170	365	0.81															56	63
	190	425	0.79																48
MMS 12000	147	305	0.83													49	57	67	77
	170	345	0.85														50	60	68
	190	390	0.84															53	60
	220	445	0.85																53
	250	505	0.85																
Max. current for cable [A]*				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497

* At particularly favourable heat dissipation conditions eg. submerged in water, note that the value is smaller if the cable is placed in air.

Cable dimensions for MMS motors at 3 x 400 V,
50 Hz, direct-on-line starting
Voltage drop: 3%

Motor	[kW]	I _{1/1} [A]	Cos φ 100%	Maximum cable length in metres from motor starter to pump															
				Cross-section [mm ²]															
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
MMS 6000	3.7	9.85	0.81	65	108	172	256	422	665										
	5.5	14.0	0.81	46	76	121	180	297	468	713	973								
	7.5	18.4	0.80	35	58	93	139	229	360	548	747								
	9.2	22.4	0.81		47	76	113	186	292	446	608	837							
	11	26.0	0.82			64	96	158	249	380	519	715	955						
	13	30.0	0.82			56	83	137	216	330	450	620	828						
	15	34.0	0.83				73	120	189	288	394	543	726	934					
	18.5	40.5	0.83				61	100	158	242	330	456	610	784	941				
	22	47.5	0.83					86	135	206	282	388	520	668	802	946			
	26	56.0	0.85					71	112	172	235	325	436	562	677	801	930		
30	64.0	0.84						99	152	207	286	383	494	594	701	813	964		
37	85.5	0.79							119	162	223	296	378	451	529	608	713	806	
MMS 8000	22	48.0	0.84					84	132	202	276	382	511	659	792	935			
	26	56.5	0.85					70	111	170	233	322	432	557	671	794	922		
	30	64.0	0.85						98	150	205	284	381	492	592	701	814	967	
	37	78.5	0.85						80	122	168	232	311	401	483	572	664	789	903
	45	96.5	0.82							102	140	193	257	330	396	466	539	635	723
	55	114	0.85								115	159	214	276	333	394	457	543	622
	63	132	0.83									140	187	240	289	340	394	466	531
	75	152	0.86									119	160	206	249	295	343	409	469
92	186	0.86										130	169	203	241	281	334	383	
110	224	0.87											140	169	200	233	279	321	
MMS 10000	75	156	0.84										157	203	244	288	334	395	452
	92	194	0.82										128	164	197	232	268	316	360
	110	228	0.84											139	167	197	228	271	309
	132	270	0.84												141	166	193	228	261
	147	315	0.81													143	165	194	221
	170	365	0.81															168	190
	190	425	0.79																143
MMS 12000	147	305	0.83													147	170	202	230
	170	345	0.85														151	179	205
	190	390	0.84															158	181
	220	445	0.85																159
	250	505	0.85																
Max. current for cable [A]*				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497

* At particularly favourable heat dissipation conditions eg. submerged in water, note that the value is smaller if the cable is placed in air.

Cable dimensions for MMS motors at 3 x 400 V,
50 Hz, star-delta-starting
Voltage drop 1%

Motor	[kW]	I _{1/1} [A]	Cos φ 100%	Maximum cable length in metres from motor starter to pump																
				Cross-section [mm ²]																
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300	
MMS 6000	3.7	9.85	0.81	37	62	99	148	244	384	585	798									
	5.5	14	0.81	26	44	70	104	172	270	412	562	773								
	7.5	18.4	0.80	20	34	54	80	132	208	317	431	593	789							
	9.2	22.4	0.81		27	44	65	107	169	257	351	483	644	826	988					
	11	26	0.82			37	55	91	144	220	300	413	552	708	849	999				
	13	30	0.82			32	48	79	125	190	260	358	478	614	735	866				
	15	34	0.83				42	69	109	166	227	313	419	539	647	763	883			
	18.5	40.5	0.83				35	58	91	140	191	263	352	453	543	641	741	877	999	
	22	47.5	0.83					49	78	119	163	224	300	386	463	546	632	747	852	
	26	56	0.85					41	65	99	136	187	252	325	391	463	537	638	731	
30	64	0.84						57	87	120	165	221	285	343	405	469	556	636		
37	85.5	0.79							69	94	129	171	218	261	305	351	412	466		
MMS 8000	22	48	0.84					48	76	117	160	220	295	380	457	540	626	742	848	
	26	56.5	0.85					41	64	98	134	186	249	322	387	458	532	633	724	
	30	64	0.85						57	87	119	164	220	284	342	405	470	558	639	
	37	78.5	0.85						46	71	97	134	179	232	279	330	383	455	521	
	45	96.5	0.82							59	81	111	149	191	229	269	311	367	417	
	55	114	0.85								67	92	124	159	192	227	264	314	359	
	63	132	0.83									81	108	139	167	197	227	269	307	
	75	152	0.86									69	92	119	144	170	198	236	271	
	92	186	0.86										75	97	117	139	162	193	221	
	110	224	0.87											81	97	116	135	161	185	
MMS 10000	75	156	0.84										91	117	141	166	193	228	261	
	92	194	0.82										74	95	114	134	155	183	208	
	110	228	0.84											80	96	114	132	156	178	
	132	270	0.84												81	96	111	132	151	
	147	315	0.81													83	95	112	127	
	170	365	0.81															97	110	
	190	425	0.79																83	94
MMS 12000	147	305	0.83													85	98	116	133	
	170	345	0.85														87	104	119	
	190	390	0.84																91	104
	220	445	0.85																	92
	250	505	0.85																	
Max. current for cable [A]*				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497	

* At particularly favourable heat dissipation conditions eg. submerged in water, note that the value is smaller if the cable is placed in air.

Cable dimensions for MMS motors at 3 x 400 V,
50 Hz, star-delta starting
Voltage drop 3%

Motor	[kW]	I _{1/1} [A]	Cos φ 100%	Maximum cable length in metres from motor starter to pump															
				Cross-section [mm ²]															
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
MMS 6000	3.7	9.85	0.81	112	187	297	444	731											
	5.5	14	0.81	79	131	209	312	515	810										
	7.5	18.4	0.80	61	101	161	240	396	623	950									
	9.2	22.4	0.81		82	131	195	322	506	772									
	11	26	0.82			111	166	274	431	659	899								
	13	30	0.82			97	144	237	374	571	779								
	15	34	0.83				126	207	326	499	682	940							
	18.5	40.5	0.83				105	174	274	419	572	789							
	22	47.5	0.83					148	234	357	488	673	900						
	26	56	0.85					123	194	297	407	562	755	974					
30	64	0.84						172	262	359	496	664	856						
37	85.5	0.79							206	281	386	513	655	782	916				
MMS 8000	22	48	0.84					145	229	350	479	661	886						
	26	56.5	0.85					122	192	295	403	557	748	965					
	30	64	0.85						170	260	356	492	660	852					
	37	78.5	0.85						139	212	290	401	538	695	836	990			
	45	96.5	0.82							177	242	334	446	572	686	808	933		
	55	114	0.85								200	276	371	478	576	682	792	941	
	63	132	0.83									242	324	417	500	590	682	807	920
	75	152	0.86									206	277	357	431	511	595	708	813
	92	186	0.86										226	292	352	418	486	579	664
	110	224	0.87											242	292	347	404	483	555
MMS 10000	75	156	0.84										272	351	422	498	578	685	782
	92	194	0.82										222	285	341	402	464	548	623
	110	228	0.84										240	289	341	395	469	535	
	132	270	0.84											244	288	334	396	452	
	147	315	0.81												248	286	336	382	
	170	365	0.81															290	330
	190	425	0.79																248
MMS 12000	147	305	0.83													255	295	349	398
	170	345	0.85														262	311	356
	190	390	0.84															274	313
	220	445	0.85																276
	250	505	0.85																
Max. current for cable [A]*				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497

* At particularly favourable heat dissipation conditions eg. submerged in water, note that the value is smaller if the cable is placed in air.

Cable dimensions for MMS motors at 3 x 460 V,
60 Hz, direct-on-line starting
Voltage drop 1%

Motor	[kW]	$I_{1/1}$ [A]	Cos φ 100%	Maximum cable length in metres from motor starter to pump																	
				Cross-section [mm ²]																	
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300		
MMS 6000	3.7	9.75	0.80	25	42	67	100	165	260	397	541	743	989								
	5.5	13.8	0.80	18	30	48	71	117	184	280	382	525	699	894							
	7.5	18.0	0.79	14	23	37	55	91	143	217	296	406	539	689	822	963					
	9.2	22.0	0.81		18	29	44	72	114	174	237	326	436	558	668	785	906				
	11	25.5	0.82			25	37	62	97	149	203	279	373	479	574	676	781	922			
	13	29.5	0.82			22	32	53	84	128	175	242	323	414	497	585	675	797	907		
	15	33.5	0.83			19	28	47	73	112	153	211	282	363	436	514	595	704	802		
	18.5	39.0	0.83			24	40	63	96	132	181	243	312	374	442	511	595	704	802		
	22	46.0	0.83				34	53	82	112	154	206	265	318	374	433	512	584			
	26	54.5	0.85				28	44	68	93	128	172	221	267	316	366	435	498			
30	62.5	0.85					39	59	81	112	150	193	233	275	320	380	435				
37	81.5	0.79						48	65	90	119	152	182	213	245	287	324				
MMS 8000	22	48.5	0.84				32	50	77	105	145	194	250	300	355	411	488	557			
	26	56.5	0.86				27	42	65	88	122	165	213	257	304	354	422	484			
	30	64.0	0.85					38	58	79	109	146	189	227	269	312	371	424			
	37	78.0	0.85					31	47	65	89	120	155	186	220	256	304	348			
	45	92.5	0.85						40	55	75	101	130	157	186	216	257	294			
	55	112	0.86							45	62	83	107	129	154	179	213	244			
	63	126	0.86								55	74	95	115	136	159	189	217			
	75	150	0.86								46	62	80	97	115	133	159	182			
92	184	0.87									50	65	79	93	109	130	150				
110	220	0.87										54	66	78	91	109	125				
MMS 10000	75	154	0.84									61	79	95	112	130	154	175			
	92	190	0.83									50	64	77	91	105	124	141			
	110	224	0.84										54	65	77	89	106	121			
	132	265	0.85											55	65	75	90	103			
	147	305	0.82												57	65	77	88			
	170	355	0.82													56	66	75			
190	405	0.79														58	65				
Max. current for cable [A]*				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497		

* At particularly favourable heat dissipation conditions eg. submerged in water, note that the value is smaller if the cable is placed in air.

Cable dimensions for MMS motors at 3 x 460 V, 60 Hz,
direct-on-line starting
Voltage drop 3%

Motor	[kW]	I _{fl} [A]	Cos φ 100%	Maximum cable length in metres from motor starter to pump															
				Cross-section [mm ²]															
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
MMS 6000	3.7	9.75	0.80	76	127	202	301	496	781										
	5.5	13.8	0.80	54	90	143	213	351	552	841									
	7.5	18.0	0.79	42	70	111	165	272	428	651	887								
	9.2	22.0	0.81		55	88	132	217	342	522	712	979							
	11	25.5	0.82			75	112	185	292	446	609	838							
	13	29.5	0.82			65	97	160	252	385	526	725	968						
	15	33.5	0.83			57	85	140	220	336	459	633	847						
	18.5	39.0	0.83			73	120	189	289	395	544	728	936						
	22	46.0	0.83				102	160	245	335	461	617	794	953					
	26	54.5	0.85				84	132	203	278	384	515	664	800	947				
30	62.5	0.85					116	177	242	335	449	579	698	826	959				
37	81.5	0.79						144	196	269	357	457	545	638	734	860	973		
MMS 8000	22	48.5	0.84				95	150	230	315	434	582	750	901					
	26	56.5	0.86				80	126	194	265	367	494	639	770	913				
	30	64.0	0.85					113	173	236	327	438	566	681	806	936			
	37	78.0	0.85					93	142	194	268	360	464	559	661	768	913		
	45	92.5	0.85						119	164	226	303	391	471	558	648	770	881	
	55	112	0.86							134	185	249	322	388	461	536	638	732	
	63	126	0.86								165	221	286	345	409	476	567	651	
	75	150	0.86								138	186	241	290	344	400	477	547	
92	184	0.87									151	195	236	280	327	390	449		
110	220	0.87										163	197	234	273	326	375		
MMS 10000	75	154	0.84									183	236	284	335	389	461	526	
	92	190	0.83									149	192	231	272	315	372	424	
	110	224	0.84										162	195	230	267	317	362	
	132	265	0.85											165	195	226	269	308	
	147	305	0.82												170	196	231	263	
	170	355	0.82													168	199	226	
190	405	0.79														173	196		
Max. current for cable [A]*				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497

* At particularly favourable heat dissipation conditions eg. submerged in water, note that the value is smaller if the cable is placed in air.

Sizing of cable

Calculation of the cross-section of the cable

Formula designations

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated current of the motor [A]

q = Cross-section [mm²]

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

$\cos\phi$ = Power factor

$\sin\phi = \sqrt{1 - \cos^2\phi}$

L = Length of cable [m]

Δp = Power loss [W]

$\rho = 1/\chi$

Materials of cable:

Copper: $\chi = 52 \text{ m}/\Omega \times \text{mm}^2$

Aluminium: $\chi = 35 \text{ m}/\Omega \times \text{mm}^2$

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

DOL

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

Star-delta

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

The values of the rated current (I) and the power factor ($\cos\phi$) can be read in the tables on pages 14-20.

Calculation of the 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: 45 kW, MMS 8000

Rated current: $I_{1/1} = 96.5 \text{ A}$

Voltage: 3 x 400 V, 50 Hz

Starting method: Direct-on-line

Required cable length: 200 m

Water temperature: 25 °C

Cable selection:

Choice A: **3 x 150 mm²**

Choice B: **3 x 185 mm²**

Calculation of power loss

Choice A:

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

$$\Delta p_A = \frac{3 \cdot 200 \cdot 0.02 \cdot 96.5^2}{150}$$

$$\Delta p_A = \mathbf{745 \text{ W}}$$

Choice B:

$$\Delta p_B = \frac{3 \cdot 200 \cdot 0.02 \cdot 96.5^2}{185}$$

$$\Delta p_B = \mathbf{604 \text{ W}}$$

Savings

Operating hours/year: h = 4000.

Annual saving (A):

$$A = (\Delta p_A - \Delta p_B) \cdot h = (745 \text{ W} - 604 \text{ W}) \cdot 4000 = 564000 \text{ Wh} = 564 \text{ kWh}$$

By choosing the cable size 3 x 185 mm² instead of 3 x 150 mm², an annual saving of 564 kWh is achieved.

Operating time: 10 years

Saving after 10 years (A_{10}):

$$A_{10} = A \cdot 10 = 564 \cdot 10 = \mathbf{5640 \text{ kWh}}$$

The saving in amount must be calculated in the local currency.

3 x 220 V, 60 Hz

Motor power		Product number				
		PVC windings				
		EN-JL1040		Ceramic/carbon		
		DIN/EN 1.4401				
[kW]	[hp]	DOL	SD	DOL	SD	
MMS 6000	3.7	5.0	96457631	-	96457658	-
	5.5	7.5	96457632	-	96457659	-
	7.5	10	96441900	-	96457660	-
	9.2	12.5	96441901	-	96457661	-
	11	15	96441902	-	96457662	-
	13	17.5	96441903	-	96457663	-
	15	20	96441904	-	96457664	-
	18.5	25	96441905	-	96457665	-
	22	30	96439622	-	96457666	-
	26	35	96439623	-	96457667	-
	30	40	96439624	-	96457668	-
	37	50	-	96446025	-	96457649
	MMS 8000	22	30	96457643	96457628	96457670
26		35	96457644	96457629	96457671	96457651
30		40	96457645	96457630	96457672	96457652
37		50	96442309	96442310	96457673	96457653
45		60	96439626	96442313	96457674	96457654
55		75	96439627	96442315	96457675	96457655
63		85	96439628	96442317	96457676	96457656
75	100	96439629	96442319	96457677	96457657	
MMS 10000	75	100	-	-	-	-
	92	125	96457647	-	96457679	-
	110	150	96457648	-	96457680	-
	132	180	96439638	-	96457682	-

3 x 220-230 V, 50 Hz

Motor power		Product number						
		PVC windings				Ceramic/carbon		
		EN-JL1040			DIN/EN 1.4401			
[kW]	[hp]	DOL	SD	DOL	SD			
MMS 6000	3.7	5.0	96432245	96432267	96444329	96444352		
	5.5	7.5	96432246	96432268	96444330	96444353		
	7.5	10	96432247	96432269	96444332	96444354		
	9.2	12.5	96432248	96432270	96444333	96444355		
	11	15	96432249	96432271	96444334	96444356		
	13	17.5	96432250	96432272	96444335	96444357		
	15	20	96432251	96432273	96444336	96444358		
	18.5	25	96432252	96432274	96444337	96444359		
	22	30	96432253	96432275	96444338	96444360		
	26	35	96432254	96432276	96444339	96444361		
	30	40	96432255	96432277	96444340	96444363		
	37	50	-	96432278	-	96444364		
	MMS 8000	22	30	96432257	96432279	96444342	96444365	
26		35	96432258	96432280	96444343	96444366		
30		40	96432259	96432281	96444344	96444367		
37		50	96432260	96432282	96444345	96444368		
45		60	96432261	96432283	96444346	96444369		
55		75	96432262	96432284	96444347	96444370		
MMS 10000	63	85	96432263	96432285	96444348	96444372		
	75	100	-	-	-	-		
	92	125	96432291	96432294	96444350	96444514		
	110	150	96432292	96432295	96444351	96444515		

3 x 380-415 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		
[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	
3 x 380-415 V, 50 Hz										
3 x 460 V, 60 Hz										
MMS 6000	3.7	5.0	96430655	-	96444516	-	96477813	-	96095037	-
	5.5	7.5	96430656	96432081	96444517	96444546	96477814	96094978	96095038	96095050
	7.5	10	96430657	96432082	96444518	96444547	96477815	96094979	96095039	96095051
	9.2	12.5	96430658	96432083	96444519	96444548	96477816	96094980	96095040	96095052
	11	15	96430659	96432084	96444520	96444549	96477817	96094981	96095041	96095053
	13	17.5	96430660	96432085	96444521	96444550	96477818	96094982	96095042	96095054
	15	20	96430661	96432086	96444522	96444551	96477819	96094983	96095043	96095055
	18.5	25	96430662	96432087	96444523	96444552	96477850	96094984	96095044	96095056
	22	30	96430663	96432088	96444524	96444553	96477851	96094985	96095045	96095057
	26	35	96430664	96432089	96444525	96444554	96477852	96094986	96095046	96095058
MMS 8000	30	40	96430665	96432090	96444526	96444555	96477853	96094987	96484742	96095059
	37	50	96430666	96432091	96444527	96444556	96457282	96457294	96457305	96457316
	22	30	96430667	96432092	96444528	96444557	96095117	96095127	96095177	96095187
	26	35	96430668	96432093	96444529	96444558	96095118	96095128	96095178	96095188
	30	40	96430669	96432094	96444530	96444559	96095119	96095129	96095179	96095189
	37	50	96430670	96432095	96444531	96444560	96095120	96095130	96486180	96095190
	45	60	96430671	96432096	96444532	96444561	96457284	96457295	96457306	96457317
	55	75	96430672	96432097	96444533	96444562	96457285	96457296	96457307	96457318
	63	85	96430673	96432098	96444534	96444563	96457286	96457297	96457308	96457319
	75	100	96430674	96432099	96444535	96444564	96457287	96457298	96457309	96457320
MMS 10000	92	125	96430675	96432100	96444536	96444565	96457288	96457299	96457310	96457321
	110	150	96430676	96432101	96444537	96444566	96457289	96457300	96457311	96457322
	75	100	-	-	-	-	-	-	-	-
	92	125	96430678	96432103	96444539	96444568	96513080	96540680	96540682	96540685
	110	150	96430679	96432104	96444540	96444569	96494090	96494091	96540683	96540686
	132	180	96430680	96432105	96444541	96444570	96457290	96457301	96457312	96457323
	147	200	96430681	96432106	96444542	96444571	96457291	96457302	96457313	96457324
	170	230	96438116	96438117	96444543	96444572	96457292	96457303	96457314	96457325
190	260	96438118	96438119	96444544	96444573	96463669	96540308	96540314	96540320	
3 x 380-415 V, 50 Hz										
MMS 12000	147	200	96430682	96432107	96444628	96444633	96540687	96540688	96540689	96540691
	170	230	96430683	96432108	96444629	96444634	96493224	96481314	96540690	96540692
	190	260	96430684	96432109	96444630	96444635	96457293	96457304	96457315	96457326

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

Motor power		Product number								
		PE/PA windings								
		Ceramic/carbon				SiC/SiC				
		EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		
[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	
3 x 380-415 V, 50 Hz										
3 x 460 V, 60 Hz										
MMS 6000	7.5	10	96094991	-	96539856	-	96540057	-	96540170	-
	9.2	12.5	96094992	-	96539858	-	96540058	-	96540171	-
	11	15	96470733	96095005	96539859	96539876	96540059	96540120	96540172	96540192
	13	17.5	96470734	96095006	96539870	96539878	96540110	96540121	96540173	96540193
	15	20	96470735	96095007	96539871	96539879	96540111	96540122	96540174	96540194
	18.5	25	96470736	96095008	96526826	96539880	96497415	96540123	96540175	96540195
	22	30	96464411	96095009	96539872	96539881	96540113	96540124	96540176	96540196
	26	35	96221394	96095010	96511389	96539882	96497110	96540125	96540177	96540197
	30	40	96470737	96095011	96539873	96539883	96509553	96540126	96540178	96540198
	37	50	96470738	96095012	96496461	96539884	96476890	96540127	96540179	96540199
MMS 8000	22	30	96095137	96095147	96529936	96530008	96530168	96530185	96530081	96530102
	26	35	96095138	96095148	96529937	96530009	96530169	96530187	96530083	96530103
	30	40	96095139	96095149	96529938	96530011	96530180	96530189	96530084	96530104
	37	50	96095140	96095150	96529939	96530012	96530182	96530191	96530085	96530105
	45	60	96470739	96095151	96530000	96530013	96476891	96530192	96481247	96530106
	55	75	96470780	96095152	96530002	96530014	96476892	96530193	96530087	96530107
	63	85	96473399	96095153	96530003	96530016	96530184	96530195	96530088	96530108
	75	100	96221395	96095154	96530004	96530017	96476893	96489499	96530089	96530109
	92	125	96473490	96095155	96530005	96530018	96476894	96489347	96530100	96530110
	110	150	96466552	96095156	96530006	96530019	96511375	96530196	96496894	96530111
MMS 10000	75	100	-	-	-	-	-	-	-	-
	92	125	96473394	96540275	96540290	96540295	96540300	96540304	96540310	96540316
	110	150	96526004	96540276	96540291	96540296	96540301	96540305	96540311	96540317
	132	180	96473395	96540277	96540292	96540297	96521619	96540306	96540312	96540318
	147	200	96473396	96540278	96540293	96540298	96540302	96540307	96540313	96540319
	170	230	96438116	96438117	96444543	96444572	96457292	96457303	96457314	96457325
	190	260	96438118	96438119	96444544	96444573	96463669	96540308	96540314	96540320
MMS 12000	3 x 380-415 V, 50 Hz									
	147	200	96540322	96540326	96540329	96540332	96540337	96540352	96540356	96540361
	170	230	96540323	96540327	96540330	96540333	96540338	96540366	96540357	96540362
	190	260	96465240	96540328	96540331	96540334	96540339	96540353	96540358	96540363
	220	300	96430685	96432110	96444631	96444636	96540350	96540354	96540359	96540364
	250	340	96430686	96432111	96444632	96444637	96540351	96540355	96540360	96540365

3 x 500 V, 50 Hz and 3 x 575 V, 60 Hz

Motor power	Product number					
	PVC windings					
	Ceramic/carbon					
	EN-JL1040			DIN/EN 1.4401		
[kW]	[hp]	DOL	SD	DOL	SD	
3 x 500 V, 60 Hz						
MMS 6000	7.5	10	96437548	-	96444574	-
	9.2	12.5	96435750	-	96444575	-
	11	15	96437552	96437567	96444576	96444603
	13	17.5	96437554	96437568	96444577	96444604
	15	20	96437555	96437569	96444578	96444605
	18.5	25	96437556	96437570	96444579	96444606
	22	30	96437561	96437571	96444580	96444607
	26	35	96437562	96437572	96444581	96444608
	30	40	96437563	96437573	96444582	96444609
	37	50	96437564	96437574	96444583	96444610
3 x 500 V, 50 Hz						
3 x 575 V, 60 Hz						
MMS 8000	22	30	96432296	96432316	96444584	96444611
	26	35	96432297	96432317	96444585	96444612
	30	40	96432298	96432318	96444586	96444613
	37	50	96432299	96432319	96444587	96444614
	45	60	96432300	96432320	96444588	96444615
	55	75	96432301	96432321	96444589	96444616
	63	85	96432302	96432322	96444590	96444617
	75	100	96432303	96432323	96444591	96444618
	92	125	96432304	96432324	96444592	96444619
	110	150	96432305	96432325	96444593	96444620
MMS 10000	75	100	-	-	-	-
	92	125	96432307	96432327	96444595	96444622
	110	150	96432308	96432328	96444596	96444623
	132	180	96432309	96432329	96444597	96444624
	147	200	96432310	96432330	96444598	96444625
	170	230	96438170	96438172	96444599	96444626
	190	260	96438171	96438173	96444600	96444627
3 x 500 V, 50 Hz						
MMS 12000	147	200	96432311	96432331	96444638	96444643
	170	230	96432312	96432332	96444639	96444644
	190	260	96432313	96432333	96444640	96444645
	220	300	96432314	96432334	96444641	96444646
	250	340	96432315	96432335	96444642	96444647

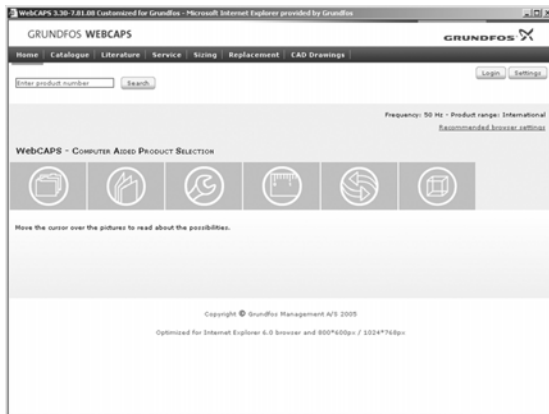
3 x 380 V, 60 Hz, PVC windings

Motor power		Product number				
		EN-JL1040		DIN/EN 1.4401		
		PVC windings		Ceramic/carbon		
[kW]	[hp]	DOL	SD	DOL	SD	
MMS 6000	3.7	5.0	96438729	-	96457683	-
	5.5	7.5	96438730	-	96457684	-
	7.5	10	96438731	-	96457685	-
	9.2	12.5	96438732	-	96457686	-
	11	15	96438733	-	96457687	-
	13	17.5	96438734	-	96457688	-
	15	20	96438735	-	96457689	-
	18.5	25	96438736	-	96457690	-
	22	30	96438737	-	96457691	-
	26	35	96438738	-	96457692	-
	30	40	96438739	-	96457693	-
	37	50	96438741	96446026	96457694	96457713
	MMS 8000	22	30	96453623	96453630	96457695
26		35	96453624	96453631	96457696	96457715
30		40	96453625	96453632	96457697	96457716
37		50	96442311	96442312	96457699	96457717
45		60	96439632	96442314	96457700	96457718
55		75	96439633	96442316	96457701	96457719
63		85	96439634	96442318	96457702	96457720
75		100	96439635	96442320	96457703	96457721
MMS 10000	92	125	96439636	96442322	96457704	96457722
	110	150	96439637	96453633	96457705	96457723
	75	100	-	-	-	-
	92	125	96453627	96453635	96457707	96457725
	110	150	96453628	96453636	96457708	96457726
	132	180	96439639	96453637	96457709	96457727
	147	200	96439640	96453638	96457710	96457728
170	230	96439641	96453639	96457711	96457729	
190	260	96453629	96453640	96457712	96457730	

3 x 380 V, 60 Hz, PE/PA windings

Motor power		Product number								
		PE/PA windings								
		Ceramic/carbon				SiC/SiC				
		EN-JL1040		DIN/EN 1.4401		EN-JL1040		DIN/EN 1.4401		
[kW]	[hp]	DOL	SD	DOL	SD	DOL	SD	DOL	SD	
MMS 6000	37	50	96507886	96507887	96540392	96510921	96540395	96483156	96540397	96540399
	22	30	96540463	96540482	96540491	96540501	96540511	96540532	96540537	96540546
	26	35	96540464	96540483	96540492	96540502	96540512	96540533	96540538	96540547
	30	40	96540465	96540484	96540493	96540503	96540513	96540534	96540539	96540548
MMS 8000	37	50	96540467	96540485	96540494	96540504	96540514	96540535	96540540	96540549
	45	60	96507888	96509371	96540495	96540505	96540515	96483158	96491000	96540550
	55	75	96507889	96509372	96540496	96540506	96540517	96483160	96540541	96540551
	63	85	96540468	96540486	96540497	96540507	96540518	96483161	96540542	96540556
	75	100	96540469	96540487	96540498	96540508	96540519	96483162	96540543	96540557
	92	125	96507900	96540488	96540499	96540509	96540530	96483163	96540544	96540558
	110	150	96500150	96540490	96540500	96540510	96540531	96540536	96540545	96540559
	75	100	-	-	-	-	-	-	-	-
MMS 10000	92	125	96540571	96509374	96540585	96540602	96540609	96540614	96540622	96540671
	110	150	96540570	96509375	96540586	96540603	96540610	96540616	96540623	96540672
	132	180	96509377	96540579	96540587	96540604	96511772	96540617	96111546	96540673
	147	200	96507901	96507902	96540589	96540606	96540611	96540618	96540624	96540674
	170	230	96439641	96453639	96457711	96457729	96505267	96485244	96540625	96540675
	190	260	96453629	96453640	96457712	96457730	96540612	96540619	96540626	96540676

WebCAPS

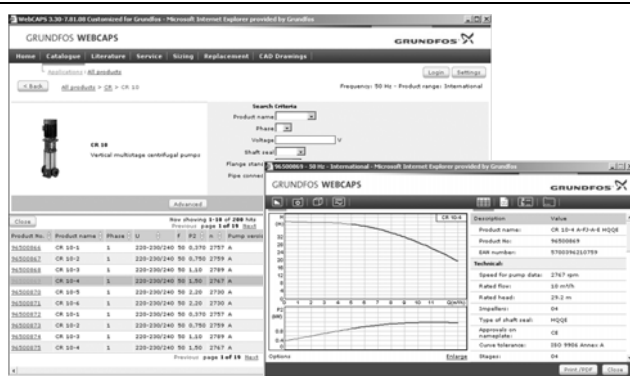


WebCAPS is a **Web-based Computer Aided Product Selection** program available on www.grundfos.com.

WebCAPS contains detailed information on more than 185,000 Grundfos products in more than 20 languages.

In WebCAPS, all information is divided into 6 sections:

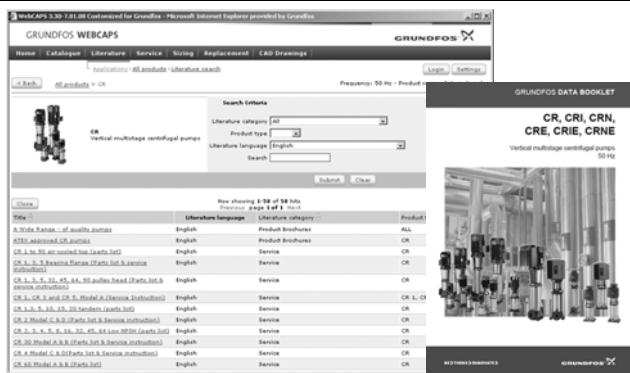
- Catalogue
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.



Catalogue

This section is based on fields of application and pump types, and contains

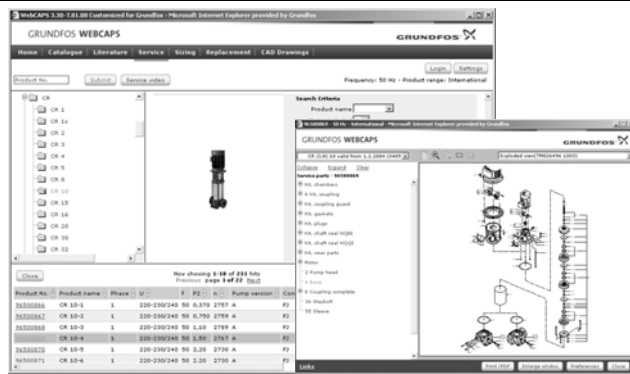
- technical data
- curves (QH, Eta, P1, P2, etc.) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.



Literature

In this section you can access 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, this 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

- 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. 18 WinCAPS CD-ROM

WinCAPS is a **Windows-based Computer Aided Product Selection** program containing detailed information on more than 185,000 Grundfos products in more than 20 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.

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Repl. V71156900 0905	

Subject to alterations.