# MS6000C

## Submersible motors
60 Hz


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# 1. Product description

The Grundfos MS6000C product range is a complete range of submersible motors available in 60 Hz from 7.5 to 40 hp (5.5 to 30 kW).

Two material versions are available:

- A standard version made of stainless steel AISI 304 (EN 1.4301).
- An R-version made of stainless steel AISI 904L (EN 1.4539) for aggressive liquids such as seawater and mine water.

Grundfos MS6000C submersible motors are designed according to market standards. All Grundfos MS6000C motors are designed to fit pump ends manufactured according to NEMA standards, and therefore they can be fitted on all Grundfos SP pumps without the need for adapters. The motors are also available with a flange extension in order to fit pump ends from other pump manufactures. See fig. 1.

General characteristics of the MS6000C motor:

- 6" diameter (OD = 139.5 mm).
- high efficiency.
- stator completely encapsulated in stainless steel.
- cooled by pumped liquid.
- hermetically sealed, canned motor with a dry stator.
- enclosure class IP68.
- factory filled with Grundfos motor liquid SML-3, alternatively filled with demineralized water.
- built-in temperature transmitter (Tempcon).
- motor temperature can also be monitored via a Pt100 or Pt1000 sensor (used for frequency controlled installations).


GR 1015371 0614

**Fig. 1** MS6000C motor with flange extension

## Features and benefits

The Grundfos MS6000C submersible motor offers the following features and benefits:

**High motor efficiency**

The complete motor range is characterized by high efficiency which contributes to improved economy of the entire pump system.

**Sealing system**

All motors are with mechanical shaft seals.

**High reliability**

New state-of-the-art shaft seal design and materials offering high wear resistance, long operating life, improved sticking and dry-running capabilities.

**Super stainless steel versions**

Super stainless steel version AISI 904L (EN 1.4539) with silicon carbide based (SiC/SiC) mechanical shaft sealing system and FKM rubber parts for applications in seawater and slightly contaminated environment which might contain hydrocarbons.

**Worldwide usage**

With different voltage and frequency combinations, the product range covers markets worldwide.

**Highly reliable thrust bearing**

Fitted with a sturdy MICHELL thrust bearing, the motors offers reliable operation.

**Monitoring of motor temperature**

In order to achieve maximum protection of the motor against burnout, the motor has a built-in Tempcon temperature sensor with power line communication. In combination with motor protection (MP204), the sensor offers optimal protection of the motor.

**Additional monitoring of motor temperature**

As over-temperature protection, the MS6000C motors also offer the possibility of connecting a Pt100 or Pt1000sensor to monitor the temperature.

This solution is used in combination with frequency controlled motors.

## Applications

Grundfos submersible motors are designed for a wide range of applications such as these:

- deep well water supply
- irrigation
- groundwater regulation
- pressure boosting
- industrial water transfer and similar applications
- fountains
- dewatering.

The MS6000C motor is available in a wide range of variants to suit these different kinds of applications:

Technical data on the following variants can be found in the appendix.

**MS6000CQFT40**

For operation in normal groundwater with temperatures up to 104 °F (40 °C). The motor contains a SiC/SiC shaft seal with rubber parts of NBR, and therefore it is approved for drinking water. Furthermore, it is mounted with an extension flange for the US market.

**MS6000CT40**

For operation in normal groundwater with temperatures up to 104 °F (40 °C).

**MS6000CXT40**

For operation in normal groundwater with temperatures up to 104 °F (40 °C). The motor is without Tempcon sensor.

**MS6000CWT40**

For applications where horizontal operation is common and turbine operation may occur. The motor contains tungsten carbide/SiC bearings

**MS6000CREST40**

For operation in aggressive liquids with abrasive particles

**MS6000CRESWT40**

For operation in aggressive liquids with abrasive particles in applications where horizontal operation is common and turbine operation may occur.

**MS6000CRESDT40**

For applications where a high degree of process control is required, e.g. in chip manufacturing. The motor is factory-filled with demineralized water.

**MS6000CEST40**

For operation in neutral liquids with low content of hydrocarbons and dissolved gasses.

**MS6000CT60**

For operation in normal groundwater with temperatures up to 140 °F (60 °C).

**MS6000CREST60**

For operation in aggressive liquids with temperatures up to 140 °F (60 °C).

**MS6000CRESWT60**

For operation in aggressive liquids with temperatures up to 140 °F (60 °C) and with abrasive particles in applications where horizontal operation is common and turbine operation may occur.

# 2. Identification

## Type key

**Example pump: MS6000CQFT40 3 x 460/60 25 hp**

| Description | MS6000C | Q | F | T40 | 3 x 460/60 | 25 hp |
|---|---|---|---|---|---|---|

**Motor type**

**Material type**

| | | |
|---|---|---|
| | = | AISI 304 Stainless Steel (EN 1.4301) |
| R | = | AISI 904L stainless steel (EN 1.4539) |

**Rubber**

| | | |
|---|---|---|
| | = | NBR |
| E | = | FKM |

**Shaft seal**

| | | | |
|---|---|---|---|
| | = | Ceramic/carbon | BXPFF/NBR |
| S | = | SiC/SiC | Q1Q1VFF/FKM |
| Q | = | SiC/SiC | Q1Q1PFF/NBR |

**Radial bearings**

| | | |
|---|---|---|
| | = | Ceramic/hard metal |
| W | = | SIC/Tungsten carbide |

**Motor liquid**

| | | |
|---|---|---|
| | = | SML-3 |
| D | = | Demineralized water |
| H | = | Glycol 60 vol % HTF |

**Flange extension**

| | | |
|---|---|---|
| | = | Without |
| F | = | With |

**Tempcon**

| | | |
|---|---|---|
| | = | With |
| X | = | Without |

**Max. liquid temperature**

| | | |
|---|---|---|
| T40 | = | 104 °F (40 °C) |
| T60 | = | 140 °F (60 °C) |

**Voltage**

| | | | |
|---|---|---|---|
| 35 | 3 x 460/60 | = | 3 x 440-460-480 V, 60 Hz |
| 30 | 3 x 208-230/60 | = | 3 x 208-220-230 V, 60 Hz |
| 39 | 3 x 575/60 | = | 3 x 575 V, 60 Hz |

**Method of starting**

| | | |
|---|---|---|
| | = | DOL |
| SD | = | SD |

**Motor power**

| | |
|---|---|
| 7.5 hp | 5.5 kW |
| 10 hp | 7.5 kW |
| 15 hp | 11 kW |
| 20 hp | 15 kW |
| 25 hp | 18.5 kW |
| 30 hp | 22 kW |
| 40 hp | 30 kW |

Note ***The type key cannot be used for ordering as not all combinations are possible.***

Note ***Additional voltage codes can be found in section 9. Appendix.***

# 3. Operating conditions

## Pumped liquids

The MS6000C motors are produced in two material versions to enable use in various liquids.

- We recommend MS6000C for use in groundwater. It is made of AISI 304 stainless steel (EN 1.4301).
- We recommend MS6000C RE for use in aggressive and slightly contaminated liquids. It is made of AISI 904L stainless steel (EN 1.4539), and the rubber parts are made from FKM.

In case of doubt, please make an analysis of the liquid and contact Grundfos.

The motors are designed with SiC/SiC shaft seals for use in applications with abrasive content in the pumped liquid. If the pumped liquids contain abrasives, Grundfos recommends a motor with SiC/SiC shaft seal.

## Ambient pressure

Maximum 870 psi (60 bar).

We do not recommend that you use the motor for operation in a vacuum. If this cannot be avoided, please contact Grundfos for guidance.

## Cooling

The cooling of the motor depends on the temperature and the flow velocity of the pumped liquid past the motor. It is important that the values for maximum temperature of the pumped liquid and its minimum velocity past the motor are retained to ensure sufficient cooling of the motor. See the table below.

| Motor | Installation | | |
|---|---|---|---|
| | Flow past the motor | Vertical | Horizontal |
| MS6000C (T40 versions) | 0.15 m/s (0.5 ft/s) | 40 °C (~ 104 °F) | 40 °C (~ 104 °F) |
| MS6000C (T60 versions) | 1 m/s (3.3 ft/s) | 60 °C (~ 140 °F) | 60 °C (~ 140 °F) |

### Calculation of the flow velocity

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

Required data:

$Q_{min}$: Flow in gpm
$D_i$: Borehole diameter in inches
$d_A$: Motor diameter in inches

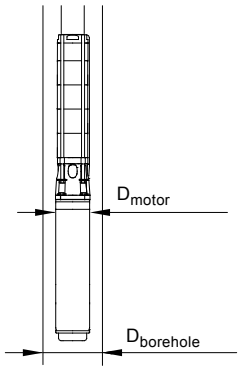



**Fig. 2** Drawing for cooling flow

### Recommendations for optimum cooling

We recommend that you install the motor above the well screen in order to achieve proper motor cooling.

In cases where the stated liquid velocity cannot be achieved, a flow sleeve must be installed.

If there is a risk of sediment build-up, such as sand around the motor, a flow sleeve should be used in order to ensure proper cooling of the motor. If a flow sleeve is used, the motor can be placed in the well screen. See section *Flow sleeves* page 26.

## Start/stop frequency per hour

The motor is designed for continuous as well as intermittent operation.

### Frequency of starts and stops

Minimum number of starts: 1 per year is recommended. (alternatively the shaft can be turned by hand)

Maximum number of starts: 30 per hour
300 per day.

**Note:** The maximum number of starts applies only to the motor. The maximum number of starts may be limited by the pump design.

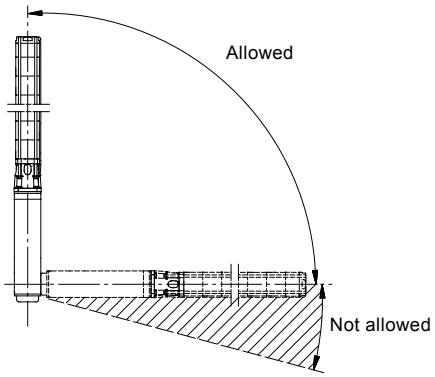
# 4. Installation

## Mechanical installation

The motor must be fully submerged in the pumped liquid during operation to ensure sufficient cooling and it can be installed either horizontally or vertically.

### Horizontal installation

If the motor is installed horizontally, the shaft end must not fall below the horizontal level. We always recommend that you use a flow sleeve when the motor is installed horizontally.




TM00 1355 5092

**Fig. 3** Positional requirements

### Vertical installation

#### Installation depth below water level

Maximum 1970 ft (600 m).

#### Fitting the motor to the pump

Fit the motor to the pump as follows:

1. Use pipe clamps when handling the motor.
2. Place the motor in vertical position at the wellhead seal, see fig. 4.

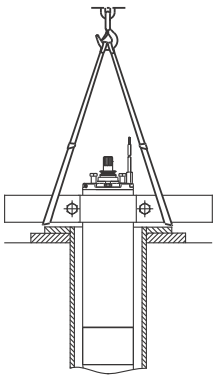


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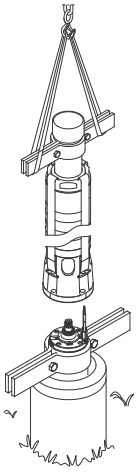
**Fig. 4** Motor in vertical position

3. Lift the pump part by means of pipe clamps fitted to the extension pipe, see fig. 5.



TM06 0544 0414

**Fig. 5** Lifting the pump into position

4. Place the pump part on top of the motor and tighten the screws.
5. Fit the cable along the chamber stack, and mount the cable guard.

**Note:** Make sure that the coupling between the pump and motor engages properly.

#### Lowering the motor

We recommend that you check the borehole by means of an inside calliper before lowering the motor to ensure unobstructed passage.

Lower the motor carefully into the borehole and be careful not to damage the motor cable and the submersible drop cable.

**Note:** Do not lower or lift the motor by means of the motor cable.

#### Flow sleeves

For proper cooling of motors in larger bodies of water, like pumping from a tank or pond, see fig. 19 and fig. 20 in *Flow sleeves*.

# Electrical installation

Electrical installation must comply with local legislation.

## Supply requirements

The motor requires the following voltage quality requirements in relation to the rated voltage stamped on the motor:

- Voltage range motors: + 6 %/- 10 %
- Fixed voltage motors: + 10 %/- 10 %

The voltage is either measured at the motor terminals or calculated. The tolerance covers variations in the mains supply and losses in the cables.

There must be voltage symmetry in the supply network, i.e. there must be the same voltage difference between the individual phase leads. When the motor is operating there must be current symmetry, i.e. the three phases must be evenly loaded.

The voltage and current unbalance between the phases must be within the limits below:

- maximum voltage unbalance: 2 %
- maximum current unbalance: 5 %.

## Direction of rotation

When the motor has been connected to the electricity supply, determine the correct direction of rotation as follows:

1. Energize the motor for a short period and check the direction of rotation by watching the motor shaft.
2. Compare the result from point 1 with the demand of the pump.
3. Interchange two of the phase connections in case the direction of rotation is wrong.

If the motor is fitted to a Grundfos SP or SPA submersible pump, the correct direction of rotation is counter-clockwise as seen from the shaft end.

**Note:** If the motor is started without being connected to a pump, the shaft end must be shielded.

## Frequency converter operation

The motor can be connected to a frequency converter.

Generally, the motor must be protected against overload by adjusting the current limiter of the frequency converter to the same value as the rated current or the maximum actual current of the submersible motor.

**Note:** If the motor is operated via a frequency converter this will cause a fuse in the temperature transmitter (Tempcon) to melt and you will not be able to monitor the temperature of the motor via the built-in Tempcon temperature sensor and the MP 204 motor protection unit.

The fuse cannot be replaced!

**Note:** To enable monitoring of the motor temperature, Grundfos recommends installing a Pt100 or Pt1000 sensor together with a PR 5714 relay.

**The rated frequency must not be exceeded.**

Permissible frequency ranges: 30-50 Hz and 30-60 Hz.

A reduction of the frequency will often result in an increased generation of heat in the motor even if the motor load is reduced. The reason is that the reduction of the power input will only be very small as the major part of the power input of a submersible motor is consumed to overcome the static head. Besides, the flow past the motor will be reduced, i.e. the cooling will be poor. It is therefore important never to adjust the frequency (and thus the pump speed and the flow) to a lower level, as there must still be a sufficient flow of pumped liquid past the motor. The minimum permissible flow is 0.49 ft/s (0.15 m/s). The motor must still cut out immediately if the pump stops pumping water.

**Ramp times:** Maximum 3 seconds for start and stop.

Depending on the type, the frequency converter may cause increased acoustic noise from the motor. Furthermore, it may expose the motor to detrimental voltage peaks. This can be compensated by installing an LC filter or even better a sine-wave filter between the frequency converter and the motor.

For further details, please contact your frequency converter supplier or Grundfos.

## Soft starter

Grundfos only recommends the use of soft starters which control the voltage on all three phases and which are provided with a bypass switch.

Ramp times:

- Ramp-up time (until the voltage stated on the nameplate is reached): 3 seconds.
- Ramp-down time: 3 seconds.

If the ramp-up and ramp-down times are followed, unnecessary heating of the motor is avoided.

### Soft starter with bypass switch

Soft starters with bypass switch will only be in operation during ramp-up and ramp-down.
This reduces both the load on the soft starter and the energy consumption in comparison with operation without bypass switch.

The soft starter must not be used in connection with operation via a generator.

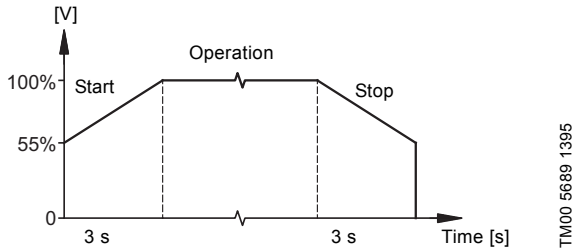



**Fig. 6** Soft starter

The starting voltage is minimum 55 % of the value stated on the nameplate.

If a high locked-rotor torque is required or if the electricity supply is not optimal, the starting voltage should be higher.

For further details, please contact your soft starter supplier or Grundfos.

## Service factor (60 Hz motors only)

The service factor (SF) allows the motor to provide power under optimum conditions at the nameplate rated power P2 times the SF. At rated conditions (i.e. 10 hp motor with a SF of 1.15 is designed to provide 11.5 hp under continuous load).
Grundfos submersible motors are designed to run continuous at a service factor load. SF is stated on the nameplate.

# 5. Construction

## Material specification

| Pos. | Description | | MS6000CQFT40 | |
|---|---|---|---|---|
| | | | ASTM | W/Nr. |
| 27 | Sand shield | | 304* | 1.4301 |
| | | | NBR* | |
| 27a | Spacer for sand shield | | 316* | 1.4436 |
| 25a | Flange extension | | 304 H* | |
| 22 | Screw | | 316* | 1.4436 |
| 21 | Washer | | S32101* | 1.4162 |
| 32 | Shaft seal housing | | 304L | 1.4306 |
| 24 | O-ring | | NBR | |
| 32a | Lip seal | | - | |
| 27 | Sand shield | | 304 | 1.4301 |
| | | | NBR | |
| 22 | Screw | | 316 | 1.4436 |
| 22a | Screw and washer | | 316 | 1.4436 |
| | | | PA66 | |
| 50 | Screw | | 316 | 1.4436 |
| 33 | Shaft seal stationary | | SIC | |
| 34 | Shaft seal rotating | | SIC | |
| | | | NBR | |
| 28 | Washer | | 304 | 1.4301 |
| 1a | Valve | | 316 L | 1.4435 |
| | | | NBR | |
| 5 | Bearing DE | bearing retainer | 304L | 1.4306 |
| | | stationary bush** | Carbon graphite | |
| | | stationary bush*** | SiC | |
| 2a | Upthrust ring | | PEEK+PTFE20 | |
| 2 | Shaft with rotor | shaft extension | 329 | 1.4460 |
| | | bearing bush** | 431 | 1.4057 |
| | | bearing bush*** | WC 74 % Cr 20 % Ni6 % | |
| 1 | Stator outer encapsulation | | 304 | 1.4301 |
| | | | 316 | 1.4436 |
| 4 | Bearing NDE | bearing retainer | Low carbon sheet steel | 1.0335 |
| | | stationary bush** | Carbon graphite | |
| | | stationary bush*** | SiC | |
| 7a | Clamping flange | | Gr. 50 Hot rolled Steel | 1.0976 |
| 41 | Screw | | Steel | |
| 42 | Stop for bearing | | Cold rolled low carbon steel | 1.0330.3 |
| 6 | Thrust bearing rotating | | 1213 | 1.0715 |
| | | | Ceramic | |
| 3 | Thrust bearing stationary | | 1213 | 1.0715 |
| | | | Carbon | |
| 45 | Shaft adjustment unit | | A193 | 1.7139 |
| 49 | Lock ring | | 304 | 1.4301 |
| 7 | Clamping flange | | Gr. 50 Hot rolled Steel | 1.0976 |
| 48 | Screw and washer | | 304 | A2 |
| | | | PA66 | |
| 46 | Screw | | Steel | |
| 12 | Diaphragm | | NBR | |
| 13 | Bottom cover | | 304 | 1.4301 |
| 220 | Flat cable | | EPR TML-B | |

* Motors with extension flange
** Motor with soft radial bearings (stainless steel/carbon graphite)
*** Motor with hard radial bearing (tungsten carbide/SiC)

## Exploded drawing of MS6000CF (with flange extension)

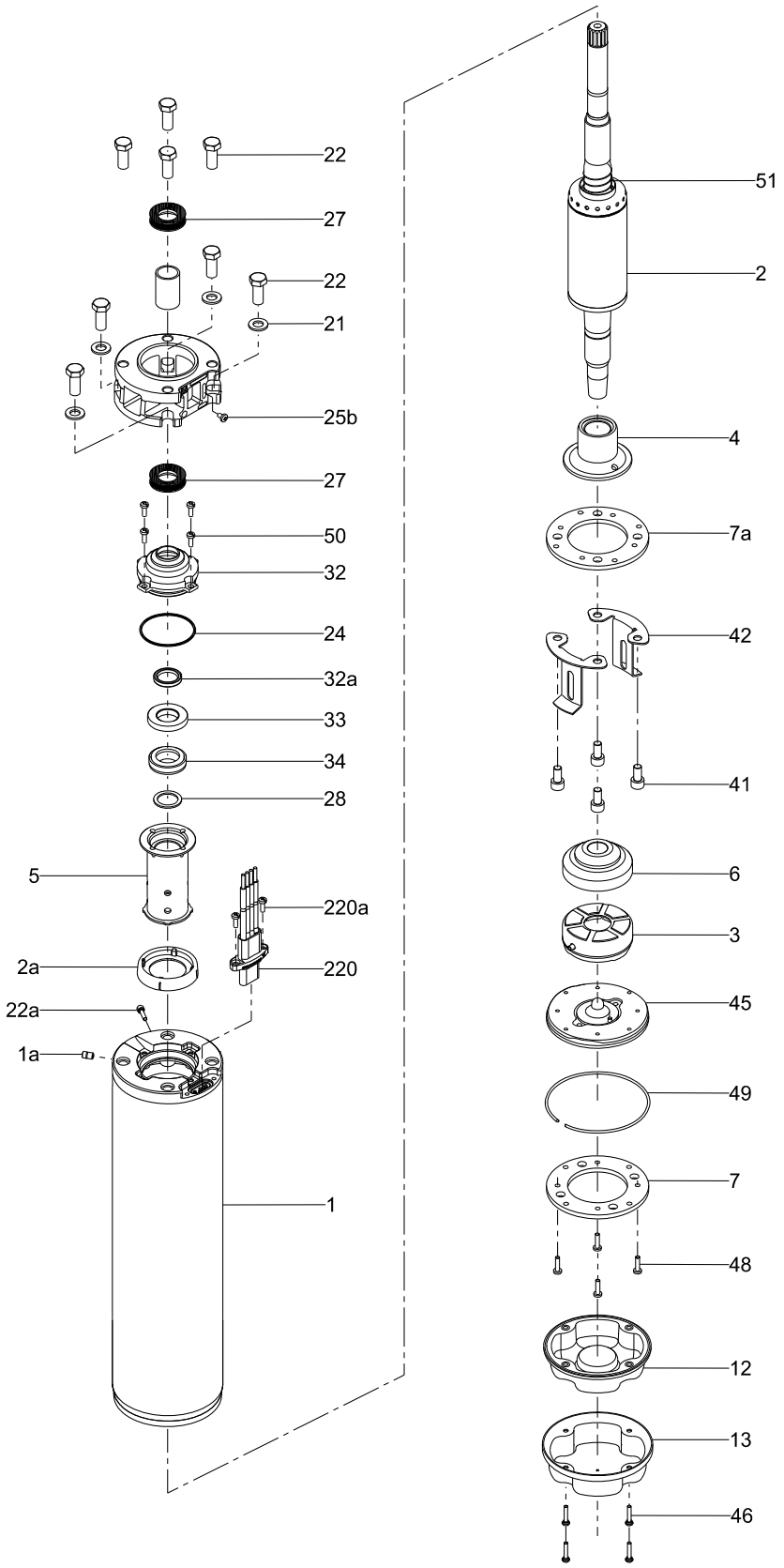



**Fig. 7** Exploded drawing of the MS6000CF

# Description of construction

The motor is a 2-pole, asynchronous squirrel-cage submersible motor:

- enclosure class: IP68 according to IEC 60034-5
- insulation class: F according to IEC 60034-1

The entire surface is stainless steel which means that all external components have uniform corrosion resistance.

## Cable connection

The motor is connected to the drop cable via a special motor cable which is approved drinking water usage.

The motor cable cannot be fitted/removed when the motor and pump are assembled.

Motors for star-delta starting are fitted with two cables displaced by 90 °.

- cCSAus marked motors are equipped with four single leads XLPE AWG8

## Motor D-end connection

The motor has standardized D-end according to NEMA standard MG1-18.413 with 4 pcs 1/2-20 UNF machine screws for mounting of the pump.

## Shaft

The stainless steel splined shaft end fulfils ANSI B92.1, 1970, class 5. The motor has a 15-tooth module. Pressure angle 30 °.

## Shaft seal

The motor is fitted with a SIC/SIC shaft seal standard.

The shaft seal is available in three variants for different applications:

- Ceramic against carbon graphite with NBR rubber parts (standard, approved for drinking water).
- Silicon carbide against silicon carbide with NBR rubber parts (approved for drinking water).
- Silicon carbide against silicon carbide with FKM rubber parts (suitable for high temperatures and liquids containing hydrocarbons).

## Radial bearing

The shaft accommodates the rotating parts of the radial bearing both at the top and bottom. The radial bearings are available as a soft or hard version.

- Soft radial bearing (standard)
  The rotating bearing bush is made of AISI 431 stainless steel (En 1.4057) fixed to the shaft by interference fit. It runs against the static bush made of carbon graphite fixed to the bearing retainer by interference fit.
- Hard radial bearing (W)
  The rotating bearing bush is made of tungsten carbide sprayed to the shaft. It runs against the static bush made of silicon carbide fixed to the bearing retainer by interference fit (recommended for use in horizontal booster applications).

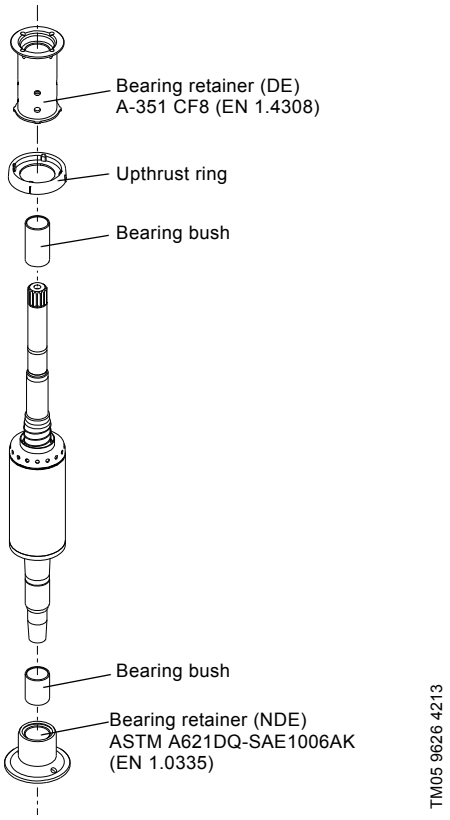



**Fig. 8** Bottom and top radial bearings

## Upthrust ring

The upthrust ring prevents damage in case of upthrust. It is designed as a thrust ring limiting the upward axial movement of the motor shaft. In case of upward axial movement, the upthrust ring will be stopped by the upper radial bearing retainer. See fig. 8.

## Rotor

The rotor is a squirrel cage copper rotor which has been interference fitted on the shaft. The upper short-circuit ring is equipped with a small impeller ensuring internal circulation of liquid in the rotor chamber and thus optimum cooling.

## Stator

The stator is hermetically encapsulated in stainless steel. The stator windings are embedded in polymer compound. This results in high mechanical stability, optimum cooling and eliminates the risk of short circuits in the windings caused by condensing water.

## Thrust bearing

The thrust bearing is of MICHELL type, a very simple but highly efficient bearing. It fulfils the requirements specified in the NEMA standards.

The thrust bearing consist of:

- A ceramic rotating part with precision-ground and polished sliding surface for optimum surface finish.
- A stationary part which has 6 moveable, specially ground carbon shoes for all sizes. It is moveable in such way that all tolerances are absorbed and thus the bearing achieves optimum thrust capacity and minimum friction.

As the thrust bearing is made for bidirectional rotation, the motor can operate both clockwise and counterclockwise.

The thrust bearing are available in three sizes depending on pump load and temperature of the pumped liquid. These bearings are dimensioned for axial load rated to 1686, 6070, and 8992 ft-lbs. (7.5, 27, and 40 kN). See fig. 9.

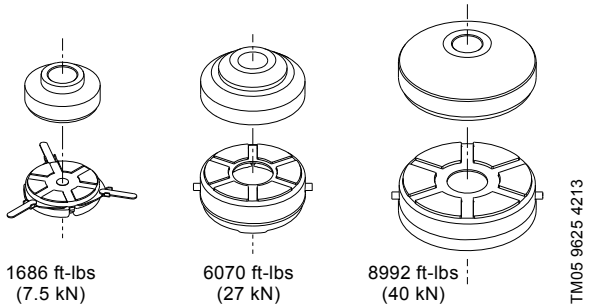



**Fig. 9** Thrust bearings

| Motor type | Motor power [hp (kW)] | | Size of thrust bearing | |
|---|---|---|---|---|
| | Min. | Max. | [ft-lbs] | [kN] |
| T40 | 7.5 (5.5) | 10 (7.5) | 1686 | 7.5 |
| | 15 (9.2) | 40 (30) | 6070 | 27 |
| T60 | 7.5 (5.5) | 10 (7.5) | 6070 | 27 |
| | 15 (9.2) | 25 (22) | 8992 | 40 |

**Note:** The motor can always be upgraded with a larger thrust bearing, as stated in the table above. But the motor must not be downgraded with a smaller thrust bearing than stated.

## Diaphragm

The rubber diaphragm fitted between the stator and the motor end shield is dimensioned to equalize volume variations caused by the temperature rises in connection with intermittent operation.

## Motor liquid

The motor liquid which is used is SML-3 containing monopropylene glycol, which is frost-proof down to -4 °F (-20 °C).

The motor liquid contains anti-corrosive and lubricating additives.

For some applications you are not allowed to use the monopropylene glycol-containing motor liquid mixed with water. In this case motor can be filled with clean tap water.

The table below indicates the freezing points which can be obtained with various percentages of monopropylene glycol-containing motor liquid.

| Monopropylene glycol-containing motor liquid % volume | Freezing point | |
|---|---|---|
| | [°F] | [°C] |
| 31.6 | 5 | -15 |
| 37.3 | -4 | -20 |
| 42.0 | -13 | -25 |
| 46.0 | -22 | -30 |
| 49.3 | -31 | -35 |
| 52.2 | -40 | -40 |
| 54.7 | -49 | -45 |
| 57.0 | -58 | -50 |

## Motor cooling

The motor has cooling chambers at the top and bottom. An efficient internal circulation system helps transporting the heat from the rotor and bearings via the motor liquid to the outer surface of the motor.

Heat generated in the motor is carried away to the surrounding pumped liquid via the outer surface of the motor.

This is the reason why the temperature of the pumped liquid and its flow velocity past the motor are of vital importance to the life of the motor. See cooling requirements in section *3. Operating conditions*.

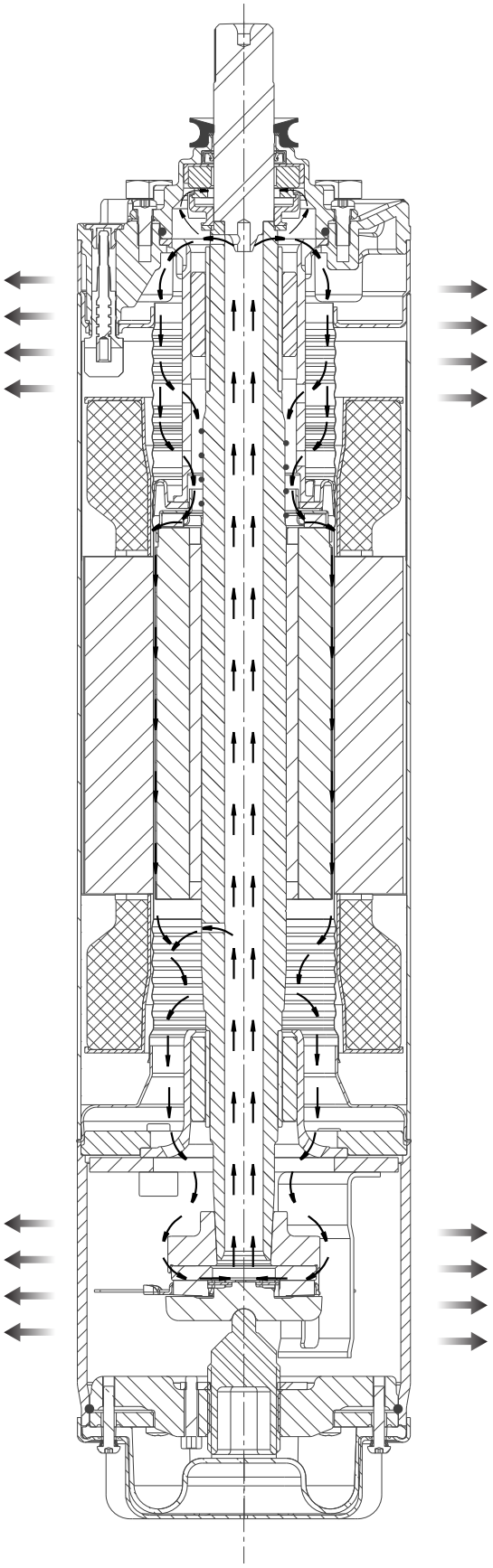



**Fig. 10** Liquid circulation inside motor

# 6. Technical data

## MS6000C with flange extension


**Fig. 11** Dimensional drawing of MS6000C with extension flange

| Motor power, $P_2$ | | L | | | | Shipping weight | | Shipping volume | |
|---|---|---|---|---|---|---|---|---|---|
| | | T40 | | T60 | | | | | |
| [hp] | [kW] | [in] | [mm] | [in] | [mm] | [lbs] | [kg] | [$ft^3$] | [$m^3$] |
| 7.5 | 5.5 | 23.50 | 597 | 25.87 | 657 | 96 | 44 | 1.52 | 0.043 |
| 10 | 7.5 | 24.69 | 627 | 27.05 | 687 | 102 | 46 | 1.52 | 0.043 |
| 15 | 11 | 27.05 | 687 | 29.61 | 752 | 123 | 56 | 1.62 | 0.046 |
| 20 | 15 | 29.61 | 752 | 34.13 | 867 | 142 | 64 | 1.84 | 0.052 |
| 25 | 18.5 | 31.77 | 807 | 36.50 | 927 | 151 | 68 | 1.84 | 0.052 |
| 30 | 22 | 34.13 | 867 | 39.25 | 997 | 167 | 76 | 2.05 | 0.058 |
| 40 | 30 | 39.25 | 997 | - | - | 199 | 90 | 2.22 | 0.063 |

## Motor cables

The motor is available with the following motor cable,

| Cable type | Designation |
|---|---|
| 4 x 1 G 8 AWG single XLPE | 8 |

| Motor | | - | 3 x 380-400-415 V | 3 x 500-525 V |
|---|---|---|---|---|
| | | 3 x 208-220-230 V | 3 x 440-460-480 V | 3 x 575 V |
| | | cCSAus | cCSAus | cCSAus |
| hp | kW | DOL | DOL | DOL |
| 7.5 | 5.5 | 8 | 8 | 8 |
| 10 | 7.5 | 8 | 8 | 8 |
| 15 | 11 | 8 | 8 | 8 |
| 20 | 15 | 8 | 8 | 8 |
| 25 | 18.5 | 8 | 8 | 8 |
| 30 | 26 | 8 | 8 | 8 |
| 40 | 30 | - | 8 | 8 |

## Product numbers for motor cables

| Motor type | Length | | Single leads XLPE rubber | |
|---|---|---|---|---|
| | [ft] | [m] | 4 x 1 G 8AWG | 3 x 1 x 8AWG |
| MS6000C with flange extension | 10 | 3 | 96164221 | - |
| | 16 | 5 | 96164222 | - |
| | 102 | 31 | 96164223 | - |
| | 220 | 67 | 96164224 | - |
| MS6000C for booster applications | 16 | 5 | - | 96164225 |
| | 26 | 8 | - | 96164226 |
| MS6000C | 10 | 3 | 96164227 | - |
| | 16 | 5 | 96164228 | - |
| | 26 | 8 | - | - |
| | 33 | 10 | - | - |
| | 66 | 20 | - | - |
| | 98 | 30 | - | - |
| | 102 | 31 | 96164229 | - |
| | 164 | 50 | - | - |
| | 213 | 65 | - | - |
| | 220 | 67 | 96164230 | - |
| | 328 | 100 | - | - |
| MS6000CR | 10 | 3 | 96300135 | - |
| | 16 | 5 | 96300136 | - |
| | 33 | 10 | - | - |
| | 49 | 15 | - | - |
| | 66 | 20 | - | - |
| | 82 | 25 | - | - |
| | 98 | 30 | 96300137 | - |
| | 131 | 40 | - | - |
| | 164 | 50 | - | - |
| | 197 | 60 | 96300138 | - |
| | 230 | 70 | - | - |
| | 295 | 90 | - | - |
| | 328 | 100 | - | - |
| MS6000CR for booster applications | 16 | 5 | - | 96300133 |
| | 26 | 8 | - | 96300134 |

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

# 7. Electrical data

## Overview

| Voltage code | Supply voltage | Method of starting | Service factor | Approvals | Comment |
|---|---|---|---|---|---|
| 35 | 3 x 380-400-415 V, 50 Hz | DOL | - | cCSAus | |
| | 3 x 440-460-480 V, 60 Hz | | 1.15 | | |
| 30 | 3 x 208-220-230 V, 60 Hz | DOL | 1.15 | cCSAus | |
| 39 | 3 x 500-525 V, 50 Hz | DOL | - | cCSAus | |
| | 3 x 575 V, 60 Hz | | 1.15 | | |

## Voltage code 30

### 3 x 208 V, 60 Hz, T40

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [%of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 24.2 | 1.15 | 27.5 | 79.4 | 80.2 | 79.8 | 76.5 | 0.83 | 0.82 | 0.79 | 0.70 | 430 |
| 7.5 | 10 | 32.0 | 1.15 | 37.5 | 79.2 | 80.5 | 80.8 | 78.3 | 0.85 | 0.84 | 0.82 | 0.75 | 350 |
| 11 | 15 | 46.5 | 1.15 | 53.5 | 81.1 | 82.1 | 82.3 | 80.0 | 0.85 | 0.84 | 0.81 | 0.72 | 390 |
| 15 | 20 | 61.5 | 1.15 | 71.5 | 81.5 | 82.7 | 83.4 | 81.6 | 0.86 | 0.86 | 0.83 | 0.76 | 460 |
| 18.5 | 25 | 75.0 | 1.15 | 87.0 | 82.3 | 83.4 | 84.1 | 82.4 | 0.86 | 0.86 | 0.83 | 0.76 | 470 |
| 22 | 30 | 88.0 | 1.15 | 104 | 81.8 | 83.3 | 84.6 | 83.6 | 0.87 | 0.87 | 0.85 | 0.79 | 450 |
| 30 | 40 | 118 | 1.15 | 138 | 82.9 | 84.1 | 85.1 | 83.8 | 0.88 | 0.88 | 0.86 | 0.80 | 440 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3450 | 0.09 | 0.00372 | 13 | 17.6 | 120 | 220 |
| 7.5 | 10 | 3420 | 0.10 | 0.00441 | 17.7 | 24.0 | 120 | 210 |
| 11 | 15 | 3430 | 0.13 | 0.00567 | 25.8 | 35.0 | 130 | 230 |
| 15 | 20 | 3430 | 0.17 | 0.00716 | 35.4 | 48.0 | 120 | 220 |
| 18.5 | 25 | 3430 | 0.20 | 0.00836 | 43.5 | 59.0 | 120 | 230 |
| 22 | 30 | 3420 | 0.23 | 0.00968 | 52.0 | 70.5 | 110 | 210 |
| 30 | 40 | 3430 | 0.30 | 0.0125 | 70.8 | 96.0 | 130 | 230 |

### 3 x 220 V, 60 Hz, T40

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [%of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 23.4 | 1.15 | 26.5 | 80.5 | 80.6 | 79.5 | 75.4 | 0.82 | 0.81 | 0.75 | 0.64 | 490 |
| 7.5 | 10 | 30.5 | 1.15 | 35.0 | 80.8 | 81.4 | 81.0 | 77.6 | 0.84 | 0.83 | 0.79 | 0.69 | 400 |
| 9.2 | 12 | 37.0 | 1.15 | 42.5 | 81.3 | 82.0 | 81.6 | 78.4 | 0.84 | 0.83 | 0.79 | 0.69 | 370 |
| 11 | 15 | 44.5 | 1.15 | 50.5 | 82.4 | 82.8 | 82.3 | 79.2 | 0.83 | 0.82 | 0.77 | 0.66 | 440 |
| 13 | 18 | 51.0 | 1.15 | 58.5 | 82.4 | 83.1 | 83.0 | 80.2 | 0.85 | 0.84 | 0.80 | 0.70 | 510 |
| 15 | 20 | 58.5 | 1.15 | 67.0 | 82.9 | 83.7 | 83.5 | 80.9 | 0.85 | 0.84 | 0.80 | 0.70 | 520 |
| 18.5 | 25 | 71.5 | 1.15 | 82.0 | 83.6 | 84.3 | 84.2 | 81.6 | 0.85 | 0.84 | 0.80 | 0.69 | 540 |
| 22 | 30 | 83.0 | 1.15 | 96.5 | 83.5 | 84.5 | 85.0 | 83.1 | 0.87 | 0.86 | 0.83 | 0.74 | 520 |
| 26 | 35 | 97.5 | 1.15 | 112 | 83.6 | 84.5 | 85.1 | 83.2 | 0.88 | 0.86 | 0.83 | 0.76 | 530 |
| 30 | 40 | 112 | 1.15 | 130 | 84.4 | 85.2 | 85.3 | 83.2 | 0.88 | 0.86 | 0.83 | 0.74 | 510 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3470 | 0.09 | 0.00372 | 13.0 | 17.6 | 140 | 260 |
| 7.5 | 10 | 3450 | 0.10 | 0.00441 | 17.7 | 24.0 | 140 | 240 |
| 11 | 15 | 3460 | 0.13 | 0.00567 | 25.8 | 35.0 | 150 | 270 |
| 15 | 20 | 3450 | 0.17 | 0.00716 | 35.4 | 48.0 | 140 | 260 |
| 18.5 | 25 | 3460 | 0.20 | 0.00836 | 43.5 | 59.0 | 140 | 260 |
| 22 | 30 | 3450 | 0.23 | 0.00968 | 52.0 | 70.5 | 120 | 240 |
| 30 | 40 | 3460 | 0.30 | 0.0125 | 70.8 | 96.0 | 150 | 260 |

### 3 x 230 V, 60 Hz, T40

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [%of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 23.4 | 1.15 | 26.0 | 80.8 | 80.6 | 78.9 | 74.2 | 0.80 | 0.77 | 0.70 | 0.58 | 520 |
| 7.5 | 10 | 30.0 | 1.15 | 33.5 | 81.5 | 81.7 | 80.7 | 76.7 | 0.83 | 0.81 | 0.75 | 0.64 | 440 |
| 11 | 15 | 44.5 | 1.15 | 49.5 | 82.9 | 83.0 | 81.9 | 78.2 | 0.82 | 0.79 | 0.72 | 0.60 | 480 |
| 15 | 20 | 57.5 | 1.15 | 65.0 | 83.7 | 84.0 | 83.3 | 80.0 | 0.84 | 0.82 | 0.76 | 0.65 | 570 |
| 18.5 | 25 | 71.0 | 1.15 | 80.0 | 84.3 | 84.6 | 83.9 | 80.7 | 0.83 | 0.81 | 0.75 | 0.64 | 590 |
| 22 | 30 | 81.0 | 1.15 | 92.0 | 84.4 | 85.1 | 84.9 | 82.5 | 0.85 | 0.84 | 0.79 | 0.69 | 570 |
| 30 | 40 | 110 | 1.15 | 124 | 85.1 | 85.4 | 85.1 | 82.4 | 0.85 | 0.84 | 0.79 | 0.68 | 560 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3480 | 0.09 | 0.00372 | 13.0 | 17.6 | 160 | 280 |
| 7.5 | 10 | 3470 | 0.10 | 0.00441 | 17.7 | 24.0 | 150 | 260 |
| 11 | 15 | 3470 | 0.13 | 0.00567 | 25.8 | 35.0 | 170 | 300 |
| 15 | 20 | 3470 | 0.17 | 0.00716 | 35.4 | 48.0 | 160 | 290 |
| 18.5 | 25 | 3480 | 0.20 | 0.00836 | 43.5 | 59.0 | 160 | 290 |
| 22 | 30 | 3470 | 0.23 | 0.00968 | 52.0 | 70.5 | 140 | 270 |
| 30 | 40 | 3470 | 0.30 | 0.0125 | 70.8 | 96.0 | 170 | 290 |

## Voltage code 35

### 3 x 440 V, 60 Hz, T40

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 11.6 | 1.15 | 13.2 | 80.4 | 80.6 | 79.5 | 75.4 | 0.82 | 0.81 | 0.75 | 0.64 | 490 |
| 7.5 | 10 | 15.2 | 1.15 | 17.4 | 81.0 | 81.5 | 81.1 | 77.7 | 0.84 | 0.83 | 0.79 | 0.69 | 410 |
| 11 | 15 | 22.0 | 1.15 | 25.0 | 82.1 | 82.8 | 82.6 | 79.7 | 0.84 | 0.83 | 0.79 | 0.69 | 420 |
| 15 | 20 | 29.0 | 1.15 | 33.5 | 82.9 | 83.7 | 83.5 | 80.9 | 0.85 | 0.84 | 0.80 | 0.70 | 520 |
| 18.5 | 25 | 36.0 | 1.15 | 41.0 | 83.6 | 84.3 | 84.2 | 81.6 | 0.85 | 0.84 | 0.80 | 0.69 | 540 |
| 22 | 30 | 41.5 | 1.15 | 48.0 | 83.5 | 84.5 | 85.0 | 83.1 | 0.87 | 0.86 | 0.83 | 0.74 | 520 |
| 30 | 40 | 56.0 | 1.15 | 65.0 | 83.6 | 84.7 | 85.3 | 83.5 | 0.88 | 0.87 | 0.84 | 0.76 | 470 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3470 | 0.09 | 0.00372 | 13.0 | 17.4 | 140 | 260 |
| 7.5 | 10 | 3450 | 0.10 | 0.00441 | 17.7 | 23.8 | 140 | 240 |
| 11 | 15 | 3450 | 0.13 | 0.00567 | 25.8 | 35.0 | 140 | 250 |
| 15 | 20 | 3450 | 0.17 | 0.00716 | 35.4 | 47.5 | 140 | 260 |
| 18.5 | 25 | 3460 | 0.20 | 0.00836 | 43.5 | 58.5 | 140 | 260 |
| 22 | 30 | 3450 | 0.23 | 0.00968 | 52.0 | 70.0 | 130 | 240 |
| 30 | 40 | 3440 | 0.30 | 0.0125 | 70.8 | 95.5 | 140 | 240 |

## 3 x 460 V, 60 Hz, T40

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 11.6 | 1.15 | 13.0 | 80.8 | 80.6 | 78.9 | 74.1 | 0.80 | 0.77 | 0.70 | 0.58 | 520 |
| 7.5 | 10 | 15.0 | 1.15 | 16.8 | 81.7 | 81.8 | 80.8 | 76.8 | 0.83 | 0.81 | 0.75 | 0.64 | 440 |
| 11 | 15 | 21.6 | 1.15 | 24.4 | 82.8 | 83.1 | 82.4 | 78.9 | 0.83 | 0.81 | 0.75 | 0.64 | 460 |
| 15 | 20 | 29.0 | 1.15 | 32.5 | 83.7 | 84.0 | 83.3 | 80.0 | 0.84 | 0.82 | 0.76 | 0.65 | 570 |
| 18.5 | 25 | 35.5 | 1.15 | 40.0 | 84.3 | 84.6 | 83.9 | 80.7 | 0.83 | 0.81 | 0.75 | 0.64 | 590 |
| 22 | 30 | 40.5 | 1.15 | 46.0 | 84.4 | 85.1 | 84.9 | 82.5 | 0.85 | 0.84 | 0.79 | 0.69 | 570 |
| 30 | 40 | 54.5 | 1.15 | 62.0 | 84.7 | 85.2 | 85.2 | 82.8 | 0.86 | 0.85 | 0.80 | 0.70 | 520 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3480 | 0.09 | 0.00372 | 13.0 | 17.4 | 160 | 280 |
| 7.5 | 10 | 3470 | 0.10 | 0.00441 | 17.7 | 23.8 | 150 | 260 |
| 11 | 15 | 3470 | 0.13 | 0.00567 | 25.8 | 35.0 | 160 | 280 |
| 15 | 20 | 3470 | 0.17 | 0.00716 | 35.4 | 47.5 | 160 | 290 |
| 18.5 | 25 | 3480 | 0.20 | 0.00836 | 43.5 | 58.5 | 160 | 290 |
| 22 | 30 | 3470 | 0.23 | 0.00968 | 52.0 | 70.0 | 140 | 270 |
| 30 | 40 | 3460 | 0.30 | 0.0125 | 70.8 | 95.5 | 160 | 270 |

## 3 x 480 V, 60 Hz, T40

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 12.0 | 1.15 | 13.0 | 80.7 | 80.2 | 78.0 | 72.6 | 0.77 | 0.73 | 0.65 | 0.52 | 550 |
| 7.5 | 10 | 15.0 | 1.15 | 16.6 | 82.0 | 81.8 | 80.2 | 75.6 | 0.80 | 0.77 | 0.69 | 0.57 | 470 |
| 11 | 15 | 21.6 | 1.15 | 24.0 | 83.2 | 83.1 | 81.8 | 77.8 | 0.80 | 0.77 | 0.69 | 0.57 | 490 |
| 15 | 20 | 29.0 | 1.15 | 32.0 | 83.9 | 83.9 | 82.7 | 78.8 | 0.81 | 0.78 | 0.70 | 0.57 | 610 |
| 18.5 | 25 | 36.0 | 1.15 | 39.5 | 84.4 | 84.3 | 83.2 | 79.4 | 0.80 | 0.77 | 0.69 | 0.57 | 620 |
| 22 | 30 | 40.0 | 1.15 | 45.0 | 85.0 | 85.2 | 84.6 | 81.5 | 0.83 | 0.81 | 0.75 | 0.63 | 620 |
| 30 | 40 | 54.5 | 1.15 | 61.0 | 85.1 | 85.3 | 84.8 | 81.8 | 0.84 | 0.82 | 0.75 | 0.63 | 560 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3490 | 0.09 | 0.00372 | 13.0 | 17.4 | 180 | 310 |
| 7.5 | 10 | 3480 | 0.10 | 0.00441 | 17.7 | 23.8 | 170 | 290 |
| 11 | 15 | 3480 | 0.13 | 0.00567 | 25.8 | 35.0 | 180 | 310 |
| 15 | 20 | 3480 | 0.17 | 0.00716 | 35.4 | 47.5 | 180 | 320 |
| 18.5 | 25 | 3490 | 0.20 | 0.00836 | 43.5 | 58.5 | 170 | 320 |
| 22 | 30 | 3480 | 0.23 | 0.00968 | 52.0 | 70.0 | 160 | 300 |
| 30 | 40 | 3480 | 0.30 | 0.0125 | 70.8 | 95.5 | 180 | 300 |

# Voltage code 39

## 3 x 575 V, 60 Hz, T40

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 9.25 | 1.15 | 10.2 | 80.8 | 80.6 | 79.0 | 74.3 | 0.81 | 0.78 | 0.71 | 0.59 | 520 |
| 7.5 | 10 | 12.0 | 1.15 | 13.4 | 81.2 | 81.4 | 80.5 | 76.6 | 0.83 | 0.81 | 0.76 | 0.64 | 440 |
| 11 | 15 | 17.2 | 1.15 | 19.4 | 82.7 | 83.0 | 82.3 | 79.0 | 0.83 | 0.81 | 0.76 | 0.65 | 450 |
| 15 | 20 | 23.4 | 1.15 | 26.0 | 83.5 | 83.8 | 83.0 | 79.5 | 0.83 | 0.81 | 0.75 | 0.63 | 580 |
| 18.5 | 25 | 28.5 | 1.15 | 32.0 | 83.7 | 84.0 | 83.2 | 79.9 | 0.83 | 0.82 | 0.75 | 0.63 | 590 |
| 22 | 30 | 32.0 | 1.15 | 37.0 | 84.0 | 84.8 | 84.9 | 82.7 | 0.86 | 0.85 | 0.81 | 0.71 | 550 |
| 30 | 40 | 43.5 | 1.15 | 49.5 | 84.7 | 85.2 | 85.2 | 82.8 | 0.87 | 0.85 | 0.81 | 0.71 | 530 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3480 | 0.09 | 0.00372 | 13.0 | 17.4 | 160 | 280 |
| 7.5 | 10 | 3470 | 0.10 | 0.00441 | 17.7 | 23.8 | 150 | 260 |
| 11 | 15 | 3460 | 0.13 | 0.00567 | 25.8 | 35.0 | 160 | 280 |
| 15 | 20 | 3480 | 0.17 | 0.00716 | 35.4 | 47.5 | 160 | 290 |
| 18.5 | 25 | 3480 | 0.20 | 0.00836 | 43.5 | 58.5 | 160 | 290 |
| 22 | 30 | 3460 | 0.23 | 0.00968 | 52.0 | 70.0 | 130 | 260 |
| 30 | 40 | 3470 | 0.30 | 0.0125 | 70.8 | 95.5 | 160 | 270 |

# 8. Electrical Accessories

## CUE frequency converter

GrSS 316404 3407

**Fig. 12** The CUE range

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

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

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

When a CUE is installed, the motor requires no further overload protection. Pt100/1000 together with the MCB 114 provides overheat protection of the motor windings, if needed.

**Note:** If the motor has a built-in Tempcon sensor, this sensor will be disconnected when it is exposed to the frequency converter drive. An internal fuse in the motor blows and it cannot be replaced. The motor will work without the sensor, but it is not possible to restore the functionality of the Tempcon sensor.

The CUE is available in two enclosure classes:

- Nema 1 (IP20/21)
- Nema 12 (IP54/55).

**RFI filters**

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

### Functions

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

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

### Features

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

## Accessories

Grundfos offers various accessories for the CUE.

### MCB 114 sensor input module

The MCB 114 offers additional analog inputs for the CUE:

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

### Output filters

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

Grundfos offers sine-wave filters as an CUE accessory.

### Sensors

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

- pressure sensors, up to 362 psi (25 bar)
- temperature sensors
- differential-pressure sensors
- differential-temperature sensors
- flowmeters
- potentiometer box for external setpoint setting.

## Installation

### Use of output filters

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

The selection depends on these factors:

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

| Pump type | Typical shaft power, P2 | Sine-wave filter |
|---|---|---|
| SP with 380 V motor and up | All sizes | 0-984 ft (0-300 m) |

The lengths stated apply to the motor cable.

### Cables used in CUE installations

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

- installation in EMC-insensitive sites. See fig. 13.
- installation in EMC-sensitive sites. See fig. 14.

The two types of installation are different when it comes to the use of screened cable.

**Note:** Drop cables are always unscreened.

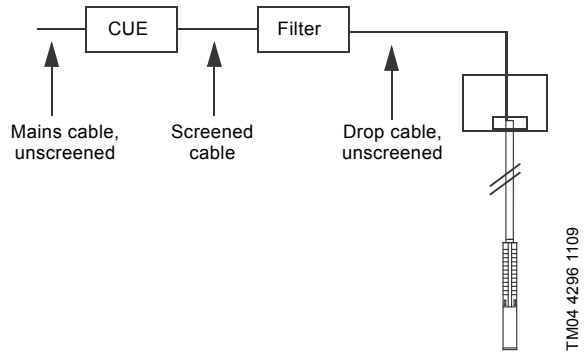



**Fig. 13** Example of installation in EMC-insensitive sites

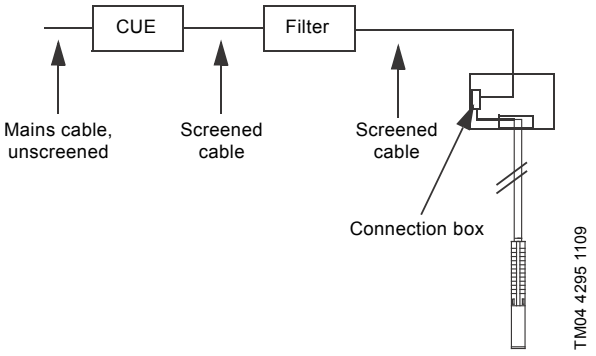



**Fig. 14** Example of installation in EMC-sensitive sites

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

The CUE is the right choice of frequency converter in SP installations as it meets all basic issues.

The CUE has a pre-installed start-up guide which takes the installer through all the necessary settings.

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

| Issues to be considered | Explanation |
|---|---|
| Ramp (up and down): Maximum 3 seconds. | The journal bearings must be lubricated in order to limit wear and overheating of windings. |
| Use temperature monitoring by Pt sensor. | Overheating of the motor => low insulation resistance => sensitive to voltage peaks. **Note:** Tempcon sensors do not work with frequency converter operation. |
| Reduce peak voltages (max. 800 V peaks). | Never exceed peak voltages of 850 V at motor leads. |
| For MS and MMS, we recommend to use motors with 10 % extra in given duty point. For MMS, always use motors wound PE2-PA. | Grundfos CUE with output filter is a safe solution. |
| Remember output filter. | Cables act as an amplifier => measure peaks at the motor. |
| Rise time (dU/dt) must be limited to a maximum of 1000 V/µs. Determined by the equipment in the CUE. | Time between switches is an expression of losses, so in the future, we might have to exceed the limit of 1000 V/µs. The solution is not higher insulation of the motor, but filter in the output from the CUE. |
| Constant operation at min. 30 Hz. Use a 60 Hz motor for larger ranges. | Too low speed => low flow and thereby poor lubrication of journal bearings. |
| Size the CUE in respect of the current, not the power output. | Can end up with a too small CUE. |
| Size cooling provision for stator tube at duty point with lowest flow rate. | Flow min. m/s along the stator housing must be considered. |
| Ensure that the pump is used within the range of the pump curve. | Focus on discharge pressure and sufficient NPSH, as vibrations will "kill" the motor. |

For further information about frequency converters, see the CUE documentation available on www.grundfos.us (WebCAPS).

## MP 204 motor protector


TM055456 3712

**Fig. 15** MP 204 motor protector

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

The MP 204 cannot be used in installations where a frequency converter is installed.

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 will continue to run, but the warnings will appear in the MP 204 display.

You can also read-out the warning with the Grundfos R100 or Grundfos GO 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 MP 204 protects the motor primarily by measuring the motor current by means of a true RMS measurement.
- 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 many monitoring options of the MP 204

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.

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. 16** Single-turn transformers

### Technical data, MP 204

| | |
|---|---|
| Enclosure class | IP20 |
| Ambient temperature | -4 °F to 140 °F (-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 rated voltage |
| Approvals | EN 60947, EN 60335, UL/CSA 508 |
| Marking | CE, cUL, C-tick |
| Consumption | Max. 5 W |
| Plastic type | Black PC/ABS |

### Electrical data, MP 204

| | Measuring range | Accuracy | Resolution |
|---|---|---|---|
| Current without external current transformers | 3-120 A | ± 1 % | 0.1 A |
| Current with external current transformers | 120-999 A | ± 1 % | 1 A |
| Phase-to-phase voltage | 80-610 VAC | ± 1 % | 1 V |
| Frequency | 47-63 Hz | ± 1 % | 0.5 Hz |
| Power | 0-1 MW | ± 2 % | 1 W |
| Power factor | 0 - 0.99 | ± 2 % | 0.01 |
| Energy consumption | 0-4 x $10^9$ kWh | ± 5 % | 1 kWh |

### Product numbers, MP 204

| Product | Product number |
|---|---|
| MP 204 | 96079927 |
| Grundfos Go Remote variants | |
| Grundfos MI 201 | 98140638 |
| Grundfos MI 202 | 98046376 |
| Grundfos MI 204 | 98424092 |
| Grundfos MI 301 | 98046408 |
| **Single-turn transformers** | |
| Current transformer ratio: 200:5, $I_{max.}$ = 120 A | 96095274 |
| Current transformer ratio: 300:5, $I_{max.}$ = 300 A | 96095275 |
| Current transformer ratio: 500:5, $I_{max.}$ = 500 A | 96095276 |
| Current transformer ratio: 750:5, $I_{max.}$ = 750 A | 96095277 |
| Current transformer ratio: 1000:5, $I_{max.}$ = 1000 A | 96095278 |

For further information about motor protection via MP 204, see the MP 204 documentation available on www.grundfos.us (WebCAPS).

### IO 112 module

| Product | Description | Product number |
|---|---|---|
|  TM03 5811 3906 | The IO 112 is a measuring module and a single-channel protection unit for use in connection with the MP 204 motor protector. The module can be used for protection of the pump against other factors than the electrical conditions, for instance dry running. It can also be used as a stand-alone protection module.<br><br>The IO 112 interface has three inputs for measured values, one potentiometer for setting of limits and indicator lights indicating the following:<br>• measured value of the input<br>• value of the limit set<br>• alarm source<br>• pump status.<br><br>**Electrical data**<br>• Supply voltage: 24 VAC ± 10 %, 50/60 Hz or 24 VDC ± 10 %.<br>• Supply current: Min. 2.4 A, max. 8 A.<br>• Power consumption: Max. 5 W.<br>• Ambient temperature: -18 °F to 149 °F (-25 °C to +65 °C).<br>• Enclosure class: IP20. | 98097390 |

# CIU communication interface units


GrA6118 3908

**Fig. 17** Grundfos CIU communication interface unit

The Communication Interface Unit (CIU) enables data communication via open and interoperable networks, such as Profibus DP, Modbus RTU, LonWorks, BACnet MS/TP, GSM/GPRS or Grundfos Remote Management (GRM) for complete control of pump systems.

### Applications

The range of Grundfos CIU communication interface units offers ease of installation and commissioning as well as user-friendliness. All units are based on standard functional profiles for an easy integration into the network.

The CIU units enable communication of operating data, such as measured values and setpoints, between pumps and PLCs, SCADA system and building management system.

### Benefits

The CIU offers these benefits:

- open communication standards
- complete process control
- one concept for Grundfos products
- 24-240 VAC/DC power supply in CIU modules
- simple configuration and easy to install
- prepared for DIN rail or wall mounting.

For data communication between an SP pump and a main network, a CIU unit together with a CUE frequency converter or an MP 204 motor protector is required.

TM05 5456 3712 - GrSS 316 412 3307

**Fig. 18** MP 204 motor protector and CUE frequency converter

Fieldbus support for these products is shown in the following table:

| CIU unit | Fieldbus protocol | CUE | MP 204 |
|---|---|---|---|
| CIU 100 | LonWorks | ● | - |
| CIU 150 | Profibus DP | ● | ● |
| CIU 200 | Modbus RTU | ● | ● |
| CIU 250 | GSM/GPRS | ● | ● |
| CIU 270/271* | GRM | ● | ● |
| CIU 300 | BACnet MS/TP | ● | - |

* Grundfos Remote Management (GRM) is an easy-to-install low-cost solution for wireless monitoring and management of Grundfos products.

### Product numbers

| CIU unit | Fieldbus protocol | Product number |
|---|---|---|
| CIU 100 | LonWorks | 96753735 |
| CIU 150 | Profibus DP | 96753081 |
| CIU 200 | Modbus RTU | 96753082 |
| CIU 250* | GSM/GPRS | 96787106 |
| CIU 270* | GRM | 98176136 |
| CIU 271* | GRM | 96898819 |
| CIU 300 | BACnet MS/TP | 96893769 |

* Antenna not included. See below.

### Antennas for CIU 250 and 270/271

| Description | Product number |
|---|---|
| Antenna for roof | 97631956 |
| Antenna for desk | 97631957 |

For further information about data communication via CIU units and fieldbus protocols, see the CIU documentation available on www.grundfos.us (WebCAPS).

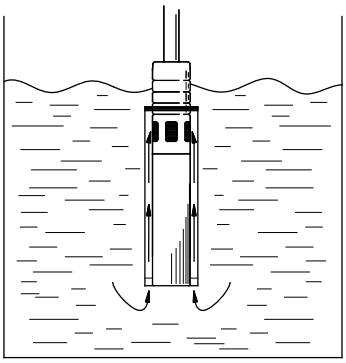
## Flow sleeves

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

TM01 0751 2197 - TM01 0750 2197

**Fig. 19** Flow sleeves

The flow sleeve is fitted to the submersible motor so that the liquid passes close by the motor on its way towards the pump suction interconnector thus ensuring optimum cooling of the motor. See fig. 20.



TM01 0509 1297

**Fig. 20** Flow sleeve function

Flow sleeves are to be fitted in these cases:

- If the submersible pump is exposed to high thermal load such as current unbalance, dry running, overload, high ambient temperature and bad cooling conditions.
- If aggressive liquids are pumped, since corrosion is doubled for every 18 °F (10 °C) the temperature rises.
- If sedimentation or deposits occur around and/or on the motor.

More information about flow sleeves is available on request.

# 9. Appendix

## Material specification

| Pos. | Description | | MS6000CXT40<br>MS6000CT40<br>MS6000CT60<br>MS6000CWT40 | | MS6000CET60 | | MS6000CREST40<br>MS6000CRESDT40<br>MS6000CREST60<br>MS6000CRESWT40<br>MS6000CRESWT60 | |
|---|---|---|---|---|---|---|---|---|
| | | | **ASTM** | **W/Nr.** | **ASTM** | **W/Nr.** | **ASTM** | **W/Nr.** |
| 32 | Shaft seal housing | | 304L | 1.4306 | 304L | 1.4306 | 316 | 1.4436 |
| 24 | O-ring | | NBR | | NBR | | FKM | |
| 32a | Lip seal | | - | | - | | 304 | 1.4301 |
| | | | | | | | FKM | |
| 27 | Sand shield | | 304 | 1.4301 | 304 | 1.4301 | 904L | 1.4939 |
| | | | NBR | | NBR | | FKM | |
| 22 | Screw | | 316 | 1.4436 | 316 | 1.4436 | 904L | 1.4939 |
| 22a | Screw and washer | | 316 | 1.4436 | 316 | 1.4436 | 904L | 1.4939 |
| | | | PA66 | | PA66 | | PA66 | |
| 50 | Screw | | 316 | 1.4436 | 316 | 1.4436 | 904L | 1.4939 |
| 33 | Shaft seal stationary | | Ceramic | | SIC | | SIC | |
| 34 | Shaft seal rotating | | Carbon | | SIC | | SIC | |
| | | | NBR | | NBR | | FKM | |
| 28 | Washer | | 304 | 1.4301 | 304 | 1.4301 | 304L | 1.4306 |
| 1a | Valve | | 316L | 1.4435 | 316L | 1.4435 | - | |
| | | | NBR | | NBR | | - | |
| 5 | Bearing DE | bearing retainer | 304L | 1.4306 | 304L | 1.4306 | 304L | 1.4306 |
| | | stationary bush** | Carbon graphite | | Carbon graphite | | - | |
| | | stationary bush*** | SiC | | - | | SiC | |
| 2a | Upthrust ring | | PEEK+PTFE20 | | PEEK+PTFE20 | | PEEK+PTFE20 | |
| 2 | Shaft with rotor | shaft extension | 329 | 1.4460 | 329 | 1.4460 | S31803 (2205) | 1.4462 |
| | | bearing bush** | 431 | 1.4057 | 431 | 1.4057 | 431 | 1.4057 |
| | | bearing bush*** | WC 74 % Cr 20 % Ni 6 % | | - | | WC.74 % Cr 20 % Ni 6 % | |
| 1 | Stator outer encapsulation | | 304 | 1.4301 | 304 | 1.4301 | 904L | 1.4939 |
| | | | 316 | 1.4436 | 316 | 1.4436 | Similar to 904L | 1.4584 |
| 4 | Bearing NDE | bearing retainer | Low carbon sheet steel | 1.0335 | Low carbon sheet steel | 1.0335 | Low carbon sheet steel | 1.0335 |
| | | stationary bush** | Carbon graphite | | Carbon graphite | | - | |
| | | stationary bush*** | SiC | | - | | SiC | |
| 7a | Clamping flange | | Gr. 50 Hot rolled Steel | 1.0976 | Gr. 50 Hot rolled Steel | 1.0976 | Gr. 50 Hot rolled Steel | 1.0976 |
| 41 | Screw | | Steel | | Steel | | Steel | |
| 42 | Stop for bearing | | Cold rolled low carbon steel | 1.0330.3 | Cold rolled low carbon steel | 1.0330.3 | Cold rolled low carbon steel | 1.0330.3 |
| 6 | Thrust bearing rotating | | 1213 | 1.0715 | 1213 | 1.0715 | 1213 | 1.0715 |
| | | | Ceramic | | Ceramic | | Ceramic | |
| 3 | Thrust bearing stationary | | 1213 | 1.0715 | 1213 | 1.0715 | 1213 | 1.0715 |
| | | | Carbon | | Carbon | | Carbon | |
| 45 | Shaft adjustment unit | | A193 | 1.7139 | A193 | 1.7139 | A193 | 1.7139 |
| 49 | Lock ring | | 304 | 1.4301 | 304 | 1.4301 | 304 | 1.4301 |
| 7 | Clamping flange | | Gr. 50 Hot rolled Steel | 1.0976 | Gr. 50 Hot rolled Steel | 1.0976 | Gr. 50 Hot rolled Steel | 1.0976 |
| 48 | Screw and washer | | 304 | 1.4301 | 304 | A2 | 904L | 1.4939 |
| | | | PA66 | | PA66 | | PA66 | |
| 46 | Screw | | Steel | | Steel | | Steel | |
| 12 | Diaphragm | | NBR | | NBR | | FKM | |
| 13 | Bottom cover | | 304 | 1.4301 | 304 | 1.4301 | 904L | 1.4939 |
| 220 | Flat cable | | EPR TML-B | | EPR TML-B | | EPR TML-B | |

** Motor with soft radial bearings (stainless steel/carbon graphite)
*** Motor with hard radial bearing (tungsten carbide/SiC)

| Motor | | 50 Hz | 3 x 2220-230 V | | - | | 3 x 340-380 V | | - | | 3 x 380-400-415 V | | 3 x 500-525 V | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 60 Hz | - | | 3 x 208-220-230 V | | 3 x 440 V | | 3 x 380-400 V | | 3 x 440-460-480 V | | 3 x 575 V | |
| | | Approval | CE | | CE | | CE | | CE | | CE | | CE | |
| kW | hp | | DOL | SD | DOL | SD | DOL | SD | DOL | SD | DOL | SD | DOL | SD |
| 5.5 | 7.5 | | 6 | 6 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | - |
| 7.5 | 10 | | 6 | 6 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | - |
| 9.2 | 12 | | 6 | 6 | 10 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | - |
| 11 | 15 | | 10 | 6 | 10 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | - |
| 13 | 18 | | 10 | 6 | 10 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | - |
| 15 | 20 | | 10 | 6 | 10 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | - |
| 18.5 | 25 | | 10 | 6 | 10 | 10 | 10 | - | 10 | 6 | 6 | 6 | 6 | - |
| 22 | 30 | | 10 | 10 | 10 | 10 | 10 | - | 10 | 6 | 10 | 6 | 6 | - |
| 26 | 35 | | - | 10 | - | 10 | 10 | - | 10 | 6 | 10 | 6 | 6 | - |
| 30 | 40 | | - | 10 | - | 10 | 10 | - | 10 | 6 | 10 | 6 | 10 | - |

| Motor | | 50 Hz | 3 x 200 V | | 3 x 400 V | |
|---|---|---|---|---|---|---|
| | | 60 Hz | 3 x 200-220 V | | 3 x 400-440 V | |
| | | Approval | CE | | CE | |
| kW | hp | | DOL | SD | DOL | SD |
| 5.5 | 7.5 | | 6 | - | 6 | - |
| 7.5 | 10 | | 6 | - | 6 | - |
| 9.2 | 12 | | 6 | - | 6 | - |
| 11 | 15 | | - | 6 | - | 6 |
| 13 | 18 | | - | 6 | - | 6 |
| 15 | 20 | | - | 6 | - | 6 |
| 18.5 | 25 | | - | 10 | - | 6 |
| 22 | 30 | | - | 10 | - | 6 |
| 26 | 35 | | - | - | - | - |
| 30 | 40 | | - | - | - | - |

**Flat cable**
**(for CE marked motors, not allowed for cCSAus marked motors)**

| Motor type | EPDR rubber | |
|---|---|---|
| | 4 G 6 mm$^2$ | 4 G 10 mm$^2$ |
| | - | - |
| MS6000C with flange extension | - | - |
| | - | - |
| | - | - |
| | - | - |
| MS6000C for booster applications | - | - |
| | 96164209 | 96164214 |
| | 96164210 | - |
| | 96164211 | 96164215 |
| | 96164212 | 96164216 |
| | 96164213 | 96164217 |
| MS6000C | - | - |
| | - | 96164218 |
| | - | 96164219 |
| | - | - |
| | - | 96164220 |
| | - | - |
| | 96300112 | 96300123 |
| | 96300113 | 96300124 |
| | 96300114 | 96300125 |
| | 96300115 | 96300126 |
| | 96300116 | 96300127 |
| | 96300117 | 96300128 |
| MS6000CR | 96300118 | 96300129 |
| | - | 96300130 |
| | 96300119 | - |
| | - | 96300131 |
| | 96300120 | - |
| | 96300121 | 96300132 |
| | - | - |
| MS6000CR for booster applications | - | - |

# Voltage code 19 DOL, 69 SD

## 3 x 440 V, 60 Hz, T60

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 11.8 | 1.15 | 13.2 | 81.6 | 81.1 | 79.0 | 73.8 | 0.83 | 0.82 | 0.77 | 0.67 | 610 |
| 7.5 | 10 | 15.6 | 1.15 | 17.4 | 82.2 | 82.0 | 80.5 | 76.1 | 0.84 | 0.83 | 0.79 | 0.69 | 520 |
| 11 | 15 | 21.4 | 1.15 | 24.6 | 82.4 | 82.7 | 81.9 | 78.4 | 0.88 | 0.86 | 0.83 | 0.76 | 470 |
| 15 | 20 | 29.5 | 1.15 | 33.5 | 83.6 | 83.6 | 82.5 | 78.8 | 0.87 | 0.85 | 0.82 | 0.73 | 530 |
| 18.5 | 25 | 35.0 | 1.15 | 40.0 | 83.9 | 84.2 | 83.5 | 80.5 | 0.88 | 0.86 | 0.83 | 0.76 | 510 |
| 22 | 30 | 42.0 | 1.15 | 48.0 | 84.0 | 84.2 | 83.6 | 80.6 | 0.88 | 0.86 | 0.83 | 0.76 | 520 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | Moment of inertia [kg•m$^2$] | Rated torque [ft-lb] | Rated torque [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3500 | 0.12 | 0.00507 | 12.7 | 17.2 | 160 | 280 |
| 7.5 | 10 | 3480 | 0.13 | 0.00567 | 17.4 | 23.6 | 150 | 260 |
| 11 | 15 | 3470 | 0.17 | 0.00716 | 25.8 | 35.0 | 160 | 280 |
| 15 | 20 | 3480 | 0.23 | 0.00961 | 35.0 | 47.5 | 160 | 290 |
| 18.5 | 25 | 3470 | 0.26 | 0.0110 | 43.1 | 58.5 | 160 | 290 |
| 22 | 30 | 3470 | 0.30 | 0.0125 | 51.3 | 69.5 | 130 | 260 |

## 3 x 460 V, 60 Hz, T60

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 11.6 | 1.15 | 12.8 | 81.8 | 81.1 | 78.6 | 73.0 | 0.82 | 0.80 | 0.73 | 0.63 | 660 |
| 7.5 | 10 | 15.2 | 1.15 | 17.0 | 82.6 | 82.2 | 80.3 | 75.5 | 0.83 | 0.81 | 0.76 | 0.65 | 570 |
| 11 | 15 | 20.8 | 1.15 | 23.6 | 83.1 | 83.1 | 81.9 | 78.0 | 0.86 | 0.85 | 0.81 | 0.72 | 510 |
| 15 | 20 | 28.5 | 1.15 | 32.5 | 84.1 | 83.8 | 82.4 | 78.2 | 0.85 | 0.83 | 0.79 | 0.69 | 580 |
| 18.5 | 25 | 34.0 | 1.15 | 38.5 | 84.5 | 84.5 | 83.5 | 80.0 | 0.86 | 0.85 | 0.81 | 0.71 | 560 |
| 22 | 30 | 41.0 | 1.15 | 46.5 | 84.6 | 84.6 | 83.6 | 80.1 | 0.86 | 0.85 | 0.81 | 0.71 | 660 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | Moment of inertia [kg•m$^2$] | Rated torque [ft-lb] | Rated torque [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3510 | 0.12 | 0.00507 | 12.7 | 17.2 | 160 | 290 |
| 7.5 | 10 | 3500 | 0.13 | 0.00567 | 17.4 | 23.6 | 140 | 250 |
| 11 | 15 | 3480 | 0.17 | 0.00716 | 25.8 | 35.0 | 150 | 240 |
| 15 | 20 | 3490 | 0.23 | 0.00961 | 35.0 | 47.5 | 170 | 310 |
| 18.5 | 25 | 3480 | 0.26 | 0.0110 | 43.1 | 58.5 | 150 | 280 |
| 22 | 30 | 3480 | 0.30 | 0.0125 | 51.3 | 69.5 | 160 | 290 |

## 3 x 480 V, 60 Hz, T60

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 11.6 | 1.15 | 12.6 | 81.8 | 80.9 | 78.0 | 72.1 | 0.79 | 0.76 | 0.69 | 0.57 | 700 |
| 7.5 | 10 | 15.0 | 1.15 | 16.6 | 82.8 | 82.2 | 79.9 | 74.8 | 0.81 | 0.79 | 0.71 | 0.60 | 610 |
| 11 | 15 | 20.4 | 1.15 | 22.8 | 83.6 | 83.3 | 81.8 | 77.5 | 0.85 | 0.83 | 0.78 | 0.68 | 560 |
| 15 | 20 | 28.5 | 1.15 | 31.5 | 84.3 | 83.9 | 82.0 | 77.5 | 0.83 | 0.81 | 0.75 | 0.63 | 620 |
| 18.5 | 25 | 33.5 | 1.15 | 37.5 | 84.9 | 84.7 | 83.3 | 79.4 | 0.85 | 0.83 | 0.78 | 0.67 | 610 |
| 22 | 30 | 40.5 | 1.15 | 45.0 | 84.9 | 84.7 | 83.4 | 79.4 | 0.84 | 0.82 | 0.77 | 0.66 | 630 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | Moment of inertia [kg•m$^2$] | Rated torque [ft-lb] | Rated torque [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3520 | 0.12 | 0.00507 | 12.7 | 17.2 | 180 | 320 |
| 7.5 | 10 | 3510 | 0.13 | 0.00567 | 17.4 | 23.6 | 160 | 270 |
| 11 | 15 | 3490 | 0.17 | 0.00716 | 25.8 | 35.0 | 160 | 270 |
| 15 | 20 | 3500 | 0.23 | 0.00961 | 35.0 | 47.5 | 190 | 340 |
| 18.5 | 25 | 3500 | 0.26 | 0.0110 | 43.1 | 58.5 | 170 | 310 |
| 22 | 30 | 3500 | 0.30 | 0.0125 | 51.3 | 69.5 | 160 | 310 |

# Voltage code 18

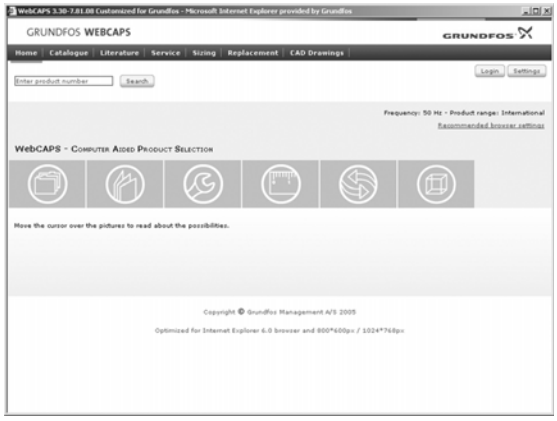
## 3 x 575 V, 60 Hz, T60

| Power [kW] | Power [hp] | Rated current $I_{1/1}$ [A] | Service factor | Nameplate current $I_{SF}$ [A] | Motor efficiency η [%] | | | | Cos φ | | | | LRC [% of $I_{SF}$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 115 % (SF) | 100 % | 75 % | 50 % | 115 % (SF) | 100 % | 75 % | 50 % | |
| 5.5 | 7.5 | 9.30 | 1.15 | 10.2 | 81.7 | 81.0 | 78.5 | 72.9 | 0.82 | 0.79 | 0.72 | 0.62 | 670 |
| 7.5 | 10 | 12.0 | 1.15 | 13.6 | 82.4 | 82.1 | 80.3 | 75.5 | 0.83 | 0.82 | 0.76 | 0.66 | 560 |
| 11 | 15 | 16.6 | 1.15 | 18.8 | 83.0 | 83.1 | 81.9 | 78.2 | 0.87 | 0.85 | 0.82 | 0.73 | 500 |
| 15 | 20 | 22.8 | 1.15 | 25.5 | 84.0 | 83.8 | 82.4 | 78.3 | 0.86 | 0.84 | 0.80 | 0.69 | 580 |
| 18.5 | 25 | 27.5 | 1.15 | 31.0 | 84.6 | 84.6 | 83.5 | 79.9 | 0.86 | 0.84 | 0.80 | 0.70 | 570 |
| 22 | 30 | 33.0 | 1.15 | 37.0 | 84.5 | 84.5 | 83.6 | 80.1 | 0.86 | 0.85 | 0.81 | 0.71 | 580 |

| Power [kW] | Power [hp] | n [rpm] | Moment of inertia [lb*ft$^2$] | [kg•m$^2$] | Rated torque [ft-lb] | [Nm] | LRT [%] | BT [%] |
|---|---|---|---|---|---|---|---|---|
| 5.5 | 7.5 | 3510 | 0.12 | 0.00507 | 12.7 | 17.2 | 170 | 300 |
| 7.5 | 10 | 3490 | 0.13 | 0.00567 | 17.4 | 23.6 | 140 | 250 |
| 11 | 15 | 3480 | 0.17 | 0.00716 | 25.4 | 34.5 | 140 | 230 |
| 15 | 20 | 3490 | 0.23 | 0.00968 | 34.7 | 47.0 | 170 | 300 |
| 18.5 | 25 | 3490 | 0.26 | 0.0110 | 43.1 | 58.5 | 150 | 290 |
| 22 | 30 | 3480 | 0.30 | 0.0125 | 51.3 | 69.5 | 140 | 280 |

# 10. Further product information

## WebCAPS

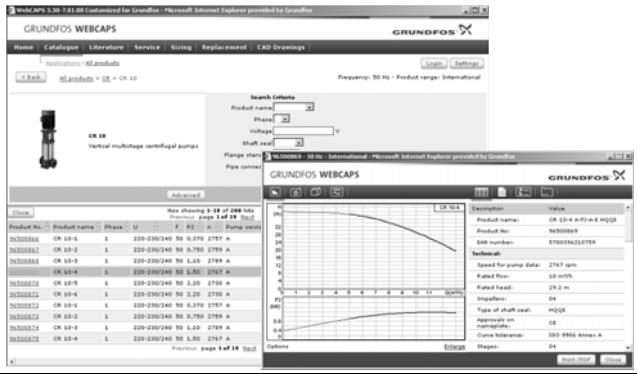



WebCAPS is a **Web**-based **C**omputer **A**ided **P**roduct **S**election program available on www.grundfos.us.

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

Information in WebCAPS is divided into six sections:

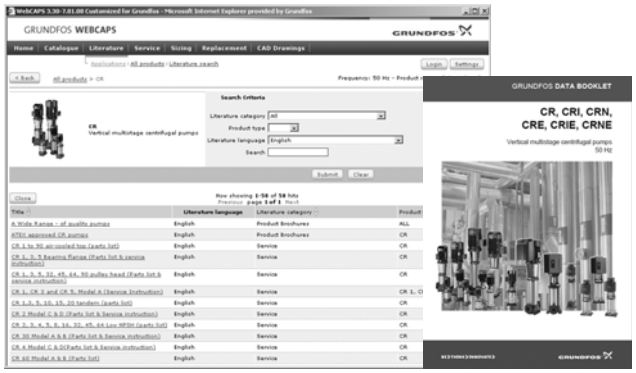
- catalog
- literature
- service
- sizing
- replacement
- cad drawings.




**Catalog**

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

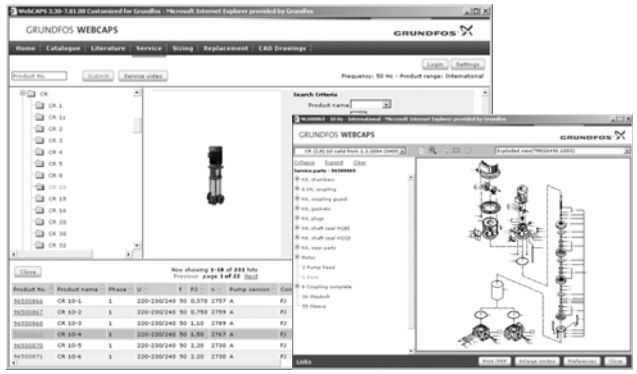
- technical data
- curves (QH, Eff, P1, P2, etc.) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.




**Literature**

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

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




**Service**

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


**Sizing**

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

- Select the most suitable and efficient pump for your installation.
- Carry out advanced calculations based on energy, consumption, payback periods, load profiles, life cycle costs, etc.
- Analyze 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. 21** WinCAPS DVD

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

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

WinCAPS is available on DVD and updated once a year.

## Grundfos GO

**Mobile solution for professionals on the GO!**

Grundfos GO is the mobile tool box for professional users on the go. It is the most comprehensive platform for mobile pump control and pump selection including sizing, replacement and documentation. It offers intuitive, handheld assistance and access to Grundfos online tools, and it saves valuable time for reporting and data collection.

GET IT ON Google play

Available on the App Store

Subject to alterations.

MS-PG-001

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