

CRFlex pump

Renewable energy-based water supply systems



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1. MGFlex motor

Applications

The Grundfos solar surface pump system is designed for renewable energy supply. Powered by a solar panel, the system is especially suitable for supplying water in applications such as these:

- irrigation
- livestock
- pressure boosting
- floating pump
- swimming pool (OEM).

The MGFlex motor can be mounted on select Grundfos CR pump models.

Motor

The MGFlex motor is a new solar-powered motor. It is a 2-pole motor with integrated variable frequency drive (VFD).

The VFD enables the motor to run at high efficiency in a wide speed range:

- power input (P1) of 70 to 1250 W
- motor speed range of 1000 to 3400 rpm
- maximum input current of 5 A
- IP54.

The motor is suitable for both DC and AC voltage supply:

- 110-415 VDC, PE
- 1 x 220-240 V, -10 % / +6 %, 50/60 Hz, PE.

Features and benefits

Maximum Power Point Tracking (MPPT)

The motor continuously optimizes the speed according to the input power available when connected to DC supply.

Wide voltage range

The wide voltage range enables the motor to operate at any voltage from 110 to 415 VDC or 220 to 240 VAC. The motor will operate from 100 VAC with a derated power (at maximum input current $3 A_{rms}$).

Overvoltage and undervoltage protection

Overvoltage and undervoltage may occur in case of unstable power supply or a faulty installation. The motor will be cut out if the voltage falls outside the permissible voltage range, and it will be cut in when the voltage is again within the permissible voltage range. No extra protection relay is required.

Overload protection

The motor is supplied with built-in thermal protection according to IEC60034-11, both steady overload and stalled condition. It will be stopped and restarted automatically.

The motor is to be connected to the power supply as shown in fig. 1.

As the integrated electronic unit enables the motor to handle both DC and AC supply voltages, it makes no difference how the wires + and – or N and L are connected.

Other connections

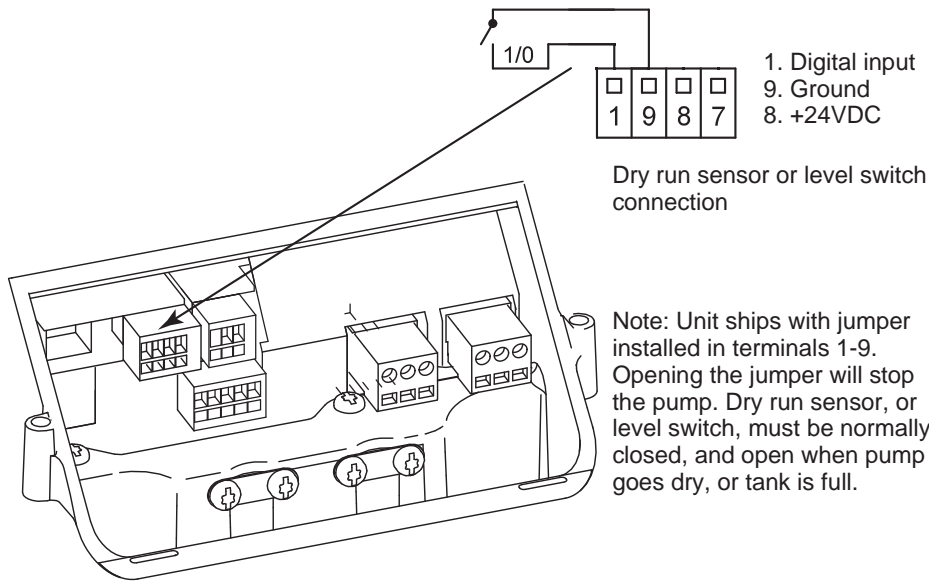


Fig. 1 Wiring diagram

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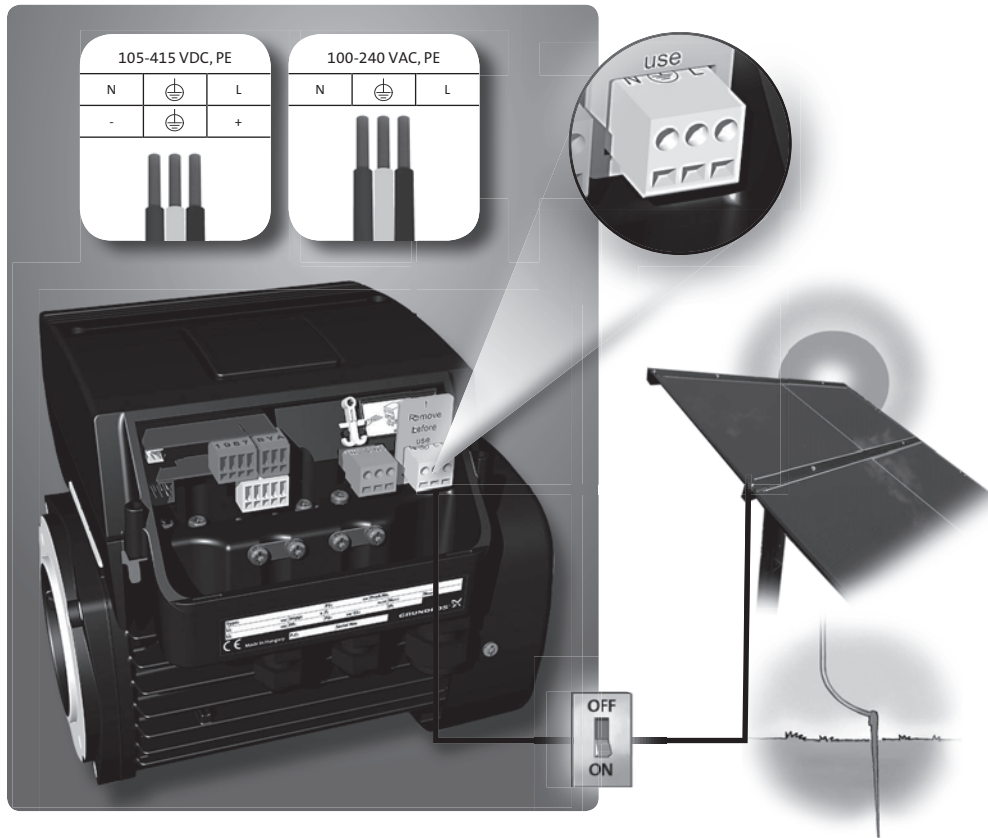


Fig. 2 Electrical connections, MGFlex motor

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Electrical data

Power supply to pump	110-415 VDC, PE. 1 x 220-240 V, -10 % / +6 %, 50/60 Hz, PE.
Energy source	Solar module. Generator. Grid.
Start/stop control	Digital input for start/stop of motor.
Power switch on/off or DC to/from AC	Maximum four times per hour.
Enclosure class	IP54.
Motor protection	Built-in motor protection: <ul style="list-style-type: none"> • overvoltage and undervoltage • overload • overtemperature.
Sound pressure level	< 63 db (A).
Power factor	0.97.
Sensor connection	The motor electronics allow one external sensor connection. The motor can supply maximum 24 VDC, 40 mA to this connected device.
Earth-leakage circuit breaker	If the pump/motor is connected to an earth-leakage circuit breaker (ELCB) for additional protection, this circuit breaker must trip when AC fault currents, pulsating DC or smooth DC fault currents occur.
Ambient temperature	During operation: -4 °F to 104 °F (-20 °C to +40 °C). During storage/transport: -40 °F to 140 °F (-40 °C to +60 °C).
Relative humidity	Maximum 95 %.
Leaking current	< 3.5 mA.
Installation outdoor	The motor/pump must be protected from rain and direct sunlight.
Marking	CE.
Insulation class	F (IEC 85).
EMC compatibility	EN 61 800-3.

Note: Grundfos only guarantees performance and reliability of the MGFlex motors if both the conditions below are fulfilled:

1. The motor must be connected to the pump end as described in this document.
2. The assembly of the motor and the pump are carried out by Grundfos-authorized and trained persons.

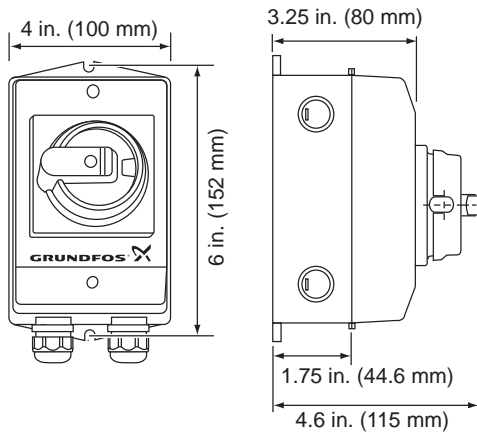
In the case of OEM usage, please contact Grundfos to obtain full warranty coverage.

2. System components

IO 50 switch box

The IO 50 is designed specifically for solar-powered systems.

The IO 50 enables manual starting and stopping of the pump in an CRFlex Solar system and functions as a connection box joining all necessary cables.



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Fig. 3 IO 50, dimensional sketch

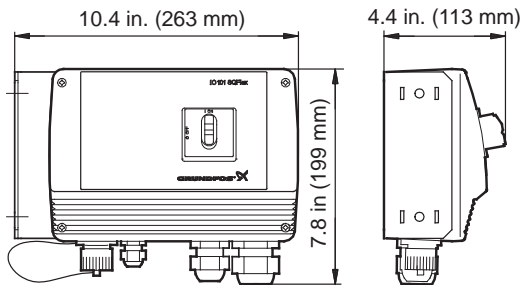
IO 101 switch box

The IO 101 is designed specifically for solar-powered systems.

The IO 101 enables the connection of a backup generator in case of insufficient solar energy. The switching between solar power and generator must be made manually.

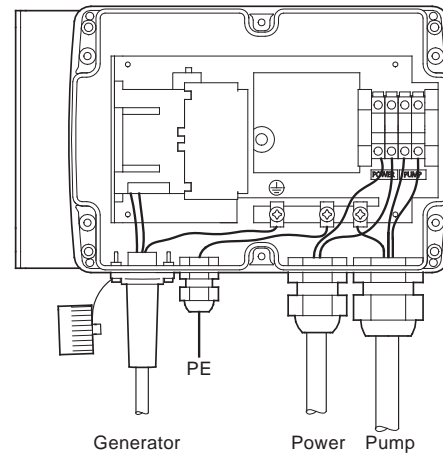
In case the generator is stopped manually or runs out of fuel, the IO 101 will automatically change over to the solar panels.

The IO 101 functions as a connection box joining all necessary cables.



TM02 2546 4003

Fig. 4 IO 101, dimensional sketch



TM02 4162 5001

Fig. 5 Electrical connections

Generator

The generator can be either diesel- or gasoline-driven. It must be running steadily before the pump is cut in.

3. CRFlex pump

The CRFlex pump is a non-self-priming, vertical multistage centrifugal pump.

The pump consists of a base and a pump head. The chamber stack and the outer sleeve are secured between the pump head and the base by means of stay bolts.

The base has suction and discharge ports on the same level (in-line).

All pumps are equipped with a maintenance-free mechanical shaft seal of the cartridge type.

The CRFlex pump is available as a complete unit only, consisting of these parts:

- MGFlex motor
- CRI pump end.

Pumped liquids

CRFlex pumps are applicable in thin, clean, non-aggressive, non-explosive liquids, not containing solid or long-fibered particles larger than sand grains.

pH value: 5 to 9.

Liquid temperature: +32 °F to +104 °F (0 °C to +40 °C).

Sand content

Maximum sand content: 20 ppm.

A higher sand content will reduce the pump life considerably due to wear.

Salt content

The table below shows the resistance of stainless steel to Cl⁻. The values in the table are based on a pumped liquid with a pH value of 5 to 9.

Stainless steel	Cl ⁻ content	Liquid temperature
AISI 304 (EN 1.4301)	0-300 ppm	< +104 °F (+40 °C)
	300-500 ppm	< +86 °F (+30 °C)
AISI 316 (EN 1.4401)	0-500 ppm	< +104 °F (+40 °C)

System sizing

Grundfos has developed a PC-based sizing tool enabling the sizing of the system.

The sizing tool is integrated in Grundfos WinCAPS and covers solar powered systems.

The following three parameters must be known for the sizing of the optimum system:

- installation location
- maximum head required
- quantity of water required.

Minimum inlet pressure, NPSH

Calculation of the inlet pressure "H" is recommended in these situations:

- The liquid temperature is high.
- The flow is significantly higher than the rated flow.
- Water is drawn from depths.
- Water is drawn through long pipes.
- Inlet conditions are poor.

To avoid cavitation, make sure that there is a minimum pressure on the suction side of the pump.

The maximum suction lift "H" in feet can be calculated as follows:

$$H = p_b - \text{NPSHR} - H_f - H_v - H_s$$

P_b = Barometric pressure in feet absolute.

NPSHR = Net Positive Suction Head Required in feet.
(To be read from the NPSHR curve at the highest flow the pump will be delivering).

H_f = Friction loss in suction pipe in feet.
(At the highest flow the pump will be delivering.)

H_v = Vapor pressure in feet. (To be read from the vapor pressure scale. " H_v " depends on the liquid temperature " T_m ").

H_s = Safety margin = minimum 2.0 feet.

If the "H" calculated is positive, the pump can operate at a suction lift of maximum "H" feet.

If the "H" calculated is negative, an inlet pressure of minimum "H" feet is required.

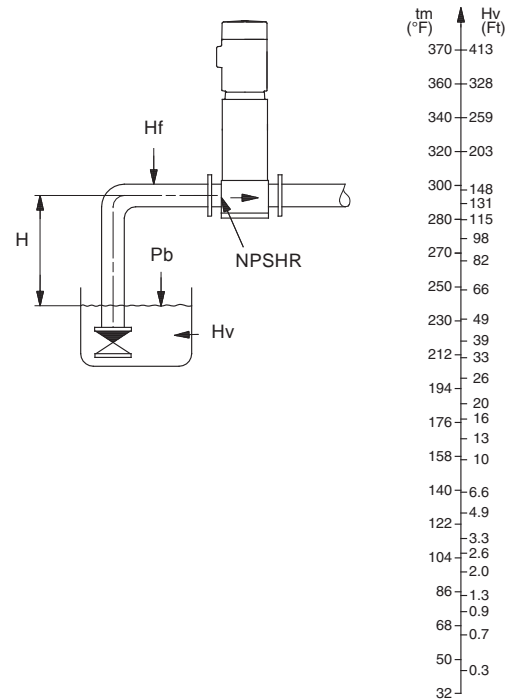


Fig. 6 Minimum inlet pressure - NPSH

Note: To avoid cavitation, never select a pump with a duty point too far to the right on the NPSH curve. Always check the NPSH value of the pump at the highest possible flow rate.

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Material specification



Fig. 7 CRFlex pump
(Note: pump pictured here without included oval flange connections)

Sectional drawing

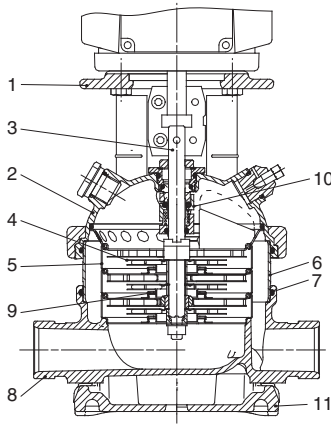


Fig. 8 Sectional drawing of CRFlex pump end

Pump materials

Pos.	Designation	Materials	EN/DIN	AISI/ASTM
1	Pump head	Cast iron EN-GJL-200 ¹⁾	EN-JL1030	ASTM 25B
2	Pump head cover	Stainless steel	1.4408	CF 8M eq. to AISI 316
3	Shaft	Stainless steel	1.4401 ²⁾ 1.4460 ³⁾	AISI 316 AISI 329
8	Base	Stainless steel	1.4408	CF 8M eq. to AISI 316
9	Neck ring	PTFE		
10	Shaft seal	Cartridge type		
11	Base plate	Cast iron EN-GJL-200 ¹⁾	EN-JL1030	ASTM 25B
	Rubber parts	EPDM or FKM		
CR(E)				
4	Impeller	Stainless steel	1.4301	AISI 304
5	Chamber	Stainless steel	1.4301	AISI 304
6	Sleeve	Stainless steel	1.4301	AISI 304
7	O-ring for sleeve	EPDM or FKM		

¹⁾ Stainless steel available on request.

²⁾ CR(E) 1S, 1, 3, 5

³⁾ CR(E) 10, 15, 20

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TM02 1195 1403

4. Applications

CRFlex Solar

The CRFlex Solar is the simplest system utilizing solar energy for water transfer.

Benefits

Thanks to the intelligent MGFlex motor, no further motor protection is required.

By means of an IO 50, the power supply to the pump can be switched off manually in cases such as these:

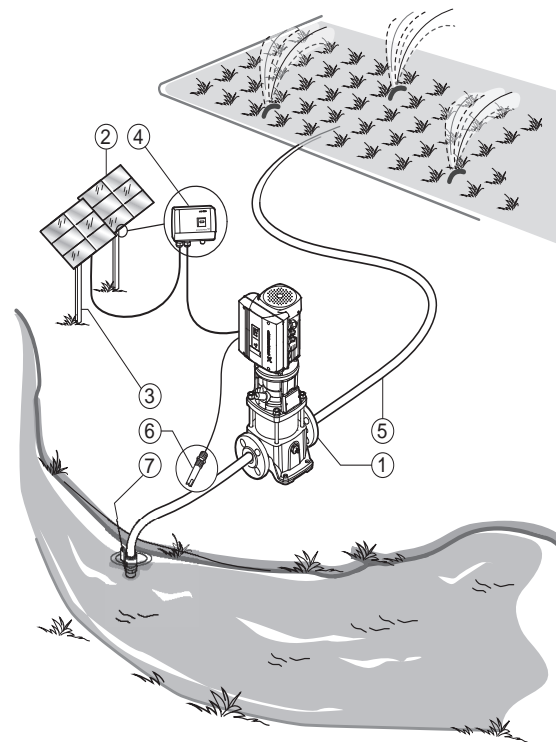
- There is no need for water supply.
- The system requires service.

The system also offers these benefits:

- easy installation
- maintenance confined to periodic cleaning of the solar panels
- few and simple components.

Note

1. To calculate the number of solar panels required, please use the sizing tools in Grundfos WinCAPS or WebCAPS.
2. The vertical distance between the inlet of the CRFlex pump and the dynamic level of the water source must be less than 20 feet. See also section *Minimum inlet pressure, NPSH* on p. 8.
3. The CRFlex pump must be protected against rain and direct sunlight.



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Fig. 9 CRFlex Solar

Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	IO 50 switch box
5	Water pipe
6	Dry-running sensor (optional)
7	Foot valve

CRFlex Solar with level switch

The CRFlex system allows solar energy to be stored as water in a reservoir in cases such as these:

- Water supply is needed at night.
- For short periods, the solar energy is insufficient to run the pump.
- There is a need for a backup water source.

Benefits

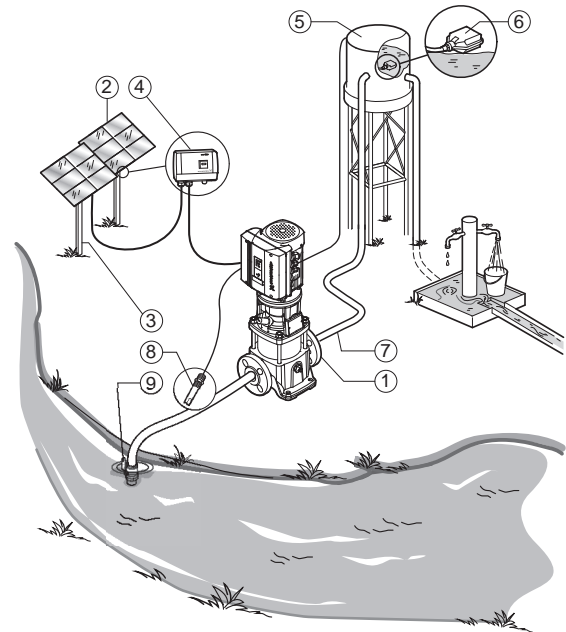
Connected directly to the electronics box on the MGFlex motor, the level switch will stop the pump when the water reservoir is full.

The system also offers these benefits:

- easy installation
- maintenance confined to periodic cleaning of the solar panels
- few and simple components.

Note

1. To calculate the number of solar panels required, please use the sizing tools in Grundfos WinCAPS or WebCAPS.
2. The vertical distance between the inlet of the CRFlex pump and the dynamic level of the water source must be less than 20 feet. See also section *Minimum inlet pressure, NPSH* on p. 8.
3. The CRFlex pump must be protected against rain and direct sunlight.



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Fig. 10 CRFlex Solar with level switch

Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	IO 50 switch box
5	Water reservoir
6	Level switch
7	Water pipe
8	Dry-running sensor (optional)
9	Foot valve

CRFlex Solar with generator

During periods of insufficient solar energy, the CRFlex can provide a reliable water supply when powered with a generator.

The system is connected to an external backup generator via the IO 101 and will automatically switch to operation via generator when the generator is started.

If the generator is stopped manually or runs out of fuel, the IO 101 will automatically change back to operation via solar energy.

Benefits

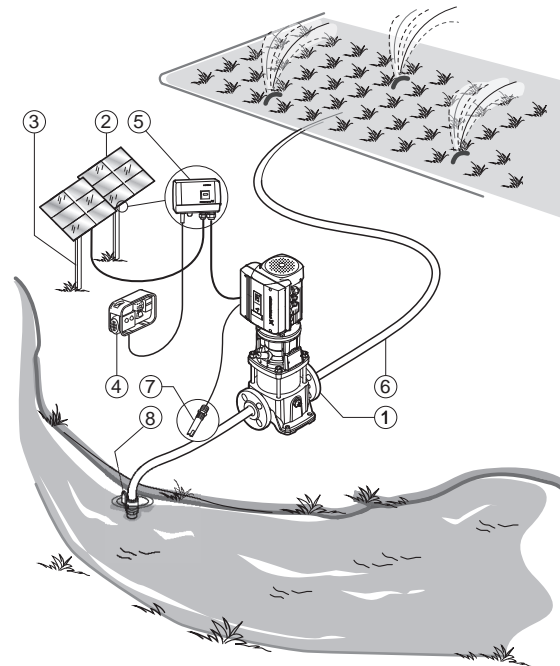
The system offers water supply during the night or during periods of insufficient solar energy.

The system also offers these benefits:

- easy installation
- few and simple components
- flexible energy supply.

Note

1. To calculate the number of solar panels required, please use the sizing tools in Grundfos WinCAPS or WebCAPS.
2. The vertical distance between the inlet of the CRFlex pump and the dynamic level of the water source must be less than 20 feet. See also section *Minimum inlet pressure, NPSH* on p. 8.
3. The CRFlex pump must be protected against rain and direct sunlight.

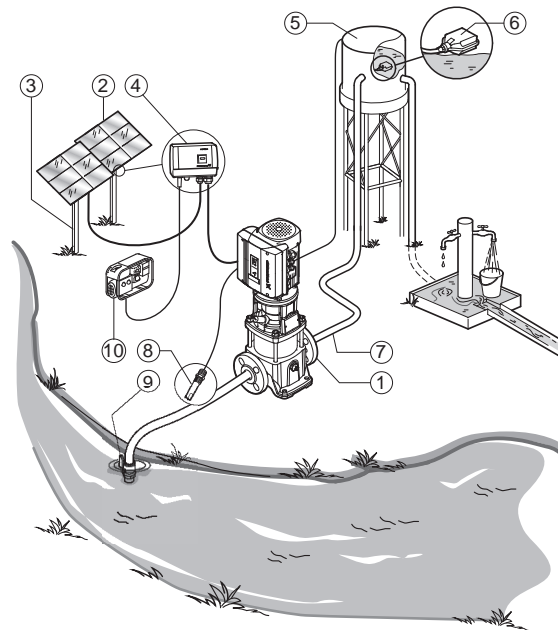


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Fig. 11 CRFlex Solar with generator

Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	Diesel- or gasoline driven generator (1 x 240 VAC max.)
5	IO 101 switch box
6	Water pipe
7	Dry-running sensor (optional)
8	Foot valve

CRFlex Solar with level switch and generator



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Fig. 12 CRFlex Solar with level switch and generator

Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	IO 101 switch box
5	Water reservoir
6	Level switch
7	Water pipe
8	Dry-running sensor (optional)
9	Foot valve
10	Diesel- or gasoline-driven generator

CRFlex and SQFlex Solar

In addition to enabling customers to store solar energy as water in a reservoir, it offers pressure boosting.

Benefits

The SQFlex pumps water from wells as small as 3-inch and stores it in a reservoir. The CRFlex pump transfers water over a long distance or increases the water pressure.

Combined with a CU 200, the level switch will stop the SQFlex when the reservoir is full.

The CU 200 offers the following indications:

- full water reservoir (level switch activated)
- pump operation
- input power.

The CU 200 indicates operational stoppage in these cases:

- dry running
- insufficient energy supply.

The system also offers these benefits:

- easy installation
- maintenance confined to periodic cleaning of the solar panels
- few and simple components

See the SQFlex data booklet in WebCAPS for further information.

Note

1. To calculate the number of solar panels required, please use the sizing tools in Grundfos WinCAPS or WebCAPS.
2. The vertical distance between the inlet of the CRFlex pump and the dynamic level of the water source must be less than 20 feet. See also section *Minimum inlet pressure, NPSH* on page 8.
3. The CRFlex pump must be protected against rain and direct sunlight.

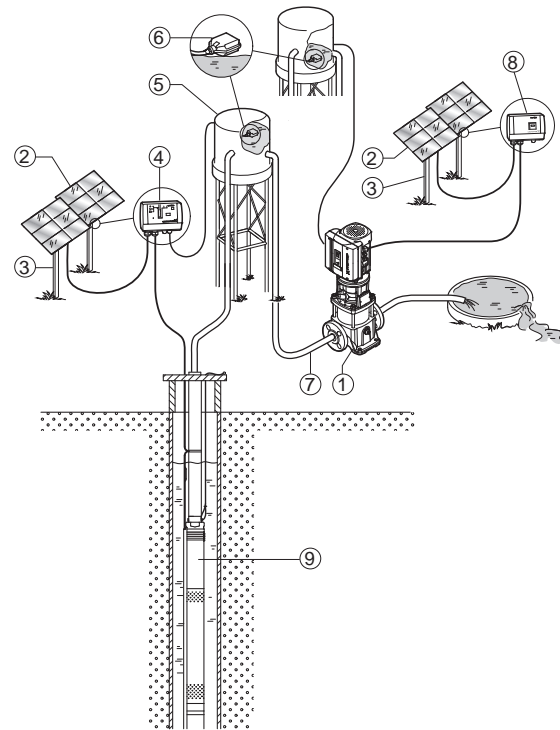


Fig. 13 CRFlex and SQFlex Solar

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Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	CU 200 control unit
5	Water reservoir
6	Level switch
7	Water pipe
8	IO 50 switch box
9	SQF pump

5. Accessories

IO 50 switch box

Product	Product number
IO 50	96959028

IO 101 switch box

Product	Product number
IO 101 (230 V)	96475074
IO 101 (115 V)	96481502

Level switch

Product	Product number
Level switch (normally closed)	97911220

6. Technical data

Dimensional sketch

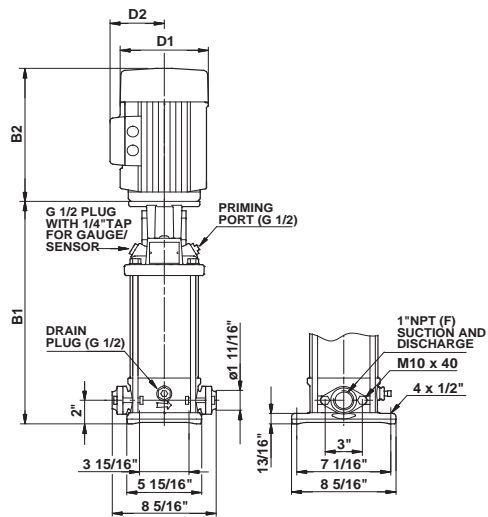


Fig. 14 CRI Flex 3-9 standard

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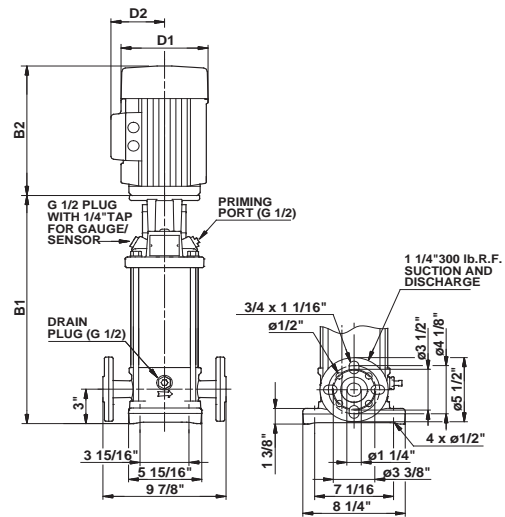


Fig. 15 CRI Flex 3-9 with optional FGJ ANSI flange (contact Grundfos for details)

TM03 1453 2205

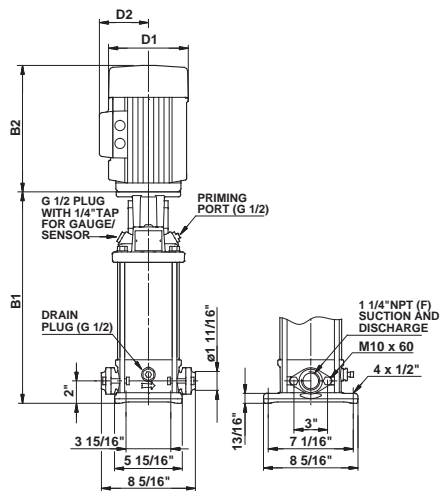


Fig. 16 CRI Flex 5-5 standard

TM03 1456 2205

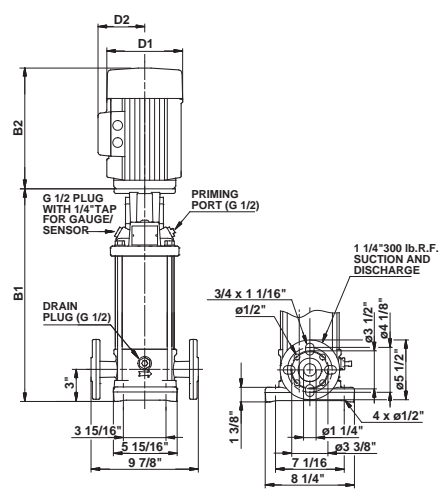


Fig. 17 CRI Flex 5-5 with optional FGJ ANSI flange (contact Grundfos for details)

TM03 1453 2205

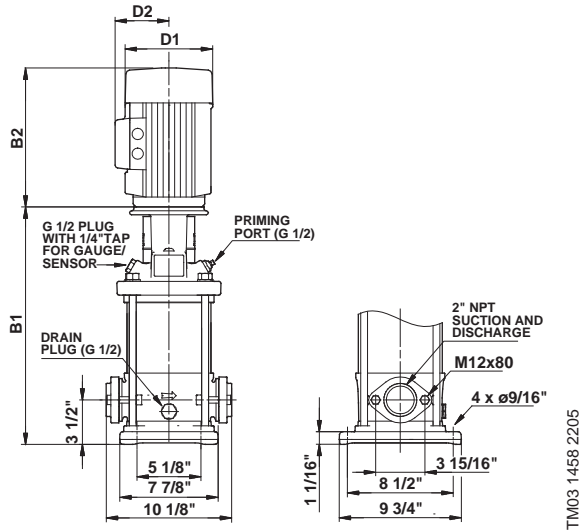


Fig. 18 CRI Flex 10-2 standard

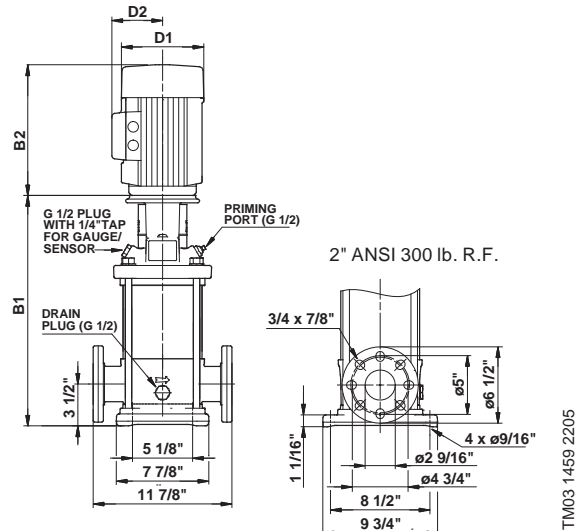


Fig. 19 CRI Flex 10-2 with optional FGJ ANSI flange (contact Grundfos for details)

Dimensions and weights

Pump type	Dimensions [in (mm)]				Net weight [lb (kg)]	Gross weight [lb (kg)]
	B1	B1 + B2	D1	D2		
CRI Flex 3-9	15.34 (390)	24.34 (620)	5.5 (140)	5.5 (140)	61.8 (28.0)	72.8 (33.0)
CRI Flex 5-5	14.28 (363)	23.28 (592)	5.5 (140)	5.5 (140)	60.1 (27.3)	71.1 (32.3)
CRI Flex 10-2	15.28 (388)	24.28 (617)	5.5 (140)	5.5 (140)	77.2 (35.0)	82.2 (40.0)

Electrical data

110-415 VDC or 1 x 220-240 VAC, 50/60 Hz

Pump type	Motor type	Maximum power input P ₁ [W]	Maximum current [A]
CRI Flex 3-9	MGFlex	1250	5
CRI Flex 5-5			
CRI Flex 10-2			

7. Performance curves

Curve conditions

Specific performance charts

The specific performance charts on p. 18 through p. 20 are based on the following guidelines:

- All curves show mean values.
- The curves must not be used as guarantee curves.
- Typical deviation: + / - 15 %.
- The measurements have been made at a water temperature of +70 °F (+20 °C).
- If the pump is used for liquids with a viscosity higher than that of water, this will reduce the head and increase the power consumption.

CRFlex 3-9

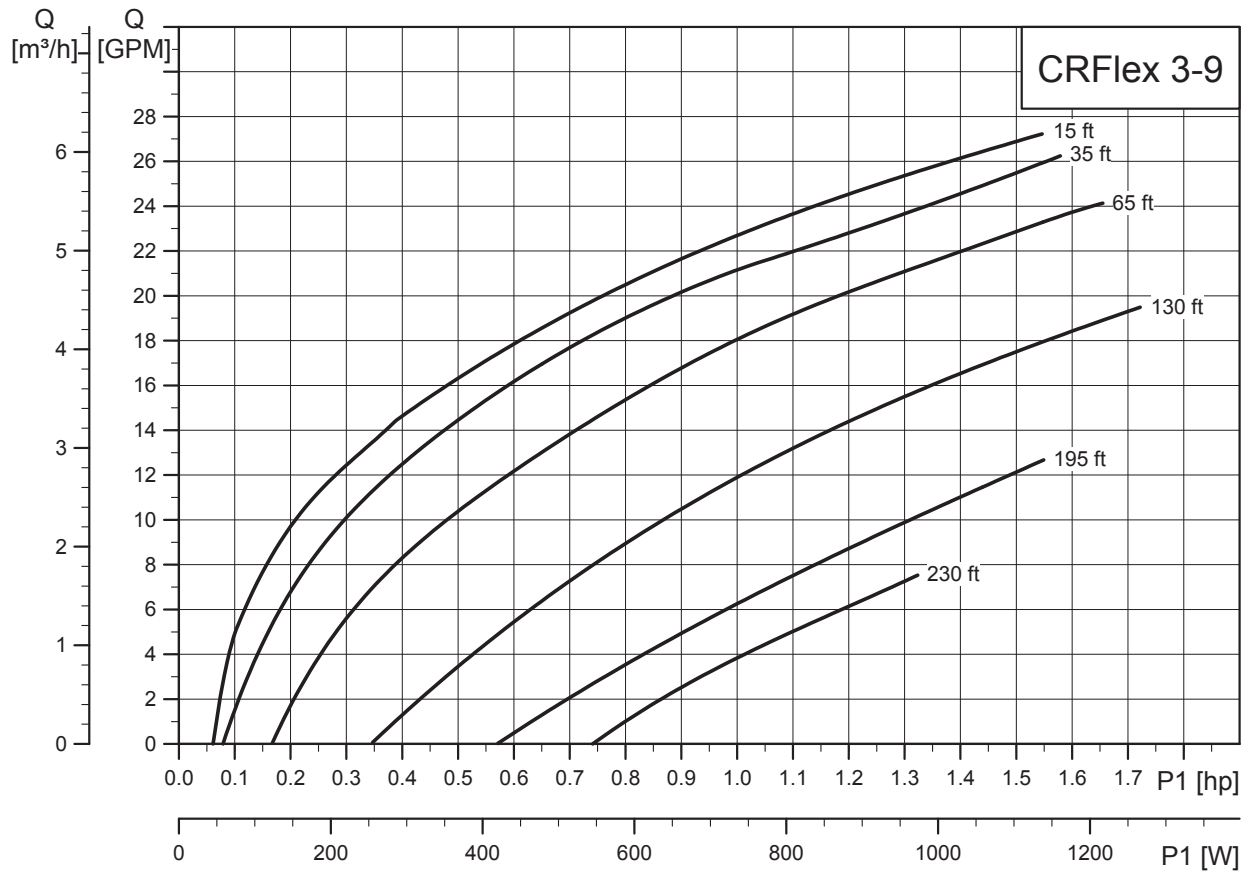
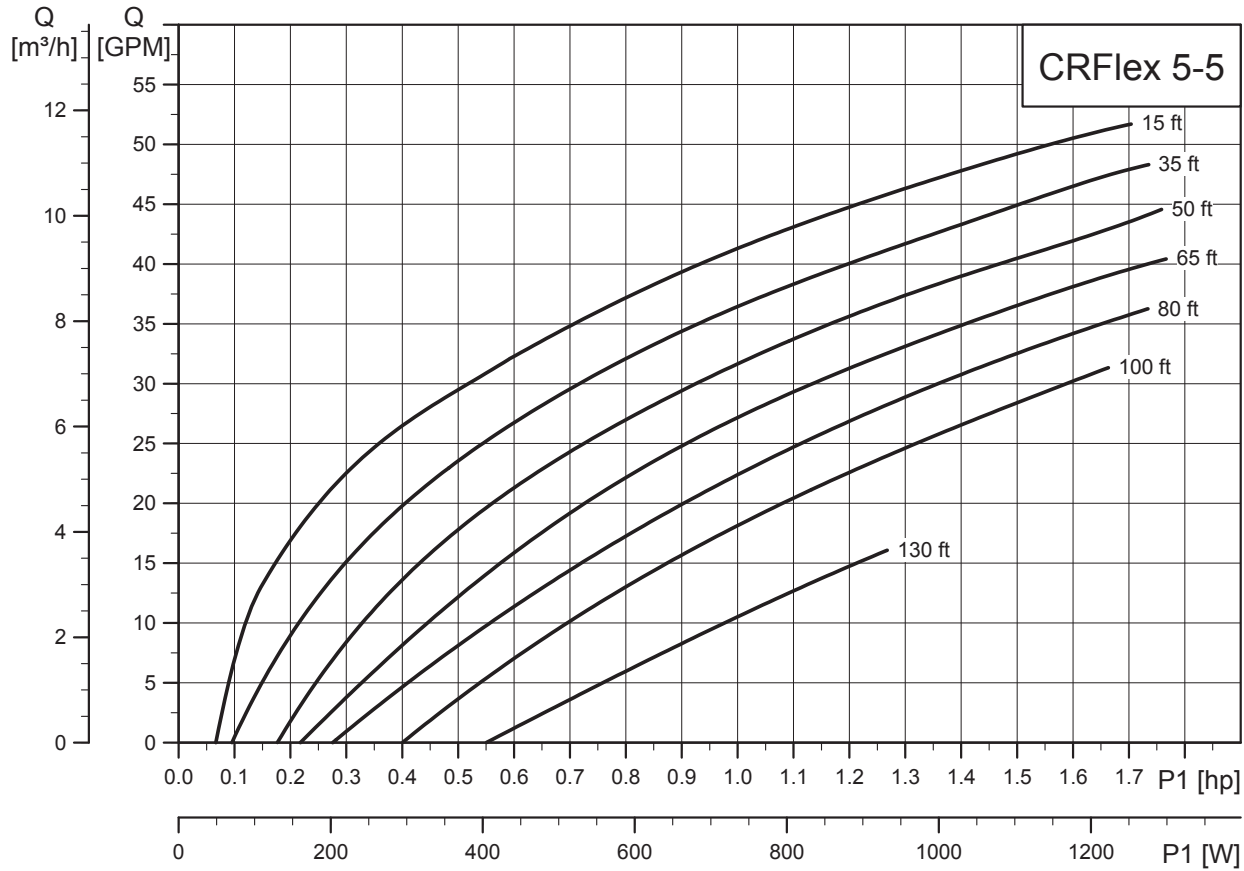


Fig. 20 Performance curves, CRFlex 3-9

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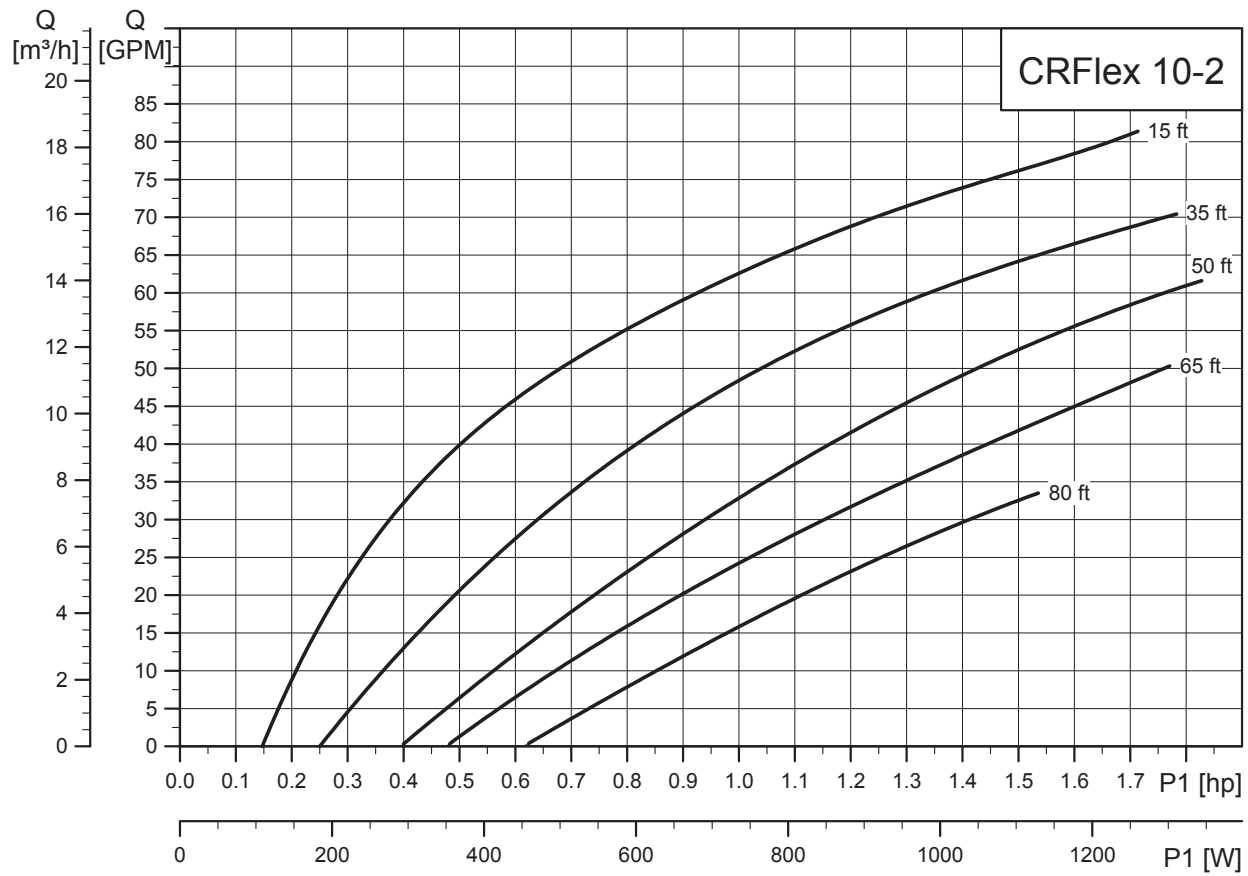
CRFlex 5-5



TM05 0874 1811

Fig. 21 Performance curves, CRFlex 5-5

CRFlex 10-2

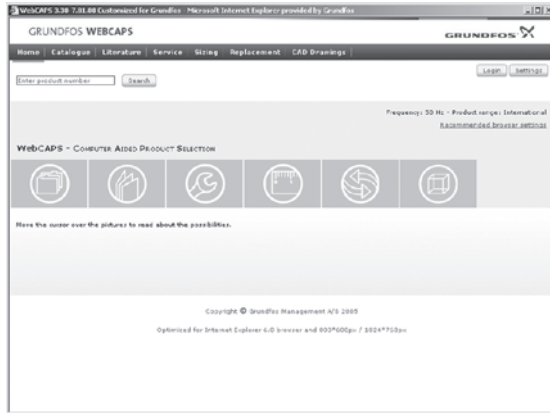


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Fig. 22 Performance curves, CRFlex 10-2

8. Further product documentation

WebCAPS

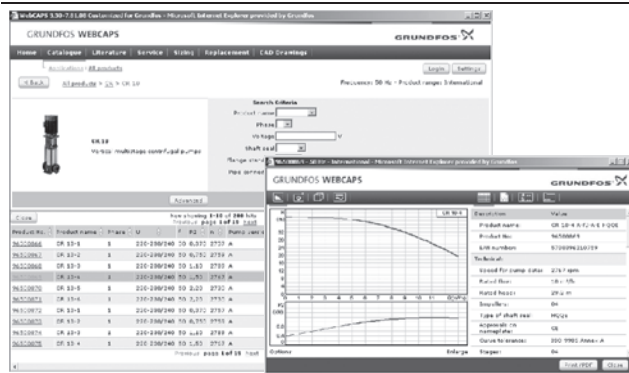


WebCAPS is a **Web-based Computer Aided Product Selection** program available on www.grundfos.com.

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:

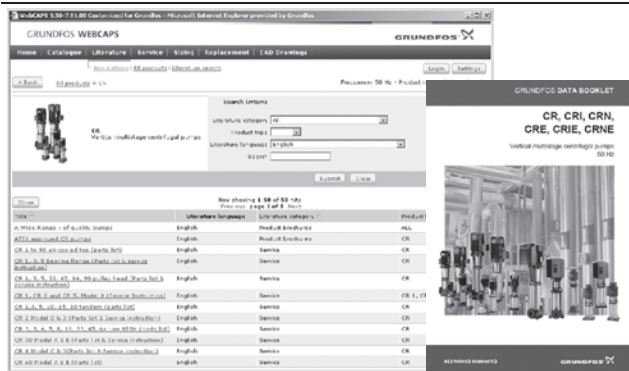
- Catalog
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.



Catalog

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

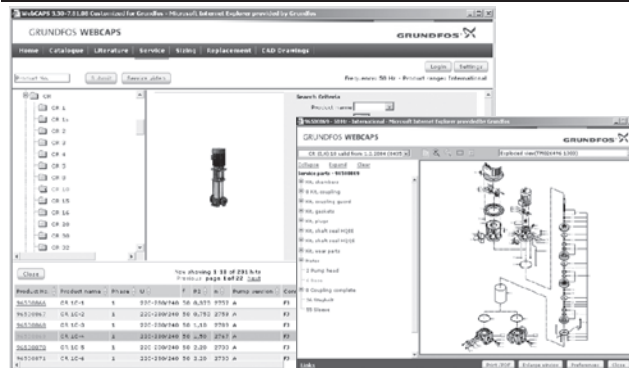
- technical data
- curves (QH, Eta, P1, P2, etc.) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.



Literature

In this section you can access all the latest documents of a given pump, such as

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



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, 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.
- 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



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.

Subject to alterations.

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