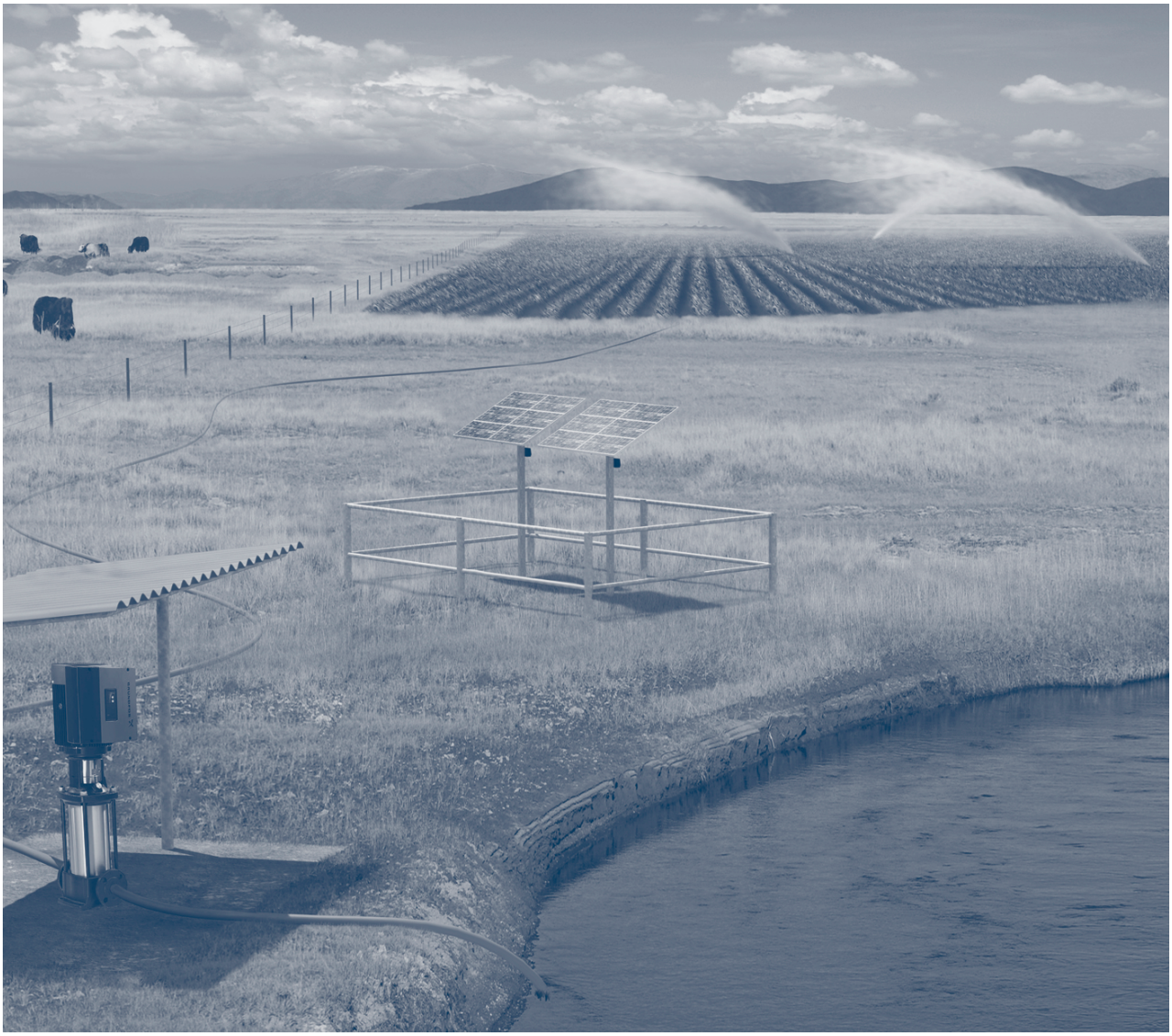
Grundfos solar surface pump

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:

- irrigation
- watering of livestock
- pressure boosting
- floating pump
- recirculation of swimming-pool water (OEM).

The MGFlex motor can be mounted on Grundfos CR, MTR (as float pump) and GP pumps.

Motor

The MGFlex motor is a new solar-powered 2-pole motor, frame size 80 with integrated frequency converter.

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

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

Nameplate

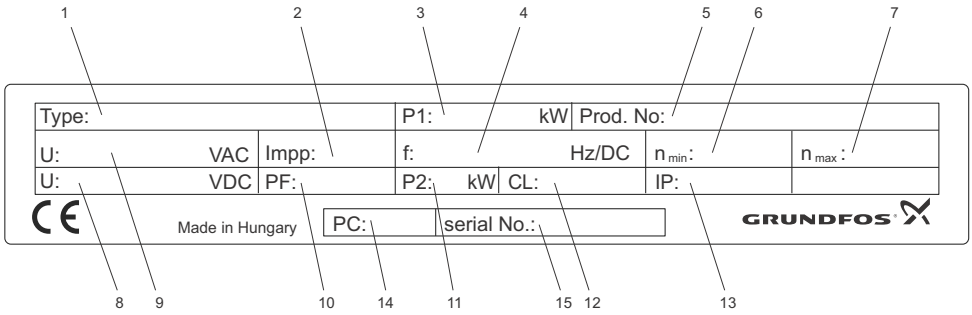

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Fig. 1 Nameplate of the MGFlex motor

Pos.	Description
1	Type designation
2	Maximum current
3	Power consumption
4	Frequency range
5	Product number
6	Minimum speed
7	Maximum speed
8	DC supply voltage
9	AC supply voltage
10	Power factor
11	Output power
12	Insulation class according to 2114
13	Enclosure class
14	Production code, year and week
15	Serial number

Features and benefits

Maximum Power Point Tracking (MPPT)

The motor continuously optimises 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 range, and it will be cut in when the voltage is again within the permissible range. No extra protection relay is required.

Overload protection

The motor incorporates thermal protection against both steady overload and stalled condition according to IEC 60034-11. It will be stopped and restarted automatically.

The motor is to be connected to the power supply as shown in fig. 2.

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

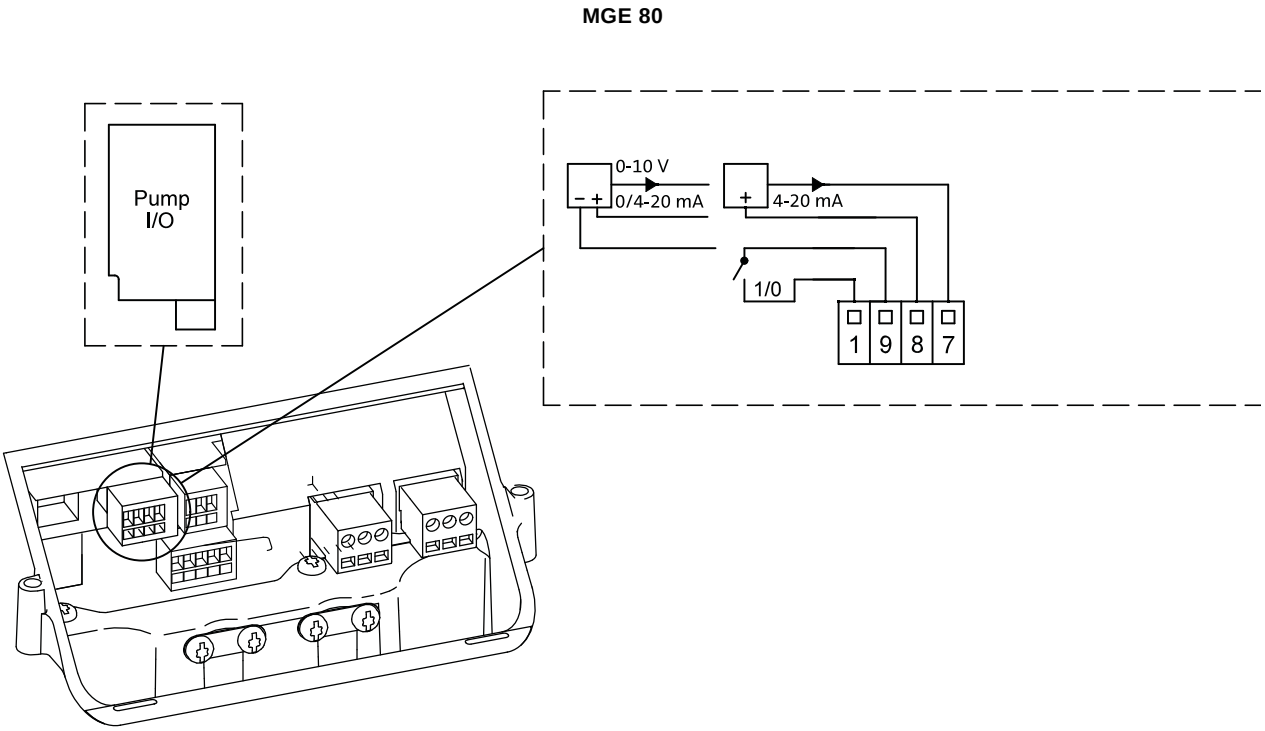

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Fig. 2 Wiring diagram

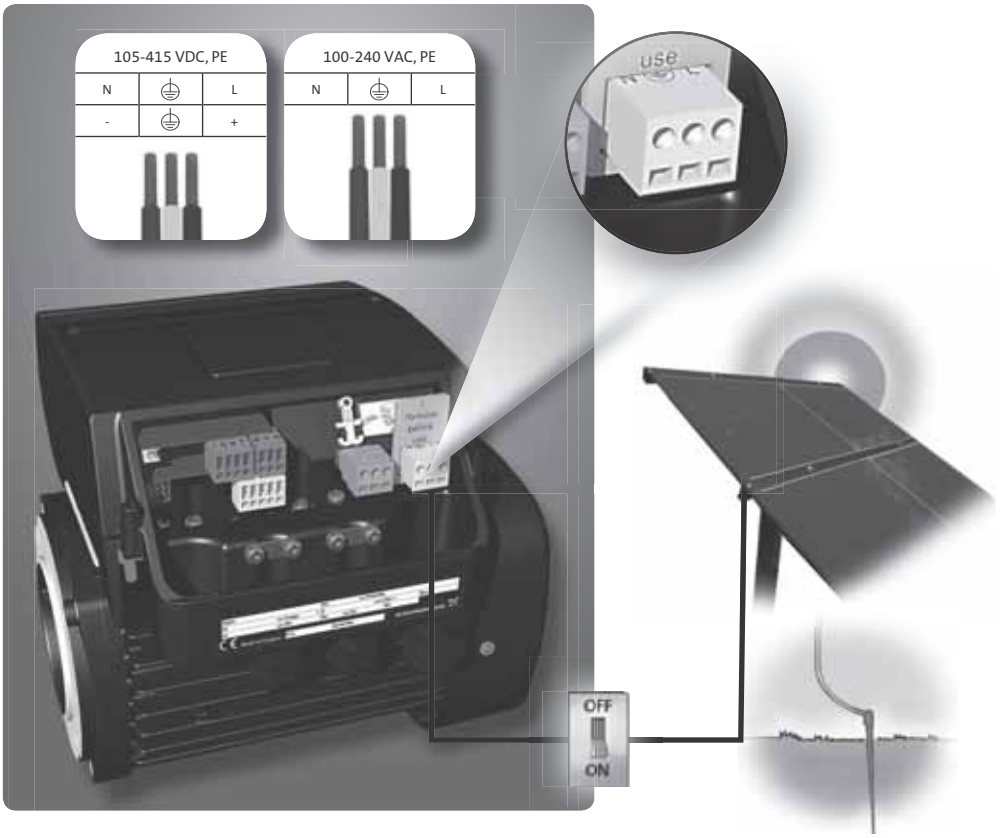

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Fig. 3 Electrical connections, MGFlex motor

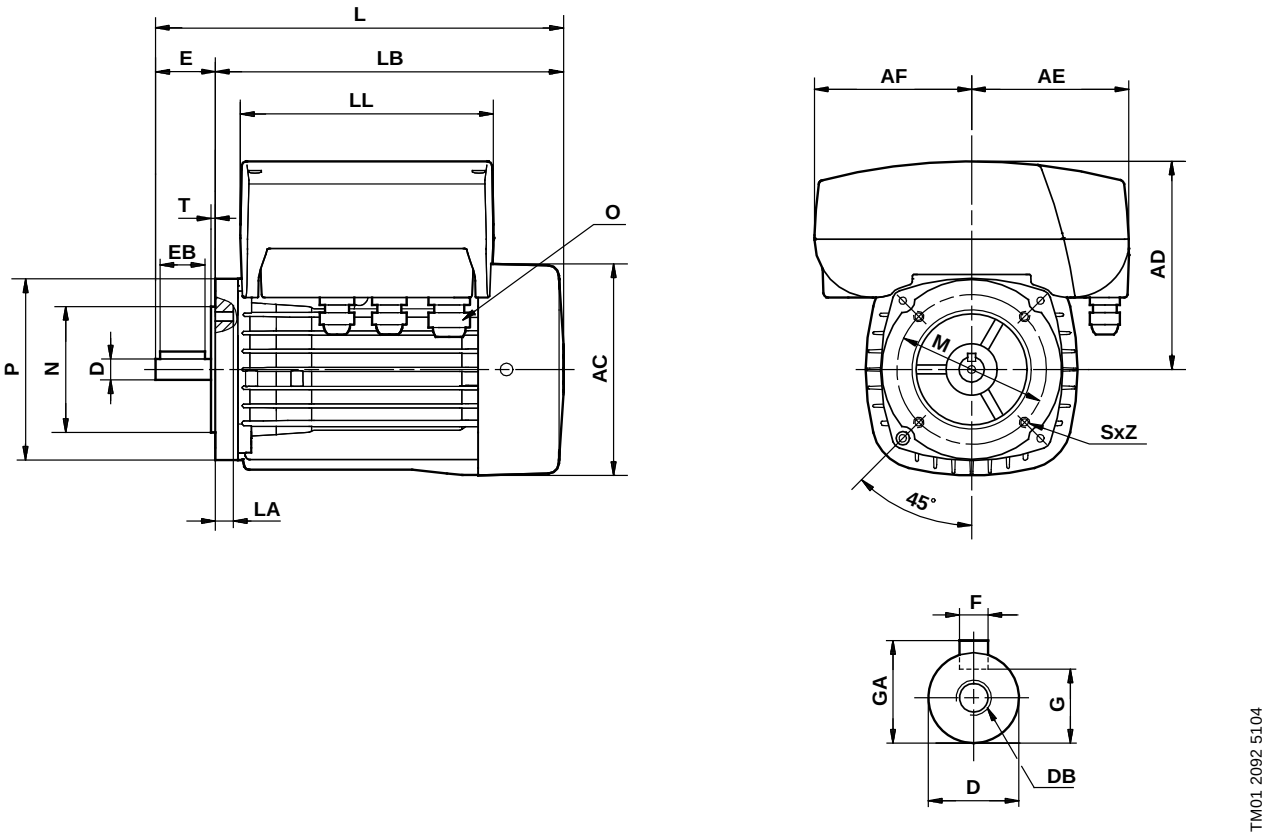
Technical data

Dimensions and weights

GR9029

Fig. 4 MGE 80 IM B14

Dimensional drawing



TM01 2092 5104

Fig. 5 Dimensional drawing of MGFlex

Power [kW]	Short type designation	Stator housing								Shaft end						
		IEC:	AC	AD	AE	AF	L	LB	LL	D	DB	E	EB	F	G	GA
		DIN:	g	p1						d	d6	l		u		t
1.1	MGE80B2-C2		141	140	105	105	271	231	169	19	M6	40	32	6	15.5	21.5

Power [kW]	Short type designation	Flange						Cable entries
		IEC:	LA	M	N	P	SxZ	T	O
		DIN:	c1	e1	b1	a1	s1	f1	
1.1	MGE80B2-C2		12	100	80	120	M6 X 4	3	2 x M16 + 1 x M20 + 1 x M16 knock-out cable entry

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: • 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 device connected.
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: -20 °C to +45 °C. During storage/transport: -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.

Product range

Product	Product number
MGFlex motor (P1 = 1250 W)	85903667

Note

Grundfos only guarantees the performance and reliability of the MGFlex motors if both 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 must be carried out by persons trained and authorised by Grundfos.

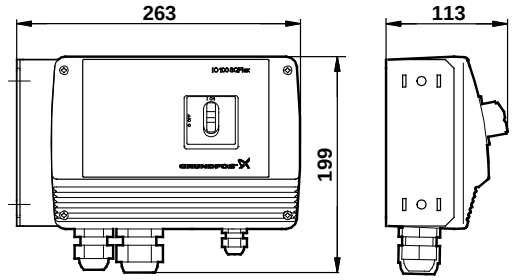
In the case of OEM usage, please contact Grundfos to obtain full warranty coverage.

2. System components

IO 100 switch box

The IO 100 is designed specifically for solar-powered systems.

The IO 100 enables manual starting and stopping of the pump and functions as a connection box joining all necessary cables.



Dimensions stated in mm.

Fig. 6 Dimensions

Technical data

Voltage	Maximum 400 VDC, 8.4 A. Maximum 265 VAC, 8.4 A.
Enclosure class	IP55.
Ambient temperature	During operation: -30 °C to +50 °C. During storage: -30 °C to +60 °C.
Marking	CE.

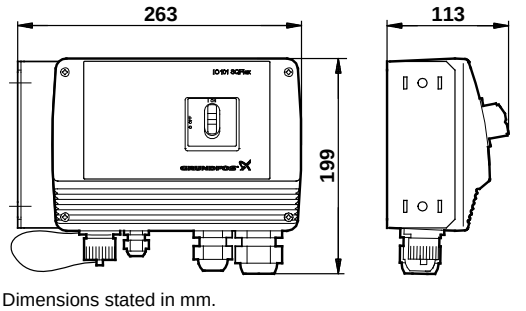
IO 101 switch box

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.



Dimensions stated in mm.

Fig. 7 Dimensions

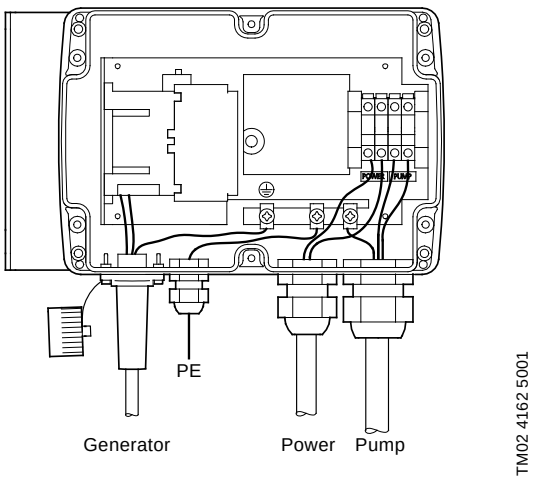


Fig. 8 Electrical connections

Technical data

Voltage	230 VAC - 15 %/+ 10 %, 50/60 Hz (internal relay). Maximum 225 VDC, 8.4 A. Maximum 265 VAC, 8.4 A.
Enclosure class	IP55.
Ambient temperature	During operation: -30 °C to +50 °C. During storage: -30 °C to +60 °C.
Marking	CE.

Generator

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

3. CRFlex pump

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

- MGFlex motor
- CRN or CRI pump end.

Pumped liquids

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

pH value: 5-9.

Liquid temperature: 0 °C to +120 °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 [ppm]	Liquid temperature [°C]
EN 1.4301	0-300	< 40
	300-500	< 30
EN 1.4401	0-500	< 40

Nameplate

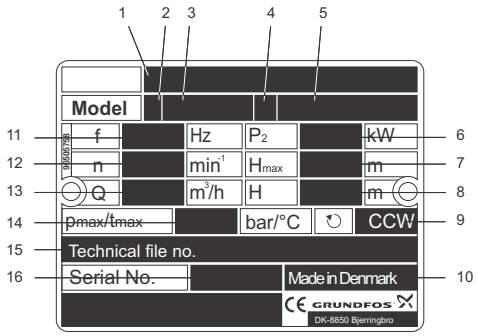


Fig. 9 Nameplate of CRFlex pump end

Pos.	Description
1	Type designation
2	Model
3	Product number
4	Place of production
5	Production code, year and week
6	Rated shaft power
7	Closed valve head
8	Head at rated flow rate
9	Direction of rotation (CCW = counter-clockwise)
10	Country of production
11	Mains frequency
12	Speed
13	Rated flow rate
14	Maximum pressure and temperature
15	Technical file number
16	Serial number

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 metres head can be calculated as follows:

$H = p_b \times 10.2 - NPSH - H_f - H_v - H_s$

p_b	=	Barometric pressure in bar. (Barometric pressure can be set to 1 bar). In closed systems, p_b indicates the system pressure in bar.
NPSH*	=	Net Positive Suction Head in metres head. (To be read from the NPSH curve at the highest flow the pump will be delivering.)
H_f	=	Friction loss in suction pipe in metres head. (At the highest flow the pump will be delivering.)
H_v	=	Vapour pressure in metres head. (To be read from the vapour pressure scale."H_v" depends on the liquid temperature "T_m".)
H_s	=	Safety margin = minimum 0.5 metres head.

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

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

* For NPSH curves, see section *8. Appendix*.

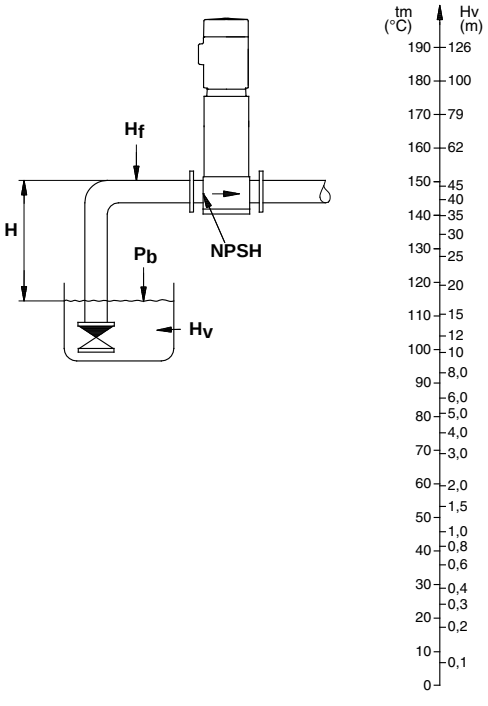


Fig. 10 Minimum inlet pressure - NPSH

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.

Material specification

Fig. 11 CRFlex pump

Sectional drawing

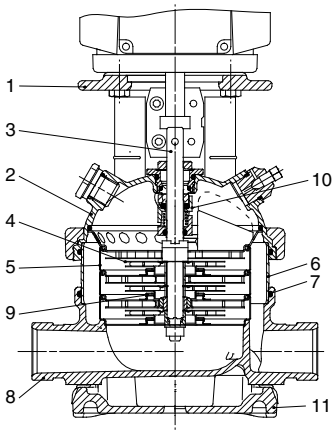


Fig. 12 Sectional drawing of CRFlex pump end

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		
	CRI(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		
	CRN(E)			
4	Impeller	Stainless steel	1.4401	AISI 316
5	Chamber	Stainless steel	1.4401	AISI 316
6	Sleeve	Stainless steel	1.4401	AISI 316
7	O-ring for sleeve	EPDM or FKM		

[1] Stainless steel available on request.

[2] CRI(E), CRN(E) 1S, 1, 3, 5

[3] CRI(E), CRN(E) 10, 15, 20

Product range

The CRFlex pump complete is supplied with a 2-metre cable.

Product	Stainless steel	Pump end	Product number
CRFlex 3-9	AISI 304/EN 1.4301	CRI	97756769
CRFlex 5-5	AISI 304/EN 1.4301	CRI	97756770
CRFlex 10-2	AISI 304/EN 1.4301	CRI	97756772
CRFlex 3-9	AISI 316/EN 1.4401	CRN	97756607
CRFlex 5-5	AISI 316/EN 1.4401	CRN	97756748
CRFlex 10-2	AISI 316/EN 1.4401	CRN	97756764

4. Applications

CRFlex Solar

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

Benefits

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

By means of an IO 100, 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 6 metres.
   See also section *Minimum inlet pressure, NPSH* on page 8.
3. The CRFlex pump must be protected against rain and direct sunlight.

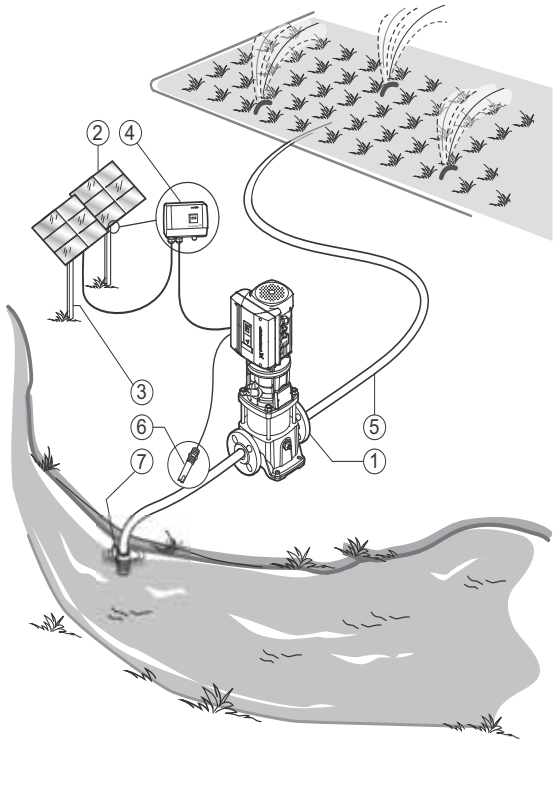


Fig. 13 CRFlex Solar

Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	IO 100 switch box
5	Water pipe
6	Dry-running sensor (optional)
7	Non-return valve

CRFlex Solar with level switch

The CRFlex Solar 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 6 metres.
   See also section *Minimum inlet pressure, NPSH* on page 8.
3. The CRFlex pump must be protected against rain and direct sunlight.

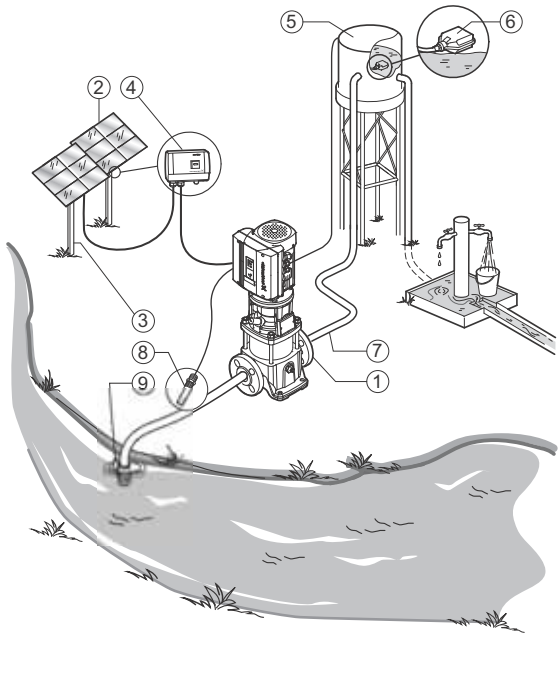


Fig. 14 CRFlex Solar with level switch

Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	IO 100 switch box
5	Water reservoir
6	Level switch
7	Water pipe
8	Dry-running sensor (optional)
9	Non-return valve

CRFlex Solar with generator

During periods of insufficient solar energy, the CRFlex Solar system provides a reliable water supply.

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
- maintenance confined to periodic cleaning of the solar panels
- 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 6 metres.
   See also section *Minimum inlet pressure, NPSH* on page 8.
3. The CRFlex pump must be protected against rain and direct sunlight.

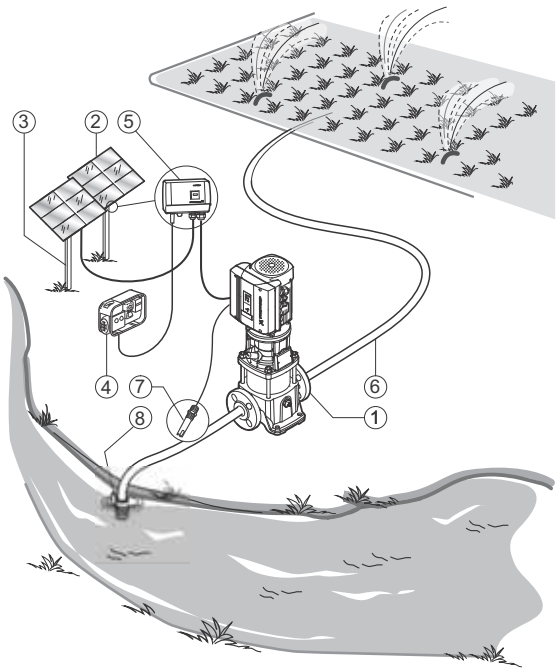


Fig. 15 CRFlex Solar with generator

Pos.	Description
1	CRFlex pump
2	Solar panels
3	Support structure
4	Diesel or petrol-driven generator
5	IO 101 switch box
6	Water pipe
7	Dry-running sensor (optional)
8	Non-return valve

CRFlex Solar with level switch and generator

During periods of insufficient solar energy, the CRFlex Solar system will provide a reliable water supply.

The supply of water is ensured by a diesel or petrol-driven generator connected to the system via the IO 101. The system 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
- maintenance confined to periodic cleaning of the solar panels
- 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 6 metres.
   See also section *Minimum inlet pressure, NPSH* on page 8.
3. The CRFlex pump must be protected against rain and direct sunlight.

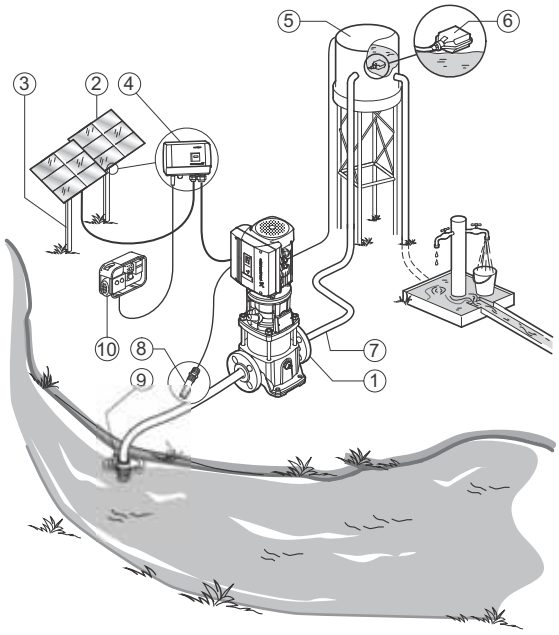


Fig. 16 CRFlex Solar with level switch and generator

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	Non-return valve
10	Diesel or petrol-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" 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 6 metres.
3. See also section *Minimum inlet pressure, NPSH* on page 8.
4. The CRFlex pump must be protected against rain and direct sunlight.

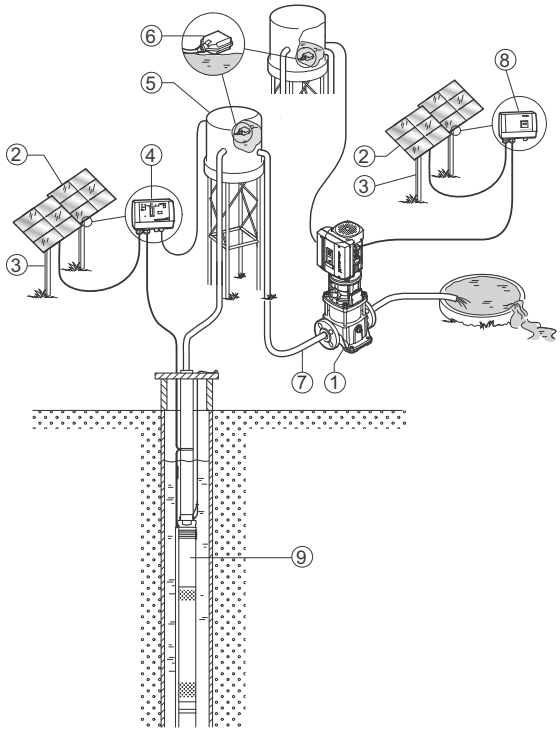


Fig. 17 CRFlex and SQFlex Solar

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 100 switch box
9	SQF pump

5. Accessories

IO 100 switch box

Product	Product number
IO 100	96475073

IO 101 switch box

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

Connection adapter

Pump type	Product	Product number
CRFlex 3-9, CRFlex 5-5	Oval Rp 1 1/4	96449747
	Oval 1 1/4" NPT	97757339
CRFlex 10-2	Oval Rp 1 1/2	96498728
	Oval 1 1/2" NPT	96498837
	Oval 2" NPT	96498839

Material: 1.4408/AISI 316.

Dry-running sensor

Product	Product number
Dry-running sensor	97911215

Level switch

Product	Product number
Level switch (normally closed)	97911220
Level switch (normally open)	010748

6. Technical data

Dimensions and weights

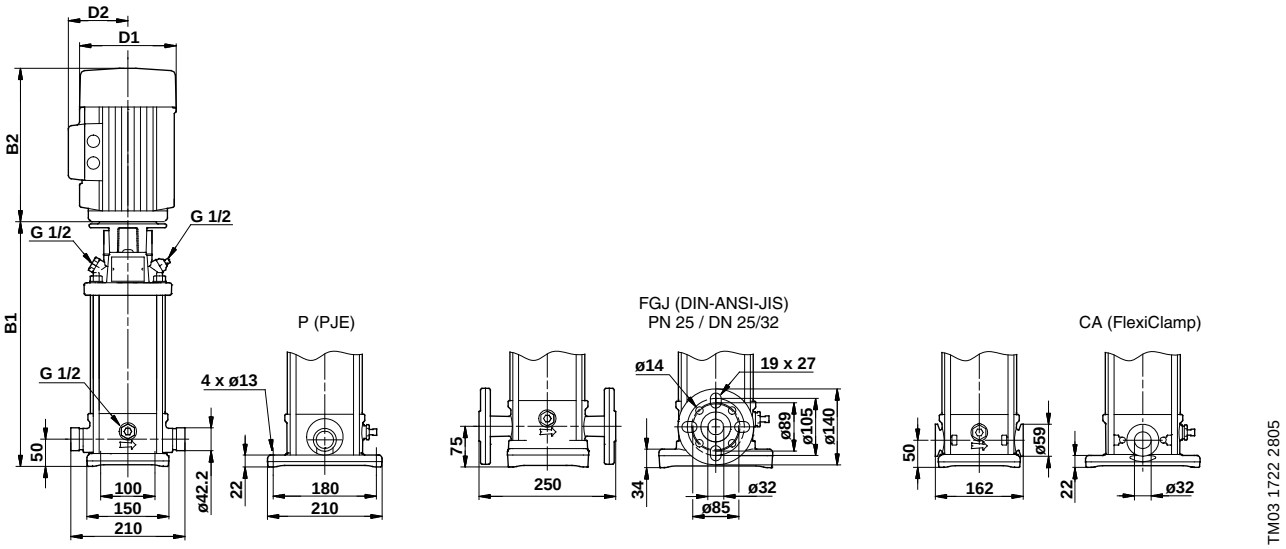


Fig. 18 Dimensional drawing of CRFlex

Pump type	Product number	Dimensions [mm]				Net weight [kg]	Gross weight [kg]	Shipping volume [m^3]
		B1	B1 + B2	D1	D2			
CRN Flex 3-9	97756607	371	602	178	167	26.1	29.1	0.0413
CRN Flex 5-5	97756748	344	575	178	167	25.6	28.3	0.0413
CRN Flex 10-2	97756764	357	588	178	167	25.0	28.0	0.0413
CRI Flex 3-9	97756769	371	602	178	167	26.6	29.2	0.0413
CRI Flex 5-5	97756770	344	575	178	167	25.7	28.4	0.0413
CRI Flex 10-2	97756772	357	588	178	167	25.0	28.0	0.0413

Electrical data

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

Pump type	Product number	Motor type	Maximum power input P1 [W]	Maximum current [A]
CRN Flex 3-9	97756607	MGFlex	1250	5
CRN Flex 5-5	97756748	MGFlex	1250	5
CRN Flex 10-2	97756764	MGFlex	1250	5
CRI Flex 3-9	97756769	MGFlex	1250	5
CRI Flex 5-5	97756770	MGFlex	1250	5
CRI Flex 10-2	97756772	MGFlex	1250	5

Curve conditions

Specific performance charts

The specific performance charts on pages 17 to 19 are based on the following guidelines:

- Tolerances to ISO 9906, Annex A, if indicated.
- 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 +20 °C.
- The curves apply to a kinematic viscosity of 1 mm^2/s (1 cSt). 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.

Pressure loss

The QH curves are inclusive of inlet and valve losses at actual speed.

NPSH curves

The NPSH curve is an average curve for all the variants shown. When sizing the pumps, add a safety margin of at least 0.5 m.

7. Performance curves

CRFlex 3-9

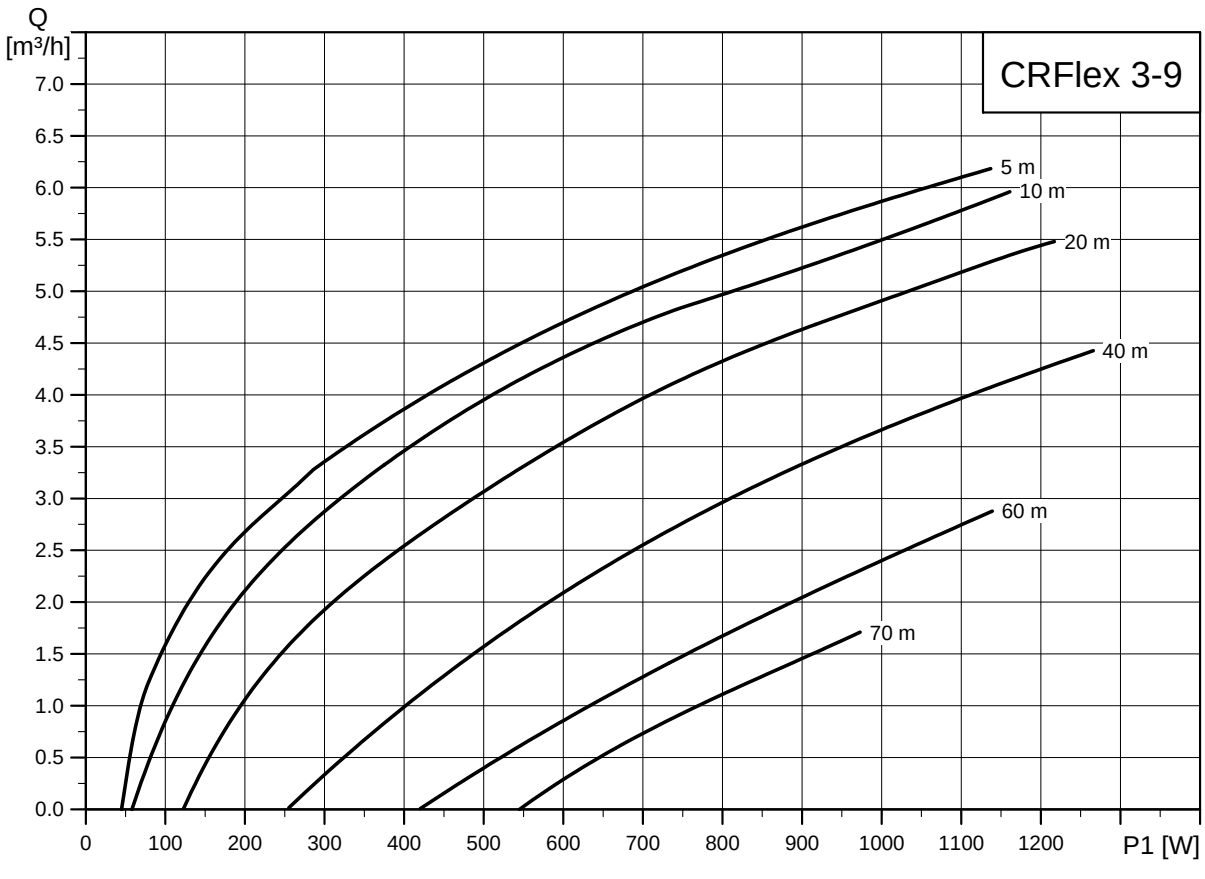


Fig. 19 Performance curves, CRFlex 3-9

CRFlex 5-5

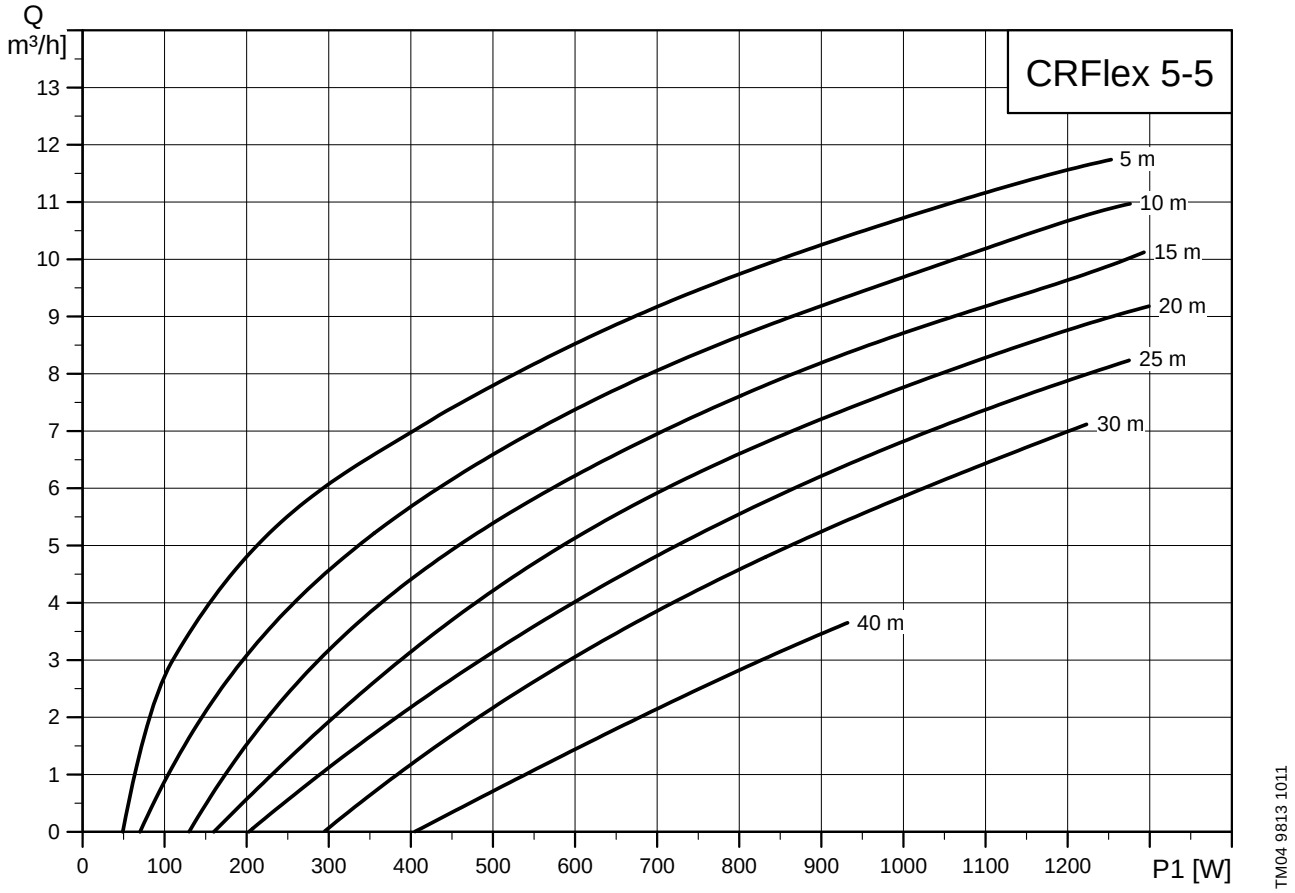


Fig. 20 Performance curves, CRFlex 5-5

CRFlex 10-2

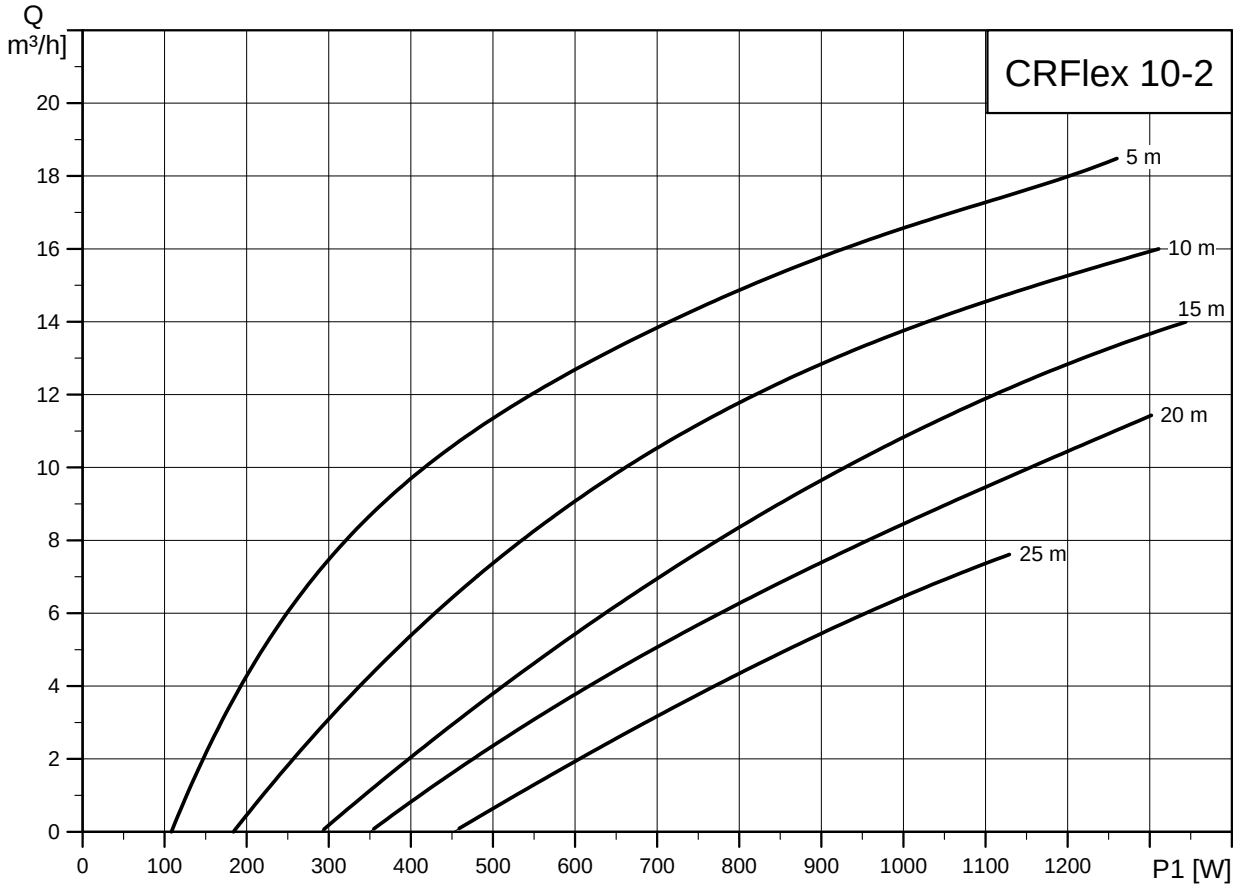


Fig. 21 Performance curves, CRFlex 10-2

8. Appendix

Performance curves, CR 3-9

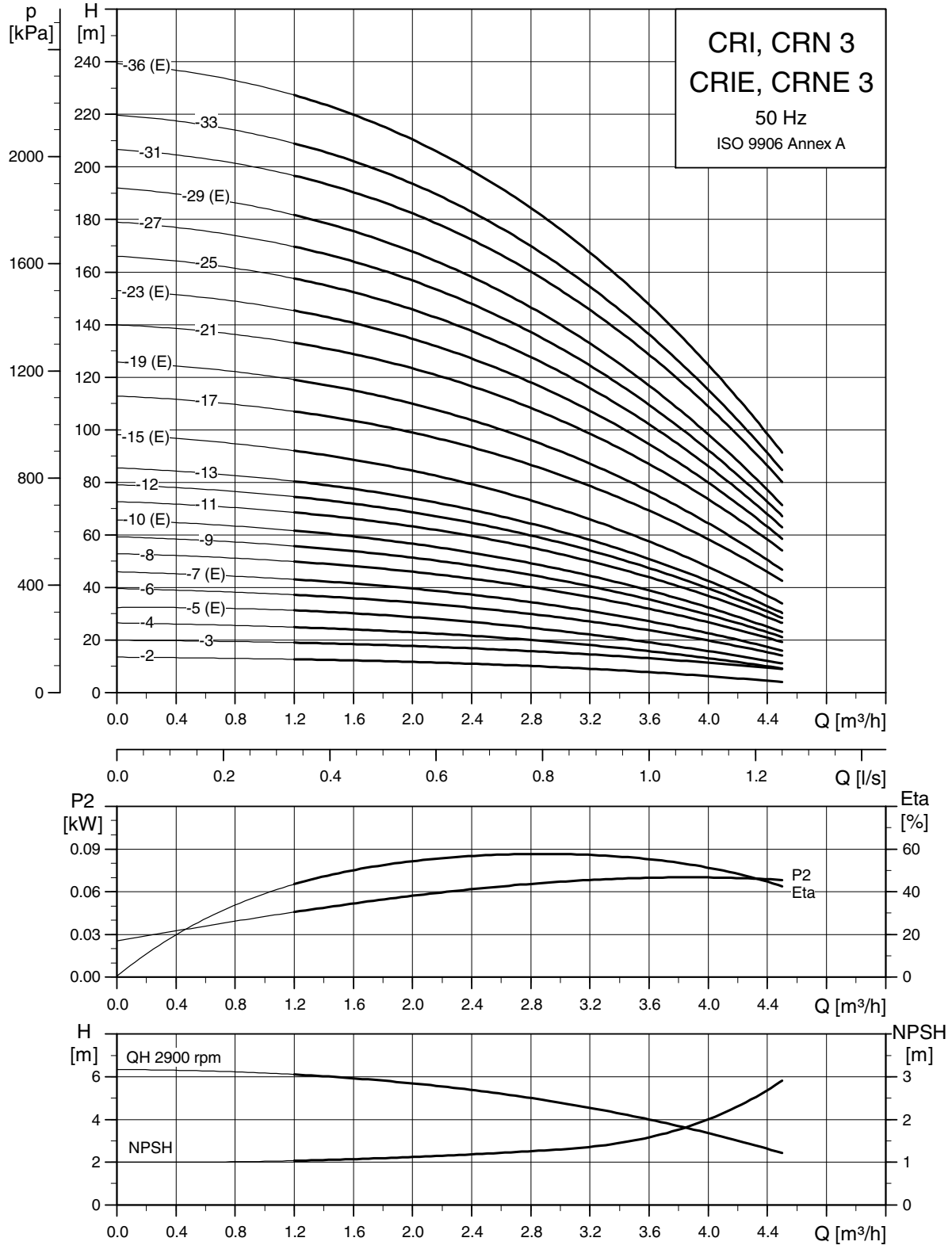


Fig. 22 Performance curves, CR 3-9

Performance curves, CR 5-5

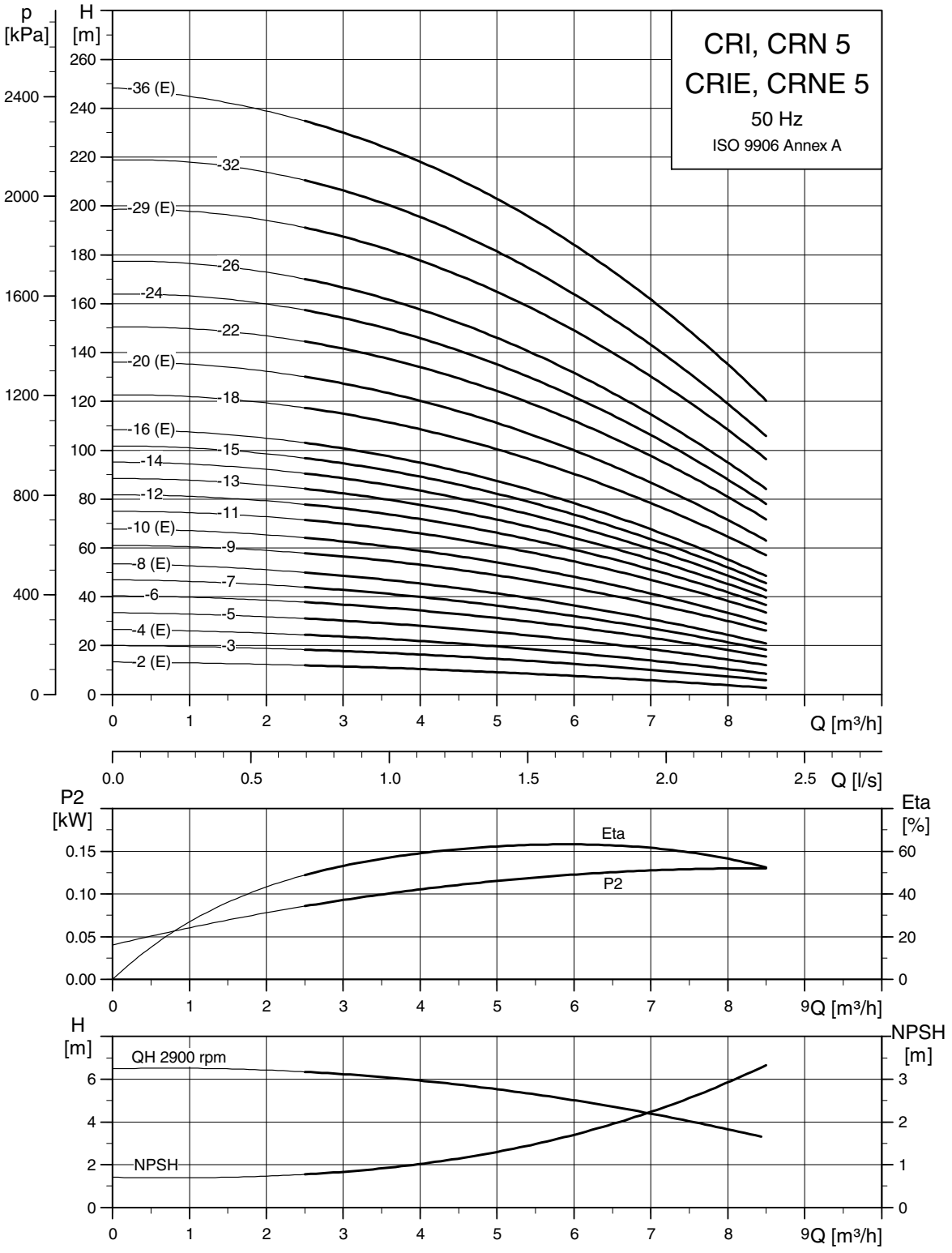


Fig. 23 Performance curves, CR 5-5

Performance curves, CR 10-2

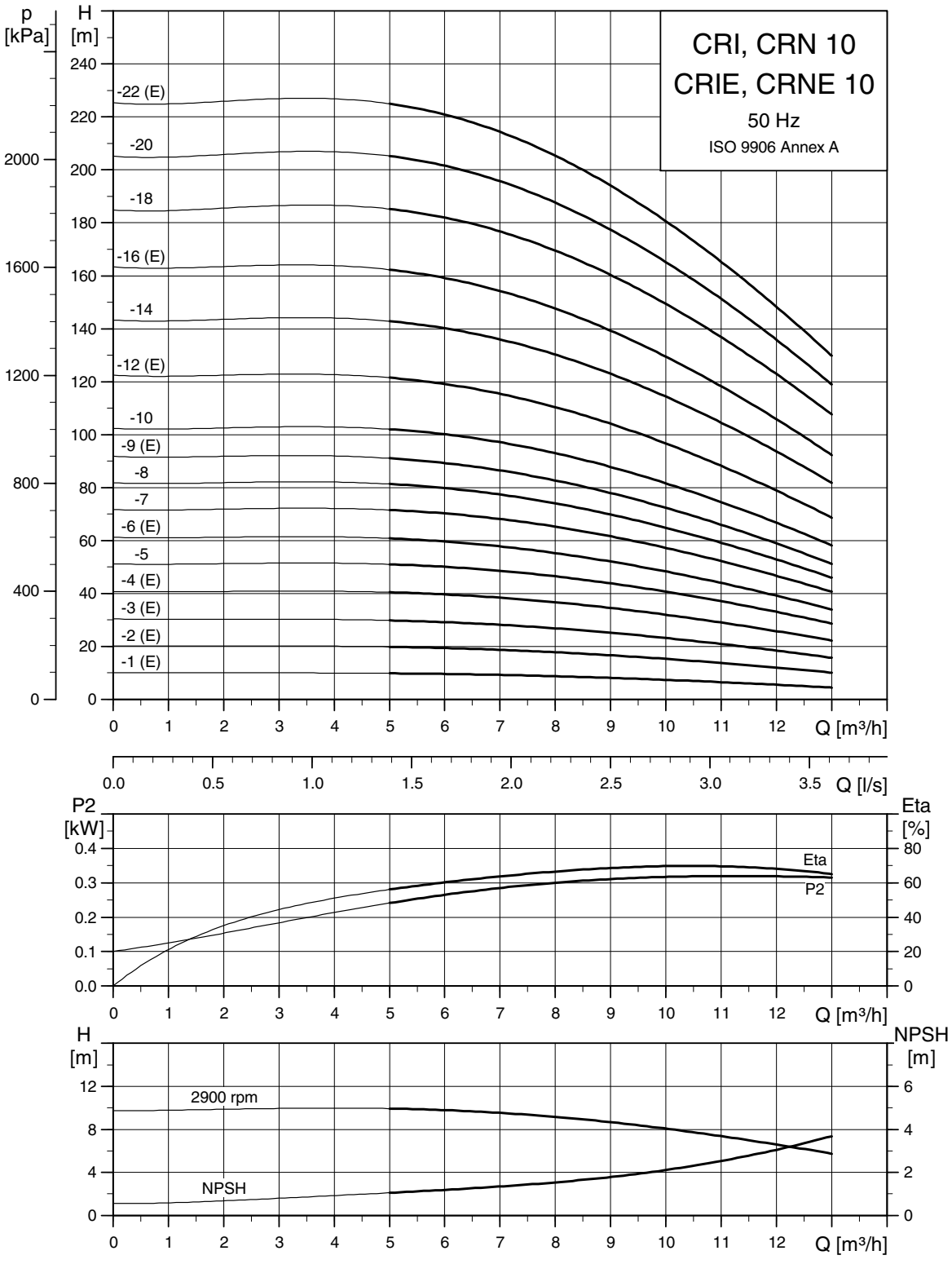
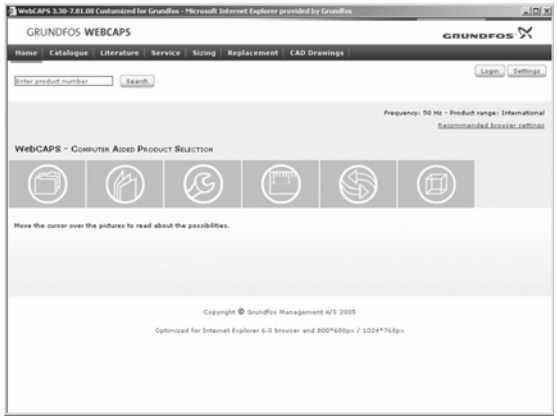


Fig. 24 Performance curves, CR 10-2

9. Further product documentation

WebCAPS

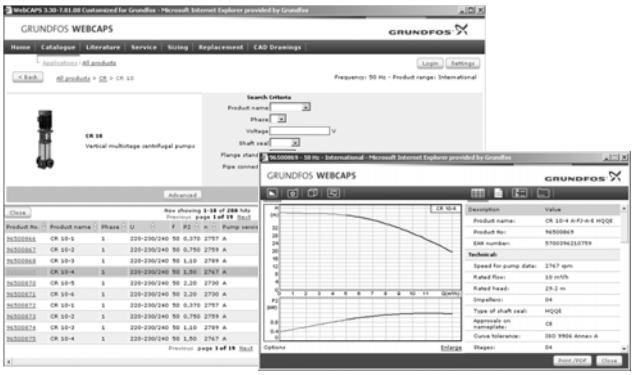


WebCAPS is a **Web**-based **C**omputer **A**ided **P**roduct **S**election program available on www.grundfos.com.

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

In WebCAPS, all information is divided into 6 sections:

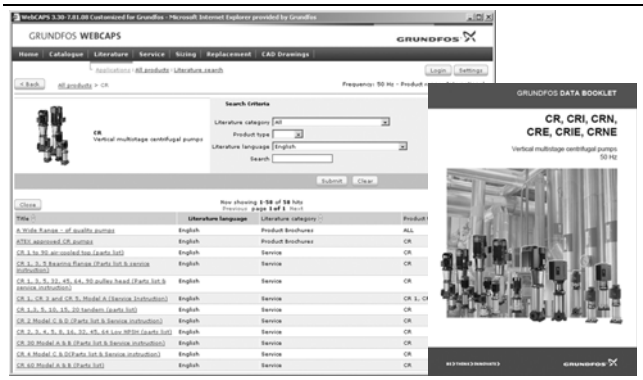
- Catalogue
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.



Catalogue

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

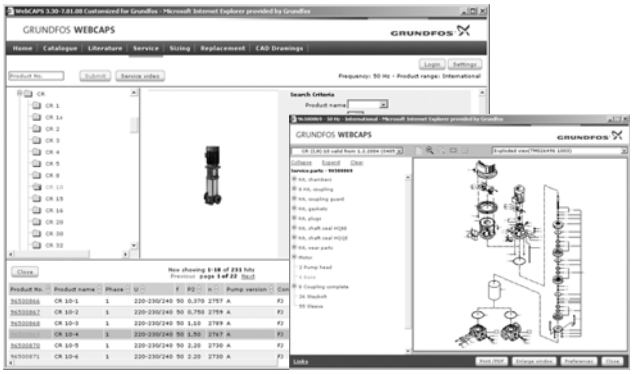
- technical data
- curves (QH, Eta, P1, P2, etc.) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.



Literature

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

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



Service

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

Sizing

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

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

Replacement

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

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

CAD drawings

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

These formats are available in WebCAPS:

2-dimensional drawings:

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

3-dimensional drawings:

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

WinCAPS

Fig. 25 WinCAPS CD-ROM

WinCAPS is a **Win**dows-based **C**omputer **A**ided **P**roduct **S**election 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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