

SOLAR PM2

Circulator pumps

50/60 Hz



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1. General data

Introduction

This data booklet deals with the Grundfos SOLAR PM2 product range:

- SOLAR PM2 xx-45
- SOLAR PM2 xx-65
- SOLAR PM2 xx-85
- SOLAR PM2 xx-105
- SOLAR PM2 xx-145.

Applications

This circulator pump is designed to be integrated in matched-flow solar thermal energy systems with remote control of the speed, corresponding to low-voltage PWM signal from a solar controller.

By controlling the speed of the pump in so-called matched-flow systems, the solar harvesting and the temperature of the system can be optimised.

Additionally, the power consumption of the pump will be reduced considerably.



Fig. 1 Solar thermal system

TM05 2140 4411

Features and benefits

Grundfos SOLAR PM2 pumps offer a number of features and benefits of importance to the customer.

Features

- Remotely speed-controlled high-efficiency pump fitted with electronically commutated motor (ECM) with permanent-magnet rotor and frequency converter, optimised for matched-flow solar thermal systems.
- to be controlled via digital pulse-width modulation (PWM) low-voltage signal
- validated components, second generation of variable-speed ECM solar thermal circulator pumps
- highly reliable, using the same technology as more than 250,000 units installed with success since 2006
- fits into existing systems with the SOLAR PM2 pump, no expanded space requirements, possible use of existing pump housings, electrical compatibility with existing PWM solar controllers and no ambient-temperature constraints (EN 60335)

- cost-optimised and highly available thanks to the use of existing mass production facilities
- energy-optimised due to improved hydraulic efficiency
- suitable for solar media containing glycol
- electrocoated cast-iron housing.

Benefits

- Uses up to 80 % less electrical power than conventional constant-speed pumps
- Uses up to 60 % less electrical power than conventional speed-controlled pumps.

EuP, Ecodesign regulation in brief

The EU has addressed the climate challenge:

In August 2015, the new Energy-using Products (EuP) regulation on glandless circulator pumps integrated in products will take effect. The regulation will set radically new standards for energy efficiency in pumps integrated in boiler, solar and heat pump systems.

The essentials

- Glandless circulator pumps integrated in products shall have an energy efficiency index (EEI) of not more than 0.23, the benchmark level being 0.20.
- Integrated pumps will be measured differently from stand-alone pumps due to the various integrated functions in the many customised hydraulic solutions on the market.
- All circulator pumps integrated in products which generate and/or transfer heat, and all types of media, are included. This means that not only heating systems, but also solar thermal and heat pump systems, will be affected by the EuP Directive.
- Spare pumps for systems sold before August 2015 are allowed until 2020.
- Conformity with EU regulations will be governed through mandatory CE marking.

Grundfos is EuP-ready

Grundfos SOLAR PM2 pumps already meet the new ecodesign requirements described in prEN 16297 Part 3.

Pumped liquids

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles, fibres or mineral oil.

Glycol or other antifreeze media

SOLAR PM2 pumps can be used in circuits filled with glycol-containing or other antifreeze media as solar medium. Depending on the type of glycol, mixture and liquid temperature, the viscosity will increase, compared to water as medium. The viscosity increase will affect the pressure loss in the system as well as the efficiency, performance and load of the pump. This may result in a lower maximum curve due to the pump being controlled by a power-limiting function which protects against overload.

Example

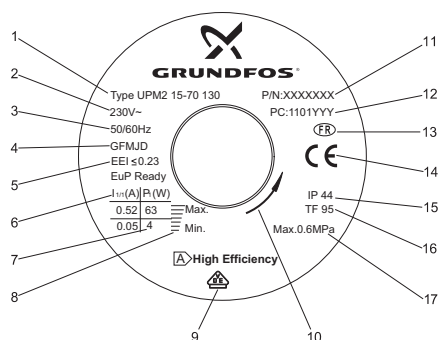
If the water/propylene glycol mixture is 50 %, and the liquid temperature is +2 °C, the viscosity will be 15 cSt. Compared to 100 % water at 60 °C (at the same flow), the maximum head will decrease by 1.0 metre to 1.5 metres.

Identification

Type key

Example	SOLAR PM2 15 - 45	130
Pump range: SOLAR PM2		
Nominal diameter (DN) of suction and discharge ports [mm]		
Maximum head [dm]		
[]: Cast-iron pump housing		
Port-to-port length [mm]		

Nameplate

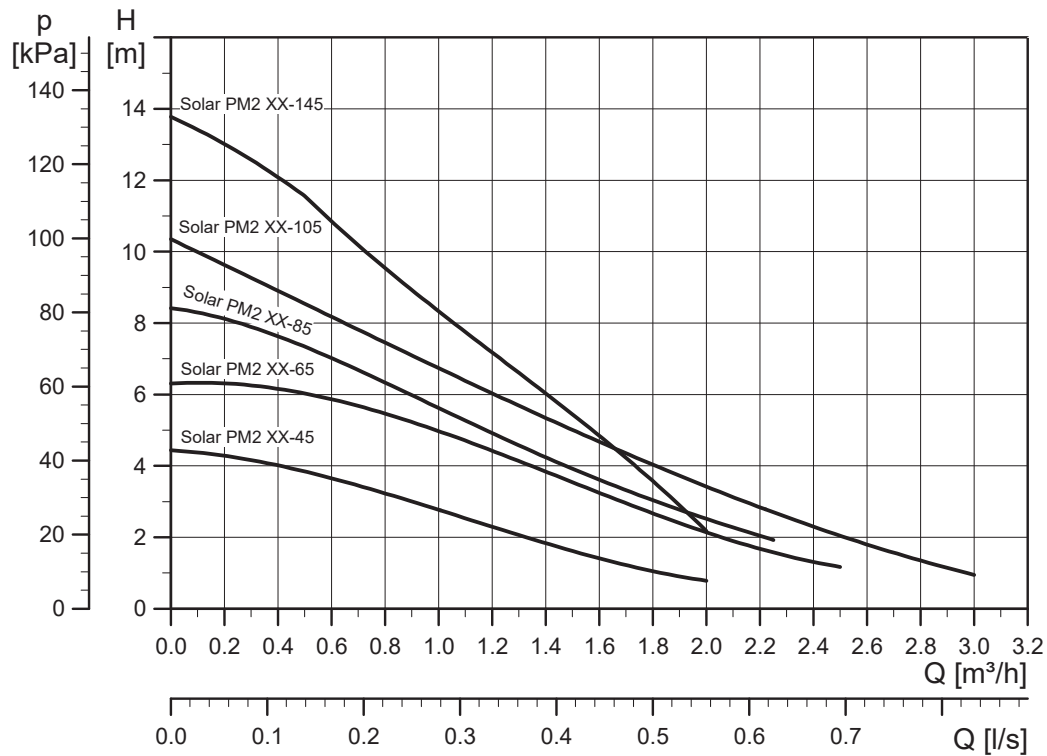


TM04 9721 5010

Fig. 2 Nameplate

Pos.	Description
1	Type designation
2	Voltage [V]
3	Frequency [Hz]
4	CE code
5	Energy index
6	Rated current at maximum and minimum performance [A]
7	Input power P1 at maximum and minimum performance [W]
8	Speed
9	Approvals
10	Direction of rotation
11	Product number
12	Production code (YYWW)
13	Country of origin
14	CE marking
15	Enclosure class
16	Temperature class
17	Maximum system pressure [MPa]

Performance range



TM05 1391 4311

Fig. 3 SOLAR PM2

Product range

Connection	Pump type	Port-to-port length [mm]	Data sheet page
G 1	SOLAR PM2 15-45	130	18
G 1 1/2	SOLAR PM2 25-45	130	19
G 1 1/2	SOLAR PM2 25-45	180	20
G 1	SOLAR PM2 15-65	130	21
G 1 1/2	SOLAR PM2 25-65	130	22
G 1 1/2	SOLAR PM2 25-65	180	23
G 1	SOLAR PM2 15-85	130	24
G 1 1/2	SOLAR PM2 25-85	130	25
G 1 1/2	SOLAR PM2 25-85	180	26
G 1	SOLAR PM2 15-105	130	27
G 1 1/2	SOLAR PM2 25-105	130	28
G 1 1/2	SOLAR PM2 25-105	180	29
G 1	SOLAR PM2 15-145	130	30

2. Control mode and signals

Control principles

The SOLAR PM2 pumps are controlled via a digital low-voltage pulse-width modulation (PWM) signal which means that the speed of rotation depends on the input signal. The speed changes as a function of the input profile.

Control signals

Digital low-voltage PWM signal

The square-wave PWM signal is designed for a 100 to 4000 Hz frequency range.

The PWM signal is used to select the speed (speed command) and as feedback signal. The PWM frequency on the feedback signal is fixed at 75 Hz in the pump.

Duty cycle

$$d \% = 100 \times t/T$$

Example

$$T = 2 \text{ ms (500 Hz)}$$

$$t = 0.6 \text{ ms}$$

$$d \% = 100 \times 0.6 / 2 = 30 \%$$

$$U_{iH} = 4\text{-}24 \text{ V}$$

$$U_{iL} = < 1 \text{ V}$$

$$I_{iH} = < 10 \text{ mA}$$

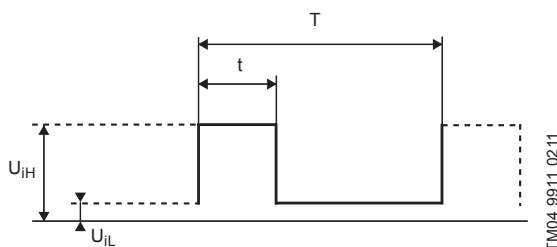


Fig. 4 PWM signal

Abbreviation	Description
T	Period of time [sec.]
d	Duty cycle (t/T)
U_{iH}	High-level input voltage
U_{iL}	Low-level input voltage
I_{iH}	High-level input current

Interface

The SOLAR PM2 interface consists of an electronic part connecting the external control signal to the pump. The interface translates the external signal into a signal type that the microprocessor can understand.

In addition, the interface ensures that the user cannot get into contact with dangerous voltage if touching the signal wires when 230 V is connected to the pump.

Note: "Signal ref." is a signal reference with no connection to protective earth.

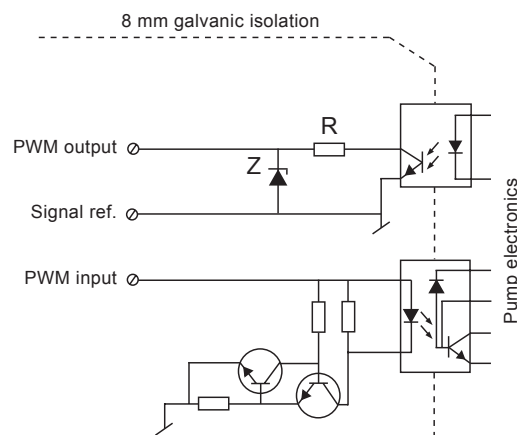
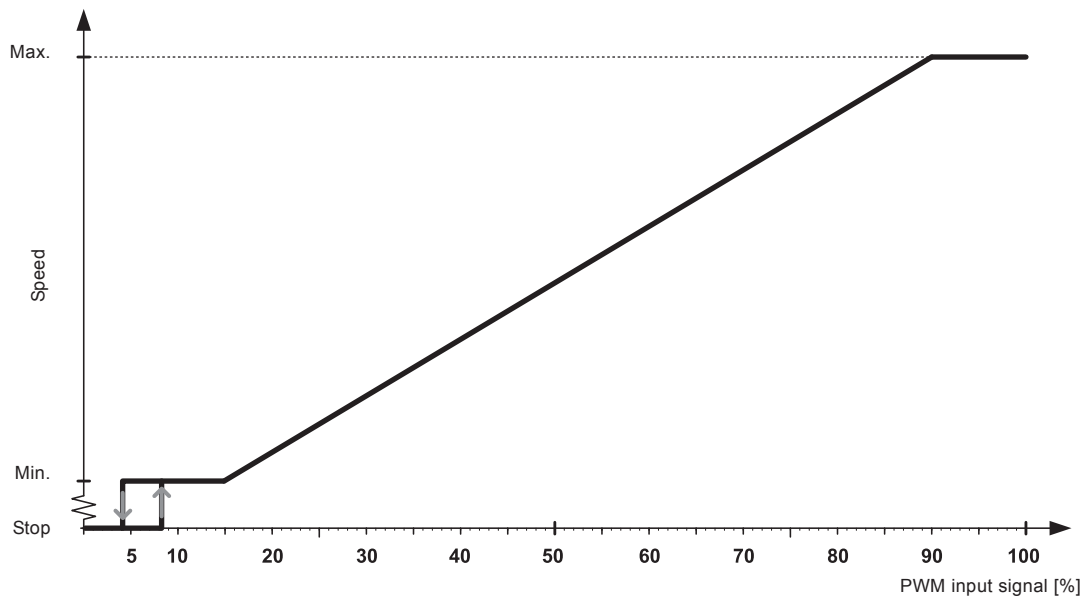


Fig. 5 Schematic drawing, interface

PWM input signal (solar profile)

At low PWM signal percentages (duty cycles), a hysteresis prevents the pump from starting and stopping if the input signal fluctuates around the shifting point.

Without PWM signal percentages, the pump will stop for safety reasons. If a signal is missing, for example due to a cable breakage, the pump will stop to avoid overheating of the solar thermal system.



TM05 1575 3211

Fig. 6 PWM input profile

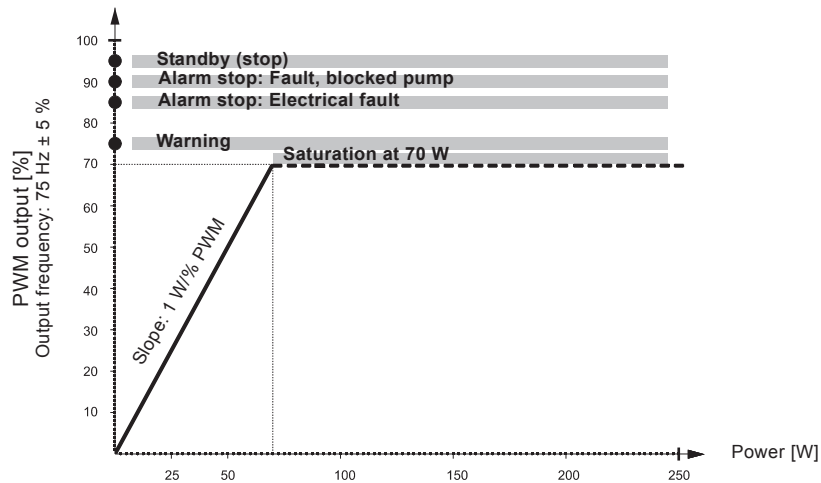
PWM input signal [%]	Pump status
< 6	Standby (stop).
6-8	A hysteresis prevents the pump from starting and stopping if the input signal fluctuates around the shifting point.
9-15	The pump runs at minimum speed.
16-90	The pump speed increases linearly from minimum to maximum rpm.
91-100	The pump runs at maximum speed.

PWM feedback signal

A PWM feedback signal provides information about the current performance of the pump, such as current power consumption or various alarm or warning modes. See fig. 7 or 8.

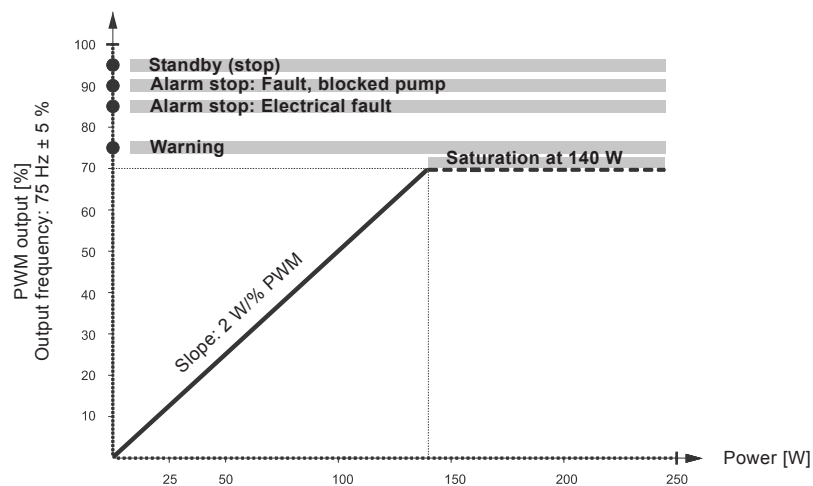
Alarms

Alarm output signals are available. Some PWM output signals are dedicated to alarm information. If the supply voltage is measured to a value below 195 V, the output signal is set to 75 %. If, at the same time, the rotor is locked due to deposits in the hydraulics, the output signal is set to 90 %, as this alarm is given a higher priority.



TM05 0006 0411

Fig. 7 PWM feedback signal, SOLAR PM2 up to 10.5 metres



TM05 0021 0411

Fig. 8 PWM feedback signal, SOLAR PM2 15-145 130

PWM output signal [%]	Pump status	Priority and description
95	Standby (stop)	1 The pump is intentionally stopped.
90	Alarm stop: Fault, blocked pump	2 The pump is not running. The pump will restart when the fault has disappeared.
85	Alarm stop: Electrical fault	3 The pump is not running. The pump will restart when the fault has disappeared. Example: undervoltage.
75	Warning	4 The pump is running. In this case, a fault has been detected, but the fault is not crucial, and the pump is still capable of running.
0-70	Up to SOLAR PM2 xx-105: 0-70 W (slope 1 W/% PWM)	5
	SOLAR PM2 15-145: 0-140 W (slope 2 W/% PWM)	

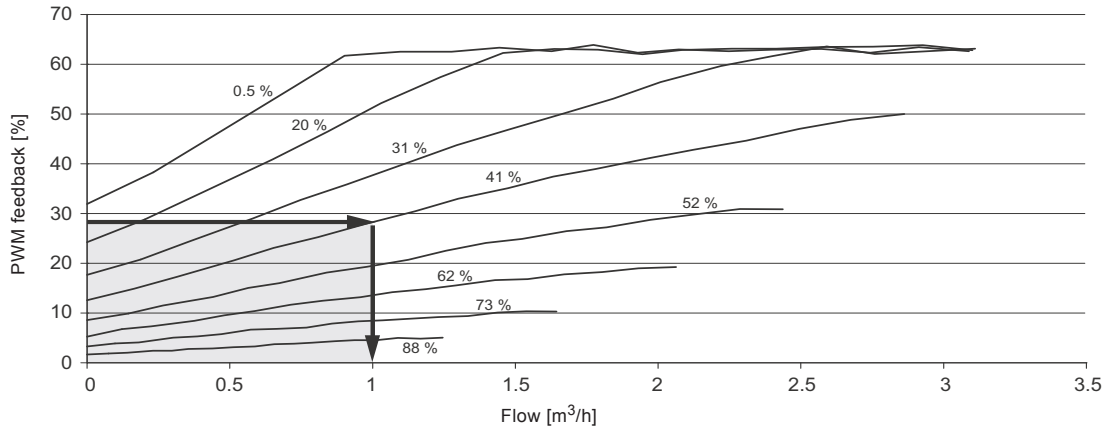
How to use the signal

The signal can be used to measure the power consumption of the pump. Instead of measuring the current via the system control, the signal from the pump can be used. The signal is also suitable for finding the actual duty point of the system, if comparing speed setpoint and feedback. See fig. 9.

Example

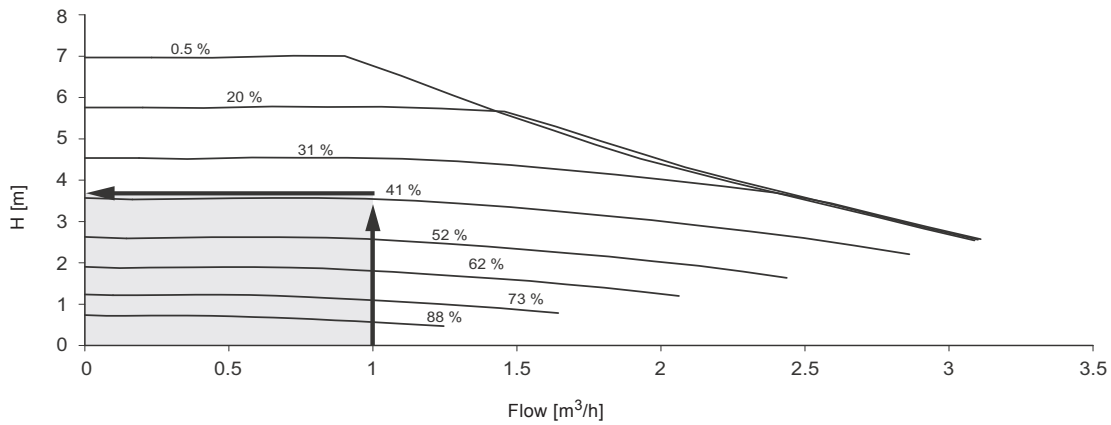
A solar system gives a setpoint to the SOLAR PM2 pump of 41 % PWM signal. See fig. 9.

If, at the same time, the control system measures 28 % PWM signal on the feedback signal, the flow is approx. 1 m³/h. See fig. 9. The corresponding head is 3.5 m. See fig. 10.



TM04 9987 0111

Fig. 9 SOLAR PM2, feedback signal



TM05 0026 0111

Fig. 10 SOLAR PM2, QH curves

Data

Maximum rating	Symbol	Value
PWM frequency input		
High-speed optocoupler	f	100-4000 Hz
Low-speed optocoupler		150-800 Hz
Rated input voltage		
High level	U_{iH}	4-24 V
Low level	U_{iL}	< 1 V
High-level input current	I_{iH}	< 10 mA
Input duty cycle	PWM	0-100 %
PWM frequency output, open collector	f	75 ± 5 %
Accuracy of output signal regarding power consumption	-	± 2 % of PWM signal
Accuracy of output signal regarding flow		
< 1 m ³ /h		± 0.1 m ³ /h
1 to 2.5 m ³ /h		± 0.2 m ³ /h
Note: A PWM output signal below 5 % is too inaccurate for the calculation of the flow.		
Output duty cycle	PWM	0-100 %
Collector emitter breakdown voltage on output transistor	U_c	< 70 V
Collector current on output transistor	I_c	< 50 mA
Maximum power dissipation on output resistor	P_R	125 mW
Zener diode working voltage	U_z	36 V
Maximum power dissipation in Zener diode	P_z	300 mW

3. Construction

Exploded view

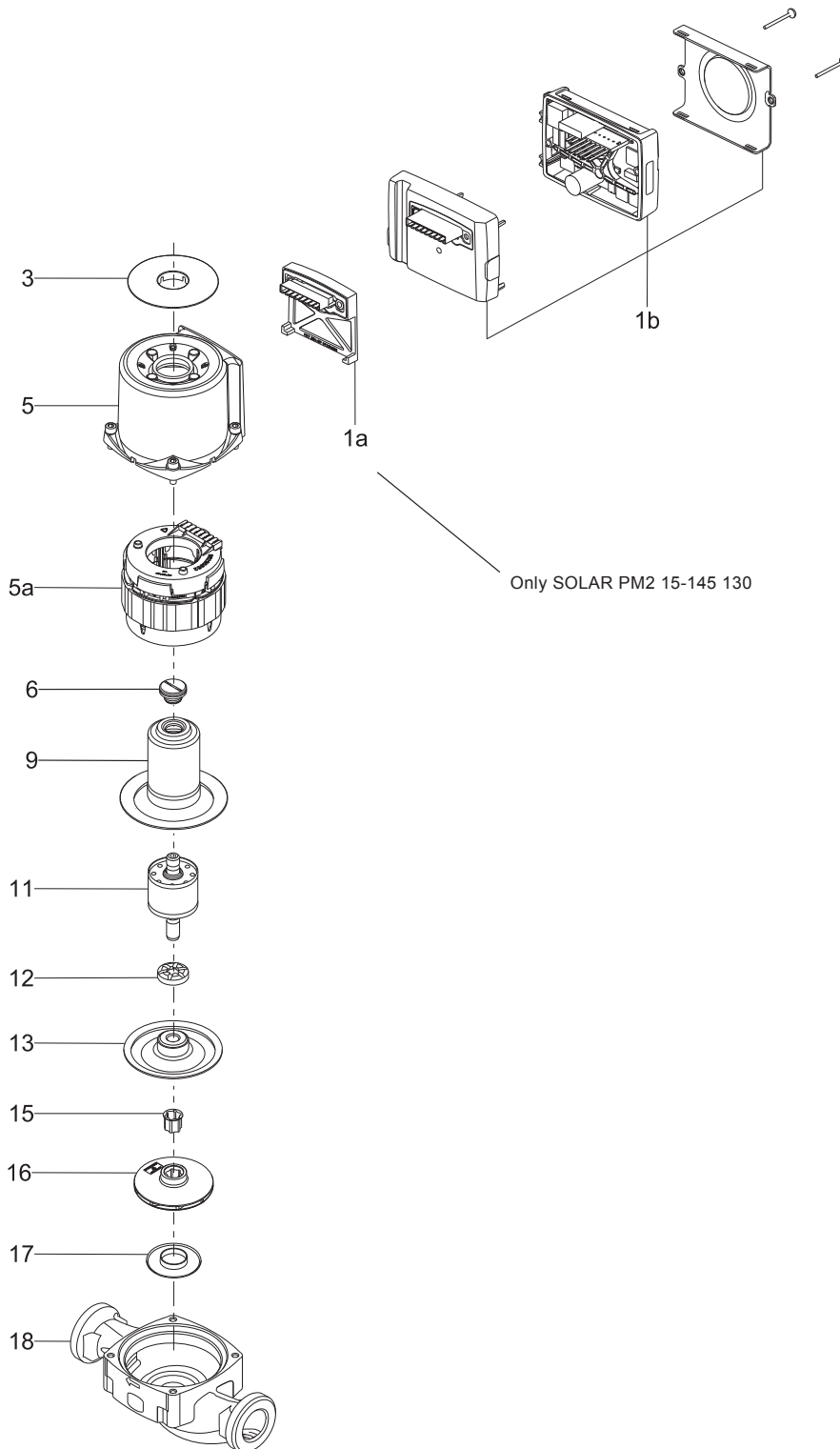
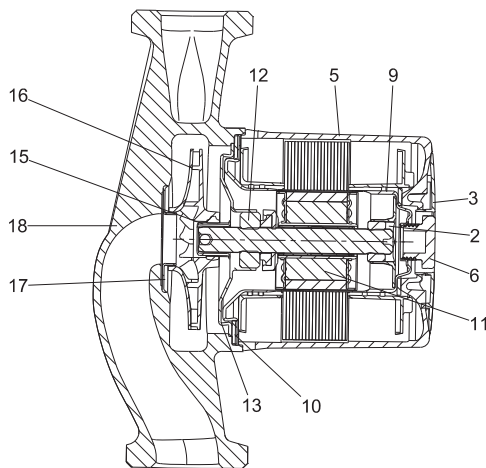


Fig. 11 SOLAR PM2

TM05 0418 1011

Sectional drawing



TM04 9747 5110

Fig. 12 SOLAR PM2

Material specification

See fig. 11.

Pos.	Component	Material	EN/DIN	AISI/ ASTM
1a	Spacer (only SOLAR PM2 15-145 130)	Composite		
1b	Control box and cooling cover	Composite		
2	Radial bearing	Ceramics		
3	Nameplate	Composite, PA 66		
5	Stator housing	Aluminium, ALSi10Cu ₂		
5a	Stator	Copper wire		
6	Air-venting/ de-blocking screw	Brass, nickelled, Ms58	2.0401.30	
9	Rotor can	Stainless steel	1.4301/ 1.4521	304
10	Gasket	EPDM rubber		
11	Shaft	Ceramics		
	Rotor cladding	Stainless steel	1.4301/ 1.4521	304
	Thrust bearing	Carbon		
12	Thrust bearing retainer	EPDM rubber		
13	Bearing plate	Stainless steel	1.4301	304
15	Split cone	Stainless steel	1.4301	304
16	Impeller	Composite/ PES 30 % GF or PP 30 % GF for 15-145		
17	Neck ring	Stainless steel	1.4301	304
18	Pump housing	Cast iron Stainless steel (for 15-145)	EN-GJL-150 1.4308 (for 15-145)	CF-8

Description of components

The Grundfos SOLAR PM2 pumps are of the canned-rotor type, i.e. pump and motor form an integral unit without shaft seal and with only one gasket for sealing and four screws for fastening the stator housing to the pump housing. The bearings are lubricated by the pumped liquid. The focus has been on using eco-friendly materials as well as on limiting the number of materials.

Motor

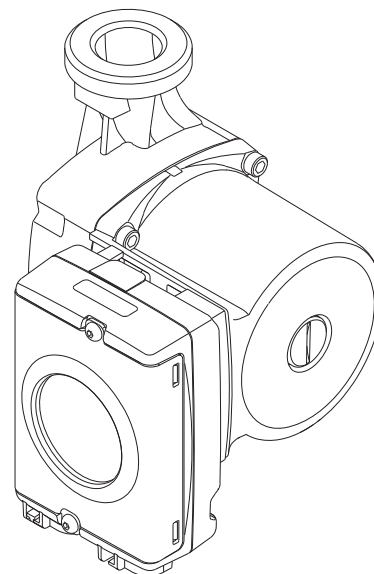
The efficiency of the 4-pole, synchronous, electronically commutated permanent-magnet (ECM/PM) motor type is considerably higher compared to a conventional asynchronous squirrel-cage motor. The PM motor is designed according to the canned-rotor principle. The design of the mechanical motor components has mainly focused on these features:

- robustness achieved through efficient protection of loaded components
- simple design meaning as few components as possible, each with several functions
- high efficiency due to permanent magnets and low-friction bearings.

The motor is cooled by the pumped liquid which reduces the sound pressure level to a minimum. Being software-protected, the pump requires no further motor protection. The motor/pump and control box have been tested according to VDE 0700 and meet the requirements of EN 61800-3 concerning electromagnetic compatibility.

Stator housing

The die-cast stator housing with four fixing holes enables easy change of control box and nameplate positions by removing the four screws holding the stator housing and turning the housing to the desired position. See fig. 13.

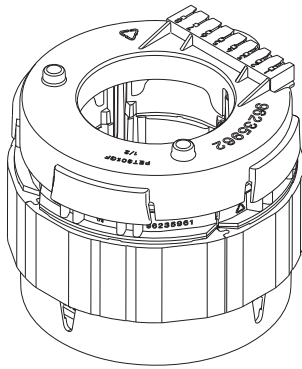


TM 05 0417 1011

Fig. 13 Stator housing

Stator and windings

The SOLAR PM2 has a two-phase inserted stator similar to the UP Series 100 circulator pumps.

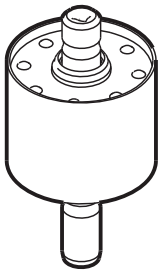


TM05 0415 1011

Fig. 14 Stator

Shaft with rotor

The shaft is made of ceramics. The rotor core is made of iron lamination and fitted with permanent magnets. The rotor and shaft are moulded together. The rotor is fitted to the shaft with a pipe and an elastic sleeve. The rotor is encapsulated in a thin stainless-steel cladding welded to the end covers and shaft pipe. To avoid precipitation of calcium in the radial bearings, the shaft has been plunge-ground at the journals. It has a through-going hole to ensure good lubrication and cooling of the upper bearing. Air in the rotor chamber escapes into the system through the through-going holes of the shaft.

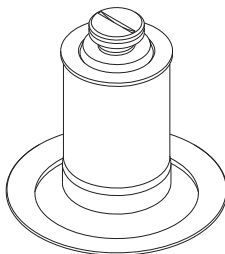


TM03 1803 3205

Fig. 15 Shaft with rotor

Rotor can

The drawn stainless-steel rotor holds the ground and honed upper radial bearing at the top. The rotor can has an air-venting/de-blocking screw.

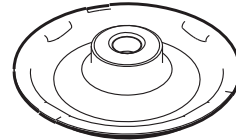


TM05 0416 1011

Fig. 16 Rotor can

Bearing plate

The bearing plate is made of stainless steel. The ground and honed inner radial bearing is pressed into the bearing plate. Thanks to the relatively large bearing plate surface, the motor heat is effectively carried away by the pumped liquid. The four tiny laser holes of the bearing plate ensure optimum venting and minimise the gradual replacement of rotor liquid with the pumped liquid.



TM03 1793 3105

Fig. 17 Bearing plate

Thrust bearing

The thrust bearing is fitted to the shaft in a flexible suspension. In combination with the bearing plate, the thrust bearing prevents forces from being transmitted axially to rotor and rotor can.

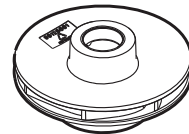


TM03 1792 3105

Fig. 18 Thrust bearing

Impeller

The composite impeller is of the radial type with curved blades. See fig. 19. The impeller is secured to the shaft with a split cone. On the SOLAR PM2 15-145 130, the impeller is pressed on the shaft. See fig. 11, pos. 15. The impeller, shaft with rotor and bearing plate are assembled in one unit to eliminate possible misalignment in the bearings.

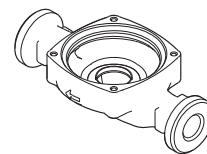


TM03 1794 3105

Fig. 19 Impeller

Pump housing

As standard, the pump housing is available in electrocoated cast iron with threaded suction and discharge ports. The pump housing is of the in-line type. The stainless-steel neck ring is pressed into the pump housing to minimise the amount of liquid running from the discharge side of the impeller to the suction side.

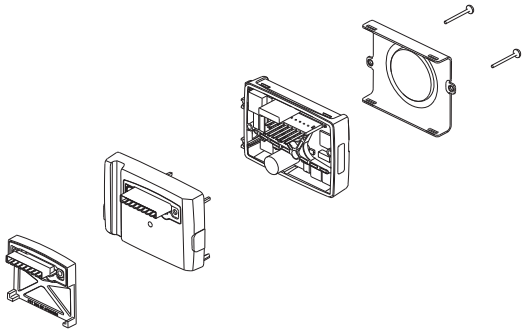


TM03 9732 4307

Fig. 20 Pump housing

Control box

The SOLAR PM2 control box is made of black composite material with a cooling cover made of an aluminium heat sink. It contains the PCBs for internal power supply and communication.



TM05 0412 1011

Fig. 21 Control box

4. Installation

Mechanical installation

Mounting dimensions appear from the data sheets. See pages 20 to 35.

Arrows on the pump housing indicate the liquid flow direction through the pump. The pump is designed to be installed pumping upwards, downwards or horizontally.

Note: The pump must always be installed with horizontal motor shaft within $\pm 5^\circ$.

The pump should be installed in the system in such a way that no major amount of air flowing through the pump or gathering in the pump housing will affect the pump when it is out of operation. If, in addition, a non-return valve is installed in the flow pipe, there is a high risk of dry running as the air cannot pass the valve.

Control box positions

The permissible control box positions are indicated in the specific pump data sheets. See pages 20 to 35.

Changing the control box position

To change the control box position, remove the screws holding the pump head, and turn the control box to the desired position. Replace the screws and tighten securely.

Note: Before any dismantling of the pump, the system must be drained, or the isolating valves on either side of the pump must be closed.

Insulation

When the pump is to be insulated, the control box (especially the cooling cover) must not be covered in order to allow cooling by the surrounding air. If the pump is installed in a cabinet or fitted with insulation shells, the inside air temperature has to be evaluated. If constant ambient air temperatures higher than 55°C are to be expected, please contact our Grundfos HVAC OEM Division.

Diffusion-tight, cold-water insulation must not cover the pump head. The drain holes located in the stator housing must always be free.

Ambient temperature

Maximum $+55^\circ\text{C}$.

Relative air humidity

Maximum 95 %, non-condensing environment.

Storage temperature

Maximum $+70^\circ\text{C}$.

Electrical installation

The electrical connection and protection must be carried out in accordance with local regulations.

- The pump requires no external motor protection.
- Check that the supply voltage and frequency correspond to the values stated on the nameplate.

Supply voltage

1 x 230 V - 15 %/+ 10 %, 50/60 Hz.

Reduced supply voltage

The pump will run with reduced performance at voltages down to 160 VAC.

Inrush current

The inrush current is the charge current to the electrolytic capacitor in the power supply to the electronics. The maximum current amplitude depends on the power supply and the complete wiring from the distributor transformer to the pump.

The pump is internally controlled by a small frequency converter running on a DC voltage. Therefore, the 230 VAC supply voltage is rectified to a DC voltage before it reaches the frequency converter. This is done by a rectifier and a capacitor. See fig. 22.

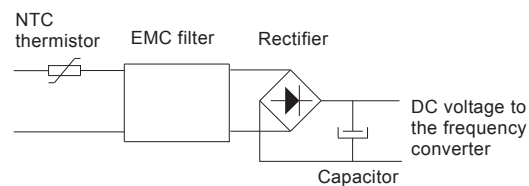


Fig. 22 Rectification of VAC voltage to DC voltage

The load of electronically commutated motors (ECM) behaves as a capacitive load and not as a motor load like in a standard pump.

When the power supply is switched on, the capacitor will behave as a short-circuit (as it is "empty", i.e. it has not been charged). Therefore, the current is only limited by the sum of the resistance in the NTC thermistor and the resistance in the coil of the EMC filter.

If the power supply is switched on when the supply voltage is at its highest level, the inrush current can become up to 7.9 A (see below) for a very short period of time. After this period of time, the current will drop to the rated current.

Note: The inrush current of 7.9 A is measured on a flicker network according to IEC 61000-3-3:1994 + A1 + A2, Annex B.

When the power supply to the pump is switched on and off via an external relay, it must be ensured that the contact material of the relay is able to handle higher inrush currents.

We recommend to use special inrush relays with silver tin oxide (AgSnO) contacts.

Leakage current

The pump mains filter will cause a discharge current to earth during operation.

Leakage current: < 3.5 mA.

High-voltage test

The pump incorporates filter components that are connected to protective earth. Therefore, a standard high-voltage test **cannot** be made without damaging the filters.

Earth leakage circuit breaker (ELCB)

If the pump is connected to an electric installation where an earth leakage circuit breaker (ELCB) is used as additional protection, this circuit breaker must trip when earth fault currents with DC content (pulsating DC) occur (type A).

The earth leakage circuit breaker must be marked with the symbol shown in fig. 23.



TMA0 6789 2511

Fig. 23 Symbol on earth leakage circuit breaker

Power supply

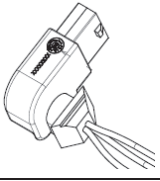
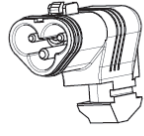
Externally speed-controlled SOLAR PM2 pumps must be connected to a solar controller via a PWM signal.

The pump must not be used with an external speed control which varies the supply voltage, for example phase-cut or pulse-cascade control.

The pump can be connected to the power supply in different ways, depending on the pump model.

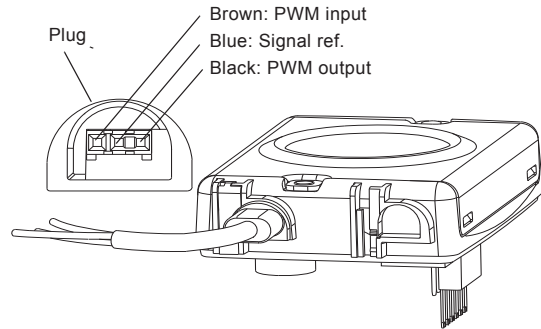
See section 7. *Accessories*, page 31.

Note: All cables and connectors used must comply with EN 60335-1.

Plug connection	Description
	Molex 3-pin plug pointing towards or away from the nameplate TM05 0414 1011
	Volex plug pointing towards or away from the nameplate TM05 0419 1011
Power supply cable	Dimension
H03V2V2-F 3G 0.75 ZW 105 GR	3 x 0.75 mm ²

Signal cable

The SOLAR PM2 are speed-controlled pumps. To enable pump control, a signal cable is required, otherwise the pump will always run at maximum speed. The signal cable has three leads, i.e. signal input, signal output and signal ref. The cable must be connected to the control box by a dubox housing with a FCI terminal block and terminals. It is fixed with a white fixing plug. The optional signal cable can be supplied with the pump as an accessory. See section 7. *Accessories*, page 31. The cable length is customised to specific requirements (maximum 3 metres).



TM05 1109 2111

Fig. 24 Signal cable

5. Start-up

Do not start the pump until the system has been filled with liquid and vented. Being self-venting, the rotor can does not require venting before start-up. Air inside the pump will be transported by the medium into the system during the first minutes after pump start-up.

Furthermore, the required minimum inlet pressure must be available at the pump inlet.

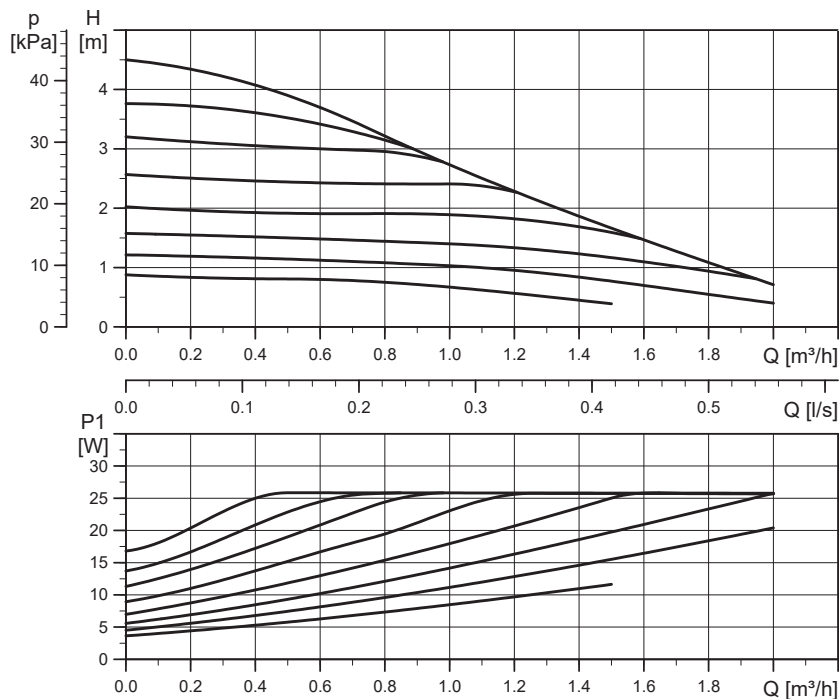
Note: The system must not be vented through the air-venting/de-blocking screw in the front of the pump. However, the screw may be loosened to check if the system has been vented completely.

Attention: When loosening the air-venting/de-blocking screw, be aware of hot, spraying water. It might happen that the pump stops when the air-venting/de-blocking screw is loosened.

The SOLAR PM2 must be connected to a solar controller sending a PWM signal. The pump will not run without a signal. The speed is to be changed via the solar controller.

6. Performance curves and technical data

SOLAR PM2 15-45 130, 1 x 230 V, 50/60 Hz



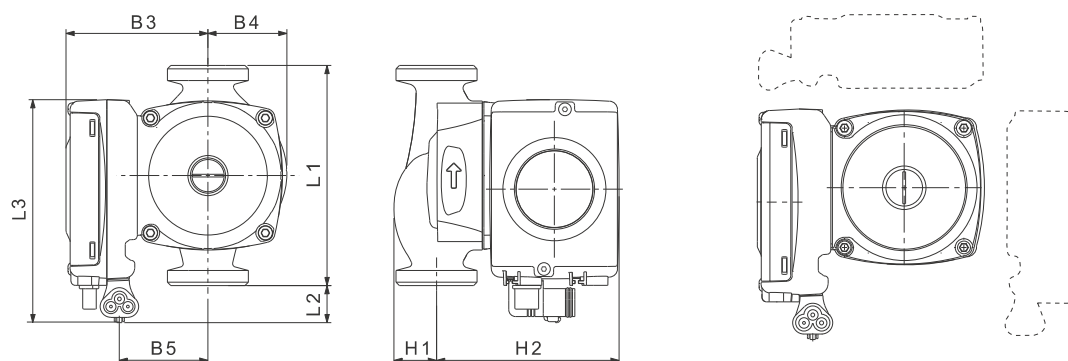
EEL ≤ 0.23

TM05 1400 2711 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3.6	0.04
Max.	26	0.2

Dimensional sketches and position of terminal box



TM04 9212 3810 - TM04 9473 4310

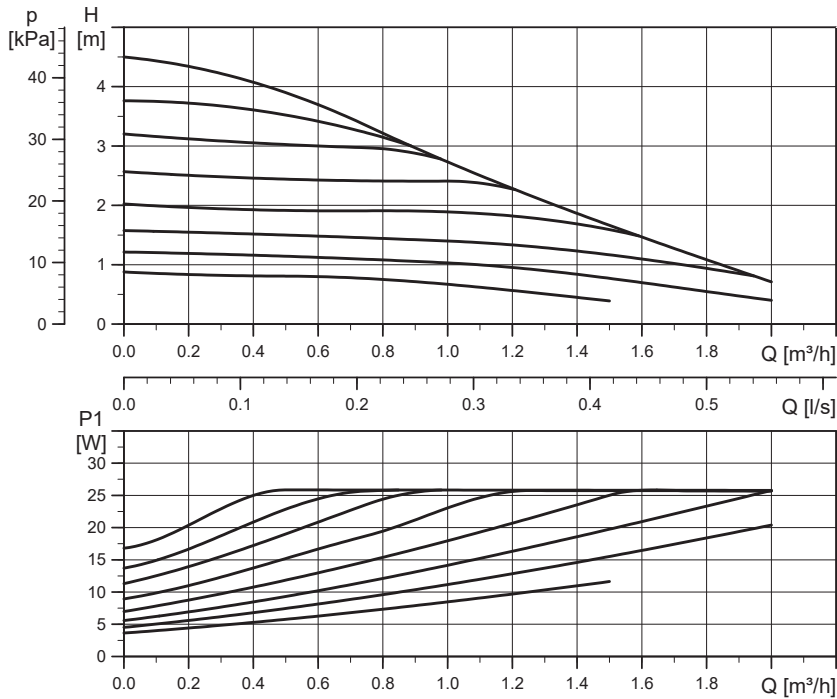
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 15-45 130	130	22	132	84	47	52	25	108	G 1	2.27	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-45 130, 1 x 230 V, 50/60 Hz



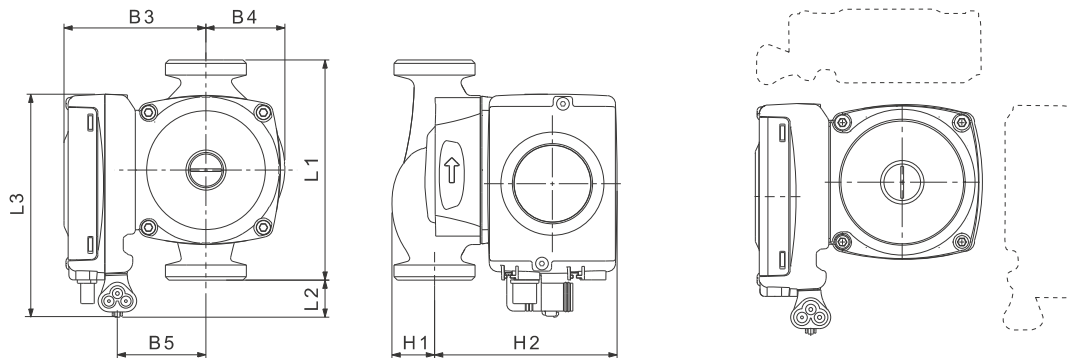
EEI ≤ 0.23

TM05 1174 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{n1} [A]
Min.	3.6	0.04
Max.	26	0.2

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9482 4310

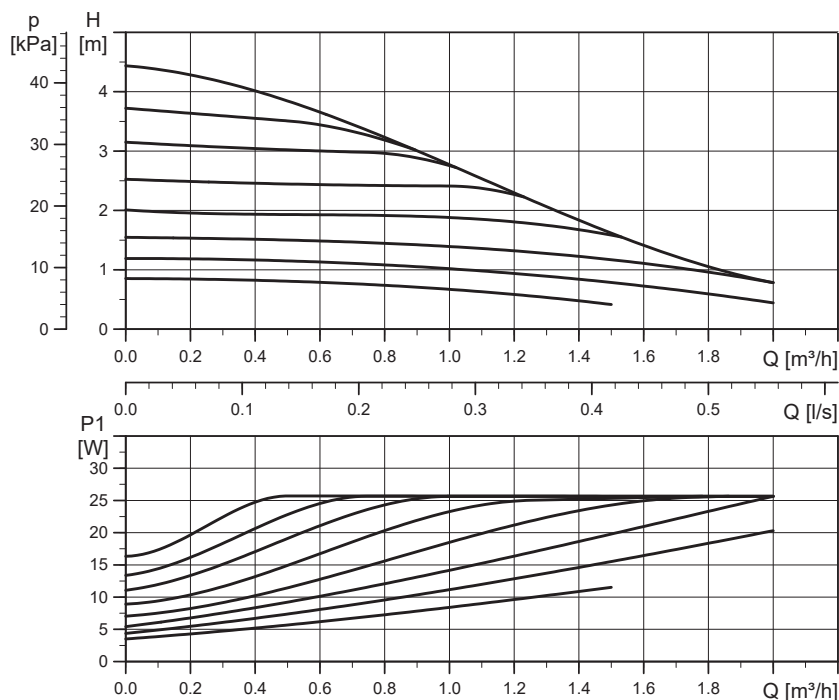
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-45 130	130	22	132	84	47	52	25	108	G 1 1/2	2.50	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-45 180, 1 x 230 V, 50/60 Hz



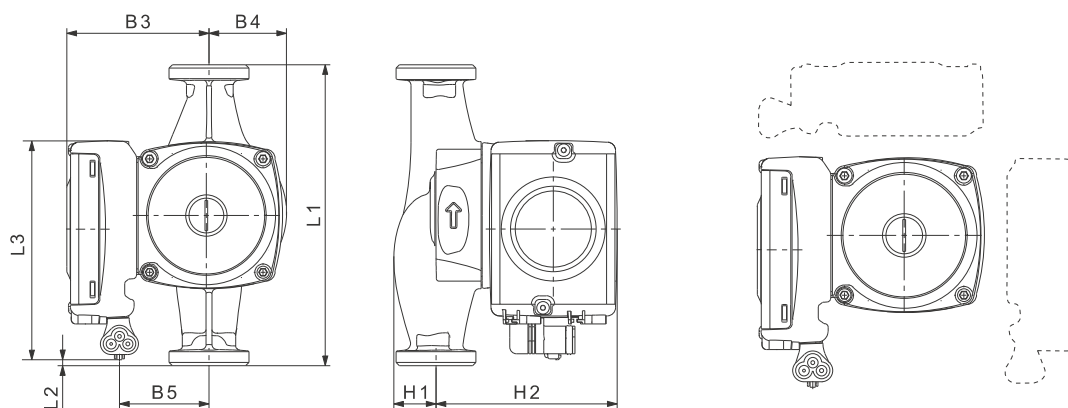
EEI ≤ 0.23

TM05 1175 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	$I_{1/1}$ [A]
Min.	3.5	0.04
Max.	26	0.21

Dimensional sketches and position of terminal box



TM04 9212 3810 - TM04 9482 4310

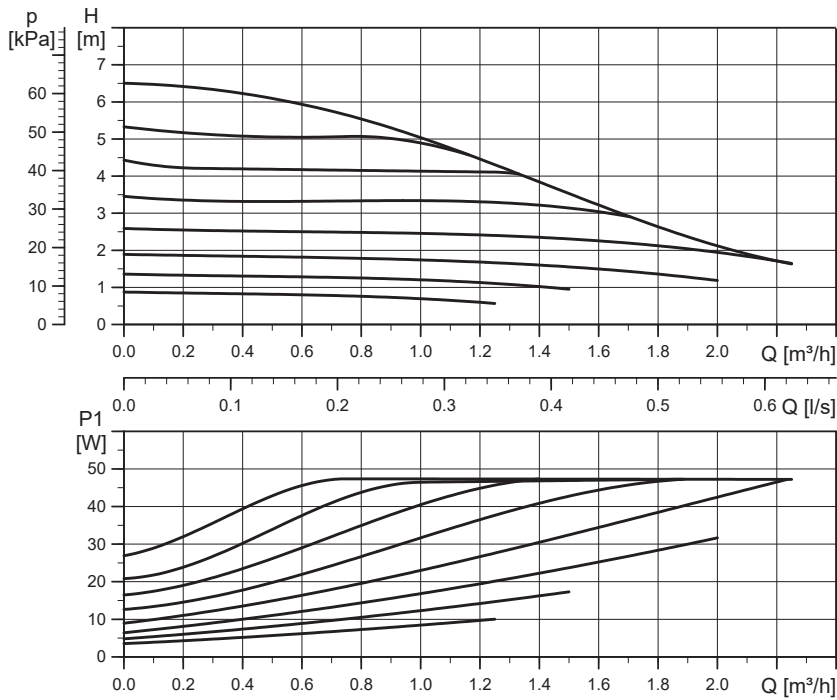
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-45 180	180	3	132	82	46	52	25	108	G 1 1/2	2.63	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 15-65 130, 1 x 230 V, 50/60 Hz



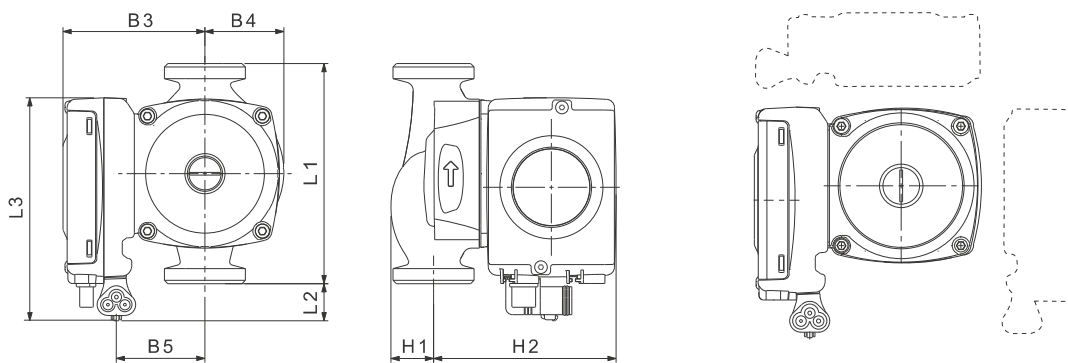
EEl ≤ 0.23

TM05 1176 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3.5	0.04
Max.	48	0.4

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9473 4310

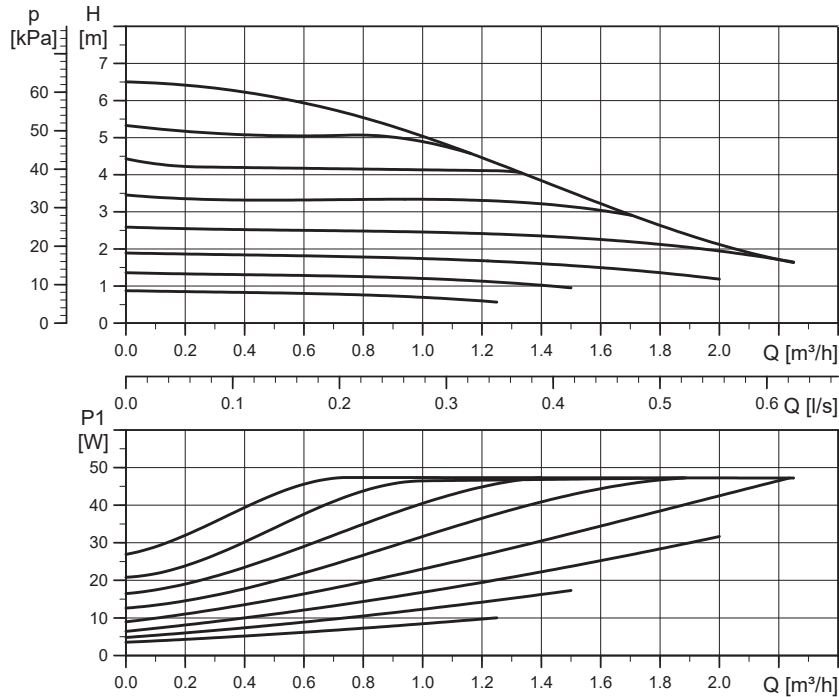
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 15-65 130	130	22	132	84	47	52	25	108	G 1	2.27	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-65 130, 1 x 230 V, 50/60 Hz



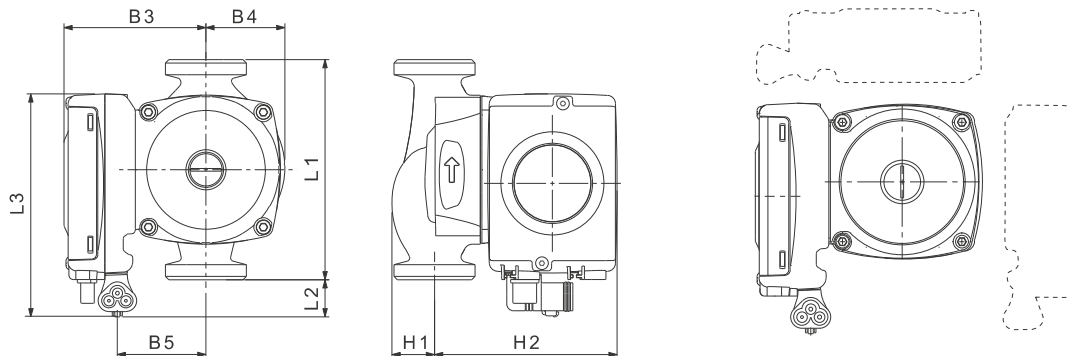
EEI ≤ 0.23

TM05 1176 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3.5	0.04
Max.	48	0.4

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9482 4310

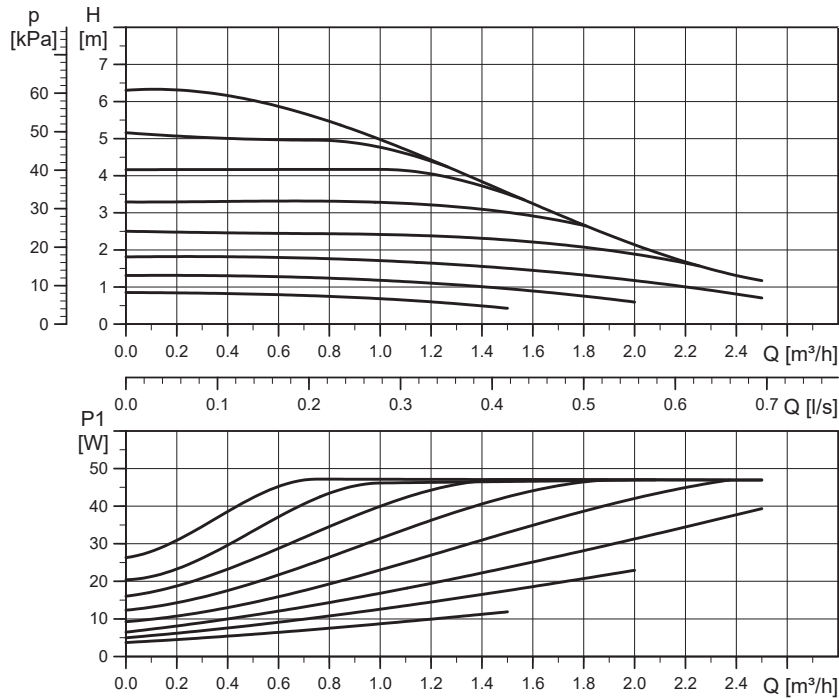
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-65 130	130	22	132	84	47	52	25	108	G 1 1/2	2.50	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-65 180, 1 x 230 V, 50/60 Hz



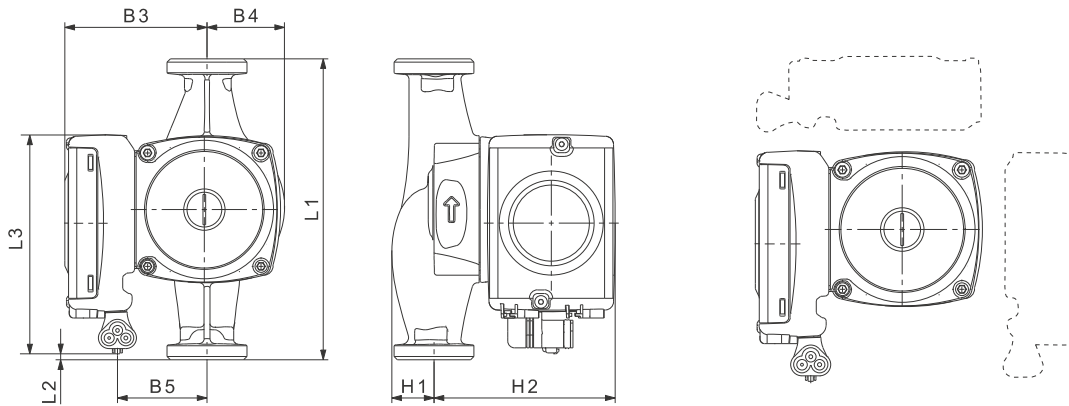
EEL ≤ 0.23

TM05 1177 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3.7	0.04
Max.	47	0.37

Dimensional sketches and position of terminal box



TM04 9212 3810 - TM04 9482 4310

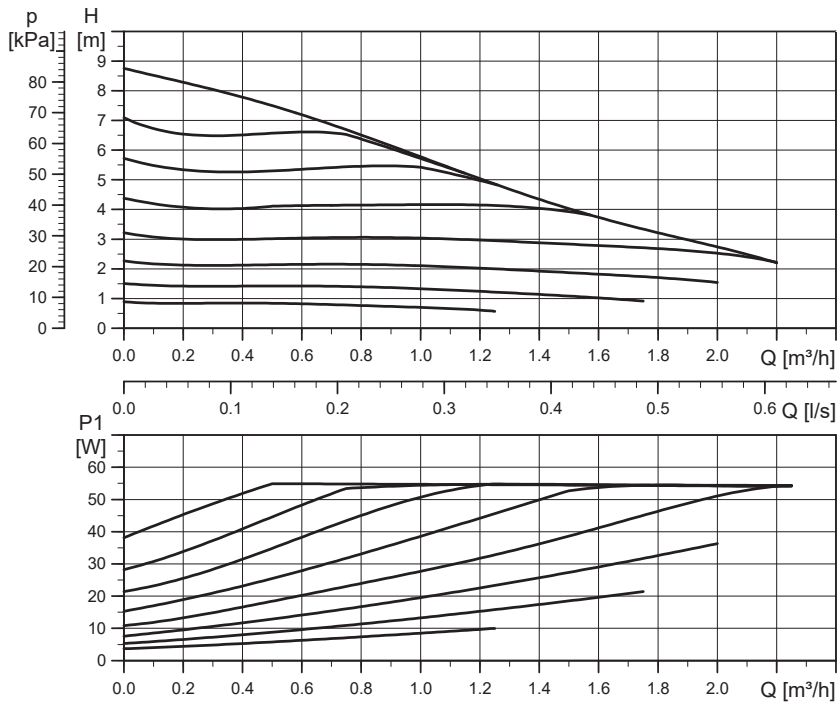
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-65 180	180	3	132	82	46	52	25	108	G 1 1/2	2.63	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 15-85 130, 1 x 230 V, 50/60 Hz



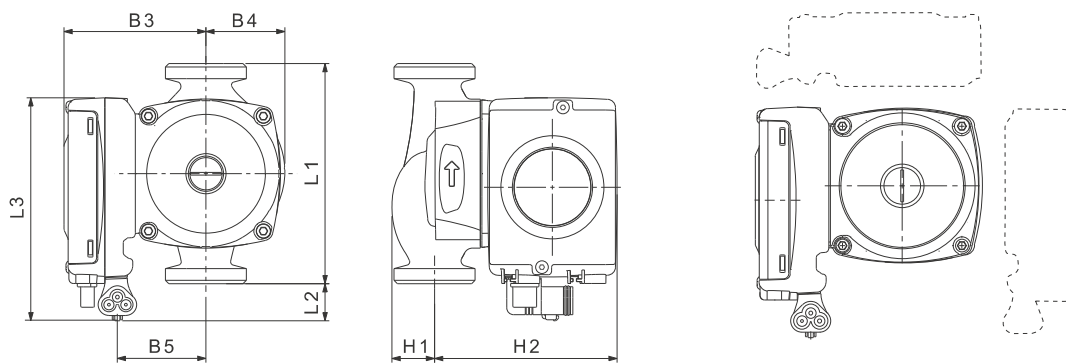
EEI ≤ 0.23

TM05 2092 4311 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3	0.04
Max.	57	0.48

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9473 4310

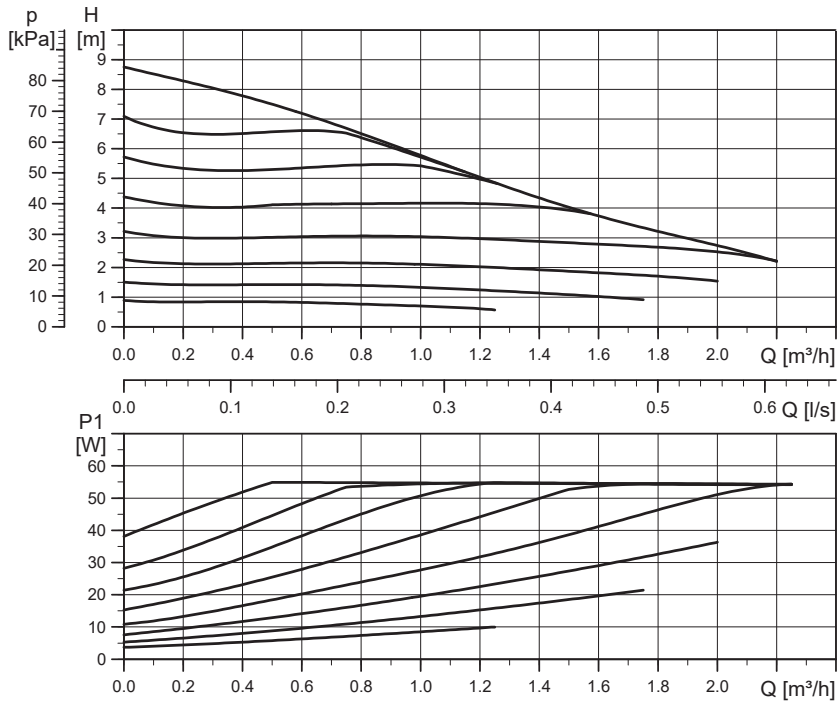
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 15-85 130	130	22	132	84	47	52	25	108	G 1	2.27	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.01 MPa (0.10 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-85 130, 1 x 230 V, 50/60 Hz



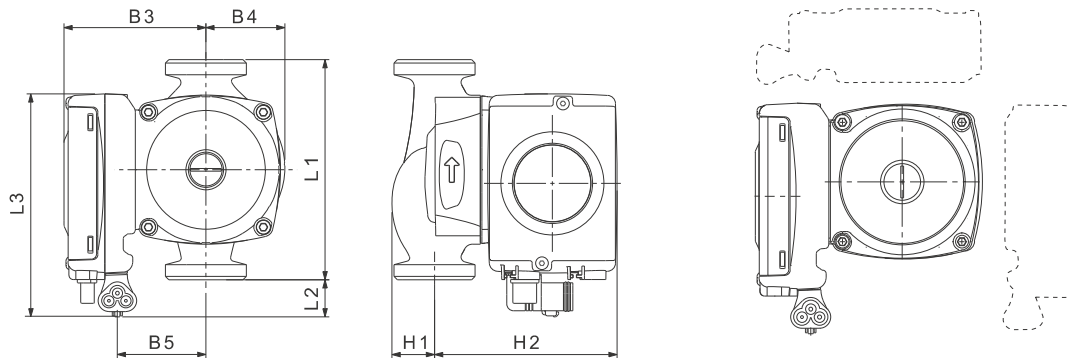
EEI ≤ 0.23

TM05 2093 4311 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3	0.04
Max.	57	0.48

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9482 4310

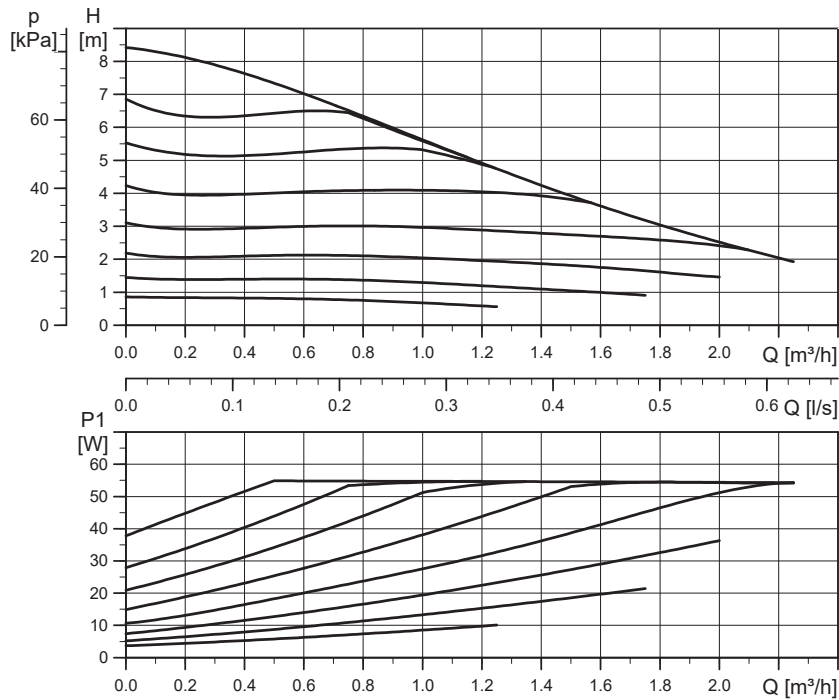
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-85 130	130	22	132	84	47	52	25	108	G 1 1/2	2.48	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-85 180, 1 x 230 V, 50/60 Hz



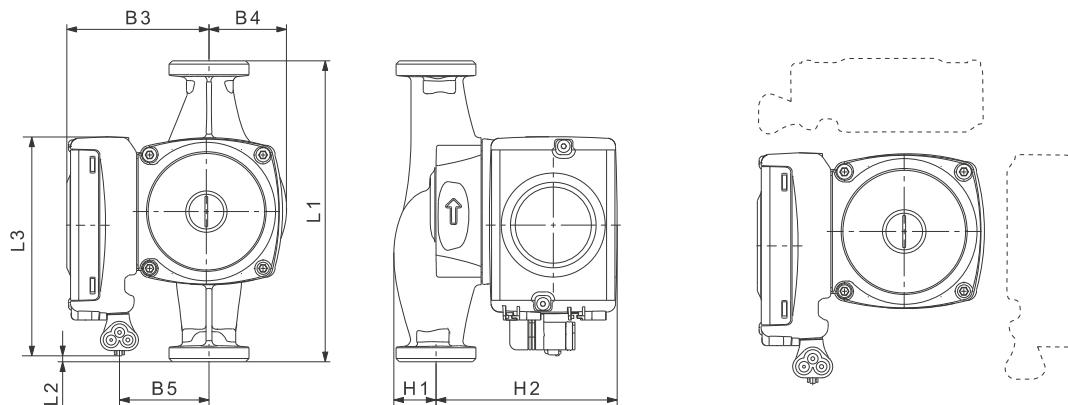
EEl ≤ 0.23

TM05 2093 4311 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3	0.04
Max.	57	0.48

Dimensional sketches and position of terminal box



TM04 9212 3810 - TM04 9482 4310

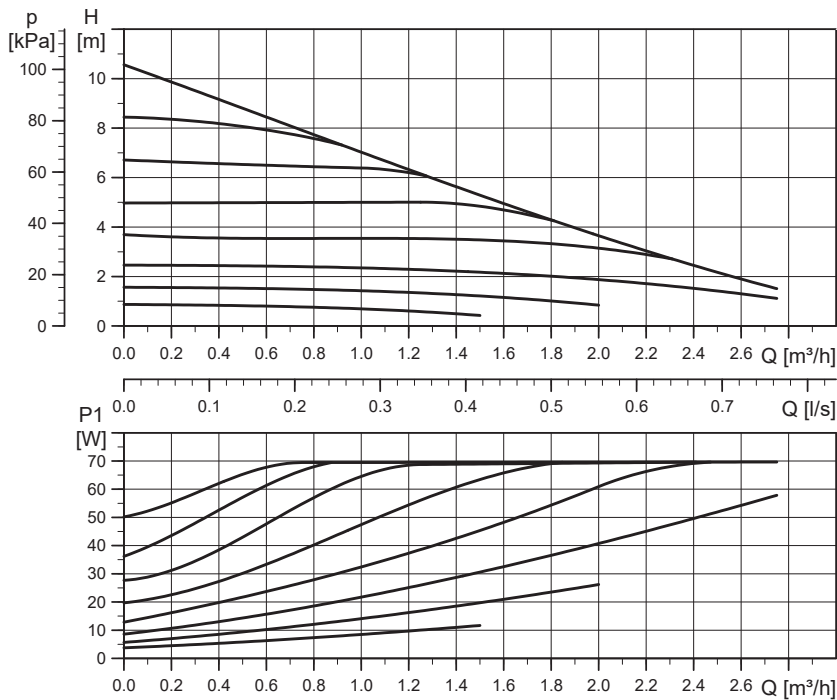
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-85 180	180	3	132	82	46	52	25	108	G 1 1/2	2.61	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 15-105 130, 1 x 230 V, 50/60 Hz



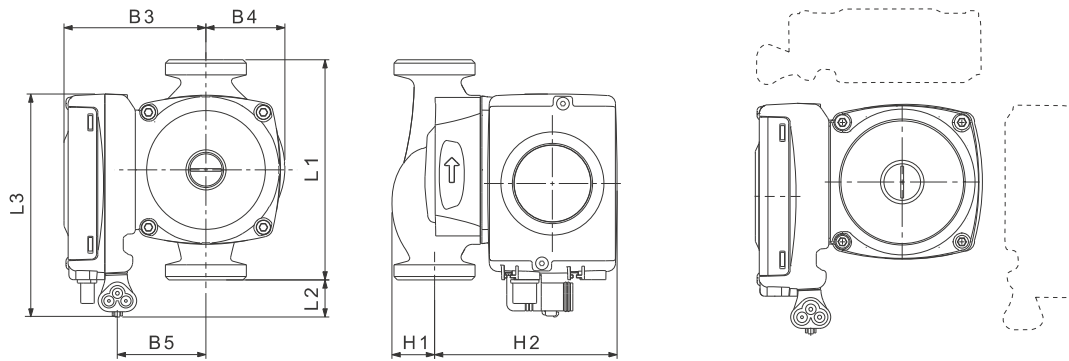
EEI ≤ 0.23

TM05 1178 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3.8	0.05
Max.	70	0.58

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9482 4310

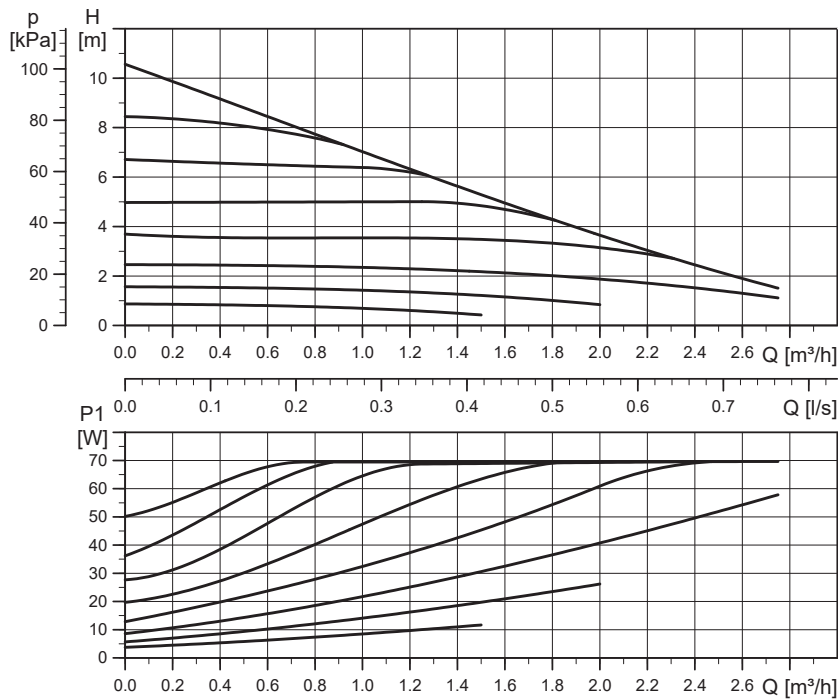
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 15-105 130	130	22	132	84	47	52	25	108	G 1	2.27	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-105 130, 1 x 230 V, 50/60 Hz



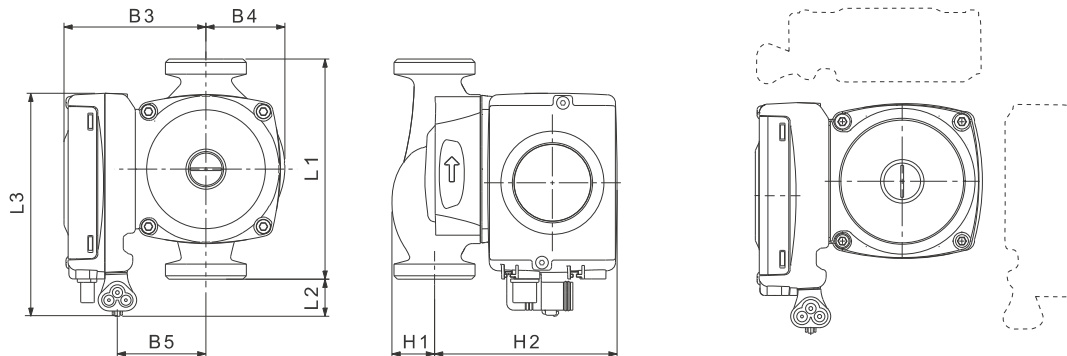
EEI ≤ 0.23

TM05 1178 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3.8	0.05
Max.	70	0.58

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9482 4310

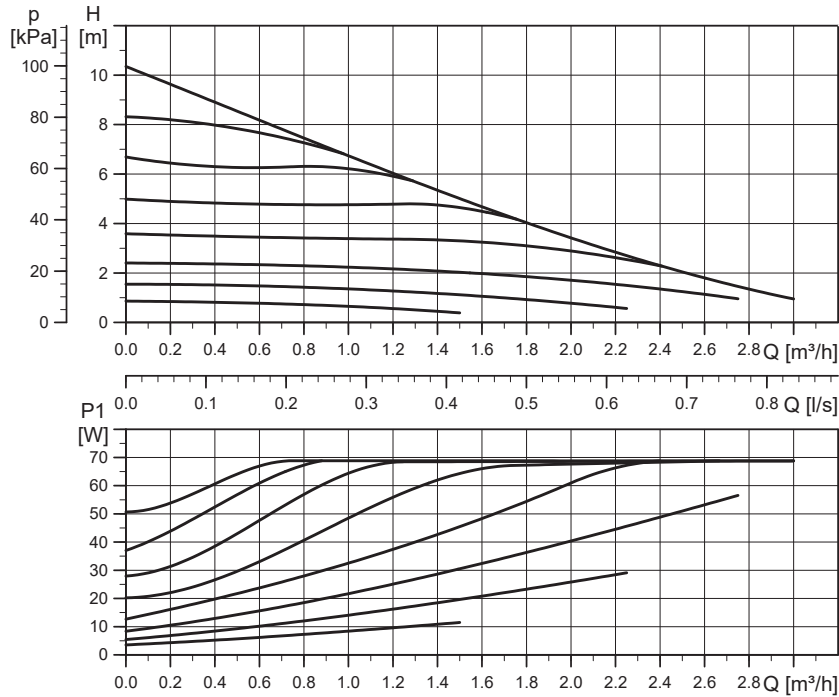
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-105 130	130	22	132	84	47	52	25	108	G 1 1/2	2.50	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 25-105 180, 1 x 230 V, 50/60 Hz



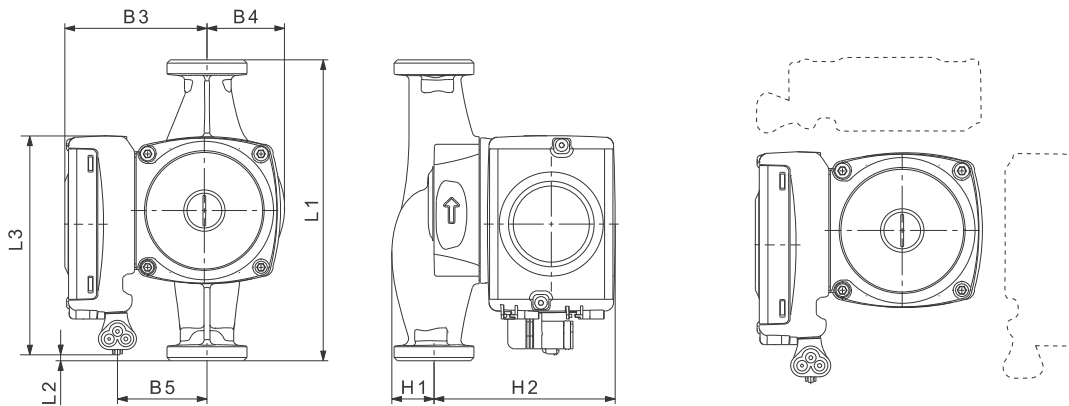
EEl ≤ 0.23

TM05 1179 2411 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	I _{1/1} [A]
Min.	3.5	0.04
Max.	70	0.54

Dimensional sketches and position of terminal box



TM04 9212 3810 - TM04 9482 4310

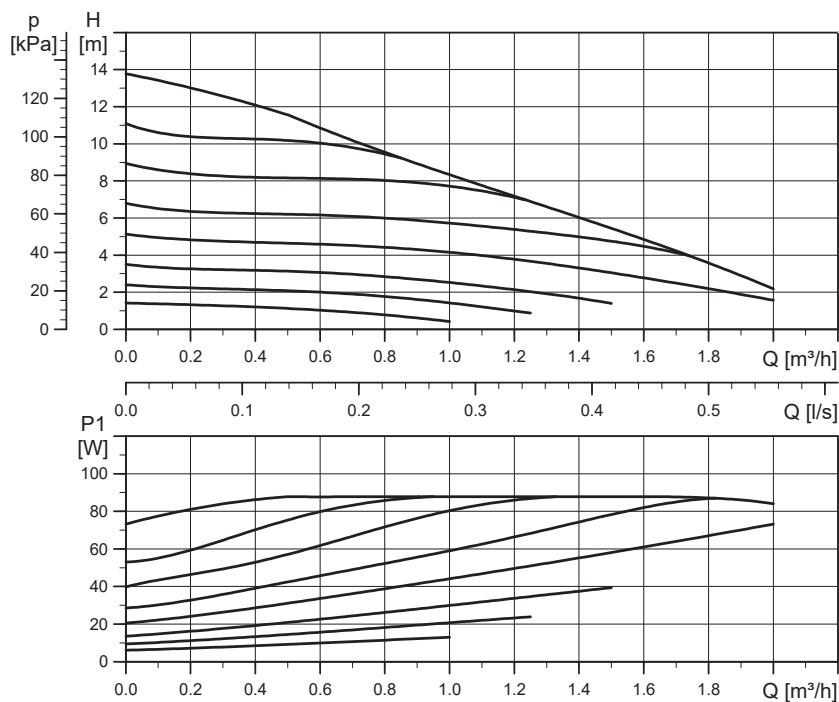
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 25-105 180	180	3	132	82	46	52	25	108	G 1 1/2	2.63	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 July 2011

SOLAR PM2 15-145 130, 1 x 230 V, 50/60 Hz



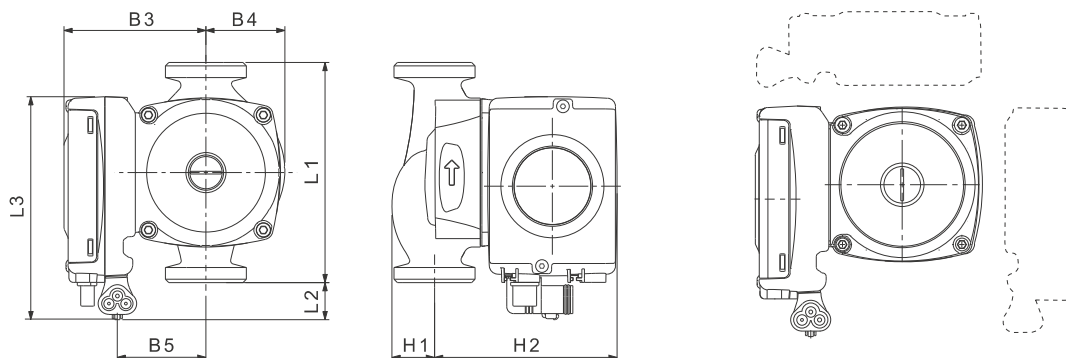
EEl ≤ 0.23

TM05 2092 4311 - TM04 9200 3710

Electrical data, 1 x 230 V, 50 Hz

Speed	P1 [W]	$I_{1/1}$ [A]
Min.	7	0.06
Max.	69	0.68

Dimensional sketches and position of terminal box



TM05 1400 2711 - TM04 9482 4310

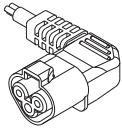
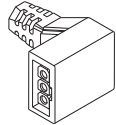
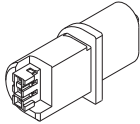
Pump type	Dimensions [mm]								Connection	Net weight [kg]	Quantity per pallet
	L1	L2	L3	B3	B4	B5	H1	H2			
SOLAR PM2 15-145 130	130	22	132	94	54	62	23	107	G 1	2.35	160

Technical data

System pressure:	Max. 1.0 MPa (10 bar)	Enclosure class:	IPX4D
Minimum inlet pressure:	0.05 MPa (0.5 bar) at 95 °C liquid temperature	Insulation class:	H
Liquid temperature:	+2 °C to +95 °C (TF 95)	Equipment class:	I
Motor protection:	Overload protection	Approval and marking:	VDE, CE

Revision date: 1 June 2011

7. Accessories

Product	Description	Product number
Power supply plug with cable		
	TM05 1102 2111 Volex power supply cable, 2000 mm, H03V2V2-F 3G 0.75 ZW 105 GR, 3 x 0.75 mm ² , with wire pins and moulded cable relief.	97940975
	TM05 1103 2111 Molex power supply cable, 2000 mm, H03V2V2-F 3G 0.75 ZW 105 GR, 3 x 0.75 mm ² , with wire pins.	97940977
Signal cable and blanking plug		
	TM05 1106 2111 PWM signal cable, 2000 mm, RKK90 3 x 0.50 ZW 3 x 0.50 mm ² .	97940991

Note: The optional signal cable is available with two leads only. Note that if a two-lead cable is used, it will not be possible to get the feedback signal from the pump.

8. EC declaration of conformity

We, Grundfos, declare under our sole responsibility that the below-mentioned circulator pumps, to which this declaration relates, are in conformity with these Council directives on the approximation of the laws of the EC member states:

Products:

GFMXX SOLAR PM.

The code is printed on the front nameplate.
X can have any alphabetic or numeric value.

Directives:**Low Voltage Directive (2006/95/EC)**

Standards used: EN 60335-1: 2002, + A1, A2, A11, A12,
EN 60335-2-51: 2003 + A1.

EMC Directive (2004/108/EC)

Standards used: EN 61000-6-2: 2005,
EN 61000-6-3: 2007,
EN 55014-1: 2006,
EN 55014-2: 1997.

Bjerringbro, 7th March 2011



Preben Jakobsen
Technical Manager
Grundfos HVAC OEM Division
Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro, Denmark

Person authorised to compile technical file and
empowered to sign the EC declaration of conformity.

9. Approvals and certificates

VDE certificate

These pumps are certified by VDE.

Product code: GFMJC (up to xx-105), GFMJD (for 15-145).

VDE certificate: No. 40014569.

This Marks Approval forms the basis of the EC declaration of conformity and the CE marking by the manufacturer or his agent and proves the conformity with the essential safety requirements of the EC Low Voltage Directive (2006/95/EC) including amendments.

ETL approval

Special versions are available for the North American market. Such versions are approved by ETL. If special versions are required, please contact Grundfos HVAC OEM Division by mail: upoem@grundfos.com.

Complete REACH compliance

New European Regulation (EC) 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) entered into force.

One of the requirements of REACH is that manufacturers and importers have the duty to register chemical substances that they produce or import in quantities over 1 t/year. Another requirement is to inform our customers if our products contain substances from the candidate list in a concentration above 0.1 % (w/w).

Grundfos has a high global standard for human health and environmental awareness, and we declare to comply with the requirements of REACH.

Regarding Substances of Very High Concern (SVHC), Grundfos aims higher than REACH requires. We will strive to substitute all substances from the candidate list that are found in our products in a concentration above 0.1 % (w/w).

Grundfos policy is to be fully compliant with the REACH legislation and to work closely with suppliers and customers. This declaration is part of our policy of keeping our customers fully informed about our REACH commitment.

With kind regards,



Torben Brændgaard

Group Environment Manager

WEEE and RoHS directives

Statement regarding Grundfos' compliance with the WEEE and RoHS directives

Grundfos pumps and motors are not covered by the WEEE and RoHS directives as these products are not mentioned in the special Annex 1A to the WEEE directive. This annex mentions all the groups of products covered by the directives.

In spite of the fact that Grundfos has no legal obligation to comply with the WEEE and RoHS directives, Grundfos does find the thoughts and ideas behind the directives very important.

In regard to the RoHS directive, Grundfos is now in complete voluntary RoHS compliance. To ensure that this continues, we have launched the following initiatives:

- All suppliers to Grundfos are under contractual obligation not to deliver products that hold RoHS-restricted substances.
- Grundfos continuously audits our suppliers to ensure full contractual compliance, including RoHS compliance.
- Grundfos does not accept hazardous substances in our products. It is a standard task in our product developing projects to ensure that hazardous substances are not used.

In regard to the WEEE directive and its impact on pumps, Grundfos recommends reading the Euro-pump position paper of 16 December 2005 which can be found on <http://www.europump.org> or <http://publications.orgalime.org>

Yours faithfully,

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