

1. Product introduction

The Grundfos MAGNA1 circulator pumps are designed for circulating liquids in the following systems:

- heating systems
- air conditioning and cooling systems.

The pump range can also be used for the following systems:

- ground source heat pump systems
- solar heating systems.



Fig. 1 Single-head MAGNA1 pumps

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Applications

Heating systems

- Main pump
- Mixing loops
- Heating surfaces
- Air conditioning surfaces.

The MAGNA1 circulator pumps are designed for circulating liquids in systems with variable flows where it is desirable to optimize the setting of the pump duty point, thus reducing energy costs.

To ensure correct operation, it is important that the sizing range of the system falls within the duty range of the pump.

Duty range

Data	MAGNA1 (N) Single-head pumps
Maximum flow rate, Q	313 gpm (71 m ³ /h)
Maximum head, H	59 ft (18 m)
Maximum system pressure	175 psi (12 bar)
Liquid temperature	+14 °F to +230 °F (-10 °C to +110 °C)

Features and benefits

Features

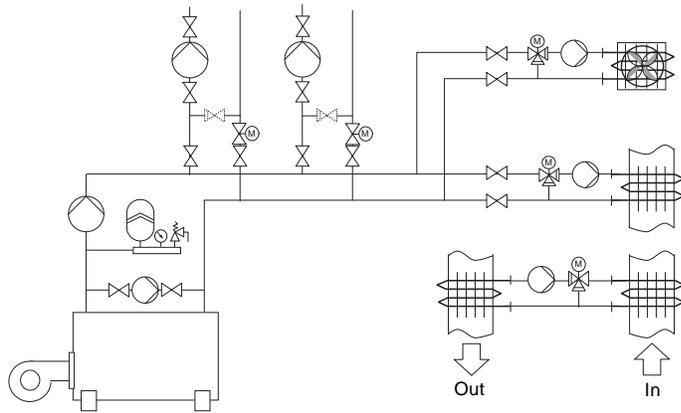
- Proportional pressure control.
- Constant pressure control.
- Constant curve/constant speed duty.
- No external motor protection required.
- Insulating shells supplied with single-head pumps for heating systems.
- Wide temperature range where the liquid temperature and the ambient temperature are independent of each other.

Benefits

- Simple installation.
- Low energy consumption.
- Eight light fields for indication of pump setting.
- Low noise level.
- No maintenance and long life.

System applications

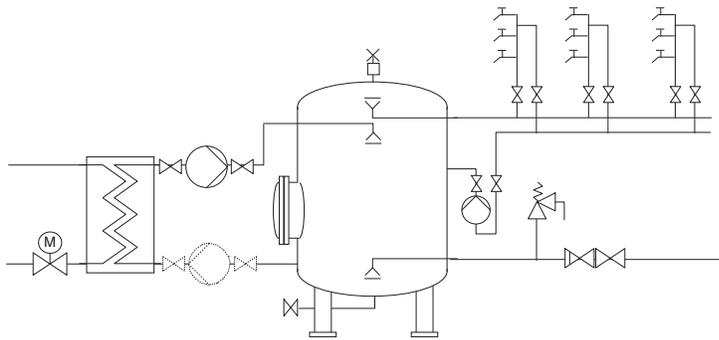
Heating systems



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- One- and two-pipe heating systems
- Main pumps
- Zone pumps
- Mixing loops
- Boiler shunt pumps
- Pumps for heating surfaces
- Calorifiers
- Underfloor heating systems
- Solar heating systems
- Ground source heat pump systems
- Heat recovery systems.

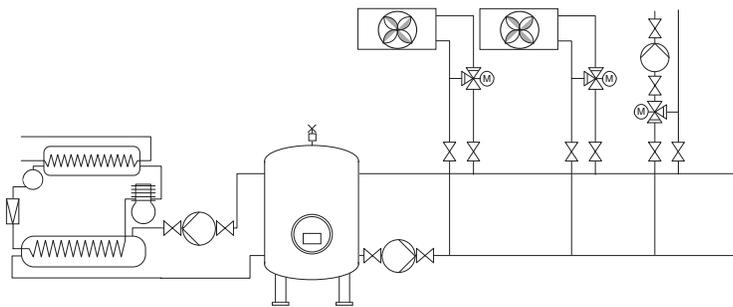
Domestic hot-water systems



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- Domestic hot-water systems.

Air conditioning and cooling systems



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- Two-pipe air conditioning systems
- Main pumps
- Zone pumps
- Pumps for refrigeration units
- Heat pump systems
- Ground source heat pump systems
- Heat recovery systems
- Air conditioning surfaces.

2. Performance range

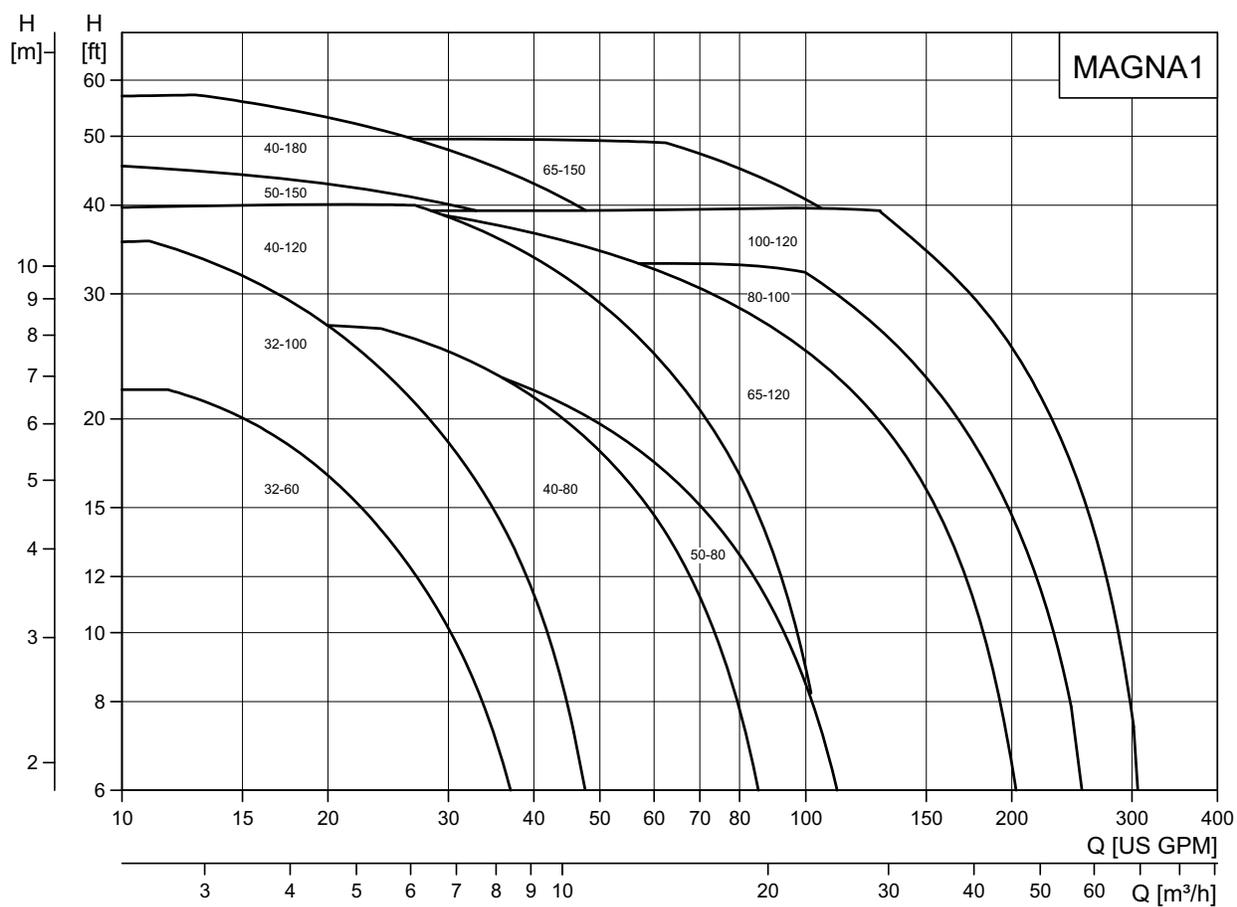


Fig. 2 Performance range, MAGNA1

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3. Product range

Single-head pump	Cast Iron		Stainless steel (N)		Page reference
	115 V	208-230 V	115 V	208-230 V	
MAGNA1 32-60 F (N)	98126819		98126821		18
MAGNA1 32-100 F (N)	98126823		98126825		19
MAGNA1 40-80 F (N)	98126799	98126827	98126801	98126829	20
MAGNA1 40-120 F (N)	98126803	98126831	98126805	98126833	21
MAGNA1 40-180 F (N)	98126807	98126835	98126809	98126837	22
MAGNA1 50-80 F (N)	98126811	98126839	98126813	98126841	23
MAGNA1 50-150 F (N)	98126815	98126843	98126817	98126845	24
MAGNA1 65-120 F (N)	98124695	98126847	98126853	98126849	25
MAGNA1 65-150 F (N)	-	98126851	-	98126853	26
MAGNA1 80-100 F (N)	-	98126855	-	98126857	27
MAGNA1 100-120 F (N)	-	98126859	-	98126861	28

Pump selection

Pump size

The selection of pump size should be based on the following:

- required maximum flow
- maximum pressure loss in the system.

Refer to the system characteristics to determine the duty point. See fig. 3.

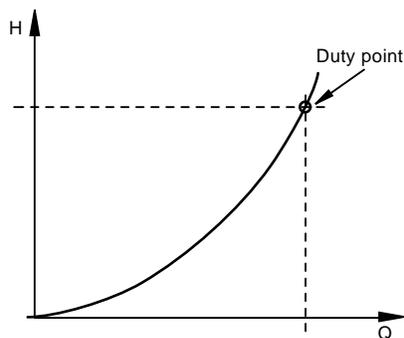


Fig. 3 System characteristic

Operating conditions

It should be checked whether the operating conditions are fulfilled, i.e.

- liquid quality and temperature
- ambient conditions
- minimum inlet pressure
- maximum operating pressure.

Control modes

- Proportional pressure control in systems with considerable pressure losses in relation to large flow variations.
- Constant pressure control in systems with insignificant pressure losses in relation to large flow variations.
- In constant curve/constant speed operation, the pump will run at a constant speed, independent of the actual flow demand in the system.

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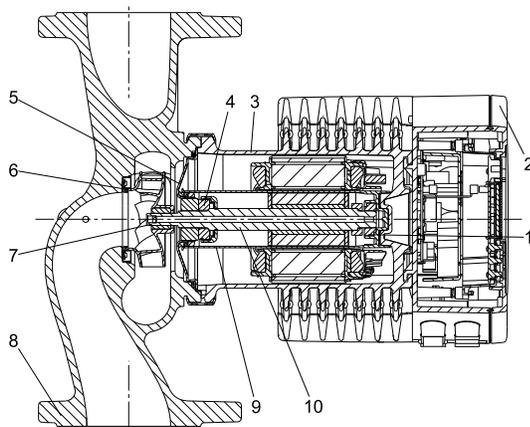
4. Identification

Type key

Code	Example	MAGNA1	80	-100	(F)	(N)	360
	Type range MAGNA1						
	Nominal diameter (DN) of suction and discharge ports [mm]						
	Maximum head [dm]						
	Pipe connection Threaded F Flange						
	Pump housing material Cast iron N Stainless steel						
	Port-to-port length [mm]						

5. Construction

Sectional drawing



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Fig. 4 MAGNA1 flanged version with PPS-composite rotor can

Material specification

See fig. 4.

Pos.	Component	Material	EN
1	Outer bearing ring	Aluminium oxide	
2	Control box	Polycarbonate	
3	Stator housing	Aluminium	
	O-rings/gaskets	EPDM	
4	Thrust bearing	Aluminium oxide/carbon	
5	Bearing plate	Stainless steel	EN 1.4301
6	Neck ring	Stainless steel	EN 1.4301
7	Impeller	PES	
8	Pump housing	Cast iron	EN 1561 EN-GJL-250
9	Rotor can	PPS or stainless steel	
10	Shaft	Stainless steel	EN 1.4404

Mechanical construction

The MAGNA1 is of the canned-rotor type, i.e. pump and motor form an integral unit without shaft seal and with only two gaskets for sealing. The bearings are lubricated by the pumped liquid.

The pump is characterized by the following:

- controller integrated in the control box
- control panel on the control box
- control box prepared for optional CIM modules
- built-in differential pressure and temperature sensor
- cast-iron or stainless-steel pump housing
- twin-head versions
- no external motor protection required
- insulating shells supplied with single-head pumps for heating systems.

Motor and electronic controller

The MAGNA1 incorporates a 4-pole synchronous, permanent-magnet motor (PM motor). This motor type is characterized by higher efficiency than a conventional asynchronous squirrel-cage motor. The pump speed is controlled by an integrated frequency converter.

A differential pressure and temperature sensor is incorporated in the pump.

Pump connections

See individual product pages.

Surface treatment

The pump housing and pump head are electrocoated to improve the corrosion resistance.

Electrocoating includes:

- alkaline cleaning
- pretreatment with zinc phosphate coating
- cathodic electrocoating (epoxy)
- curing of paint film at +392 to +482 °F (+200 to +250 °C).

Color

Color codes for the pump:

Color	Code
Red	NCS40-50R
Black	NCS9000

6. Operating conditions

Pumped liquids

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibers that may attack the pump mechanically or chemically.

In heating systems, the water should meet the requirements of accepted standards on water quality in heating systems.

In domestic hot-water systems, we recommend to use MAGNA1 pumps only for water with a degree of hardness lower than approx. 14 °dH.

In domestic hot-water systems, we recommend to keep the liquid temperature below +149 °F (+65 °C) to eliminate the risk of lime precipitation.

The MAGNA1 pumps can be used for pumping water/glycol mixtures up to 50 %.

Example of a water/ethylene glycol mixture:

Maximum viscosity: 50 cSt ~ 50 % water / 50 % ethylene glycol mixture at +14 °F (-10 °C).

The pump is controlled by a power-limiting function that protects against overload.

The pumping of glycol mixtures will affect the max. curve and reduce the performance, depending on the water/ethylene glycol mixture and the liquid temperature.

To prevent the ethylene glycol mixture from degrading, avoid temperatures exceeding the rated liquid temperature and minimize the operating time at high temperatures.

It is important to clean and flush the system before the ethylene glycol mixture is added.

To prevent corrosion or lime precipitation, check and maintain the ethylene glycol mixture regularly. If further dilution of the supplied ethylene glycol is required, follow the glycol supplier's instructions.

General recommendations

Water in heating systems	Water quality according to local standards
Domestic hot water	Degree of hardness up to 14 °dH
Water containing glycol	Maximum viscosity = 50 cSt ~ 50 % water/50 % ethylene glycol at +14 °F (-10 °C)

Temperatures

Liquid temperature

Application	Temperature range
General	+14 to +230 °F (-10 to +110 °C)
Domestic hot-water systems	+150 °F (Up to +65 °C) recommended

Ambient conditions

Ambient conditions	
Ambient temperature during operation	+32 to +104 °F (0 to +40 °C)
Ambient temperature during storage and transport	-40 to +158 °F (-40 to +70 °C)
Relative air humidity	Maximum 95 %

Pressures

Maximum operating pressure

175 psi (12 bar).

Minimum inlet pressure

The following relative minimum pressure must be available at the pump inlet during operation to avoid cavitation noise and damage to the pump bearings.

The values in the table below apply to single-head pumps and twin-head pumps in single-head operation.

MAGNA1 DN	Liquid temperature		
	+167 °F (75 °C)	+203 °F (95 °C)	+230 °F (110 °C)
	Inlet pressure psi [bar]		
32-60/100	1.5 (0.10)	5.0 (0.35)	14.5 (1.0)
40-80	1.5 (0.10)	7.3 (0.50)	16.0 (1.1)
40-120/150/180	1.5 (0.10)	5.8 (0.40)	14.5 (1.0)
50-80	1.5 (0.10)	1.5 (0.10)	10.2 (0.7)
50-150	2.9 (0.20)	8.7 (0.60)	17.4 (1.2)
65-120	1.5 (0.10)	7.3 (0.50)	16.0 (1.1)
65-150	5.8 (0.40)	11.6 (0.80)	17.4 (1.2)
80-100	7.3 (0.50)	13.1 (0.90)	21.8 (1.5)
100-120	7.3 (0.50)	13.1 (0.90)	21.8 (1.5)

Note: Actual inlet pressure plus pump pressure against a closed valve must be lower than the maximum permissible system pressure.

The relative minimum inlet pressures apply to pumps installed up to 984 ft (300 m) above sea level. For altitudes above 984 ft (300 m), the required relative inlet pressure must be increased by 1.45 psi per 330 ft (0.1 bar / 0.01 MPa per 100 m) altitude. The MAGNA1 pump is only approved for an altitude of 6560 ft (2000 m).

7. Installation

Mechanical installation

The MAGNA1 is designed for indoor installation. The pump must be installed with horizontal motor shaft.

The pump may be installed in horizontal as well as vertical pipes.

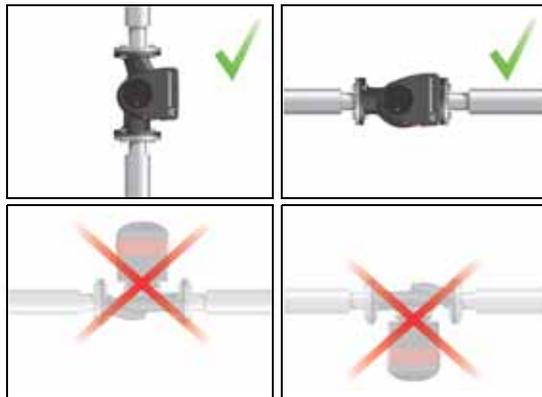


Fig. 5 Installation positions

Arrows on the pump housing indicate the liquid flow direction through the pump.

The control box must be in horizontal position with the Grundfos logo in vertical position. See fig. 5.

This is described in the installation and operating instructions.

The pump must be installed in such a way that it is not stressed by the pipework.

The pump may be suspended direct in the pipes, provided that the pipework can support the pump.

To ensure adequate cooling of motor and electronics, the following must be observed:

- Position the pump in such a way that sufficient cooling is ensured.
- The ambient temperature must not exceed +104 °F (+40 °C).

Insulating shells

The insulating shells supplied with MAGNA1 pumps are for heating systems and should be fitted as part of the installation.

For cooling applications, if the supplied insulation shell is to be used then a silicon sealant must be liberally applied to the inside of the insulation shell to ensure all air gaps are eliminated between the shell and pump housing to prevent condensation between the shell and pump housing.

Electrical installation

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

- The pump must be connected to an external mains switch.
- The pump must always be correctly grounded.
- The pump requires no external motor protection.
- The pump incorporates thermal protection against slow overloading and blocking.
- When switched on via the power supply, the pump will start pumping after approx. 5 seconds.

Note: The number of starts and stops via the power supply must not exceed four times per hour.

The pump mains connection must be made as shown in fig. 6.

Cables

- All cables used must be connected in accordance with local regulations.

Additional protection

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

The earth leakage circuit breaker must be marked with the first or both of the symbols shown below:



Symbol	Description
	High-sensitivity ELCB, type A, according to IEC 60775
 	High-sensitivity ELCB, type B, according to IEC 60775

Connection diagrams

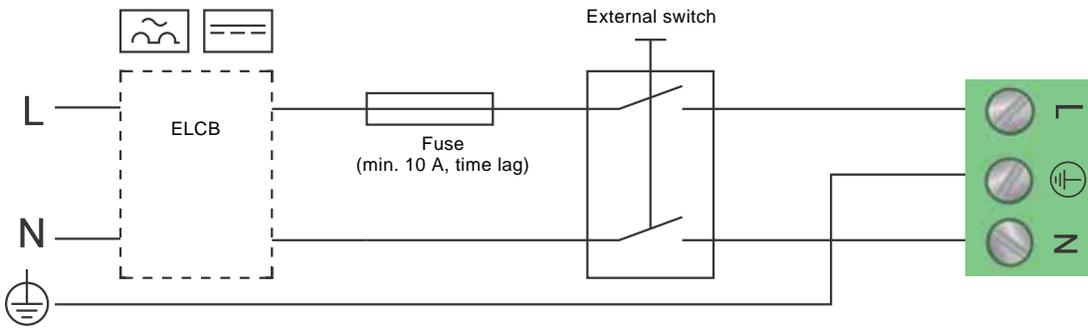
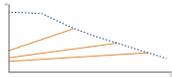
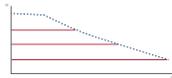
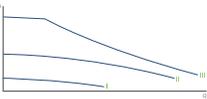


Fig. 6 Example of terminal connection, 1 x 230 V \pm 10 %, 50/60 Hz, PE

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8. Functions

Selection of control mode

System application	Select this control mode
<p>In systems with relatively large pressure losses in the distribution pipes and in air conditioning and cooling systems.</p> <ul style="list-style-type: none"> • Two-pipe heating systems with thermostatic valves and <ul style="list-style-type: none"> – very long distribution pipes – strongly throttled pipe balancing valves – differential pressure regulators – large pressure losses in those parts of the system through which the total quantity of water flows (for example boiler, heat exchanger and distribution pipe up to the first branching). • Primary circuit pumps in systems with large pressure losses in the primary circuit. • Air conditioning systems with <ul style="list-style-type: none"> – heat exchangers (fan coils) – cooling ceilings – cooling surfaces. 	<p>Proportional pressure</p> 
<p>In systems with relatively small pressure losses in the distribution pipes.</p> <ul style="list-style-type: none"> • Two-pipe heating systems with thermostatic valves and <ul style="list-style-type: none"> – dimensioned for natural circulation – small pressure losses in those parts of the system through which the total quantity of water flows (for example boiler, heat exchanger and distribution pipe up to the first branching) or – modified to a high differential temperature between flow pipe and return pipe (for example district heating). • Underfloor heating systems with thermostatic valves. • One-pipe heating systems with thermostatic valves or pipe balancing valves. • Primary circuit pumps in systems with small pressure losses in the primary circuit. 	<p>Constant pressure</p> 
<p>The pump can also be set to operate according to the max. or min. curve, like an uncontrolled pump:</p> <ul style="list-style-type: none"> • The max. curve mode can be used in periods in which a maximum flow is required. This operating mode is for instance suitable for hot-water priority. • The min. curve mode can be used in periods in which a minimum flow is required. This operating mode is for instance suitable for manual night setback. 	<p>Constant curve</p> 

Control modes

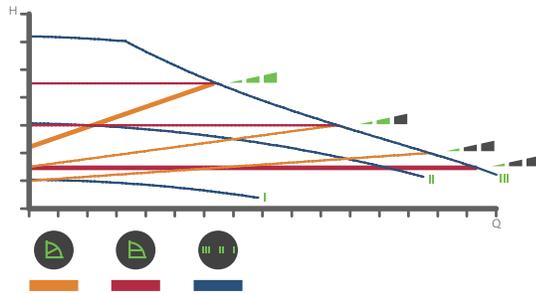


Fig. 7 Selection of pump setting for system type

Factory setting: Intermediate proportional-pressure curve, referred to as PP2.

Proportional pressure curve (PP1, PP2 or PP3)

Proportional pressure control adjusts the pump performance to the actual heat demand in the system, but the pump performance follows the selected performance curve, PP1, PP2 or PP3. See fig. 8 where PP2 has been selected.

See [Selection of control mode](#) on page 12 for further information.

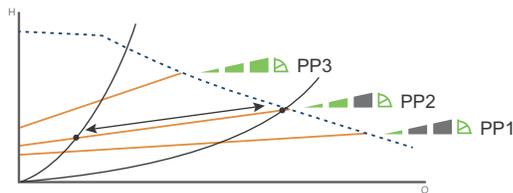


Fig. 8 Three proportional pressure curves/settings

The selection of the right proportional pressure setting depends on the characteristics of the heating system in question and the actual heat demand.

Constant pressure curve (CP1, CP2 or CP3)

Constant pressure control adjusts the pump performance to the actual heat demand in the system, but the pump performance follows the selected performance curve, CP1, CP2 or CP3. See fig. 9 where CP1 has been selected.

See [Selection of control mode](#) on page 12 for further information.

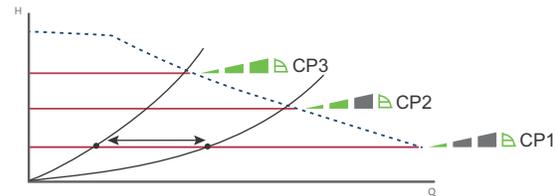


Fig. 9 Three constant pressure curves/settings

The selection of the right constant pressure setting depends on the characteristics of the heating system in question and the actual heat demand.

Constant curve/constant speed (I, II or III)

In constant curve/constant speed operation, the pump will run at a constant speed, independent of the actual flow demand in the system. The pump performance follows the selected performance curve, I, II or III.

See fig. 10 where II has been selected.

See [Selection of control mode](#) on page 12 for further information.

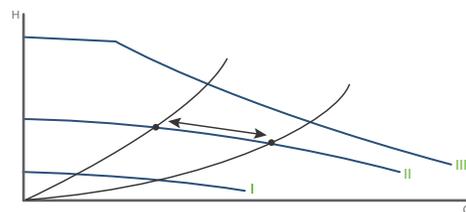


Fig. 10 Three constant curve/constant speed settings

The selection of the right constant curve/ constant speed setting depends on the characteristics of the heating system in question.

Control panel



Fig. 11 Control panel at first start-up

The control panel on the pump comprises the following:

Pos.	Description
1	Grundfos Eye operating status. See section Grundfos Eye .
2	Eight light fields indicating the pump setting. See section Light fields indicating the pump setting .
3	Push-button for selection of pump setting.

Grundfos Eye

The Grundfos Eye is on when the power supply has been switched on. See fig. 11, pos. 1.

The Grundfos Eye is an indicator light providing information about the actual pump status.

The indicator light will flash in different sequences and provide information about the following:

- power on/off
- pump alarms.

Light fields indicating the pump setting

The pump has nine optional performance settings which can be selected with the push-button.

See fig. 11, pos. 3.

The pump setting is indicated by eight light fields in the display. See fig. 11, pos. 2.



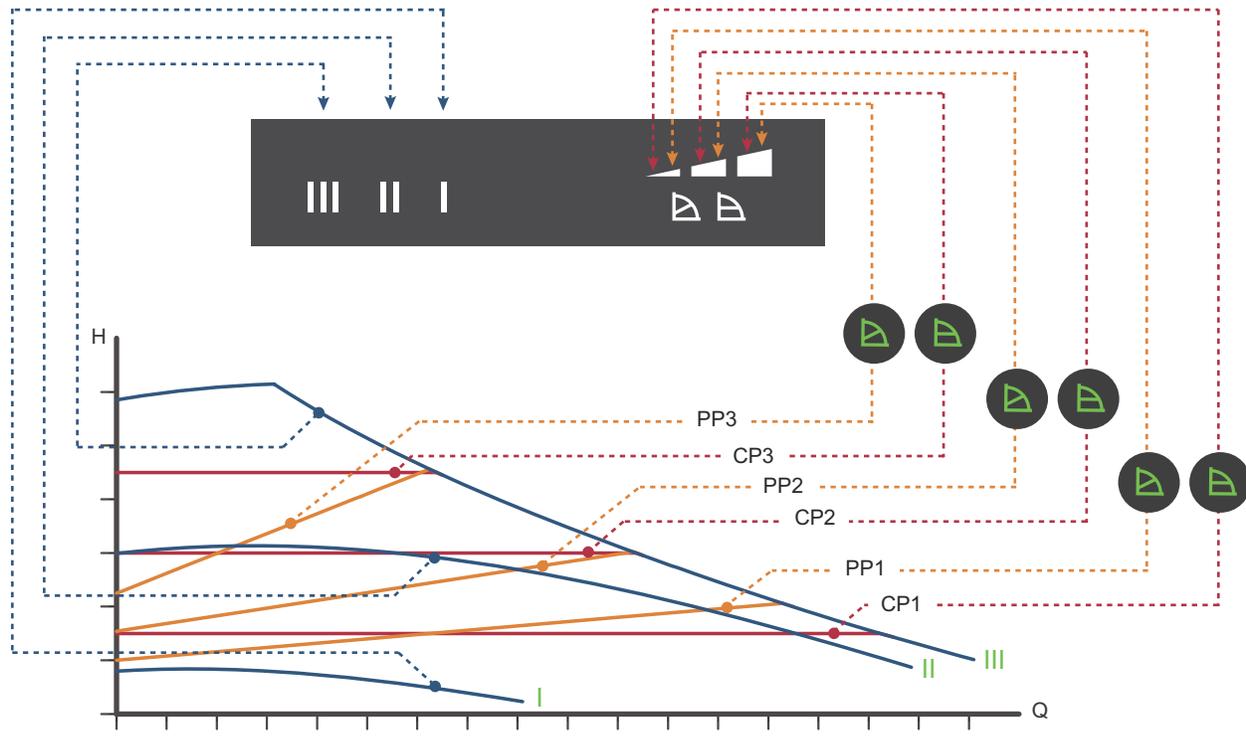
Fig. 12 Factory setting, PP2

Button presses	Active light fields	Description
0		Intermediate proportional pressure curve, referred to as PP2
1		Highest proportional pressure curve, referred to as PP3
2		Lowest constant pressure curve, referred to as CP1
3		Intermediate constant pressure curve, referred to as CP2
4		Highest constant pressure curve, referred to as CP3
5		Constant curve/constant speed III
6		Constant curve/constant speed II
7		Constant curve/constant speed I
8		Lowest proportional pressure curve, referred to as PP1

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Overview of settings



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Fig. 13 Pump setting in relation to pump performance

Setting	Pump curve	Function
PP1	Lowest proportional pressure curve	The duty point of the pump will move up or down on the lowest proportional pressure curve, depending on the heat demand. See fig. 13. The head (pressure) is reduced at falling heat demand and increased at rising heat demand.
PP2	Intermediate proportional pressure curve	The duty point of the pump will move up or down on the intermediate proportional pressure curve, depending on the heat demand. See fig. 13. The head (pressure) is reduced at falling heat demand and increased at rising heat demand.
PP3	Highest proportional pressure curve	The duty point of the pump will move up or down on the highest proportional pressure curve, depending on the heat demand. See fig. 13. The head (pressure) is reduced at falling heat demand and increased at rising heat demand.
CP1	Lowest constant pressure curve	The duty point of the pump will move out or in on the lowest constant pressure curve, depending on the heat demand in the system. See fig. 13. The head (pressure) is kept constant, irrespective of the heat demand.
CP2	Intermediate constant pressure curve	The duty point of the pump will move out or in on the intermediate constant pressure curve, depending on the heat demand in the system. See fig. 13. The head (pressure) is kept constant, irrespective of the heat demand.
CP3	Highest constant pressure curve	The duty point of the pump will move out or in on the highest constant pressure curve, depending on the heat demand in the system. See fig. 13. The head (pressure) is kept constant, irrespective of the heat demand.
III	Speed III	The pump runs on a constant curve which means that it runs at a constant speed. In speed III, the pump is set to run on the max. curve under all operating conditions. See fig. 13. Quick venting of the pump can be obtained by setting the pump to speed III for a short period.
II	Speed II	The pump runs on a constant curve which means that it runs at a constant speed. In speed II, the pump is set to run on the intermediate curve under all operating conditions. See fig. 13.
I	Speed I	The pump runs on a constant curve which means that it runs at a constant speed. In speed I, the pump is set to run on the min. curve under all operating conditions. See fig. 13.

9. Guide to performance curves

Each pump setting has its own performance curve (Q/H curve). A power curve (P1 curve) belongs to each Q/H curve. The power curve shows the pump power consumption (P1) in Watt at a given Q/H curve.

The P1 value corresponds to the value that can be read from the pump display. See fig. 14.

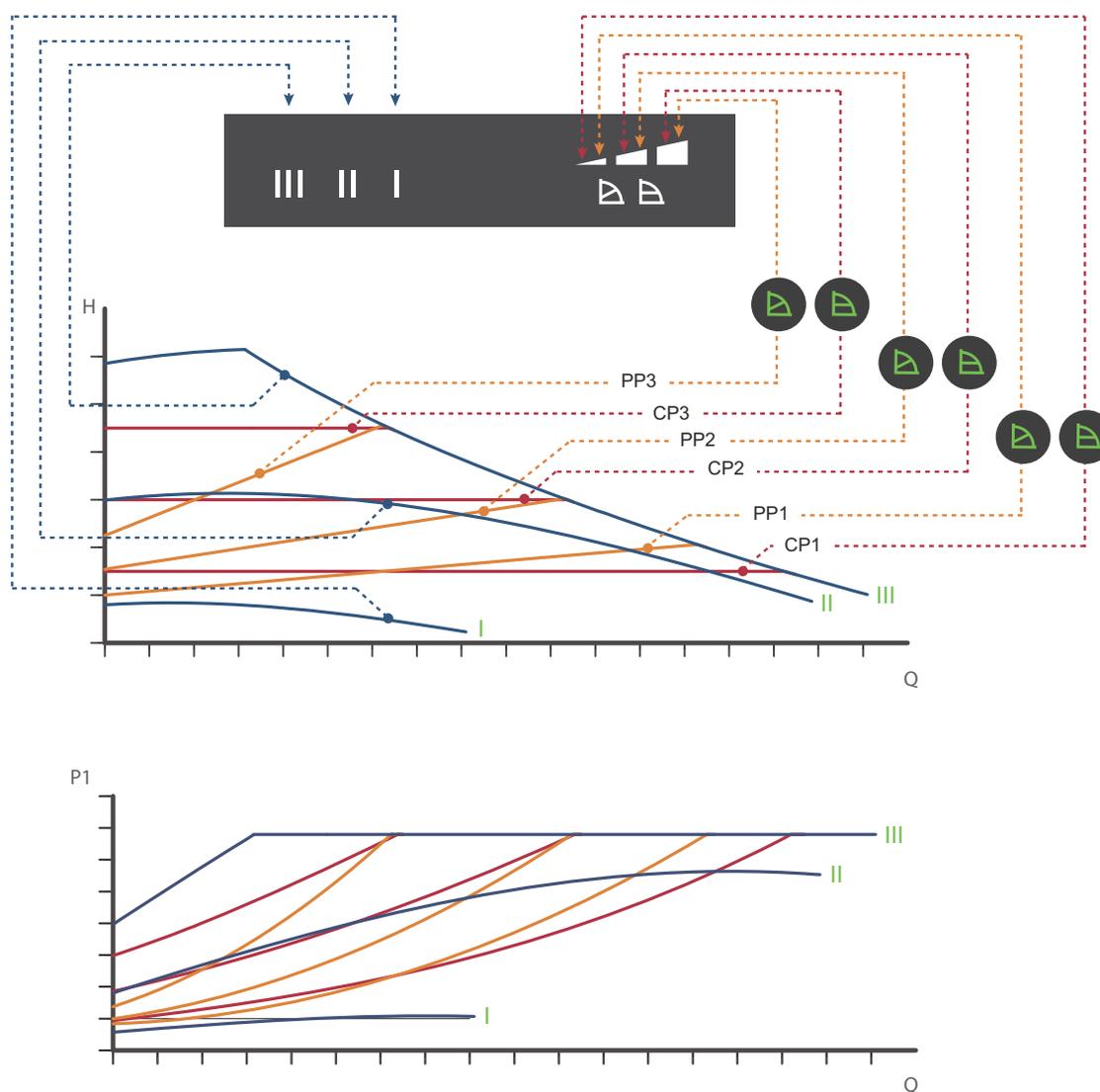


Fig. 14 Performance curves in relation to pump setting

Setting	Pump curve
PP1	Lowest proportional pressure curve
PP2	Intermediate proportional pressure curve
PP3	Highest proportional pressure curve
CP1	Lowest constant pressure curve
CP2	Intermediate constant pressure curve
CP3	Highest constant pressure curve
III	Constant curve duty, fixed speed III
II	Constant curve duty, fixed speed II
I	Constant curve duty, fixed speed I

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Curve conditions

Performance curves

The guidelines below apply to the performance curves.

- Test liquid: airless water.
- The curves apply to a density of $\rho = 61.38 \text{ lb/ft}^3$ (983.2 kg/m^3) and a liquid temperature of $+140 \text{ }^\circ\text{F}$ ($+60 \text{ }^\circ\text{C}$).
- All curves show average values and should not be used as guarantee curves. If a specific minimum performance is required, individual measurements must be made.
- The curves apply to a kinematic viscosity of $\nu = 0.474 \text{ mm}^2/\text{s}$ (0.474 cSt).
- Reference supply voltage: $1 \times 230 \text{ V}$, 50 Hz .
- EEI obtained according to EN 16297.

Symbols used on the following pages



Fig. 15 Energy efficiency index (EEI)

The MAGNA1 is energy-optimized and complies with the EuP Directive (Commission Regulation (EC) No 641/2009) which will be effective as from 1 January 2013.

For MAGNA1 pumps, the average energy efficiency index (EEI) is 0.18 with values down to 0.17, categorized as best in class.

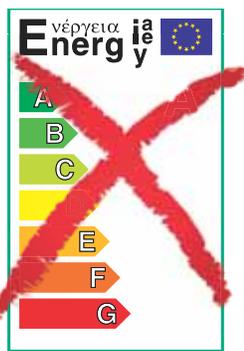


Fig. 16 Old energy label

From 1 January 2013, the old A to G energy label will be replaced by the new energy efficiency index (EEI). Only the best of today's A-labelled circulator pumps will meet the new requirements.

Figure 17 shows the energy consumption index for a typical circulator pump compared to the various EEI limits.

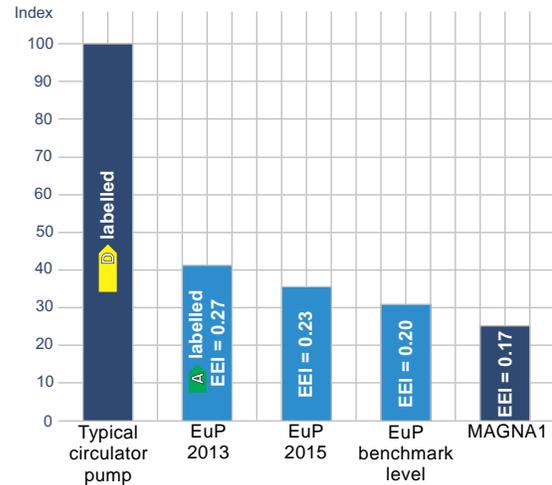


Fig. 17 Energy consumption index

QR code on pump nameplate



Fig. 18 QR code on pump nameplate

With the Grundfos GO Remote or a smartphone, it is possible to get the following information about the MAGNA1:

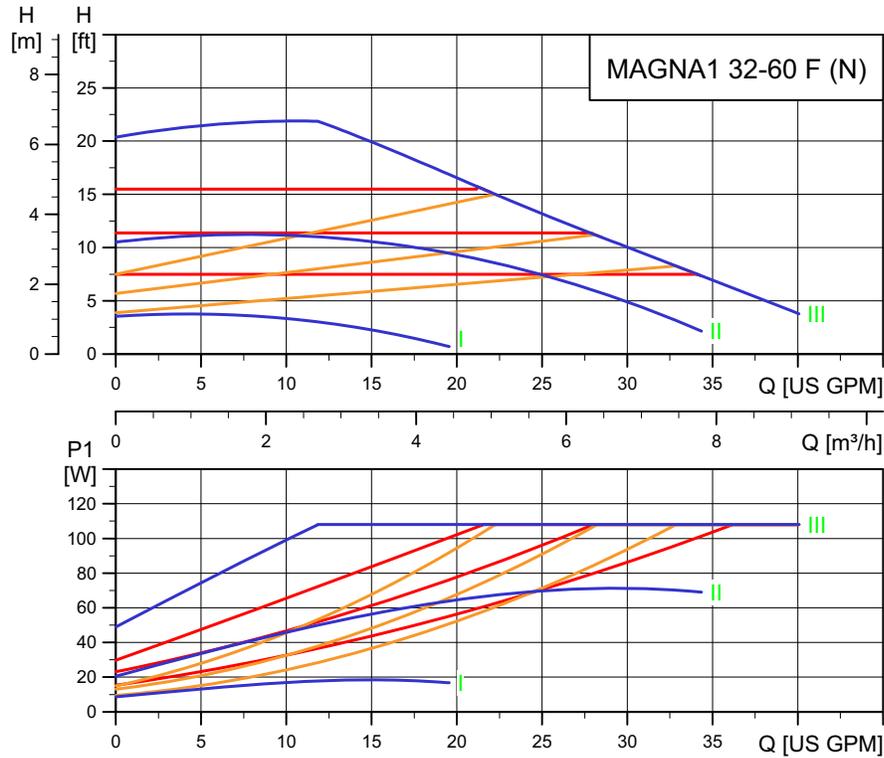
- product photo
- pump performance curves
- dimensional sketches
- wiring diagram
- quotation text
- technical data
- PDF files, such as data booklet and installation and operating instructions.

Note: The GO Remote or Smart phone may be used to read the QR Code to download product information from GO CAPS. The MAGNA1 does not communicate with the GO.

10. Performance curves and technical data

MAGNA1 32-60 F (N)

1 x 115-230 V, 50/60 Hz



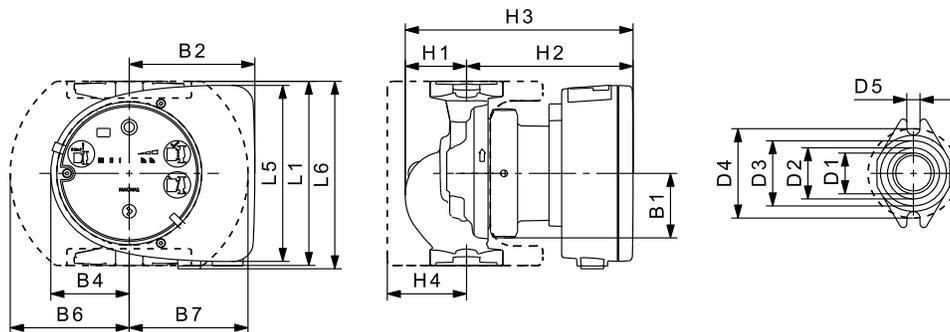
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Speed	I _{1/1} [A]	P1 [W]
Min.	0.28	8.70
Max.	1.01	107.00

System pressure: Max. 175 psi (12 bar).
 Liquid temperature: +14 to +230 °F (-10 °C to +110 °C).
 Also available with: Stainless-steel pump housing, type N.
 Specific EEI: 0.20

The pump incorporates overload protection.

Net weights [lbs (kg)]	Gross weights [lbs (kg)]	Ship. vol. [ft³ (m³)]
11.0 (5.0)	13.2 (6.0)	0.46 (0.014)



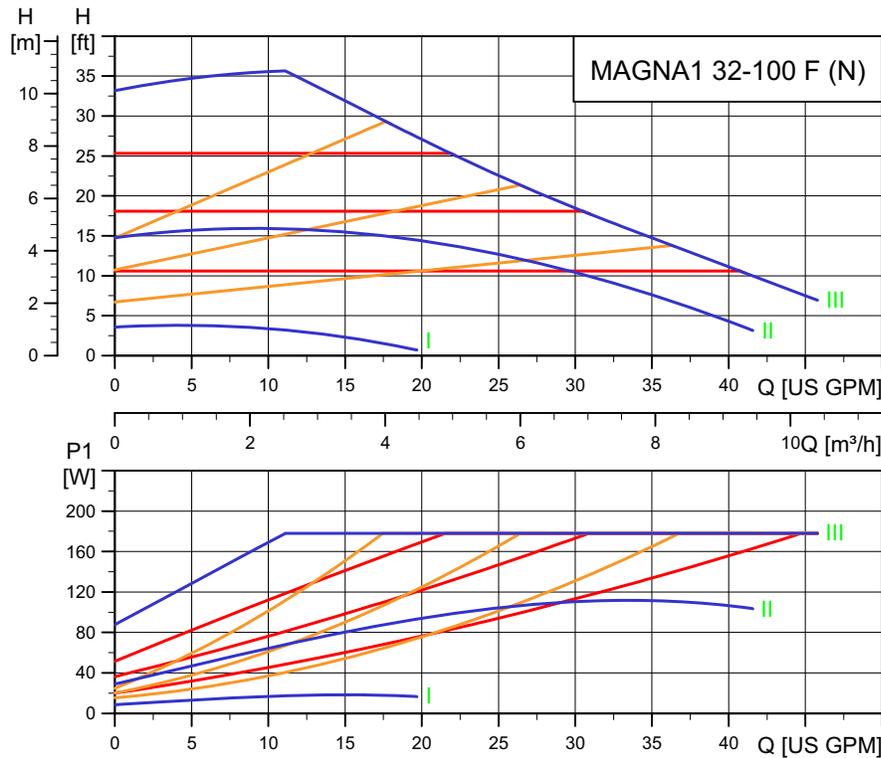
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Pump type	Dimensions [in (mm)]								
	L1	L5	L6	B1	B2	B4	B6	B7	D1
MAGNA1 32-60 F (N)	6.50 (165)	6.23 (158)	6.62 (168)	2.29 (58)	4.38 (111)	2.72 (69)	4.18 (106)	4.18 (106)	1.26 (32)
	D2	D3	D4	D5	H1	H2	H3	H4	
	1.82 (46)	2.29 (58)	3.15 (80)	0.46 (11.5)	2.13 (54)	5.79 (147)	7.92 (201)	2.76 (70)	

For product numbers, see page 6.

MAGNA1 32-100 F (N)

1 x 115-230 V, 50/60 Hz



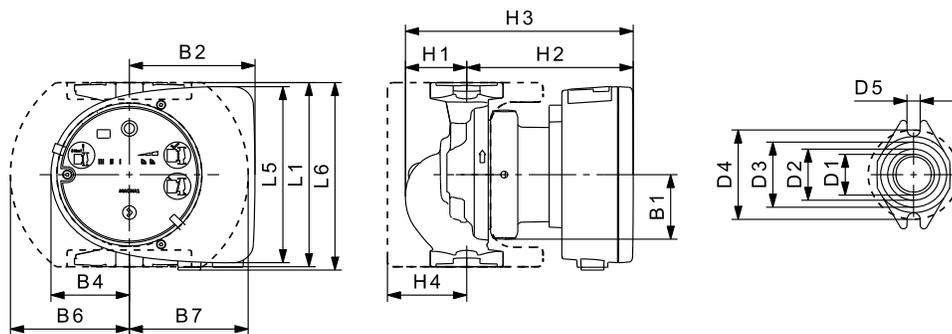
TM06 0663 0714

Speed	$I_{1/1}$ [A]	P1 [W]
Min.	0.28	8.62
Max.	1.61	178.00

System pressure: Max. 175 psi (12 bar).
 Liquid temperature: +14 to +230 °F (-10 °C to +110 °C).
 Also available with: Stainless-steel pump housing, type N.
 Specific EEI: 0.19

The pump incorporates overload protection.

Net weights [lbs (kg)]	Gross weights [lbs (kg)]	Ship. vol. [ft ³ (m ³)]
11.0 (5.0)	13.2 (6.0)	0.46 (0.014)



TM06 0732 0814

Pump type	Dimensions [in (mm)]								
	L1	L5	L6	B1	B2	B4	B6	B7	D1
MAGNA1 32-100 F (N)	6.50 (165)	6.23 (158)	6.62 (168)	2.29 (58)	4.38 (111)	2.72 (69)	4.18 (106)	4.18 (106)	1.26 (32)
	D2	D3	D4	D5	H1	H2	H3	H4	
	1.82 (46)	2.29 (58)	3.15 (80)	0.46 (11.5)	2.13 (54)	5.79 (147)	7.92 (201)	2.76 (70)	

For product numbers, see page 6.

Technical data

Electrical data

Pump type	MAGNA1
Enclosure class	Type 2, IPX4D(EN 60529).
Insulation class	F.
Supply voltage	1x115V ± 10 % 50/60 Hz, 1x208-230V ± 10 % 50/60 Hz.
Leakage current	$i_{\text{leakage}} < 3.5 \text{ mA}$. The leakage current is measured in accordance with EN 60335-1.
EMC	EN 55014-1:2006, EN 55014-2:1998, EN 61800-3-3:2008 and EN 61000-3-2:2006.

Sound pressure level

Pump type	MAGNA1
Sound pressure level	≤ 43 dB(A).