ARMSTRONG

COMPASS H | HIGH-EFFICIENCY WET-ROTOR CIRCULATORS |
INSTALLATION AND OPERATING INSTRUCTIONS

File No: 10.896
Date: OCTOBER 23, 2019
Supersedes: 10.896
Date: NOVEMBER 06, 2017

WARNING

- Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.
- The use of this product requires experience with and knowledge of the product. Only licensed or trained installers should install this product.
- For supply connection, use wires acceptable for at least 90°C (194°F).
- **Risk of shock:** this pump has not been tested for use in swimming pools or marine areas.
- To reduce risk of electric shock: Shut off/ Disconnect power before servicing, see instructions for proper installation, connect to a properly grounded, grounding type receptacle only.
- For indoor use only.
- Use copper conductors only.
- Do not install with motor above or below pump body.
- Do not submerge.
- Do not run pump dry.

1.0 SYMBOLS USED IN THIS DOCUMENT

WARNING

The safety instructions must be followed to prevent potential personal injury.

CAUTION

The safety instructions must be followed to prevent potential malfunction or damage to the equipment.

HINT

Hints or instructions that make the setup easier and ensure safe operation

2.0 GENERAL INSTALLATION

2.1 THE ARMSTRONG COMPASS H CIRCULATOR

Compass H AUTO zone changes the pump speed according to the system demand without any requirement of external controls or control wiring.

The Armstrong Compass H circulator is recommended for circulating water in closed hydronic heating systems or potable water systems.

Models

- Compass H 20-20 CI
- Compass H 20-20 SS
- Compass H 22-20 SSU

The Armstrong Compass H includes operating modes suitable for systems with constant or variable flows, such as:

- Underfloor heating systems
- One-pipe (series) systems
- Two-pipe (parallel) systems

Armstrong Compass H circulators incorporate Armstrong patented Design Envelope variable speed control technology with an ECM motor, enabling optimum energy efficiency and occupant comfort, with built-in control algorithms that can adapt to continuously changing system requirements.

The Armstrong Compass H features a user-friendly front-mounted control panel (see section 5) and wiring box for ease of installation.

2.2 ADVANTAGES OF INSTALLING AN ARMSTRONG COMPASS H CIRCULATOR

Nine different modes of operation to suit different system requirements:

- Easily selectable from the front mounted display.
- Modes include sensorless demand-based control, Auto and proportional pressure, fixed speed and constant pressure.
- Analog input for external variable speed control.
- Power consumption and flow rate clearly displayed.

Broad operating range, producing 20 feet of head or 20 USgpm of flow, provides versatility to cover the performance of a wide range of fixed speed or variable speed circulators.

- Flange to flange compatibility with existing Armstrong circulators and many competing models.

Front mounted wiring box for ease of installation and service.

3.0 INSTALLATION

3.1 EXTRA ELECTRICAL CONNECTOR IN THE BOX

For your convenience Armstrong has supplied a PG7 electrical strain relief connector in the box. It can replace the signal port plug to secure an insulated signal cable with an outer diameter between 3.0 to 6.5mm.

3.2 MOUNTING

All servicing personnel should be equipped with proper personal protective equipment. Shut off the water supply, or isolate the pump area. If valves have been installed, on the suction and discharge sides of the pump, close them. If no valves have been installed it may be necessary to drain the system. It is best to leave the drain valve open while working on the system.

Install suction and discharge flanges on the pipe ends. The use of Teflon tape sealer or a high quality thread sealant is recommended. Install the Compass H with the flange gaskets. Flange bolts should be tighten evenly to 60in/lbs of torque. To wire the Compass H, follow section 4.0 in the Electrical Connection section below.

Install the circulator where there will be sufficient room for inspection and service.

Note:
For future servicing, isolation flanges can be used in place of standard flanges.

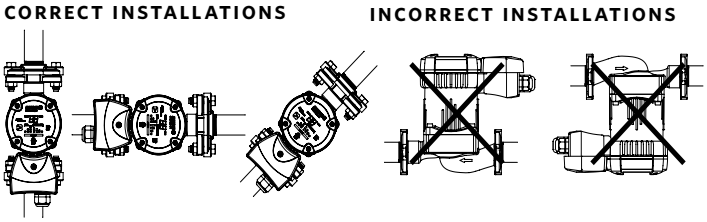

FIG. 2 Mounting the Armstrong Compass H

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

1. Fit the two gaskets supplied when the pump is mounted in the pipe.
2. Install the pump with the motor shaft horizontal (see **FIG. 2**).

3.3 CONTROL BOX POSITIONS

The orientation of the display can be adjusted by removing four screws that attach the motor to the pump housing (see **FIG. 3**). Pump must be isolated from the system when making this adjustments as this will open the system to the atmosphere.

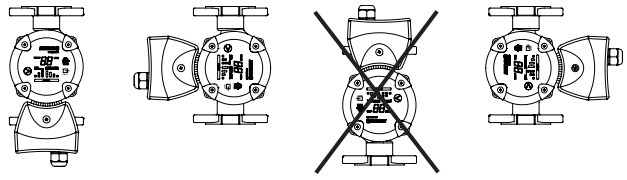

FIG. 3 Control box position (The inverted pump will work, just reading the panel upside down is not recommended)

Ensure the gasket is intact and seated before evenly retightening the mounting screw to 4.5 - 5.5 lb/ft (6 - 7.5 Nm).

WARNING

The pumped liquid may be scalding hot and under high pressure. Drain the system or close the isolating valves on either side of the pump before the screws are removed.

CAUTION

After the position of the control box has been rotated, refill the pump with system liquid before startup.

4.0 ELECTRICAL CONNECTION

4.1 POWER SUPPLY

The electrical wiring must be installed strictly in accordance with national electrical codes, local codes and regulations.

1. Electrical installation should be conducted by a qualified electrician.
2. Always make sure electric power is disconnected before wiring the circulator.

The motor is designed for 60 Hz, 1 phase, 115 volt power.

Wire shall be 14 to 16 gauge solid wire or 16 to 18 gauge stranded wire.

To connect, loosen the screw from the wiring box cover and remove the screw and cover.

Install a ½" NPT strain relief fitting (not included) for the power wiring in the large access hole provided on the right side of the box.

Insert the power wires through the fitting and secure the wires.

Strip 3⁄16" of insulation from the ends of the three wires to be connected.

To insert the wires into the terminal strip, press the terminal lever forward firmly. Insert the stripped wire into the opening and release the lever (see **FIG. 4**). Tug on the wire gently to ensure it is secured.

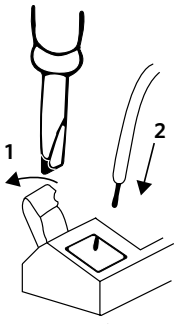

FIG. 4 Terminal strip

Connect the hot wire to terminal 'L1', the neutral wire to terminal 'L2/N', and the ground wire to terminal ⏚ (see **FIG. 5**).

Replace the wiring box cover and tighten screw, unless you plan to use analog input (see section **4.2**)

The pump is thermally protected so overload protection is not necessary. All that is required is a fused plug or circuit breaker in the power line. Electrical information can be found on the side of the wiring box.

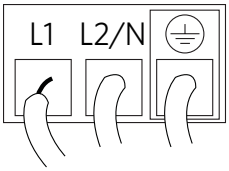

FIG. 5 Power supply connection

The electrical connections and protection must be carried out in accordance with National Electric codes.

WARNING

The electrical supply must be disconnected when wiring the circulator.

4.2 ANALOG INPUT (OPTIONAL)

WARNING

Ensure circulator is disconnected. Wire must remain isolated from power.

Wire shall be 18 to 24 gauge solid wire or stranded wire.

To connect, loosen the screw from the wiring box cover and remove the screw and cover.

Install some form of strain relief connector (included in the box) on the left side of the wiring compartment and tighten enough so the wire does not slide when pulled.

Insert wires through the connector(s).

Strip 3⁄16" of insulation from the ends of the two wires to be connected.

To insert the wires into the analog input terminal strip, press the terminal lever forward firmly. Insert the stripped wire into the opening and release the lever (see **FIG. 4**). Tug on the wire gently to ensure it is secured.

Connect the positive wire to terminal 'V' for voltage input control and the neutral wire to terminal 'C' (see **FIG. 6**).

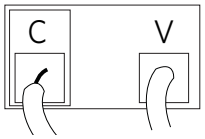

FIG. 6 Analog input connection 0-10VDC or 2-10VDC

Replace the terminal box cover and tighten screw.

Analog input setting

The pump can be controlled by an external controller via 0-10Vdc. (See **FIG. 6** for how to install analog input wiring) Ensure the analog input mode is selected.

The pump will vary the performance as per the external analog signal. See **FIG. 7**.

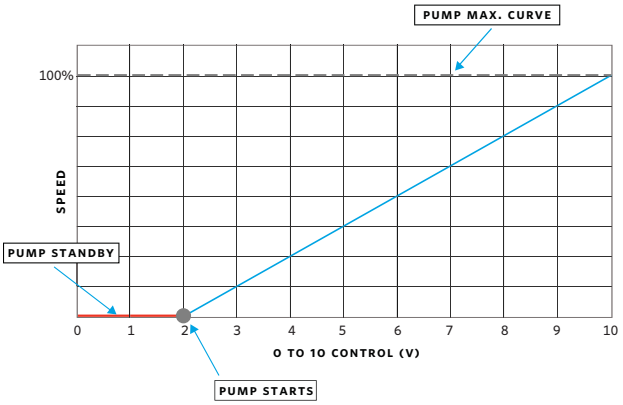

FIG. 7. 0 – 10V operation

At an input voltage lower than 2V, the pump will be off. The pump will start to operate at the min. curve at or above 2V. The pump will reach max. curve at 10V. (See **FIG. 8**)

Compass H A1 Analog Input Performance Curve

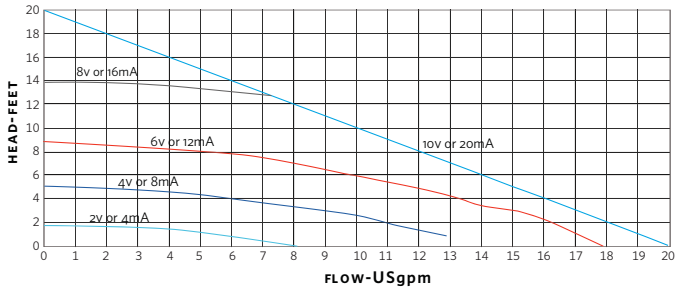

FIG. 8 Pump performance at different Analog input

5.0 CONTROL PANEL

5.1 THE CONTROL PANEL

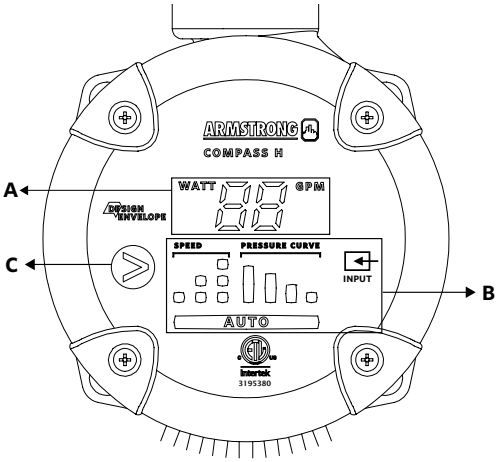

FIG. 9 Armstrong Compass H control panel

POSITION	DESCRIPTION
A	Display showing the actual pump power consumption in Watts and reference flow in USgpm. Display alternates between Watt and GPM every 5 seconds.
B	Pump setting LEDs
C	**Mode Select** button for changing pump setting

Note

GPM value and flow indicator are uncalibrated.

5.2 FIRST POWER-UP

The display is on and in Auto mode (position 0 in **FIG. 10**) the first time the panel is powered on.

Note

Display shows "E#" when the pump is not operating properly (see section 10). (E1, E2, E3 or ER,)

5.3 DISPLAY

The Armstrong Compass H has nine pump settings which can be selected with the Mode button.

Every time the Mode button is pressed (see **FIG. 9**, **C**) the pump setting is changed to the next mode.

A full cycle through the available modes requires nine button presses.

The selected pump setting is indicated by one of nine different light fields (see **FIG. 10**).

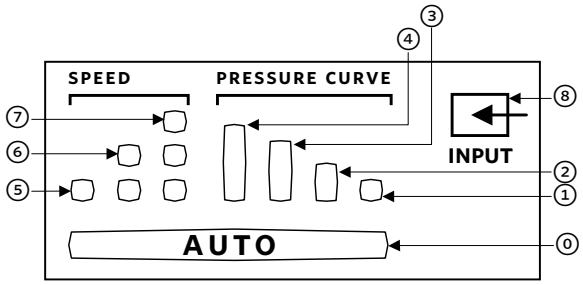

FIG. 10 Pump setting LEDs

See section 9, Pump settings and pump performance, for information about the function of each setting.

POSITION	DESCRIPTION
⓪	AUTO (factory setting)
①	PC1 Lowest proportional-pressure curve
②	PC2 Highest proportional-pressure curve
③	PC3 Lowest constant-pressure curve
④	PC4 Highest constant-pressure curve
⑤	Constant speed curve, speed I

POSITION	DESCRIPTION
⑥	Constant curve, speed II
⑦	Constant curve, speed III
⑧	Analog input

6.0 SETTING THE PUMP

6.1 PUMP SETTING FOR SYSTEM TYPE

Note : Optimum energy savings & comfort can be achieved by careful selection of the correct operation mode (see **FIG. 11**).

Recommended and alternative pump settings are shown below:

IMAGE	SYSTEM TYPE	RECOMMENDED SETTING	ALTERNATIVE SETTING
A	Under floor heating (Radiant single zone)	**AUTO**	Highest constant-pressure curve (PC4)* OR Lowest constant-pressure curve (PC3)*
B	Two-pipe (parallel) systems	**AUTO**	Highest proportional-pressure (PC2)*
C	One-pipe (series) systems	Lowest proportional-pressure curve (PC1)*	Highest proportional-pressure (PC2)*

* See pump settings and pump performance (section 9).

AUTO (underfloor heating and two-pipe (parallel) systems)
AUTO function observes and adjusts the pump performance to satisfy the system requirement. The pump adapts to the system over time, it is recommended to leave the pump in the **AUTO** position at least one week before selecting other pump settings.

Changing from recommended (AUTO) to alternative pump setting:
Heating systems are 'slow' systems that cannot be set to the optimum operation within minutes or hours.

If the recommended pump setting does not give the desired comfort in some areas of the building, change the pump setting to the shown alternative.

See pump settings and pump performance (section 9) for more details.

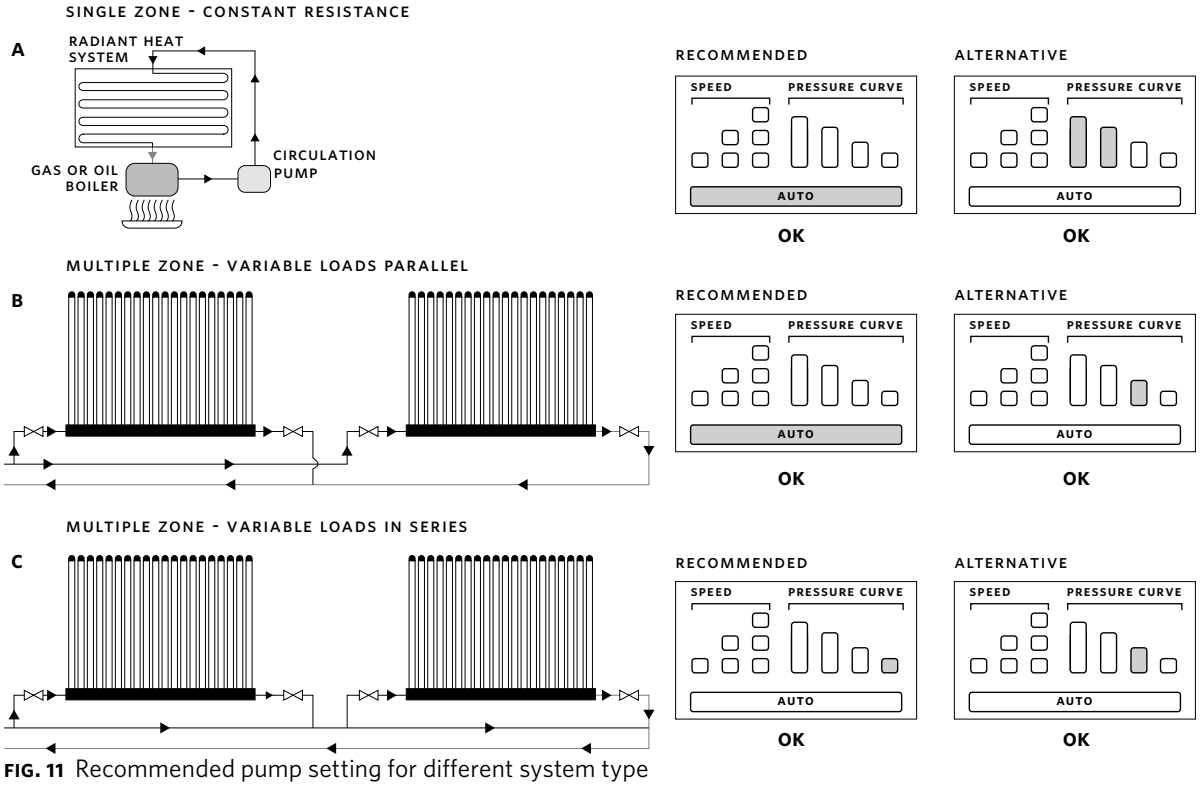

FIG. 11 Recommended pump setting for different system type

7.0 SYSTEMS WITH BYPASS VALVE BETWEEN FLOW AND RETURN PIPES

7.1 PURPOSE OF BYPASS VALVE

The purpose of a differential pressure bypass valve is to ensure that the heat from the boiler can be distributed when all valves in the underfloor-heating circuits and/or thermostatic radiator valves are closed. These valves were commonly applied in multi zone systems with traditional fixed speed pumps.

A Compass H circulator can eliminate the need for a differential bypass valve when used in Auto or proportional pressure modes, because the circulator will reduce speed when the valves in the system close and the heat demand is reduced.

If you are servicing an existing system with a bypass valve and you are replacing a fixed speed circulator with a Compass H circulator, there is no need to remove or open/ close the bypass valve, leave as it is currently installed.

8.0 START-UP

8.1 BEFORE START-UP

Fill the system with liquid and properly vent the system before starting the pump. The required minimum inlet pressure in relation to liquid temperature must be available at the pump inlet (see section 11).

8.2 VENTING THE PUMP

Even with system vented, air may be still be present in the pump. The air in the pump may cause noise but the noise should cease after a few minutes running.

The venting process can be shortened by setting the pump to run at speed III for a short period of time (20 seconds).

Once the pump is vented and (the noise has ceased), set the pump mode according to the recommendations (see section 6).

CAUTION

The pump must not run dry.

9.0 PUMP SETTINGS AND PUMP PERFORMANCE

9.1 RELATION BETWEEN PUMP SETTING AND PUMP PERFORMANCE

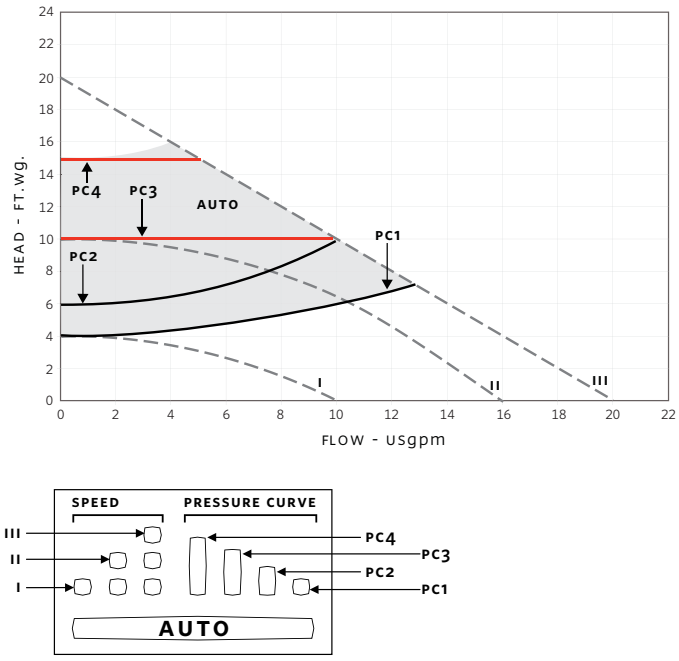

FIG. 12 Pump setting in relation to pump performance

Select the optimum setting:

The Compass H circulator comes with 9 modes of operation.

There are three fixed speed curve options which will operate just like traditional fixed speed circulators, except that Compass H motor technology is far more energy efficient than traditional fixed speed circulators.

The proportional pressure curves operate as Sensorless differential pressure circulators. These curves follow pre-selected performance curves and will reduce flow and energy consumption when the valves in the system close or open and the flow requirements are reduced.

The constant pressure curves and **AUTO** mode maintain pre-selected pressure ratings at the circulator.

AUTO mode operates on the sensorless differential pressure principle, but will **Learn** usage patterns and adjust circulator performance over time to optimize energy efficiency. The operating point will be within the gray envelope seen in **FIG. 12** .

SETTING	PUMP CURVE	FUNCTION
AUTO (factory setting)	Operating within the defined range	The **AUTO** function controls the pump performance automatically within a defined performance range (see **FIG. 12** - within the grey envelope). • Adapt to the size of the system. • Adapt to system demand over time. In **AUTO** mode the Compass H is set to a proportional-pressure curve control.
PC1	Lowest proportional pressure curve	The operation point of the pump will follow the lowest proportional-pressure curve (see **FIG. 12**) depending on the load demand. The head (pressure) is reduced during low demand and increased during high demand until the maximum wattage is reached, then the pump will run on the speed III curve.
PC2	Highest proportional pressure curve	The operation point of the pump will follow the highest proportional-pressure curve (see **FIG. 12**) depending on the load demand. The head (pressure) is reduced during low demand and increased during high demand until the maximum wattage is reached, then the pump will run on the speed III curve.
PC3	Lowest constant pressure curve	The operation point of the pump will follow the lowest constant-pressure curve (see **FIG. 12**) depending on the load demand. The head (pressure) is kept constant, regardless of the load demand until the maximum wattage is reached, then the pump will run on the speed III curve.
PC4	Highest constant pressure curve	The operation point of the pump will follow the highest constant-pressure curve (see **FIG. 12**) depending on the load demand. The head (pressure) is kept constant, regardless of the load demand until the maximum wattage is reached, then the pump will run on the speed III curve.
III	Speed III	Speed III is the highest constant speed performance curve of Compass H and it also presents the max performance capability of the pump (see **FIG. 12**). Speed III can also be used to vent the pump (see section 8.2).
II	Speed II	Speed II is the medium constant speed performance curve of Compass H (see **FIG. 12**).
I	Speed I	Speed I is the lowest constant speed performance curve of Compass H (see **FIG. 12**).
 **INPUT**	Analog input	Analog input controls the operation of Compass H from off up to 100% performance (see **FIG. 7**)

10.0 TROUBLESHOOTING

WARNING

Before starting any work on the pump, make sure that the electrical supply has been switched off and that it cannot be accidentally switched on.

FAULT	CONTROL PANEL	CAUSE	REMEDY
No Fault	Shows "E1"	Voltage too high or too low (than ±10% of the rated voltage)	Check voltage level of the electricity supply.
The pump does not run	Light off	No power to the pump	Check power supply.
		The pump is defective	Replace the pump.
	Shows "E2"	Jammed rotor	Remove the casing and manually unlock the impeller/rotor.
	Shows "E3"	No liquid in the system at start up.	Fill up the system.
	Shows "ER"	Miscellaneous internal failure	Check voltage of the electricity supply.
			Replace the pump.
Noise in the system	Shows watts and USgpm	Air in the system	See section 8.2 Venting of the pump system.
		The flow is too high	Select a lower speed or pressure curve (see section 9). Pump settings and pump performance.
Noise in the pump	Shows watts and USgpm	Lock Rotor	Change to another operation mode. If the situation continues remove the casing and free the rotor.
		Air in the pump	Let the pump run. It vents itself over time (see section 8.2) venting the pump.
		The inlet pressure is too low	Increase the inlet pressure or check the air volume in the expansion tank, if installed.
Insufficient heat in space	Shows watts and USgpm	No Water in the pump	Fill the system.
		The pump performance setting may be too low	Select a higher speed or pressure curve setting (see section 9). Pump settings and pump performance.
			Confirm that the system requirement can be met by this pump capacity or larger pump may be required.

11.0 TECHNICAL DATA AND INSTALLATION DIMENSIONS

11.1 TECHNICAL DATA

Supply voltage: 1 × 115 V ± 10% 60 Hz

	MINIMUM	MAXIMUM
Amp	0.05	0.72
Watt	5	45

ANALOG INPUT

Analog Input: DC voltage only

SIGNAL TYPE	MIN. VOLTAGE LIMIT	MAX VOLTAGE LIMIT	MAX CURRENT LIMIT
2-10V	0 vdc	10 vdc	32 mA

Motor protection: The pump requires no external motor protection.

Maximum working temperature: 230°F (110°C) maximum

Maximum working pressure: 150 psi (10 bar).

Maximum relative air humidity (rh): 95%.

Enclosure class: Type 2

Insulation class: H

Certification: ETL listed for US and Canada (conforms to UL STD 778 certified to CSA STD C22.2 NO.108-01)
NSF 372 (stainless steel models)

INLET PRESSURE

Minimum inlet pressure in relation to liquid temperature:

Sound pressure level: The sound pressure level of the pump is lower than 43 dB(A).

Ambient temperature: 0°C (32°F) – 40°C (104°F)

Pumped liquids: Water or water Glycol mix.

LIQUID TEMPERATURE	MINIMUM INLET PRESSURE
150°F (65°C)	3.0 ft (0.91 m)
167°F (75°C)	4.4 ft (1.34 m)
194°F (90°C)	9.2 ft (2.8 m)
230°F (110°C)	36.1 ft (11.0 m)

WARNING

No flammable liquids such as diesel oil, petrol or similar liquids

Liquid temperature: 2°C (36°F) – 110°C (230°F)

To avoid condensation in the control box and stator, the liquid temperature must always be higher than the ambient temperature.

AMBIENT TEMPERATURE	LIQUID TEMPERATURE	
	MIN.	MAX.
0°C (32°F)	2°C (35.6°F)	110°C (230°F)
10°C (50°F)	10°C (50°F)	110°C (230°F)
20°C (68°F)	20°C (68°F)	110°C (230°F)
30°C (86°F)	30°C (86°F)	110°C (230°F)
35°C (95°F)	35°C (95°F)	90°C (194°F)
40°C (104°F)	40°C (104°F)	70°C (158°F)

CAUTION

Since water conditions can vary with geographical location (i.e. amount and type of dissolved solids) it is recommended that the operating temperature of the liquid for open (potable) systems be kept as low as possible (i.e. below 150°F or 65°C) to avoid crystalization of calcium.

VOLUTE MATERIAL

Cast iron: For closed systems (boiler loops)

Stainless steel: Open or closed systems (potable hot water or boiler loops)

Certified <0.25 weighted average percent lead (NSF 372) and complies with California Health and Safety code section 116875 (commonly known as AB1953).

SPARE PARTS

SPARE PART	ITEM NO.
Check valve 1"	810223–104

12.0 GRANTED PATENTS WITH THE PATENT NUMBER

Patented in Canada PCT/CA/05086, Patent Pending; USA, UA, etc.

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