



**Wilo- Star E 21**  
**EC Motor-Driven, High-Efficiency, Wet-Rotor, Circulator**

**Installation and operating instructions**

Fig. 1 - Model numbering information format

**Wilo-Star E 21**

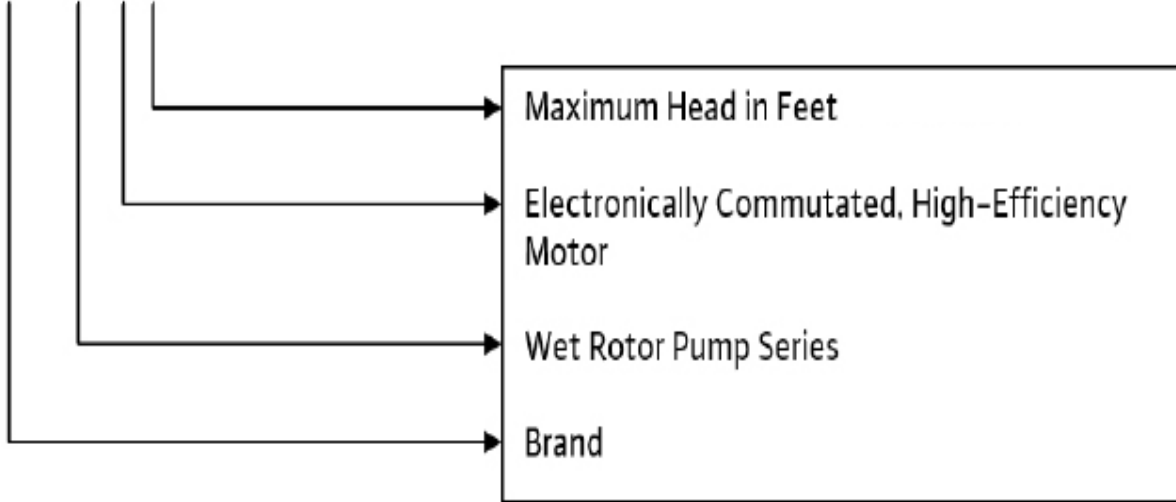
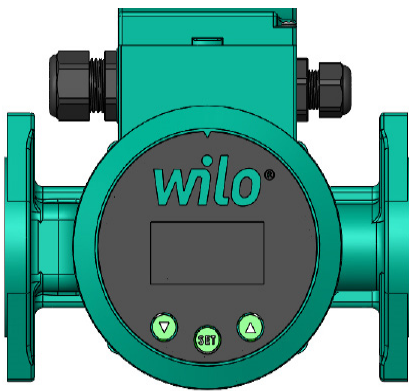


Fig. 2 - Proper Mounting

Figure 2a



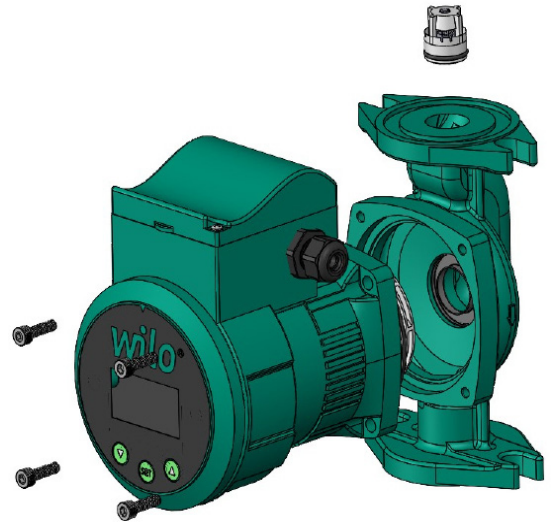
HORIZONTAL MOUNTING  
(DEFAULT CONFIGURATION)

Figure 2b



VERTICAL MOUNTING

Figure 2c



ROTATING THE DISPLAY

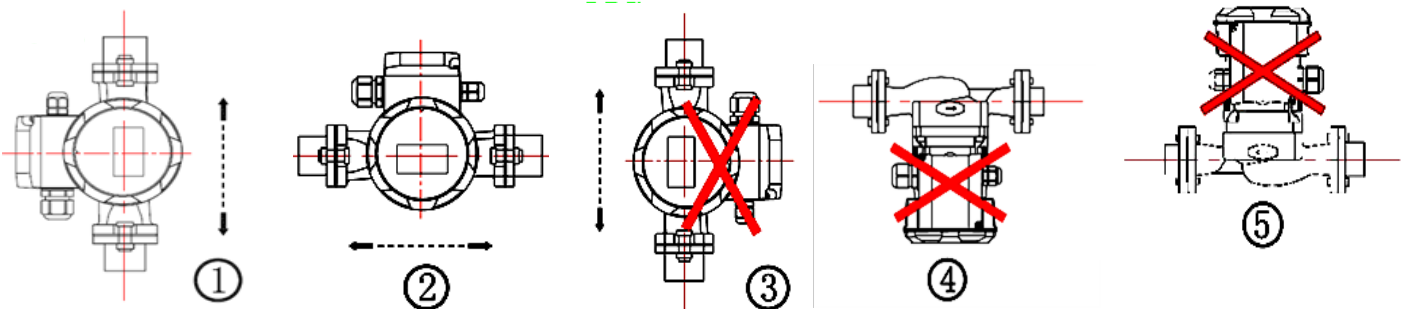


Fig. 3 - Dimensional Data

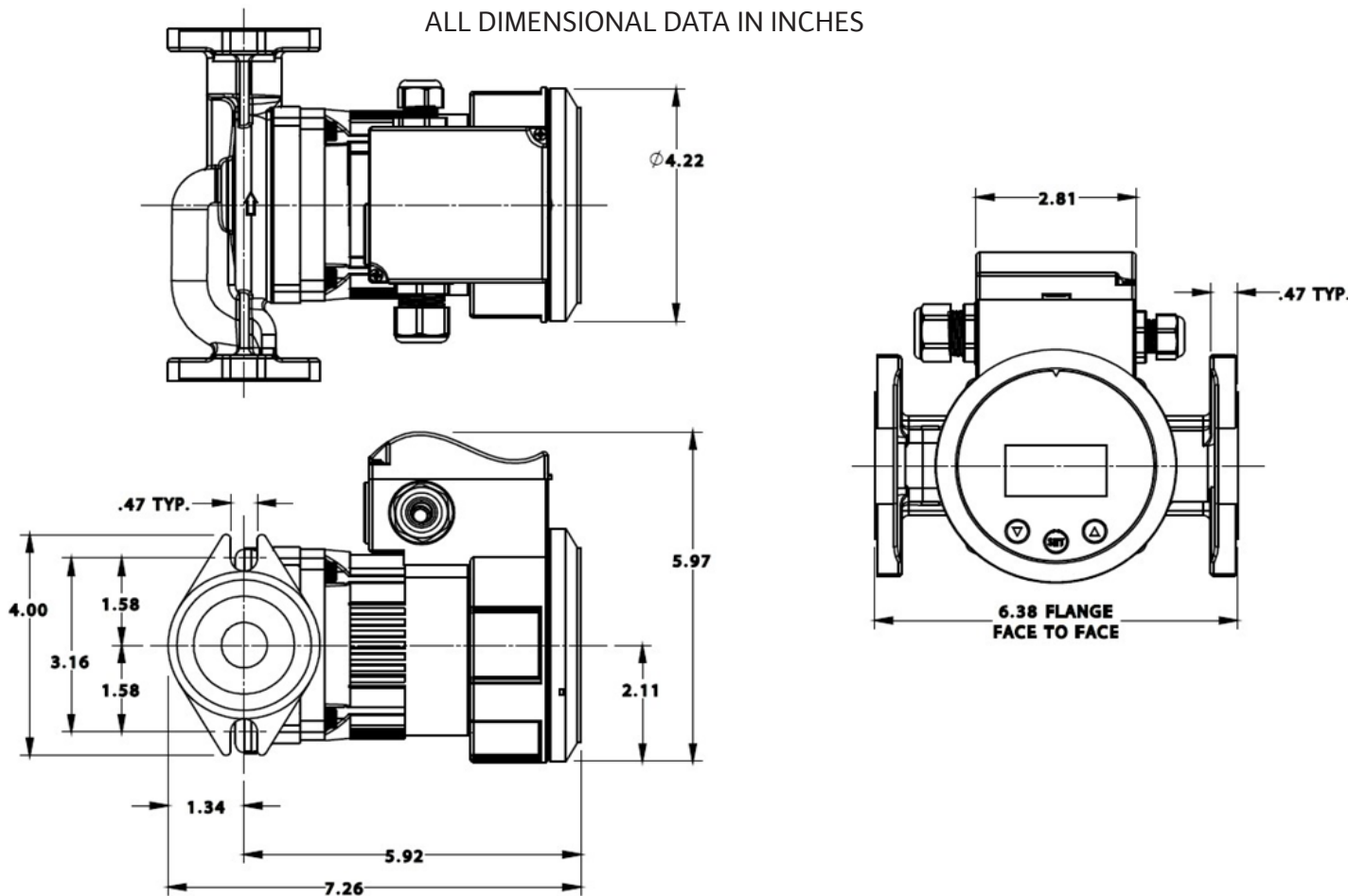
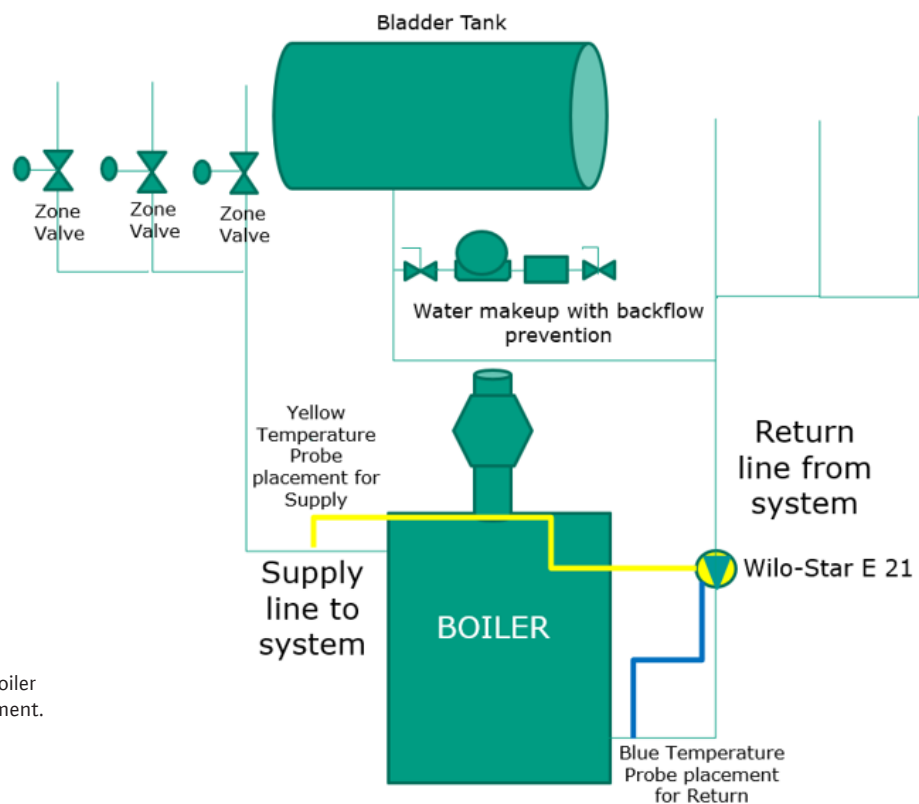


Fig. 4- Probe Location



**Special Note:** Refer to the boiler manufacturer's pump placement. This is only an example.

Figure 5a - Installing the gaskets

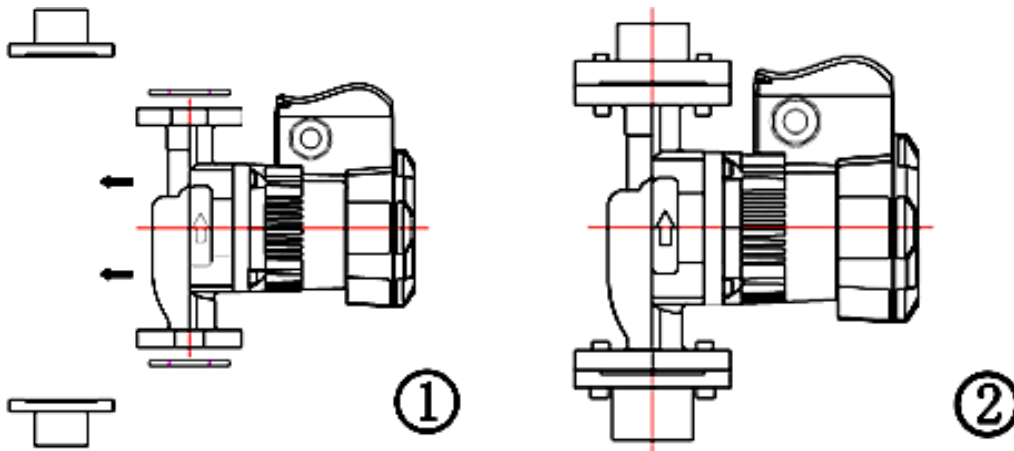


Figure 5b - Position of junction box

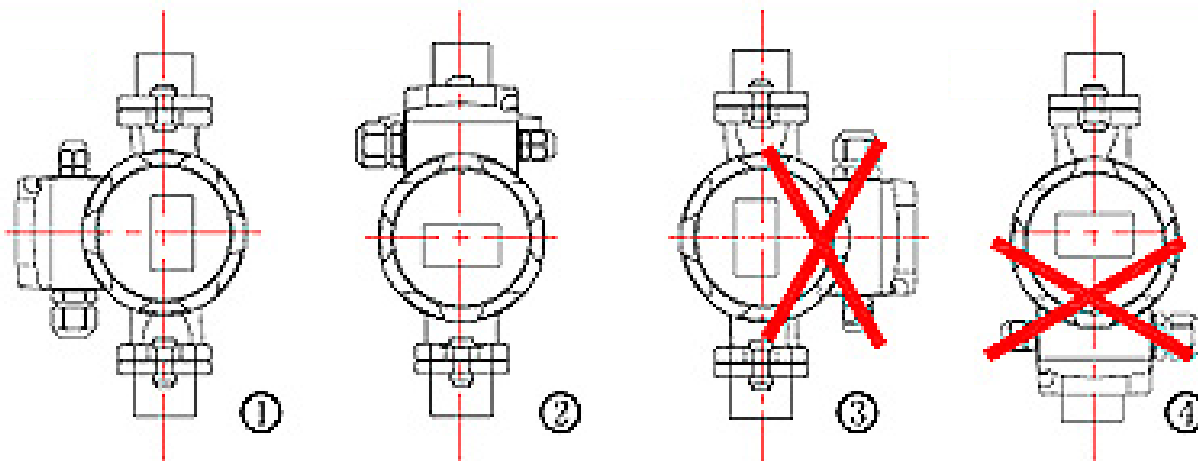


Fig. 6 - Wiring Diagram

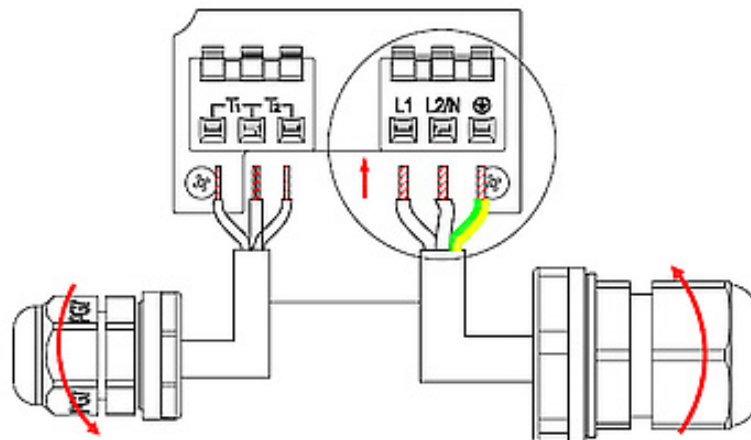


Fig. 7 - Display navigation

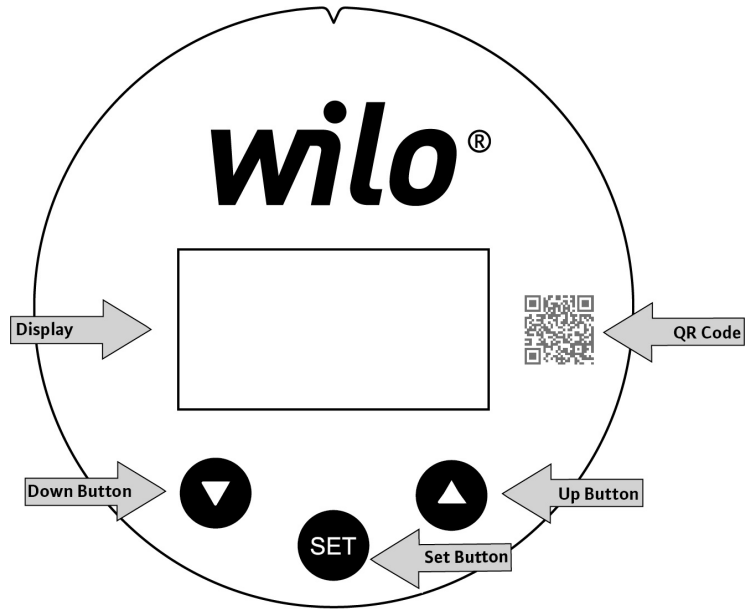
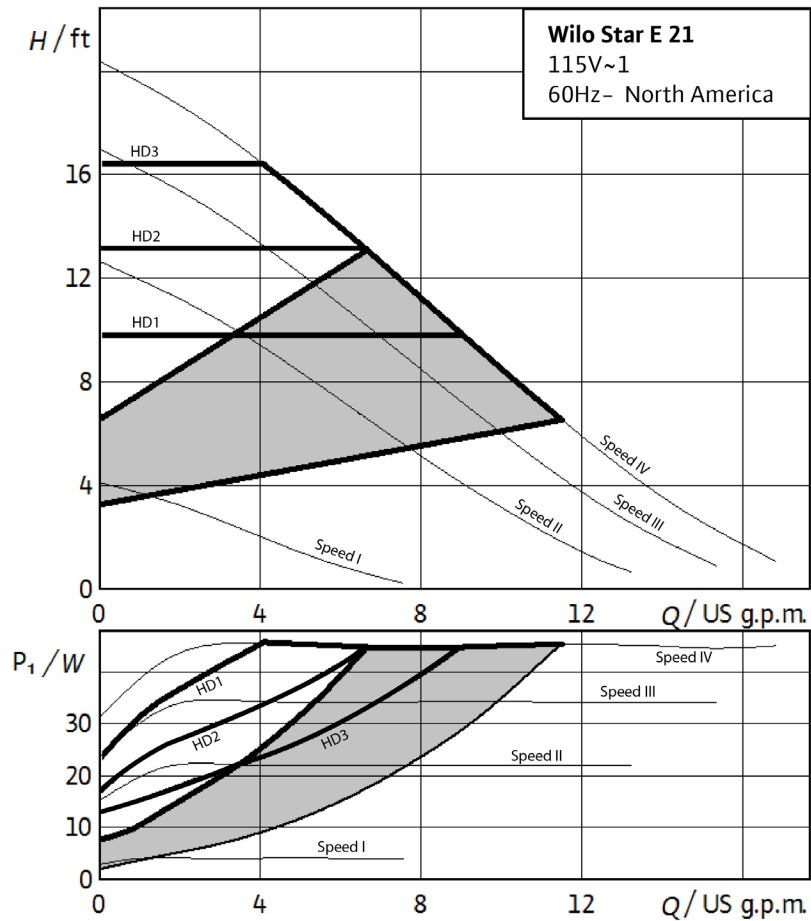


Fig. 8 - Performance curves for Constant Speed, HD mode, and Auto mode



## 1. General

### 1.1 About this document

These installation and operating instructions are an integral part of the product. They must be kept readily available at the place where the product is installed. Strict adherence to these instructions is a precondition for the proper use and correct operation of the product. These installation and operating instructions correspond to the relevant version of the product and the underlying safety standards valid at the time of publication.

### 1.2 Modeling information

Please refer to **Fig.1–page 2– Model numbering information format**, for the reference concerning the model description.

## 2. Safety

These instructions contain important information which must be followed when installing and operating the pump. It is therefore imperative that they be read by both the installer and the operator before the pump is installed or operated.

Both the general safety instructions in this section and the more specific safety points in the following sections should be observed.

### 2.1 Instruction symbols used in this operating manual

#### Symbols



General danger symbol



Hazards from electrical causes



NOTE: ...

#### Signal words:



**DANGER!** Imminently hazardous situation.  
Will result in death or serious injury if not avoided.



**WARNING!** Risk of serious injury. 'Warning' implies that failure to comply with the safety instructions can potentially result in severe personal injury.



**CAUTION!** Risk of damage to the pump if improperly installed.



NOTE: Useful information on the handling of the product. It alerts the user to possible problems.

### 2.2 Personnel qualification

The personnel installing the pump must have the appropriate qualification for this work.

### 2.3 Possible risks incurred by failure to comply with the safety instructions

Failure to comply with the safety instructions could result in personal injury or damage to the pump or installation. Failure to comply with the safety instructions could also invalidate any claim for damages.

In particular, failure to comply with these safety instructions could give rise, for example, to the following risks:

- Failure of the pump is sufficient,

- Personal injury due to electrical, mechanical and environmental causes,
- Damage to property.

### 2.4 Safety precautions for the operator

The relevant accident precaution regulations must be observed. Dangers caused by electrical energy must be eliminated. Local or general regulations [e.g. NEC, etc.] and directives from local codes, must be observed.

### 2.5 Safety precautions for inspection and installation

The operator must ensure that all inspection and installation work is carried out by authorized and qualified specialists who have carefully studied these instructions. Work on the pump/unit must be carried out only with the pump disconnected from the electrical supply and at complete standstill. For proper mounting options concerning the pump installation please refer to **Fig.2 –page 2–Proper Mounting**.

### 2.6 Unauthorized alterations

Alterations to the pump or installation may only be made in agreement with the manufacturer.

### 2.7 Improper use

The proper operation of the pump or installation can only be guaranteed if it is used in accordance with the operating instructions. All values must neither exceed, nor fall below, the limit values given in the catalogue or data sheet.

## 3. Shipment and interim storage

When receiving the material, check that there has been no damage during shipment. If shipping damage has occurred, take all necessary steps with the carrier within the allowed time.



**CAUTION!** Outside influences may cause damages !

If the delivered material is to be installed later on, store it in a dry place and protect it from impact.

## 4. Installation and electrical connection

**Installation and electrical work must be carried out in compliance with any local codes and by qualified personnel only.**



**WARNING! Bodily injury!**

Existing regulations for the prevention of accidents must be observed.



**WARNING! Electrical shock hazard!**

It is strongly suggested to have a trained technician install and set the Star E 21 pump for operation.

### 4.1 Unpacking

Unpack the pump and dispose of the packaging in an environmentally responsible manner.

Scope of supply:

- One circulating pump, Model, Star E 21 (provided by Wilo).
- Two gaskets need to be placed into the flange ends of the pump (provided by Wilo).

- One, optional flow check valve (recommended for parallel pumping systems, provided by Wilo).
- Installation and operation instructions (provided by Wilo).
- Three wire nuts and three cable ties (provided by Wilo).

#### 4.2 Installation

It is recommended that full port isolation ball valves be placed on the supply and return lines for the pump so that the pump can be serviced without having to drain the system. Make sure that the pump is pumping away from the bladder tank. Pumping toward the tank during extremely low speeds, in rare cases, can cause the pump to become air bound and stop the flow of water. It is recommended that the system includes an air vent device at highest point of the system.

- Install the pump in a vertical or horizontal position. Refer to **Fig.2a Horizontal Mounting and 2b Vertical Mounting-Page 2**
- Adjust the display to the proper orientation. The default orientation for the display view is in the horizontal position. In a vertical installation, remove the four hex head bolts (4 mm) and turn the pump counterclockwise 90° and reinsert the hex bolts and tighten in a crisscross pattern evenly until tight. Refer to **Fig.2c-Page 2-Rotating the Display**.
- The installation and connection dimensions (connection flanges and pump footprint) are given in **Fig.3-Page 3-Dimensional Data**
- It is **strongly** recommended to capture sediment by using permanent magnet separator upstream of the pump.

Using the supplied O-ring gaskets, install them on the supply and return body flanges of the pump, Tighten the flange bolts evenly to the pump. Only use the O-ring gaskets provided, any other gaskets used will void the warranty. Refer to **Fig. 5a-Page 4-Installing the Gaskets**

The flow check option should be used when parallel pumping is the primary piping configuration. When used, please insert the flow check into the discharge neck until it locks into place. Make sure the check moves freely. Refer to **Fig.2c-Page 2 - Rotating the Display**.



#### **WARNING! Risk of injury due to hot surfaces!**

The pump must be positioned so that someone cannot come into contact with the hot pump surfaces while in operation.

If you are using differential temperature as the method of control, zip-tie the probes to the supply and return piping. **Fig.4 -Page 3-Probe Location**. If you have issues (e.g. not enough wire length available to attach the probe to the return piping), it is recommended to switch the control mode from the Delta-T mode to the Auto mode.

This pump's basic function is to pump hot or cold water or water with 50% ethylene or propylene glycol.



**NOTE:** If introducing propylene or ethylene glycol into the system, it is important to dose downstream of the pump.



#### **DANGER! Risk of explosion!**

The pump must not be used to pump flammable liquid such as rapeseed oil and gasoline. Allowed liquids should be thin, clean, non-corrosive and non-explosive and should not contain any solid particles, fiber or mineral oil.

#### 4.3 Application areas:

##### **Heating, Ventilation and Air-Conditioning:**

- Boilers
- Induction heating
- Heat exchangers
- Temperature control systems
- Cooling circuits

## 5. Technical data

### 5.1 Technical data

- Ambient temperature range: 0°F -104°F
- Max relative humidity: 95%
- Degree of protection: IP42
- Max flow: 14.5 Gallons Per Minute
- Max dBA: 42
- Max system pressure: 145 PSI (10 BAR)
- Fluid temperature range: 36°F -230°F

Liquid Temperature	<185°F	194°F	230°F
Minimum Inlet Pressure	0.725 PSI	4.1 PSI	14.5 PSI
	1.68 Ft. of Hd	9.5 Ft. of Hd	33.5 Ft. of Hd



#### **WARNING CONCERNING CONDENSATION**

To avoid condensation in the control box and stator, the temperature of the pumped liquid must be always higher than ambient temperature. In cooling circuits it is recommended to insulate the pump housing. **DO NOT INSULATE THE MOTOR!**

### 5.2 Motor Information

The Star E 21 pump is equipped with permanent-magnet motor and differential temperature controller, capable of automatically & continuously adjusting motor performance to meet the actual needs of system.

### 5.3 Accessories

Original accessories are available for the Wilo-Star E 21. The accessories must be ordered separately.

## 6. Electrical connections

Wire the pump from the boiler pump relay to the conduit box. Note: Please follow the appropriate national and local electrical codes. Two 3/4" knock-outs are available for wiring; one on the side and one on the back. Liquid-tite, BX, or Rigid conduit are the preferred methods to protect the wiring. **Fig. 6-page 4-Wiring diagram**.



#### **DANGER! Danger of death!**

National Electrical Codes (NEC), local codes and regulations must be followed.



#### **WARNING! Electrical shock hazard!**

All electrical work must be conducted by a qualified electrician! Make sure that the supply voltages are

suitable for the motor used.

## 7. Modes and functions

### 7.1 Mode description

**Delta-T Mode (Default)** – Variable speed, maintains constant  $\Delta T$ , and provides exact GPM flow required. Attach the WHITE wire probe to the supply piping using the provided zip-ties. The BLUE wire probe should be zip-tied to the boiler return line. **Fig. 4 –page 3–Probe Location.** Press and hold down the “Set” button until the screen flashes “Delta-T mode”. Press the “Set” button again, and you will see the 20°F default setting flashing. Use the “Up” and “Down” arrow to either decrease or increase the desired differential temperature. Press the “Set” button to accept the change and to exit the setting. **Fig. 7 –page 5–Display navigation.**

**Constant Speed Mode** – Press and hold down the “Set” button until the screen flashes “Delta-T mode”. Press the “Down” arrow to change the mode from Delta-T mode to “Constant Speed Mode”. Press the “Set” button again, and you will see the “Speed 4” default setting flashing. Use the “Up” and “Down” arrow to either decrease or increase the desired speed curve. Press the “Set” button to accept the change and to exit the setting. This mode runs the pump at a fixed speed when a thermostat has called for the boiler to run. Four speeds are available for this mode. Please refer to the performance curves **Fig. 8 –page 5–Performance curves for Constant Speed, HD mode, and Auto mode**

**HD Mode (Head Defined)** – This mode runs the pump at a variable speed while limiting the Maximum head in relation to the flow. Three performance curves are available for this mode. Please refer to the performance curves **Fig. 8 –page 5–Performance curves for Constant Speed, HD mode, and Auto mode**

**Auto Mode** – adjusts the speed of the circulator in accordance with the resistance in the system. As zone valves open or close, the circulator will automatically adjust its speed to meet the most efficient point on the curve. To get to this setting, press and hold down the “Set” button and use the “Up” and “Down” arrow to get to the Auto mode and press “set” to accept and exit the mode. This mode does not use the temperature probes for monitoring. Please refer to the performance curves **Fig. 8 –page 5–Performance curves for Constant Speed, HD mode, and Auto mode**

**SP Heat Mode** – Set Point Heat Mode adjusts the speed of the circulator by slowing down the circulator if the supply temperature increases over setpoint. To get to this setting, press and hold down the “Set” button and use the “Up” and “Down” arrow to get to the SP Heat mode and press “Set” to accept and exit the mode.

**SP Cool Mode** – Set Point Cool Mode adjusts the speed of the circulator by speeding up the circulator if the supply temperature increases over setpoint. To get to this setting, press and hold down the “Set” button and use the “Up” and “Down” arrow to get to the SP Cool mode and press

“Set” to accept and exit the mode.

**BP Mode** – Boiler Protection Mode adjusts the speed of the circulator by monitoring the return line temperature. The pump slows down as return temperature increases. To get to this setting, press and hold down the “Set” button and use the “Up” and “Down” arrow to get to the BP Mode and press “Set” to accept and exit the mode.

**Set Up Mode** – This mode is used to change the language and read-out units. To get to this setting, press and hold down the “Set” button and use the “Up” and “Down” arrow to get to the Set-up mode and press “Set” to accept and exit the mode.

## 8. Maintenance

**The Wilo Star E 21 is a maintenance free pump.**



### **WARNING! Electrical shock hazard!**

Dangers caused by electrical energy must be excluded. All electrical work must be performed after the electrical supply has been secured against unauthorized switching.



### **WARNING! Risk of scalding!**

At high water temperatures and system pressure close isolating valves before and after the pump. First, allow pump to cool down.



## 9. Faults, causes and remedies



**WARNING! Electrical shock hazard!**

Error Shown	Description	Remedies
Sensor 1 missing	Supply sensor disconnected	Reconnect sensor
Sensor 2 missing	Return sensor disconnected	Reconnect sensor
Sensor 1 shorted	Supply sensor shorted	Replace sensor
Sensor 2 shorted	Return sensor shorted	Replace sensor
Under-voltage protection	Under voltage	Power inspection
Over-voltage protection	Over voltage	Power inspection
Over-current protection	Locked rotor possibility	Replace pump
Under-load protection	Dry running of the pump	Fill with water
Lose-phase protection	Locked rotor or motor failure	Replace pump
Over-heating protection	PCB overheating	Pump will reduce current and speed until PCB temperature is acceptable. If speed falls below 1650RPM, pump will stop on safety. Cycle AC power OFF/ON to restart.

## OHMS TABLE

Temp in °F	Resistance KΩ	Temp in °F	Resistance KΩ	Temp in °F	Resistance KΩ	Temp in °F	Resistance KΩ
-22	173.7550	50	20.0690	122	3.5835	194	0.9180
-13	129.4075	59	15.7608	131	2.9891	203	0.7910
-4	97.4205	68	12.5131	140	2.4901	212	0.6830
5	73.2141	77	10.0000	149	2.0891	221	0.6000
14	55.8015	86	8.0703	158	1.7491	230	0.5210
23	42.7122	95	6.5443	167	1.4810	239	0.4580
32	32.9977	104	5.3202	176	1.2580	248	0.4000
41	25.5513	113	4.3522	185	1.0729	257	0.3490

## 10. Ohms Table

A good quality test meter capable of measuring up to 5000kΩ (1kΩ=1000Ω) is required to measure the sensor resistance. In addition to this, the actual temperature must be measured with a good quality digital thermometer. First measure the temperature using thermometer and then measure the resistance of the sensor. The wires from the sensor must not connect to the circulator while this test is performed. The wire terminals are easily removed by pulling them from the circulator. Using the chart above, estimate the temperature measured by the sensor. The sensor and thermometer reading should be close. If the test meter reads a very high resistance, there may be a broken wire, a poor wiring connection or a defective sensor. If the resistance is very low, the wire may be shorted, there may be moisture in the sensor or the sensor may be defective. To test for a defective sensor, measure the resistance directly at the sensor location.

## 11. Accessories

Accessories may be ordered via the local WILO USA LLC. distributor.

To avoid any questions or wrong orders, all data of the name plate should be mentioned when ordering, including date codes.



### **CAUTION! Danger of material damage!**

Pump performance can only be guaranteed when original accessories are used.

- Only use original accessories.

WILO USA LLC

+1 262-204-6600  
[www.wilo-usa.com](http://www.wilo-usa.com)  
[info.us@wilo.com](mailto:info.us@wilo.com)

WILO Canada Inc.

+1 403-276-9456  
[www.wilo-canada.com](http://www.wilo-canada.com)  
[info@wilo-canada.com](mailto:info@wilo-canada.com)

WILO Mexico

+52 442 167 00 32  
[www.wilo-mexico.com](http://www.wilo-mexico.com)  
[info@wilo.com.mx](mailto:info@wilo.com.mx)

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