Basic Radiant Panel
Models RHP, RHP-1 & RHP-2
Warning!

Safety First - The following symbols are used through this document. For your safety please pay attention.

Always!

- **Treated Water, Do Not Drink**
  - When used with a boiler, fluid in panel is typical of fluids found in boilers.
  - Not for human consumption or for washing, cleaning or as a dilution fluid.

- **Warning**
  - Pay Attention, Heath Hazard
  - Do Not Take Risks
  - Possible Dangers
  - If In Doubt, Contact CPI

- **Danger**
  - Live Power
  - 24 Volt and 110 Volt
  - Qualified Electrician Only
  - Do Not Touch

- **Do Not Touch**
  - Hot Pipes, Corrosive Liquids
  - Scalding is Possible

- **Corrosive**
  - High or Low pH
  - Do not store corrosives near this panel

- **Danger**
  - Explosion
  - Electrical sparks could cause explosion.
  - Do not operate near flammable substances such as, but not limited to:
    - Gas, Oils, Propane,
    - Solvents, Paints,
    - etc.

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Warning!

Safety First - Always!

This product must be installed, used, stored and operated strictly in accordance with the terms set out in this manual and in accordance with all laws, rules, codes and regulations of the jurisdiction wherein the product is located. Failure to follow the terms set out in this manual, or the foregoing laws, rules, codes or regulations may result in property damage, serious injury or death.

In the event this product is not installed by a qualified person, as defined herein, or in the event this product is not installed, used, stored or operated in accordance with the terms set out in this manual or in accordance with all laws, rules, codes or regulations of the jurisdiction wherein the product is located, or in the event this product is repaired or altered without the written consent of CPI, any and all warranties offered by CPI in relation to this product will be void, and CPI will not be responsible for any direct or indirect damage to this product or to any other property, personal injury, and/or death, regardless of whether CPI advised of the possibility of such damage, injury or death.

WARNING SYMBOLS:

This panel contains electrical devices which could ignite flammable vapors. Do not connect power to, nor operate this equipment in the presence of flammable vapors.

The heated fluid supplied to this panel could be hot enough to cause personal injury should skin remain in contact with pipes. Do not mount this panel in any area or manner which could lead to injury. Treat like any other boiler room equipment. Keep children away.

The power to be connected to this panel has dangerous capabilities with potential to cause fatal injury. The capability to injure continues to exist whether the power is on or off. No persons should attempt to connect, service, repair or alter this equipment. Only a competent electrician, qualified by local jurisdictions having authority should connect power to the panel. It is the responsibility of the person installing this equipment to provide proper grounding.

Improper handling and installation of this product may cause equipment failure, serious injury or death. Follow this manual, National Electrical and Plumbing Codes and Local Codes.

Motors and valves mounted on this panel require continuous air circulation. Overheated equipment will lead to premature failure.

This panel does not come with pressure control equipment such as a pressure relief valve or expansion tank. This panel is only to be connected to a heating plant which contains safety devices.

Do not use petroleum based products in or on this panel. Damage to seals can occur resulting in personal and/or property damage.

This product is not protected from freezing. In applications where freeze protection is required, use antifreeze solutions suitable for hydronic systems such as 50/50 mixture of propylene glycol and water. Installing contractor to meet all local environmental and plumbing codes governing backflow prevention. With Glycol, use a stabilized type, a separate stabilizer, or change fluids annually to avoid a buildup of corrosive glycolic acid.

Brass products such as the valves supplied with this product are adversely affected by media that contain - or that during the process of treatment could develop, agents aggressive to brass. This could include Ammonia, Mercury, Oxygen, Carbon Dioxide, and Chloride. Further, the pH-value of the fluid in the hydronic heating system in contact with the brass products should not exceed 9.5.

Neglecting the above restrictions may in some circumstances cause damage to the brass in the panel allowing the heating fluid to escape, possibly causing damage to property and/or persons.
<table>
<thead>
<tr>
<th>Definition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASTM</strong></td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td><strong>ASHRAE</strong></td>
<td>American Society of Heating, Refrigeration and Air-Conditioning Engineers</td>
</tr>
<tr>
<td><strong>BTU</strong></td>
<td>British thermal unit. A unit of measuring the amount of energy required to raise one pound of water by 1°F.</td>
</tr>
<tr>
<td><strong>Btuh</strong></td>
<td>British thermal unit per hour. The rate at which energy is transferred.</td>
</tr>
<tr>
<td><strong>Circuit</strong></td>
<td>Pipe that is connected from supply manifold to the return manifold.</td>
</tr>
<tr>
<td><strong>CSA</strong></td>
<td>Canadian Standard Association</td>
</tr>
<tr>
<td><strong>Dura-Pex</strong></td>
<td>Cross linked polyethylene pipe or Barrier Pex (tubing) manufactured by CPI.</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td>The temperature of the system needed to be maintained under extreme outside temperature conditions.</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>The temperature of the system needed to be maintained under extreme outside temperature conditions.</td>
</tr>
<tr>
<td><strong>Heat Source</strong></td>
<td>A source of heated fluid for the RHP. This could be electric, gas, or wood-fired heat from a boiler or water heater.</td>
</tr>
<tr>
<td><strong>Loop</strong></td>
<td>Single piece of Dura-Pex pipe connected to a manifold.</td>
</tr>
<tr>
<td><strong>RFH</strong></td>
<td>Radiant Floor Heating</td>
</tr>
<tr>
<td><strong>BRP</strong></td>
<td>Basic Radiant Heat Panel Model RHP, RHP-1 or RHP</td>
</tr>
<tr>
<td><strong>Thermostatic Control</strong></td>
<td>An internal mechanical element which reacts to temperature changes.</td>
</tr>
<tr>
<td><strong>Thermostatic</strong></td>
<td>Non electrical temperature control</td>
</tr>
<tr>
<td><strong>UL</strong></td>
<td>Underwriter’s Laboratory</td>
</tr>
<tr>
<td><strong>USgpm</strong></td>
<td>Gallons (US) per minute of liquid flow.</td>
</tr>
<tr>
<td><strong>Zone</strong></td>
<td>Area with one or more loops controlled by single thermostat.</td>
</tr>
</tbody>
</table>
Introduction

Thank you for purchasing a CPI (Consolidated Plumbing Industries) Basic Radiant Heat Panel (BRP). The BRP is the easiest way to link a properly sized heat source to the radiant system using time tested control technology. Backed by years of experience designing components for the heating industry, the CPI BRP is a reliable choice for radiant system control.

Features/Benefits

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-engineered</td>
<td>Designed for Dependable Performance using Proven Components</td>
</tr>
<tr>
<td>Pre-assembled</td>
<td>Tested for Installation Leak Free Consistency.</td>
</tr>
<tr>
<td>Pre-wired</td>
<td>Facilitates Quick Trouble Free Start Ups.</td>
</tr>
<tr>
<td>Compact</td>
<td>Minimal area needed for installation.</td>
</tr>
<tr>
<td>Modular</td>
<td>Systems of any size can be assembled.</td>
</tr>
<tr>
<td>Warranty</td>
<td>12 months from purchase.</td>
</tr>
</tbody>
</table>

Capacity

The RHP and RHP-1 models will serve up to five loops, the RHP-2 model will service 10 loops. Each loop is capable of handling no more than 0.5 USgpm. Each loop is to be ½“ Dura-Pex (or Barrier Pex). Each loop is not to exceed 250 ft.

Function

The BRP moves heated fluid to the Radiant Floor Heating (RFH) system and allow you to raise or lower the room temperature. As long as the circulator is moving water and the control valves are opening and closing according to instructions from the thermostat, the BRP is operating as intended.

Performance

The delivery of heat to your floor and room is based on the temperature of the fluid, the capacity of the BRP circulator and design of the RFH. Restriction to water flow such as the radiant floor heating pipes in your floor, temperature of the heated water, and the design/installation of your RFH system will have an impact on the system. Most RFH systems need a minimum of 110°F water to work properly, while some need temperatures of 150°F.

The proper design of a RFH system will make the difference between your satisfaction or dissatisfaction. Several factors such as slab insulation, tube length, spacing, floor covering and heat loss will affect the performance of your system. The CPI BRP has no control over these important factors.

Expectations

The CPI BRP simply moves the heated water to the RFH(s) based on instructions from the thermostat. There is no need to modify, cut, change, or otherwise alter the CPI BRP. Doing so will void warranty.

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Specifications & Restrictions

**Circulators**

CPI’s BRP is pre-assembled and pre-wired using our standard products. The circulator has been selected to handle the flow requirements for a typical system plus a marginal allowance for any additional pressure capacity not considered. The circulator will be undersized if there are more than 5 loops per zone (RHP and RHP-1 Models), 10 loops (for the RHP-2), if the loops are longer than 250 ft. or if they are smaller than 1/2” in diameter.

**Hydraulics**

Pressure losses have been dimensioned based on design flows through ½” nominal Dura-Pex tubing at at rate of 0.5 to 0.7 USgpm. A nominal 9 ft. of head for the radiant tubing and 4 ft. of head for control valves, pipe and fittings has been allowed for in the circulator selection.

If system requires a larger circulator, you should consider a modular approach and use multiple BRP. Mixing valves have been selected to provide sufficient flow for a minimum and maximum case.

**Control Format**

The CPI BRP utilizes an electronic thermostat, which is placed within the room where temperature is monitored by an internal room sensor. Some models include a floor sensor which is applicable under wood floors where excess heat can cause damage to the flooring.

**Mixing**

Mixing valve capacities are based on 20 °F temperature difference between heating supply being tempered and the temperature returning to the boiler or water heater from the BRP. For example: If heating supply measures 180 °F with a final mixed temperature of 120 °F, the return temperature from the RHP will be approximately 100 °F. **The RHP model does not include a mixing valve, so you will need to use the controls of the water heater to control fluid temperature. As a safety precaution, the RHP model includes a limit switch which will shut down the pump if the fluid temperature exceeds 140 °F.**

**Boiler vs. Domestic Water Heaters**

All equipment performances are based on the use of a heating supply with 20 °F ΔT. A boiler or domestic water heater are compatible with the RHP-1 and RHP-2 models. **Only a water heater should be used with the RHP model.**

**NOTE:** The circulators supplied with the BRP are suitable for potable applications. If any type of glycol is used in the system, it must be isolated from domestic water use. Propylene glycol is poisonous and ethylene glycol is toxic. Follow codes and standards of authorities having jurisdiction. With Glycol, use a stabilized glycol, a separate stabilizer, or change fluids annually to avoid a buildup of corrosive glycolic acid.

**Manifold Connections**

The RHP and RHP-1 are designed for 3/4” Dura-PEX piping to and from the heat source and to and from the distribution manifold. The RHP-2 is designed for 1” connections.

**Material Properties of Components**

The parts used on the BRP are composed of non-ferous material. The types of materials used that are in contact with water are brass, ANSI 316 stainless steel, and EPDM rubber.
Quick Install

1. **Unpacking**
   - Remove BRP from box. Check to ensure there is no visible damage as a result of shipping.

2. **Location of Panel**
   - It is recommended the piping distance between BRP and heating source should be no greater than 20 ft. and central to the RFH manifold. The BRP must be easily accessible should repair or service be required.

3. **Mounting Panel**
   - Securely fasten BRP to wall using appropriate fasteners. Take into consideration the weight of the panel. Mount the BRP level.

4. **Pipe Connections**
   - BRP heat and return connections and supply and returns to RFH manifolds are male pipe thread. This enables you to attach adapters for connections of type: crimp, sweat, and compression.

5. **Fill and Purge**
   - For proper installation of your BRP, it is necessary to install a fill valve, an isolation valve, and a drain valve on the supply or return side of the panel as seen on page 10. These valves are sold separately
     1. Turn off power to panel and fill water heater or boiler with fluid.
     2. Attach a hose to fill and purge valves and close the isolation valve in between them.
     3. Allow water to flow from the return side to supply side (backwards of normal flow). Use isolation (balancing) valves to purge each loop individually.
     4. Loosen the large silver screw on the pump a full turn.
     5. When water appears dripping from pump wait for a minute then tighten pump screw and close remaining drain valve (pump may continue to drip for as long as an hour until seals are lubricated).
     6. When flow appears free of air bubbles on all loops, close fill and purge valves
     7. Before operation of the BRP perform a complete installation leakage test.

6. **Wiring**
   - Locate and install thermostat.
   - Connect thermostat plug to phone type socket on panel. With RHP model use a minimum 3 conductor wire and connect the Aa, B, and 3 terminals on the RHP to the corresponding terminals on the thermostat.
   - If desired, locate and install floor sensor in the appropriate location for the RHP-1 and RHP-2 Models. It should be imbedded in the floor 2-3 inches. If not in use, the floor sensor should be coiled up in the wall behind the thermostat.

7. **Start-Up**
   - Turn on power to BRP.
   - Adjust temperature at mixing valve. See Appendix 2 for details
   - Set room temperature and / or floor temperature at thermostat. See Appendix 1 for details
   - Adjust individual room temperatures using valves on individual loops at manifold.
The room thermostat (sold separately on some models) is the controller that signals the circulator and has an internal air sensor which monitors the temperature. Some thermostats include a limitation sensor which should be in a protective sleeve (such as a short piece of Dura-Pex) when placed in a slab. If your thermostat has a floor sensor, you have two options when controlling temperature. One option is to use the floor sensor to ensure the set maximum temperature is not exceeded. The second option uses the sensor to keep a constant set temperature in the floor. For either option when there is a call for heat the thermostat signals the circulator which causes heated fluid to enter the radiant system.

This is a representative panel. Your model may differ slightly. RHP-2 Panel is very similar but utilizes 1” copper tubing instead of 3/4”. RHP model has no timer or mixing valve.
Model Shown:  RHP-1
Description: Shown with 4 Loop Manifold and 3 Loops, Closed system.
1. Unpacking
Remove BRP from box. Check to ensure that the panel includes components as shown in the diagram on pages 9.

2. Location of Panel
It is recommended the piping distance between the BRP and the heater should be no greater than 20ft. and central to RFH manifolds. In addition, the components on the BRP must be easily accessible should repair or service be required.

3. Mounting Panel
Securely fasten the BRP to the wall using appropriate fastening devices. Mount the BRP level.

4. Distribution Pipe
Dimension lines are to a pipe velocity between 2 and 5 ft./sec. (see chart below)
The circulators supplied with the BRP has differential pressure available for some limited distribution piping. Exceeding the available differential pressure could cause under-performance. Please refer to specification sheet or contact CPI.
Adapters may be required to increase or decrease the distribution piping to match BRP.

5. Connecting RHP to Radiant Floor Heating Manifolds
Use ¾” Dura-PEX or Copper with the RHP & RHP-1, 1” with the RHP-2. Connect the BRP supply outlet to your radiant floor supply manifold. Connect your radiant return manifold to the return inlet on the BRP.

<table>
<thead>
<tr>
<th>Flow US gpm, 100% water</th>
<th>1/2” Head Loss ft of Head/100ft Velocity fps</th>
<th>3/4” Head Loss ft of Head/100ft Velocity fps</th>
<th>Flow US gpm, 100% water</th>
<th>1/2” Head Loss ft of Head/100ft Velocity fps</th>
<th>3/4” Head Loss ft of Head/100ft Velocity fps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1.25</td>
</tr>
<tr>
<td>1.5</td>
<td>10</td>
<td>2.5</td>
<td>1.5</td>
<td>3.5</td>
<td>1.75</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>4</td>
<td>2</td>
<td>6.5</td>
<td>2.4</td>
</tr>
<tr>
<td>2.5</td>
<td>25</td>
<td>4.5</td>
<td>5</td>
<td>11</td>
<td>3.5</td>
</tr>
</tbody>
</table>

6. Connecting BRP to Heat Source
Use ¾” Dura-PEX or Copper with the RHP & RHP-1, 1” with the RHP-2. Connect the BRP inlet marked “Supply from Heat Source” to the outlet of the heat source. Connect the BRP outlet marked “Return to Heat Source Outlet” to the return connection of the heat source.

<table>
<thead>
<tr>
<th>Flow US gpm, 100% water</th>
<th>3/4” Head Loss ft of Head/100ft Velocity fps</th>
<th>1” Head Loss ft of Head/100ft Velocity fps</th>
<th>Flow US gpm, 100% water</th>
<th>3/4” Head Loss ft of Head/100ft Velocity fps</th>
<th>1” Head Loss ft of Head/100ft Velocity fps</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>2.6</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>7</td>
<td>6</td>
<td>9.5</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>10</td>
<td>8</td>
<td>1.5</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>20</td>
<td>10</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

7. Type of Connections on BRP.
The connection type is male pipe thread. This enables you to attach female pipe thread adapters of type: crimp, sweat, or compression.
Installation Instructions

8. Fill and Purge

If you are employing a closed system, i.e. the fluid remains in the system indefinitely, it is required to install an in-line expansion tank in the supply from heat source. This allows for contraction and expansion of the fluid. If your system is open to a municipal water supply and no backflow preventer is in use, an expansion tank is unnecessary.

The objective in filling the BRP and related equipment is to purge air from the piping network. To allow proper filling and purging, it is necessary to install fill and purge valves as seen in the example schematic on page 10. The fill and purge valves are not included with the BRP. Allow sufficient time and flow for air bubbles to be flushed from the system. An air eliminator (not included) will facilitate the final purging of air. The BRP has no ability to deal with air locks, which impede the performance of the system and can cause the pump to fail. Installer will need two hoses to complete the following procedure. Hoses must each have a female connection to attach to appropriate valves. (Installer takes responsibility and liability to meet all local environmental codes for discharging fluids).

Purging Instructions

1. Turn off power to BRP and fill heat source with fluid. Open all isolation and drain valves (except the one between the fill and purge valves).
2. Close all individual loop isolation (balancing) valves on manifold except one. Connect hose to water source outlet and the other end to fill valve. Connect another hose to purge valve and to a suitable discharge (such as a large bucket) and begin filling. Flow will be in reverse of normal.
3. When flow appears free of air bubbles, close the open loop and move to the next loop - thus filling and purging each loop in turn.
4. Turn large silver screw located on the face of the pump a full turn counter clockwise. When water appears dripping from the pump allow air to escape and allow water to lubricate the internals of the pump. After two minutes tighten the pump screw clockwise.

Note:
If using a glycol mix, pump in the mix from a large container and purge back into the same container.

9. Wiring

Locate room thermostat, install and run the wire back to the BRP. Plug jack into socket. The room thermostat should be located in an area representative of the most commonly used space, between 50 and 60 inches above the floor, away from doors, curtains, draughts, direct sunlight, air registers, fireplaces, or any other form of heat, which may influence the control. For the RHP model, use a suitable 3 conductor wire and connect the A, B, and 3 terminals on the RHP wiring block to to the corresponding positions on the thermostat. If you desire to use the RHP-1 or RHP-2 panels to signal a boiler to fire, use the auxiliary contacts. This pair may be connected to a boiler and the circuit will close when heat is called for by the panel.

Finally, connect 110V power to BRP.

10. Pipe Insulation

To reduce heat transfer from BRP to room, insulate with standard grade pipe insulation. Do not insulate electric motors.
Control Sequence

Control Notes
The BRP does not control the heat source (however see note at bottom of page 12)
The heat source requires its own control system, according to local codes independent of the BRP.

Control Sequence

1. When room thermostat calls for heat the dry contacts in the thermostat are closed.
2. The radiant circulator will begin to pump heated fluid to the system.
3. For the RHP-1 and RHP-2 models, the limitation sensor (if in use) monitors the temperature of the floor to ensure the maximum temperature is not exceeded or the target temperature is maintained.
4. When the room temperature is met, the dry contact opens which turns the radiant circulator off.

Field Setting of the Limitation Sensor Thermostat for the RHP-1 and RHP-2 Models.

Some thermostats include a floor sensor. If in use, there are two available options when setting the limitation sensor. From the factory, the thermostat is set not to utilize the floor sensor.

One option allows the use of the sensor as a limitation to the maximum temperature allowed for the floor. For example, the placement of the limitation sensor in a radiant wooden floor. Typically the floor should be under 85°F. With the limitation sensor set to the first option (maximum sensor), a temperature reading above 85°F will cause the thermostat to close the actuator ensuring an overshoot will not occur.

The second option which can be chosen uses the limitation sensor as a temperature set point. With this setting a particular temperature can be set for the floor, which the thermostat will maintain. For example, the floor in the bathroom might require a constant temperature of 80°F for comfort. All one has to do is adjust the set point in the thermostat to the 80°F and the limitation sensor will maintain the desired set temperature.

To adjust the temperature setting of the sensor or to change from one option to another, it is necessary first to gently pry off the thermostat dial. Then loosen the larger straight slotted screw toward the middle of the thermostat. Next, lift off the faceplate. You will see a small black dial on the right side which has a slot for turning with a screwdriver and an indicator arrow pointing to a series of temperature settings.

The scale has two sections. The black portion, labelled “MAX”, allows setting of the thermostat as a limit switch. This corresponds to option one above i.e. limiting the temperature under a wood floor. The white portion of the scale, labelled “MIN”, allows setting of the thermostat as a minimum set point. This corresponds to option two above i.e. setting the minimum floor temperature of a bathroom ceramic floor.

Field Setting of the Mixing Valve for the RHP-1 and RHP-2 Models.

The Thermostatic Mixing Valve (“TMV”) mixes hot water from the heat source and return water from the floor. This enables tempering of the hot water supplied to the floor and the return water going back to the heat source. This is particularly important when utilizing a boiler or with a wooden floor. Please consult your boiler manufacturer or installer to determine the correct return water temperature for your heat source.
The TMV has six settings which are changed by turning the knob under the square cover on top of the TMV. Remove the cover by prising against the small tab on either side. In order to adjust the TMV to the proper setting, determine the supply temperature to the BRP and the desired return temperature. [Some boilers require a minimum return temperature to protect against flue gas condensation, consult your boiler provider if applicable] Subtract 50 from the return temperature and divide by 10. Add this number to the return temperature to determine the target temperature on the chart below:

<table>
<thead>
<tr>
<th>Hot water Temperature</th>
<th>95–140°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>120°F</td>
<td>95</td>
</tr>
<tr>
<td>140°F</td>
<td>106</td>
</tr>
<tr>
<td>160°F</td>
<td>115</td>
</tr>
<tr>
<td>180°F</td>
<td>119</td>
</tr>
</tbody>
</table>

An example: Your supply temperature is 140 degrees F and your target return temperature is 100 degrees F. 
\[(100 - 50) / 10 = 5\] and \[100 + 5 = 105\]. Referring to the chart yields a TMV dial setting just below 2.

SEE APPENDIX 2 FOR MORE DETAILS

Timer for the RHP-1 and RHP-2 Models

The integral timer’s purpose is to circulate water for a short period each day within the system. If you are employing an open system (sharing the heat source with domestic uses) this prevents any “stale” water from accumulating in the pipes during the summer period. The timer will activate the system for 15 minutes every 24 hours.

The RHP model panel should only be used with a closed system since it has no timer and would allow a buildup of stale water!
Thermostat
Type: RHP-1 & RHP-2: MTD39994UF (Pictured).
RHP: RET24-U

Description/Function:
The MTD thermostat (sold with RHP-1 & RHP-2 models in some cases) is designed to be installed in a standard single gauge electrical box. It has an adjustable limit sensor which can be set to maintain a minimum floor temperature or to protect the floor via a maximum temperature setting. An On/Off selector switch on the front of the thermostat makes system operation extremely simple.

Specifications:
- Temperature range 40 -100°F
- 24V AC, 60Hz
- SPST switch
- Dry Contact, Max 2A
- Fully electronic
- LED status indicator

The RET thermostat (RHP model) is designed to be flush mounted.

Specifications:
- Temperature range 42 -86°F
- 24V AC, 60Hz
- Dry Contact, Max 3A
- Fully electronic
- LED status indicator

Mixing Valve
Type: TMV
Model: RHP-1: 065b886400 (Pictured) & RHP-2: 065b891300

Description/Function:
The TMV (Thermostatic Mixing Valve) is a 3-way brass valve which regulates the temperature in the radiant system.

Specifications:
- Maximum flow temperature 180°F
- 3/4” NPT / 1” NPT
- Maximum working pressure 145 psi
Specifications

Electrical Specifications

- 6 Amp Inductive Load Transformer
- 110 Volt Circulators

Volumes

- Single Zone
  - 60 in³
  - 0.9 L

Weights

- Dry: 25lb (12kg)
- Filled: 30lb (14kg)

Thermal Output to Room

- 136 BTU/hr @120 °F AWT
- 205 BTU/hr @140 °F AWT
- 280 BTU/hr @160 °F AWT

Flow Velocity

<table>
<thead>
<tr>
<th>Flow in US gpm</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity in FPS</td>
<td>1.6</td>
<td>3.5</td>
<td>5.5</td>
<td>6.6</td>
<td>7.3</td>
</tr>
</tbody>
</table>

Materials in Contact with Water

- Control Valves**: TMV: Brass body.
- Ball Valves
  - Hose bib/ Pet cock: Brass body, Teflon™, Viton™, EPDM rubber seals
- Circulator
  - Standard Models Grundfos: PES composite, Bronze Pump Housing, EP Rubber, PES Composite
- Piping
  - Type L Copper

Maximum Ambient Temperature

- 180°F

Maximum Operating Pressure

- 145 psi

Maximum Operating Temperature

- 180°F
Limited Warranty

BASIC RADIANT - RADIANT HEAT PANELS

1 Confirmation of Purchase  CPI shall not be deemed to have sold this product unless written proof of purchase is provided. Proof of purchase documents are subject to confirmation by CPI. This warranty is limited to the original purchaser of the product.

2. Risk  From the moment of purchase the purchaser shall bear all risks for the goods, and CPI shall not be responsible for loss and damage incurred during transportation and installation.

3. Information  The information and technical data contained in catalogues, leaflets and other written material constitutes an approximate guide only. No responsibility for errors or wrong interpretation can be placed on CPI. The purchaser cannot claim any rights based on this material. Such reservation shall also apply to suggestions, advice and other services rendered to customers, including installation and servicing instruction for the product delivered.

4. Alterations  CPI reserves the right to make alterations to their products without notice.

5. Warranty  THE FOLLOWING REMEDY DESCRIBED IN THIS SECTION SHALL BE THE EXCLUSIVE REMEDY FOR ANY BREACH OF THIS WARRANTY. Provided that proof of purchase is provided, the original purchaser is offered a warranty of 12 months on components from the date of purchase. The warranty covers faulty manufacture, design and/or defective materials. The warranty shall cease to be valid if the product is repaired or altered without the consent of CPI, applied for purposes for which it is not designed or installed and applied contrary to the instructions given by CPI. CPI agrees under the warranty to repair or replace at the discretion of such products, which on examination by CPI are found to be defective. CPI shall not pay expenses in connection with dismantling and mounting. If defects occur while under warranty, the product shall be forwarded to CPI at the address noted [below/above], insurance and freight paid. A description of the reason for returning the product shall be enclosed. Products returned shall be free of extraneous equipment. Products repaired under warranty will be returned to the purchaser, freight paid by CPI. Parts that have been replaced shall be the property of CPI. Guarantee for products not of CPI’s own manufacture is only given to the same extent as given to CPI, however, not exceeding the normal CPI warranty.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESS, IMPLIED OR STATUTORY, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION ON THE PART OF CPI. CPI makes no warranty or representation that the product complies with the requirements of federal, state, and local laws and/or industrial codes, or any other warranty or representation, express or implied, except as specified herein. Any and all representations or warranties by CPI or any other party that differ in any manner from the terms of this written Warranty shall be of no force or effect.

6. Secondary Damages  CPI SHALL NOT BE HELD RESPONSIBLE FOR ANY OTHER DAMAGES OF ANY KIND, INCLUDING INCIDENTAL OR CONSEQUENTIAL DAMAGE E.G. DAMAGES TO PERSON OR PROPERTY, CONSEQUENTIAL LOSS, INCLUDING LOSS OF PRODUCTION, LOSS OF PROFIT, LOSS ON GOODS IN STORE OR THE LIKE, WHICH MIGHT ARISE OUT OF DEFECTS AND/OR DELAY IN DELIVERY OF THE PRODUCTS SOLD, IRRESPECTIVE OF THE CAUSE, INCLUDING FAULTY MANUFACTURE, DESIGN OF MATERIAL.

7. Notice of Claims  Any claim or complaint as to defects and / or delay in delivery of the products shall be submitted in writing by the purchaser to CPI immediately.

8. Disputes  Any disputes or differences arising between the parties hereto shall be resolved according to the law of the State of Ohio. CPI reserves the right to decide whether any dispute or difference between the parties hereto shall be referred to binding arbitration or be resolved by legal action. In the event of an election to resolve the dispute or difference by legal action, such action shall take place in the Courts of Ohio having competent jurisdiction.

Special Notice to Consumers  If you have purchased this product for personal, family or household use:

(1) Some states do not permit disclaimers or term limitations of implied warranties so the disclaimers and limitations in this Warranty may not apply to you; (2) Some states do not permit the exclusion or limitation of incidental or consequential damages so the exclusions and limitations in this Warranty may not apply to you; and (3) This Warranty gives you specific legal rights and you may have other rights that vary from State to State.

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Appendix 1 - Thermostat

MTD is an electronic heating thermostat designed to be installed in a standard single gang electrical box with a minimum width of 2-1/4". Once installed, it requires no maintenance. MTD has an adjustable limit sensor (floor sensor) which can be set to maintain a minimum floor temperature or to protect the floor via a maximum temperature setting.

A LED illuminates to indicate “call” for heating, this also aids in system testing. An On/Off selector switch on the front of the thermostat makes system operation extremely simple.

PRODUCT LINE
24V supply, °F
MTD-39994UF with built-in room sensor and separate limitation (floor) sensor

24V supply, °C
MTD-39994UC with built-in room sensor and separate limitation (floor) sensor

CE MARKING
OJ declare under their own responsibility that this product meets the requirements of the European Council’s directive 89/336 and successive modifications as to electromagnetic compatibility and the Council directive 73/23 as to electrical equipment to be applied within certain voltage ranges.

Standards applied
En 50 081-1, En 61000-6-2, and En 60730-2-9.

If the product has been exposed to damage e.g. in transport, it must be checked and overhauled by qualified staff before the product is powered up.

CLASSIFICATION
The product is a class III device according to IEC 60730-2-9 and EN 60730-2-9 and the product must be connected to the following conductors:
1) L-24V AC
2) N - 0 (Neutral)

WARNING
The system may not be energized unless the system is installed according to this instruction and the installation meets all applicable codes.

Warranty is void if not installed according to this instruction and proper procedure.

TECHNICAL DATA
Power supply (model dependent)........... 24V AC ±10%, 60Hz
Output relay, SPST, dry contact 24V ........ max. 2A
Built-in switch .................. 2 pole
Ambient operating temperature ............ -32-122°F (-0-50°C)
Scale limitation .................. minimum/maximum
Scale range .................. -40-104°F (-5-40°C)
Temperature setback (adjustable) 4-14°F (2-8°C)
........ see programming/operation
On/Off differential ............... 0.7° (0.4°C)
Enclosure .................. IP20
Dimensions (HxWxD) ............... 4.5"x3"x2.0" (115x84x50 mm)

FLOOR SENSOR INSTALLATION
The sensor shall be mounted in a conduit which should be sealed and placed as high as possible in the concrete, etc. The sensor is UL and cUL approved regarding the isolation test. The sensor wiring may be extended up to 150' (50 m) using 18 gauge wire and the wiring resistance shall not exceed 20 ohms. Sensor wires must be kept in a separate conduit, away from all other wiring. The sensor and wires must be protected from damage during the installation. If shielded wire is used, it must not be grounded but connected to terminal 6 on the thermostat.

ERROR DETECTION
The MTD has built-in error detection which will de-energize the heating circuit if the sensor is damaged or if it detects an open or shorted sensor circuit.

CAUTION
Disconnect all electrical power prior to installing or servicing this unit.

THERMOSTAT INSTALLATION (fig. 1-3)
1. Remove thermostat knob, noting the position (A).
2. Loosen screw to remove frame and cover (B).
3. Attach wiring from the rear of the thermostat according to the wiring diagram.
4. The thermostat is to be mounted in a standard single gang electrical box with a minimum width of 2-1/4".
   - re-install frame and cover
   - re-install the knob in the proper position.

LIMIT SENSOR/SETTING AND OPERATION
Minimum limitation:
Adjustable 59-86°F (15-30°C), typical use is to maintain a warm bathroom floor even when there is intermittent heating demand as typically encountered in the spring or fall.
Maximum limitation:
Adjustable 77-122°F (25-50°C), typical use is to protect the heating element or floor from extremely high temperatures.

TEMPERATURE SETBACK (fig. 2-3)
Room temperature can be set back during unoccupied times via a remote time switch. The time switch must be the same voltage as the MTD and it must switch the same voltage as required by the MTD, all wiring must be in accordance with Figure 3. The setback temperature is adjustable with a screwdriver 4-14°F (2-8°C).

TEMPERATURE SETTING/ADJUSTMENT
Adjust the thermometer knob to the desired room or floor temperature, if after a few days you find the temperature to be different from the setting, adjustment can be made as follows: Measure the room temperature with a thermometer, remove the knob without rotating it, then reposition the knob according to the measured temperature on the scale and re-install it.

MAXIMUM/MINIMUM TEMPERATURE LIMITATION
Behind the knob there are red and blue locking rings held in position by a screw. To set the limitations, loosen the screw (C) and adjust the red limit ring to the desired maximum, set the blue ring to the desired minimum temperature, then retighten the screw. The knob must be re-installed exactly as it was removed.
**Applications**
The Series 30 is a multi-purpose thermostatic mixing valve designed for ease of installation and a wide variety of uses. The TMV offers accurate temperature control via a self-regulating thermostat. The valves are designed to control temperature of Domestic Hot Water (DHW), Hydronic Radiant Space Heating, Heat Pump, and Solar Systems for central mixing applications.

Series 30 MR offer the following features:
- Anti-scald function* (see below).
- Listed to meet ASSE 1017 requirements (applies to 85–120°F and 95–140°F only).
- Purpose: Mixing function.
- Temperature Ranges: 70–110°F (20–43°C), 85–120°F (29–49°C), or 95–140°F (35–60°C).
- Maximum working pressure: 150psi (10 bar).
- Maximum hot water inlet temperature: 194°F (90°C).
- Maximum pressure difference between hot and cold supply: 20% to max. 44psi (3 bar).
- Minimum flow requirement: 0.5USgpm (113.5l/hr).
- Designed for long-life and easy maintenance.
- Minimal outlet temperature fluctuation.

*The Serie 30 is designed to respond to a failure of the cold water supply by a complete closing of the hot water supply port before the outlet temperature exceeds the setting by 18°F (10°C).

**Setting**
The Series 30 MR temperature setting is accomplished by adjusting the setting wheel between 1 and 6 to obtain the required mixed water temperature. For quick setting refer to the table below. Series 30 MR valves are not factory calibrated. For accurate setting, measure the mixed water temperature once hot and cold supply temperatures are stabilized. Adjust setting as required to obtain the desired temperature.

**Installation**
To protect the TMV from excessive heat, and avoid voiding the warranty, the tailpieces must be soldered before attaching them to the TMV (see below). Gaskets supplied must be installed as shown.

1. Position union nut over tailpiece before soldering.
2. Solder tailpiece to tubing.
3. Insert gasket in nut.
4. Connect to TMV.

**Gasket**

**Adjust temperature setting between 1-6.**

**Installation and Maintenance Instructions**

\[ \begin{array}{|c|c|c|c|c|c|c|c|c|c|}
\hline
\text{Hot water temperature} & \text{70–110°F} & & & & & & & & \\
\hline
\text{Temperature} & 1 & 2 & 3 & 4 & 5 & 6 & 1 & 2 & 3 & 4 & 5 & 6 \\
\hline
120°F & 67 & 74 & 81 & 87 & 94 & 109 & 80 & 90 & 97 & 102 & 107 & 115 \\
140°F & 68 & 75 & 82 & 89 & 97 & 113 & 81 & 91 & 99 & 104 & 109 & 117 \\
160°F & 69 & 76 & 84 & 92 & 100 & 118 & 82 & 93 & 100 & 106 & 112 & 118 \\
\hline
\text{95–140°F} & & & & & & & & & & & & \\
\hline
120°F & 95 & 106 & 115 & 116 & 120 & 120 \\
140°F & 97 & 108 & 117 & 126 & 133 & 140 \\
160°F & 99 & 109 & 118 & 127 & 135 & 145 \\
\hline
\end{array} \]

*Note:** Table is based on 50°F cold water and no difference between hot and cold water supply pressures. For other cold water temperatures correct the mixed temperature by 1°F for every 10°F from 50°F, up or down.

**Push pin to remove cap.**

**Remove cap.**

**Adjust temperature setting between 1-6.**

**Replace cap.**

**Mount label on cap to seal valve.** Space is provided on the label to indicate measured outlet temperature, date and signature of installer.

**Index**

**OVER TIME THE TEMPERATURE SETTING MAY HAVE TO BE ADJUSTED DUE TO SCALING OR DIRT DEPOSITED IN THE VALVE.**

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Installation continued

The Series 30 MR valves are not intended to provide final temperature control at the fixtures or appliances. Use Series 30 HR/HV valves that meet ASSE 1016 for these applications.

The valve should be installed below the storage tank or water heater as shown in Fig. 3 wherever possible. If the valve is installed adjacent to, or higher than the storage tank or water heater, it is important to prevent gravity circulation during times where there is no consumption of water. This is done by various methods such as a heat trap loop or a check valve in the cold water feed line as shown in the examples below.

A check valve should also be installed whenever a high temperature (uncontrolled) water outlet is included (Fig. 4). For installation of a TMV in a system providing recirculated tempered water using a circulation pump refer to Fig. 6.

An aquastat to limit circulation of recirculated water is not required with Series 30 MR/HR/HV valves.

---

**Diagram:**

- **1** Central Mixing
- **2** Central Mixing
- **3** Central Mixing
- **4** Central Mixing
- **5** Radiant Floor Heating
- **6** Recirculated Domestic Water
- **7** Primary-Secondary Pumping
- **8** Boiler Return Water Temperature Control

---

**Inspection and maintenance – important!**

To ensure proper function, a licensed contractor should verify the mixed outlet temperature annually. The following maintenance procedure should be performed each year and at times when increase in water outlet temperature is observed. Replacement of the valve insert may be required if maintenance and calibration of the valve does not result in correct temperature readings.

To clean and/or restore the valve, shut off water and:

1. Remove cap (item 1) and note position of adjustment wheel.
2. Remove wheel and disassemble valve by removing adjustment bonnet (item 2) and internal parts. (items 3–6).
3. Remove carefully all scaling (calcium deposits) or foreign particles from all parts. Do not use sharp tools or scratch surfaces. Regrease all internal components using silicon grease.
4. Assemble the valve and restore water supplies.
5. Calibrate by measuring the mixed outlet temperature.
6. Replace adjustment wheel and cap to prevent tampering.
7. Record service date and valve setting on valve label.

---

**Spare Parts:**

- 1 - Cap
- 2 - Adjustment bonnet*
- 3 - Thermostat*
- 4 - Shuttle*
- 5 - Spring*
- 6 - Body
- *Spare Parts

---

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Appendix 2a - 1" Thermostatic Mixing Valve (Model RHP-2)

![ESBE THERMOSTATIC MIXING OR DIVERTING VALVE TMV]

The TMV is a multi-purpose mixing valve designed for ease of installation and a wide variety of uses. The valve offers accurate temperature control via a self-regulating thermostat. The valves are designed to control Domestic Hot Water (DHW), temperature, Hydronic Radiant, Space Heating, Heat Pump and Solar Systems.

TMV valves offer the following features:
- Anti-Scald function (see below).
- Meets ANSI/ASSE 1017.
- Dual purpose: Mixing or diverting function.
- Desired temperature can be locked at any point.
- Max. working pressure 150 psi (10 bars).
- Max. hot water inlet temperature 212°F (100°C).
- Designed for long-life and easy maintenance.
- Available with 3 different temperature ranges.
- Unique compression design in 1/2" and 3/4" sizes.
- Minimal outlet temperature fluctuation.
- Temperature ranges available on special request 50-80°F (10-25°C) and 110-170°F (45-77°C).

**NOTE:** When installing a TMV on plumbing systems using CPVC piping, always follow the pipe manufacturer's instructions.

*TMV* is designed to respond to failure of the cold water supply by a partial closing of the hot water supply port, reducing outlet water flow to below 0.5 gpm whenever the outlet temperature exceeds the setting by 18°F (10°C). If the outlet temperature exceeds the setting by 36°F (20°C), a complete closing of the hot water supply port is automatically effected providing system differential pressure does not exceed 72 psi (5 bar), in which case leakage may occur.

### Ordering

<table>
<thead>
<tr>
<th>Art nr</th>
<th>Code Number</th>
<th>CV</th>
<th>Size/Connection</th>
<th>DHW Flow/Gpm</th>
<th>Temp. range</th>
<th>Dimensions (in)</th>
<th>Weight lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>474A</td>
<td>0658890700</td>
<td>1,6</td>
<td>1/2&quot; NPT</td>
<td>7</td>
<td>110-140°F (43-60°C)</td>
<td>4.1, 2.8, 1.7</td>
<td>1.0</td>
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<tr>
<td>474E</td>
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<td>1/2&quot; Solder</td>
<td></td>
<td></td>
<td></td>
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<td>1/2&quot; NPT</td>
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<td>68-105°F (20-40°C)</td>
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<td>0658893105</td>
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<td>1/2&quot; Solder</td>
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<td>68-105°F (20-40°C)</td>
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<td>1.0</td>
</tr>
<tr>
<td>473A</td>
<td>0658890905</td>
<td>1,6</td>
<td>3/4&quot; NPT</td>
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<td>110-140°F (45-65°C)</td>
<td>5.2, 3.6, 1.8</td>
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<td>110-140°F (45-65°C)</td>
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<td>3/4&quot; Solder</td>
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<td>68-105°F (20-40°C)</td>
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<td>1&quot; Solder</td>
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<td>110-140°F (45-65°C)</td>
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<td>477EM</td>
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<td>1&quot; Solder</td>
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<td>68-105°F (20-40°C)</td>
<td>6.3, 3.5, 2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**At a pressure drop of 22 psi (95kPa).** **Can be recalibrated to 118-149°F (49-65°C).**

**Temperature selection:** Selections per tables below. Line up number on valve cap with boss on valve body. Tables are based on 50°F cold water. For other cold water temperatures, correct mixing temperature to 1°F for every 10°F deviation from 50°F, up or down.

### Temperature Table

<table>
<thead>
<tr>
<th>Hot supply of °F</th>
<th>Valve position</th>
<th>TMV 80-105°F Valve position</th>
<th>TMV 85-120°F Valve position</th>
<th>TMV 115-140°F Valve position</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>64</td>
<td>81</td>
<td>98</td>
<td>115</td>
</tr>
<tr>
<td>70</td>
<td>74</td>
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<td>80</td>
<td>84</td>
<td>94</td>
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<td>127</td>
</tr>
<tr>
<td>90</td>
<td>94</td>
<td>104</td>
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</tr>
<tr>
<td>100</td>
<td>104</td>
<td>119</td>
<td>133</td>
<td>140</td>
</tr>
</tbody>
</table>

**Note:** Temperatures given in table are average values.
SIZING FOR DOMESTIC HOT WATER

Procedure:
1. Determine type and number of fixtures.
2. Read fixture units from Table 1.
3. Calculate number x fixture unit for each fixture type.
4. Calculate total units of all fixtures.

Example: 6 lavatories, 1 kitchen sink, 3 baths, 1 shower, 1 clothes washer, 1 dish washer.
Total fixture units = 19. Select a 1/2" TMV.

INSTALLATION
The valve should be installed below the storage tank or water heater as shown in Fig. 3 whenever possible.
If the valve is installed adjacent to, or higher than the storage tank or water heater, it is important to prevent gravity circulation in the event that there is no discharge of water. This is done using various methods such as a check valve in the cold water feed line (Fig. 5).
A check valve should also be installed when a high temperature (uncontrolled) outlet is used for hot water (Fig. 4) and when the valve is installed near the fixture (Fig. 5).
If a circulation pump is installed in the system, we suggest the use of an "on-off" thermostat to control the temperature in the return line. This thermostat is normally set between 112-120°F (45-45°C). (Fig. 6).

BASIC WAYS HOW TO USE TMV
1. Mixing of domestic hot and cold water.
2. Maintaining a constant supply temperature in a closed heating system.
3. Maintaining a constant return temperature in a closed heating system.
In applications 2 and 3 water is not used up. It is continuously recirculated acting as a heat transfer medium only.
Applications 1 and 2 require piping as a mixing valve, and 3 as a diverting valve.
LIMITING OR LOCKING TEMPERATURE RANGE

It is possible to lock in a specific temperature setting or a limited temperature range. To use this feature:

1. Turn knob to selected temperature setting lining up with the boss on valve.
2. Remove knob.
3. To lock in temperature at a fixed level: Replace knob so that arrow on wheel is in-line with the boss on valve.
4. SAFETY CHECK: To make sure above procedure has been followed correctly ascertain that actual mixed temperatures are within the desired range.

TYPICAL INSTALLATION OF ESBE TMV

(Thermostatic Mixing Valve) on Radiant Heating System

INSTALLATION OF TMV WITH SOLDER CONNECTIONS

To protect the TMV from excessive heat, and avoid voiding the warranty, the tail pieces must be soldered before attaching them to the TMV (as shown). Gaskets supplied with 1/2" and 3/4" must be installed as shown.

1. Position the nut over the tail piece before soldering. 2. Solder fitting to tubing. 3. Insert gasket in nut. 4. Connect to TMV.

TYPICAL COMBINATION SYSTEM

With Standard Radiators/Baseboard and Radiant Heating

Application: ESBE TMV controls the maximum flow temperature within the Radiant Zone. Also available, ESBE TV protects the boiler from operating at low temperatures.
ESBE TMV VALVE
MANDATORY PERIODIC MAINTENANCE - Important!
To ensure proper function, the following maintenance procedure must be performed each year and at times when increase in water outlet temperature is observed. Replacement of the thermostat may be required if maintenance and calibration of the valve does not result in correct temperature readings.

1. Screw
2. Knob
3. Cover
4. Spindle
5. Gasket
6. Thermostat
7. Gasket
8. Plug
9. Upper Spring
10. Wire ring
11. Seat
12. Lower Spring

To clean and/or restore the valve, shut off the water and:
1. Remove the knobs and then the parts 3-8.
2. Remove carefully all scaling (platinum deposits) or foreign particles from all internal parts.
3. When necessary remove and clean the seat assembly in the same way.
4. Assemble the valve carefully and calibrate as described below.

The parts 1-8 are available as Replacement Kits as follows:

<table>
<thead>
<tr>
<th>Temp. range</th>
<th>1/2&quot; and 3/4&quot;</th>
<th>&quot;1&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>113-140°F (51-60°C)</td>
<td>08270894</td>
<td>08270897</td>
</tr>
<tr>
<td>65-100°F (18-38°C)</td>
<td>08270895</td>
<td>08270898</td>
</tr>
<tr>
<td>65-120°F (18-49°C)</td>
<td>08270896</td>
<td>08270899</td>
</tr>
</tbody>
</table>

CALIBRATION AND SAFETY TEST
FOR THERMAL PROTECTION
It is important that the thermostat is done exactly as indicated above to prevent malfunction, temperature range inaccuracies or possible scalding.

Field replacement or exchange does not guarantee accurate factory calibration and the ESBE TMV may be off by several degrees. To test the calibration, set Position 1 marked on the knob over the boss on the valve body: run water for two minutes and measure hot and cold inlet temperatures and (mixed) outlet temperature with a thermometer.

If the supply-water temperatures do not correspond with those on the table, correct for any differences before continuing. Once corrected, if the measured outlet temperature does not agree with the temperature shown in column 1 of the table on page 1, reposition the knob (without disturbing the setting of the spindle) so that the number shown on the table lines up with the boss.

Example: Using a TMV 65-120°F (18-49°C) valve. The hot water supply temperature is 160°F (71°C), the thermometer reads 150°F (65°C), the table says that for 101°F (38°C) the number on the knob should read 3.
If it does not, lift the knob off the spindle and re-install the knob so that the number 3 marking lines up with the boss.
Appendix 3 - Pump

Maintenance-Free Circulators

Shipment Inspection
Examine the components carefully to make sure no damage has occurred to the pump during shipment. Care should be taken to ensure the pump is NOT dropped or mishandled; dropping will damage the pump.

Pre-Installation Checklist
Before beginning installation procedures, the following checks should be made. They are all important for proper installation of the circulator pump.

1. Uses: Model UPS15, and UP15, 25, 26, 43 and 50 series pumps are generally designed to circulate water from 32 deg F to 230 deg F up to a maximum pressure of 145 psi. Some models have temperature limitations which are shown in Table 2A below. If required, a 50% by volume solution of ethylene or propylene glycol and water can be used, however, a decrease in pump performance may result due to an increase in the viscosity of the solution. Check with manufacturer for information regarding suitability of pumping other fluids.

Closed Systems: Model UPS15, and UP15, 25, 26, 43 and 50 series pumps with cast iron pump housings are designed to pump water compatible with their cast iron construction. They are recommended for use in closed hydronic systems. (i.e. airless, non-potable water).

Open Systems: Model UPS15, and UP15, 25, 26, 43 and 50 series pumps with stainless steel or bronze pump housings are designed to pump water compatible with their construction and can be used in both open and closed systems.

2. Maximum Water Temperature: The maximum allowable water temperature is determined by the ambient or surrounding air temperature as shown in Table 2A.

Table 2A – Maximum Water Temperature

<table>
<thead>
<tr>
<th></th>
<th>104</th>
<th>120</th>
<th>140</th>
<th>160</th>
<th>175</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient °F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water All UP° °F</td>
<td>230</td>
<td>220</td>
<td>210</td>
<td>190</td>
<td>175</td>
</tr>
</tbody>
</table>

*Exceptions below:

<table>
<thead>
<tr>
<th></th>
<th>200</th>
<th>190</th>
<th>180</th>
<th>170</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPS15-FC &amp; UPS43-FC °F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UP15-BUC5 &amp; BUC7 °F</td>
<td>200</td>
<td>190</td>
<td>180</td>
<td>170</td>
</tr>
<tr>
<td>UP15-100 °F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UP26-120U °F</td>
<td>205</td>
<td>195</td>
<td>185</td>
<td>175</td>
</tr>
<tr>
<td>UP26-116 °F</td>
<td>150</td>
<td>140</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Inlet Pressure Requirements
The amount of pressure required at the inlet of the pump is a function of the temperature of the water as shown in Table 2B.

**Table 2B – Inlet Pressure Requirements**

<table>
<thead>
<tr>
<th>Water (°F)</th>
<th>190</th>
<th>165</th>
<th>140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Inlet Pressure (ft.)</td>
<td>5</td>
<td>4.5</td>
<td>3</td>
</tr>
<tr>
<td>Required Inlet Pressure (psi)</td>
<td>2.2</td>
<td>1.9</td>
<td>1.3</td>
</tr>
</tbody>
</table>

In a pressurized system, the required inlet pressure is the minimum allowable system pressure.
In a system open to the atmosphere, the required inlet pressure is the minimum distance the pump must be located below the lowest possible water level of the water source (tank, pool, etc.).

**Installation**

**Position of terminal box**: Proper installation of the pump will have the terminal box located to one side of the pump or the other, with the conduit entry down. See Figure 3A.

**Figure 3A**

*Recommended Terminal Box Orientation*

If the terminal box position needs to be changed, it is best to do so before installation. However, if the pump is already installed, ensure that the electrical supply is turned off and close the isolation valves before removing the Allen screws.

**To change terminal box position:**
1. Remove the four (4) Allen screws (4 or 5mm wrench) while supporting the stator (motor).
2. Carefully separate the stator from the pump chamber and rotate it to the correct terminal box orientation.
3. Replace the Allen screws and tighten diagonally and evenly (7 ft.-lb. torque).
4. Check that the impeller turns freely. If the impeller does not turn easily, repeat the disassembly/reassembly process.
Maintenance-Free Circulators

Pump Mounting: For Indoor Use
Arrows on the side or bottom of the pump chamber indicate direction of flow through the pump. GRUNDFOS circulators can be installed in both vertical and horizontal lines. The pump must be installed with the motor shaft positioned horizontally. 
Under no circumstances should the pump be installed with the shaft vertical or where the shaft falls below the horizontal plane.
See Figure 3B.

![Figure 3B](image)

It is recommended that isolation valves be installed on each side of the pump. If possible, do not install elbows, branch tees, and similar fittings just before or after the pump. Provide support to the pump or adjacent plumbing to reduce thermal and mechanical stress on the pump.

Installation Requirements
1. Thoroughly clean and flush the system prior to pump installation.
2. Do not install the pump at the lowest point of the system where dirt and sediment naturally collect.
3. Install an air vent at the high point(s) of the system to remove accumulated air.
4. Ensure that water does not enter the terminal box during the installation process.
5. (Open System) Install the pump in the supply line; the suction side of the pump should be flooded with water. Ensure that the static head requirement from Table 2B is achieved.
6. (Closed System) Install a safety relief valve to protect against temperature and pressure build-up.
7. If there are excessive suspended particles in the water, it is recommended that a strainer and/or filter be installed and cleaned regularly.
8. DO NOT START THE PUMP UNTIL THE SYSTEM HAS BEEN FILLED.

CHECK VALVE REMOVAL:
1. Use needle nose pliers to remove check valve from pump housing. 2. Check to make sure no part of the valve remains in the pump housing. 3. Apply enclosed round “Check Valve Removed” label over the Check mark symbol located on the name plate of the pump.
Maintenance-Free Circulators

**Electrical**

*All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.*

**Warning:** The safe operation of this pump requires that it be grounded in accordance with the National Electrical Code and local governing codes or regulations. The ground wires should be copper conductor of at least the size of the circuit conductor supplying power to the pump. Minimum ground wire size is 14 AWG. Connect the ground wire to the grounding point in the terminal box and then to an acceptable ground. Do not ground to a gas supply line.

The proper operating voltage and other electrical information can be found on the nameplate attached to the top of the motor. Depending on pump model, the motor has either built-in, automatic resetting thermal protection or is impedance protected and in either case does not require additional external protection. The temperature of the windings will never exceed allowable limits, even if the rotor is locked.

Wire sizes should be based on the ampacity (current carrying properties of a conductor) as required by the latest edition of the National Electrical Code or local regulations. Both the power and grounding wires must be suitable for at least 194°F (90°C).

*For all 115V and 230V models: Connect the white/yellow electrical leads from the circulator to the incoming power leads with wire nuts or other approved connectors. Attach incoming grounding wire to either of the green grounding screws.*

**Wiring diagram for 115V and 230V multi-speed pumps.**

![Diagram of wiring connections](image.png)
Maintenance-Free Circulators

Wire the hot lead to terminal "L," neutral wire to terminal "N," and ground to the grounding terminal. For 230 volt pumps, the two hot leads should be to "L" and "N" and the ground to the grounding terminal.

Wiring diagram for all 115V and 230V single speed pumps.

Start-Up
Do not use the pump to vent the system. Do not start the pump before filling the system. Never operate the pump dry.

Operation
GRUNDFOS domestic circulating pumps, installed properly and sized for correct performance, will operate quietly and efficiently and provide years of service. Under no circumstances should the pump be operated without water circulation or without the minimum required inlet pressure for prolonged periods of time. This could result in motor and pump damage.

UPS model pumps are multispeed, and the speed can be changed by a speed selector switch located on the front of the terminal box. UP models are single speed.

Failure to Operate
When UPS 15-42 and UPS 26 pumps are first started, the shaft may rotate slowly until water has fully penetrated the bearings. If the pump does not run, the shaft can be rotated manually. To accomplish this, switch off the electrical supply, and close the isolation valves on each side of the pump. Remove the indicator plug in the middle of the nameplate. Insert a small flat blade screwdriver into the end of the shaft, and gently turn until the shaft moves freely. Replace and tighten the plug. Open the isolation valves and wait 2 to 3 minutes for the system pressure to equalize before starting the pump.

NOTE: After a long shut down multi-speed pumps should be started on speed 3 and then adjusted to the regular setting. The UPS 15-42 has automatic function to assist in restart.

Important note: For your convenience, the cap plug has not been installed. This pump is supplied with two wiring ports. To ensure safe operation of your installation, the enclosed cap plug MUST be inserted into the unused port.