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USER GUIDE

UGH052-1215

Thermolator TW-P

Temperature Control Unit

Corporate Office: 724.584.5500 | Instant Access 24/7 (Parts and Service): 800.458.1960 | Parts and Service: 814.437.6861

Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this User Guide and all manuals, engineering prints, and parts lists together for documentation of your equipment.

Date:

Manual Number: UGH052-1215

Serial Number(s):

Model Number(s):

DISCLAIMER: Conair shall not be liable for errors contained in this User Guide or for incidental, consequential damages in connection with the furnishing, performance or use of this information. Conair makes no warranty of any kind with regard to this information, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

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Introduction

Purpose of the User Guide

This User Guide describes the Conair Thermolator TW-P and explains step-by-step how to install and operate this equipment.

Before installing this product, please take a few moments to read the User Guide and review the diagrams and safety information in the instruction packet. You also should review manuals covering associated equipment in your system. This review won't take long, and it could save you valuable installation and operating time later.

How the Guide is Organized

Symbols have been used to help organize the User Guide and call your attention to important information regarding safe installation and operation.

 Symbols within triangles warn of conditions that could be hazardous to users or could damage equipment. Read and take precautions before proceeding.

1 Numbers indicate tasks or steps to be performed by the user.

◆ A diamond indicates the equipment's response to an action performed by the user or a situation.

❒ An open box marks items in a checklist.

• A circle marks items in a list.

 Indicates a tip. A tip is used to provide you with a suggestion that will help you with the maintenance and the operation of this equipment.

 Indicates a note. A note is used to provide additional information about the steps you are following throughout the manual.

Your Responsibility as a User

You must be familiar with all safety procedures concerning installation, operation, and maintenance of this equipment. Responsible safety procedures include:

- Thorough view of this User Guide, paying particular attention to hazard warnings, appendices, and related diagrams.
- Thorough review of the equipment itself, with careful attention to voltage sources, intended use, and warning labels.
- Thorough review of instruction manuals for associated equipment.
- Step-by-step adherence to instructions outlined in this User Guide.

ATTENTION:
Read This So No One Gets Hurt

We design equipment with the user's safety in mind. You can avoid the potential hazards identified on this machine by following the procedures outlined below and elsewhere in the User Guide.

⚠ WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

⚠ WARNING: Voltage hazard

This equipment is powered by three-phase alternating current, as specified on the machine serial tag and data plate.

A properly sized conductive ground wire from the incoming power supply must be connected to the chassis ground terminal inside the electrical enclosure. Improper grounding can result in severe personal injury and erratic machine operation.

Always disconnect and lock out the incoming main power source before opening the electrical enclosure or performing non-standard operating procedures, such as routine maintenance. Only qualified personnel should perform troubleshooting procedures that require access to the electrical enclosure while power is on.

⚠ WARNING: Compressed air hazard

If you use compressed air, you must wear eye protection and observe all OSHA and other safety regulations pertaining to the use of compressed air. Bleed off pressure before servicing equipment.

⚠ CAUTION: Hot Surfaces

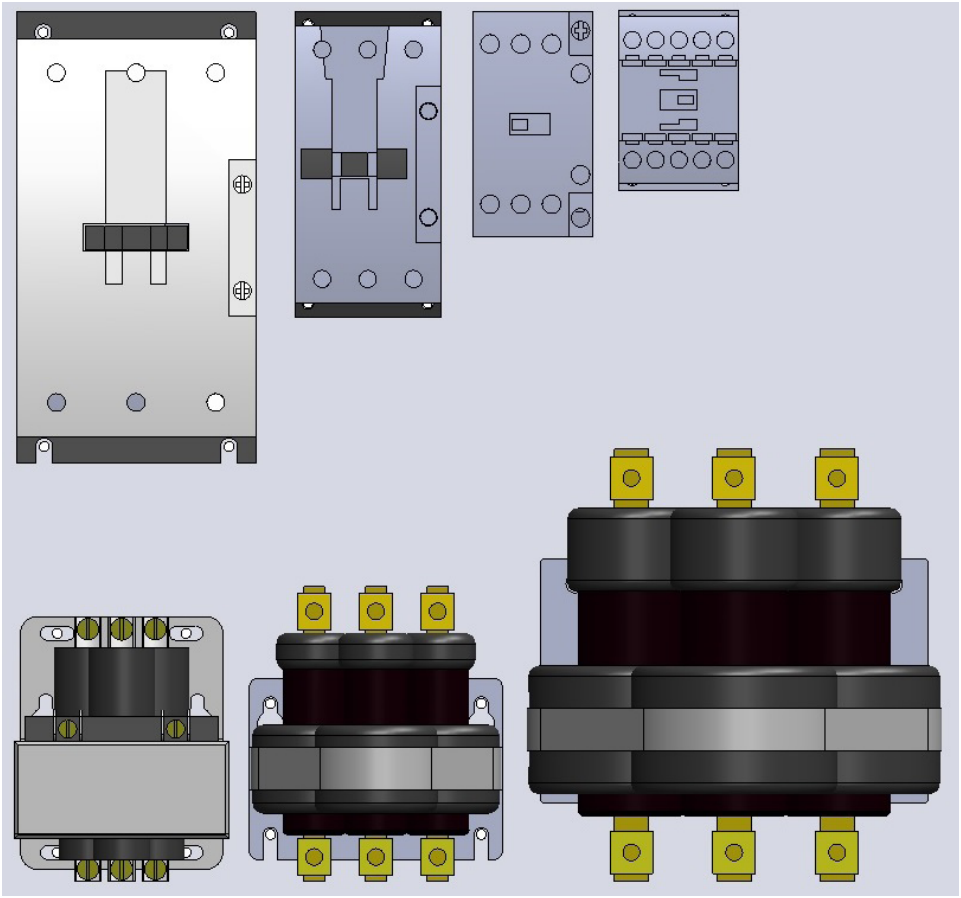
Surface temperatures inside the Thermolator can exceed 300° F {149° C}. Always allow the unit to cool below 100° F {38º C} before opening, servicing, or disassembling the unit.

⚠ WARNING: Hazardous Substance

Some of the electrical contactors in the Thermolator may have mercury contactors. Mercury is considered a hazardous substance and must be dealt with accordingly. Material Safety Data Sheet #7439-97 has been included in the appendix of this instruction packet. This sheet explains the potential hazards, how to avoid them and how to clean up and dispose of the mercury if it spills.

Non-Mercury

Mercury

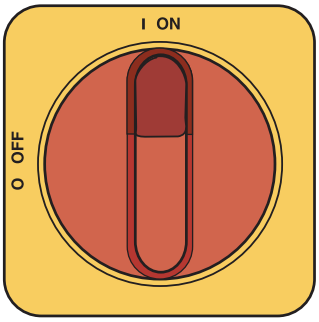


How to Use the Lockout Device

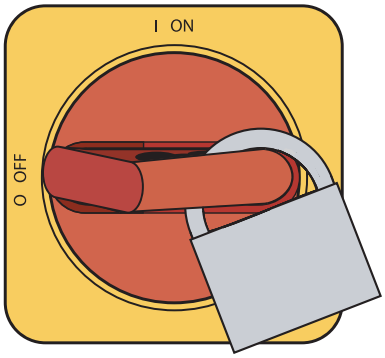
⚠ **CAUTION:** Before performing maintenance or repairs on this product, you should disconnect and lockout electrical power sources to prevent injury from unexpected energization or start-up. A lockable device may be provided to isolate this product from potentially hazardous electricity.

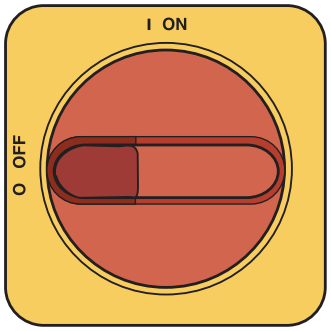
⚠ **WARNING:** Before removing lockout devices and returning switches to the ON position, make sure that all personnel are clear of the machine, tools have been removed and all safety guards reinstalled.

Lockout is the preferred method of isolating machines or equipment from energy sources. Your Conair product may be equipped with the lockout device pictured below. To use the lockout device:



1. **Stop or turn off the equipment.**
2. **Isolate the equipment from the electric power.**
3. **Turn the rotary disconnect switch to the OFF, or "O" position**
4. **Secure the device** with an assigned lock or tag.
5. The equipment is now locked out.





If the machine has no included lockout device, perform the same procedure at the upstream device as part of premises electrical system. Incoming cooling water and compressed air (if purge) are additional energy sources that need to be controlled.

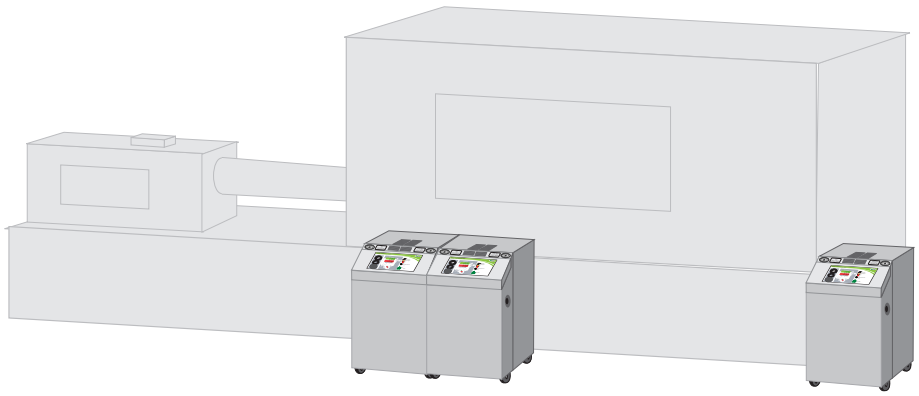
SECTION
2

Description

What is the Thermolator TW-P

The Thermolator TW-P circulates water at a temperature higher than the available water supply, to add or remove heat as needed to maintain a uniform temperature setpoint in the process.

The TW-P is available in single or multiple-zone configurations for process heating and cooling. Two-zone models can control up to two temperatures at different locations in the process. Two-zone models have common cooling water manifolds and electrical connections.



Typical Applications

The best model for your application depends on the process temperature you need to maintain and the quality of the cooling water supply.

TW direct injection (DI) models control the temperature by discharging heated process water and adding cooling water directly from the water supply. DI models are designed for:

- Process temperatures up to 250°F {121° C} - with options up to 300° F {149° C}.
- Use with chiller water or properly treated and filtered tower or city water.

Direct injection models may be used with glycol/water process loop mixtures, as long as the glycol does not exceed 50% of the mixture. If your application requires a higher percentage of glycol, or if you have a contaminated cooling water supply, ask your Conair representative about our closed-circuit or isolated circuit Thermolator TW-S and TW-P models.

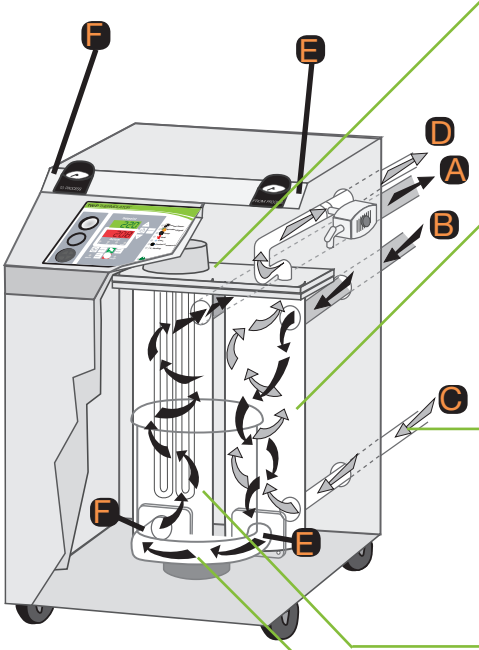
IMPORTANT: Do not use deionized water or glycol mixtures containing additives in the Thermolator. Softened water or glycol mixtures with additives, such as automotive fluids, can damage the Thermolator. Glycol/water process loop mixtures should use only industrial-grade ethylene or propylene glycol.

Contact Conair Customer Service
1 800 458 1960.
From outside of the United States,
call: 814 437 6861

Contact Conair for more information about recommendations for your product.

How the TW-P Direct Injection Works

Direct injection models maintain the process temperature by electrically heating and/or injecting cool water supplied to the Thermolator by a chiller, tower, or other water source.



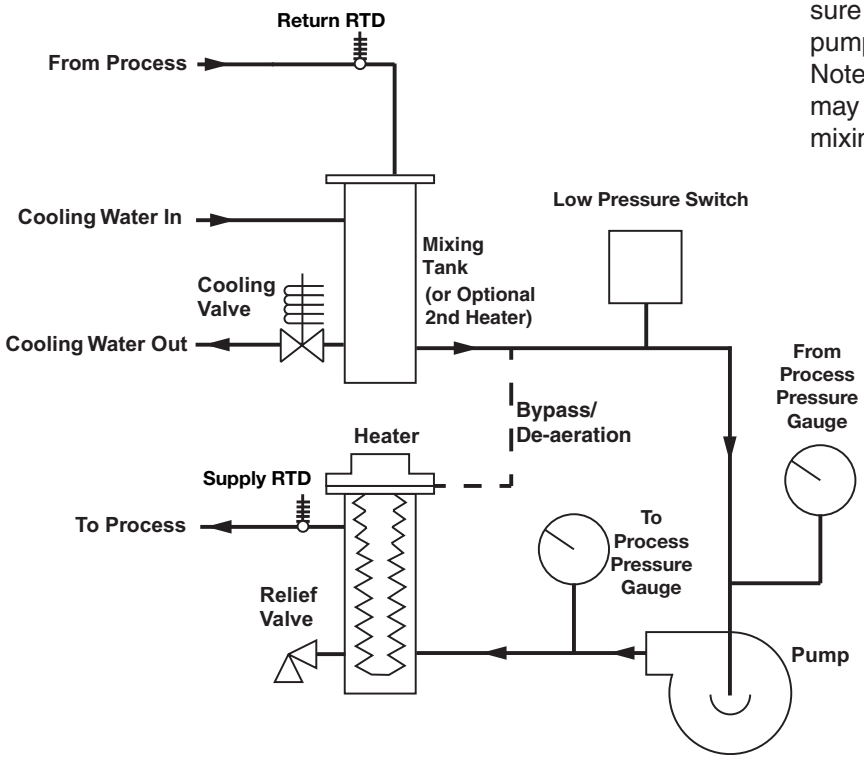
1 The temperature of the process fluid is measured as it leaves the unit's primary heater tank. The fluid then flows through the "To Process" line A to the mold or process. The fluid returns to the unit through the "From Process" line B for reheating or cooling.

2 The temperature of the process fluid is measured as it flows into the mixing tank through the "From Process" line B.

3 If the "To Process" temperature is above the setpoint value, the cooling valve opens. Cool water enters the bottom of the mixing tank via the "Cooling In" line C. Warm water flows out of the top of the tank via the "Cooling Out" line D.

If the "To Process" temperature is below the setpoint, the heater elements inside the heater tank are energized.

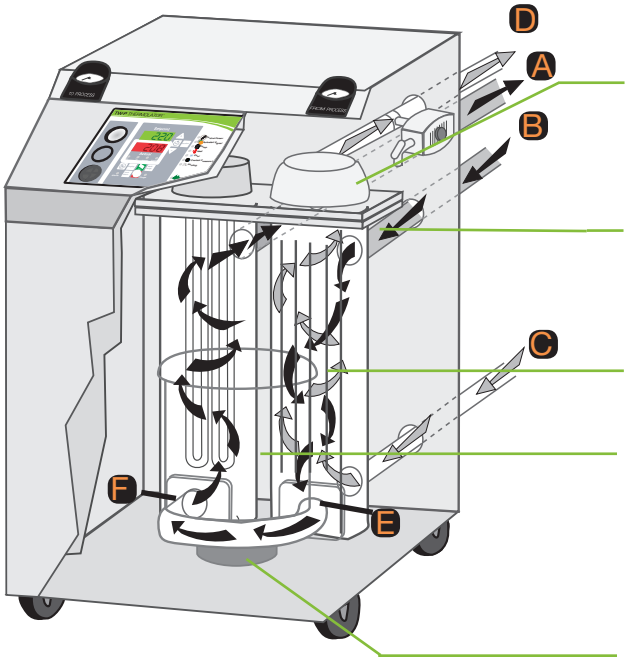
4 The pump moves water from the mixing tank into the heater tank. Pressure is measured before and after the pump with pressure gauges E and F. Note: Depending on your model, you may have an additional heater in the mixing tank.



TW-P Direct Injection

How the Closed Circuit Works

Closed Circuit models maintain the process temperature by electrically heating and indirectly cooling fluid in the process circuit. Cooling water supplied by a chiller, tower or other water source, is mixed with the process fluid only during the initial filling or when water is needed to make up process fluid loss. A brazed-plate heat exchanger replaces the mixing tank used on direct injection units.

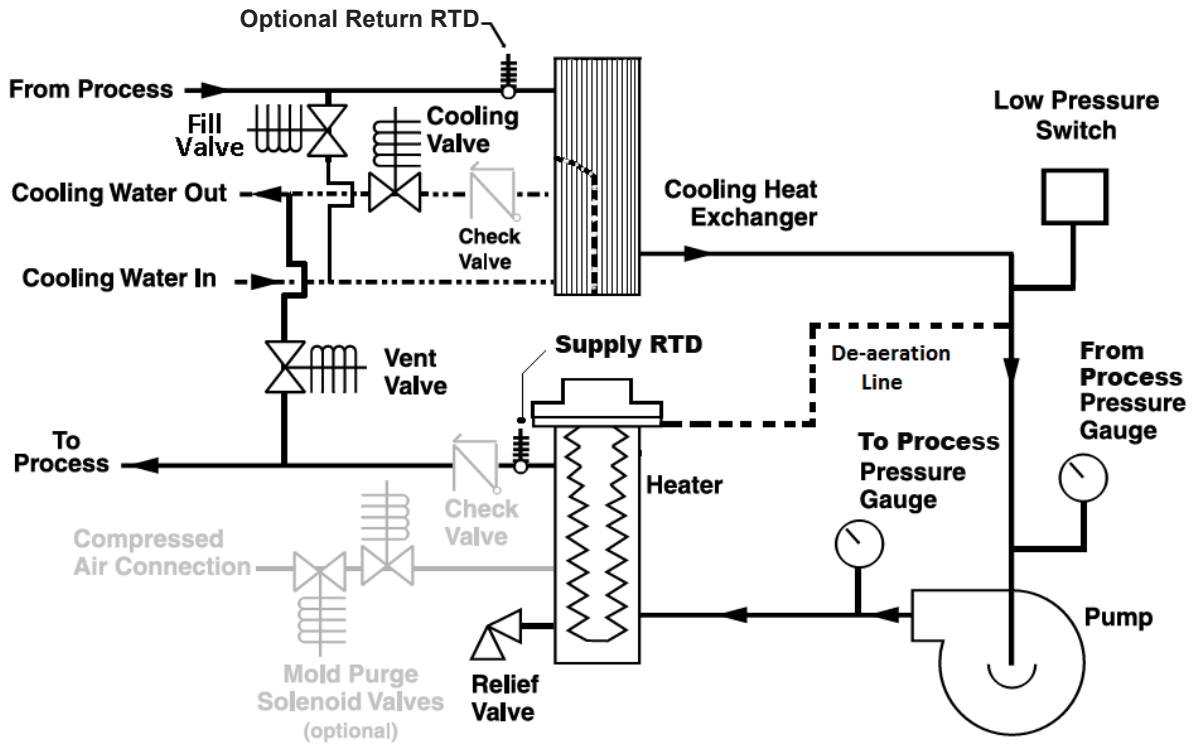


1. The temperature of the process fluid is measured as it leaves the unit's heater tank. The fluid then flows through the "To Process" line A to the mold or process. The fluid returns to the unit through the "From Process" line B for reheating or cooling.

2. Alternatively, the temperature of the process fluid may be measured as it flows into the mixing tank through the "From Process" line B.

3. If the temperature is above the setpoint value, the cooling valve opens. Cool water enters the heat exchanger via the "Cooling In" line. Process fluid is always being circulated through the process side of the heat exchanger. The process fluid is indirectly cooled via conduction from the colder water now running through the cooling side of the heat exchanger. If the measured temperature is below the setpoint, the heater elements inside the heater tank are energized.

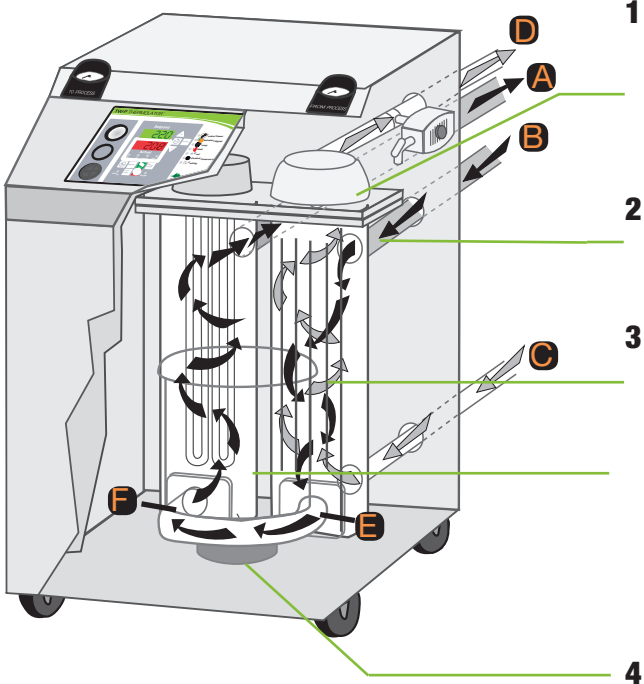
4. The pump moves water from the heat exchanger to the heater tank. Pressure is measured before and after the pump with pressure gauge E and F.



TW-P Closed Circuit

How the Closed Circuit Separate Source Works

Closed Circuit Separate Source models maintain the process temperature by electrically heating and indirectly cooling fluid in the process circuit. Cooling water supplied by a chiller, tower or other water source, is never mixed with process fluid. Fluid to fill the process loop is provided by a "separate source" A brazed plate heat exchanger replaces the mixing tank used on direct injection units.

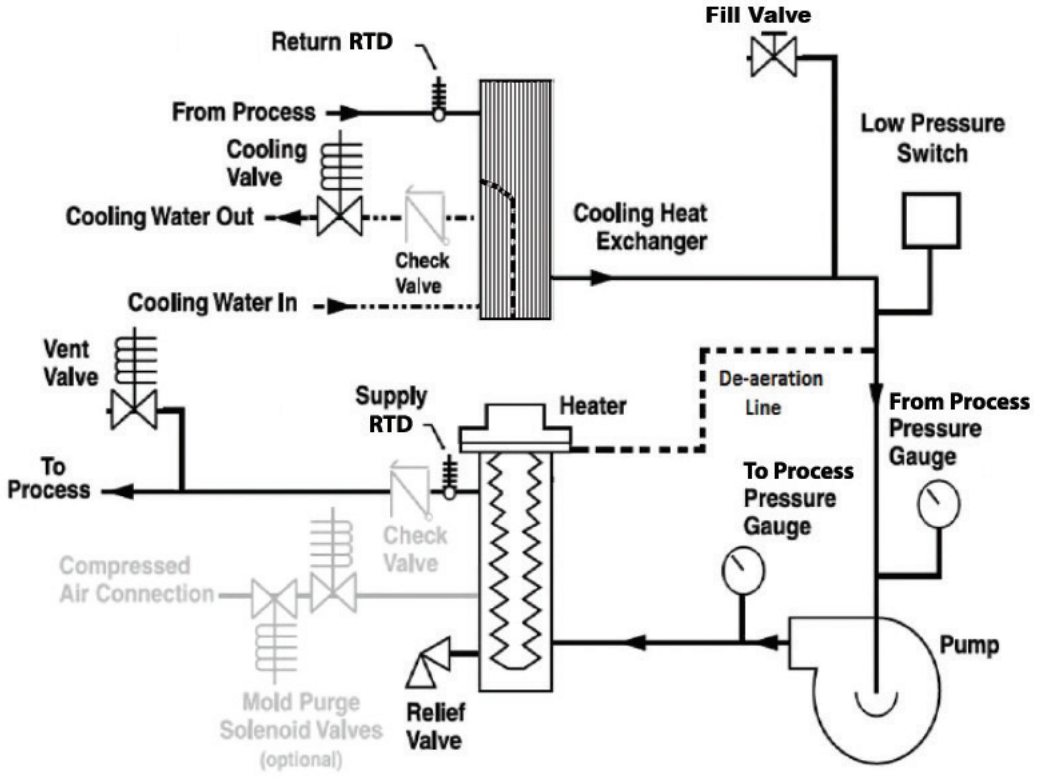


1. The temperature of the process fluid is measured as it leaves the unit's heater tank. The fluid then flows through the "To Process" line A to the mold or process. The fluid returns to the unit through the "From Process" line B for reheating or cooling.

2. Alternatively, the temperature of the process fluid may be measured as it flows into the mixing tank through the "From Process" line B.

3. If the temperature is above the setpoint value, the cooling valve opens. Cool water enters the heat exchanger via the "Cooling In" line. Process fluid is always being circulated through the process side of the heat exchanger. The process fluid is indirectly cooled via transmission from the colder water now running through the cooling side of the heat exchanger. If the measured temperature is below the setpoint, the heater elements inside the heater tank are energized.

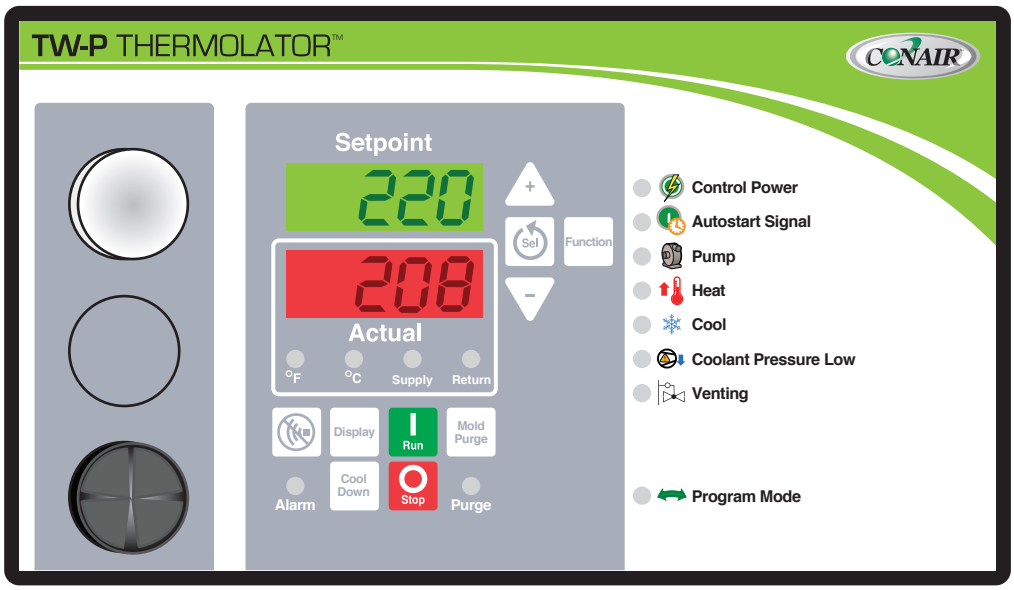
4. The pump moves water from the heat exchanger to the heater tank. Pressure is measured before and after the pump with pressure gauge E and F.



TW-P Closed Circuit Separate Source

TW-P Control Features vs TW-V and TW-S

The TW-P Control - shown with optional features



MODEL	TW-P
Direct Injection	●
Closed Circuit	❍
CONSTRUCTION	
Standard Pump Range	3/4 to 10 Hp
Standard Heater Range	9 to 48 kW
Cast Heater / Pump	●
Incoloy Heaters	●
Silicon Carbide Seal	●
Pressure Gauges	●
CONTROLS	
PID Control	●
Setpoint / Actual Display	●
Password Protection	●
Modbus RTU via RS-485	❍
Modbus TCP via Ethernet	❍
Ethernet/IP	
Retransmit Proc. Temp (4-20mA)	❍
Auto Restart Capability	❍
High Temperature Safety	❍
Mold Purge (Factory Installed)	❍
Phase Detection Circuit	❍
Choice of Control Points	●
Remote Start/Stop	❍
Cool down mode	●
STATUS / ALARM LIGHTS	
Panel-mounted status lights	13 LED's
Panel-mounted alarm lights	(6) 7-segment
Audible alarm / Strobe light	❍

● = Standard ❍ = Optional

Purge On/Off button included on control.

Phase detection indicates incorrect pump rotation or an open electrical leg.

Control temperature based on temperature at process supply or return points, or an average of the two points.

Remote Start/Stop works with external timers or switches for convenient preheating of molds.

Control features on the TW-S and TW-V Series Thermolators

MODEL	TW-S	TW-V
Direct Injection	●	●
Closed Circuit	❍	
CONSTRUCTION		
Standard Pump Range	3/4 to 10 Hp	3/4 or 2 Hp
Standard Heater Range	9 to 48 kW	12 kW
Cast Heater / Pump	●	●
Incoloy Heaters	●	●
Silicon Carbide Seal	●	●
Pressure Gauges	●	●
CONTROLS		
PID Control	●	●
Setpoint / Actual Display	●	●
Password Protection	●	
Modbus RTU via RS-485	❍	
Modbus TCP via Ethernet	❍	
Ethernet/IP	❍	
Retransmit Proc. Temp (4-20mA)	❍	
Auto Restart Capability		
High Temperature Safety	❍	
Mold Purge (Factory Installed)	❍	❍
Phase Detection Circuit		
Choice of Control Points		●
Remote Start/Stop	❍	
Cool down mode		
STATUS / ALARM LIGHTS		
Panel-mounted status lights	3 LED's	1 LED
Panel-mounted alarm lights	button/light	1 LED
Audible alarm / Strobe light	❍	

Specifications: TW-P

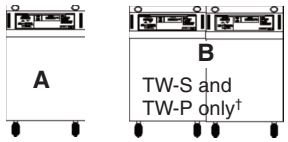
MODELS	TW-P (direct injection)‡	TW-P (closed circuit)§
Performance Characteristics		
Minimum setpoint temperature °F {°C}	40 {4}	40 {4}
Maximum setpoint temperature °F {°C}	250 {121}, (300 {149} optional)	250 {121}, (300 {149} optional)
Minimum operating temperature °F {°C}	Approximately 20° {11°} above the cooling water inlet temperature*	
Standard cooling valve size inches {mm}	1/4 {6.35}	3/4 {19.05}
Available pump sizes	0.75, 1, 2, 3, 5, 7.5, 10 Hp {0.56, 0.75, 1.49, 2.24, 3.73, 5.59, or 7.46 kW}	
Available heater sizes	6, 9, 12, 18, 24, 36 or 48 kW	9, 12, 18 or 24 kW
Connections to/from process NPT inches (female)	1.25	
Connections cooling water NPT inches (female)	0.75	

PUMP PERFORMANCE - Consult your Conair representative for pump performance characteristics at other operating points.

Pump	3/4 Hp {0.56 kW}	1 Hp {0.75 kW}	2 Hp {1.49 kW}	3 Hp {2.24 kW}	5 Hp {3.73 kW}	7.5 Hp {5.59 kW}	10 Hp {7.46 kW}
Nominal flow gpm {lpm}	50 {189}	55 {208}	75 {284}	85 {322}	100 {379}	120 {454}	150 {568}
Pressure@ nominal flow psi {kg/cm²}	20 {1.4}	25 {1.7}	30 {2.1}	32 {2.2}	46 {3.2}	56 {3.9}	65 {4.5}

DIMENSIONS inches {mm}

Cabinet Style	Single Zone (A)	Dual Zone (B)†
Height	28.43 {722}	28.43 {722}
Width	14.00 {356}	34.00 {864}
Depth	25.75 {654}	25.75 {654}



SHIPPING WEIGHT RANGES lb {kg} Weights vary depending on cabinet size, options,and cooling type (DI or CC).

	Single Zone		Dual Zone	
Pump	Minimum	Maximum	Minimum	Maximum
0.75 Hp {0.56 kW}	240 {109}	280 {127}	491 {223}	576 {261}
1 Hp {0.75 kW}	245 {111}	290 {132}	499 {226}	584 {265}
2 Hp {1.49 kW}	248 {113}	298 {135}	515 {234}	590 {268}
3 Hp {2.24 kW}	259 {118}	299 {136}	538 {244}	623 {283}
5 Hp {3.73 kW}	302 {137}	352 {160}	629 {285}	699 {317}
7.5 Hp {5.59 kW}	317 {144}	362 {164}	649 {294}	729 {331}
10 Hp {7.46 kW}	329 {149}	379 {172}	683 {310}	763 {346}

TOTAL FULL LOAD AMPS PER ZONE

Heater	9 kW						12 kW						18 kW					
Voltage	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60
Pump size																		
0.75 Hp {0.56 kW}	25.9	25.9	15.0	15.0	12.9	10.5	33.4	33.4	19.3	19.3	16.7	13.5	48.5	48.5	28.0	28.0	24.2	19.5
1.0 Hp {0.75 kW}	26.8	26.8	15.2	15.3	13.3	10.6	34.3	34.3	19.5	19.6	17.1	13.6	49.4	49.4	28.2	28.3	24.5	19.6
2.0 Hp {1.49 kW}	28.9	28.9	16.6	16.7	14.3	11.6	36.4	36.4	20.9	21.0	18.1	14.6	51.5	51.5	29.6	29.7	25.6	20.6
3.0 Hp {2.24 kW}	31.7	31.7	13.4	18.0	15.4	12.5	39.2	39.2	22.4	22.3	19.2	15.5	54.3	54.3	31.1	31.0	26.7	21.5
5.0 Hp {3.73 kW}	36.3	36.3	20.7	18.2	17.7	14.2	43.8	43.8	25.0	22.5	21.5	17.2	58.9	58.9	33.7	31.2	29.0	23.2
7.5 Hp {5.59 kW}	42.1	42.1	24.9	20.5	20.3	16.3	49.6	49.6	29.2	24.8	24.1	19.3	64.7	64.7	37.9	33.5	31.6	25.3
10.0 Hp {7.46 kW}	50.3	50.3	28.9	24.8	24.1	18.9	57.8	57.8	33.2	29.1	27.9	21.9	72.9	72.9	41.9	37.8	35.4	27.9

TOTAL FULL LOAD AMPS PER ZONE

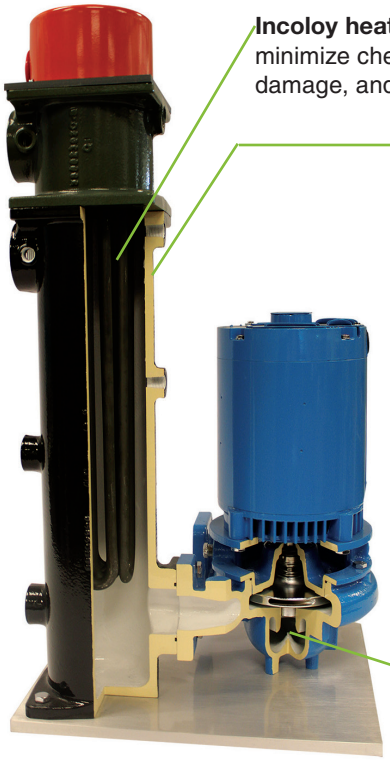
Heater	24 kW						36 kW						48 kW					
Voltage	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60
Pump size																		
0.75 Hp {0.56 kW}	63.6	63.6	36.6	36.6	31.7	25.6	93.7	93.7	54.0	54.0	46.8	37.6	N/A	N/A	N/A	N/A	61.9	49.7
1.0 Hp {0.75 kW}	64.5	64.5	36.8	36.9	32.1	25.7	94.6	94.6	54.2	54.3	47.2	37.7	N/A	N/A	N/A	N/A	62.3	49.8
2.0 Hp {1.49 kW}	66.6	66.6	38.2	38.3	33.1	26.7	96.7	96.7	55.6	55.7	48.2	38.7	N/A	N/A	N/A	N/A	63.3	50.8
3.0 Hp {2.24 kW}	69.4	69.4	39.7	39.6	34.2	27.6	99.5	99.5	57.1	57.0	49.3	39.6	N/A	N/A	N/A	N/A	64.4	51.7
5.0 Hp {3.73 kW}	74.0	74.0	42.3	39.8	36.5	29.3	104.1	104.1	59.7	57.2	51.6	41.3	N/A	N/A	N/A	N/A	66.7	53.4
7.5 Hp {5.59 kW}	79.8	79.8	46.5	42.1	39.1	31.4	109.9	109.9	63.9	59.5	54.2	43.4	N/A	N/A	N/A	N/A	69.3	55.5
10.0 Hp {7.46 kW}	88.0	88.0	50.5	46.4	42.9	34.0	118.1	118.1	67.9	63.8	58.0	46.0	N/A	N/A	N/A	N/A	73.1	58.1

SPECIFICATION NOTES:

* Lower operating temperatures can be obtained with larger cooling valves.
† Available in TW-S and TW-P models only.
‡ Direct Inject (DI) cooling injects cooling water directly into the process loop upon demand.
§ Closed Circuit (CC) cooling injects cooling water into the process loop only during the initial filling or when make-up water is needed.

Specifications can change without notice. Check with a Conair representative for the most current information.

TW-P Features and Options



Incoloy heaters
minimize chemical and high temperature damage, and maximizes life.

Two-piece cast
construction

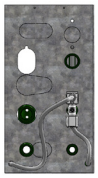
High efficiency pumps
from 3/4 to 10 Hp. Silicon carbide seals are standard.

Built-in sediment trap
settles contaminants away from the pump seals.

Options

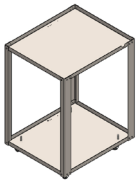
Modulating Valve
Sometimes referred to as a “floating valve”, this option eliminates thermal shock from your process circuit by modulating the cooling water. If Modulating valve option is not chosen, the Solenoid valve replaces it.

Solenoid Valve



Compressed Air Mold Purge
This option quickly evacuates fluid from the process circuit, allowing for faster, cleaner disconnection of the temperature controller from molds and hoses.

Alarm packages
The Thermolator control includes an output relay that can be connected to an optional external alarm package to call attention to alarm conditions.



Stacking Rack
Save floor space by stacking Thermolators two-high. The stacking rack can be used only with single-zone models with a height of less than 30 inches{262 mm} high cabinets.

SECTION
3

Installation

Unpacking the Boxes

Thermolator TW models come fully assembled. If they were specified at the time of the order, the optional purge valve or modulating valve is factory-installed.

CAUTION: Lifting

To avoid personal injury or damage to the Thermolator, lift the unit using a forklift or hoist with straps that have been positioned at the center of gravity.

NOTE: If ordered with the remote HMI option, the remote HMI may arrive in a separate box.

1. **Carefully remove the Thermolator** and components from their shipping containers.
2. **Remove all packing material**, protective paper, tape, and plastic. Compare contents to the shipping papers to ensure that you have all the parts.
3. **Carefully inspect all components** to make sure no damage occurred during shipping. Check all wire terminal connections, bolts, and any other electrical connections, which may have come loose during shipping.
4. **Record serial numbers and specifications** in the blanks provided on the back of the User Guide's title page. This information will be helpful if you ever need service or parts.
5. **You are now ready to begin installation.** *See Installation Section entitled, Preparing for Installation.*

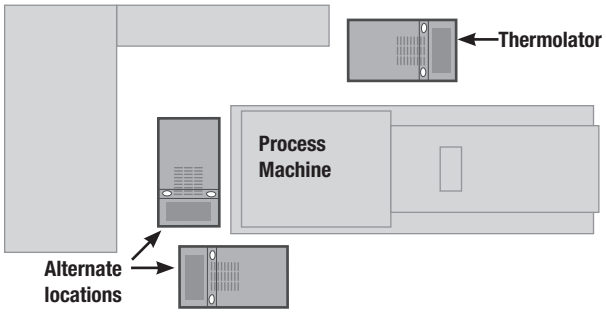
Preparing for Installation

The Thermolator is easy to install, if you plan the location and prepare the area properly.

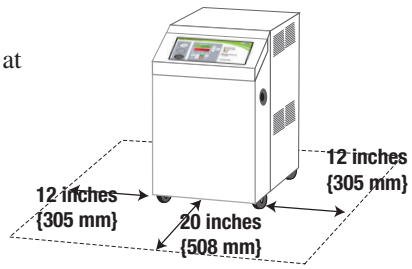
> ⚠ **WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.**
>
> This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.
>
> All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

1 **Position the Thermolator as close to the process machine as possible.**

2 **Make sure the installation area provides**:



- ❒ **A three-phase power source supplying the correct current for your Thermolator model.** Check the serial tag on the unit for required voltage, phase, frequency, and full load amps. Check the last page of the electrical power prints for the disconnect fuse size and minimum wire connection size. All wiring should be completed by qualified personnel and should comply with your region's electrical codes.
- ❒ **A clean, well-ventilated environment.** The room temperature should not exceed 104° F {40° C} with 95% non-condensing humidity and should not fall below 32° F {0° C}.
- ❒ **Minimum clearance for safe operation and maintenance.** The diagram at the right shows minimum clearance for operation. You also need enough clearance in rear for water hookups. For maintenance, you should move the Thermolator to provide at least 36 inches {91 cm} on any side of the Thermolator. Additionally, your required electrical codes may require a larger service area in front of the electrical panel.



- ❒ **A source of water for cooling.** City, tower or chiller water may be used as long as the supply pressure is at least 25 psi and not more than 95 psi for most units; *refer to the appendix for more information on 48 kW and 300° F {149° C} units.*

3 **Install plumbing for process and cooling lines.**
You will need two $1^{1}/_{2}$-inch NPT male fittings for the process inlet and outlet and two 1-inch NPT male fittings for the cooling inlet and outlet. Larger line sizes are acceptable as long as they are reduced at the Thermolator connections. Smaller line sizes are not recommended.

Tools for Installation:

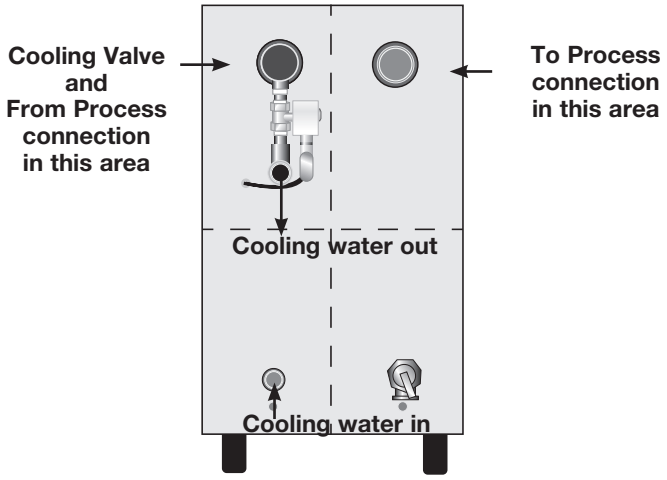
- ❒ *Pipe wrench large enough for a 2-inch pipe*
- ❒ *Premium quality Teflon thread sealant*

✎ **NOTE:** Conair recommends that you install an external ball valve on the cooling water inlet of the Thermolator. This valve is required when the purge valve option is installed.

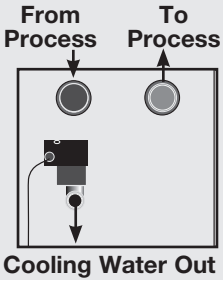
Connecting Process and Water Supply Lines Without Purge

The Thermolator process inlets and outlets must be connected to the plumbing that will circulate the temperature-controlled water or fluid through the process. Cooling water inlets and outlets are connected to the cooling water supply.

1. **Remove the shipping pipe plug** from the female connections on the back of the Thermolator.
2. **Install pipe to the rear of the Thermolator.** Use male $1^{1}/_{2}$-inch NPT piping for process connections and male 1-inch NPT piping for water connections. Pipe and pipe threads must be clean and new. Clean threads with solvent, removing all oil, grease and dirt. Allow the threads to dry before proceeding.
3. **Coat the pipe threads with thread sealant.** Follow the sealant manufacturer's directions.
4. **Connect the male pipe to the appropriate female connection** on the back of the unit. Start by hand until the threads engage, then use a pipe wrench to tighten the connection only enough to prevent leaks. **Do not over-tighten!**



DIRECT INJECTION



Floating Cooling Valve

If you have the optional floating cooling valve, connect the cooling water return to the female 1-inch NPT fitting on the valve. Except as noted, all other connections should be made as described above.

Optional Mold Purge Valve Connections

A mold purge valve is available as an option. This valve quickly evacuates fluid from the process circuit, allowing faster disconnection of the temperature controller from molds and hoses. A manual purge button controls this valve.

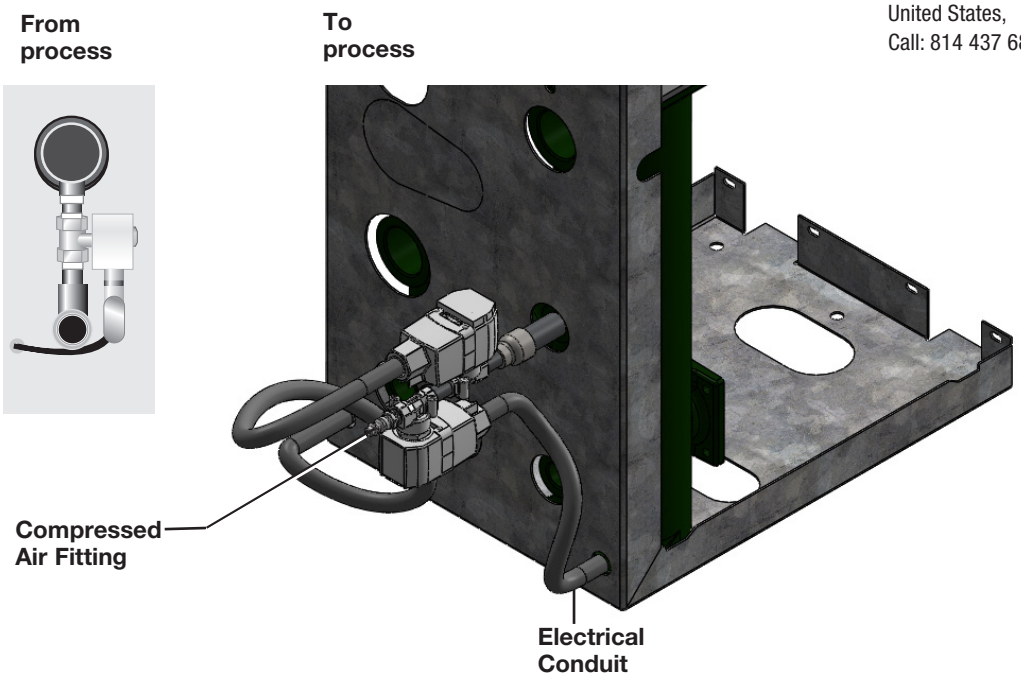
If this option is ordered with the Thermolator, purge control wiring and installation of the valve on the process line outlet of the unit is completed at the factory. You still must connect process and cooling water inlets and outlets, as well as supply of non-lubricated compressed air.

TIP: Conair recommends ordering the purge valve with the Thermolator so that wiring and installation is completed at the factory. However, aftermarket addition of the purge valve is possible.

1. **Remove the shipping pipe plug** from the female connections on the back of the Thermolator.
2. **Install an external ball valve on the cooling water inlet of the Thermolator.** This valve is required when a purge valve is used.
3. **Install pipe to the rear of the Thermolator.** Use male $1^{1}/_{2}$-inch NPT piping for process connections and male 1-inch NPT piping for water connections. Pipe and pipe threads must be clean and new. Clean threads with solvent, removing all oil, grease and dirt. Allow the threads to dry before proceeding.
4. **Coat the pipe threads with thread sealant.** Follow the sealant manufacturer's directions.
5. **Connect the male pipe to the appropriate female connection** on the back of the unit. Connect cooling water lines as indicated on the previous page. Connect process lines as indicated below. Start by hand until the threads engage, then use a pipe wrench to tighten the connection only enough to prevent leaks. **Do not over-tighten!**
6. **Connect the purge valve to the compressed air supply.** The air pressure should not exceed 100 psi.

NOTE: For information about how to add a purge valve to your Thermolator if you did not order it equipped that way from the factory, contact Conair Service.

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861



Connecting the Main Power Source

Before beginning, note the electrical specifications on the serial tag mounted to the side of the unit. The electrical connection must match these specifications with +/- 10% maximum voltage variance. An improper power supply could damage the unit as well as seriously injure an operator. The electrical connection should run through a fused disconnect sized for the amperage noted on the serial tag and conforming to all local and national codes, including Article 250 of the National Electric Code.

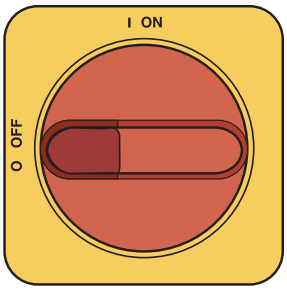
WARNING: Electrical hazard

Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device must be used to isolate this product from potentially hazardous electricity.

WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.



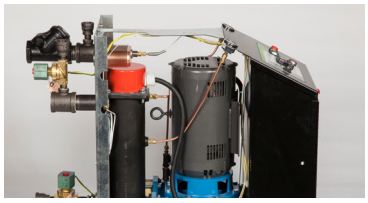
Optional Disconnect Switch

IMPORTANT: Always refer to the wiring diagrams that came with your temperature control unit before making electrical connections. The diagrams show the minimum size main power cable required for your unit, and the most accurate electrical component information.

IMPORTANT: Before initiating power to the unit:

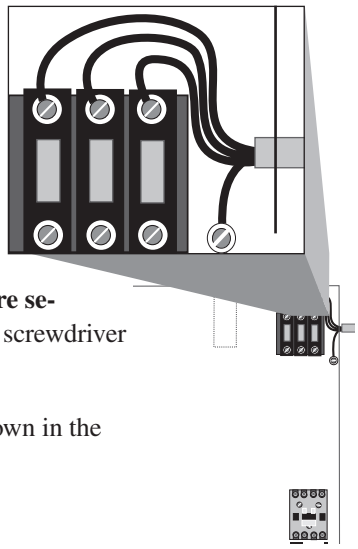
- ❒ Check the system for leaks.
- ❒ Verify that the voltage, phase, frequency, amperage, disconnect fuse, and minimum wire size meet the specifications.
- ❒ Verify that resistance to ground on each phase is at least 1 mega ohm (use a multi-meter, not a megger for this measurement).

1 **Open the unit's electrical enclosure.** Removing the top panel is recommended. The Thermolator comes from the factory with a knockout for 1/2 inch conduit. A knockout punch should be used if necessary to enlarge the hole for larger diameter conduits.



2 **Insert the main power wires through the conduit in the right side of the enclosure**. See electrical prints for recommended wire size.

NOTE: If using a flexible cord, secure the wire with a rubber compression fitting or strain relief.



3 **Connect the power wires to the terminals indicated on the wiring diagram** that came with your machine. The Thermolator comes pre-wired expecting clockwise (L1-L2-L3) phase rotation.

4 **Check every terminal screw to make sure wires are secure.** Gently tug each wire. If a wire is loose, use a screwdriver or allen wrench to tighten the terminal.

5 **Connect the ground wire to the grounding lug** shown in the wiring diagram shipped with your unit.

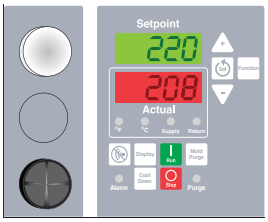
Testing the Installation

WARNING: Only qualified personnel should perform this procedure.

Part of this test requires opening the unit while it is energized. Only qualified personnel who have been trained in the use of electrical testing devices and in avoiding the safety hazards involved in safely troubleshooting this type of equipment should perform this test procedure.

1 **Turn on the cooling water supply and check for leaks.** If any leaks appear, stop the test and fix the problem before continuing. The cooling water must be at least 25 PSI or the unit will not function on standard 250° F {121° C} units less than 48kW. *Refer to the appendix for PSI requirements for units with 48kW heaters and 300° F {149° C} capabilities.*

2 **Apply power to the unit.** The temperature controller display lights up to indicate that the control has power. All LED segments on the display will light for a few seconds while the control performs a self-test. The control then displays the software version, followed by temperature display.



3 **Check the rotation of the pump.** Remove the top access panel and a side panel.

Press the **RUN** Run button, and wait until the pump starts. It will take approximately 30 seconds to complete vent cycle.

When the pump starts, quickly press the **STOP** Stop button and look at the pump shaft. With a flashlight, verify that the pump rotation matches the direction indicated on the rotation sticker on the side of the pump motor.

Tools Required

❒ *Flashlight*

NOTE: If the rotation is incorrect, stop the test and disconnect power to the unit. Open the electrical enclosure and switch any two of the three power source wires on the incoming power distribution block. Return to step 2 and check rotation again.

4 **Replace the top/side access panel.**

5 **Press the RUN button** Run

If everything is working correctly:

- The venting and/or pump LED illuminates.
- The unit initiates a 30-second venting sequence. The pump starts automatically when the venting sequence is over.
- Normal operation begins. The heater turns on if the process temperature is below setpoint. The cooling valve is activated if the process temperature is above setpoint.

NOTE: If the coolant pressure low LED illuminates, verify that the cooling water supply is connected properly and that the water pressure is at least 25 PSI or greater except for 48 kw or 300° F {149° C} units. *Refer to the Appendix for more information.*

If everything tested correctly, proceed to the Initial Setup instructions on the next page. If something did not work correctly, *refer to the Troubleshooting section of this user guide.*

Initial Setup

The temperature controller has been configured at the factory to satisfy most applications, but you can change some settings easily as needed:

Heating-Driven vs. Cooling-Driven Operating Modes

The temperature controller has two different operating modes. It is important that the operator recognizes which is the best mode for his/her application. If the wrong mode is selected, the performance of the temperature controller will not be optimal.

Cooling-Driven

Most applications will be cooling-driven. This is the default mode that the Thermolator ships with, although the user can easily switch modes if necessary.

Description:

- Heating is course-controlled, cooling is fine-controlled.

Examples:

- Injection molding where the Thermolator will perform an initial warm-up of the die, but will then be removing heat from the die during normal production.

> ✎ **Note**: Cooling-driven operating mode does NOT imply that the heater is inactive; it simply implies that during steady-state operation, the Thermolator's primary task will be cooling the process fluid.

Heating-Driven

Heating-driven can be selected on the controller. These applications are rare, but the Thermolator can very effectively control them.

Description:

- Cooling is course-controlled, heating is fine-controlled.

Examples:

- Hot rolls for thin-film applications where the film is kept warm by the rolls it passes over.
- Jacketed vessels there the process fluid is bringing another substance (food, chemical, etc) up to a temperature.
- An endothermic chemical reaction where external heat must be added to make the product.

(Continued)

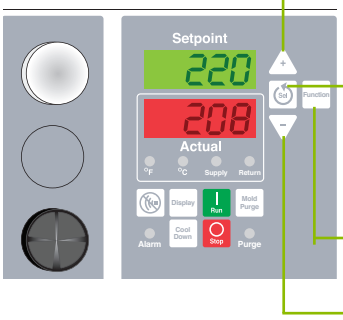
Initial Setup (Continued)

- ❒ Operating Mode
- ❒ Temperature Units
- ❒ Setpoint
- ❒ Alarm Points

⚠ **CAUTION:** The Thermolator will not operate correctly if certain factory-set parameters are changed. Parameters should only be changed by qualified technical personnel who are familiar with the operation of this type of equipment. If the Thermolator does not appear to be working correctly, verify the parameters against the list of factory settings.

For a complete list of the factory-set parameters *see Default Parameters in the appendix of this user guide.*

All parameters can be changed using the keypad and the menu system.



Raise Key
Used to increase values or toggle between setting choices.

Select Key
Used to select a parameter for editing, or save the new value of a changed parameter.

Function Key
Used to access configuration menu.

Lower Key
Used to decrease values or toggle between setting choices.

Operating Mode

To select the proper operating mode of the system (cooling-driven vs. heating-driven), follow this procedure:

1. **Stop the Thermolator or ensure that you are on the home screen by pressing the STOP**  **button.**

2. **Enter the user configuration menu by holding the "Function"**  **button for 5 seconds.**
   If the passcode is at its default "0", simply push "Select"  .
   If the passcode has been changed to something else, use the "Up"  and "Down"  buttons to scroll to the correct passcode, and then push "Select"  .

3. **Repeatedly push "Select" to scroll through available user parameters until** AL **(Algorithm type) is displayed** in the upper display (about 12 presses).
   In the lower display, use the "Up"  or "Down"  buttons to select Hd for a heating-driven application or Cd for a cooling-driven application.

4. **Push "Select"**  **to save the changed parameter.** Push "STOP"  to exit.

Temperature Units

To select the desired temperature units for your system (°F vs. °C), follow this procedure:

1 **Stop the Thermolator or ensure that you are on the home screen by pressing the STOP**  **button.**

2 **Enter the user configuration menu by holding the "Function"**  **button for 5 seconds.**
If the passcode is at its default "0", simply push "Select"  .
If the passcode has been changed to something else, use the "Up"  and "Down"  buttons to scroll to the correct passcode, and then push "Select"  .

3 **Repeatedly push "Select" to scroll through available user parameters until** Unt **(Units) is displayed** in the upper display (about 2 presses).

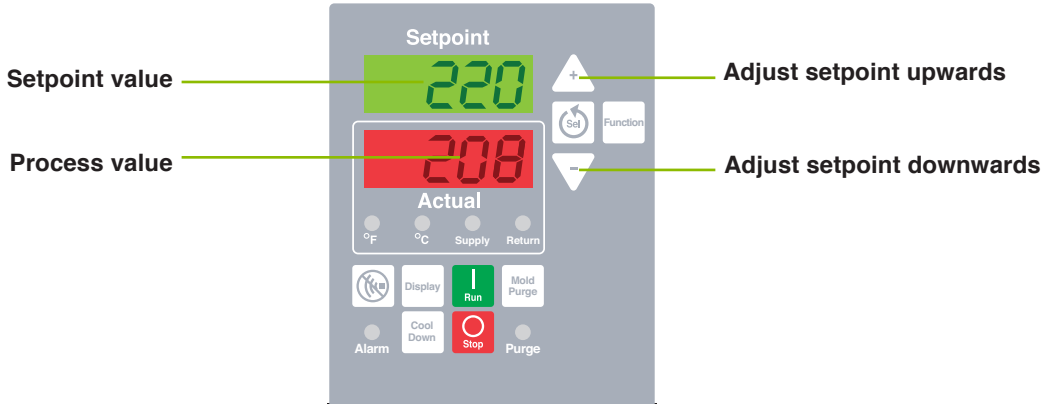
In the lower display, use the "Up"  or "Down"  buttons to select F for a Fahrenheit or C for Celsius.

4 **Push "Select"**  **to save the changed parameter.** Push "STOP"  to exit.

Setpoint

To select the proper operating mode of the system (cooling-driven vs. heating-driven), follow this procedure:

1. **From the home screen you should observe the current setpoint** in green in the upper display and the actual process temperature in the lower window.
2. **Change the setpoint using the "Up"**  **or "Down"**  **buttons.** The new value will automatically be implemented a few seconds after the up or down button is released.



NOTE: From the factory, the TW-P will control the "To Process" or "Supply" fluid to the setpoint. If you need to choose another control source (such as "From Process" or "Return" or an average of "To Process" and "From Process), you will need to change user parameter CS.

Alarm Points

To select the desired alarm points for your system (low alarm and high alarm), follow this procedure:

1 **Stop the Thermolator or ensure that you are on the home screen by pressing the STOP**  **button.**

2 **Enter the user configuration menu by holding the "Function"**  **button for 5 seconds.**
If the passcode is at its default "0", simply push "Select"  .
If the passcode has been changed to something else, use the "Up"  and "Down"  buttons to scroll to the correct passcode, and then push "Select"  .

3 **Repeatedly push "Select"**  **to scroll through available user parameters until the desired parameter is shown in the upper display.**

In the lower display, use the "Up"  or "Down"  buttons to select the desired setting. See the following table for a list of relevant parameters.

Display	Description	Default	Permissible Range
The deviation alarms below can be used to create a permissible operating temperature window around the setpoint. Actual process temperature outside of this window for a certain amount of time will create a deviation alarm.			
Lod	User temperature deviation - under setpoint	10	5 to 100 (degrees)
HI d	User temperature deviation - over setpoint	10	5 to 100 (degrees)
Deviation delays below modify the deviation alarms above. You can select how long you want the system to tolerate a temperature excursion outside of the deviation window before alarming.			
idd	Machine startup "ignore deviation" delay	30	0 to 999 (minutes)
AdL	Alarm delay for low deviation	30	10 to 60 (minutes)
AdH	Alarm delay for high deviation	30	10 to 60 (minutes)
These parameters function as absolute temperature alarms. Any excursion beyond these limits will create an immediate alarm. Do not set these within your normal warm-up or operating ranges or you will experience nuisance alarms.			
LSU	User temperature low limit warning	32	Between (factory low - 8) and (factory high + 10) limits.
HSU	User temperature high limit warning	260	Between (factory low - 8) and (factory high + 10) limits.

4 **Push "Select"**  **to save the changed parameters.** Push "STOP"  to exit.

SECTION
4

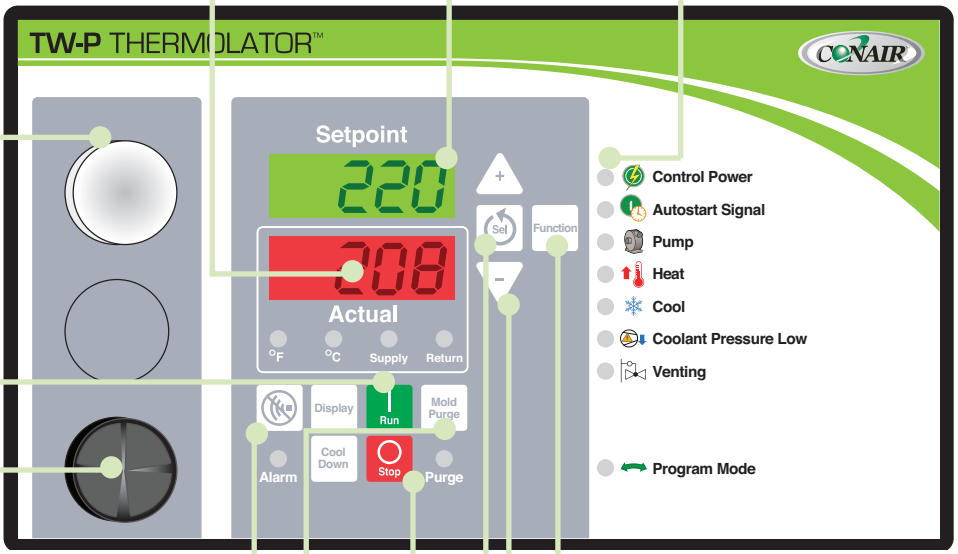
Operation

The TW-P Control

Process Value Display
The window displays the actual temperature of fluid entering the "To Process" line by default.

Setpoint Value Display
The window displays the fluid temperature setpoint during normal operation.

Status Lights
The lights indicate the operating status of the listed components.
- = Off or inactive
- = Problem or Warning
- = Operational
- = Operational



Alarm Strobe (Optional)

Run Button
Press to begin normal operation.

Audible Alarm (Optional)

Fault Light and Audible Alarm Silence Button (Optional)
Press the FAULT button to acknowledge the alarm light and silence the optional audible alarm. The optional alarm strobe remains on until the cause of the alarm condition is fixed.

The red alarm light flashes to indicate high/low deviation, pump overload or over temperature condition.

Mold Purge Button (optional)
The purge uses compressed air to clear fluid from the mold and lines before a mold change. Press and hold the purge while evacuating all fluid from mold and line. The purge button is inactive when the TW is running.

⚠ WARNING: Shut off the supply to cooling water inlet before purging.

Stop Button
Press to stop the Thermolator.

Select Key
Used to edit a parameter or save a changed parameter.

Function Key
Press and hold Function for five seconds to enter the menu system.

Press + or − to index to the next menu.

IMPORTANT: Changing menus and parameters incorrectly can result in improper operation of the Thermolator. Accessing menus and changing parameters is not necessary during normal operation.

Raise and Lower Key
Used to enter the setpoint temperature, index through the operating modes or change other parameter values.

Press + to increase a value.

Press − to decrease a value.

TIP: Press and hold the key for faster scrolling speed.

Default Display

These items are shown by default on the controller. Use the "Up"  and "Down"  buttons to change the setpoint.

DISPLAY EXAMPLE	ITEM	UNITS	DESCRIPTION
70	Active Process Value (shown on lower display in red)	°F or °C	The current temperature of the process fluid.
75	Active Set Point (shown on upper display in green)	°F or °C	The temperature that the temperature controller is attempting to reach by either heating or cooling the process fluid.

NOTE: The active process value can be changed by pushing the "Display" 

button. The default process value can be changed in the user parameter menu.

(Continued)

Starting the Thermolator

Before starting the Thermolator, verify that the system has been installed correctly for your application. *See the Installation section*.

1 **Turn on the water supply to the Thermolator.** The supply pressure must be at least 25 psi for most units. *Refer to the appendix G for more information on 48 kw and 300° F {149° C} units*. Check for leaks in the cooling water and process fluid lines before continuing.

2 **Turn on main power to the Thermolator.**

- The controller display and "Control Power" LED will illuminate to indicate the control has power.
- The controller will show the firmware version on the lower display while showing "tcP" on the upper display. After a few seconds, process temperature will be displayed (red, bottom display) and setpoint will be shown (green, top display).

NOTE: All LEDs will flash to test their operation.

3 **Set the temperature setpoint to 40° F (4.4° C)** if the Thermolator's process lines were recently reconfigured, or if you suspect excessive air is in the process lines.

Press  to increase or  to decrease the temperature setting. This will provide additional flushing and de-aeration in the process lines via the cooling valve.

NOTE: If the coolant pressure low LED illuminates, verify that the cooling water supply is connected properly and that the water pressure is at least 25 PSI or greater except for 48 kw or 300° F {149° C} units. *Refer to the Appendix for more information.*

4 **Press RUN** 

.
The unit initiates a 30-second (or as otherwise defined by user parameter) venting sequence. The Venting LED illuminates.

- The pump starts after the venting cycle is over. The Pump LED illuminates when the pump is running.
- Normal operation begins. The heater turns on if the actual temperature is below setpoint. The cooling valve opens if the actual temperature is above setpoint.

NOTE: Both venting stages will be skipped if the process temperature is above the vent bypass temperature, and the Thermolator will consequently start the pump immediately in the "RUNNING" state.

5 **Set the setpoint to the desired temperature**, Shown in green on the top display.

Press  to increase or  to decrease the temperature setpoint. If you followed step 3, wait until process lines are de-aerated before raising setpoints.

6 **If the Alarm LED turns on, press "Silence/Reset"**  to silence the optional audible alarm.
Refer to the Troubleshooting section for more information.

Stopping the Thermolator

WARNING: Electrical Shock and Hot Surface Hazards

Before attempting maintenance of any kind on the Thermolator, you must stop the unit, disconnect and lockout the main power supply, and allow the unit to cool to less than 100° F {38° C}.

You must shut down the Thermolator whenever you:

- Change the water hookups.
- Shut down the process machine.
- Purge the process circuit of the water or fluid.
- Perform routine or preventative maintenance.
- See an alarm condition that requires troubleshooting.
- Relocate, ship or store the unit.

To shut down the unit during a normal interruption in production process, where no maintenance will be performed:

1 **Press STOP** 

.

To shut down the unit to change water hookups:

1 **Change setpoint to 80° F {27° C} and allow the Thermolator to cool itself to less than 100° F {38° C}.**

2 **Press STOP** 

.

3 **Shut off the cooling water supply, and relieve any pressure in the unit** (see pressure gauge) by lifting the relief valve lever; then drain the unit of all fluid. The cooling water inlet hose can be removed to provide additional draining.

4 **Once the unit is cool, remove the water hookups.**

To shut down the unit for relocation or storage:

1 **Change setpoint to 80° F {27° C} and allow Thermolator to cool itself to less than 100° F {38° C}.**

2 **Press STOP** 

.

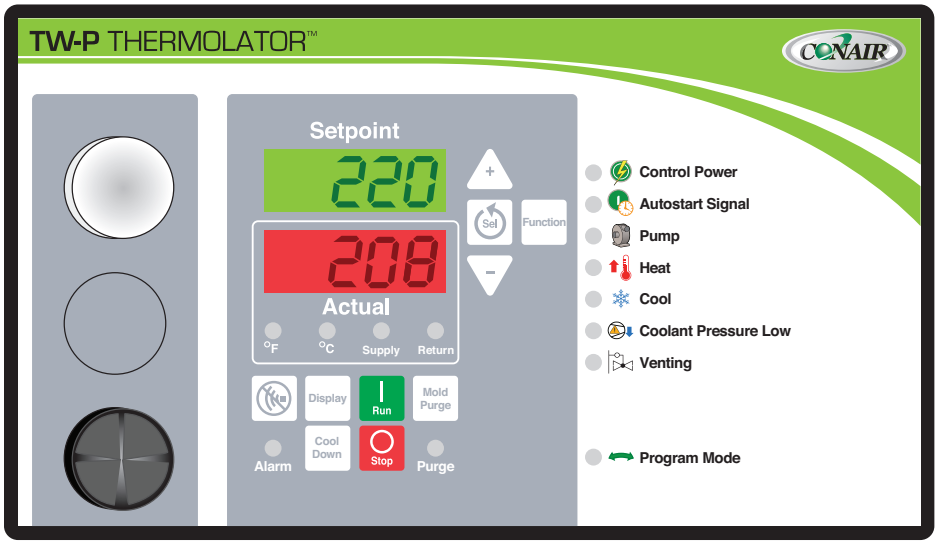
3 **Shut off the cooling water supply, and relieve any pressure in the unit** (see pressure gauge) by lifting the relief valve lever; then drain the unit of all fluid. The cooling water inlet hose must be removed to provide maximum draining.

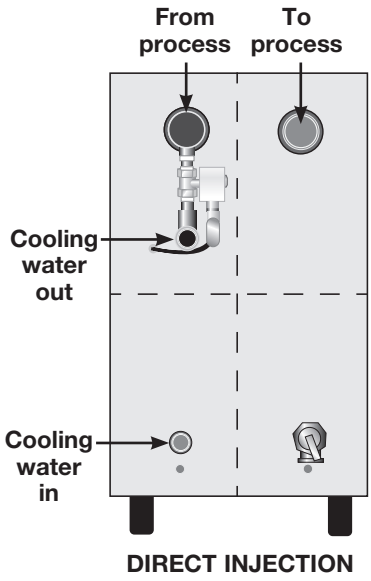
4 **Disconnect the power supply and all water feeds.**

In shipment or storage, the Thermolator can withstand an environment between -40° F {-40° C} and 150° F {65° C} with 95% relative humidity non-condensing.

Using the Optional Mold Purge Option

The TW-P Thermolator can be ordered with an optional purge valve (Mold Purge), which clears the process lines of fluid using compressed air. The valve is operated by an optional manual purge button on the control panel.





DIRECT INJECTION

IMPORTANT: Before purging the process lines, be sure that the cooling water source feed is closed. If the feed is open and the air line has a higher pressure than the cooling water, air may be injected into the cooling water system. If the cooling water pressure is higher than the air line, cooling water may be injected into the air line.

1 **Press STOP** Stop **to stop the Thermolator.**

2 **Shut off the cooling water supply valve.**

3 **Press MOLD PURGE** Mold Purge **to start purging.**

- The "Purge" LED lights.
- The cooling valve is opened.

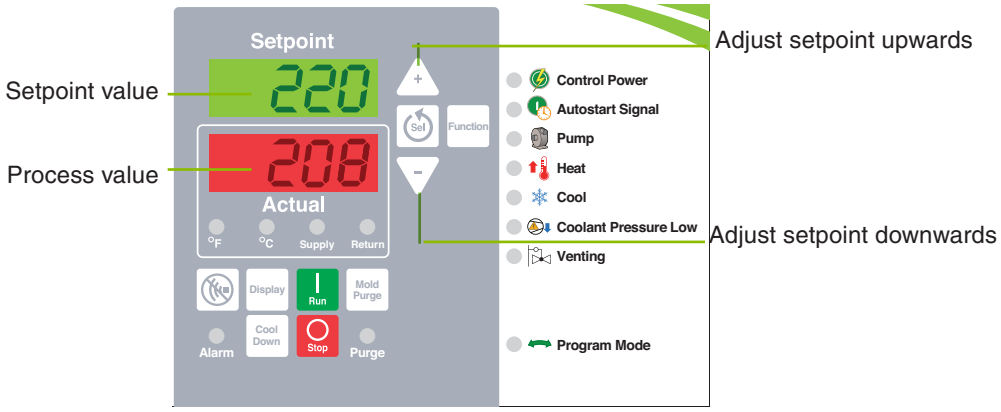
The time required to clear the process lines of fluid will vary according to the length of the process piping and the size of the tooling.

4 **Release MOLD PURGE** Mold Purge **to stop purging.**

Conair TW-P Thermolator

Normal Operation

For normal operation of the TW-P Thermolator, set the setpoint on the temperature controller using the + and − buttons. On the display, the lower red display shows the current temperature, and the upper green display shows the setpoint. In the right-hand column, the various LEDs describe the status of the machine.



(Continued)

Conair TW-P Thermolator (Continued)

Programmable Parameters

NOTE: Customer can change this code to something other than "000" default.

Menu Item Name		Item Code	Default Valve	Range
USER MENU Enter by holding "Function" for 5 seconds then acknowledging the default "000" by hitting "Select". Hit "Select" to save a changed parameter. Hit "STOP" to exit.				
U1	User password	UPA	000	0 to 500
U2	Display units	Unt	F	F or C (degrees)
U3	Flowmeter display units	FLU	GAL	GAL or L it (gallons per minute or liters per minute)
U4	Default display	dS	SUP	SUP, rEt, Avg or FL (supply, return, average, flowmeter)
U5	User temperature deviation - under setpoint	Lod	10	5 to 100 (degrees)
U6	User temperature deviation - over setpoint	Hi d	10	5 to 100 (degrees)
U7	Startup "ignore deviation" delay	idd	30	0 to 999 (minutes)
U8	Alarm delay for low deviation	AdL	30	10 to 60 (minutes)
U9	Alarm delay for high deviation	AdH	30	10 to 60 (minutes)
U10	User temperature low limit warning	LSU	32	Between factory low (-8) and high (+10) limits.
U11	User temperature high limit warning	HSU	260	Between factory low (-8) and high (+10) limits.
U12	Control source	CS	SUP	SUP or rEt or Avg (Supply, return, or average. "Avg" is average of supply & return temp.)
U13	Algorithm type	At	Cd	Hd or Cd (Heating-driven or Cooling-driven)
U14	Proportional band: Cooling-driven	PbC	7	1 to 300 (Smaller # is more aggressive derivative response.)
U15	Derivative time: Cooling-driven	dEC	30	0 to 200 (Larger # is more aggressive derivative response.)
U16	Integral time: Cooling-driven	inC	200	0 to 800 (Smaller # is more aggressive derivative response.)
U17	Proportional band: Heating-driven	PbH	7	1 to 300 (Smaller # is more aggressive derivative response.)
U18	Derivative time: Heating-driven	dEH	10	0 to 200 (Larger # is more aggressive derivative response.)
U19	Integral time: Heating-driven	inH	30	0 to 800 (Smaller # is more aggressive derivative response.)
U20	Proportional band ratio	Pbr	10	1 to 100 (÷10 implies a mathematical range of 0.1 to 10.0)
U21	Brownout monitor	brn	EnA	Disabled (dis) or Enabled (EnA)
U22	Auto restart / remote start	AUt	oFF	Both disabled (oFF), Auto Restart Enabled (Ar S), or Remote Start Enabled (rES).
U23	Vent timer stage 1 timer (Open cooling valve and vent solenoid)	ut 1	30	Selection of 5, 10, 20, 30, 45, 60, 90, 120, 150, 180 (sec)
U24	Vent timer stage 2 timer (Open cooling valve, vent solenoid, and turn on pump)	ut2	30	Selection of 5, 10, 20, 30, 45, 60, 90, 120, 150, 180 (sec)
U25	Vent sequence cancel temperature	SCt	120	Between factory low and high limits
U26	Pump run hours	PrH	0	0 to 999 (x100)

(Continued)

Conair TW-P Thermolator (Continued)

U27	Heat calls	HtH	0	0 to 999 (x10,000) # of rising edges sent to heater output.
U28	Cool-down shutdown temperature	SSt	90	Between factory low and high limits
U29	Low-pressure standby time limit	LPS	10	non, 1, 2, 3, 5, 10, 15, 30, 60, 120, inF (minutes)
U30	Low-pressure fault counts	LPC	3	1 to 25 (number of low pressure events)
U31	Low-pressure fault counts expiration timer	LPt	15	1 to 999 (minutes)
U32	Automatic mold purge timeout	APt	600	0 to 999 (seconds)
U33	Flowmeter alarm threshold	FA	0	0 to 999 (gpm or lpm, per FLU). 0 implies no alarm.
U34	Remote setpoint enabled	rSE	dIS	Disabled (dIS) or Enabled (EnA) (via analog wiring)
U35	Remote setpoint type	rSt	mnA	4-20mA (mnA) or 0-10 Volts (u)
U36	Remote setpoint high range	rSH	260	rSL to 999
U37	Remote setpoint low range	rSL	10	-99 to rSH
U38	Communications type	Cot	OFF	OFF, Retransmit (rEt), ModBus-RTU (bUS), ModBus-TCP (tcP), or Handheld Remote (HAn)
U39	Retransmit type	rtt	mnA	4-20mA (mnA) or 0-10 Volts (u)
U40	Retransmit high limit	rtH	260	rEL to 999
U41	Retransmit low limit	rtL	10	-99 to rEH
U42	Communications baud rate	bAU	96	12 to 96
U43	Modbus ID	bId	1	1 to 247
U44	Onboard temperature monitor	obt	EnA	Enabled (EnA) or Disabled (dIS)
U45	Board temperature readout	PtE	n/a	Display only.

✎ **NOTE**: No SPI communications.

(Continued)

SECTION
5

Maintenance

Maintenance of your Thermolator

Depending on which features, options, and additions you ordered with your Thermolator, your maintenance procedures and necessities may differ from what is shown in this user guide. Please note that all illustrations, photos, and instructions are based on a typical configuration of a Thermolator. Always refer to the wiring diagrams and other documentation - including manuals from the manufacturer of any valves, heat exchangers, and parts used on your Thermolator - when completing any maintenance or troubleshooting tasks.

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

If you have any questions or concerns about your Thermolator, feel free to call Conair's Parts and Service departments for assistance.

Preventative Maintenance Schedule

Thermolator TW water temperature controllers are essentially maintenance-free. However, to maintain the best performance, we recommend the following maintenance schedule.

- **Daily or as often as necessary**
  - ❒ **Check for leaks in cooling and process lines.**
    Before and during operation, you should inspect the unit and all plumbing lines for leaks. If a leak develops, stop the Thermolator and repair it.
  - ❒ **Keep the unit and the area around it clean.**
    Check for and remove lint, dust, or other obstructions on the unit, especially around air vent areas. Keep floor around the unit dry. The Thermolator exchanges air from in front of, underneath, on top and beside the unit, so make sure that nothing is against the front, bottom, top or sides of the unit that would stop proper ventilation around the unit.
- **Quarterly (every 3 months) or as often as necessary**
  - ❒ **Inspect power cords, wires, and electrical connections.**
    Check for loose or frayed wires, burned contacts, and signs of overheated wires. Check exterior power cords to the main power source and from the electrical box to the pump and heating elements. Check the ground wire and RTD connections. Replace any wire that appears damaged or has worn or cracked insulation.

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Phone: 800-458-1960
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United States,
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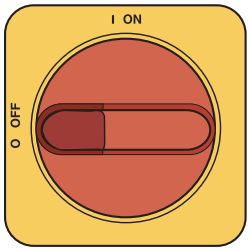
- **Every five years**
  - ❒ **Replace cooling fan in electrical cabinet.**

Accessing the Thermolator Enclosure

Depending on which features, options, and additions you ordered with your Thermolator, your Thermolator may appear different and operate differently from the illustrations and photos shown in this user guide.

WARNING: Electrical shock and hot surface hazards.
Before attempting maintenance of any kind on the Thermolator, you must stop the unit, disconnect and lockout the main power supply, and allow the unit to cool to less than 100° F {38° C}.



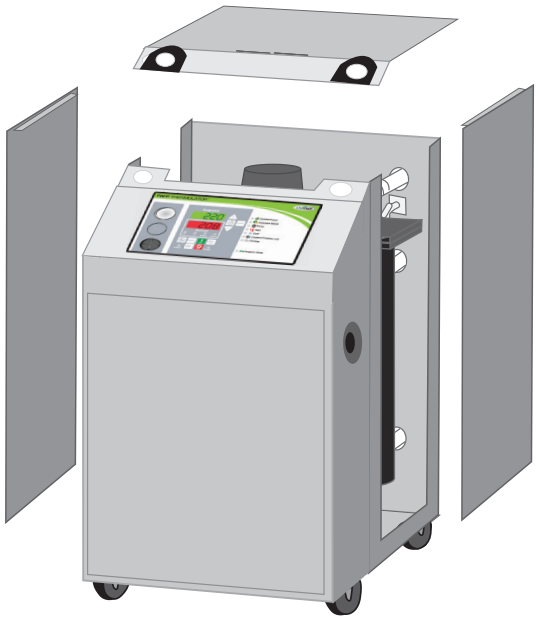
To access the Thermolator enclosure:

1 **Remove the top panel. Lift the back of the lid up while pulling the lid towards the front of the unit.**

2 **Remove each side panel by lifting straight up**.

NOTE: The side panels fit into slots at the bottom. Note how they fit so that reassembly will be easy.

3 **Set the top panel and side panels out of the way for maintenance procedures.** Note that the right side and left side panels are unique and will only fit on the unit in their appropriate position.



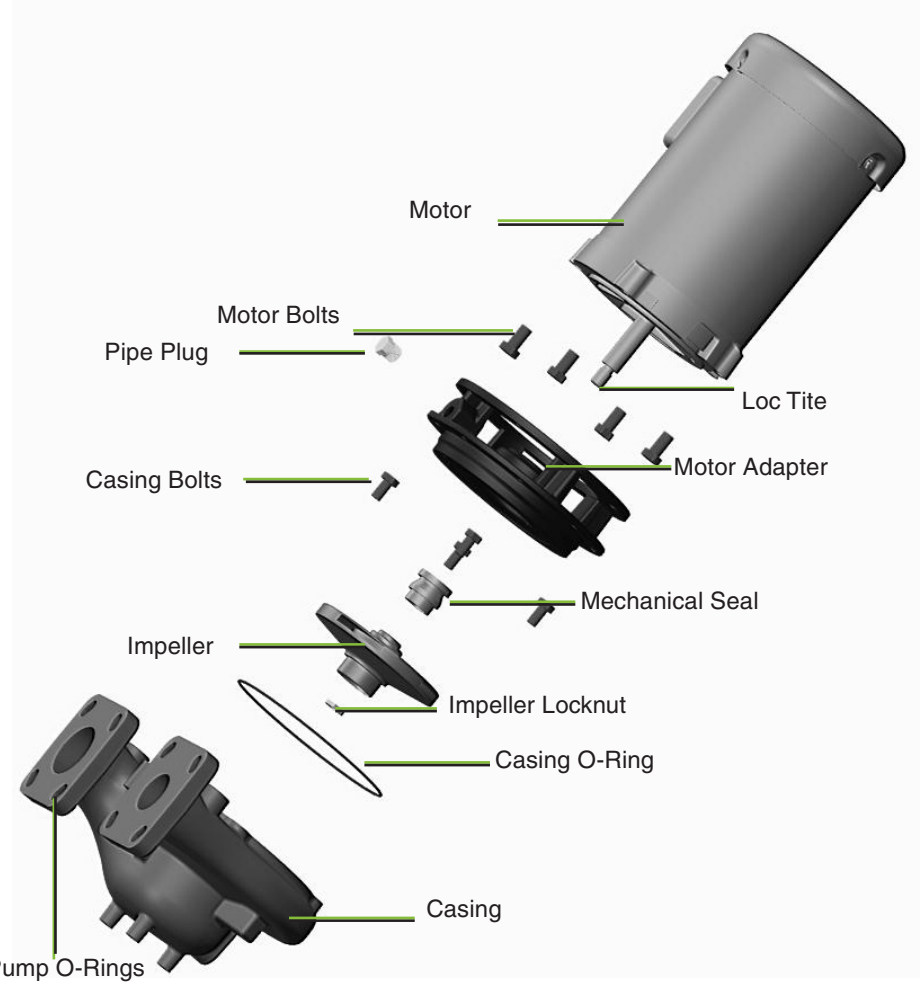
Removing the Pump Motor and Seal (1/2 to 3 Hp units)

Tools Required

- ❒ *9/16-inch wrench*
- ❒ *Flat-blade screwdriver*
- ❒ *5/8 inch deep socket*
- ❒ *Press for removal of pump seal*

Time Required

45 Minutes



If the pump motor or seal ever needs to be replaced, the following procedure can be used on all models with 1/2 to 3 Hp motors for disassembly:

1 **Using a 9/16-inch wrench, remove the four (4) casing bolts** that hold the motor and impeller adapter assembly to the Thermolator.

2 **Remove the motor and adapter from the pump adapter to volute.**

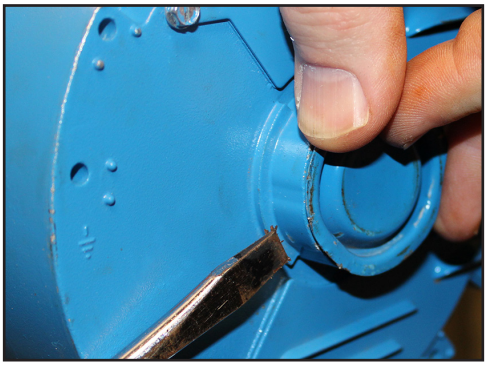
3 **Remove the casing O-ring.** Inspect for damage or wear. If in good condition, set aside for re-use. If a new part is needed, contact Conair Parts and request part number 267204-0160-02

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

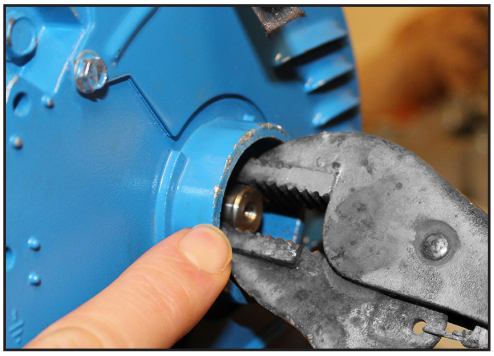
(Continued)

Removing the Pump Motor and Seal (1/2 to 3 Hp units) (Continued)

4 **Remove the dust cap** from the bell end motor housing to expose the motor shaft.

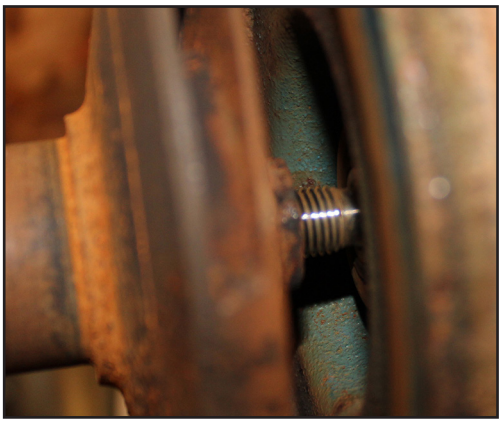


5 **Using a locking pair of pliers, grip the flat sides of the motor shaft.**



6 **Remove impeller lock nut using a 5/8 inch deep socket.** The lock nut is secured in place with a high performance thread locker. A significant amount of torque will be required to break it free. Use the locking pliers at the other end of the shaft to prevent shaft rotation when removing the lock nut and impeller. Standard clockwise thread is used.

7 **Unscrew the impeller from the shaft.**

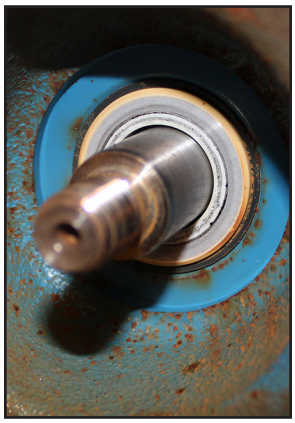


(Continued)

Removing the Pump Motor and Seal (1/2 to 3 Hp units) (Continued)

8 **Slide the rotating half of the shaft seal off of the shaft**. Be careful not to contaminate, chip, or scratch seal surfaces if it is to be re-used. Set seal half aside for re-use if appropriate.





9 **Using a 9/16-inch wrench, remove the four (4) casing bolts.**



10 **Slide motor adapter off of motor shaft.**

11 **Press stationary half of pump seal out of motor adapter, being careful not to damage rubber diametral seal or rotating/non-rotating seal interface surface. Set seal half aside for re-use if appropriate.**


Reassembling the Pump Motor and Seal (1/2 to 3 Hp units)

The following procedure can be used on all models with 1/2 to 3 Hp motors for reassembly:

Tools Required

- ❒ *9/16-inch wrench*
- ❒ *Flat-blade screwdriver*
- ❒ *5/8 inch deep socket*
- ❒ *Blue Loc-Tite ® (271)*

Time Required

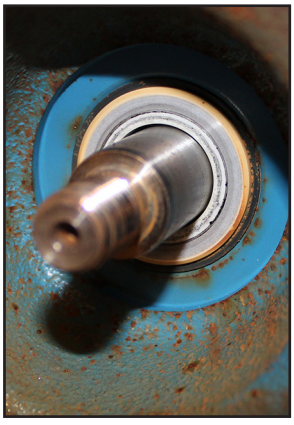
25 Minutes

1 **Gently press stationary half of pump seal into motor adapter** being careful to not damage rotating / non-rotating seal interface surface.

2 **Slide motor adapter assembly on to motor shaft.**

3 **Install and tighten the 4 bolts to 20 ft-lbs {27.12 N·m}.** While tightening the bolts, be careful to maintain the motor adapter perpendicular to the shaft.

4 **Slide the rotating portion of the shaft seal onto the shaft** with the spring on the impeller side.



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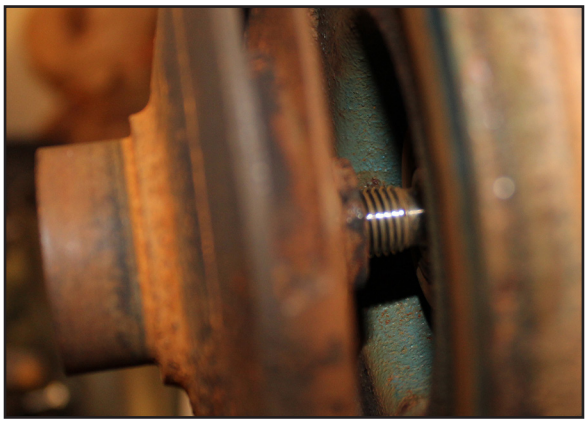
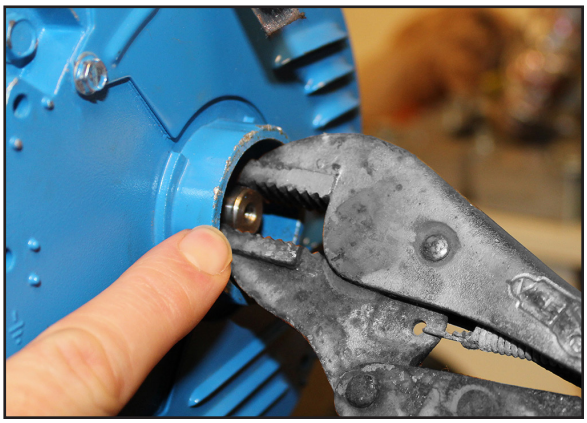
Reassembling the Pump Motor and Seal (1/2 to 3 Hp units) (Continued)

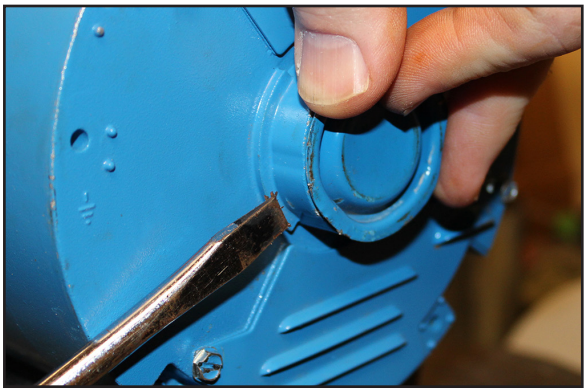
5 **Align the impeller and screw on to shaft.**



6 **Place a small amount of Blue Loc-Tite #271 on the shaft end thread.**



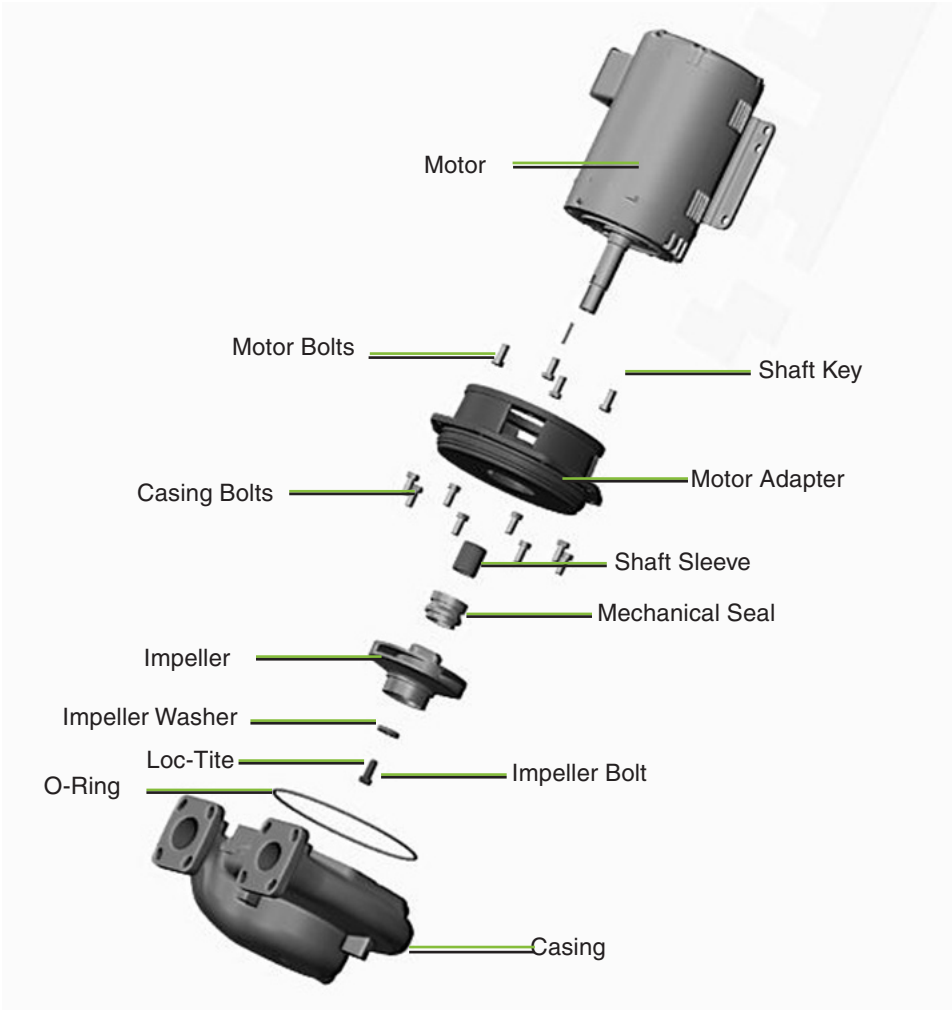
7 **Install the impeller jam nut on the shaft, and tighten to 12 ft-lbs {16.27 N·m}. Use a locking pair of pliers to grip the flat side of the shaft at the motor bell end. Re-install dust cap if removed during disassembly.**



8 **Place pump to adapter o-ring on motor adapter.** Locate the o-ring as far up the adapter as possible such that it sits tight to the angle formed by the mounting flange.

9 **Locate the motor and motor adapter assembly on the pump volute. Install the 4 bolts, tightening to 20 ft-lbs {27.12 N·m}.**

Removing the Pump Motor and Seal (5 to 10 Hp units)



Tools Required

- ❒ *9/16-inch wrench*
- ❒ *Flat-blade screwdriver*
- ❒ *9/16-inch deep socket*

Time Required

20 Minutes

The following procedure can be used on all models with 5 to 10 hp pump motors for disassembly:

1. **Remove eight (8) pump casing bolts using a 9/16-inch wrench.**
2. **Remove motor and adapter from casing.**
3. **Inspect pump casing to adapter o-ring for damage.** If appropriate obtain replacement part number 267204-0265-02.
4. **Remove impeller bolt and washer using a 9/16-inch deep socket.** The bolt is secured in place with a high performance thread locker. A significant amount of torque will be required to break it free. The impeller may be clamped on the smallest diameter round section behind the witness line of the casing interface only. Do not damage the outside surface where the close clearance between the casing and impeller exists.

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

(Continued)

Removing the Pump Motor and Seal (5 to 10 Hp units) (Continued)

5 **Unscrew impeller from shaft.**

6 **Slide rotating half of shaft seal off of shaft.** Be careful not to contaminate, chip or scratch seal surfaces if it is to be re-used. Set seal half aside for re-use if appropriate.

7 **Slide shaft sleeve off of shaft.**

8 **Remove 4 motor bolts using 9/16-inch wrench.**

9 **Slide motor adapter off of motor shaft.**

10 **Press stationary half of pump seal out of motor adapter** being careful not to damage rubber diametral seal or rotating / non-rotating seal interface surface. Set seal half aside for re-use if appropriate.

Reassembling Pump Motor and Seal (5 to 10 Hp units)

The following procedure can be used on all models with 5 to 10 Hp motors for disassembly:

1. **Gently press stationary half of pump seal into motor adapter being careful not damage rotating / non-rotating seal interface surface.**
2. **Slide motor adapter assembly on to motor shaft.**
3. **Install and tighten the four (4) bolts to 37 ft lbs {50.12 N·m}. Holding the motor adapter on to the motor being careful to maintain the adapter perpendicular to the shaft.**
4. **Slide the shaft sleeve over top of shaft.**
5. **Slide the rotating portion of the shaft seal on to the shaft with the spring on the impeller side.**
6. **Align the impeller and screw on to shaft.**
7. **Place a small amount of Blue Loc-Tite #271 on the impeller bolt thread.**
8. **Install the impeller bolt and washer on the shaft, tighten to 20 ft-lbs {27.12 N·m}.**
9. **Place pump to adapter o-ring on motor adapter if removed. Locate the o-ring in the groove on the adapter without residual twist.**
10. **Locate the motor and motor adapter assembly on the pump casing. Install the eight (8)bolts, tightening to 37 ft-lbs {50.12 N·m}.**

Tools Required

- ❒ *9/16-inch wrench*
- ❒ *Flat-blade screwdriver*
- ❒ *9/16-inch deep socket*
- ❒ *Blue Loc-Tite ® (271)*

Time Required

60 Minutes

SECTION
6

Troubleshooting

Before Beginning

You can avoid most problems by following the recommended installation, operation and maintenance procedures outlined in this User Guide. If you have a problem, this section will help you determine the cause and tell you how to fix it.

Before you begin troubleshooting:

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Department for a nominal fee. Most manuals can be downloaded free of charge from the product section of the Conair website.www.conairgroup.com

- ❒ Find any wiring, parts, and assembly diagrams that were shipped with your equipment. These are the best reference for correcting a problem. The diagrams will note any custom features or options not covered in this User Guide.
- ❒ Verify that you have all instructional materials related to the Thermolator. Additional details about troubleshooting and repairing specific components are found in these materials.
- ❒ Check that you have manual for other equipment connected in the system. Troubleshooting may require investigating other equipment attached to, or connected with the Thermolator.

A Few Words of Caution

WARNING: Improper installation, operation or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed and adjusted by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

WARNING: Electrical hazard

Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

WARNING: Compressed air hazard

If you use compressed air, you must wear eye protection and observe all OSHA and other safety regulations pertaining to the use of compressed air. Bleed off pressure before servicing equipment.

WARNING: Hot surface and liquid hazards.

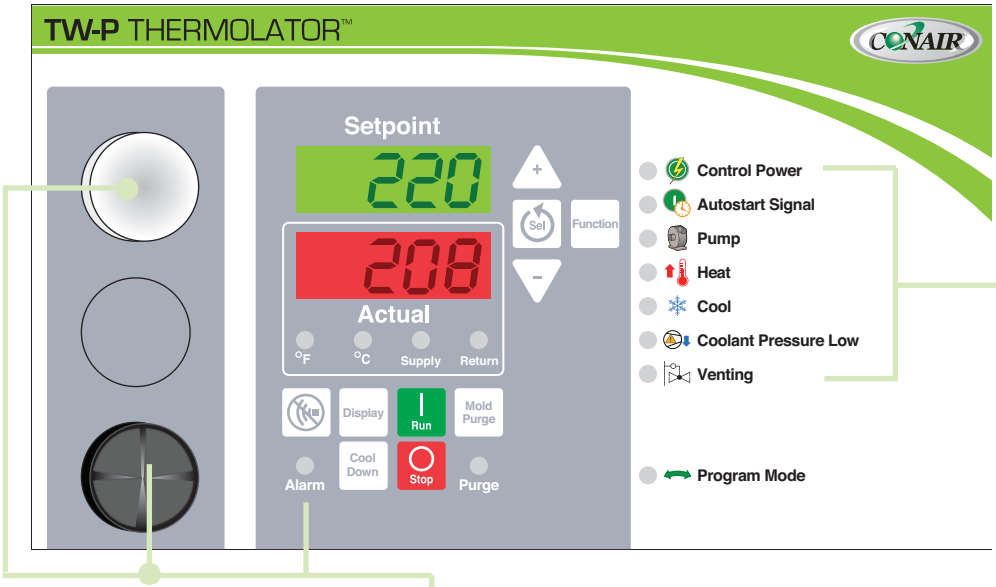
Before attempting maintenance of any kind on the Thermolator, you must stop the unit, disconnect and lockout the main power supply, and allow the unit to cool to less than 100° F {38° C}.

Identifying the Cause of a Problem

NOTE: Additional troubleshooting help can be found in the documentation manuals included with this User Guide.

The Troubleshooting section covers problems directly related to the operation and maintenance of the TW-P. This section does not provide solutions to problems that originate with other equipment. Additional troubleshooting help can be found in manuals supplied with the other equipment.

Illuminated alarm LEDs and error codes on the temperature controller will alert you to many malfunctions. If the optional alarm package is installed, an audible alarm also will activate.



Standard Indicator Lights and Alarm Codes
Refer to Controller Alarms in this Section.

Visual + Audible Alarm (Optional) and Illuminated Fault Light
Refer to Mechanical/Electrical Problems in this section.

When an Alarm condition occurs:

1. **Press Fault to silence optional audible alarm.**
2. **Note any indicator lights or error messages** to help determine the cause of the problem.
3. **Note what the machine was doing prior or during the alarm occurrence.** (Was it starting up, running steadily, etc.?)
4. **Find the alarm or error code in the diagnostics tables** in this section of the User Guide. Causes are listed in the order of most likely to least likely problem.
5. **Determine and fix the cause of the alarm**.

WARNING: Always disconnect and lock out the main power source before opening the Thermolator or its electrical enclosure.

Also disconnect air and water supply lines as needed.

Controller Alarms

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

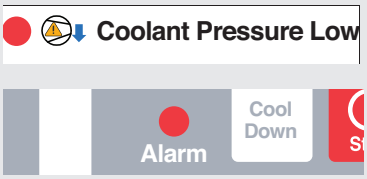
Alarm	Possible Cause	Solution
	Is fresh water turned on to the TCU?	Be sure to turn on the water supply before starting the TCU. The pressure status can be observed on the COOLANT PRESSURE LOW LED even when the TCU is not running.
Low Coolant Inlet Pressure The TCU fluid circuit does not have enough pressure to operate the pump or heater. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ COOLANT PRESSURE LOW LED illuminates. Optional strobe, sounds, dry contacts actuated. ◆ Pump temporarily turns off. ◆ Heater temporarily turns off. ◆ Cooling valve continues to regulate. **This alarm will automatically reset when system pressure returns. When it does, the TCU will automatically resume normal operation.**	Does your facility have the required water pressure to run the TCU? Normally this is 25psi, but may be significantly higher on certain models.	Observe the pressure indicated on the pressure gauges. Compare this to the minimum required operating pressure for your specific TCU model.
	Is the pressure switch faulty?	Upgrade your facility plumbing if necessary, or add an external booster pump If you are sure that sufficient water pressure is present, test the pressure switch with a VOM. Low pressure should allow the switch to open, whereas high pressure should cause it to close.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Alarm	Possible Cause	Solution
 **Coolant Pressure Low Timeout** The TCU has experienced either; 1. Too many low pressure alarms within a certain time period. OR 2. The TCU has remained temporarily shut down with a low pressure alarm for too long. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjunction with COOLANT PRESSURE LOW LED. ◆ Optional strobe, sounds, dry contacts actuated. ◆ Pump turns off. ◆ Heater turns off. ◆ Cooling valve closes. **Once you have corrected the problem, push the alarm silence/reset button to clear this alarm. Then push the RUN button to restart the TCU.**	Water pressure in your building is only marginally acceptable to run the TCU. Any small fluctuations can cause the TCU to cycle on and off repeatedly. Other equipment fed from the same water line as the TCU is consuming significant water flow at intermittent intervals. Due to the high demand, pressure at the TCU temporarily drops.	Observe the building water pressure over time. If it drops below the minimum require pressure, you will need to upgrade your facility plumbing, or add an external booster pump. Observe the building water pressure over time. If it drops below the minimum require pressure, you will need to upgrade your facility plumbing, or add an external booster pump. If permitted by the manufacturer of the other equipment, install flow reducers to the other equipment so that flow is restricted to a reasonable level and sufficient pressure is retained for the TCU.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Alarm	Possible Cause	Solution
 **Deviation Alarm – Over Setpoint** The process temperature has exceeded the allowable deviation window for a certain amount of time. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjuction with an alternating actual temperature display. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump continues to run normally. ◆ Heater continues to run normally. ◆ Cooling valve continues to run normally. **This alarm will automatically reset when the problem is corrected.**	Has water stopped flowing throughout the unit or between supply outlet and return inlet?	Verify that the unit is running and that the pump is working. Check for closed or defective cooling or vent valves and plugged lines. *See Repairing Cooling Valves.* Check for external closed valve on the process fluid going to external equipment. Check for a plugged pipe.
	Did the cooling valve fail closed?	Check the cooling valves. *See Repairing Cooling Valves or the Motorized Cooling Valve instructions.*
	Is the temperature difference between the cooling water supply and the setpoint too small?	The temperature difference should be at least 25° F {14° C} to achieve proper cooling. Increase the process setpoint, decrease the cooling water supply temperature or increase the cooling water supply pressure.
	Is the cooling valve under-sized for the application?	Check the cooling load (Btu/hr) for which the valve was specified.
	Is the high process temperature alarm too sensitive?	Modify the High Deviation Alarm trigger point by increasing parameter H ıd.
	Is the high deviation temperature alarm delay too short?	Modify the High Deviation Alarm Delay by increasing parameter AdH.
	Is the initial deviation alarm delay parameter too short?	Modify the "Startup Ignore Deviation Delay" by increasing parameter ıdd.
	Are the algorithm and PID parameters set correctly?	Check the algorithm/PID parameters, including: At, PbC, dEC, ınC, PbH, dEH, ınH, and Pbr.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Alarm	Possible Cause	Solution
 **Deviation Alarm – Under Setpoint** The process temperature has dropped below the allowable deviation window for a certain amount of time. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjuction with an alternating actual temperature display. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump continues to run normally. ◆ Heater continues to run normally. ◆ Cooling valve continues to run normally. **This alarm will automatically reset when the problem is corrected.**	Is the cooling valve stuck open or leaking water?	Disassemble the cooling valve and check for particles blocking the valve seat. Check the valve seat for excessive wear. Replace as required using a valve repair kit. *See Repairing Cooling Valves.*
	Did a heater element fail or open?	With the unit powered down: Check for loose connections on heater wiring. Check resistance between the phase legs on the output side of the heater contactor (or SSR if present). Readings should be within 0.25 ohms of each other. Replace the heater, if necessary. *See Replacing Heater Elements.*
	Did a heater contactor fail open?	Replace the contactor if defective. *See Replacing the Heater Contactor.*
	Is the low process temperature alarm too sensitive?	Modify the Low Deviation Alarm trigger point by increasing parameter Lod.
	Is the low deviation temperature alarm delay too short?	Modify the Low Deviation Alarm trigger point by increasing parameter AdL.
	Is the initial deviation alarm delay parameter too short?	Modify the "Startup Ignore Deviation Delay" by increasing parameter idd.
	Is the Thermolator under-sized for the application?	Review specifications and selection guidelines that apply to heater and pump sizes in temperature control units.
	Is the Thermolator or equipment to which it is attached leaking?	Verify that there are no water leaks. Fix as necessary.
	Are the algorithm and PID parameters set correctly?	Check the algorithm/PID parameters: At, PbC, dEC, inC, PbH, dEH, inH, and Pbr.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Alarm	Possible Cause	Solution
 **User Temperature – High Limit** The process temperature has risen beyond the user-configured maximum high limit. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjunction with an alternating actual temperature display. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump continues to run normally. ◆ Heater continues to run normally. ◆ Cooling valve continues to run normally. **This alarm can be reset by pushing the Alarm Silence/Reset button once the temperature returns to an acceptable level.**	Has water stopped flowing thought the unit or between the supply outlet and return inlet?	Verify that the unit is running and that the pump is working. Check for closed or defective cooling or vent valves and plugged lines. *See Repairing Cooling Valves.* Check for external closed valve on the process fluid going to external equipment. Check for a plugged pipe.
	Did the cooling valve fail closed?	Check the cooling valve. *See Repairing Cooling Valves or the Motorized Cooling Valve instructions.*
	Is the temperature difference between the cooling water supply and the setpoint too small?	The temperature difference should be at least 25°F {14°C} to achieve proper cooling. Increase the process setpoint, decrease the cooling water supply temperature or increase the cooling water supply pressure.
	Has the heater contactor failed with the contacts welded closed?	Replace the contactor if defective. *See Replacing the Heater Contactor.*
	Is the cooling valve under-sized for the application?	Check the cooling load (Btu/hr) for which the valve was specified.
	Is the high process temperature alarm too sensitive?	Increase the alarm trigger point HSU. The recommended setting is the setpoint plus 2° F {4° C} to 10°F {18° C}.
	Is the cooling water return line plugged?	Verify the free flow of water out of the unit.
	Has the cooling water return pressure risen?	Check the water return pressure with valve.
	Has the cooling water supply pressure dropped?	Check the water supply pressure. If equipped, verify that strainer is not clogged.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

Alarm	Possible Cause	Solution
 **Factory Temperature – High Limit** The process temperature has risen beyond the factory-configured maximum high limit. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjunction with an alternating actual temperature display. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump continues to run normally. ◆ Heater continues to run normally. ◆ Cooling valve continues to run normally. **This alarm can be reset by pushing the Alarm Silence/Reset button once the temperature returns to an acceptable level.**	Has water stopped flowing thought the unit or between the supply outlet and return inlet?	Verify that the unit is running and that the pump is working. Check for closed or defective cooling or vent valves and plugged lines. *See Repairing Cooling Valves.* Check for external closed valve on the process fluid going to external equipment. Check for a plugged pipe.
	Did the cooling valve fail closed?	Check the cooling valve. *See Repairing Cooling Valves or the Motorized Cooling Valve instructions.*
	Has the heater contactor failed with the contacts welded closed?	Replace the contactor if defective. *See Replacing the Heater Contactor.*
	Is the cooling valve under-sized for the application?	Check the cooling load (Btu/hr) for which the valve was specified.
	Is the cooling water return line plugged?	Verify the free flow of water out of the unit.
	Has the cooling water return pressure risen?	Check the water return pressure with valve.
	Has the cooling water supply pressure dropped?	Check the water supply pressure. If equipped, verify that strainer is not clogged.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Alarm	Possible Cause	Solution
 **User Temperature – Low Limit** The process temperature has risen beyond the user-configured minimum low limit. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjuction with an alternating actual temperature display. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump continues to run normally. ◆ Heater continues to run normally. ◆ Cooling valve continues to run normally. **This alarm can be reset by pushing the Alarm Silence/Reset button once the temperature returns to an acceptable level.**	Is the cooling valve stuck open or leaking water?	Disassemble the cooling valve and check for particles blocking the valve seat. Check the valve seat for excessive wear. Replace as required using a valve repair kit. *See Repairing Cooling Valves.*
	Did a heater element fail or open?	With the unit powered down: Check for loose connections on heater wiring. Check resistance between the phase legs on the output side of the heater contactor (or SSR if present). Readings should be within 0.25 ohms of each other. Replace the heater, if necessary. *See Replacing Heater Elements.*
	Did the heater contactor fail open?	Replace the contactor if defective. *See Replacing the Heater Contactor.*
	Is the low process temperature alarm too sensitive?	Decrease the alarm trigger point LSU. The recommended setting is the setpoint minus 2°F {4°C} to 10°F {18°C}. Replace the contactor if defective. *See Replacing the Heater Contactor.*
	Is the Thermolator under-sized for the application?	Review specifications and selection guidelines that apply to heater and pump sizes in temperature control units.
	Is the Thermolator or equipment to which it is attached leaking?	Verify that there are no water leaks. Fix as necessary.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Alarm	Possible Cause	Solution
 **Factory Temperature – Low Limit** The process temperature has risen beyond the factory-configured minimum low limit. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjuction with an alternating actual temperature display. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump continues to run normally. ◆ Heater continues to run normally. ◆ Cooling valve continues to run normally. **This alarm can be reset by pushing the Alarm Silence/Reset button once the temperature returns to an acceptable level.**	Is the cooling valve stuck open or leaking water?	Disassemble the cooling valve and check for particles blocking the valve seat. Check the valve seat for excessive wear. Replace as required using a valve repair kit. *See Repairing Cooling Valves.*
	Did a heater element fail or open?	With the unit powered down: Check for loose connections on heater wiring. Check resistance between the phase legs on the output side of the heater contactor (or SSR if present). Readings should be within 0.25 ohms of each other. Replace the heater, if necessary. *See Replacing Heater Elements.*
	Did the heater contactor fail open?	Replace the contactor if defective. *See Replacing the Heater Contactor.*
	Is the Thermolator under-sized for the application?	Review specifications and selection guidelines that apply to heater and pump sizes in temperature control units.
	Is the Thermolator or equipment to which it is attached leaking?	Verify that there are no water leaks. Fix as necessary.

Controller Alarms

When an alarm occurs, the Thermolator has detected a problem with the process. Without correction, the TCU will not be able to produce process fluid of the correct temperature. Under certain conditions, an alarm could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- If the optional alarm package is installed, the Fault strobe will illuminate and the audible alarm will activate.

Alarm	Possible Cause	Solution
 **Low Flow** The optional flowmeter has detected flow below the user-configured low flow limit.	Is a valve closed in the process loop?	Examine the process loop and look for blockages, closed valves, etc.
	Is there some kind of blockage in the process loop?	
◆ "FLL" is displayed in the setpoint display. ◆ Pump continues to run normally. ◆ Heater continues to run normally. ◆ Cooling valve continues to run normally. ◆ Alarm LED, optional strobe, sounder, dry contacs are all not actuated.	Did the process loop change in length or configuration that now provides more flow resistance to the pump?	Modify the Flowmeter Alarm Threshold by decreasing parameter FA.
	Is the user-configured low-flow limit set too high?	Modify the Flowmeter Alarm Threshold by decreasing parameter FA.
This alarm will automatically reset once flow is above the low flow limit.		

Unit Faults

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
tcU hot **Hardware Over-Temperature Trip** The temperature of the process fluid bypass tube has exceeded the maximum permissible operating temperature. For models with SSR's, this fault can also refer to an overheated SSR heatsink. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED illuminated. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump locks on. ◆ Heater locks off. ◆ Cooling valve locks open. **Power must be cycled to reset this fault.**	Has water stopped flowing through the unit or between the supply outlet and return inlet?	Verify that the unit is running and that the pump is working. Check for closed or defective cooling or vent valves and plugged lines. *See Repairing Cooling Valves.* Check for external closed valve on the process fluid going to external equipment.
	Has the heater contactor (or SSR) failed with the contacts welded closed?	Replace the contactor if defective. *See Replacing the Heater Contactor.*
	If SSR Model: Has the heatsink fan failed or is the air pathway blocked?	Replace the fan or clear the blocked air pathway. Reset the heatsink thermostat by depressing the button on the top of it.
	Has the optional high temperature switch failed?	Verify that the switch is closed near room temperature with a VOM. If not, replace the optional temperature limit switch.

(Continued)

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
brd hot **Controller Board Overheated** The temperature of the controller board has exceeded the maximum permissible operating temperature. This is probably due to excessive temperature inside the electrical control enclosure. **WARNING:** : Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED illuminated. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump operates normally. ◆ Heater operates normally. ◆ Cooling valve operates normally. **This fault can be reset by pushing the Alarm Silence/Reset button once the controller board temperature returns to an acceptable level.**	Have the cooling vents on the TCU been blocked?	Check for blocked or plugged cooling vents.
	Is the TCU operating in an ambient environment outside its maximum permissible limits (max of 104°F {40°C}?	Relocate the TCU or provide additional external ventilation or cooling.
	Has the enclosure cooling fan failed or is the air pathway blocked?	Replace the fan or clear the blocked air pathway.

6 Troubleshooting

(Continued)

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

NOTE: Although somewhat counter-intuitive, restrictions in the fluid make it easier for the motor to pump the fluid, and therefore require less electrical current.

Fault	Possible Cause	Solution
PUP oL **Pump Overload** The pump is pulling more electrical current than its maximum ratings permit. This is probably due to excessive mechanical loading of the motor. **WARNING:** : Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED illuminated. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump shuts off. ◆ Heater shuts off. ◆ Cooling valve closes. **The reset button on the overload must be depressed to clear this fault.** *See Resetting Pump Overload section.*	Is enough restriction provided in the fluid circuit loop?	Install a flow-reducing orifice or introduce some additional fittings/smaller diameter piping.
	Is there mechanical binding due to a physical jam/obstruction in the pump casing volute?	Remove the endcap from the motor and check that the shaft is free to rotate. If not, *see Removing the Pump and Motor.*
	Have the bearings in the motor failed, causing excessive mechanical loading or misalignment?	Remove the endcap from the motor and check that the shaft is free to rotate. If not, *see Removing the Pump and Motor.*
	Is the correct voltage supplied to the pump motor?	Supply voltage should match the rating on the pump nameplate ±10%. If voltage is correct, check wiring connections.
	Is a phase open?	Check voltage, L1 to L2, L2 to L3, L3 to L1. All should be within 3% voltage imbalance*.
	Is the motor overload faulty or set incorrectly?	Disconnect the power and open the electrical enclosure. Verify that the overload is set to trip at the proper amperage, which is specified on the electrical power prints. Manually trip and reset the overload. If the problem continues, replace the overload. *See Resetting and Replacing Overloads.*

* % Voltage imbalance = 100 x (Maximum deviation from average voltage) / (average voltage)

(Continued)

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
htr Er 1 **Heater Contactor is Welded Closed** The heater contactor is NOT disconnecting the heater when told to open by the controller. The heater is likely running continuously. ✎ **Note:** This fault is only valid for units with electromechanical contactors. Mercury or SSR heater controls do not produce this error. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED illuminated. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump locks on. ◆ Heater locks off (although it is probably still active due to malfunction). ◆ Cooling valve locks open. **Power must be cycled to reset this fault.**	Have the electromechanical heater contactor contacts welded shut and are preventing the contactor from mechanically shuttling to an open position?	Replace the heater contactor. Ensure that the application is a cooling-based application and will only require heater operation for initial machine warm up. For applications requiring continuous heating regulation, contact Conair customer service and inquire about Mercury or SSR upgrade kits for the heater contactor. Contact Conair Parts and Service Phone: 800-458-1960 From outside of the United States, Call: 814 437 6861
	Is a fault in the control wiring or controller outputs continuously powering the heater contactor coil?	Test voltage between the A1 and A2 terminals (coil) on the heater contactor. If 120VAC is found, the contactor is probably not defective. Troubleshoot the problem by searching for the source of this voltage.

(Continued)

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
htr Er2 **Heater Contactor is NOT Closing** The heater contactor is NOT closing when told to open by the controller. The heater is likely not able to run. ✎ **Note:** This fault is only valid for units with electromechanical contactors. Mercury or SSR heater controls do not produce this error. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED illuminated. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump locks on. ◆ Heater locks off. ◆ Cooling valve locks open. **Power must be cycled to reset this fault.**	Has the electromechanical heater contactor become jammed and is being prevented from mechanically shuttling to a closed position?	Replace the heater contactor. Ensure that the application is a cooling-based application and will only require heater operation for initial machine warm up. For applications requiring continuous heating regulation, contact Conair customer service and inquire about Mercury or SSR upgrade kits for the heater contactor. Contact Conair Parts and Service Phone: 800-458-1960 From outside of the United States, Call: 814 437 6861
	Is a fault in the control wiring or controller outputs failing to provide power to the heater contactor coil?	Test voltage between the A1 and A2 terminals (coil) on the heater contactor. If 120VAC is never found, the contactor is probably not defective. Troubleshoot the problem by searching for why the control signal is not reaching the heater contactor coil.

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
brn oUt **Brownout** The TCU experienced a loss of power while it was running. ✎ **Note:** This fault can be selectively enabled/disabled in the user menu under parameter brn. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED illuminated. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump turns off. ◆ Heater turns off. ◆ Cooling valve closes. **Push the Fault Silence/Reset button to reset this fault.**	Did your facility experience a power outage?	Ensure that no other connected equipment has been adversely affected by the power outage. Push the Fault Silence/Reset button, and then push the Run button to restart the TCU.
	Is there a disturbance or voltage imbalance in your electrical system?	Have a qualified electrician review your facility wiring and electrical power. Correct any issues so that the voltage provided to the TCU is as required.

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
PhS Err **Phase Loss/Rotation Error** The three-phase electrical power being provided to the TCU is either missing a leg, or has incorrect phase rotation direction (TCU is factory-wired for clockwise, L1-L2-L3, phase rotation). This fault is only present on TCU's that have the optional three-phase monitor included. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED illuminated. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump locks off. ◆ Heater locks off. ◆ Cooling valve locks closed. **Power must be cycled to reset this fault.**	Do you have a dead/low leg in the incoming three phase power? If a portable installation, are different parts of your factory phased differently?	Have a qualified electrician check your three-phase power, and correct any problems. Ensure consistent phasing throughout your facility. --Or-- Reverse any two incoming power legs on the TW-P. *See Connecting the Main Power Source.* Check for proper rotation of pump. *See Testing the Installation.*

✎ **NOTE:** This feature is an option and not present on all models.

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
PrS EH1 **Supply Probe Fault Hi** The "To Process" RTD is malfunctioning or has a break in the wiring. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjunction with SUPPLY LED. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump turns off. ◆ Heater turns off. ◆ Cooling valve closes. **This fault will automatically reset when the problem is corrected.**	Do you have a break in your RTD wiring? Do you have a loose wire?	Check the RTD loop wiring with a VOM. *See Checking the RTD.*
	Has the RTD itself failed or sustained physical damage?	Test the RTD with a VOM. *See Checking the RTD.* If damaged, replace the RTD.

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
PrS ELo **Supply Probe Fault Low** The "To Process" RTD is malfunctioning or has a short circuit. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjunction with SUPPLY LED. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump turns off. ◆ Heater turns off. ◆ Cooling valve closes. **This fault will automatically reset when the problem is corrected.**	Do you have a short circuit in your RTD wiring?	Check the RTD loop wiring with a VOM. *See Checking the RTD.*
	Has the RTD itself failed or sustained physical damage?	Test the RTD with a VOM. *See Checking the RTD.* If damaged, replace the RTD.

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
Prr EH 1 **Return Probe Fault Hi** The "To Process" RTD is malfunctioning or has a break in the wiring. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjunction with SUPPLY LED. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump turns off. ◆ Heater turns off. ◆ Cooling valve closes. **This fault will automatically reset when the problem is corrected.**	Do you have a break in your RTD wiring? Do you have a loose wire?	Check the RTD loop wiring with a VOM. *See Checking the RTD.*
	Has the RTD itself failed or sustained physical damage?	Test the RTD with a VOM. *See Checking the RTD.* If damaged, replace the RTD.

Unit Faults (Continued)

The Thermolator has detected a problem with the internal components, wiring, electrical power, or operating environment. Without correction, the fault could lead to equipment damage or personal injury if it is not corrected.

- The controller displays an error code indicating the cause of the problem.
- The TCU may take automatic control actions, based on the nature of the fault, to best protect the operator and the TCU until the fault is corrected.
- If the optional alarm package is installed, the fault strobe will illuminate and the audible alarm will activate.
- Some faults require a power cycle to reset.

Fault	Possible Cause	Solution
Prr ELo **Return Probe Fault Low** The "To Process" RTD is malfunctioning or has a short circuit. **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current. ◆ ALARM LED flashes in conjunction with RETURN LED. ◆ Optional strobe, sounder, dry contacts actuated. ◆ Pump turns off. ◆ Heater turns off. ◆ Cooling valve closes. **This fault will automatically reset when the problem is corrected.**	Do you have a break in your RTD wiring?	Check the RTD loop wiring with a VOM. *See Checking the RTD.*
	Has the RTD itself failed or sustained physical damage?	Test the RTD with a VOM. *See Checking the RTD.* If damaged, replace the RTD.

Unit Will Not Power Up

If you press the control power button and the control panel does not light, you have a problem with the main power circuit or the unit's temperature controller.

⚠ **WARNING: Electrical Shock Hazard**
Disconnect and lockout the main power supply before proceeding.

Symptom	Possible Cause	Solution
Applying power does not illuminate the temperature controller display.	Is power reaching the Thermolator?	Verify that the main power supply and any customer-installed electrical disconnect or emergency stop devices are in the ON position. Verify correct electrical connections between the unit and the power supply. Replace any damaged wires or cables.
	Is the correct voltage reaching the Thermolator?	Check the electrical requirements on the unit nameplate. Verify correct main supply voltage to the unit and the secondary voltage supply from the transformer to unit components. Replace the transformer, if necessary

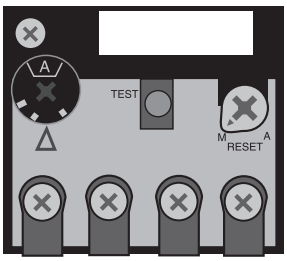
Resetting Pump Overload

The pump motor overload is located inside the unit's electrical enclosure.

1 **Disconnect and lockout the main power.**

2 **Open the electrical enclosure door.** Turn the screw on the front panel counterclockwise to open.

3 **Check the overload.** Press the blue button to attempt to reset the overload. If it clicks, the overload was tripped. Verify that the overload trip point is set as specified by the electrical power prints.



Replacing Pump Overload

1 **Disconnect and lockout the main power.**

2 **Open the electrical enclosure door.** Turn the screw on the front panel counterclockwise to open.

3 **Locate the pump overload module** attached to the pump motor starter.

Tools Required

❒ *Phillips Screwdriver*

4 **Disconnect the three power leads** from the overload module to the pump motor. Note the color/placement of each lead and label as needed.

5 **Disconnect auxiliary wiring on the overload module.**

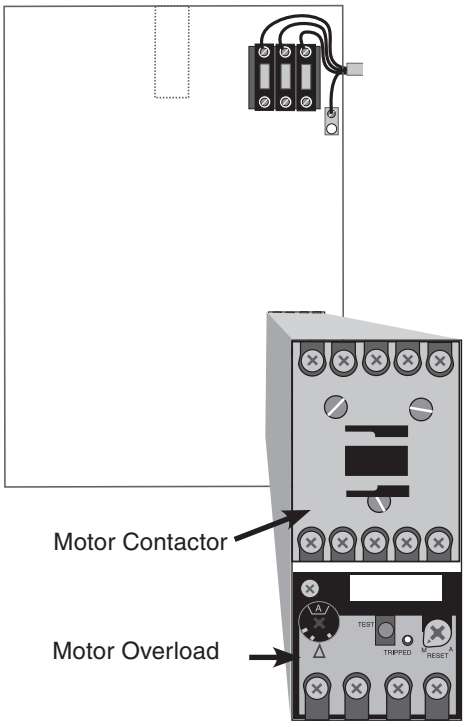
6 **Remove the overload module.** Loosen the three screws that connect the overload module to the motor contactor. Pull the overload module down to release it from the starter.

7 **Reverse these steps to install the new overload module.**

8 **Set the module reset mode to M for manual.**

9 **Set the proper FLA trip point.** Trip point will be shown on electrical prints

10 Push reset button on overload to ensure it is not in the tripped state.



11 Verify that pump rotation is correct (*see Installation section of this manual*).

Replacing the Controller Boards

The controller boards used in the Thermolator TW-P can be replaced if necessary. Two main circuit boards make up the controller. One is the display board that contains all the numeric displays, LEDs and pushbuttons. The other is the main board that contains the microprocessor, inputs, outputs, and option daughter cards. They are connected with a 20-conductor ribbon cable. Any or all can be independently replaced.

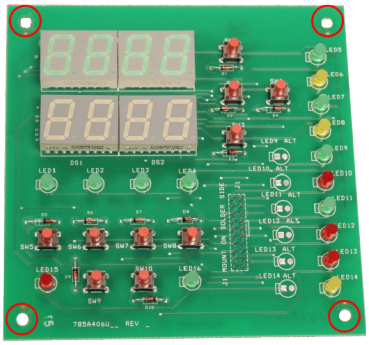
To remove controller:

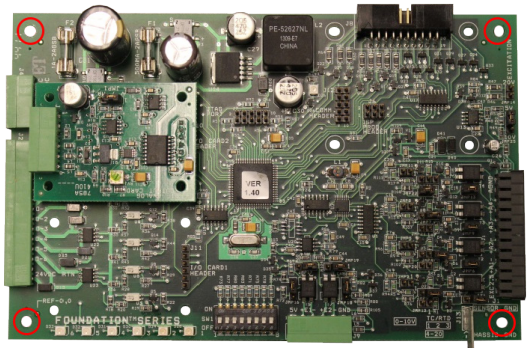
1 **Disconnect and lockout the main power supply.**

2 **If replacing the main board, remove all terminal strips.** If the daughter cards are to not be replaced, use a pair of needle-nose pliers to release the daughter cards from the plastic standoffs. Unplug ribbon cable.

If replacing the HMI board, unplug ribbon cable from the back.

3 **Remove the four mounting screws as shown in the picture below:**





4 **Remove the board to be replaced**.

To reinstall the controller:

5 **If replacing the main board and/or any of the daughter cards, please check carefully that all the jumpers and DIP switches on the new part are set exactly the same as the old part.** If the old part is not available for reference, all factory jumper settings are shown on the electrical control prints.

6 **If replacing the main board, insert all terminal strips.** Replace all daughter cards on plastic standoffs. Take care to ensure that daughter card connections to the main board are properly aligned. Reattach ribbon cable.

If replacing HMI board, reattach ribbon cable from the back.

7 **Replace the four mounting screws as shown in the pictures above in step 3.**

8 **The user parameters are stored on the main board, and will be set to their factory defaults. If the main board was replaced, please be sure to re-configure parameters to control operation of the TCU as desired.**

IMPORTANT: Always refer to the wiring diagrams that came with your Thermolator to locate specific electrical components. Illustrations in the User Guide are intended to be representative only.

Tools Required

- ❒ *Phillips Screwdriver*
- ❒ *Needlle-nose Pliers*

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

Replacing the Heater Contactor

IMPORTANT: Always refer to the wiring diagrams that came with your Thermolator to locate specific electrical components. Illustrations in the User Guide are intended to be representative only.

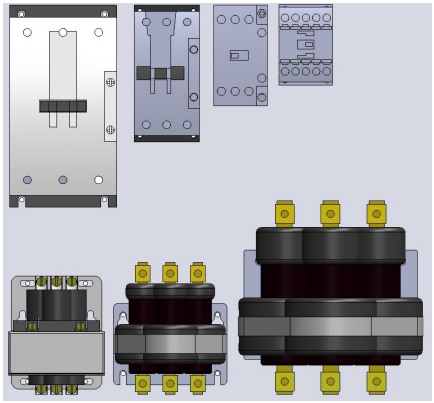
IMPORTANT: Mercury contactors only function and test properly when mounted on a vertical panel with power lugs facing up and down.

⚠ WARNING: Electrical Shock Hazard

Only qualified service personnel who have been trained on electrical testing and the procedures for avoiding the hazards should diagnose or correct problems that require opening the unit with power on.

Some Thermolators use mercury displacement heater contactors. The heater contactors should be replaced if:

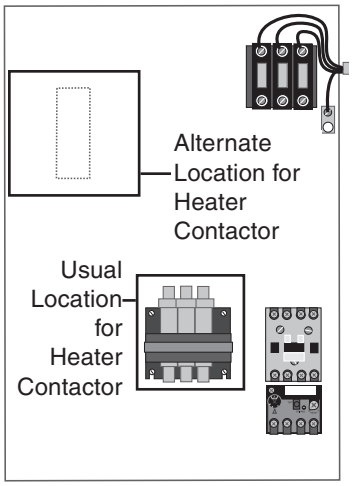
- You have checked the continuity and found that resistance across the coil equals zero ohms or is an open circuit.
- You have checked continuity of the power legs (with the heater wires disconnected) and find them continuously connected. Or, you have checked continuity across the power legs and find an open circuit even when the coil is energized.



Non-Mercury

Mercury

To replace the heater contactor:



1. **Disconnect and lockout the main power.**
2. **Open the electrical enclosure door.** Turn the screw on the front panel counterclockwise to open.
3. **Disconnect wires from the heater contactor.** Make sure you label the wires to ensure you can connect them correctly to the new contactor.
4. **Remove the contactor** by removing the mounting screws that hold it in place.
5. **If of Mercury type, discard the old contactor using the proper disposal procedure.** *See Material Safety Data Sheet #7439-97 in the Appendix.*
6. **Reverse this procedure starting with step 4 to install the new contactor.** Make sure the wires are connected correctly.

⚠ WARNING: Hazardous Substance

Thermolators may use mercury displacement contactors. Mercury is considered a hazardous substance and must be dealt with accordingly. *See Material Safety Data Sheet #7439-97-6* for information on the how to avoid the potential hazards and how to clean up and dispose of mercury if it spills.

Checking the RTD

WARNING: Electrical Shock Hazard

Only qualified service personnel who have been trained on electrical testing and the procedures for avoiding the hazards should diagnose or correct problems that require opening the unit with power on.

The Thermolator uses a Pt100 RTD to monitor the “to process” and “from process” temperature. One Pt 100 RTD is installed in the wall of the heater tank at the “to process” outlet. The other is installed in the mixing tank (or heat exchange) near the “from process” outlet.

Sensor error codes (Er_ıl) displayed by the temperature controller may indicate RTD failure.

To check a RTD after a sensor error:

1. **Disconnect and lockout the main power.**
2. **Open the electrical enclosure door.** Turn the screw on the front panel counterclockwise to open.
3. **Remove RTD wiring terminal strip.** Refer to the wiring diagrams that came with your unit.
4. **Verify the resistance of the RTD using a VOM. Polarity does not matter. If incorrect, replace.** *Refer to the table on the nest page.*

(Continued)

Checking the RTD (Continued)

Pt100

	0	1	2	3	4	5	6	7	8	9	
Temp T	**Resistance at T**	**Resistance at T+1°F**	**Resistance at T+2°F**	**Resistance at T+3°F**	**Resistance at T+4°F**	**Resistance at T+5°F**	**Resistance at T+6°F**	**Resistance at T+7°F**	**Resistance at T+8°F**	**Resistance at T+9°F**	**Temp T**
°F	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	°C
50	103.9	104.1	104.3	104.6	104.8	105.0	105.2	105.4	105.6	105.8	10.0
60	106.1	106.3	106.5	106.7	106.9	107.1	107.4	107.6	107.8	108.0	15.6
70	108.2	108.4	108.7	108.9	109.1	109.3	109.5	109.7	109.9	110.2	21.1
80	110.4	110.6	110.8	111.0	111.2	111.5	111.7	111.9	112.1	112.3	26.7
90	112.5	112.7	113.0	113.2	113.4	113.6	113.8	114.0	114.3	114.5	32.2
100	114.7	114.9	115.1	115.3	115.5	115.8	116.0	116.2	116.4	116.6	37.8
110	116.8	117.0	117.3	117.5	117.7	117.9	118.1	118.3	118.5	118.8	43.3
120	119.0	119.2	119.4	119.6	119.8	120.0	120.3	120.5	120.7	120.9	48.9
130	121.1	121.3	121.5	121.7	122.0	122.2	122.4	122.6	122.8	123.0	54.4
140	123.2	123.5	123.7	123.9	124.1	124.3	124.5	124.7	124.9	125.2	60.0
150	125.4	125.6	125.8	126.0	126.2	126.4	126.6	126.9	127.1	127.3	65.6
160	127.5	127.7	127.9	128.1	128.3	128.6	128.8	129.0	129.2	129.4	71.1
170	129.6	129.8	130.0	130.3	130.5	130.7	130.9	131.1	131.3	131.5	76.7
180	131.7	132.0	132.2	132.4	132.6	132.8	133.0	133.2	133.4	133.6	82.2
190	133.9	134.1	134.3	134.5	134.7	134.9	135.1	135.3	135.5	135.8	87.8
200	136.0	136.2	136.4	136.6	136.8	137.0	137.2	137.4	137.7	137.9	93.3
210	138.1	138.3	138.5	138.7	138.9	139.1	139.3	139.6	139.8	140.0	98.9
220	140.2	140.4	140.6	140.8	141.0	141.2	141.4	141.7	141.9	142.1	104.4
230	142.3	142.5	142.7	142.9	143.1	143.3	143.5	143.8	144.0	144.2	110.0
240	144.4	144.6	144.8	145.0	145.2	145.4	145.6	145.9	146.1	146.3	115.6
250	146.5	146.7	146.9	147.1	147.3	147.5	147.7	147.9	148.2	148.4	121.1
260	148.6	148.8	149.0	149.2	149.4	149.6	149.8	150.0	150.2	150.4	126.7
270	150.7	150.9	151.1	151.3	151.5	151.7	151.9	152.1	152.3	152.5	132.2
280	152.7	153.0	153.2	153.4	153.6	153.8	154.0	154.2	154.4	154.6	137.8
290	154.8	155.0	155.2	155.4	155.7	155.9	156.1	156.3	156.5	156.7	143.3
300	156.9	157.1	157.3	157.5	157.7	157.9	158.1	158.4	158.6	158.8	148.9

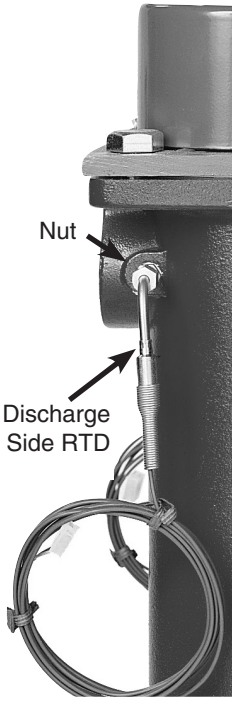
Replacing RTDs

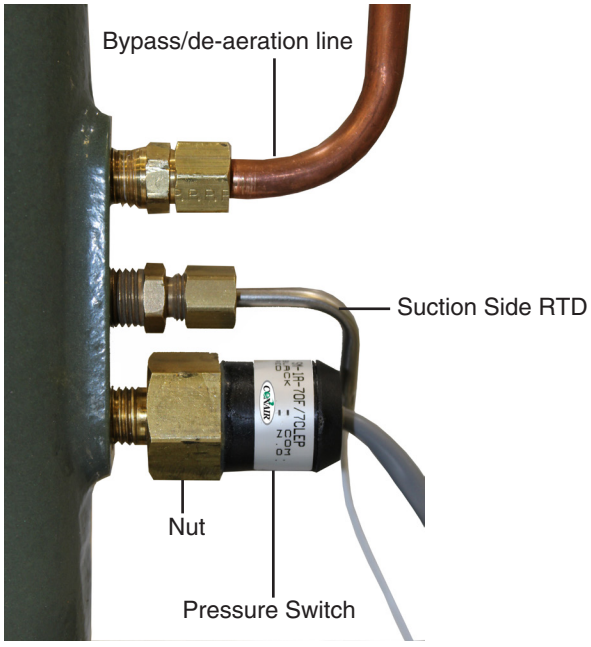
WARNING: Hot Surfaces

Allow the Thermolator to cool to below 100° F {38° C} before servicing the unit.

To replace an RTD:

1. **Disconnect and lockout the main power.**
2. **Shut off the cooling water in and drain the unit.** Drain water to below the RTD level using the handle on the Pressure Relief Valve located the bottom of the unit.
3. **Remove the unit's top panel and open the electrical enclosure.**
4. **Remove the RTD.** Loosen the compression nut to slide the RTD out of the casing. Disconnect the RTD wires at the terminal strip. Note locations of wires before disconnecting. Remove wire ties.
5. **Install the new RTD.** Insert the tip of the new RTD at least 1 inch into the tank. Tighten the compression nut. Thread the leads through the raceway leading to the electrical enclosure.
6. **Re-secure RTD wires to the various wire mounts** to keep the wire from contacting the heater housing, pump casing, or motor housing. Wire the RTD wires to secure them within the electrical cabinet.
7. **Trim extra wire off, if possible. Strip and attach RTD leads to the terminal strip at locations noted in step 4.** Polarity does not matter.





IMPORTANT: Always refer to the wiring diagrams that came with your Thermolator to locate specific electrical components. Illustrations in the User Guide are intended to be representative only.

NOTE: You may want to test the resistance of the new RTD to ensure it aligns with the table in the previous section.

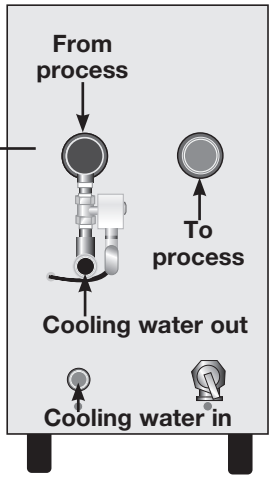
Repairing Cooling Valves

Every Thermolator has a valve assembly that controls the cooling water out flow. Cooling valves also are found on the optional purge valve.

WARNING: Electrical Shock and Hot Surface Hazard

Before attempting maintenance of any kind on the Thermolator, you must stop the unit; disconnect and lockout the main power supply; and allow the unit to cool to 100° F {38° C}.

This configuration is used for 48 kW and ¾ valves and up.



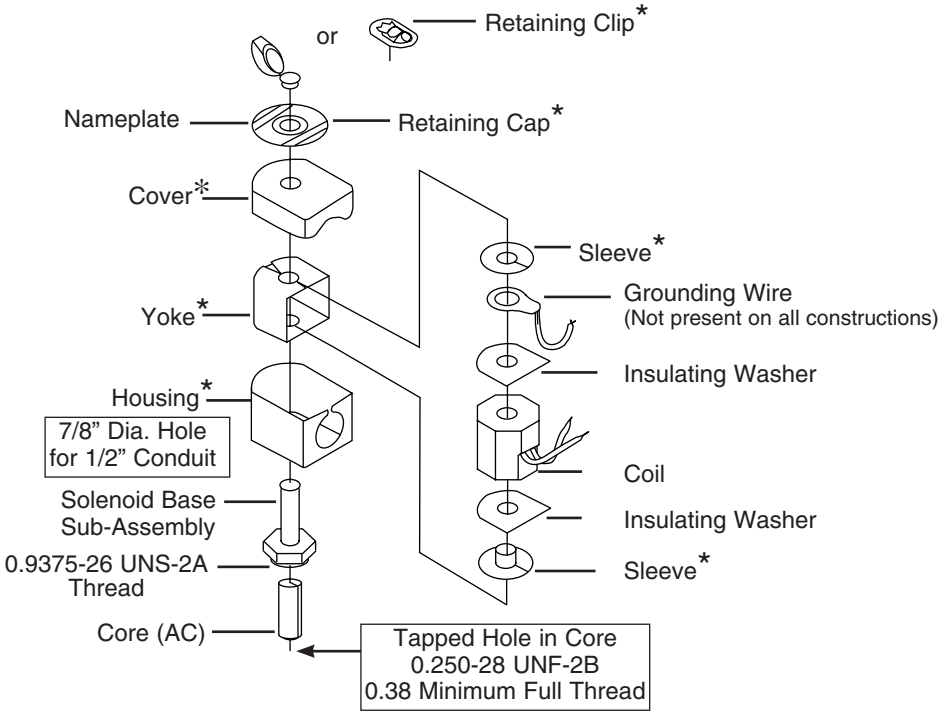
DIRECT INJECTION

1. **Shut off the cooling water in.**
2. **Drain the unit of all water** through the drain plug in the rear of the unit.
3. **Remove the connections to the cooling water out.**
4. **Disconnect and lockout main power.**
5. **Remove the valve from the cooling water out line.**
6. **Disassemble the valve.** *(See exploded views on next page.)*
7. **Inspect and clean or repair the valve body assembly.** Remove foreign particles and replace damaged parts as necessary.
8. **Reassemble the valve and other components.** Reassemble in reverse order. Seal all pipe fittings with pipe sealant. Check that all flows are in the correct direction. Check for leaks before resuming operation.

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

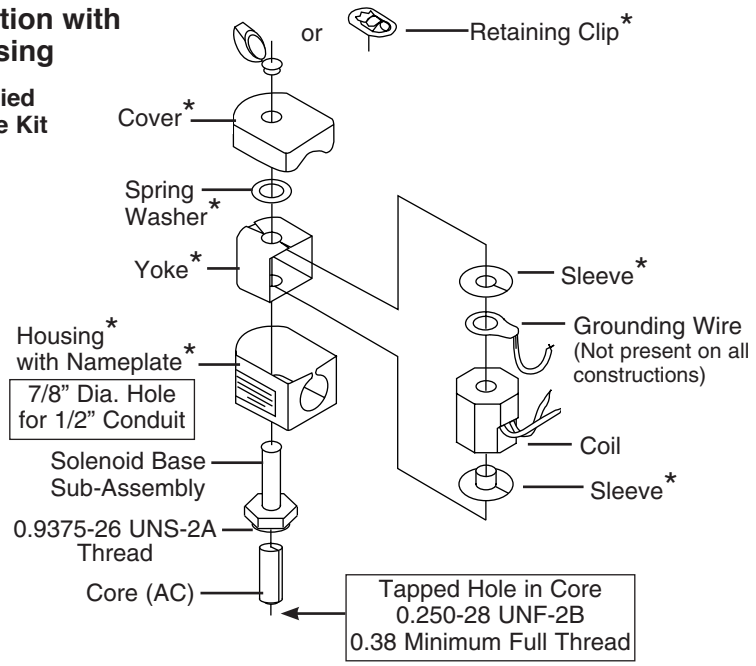
Repairing Cooling Valves

*Indicates Parts Supplied in Solenoid Enclosure Kit



Alternate Construction with Nameplate on Housing

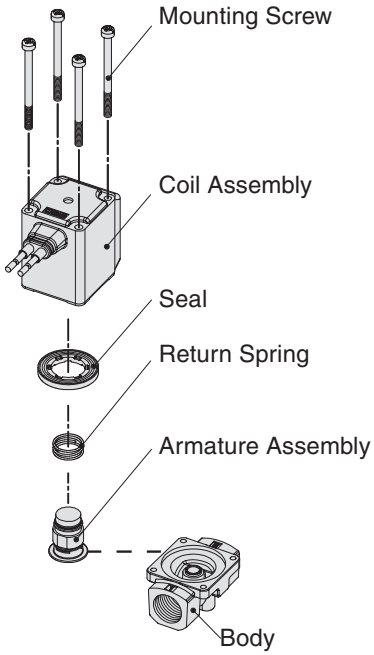
*Indicates Parts Supplied in Solenoid Enclosure Kit



Disassembly of Alternate Direct Acting Solenoid Valves

Disassembly

1 **Loosen the mounting screws.** The coil assembly, seal, return spring, armature assembly and body can be removed.



Assembly

Common to N.C. and N.O.

1 **Loosen the mounting screws.** The coil assembly, seal, return spring, armature assembly and body can be removed.

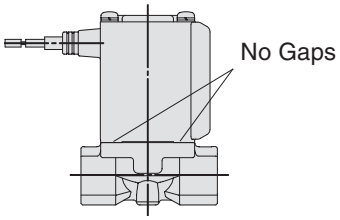
2 **When changing the electrical entry direction, turn the coil assembly in a desired direction to mount it**.

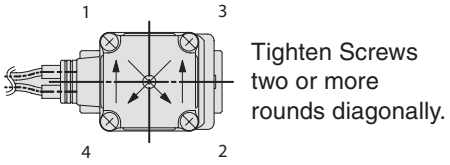
3 **Push the coil assembly against the body and tighten the screws two or more rounds diagonally in the status that there are not gaps between the coil assembly and body.** Tighten the screws in the order of "1-> 2 -> 3 -> 4 -> 1 -> 2 -> 3 -> 4".

NOTE: Your valve may appear different from this model. *Refer to the next page.*

Proper Tightening Torque

267201-01 & 267201-02	0.37 lbf ft {0.5 N·m}
All others	0.52 lbf ft {0.7 N·m}

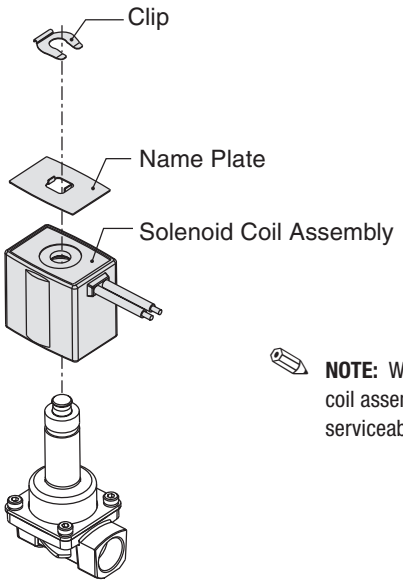




4 **After tightening the screws, make sure that there are no gaps between the coil and body.**

5 **After the disassembly and assembly have been completed, make sure that no leak occurs from the seal.** Additionally, when restarting the valve, make sure that the valve operates correctly after checking the safety.

6 Alternate Pilot Operated Solenoid Valves



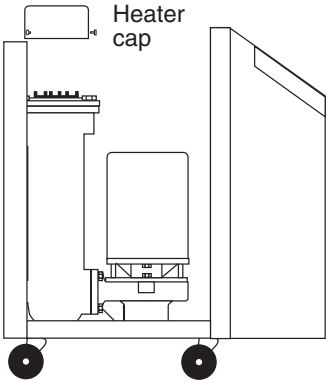
NOTE: Within the valve body and coil assembly there are no user serviceable parts.

Replacing Immersion Heaters

WARNING: Electrical Shock and Hot Surface Hazard

Before attempting maintenance of any kind on the Thermolator, you must stop the unit; disconnect and lockout the main power supply; and allow the unit to cool to 100° F {38° C}.

1. **Disconnect and lockout the main power.**
2. **Remove the top panel of the Thermolator.**
3. **Remove the heater cap.** Use a 1/4-inch open-ended wrench to remove the three bolts that hold the cap to the heater tank.



4. **Remove the heater wiring harness.** Label the wiring layout of the heater terminals; wires are labeled as 2T1, 2T2, 2T3 and GND. (They may also be labelled as 3T1, 3T2, 3T3 if dual-fed or 48kw units)

IMPORTANT: Always refer to the wiring diagrams that came with your Thermolator to locate specific electrical components. Illustrations in the User Guide are intended to be representative only.

   Record the position of bus links, jumpers, and feed wires so they can be replaced in exactly the same manner on the replacement heater.

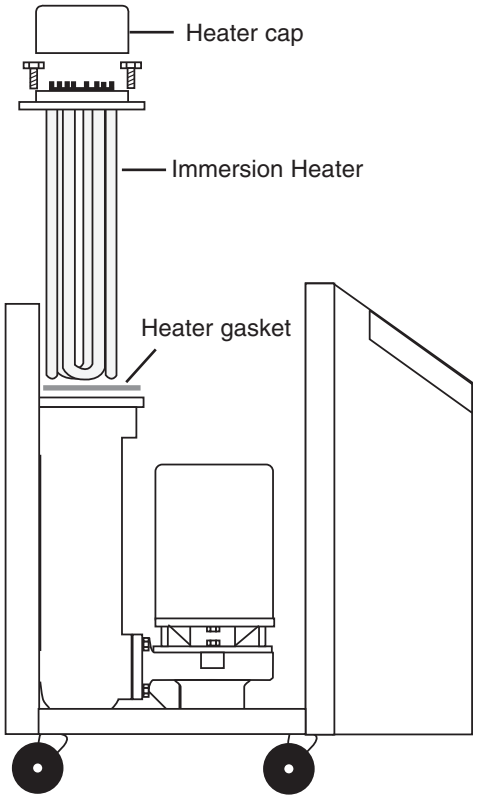
   Then unscrew the nuts on the cable connectors and remove the wires.

5. **Shut off the cooling water in.**
6. **Drain the Thermolator using the Pressure Relief Valve located at the rear of the unit.**
7. **Remove the four bolts that hold the heater element in place.** Use a 9/16-inch socket.

(Continued)

Replacing Immersion Heaters (Continued)

8 **Lift the heating element out of the heater tank.** Lift the element straight up.



9 **Clean the heater tank.** Remove any rust or solids that may have built up before inserting the heater elements.

10 **Replace the heater gasket** if it is worn or cracked.

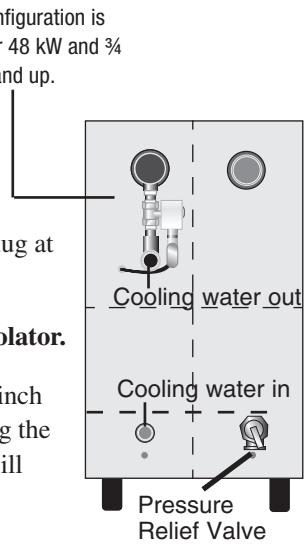
11 **Reverse these steps to install the new heater element and reassemble the unit.**

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

Removing the Pump

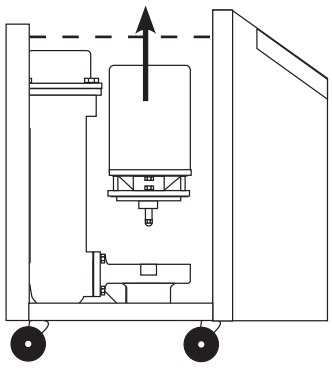
WARNING: Electrical Shock and Hot Surface Hazard

Before attempting maintenance of any kind on the Thermolator, you must stop the unit; disconnect and lockout the main power supply; and allow the unit to cool to 100° F {38° C}.



1. **Disconnect and lockout the main power.**
2. **Shut off the cooling water in feed.**
3. **Drain the unit of all fluid.** Remove the drain plug at the rear of the unit.
4. **Remove the top and side panels of the Thermolator.**
5. **Remove the pump assembly bolts.** Use a 9/16-inch open-end box wrench to remove the bolts holding the pump to the pump casing. The bolt in the rear will require a 9/16-inch socket wrench.
6. **Remove the center brace that runs from the top rear to the front of the Thermolator.**
7. **Lift the pump assembly straight up to remove.** The pump can now be replaced or disassembled for repair. The center brace detail needs to be removed on selection pumps removal.
8. **Reverse the steps to reassemble the unit.**

NOTE: Before restarting, close all drain openings using sealant on the threads and reprime the pump. Do not start until the pump is completely filled with water.



We're Here to Help

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Department for a nominal fee.
Most manuals can be downloaded free of charge from the product section of the Conair website.
www.conairgroup.com

How to Contact Customer Service

To contact Customer Service personnel, call:

NOTE: Normal operating hours are 8:00 am - 5:00 pm EST. After hours emergency service is available at the same phone number.

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

Before You Call...

If you do have a problem, please complete the following checklist before calling Conair:

- ❒ Make sure you have all model, control type from the serial tag, and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- ❒ Make sure power is supplied to the equipment.
- ❒ Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- ❒ Check the troubleshooting guide of this manual for a solution.
- ❒ Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.

Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated, and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices, or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

PID Parameters

The Conair TW-P Thermolator features a PID ("proportional-integral-derivative") control-loop algorithm implemented in the programming of the controller board. This algorithm is used to achieve the proper temperature of the process fluid quickly and accurately. The following tables and paragraphs describe its operation.

The default factory PID parameters loaded into the TW-P should work well under most applications. However, due to a wide variety of situations and system requirements, these parameters can be adjusted to best serve a particular application.

PID Default Parameters			
	Cooling-Driven Mode	**Controller Parameter**	**Comments**
Proportional band: Cooling-driven	7	PbC	*Smaller* number = more aggressive proportional cooling response.
Derivative time: Cooling-driven	30	dEC	*Larger* number = more aggressive derivative cooling response.
Integral time: Cooling-driven	200	inC	*Smaller* number = more aggressive integral cooling response.
Proportional band: Heating-driven	7	PbH	*Smaller* number = more aggressive proportional heating response.
Derivative time: Heating-driven	10	dEH	*Larger* number = more aggressive derivative heating response.
Integral time: Heating-driven	30	inH	*Smaller* number = more aggressive integral heating response.
Proportional band ratio	10	Pbr	Used to adjust closing vs. opening strength of floating valve.

Proportional

The main driver for the Thermolator control loop is the proportional response. Proportional logic is very simple—it selects a heating or cooling level (strength) based on how close the process temperature is to the setpoint.

The proportional parameter defines a band over what range of degrees the temperature controller will taper-off its heating or cooling. Heating/Cooling will be applied at 100% if the process temperature is more than the band parameter away from the setpoint. A smaller number will produce a more aggressive proportional response because it will shrink the band.

If the Thermolator is not providing a strong enough heating or cooling response for a given situation, this parameter number should be made more aggressive (a smaller number should be used).

Typical values would be 1% to 30% of setpoint. The cool proportional band and the heat proportional band are factory set to the same number. If you have a very warm external cooling water source, you may want to make the cool proportional band number smaller than the heat proportional band. Likewise, if your cooling water source is very cold, you may want to make the cool proportional band larger than the heat proportional band.

(Continued)

PID Parameters (Continued)

Integral

Using only proportional control will cause the Thermolator to have steady-state error (it will never exactly reach setpoint). Integral response is used to eliminate this undesirable condition.

Integral logic introduces the awareness of the passage of time into the logic by looking into the past—and observing how far the process has been from the setpoint over time. The farther away the process is from setpoint for a longer and longer time, the more it causes the Thermolator to produce a stronger counter-response. Integral action is internally disabled whenever the Thermolator is far (further than the proportional band) from the setpoint because it has no merit under this condition.

A smaller number will produce a more aggressive integral response. "0" will completely turn off integral response.

If the process temperature is approaching the setpoint too slowly, a stronger integral response (a smaller parameter number) can be used to remedy the situation. Too much integral response can cause the Thermolator temperature to severely oscillate. Typical values would range from 30 to 400.

Derivative

Derivative response is used to eliminate overshoot. It is also used to compensate for the slow-responding floating valve option. Like integral logic, it is aware of the passage of time—it looks forward into the future and anticipates if the machine will be overshooting the setpoint at some point in the future, based on current trends.

Derivative action is disabled whenever the Thermolator is far (further than twice the proportional band) from the setpoint.

A larger number will produce a more aggressive derivative response.
If the system temperature is overshooting the setpoint, try a more aggressive derivative response. If the system stutters or temporarily reverses temperature direction as approaching setpoint, your derivative response is too aggressive. If overshoot is not a concern, or you have a very large system, derivative control can be completely turned off by setting the parameter to "0" without negative consequences.

Manual Tuning Procedure

If you find yourself in a situation where the Thermolator is responding in an unpredictable manner, follow the procedure below to simplify the control loop and pick appropriate PID parameters.

PREREQUISITES:

- ❒ *Your cooling water must be at a reasonably stable temperature and pressure.*
- ❒ *Your external heat load on the Thermolator must be reasonably constant.*
- ❒ *Select a setpoint for tuning that is similar to a typical setpoint for the process.*
- ❒ *You must have sufficient time to run your system through several thermal cycles in order to perform a full tuning.*

(Continued)

PID Parameters (Continued)

STEPS:

Set Default Parameters

1 **Turn off all derivative control by setting dEC and dEH to "0".**

2 **Minimize integral control by setting inC and inH to "800".**

3 **Set proportional control of PbC and PbH to an initial value of approximately 10% of setpoint.** For example, if your setpoint is 150°F {66°C}, set these parameters to "15".

Run a Test - Proportional

4 **Start the Thermolator and observe it attempting to reach setpoint.**

5 **Decrease the values of PbC and PbH until the system beings to oscillate around the setpoint.** You may have to cool-down your system and repeat the experiment several times so you can accurately observe the process temperature approaching setpoint.

6 **Multiply the value determined by step 5 by "2" and enter it as parameters PbC and PbH.**

Continue the Test – Proportional + Integral

7 **Decrease the integral setting inC and inH by a factor of two and run the system through a thermal cycle.** For example, change it from "800" to "400", then "200", then "100, etc. Repeat as necessary. You should observe the steady-state error disappear and the system reach setpoint. If the system begins to oscillate around the setpoint, you have gone too far.

8 **Cool-down your system and repeat the experiment so you can truly observe the process temperature approaching setpoint.** You will probably observe the temperature overshooting the setpoint. If overshoot is acceptable for your process, there is no reason to continue tuning. If you would like to eliminate overshoot in exchange for slightly longer times until setpoint it reached, read on, as overshoot can be eliminated using the next step.

Continue the Test – Proportional + Integral + Derivative

9 **Set the derivative parameters dEC and dEH to "1".** Run the system through a thermal cycle and observe the overshoot the first time it reaches setpoint.

10 **Double the derivative parameters dEC and dEH and run the machine through another thermal cycle.** If you have a floating valve, you may wish to observe its position, since derivative control will help the system properly anticipate the slow operating time for such a valve.

11 **Repeat the doubling process of parameters dEC and dEH until overshoot is satisfactorily eliminated.** If the system stutters or temporarily reverses temperature direction as approaching setpoint, your derivative response is too aggressive and you need to decrease this parameter.

(Continued)

PID Parameters (Continued)

Finished

12 **You should review your work and make sure your system is not on the verge of oscillating.** If your system oscillates intermittently, you probably have your gains too aggressive. It is better to be mild in your tuning than over-aggressive.

13 **You are now finished tuning your system.** Be sure to record your parameters PbC, dEC, inC, PbH, dEH, inH. The parameters may need to be tweaked if your system or setpoint changes significantly.

Setting the Security Passcode

The TW-P Thermolator provides the ability to protect system parameters from accidental or unauthorized changes. Access to all user-configurable parameters can be limited by selecting a three digit passcode between 0 and 500.

While the TW-P ships with the factory-default "0" as the passcode, we recommend selecting your own unique passcode to protect your machine setup and application.

To change the security passcode:

1 **Stop the TCU or ensure that you are on the home screen by pressing the STOP button** 

.

2 **Enter the user configuration menu by holding the "Function"** 

button for five seconds. Assuming that the existing passcode is at its default "0", simply push "Select" 

.

3 **The upper display should now show UPA. In the lower display, use the "Up"** 

or "Down" 

buttons to select the three-digit passcode from 0 to 500 as desired.

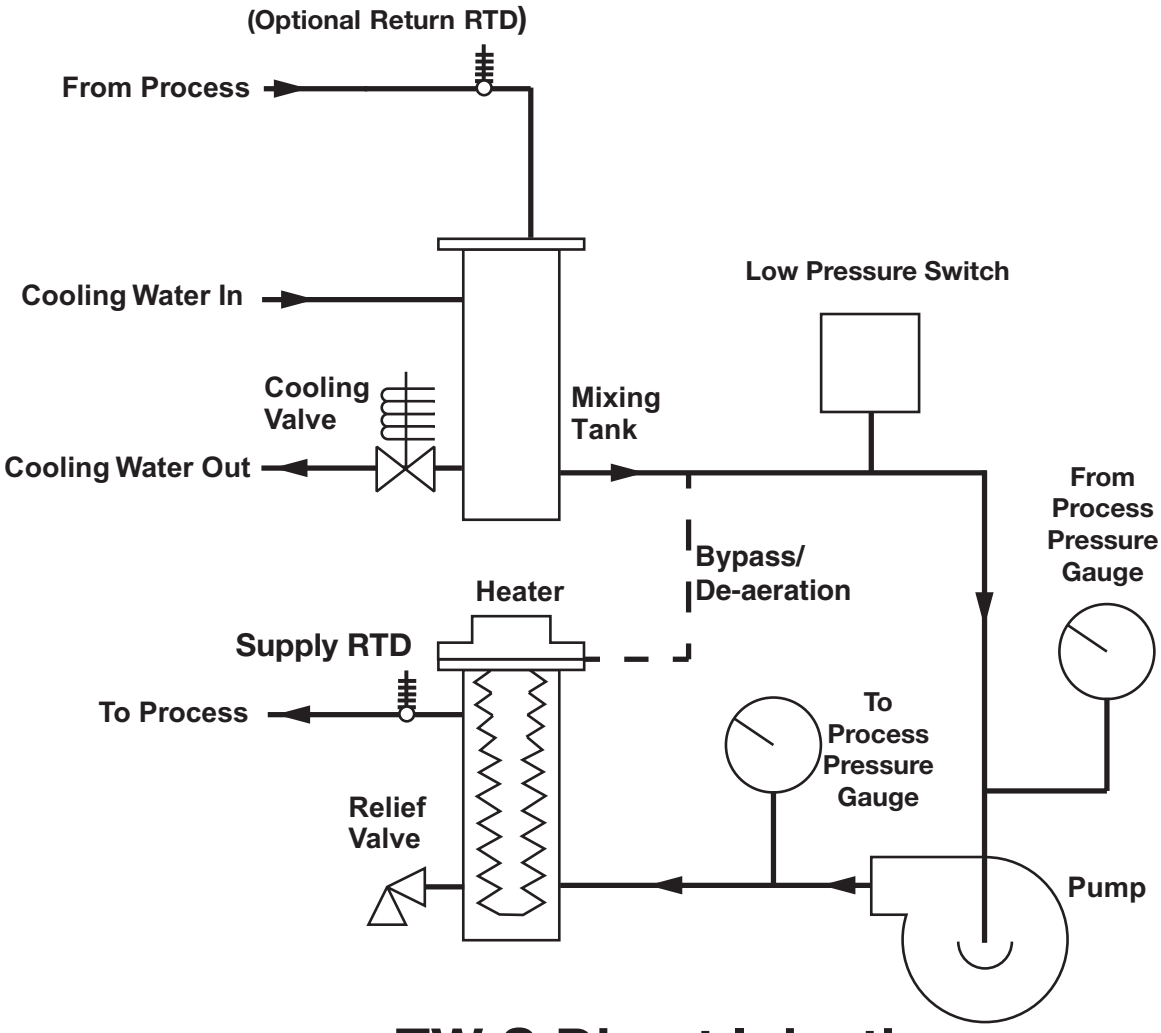
4 **Push "Select"** 

to save the changed parameter. Push "STOP" 

to exit.

(Continued)

Plumbing Diagram

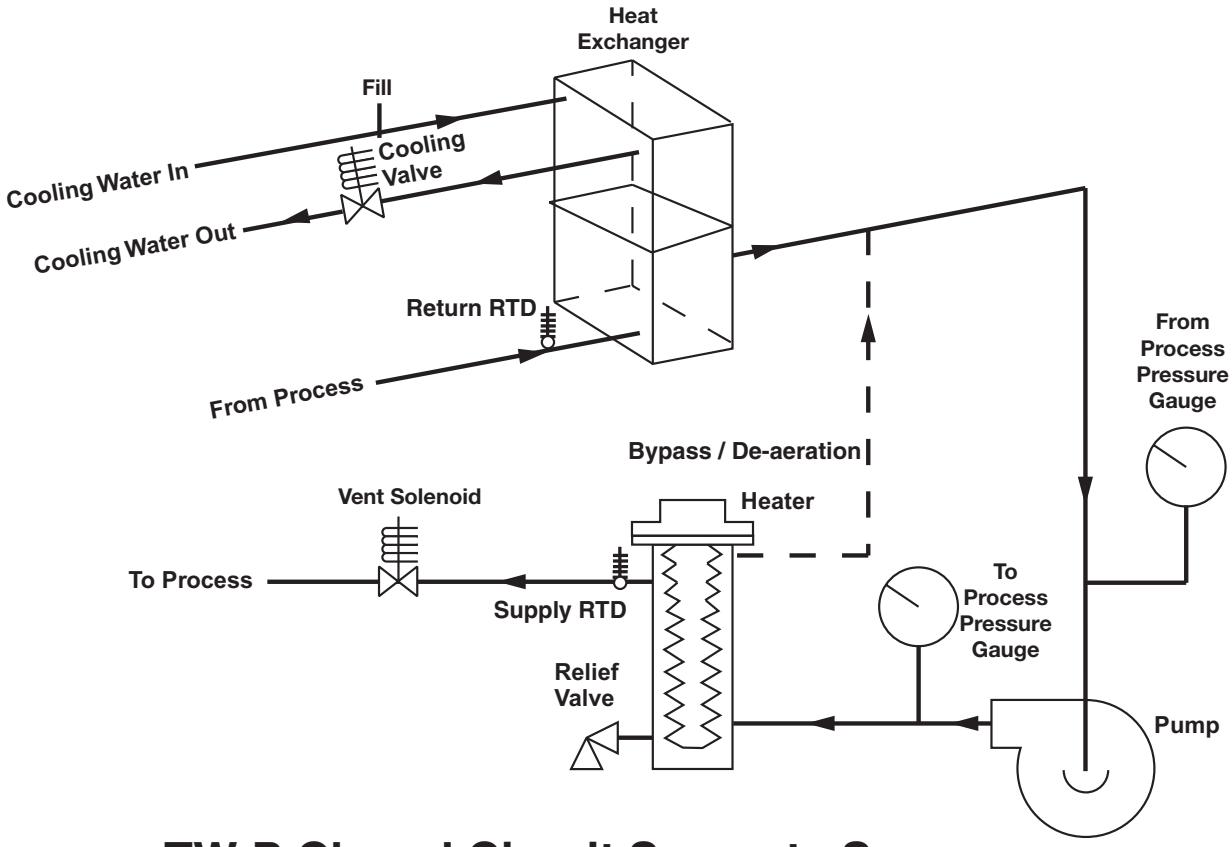


TW-S Direct Injection

(Continued)

Plumbing Diagram (Continued)

Closed Circuit Separate Source



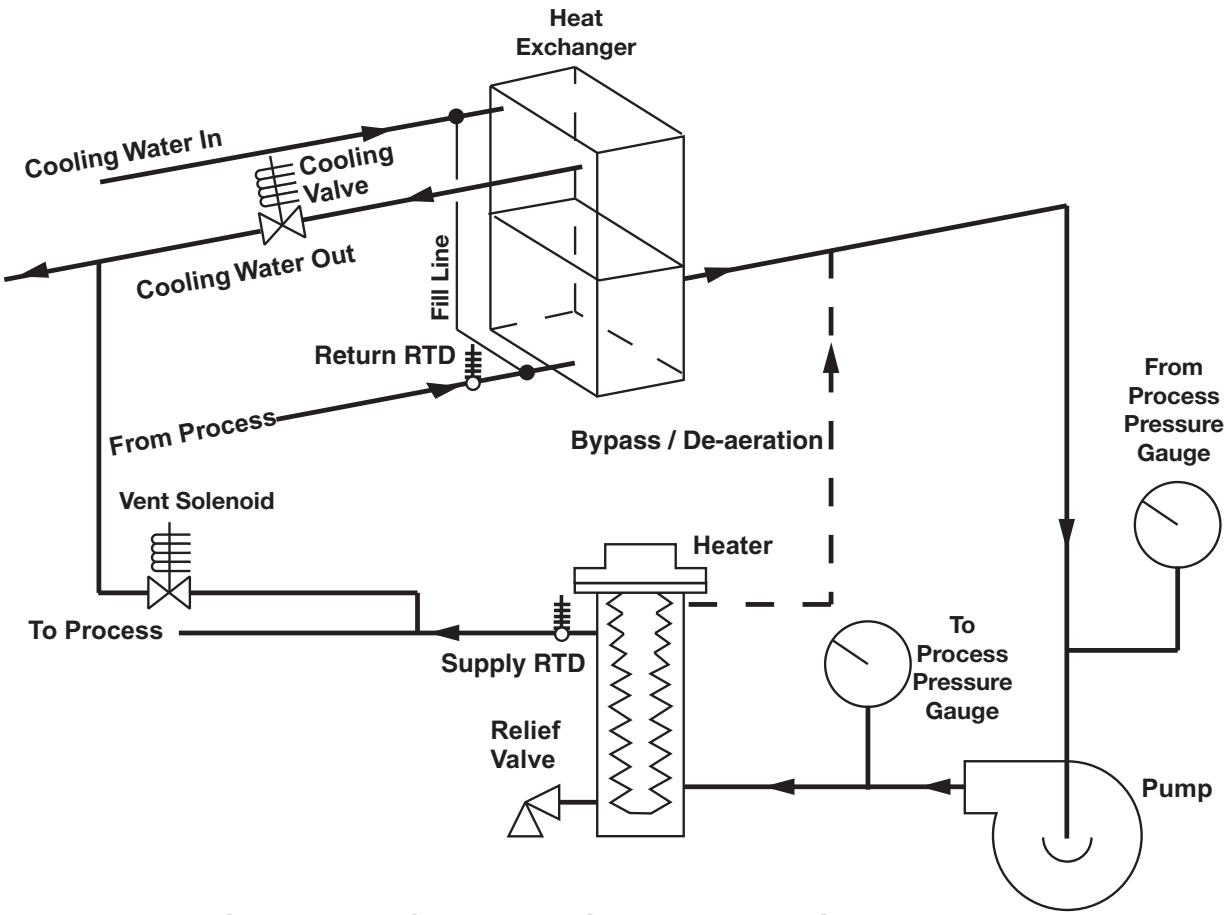
TW-P Closed Circuit Separate Source

In this configuration process and cooling fluids do not mix.

(Continued)

Plumbing Diagram (Continued)

Closed Circuit Common Source



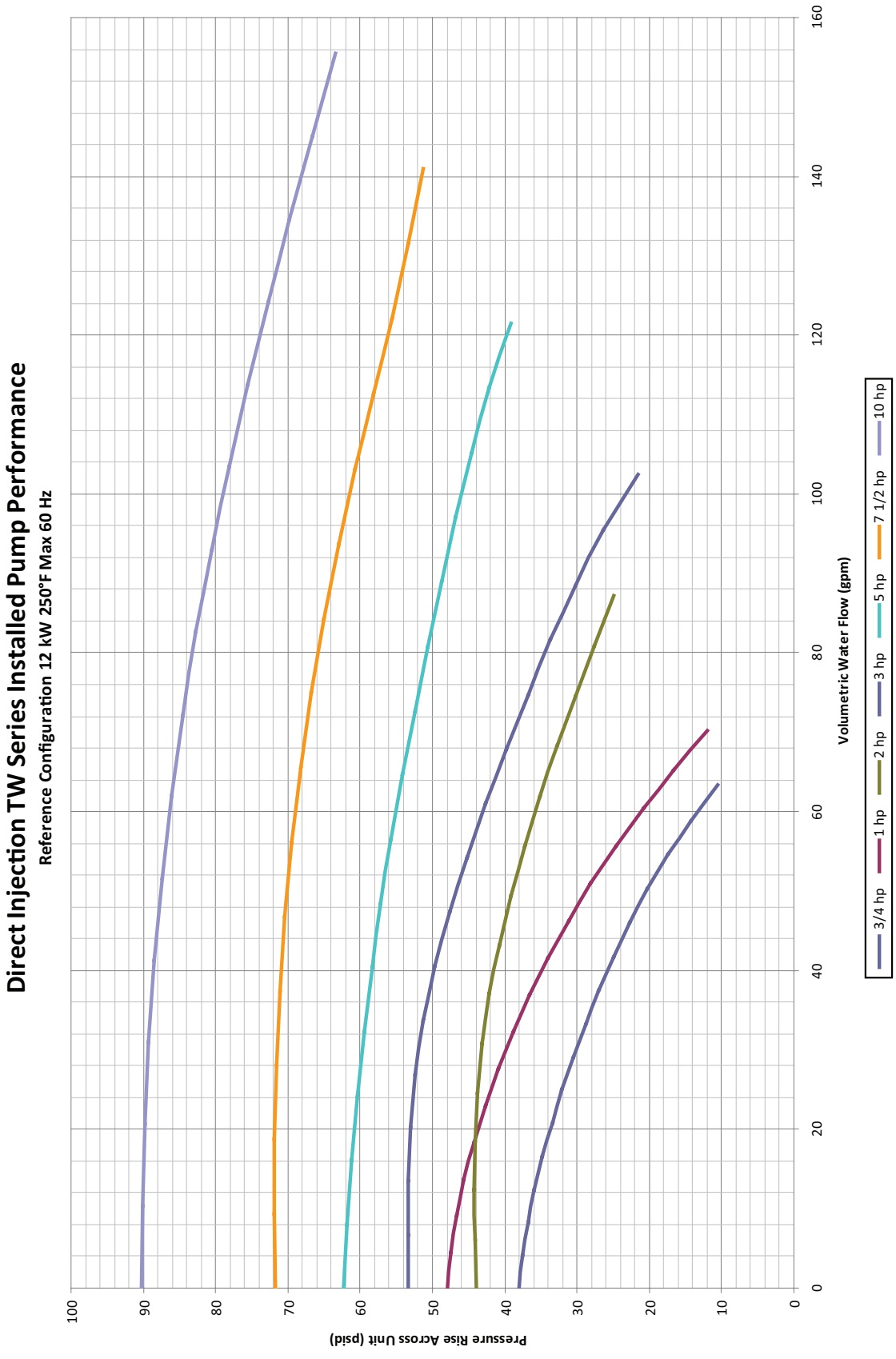
TW-P Closed Circuit Common Source

In this configuration process and cooling fluids mix only at filling.

Fill line is used for both pressurization and expansion of process fluid (causes limited interaction of process and cooling water).

Plumbing Curves

Direct Injection



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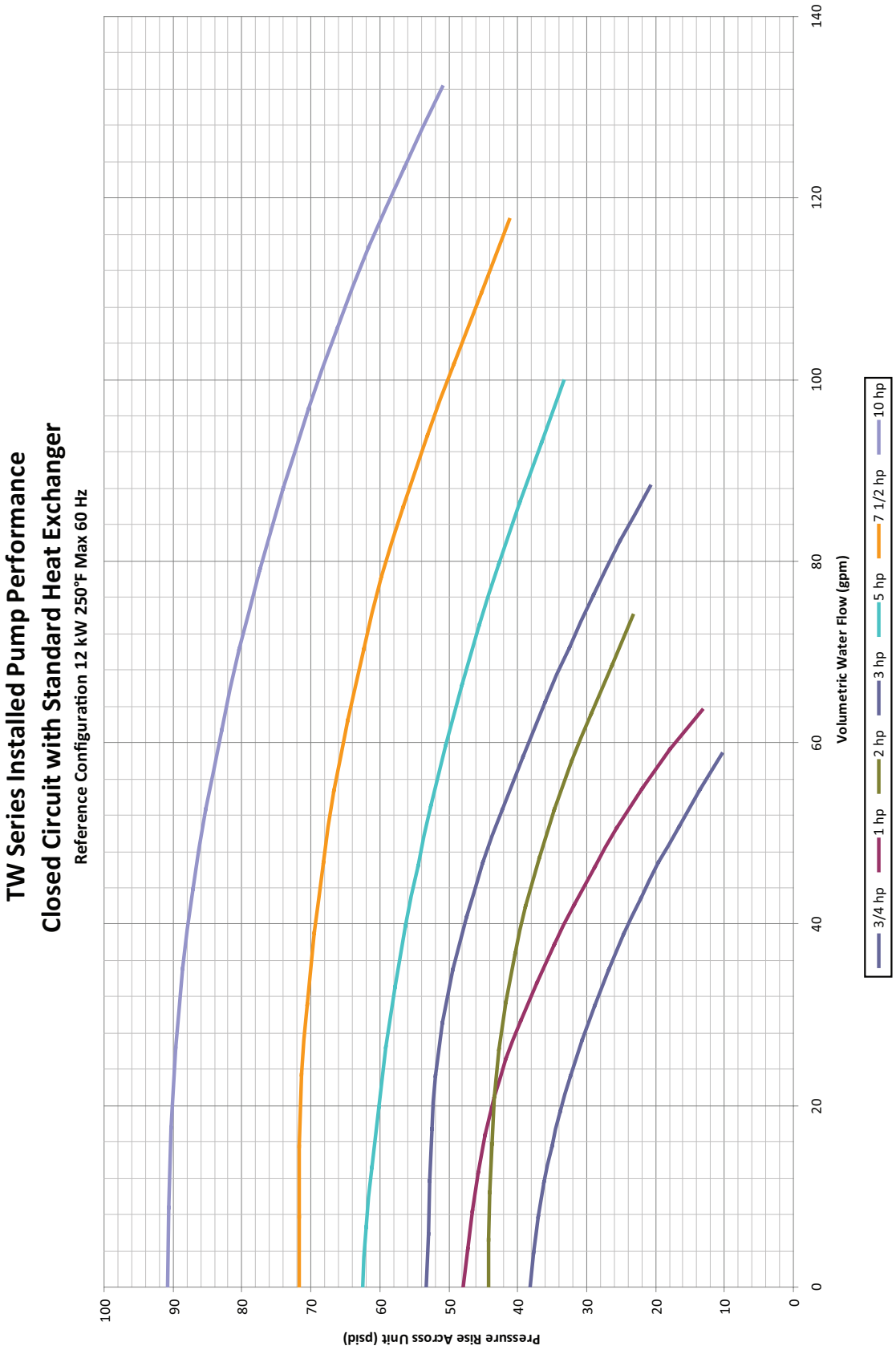
Plumbing Curves (Continued)

Closed Circuit Standard Performance



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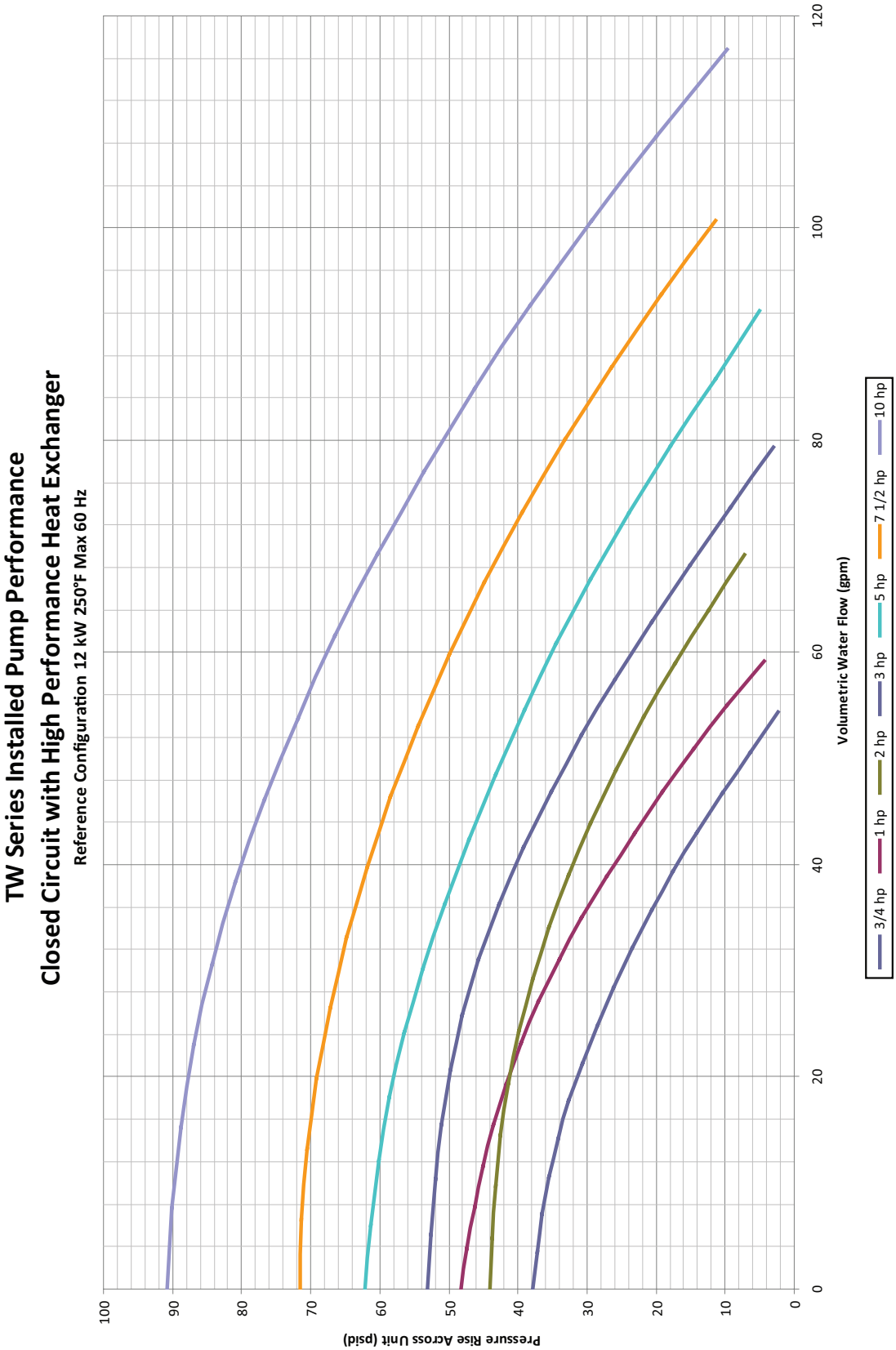
Plumbing Curves (Continued)

Closed Circuit High Performance



MSDS: 7439-97-6 Mercury
Material Safety Data Sheet

An explanation of the terms used in this document may be found in OSHA 29 CFR 1910.1200 whichis available from OSHA regional or area offices.

1. Chemical Identification

Substance: Mercury	**CAS-Number:** 7439-97-6
Chemical name: Mercury	**Synonyms:** Quicksilver; Liquid silver
Formula: Hg	**Molecular weight:** 200.59
Trade name: Not applicable	**Chemical family:** Metal
Supplier of MSDS information: Conair 200 West Kensinger Drive Cranberry Township, PA 16066 412-312-6000	**Emergency contact:** For CHEMTREC assistance call 800-424-9300 (in the U.S.) 703-527-3887 (international)

2. Composition and Exposure Limits

Material	Weight (%)	Exposure Limits
Mercury	100	0.05 mg/m^3 Threshold Limit Value(skin)/TWA
		0.1 mg/m^3 Permissible Exposure Limit (PEL)

3. Hazards Identification

Hazard Ratings (0 = no hazard; 4 = extreme hazard):

Health	- 4 Extreme (Poison)	Carcinogenic:	NTP – No
Flammability	- 0 None		IARC – No
Reactivity	- 1 Slight		Z List – No
Contact	- 3 Severe (Life)		OSHA Reg – No

Personal Health Effects:

WARNING Mercury is a dangerous poison and an extreme contact hazard. Mercury may be absorbed by the skin or through the eyes. It may be fatal if swallowed or inhaled. It emits toxic vapors, especially when heated. Do not get mercury in your eyes, on your skin or on your clothing. Do not breathe mercury dust. Keep mercury in a tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

Effects of overexposure Mercury causes skin, digestive tract and severe respiratory tract irritation. It may affect the central nervous system and cause severe eye irritation. Inhalation of vapors may cause coughing, chest pains, nausea and vomiting.
Chronic effects of overexposure may include kidney and/or liver damage, and central nervous system depression. Chronic effects of mercury poisoning include a buildup of the metal in the brain, liver and kidneys. Symptoms include headache, tremors, loose teeth, loss of appetite, blisters on the skin and impaired memory. This substance has caused adverse reproductive and fetal effects in animals.

Target organs Eyes, skin, respiratory system, central nervous system, kidneys and liver.

Routes of entry Inhalation, absorption, eye contact, skin contact.

4. Emergency and First Aid Measures

Call a physician immediately.

If swallowed:	Immediately induce vomiting, if person is conscious.
If inhaled:	Immediately remove exposed person to fresh air. If the person is not breathing, give artificial respiration. If breathing is difficult, give oxygen.
In case of contact:	Immediately flush eyes or skin with plenty of water for at least 15 minutes, while removing contaminated clothing and shoes. Wash clothing before using again.

MSDS: 7439-97-6 Mercury

5. Fire and Explosion Data	
Fire and explosion hazards:	Mercury presents a slight fire and explosion hazard when exposed to heat or flame. Mercury vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back.
Firefighting media:	Dry chemical, carbon dioxide, water spray or foam. For larger fires, use water spray, fog or alcohol foam. (1984 Emergency Response Guidebook, DOT P 5800.3).
Firefighting procedures:	Use agents suitable for type of fire. Use water in flooding amounts as a fog. Avoid breathing corrosive and poisonous vapors. Keep upwind. Move containers from the fire area if possible. Cool containers exposed to flames with water from side until well after fire is out. (1984 Emergency Response Guidebook, DOT P 5800.3).

6. Spill and Disposal Procedures	
EPA Hazardous Waste Number: U151 (Toxic Waste)	
If spilled or discharged:	Wear self-contained breathing apparatus and full protective clothing. Clean up the spill immediately. Collect and store using a suction pump with a capillary tube. Calcium polysulfide with excess sulfur should be sprinkled into cracks or inaccessible sites. Keep collected mercury in a tightly closed bottle for recovery or disposal.
Disposal procedure:	Dispose in accordance with all applicable federal, state, and local environmental regulations.

7. Storage and Handling Precautions
Mercury should be stored in a secure poison area inside a tightly closed container.

8. Exposure Control and Protective Equipment	
Ventilation:	Use general or local exhaust ventilation to meet TLV requirements.
Respiratory protection:	None required where appropriate ventilation conditions exist. If the TLV is exceeded, a self-breathing apparatus is advised.
Eye/skin protection:	Safety goggles and face shield, uniform, protective suit and rubber gloves are recommended.

9. Physical and Chemical Properties	
Appearance and odor: Silver-white, heavy, mobile liquid metal; odorless	
Boiling point: 675° F (357° C)	**Melting point:** -38° F (-39° C)
Specific gravity: 13.5	**Vapor pressure:** 0.002 mm Hg
Vapor density: 1.01	**Solubility in H_20:** negligible, less than 0.1%
Solubility in solvents: Sulfuric acid, nitric acid, lipids	

10. Stability and Reactivity Data	
Stability: Stable	**Hazardous polymerization:** Will not occur
Conditions to avoid:	Heat
Incompatibles:	Strong acids

IMPORTANT: Users of this equipment should study this MSDS carefully to become aware of and understand the hazards associated with the product. If necessary or appropriate, the reader should consider consulting reference works or individuals who are experts in ventilation, toxicology and fire prevention to use and understand the data in this MSDS. To promote safe handling, the reader should furnish this information to anyone whom he or she knows or believes will use this equipment.

Service Parts List

TW-P Thermolators

Manuals	
PART NUMBER	**DESCRIPTION**
UGH052/1215	User Guide, Thermolator TW-P

Contact Conair
Parts and Service
Phone: 800-458-1960
From outside of the
United States,
Call: 814 437 6861

PUMP ASSEMBLIES	HP	VOLTAGE	POWER FREQUENCY	NON FERROUS
PART NUMBER				
2672030101	3/4	208-230/460	60	X
2672030201	1	208-230/460	60	X
2672030301	2	208-230/460	60	X
2672030401	3	208-230/460	60	X
2672030501	5	208-230/460	60	X
2672030601	7.5	208-230/460	60	X
2672030701	10	208-230/460	60	X
MOTOR (ONLY)				
2672030000A2	3/4	208-230/460	60	X
2672030000A3	1	208-230/460	60	X
2672030000A4	2	208-230/460	60	X
2672030000A5	3	208-230/460	60	X
2672030000A6	5	208-230/460	60	X
2672030000A7	7.5	208-230/460	60	X
2672030000A8	10	208-230/460	60	X
VOLUTE/CASING				
2672030000E4	3/4	208-230/460	60	X
2672030000E4	1	208-230/460	60	X
2672030000E5	2	208-230/460	60	X
2672030000E5	3	208-230/460	60	X
2672030000E6	5	208-230/460	60	X
2672030000E6	7.5	208-230/460	60	X
2672030000E6	10	208-230/460	60	X
MOTOR ADAPTERS				
2672030000F3	3/4	208-230/460	60	X
2672030000F3	1	208-230/460	60	X
2672030000F3	2	208-230/460	60	X
2672030000F3	3	208-230/460	60	X
2672030000F4	5	208-230/460	60	X
2672030000F4	7.5	208-230/460	60	X
2672030000F4	10	208-230/460	60	X

(Continued)

Service Parts List (Continued)

TW-P Thermolators

PUMP ASSEMBLIES	HP	VOLTAGE	POWER FREQUENCY	NON FERROUS
IMPELLERS				
2672030000G8	3/4	208-230/460	60	X
2672030000G9	1	208-230/460	60	X
2672030000G10	2	208-230/460	60	X
2672030000G11	3	208-230/460	60	X
2672030000G12	5	208-230/460	60	X
2672030000G13	7.5	208-230/460	60	X
2672030000G14	10	208-230/460	60	X
SEAL KITS				
267203SK0101	3/4			
267203SK0102	3/4			
267203SK0101	1			
267203SK0102	1			
267203SK0101	2			
267203SK0102	2			
267203SK0101	3			
267203SK0102	3			
267203SK0201	5			
267203SK0202	5			
267203SK0201	7.5			
267203SK0202	7.5			
267203SK0201	10			
267203SK0202	10			

External Interfaces

Analog Remote Setpoint / Process Temp Retransmit

Connecting to the Thermolator

WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

External analog signals must be fully isolated from ground. Be sure to use fully isolated analog channels and/or power supplies. Analog wires must not be common or referenced to earth ground! Failure to heed this requirement will permanently damage the analog circuits in the TCU.

Setting the Jumpers

See the table below for the proper jumper position. These jumpers are also shown on sheet 4 of the electrical print.

Wiring the circuit

Sheet 4 on the electrical print illustrates the proper way to wire the remote interface. You can choose either 4-20mA or 0-10VDC, not both simultaneously.

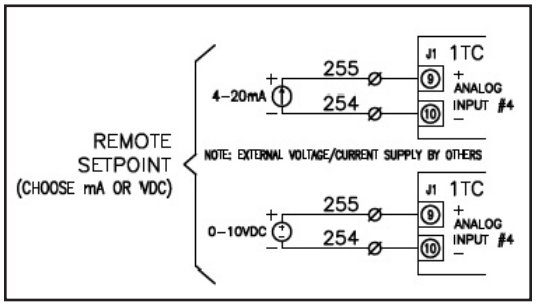
Circuit Impedance Requirements		
	0-10VDC	**4-20mA**
Remote Temperature Setpoint (Input)	11kΩ internal controller impedance.	50Ω internal controller impedance.
	NOTE: Voltage or loop current source must be supplied by the external interface.	
Process Temperature Retransmit (Output)	1kΩ minimum external impedance.	500Ω maximum external impedance.
	NOTE: Voltage or loop current is self-generated by the TCU's temperature controller.	

Terminal Wiring / Jumpers								
	0-10VDC		**4-20mA**					
Remote Temperature Setpoint (Input)	+ Terminal 255	- Terminal 254	+ Terminal 255	- Terminal 254	Analog Input	Jumper Number	Placement (4-20mA)	Placement (0-10V)
					Input #4 J1-9 & J1-10	JMP10	OUT	OUT
						JMP11	OUT	IN
						JMP13	IN	IN
						JMP22	IN	OUT
Process Temperature Retransmit (Output)	+ Terminal #5 on 10-pin analog output daughter card	- Terminal #6 on 10-pin analog output daughter card	+ Terminal #3 on 10-pin analog output daughter card	- Terminal #4 on 10-pin analog output daughter card	Jumper Number	Placement (4-20mA)	Placement (0-10V)	
					JMP1	Pins 2 & 3	Pins 1 & 2	
					For 0-10VDC operation, pins 3&4 must be connected together with an external jumper.			

See electrical print sheet 5 for terminal block locations.

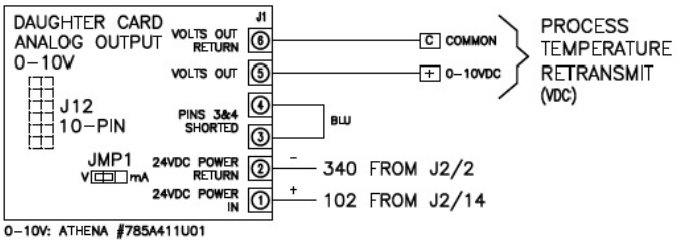
(continued)

External Interfaces (Continued)



1TC Input #4 Jumper Positions			
Analog Input	**Jumper Number**	**Placement (4-20mA)**	**Placement (0-10V)**
Input #4 J1-9 & J1-10	JMP10	OUT	OUT
	JMP11	OUT	IN
	JMP13	IN	IN
	JMP22	IN	OUT

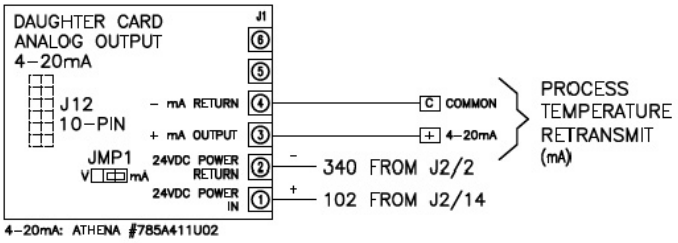
NOTE: Signal is not ground-isolated. Customer's interface must be isolated from ground (or ground loop damage will result).



1kΩ Minimum input impedance

Terminate analog output signal wire directly on J12 daughter board connector J1.

Analog Output (J12) Daughter Card Jumper Positions		
Jumper Number	**Placement (4-20mA)**	**Placement (0-10V)**
JMP1	Pins 2 & 4	Pins 1 & 2



500Ω Maximum input impedance

Terminate analog output signal wire directly on J12 daughter board connector J1.

NOTE: Voltage signal is self-generated by temp controller, but is not ground-isolated. Customer's interface must be isolated from ground (or ground loop damage will result).

NOTE: Current signal is self-generated by temp controller but is not ground-isolated. Customer's interface must be isolated from ground (or ground loop damage will result).

NOTE: Both analog input and output signals are not isolated from each other in controller. Customer's interface must have isolated channels (or reference loop damage will result).

(continued)

External Interfaces (Continued)

Setting the Software

Remote Setpoint Analog Input

If you ordered the "remote setpoint" option with the TCU, your TCU will come pre-configured to accept a remote setpoint. This means that you will NOT be able to select a setpoint directly from the temperature controller (without changing the default parameters). Additionally, the TCU comes from the factory set to 0-20mA covering the entire range of 10°F to 260°F.

Remote Setpoint Related Parameters				
U34	Remote setpoint enabled	rSE	EnA	Disabled (dLS) or Enabled (EnA)
U35	Remote setpoint type	rSt	mmA	4-20mA (mmA) or 0-10 Volts (U) (be sure to also change jumpers)
U36	Remote setpoint high range	rSH	260	rSL to 999
U37	Remote setpoint low range	rSL	10	-99 to rSH

Process Value Retransmit Analog Output:

If you ordered the "process value retransmit" communication option with the TCU, your TCU will come pre-configured to accept a remote setpoint. This means that you will NOT be able to select a setpoint directly from the temperature controller (without changing the default parameters). Additionally, the TCU comes from the factory set to 0-20mA covering the entire range of 10°F to 260°F.

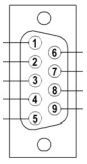
Process Value Related Parameters				
U38	Communications type	Cot	rEt	OFF, Retransmit (rEt), ModBus-RTU (bUS), ModBus-TCP (tcP), or Handheld Remote (HAn) ✎ NOTE: No SPI communications
U39	Retransmit type	rtt	mmA	4-20mA (mmA) or 0-10 Volts (U)
U40	Retransmit high limit	rtH	260	rSL to 999
U41	Retransmit low limit	rtL	10	-99 to rEH

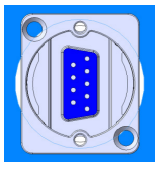
Modbus RTU Communication

Connecting to the Thermolator

The Thermolator has a 2-wire (plus common) RS-485 network for Modbus communication.

Pin 4	T+/R+
Pin 5	T-/R-
DB-9 hood	Common





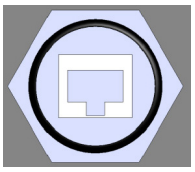
Setting the Modbus Address and Speed

Modbus Related Parameters				
U38	Communications type	Cot	bUS	OFF, Retransmit (rEt), ModBus-RTU/TCP (bUS), or Handheld Remote (HAn)
U42	Communications Baud Rate	bAU	96	12 to 96
U43	Modbus ID	b id	1	1 to 247

(continued)

External Interfaces (Continued)

Modbus TCP Communication



Connecting to the Thermolator

The Thermolator has a RJ-45 port on the front panel for Modbus-TCP communication on an Ethernet-based network.

The TCU comes with the default IP address set to "dynamic" or "DHCP". This means that its actual IP address will be whatever is assigned by the DHCP server on the network. The same method is used to assign the subnet mask and default gateway.

This default dynamic IP address setting should be changed to meet the installation requirements since fixed IP addresses are advisable for best functionality and reliability in an industrial environment. An external utility called "DeviceInstaller" from Lantronix is required to assign a fixed IP address, subnet mask, and default gateway to the communications daughter card. *See the external document "DeviceInstaller User Guide" for more information and exact procedures.*

✎ NOTE: If multiple TCU's will be installed on the same network, they must not share duplicate IP addresses or serious communication problems will occur.

Setting the Jumpers

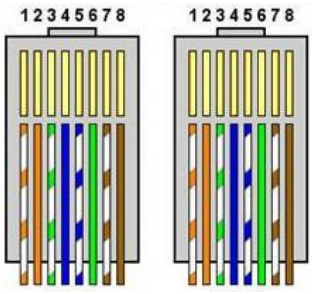
There are no jumpers to set. IP address selection is performed via internal software settings.

Wiring the circuit

Other than plugging in a standard ethernet cable (CAT5, CAT5e, or CAT6 type), there is no additional wiring required. Shielded ethernet cable may be used in environments where electrical interference may be present.

If the Thermolator is being connected to an ethernet switch, use a "straight-through" style ethernet cable. If the Thermolator is being connected directly to a computer, use a "crossover" style ethernet cable. See diagrams below.

"Straight Through" Ethernet Cable		
Pin #	**Plug A**	**Plug B**
1	Orange/White	Orange/White
2	Orange	Orange
3	Green/White	Green/White
4	Blue	Blue
5	Blue/White	Blue/White
6	Green	Green
7	Brown/White	Brown/White
8	Brown	Brown
✎ **NOTE:** T568B standard shown. Other colors are acceptable.		

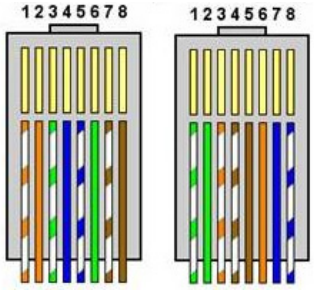


Plug A Plug B

(continued)

External Interfaces (Continued)

"Crossover" Ethernet Cable		
Pin #	**Plug A**	**Plug B**
1	Orange/White	Green/White
2	Orange	Green
3	Green/White	Orange/White
4	Blue	Brown/White
5	Blue/White	Brown
6	Green	Orange
7	Brown/White	Blue
8	Brown	Blue/White
NOTE: T568B standard shown. Other colors are acceptable.		



Plug A Plug B

Setting the Software

Modbus Related Parameters				
U38	Communications type	CoE	bUS	OFF, Retransmit (rEt), ModBus-RTU/TCP (bUS), or Handheld Remote (HAn)

Modbus Registers

The following is a list of Modbus Registers that are remotely available.

Notes:

- There is a limitation on the maximum Modbus block size of 40 for integers and 20 for floats.
- Additional settings include:
  - Baud: Set by parameter bAU, 9600 baud by default.
  - Parity: None
  - Data bits: 8
  - Stop bits: 1
  - Flow control: None
- It is common for external software to apply an address offset of “1”, so you may need to add “1” to the Modbus addresses based on the software in the remote system.
- In newer versions of Modbus, you may have to append a “4” or a “40” prefix on the registers listed.

For example, to get to “MACHINE STATE” in register 4002, you may have to access register 4002, 4003, 44002, 44003, 404002, or 404003. Once you test your system and get a valid response, you will know the rules to consistently apply to your system for all addresses.

(continued)

Modbus Registers (Continued)

Integers

Type VT_12 (Signed Integers)

Register	Item	Read/ Write	Notes
4000	CONTROLLER BOARD TYPE	R	0x5432=F20, 0x5434=F40
4001	SOFTWARE VERSION	R	100x version, e.g. 119=ver 1.19
4002	MACHINE STATE	R	*See TCU States Table.*
4003	INPUT TYPE 0	R	0=RTD2, 1=RTD3, 2=RTD PWC, 3=4-20mA, 4=0-1V, 5=TC, 6=0-10V
4004	INPUT TYPE 1	R	0=RTD2, 1=RTD3, 2=RTD PWC, 3=4-20mA, 4=0-1V, 5=TC, 6=0-10V
4005	INPUT TYPE 2	R	0=RTD2, 1=RTD3, 2=RTD PWC, 3=4-20mA, 4=0-1V, 5=TC, 6=0-10V
4006	INPUT TYPE 3	R	0=RTD2, 1=RTD3, 2=RTD PWC, 3=4-20mA, 4=0-1V, 5=TC, 6=0-10V
4007	DERIVATIVE - COOL DRIVEN ALG.	R/W	
4008	INTEGRAL - COOL DRIVEN ALG.	R/W	
4009	HEAT CYCLE RATE	R/W	
4010	COOL CYCLE RATE	R/W	
4011	LOW ALARM DELAY	R/W	
4012	HI ALARM DELAY	R/W	
4013	DISPLAY UNITS	R/W	0=°F, 1=°C
4014	CONTROLLER TYPE (Reserved for future)	R	TBD
4015	BROWNOUT ENABLED	R/W	0=DISABLED, 1=ENABLED
4016	NOT USED	X	
4017	NOT USED	X	
4018	NOT USED	X	
4019	PURGE ENABLED	R	0=DISABLED, 1=ENABLED
4020	NOT USED	X	
4021	FLOW ENABLED (Reserved for future)	R	0=DISABLED, 1=ENABLED
4022	NOT USED	X	
4023	NOT USED	X	
4024	REM SETPOINT ENABLED	R/W	0=DISABLED, 1=ENABLED
4025	AUTO OR REMOTE START	R/W	0=OFF, 1=AUTO RESTART, 2=REMOTE START
4026	NOT USED	X	
4027	COMM BAUD RATE	R/W	0=1200, 1=2400, 2=4800, 3=9600
4028	MODBUS ID	R/W	
4029	CURRENTLY CONTROLLING	R	0=NO, 1=YES
4030	NOT USED	X	
4031	MODICON FLOAT FORMAT	R	0=NO, 1=YES
4032	COMM TYPE	R/W	0=NONE, 1=MODBUS, 2=PV RETRANSMIT, 3=HAND HELD DISPLAY
4033	NOT USED	X	
4034	NOT USED	X	
4035	DAC OUTPUT SPI0 (I/O Header 1)	R	16 bit value being sent to DAC card if installed and used
4036	DAC OUTPUT SPI1 (I/O Header 2)	R	16 bit value being sent to DAC card if installed and used
4037	DAC OUTPUT COMM (Comm Header)	R	16 bit value being sent to DAC card if installed and used
4038	PID OUT	R	-100 to 100 PID algorithm output
4039	MODBUS COMMAND	R/W	*See Modbus Commands Table.*

(continued)

Modbus Registers (Continued)

4040	EXTENDED RANGE ENABLED	R	0=DISABLED, 1=ENABLED
4041	DERIVATIVE - HEAT DRIVEN ALG.	R/W	
4042	INTEGRAL - HEAT DRIVEN ALG.	R/W	
4043	DEFAULT DISPLAY	R/W	0=SUPPLY, 1=RETURN, 2=AVERAGE
4044	CONTROL SOURCE	R/W	0=SUPPLY, 1=RETURN, 2=AVERAGE
4045	ALGORITHM TYPE	R/W	0=COOL DRIVEN, 1=HEAT DRIVEN
4046	INITIAL DEVIATION DELAY MINUTES	R/W	
4047	VENT TIMER STAGE 1 SECONDS	R/W	
4048	VENT TIMER STAGE 2 SECONDS	R/W	
4049	REMOTE SETPOINT ANALOG TYPE	R/W	0=4-20mA, 1=0-10V
4050	PV RETRAMSMIT ANALOG TYPE	R/W	0=4-20mA, 1=0-10V
4051	LOW PRESSURE STANDBY TIME MINUTES	R/W	0=NONE, 9999=INFINITY, Otherwise actual values.
4052	HARDWARE OVERTEMP ALARM ENABLED	R	0=DISABLED, 1=ENABLED
4053	DIGITAL INPUT STATUS BITS	R	Bit 0=Input 1, Bit 1= Input 2, etc. Encoder 1=Bit 14, Encoder 2=Bit 15
4054	DIGITAL OUTPUT STATUS BITS	R	Bit 0=Output 1, Bit 1= Output 2, etc.
4055	ON BOARD TEMPERATURE MONITOR ENABLED	R/W	0=DISABLED, 1=ENABLED
4056	FLOW K FACTOR	R/W	
4057	FLOW UNITS	R/W	0=Gallons/Minute, 1=Liters/Minute
4058	LOW PRESSURE STRIKE COUNT LIMIT	R/W	
4059	LOW PRESSURE STRIKE TIME PERIOD	R/W	
4060	AUTOPURGE TIME	R/W	
4061	HEAT OUTPUT PERCENT HIGH LIMIT	R/W	
4062	TEST RESISTANCE DEBOUNCE TIME	R/W	Scaled /100 ms… 1 = 100ms, 50 = 5000ms
4063	FLOW K FACTOR DIVISOR	R/W	1 OR 10

TCU States	
0	Off
1	Stop
2	Run
3	Not Used
4	Vent 1
5	Vent 2
6	Fault 1
7	Fault 2
8	Fault 3
9	Purge
10	Run Fault 3
11	Not Used
12	Factory Menu
13	User Menu
14	Not Used
15	Not Used
16	Cooldown
17	Not Used
18	Get User Password
19	Master Reset

Modbus Commands	
0	Do Nothing
1	Start
2	Stop
3	Cooldown
4	Purge
5	Alarm Silence

(continued)

Modbus Registers (Continued)

Floats

Type VT_R4 (Floating Point)

Register	Item	Read/ Write	Notes
8000	SETPOINT	R/W	
8002	CONTROLLING PROCESS VALUE	R	Error Hi=9.9E05, Error Low=-9.9E05
8004	SUPPLY/RETURN AVERAGE VALUE	R	Error Hi=9.9E05, Error Low=-9.9E05
8006	CHANNEL 0 VALUE (TBD Temp.)	R	Error Hi=9.9E05, Error Low=-9.9E05
8008	CHANNEL 1 VALUE (Supply Temp.)	R	Error Hi=9.9E05, Error Low=-9.9E05
8010	CHANNEL 2 VALUE (Return Temp.)	R	Error Hi=9.9E05, Error Low=-9.9E05
8012	CHANNEL 3 VALUE (Remote SP Temp.)	R	Error Hi=9.9E05, Error Low=-9.9E05
8014	REMOTE SETPOINT	R	
8016	LOW DEVIATION	R/W	
8018	HI DEVIATION	R/W	
8020	LOW SETPOINT	R	
8022	HI SETPOINT	R	
8024	REXMIT RANGE LOW	R/W	
8026	REXMIT RANGE HI	R/W	
8028	LOW SAFETY TEMP USER	R/W	
8030	HI SAFETY TEMP USER	R/W	
8032	PROPORTIONAL BAND - COOL DRIVEN ALG.	R/W	
8034	PROP BAND RATIO (Scaled x10)	R/W	
8036	ZERO CAL CHAN 0	R	
8038	ZERO CAL CHAN 1	R	
8040	ZERO CAL CHAN 2	R	
8042	ZERO CAL CHAN 3	R	
8044	SPAN CAL CHAN 0	R	
8046	SPAN CAL CHAN 1	R	
8048	SPAN CAL CHAN 2	R	
8050	SPAN CAL CHAN 3	R	
8052	NOT USED	X	
8054	NOT USED	X	
8056	VENT SEQ CANCEL TEMP	R/W	
8058	PUMP RUN HOURS	R	
8060	LOW SAFETY TEMP FACT	R	
8062	HI SAFETY TEMP FACT	R	
8064	NOT USED	X	
8066	NOT USED	X	
8068	NOT USED	X	
8070	NOT USED	X	
8072	NOT USED	X	
8074	SUPPLY TEMP INPUT OFFSET	R/W	
8076	RETURN TEMP INPUT OFFSET	R/W	
8078	REMOTE SP INPUT OFFSET	R/W	
8080	FLOW INPUT OFFSET	R/W	
8082	NOT USED	X	
8084	REM SETPOINT LOW	R/W	
8086	REM SETPOINT HI	R/W	

(continued)

Modbus Registers (Continued)

8088	ZERO CAL LINEAR CHAN 0 (4-20mA, 0-1V)	R	
8090	ZERO CAL LINEAR CHAN 1 (4-20mA, 0-1V)	R	
8092	ZERO CAL LINEAR CHAN 2 (4-20mA, 0-1V)	R	
8094	ZERO CAL LINEAR CHAN 3 (4-20mA, 0-1V)	R	
8096	SPAN CAL LINEAR CHAN 0 (4-20mA, 0-1V)	R	
8098	SPAN CAL LINEAR CHAN 1 (4-20mA, 0-1V)	R	
8100	SPAN CAL LINEAR CHAN 2 (4-20mA, 0-1V)	R	
8102	SPAN CAL LINEAR CHAN 3 (4-20mA, 0-1V)	R	
8104	CJC ZERO CAL	R	
8106	TC SPAN CAL CHAN 0	R	
8108	TC SPAN CAL CHAN 1	R	
8110	TC SPAN CAL CHAN 2	R	
8112	TC SPAN CAL CHAN 3	R	
8114	NOT USED	X	
8116	NOT USED	X	
8118	PANEL (CJC) TEMPERATURE	R	
8120	NOT USED	X	
8122	NOT USED	X	
8124	PROPORTIONAL BAND - HEAT DRIVEN ALG.	R/W	
8126	COOL LOW DEVIATION FOR CONTROL	R/W	
8128	HEAT HIGH DEVIATION FOR CONTROL	R/W	
8130	HEAT LOW DEVIATION FOR CONTROL	R/W	
8132	ZERO CAL LINEAR CHAN 0 (0-10V)	R	
8134	ZERO CAL LINEAR CHAN 1 (0-10V)	R	
8136	ZERO CAL LINEAR CHAN 2 (0-10V)	R	
8138	ZERO CAL LINEAR CHAN 3 (0-10V)	R	
8140	SPAN CAL LINEAR CHAN 0 (0-10V)	R	
8142	SPAN CAL LINEAR CHAN 1 (0-10V)	R	
8144	SPAN CAL LINEAR CHAN 2 (0-10V)	R	
8146	SPAN CAL LINEAR CHAN 3 (0-10V)	R	
8148	HEAT CALLS (1 count=10000 calls)	R	
8150	COOLDOWN SHUTDOWN TEMPERATURE	R/W	
8152	FLOW RATE	R	Always in GPM
8154	FLOW ALARM THRESHOLD	R/W	Always in GPM

(continued)

Modbus Registers (Continued)

Remote Resistor Control

The ability to remotely control certain functions by applying a precision resistance to of the analog inputs is provided. This feature is intended to allow for limited remote control ability without a communications bus.

Resistance	Description	Display		Action
Open (> 372Ω)	No alarm	rES	non	Nothing.
365Ω ± 7Ω	External Machine Control	rES	tSt	Nothing, test display only.
340Ω ± 7Ω	Spare	rES	U 1	Nothing. (U = unused)
324Ω ± 7Ω	Spare	rES	U 2	Nothing. (U = unused).
301Ω ± 7Ω	Spare	rES	U 3	Nothing. (U = unused).
280Ω ± 7Ω	Spare	rES	U 4	Nothing. (U = unused).
261Ω ± 7Ω	Spare	rES	U 5	Nothing. (U = unused).
243Ω ± 7Ω	External Message	SYS	FLo	Display message only, no action.
226Ω ± 7Ω	External Message	SYS	CLd	Display message only, no action.
210Ω ± 7Ω	External Message	SYS	hot	Display message only, no action.
196Ω ± 4Ω	External Setpoint Control	inC	SP	Increment setpoint by 1°.
187Ω ± 4Ω	External Setpoint Control	dEC	SP	Decrement setpoint by 1°.
174Ω ± 4Ω	Spare	rES	U 6	Nothing. (U = unused).
162Ω ± 4Ω	Spare	rES	U 7	Nothing. (U = unused).
150Ω ± 4Ω	External Mode Control	S iL	bUt	ALARM SILENCE Button Press
140Ω ± 4Ω	External Mode Control	PUr	bUt	PURGE Button Press
130Ω ± 4Ω	External Mode Control	Cd	bUt	COOLDOWN Button Press
121Ω ± 4Ω	External Mode Control	StP	bUt	STOP Button Press
110Ω ± 4Ω	External Mode Control	rUn	bUt	RUN Button Press
100Ω ± 4Ω	Spare	rES	U 8	Nothing. (U = unused)
90.9Ω ± 2Ω	Spare	rES	U 9	Nothing. (U = unused)
80.6Ω ± 2Ω	Spare	rES	U 10	Nothing. (U = unused)
69.8Ω ± 2Ω	Spare	rES	U 11	Nothing. (U = unused)
59.0Ω ± 2Ω	Spare	rES	U 12	Nothing. (U = unused)
49.9Ω ± 2Ω	Spare	rES	U 13	Nothing. (U = unused)
40.2Ω ± 2Ω	Spare	rES	U 14	Nothing. (U = unused)
30.1Ω ± 2Ω	External Machine Control	HEt	oFF	Turn off heat.
25.5Ω ± 2Ω	External Machine Control	CoL	oFF	Turn off cooling.
20.0Ω ± 2Ω	External Machine Control	PH	oFF	Turn off pump and heat.
15.0Ω ± 2Ω	External Machine Control	PHC	oFF	Turn off pump and heat and cooling.
10.0Ω ± 2Ω	External Machine Control	LoC	oUt	Turn off pump and heat and lockout until power cycle.
0.00Ω + 7Ω (Short)	Not possible	rES	Sht	Nothing, show on display only.

Pressure Switch Settings

All 250° F {121° C} maximum set point temperature units require 25 psig to operate.
For 250° F {121° C} maximum set point temperature and 48 kW heater units the unit with 36 kW of heat will operate at 25 psig, the last 12 kW of heat will not operate without at least 35 psig in the suction side tank.
For 300° F {149° C} units please refer to the tables below.

Direct Injection Units at 300 °F {149° C}									
Minimum System Pressure Required for System Operation (in psig) for 60 Hz Input Power (Digit 7 of Part # is B,C, F, A or D)									
Heater Capacity (Digit 7 of Part #)		Pump Power (Digit 6 of Part #)							
		¾ hp	1 hp	2 hp	3 hp	5 hp	7½ hp	10 hp	Description
Description	Digit 7 Value	D	E	H	J	K	L	M	Digit 6 Value
0 kW	0	60	60	60	60	60	60	60	
3 kW	A	65	65	65	60	60	60	60	
6 kW	B	65	65	65	60	60	60	60	
9 kW	C	65	65	65	60	60	60	60	
12 kW	D	65	65	65	60	60	60	60	
18 kW	E	65	65	65	60	60	60	60	
24 kW	F	60	60	60	60	60	60	60	
36 kW	G	N/A	75	75	75	60	60	60	
48 kW*	H	N/A	75	75	75	60	60	60	
* For 300°F {149° C}, 48 kW, Direct Injection units the minimum pressure in the suction tank for the 12 kW heater to operate is 80 psig									
Minimum System Pressure Required for System Operation (in psig) for 50 Hz Input Power (Digit 7 of Part # is E)									
Heater Capacity (Digit 7 of Part #)		Pump Power (Digit 6 of Part #)							
		½ hp	¾ hp	1 hp	2 hp	3 hp	5 hp	7½ hp	Description
Description	Digit 7 Value	C	D	E	H	J	K	L	Digit 6 Value
0 kW	0	60	60	60	60	60	60	60	
3 kW	A	N/A	70	70	70	60	60	60	
6 kW	B	N/A	70	70	70	60	60	60	
9 kW	C	N/A	70	70	70	60	60	60	
12 kW	D	N/A	70	70	70	60	60	60	
18 kW	E	N/A	70	70	70	60	60	60	
24 kW	F	N/A	70	70	70	70	60	60	
36 kW	G	N/A	N/A	N/A	N/A	75	60	60	
48 kW*	H	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Pressure Switch Settings(continued)

Closed Circuit Units at 300 °F {149° C}									
Minimum System Pressure Required for System Operation (in psig) for 60 Hz Input Power (Digit 7 of Part # is B,C, F, A or D)									
Heater Capacity (Digit 7 of Part #)		Pump Power (Digit 6 of Part #)							
		¾ hp	1 hp	2 hp	3 hp	5 hp	7½ hp	10 hp	Description
Description	Digit 7 Value	D	E	H	J	K	L	M	Digit 6 Value
0 kW	0	60	60	60	60	60	60	60	
3 kW	A	65	65	65	65	60	60	60	
6 kW	B	65	65	65	65	60	60	60	
9 kW	C	65	65	65	65	60	60	60	
12 kW	D	65	65	65	65	60	60	60	
18 kW	E	65	65	65	65	60	60	60	
24 kW	F	65	60	60	60	60	60	60	
36 kW	G	N/A	N/A	N/A	N/A	60	60	60	
48 kW*	H	N/A	75	75	75	60	60	60	
Minimum System Pressure Required for System Operation (in psig) for 50 Hz Input Power (Digit 7 of Part # is E)									
Heater Capacity (Digit 7 of Part #)		Pump Power (Digit 6 of Part #)							
		½ hp	¾ hp	1 hp	2 hp	3 hp	5 hp	7½ hp	Description
Description	Digit 7 Value	C	D	E	H	J	K	L	Digit 6 Value
0 kW	0	60	60	60	60	60	60	60	
3 kW	A	70	70	70	70	60	60	60	
6 kW	B	70	70	70	70	60	60	60	
9 kW	C	70	70	70	70	60	60	60	
12 kW	D	70	70	70	70	60	60	60	
18 kW	E	70	70	70	70	60	60	60	
24 kW	F	75	70	70	70	75	70	70	
36 kW	G	N/A	N/A	N/A	N/A	N/A	70	70	
48 kW*	H	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Mold Purge Installation Instruction Sheet

PRH020-0915

1 Install external ball valve into cooling water inlet if necessary in order to shut off of water supply.

2 Remove 1/2" NPT plug from port in the discharge tank where the mold purge components are to be attached, between the pressure relief valve and 'To Process' connection.

3 Starting with part closest to tank from Detail D on Sheet 2. Add sealant to threads and attach components to tank.

– Flow direction arrow on solenoid valve closest to discharge tank should point away from unit. Flow direction arrow on the valve attached to air fitting should point towards discharge tank. See Detail D.

4 Assemble the two flexible metallic conduit to 1/2" NPT elbows, Item 9, to the solenoid valves, Items 4 and 5.

5 Attach the 1/2" pulling elbow, Item 11, to the back of the mechanical enclosure with the male end going through the hole labeled in Detail A, and the female end pointing straight up. Attach the duplex connector, Item 10, to the female end of the elbow.

6 Cut the flex metallic conduit, Item 7, into two pieces long enough to carry the wires of each solenoid valve to the duplex connector on the back of the mechanical enclosure.

7 Using anti-short bushings, Item 8, on each end of the conduit pieces run the wires of the solenoid valves through the separate pieces of flex conduit, the duplex connector and elbow, the mechanical enclosure, the hole towards the bottom of the electrical enclosure back panel labeled in Detail B and into the electrical enclosure.

8 Secure the flexible conduit pieces in the elbows on the solenoid valves and the duplex connector.

9 If installing on a Standard unit, knock out the hole in the electrical enclosure top panel labeled in Figure C for the mold purge push button, and replace the overlay.

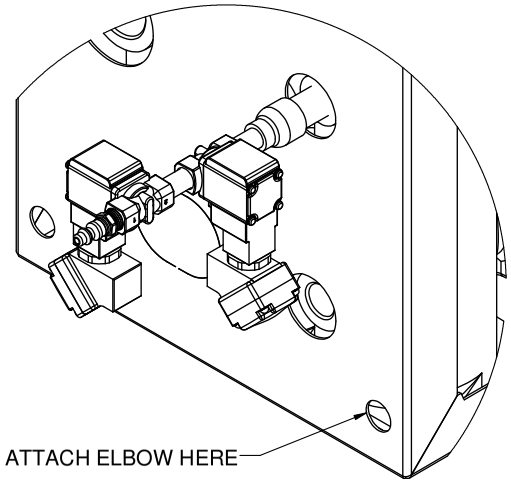
10 Wire the electrical components according to the mold purge option in the control schematic. This drawing is included in the customer prints originally sent with the unit. Contact Conair Customer Service Department to receive a copy (US – 800 458 1960, International - +1 814 437 6861) :

– Value Units – 334086-BE-xM-00*, Sheet 3, AA24
– Standard Units
  - Non-SSR – 334086-NE-xM-x0*, Sheet 3, AA24
  - SSR – 334086-NE-xE-x0*, Sheet 3, AA24
– Premium Units
  - Non-SSR – 334086-PE-xM-0*, Sheet 3, AA24
  - SSR – 334086-PE-xE-x0*, Sheet 3, AA24

*"x" may be any digit.

11 If installing on a TW-S TCU, secure the push button, Item 15, into the knocked out hole in the electrical enclosure top panel.

(continued)

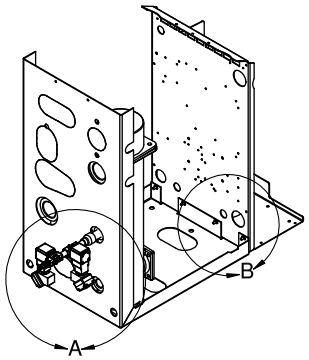


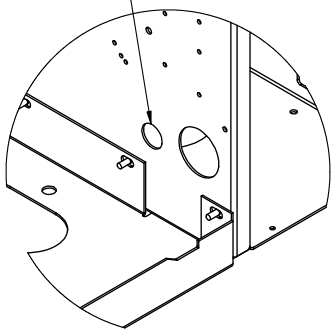
DETAIL A

ITEM NO.	QTY.	U/M	PART NUMBER	LOC	DESCRIPTION
1	1	EA	19005406		NIPPLE, 1/2" NPT x 2"
2	1	EA	19110505		REDUCER, 1/2" x 1/4" NPT
3	2	EA	19001906		NIPPLE, 1/4" NPT x 1-1/2"
4	1	EA	26720107010101		SOLENOID, TCU, WATER, 1/4 NPT, 115VAC
5	1	EA	26720108010101		SOLENOID, TCU, AIR, 1/4 NPT, 115VAC
6	1	EA	24222102		AIR FITTING, 1/4 NPT, TOMCO 200
7	2	FT	20700201		3/8" FLEXIBLE METALLIC CONDUIT
8	4	EA	09002546		3/8" FMC ANTI-SHORT BUSHINGS
9	2	EA	09002091		3/8" FMC TO 1/2" NPT 90° ELBOW
10	1	EA	09004709		3/8" FMC TO 1/2" NPT DUPLEX CONNECTOR
11	1	EA	20700455		1/2" PULLING ELBOW (FEMALE/MALE)
12	1	EA	26695050		SUPPRESSOR; RC
13	CHT	EA	26684950		RELAY; SPDT, 6A, 250VAC; 115VAC COIL
14	CHT	EA	26684952		RELAY; SPDT, 6A, 250VAC; 24VDC COIL
15	CHT	EA	27700221		PUSHBUTTON, YELLOW
16	CHT	EA	334086-XX-XX		OVERLAY
17	1	EA	PRH020-0915		FIELD INSTALLATION INSTRUCTIONS

NOTES:
1. SEE SHEET 2 FOR CHARTED ITEMS

2. SELECT OVERLAY, ITEM 16, ACCORDING TO THE ALARMS INSTALLED AND TYPE OF COMMUNICATION ON THE CURRENT UNIT. SEE TABLE 2 ON SHEET 2 FOR PART NUMBER.





DETAIL B

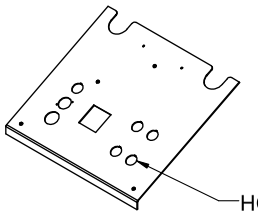


FIGURE C

NOTE:
ITEMS 7-17 NOT SHOWN

REV	BY	DESCRIPTION	DATE	APP	ECN	DWG
A	NRP	INITIAL RELEASE	8/26/15	JWG	104535	

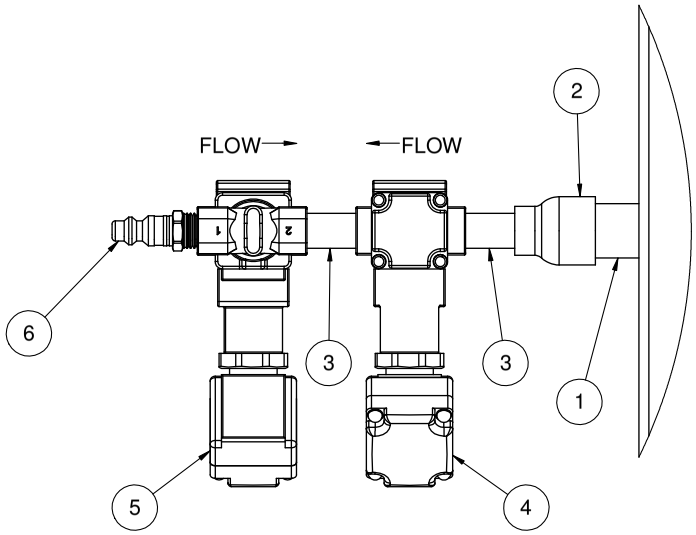
MACHINING TOLERANCES:	
FRACTIONS	±1/32
DECIMAL MACHINING:	
XX:	±0.015
XXX:	±0.005
FORMED SHEETMETAL:	±0.015
ANGLES:	±1/2°
FINISH:	125

The Conair Group Inc.
200 West Kensinger Drive
Cranberry Twp., PA 16066

A.01.8

UPGRADE KIT, MOLD PURGE, TCU

DRAWN BY:	DATE:	SHEET:	DWG NO.:	REV:
NRP	8/26/15	1 OF 2	33104601	A



DETAIL D

ASSEMBLY P/N	DESCRIPTION	ITEM 13 QTY.	ITEM 14 QTY.	ITEM 15 QTY.	ITEM 16 QTY.	ITEM 16 P/N
3310460101	VALUE CONTROL	0	0	0	0	N/A
3310460102	STANDARD CONTROL	1	0	1	1	SEE TABLE 2
3310460103	PREMIUM CONTROL	0	1	0	1	N/A

TABLE 1

DESCRIPTION	ITEM 16
STANDARD CONTROL, NO ALARMS, NO COMMUNICATIONS	334086-NL-05
STANDARD CONTROL, NO ALARMS, COMMUNICATIONS	334086-NL-06
STANDARD CONTROL, ALARMS, NO COMMUNICATIONS	334086-NL-07
STANDARD CONTROL, ALARMS, COMMUNICATIONS	334086-NL-08

TABLE 2
SEE NOTE 2

REV	BY	DESCRIPTION	DATE	APP	ECN	DXF
A	NRP	INITIAL RELEASE	8/26/15	JWG	104535	

MACHINING TOLERANCES:
FRACTIONS ±1/32
DECIMAL MACHINING:
XX: ±0.015
XXX: ±0.005
FORMED SHEETMETAL: ±0.015
ANGLES: ±1/2°
FINISH: 125

The Conair Group Inc.
200 West Kensinger Drive
Cranberry Twp., PA 16066 A01 S

UPGRADE KIT, MOLD PURGE, TCU

DRAWN BY: NRP | DATE: 8/26/15
SHEET: 2 OF 2 | DWG NO.: 33104601 | REV: A