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USER GUIDE

UGH051-1215

Thermolator TW-S

Temperature Control Unit

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: UGH051-1215

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-S 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

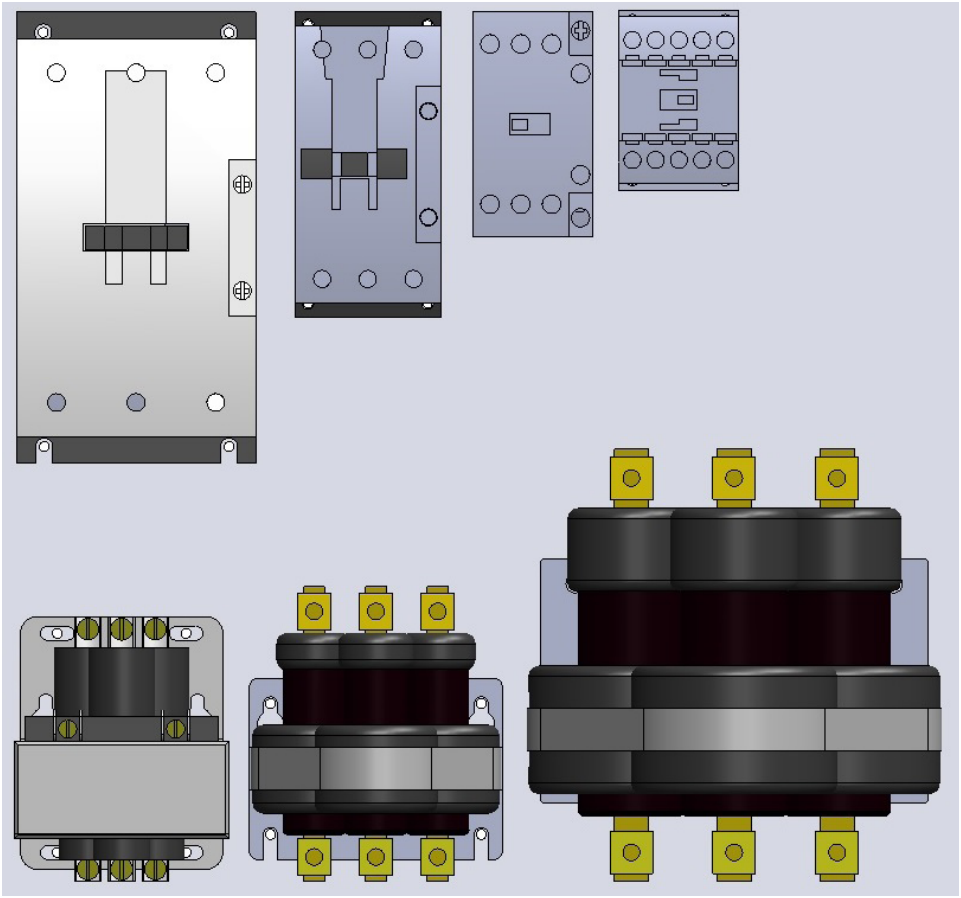
Surface temperatures inside the Thermolator can exceed 300° F {149° C}. Always allow the unit to cool below 100° F {38º C} before opening, servicing, or disassembling the unit.

⚠ 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

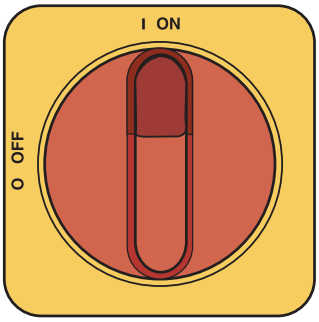


How to Use the Lockout Device

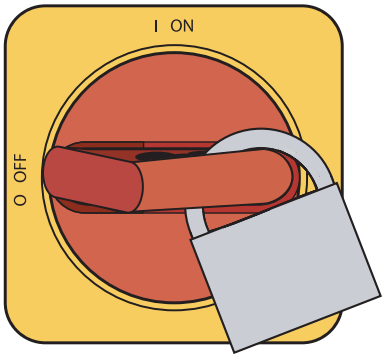
⚠ **CAUTION:** Before performing maintenance or repairs on this product, you should disconnect and lockout electrical power sources to prevent injury from unexpected energization or start-up. A lockable device may be provided to isolate this product from potentially hazardous electricity.

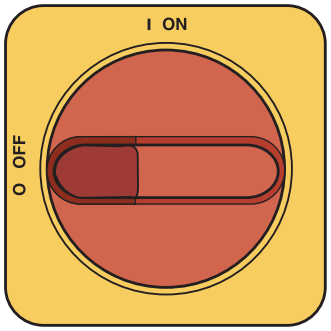
⚠ **WARNING:** Before removing lockout devices and returning switches to the ON position, make sure that all personnel are clear of the machine, tools have been removed and all safety guards reinstalled.

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 energy sources that need to be controlled.

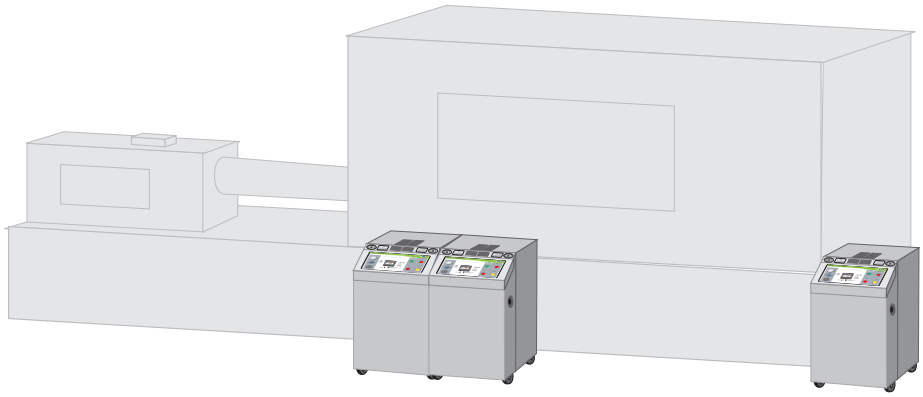
SECTION
2

Description

What is the Thermolator TW-S

The Thermolator TW-S 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-S 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.

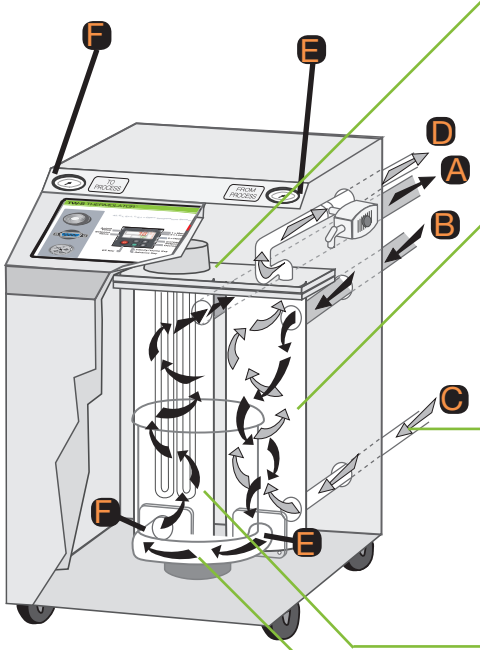
IMPORTANT: Do not use deionized water or glycol mixtures containing additives in the Thermolator. Softened water or glycol mixtures with additives, such as automotive fluids, can damage the Thermolator. Glycol/water process loop mixtures should use only industrial-grade ethylene or propylene glycol.

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-S 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.



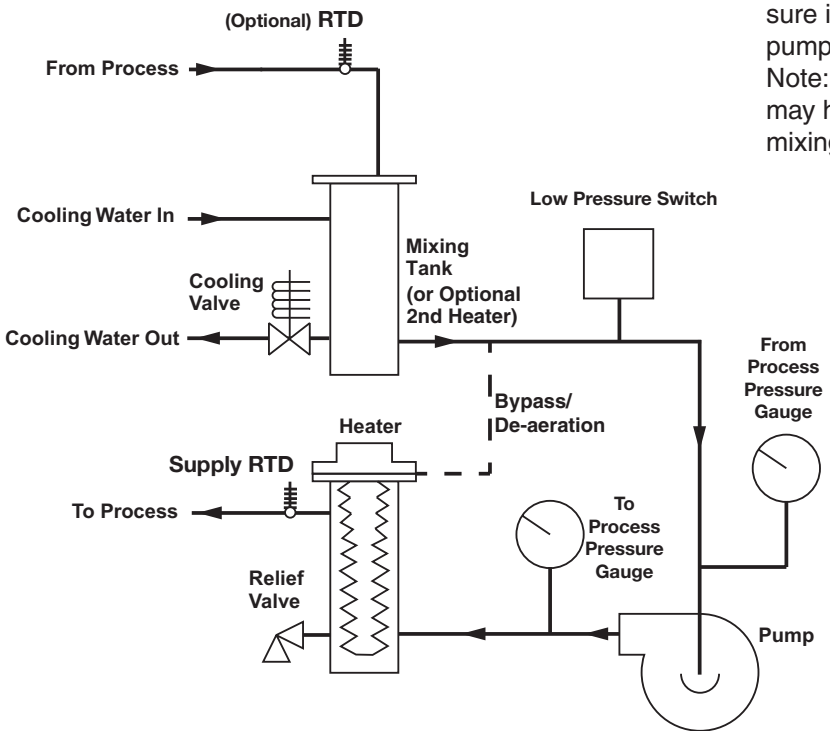
1 The temperature of the process fluid is measured as it leaves the unit's primary heater tank. The fluid then flows through the "To Process" line A to the mold or process. The fluid returns to the unit through the "From Process" line B for reheating or cooling.

2 The temperature of the process fluid may be 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.

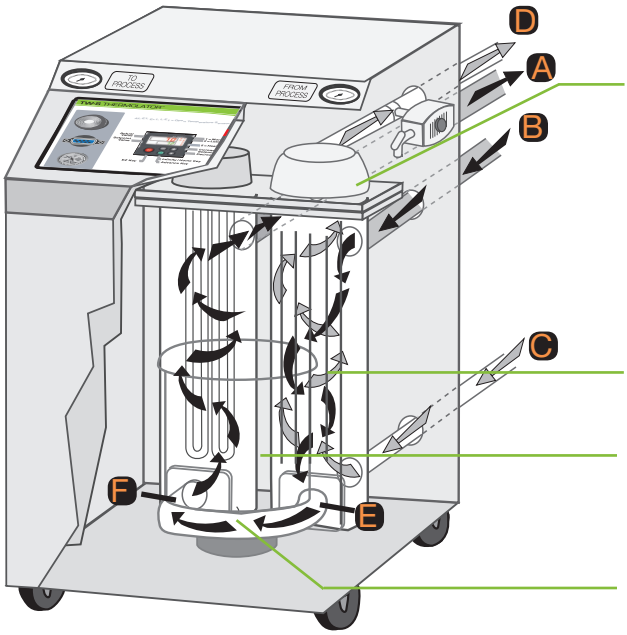
4 The pump moves water from the mixing tank into the heater tank. Pressure is measured before and after the pump with pressure gauges E and F. Note: Depending on your model, you may have an additional heater in the mixing tank.



TW-S Direct Injection

How the Closed Circuit Works

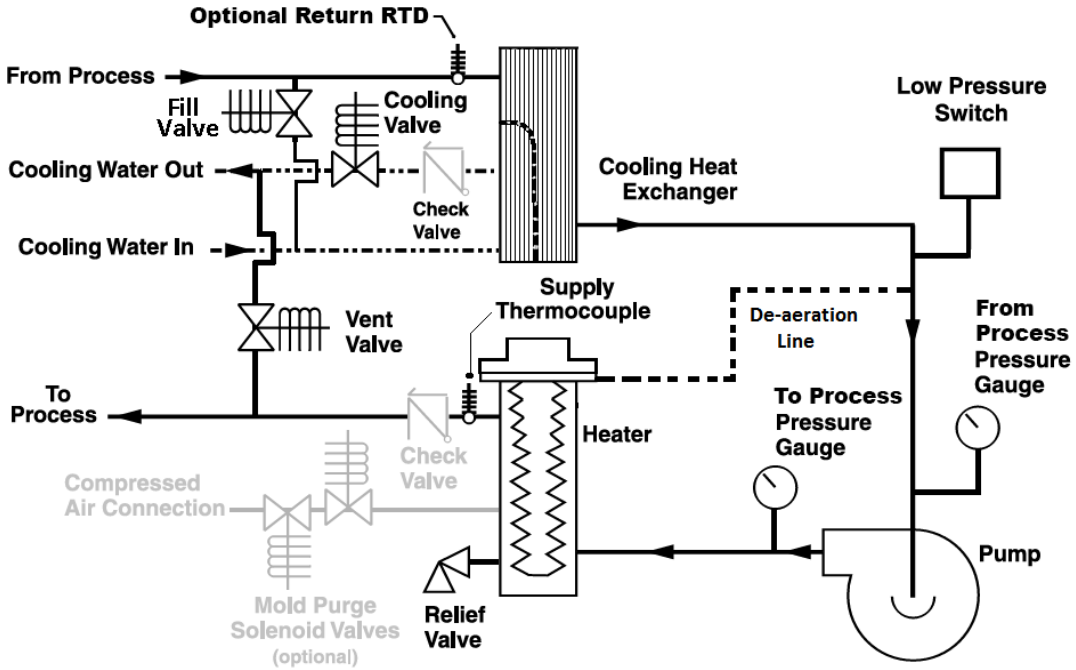
Closed Circuit models maintain the process temperature by electrically heating and indirectly cooling fluid in the process circuit. Cooling water supplied by a chiller, tower or other water source, is mixed with the process fluid only during the initial filling or when water is needed to make up process 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. 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.

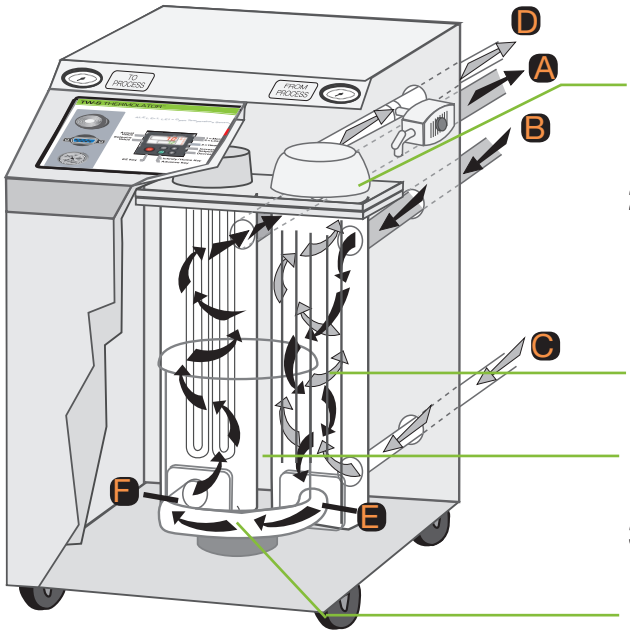
3. The pump moves water from the heat exchanger to the heater tank. Pressure is measured before and after the pump with pressure gauge E and F.



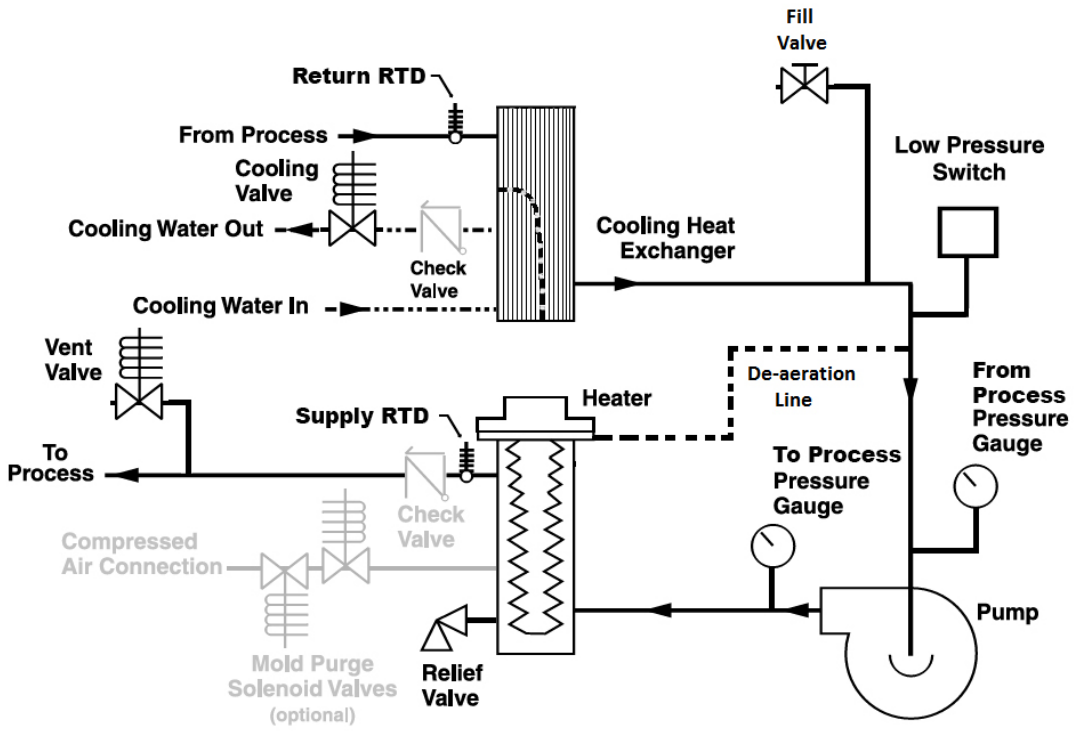
TW-S Closed Circuit

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.



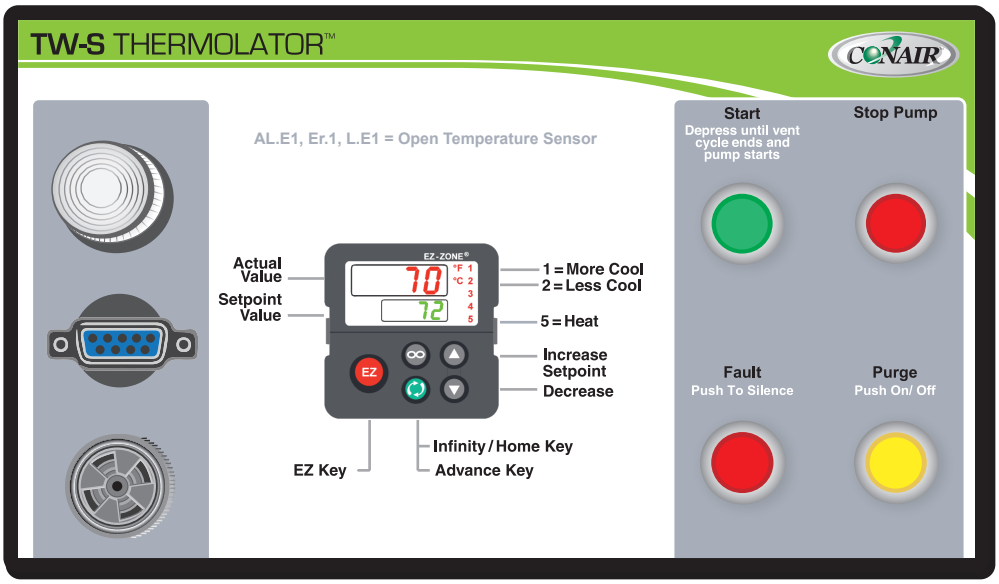
1. The temperature of the process fluid is measured as it leaves the unit's heater tank. The fluid then flows through the "To Process" line A to the mold or process. The fluid returns to the unit through the "From Process" line B for reheating or cooling.
2. If the temperature is above the setpoint value, 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.
3. 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-S Closed Circuit Separate Source

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

The TW-S Control - shown with optional features



MODEL	TW-S
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	3 LED's
Panel-mounted alarm lights	button/light
Audible alarm / Strobe light	❍

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.

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

MODEL	TW-P	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	13 LED's	1 LED
Panel-mounted alarm lights	(6) 7-segment	1 LED
Audible alarm / Strobe light	❍	

● = Standard ❍ = Optional

Specifications: TW-S

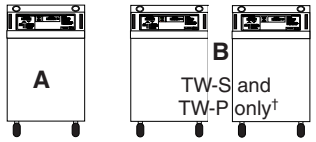
MODELS	TW-S (direct injection)‡	TW-S (closed circuit)§
Performance Characteristics		
Minimum setpoint temperature °F {°C}	40 {4}	40 {4}
Maximum setpoint temperature °F {°C}	250 {121}, (300 {149} optional)	250 {121}, (300 {149} optional)
Minimum operating temperature °F {°C}	Approximately 20° {11°} above the cooling water inlet temperature*	
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	9, 12, 18, 24, 36 or 48 kW	9, 12, 18, 24, or 36 kW
Connections to/from process NPT inches (female)	1.50	
Connections cooling water NPT inches (female)	1.00	

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	28.40 {721}	28.40 {721}
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 {131}	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

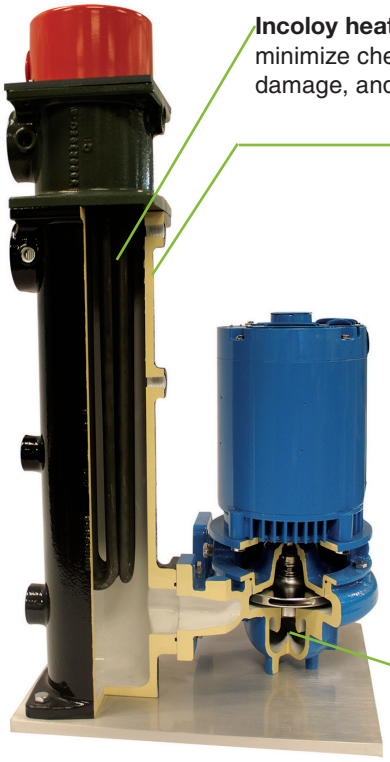
Heater	24 kW						36 kW						48 kW					
Voltage	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60	208/3/60	230/3/60	380/3/60	400/3/50	460/3/60	575/3/60
Pump size																		
0.75 Hp {0.56 kW}	63.6	63.6	36.6	36.6	31.7	25.6	93.7	93.7	54.0	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-S Features and Options



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

Two-piece cast
construction

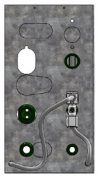
High efficiency pumps
from 3/4 to 10 Hp. Silicon carbide seals are standard.

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

Options

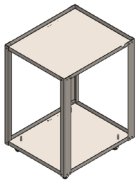
Modulating Valve
Sometimes referred to as a "floating valve", this option eliminates thermal shock from your process circuit by modulating the cooling water. If Modulating valve option is not chosen, the Solenoid valve replaces it.

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}.

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.

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.*

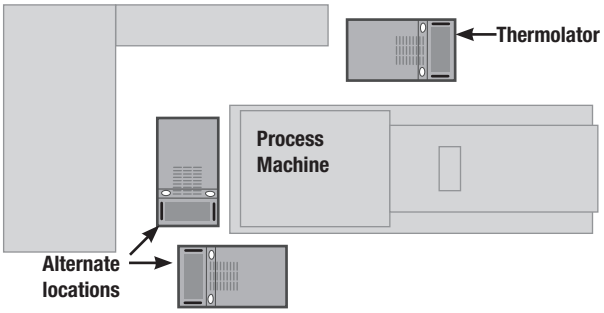
Preparing for Installation

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

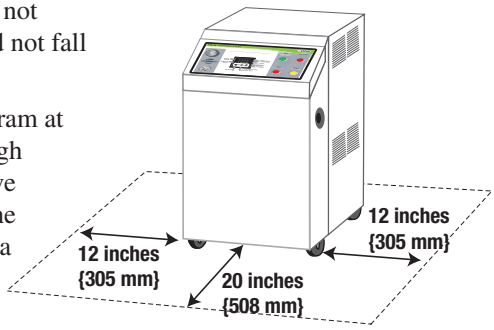
> ⚠ **WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.**
>
> This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type 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:

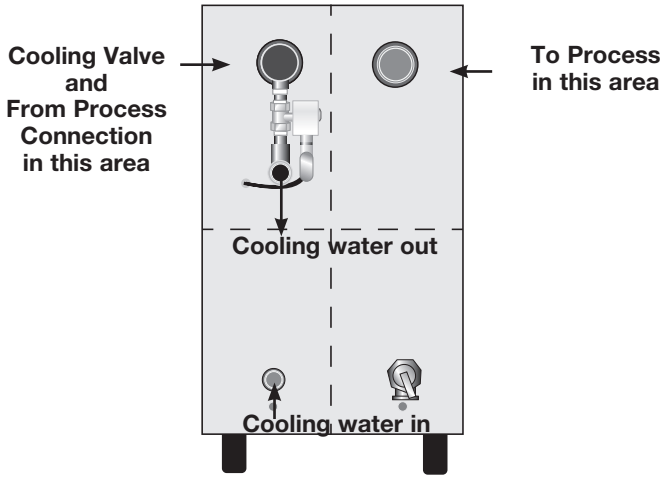
- ❒ *Pipe wrench large enough for a 2-inch pipe*
- ❒ *Premium quality Teflon thread sealant*

✎ **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.

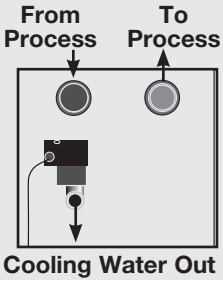
Connecting Process and Water Supply Lines Without Purge

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. An optional manual purge button controls this valve.

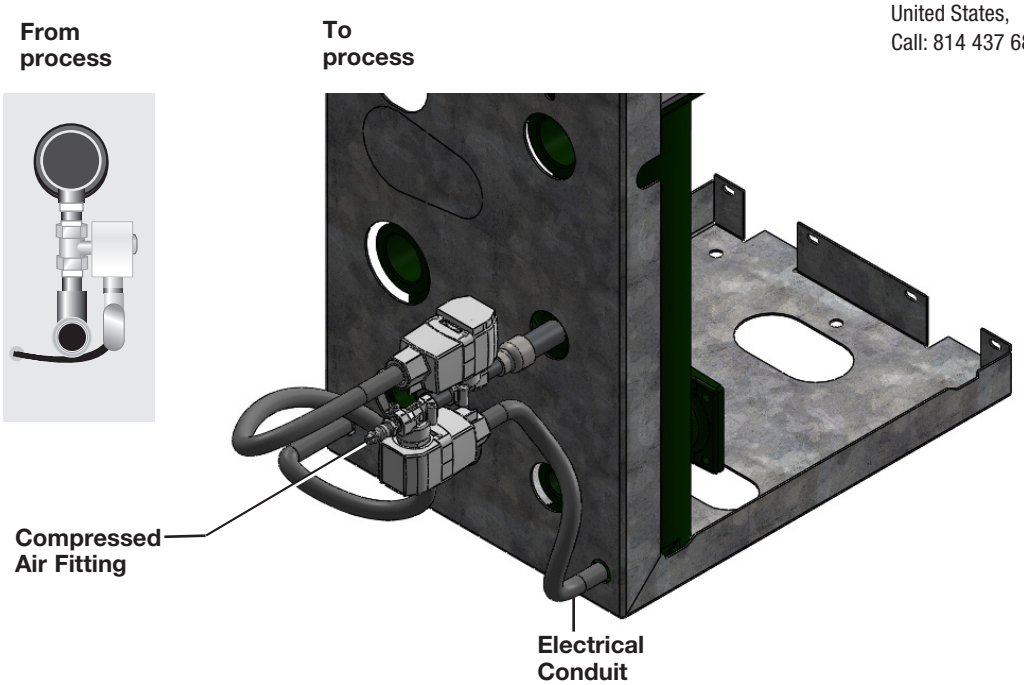
If this option is ordered with the Thermolator, purge control wiring and installation of the valve on the process line outlet of the unit is completed at the factory. You still must connect process and cooling water inlets and outlets, as well as supply of non-lubricated compressed air.

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.

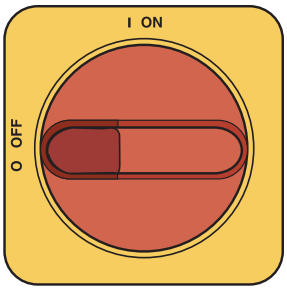
WARNING: Electrical hazard

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.



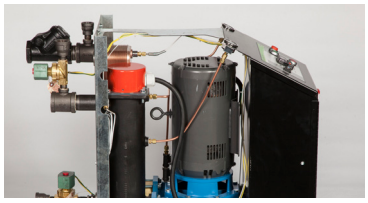
Optional Disconnect Switch

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:

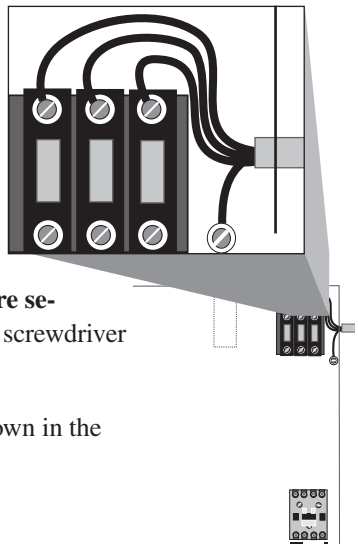
- ❒ Check the system for leaks.
- ❒ Verify that the voltage, phase, frequency, amperage, disconnect fuse, and minimum wire size meet the specifications.
- ❒ Verify that resistance to ground on each phase is at least 1 mega ohm (use a multi-meter, not a megger for this measurement).

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.

Parts of this test require 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.

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

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

Quickly press the **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.

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

4 **Press and hold the START button**

If everything is working correctly:

- The start button lights.
- The unit initiates a 30-second venting sequence. The pump starts 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 vent cycle does not begin and the pump does not start, 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 rough-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 rough-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*. For more detailed information about these parameters and instructions on returning the parameters to the initial factory setup, *see the Watlow EZ-Zone instruction manual* included with your instruction packet

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

Raise Key
Used to increase values or toggle between setting choices.
(Hold for fast-step progression)

Lower Key
Used to decrease values or toggle between setting choices.
(Hold for fast-step progression)

Menu Access Key
Used to enter or exit the menu system, index to the next menu, and enter the Security Level menu.

Operating Mode

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

1 **Press the infinity**  **key for two seconds** to ensure that you are viewing the home display.

2 **Press the**  **key until the following item is shown** (should require 12 presses):

PARAMETER TO CHANGE		POSSIBLE VALUES		
	User Settings Restore		User1 = Sets all parameters for a **cooling-driven** application. This can be used to load default cooling parameters in the system for a new tool.	*
			User2 = Sets all parameters for a **heating-driven application.** This can be used to load default heating parameters in the system for a new tool.	
			Do not use. Serious damage may result.	

* Default

3 **To change the value of this parameter, use the**  **and**  **buttons.**

4 **Press the**  **key to save the new value.**

✎ **NOTE:** The infinity  key can then be pressed for two seconds to return to the home display.

Temperature Units

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

1 **Press the infinity key for two seconds** to ensure that you are viewing the home display.

2 **Press the key until the following item is shown** (should require 8 presses):

PARAMETER TO CHANGE		POSSIBLE VALUES			
	Display Units			Fahrenheit	*
				Celsius.	

* Default

3 **To change the value of this parameter, use the and buttons.**

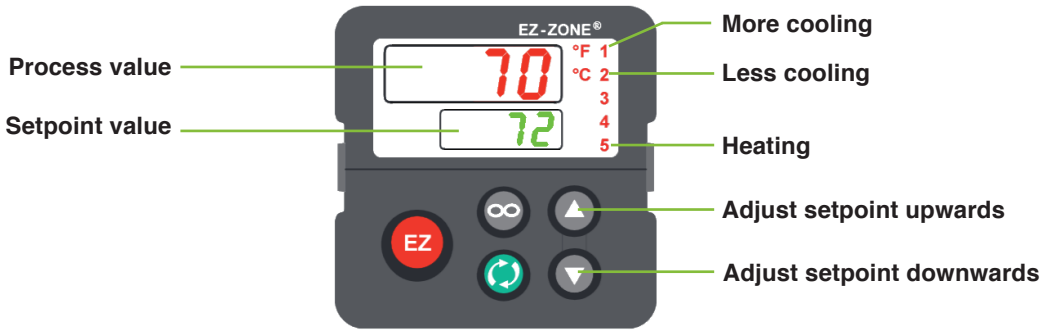
4 **Press the key to save the new value.**

✎ **NOTE:** The infinity key can then be pressed for two seconds to return to the home display.

Setpoint

1 **Press the infinity key for two seconds** to ensure that you are viewing the home display.

2 **Change the setpoint using the and buttons.** The value of the lower, green display should change accordingly. The new value will automatically be retained.



Alarm Points

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

1 **Press the infinity key for two seconds** to ensure that you are viewing the home display.

2 **Press the key until the following item is shown** (should require 10 presses):

PARAMETER TO CHANGE		POSSIBLE VALUES		
	Alarm Low Setpoint	Units are in degrees	The user can set this value so the machine will alarm when below this value. Alarm has a 3 second delay and a 1 degree hysteresis.	
Press the key to save the previous value and advance to the next item				
	Alarm High Setpoint	Units are in degrees	The user can set this value so the machine will alarm when above this value. Alarm has a 3 second delay and a 1 degree hysteresis	*

* Default

3 **To change the value of each of these parameters, use the and buttons.**

4 **Press the key to save the new value.**

✎ **NOTE:** The infinity key can then be pressed for two seconds to return to the home display.

SECTION
4

Operation

The TW-S Control

Start Button
Press and hold to begin normal operation. The button lights when the unit is running after vent cycle has completed.

Note: You must hold the button during entire unit cycle.

Status Lights
The lights indicate the operating status of the listed components.
= Off (inactive)
= On (active)
(1): More Cool
(2): Less Cool
(5): Heat

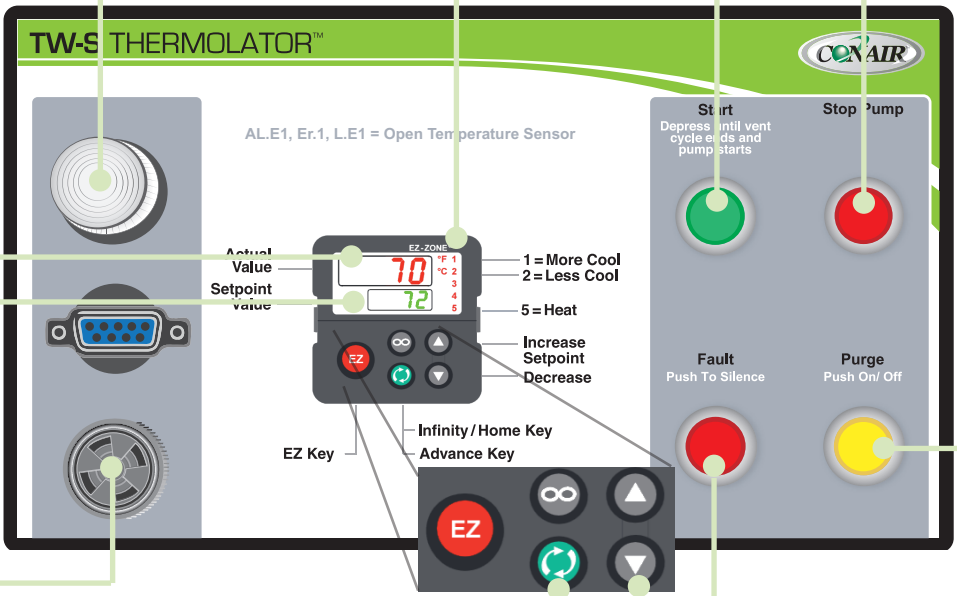
Stop Pump Button
Press to stop the Thermolator. Push again to de-assert and allow restart.

Alarm Strobe (Optional)

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

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

Audible Alarm (Optional)



Menu Access Key
Press and hold for three seconds to enter or exit the menu system. Press to index to the next menu.

This key also is used to enter the Security Level 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.

Fault Light and Audible Alarm Silence Button (Optional)
Press the red 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 illuminates to indicate high/low deviation, pump overload or over temperature condition.

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.

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.

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

Quick-Access Menu

To review or edit the quick-access menu, press the green  button to cycle through units. Use the up  and down  buttons to select a choice or change a value.

DISPLAY	ITEM	CHOICE	UNITS	DESCRIPTION
AUt 1	Autotune	no or YES	---	In cases where the default PID gains are not appropriate, the machine can perform a one-time autotune and select its own gains.
tEU 1	TRU-TUNE+ Enable	no or YES	---	This feature performs continuous adaptive tuning while the process is running. It is recommended that this is only run under close user supervision, as results may vary.
CPb 1	Cool Proportional Band	---	°F or °C	Proportional cooling response defines over what range of degrees the temperature controller will taper off its cooling. Cooling will be applied at 100% if the process temperature is more than the band value away from the setpoint. A smaller number will produce a more aggressive proportional response. If your system is not providing a strong enough cooling response for a given situation, this number may be made more aggressive (smaller).
hPb 1	Heat Proportional Band	---	°F or °C	Proportional heating response defines over what range of degrees the temperature controller will taper off its heating. Heating will be applied at 100% if the process temperature is more than the band value away from the setpoint. A smaller number will produce a more aggressive proportional response. If your system is not providing a strong enough heating response for a given situation, this number may be made more aggressive (smaller).

NOTE: 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 is very cold, you may want to make the cool proportional band larger than the heat proportional band.

(Continued)

Quick-Access Menu (Continued)

DISPLAY	ITEM	CHOICE	UNITS	DESCRIPTION
t.I	Time Integral	no or YES	sec	Integral response is used to eliminate steady-state error. A smaller number will produce a more aggressive integral response. If the process temperature is approaching setpoint very slowly, or taking a long time to reach it, this can be used to compensate.
td I	Time Derivative	no or YES	1/sec	Derivative response is used to eliminate overshoot. It is also used to compensate for the slow-responding floating valve option. A larger number will produce a more aggressive derivative response. If the system if overshooting, try a more aggressive derivative response. If the system stutters or temporarily reverses temperature direction as approaching setpoint, your derivative response is too aggressive.
db I	Dead Band	---	°F or °C	The distance around the setpoint where the temperature can vary without initiating a response from the controller.
C_F I	Display Units	---	°F or °C	Choose a unit for all temperature-based displays.
.CAI	Calibration Offset		°F or °C	This may be used if you need to provide a calibration offset on the RTD(s), or to calibrate the Thermolator to an external system or standard.
ALo4	Alarm Low Set Point		°F or °C	The user can utilize this setting to initiate alarming if the process fluid drops below a certain temperature.
Ah.4	Alarm High Set Point		°F or °C	The user can utilize this setting to initiate alarming if the process fluid goes above a certain temperature.
USr I	User Settings Restore	nonE or FCtY or SEt I or SEt2	---	Chose a heating-driven application (SEt I) or cooling-driven application (SEt2). To take no action, leave at the default nonE. Do NOT set to FCtY!

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

Many more parameters exist within the controller. *Consult the Appendix for specific information.* These parameters should only be adjusted by experienced individuals with guidance from Conair's Service Department.

Starting the Thermolator

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

If the controller has been locked with a passcode, you will not be able to change the setpoint temperature value. You may need to enter the passcode to modify any of the operating parameters, including the temperature setpoint. *See Appendices B and F for details.*

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

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.

4 **Ensure STOP**  **button is not asserted.**

5 **Press and hold START**  **until the vent cycle completes.**
If everything is working correctly:

- The unit initiates a 30-second venting sequence. The pump starts after the venting cycle is over.
- The START button lights once the pump starts.
- 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.

6 **Set the setpoint to the desired temperature**, Shown in green on the bottom 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.

7 **If the Fault light/alarm turns on, press FAULT**  to silence the optional audible alarm.
Refer to the Troubleshooting section for more information.

Stopping the Thermolator

WARNING: Electrical Shock and Hot Surface Hazards

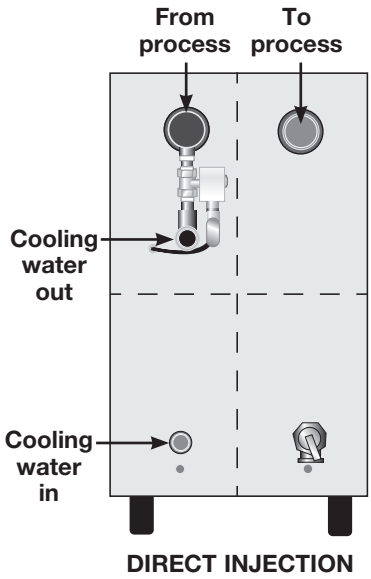
Before attempting maintenance of any kind on the Thermolator, you must stop the unit; disconnect and lockout the main power supply; and allow the unit to cool to less than 100° F {38° C}.

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 PUMP.**



DIRECT INJECTION

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 PUMP.**

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 PUMP.**

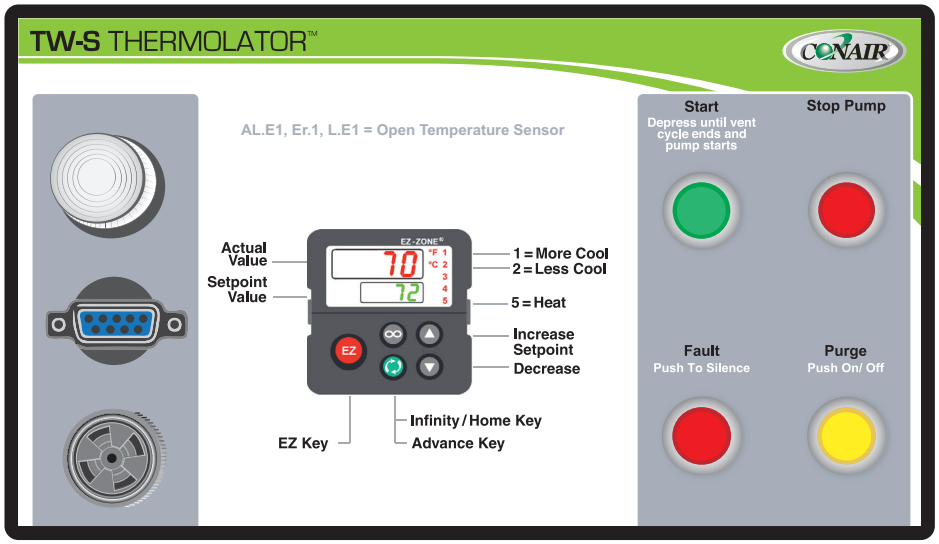
3 **Shut off the cooling water supply, and relieve any pressure in the unit** (see pressure gauge) by lifting the relief valve lever; then drain the unit of all fluid. The cooling water inlet hose must be removed to provide maximum draining.

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 Manual Purge Option

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



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 PUMP to stop the Thermolator.

2 Shut off the cooling water supply valve.

3 Press Purge to start purging.

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

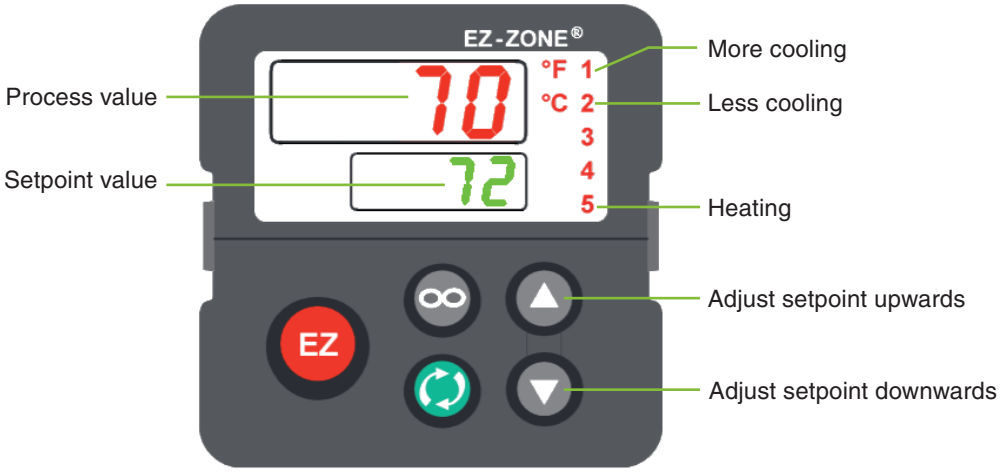
The time required to clear the process lines of fluid will vary according to the length of the process piping and the size of the tooling.

4 Release Purge to stop purging.

Conair TW-S Thermolator

Normal Operation

For normal operation of the TW-S, set the setpoint on the Watlow controller using the  and  buttons. On the display, the upper red display shows the current temperature, and the lower green display shows the setpoint. In the right-hand column, the digit "1" will illuminate for more cooling, digit "2" will illuminate for less cooling (used for floating valve option only), and digit "5" will illuminate for heat.



The remaining buttons  are not needed for normal operation.

Note that the controller is not used to execute basic control functions (such as START, STOP, and MOLD PURGE) on the Thermolator; it is only used to control the temperature loop. Use the **START, STOP** and **MOLD PURGE** (optional) buttons as necessary on the control panel next to the Watlow controller.

(Continued)

Conair TW-S Thermolator (Continued)

Changing Parameters

To review the basic system parameters, press the key to view some pre-selected, commonly changed, editable parameters. To change the value of a particular parameter, use the and buttons. After changing a value, pressing the key will both save the selected value and advance to the next parameter. Pressing no button will still save the parameter, but it will return to the home display.

PARAMETER		VALUES		
	Autotune – A one-time system tuning that will look at the system's step response and set the PID parameters accordingly.		Enable – Use only if default parameters are nor usable.	
			Disable	*
	Tru-Tune+ Enable – Applies continuous autotuning to the PID parameters.		Enable – Not recommended.	
			Disable	*
	Cool Proportional Band – The region around the setpoint where cooling transitions from 0% to 100%.	Units are in degrees.	The region between the setpoint and the setpoint plus this parameter value. Above this region, the cooling will be fully on. Within this region, the cooling will be throttled in proportion to the distance from the setpoint. Below this region, the cooling will be completely off. Increasing this value makes the tuning less aggressive.	7
	Heat Proportional Band – The region around the setpoint where heating transitions from 0% to 100%.	Units are in degrees.	The region between the setpoint and the setpoint minus this parameter value. Below this region, the heat will be fully on. Within this region, the heat will be throttled in proportion to the distance from the setpoint. Above this region, the heater will be completely off. Increasing this value makes the tuning less aggressive.	7

*Default

NOTE: For cooling-driven applications, a heat proportional response will be manifested by closing the cooling valve. The immersion heater only turns on when the process is significantly below setpoint.

(Continued)

Conair TW-S Thermolator (Continued)

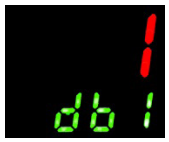
NOTE: Integral has no effect when the process value is outside the proportional band.

NOTE: Derivative has no effect when the process value is outside two times the proportional band. Increasing this value will tame overshoot, but too much increase will make the system sluggish.

NOTE: A negative deadband number will create an overlapping region where both heating and cooling will be simultaneously actuated (not recommended).

NOTE: Alarm has a 3 second delay and a 1 degree hysteresis.

NOTE: Alarm has a 3 second delay and a 1 degree hysteresis.

PARAMETER		VALUES		
	Time Integral – Use this to eliminate steady-state error of the system.	Units are in seconds.	With no integral control, the process temperature would always droop above (cooling) or below (heating) setpoint. Adding some integral action will ensure that, over time, the controller will take appropriate action to get the system exactly to setpoint.	Cooling-Driven: 200 Heating-Driven: 50
	Time Derivative – Use this to eliminate overshoot.		Derivative control will sense when the system is rapidly approaching setpoint and may overshoot. In this case, it will take action early to "back off" heating/cooling action so that the tendency to overshoot is reduced.	Cooling-Driven: 30 Heating-Driven: 15
	Deadband – Degrees from setpoint that the temperature can vary without any additional corrective measures by the controller.	Units are in degrees.	Deadband reduces wear on the Thermolator by exercising the heater and cooling valve less often. For overpowered (small thermal mass) systems, it can also decrease steady-state ripple by eliminating cycling of the cooling valve or heating elements. It may be decreased on systems with large thermal mass to achieve a more accurate tracking to setpoint.	1
	Display Units		Fahrenheit	*
			Celsius	
	Calibration Offset	Units are in degrees.	Used to calibrate RTD's or make multiple machines on the same fluid loop display the exact same temperature.	0
	Alarm Low Process Temperature	Units are in degrees.	The user can set this value so the machine will alarm when below this value.	32
	Alarm High Process Temperature	Units are in degrees.	The user can set this value so the machine will alarm when above this value. Alarm has a 3 second delay and a 1 degree hysteresis.	275

*Default

(Continued)

Conair TW-S Thermolator (Continued)

VALUES		
	Do Nothing	
	SEt 1 = Sets all parameters for a cooling-driven application. This can be used to load default cooling parameters in the system for a new tool.	*
	SEt 2 = Sets all parameters for a heating-driven application. This can be used to load default heating parameters in the system for a new tool.	
	FCtY = Do not use. Serious damage may result.	

*Default

✎ **NOTE:** The infinity ∞ key can be pressed for two seconds to return to the home display.

There are many additional parameters within the Watlow controller that can be adjusted for more atypical situations. Please consult with Conair for accessing and adjusting these parameters.

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United States,
Call: 814 437 6861

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.

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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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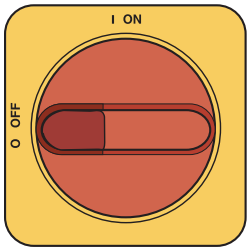
- **Every five years**
  - ❒ **Replace cooling fan in electrical cabinet.**

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}.



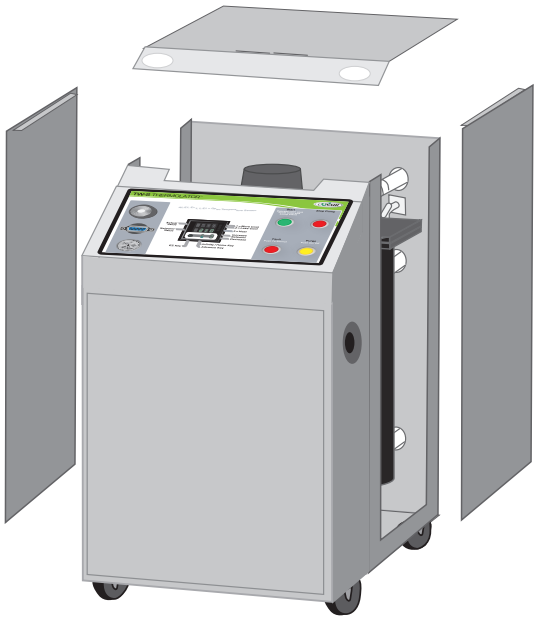
To access the Thermolator enclosure:

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.



Performing an Autotune

You may perform an Autotune after the first two hours of operation and whenever process variables change (changes in cooling water pressure, piping or molds, large ambient swings, new setpoint temperature) to ensure that the control continues to obtain good approximations of the PID constants used to compensate for the thermal lag of the system.

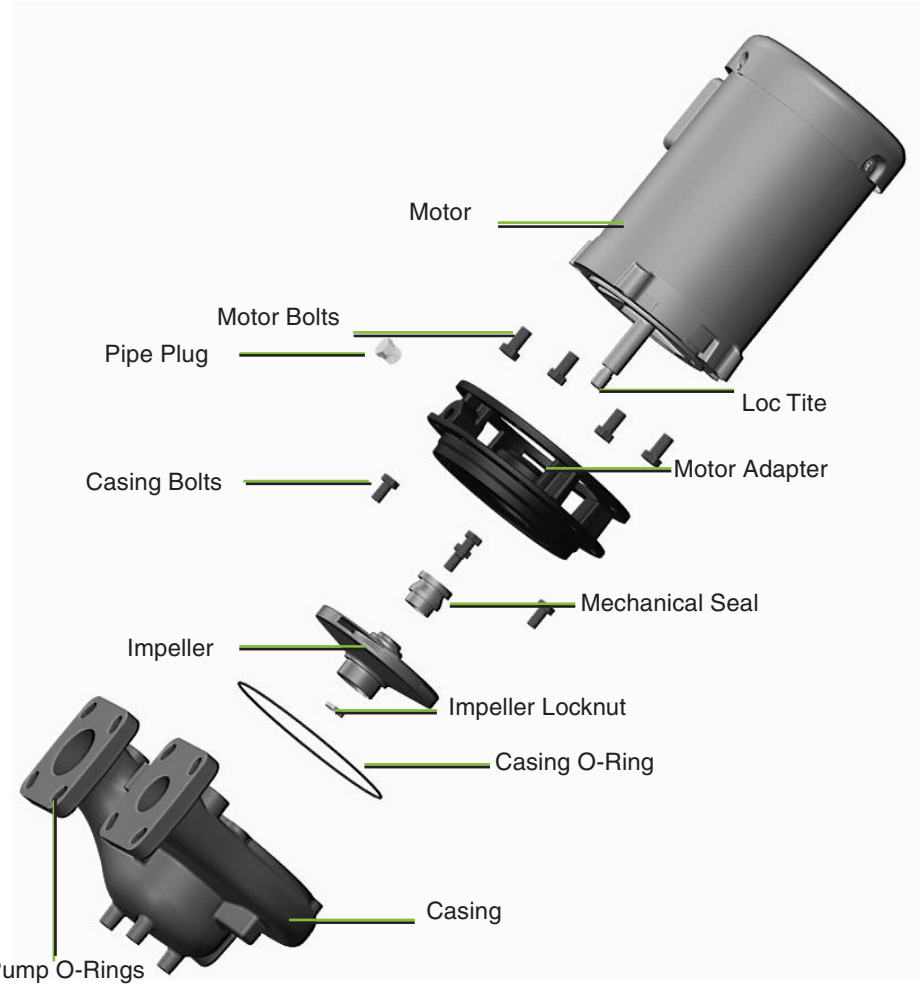
To ensure a successful Autotune, verify that:

- ❒ **The Thermolator has been stopped, cooled down, and the process value is stable.**
  A fluctuating process value will fool the software into making inaccurate tuning decisions. If the process value is not stable, the Autotune terminates and the control displays an error.

To perform an Autotune please refer to Appendix B.

(Continued)

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

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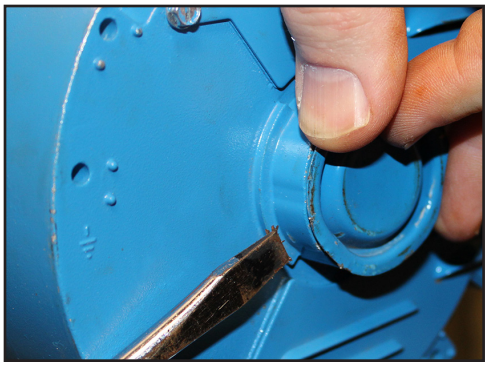
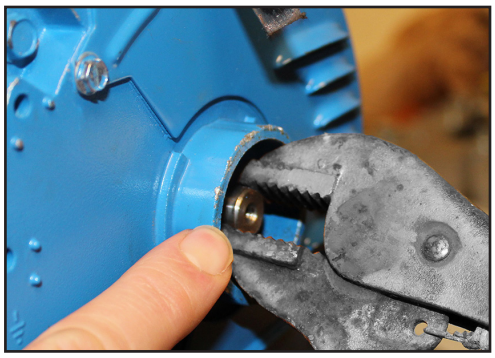
(Continued)

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.

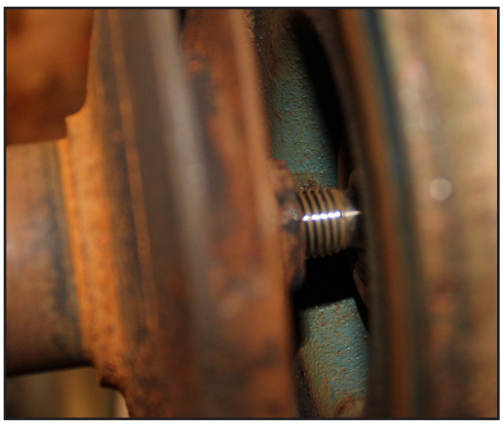


5 **Using a locking pair of pliers, grip the flat sides of the motor shaft.**



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)

Tools Required

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

Time Required

25 Minutes

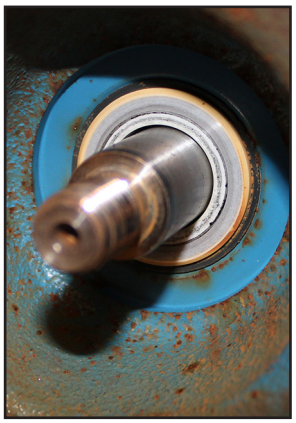
The following procedure can be used on all models with 1/2 to 3 Hp motors for reassembly:

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.

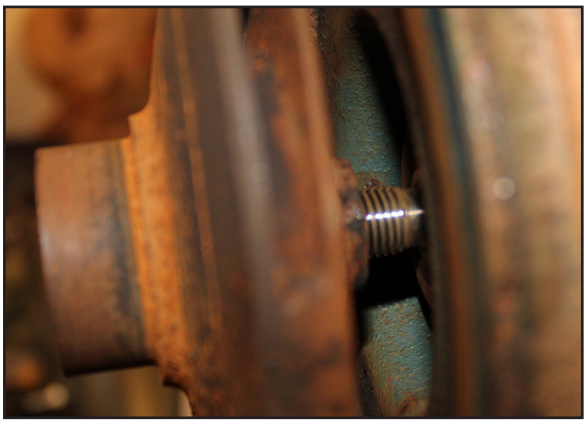
4 **Slide the rotating portion of the shaft seal onto the shaft** with the spring on the impeller side.



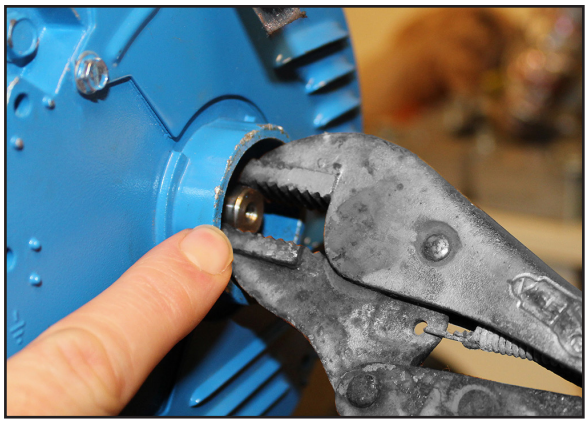
(Continued)

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

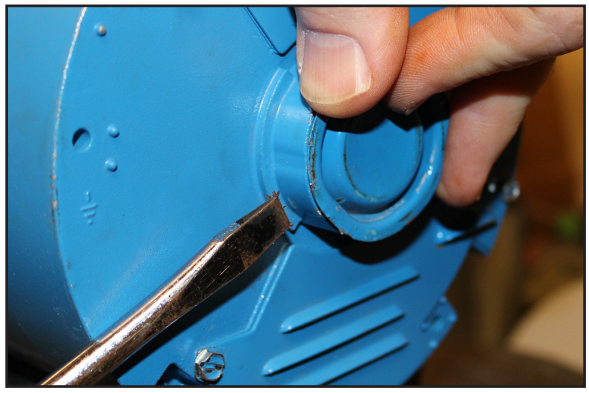
5 **Align the impeller and screw on to shaft.**



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}.**

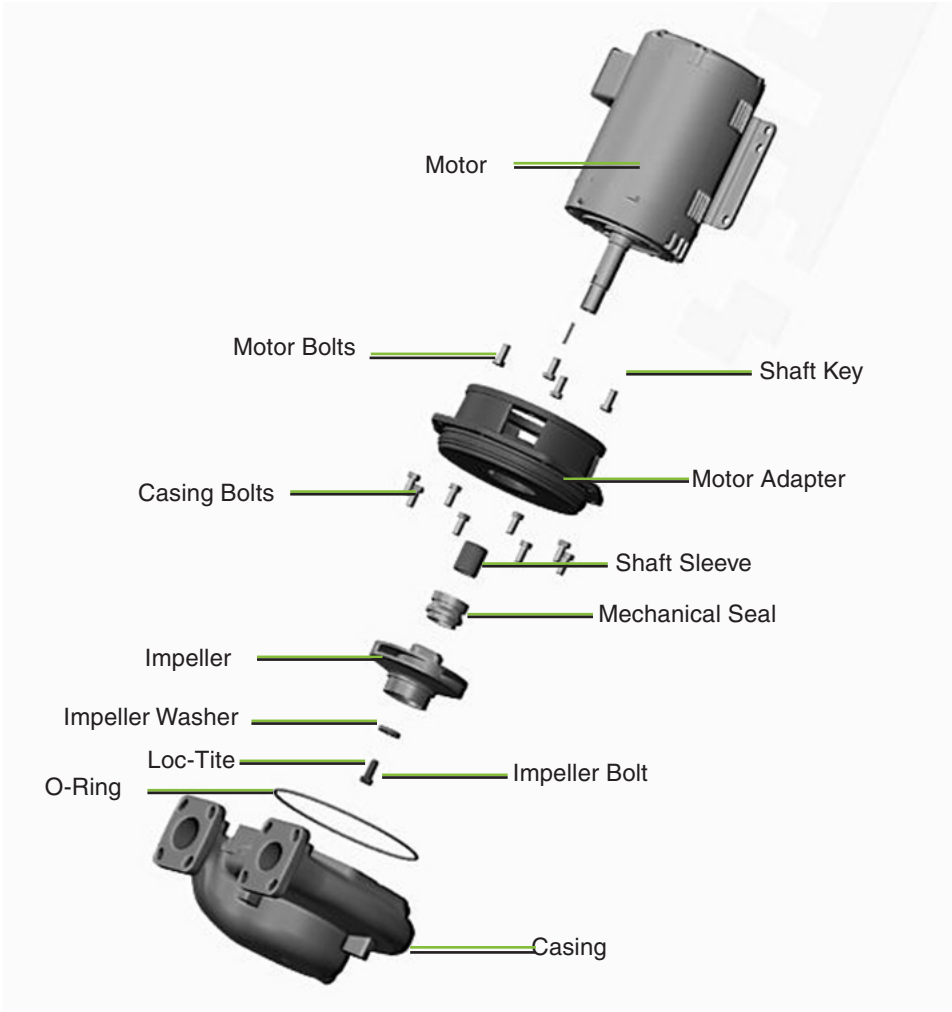
Removing the Pump Motor and Seal (5 to 10 Hp units)

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.

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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.

(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)

Tools Required

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

Time Required

60 Minutes

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}.**

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.

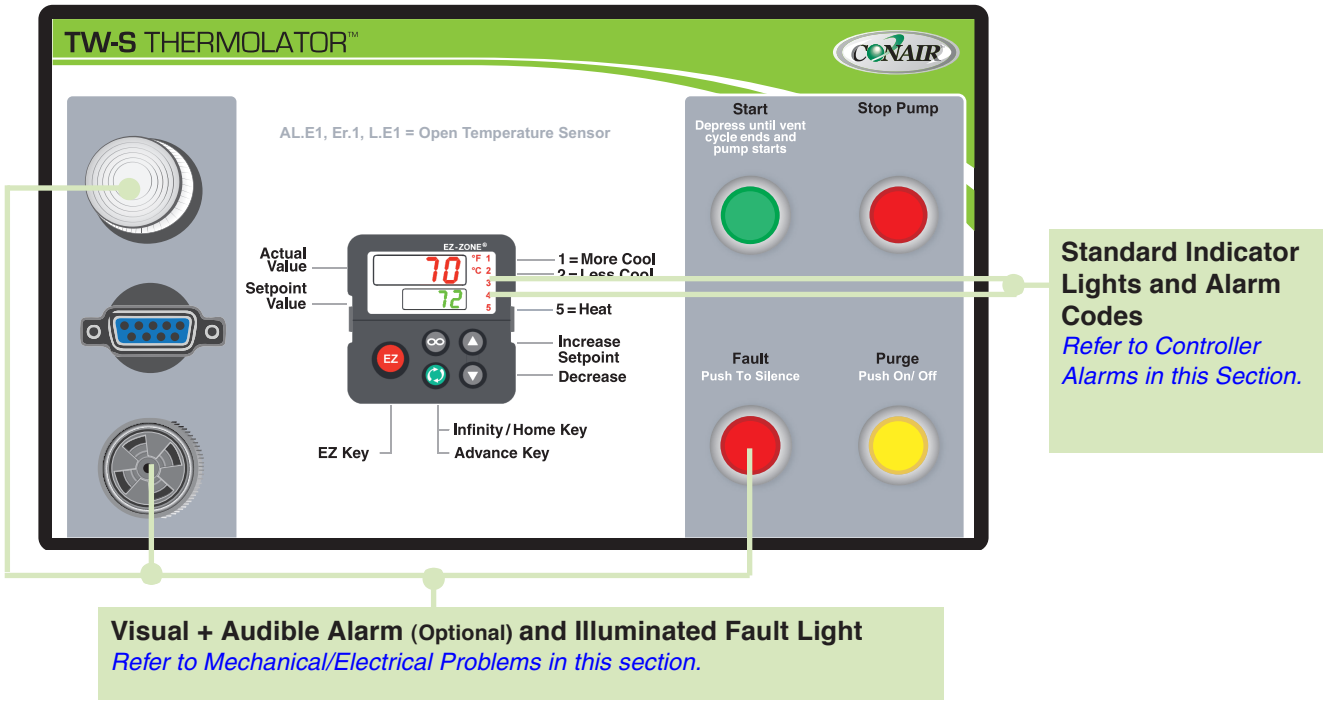
Before attempting maintenance of any kind on the Thermolator, you must stop the unit, disconnect and lockout the main power supply, and allow the unit to cool to less than 100° F {38° C}.

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-S. 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 lights 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.



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 that 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
AL.h 1 **High Temp. Alarm** The actual temperature of water supplied to the process exceeds the 275° F {135° C} (or 325° F {163° C}in units with high temperature option) high limit that is programmed in the controller **WARNING:** Only qualified electrical service personnel should examine and correct problems that require opening the unit's electrical enclosure or checking electrical current ◆ Fault light illuminated ◆ Optional strobe, sounds, dry contacts actuated ◆ Pump continues to run ◆ Heater contactor disengages ◆ Cooling valve activates	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 failed with contacts welded closed?	Replace the contactor if defective. *See Replacing the Heater Contactor.*

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem that 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
High Temp. Trip - Evident by showing 447° F {231° C} or similar on Display. The optional high temperature thermostat has tripped on the fluid line or the SSR (optional) heatsink thermostat has tripped. ◆ Fault light illuminated ◆ Optional strobe, sounds, contacts actuated ◆ Pump continues to run ◆ Heater contactor disengages ◆ Cooling valve activates	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 failed with contacts welded closed?	Replace the contactor if defective. *See Replacing the Heater Contactor.*
	Has the enclosure cooling fan failed?	Replace the fan.
	Is the airway for enclosure cooling obstructed?	Remove debris from airway. ✎ **NOTE:** In the case of a tripped SSR heatsink thermostat, the thermostat must be manually reset by depressing the button on the back of the thermostat.
	Has the optional high temperature limit switch failed?	Verify that the switch is closed near room temperature with a multimeter. If not, replace the optional temperature limit switch.

✎ **NOTE:** Fan draws air upwards from the underside of the unit and directs it through the heatsink if SSR model and into the enclosure.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem that 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
AL.h 1 **High Process Temperature** The Thermolator will not cool down, or takes too long to cool down. The actual temperature of fluid supplied to the process is higher than the setpoint deviation allows. ✎ This threshold is user- programmable up to 275° F {135° C} (or 325° F {163° C} for units with high-temperature option). **WARNING:** The Thermolator should be tested and repaired only by qualified technicians equipped with the correct tools and trained in the maintenance and repair of electrical systems and industrial appliances. ◆ Fault light illuminated ◆ Optional strobe, sounds, contacts actuated ◆ Pump continues to run ◆ Heater contactor disengages ◆ Cooling valve activates	Has water stopped flowing between supply outlet and return inlet?	Check for a plugged pipe or closed valve.
	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.
	Did a heater contactor fail with contacts welded closed?	Replace the contact 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. The recommended setting is the setpoint plus 2° F {4° C} to 10° F {18° C}. You can also increase the alarm time-delay from the default 3 seconds. Consult Conair service for changing this setting.
	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 water return pressure with valve.
	Has the cooling water supply pressure dropped?	Check water supply pressure. If equipped verify strainer not clogged.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem that 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
AL.L 1 **Low Process Temperature** The Thermolator will not heat to the setpoint temperature, or takes too long to reach the setpoint temperature. The actual temperature of fluid supplied to the process is lower than the setpoint deviation band allows. ✎ **NOTE:** This threshold is user- programmable down to 32° F {0° C}. **WARNING:** The Thermolator should be tested and repaired only by qualified technicians equipped with the correct tools and trained in the maintenance and repair of electrical systems and industrial appliances. ◆ Fault light illuminated ◆ Optional strobe, sounds, contacts actuated ◆ Pump continues to run ◆ Heater contactor disengages ◆ Cooling valve closes	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?	Decrease the alarm trigger point. The recommended setting is the setpoint minus 2° F {-4° C} to 10° F {-18° C}. You can also increase the alarm time-delay from the default 3 seconds. Consult Conair service for changing this setting.
	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.
	Is the pump turning the proper direction?	Verify correct rotation per Thermolator installation instructions.

(Continued)

Controller Alarms (Continued)

When an alarm occurs, the Thermolator has detected a problem that 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
Er. 1L **Open /Shorted Temperature Sensor (RTD)** The RTD in the process supply line is not working correctly. **WARNING:** The Thermolator should be tested and repaired only by qualified technicians equipped with the correct tools and trained in the maintenance and repair of electrical systems and industrial appliances. ◆ Fault light illuminated ◆ Optional strobe, sounds, contacts actuated ◆ Pump continues to run ◆ Heater contactor disengages ◆ Cooling valve opens.	Is the RTD wired correctly, or is the wire loose?	Check the wiring, terminal block jumpers and wiring connections between the RTD and controller. Refer to the wiring diagrams that came with your unit.
	Is the input parameter in the controller set correctly?	Verify that the Input Sensor Type in the controller's Input menu is set to r0. 1H for a Pt100 RTD. Verify other input settings against the **Default Parameters** table in the Appendix.
	Has the RTD failed?	Check the RTD and replace if necessary. *See Checking and Replacing RTD.*

(Continued)

Controller Alarms (Continued)

The Thermolator has detected a non-recoverable error involving the microprocessor control.

- The controller displays an error code indicating the cause of the problem.

Alarm	Possible Cause	Solution
 **Device Error** ◆ Fault light illuminated ◆ Optional strobe, sounds, contacts actuated ◆ Pump continues to run ◆ Heater contactor disengages ◆ Cooling Solenoid closes ◆ Cooling Floating Valve halts at current position	Controller is defective.	Replace controller.
 **Pump Overload** Fault light is lit and no alarms shown on controller or fault light comes on when you hit the start button. The pump motor overload has tripped. The contact is open. ◆ Pump will not start ◆ Heat contactor does not engage	Is the correct voltage supplied to the pump motor?	Supply voltage should match the rating on the pump name plate ± 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 required water flow greater than the pump's capacity?	❒ Review pump sizing for the application. ❒ Decrease the water flow to the process.
	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 should be as specified by the electrical power prints. Manually trip and reset the overload. If the problem continues, replace the overload. *See Resetting and Replacing Overloads.*
	Is the pump working properly?	Replace the pump motor if supply voltage, wiring and overload settings are correct, but the pump continues to draw excessive current.

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

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

Mechanical / Electrical Problems

Alarm	Possible Cause	Solution
Machine not Running. Start Light not illuminated The cooling water pressure is not sufficient ◆ From process gauge below minimum pressure. ◆ Pump will not start ◆ Cooling Valve and Vent Solenoid do not actuate ◆ Heat contactor does not engage	Is the water supply pressure sufficient?	Verify that the water supply is on and delivering water at a minimum pressure per Appendix G with the cooling valve open (hold down start button to open cooling valve). Check for closed valve or faulty pump in the supply circuit.
	Did the pressure switch fail?	Use start button to initiate vent sequence. If sufficient pressure is available during entire vent sequence, check pressure switch with VOM. Replace if necessary.
	Is STOP button depressed?	Verify that STOP button is not depressed. If depressed press again to de-assert and allow operation.
Communication Failure If a communication option is installed, failure will be indicated only by a lack of activity in the telephone receiver shaped LED light on the temperature controller when the unit should be communicating with the host machine. ◆ No effect on Thermolator Operation	Is the unit connected to the host machine?	Verify that the Thermolator is connected properly to the host machine.
	Are the network address and baud rate correct?	Verify the address and baud rate. The address assigned to the unit must not be used by any other machine on the network. The baud rate must match the host machine. *See External Interfaces, Appendix F.*
	Is something wrong with the communications cable?	Check the communication cable condition. The cable must conform to proper standards. Check for loose cable connections.

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.	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
The Power button on the control panel is illuminated, but the temperature controller does not operate.	Is power reaching the temperature controller?	❒ Verify that the Watlow EZ-Zone controller chassis is seated securely in its case housing. *See Replacing the Temperature Controller.* ❒ Verify correct electrical connections between the temperature controller and control panel power supply. Refer to the wiring diagrams that came with your unit. ❒ Verify that the control fuse(s) are not blown.
	The temperature controller has failed.	*See Replacing the Temperature Controller.*

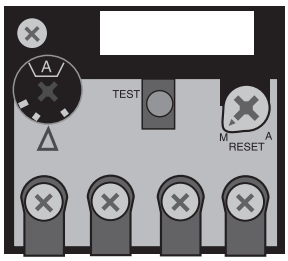
Resetting Pump Overload

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

Tools Required

❒ *Phillips Screwdriver*

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.

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.**

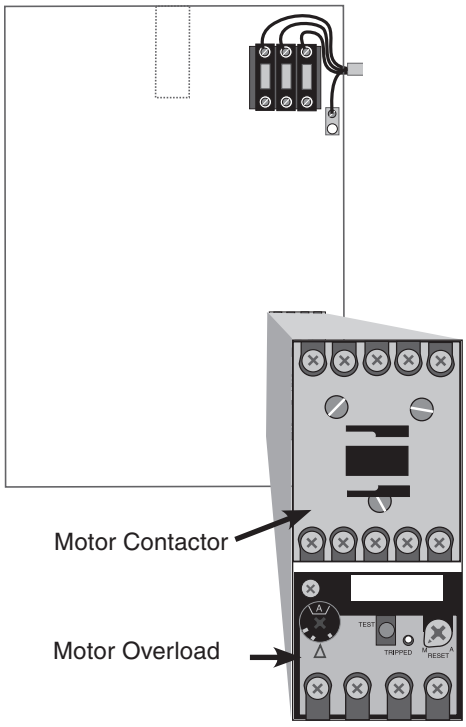
6 **Remove the overload module.** Loosen the three screws that connect the overload module to the motor contactor. Pull the overload module down to release it from the starter.

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 Temperature Controller

The temperature controller used in the Thermolator TW-S slides in and out of the control panel for easy replacement.

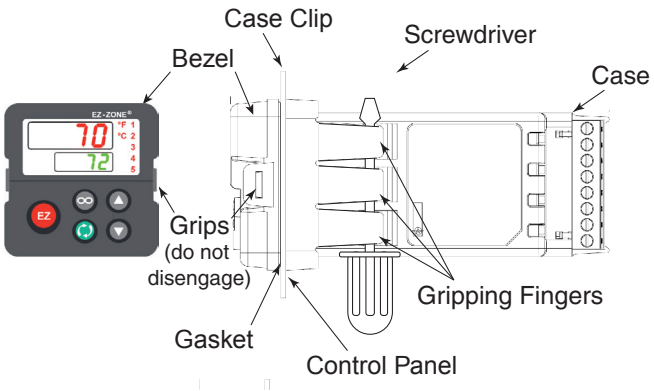
To remove the controller:

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.

1. **Disconnect and lockout the main power supply.**
2. **Disconnect all two or three connectors on the rear of the controller.**
3. **Using two small screwdrivers, release the case clips from the controller case.**
4. **Pull the controller chassis out through the control panel.**

Tools Required

- ❒ *Two small screwdriver*



To reinstall the controller:

5. **Locate the case clip** behind the control panel. Gripping fingers should be located on left and right (not on bottom and top).
6. **Carefully push the controller through the control panel, through the case clip** until the gripping fingers hold the controller against the control panel.
7. **Reinstall the rear connectors into the controller.**
8. **Program the new controller.**
   Program any user-customized parameters in the controller. Activate appropriate user parameter set. Contact Conair Service Department for more information.

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

Replacing the Heater Contactor

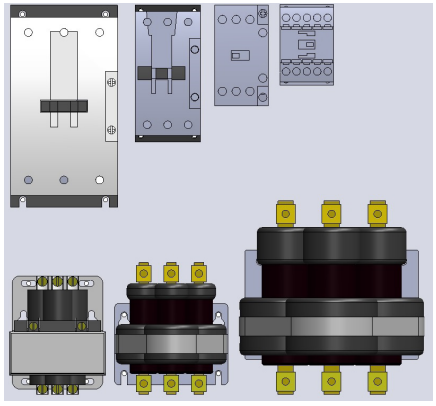
⚠ WARNING: Electrical Shock Hazard
Only qualified service personnel who have been trained on electrical testing and the procedures for avoiding the hazards should diagnose or correct problems that require opening the unit with power on.

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.

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.

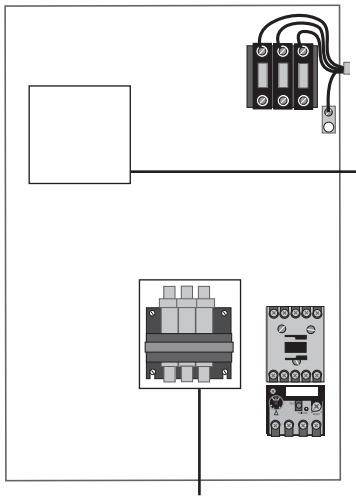
Non-Mercury



Mercury

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

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 supply process temperature. The Pt 100 RTD is installed in the wall of the heater tank at the "to process" outlet.

Sensor error codes (Er. 1) 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. R**emove 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.**

(Continued)

Checking the RTD (Continued)

Pt100

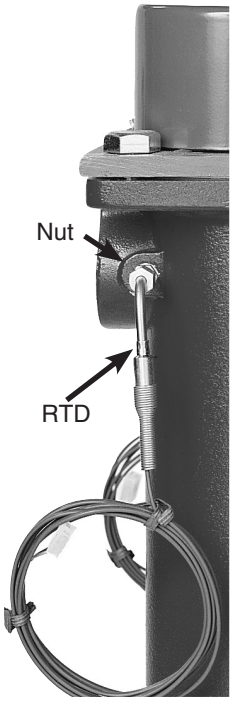
	0	1	2	3	4	5	6	7	8	9	
Temp T	**Resistance at T**	**Resistance at T+1°F**	**Resistance at T+2°F**	**Resistance at T+3°F**	**Resistance at T+4°F**	**Resistance at T+5°F**	**Resistance at T+6°F**	**Resistance at T+7°F**	**Resistance at T+8°F**	**Resistance at T+9°F**	**Temp T**
°F	Ohms	Ohms	Ohms	Ohms	Ohms	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.

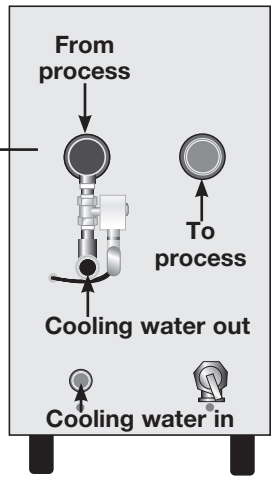
Repairing Cooling Valves

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
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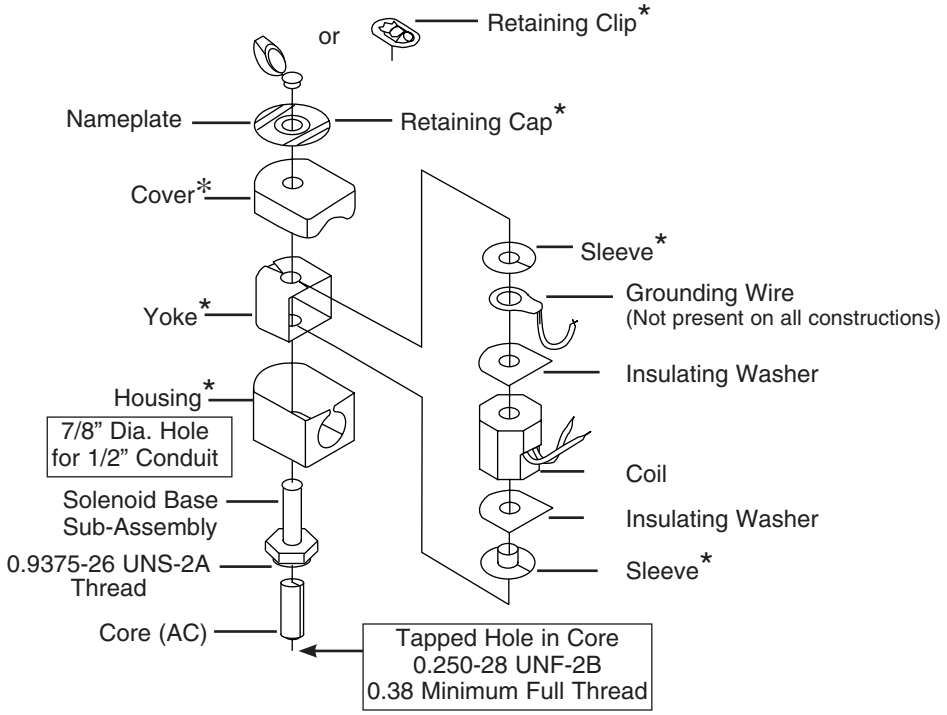
Call: 814 437 6861

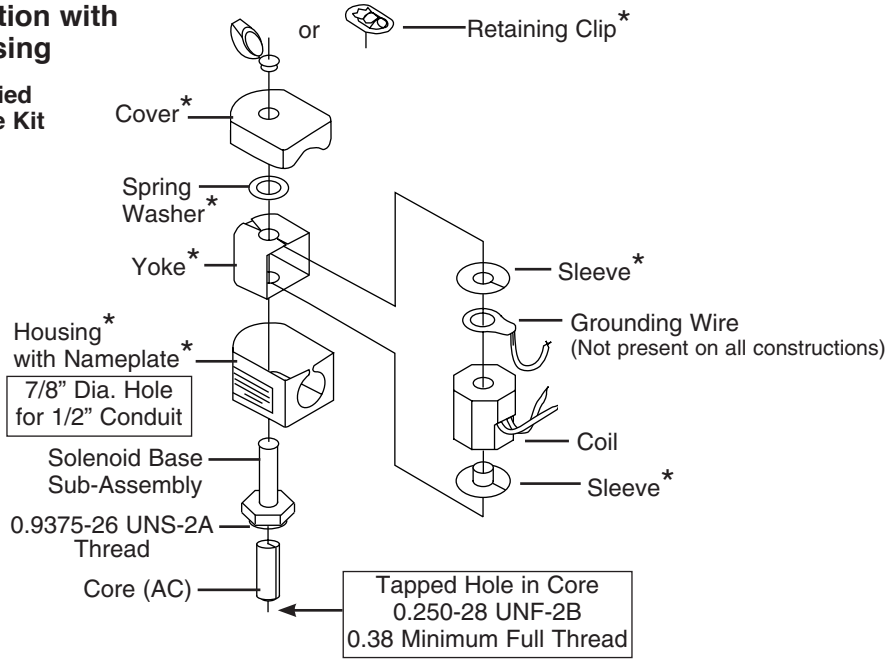
Repairing Cooling Valves (Continued)

*Indicates Parts Supplied in Solenoid Enclosure Kit



Alternate Construction with Nameplate on Housing

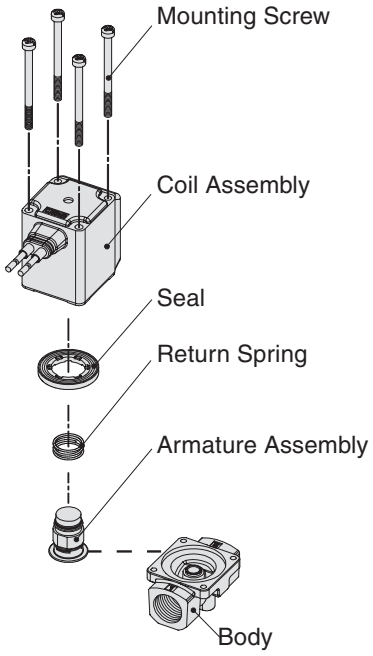
*Indicates Parts Supplied in Solenoid Enclosure Kit



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.

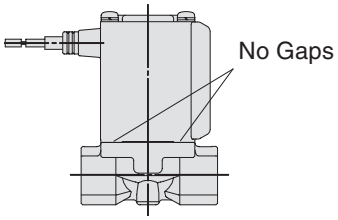
1 **Loosen the mounting screws.** The coil assembly, seal, return spring, armature assembly and body can be removed.

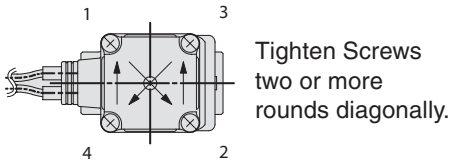
2 **When changing the electrical entry direction, turn the coil assembly in a desired direction to mount it**.

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".

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}

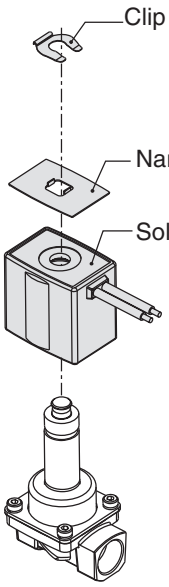




4 **After tightening the screws, make sure that there are no gaps between the coil and body.**

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.

Alternate Pilot Operated Solenoid Valves



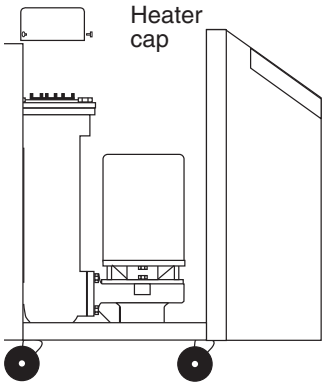
NOTE: Within the valve body and coil assembly there are no user serviceable parts.

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)



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.

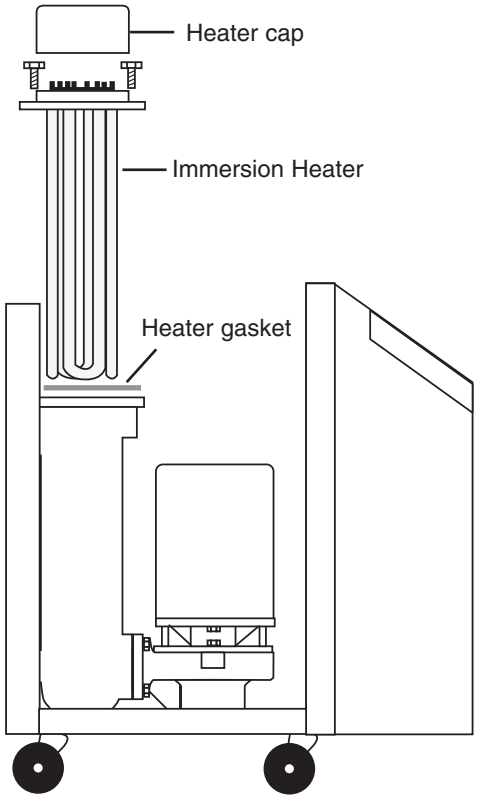
5. **Shut off the cooling water in.**
6. **Drain the Thermolator using the Pressure Relief Valve located at the rear of the unit.**
7. **Remove the four bolts that hold the heater element in place.** Use a 9/16-inch socket.

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.

(Continued)

Replacing Immersion Heaters (Continued)

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



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

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

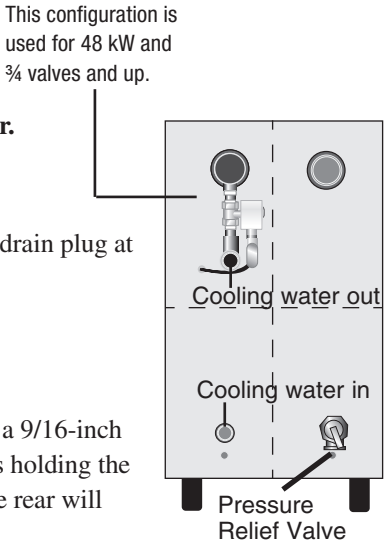
10 **Replace the heater gasket** if it is worn or cracked.

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

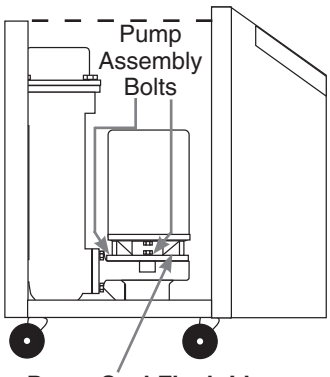
Removing the Pump

WARNING: Electrical Shock and Hot Surface Hazard

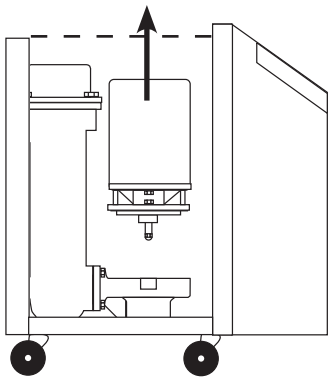
Before attempting maintenance of any kind on the Thermolator, you must stop the unit; disconnect and lockout the main power supply; and allow the unit to cool to 100° F {38° C}.



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-S Thermolator features a PID ("proportional-integral-derivative") control-loop algorithm implemented in the programming of the Watlow temperature controller. 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-S 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	**Heating-Driven Mode**	**Watlow Controller Parameter**	**Comments**
Proportional-Cooling	7	7	CPb 1	*Smaller* number = more aggressive proportional cooling response.
Proportional-Heating	7	7	hPb 1	*Smaller* number = more aggressive proportional heating response.
Integral	200	50	t i 1	*Smaller* number = more aggressive integral response.
Derivative	30	15	td 1	*Larger* number = more aggressive derivative response.

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 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 1200.

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 tdI to "0".**

2 **Minimize integral control by setting tiI to "1200".**

3 **Set proportional control of CPbI and hPbI to an initial value of approximately 10% of setpoint.** For example, if your setpoint is 150°F, 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 CPbI and hPbI 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 CPbI and hPbI.**

Continue the Test – Proportional + Integral

7 **Decrease the integral setting tiI by a factor of two and run the system through a thermal cycle.** For example, change it from "1200" to "600", then "300", then "150, 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 parameter tdI to "1".** Run the system through a thermal cycle and observe the overshoot the first time it reaches setpoint.

10 **Double the derivative parameter tdI 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 parameter tdI 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 CPb 1, hPb 1, t i 1, td 1. The parameters may need to be tweaked if your system or setpoint changes significantly.

AUTO-TUNE

If the concept of manual tuning of the PID loop yourself does not appeal to you, you have the alternative of letting the Watlow controller pick the parameters for you. This method can also be used to get reasonable parameter starting points to assist you in additional manual tuning. Auto-tuning may take a short or very long amount of time, depending on the size of the system that the Thermolator is connected to.

PREREQUISITES:

- ❒ *Your cooling water must be at a reasonably stable temperature and pressure.*
- ❒ *Your external heat load on the Thermolator must be reasonably constant.*
- ❒ *You must have sufficient time to run through at least one thermal cycle in order to perform auto-tuning.*

STEPS:

1 **Connect the Thermolator to a system that is capable of withstanding the full temperature of the Thermolator (250°F {121° C}or 300°F {149° C}, based on the unit)**.

2 **Turn on the Thermolator and have it running with a setpoint near room temperature.**

3 **When you are ready to perform the auto-tune, push the**  **button until**  **is shown in the lower display.**

4 **Use the**  **button to change the upper display from "no" to "YES".**

5 **Push the**  **button to save the new setting.**

6 **Press the**  **key to exit to the main display.**

7 **The auto-tuning will now commence. The display will show**  **on the display.** The Thermolator will ramp up to a high temperature and will select appropriate PID parameters based on system response. DO NOT DISTURB THE SYSTEM while this is occurring.

(Continued)

PID Parameters (Continued)

8 **When the auto-tune is complete, the display will return to normal.**

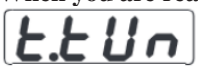
9 **You should check the results by first cooling down the system, and then changing the setpoint to something typical for your process.** Observe the machine achieve this setpoint and be mindful of how quickly it achieves setpoint and if it overshoots.

10 **It is recommended that you scroll through the quick-access menu using the key** and record the discovered value of the parameters CPb 1, hPb 1, t i 1, td 1. These values can be saved for future use, or can be further modified to meet the process needs.

CONTINUOUS TRU-TUNE+

Tru-Tune+ is a Watlow-proprietary algorithm for the continuous auto-tuning of a system while it is operational. It is only suitable if you have a solenoid valve option on your Thermolator (not recommended for floating valve models). It is also only permissable if your system is changing significantly while the Thermolator is in continuous operation. Any changes to a control loop while in production operation come with risk that you may not retain continuous, repeatable, and precise control of your system.

1 **Turn on the Thermolator and have it running with a setpoint typical for your process.**

2 **When you are ready to enable Tru-Tune+, push the button** until  is shown in the lower display.

3 **Use the button to change the upper display from "no" to "YES".**

4 **Push the button to save the new setting.**

5 **Press the key to exit to the main display.**

6 **Tru-Tune+ is now enabled.**

7 **The parameters CPb 1, hPb 1, t i 1, td 1 will be continuously adjusted as the controller finds the best values for these parameters.**

8 **It is recommended that the Thermolator's response to Tru-Tune+ is closely monitored.** If Tru-Tune+ has proven reliable for your system, you may keep it enabled. If you are in doubt, it is recommended that you disable it. It is recommended that you monitor and record the parameters CPb 1, hPb 1, t i 1, td 1 with the new values assigned by Tru-Tune+ over time. It will probably take several warm-up cycles for these parameters to be correctly and sufficiently modified.

Setting the Security Level

The TW Thermolators provide the ability to protect system parameters from accidental or unauthorized changes. Six security levels are available, allowing various degrees of access to the menus, setpoint, and operating mode selections.

We recommend selecting the most restrictive security level that suits your application. The security levels are:

Loc_0	**Key Lockout.** Highest security level. No access to any controller functions.
SP	**Setpoint.** Allows setpoint value or output percentage (manual mode) to be changed. No access to menus.
SP_PL	**Setpoint Plus** Mode. Allows changes to setpoint value, output percentage (manual mode) or the operating mode. No access to menus.
USEr	**User.** Allows access to all setpoint level privileges, as well as access to Operating Mode, Autotune and Control menus.
CnF9	**Configuration.** Allows access and changes to all parameters and menus except the Calibration menu. Access recommended only for trained service personnel.
FACt	**Factory.** Lowest security level. Allows access to all parameters, menus and calibration settings. Access recommended only for factory personnel.

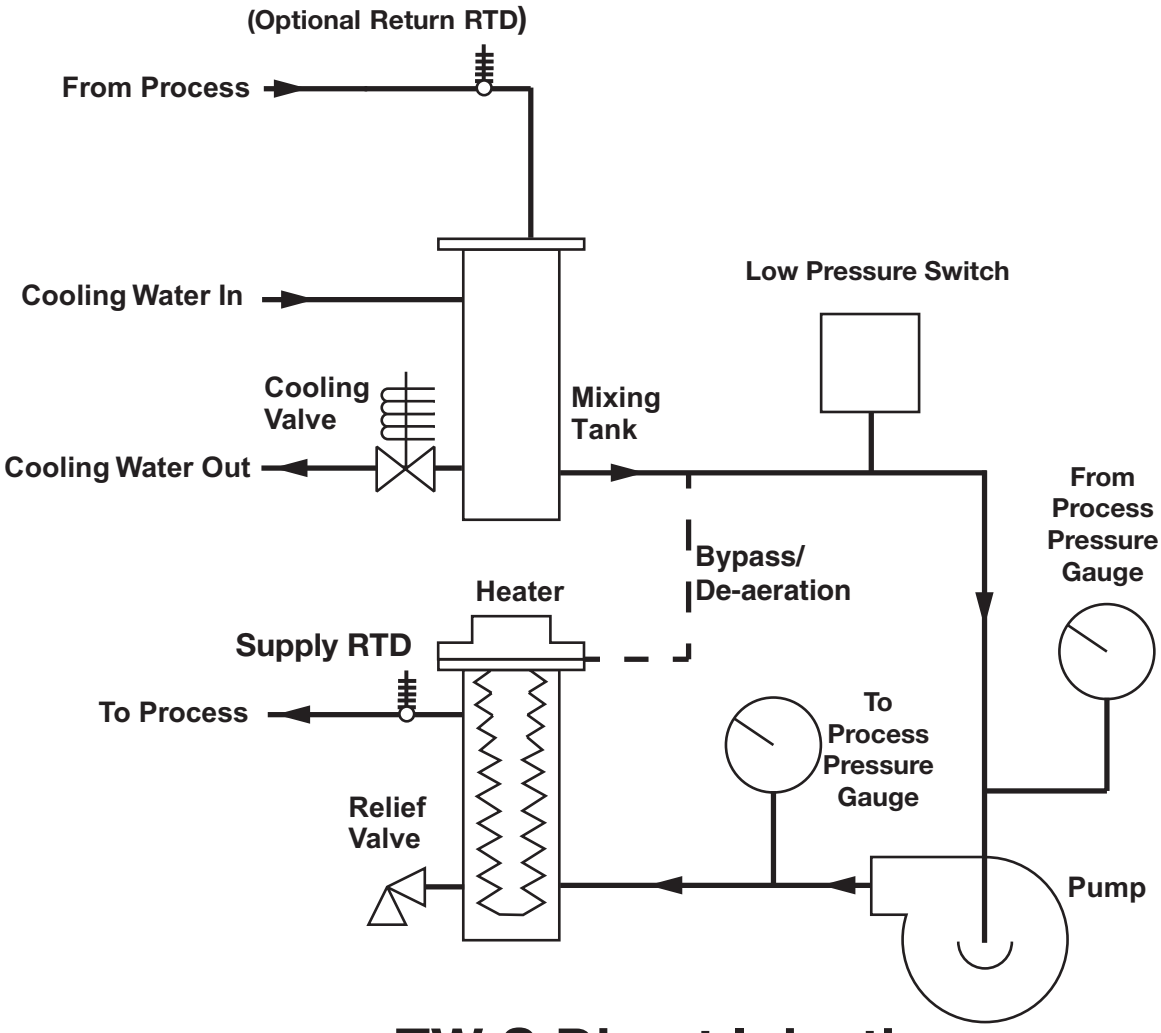
To change or view a Security Level:

1 **Press and hold**  **for about 10 seconds.** The controller will display AcLu in the upper display and the access level code in the lower display. (Ignore the menu label that appears in the upper display after three seconds.)

2 **Press**  **or**  **to index through the security levels,** stopping on the level that you want.

3 **Press**  **once to select the level and exit** to the process value display.

Plumbing Diagram



TW-S Direct Injection

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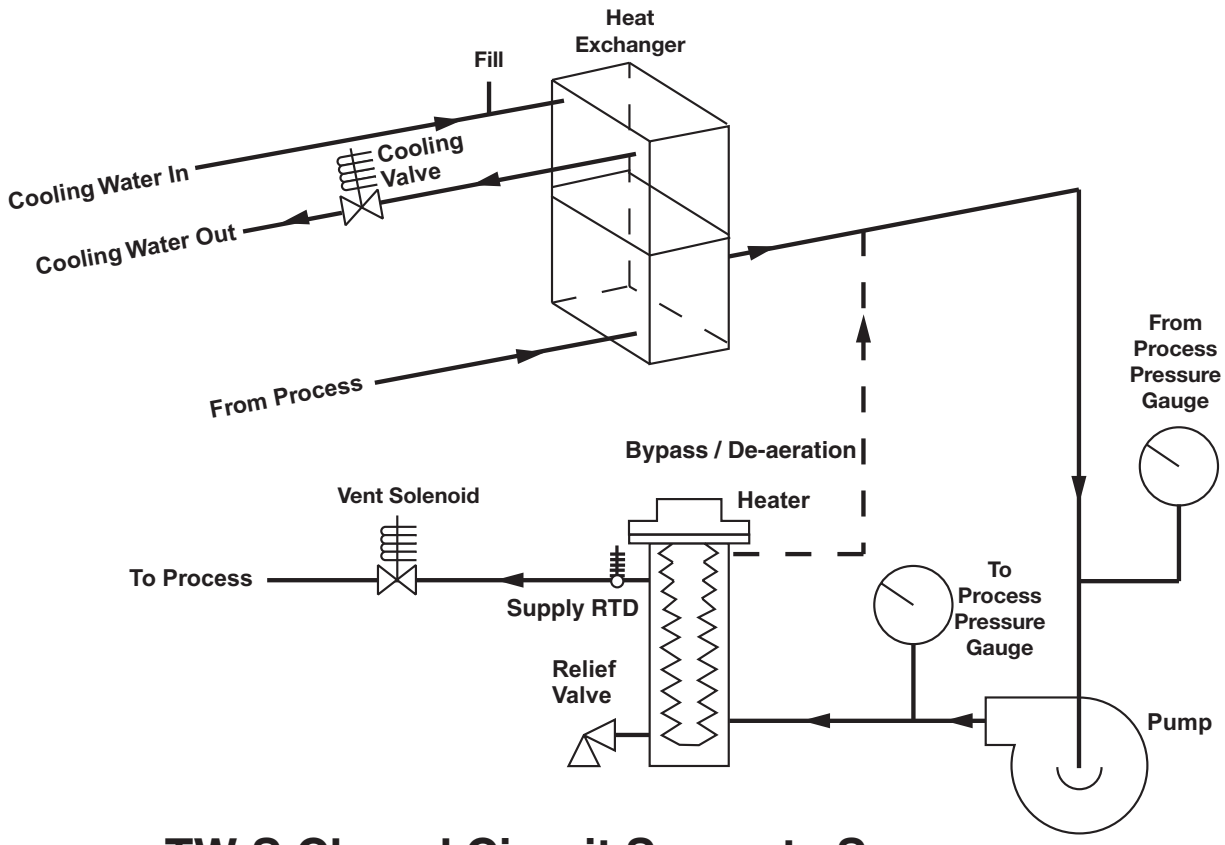
Plumbing Diagram (Continued)

Closed Circuit Separate Source



TW-S Closed Circuit Separate Source

In this configuration process and cooling fluids do not mix.

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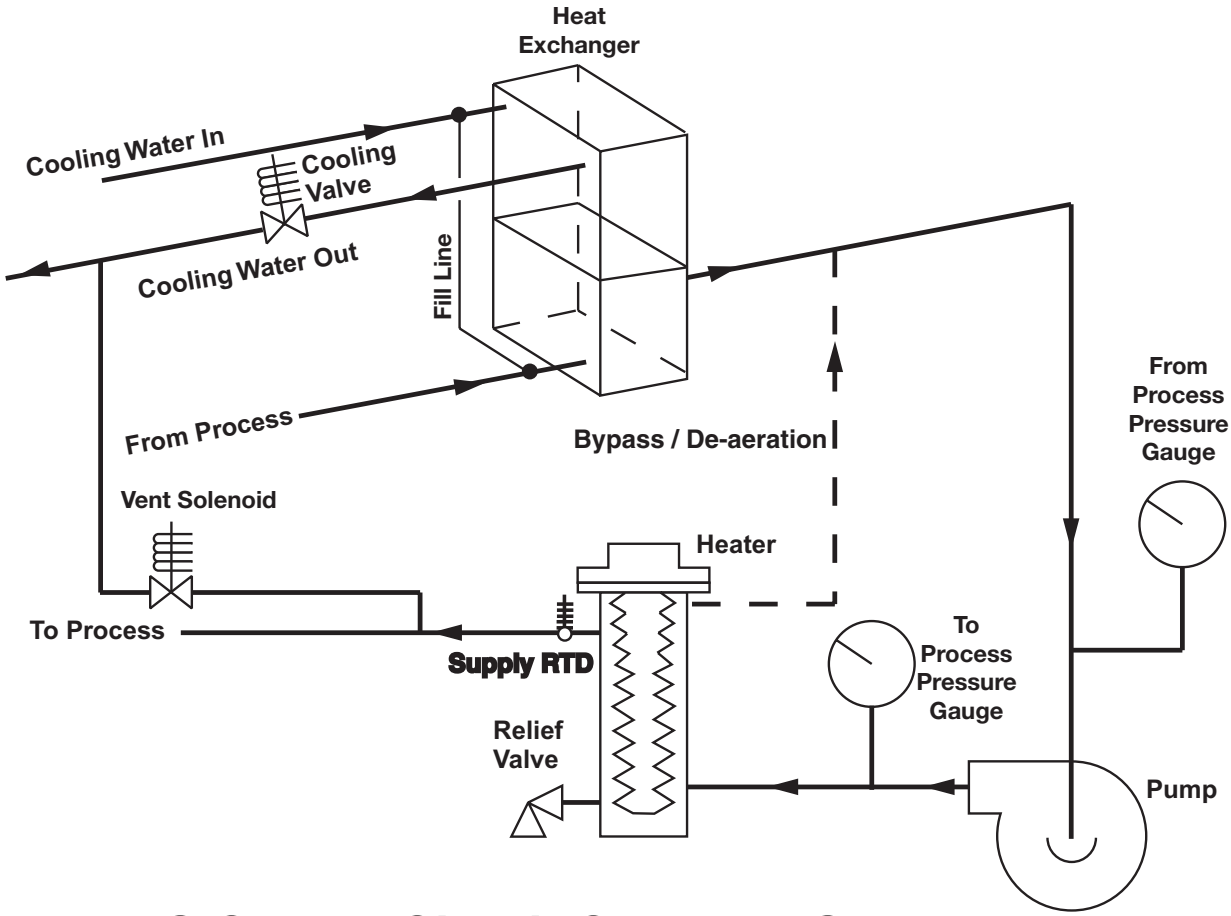
Plumbing Diagram (Continued)

Closed Circuit Common Source



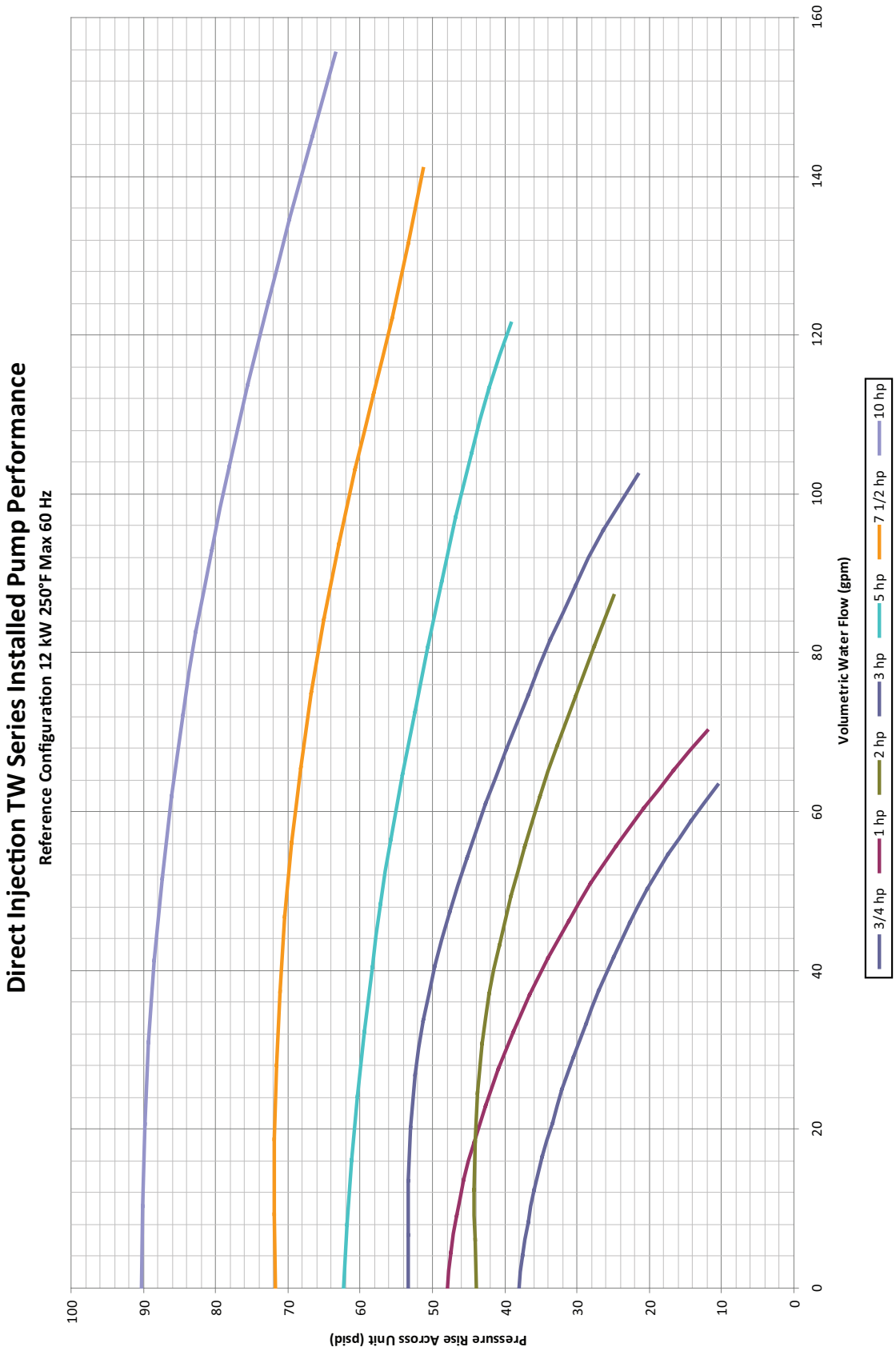
TW-S Closed Circuit Common Source

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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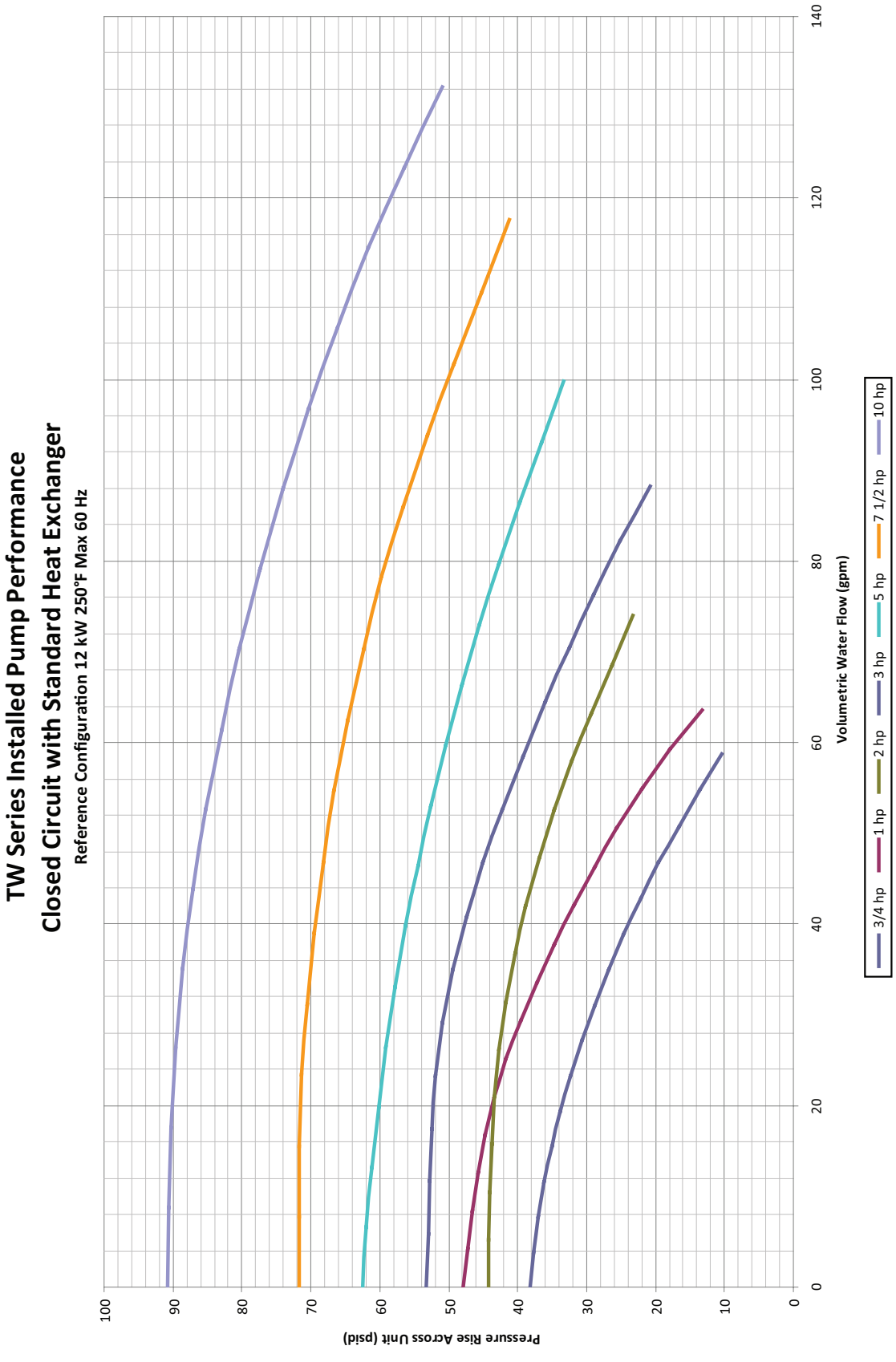
Plumbing Curves (Continued)

Closed Circuit Standard Performance



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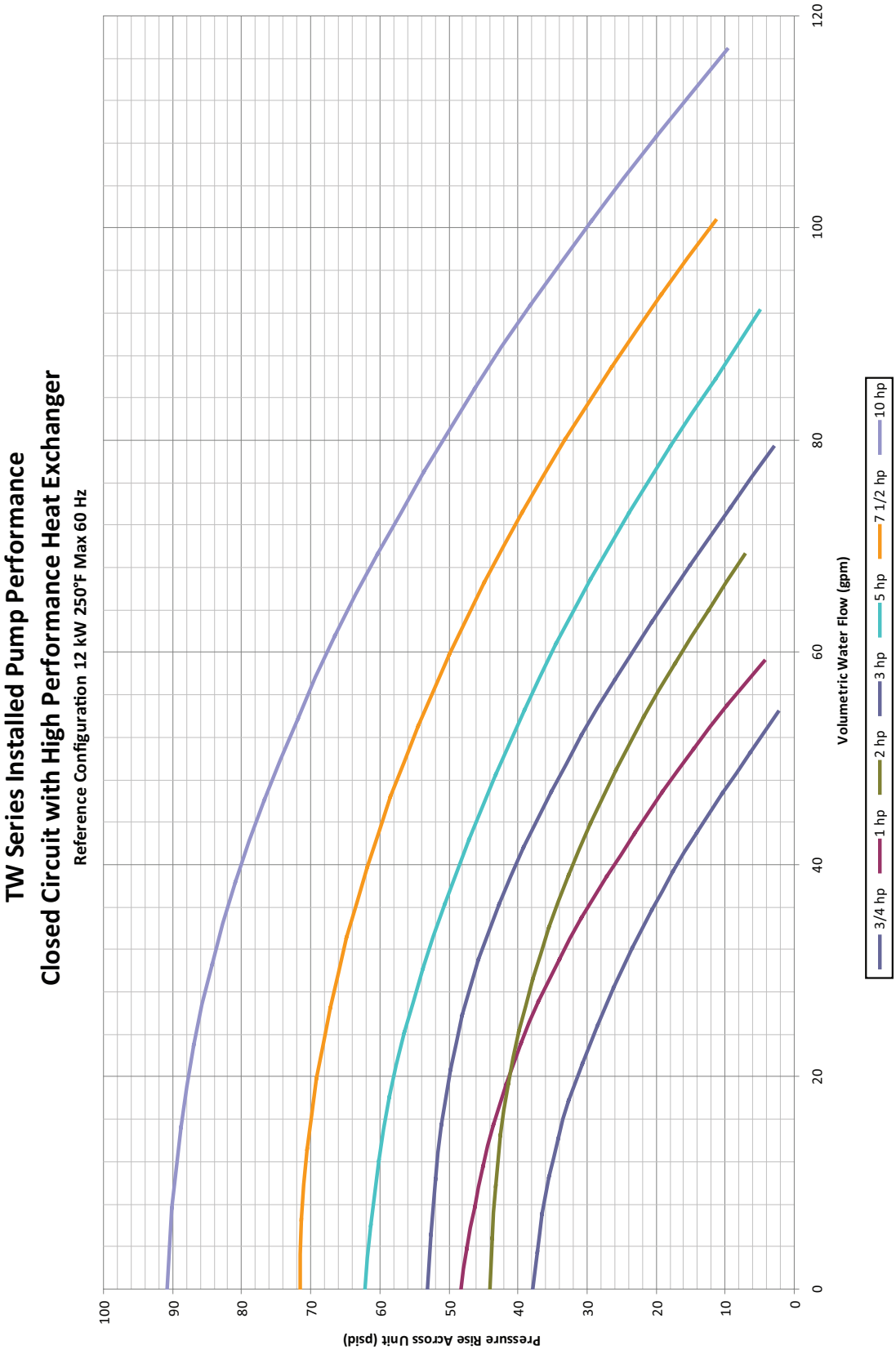
Plumbing Curves (Continued)

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-S Thermolators

Manuals	
PART NUMBER	**DESCRIPTION**
UGH051/1215	User Guide, Thermolator TW-S

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-S 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 - Interface #1

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 Thermolator.

Setting the Jumpers

There are no jumpers to set. Voltage vs. mA selection is performed by connecting the analog wiring to the desired terminal (see sheet 4 on the electrical print) and by selecting the proper software settings.

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		
Remote Temperature Setpoint (Input)	**0-10VDC**	**4-20mA**
	20kΩ internal controller impedance.	100Ω internal controller impedance.
	NOTE: Voltage or loop current source must be supplied by the external interface.	
Process Temperature Retransmit (Output)	1kΩ minimum external impedance.	800Ω maximum external impedance.
	NOTE: Voltage or loop current is self-generated by the Thermolator's temperature controler	

Terminal Wiring				
Remote Temperature Setpoint (Input)	**0-10VDC**		**4-20mA**	
	+ Terminal 269	**-** Terminal 260	**+** Terminal 262	**-** Terminal 260
Process Temperature Retransmit (Output)	**+** Terminal 359	**-** Terminal 350	**+** Terminal 352	**-** Terminal 350

See power print for terminal block locations.

External Interfaces (Continued)

Pressure-clamp style terminal blocks require a small screwdriver to release the wire clamps:

1 **Insert a small straight-blade screwdriver into the square hole.**

Tools Required

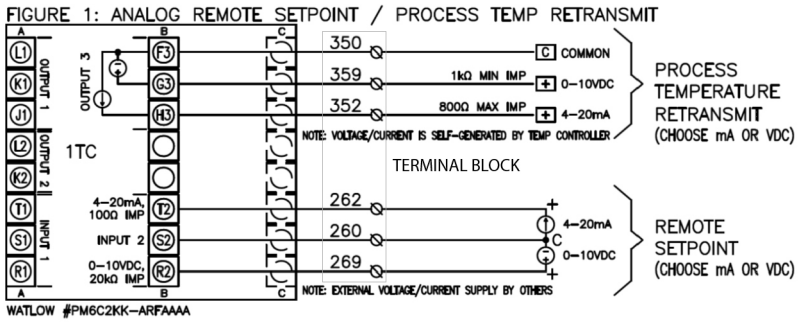
- ❒ *Small Straight screwdriver*
- ❒ *Wire Strippers*

2 **Place the stripped wire in the round hole.**

3 **Remove the screw driver.**

4 **Tug on the wire to ensure it is securely gripped.**

5 **Be sure that you gripped the bare conductor and not the insulation.**



Setting the Software

Remote Setpoint Input

If you ordered the "remote setpoint" option with the Thermolator, your Thermolator 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 (with factory default parameters). Additionally, the Thermolator comes from the factory set to 4-20mA covering the entire range of 32°F to 500°F.

If you need to change the Thermolator to allow for local (instead of remote) control, follow this procedure:

1 **Simultaneously hold the** ▲ **and** ▼ **buttons for four seconds.** The screen should show A1 oPEr. (If it shows A1 SEt, you held the buttons for too long. Press the ∞ key to exit and try again.)

LooP oPEr

2 **Using the** ▲ **button, scroll to the "loop" menu.** Push the ⟳ button to enter the loop setup menu.

3 **You should now see "r.En", which stands for "remote enable".** Using the ▲ button, change this setting from "YES" to "no". Push the ⟳ button to save the new setting.

4 **When you are finished, press the** ∞ **key twice to exit the operation menus.**

5 **You should now be able to control the setpoint locally by using the** ▲ **and** ▼ **buttons.** To re-enable remote setpoint, follow the instructions above but chose "YES" instead of "no" in step #3.

External Interfaces (Continued)

If you need to change the type or range of the analog input to your particular situation, following this procedure:

1 **Simultaneously hold the ▲ and ▼ buttons for six seconds.** The screen should show 

. (If it shows 

, you held the buttons for too long. Press the ∞ key to exit and try again.)

2 **Push the ⟳ button to enter the Analog input menu.**

3 **Using the ▲ button, scroll to input #2** (this is the analog input). Push the ⟳ button to select.

4 **You should now see the "Input Type" display.** You can use the ▲ and ▼ buttons to change between uoLt for 0-10 volts or mA for 4-20 milliamps.

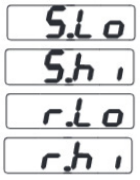
Push the ⟳ once you have made your selection

5 The next setting is "Units". This should remain in the default setting of AtP (meaning "Absolute Temperature").

Push the ⟳ button to advance to the next setting.

6 **The next four parameters determine the input scaling.** The factory defaults are set for 4-20mA.

	4-20mA (factory default)	0-10VDC
S.Lo	4mA	0VDC
S.hi	20mA	10VDC
r.Lo	32°F	32°F
r.hi	500°F	500°F



You can scale the input current/voltage with the S.Lo and S.hi parameters, and you can scale the matching setpoint temperatures with r.Lo and r.hi parameters. When the analog input is at S.Lo, the setpoint temperature will be at r.Lo, and likewise the setpoint temperature will be at r.hi when the analog input is at S.hi.

The wide range of temperature values of 32°F to 500°F shown above are the factory defaults to accommodate a full range of customer situations. Decreasing the range to better suit your custom process is encouraged, as it will also provide better resolution/accuracy of the analog signal. For example, if your Thermolator has typical process temperatures between 60°F and 140°F, you may wish to set r.Lo to 60°F and r.hi to 140°F.

7 **The next setting is "Process Error Enable".** While the default is off, this can be enabled if a controller fault is desired if there is an open circuit detected on the remote setpoint analog input. If you choose to enable this, use the next setting (

) to select a level at which the fault is triggered.

8 **The next parameter is "Filter".** You can use this to filter noise on the remote setpoint analog input. While the default is 0.5, a larger number can be used to increase filtering.

9 **The next parameter is "Input Error Latching".** This setting determines if an error on the analog input will produce a latched error, or if the error will self-reset once the analog signal comes back into the proper range.

10 **The next parameter is "Input Precision".** It is recommended that this setting remains at "0", which is whole numbers.

11 **You can also apply a calibration factor to the analog signal if desired (factory default is 0).**

12 **When you are finished, press the ∞ key twice to exit the setup menus.)**

External Interfaces (Continued)

Retransmit Output

For the process temperature retransmit functionality, you may need to change the factory default settings to match your system.

1 **Simultaneously hold the ▲ and ▼ buttons for six seconds.** The screen should show A1 oPEr.

(If it shows A1 SEt, you held the buttons for too long. Press the ∞ key to exit and try again.)

2 **Push the ↻ button to enter the output menu**.

otPt

3 **Using the ▼ button, scroll through the menus until you arrive at the output menu**, indicated by otPt/SEt.

Push the ↻ button.

4 **Using the ▲ button, scroll to output #3** (this is the retransmit analog output). Push the ↻ button to select.

o.tY
mA
volt

5 **You should now see the "Output Type" display.** You can use the ▲ and ▼ buttons to change between volt for 0-10 volts or mA for 4-20 milliamps.

Push the ↻ once you have made your selection.

Fn
rMt

6 **The next setting is "Function".** This should remain in the default setting of "rMt" (meaning "retransmit").
Push the ↻ button to advance to the next setting.

r.Sr
Pu

7 **The next function is "Retransmit Source".** Leave this set to the factory default "Pu" ("Process Value").

F1

8 **Next the function instance will display.** Leave this at the default "1". Push the ↻ button to advance to the next setting.

The next four parameters determine the output scaling. The factory defaults are set for 4-20mA.

	4-20mA (factory default)	0-10VDC
S.Lo	4mA	0VDC
S.h1	20mA	10VDC
r.Lo	32°F	32°F
r.h1	500°F	500°F

S.Lo
S.h1
r.Lo
r.h1

You can scale the input current/voltage with the S.Lo and S.h1 parameters, and you can scale the matching setpoint temperatures with r.Lo and r.h1 parameters. When the analog input is at S.Lo, the setpoint temperature will be at r.Lo, and likewise the setpoint temperature will be at r.h1 when the analog input is at S.h1.

The wide range of temperature values of 32°F {0°C} to 500°F {260°C } shown above are the factory defaults to accommodate a full range of customer situations. Decreasing the range to better suit your custom process is encouraged, as it will also provide better resolution/accuracy of the analog signal. For example, if your Thermolator has typical process temperatures between 60°F {16°C} and 140°F {60°C}, you may wish to set r.Lo to 60°F {16°C} and r.h1 to 140°F {60°C}.

o.CA

9 **You can also apply a calibration factor to the analog signal if desired** (factory default is 0).

10 **When you are finished, press the ∞ key to exit the setup menus.**

✎ **NOTE**: The "3" on the right side of the display will always blink in proportion to the analog output signal.

(continued)

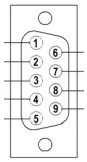
External Interfaces (Continued)

Modbus 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

1 **Simultaneously hold the ▲ and ▼ buttons for six seconds.** The screen should show 

.

(If it shows 

, you held the buttons for too long. Press the ∞ key to exit and try again.)

2 **Using the ▼ button, scroll through the menus until you arrive at the communications menu**, indicated by 

. Push the ↻ button.

3 **You should see** 

. Push the ↻ button again until you see 1/Ad.M (the "1" may be another number. Using the ▲ and ▼ buttons, set the Modbus node address. Press the ↻ button when finished.

4 **You should now see "9600/bAUd" (9600 may be a different number).** Using the ▲ and ▼ buttons, select the proper speed. Choices are 9600bps, 19.2kbps, and 38.4kpbs.

Press the ↻ button when finished.

5 **You should now see "nonE/PAr" ("none" may be something else).** Using the ▲ and ▼ buttons, select the parity. Choices are none, even and odd.

Press the ↻ button when finished.

6 **Next you can set the memory data word order.** Using the ▲ and ▼ buttons, select either LoHi or HiLo.
Press the ↻ button when finished.

7 **Next select the units for Modbus.** You can select between C or F.

8 **Next select the data map for Modbus.** This should be left at 1.

9 **Next select non-Volatile Save.** Options are YES or no. If this is set to "yes", all values written from the network will be saved in the controller and utilized on next reboot. If this is set to "no", the Thermolator will always boot up with its default internal values, ready to accept changes from the network.

10 **When you are finished, press the ∞ key twice to exit the setup menus.**

(continued)

External Interfaces (Continued)
Ethernet/Ip Communication

Connecting to the Thermolator
The Thermolator has a RJ-45 port on the front panel for Ethernet/IP communication to an ethernet-based network.

The Thermolator comes with the following default IP settings:

- IP Address: 10.1.140.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 10.1.140.2

These settings may be changed to meet the installation requirements. If multiple Thermolator's will be installed on the same network, the IP address MUST be changed from the default or a duplicate IP address fault will occur.

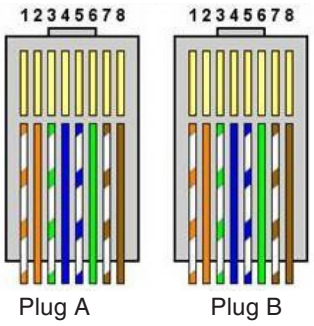
The Thermolator supports 100Mbps (half-duplex and full-duplex) ethernet only.

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

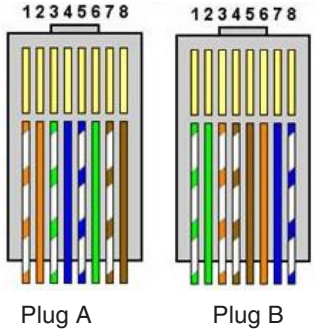
Wiring the circuit
Other than plugging in a standard ethernet cable (CAT5, CAT5e, or CAT6 type), there is no additional wiring required. Shielded ethernet cable may be used in environments where electrical interference may be present.

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.		



"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.		



(continued)

External Interfaces (Continued)

Setting the Software

1 **Simultaneously hold the ▲ and ▼ buttons for six seconds.** The screen should show  .

(If it shows  , you held the buttons for too long. Press the ∞ key to exit and try again.)

2 **Using the ▼ button, scroll through the menus until you arrive at the communications menu**, indicated by  . Push the ↻ button.

3 **Next you will need to pick the communication interface to ...** Use the ▲ button to select interface "2" (interface "1" is for factory programming). Push the ↻ button.

4 **For Modbus-TCP, you need to pick the memory data word order.** Using the ▲ and ▼ buttons, select either LoHi or HiLo.

Press the ↻ button when finished.

5 **Now pick the addressing scheme "iPn":**
a. F.Add: Fixed address (highly recommended).
b. dHCP: Address assigned by DHCP server.

6 **If you chose F_Add in step 5, use the following parameters to set the IP address:**
a. iP.F1: IP address, first octet
b. iP.F2: IP address, second octet
c. iP.F3: IP address, third octet
d. iP.F4: IP address, fourth octet
e. iP.S1: Subnet mask, first octet
f. iP.S2: Subnet mask, second octet
g. iP.S3: Subnet mask, third octet
h. iP.S4: Subnet mask, fourth octet
i. iP.g1: Gateway, first octet
j. iP.g2: Gateway, second octet
k. iP.g3: Gateway, third octet
l. iP.g4: Gateway, fourth octet

7 **If you intend to use Modbus-TCP, you need to set nb.E to "YES".**

8 **If you intend to use Ethernet/IP, you need to set E iP.E to "YES".**

9 **Next CIP Implicit Assembly Output Member Quantity set Ao.nb to "20".** Change this only if required by the supplier of the Ethernet/IP master equipment.

10 **Next CIP Implicit Assembly Input Member Quantity set A i.nb to "20".** Change this only if required by the supplier of the Ethernet/IP master equipment.

11 **Next select the units for Modbus.** You can select between C or F.

12 **Next select the data map for Modbus.** This should be left at 1.

13 **Next select non-Volatile Save.** Options are YES or no. If this is set to "yes", all values written from the network will be saved in the controller and utilized on next reboot. If this is set to "no", the Thermolator will always boot up with its default internal values, ready to accept changes from the network.

14 **When you are finished, press the ∞ key three times to exit the setup menus.**

✎ **NOTE**: Be sure to cycle power to the Thermolator after changing the IP address!

Security

To prevent unintentional changes in the controller, all settings can be locked out.

Locking the Controller

To prevent unintentional changes in the controller, all settings can be locked out. Use the following procedure:

1. **Simultaneously hold the**  **and**  **buttons for six seconds.** The screen should show CUST / FCTY.
2. **Push the**  **button to display** LOC / FCTY. Push the  button.
3. **When you see** LOC.0, **select "1" using the**  **and**  **buttons and push the**  **button.**
4. **Push the**  **button two times** until SLOC is displayed.
5. **Decrement the value from "5" to "0" using the**  **button.** Push the  button.
6. **Press the**  **key two times to exit the factory menu.**

Unlocking the Controller

1. **Simultaneously hold the**  **and**  **buttons for six seconds.** The screen should show CUST / FCTY.
2. **Push the**  **button to display** LOC / FCTY. Push the  button.
3. **When you see** LOC.0, **select "1" using the**  **and**  **buttons and push the**  **button.**
4. **Push the**  **button two times** until SLOC is displayed.
5. **Decrement the value from "0" to "5" using the**  **button.** Push the  button.
6. **Press the**  **key two times to exit the factory menu.**

Additional Security

Additional security configurations are available on the controller. While they provide significantly more security customization, they are also fairly complicated to implement. Please call Conair customer service for assistance with your application.

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

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
  - 334086-NE-XX-X0, Sheet 3, Y25*

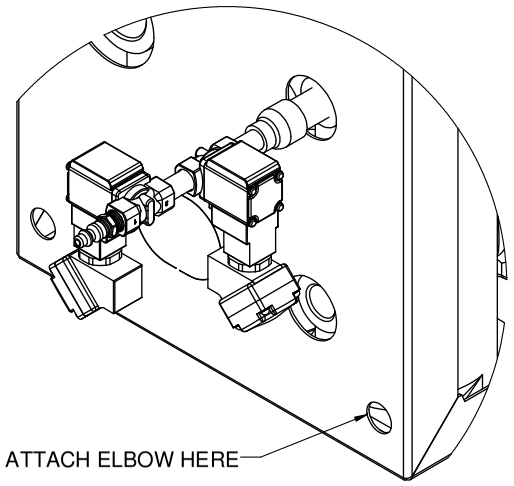
– Premium Units
  - 34086-PE-XX-X0, Sheet 3, Z23*

  * ("X" indicates that the position can be occupied by any character and is dependent on the unit the mold purge is installed on).

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)

Mold Purge Installation Instruction Sheet (continued)

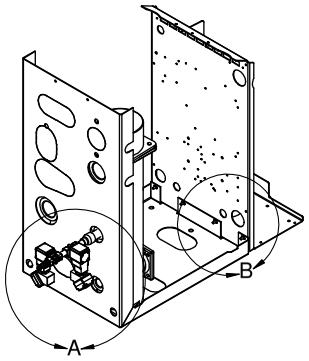


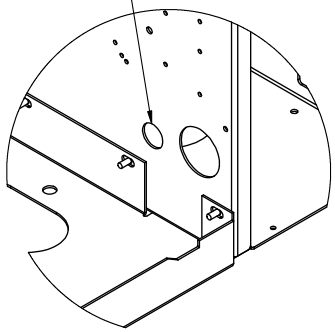
DETAIL A

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

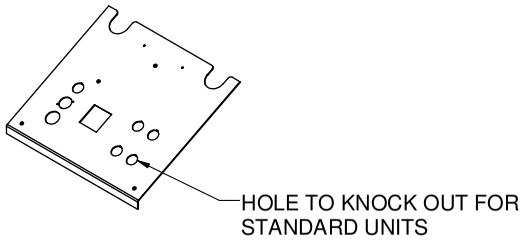


FIGURE C

NOTE:
ITEMS 7-17 NOT SHOWN

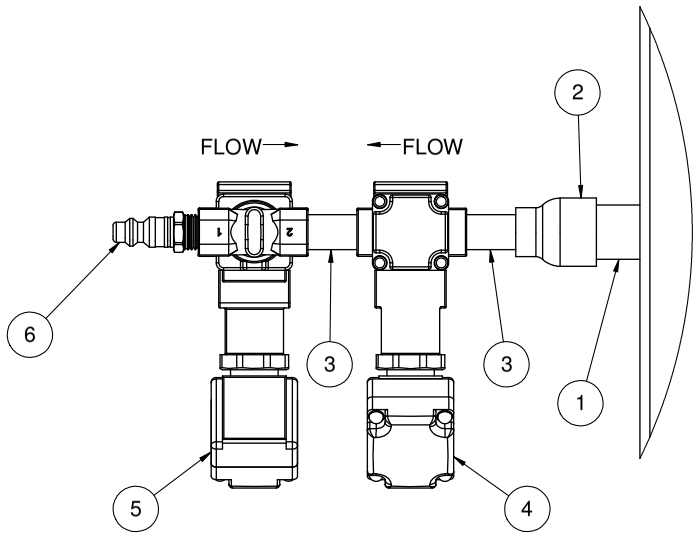
REV	BY	DESCRIPTION	DATE	APP	ECN	DXF
A	NRP	INITIAL RELEASE	8/26/15	JWG	104535	

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

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
A.01.S

UPGRADE KIT, MOLD PURGE, TCU

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