

# Types F79300 & F79400 Tube Furnaces

## OPERATION MANUAL AND PARTS LIST SERIES 1080 & 1081

Model	Voltage	Heating Zone	Control
F79320	240	12" (30.48 cm)	Single Set Point Auto
F79320-33	240	12" (30.48 cm)	Single Set Point Auto
F79325	120	12" (30.48 cm)	Single Set Point Auto
F79328	208	12" (30.48 cm)	Single Set Point Auto
F79330-70	240	12" (30.48 cm)	Program. 2 ramp/2 dwell
F79330-33-70	240	12" (30.48 cm)	Program. 2 ramp/2 dwell
F79335-70	120	12" (30.48 cm)	Program. 2 ramp/2 dwell
F79338-70	208	12" (30.48 cm)	Program. 2 ramp/2 dwell
F79340	240	12" (30.48 cm)	Multi-programmable
F79340-33	240	12" (30.48 cm)	Multi-programmable
F79345	120	12" (30.48 cm)	Multi-programmable
F79348	208	12" (30.48 cm)	Multi-programmable
F79420	240	24" (60.96 cm)	Single Set Point Auto
F79420-33	240	24" (60.96 cm)	Single Set Point Auto
F79428	208	24" (60.96 cm)	Single Set Point Auto
F79430-70	240	24" (60.96 cm)	Program. 2 ramp/2 dwell
F79330-33-70	240	24" (60.96 cm)	Program. 2 ramp/2 dwell
F79438-70	208	24" (60.96 cm)	Program. 2 ramp/2 dwell
F79440	240	24" (60.96 cm)	Multi-programmable
F79440-33	240	24" (60.96 cm)	Multi-programmable
F79448	208	24" (60.96 cm)	Multi-programmable

Thank you for buying this Thermolyne tube furnace. We believe that you will find it to be the best furnace of its kind available. Please note that this manual contains important operating and safety information. You must carefully read and understand the contents of this manual prior to the use of this furnace.

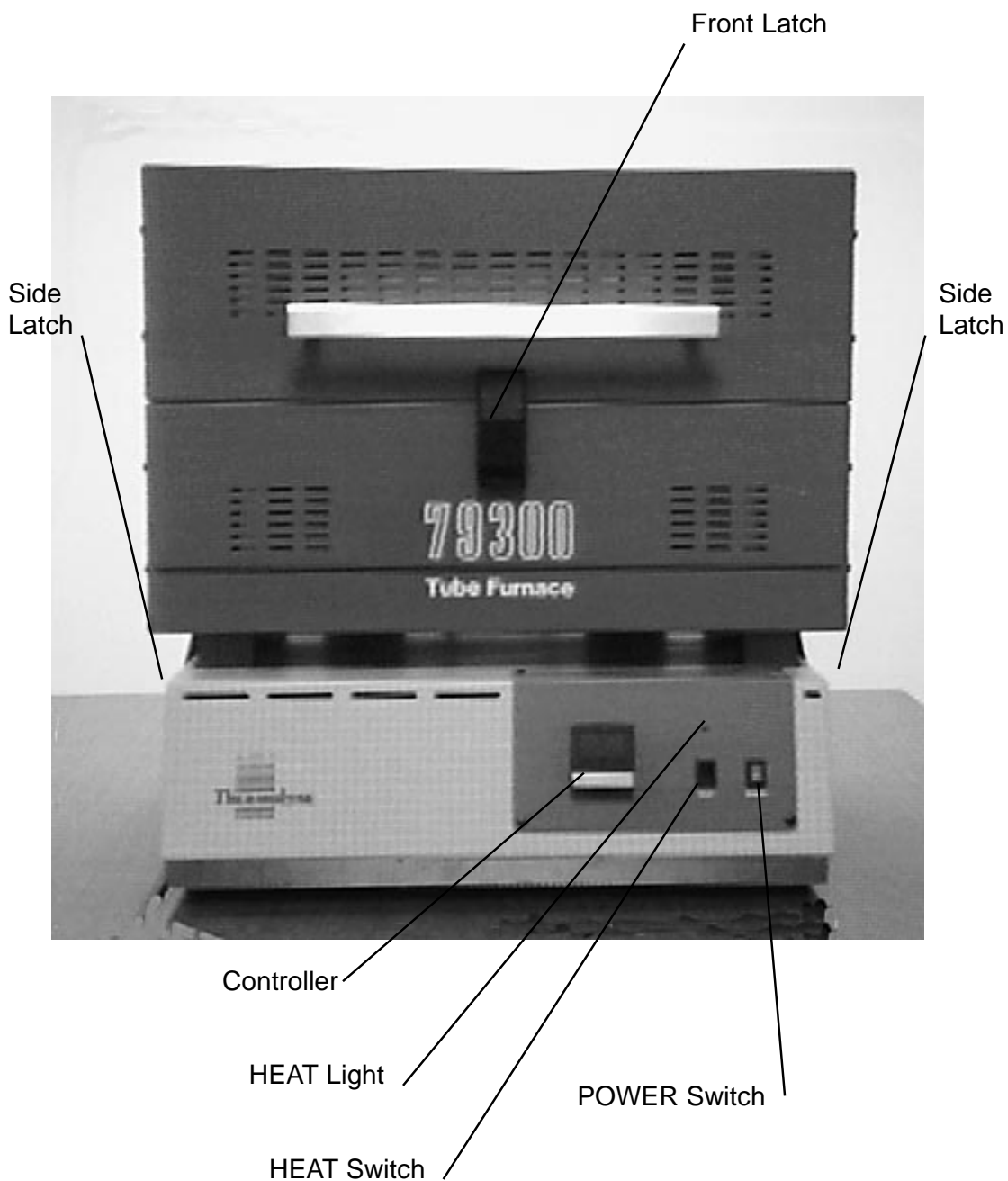


Figure 1 F79300 Tube Furnace (F79400 Tube Furnace is similar, with two Front Latches)

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# Safety Information

Your Thermolyne Type F79300 or F79400 Tube Furnace has been designed with function, reliability, and safety in mind. It is your responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert boxes throughout the manual.

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## Alert Boxes



### Warning

Warning alerts apply when there is a possibility of personal injury.



### Caution

Caution alerts apply when there is a possibility of damage to the equipment.



### Note

Notes alert you to pertinent facts and conditions.



### Hot Surface

Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.

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## Warnings

To avoid electrical shock, this furnace must:

1. Be connected to electrical service by a qualified electrician who ensures compatibility between wiring, furnace electrical requirements, electrical service and electrical codes.
2. Be disconnected from the power supply prior to maintenance and servicing.
3. Have the furnace safety switch operating properly.
4. Always use a properly sized combustion tube.

To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such material.
2. "Caution: Hot Surface - Avoid Contact." To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.
3. Do not open furnace until it has cooled sufficiently to cease to radiate dangerous amounts of heat.
4. Refer servicing to qualified personnel.

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## SAFETY INFORMATION

### PLEASE NOTE THE FOLLOWING WARNINGS:

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## WARNING

This warning is presented for compliance with California Proposition 65 and other regulatory agencies and only applies to the insulation in this product. This product contains refractory ceramic, refractory ceramic fiber or fiberglass insulation, which can produce respirable dust or fibers during disassembly. Dust or fibers can cause irritation and can aggravate pre-existing respiratory diseases. Refractory ceramic and refractory ceramic fibers (after reaching 1000°C) contain crystalline silica, which can cause lung damage (silicosis). The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber and fiberglass as possibly carcinogenic (Group 2B), and crystalline silica as carcinogenic to humans (Group 1).

The insulating materials can be located in the door, the hearth collar, in the chamber of the product or under the hot plate top. Tests performed by the manufacturer indicate that there is no risk of exposure to dust or respirable fibers resulting from operation of this product under normal conditions. However, there may be a risk of exposure to respirable dust or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing them in a manner which causes release of dust or fibers. By using proper handling procedures and protective equipment you can work safely with these insulating materials and minimize any exposure. Refer to the appropriate Material Safety Data Sheets (MSDS) for information regarding proper handling and recommended protective equipment. For additional MSDS copies, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department at Barnstead|Thermolyne Corporation at 1-800-553-0039.

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# Introduction



## **Caution**

Do not exceed limitations for continuous or intermittent operating temperature shown in the General Specifications. Exceeding these limits will result in severely reduced heating element life.



## **Hot Surface**

"Caution: Hot Surface - Avoid Contact." To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.

Do not open furnace until it has cooled sufficiently to cease to radiate dangerous amounts of heat.

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## **Intended Use**

The Type F79300 and F79400 furnaces are high quality, split, hinged furnaces ideally suited for school, chemical and industrial laboratories. They are intended for applications requiring temperatures up to 1200°C. See specification sheet for continuous and intermittent operating temperatures.

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## **General usage**

Do not use this product for anything other than its intended usage.

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## **Principles of Operation**

The furnace chamber is heated by heating elements embedded in a refractory material, with a portion of the elements exposed for maximum heat up and cool down. The split tube design provides ease of loading process tubes and allows a fast cool down. The furnace chamber is supported by the control base, which also houses the electrical connections. Three types of temperature controls are used.

# General Specifications

## Materials of Construction

Aluminum inner shell, painted steel outer shell

## Weight

Shipping.....	105 lbs (47.6 kg) (12" models)
.....	111 lbs (50.3 kg) (12", -33 models)
.....	150 lbs (68 kg) (24" models)
.....	156 lbs (70.8 kg) (24", -33 models)
Operational .....	70 lbs (31.7 kg) (12" models)
.....	76 lbs (34.5 kg) (12", -33 models)
.....	115 lbs (52.3 kg) (24" models)
.....	121 lbs (55.1 kg) (24", -33 models)

## Dimensions

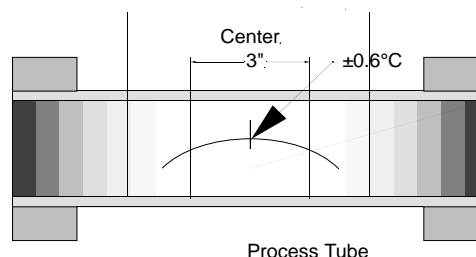
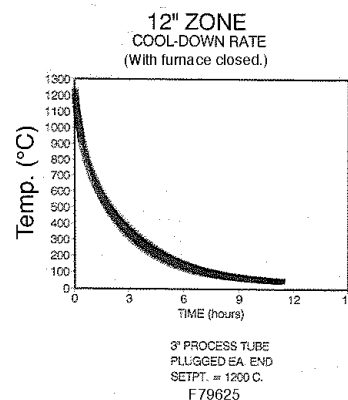
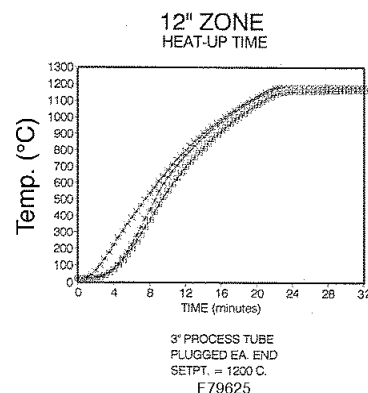
	W		H		D
12" models	22.875"	X	23.125"	X	18.875"
	(58.1 cm)		(58.7 cm)		(47.9 cm)
24" models	34.875"	X	23.125"	X	18.875"
	(88.6 cm)		(58.7 cm)		(47.9 cm)

## Electrical

12" models				
V	W	Hz	I	
120	2880	50/60	24.0	
208	2880	50/60	13.8	
240	2880	50/60	12.0	
24" models				
V	W	Hz	I	
240	5760	50/60	24.0	
208	5760	50/60	27.6	

## Operating Characteristics for F79300

Temperature Range	100°C to 1200°C
Temperature Stability	±0.5°C
Temperature Uniformity	±0.6°C over center 3"
	±3.0°C over center 6"





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## Operating Parameters (Recommended)

Ambient Temperature .....24°C

Relative Humidity .....80% (non-condensing)

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## Environmental Conditions

Operating: 17°C - 27°C; 20% - 80% relative humidity, non-condensing. Installation Category II (over-voltage) in accordance with IEC 664. Pollution Degree 2 in accordance with IEC 664. Altitude limit: 2,000 meters.

Storage: -25°C - 65°C; 10% - 85% relative humidity.

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## Declaration of Conformity (-33 models only)

Barnstead|Thermolyne hereby declares under its sole responsibility that this product conforms with the technical requirements of the following standards:

EMC: EN50081-1 Generic Emission Standard; EN 50082-1 Generic Immunity Standard.

Safety: IEC 1010-1-92 Safety requirements for electrical equipment for measurement, control and laboratory use; Part I: General Requirements  
IEC 1010-2-010 Part II: Particular requirements for laboratory equipment for the heating of materials

per the provisions of the Electromagnetic Compatibility Directive 89/336/EEC, as amended by 92/31/EEC and 93/68/EEC, and per the provisions of the Low Voltage Directive 73/23/EEC, as amended by 93/68/EEC.

The authorized representative located within the European Community is:

European Manager  
Barnstead|Thermolyne  
Saarbrückener Str. 248  
D-38116 Braunschweig  
Germany

Copies of the Declaration of Conformity are available upon request

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# Installation



## Caution

Be sure ambient temperature does not exceed 104°F (40°C). Ambients above this level may result in damage to the controller.

Allow at least six inches of space between the furnace and any combustible surface. This permits the heat from the furnace case to escape so as not to create a possible fire hazard.



## Warning

To avoid electrical shock, this furnace must be connected to electrical service by a qualified electrician who ensures compatibility between wiring, furnace electrical requirements, electrical service and electrical codes.

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## Unpacking

Visually check for any physical damage to the shipping container. Inspect the equipment surfaces that are adjacent to any damaged area.

Unpack furnace from box and remove packing material from inside furnace chamber. Furnace does not contain a refractory process tube.

Retain the original packaging material if re-shipment is foreseen or required.

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## Site Selection

Install furnace on a sturdy surface and allow adequate space for ventilation.

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## Electrical Connections

The F79300 or F79400 must be wired to an electrical box by a qualified electrician. The connections must be made with 10 AWG wires for 24 & 27.6 Amp models or 14 AWG for 12 & 13.8 Amp models, suitable for temperatures of 90°C. The electrical specifications are located on the specification plate on the back of the furnace. Consult Barnstead|Thermolyne if your electrical service is different than those listed on the specification plate. Be sure the front power switch is in the OFF position before connecting the furnace to your electrical supply.



**Note**

If your process tube is much longer than the width of your furnace, you might note some degradation in the performance of the heating zone of the furnace.

## Process Tubes

This furnace can be used with tubes of 1", 2" or 3" diameter. Each size tube requires two tube collars of corresponding size to hold it in position in the furnace. Tubes are not supplied with the furnace. Contact Barnstead|Thermolyne for suppliers of process tubes. Three sets of collars (one set of each size) are supplied with your furnace. For additional collars, see the Ordering Procedures for ordering information and the Replacement Parts List for part numbers.

## Installing Tubes

1. Unlatch and open the furnace chamber.
2. Carefully slide your tube into the round side of an appropriately sized tube collar, inserting the tube until it is flush with the surface of the square side of the collar.

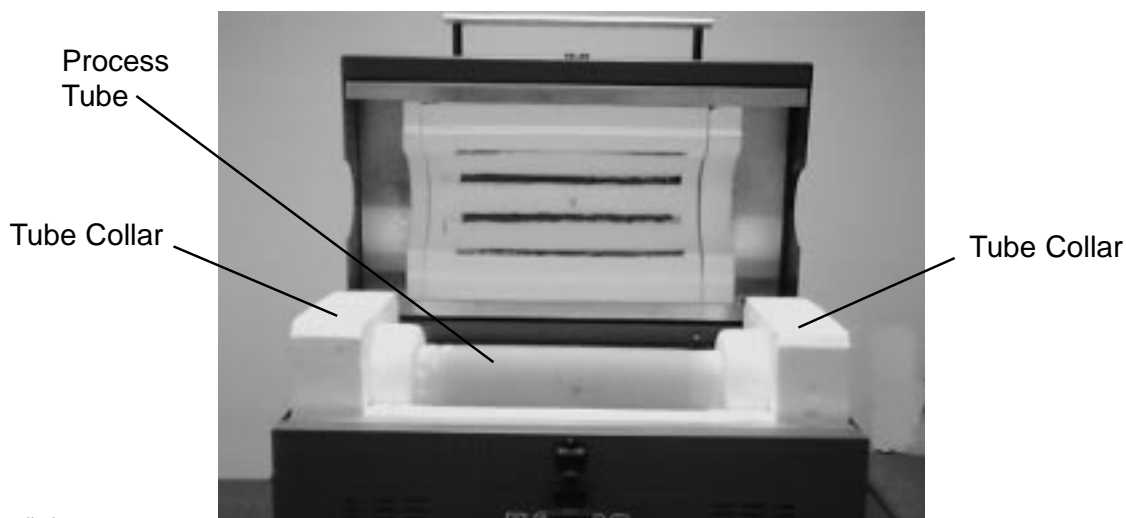


Figure 2 Tube Installation

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## INSTALLATION



### Note

In some cases, your process tube may be longer than the furnace chamber. In this case, carefully center the process tube in the furnace chamber.

3. Slide the other end of your tube into the round side of another appropriately sized tube collar, again inserting the tube until it is flush with the surface of the square side of the collar.
4. Carefully place the tube/collar assembly into the lower half of the furnace, being sure to seat the square sides of the collars fully into the furnace case.
5. Close and latch the furnace chamber.



### Note

Your F79300 or F79400 can also be operated in a vertical position. If you wish to operate your furnace in a vertical position, contact Barnstead|Thermolyne to order a Vertical Support Stand, part number AY793X1.

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## Remote Operation of Furnace

The furnace section of the F79300 or F79400 Tube Furnace can be removed from the control section, allowing you to operate your furnace from a distance. The furnace is supplied with 5 foot cords, allowing you to place your furnace up to 5 feet from the control base. For applications requiring a greater separation between the furnace and the control section, 10 foot remote operation extension cords are also available from Thermolyne (order part number AY793X2 for 208V and 220/240V, AY793X3 for 120V).

To operate your F79300 or F79400 from a distance:

1. Disconnect the unit from the power supply.

2. Disconnect the power cord from the back of the control section:
  - a. Turn the power cord plug counter-clockwise until it unlocks
  - b. Pull the plug straight out.
3. Disconnect the door switch cord and the thermocouple wire from the back of the control section. If you will be using the 10 foot remote operation extension cords, also disconnect the door switch cord from the back of the furnace section.
4. Unlatch the two latches holding the furnace section onto the control section.
5. Carefully lift the furnace section off the control section. Place the furnace section in its new, remote location.
6. If you are installing the 10 foot remote operation extension cords:

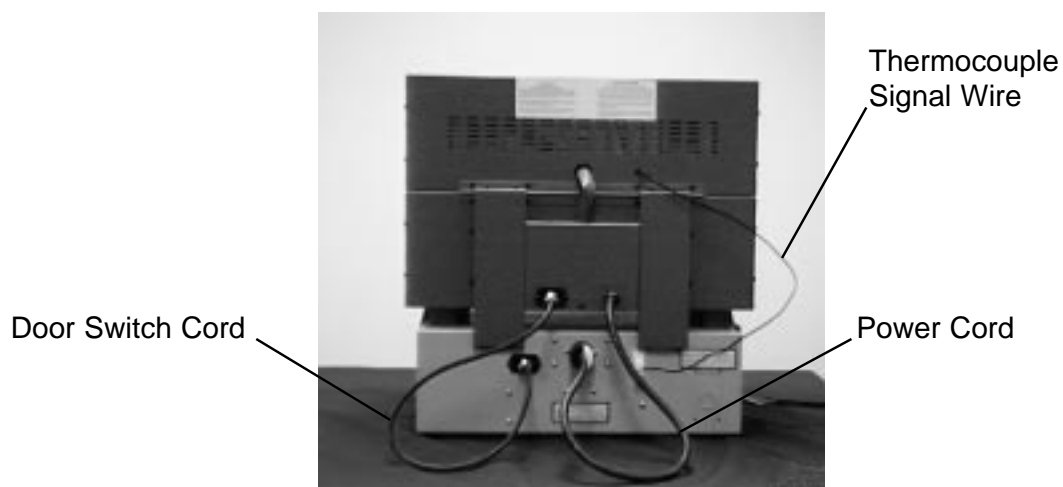


Figure 3 Furnace Back - Connections

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## INSTALLATION

- a. Insert the power cord plug into the plug receptacle on the extension power cord and turn the power cord plug clockwise until it locks.
  - b. Connect the extension thermocouple wire to the thermocouple wire, being careful to insert the thermocouple wire plug into the receptacle on the extension thermocouple wire so that the "+" prong on the plug is inserted into the "+" hole on the receptacle.
7. Connect the power cord to the back of the control section
  - a. Insert the power cord plug into the plug receptacle on the back of the control section
  - b. Turn the power cord plug clockwise until it locks.
8. Connect the door switch cord to the back of the control section. If you are using the 10 foot remote operation extension cords, connect the door switch and the two door switch extension cords together. Connect

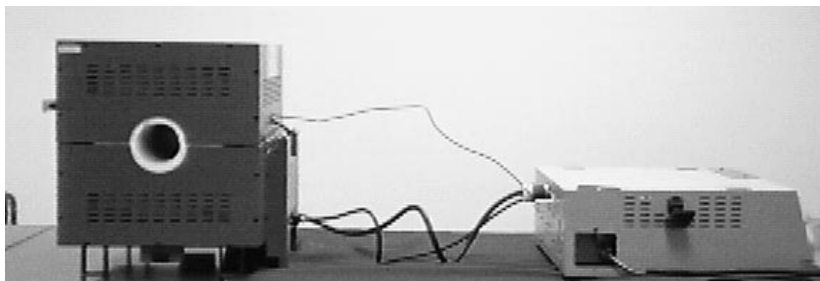


Figure 4 Remote Operation

the unattached end to the back of the furnace section.

9. Connect the thermocouple extension wire to the back of the control section, being careful to insert the thermocouple wire plug into the receptacle on the back of the control section so that the "+" prong on the plug is inserted into the top hole on the receptacle.
10. Reconnect the unit to the power supply. Single Setpoint Temperature Control (Automatic) Operation

# Single Setpoint Temperature Control (Automatic) Operation



## Note

The temperature control in these models is a single setpoint device. By using the “UP” or “DOWN” buttons a specific temperature can be chosen. The control will cause the furnace chamber to heat to the chosen temperature and hold it at this temperature until you turn off the power switch or select another temperature.



## Warning

To avoid electrical shock, this furnace must have the door switch connected and operating properly. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.

## Controls and Displays

### Power Switch

Switch power switch to the “ON” position. The CONTROLLER will illuminate when power is on.

### Furnace Power Indicator

The amber furnace power light will illuminate whenever the door is closed. This light will go out only when the door is open or when there is an over-temperature condition.

### Door Safety Switch

The door safety switch removes power from the heating elements when the door is opened. Open and close the door a few times, note that the amber furnace power light will go out while the door is open. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.

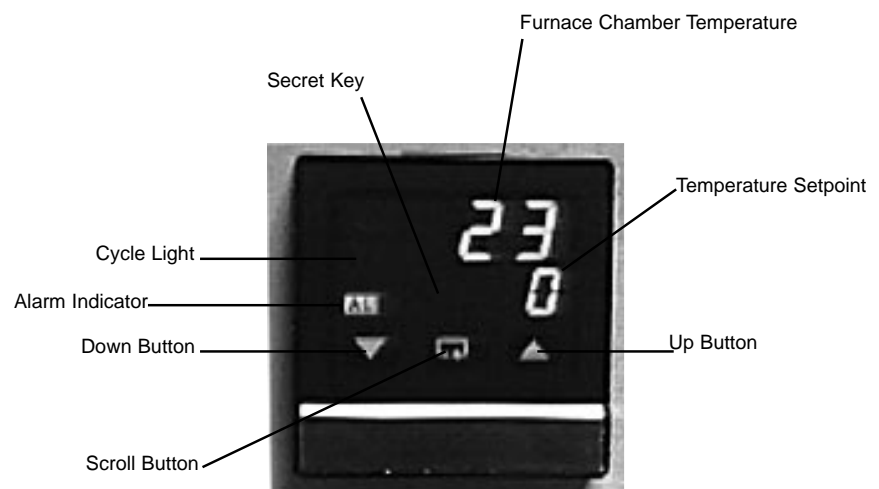


Figure 5 Single Setpoint Controller



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## SINGLE SETPOINT TEMPERATURE CONTROL (AUTOMATIC) OPERATION



### Note

When performing operations with the controller, remember that if more than eight to ten seconds elapse before the buttons are used again, the display screen will automatically switch back to displaying chamber temperature. If this happens, light up the front panel again and step through each parameter until you reach the point at which the interruption occurred. The parameter values you adjusted earlier, however, will not be lost or altered. Holding down on the “SCROLL” button allows longer viewing time.



### Caution

Do not exceed limitations for continuous or intermittent operating temperature shown in the General Specifications. Exceeding these limits will result in severely reduced heating element life.

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### Control Buttons

To illuminate the “DOWN” button, “SCROLL” button, and “UP” button, touch anywhere on the front panel.

---

### Digital Readout

The Digital Readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the “SCROLL” button is depressed.

### Startup Display

When the power switch is turned on, the controller will perform a self-test to make sure controller is operating properly. (If all four 1’s do not light up or fail to go to “8888”, contact Thermolyne.)

---

### Adjusting Furnace Set Point

#### Temperature

To illuminate the “DOWN” button, “SCROLL” button, and “UP” button, touch anywhere on the front panel.

Push the “UP” button or the “DOWN” button to modify the temperature setpoint (lower digital display).

---

### Tuning

This control incorporates a self tuning feature which determines the optimum control parameters for the best temperature accuracy. We recommend that you tune the furnace to your specific application to obtain the best results. Perform the following procedures when you first set up your furnace and each time you change your load type or operating temperature.

---

## SINGLE SETPOINT TEMPERATURE CONTROL (AUTOMATIC) OPERATION



### Note

If the power to furnace is “turned off” or interrupted while in “tuning,” upon returning power to furnace, the controller display will indicate “LinE FAIL” because sampled data could be questionable. To restart tuning, refer to “Tuning” procedure.

If the controller cannot maintain temperature setpoint, “tunE FAIL” will appear on display. First, correct the problem responsible for not maintaining the temperature setpoint, then restart the “tuning” procedure.



### Hot Surface

"Caution: Hot Surface - Avoid Contact." To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.

Do not open furnace until it has cooled sufficiently and ceased to radiate dangerous amounts of heat.

---

### To tune your furnace:

Load your furnace with a load characteristic of those you intend to heat in it.

Set the furnace's setpoint to the temperature you intend to use for your application.

Push the “SCROLL” button until “tunE” appears. To start the tuning function, push the “UP” button.

When the tuning process is started, the lower display will flash “tunE” along with the furnace temperature setpoint. During tuning, the temperature setpoint cannot be changed. To change temperature setpoint “tunE” must be turned “OFF.” (To stop the tuning function, push the “DOWN” button.)

---

## Setting Controller Parameters

### Changing Temperature Indication

Push “SCROLL” button once, “°C” will appear. This indicates temperature measurement. (Contact Thermolyne if control needs to be changed to °F.)

---

### Setting the High Alarm Temperature

#### (Over Temperature Protection OTP)

Push “SCROLL” button until “AL.SP” (Alarm Setpoint) appears.

---

## SINGLE SETPOINT TEMPERATURE CONTROL (AUTOMATIC) OPERATION



### Note

HIAL- HIGH ALARM. (over-temperature protection, OTP)

The controller is fitted with a mechanical relay which is de-energized in the alarm mode. This relay, when de-energized, removes power from the heating elements. If the primary control circuit fails, the OTP will control the furnace temperature at the preset value you have entered. It does not shut off the furnace, but will maintain the chamber temperature at that value.

Depress either the “UP” or “DOWN” button to select the OTP value you desire. Thermolyne recommends that you set the value either at the maximum operating temperature of the furnace or a value of 20 degrees above your working temperature if you desire to provide protection for your workload.

# Operation of 2 Ramp & 2 Dwell Programmable Models



## Note

In the event of a thermocouple break (open circuit), the numeric display increases rapidly upscale, then displays "Sn b" (sensor break), and may alternatively flash "HiAL" (high alarm) and/or dAL (deviation alarm) and the sensor break power value.

A reversed thermocouple connection or incorrect thermocouple will cause the display to read "ur" (underrange) and the control will maintain the sensor break power output value selected.



## Hot Surface

"Caution: Hot Surface - Avoid Contact." To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.

Do not open furnace until it has cooled sufficiently and ceased to radiate dangerous amounts of heat.

## Controls and Displays

### Digital Readout

The digital readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the PAR (parameter) button is depressed.

If a program is in either run, Hb or Hold, pressing "PAR" once causes the lower display to indicate the current segment of the program (r1, d1, r2, d2, or Hb) along with °C or °F. If the program is currently in either d1 and d2, the value shown below these parameters (d1 or d2) reflects the time remaining in the segment.

While the program is in run, Hold or Hb, the set point shown on the bottom display is the current working set point.

When the controller is in idle, depressing PAR shows each parameter and its current value in turn on the display. The parameter value can either be modified with the "up" or "down" push buttons or left unmodified.

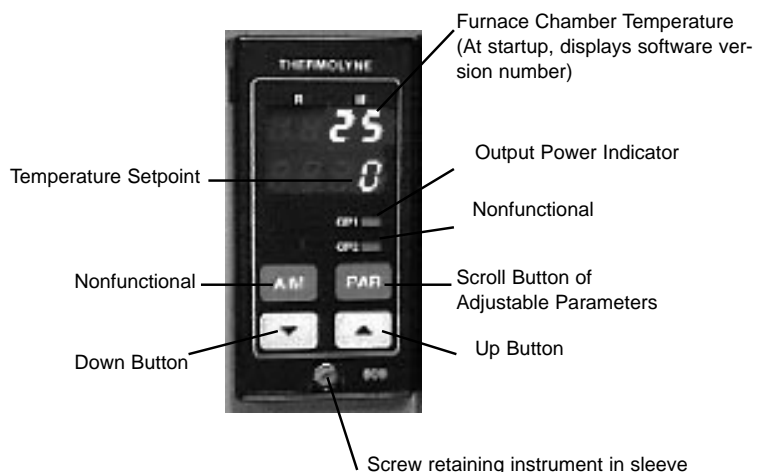


Figure 6 Programmable Control (2 ramp & 2 dwell)



**Note**

Remember that whenever the power switch is turned “ON,” the furnace will begin to heat at the setpoint temperature that was previously set. This value will remain unchanged for up to a year without power being applied to the control.



**Warning**

To avoid electrical shock, this furnace must have the door switch connected and operating properly. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.



**Note**

Pushbutton “A/M” and light “OP2” are inactive and not used.

See **Parameters** for a list of the controller parameters in order.

---

**Power Switch**

Set power switch to the “ON” position. The CONTROLLER will illuminate when power is on.

---

**Furnace Power Indicator**

The amber furnace power light will illuminate whenever the door is closed. This light will go out only when the door is open or when there is an over-temperature condition.

---

**Door Safety Switch**

The door safety switch removes power from the heating elements when the door is opened. Open and close the door a few times, note that the amber furnace power light will go out while the door is open. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.

---

**Parameters**

**PROG - program options** . By pushing up or down buttons, three options can be chosen: **run** - to start program; **idle** - to end program; **hold** - to hold program until further action.

**SP - set point temperature**. When running a program, it is the last temperature value attained. Push up or down button to set.

**TUNE - self-tuning feature**. Push up or down button to set.

**LC - loop count**. The number of times the program is repeated. Push up or down button to set.

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## OPERATION OF 2 RAMP & 2 DWELL PROGRAMMABLE MODELS



### Note

When performing operations with the controller, if you depress and release either the "PAR," scroll "up," or scroll "down" push buttons and more than 6 seconds elapse before the buttons are used again, the display screen will automatically switch to displaying chamber temperature. If this happens, you will have to step through each parameter until you reach the point at which the interruption occurred. The parameter values you adjusted earlier, however, will not be lost or altered. Holding down on "PAR" allows longer viewing time.



### Warning

The controller is fitted with a mechanical relay which is de-energized in the alarm mode. This relay, when de-energized, removes power from the heating elements. If the primary control circuit fails, the OTP will control the furnace temperature at the preset value you have entered. It does not shut off the furnace but will maintain the chamber temperature at that value.

**r1 - ramp rate #1.** The rate of heat increase or decrease in °/minute. Push up or down button to set.

**L1 - temp level #1.** The temp level that r1 will attain. Push up or down button to set.

**d1 - dwell (soak) time #1.** The amount of time in minutes to hold L1 temp level #1. Push up or down button to set.

**r2 - ramp rate #2.** The rate of heat increase or decrease in °C/minute. Push up or down button to set.

**L2 - temp level #2.** The temperature level r2 will attain. Push up or down button to set.

**d2 - dwell (soak) time #2.** The amount of time in minutes to hold L2 temperature level #2. Push up or down button to set.

**Hb - "holdback."** Automatically places the programmer into "HOLD" if the measured value deviates more than a specified amount from programmer setpoint. When measured value reenters the holdback band, the timing for the segment resumes. (Parameter is expressed in °C and only functions when running a program). Push up or down button to set.

**HiAL - high alarm (over temperature protection).** Push up or down button to set. Thermolyne recommends that you set the value either at the maximum operating temperature of the furnace or a value of 20 degrees above your working temperature if you desire to provide protection for your workload.

The next three parameters - Proportional Band, Integral and Derivatives - are the three control parameters of a P.I.D. control system. These parameters will be set when you tune your furnace. (See **Tuning**.)

**Prop - Proportional Band.**

**In.t - Integral Time.**

**dEr.t - Derivative Time.**

**HPI - High Power Limit (%)** This parameter limits the average maximum power that is applied to the



### Note

All temperature dependent parameters are automatically converted when the temperature unit (C or F) is changed.

heating elements. Remember that this parameter does not reduce the voltage to the elements. It reduces the average power to the elements by cycling power on and off.

**C/F - Centigrade/Fahrenheit.** Choose the desired temperature unit by depressing the “UP” or “DOWN” pushbutton.

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## Tuning Your Controller

This programmable control has an automatic tuning feature which installs optimum tuning parameters to give the best temperature accuracy. No manual loading of tuning parameters is needed. We **highly** recommend using this feature to provide the best temperature accuracy the controller can attain. Perform the following procedures when you first set up your furnace and each time you change your load type, operating temperature, or program.

---

### To initiate the self tune feature

Load your furnace with a load characteristic of those you intend to heat in it.

If you will be using the controller as a single Setpoint Controller, set the furnace's setpoint to the temperature you intend to use for your application.

If you will be running a multi-step program, set the furnace's setpoint to the value of **L1 (temp level #1)**.

Push “PAR” button until TUNE is displayed, then push “UP” or “DOWN” button to turn tune “ON.”

---

## OPERATION OF 2 RAMP & 2 DWELL PROGRAMMABLE MODELS



### Caution

Do not exceed limitations for continuous or intermittent operating temperature shown in the General Specifications (in furnace manual). Exceeding these limits will result in severely reduced heating element life.



### Hot Surface

"Caution: Hot Surface - Avoid Contact." To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.

Do not open furnace until it has cooled sufficiently and ceased to radiate dangerous amounts of heat.

During the operation, TUNE flashes in the lower display. Do not make any adjustments to the controller parameters during this period. The self tuning is finished when TUNE no longer flashes in the lower display.

Self tuning will calculate values for:

Proportional band - prop

Integral time - Int.t

Derivative time - der.t

- Self tuning cannot be initiated while running a program.
- A power failure will cause the TUNE parameter to revert back to NO. (Reset tune parameter to YES).
- If there are alarm conditions during self tuning, they flash alternately with TUNE.

---

## Operating the Controller

### Single Set Point Operation

The programmable control can be used as a single setpoint control or as a programmable control. To use as a single set point control simply push the "UP" or "DOWN" buttons to choose a specific temperature. The control will cause the furnace chamber to heat to the chosen temperature and hold this temperature until the power switch is set to "OFF" or another temperature is selected.

- a. The setpoint temperature presently set in the control will be read out on the lower display.



---

## OPERATION OF 2 RAMP & 2 DWELL PROGRAMMABLE MODELS

- b. To change this set point, depress the “UP” or “DOWN” push button until the desired setpoint value is displayed, then release the button.
- c. At this point the furnace will begin to heat, if the new set point temperature you have chosen is higher than the present chamber temperature.

---

### Programming Controller

To run a program, first determine your ramp rate, dwell times and program levels. It is helpful to graph your program for ease of loading the program into controller.

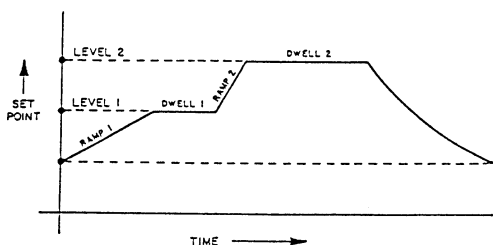
A maximum of 2 ramp and 2 dwell segment combinations are available, thus enabling 2 different set point levels to be achieved. Each ramp is programmed by specifying the temperature level (L1) and the required ramp rate (r1). The programmer then automatically calculates the time that is required to attain the temperature level (L1) based on the desired ramp rate (r1). Dwell segments (d1) then can be attached to each temperature level (L1) to hold that temperature for a specified amount of time.

Make sure the PROG parameter is set to idle (to stop program) when entering program values. (See **Parameters.**)

Push “PAR” until “r1” is displayed. Push “UP” or “DOWN” buttons and set ramp rate “r1” (heat increase or decrease) in °C/minute.

Push “PAR” until “L1” is displayed. Push “UP” or “DOWN” buttons and set temperature level “L1.” This is the target temperature for the first ramp.

Push “PAR” until “d1” is displayed. Push “UP” or “DOWN” buttons and set dwell (soak) time “d1” in minutes.



Graphing a New Program

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## OPERATION OF 2 RAMP & 2 DWELL PROGRAMMABLE MODELS

Push "PAR" until "r2" is displayed. Push "UP" or "DOWN" buttons and set ramp rate "r2" in °C/minutes.

Push "PAR" until "L2" is displayed. Push "UP" or "DOWN" buttons and set temperature level "L2." This is the target temperature for the second ramp.

Push "PAR" until "d2" is displayed. Push "UP" or "DOWN" buttons and set dwell (soak) time "d2" in minutes.

Push "PAR" until "SP" is displayed. Push "UP" or "DOWN" buttons and modify set point temperature. After "d2" dwell time has expired, thus ending the program, the last temperature level to be attained will be equal to "SP" temperature. For example, if after your program has been completed, you want the furnace to cool to ambient, set "SP" to 20. This will be the last temperature level attained.

Push "PAR" until "LC" is displayed. Push "UP" or "DOWN" buttons and set "LC" (loop count - number of times program is repeated).

### **Skipping Segments**

If you desire to skip a ramp or dwell segment, follow this procedure:

- for a dwell segment, enter a setting of "0" minutes.
- for a ramp segment, enter a high value such as 100°/min. This will cause controller to skip to the next segment as fast as the furnace is capable.

### **Setting the Holdback Feature**

This controller features a holdback (Hb) function to ensure programmed parameter values are adhered to. Holdback is set in display units (degrees C or F)



### Note

Parameter values r1, L1, D1, r2, L2, D2 and LC cannot be adjusted while running a program.

and represents the allowable excursion of measured value away from the current set point, either above or below, before the program is forced into hold (clock stops).

The program will remain in hold until the measured value comes within holdback band (clock starts). This feature is active the whole time that the program is running. (Holdback functions only while running a program).

Push PAR until "Hb" is displayed. Select desired holdback setting - a setting of 20° is recommended.

If a running program is forced into holdback, the illuminated dot below the "R" symbol on controller will flash and the PROG parameter will indicate "Hb." When the program is in "holdback," it effectively lengthens the time of the program - if the holdback band "Hb" is set too low, the program will never escape the holdback band, thus the program will never be completed. If you do not want to use the holdback function, set "Hb" to an extremely large value.

---

## Implementing Programs

When you have finished programming and are ready to run your program, push "PAR" until PROG is displayed. Pushing the "UP" or "DOWN" buttons, you have three options: "Run" (to start program), "idle" (to stop program), "hold" (to hold program) - parameter values can be changed when hold is chosen.

### Program Execution

When "run" is selected, the program will start from the actual furnace temperature at that point in time. The dot under "R" on the control will illuminate to indicate the program is running.

### **Program Hold**

To adjust parameters while running a program, you must put control into "Hold." Push "PAR" until "prog" is displayed. Push "UP" or "DOWN" buttons until Hold is displayed. When the dot underneath "R" on controller flashes and "Hold" is indicated at the "prog" parameter, the controller is in Hold. Now you are able to adjust all parameters. To restart the program, set "prog" to "run" again.

### **Program Idle**

To stop program, push "PAR" button until "prog" is displayed. Push "UP" or "DOWN" buttons until "idle" is displayed. This will terminate a running program.

# 8 Ramp & 8 Dwell Multi-Programmable Models



## Note

When performing operations with the controller, if you depress and release either the “scroll,” “up,” or “down” push buttons and more than 8 seconds elapse before the buttons are used again, the display screen will automatically switch back to displaying setpoint temperature. If this happens, you will have to step through each parameter until you reach the point at which the interruption occurred. The parameter values you adjusted earlier, however, will not be lost or altered.

## Controls and Displays

### Digital Readout:

The digital readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the scroll button is depressed.

If the scroll button is depressed and released, the lower display will indicate output power (OP) or setpoint (SP). This is referred to as the “short scroll.” Continued single step action of scroll button will cause lower display to alternate between setpoint (SP) and output power (OP).

To enter the main scroll list (list of all controller parameters that are accessed through front keyboard), the scroll button should be held depressed. PR1 (program ramp rate 1) will appear. To progress through the parameter list, the scroll button must first be released; subsequent single step depression will advance you through the list. Rapid progression through the parameter list is achieved by holding the scroll button depressed.

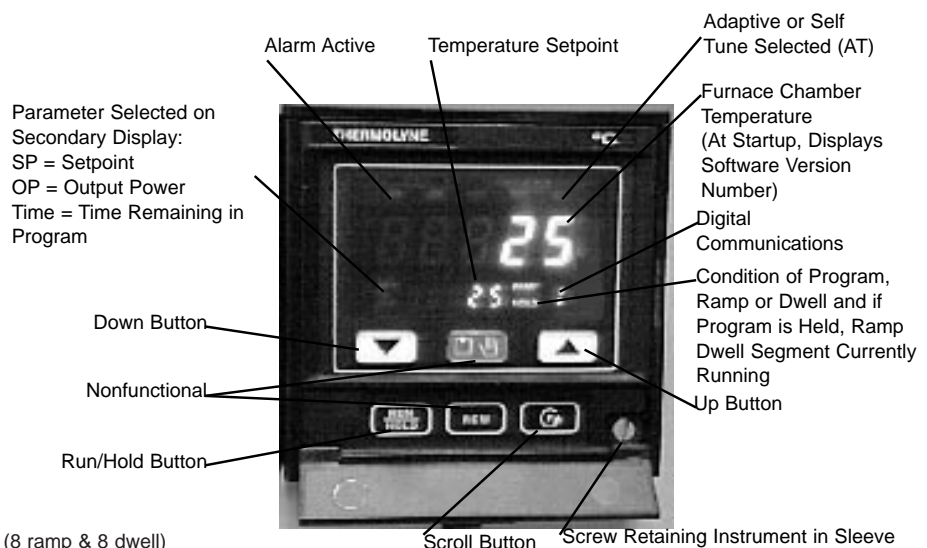


Figure 7 Multi-Programmable Control (8 ramp & 8 dwell)

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## 8 RAMP & 8 DWELL MULTI-PROGRAMMABLE MODELS



### Note

To change from °C indication to °F indication, contact Barnstead/Thermolyne.



### Caution

Remember that whenever the power switch is turned “ON,” the furnace will begin to heat at the setpoint temperature that was previously set in. This value will remain unchanged for up to a year without power being applied to the control.



### Warning

To avoid electrical shock, this furnace must have the door switch connected and operating properly. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.



### Note

The two center push buttons are inactive and not used.

See **Parameters** for a list of the controller parameters in order.

### Power Switch

Turn power switch to the “ON” position.

### Furnace Power Indicator

The amber furnace power light will illuminate whenever the door is closed. This light will go out only when the door is open or when there is an over-temperature condition.

### Door Safety Switch:

The door safety switch removes power from the heating elements when the door is opened. Open and close door a few times, note that the amber furnace power light will go out while the door is open. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.

---

## Parameters

**Pnr - Program Number.** The program number of the program you are going to work with. By pushing the up or down button you can select a program numbered from 1 to 4.

**PR1 - Program Ramp Rate.** The rate of heat increase or decrease in °C/minutes. Pushing the up or down button will give current setting of this ramp.

**PL1 - Program Level.** The temperature to which the furnace needs to attain. Push up or down button to set.

**PD1 - Program Dwell 1.** Amount of time in minutes to hold PL1 program level temperature. Push up or down button to set.

You will use the same descriptions and procedures used for PR1, PL1, PD1 for the remaining Program Ramp Rates PR2 - PR8, Program Levels PL2 - PL8, and Program Dwells PD2 - PD8.

**Cnt - Continue.** Allows linking of programs. You may select Cnt as “y” (yes) or “n” (no) by pushing the up or down button.

**HB - Holdback.** Automatically places the programmer into “Hold” if the measured value deviates more than a specified amount from programmer setpoint. When measured value re-enters the hold-back band, the timing for the segment resumes. (Parameter is expressed in °C and only functions when running a program). Push up or down button to set.

**PLC - Program Loop Count.** The number of times a program will be repeated. Push up or down button to set.

**SP1 - Setpoint One.** Indicates current setpoint. Push up or down button to set.

**SP2 - Setpoint two.** Not configured into control and nonfunctional. Set to “20”.

**AT - Adaptive Tune.** Analyzes and inputs optimum PID values when temperature has reached setpoint. This function does not have a value; it is either “ON” or “OFF.” (See Furnace Operation for function of Adaptive Tune).

**ATR - Adaptive Tune Range setting.** Determines the operational band width of the adaptive tuning function. Self Tuning automatically determines this setting.

**AL1 - Alarm 1.** A full scale alarm which protects load and furnace when temperature exceeds preset value. Furnace will control temperature at the preset temperature value; it will not shut off furnace. Push up or down button to set.



### Note

Thermolyne recommends that you set the AL1 value either at maximum operating temperature of the furnace (1100°C = 2012°F) or a value of 20 degrees above your working temperature if you desire to provide protection for your workload.

---

## 8 RAMP & 8 DWELL MULTI-PROGRAMMABLE MODELS

The next three parameters - Proportional (PB) Integral (+i) and Derivative (+d) - are the three control parameters of a P.I.D. control system. These parameters will be set when you tune your furnace. (See **Self-Adaptive Tuning**.)

**Pb** - Proportional.

**(+i)** - Integral.

**(+d)** - Derivative.

The next two parameters - cutback low (**cbi**) and cutback high (**cbh**) - are to aid the control in preventing temperature overshoots and undershoots.

The point from setpoint where the power starts “cutting back” is defined as the cutback value.

These values are also automatically adjusted by the Self Tuning and Adaptive Tuning features.

These values cannot be changed by the user; the controller automatically installs optimum cutback values when in Self Tuning and Adaptive Tuning.

**HL - Output Power** limits the average maximum power that is applied to the heating elements.

Normal setting is 100%. If you plan to use the furnace below 260°C (500°F) the output power may be reduced. This will significantly shorten the time it takes for stabilization. It will also reduce drastic temperature overshoots. Contact

**Barnstead/Thermolyne** Customer Service for advice on the proper value to use. Remember that this parameter does not reduce the voltage to the elements. It reduces the average power to the elements by cycling power on and off.

**HC - Cycle Time** is the rate at which power is supplied to power control switch. Push up or down button to set.

**Sbr - the percent of power that is supplied to the control output terminals if an open thermocouple condition exists.** Push up or down button to check. 0.0 will be displayed. This parameter cannot be changed; if 0.0 is not displayed, contact Barnstead/Thermolyne. The upper display will flash “OR” if an open thermocouple condition exists.



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## Tuning Your Controller

The programmable control has automatic tuning features which install optimum tuning parameters to give the best temperature accuracy. No manual loading of tuning parameters is needed. We **highly** recommend using these features to provide the best temperature accuracy the controller can attain. Perform the following procedures when you first set up your furnace and each time you change your load type, operating temperature, or program.

The following procedure is instruction on how to initiate the SAT Self and Adaptive Tuning feature. This feature starts the controller in the Self Tune mode, then automatically switches over to the Adaptive Tuning Feature. Self Tuning permits you to retune the instrument control parameters to suit new process conditions. Adaptive tuning takes over when the self tune is completed and continuously reevaluates the tuned parameters. Adaptive tuning will then automatically install new values if a better response could have been attained.

---

### To initiate the tuning feature

Load your furnace with a load characteristic of those you intend to heat in it.

Depress the scroll button until SAT is displayed. Depress the up and down buttons simultaneously to start self tuning. The A-T indicator is then illuminated (upper right hand corner) and the lower display indicates the setpoint at which the self-tune sequence will occur. The "SP" indicator will flash for

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## 8 RAMP & 8 DWELL MULTI-PROGRAMMABLE MODELS



### Caution

Do not exceed limitations for continuous or intermittent operating temperature shown in the General Specifications. Exceeding these limits will result in severely reduced heating element life.

1 minute, during which time the setpoint may be changed, if it is required to retune at a new setpoint either above or below the process value indicated on the upper display. *(If you will be using the controller as a single Setpoint Controller, set the furnace's setpoint to the temperature you intend to use for your application. If you will be running a multi-step program, set the furnace's setpoint to the value of **PL1 (Program Level #1)**.* At the end of the minute, the "SP" indicator will stop flashing, indicating that the setpoint can no longer be changed. The A-T indicator will start flashing and continue to flash until the self tune has completed. Once the self tune is completed, adaptive tune takes over and the A-T indicator will remain illuminated.

To stop tuning, function scroll until SAT is displayed and simultaneously push up and down buttons.



### Hot Surface

"Caution: Hot Surface - Avoid Contact." To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.

Do not open furnace until it has cooled sufficiently and ceased to radiate dangerous amounts of heat.

---

## Operating the Controller

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### Single Set Point Operation

This programmable control can be used as a single setpoint control or as a programmable control. To use as a single set point control, simply the push up or down buttons to choose a specific temperature. Temperature setpoint or output power is indicated on lower display; single depression of the scroll button will alternate between these two parameters. The control will cause the furnace chamber to heat to the chosen temperature and hold it at this temperature until you turn off the power switch or select another temperature.

---

## 8 RAMP & 8 DWELL MULTI-PROGRAMMABLE MODELS

- a. The setpoint temperature presently set in the control will be read out on the lower display.
- b. To change this set point, depress the “UP” or “DOWN” push button until the desired setpoint value is displayed then release the button.
- c. At this point the furnace will begin to heat if the new set point temperature you have chosen is higher than the present chamber temperature.

The upper display indicates the actual furnace temperature.

---

### Programming Controller

The multi-programmable controller in these units provides up to 4 separate programs of 8 ramps and 8 dwells each. This controller also allows you to link programs together, which allows you to achieve 64 total segments (4 programs X 16 segments). These functions are controlled by the controller's first two programming parameters, “Pnr” and “Cnt.”

A maximum of 8 ramp and 8 dwell segment combinations are available per program, thus enabling eight different setpoint levels to be achieved. Each ramp is programmed by specifying the program level (PL) and the required ramp rate (PR). The programmer then automatically calculates the time that is required to attain the program level (PL) based on desired ramp rate (PR). Dwell segments (soak) then can be attached to each program level (PL) to hold that temperature for a specified time.

---

## 8 RAMP & 8 DWELL MULTI-PROGRAMMABLE MODELS



### Note

Once the desired parameter has been selected, depressing either the raise or lower button will cause the parameter to be replaced with the new value. At this point, the “top dot” of the least significant digit of the secondary display will flash on and off. Any further use of up or down buttons will change parameter value. In all cases, the value shown on the display is the current working value of that parameter.

To run a program, first determine your ramp rate, dwell times and program levels. It is helpful to graph your program for ease of loading program into controller.

### Program Entry

#### *To Select Program Number*

Push scroll button until “Pnr 1” is displayed. Push the up or down button to select a program number from 1 to 4.

#### *To Link Programs Together*

Push scroll button until “Cnt n” is displayed. Press and release the up and down buttons to switch between “Cnt y” (continue yes) and “Cnt n” (continue no). The effect of selecting “Cnt y” is to continue the program to the next program number. For example, if in program #3 you select “Cnt y,” when program #3 is complete, program #4 will run automatically. Setting “Cnt y” in program #4 will initiate the start of program #1 upon the completion of program #4. Each program will complete the selected number of loops before continuing (see Loop Count). If you do not want to link programs, set Cnt to “Cnt n” (continue no).

#### *Set Ramp Rates*

1. With the programmer not operating, indicated by the bottom right hand side of the display extinguished, depress scroll button until **PR1** is displayed. Push the up or down button to scroll to the desired value, which is degrees per minute.

Scrolling down below zero will give three other options for the ramp:

**NONE**-which will force the program to skip to the next segment;

**END**-which will cause the program to stop or restart if loops remaining is not zero;

**STEP**-which will cause the program to ramp as quickly as possible to the next temperature level.

All other ramps in the program are set in a similar fashion by selecting 'PR' followed by the relevant ramp number.

### *Set Level Temperatures*

2. The level to which the first ramp is aiming is entered by scrolling through the main scroll list until "PL1" is displayed. By pressing either the up or down button, the present value of this level is indicated in display units. Using the up or down button will scroll the present value to the new value required. All other levels in the program are set in a similar fashion by selecting 'PL' followed by the relevant number.

### *Set Dwell Times*

3. To set the dwell time for the first level, scroll through the main scroll list until "Pd1" is displayed. Pressing the up or down button will reveal the current value of time in minutes. Using the up or down button will scroll the present value to the new value required. Scrolling this value downscale will allow a setting of "END." A setting of "END" will terminate the program, or force it to restart if loops remaining are not zero at the beginning of that dwell.

All other dwells in the program can be set in a similar fashion by selecting "Pd" followed by the relevant dwell number.

### *Set the Number of Times to Repeat the Program*

4. Scrolling through the main scroll until the parameter "PLC" is displayed and then depressing the up or down button will reveal the present setting of the loop count. This is the number of times that the entered program will be repeated before a continuous setpoint at the last level of the program is achieved. By pushing the up or down button, the number of loops can be set at any value from 1 to 999.

### *Set the Holdback Feature*

5. Scroll through the main scroll list until "HB" is displayed. Push the up or down button to reveal the current value of holdback. The up or down button can now be depressed to scroll to the required value. Holdback is set in display units and represents the allowable excursion of measured value away from the current setpoint, either above or below, before the program is forced into hold. The program will remain in hold until the measured value comes within holdback limits. This feature is active the whole time that the program is running. When hold is forced onto the program by holdback, the "HOLD" legend is not illuminated but either the "RAMP" or "DWELL" legend will flash.

**Note**

Be sure to select the program number before pressing "Run/Hold."

---

### Implementing Programs

**Program Execution**

Once the program has been entered it can be set running by depressing the 'RUN/HOLD' push button on the front.

With the run initiated, the program will commence and the legend on the display will indicate if a ramp or dwell is being performed. While a program is running, the short scroll will contain a third parameter "TIME." Push the scroll button once; time remaining for the current segment, either ramp or dwell, will be indicated. If the loop counter has been set to any value other than one, then the above procedure will be repeated for each loop.

At the end of the complete program, an "E" will appear on the display.

**Parameter Change While Running**

The parameters can be inspected but not changed while a program is running. If it is necessary to alter a parameter while a program is running, the program must be placed into the hold condition. To put a program into hold, push the run/hold button once. After modification of the parameter, returning the program to the run state will cause the program to continue with the changed value(s) installed. Push run/hold button again to restart program.

**Loop Count**

If the loop count is set to values other than one, then the number of loops remaining in a running program can be displayed. To determine which loop is being performed depress the scroll button until 'LR' is displayed and, by pushing either the up or down button, the remaining number of loops, excluding the one being executed, is displayed.

---

## 8 RAMP & 8 DWELL MULTI-PROGRAMMABLE MODELS



### Note

The temperature control in these models is a programmable “and” automatic single set-point device. When the program has ended, the controller will maintain the chamber temperature at a value equal to the last programmed level (PL) until the program is cancelled. It will not automatically cool to ambient unless last programmed level (PL) is set at ambient. When a program is cancelled, the controller will maintain the chamber temperature at a value equal to the main setpoint (SP1 or SP). To cancel a program, depress and release the “UP” and “DOWN” push buttons simultaneously. Be sure single set point mode is set to 20 degrees or below as described earlier in this manual.

### Program Hold

A running program can be forced into hold at any stage by depressing the “RUN/HOLD” push button on the front. When a running program is forced into hold, the “HOLD” legend will appear on the display together with the segment type and will be flashing. Pushing “RUN/HOLD” button again will return the program to a run situation and extinguish the “HOLD” legend.

### Program Reset

A running, held or finished program can be reset by depressing the up and down push buttons together.

When the reset has been enabled, the parts of the display associated with programming will be extinguished and the controller will operate as a single setpoint control.



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# Furnace Atmospheres and Furnace Loading

These furnaces are designed to be used to 1200°C in a respirable atmosphere only. When injecting atmospheres into the process tube, use proper procedures to avoid leakage which may contaminate the heating elements.

The heating elements in these furnaces are attacked by fluorine, chlorine, sodium and potassium compounds and also by molten metals.

For best results, use only the center two-thirds of the furnace chamber.

Keep objects away from the thermocouple.

Use insulated tongs and mittens when loading and unloading the furnace.

Always wear safety glasses.

Never come into contact with the heating elements. Hitting the elements with tongs or laying the load against them will cause the elements to burn out.

---

# Preventative Maintenance

Housekeeping is vital to your electric furnace – KEEP IT CLEAN. Occasionally run your furnace up to 1600°F (871°C) empty to burn off the contamination that may exist on the insulation and elements. Maintain 1600°F (871°C) for at least 4 hours to insure complete ashing of foreign materials. This is only necessary if contaminants build up on the heating elements or the insulation.

Element life is reduced somewhat by repeated heating and cooling. If the furnace is to be used again within a few hours, it is best to keep it at the operating temperature or at a reduced level such as 500°F (260°C).

Thermolyne highly recommends that you replace the thermocouple periodically (once every six months) to ensure temperature accuracy.

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## General cleaning instructions

Wipe exterior surfaces with a dampened cloth containing a mild soap solution.

---

# Troubleshooting Tips

The Troubleshooting Tips section is intended to aid in defining and correcting possible service problems. When using the chart, select the problem category that resembles the malfunction. Then proceed to the possible causes category and take necessary corrective action. If difficulties persist, call Barnstead|Thermolyne customer service at 1-800-553-0039.

Problem	Possible Causes	Solutions
The power switch does not illuminate.	The furnace is not connected to power supply.	Check furnace connection to power supply.
The furnace does not heat.	No power. Thermocouple is open. One of the elements is burned out. Heat switch not turned "On."	Check power source and fuses or breakers. Replace thermocouple. Replace the burned out element. Turn on Heat switch.
Slow heatup.	Low line voltage.  Heavy load in chamber.  Low ramp rate setting.	Install line of sufficient size and proper voltage. (Isolate furnace from other electrical loads.) Lighten load in chamber to allow heat to circulate. Increase setting.
Repeated element burnout.	Control malfunction. Thermocouple leads are reversed. Oxidized thermocouple leading to inaccurate reading. Heating element contamination.	Replace control. Check thermocouple connections. Replace thermocouple.  Contact Barnstead Thermolyne.

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## TROUBLESHOOTING TIPS

Problem	Possible Causes	Solutions
Inaccurate temperature readout.	Oxidized or contaminated thermocouple. Poor thermocouple connection. Improper loading procedures Thermocouple connections reversed. Control out of calibration.  P.I.D. values invalid. Control malfunction.	Replace thermocouple.  Tighten connections.  Use proper loading procedures. Reconnect thermocouple correctly. Contact Barnstead Thermolyne. Retune control. Verify and correct all parameter and configuration values.
Main fuses blow or circuit breakers trip.	Fuses or breakers not properly rated to furnace power requirements.	Install service line of sufficient size to match furnace power requirement. Contact qualified electrician for assistance.

---

# Maintenance and Servicing



## Warning

To avoid electrical shock, this furnace must always be disconnected from the power supply prior to maintenance and service.

Perform only maintenance described in this manual. Contact an authorized dealer or our factory for parts and assistance.

Refer servicing to qualified personnel.

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## Element Replacement

The F79300 Tube Furnace contains two heating elements, one in the bottom half of the furnace section and the other in the top half. Because these elements are wired serially, if one burns out, the other will not receive power. Therefore, even though the furnace will not heat and the amber "Heat" light will not light when the "Heat" button is pressed, you may need to replace only one element.

The F79400 Tube Furnace contains four heating elements, two in the bottom half of the furnace and two in the top half. The elements are wired serially on each side (i.e. the left top and bottom are wired together and the right top and bottom are wired together). Therefore, when one element burns out, that side of your furnace will not heat. The other side of the furnace will continue to operate and the "Heat" light will still light. Your load will show uneven heating, since the temperature in the unheated half of the furnace will be considerably lower than in the heated half. In most (but not necessarily all) instances, the furnace chamber temperature will never reach your setpoint.

Terminal Cover

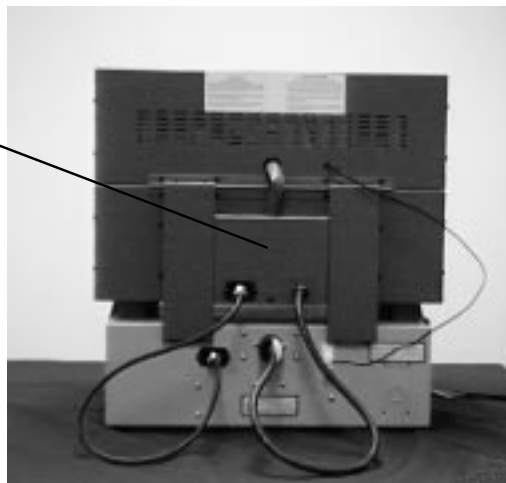


Figure 8 Terminal Cover Location

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## Element Check

To determine which of the heating elements is burned out:

1. Disconnect the power from the furnace.
2. Remove the terminal cover from the back of the bottom half of the furnace section.
3. With an ohmmeter, check the continuity of the elements. The element which returns an open or infinite reading must be replaced.

**On an F79300:** Test the top element between the top of terminal T1 and the top of terminal T3. Test the bottom element between the top of terminal T2 and the bottom of terminal T3.

**On an F79400:** Test the top right element between the top of terminal T1 and the top of terminal T3. Test the top left element between the top of terminal T1 and the top of terminal T4. Test the bottom right element between the top of terminal T2 and the bottom of terminal T3. Test the bottom left element between the top of terminal T2 and the bottom of terminal T4.

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## Replacing The Bottom Element

1. Disconnect the element leads for the burned out element from the terminals specified in Element Check step #3. At the same time, disconnect the ground wire from the grounding bolt located to the right of the terminal block.
2. Remove the side covers from the bottom furnace section. (Seven black sheet metal screws secure each side cover.)
3. Remove the brackets (one on each side) securing the element assembly. (Four pointed screws secure each bracket.)



### Note

On an F79400 furnace, you only need to remove the cover, brackets, etc. from the furnace side on which the element is burned out.

4. Remove the six flat end screws securing the inner shield to the outer shell.
5. Remove the inner shield from the outer shell.
6. Locate the screws on the bottom of the inner shield that secure the element support brackets. Loosen these screws.
7. Slide the burned out element (and an end insulation piece) out of the inner shield. Handle the insulation carefully.
8. Note the difference in length between the two element lead wires and the location of each wire's connection to the element. Remove the element leads with their protective sleeves from the element.
9. Connect the element leads to your replacement element. Be sure to attach each lead in the same position that it was attached to the old element.
10. Slide the new element (and the end insulation piece) into the inner shell, routing the element lead wires through the notches in the inner shell.
11. Center the element(s) and the two end insulation pieces in the element support brackets.
12. Tighten the screws securing the element support brackets until the element(s) is (are) secure.
13. Replace the inner shield in the outer shell, routing the element lead wires and the ground wire through the bushing in the outer shell to the terminal block.
14. Replace the six flat end screws securing the inner shield to the outer shell.

15. Replace the brackets securing the element assembly. (Four pointed screws secure each bracket.)
16. Replace the end plates. (Seven black sheet metal screws secure each side cover.)
17. Connect the element lead wires to the terminals specified in Element Check step #3. Reconnect the ground wire to the grounding bolt located to the right of the terminal blocks.
18. Replace the terminal block cover. Reconnect the furnace to the power supply and test the furnace.

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### **Replacing The Top Element**

1. Remove the thermocouple using steps 2-4 of "Replacing the Thermocouple."
2. Disconnect the element leads for the burned out element from the terminals specified in Element Check step #3. At the same time, disconnect the ground wire from the grounding bolt located to the right of the terminal blocks. Remove the protective sleeve covering the wires between the top and bottom sections of the furnace.
3. Remove the side covers from the top furnace section. (Seven black sheet metal screws secure each side cover.)
4. Remove the two brackets (one each side) securing the element assembly. (Four pointed screws secure each bracket.)
5. Remove the six flat end screws securing the inner shield to the outer shell.
6. Remove the inner shield from the outer shell.



7. Locate the screws on the top of the inner shield that secure the element support brackets. Loosen these screws.
8. Slide the element (and an end insulation piece) out of the inner shield. Handle the insulation carefully.
9. Note the difference in length between the two element lead wires and the location of each wire's connection to the element. Remove the element leads with their protective sleeves from the element.
10. Connect the element leads to your replacement element. Be sure to attach each lead in the same position that it was attached to the old element.
11. Slide the new element (and the end insulation piece) into the inner shell, routing the element lead wires through the notches in the inner shell.
12. Center the element(s) and the two end insulation pieces in the element support brackets.
13. Tighten the screws securing the element support brackets until the element(s) is (are) secure.
14. Replace the inner shield in the outer shell, routing the element lead wires and the ground wire through the bushing in the outer shell.
15. Replace the six screws securing the inner shield to the outer shell.
16. Replace the brackets securing the element assembly. (Four pointed screws secure each bracket.)
17. Replace the end plates. (Seven black sheet metal screws secure each side cover.)

18. Replace the protective sleeve over the wires between the two furnace sections. Route the wires to the terminal block.
19. Connect the element lead wires to the terminals specified in Element Check step #3. Reconnect the ground wire to the grounding bolt located to the right of the terminal block. Replace the terminal block cover.
20. Create a hole for the thermocouple in the new element.
  - a. Place a 4" (10 cm) long, 1/4" (6 mm) drill bit into the thermocouple hole in the inner shield (reached through the access hole on the top of the upper section.)
  - b. Carefully press the drill bit straight down into the furnace chamber.
21. Reinstall the thermocouple using steps 6-8 of "Replacing the Thermocouple."
22. Reconnect the furnace to the power supply and test the furnace.

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## Replacing The Thermocouple

1. Disconnect the furnace from the power supply.
2. Remove the four black screws securing the thermocouple access panel on the top of the upper furnace section. Remove the access panel.
3. Locate the thermocouple terminal block in the compartment beneath the access panel. Disconnect the thermocouple lead wires and the thermocouple signal wires from the terminal block.

4. Carefully pull the thermocouple straight out of the furnace. The ceramic thermocouple bushing will come out with the thermocouple.
5. Move the ceramic thermocouple bushing to the new thermocouple.
6. Carefully insert the new thermocouple fully into the furnace. Ensure that the thermocouple tip protrudes into the furnace chamber.
7. Connect the thermocouple signal wires and the lead wires of the new thermocouple to the thermocouple terminal block.
  - a. Connect the yellow thermocouple signal wire and the yellow beaded thermocouple lead wire to the "+" terminal.
  - b. Connect the red thermocouple signal wire and the thermocouple lead wire with only white ceramic beads to the "-" terminal.
8. Replace the thermocouple access panel and resecure it with the four screws.
9. Reconnect the furnace to the power supply and test.

# Replacement Parts List

Circuit Breaker	220/240 V	<u>F79300</u> SWX164 (-33 models)	<u>F79400</u> SWX103 (-33 models)
Element	220/240 V 120 V 208 V	EL793X2A EL793X1A EL793X3A	
End Insulation	Left Side Right Side	JC793X4 JC793X5	
Electronic Control	Single Setpoint 2R/2D 8R/8D	CN71X51 CN71X40 CN71X56	
Thermocouple		TC408X1A	
Mechanical Relay	220/240 V 208 V 120 V	RYX62 RYX62 RYX63	
Power Cordset	220/240 V 208 V 120 V	<u>F79300</u> CR793X2 CR793X2 CR793X1	<u>F79400</u> CR794X2 CR794X2 N/A
Door Switch Cordset		CR793X3	
Solid State Relay	220/240 V 208 V 120 V	RYX34 RYX34 RYX37	
Cycle Light (Amber)	220/240 V 208 V 120 V	PLX104 PLX104 PLX103	
ON/OFF Power Switch	220/240 V 208 V 120 V	SWX138 SWX138 SWX137	
HEAT Switch		SWX108	
Furnace Safety Switch		04246	
<b>Accessories</b>			
Vertical Support Stand		AY793X1	
Insulation Collars	1" I.D. 2" I.D. 3" I.D.	JC793X1 JC793X2 JC793X3	
10 Foot Remote Operation Extension Package			
Includes: 1 power cordset, 10 feet long; 1 thermocouple cordset, 10 feet long; and 2 door switch cords, each 5 feet long. Order the appropriate package for you furnace voltage.			
	220/240 V 120 V 208 V	AY793X2 AY793X3 AY793X2	

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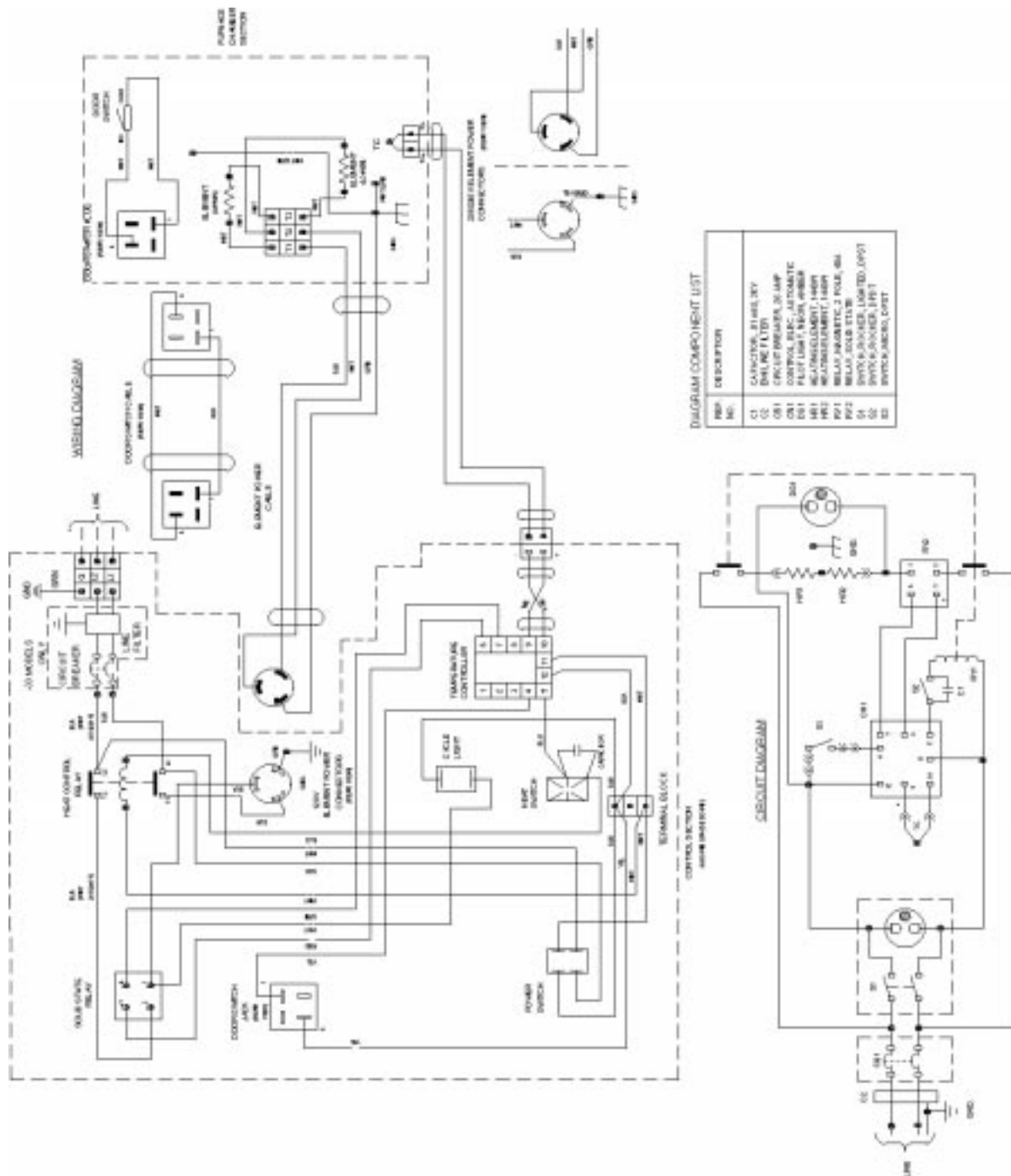
# Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

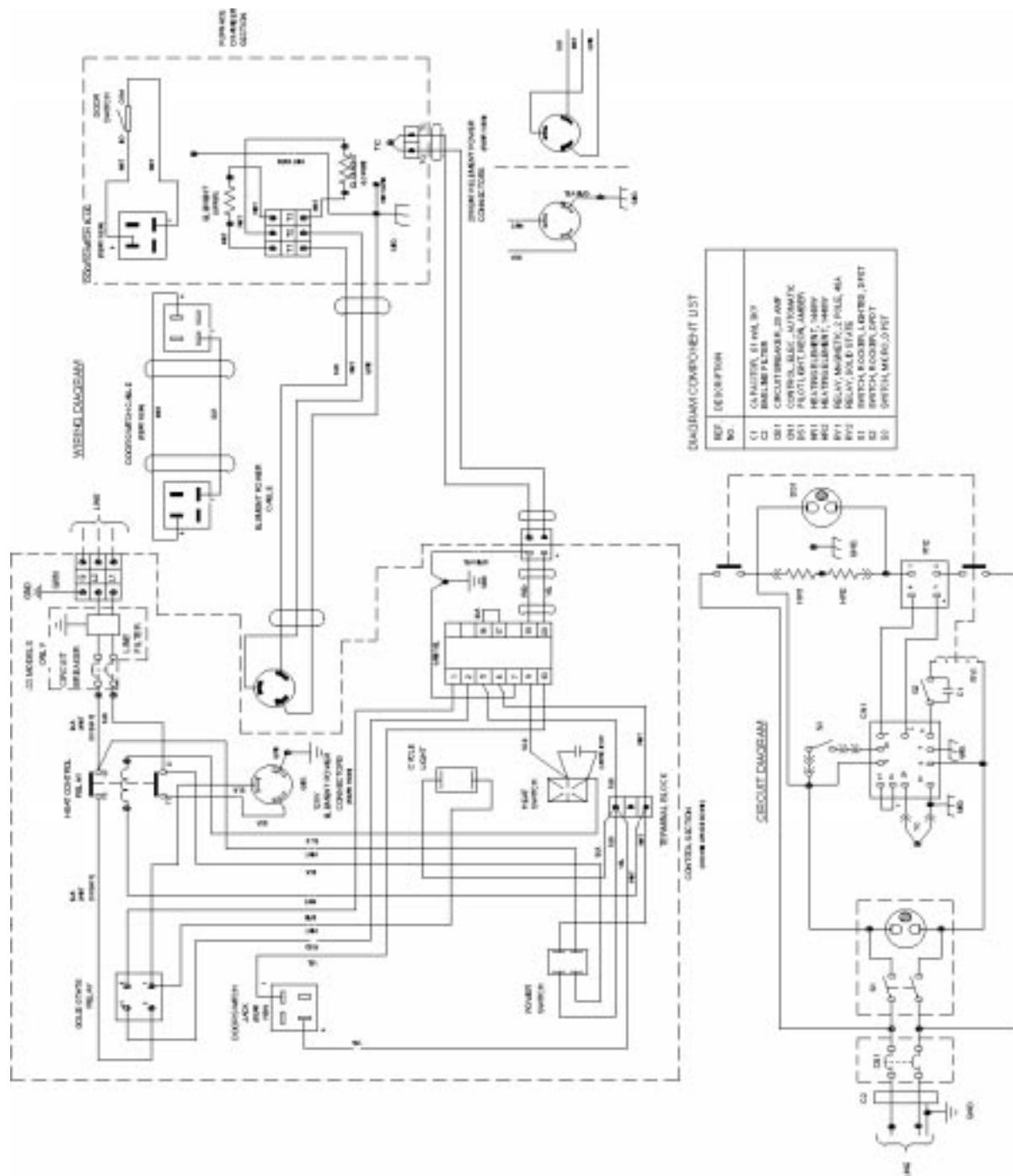
All parts listed herein may be ordered from the **Barnstead|Thermolyne** dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed we ask that you check first with your dealer. If the dealer cannot handle your request, then contact our Customer Service Department at 319-556-2241 or 800-553-0039.

Prior to returning any materials to **Barnstead|Thermolyne Corp.**, please contact our Customer Service Department for a "Return Goods Authorization" number (RGA). Material returned without a RGA number will be refused. Minimum invoice: \$25.

# Wiring Diagrams for F79300



## WIRING DIAGRAMS FOR F79300



## 56



REP No.	DESCRIPTION
C1	CAPACITOR, 0.05-0.1, 30V
C2	DIODE, 1N4001
C3	TRANSISTOR, 2N3638
C4	TRANSISTOR, 2N3638
C5	TRANSISTOR, 2N3638
C6	TRANSISTOR, 2N3638
C7	TRANSISTOR, 2N3638
C8	TRANSISTOR, 2N3638
C9	TRANSISTOR, 2N3638
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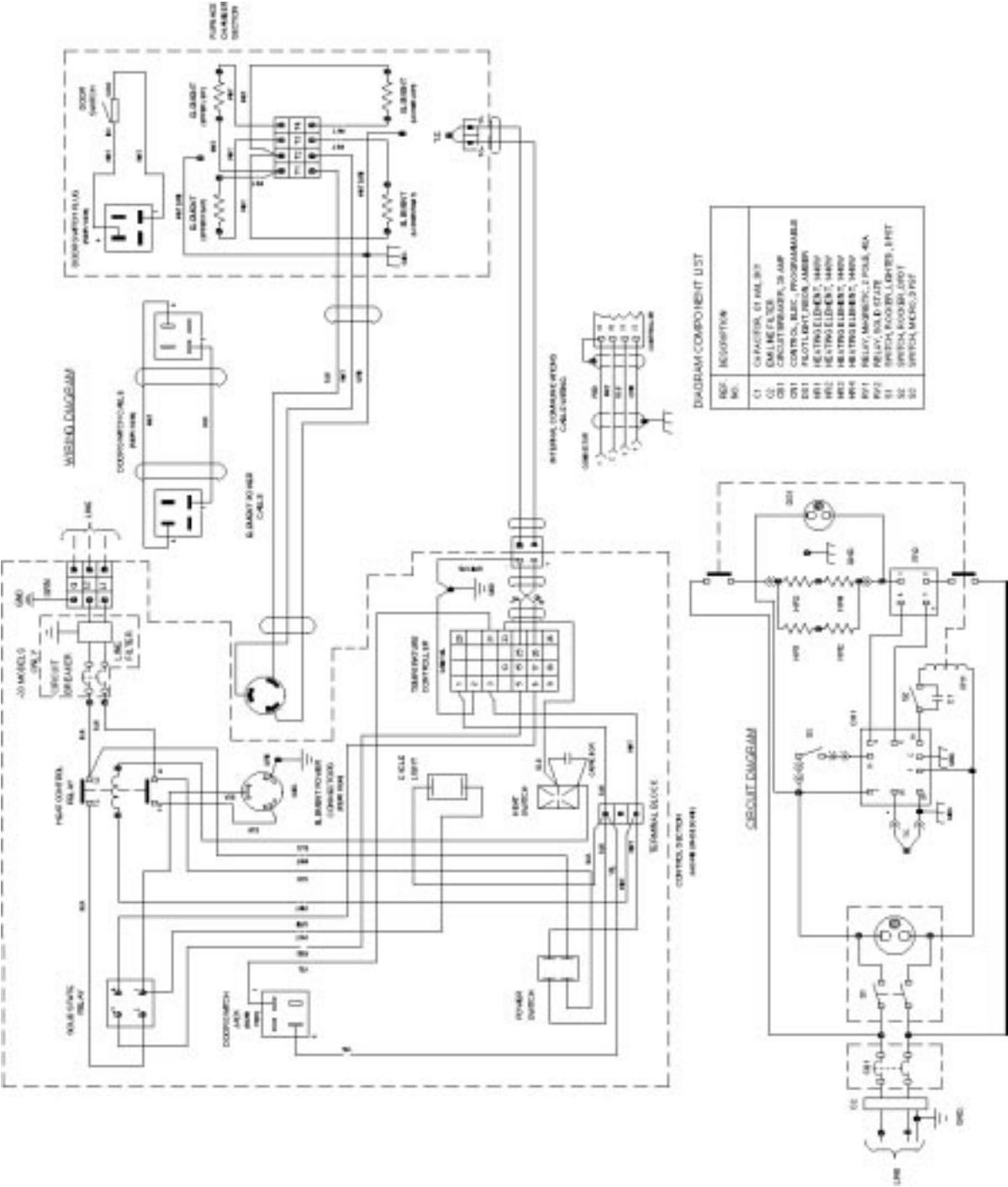


## Single Setpoint Controller Models

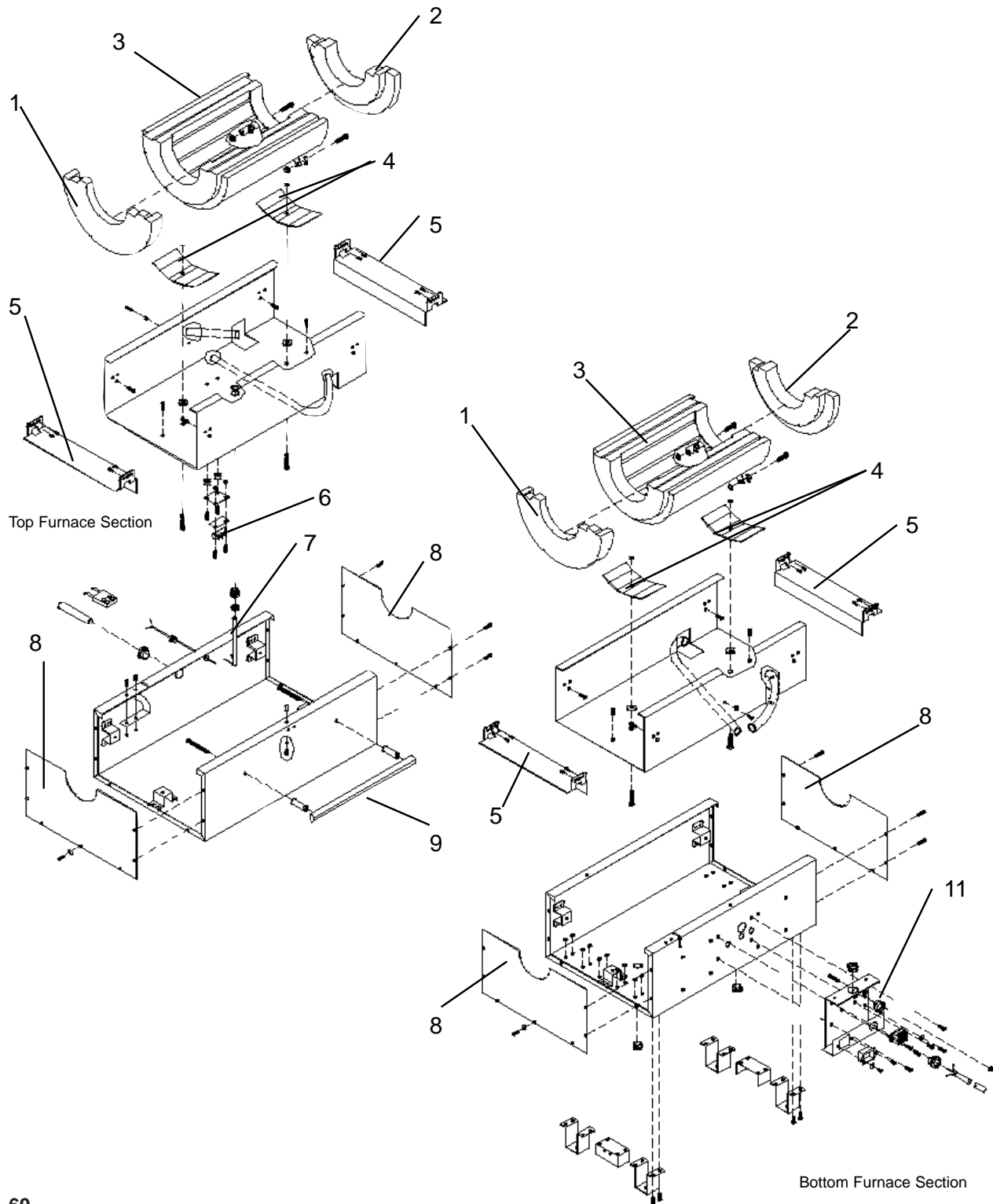


## 58

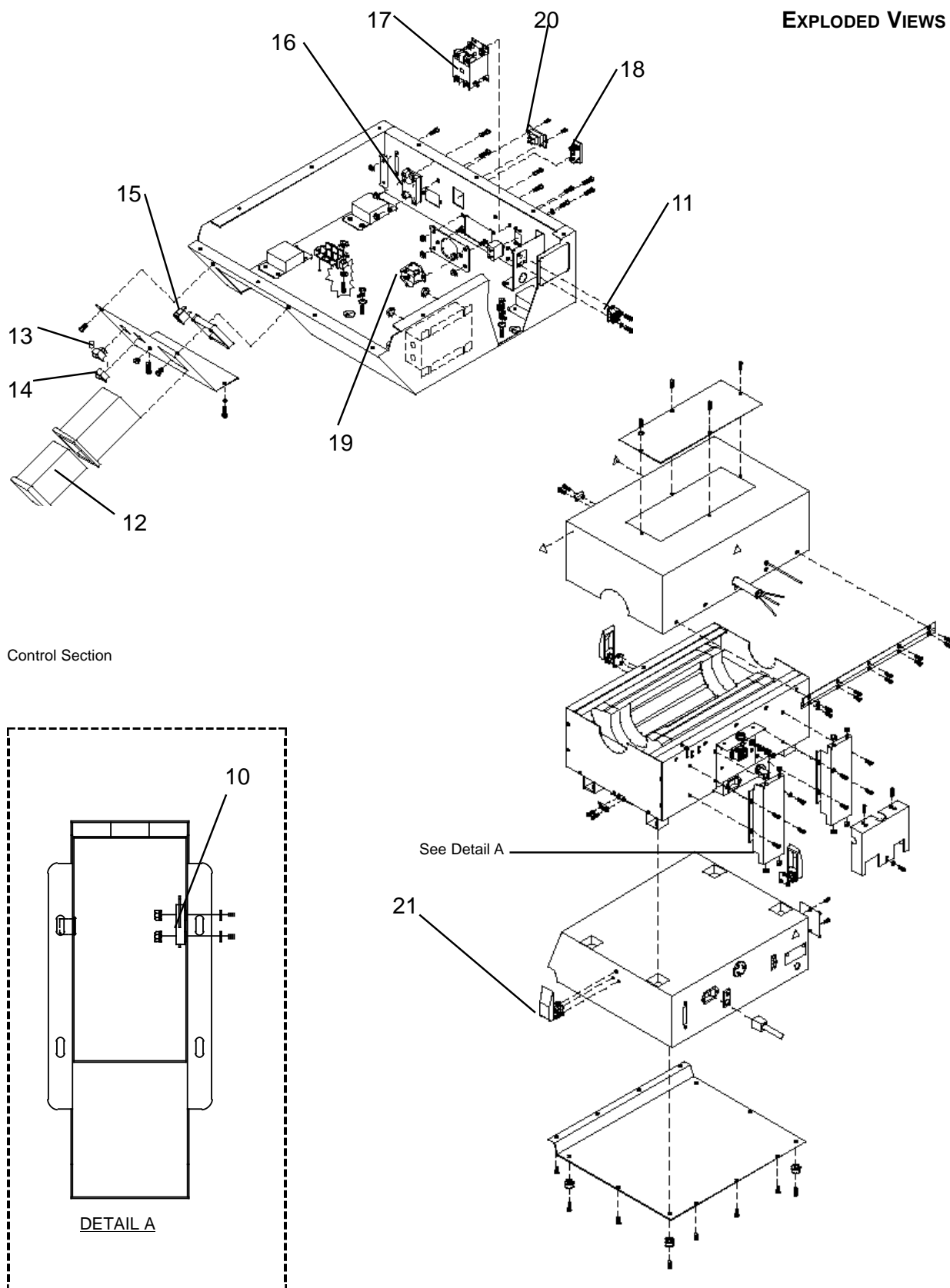
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# Exploded Views for F79300



# EXPLODED VIEWS



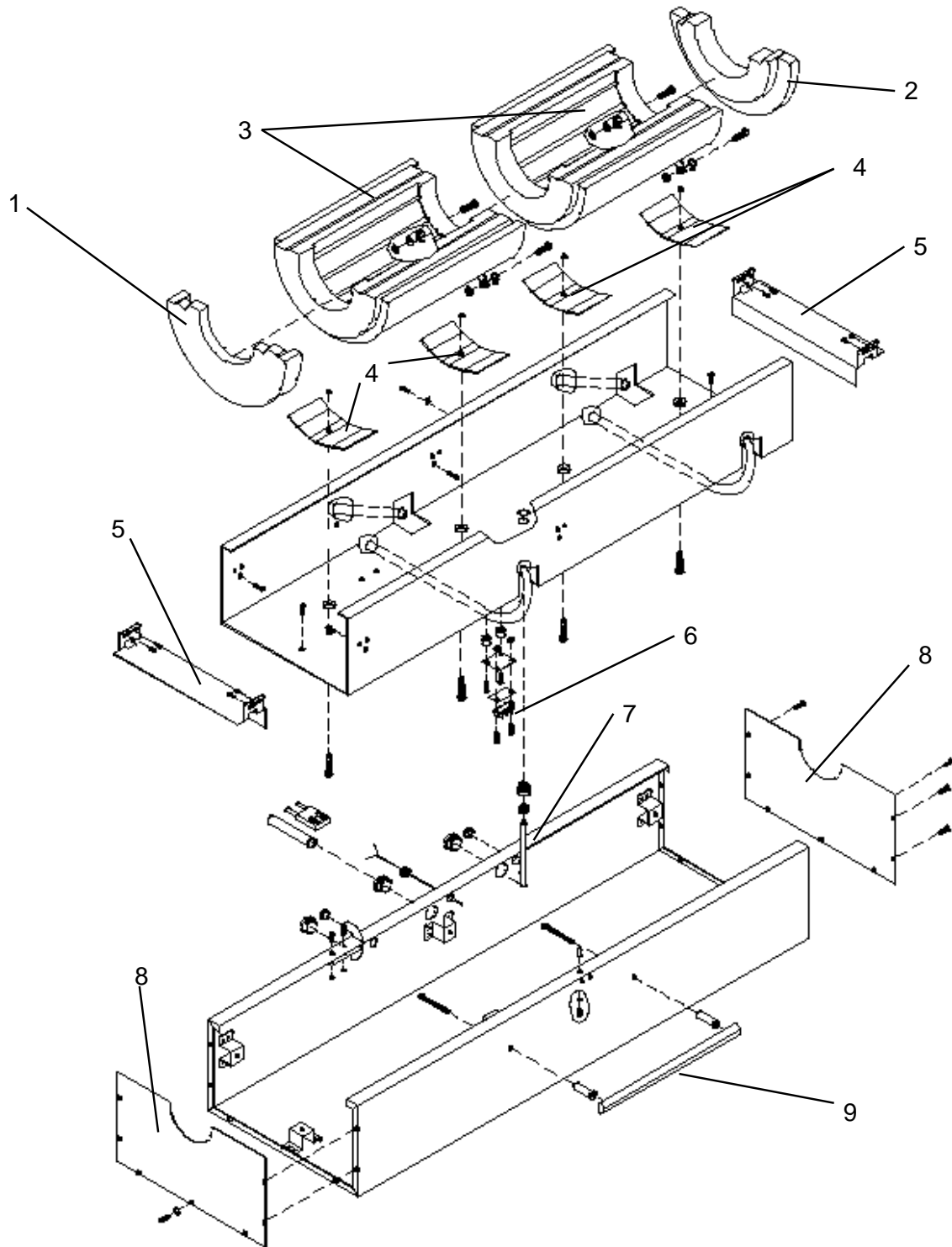
Control Section

See Detail A

# Exploded View Key (F79300)

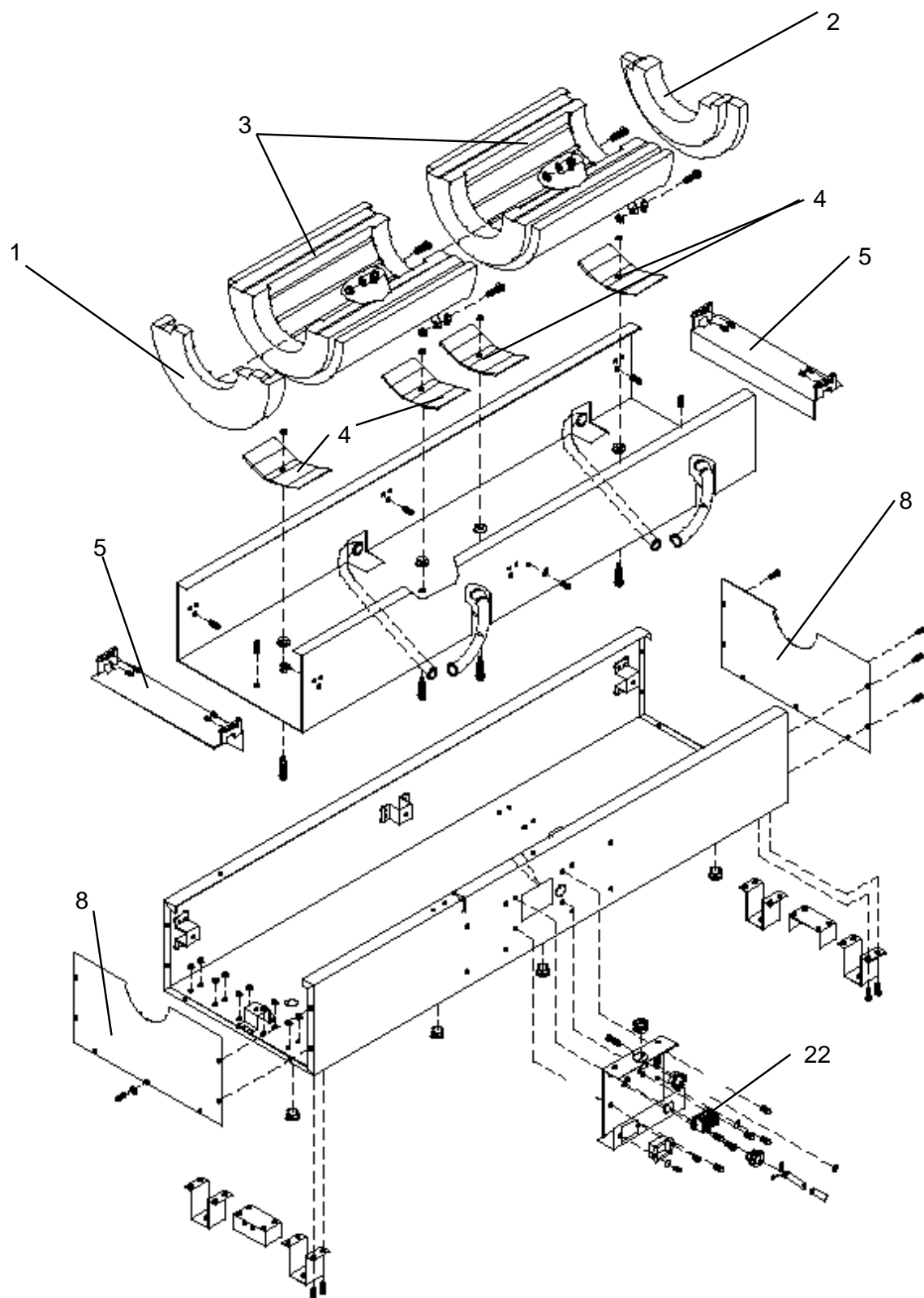
Key #	Quantity	Part #	Description
1	2	JC793X4	End Insulation
2	2	JC793X5	End Insulation
3	2	EL793X1A	Heating Element, 120 Volt
	2	EL793X2A	Heating Element, 240 Volt
	2	EL793X3A	Heating Element, 208 Volt
4	4	CS793X1	Element Retaining Bracket
5	4	BC793X5	End Bracket
6	1	TRX183	Thermocouple Terminal Block
7	1	TC408X1A	Thermocouple
8	4	PT793X3A	End Panel
9	1	HN480X1A	Handle
10	1	04246	Furnace Safety Switch
11	1	04206	Terminal Block
12	1	*	Electronic Control
13	1	SWX138	Switch
14	1	SWX108	Switch
15	1	PLX104	Pilot Light
16	1	RYX34	Relay
17	1	RYX62	Relay
18	1	CEX205	Connector
19	1	CEX206	Connector
20	1	CE1080X1A	Connector
21	3	FCX89	Latch
*Electronic Control		Single Setpoint	CN71X51
		2R/2D	CN71X40
		8R/8D	CN71X56

# Exploded Views for F79400



Top Furnace Section

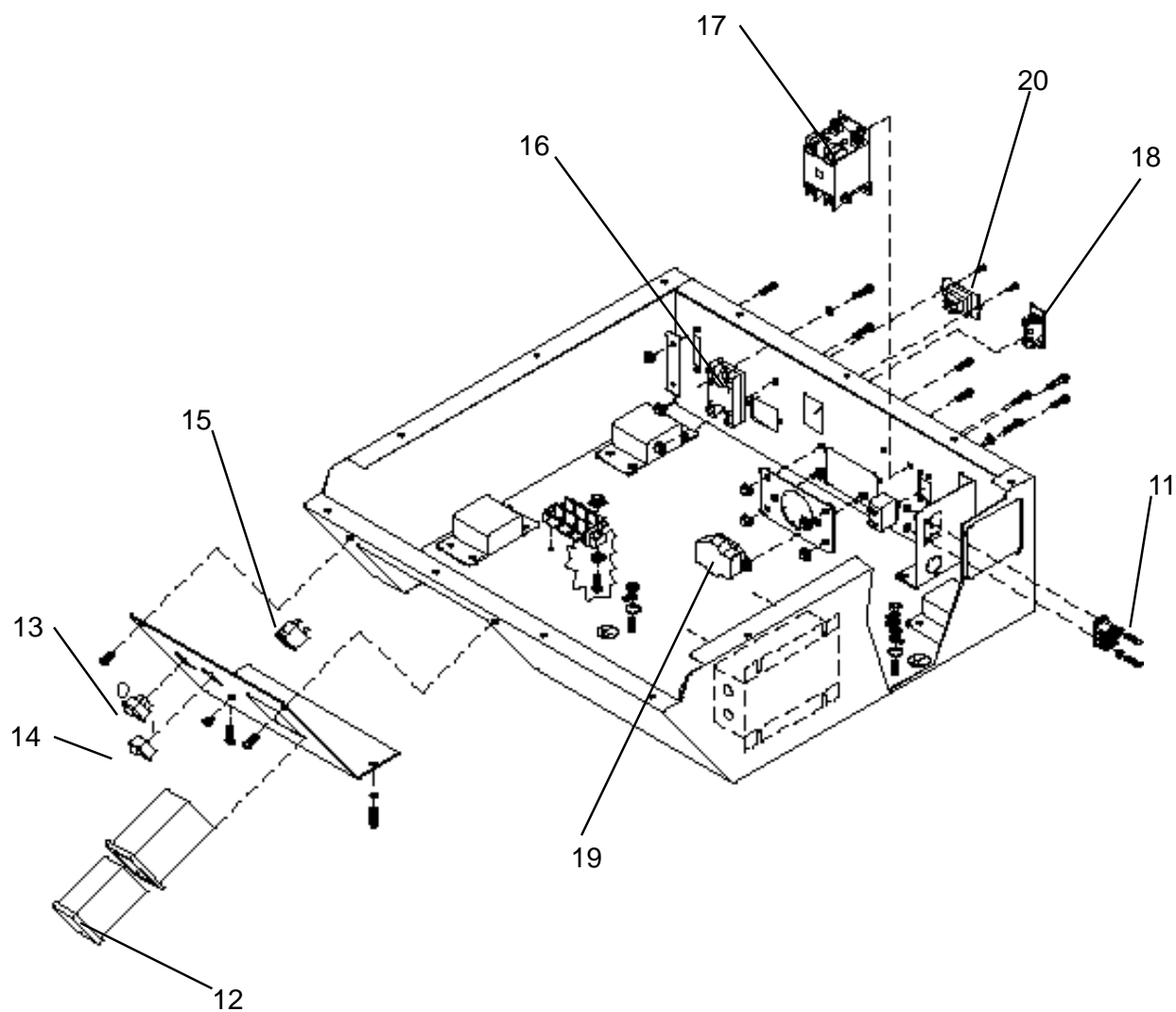
## EXPLODED VIEWS



Bottom Furnace Section



## EXPLODED VIEWS



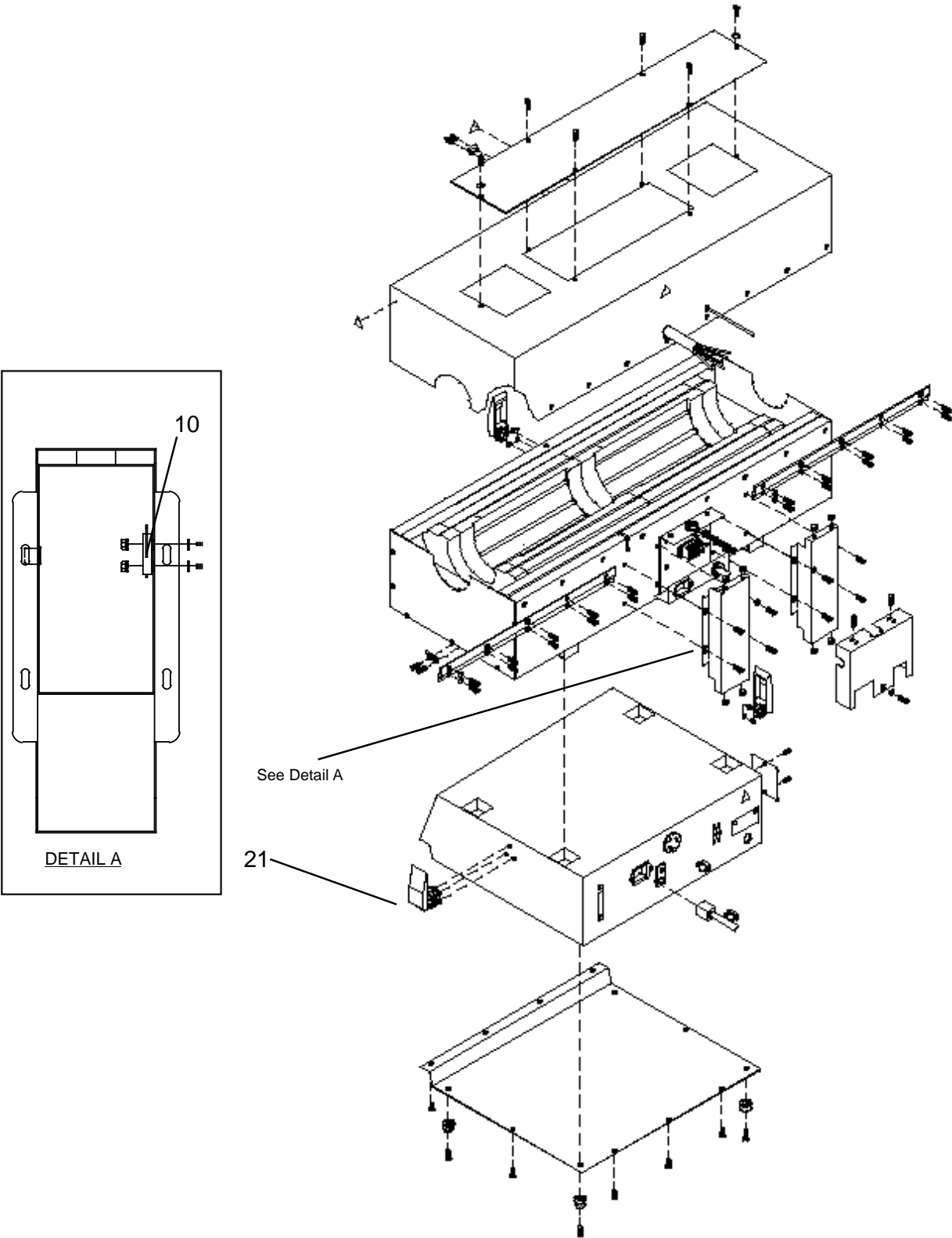
\*Electronic Control

Single Setpoint  
2R/2D  
8R/8D

CN71X51  
CN71X40  
CN71X56

Control Section

EXPLODED VIEWS



# Exploded View Key (F79400)

Key #	Quantity	Part #	Description
1	2	JC793X4	End Insulation
2	2	JC793X5	End Insulation
3	4	EL793X2A	Heating Element, 240 Volt
	4	EL793X3A	Heating Element, 208 Volt
4	8	CS793X1	Element Retaining Bracket
5	4	BC793X5	End Bracket
6	1	TRX183	Thermocouple Terminal Block
7	1	TC408X1A	Thermocouple
8	4	PT793X3A	End Panel
9	1	HN480X1A	Handle
10	1	04246	Furnace Safety Switch
11	3	04150	Terminal Block
	1	04151	Terminal Block
12	1	*	Electronic Control
13	1	SWX138	Switch
14	1	SWX108	Switch
15	1	PLX104	Pilot Light
16	1	RYX37	Relay
17	1	RYX62	Relay
18	1	CEX205	Connector
19	1	CEX229	Connector
20	1	CE1080X1A	Connector
21	3	FCX89	Latch
22	4	04150	Terminal Block
	1	04151	Terminal Block
*Electronic Control		Single Setpoint	CN71X51
		2R/2D	CN71X40
		8R/8D	CN71X56

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# One Year Limited Warranty

**Barnstead|Thermolyne Corporation** warrants that if a product manufactured by **Barnstead|Thermolyne** and sold by it within the continental United States or Canada proves to be defective in material or construction, it will provide you, without charge, for a period of ninety (90) days, the labor, and a period of one (1) year, the parts, necessary to remedy any such defect. Outside the continental United States and Canada, the warranty provides, for one (1) year, the parts necessary to remedy any such defect. The warranty period shall commence either six (6) months following the date the product is sold by **Barnstead|Thermolyne** or on the date it is purchased by the original retail consumer, whichever date occurs first.

All warranty inspections and repairs must be performed by and parts obtained from an authorized **Barnstead|Thermolyne** dealer or **Barnstead|Thermolyne (at its own discretion)**. Heating elements, however, because of their susceptibility to overheating and contamination, must be returned to our factory, and if, upon inspection, it is concluded that failure is not due to excessive high temperature or contamination, warranty replacement will be provided by **Barnstead|Thermolyne**. The name of the authorized **Barnstead|Thermolyne** dealer nearest you may be obtained by calling 1-800-446-6060 or writing to:

**Barnstead|Thermolyne**

P.O. Box 797

2555 Kerper Boulevard

Dubuque, IA 52004-0797

USA

FAX: (319) 589-0516

E-Mail: [mkt@barnsteadthermolyne.com](mailto:mkt@barnsteadthermolyne.com)

**Barnstead|Thermolyne's** sole obligation with respect to its product shall be to repair or replace the product. Under no circumstances shall it be liable for incidental or consequential damage.

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