

Type 47900 & 48000 Furnaces

OPERATION MANUAL AND PARTS LIST SERIES 1057

Model Numbers

F47910	220-240	F48010	220-240
F47910-33	220-240	F48010-33	220-240
F47914	100	F48014	100
F47915	120	F48015	120
F47918	208	F48018	208
F47920	220-240	F48020	220-240
F47920-33	220-240	F48020-33	220-240
F47924	100	F48024	100
F47925	120	F48025	120
F47928	208	F48028	208
F47920-80	220-240	F48020-80	220-240
F47920-33-80	220-240	F48020-33-80	220-240
F47924-80	100	F48024-80	100
F47925-80	120	F48025-80	120
F47928-80	208	F48028-80	208
F47950	220-240	F48050	220-240
F47950-33	220-240	F48050-33	220-240
F47954	100	F48055	120
F47955	120	F48058	208
F47958	208		

Important Information

Thank you for buying this Thermolyne 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.

Model Information

<u>MODEL NO.</u>	<u>VOLTAGE</u>	<u>CONTROL</u>	<u>DISPLAY</u>
F47910220-240	BASIC AUTOMATIC	°C	
F47910-33	220-240	BASIC AUTOMATIC	°C
F47914	100	BASIC AUTOMATIC	°
F47915	120	BASIC AUTOMATIC	°C
F47918	208	BASIC AUTOMATIC	°C
F47920	220-240	AUTOMATIC	°F & °C
F47920-33	220-240	AUTOMATIC/EUROPEAN	°F & °C
F47924	100	AUTOMATIC	°F & °C
F47925	120	AUTOMATIC	°F & °C
F47928	208	AUTOMATIC	°F & °C
F47920-80	220-240	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F47920-33-80	220-240	PROGRAMMABLE/EUROPEAN (4 RAMP & 4 DWELL)	°F
F47924-80	100	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F47925-80	120	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F47928-80	208	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F47950	220-240	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F47950-33	220-240	PROGRAMMABLE/EUROPEAN W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F47954	100	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F47955	120	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F47958	208	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F48010	220-240	BASIC AUTOMATIC	°C
F48010-33	220-240	BASIC AUTOMATIC	°C
F48014	100	BASIC AUTOMATIC	°C
F48015	120	BASIC AUTOMATIC	°C
F48018	208	BASIC AUTOMATIC	°C
F48020	220-240	AUTOMATIC	°F & °C
F48020-33	220-240	AUTOMATIC/EUROPEAN	°F & °C
F48024	100	AUTOMATIC	°F & °C
F48025	120	AUTOMATIC	°F & °C
F48028	208	AUTOMATIC	°F & °C
F48020-80	220-240	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F48020-33-80	220-240	PROGRAMMABLE/EUROPEAN (4 RAMP & 4 DWELL)	°F
F48024-80	100	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F48025-80	120	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F48028-80	208	PROGRAMMABLE (4 RAMP & 4 DWELL)	°F
F48050	220-240	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F48050-33	220-240	PROGRAMMABLE/EUROPEAN W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F48054	100	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F48055	120	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C
F48058	208	PROGRAMMABLE W/COMMUNICATIONS (8 RAMP & 8 DWELL)	°F & °C

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Safety Information

Your Thermolyne Type 47900 or 48000 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 signals throughout the manual.

Alert Signals



Warning

Warnings alert you to a possibility of personal injury.



Caution

Cautions alert you to 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.

Warnings

To avoid electrical shock, this furnace must:

1. Use a properly grounded electrical outlet of correct voltage and current handling capacity.
2. Be disconnected from the power supply prior to maintenance and servicing.
3. Have the door switch operating properly.

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. Refer servicing to qualified personnel.

PLEASE NOTE THE FOLLOWING WARNINGS:

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.

WARNING

REFER SERVICING TO QUALIFIED PERSONNEL.

1-800-446-6060
1-800-553-0039

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.

Intended Use

The Type 47900 and 48000 furnaces are general purpose laboratory and heat treating furnaces. For optimum element life, Thermolyne recommends observing these temperature ranges: from 100°C (212°F) to 1093°C (2000°F) for continuous use, or from 1093°C (2000°F) to 1200°C (2192°F) for intermittent use. Continuous use is operating the furnace for more than 3 hours and intermittent use is operating the furnace for less than 3 hours.

All furnaces consist of: 1) a vented heating chamber; 2) a temperature controller; and 3) a door interlock relay for operator safety.

General usage

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

Principles of Operation

Furnace:

The furnace chamber is heated by two open coil electric resistance heaters and is insulated with a ceramic fiber insulation. The control is located under the furnace chamber and is well insulated from the heat generated in the furnace chamber. A door safety switch removes power to the heating elements whenever the furnace door is opened. The temperature is controlled by one of four types of controllers.

General Specifications

F479 Models

Dimensions

Chamber — Width: 12.7 cm. Height: 10.2 cm. Depth: 15.2 cm.

Overall — Width: 28.6 cm. Height: 45.7 cm. Depth: 39.4 cm.

Weight — 16.8 kg.

Electrical Ratings — Volts: 220-240. Amps: 4.2. Watts: 1000. Frequency: 50/60. Phase: 1

Temperature

Operating Range (continuous): 1093°C; (intermittent): 1200°C.

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; 20% - 80% relative humidity.

F480 Models

Dimensions

Chamber — Width: 17.8 cm. Height: 12.7 cm. Depth: 25.4 cm.

Overall — Width: 33.7 cm. Height: 48.3 cm. Depth: 49.5 cm.

Weight — 25.4 kg.

Electrical Ratings — Volts: 220-240. Amps: 7.5. Watts: 1800. Frequency: 50/60. Phase: 1

Temperature

Operating Range (continuous): 1093°C; (intermittent): 1200°C.

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; 20% - 80% relative humidity.

Environmental Conditions

Operating: 17°C - 27°C; 20% to 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 to 65°C; 20% to 80% relative humidity.

Declaration of Conformity

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:

Electrothermal Engineering Ltd.
419 Sutton Road
Southend On Sea
Essex SS2 5PH
United Kingdom

Copies of the Declaration of Conformity are available upon request

Installation

Unpacking

Visually check for any physical damage to the shipping container. Inspect the equipment surfaces that are adjacent to any damaged area. Open the furnace door and remove the packing material from inside the furnace chamber. Vacuum the chamber prior to use to remove the insulation dust due to shipment. (The Type 48000 furnace is supplied with one ceramic shelf.)

Retain the original packaging material if reshipment is foreseen or required.



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 always use a properly grounded electrical outlet of correct voltage and current handling capacity.

Site Selection

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

Electrical Connections

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.

Furnace Operation, All Models



Warning

To avoid personal injury, do not use in the presence of flammable or combustible chemicals — fire or explosion may result. This device contains components which may ignite such materials.

Caution: Hot Surface — Avoid Contact. To avoid burns, this furnace must not be touched on the exterior or interior surfaces during use or for a period of time after use.



Note

The furnace will begin to heat to its controller's current setpoint each time you turn the power switch "ON."



Warning

To avoid electrical shock, this furnace must have the door switch operating properly.

Power Switch

Both the ON/OFF power switch and the digital display will illuminate when power is turned ON. The furnace will begin to heat to its controller's current setpoint. (See the instructions for your type of controller for information on checking and setting the setpoint.)

Cycle Light

The amber cycle light will illuminate whenever the power is being applied to the heating elements. The cycle light will turn on and off as the furnace reaches the setpoint.

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 CYCLE light will be out when door is open. This check must be done when the furnace is heating or when the cycle light is illuminated. If this condition is not true, consult the Troubleshooting section before proceeding.

Basic Automatic Control

This furnace controller is a single set point controller. This controller provides a single digital display to indicate either chamber temperature or setpoint temperature. Also, this controller incorporates sensor break protection, but does not have over-temperature protection.

Digital Readout

The digital readout continuously displays chamber temperature unless the Push To Set Temperature button is depressed. When the Push To Set Temperature button is depressed, the setpoint temperature is displayed.

Push To Set Temperature Button

When this button is depressed, the digital display will indicate setpoint temperature. When the button is released, the actual chamber temperature is displayed.

Temperature Adjustment Knob

Turning this knob clockwise will increase the setpoint temperature. Turning the knob counterclockwise will decrease the setpoint temperature.

Operation of Basic Automatic Control

This controller provides accurate control at one single temperature setting. To set the temperature, simply:

- a) Turn the Power switch ON.
- b) While depressing the Push To Set Temperature button, turn the temperature knob clockwise to increase the setpoint or counterclockwise to decrease the setpoint to the desired setpoint temperature as indicated on digital display.
- c) Release the Push To Set Temperature button.

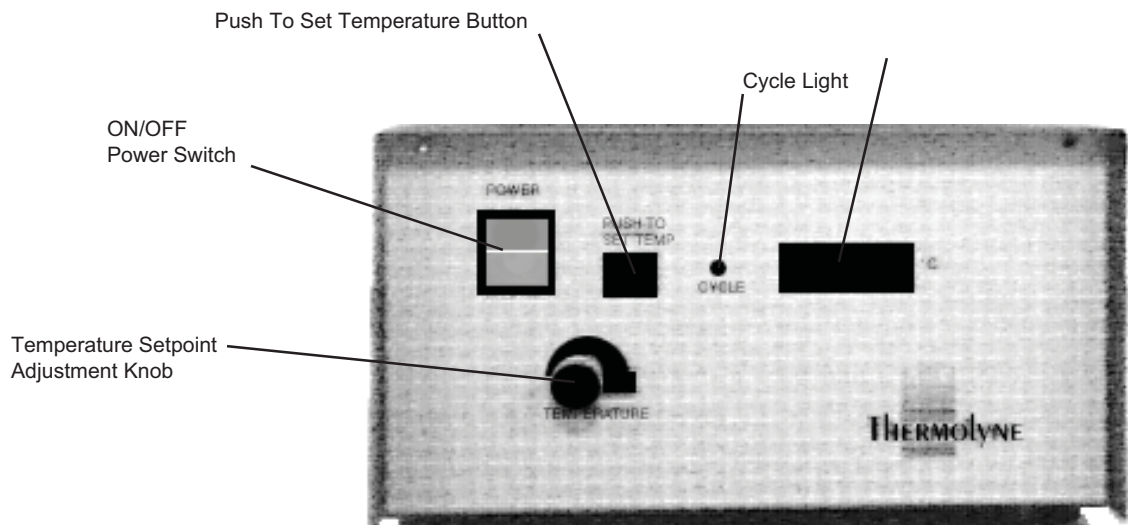


Figure 1: Basic Automatic Controller



Note

If **at any time** the Temperature Adjustment knob is turned in either direction, **the setpoint will change, even if the Push To Set Temperature button is not depressed.** To view the current setpoint temperature, depress the Push to Set Temperature button.

The digital display will now indicate the actual chamber temperature. The furnace will heat to the new setpoint temperature. The CYCLE light will remain on until the furnace temperature is within 1°C of the setpoint temperature; the cycle light will then turn on and off as the controller maintains the setpoint temperature.

Sensor Break Protection

This controller provides sensor break protection in the event the thermocouple opens. If an open thermocouple condition occurs, the digital display will indicate 5 degrees or less and the power to the heating element will be shut off (CYCLE light will extinguish).

Single Setpoint Temperature Control (Automatic)



Note

This temperature control 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.

This furnace controller consists of a microprocessor-based three-mode (Proportional, Integral, Derivative), single setpoint temperature controller. The controller features programmable over-temperature protection, thermocouple break indication and self-tuning capability.

Digital Readout:

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

Initial Startup:

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 fails to go to "8888" contact Thermolyne.)

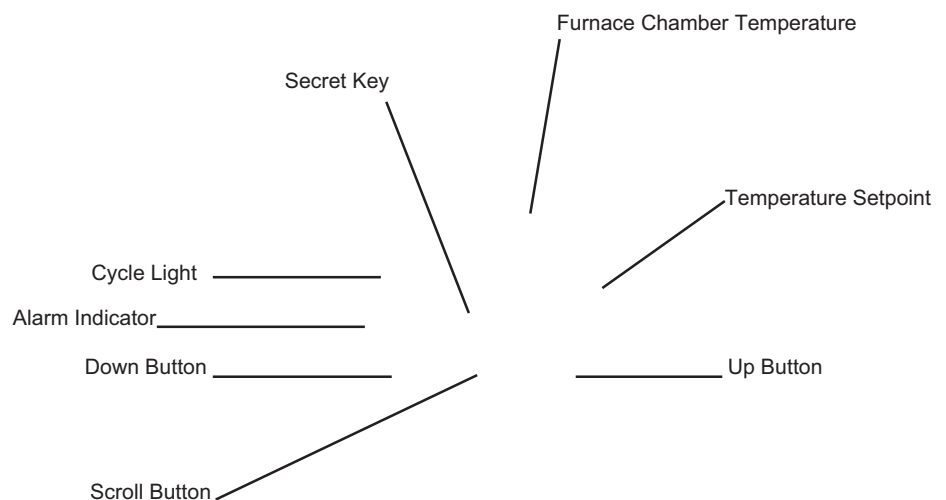


Figure 2: Single Setpoint Controller

SINGLE SETPOINT TEMPERATURE CONTROL (AUTOMATIC)



Note

When performing these steps, 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 checked earlier, however, will not be lost or altered. Holding down on the “SCROLL” button allows longer viewing time.



Note

Overtemperature

protection: 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.

Temperature Indication:

This controller will display all temperatures in °C. Contact Thermolyne if control needs to be changed to °F.

Adjustment of Parameters

This controller's buttons are incorporated into its front panel. To illuminate the “DOWN” button, “SCROLL” button, and “UP” button, touch anywhere on front panel.

Setpoint Temperature:

Push the “UP” button or the “DOWN” button to modify the temperature setpoint (shown on the lower digital display). Once set, the setpoint will remain unchanged until you reset it. This allows you to set the controller for a consistent procedure, then simply turn the furnace on and off with the power switch.

High Alarm (Over-Temperature

Protection OTP):

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

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 (1210°C) or a value of 20 degrees above your working temperature if you desire to provide protection for your workload.



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 temperature setpoint, then restart “tuning” procedure.

Tuning:

This control incorporates a self tuning feature which determines the optimum control parameters for the best temperature accuracy with your load and setpoint. Use this feature the first time you use your furnace and each time you change either your setpoint or the type of load you are heating.

Barnstead/Thermolyne highly recommends using this feature to provide the best temperature accuracy the controller can attain.

To use the Tuning feature:

First, adjust the setpoint to your desired value.

Then, 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.

The next time you use your furnace, push the “SCROLL” button until “tunE” appears. Insure that “tunE” is “OFF.”

4 Ramp & 4 Dwell Programmable Models



Warning

To avoid electrical shock, this furnace must have the door switch operating properly.

This controller consists of a microprocessor based three-mode (Proportional, Integral, Derivative), programmable temperature controller with "Fuzzy" logic capability, programmable over-temperature protection and appropriate output switching devices to control the furnace. The digital readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the "SEL" button is depressed.

The programmable control can be used as a single setpoint control or as a programmable control.



Note

For optimum control of a single setpoint operation, set the "CTR" parameter to "FUZY" to take advantage of the controller's fuzzy logic capabilities.

Single Setpoint Operation

To use as a single setpoint control simply push "UP" or "DOWN" button to choose a specific temperature.

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

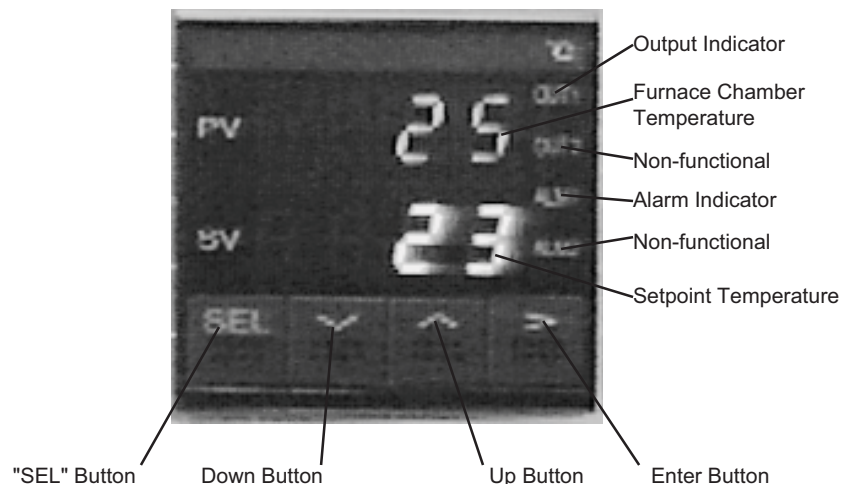


Figure 3: Programmable Control (4 ramp & 4 dwell)



Note

The furnace will begin to heat to the current setpoint temperature when you turn the power switch "ON." To examine the control parameters without heating the furnace, depress and hold the "DOWN" button until the setpoint (lower) display reads "20".

2. To change this setpoint, depress the "UP" or "DOWN" button until the desired setpoint value is displayed, then release the button.
3. At this point the furnace will begin to heat if the new setpoint temperature you have chosen is higher than the present chamber temperature.

Programmed Operation

Control Parameters

You can gain access to the control parameters by holding the "SEL" button depressed for about 3 seconds. "LoCt" will be displayed in the upper display.

Depressing "SEL" once again shows the next parameter and its current value on the display. The parameter value can either be modified with the buttons or left unmodified. Pressing the enter button (>) will allow you to modify the current value using the "Up" and "Down" buttons. Press the enter button again to set the new value as the current value. (See "Programming the Controller" for information on programming.)

The control parameters in order are:

LoCt - Parameter lock level. Determines the number of parameters displayed when you press "SEL". It should be set to "0002." If it does not, set to "0002."

Nod - Mode. By pushing "UP" or "DOWN" buttons, can be set to "Auto" or "NAn" (Manual). Set to "Auto". In Manual mode, you must enter values to control the furnace chamber temperature.



Note

When examining the parameters, if you depress and release either the "SEL," "UP," or "DOWN" buttons and more than 1 minute elapses 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 checked earlier, however, will not be lost or altered.

4 RAMP & 4 DWELL PROGRAMMABLE MODELS

At - Autotuning feature. Will automatically set optimum PID values for your process. For Tuning, set to "on." For normal operation, set to "oFF."

StAt- Status. Displays current status of program and cannot be changed.

Tine - Time. Displays the time remaining in the current program.

ProG - Program options. Can be set to one of three options: "oFF", "rUn" or "hold". "oFF" will stop any running program and reset the program to the beginning. "rUn" will start a program from the beginning or resume a program from "hold" from the point it was held. "hold" will interrupt a running program without resetting the program to the beginning.

Sü-1 - Setpoint 1. The temperature at which the first ramp is aiming and at which the first dwell will be held.

tN1r - Ramp time 1. The time the controller will take to change the chamber temperature from its present temperature to the value of Setpoint 1. This time may be limited by the physical capabilities of the furnace.

tN1S - Dwell time 1. The length of time the controller will hold the furnace at the Setpoint 1 temperature.

Sü-2- Setpoint 2.

tN2r - Ramp time 2.

tN2S - Dwell time 2.

Sü-3 - Setpoint 3.

tN3r - Ramp time 3.

tN3S - Dwell time 3.

Sü-4 - Setpoint 4.

tN4r - Ramp time 4.

tN4S - Dwell time 4.

P-on - Power-on start. Push the "Up" or "Down" Buttons to set to "Yes" or "No." When set to "Yes," your furnace will immediately begin running the set program when you power on your furnace. For most applications, set to "No."

The next three parameters - Proportional band, Integral and Derivative - are the three control parameters of a P.I.D. control system. The values for these parameters are set during the tuning process. You should not change them; doing so may cause your controller to operate incorrectly.

P - Proportional band

i - Integral

d - Derivative

AL1T - Alarm type. This parameter determines how the controller responds to any alarm input. It should display "0031." If it does not, set it to "0031."

AL11 - Furnace overtemperature alarm. This parameter determines the absolute upper limit on the furnace chamber temperature. We recommend a setting of "1200" since 1200°C is the maximum temperature your furnace can obtain without damage to furnace components.



Note

Overtemperature protection:

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 value you have entered for AL11. It does not shut off the furnace, but will maintain the chamber temperature at that value.

4 RAMP & 4 DWELL PROGRAMMABLE MODELS

You may wish to set the parameter lower if you need to ensure a crucial process is protected from high temperature.

AL12 - High deviation alarm. This parameter determines how far the furnace chamber temperature can rise above your setpoint. We recommend a setting of 20; since a P.I.D. control process involves some degree of temperature overshoot, a setting of less than 20 may interfere with the function of your controller.

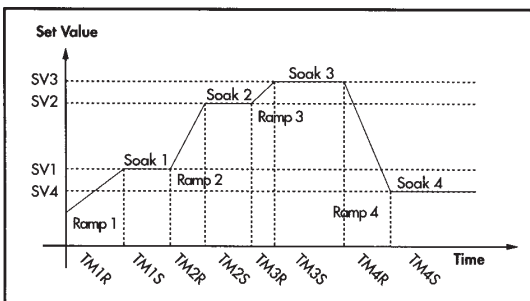
LoOP - Thermocouple break alarm detection time. For proper operation of your furnace, this parameter should be set to "0.00". If it is not, set it to "0.00".

CTrL - Control type. Push the "Up" or "Down" buttons to set to "Pid" or "FUZY". Programmed operation requires P.I.D. control. Single setpoint operation will achieve better control using Fuzzy logic control.



Caution

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.



Typical Profile for Programmable Models
(Other Profiles May Be Formed)

Programming Controller

This controller allows you a maximum of 4 ramp and 4 dwell segment combinations, thus enabling 4 different setpoint levels to be achieved. Each ramp is programmed by specifying the ending temperature level and the required time to ramp to that temperature. The controller then automatically calculates the ramp rate required to attain the ending temperature level based on the desired ramp time. Dwell segments then can be attached to each temperature level to hold that temperature for a specified amount of time.

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



Note

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 setting of "00.00" hour.minutes. This will cause controller to skip to next segment as fast as the furnace can heat or cool down.

Make sure "ProG" (program options) is set to "oFF" (to stop the program) when entering program values.

Push "SEL" button until "Sü-1" is displayed. Push the Enter button (>) to select the current value. Push "UP" or "DOWN" button and set Setpoint 1 in °C. Push the Enter button to enter the set value as the current value.

Push "SEL" button until "TN1r" is displayed. Push the Enter button (>) to select the current value. Push "UP" or "DOWN" button and set Ramp time 1 in hours and minutes in the format "X.XX" (hour.minutes). This is the time Ramp 1 will take to reach Setpoint 1. Push the Enter button to enter the set value as the current value.

Push "SEL" button until "TN1S" is displayed. Push the Enter button (>) to select the current value. Push "UP" or "DOWN" button and set Dwell time 1 in hours and minutes in the format "X.XX" (hour.minutes). Push the Enter button to enter the set value as the current value.

Set "Sü-2" "TN2r" "TN2S" "Sü-3" "TN3r" "TN3S" "Sü-4" "TN4r" and "TN4S" in the same manner as "Sü-1" "TN1r" "TN1S".

Program Execution

Push "SEL" button until "ProG" is displayed. Pushing "UP" or "DOWN" button, select "run." When "run" is selected, the program will start from the actual furnace temperature at that point in time.

Setpoint

While the program is in "run" or "Hold," the setpoint shown on the bottom display is the current working setpoint.



Note

The temperature control in these models is a programmable “and” automatic single setpoint device. When the program has ended, the controller will maintain the chamber temperature at a value equal to the last programmed level (Setpoint 4) until the program is cancelled. It will not automatically cool to ambient unless Setpoint 4 is set at ambient. When a program is cancelled, the controller will maintain the chamber temperature at a value equal to the single setpoint mode setpoint.



Note

For processes which cannot tolerate the overshoot naturally generated during the tuning process, select “Lo” rather than “on” for the “AT” setting. The “Lo” setting will tune your furnace at a temperature below your setpoint, then apply the result to your setpoint. This approach prevents the necessary tuning overshoot from exceeding your actual setpoint.

Program End

When the program ends, the controller will hold the furnace at the value of Setpoint 4 until you stop the program.

Program Stop

To stop program, push “SEL” button until “ProG” is displayed. Push “UP” or “DOWN” button until “oFF” is displayed. This will terminate program.

Self Tuning Feature

This programmable control has an automatic tuning feature which installs optimum tuning parameters to give the best temperature accuracy with your load and setpoint or program. No manual loading of tuning parameters is needed. **Barnstead/Thermolyne highly recommends using this feature to provide the best temperature accuracy the controller can attain.** Use this feature the first time you use your furnace and each time you change your setpoint or program or the type of load you are heating. To use the Tuning feature:

1. Select the temperature at which you intend to operate. If you will be running a program, enter the value of Setpoint 1 as a single setpoint.
2. Load your furnace with a characteristic sample of the load you will be heating.
3. Push “SEL” button until “AT” is displayed, then push “UP” or “DOWN” button to turn “AT” “on.”

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 - P

Integral - i

Derivative - d

- Self tuning cannot be initiated while running a program.
- A power failure will cause the AT parameter to revert back to "OFF". (Reset tune parameter to "ON" using the "UP" button).
- In the case of alarm conditions during tuning, those conditions will flash alternately with "TunE."

The next time you use your furnace, push "SEL" button until "AT" is displayed, then push "UP" or "DOWN" button to turn tune "oFF."

8 Ramp & 8 Dwell Multi-Programmable Models



Note

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

This furnace controller consists of a microprocessor-based three-mode (Proportional, Integral, Derivative), programmable control with overtemperature protection and appropriate output switching devices to control the furnace. The upper digital display indicates the measured chamber temperature and the lower display indicates the main setpoint temperature unless the scroll button is depressed. (See Figure 4.)

The programmable control can be used as a single setpoint control or as a programmable control.

Single Set Point Operation

To use as a single set point control, simply push up or down buttons to choose a specific temperature.

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

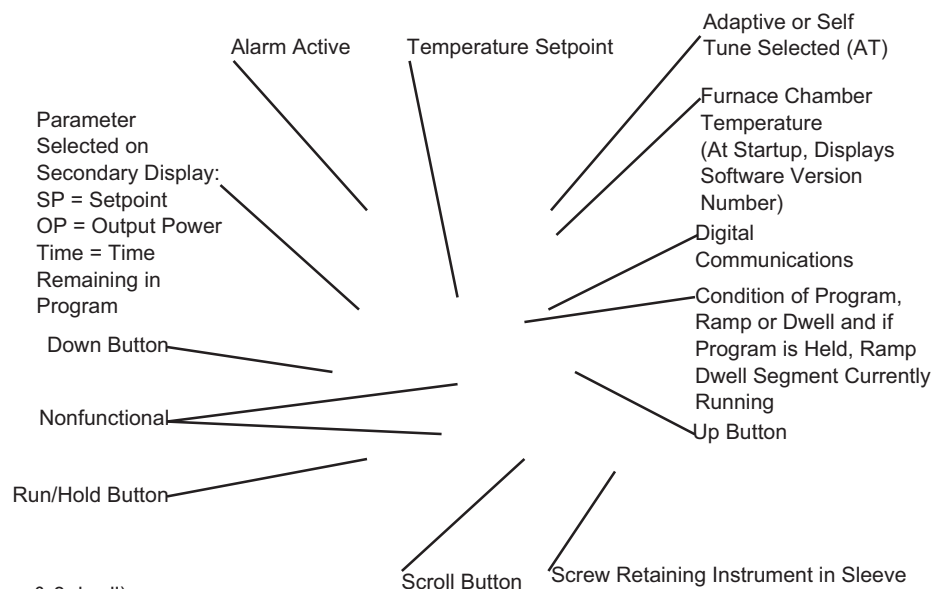


Figure 4: Multi-Programmable Control (8 ramp & 8 dwell)



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.

2. To change this set point, depress the "UP" or "DOWN" push button until the desired setpoint value is displayed, then release the button.
3. 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.
4. The upper display indicates actual furnace temperature.

The two center push buttons are inactive and not used.



Note

The furnace will begin to heat to the current setpoint temperature when you turn the power switch "ON." To examine the control parameters without heating the furnace, depress and hold the "DOWN" button until the setpoint (lower) display reads "20".

Programmed Operation

Control Parameters

Control parameters are viewed and changed using the "SCROLL" button. 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. Pnr1 (program number 1) will appear. To progress through the parameter list, release the scroll button, then use single step depression to advance through the list. You can rapidly progress through the parameter list by holding the scroll button depressed. For all the parameters, pushing the up or down button will give current setting.

8 RAMP & 8 DWELL MULTI-PROGRAMMABLE MODELS



Note

When examining the parameters, if you depress and release either the “PAR,” “UP,” or “DOWN” 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 checked earlier, however, will not be lost or altered. Holding down on “PAR” allows longer viewing time.



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.

The temperature control parameter values in order are:

Pnr 1 - Program number. By pushing the up or down button, you can select a program from 1 to 4. Each program will contain independently the following parameters:

PR1 - Program Ramp Rate. The rate of heat increase or decrease in °C/minutes.

PL1 - Program Level. The temperature to which the furnace needs to attain.

PD1 - Program Dwell 1. Amount of time in minutes to hold PL1 program level temperature entered.

The remaining Program Ramp Rates PR2 - PR8, Program Levels PL2 - PL8, and Program Dwells PD2 - PD8 follow with the same structure as PR1, PL1, and PD1.

Cnt - Continued. Allows linking of programs. Cnt may be selected as “y” (yes) or “n” (no) by pushing the up or down button.

HB - Holdback. Automatically places the controller into “Hold” if the measured value deviates more than a specified amount from controller setpoint. When measured value re-enters the holdback band, the timing for the segment resumes. (Parameter is expressed in °C and only functions when running a program).

PLC - Program Loop Count. The number of times a program will be repeated.

SP1 - Setpoint One. Indicates current setpoint.

SP2 - Setpoint two. Not configured into control and nonfunctional.

ST - Self Tune. Automatically loads PID values on initial start up. (See Furnace Operation for function of Self Tune).

AT - Adaptive Tune. Analyzes and inputs optimum PID values when temperature has reached setpoint. (See Furnace Operation for function of Adaptive Tune).

SAT - Self Adaptive Tune. When engaged, starts controller off in self-tune mode then automatically switches to Adaptive Tune (AT). (See Furnace Operation for function of Self Adaptive Tune).

ATR - Adaptive Tune Band 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.

The next three parameters – Proportional (PB) Integral (+i) and Derivative (+d) – are for high accuracy control. Self-Adaptive Tuning will change these parameters to their optimum values. You should not change them; doing so may cause your controller to operate incorrectly.

The next two parameters – cutback low (**cbi**) and cutback high (**cbh**) – are to aid the control in preventing temperature overshoots and temperature 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 Tune and Adaptive Tune features. These values cannot be changed by the user; the controller automatically installs optimum cutback values when in Self 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.

Sbr - the percent of power that is supplied to the control output terminals if an open thermocouple condition exists. Push up or down button. 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.

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 two of the controller's programming parameters, "Pnr" and "Cnt."

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

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 controller then automatically calculates the time that is required to attain the program level (PL) based on the desired ramp rate (PR). Dwell segments (soak) then can be attached to each program level (PL) to hold that temperature for a specified time.

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).

Program Entry

1. With the controller 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 step to the next program level.

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

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.
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 down 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.

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.

Holdback

This controller features a “holdback” (Hb) function to ensure programmed parameter values are adhered to. Holdback is set in display units (degrees) and represents the allowable excursion of measured value away from the current setpoint, 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 the holdback band (clock starts). This feature is active the whole time that the program is running. (Holdback functions only while running a program).

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. Select desired holdback setting – a setting of 20° is recommended. 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”.



Note

The temperature control in these models is a programmable “and” automatic single setpoint 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 as described earlier in this manual.

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.

Program Execution

Once the program has been entered it can be run 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 previous 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 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 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.

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.

SAT Self Adaptive Tuning

This programmable control has automatic tuning features which install optimum tuning parameters to give the best temperature accuracy with your load and setpoint. No manual loading of tuning parameters is needed. **Thermolyne highly recommends using these features to provide the best temperature accuracy the controller**

can attain. Use this feature the first time you use your furnace and each time you change your setpoint or program or the type of load you are heating.

The following paragraphs instruct you 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 is a one-time function which 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 use the tuning features:

1. Depress 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 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 (use temperature setpoint that your application requires). 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.

Furnace Loading



Caution

Do not overload your furnace chamber. If the load is to be heated uniformly, it should not occupy more than two-thirds of the furnace chamber. Maintain at least a 3/4 inch gap between the load and elements. Failure to observe this caution could result in damage to furnace components.

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

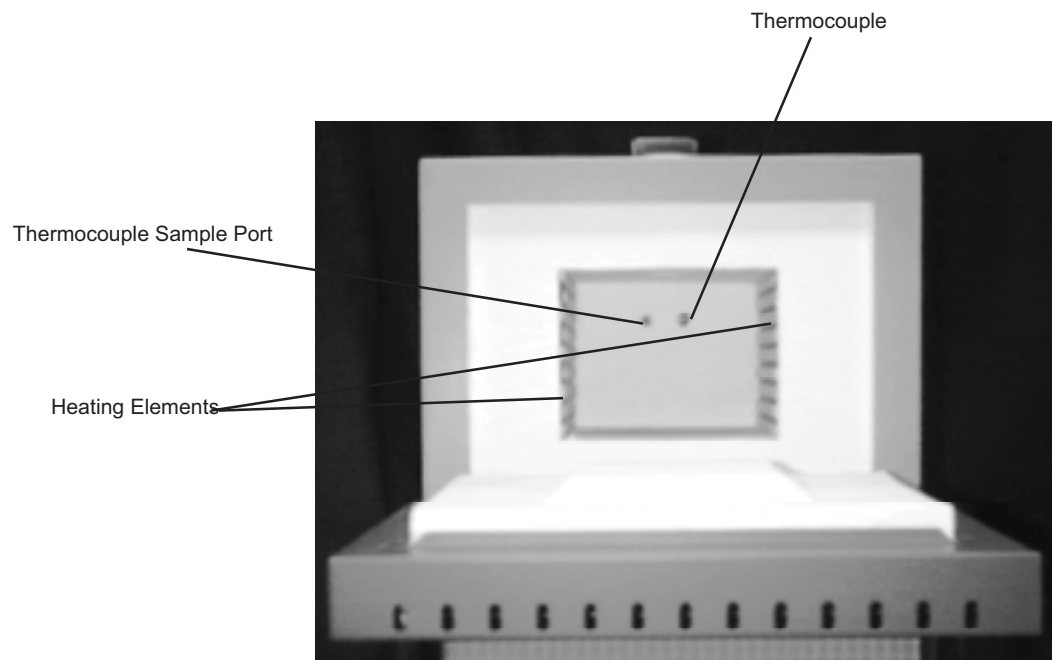
If you are heating a number of small parts, spread them throughout the center two-thirds of the furnace chamber.

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 prematurely.



Preventative Maintenance

This unit is equipped with a venting system on the top of the furnace. This is for the removal of fumes from the chamber of the unit. Contamination is a major cause of element failure, therefore, remove all fume forming material before heating. (e.g. clean cutting oil from tool steel).

Housekeeping is vital to your electric furnace – KEEP IT CLEAN. Run your furnace up to 871°C (1600°F) empty occasionally to burn off the contamination that may exist on the insulation and elements. Maintain 871°C (1600°F) for at least 4 hours to insure complete ashing of foreign materials.

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 260°C (500°F).

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

General Cleaning Instructions

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

Problem Solving Tips

The Problem Solving 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.

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
The cycle light does not illuminate.	The furnace is not connected to power supply. Incorrect power source. ON and OFF power switch defective. Defective cycle light. Door switch defective.	Reconnect furnace to power supply. Connect to correct power source. Replace power switch. Replace cycle light. Re-align or replace furnace door switch.
The furnace does not heat.	No power. Defective electrical hookup. Thermocouple has oxidized and opened the circuit. Controller malfunction. Heating elements in 208V, 230V or 240V furnaces are burned out. Door switch malfunction. Defective safety relay. Defective solid state relay.	Check power source and fuses or breakers. Repair electrical hookup. Replace thermocouple. Replace controller. Replace defective elements. Re-align or replace door safety switch. Replace safety relay. Replace output relay.
Door switch does not cut power to heating elements.	Door switch is not functioning. Safety relay malfunction.	Re-align or replace door safety switch. Replace safety relay.

PROBLEM SOLVING TIPS

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
Controller over-temperature alarm does not cut power to furnace chamber.	Alarm output device malfunction. Mechanical relay malfunction. Element shorted to ground.	Replace control unit. Replace mechanical relay. Replace faulty element.
Slow heatup.	Low line voltage. Heavy load in chamber. Wrong heating element. One heating element is burned out in 100V & 120V furnace.	Install line of sufficient size and proper voltage. (Isolate furnace from other electrical loads.) Lighten load in chamber to allow heat to circulate. Install proper element. Replace burned out element.
Repeated element burnout.	Overheating furnace. Heating harmful materials. Contamination present from previous burnout.	Keep furnace under maximum temperature. Closer supervision of control setting. Enclose material in container. Clean up spills in and on chamber. Ventilate chamber by leaving top vent slightly open when heating known harmful reagents. Replace insulation material.
Inaccurate temperature readout.	Oxidized or contaminated thermocouple. Poor thermocouple connection. Improper loading procedures. Poor ventilation of base. Thermocouple connections reversed.	Replace thermocouple. Tighten connections. Use proper loading procedures. Clear area around furnace base. Reconnect thermocouple correctly.

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.

To Replace a Heating Element:

1. Disconnect the furnace from the power supply.
2. Remove the back terminal cover of the furnace. (Note placement and connection of wires.)
3. Loosen the nuts on the terminal points of the four heating element lead wires and remove the element wires from the terminals.
4. Loosen the thermocouple hold-down clip and carefully remove the thermocouple from the rear of the furnace chamber.
5. Remove both the back of the furnace and the blanket insulation.
6. Grasp the element lead wires and pull out both elements and the back chamber insulation.
7. Replace the defective element.

8. Reverse the disassembly procedure, making sure you thread all element lead wires through the insulating porcelain bushings on the back of the furnace and cut off any excess element lead wire after securing the leads to the terminal points.
9. Reconnect the furnace to the power supply.
10. Test the operation of the furnace.

**To Replace a Chromel/Alumel
Thermocouple (All Furnaces):**

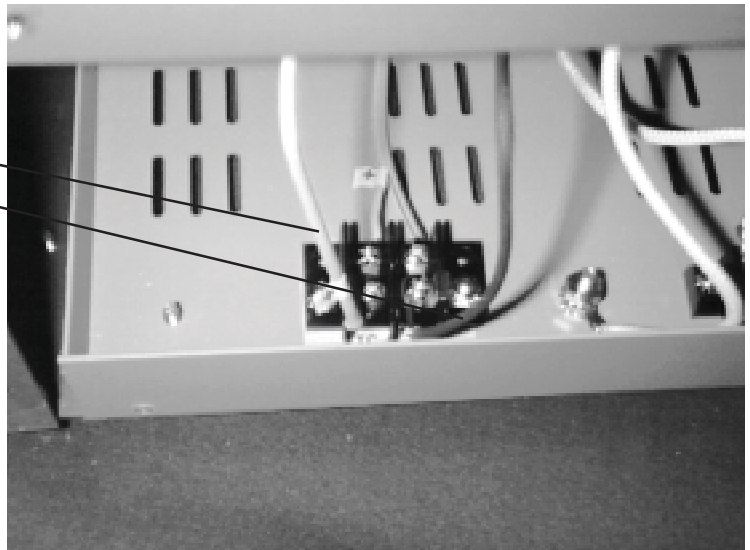
1. Disconnect the furnace from the power supply.
2. Remove both back covers. (Note placement and connection of wires.)
3. Remove the clip holding the thermocouple in place (1 screw), and remove the two screws on the thermocouple terminals.

4. Remove the thermocouple (Note: first pull the thermocouple straight out of the hole in the chamber to avoid damage to the insulation.)
5. Guide the looped ends of the new thermocouple through the plastic bushings with the red (-) lead to the right as you face the back of the furnace.
6. Form a 90° bend towards the furnace, with the red (-) lead to the right. Insert the thermocouple straight through the hole in the chamber.
7. Secure the thermocouple with clip and screw. Connect the looped ends of the thermocouple to the terminals with ⁺ to ⁺ (yellow) and - to - (red). (A polarity test of the thermocouple and lead wire is easily made with the use of a magnet. On Chromel/Alumel thermocouples and lead wire, the non-magnetic wire is positive (⁺) and the magnetic wire is negative (-).)
8. Replace both back covers.

Thermocouple Leads

+

-



9. Reconnect to the power supply.
10. Test the operation of the furnace.

To Replace Door Switch (Micro-Switch):

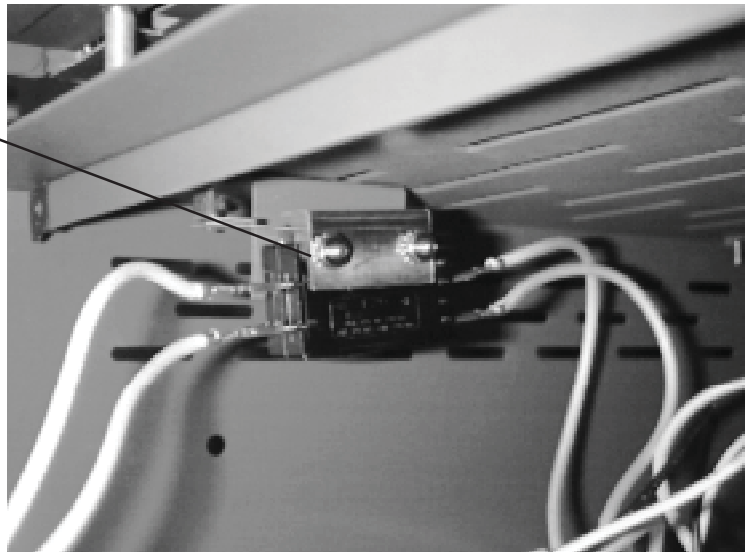
1. Disconnect the furnace from the power supply.
2. Remove the two top screws on the front dial and the two bottom screws and 1 lock washer on the back cover.
3. Slide the control section forward. (Note: do not pull excessively on the internal wires.)
4. Disconnect the wires from the door switch. (Note the connection placement of the wires to the micro-switch.)
5. Remove the two screws, lock washers and nuts from the micro-switch.
6. Insert a new micro-switch and secure with the screws, lock washers and nuts removed in step 5.

7. Reconnect the wires identified or marked in step 4 to the new door switch.
8. To realign the door switch, see the following section: **To Realign Door Switch.**
9. Slide the control section back and replace the screws and lock washer described in step 2.
10. Reconnect to the power supply.
11. Test the operation of the door switch. (See next section, step 10.)

To Realign Door Switch (Micro-Switch):

1. Disconnect the furnace from the power supply.
2. Remove the two top screws on the front dial and the two bottom screws and lock washer on the back cover.

Door Switch



3. Slide the control section forward. (Note: do not pull excessively on the internal wires.)
4. With the door closed, loosen the screws on the micro-switch and slide the switch downward, so that the screws are at the bottom of the slots in the mounting bracket.
5. Finger tighten both screws. While holding down the rear of the micro-switch housing, gently push up on the front of the switch until you hear a click.
6. Open and close the door; the switch should click when the door is opened approximately 3" and 1" to 2" before the door is closed. Slide the front of the switch up to increase the distance, down to decrease the distance.
7. Tighten the two screws to secure the micro-switch. Check the operation of the switch as described in step 6 after tightening the screws.

8. Slide the control section back and replace the screws and lock washer described in step 2.
9. Reconnect to power supply.
10. To test the operation of the door switch: turn the power switch on, set the control to a setting high enough to keep the control from cycling, open and close the door; the cycle light should turn off when the door is opened approximately 3" and turn back on 1" to 2" before the door is closed.



Note

To gain access to control section components, simply remove the two top screws on the front dial and the two bottom screws (with one lock washer) on the back cover. Slide control section forward. Do not pull excessively on the internal wires.

To Replace the Automatic or Programmable Controller:

The controller plugs into a panel mounting sleeve which should be left permanently installed in the furnace housing. To remove the controller, grasp the top and bottom of the controller front, squeeze together and pull out. Do not attempt to dismantle this unit further, but replace it either with a Thermolyne loaner or a new unit.

Replacement Parts List

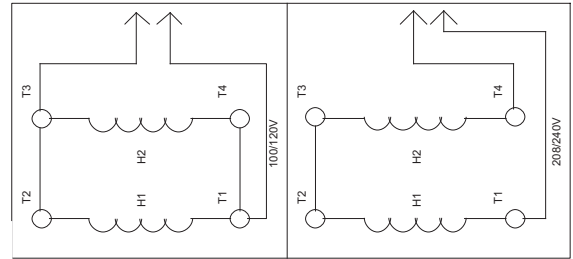
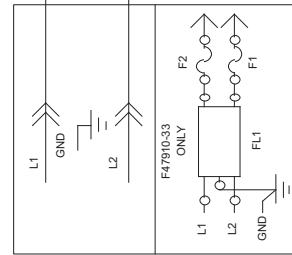
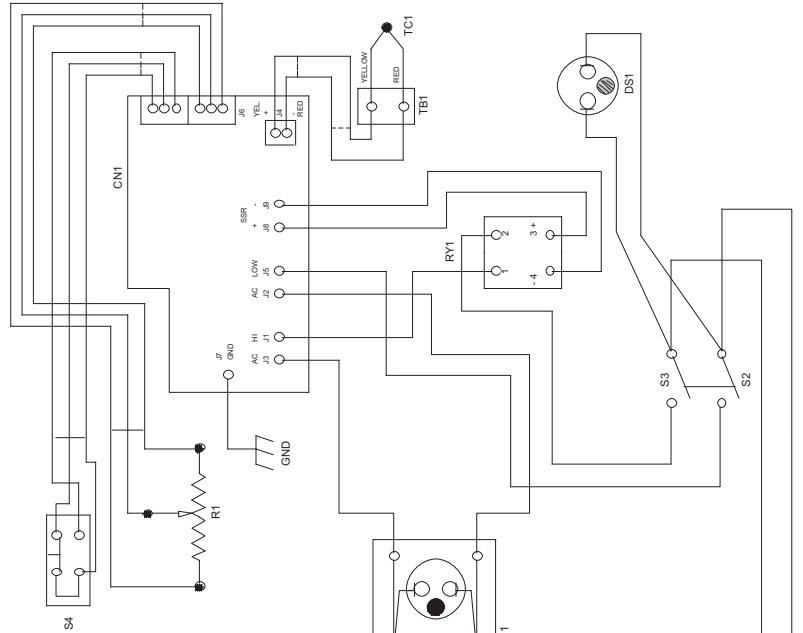
PART NO.	DESCRIPTION	MODELS USED ON
CN71X49	Control module, auto. models	F47920, F47920-26, F47920-33, F47924, F47925, F47928, F48020, F48020-33, F48020-26, F48024, F48025, F48028
CNX151	Control module, programmable models (4 ramp & 4 dwell)	F47920-80, F47920-26-80, F47920-33-80, F47924-80, F47925-80, F47928-80, F48020-80, F48020-26-80, F48020-33-80, F48024-80, F48025-80, F48028-80
CN71X57	Control module, mult-programmable w/communication option (8 ramp/8 dwell)	F47950, F47950-26, F47950-33, F47954, F47955, F47958, F48050, F48050-26, F48050-33, F48054, F48055, F48058
EL479X1A	Heating element, side (2 req'd.)	120, 220-240V, 47900 models
EL479X2A	Heating element, side (2 req'd.)	100 & 208 V, 47900 models
EL480X1A	Heating element, side (2 req'd.)	120, 220-240V, 48000 models
EL480X2A	Heating element, side (2 req'd.)	100 & 208V, 48000 models
SWX163	Door safety switch	All models
TC357X1A	Thermocouple, type K	All models
PC750X1A	PC board (basic automatic control)	F47915, F48015
PC750X2A	PC board (basic automatic control)	F47910, (-26) & (-33), F48010, (-26) & (-33)
PC750X3A	PC board (basic automatic control)	F47914, F48014
PC750X4A	PC board (basic automatic control)	F47918, F48018
PLX76	Cycle light (amber)	All 100 & 120V models except basic automatic control models*
PLX82	Cycle light (amber)	All 208, 220-240V models except basic automatic models*
RYX56	Mechanical Relay	All 100 & 120V models except basic automatic control models*
RYX57	Mechanical Relay	All 208, 220-240V models except basic automatic control models*
RYX34	Solid State Relay	All models except basic automatic control models*
RYX54	Solid State Relay	All basic automatic control models*
SWX68	ON/OFF power switch	All models except basic automatic control models*
SWX134	ON/OFF power switch	F47914, F47915, F48014, F48015
SWX144	ON/OFF power switch	F47910, (-26) & (-33), F47918, F48010, (-26) & (-33), F48018
SW745X1A	Push to Set Temp. switch	All basic automatic control models*
RS745X1A	Temp. Setpoint Adjust. rheostat	All basic automatic control models*

*Basic automatic control models include:

F47910, F47910-26, F47910-33, F47914, F47915, F47918
 F48010, F48010-26, F48010-33, F48014, F48015, F48018

Wiring Diagrams

REF. NO.	DESCRIPTION	MODEL NO. AND OUR PART NO. (s)
CN1	CONTROL	F48010 F48010-33
DS1	PILOT LIGHT	PC750X2A F48015
F1	FUSE	PLX82 PC750X1A
F2	FUSE	FZX30 PLX76
FL1	FILTER	FZX30 PLX76
H1	HEATING ELEMENT	CAX98 EL480X2A
H2	HEATING ELEMENT	EL480X1A EL480X1A
R1	RESISTOR, POT	RSX314 RSX314
RY1	RELAY, SOLID STATE	RYX54 RYX54
S1	SWITCH, POWER	SWX144 SWX143
S2	SWITCH, DOOR	SWX163 SWX163
S3	SWITCH, DOOR	SWX163 SWX163
S4	SWITCH, SET POINT	SWX63 SWX63
TB1	TERMINAL BLOCK	TRX136 TRX136
TC1	THERMOCOUPLE	TC357X1A TC357X1A



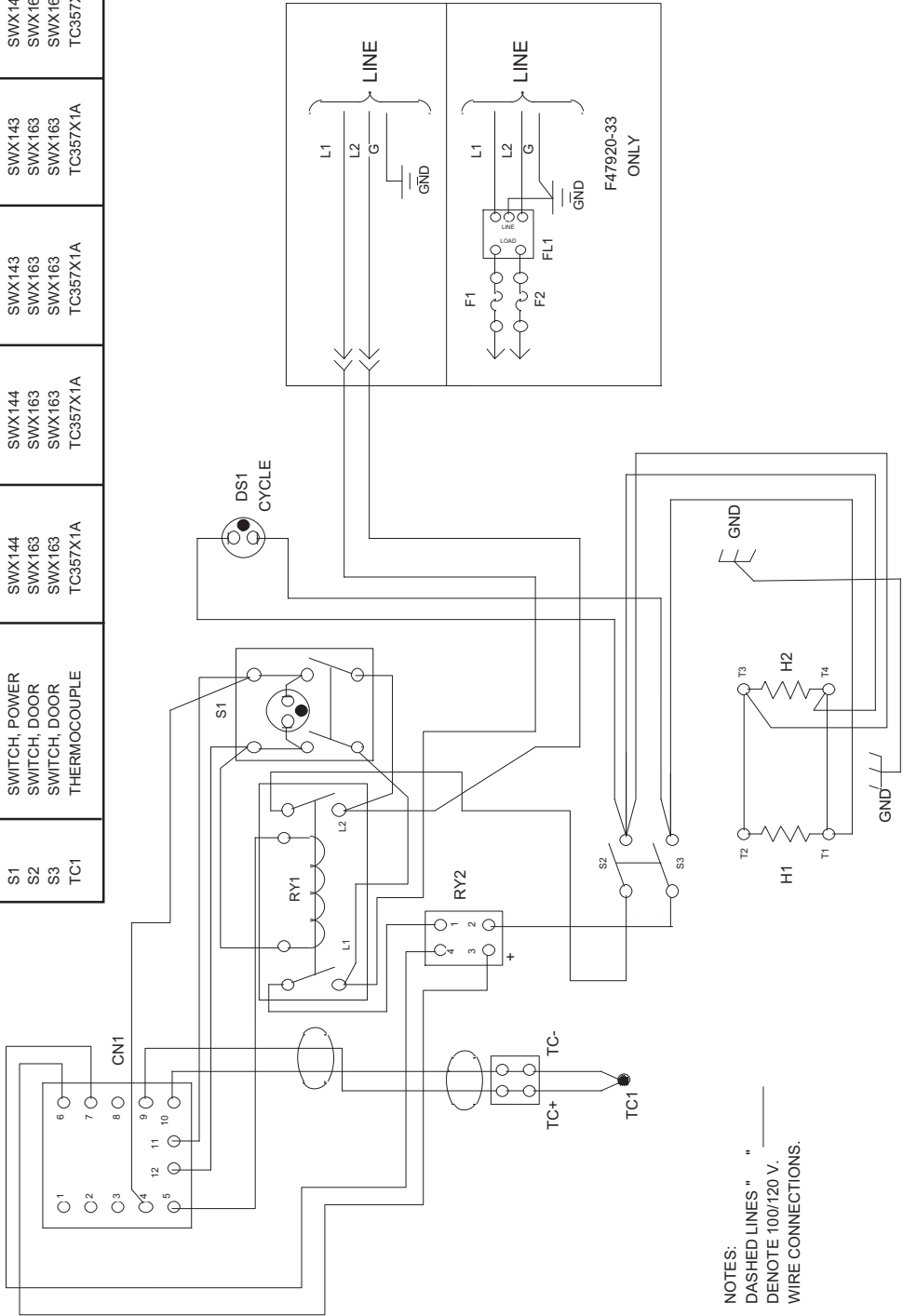
Basic Automatic Control Models

F47910, F47910-33, F47910-33, F47914, F47915, F47918
 F48010, F48010-33, F48010-33, F48014, F48015, F48018

WIRING DIAGRAMS

REF. NO.	DESCRIPTION	MODEL NO. AND OUR PART NOS. (S)			
		F48020	F4802D-33	F48024	F48025
CN1	CONTROL	F48020	F4802D-33	F48024	F48025
DS1	PILOT LIGHT, NEON	CNX146	CNX146	CNX146	CNX146
F1	FUSE	PLX82	PLX82	PLX76	PLX76
F2	FUSE	FZX30	FZX30		
FL1	FILTER, EMI	CAX94	CAX94		
H1	HEATING ELEMENT	EL480X1A	EL480X1A	EL480X2A	EL480X2A
H2	HEATING ELEMENT	EL480X1A	EL480X1A	EL480X2A	EL480X2A
RY1	RELAY, DPST, N.O.	RYX57	RYX57	RYX56	RYX56
RY2	SOLID STATE RELAY	RYX34	RYX34	RYX34	RYX34
S1	SWITCH, POWER	SWX144	SWX144	SWX143	SWX143
S2	SWITCH, DOOR	SWX163	SWX163	SWX163	SWX163
S3	SWITCH, DOOR	SWX163	SWX163	SWX163	SWX163
TC1	THERMOCOUPLE	TC357X1A	TC357X1A	TC357X1A	TC357X1A

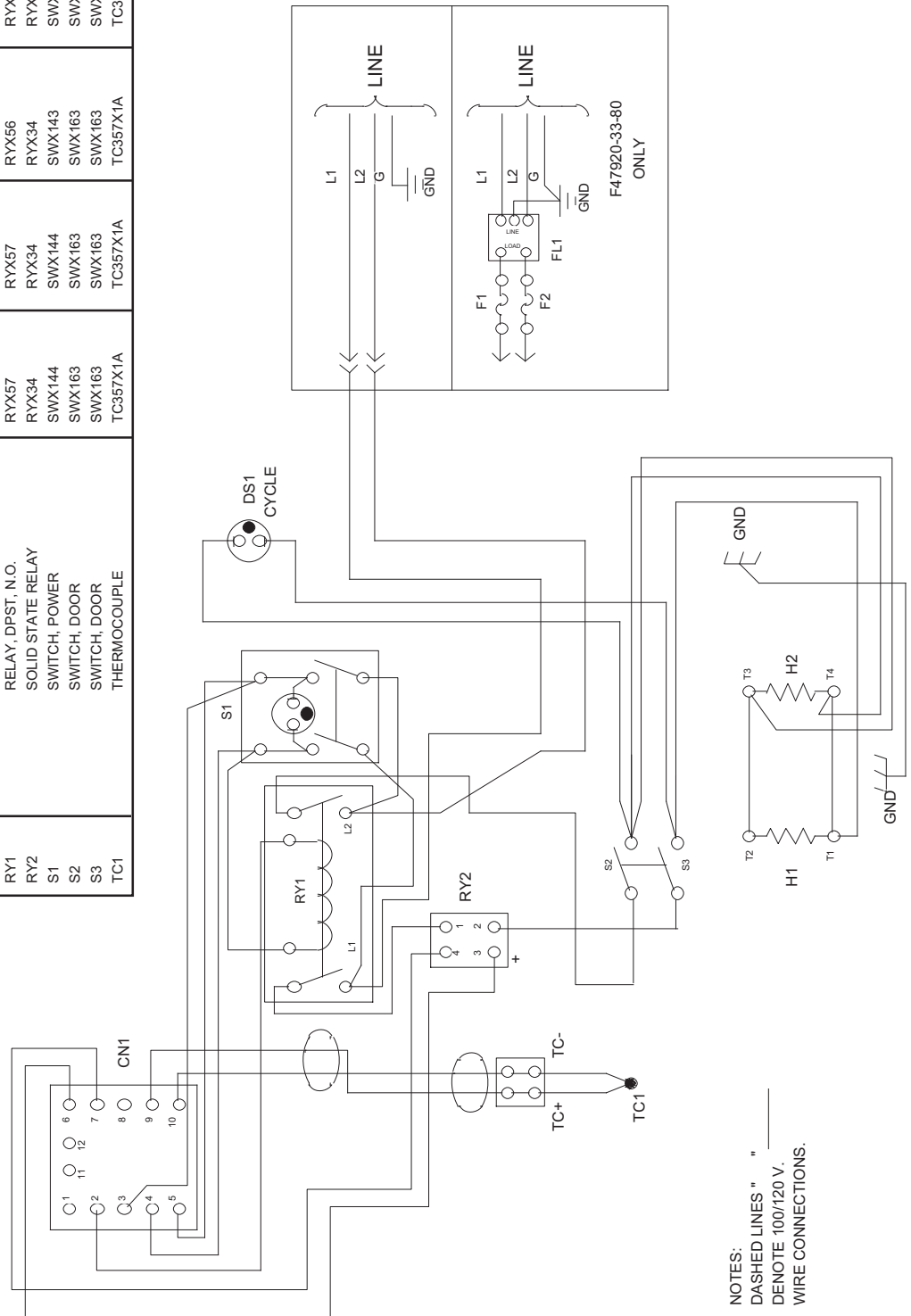
WIRING DIAGRAM



NOTES:
 DASHED LINES " " _____
 DENOTE 100/120 V.
 WIRE CONNECTIONS.

REF. NO.	DESCRIPTION	MODEL NO. AND OUT PART NO. (s)			
		F48020-80	F48020-33-80	F48024-80	F48025-80
CN1	CONTROL	CNX151	CNX151	CNX151	CNX151
DS1	PILOT LIGHT, NEON	PLX82	PLX82	PLX76	PLX82
F1	FUSE	FZX30	FZX30		
F2	FUSE	FZX30	FZX30		
FL1	FILTER, EMI	CAX94	CAX94		
H1	HEATING ELEMENT	EL480X1A	EL480X1A	EL480X2A	EL480X2A
H2	HEATING ELEMENT	EL480X1A	EL480X1A	EL480X2A	EL480X2A
RY1	RELAY, DPST, N.O.	RYX57	RYX57	RYX56	RYX57
RY2	SOLID STATE RELAY	RYX34	RYX34	RYX34	RYX34
S1	SWITCH, POWER	SWX144	SWX144	SWX143	SWX144
S2	SWITCH, DOOR	SWX163	SWX163	SWX163	SWX163
S3	SWITCH, DOOR	SWX163	SWX163	SWX163	SWX163
TC1	THERMOCOUPLE	TC357X1A	TC357X1A	TC357X1A	TC357X1A

WIRING DIAGRAM



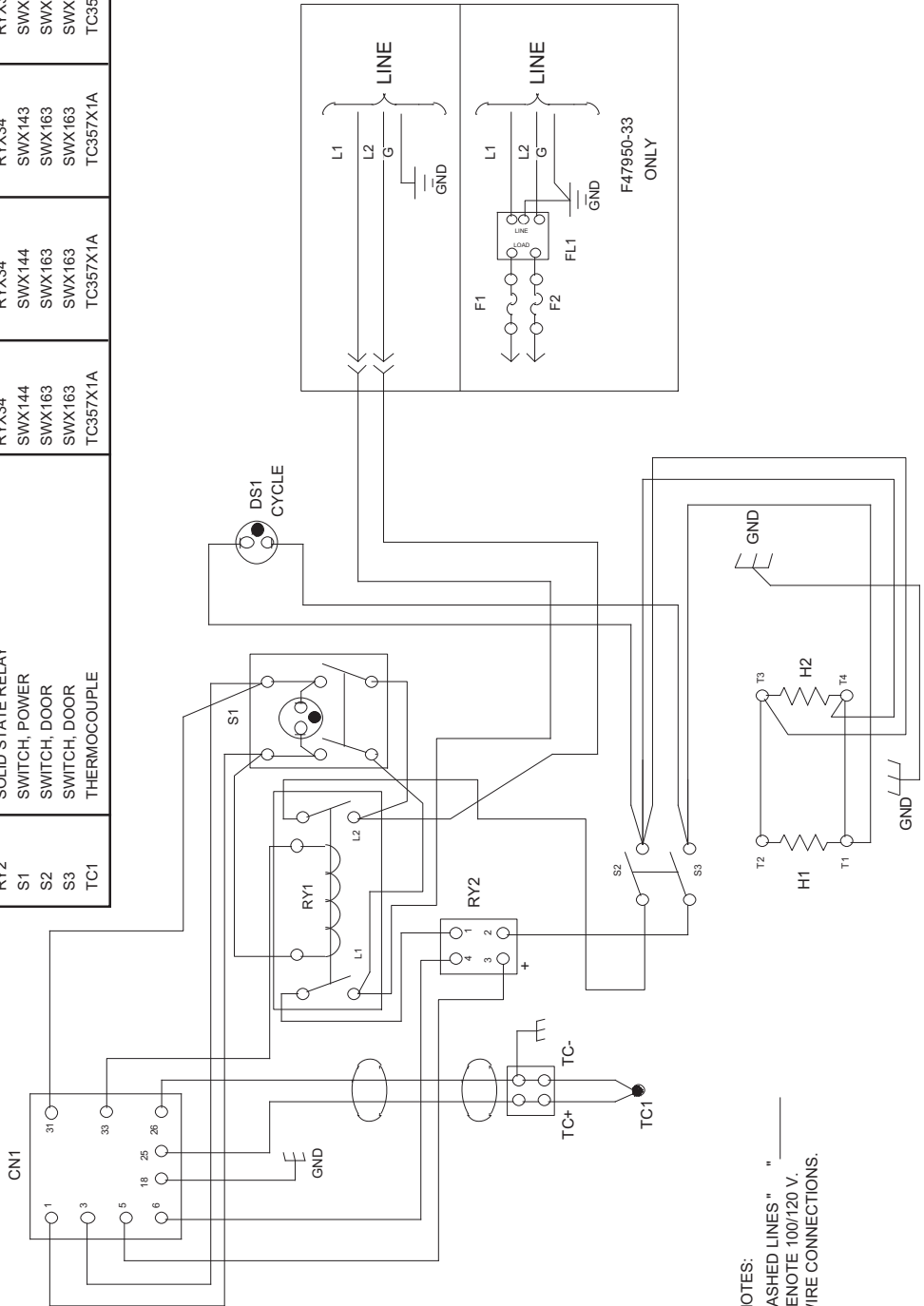
NOTES:
 DASHED LINES " " _____
 DENOTE 100/120 V.
 WIRE CONNECTIONS.

Programmable Models (4 Ramp & 4 Dwell):
 F47920-80, F47920-33-80, F47924-80, F47925-80, F47928-80
 F48020-80, F48020-33-80, F48024-80, F48025-80, F48028-80

WIRING DIAGRAMS

REF. NO.	DESCRIPTION	MODEL NO. AND OUR PART NO. (s)			
		F48050	F48050-33	F48055	F48058
CN1	CONTROL	CN71X157	CN71X157	CN71X157	CN71X157
DS1	PILOT LIGHT, NEON	PLX82	PLX82	PLX76	PLX82
F1	FUSE	FZX30	FZX30		
F2	FUSE	FZX30	FZX30		
FL1	FILTER, EMI	CAX94	CAX94		
H1	HEATING ELEMENT	EL480X1A	EL480X1A	EL480X2A	EL480X2A
H2	HEATING ELEMENT	EL480X1A	EL480X1A	EL480X2A	EL480X2A
RY1	RELAY, DPST, N.O.	RYX57	RYX57	RYX56	RYX57
RY2	SOLID STATE RELAY	RYX34	RYX34	RYX34	RYX34
S1	SWITCH, POWER	SWX144	SWX144	SWX143	SWX144
S2	SWITCH, DOOR	SWX163	SWX163	SWX163	SWX163
S3	SWITCH, DOOR	SWX163	SWX163	SWX163	SWX163
TC1	THERMOCOUPLE	TC357X1A	TC357X1A	TC357X1A	TC357X1A

WIRING DIAGRAM



NOTES:
 DASHED LINES " " DENOTE 100/120 V.
 WIRE CONNECTIONS.

Programmable Models (8 Ramp & 8 Dwell):
 F47950, F47950-33, F47954, F47955, F47958
 F48050, F48050-33, F48054, F48055, F48058

Material Safety Data Sheet

Thermal Ceramics

Date Revised: 7/2/91

PRODUCT IDENTIFICATION

Trade Name(s):	CERAFIBER	CAS #:	65997-17-3
Generic Name:	REFRACTORY CERAMIC FIBER INSULATION	Formula:	MIXTURE
Chemical Name:	ALUMINA SILICA	Telephone:	(404) 796-4200
Manufacturer:	Thermal Ceramics		
Address:	P.O. BOX 923, 2102 Old Savannah Road		
City:	Augusta	State:	Georgia
		Zip:	30903

PRODUCT INGREDIENTS

PHYSICAL DATA

Appearance and Odor:	WHITE FIBER-NO ODOR.		
Boiling Point:	NA	Evaporation Rate (NA = 1):	NA
Vapor Pressure:	NA	Specific Gravity (water = 1):	2.6
Water Solubility (%):	NIL	Melting Point:	>3000°F
Vapor Density (Air= 1):	NA	% Volatile by Volume:	0

FIRE AND EXPLOSION DATA

HEALTH HAZARDS

Summary/Risks

Summary: EXPOSURE TO DUST FROM THIS PRODUCT SHOULD BE MINIMIZED. ANIMAL INHALATION AND ARTIFICIAL IMPLANTATION STUDIES HAVE REPORTED THE DEVELOPMENT OF TUMORS. BASED ON PRELIMINARY RESULTS, A NOTICE OF SUBSTANTIAL RISK HAS BEEN FILED WITH THE EPA ACCORDING TO SECTION 8(e) OF THE TOXIC SUBSTANCES CONTROL ACT. BASED ON ANIMAL STUDIES, IARC HAS CLASSIFIED RCF AS POSSIBLY CARCINOGENIC FOR HUMANS (2B). DATA FROM HUMAN EPIDEMIOLOGICAL STUDIES IS INSUFFICIENT. THIS SUBSTANCE OR MIXTURE HAS NOT BEEN CLASSIFIED A CARCINOGEN BY NTP OR OSHA.

Medical conditions which may be aggravated: AS WITH ANY DUST, PRE-EXISTING UPPER RESPIRATORY AND LUNG DISEASES MAY BE AGGRAVATED.

Target Organ(s): LUNGS, SKIN AND EYES .

Acute Health Effects: PRODUCT IS A MECHANICAL IRRITANT TO SKIN, EYES AND UPPER RESPIRATORY SYSTEM.

Chronic Health Effects: EXCESSIVE EXPOSURE TO RCF DUSTS AND AFTER SERVICE FIBERS MAY CAUSE LUNG DAMAGE (FIBROSIS). IARC STATES THERE IS SUFFICIENT EVIDENCE IN ANIMALS AND LIMITED EVIDENCE IN HUMANS TO CLASSIFY CRYSTALLINE SILICA AS A PROBABLE CARCINOGEN (2A) AND RCF AS A POSSIBLE CARCINOGEN (2B).

Primary Entry Route(s): INHALATION, SKIN AND EYE CONTACT.

Signs/Symptoms of Overexposure

Inhalation: IRRITATION OR SORENESS IN THROAT & NOSE. IN EXTREME EXPOSURES SOME CONGESTION MAY OCCUR.

Skin Contact: TEMPORARY IRRITATION OR RASH.

Skin Absorption: NA

Ingestion: NOT HAZARDOUS WHEN INGESTED. MAY CAUSE TEMPORARY IRRITATION TO GI TRACT.

Eyes: TEMPORARY IRRITATION OR INFLAMMATION

MATERIAL SAFETY DATA SHEET

First Aid/Emergency Procedures

Inhalation: REMOVE TO FRESH AIR. DRINK WATER TO CLEAR THROAT AND BLOW NOSE TO EVACUATE FIBERS.

Skin Contact: WASH AFFECTED AREAS GENTLY WITH SOAP AND WARM WATER.

Skin Absorption: NA

Ingestion: NA

Eyes: FLUSH EYES WITH COPIOUS QUANTITIES OF WATER. IF IRRITATION PERSISTS CONSULT A PHYSICIAN.

REACTIVITY DATA

MATERIAL IS STABLE.

HAZARDOUS POLYMERIZATION CANNOT OCCUR.

Chemical Incompatibilities: HYDROFLUORIC ACID

Conditions to Avoid: NONE IN DESIGNED USE.

Hazardous Decomposition Products: NONE

SPILL OR LEAK PROCEDURES

Procedures for Spill/Leak: VACUUM CLEAN DUST WITH EQUIPMENT FITTED WITH HEPA FILTER. IF SWEEPING IS NECESSARY USE A DUST SUPPRESSANT.

Waste Management: WASTES ARE NOT HAZARDOUS AS DEFINED BY RCRA (40 CFR PART 261) . COMPLY WITH FEDERAL, STATE & LOCAL REGULATIONS. METHOD OF DISPOSAL - LANDFILL. RQ - N/A.

SPECIAL PROTECTION INFORMATION

Goggles: GOGGLES OR SAFETY GLASSES WITH SIDE SHIELDS ARE RECOMMENDED.

Gloves: GLOVES ARE RECOMMENDED.

Respirator: <1 F/CC, USE 3M 9900; <10 F/CC, USE MSA COMFO II WITH H FILTER; <50 F/CC, USE MSA ULTR[®]At[™]WIN H FILTER; OR EQUIVALENTS. SEE SECTION IX-OTHER.

Ventilation: USE SUFFICIENT NATURAL OR MECHANICAL VENTILATION TO KEEP DUST LEVEL TO BELOW PEL/TLV/WEG (WORKPLACE EXPOSURE GUIDELINE) USE DUST COLLECTION WHEN TEARING OUT.

Other: WEAR LOOSE FITTING, LONG SLEEVED CLOTHING. WASH EXPOSED AREAS WITH SOAP & WARM WATER AFTER HANDLING. WASH WORK CLOTHES SEPARATELY FROM OTHER CLOTHING; RINSE WASHER THOROUGHLY.

Special Considerations for repair/maintenance of contaminated equipment: CRISTOBALITE RESPIRATOR: <10X PEL, USE 3M 9900; <100X PEL, USE MSA ULTR[®]At[™]WIN H FILTER; OR EQUIV. SEE SEC IX-OTHER.

SPECIAL PRECAUTIONS

***** ALWAYS SEGREGATE MATERIALS BY MAJOR HAZARD CLASS *****

THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Storage Segregation Hazard Classes: IRRITANT

Special Handling/Storage: KEEP MATERIAL DRY.

Special Workplace Engineering Controls: ADEQUATE VENTILATION TO KEEP DUST LEVEL TO BELOW PEL/TLV/WEG (WORKPLACE EXPOSURE GUIDELINE).

Other: ADDITIONAL INFORMATION ON THE HEALTH AND SAFETY ASPECTS OF REFRACTORY CERAMIC FIBERS IS AVAILABLE.

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MSDS/MSD3 FORM REV. 7/2/91

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.

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 (319-556-2241) or writing to:

Barnstead|Thermolyne
P.O. Box 797
2555 Kerper Boulevard
Dubuque, IA 52004-0797
USA
FAX: (319) 589-0516
E-MAIL ADDRESS: mkt@barnstead.com

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

THE WARRANTY STATED HEREIN IS THE SOLE WARRANTY APPLICABLE TO **Barnstead|Thermolyne** PRODUCTS. **Barnstead|Thermolyne** EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE.

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