Vulcan® 3-Series Burnout Furnaces

Multi-Stage Programmable

Owner & Operator's Manual

Models:	3-130	3-550	3-550A	3-550PD	3-1750	3-1750A
120V	---	9493308	---	9493826	---	---
100-120V	9493302	---	---	---	---	---
230V	---	---	9493985	9493827	---	9493990
200-240V	9493303	9493309	---	---	9493409	---
230V (EURO only)	---	---	---	---	9493658	9494064

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DENTSPLY | CERAMCO®

SAFETY:

- Never operate furnace in close proximity to combustible materials or place materials on top of the furnace.
- Caution: To provide continued protection against risk of electric shock, connect to properly grounded outlet only.
- The furnace must be electrically grounded to a three wire electrical outlet or receptacle. The electrical service provided must be a dedicated line of the proper size according to local electrical codes.
- Disconnect the line cord before attempting to service the furnace.
- Do not attempt to service the furnace until you read and understand the service manual. (See Service Manual under Accessories)
- Do not operate the furnace controls with tongs or other tools; the tongs will damage the control switches.
- Do not use solvents or liquid cleaners on the control panel; they will enter the panel and damage it.
- Do not place firing trays or other hot objects directly in front of the furnace; they will melt the graphic overlay.
- Always verify that the power switch light is off before attempting to load or reach into the furnace chamber with any tools or instruments.
- As a routine working precaution, always wear safety glasses and protective gloves when operating, loading, and unloading the furnace.

If the furnace is not used in the manner as specified in this manual, the protection provided by the furnace may be impaired.

OSHA AND CALIFORNIA PROPOSITION 65: MUFFLE DUST EXPOSURE

In keeping with the policy of DENTSPLY Ceramco to build safe products, comply with all National and State statutes and keep you, the valued customer informed; the services of a Certified Industrial Hygienist firm were employed to test and evaluate the lab operator's exposure to respirable refractory ceramic fiber (RCF) and crystobalite (a form of crystalline silica) present in the furnace muffle.

When it becomes necessary to replace the muffle, the person doing this work is recommended to wear a HEPA filter respirator and protective gloves as a precautionary matter.

Seal used muffle in a plastic bag and dispose of in accordance with local, state and Federal regulations.

Because this product and many similar products on the market today contain crystalline silica and ceramic fibers, it is necessary under the statutes of California Proposition 65 that DENTSPLY Ceramco include the following statement:

"This product contains substance(s) known to the State of California to cause cancer."

Material Safety Data Sheets for RCF materials supplied upon request.

SYMBOL TABLE

~ - Alternating current

I - On (Supply)

O - Off (Supply)

 - Caution, Hot Surface

 - Protective Conductor Terminal

 - Caution

FEATURES:

- High Performance / Hybrid Muffle
  Longer life and more durable than fiber
  Faster heating and faster cooling than firebrick
- Wide operating temperature range
  50°C (122°F) --- 1100°C (2012°F)
- Smooth, low force vertical lift door, with roll back action gives maximum access with minimum vertical space
- Power operated door with automatic timed closing (3-550PD only)
- Programmable controller with 9 three stage programs (6 segments each) and 1 program with a single temperature hold
- Heavy duty construction with stainless steel front panel
- Delay Start operation that enables the user to program the cycle completion time rather than calculating the start time
- Easy to operate and program with user friendly graphic interface
- Programs linkable for 6 stage operation
- Integrated door safety switch breaks both sides of the power line to muffle
- Wide programmable linear temperature rates both positive and negative (0.1 to 40°C/minute)
- Easy / Lower Cost Muffle Service
- Individual muffle heating plate replacement

3-SERIES APPLICATIONS:

- WAX BURNOUT
- MATERIAL ASHING
- MATERIAL HEAT TREATING
- CERAMIC FIRING
- GLASS SEAL FIRING
- MATERIAL OXIDIZING

INSTALLATION INSTRUCTIONS:

UNPACKING:

Carefully unpack and remove the furnace from its shipping carton. **Save the carton and other packing material for future use in transporting the furnace.**

Shipping damage should be reported to the carrier as soon as detected.

LIFTING AND CARRYING:

NOTE: The 1750 models require two people.

- Get a firm footing. Keep your feet shoulder width apart for a stable base.
- Bend your knees. Don't bend at the waist.
- Grip the base of the furnace and lift with your legs.

DO NOT LIFT FURNACE BY THE TOP MUFFLE ASSEMBLY!

- Keep the load close to your body and carry the unit to the destination. Keep your back upright during lifting.

The shipping carton contains the following:

- One furnace complete w/ power cord
- Ceramic floor tray (shipped in the muffle)
- Auxiliary switch (Model 3-550PD only)
- Exhaust port ball plug (for heat treating applications only)
- Owner & Operator's Manual
- Muffle shelf (Model 1750 only)

INSTALLATION:

1. Remove all packing material from in and around the furnace. The furnace should be located at least 15cm (6") away from walls, shelves, and heat sensitive materials. Open the furnace door and remove the packing material from inside the furnace.
   NOTE: The furnace front panel may show some discoloration around the muffle due to the calibration and burning cycles performed at the factory.
2. The furnace should not be located directly under shelves and other airflow restrictions.
3. On high voltage (200-240 volt) units, connect the power cord to the socket in rear of furnace. (this applies to 550A only, 1750A cord is already connected).
4. Positioning the furnace:
   a) (Combustion, Burnout or Reaction Processes) Position the furnace under a vent hood or connect the exhaust port to a ventilation system to prevent exposure to the exhaust fumes. The furnace exhaust port **25 mm (1") OD by 25 mm (1") long** [50 mm (2") OD by 20 mm (0.8") long on 1750 Model] can be ducted into the exhaust hood for more effective ventilation. Stainless Steel flexible metal tubing can be used for this ducting.
   b) (Heat Treating or Non-Reaction Processes) Position the furnace under a vent hood. Plug the exhaust port with the ball plugs provided in the furnace accessory kit. This will reduce heat loss and electricity requirements.
5. Connect the furnace to a power circuit or receptacle with an overcurrent protection (circuit breaker or fuse) rating of 20 Amps on the low voltage model and 10 Amps on the high voltage model. This circuit should only supply the furnace. The 1750 North American model requires a 20A supply (breaker/receptacle). The 1750 European model requires a dedicated 32A supply breaker/receptacle).
6. (3-550PD only) Plug the auxillary switch cord into the two prong socket located next to the power cord/socket.
7. Turn on the furnace's green power switch (right-hand side of the control panel) and the LCD display will come on. The light in the green power switch lights when the door is closed and the start key is pressed.
8. At this time, your new furnace should be ready to operate. Please review the OPERATIONS and SETUP & MAINTENANCE sections of the manual before proceeding to select special options.

CONTROL PANEL DESCRIPTION:

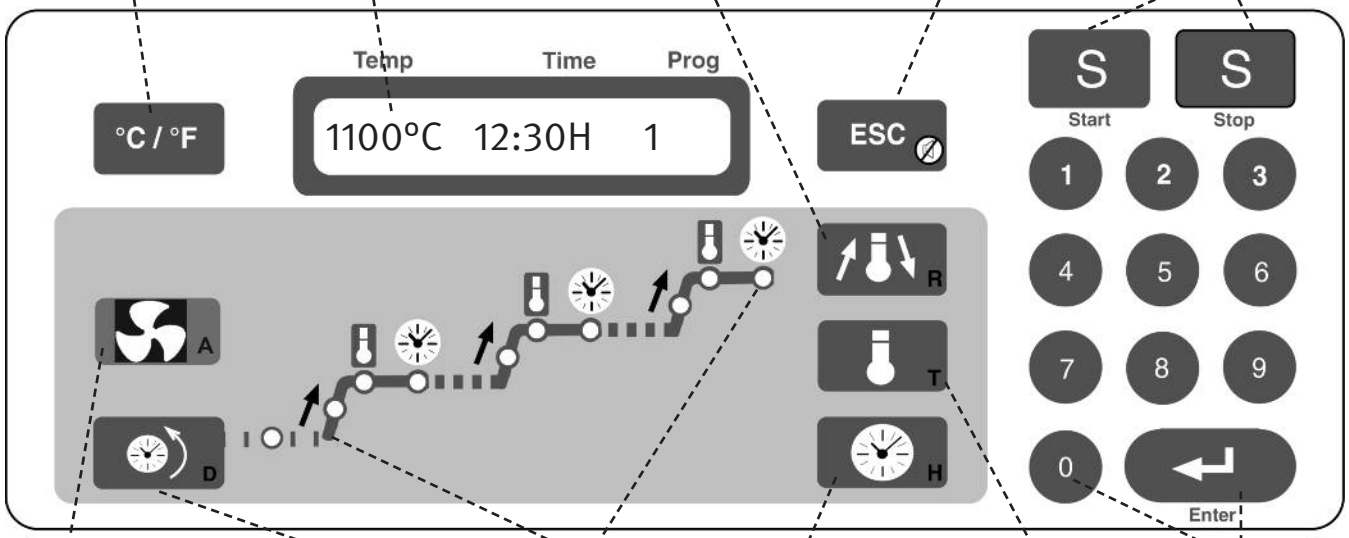
°C / °F changes the temperature from °C to °F and back. This key is not active when viewing parameters.

LCD Display displays the furnace muffle temperature, program count down time, and program number. During parameter programming the display shows the current value and new value for confirmation. It signals program operation by flashing the colon in the program time.

Rate key displays the current program's heat rates in degrees per minute. Press once for R1 (rate 1), twice for R2 (rate 2), and three times for R3 (rate 3). The corresponding LED lights and the current value is displayed. New parameter values can be stored in memory at this time followed by the ENTER key.

ESC (Escape) key cancels or aborts parameter programming by returning the control to the current conditions display. The display shows the current muffle temperature, program number, and program time or time remaining. This key also cancels the beeping at the end of the program.

Green **START** key starts current program. Red **STOP** key stops or aborts program if already operating. The red LEDs turn on when the cycle is started and are turned off as the program is completed. The display counts down the time remaining in the program during operation.



Air Control (available on air exchange models only) activates the air exchange feature for a chosen stage during a firing cycle. Press once for S1 (stage 1), twice for S2 (stage 2) and three times for S3 (stage 3). Press ENTER to stage new value. A setting of 0 means fan is off. A setting of 9 means maximum air exchange.

DELAY START activates the function that allows the furnace to automatically turn on at a later time and run a program. The delay time is programmed in the number of days and the time when the program is to be finished. The time is based on a 24 hour clock. Press this key once followed by the Start key to activate or start a delayed program and the LED will be turned on. Press this key several times to change the delay parameters.

Program Parameter LEDs indicate which parameters are activated and then completed as the program is running. All LEDs are turned on initially and then turned off as completed. During parameter programming the LED lights to indicate which parameter is currently selected. The LEDs do not light if a particular stage is turned off during that cycle.

Hold time key displays the current program's hold times in hours and minutes (hh:mm). Press once for H1 (hold 1), twice for H2 (hold 2), and three times for H3 (hold 3). The corresponding LED lights and the current value are displayed. New parameter values can be stored in memory at this time followed by the ENTER key.

Temperature key displays the current program's temperatures in degrees. Press once for T1 (temp 1), twice for T2 (temp 2), and three times for T3 (temp 3). The corresponding LED lights and the current value is displayed. New parameter values can be stored in memory at this time followed by the ENTER key.

Digit Keys are used to **CHANGE PROGRAMS** and enter new program parameters. **ENTER** key is used to store new program number or parameter in memory.

OPERATING INSTRUCTIONS:

RUNNING A PROGRAM:

The furnace has 9 three stage programs and one single temperature hold program. The furnace is sold with the program parameters set to the factory defaults which can be used for testing. First time operation will require the user to enter their desired parameters into one of these programs.

1. Turn on green power switch (right-hand side of control panel)
   After a short delay for internal testing, the furnace will display approximate room temperature, program time (hours:minutes), and program number. All red LEDs are off. (If any of the LEDs are on, the furnace was already running a program when it was last turned off.)
2. Select or change the program to the desired number by pressing the digit key (1-9) for the desired program followed by the ENTER ↵ key. The display will be updated to show the new program number and its approximate run time.
3. Pressing the green Start S key will start this program. The red LEDs will come on and the time will start to count down. The green power switch will light when the door is closed. The LEDs will be turned off as each segment of each stage of the program is completed.
   - During program operation, the total program cycle time is counting down as indicated by the flashing colon in the time.
   - If a program is started when the muffle is already heated, the furnace will heat or cool at the first ramp rate to the first temperature from the current muffle temperature. It will not cool to room temperature before starting.
   - The program will end by maintaining the last muffle temperature, displaying "Hold", beeping every 3 seconds and flashing the last Temp LED. See information on End Of Program options (point 1) in the "Setup & Maintenance" section if other operations are preferred.
4. Pressing the °C / °F key will change the temperature display from °C to °F and back. This key is not active during parameter programming.
5. A short power outage during the operation of a program will not terminate or abort the program unless the muffle temperature drops more than 32°C (58°F). If the power outage occurs when the muffle temperature is close to, or at room temperature (e.g. during Delay Start operation) the furnace will continue the program when power is restored regardless of the temperature drop or the amount of time that has expired.
6. Pressing the Escape ESC key cancels beeping at the end of a program. It also will return the furnace to a display of the current conditions during programming operations.
7. Opening the door during a cycle interrupts power to the heating elements.

STOPPING A PROGRAM:

1. Pressing the red Stop S key will stop the program that is currently running. The red LEDs will go out and the display will show the current program number, approximate cycle time, and the current muffle temperature.

PROGRAMMING:

The furnace increases productivity and reliability for the operator because cycles or programs can be preprogrammed and operated automatically. Once programmed, the parameters are retained in memory even with the loss of power. Parameters are not retained in memory if entered during the operation of a program.

Each program is made up of 3 stages which require 3 parameters each. The parameters are grouped into ramp rates **(R1, R2, R3)**, temperatures **(T1, T2, T3)**, and dwell or hold times **(H1, H2, H3)**. The 1,2,3 indicates the stage number or sequence. The temperatures can be programmed in either °C or °F; the ramp rates in °C per minute or °F per minute; and the hold times in hours and minutes (hh:mm).

RAMP RATES (R) (0 - 40°C/minute)

1. Pressing the Rate key makes the display show the current value of the R1 parameter followed by 3 blanks for a new value.
   - For example: R1 8.0°C/M ->_ _ _
   - The corresponding LED will also light to indicate the selected stage and parameter.

2. Use the digit keys (0,1,2,...,9) to enter the desired parameter value followed by the ENTER ↵ key. The new parameter is now stored in memory.
   - If a value is entered that is out of the acceptable range, the furnace will beep and display the acceptable range.
   - Programming a Rate to 0 will cause the furnace to terminate the remainder of the program stages. For example, if R2 is set equal to 0 then at the end of the first hold time (H1) the furnace will go to the end of the program, making the

program single stage.

3. Pressing the Rate  key additional times will display and give access to the Rate parameters for the other two stages. The 4th time the key is pressed the display circulates back to the beginning and the R1 parameter will be displayed again.
   - The Rate  key operates the same if pressed during the operation of a program with the following exception. The new Rate entered is used only for that one program or cycle and not stored in memory.
   - Negative ramp rates are also possible if slower than natural cooling.

TEMPERATURES (T) (50 - 1100°C or Tmax)

1. Pressing the Temp  key makes the display show the current value of the T1 parameter followed by 4 blanks for a new value.
   - For example: T1 160°C ->_ _ _ _
   - The corresponding LED will also light to indicate the selected stage and parameter.
2. Use the digit keys (0,1,2,...,9) to enter the desired parameter value followed by the ENTER  key. The new parameter is now stored in memory.
   - If a value is entered that is out of the acceptable range the furnace will beep and display the acceptable range.
3. Pressing the Temp  key additional times will display and give access to the Temp parameters for the other two stages. The 4th time the key is pressed the display circulates back to the beginning and the T1 parameter will be displayed again.
   - The Temp  key operates the same if pressed during the operation of a program with the following exception. Any new parameter entered is used only for that one program or cycle and not stored in memory.

HOLD TIMES (H) (0 - 99:59 hh:mm)

1. Pressing the Hold  key makes the display show the current value of the H1 parameter followed by 4 blanks for a new value.
   - For example: H1 1:00H ->_ _ : _ _ (1 hours and 00 minutes)
   - The corresponding LED will also light to indicate the selected stage and parameter.
2. Use the digit keys (0,1,2,...,9) to enter the desired parameter value up to 99 minutes and 59 seconds followed by the ENTER  key. The new parameter is now stored in memory.
3. Pressing the Hold  key additional times will display and give access to the Hold parameters for the other two stages. The 4th time the key is pressed the display circulates back to the beginning and the H1 parameter will be displayed again.
   - The Hold  key operates the same if pressed during the operation of a program with the following exception. Any new parameter entered is used only for that one program or cycle and not stored in memory.

AIR EXCHANGE OPERATION

1. The air exchange operation is accomplished by using the venturi principle to draw air out of the muffle and into an exhaust air flow. The hot muffle air does not pass through the fan. Make up air for the muffle is introduced behind the muffle heating plates. This indirect air path causes the make up air to preheat before it reaches the muffle cavity to assure temperature uniformity.
2. The air exchange fan produces about 20CFM of flow when operated at full speed. The vent hood or system being used for the furnace should have sufficient capacity to accommodate this airflow.
3. The air exchange operation may be controlled for 10 different settings, ranging from 0 to 9 (off to full on). The maximum setting of 9 on the control performs approximate 5 air exchanges per minute. The curves shown on page 13 show approximate air changes vs. fan setting.

Example: Stage 1 of program 5 can be programmed to a fan setting of 9 while stage 2 of program 5 can be programmed to a fan setting of 3 and stage 3 of program 5 to a fan setting of 0 (off).

4. The air control settings are retained in memory for each program even when the power is removed.
5. The air control settings are programmed into memory the same way as other parameters. Change to the program

number of interest, press the  key: once for stage 1, twice for stage 2 and three times for stage 3. The display shows the current fan level and a new level may be programmed.

A fan speed setting is changed and stored by pressing a digit key (0-9) followed by the ENTER key. A fan setting change made while a program is operating (running) is only used during that cycle and is not saved in permanent memory.

The higher the air control setting the slower the furnace will heat. High air control settings with low line voltages may prevent the furnace from reaching the maximum temperature.

PROGRAM 0

Program 0 is a single temperature hold program. The furnace will heat to this temperature and maintain it as long as power is applied.

1. Press the 0 key. The display shows the current programmed temperature and the 0 program number.
2. For example: T0 100°C -› _ _ _ _
3. Use the digit keys (0,1,2,...9) to enter the desired temperature followed by the ENTER key. The new parameter is now stored in memory after 3 seconds. The display shows: 100°C ***** 0 where 100 is the current muffle temperature, 0 the program number, and ***** indicates that the program is not started.
4. Pressing the Start S key will cause the furnace to heat at full power to the programmed temperature. The display will show "xxxx°C *Hold* 0" "xxxx" is the current muffle temperature, the word "Hold" illustrates single stage and 0 for the program number. The T1 LED will also be on.

SPECIAL FEATURES

DELAY START (D)

The Delay Start functions as a timer that automatically starts a program so that it is completed at a selected time up to 7 days later. The delay is programmed in terms of the number of delay days and the desired completion time. The furnace uses a clock to keep track of time when the furnace power switch is on. If a power outage should occur during a "Delay Start", the completion time will be delayed by the length of time the power was off.

Programming The Delay Start:

1. Pressing the Delay Start  key makes the display show the current value of the time of day and beep.
   - For example: Now = 7:30 -› _ _:_ _
   - The corresponding LED will also light to indicate the Delay Start is selected.
2. Use the digit keys (0,1,2,...,9) to enter the current time of day followed by the ENTER key. The new parameter is now stored in memory. The time of day must be entered in as a 24 hour clock (11:34PM is 23:34), (8:10AM is 08:10).
   - Programming the current clock time "Now = 7:30 -› _ _:_ _" is only displayed and requested if there has been a power outage since the last time the Delay Start was operated Turning the power switch off stops the internal delay start timer.
3. Pressing the Delay Start  key again makes the display show the current value of the Delay D parameter in days.
   - For example: Day: 1 [1,2,...,7]
   - The corresponding LED will also light to indicate the Delay Start is selected.
4. Use the digit keys (0,1,2,...,7) to enter the desired number of days of delay followed by the ENTER key. The new parameter is now stored in memory.
   - If a value is entered that is greater than 7, then the furnace will display and use 7.
5. Pressing the Delay Start  key again displays the program completion time. The furnace will calculate the approximate time that the program needs to start so that it is completed by the programmed time.
   - For example: End = 8:00 -› _ _ :_ _
   - The computer uses a 24 hour clock. For example if 14:30 is programmed, the completion time is 2:30 PM.
6. Pressing the Delay Start  key again will show the actual time (Now).
   - Pressing the key additional times will cycle through the other parameters. Press the Escape  key to stop the function.

OPERATING INSTRUCTIONS (CONTINUED):

LINKING PROGRAMS

Programs can automatically run in sequence by using the Linking feature. With this method, a 6 stage (12 segment) program can be run automatically. Additional programs can also be linked as each program is completed.

Running Linked Programs:

1. Press the green Start (S) key with the first program to be run. The furnace will start operation.
2. Use the digit keys (1,2,...,9) to enter the next program number to be run followed by the ENTER (↵) key. The furnace will now run the first program followed automatically by the second. The program cycle time on the display will be the combination of the two programs. The display will alternately show the first program and then the second program number will be displayed for a shorter time.

POWER DOOR (3-550PD only)

The remote activation switch is used to operate the power door. Activating the switch once, will cause the door to open or close. Activating the switch while the door is moving will cause the door to stop. Once stopped, activating the switch again will cause it to reverse directions.

The furnace will also automatically close the door after a programmed amount of time during a firing cycle. This feature is disabled at the factory and needs to be activated to operate. See Setup, page 11 for instructions.

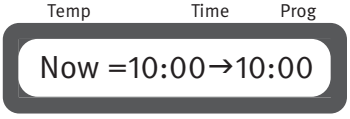
DELAY SET-UP AND RUNNING A DELAY START PROGRAM PROCEDURE:

EXAMPLE 1:

It is 10:00 am and I want the burn out to be completed at 4 PM today using program 1.

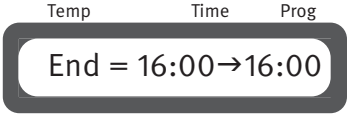
Set the program you want to run.
Press "1" then "ENTER"
The display will show Prog 1

Set the current time of day (24 hour format).
Press "DELAY"- enter time "10:00"-Press "ENTER"
The display will show this:



Set the Day you want it to start.
Press "DELAY"-Press "0"-Press "ENTER"
The display will show this:

Set the finish time (24 hour format).
Press "DELAY"-Press "1600"-Press "ENTER"
The display will show this:

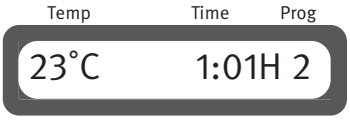


Set to the "DELAY" mode.
Press "DELAY"-Press "START"
The Display will show this: **

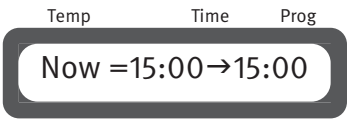
EXAMPLE 2:

It is 3:00 PM and I want the burn out to be completed tomorrow at 8:00 AM using program 2.

Set the program you want to run.
Press "2" then "ENTER"
The display will show Prog 2

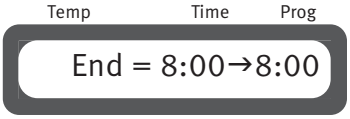


Set the current time of day (24 hour format).
Press "DELAY"- enter time "1500"-Press "ENTER"
The display will show this:



Set the Day you want it to start.
Press "DELAY"-Press "1"-Press "ENTER"
The display will show this:

Set the finish time (24 hour format).
Press "DELAY"-Press "0800"-Press "ENTER"
The display will show this:



Set to the "DELAY" mode.
Press "DELAY"-Press "START"
The Display will show this: **

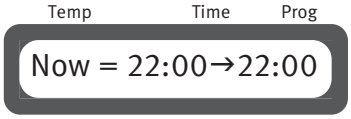
DELAY SET-UP AND RUNNING A DELAY START PROGRAM PROCEDURE (CONTD):

EXAMPLE 3:

It is 10:00 PM on Friday and I want the burn out to be completed Monday at 7:30 AM using program 3.

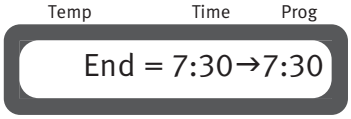
Set the program you want to run.
Press "3" then "ENTER"
The display will show Prog

Set the current time of day (24 hour format).
Press "DELAY"- enter time "2200"-Press "ENTER"
The display will show this:



Set the Day you want it to start.
Press "DELAY"-Press "3"-Press "ENTER"
The display will show this:

Set the finish time (24 hour format).
Press "DELAY"-Press "0730"-Press "ENTER"
The display will show this:



Set to the "DELAY" mode.
Press "DELAY"-Press "START"
The Display will show this: **

NOTE: THINGS TO REMEMBER

Day 0 = today
Day 1= tomorrow

If you operate a night shift
12 midnight = 24:00 hours and 1am = 01:00

End Time means the **approximate** time the process will be finished.

You may need to press the "Delay" several times to make sure the display shows the proper mode of operation NOW, END or DAY.

** If you are trying to program and end time sooner than the amount of time it takes the furnace to complete all stages of the process your furnace will start as soon as you press START.

SPECIFICATIONS:

PARAMETER

- Temperature Range: 50°C (122°F) - 1100°C (2012°F) / 1° Resolution
- Hold Time Range: 0:00 - 99:59 (hours:minutes) / 1 Min Resolution
- Ramp Rate Range: 0 - 40.0°C/minute (72°F) / 0.1°C Resolution
- Temperature Accuracy: ± 5°C (± 9°F) at steady state
- Muffle Temperature Uniformity: ± 8°C (± 15°F) at steady state

ELECTRICAL

	3-130	3-550	3-550PD	3-550A	3-1750 (EURO)	3-1750	3-1750A
Voltage Range:	100-120	----	----	----	----	----	----
@ 50/60Hz	----	120	120	----	----	----	----
	----	----	230	230	230	230	230
	200-240	200-240	----	----	----	200-250	----
Steady State Current: Amps @							
100V	----	14.7	14.7	----	----	----	----
120V	12.0	16.0	16.0	----	----	----	----
230V	----	----	----	9.6			19.0
240V	4.4	10.0	10.0	----	20.0	19.0	----
Max Power Watts:	1440 (120V) 1060 (240V)	1470 (100V) 1920 (120V) 2400 (240V)	1470(100V) 1920 (120V) 2400 (240V)	2204	4800	4370	4370
Watts to Maintain 1000°C (1832°F) (Air Exchange setting @ 0)	525	1050	1050	1050	2200	2200	2200

ENVIRONMENTAL

- Ambient Operating Temperature: 5 - 40°C (41-104°F)
- Relative Humidity: Maximum 80%, non-condensing

OUTLINE DRAWINGS MM(IN)

MECHANICAL

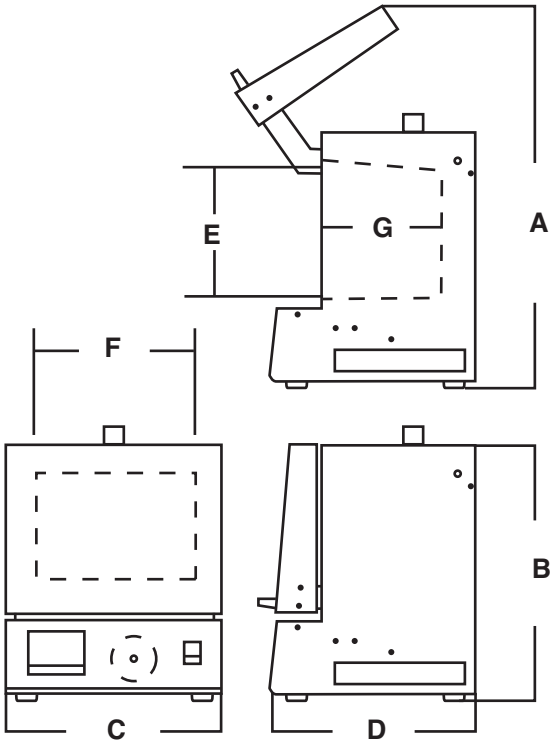
Exterior Dimensions:

MODEL	A	B	C	D
130	510mm (20.0”)	350mm (13.8”)	290mm (11.5”)	330mm (13.0”)
550	635mm (25.0”)	410mm (16.0”)	400mm (15.8”)	430mm (17.0”)
3-550A	635mm (25.0”)	430mm (17.0”)*	400mm (15.8”)	489mm (19.3”)*
3-550PD	635mm (25.0”)	430mm (17.0”)*	400mm (15.8”)	489mm (19.3”)*
1750	815mm (32.0”)	545mm (21.5”)	610mm (24.0”)	535mm (21.0”)
3-1750A	815mm (32.0”)	541mm (21.3”)	610mm (24.0”)	584mm (23.0”)*

* Dimension includes exhaust tube

Internal Muffle Dimensions:

MODEL	E	F	G
130	120mm (4.6”)	140mm (5.7”)	130mm (5.2”)
550	180mm (7.0”)	230mm (9.0”)	230mm (9.0”)
3-550A	180mm (7.0”)	230mm (9.0”)*	230mm (9.0”)
3-550PD	180mm (7.0”)	230mm (9.0”)*	230mm (9.0”)
1750	250mm (10.0”)	360mm (14.0”)	320mm (12.5”)
3-1750A	250mm (10.0”)	360mm (14.0”)	320mm (12.5”)



Model	Furnace Weight:	Shipping Weight:
130	11 kg (25 lbs.)	16 kg (35 lbs.)
550	20 kg (45 lbs.)	27 kg (60 lbs.)
3-550A	23 kg (51 lbs.)	28 kg (62 lbs.)
3-550PD	23 kg (51 lbs.)	28 kg (62 lbs.)
1750	45 kg (100 lbs.)	61 kg (135 lbs.)
3-1750A	55 kg (120 lbs.)	67 kg (148 lbs.)

SETUP & MAINTENANCE:

SETUP:

The Vulcan furnace goes through a self test that lasts for 4 to 6 seconds each time that power is applied. After the test, the display will show the word "SETUP?" for approximately 5 seconds. In the Setup mode, several different options are available for the user to select.

The first is the END OF PROGRAM operation which allows the user to select how the furnace should operate at the end of the program. The second is the TMAX parameter which limits the maximum temperature that can be programmed into the furnace. The last is TEMPERATURE ADJUSTMENT/CALIBRATION which allows the user to alter the furnace temperature calibration.

1. Turn on power to the furnace. Pressing the ENTER ↵ key when the word "Setup?" is being displayed will start the Setup mode first with the End of Program options.
   - The current END OF PROGRAM option is now displayed as "Hold = 1 (2),(3)". The (1) option is the factory default. It will cause the furnace to maintain or hold the last programmed temperature, display "Hold" and beep every 3 seconds until the red Stop S key is pressed. Pressing the Escape ESC key will stop the beeping but not the program.
   - The (2) option will cause the furnace to maintain or hold the last programmed temperature, and display "Hold" but without beeping until the red Stop S key is pressed.
   - The (3) option will cause the furnace to turn off and cool to room temperature at the end of the program and display "End". The Stop key does not have to be pressed.
   - Use the digit keys (1,2,3) to change the END OF PROGRAM option.
2. Pressing the ENTER ↵ key when the desired End Of Program is selected will store it in memory and then advance to TMAX which is the next option. The TMAX value limits the maximum temperatures that the furnace can be programmed to or fire to. The factory setting for TMAX is 1100°C. Use the digit keys (0,1,2,...,9) to enter the desired TMAX value followed by the ENTER ↵ key. The new Maximum Temperature is now stored in memory and the next option is displayed.
3. 3-550PD only) The automatic closing portion of the Power Door feature is shipped from the factory in the disabled condition of 0 (Door 0sec-›). A delay time before closing of 1 to 99 seconds can be entered to activate the auto closing. The automatic closing is only active during firing cycles.
4. The final option is the temperature adjustment/calibration which is displayed as "Tcal 1000°C-›_ _:_ _". The factory setting for Tcal is 1000°C. Use the digit keys (0,1,2,...,9) to enter the desired Tcal value followed by the ENTER ↵ key. The new Temperature Calibration is now stored in memory. Entering a 1000 will return the furnace to the factory calibration. See the next section on Temperature Adjustment/Calibration for specifics on how to determine the adjustment number.

TEMPERATURE ADJUSTMENT/CALIBRATION:

Every VULCAN furnace is calibrated in the factory at 1000°C. Under normal use the furnace should not require calibration. The electronics used in the VULCAN furnaces are very stable and will have minimal drifts over the life of the furnace. Thermocouple replacement could be a potential requirement for calibration if high accuracy is required.

This calibration can be altered by entering a new Tcal value in the Setup mode listed previously. The Tcal value has a range of 900 to 1100°C.

For example: A program is operating at a stable temperature and a separate thermocouple is inserted in the furnace and a digital thermometer measures the muffle temperature. The display shows 875°C which is the programmed temperature but the digital thermometer reads 868°C. A new calibration value could be calculated by dividing the display temperature by the actual temperature (digital thermometer) and then multiplying by the current Tcal value (factory default is 1000°C). In this case the result is 1008 (875/868 = 1.008; 1.008 * 1000 = 1008). 1008 is entered in as the Tcal value. With this method the furnace calibration can be done at the normal operation temperature.

Second example: Programmed temperature is 1050°C and the digital thermometer reads 1065°C. The old Tcal value is 985°C.

(1050/1065 = 0.986 then 0.986 * 985 = 971) 971 should be entered as the new Tcal value.

CLEANING:

- Vacuum dust and dirt from the furnace rather than attempting to blow the dust off. This will minimize the amount of air born particles.
- Use a soft damp cloth to clean the control panel. Avoid excess water or solution when cleaning the furnace. These solutions can attack the panel or electronics and cause the furnace to malfunction.

TROUBLESHOOTING:

ERROR CODES:

Err codes can be cleared from the display by turning the front panel power switch off and then on again.

Code	Description	Possible Cause
Err 1	Over Temperature	Temp › 1120°C, shorted thermocouple, shorted triac, shorted optotriac, wiring connections, computer PCB
Err 2	Open Thermocouple (TC)	Open TC tip, connection to TC, TC to PCB connection, computer PCB
Err 3	Temp › Tmax	Muffle temperature has exceeded the programmed limit temperature TMAX (see SETUP)
Err 7	Brown-out	Low line voltage ‹ 90VAC (‹190VAC for 200-240V), wall socket shared with other loads, furnace connected with extension cord
Err 8	EEPROM error	Parameter program memory error; computer PCB
Err 19	Line frequency	No line frequency detected, computer PCB

TROUBLESHOOTING THE VULCAN 3-SERIES FURNACE

PROBLEM	CHECK LIST / CAUSES
Dead, Not Operating No Power / Display	- Check power receptacle or outlet for power. - Check line or power cord connections. - Turn on green power switch. - Check fuse (20 amp) and lamp on control PDB.
Not Heating During Program Operation	- Is door completely closed? Door switch may be interrupting power. - Check heating element plates for continuity.
Door Too Loose or Tight	- The amount of force or drag on the door movement can be changed by adjusting the hex screws (both sides should be adjusted equally) located on the upper rear corners of the furnace cabinet. Turning the screw clockwise adds drag and requires more force.
Heating Too Slow	- Rate programmed wrong. 1.5°/minute rather than 15.0°/minute. - Large loads will slow down response time and increase the time to temperature by 2 to 5 times. - Muffle near end of life.
Program Turns Off Too Early	- Programming a Rate to zero will terminate the remainder of the program. - End of program option has been changed from 1 or 2 to option 3 which turns off the furnace at the end of the program [End].
Power Door Does Not Open (3-550PD only)	- A hidden switch to activate the door is located between the °C/°F key and the Delay Start key. Try pressing it to test the operation. - Check activation switch connections to back of furnace. - Allow the furnace to cool and test the door by activating the switch and then lifting up/pushing door on the door in the appropriate direction of travel.
Fan Does Not Operate (Air Exchange Model Only)	- Operates only in a start cycle - Setting of 0 means no fan active

ACCESSORIES:

DESCRIPTION	PART NUMBER
Tongs; 30cm (12”) Stainless Steel	9390015
Tray- Bottom, Model 130	9353053
Tray- Bottom, Model 550	9353057
Tray- Bottom, Model 1750	9353060
Shelf - free standing, Model 550	9493327
Shelf - Model 1750	9493396
Muffle Hardening Agent	9491006
Temperature Sticks	
705 °C (1300 °F)	9199073
815 °C (1500 °F)	9199074
Exhaust port ball plug	
Small (130, 550)	9491093A
Large (1750)	9492456
Service Manual, VULCAN	9363049