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LMF-A550 SHOWN

LMF-A550/120, LMF-A550/240, LMF-3550/120, and LMF-3550/240

Benchtop Muffler Furnace

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Unpacking Instructions

Remove the Packing List and verify that you have received all equipment, including the following (quantities in parentheses):

LMF-A550 or LMF-3550 Benchtop Muffle Furnace (1)
Ceramic Floor Tray (1)
Exhaust Port Plugs (2)
Power Cord (1)
Operator's Manual (1)

If you have nay questions about the shipment, please call OMEGA Customer Service Department.

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

TABLE OF CONTENTS

LMF-550 Series
Benchtop Muffle Furnace

Notes

This manual is in two parts - the first half covers the LMF-A550 Series Furnaces. The second half covers the LMF-3550 Series Furnaces.

1.1 General Description

LMF Series Benchtop Muffle Furnaces feature a 550 cubic inch chamber with fiber insulation and firebrick heating plates. The furnace cabinet is constructed of 16 gauge steel with a backed epoxy finish. A atop exhaust port allows gases to be vented or may be plugged during operation to seal the opening. Two temperature controller models are available: automatic and multi-stage programmable. LMF series furnaces are ideal for hear treating applications, material research and sample ashing determinations in the geological, metallurgical, and wastewater treatment industries. These furnaces are also used in chemistry, physics, and engineering laboratories.

1.2 LMF-A550 Series Furnace Description

The Model LMF-A550 furnace has an analog pyrometer which displays temperature, scaled in 50˚ increments. Temperature is adjusted via a large control dial, scaled in 100˚ increments. The controller repeatability is excellent.

1.3 Features

- High performance/hybrid muffle
- Longer life and more durable than Fiber
- Faster heating, and faster cooling than Firebrick
- Wide operating temperature range 200˚C (392˚F) to 1100˚C (2012˚F)
- Smooth, low force vertical lift door, with roll back action which gives maximum access with minium vertical space
- Durable stainless steel front panel

- Automatic temperature controller; select temperature with front panel control knob and muffle temperature is maintained at that temperature
- Easy to operate; power switch and temperature set knob
- Integrated door safety switch breaks both sides of the power line to the muffle
- Designed for Safety Agency Approvals, (CSA & TÜV Pending)
- Individual muffle eating plate replacement
- One plate service all voltages

1.4 Available Models

Part Number	Volts	Controller Type
LMF-A550/120	100-125	Analog
LMF-A550/240	200-250	Analog

LMF-A550 Series
Installing the Furnace

1. Remove all packing material from in and around the furnace. The furnace should be located at least 15 cm (6") away form 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 burn-in cycles performed at the factory.

2. The furnace should **not** be located directly under shelves and other airflow restrictions.

3. On high voltage (200-250 volt) units, connect the power cord packaged in the rear of the furnace to the socket in rear of furnace.

4. For positioning the furnace:

   a. (Combustion, Burnout or Reaction Processes) Position the furnace under a vent hook or connect the exhaust port to a ventilation system to prevent exposure to the exhaust fumers. The furnace exhaust port 258 mm (1") OD by 25 mm (1") long 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. The furnace should be the only load on this circuit.

6. Turn on the furnace lighted green power switch (at the right side of the control panel.)

7. When the door is fully closed, the power switch light should be illuminated. As the door opens, the power switch light should turn off. **Do not attempt to operate the furnace if this light does not turn off when the door is open.**

8. At this time, your new furnace should be set up to operate. Review the Operations Section of the manual before proceeding to operate the furnace

3.1 Safety Considerations

- Never operate the furnace in close proximity to combustible materials or place materials on top of the furnace.

- The furnace must be electrically grounded to a three-wire electrical outlet or receptacle. The electrical service provided must be dedicated line of the proper size according to local electrical codes.

- Disconnect the line cord before attempting to service the furnace.

- 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.

OSHA AND CALIFORNIA PROPOSITION 65:

MUFFLE DUST EXPOSURE

In keeping with the policy of OMEGA Engineering 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 for of crystalline silica) present tin the furnace muffle.

The findings of this test revealed that levels of exposure during the normal operation of this equipment, as outlined in the Operator's Manual, were far less than the Permissible Exposure Limit set by the Federal Government.

When it becomes necessary to replace the muffle, the person doing this work is recommended to wear 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 OMEGA Engineering 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.

Designed to meet Canadian Standards Association (CSA), TÜV and Underwriters Laboratories (UP) safety requirements.

3.2 Starting Operation

Close the furnace door. Turn the green power switch to the on (I) position. The light inside the switch will turn on. An interlock door switch located inside the furnace disconnects the power to the muffle when the door is opened. The door must be closed for the furnace to heat.

Turn the setpoint know to the desired temperature and the furnace will ramp to the set temperature. Turn off the power switch to turn off the furnace.

The temperature rate will start out at full speed and gradually slow down as it approaches the setpoint temperature. If a slower temperature increase rate is required, set the temperature at serval intermediate temperatures. This will cause the control to approach each intermediate temperature at a slower rate.

NOTE

See the rate curve in Chapter 7 to determine the time required to reach setpoint.

Operating Examples:

The furnace will continuously operate a 900˚C each day.

- Insert your work, close the door, adjust the knob to 900˚C (white inside scale).

- Turn the power switch to the on position (the green light should come on when the door is down). IF the same temperature is needed each day, the knob does not have to be adjusted.

- The furnace will heat to the temperature indicated on the front control panel. Turn off the power switch when the cycle is finished.

A temperature cycles calls for a slow ramp to 700˚C (1300˚F).

Procedure:

- Insert your work and close the door.

- Turn the power switch to the on position (the green light should come on when the door is down).

- Turn the setpoint knob to 300˚C (inside scale), 30 minutes later turn te know to 500˚C, and finally 30 minutes later to 700˚C

- The furnace load slowly heats to the desired 700˚C.

NOTE

Because of the nature of the control, the first 90% of the rate will be relatively fast while the last 10% take somewhat longer. The furnace will reach the setpoint, but it takes some time. If a faster rate is required, set the furnace to approximately 10% to 20% higher than desired setpoint and them adjust to the desired setpoint when the temperature is reached.

Notes

4.1 Temperature Adjustment

CAUTION

Unplug the power cord before attempting to adjust the calibration. The Thermocouple and PC board are connected to the ac power supply.

Every furnace is calibrated in the factory at 1100˚C. The calibration can be adjusted by turning the trimmer potentiometer (pot) RP1 located on te controller board. If the meter temperature is lower than the temperature setting that the control now is set to , turn the trimmer pot one 1/4 turn clockwise. IF the temperature is higher than the temperature setting that the control know is set to, turn the rimmer pot on 1/4 turn counter-clockwise. Allow the furnace 10 to 20 minutes to stabilize before making further adjustments.

4.2 Cleaning

- Vacuum dust and dirt from the furnace rather than blow. This will minimize the amount of airborne dust particles.

- Use a sot damp cloth to clean the control panel. Avoid excess water or solution when cleaning the furnace. These solutions can attach the panel or electronics and cause the furnace to malfunction.

4.3 Fuses

F250V @ 20A - Fast acting, ceramic (Bussman 3AB - 20 Amp, 250V)

Symbol Table

- Alternating current
- On (Supply)
- Off (Supply)
- Hot Surface
- Protective Conductor Terminal

Notes

Problem	Checklist/Causes
Not Heating	Does the green power switch light? No - Check the power receptacle or outlet for power. - Check the door that it is completely closed. Dor switch may be interruption power. Yes - Check the control knob and verify that it is turned to the desired temperature. - Check the fuse on the controller printed circuit board. - Check the hating element plates for continuity. - f the muffle is hot but the meter reads a low temperature check the thermocouple for shorts to the cabinet.
Slow Heating	The control will slowly approach the setpoint temperature. Set to a higher temperature and then turn down to reduce the heat up time. On the low voltage (100-125Vac) models, the heating element plates are wired in parallel. If one plate fails, the furnace will heat very slowly and not reach the setpoint temperature.
Poor Temperature Accuracy	Slight changes in the knob rotation will have a significant impact on the setpoint temperature. If major differences exist between the meter and the knob scale, a temperature adjustment can be made as described in Section 4.1.
The door is too loose or too tight	The amount of force or drag on the door movement can be changed by adjusting the hex screws located on te upper rear corners of the furnace cabinet. Turning the screw clockwise adds drag and requires more force.

Notes

6 LMF-A550 Series Accessories

Description	Part Number
Tongs; 25 cm (10”) Stainless Steel Tongs: 30 cm (12”) Stainless Steel Tongs: 36 cm (14”) Plated Steel	9390014 9390015 9491010B
Heating Plate (1)	LMF-HP
Ceramic Floor Tray	LMF-CFT
Thermocouple	LMF-TC
Muffle Hardening Agent	9491006
Temperature, Pellets, Bottle of 25 705˚C (1300˚F) 815˚C (1500˚F)	 9490911 9490912A
Exhaust port ball plug (small)	9491093A

Notes

7 LMF-A550 Series Specifications

Parameter

Temperature Range:	392˚F to 2012˚F (200˚C to 1100˚C) / 1˚ Resolution
Temperature Accuracy:	±45˚F (±25˚C) at steady state
Muffle Temperature Uniformity:	±15˚F (±8˚C) at steady state
Air-Circulation:	Top exhaust port
Muffle:	Fiber insulation with firebrick heating plates

Electrical

Voltage Ranges:	100 to 125
@ 50/60Hz	200 to 250
Current (amps)	
125V:	18 to 14.4
250V:	9 to 7.2
Input Power (watts):	1800
Max Ramping Power:	2000
Watts to Maintain 1000˚C:	1050

Environmental

Ambient Operating Temperature:	5˚ to 40˚C
Relative Humidity:	Maximum 80%, non-condensing

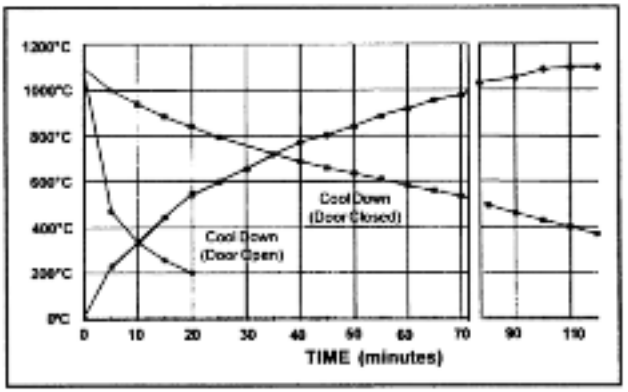


Figure 7 - 1. Performance Curve

Mechanical

Exterior Dimensions:	A: 25” (635 mm) C: 15.8” (400 mm)	B: 16.0” (410 mm) D: 17.0” (430 mm)
Internal Muffle Dimensions:	E: 7.0” (180 mm) G: 9.0” (230 mm)	F: 9.0” (230 mm)

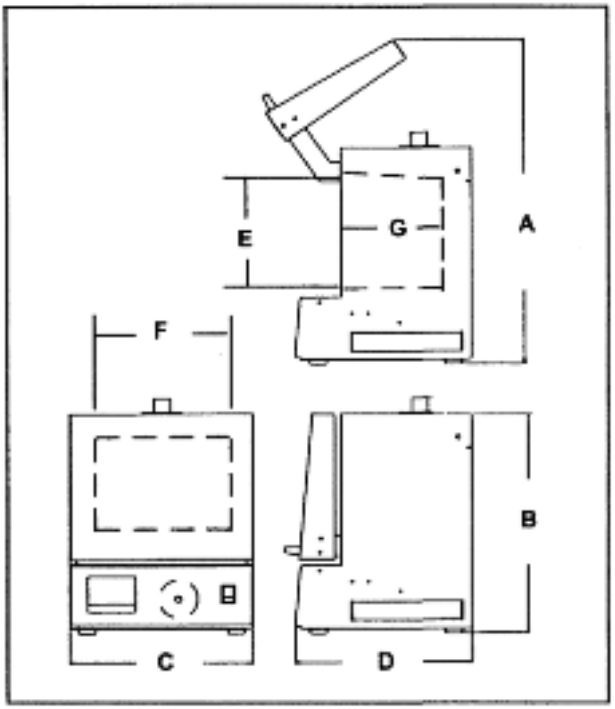


Figure - 7-2 Dimensions

Chamber Size:	550 cubic inches (9.13 liters)
Cabinet Construction:	16 guages steel with baked epoxy finish
Furnace Weight:	47 lb (21.3 kg)
Shipping Weight:	54 lb (24.5 kg)

This manual is in two parts - the first half covers the LMF-A550 Series Furnaces. The second half covers the LMF-3550 Series Furnaces.

1.1 General Description

LMF Series Benchtop Muffle Furnaces feature a 550 cubic inch chamber with fiber insulation and firebrick heating plates. The furnace cabinet is constructed of 16 gauge steel with a backed epoxy finish. A top exhaust port allows gases to be vented or may be plugged during operation to seal the opening. Two temperature controller models are available: automatic and multi-stage programmable. LMF series furnaces are ideal for hear treating applications, material research and sample ashing determinations in the geological, metallurgical, and wastewater treatment industries. These furnaces are also used in chemistry, physics, and engineering laboratories.

1.2 LMF-3550 Series Furnace Description

The Model LMF-3550 furnace has a 3-stage programmable temperature controller which stores up to10 programs in memory. Any tow programs can be linked to create a single six-stage program. One program is dedicated to a single set point that holds the setpoint indefinitely. The delay cycle allow the furnace to be set to its heating cycle at a specific time on a future date. The PID controller allows heat increase and decrease to be programmed into the cycle.

1.3 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) to 1100˚C (2012˚F)
- Smooth, low force vertical lift door, with roll back action which gives maximum access with minium vertical space

- Programmable controller wtih 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)
- Designed for Safety Agency Approvals, (CSA & TÜV Pending)
- Individual muffle beating plate replacement
- One plate services both voltages

8.4 Available Models

Part Number	Volts	Controller Type
LMF-A550/120	100-125	Programmable
LMF-A550/240	200-250	Programmable

1. Remove all packing material from in and around the furnace. The furnace should be located at least 15 cm (6") away form 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 burn-in cycles performed at the factory.

2. The furnace should **not** be located directly under shelves and other airflow restrictions.

3. On high voltage (200-250 volt) units, connect the power cord to the socket in rear of furnace.

4. For positioning the furnace:

   a. (Combustion, Burnout or Reaction Processes) Position the furnace under a vent hook or connect the exhaust port to a ventilation system to prevent exposure to the exhaust fumers. The furnace exhaust port 258 mm (1") OD by 25 mm (1") long 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. The circuit should only supply the furnace.

6. Turn on the furnace's green power switch (at the right 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.

7. At this time, your new furnace should be ready to operate. Review Sections 11.1 and 11.2 of this manual before proceeding to select special options.

10.1 Safety Considerations

- Never operate the furnace in close proximity to combustible materials or place materials on top of the furnace.

- 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 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.

OSHA AND CALIFORNIA PROPOSITION 65:

MUFFLE DUST EXPOSURE

In keeping with the policy of OMEGA Engineering 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 for of crystalline silica) present tin the furnace muffle.

The findings of this test revealed that levels of exposure during the normal operation of this equipment, as outlined in the Operator's Manual, were far less than the Permissible Exposure Limit set by the Federal Government.

When it becomes necessary to replace the muffle, the person doing this work is recommended to wear 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 OMEGA Engineering 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.

Designed to meet Canadian Standards Association (CSA), TÜV and Underwriters Laboratories (UP) safety requirements.

10.2 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 side of control panel). After a short delay for 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.) The green power switch will light when the door is closed and te Start key is pressed

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 ▶ key will start this program. The red LEDs will come on and the time will start to count down. The LEDs will be turned off as each segment of each stage of the program is completed.

   - During the operation of the program, the total program operation or 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, displayed “Hold”, beeping every 3 seconds and flashing the last Temp LED. See information on End Of Program options (point 1) in the “Setup & Maintenance” sections if other operations are performed.

4. Pressing the 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 (eg. during Delay Start operations), 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 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. The display shows “Door” but the program timer continues if the program is in a hold portion of the program. If the “Door” timer is activated (see Section 11.1), the furnace will beep indicate the open door.

10.3 Stopping a Program

Pressing the red Stop 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.

10.4 Programming

The furnace increases productivity and reliability for the operator because cycles or programs can be preprogrammed and operate 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).

10.4.1 Ramp Rates (R)

1. Pressing the Rate key make 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 not 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 remainer of the program stages. For example if R2 is set equal to 0 then at te 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 time 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.

10.4.2 Temperatures (T)

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.

10.4.3 Hold Times (H)

1. Pressing the Hold key makes the display show the current value of the H1 parameter followed by 4 blanks for a new value.

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.

10.4.4 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.

   For example: T0 100˚C -> _ _ _ _

2. 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 aft 3 seconds. The display shows: 100˚C ***** 0, where 100 is the current muffle temperature, 0 is the program number and ***** indicates that the program is not started.

3. Pressing the Start key will cause the furnace to heat to 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 is the program number. The T1 LED will also be on.

10.5 Special Features

10.5.1 Delay Start (D)

The Delay Start functions as a timer that automatically starts a program so that it is completed at the 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 would be delayed by te 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 digits keys (**0, 1, 2 ... 7**) to enter the current time of day followed by the Enter key. The new parameter is not stored in memory. The time of day must be entered in as a 24 hour clock 11:34 PM is 23:34).

3. Pressing the Delay Start key again makes the display shoe 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 entered 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 -> _ _:_ _

   he 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 shoe the actual time (Now).

   Pressing the key additional times will cycle through the other parameters. Press the Escape key to stop the function.

Running a Delay Start Program:

1. Select the desired program number (See Section 3.2).

2. Pressing the Delay Start key the display shows the programmed delay in days.

3. Pressing the green start key will start the delay timer.

   - The corresponding LED will also light to indicate the Delay Start is selected.

   - If the program run time is longer than the current delay time the furnace will skip the delay and start the program immediately.

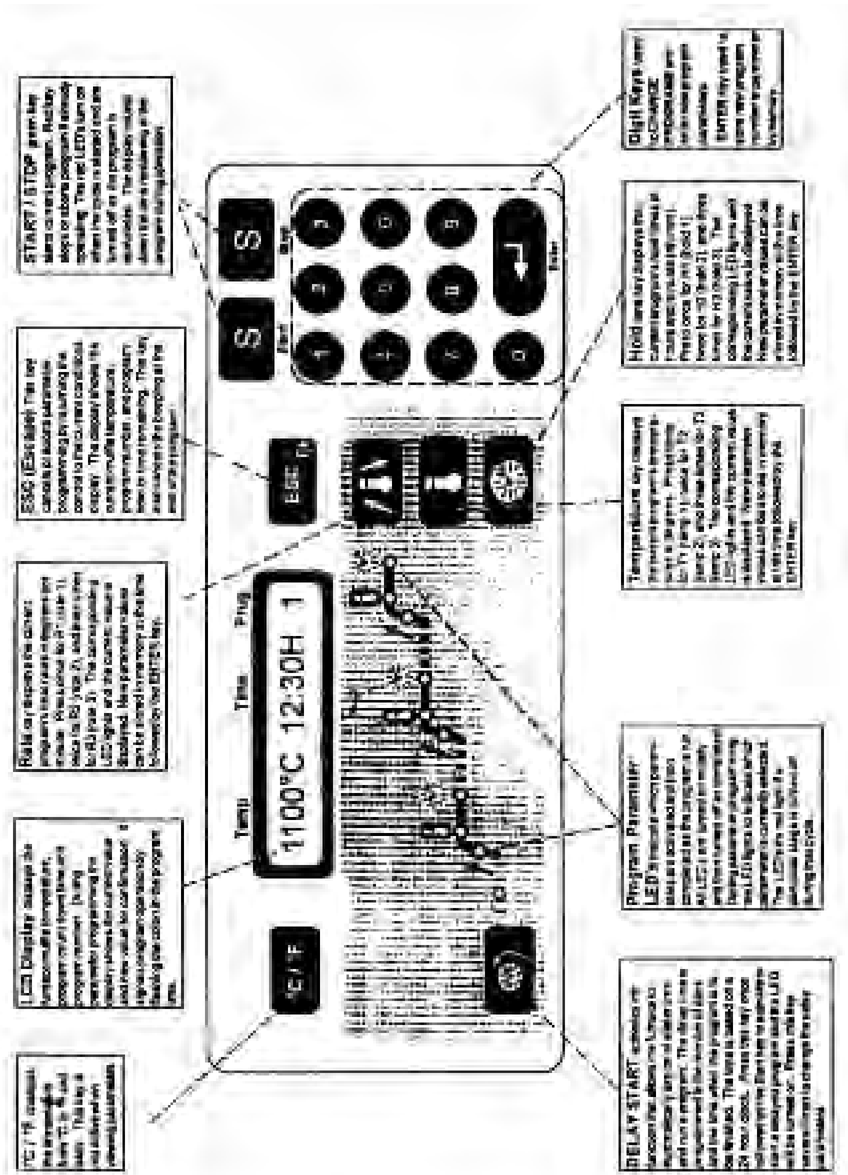
10.5.2 Linking Programs

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. Pressing the green Start key with the first program that is 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 or cycle time on the display will alternately show the first program and then the second program number will be displayed for a shorter time.



START / STOP
ESC (Escape)
LCD Display
Digit Keys
Hold
DELAY START
Program Parameter
Temp
Time
Prg
1100°C 12:30H 1

Notes

11 LMF-3550 Series Setup & Maintenance

11.1 Setup

The furnace goes though a self test that lasts for 4 to 6 seconds each time that power is applied. After the test the display shows the word “SETUP?” for approximately 5 seconds. In the Setup mode several different options are available for the used 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 third is the “Door” timer which sounds an alarm if the door is not closed before the programmed time out. 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 key is pressed. Pressing the Escape ESC key will stop the beeping but not the program.

   he (**2**) option will cause the furnace to maintain or hold the last programmed temperature, display “Hold” but without beeping until the red Stop 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. The third option is the “Door” timer which is displayed as “Door 0Sec ->_ _”. This timer sounds an alarm when the door is open for more than the preprogrammed time when a program is running. This timer can be programmed from 1 to 99 seconds. The factory default setting is 0 which disables the timer. Use the digit keys (**0, 1, 2 ... 9**) to enter the desired “Door” timer value followed by the ENTER ↵ key. The new “Door” time is now stored in memory and the next option is displayed.

4. The final option is the temperature adjustment/calinration 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/Calibraton for specifics on how to determine the adjustment number.

11.2 Temperature Adjustment/Calibrations

Every furnace is calibrated in the factory at 1000˚C. Under normal use the furnace should not require calibration. The electronics used in the furnace 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˚C 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 whish 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 multiply by the current Tcal value (factory default is 1000˚C). In this case the result is 1008 (875/868 = 1.008;1.008 x 1000 = 1008). 1008 is entered in as the Tcal value. With this method the furnace calibration can be done at 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 x 985 = 971). 971 should be entered as the new Tcal value.

11.3 Cleaning

- Vacuum dust and dirt from the furnace rather than blow. This will minimize the amount of airborne dust particles.

- Use a sot damp cloth to clean the control panel. Avoid excess water or solution when cleaning the furnace. These solutions can attach the panel or electronics and cause the furnace to malfunction.

11.4 Fuses

F250V @ 20A - Fast acting, ceramic (Bussman 3AB - 20 Amp, 250V)

F250V @ 1.0A - Fast acting, glass (Littlefuse 2AG - 1.0 Amp, 250V)

Symbol Table

- Alternating current
- On (Supply)
- Off (Supply)
- Hot Surface
- Protective Conductor Terminal

Notes

12 LMF-3550 Series Troubleshooting

Err codes can be cleared form 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	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 in Section 11.1)
Err 7	Brown-out	Low line voltage <90Vac (<190Vac for 200-250V), wall socket shared with other loads, furnace connected with small extention cord
Err 8	EEPROM error	Parameter program memory error: computer PCB
Err 19	Line frequency	No line frequency detected, computer PCB

Problem	Checklist/Causes
Dead, not operating	- Check power receptacle or outlet for power - Check line or power cord connections - Turn on green power switch
Not heating during program operation	Does the green power switch when the start key is pressed? No: - Check door that it is completely closed. - Door switch may be interrupting power. Yes: - Check the fused on the controller PCB - 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 located on the upper rear corners of the furnace cabinet. Turning the screw clockwise adds drag and requires more force.
Heating too slowly	- Rate programmed wrong. 1.5˚ / minute rather than 15.0˚ / minute - Large loads will slow down response time by 2 to 5 times.
Program turns	Programming a Rate to zero will terminate the remainder of the program. End Of Program options has been changed from 1 or 2 to option 3 which turns off the furnace at the end of the program.

13 LMF-3550 Series Accessories

Description	Part Number
Tongs; 25 cm (10”) Stainless Steel	9390014
Tongs: 30 cm (12”) Stainless Steel	9390015
Tongs: 36 cm (14”) Plated Steel	9491010B
Heating Plate (1)	LMF-HP
Ceramic Floor Tray	LMF-CFT
Thermocouple	LMF-TC
Muffle Hardening Agent	9491006
Temperature, Pellets, Bottle of 25	
705˚C (1300˚F)	9490911
815˚C (1500˚F)	9490912A
Exhaust port ball plug (small)	9491093A

Notes

14 LMF-3550 Series Specifications

Parameter

Temperature Range:	122˚F to 2012˚F (50˚C to 1100˚C) / 1˚ Resolution
Hold Time Range;	0:00 to 99:59 (hours:minutes) / 1 Min Resolution
Ramp Rate Range:	0 to 40˚C/minute (72˚F) / 0.1˚C Resolution
Temperature Accuracy:	±45˚F (±25˚C) at steady state
Muffle Temperature Uniformity:	±15˚F (±8˚C) at steady state
Air-Circulation:	Top exhaust port
Muffle:	Fiber insulation with firebrick heating plates

Electrical

Voltage Ranges:	100 to 125
@ 50/60Hz	200 to 250
Current (amps)	
125V:	18 to 14.4
250V:	9 to 7.2
Input Power (watts):	1800
Max Ramping Power:	2000
Watts to Maintain 1000˚C:	1050

Environmental

Ambient Operating Temperature:	5˚ to 40˚C
Relative Humidity:	Maximum 80%, non-condensing

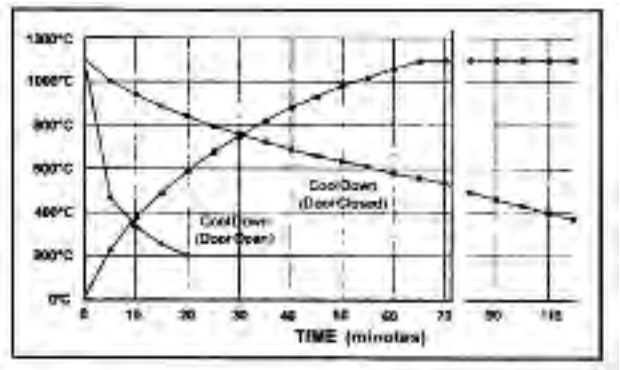


Figure 14 - 1. Performance Curve

Mechanical

Exterior Dimensions:	A: 25” (635 mm) C: 15.8” (400 mm)	B: 16.0” (410 mm) D: 17.0” (430 mm)
Internal Muffle Dimensions:	E: 7.0” (180 mm) G: 9.0” (230 mm)	F: 9.0” (230 mm)

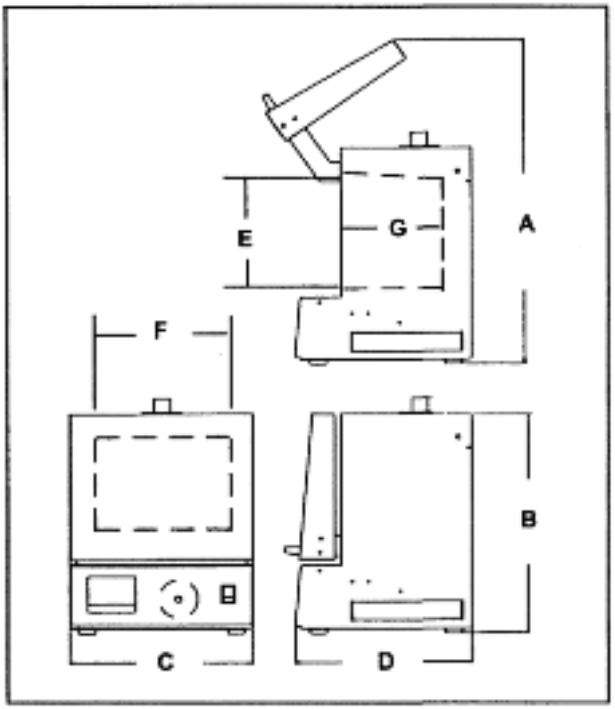


Figure 14 - 2. Dimensions

Chamber Size:	550 cubic inches (9.13 liters)
Cabinet Construction:	16 guages steel with baked epoxy finish
Furnace Weight:	47 lb (21.3 kg)
Shipping Weight:	54 lb (24.5 kg)

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OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

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FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of theproduct, and
3. Repair instructions and/or specific problems relative to the product.

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