



## OPERATING MANUAL

### Gilson Binder Ignition System HM-378



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## 1.0 IMPORTANT NOTICE - INITIAL UNPACKING

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### FURNACE INTERIOR PACKING REMOVAL REQUIRED!

To unlock the Furnace Door to remove packing material:

1. First, turn the main power switch ON. The display will show "ErrP" and an alarm will sound.
2. Press <ANY> key (except <STOP>) and "IdLE" will appear. Press the <ENTER> key twice until "-On-" appears.
3. When "-On-" is replaced by a temperature value, press the button on the lock enclosure near the end of the door handle to unlock the door. Open the door and remove the packing material.
4. Close the door and press the <STOP> key. Press <ANY> key to return to the "IdLE" display.

**WARNING!:** Read the Operating Manual completely BEFORE using this Furnace! Become thoroughly familiar with Section 3.0, "Important Safety Rules", before operating your Binder Ignition Furnace.

Note especially Section 6.0, "Seating the Elements". Elements may become dislodged in shipping and are more difficult to correct once the Furnace has been heated.

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## 2.0 INTRODUCTION

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To help assure the Gilson HM-378 Binder Ignition System will give you many years of trouble-free service, please read this manual carefully.

The Gilson HM-378 Binder Ignition System is designed to test hot-mix asphaltic concrete paving material for binder contents of up to 10%. Testing of other materials, or asphaltic materials with higher binder content or using the furnace for different purposes will void the warranty. Such uses may also damage the furnace and result in personal injury. Damage from failure to follow instructions is NOT covered by warranty.

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## 3.0 IMPORTANT SAFETY RULES

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**NOTE:** READ BEFORE CONNECTING, OPERATING, OR SERVICING FURNACE! If any questions, call Gilson Technical Support at 800-444-1508.

1. Place the furnace only on a noncombustible surface, positioned no closer than 12in (305mm) to any combustible surface. Allow a minimum of 6in (152mm) clearance around the unit for proper air circulation.
2. Electrical installations and connections should be performed by a qualified electrician familiar with local code requirements. Wiring diagrams and power requirements are included in this manual.
3. Diagnostic and repair procedures in or around high voltage circuits should be performed only by a qualified electrician. The electrical supply MUST be disconnected and locked out prior to servicing the furnace.
4. The furnace exhaust MUST be vented to the outside. Fire the furnace only in a well ventilated, covered and protected area.
5. To prevent serious injury, the door is locked during critical phases of Binder Ignition Testing. NEVER attempt to override or defeat operation of the lock mechanism or its electronic control. When creating a custom program, ALWAYS program the door to be locked during any ignition process and/or whenever an opened door might cause a dangerous situation.
6. NEVER place combustible materials on or near the furnace.
7. DANGEROUS VOLTAGE: DO NOT touch heating elements unless electrical supply to the furnace has been disconnected and locked out.
8. ALWAYS wear heat resistant gloves and a face shield when loading or unloading samples.

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## 4.0 UNPACKING & SETTING UP FURNACE

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See Section 1.0 for instructions on releasing the door lock to open the door and remove packing material.

Carefully inspect the furnace as soon as it arrives and check for all enclosures. If the furnace is damaged or if parts are missing, contact Gilson Customer Service immediately at 800-444-1508 or 740-548-7298 for instructions. Save all packing materials for inspection by the freight claims adjuster if damage is reported.

The following accessory items are supplied with the furnace:

- 2 Sets of Sample Basket, Screen, and Cover (Extra sets available as HMA-69)
- 1 Loading/Unloading Fork
- 1 Replaceable Filter (Order extra as HMA-812, box of 12)
- 1 Filter Holder
- 2 Two-Piece Hearth Plate
- 1 Cooling Tray
- 1 NEMA 6-50 Cord/Plug Set

The furnace is supplied with an electrical cord for 230V/60Hz single phase operation. For connection to other voltages, 50Hz, or three phase by an electrician, see the wiring diagram packed on top of the furnace and also Figures 3 & 4 of this manual.

The blower assembly is shipped installed on the top of the furnace with exhaust vent connection to the rear. It can also be installed on the rear with vent connection to the top if desired.

**WARNING:** The blower assembly of this furnace must be connected to an exhaust vent prior to use. Failure to do so will result in combustion product fume emissions from the furnace into the laboratory environment. Fumes may cause eye or lung irritation or more severe injury, depending on compounds in the binder being burned.

While other types of exhaust venting may be used, a vent kit as used for a home clothes dryer is suitable. Such kits are obtainable locally in hardware or appliance stores or can be purchased from Gilson as model HMA-814.

The two 10 x 20in Hearth Plates are to be placed on the floor of the main chamber. They are designed as a wearing surface to prevent erosion of the firebrick.

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## 5.0 WHERE TO LOCATE FURNACE

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1. Place the furnace in a well ventilated, covered and protected area. **DO NOT** store gasoline, paint or other flammable liquids in that room.
2. Provide a minimum of 12in (305mm) clearance between the furnace and the closest combustible wall, or 6in (152mm) to masonry walls.
3. Keep the furnace away from curtains or other combustible materials. **DO NOT** place combustible materials on or near the furnace.
4. Position the furnace on a level, fireproof surface. The Model HMA-810 Furnace Support Stand accessory has a convenient working height. If the accessory stand is not used, a metal table is recommended.
5. Keep the power supply cord away from the side of the furnace. The furnace case is hot during firing and touching could damage the cord set.

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## 6.0 SEATING THE ELEMENTS

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The heating elements of the furnace may have become dislodged during shipping. Before firing the furnace for the first time, please make sure the elements are seated in their grooves.

**WARNING:** ALWAYS unplug furnace and lock out electrical supply before touching an element with anything.

Press the elements into their grooves by running a blunt object such as a wooden tongue depressor or plastic comb completely around each groove. The element must fit all the way back into each corner and must NOT bulge outside the groove. The element will not seat in the curved portions of the groove, but must be seated in the straight grooves and corners.

**NOTE:** Before the furnace is fired, there is little danger of breaking the elements. After firing, however, the elements must be reheated using a special procedure if they bulge out of the groove. See Section 10.2.1, "Reseating the Elements" for instructions.

## 7.0 BINDER IGNITION TEST

### 7.1 Introduction

This section describes preparation and burnout procedures using the Gilson HM-378 Binder Ignition System for determination of binder content in hot-mix asphalt. Example temperatures and times noted have proven suitable with many sample types. Variations in temperatures and/or times may be necessary to comply with procedures of agencies developing standard test methods or to suit various sample quantities. Recommended sample quantity is up to 3,000g.

During a binder ignition test, the asphalt sample is heated until the binder portion ignites (see Figure 5 for a schematic representation of a typical burnout cycle). The most volatile components of the binder are ignited first, then ultimately the coke-type residual products are burned off. This process results in the main chamber temperature rising above the set point. Volatilized binder components are burned to completion in the higher-temperature afterburner of the furnace.

**WARNING!: DO NOT DISCONNECT OR OTHERWISE DEFEAT FUNCTIONING OF THE DOOR LOCKOUT!** During ignition phase, danger of flashing exists if the door is opened allowing oxygen to enter the chamber. Injury from burns is possible. For the operator's protection, the door lockout mechanism must be active during this dangerous period.

### 7.2 Programming the Controller

The following programming instructions apply to the Binder Ignition function. The Model HM-378 System has a dual-purpose controller enabling it to also be used for custom Ramp-Hold programming as described in Section 8.0 (see Figure 1).

Times and temperatures in Program 1 have been programmed into the controller at the factory. The furnace is ready to operate upon installation using this default program. To vary temperatures or times, re-program the controller in the sequence of this sample.

Values to be programmed are:

Description	Display	Default Value	Function
Program	PRO	1	Selects a memory location for program being input.
Main Chamber Preheat Temperature	CPR	500°C	Main Chamber Temperature setpoint for pre-heating.
Main Chamber Burnout Temperature	CbO	538°C	Main Chamber setpoint temperature during testing.
Hold Time	HOLd	15 Minutes	Period starting when the main chamber returns to the programmed burnout setpoint temperature after ignition. At the end of this period, the test is complete and the door lock is released.
Afterburner Temperature	CAB	850°C	Temperature setpoint for the Afterburner.
Fan-On Temperature	CFN	850°C	Temperature setpoint in Afterburner chamber when exhaust fan is activated.

The following **MINIMUM** Hold Times are recommended, depending on size of the sample used. Actual times should be adjusted based on experimental results:

1,200g	15 Minutes
2,000g	20 Minutes
2,500g	25 Minutes
3,000g	30 Minutes

**WARNING!:** Programming Shorter time settings may cause the door to unlock prior to test completion. If less than the recommended times are programmed, **DANGER** will exist from the possibility of a flashback if the door is opened. **DO NOT** defeat the intended purpose of the door lockout by reducing the hold time below what is recommended.

*Binder Ignition Programming Sequence:*

- Furnace must be plugged in and the toggle switch must be in the "ON" position.
- All programming starts from the IdLE display. Press <ANY> key except <STOP> to obtain the IdLE display.
- Insure the °C indicator in the display is lit. If not, press <ENTER>, then <°F/°C>. "CHG" will display. Press <ENTER> again and °C will be lit.
- Displays noted with "I" alternate between the two displays shown.
- Program #1 may be confirmed, reprogrammed, or altered by the following steps:

Action	Display
Starting display.	<b>IdLE/XXX</b> - Current main chamber temperature.
Press <PROGRAM> Press <ENTER>. Press <ENTER> again to accept displayed value, or input new main chamber preheat temperature, then press <ENTER>.	<b>Pro/1 (for Program 1)</b> <b>CPR/500</b> - Indicates 500°C is set as main chamber preheat temperature.
Press <ENTER>. Press <ENTER> again to accept displayed value, or input new main chamber burnout temperature, then press <ENTER>.	<b>Cbo/538</b> - Indicates 538°C is set as main chamber burnout temperature.
Press <ENTER>. Press <ENTER> again to accept displayed value, or input new hold time, then press <ENTER>.	<b>HOLd/00.15</b> - Indicates 15 minutes hold time for decoking.
Press <ENTER>. Press <ENTER> again to accept displayed value, or input new Afterburner setpoint temperature, then press <ENTER>.	<b>CAb/850</b> - Indicates 850°C is setpoint for Afterburner chamber.
Press <ENTER>. Press <ENTER> again to accept displayed value, or input new exhaust fan activation temperature, then press <ENTER>.	<b>CFN/850</b> - Indicates exhaust fan will activate at 850°C Afterburner temperature.
Ending display.	<b>IdLE</b> - Programming sequence is complete, ready for continued operation.

- After completing the Programming sequence as shown, the furnace is ready to run using Program #1.
- The fan-on temperature (CFN) is set at or below the Afterburner temperature setting (CAb) to allow faster preheating. DO NOT attempt to test samples if the fan is not on.
- To review the program last used or just programmed, start from IdLE, press <ENTER>, then press <PROGRAM REVIEW>. Programmed values will display in sequence.

- To confirm the active program during firing, press <PROGRAM REVIEW> at any time after -ON- has been displayed (as described below).
- To recall a program from memory or review, proceed from IdLE as in the above sequence until the desired program number is displayed (PRO/1, etc.). Press <ENTER>, then press <STOP>. The desired program is then ready for review as described above.

*Delayed Firing:*

In cases where the furnace must be ready for testing at the beginning of a shift, it can be programmed to begin the preheat cycle at a delayed time. Follow this procedure to initiate a Delayed Firing:

Action	Display
Starting display.	<b>IdLE</b>
Press <DELAY>.	<b>DELA/XX.XX</b> - Indicates hh.mm until furnace starts pre-heating. Maximum time is 99hr, 99min.
Input desired delay time, for example: 12 hrs, 30 min.	<b>DELA/12.30</b>
Press <ENTER>.	<b>IdLE</b> - Programming is complete.
Press <START>. Initiates Delay Countdown.	<b>DELA/XX.XX</b> - Counts down time remaining. Furnace will begin preheating in 12 hrs, 30 min.

- Press <STOP> at any time to cancel the delayed firing sequence or if a programming error is made. The display will return to IdLE.
- Delayed Firing programming must be repeated for each use. Program is not retained in memory.

*Preheating the Furnace:*

Action	Display
Starting display.	<b>IdLE/XXXX</b> - Main chamber temperature is indicated.
Press <ENTER>.	<b>-ON-</b> - Controller runs a self-diagnostic routine for 5—10 seconds.
No action required.	<b>PRHT/XXXX</b> - Main chamber temperature.
No action required.	<b>dELA/XX.XX</b> - Time remaining if delayed firing is active.

- Red lights on the front of the furnace will be lit when main chamber and after-burner heating elements are active.



- Once the furnace reaches programmed setpoint temperatures, it will maintain these temperatures awaiting initiation of a Binder Ignition Test.
- The furnace should be preheated for at least one hour prior to testing a sample.

### 7.3 Performing a Typical Binder Ignition Test

1. Preheat hot-mix asphalt samples in a separate laboratory oven to 100°C to facilitate even distribution of the material in the sample basket. Even distribution is essential to obtaining good test results.
2. Insure that a filter is properly installed and is not clogged or blinded from previous tests to inhibit air flow. Check the filter before each test.
3. Insure all program settings are correct, as noted above.
4. Remove the pre-heated asphalt sample from the laboratory oven and place on the sample basket, distributing the material as evenly as possible. Even distribution is key to obtaining good test results.
5. Place the sample basket with sample into the tray, and place the cover over the basket. The cover must be in place to prevent sample loss and possible damage to the elements (see Figure 1 for details on sample tray assembly).

**WARNING!:** ALWAYS use heat-resistant gloves and a face shield when operating the furnace. Long hair should be tied back or covered and loose clothing should be secured.

6. Using the loading fork provided, place the Sample Tray, Basket, and Lid assembly into the furnace, centering it on the hearth plates. Close the door, checking to be sure that the locking pin has engaged the electronic door lock mechanism.
7. Immediately press the <CONTINUE> key. **CONT** will appear on the display. The door will lock automatically and the exhaust fan will turn on (if not on already).

**WARNING!:** DO NOT FAIL to press the <CONTINUE> key once the sample is loaded. If this key is not pressed, the sample will begin ignition with the door unlocked. The automatic safety door lock will not be activated, and DANGER of severe burns or injury will exist if the door is opened.

8. The display will alternate between **bo** (burn-out set point) and the actual main chamber temperature. To check after-burner temperature, press <2>. **AFTb** will alternate display with the after-burner temperature. When the main chamber temperature reaches the burn-out setpoint, the display will alternate between **TEST** and the actual main chamber temperature. The onset of ignition can be confirmed by observation of flames in the chamber **FROM A DISTANCE** via the small hole in the front of the chamber.

**WARNING!:** NEVER leave the furnace unattended near the end of firing! Gilson cannot guarantee the furnace against over-firing even though the controller is automatic. The operator assumes full responsibility for shutting the furnace off at the proper time.

9. Once ignition occurs, the temperature of the main chamber will rise a minimum of 20°C above burn-out set point and is controlled only by the amount of oxygen allowed to enter the furnace. During this time the controller cannot maintain a constant temperature in the main chamber. When ignition is nearing completion, the chamber will return to the burn-out set point temperature, and the Hold Time timer will begin. The display will alternate between **HOLD** and the time remaining. Once the time has expired, the door lock will release automatically and a beeping alarm will sound. Press <ANY> key except <STOP> to silence the alarm. The controller will automatically begin to bring the furnace to pre-heat conditions in preparation for the next test.

**NOTE:** If the temperature does not rise at least 20°C above the burn-out set point, i.e., ignition does not occur, the controller will wait 10 minutes before proceeding to **CPLT** and unlocking the door.

10. Carefully remove the Sample Tray Assembly the furnace using the fork. Place it on the cooling stand, and remove the cover. Check the sample to insure that is free of coke. Coke is the solid residual of the binder after all volatile material has been removed. If Coke remains, replace the cover and return the assembly to the furnace in "PREHEAT" mode until Coke is absent upon re-inspection. Adjust program Hold Time for subsequent tests as necessary. Larger sample quantities and larger binder contents will require longer Hold Times.

**NOTE:** If it is necessary to return sample to furnace, DO NOT press <CONTINUE>. This will initiate another test cycle.

## 7.4 Shutting Down the Furnace

When the furnace is not in the middle of a test and the main chamber is at the preheat temperature with PRHT/ Main Chamber Temperature flashing on the display, open the door and leave it slightly ajar. Press <STOP>. The display will flash between AbRT, the temperature when <STOP> was pressed and the current temperature. The bottom red pilot light will be off, indicating that the main chamber elements are off. The fan will continue to run and the Afterburner elements will cycle to maintain temperature in the Afterburner. The door-lock push button will be disabled. The furnace will remain in this state until the main chamber temperature cools to 350°C. The process may be accelerated by fully opening the door. Once the main chamber temperature is below 350°C, press <ANY> key and IdLE will be displayed. The Afterburner elements will be shut off as evidenced by the upper red pilot light and the door-lock push button will be enabled again. Once the Afterburner temperature falls below Cfn set point, the fan will shut off. At this point, the furnace can be switched off.

## 7.5 Aborting a Test

- DO NOT push <CONTINUE> until the furnace has been properly preheated and the sample with all parts of the Basket, Tray and Cover assembly are in the chamber. Once <CONTINUE> has been pressed, the door lockout makes it time consuming to abort a test, and the furnace will need to be preheated again once the abort procedure is completed.
- To abort a test after <CONTINUE> has been pressed, press <STOP>. **COdE** displays. The operator must then enter the Code "31" within 3 to 4 seconds and press <ENTER>. **AbRT/XXXX** (main chamber temperature) is then displayed. Press <ANY> key and the furnace shuts down.
- The door lock does NOT release until the chamber cools to less than 300°C. Press <ANY> key to begin display of chamber temperature.
- To abort BEFORE <CONTINUE> has been pressed, press <STOP>. The display shows **AbRT/XXXX** (main chamber temperature). Then press <ANY> key and the display will show **IdLE/XXXX** (main chamber temperature). The furnace is now shut down.

## 8.0 CUSTOM APPLICATIONS

The Gilson HM-378 is designed for asphalt binder ignition tests of asphaltic hot-mix to determine binder content percentage in the mix. Refer to and follow instructions for that procedure as described in Section 7.0. While the programming procedure described in Section 8.2 has been found to be adequate, the user should recognize that a more complicated program is possible, involving a series of temperature ramps and dwells.

### 8.1 Ramp-Hold Programming

The controller of the HM-378 has wider capabilities than believed necessary for binder ignition work. In addition to storing ten binder ignition programs as outlined in Section 7.2 the controller can also store a Ramp-Hold program as described in this section.

A Ramp-Hold program consists of a series of up to four segments or stages. Each segment includes programming of the following values. The symbol "#" represents segment number being programmed.

Value	Display	Function
Firing Rate	<b>rA#</b>	Ramped temperature change, °C per hour.
Ramp Final Temperature	<b>C#</b>	Desired temperature at end of ramp.
Hold Timer	<b>Hld#</b>	XX.XX Hours Minutes final temperature is to be held.
Afterburner Temperature	<b>CAb</b>	Temperature to which the Afterburner section is controlled during the test.
Fan-On	<b>CFN</b>	Temperature at which the Afterburner exhaust fan is activated. (It runs automatically during a test.)

All programming starts from the **IdLE** display. To obtain this display, press <ANY> key, except <STOP>. Before programming, be sure the °C indicator is lit. If not, press the <ENTER> key, then the <°F/°C> key. **CHG** will appear, then press <ENTER> again, and the °C indicator will be lit. The Ramp-Hold program contained in memory may be confirmed, reprogrammed, or altered by the following steps. Displays with "/" mean the display alternates between the two values shown. To retain an existing value without change, merely press <ENTER> during display. To change an existing value, input the desired number then press <ENTER>. To return to a previous segment for review or editing, press <STOP>.



**WARNING!:** In custom programming mode, the programmer is responsible for programming the door to be locked during any segments where danger may exist by opening the door. See other WARNINGS regarding door lockout throughout this manual!

Action	Display
Starting display.	<b>IdLE</b>
Press <RAMP-HOLD>.	<b>RA 1/XXXX</b> - Indicating °C per hour ramp rate for segment 1.
Press <ENTER> (or new value, then <ENTER> 9999°C/hour maximum).	<b>C1/XXXX</b> - Indicating °C final temperature for segment 1.
Press <ENTER> (or new terminal temperature at end of ramp, then <ENTER>).	<b>Hd/XX.XX</b> - Indicating Hours Minutes Hold time for final temperature of segment 1.
Press <ENTER> (or new hold time).	<b>RA 2</b>

This is the start of the 2nd segment. Repeat programming in the same sequence as above for 1st segment to program additional segments 2, 3, and 4 if desired. If less than 4 segments are used, after last Hold Time is keyed and <ENTER> is pressed:

Action	Display
Press <ENTER> (or new Afterburner temperature).	<b>CAb/XXXX</b> - Indicating Afterburner temperature, °C.
Press <ENTER> (or new Fan-On temperature, 1,820°C is maximum).	<b>CFN/XXXX</b> - Indicating Fan-On temperature setting, °C.
Press <ENTER>.	<b>IdLE/XXXX</b> - Indicating Main Chamber temperature.

To review a program last used or just programmed, start from "**IdLE**", press <PROGRAM REVIEW> key. Program values will display in sequence. The furnace is now ready to run a Ramp-Hold program.

## 8.2 Delayed Firing Programming

If you wish to start the program at a delayed firing time, it may be programmed for one-time use by adding the following:

Action	Display
Starting display.	<b>IdLE</b>
Press <DELAY>.	<b>DELA/XXXX</b> - Max. time 99.95 hours minutes.
Input desired delay time, for example: 12 hrs, 30 min.	<b>DELA/12.30</b>
Press <ENTER>.	<b>IdLE</b>

The furnace is now programmed to delay for 12 hours, 30 minutes from the time it is turned on until it starts the Ramp-Hold program. Delay instructions are NOT retained as part of the program and must be reset for each desired use. To start a program:

Action	Display
Starting display.	<b>IdLE</b>
Press <ENTER>.	<b>-On-</b> then <b>XXXX</b> - Temperature of main chamber.
Press <ENTER>.	<b>XX.XX</b> - Time remaining in delay program.

When **-On-** is displayed, the controller runs a self-diagnostic routine for 5—10 seconds. Then a chamber temperature display appears. The furnace will automatically step through the four (or less) segments of rate ramps and timed holds as programmed. If a delay was programmed, the display shows time remaining, and **-On-** activates at **00.00** time.

When a Ramp-Hold program is firing, it is possible to skip to the next segment at any time by pressing <CONTINUE>. **SKIP** will display momentarily followed by the **RA#** display of the next segment. Press <ENTER> immediately to skip to the next segment. If <ENTER> is not pressed, the original segment resumes. At the end of the program, the furnace will shut off and the display will show **CPLT**.

## 9.0 ADDITIONAL CONTROLLER OPERATING DETAILS

- A. Operation:** The first time the furnace is powered, the HM-378 controller will display **IdLE** and the alarm will sound briefly. The controller will self-test for a period of 10—15 seconds and the display will alternately display **IdLE** and the Main Chamber temperature.
- B. Programming:** Programming begins from **IdLE**. If the display shows FAIL or TC2 instead of **IdLE**, the thermocouple is probably either disconnected or burned out.
- C. Time & Temperature Display:** During time display, a centered display period appears (**XX.XX**). During temperature display, the period disappears. The centered display period separates hours from minutes (i.e. 1 hour and 30 minutes displays as **01.30**). Up to 99 hours and 99 minutes can be entered, displayed as **99.99**. Thus it is important to note that more than one hour can be entered in minutes only. The integers after the decimal are NOT hundredths of hours.

- D. Fahrenheit or Centigrade:** The controller operates in Fahrenheit or Centigrade. In °C, a light appears in the lower right of the display window. In °F, it disappears. To switch from °F to °C or vice versa, from **IdLE**, press the <°F/°C> key. **CHG** will be displayed. Press the <ENTER> key again.

**NOTE:** All instructions in this manual are in °C. Please ensure that the controller is in °C before programming.

- E. Delay Fire:** The Delay Fire programs the furnace to begin firing later. It zeros out after each completed firing, so if you use this function for repeat firings, **IT MUST BE RESET EACH TIME.**
- F. Repeat Firings:** To repeat the last firing of the Ramp-Hold Program press <ENTER> from **IdLE**. The furnace will begin firing.

**WARNING!:** First perform a Program Review to be sure that the correct program is in place.

- G. Program Review:** Use this function to review program settings for ignition tests or for the Ramp-Hold program. From **IdLE**, press the <ENTER> key, then the <PROGRAM REVIEW> key. Values for the last program will scroll in order. A program in operation can always be reviewed simply by pressing the <PROGRAM REVIEW> key. To review a program from memory, from **IdLE** press <PROGRAM>, enter desired program number, and press <ENTER>. Then press <STOP> and proceed as a normal program review.
- H. Power Failure:** After a power failure during a firing, the furnace will spend 10–15 seconds to perform a self-test and then resume firing from its position in the profile before the power failure.
- I. Setting Alarm Before Firing Begins:** An alarm can be set to beep when a preset temperature is reached.
1. From "IdLE", press the <ALARM> key. **ALAR** will appear alternating with the last alarm temperature entered. A new temperature must be entered within 10 seconds.
  2. Key in the new alarm temperature. Then, press the <ENTER> key. **IdLE** will appear. To remove an alarm setting, key in 1820 (max. temperature) as the alarm temperature.

When the alarm sounds during a firing, shut it off by pressing <ANY> key except the <STOP> key. (If it sounds as soon as the furnace begins firing, it is because the alarm was set too low.)

- J. Setting Alarm During Firing:** After shutting off the alarm during firing, it can be set to go off again later at either a higher or lower temperature. To set the alarm during a firing, perform these steps:
1. When the alarm beeps during furnace operation, press the <ALARM> key.
  2. Enter the new temperature.
  3. Press the <ENTER> key. The alarm will sound when the new point has been reached.

**NOTE:** If you press the <ALARM> key, enter a new temperature, and forget to press <ENTER>, the alarm value will revert to the previously stored value. You must press the <ENTER> key after entering the new alarm temperature.

- K. Segment (For Ramp-Hold Program Only):** The furnace fires in segments, or stages. Each segment has a firing rate, firing temperature, and hold time. The Ramp-Hold program has up to four segments.
- L. Firing Rate:** The Firing Rate is measured in degrees of temperature change per hour, from 1°– 9999°C per hour (e.g., to increase temperature by 500°C per hour, enter rate of 500). A rate of 9999°C will be displayed as **FULL**.
- M. Storing Programs:** The HM-378 Controller allows the user to store nine Asphalt Binder Ignition programs and one custom Ramp-Hold program. To store an Asphalt Binder Ignition program follow the HM-378 Controller instructions in Section 7.2. When **PRO** appears alternately with a value between **1** and **9** select the number under which you wish to save this program. After entering the number, press <ENTER>, then key in the remaining desired values as prompted. When the display reads **IdLE**, the program is automatically saved.

To run the program immediately, press the <ENTER> key until **-ON-** appears. To run the program at a later time or after running another program, follow the instructions in Section 7.2. To save a custom Ramp-Hold program follow the instructions in Section 8.1. Once the program is entered, it is automatically saved until it is overwritten with a new program—except for the delay function, which must be reset with each use.

- N. Hold Time:** Hold Time means the heat-soaking time at the end of the segment. The temperature in each segment can be held for up to 99 hours and 99 minutes.
- O. Present Status:** Present Status shows which segment the furnace is in while firing. This function is especially useful for firings that have heat-up and cool-down segments. To use Present Status, press the <PRESENT STATUS> key during a firing. The current segment will display momentarily.
- P. Continue:** Continue works only during firing. In a binder ignition program, CONTINUE starts the ignition cycle after the sample has been loaded. In a Ramp-Hold program it is used to skip to the following segment of the program by pressing <CONTINUE> followed quickly by the <ENTER> key.

## 10.0 MAINTENANCE & TROUBLESHOOTING

**WARNING!:** ALWAYS disconnect and lockout electrical supply to the furnace prior to performing maintenance or repair.

**NOTE:** See Section 11.0 for diagnosis of Controller problems.

### 10.1 Electrical Problems

If the furnace stops heating while firing, check fuses or circuit breakers first. A blown fuse or tripped circuit breaker is not necessarily an indication of electrical trouble with the furnace. A short circuit causes a large amount of current to flow, generating so much heat that the fuse or breaker opens the circuit almost instantly. If the furnace should blow a fuse after firing for some time, there is little probability of a short. Replace the fuse or reset the breaker, and, if it does not blow again as soon as the furnace is turned back on, there is no short in the furnace wiring.

A loose or poor connection at the fuse or breaker will generate heat. If the fuse or circuit breaker panel feels unusually warm, have an electrician check for loose connections, particularly at the center screw of the fuse socket, even in a new fuse box.

#### *Slow Firing:*

The furnace should preheat to desired conditions in one hour or less. If not, the probable cause is a low voltage

supply. A minimum of 200V is required. If the furnace fires too slowly, have the power company check your voltage and readjust transformer if necessary.

#### *Hot Plug or Outlet:*

If the plug or outlet is hot, the probable cause is a defective plug or outlet. The remedy is to replace the plug if it becomes too hot to hold.

**WARNING!:** DO NOT fire the furnace until the plug is repaired.

### 10.2 Elements

The elements in the Gilson Furnace will last for many years of normal use. With time, however, the elements will gradually draw less and less power, finally reaching a point where they will not develop enough heat.

High temperature elements are damaged by contact with silica or silica bearing compounds. If silica touches an element, the element will burn out during the next firing. This type of damage is NOT covered by the warranty.

Service life of the elements can be severely shortened if the furnace is fired with a clogged filter. Filters should be checked prior to each firing and changed before they become clogged.

**WARNING!:** Reduction firing, which removes the oxygen from the furnace, will ruin the elements. Reduction firing destroys the coating of oxidation protecting the elements. Reduction is performed at your own risk, and elements damaged by reduction are not covered by warranty.

#### 10.2.1 Reseating

If elements are seated properly before firing the furnace for the first time, there probably will be no trouble in the future with an element bulging out of its groove. However, should an element do this, it must be reseated immediately as follows:

- a. Once an element has been fired, it becomes brittle and will break if it is bent while cold. Use the following procedure to heat the element.

**WARNING!:** Always disconnect and lockout the power supply before touching an element with anything!

Program the controller for the element to heat at the full rate. When the elements glow dull red, turn the controller's main power switch to the OFF position, **disconnect and lockout the power supply**.

- b. With a pair of long-nosed pliers, shrink the bulging portion of the element by pressing the individual turns in the coils together slightly. Take a little from each turn so that no two turns are pressed tightly enough to touch.
- c. As the element shrinks, work it back toward the groove and into place. Work rapidly, and at the first sign of stiffness in the coils, **STOP** bending and reheat the furnace. The elements do not have to be red to be bent safely, as the stiffening can be felt through the pliers.
- d. To lengthen the element to fit into the corners, reverse the above procedure and expand the distance between coils by using snap-ring pliers. Use caution, as the warranty covers only elements that fail in service under normal use and not from being broken while cold.
- e. When you have the coils positioned above the dropped recess in the grooves, reheat the furnace, disconnect and lockout the power supply, and run a blunt object around the elements to seat them into grooves and to make sure they fit all the way back into each corner.

### 10.2.2 Replacing Main Chamber Elements

The replacement elements for the furnace are made to fit. However, a little stretching or compressing may be necessary for a perfect fit.

**NOTE:** It is safe to bend and stretch new elements before they have been fired, but once fired and allowed to cool, elements become brittle and will break if bent.

**WARNING!:** Disconnect and lockout electrical supply before proceeding.

- a. Allow the furnace to cool to room temperature.
- b. Remove the screws on each side of switch box and place the box to the side being careful not to stress the wiring.
- c. Remove the screws in the element connectors that hold the element lead wires to the element you are replacing.

- d. On the same connectors, loosen the screws that hold the element and throw old connectors away.

**NOTE:** ALWAYS use the new connectors furnished with the new element.

- e. Remove and save the porcelain insulators that were under the element connectors.
- f. Using long-nose pliers, remove the staples that hold the elements in place. Save the staples and mark the locations of the holes for later installation.
- g. Remove the old element carefully to prevent breaking the lip of the element grooves. If the old element burned out due to contact with foreign materials, there will probably be a melted, glazed spot in the element groove. Glazed spots left in the grooves may ruin the new elements, so dig out any of these spots. A small mirror is helpful in locating these spots in the grooves. The small hole left in the groove will not affect the new element. Pieces of firebrick in the grooves should be removed with a dry paint type brush or vacuum cleaner.
- h. Protect the new element from accidentally coming in contact with foreign materials by placing newspaper on the furnace floor.
- i. Reach inside the furnace and push one end of the new element into one of the element holes. The element end will appear at the other side of the hole outside the case. Begin threading the element into the groove.
- j. The element must fit all the way into the back of each corner. Making a bend in the element at the corner will help hold the element in place during firing. Start by pushing the element into the first corner with a screwdriver. Make sure the element is pushed as far into the corner as it will go. Hold the element against the back of the corner with the screwdriver. Then gently pull the free end of the element towards you. The element will bend where the screwdriver presses against it.

**NOTE:** If you do not push the element fully to the back of each corner, the element will NOT stay in the grooves when fired!

- k. To hold elements in grooves, reinstall staples at marked locations by pressing them in using a pair of long nose pliers.

If the element is slightly too long when you reach the second firebrick hole, insert element end into the firebrick hole and let the curved groove take up the extra length. You can compress the element with long nose pliers if necessary. If the element is several inches too long, it was not pushed all the way to the back of each corner and should be re-threaded. If the element is too short to reach the second firebrick hole, unthread some of it. Gently stretch it in your hands. Avoid stretching only a short portion of the element. It is better to distribute the stretch over a longer section.

Press the element down into the lower part of the groove with a plastic comb or wooden tongue depressor. Reinstall the porcelain insulators. Push them flush against the furnace case. They protect the element from contact with the case, so they must not work their way out after the element connector is tightened into place. Sandpaper the eyelet of the element lead wires if insulation on old ones is brittle. Use the brass screw to connect lead wire eyelets to the new element connectors.

Before tightening the screw, adjust eyelet to where it will be tilted away from furnace case when connector is attached to element. Then hold the connector with pliers and tighten brass screw securely with nut driver. Pull the end of the element tight and install new element connectors even against porcelain insulators to prevent insulator from slopping away from brick wall. Use stainless screw in the element connector to hold the element. The brass screw holds the lead wire eyelet.

Hold connector with pliers as you tighten the screw. Tighten the screw until it squeaks, and then tighten some more. Cut off twisted end of element even with side of element connectors.

**NOTE:** Leaving the excess element sticking out past element connector could ruin your new element! The element can short against something in the switch box.

As you move the switch box back into place, check to see that no wire touches an element connector. Wires and wire nuts must also not touch the furnace case inside the switch box.

Wires and wire nuts will burn if they touch the case or element connectors. Replace screws in switch box and tighten into place.

### 10.2.3 Replacing Afterburner Elements

The replacement elements for the furnace are made to fit. However, a little stretching or compressing may be necessary for a perfect fit.

**NOTE:** It is safe to bend and stretch new elements before they have been fired, but once fired and allowed to cool, elements become brittle and will break if bent.

**WARNING!:** Disconnect and lockout electrical supply before proceeding.

- a. Allow the furnace to cool to room temperature.
- b. Remove the screws on each side of switch box and place the box to the side being careful not to stress the wiring.
- c. Remove the screws in the element connectors that hold the element lead wires to the element you are replacing.
- d. On the same connectors, loosen the screws that hold the element and throw old connectors away.

**NOTE:** ALWAYS use the new connectors furnished with the new element.

- e. Remove and save the porcelain insulators that were under the element connectors.
- f. Disconnect the power and conduit from the fan by removing the access plate at the motor with two screws. Remove the wire nuts and separate the wires. Loosen the conduit clamp screws and pull the conduit with wires from the fan.
- g. Remove the 12 sheet metal screws holding the fan and shroud to the top plate of the furnace. Remove the fan assembly from the furnace.
- h. Remove the ten screws holding the top metal plate to the top of the furnace and remove the top plate.



- i. Remove four screws holding the front plate above the door to the furnace and remove the front plate. Be careful not to damage the gasket.
- j. The top slab of fire brick is now free to be removed. Start at the front of the furnace and insert a flat putty knife or screw driver to lift the slab just enough to insert your fingers. Gently lift and pull the slab toward you as you slide your hand under the slab. Lift the firebrick slab clear of the furnace.
- k. The after burner element is now exposed in grooves on the floor of the after burner chamber. Using long-nose pliers, remove any staples that hold the elements in place. Save the staples and mark the locations of the holes for later installation.
- l. Remove the old element carefully to prevent breaking of the firebrick. If the old element burned out due to contact with foreign materials, there will probably be a melted, glazed spot in the element groove. Glazed spots left in the grooves may ruin the new elements, so dig out any of these spots. The small hole left in the groove will not affect the new element. Pieces of firebrick in the grooves should be removed with a dry paint type brush or vacuum cleaner.
- m. Reach inside the after burner chamber and push one end of the new element into one of the element holes. The element end will appear at the other side of the hole outside the case. Begin threading the element into the groove.
- n. The element must fit all the way into the groove and follow the serpentine pattern to the other end.
- o. To hold elements in grooves, reinstall staples at marked locations by pressing them in using a pair of long nose pliers.

If the element is slightly too long when you reach the second firebrick hole, insert element end into the firebrick hole and let the curved groove take up the extra length. You can compress the element with long nose pliers if necessary. If the element is several inches too long, it was not pushed all the way to the back of each corner and should be re-threaded. If the element is too short to reach the second firebrick hole, unthread some of it. Gently stretch it in your hands. Avoid stretching only a short portion of the element. It is better to distribute the stretch over a longer section.

Press the element down into the lower part of the groove with a plastic comb or wooden tongue depressor. Reinstall the porcelain insula-

tors. Push them flush against the furnace case. They protect the element from contact with the case, so they must not work their way out after the element connector is tightened into place. Sandpaper the eyelet of the element lead wires if insulation on old ones is brittle. Use the brass screw to connect lead wire eyelets to the new element connectors.

Before tightening the screw, adjust eyelet to where it will be tilted away from furnace case when connector is attached to element. Then hold the connector with pliers and tighten brass screw securely with nut driver. Pull the end of the element tight and install new element connectors even against porcelain insulators to prevent insulator from slopping away from brick wall. Use stainless screw in the element connector to hold the element. The brass screw holds the lead wire eyelet.

Hold connector with pliers as you tighten the screw. Tighten the screw until it squeaks, and then tighten some more. Cut off twisted end of element even with side of element connectors.

**NOTE:** Leaving the excess element sticking out past element connector could ruin your new element! The element can short against something in the switch box.

- p. Replace the top slab of firebrick and reassemble the furnace by reversing the above steps.
- q. As you move the switch box back into place, check to see that no wire touches an element connector. Wires and wire nuts must also not touch the furnace case inside the switch box. Wires and wire nuts will burn if they touch the case or element connectors. Replace screws in switch box and tighten into place.

### 10.3 Firebrick Damage

If large chips occur in the firebrick, DO NOT fill them completely with repair cement because expansion of the cement differs from expansion of the brick. The cement will break out when fired. Instead, seal large chips with a very thin coat of repair cement and leave the chips unfilled. Suitable cement is available from Gilson in dry form in one-pound bags as Model RPHM-378-17.



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## 11.0 THE TEMPERATURE CONTROLLER - TROUBLESHOOTING

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**WARNING!:** ALWAYS disconnect and lockout the electrical supply to the furnace prior to maintenance or repair. Diagnostic and repair procedures performed in or around high-voltage circuits should be conducted only by a qualified electrician.

### Controller Self Test

The Controller will enter a self test mode if the <4> key is pressed while power is applied to the furnace. This mode will sequentially test each of the inputs and outputs to the controller card. Upon entering the self-test mode, the display will show **FAN** and the exhaust fan will be turned on. No other controller outputs will be turned on except the fan. This situation will remain until the operator presses <ENTER> or removes power from the furnace.

Upon pressing <ENTER> the display will show **LOCK** and the fan will be turned off. At this point the output controlling the door lock will be turned on and the door latch mechanism can be tested. This situation will remain until the operator presses <ENTER> or removes power from the furnace.

Upon pressing <ENTER> the display will show **ALAR** and the alarm output will be turned on. Since this function is reserved for future use, no visual effect will be noticed. This situation will remain until the operator presses <ENTER> or removes power from the furnace.

Upon pressing <ENTER> the display will alternately display **MAIN** and the main chamber temperature. The Lower red pilot light on the front panel of the switch box will also be on. If the pilot light is not on, be sure the door is in the closed position and latched. This activates a switch that applies power to the main chamber elements only when the door is closed. Leave the furnace in this condition for several minutes and note the readings for the main chamber temperature. They should be increasing indicating the main chamber is getting warmer. If the readings are decreasing, the thermocouple leads are connected to the controller card with the wrong polarity. Do not leave the furnace unattended in this situation, as there is no upper limit on the main chamber temperature. If left unattended the elements will burnout due to thermal runaway. The furnace will remain in this situation until the operator presses <ENTER> or removes power from the furnace.

Upon pressing <ENTER> the display will alternately show **AFT** and the temperature in the Afterburner chamber.

Leave the furnace in this condition for several minutes and note the readings for the Afterburner chamber temperature. They should be increasing indicating the Afterburner chamber is getting warmer. If the readings are decreasing, the thermocouple leads are connected to the controller card with the wrong polarity. Do not leave the furnace unattended in this situation as there is no upper limit on the after burner chamber temperature. If left unattended the elements will burnout due to thermal runaway. The furnace will remain in this situation until the operator presses <ENTER> or removes power from the furnace.

Upon pressing <ENTER> the display will alternately display **IdLE** and the temperature of the main chamber. At this time the furnace is ready to run and is out of the self test mode.

### Problem #1: Controller Display does Not Turn On

#### *Probable Causes:*

1. Tripped circuit breaker or blown fuse; furnace unplugged.
2. Blown furnace switch box fuse.
3. Defective transformer.
4. Defective controller board.
5. Disconnected wire in switch box.

Check circuit breakers or fuses for the wall outlet. Then, remove the furnace fuse and check it by placing the leads of an ohmmeter on the ends of the fuse. If the ohmmeter reading is 0 ohms, the fuse is okay. If the reading is infinity or no needle movement, the fuse is bad. Replace a bad fuse with a SS2-250mA, 250VAC fuse.

Next, check the controller board with a voltmeter. Make sure the furnace is unplugged. Remove the four screws holding the controller board faceplate to the switch box. Lift faceplate out of box and let the board hang on the box with the back of the board facing you. Plug the furnace back in. Touch the voltmeter probes, in AV Volt mode, to connectors with the orange and white wires. Make sure the voltmeter is in the AC mode when placing the probes on these connectors. If you find voltage (approximately 20V AC) present, that means current is reaching the board from the transformer, so the board is probably defective.

If there is no voltage, the transformer is probably defective. But before replacing the transformer, **disconnect and lockout the power supply**. Remove the switch box and look for both a disconnected wire between the cord set and transformer and between the transformer and the controller board.

**Problem #2: Controller Display Lights Up Normally; Some or All Heating Elements Do Not Fire***Probable Causes:*

1. Worn or burned-out elements.
2. Defective controller board.
3. Defective relay(s).
4. Disconnected wire in switch box.

First check the controller board with a voltmeter. Make sure the furnace is unplugged. Remove the four screws holding the controller board faceplate to the switch box. Lift the faceplate out of the box and let the board hang on the box with the back of the board facing you. Plug the furnace back in. Program the controller to fire the furnace at full power.

Put the voltmeter in **DC** mode. Touch the probes to the red and black wire connectors. If voltage is present (approximately 12 VDC) current is going to the relays from the board, so the board is okay. If there is no voltage at the red and black wire connectors, replace the board.

If the controller board checks out okay, **disconnect and lock out the power supply**, and remove the switch box. Look for loose or disconnected board to relay, relay to element, and cord set to relay wires.

If you still haven't found the problem, check the elements with an ohmmeter. **Be sure the power supply is still disconnected.** Touch the ohmmeter leads to the two element connectors of each element. No needle movement indicates a broken (burned-out) element.

If the element you are testing has two or more element lead wires attached to the same element connector, you must temporarily disconnect those wires. Hold the element connector with pliers as you remove the brass screw. Be gentle to avoid breaking the element. Elements are brittle after being fired. **DO NOT** disturb the stainless steel screw holding the element, only the one holding the lead wires. Reconnect the wires securely after testing the element.

If the elements and wiring check out okay, the problem is most likely a relay.

**Problem #3: FAIL or TC2 Message***Probable Causes:*

1. Defective thermocouple.
2. Disconnected thermocouple lead wires.
3. Reversed thermocouple lead wires.
4. Defective board.

The controller displays **TC2** when the thermocouple (temperature sensor) in the firing chamber burns out and **FAIL** when the thermocouple in the Afterburner chamber burns

out. **Disconnect and lock out power supply.** Remove the four screws holding the controller faceplate to the switch box. Lift the faceplate out of the box. Look at the back of the board. You will see two wires, each with a red and yellow conductor, near the bottom of the board. If one of these wires is disconnected or loose, lift the locking bar, reseal the wires, and press the locking bar back into place. Be sure the color of the wire matches the color of the connector. The controller should work now.

If the wires are attached securely to their connectors, remove one pair of red and yellow wires from the connector. Touch ohmmeter probes to the red and yellow wires. If you get continuity (0 ohms), place the wires back into the connector being sure to match the wire color to the connector color. Remove the other pair of red and yellow wires from the connector. If you get continuity (0 ohms), replace the board. If there is no movement of the ohmmeter needle (infinity, or no continuity) with either thermocouple, you have a burned out thermocouple or a disconnected thermocouple wire.

**Problem #4: Controller Displays ETH (Electronics Too Hot)**

The circuit board temperature is above 185°F/85°C. Open windows and use a fan to circulate the air in the room before firing the furnace. If you have more than one furnace in the room, place them farther apart. Never allow the firing room temperature to exceed 110°F/43°C. (Measure room temperature three feet away from the furnace.)

**Problem #5: Controller displays PLOG**

A PLOG error code indicates that the controller failed a self-diagnostic test. The controller will not operate while a PLOG message is displayed. Clear the PLOG error code by pressing <ENTER>. If that doesn't work, turn off the power to the furnace for 10 seconds. If the PLOG message remains after 3 Resets and after you have turned off power for 10 seconds, the controller is defective.

## 12.0 REPAIR & REPLACEMENT PARTS

Model No.	Description
HM-378	Binder Ignition Furnace, complete with Accessories
HMA-810	Support Stand
HMA-812	Replacement Air Filters, pkg. of 12
HMA-813	Sample Cooling Cage
HMA-814	Flexible Metal Exhaust Line, 4in diameter
HMA-69	Sample Tray Set
RPHMA-69-1	Sample Tray
RPHMA-69-2	Sample Basket
RPHMA-69-3	Sample Basket Cover
RPHM-378-1	Sample Tray Fork
RPHM-378-2	Cooling Tray
RPHM-378-3	NEMA 6-50 Cord/Plug Set
RPHM-378-4	Filter Holder
RPHM-378-5	Hearth Plate, 10 x 20in, 2 Required
RPHM-378-6	Heating Elements, Main Chamber, 2 Required
RPHM-378-7	Heating Element, Afterburner Chamber
RPHM-378-8	Controller with Faceplate
RPHM-378-8-1	Wiring Harness for Controllers installed in ovens manufactured before 2001. Please supply serial number.
RPHM-378-9	TF-3 Relay
RPHM-378-10	Thermocouple for Main or Afterburner Chamber
RPHM-378-12	NEMA 6-50 Receptacle
RPHM-378-13	Gaskets, top or Bottom, 2 Required
RPHM-378-14	Gaskets, Sides, 2 Required
RPHM-378-15	Gasket Conversion Kit, includes Gaskets and Bracket
RPHM-378-16	Door Lock Solenoid
RPHM-378-17	Firebrick Repair Compound
RPHM-378-18	Exhaust Fan Assembly
RPHM-378-19	Door Lock Assembly, complete with Housing
RPHM-378-20	Adapter: Exhaust Fan Adapter Flange
RPHM-378-22	Hold-down Staples for Heating Elements, pkg. of 24
RPHM-378-23	Power ON/OFF Switch
RPHM-378-24	Door Operated Cut-Off Switch
RPHM-378-25	Fuse Holder
RPHM-378-34	Porcelain Insulator, pkg. of 4
RPHM-378-35	Factory Replacement of Firebrick and Elements

Parts & Accessories Diagram

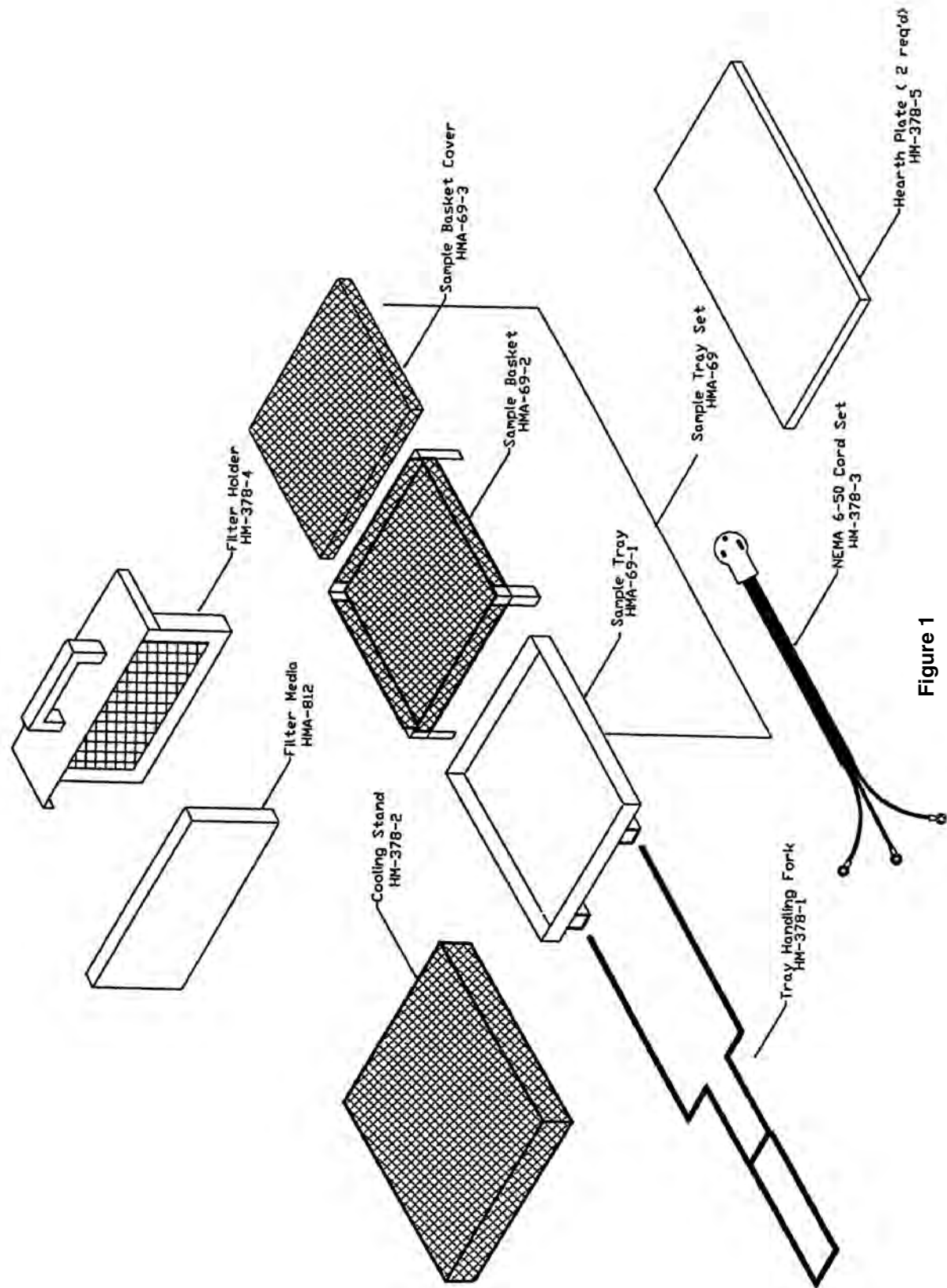


Figure 1

## Control Panel



Figure 2

# Wiring Diagram, 208—240V, 50/60Hz

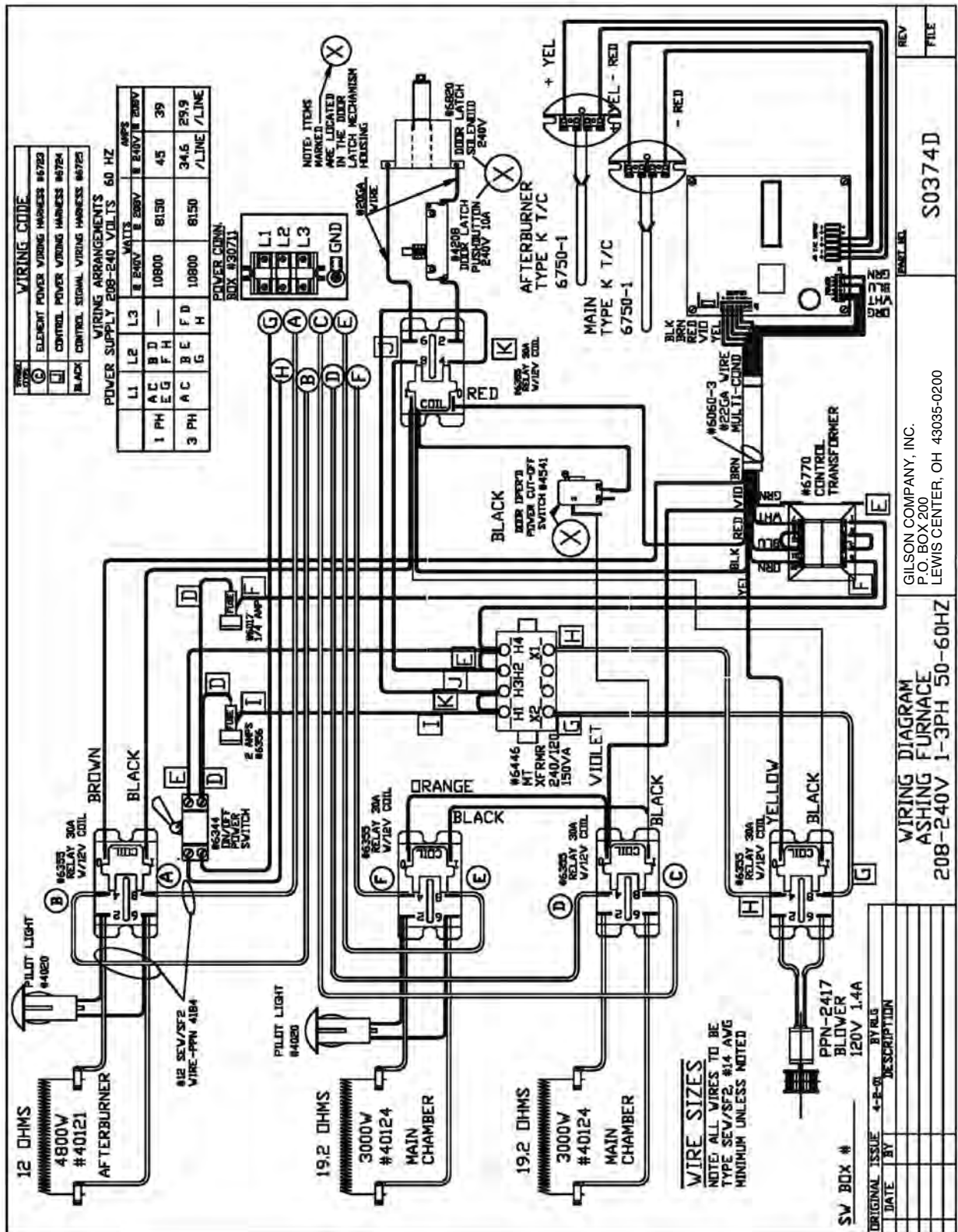
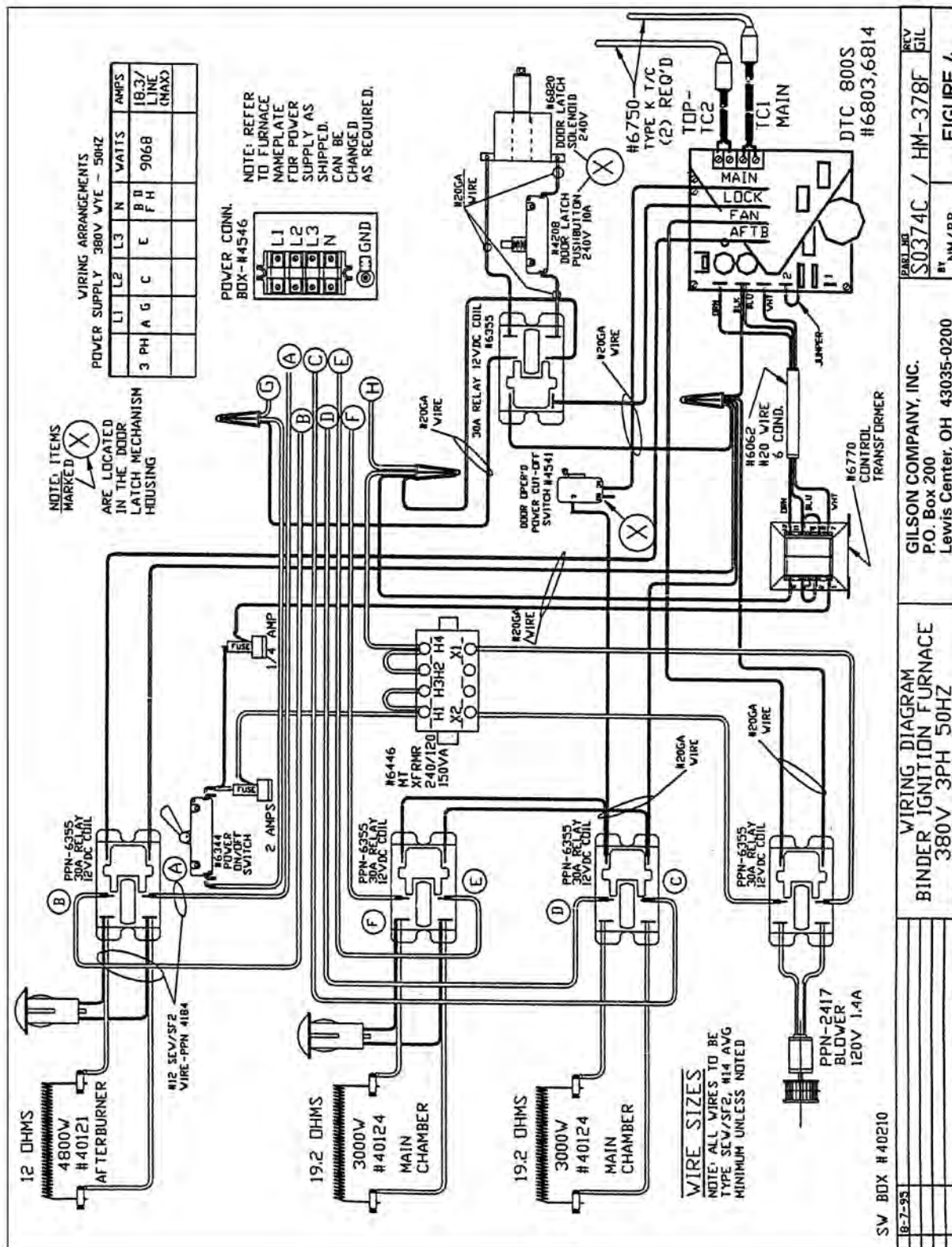


Figure 3

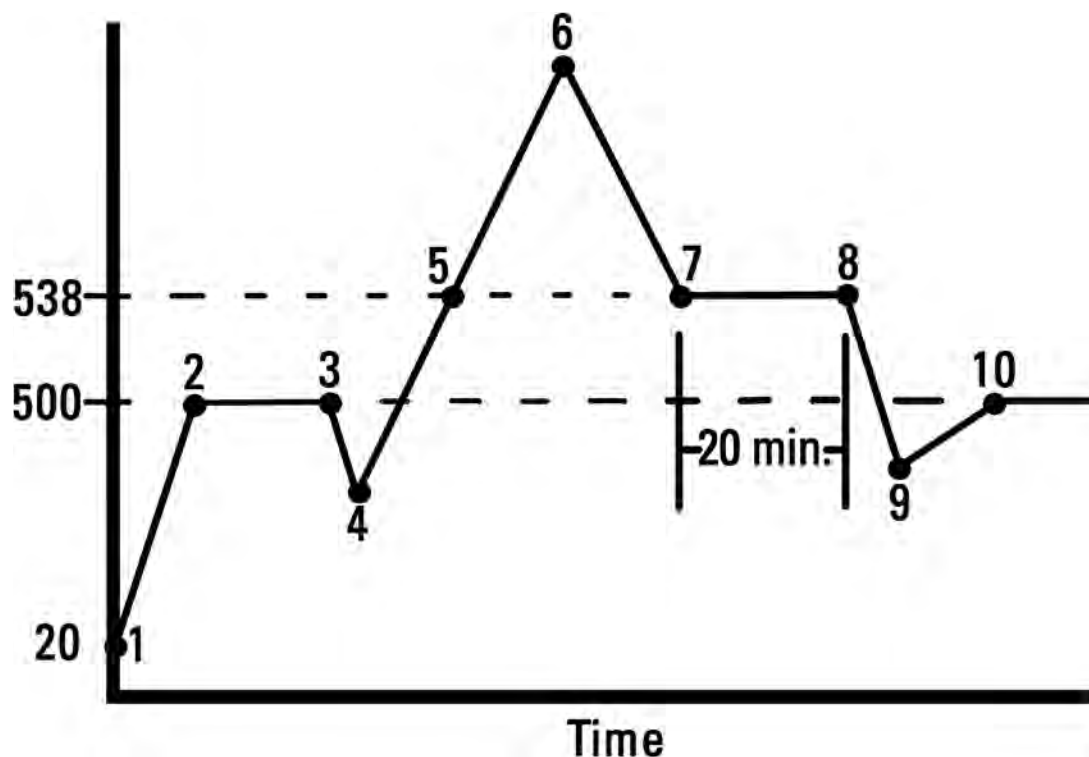


## Wiring Diagram, 380V/50Hz



### Figure 4

## Ignition Sequence Schematic



### Example:

Preheat Temperature set to 500°C  
Burnout Temperature set to 538°C  
Hold Time (Decoking) set at 20 Minutes

1. Room temperature.
2. Preheat temperature programmed by user.
3. Open door to load sample, heat escapes.
4. Close door and start test.
5. Burnout temperature programmed by user. (Could be the same as 2)
6. Peak temperature as asphalt ignites and burns off. (Varies)
7. Temperature returns to programmed burnout setting. Hold time (decoking) starts.
8. End of hold time. Door can be opened, sample is removed, heat escapes.
9. Door is closed.
10. Furnace returns to programmed preheat temperature.

**Figure 5**

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## 13.0 STATEMENT OF WARRANTY

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Gilson Furnaces with a temperature rating up to and including 2,000°F are warranted to the original purchaser, subject to the listed exclusions below, to be free of defects in workmanship for a period of one year from date of original purchase from Gilson or an authorized Gilson distributor or dealer.

*The Warranty Excludes:*

1. Main chamber and Afterburner heating elements.
2. Furnaces damaged by overfiring (exceeding the melting temperature of the materials being fired) regardless of cause of overfiring.
3. Anything inside the furnace damaged by overfire.
4. Furnaces allowed to exceed the maximum temperature shown on the furnace's nameplate.
5. Furnaces subjected to abuse, neglect, freight damage or improper storage.
6. Furnaces used for either reduction or salt firing.
7. Furnaces damaged by improper electrical installation.

Gilson will repair or replace any parts which become defective under normal and proper use during the specified period providing the furnace has not been subjected to misuse or the listed exclusions. Gilson will furnish and install replacement parts at the factory with transportation costs paid by the owner, or upon receipt of defective parts at the factory, and after factory examination of the defect, replacements complete with installation instructions will be shipped postpaid to owner.

Call Gilson Customer Service to discuss desired remedy at 800-444-1508 or 740-548-7298. Any claim for adjustment under this warranty must include name and address of dealer from whom furnace was originally purchased. Always contact Gilson for a return authorization before returning furnace or parts. Repair or replacement of any defective parts shall fulfill all obligations of Gilson. No other obligations or liabilities are assumed in connection with Gilson Furnaces nor does Gilson authorize its distributors or dealers to assume any other obligations or liabilities. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.