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PROJ 230-5301
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LINE-1

# Operation Manual

## Microwave Muffle Furnace

# MAS-7000™

ASSET TAG# M-3162
SERIAL # MA2084
MODEL # 920901



CEM
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MANUFACTURED IN THE
UNITED STATES OF AMERICA

600017
Rev. 3
7/98

## CAUTION

**DO NOT** install the MAS-7000 inside a fume hood.

To avoid the possibility of a thermal overload, the MAS-7000 should not be physically located inside a fume hood. Vapors should be vented into a fume hood by means of the exhaust hose only.

Installation of the MAS-7000 inside a fume hood will void any written or implied warranty from the manufacturer.

## WARNING

The muffle furnace included with this instrument contains ceramic fiber material and high temperature coating cement.

- Possible carcinogen based on tests with laboratory animals.
- May be irritating to skin, eyes and respiratory tract.
- May be harmful if swallowed or inhaled.
- Cristobalite (crystalline silica) formed at high temperatures (above 1600° F) can cause severe respiratory disease.

For further information, call (800) 726-3331 and request Material Safety Data Sheet part number 600531.

# Operating Precautions

**The following precautions should be observed to avoid possible exposure to excessive microwave energy:**

- Do not tamper with the safety interlocks. The MAS-7000 is equipped with three door safety interlock switches which prevent the instrument from producing microwave power if the door is open. Tampering with the safety interlocks will allow microwave production when the door is open, which is very dangerous.

- Do not place any object between the front of the microwave cavity and the door or allow soil or cleaner residue to accumulate on sealing surfaces.

- Do not operate the instrument if it is damaged. It is particularly important that the instrument door close properly and that there is no damage to the door (bent), hinges and latches (broken or loosened), or door seals or sealing surfaces.

- The instrument should be adjusted or repaired only by qualified service personnel.

**The following precautions should be observed to avoid instrument-induced electromagnetic interference:**

- The possibility of instrument-induced electromagnetic interference (EMI) is minimal if precautions outlined above are followed.

- The instrument should not be placed close to any electrical device susceptible to EMI. It is suggested that the user post a sign warning pacemaker wearers that a microwave device is in operation.

- If the instrument is suspected of inducing EMI, the door and the front of the cavity should be carefully inspected as outlined on page 9. A microwave leakage measurement should be performed as outlined on page 58. Leakage measured above the legal limit of 5 $mW/cm^2$ should be reported to the CEM Service Department.

**Electrical Precautions:**

- The MAS-7000 must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This instrument is equipped with a cord having a grounding wire with a grounding plug. The plug must be plugged into an outlet that is properly installed and grounded.

| WARNING |
| --- |
| Improper installation or use of the instrument grounding wire and/or plug can result in electrical shock. |

If grounding instructions are not completely understood or if doubt exists that the instrument is properly grounded, consult a qualified electrician or service technician. If it is necessary to use an extension cord, use only a 3-wire extension cord with a 3-blade grounding plug that has a 3-slot electrical receptacle. The marked rating of the extension cord shall be equal to or greater than the electrical rating of the instrument.

- **This instrument utilizes high voltages and microwave radiation.** Instrument service and repair should be performed only by those trained in repair and maintenance of high voltage and microwave power systems.
- This instrument complies with United States Code of Federal Regulations (CFR) Title 21, Part 1030 for microwave leakage. A verification report is on file.
- This instrument complies with United States Code of Federal Regulations (CFR) Title 47, Federal Communications Commission (FCC) Part 18 – Industrial, Scientific and Medical (ISM) Equipment – emissions requirements. A verification report is on file.

## Warnings, Cautions and Notes

Warnings, cautions and notes are included throughout this manual and should be read thoroughly and strictly followed.

**WARNING:** A Warning is inserted for essential information used to emphasize dangerous or hazardous conditions to the operation, cleaning and maintenance of the instrument which may result in personal injury.

**CAUTION:** A Caution is inserted for essential information used to emphasize procedures which, if not strictly followed, may result in damage or destruction to the instrument or improper instrument operation.

**NOTE:** A Note is inserted for emphasis of procedures or conditions which may otherwise be misinterpreted or overlooked and to clarify possible confusing situations.

To the best of our knowledge, the information contained herein is accurate. However, CEM cannot accept liability of any kind for the accuracy or completeness of the information contained in this manual. The final determination of the suitability and proper use of the nstrument described herein, the accuracy of the information and data obtained from such use, and whether such use infringes any patents or the legal safeguards of others are the sole responsibility of the user.

# Table of Contents

## Table of Contents (Continued)

# 1 Introduction

The Microwave Muffle Furnace, Model MAS-7000, is a special purpose microwave system designed for laboratory use in ashing a wide range of materials. Its primary purpose is the rapid preparation of samples for the gravimetric determination of ash content (loss on ignition).

The MAS-7000 consists of

- a microwave power system with an output of a minimum of 900 watts,
- a stainless steel microwave cavity with exhaust fan,
- a programmable digital computer,
- a muffle furnace,
- an internal temperature control system,
- internal calibration software,
- two (2) RS-232 ports and one (1) parallel printer port, and
- exhaust hose to vent fumes.

Available accessories for use with the MAS-7000 include

- ashing crucibles and accessories,
- balances,
- printers, and
- calibration instrumentation.

# II Installation

## Unpacking

1. Carefully remove the MAS-7000 from its shipping carton and place it on a sturdy workbench or laboratory table. *Retain all packing materials.*

> **WARNING**
>
> Do not lift the instrument by the door handle. Damage to the door and lock mechanism may result, causing microwave leakage.

2. Remove all packing and protective materials from the instrument. Remove the muffle furnace from its shipping carton.

3. Verify that all accessories listed below and illustrated in figure 1, page 4, are included.
   - Muffle Furnace with heating insert
   - Thermocouple
   - Exhaust Hose
   - Fuses, 10 AMP (2)
   - Pedestal Access Tool
   - Power Cord (60 Hz Only)
   - Operation Manual
   - Ashing Disks (Package of 200)
   - Ashing Crucibles (Package of 20)

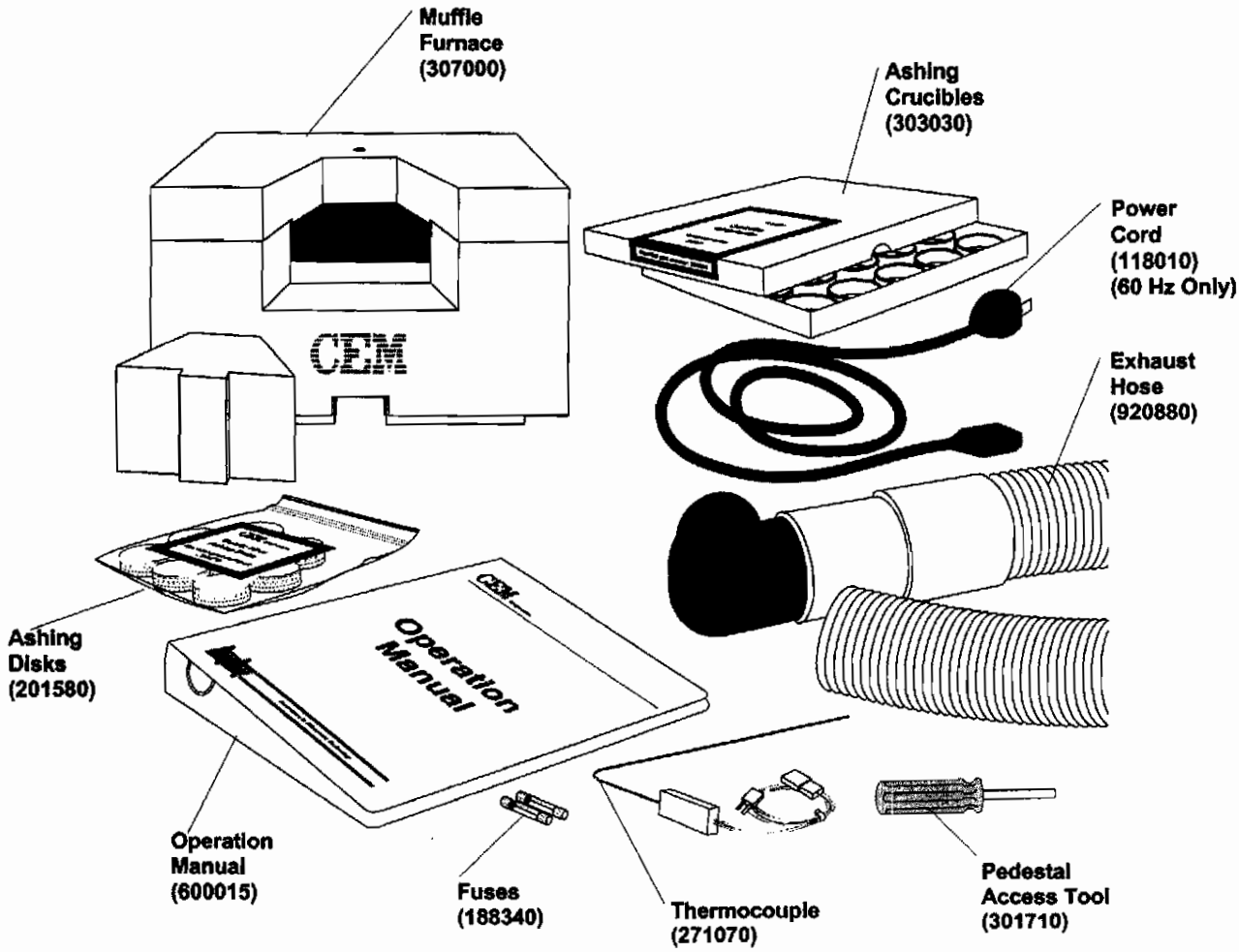



**Figure 1. Accessories**

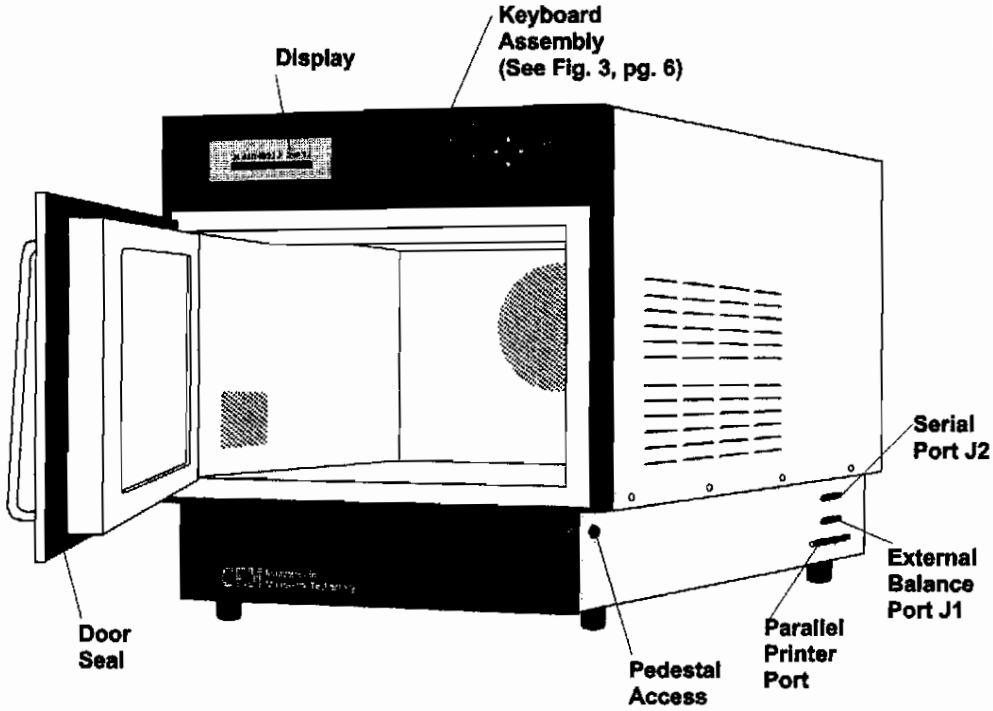



**Figure 2. MAS-7000 Front View**

- **Display** – displays instructional messages, instrument settings and data on a 30 character liquid crystal display which will display eight lines of text.

- **Keyboard** – controls operation of the MAS-7000. Temperature level, dwell time, or other numeric data may be entered as requested on the display.

  - **F1 - F4** – Press to perform functions as required on various display screens. In all editing functions, pressing "F1" will clear the variable to be edited; pressing "F2" will change from upper to lower case letters or vice versa.

  - **0 - 9** – Press to select values for parameters such as power and dwell time and to enter text items such as program name, program identification, etc. Pressing a numeric key one time will enter its numeric value. Pressing the same numeric key two times will enter its first alpha (letter) value. Pressing the same numeric key three times will enter its second alpha value. Pressing the same numeric key four times will enter its third alpha value. Pressing the same numeric key five times will enter its numeric value, restarting the above process. The "0" key multifunctions with symbols. (Example: To enter a program name of BUTYL RUBBER, press "1" three times; press "7" four times; press the "right arrow" key; press "7" three times; press "9" two

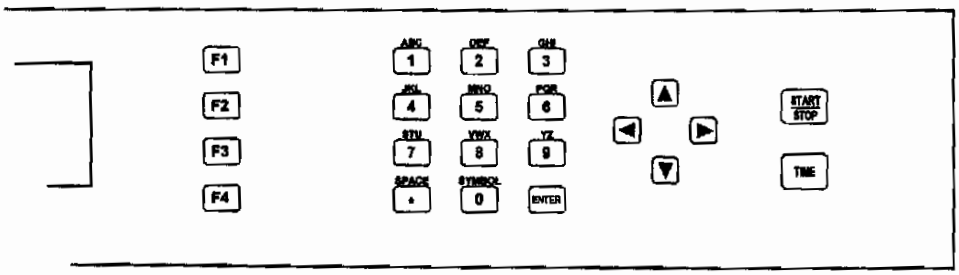



**Figure 3. Keyboard**

times; press "4" four times; press the "dot" key two times to enter a space; press "6" four times; press "7" four times; press "1" three times; press the "right" arrow key; press "1" three times; press "2" three times; and press "6" four times.

- **. (dot) or Space** – Press once to insert a period or two times to insert a "space" in a program name or identification.
- **Enter** – Press to store entered parameters and data in computer memory.
- **▲,▼,►, ◄** – Press to move the cursor (entry window) to the selection to be programmed or changed. The left arrow key is also the backspace key. When entering method names, the right arrow key functions as "revert," to permit entry of consecutive letters using the same number key.
- **Start/Stop** – Press to begin or stop microwave power. Microwaves are activated when the Start/Stop button is pressed unless the instrument door is open. After the Time key is pressed, operation will continue through the analysis unless the Start/Stop key is pressed to interrupt or stop an ashing procedure. When the Start/Stop button is pressed to stop operation, microwave energy and time countdown are simultaneously suspended.
- **Time** – Press to begin countdown of dwell time.

- **Printer and Computer Ports** – allow communication with external devices such as an external balance, PC, and/or printer.
- **Door Seal** – ensures tight fit between the door and interior cavity to prevent microwave leakage.
- **Pedestal Access** – releases latch to permit access to components in pedestal.

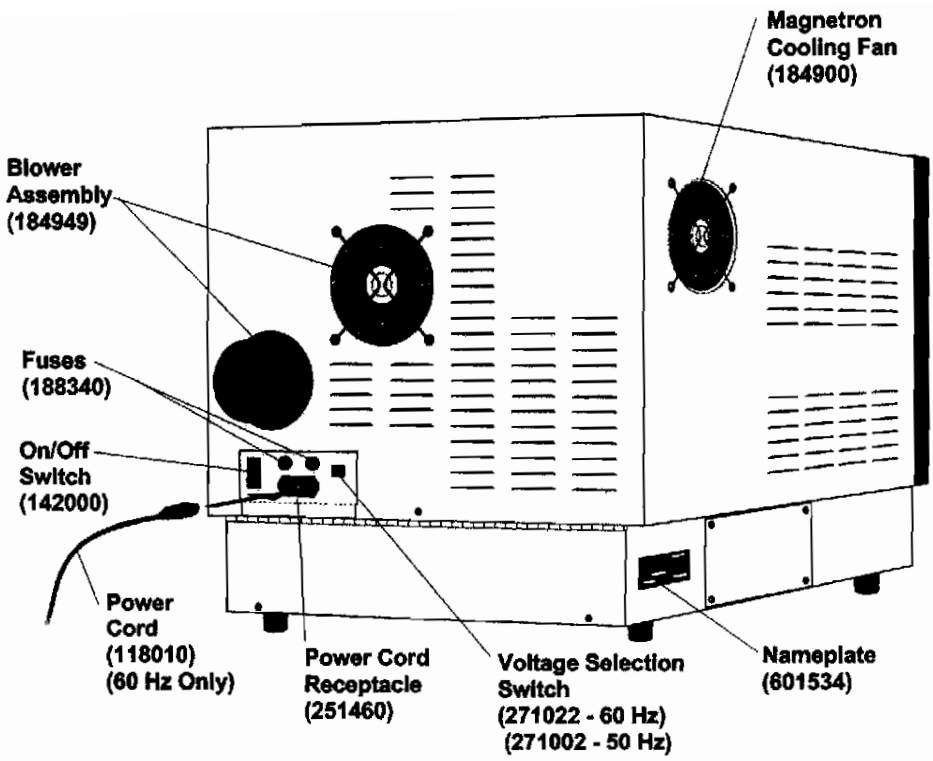



**Figure 4. MAS-7000 Rear View**

- **Blower Assembly** – exhausts heat and smoke from instrument cavity during sample ashing.
- **Magnetron Cooling Fan** – draws air through the magnetron.
- **Fuses** – prevent electrical power overload.
- **Power Cord Receptacle** – receives the female end of the power cord.
- **Power Cord** – conducts electrical power from the AC outlet to the instrument. It is detachable.
- **On/Off Switch** – turns electrical power to the instrument on and off.
- **Nameplate** – lists instrument model and serial number.
- **Voltage Selection Switch** – permits electrical voltage to be switched from 208 to 230V or 220 to 240V.

## Door Protection

The MAS-7000 is equipped with an infrared detection device to protect the instrument from possible damage from exposure to excessive temperatures.

An infrared receptor diode array is located in the ceiling of the instrument cavity. It produces an output voltage as a function of the amount of infrared energy to which the detector is subjected. If the infrared energy level reaches a predetermined setpoint, the receptor assembly energizes a relay which prevents the instrument door from locking. It also signals the microprocessor which turns off the magnetron. If the instrument door is open when the door protection device is activated, the door cannot be closed.

The door protection device is activated, preventing the instrument door from being closed, when the muffle furnace door is removed (inserting and removing samples). Once the muffle furnace door is installed, the door protection device will deactivate, permitting the instrument door to be closed.

**WARNING**

Do not force the instrument door to close. Forcing the door will result in damage to the interlock system, the door mechanism and/or door alignment.

If the instrument door is closed when the door protection device is activated, the microprocessor will turn off the magnetron, and microwave heating will cease, thus preventing damage to the instrument.

## Instrument Location

Place the MAS-7000 in a location that:

1. provides at least 8 in. (20 cm) open space on each side and 6 in. (31 cm) open space in the rear of the instrument for ventilation.

2. provides adequate bench space for sample handling and optional accessories (printer and balances), if applicable.

3. allows instrument to be connected to a dedicated, grounded 208/230 VAC 60 Hz outlet (220/240 VAC 50 Hz outlet) capable of supplying 10 Amps. The dedicated service must maintain the specified voltage within ±10 VAC of nominal.

> **CAUTION**
>
> Line voltage fluctuations greater than 10 volts from the nominal will affect instrument performance.

4. provides access to a fume hood or other means of fume disposal.

> **CAUTION**
>
> Do not install the MAS-7000 inside a fume hood. Placing the instrument in a fume hood can cause a thermal overload. Vent the MAS-7000 into a fume hood by means of the exhaust hose.

## Instrument Inspection

1. Inspect the instrument cover and door for cracks, dents or warping.

2. Inspect the rubber door seal for damage.

3. Inspect the door for proper alignment. When closed, the door and seal should seat firmly against the front of the microwave cavity. The door must open and close freely with no binding or restriction of movement.

> **WARNING**
>
> If damage is noted, do not attempt instrument startup.

If the instrument has been damaged in shipping, contact the freight carrier to report damage and to file a damage report. Contact the CEM Service Department or your local distributor to report damage and to request service information.

## Instrument Startup

1. Connect the exhaust hose to the cavity exhaust outlet (figure 6, page 12) by pushing the plastic elbow as far into the exhaust outlet as possible. Orient the plastic elbow so that the exhaust hose extends toward the fume disposal mechanism. Place the open end of the exhaust hose in a fume hood or other suitable fume disposal mechanism.

2. Remove the door of the muffle furnace. Inspect the muffle furnace assembly for proper element placement (figure 5, page 11).

3. Position the muffle furnace in the center of the microwave cavity, ensuring that the thermocouple ports in the furnace and the top of the instrument cavity are aligned.

4. Remove the thermocouple access door from the top of the cover (figure 7, page 12).

> **CAUTION**
>
> The thermocouple ports in the muffle furnace and the instrument cavity must be properly aligned to avoid damage to the muffle furnace.

5. Carefully lower the thermocouple through the thermocouple port of the instrument into the port in the top of the muffle furnace (figure 7, page 12).

6. Place the furnace door in position.

7. Tighten the thermocouple nut (figure 11, page 71) finger tight; then, using an adjustable wrench, tighten the nut an additional 3/4 turn.

> **WARNING**
>
> Failure to tighten the thermocouple nut could result in microwave leakage that can cause damage to the microwave furnace system and be harmful to the operator.

8. Attach the subminiature connector from the thermocouple wiring to the MAS-7000 subminiature plug. The second thermocouple connector is used for temperature verification, and will remain disconnected at this time. See page 61 for temperature verification procedures.

9. Install the thermocouple access door on the top of the instrument cover.

10. Plug the female end of the power cord into the power cord receptacle on the power panel in the rear of the instrument. Plug the male end of the power cord into a grounded, dedicated electrical outlet.

11. Ensure that the voltage selection switch (figure 4, page 7) is in the proper position (setting) to parallel line voltage (208/230V or 220/240V).

12. If applicable, install printer and/or external balance according to instructions on pages 13 and 14.

> **CAUTION**
>
> Ensure that the MAS-7000 power switch is in the "off" position when installing an external balance and/or printer to avoid damage to the MAS-7000 and/or peripheral instrument.

13. Position the power switch located on the power panel in the rear of the instrument in the "on" position.

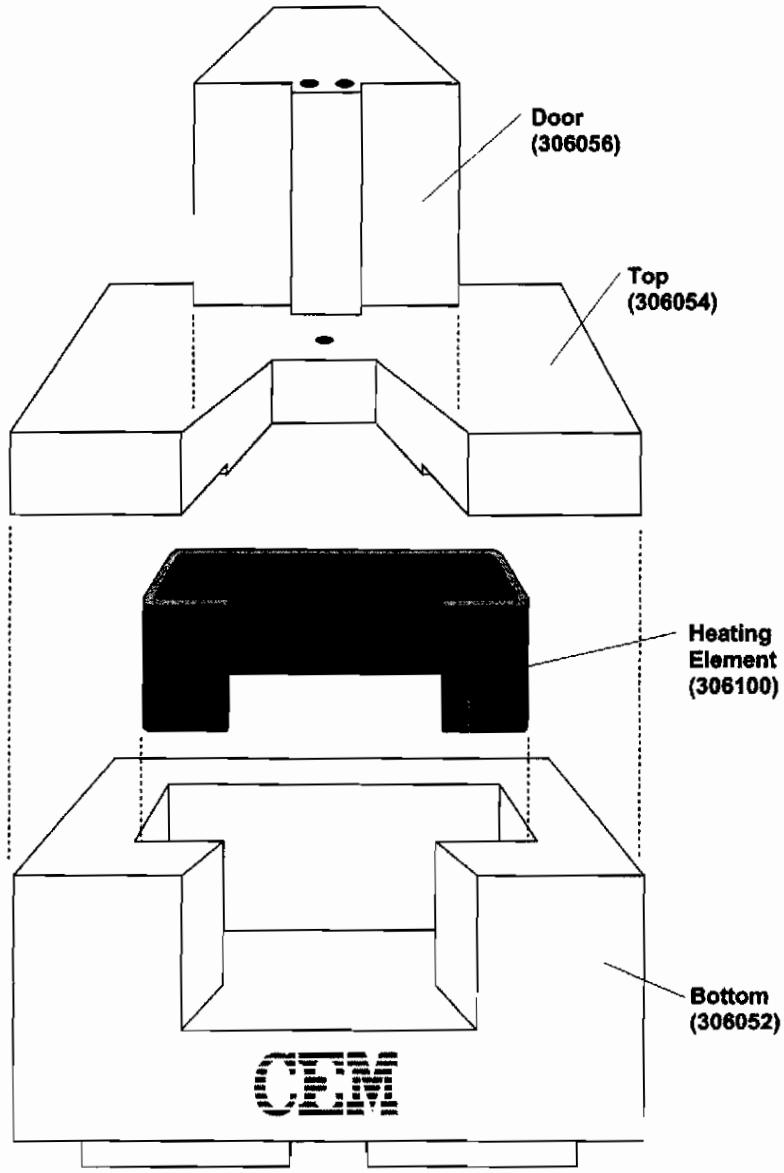



**Figure 5. Muffle Furnace Assembly (307000)**

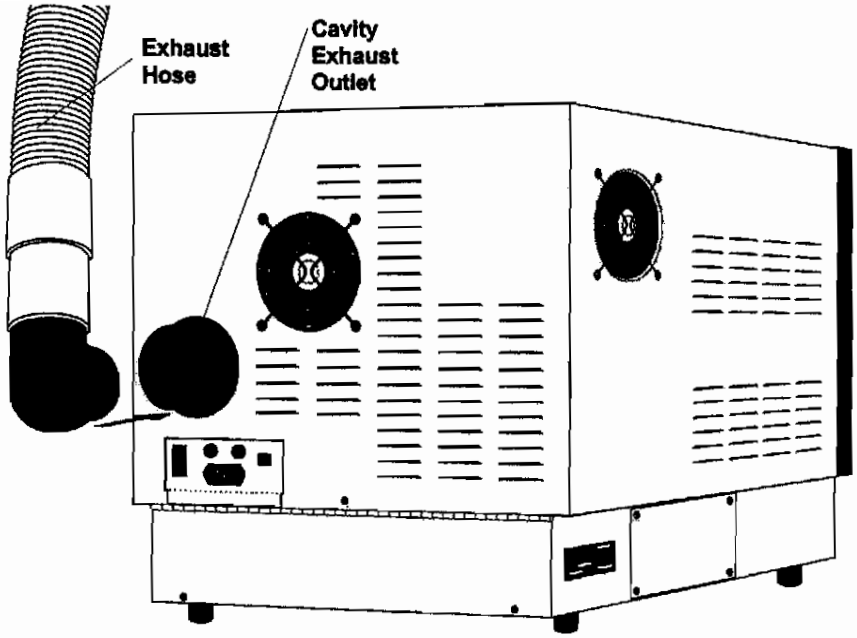



**Figure 6. Exhaust Hose Connection**

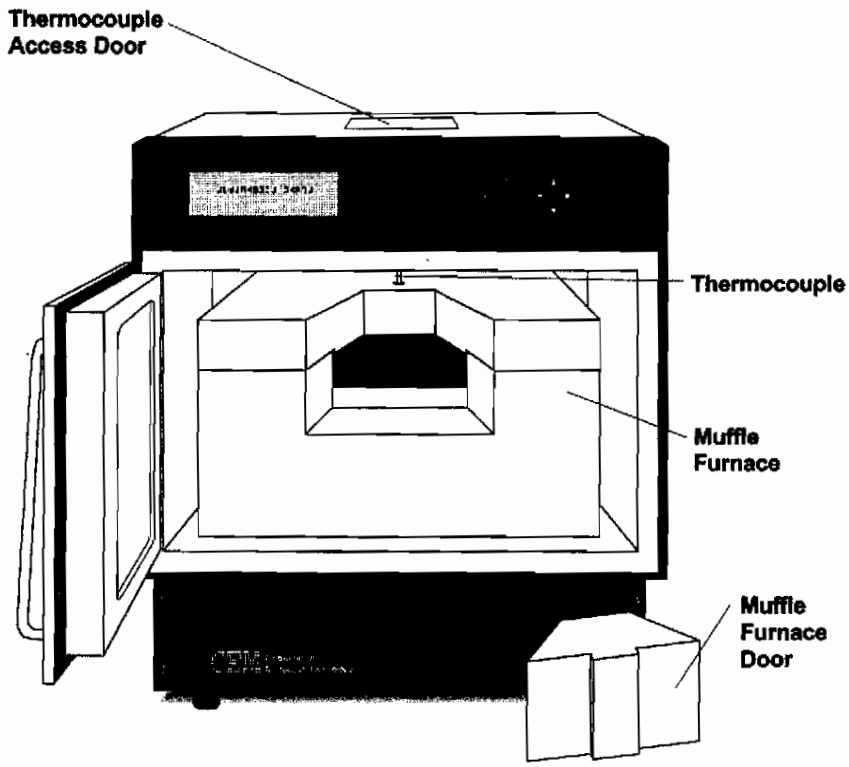



**Figure 7. MAS-7000 with Ashing Furnace and Thermocouple Installed**

## Printer Installation

The MAS-7000 supports a variety of different printer standards. Refer to the printer manual for specific installation and operation instructions.

- Citizen – available from CEM Corporation. This printer is factory set and requires no additional setup.
- IBM Graphics Compatible – key word is "Graphics." The printer must support IBM graphics to operate properly.
- Epson Compatible Graphics – for standard Epson graphics printers and clones that do not have the ability to print in color.
- HP Thinkjet – for HP Thinkjet printers only.
- Standard ASCII – for printers that do not print in the graphics mode.

To install the Citizen printer, follow the procedures outlined below. Refer to the manual shipped with the printer for specific installation and operation instructions.

1. Press the MAS-7000 power switch to the "off" position and remove the AC power cord from the electrical outlet.

> **CAUTION**
>
> Ensure that the MAS-7000 power switch is in the "off" position when installing an external balance and/or printer to avoid damage to the MAS-7000 and/or peripheral instrument.

2. Remove the printer and its accessories from the shipping carton. Place the printer on a vibration-free printer stand or a solid, sturdy laboratory workbench or table. *Save all packing material.*
3. Perform setup instructions as outlined in the printer manual. (For color printing, the Color Kit must be installed. Refer to the printer manual for instructions.)
4. Plug one connector of the computer cable into the socket on the printer. Plug the other connector into the parallel port of the MAS-7000 (figure 2, page 5). Plug the printer power cord into a grounded AC electrical outlet.
5. Press the printer power switch located on the bottom, left side to "on."
6. Plug the MAS-7000 power cord into a grounded AC electrical outlet. Press the MAS-7000 power switch to the "on" position.

## External Balance Installation

**Note:** The following procedures are for setup and installation of the Denver external balance (CEM part number 003130). If using an external balance other than the Denver balance, refer to the balance manufacturer's manual for specific installation and operation instructions. For proper operation, ensure that the serial and power cables are installed as outlined below.

> **CAUTION**
>
> Ensure that the MAS-7000 power switch is in the "off" position when installing an external balance and/or printer to avoid damage to the MAS-7000 and/or peripheral instrument.

### Instrument Setup

1. Press the MAS-7000 power switch to the "off" position and remove the AC power cord from the electrical outlet. Refer to the preceding caution on page 13.
2. From the Main Menu, press "F2" (Setup/Diagnostics).
3. From the System Setup screen, press "F2" (Set System Parameters).
4. From the Set System Parameters screen, press "F3" (Options Setup).
5. From the Select Options screen, press "F1" (Select Balance).
6. From the Sel (Select) Balance screen, press "4" (Denver Instrument). If using a balance other than the Denver balance, select the appropriate balance and refer to the manufacturer's manual for installation and operation instructions.
7. Press "Enter" to accept the balance selection and return to the Select Options screen.
8. Press any numeric key three times to return to the Main Menu.
9. Position the power switch of the CEM instrument in the "off" position, and remove the power cord from the electrical outlet.

### Balance Setup

10. Position the external balance on a sturdy laboratory workbench or table so that it can be interfaced with the CEM instrument.
11. Plug the 12 volt transformer into the Denver balance and into the electrical outlet. Wait for the balance to zero.
12. Press "menu" 3 times (Menu #3 of 3).

13. Press "3" (Factory Defaults).

14. Press "1" (Yes {Clear All}).

15. Press "ent" (Enter). "WORKING" should briefly flash on the screen.

16. Press the "zero" key (not the numerical "0" key).

17. Press "menu" 2 times (Menu #2 of 3).

18. Press "1" and "3" simultaneously (both keys at the same time). Display should not change.

19. Press the "zero" key (not the numerical "0" key).

20. Press "1" and "3" simultaneously. The sixth line of the balance screen should read "Emulate = ON." (If the sixth line is blank, press "0" (zero) and repeat steps 17 through 20.)

21. Press the "zero" key (not the numerical "0" key).

22. Unplug the balance power cord from the electrical outlet.

**Instrument and Balance Interface**

23. With the balance and CEM instrument electrical cords both removed from the electrical outlets, plug the cable shipped with the Denver balance into the socket on the balance. Plug the connector on the other end of the cable into the external balance port of the CEM instrument. (Refer to Operation Manual for position of external balance port.)

24. Plug the Denver balance power cord into the electrical outlet. Wait for the balance to zero.

25. Plug the electrical cord of the CEM instrument into the electrical outlet. Position the power switch in the "on" position.

When properly performed, these procedures should eliminate communication errors and the inability to "tare" the balance.

Note: To avoid losing balance setup, permit balance to remain on at all times, even if the CEM instrument is turned off. Loss of power to the balance can cause loss of setup procedures.

## External Balance Setup (Port J1)

Refer to figure 2, page 5, for location of balance, printer and computer ports.

Outlined below are serial port configurations for external balances:

| | | | |
|---|---|---|---|
| **Denver Instrument*:** | 300 Baud | **Pin** | **Function** |
| | 8 Data Bits | 2 | RX |
| | 2 Stop Bits | 3 | TX |
| | No Parity | 5 | GND |
| **Sartorius:** | 1200 Baud | | |
| | 7 Data Bits | 2 | RX |
| | 1 Stop Bit | 3 | TX |
| | Odd Parity | 5 | GND |
| **Mettler:** | 2400 Baud | | |
| | 7 Data Bits | 2 | RX |
| | 1 Stop Bit | 3 | TX |
| | Even Parity | 5 | GND |

*The MAS-7000 defaults to a CEM external balance.

## Personal Computer Setup (Port J2)

Information transfer to an external computer is accomplished with RS-232C serial compatible signals using 8 data bits, 1 stop bit and null parity. The interface connector is a 9 pin DB9 (male). The information is transmitted in standard ASCII format.

Note to programmer: Parse data on tab.

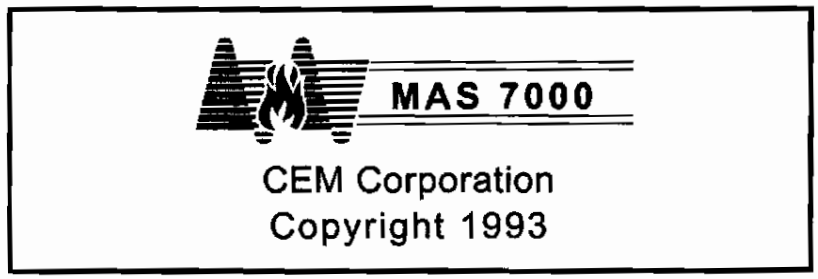
| **Comm. Port Setup** | **DB9 Connections** | |
|---|---|---|
| 2400 Baud | **Pin** | **Function** |
| 8 Data Bits | 2 | RX |
| 1 Stop Bit | 3 | TX |
| No Parity | 5 | GND |

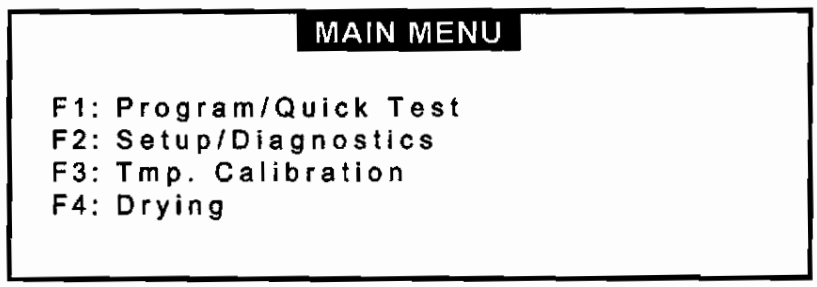
PC software to interface and collect data must be supplied by the user.

# III Setup

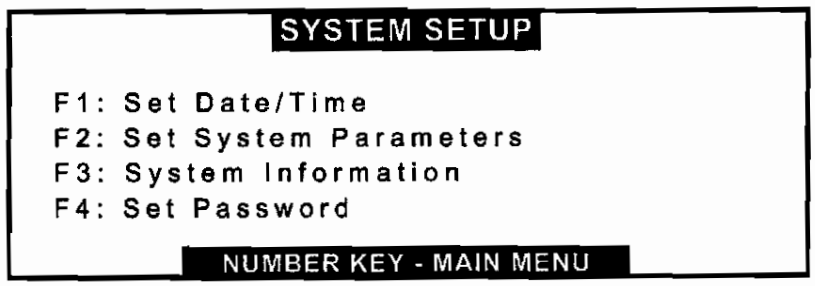
Prior to system operation and sample ashing, perform the following procedures to set system parameters such as date/time, printer and balance functions, utilities, system password, etc.

1. Ensure that the power switch is in the "on" position.

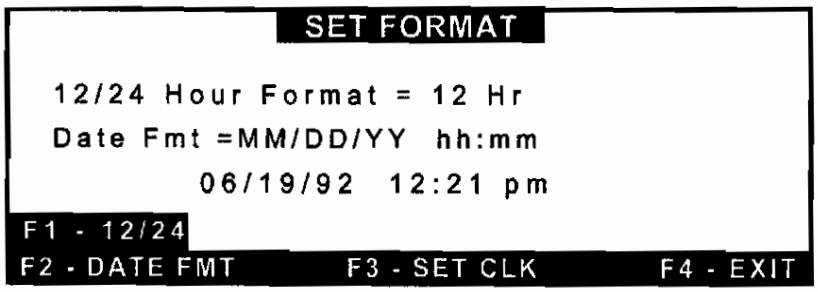




2. Press "F2" to activate the System Setup screen.

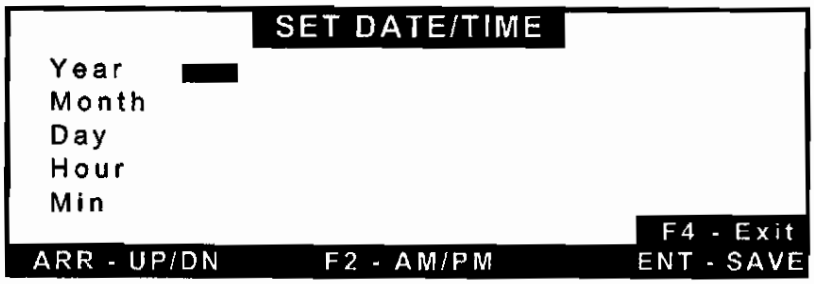



3. Press "F1" to set date/time format.




4. Hour Format can be set for either 12 hour or 24 hour format. Change format by pressing "F1." Date format can be set for either year/month/date, month/date/year or date/month/year. Change date format by pressing "F2."

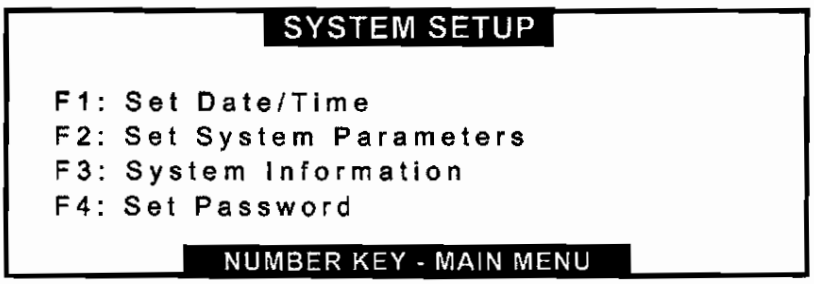
5. Press "F3" to set clock (date/time).



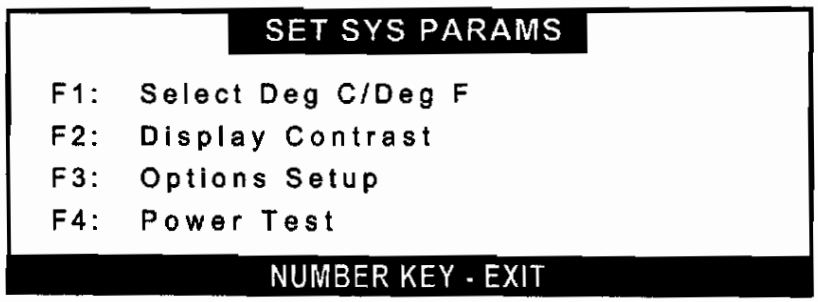

6. Using the numeric keys, enter the year. Press the "down" arrow key to move the entry window to month. Using the numeric keys, enter the month. Continue using the "down" arrow key and numeric keys to enter the day of the month, the hour and minutes. If necessary, press "F2" to change AM to PM or vice versa. If an error is detected in entered data, use the "up" and "down" arrow keys to move the entry window to the desired position, and using the numeric keys, enter the correct information.

7. Press "Enter" to save data in the instrument computer.

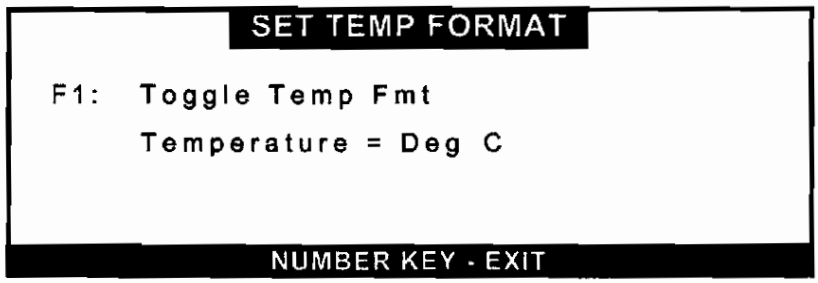
**Note:** If correct date and time settings have been previously set, press "F4" to escape back to System Setup screen.



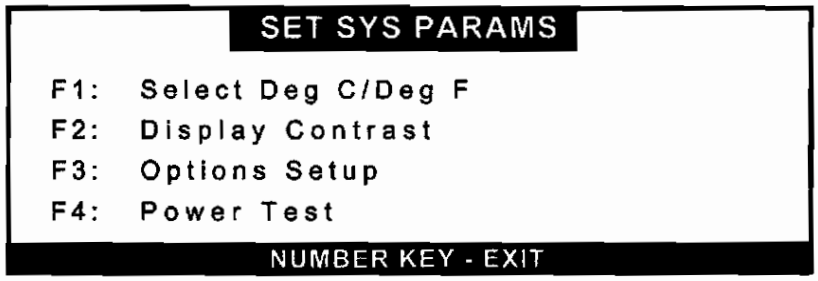

8. Press "F2" to activate the Set System Parameters screen.



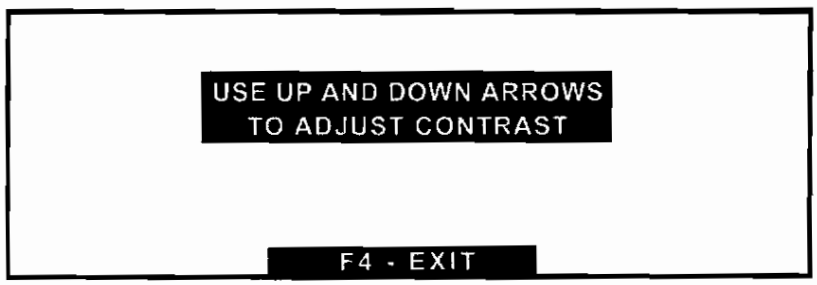

9. Press "F1" to activate the Select degrees C/degrees F screen.




10. Press "F1" to change temperature format from degrees F to degrees C, etc. Press any key to return to the Set System Parameters screen.

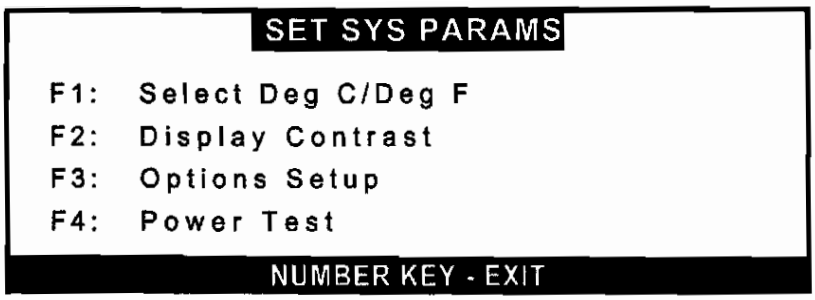



11. Press "F2" to activate the Display Contrast screen.

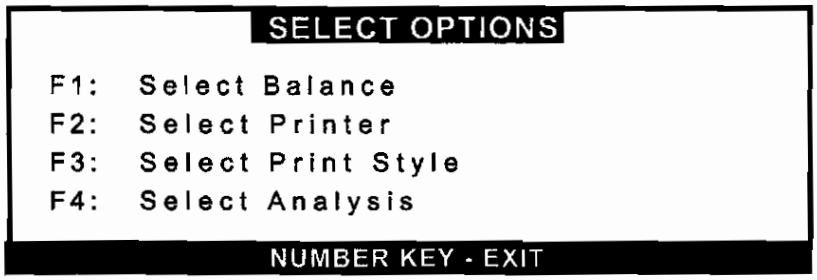



12. Use the "up" and "down" arrow keys to adjust screen contrast to desired level.

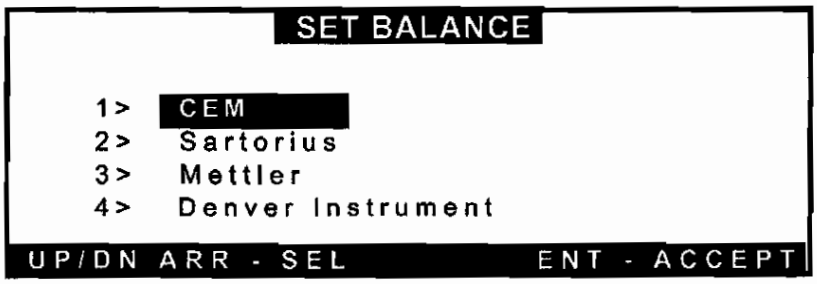
13. Press "F4" to exit and return to the Set System Parameters screen.




14. Press "F3" to activate the Options Setup screen.

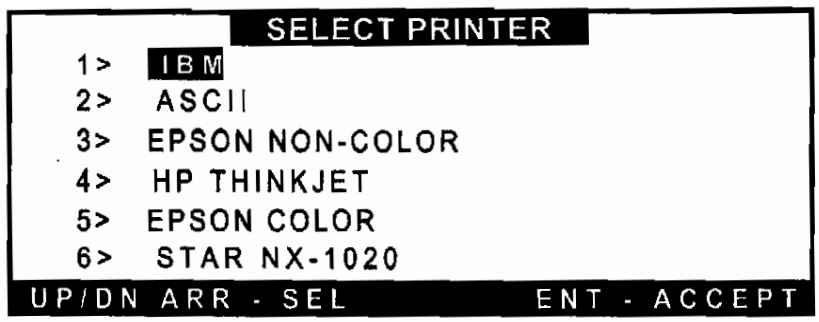



15. Press "F1" to activate the Select Balance screen.




16. Available external balances include CEM, Sartorius and Mettler and Denver Instrument. Select the proper balance by pressing the "Up" or "Down" key. (To select the Denver Instrument 100g balance, press "4.") Refer to "External Balance Setup," page 14 for proper settings of external balances. Press "Enter" to exit.


17. Press "F2" to activate the Select Printer screen.



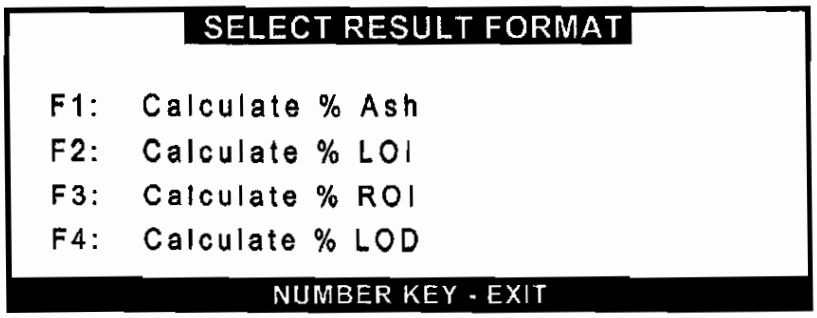

18. Use the "up" and "down" arrow keys to choose the type printer installed with the instrument. (If a Citizen printer is installed, select "5 - Epson Color.") Refer to "Printer Installation," page 13 for printer information. Press "Enter" to exit.


19. Press "F3" to activate the Select Print Style screen.


20. Printer quality can be set for "Draft Quality" or "Near Letter Quality." If required, change printer quality by pressing "F1." Printer pitch can be set for 10, 12 or 17. If required, change printer pitch by pressing "F2." Draft quality and 17 characters per inch are recommended for the Star NX-1020 printer.

21. Press "Enter" to accept selection and exit.

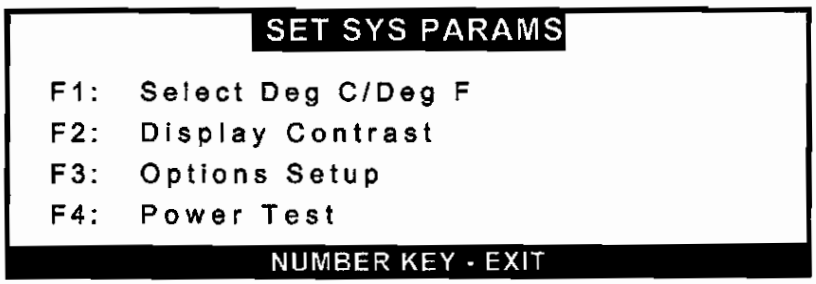

22. Press "F4" to activate the Select Analysis screen.




23. Press "F1" to select data format for % ASH; press "F2" to select % LOI, etc. Press any number key to return to the Select Options screen.

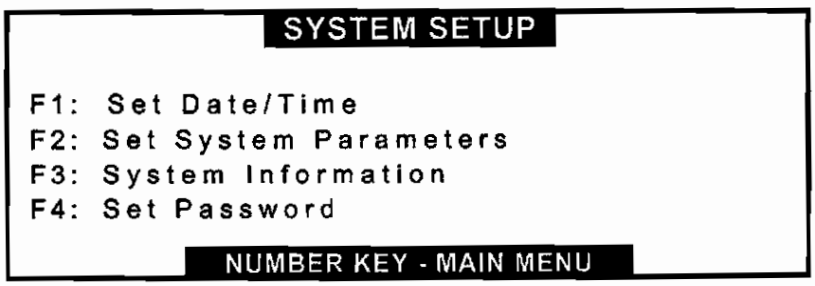
**Note:** % LOI is the same value as % ROI.


24. Press any number key to return to the Set System Parameters screen.

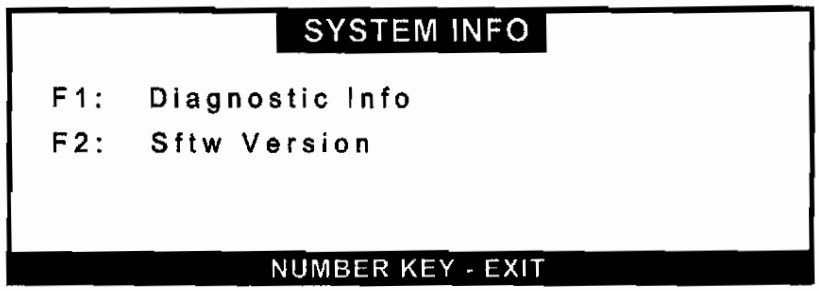



**Note:** Performance of a power test (F4) is not necessary during system setup. Refer to the maintenance and troubleshooting section of this manual, page 57, for specific instructions for performing a power test.

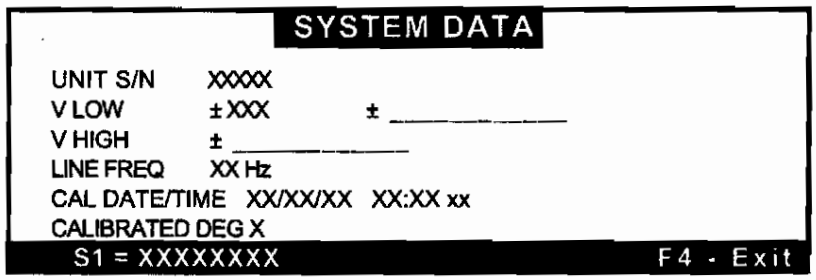
25. Press any number key to return to the System Setup screen.



26. Press "F3" to activate the System Information screen.

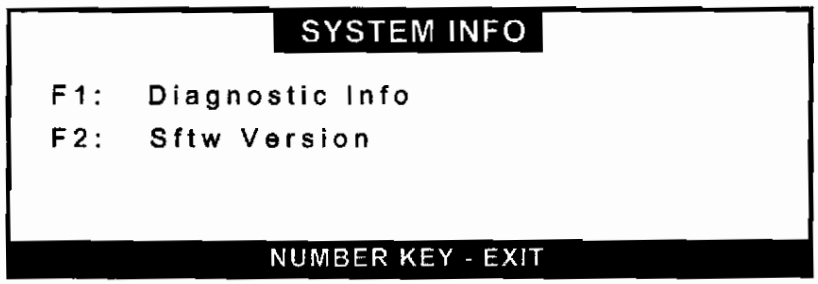



27. Press "F1" to activate the Diagnostic Data screen.



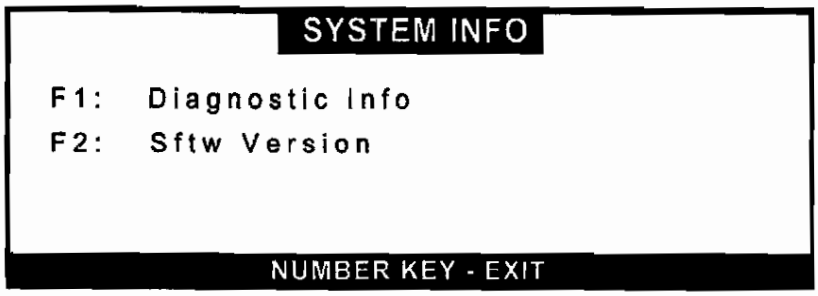

**Note:** Record the "V Low" and "V High" values in the spaces provided in the above screen for future reference in case of system data loss.

28. Press "F4" to return to the System Info screen.

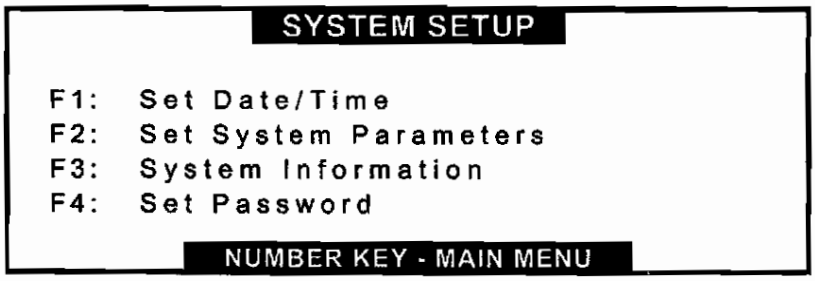



29. Press "F2" to activate the Software Version screen.


30. Press any key to return to the System Info screen.




30. Press any number key to return to the System Setup screen.



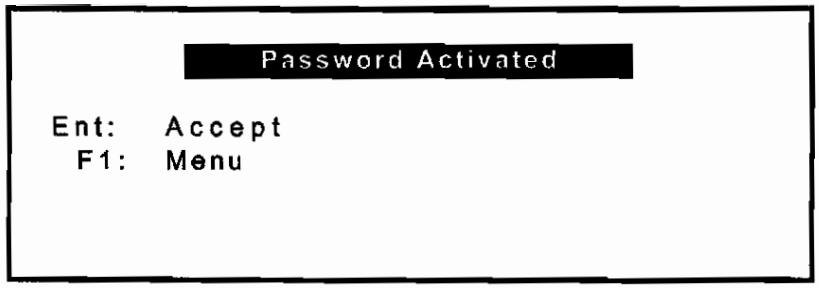

31. Press "F4" to activate the Set Password screen.


**Note**: Activation of a password prevents unauthorized usage of the MAS-7000. Once a password is entered and activated, the instrument cannot be operated without entry of the proper password.

**CAUTION**

To avoid rendering the instrument inoperative, ensure that any activated password is recorded or documented for later retrieval.

32. If a password is not desired, press "F4" to exit and return to the System Setup screen. If a password is to be entered, press "F1" to activate the Password Activated screen.



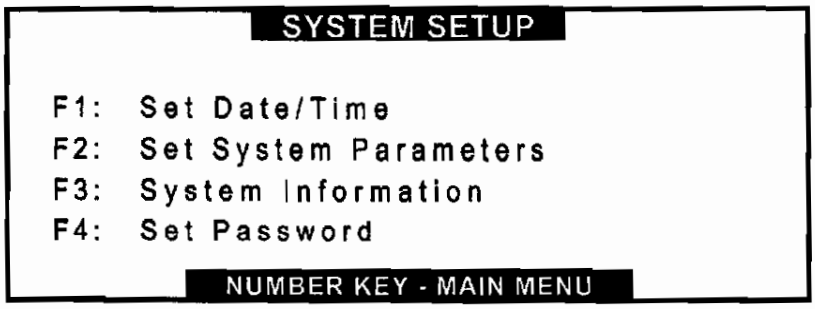

33. Press "Enter."


34. Using the numeric keys and the "right" arrow key, enter the selected password (8 letters and/or numbers maximum). (Example: For the password CEM, press "1" four times; press "2" three times; and press "5" two times.) If an error is made during entry, use the "left" and "right" arrow keys to move cursor to letter or number to be corrected. Press the applicable numeric key the appropriate number of times to select the correct letter or number. Note: A space is not permitted as part of a password.

35. Press "Enter."

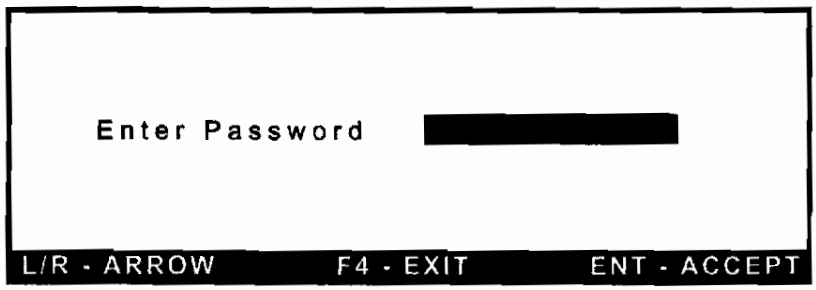

**Note:** If password is entered incorrectly or if the password is to be altered or changed, press "F1" to clear the existing password and enter the selected (new) password.

36. Press "Enter" to accept the password and return to the System Setup screen.




**Note:** When the password is entered and accepted, it will be required prior to system operation.

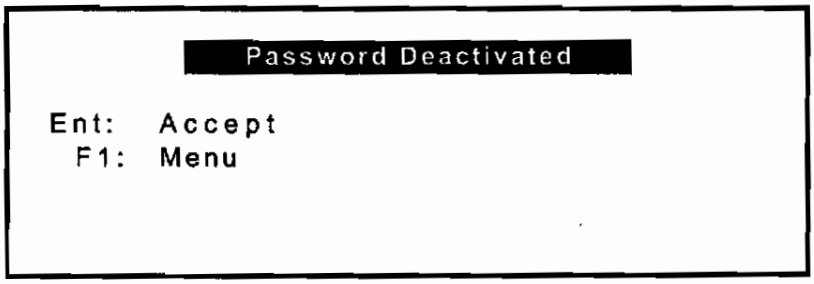
37. If the password is to be deactivated, press "F4" to activate the Password screen.



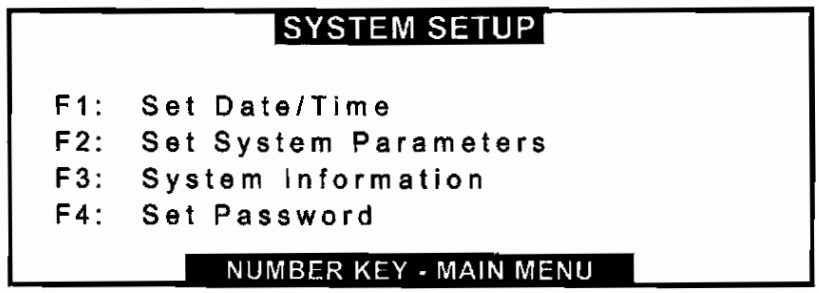

38. Using the numeric keys and the "right" arrow key (for double letter entry), enter the accepted password.

39. Press "Enter."

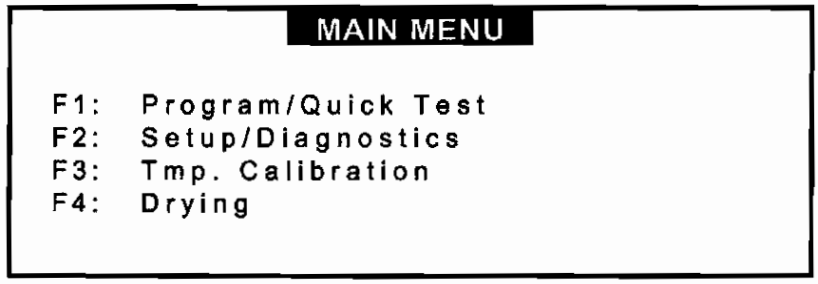

40. Press "F2" to deactivate the password.




41. Press "Enter" to accept deactivation of the password.



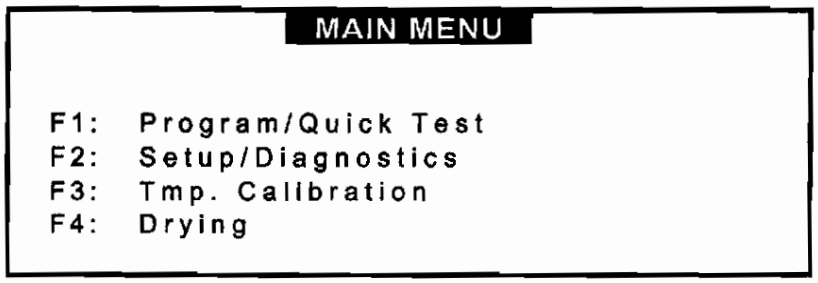

42. Press any numeric key to return to the Main Menu.



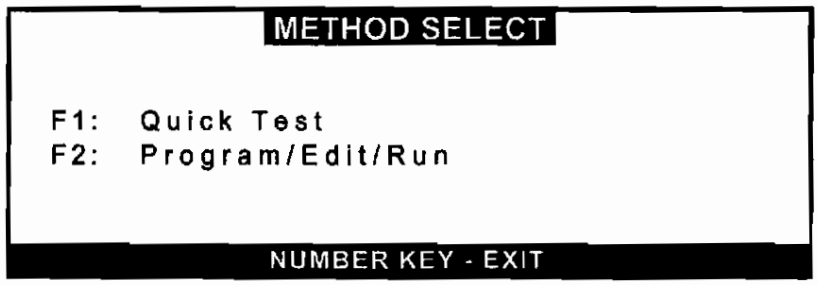
# IV Quick Test

Quick Test permits entry of temperature and dwell time for a one-time ashing procedure with either the standard weighing format (below) or with syringe weighing format (page 36). Programs which require ramping temperatures and stages of ashing times may be entered and stored in the instrument directory for quick recall (pages 43 through 47).

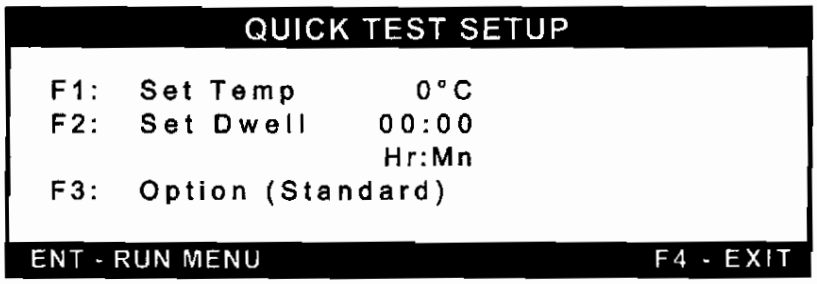
## (Standard Weigh Format)




1. Press "F1" to activate the Method Selection screen.




2. Press "F1" to activate the Quick Test screen.




**Note:** To change from standard weighing format to syringe weighing format, press "F3." Refer to page 36 for syringe weighing format instructions.

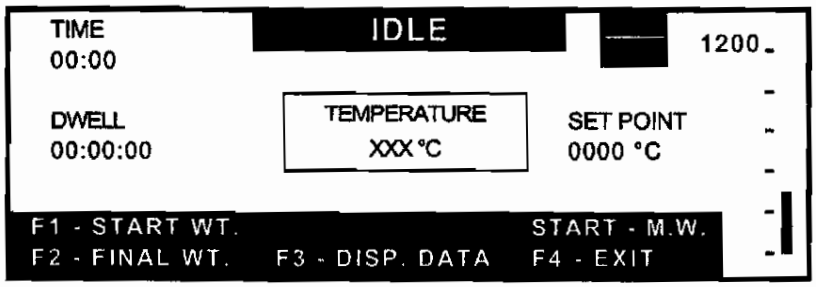
3. Press "F1." Using the numerical keyboard, enter the desired test temperature. (1200° C is the maximum permissible temperature.) Press "Enter."

**Note:** If a value greater than 1200° C is entered, the MAS-7000 will automatically default to 1200° C.

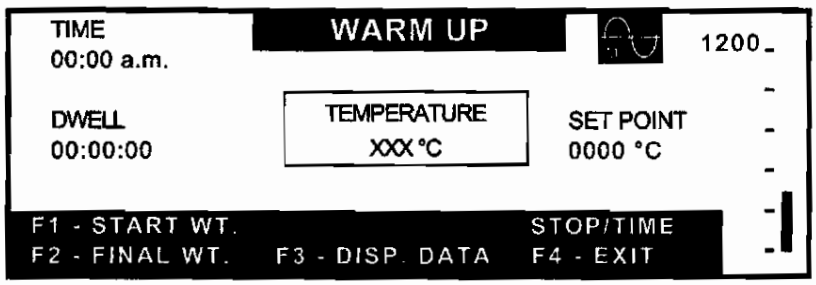
4. Press "F2." Using the numerical keyboard, enter the desired test dwell time. Time can be set for 1 minute to 99 hours and 99 minutes. (Examples: To enter 5 minutes, press "5"; to enter 1 hour, press "1," "0," "0.") Press "Enter."

**Note:** To edit test temperature or dwell time, repeat procedures outlined in step 3 and/or 4.

5. Press "Enter" to enter test parameters .



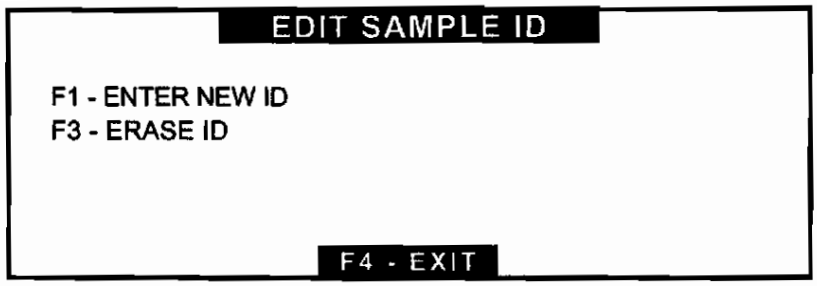

6. Press "Start" to activate microwaves to preheat furnace to set-point temperature.




**Note:** The temperature graph located on the right side of the display is designed to provide a visual representation of the furnace temperature. It will begin to rise as the furnace temperature increases. When the set-point temperature is reached, an audible beep will be heard, and the display will read "AT TEMP." The wavy line in the microwave indicator box indicates that microwaves are activated. The "M" in the lower left corner of the microwave indicator box indicates that the magnetron is on and producing microwaves. When the set-point temperature is reached, the magnetron will switch off and the "M" will no longer appear in the microwave indicator box. As the magnetron switches on and off to maintain the set-point temperature, the "M" will also alternate on and off.

7. For instruments not equipped with an external balance, proceed to step 29 to continue ashing of sample. For instruments equipped with an external balance, proceed as follows.

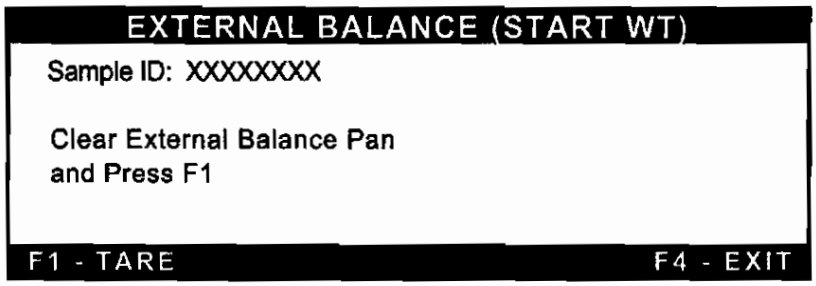
8. Press "F1."




9. Press "F1" to enter new sample identification.

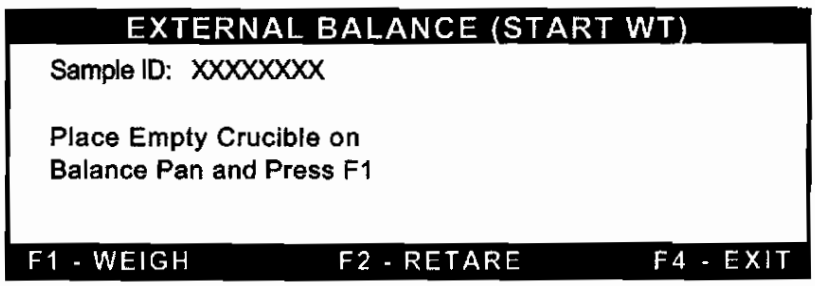

10. Using the numeric keys, enter the sample identification (8 letters, numbers and/or spaces maximum).

11. Press "Enter" to accept the sample identification.



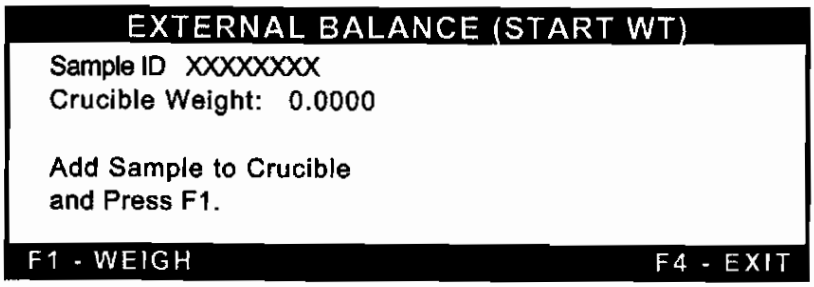

12. Ensure that external balance is free of any weight.

13. Press "F1" to tare external balance.

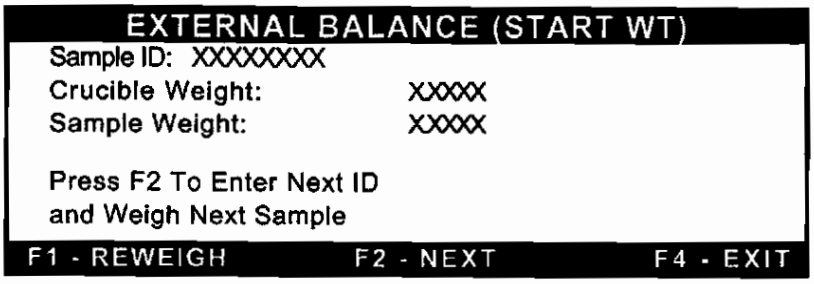



**Note:** If necessary, press "F2" to retare the external balance prior to placing empty sample dish on the balance.

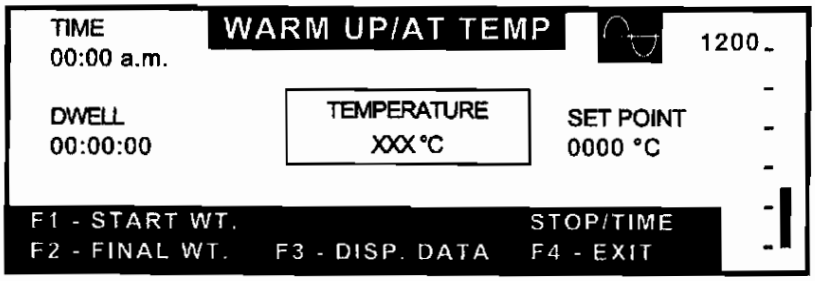
14. Place the empty sample dish on the external balance. Press "F1" to weigh the dish.




15. Place sample in the sample dish on the external balance and wait for the weight to stabilize. Press "F1." The MAS-7000 records the weight of the empty sample dish and the weight of the sample dish containing the sample.




16. Press "F2" to enter the next sample ID number and weigh the next sample, or press "F4" to exit to the next screen.




**WARNING**

To avoid the possibility of serious burns, ensure that insulated gloves are worn and metal tongs are used to insert and remove sample containers from the ashing furnace.

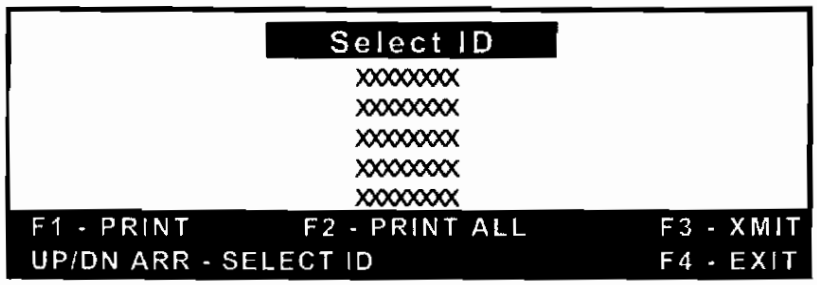
17. When the instrument has reached set-point temperature, open the instrument door and remove the ashing furnace door. Using metal tongs, place the ashing crucibles containing samples into the furnace. Install the furnace door, and close the instrument door. (The instrument door will not close if the furnace door is not properly installed.)

18. Press "Start" and "Time." The dwell time displayed will begin counting down when the furnace has reached the set-point temperature. When the dwell time is complete, an audible beep will be heard, signaling the end of the ashing time.

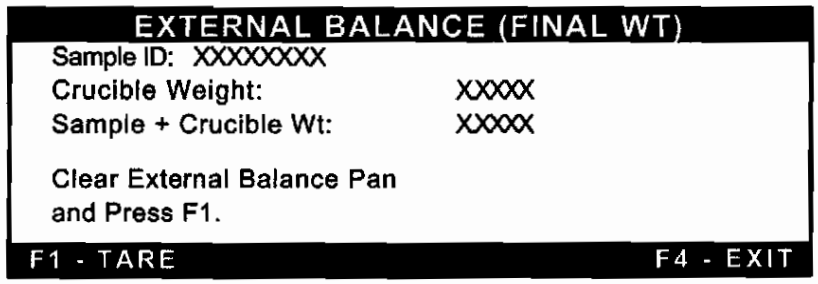
19. Open the instrument door and remove the furnace door. Using metal tongs, remove the ashing crucibles containing samples from the muffle furnace. Replace the furnace door and close the instrument door. Press "Start" to maintain set-point temperature.

20. For instruments not equipped with an external balance, proceed to step 29. For instruments equipped with an external balance, proceed as follows.

21. Press "F2" to determine final weight.

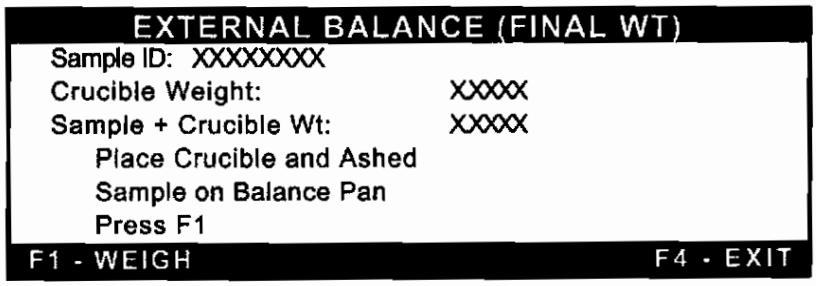



22. Using the "Up" and "Down" arrow keys, select the sample ID number to be weighed. Press "Enter."



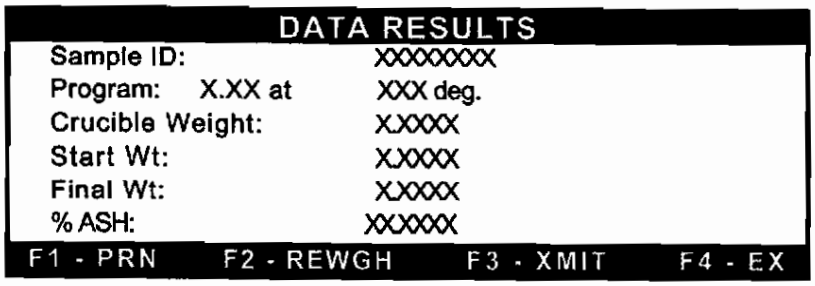

23. Ensure that external balance is free of any weight.

24. Press "F1" to tare external balance. A "TARING BALANCE" message will be displayed momentarily.



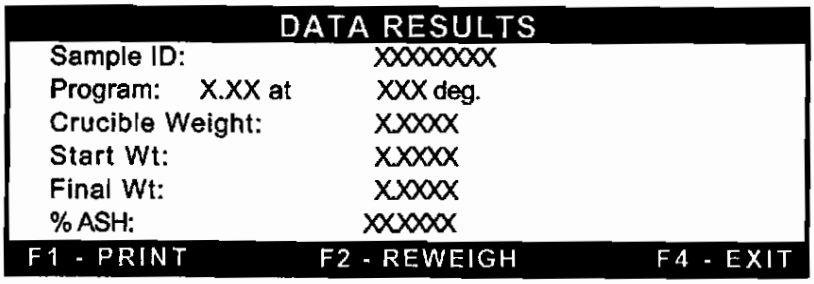
25. Place the sample dish containing the ashed sample on the external balance.

26. Press "F1" to weigh the ashed sample. The MAS-7000 calculates the percentage based on weights prior to and following ashing of the sample.

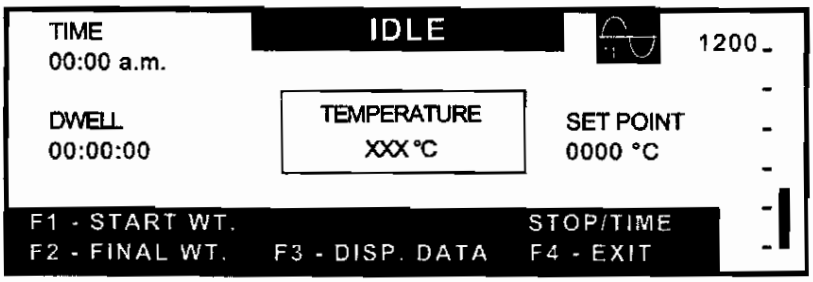



27. To print results, press "F1." To transmit data to external computer, press "F3." To weigh next sample, press "F4" and repeat steps 22 through 26.

**Note:** If necessary, press "F2" to reweigh sample.




28. After the final data screen is displayed, continue to press "F4" to exit to the Test Run screen.

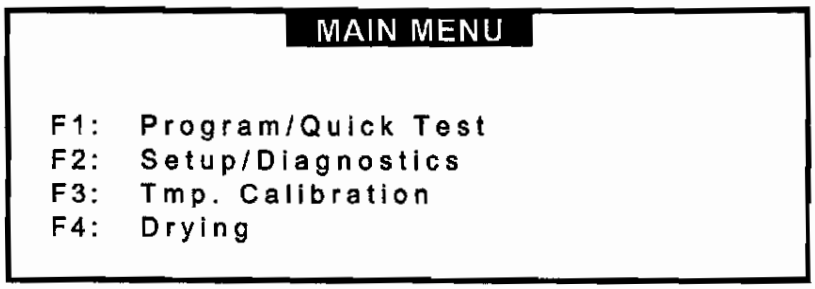



29. To ash additional samples using the same parameters (set-point temperature, dwell time), press "Start," and repeat applicable procedures outlined on pages 29 through 33.

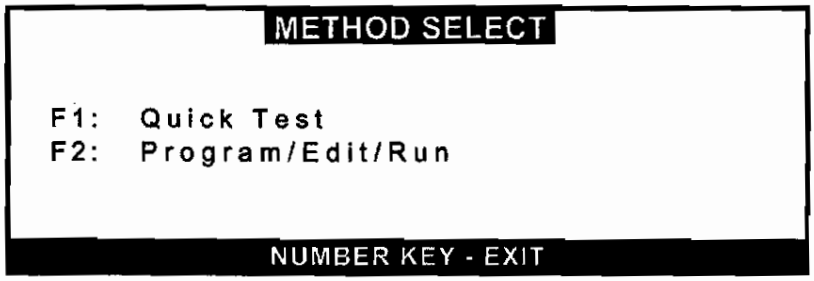
30. To ash additional samples with modified parameters (set-point temperature and dwell time), press "F4" to exit to the Quick Test Setup screen and repeat the applicable procedures on pages 29 through 33.

31. To end the Quick Test program, press "F4" to exit to the Quick Test Setup screen; press "F4" to exit to the Method Selection screen, and press any numeric key to return to the Main Menu.

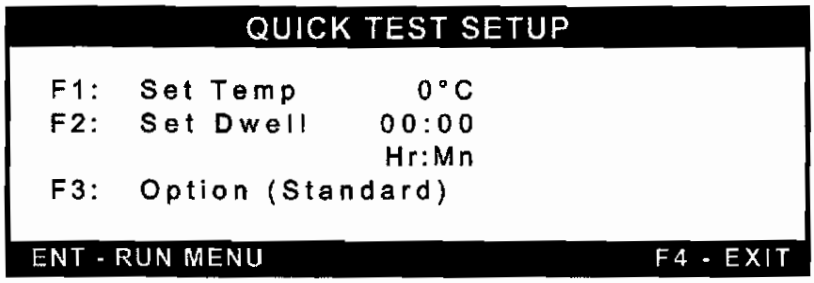
**(Syringe Weigh Format)**




1. Press "F1" to activate the Method Selection screen.




2. Press "F1" to activate the Quick Test screen.



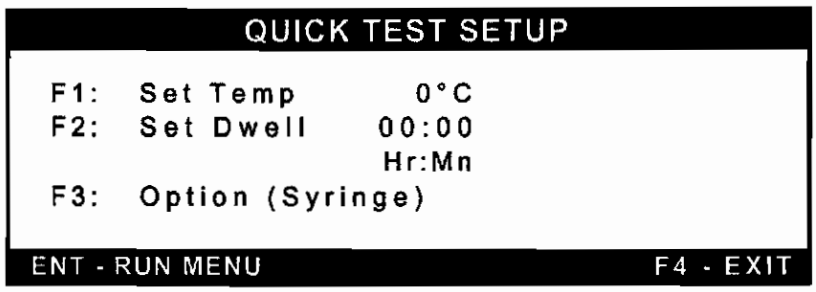

3. Press "F1." Using the numerical keyboard, enter the desired test temperature. (1200° C is the maximum permissible temperature.) Press "Enter."

**Note:** If a value greater than 1200° C is entered, the MAS-7000 will automatically default to 1200° C.

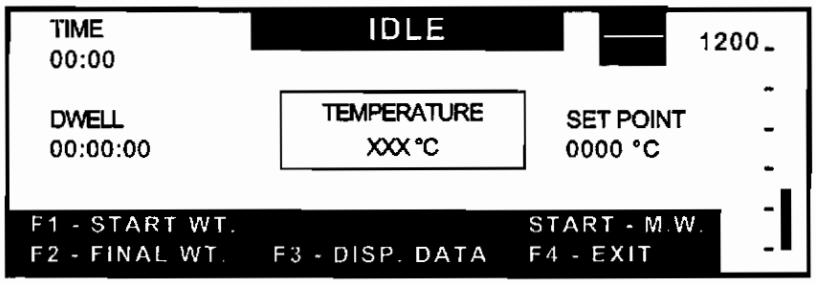
4. Press "F2." Using the numerical keyboard, enter the desired test dwell time. Time can be set for 1 minute to 99 hours and 99 minutes. (Examples: To enter 5 minutes, press "5"; to enter 1 hour, press "1," "0," "0.") Press "Enter."

**Note:** To edit test temperature or dwell time, repeat procedures outlined in step 3 and/or 4.

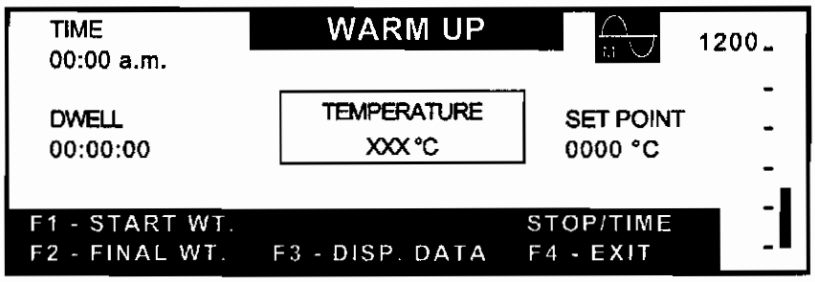
5. Press "F3" to change from standard weighing format to syringe weighing format.




6. Press "Enter" to enter test parameters .

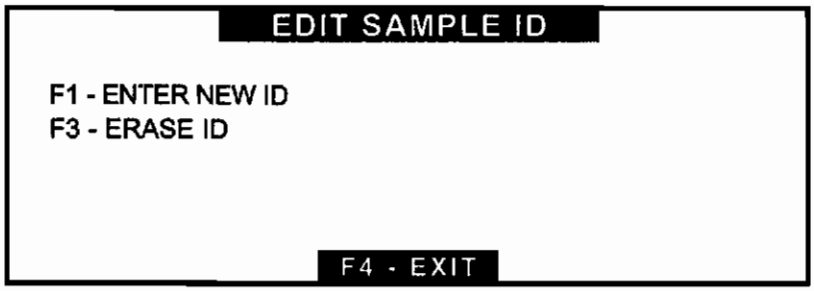



7. Press "Start" to activate microwaves to preheat furnace to set-point temperature.




**Note:** The temperature graph located on the right side of the display is designed to provide a visual representation of the furnace temperature. It will begin to rise as the furnace temperature increases. When the set-point temperature is reached, an audible beep will be heard, and the display will read "AT TEMP." The wavy line in the microwave indicator box indicates that microwaves are activated. The "M" in the lower left corner of the microwave indicator box indicates that the magnetron is on and producing microwaves. When the set-point temperature is reached, the magnetron will switch off and the "M" will no longer appear in the microwave indicator box. As the magnetron switches on and off to maintain the set-point temperature, the "M" will also alternate on and off.

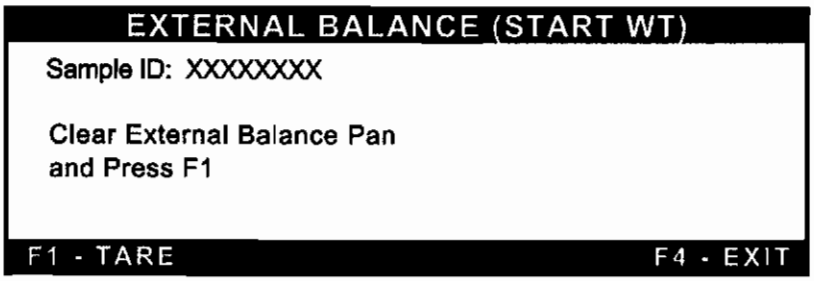
8. Press "F1."




9. Press "F1" to enter new sample identification.


10. Using the numeric keys, enter the sample identification (8 letters, numbers and/or spaces maximum).

11. Press "Enter" to accept the sample identification.

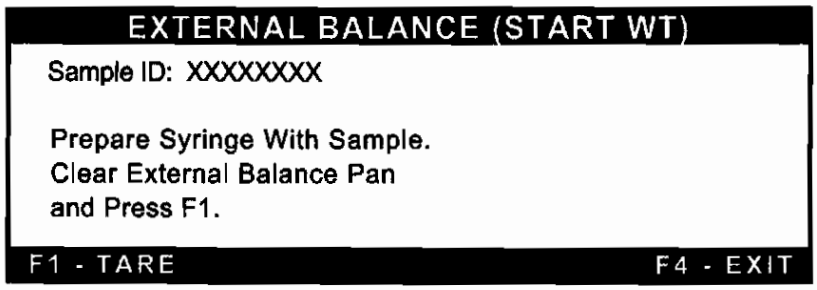



12. Ensure that external balance is free of any weight.

13. Press "F1" to tare external balance.


**Note:** If necessary, press "F2" to retare the external balance prior to placing empty sample dish on the balance.

14. Place the empty sample dish on the external balance. Press "F1" to weigh the dish.

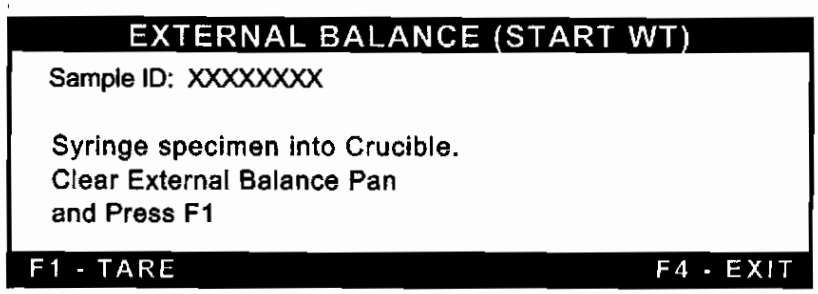



15. Ensure that external balance is free of any weight.

16. Press "F1" to tare external balance.

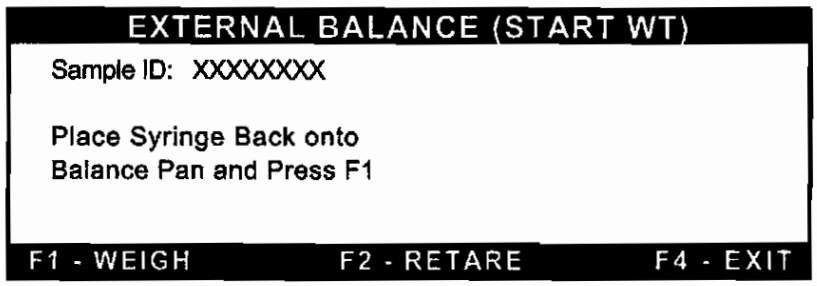

**Note:** If necessary, press "F2" to retare the external balance prior to placing syringe on the balance.

17. Place the syringe with sample on the external balance. Press "F1" to record the weight of the syringe with sample.

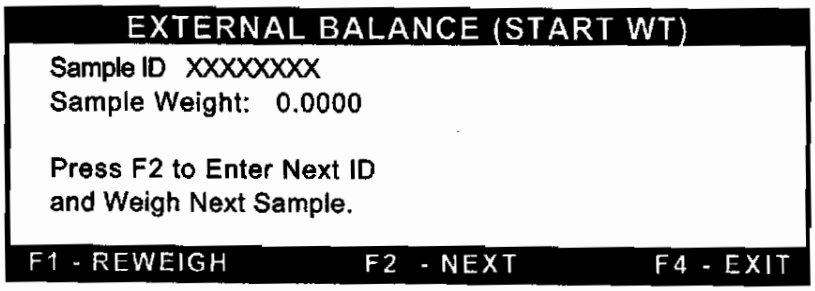



18. Ensure that external balance is free of any weight. Press "F1" to tare external balance.

19. Dispense sample from syringe into empty crucible.

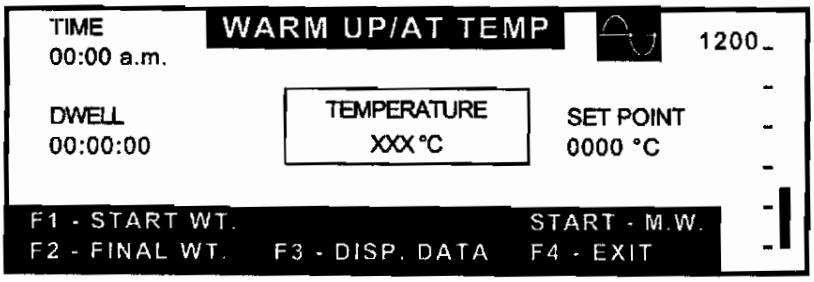


20. Place the empty syringe on the external balance pan. Press "F1." The following screen will appear with initial sample weight.




**Note:** If necessary, press "F1" to reweigh the sample. To weigh additional samples, press "F2" to enter a sample identification name and/or number and repeat previous instructions.

21. Press "F4" to exit to the next screen.




**WARNING**

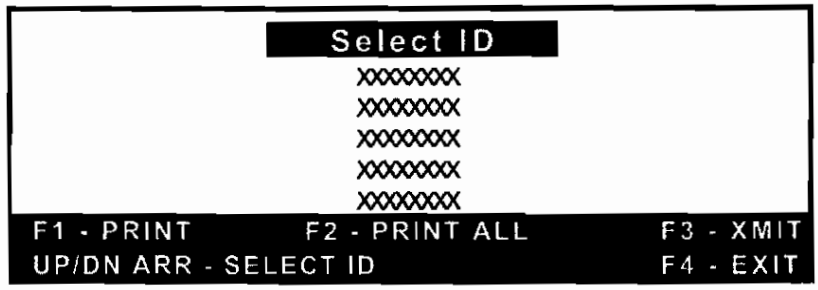
To avoid the possibility of serious burns, ensure that insulated gloves are worn and metal tongs are used to insert and remove sample containers from the ashing furnace.

22. When the instrument has reached set-point temperature, open the instrument door and remove the ashing furnace door. Using metal tongs, place the ashing crucibles containing samples into the furnace. Install the furnace door, and close the instrument door. (The instrument door will not close if the furnace door is not properly installed.)

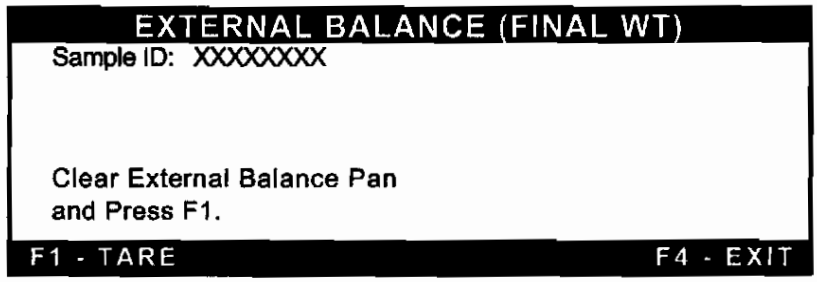
23. Press "Start" and "Time." The dwell time displayed will begin counting down when the furnace has reached the set-point temperature. When the dwell time is complete, an audible beep will be heard, signaling the end of the ashing time.

24. Open the instrument door and remove the furnace door. Using metal tongs, remove the ashing crucibles containing samples from the muffle furnace. Replace the furnace door and close the instrument door. Press "Start" to maintain set-point temperature.

25. Press "F2" to determine final weight.

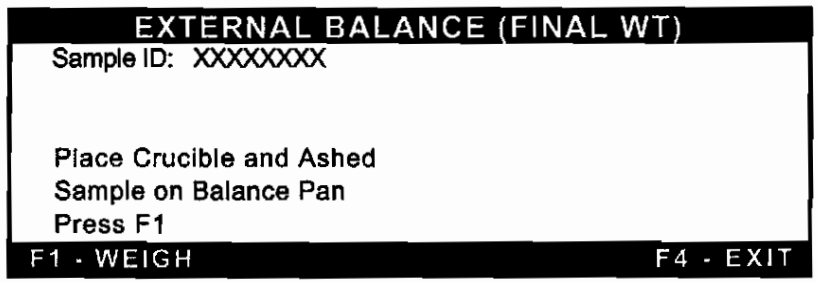



26. Using the "Up" and "Down" arrow keys, select the sample ID number to be weighed. Press "Enter."



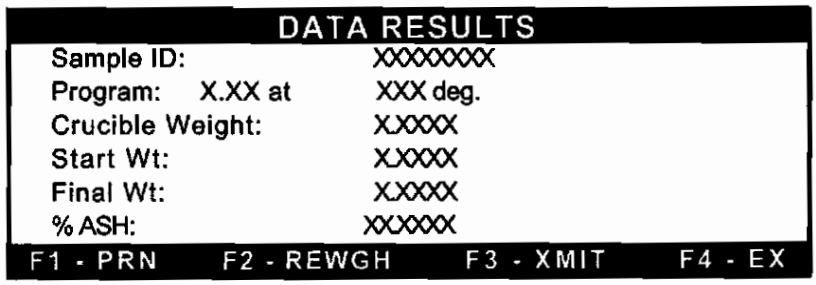

27. Ensure that external balance is free of any weight.

28. Press "F1" to tare external balance. A "TARING BALANCE" message will be displayed momentarily.




29. Place the sample dish containing the ashed sample on the external balance.

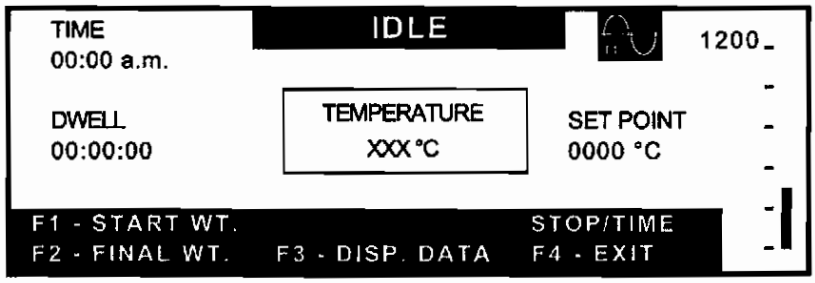
30. Press "F1" to weigh the ashed sample.



31. To print results, press "F1." To transmit data to external computer, press "F3." To weigh next sample, press "F4" and repeat applicable steps.

**Note:** If necessary, press "F2" to reweigh sample.


32. After the final data screen is displayed, continue to press "F4" to exit to the Test Run screen.




33. To ash additional samples using the same parameters (set-point temperature, dwell time), press "Start," and repeat applicable procedures.

34. To ash additional samples with modified parameters (set-point temperature and dwell time), press "F4" to exit to the Quick Test Setup screen and repeat the applicable procedures.

## Drying Program

1. To activate the drying program, press "F4" from the Main Menu and follow procedures outlined from step 3, page 29, through step 28, page 34

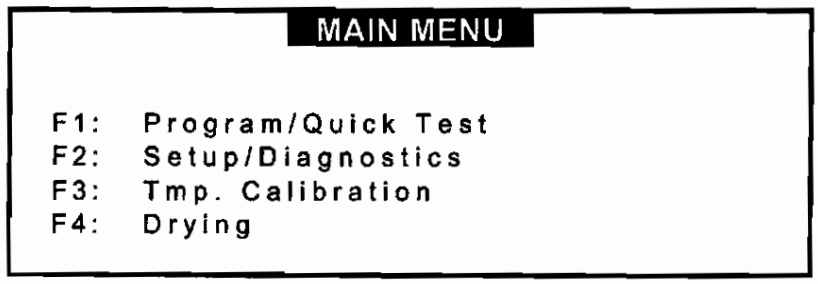
**NOTE**

The drying program is designed to be utilized only when operating the MAS-7000 at temperatures below 350° C. This program should be used for drying of samples only – never for ashing purposes.

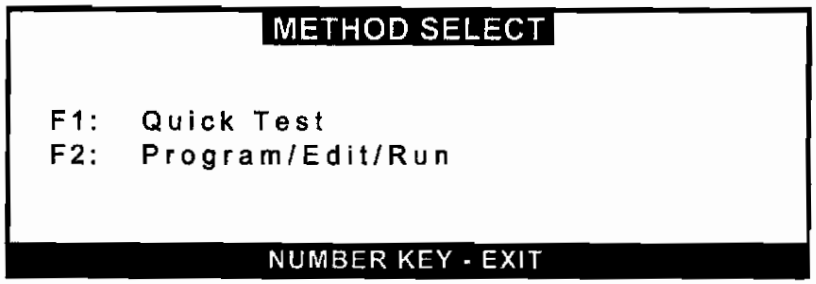
# V Program/Edit/Run

Program/Edit/Run permits entry and storage of ashing programs for a variety of different sample types (20 program capacity). Up to 8 cycles with varying temperatures, ramp and dwell times can be stored in each program. To enter, store and edit programs, follow procedures outlined below (pages 43 through 46).

### Program




1. Press "F1" to activate the Method Selection screen.



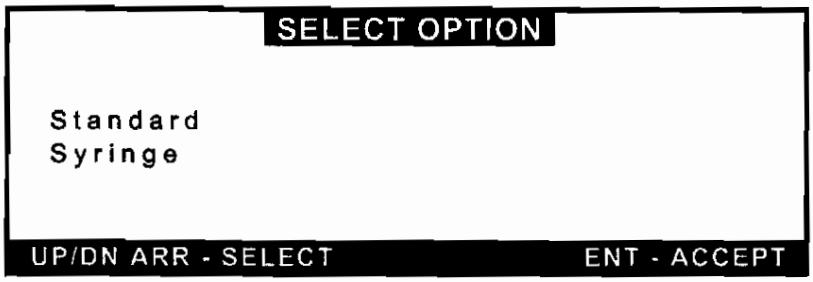

2. Press "F2" to activate the Program/Edit/Run screen.


3. Press "F1" to enter and store a new program in memory.

**Note:** Press "F2" to activate the program directory for a listing of available programs. Press "F3" to delete a program from the directory. Press "0" to edit parameters of a program. Press "1" to print the program directory, a selected program, or all stored programs. Press "Enter" to perform a selected ashing program.

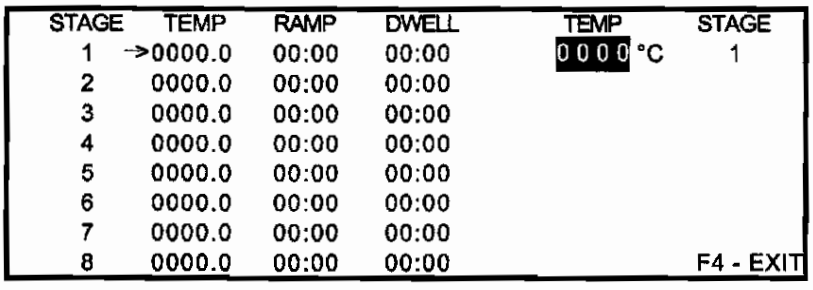

4. Using the numeric keyboard, enter the selected program name (16 letters, numbers and/or spaces maximum). (Example: For the program "Paper 1," press "6" two times, "1" two times, "6" two times, "2" three times, "6" four times, ".(dot)" two times, and "1" 1 time.

5. Press "Enter" to proceed to the next screen.




6. Using the "up" and "down" arrow keys, select standard weighing function or syringe weighing function.

7. Press "ENTER" to accept selection and proceed to the next screen.




**Note:** The internal temperature controller permits programming for up to eight cycles (stages 1 - 8) with different operating parameters. The dwell time for each cycle does not begin countdown until the selected temperature for that cycle has been reached.

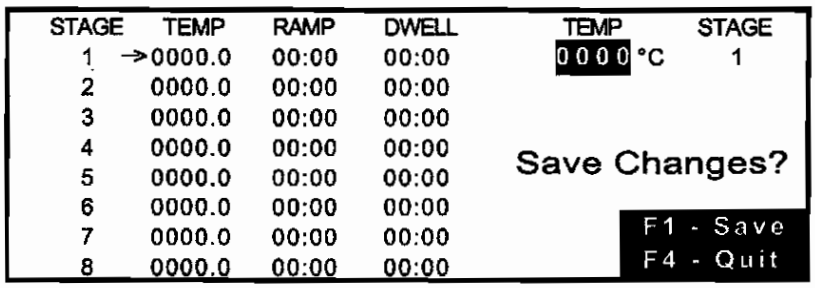
When selecting heating rates for a ramping program, follow the table below as a guide for the maximum rates which can be obtained.

| ° C Range | °C Min. | Line Voltage |
|---|---|---|
| 25 - 100 | 29/min. | 208 - 230V |
| 100 - 300 | 27/min. | 208 - 230V |
| 300 - 500 | 22/min. | 208- 230V |
| 500 - 800 | 16/min. | 208 - 230V |
| 800 - 1200 | 9/min. | 208 - 230V |

**Note:** Maximum rates will be slightly higher when using a 220/240V MAS-7000.

8. Using the numeric keyboard, enter the program parameters (set-point temperature, ramp time and dwell time for the applicable number of stages). After each entry, press "Enter." The entry arrow will advance to the next parameter. To edit parameters, use the "Up" and "Down" arrow keys to position the entry arrow on the parameter to be edited.

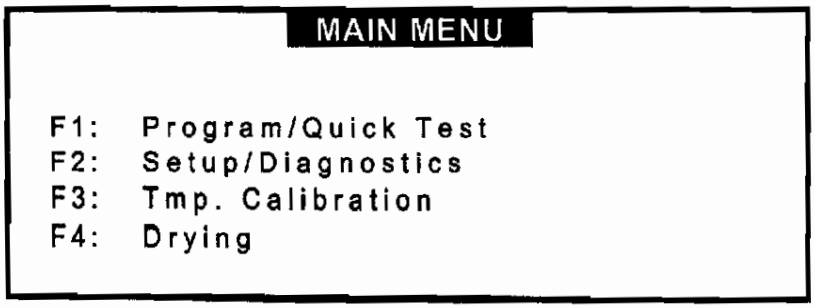
9. Press "F4" to exit.



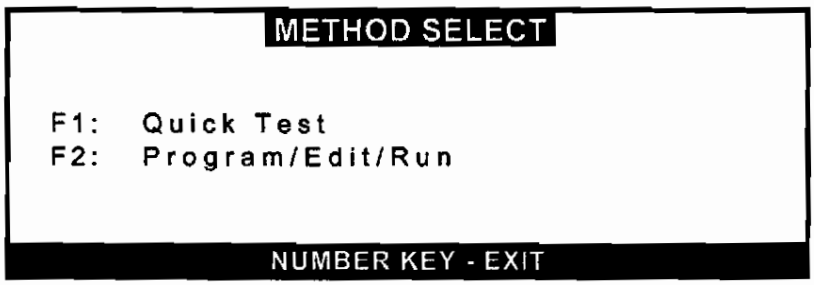

10. Press "F1" to save the entered program parameters and return to the Select Program screen.


**Note:** To perform a program, refer to page 48, "Run," and follow procedures outlined in steps 4 through 30. To end instrument operation, press "F4" to exit to the Method Selection screen; then press any numerical key to exit to the Main Menu.

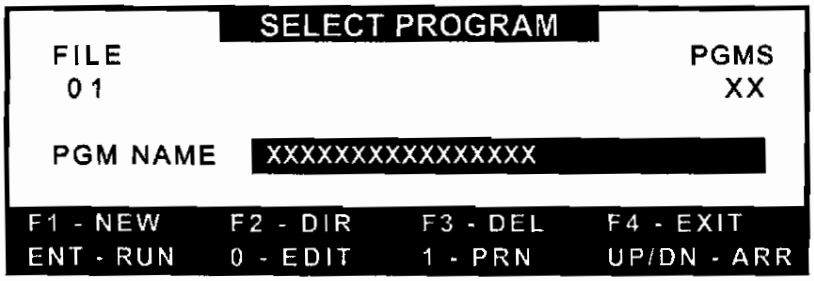
## Edit




1. Press "F1" to activate the Method Selection screen.



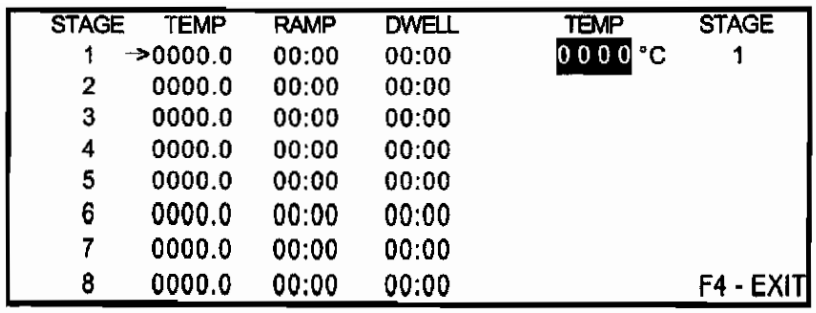

2. Press "F2" to activate the Program/Edit/Run screen.




3. Using the "up" and/or "down" arrow keys, select the program for which parameters are to be edited.

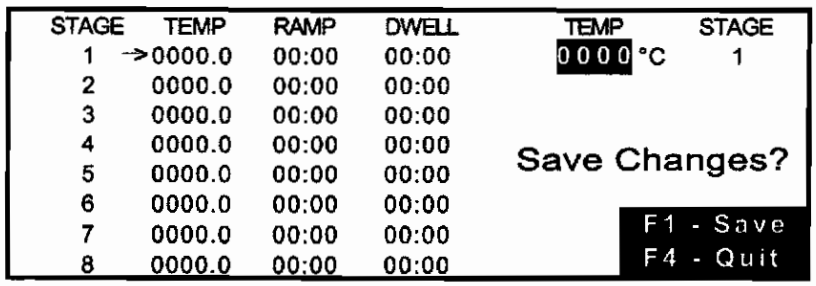
4. Press "0" to activate the Edit Program screen.


5. To accept the program being displayed, press "ENTER."

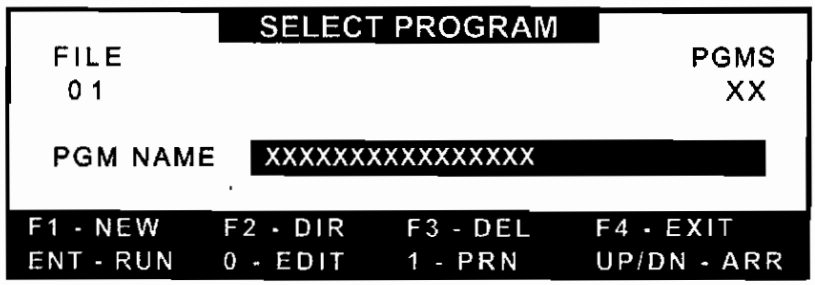



6. Using the arrow keys, position the entry arrow on the parameter to be edited. Using the numeric keys, enter the new parameter. Continue this process until all necessary parameters have been edited.

7. Press "F4" to exit.




8. Press "F1" to save the edited program parameters and return to the Select Program screen.

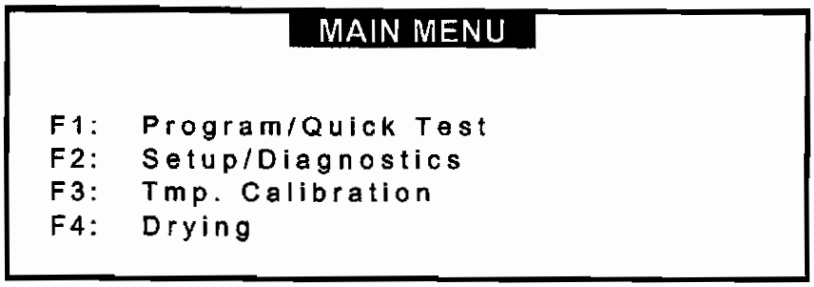



9. To accept the program being displayed, press "ENTER."

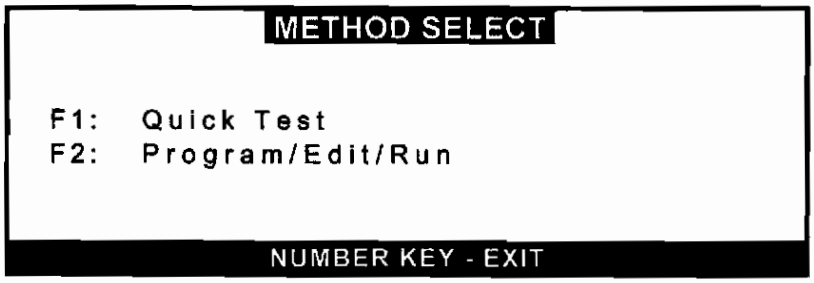
10. Press "Enter" to advance to the next screen.

**Note:** To perform a programmed ashing procedure, proceed to step 5 and follow instructions as outlined. To end instrument operation, press "F4" to exit to the Method Selection screen; then press any numeric key to exit to the Main Menu.

## Run




1. Press "F1" to activate the Method Selection screen.

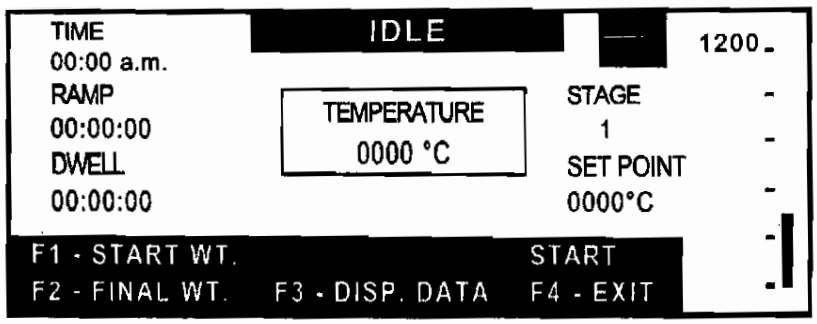



2. Press "F2" to activate the Program/Edit/Run screen.


3. Using the "up" and/or "down" arrow keys, select the desired program.

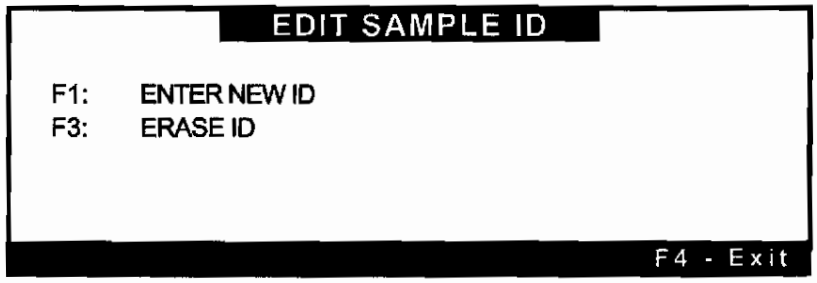
**Note:** Press "F1" to create a new program. Press "F2" to view the program directory. Press "F3" to erase a program from the directory. Press "0" to edit parameters of a stored program. Press "1" to print the program directory, a selected program, or all stored programs.

4. Press "Enter" to perform the selected program.




5. For instruments not equipped with an external balance, proceed to step 29 to continue ashing of sample. For instruments equipped with an external balance, proceed as follows.

6. Press "F1."

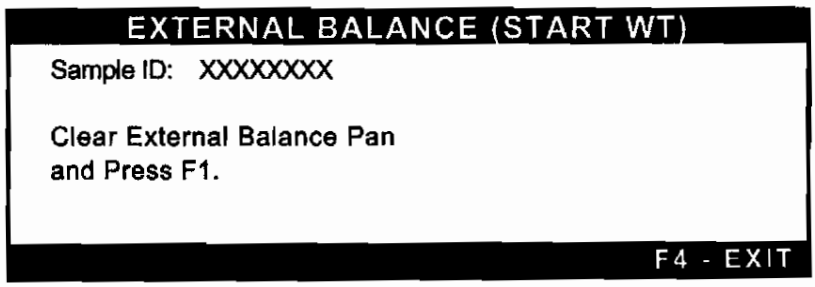



7. Press "F1" to enter new sample identification. Press "F3" to erase an identification.


8. Using the numeric keys, enter the sample identification (8 letters, numbers and/or spaces maximum).

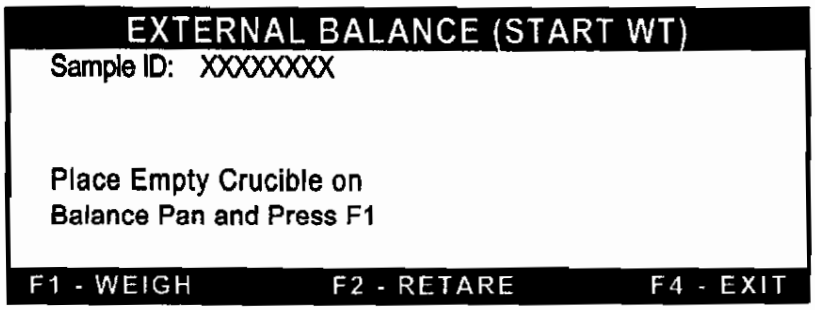
9. Press "Enter" to accept the sample identification.

**Note:** If using syringe weighing function, omit steps 10 through 13, page 50, and perform steps 13 through 21, pages 38 through 40.



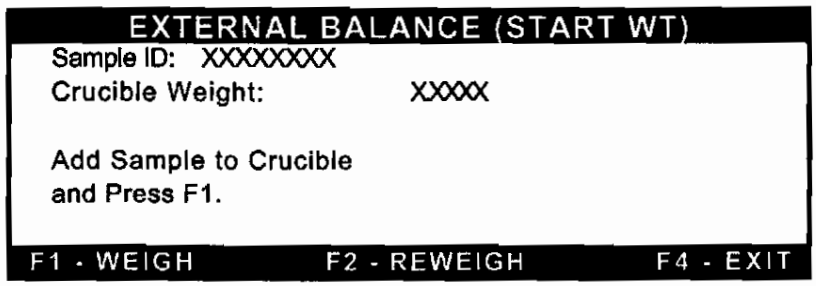
10. Ensure that external balance is free of any weight.

11. Press "F1" to tare external balance.

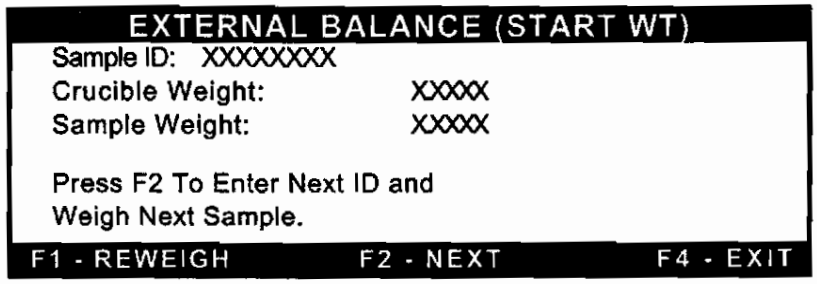



**Note:** If necessary, press "F2" to retare the external balance prior to placing empty sample dish on the balance.

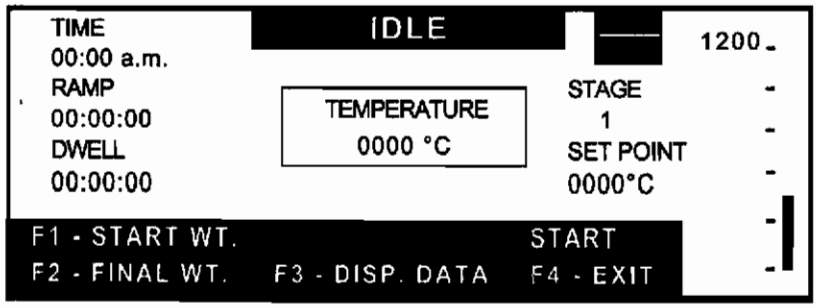
12. Place the empty crucible on the external balance and press "F1" to weigh the crucible.




13. Place sample in the crucible on the external balance and wait for the weight to stabilize. Press "F1." The MAS-7000 records the weight of the empty crucible and the weight of the crucible containing the sample.




14. Press "F2" to enter the next ID number and weigh the next sample. Press "F4" to exit to the next screen.

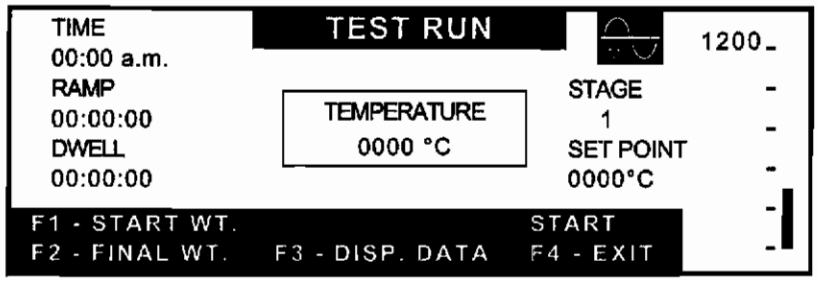



**WARNING**

To avoid the possibility of serious burns, ensure that insulated gloves are worn and metal tongs are used to insert and remove sample containers from the ashing furnace.

15. Open the instrument door and remove the ashing furnace door. Using metal tongs, place the ashing crucibles containing samples into the furnace. Install the furnace door, and close the instrument door. (The instrument door will not close if the furnace door is not properly installed.)

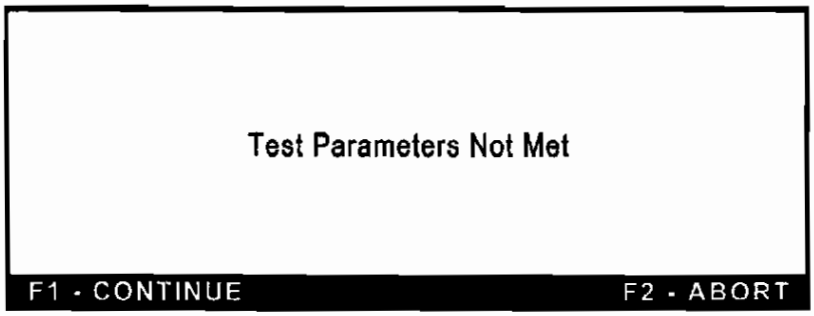
16. Press "Start" to activate microwaves and begin test.




**Note:** The temperature graph located on the right side of the display is designed to provide a visual representation of the furnace temperature. It will begin to rise as the furnace temperature increases. When the set-point temperature is reached, an audible beep will be heard. The wavy line in the microwave indicator box indicates that microwaves are activated. The "M" in the lower left corner of the microwave indicator box indicates that the magnetron is on and producing microwaves. When the set-point temperature is reached, the magnetron will switch off and the "M" will no longer appear in the microwave indicator box. As the magnetron switches on and off to maintain the set-point temperature, the "M" will also alternate on and off.

17. The ramp time for stage 1 will begin counting down. When the ramp time is complete, the dwell time for stage 1 will begin counting down. Ramp time and dwell time will continue through each programmed stage. When the final dwell time is complete, an audible beep will be heard, signaling the end of the ashing procedure.

18. If insufficient ramp time is programmed, and the set-point temperature is not achieved, au audible tone will be heard, and the display will alert the operator that conditions were not met.



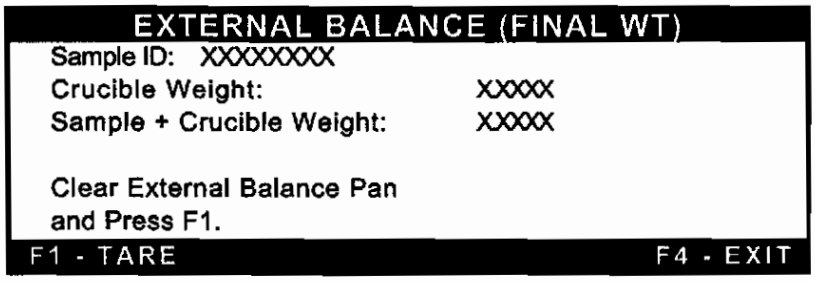

19. Press "F1" to continue the programmed stage although conditions were not met. Press "F2" to abort the test and reset program parameters.

20. Open the instrument door and remove the furnace door. Using metal tongs, remove the ashing crucibles containing samples from the muffle furnace.

21. For instruments not equipped with an external balance, proceed to step 29. For instruments equipped with an external balance, proceed as follows.

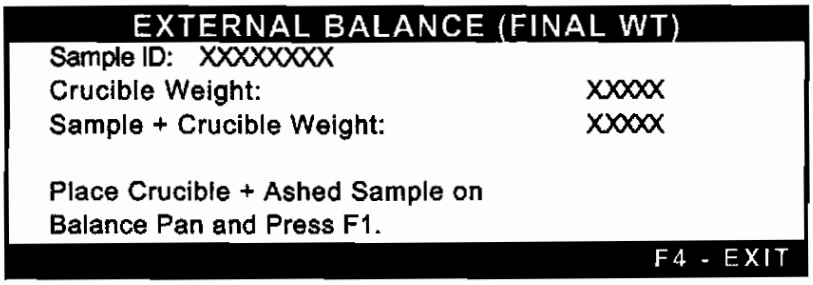
22. Press "F2" to determine final weight.

**Note:** To terminate an ashing procedure, press the Start/Stop key.




23. Ensure that external balance is free of any weight.

24. Press "F1" to tare external balance.



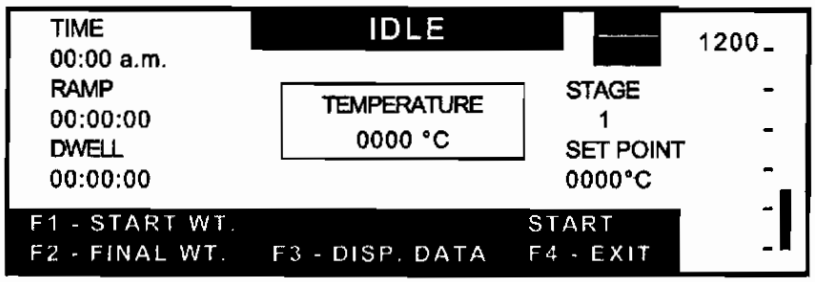
25. Place the sample dish containing the ashed sample on the external balance.

26. Press "F1" to weigh the ashed sample. The MAS-7000 calculates the percent ash and percent LOI based on weights prior to and following ashing of the sample.


27. Press "F1" to print results. To weigh the next sample, press "F4" and repeat steps 7 through 26.

**Note:** If necessary, press "F2" to reweigh sample.

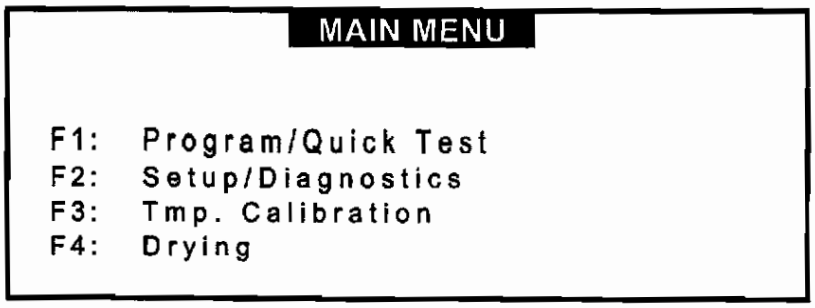
28. After the final data screen is displayed, press "F4" to exit to the Method Test screen.



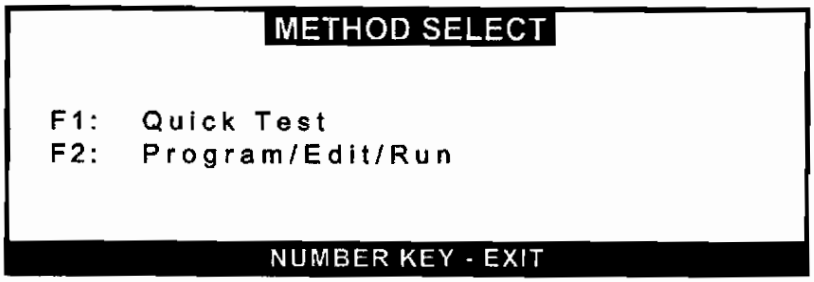

29. To ash additional samples using the same program, press "Start" and repeat applicable procedures outlined on pages 48 through 53.

30. To end the ashing program, press "F4" to exit to the Select Program screen; press "F4" to exit to the Method Selection screen; then press any numeric key to exit to the Main Menu.

## Program Deletion

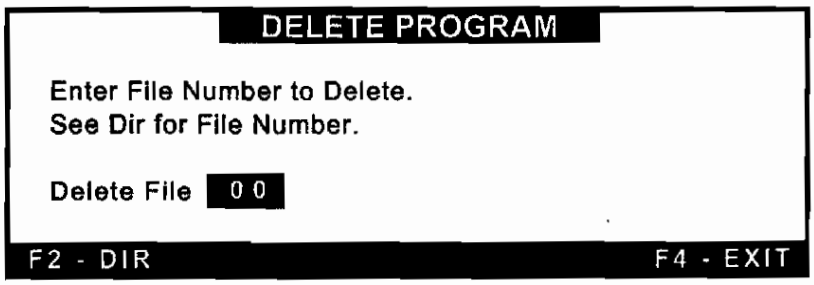



1. Press "F1" to activate the Method Selection screen.




2. Press "F2" to activate the Program/Edit/Run screen.

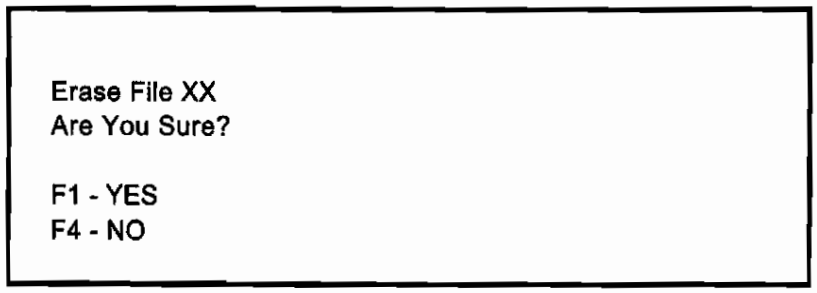

3. Press "F3" to activate the Delete (Erase) Program screen.




**Note:** Press "F2" to activate the directory to determine the file number to be deleted.

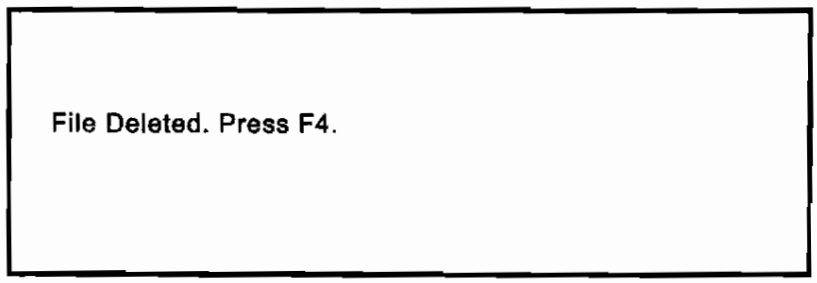
4. Using the numeric keys, enter the file number to be deleted from the directory.

5. Press "Enter."




6. Press "F1" to delete selected file.

**Note:** Press "F4" to cancel program deletion.




7. Press "F4" to exit to the Select Program screen; press "F4" to exit to the Method Selection screen; then press any numeric key to exit to the Main Menu.

# VI Maintenance, Troubleshooting and Service

Routine maintenance should be performed on the instrument to prolong the life of the instrument and minimize downtime. Basic operational troubleshooting procedures should be limited to replacement of defective sub-system components. For detailed instructions concerning service and repair, contact the CEM Corporation Service Department or your local distributor.

## Routine Maintenance

A monthly routine preventive maintenance program is recommended to ensure optimum performance of the MAS-7000.

**NOTE**

Failure to properly maintain the MAS-7000 will nullify the instrument warranty.

**Door, Seals and Interlocks** – Carefully inspect the door, door seals, and door interlock to verify that they are clean and working properly. Ensure that there is no loosening of or damage to the door hinges or latch. Ensure that the door closes securely.

**Cleaning Recommendations** – Routine cleaning of the instrument is necessary to prevent carbon buildup which can restrict air flow through the system, clog exhaust ports, and render the thermocouple inoperative. Scheduled (monthly) cleaning of the door seals, cavity interior and exhaust blower are necessary. For applications where carbonaceous buildup is more prevalent, a weekly inspection should be performed to detect the necessity for more frequent cleaning. Inspect and clean the MAS-7000 as follows:

1. Permit the instrument interior surfaces to cool to room temperature. Unplug the instrument from the electrical outlet.

2. Remove the screw in the thermocouple access door on top of the instrument cover and remove the access door.

3. Loosen the thermocouple nut and slide the thermocouple out of the instrument cavity. Using a soft cloth, clean the thermocouple. Inspect the thermocouple for any pitting and/or wear. Replace thermocouple as required. Place the thermocouple in an area where it will be safe from damage.

4. Remove the muffle furnace chamber.

5. Loosen the exhaust hose clamp and remove the exhaust hose.

6. Using a vacuum or soft bristle brush, clean the cavity exhaust outlet located on the back wall of the instrument cavity. Use a soft cloth and clean the outlet with an organic solvent such as varsol or alcohol.

7. Using a soft bristle brush with a handle long enough to reach all areas of the hose, clean the interior of the exhaust hose. Using a soft cloth, clean the hose with an organic solvent such as varsol or alcohol.

8. Using a soft cloth, clean the blades of the mode stirrer located in the ceiling of the instrument cavity. Use caution to avoid bending the blades, causing reduced power delivery.

9. Using a vacuum or soft bristle brush, clean the waveguide entry port located in the ceiling of the instrument cavity.

10. Using a vacuum, remove the debris caused by the above cleaning processes from the interior of the cavity.

11. Using a soft cloth and warm soapy water, clean the instrument cavity, door and door seal. Rinse and thoroughly dry cleaned areas.

12. Clean the muffle furnace chamber by operating the MAS-7000 for 15 minutes at 1200° C.

### Microwave Leakage Measurement

The door and cavity of the MAS-7000 are designed for durability and reliable operation under severe laboratory conditions. External radiation checks are performed on the instrument at several points in the manufacturing process to ensure that microwave leakage is only a fraction of that permitted by U.S. law (5 $mW/cm^2$).

The door of the MAS-7000 is equipped with a safety interlock system (figures 12 and 13, page 72) which stops the generation of microwave energy when the instrument door is ajar. If the interlock system fails, the fusible link to the magnetron will open, rendering the microwave power system inoperable.

To verify that door seals and interlock system are working properly, the MAS-7000 should be tested periodically for microwave leakage. Leakage measurements should also be performed at any time that damage to the instrument door has occurred or following replacement of any high voltage component. To test for microwave leakage, ensure that the muffle furnace is properly positioned within the instrument cavity and that the thermocouple is properly connected. Program the instrument for a quick test procedure. With the instrument operating in the pre-heat cycle, use a federally approved microwave leakage detector such as the Holaday Model HI-1500 and measure the microwave leakage around the door seal, at the louvers in the cover, and at the fan grills in the cover. Leakage should not exceed 5$mW/cm^2$. If the instrument shows excessive microwave leakage, do not attempt further operation. Contact the CEM Corporation Service Department or your local distributor.

Microwave test meters are available from CEM Corporation. CEM does not recommend use of inexpensive meters available in electronics stores because they lack the necessary sensitivity to properly test an instrument for microwave leakage.

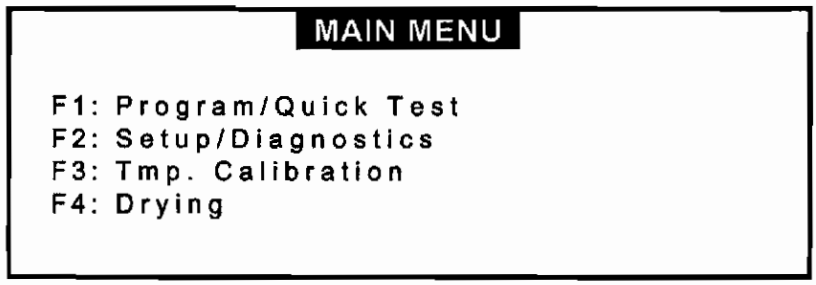
## Microwave Power Measurement

The MAS-7000 has a microwave power output of a minimum of 900 watts, at 100% power. Use the following procedures to determine power output.

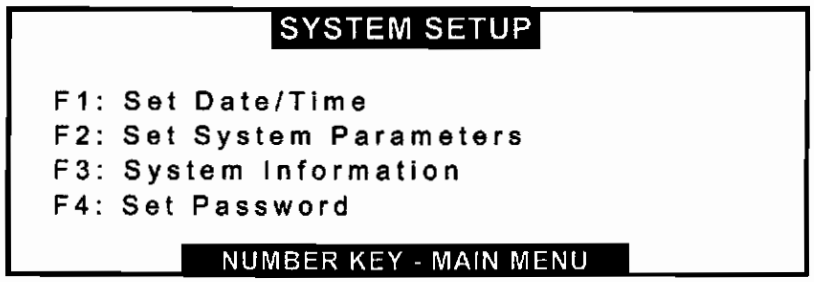
1. Permit the instrument to cool down to below 100° C. Ensure that the exhaust blower is not operating. Position the on/off switch in the "off" position. Unplug the instrument from the power receptacle.

2. Remove the thermocouple from the muffle furnace, and remove the muffle furnace from the instrument cavity.

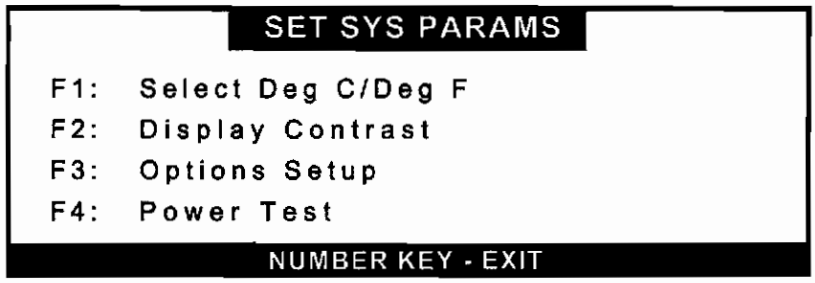
3. Plug the instrument into the power receptacle. Position the on/off switch in the "on" position.



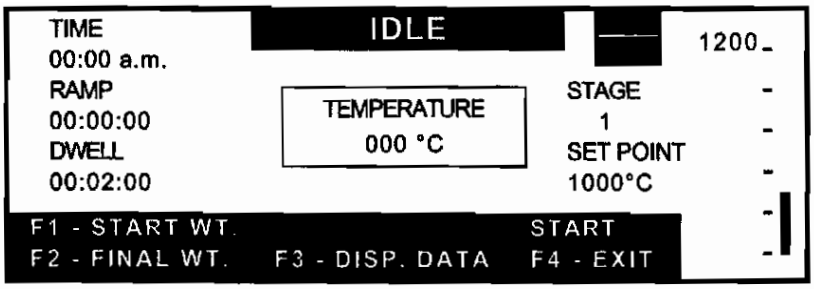

4. Press "F2" to activate the System Setup screen.




5. Press "F2" to activate the Set System Parameters screen.




6. Press "F4" to activate the Power Test screen.



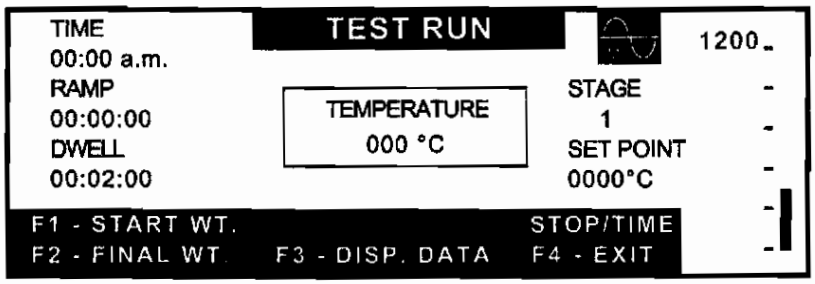

**Note:** The power test is programmed for 1000° C and 2 minutes time. The flat straight line in the microwave indicator box indicates that microwaves are not being produced.

7. Pour 1000 mL of room temperature water into a 1000 mL glass or polypropylene beaker. Using a thermometer with 0.1 degree C gradations, stir the water and measure its temperature. Record this temperature as the initial water temperature (Ti). Remove the thermometer from the container.

8. Open the instrument door, and carefully place the container of water in the center of the cavity. Gently close the door to avoid spilling the water.

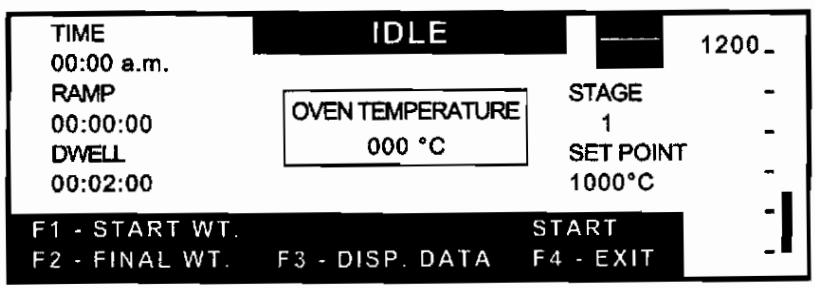
9. Press "Start."

10. Press "Time."




**Note:** The flashing wavy line and the "M" in the microwave indicator box indicate that microwaves are activated and being produced by the magnetron.

11. At the end of the 2-minute period, five short beeps will sound, signaling the end of the power test.




**Note:** The flat straight line in the microwave indicator box indicates that microwaves are not being produced.

12. Remove the container of water from the instrument cavity. Using the thermometer, stir the water for 30 seconds. Measure and record the peak temperature reading. This is the final water temperature (Tf).

13. Calculate microwave power output as follows:

**Power in Watts = 35 (Tf - Ti)**

14. If the measured power is below 900 watts, repeat the power measurement test by performing steps 5 through 12. If the measured power remains below 900 W, contact the CEM Corporation Service Department or your local distributor.

15. To end the power test, press "F4" to exit to the Set System Parameters screen; press any numeric key to exit to the System Setup screen; then press any numeric key to exit to the Main Menu.

## Temperature Verification

**NOTE**

A certified digital thermometer equipped with a universal keyed connector and usable with a type K thermocouple is required to perform a temperature verification. Thermometers are available from Fisher Scientific.

1. The MAS-7000 should be operating at a set-point temperature. Program the instrument and permit it to reach the set-point temperature.

2. When the set-point temperature is reached, remove the thermocouple access door from the top of the instrument (figure 7, p.12).

3. Connect the digital thermometer to the disconnected lead attached to the MAS-7000 thermocouple.

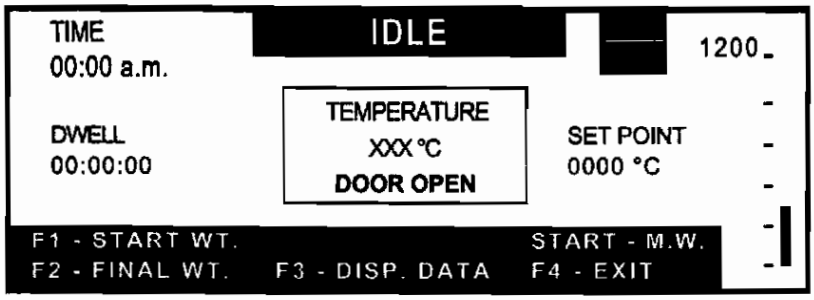
4. Compare the temperature readings of the MAS-7000 and the attached thermometer.

5. The temperature readings should be within ± 6° C. If the temperature difference is not within tolerance, calibrate the MAS-7000 per calibration procedures on page 73 and then repeat the above procedure.

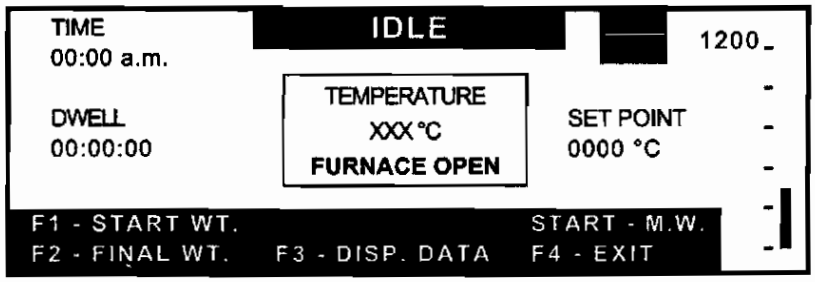
6. If the temperature variance remains out of tolerance and calibration of the digital thermometer is certified, the MAS-7000 thermocouple may require replacement. Contact CEM Service for further instructions.

## Error Messages

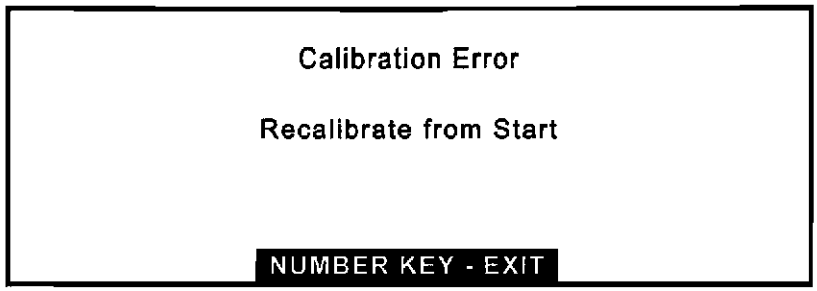
Due to improper system operation or component failure, the following error messages can appear on the display:



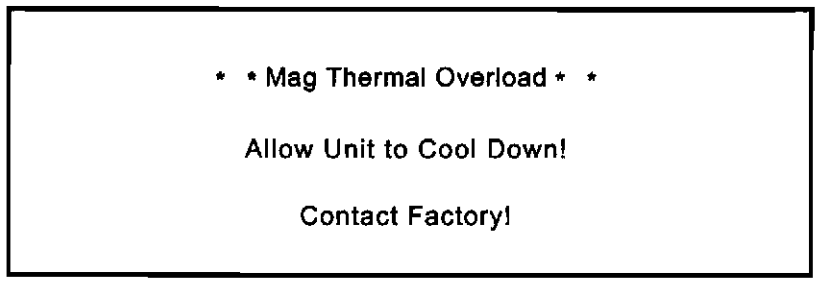

If the instrument door is not properly closed, the "Door Open" message will be displayed, and the keyboard will become inoperable. Ensure that the instrument door is properly closed. If the door is properly closed, but the "Door Open" message is still displayed, refer to the troubleshooting chart, page 66, and/or contact the CEM Service Department or your local distributor for service assistance.



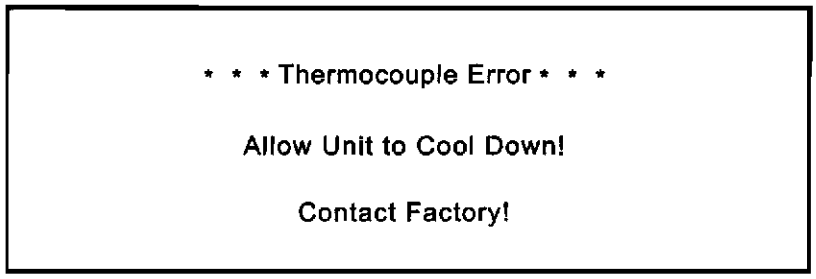

If the furnace door is not properly installed, permitting heat to escape from the furnace, the "Furnace Open" message will be displayed, and the keyboard will become inoperable. Ensure that the furnace door is properly installed. If the furnace door is properly installed, but the "Furnace Open" message is still displayed, refer to the troubleshooting chart, page 66, and/or contact the CEM Service Department or your local distributor for service assistance..



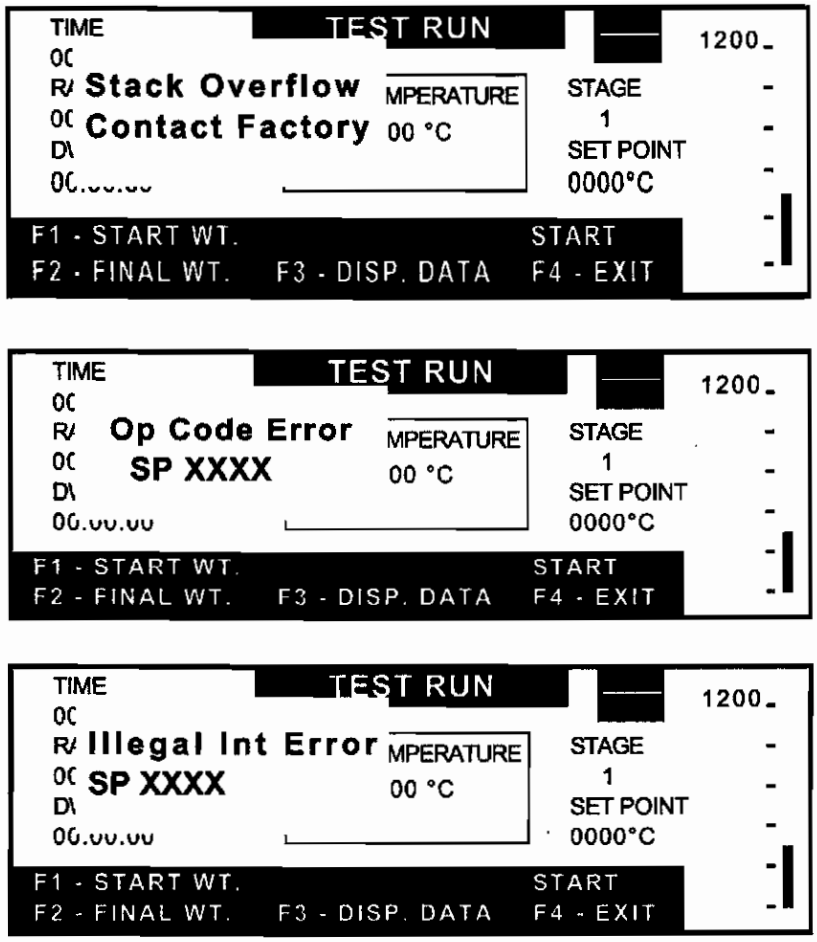

The above error message indicates that the instrument has been improperly calibrated or that the instrument detects a calibration error such as the "V High" calibration value remaining at "0" because the value was entered incorrectly. Refer to Calibration Procedures, page 73, and ensure that both "V High" and "V Low" calibration values are properly entered and recorded.




The above error message indicates that the magnetron has, for some reason, overheated. The procedure in progress will be terminated; the magnetron will turn off; and all fans will turn on to cool the instrument. Open the instrument door, leaving the furnace door in place, and permit the instrument to cool down to ambient (room) temperature prior to turning power off to instrument. Contact the CEM Service Department or your local distributor for service assistance.




The above error message indicates that the thermocouple is unable to measure temperature. If the temperature of the muffle furnace does not increase three degrees in a two-minute period, the magnetron will turn off; all fans will turn on; and the above message will appear. Permit the instrument to cool down to ambient (room) temperature prior to turning power off to instrument. Contact the CEM Service Department or your local distributor for service assistance.










The three above error messages indicate component failure. If any of these messages appears on the display, do not attempt further operation. Open the instrument door, ensure that the furnace door is closed, and permit the instrument to cool down to ambient (room) temperature. Call the CEM Corporation Service Department or your local distributor for service assistance.

## Troubleshooting

**WARNING**

The MAS-7000 utilizes high voltage and microwave radiation. Instrument service and repair must be undertaken only by technicians trained in the repair and maintenance of high voltage and microwave power systems.

The most important principle in troubleshooting the MAS-7000 is to check each component of the system separately and trace any malfunction to its source.

Verify each of these factors:

- Microwave Power (page 59)
- Analytical Method (Verify method of analysis.) If necessary, contact CEM Corporation of your local distributor for assistance.

In most cases, an analysis of the symptoms will lead to the area in which a defect is located. For example, if no microwave power is being produced, check the following components which affect microwave production:

- Fuses
- Door interlock switches
- High voltage and filament transformers, high voltage capacitor, magnetron and associated wiring
- Thermal switches
- Control boards

## Troubleshooting Guide

| Symptom | Possible Cause/Remedy |
|---|---|
| Instrument Inoperative | Verify line voltage.<br>Ensure that the instrument is properly connected to the electrical outlet and the instrument is switched on. Check fuses and replace, if necessary.<br>Check for loose or broken wiring connections. |
| Power Output | Verify that voltage selection switch is properly positioned for line voltage.<br>Verify line voltage.<br>Faulty mode stirrer motor* |
| Blank Display | Instrument is in a stand-by mode. |
| "Door Open" Message | Ensure that instrument door is properly closed.<br>Faulty interlock system* |
| "Furnace Open" Message | Ensure that furnace door is properly positioned. |
| No Microwaves | Verify proper operating procedure.<br>Faulty interlock system* |
| Keyboard Inoperative | Loose cable connection to PC board<br>Faulty PC board* |
| Thermocouple Error | Ensure that furnace is heating.<br>Ensure that thermocouple is properly connected.<br>Faulty connector<br>Faulty thermocouple<br>Thermocouple improperly calibrated<br>Verify line voltage.<br>Verify that voltage selection switch is properly positioned for line voltage.<br>Ensure that furnace is not overloaded.<br>Faulty PC board*<br>Faulty AC/DC board* |
| Balance Error | Loose connection<br>Balance unstable<br>Faulty balance* |
| Furnace Not Heating | Verify operating parameters.<br>Verify line voltage.<br>Varify that voltage selection switch is properly positioned for line voltage.<br>Faulty thermocouple connector<br>Faulty thermocouple<br>Faulty PC board* |
| Blower Assembly Inoperative | Loose cables to boards<br>Faulty thermocouple connector<br>Faulty thermocouple<br>Faulty PC board* |

*Contact CEM Service Department

## Service and Repair

**WARNING**

The MAS-7000 utilizes high voltage and microwave radiation. Instrument service and repair must be undertaken only by technicians trained in the repair and maintenance of high voltage and microwave power systems.

If damage to the MAS-7000 is detected, do not attempt further instrument operation. Contact the CEM Corporation Service Department or your local distributor.

CEM Corporation
Service Department
3100 Smith Farm Road
P.O. Box 200
Matthews, NC 28106-0200

**Within the United States**
(800) 726-5551
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Via Circonvallazione, 16
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It is recommended that service and repair by the user be limited to identifying and replacing defective sub-system modules such as printed circuit boards, transformers, fans, or motors. The user may find it convenient to stock an assortment of replacement parts to facilitate service procedures. A list of recommended spare parts is provided on page 77.

**WARNING**

To avoid possible electrical shock or exposure to microwave energy, disconnect instrument from electrical outlet prior to any disassembly procedures. Ensure that furnace is at room temperature prior to disconnecting instrument from electrical outlet.

**CAUTION**

Prior to lifting the instrument cavity for service to pedestal components, the thermocouple must be removed from the muffle furnace, and the muffle furnace must be removed from the instrument cavity to avoid possible damage to the thermocouple due to the weight of the furnace and/or to the instrument door due to heat escaping from the furnace.

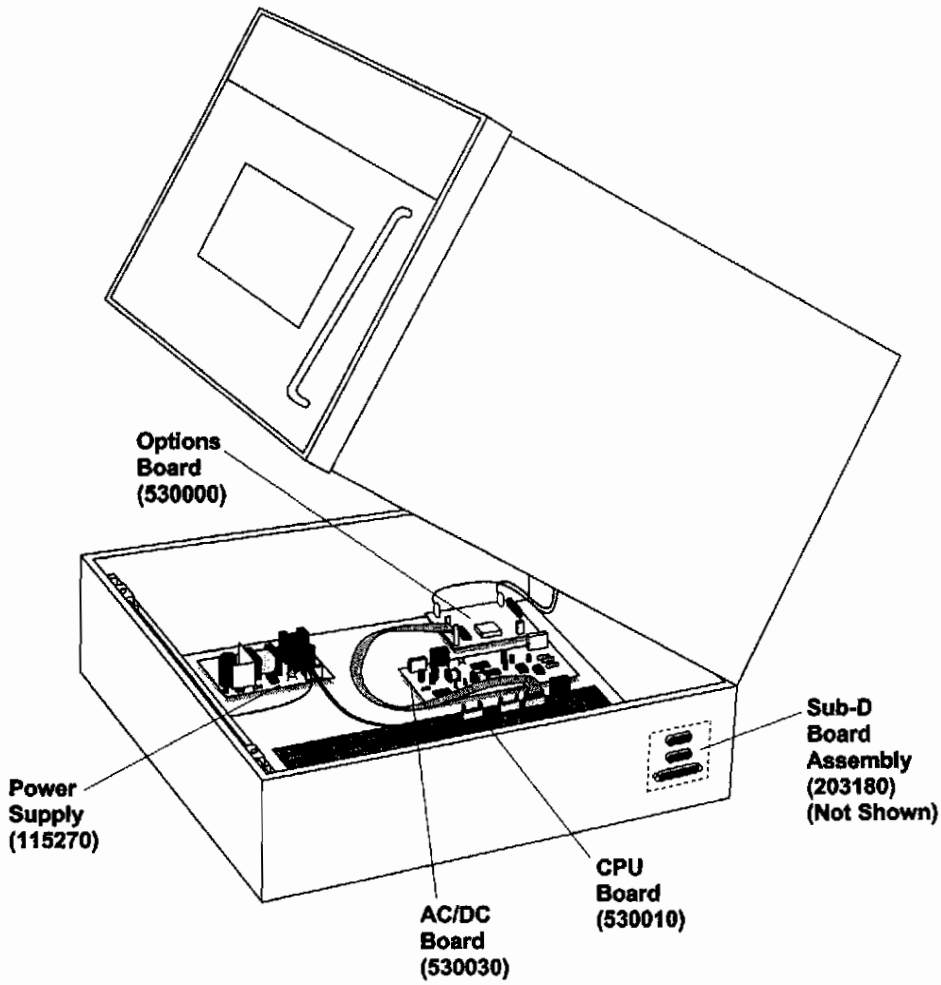



**Figure 8. MAS-7000 with Cavity Hinged for Service of Pedestal Components**

To remove the cover of the MAS-7000 for service to the high voltage components, remove the screws located along the bottom of the sides and back of the cover. Pull back and lift up on the cover to remove it from the instrument cavity.

**WARNING**

Prior to troubleshooting or replacement of any component in the high voltage section of the MAS-7000, the instrument must be switched off and unplugged from the electrical outlet. Permit instrument to sit idle for at least two minutes. Using a well insulated screwdriver, touch the end of the screwdriver between terminals of the high voltage capacitor to discharge all residual voltage from the instrument.

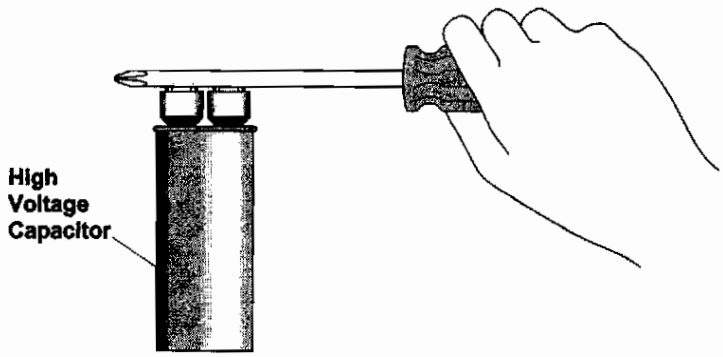



**Figure 9. Discharging Residual Voltage**

Prior to replacement of the cover, visually check the components to ensure the integrity of electrical connections. Install the cover carefully to avoid damage to wiring or internal components.

After performing any service to or inspection of the MAS-7000 which requires removal of the cover or replacement of components in the instrument door, interlock assemblies, or microwave generation system, perform a microwave leakage measurement, page 58, prior to instrument operation.

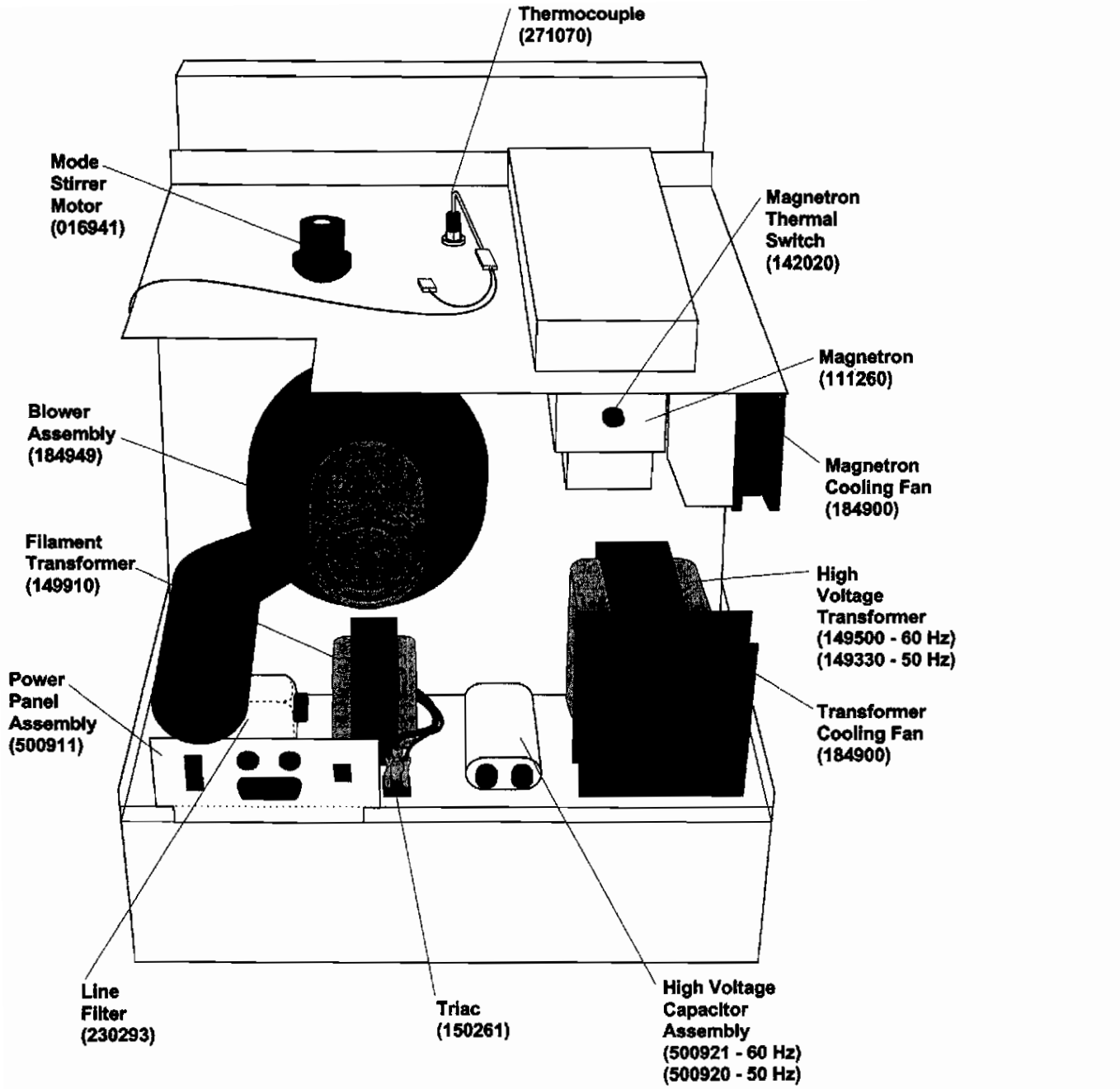



**Figure 10. MAS-7000 with Cover Removed for Service in High Voltage Section**

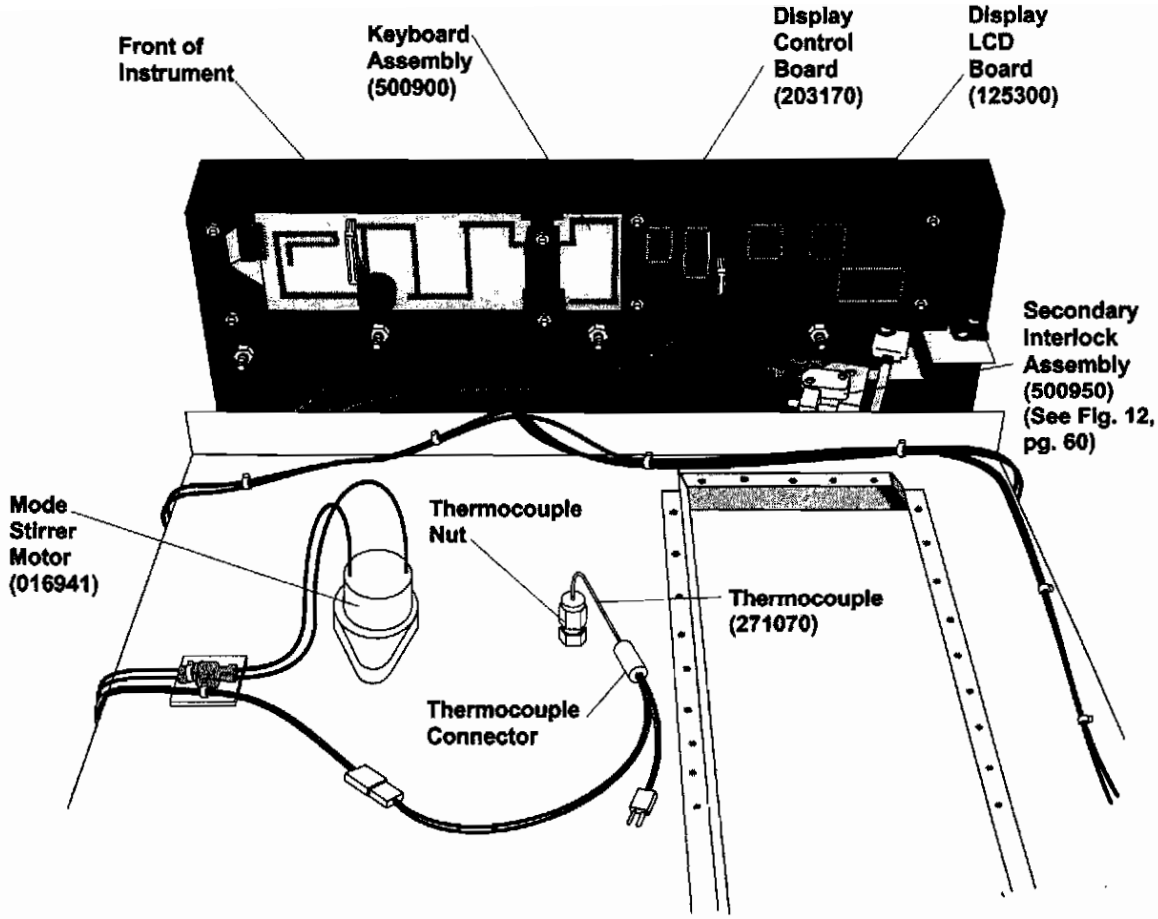



**Figure 11. MAS-7000 Front Panel (from rear of instrument)**

"THERMOCOUPLE ERROR"

Cool down UNIT - CALL FACTORY

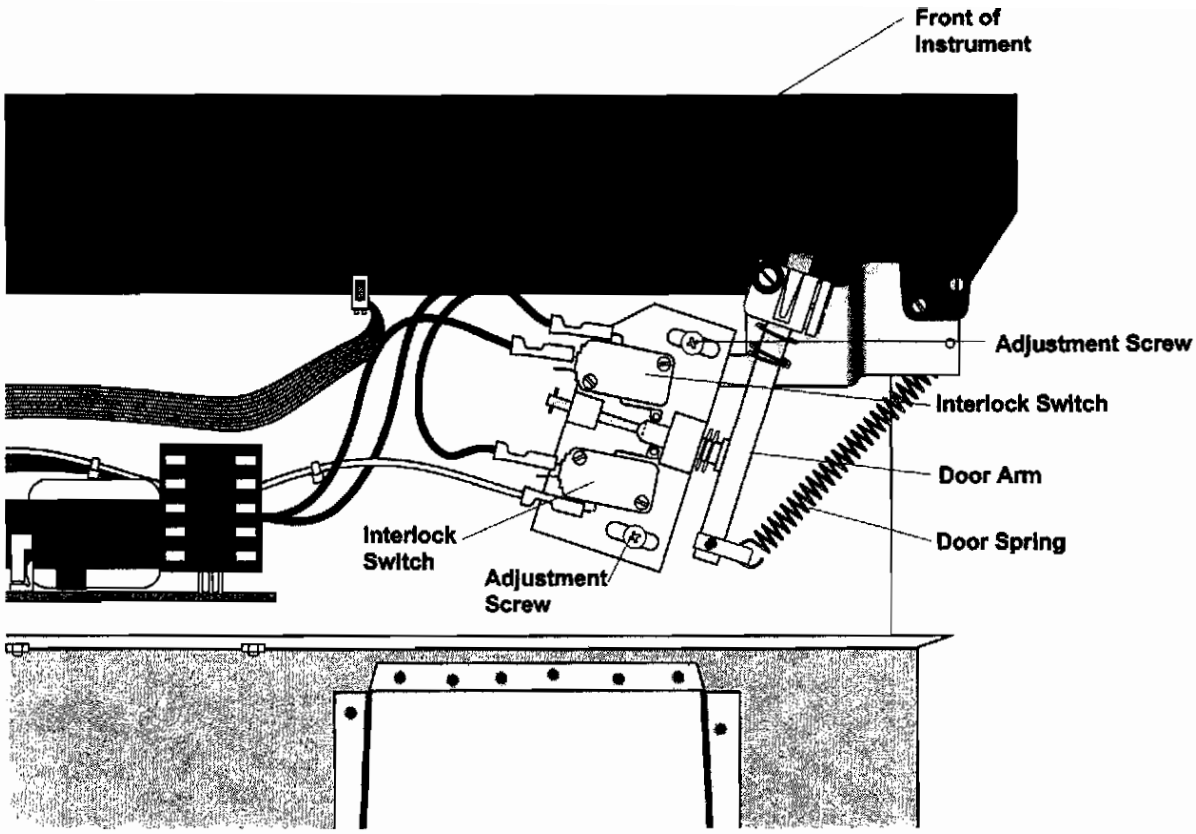



**Figure 12. Primary Interlock Assembly (500950)**

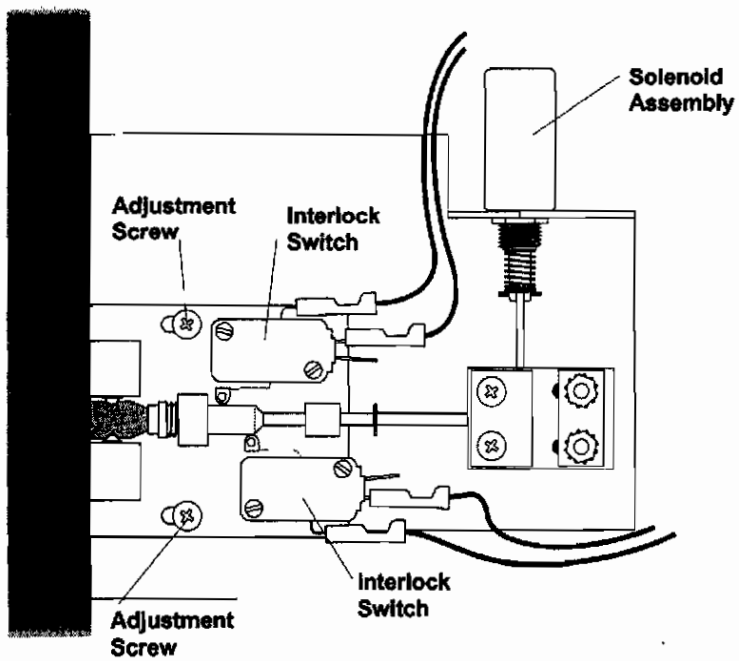



**Figure 13. Secondary Interlock Assembly (500930)**

## Calibration Procedures

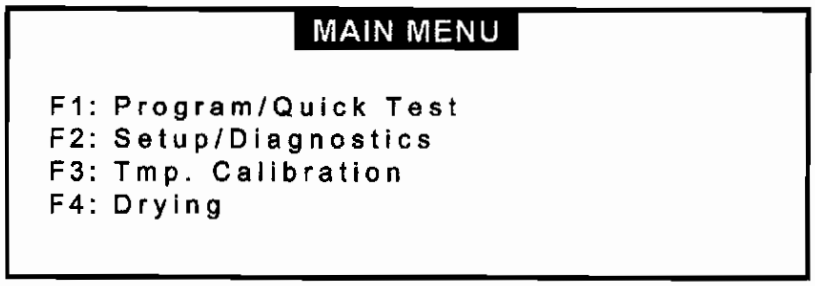
Following are procedures to properly calibrate the MAS-7000.

> **CAUTION**
>
> The MAS-7000 is factory calibrated in degrees C. To verify calibration or to recalibrate, a degrees C calibration device **must** be utilized. Calibration using a degrees F calibration device will cause the instrument to incorrectly calculate temperatures.

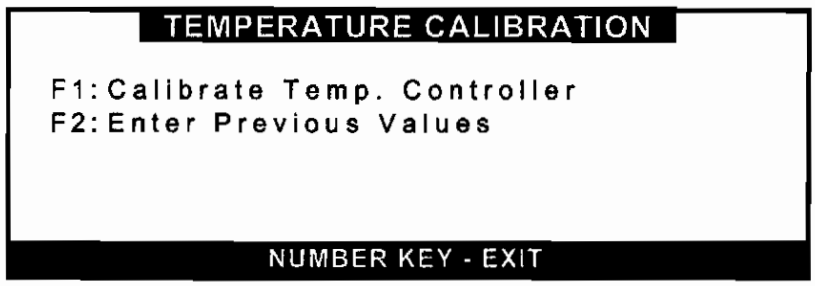
**Note:** Temperature display can be selected in degrees C or degrees F (page 19, step 10).

> **CAUTION**
>
> The muffle furnace temperature must be below 100° C (212° F) prior to temperature calibration.

1. Remove the thermocouple access door located on top of the instrument.
2. Unplug the thermocouple from the yellow extension cable.
3. Using a degrees C calibration device, insert the calibration device connector (male end) into yellow thermocouple extension cable.
4. Select the Main Menu on the MAS-7000.



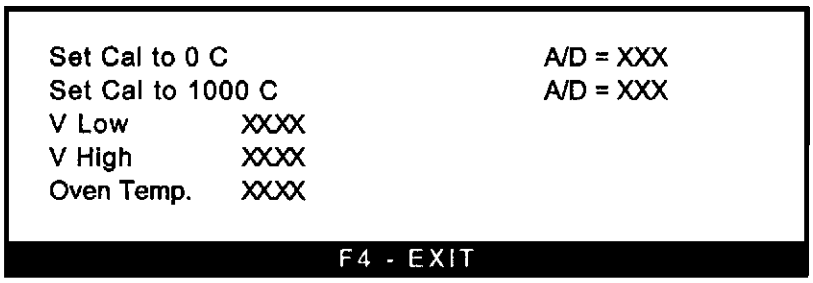

5. Press "F3" to activate the Temperature Calibration screen.




6. Press "F1" to activate the Temperature Calibration screen.


7. Turn the calibration device on. Ensure that the slide switch is positioned at the 0° C position.
8. Wait approximately 3 seconds, permitting the calibration device output to stabilize.
9. Press "Enter" on the MAS-7000.


10. Position the slide switch on the calibration device at the 1000° C position.
11. Wait approximately 3 seconds, permitting the calibration device output to stabilize.
12. Press "Enter" on the MAS-7000.




13. Record new "V Low" and "V High" calibration points.
14. Press "F4" to exit the calibration menu. The MAS-7000 is now calibrated. Press any numeric key to activate the Main Menu.
15. Turn the calibration device off. Remove the calibration device connector from the yellow thermocouple extension cable.
16. Connect the thermocouple to the yellow extension cable.
17. Install the thermocouple access door located in the top of the instrument cover.

# VII Specifications

| | |
|---|---|
| Temperature Capabilities: | 1000° C ± 3° C<br>1200° C ± 3° C<br>(Limited lifespan of furnace insulation when operated at 1200° C) |
| Electrical Ratings: | 208/230 VAC, 60 Hz, 10 amps<br>220/240 VAC, 50 Hz, 10 amps<br>Voltage selection switch permits electrical voltage to be switched from 208/230V or 220/240V |
| Power Output: | 1400 watt magnetron with a power output of 900 watts minimum (at nominal line voltage) |
| Magnetron Frequency: | 2455 MHz |
| Exhaust Capabilities: | 100 CFM |
| Printer Port: | 25-Pin Parallel (System compatible with IBM, Epson, Okidata, ASCII, Star NX-1020 and HP Thinkjet printers) |
| Computer Interface: | RS-232 Serial Interface (PC software to interface and collect data - must be supplied by the user) |
| Balance Interface: | RS-232, Serial Interface |
| Overall Instrument Dimensions: | 18.17 25.75 x 19.60 in. (WxDxH)<br>46.15 x 65.40 x 49.78 cm (WxDxH) |
| Furnace Chamber Volume: | 112.5 $in^3$ (1.8 liters) |
| Furnace Chamber Dimensions: | 8.25 x 4.55 x 3.00 in. (WxDxH)<br>20.96 x 11.56 x 7.62 cm (WxDxH) |
| Unit Weight: | 97.5 lbs.<br>44.226 kg. |
| IR Detection System: | Infrared detection device for door protection |
| Internal Calibration of Temperature Control: | Calibrated to NIST Traceable Standard |
| Internal Diagnostic Software: | BITS System (Built-in Test System) Analyzes magnetron hrs., system power on hrs., time spent at various temperatures, number of door openings and closings, calibration time and date, calibration set points, calibration tables and data |
| Safety Interlock: | Three safety interlock mechanisms prevent instrument operation and microwave emissions in case of improper door closure or misalignment |

## Emission and Safety Approvals

### U.S. and Canada

**Emissions** – *Complies with FCC part 18* (47 CFR part 18 Industrial, scientific and Medical Equipment).

**Safety** – *ETL* approved to UL standard 1262* (Laboratory Equipment). CSA** approved to standard CAN/CSA C22.2 No. 1010.1 (Laboratory Equipment).

78355
Conforms to UL Std. 3101

Certified to
CAN/CSA C22.2 No. 1010.1

### European Community

**Emissions** – *Conforms to EC standard EN 55011* (Emissions for Industrial, Scientific and Medical Equipment).
Conforms to EC standard EN50082-1 (Electromagnetic Compatability - Part 1).

**Safety** – *Conforms to EC standard IEC 1010-1* (Safety Requirements for Electrical equipment for measurement, control and laboratory use - Part 1).

**ETL and UL are equivalent NRTL's (Nationally Recognized Testing Laboratories)*
***CSA is approved testing laboratory by the Standards Council of Canada*

# VIII Ordering Information

Use a copy of this page as an order form when ordering spare parts listed below. Mail, call or fax your order to CEM.

CEM
P.O. Box 200
Matthews, NC 28106-0200
(800) 726-3331 (704) 821-7015 FAX (704) 821-7894

| Part No. | Description |
|---|---|
| 149910 | Filament Transformer |
| 184949 | Blower Assembly |
| 188340 | 10 AMP Fuse |
| 201580 | Ashing Disk (Consumable) |
| 271070 | Thermocouple |
| 271061 | Calibration Instrument |
| 300500 | Microwave Leakage Test Meter |
| 302070 | Crucible Marking Ink |
| 303040 | Ashing Crucible* (Consumable) (100 per box) |
| 306056 | Ashing Furnace Door |
| 307000 | Ashing Furnace Assembly (Complete assembly including heating element) |
| 920880 | Exhaust Hose |
| 920912 | 100g Balance w/Cable (60 Hz Instruments) |
| 920911 | 100g Balance w/Cable (50 Hz Instruments) |
| 111420 | Citizen Printer |

*Blanket orders for ashing crucibles ensure a continuous supply.

When placing an order, provide the following information:

_____
Company Name

_____
Shipping Address (Street, City, State, Zip Code)

_____
Billing Address (Street or P.O. Box, City, State, Zip Code)

_____
Ship to the Attention of:

_____
Your Name and Telephone No.

_____
Purchase Order No.

# Warranty

**What Is Covered:**
CEM warrants that the instrument will be free from any defect in parts or workmanship and will, at its option, replace or repair any defective part (excluding consumables) or instrument.

**For How Long:**
This warranty remains in effect for 365 days from date of delivery to the original purchaser.

**What Is Not Covered:**
This warranty does not cover parts or workmanship which have been damaged due to:

- Neglect, abuse or misuse,
- Damage caused by or to test samples,
- Damage incurred during instrument relocation,
- Damage caused by or to any attached equipment,
- Use of incorrect line voltages or fuses,
- Fire, flood, "acts of God," or other contingencies beyond the control of CEM,
- Improper or unauthorized repair, or
- Any other damage caused by purchaser or its agents.

**Responsibilities of Purchaser:**
To ensure warranty coverage, purchaser must:

- Use the instrument according to directions
- Connect the instrument properly to a power supply of proper voltage
- Replace blown fuses
- Replace consumables, and
- Clean the instrument as required.

**How to Get Service:**
Purchaser should contact the CEM Service Department or your distributor for return authorization and for proper crating and shipping instructions to return instrument, freight prepaid, for service. On-site repairs by an authorized service technician are available through the CEM Service Department. Travel costs will be charged to the purchaser for on-site repairs.

**Within the U.S.:**
CEM
3100 Smith Farm Rd.
Matthews, NC 28106
(800) 726-5551

**Outside the U.S.:**
CEM
3100 Smith Farm Rd.
Matthews, NC 28106
(704) 821-7015
FAX: (704) 821-7894
TELEX: 802118

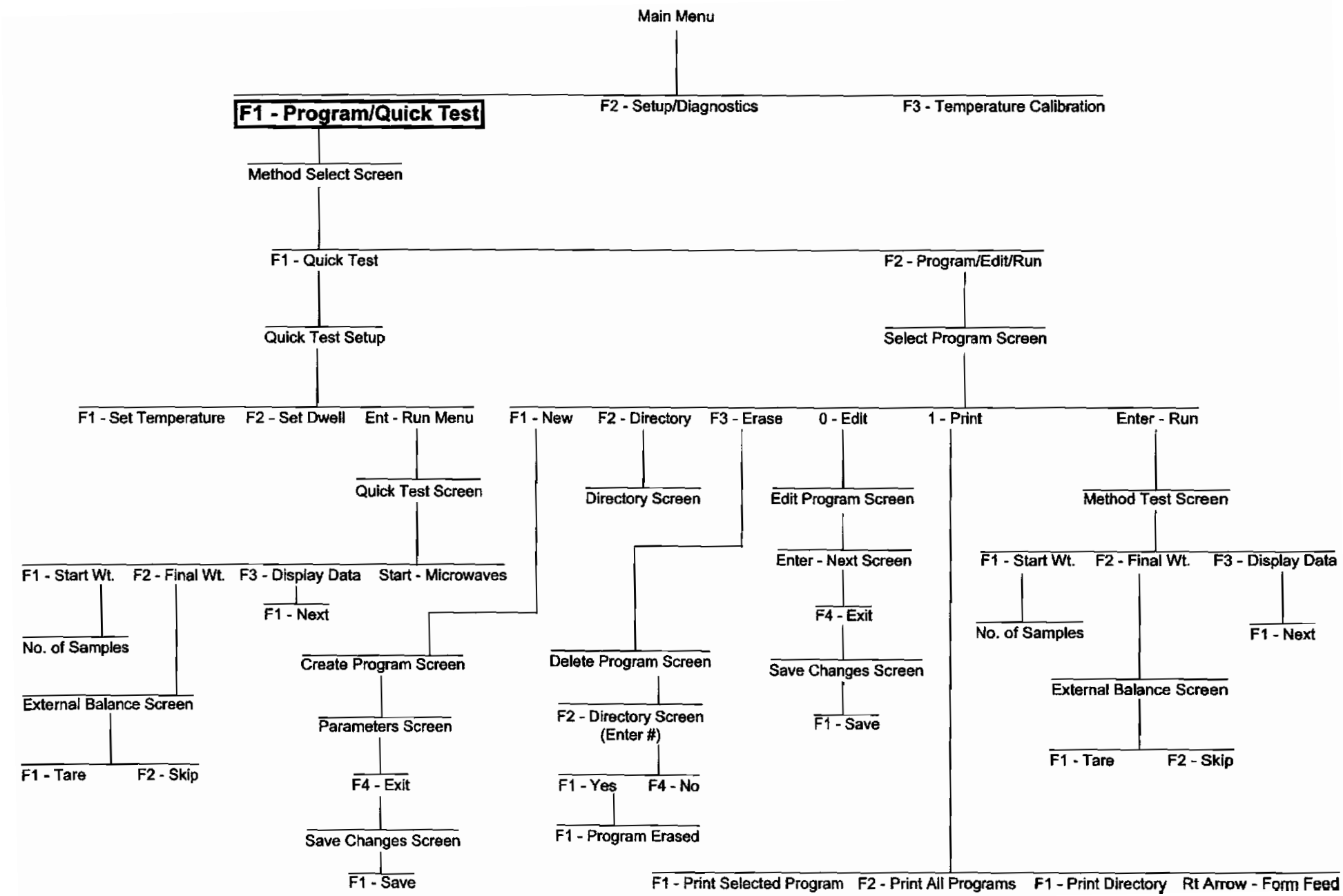
**Warranty Disclaimer:**
**CEM hereby excludes and disclaims any warranty of merchantibility or fitness for any particular purpose. No warranty, express or implied, extends beyond the face hereof. CEM Corporation shall not be liable for loss of use of instrument or other incidental or consequential costs, expenses or damages incurred by the purchaser or any other user.**

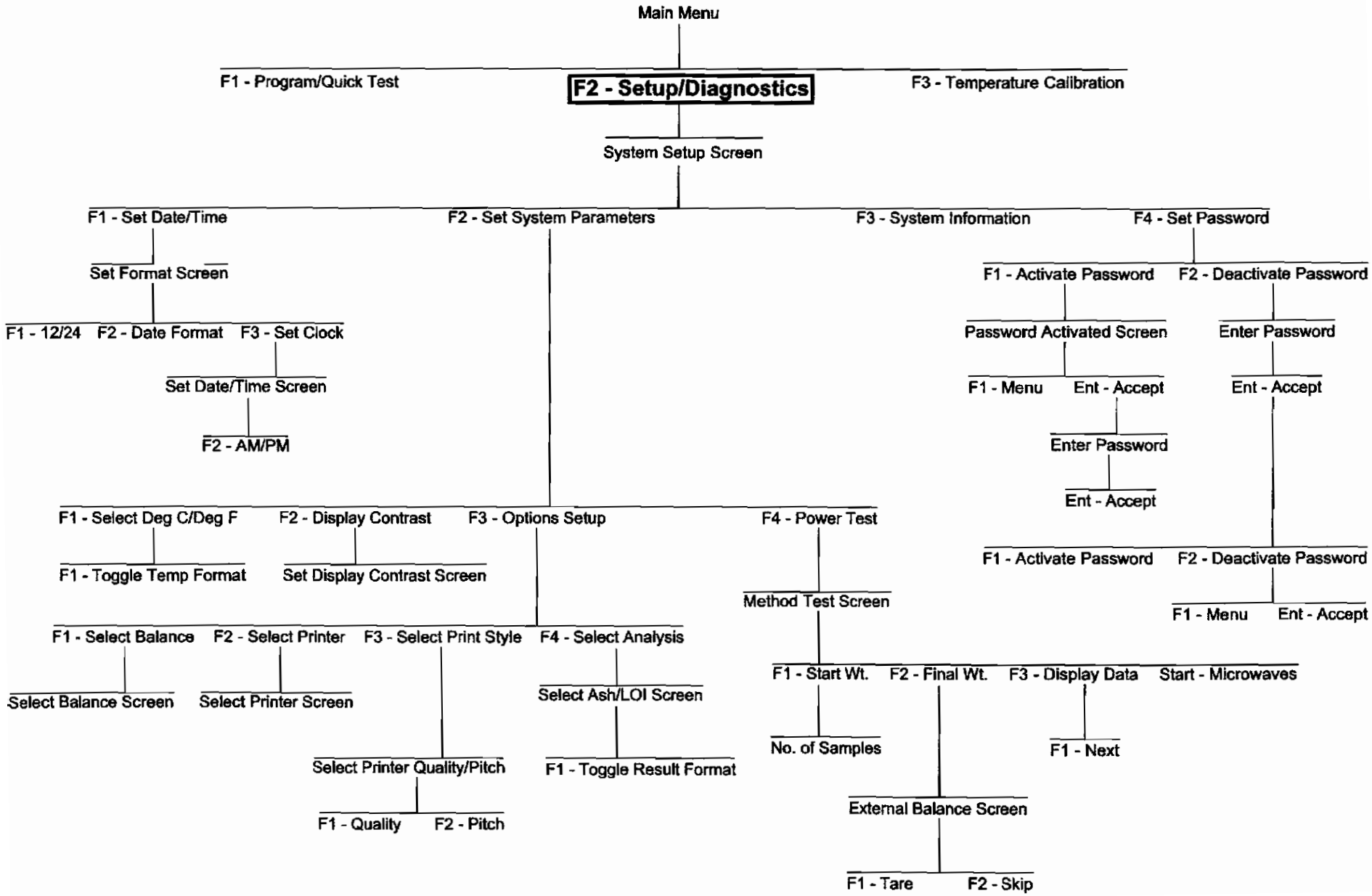
**Purchaser's Rights under State Law:**
This warranty gives the purchaser specific legal rights, and the purchaser may also have other rights which vary from state to state.

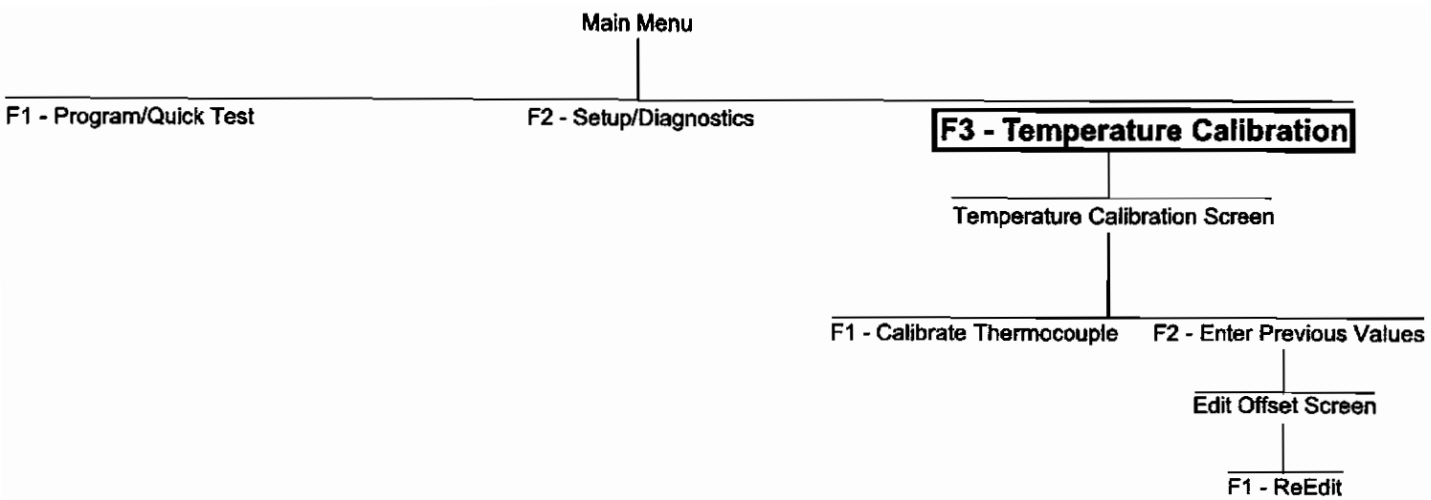
## Customer Support Service Contacts

For customer support in the areas of service, applications or sales, call the following toll-free numbers.

| | Ext. |
|---|---|
| Applications Assistance (800) 726-3331 | 236<br>167 |
| Service Assistance (800) 726-5551 | 182<br>169<br>174<br>144 |
| Sales Assistance (800) 726-3331 | 236<br>164 |


Main Menu
F1 - Program/Quick Test
F2 - Setup/Diagnostics
F3 - Temperature Calibration
Method Select Screen
F1 - Quick Test
F2 - Program/Edit/Run
Quick Test Setup
Select Program Screen
F1 - Set Temperature
F2 - Set Dwell
Ent - Run Menu
F1 - New
F2 - Directory
F3 - Erase
0 - Edit
1 - Print
Enter - Run
Quick Test Screen
Directory Screen
Edit Program Screen
Method Test Screen
F1 - Start Wt.
F2 - Final Wt.
F3 - Display Data
Start - Microwaves
Enter - Next Screen
F1 - Start Wt.
F2 - Final Wt.
F3 - Display Data
F1 - Next
F4 - Exit
No. of Samples
F1 - Next
No. of Samples
Create Program Screen
Delete Program Screen
Save Changes Screen
External Balance Screen
External Balance Screen
Parameters Screen
F2 - Directory Screen
(Enter #)
F1 - Save
F1 - Tare
F2 - Skip
F1 - Tare
F2 - Skip
F4 - Exit
F1 - Yes
F4 - No
Save Changes Screen
F1 - Program Erased
F1 - Save
F1 - Print Selected Program
F2 - Print All Programs
F1 - Print Directory
Rt Arrow - Form Feed


Main Menu
F1 - Program/Quick Test
F2 - Setup/Diagnostics
F3 - Temperature Calibration
System Setup Screen
F1 - Set Date/Time
F2 - Set System Parameters
F3 - System Information
F4 - Set Password
Set Format Screen
F1 - 12/24
F2 - Date Format
F3 - Set Clock
Set Date/Time Screen
F2 - AM/PM
F1 - Activate Password
F2 - Deactivate Password
Password Activated Screen
Enter Password
F1 - Menu
Ent - Accept
Enter Password
Ent - Accept
Ent - Accept
F1 - Select Deg C/Deg F
F2 - Display Contrast
F3 - Options Setup
F4 - Power Test
F1 - Toggle Temp Format
Set Display Contrast Screen
F1 - Activate Password
F2 - Deactivate Password
Method Test Screen
F1 - Menu
Ent - Accept
F1 - Select Balance
F2 - Select Printer
F3 - Select Print Style
F4 - Select Analysis
F1 - Start Wt.
F2 - Final Wt.
F3 - Display Data
Start - Microwaves
Select Balance Screen
Select Printer Screen
Select Ash/LOI Screen
No. of Samples
F1 - Next
Select Printer Quality/Pitch
F1 - Toggle Result Format
External Balance Screen
F1 - Quality
F2 - Pitch
F1 - Tare
F2 - Skip


Main Menu
F1 - Program/Quick Test
F2 - Setup/Diagnostics
F3 - Temperature Calibration
Temperature Calibration Screen
F1 - Calibrate Thermocouple
F2 - Enter Previous Values
Edit Offset Screen
F1 - ReEdit

| Sample Type | Sample Size | Temp.(C) | Time | Crucible | Comments |
|---|---|---|---|---|---|
| Adhesive (urethane amine) | 3 | 600 | 15 to 30 | CEM, 20 mL | |
| Aluminum Oxide (catalyst) | 2 | 500/1100 | 5 | self-sealing | use covers only during dessication |
| Aluminum Stearate | 1.5 | 900 | 5 | CEM, 20 mL | |
| Amoxicillin Trihydrate | 2 | 200/800 | 30 | 25 mL porcelain | sulfated ash procedure |
| Apple Jelly | 2 | 550 | 25 | 25 mL platinum | hot plate method |
| Aqueous Solutions Ni, Zr, Ti | 1 | 600 | 15 | CEM, 20 mL | |
| Artificial Sweeteners (Asparatane) | 2 | 600 | 30 | CEM, 20 mL | |
| Beef Liver | 2 | 950 | 30 | CEM, 20 mL | |
| Bones (human) | 0.7-0.11 | 800 | 120 | CEM, 20 mL | |
| Calcium Carbonate | 3 | 400 | 30 | CEM, 20 mL | |
| Carbon (activated) | 2 | 925 | 5 to 20 | CEM, 20 mL | |
| Carbon Black | 2 | 550 | 90 | CEM, 20 mL | |
| Carrageenan | 0.5 | 545 | 5 | CEM, 20 mL | |
| Cat Food (canned) | 2 to 5 | 600 to 950 | 10 to 90 | CEM, 20 mL | |
| Catalyst (Aluminum Oxide) | 2 | 500/1100 | 0 | self-sealing | use covers only during dessication |
| Citric Acid | 10 | 800 | 15 to 50 | 25 mL porcelain | sulfated ash procedure |
| Coal | 1 | 450/750 | 45 | CEM, 20 mL | quick method 750 degrees at 35 mins. |
| Coal Tar & Pitch | 2.5 | 550/800 | 90 | CEM, 20 mL | cover sample with disk |
| Coke | 1 | 750 | 60 | CEM, 20 mL | |
| Deodorant (liquid) | 0.25 | 1100 | 15 | 10 cm sq. quartz | |
| Dextromethorphan | 2 | 800 | 30 | 25 mL porcelain | |
| Dog Food (dry) | 2.5 | 575 | 30 | CEM, 20 mL | |
| Eggs | 5 | 925 | 20 to 35 | CEM, 20 mL | |
| Elastomer, peroxide polymer | 1 | 600 | 30 | CEM, 20 mL | |
| Feed, poultry layer | 2 | 600 | 10 | CEM, 20 mL | |
| Feed, turkey | 2 | 600 | 20 | CEM, 20 mL | |
| Fiberglass | 5 to 10 | 600 | 5 | CEM, 20 mL | |
| Flour, soy | 1 | 935 | 15 | CEM, 20 mL | |
| Flour, wheat | 2 | 935 | 10 | CEM, 20 mL | magnesium acetate/ethyl alcohol |
| Fly Ash | 0.5 | 900 | 10 | CEM, 20 mL | |
| Friction Paper (brake lining) | 1 | 760 | 10 | CEM, 20 mL | |
| Glycols | 50 | 775 | 5 | 100 mL porcelain | flame-off method used |
| Graphite Powder | 1 | 925 | 30 to 60 | CEM, 20 mL | |
| Graphite with lubricant | 2 | 100 | 5 to 10 | CEM, 20 mL | ash dry sample at 1090 for 20-75 mins. |
| Graphite/Silicon Carbide | 1 | 850 | 30 | CEM, 20 mL | petroleum coke w/silica sand |
| Gum Base | 2 | 500 | 20 | CEM, 20 mL | cover sample with disk |
| Hexamine | 0.2 | 800 | 10 | CEM, 20 mL | cover sample with disk |
| Hydrocarbon Resin | 2 | 950 | 15 | CEM, 20 mL | |
| Juices, Fruit | 10 | 540 | 3 | 100 mL porcelain | |
| Kaolin | 2 | 600 | 30 | CEM, 20 mL | cover sample with disk |

| Sample Type | Sample Size | Temp.(C) | Time | Crucible | Comments |
|---|---|---|---|---|---|
| Kerosene based silicon antifoam | 2 | 220 | 8 | Fiberglass pads | |
| Lactose | 5 | 550 | 30 to 35 | CEM, 20 mL | |
| Lime (CaO, CaOH2, CaC03) | 2 to 4 | 1050 | 10 | CEM, 20 mL | cover sample with disk |
| Meat & Bone Meal (dog) | 2.5 | 575 | 10 | CEM, 20 mL | |
| Metal Stearates | 1.5 | 900 | 5 | CEM, 20 mL | Aluminum, Calcium, Magnesium, Zinc stearates |
| Milk, powdered | 2 | 935 | 10 | CEM, 20 mL | magnesium acetate/ethyl alcohol |
| Nicotinamide | 1 | 800 | 10 | 50 mL porcelain | sulfated ash procedure |
| Noodle mix | 3 | 935 | 15 | CEM, 20 mL | |
| Nylon | 2 | 900 | 5 | CEM, 20 mL | |
| Nystatin | 1 to 2 | 800 | 40 | 50 mL porcelain | sulfated ash procedure |
| Oil (residual) | 50 | 540 | 75 | 50 mL porcelain | flame-off method used |
| Oil (soybean) | 10 | 600 | 10 | 25 mL porcelain | 10 g maximum sample allowed |
| Organic solutions (drying) | 2 | 160 | 8 | CEM, 20 mL | surfactant, kerosene, naphtha, xylene |
| Paper (fine CaCO3 coated) | 1 to 2 | 550 | 15 | CEM, 50 mL | |
| Petroleum Products | 50 | 775 | 6 | 100 mL porcelain | |
| Phenolic Resins | 1 | 800 | 10 to 20 | CEM, 20 mL | |
| Plastic Pipe PE | 2 | 750 | 5 | CEM, 20 mL | |
| Polyester Film | 1" square | 825 | 15 | CEM, 20 mL | |
| Polycarbonate, Ni plated | 2 | 650 | 20 | CEM, 20 mL | |
| Polyester (unfilled) | 2 to 6 | 900 | 20 | CEM, 20 mL | |
| Polyether-Polyurethane | 1 | 700 | 5 | CEM, 20 mL | |
| Polyetherimide (% nickel) | 0.1 to 0.2 | 700 | 20 | self-sealing | |
| Polyethylene (unfilled) | 2 to 6 | 800 | 5 | CEM, 20 mL | |
| Polyethylene (TiO2 filled) | 5 | 800 | 10 | CEM, 20 mL | |
| Polyethylene (% carbon black) | 1.5 to 2.0 | 600 | 7 | self-sealing | |
| Polyphenylene Sulfide (% carbon) | 0.1 to 0.2 | 700 | 210 | self-sealing | |
| Polypropylene | 2 to 6 | 800 | 5 | CEM, 20 mL | |
| Polystyrene | 2 to 6 | 900 | 20 | CEM, 20 mL | |
| Polysulfone (% carbon) | 0.1 to 0.2 | 700 | 180 | self-sealing | |
| Polytetrafluoroethylene TFE | 2 | 600 | 10 | CEM, 20 mL | cover sample with disk |
| Rice Germ and Bran | 2 | 550 | 20 | CEM, 20 mL | |
| Rubber (butyl) | 1 | 550 | 20 | CEM, 20 mL | |
| Salts | 10 | 350 | 10 | CEM, 20 mL | LiCl, BaCl2, CaCl2, NaCl, cover w/disk |
| Silicon Carbide Mix (drying) | 2 | 115 | 10 | CEM, 20 mL | |
| Silver Powder & Ink | 1 | 600 | 15 | CEM, 20 mL | |
| Sludge, Petr. based | 2.5 | 500/900 | 5 | 30 mL porcelain | |
| Starch, Corn | 2 | 575 | 10 | CEM, 20 mL | |
| Starch, Pre-jelled tapioca | 1 | 650 | 120 | CEM, 20 mL | magnesium acetate/ethyl alcohol |
| Sugar, granulated | 10 | 550 | 240 | 25 mL porcelain | sulfated ash procedure |

| Sample Type | Sample Size | Temp.(C) | Time | Crucible | Comments |
|---|---|---|---|---|---|
| Sugar, raw | 4 | 550 | 180 | 25 mL porcelain | sulfated ash procedure |
| Talc | 2 | 1000 | 10 | CEM, 20 mL | |
| Thiabendazole | 1 | 800 | 20 | 25 mL porcelain | sulfated ash procedure |
| Titanium Dioxide | 2 | 800 | 10 | CEM, 20 mL | |
| Whey | 2 | 935 | 10 | CEM, 20 mL | magnesium acetate/ethyl alcohol |