

NCAT Asphalt Content Tester

OPERATION MANUAL AND PARTS LIST

Series 1087

<u>Model No.</u>	<u>Phase</u>	<u>Voltage</u>	<u>Watts</u>	<u>Amps</u>
F85930	1	220-240	4879/6379	20/27
F585938	1	208	5757	28
F85930-33	1	220-240	4879/6379	20/27
45-3790/01	1	220-240	4879/6379	20/27
45-3790/07	1	208	5757	28

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Alert Signals



Warning

Warnings alert you to a possibility of personal injury.



Caution

Cautions alert you to a possibility of damage to the equipment.



Note

Notes alert you to pertinent facts and conditions.



Hot Surface

Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.



Warning

Barnstead/Thermolyne does not condone the use of this product for the purpose of cleaning glassware, such as rolling thin film oven bottles. Prior to ignition, the asphalt in these bottles will liquify and may flow into the lower control section of this product, causing severe damage or fire.

This manual contains important operating and safety information. You must carefully read and understand the contents of this manual prior to using this equipment.

Your NCAT Asphalt Content Tester has been designed with function, reliability and safety in mind. It is your responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert signals throughout the manual.

Warnings

To avoid electrical shock:

1. This furnace must be installed by a competent, qualified electrician who ensures compatibility among furnace specifications, power source and servicing.
2. Disconnect from power supply before servicing.
3. Ensure that the furnace is not connected to the power supply prior to installing or removing the balance.
4. Ensure that the door switch is operating properly.

To avoid burns:

1. Do not touch the exterior or interior surfaces of the chamber or exhaust area when chamber is hot. "Hot Surface. Avoid Contact with Chamber Area."

To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials, including cutback asphalts; fire or explosion may result. This device contains components which may ignite such material.
2. Refer servicing to qualified personnel.
3. Allow the furnace to cool to room temperature before performing any maintenance or servicing.
4. Failure to connect the exhaust port to an appropriate exhaust system will result in smoke and gases entering the work area. Without the connection, gases and smoke will escape from the furnace.

5. This furnace contains refractory ceramic insulation which can produce respirable fibers and dust when handled. These fibers can cause irritation and can aggravate preexisting respiratory disease. The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber as possibly carcinogenic. After service refractory ceramic fiber dust may contain crystalline silica, which may cause lung damage (silicosis) and which has been classified by IARC as a carcinogen.

**Warning**

Refer servicing to qualified personnel.

Warning

This warning is presented for compliance with California Proposition 65 and other regulatory agencies and only applies to the insulation in this product. This product contains refractory ceramic, refractory ceramic fiber or fiberglass insulation, which can produce respirable dust or fibers during disassembly. Dust or fibers can cause irritation and can aggravate preexisting respiratory diseases. Refractory ceramic and refractory ceramic fibers (after reaching 1000°C) contain crystalline silica, which can cause lung damage (silicosis). The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber and fiberglass as possibly carcinogenic (Group 2B), and crystalline silica as carcinogenic to humans (Group 1).

The insulating materials can be located in the door, the hearth collar, in the chamber of the product or under the hot plate top. Tests performed by the manufacturer indicate that there is no risk of exposure to dust or respirable fibers resulting from operation of this product under normal conditions. However, there may be a risk of exposure to respirable dust or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing them in a manner which causes release of dust or fibers. By using proper handling procedures and protective equipment you can work safely with these insulating materials and minimize any exposure. Refer to the appropriate Material Safety Data Sheets (MSDS) for information regarding proper handling and recommended protective equipment. For additional MSDS copies, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department at Barnstead|Thermolyne Corporation at 1-800-553-0039.

Introduction

Congratulations on your purchase of a Barnstead|Thermolyne NCAT Asphalt Content Tester.

Introduction

The unit is designed to perform a specific test within your laboratory. Please read the instructions carefully to ensure that you receive maximum benefit from it. Also, be sure to fill out and return the enclosed warranty registration card. We would like to receive the information requested, and it will help us assure you of proper warranty coverage.

Intended Use

The NCAT Asphalt Content Tester is an analyzer which determines the asphalt content of a sample by loss on ignition per standard methods. The asphalt sample is bathed in oxygenated air and weighed continuously throughout the ignition procedure. The NCAT Asphalt Content Tester's software identifies the endpoint of ignition and indicates the completion of the test. Results are documented by a printer.

General Usage

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

Software Updates

Software improvements are initiated based on market feedback. Currently your tester contains Revision G software. You will be notified by your sales representative, distributor or Barnstead|Thermolyne as a software improvement becomes available. A software packet includes installation instructions, operational data and an EPROM. The EPROM is easy to install and can be installed within a few minutes.

Theory of Operation

The furnace is heated to a setpoint temperature within the range of 450° - 550°C.

The hot mix asphalt sample is weighed, equally divided and placed in two screened baskets which are mounted on a tray assembly. This complete assembly is placed on the furnace hearth tray. The hearth tray is mounted on four ceramic support tubes, which are in turn mounted on a digital balance platform. A blower draws ambient air through the four ceramic tube support openings located on the chamber floor. This oxygenated air saturates the spread asphalt sample to promote ignition and ashing. The released volatiles are further oxidized while passing through a ceramic filter heated to 750°C in a chamber above the main chamber. Five air exit ports direct the exhausted air to a louvered plenum. The exhaust is then cooled by mixing with ambient air. The blower then directs the exhaust through the plenum exhaust port. Standard seamless exhaust tubing directs the exhaust to an outside exhaust system.

General Specifications

Model		F85930-33, F85940-33, 45-3790/01, F85930 (240 V)	45-3790/07, F85948, F85938 (208V)
Overall Dimensions IN. (CM)	Width	21.375 (54.29)	21.375 (54.29)
	Height	40.500 (102.87)	40.500 (102.87)
	Depth	25.625 (65.09)	25.625 (65.09)
Chamber Dimensions IN. (CM)	Width	14.000 (35.56)	14.000 (35.56)
	Height	14.000 (35.56)	14.000 (35.56)
	Depth	14.000 (35.56)	14.000 (35.56)
Weight	Lbs. (KG)	302 (137)	302 (137)
Electrical Ratings	Volts	220-240	208
	Amps	20/27	28
	Watts	4879/6379	5757
	Freq.	50/60	50/60
	Phase	1	1
Chamber Temperature Ratings*		100°C-650°C	100°C-650°C
Max. Sample Cap.		5 kilograms of asphalt sample.	
Max. Operating Temp.	Chamber	650°C	650°C
	Filter	900°C	900°C
Maximum Program Run Time		255 minutes	255 minutes
Allowable Values for Selected Functions	Chamber Set point	100°C-650°C	100°C-650°C
	Filter Set point	0°C-900°C	0°C-900°C
	Sample Weight	100g-5000g	100g-5000g
	Correction Factor	0.00-99.99	0.00-99.99
	Wake up Time	0:00-24:00	0:00-24:00
	Wake up Date	0.00 - 12.31	0.00 - 12.31
	Inactivity Check	On/Off	On/Off
	Auto Shut down	On/Off	On/Off
	Beeper	On/Off	On/Off
	Serial Port Output	Continuous/Test Only	Continuous/Test Only
	Chamber Calibration Offset	+50 to -50	+50 to -50
	Test Stability Threshold	0.01-0.5%	0.01-0.5%
	Intermediate Printing (Internal Printer)	On/Off	On/Off
	Chamber Set point	538°C	538°C
	Filter Set point	750°C	750°C
Sample Weight	1200g	1200g	
Correction Factor	0.00	0.00	
Wake up Time	5:00	5:00	
Wake up Date	0.00	0.00	
Inactivity Check	On	On	
Auto Shut down	On	On	
Beeper	On	On	
Serial Port Output	Continuous	Continuous	
Chamber Calibration			

Offset	0°C	0°C
Test Stability Threshold	0.01%	0.01%
Intermediate Printing (Internal Printer)	On	On

* Maximum temperature can be achieved at the maximum line voltage specified on the Specification Plate.

Environmental Conditions

Operating: 17°C - 27°C; 20% - 80% relative humidity, non-condensing. Installation Category II (overvoltage) in accordance with IEC 664. Pollution Degree 2 in accordance with IEC 664.

Altitude limit: 2,000 meters.

Storage: -25°C - 65°C; 10% - 85% relative humidity.

Declaration of Conformity(-33 models only)

Barnstead/Thermolyne hereby declares under its sole responsibility that the model 45-3790/01 (F85940-33) conforms with the technical requirements of the following standards:

EMC:	EN 50081-1	Generic Emission Standard
	EN 50082-1	Generic Immunity Standard
	EN 61326	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part I: General Requirements.
Safety:	EN 61010-1-92	Safety requirements for electrical equipment for measurement, control and laboratory use; Part I: General Requirements
	EN 61010-2-010	Part II: Particular requirements for laboratory equipment for the heating of materials

per the provisions of the Electromagnetic Compatibility Directive 89/336/EEC, as amended by 93/68/EEC, and per the provisions of the Low Voltage Directive 73/23/EEC, as amended by 93/68/EEC.

The authorized representative located within the European Community is:

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

Copies of the Declaration of Conformity are available upon request.

Unpacking



Note

The NCAT Asphalt Content Tester does not come with a power cord. The furnace has the capability of being hard wired or having a power cord attached depending on your local electrical code requirements.

Unpacking

1. Visually check for any physical damage to the shipping container. Remove the furnace from the shipping container. Inspect the equipment surfaces that are adjacent to any damaged area of the shipping container. Retain damaged packing material. File claim with the delivery carrier if damage is incurred.
2. Open the furnace door and carefully remove packing material from inside the furnace chamber. Remove the screws (4) securing the front display panel. Open the front display panel. Vacuum the chamber and the balance support plate (beneath the chamber) prior to use to remove the insulation dust which may have accumulated during shipment. Wear a dust mask and gloves while cleaning.
3. Remove the balance, ceramic posts, fuses, manual and hearth tray from the shipping container.
4. Retain the original packaging material if reshipment is foreseen or required for mobile lab use.

Allow adequate work area and bench space for loading and unloading. Locate the cooling plate alongside the furnace to allow for convenient transport of hot loads.

Contents of Carton

Each palletized furnace carton contains:

- 1 Asphalt Content Tester
- 1 Electronic Balance
- 1 Hearth tray, gray silicon carbide
- 8 Ceramic tube supports, Inside Furnace Chamber
- 1 Instruction Manual, Inside Furnace Chamber
- 6 Replacement Fuses

Accessory Kit Contents

Part # AY1087X1

Two basket assemblies consisting of:

- 2 Basket Retainer Brackets
- 2 Transport and Catch Trays
- 2 Top Baskets
- 2 Bottom Baskets
- 2 Covers for Top Baskets
- 1 Transport Handle
- 1 Aluminum Cooldown Plate
- 1 Cooldown Safety Cage with HOT Sign
- 1 Face Shield with Head gear
- 1 Pair High Temperature Gloves
- 1 Can of Fan Motor Lubricant
- 1 Stainless Steel Basket Brush
- 4 Rolls of Thermal Printer Paper

Optional purchase:

- 1 Length of exhaust tubing (3" I.D. x 10', shipped in a separate carton), part # TU859X1

Installation



Caution

Be sure ambient temperature does not exceed 40°C (104°F). Ambients above this level may result in damage to or malfunction of the controller.

Allow at least 6 inches of space between the furnace and any vertical surface. This permits the heat from furnace case to escape so as not to create a possible fire hazard.



Hot Surface

Do not install above or near flammables.

Site Selection

Place the furnace on a sturdy level surface about 26-28 inches high and capable of supporting the weight of the fully assembled furnace. Furnace must be placed on a level surface to permit door to safely swing and remain open for loading and unloading. Allow space for air flow around the furnace (6" minimum). Locate the furnace so you can direct the furnace's emissions through ducting to a fume hood or other appropriate ventilation system. We recommend an exhaust length of not more than 10 feet, if possible. Leveling feet are adjustable. The furnace should be leveled so the door will remain open.



Warning

To avoid electrical shock, this furnace must be installed by a competent, qualified electrician who ensures compatibility among furnace specifications, power source and ground code requirements.



Caution

For supply connections, use 10 AWG or larger wires suitable for at least 90°C. Failure to observe this caution could result in damage to furnace and/or work area.



Note

Do not operate the 220-240 volt NCAT Asphalt Content Tester on 208 volts. Your test results will be negatively affected by the lower voltage. Consult with your supplier if this is the case.

Electrical Connections

The electrical specifications are:

Volts	Amps	Watts	Hertz
220-240	20/27	4879/6379	50/60
208	28	5757	50/60

Your furnace is factory configured for a 27 amp supply. You have the option of re-configuring the wiring at the back of the furnace for 20 amps. Please see page 64. Typically, a 20 amp configuration is used for mobile laboratory installations or if your supply is only rated for 20 amps.

Prior to connecting your asphalt testing furnace to your electrical supply, be sure the front power switch and rear circuit breaker are in the OFF position.

The power supply entry is located at the right rear of the lower case (as you face the rear of the unit). A terminal block is located behind an access plate. Remove the six screws retaining the plate covering the terminal connection block. The line and ground connections to the terminal block are depicted in Figure 2.

Your NCAT Asphalt Content Tester may be wired either directly through a conduit system or by using a power cord and plug. Electrical wiring should conform to your local electrical code requirements.

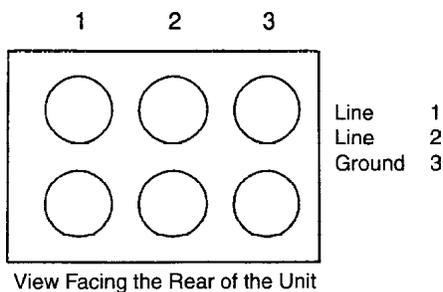


Figure 2 Terminal Block Connections

**Warning**

Failure to connect the exhaust port to an appropriate exhaust system will result in smoke and gases entering the work area. Without the connection, gases and smoke will escape from the furnace.

**Caution**

Do not connect the exhaust port to tubing less than 3" in diameter or otherwise restrict the exhaust flow from the furnace. Also, do not connect the tubing directly to an external fan or otherwise increase the velocity of the exhaust flow from the furnace. Either restricting or increasing the exhaust flow from the furnace may damage the furnace or reduce its efficiency.

**Note**

Appropriate exhaust must be provided to remove smoke and gases produced in a testing procedure. Seamless flexible exhaust tubing with an inside diameter of 3" is recommended. Seamless flexible 3" steel tubing is available. (See Replacement Parts list.)

The exhaust exiting the furnace exhaust port may reach 270°C. Do not use flammable materials or materials with a low melting point for exhaust tubing.

Exhaust Installation Tips

1. Select a location to minimize exhaust length. We recommend an exhaust length of not more than 10 feet.
2. Flexible 3" I.D. seamless steel tubing or electrogalvanized steel tubing is recommended for venting. Lightly seal connections at blower exit at the top of the tester with clear silicon such as DOW >32 or GE RTV or equivalent. Use sparingly so the exhaust tube can be detached for servicing. Do not use galvanized tin dryer pipe or double-wall galvanized tin as the seams will leak fumes into the lab. Do not use vent pipe that is reduced to less than 3" I.D.
3. Minimize 90° bends in your exhaust system if possible. Bends restrict the exhaust air flow and tend to accumulate particulates which can also restrict air flow.
4. Termination of your exhaust system may be in open air or to a larger exhaust duct. Open air termination is the most efficient. Duct termination should not be in the vicinity of fresh air intakes. Also, the duct cap must not restrict the air flow.

Exhausting into a larger duct requires an airtight connection. The larger duct must not create a positive air pressure internally which can diminish the "tester's" blower efficiency. Perform the "lift test" to ensure a -3.2 to -8.2 gram lift. (See page 22). Increasing the velocity of the exhaust flow above the lift of

-8.2 grams may blow fines from the basket resulting in an exaggerated asphalt cement content.

5. Turn on fume hood blowers and conduct "lift test" to ensure the -3.5 to -10 gram lift is maintained. Perform the test with room doors open and closed to ensure proper makeup air for the room.



Note

The balance is shipped separately to ensure that the balance is not damaged during shipment.

Balance Installation

The NCAT Asphalt Content Tester is supplied with an electronic balance, for use in the NCAT Asphalt Content Tester. The balance operates on voltage supplied by the tester.

The balance is shipped in a separate carton containing specialized packaging material. It is recommended that the specialized carton and packaging be retained for safe balance storage or reshipment.

The balance carton will contain the following:

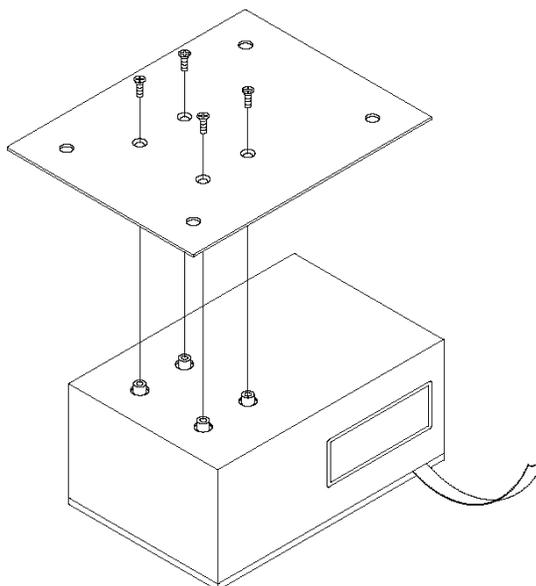
- 1 Balance
- 1 Support plate
- 1 Catch pan
- 4 Screws

Balance Assembly

Install support plate onto balance load cell with the screws provided as shown.

To install the balance:

1. Ensure that the furnace is disconnected from the power supply. Remove the four screws along the top of the front control panel securing the control panel to the lower case of the furnace. Move furnace forward about 2 inches beyond counter



Balance Assembly

INSTALLATION

edge or adjust all feet up about 1/4 inch. This will allow the hinged control panel to open without obstruction.

2. Open the lower case by carefully pulling the control panel forward and downward. The control panel is hinged on the bottom edge to the lower furnace case. Do not allow the panel to fall completely open as this may excessively strain cables attached to the panel.
3. Inside the lower furnace case, observe the suspended table (balance support plate) supported by four aluminum rods. The balance will be supported by this table. Vacuum the table if dust, etc., appears on it.
4. Mount the support plate and the catch pan on the balance. Note the four pins on the catchpan. These will retain the ceramic support tubes, which will project into the furnace chamber after mounting.
5. Place the Setra balance on the balance support table so that the gray ribbon cable is protruding from your left. This gray ribbon cable will be plugged into the front panel display board, into the connector marked P2. On this same display board, the connector marked P6 should have a red and white power jack cable plugged into it, and the connector marked P3 should have a 9-pin ribbon cable connected to it. All three of these connections are necessary in order for the Setra balance to function.
6. Position the balance so that the pins on the platform support plate are directly beneath the four tube ports in the bottom of the furnace chamber.



Note

Do not close the control panel yet.



Warning

Ensure that the furnace is not connected to the power supply prior to installing or removing the balance.

**Caution**

Do not allow the ceramic support tubes to contact the sides of the tube ports, as this will cause an unstable and inaccurate balance readout.

7. Open the furnace door. Insert the four ceramic support tubes through the tube ports located in the bottom of the furnace chamber. Adjust the position of the balance until the four ceramic support tubes are seated on the appropriate pins on the balance plate. Finely adjust the position of the balance until the tubes are centered in their ports, but not touching the sides of the ports.
8. Place the 10" x 11" gray silicon carbide hearth tray on the four ceramic support tubes with the 11" dimension from front to back. Position the front of the hearth tray about one inch back from the lip of the bottom element plate. Center the hearth tray on the four support tubes, equally distant from side to side.
9. Close the lower case by returning the control panel to its original position. Secure the control panel with the four screws you removed in step 1.
10. Switch the main circuit breaker (located on the lower left rear corner of the case when facing the front of the furnace) on. Close the furnace door and switch the power switch "on." The balance display board will read 0.0 grams after approximately 20 seconds of initialization. Turn power "off" and reposition the balance if the display is unstable or reads anything other than 0.0 grams. Instability may be caused by one of the support tubes rubbing.



Note

The balance control buttons can be accessed through the pin holes located on the right front furnace control panel, below the balance indicator, with a tool of .063 diameter or smaller.

Setra Balance Operating Instructions When Used In The Type F85900 NCAT Furnaces

Balance Control Ports:

ENTER	Not used	Not used	ON/OFF
-------	----------	----------	--------

The Balance Default Settings When Used in the Type F85900 NCAT Furnace:

Time: 24 hour format (0 to 24 hours).

Date: US type, 2 Digit Year format, Use the 2-digit year only.

Examples:

23:30:30

12/29/97

To Set the Time and Date Setting

The balance supplies the date and time to the furnace controller. For ease of record keeping, you should set the time to reflect your local time and date.

We recommend performing a hidden "weight" key routine to print the initial date and time before making any changes. After changing the date and time, print the information again and compare to be certain you changed it correctly.

To Set the Time

1. Switch the green power switch down to "OFF".
2. While holding the "4" key down, switch the green power switch up to "ON", the red display should indicate [BAL CAL].
3. Press and hold the balance "ON/OFF" key.
4. Press the balance "ENTER" key, then release both keys. "71nE" will be displayed, press the balance "ENTER" key. The two hour digits will be blinking (Note the time is in a 24 hour format).
5. Press the balance "ON/OFF" key until the correct hour is displayed.
6. Press the balance "ENTER" key, the two minute digits will be blinking.
7. Press the balance "ON/OFF" key until the correct minute is displayed.
8. Press the balance "ENTER" key, the balance will return to the normal weight display.

To Set the Date

1. Switch the green power switch down to "OFF".
2. While holding the "4" key down, switch the green power switch up to "ON", the red display should indicate [BAL CAL].
3. Press and hold the balance "ON/OFF" key.
4. Press the balance "ENTER" key, then release both keys. [71nE] will be displayed, press the balance "ON/OFF" key, [dA7E] will be displayed.

5. Press the balance “ENTER” key, [US] (United States) or [Eur0] (European) date type will be displayed.
6. Press the balance “ON/OFF” key until the desired type is displayed.
7. Press the balance “ENTER” key, [2d Yr] (Two digit year) or [4d Yr] (Four digit year) will be displayed.
8. Press the balance “ON/OFF” key until the desired format is displayed.
9. Press the balance “ENTER” key, [dAY XX] (Day) will be displayed.
10. Press the balance “ON/OFF” key until the desired day is displayed.
11. Press the balance “ENTER” key , [nn0 XX] (Month) will be displayed.
12. Press the balance “ON/OFF” key until the desired month is displayed.
13. Press the balance “ENTER” key, [Yr XX] (Year) will be displayed.
14. Press the balance “ON/OFF” key until the desired year is displayed.
15. Press the balance “ENTER” key, the balance will return to the normal weight display.

To Span Calibrate the Balance

1. Switch the green power switch down to “OFF”.
2. After furnace has cooled to room temperature, open the furnace door.
3. Remove and clean any debris from the ceramic load plate, balance load plate, and ceramic support posts, replace posts and plates.



Note

Furnace door should remain open during the balance calibration.

4. While holding the “4” key down, switch the green power switch up to “ON”, the red display should indicate [BAL CAL].
5. Press and hold the balance “ON/OFF” key.
6. Press the balance “ENTER” key, then release both keys. [71 nE] will be displayed, press the balance “ON/OFF” key twice, [CAL] will be displayed.
7. Press the balance “ENTER” key, [LOAD 8000] will be blinking on the display.
8. Place an 8000 gram (NIST traceable) weight on the ceramic load plate in the furnace.
9. Press the balance “ENTER” key, the balance will display [ACAL], then return to the normal weight display.



Note

The balance must display “0.0” before doing calibration.

To Set Factory Defaults

1. Switch the green power switch down to “OFF”.
2. While holding the “4” key down, switch the green power switch up to “ON”, the red display should indicate [BAL CAL].
3. Press and hold the balance “ON/OFF” key.
4. Press the balance “ENTER” key, then release both keys. [71 nE] will be displayed, press the balance “ON/OFF” key three times, [FACdEF] will be displayed.
5. Press the balance “ENTER” key, the balance will display [BUSY], then return to the normal weight display.



Note

This function is to reset parameters inside the balance which are not user accessible, the TIME, DATE, and BALANCE CALIBRATION are unaffected.

To Escape Configuration Menu

1. Press the balance "ON/OFF" key until [ESCAPE] is displayed.
2. Press the balance "ENTER" key, the balance will return to the normal weight display.

Lift Test Procedures

The efficiency of the blower and/or exhaust system is indirectly monitored by a quick test procedure named the "lift test." The procedure is detailed as follows:



Caution

Perform the "lift test" only when the furnace is at room temperature.

1. Fully assemble tester with exhaust system attached, hearth tray is mounted on the four ceramic support tubes, and at room temperature with no load. This test should always be performed with the furnace chamber at room temperature.
2. Depress power switch to the "on" position. Depress "0" key to tare balance display.
3. Push program "start button". Blower will turn "on". Observe balance display reading. Display should read -3.2 to -8.2 grams. Detach the exhaust system and repeat the test to determine if the exhaust system is restricting the tester air exchange, if the initial test is out of spec or is borderline spec on the -3.5 grams low side.

Printer Operation

The printer automatically prints a record of your furnace's operation. When you press "Start/Stop", the printer will print the current date, then the current time. The printer will then print a space for you to record a sample identification number, another space for you to record the mix type, and a third space for you to record the tester's name or identification number. The printer will then print the filter setpoint and chamber setpoint.



Caution

The printer uses thermal paper which is sensitive to heat and light. Radiated heat from the hot basket assembly can blacken the test data on the tape. Store tape in a cool, dark environment. The test results and header can be printed again by depressing the "Enter" key. The results will not be printed if furnace is powered down or a new test was run.

After the printer has printed all this header information, it will print a column header line "T:TEMP:WT.LOSS:%LOSS". The first column is elapsed minutes. The second column is the main chamber temperature in °C. The third column is direct weight loss in grams, and the fourth column is the uncorrected percentage of sample weight lost. The printer will print the current values of those four measurements every minute during the test.

When you press "Start/Stop" to complete your test, the printer will print the calibrated asphalt content, the Bitumen Ratio, the calibration factor used during the test, the temperature compensation factor used during the test, the total uncorrected percentage of the sample weight lost, the total weight lost in grams, the initial sample weight and the total elapsed time for the test.



Note

A colored stripe along the edge of the paper indicates that you are approaching the end of the roll. When the stripe appears, approximately 18 inches of paper remain. Replace the roll before it is completely exhausted to ensure a complete record of your test procedures.

If the printer runs out of paper during the test, the test will not halt, though the printer will not continue to print. Your results will be safely stored and accessible, providing you have spare rolls of paper. If possible, install a new roll while your test is still running. The printer will resume printing at that point.

If the test is completed before you install a new roll of paper, press "Start/Stop" to conclude the test. "Prn" will be displayed in the Elapsed Time window. This indicates that the printer ran out of paper during a test and a new roll of paper was not loaded. Provided that you do not start another test, you can still retrieve the results of the test. After you load a new roll of paper, press "Enter". The results of the last test will print. This feature is always available after you run a test, and you can print multiple copies of the results of a test simply by pressing "Enter" repeatedly after your test is completed. Allow the printer to finish printing before pressing "Enter" again for additional printouts.

PRINTER OPERATION

```
-----  
Elapsed Time: 39:00  
Sample Weight: 1270g  
Weight Loss: 79.8g  
Percent Loss: 6.28%  
Temp Comp: 0.17%  
Calib. Factor: 0.26%  
Bitumen Ratio: 6.27%  
=====
```

```
Calibrated Asphalt Cnt  
5.85%  
=====
```

39	495	79.8	6.28*
38	494	79.8	6.28
37	495	79.7	6.27
36	495	79.5	6.25
35	497	79.3	6.24
34	499	79.1	6.22
33	503	78.7	6.19
32	506	78.2	6.15
31	509	77.7	6.11
30	513	77.1	6.07
29	516	76.2	6.00
28	519	75.4	5.93
27	521	74.5	5.86
26	524	73.5	5.78
25	526	72.2	5.68
24	528	70.8	5.57
23	529	69.5	5.47
22	530	68.0	5.35
21	531	66.4	5.22
20	531	64.8	5.10
19	532	63.2	4.97
18	536	59.6	4.69
17	536	59.3	4.66
16	536	59.0	4.64
15	537	58.2	4.58
14	539	56.9	4.48
13	548	54.8	4.31
12	563	50.9	4.00
11	612	43.9	3.45
10	640	34.1	2.68
9	536	22.1	1.74
8	459	11.7	0.92
7	439	5.3	0.41
6	433	4.0	0.31
5	427	2.8	0.22
4	420	2.0	0.15
3	414	1.4	0.11
2	409	0.9	0.07
1	411	0.5	0.03

```
-----  
T:TEMP|WT.LOSS|%LOSS  
-----
```

```
Filter Set Pt: 750°C  
Chamber Set Pt: 500°C
```

```
Tested By:-----
```

```
Mix Type:-----
```

```
Sample ID:-----
```

```
Time: 15:41:31
```

```
Date: 3-11-97
```

Test Results Printout

Printer Access

The printer is protected by a protective cover. The printer cover pulls off the front when you squeeze the buttons on each side and pull forward. The printer will then slide forward when you pull gently on the metal tab provided on the leading edge of the printed circuit board.

The printed paper tape exits the printer through a slot in the protective cover. The serrated slot provides a clean tearing of the taped test results. Use only printer tape specified by Barnstead|Thermolyne or your Barnstead|Thermolyne distributor.

Paper Advance Button

A paper advance button is located on the upper right corner of the printer. Pressing the paper advance button while the printer is inactive will advance the paper through the printer. The paper advance button is useful for installing a new roll of paper tape and for advancing a tape for tearing off at the end of a test.

Paper Tape Rolls

The special heat sensitive paper for the printer is available from Barnstead|Thermolyne or your Barnstead|Thermolyne distributor (Part Number PRX2). The printer will not print on plain paper. For paper roll installation, see next page.

Conserving Paper

If you don't require them, you can turn off the printing of intermediate values and only print initial values and final results. This will save a significant amount of paper per test. To turn off the printing of intermediate values:

Depress power switch to "on" while simultaneously depressing the "1" key. Depress the power switch to "off" to exit procedure. See Hidden Key Procedures for more details.



Note

At the end of each day, the printed portion of the printer tape should be removed and stored in an appropriate way. See **Printer Record Storage** for details.

Paper Tape Roll Installation

The heat sensitive paper will print on only one side, and therefore, must be installed properly to function.

1. Switch furnace power on. Press the Paper Advance button to feed out any paper remaining in the printer.
2. Remove the printer cover and pull out the printer as described in **Printer Access**.
3. Cut the lead end of the replacement paper as shown in the illustration. Remove at least six inches of the lead end of the paper to remove the adhesive which secured the roll for shipping.
4. Insert the paper roll on the paper roll shaft as shown.
5. Feed the cut end of the paper into the slot at the bottom of the printer (A). Push the feed button on the front of the printer until about 1" of paper comes out the front of the printer.
6. Feed the paper through the cover and reinstall the cover.

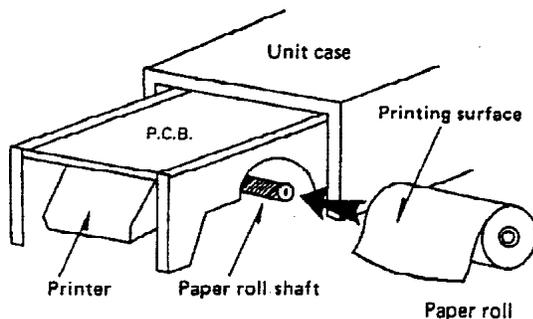
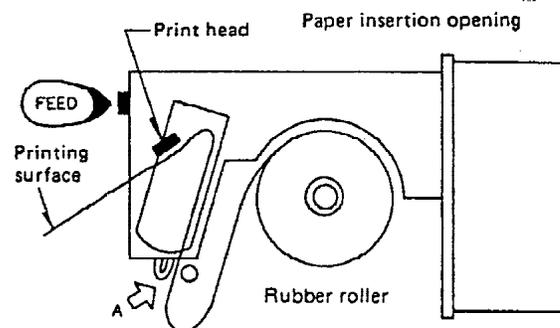


Figure 3
Paper Roll Installation



Printer Record Storage

In addition to being heat-sensitive, the paper tape is also light sensitive and will darken if left exposed to light for an extended length of time. To ensure the long-term legibility of your records, choose one of the following methods:

1. Photocopy each day's tapes and file the photocopy.
2. Store the tapes in an opaque folder, file or envelope.

Note that certain situations and substances will hasten the degradation of the thermal paper and should be avoided:

1. Exposure to heat or hot surfaces will darken the paper and obliterate your readings.
2. Ultraviolet light will darken the paper and obliterate your readings. Common fluorescent lights emit low levels of ultraviolet light; thermal paper tapes left exposed to fluorescent light in a lab or office will eventually darken and become unreadable.
3. Common cellophane tape interacts with the thermal paper and will darken it to illegibility. Use care if you tape your original thermal paper tapes into a notebook.

Operation



Note

If you do not press any other keys, the displays will revert to their standard displays after five seconds.

Displays

The furnace has four displays, labeled “Chamber Temp.,” “Percent Loss,” “Elapsed Time” and “Balance Indicator.”

“**Chamber Temp.**” displays the current temperature of the main chamber in °C. If you press the “Temp.” button on the keypad, the “Chamber Temp.” display indicates the current setpoint for the furnace chamber. The “Setpoint” LED will illuminate when the setpoint is displayed.

“**Percent Loss**” displays the percentage of the total sample weight currently consumed by combustion. When you press the “Weight” button on the keypad, “Percent Loss” displays the last sample weight you entered. When you press the “Calib. Factor” button on the keypad, “Percent Loss” displays the last calibration factor you entered.

“**Elapsed Time**” displays the elapsed time since you started the test. Pressing the “Start/Stop” button starts a test. Pressing the “Start/Stop” button stops a test and also stops the timer and freezes the “Elapsed Time” display until the next test is started.

“**Balance Indicator**” displays the weight change of the sample, in grams (only during a test).

“**Balance Stability Indicator**” is a flashing LED located within the balance indicator window. The indicator normally flashes throughout the test period as the sample loses mass during the “ignition” process. The indicator will typically remain full “on” when the mass becomes stable.



Note

Other parameters can be adjusted through the **Hidden Key Routines**, explained on page 41 of this manual.

Controls

To View the Current Settings of the Controller:

Press the “Temp.” button to view the current chamber setpoint on the “Chamber Temp.” display. Press the “Weight” button to view the initial weight of the last sample on the “Percent Loss” display. Press the “Calib. Factor” button to view the current calibration factor on the “Percent Loss” display.

To Change the Setpoint Temperature:

1. Press the "Temp." button. The "Chamber Temp." display will show the furnace's current setpoint.
2. Enter your new setpoint. Press the "Enter" button to accept your new setpoint. This must be done before the "Chamber Setpoint" light goes out.
3. Press the "Temp." button again to verify your new setpoint.

To Change the Initial Sample Weight:

1. Press the "Weight" button. The "Percent Loss" display will show the current initial sample weight.
2. Enter your new initial sample weight (in grams). Your initial sample weight should be a four digit number, in whole grams. Press the "Enter" button to accept your new initial sample weight. This must be done before the "Sample Weight" light goes out.
3. Press the "Weight" button again to verify your sample weight.

To Change the Calibration Factor:

1. Press the "Calib. Factor" key once to enter a negative weight loss value and twice to enter a positive value. The "Percent Loss" display will show the current calibration value. For a calibration factor of 0.21%, enter 21.

2. Enter your new calibration factor. Press the "Enter" key to accept your new calibration factor. This must be done before the calibration factor light goes out.
3. Press the "Calib. Factor" button again to verify your new calibration factor.

To Tare Balance:

1. Press the "0" key.

Outline of Operational Procedures

1. Weigh your sample on an external balance accurate ± 1 gram.
2. Enter sample weight into controller. Using the instructions under **To Change the Initial Sample Weight**, enter the initial weight of your sample.
3. Check and, if necessary, adjust your temperature setpoint and correction factor. See the instructions under **Controls** on pages 27-29.
4. Load the basket assembly into the furnace chamber by inserting it directly above the hearth tray and setting gently on the hearth tray. The carrier tines of the transport handle will extend past the rear of the transport tray when locked in place. As you insert the load into the furnace chamber, allow the carrier tines of the transport handle to touch the rear wall of the of the furnace chamber, then gently set the load on the hearth tray. This will ensure proper placement of the load from front to back. Check the load for proper clearance on each side.



Note

Once the test is started, the setpoints cannot be changed.



Warning

Do not open door while program is in process. Flame and noxious fumes may be released into the laboratory. Operator will be exposed to the risk of burns. Always allow test program to reach endpoint before opening door.



Warning

Do not load cutback asphalt samples containing naphtha, gasoline, fuel oil or explosive volatiles. Explosive ignition can occur resulting in a fire or a threat of burns to the operator.

Keep objects away from the thermocouple. Do not slide basket assembly against the thermocouple. This will affect temperature reading and weight indication.



Hot Surface

To avoid burns, this furnace must not be touched on the exterior or interior furnace surfaces of the chamber area (except door handle and front control panel) during use or for a period of time after use. "Hot Surface. Avoid Contact."



Warning

Do not use in the presence of flammable or combustible chemicals; fire or explosion may result. This device contains components which may ignite such materials.



Caution

Do not exceed the 5000 gram capacity. Failure to observe this caution could result in damage to furnace components and/or balance. "HHHHHH" will be displayed on the balance display if the weight limit is exceeded.

If your load touches either side, the front or the back of the furnace chamber during a test, the test is invalid. Balance instability will result. This is typically evidenced by a weight gain on the one-minute printed test result readout.

Use insulated gloves and a fire retardant apron when loading and unloading furnace. Always wear safety glasses or a safety face shield and high temperature gloves when loading or unloading furnace. Long sleeve, fire retardant attire is recommended. Always keep your gloves and glasses clean. Allow clearance for the basket tray so it will not touch the door insulation. See furnace loading tips.

5. Close the door. The furnace will not operate with the door open.
6. Press the "Start/Stop" button.

When you press "Start/Stop", the automatic locking mechanism will lock the door. After approximately five to fifteen minutes of heating (depending on sample size and sample volatility), the asphalt will ignite. You will see a sudden increase in the actual chamber temperature ("Chamber Temp." display). The main chamber temperature may remain significantly higher than your setpoint temperature for some time (again, depending on sample size and volatility). When the main chamber temperature begins to decline, you will also see both the "Percent Loss" and "Balance Indicator" displays begin to stabilize. After the sample weight has stabilized, an audible alarm and stable light will illuminate to signal test completion and the printer will stop. Note: The printer will only stop if the Auto Program Switching Mode is on. The furnace will continue to heat at setpoint temperature.

7. Press the "Start/Stop" button. The automatic locking mechanism will unlock the door. Use appropriate safety apparel and tools when unloading the hot furnace. Note: The door will automatically unlock, if the Auto Program Switching Mode is on.

Timer Mode

Programmable Timer

Heating the furnace to operational levels may require two or more hours of preheating but leaving the furnace on constantly may not be efficient, consuming both electricity and heating elements. To optimize your working hours, we have designed an automatic preheat timer into your asphalt testing furnace. This feature allows you to begin work immediately each day, but only run your furnace as much as necessary to complete your days work.



Note

If you don't want to enter a "wake-up" date you can bypass this feature by simply pressing ENTER after you have pressed the timer button in step 1. Bypassing the date automatically converts the timer from a programmable 364 day timer to a 24-hour timer. This means that when the programmed "Time" is reached, the unit will begin heating, ignoring the "wake-up" date. The date needs to be set at 0.00 for this to happen.



Note

The timer format is European or Military time so to enter a "wake-up" time of 5:00 a.m. you would input 500 and then press ENTER. A wake-up time of 5:00 p.m. would be entered as 1700; then press ENTER. The start up time and date are now entered.

Programming the Timer

The following directions will explain how to program the "wake up" date and time into your asphalt furnace. This will determine exactly when the furnace will begin preheating to your setpoint temperature. We recommend that you set the time for at least 2-21/2 hours before you want to begin work.

1. Press the timer button on the key pad. The heating elements will shut down at this time. The wake up time will be displayed in the "Elapsed Time" display and the "wake-up" date will be displayed in the "Percent Loss" display.
2. Enter the "wake-up" date by inputting the month and then the day. Example: May 16th would be entered as 516. Then press ENTER. The "wake-up" date is now set.
3. You may now proceed to enter the "wake-up" time.

If at any time you wish to disable the timer, press the START/STOP button.

Inactivity Mode

By using the hidden key feature with the "Timer" key, you can select the Inactivity Mode. This mode allows the furnace to "wake-up" at the programmed time and date, but if the user does not press any keys for a period of 4 hours, the unit will shut down and "In Ac" will be displayed in the

TIMER MODE

chamber temp display. The unit will remain shut down until the user presses the START/STOP key. Pressing the START/STOP key will set the unit into its normal idle mode.

The Inactivity Mode is a valuable feature should the unit be placed in a remote location and the operator is not able to return due to unexpected circumstances such as inclement weather. The unit will remain shut down until the user presses the START/STOP key.

Interrupting the Timer Mode

Should you need to interrupt the Timer mode for any reason, simply press "Start/Stop". The heating elements will reenergize. Depending on how long the furnace has been in Timer mode, some preheating time may be necessary before your furnace is ready for use. To return the furnace to Timer mode again, press the Timer button on the keypad.

Methodology and Tester Tips



Note

For complete Ignition Method Procedure, contact your Provincial or State D.O.T. or see the A.S. T. M. or AASHTO procedures.

1. Sample aggregate and sample asphalt cement are preheated to a constant weight in preparation for the standard ignition method. Failure to preheat samples will introduce inconsistent asphalt content values.
2. Cutback asphalts or slurry seals containing potentially explosive naphtha, gasoline, Kerosene or other explosive solvents must not be placed in the tester. Explosion can occur. The solvents must be reduced to a safe level prior to preheating in an oven and igniting in the tester.
3. Your tester has a rated load capacity of 5,000 grams. Splitting large samples may save time and produce improved results particularly if your test stability threshold is set at a lower value.
4. Back to back testing: Proposed AASHTO and ASTM drafts specify "Samples can be placed in the furnace at significantly lower temperature since the furnace will quickly heat to the desired temperature once the sample begins to burn." For example, this means the furnace temperature does not need to recover to 538°C. The heat from ignition will typically cause the chamber temperature to recover rapidly. This allows you to increase your daily test capacity significantly.
5. Your tester automatically compensates for the initial weight change of the load, caused by heating the load from a low temperature to a higher chamber temperature. Note that the load has not lost any mass at this point; it changes weight because its temperature has increased. Temperature compensation typically ranges from 0.1% to 0.25%. A warm HMA sample will be assigned a value of 0.1% or higher. A cold

METHODOLOGY AND TESTER TIPS

sample will be assigned a value near .25%. Test time will be reduced if an HMA sample is warm or hot.

<u>Problem</u>	<u>Possible Cause</u>	<u>Diagnostic</u>	<u>Remedy</u>
AC results too high	Sample not dried to a constant weight	Review standard method HMA sample preparation	Re-dry
	Calibration factor for the aggregate not entered or is incorrect	Review Calibration Factor Display	Correct or reenter
	Calibration factor is incorrect.	Review Calibration Factor Display	Correct calibration factor
	Entered sample weight incorrectly	Review Sample Weight Display	Correct weight entry
	Chamber temperature too high, causing aggregate to deteriorate, causing excessive weight loss	Review standard method calibrating factor procedure for sample preparation	Rerun calibration factor test per standard method
AC results too low	Insufficient air exchange in chamber resulting in incomplete combustion of sample	Perform "lift test" to ensure a -3.2 to -8.2 gram lift.	Oil and clean blower assembly. Replace blower. Clean exhaust system. Repeat lift test.
	Sample weight and/or calibration factor readout entered incorrectly	Check test tape	Correct Calibration Factor
	Basket assembly lodged against chamber or door resulting in low weight value		Correct position of basket assembly

Software Features



Note

If you use Bitumen Ratio for your end results, you must use this factor during your mix calibration procedure. Ignore the calibrated asphalt content number.

Equations Used to Determine Bitumen Ratio

The Bitumen Ratio has been added to the Rev. G software. This test result is used in the United States, Canada and Europe. The Bitumen Ratio equation is detailed as follows:

$$\text{Bitumen Ratio} = (\text{Weight Loss}/\text{Sample Weight after ignition}) \times 100 \text{ minus temperature compensation, minus correction factor.}$$

The Bitumen Ratio test results are printed in the header above the calibrated asphalt content for each test.

$$\text{Calibrated Asphalt Content} = (\text{Weight Loss}/\text{Sample Weight}) \times 100 \text{ minus temperature compensation, minus correction factor.}$$

Test Interrupt/Power Interrupt

If the power to the furnace is interrupted during an ignition test, and then restored—the furnace will continue the test but will print the following information on the ticket.

{Results Invalid}

Test Interrupted

Time: XX:XX:XX

The elapsed time will restart at 1 and continue to count up. The software will continue to monitor the weight loss and recognize the endpoint to end the test.

This feature will prevent smoke from entering the lab should a power interrupt occur. Once power has been restored the blower will start up again to maintain air flow through the chamber. This will also prevent the user from prematurely opening the door.

The power interrupt feature also applies to the programmable timer. Should the power go off during the night while the unit is asleep and then come back on prior to the programmed “wake-up” time, the software will recognize the present time and “wake-up” at the correct programmed time.

Auto Shutdown Mode

The software can be toggled between Auto Mode and Manual Mode by performing a Hidden Temp Key Routine. In the Auto Mode, the unit will recognize the endpoint, stop the blower, print the results and then BEEP once every 60 seconds until the operator presses the START/STOP key. This will unlock the door and disable the beep.

In the Manual Mode the unit will recognize the endpoint and place an asterisk by the endpoint. It will continue to run the test and beep until the operator presses the START/STOP button.



Note

If your test procedure calls for aggregate calibrations to determine the calibration factor, you will need to run the tester in the Manual Mode.

Positive Calibration Factor

Software has the ability to accept a positive calibration factor. By pressing the calibration factor key twice simultaneously, then entering your number and pressing ENTER, a (-) sign will appear in the percent loss display. The software will now subtract a negative number (same as adding) from the percent loss. This is necessary when testing HMA that contains hydrated lime that has been added with the oil as an antistriper.

Stability Threshold

Endpoint detection can be adjusted from .01% - .5% of the sample weight. A higher stability threshold can sometimes be advantageous when burning off samples containing very soft aggregates. The stability threshold can be changed by performing a “hidden key” function using the calibration factor key, then entering the new number. (See **Hidden Key Routines.**)

Serial Port Output/Operation

Serial Port Output/Operation

The furnace has a serial output port on the rear of the unit. The port outputs a data string to any computer able to receive RS232 serial communications. A one-way cable to connect the computer with the furnace is needed, along with software on the computer to collect the data. *graphAct* Data Logging and Graphing Software will automatically collect and graph data from the computer for you. If you are interested in the graphACT Data Logging Software, contact KG Systems at (201) 429-9300 or fax them at (201) 429-2298. Order computer cable from Barnstead|Thermolyne or your Barnstead|Thermolyne distributor. Other software, such as "Terminal" in Microsoft Windows™, can be used to collect and manipulate the raw data from the furnace. Raw data collected in this manner can be graphed and manipulated in a spreadsheet program such as Lotus 123™.

Sample Data Serial Port Output

On the next page are two lines of sample data output. Each line contains the data output of a single second of the test cycle, sampled once every minute. The data output can be either continuous or just output during a test. To change, see **Hidden Key Routines**, page 41.

Description of Sample Data

Key	Description
1	Test Status (ON/OFF)
2	Elapsed Time (minutes)
3	Actual Chamber Temperature (°C)
4	Actual Weight Loss (g)
5	Actual Weight Loss (%)
6	Actual Filter Temperature (°C)
7	Chamber Setpoint (°C)
8	Filter Setpoint (°C)
9	Sample Weight (g)
10	Time (24 hour format)
11	Date (M/D/Y) or (D/M/Y)
12	Temperature Compensation (%)
13	Calibration Factor (%)
14	Calibrated Asphalt Content (%)
15	Test Stability Threshold (g)
16	Stability Indication (+/-)
17	Bitumen Ratio

Key	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
ON,	34	552	166.9	5.49	784	538	750	3036	12:03:54	6-11-97	0.09	-2.56	7.96	0.01	-	8.28	
OFF,	34	552	167.0	5.50	784	538	750	3036	12:03:55	6-11-97	0.09	-2.56	7.97	0.01	+	8.29	

Sample Data Output

Explanation of Error Codes

Furnace Error Codes

All errors (unless explicitly noted) will cause the test procedure to stop. Furnace error codes are displayed in red LED windows located on control panel.

- E001** Chamber thermocouple circuit is open. Tip may be cracked at weld. The chamber heat may open the crack by thermal expansion. Replace thermocouple. Resistance of a normal thermocouple is ≤ 1 ohm. Also, look for loose connection at terminal connection at rear of furnace. Thermocouple leads are red (-) and yellow (+).
- E002** Filter thermocouple open. Follow above procedure for filter thermocouple.
- E003** Chamber temperature limit of 675°C is exceeded. This error is disabled while in the test program mode. Exceeding the 675°C limit can be caused by:
1. Thermocouple has deteriorated. Remedy: Check for 1 ohm resistance or less. Replace if indicated.
 2. HMA sample size and oil BTU content cause the chamber temperature to exceed limit setpoint. Remedy: Split sample or reduce sample size.
- E004** Filter temperature limit of 975°C is exceeded (See E003 explanation).
- E005** Door interlock not functioning. This may be caused by:
1. Plunger rod off center of lock port due to door out of adjustment, mechanical linkage jamming or plunger location shifted. Remedy: Adjust as needed.
 2. Check for a bend or ding in the outer case where the Door Lock Linkage is attached. This can happen during shipping or handling. Straighten case and adjust linkage.
 3. Microswitch failure.
- E007** Analog to Digital Converter is not functioning properly. This may be caused by a component failure or faulty cable connection.
- E008** The DTR signal from the balance is indicating the balance is either not ready or not connected.

EXPLANATION OF ERROR CODES

- E009** Setpoint is out of range. This is a temporary error to alert you that you have crossed the allowable boundary for the function you are setting. The furnace will beep for 3 seconds while displaying the error, and then return to normal operation. The setpoint will revert to its previous value.
- E010** Chamber thermocouple leads reversed. Thermocouple is type "K". Polarity is coded as red (-) and yellow (+). Polarity must be consistent throughout the circuit.
- E011** Filter thermocouple leads reversed. Thermocouple is type "K". Polarity is coded as red (-) and yellow (+). Polarity must be consistent throughout the circuit.
- E012** Balance not communicating; weight, time and date **not** received. This may be caused by the balance not being configured correctly. Follow the procedure on pages 18-21.

Setra Balance Error Codes

Displayed in green Balance indicator window.

- | | |
|--------|---|
| HHHHHH | Exceeds maximum specified load. Remedy: Reduce loads to specified range. |
| LLLLLL | Load does not meet minimum specified load requirements. Remedy: Increase load to specified range. |
| NOCAL | Unable to do span calibration (load not within 1% of cal weight, or weight unstable). |
| UnABLE | Unable to process command (usually due to being in improper mode). |
| ProtEc | Calibration protect switch not in the PROTECT position during operation. |
| REPlug | System not calibrated. |
| OFLO | Internal arithmetic overflow. |
| S Err | Processor stack overflow. |
| In Err | Memory indexing error. |

Hidden Key Routines

Hidden Keys provide multiple use of the keypad. Hidden Key Procedures typically are used to access infrequently changed user variables and infrequently used diagnostic procedures. The access, procedure, and exit are detailed under each key procedure. The furnace must be in the (non-programmable) mode to access the Hidden Keys.

0 Key-Diagnostics

Access: Depress the Power Switch to "ON" while simultaneously depressing the "0" key.

Procedure: Enters the diagnostic procedure for factory testing. The printout is typically filed with the Operation Manual.

Exit: Depress Power Switch to "OFF" and then "ON" to return to normal operation.

1 Key-Printout Paper Saver:

Access: Depress Power Switch to "ON" while depressing the 1 key simultaneously.

Procedure: Chamber temperature display PRN and the Percent Loss display will toggle "ON" or "OFF" as the access procedure is repeated. The new mode will be displayed for three seconds and then the furnace will return to normal operation.

Exit: Automatic

2 Key-Default

Access: Depress the 2 key while simultaneously depressing Power Switch to "ON".

Procedure: DEF will be displayed for three seconds to indicate variables have been reset to factory values. The furnace will return to normal operation. Defaulting to factory values is a useful diagnostic tool as a comparison of current values vs. factory values can be made within minutes. Values can be printed by depressing ENTER while simultaneously depressing the Power

Switch to the "ON" position.

Exit: Automatic

3 Key-Chamber Calibration Procedure

Equipment Needed: 1 ea. Digital Pyrometer with Penetration Probe, Sensor NIST Traceable. (PM20700 Pyrometer with TC405X4 Penetration Probe).

Setup: Calibration consists of inserting a sensor penetrating through the covered stainless steel tube located adjacently to the control thermocouple. Entry is at the top center rear of furnace. The penetrating probe is needed to penetrate through the soft insulation. Probe insertion is at the same depth of the chamber control thermocouple. Cover probe entry tube after the calibration procedure has been completed. Do not place pyrometer on top of hot furnace. After inserting the test thermocouple penetration probe, set furnace chamber and filter at 538° C or standard method specified temperature. Allow furnace to stabilize at setpoint in the idle mode. The maximum offset allowed before calibration is required is $\pm 50^{\circ}\text{C}$.

Access: Depress 3 key while simultaneously depressing power switch to "ON".

Procedure: CHBR CAL will be displayed in the Percent Loss and Elapsed Time windows respectively. The Chamber Temperature window will display the actual chamber temperature which should be at or near setpoint temperature. Allow the furnace to stabilize at setpoint.

Enter the temperature displayed in °C by the digital pyrometer by using the keypad. Press "ENTER". The new offset value will be used and the entered temperature will be displayed. The entered temperature is the temporary setpoint.

The original setpoint will return upon exiting. The software has calculated and saved the new offset value which will apply to all setpoints throughout the operating range.

Exit: Depress Power Switch to "OFF" and then "ON" to return furnace to normal use. Remove sensor probe and cover entry tube.

4 Key-Provides Entry to Balance Menus

Access: Depress 4 key while simultaneously depressing Power Switch to "ON".

Procedure: BAL will display in Chamber Temperature window. CAL will display in Percent Loss window. Entry allows user to change time and date settings, review and adjust balance inputs, and calibrate balance. These topics are detailed under the "Balance Calibration" instructions. (See pages 18-23.)

Exit: Depress Power Switch "OFF" and then "ON" to return furnace to normal use.

5 Key-Filter Temperature Adjustments

Access: Depress 5 key while simultaneously depressing the Power Switch to "ON".

Procedure: Adjustment range is 0-900°C. Factory setpoint is 750°C. Chamber Temperature displays current setpoint. Percent Loss window displays FIL. Elapsed Time window displays SP for setpoint. Use the keypad to change the display to the new setpoint value. Depress "ENTER" promptly. This new setpoint value will be displayed.

Exit: Depress Power Switch to "OFF" and then "ON" to return furnace to normal operation.

6 Key-Disables Error Codes:

Access: Depress 6 key while simultaneously switching the Power Switch to "ON."

Procedure: ERR will be displayed in the Chamber Temperature window. "OFF" will be displayed in the Percent Loss window. The furnace will automatically return to normal operation within five seconds with the ERR codes inactivated.

ERR codes are defeated to perform diagnostic procedures as to temporarily ensure continued furnace operation in the event of a false error code.

Exit: Depress the Power Switch to "OFF" and then "ON" to return the furnace to normal operation with activated error codes.

7 Key-Displays Actual Filter and Chamber Temperature:

Access: Depress the 7 key while simultaneously depressing the Power Switch to "ON".

Procedure: Chamber Temperature will display actual temperature. The Percent Loss displays actual filter temperature. You can compare actual chamber and filter temperatures with setpoint to assess the need for the thermocouple or element replacement or re-calibration.

Exit: Depress the Power Switch to "OFF" and then "ON" to return the furnace to normal operation.

8 Key-Serial Port Output Adjustment

Access: Depress the 8 Key while simultaneously depressing the Power Switch to "ON".

Procedure: SPC or SPn will display in the Chamber Temperature window for three seconds. SPC prints the serial output continuously. SPn prints the serial output only when the furnace is in the program mode. Accessing toggles the mode between SPC and SPn. The displayed mode is the active mode. Default is the SPC mode.

Exit: Automatically returns to manual operation within three seconds.

9 Key-Disables Beep

Access: Depress the 9 Key while simultaneously depressing the Power Switch to "ON".

Procedure: The Chamber Temperature will display BEEP. The Percent Loss window will display "ON" or "OFF". The mode condition will display for three seconds. Accessing toggles the mode between "ON" and "OFF". The displayed mode is the active mode. The default mode is BEEP "ON".

The beep should only be deactivated when the tester is used in the Manual Test Mode. The beeper should always remain active when the tester is in Auto Mode.

The option to inactivate the beeper is useful for raw aggregate calibration when minute losses may cause the endpoint beeps to activate prematurely before the procedure has been completed. The key press beep is not disabled in the BEEP "OFF" mode.

Weight Key-Prints Out Balance Variables

Access: Depress the weight key while simultaneously depressing the Power Switch to "ON".

Procedure: The Percent Loss Window will display SCAL. The Elapsed Time window will display LIS. The printout will generate automatically upon entering the printout mode. See example of factory printout for balance variables on page 24.

Exit: The furnace will automatically return to normal operation after the printout is generated.

HIDDEN KEY ROUTINES

Enter Key-Prints Out User Variables

Access: Depress the ENTER Key while simultaneously depressing the Power Switch to "ON".

Procedure: PRN will display in the Percent Loss window. USR will display in the Elapsed Time window. The printout will generate automatically upon entering the printout mode.

Exit: The furnace will automatically return to normal operation after the printout is generated.

Calibration Factor Key-Adjust or Check Test Stability Threshold of a Test

Access: Depress the Calibration Factor Key while simultaneously depressing the Power Switch to "ON".

Procedure: The stability threshold setting will be displayed in the Percent Loss window. The Elapsed Time window will display FLN. The value options are 0.01 - 0.5%. Enter the new value via keypad. Observe the Percent Loss window as the new value is entered. The new value must be entered and the ENTRY key must be depressed within five seconds.

ASTM Draft 6 specifies test endpoint completion when the measured mass loss does not exceed 0.01% over three consecutive one minute periods. AASHTO specifies endpoint completion when the mass loss does not exceed 0.02% over two consecutive one minute periods. The test stability threshold value defines the endpoint. The value must match the standard specification you are applying. The test stability value is printed on the User Variable Printout. See Hidden Key ENTER. An example of the printout is depicted on page 24.

Exit: Depress Power Switch to "OFF" and then "ON" to return furnace to normal operation.

```
Software Version 1.7
7/13/98 15:31:55
Listing of Scale Var.
```

ON/WEIGHT printout example

```
-----
Auto Shutdown: On
RS232 Out: Continuous
Printing: All data
Beeper: On
Inactivity Check: On
Awake Date: 06-17
Awake Time: 3:30
Test Stability: 0.01%
Calib. Factor: 0.00%
Sample Weight: 1200g
Chamber Offset: 0°C
Filter Set Pt: 750°C
Chamber Set Pt: 538°C
Software: SC859X1 Rev G
```

ON/ENTER printout example

Temp Key - Toggles from Auto Program Switching Idle to Manual Program Switching to Idle at Endpoint

Access: Depress TEMP key while simultaneously depressing the Power Switch to "ON".

Procedure: AU appears in the Chamber Temp display. The Percent Loss displays either "ON" or "OFF". Repeat ACCESS if "OFF" is displayed. Repeating access changes the display to AU "ON". You are now in the Auto Program Switching to Idle mode. Repeat ACCESS again to return to the Manual Program Switching to Idle mode.

Auto Program Switching to Idle can increase the number of tests run per day. The operator's monitoring time is eliminated as the test results automatically print out at endpoint. The Manual Program Switching to endpoint is still available in the event continuous running is required after endpoint.

Exit: AU "ON" or "OFF" is displayed for approximately five seconds. The furnace automatically returns to idle.

Timer Key - Disables Inactivity Check

Access: Depress the Time key while simultaneously depressing the Power switch to "ON."

Procedure: The chamber temperature will display IN AC. The Percent Loss window will display "ON" or "OFF." The mode condition will display for three seconds. Accessing toggles the mode between "ON" and "OFF." The displayed mode is the active mode.

Active Keys

These keys activate a function when depressed. The furnace must be in the idle (non-programmable) mode.

0 Key-Tares the Balance

Access: Depress "0" key. The balance will automatically tare to "0" grams in the balance display.

Procedure: This mode is useful to perform the "lift test", as the balance must be tared before conducting test. See Glossary.

The weight of the loaded basket assembly can be rechecked if the balance is tared prior to loading.

Exit: Automatic at ACCESS.

Enter Key-Duplicates Header Test Results

Access: Depress the ENTER key.

Procedure: The header test results will print out for last test if no other key functions have been performed since printing of the last test results. The power switch must not be switched "OFF" and "ON" after the original test report is generated.

This feature provides as many header copies of the last test results as needed by the operator.

Exit: Automatic upon completion of printout.

Preventive Maintenance and Servicing



Warning

This furnace contains refractory ceramic insulation which can produce respirable fibers and dust when handled. These fibers can cause irritation and can aggravate preexisting respiratory disease. The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber as possibly carcinogenic. After service refractory ceramic fiber dust may contain crystalline silica, which may cause lung damage (silicosis) and which has been classed by IARC as a probable carcinogen. (See MSDS, p. 68.)

Refer servicing to qualified personnel.



Hot Surface

Allow the furnace to cool to room temperature before performing any maintenance or servicing. "Hot Surface. Avoid Contact."



Warning

To avoid electrical shock, this furnace must always be disconnected from the power supply prior to maintenance and service.

Perform only maintenance described in this manual. Contact an authorized dealer or our factory for parts and assistance.

Refractory ceramic materials are located in the door, and in the chamber of the furnace. Tests performed by the manufacturer indicate that there is no significant risk of exposure to dust or respirable refractory ceramic fiber resulting from operation of the equipment under normal conditions. However, there may be a risk of exposure to respirable refractory ceramic dust or fiber when repairing or maintaining the insulating materials, or when otherwise disturbing the materials in a manner which causes release of dust or fibers therefrom. Through the use of proper handling procedures you can work safely with these insulating materials and minimize any exposure. Accordingly, before you repair or replace any insulating materials, or perform any other servicing on this product which could disturb or cause exposure to dust from insulating materials, you should consult the appropriate Material Safety Data Sheets (MSDSs) for such products with respect to proper handling and appropriate protective equipment. For additional MSDSs, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department of Barnstead|Thermolyne or Barnstead|Thermolyne distributor.

Element Plate Construction Use and Care

Your tester contains five element refractory plates containing special helical coiled element embedded in the refractory. The proprietary element design protects the element wire from harmful asphalt ignition fumes, arrests coil expansion and contraction and protects the coils from mechanical damage. The filter element heats the ceramic filter and is controlled by a separate electronic controller. The sides, top, and bottom elements heat the chamber.

It is normal for the refractory plates to develop hairline cracks in the refractory plates. This does not necessitate element plate replacement if the mechanical strength is not compromised.

Periodically fire the chamber at 650°C for two hours in the idle mode to clean element plates. Vacuum chamber floor as needed.

Your tester requires blower maintenance which consists of cleaning and oiling the motor about every six months or if the "lift test" results indicate a decline in blower efficiency. This service requires detaching the exhaust duct, removing the top cover and fume hood. The motor is fastened to the rear of the fume hood. Place one drop of Anderol High Temperature Lubricant (included in accessory kit), into the small oil ports located on the blower motor. Locate the tester where adequate space for servicing is available. Excessive air leakage around the door insulation can also reduce lift values. The remedy is to adjust the door fit or replace door insulation. Door fit adjustment is performed by loosening the top and bottom hinge screws. Adjust the door and refasten.

Door lock adjustment may also be required to ensure proper door seal. The latch hook on the door, hooks the latch pin in the closed position. The latch pin is adjustable. The two Phillips screws located above the latch pin port tighten the doors fit when turned counter clockwise. One screw should be turned a half turn followed by turning the second screw a half turn. This adjustment procedure will ensure proper latch pin position and prevent binding.

The blower assembly consists of the wheel housing, cooling fan bracket and motor. A 2" wide paint brush with a vacuum cleaner works nicely to clean the assembly, baffle plates, ceramic vent tubes and flame deflectors. We recommend wearing glasses.

To Replace a Chamber Heating Element

1. Disconnect furnace from power supply. (See parts list for normal cold resistance values.)
2. Remove the back terminal cover of the furnace. (Note placement and connections of wires.)
3. Loosen the screws and nuts on the terminals of the element to be replaced.
4. Open the door.
5. Remove the hearth tray and the ceramic supporting posts.
6. Pull the defective element out.

7. Slide the new element into place, threading the leads through the insulating porcelain bushing on the back of the furnace.
8. Cut off any excess lead wire. Reinstall terminal connections and tighten screws and nuts securely.
9. Replace the ceramic supporting posts and the hearth tray.
10. Replace the back terminal cover.
11. Reconnect furnace to power supply.
12. Test operation of furnace.



Caution

Make sure to align the five holes in the insulation to the top cover plate.

To Replace a Filter Heating Element

1. Disconnect the furnace from the power supply. (See parts list for normal cold resistance value.)
2. Remove the back terminal cover of the furnace. (Note placement and connections of wires.)
3. Loosen the screws and nuts on the terminals of the filter element. Remove the filter thermocouple.
4. Remove exhaust tubing, remove top cover and fume hood.
5. Open the door of furnace, remove the (4) screws retaining the cover above the door.
6. Remove the fume hood retaining brackets and remove all screws which are holding the top cover plate onto the furnace.
7. Remove top cover plate, blanket insulation, and top piece of vacuum formed insulation. The element will be exposed. Remove the filter element. Inspect the filter.
8. If filter is OK, then install the new element, threading leads through the insulation, porcelain bushings and terminals on back of furnace.
9. Replace the insulation, top cover and front cover.

10. Tighten screws and nuts on the element terminals, trim the excess wire from the element leads.
11. Replace the back terminal cover, fume hood, fume hood retaining brackets, ceramic posts, hearth plate, top cover, and exhaust.
12. Reconnect furnace to power supply.
13. Test operation of furnace.

To Replace a Type K Chamber Thermocouple

1. Disconnect furnace from power supply. (See **Replacement Parts** list for normal cold resistance value).
2. Remove the back terminal cover of the furnace. (Note placement and connection of T/C lead wires).
3. Remove the screws on the chamber thermocouple terminals and disconnect the wires.
4. Remove the clamp retaining the thermocouple.
5. Pull the thermocouple straight back.
6. Insert the new thermocouple into the furnace and connect the leads to the terminal block, matching the wire colors with the incoming wires.
7. Secure connections with screws removed in Step 3.
8. Replace the back terminal cover.
9. Reconnect the furnace to power supply.
10. Test operation of furnace.



Note

The thermocouple circuit consists of the thermocouple and thermocouple extension lead wires. Polarity plus to plus and minus to minus must be maintained in the circuit. Reversing lead wire polarity, thermocouple lead wires touching one another or grounding to case will cause the chamber temperature to exceed the setpoint temperature and could cause element failure. The actual displayed temperature will read on the low side of setpoint temperature.

To Replace a Type K Filter Thermocouple

1. Disconnect furnace from power supply. (See **Replacement Parts** list for normal cold resistance value.)
2. Remove the back terminal cover of the furnace. (Note placement and connection of T/C lead wires.)

3. Remove the screws on the filter thermocouple terminals and disconnect the filter thermocouple wires.
4. Remove the clamp retaining the thermocouple.
5. Pull the thermocouple straight back.
6. Insert the new thermocouple into the case.
7. Replace the clamp securing the thermocouple.
8. Connect the leads to the terminal block, matching the wire colors with the incoming wires.
9. Replace the back terminal cover on the furnace.
10. Reconnect the furnace to the power supply.
11. Test the operation of the furnace.

To Replace a Solid State Relay

Three solid state relays are located inside the lower control section at the rear. The relays are mounted on the heat sink inside the case. Facing the front of the furnace, the fan relay is on the right, chamber elements relay middle and filter relay on the left. See wiring schematic on page 62.

1. Disconnect furnace from power supply.
2. Remove the screws on the front dial plate. Open the front dial plate and remove the two hex 8/32" (11/32" socket or wrench is required) nuts in the lower corners behind the front dial plate. Remove the eight screws on the lower back cover.
3. Remove the (3) four wire modular connectors, one on the right and two on the left, behind the front cover. (The connectors have a locking tab which has to be opened before removal).
4. Remove the remaining (5) cables from the printer, balance, and display board.
5. Remove the nut from the short ground wire on the front cover. Disconnect the ground wire.
6. Slide the base toward the rear of the furnace about 3 inches.

7. Remove the large brown modular connector from the center rear of the control section by squeezing the tabs on the side of the connector and pulling up.
8. Remove the small (4 wire) modular connector on the right side of the brown connector above the fan. (This connector has the same locking tab as the previous (3) connectors.
9. Slide the base toward the rear of the furnace an additional 3 inches.
10. Remove the two yellow cables with green connectors from the PC board to which they are connected. Mark the locations of the wires to ensure that they are connected to the same terminals when they are reinstalled.
11. Slide the base the remaining distance out of the furnace control section being careful not to catch and damage any of the cables.
12. Mark wiring of locations on the relay to be replaced. Remove wiring and screws.
13. Replace relay, replace wiring and screws on the relay.
14. Slide the base section back into the furnace, again being careful not to damage any of the cables, to about 6 inches from case.
15. Reinstall the two yellow cables with green connectors to their original locations, loop wire down toward bottom of base section.
16. Slide the base section in an additional 3 inches and reconnect the two modular connectors.
17. Slide the base section in the remaining distance, refasten all screws and nuts which retain the base.
18. Reconnect all cables and ground wire.
19. Close front cover and install the screws.
20. Reconnect the furnace to the power supply.
21. Test the operation of the furnace.

To Replace a Fuse

Six fuse holders are located at the rear of the lower control section. A medium flat-bladed screwdriver is needed to remove the carriage from the barrel-style fuse holder. Both sides of the circuits are fused. The 6.3 amp FZX61 fuse protects the low voltage circuitry. The 1.6 amp FZX47 fuse protects the low amperage/high voltage circuit consisting of the control boards, front control panels display and RS232 port. The 4 amp fuse (FZX53) is tiered over all other circuits but not the filter or chamber elements. The filter and chamber elements are protected by the 30 amp circuit breaker which is tiered above the 4 amp fuse circuit.

Fuse failure may be caused by:

1. Dielectric breakdown of insulators due to cracking, moisture pickup and contamination resulting in case to ground shorts.
2. Excessive current due to line spikes or lightning strikes.

The cause of fuse failure must be determined and resolved before installing replacements. See the **Replacement Parts** list on page 57 for fuse details.

To Replace a Door Switch (Microswitch)

1. Disconnect furnace from power supply.
2. Remove the four top screws on the front dial plate.
3. Open the front dial plate. Remove the shield which covers the door switches.
4. Disconnect the wires from the door switch to be replaced. (Note connection and placement of wires to Microswitch.)
5. Remove the two screws from the Microswitches.
6. Insert new Microswitch and secure with screws removed in Step 5.

7. Reconnect wires to new door switch. Replace wire shield.
8. Close front dial plate and install screws.
9. Reconnect to power supply.
10. Test operation of door switch.

To Realign Door Switch (Microswitch) Bracket

1. Disconnect furnace from power supply.
2. Loosen the screws which retain the door switch bracket on the bottom left side of door.
3. Move the bracket closer to furnace to make switch engage sooner. Move bracket further away to make switch engage later. (Lightly tighten screws between each adjust to hold bracket while you test the switch.)
4. The switches should click when the door is approximately 1" from being completely closed.
5. Tighten screws when bracket is positioned correctly.
6. Reconnect to power supply.
7. To test the operation of the door switch: turn the power switch on, set the control to a setting high enough to keep the control from cycling, open and close the door; the mechanical relay should be heard when the door is about 1" from being closed.

To Realign Door Lock

The door lock plunger interlocks through a port at the bottom of the door. If the plunger is missing the port, realign the door by adjusting the position of the door hinge pins in the door hinge brackets.

Replacement Parts

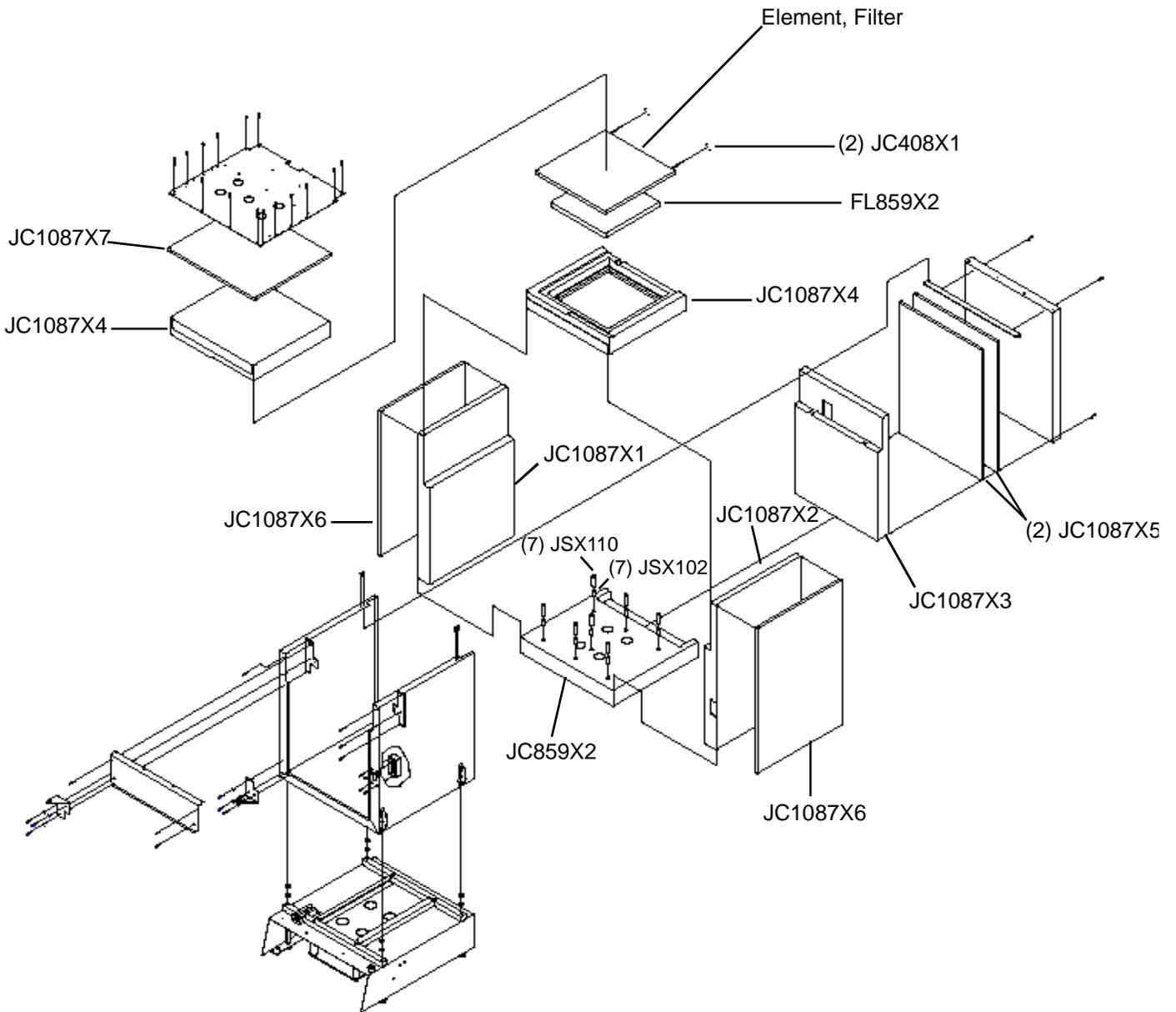
Models: 220-240 Volts, 208 Volts
Series: 1087

<u>Number</u>	<u>Part Number</u>	<u>Description</u>	<u>Voltage</u>
<u>Required</u>			
1	04246	Micro Switch, Solenoid Door Lock	All Models
2	04246	Switch, Door	All Models
1	AYX3	Printer	All Models
1	EL859X3	Element, Side, Right - Cold Resistance, 55 ohms	All Models
1	EL859X4	Element, Side, Left - Cold Resistance, 55 ohms	All Models
1	EL1087X1	Element Filter - Cold Resistance, 36 ohms	220-240
1	EL1087X2	Element, Chamber, Bottom - Cold Resistance, 10 ohms	220-240
1	EL1087X3	Element, Chamber, Top - Cold Resistance, 10 ohms	220-240
1	EL1087X4	Element, filter - Cold Resistance, 30 ohms	208
1	EL1087X5	Element, Chamber, Bottom - Cold Resistance, 8 ohms	208
1	EL1087X6	Element, Chamber, Top - Cold Resistance, 8 ohms	208
1	FA759X1A	Fan, cooling, control case	All Models
1	FA1087X2	Fan, Blower	All Models
1	FL859X2	Filter, Ceramic, Coarse	All Models
2	FZX47	1.6 Amp Fuse, Little Fuse #23901.6	All Models
6	FZX50	Fuse Holder	All Models
2	FZX53	4 Amp Fuse, Schurter #034.3123	All Models
2	FZX61	6.3 Amp Fuse, Schurter #FSTO34.3125	All Models
10	JC408X1	Insulators, Blanket, element lead	All Models
1	JC412X1	Insulation, formed, door All Models	
4	JC412X10	Insulation, blanket, door All Models	
1	JC859X2	Insulation, formed, chamber bottom	All Models
1	JC1087X3	Insulation, formed, chamber rear	All Models
2	JC1087X4	Insulation, formed filter assembly, top or bottom	All Models
2	JC1087X5	Insulation, blanket, chamber rear	All Models
2	JC1087X6	Insulation, formed, chamber sides	All Models
1	JC1087X7	Insulation Blanket, filter assembly top	All Models
10	JS356X1	Insulators, ceramic, element lead	All Models
7	JSX102	Insulator, ceramic, chamber support bottom	All Models
7	JSX110	Insulator, ceramic, chamber support bottom	All Models
4	JSX122	Tube, Ceramic, Balance platform to hearth tray	All Models
10	JSX124	Insulators, element lead terminals	All Models
10	JSX125	Insulators, element lead terminals	All Models
1	LT1087X1	Owner's Manual	All Models
1	ME1087X1	Balance	All Models
1	PC859X1A	Logic, Printed Circuit Board	All Models
1	PC859X3A	Analog, Printed Circuit Board	All Models

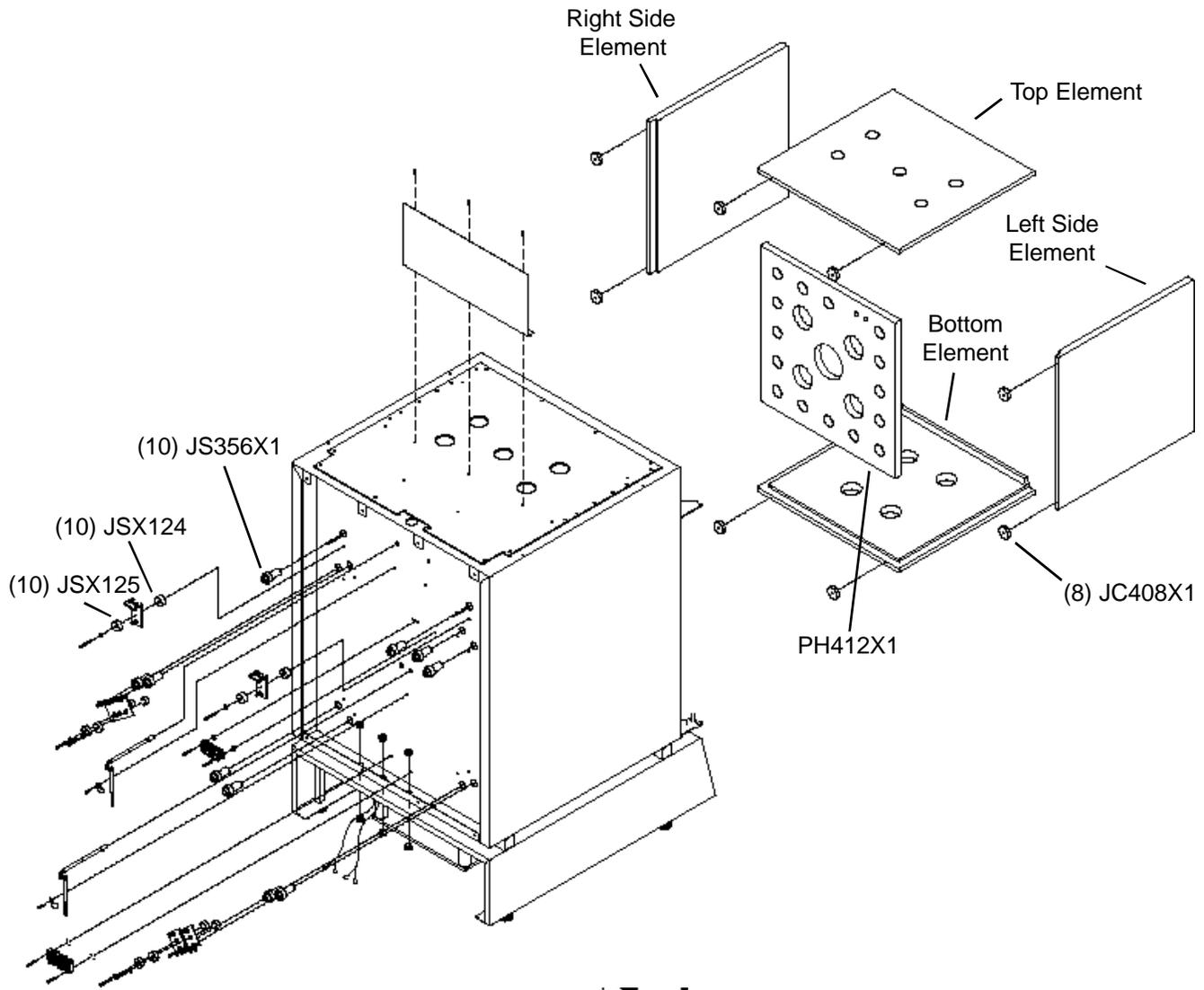
REPLACEMENT PARTS

1	PC859X4A	Power, Printed Circuit Board	All Models
1	PC1087X1	Display, Printed Circuit Board	All Models
1	PH42X1	Hearth Tray	All Models
1	PH412X1	Hearth Plate, Chamber, Rear	All Models
1	PRX2	Printer Paper Tape	All Models
3	RYX34	Solid State Relay Chamber/Fan /Filter	All Models
1	RYX59	Solenoid, Door Lock	All Models
1	RYX62	Contactator, Main	All Models
1	SC859X1	EPROM Software	All Models
1	SWX103	Circuit Breaker	All Models
1	SWX144	Switch, Power	All Models
1	TC859X1A	Thermocouple, Chamber - Cold Resistance, 1 ohm or less	All Models
1	TC1087X1	Thermocouple, Filter - Cold Resistance, 1 ohm or less	All Models
1	TNX81	Transformer, stepdown	All Models
1	TRX116	Terminal, fan connection, back top case	All Models
1	TU859X1	Tubing, Exhaust, 3" X 10', Electrogalvanized Steel (optional accessory, order separately)	All Models
1	WH1087X3	Wire harness, Balance RS232 Cable	All Models
1	WH1087X4	Wire harness, Printer Cable	All Models
1	WH1087X15	Wire harness, 14 Pin Display Cable	All Models

Exploded View (Insulation & Filter)



Exploded View (Elements)



Note

See **Replacement Parts** list to properly identify replacement elements. Element Part Numbers will vary with the voltage of the furnace. The voltage of the furnace may be 208 volts or 220-240 volts. See the electrical specification label located at the rear of the control section of the furnace to obtain the rated voltage.

Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

All parts listed herein may be ordered from Barnstead|Thermolyne or your Barnstead|Thermolyne distributor from whom you purchased this unit.

Decontamination Statement

We cannot accept any product or component sent to Barnstead|Thermolyne for repair or credit that is contaminated with or has been exposed to potentially infectious agents or radioactive materials. No product or component will be accepted without a "Return Goods Authorization" (RGA) number.

Wiring Diagram

Wiring Diagram Component List

<u>Ref. No.</u>	<u>Description</u>	<u>Ref. No.</u>	<u>Description</u>
C1	Capacitor	TB1	Terminal Block, power entry
CB1	Circuit Breaker	TB2	Terminal Block, main
F1	Fuse 4 amp	TB3	Terminal Block, fan
F2	Fuse 4 amp	TB4	Terminal Block, TC
F3	Fuse 1.6 amp	TC1	Thermocouple, chamber
F4	Fuse 1.6 amp	TC2	Thermocouple, filter
F5	Fuse 6.3 Amp		
F6	Fuse 6.3 Amp		
FL1	Filter, Low Amp Circuits		
FL2	Filter, Main		
HR1	Element, Right Chamber		
HR2	Element, Top Chamber		
HR3	Element, Left Chamber		
HR4	Element, Bottom Chamber		
HR5	Element, Filter		
J1	Wire Harness Ass'y, RS232 Port, External		
J2	Cordset		
J3	Wire Harness Ass'y, RS232 Balance		
J4	Wire Harness, 15V, Balance		
M1	Fan, Chamber Exhaust		
M2	Fan, Cooling		
PC1	PC Ass'y, Main/Logic		
PC2	PC Ass'y, Power		
PC3	PC Ass'y, Display		
PC4	PC Ass'y, Analog		
PC5	PC Ass'y, Display Balance		
PR1	Printer		
RY1	Relay, Contactor		
RY2	Relay, S.S., Chamber		
RY3	Relay, S.S., Filter		
RY4	Relay, S.S., Fan		
S1	Switch, Main (Green)		
S2	Switch, Door Switch		
S3	Switch, Door Switch		
S4	Switch, Interlock		
S5	Switch, Keypad		
SC1	Meter, Balance		
SO1	Relay, Solenoid		
T1	Transformer		

Amperage Configurations

Amperage Configurations

240V Unit Only

The original wiring of your furnace is configured to the 27 Amp (High Amp) configuration. The furnace is capable of being wired to a 20 Amp (Low Amp) configuration.

1. Disconnect the furnace from power supply.
2. Remove the rear terminal cover.
3. Configure as desired.

Low Amp to High Amp

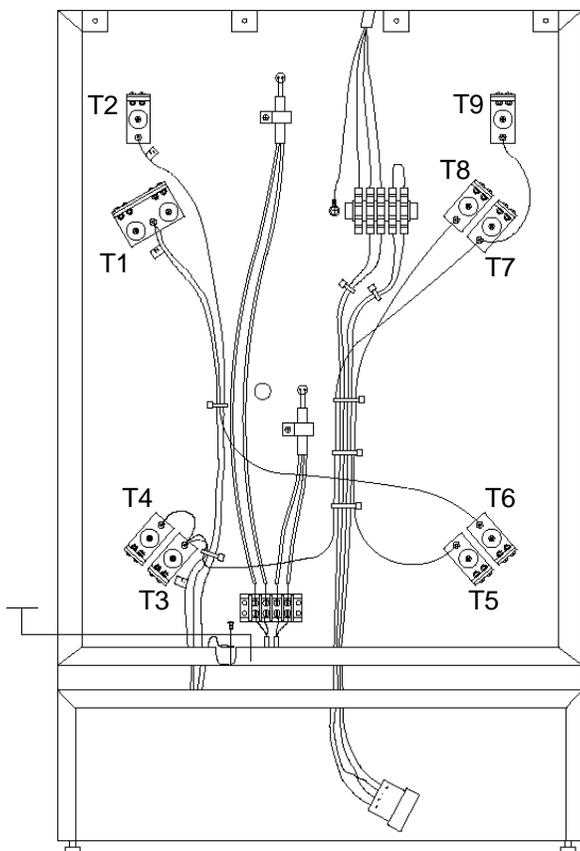
To change from Low Amp configuration to High Amp configuration - move the wire at Terminal T4 which goes to Terminal T6 to Terminal T1, also move one end of the short looped wire at T4 to T3. See below.

High Amp to Low Amp

To change from High Amp configuration to Low Amp configuration - move the wire at Terminal T1 which goes to Terminal T6 to Terminal T4, also move the T3 end of the short wire to T4 (it will be connected on both ends to the same terminal).

All other wiring will remain the same.

4. Replace the rear terminal cover.
5. Reconnect power supply.
6. Test operation of furnace. (See **Hidden Key Routine "0" Zero**).



Wiring Configuration Key

- - - Low Amperage - Wire connected between T4 & T6, wire disconnected between T3 & T4.

— High Amperage - Wire connected between T1 & T6, wire connected between T3 & T4.

Glossary

- Balance Stability:** A green LED will flash on and off at the lower right side of the balance display. When the LED is shown, the balance is stable. It is normal for the LED to flash early in the ignition procedure, as rapid sample weight loss occurs early in the firing procedure and diminishes as ignition nears completion. The LED will not illuminate if the furnace is subject to vibration from other equipment in the lab. The stable indicator on the control panel is not related to the LED balance stability indicator.
- Calibration Factor:** Addresses the aggregate weight loss or gain which occurs during the ignition process. This loss or gain is not related to asphalt content loss and is added or subtracted from the asphalt content. Standard methods specify the procedure for determination. This calibration factor is entered by the operator.
- Default:** Resets your current values to the factory values. See hidden key 0 and 2.
- Default Values:** These are factory values assigned to each unit for testing during production. A printout of these values is supplied with each unit. Default values can be compared to your current values to assess correct entry of each value.
- EPROM:** Electronically Programmable Read Only Memory. Part #SC859X1 is an EPROM programmed to the current software configuration. Software revisions are designated alphabetically. Current software is Revision G.
- Error Codes:** Error codes are displayed to notify the operator of out-of-specification condition or modification. Error codes range from E001 to E005 and E007 to E012.

GLOSSARY

HMA:	Hot Mix Asphalt.
Idle Mode:	This mode is entered on startup after initialization. Revision G software automatically transfers from the program mode to the idle mode upon completion of the test. The furnace will idle at setpoint temperature in preparation for the next test. The blower is "OFF" in the idle mode.
Initialization:	This procedure sets up and configures the tester for operator use when the Power Switch is depressed to "ON". Initialization time is approximately 5-15 seconds.
Lift Test:	This test measures the blower efficiency when the furnace is in an unloaded condition and is at room temperature. The operator is required to tare the balance, depress the start-stop key, and observe the balance display. Normal lift measurements are minus 4-6 grams.
NCAT:	National Center for Asphalt Technology.
Offset Value:	This value is the temperature difference between the stabilized chamber displayed temperature value and the chamber temperature verification value determined by the re-calibration process.
Program Mode:	This mode is entered by depressing the start-stop key. The program mode is used to determine asphalt content of a HMA sample, calibration of the HMA sample, or raw aggregate.
Temperature Compensation Factor:	This factor compensates for the loaded basket assembly weight reduction experienced when placed in the ignition furnace chamber at temperature. The Temperature

Compensation Factor is automatically calculated by the furnace software. This factor must be employed in the ignition process to achieve acceptable precision and accuracy specified by standard methods. This factor is subtracted from the asphalt content.

Test Endpoint: This is the point at which the HMA samples weight loss does not exceed the “Test Stability Threshold Setting” for three consecutive one minute periods. Furnaces containing Rev. G software will end the test, asterisk the endpoint reading on the printout, and switch from the program mode to the idle mode at endpoint if the Auto Program Switching to Idle is employed.

Test Stability This adjustable variable defines the endpoint sensitivity by measuring the HMA sample mass loss and comparing it to the test threshold setting. The test is complete when the measured mass loss does not exceed the stability threshold setting for three consecutive one minute periods. The stable indicator on the front control panel indicates the test stability threshold (endpoint) has been attained.

One Year Limited Warranty

Barnstead International (“BARNSTEAD”) warrants that if a product manufactured by Barnstead shall be free of defects in materials and workmanship for one (1) year from the first to occur of (i) the date the product is sold by BARNSTEAD or (ii) the date the product is purchased by the original retail customer (the “Commencement Date”). Except as expressly stated above, BARNSTEAD MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO THE PRODUCTS AND EXPRESSLY DISCLAIMS ANY AND ALL WARRANTIES, INCLUDING BUT NOT LIMITED TO, WARRANTIES OF DESIGN, MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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Heating elements, because of their susceptibility to overheating and contamination, must be returned to the BARNSTEAD factory and if, upon inspection, it is concluded that failure is due to factors other than excessive high temperature or contamination, BARNSTEAD will provide warranty replacement. As a condition to the return of any product, or any constituent part thereof, to BARNSTEAD’s factory, it shall be sent prepaid and a prior written authorization from BARNSTEAD assigning a Return Goods Number to the product or part shall be obtained.

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The name of the authorized Barnstead International dealer nearest you may be obtained by calling 1-800-446-6060 (563-556-2241) or writing to:

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2555 Kerper Boulevard
P.O. Box 787
Dubuque, IA 52004-0787
Phone: 563-556-2241 or 800-553-0039
Fax: 563-556-0516
E-mail Address: rsld@barnstead.com

