Manual of Operation and Instruction

Troxler ICO™
NCAT Oven
(Model 4740)

Troxler Electronic Laboratories, Inc.
3008 Cornwallis Rd. • P.O. Box 12057
Research Triangle Park, NC 27709
Phone: 1.877.TROXLER
Outside the USA: +1.919.549.8661
Fax: +1.919.549.0761
www.troxlerlabs.com

UM-4740

TPN 121600

January 2025

Edition 1.14

SAFETY ALERT SYMBOL

The Safety Alert Symbol shall appear within this manual. Wherever it appears in this manual or on safety signs affixed to the machine, this is to make all aware of the potential for personal injury and to be cautious when these images are present.

Always observe all WARNING, CAUTION, and NOTE recommendations listed within this manual before operating the machine.

TROXLER SERVICE CENTERS

Troxler Corporate Headquarters
P.O. Box 12057
Research Triangle Park, NC 27709
Phone: 1.877.TROXLER (1.877.876.9537)
Outside the U.S.A.: +1.919.549.8661
Fax: +1.919.549.0761

Technical Support
Phone: 1.877.TROXLER
(1.877.876.9537)
TroxTechSupport@troxlerlabs.com

North Carolina Service Center
3008 E. Cornwallis Road
Research Triangle Park, NC 27709
Phone: +1.919.549.8661
Fax: +1.919.549.0761
TroxTechSupport@troxlerlabs.com

Florida Office & Service Center
2376 Forsyth Road
Orlando, FL 32807
Phone: +1.407.681.4221
Fax: +1.407.681.3188
TroxTechSupport@troxlerlabs.com

Midwestern Office & Service Center
1430 Brook Drive
Downers Grove, IL 60515
Phone: +1.630.261.9304
Fax: +1.630.261.9341
TroxTechSupport@troxlerlabs.com

Western Office & Service Center
11300 Sanders Drive, Suite 7
Rancho Cordova, CA 95742
Phone: +1.916.631.0234
Fax: +1.916.631.0541
TroxTechSupport@troxlerlabs.com

Southwestern Office & Service Center
2016 East Randol Mill Rd., Suite 406
Arlington, TX 76011
Phone: +1.817.275.0571
Fax: +1.817.275.8562
TroxTechSupport@troxlerlabs.com

Troxler Europe & Service Center
Troxler Electronics GmbH
Waldstrasse 4, D.82239 Alling nr.
Munich, Germany
Phone: ++ 49.8141.71063
Fax: ++49.8141.80731
troxler@t-online.de

Troxler Electronic Technologies (Zhangjiagang)
1F, Bldg G, No. 1 Guotai North Road
ZJG, China, 215600
Phone: 0086.512.56793702
Fax: 0086.512.56793701
kjin@troxlerlabs.cn

To locate an independent, Troxler-authorized service partner near you, call 1.877.TROXLER (1.877.876.9537).

ABOUT THIS MANUAL

The *Troxler ICO NCAT Oven (Model 4740) Manual of Operation and Instruction* provides detailed information about the oven. The manual includes product safety information, as well as instructions for selecting an installation site, installing the oven, and using the oven to burn hot-mix asphalt (HMA) samples and to store sample data.

This manual is organized as follows:

Chapter 1, Introduction to the ICO – Provides a brief overview of the oven and its features, as well as a list of parts and accessories, and instructions for unpacking and inspection.

Chapter 2, Product Safety Information – Includes information on the safe use of the oven.

Chapter 3, Installation – Contains instructions for installing the oven, including the criteria for selecting an installation site.

Chapter 4, Setup and Operation – Describes the oven keypad, and provides instructions for setting up, starting, operating, and shutting down the oven.

Chapter 5, Main Menu – Provides a detailed description of the oven software, including examples and explanations of the control menus.

Chapter 6, Calibration – Includes instructions for determining correction factors, and for calibrating the integrated scale.

Chapter 7, Handling Data – Contains instructions on creating and using *project files* and describes how to view, erase, print, and download data.

Appendix A, Maintenance and Service – Provides maintenance and service information, as well as instructions on basic troubleshooting.

Appendix B, Menu Map – Shows a map of the menus in the oven control software.

Appendix C, Specifications – Contains the environmental, performance, electrical, and mechanical specifications of the oven.

HOW TO USE THIS MANUAL

Before using the ICO, read this manual carefully. Of particular importance is the safety information in Chapter 2. Do not attempt to operate the oven before reading this manual and the safety warnings posted on the unit. Troxler stresses that the user is solely responsible for ensuring the safe use of the oven. Neither the manufacturer, its subsidiary, distributors, nor representatives can assume responsibility for any mishaps, damage, or personal injury that may occur from failure to observe the safety warnings in this manual and posted on the unit.

The oven allows measurement of the asphalt content of asphalt mixes. After ignition testing, the remaining aggregates may be used as sample for gradation measurements. The *Troxler ICO NCAT Oven (Model 4740) Manual of Operation and Instruction* describes the installation, setup, and operation of the ICO.

CONVENTIONS USED IN THIS MANUAL

Throughout this manual the following symbols and special formatting are used to reveal the purpose of the text.

WARNING

Warnings indicate conditions or procedures that, if not followed correctly, may cause personal injury.

CAUTION

Cautions indicate conditions or procedures that, if not followed correctly, may cause equipment damage.

NOTE

Notes indicate important information that must be read to ensure proper operation.

⟨**KEY**⟩ This style indicates a key or character to press on the ADU keypad.

DISPLAY–Typestyle and shading used to simulate the control panel display

1. Indicates a procedure with multiple steps.

♦ Indicates a list of items required (such as equipment) or important points to know.

▶ Indicates that more than one option is available. Carefully select the option that applies.

TABLE OF CONTENTS

LIST OF FIGURES

Chapter 1:
INTRODUCTION TO THE ICO

This chapter provides a brief overview of the ICO. This information includes a list of the parts and accessories, as well as instructions for unpacking and inspecting the oven upon receipt.

INTRODUCTION

The two major components of HMA are the asphalt binder and the aggregate. Thus, accurate measurements of the percent asphalt content (%AC) and aggregate gradation are required for HMA quality control and assurance. The ICO allows safe, quick, and reliable measurement of the %AC of HMA samples and creates samples for aggregate gradation measurements.

The oven employs a method developed by the National Center for Asphalt Technology (NCAT) called *pyrolysis*, or ignition. In this method, an HMA sample of known mass is prepared. The asphalt binder in the sample is then burned. The change in sample mass indicates the %AC. Standard sieve analysis of the remaining clean aggregate provides the gradation.

The ignition oven test method is covered by the provisions of ASTM D6307 (*Standard Test Method for Asphalt Content of Asphalt Mixture by Ignition Method*) and AASHTO T 308 (*Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method*).

The oven can also be used in conjunction with a nuclear asphalt content gauge, such as Troxler Models 3241–D, 3241 USS, and 3242. The nuclear gauge provides a fast method of measuring the %AC when the aggregate gradation is not needed. The oven can be used when a job requires aggregate gradation.

The nuclear gauge test method is covered by the provisions of the ASTM Standard D 4125, *Standard Test Method for Asphalt Content of Bituminous Mixtures by the Nuclear Method*. For more information on Troxler's asphalt content gauges, contact your Troxler representative.

WARNING

Do not attempt to operate the oven before reading this manual and the safety warnings posted on the unit. Troxler stresses that the user is solely responsible for ensuring the safe use of the oven. Neither the manufacturer, its subsidiary, distributors, nor representatives can assume responsibility for any mishaps, damage, or personal injury which may occur from failure to observe the safety warnings in Chapter 2 of this manual and posted on the unit.

FEATURES

The oven incorporates a number of features that provide unparalleled efficiency, safety, usability, and flexibility.

The oven can be powered from a 208–240 V AC, 50/60 Hz, 40 amp circuit. The oven is therefore convenient for use in construction trailers, where power sources may be limited.

Oven Door Lock

The *oven door lock* helps ensure operator safety. The oven monitors the state of the door and will not apply electrical power to the heating element if the door is open. The oven door locks automatically at the start of a burn cycle. The door remains locked until five minutes have elapsed since the chamber temperature has peaked or since the ⟨**ABORT**⟩ key was pressed.

Sample Basket

The *sample basket assembly* provides operator safety while handling HMA samples, and to ensure an even burn of the asphalt binder. A *basket carrier* is available for lifting the baskets in and out of the oven. A *sample safety cage* shields the hot sample basket assembly while the asphalt sample cools.

Integrated Scale

The *integrated scale* continuously monitors the sample mass loss during a burn cycle.

The oven features an *Auto-Tare* function that automatically tares (zeroes) the integrated scale when no mass is present. The oven software also enables the operator to tare the scale manually, to calibrate the scale, and to verify the scale calibration.

Oven Keypad and Internal Logic

The oven *keypad* and *internal logic* provide control, data storage, and output flexibility. The keypad enables the operator to set up

and operate the oven, to store sample data, to calibrate and verify the integrated scale, and to enter correction factors.

Auto-Timer

The oven includes an *Auto-Timer* function that can preheat the oven automatically based upon start and stop dates and times entered by the operator.

Audible Indicators

The oven features two audible indicators, an internally mounted *beeper* and a louder *annunciator* mounted on the rear panel. The beeper emits a short beep in response to a valid keystroke on the oven keypad. It sounds a longer beep when the operator presses an invalid key or the oven displays an error message. The annunciator sounds when the door is unlocked at the completion of a burn cycle. The red **BURN COMPLETE** indicator on the front panel also lights when the door is unlocked.

Internal Printer

The *internal printer* enables the operator to print sample data and system status information, either automatically or manually.

External Communications Ports

Two ports, a serial communications port and an auxiliary port, are mounted on the rear panel of the oven. The serial communications port, the leftmost of the two ports (as viewed from the rear of the oven), is used to output data to a serial device, such as a computer or printer. The auxiliary (right) port is intended for factory use only.

Aggregate Correction Factors

The oven stores up to twenty user-defined *aggregate correction factors* (*ACFs*), which are percentage values used to adjust the measured asphalt content for specific aggregates.

Measurement Displays

During a burn cycle, the oven displays measurement units of *percent loss* (*%Loss*). The *%Loss* measurement is the difference between the sample weights before and after the burn cycle, expressed as a percentage of the starting mass.

Two Burn Modes

The oven offers two *burn modes*. The burn time can be set manually by the operator (*Program Time* mode), or it can be adjusted automatically by the oven (*Auto-Control* mode). In *Auto-Control* mode, the oven limits the burn time according to the *cutoff limit* specified by the operator. The cutoff limit can be defined in grams or as a percentage.

The oven can store data for up to 200 HMA samples. Sample data is stored in *project* files created by the operator. Up to twenty project files can be defined. Sample data is stored in the active project file, either manually using identification numbers entered by the operator, or automatically using the *Auto-Store* function.

PARTS AND ACCESSORIES

Figure 1.1 shows the ICO and Figure 1.2 shows the starter kit and accessories. Use the figures to locate and identify the following parts:

1. The **oven** contains the electronics and heating elements to burn the asphalt binder from the aggregate. The oven includes an **internal printer** used to print sample data and system status information. An **integrated scale** (not shown) monitors mass loss throughout the burn cycle. The oven's **exhaust duct** vents fumes produced during the ignition to a suitable ventilation system.

2. The unbreakable steel **hearth plate** (not shown) provides even distribution of heat beneath the sample baskets.

3. The **basket cover** fits on the top of the sample baskets.

4. A stackable set of two **sample baskets** to hold the HMA sample for burning.

5. The **catch pan** catches aggregate particles that may fall through the bottom of the sample basket(s).

6. The ***Troxler ICO NCAT Oven (Model 4740) Manual of Operation and Instruction*** (not shown) details how to operate and maintain the oven.

Starter Kit

- Additional accessories available and sold separately in the ICO Starter Kit include:

- A **basket carrier** provides added safety when moving the sample basket assembly in and out of the oven.

- A **sample safety cage** shields the hot sample basket assembly while the asphalt sample cools.

- A **soft-bristled brush** is used to brush soot from the turbine blades of the oven's exhaust fan when cleaning the exhaust plenum box.

- A pair of **Insulated gloves** protect hands and forearms when moving the heated sample basket(s).

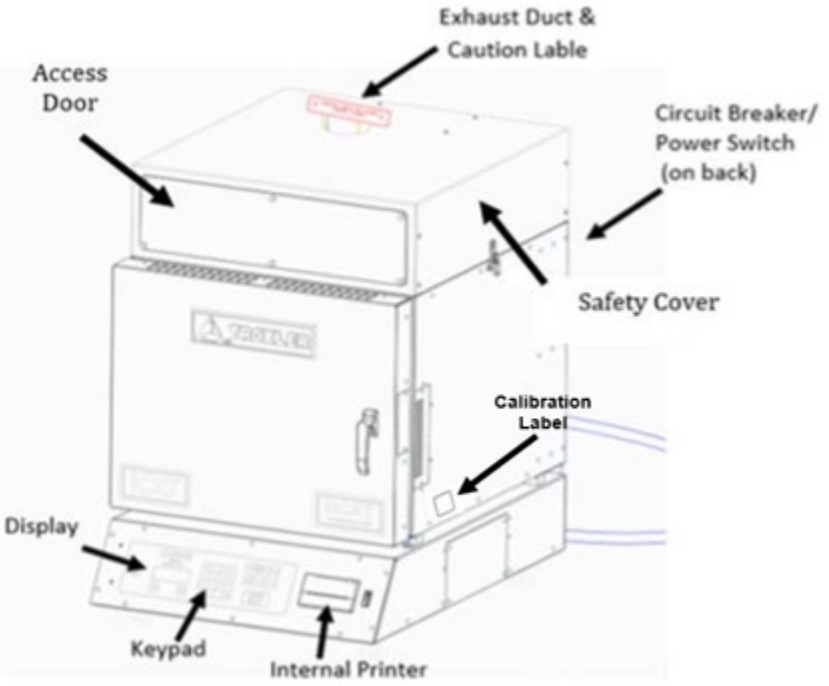


Figure 1.1: ICO (Access Door & Saftey Cover)

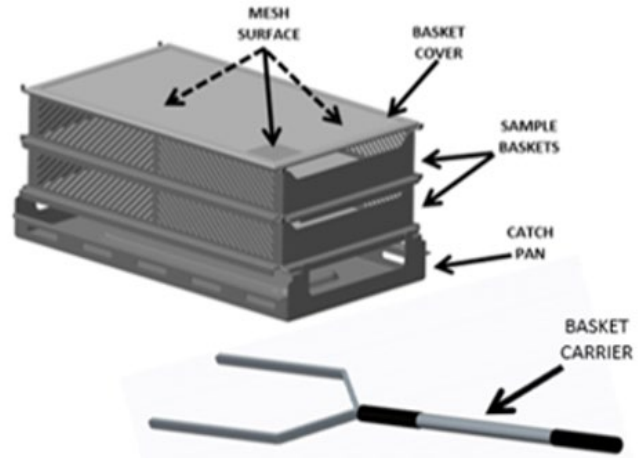


Figure 2.2: ❖ ICO Starter Kit (Parts and Accessories)

UNPACKING AND INSPECTING

NOTE

To ensure the safe return of the oven to Troxler for repair or maintenance, please keep the original shipping box, pallet, and all packing materials. The box folds for easy storage.

Upon receiving the oven from the factory:

1. Perform a complete inspection and inventory. If the shipping case and/or any other part or accessory appears damaged, notify the carrier and your Troxler representative **immediately**.

2. Cut the bands from around the carton, then lift off the top half of the box, and remove all accessory items.

3. Remove any packing material packed around the oven or inside the oven chamber. Save all packing material, including the plastic sheet used to cushion the inside of the chamber door during shipping, for reuse if the oven needs to be returned for service or repair. The box folds for easy storage.

4. Remove the bottom half of the box.

5. Check the shipping case for the following items:

    - Oven
    - Steel Hearth plate
    - Sample basket assembly (*starter kit solid separately)
    - Exhaust duct
    - Duct adapter, 3- to 4-inch
    - Clamp, 4-inch hose

- *Troxler ICO NCAT Oven (Model 4740) Manual of Operation and Instruction* Universal Serial Bus (USB) flash drive

- Material Safety Data Sheet (MSDS) Information Kit

6. Inspect the outside surfaces of the oven and accessories for damage.

Chapter 2: **PRODUCT SAFETY INFORMATION**

This chapter provides basic product safety information concerning the ICO, as well as cautions and warnings related to the safe use of the oven.

INTRODUCTION

The ICO is designed to be safe for the user. The system uses modern, refractory ceramic fiber (RCF) materials to provide highly efficient insulation of the heated chambers. This material is completely enclosed and should present no health risk to the operator during normal use in accordance with this manual. RCF can present a potential health hazard if the fibers become airborne and thus become respiratory issues. Since, under normal operating conditions, the design of the oven completely encloses these materials, fibers should not become airborne during normal use. Therefore, no special precautions are necessary when using the oven to perform asphalt content analysis.

Special precautions should be taken during maintenance operations or other activities that involve removal of the system sheet-metal covers. **These maintenance operations should be performed only by authorized, experienced maintenance personnel**. They include removal of the rear or top panels for troubleshooting, cleaning, or making repairs.

During the performance of such maintenance operations, observe the precautions set forth in the Material Safety Data Sheets (MSDSs) enclosed with the product. Wear respirators approved by the National Institute for Occupational Safety and Health (NIOSH) to prevent possible inhalation of airborne ceramic fibers. Wear gloves and long sleeve clothing to prevent irritation of the skin. Wear safety goggles to prevent irritation of the eyes. Unplug the oven from its power source before performing any maintenance operations.

All maintenance operations should be performed with special effort to minimize generating airborne fiber dust. Do not use compressed air to clean and do not rub or wipe ceramic fiber surfaces. Although no periodic cleaning of ceramic fiber surfaces is required, it is best to use a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter system to remove any debris from the surfaces of the ceramic fiber, if desired. This applies to the outside or inside of the primary, heated oven chamber.

The MSDSs are designed to communicate important information about the safe handling of refractory ceramic fiber products, recommended protective measures, and health hazard information.

For disposal information, please refer to the MSDSs enclosed with the product. If you have any questions regarding these MSDSs, please contact the nearest Troxler Service Center, as listed on pages ii.

CAUTIONS AND WARNINGS

LOWER REAR OF OVEN (IDENTIFICATION OF INTERCONNECTS)

- Cable for 208–240 V AC, 50/60 Hz power to the oven.
- The oven power source must have a reliable earth ground connection, or a hazardous condition may occur during oven operation.
- Two 9-pin serial interfaces: the left interface is used to connect the oven to a serial device, such as a computer or printer; the right interface is for factory use only.

UPPER RIGHT OF OVEN DOOR

- Surfaces of the oven are hot and may cause burns to unprotected skin.
- Place oven on a non-combustible surface and 15 cm (6 in.) away from any structure or other items.
- Always use the door as a shield when opening the door.
- If any flames appear at the top of the door, close it immediately.
- When operating the unit, always wear protective clothing.

UPPER SIDES OF OVEN

- Upper surfaces of the oven are hot and may cause burns to unprotected skin.
- Place oven 15 cm (6 in.) away from any structure or other items.

TOP OF OVEN

- Upper surfaces of the oven are hot and will cause burns to unprotected skin.

- During normal operations, the chamber door cannot be opened during a burn cycle. However, if the door lock should fail or be defeated by the operator, it may be possible to open the door while combustion is occurring inside the oven. If this should happen, flames may exit from the top of the door. Therefore, there must be at least 91 cm (3 ft) of clearance above the oven.

- **WARNING –** The unit must not be operated without an exhaust system. Refer to Chapter 3 for information on proper installation of the exhaust system.

REAR OF ELECTRONICS MODULE (BATTERY HOLDER)

- Carefully note the polarity of the DL2450 lithium battery when installing it in the battery holder. A battery may explode or leak if installed improperly.

- Do not dispose of batteries in a fire. A battery may explode if exposed to excessive heat.

- If the lithium battery should leak, do not allow the contents to come into contact with skin or eyes. If it does, immediately wash the affected area with cold water and seek medical advice.

SAFETY WARNINGS

The ICO is a safe, durable unit. Troxler cannot anticipate every example of improper or unauthorized use of this oven that may lead to malfunction or accident. If a particular use is *not specifically mentioned* in this manual as authorized, then assume that the use is unauthorized and improper.

Always follow the safety warnings in this manual and the safety procedures of your laboratory/company. Refer to the MSDS (page 1-2) provided with each oven for further safety information. Troxler recommends the following safety precautions.

READ ALL INSTRUCTIONS CAREFULLY

- The installation of the oven must comply with local building code rulings.
- Troxler recommends the installation of a carbon monoxide detector.
- Keep the area around the oven clear and free from all combustible materials, gasoline, and other flammable vapors and liquids. Failure to do so could cause fire or explosion.
- Place the oven on a level, sturdy, fireproof surface.
- The ambient temperature should be between 10°C and 40°C (50°F and 104 °F), and the relative humidity should be less than 92%.
- Allow at least 15 cm (6 in.) between the oven and other vertical structures.
- During normal operations, the chamber door cannot be opened during a burn cycle. However, if the door lock should fail or be defeated by the operator, it may be possible to open the door while combustion is occurring inside the oven. If this should happen, flames may exit

from the top of the door. Therefore, there must be at least 91 cm (3 ft) of clearance above the oven.

- Locate the oven *no more than* 1.2 m (4 ft) from the required electrical power source (see Appendix C). Ensure that the distance does not place stress on the power cord. The power source must be wired by a qualified electrician.

- Connect the oven to a power source that provides proper voltage and current (see Appendix C). Ensure that the oven, power source, and ground code requirements are compatible.

- The oven power source must have a reliable earth ground connection, or a hazardous condition may occur during oven operation.

- Keep all cords away from the top and sides of the oven.

- Burning asphalt releases carbon monoxide. Ensure that the oven is properly ventilated.

- Locate the oven in a well-ventilated room with access to a fume hood or other suitable ventilation system. If the exhaust duct shipped with the oven is used, locate the oven *no more than* 4.6 m (15 ft) from the exhaust outlet. Be sure to sufficiently insulate the exhaust duct. Follow local code for exhaust outlet.

- Do not restrict the airflow in and around the bottom of the oven.

- Do not place any objects, other than those specified in this manual, into the oven chamber.

- Remove all extraneous material in or around the oven.

- Keep the area around the oven clear and **free from all combustible materials**, gasoline, and other flammable vapors and liquids. Failure to do so could cause fire or explosion.

- Do not place anything on top of the oven.
- Never hit, puncture, or abuse the oven interior.
- Do not override the door lock.
- This oven should only be operated by personnel who are familiar with the proper operation of the device.
- Do not use the oven for cooking, cleaning, or testing materials other than asphalt or aggregate as defined by this manual.
- Do not attempt to dry any aggregates mixed with volatile chemicals.
- Obtain and use appropriate safety equipment.
- Troxler recommends wearing a face shield when handling hot substances and operating the oven (not supplied).
- Always wear heat-resistant gloves when handling hot substances.
- Use the basket carrier to move hot sample baskets (see Figure 2). Always keep the basket carrier to the left side of your body, with the handle between your body and the open oven door. This helps prevent the operator from backing into the hot insulation on the inside surface of the door.

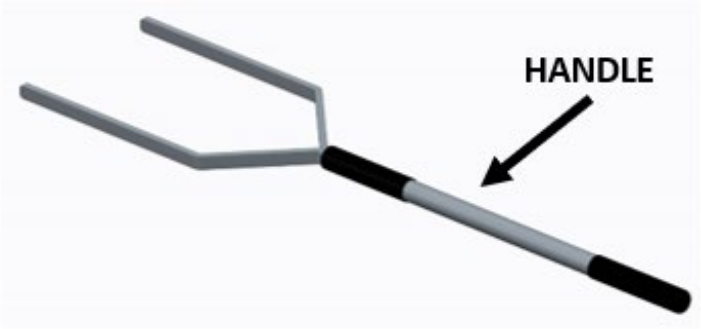


Figure 3: Basket Carrier

- Use care when loading and unloading the oven to avoid touching or scraping the hearth plate, chamber sides, or heating element.
- Avoid bodily contact with the heating element.
- Step away from the oven during ignition.
- If you see or smell smoke, discontinue use until the cause is determined and corrected.
- Following a burn cycle, cover the asphalt sample and basket assembly with the sample safety cage while the sample cools.
- To prevent personal injury, do not touch the interior or exterior oven surfaces (except door and control panel) during use.
- Depending upon environmental and other conditions, the oven can take several hours to cool off after power is removed from the heating element. Do not touch the interior or exterior oven surfaces (except door and control panel) for an extended period after use.
- Only qualified personnel (Troxler service representatives) should perform service and maintenance on the oven when disassembly is required.

- Always unplug the oven before performing service or maintenance.
- Allow the oven to cool completely before performing service or maintenance.
- Soot may build up in the exhaust connector and pipe. Troxler recommends that the exhaust plenum box be cleaned after every 30 burn cycles, or sooner if there is an unusual increase in burn times.
- Failure to clean soot can cause serious damage to the equipment.

Chapter 3:
INSTALLATION

This chapter provides instructions on site selection and installation of the ICO.

SITE SELECTION

After unpacking and inspecting the ICO as described in Chapter 1, select a suitable site for installation. Apply the following criteria when selecting a site for the oven:

- The oven must be installed in a well-ventilated room with access to a fume hood or other suitable ventilation system. If the exhaust duct shipped with the oven is used, locate the oven *no more than* 4.6 m (15 ft) from the exhaust outlet. Be sure to insulate the exhaust duct sufficiently. Follow local codes for proper installation of the exhaust outlet.

- Locate the oven *no more than* 1.2 m (4 ft) from the required electrical power source (see Appendix C). Ensure that the distance does not place stress on the power cord. The power source must be wired by a qualified electrician.

- Place the oven on a level, sturdy, fireproof surface.

- Locate the oven at least 15 cm (6 in.) from other vertical structures.

- During normal operations, the chamber door cannot be opened during a burn cycle. However, if the door lock should fail or be defeated by the operator, it may be possible to open the door while combustion is occurring inside the oven. If this should happen, flames may exit from the top of the door. Therefore, there must be at least 91 cm (3 ft) of clearance above the oven.

- Do not restrict the airflow in and around the bottom of the oven.

- Do not install the oven near combustibles, such as gasoline or paint.

- Keep all cords away from the top and sides of the oven.

- The ambient temperature should be between 10 and 40 °C (50 and 104 °F), and the relative humidity should be less than 92%.

OVEN INSTALLATION

The oven requires assembly. To install the oven, follow the steps below:

NOTE

Remove all package wrapping. Review Caution Label from the exhaust opening then remove.

⚠ CAUTION

Troxler has optimized the airflow in the oven to ensure efficient combustion. Do not attach the exhaust duct directly to a central exhaust unit. An increase in suction due to external exhaust fans can affect the oven performance.

1. Following the site selection guidelines on the previous page, set the oven in place.
2. Using the adjustable feet, level the oven from front to back and from side to side.
3. Remove all packaging material from the oven chamber, including the pads under the rails.
4. Unpack the hearth plate and place it in the center of the oven chamber resting on the 4 posts. Ensure that the hearth plate does not touch the sides of the chamber.
5. Position the circuit breaker/power switch, found in the lower left of the oven rear panel (see Figure 1) to the **OFF** (down) position.

6. Connect the oven exhaust system as described in the following section.

7. Connect the oven to the required power source (refer to Appendix C).

WARNING

The power source must have a reliable earth ground connection, or a hazardous condition may occur during oven operation.

NOTE

The ICO oven requires a minimum 40 amp. for a power supply circuit.

8. Set up the oven as described in Chapter 4.

EXHAUST SYSTEM INSTALLATION

To ensure the safe and efficient operation of the oven, the oven exhaust system must be installed according to the guidelines contained in this section.

These guidelines were prepared according to the Uniform Mechanical Code, Section 914(b). While every installation is unique, these instructions provide general guidelines on proper installation of the exhaust system. Refer to local building codes and/or a licensed heating, ventilation, and air conditioning (HVAC) contractor for further details.

The following figures illustrate the recommended methods of exhausting the oven through an exterior wall penetration, a roof penetration, or a fume hood.

NOTE

The ICO must be placed at least 15 cm (6 in.) from other vertical surfaces or structures.

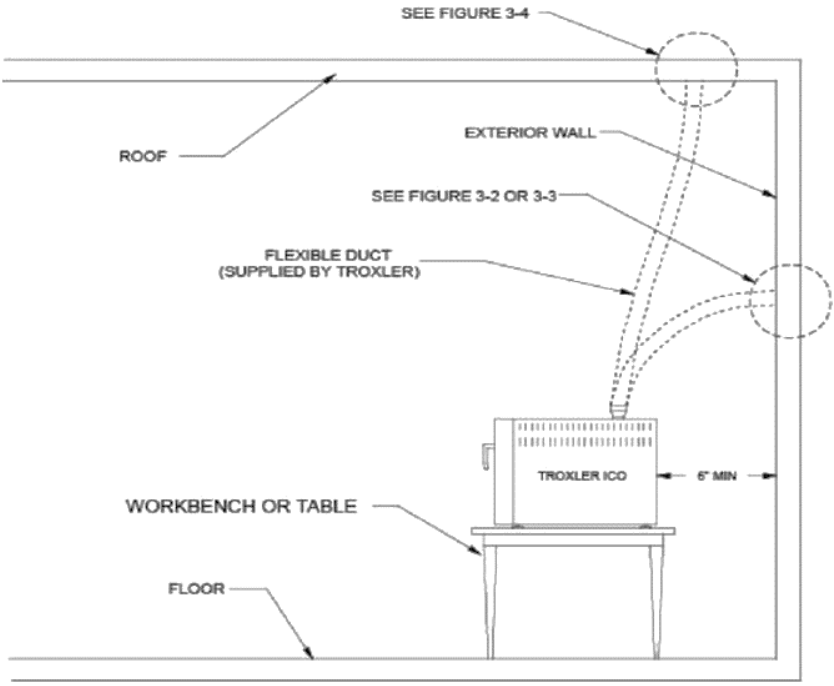


Figure 4: Overall Schematic for Exterior Wall and Roof Penetrations

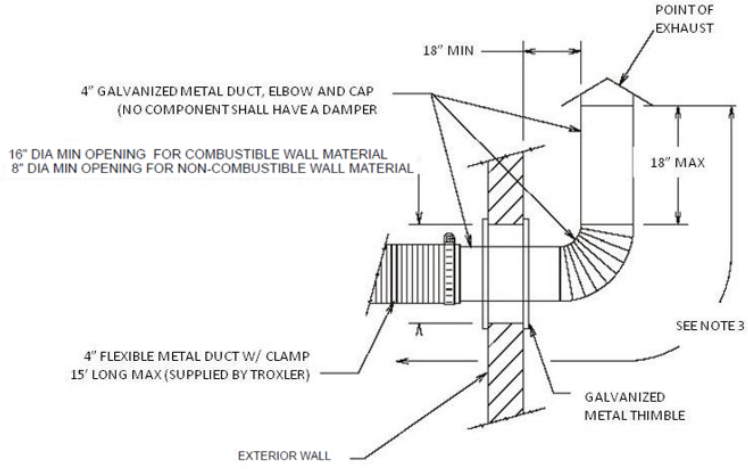


Figure 5: Exterior Wall Penetration Using a Metal Elbow and Cap

NOTES:

1. Seal all joints between wall and thimble and between thimble and duct with a high-temperature caulk.
2. The minimum thickness of all galvanized metal parts is 28 gauge, or that which is called for in local building codes, whichever is thicker.
3. The overall diameter of all ducts should be 4 inches or greater and the length should not exceed 4.6 m (15 ft) from the top of the oven to the point of exhaust.
4. No component shall have a damper, screen, louver, or other such device that may become clogged with soot over time.
5. Do not locate exhaust point near air intakes for building. Refer to local building codes and/or a licensed HVAC contractor for recommended/required distance.
6. Refer to local building codes and/or a licensed HVAC contractor for more details.

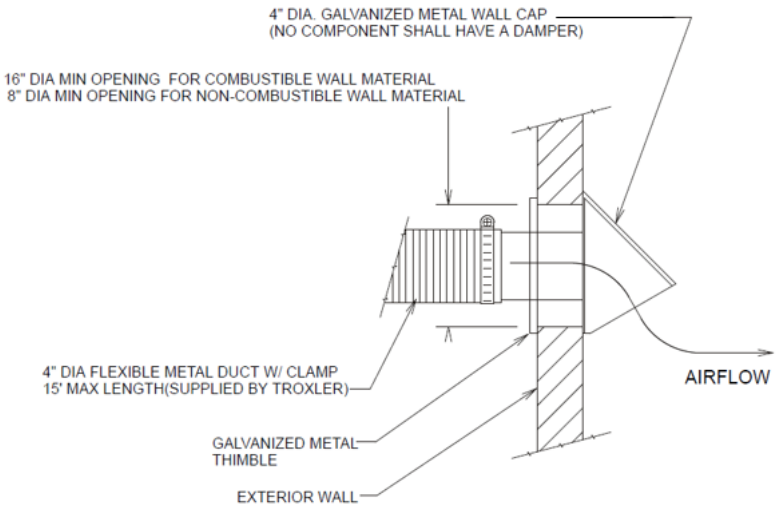


Figure 6: Exterior Wall Penetration Using a Metal Wall Cap

NOTES:

1. Seal all joints between wall and thimble and between thimble and duct with a high-temperature caulk.

2. The minimum thickness of all galvanized metal parts is 28 gauge, or that which is called for in local building codes, whichever is thicker.

3. The overall diameter of all ducts should be 4 inches or greater and the length should not exceed 4.6 m (15 ft) from the top of the oven to the point of exhaust.

4. No component shall have a damper, screen, louver, or other such device that may become clogged with soot over time.

5. Do not locate exhaust point near air intakes for building. Refer to local building codes and/or a licensed HVAC contractor for recommended/required distance.

6. Refer to local building codes and/or a licensed HVAC contractor for more details.

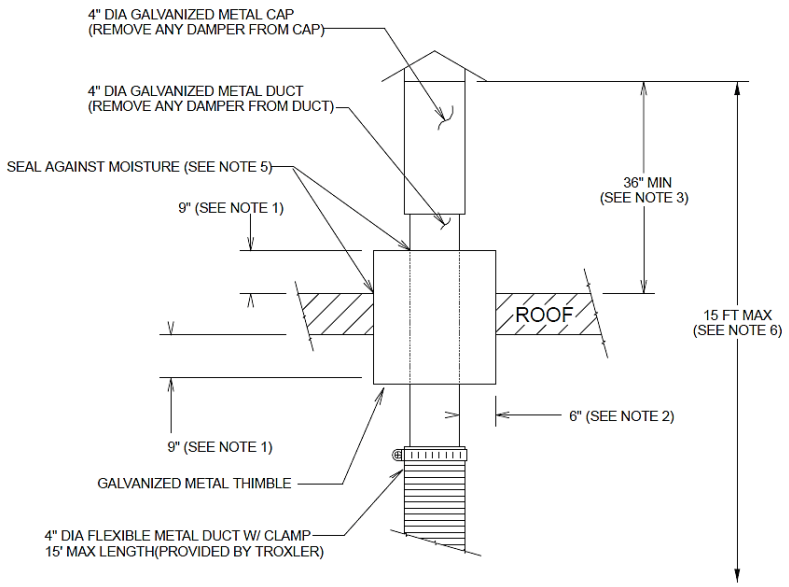


Figure 7: Roof Penetration

NOTES:

1. Galvanized metal thimble must extend at least 23 cm (9 in.) above and below roof.
2. Galvanized metal thimble must provide at least 15 cm (6 in.) of clearance between the duct and the nearest combustible material.
3. The point where exhaust exits the cap must be at least 91 cm (36 in.) above the roof.
4. The minimum thickness of all galvanized metal parts is 28 gauge, or that which is called for in local building codes, whichever is thicker.
5. Seal all joints between thimble and roof and between thimble and duct with a high-temperature caulk.
6. The overall diameter of all ducts should be 4 inches or greater and the length should not exceed 4.6 m (15 ft) from the top of the oven to the point of exhaust.

7. Do not locate exhaust point near air intakes for building. Refer to local building codes and/or a licensed HVAC contractor for recommended/required distance.

8. No component shall have a damper, screen, louver, or other such device that may become clogged with soot over time.

9. Refer to local building codes and/or a licensed HVAC contractor for more details.

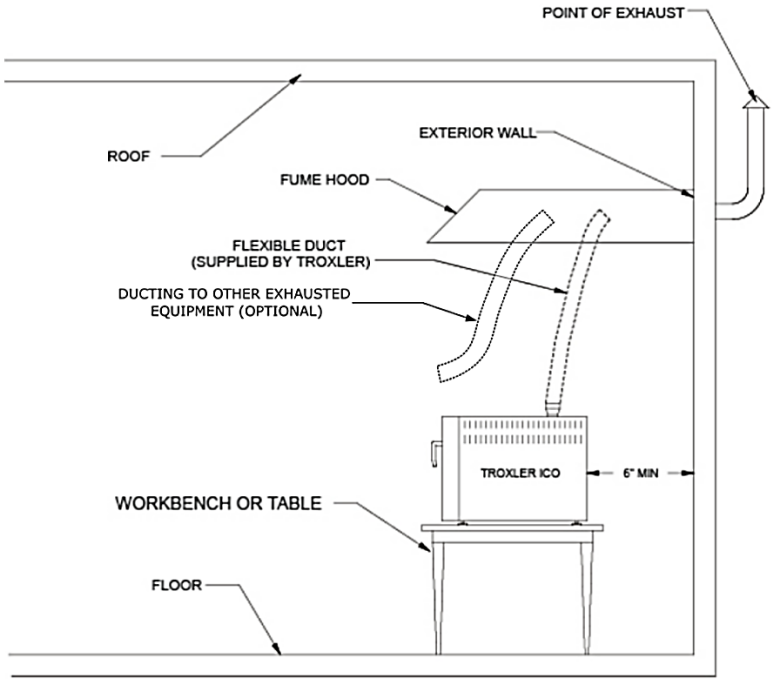


Figure 8: Exhausting to a Fume Hood/Optional Exhausted Equipment.

NOTES:

10. Consult fume hood manufacturer regarding proper installation of the hood.

11. Fasten 4-inch flexible duct to wall or fume hood so that the oven exhausts under the hood. If the fume hood is equipped with a fan or blower, place the end of the flexible duct at least 45 cm (18 in.) away from the intake to the fan or blower.

12. The overall diameter of all ducts should be 4 inches or greater and the length should not exceed 4.6 m (15 ft) from the top of the oven to the point of exhaust.

13. No component shall have a damper, screen, louver, or other such device that may become clogged with soot over time.

14. Do not locate exhaust point near air intakes for building. Refer to local building codes and/or a licensed HVAC contractor for recommended/required distance.

INSTALLATION WITH AN EXHAUST HOOD

AIR VELOCITY

In most cases, the exhaust pipe from the ICO extends into the open hood area above the hood intake edge. The air velocity at the hood intake edge must be sufficient to prevent smoke from escaping.

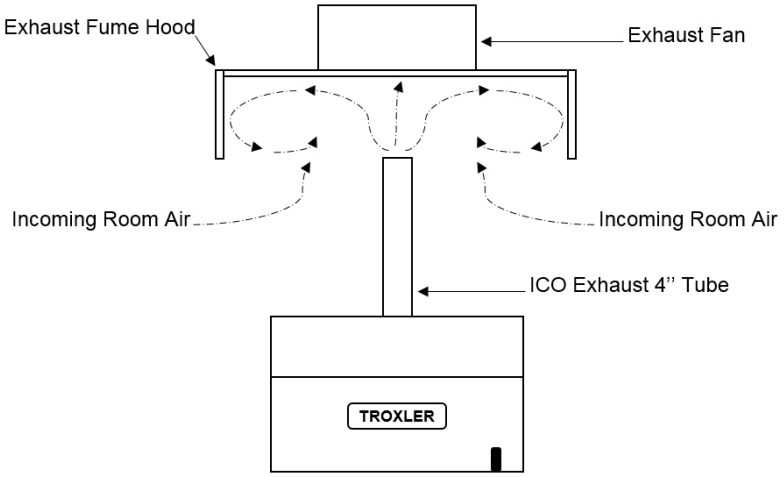


Figure 9: ICO Exhaust Pipe Below the Hood Intake Edge

The air velocity at the hood intake edge is a function of the hood exhaust fan capacity and the area of the hood opening.

EXAMPLE

- Hood exhaust fan capacity = 2,500 ft.^{3}/min.
- Hood opening = 4 ft. x 5 ft. = 20 ft.^{2}
- Air velocity at hood intake edge = 2,500 ft.^{3}/min./ 20 ft.^{2} = 125 ft./min. = 2 ft./sec.

EXHAUST HOOD CONFIGURATION

You can mount the hood exhaust fan on the exterior wall or in line with the hood exhaust duct.

If necessary, you can mount the exhaust pipe further into the hood or even into the exhaust duct at the top of the hood. This should only be done, however, if the hood exhaust fan capacity is insufficient to draw all the smoke out of the hood.

If you move the exhaust pipe close to or inside the hood exhaust duct, you must ensure that there is minimal draw of air through the unit. Measure the airflow lift and adjust the louvers as applicable. (The ideal range is between -2.5 and -3.5 grams.)

NOTE

If you have trouble getting satisfactory airflow lift values, contact 1.877.TROXLER (1.877.876.9537).

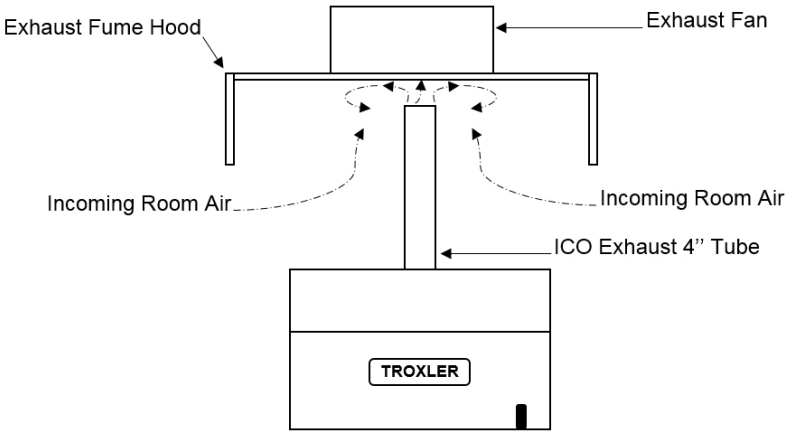


Figure 10: ICO Exhaust Pipe Extended into the Hood

Airflow Draw Test

1. Turn off the hood exhaust fan.
2. Measure the unit's airflow lift with only its fan running. (For information about measuring the airflow lift, see page 3-20.)
3. Turn on the hood exhaust fan.
4. Measure the unit's airflow lift with both its fan and the hood exhaust fan running.

   - If the airflow lift value does not change, the position of the unit's exhaust vent is appropriate.
   - If the value increases, move the unit's exhaust pipe away from the hood exhaust duct and go back to step 1.

INSTALLATION WITHOUT AN EXHAUST HOOD

NOTE

The ideal configuration utilizes an exhaust hood, which eliminates the effects of positive or negative air pressure in the environment.

WARNING

Use of the ICO inside of buildings with other high-flow exhaust ventilation systems can cause air to be drawn backwards through the ICO exhaust system due to negative air pressure in the building, causing overheating and damage to the ICO.

This is mostly likely to occur when other exhaust systems in the building are running while the ICO is still hot, but recently powered off.

If multiple exhaust systems are in use, consult a licensed HVAC technician to ensure hot exhaust flow reversal does not occur. A recommended installation is the use of a common fume hood for all exhausted equipment, as shown in Figure.7.

POSTIVE AND NEGATIVE AIR PRESSURE

Positive Air Pressure

Many air handling systems pump air from the outdoors into a building, which creates positive air pressure. If the unit is vented via a wall exhaust pipe, this positive air pressure will move air through the furnace and out the pipe, causing the unit warm-up time and the recovery time after opening the door to increase. If the airflow is excessive, the unit may not heat up to the proper temperature (i.e., 540°C +/- 5°C) at all.

Negative Air Pressure

A lot of labs have mounted exhaust fans to move air out of the area, which create negative air pressure. This causes air to enter the furnace via the exhaust pipe. If this airflow is excessive, it will pull exhaust gases into the room and can damage the furnace.

The best way to mitigate this issue is to configure the airflow lift with the fans off. (For information about measuring the airflow lift, see page 3-20.)

1. After the unit is set up, turn off the fans, close the door, and allow the airflow lift to stabilize. (The ideal range is between -2.5 and -3.5 grams.)

2. Turn on the fans and monitor the airflow lift. If the values are between -2.0 and -6.0 grams, perform a few test burns to see if the unit is operating normally.

    - Airflow lift values greater than -2.0 (i.e., between -1.9 and 0.0) may cause incomplete burns due to insufficient airflow.

    - Airflow lift values less than -6.0 (i.e., between -6.1 and -10.0 grams) may cause longer warm-up times and high aggregate correction factors.

NOTE

If you have trouble getting satisfactory airflow lift values, contact 1.877.TROXLER (1.877.876.9537).

EXHAUST PIPE LENGTH

The length of the exhaust pipe must be less than fifteen feet. Anything longer will create excessive back pressure on the unit.

EXTERNAL DUCT CONFIGURATION

The exhaust system configuration that requires the least amount of setup is a duct that allows exhaust to exit the environment through the wall. For more information, see page 3-5.

The external duct cover must be an open design that does not restrict airflow (see the figure on the next page).

Figure 11: External Duct Cover (Open Design)

A design that is not open (e.g., one that incorporates louvers) will create back pressure on the exhaust line (see the figure below).

Figure 12: External Duct Cover (Closed Design)

NOTE

If a screen is added to keep out birds, etc., it needs to be cleaned periodically or soot will build up that will eventually cause back pressure. This back pressure can seriously damage the equipment.

MULTIPLE OVEN INSTALLATION

If multiple ovens are needed to support operations adhere to the ***WARNING*** below.

WARNING

If the oven is to share the same exhaust system with multiple ovens consult with a licensed HVAC Technician to determine system requirements.

AIRFLOW LIFT

NOTE

Airflow is very important for fast and complete burns. Perform the procedure in this section before the first burn.

NOTE

The unit was configured at the factory and requires very little setup before the first burn.

Air enters the chamber through the hole in the bottom of the furnace where the loadcell (scale) supports are positioned. This incoming air creates lift on the stainless-steel hearth plate. (The ideal range is between -2.5 and -3.5 grams.)

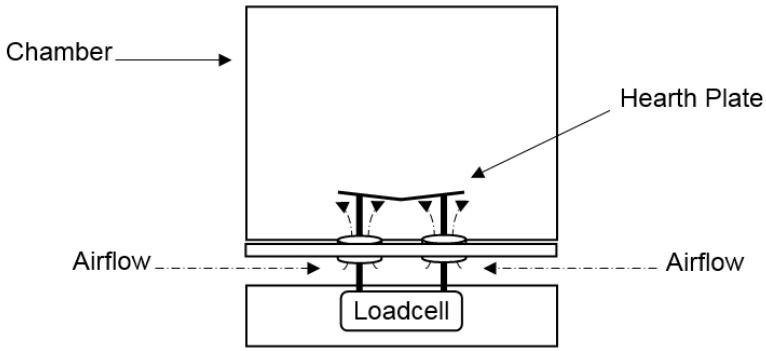


Figure 13: ICO Airflow

NOTE

You can adjust the airflow by moving the louvers on the exhaust plenum box, which is located under the black box at the top of the furnace. (Closing the louvers increases the airflow.) However, the louvers are preset at the factory and should not need adjustment.

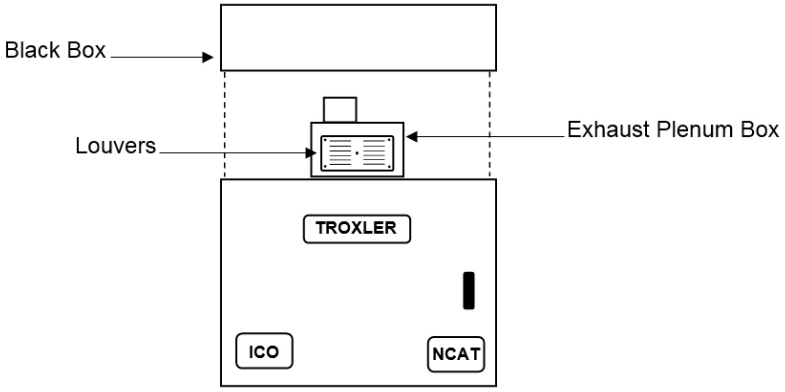


Figure 14: Exhaust Plenum Box and Louvers

MEASURING THE AIRFLOW LIFT

NOTE

Airflow lift is measured using the exhaust pipe connected to the furnace. Be sure this pipe is connected to the unit and the exhaust system before proceeding.

1. Turn on the unit and leave the door open.
2. Let the unit stabilize for at least fifteen minutes. (Do not close or latch the door during this period.)
3. Check to see if the environment is appropriate.

a. Ensure that there is little or no air movement or vibration in the room.

b. Turn off all fans and air conditioning if possible. If you cannot turn them off, position the furnace so that no air is blowing in its direction.

NOTE

The scale is very sensitive. Simply walking past the unit can cause enough movement to affect a measurement.

4. With the door open and only the hearth plate in the unit, press **<TARE>**.

5. Set a timer for one minute and monitor the mass on the control panel display.

   - If the scale drifts to any point less than or greater than 0.0, go back to step 2.

   - Otherwise, go to step 6.

6. When the unit is stable, close the door and move its handle to partially engage it (about forty-five degrees).

NOTE

Do not move the door handle to the point where the solenoid interlock is engaged, or the unit will heat up. The unit's temperature must be less than 30°C to perform this procedure.

7. Set the timer for four minutes.

8. After four minutes, record the airflow lift. (The ideal range is between -2.5 and -3.5 grams.)

9. Open the door and set the timer for four minutes.

10. Before five minutes have elapsed, the scale should return to 0.0 grams.

    - If the scale returns to 0.0 grams (even before the four-minute period ends), go to step 11.

    - If the scale does not return to 0.0 grams, go back to step 2.

NOTE

If the scale does not return to 0.0 grams after repeated tries, recalibrate it. If this does not resolve the issue, contact 1.877.TROXLER (1.877.876.9537).

11. Adjust the louvers as applicable based on the value recorded in step 8.

    - If the value is low, chose the louvers slightly from their current position and go back to step 4.

    - If the value is high, open the louvers about 50 percent from their current position and go back to step 4.

EXHAUST LEAKS

Leaks in the exhaust system are annoying and somewhat dangerous. The smoke emitted from any furnace contains many noxious gases that are unsafe to breathe over an extended period.

When the unit is set up properly, there should not be any exhaust smell in its vicinity.

Check frequently to see if there are leaks at the connections in the hood exhaust duct and seal them with metal duct tape.

Chapter 4: **SETUP AND OPERATION**

This chapter provides information on using the ICO. It describes the oven keypad and provides procedures for starting up the oven and setting it up for the first time, daily startup and operation, and shutting the oven down.

The procedures in this chapter are general in nature. More detailed instructions are provided in Chapters 5 through 7.

KEYPAD

Figure 14 shows the layout of the oven keypad. The table lists the function of each key.

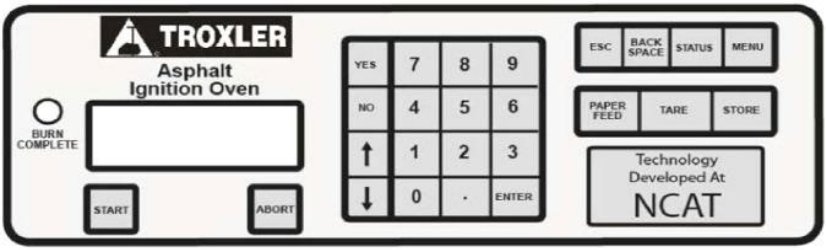


Figure 15: Oven Keypad

KEY	FUNCTION
⟨**ESC**⟩	Returns to the next higher-level menu without updating or storing data. In response to *yes/no* questions, has the same effect as pressing ⟨**NO**⟩. If an error message is displayed, the ⟨**ESC**⟩ key is ignored.
⟨**BACK SPACE**⟩	Moves the cursor back one space.
⟨**STATUS**⟩	Displays system status information. Available only when the default screen (see page 4-5) is
⟨**MENU**⟩	Accesses the **MAIN MENU**. Available only when the default screen (see page 4-5) is displayed. The functions available from the **MAIN MENU** are described in Chapters 5 – 7. A menu map is provided in **Appendix B**.
⟨**YES**⟩	Responds *yes* to *yes/no* questions.
⟨**NO**⟩	Responds *no* to *yes/no* questions.
⟨↑⟩, ⟨↓⟩	Scroll through menu options, view screens, or through alphanumeric characters on input screens. Also, can be used to adjust the contrast of the display when the default screen is
⟨**0**⟩.⟨**9**⟩	Enter numbers and access menu options.
⟨**.**⟩	Enters a decimal point.
⟨**ENTER**⟩	Accepts data entry. Also prints burn cycle data for a selected sample when viewing project data (see page 7-5).

⟨**PAPER FEED**⟩	(Printer Optional) Commands the internal printer to advance the paper by several lines (as opposed to the paper feed button on the printer, which advances the paper as long as it is
⟨**TARE**⟩	Tares the integrated scale. Available when the default screen is displayed.
⟨**STORE**⟩	Manually stores data. Available when the default screen is displayed following a burn cycle. If no burn data is available for storage, an error message is displayed.
⟨**START**⟩	Begins the burn cycle. Available when the default screen is displayed.
⟨**ABORT**⟩	Stops the burn cycle. The oven stops collecting burn data and provides burn summary information. Available only during a burn cycle.

PRINTER

The following figure shows the front panel of the oven printer.

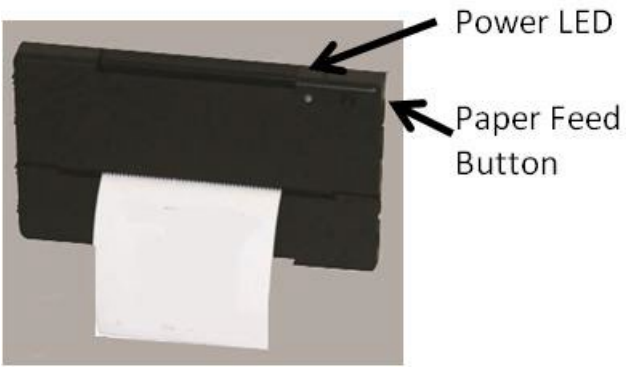


Figure 16: Printer Front Panel

The paper feed button activates the paper feed mechanism. Paper continues to feed until the button is released.

For information on replacing the printer paper, refer to REPLACING THE PRINTER PAPER on page A-10.

FIRST-TIME STARTUP AND SETUP

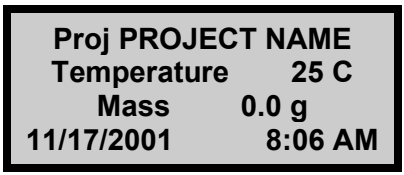
WARNING

To prevent personal injury or equipment damage, the operator should become familiar with the safety warnings and information in Chapter 2 before operating the ICO.

This section summarizes the initial startup and setup of the oven. For more detailed instructions, see Chapters 5 through 7, as referenced in this summary.

1. Ensure that the oven is installed as described in Chapter 3.

2. **With the chamber door open,** position the circuit breaker/power switch, found in the lower left of the oven rear panel (see Figure 1-1), to the **ON** (up) position. This breaker does not need to be turned off during normal operation. Press the on/off rocker switch on the right-hand side of the front panel to the on position (1 for on, 0 for off). The oven performs a self-test, and then displays the following *default screen*. The second line of the default screen shows the current chamber temperature (*25 ℃* in this example). Note that the open chamber door prevents the heating element from heating. The chamber must be at room temperature to verify the scale as described in step 4.



NOTE

When the default screen is displayed, the up and down arrow keys can be used to adjust the display contrast.

3. Press ⟨**MENU**⟩ to display the **MAIN MENU**.

4. From the **MAIN MENU**, press **(5)** to access the **Scale Menu**. Press **(3)** to verify the scale. Follow the prompts to verify the scale. **For more information, refer to page 6-14.**

NOTE

Scale verification should be done at room temperature.

5. Close the chamber door. The oven applies power to the heating element.

6. Press **(8)** to access the **Miscellaneous Menu**. **For more information, refer to page 5-30.**

    a. The oven is shipped with the current date and time (Eastern Standard Time) stored in its memory. By default, the oven displays the date in *mm/dd/yyyy* format (where *mm* = month, *dd* = day, and *yyyy* = year) and the time in *AM/PM* format. To change the date or time, or to change the display format, press **(1)** to access the **Time/Date Menu**. **For more information, refer to page 5-31 and 5-32.**

    b. The oven is shipped with the baud rates for the serial communications and auxiliary ports set to 9600 baud. To change the baud rates, press **(2)**. **For more information, refer to page 5-33.**

    c. As shipped, the oven is setup to display temperatures in degrees Celsius. To select the desired temperature scale (*Celsius* or *Fahrenheit*),

press **(3)**. **For more information, refer to page 5-34.**

d. Press **(4)** to enter the customer name. **For more information, refer to page 5-34.**

e. The oven features a *System Information* function that outputs a listing of operating parameters to the serial communications port once each second, either anytime the oven is powered on or only during a burn cycle. As shipped, this feature is turned off. To turn the system information output on or off, press **(5)**. **For more information, refer to page 5-35.**

f. Press **(ESC)** to return to the **MAIN MENU**.

7. Press (1) to access the Burn Setup Menu. For more information, refer to page 5-4.

a. Press **(1)** to access the **Burn Parameter Menu**. **For more information, refer to page 5-4.** Set the burn mode to *Program Time* or *Auto-Control*, as desired (the default setting is *Auto-Control*). Set the desired burn time and/or cutoff limit. Set the calculation type to *bitumen-to-sample* or *bitumen-to-aggregate*, as desired (the default is *bitumen-to-sample*). Select the desired burn profile. Press **(ESC)** to return to the **Burn Setup Menu**.

b. The oven features an *Auto-Print* function that, when turned on, automatically prints sample data during a burn cycle. As shipped, this function is turned on. To change the status of the *Auto-Print* function, press **(2)**. **For more information, refer to page 5-10.**

c. The oven also includes an *Auto-Store* function that, when on, automatically stores sample data in the active project upon completion of a burn cycle. As shipped, this function is turned off. To turn the *Auto-Store* function on, press **(3)**. **For more information, refer to page 5-12.**

d. Press **(ESC)** to return to the **MAIN MENU**.

8. Press **(2)** to set up the *Auto-Timer* feature, if desired. The *Auto-Timer* automatically powers the heating element on and off based upon start and stop times and dates entered by the operator. **For more information, refer to page 5-16.**

9. Determine the aggregate correction factors (ACFs), if necessary.

   From the **MAIN MENU**, press **(4)** to access the **Correction Menu**. Use this menu to create and store up to twenty ACFs and to select the active ACF. **For more information, refer to Chapter 6.**

DAILY STARTUP AND OPERATION

WARNING

To prevent personal injury or equipment damage, the operator should become familiar with the safety warnings and information in Chapter 2 before operating the ICO.

Troxler recommends the following method for burning samples. For additional information, refer to the following ASTM or American Association of State Highway and Transportation Officials (AASHTO) standards:

- ASTM C 117 (AASHTO T11), Materials Finer Than 76-µm (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C 136 (AASHTO T27), Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 979 (AASHTO T168), Sampling Bituminous Pavement Mixtures

1. Power the oven on as follows:

   - If the *Auto-Timer* is not enabled, close the chamber door and position the circuit breaker/power switch (see Figure 1) to the **ON** (up) position. Press the on/off rocker switch on the right-hand side of the front panel to the on position (1 for on, 0 for off). The oven performs a self-test, displays the default screen as shown on page 4-5, then applies power to the heating element.
   - If the *Auto-Timer* is enabled and the chamber door is closed, the oven will automatically apply power to the heating element and exhaust fan at the designated start time. To set up the *Auto-Timer*, see page 5-16.

Note that opening the chamber door prohibits the oven from applying power to the heating element.

2. Press **(STATUS)**. From the status display, check that the following parameters and functions are configured as desired, and then press **(ESC)** to return to the default display. To change any of these parameters, refer to the ***Burn Parameters*** section that begins on page 5-4.

   - Burn Mode
   - *Auto-Store* function
   - *Auto-Print* function

3. The oven stores sample data in *projects*. To manage the oven's project files, press **(MENU)** to access the **MAIN MENU**, and then press **(3)** to access the **Project Menu**. Use this menu to create the active project or to select the active project from a list of existing projects. **For more information, refer to Chapter 7.**

4. Use an external scale to weigh the sample basket assembly, including the catch pan and sample basket cover. Record the mass of the basket assembly (W_B).

⚠ WARNING

Always wear heat-resistant gloves when handling any hot substance.

NOTE

The maximum HMA sample size for the oven is 5000 g.

5. If the mixture is not soft enough to separate with a spatula or trowel, place it in a large, flat pan and warm in an oven set at 110 ± 5 °C until it can be separated or mixed. Split or quarter the material in accordance with

ASTM method C 702 until the mass of material required for the test is obtained.

6. With the catch pan under the sample baskets, spread the sample evenly in the two baskets. Do not place more than 2500 g in either basket.

7. Place the basket cover over the top sample basket as shown in Figure 16. Secure the sample baskets and cover to the catch pan with the lock arms. Ensure that the lock arms fully engage the slots in the top sample basket.

8. Use the external scale to weigh the sample, sample baskets, catch pan, and sample basket cover. Record the total mass (W_T).

9. Press **(START)** to begin the process.

10. The oven requests the sample mass (W_S) as shown below. To determine the sample mass, subtract the basket assembly mass (W_B) recorded in step 4 from the total mass (W_T) recorded in step 9 ($W_S = W_T - W_B$). Enter the sample mass and press **(ENTER)**.

Enter Sample
Mass g
then press ENTER

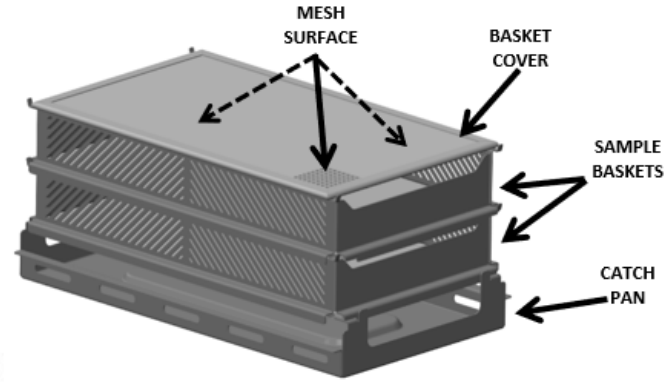


Figure 17: Starter Kit (Sample Basket Assembly)

WARNING

Always wear heat-resistant gloves when handling any hot substance.

Troxler recommends wearing a face shield when the oven door is open and when handling the sample.

Use the basket carrier to move hot sample baskets (see Figure 2 on page 2-9). Always keep the basket carrier to the left side of your body, with the handle between your body and the open oven door. This helps prevent the operator from backing into the hot insulation on the inside surface of the door.

CAUTION

Use care when loading and unloading samples to avoid touching or scraping the hearth plate, chamber sides, or heating element.

11. The oven displays:

Place Sample in chamber and close door. xxx.x g Then press START.

Wearing heat-resistant gloves and a face shield, use the basket carrier to place the sample with the baskets and catch pan on the hearth plate in the center of the oven. Ensure that the hearth plate and sample baskets do not touch the chamber sides. Close the oven door.

The third line of the display shows the total weight of the sample, baskets, and catch pan as measured by the oven's internal scale. The displayed weight should be within ± 5 g of the weight recorded in step 9. If it is not, ensure that the hearth plate and sample baskets do not touch the chamber sides. If the displayed weight is within ± 5 g of the weight recorded in step 9, press ⟨**START**⟩ to begin the burn cycle.

⚠ WARNING

Step away from the oven during ignition. Do not override the door lock. As the binder burns, the oven display may indicate higher oven temperatures than expected. This can be caused by the flame contacting the oven thermocouple.

12. The oven locks the chamber door at the start of the burn cycle. During the burn, the oven displays the chamber temperature, the current sample mass and initial sample mass, the %Loss, and the elapsed burn time:

Temperature XXX C M. (XXXX.X) XXXX.X g %Loss -XX.XX % Burn Time XXX:XX

13. When the mass loss does not exceed 0.01% of the sample mass (*Ws*) for three consecutive one-minute periods, the burn is complete. The oven displays the results of the burn as shown below. If five minutes have elapsed since the chamber temperature has peaked, the oven also releases the door lock, lights the red **BURN COMPLETE** indicator, and sounds the annunciator.

NOTE

The oven will not unlock the chamber door, light the BURN COMPLETE **indicator, or sound the annunciator until five minutes have passed since the chamber temperature has peaked. Typically, this five-minute period will have elapsed before the burn is complete.**

NOTE

To ensure the continued safe and efficient operation of the oven, the exhaust system should be cleaned regularly. The oven monitors the total burn time that has elapsed since the last cleaning. Upon completion of a burn cycle, if the burn time since the last cleaning exceeds 1050 minutes, the oven displays:

WARNING! Clean ICO Exhaust System. See Operation Manual for details. Press ENTER

When this warning is displayed, press (ENTER) to continue with the remainder of this procedure. Upon completion, clean the exhaust plenum box as described on page A-5.

14. Press **(ENTER)** to return to the default screen.

    - If the *Auto-Store* option is not enabled, the results can be stored any time **before** the next burn by pressing **(STORE)** from the default screen, or by pressing **(MENU)**, then pressing **(7)** (*Store*). Refer to the ***Store Function*** section on page 5-27 for more information.

NOTE

A project must be active in order to store. For more information on using projects, refer to Chapter 7.

    - If the *Auto-Store* option is enabled, the oven stores the results as the next sample number in the active project file and returns to the default screen. Refer to the ***Auto-Store*** section on page 5-12 for instructions on enabling this option.

15. **Wearing gloves and a face shield,** use the basket carrier to remove the sample from the oven and cover it with the sample safety cage until the sample has cooled to room temperature.

16. Determine the aggregate gradation per ASTM standards C 117 and C 136 (AASHTO standards T11 and T27).

DAILY SHUTDOWN

To power down the oven:

- If the *Auto-Timer* function is **disabled**, position the on/off rocker switch on the right-hand side of the front panel to the off position (1 for on, 0 for off). The front panel display will be dark.

- If the *Auto-Timer* function is **enabled**, leave the on/off rocker switch on the right-hand side of the front panel to the on position (1 for on, 0 for off). The oven will automatically power down the heating element and exhaust fan at the designated stop time

WARNING

Depending upon environmental and other conditions, the oven can take several hours to cool off after power is removed from the heating element. Do not touch the interior or exterior oven surfaces (except door and control panel) for an extended period after use.

.

Chapter 5: MAIN MENU

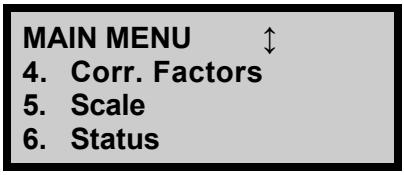
The operator controls and configures the ICO from the **MAIN MENU**, its submenus, and displays. This chapter describes the many menu options.

OVEN MAIN MENU

WARNING

To prevent personal injury or equipment damage, the operator should become familiar with the safety warnings and information in Chapter 2 before operating the ICO.

The oven control software includes a number of options that can be configured by the operator for greater flexibility of operation. To access these options, press ⟨**MENU**⟩. The oven displays the **MAIN MENU** shown below. To select an item from the menu, press the corresponding numeric key. Use the up and down arrows to scroll through the menu options.



For most of these items, pressing the corresponding numeric key displays a submenu. Many of these submenus in turn have submenus of their own.

A complete map of these menus is provided in Appendix B of this manual.

The remainder of this chapter describes each menu option, except for the *Project* option, which is described in Chapter 7, and the *Corr. Factors* and *Scale* options, which are described in Chapter 6.

BURN SETUP MENU

The **Burn Setup Menu** is used to configure the parameters of the burn mode and to turn the *Auto-Print* and *Auto-Store* functions on or off. To display the **Burn Setup Menu**, press (**1**) at the **MAIN MENU**. The oven displays:

```
Burn Setup Menu
1. Burn Parameters
2. Set Chamber Temp
3. Auto-Print
4. Auto-Store
```

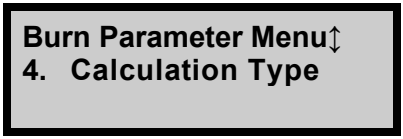
BURN PARAMETERS

The oven offers two burn modes: *Program Time* and *Auto-Control*. In the *Program Time* mode, the burn time is set manually. In *Auto-Control* mode, the oven automatically completes a burn cycle when the incremental mass decrease of the sample falls below a cutoff limit specified by the operator.

The burn mode is selected from the **Burn Parameter Menu**. This menu is also used to select the calculation type (*bitumen-to-sample* or *bitumen-to-aggregate*) and burn profile (*Default*, *Option 1*, or *Option 2*).

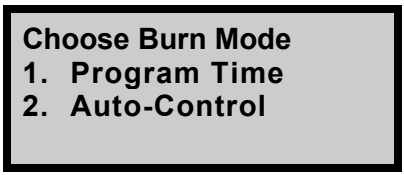
To access the **Burn Parameter Menu**, press (**1**) at the **Burn Setup Menu**. The oven displays the following screens. Use the up and down arrows to scroll through the menu options.

```
Burn Parameter Menu↕
1.  Burn Mode
2.  Burn Time
3.  Cutoff Limit
```

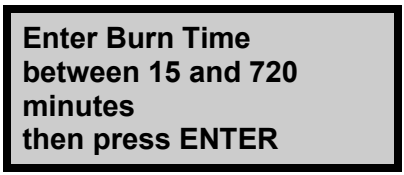


Burn Mode

To select the burn mode, press **(1)** at the **Burn Parameter Menu**. The oven displays:



- To configure the oven to burn for a specified number of minutes, press **(1)**. The oven displays:



  Use the numeric keys to set the burn time. To move the cursor back one position, press the **(BACK SPACE)** key. When finished, press **(ENTER)**. For more information on setting the burn time, refer to the *Burn Time* section on the following page.

- To select the *Auto-Control* mode, press **(2)** at the **Choose Burn Mode** menu shown above. The oven controls the burn time based on the cutoff limit. For instructions on setting the cutoff limit, see page 5–7.

Burn Time

Different asphalt mixes may require different burn times, depending upon the sample %AC and the sample mass. The optimum burn time can be determined by preparing a test sample of known %AC. The test sample should closely represent

the production mixture. Burn the test sample until it is clean (free of coke, the solid binder residue).

NOTE

Using the Auto-Control with cutoff limit of 0.01% or 0.1 g will accomplish a clean burn test sample.

Use the time required to produce a clean test sample as the burn time. This lists the minimum recommended burn times for selected sample masses.

To program the burn time manually, press **(2)** at the **Burn Parameter Menu** shown on page 5-4. The oven requests the burn time between 15 and 720 minutes. Use the numeric keys to set the burn time. To move the cursor back one position, press the **(BACK SPACE)** key. When finished, press **(ENTER)**. The oven sets the new burn time, displays a brief confirmation message, and returns to the **Burn Parameter Menu**.

NOTE

The oven will not store burn data for burn times greater than 120 minutes. Burn data storage is available only for burn times of 120 minutes or less.

Cutoff Limit

In the *Auto-Control* burn mode, the oven adjusts the burn time according to the *cutoff limit*. The cutoff limit can be defined in *grams* or as a *percentage* of the initial sample mass. When the change in the sample mass is less than the cutoff limit for three consecutive minutes, the oven completes the burn cycle.

To enter a cutoff limit, press **(3)** at the **Burn Parameter Menu** shown on page 5-4. The oven displays:

```
Cutoff Units
1. Grams
2. Percentage
```

CUTOFF LIMIT IN GRAMS. To enter the cutoff limit in grams, press **(1)**. The oven displays:

```
Current Cutoff Limit
X.X g
do you want to
change Cutoff Limit?
```

- To exit without changing the cutoff limit, press **(NO)**. The oven returns to the **Burn Parameter Menu**.

- To change the cutoff limit, press **(YES)**. The oven displays:

```
Enter Cutoff Limit from
0.1 - 1.0g in 0.1g steps
then press ENTER
```

Use the numeric and decimal keys to enter a cutoff limit from 0.1 to 1.0 gram in increments of 0.1 gram. After entering the cutoff limit, press **(ENTER)**. The oven displays a brief confirmation message and returns to the **Burn Parameter Menu**.

CUTOFF LIMIT AS A PERCENTAGE. To enter the cutoff limit as a percentage of the initial sample mass, press **(2)** at the **Cutoff Units** menu shown on page 5-6. The oven displays:

```
Current Cutoff Limit
X.XXX %
do you want to
change Cutoff Limit?
```

- To exit without changing the cutoff limit, press **(NO)**. The oven returns to the **Burn Parameter Menu**.

- To change the cutoff limit, press **(YES)**. The oven displays:

Enter Cutoff Limit from 0.001% - 1.000% in 0.001% steps _ then press ENTER

Use the numeric and decimal keys to enter a cutoff limit from 0.001% to 1.000% in increments of 0.001%. Use the numeric keys to set the burn time. After entering the cutoff limit, press **(ENTER)**. The oven returns to the **Burn Parameter Menu**.

Calculation Type

The oven provides two methods for calculating *%Loss*: the *bitumen-to-sample* method and the *bitumen-to-aggregate* method. Both methods measure the difference in the sample weights before and after the burn. However, the *bitumen-to-sample* method expresses the difference as a percentage of the *starting mass* while the *bitumen-to-aggregate* method expresses the difference as a percentage of the *final (aggregate) mass*.

The formulas for the two calculation types are as follows:

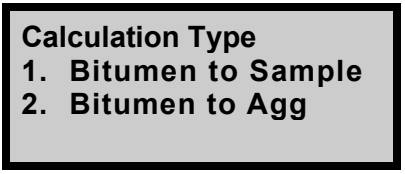
Bitumen-to-Sample Calculation Type:

$$\%Loss = \frac{(Initial\ Mass - Final\ Mass)}{Initial\ Mass}\ x\ 100$$

Bitumen-to-Aggregate Calculation Type:

$$\%Loss = \frac{(Initial\ Mass - Final\ Mass)}{Final\ Mass}\ x\ 100$$

To select the desired calculation type, press ⟨**4**⟩ at the **Burn Parameter Menu** shown on page 5-4. The oven displays:

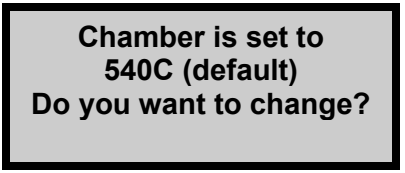


Use the numeric keys to select the desired calculation type. The oven sets the calculation type and returns to the **Burn Parameter Menu**.

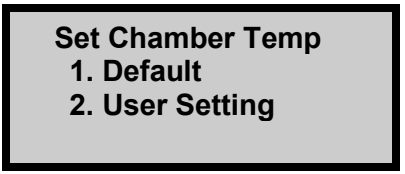
Set Chamber Temp

The Set Chamber Temp option allows the user to select the operating temperature of the Chamber. Temperatures that are allowed are 200C to 600C.

To use the Set Chamber Temp function, press (2) at the Burn Setup Menu. The oven displays:

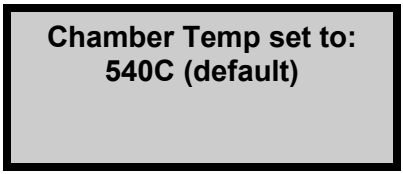


If the user presses (YES), the screen will change to:



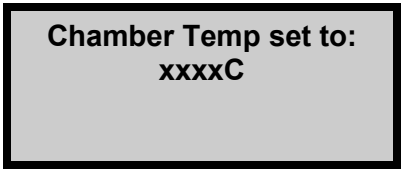
If the user presses (NO), the display returns to the Burn Setup Menu.

If the user selects (1), the display below is momentarily displayed before returning to the Burn Setup menu.



If the user selects (2), the display below will appear:

The user enters the desired temperature, presses Enter; the screen below momentarily displays before returning to the Burn Setup Menu.:



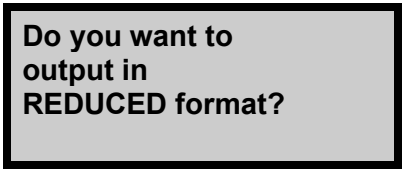
AUTO-PRINT

The *Auto-Print* function automatically prints sample data during a burn cycle. The oven offers two *Auto-Print* printout options: *standard* and *reduced*. A standard printout includes minute-by-minute burn data. A reduced printout (see Figure 17) includes only a header and footer and a summary of the burn data.

To set up the *Auto-Print* function, press **(3)** at the **Burn Setup Menu**. The oven displays:

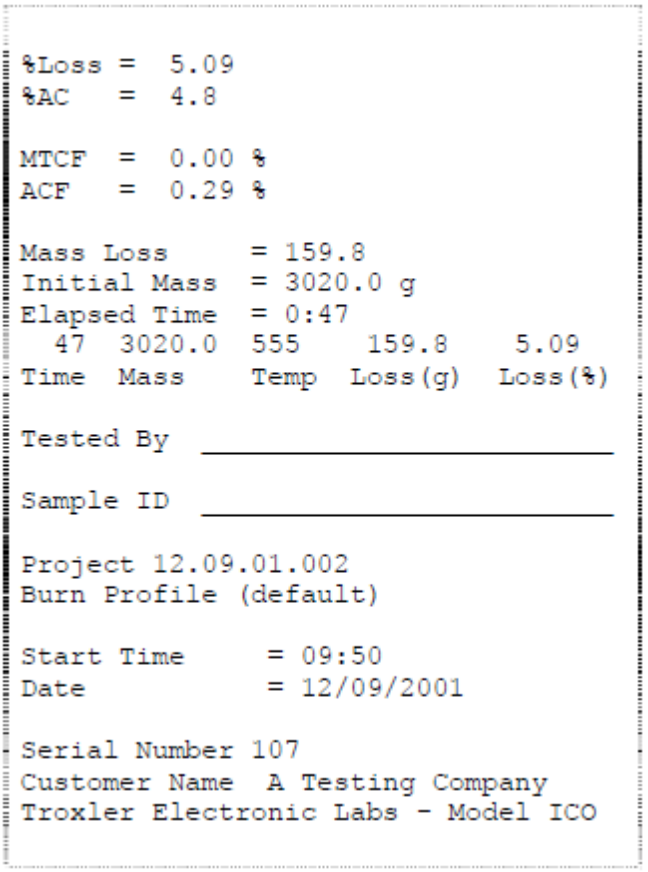
- To return to the **Burn Setup Menu** without changing the *Auto-Print* status, press **(ESC)**.

- To turn the *Auto-Print* function on, press **(1)**. The oven displays:



To enable a reduced printout, press **(YES)**; to enable a standard printout, press **(NO)**. The oven updates the *Auto-Print* status, displays a brief confirmation message, and returns to the **Burn Setup Menu**.

- To turn the *Auto-Print* function off, press **(2)**. The oven updates the *Auto-Print* status, briefly displays a confirmation message, and returns to the **Burn Setup Menu**.



```
%Loss =  5.09
%AC   =  4.8

MTCF  =  0.00 %
ACF   =  0.29 %

Mass Loss      = 159.8
Initial Mass   = 3020.0 g
Elapsed Time   = 0:47
  47  3020.0  555    159.8    5.09
Time  Mass    Temp  Loss(g)  Loss(%)

Tested By  _____________________________

Sample ID  _____________________________

Project 12.09.01.002
Burn Profile (default)

Start Time      = 09:50
Date            = 12/09/2001

Serial Number 107
Customer Name  A Testing Company
Troxler Electronic Labs - Model ICO
```

Figure 18: Sample Reduced Printout

AUTO-STORE

The *Auto-Store* function automatically stores sample data upon completion of a burn cycle. The data is stored under the active project, using a sequential auto-sample ID number. When a new project is created, the sample ID number for the *Auto-Store* function starts at *1* and is incremented each time a sample is stored automatically.

NOTE

The Auto-Store sample ID number is not incremented if sample data is stored manually (see page 5-27). When using the manual Store function, the operator enters a sample ID number manually. Therefore, duplicate sample ID numbers could be stored under the active project.

For example, if the Auto-Store function is turned on for a new project, the oven stores the sample data for the first two burn cycles under sample IDs 1 and 2. Assume that the Auto-Store is then turned off, and the operator manually stores data from two more burn cycles using sample IDs 3 and 4. If the Auto-Store function is then turned on, the sample data for successive burn cycles will also be stored using sample IDs 3, 4, and so on.

To prevent duplication of sample ID numbers, Troxler recommends either using sample IDs beginning at 100 or higher when storing sample data manually or always enabling the Auto-Store function.

To access the *Auto-Store* function, press (**4**) at the **Burn Setup Menu**. The oven displays:

- To return to the **Burn Setup Menu** without changing the *Auto-Store* status, press (**ESC**).

- To turn the *Auto-Store* function on, press **(1)**.

- To turn the *Auto-Store* function off, press **(2)**. The oven updates the *Auto-Store* status, displays a brief confirmation message, and returns to the **Burn Setup Menu**.

Active Project Selected

If the operator attempts to turn the *Auto-Store* function on *and* a project has been selected as active, the oven enables the *Auto-Store* function, briefly displays the confirmation message shown below, and then returns to the **Burn Setup Menu**.

No Project Data

If the operator attempts to turn the *Auto-Store* function on, but no projects have been created, the oven displays:

- To return to the **Burn Setup Menu** without enabling the *Auto-Store* function, press **(NO)**.

- To create a project and enable the *Auto-Store* function, press **(YES)**. The oven displays the screens required to create a project as described in Chapter 7. When the project ID is complete, the oven sets the project as active, briefly displays the confirmation shown above, and then returns to the **Burn Setup Menu**.

No Project Selected

If the operator attempts to turn the *Auto-Store* function on and one or more projects have been created (see Chapter 7) but no project has been selected as active, the oven displays:

- To select an existing project, press **(1)**. The oven displays the screens required to select a project as described in Chapter 7. After the project is selected, the oven sets the project as active, briefly displays the confirmation shown on page 5-28, and then returns to the **Burn Setup Menu**.

- To create a new project ID, press **(2)**.

  - If twenty project IDs have already been defined, the oven displays an error message.

  - If fewer than twenty projects have been defined, the oven displays the screens required to create a project as described in Chapter 7. When the project ID is complete, the oven sets the project as active, briefly displays the confirmation shown on page 5-28, and then returns to the **Burn Setup Menu**.

AUTO-TIMER

The *Auto-Timer* function can be used to automatically power the heating elements on and off at specified times and on specified days.

NOTE

When the Auto-Timer powers down the heating element, the control electronics and exhaust fan remain powered.

NOTE

In the Auto-Timer mode, the oven will not turn off at the programmed time if a burn cycle is in progress.

After the *Auto-Timer* has been enabled, the operator can *disable* or *suspend* it as desired.

If the *Auto-Timer* is *disabled*, it will not turn the oven on or off. To re-enable the *Auto-Timer*, the operator must re-enter all of the *Auto-Timer* parameters (start and stop dates and times, and so on).

If the *Auto-Timer* is *suspended*, the oven retains all of the *Auto-Timer* parameters. The *Auto-Timer* can then be re-enabled without requiring the operator to re-enter this information.

The following sections describe how to enable, disable, and suspend the *Auto-Timer*.

ENABLING THE AUTO-TIMER

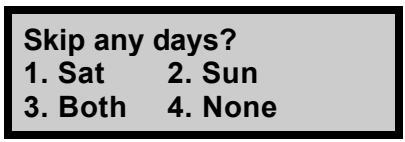
To enable the *Auto-Timer*, press ⟨**2**⟩ at the **MAIN MENU** shown on page 5-2. If the *Auto-Timer* is not already enabled, the oven requests the *start date* for the *Auto-Timer* as shown below. The start date is the date on which the *Auto-Timer* is to begin controlling power to the heating element.

The top line of the display shows the current setting for the start date. The date format (in this example, mm = month, dd = day, and yyyy = year) is the same as that displayed on the default screen. To change the date format, refer to page 5-33. Use the numeric keys to enter the desired start date. To move the cursor back one position, press the (**BACK SPACE**) key. When finished, press (**ENTER**).

If the start date is valid, the oven requests the stop date for the Auto-Timer as shown below. The stop date is the date after which the Auto-Timer will not power up the heating element.

The top line of the display shows the current setting for the stop date. Use the numeric keys to enter the desired stop date. To move the cursor back one position, press the **(BACK SPACE)** key. When finished, press **(ENTER)**.

If the stop date is valid, the oven requests the days for the *Auto-Timer* to skip each week:



Use the numeric keys to select the desired days to be skipped and press **(4)**.

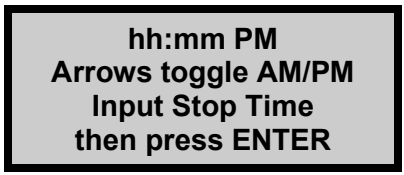
The oven then requests the *start time* for the *Auto-Timer* as shown below. The start time is the time of day at which the *Auto-Timer* is to turn the heating element on.

The top line of the display shows the current setting for the start time. The time format (in this example, the *AM/PM* format) is the same as that displayed on the default screen. To change the time format, refer to page 5-33. Use the numeric keys to enter the desired start time and the arrow keys to toggle between *AM* and *PM*. To move the cursor back one position, press the **(BACK SPACE)** key. When finished, press **(ENTER)**.

NOTE

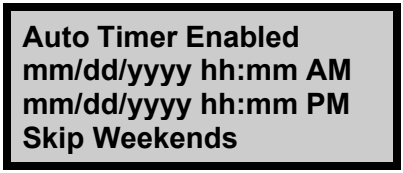
The start time should be set at least 60 – 90 minutes before the first sample is to be burned. To ensure consistent, repeatable results.

If the start time is valid, the oven requests the *stop time* for the *Auto-Timer* as shown below. The stop time is the time of day when the *Auto-Timer* is to turn the heating element off.



The top line of the display shows the current setting for the stop time. Use the numeric keys to enter the stop time and the arrow keys to toggle between *AM* and *PM*. To move the cursor back one position, press the **(BACK SPACE)** key. When finished, press **(ENTER)**.

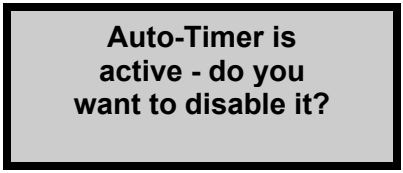
If the stop time is valid, the oven displays the **Auto-Timer Enabled** screen, showing the start date and time, the stop date and time, and the days to be skipped (if any). If no days are to be skipped, the bottom line of the display is blank.



The oven then returns to the MAIN MENU shown on page 5-2.

DISABLING THE AUTO-TIMER

To disable the *Auto-Timer*, press **(2)** at the **MAIN MENU** shown on page 5-2. If the *Auto-Timer* is active, but has not applied power to the heating element, the oven displays:

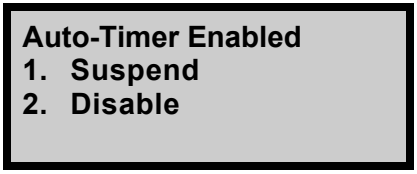


- To return to the **MAIN MENU** without disabling the *Auto-Timer*, press **(NO)**.

- To disable the *Auto-Timer*, press **(YES)**. The oven displays the message **Auto-Timer is Disabled** and returns to the **MAIN MENU**.

SUSPENDING THE AUTO-TIMER

To suspend the *Auto-Timer*, press **(2)** at the **MAIN MENU** shown on page 5-2. If the *Auto-Timer* is enabled and has applied power to the heating element, the oven displays:



- To return to the **MAIN MENU** without suspending or disabling the *Auto-Timer*, press **(ESC)**.

- To suspend the *Auto-Timer*, press **(1)**. The oven briefly displays the message shown below and returns to the **MAIN MENU**.

```
Auto-Timer is
Suspended
must be explicitly
reenabled to resume
```

The *Auto-Timer* can also be disabled from this display by pressing **(2)**. The oven displays the message **Auto-Timer Disabled** and returns to the **MAIN MENU**.

To re-enable the *Auto-Timer* after it has been suspended, press **(2)** at the **MAIN MENU** shown on page 5-2. The oven displays:

```
Auto-Timer Suspended
1. Re-enable
2. Disable
```

To re-enable the *Auto-Timer*, press **(1)**. The oven displays the following **Auto-Timer Enabled** screen, which shows the start date and time, stop date and time, and days to be skipped (if any).

```
Auto-Timer Enabled
mm/dd/yyyy hh:mm AM
mm/dd/yyyy hh:mm PM
Skip Weekends
```

The oven then returns to the MAIN MENU shown on page 5-2.

PROJECT MENU

The oven stores sample data in *project files*. The **Project Menu** enables the operator to create a new project; to select the active project from a list of created ones; and to view, erase, print, or download project data. The functions available from the **Project Menu** are described in Chapter 7, *Handling Data*.

CORRECTION MENU

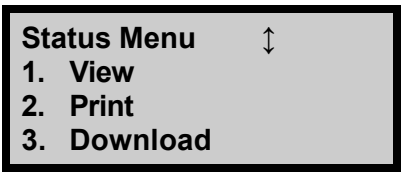
The oven stores up to twenty operator-defined *aggregate correction factors* (*ACFs*). The **Correction Menu** enables the operator to create, select, and erase ACFs. The **Correction Menu** is described in Chapter 6, *Calibration*.

SCALE MENU

This includes an integrated scale that continuously monitors the sample mass loss during a burn cycle. The Scale Menu enables the operator to tare the scale, either manually or automatically, and to verify and calibrate the scale. The Scale Menu is described in *Chapter 6, Calibration*.

STATUS MENU

The **Status Menu** allows the operator to view, print, and download system status information. The oven can also be set up to print this status information automatically upon power up. To access the **Status Menu**, press **(6)** at the **MAIN MENU** shown on page 5-2. Use the up and down arrows to scroll through the menu options.



VIEW STATUS

To view the system status information, press **(1)**. The oven displays five screens showing:

- Burn mode (*AUTO*-or *MANUAL*)
- Cutoff criteria for the burn mode (*Cutoff Limit* or *Burn Time*)
- Current temperature
- Display units (*%Loss*)
- Calculation type (*Bitumen to Sample* or *Bitumen to Aggregate*)
- Unit serial number and software version
- Active aggregate correction factor (*ACF*) identification and value
- *Auto-Timer* status (*Enabled*, *Disabled*, or *Suspended*) and settings (if enabled)

- *Auto-Tare*, *Auto-Store*, and *Auto-Status Print* status (*ON* or *OFF*)

Use the up and down arrows to scroll through the various screens. To return to the **Status Menu**, press **(ESC)**.

NOTE

The system status display can also be viewed directly from the default display by pressing the (STATUS) **key.**
To return to the default display, press (ESC).

PRINT STATUS

To print system status information to the internal printer, press **(2)** at the **Status Menu**. While printing, the oven displays **Printing data please wait...** When finished, the oven returns to the **Status Menu**.

DOWNLOAD STATUS

To download the system status information from the oven, connect the serial communications port to a computer or other serial device. The serial communications port is the leftmost of the two serial ports on the rear panel, as viewed from the rear of the oven.

NOTE

To ensure proper data transfer, the cable connected to the serial communications port should not exceed 3 m (10 ft) in length.

Check the baud rate as described on page 5-33. Press **(3)** at the **Status Menu**. While downloading the system status information, the oven displays **Downloading data please wait...** When finished downloading, the oven returns to the **Status Menu**.

AUTO-STATUS PRINT

The oven can also be configured to automatically print system status information each time it is powered on. To enable this function, press **(4)** at the **Status Menu**. The oven displays the *Auto-Status Print* menu, as shown below:

- To return to the **Status Menu** without changing the *Auto-Status Print* function, press **(ESC)**.

- To turn the *Auto-Status Print* function on, press **(1)**. The oven updates the status of the function, briefly displays a confirmation message, and returns to the **Status Menu**.

- To turn the *Auto-Status Print* function off, press **(2)**. The oven updates the status of the function, displays a brief confirmation message, and returns to the **Status Menu**.

STORE FUNCTION

After burning a sample and before burning another sample, sample data can be stored under the active project ID. (See Chapter 7 for details on creating a project ID.) The *Store* selection from the **MAIN MENU** enables the operator to store sample data manually.

NOTE

This function can also be accessed directly from the default screen by pressing the (STORE) **key.**

After burning a sample and before burning another sample, press **(7)** at the **MAIN MENU** or press the **(STORE)** key if the default screen is displayed.

If there is no sample data to be stored, the oven displays an error message and returns to the previous display.

NOTE

The Auto-Store sample ID number is not incremented if sample data is stored manually. When using the manual Store function, the operator enters a sample ID number manually. Therefore, duplicate sample ID numbers could be stored under the active project.

For example, if the Auto-Store function is turned on for a new project, the oven stores the sample data for the first two burn cycles under sample IDs 1 and 2. Assume that the Auto-Store is then turned off, and the operator manually stores data from two more burn cycles using sample IDs 3 and 4. If the Auto-Store function is then turned on, the sample data for successive burn cycles will also be stored using sample IDs 3, 4, and so on.

NOTE

To prevent duplication of sample ID numbers, Troxler recommends either using sample IDs beginning at 100 or higher when storing sample data manually or always enabling the Auto-Store function.

ACTIVE PROJECT SELECTED

If the operator initiates the *Store* function, there is sample data to be stored, *and* a project has been selected as active, the oven displays:

Input new sample number _

then press ENTER

Enter a sample number (up to six numerals). Troxler recommends that manually stored samples be numbered beginning at *100* or higher. When the sample number is complete, press **(ENTER)**.

If there is sufficient memory, the oven stores the sample data under the active project ID and sample number entered, briefly displays a confirmation message, and then returns to the previous screen.

If there is insufficient memory to store the data, the oven displays an error message and returns to the previous screen. One or more projects must be deleted before the new project data can be stored.

NO PROJECT DATA

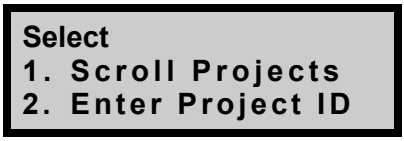
If the operator initiates the *Store* function and there is sample data to be stored, but no project IDs have been created, the oven displays:

- To return to the previous display without creating a project or storing the sample data, press **(NO)** or **(ESC)**.

- To create a project, press **(YES)**. The oven displays the screens required to create a project as described in Chapter 7. When the project ID is complete, the oven sets the project as active, displays a brief confirmation message, and then requests the sample number as described in the *Active Project Selected* section on page 5-28.

NO PROJECT SELECTED

If the operator initiates the *Store* function and there is sample data to be stored, but there is no active project (although project IDs have been created), the oven displays:



- To return to the previous display without selecting a project or storing the sample data, press **(ESC)**.

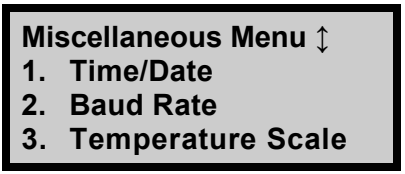
- To select a project, press **(1)** to scroll through the list of created projects, or **(2)** to enter a known project ID. For more information on selecting a project, refer to Chapter 7. After a project ID has been selected, the oven sets the project as active, briefly displays a confirmation message, and then requests the sample number as described in the *Active Project Selected* section on page 5-28.

MISCELLANEOUS MENU

The **Miscellaneous Menu** allows the operator to:

- Configure the system time and date parameters
- Set the baud rates for the serial communication and auxiliary ports
- Select the desired temperature scale
- Enter the customer name
- Turn the system information output on and off
- Abort printing

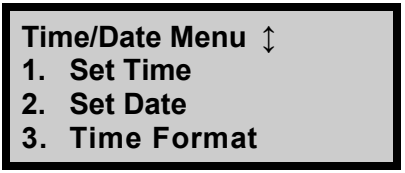
To access the **Miscellaneous Menu**, press **(8)** at the **MAIN MENU** shown on page 5-2. Use the up and down arrows to scroll through the menu options.

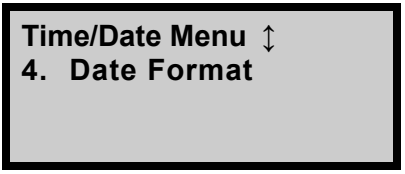


TIME/DATE MENU

The **Time/Date Menu** allows the operator to set the current time and date and to select the desired format for the date and time displays.

To access the **Time/Date Menu**, press **(1)** at the **Miscellaneous Menu** shown above. Use the up and down arrows to scroll through the menu options.





Set Time

To set the current time, press **(1)** at the **Time/Date Menu**. The oven displays:

(Note that in this example, the time is displayed in *AM/PM* format. To change the format, see the *Time Format* section on page 5-32.) To accept the displayed time, press **(ENTER)**. To change the time, use the numeric keys to enter the new time, and the arrow keys to toggle between *AM* and *PM*. When finished, press **(ENTER)**. The oven sets the time and returns to the **Time/Date Menu**.

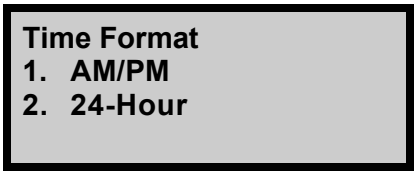
Set Date

To set the current date, press **(2)** at the **Time/Date Menu**. The oven displays:

(Note that in this example, the time is displayed in *mm/dd/yyyy* format. To change the date format, refer to the *Date Format* section on the following page.) To accept the displayed date, press **(ENTER)**. To change the date, use the numeric keys to enter the new date. When finished, press **(ENTER)**. The oven sets the date and returns to the **Time/Date Menu**.

Time Format

The oven can display the time in either *AM/PM* or *24-hour* format. To select the desired time format, press **(3)** at the **Time/Date Menu**. The oven displays:



Use the numeric keys to select the desired format, and press **(ENTER)**. The oven sets the time format and returns to the **Time/Date Menu**.

Date Format

The oven can display the date in either *mm/dd/yyyy* or *dd/mm/yyyy* format, where *mm* = month, *dd* = day, and *yyyy* = year. To select the desired date format, press **(4)** at the **Time/Date Menu**. The oven displays:

```
Date Format
1. mm/dd/yyyy
2. dd/mm/yyyy
```

Use the numeric keys to select the desired format, and press **(ENTER)**. The oven sets the date format and returns to the **Time/Date Menu**.

BAUD RATE

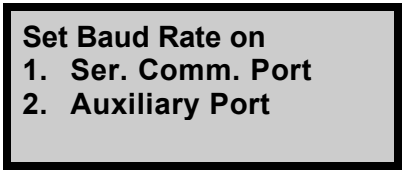
The oven includes a serial communications port and an auxiliary port mounted side-by-side at the left side of the rear panel (as viewed from the rear of the oven). The serial communications port (the leftmost of the two ports) is used to connect the oven to an RS-232 serial device, such as a printer or computer. The auxiliary (right) port is intended for factory use only.

NOTE

To ensure proper data transfer, the cable connected to the serial communications port should not exceed 3 m (10 ft) in length.

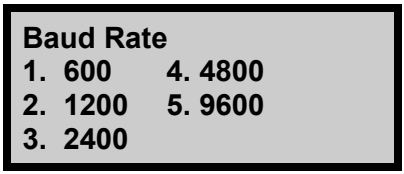
To ensure proper communications over these ports, the baud rate, or communication speed, of the oven must match that of the peripheral device. The baud rate on each port can be set to 600, 1200, 2400, 4800, or 9600 baud. The default setting is 9600 baud.

To set the baud rate for the serial communications port and/or auxiliary port, press **(2)** on the **Miscellaneous Menu**. The oven displays:



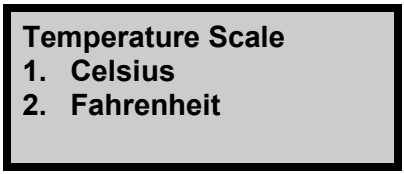
Press **(1)** to set the baud rate for the serial communications port or **(2)** to set the baud rate for the auxiliary port. The oven displays:

Use the numeric keys to select the baud rate that matches that of the peripheral device. Refer to the device user manual to determine the proper setting. The oven sets the baud rate for the selected port, displays a brief confirmation message, and returns to the **Miscellaneous Menu**.



TEMPERATURE SCALE

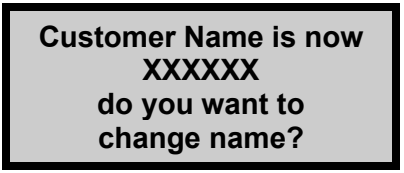
The oven can display the temperature in degrees *Celsius* or *Fahrenheit*. To select the temperature scale, press **(3)** on the **Miscellaneous Menu**. The oven displays:



Use the numeric keys to select the desired temperature scale. The oven sets the scale, briefly displays a confirmation message, and returns to the **Miscellaneous Menu**.

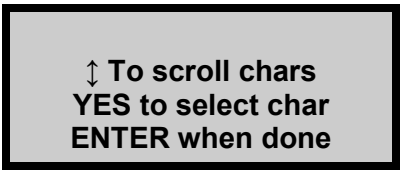
CUSTOMER NAME

The oven enables the operator to enter a 16-character customer name into the oven. To enter a customer name, press **(4)** on the **Miscellaneous Menu**. The oven displays:



- To accept the name displayed and return to the **Miscellaneous Menu**, press **(NO)** or **(ESC)**.

- To change the customer name, press **(YES)**.



Enter a customer name using up to sixteen alphanumeric characters. Use the numeric keys to enter numbers and move the cursor to the next position. To enter alphabetic characters, use the arrow keys to scroll through the characters. When the desired character is displayed, press **(YES)** to move the cursor to the next position. To move the cursor back one position, press the **(BACK SPACE)** key.

NOTE

After the last character has been entered, press (YES) **to accept the character before pressing** (ENTER) **to accept the customer name.**

When the customer name is complete, press **(ENTER)**. The oven changes the name, displays a brief confirmation message, and returns to the **Miscellaneous Menu**.

SYSTEM OUTPUT

The oven features a *System Information* function that outputs the following data to the serial communications port every second. The data is output in the order shown. The operator can

elect to enable this function anytime the oven is powered on (*Always On*) or only during a burn cycle (*During Burn Only*).

- Current time
- Current chamber temperature in degrees Celsius or Fahrenheit, as selected by the operator
- Total mass on the scale
- Elapsed time in seconds of a burn cycle (applies only during a burn cycle)
- Current mass loss in grams (applies only during a burn cycle)
- Current percentage mass loss (applies only during a burn cycle; takes into account the current calculation typesetting)
- Current corrected %AC (applies only during a burn cycle)

To enable or disable the *System Information* function, press **(5)** on the **Miscellaneous Menu**. The oven displays:

```
System Info Output
1. Always On
2. During Burn Only
3. Off
```

Press **(1)** to turn the *System Information* function always on; **(2)** to enable the function only during a burn; or **(3)** to disable it. The oven displays a brief confirmation message and returns to the **Miscellaneous Menu**.

ABORT PRINT

The *Abort Print* function enables the operator to halt a print operation. To access the *Abort Print* function, press **(6)** on the **Miscellaneous Menu**. The oven displays:

Upon completion, the oven returns to the **Miscellaneous Menu**.

UNLOCK DOOR

The *Unlock Door* function allows the operator to unlock the chamber door if the sample burn time is less than 30 minutes or under any other condition from the default screen. To unlock the door, press **(7)** on the **Miscellaneous Menu**. The oven briefly displays the following message, and then returns to the **Miscellaneous Menu**.

WARNING

To prevent personal injury, do not unlock the door during a burn.

Chapter 6:
CALIBRATION

This chapter provides information on calibrating and verifying operating parameters for the ICO. The information includes procedures for determining an aggregate correction factor (ACF); for using the **Correction Menu** to manage ACFs; and for using the **Scale Menu** to tare, verify, and calibrate the integrated scale.

CORRECTING %AC MEASUREMENTS

WARNING

To prevent personal injury or equipment damage, the operator should become familiar with the safety warnings and information in Chapter 2 before operating the ICO.

During the ignition process, a complex interaction of various effects (mass, temperature, airflow, materials type) can produce a result that could be interpreted as a "mass loss." This "mass loss" effect could consequently affect the determination of the asphalt content.

To compensate for this "mass loss" effect, the oven uses an *aggregate correction factor* (*ACF*) to adjust asphalt content measurements.

The magnitude of the "mass loss" effect is influenced most by the *type of aggregate*. Granite aggregates have been shown to yield the least "mass loss," while limestone aggregates can produce higher losses. To ensure accurate determination of the asphalt content, an *aggregate correction factor (ACF)* is necessary to compensate for this aggregate "mass loss" effect. The following sections provide instructions for determining an ACF.

To ensure precise asphalt content measurements, use a consistent sample preparation and selection method. For more information, refer also to ASTM standard D 75 (AASHTO T2), *Standard Practice for Sampling Aggregates*.

EQUIPMENT NEEDED

The following equipment is required to determine an ACF to adjust the %AC measurements:

- ICO
- Safety equipment - including but not limited to heat-resistant gloves and face shield
- External scale precise to ± 0.1 g
- Drying oven that can maintain 105 °C (221 °F) per ASTM
- D 6307, *Standard Test Method for Asphalt Content of Hot-Mix*
- *Asphalt by Ignition Method*
- Stainless steel mixing bowl and assorted spoons and spatulas
- Sample basket assembly (provided)
- Aggregate correction factor form (see sample in Figure 6-1)

PREPARING CORRECTION SAMPLES

See the safety warnings in Chapter 2. Refer to Figure 18 on the following page for a sample form for recording and calculating data.

To prepare correction samples, follow the steps below:

1. Ensure that the oven is properly set up for ignition (see Chapter 4) with an ACF of 0.0%. See page 6-8 for instructions on changing the ACF, if necessary.
2. To ensure the accuracy of the ACF calculations, allow the oven temperature to reach 540 C (default).
3. Prepare a correction sample that closely represents the production mixture per ASTM D 6307, or local and state requirements.

4. Divide the HMA sample into a minimum of three correction samples.

5. Use an external scale to weigh the sample baskets with the catch pan and basket cover. Record the mass (W_P).

6. With the catch pan under the sample baskets, spread the correction sample evenly in the baskets. Put no more than 2500 g in each basket.

Date _____ Project _____ $\%AC_T$ _____

	Sample Number			
	1	2	3	4
Sample Basket, Catch Pan, and Basket Cover Mass (W_P)				
Sample, Sample Basket, Catch Pan, and Basket Cover Mass (W_T)				
Sample Weight ($W_S=W_T-W_P$)				
True Asphalt Content ($\%AC_T$)				
Asphalt Content of Sample Measured by Oven ($\%AC_0$)				
Correction Factor ($ACF = \%AC_0 - \%AC_T$)				
Average Aggregate Correction Factor (ACF_{AVG})				

Figure 19: Sample Aggregate Correction Factor Form

⚠ WARNING

Always wear heat-resistant gloves when handling any hot substance.

Troxler recommends wearing a face shield when the oven door is open and when handling the sample.

Use the basket carrier to move hot sample baskets (see Figure 2-1 on page 2-8). Always keep the basket carrier to the left side of your body, with the handle between your body and the open oven door. This helps prevent the operator from backing into the hot insulation of the inside surface of the door.

7. Place the sample basket cover over the top sample basket.

8. Use the lock arms to secure the sample basket cover to the top basket.

9. Place the sample with the baskets, catch pan, and sample basket cover in the center of the external scale. Record the mass (W_T) from the external scale.

10. Determine the sample mass ($W_S = W_T - W_P$).

11. Set up the *Auto-Print* function for a printout that will include %Loss, %AC, sample mass, and so on. Refer to the *auto-print* section on page 5-10 for setup instructions.

12. Press ⟨**START**⟩.

13. 15. The oven requests the sample mass ($W_S = W_T - W_P$). Enter the sample mass and press **(ENTER)**.

CAUTION

Use care when loading and unloading samples to avoid touching or scraping the hearth plate, chamber sides, or heating element.

14. Place the sample with the baskets and catch pan on the hearth plate in the center of the oven. Ensure that the hearth plate and sample baskets do not touch the chamber sides. Immediately close the chamber door.

15. Press **(START)**.

WARNING

Step away from the oven during ignition. Do not override the door lock.

16. After ignition is complete, the oven releases the door lock and prints a summary of the sample burn data. **Wearing insulated gloves and a face shield**, remove the sample from the oven and cover it with the sample safety cage until the sample has cooled to room temperature.

NOTE

The accuracy of the ACF calculations can be reduced if the sample is allowed to remain in the oven chamber after the burn is complete.

17. Record the %AC determined by the oven ($\%AC_0$) with an ACF of 0.0%.

18. Repeat steps 6 through 19 for the remaining correction samples.

CALCULATING AN ACF

1. Using the following equation, calculate and record the aggregate correction factor for each correction sample:

$$ACF = \%AC_0 - \%AC_T$$

where: ACF = Aggregate correction factor

$\%AC_0$ = Asphalt content of sample as determined by the oven

$\%AC_T$ = True asphalt content

2. Determine the average ACF value *(ACFAVG)* as follows:

   - If the difference between the two ACF values is less than 0.15%, then average the two values.

   - If the difference between the two ACF values is greater than 0.15%, then prepare two additional correction samples. Discard the high and low ACF values, and then average the two remaining values.

3. Enter the ACF as described in the *Create ACF* section on page 6-9. The oven will automatically adjust the asphalt content measurements using the active ACF.

CORRECTION MENU

The oven can store up to twenty *aggregate correction factors* (*ACFs*). Each ACF is stored using an alphanumeric ID entered by the operator. The ACF ID can be up to twelve characters. When a correction factor is *active*, all measurements are adjusted using that correction factor.

The **Correction Menu** enables the operator to select (activate) an existing ACF, to create a new ACF, or to erase one or more stored ACFs. To access the **Correction Menu**, press **(4)** at the **MAIN MENU**. The oven displays:

```
Correction Menu
1. Select ACF
2. Create ACF
3. Erase ACF
```

To select an item from the menu, press the corresponding number key.

SELECT ACF

To select (activate) for an existing ACF, press **(1)** at the **Correction Menu** shown on page 6-8. If there are no stored ACFs, the oven displays the error message **No ACFs Found** and returns to the Correction Menu.

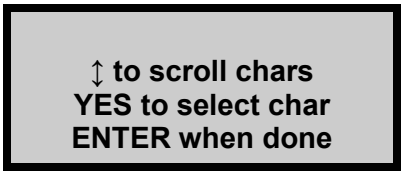
If there are stored ACFs, the oven displays:

```
Select
1. Scroll ACFs
2. Enter ACF ID
```

- To choose from a list of ACFs, press **(1)**. The oven displays the ID for the active ACF on the first line, and the correction factor on the second line. Use the arrow keys to scroll through the list. Press **(ENTER)** when the desired ACF is displayed. The oven sets the selected ACF

as active, briefly displays a confirmation message, and returns to the **Correction Menu**.

- To enter the desired ACF ID, press **(2)**. The oven displays:



Enter the desired ACF ID. Use the numeric keys to enter numbers and move the cursor to the next position. To enter alphabetic characters, use the arrow keys to scroll through the characters. When the desired character is displayed, press **(YES)** to move the cursor to the next position. To move the cursor back one position, press the **(BACK SPACE)** key.

NOTE

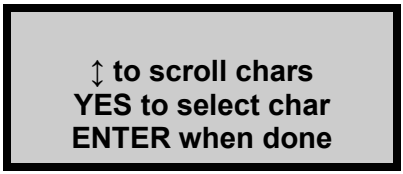
After the last character has been entered, press (YES) **to accept the character before pressing** (ENTER) **to accept the ACF ID.**

When the ACF ID is complete, press **(ENTER)**. If the ACF ID is valid, the oven activates the selected ACF, displays a brief confirmation message, and returns to the **Correction Menu**. If the ACF ID entered is not valid, the oven displays an error message. Press **(ENTER)** to return to the **Correction Menu**.

CREATE ACF

To create a new ACF, press **(2)** at the **Correction Menu** shown on page 6–8. If the maximum number (twenty) of ACFs already exists, the oven displays an error message. Press **(ENTER)** to return to the **Correction Menu**. To clear space in memory for the new ACF, use the *Erase ACF* function described on page 6-10.

If the maximum number of ACFs does not already exist, the oven displays:



Enter the desired ACF ID. Use the numeric keys to enter numbers and move the cursor to the next position. To enter alphabetic characters, use the arrow keys to scroll through the characters. When the desired character is displayed, press **(YES)** to move the cursor to the next position. To move the cursor back one position, press the **(BACK SPACE)** key.

NOTE

After the last character has been entered, press (YES) **to accept the character before pressing** (ENTER) **to accept the ACF ID.**

When the ACF ID is complete, press **(ENTER)**. The oven then requests the new ACF value:

The ACF value can be from –5.00 to 5.00%, in increments of 0.01%. Use the numeric keys to enter the ACF. Use the arrow keys to toggle the sign (positive [+] or negative [–]) of the correction factor. When the new ACF value is complete, press **(ENTER)**. The oven activates the new ACF value, briefly displays a confirmation message, and returns to the **Correction Menu**.

ERASE ACF

To erase one or more ACFs, press **(3)** at the **Correction Menu** shown on page 6–8. The oven displays:

To erase all ACFs, press **(2)** and follow the prompts. To erase a single ACF, press **(1)**. The oven displays:

- To choose an ACF from a list, press **(1)**. The oven displays the ID of the first ACF. Use the arrow keys to scroll through the list. To select an ACF for erasure, press **(ENTER)** when the oven displays the ACF ID.

- To select a *known* ACF ID to be erased, press **(2)**. The oven displays:

Enter the desired ACF ID and press **(ENTER)**.

After the ACF ID has been selected or entered, the oven displays:

- To erase the ACF, press **(YES)**. The oven erases the ACF, displays a brief confirmation message, and returns to the **Correction Menu**.

- To return to the **Correction Menu** without erasing the ACF, press **(NO)** or **(ESC)**.

SCALE MENU

The **Scale Menu** allows the operator to tare, verify, and calibrate the oven's integrated scale.

NOTE

The operator can also tare the integrated scale by pressing the (TARE) **key when the default screen is displayed.**

The scale should only be verified or calibrated when the oven chamber is at room temperature. When calibrated correctly, the scale complies with the following standards:

- AASHTO M 231, Standard Specification for Weighing Devices Used in the Testing of Materials
- ASTM D 4753, Standard Specification for Evaluating, Selecting, and Specifying Balances and Scales for use in Soil, Rock, and Construction Materials Testing.

Please refer to these standards when identifying the accuracy and linearity requirements. Troxler recommends calibrating the scale should it fail the *Verify* test.

To access the **Scale Menu**, press **(5)** at the **MAIN MENU**. The oven displays:

To select an item from the menu, press the corresponding number key. Use the up and down arrows to scroll through the menu options.

TARE

To tare, or "zero" the integrated scale manually, press (**1**) at the **Scale Menu**.

NOTE

The operator can also tare the scale manually by pressing the (TARE) **key when the default screen is displayed.**

The oven tares the scale, displays a brief confirmation message, and returns to the **Scale Menu**.

AUTO-TARE

The oven features an *Auto-Tare* function that, when enabled, automatically tares the integrated scale approximately every 100 minutes. The *Auto-Tare* function is suspended when the chamber door is open.

The *Auto-Tare* function is also suspended if the mass on the scale is above a predetermined threshold (such as when loaded sample baskets are placed in the oven). The *Auto-Tare* function resumes when the difference between the current mass on the scale and the last measured tared output is below the threshold.

To turn the *Auto-Tare* function on or off, press (**2**) at the **Scale Menu**. The oven displays:

Press (**1**) to turn the *Auto-Tare* function on; press (**2**) to turn the function off. The oven displays a brief confirmation message and returns to the **Scale Menu**.

VERIFY

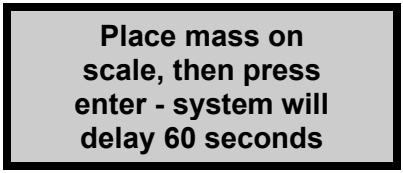
The oven enables the operator to verify the accuracy of the integrated scale using a known mass. To verify the scale, press **(3)** at the **Scale Menu**. Ensure that the oven chamber is at room temperature, the hearth plate is in place on the rails, and the chamber door remains open throughout the process. Ensure that the hearth plate does not touch the chamber sides.

NOTE

The oven chamber must be at room temperature (less than 35 °C), the hearth plate must be in place, and the chamber door must remain open to properly verify the scale.

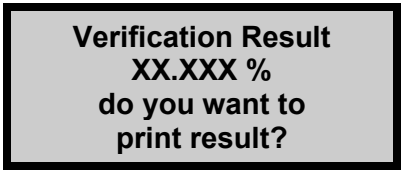
The oven automatically tares the scale, and then requests the mass being used to verify the scale:

Enter the mass in grams, and press **(ENTER)**. The oven displays:



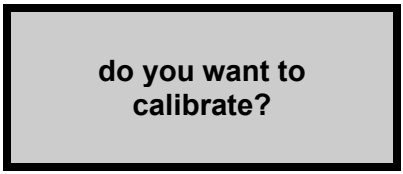
Place the mass on the hearth plate, and then press **(ENTER)**.

The oven verifies the scale accuracy, computes the error percentage, then displays the results as shown:



To print the results, press **(YES)**; to continue without printing, press **(NO)** or **(ESC)**.

If the error percentage is less than ± 0.025%, the oven returns to the **Scale Menu**. If the error percentage is greater than ± 0.025%, the oven displays:



- To continue without calibrating the scale, press **(NO)** or **(ESC)**. The oven returns to the **Scale Menu**.

- To calibrate the scale, press **(YES)**. The oven proceeds as described in the *Calibrate* section that follows.

CALIBRATE

NOTE

To ensure accurate results, the oven must not be subject to vibration during the calibration of the scale. The surfaces on which the unit rests, or the floor surrounding the unit is bumped during scale calibration, immediately re-calibrate the scale.

NOTE

To calibrate the scale, the oven chamber must be at room temperature (less than 35° C), the steel hearth plate must be in place, and the chamber door must be closed. Ensure that the heating elements are not heating. The door latch should be only partially engaged.

NOTE

It is not necessary to tare the scale before calibration.

To calibrate the scale after verifying its accuracy, press **(YES)** at the **do you want to calibrate?** Prompt shown on the previous page.

To calibrate the scale from the **Scale Menu**, press **(4)**.

If the chamber is at the proper temperature (below 35 °C) and the door is open, the oven displays:

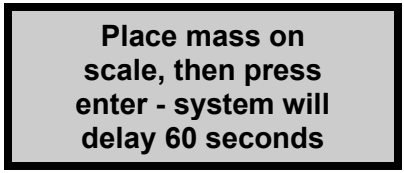
Enter number of Calibration points (3-10) then press ENTER

The oven enables the operator to calibrate the scale using from two to ten calibration points (weights). Troxler recommends using at least three calibration points. Enter the desired number of calibration points, and then press **(ENTER)**. The oven requests the mass of the first calibration point as shown below:

NOTE

Troxler recommends using at least three calibration points (mass).

Ensure that the hearth plate does not touch the chamber sides. For the first mass, enter mass 3000 to 9000 g and then press **(ENTER)**. The oven displays:



Press **(ENTER)**. The oven measures the loaded mass, and then requests the mass of the second calibration point as shown on the previous page. Enter the mass value and press **(ENTER)**.

NOTE

When calibrating the scale Troxler recommends using a 5000-g ANSI/ASTM Class 4 or NIST Class P mass over that span the range over which the oven will be used. The lowest point of this range should be slightly less than the mass of the unloaded sample pan assembly (approx. 3500g).The highest point should be the combined mass of the sample pan assembly and the maximum weight of the prepared samples that will be tested. Verify the sample mass using an external scale that is accurate to ± 0.1 g.

As directed, place the second mass or sample on the hearth plate and press **(ENTER)**.

- If the number of calibration points entered is *2*, the oven measures the mass, calibrates the scale, and then returns to the **Scale Menu**.

- If the number of calibration points is greater than *2*, the oven continues to request each mass until all calibration points are complete. The oven then displays:

where: *CC* = Correlation coefficient, which indicates the strength of the relationship between two variables. In this case, the two variables are the mass placed on the scale and the corresponding response of the scale.

Correlation coefficients are always between *–1* and *+1*. A value close to *0* indicates a weak relationship between the variables. If two variables have a *negative* linear relationship (one variable increases as the other decreases), their correlation coefficient is close to *–1*. If two variables have a *positive* linear relationship (one variable increases as the other increases), their value is close to *+1*. In an ideal scale calibration, the *CC* value would be close to *+1*.

SEE = Standard error of estimate, which is a measure of the linearity of the data used to calibrate the scale. The more linear the scale calibration data, the smaller the value of *SEE*. In an ideal scale calibration, the *SEE* value would be less than *0.3*.

Press (ENTER). The oven then asks, "Do you want to accept this calibration?".

Press(YES) to accept the calibration. The oven stores the scale calibration and returns to the Scale Menu.

After a successful calibration, place a known mass (ANSI/ASTM Class 4 or NIST Class P) on the hearth plate. Verify the scale as described on page 6–15, then remove the known mass.

Chapter 7:
HANDLING DATA

The ICO can store sample data for viewing and printing later. This data is stored in *projects*. This chapter explains how to use the **Project Menu** to create, select, view, erase, print, and download projects and data.

PROJECTS

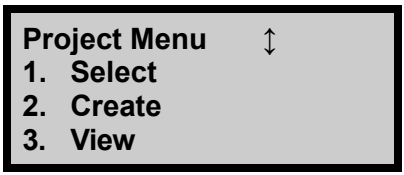
The ICO can store burn data for up to 200 samples. The oven stores sample data in *project files* under *project IDs* defined by the operator. Up to 20 project IDs can be defined.

The operator manages project files from the **Project Menu** described in the remainder of this chapter. This menu allows the operator to create project IDs, to select the active project, and to view, erase, print, or download project data.

When a project is *active*, all measurements are stored in memory under the active project ID. Stored data can be retrieved, printed, and downloaded.

PROJECT MENU

The **Project Menu** allows the operator to select (activate) an existing project; to create and activate a new project; to view stored project data, and to erase, print, or download a project. To access the **Project Menu**, press **(MENU)** then **(3)**. The oven displays:



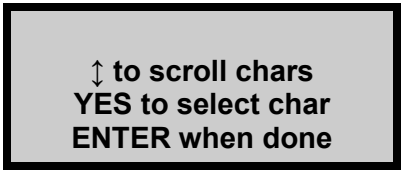
Use the arrow keys to scroll through the menu options. Use the numeric keys to select a menu option.

SELECT

The *Select* function allows the operator to activate an existing project. To select an existing project, press **(1)** at the **Project Menu** shown above. The oven displays:

- To scroll through the stored projects, press **(1)**. The oven displays the first project ID. Use the arrow keys to scroll through the list of projects, and then press **(ENTER)** when the desired project ID is displayed. The oven sets the selected project as active, briefly displays a confirmation message, and returns to the **Project Menu**.

- To activate a *known* project ID, press **(2)** at the **Select** display. The oven displays:



Enter a project ID using up to twelve alphanumeric characters. Use the numeric keys to enter numbers and move the cursor to the next position. To enter alphabetic characters, use the arrow keys to scroll through the characters. When the desired character is displayed, press **(YES)** to move the cursor to the next position. To move the cursor back one position, press the **(BACK SPACE)** key.

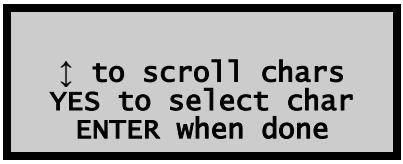
NOTE

After the last character has been entered, press (YES) **to accept the character before pressing** (ENTER) **to accept the project ID.**

When the project ID is complete, press **(ENTER)**. If the project ID entered is not valid, the oven displays **Requested Project not found** and returns to the **Project Menu**. If the project ID entered is valid, the oven sets the project as active, displays a brief confirmation message, and returns to the **Project Menu**.

CREATE

To create and activate a new project, press **(2)** at the **Project Menu** shown on page 7-3. The oven displays:



Enter a project ID using up to twelve alphanumeric characters. Use the numeric keys to enter numbers and move the cursor to

the next position. To enter alphabetic characters, use the arrow keys to scroll through the characters. When the desired character is displayed, press **(YES)** to move the cursor to the next position. To move the cursor back one position, press the **(BACK SPACE)** key.

NOTE

After the last character has been entered, press (YES) **to accept the character before pressing** (ENTER) **to accept the project ID.**

When the project ID is complete, press **(ENTER)**. The oven sets the entered project ID as active, briefly displays a confirmation message, and returns to the **Project Menu**.

VIEW

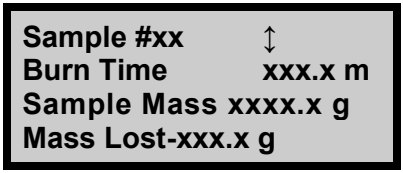
To view the sample data for a selected project, press **(3)** at the **Project Menu** shown on page 7-3. The oven displays:

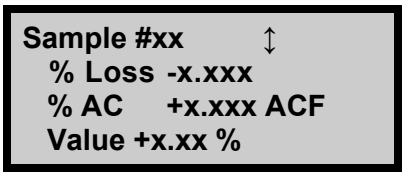
```
View
1.  Scroll Projects
2.  Enter Project ID
```

Press **(1)** to scroll through the stored projects, or **(2)** to enter a *known* project ID. Follow the same procedures as described in the *Select* section on page 7-3 to select or enter the desired project ID.

If the selected project contains no sample data, the oven displays the message **No Samples found in selected project** and returns to the **Project Menu**.

If the selected project contains sample data, the oven displays the data for the first sample. Two screens of data are shown for each sample, as follows:





Use the arrow keys to scroll through the sample data.

NOTE

To print the minute-by-minute burn cycle data for the selected sample, press (ENTER) **while the sample data is displayed.**

When finished, press **(ESC)** to return to the **Project Menu**.

ERASE

The *Erase* function allows the operator to erase a selected project or all projects. To access the *Erase* function, press **(4)** at the **Project Menu**. The oven displays:

To erase all project files, press **(2)** and follow the prompts. To erase a single project file, press **(1)**. The oven displays:

Press (1) to scroll through the stored projects, or (2) to enter a known project ID. Follow the same procedures as described in the Select section on page 7-3 to select or enter the ID of the project to be erased.

The oven displays:

- To erase the displayed project, press **(YES)**. The oven erases the project, displays a brief confirmation message, and returns to the **Project Menu**.

- To return to the **Project Menu** without erasing the project, press **(NO)** or **(ESC)**.

PRINT

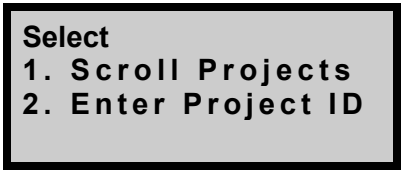
The *Print* function allows the operator to print the data for all samples stored in a selected project.

NOTE

To print only the data stored for a selected sample, see the note on page 7-5.

To print project data, press **(5)** at the **Project Menu**. The oven displays:

- To print a single project, press **(1)**. The oven displays:



Press **(1)** to scroll through the stored projects, or **(2)** to enter a *known* project ID. Follow the same procedures as described in the *Select* section on page 7-3to select or enter the desired project ID.

- To print all projects, press **(2)**. The oven prompts **do you want to output in REDUCED format?** To enable a reduced printout, press **(YES)**, to enable a standard printout, press **(NO)**. A standard printout includes minute-by-minute burn data. A reduced printout includes only a header and footer and a summary of the burn data.

While printing the selected project data, the oven displays **Printing data please wait...** When finished printing, the oven returns to the **Project Menu**.

NOTE

A print operation can be halted using the Abort Print function described on page 5-37.

DOWNLOAD

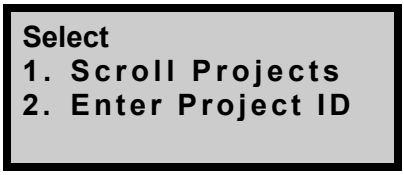
The *Download* function enables the operator to download project data previously stored in the oven to a computer or other serial device. Before enabling this function, connect the serial communications port to the external device and check the baud rate as described on page 5-33.

NOTE

To ensure proper data transfer, the cable connected to the serial communications port should not exceed 3 m (10 ft) in length.

To download project data stored previously, press **(6)** at the **Project Menu**. The oven displays:

- To output a single project, press **(1)**. The oven displays:



  Press **(1)** to scroll through the stored projects, or **(2)** to enter a *known* project ID. Follow the same procedures as described in the *Select* section on page 7-3 to select or enter the desired project ID.

- To output all projects, press (**2**). The oven prompts **do you want to output in REDUCED format?** To enable a reduced output, press (**YES**), to enable a standard output, press (**NO**). A standard output includes minute-by-minute burn data. A reduced output includes only a header and footer and a summary of the burn data.

While downloading the selected project data, the oven displays **Downloading data please wait...** When finished downloading, the oven returns to the **Project Menu**.

Appendix A: MAINTENANCE AND SERVICE

This appendix contains information on maintaining and servicing the ICO.

TROUBLESHOOTING

WARNING

To prevent personal injury or equipment damage, the operator should become familiar with the safety warnings and information in Chapter 2 before operating the ICO.

If you are unable to determine the cause of a problem after reading the hints below, contact a Troxler Service Center (see page A-13).

OVEN DOES NOT TURN ON

- ✓ Ensure that the oven is plugged into an outlet and that the circuit breaker for the outlet is on.
- ✓ Check that the circuit breaker/power switch at the lower left corner of the oven rear panel is in the **ON** (up) position.
- ✓ Check the outlet and power cord.

%AC MEASUREMENTS ARE NOT ACCURATE

- ✓ Verify the scale (see Chapter 6).
- ✓ Correct measurements with a correction factor (see Chapter 6).

ALL OTHER OVEN ERROR MESSAGES

- ✓ Record the error message.
- ✓ Contact a Troxler representative for further information.

THE SCALE SHOWS ERRATIC READINGS

- ✓ Ensure that the baskets do not touch the side of the sample chamber.
- ✓ Contact a Troxler representative for further information.

OVEN DISPLAYS: WARNING! Clean ICO Exhaust System. See Operation Manual for details. Press ENTER

To ensure the continued safe and efficient operation of the oven, the exhaust system should be cleaned regularly. The oven monitors the total burn time that has elapsed since the last cleaning. Upon completion of a burn cycle, if this elapsed time exceeds 1050 minutes, the oven displays the warning shown above. When this warning is displayed:

- ✓ Press ⟨**ENTER**⟩ to complete the current operation.
- ✓ Clean the exhaust plenum box and fan blades as described on page A-5.

OVEN SMOKES EXCESSIVELY OR SHOWS SYMPTOMS OF REDUCED AIRFLOW

- ✓ Check the air ducts for blockages.
- ✓ Clean the exhaust plenum box and fan blades as described on page A-5.

- ✓ Check for ventilation fans in the lab area. Any fan that removes air from the lab could cause the ICO to smoke if the fan is removing a high volume of air from the lab. Check cooling fans, hood fans, etc. Turn off the fan or open an exterior door to help equalize air pressure in the room with outside air pressure. Negative air pressure results in air being pulled into the unit via the exhaust tube.

CLEANING

When the oven is at room temperature and the circuit breaker/power switch is turned off, the outside surface may be cleaned with a damp cloth.

CLEANING THE EXHAUST PLENUM BOX

To ensure the continued safe and efficient operation of the oven, the exhaust system should be cleaned regularly. Towards this end, the oven monitors the total burn time that has elapsed since the last cleaning and warns the operator when the elapsed time exceeds 1050 minutes. Upon completion of a burn cycle, if the total burn time since the last cleaning is 1050 minutes or greater, the oven displays:

WARNING! Clean ICO Exhaust System. See Operation Manual for details. Press ENTER

When this warning is displayed, Troxler strongly recommends cleaning the exhaust plenum box as described on the following page.

To ensure that the exhaust system has been cleaned, when the operator presses **(START)** to begin another burn cycle, the oven displays the following reminder:

**Please confirm that the plenum has been cleaned:
Press YES/NO**

- IF the exhaust plenum box has been cleaned, press **(YES)**. If yes is selected the user accepts that the plenum has been cleaned and the oven restarts the total burn time counter and proceeds with the burn cycle.

Cannot perform burn. Please clean the plenum before the next burn cycle.

- If the exhaust plenum box has not been cleaned, press **(NO).** The oven displays the message above and will exit out of the burn cycle cancelling the burn cycle.
- To ensure optimum performance and safe operations the oven does not allow any new burn cycles until the plenum has been cleaned.
- The oven repeats the message displayed above until the exhaust system has been cleaned and the operator has pressed **(YES)** in response to the reminder.

⚠ WARNING

To prevent personal injury or equipment damage, turn the oven circuit breaker/power switch off, unplug the oven, and allow the oven to cool before removing the access panel.

To clean the exhaust plenum box:

1. Turn the oven circuit breaker/power switch off, unplug the oven, and **allow the oven to cool.**
2. Carefully remove the flexible exhaust duct from the oven's exhaust port.
3. Remove the safety cover on top of the oven to access the plenum box.
4. If the oven has an access door on the front of the safety cover this can be removed to access the plenum box.

CAUTION

Do not loosen the nuts that secure the louvers to the plenum access panel. Moving the louvers will degrade the factory calibration of the exhaust system.

5. Use a wet/dry vacuum cleaner to clean the soot from the plenum box. The vacuum cleaner should be equipped with a filter that has a rating of 0.6 micron or less.

6. Using the small, soft-bristled brush provided with the oven, gently brush all soot from the turbine blades of the exhaust fan.

CAUTION

Use care when cleaning the turbine to prevent bending the blades. If a blade is bent, the turbine will be unbalanced. This will cause excessive vibration and shorten the life of the fan on the unit.

7. Use the vacuum cleaner to clean the loosened soot from the turbine. **DO NOT** insert the vacuum cleaner nozzle into the exhaust fan intake.

CAUTION

To prevent bending the turbine blades, do not insert the vacuum cleaner nozzle into the fan intake. If a blade is bent, the turbine will be unbalanced, which will cause excessive vibration and shorten the life of the fan

8. Using your finger, a screwdriver, or other long tool, gently push on the exhaust fan turbine blade. It should rotate freely without resistance. If it does not rotate freely, contact a Troxler representative.

9. Replace the plenum box and filter in the proper location. Then tighten screws that hold plenum box cover in place.
10. Replace top cover or plenum access panel.

REPLACING PARTS

This section provides information on replacing parts, including the battery, printer paper, print cartridges, and fuses.

REPLACING THE LITHIUM BATTERY

The oven uses one DL2450 3-volt lithium battery (Troxler PN 15706) to maintain the stored data and real time clock. The oven monitors the battery voltage. If the battery voltage is low, the oven displays a "low battery" symbol on the default screen. To avoid oven memory loss, replace the battery at least once a year.

WARNING

Carefully note the polarity of the battery when installing it in the battery holder. A battery may explode or leak if installed improperly.

The battery holder is located on the back of the electronics module. To replace the lithium battery:

1. Turn the oven circuit breaker/power switch off.
2. Remove the four Phillips screws that attach the electronics module to the front of the oven.
3. Carefully remove the electronics module from the oven. The cables attached to the module do not need to be disconnected.
4. Locate the battery access hole and battery cover on the back of the electronics module. Remove the battery cover and remove the old battery.
5. Install a new DL2450 lithium battery and install the battery cover.
6. Install the electronics module.

7. Turn the oven circuit breaker/power switch on and allow the oven to complete its self-test. Upon completion of the self-test, the “low battery” symbol will still be displayed. To reset the “low battery” indication, turn the circuit breaker/power switch off, then on again.

REPLACING THE PRINTER PAPER

To replace the paper roll in the printer:

1. As shown in the following figure, open the bottom printer door by grasping the sides of the door and pull out and down.

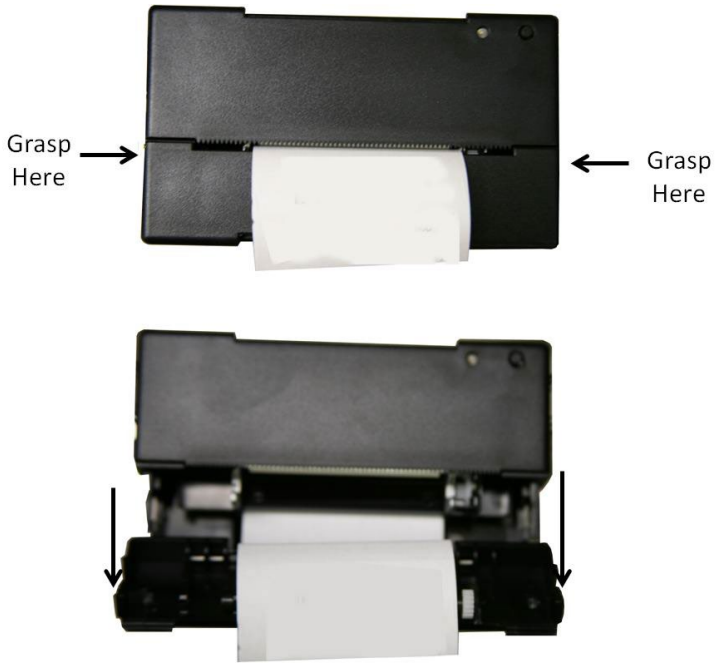


Figure 20: Opening Bottom Printer Door to Access Paper

2. As shown in the following figure, open the top printer door by grasping the sides of the door and pull out and up.

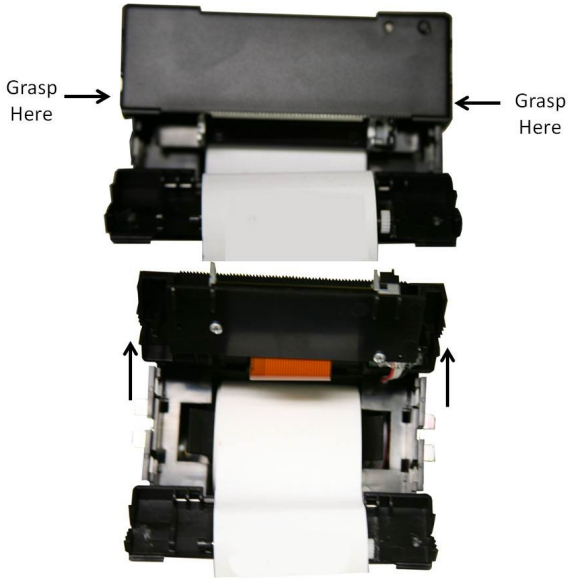


Figure 21: Opening Upper Printer Door to Access Paper

3. Push the two tabs out to disengage the paper spindle as shown in the following figure.

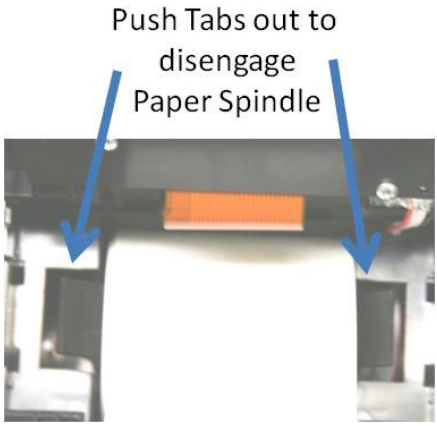


Figure 22: Disengage Paper Spindle

4. Insert new paper roll into the printer. Make sure that the paper feeds from the top of the roll and the paper extends past the bottom door opening as shown in the following figure.

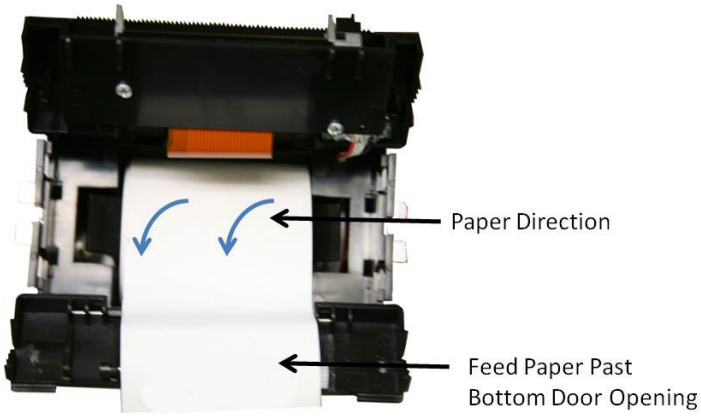


Figure 23: Insert New Paper Roll

5. Press the paper feed button to ensure that the paper feeds freely.

REPLACING FUSES

Repair or replacement of fuses should be performed only by qualified service personnel (Troxler Service Representatives).

RETURNING PARTS FOR SERVICE

Items returned for service must be accompanied by an RGA (Returned Goods Authorization) number, and a description of the item and its problem. This information is used by Troxler shipping and service personnel to expedite the repair work.

To obtain an RGA number, please call or fax Troxler headquarters at Research Triangle Park, or one of the branch offices with your request.

When shipping the oven, use the factory-supplied shipping container and packing material, including the plastic sheet used to cushion the inside of the chamber door. The box folds for easy storage.

Please have the following information available when requesting an RGA number:

- Unit (or part) model and serial number.
- Part number/serial number (if applicable).
- Is the unit (part) still under warranty?
- Problem or difficulty you are having with the unit.
- Shipment method to Troxler and for return shipment.
- Shipping and billing address (not post office box) – street address and zip code.
- Telephone number/contact (for questions from Troxler).
- Will an estimate be required before performing any work on the part?
- Payment method: credit card, account number, or purchase order number. All government agencies (city, county, state, and federal) must send purchase order numbers.

NOTE

To prevent order duplication, if an order has been placed by telephone, please write "Confirming Order" on any follow-up written requests.

Appendix B: MENU MAP

This appendix provides a map of the menus in the ICO control software.

MENU MAP DESCRIPTION

Figure B-1 is a map of the **MAIN MENU** of the oven control software and each of its submenus. To access the **MAIN MENU**, press **(MENU)**. Where applicable, the default (as shipped) menu settings are highlighted in yellow.

The menu map uses indentation to indicate submenus that result from selection of a menu item. For example, the first five lines of Figure B-1 are:

MAIN MENU

1. Burn Setup

Burn Setup Menu

1. Burn Parameters

Burn Parameter Menu

This indicates that the first menu item under the **MAIN MENU** is

1. Burn Setup. Press **(1)** to access the **Burn Setup Menu**, a submenu of the **MAIN MENU**.

Similarly, the first menu item under the **Burn Setup Menu** is **1. Burn Parameters**. Press **(1)** to access the **Burn Parameter Menu**, a submenu of the **Burn Setup Menu**.

NOTE

The menu map contains only the displays that allow or require a keypad selection by the operator. Other displays (such as status information, confirmation messages, or error displays) are not included.

NOTE

Default (as shipped) settings are highlighted in yellow.

MAIN MENU

1. Burn Setup
   Burn Setup Menu

   1. Burn Parameters
      Burn Parameter Menu

      1. Burn Mode
         Choose Burn Mode

         1. Program Time

         2. Auto Control

         3. Burn Time

      2. Set Chamber Temp

      3. Cutoff Limit
         Cutoff Units

         1. Grams

         2. Percentage

      4. Calculation Type
         Calculation Type

         1. Bitumen to Sample

         2. Bitumen to Agg

   2. Auto-Print
      Auto-Print

      1. On

      2. Off

   3. Auto Store
      Auto-Store

      1. On

2. Off

2. Auto-Timer
   Skip Any Days?

   1. Sat

   2. Sun

   3. Both

   4. None

      Auto-Timer Enabled

      1. Suspend

      2. Disable

      Auto-Timer Suspended

      1. Re-enable

      2. Disable

3. Project
   Project Menu

   1. Select
      Select

      1. Scroll Projects

      2. Enter Project ID

   2. Create

   3. View
      View

      1. Scroll Projects

      2. Enter Project ID

   4. Erase
      Erase

1. One Project
   Select

   1. Scroll Projects

   2. Enter Project ID

2. All Projects

5. Print
   Output

   1. One Project
      Select

      1. Scroll Projects

      2. Enter Project ID

   2. All Projects

6. Download

   1. One Project
      Select

      1. Scroll Projects

      2. Enter Project ID

   2. All Projects

4. Corr. Factors
   Correction Menu

   1. Select ACF
      Select

      1. Scroll ACFs

      2. Enter ACF ID

   2. Create ACF

3. Erase ACF
   Erase

      1. One ACF
         Select

            1. Scroll ACFs

            2. Enter ACF ID

      2. All ACFs

5. Scale
   Scale Menu

   1. Tare

   2. Auto-Tare
      Auto-Tare

      1. On

      2. Off

   3. Verify

   4. Calibrate

6. Status
   Status Menu

   1. View

   2. Print

   3. Download

   4. Auto-Status Print Auto-Status Print

      1. On

      2. Off

7. Store

8. Miscellaneous|
   Miscellaneous Menu

   1. Time/Date
      Time/Date Menu

      1. Set Time

      2. Set Date

      3. Time Format
         Time Format

         1. AM/PM

         2. 24-Hour

      4. Date Format
         Date Format

         1. mm/dd/yyyy

         2. dd/mm/yyyy

   2. Baud Rate
      Set Baud Rate on

      1. Ser. Comm. Port
         Baud Rate

         1. 600

         2. 1200

         3. 2400

         4. 4800

         5. 9600

      2. Auxiliary Port

         1. 600

         2. 1200

3. 2400

4. 4800

5. 9600

3. Temperature Scale
   Temperature Scale

   1. Celsius

   2. Fahrenheit

4. Customer Name

5. System Output
   System Info Output

   1. Always On

   2. During Burn Only

   3. Off

6. Abort Print

7. Unlock Door

Appendix C: SPECIFICATIONS

This appendix contains specifications for the ICO.

ENVIRONMENTAL CONDITIONS

Use	Indoor
Ambient Storage	–55 to 85 °C
Temperature	(–67 to 185 °F)
Ambient Operating	10 to 40 °C
Temperature	(50 to 104 °F)
Altitude Rating	2000 m maximum
Main Supply Voltage	± 10%
Fluctuation	
Pollution Degree	2
Installation Category	II
(Overvoltage Category)	
Humidity	92% maximum

PERFORMANCE SPECIFICATIONS

Maximum sample size	2500 g per sample basket 5000 g total
Integrated scale resolution	0.1 g
Burn time for 1200 g	20 minutes (at 240 VAC)
Internal memory capacity:	
Sample data	200 samples
Aggregate correction factors	20
Project IDs	20
Temperature sensors	Type K thermocouples (see note below)

NOTE

The ignition method employed by the ICO does not require precise control of the chamber or other temperatures. If desired, oven performance can be verified using a precision asphalt mix.

The oven thermocouples are calibrated at the factory and do not require re-calibration by the operator. If verification of the thermocouples is desired, Troxler recommends checking their accuracy at room (ambient) temperature.

ELECTRICAL SPECIFICATIONS

Power sources	208 to 240 VAC 50 to 60 Hz
Peak power consumption	5408 /7200 W
Current	26/30 Amps
Length of power cord	1.8 m (6 ft)
Liquid crystal display	4 lines x 20 character
Keypad	25-key sealed membrane
RS-232C configuration	Data Terminal Equipment (DTE)
Serial data format	8 data bits, 2 stop bits, no parity
Baud rate range	600 to 9,600 baud
Maximum length of serial cable	3 m (10 ft)

Oven to PC-Compatible Computer Cable:

9-pin FEMALE	**9-pin FEMALE**
Rx (pin 2)	Tx (pin 3)
Tx (pin 3)	Rx (pin 2)
DTR (pin 4)	DSR (pin 6)
DSR (pin 6)	DTR (pin 4)
RTS (pin 7)	CTS (pin 8)
CTS (pin 8)	RTS (pin 7)
GND (pin 5)	GND (pin 5)

MECHANICAL SPECIFICATIONS

Outside dimensions (L x W x H)	24 x 31.5 x 35 in (60 x 80x 89 cm)
Chamber dimensions (L x W x H)	13 x 19.7 x 12 in (33 x 50 x 30.5 cm)
Weight	160 lbs. (72.7 kg)
Sample basket dimensions (L x W x H)	8 x 14.5 x 2.5 in (20.3 x 36.8 x 6.3 cm)
Basket assembly (L x W x H)	9.4 x 15.5 x 6.5 in (23.8 x 39.4 x 16.5 cm)

DECLARATION OF CONFORMITY

The 4740 ICO has been evaluated and is in compliance with the applicable Directives.

Safety requirements and Low Voltage Directive 2014/035 EU

IEC 61010-1:2010, IEC 61010-1:2010/AMD1:2016,
IEC 61010-2-010:2019

EMC Directive

Emissions: EN 61326-1:2020,
CISPR 11:2015/AMD1:2016/AMD2:2019,
CISPR 11:2015/AMD1:2016/AMD2:2019
Immunity: EN 61000-4-2:2009, IEC 61000-4-2:2008,
EN 61000-4-3:2006: +A1:2008 + A2:2010, IEC 61000-4-3:2006 + A1:2007 + A2:2010,
EN/IEC 61000-4-4:2012, EN/IEC 61000-4-5:2014,
EN 61000-4-6:2014, IEC 61000-4-6:2013,
EN 61000-4-8:2010, IEC 61000-4-8:2009,
EN/IEC 61000-4-11:2004

The product above was found to be Compliant to the above standards and Technical Reports have been issued in accordance by the laboratory scope of accreditation by Competent Body, namely:

TUV Rheinland of North America
295 Foster St. Suite 100
Littleton, MA 01460 - U.S.A.

Manufacturer: Troxler Electronic Laboratories, Inc.
P.O. Box 12057,3008 Cornwallis Road
Research Triangle Park, North Carolina
27709- U.S.A

Apparatus: Model 4740 ICO
NCAT Oven

Year of Declaration: 2023

INDEX

TROXLER ELECTRONIC LABORATORIES, INC.

LIMITED WARRANTY
(No warranty for Beta Units)

TROXLER ELECTRONIC LABORATORIES, INC., hereinafter referred to as "TROXLER," warrants this ICO Asphalt Content Ignition Oven, Serial Number _____, against defects in material and workmanship for a period of twelve (12) months from date of shipment for parts, and ninety (90) days for labor with specific exclusions as indicated below. For instruments sold through authorized TROXLER representatives, the date of shipment will be as of the transfer from representative to purchaser. During the applicable warranty period, TROXLER's obligation under this warranty shall be limited exclusively to the repair at a TROXLER facility at no charge, except for shipping to and from TROXLER's plant, of any instrument which may prove defective under normal use and which TROXLER's examination shall disclose to its satisfaction to be thus defective. Normal use is defined for the purpose of this warranty as operation under normal load, usage, and conditions with proper care and maintenance and competent supervision. In no event shall TROXLER be held liable for damages, delays, or losses consequential, incidental, or otherwise attributable to the failure of this instrument. TROXLER's liability being specifically limited to repair as stated hereinabove. This warranty is automatically initiated except where modified by contractual or other written and signed agreement.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, AND THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND TROXLER NEITHER ASSUMES, NOR AUTHORIZES ANYONE TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THE INSTRUMENT. THIS WARRANTY SHALL NOT APPLY TO THE INSTRUMENT OR ANY PART THAT HAS BEEN SUBJECTED TO DAMAGE BY ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, MISUSE, OR SERVICE NOT AUTHORIZED IN WRITING BY TROXLER. SUCH DAMAGE TO INCLUDE BUT NOT BE LIMITED TO BURNING OF CIRCUIT BOARDS FROM IMPROPER SOLDERING TECHNIQUES AND DAMAGE TO THE INSTRUMENT DUE TO PURCHASER'S FAILURE TO PERFORM MAINTENANCE AS OUTLINED IN THE AUTHORIZED OPERATOR'S MANUAL. THIS WARRANTY SPECIFICALLY EXCLUDES 1) OVENS DAMAGED BY OVERFIRING (EXCEEDING THE MELTING TEMPERATURE OF THE MATERIALS BEING FIRED) REGARDLESS OF THE CAUSE OF OVERFIRING; 2) ANYTHING INSIDE THE OVEN DAMAGED BY OVERFIRE; 3) OVENS ALLOWED TO EXCEED THE MAXIMUM TEMPERATURE SHOWN ON THE OPERATOR MANUAL; 4) OVENS SUBJECT TO ABUSE, NEGLECT, FREIGHT DAMAGE, OR IMPROPER STORAGE; 5) OVENS USED FOR EITHER REDUCTION OR SALT FIRING; AND 6) OVENS DAMAGED BY IMPROPER ELECTRICAL INSTALLATION. DUE TO THE NATURE OF THEIR USE, MECHANICAL ACCESSORY PARTS AND BATTERIES ARE WARRANTED FOR NINETY (90) DAYS FROM SHIPMENT DATE.

TROXLER ELECTRONIC LABORATORIES, INC.
Troxler International, Ltd.
Troxler Electronics (Canada), Ltd.
3008 Cornwallis Road
Post Office Box 12057

Research Triangle Park, NC 27709 USA

NOTICE TO CONSUMERS

Any disclaimer or limitation on the remedies expressed above shall not be effective to the extent prohibited by state or federal law.

NOTE: THIS WARRANTY EXCLUDES DAMAGE INCURRED IN SHIPMENT. IF THIS INSTRUMENT IS RECEIVED IN DAMAGED CONDITION, THE CARRIER SHOULD

BE CONTACTED IMMEDIATELY. ALL CLAIMS FOR DAMAGE IN TRANSIT