

RTFO

Rolling Thin Film Oven



This manual contains important operating and safety information. Carefully read and understand the contents of this manual prior to the operation of this equipment.

www.atspa.com

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Information in this document is subject to change without notice and does not represent a commitment on the part of

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For assistance with set-up or operation, contact the ATS service department. Please have this manual and product serial number available when you call.

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A. Introduction

A.1 Unpacking

Retain all cartons and packing materials until the unit is operated and found to be in good condition. If damage has occurred during shipping, notify Applied Test Systems (ATS) and the carrier immediately. If it is necessary to file a damage claim, retain the packing materials for inspection by the carrier.



WARNING: Always lift from under the oven with forks or proper lifting equipment. Do not lift from the electrical enclosure.

A.2 Warranty Information

All new ATS systems are shipped with a warranty. Units have a warranty against defective parts and workmanship for one full year from the date of shipment. Please see APPENDIX A of this manual for complete details on the warranty.

A.3 After Sale Support

If there are any questions concerning the operation of the unit or software, contact the ATS Service Department at +1-724-283-1212.

Before calling, please obtain the software revision number and the serial number from the unit's data tag. A sample data tag is illustrated below, and can be completed with the unit's information for easy reference. Please be prepared to give a complete description of the problem to the ATS Service Department at +1-724-283-1212.


 APPLIED TEST SYSTEMS www.atspa.com MADE IN USA	NO. <input type="text"/>	
	<input type="text"/> AMP	<input type="text"/> VAC
	<input type="text"/> PH	<input type="text"/> HZ
	<input type="text"/>	
DWG <input type="text"/>	<input type="text"/>	
<input type="text"/>		
<input type="text"/>		
<input type="text"/>		
<input type="text"/>		

Figure A.1: ATS Sample Data Tag

B. Safety

B.1 For Owners, Operators, and Maintenance

Read and understand all instructions and safety precautions listed in this manual before installing or operating the unit. If there are any questions regarding operation of the unit or the instructions in this manual, contact the ATS service department at +1-724-283-1212.

In addition to the safety warnings listed on the equipment, warnings are posted throughout this manual. Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, personal injury, or death.

All Applied Test Systems (ATS) equipment is designed to be operated with the highest level of safety. To maintain the safe operation of this tester, ATS endeavors to educate the operator about safety issues surrounding certain parts of the machinery. These safety issues are addressed through the use of labeling on the equipment. The following labels may appear on your test unit:



Burn Hazard/Hot Surface



Electrical Shock/Electrocution



Protective Earth (Ground)



General Danger. When this symbol is displayed, user must always consult the manual to determine the potential hazard(s) and any actions required to avoid them.



No Access for Unauthorized Persons



Read Operator's Manual



Hand Entanglement



Ignition/Explosion

Additionally, the responsible body shall ensure that:

- i. appropriate decontamination is carried out if hazardous material is spilled onto or into the equipment.

- ii. no decontamination or cleaning agents are used which could cause a hazard as the result of a reaction with parts of the equipment or with material contained in it.
- iii. the manufacturer or his agent is consulted if there is any doubt about the compatibility of decontamination or cleaning agents with parts of the equipment or with the material contained in it.

B.2 Warnings

The following statements are warning statements. Unlike caution statements, warning statements alert the operator to conditions that may injure personnel. Operators must be aware of these conditions in order to prevent injuries that may occur while operating this equipment.



WARNING: Disconnect power prior to performing maintenance. Place Main Power Switch in "OFF" position and disconnect the line cord from the power source before performing any maintenance procedures.



WARNING: Obey electrical code requirements. The oven and control system must be wired and grounded in accordance with national and electrical code requirements.



WARNING: Be careful when working with equipment at elevated temperatures. In order to prevent burns, wear protective clothing.



WARNING: Use caution when opening the oven. Electrically heated equipment can cause severe burns.



WARNING: The air circulation fan is controlled by a door switch to protect operators from the fan. If the fan continues to operate after the door is opened, discontinue use immediately and contact the ATS Service Department at +1-724-283-1212.



WARNING: Unpack and operate on a stable surface.



WARNING: Pinch hazard.



WARNING: Do not open the side panel unless explicitly instructed to do so for troubleshooting purposes.



WARNING: Do not use flammable solvents to clean the oven or use with products other than designed for.



WARNING: Using solvents or products not specified by the equipment manufacturer may create potential for formation of flammable or volatile gas mixtures. Always refer to product SDS or contact the manufacturer.



WARNING: Do not place objects that may obstruct the sample rack or blower.



WARNING: Before removing the air coil assembly always make sure the unit is powered off and unplugged.



WARNING: Unit should always be operated in a well ventilated area. Refer to and adhere to SDS sheets of product being tested.



WARNING: Proper Personal Protective Equipment (PPE) required for removal of hot glassware.

B.3 Cautions

The following statements are caution statements. These statements alert the operator to conditions that may damage equipment. Operators must be aware of these conditions in order to ensure safe operation of the equipment.



CAUTION: Installation of electrical devices must be accomplished by competent personnel and done in accordance with any current local and national codes.



CAUTION: The RTFO must be grounded and wired in accordance with national and local electrical code requirements.



CAUTION: Before energizing the electrical power to the RTFO, place all controls in an OFF position.



CAUTION: Do not exceed the maximum operating temperature.



CAUTION: All supporting and contacting surfaces must be non-flammable. Do not allow flammable materials to contact the shell.



CAUTION: If an emergency shutdown needs to be performed, place ON/OFF switch in an OFF position.



CAUTION: Do not overflow RTFO bottles. Refer to test specifications for proper amount of material.

C. System Overview

C.1 General Description

The RTFO provides a controlled flow of heated air directed into the openings of horizontal glass bottles as they rotate on a carousel rack, simulating short term aging of binder during production, handling, and paving operations. It exceeds ASTM D2872, AASHTO T 240, and California 346 testing standards with a 5 to 8 minute recovery time.

When operating the RTFO, always make sure to wear the proper personal protective equipment (PPE), including high temperature work gloves.

This equipment is intended to be used only as described in this manual and the applicable standards. Use in any other manner may result in personal injury, property damage, damage to the equipment, and void of warranty.

Product Specifications

Size	34.50" W x 24" D x 32.00" H
Power Requirements	208V-240V, 1 ph, 50/60 HZ, 10A
Power Rating	2400 VA (+/- 10%: 2640 VA - 2160 VA)
Air Pressure	60-150 PSI inlet pressure
Weight	270 lbs.
Temperature Range	0°C to 200°C ± 0.5°C
Specimen Capacity	8 high temperature glass bottles

C.2 RTFO Layout

Front of Unit

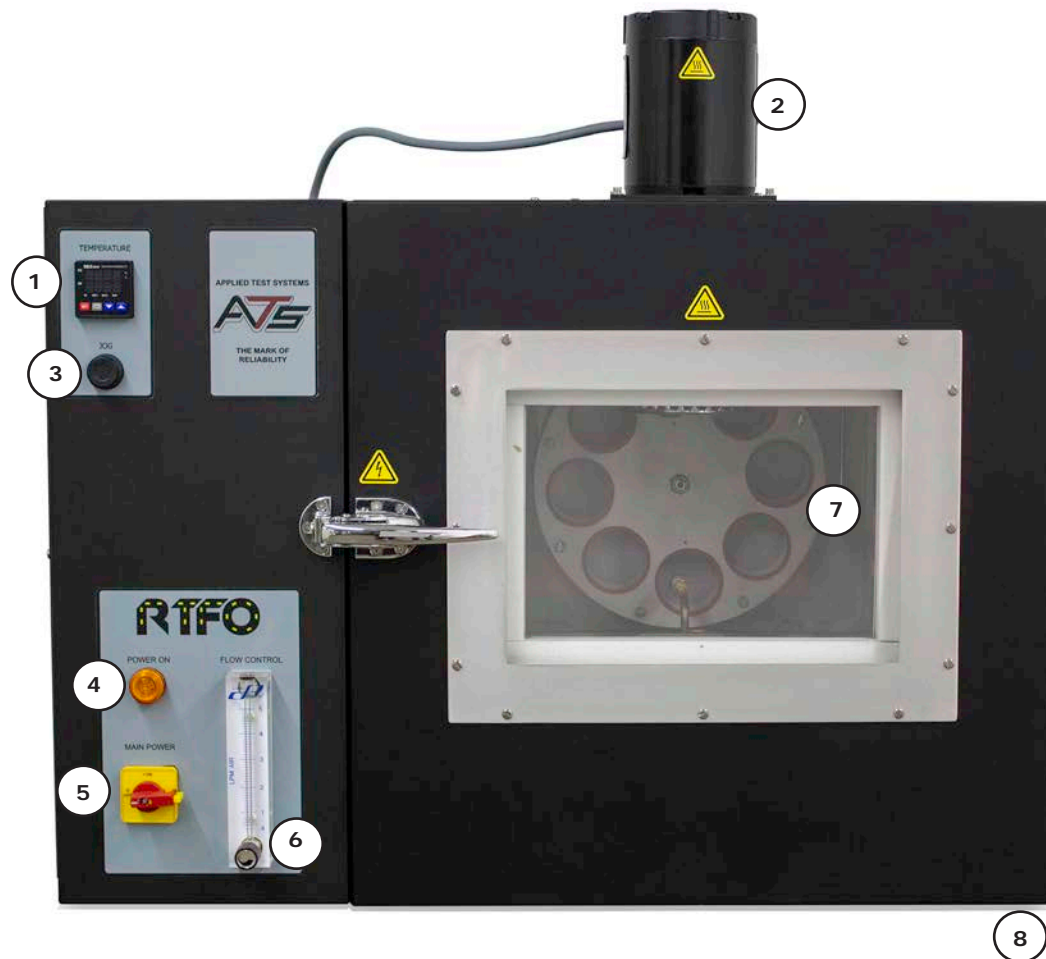


Figure C.1: RTFO Front

- | | |
|---------------------------|--|
| 1. Temperature Controller | 6. Flow Meter |
| 2. Fan Motor | 7. Carousel with High Temp. Silicone Rings |
| 3. Carousel Jog Button | 8. Leveling Legs |
| 4. Power Indicator | |
| 5. Power Switch | |

Back of Unit



Figure C.2: RTFO Back

1. Cooling Fan

3. Power Inlet Module

2. Air Inlet/Input Filter

Interior Chamber

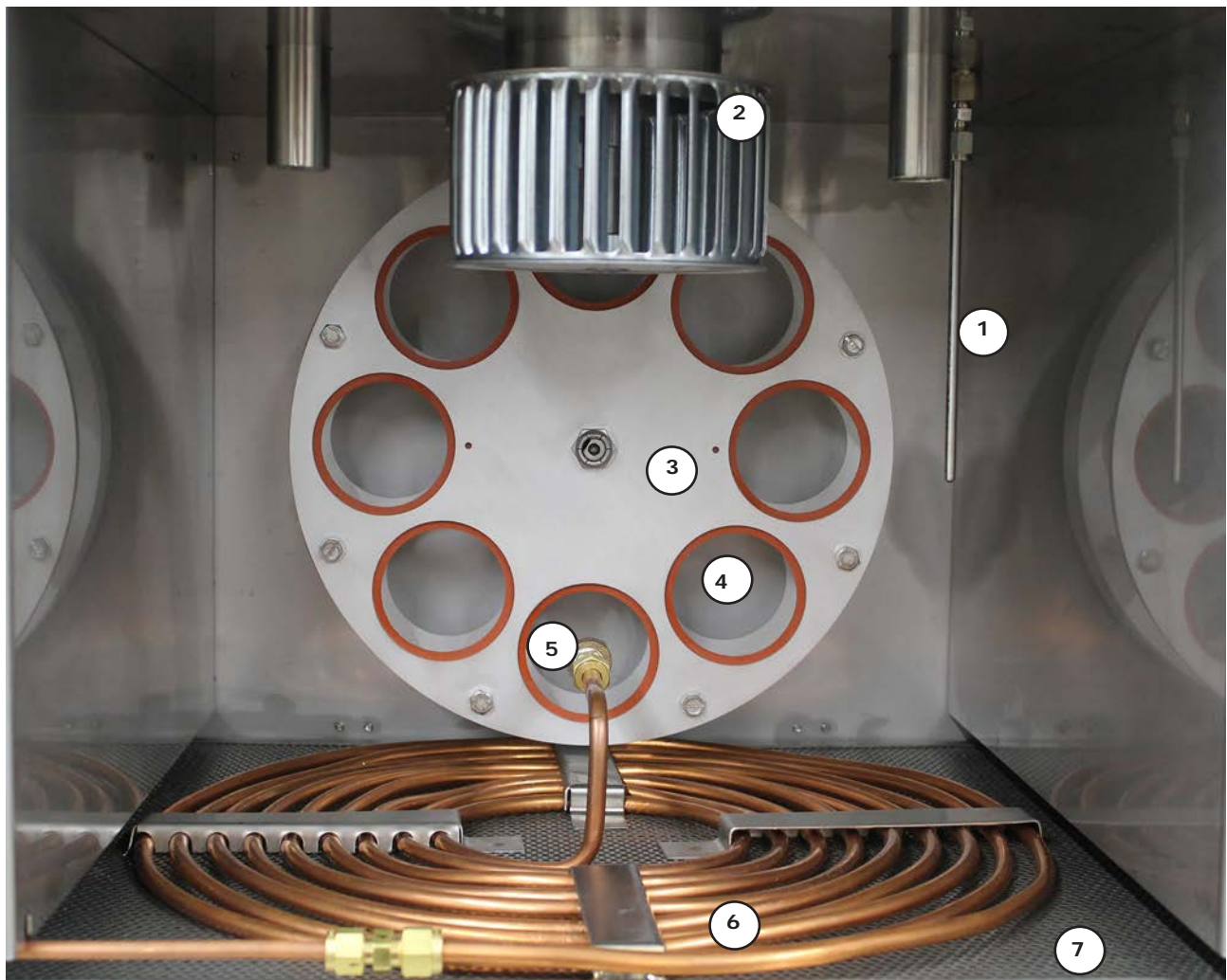


Figure C.3: RTFO Chamber

- | | |
|-----------------|---------------------------------|
| 1. Internal RTD | 5. Air Oriface |
| 2. Fan | 6. Airline Plumbing |
| 3. Carousel | 7. Tray |
| 4. Jar Holder | 8. Heaters (located under tray) |

Panel Layout and Components

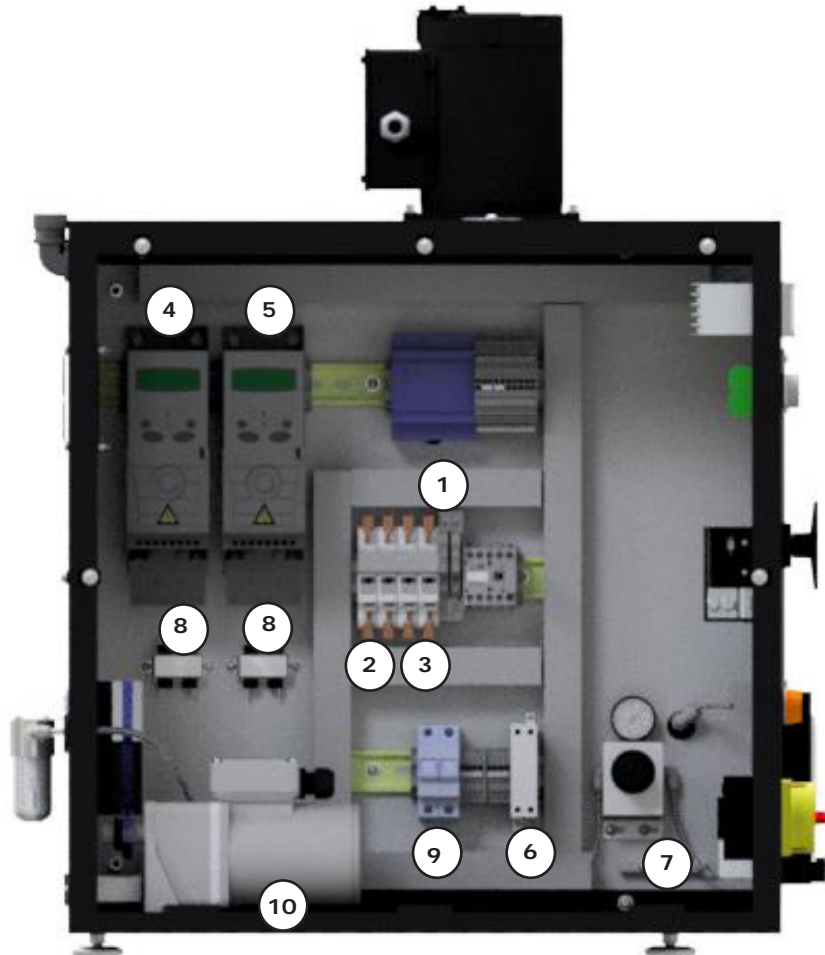


Figure C.4: Panel Layout & Components

- | | |
|----------------------|---|
| 1. Fuses 1-2* | 6. Heat Control |
| 2. Fuse 3** | 7. Air Regulator - setting should be at 22-25 PSI |
| 3. Fuse 4** | 8. Line Filter |
| 4. Blower Drive | 9. Circuit Breaker |
| 5. Sample Rack Drive | 10. Sample Rack Motor |

*Fuses 1 & 2 for 24VDC Supply

**Fuse 3 for Blower

***Fuse 4 for Sample Rack

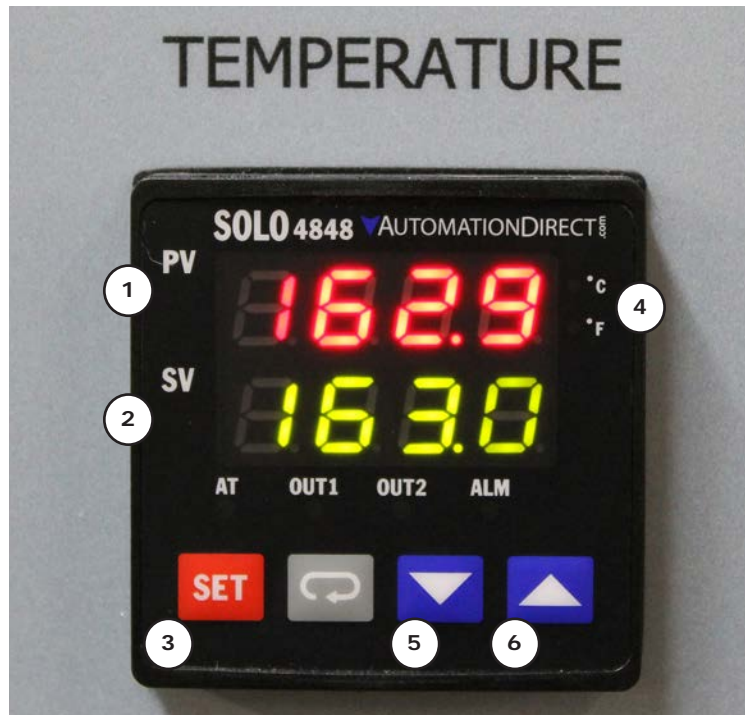


Figure C.5: Temperature Controller

- | | |
|---------------|----------------|
| 1. PV Display | 4. °F, °C LEDS |
| 2. SV Display | 5. Down Button |
| 3. Set Button | 6. Up Button |

Temperature Controller

PROCESS VALUE (PV) DISPLAY: The Process Value Display indicates the value from the input source. This is the actual oven temperature, shown in red, from the thermocouple.

SET VALUE (SV) DISPLAY: The Set Value Display indicates the desired set point in green.

SET BUTTON: Press the SET button to select the desired function mode and confirm the setting value.

ROTATE BUTTON: Press the ROTATE button to select parameters within the function mode.

DOWN BUTTON: Press the DOWN button to decrease values displayed on the SV display. Hold down this button to speed up the decrement.

UP BUTTON: Press the UP button to increase the values displayed on the SV display. Hold down this button to speed up the increment.

D. Installation

D.1 General Installation

The following procedure describes how to properly unpack, connect, and power the RTFO.

1. Carefully remove the RTFO from shipping packaging, removing any packing material and/or accessories that may have been placed inside of the oven chamber for shipment.



WARNING: Obey electrical code requirements. To avoid electric shock, the oven and control system must be wired and grounded in accordance with national and electrical code requirements. Use a properly grounded electrical supply of correct voltage and current handling capacity.

2. The oven has been completely tested and checked at ATS before shipment. A power cord 10 feet long is supplied with the oven. The end user is required to supply a plug and receptacle rated for 10 Amp, 240 Volt, single phase, electrical service. The customer supplied plug shall be installed by a qualified electrician in accordance with the Electrical Wiring Diagram (Appendix B) and all applicable Electric and Safety Codes.



Figure D.1 - Power switch in the OFF position



Figure D.2 - Power switch in the ON position

3. Rotate the power switch on the front from the horizontal OFF position to the vertical ON position (Fig. D.1 and Fig. D.2) to turn the unit on. The power light above the switch should now be illuminated.

4. This unit requires an air supply of at least 60-150 PSI.

5. Set up the air by installing your male air fitting into the female receiver (1/4" NPT) (Fig. D.3). Seal threads with Teflon tape.

D.2 Adjusting the Air Flow

The RTFO's airflow should always be set at the specification provided on the calibration label attached to the side of the airflow meter (Fig. D.4). If this



Figure D.3: Air Receiver

setting is not correct, adjust the airflow to match the value on the label. Adjustments are accomplished by rotating the knob located on the bottom of the gage (Fig. D.5).



Figure D.4 - Calibrated label location on airflow meter

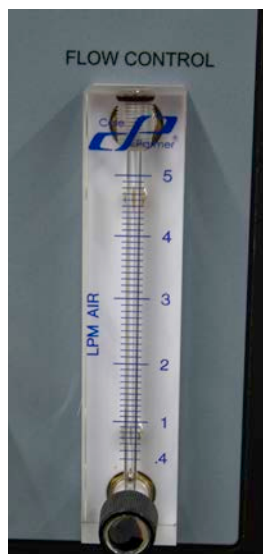


Figure D.5 - Airflow meter

D.3 Setting the Temperature

1. To change the RTFO temperature set point, press and hold the UP and DOWN arrow buttons at the same time until the GREEN SV temperature display begins to blink.
2. Hold the UP arrow button to increase temperature or the DOWN arrow button to decrease temperature until the desired set point is reached.
3. When the desired temperature set point is reached, press the red SET button (Fig. D.6).



Figure D.6 - Temperature Controller

D.4 Leveling the Machine

1. Using a digital level check the level on the top of the RTFO and the bottom portion of the RTFO for a reference point.
2. Insert the leveling jar into the carriage to check the level at different points of rotation. The level should be +/- 1.0 degrees from the reference point.
3. Use the adjustable legs on the bottom of the RTFO to attain proper level.

E. Verification

E.1 Temperature Verification

1. Insert a temperature probe into the top left port-hole.
2. Connect probe with a brass block to the RTD inside (right side).
3. Allow oven to preheat.
4. Allow unit to heat up and stabilize.
5. Once stabilized at the temperature that needs verifying, take five readings 10 minutes apart and compare results.

E.2 Verification of Air Flow

1. Attach a flow verification device to the copper tubing inside the RTFO (Sec. C.2, Fig. C.3) (if using a flow through device the orifice can be removed from the tubing and attached to the downstream end).
2. Allow 15 minutes to stabilize.
3. Take 5 comparison readings every 3-5 minutes. 3 readings minimum, 5 recommended.

F. Operation

F.1 Basic Operation



WARNING: The RTFO door and glass will be very hot during operation. Use personal protective gear when operating the RTFO and handling materials associated with the testing procedure.

1. Turn the power switch on the front of the Rolling Thin Film Oven (RTFO) to the ON position. The POWER light located on the front of your RTFO will light up and the temperature controller display will power on.
2. Use the temperature controller to set the RTFO temperature to the desired specification. See (Sec. D.3) for details.
3. Verify that the air flow setting matches the value on the side of the meter. Adjust if necessary. See (Sec. D.2) for details.
4. Once the chamber reaches the set point and has stabilized per the specification, load the sample jars. Rotate the carousel using the JOG button. It is normal for the unit temperature to drop when the door is open. The RTFO will recover back to set point within eight minutes once the unit door is closed.
5. Once the aging process is complete, open the door and remove the samples per the specification.

G. Troubleshooting

G.1 Preface

Listed within this section are the most common troubleshooting errors that operators may encounter when using the RTFO. Users may follow the steps provided to work through these basic errors.



WARNING: Any additional issues or system errors should be brought to the attention of the ATS Service Department immediately. Please do not attempt to independently fix any other system errors. Any additional errors fixed independent of technical support at Company could result in damage to the equipment, or injury on the part of the operator.



WARNING: Place Main Power Switch in “OFF” position and disconnect power before removing side cover to access electrical panel. ONLY open the side panel when explicitly instructed to. Do not touch or alter anything within the side panel unless instructed to. Failure to adhere to this warning could result in severe electrical shock, injury, or death.

G.2 Unit Will Not Turn On

1. Verify the system is plugged in to the correct power source and that the cord is secured to the power input on the machine.
2. Verify the power switch on the front of the unit is in the ON position and the amber light is on (Sec. D.1, Fig. D.2).
3. Verify that the system’s circuit breaker is not tripped. Remove the side door panel and refer to (Sec. C.2, Fig. C.4) for the circuit breaker location. If the breaker is in the OFF position instead of the ON position (Fig. G.1), switch it back to the ON position (Fig. G.2).



Figure G.1: Circuit breaker in the OFF position



Figure G.2: Circuit breaker in the ON position

4. Verify the outlet is rated for the correct amperage (10 Amps).
5. If the unit still does not power on after checking each of these areas, please contact the ATS Service Department.

G.3 Carousel Will Not Rotate

When the unit is powered on and the RTFO door is closed, the fan should rotate continuously. The carousel will only start rotating once the unit is in the run cycle mode (when a test is running).



CAUTION: Carousel rotates in the Clockwise direction.

1. If the carousel does not rotate during run cycle mode and the door is closed, first open the door, then press the “Jog” button with the door open.



WARNING: Place Main Power Switch in ‘OFF’ position and disconnect power before removing side cover to access electrical panel and fuses.

2. If the carousel still does not rotate you will need to check the carousel fuses (fuse #3 and #4). Remove the side panel and refer to (Sec. C.2, Fig. C.4) for location.
3. Remove and inspect the fuses. If a fuse is defective, replace the fuse with a new fuse of the correct type and rating, then replace the fuses and press the “Jog” button with the RTFO door open to verify that the carousel rotates.
4. If the carousel still does not rotate, check the RTFO door proximity switch. The switch is located inside the door jam area behind the handle latch (Fig. G.3).



Figure G.3: RTFO door proximity switch



Figure G.4: Side panel removed, exposing the door proximity switch. Adjustment nut indicated in red.

5. With the door open, place a piece of metal on the proximity switch. This will mimic the properties of the closed RTFO door. The carousel should begin to rotate.
6. If the carousel begins to rotate when the metal is placed against the door proximity switch, you may need to adjust the proximity switch. Remove the side panel of the unit and loosen the nut on the back side of the door proximity switch bracket (Sec. G.3, Fig. G.4).
7. Unplug the cable from the door proximity switch to allow it to move, and adjust the switch by moving it in or out as needed. Once the door proximity switch is properly adjusted, re-tighten the nut and plug the cable back in.
8. If the carousel still will not rotate, contact the ATS Service Department at +1-724-283-1212.

G.4 Fan Motor Will Not Rotate

When the unit is powered on and the RTFO door is closed, the fan should rotate continuously in a counter clockwise direction as viewed from above.



WARNING: Place Main Power Switch in 'OFF' position and disconnect power before removing side cover to access electrical panel and fuses.



WARNING: The fan should not rotate when the door is open. If the fan continues to operate when the door is open, contact the ATS service department.

1. If the fan does not rotate you will need to check the fan fuses (fuse #1 and #2). Remove the side panel and refer to (Sec. C.2, Fig. C.4) for location.
2. Remove and inspect the fuses, if a fuse is defective, replace it with a new fuse of the correct type and rating then check for fan operation. If you replace the fuses and the fan still does not turn, contact the ATS service department at +1-724-283-1212.

G.5 Unit Has No Airflow

1. Verify that the supply air connection is secure in the rear of the machine, and that the air flow is set to the specified setting on the Settings Screen.



WARNING: Place Main Power Switch in 'OFF' position and disconnect power before removing side cover to access electrical panel and fuses.

2. If the air flow is set at the appropriate setting but the unit still has no air flow, you will need to remove the side panel and check the air regulator. Refer to (Sec. C.2) for location.
3. Verify that the air regulator is set at 22-25 PSI. If it is not, adjust as needed.

4. If the unit still has no air flow please contact the ATS service department at +1-724-283-1212.

G.6 Unit Will Not Heat

1. Verify that there is power to the unit - refer to (Sec. G.2).
2. If the unit still will not heat, check the temperature controller on the front of the unit to verify that it is turned on and that the SV temperature is higher than the PV temperature. If not, adjust.
3. If the unit still will not heat or the temperature controller will not turn on, open the side panel and refer to (Fig. C4) - Panel Layout to locate Fuses 1 & 2. These fuses are for the 24VDC supply. Remove and inspect the fuses, if a fuse is defective, replace it with a new fuse of the correct type and rating. If the unit still will not heat after replacing the fuses, please contact the ATS Service Department at +1-724-283-1212.
4. If the fuses are functioning properly but the unit still will not heat, check the Heat Control to ensure it is functioning properly. Refer to (Sec. C.4) for location. If functioning properly, the green light on the Heat Control should be illuminated (Fig. G.5). If the green light is not illuminated, please contact the ATS Service Department at +1-724-283-1212.
5. If the heat control light is green but the unit still won't heat, perform a visual check of the heat coils for any breaks. As the coils are very sensitive, do not physically touch, move, or alter the coils. A broken coil will be completely disrupted and obvious to the eye. If there is a broken coil, please contact the ATS Service Department at +1-724-283-1212.



Figure G.5: RTFO heat control

H. Maintenance

H.1 Cleaning the Unit

Before cleaning the RTFO, unplug the machine and allow it to cool. Always wear personal protective gear and clean using Acetone. Do not use any other flammable solvents to clean this machine. Allow equipment to sit, with door open, for a minimum of 15 minutes before further use to allow any vapors from the cleaning solvent to dissipate.



WARNING: Do not use flammable solvents other than what is specified.



WARNING: Using solvents or products not specified by the equipment manufacturer may create potential for formation of flammable or volatile gas mixtures. Always refer to product SDS or contact the manufacturer.

H.2 Replacing Damaged Cables

A qualified person should perform the replacement of any cable. Replacement cables shall be of like kind, size, rating, and specification, as originally supplied by the manufacturer. Use of cables not meeting original specifications may result in injury to personnel, improper operation, damage to equipment, and void warranty.

H.3 Bearing Service and Replacement

The two shaft bearings that support the carousel wheel are sealed, non-servicable bearings. In the event of bearing failure, contact the ATS Service Department at +1-724-283-1212.

To remove bearing assembly:

1. Place Main Power Switch in "OFF" position and disconnect power.



WARNING: Electrical shock hazard. The heating elements remain electrically live when the Main Power Switch is in the "ON" position. Always remember to place the Main Power Switch in the "OFF" position and disconnect power before performing any maintenance.



WARNING: Finger crush hazard. Ensure machine operation has been disabled before removing rear cover.

2. Remove the air coil and tray by disconnecting the air line at the coupling (Fig. H.1), remove the retaining screw (Fig. H.2), and slide the tray out of the RTFO (Fig. H.3).

3. Remove the Carousel by removing the retaining nut, then slide the carousel from the shaft. (Fig. H.4, H.5)
4. At the rear of the RTFO, remove the back cover (Fig. H.6)
5. Loosen the Chain Tensioner (Refer to Sec. H.4)
6. Remove the Chain by disassembly of the chain master link (Fig. H.7).
7. Remove the four 1/4-20" x 3/4" bolts retaining the bearing and shaft assembly, then slide the assembly out of the RTFO (Fig. H.8).
8. Replace bearing and shaft assembly with new assembly and return the damaged assembly to ATS Service.



Figure H.1: Disconnect air line coupling

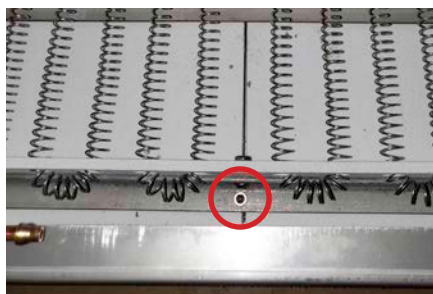


Figure H.2: Retaining Screw



Figure H.3: Removing the tray



Figure H.4: Carousel retaining nut



Figure H.5: Use a 3/4 wrench to remove the carousel retaining nut



Figure H.6: Five screws on rear cover



Figure H.7: Disassemble chain master link



Figure H.8: Bearing and shaft assembly mounting bolts (both sides)

H.4 Chain Maintenance

1. Place Main Power Switch in “OFF” position and disconnect power.



WARNING: Finger crush hazard. Ensure machine operation has been disabled before removing rear cover.



Figure H.9: Chain is too loose



Figure H.10: Chain is properly tensioned

2. Remove the rear cover (Fig. H.6).
3. Proper chain tension is required for reliable operation of the RTFO and ensures long life of the bearings. The chain should not be tightened to the point where it is in tension and should not be loosened to the point where it visibly sags (Fig. H.9).
4. Adjust the chain tension by loosening both nuts on the threaded adjustment rod. Adjust the tensioner up or down as needed to apply proper tension on the chain. Optimum chain tension is achieved when the chain has approximately 3/4” of free movement when compressed between your fingers (Fig. H.10).

H.5 Tray Cleaning

1. Place Main Power Switch in “OFF” position and disconnect power.



WARNING: Electrical shock hazard. The heating elements remain electrically live when the Main Power Switch is in the “ON” position. Always remember to place the Main Power Switch in the “OFF” position and disconnect power before performing any maintenance.



WARNING: Do not use flammable solvents other than what is specified.



WARNING: Using solvents or products not specified by the equipment manufacturer may create potential for formation of flammable or volatile gas mixtures. Always refer to product SDS or contact the manufacturer.

2. Remove the copper air tube coil and tray (Fig. H.3).
3. Clean the copper air tube coil and tray with acetone.

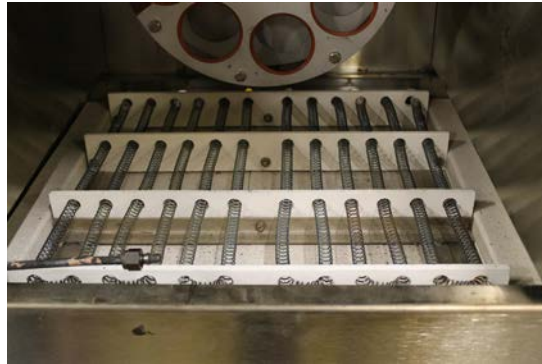


Figure H.11: Heating element coils-
DO NOT CLEAN!

4. The heating element coils underneath the tray are extremely sensitive and do not require regular cleaning (Fig. H.11). Any materials that may drip onto the coils will burn off gradually over time. Any additional cleaning may damage the coils.

H.6 Replacement Parts and Accessories

PART NUMBER	DESCRIPTION
RTFO-JAR	Additional glass containers
RTFO-SCRAPER	Custom scraper for RTFO jars
RTFO-TONGS	For handling hot jars
RTFO-COOLING-RACK	Cooling rack for jars
RTFO-VER-KIT	Verification Kit includes: thermometer, RTD with brass block, flowmeter, digital level, and verification jar with open end
100573	Cooling fan
103691	Fuse, Class CC, 10A, 600 V (Fig. C4, Items 2 and 3)
ELE6111	Fuse, Class MDL, 1A, 250V (Fig. C4, Item 1)
103693	Heating element assembly
4-13492	Silicon gasket for specimen wheel

Appendix A: Warranty

Your Applied Test Systems product has been manufactured and inspected by experienced craftsmen. Applied Test Systems warrants, for the original purchaser, each product to be free from defects in material and workmanship for a period of thirteen (13) months from date of shipment or twelve (12) months from date of installation - whichever comes first. This warranty does not apply to failures caused by normal usage, misuse, or repair or service by unauthorized personnel, nor does it cover limited life electrical components which deteriorate with age such as tubes, lamps, fuses, and heaters. Load cells are covered for manufactured defects only - incidents of over load or other customer misuse are not covered under warranty. The warranty does not extend to products not manufactured or assembled by Applied Test Systems.

This warranty is expressly limited to the repair, replacement, or adjustment of the product at Applied Test Systems' option. The product must be returned to the Applied Test Systems factory or an authorized repair center. Applied Test Systems shall not be liable for any labor, transportation, or installation costs that may arise in connection with the product or return.

To obtain warranty service:

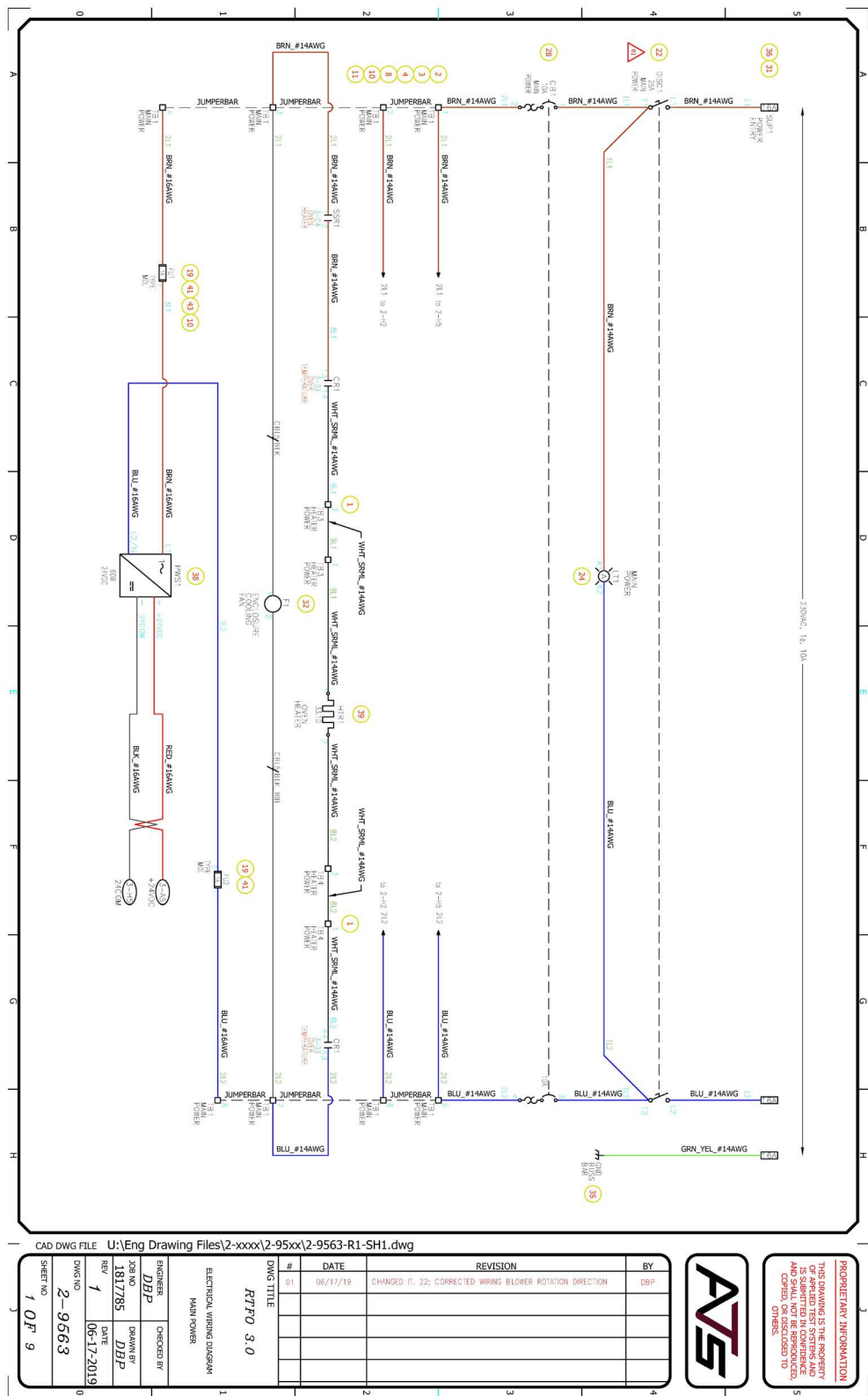
1. Applied Test Systems must be promptly notified in writing of the defect.
2. Upon receipt of written authorization, said defective equipment is returned as directed, with transportation charges prepaid by the buyer.
3. Applied Test Systems examination of such equipment discloses to its satisfaction that the defect exists and was not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of merchantability or fitness for particular purpose. In no event shall Applied Test Systems be liable for direct, indirect, special, incidental, collateral, or consequential damages.

The aforementioned provisions do not extend the original warranty period of any article that has been either repaired or replaced by Applied Test Systems.

Applied Test Systems reserves the right to change published specifications.

Appendix B: Wiring Diagram



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