

Quality is more than a word



ESPEC Benchtop Series User Manual

BTL, BTX, BTZ, BTU Models

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Disclaimer

ESPEC North America, Inc. assumes no responsibility for accidents or equipment trouble that comes from the failure to observe handling instructions contained in this user manual. Do not perform any operation or handle the chamber in any way that is not described in this manual or that is specifically prohibited.

The contents are subject to change without prior notice.

Read this manual thoroughly and familiarize yourself with all safety precautions before using equipment.

Regulatory Compliance

Products with the CE label comply with the Directives and European Standards applicable at the time of certification. Specific Directives and Standards will be listed on provided Declaration of Conformity when applicable.

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Chapter 1

ESPEC Benchtop System Overview

1.1 About the Benchtop Series

Chambers of the Benchtop Series are built for testing functionality, operation, durability, and other specifications under various environmental conditions. They are used to evaluate the effects that temperature and humidity can have on equipment and parts across the entire product life-cycle from development, production, shipping, and use; to when the equipment or part is discarded. With the Benchtop Series, you can test the following:

- Heat resistance
- Cold resistance
- Maximum humidity resistance (BTL and BTX models only)
- Minimum humidity resistance (BTL and BTX models only)
- Storability
- Service life
- Serious deterioration or aging

1.2 Series Models

Temperature and Humidity (BTL and BTX) Models

- BTL-433, BTX-475

Temperature Only (BTU and BTZ) Models

- Size 1 - BTZ-133, BTZ-175, BTZ-175E, BTU-133
- Size 4 - BTZ-475, BTU-433, BTZ-475E, BTZ-4200, BTZ-4200E

1.3 Included Safety Features

To protect from the risk of overheating, there are three levels of protection:

- Settable with the programmer
- An independent settable monitor
- A thermal fuse

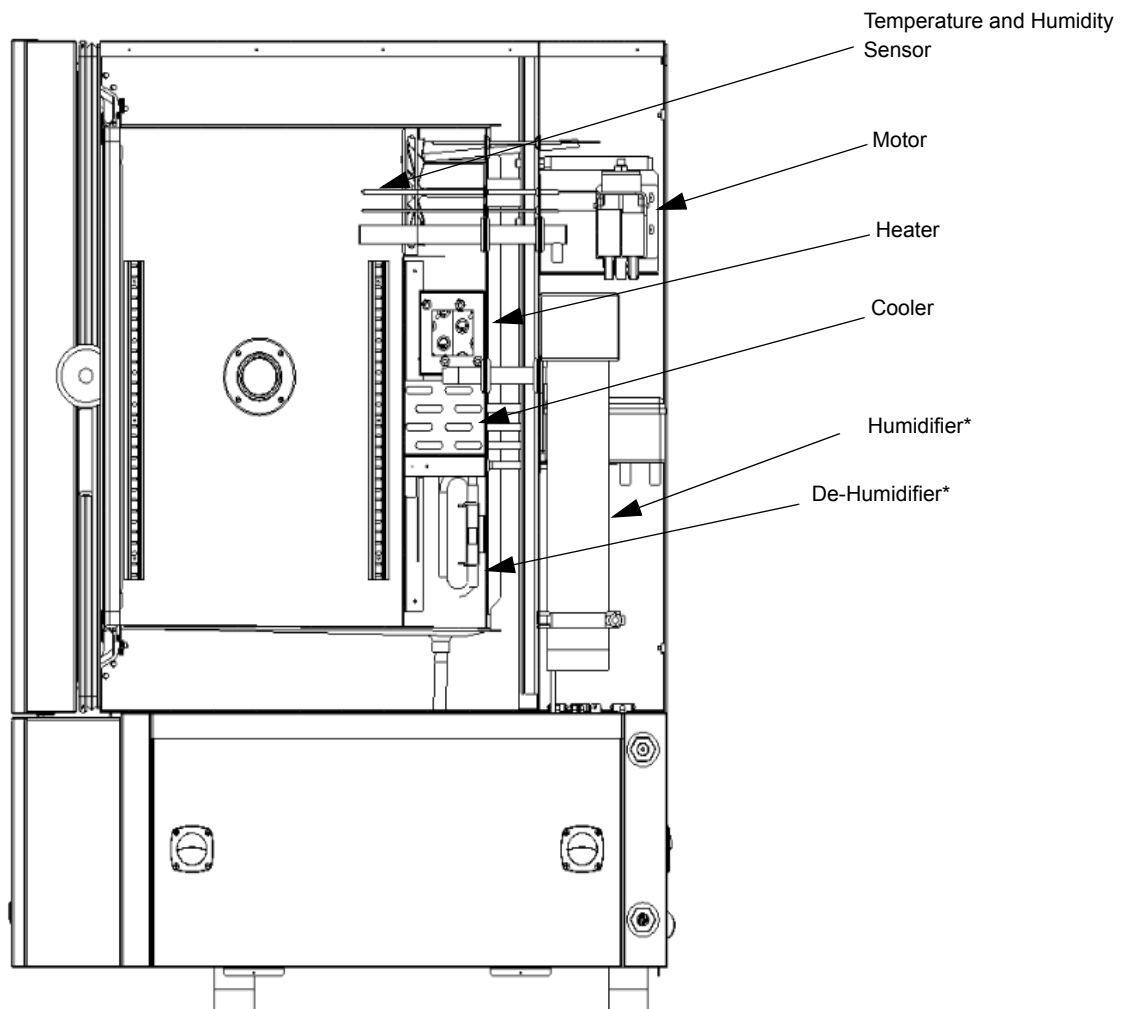
In addition, a specimen power terminal allows the user to safely operate powered equipment inside or with the chamber. If the chamber is shut down, the interlocked device will also be shut down.

1.4 Temperature & Humidity Control and Instrumentation

The Benchtop Series employs a Bi-Modal PID system to control temperature and humidity. The Bi-Modal PID system balances temperature and humidity inside the chamber to reproduce the desired conditions. This is done by alternately controlling the capacity of a cooler and dehumidifier* of high heat load, and a heater and humidifying heater* of low heat load, in real time.

The central unit, which controls everything, is the temperature and humidity* controller. The instrumentation acts as the user interface.

FIGURE 1.1.PRINCIPLE OF SYSTEM- TEMP AND HUMIDITY CONTROL



*Not provided on temperature only chambers

1.4.1 Watlow F4T Controller

The Watlow F4T Instrumentation enables environmental testing under both constant conditions and programmed conditions, referred to as the “constant mode” and the “program mode” respectively.

1.4.2 F4T Controller Video Training

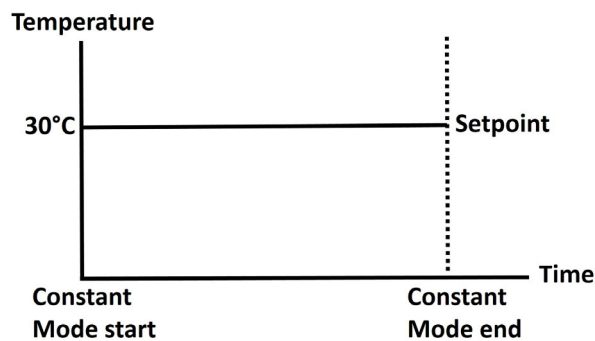
F4T videos are available online at <https://www.watlow.com/products/Controllers/Temperature-and-Process-Controllers/F4T-Integrated-Controller/F4T-D4T-Videos>

- Tutorial: Data Logging
- Tutorial: Trending & Graphing
- Tutorial: File Transfers

Constant Mode

The constant mode maintains the user target temperature and humidity* at a constant setting.

FIGURE 1.2. TEST CONDITIONS IN CONSTANT MODE



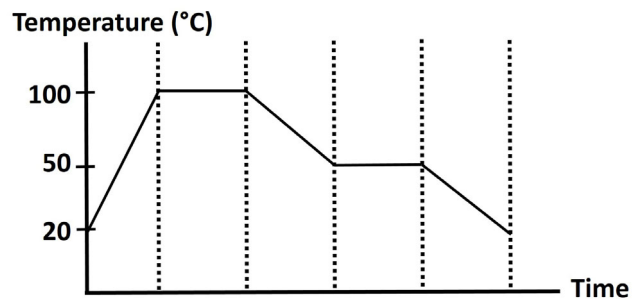
*Not provided on temperature only chambers

Program Mode

The program mode changes chamber temperature and humidity according to a user-set program.

This program is created before testing starts. It contains multiple steps. Each step contains temperature, humidity*, and other settings as with the constant mode. Settings can be maintained throughout an entire step or changed at the constant rate.

FIGURE 1.3. TEST CONDITIONS IN PROGRAM MODE



*Not provided on temperature only chambers

1.5 How to Read Chamber Model Number

Model numbers for ESPEC equipment are assigned as follows. Note: Not all model number combinations are valid. Model numbers are valid only for equipment listed on ESPEC standard price lists or as assigned by ESPEC Application Engineering on an ESR form (EWI 0502)

1.5.1 Benchtop Chamber Description

	BT	Z	-	1	33	E
<u>Series:</u>						
Benchtop	BT					
<u>Model:</u>						
Single Stage Humidity	L					
Single Stage Temperature	U					
Cascade Humidity	X					
Cascade Temperature	Z					
<u>Test area volume (ft³)</u>						
	1					
	4					
<u>Compressor HP:</u>						
1/3	33					
3/4	75					
3	200					
<u>USA or export model:</u>						
Export	E					
USA	Blank					

Chapter 2

Safety Precautions

This chapter explains safety precautions that should be observed to operate the equipment safely. Be sure to read carefully and follow instructions so as to prevent harm to yourself, anyone else, specimens, or the equipment.

Damage to any chamber equipment by prohibited substances is not covered by ESPEC warranty

2.1 Safety Symbols and Descriptions

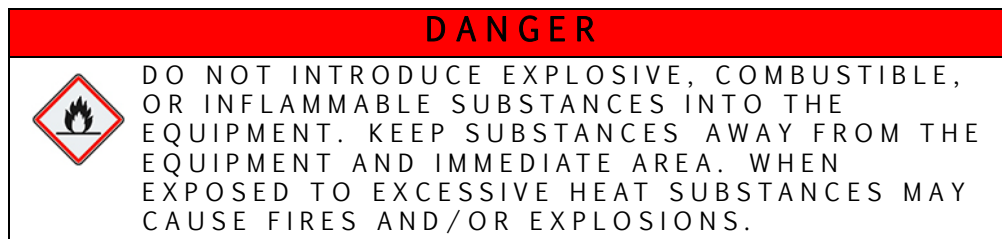
DANGER
DANGER INDICATES IMMEDIATE DANGER OR SERIOUS INJURY AND PRECAUTIONS ARE NECESSARY
CAUTION
CAUTION WARNS AGAINST POTENTIAL HAZARDS OR TO CAUTION AGAINST UNSAFE PRACTICES
WARNING
WARNING IF THE PRECAUTION IS NOT TAKEN, IT MAY CAUSE MINOR OR MODERATE INJURY OR DAMAGE

Note: A note provides information for gaining full performance from the chamber or to prevent damage to equipment.

Procedure: A procedure explains how to operate on a step-by-step basis. Offers supplementary information.

2.2 Substances Not to Be Placed Inside Equipment

2.2.1 Explosive, Inflammable and Combustible Substances



EXPLOSIVE SUBSTANCES

- Nitro glycol, nitroglycerine, nitrocellulose and other explosive ester nitrates.
- Trinitro-benzene, trinitrotoluene, picric acid and other explosive nitro compounds
- Peracetic acid, methyl ethyl ketone peroxides, benzoyl peroxide and other organic peroxides.

INFLAMMABLE SUBSTANCES

- Combustible Substances:
 - Metal lithium, metal potassium, metal sodium, yellow phosphor, phosphor sulfide, red phosphor, celluloids, calcium carbonate (also called carbide), calcium phosphate, magnesium powder, aluminum powder, metal powders other than magnesium powder and aluminum powder, hydrosulfite.
- Oxides:
 - Potassium chlorate, sodium chlorate, ammonium chlorate and other chlorates.
 - Potassium perchlorate, sodium perchlorate, ammonium-perchlorate and other perchlorates.
 - Potassium peroxide, sodium peroxide, barium peroxide and other inorganic peroxides.
 - Potassium nitrate, sodium nitrate, ammonium nitrate and other nitrates.
 - Sodium chlorite and other chlorites.
 - Calcium hypochlorite and other hypochlorites.
- Ignitable Substances:
 - Ethyl ether, gasoline, acetaldehyde, propylene oxide, carbon disulfide and other substances with an ignition point of -30°C (-22°F).
 - Normal hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone and other substances with an ignition point above -30°C (-22°F) and below 0°C (32°F).
 - Methanol, ethanol, xylene, pentyl acetate, amylacetate and other substances with an ignition point above 0°C and below 30°C (85°F).
 - Kerosene, light oil, turpentine oil, isopentyl alcohol (also called isoamyl alcohol), acetic acid and other substances with an ignition point above 30°C (85°F) and below 65°C (150°F).

- Combustible Gases
 - Hydrogen, acetylene, ethylene, methane, ethane, propane, butane and other combustible substances that are in a gaseous state at a temperature of 15°C (60°F) and at a pressure of 1 atmosphere.

2.2.2 Corrosive Substances



Humidifying water or specimens which generate substances that corrode stainless steel or silicone rubber can drastically shorten service-life of internal parts, including the refrigerator and packing.

Though apparently harmless at ambient temperature, these substances can readily corrode circuit boards and other parts when the equipment is run at high temperature and high humidity.

Even trace amounts of corrosives in the humidity water supply or released by the test items will become concentrated in the humidifying tray during extended periods of humidity operation. If corrosion is observed in the humidifying tray during extended high humidity testing, it should be drained and refilled daily to flush out the corrosive contaminants. This can be done by opening the wick arm drain valve for a least 30 seconds.

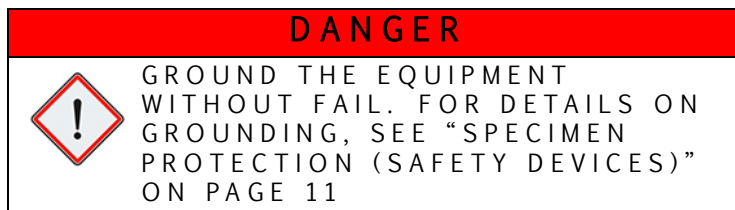
CORROSIVE SUBSTANCES (NOT LIMITED TO)

- Chlorine
- Chlorides
- Acids

2.3 Spark-Resistant Interior Precautions (Optional)

If chamber interior is spark-resistant (equipped with safety devices configured for specific substances) refer to chamber specification for minimum allowable auto-ignition temperature (AIT). Consult ESPEC for use with other substances.

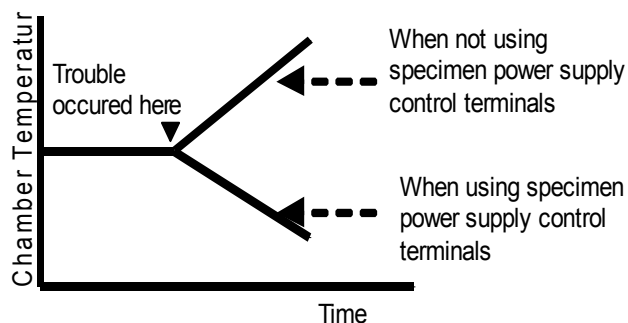
2.4 Specimen Power Supply Control Terminals



Use only the specimen power supply control terminals to apply voltage to specimens.

Specimens generate heat as they are charged. The specimen power supply control terminals are interlocked with the chamber control circuit, so power to specimens is turned OFF when the chamber is not running. Using other means to power specimens leaves the specimens charged in the event of chamber trouble. This can drive up temperature inside the chamber, which can damage specimens and in worse cases result in fire. See “How to Power Specimens (use only when required)”.

FIGURE 2.1. TEMPERATURE AND SPECIMEN POWER SUPPLY CONTROL TERMINALS



2.5 Specimen Protection (Safety Devices)

CAUTION	
	SET SAFETY DEVICES ACCORDING TO TEST CONDITIONS AND THE TYPE OF SPECIMENS. UNLESS PROPERLY SET, SPECIMENS COULD BE DAMAGED IF SOMETHING GOES WRONG DURING TESTING.

The chamber is controlled to a target temperature and humidity* by the controller. Nonetheless, temperature and humidity can get out of control for various reasons. In such cases, to protect specimens against thermal damage, the chamber has an independent product temp protector. See Table 2.1 below.

*BTL and BTX models only

TABLE 2.1. HARDWARE AND SOFTWARE SAFETY DEVICES

Safety Device	Trip Point	Equipment Response when Tripped
Product Temp Protector	- Set approximately 20°C higher than target temperature. - Set below specimen's maximum allowed temperature.	- Alarm displayed - Heater shut OFF - Humidifier shut OFF (Temperature only chambers excluded) - Refrigerator shut OFF - Air circulator shut OFF - Specimen power supply control terminal interrupted

2.5.1 Safety Device Setting Example

High Limit Temperature

In the following example, the target temperature is 40°C and the maximum allowed temperature of the specimens is 60°C. Safety devices are set as follows:

Product Temp Protector	+60°C	- Set 20°C higher than target temperature - Set to specimen's maximum allowed temperature
------------------------	-------	--

2.6 Global Warming Potential of Refrigerants

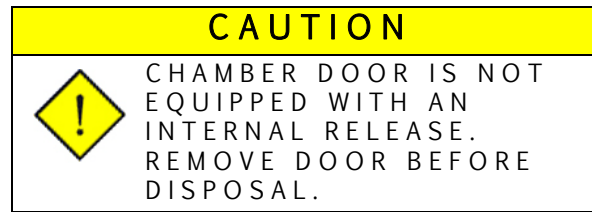
Refrigeration circuit contains fluorinated greenhouse gases covered by the Kyoto Protocol. See Table for global warming potential of refrigerants used by ESPEC. See chamber serial tag for refrigerant and quantity used in this chamber.

TABLE 2.2. GLOBAL WARMING POTENTIAL OF REFRIGERANTS

Substance	GWP
R-23	12,000
R-134a	1,300
R-404a	3,800
R-449a	1,400
R-508b	12,000

Insulation material is made of foam blown with fluorinated greenhouse gases.

2.7 Disposing of the Chamber



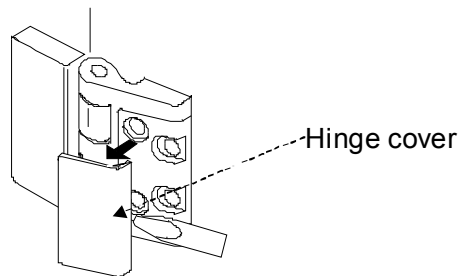
Tools Required:

- Slotted head screwdriver
- 7/16" socket box wrench to detach the door

Procedure:

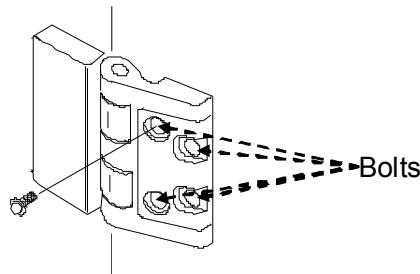
1. Pry off the hinge cover on the door side part of the hinge. Use the slotted head screwdriver.

FIGURE 2.2.PRYING OFF THE HINGE COVER



2. Open the door slightly and prop it up with the hand winch. Then remove the bolts (4), which lock the hinge to the door. Use the box wrench.

FIGURE 2.3.HINGE BOLTS TO REMOVE



3. Detach the door

2.8 Other Precautions

DANGER



DO NOT USE OR LEAVE EQUIPMENT OUTDOORS. OUTDOOR ENVIRONMENTS ADVERSELY AFFECT PERFORMANCE AND FUNCTIONING. ELECTRICAL PART CONTACT WITH WATER CAN LEAD TO SHORT-CIRCUIT, FIRE, ELECTRICAL SHOCK, AND BREAKDOWN.



OPERATE IN A WELL VENTILATED AREA OR EXHAUST VENT PORT OUTSIDE OF BUILDING. CHAMBER USES LIQUID NITROGEN INJECTED DIRECTLY INTO WORKSPACE FOR COOLING. NITROGEN GAS WILL DISPLACE THE OXYGEN IN THE AIR AND CAN CREATE A HAZARDOUS CONDITION.

CAUTION



DO NOT INTRODUCE ELECTRICALLY CONDUCTIVE SPECIMENS WHICH MIGHT EASILY BE THROWN ABOUT BY AIR CURRENTS INSIDE THE CHAMBER. SPECIMENS OF THIS SORT CAN CAUSE LEAKS IN THE HEATER IF THEY INFILTRATE THE AIR CONDITIONER.



HOT AIR BLAST WHEN OPEN! USE CAUTION WHEN OPENING THE DOOR DURING AND SHORTLY AFTER OPERATION AT HIGH TEMPERATURE OR HIGH HUMIDITY. HOT (WET) AIR IS BLOWN FROM INSIDE THE CHAMBER WHEN OPENED.

WARNING



HOT INSIDE! DIRECT CONTACT MAY RESULT IN BURNS. WEAR HEAT RESISTANT GLOVES. DURING AND SHORTLY AFTER OPERATION ABOVE 55°C, THE CHAMBER IS HOT ON THE INSIDE (INCLUDING SPECIMENS, SHELVES, DOOR GASKET, AND TEST AREA WALLS).

Chapter 3

Before You Install Your ESPEC Chamber

3.1 Related Documents

- Watlow F4T Controller Manual
- Web Controller for Watlow F4T Controller
- Web Controller Locator
- Options Manual
- Declaration of Conformity
- Features Details
- Parts List and Schematics
- Specifications
- Jabsco Water Pump Manual (BTX and BTL models only)
- Vaisala HMM100 User's Guide (BTX and BTL models only)

3.2 Accessories and Spare Parts

Confirm that the following accessories and spare parts have been included with your chamber.

Accessory/Part	Use	Quantity
Power Cable with Plug*	To provide power to the chamber from an outlet. For details of plug type See “Power Supply Work for Models with Power Cable” on page 29.	1 Set
Wet Bulb Wicks (BTL and BTX models only)	For humidity detection in humidity models	1 Box
Inlet Plug	For specimen power and time signal inlet	2

*No separate power cord provided with BTZ-4200 model. [See “Power Supply Work for BTZ-4200 Model” on page 30.](#)

3.3 Preparing Installation Site

This equipment may require the following utilities:

- Electrical power
- Refrigeration cooling water
- Humidity water supply
- Drainage
- Compressed air
- Gaseous Nitrogen
- Liquid Nitrogen

3.4 Additional Product Information and Customer Support

Contact Information for Customer Support and/or Sales:

- Online Customer Support: www.espec.com/na/support
- Online Sales: www.espec.com/na/about/contact_us
- Customer Support: 616-896-6170
- Corporate and Sales: 616-896-6100

Download software, related documents and manuals:

- Manuals: www.espec.com/manuals and enter your serial number to download
- Related documents: www.espec.com/manuals and enter your serial number to download
- Software: www.espec.com/na/support/software to download

Please have the following information available when calling ESPEC Support and/or Sales:

- Chamber Model and Serial Number located on the equipment data tag
- Detailed information on the suspected failure and/or alarm detail
- Operating mode at time of failure, i.e., heating, cooling, temp, humidity
- If a specific part is needed, the ESPEC part number from your replacement parts list

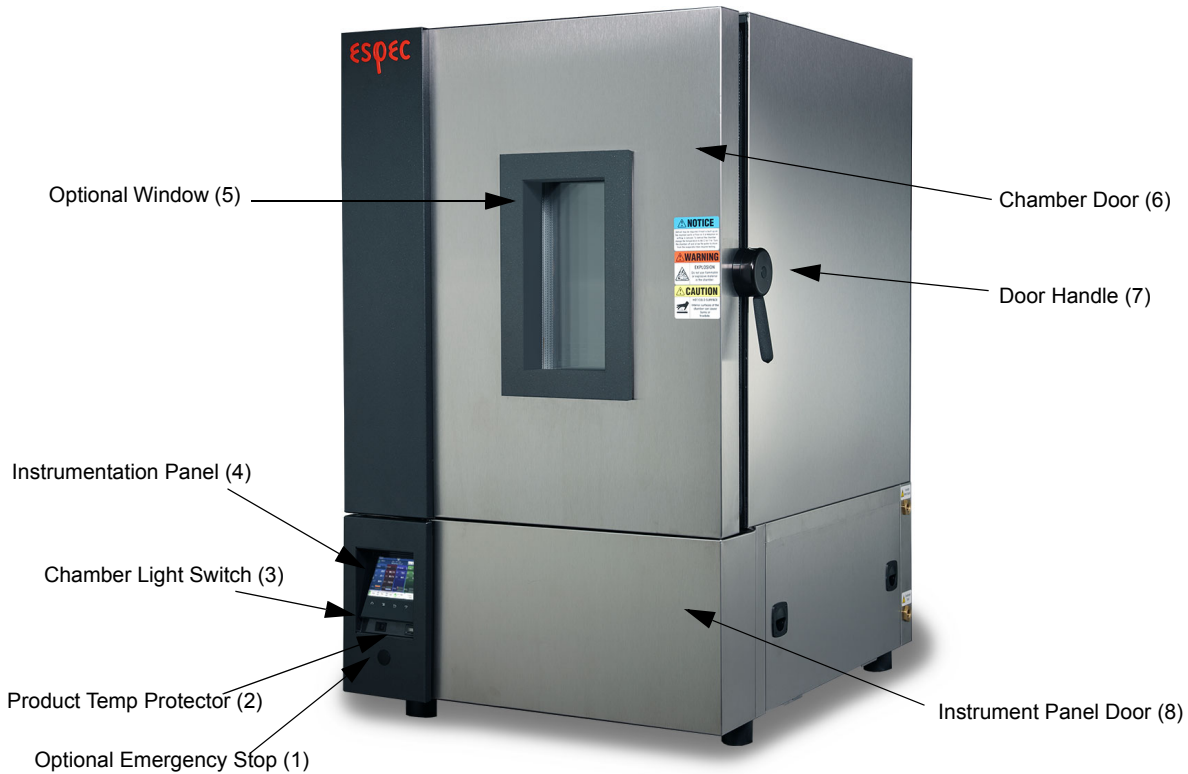
Chapter 4

Names & Functions of Parts

4.1 Chamber

4.1.1 Front

FIGURE 4.1.CHAMBER FRONT (BTZ-475 MODEL SHOWN)



	Name	Function/Use
(1)	Emergency Stop (optional)	Emergency shutdown of the chamber
(2)	Product Temp Protector	Stops the chamber to prevent damage to specimens. See "Product Temp Protector" 5.4.1.
(3)	Chamber Light Switch (optional)	Controls interior chamber lamp
(4)	Instrumentation Panel	User-interface panel for controlling the temperature and humidity* controller
(5)	Window (optional)	Observation of the specimen in test chamber
(6)	Chamber Door	Open to access the test area
(7)	Door Handle	Use to open/close the chamber door
(8)	Instrument Panel Door	Access to electrical parts behind instrument panel

*Not provided on temperature only chambers

4.1.2 Door Operation

The chamber door is designed with a two-step latching process.

Procedure:

1. In this position the door is not fully sealed and will cause the chamber to leak water, and frost to accumulate in the workspace and on the gasket.
2. Apply pressure to the door handle to completely seal the gasket. In this position the door is completely sealed.

FIGURE 4.2.DOOR LATCH STEPS 1 AND 2.



STEP 1



STEP 2

4.1.3 Instrumentation Panel

For information regarding how to operate the Watlow F4T Controller, see separate manuals, “Using the Watlow F4T Controller - Supplemental User Manual” and the “Watlow F4T Controller Setup and Operations User’s Guide”.

FIGURE 4.3. INSTRUMENTATION PANEL WITH WATLOW F4T CONTROLLER



Controller Password Protection

The controller has password security protection, thereby decreasing the probability of inadvertently changing the factory set-up configurations of the controller. Consideration in changing this password or changing the factory set-up configurations of the controller will require calling the [ESPEC Customer Support](#). If a fault occurs when the chamber is in the run mode, and the fault display button is cleared, the chamber will not start running again until the “start/stop” button is pushed.

4.1.4 Left Side

FIGURE 4.4.LEFT SIDE WITH OPTION PANEL (SIZE 1 MODEL SHOWN)



	Name	Function/Use
(1)	Cable Port	Feed Cables (i.e. to charge specimens) into the test area through here
(2)	Power Connection	Connection point for power cord (not included on BTZ-4200 model)
(3)	Electrical Compartment Door	Access to electrical circuit protectors. Always unplug power before opening this access.
(4)	Option Panel	Can include items listed below
	RS-232 Communications RS-485 Ethernet (ETH)	Optional serial interface Connect a PC here to control/monitor the chamber
	Humidity T/C	For Recorder Option. BTL and BTX models only For Recorder Option
	Time Signal	Contact-type output terminal. Outputs signal via a relay to remote devices during tests
	Specimen Power	For supply power to specimens. If trouble occurs with the chamber, the contact opens and shuts OFF power supply to specimens

4.1.5 Right Side

FIGURE 4.5.RIGHT SIDE (SIZE 1 MODEL SHOWN)



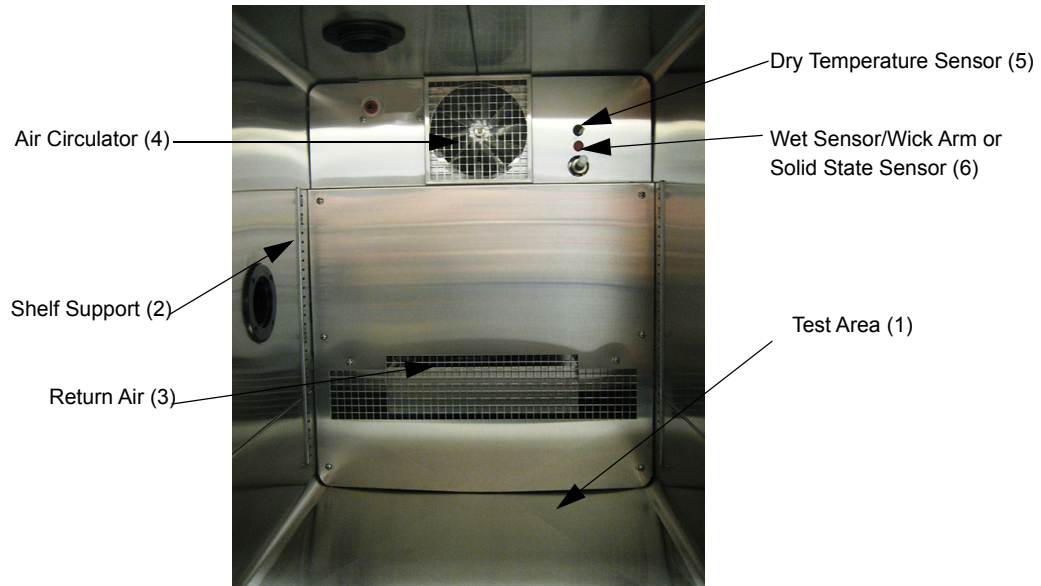
	Name	Function/Use
(1)	Humidity Water Supply Port	For humidity water. BTL and BTX models only
(2)	Chamber Drain	Drain for condensate water from workspace and humidifier water
(3)	Refrigeration Room Access	For maintaining refrigeration system

4.1.6 Test Area

FIGURE 4.6. TEST AREA PARTS - SIZE 1 CHAMBER



FIGURE 4.7. TEST AREA PARTS - SIZE 4 CHAMBER



	Name	Function/Use
(1)	Test Area	Area where specimens are located for testing
(2)	Shelf Support	Install shelf clips here
(3)	Return Air	Re-circulating air returns to the conditioning plenum here. Do not block this grille.
(4)	Air Circulator	Air is supplied to the product through this grille. Do not block.
(5)	Dry Temperature Sensor	Measures the temperature of the chamber
(6)	Wet Sensor/Wick Arm or Solid State Sensor	Measures the humidity of the chamber air. Only used on BTL or BTX models (actual parts not shown for solid state sensor).

Chapter 5

Installation & Start-Up

This chapter gives an overview of the Benchtop Series and temperature and humidity control.

5.1 Installation Site Check

Install the chamber in a place which satisfies the following conditions:

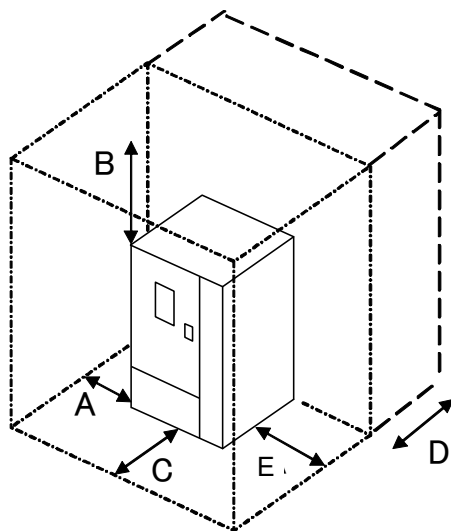
- On a flat, level bench which is strong enough to bear the weight of the equipment.
- Where subject to only minimal mechanical vibrations.
- Where not exposed to direct sunlight but which is well-ventilated.
- Where ambient temperature is +5 ~ 35°C and free of sharp temperature fluctuations. (0.1°C/min. or 3°C/30 mins.)
- In a dust-free room.
- Where not exceptionally wet or humid.
- Away from flammables and explosives.
- Where not exposed to combustible or corrosive gases.
- Near power, water, and drainage utilities.
- Not directly underneath or near fire alarms.

Note: Chamber working temperature range is 5 ~ 35°C (from chamber specs). Using the chamber outside of this range will lead to equipment problems.

5.2 Installation Space

The chamber requires operational and maintenance space on the left and right sides. It must also be a safe distance from objects on the front side so that the door can be opened.

FIGURE 5.1. INSTALLATION SPACE



- A: Min. 7" (18 cm)*
BTZ-4200 Min. 42" (106.7 cm)
- B: Min. 24" (61 cm)
- C: Min. 36" (91.5 cm)
- D: Min. 0" (0 cm)*
BTZ-4200 Min. 36" (91.5 cm)
- E: Min. 7" (18 cm)*

*These dimensions are the operating space required. Maintenance space required is 42" (106.7 cm), however, the chamber can easily be moved for compressor and electrical maintenance.

5.3 Chamber Casters (BT-CT)

Casters are included with optional cart. The BTZ-4200 model includes casters. Casters allow chamber portability and use in multiple locations. Casters include feet to level the unit and fix it in place.

5.3.1 Operation

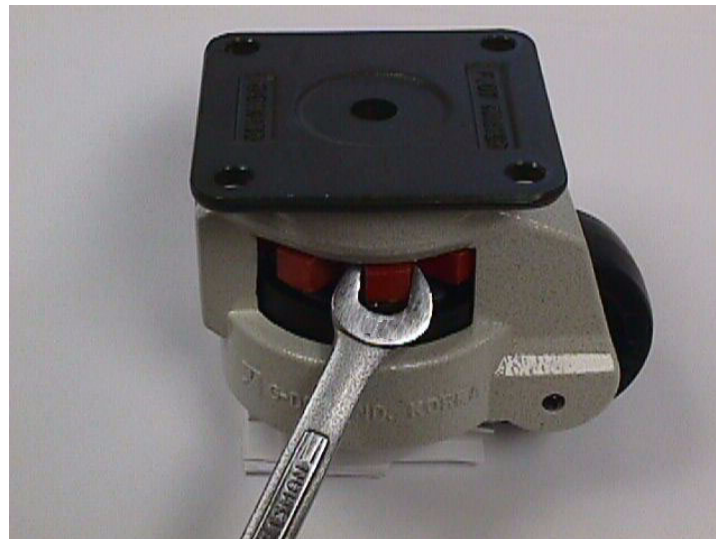
CAUTION	
	DO NOT MOVE THE CHAMBER WITH SPECIMENS INSIDE. SPECIMENS COULD OVERTURN OR FALL OFF SHELVES DURING TRANSPORT.

WARNING	
	USE CART/CHAMBER ONLY ON A FLAT/LEVEL FLOOR. AN UNLEVEL FLOOR COULD TRIGGER AN ALARM OR DESTABILIZE HUMIDITY CONTROL.

The chamber must be level side to side and front to back for proper humidity system operation.

Casters and adjuster feet are found under each of the four corners of the cart base. Adjuster foot height can be adjusted by loosening and tightening the nut. This will require a 1/2 inch or 13mm open end wrench.

FIGURE 5.2. HOW TO LOOSEN/TIGHTEN ADJUSTER FEET



Note: Always anchor the cart in place with adjuster feet BEFORE use. Unless anchored, the chamber could move unexpectedly under external force.

5.3.2 Leveling Chamber Cart

Procedure:

1. Lower the adjuster feet until the casters rise off the floor
2. Once installed, check that the chamber is level from side to side and front to back, using a level placed on the top of the chamber.

5.3.3 Moving Chamber Cart

Procedure:

1. Raise the adjuster feet until the chamber is sitting on the casters
2. Move the chamber

5.4 Power Supply Work for Models with Power Cable

5.4.1 Primary Power Supply Requirements

The primary power supply must satisfy the following requirements:

- See chamber specifications for chamber power requirements
- A power cable is provided of the proper wire gauge for the chamber. An appropriate plug is also provided for chambers sold in North America. Reference the Benchtop Series Features Details Specification (ECSP07011) for details on the type of plug provided with the chamber.

5.4.2 Primary Power Supply Connections

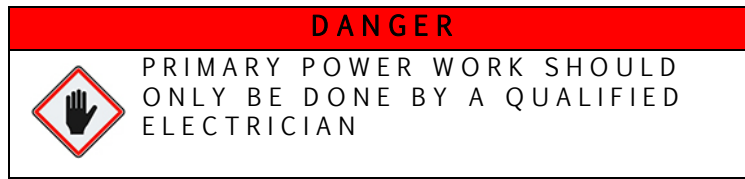
The chamber is connected to the primary power supply via the power cable. It is also grounded to prevent noise from infiltrating electronic circuits and to protect users against electric shock which can result from leakage current.

DANGER	
	EXPLOSION! DO NOT GROUND THE EQUIPMENT ON GAS PIPES. GROUNDING OF THIS SORT COULD RESULT IN AN EXPLOSION.
	GROUND THE EQUIPMENT PROPERLY. ELECTRICAL SHOCK! UNLESS THE EQUIPMENT IS GROUNDED, OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES CANNOT OPERATE PROPERLY, POSSIBLY RESULTING IN ELECTRIC SHOCK. THIS WILL ALSO LEAVE THE EQUIPMENT UNPROTECTED AGAINST POWER SUPPLY NOISE.

Procedure:

1. Use power cable provided or fabricate your own cable using the power requirements on the schematic and your local codes for wire sizing
2. Plug the cable into the chamber receptacle
3. Plug the chamber into the power receptacle
4. The Watlow F4T will power up immediately. The controller will display the current conditions in the chamber.

5.5 Power Supply Work for BTZ-4200 Model



5.5.1 Primary Power Supply Requirements

See chamber specifications for chamber power requirements.

5.5.2 208/230VAC Transformer Supply Voltage Selection

Note: Applies only to 208/230 volt Benchtop models

The control transformer can be wired for 208VAC or 230VAC supply power to the chamber. The default voltage the transformer is wired for is 208VAC unless specified for 230VAC when ordered. Refer to the following procedure to change the transformer wiring. Changing the wire connections should only be performed by qualified personnel.

Procedure: Change transformer wiring

1. Verify the chamber has been disconnected from the main power source and that the specimen power and time signal have been unplugged from the chamber
2. Open the instrument panel door and locate the main transformer
3. Reference the chambers electrical power print for the wire connections on the primary power side of the transformer
4. Loosen the appropriate screw terminal on the transformer and remove the wire. See Figure 5.3 below. Move the wire to the appropriate terminal on the transformer and tighten the screw to 20 inch pounds.

FIGURE 5.3.PRIMARY POWER WIRES TO TRANSFORMER



5.5.3 Primary Power Supply Connections

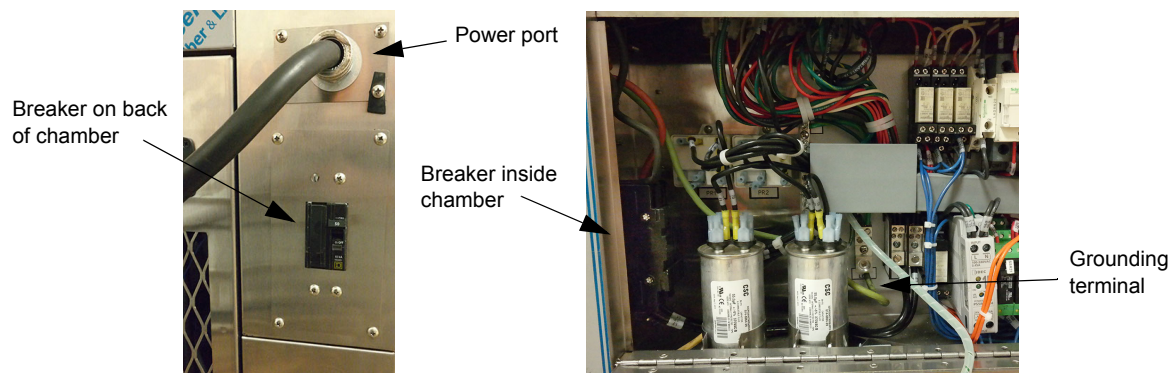
The chamber is connected to the primary power supply via the power cable. It is also grounded to prevent noise from infiltrating electronic circuits and to protect users against electric shock which can result from leakage current.

DANGER	
	EXPLOSION! DO NOT GROUND THE EQUIPMENT ON GAS PIPES. GROUNDING OF THIS SORT COULD RESULT IN AN EXPLOSION.
	GROUND THE EQUIPMENT PROPERLY. ELECTRICAL SHOCK! UNLESS THE EQUIPMENT IS GROUNDED, OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES CANNOT OPERATE PROPERLY, POSSIBLY RESULTING IN ELECTRIC SHOCK.

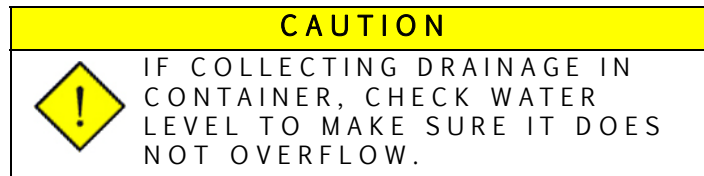
Procedure:

1. Open electrical box door
2. Enlarge power port to proper size for installed conduit or strain relief. Protect electrical components from any debris while enlarging hole. Feed a power cable through the top power port.
3. Connect phase wires to terminals on top of breaker
4. Connect the grounding wire of the power cable to the grounding terminal. Be sure the ground wire would be the last connection broken if stress was put on the primary power wires.

FIGURE 5.4. CONNECTING POWER SUPPLY



5.6 Drainage



Drainage is needed to remove water from the humidifier (BTX and BTL models only) and dew formed in the test area out of the chamber.

Procedure:

1. Connect the supplied 1/2" barbed hose fitting to the threaded drain fitting on the right side of the chamber and connect drain hose.
2. The hose used for drainage must have an internal diameter of 1/2".

Note: If a drainage pit is not located close enough to the chamber, run drainage into a container or condensate pump. Whether running drainage into a pit or a container, keep the end of the drain hose open to the atmosphere. If submerged, water can backflow into the chamber.

5.7 Humidity Water Supply (BTL and BTX models only)

For proper chamber operation, water level in the humidity tray must be checked. [See "Humidifier Level Check \(Size 4 Chamber Only\)" on page 49.](#)

5.7.1 Water Supply Installation

Procedure: Connection of the Water Supply Hose for the Humidifying Water Circuit

1. Connect the supplied 3/8" barbed hose fitting to the threaded water supply fitting on the right side of the chamber, and connect supply water line.
2. The supply water must be from a purified* water source. The water supply should have a pressure between 30 ~ 50 psi to ensure proper operation of the humidifying circuit.

*The type of purifying system does not matter, but the purified water should be filtered (5 micron), have a conductivity of 0.2µS/cm to 10µS/cm, and a maximum of 2mg/L of free chlorine.

Note: If your chamber is equipped with an optional water supply tank, please see the option manual for the water supply installation procedure.

5.7.2 Water Consumption Rate

Humidity Water Consumption Rates

- For humidity models: BTL-433, BTX-475
- Peak flow rate of 5 GPH
- Peak flow occurs during the initial filling of the humidifier or when turning on humidity control during a test
- Typical humidity water consumption rate of 0.3 GPH
- Water consumption rate depends on test set point as well as test load and room conditions

TABLE 5.1. WATER CONSUMPTION RATE

Chamber Model	Water Consumption Rate
BTL-433, BTX-475	Peak* 5 GPH/Typical 0.3 GPH

*Peak flow rates are for the initial filling of the humidifier or for filling after a temperature only set point

5.8 Liquid Nitrogen (LN₂) - LN₂ Supply Installation

Attach LN₂ supply to the LN₂ fitting. The location of the fitting varies by model. Always insulate the LN₂ supply pipe before operating the chamber.

Chamber Model/Size	Fitting Location
Sizes 1,4	Rear top
BTZ-4200	Left side

Utilities Required:

- Supply Rate: 2 Lbs/minute
- Supply Pressure: 30-35 PSIG
- Connection: 1/4" flare (male)

Chapter 6

Operation

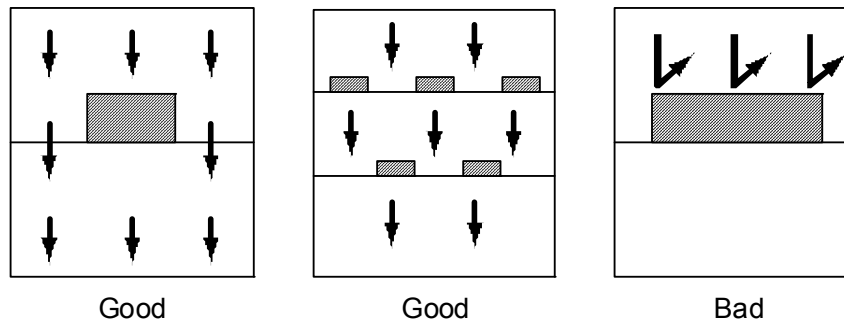
This chapter identifies parts found on the chamber, instrumentation panel, electric parts compartment, and water circuit compartment by name and function.

6.1 Test Preparation

6.1.1 How to Arrange Specimens

Space specimens apart and away from walls so as not to block air circulation inside the test area. Temperature and humidity uniformity drops if air cannot flow freely, which will throw off test results.

FIGURE 6.1.HOW TO ARRANGE SPECIMENS



Specimens should be placed only within the “working” space of the chamber. The “working” space is defined as the inner 80% of the chamber interior volume with a minimum distance from the walls being 2” (50mm). For example:

- If the chamber width is 20” then the specimen should not be placed closer than 2” to the chamber side wall.
- If that same chamber has a depth of 11” then the specimen should not be placed any closer than 2” to the door or rear wall. (10% is 1.1”, however the minimum is 2”.)
- If the chamber height is 32” then the specimen should not be placed closer than 3.2” from the ceiling or the floor.

6.2 Preparation of Operation

6.2.1 How to Use the Controlled Specimen Power Terminal and the Time Signal Output Terminals

All the external terminals are equipped on the left side of the chamber.

The controlled specimen power terminal should be used when testing heat generating specimens. This is suggested because if one of the safety devices is activated, the chamber and specimen power will be disrupted, and no damage will occur to either the chamber or the specimen. The time signal output terminals relay the time signal of the temperature digital programmable controller to an outside source.

Controlled Specimen Power Terminal

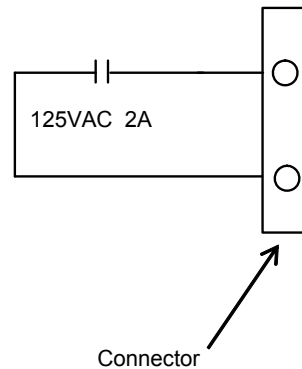
DANGER	
	IT IS EXTREMELY DANGEROUS TO STOP OPERATION OF THE CHAMBER WHILE SUPPLYING ELECTRICITY TO SPECIMENS, THEREFORE A PROTECTION CIRCUIT MUST BE USED TO ENSURE SAFETY.

The circuit is in a connected state during normal operation of the chamber. When a chamber safety device is activated, power is turned OFF, or in case of power failure, the terminal assumes an open state.

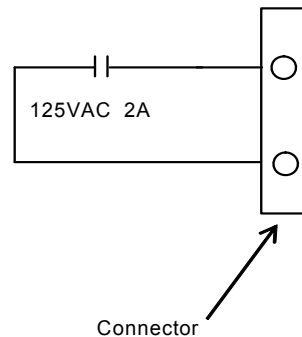
Time Signal 1

When the chamber is operating normally in the program mode, the terminals are closed whenever the controller is programmed to turn Time Signal 1 ON. If the temperature digital programmable controller alarm activates, the terminals change to an open state. If power is turned off by switching the Run Switch to the OFF position, Time Signal 1 remains energized. Time Signal 1 corresponds to the digital output 1 menu of the temperature digital programmable controller.

Specimen Power

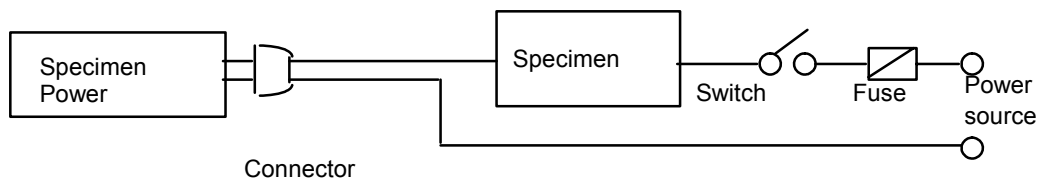


Time Signal 1



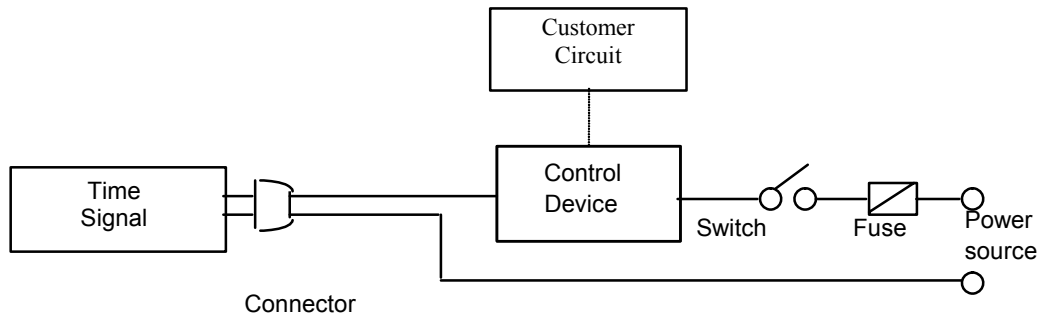
CAUTION	
	THE RATED ELECTRICAL CAPACITY OF THE SPECIMEN POWER IS 2A 125VAC. THE CAPACITY OF THE TIME SIGNAL IS 2A 125VAC. VERIFY THAT THE TOTAL FOR THE DEVICES CONNECTED DO NOT EXCEED THE CIRCUIT LIMITS. FOR LOADS HIGHER THAN THE LIMITS, A RELAY OR CONTACTOR MUST BE USED. FUSING OF THE CIRCUIT IS THE CUSTOMER'S RESPONSIBILITY.

FIGURE 6.2.SPECIMEN POWER CIRCUIT EXAMPLE



In this case, power to the specimen is shut off when the chamber stops.

FIGURE 6.3.TIME SIGNAL CIRCUIT EXAMPLE

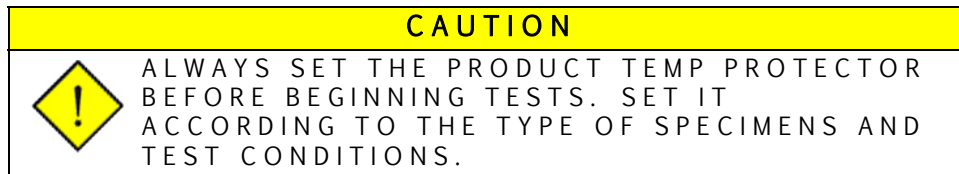


In this case, power to customer circuit is shut off when the event is completed or the chamber stops.

6.3 Specimen Safety Device Setup

6.3.1 Product Temp Protector

Set the appropriate temperature values (required for product protection) of the Product Temp Protector. This is accomplished by using the Product Temp Protector digital selector located on the front under the controller next to the option panel. Both an “Overtemp” and “Overcool” value are set using the digital selector..



Note: Unless properly set, the product temp protector will not trip in the event of chamber trouble, which could lead to specimen damage. For details on the product temp protector setting values, [See “Specimen Protection \(Safety Devices\)” on page 10.](#)

Do not press the Up and Down keys of the selector at the same time for five seconds or more.

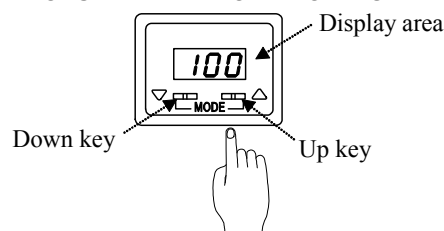
If the keys are pressed at the same time for five seconds or more, the equipment enters maintenance mode and the thermocouple range, temperature range, and warning mode settings of the selector are displayed. If these settings are changed, there are cases where the equipment malfunctions or does not operate even if the temperature set point is reached.

If an error occurs while settings are being changed, “Err” appears on the display and the program returns to the Set Point Display mode.

Procedure: Set the Product Temp Protector (Overheat and Overcool)

1. Under normal operation, the Product Temp Protector display toggles every three seconds between the overheat and overcool settings. To change settings, press the Up or Down key for 1/2 second. The current overheat (high limit) setting is displayed and “R&A” are displayed in the display area.
2. Specify the desired temperature. Each time that you press the Up or Down key, the temperature is increased (or reduced) by 1°C. If you press and hold the key for approximately two seconds or more, the ones digit is set to zero and the value is increased (or reduced) by 10°C.
3. Once the overheat (high limit) is set, do not press the Up or Down buttons for five seconds. The display will switch over to the overcool (low limit) setting and “M&A” are displayed in the display area.
4. Repeat step 2 to set the overcool (low limit) setting. Once the overcool (low limit) setpoint is entered, do not press the Up or Down buttons for five seconds. The “M&A” will disappear from the display and the overheat and overcool settings begin to toggle back and forth on the display every three seconds.

FIGURE 6.4.PRODUCT TEMP PROTECTOR DISPLAY/SELECTOR



Chapter 7

Recommended Maintenance & User-Level Servicing

This chapter explains equipment checks and maintenance. To keep the chamber in good working condition, perform checks and maintenance periodically.

7.1 Check and Maintenance Lists

Checklist

For an explanation on each check item, [See “Checks” on page 41](#). If any of the following checks result in problems, contact [ESPEC Customer Support](#).

TABLE 7.1. CHECK LIST

Check Item	When to Check
Product Temp Protector Trip Test	Before long test runs Before unattended tests
Wet-Bulb Wick Check*	Before each test
Wick Pan Water Level Check	Once every 3 months After moving chamber. See “Product Temp Protector Trip Test” on page 42.

Maintenance List

For an explanation on each maintenance item, [See “Maintenance” on page 43](#).

TABLE 7.2. MAINTENANCE LIST

Maintenance Item	When to Perform
Condenser Cleaning***	Once monthly
Steam Generator Cleaning**	Once monthly
Test Area Cleaning	Before every test
Take-Down	Before long periods of disuse

*Not required on humidity models with solid state humidity sensor option

**Humidity models (BTL, BTX) only

***Not required on models with liquid nitrogen cooling only

+optional equipment

7.2 Checks

7.2.1 Wet Bulb Wick Check (BTL and BTX models only)

Running Temperature-Humidity Programs

The wet-bulb wick (included) must be installed to run humidity tests. If already in place, check whether it is wet or dry before starting. If dry, change it. When running a temperature-humidity program, always supply the wick with water, even during temperature-only parts of the program. Unless water is continually supplied, the wick might dry out, which will interrupt testing in progress when the situation is detected.

Temperature-Only Programs

Remove the wet-bulb wick for temperature-only tests, especially if running the chamber above ambient temperature. Should the wick dry out, it will be harder to supply it with water, which will throw off humidity measurements the next time a humidity test is run.

Note: Bacteria adhering to the wet-bulb wick can proliferate during tests and block water supply. Wash hands with soap and water before handling the wick.

Procedure:

1. Remove the wet-bulb wick from its bag
2. Gently fold the wick in half and slide over the sensor

Note: Make sure the tail end of the wet-bulb wick is aligned with the tip of the wet-bulb temperature sensor. Humidity control can be destabilized if the sensor is overly exposed or if the sensor is out of position.

3. Gently unfold and insert bottom portion of the wick in the central slot of the wick pan

FIGURE 7.1.HOW TO SET THE WET-BULB WICK



7.2.2 Product Temp Protector Trip Test

Before every test, test-trip the product temp protector.

Procedure:

1. Press the START/STOP key on the F4T controller. The chamber will start up.
2. Set the Product Temp Protector overheat setting about 5°C lower than chamber temperature. If the overheat protector is working properly, the Fault display on the F4T will come on and the chamber will stop running when temperature inside the chamber reaches the product temp protector setting. If the Fault display on the F4T does not turn on, something is wrong with the equipment. Contact [ESPEC Customer Support](#).
3. The Product Temp Protector will automatically reset when the temperature inside the chamber falls below the trip setting.
4. Set the Product Temp Protector overcool setting 5°C warmer than the chamber's setpoint. If the Product Temp Protector is working properly, a buzzer will sound, the Alarm screen will appear on the display, and the chamber will stop running when temperature inside the chamber reaches the Product Temp Protector overcool setting. If a buzzer does not sound for one or both of the above tests, something is wrong with the equipment.

7.3 Maintenance

WARNING	
	UNPLUG THE CHAMBER! WHEN MAINTENANCE IS PERFORMED ON THE CHAMBER, UNPLUG THE CHAMBER FROM THE POWER RECEPTACLE AND UNPLUG BOTH THE SPECIMEN AND TIME SIGNAL PLUGS FROM THE OPTION PANEL. THIS IS THE ONLY SAFE METHOD IN MAKING SURE THERE IS NO ELECTRICAL POWER ANYWHERE ON THE CHAMBER.

7.3.1 Condenser Cleaning

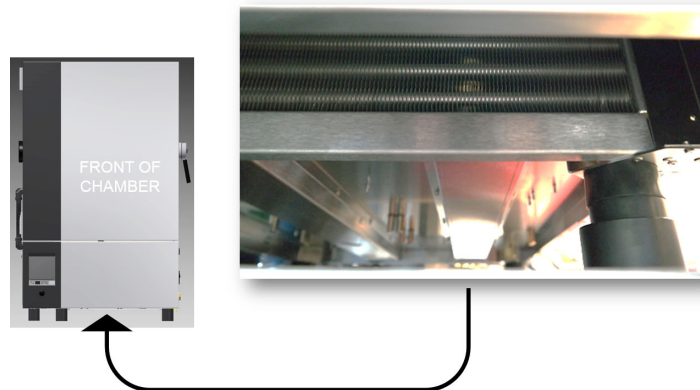
Clean the condenser to remove dust and improve chamber efficiency and safety.

Note: Not required on models with liquid nitrogen cooling only

Procedure:

1. Unplug the cabinet from its electrical outlet or turn off power supply to chamber
2. Remove dust with a vacuum cleaner or by rinsing

FIGURE 7.2. LOCATION AND VIEW OF CONDENSER



7.3.2 Steam Generator Cleaning

During operation, dirt and foreign matter stick to the steam generator and humidifying heater. To ensure long lasting use, clean the generator and heater of dirt once a month. A good way to inhibit dirt from accumulating is to drain the humidifying tray after every test.

CAUTION	
	SHARP EDGES! BE CAREFUL OF PROJECTIONS OR SHARP EDGES INSIDE THE CHAMBER. FOR YOUR SAFETY, ALWAYS WEAR GLOVES WHEN WORKING INSIDE THE CHAMBER.
	HOT ON THE INSIDE! DURING AND SHORTLY AFTER OPERATION, THE STEAM GENERATOR IS HOT AND HUMID ON THE INSIDE.

Procedure:

1. Unplug chamber power cord
2. Turn off humidity water supply to the chamber
3. Remove chamber rear access panel. Humidifier is inside on left hand side
4. Open humidifier drain valve
5. Loosen thumbscrew clamp and quick disconnect drain fitting. Carefully remove bottom cup. Retain Teflon ring.
6. Clean sediment/dirt from bottom cup
7. Clean scale from heater and humidifier body
8. Replace Teflon ring onto bottom cup and realign cup with humidifier body. While holding the bottom cup in place, tighten the thumbscrew clamp.
9. Tighten thumbscrew clamp and reattach drain



10. Clean debris from float cup and level control float
11. Close humidifier drain valve
12. Turn humidity water supply on
13. Check for leaks
14. Replace chamber rear panel
15. Plug in chamber power cord



7.3.3 Test Area Cleaning

Dirt and foreign matter inside the test area can throw test results off. Clean the test area before every test.

Procedure:

1. Open the chamber door.
2. Wipe walls and parts clean with a soft cloth.
3. Close the door.

7.3.4 Take-Down Before Long Periods of Inactivity

Before inactivity of three days or more, dry the test area to prevent mildew or scale formation. Failure to do so can affect testing and shorten equipment service-life.

Procedure:

1. Check that the main power cord is plugged in or main power is ON
2. Set target temperature to 20°C and turn OFF humidity control, if applicable
3. Press the START/STOP key on the F4T controller
4. Run the chamber for about 60 minutes with the door closed
5. Press the START/STOP key on the F4T controller
6. Open chamber door and leave open
7. Unplug chamber power cord or turn OFF main power
8. Drain steam generator, if applicable

7.4 User-Level Servicing

7.4.1 Resetting Circuit Protector

When a circuit protector trips it can be reset manually.

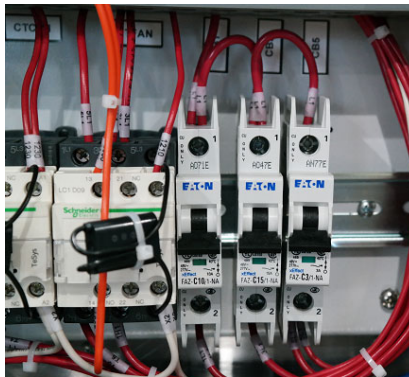
Note: If a circuit protector trips soon after being reset, contact [ESPEC North America](#).

DANGER	
	UNPLUG THE CHAMBER OR TURN OFF POWER MAIN! PRESSING THE ENABLE BUTTON OFF DOES NOT MAKE IT SAFE TO OPEN THE ELECTRICAL BOX OR BREAKER ACCESS AREA. THE ONLY SAFE METHOD OF ACCESS IS TO TURN OFF ALL POWER AND UNPLUG POWER MAIN, SPECIMEN POWER AND TIME SIGNAL PLUGS.

Procedure:

1. Unplug chamber from the power source
2. Open the circuit protector access panel (Phillips screwdriver required). Locate removable panel.

FIGURE 7.3.VIEW OF CIRCUIT PROTECTORS IN THE OFF POSITION



3. Locate the tripped circuit protector. To reset, move the protector to the off position and back to the on position.
4. Secure access cover with all fasteners

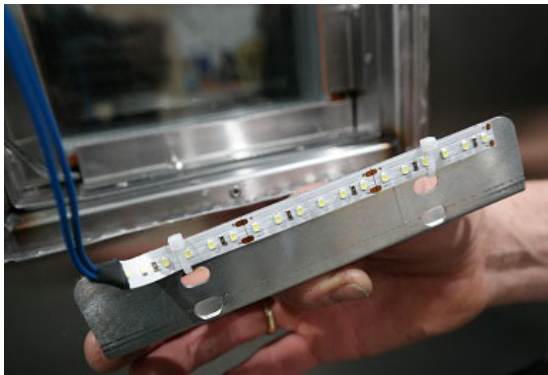
7.4.2 LED Strip Replacement

Procedure:

1. Set main power switch to OFF position
2. Remove screws from top and bottom of viewing window frame
3. Cut cable ties and remove screws from light panel



4. Disconnect power connector and replace LED strip. See replacement parts list for chamber model.



7.4.3 Defrosting

Frost may form on the refrigeration cooling coil in temperature operations below 40°C. Defrost the chamber in the following cases.

- If temperature inside the chamber is uncontrollable or rises slowly.
- If air blowing from the chamber is weak (when the door is opened).
- If frost or ice form on the test area wall.

Procedure:

1. Check the chamber is plugged in and main power is ON
2. Set target temperature to a minimum 70°C and turn OFF humidity control, if applicable.
3. Press START/STOP to start chamber. Run the chamber for about 60 minutes with the door closed, then for 15 minutes with the door slightly cracked.

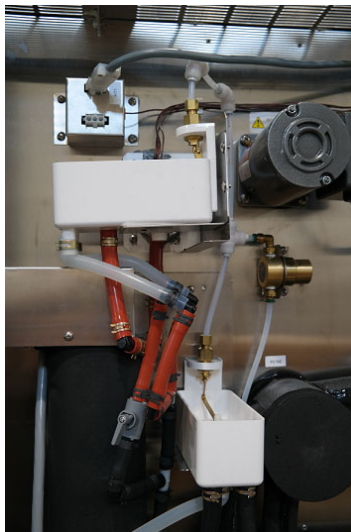
7.4.4 Checking Water Level in the Wick Pan

If water level in the wick pan is low or high, regulate it following procedure below.

Procedure: Regulate water level

1. Stop the supply of water and drain the water from inside the pan by slowly opening the valve below the water level regulator
2. Loosen the screws that hold the wick cup
3. Adjust the wick cup to the correct height
4. Tighten screws
5. Repeat steps 1-4 until water level is correct

FIGURE 7.4. WATER LEVEL IN WICK PAN



7.4.5 Humidifier Level Check (Size 4 Chamber Only)

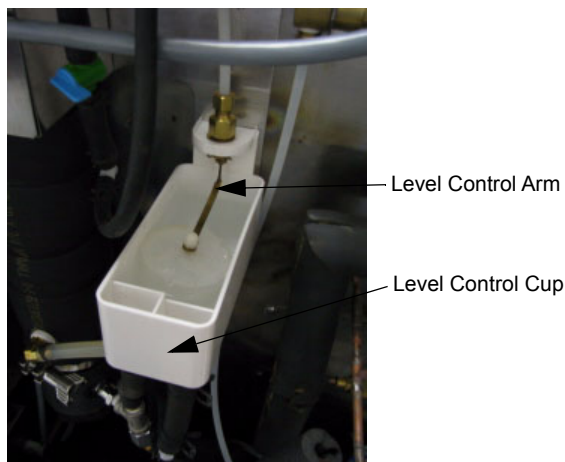
The chamber will need to have power applied, water supplied, and the controller power ON. The chamber should not be running when checking the water level.

Procedure: Check water level in control cup

1. While the chamber is NOT running, observe the water level in the humidifier level control cup.
2. The water level in the cup should be regulated at 1" - 1 1/4" from the top edge of cup. If the level is not at this level, follow procedure below.

Procedure: If water level in the level control cup is low or high -

1. Stop the supply of water and drain the water from the level control cup and steam generator by opening the steam generator drain valve.
2. Slightly bend the level control arm up to increase the level in the cup, or down to lower the level in the cup.
3. Close the steam generator drain valve and re-supply water to the chamber.
4. Repeat steps 1-3 when the water level cannot be adjusted in one try.



Note: Water level cup does not have a lid on it, this is intentional and does not mean that your chamber is missing a part.

7.5 Consumable Parts and Replacement Interval

Parts listed must be replaced periodically. Promptly replace them at the specified interval if not sooner. Maintenance service is also provided by ESPEC North America. For spare parts and servicing, contact **ESPEC Customer Support**.

TABLE 7.3. CONSUMABLE PARTS AND REPLACEMENT INTERVAL

Part	Replacement Interval	Replacement Procedure
Door Gasket	3 Years	Contact the place of purchase or ESPEC
LED Strip	Change the LED after every 50,000 hours of service whenever the LED becomes too dim or stops working	See “LED Strip Replacement” on page 47.
Humidity Wick	2-4 weeks depending on water quality	See “Product Temp Protector Trip Test” on page 42

Chapter 8

Troubleshooting

This chapter explains equipment problems and how to remedy them. When a problem is detected by the fault circuit, chamber operation is stopped and the Alarm will display on the controller. For a list of various faults or alarms and possible causes and remedies, [See “Alarm on F4T Display” on page 53](#). For problems not found with self-checks and help with operator errors, [See “Operator Error and Additional Troubleshooting” on page 54](#).

8.1 Chamber Faults

DANGER	
	ELECTRIC SHOCK! BEFORE WORKING ON THE POWER CIRCUITS, UNPLUG CHAMBER OR POWER OFF MAIN. UNPLUG THE SPECIMEN POWER AND TIME SIGNAL CONNECTORS FROM THEIR SOCKETS. TAKE MEASURES TO PREVENT ACCIDENTAL CHARGING. WORKING WITH PRIMARY POWER SUPPLY ON RUNS THE RISK OF ELECTRIC SHOCK. UNPLUG POWER FROM THE CHAMBER BEFORE OPENING THE ELECTRICAL COMPARTMENT PANEL.

The chamber is equipped with an alarm indicator on the F4T controller display when problems occur. After trouble has been corrected, alarms can be cleared by pressing fault is cleared on display.

For problems not found with self-checks, [See “Operator Error and Additional Troubleshooting” on page 54.](#)

If the issue is not resolved, contact [ESPEC Customer Support](#).

8.1.1 Alarm on F4T Display

The following faults will cause the Alarm Indicator on display to be illuminated and the chamber to be shut down:

TABLE 8.1. ALARM TABLE

Type	Device	Trouble	Cause	Remedial Action
1st	Product Temp Protector	Test area temperature exceeds the setting (left side of chamber by option panel).	Temperature was driven up by heat generated from specimens or the protector is set too low	Press START/STOP on controller. Chamber will stop running. Remove heat sources from the test area and set the protector higher. Press CLEAR button to reset the alarm and press START/STOP to turn back on. If the same alarm occurs again, call for service.
			Possible causes include infiltrating of outside air, excessive cooling, the effects of cooling sources inside the chamber, and the protector being set too high	Press START/STOP on controller. Chamber will stop running. Check that the test area door and cable port are closed. If caused by excessive cooling sources inside the test area, reduce their number. Press the CLEAR button to reset the alarm and press START/STOP to resume testing. If the same alarm occurs again, call for service.
	MTS	The thermal protector in the air circulator motor tripped because of abnormally high temperature	The air circulator motor is overloaded. Fan or fan shaft is binding or obstructed.	Press START/STOP on controller. Chamber will stop running. Remove shaft/fan obstruction and leave the chamber OFF for a while to cool the air circulator. Press CLEAR button to reset the alarm and press START/STOP to resume testing. If the same alarm occurs again, call for service.
	WTS	The humidifier's boil-dry protector tripped because of high surface temperature	Humidifier surface temperature rose above the trip temperature	Press START/STOP on controller. Chamber will stop running. Check water level in the humidifying tray water level regulator. Leave the chamber OFF for a while to cool the humidifier. Press CLEAR button to reset the alarm and press START/STOP to resume testing. If the same alarm occurs again, call for service.
	Thermal Overheat Protection Module plus Thermocouple	Test area temperature exceeded chamber limits	Test area temperature exceeded chamber limits, possibly due to a component failure	Remove power from machine, and try to determine the cause of the overheat condition. Call service if necessary. The Thermal overheat protection module is self-resetting upon power-up, provided the chamber temperature is below the module threshold. Press START/STOP to resume power. Press CLEAR button to reset the alarm and resume testing. Monitor chamber temperature to make sure it does not exceed set limit.

8.2 Operator Error and Additional Troubleshooting

DANGER	
	ELECTRIC SHOCK! BEFORE WORKING ON THE POWER CIRCUITS, UNPLUG CHAMBER OR POWER OFF MAIN. UNPLUG THE SPECIMEN POWER AND TIME SIGNAL CONNECTORS FROM THEIR SOCKETS. TAKE MEASURES TO PREVENT ACCIDENTAL CHARGING. WORKING WITH PRIMARY POWER SUPPLY ON RUNS THE RISK OF ELECTRIC SHOCK. UNPLUG POWER FROM THE CHAMBER BEFORE OPENING THE ELECTRICAL COMPARTMENT PANEL.

This section explains problems not found with chamber self-checks and cases of operator error. If the issue is not resolved, contact [ESPEC Customer Support](#).

TABLE 8.2. OPERATOR ERROR AND ADDITIONAL TROUBLESHOOTING

Trouble	Cause	Remedial Action
The instrumentation panel does not light up	Primary power supply is OFF	Activate the primary power supply
Strange odors are detected	Lingering odors inside the chamber	Clean the test area. See “Test Area Cleaning” on page 45.
	Specimens are generating odors	Remove the source of the odor
The chamber is wet on the outside	The room is highly humid	There is nothing wrong with the equipment. Proceed as planned.
	The door is not completely latched	Close the door. See “Door Operation” on page 20.
Temperature and Humidity is unstable	Ambient temperature changes more than 5°C/hr	Stabilize ambient temperature and resume testing
	High heat load equipment is being turned ON/OFF	Reduce the heat load
Temperature heat-up/pull-down rate does not satisfy specifications	The door is not completely latched	Close the door. See “Door Operation” on page 20.
	Specimen heat load is high	Reduce the amount of specimens
	Ambient temperature is too low/high	Raise/lower ambient temperature
	The condenser is clogged. (models without LN2 only)	Clean the condenser. See “Condenser Cleaning” on page 43.
	Poor LN2 Supply (BT-1LN only)	Verify LN2 supply to chamber
Temperature gradually rises higher than the target temperature	Specimens are generating heat	Reduce the amount of heat generated by specimens

TABLE 8.2. OPERATOR ERROR AND ADDITIONAL TROUBLESHOOTING

Trouble	Cause	Remedial Action
Temperature (or Humidity) rises or lowers too slowly.	The door is not fully latched	Close the door. See “Door Operation” on page 20.
	Specimens are generating heat	Reduce the amount of heat generated by specimens
	Ambient temperature is too low or too high	Raise or lower the ambient temperature
	Circuit protector for compressor or heater is tripped	Reset circuit protector. If it trips a second time call for service
Temperature stops rising or begins to drop during heat-up	Frost has formed on the dehumidifier-cooler	There is nothing wrong with the equipment. Proceed as planned. Or, defrost the chamber. See “Defrosting” on page 48.
Poor temperature uniformity	Air flow inside the chamber is poor	Improve air flow by rearranging specimens. Be sure not to block the air supply or return. See “How to Arrange Specimens” on page 35.
	Specimens are generating heat	Reduce the amount of heat generated by specimens
The chamber LED does not work	The strip connection is loose or needs to be replaced	See “LED Strip Replacement” on page 47.

Chapter 9

Warranty & Procedure

Warranty

WARRANTY CALL EFD 0895 01/29/15

This warranty policy is applicable to all chamber models.

ACCEPTANCE LIMITED TO FOLLOWING TERMS: A party seeking to purchase ESPEC NORTH AMERICA, INC. products (the "Buyer") is strictly limited to the following terms. These terms supersede all prior agreements and understandings between the parties, and these terms shall not be varied or waived without the express written authorization of ESPEC NORTH AMERICA, INC. ("ESPEC").

TECHNICAL INFORMATION/SPECIFICATIONS: All commercial and technical details and information furnished by ESPEC relating to its products, including without limitation, drawings, weights and dimensions, and all performance specifications quoted by ESPEC, are approximations only unless specifically provided to the contrary.

PRICES: The prices for goods to be sold do not include sales, use, excise or any other taxes, charges or expenses related to the sale, delivery, use or consumption of the goods to be sold. The Buyer agrees to directly pay when due all such taxes, charges or expenses to the extent possible and to promptly reimburse ESPEC for all such taxes, charges or expenses which ESPEC pays.

The prices for the goods to be sold are based on details, information and specifications provided by the Buyer, including without limitation, the delivery date and place for the goods, engineering standards and installation site conditions. All such details, information and specifications are assumed to be proper, correct and complete. Any addition to or impropriety, incorrectness, incompleteness or change in any such details, information and specifications may result in a change in the purchase price for the goods sold, which change ESPEC may unilaterally make and Buyer shall pay.

Except as otherwise specifically provided, the purchase price shall be paid by the Buyer in U.S. dollars.

PAYMENT TERMS: Full payment for the goods shall be due within 30 days after ESPEC delivers the goods alongside the carrier at ESPEC's plant.

ESPEC may impose a late charge for each payment under a Contract of Sale not made when due in an amount not to exceed 5% and may charge interest on any late payment from the due date at the highest rate permitted by law.

Buyer shall repay ESPEC all attorney's fees ESPEC incurs collecting late payments or unpaid accounts.

LIMITED WARRANTY: A limited warranty is given by ESPEC to the original buyer of new ESPEC equipment. Subject to the conditions and limitations below, ESPEC warrants that the equipment manufactured by ESPEC is free from defects in material and workmanship which would render the equipment unfit for normal and recommended use.

This limited warranty is effective only for the 360 days after the date of shipment.. During this period, ESPEC will provide repaired or replacement parts without charge. This warranty covers all components, labor, installation and associated expenses for the replacement parts, subject to the exceptions below.

This limited warranty does not cover:

Parts, labor and installation for the following components: light bulbs, port plugs, fuses, deionizer cartridges, wiper blades, plug-in relays, wick socks, water filters, plug-in timers, fasteners, recorder pens, chart paper, nor water level, flow regulated or height level adjustments.

Defects or damages arising as the result of shipment by common carriers or private transportation unless ESPEC contractually assumes the risk of damage to the equipment during shipment.

Defects, damages or malfunctions caused by parties other than ESPEC, including but not limited to defects, damages or malfunctions arising as the result of improper utilities, mishandling, modification, abuse, misuse, neglect, intentional damage, improper repair, loss of refrigerant or improper maintenance, start-up or installation of the equipment.

Defects or damages arising as the result of accident, flood, fire, earthquake or other act of God.

This is the EXCLUSIVE remedy as between you and the Company with respect to the equipment provided to you, and ESPEC SHALL NOT BE LIABLE FOR LOSS OR DAMAGE TO PROPERTY INCLUDING LOSS OR DAMAGE CAUSED BY FIRE OR EXPLOSION OR FOR ANY ASSOCIATED INCIDENTAL OR CONSEQUENTIAL LOSS OR EXPENSE, due directly or indirectly to the use of the equipment.

Except as described above, ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, including the implied warranty of MERCHANTABILITY are disclaimed and excluded.

This limited warranty is only valid in the contiguous states of the United States of America and a 150 mile radius from the following Canadian cities; Vancouver, Toronto, Windsor and Ottawa.

INDEMNIFICATION: Buyer shall defend, indemnify and hold seller harmless from and against all claims, liabilities, losses, damages, settlement expenses, and/or attorney's fees, for injury or death of any person and/or the damage or loss of any property allegedly or actually resulting from or arising out of the use or failure of the equipment unless such losses are solely and completely the result of ESPEC's negligence. Without limiting the foregoing in any respect, Buyer's indemnification duty shall arise out of any misuse of the equipment or any other negligent or wrongful act or omission of the Buyer or its employees, agents, and/or subcontractors, or any person or entity who purchases or gains access to the equipment through the Buyer whether or not ESPEC or any other person or entity is jointly negligent in the design, manufacture, instruction, training, provision of warnings, selection, delivery, repair, maintenance, possession, use, operation or return of the equipment.

DELIVERY/RISK OR LOSS: The risk of loss with respect to the goods to be sold will pass to the Buyer at ESPEC's plant upon the delivery of the goods alongside the designated carrier; and all shipping costs, losses, liabilities and damages and all insurance and delivery obligations with respect to the goods once delivered by ESPEC alongside the carrier at ESPEC's plant, are the Buyer's risk and responsibility, although ESPEC will give reasonable assistance to the Buyer in tendering claims to the carrier.

GOVERNING LAW: Any offer made by ESPEC or any contract entered into by ESPEC and the Buyer shall be construed and interpreted only according to the laws of the State of Michigan, U.S.A., including without limitation, the Uniform Commercial Code as in effect in the State of Michigan, U.S.A. In that regard, Buyer and Seller specifically agree and acknowledge that the provisions of the United Nations Convention on Contracts for the International Sale of Goods shall not apply to the rights and obligations of the parties under the Contract.

VENUE: The Buyer hereby agrees that any suit or claim relating to the sale or operation of ESPEC's products shall be filed in the Michigan Circuit Court for Kent County or in the Federal Court for the Western District of Michigan.

Std/360/360 EFD 0897 08/21/15 Rev. 1.03

ESPEC Warranty Procedure

All warranty service and parts calls must be directed to ESPEC Customer Support Department @ 877-463-7732 or 616-896-6100 between 8:00 am and 5:00 pm Eastern Time, or email to support@espec.com

Unauthorized service during the warranty period may void warranty.

Certain types of service during the warranty period will require a purchase order prior to service.

Before you call, check the following items:

1. Follow the steps in the Troubleshooting and Maintenance Chapters of this manual
2. Confirm that all utilities are connected to the chamber and functioning properly
3. Locate the ship date on the chamber data tag
4. Confirm the chamber is within the warranty period by reading the Warranty in this manual

When placing the call, be sure to have the following information available:

1. Chamber Model and Serial Number that is located on the side of the chamber
2. Detailed information on the suspected failure and/or alarm detail
3. Operating mode at time of failure, i.e., heating, cooling, temp., humidity
4. Detail of program being run at the time of failure and a copy of recorder chart or test data, if available

To order a replacement part, please provide the following:

1. The complete ESPEC part number from your replacement parts list.
2. Model and serial number of the chamber for which the replacement part is being requested.
3. The specific complaint regarding the failed part.

The Customer Support Department will authorize the return of the failed material and issue an RMA (Return Material Authorization) number.

1. Put the RMA number on the packing list along with the name and phone number of a contact person.
2. All parts being returned may be shipped freight collect via:
 - 0 – 70 lbs. – UPS surface
 - 71 lbs. and over – Contact ESPEC for routing instructionsAny other means of shipment will result in an additional charge to the customer.

Any failed part, replaced under terms of the warranty, and not returned to ESPEC when an RMA is issued, will be invoiced at the current price.

All parts are shipped FOB Hudsonville, MI 49426

Chapter 10

Appendix

10.1 Glossary

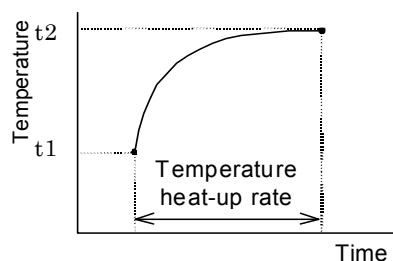
Air-Cooled Specifications	The condenser in the refrigeration circuit is cooled by air.
Boil-Dry Protector	A device which prevents the humidifying heater from overheating when humidifying water is low or empty.
Constant Control	A control method which keeps temperature and humidity inside the chamber constant.
Dewing	A phenomenon whereby moisture in the air forms a dew. Dew forms on an object if its temperature is below the dew point determined by air temperature and humidity. For example, the dew point for an air temperature of 85°C and a humidity of 85%RH is 81°C.
Dry-Bulb Temperature	The air temperature measured by a dry-bulb temperature sensor.
Effective Area	The area inside the test area up to 1/6 the distance from walls in all directions.
External Alarm Terminal	A terminal which outputs a signal when the chamber is stopped by trouble. The terminal is designed to set off a buzzer or bell in the area around the chamber or to send an alarm signal to a remote point.
Heat Load	The heat generated by specimens inside the chamber. The name comes from the fact that this heat acts as a load on the chamber.
Humidifying Water	Water used to humidify the test area. Water is kept in the humidifying tray. The humidifying heater evaporates it to humidify the test area.
Humidity Fluctuation	The variation between the mean maximum humidity around the geometric center of the chamber. Not the same as the difference from the true humidity.
Humidity Range	The range of humidity that can be reproduced inside the chamber.
Humidity Uniformity	The difference in humidity between the geometric center of the chamber and any arbitrary point in the effective area.
Lowest Attainable Temperature	The lowest temperature that can be reproduced inside the chamber.
Maximum Current	The maximum amount of electric current supplied to the chamber through the power cable when the chamber is running within the temperature and temperature-humidity control range. With a 3-phase power supply, the maximum current is that which flows through any one of the wires. Maximum current is measured in amperes (A).
Product Temp Protector	A device for preventing temperature inside the chamber from rising abnormally high because of chamber trouble or heat generated by specimens, or abnormally low because of chamber trouble with the refrigeration circuit.

Specimens Power Supply Control Terminal

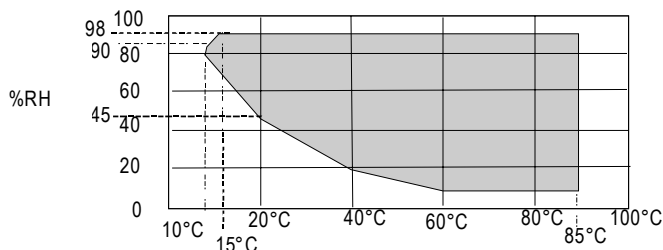
A terminal to charge specimens, which is interlocked with the chamber power circuit so that power to specimens is shut OFF in the event of chamber trouble.

Temperature Fluctuation

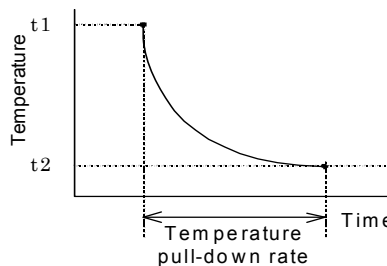
The variation between the mean maximum temperature and mean minimum temperature around the geometric center of the chamber. Not the same as the difference from the true temperature.

Temperature Heat-up Rate**FIGURE 10.1. TEMPERATURE HEAT UP RATE****Temperature-Humidity Control Range**

The range in which temperature and humidity can be reproduced inside the chamber. It is normally expressed as a graph with temperature as the x-axis and humidity as the y-axis.

FIGURE 10.2. TEMPERATURE-HUMIDITY CONTROL RANGE**Temperature Pull-down Rate**

The time required for the temperature to change from a defined temperature t_1 to a defined lower temperature t_2 . This is simply the time required for the drop in temperature and does not include the time it takes for the temperature to stabilize.

FIGURE 10.3. TEMPERATURE PULL-DOWN RATE**Temperature Range**

The range of temperatures that can be reproduced inside the chamber.

Temperature Uniformity

The difference in temperature between the geometric center of the chamber and any arbitrary point in the effective area.

Test Chamber

A contained ambient constructed so as to obtain a desired temperature and humidity.

**Water-cooled Specification
(Water Cooled Condenser)**

The condenser in the refrigeration circuit is cooled by water. Usually, a cooling tower or similar unit is used to supply water and cool heat generated by the condenser. The water-cooled specification is an option with Platinous Series Chambers.

Wet-Bulb Temperature

The temperature measured by a temperature sensor on which a wet cloth has been draped. Is is used to measure humidity. Relative humidity is calculated from this temperature and the air temperature measured by a dry-bulb sensor.

Wet-Bulb Wick

The cloth draped over a wet-bulb temperature sensor. It absorbs water and keeps the sensor wet. Though gauze is used in meteorological applications, a woven cloth is used inside an environmental chamber because of its strong resistance to heat and cold.

