

ALTITUDE CHAMBER CUSTOM SERIES INSTRUCTION MANUAL MODEL NO. EV21 SERIAL NO. 409380



- Read this manual carefully before using the equipment.
 - · Familiarize yourself with all safety precautions before using the equipment.
 - · Keep this manual handy for future reference.

ESPEC NORTH AMERICA, INC.

TABLE OF CONTENTS

1. PRECAUTIONS	
1.1. Substances Which Should Not Be Placed Inside the Equipment	3
1.2. Operation Precautions (General)	5
2. SPECIFICATION	7
3. NAMES AND FUNCTIONS OF PARTS	13
3.1. Control Panel	16
3.3. Watlow Series F4 Controller	17
4. INSTALLATION	18
4.1. Installation Site Check	20
4.2. How to Install	21
5. OPERATION	22
5.1. Chamber Operation	25
5.2. Safety/Fault	26
5.3. Event #1 - Altitude	26
6. SAFETY DEVICES	28
7. EXTERNAL ALARM INLET, CONTROLLED SPECIMEN POW SIGNAL OUTPUT INLETS (OPTIONAL)	
8. INSPECTION AND MAINTENANCE	38
8.1. Table Of Inspection And Maintenance	40
8.2. Preventive Maintenance	41
9. TROUBLE SHOOTING	44
10. WARRANTY	47

1. PRECAUTIONS

This chapter explains safety precautions which should be observed when operating the equipment. Be sure to read carefully and follow instructions so as to prevent harm to personnel, specimens, or the equipment.

1.1. Substances Which Should Not Be Placed Inside the Equipment

 DO NOT introduce the following explosives, combustibles or substances which contain them into the equipment. Moreover, keep these substances away from the equipment and immediate area. When exposed to excessive heat, these substances may cause fires and/or explosions.

Explosive Substances

Nitroglycol, nitroglycerine, nitrocellulose and other explosive ester nitrates.

Trinitro-benzene, trinitrotoluene, picric acid and other explosive nitrocompounds.

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 (32°F) 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.

/!\ CAUTION

DO NOT introduce corrosive substances into the equipment.

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.

Corrosive substances include, but are not limited to, chlorine, chlorides and acids. 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.

1.2. Operation Precautions (General)

Observe the following precautions when using the chamber.

/ DANGER

- Ground the equipment WITHOUT FAIL.
 For details on grounding, see 4.2.3. Grounding Work on page 21.
- Use only the specimen power supply control terminals to apply voltage to specimens.

! CAUTION

- HOT AIR BLAST WHEN OPEN! Use caution when opening the door during and shortly after operation at high temperature.
 Hot air is blown from inside the chamber when opened.
- HOT ON THE INSIDE! During and shortly after operation above 55°C, the inside surface of the door will be too hot to touch. Direct contact may result in burns. Wear heat resistant gloves.
- Avoid ON-OFF operation of the refrigeration for short periods of time. (Less than 5 minutes.)

2. SPECIFICATION

The following specification is specific for your chamber. Read carefully prior to chamber installation.

PREPARED B'	Y	05/09/08 GLM		Model	Drawing No.	Spc. No.	409380	1/1
	Α	12/17/08 GLM						
	В		ALTITUDE			8	SME	
REVISION	С		CHAMBER SPECIFICATION					
	D						•	
	Ε							

1. Product Name

Model

3. Temperature Control System

4. Performance

4.1. Altitude Performance

4.1.1. Altitude Range

4.1.2. Altitude Fluctuation

4.1.3. Altitude Transition

5. Dimensions

5.1. Exterior

Altitude chamber.

EV21.

Bi-modal altitude PID.

With clean, dry, chamber. Site level to 15,000 ft.

±500 ft.

From site level to 15,000 ft within 20 minutes.

Model	Wi	dth	De	pth	Hei	ight1	We	ight
IVIOUCI	ln.	mm.	ln.	mm.	ln.	mm.	Lb.	Kg.
EV21	53.8	1544	48.2	1283	79.7	1854	3000	1364

5.2. Interior

Model	Wi	dth	De	Depth Height		Volume		
Model	ln.	mm.	ln.	mm.	ln.	mm.	Ft³	m^3
EV21	35.0	889	35.0	889	30.0	762	21	0.59

6. Site requirements

6.1. Ambient Temperature

6.2. Electrical Power

6.2.1. Chamber Service

6.3. Vacuum Pump Vent

6.3.1. Connection

6.3.2. Flow

7. Construction

7.1. General Material

7.1.1. Altitude Vessel

7.1.2. Color

7.2. Door

7.2.1. Size

7.2.2. Configuration

7.2.3. Window

7.2.4. Hinge/Latch

7.2.5. Gaskets

7.3. Test Space

7.4. Instrumentation Panel

7.5. Machinery Compartment

7.5.1. Rear

7.5.2. Inside

Allowable Range of Operation: 5 to 35°C (41 to 95°F). Range of Assured Performance: 10 to 25°C (50 to 77°F).

460V, 3PH, 60HZ.

15A.

7/8" copper stub.

15 scfm.

Welded steel plate with structural reinforcement to withstand all

pressures below ambient.

Medium gray inside and out.

Full Opening

Hinged on right side.

Pressure pane, 11"W x 11"H view, with integral fluorescent light.

Floating altitude hinges / handwheel latches.

Neoprene.

Cables extending through cable glands, AC power plug/receptacle

panel, overtemp limit temperature detector.

Altitude programmer/controller, chamber control switches, overtemp protector, run time meter, specimen power and external alarm inlets.

Vacuum pump vent outlet.

Vacuum pump, altitude control valves, altitude transducer.

ISSUED BY ESPEC NORTH AMERICA, INC.

¹ Including components protruding on top of chamber structure.

Spc. No. 409380 2/2

8. Altitude System

8.1. Vacuum Pump 1.5 hp, 15 cfm nominal pumping capacity, with oil mist eliminator.

Control Valves Solenoid climb (throttle) and dive (bleed) valve.

Manual override dive safety valve.

Absolute pressure transducer with pressure to altitude signal

conditioner.

9. Instrumentation

Altitude Measurement

8.2.

9.1. Model
10. Safety Devices
Altitude programmer/controller......Watlow F4.
Fuse
for control circuit.

Overload for vacuum pump motor.

Pressurization check valve for chamber.

Adjustable overtemp for chamber.

Specimen power supply control for specimen power interlock.

External alarm terminal for equipment.

11. Accessories

11.1. Maintenance Items Fuse(s), light bulb, mating plugs for specimen power and external

alarm inlets.

11.2. Documentation Chamber operation manual.

Control operation manual. Replacement parts list.

12. Included Features

12.1. Shelf Adjustable height stainless steel welded wire shelf.

12.2. Port 4" dia, with bolted/gasketed cover.

12.3. Recorder Yokogawa FX-106, 6 chan paperless recorder. Flash memory data

storage, and ethernet communication port. Data view software

included.

Chan 1: chamber altitude.

Chan 2-6: spare.

12.4. Computer Interface RS-232 for Watlow F4.

12.5. Software WatView RT remote monitoring/control software.

Spc. No. 409380 3/3

12.6. Cable Feedthroughs

Through chamber left side wall as follows (see drawing C-409380-001):

Feedthrough	Seal Type	Feedthru Type / ID	Gender/Termination/Length			
#			Atmosphere	Vacuum		
Connection 1						
1	Cable gland (2.5")	1) Ribbon cable (460939-04) ²	M / connector / TBD	F / header / TBD		
		1) 2-coax with overbraid ³ (460895-04) ²	MF / connector / TBD	2)M / connector		
2	Sealed bulkhead	2) SMA 50 ohm coax	M / SMA / NA	M / SMA / NA		
3	Sealed bulkhead	with overbraid (460894- 05)	M / SMA / NA	M / SMA / NA		
Connection 2						
4	Sealed bulkhead	15-pin sub-D bulkhead	M / mates with 30-460872 female end / NA	F / mates with 30-460872 male end / NA		
5	Sealed bulkhead	15-pin sub-D bulkhead	M / mates with 30-460872 female end / NA	F / mates with 30-460872 male end / NA		
6	Sealed bulkhead	15-pin sub-D bulkhead	M / mates with 30-460872 female end / NA	F / mates with 30-460872 male end / NA		
Connection 3						
7	34" NPT molded multi- conductor feedthu	115 vac power	M / computer power inlet / NA	F / NEMA 5-15 receptacle / NA		
		115 vac power	F/ NEMA ML2 receptacle (mates with 460819-01 male end) / NA	M / NEMA ML2 plug (mates with 460819-01 female end) / NA		
		Ground	NA / Binding post (for 460620- 02 w/ ring terminal) / NA	NA / Binding post (for 460620-02 w/ ring terminal) / NA		
8	Cable gland (2.5")	Small HD cable (460960- 02) ²	M / connector / TBD	M / connector / TBD		
		Large HD connector (460749-02) ²	M / connector / TBD	M / connector / TBD		
9	Sealed bulkhead	26-pin HD sub-D bulkhead	M / mates with 460996-03 female end / NA	F / mates with 460996-03 male end / NA		
10	Tubing bulkhead	1/4" ID tubing	NA / ¼"hose barb fitting / NA	NA / ¼" hose barb fitting / NA		

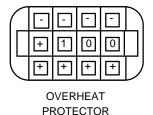
² Customer supplied cables routed through cable gland.

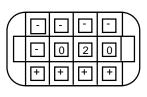
³ Requires removal of overbraid where coax cable passes through cable gland.

3. NAMES AND FUNCTIONS OF PARTS

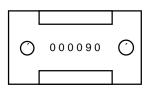
This chapter identifies parts found on the chamber instrumentation and operating panel by name and function.







OVERCOOL PROTECTOR



HOUR METER

Chamber Lamp Operation Switch

(If chamber is equipped with chamber light)

This switch is used to switch the chamber lamp on and off.

To preserve the life of the lamp (bulb), it should only be used to visually inspect the chamber specimen.

Overheat Protector

This temperature controller protects the specimen from high temperatures. It should be set to the maximum allowable temperature for the specimen.*

Note

The main controller has a function to prevent the chamber from overheating, so this temperature controller should be used to protect the specimen from overheating.

Overcool Protector (Option)

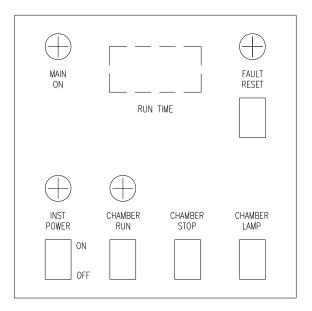
This temperature controller protects the specimen from low temperatures. It should be set to the minimum allowable temperature for the specimen.*

*When in program operation, this should always be set at least 10°C higher (lower) than the maximum (minimum) step temperature.

Hour Meter

This is an accumulating display of operating hours. It can be used to monitor operating time and determine the regular inspection and maintenance intervals. When the machine is in an abnormal state, the hours are not accumulated.

3.1. Control Panel



3.2. Switch / Light Panel

3.2.1. Main On Light

Indicates Main Power Disconnect is On.

3.2.2. Instrument power/Light

Applies power to the instrumentation.

3.2.3. Chamber Run/Light

Enables power to motors and solenoids.

3.2.4. Chamber Stop

Disables power to motors and solenoids.

3.2.5. Fault Reset/Light

Silences the alarm buzzer.

3.3. Watlow Series F4 Controller

This conditioner uses a Watlow Series F4 Controller.

Note



Refer to the Watlow Series F4 Manual for additional controller information.

4. INSTALLATION

This chapter explains how to install the chamber and prepare for tests. Be sure to ready the parts on installation even if having the chamber installed by the place of purchase or ESPEC Corp. Also, refer to this chapter whenever relocating the chamber.

4.1. Installation Site Check

This section describes installation site and space requirements.

Installation Site

Install the chamber in a location which can satisfy the following conditions.

- On a flat, level floor (at the time of installation, use a level on the test room floor to confirm that it is level) 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 is well-ventilated.
- Where ambient temperature is +5 ~ +35°C and free of sharp temperature fluctuations.
- In a dust-free room.
- Where it is not exceptionally wet or humid.
- Away from flammables and explosives.
- Where not exposed to combustible or corrosive gases.
- Near to power, water and drainage utilities.
- Not directly underneath or near to fire alarms.

4.2. How to Install

Electrical

The electrical schematics reference the correct power requirements and connections from house power to the chamber. As a further check, verify correct rotation of the chamber circulator fans. Voltages used to operate this equipment are considered high voltage and caution should be exercised when making connections.

Grounding Work

Connect the grounding conductor to the grounding lug in the electrical box and the other end to the grounding conductor or other proper grounding means prepared by the user. (See Article 250 of the NFPA NEC on grounding or consult with a qualified electrician.)

! CAUTION

Care should be taken when using a city water pipe as a grounding pole since resin pipes (PVC pipe) may be used in between the piping in which case grounding isn't effective.

Do not ground to a city gas or LP gas pipe.

Refrigeration Machinery

Remove packaging material, shipping bolts, etc. from compressors during installation.

Copeland Semi-hermetic Compressors are spring mounted, but tightened down prior to shipment. Check the compressors and insure that all shipping bolts, supports, packaging materials, etc. are removed so that the compressors are free to float on their springs.

If the chamber has remote refrigeration:

- Set the machine package and chamber in their final position and secure them in place with lag bolts.
- Interconnect the refrigeration section per the supplied prints.
- Once the refrigeration piping has been completed, it is necessary to leak check the interconnect piping that has been added to the circuit.
- When leak checking has been completed, the valves on the compressors and on the condenser tanks that are tagged, must be opened before the power is connected to the unit.

Check all connections to insure that there are no obvious leaks from any joints as a result of shipping vibration. If your chamber is shipped with gauges, the gauges should be checked to insure that the system is fully charged before turning the power on.

Note

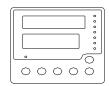
Main power must be on until the compressor crankcase of the high stage compressor is warm to the touch.

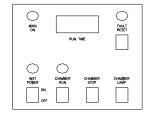
5. OPERATION

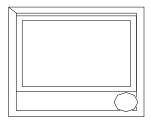
This section describes the operating procedure to be followed after completing the initial inspection and positioning of the specimens.

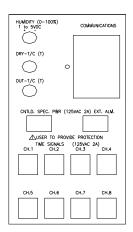
Confirm that the POWER SWITCH CIRCUIT BREAKER, located on the chamber, is ON. The "MAIN ON" pilot light will be illuminated. Press the "INST. POWER" switch, located on the front of the control panel, to apply instrumentation power.

Control System Switch Layout









The chamber is now ready to have a temperature set or a program created. Reference the Watlow F4 Manuals for more detailed information on set point generation and/or programming.

5.1. Chamber Operation

To start chamber operation push the "CHAMBER RUN" switch. This will allow the chamber to execute the controller commands.

Steady State (Non-Programmed) Operation

Pushing the "CHAMBER RUN" Switch does not initiate operation of the vacuum system to execute the F4 Controller steady setpoint. Manually turn on event #1 to enable operation of the vacuum system.

Programmed Operation:

Pushing the "CHAMBER RUN" switch does not initiate a program in the Watlow F4 controller. Watlow F4 program RUN <u>must</u> be initiated in the Watlow F4 controller and event #1 must be turned on in the program to enable the vacuum system.

To stop the chamber operation, manually push the "CHAMBER STOP" switch or set Event # 1 OFF. Event # 1 must be turned ON before the chamber can run again.

Note

Pushing the "CHAMBER STOP" switch does not stop the running of a program in the Watlow F4 controller. The Watlow F4 program STOP <u>must</u> be initiated in the Watlow F4 controller.

The upper controller is a two channel unit. Channel #1 is used to control temperature and channel #2 to control altitude. Channel #1 is set to monitor and control in degrees Celsius and Channel #2 is set to monitor and control in thousands of feet (K. Ft.).

The lower controller is a one channel unit used to control altitude. Altitude can only be run when the chamber temperature is below 85°C and not in humidity mode. When altitude is being controlled and 20K. Ft. are reached, the heating and cooling function of the chamber are stopped.

5.2. Safety/Fault

A SYSTEM FAULT light will illuminate and an alarm buzzer will sound if there is a safety fault within the chamber safety devices. To silence the buzzer, push the FAULT RESET push button.

Note



The SYSTEM FAULT light remains illuminated until the fault has been corrected and the FAULT RESET push button is reset a second time.

5.3. Event #1 - Altitude

Event #1 must be programmed ON to activate the vacuum pump and allow altitude control. The altitude setpoint is controlled by the lower F4 controller.

Check and fill vacuum oil before and during altitude tests (see section 8.1.).

6. SAFETY DEVICES

This chapter explains additional safety devices installed on the chamber for protection of specimens.

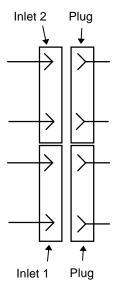
ACTIVATED SAFETY DEVICE CHART

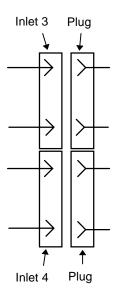
Event	Safety Devices	Signal	State When Activated	Resets
Vacuum Pump	Motor Overload	OL3		
Circuit	Phase Monitor	PPM	Chamber Stops Immediately	Manual
Overheat	Temperature Sensor	OHP		
Controller	PV Alarm	PV Limit		Auto

^{*} Overheat limit setpoint setting can be accessed inside of main electrical panel.

7. EXTERNAL ALARM INLET, CONTROLLED SPECIMEN POWER INLET AND TIME SIGNAL OUTPUT INLETS (OPTIONAL).

Chapter 7. External Alarm, Controlled Specimen Power, and Time Signal Output Inlets





The external alarm inlet is assembled in the safety circuit of the chamber making it possible to transmit an alarm signal to an external safety device. The controlled specimen power inlet 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, thus no damage will occur to either the chamber or the specimen. The time signal output inlets relay the time signal of the temperature and humidity digital programmable controller to an outside source.

The following applies to the controlled specimen power inlet. It is extremely dangerous to stop operation of the chamber while supplying electricity to specimens; therefore, either circuit A or circuit B must be used to ensure the safety of all personnel.

Circuit A: External Alarm Output Inlet

The circuit is of an open state during normal operation of the chamber. When a safety device is activated, the inlet assumes a connected state. See the chart of safety devices.

Circuit B: Controlled Specimen Power Inlet

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

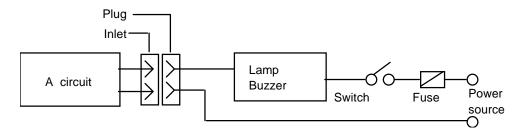
Circuit C: Time Signals (Optional)

When the chamber is operating normally in the program mode, the inlets are connected whenever the programmer sends a time signal. If the temperature programmable controller alarm activates, or if the power is switched "OFF" or is otherwise interrupted, the inlets change to an open state.

! CAUTION

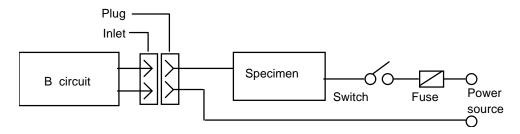
The rated electrical capacity of circuit A is 250VAC 2A. Circuit B is 250VAC 2A, and circuit C is up to AC250V 1A. Verify that the total rating for the devices on the secondary or load side of the connector does not exceed the rating of the circuits A, B or C. Furthermore, it is recommended to use a magnetic contactor, etc. and connect its coil to circuit A, B or C in case the electrical capacity exceeds the rating of circuit A, B or C.

[EXAMPLE 1]



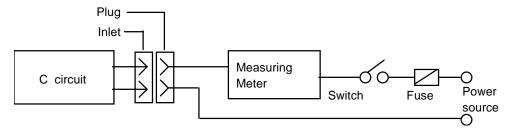
The diagram above is an example of the lamp or buzzer circuit connected to circuit A. In this case, the buzzer will sound or the lamp will light when the chamber stops.

[EXAMPLE 2]



The diagram above is an example of the specimen power circuit connected with circuit B. In this case, power to the specimen is shut off when the chamber stops.

[EXAMPLE 3]

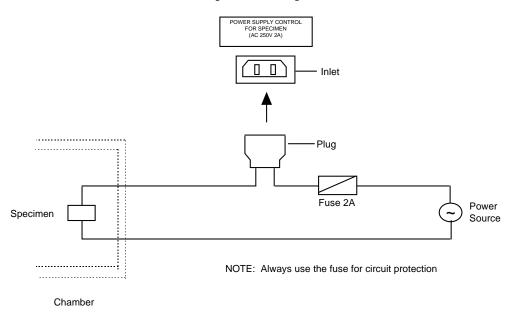


The diagram above is an example of the power circuit using a measuring meter connected with circuit C. In this case, power to specimens is shut off when the programmed step is completed or when the chamber stops.

How to Use Controlled Specimen Power Terminal

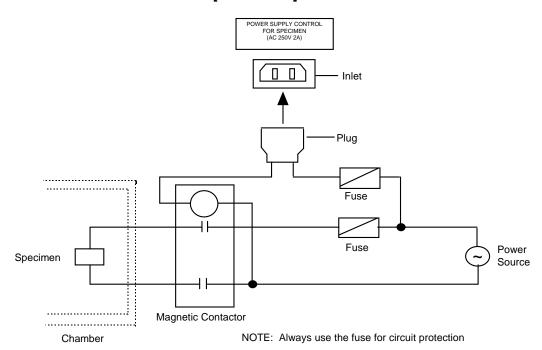
In the Event the Electrical Capacity is less than 2A

[EXAMPLE 4]



In Case of Electrical Capacity at 2A and more

[EXAMPLE 5]



Chapter 7. External Alarm, Controlled Specimen Power, and Time Signal Output Inlets

8. INSPECTION AND MAINTENANCE

Perform the following inspection and maintenance on a regular basis to assure long lasting operation of the chamber.

8.1. Table Of Inspection And Maintenance

Item	Time	Remarks
Checking operation of the	Prior to unmanned operation	Page 41
Overheat (Overcool) Protect	or continuous operation	
Controller Hi limit	Prior to unmanned operation	Page 41
Controller Low limit	or long continuous operation	
Cleaning of chamber	After each operation	Wipe interior surface
interior		with cloth
Cleaning of electrical	Once a year	Wipe with cloth
compartment		
Cleaning of the chamber	Once a year	Wipe with cloth
exterior		
Safety devices	Once a month	Page 41
Electrical covers	Once a month	Page 41
Electrical system	Once a month	Page 41
Electrical current draws	Once a month	Page 41
Seals and gaskets	Once a month	Page 41
Tighten fasteners	Once a month	Page 42
Inspect relief vents	Once a month	Page 42
Motor Shaft Seal	Every 3 months	Page 42
Check Oil Level of Vacuum	Before and during tests	Refer to Vacuum Pump
Pump	_	Manual
Change Oil Mist Eliminator	As required	Change if oil mist output is
Cartridge		excessive. See vacuum pump
		manual.
Vacuum Valves	Once a year	Page 42

8.2. Preventive Maintenance

Operation of Overheat (Overcool) Protector

With the chamber on, set the Overheat (Overcool) protector below (above) the temperature inside the chamber. If it is functioning properly, the alarm buzzer will sound and the chamber will stop.

Temperature High Limit (Low Limit) Operation Test

The temperature and humidity digital programmable controller display should be set to a temperature lower (higher) than the chamber temperature in constant mode. After changing to limit mode, the high limit (low limit) should be set to a temperature lower (higher) than the chamber temperature.

If normal, the alarm buzzer sounds and the power supplied to the heating circuit and humidification circuit is stopped. At the same time, "02:Hi-TEMP Limit" (03:Lo-TEMP Limit) is shown on the display. The operation should be checked especially before a long period of continuous operation or unmanned operation.

Checking Safety Devices

The proper function of the safety control devices must be checked frequently.

- 1. Remove any items in the chamber that might be harmed due to a high altitude condition. Start chamber operation (OHP).
- 2. If the chamber is equipped with a high heat limit, set the heat limit to approximately 10°C below the chamber interior temperature. The OHP should trip and stop chamber operation.
- Increase the setting of the altitude controller to approximately 5000 ft. below the controller altitude. Controller PV limit should trip and stop chamber operation.

Electrical Covers

The electrical system should be inspected to verify that all electrical component covers are properly installed. These covers are provided for operator safety and their absence could expose the operator to electrical hazards.

Electrical System

The electrical system should be checked looking for evidences of chattering relays, pitted or arching relay contacts, and unterminated wires. The electrical panel area should be kept clean and vacuumed if necessary.

Electrical Current Draws

The current draw of the major equipment components should be checked with an amp probe. The readings should be compared with those on the electrical schematics. Amp draws for other major components can be found at the front of this manual in the system description section. Extreme caution should be taken whenever working with high voltage components.

Seals and Gaskets

Inspect gaskets on door for adequate sealing. Remove any foreign material embedded in the gasket. Replace torn or otherwise unserviceable gaskets.

Tighten Fasteners Check the chamber hardware for any loose fasteners that may have been

caused by vibration of constant use.

Inspect Relief Vents Inspect all pressure relief vents on the chamber. Verify that they are in

proper operating condition, providing adequate seals and flow when

required.

Motor Shaft Seals Remove lower plug on motor seal housing, fluid level can be observed at

the lower edge of the hole. If the level is low, add Dextron III ATF into upper

fill elbow until appropriate fluid level is obtained.

Vacuum Valves The climb and dive valves should be checked for leakage every year. Run

chamber to 50,000 ft. in less than 2 hours, if leakage is observed, repair or

replace valve as required.

9. TROUBLE SHOOTING

This chapter explains some basic troubleshooting techniques and remedies.

Unusual States	Causes	Remedies
High heat limit trips	A heat generating load in the chamber is too great.	
Unit will not start	Main power not turned on.	
	Utilities not hooked up or turned on.	See Installation Section (4.0) and piping and wiring schematics.
Unit runs but fails to reach altitude.	Altitude controller set beyond range of unit.	See Specification Section (2.).
	Malfunction of altitude controller.	
	Vacuum pump not operating.	Refer to vacuum pump manual.
	Climb and dive valves leaking.	See Maintenance Section (8.).
	Chamber gaskets not sealing.	Inspect gaskets and repair or replace as required.

10. WARRANTY



ESPEC WARRANTY PROCEDURE

Please follow these steps when requesting warranty service:

- If a chamber fails or you suspect a failure;
 - 1. For help in identifying the problem before you place a warranty call, follow the steps in the "troubleshooting" section of your manual.
 - 2. Confirm that all utilities are connected to the chamber and functioning properly.
 - 3. Locate the ship date on the chamber data tag.
 - Confirm the chamber is within the warranty period by reading the Warranty Policy in the back of your Chamber User's Manual.
- All warranty calls must be directed to ESPEC Customer Support Department @ 800-5-ESPEC-0 between 8:00 am and 5:00 pm Eastern Time, unauthorized service during the warranty period may void warranty. When placing the call, be sure to have the following information available:
 - 1. Chamber Model and Serial Number, located on the data tag.
 - 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.
- Upon receipt of this information, the Customer Support Department will arrange for appropriate service.
- Certain types of service during the warranty period will require a purchase order prior to service.

The following steps apply when requesting warranty parts:

 Contact the ESPEC Customer Support Department at 800-5-ESPEC-0 between 8:00 am and 5:00 pm Eastern Time.

- To order a replacement part, please provide the following:
 - 1. The complete ESPEC part number from your replacement parts list.
 - 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.
- 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 instructions Any 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 Byron Center, Michigan 49315.

This warranty policy is applicable to chamber models beginning with ET, ETO, ETH, ESS, EWP, EWS, EVT, EDC and MAP.

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.

<u>PRICES</u>: 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.

<u>PAYMENT TERMS</u>: 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.

<u>LIMITED WARRANTY</u>: 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 for parts and 90 days for labor 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 or 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.
- Refrigerant after the 90 day labor warranty period.
- 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.
- 4) Defects, damages or malfunctions caused by parties other than ESPEC, including but not limited to defects, damages or malfunctions arising as the result of mishandling, modification, abuse, misuse, neglect, intentional damage, improper repair, loss of refrigerant or improper maintenance, start-up or installation of the equipment.
- 5) 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.

<u>DELIVERY/RISK OR LOSS</u>: 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.

<u>VENUE</u>: 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.



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ESPEC NORTH AMERICA 4141 Central Pkwy Hudsonville, MI 49426

Telephone: 616-896-6100 Facsimile: 616-896-6150