

# LR

*ENVIRONMENTAL  
EQUIPMENT & TEST LAB*

## THERMOTRON MANUAL MODEL S-1.2C



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**NOTE Manual For Reference Only - Actual Chamber May Vary Depending on Model Year, Options, Controllers, and Individual Configuration - Custom Manual Will Be Provided Upon Purchase Of Specific Chamber**

**THERMOTRON**

*A Venturedyne, Ltd., Company*

®

## S-1.2

# Environmental Test Chamber Instruction Manual

*General Description/ Installation/ Operation/ Maintenance/ Service/  
Engineering Drawings*

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## General Safety Instructions

Follow all **WARNINGS** to prevent personal injury or death.

- WARNING:** Dangerously high voltages that could kill you are present in the electrical system. Before doing any electrical work, disconnect the electrical power.
- WARNING:** The gases from gaseous nitrogen (GN<sub>2</sub>) purge systems, liquid nitrogen (LN<sub>2</sub>) injection systems, and liquid carbon dioxide (CO<sub>2</sub>) injection systems displace oxygen. These gases must be adequately diluted by breathable room air. Using the chamber in a poorly ventilated area results in a lack of oxygen, which could cause death. To safely install and use these systems, you must follow the instructions on the material containers as well as the installation instructions and the operating instructions in this manual.
- WARNING:** Do not attempt to perform electrical or refrigeration work if you are not qualified. This manual is not a substitute for electrical or refrigeration training.
- WARNING:** Make sure all warning labels remain attached to the chamber. If needed, order new labels from Thermotron Industries.
- WARNING:** Before working near moving parts, disconnect the electrical power. Keep all guards and shields in place. Because of the automatic pump-down system, condenser fans and refrigeration compressors can start at ANY time while the main power is connected—even when the chamber is not operating.
- WARNING:** Do not operate this chamber unless it is completely assembled.
- WARNING:** Use this chamber only for testing the products it was designed to test. Do not put products in the chamber that could burn, explode, or emit toxic fumes at high temperatures. **NOTE:** Open coil heaters could cause fumes to explode even at low temperatures.
- WARNING:** If you work with a hazardous material, read the Material Safety Data Sheet (MSDS) and the safety instructions on the container.
- WARNING:** Make sure the door is closed while the chamber is operating. Before opening the door, make sure the circulator fan is not rotating and the test space is near room temperature.
- WARNING:** This chamber operates at extreme temperatures. To prevent severe burns or frostbite, avoid contact with air, objects, and surfaces that are hot or cold.
- WARNING:** This manual has important safety information. Keep this manual in a place where it will be available to anyone working with the chamber.

Follow all **CAUTIONS** to prevent equipment damage.

- CAUTION:** Do not shut down or remove power from the chamber until the chamber air temperature has cooled to ambient or lower. Shutting down the chamber when the chamber air temperature is high, especially with a live load, can allow the heat to continue building, causing damage to heat links and other components.
- CAUTION:** Do not tip the machinery section more than 45° without special instructions from Thermotron Industries.

Read all **SAFETY** labels on the chamber.

*Red and white **DANGER** labels indicate immediate hazards that **WILL** result in death or severe personal injury.*

*Orange and black **WARNING** labels indicate hazards or unsafe practices that **COULD** result in death or severe personal injury.*

*Yellow and black **CAUTION** labels indicate hazards or unsafe practices that could result in minor personal injury or damage to products or property.*

*Blue and white **SAFETY INSTRUCTIONS** are important reminders that should be read before operating the chamber.*

## Chamber Specifications

	S-1.2C		
Temperature Range	-73°C to +177°C		
Cooling Change Rate +25°C to -40°C	20 Minutes		
+25°C to -54°C	30 Minutes		
Heating Change Rate +25°C to +110°C	18 Minutes		
+25°C to +177°C	45 Minutes		
Temperature Control Tolerance*	±1.1°C (±2°F)		
Window	6 x 8 Inches 15 x 20 Centimeters		
Volume	1.2 Cubic Feet 34 Liters		
Weight	320 Pounds 138 Kilograms		
Dimensions	W	D	H
Workspace	16 in	11 in	12 in
	41 cm	28 cm	30 cm
Move-in	30 in	22 in	41 in
	75 cm	55 cm	102 cm
Standard Electrical Voltage	115/1/60		
Recommended Minimum Service	16 Full Load Amps		
Compressor Size	(2) 1/3 Horsepower		
Live Load Capacity -18°C	350 Watts		
-40°C	250 Watts		
-54°C	200 Watts		

\*Standard deviation from mean, measured at -25°C (-13°F) or at +100°C (+212°F)

**NOTE:** Cooling performance is based on operation at +23.9°C. Cooling performance will decrease as ambient temperature increases. There is a potential for refrigeration trips during temperature pull-downs when the ambient temperature exceeds +32.2°C. Thermotron does not recommend operating the refrigeration system in ambient temperatures greater than +37.8°C.

## S-1.2 2800 Configuration

2800/4800 Selection	2800
Ch. 2 Option (On/Off)	OFF
Deg F Option (On/Off)	OFF
Display Resolution (Tenth/Intgr)	TENTH
External Lock (Prog/All)	PROG
3.5 CF Option (2800 Ch 2 Only) (On/Off)	N/A
Control (Heat Only/Cool Control)	HEAT
If Cool Control: STD Cooling/SL Cooling	N/A

## S1.2 Check-Off Page

<input checked="" type="checkbox"/>	General Safety Instructions.....	i
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### Installation

<input checked="" type="checkbox"/>	Location.....	1
<input checked="" type="checkbox"/>	Setting Up Your Chamber.....	1
<input type="checkbox"/>	Setting Up a Therm-Alarm.....	1
<input type="checkbox"/>	Connecting a Dry Air Purge Air Supply.....	2
<input type="checkbox"/>	Installing a ___GN <sub>2</sub> , ___LN <sub>2</sub> , or ___CO <sub>2</sub> System.....	2
<input checked="" type="checkbox"/>	Starting Up a Chamber.....	3

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### Operation

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### Additional Manuals

<input checked="" type="checkbox"/>	Programmer/Controller Manual.....	
<input checked="" type="checkbox"/>	Recorder Manual (CD-ROM).....	Located on the CD-ROM in the front pocket of the binder.

## CONTROLS & INSTRUMENTATION

The following paragraphs describe the controls and instruments that monitor and operate your chamber.

### Function Switch Descriptions

- The **POWER** switch applies power to the control circuit. You must turn the **POWER** switch on to operate the chamber.
- The optional **LIGHT** switch operates the chamber's interior light.

### 3800 Programmer/Controller

The 3800 is a programmable microcomputer that controls and monitors the chamber functions. You can program the 3800 to automatically operate your chamber, or you can manually operate the chamber using the 3800 front panel keyboard and display. You also can operate the 3800 from a host computer using the Ethernet (TCP/IP) interface.

The following paragraphs describe the interface between the 3800 and your chamber. For more detailed information, see the 3800 manuals in Section F.

#### Control Channels

Control channels monitor the chamber's environmental conditions and operate the control systems. Channel 1 senses the chamber temperature using a dry bulb thermocouple input. Its outputs control the heating and cooling systems.

#### Solid-State Relay Boards

The 3800 uses solid-state relay boards on the control module for its control signals, including the auxiliary relays. Terminal block TB2 on the relay board provides the chamber control system connections. For an electrical description of the solid-state relay boards, see "Control Module Solid-State Relay Boards" in *3800 Technical Manual*.

#### Chart Recorder

The chart recorder is a microprocessor-based device used to chart the temperature changes of the testing space and the products under test during test intervals. Input 1 charts the chamber temperature reading.

# Installation

## Location

Note the following when choosing a location for the chamber:

- The foundation must be solid, level, and able to support the weight of both the chamber and the product being tested.
- Heat is produced when the chamber operates; enough ventilation must be provided to prevent excess heat build-up.
- If LN<sub>2</sub>, CO<sub>2</sub>, or GN<sub>2</sub> will be injected into the chamber, the area must be adequately ventilated to dilute the gas that is left in the chamber after each test.

## Setting Up Your Chamber

1. Remove your chamber from the shipping container. Cut any bands holding it to the pallet.
2. Lift the chamber into place using a fork lift or other lifting device.
  - See the location directions above.
  - Slide the lifting device under the baseplate to lift it.
3. Leave at least 18 inches of space around the chamber for air circulation and serviceability.

## Setting Up a Therm-Alarm

The Therm-Alarm is a product protection device. If your chamber has a Therm-Alarm, it was set at the factory to trip out the control system and sound an alarm if the test space reaches unsafe product temperatures. During normal operations, you can change the temperature trip limits at the Therm-Alarm's® keypad for your products' safety needs.

The Therm-Alarm also has normally open and normally closed relay contacts for your use. You can use them to remove power from your products or operate an additional alarm system. See "Connecting a Back-Up Safety to TB4" in the Therm-Alarm manual to use the relay contacts.

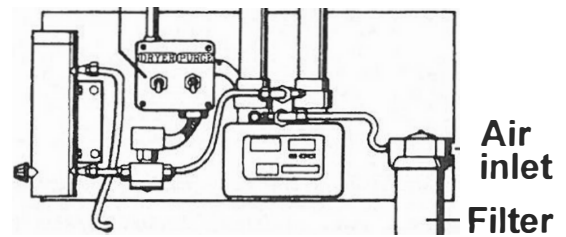
## Connecting a Dry Air Purge Air Supply

1. Connect the air supply to the air inlet. The air must be clean, oil free, and dry.
2. Find the dryer size (DS1, DS2, or DS3) on the dryer's serial plate, and check its inlet pressure. From the chart below, find the purge's air flow rate. The air flow rates are the maximum amount of air that the dryer can dry without becoming saturated.
3. With the purge operating, use the flowmeter to adjust the air flow rate to the rate shown on the chart.

Air Flow Rates			
ft <sup>3</sup> /min.			
psig	DS1	DS2	DS3
100	5.2	6.8	10.3
90	4.7	6.2	9.0
80	4.0	5.0	7.5
70	3.5	4.3	6.5
60	2.8	3.5	5.4

### Dryer and purge switches

### Dryer



## Installing a GN<sub>2</sub>, LN<sub>2</sub>, or CO<sub>2</sub> System

**WARNING:** Improper installation of a GN<sub>2</sub> (gaseous nitrogen), LN<sub>2</sub> (liquid nitrogen), or CO<sub>2</sub> (carbon dioxide) system can cause death by suffocation. Make sure the chamber is vented according to the following instructions.

1. Connect a vent line from the chamber vent, located on top of the chamber, to the outside of the building.
  - Make sure the vent outlet is not near a fresh air intake to the building.
  - To prevent back pressure, the vent line must be short, straight, and at least as large in diameter as the chamber vent.
  - If your chamber has more than one vent, repeat this step for the other vent(s).
2. Find the GN<sub>2</sub>, LN<sub>2</sub>, or CO<sub>2</sub> inlet on the chamber (the assemblies are labeled), and connect the needed supply:
  - For GN<sub>2</sub> systems, connect a gaseous nitrogen supply to the inlet at a maximum pressure of 100 psig.
  - For LN<sub>2</sub> systems, connect a liquid nitrogen supply to the inlet at a maximum pressure of 40 psig. Include a high-pressure relief valve in the line, and insulate the line.
  - For CO<sub>2</sub> systems, connect a carbon dioxide supply to the inlet at a maximum pressure of 1,000 psig. Include a high-pressure relief valve in the line, and insulate the line.
3. Use a leak-detecting solution to check for leaks.

## Starting Up a Chamber

**WARNING:** You must operate the chamber to perform this procedure. Do not attempt to operate the chamber unless you have read the instructions in the Operation section of this manual.

**WARNING:** Do not start up the chamber until all the other installation procedures are complete. Make sure the chamber is completely assembled according to your engineering drawings.

1. Make sure the **POWER** switch is in the OFF position.
2. Make sure the input voltage is correct (refer to your electrical schematics), and connect your chamber to the power supply.

**NOTE:** For North American S-1.2 chambers, the chamber should be directly connected to a dedicated 20 amp circuit. Do not use an extension cord to connect the chamber to an electrical outlet.

**NOTE:** For non-North American S-1.2 chambers, the chamber should be directly connected to a dedicated 1840 VA circuit. Do not use an extension cord to connect the chamber to an electrical outlet.

3. You can now perform a test.

# Operation

## Performing a Test

**WARNING:** Stay away from moving machinery. Keep all guards, shields, and safety devices in place.

**WARNING:** Read everything in this section before operating the chamber.

**NOTE:** Refer to the Controls and Instrumentation section on page vi for a general description of your chamber's instruments.

**WARNING:** Gas from an LN<sub>2</sub> (liquid nitrogen), GN<sub>2</sub> (gaseous nitrogen), or CO<sub>2</sub> (carbon dioxide) system can cause death by suffocation. Read the instructions on page 6 or 7 if you have one or more of these systems.

## Operating the Chamber In the Automatic Mode

1. Load the products into the chamber. If applicable, put the Therm-Alarm thermocouple on or near the products at test. Close the doors.
2. Program a test on the programmer/controller.
  - a. Program any auxiliaries, systems, and/or options on or off for each interval as needed to perform the test.
  - b. Refer to the programmer/controller manual.
3. Put the **POWER** switch in the ON position.
4. If applicable, prepare the chart recorder and/or Therm-Alarm for the test according to their manuals.
5. Start the test with the programmer/controller.
6. Before removing a product after a test, operate the chamber back to ambient temperature, and dilute any nitrogen or carbon dioxide gas you injected into the chamber. Stay away for at least five minutes while diluting the gas.

## Operating the Chamber In the Manual Mode

1. Load the products into the chamber. If applicable, put the Therm-Alarm thermocouple on or near the products. Close the door.
2. Put the **POWER** switch in the ON position.
3. If applicable, prepare the chart recorder and/or Therm-Alarm for the test according to their manuals.
4. At the programmer/controller, use the manual mode to operate the chamber.
  - a. Turn any auxiliaries, systems, and/or options on or off as needed to perform the test.
  - b. Refer to the programmer/controller manual.
5. Before removing a product after a test, operate the chamber back to ambient temperature, and dilute any nitrogen or carbon dioxide gas you injected into the chamber. Stay away for at least five minutes while diluting the gas.

## Using a Therm-Alarm

**NOTE:** For specific operating instructions, see the *Therm-Alarm Instruction Manual*.

The Therm-Alarm protects your product(s) from temperatures that are too high or too low. If it senses a temperature that is too high or low, it produces an audible alarm, shuts the chamber down, and, if necessary, removes power from the product being tested. To remove power from the product, it must be wired through mechanical relay TB4 of the Therm-Alarm. (See “The Rear Panel Connections” in the Therm-Alarm manual.)

The Therm-Alarm thermocouple is on a long wire in the test space. You must place this thermocouple on the product being tested or as near to the product as possible to properly protect it.

## Using a Purge System: Dry Air or GN<sub>2</sub> (Gaseous Nitrogen)

**WARNING:** You can suffocate if you breathe gas from a GN<sub>2</sub> system. Make sure the chamber is vented according to the instructions on page 2. Before removing a product after a test, you must dilute the nitrogen gas as follows:

- a. Remove a port plug or open the chamber door several inches.
- b. Make sure the **POWER** switch is in the ON position and operate the circulator fan for at least five minutes. Operate the circulator fan by placing the programmer/ controller in RUN mode.
- c. Stay away from the chamber until the gas is diluted. Do not operate a GN<sub>2</sub> system when the chamber door is open.

The purge system injects dry air or dry gaseous nitrogen (GN<sub>2</sub>) directly into the test space to reduce the amount of moisture in the chamber air and reduce frost accumulation on the product and on the cooling coils.

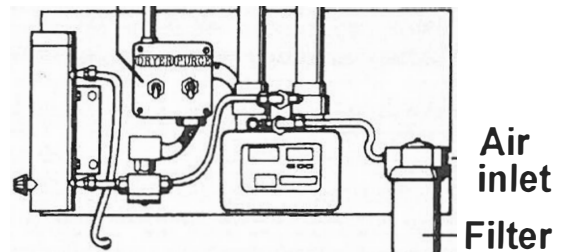
If you have a dry air purge assembly with **DRYER** and **PURGE** switches, leave the switches in the ON position for normal operation.

If you must adjust the rate of dry air or GN<sub>2</sub> injection, turn the valve on the flowmeter.

**WARNING:** To avoid injury, do not turn the flowmeter valve all the way out unless the flowmeter is completely depressurized.

### Dryer and purge switches

Dryer



## Using an LN<sub>2</sub> or CO<sub>2</sub> Injection System

**WARNING:** You can suffocate if you breathe gas from the LN<sub>2</sub> (liquid nitrogen) or CO<sub>2</sub> (carbon dioxide) system. Make sure the chamber is vented according to the instructions on page 2. Read all warnings on the container of LN<sub>2</sub> or CO<sub>2</sub>. If you use a direct-injection system, nitrogen gas or carbon dioxide gas will be concentrated in and around the chamber. Before removing a product after a test, perform one of these steps to dilute the gas:

- a. If you have a dry air purge, operate it for five minutes to purge the chamber air.
- b. If you do not have a dry air purge, remove a port plug or open the chamber door several inches.
  - Make sure the **POWER** switch is in the ON position and operate the circulator fan for at least five minutes. Operate the circulator fan by placing the programmer/controller in RUN mode.
  - Stay away from the chamber until the gas is diluted. Do not operate an LN<sub>2</sub> or CO<sub>2</sub> system when the chamber door is open.

**NOTE:** CO<sub>2</sub> is heavier than air; LN<sub>2</sub> is lighter than air.

LN<sub>2</sub> or CO<sub>2</sub> is injected into the chamber (either directly or through a coil) to cool the test space. This cooling can be used in two possible ways:

- **“Boost” or “auxiliary” cooling** – The LN<sub>2</sub> or CO<sub>2</sub> is used along with the mechanical refrigeration system to provide additional cooling.
- **“Backup” cooling** – The LN<sub>2</sub> or CO<sub>2</sub> cools the chamber if the mechanical refrigeration system fails.

If you must adjust the rate of LN<sub>2</sub> or CO<sub>2</sub> injection, see your programmer/controller manual for instructions. If you cannot adjust the rate using your programmer/controller, use the capacity controller located near the LN<sub>2</sub> or CO<sub>2</sub> inlet. If you turn the capacity controller toward the HI position, the LN<sub>2</sub> or CO<sub>2</sub> is injected at a faster rate. If you turn the capacity controller toward the LO position, the LN<sub>2</sub> or CO<sub>2</sub> is injected at a slower rate.

## What to Do If the Chamber Does Not Operate

Thermotron chambers have safety devices that prevent the chamber from operating when a problem exists. If a failure is due to a temporary problem, you may only need to reset a safety switch. Some commonly used safety devices that can be reset by the operator are explained here. If necessary, call the nearest Thermotron field service office. (See the field service office list in the front pocket of this manual.)

**WARNING:** If you need further service, get qualified help. Attempting to service the chamber without adequate training can cause death or serious injury, or could damage the chamber.

**CAUTION:** Immediately release all reset buttons; do not hold them in. If a switch trips more than once, get qualified help; the cause of the tripping must be determined before you use the chamber. Improper resetting can result in damage to the chamber and the product.

A **Therm-Alarm** or **other optional instrument** can cause trips that can be reset by the operator. See the manuals for these instruments if necessary.

All chambers have **pressure switches** located on gray or white boxes near the compressor(s). If your chamber stops operating, check these switches. You can reset them either by pushing in a button or by pushing down a tab that is located in the upper left corner of the box. If your chamber will not start up or starts up and quits again, get qualified help.

Some chambers (usually those with LN<sub>2</sub> or CO<sub>2</sub> cooling) have a **low limit switch (LLS)**. The LLS trips if the chamber gets too cold. After the chamber has returned to an acceptable temperature, the LLS automatically resets.

## Preventive Maintenance

### Checking the R-23 Charge

**Suggested Frequency: Every Week**

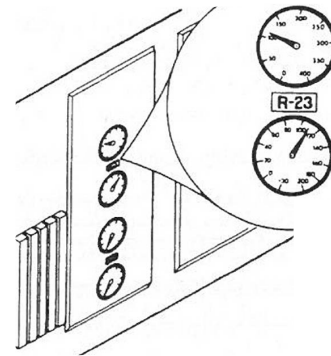
**NOTE:** Check the R-23 charge if your chamber is equipped with refrigeration gauges.

**CAUTION:** The refrigeration system must be at room temperature. If you leave the chamber off at night, check the charge in the morning.

1. Make sure the refrigeration system is at room temperature. The system may need to be off for 12 hours or more to reach room temperature.

**NOTE:** If your refrigeration gauges have shut-off valves, open the valves while checking the gauges, and close them when you are done.

2. Make sure the R-23 discharge and suction gauges show the same pressure.
3. Compare the pressure shown on the gauges with the low-stage standby pressure shown on the serial tag located on the electrical compartment. If the pressure shown on the gauges is more than 5 psig below the pressure shown on the tag, the system must be charged. Before turning to the charging instructions, check the R-23 charge using a refrigeration gauge manifold. (See page 11.)



### Checking the R-134a Charge

**Suggested Frequency: Every Week**

**WARNING:** You must operate the chamber to perform this procedure. Do not attempt to operate the chamber unless you have read the instructions in the Operation section of this manual.

**NOTE:** S-1.2 chambers do not have sight glasses. You must “check” the charge of these chambers by the general performance of their refrigeration systems.

1. Check the R-23 charge.
2. If the R-23 charge is good, run a performance test.
3. If the chamber performs poorly, you may have a low R-134a charge. (See page 16.)

## Cleaning the Air-Cooled Condenser

### Suggested Frequency: Every week

Check for dirt in the condenser fin coils. If you see dirt, disconnect the condenser's electrical power and either vacuum the dirt out of the fin coils or use compressed air to blow it out. If you use compressed air, blow the dirt to the outside of the machinery section so that it will not become lodged in the coil. Also, check the condenser for signs of rubbing or abrasion on tubing, and make sure the fan blades are tight and the condenser fan motor is bracketed down tightly.

## Checking and Replacing the Dry Air Purge Filter

### Suggested Frequency: Every Month

**NOTE:** If the filter element is very dirty, check it more frequently.

1. Depressurize and drain the filter by unscrewing the petcock on the filter bowl. (See the figure on page 2.). Depending on the air supply quality, you may need to drain the filter weekly or more often.
2. Remove the filter bowl and check the filter element.
  - If the element is dirty, replace it. New filter elements are available from Thermotron Industries.
  - If large amounts of water and oil are always present, the dryer could be damaged. Replacement dryers are available from Thermotron Industries.
3. Replace the filter bowl; do **not** use a wrench to tighten it.

## Miscellaneous Checks

### Suggested Frequency: Every Three Months

**WARNING:** High voltages that can kill are present. Use extreme caution.

**WARNING:** Do not attempt to perform electrical work if you are not qualified. This manual is not a substitute for electrical training.

- Check the operating currents of the circulator, heaters, compressors, and other components. Make sure they match the values ( $\pm 10\%$ ) on the electrical drawings. Keep a log of these values so you will see any changes that could indicate the need to service your chamber.
- Disconnect the electrical power and check for loose electrical connections in the electrical compartment. Also, visually check for warping or pitting on contactors.
- Make sure all warning labels are firmly attached and easy to read. New labels are available from Thermotron Industries.
- Check the chamber door seals for rips, cracks, or deterioration.
- Make sure the circulator fan is tightly connected to its shaft and can spin freely.
- Make sure the instrument sensor(s) are positioned in the strongest air flow for accurate temperature readings.
- Check for corrosion or abrasion on refrigeration lines, including the small lines attached to gauges and switches. Check the compressors for loose or broken head fans.

## Testing Safety Switches

### Suggested Frequency: Every Three Months

**NOTE:** For the most accurate results, test safety switches one at a time.

**NOTE:** Table 1 on page 13 contains a list of common safety switches. Check your electrical drawings and your chamber to see which ones are on it. You should also look at the drawings to find out if the chamber has any switches that are not listed in the table.

To test a switch, set it so it will trip under normal testing conditions and operate the chamber with no load. For example, to test a low limit switch, raise the limit of the switch so it is within the normal testing range you use, and program the chamber to perform a pull-down. If the switch is working, it will trip and shut the chamber down when the air temperature reaches the temperature setting on the switch.

If the switch is not working, replace it. You can get replacement switches from Thermotron Industries.

## Checking the R-23 Charge Using a Refrigeration Gauge Manifold

### Suggested Frequency: Every Three Months

**WARNING:** Do not attempt to check the charge using a refrigeration gauge manifold if you are not a qualified refrigeration technician. You could seriously injure yourself or damage the chamber. This manual is not a substitute for refrigeration training.

**CAUTION:** Before performing this procedure make sure the chamber is off and the refrigeration system is at room temperature.

**CAUTION:** Use only a calibrated gauge manifold to perform this procedure.

1. Shut off the refrigeration system and allow the entire R-23 system to reach room temperature.
2. Remove the lower rear panel to allow access to the compressors.
3. Connect hoses from the suction and discharge gauges to the R-23 suction service and discharge service valves.
4. Open both manifold valves and allow the pressure to equalize.
5. Compare the pressure shown on the manifold gauges to the R-23 standby pressure shown on the serial tag on the electrical compartment. If the pressure is 5 psig or more below the pressure on the serial tag, you must charge the system. See "Charging the R-23 Refrigeration System" on page 15.
6. If the system does not need charging, remove the hoses and replace the lower rear panel you removed.

## Checking the R-134a Discharge Pressure

### Suggested Frequency: Every Three Months

**WARNING:** You must operate the chamber to perform this procedure. Do not attempt to operate the chamber unless you have read the instructions in the Operation section of this manual.

#### Chambers with Gauges

The chamber should be performing a pull-down when you check the discharge pressure. If your chamber has built-in refrigeration gauges, check the pressure on the discharge gauge and compare it to the temperature/pressure saturation chart in the front pocket of this manual.

**NOTE:** To find the correct pressure on the chart, add 20°F to the actual ambient temperature, and use this adjusted temperature when checking the chart.

#### Chambers without Gauges

If your chamber does not have built-in gauges, you need to use a refrigeration gauge manifold:

1. Connect a hose between the discharge gauge and discharge service valve.
2. Open the manifold gauge and read the pressure.
3. Compare it to the pressure on the temperature/pressure saturation chart in the front pocket of this manual. To find the correct pressure, you need to add 20°F to the actual ambient temperature and use this adjusted temperature when checking the chart.

## Service

If you need technical assistance troubleshooting problems with your Thermotron environmental test chamber, please contact the Thermotron Technical Liaison office at (616) 392-6550 between 8:00am and 4:30pm Eastern Standard Time.

### Resetting Safety Switches

Safety switches shut systems down if the system condition exceed the switch limits.

- Automatic reset switches reset themselves when the cause of the trip is corrected.
- Manual reset switches must be reset by you. To reset a manual reset switch, push the button or tab on the switch after the cause of the trip is corrected.

Some commonly used manual reset switches are listed in Table 1.

**CAUTION:** Do not hold reset switches in, release them immediately. If a switch continues tripping, find and correct the cause before using the chamber. Improper resetting can result in damage to the chamber and the product.

**NOTE:** Some switches need to cool down or heat up before they can be reset.

**NOTE:** Therm-Alarms® and other optional instruments can also act as safety switches. See the manuals for more information.

**Table 1**

Manual Reset Switch	Common Abbreviation	Location	Reason for Tripping
Low Limit*	LLS	Externally mounted	Chamber temperature too low
High Pressure**	HPS	Machinery section	Refrigerant pressure too high
Low Pressure**	LPS	Machinery section	Refrigerant pressure too low

\*Automatic reset

\*\*Automatic reset when used with System Monitor

## Replacing Heat Links

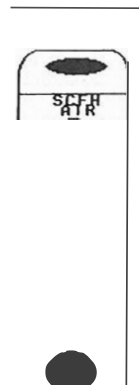
**WARNING:** Disconnect the electrical power when checking and replacing the heat links. High voltages that can kill you are present.

Heat links remove power from the heating coils if the temperature at the heating coils is too high. If one or more heat links are blown, the chamber heats slowly or does not heat at all. Blown heat links must be replaced; they are located by the heaters in the plenum. Usually, heat links blow because of a lack of sufficient air flow from the circulator.

1. Disconnect the electrical power from the chamber. Allow the entire chamber to reach room temperature.
2. Remove any sensors from the cover on the plenum, and then remove the plenum cover itself.
3. Find the heat link(s). Heat links are tubular in shape and look similar to resistors. They are located on the heater studs or on a bracket mounted near the heaters.
4. Perform a resistance check on the heat link(s) using an ohm meter. (You cannot check them visually.)
  - If the ohm meter reads 0, the heat link is working.
  - If the ohm meter reads infinity or **OL** (out of range), the heat link is blown and must be replaced.
5. Follow this procedure to change the heat link(s).
  - a. Loosen the two nuts that hold the heat link.
  - b. Remove the blown heat link.
  - c. Install a new heat link.
  - d. Tighten the two nuts.
6. Replace the plenum cover, and reattach any control sensors you removed.
7. Reconnect the electrical power.

## Cleaning the Flowmeter

1. Make sure the flowmeter is depressurized.
2. Remove the valve knob by turning it counterclockwise as far as possible and gently pulling it straight out.
3. Remove the four mounting screws located on the sides of the flowmeter.
4. Gently pull the body of the flowmeter straight away from the back plate.
5. Remove the cap from the top of the flowmeter. To do so, put a screwdriver in the notch and push gently in the direction of the arrow to slide the cap off.
6. With an Allen wrench, remove the plug ball stop from the top of the flowmeter.
7. Turn the flowmeter upside down over your hand and catch the float when it falls out.
8. Clean the flowmeter using only a mild solution of pure soap and water. Other cleaners may damage the flowmeter.
9. Replace the float, plug ball stop, and flowmeter cap. If the float is cylindrical, you must replace it in the same position in which it was removed. Re-install the flowmeter body, and replace the valve knob.



## Recovering Used Refrigerant

Any time you need to evacuate a refrigeration system for any reason, you must collect the refrigerant. The Clean Air Act prohibits venting it to the air.

If you are properly certified, you can recover the refrigerant yourself using a commercially available recovery unit or have a professional do it for you. You may also call our field service engineers to recover the refrigerant for you. To arrange to have the procedure done, call the nearest Thermotron field service office.

You can recharge your refrigeration system using the recovered refrigerant as long as it is not contaminated. If the refrigerant is contaminated, you can ship it to Thermotron for disposal, but the contaminated refrigerant will remain your property until it is properly disposed of.

## Charging the R-23 Refrigeration System

**WARNING:** DO NOT attempt to charge the system if you are not a qualified refrigeration technician. You could kill or seriously injure yourself, or damage your chamber.

**WARNING:** This manual is not a substitute for electrical or refrigeration training.

**WARNING:** Read the safety instructions on the refrigerant tank. R-23 refrigerant is under very high pressure in the tank. Do not open the outlet valve rapidly.

**CAUTION:** This is a static charging procedure. Make sure the chamber is off and the refrigeration system is at room temperature before charging the system.

**NOTE:** To check the refrigerant charge, see “Checking the R-23 Charge” on page 9.

1. Make sure you have the correct refrigerant.
2. This is a static charging procedure. Disconnect the power to your chamber and allow the chamber to reach room temperature.
3. Connect hoses from the suction and discharge gauges on the refrigeration gauge manifold to the suction and discharge access ports.
4. Connect a hose from the refrigerant tank to the center fitting of the refrigeration gauge manifold.
5. Purge the hoses by opening both the discharge and suction gauges. Tighten the hose on the refrigeration tank and charge the system by adding refrigerant to both the suction and discharge sides at the same time.
6. Wait a few minutes after you charge the system for the pressure to equalize. Read the pressures on the gauges. Both should show the same pressure.
7. Compare the gauge pressure with the standby pressure on the serial tag on the electrical compartment. If it is less than the required pressure, you must add more refrigerant.
8. Check the compressor amperage to make sure the system is not overcharged. If the system is overcharged, the amperage will be higher than normal.

## Charging the R-134a Refrigeration System

**WARNING:** DO NOT attempt to charge the system if you are not a qualified refrigeration technician. You could seriously injure or kill yourself or damage the chamber.

**WARNING:** This manual is not a substitute for electrical or refrigeration training.

**WARNING:** You must operate the chamber to perform this procedure. Do not attempt to operate the chamber unless you have read the instructions in the Operation section of this manual.

**WARNING:** Read the safety instructions on the refrigerant tank.

**NOTE:** To check the charge, see “Checking the R-134a Charge” on page 9.

1. Make sure you have the correct refrigerant.
2. Loosely connect a hose from the center fitting of the refrigeration gauge manifold to the refrigerant tank.
3. Connect hoses from the suction and discharge gauges on the refrigeration gauge manifold to the suction and discharge access ports.
4. Purge the hoses by opening both the discharge and suction gauges.
5. Tighten the hose on the refrigeration tank and charge the system during a pull-down:

**NOTE:** Because S-1.2 chambers require small amounts of refrigerant and do not have sight glasses, you will need to use a graduated cylinder. See the chamber’s serial tag for the proper amount of refrigerant.

**NOTE:** With an ambient temperature of +70°F, the discharge pressure should be between 105 and 125 psig and the suction side pressure should be between 10 and 15 psig.

6. Check the compressor amperage to make sure the system is not overcharged. If the system is overcharged, the amperage will be higher than normal.

## Replacing a Circulator Fan and Motor

**NOTE:** The circulator motor and fan must be replaced at the same time because they are balanced.

1. Disconnect the main power to the chamber.
2. Remove any sensors attached to the plenum cover, and remove the plenum cover.
3. Take the fan blade off the shaft.
  - a. Remove the set screw with an Allen wrench.
  - b. Pull the fan blade off the shaft.
4. Disconnect the electrical connections to the circulator motor.
5. Remove the circulator motor.
  - a. Remove the motor mounting screws that hold the circulator motor in place.
  - b. Pull the motor and shaft away from the chamber.
6. Install the new motor.
  - a. Apply a bead of non-hardening caulk around the circulator shaft hole.
  - b. Insert the shaft of the circulator into the hole.
  - c. Attach the motor with the motor mounting screws and washers. **Do not tighten the screws yet.**
7. Install the fan blade.
  - a. Slide the fan blade on the shaft with the hub facing you.
  - b. Insert the set screw so it contacts the flat side of the shaft. **Do not tighten the set screw yet.**
8. Tighten the motor mounting screws.
9. Spin the fan blade with your hand to make sure it spins freely. If it hits something, adjust the position of the motor using mounting screws to center the shaft.
10. Test again for free movement of the fan blade. Re-adjust the motor's position if necessary.
11. Reconnect the circulator motor's electrical connections.

## Recommended Spare Parts

To minimize down time, maintain a supply of spare parts. See the parts list in this section to determine the appropriate parts and part (item) numbers.

### High Usage Parts

Contactors  
Filter driers  
Fuses  
Heat links  
Solenoids

### Low Usage Parts with Long Lead Times

Circulator motors  
Compressors

### Other Recommended Spare Parts

Bulbs, lights, lamps  
Expansion valves  
Injection valves  
Fan blades  
Heating coils  
Pressure switches  
Selector switches  
Relay sensors  
Thermocouples  
Thermostats

### Calling Thermotron for Assistance

At Thermotron, our telephone staff is trained to match your current needs to the proper person or department. To accomplish this, they need the following information:

- Your name
- Name of your company
- Model and serial number of the chamber
- Brief description of the problem, question, or request

Once you obtain this information, contact the Parts and Logistics Department at Thermotron Industries in Holland, Michigan, USA. Telephone (616) 392-6550 between 7:30 a.m. and 5:30 p.m. Eastern Standard (Daylight) Time. The telephone staff person who takes your call will use the above information to determine where to direct your call or how to assist you.

## Returning Materials

### What to Do If a Part Fails

1. Contact your local Thermotron field service office. A service representative will help you determine the nature of the problem and the proper steps to resolving the problem.
2. To return a part or Thermotron instrument, follow these steps:
  - a. Contact the Parts and Logistics department at Thermotron Industries in Holland, Michigan, USA. The telephone number is (616) 392-6550, and the fax number is (616) 393-4549. The hours of operation are 7:30 a.m. to 5:30 p.m. Eastern Standard (Daylight) Time.
  - b. When you telephone, our staff needs the following information: your name, the name of your company, the model and serial number of your chamber, and a brief description of the failure.
  - c. Parts and Logistics will authorize return of the material and issue a Returned Material Tag (RMT) number.
  - d. Write the name and telephone number of a contact person at your location and the RMT number on the packing list.
  - e. Write the RMT number on the outside of the shipping container in a visible location.
  - f. Ship all parts FOB to:

Thermotron Industries  
836 Brooks Avenue  
Holland, MI 49423  
ATTN: (Issued RMT Number)

**NOTE:** Thermotron will replace a part under the terms of the warranty at no charge if the defective part is received within 30 days of the issuance of the RMT number. If the part is received after 30 days, Thermotron will invoice the customer for the full cost of the replacement part.

### What to Do If a Non-Thermotron Instrument Fails

1. Contact the original equipment manufacturer according to the instructions in the OEM instrument manual. Follow the manufacturer's procedure for replacing the failed instrument.
2. To contract Thermotron to install the instrument at the prevailing rates, contact your local Thermotron field service office.

## Glossary

**ambient:** The temperature and other conditions of the air surrounding the chamber.

**auxiliary relay:** A relay that you can program on or off with the programmer/controller.

**bypass mode:** A state in which the refrigeration compressor(s) are running but some or all of the refrigerant does not pass through the cooling coil.

**cascade:** A combination of two refrigeration systems that is used to achieve very low temperatures. The evaporator of one system serves as the condenser for the other system.

**CO<sub>2</sub>:** Carbon dioxide.

**dry bulb temperature:** The actual test space (chamber) air temperature.

**GN<sub>2</sub>:** Gaseous nitrogen.

**interval:** A segment of a program.

**kW:** Kilowatt; a unit of electrical power.

**live load:** Heat produced by a product being tested.

**LN<sub>2</sub>:** Liquid nitrogen.

**machinery section:** The section of the chamber that contains the refrigeration compressors and other machinery.

**machinery section panels:** Removable panels that enclose the machinery section.

**plenum:** The plenum contains the equipment needed to heat, cool, and circulate the chamber air.

**port plug:** A piece of insulation material that fits into a chamber port.

**psig:** Pounds per square inch gauge; a unit of pressure.

**pull-down:** A transition from a higher temperature to a lower temperature.

**R-23 and R-134a:** Types of refrigerant.

**RTD:** Resistance temperature device, a temperature sensing device.

**scfm:** Standard cubic feet per minute; a unit of gaseous flow rate.

**serial tag:** A label attached to the electrical compartment listing the chamber specifications, serial number, and model number.

**set point:** An assigned value for a test space condition such as temperature. The initial set point is the value assigned at the beginning of an interval. The final set point is the value the chamber must reach within an interval. Current set points are set by the programmer/controller when going from the initial to the final set point.

**test compartment:** The section of the chamber enclosing the test space.

**test space:** The area in the chamber where the product is tested.

**thermocouple:** A temperature sensing device.

## S-1.2 Parts List Guide

Seq.	Description	Contents
15	S 1.2 – Paint	<ul style="list-style-type: none"><li>• Housings and panels</li></ul>
20	S 1.2 – Base refrig.	<ul style="list-style-type: none"><li>• Cart</li><li>• Compressors</li><li>• Condensers</li></ul>
30	S 1.2 – Cabinet	<ul style="list-style-type: none"><li>• Circulator motors</li><li>• Heaters</li><li>• Ports (optional)</li><li>• Baffles</li><li>• Filter dryer</li><li>• Fan blades</li><li>• Light (optional)</li><li>• Door latch</li><li>• Door mount</li></ul>
35	S 1.2 – Refrigeration	<ul style="list-style-type: none"><li>• Top kit refrigeration</li><li>• Gauges (optional)</li><li>• Solenoids</li><li>• Purge and boost (options)</li></ul>
40	S 1.2 – Electrical Ass'y	<ul style="list-style-type: none"><li>• Electrical panel</li><li>• Thermocouples</li><li>• 3800 display</li></ul>
110	S 1.2 – Shipping	<ul style="list-style-type: none"><li>• Decals and labels</li><li>• Shelves (optional)</li></ul>
325	Misc	<ul style="list-style-type: none"><li>• Cart (optional)</li><li>• Ports (optional)</li></ul>
999	Misc	<ul style="list-style-type: none"><li>• Insulation</li></ul>

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Seq/Description

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15 PAINT

<u>component</u>	<u>description</u>	<u>qty per</u>	<u>u/m</u>
1150921	BASE WELDMENT ASSY S1.2	1.00	EA
1150989	PANEL MACH BASE REAR S1.2	1.00	EA
1151375	BRACKET REFRIG LINE SUPPORT	2.00	EA
1170507	HOUSING INSTRUMENT S1.2 3800	1.00	EA
880833	SHELL DOOR W/WINDOW S1.2	1.00	EA
980935	SHELL ASSEMBLY S1.2 CFC FREE	1.00	EA
980943	PANEL CONSOLE SIDE S1.2	1.00	EA
981028	PANEL MACH BASE END S1.2	1.00	EA
981060	PANEL ELECT COMPT FRONT S1.2	1.00	EA
981117	PANEL SHELL REAR S1.2	1.00	EA

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20 BASE REFRIG

<u>component</u>	<u>description</u>	<u>qty per</u>	<u>u/m</u>
1124564	CONDENSING UNIT 1/3HP 115V	1.00	EA
1124572	COMPRESSOR 1/3 HP 115/1/60	1.00	EA
556723	GROMMET BUMPER W/WASHER LAVELL	4.00	EA
557355	FIN COIL 1.2 DESUPERHEATER	1.00	EA
562774	FILTER DRIER 1/4" ODF	1.00	EA
941557	VALVE RELIEF ATMOSPHERIC 350	1.00	EA
987921	ADAPTER RELIEF VALVE 1/8X3/8	1.00	EA
989037	GROMMET RUBBER 1/4ID 1/16 GROV	6.00	EA

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## Seq/Description

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30 CABINET

component	description	qty per	u/m
1077979	SWITCH PRESSURE HIGH CE	1.00	EA
1091436	GUARD LIGHT S1.2	1.00	EA
1106338	GASKET SILICON OUTFR 23.63X23.63	1.00	EA
1180544	BAG POLY 95X115 4MIL NOT GUSSE	1.00	EA
528675	GASKET NEOP SPONGE CLOSED CELL	2.00	FT
529180	WINDOW 7X9X4"	1.00	EA
530023	GASKET NEOP 1/16TH 502 VENT	2.00	EA
532387	STRIP LINER BREAKER S1.2	1.00	EA
532433	LINER ASSY S1.2	1.00	EA
534754	BAFFLE BENCH MODEL	1.00	EA
534762	BAFFLE FRONT BENCH MODEL S1.2	1.00	EA
535610	ELBOW CU 1-5/8 90' EL	4.00	EA
541424	HEATER .5KW 115V1PH FOR S1.2	1.00	EA
543030	DISC INSULATOR LIGHT SKT	1.00	EA
543120	BRACKET FIN COIL FRONT MTG	1.00	EA
543130	BRACKET FIN COIL REAR MTG	1.00	EA
547155	PORT SLEEVE KIT MOTOR BENCH MD	1.00	EA
547228	PORT VENT W/FLANGE 4-5/8"LG	1.00	EA
5488955	BAG POLY40X27X50 4MLUSE1180544	1.00	EA
551306	SHROUD BENCH MODEL	1.00	EA
552299	SEAL VAPOR FAN MOTOR SHAFT	1.00	EA
552302	SEAL VAPOR FAN MOTOR SHAFT	1.00	EA
554720	PORT PLUG TEMP ONLY 2-1/4	1.00	EA
556405	LABEL NAMEPLATE DIECAST 3/4"XB	1.00	EA
557428	FIN COIL BOHN DWG NO 916009C	1.00	EA
559323	SWITCH PRESSURE OPEN LD 240PSI	1.00	EA
560399	GASKET SILICON IN 16.12IDX15.62	1.00	EA
562774	FILTER DRIER 1/4" ODF	1.00	EA
564394	RECEPTACLE BRASS	1.00	EA
564866	HANGER BRACKET STEEL BOTH WALL	2.00	EA
569299	VENTILATOR ALUMINUM POLISHED	1.00	EA
570688	FAN BLADE PM 4" 5/16B ALUM	1.00	EA
574977	TEE COPPER 5/8X3/8X3/8	1.00	EA
596809	PORT FLANGE 3-1/2OD 2-1/8ID SW	2.00	EA
596817	PORT SLEEVE 2"IDX4-7/8"LG	1.00	EA

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## Seq/Description

30 CABINET

component	description	qty per	u/m
596981	TUBING CASCADE 3/8"X5/8"X12'	1.00	EA
698091	GAUGE PRESSURE NOSHOK 30"-200#	2.00	EA
698105	GAUGE PRESSURE NOSHOK 0-400#	2.00	EA
734136	LAMP APPLIANCE 40W	1.00	EA
785695	MOTOR CIRC 3000RPM 1/15HP CW	1.00	EA
803618	VALVE SOLENOID 120/50-60	1.00	EA
810827	WINDOW FRAME 7X9	1.00	EA
820830	HINGE BUTT 4X4 STEEL W/HOLES	2.00	EA
858013	PILASTER SET 1.2 CU FT	1.00	ST
877069	LATCH SOUTHCO OVR-CTR BLACK	1.00	EA
880841	LINER DOOR W/WINDOW S1.2	1.00	EA
981168	BRKT PRESSURE SWITCH MTG S1.2	1.00	EA

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## Seq/Description

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40 ELECTRICAL ASS'Y

component	description	qty per	u/m
1056389	PCB ASSY R+D 7800 SSR ENH240MA	2.00	EA
1159381	INST CONTROL MODULE X	1.00	EA
1168209	CABLE ASSY 3800 DISP 2FT	1.00	EA
1170515	PLATE INTERFACE COVER-BLANK	1.00	EA
1178270	INST 3800 DISPLAY	1.00	EA
1182693	CLAMP 3800 DM MOUNTING	4.00	EA
1191105	CONN BLKHD RJ45 COUPLER	1.00	EA
1193092	NETWORK RC 150 OHM .5UF 250V	2.00	EA
1202875	CABLE ASSY ETHERNET CAT5 3FT	1.00	EA
1203562	PANEL ELEC ASSY S-1.2-38 115V	1.00	EA
151008	THERMOCOUPLE R-W 6TEFLON 20 AW	1.00	EA
538318	SENSOR BULB HOLDER	1.00	EA
5512175	SCREW OVL PHL. BLK OX. #4X1/2	4.00	EA
553074	TERMINAL BLOCK CURTIS 4 HOLE	1.00	EA
713163	CORD GRIP 1/2" .312 TO .437	2.00	EA
755125	SENSOR YSI RTD 100 OHM PTDIN 7	1.00	EA
864161	CORD POWER 20A W/5-20P F/S1.	1.00	EA
874213	KIT WIRE F/S, SM SERIES LIGHT	1.00	PR
909378	BUSHING STRAIN RELIEF HEVCO	1.00	EA
928135	CORD POWER 18-3 10A 3FT LG	1.00	EA
971782	RECORDER HONEYWELL IPEN GRAY	1.00	EA

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Seq/Description

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110 SHIPPING

<u>component</u>	<u>description</u>	<u>qty per</u>	<u>u/m</u>
564688	CHART CIRC -100 TO 200 EVEN	1.00	BX

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## Seq/Description

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999 SHIPPING

component	description	qty per	u/m
1015927	SCREW HEX SELF TAP 1/4-20X1	4.00	EA
1015935	SCREW HEX WASHER HEAD SELF TAP	4.00	EA
1037115	RIVET POP LRG HD SS 1/8 X .39	80.00	EA
1048140	INSULATION FIBERGLAS 2"X 24"W	4.00	SF
251009	BUSHING SNAP 3/8ID X .50 HOLE	1.00	EA
534045	GASKET NEOP EDGE ANGLE 40DURD	8.00	FT
535696	ELBOW CU 3/8 90' ST EL	1.00	EA
561816	VALVE SCHRADER 1/4 X 2" TUBE	4.00	EA
562243	BUSHING SNAP 1/4ID X .375 HOLE	2.00	EA
562286	BUSHING SNAP 7/16ID X .562 HOLE	1.00	EA
562308	BUSHING SNAP 5/8ID X .750 HOLE	1.00	EA
562316	BUSHING SNAP 11/16ID X 1.093 HD	1.00	EA
574934	TEE COPPER 1/4	6.00	EA
574942	TEE COPPER	1.00	EA
575892	NUT FLARE 1/4	4.00	EA
577445	WIRE CORD RUBBER BLACK 14-3	10.00	FT
577623	TUBING COPPER REFRIG GRD 5/16"	4.00	FT
577631	TUBING COPPER REFRIG GRADE 3/8	1.00	FT
577682	TUBING COPPER REFR GRADE 3/16	1.00	FT
577690	TUBING COPPER REFRIG GRADE 1/4	19.00	FT
577690	TUBING COPPER REFRIG GRADE 1/4	1.00	FT
581558	TUBING COPPER HD DN 1-5/8	6.00	FT
646105	WIRE SHIELDED 3 CONDUCTOR	12.00	FT
651729	STEEL SS SHEET 18GA 36"W 120"L	2.00	SF
987409	SCREW SHT MTL PH PAN HD TYPE F	50.00	EA
989037	GROMMET RUBBER 1/4ID 1/16 GROV	10.00	EA