

Thermo Forma

Models:

8515 and 8520

8580 and 8583

Power Plus™

Upright Freezers

17 and 23 cu. ft. capacity

Operating and Maintenance Manual

Manual No: 7028515 Rev. 7

Read This Instruction Manual.

Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance.



CAUTION! All internal adjustments and maintenance must be performed by qualified service personnel.

Refer to the serial tag on the back of this manual.

The material in this manual is for information purposes only. The contents and the product it describes are subject to change without notice. Thermo Forma makes no representations or warranties with respect to this manual. In no event shall Thermo Forma be held liable for any damages, direct or incidental, arising out of or related to the use of this manual.

MANUAL NUMBER 7028515				
REV	ECR/ECN	DATE	DESCRIPTION	By
--	21210/FR-1661	12/4/02	Added vacuum relief port information	ccs
7	20820/FR-1619	6/3/02	Corrected line side wiring in the boost/buck relay	aks
--	20684/FR-1596	3/28/02	Added sample pull-down chart after specs	ccs
6	20251/FR-1526	2/22/02	Cordset connector	aks
--	19785/FR-1482	1/23/01	Added where-used to schematics	ccs
--	19363/FR-1429	10/19/00	New thermostat condenser hot temp to 43°C	ccs
5	19151/FR-1384	7/21/00	Resize cabinet (RICH)	aks
--	18249/SI-7545	7/7/99	Added P/N 195517 air filter kit to parts list	ccp
4	--	11/9/98	Added battery change frequency in Section 3.2/E. Dutton	ccp



Important operating and/or maintenance instructions. Read the accompanying text carefully.

Ce symbole attire l'attention de l'utilisateur sur des instructions importantes de fonctionnement et/ou d'entretien. Il peut être utilisé seul ou avec d'autres symboles de sécurité. Lire attentivement le texte d'accompagnement.

Wichtige Betriebs- und/oder Wartungshinweise. Lesen Sie den nachfolgenden Text sorgfältig.

Importante instrucciones de operacion y/o mantenimiento. Lea el texto acompanante cuidadosamente.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.

Ce symbole attire l'attention de l'utilisateur sur des risques électriques potentiels. Seules des personnes qualifiées doivent appliquer les instructions et les procédures associées à ce symbole.

Gefahr von Stromschlägen. Nur qualifizierte Personen sollten die Tätigkeiten ausführen, die mit diesem Symbol bezeichnet sind.

Potencial de riesgos electricos. Solo personas das capacitadas deben ejecutar los procedimientos asociadas con este simbolo.



Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.

Risques potentiels liés à l'énergie. L'équipement en entretien ou en maintenance doit être éteint et mis sous clé pour éviter des blessures possibles.

Geräte, an denen Wartungs- oder Servicearbeiten durchgeführt werden, müssen abgeschaltet und abgeschlossen werden, um Verletzungen zu vermeiden.

El equipo recibiendo servicio o mantenimiento debe ser apagado y asegurado para prevenir danos.



Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.

Présence de surface(s) chaude(s) pouvant causer des brûlures sur la peau non protégée, ou sur des matières pouvant être endommagées par des températures élevées.

Heiße Oberfläche(n) können ungeschützter Haut Verbrennungen zufügen oder Schäden an Materialien verursachen, die nicht hitzebeständig sind.

Superficies calientes que pueden causar quemaduras a piel sin proteccion o a materiales que pueden estar danados por elevadas temperaturas.

- √ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
- √ Always dissipate extreme cold or heat and wear protective clothing.
- √ Always follow good hygiene practices.
- √ Each individual is responsible for his or her own safety.

Do You Need Information or Assistance on Thermo Forma Products?

If you do, please contact us 8:00 a.m. to 6:00 p.m. (Eastern Time) at:

1-740-373-4763	Direct
1-888-213-1790	Toll Free, U.S. and Canada
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Our **Sales Support** staff can provide information on pricing and give you quotations. We can take your order and provide delivery information on major equipment items or make arrangements to have your local sales representative contact you. Our products are listed on the Internet and we can be contacted through our Internet home page.

Our **Service Support** staff can supply technical information about proper setup, operation or troubleshooting of your equipment. We can fill your needs for spare or replacement parts or provide you with on-site service. We can also provide you with a quotation on our Extended Warranty for your Thermo Forma products.

Whatever Thermo Forma products you need or use, we will be happy to discuss your applications. If you are experiencing technical problems, working together, we will help you locate the problem and, chances are, correct it yourself...over the telephone without a service call.

When more extensive service is necessary, we will assist you with direct factory trained technicians or a qualified service organization for on-the-spot repair. If your service need is covered by the warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 6:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

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Marietta, OH 45750

International customers, please contact your local Thermo Forma distributor.

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Section 1 - Receiving

Section 2 - Installation/Start-Up

1.1 Preliminary Inspection

The freezer was thoroughly inspected and carefully packed prior to shipment and all necessary precautions were taken to ensure safe arrival of the merchandise at its destination. Immediately upon receipt, before the unit is moved from the receiving area, carefully examine the shipment for loss or damage. Unpack the shipment and inspect both interior and exterior for any in-transit damage.

1.2 Visible Loss or Damage

If any loss or damage is discovered, note any discrepancies on the delivery receipt. Failure to adequately describe such evidence of loss or damage may result in the carrier refusing to honor a damage claim. Immediately call the delivering carrier and request that their representative perform an inspection. Do not discard any of the packing material or move the shipment from the receiving area.

1.3 Responsibility for Shipping Damage

For products shipped F.O.B. Marietta, Ohio, the responsibility of Thermo Forma ends when the merchandise is loaded onto the carrier's vehicle.

On F.O.B. Destination shipments, Thermo Forma's and the carrier's responsibility ends when your Receiving Department personnel sign a free and clear delivery receipt.

Whenever possible, Thermo Forma will assist in settling claims for loss or in-transit damage.

2.1 Introduction

The Thermo Forma Power Plus™ non-CFC, Ultra-Low Temperature Freezers feature front-to-back air circulation for cooler compressor temperatures, increased performance and reliability and longer compressor life. In this unique system, ambient air enters the front grille of the freezer and passes through the filter, condenser and compressor housing, exiting out of the rear of the unit.

The semi-hermetic compressors provide for increased reserve BTU removal and quicker temperature recovery.

An enlarged condenser and two cooling fans contribute to better efficiency, even in high ambient conditions. Oversize condensers also help extend compressor life. Cleaning the air filter and condenser fins is done from the front of the unit. Other important features of the Thermo Forma Power Plus™ Freezers are:

a. Enviro-Scan Microprocessor Monitoring System

Enviro-Scan uses a digital display, audible and visual indicators and a touch sensitive key pad to provide total control of all freezer functions. The module digitally displays chamber temperature and control setpoint, to the nearest degree C. High and low alarm set points are easily programmed. A back-up battery system supplies power to the monitoring system during electrical outages.

An RS-232 port provides a computer interface and monitoring of temperatures and alarms. A remote alarm connector is also a standard feature.

b. Non-CFC, non-HCFC and non-flammable refrigerants

Committed to a safer, healthier environment, Thermo Forma has phased out the use of ozone depleting CFC (chloro-fluorocarbons) in all of the company's refrigerated products. Thermo Forma also uses non-CFC foamed-in-place urethane insulation and all packaging materials used in shipping are non-CFC.

c. Peak Control System

Due to the increased demands on today’s refrigeration systems, Forma Scientific has engineered a compressor protection system called PEAK Control. In this system, a pressure switch senses excessive compressor discharge pressure. When the discharge pressure exceeds the design limit, a solenoid valve opens allowing refrigerant to enter an expansion tank. The refrigerant returns to the system through a capillary tube. The PEAK Control System continues to monitor system pressures, insuring they stay within design limits to help extend compressor life.

d. “Smart” Condenser Fans

For maximum compressor protection, all Forma ULT freezers include two tube axial fans in the compressor housing. When both compressors are running, both fans operate to pull ambient air through the condenser and over the compressors. When both compressors are off, one fan remains ready to cycle on when the thermostat senses a temperature rise above 32°C.

e. Built-In Automatic Voltage Compensation

A built-in, automatic voltage compensator is built into every Forma 8500 Series non-CFC, Ultra-Low Temperature Freezer to detect and respond to high or low voltage situations. Voltage from the incoming power supply is monitored and adjusted by the automatic voltage compensator, ensuring compressor operation within design parameters. A light on the front of the control panel indicates when incoming voltage is being corrected.

An enlarged condenser and two temperature controlled cooling fans also contribute to better efficiency, even in high ambient conditions.

2.2 Environmental Conditions

The Thermo Forma Power Plus™ ULT Freezers are designed to operate in the following environmental conditions:

- Indoors
- Altitude - up to 2,000 meters
- Temperature - 5°C to 40°C
- Humidity - 80% RH at or below 31°C, decreasing linearly to 50% RH at 40°C
- Mains Supply Fluctuations - ± 10% of nominal
- Installation Category II ¹
- Pollution Degree 2 ²
- Class of Equipment I
- Climatic Class T (Tropical)³

¹ Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

² Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.

³ Class T (Tropical) means that the freezers are electrically safe in a 43°C ambient.

2.3 Unpacking List

A small bag containing the following accessories is packed inside the freezer:

Qty.	Stock #	Description	Purpose
2	510016	1/4-20 x 5-1/2” Bolt	Wall Bumper
2	380520	Neoprene Cap	Cap Protector
1	235013	Screwdriver Set	
1	435051	8-3/4” Phillips Screwdriver	
1	444062	Box end ratchet wrench	Loosen shipping bolts
1	34040	Key ring	

2.4 Removing the Compressor Wedge Assemblies



The wedge assemblies, securing both compressors for shipment, must be removed before putting the freezer into service. Failure to follow these instructions may damage the freezer and void the warranty.

1. Make sure the freezer is not connected to electrical power.
2. Using a Phillips screwdriver remove the lower right side and rear panels.
3. Remove the box end ratchet wrench from the parts bag.
4. Both compressors are secured with wedges, connected by threaded rods, secured on both ends of the rods.

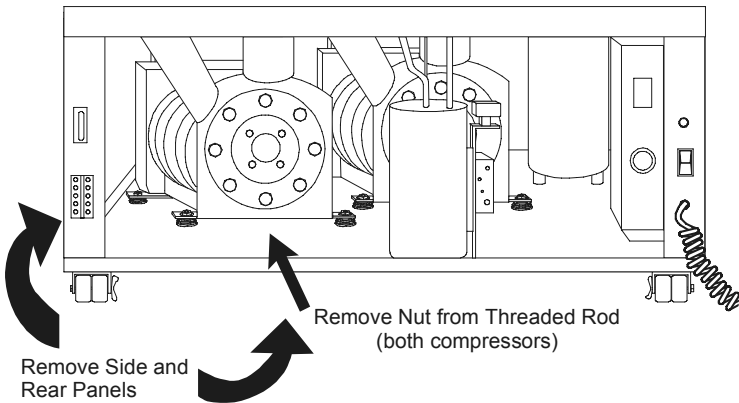


Figure 2-1
Rear Compressor Section

5. Working from the back of the compressor section, use the wrench to remove the nut and washer securing the wedge on the threaded rod. Remove the rear wedge.
6. Rotate the threaded rod counterclockwise to remove it from the front wedge. Remove the front wedge. Discard these packing materials (wedges, rods, nuts and washers).
7. Repeat these last two steps to remove the wedge assembly from the second compressor.
8. Replace the side and rear panels.

2.5 Installing the Wall Bumpers

The parts bag contains two (2) 1/4-20 x 5-1/2” bumper bolts and two (2) neoprene caps. Install the bolts (the holes are pre-tapped) on the back side of the compressor section. Refer to Figure 2-3. Install a neoprene cap on each bolt.



If the bumpers are removed, they must be reinstalled before the freezer is placed in the desired location to ensure adequate ventilation and air-flow for the compressor.

For proper ventilation and air flow, a minimum of 5” of clear space is required behind the freezer. an additional 5” (minimum) of clear space is also required on both sides of the freezer. when locating the back of the freezer toward a wall or obstacle(s), make sure that the wall bumpers are installed.

2.6 Moving the Model 8520 Through a Doorway

To move the Model 8520 through a 34.50” doorway, the door stop bracket(s) must be removed. The single door units have one door stop at the top right side of the unit. Double door units have a second door stop at the bottom right side of the unit. Using a 7/16” socket wrench, remove the two screws securing each bracket. This permits the door(s) to be fully opened so that the freezer can be moved through the doorway.



Remove the door stop bracket screws only. Removing hinge screws will weaken the door, or cause it to fall, and may result in injury to personnel and/or damage to the freezer.

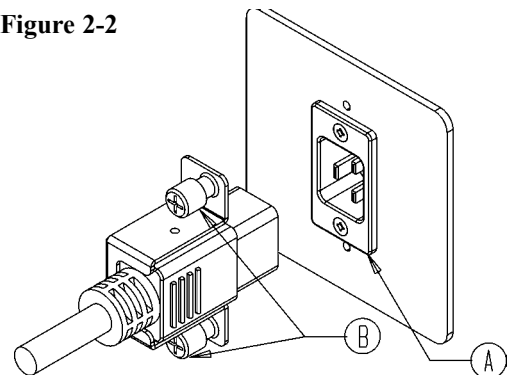
2.7 Location

Locate the freezer on a firm, level surface in an area of minimum ambient temperature fluctuation.

2.8 Attaching the Power Cord

1. Insert the power cord into the power outlet module (A).
2. Tighten screws (B) on the power cord retainer.

Figure 2-2



2.9 Connecting Power to the Freezer



Thermo Forma recommends that the freezer be operated on a dedicated electrical circuit to avoid circuit overload.

Before connecting the freezer to an adequate power source, refer to the electrical data plate mounted on the back of the unit or to the electrical specifications listed in Specifications.

2.10 Deactivating the Enviro-Scan Monitor for Storage

The Enviro-Scan Monitor has been deactivated (placed in a sleep mode) prior to shipment. The monitor activates when power is applied to the freezer. If electrical power is lost or the freezer is disconnected, the monitor will be sustained by the battery back-up.



Whenever the freezer is unplugged for storage, the “Enviro-Scan” must be de-activated to preserve the life of the battery and preserve the warranty.

1. Turn off or unplug the freezer.
2. Obtain the access code prompt by pressing the UP ARROW key and the BATTERY % CHARGE key simultaneously. a “1” must appear in the display window. If “1” does not appear in the window, repeat step 2.
3. Enter the four digit access code. The Access Code set at the factory - 1, 2, 3, 4. For Access Code information, refer to Section 3.2. To change the Access Code, refer to Section 4.4.
4. After entering the four-digit Access Code, press the ENTER key and “CAL” will appear in the window.
5. Press the DOWN ARROW key.
6. The Enviro-Scan monitor is now deactivated (placed in a sleep mode) until electrical power is restored.

2.11 RS-232 Output Interface

The 8500 Series freezers are equipped with an RS-232 Serial Communication Interface for the remote transmission of sensor data. A standard DB-25S connector is located on the rear of the compressor housing. The data is “dumb terminal” formatted, which permits interfacing with either a computer or a serial printer.

Three wires are used for the RS-232 interface:

- 1) TX Data = Pin 2
- 2) RX Data = Pin 3
- 3) Signal Ground = Pin 7

The data format is seven-bit ASCII with a leading zero (8th bit). Each character is transmitted with one start-bit, eight data-bits, and two stop-bits, totaling eleven bits. NO parity-bit is included. Baud rate is 1200.

A data transfer sequence is transmitted according to the following format. X refers to the variable numerical temperature

data.

(NUL) (-) XXX (SP) C (SP) (OVERTEMP) (SP) (LF) (CR) (EOT) (SP) (UNDER TEMP)

The words “OVERTEMP” or “UNDER TEMP” are transmitted with the temperature if one of those conditions exists at the time the data is transmitted. When there is no alarm condition, spaces will be sent instead so that there is always a total of 20 characters sent.

- SP - space
- LF - line feed
- CR - carriage return
- EOT - end of text
- NUL - null character (00)

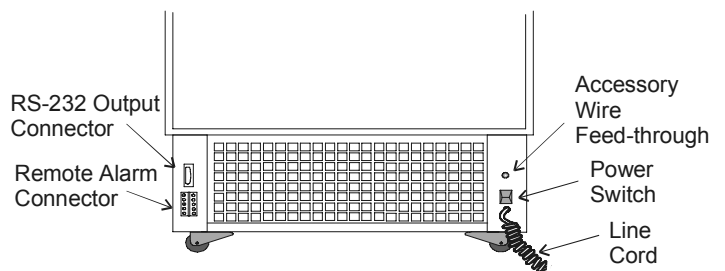
The Enviro-Scan Monitor transmits temperature and alarm condition data when power is first applied to the monitor, then once every hour.

The Enviro-Scan Monitor responds to two ASCII commands from the remote: DC1 (XON) and DC3 (XOFF)

DC1 (11H): The Enviro-Scan Monitor will transmit temperature and alarm condition data upon receipt of DC1 and resume 60 minute interval transmissions if they had been inhibited by a DC3.

DC3 (13H): Receiving a DC3 from the remote inhibits the Enviro-Scan Monitor from sending serial data indefinitely until a DC1 is received or monitor power is removed and then reapplied.

Figure 2-4 identifies the location of the RS-232 output connector.



Component Locations on Freezer Rear Panel

Figure 2-3

2.12 Remote Alarm Connector

For installations requiring remote temperature monitoring or high/low temperature alarm systems, a remote connector is provided on all Thermo Forma 8500 Series Upright Freezers. Figure 2-3 identifies the location of the remote alarm connector, Figure 2-4 identifies the pin output. (A label on the back of the freezer cabinet also contains this information.)

The alarm contacts are rated:

- 0.5A at 30VDC, 15 watts maximum.
- 0.6A at 24 VAC, 14 watts maximum

2.14 Setting the Low and High Limit Set Points

The High Limit set point is factory-set at -65° C. The Low Limit set point is set at 3° below the operating temperature. If another temperature limit set point is desired, set as follows:

Key	Pin #	Description
1	1	Over temperature Common
2	2	Over temperature N.C.
3	3	Over temperature N.O.
4	4	Millivolt Out (Positive +)
5	5	Under temperature N.C.
6	6	Millivolt Out (Negative -)
7	7	Under temperature Common
8	8	Under temperature N.O.
9	9	(Not Used)
10	10	(Not Used)

Figure 2-4

IMPORTANT USER INFORMATION

Caution! Stored product should be protected by an activated alarm system capable of initiating a timely response 24 hours/day. Forma Alarms provide interconnect for centralized monitoring.

a. To Display or Change the Low Limit Set Point

1. Press the LOW LIMIT key and a “1” will appear in the LCD window.
2. Enter the access code (1,2,3,4).
The “1” will remain in the LCD window.
3. Press the ENTER key and the Low Limit temperature along with the word “SET LOW LIMIT” will be displayed in the LCD window.
4. Change the existing Low Limit temperature by pressing the UP or DOWN arrow keys.
5. Press the ENTER key and the LCD display will return to cabinet temperature.

b. To Display or Change the High Limit Set Point

1. Press the HIGH LIMIT key and a “1” will appear in the LCD window.
2. Enter access code (1,2,3,4).
A “1” will remain in the LCD window.
3. Press the ENTER key and the existing High Limit along with the word “SET HIGH LIMIT” will be displayed in the LCD window.
4. Change the existing HIGH LIMIT by depressing either the UP or DOWN arrow keys.
5. Press the ENTER key and the LCD display will return to cabinet temperature.

2.13 Setting the Operating Temperature

1. Turn the freezer on. The cabinet temperature will be displayed in the LCD window.
2. Press the CONTROL SET POINT key and a “1” will appear in the LCD window.
3. Enter access code (1,2,3,4). The “1” will remain in the LCD window.
4. Press the ENTER key and the word “SET”, along with the control set point temperature will be displayed in the LCD window.
5. If an operating temperature other than that displayed in the window is desired, turn the temperature set point screw using the adjustment screwdriver. The set point screw is located to the right of the ENTER key on the Enviro-Scan Monitor control panel. (The adjustment screwdriver is located on the bottom of the freezer frame. Refer to Figure 3-2.)

Note: Thermo Forma recommends setting the cabinet temperature no colder than necessary for product storage.

6. Press the ENTER key and the LCD display will return to the cabinet temperature.

2.15 General Recommendations

Avoid opening the door for extended time periods. Room air, which is higher in humidity, will replace chamber air and cause frost to develop. allowing the door to remain open for extended time periods will cause the chamber to “warm-up”, putting undue stress on the compressors.

This unit is not a “quick-freeze” device. Freezing large quantities of liquid, or high-water content items, will temporarily increase the temperature and will cause the compressors to operate for a prolonged time period. damage to the compressors may result and product safety may be jeopardized.

2.16 Preparing the (optional) CoBex Temperature Recorder

a. Installing the chart recorder battery

The seven-day circular chart recorder is located on the bottom front of the freezer cabinet and is protected by a glass door.

To prepare the recorder for operation, open the glass door and snap the connector onto the 9-volt battery as shown in Figure 2-5. If the freezer is operating, the green LED will show a steady light. If the freezer is not turned on, the LED will flash.

If the battery is weak or not connected, the green LED will flash. If power is lost to the cabinet, the LED will also flash as the Alarm/Monitor goes into the alarm state.

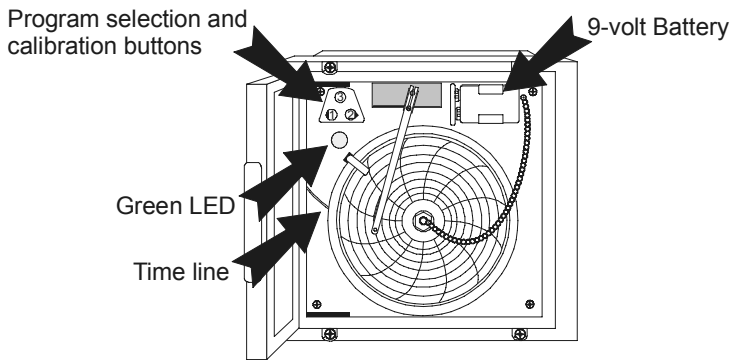


Figure 2-5

b. Installing the chart paper

(Refer to Figure 2-6) Press and hold button #3 for about one second until the pen begins to move to the left. Unscrew the knob at the center of the chart and install the paper, positioning the chart so the correct time line coincides with the time line groove on the chart plate. Replace the knob and press the #3 button until the pen begins to move to the right.

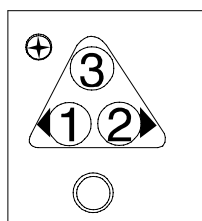


Figure 2-6

c. Changing the recorder range

The chart recorder contains eight temperature ranges and is factory-programmed for the freezer. (Refer to Figure 2-6)

1. Press and hold button #3 for one second, then let the pen move off of the chart paper.
2. Press and hold for five seconds either button #1 or button #2.
3. Release the button and the green LED will begin to flash. Count the number of flashes to determine the present program setting.
4. To change the program setting, press the left or right arrows to increase or decrease the count.
5. When the desired program number is flashing, press the change chart button to bring the pen arm back onto the chart. Recording will begin in the new program.

Note: Changing ranges may require an offset calibration as outlined in the following procedure. See the CoBex Instruction Manual.

Program No.	Range
Program 1	-40°C to 30°C
Program 2	0°C to 60°C
Program 3	-100°C to 38°C
Program 4	-5°C to 50°C
Program 5	0°C to 100°C
Program 6	-100°C to -200°C
Program 7	-115°C to 50°C
Program 8	-10°C to 70°C

d. Calibrating the chart recorder

Place an accurate thermometer in the chamber next to the recorder's probe. After about three minutes, compare the thermometer with the chart recorder. If an adjustment is necessary, press either the #1 or #2 button to move the pen left or right. The button must be held about five seconds before the pen begins to move. Release the button when the pen matches the thermometer.

Temperature probes for the CoBex Recorder and for the Enviro-Scan monitor are located in the left front corner of the freezer chamber. Figures 2-7, 2-9, and 2-10 illustrate the temperature probes and the probe cover.

Note: The felt-tip pen on the CoBex recorder requires periodic replacement. Usually the ink will appear to fade before replacement becomes necessary. Additional pen tips may be purchased from Thermo Forma.

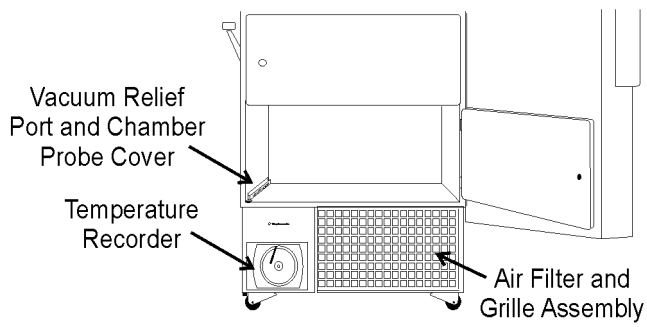


Figure 2-7

e. Recorder Outlet

The 115VAC recorder outlet is located at the end of the relay enclosure. Refer to Figure 2-8.

The outlet is only to be used for CoBex recorders supplied by Thermo Forma.

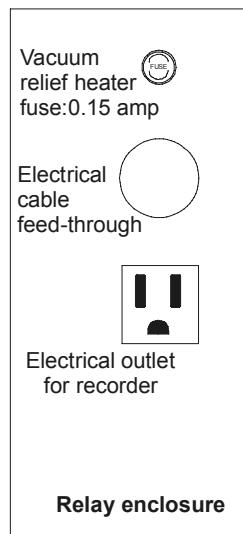


Figure 2-8

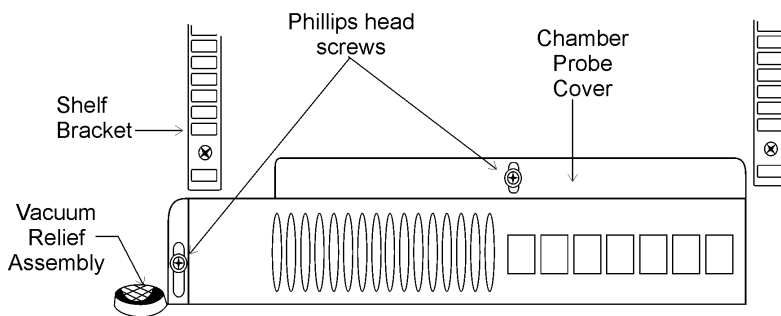


Figure 2-9

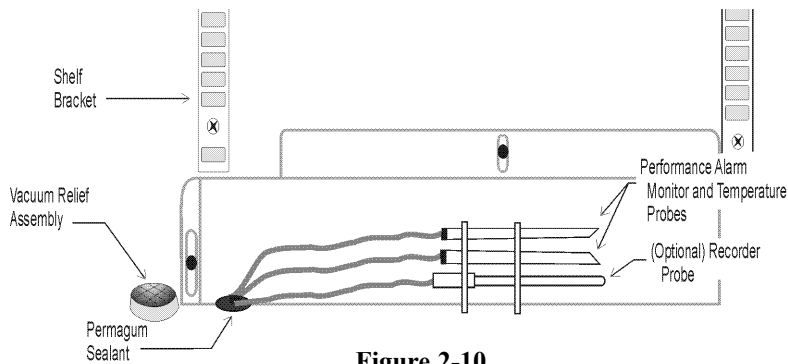


Figure 2-10

Section 3 - Operation

3.1 The Enviro-Scan Monitor

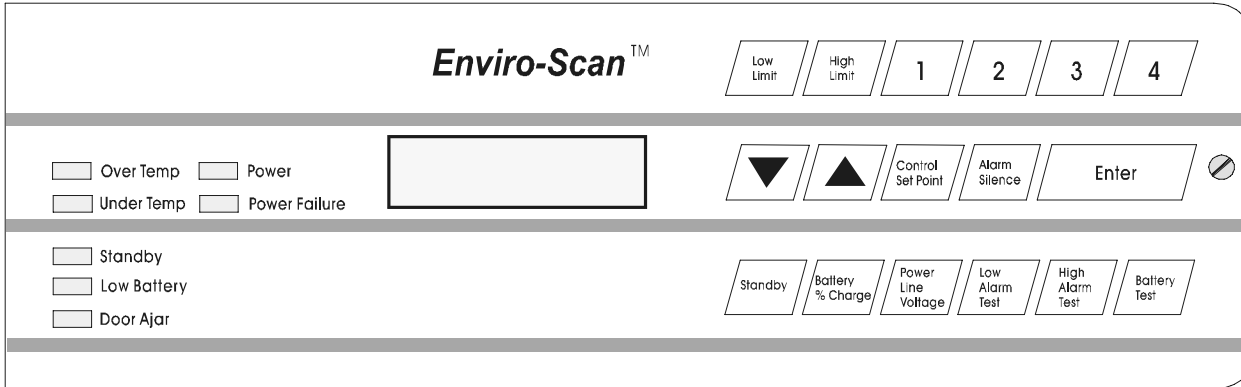


Figure 3-1
Enviro-Scan Monitor

The Enviro-Scan Monitor provides constant monitoring of the freezer’s operation. The numerical LCD display provides a readout of the freezer chamber temperature in increments of 1°C.

Some functions of the Enviro-Scan Monitor require the entry of a four digit security code to access, display or change them. Access code 1,2,3,4 is programmed into each unit at the factory. This code may be changed to any four digit combination of the numbers 1,2,3, and 4. (Section 4.4 describes the procedures to change the Access Code.)

Functions requiring no access code are:

- | | |
|----------------|--------------------|
| Alarm Silence | Power Line Voltage |
| Enter | Low Alarm Test |
| Standby | High Alarm Test |
| Battery Charge | Battery Test |

Other features include:

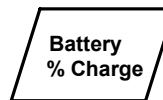
- | | |
|---------------------|----------------------------|
| Over Temp light | Under Temp light |
| Standby light | Low Battery light |
| Door Ajar light | Power light |
| Power Failure light | Condenser Hot light-hidden |

3.2 Main Power Switch (mains disconnect)

The main power switch is located on the back of the refrigeration unit, directly above the line cord.

- Off = (o) On = (|)

3.3 Key Functions Requiring No Access Code (Refer to Figure 3-1)

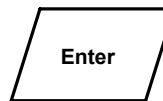


Displays the Enviro-Scan Monitor backup battery’s percent of charge. The reading gives some indication of how long the monitor will operate on battery backup. The Backup system is designed to maintain monitor operation for at least 72 hours. a reading of 50%, when on battery power, indicates that the monitor will run for approximately 36 hours.

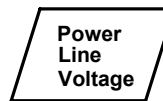
The Battery % Charge may not indicate the full number of hours of monitor backup power. The % of charge can vary depending on the age, usage and condition of the battery. For a consistent and dependable charge, replace the battery every 2 years.



Silences all alarms for approximately 30 minutes and changes the display to cabinet temperature.



Displays cabinet temperature. This key is also used for functions requiring the access code.



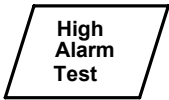
Displays the operating voltage of the freezer when both compressors are running. A zero will be displayed on the LCD when the line voltage reading drops below 100 volts on a 208/220 volt circuit (50 volts on a 115 volt circuit).



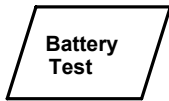
The standby key silences the audible alarm after an alarm condition or a power failure. The standby key will silence the audible alarm only. The alarm light will stay on until the alarm condition has been corrected. A built-in ring-back feature audibly signals that the unit has returned to normal set point limits. Press the STANDBY key to remove the audible tone.



The low alarm limit must be set to within 45°C of actual cabinet temperature to perform this test. If the alarm limit is not set within this limit, a long tone will sound and no test will occur. If within limits, the alarm will be activated when the probe temperature drops below the low alarm limit. The test may be aborted at any time by pressing ENTER. All other key functions are “locked-out” during this test.



The high alarm limit must be set to within 45°C of actual cabinet temperature to perform this test. If the alarm limit is not set within this limit, a long tone will sound and no test will occur. If within limits, the probe will be heated until it reaches the alarm limit and the alarm will be activated. The probe will then gradually cool back to the actual cabinet temperature. The test may be aborted at any time by pressing ENTER. All other key functions are “locked-out” during this test.

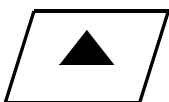


Disconnects the main power from the monitor, making it switch and operate on battery power.

a. Access Keys:

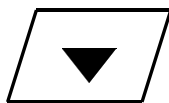
Keys 1,2,3 and 4 are used for the entry of the four digit Access Code.

3.4 Key Functions Requiring the Access Code (refer to Figure 3-1)



Pressing the up arrow key will increase the display by increments of one division. If this key is held down for more than two seconds the display will increment automatically.

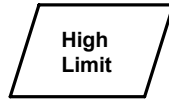
Note: The up and down arrow keys are used for setting the high and low limits and all calibration functions.



Pressing the down arrow key will decrease the display by increments of one division. If this key is held down for more than two seconds the display will increment automatically.



The low limit key is used to establish a Low Limit set point. When the chamber temperature reaches (or exceeds) the Low Limit set point, the audible alarm will sound and the UNDER TEMP indicating light will come on. The remote alarm contacts, located on the back of freezer, will also be activated. Refer to Section 2.14 for Low Limit setting instructions.



The high limit key is used to establish a High Limit set point. When the chamber temperature reaches, or exceeds, the High Limit set point, the audible alarm will sound and the OVER TEMP indicating light will come on. The remote alarm contacts, located on the back of the freezer, will also be activated. Refer to Section 2.14 for High Limit setting instructions.



After depressing this key and entering the access code, the setting for the temperature control will appear in the display. The control setting is adjusted by turning the Set Point Adjusting Screw located on the far right of the monitor panel.

Note: When in a battery backup condition (AC power off), the control set point value is replaced with “—” to prevent false data from being displayed. Press ENTER to return to the temperature display.



Set Point Adjustment Screw located to the right of the ENTER key is used to set the operating temperature of the freezer. An adjustment screwdriver is located on the back panel of the compressor section. (See Figure 3-2 and Figure 2-1).

3.5 Audible Alarm and Control Panel Indicators

Audible alarm:

Provides a pulsing audible tone whenever an alarm condition is present. The DOOR AJAR audible alarm has a 30 second delay to prevent nuisance alarms when the door is opened. Pressing the ALARM SILENCE key will silence all alarms for 30 minutes.

Note: When in STANDBY mode, the audible alarm is silent until all alarm conditions are cleared. Audible alarm conditions include OVER TEMP, UNDER TEMP, DOOR AJAR and AC power failure.



Over Temp (LED):

Flashes when an over temperature condition exists.



Under Temp (LED):

Flashes when an under temperature condition exists.



Standby (LED):

Lights when in standby mode.



Low Battery (LED):

On when battery state of charge is below 50% and AC power is on. When AC power is off, the LOW BATTERY LED comes on when the battery state of charge is below 15%.



Door Ajar (LED):

Flashes when the freezer lid is open.



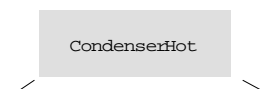
Power (LED):

Lights when the AC power is on. Out when the AC power is off.



Power Failure (LED):

Lights when power is removed from the unit. Press Silence or Standby to silence the audible alarm. Deactivate the Enviro-Scan Monitor if unit is to be turned off for more than five hours. (Refer to Section 2.9)



The words Condenser Hot will appear in the alpha-numeric display and a audible alarm will sound for 12 seconds every 15 minutes when the thermostat on the condenser reaches 43°C. This condition typically indicates a clogged condenser, fan failure, dirty filter or high ambient temperature conditions. The audible alarm is silenced only by correcting the problem causing the alarm.



The user should immediately check the air filter (Figure 3-2) and the condenser for cleanliness and the fan for proper operation. Failure to do so may cause compressor damage and result in loss of the freezer contents. Refer to Section 5.2, "Cleaning the Condenser" and Section 5.3, "Cleaning the Air Filter".

3.6 Double Door Freezer (Factory-Built Option)

Double door models of the Thermo Forma ULT freezers are available as a factory-built option. These freezers reduce the amount of temperature loss by allowing longer term material to be stored in the bottom portion of the freezer and more frequently accessed short term material to be stored on the upper shelves. Operation of the double door freezers is the same as single door models.

Stock # 189757 - 13 cu. ft. models, 120 VAC

Stock # 189759 - 13 cu. ft. Models, 220 VAC

Inventory rack ordering information for 13 cu. ft. (368 liters) models is listed below.

Order No.	Description	Max Qty per Chamber
189771	Rack includes (9) 3" boxes for top chamber	8
189795	Rack includes (12) 2" boxes for top chamber Dimensions: 5.5"W x 9.7"H x 16.1"F-B (14.0cm x 24.6cm x 40.9cm)	8
820009	Rack includes (9) 3" boxes for bottom chamber	8
820015	Rack includes (15) 2" boxes for bottom chamber Dimensions: 5.5"W x 10.9"H x 16.5"F-B (14.0cm x 27.4cm x 41.9cm)	8

3.7 Set Point Adjustment Screwdriver

A small screwdriver, located on the lower left side of the freezer frame, is used to set the temperature set point. To remove the screwdriver from its holder, pull downward on the black knob located directly below the temperature recorder compartment. The knob is the handle of the screwdriver. Refer to Figure 3-2.

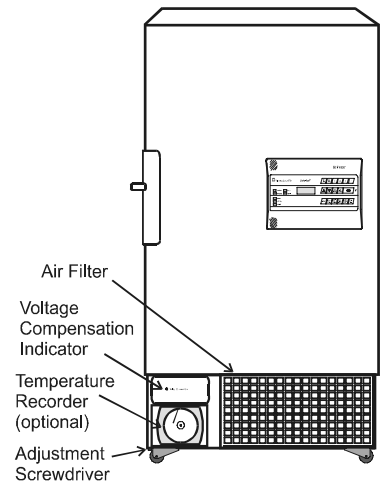


Figure 3-2

3.8 Automatic Voltage Compensation System

The Thermo Forma Power Plus™ Ultra-Low Temperature Freezers are equipped with an automatic line voltage compensation system to monitor in-coming electrical power and automatically adjust the voltage to the freezer. This compensation system ensures that the compressors operate within specification and provides an additional margin of product protection.

A green Voltage Compensation indicator lights when the system is operating.

3.9 Cobex Temperature Recorder (optional)

Operation of the recorder chart drive is automatic when power is applied to the freezer. In the event of a power failure, the 9 volt back-up battery will allow the recorder to sense and record temperature for about 24 hours. Refer to Section 2.16 and the Cobex instructions included in this manual.

Section 4 - Calibration

4.1 Calibration

Calibration of the freezer control system is done from the monitor keypad. Access to the calibration mode requires entry of the four digit access code.

Note: The access code (1,2,3,4) is assigned at the factory.

To obtain the access code prompt, simultaneously press the UP ARROW key and the BATTERY %CHARGE key.

Note: The keys must be pressed firmly and at the same time.

When this has been done correctly, a "1" will appear in the display window. After keying in the access code, press ENTER and "CAL" will appear in the display. At this point, the parameter to be calibrated may be selected by pressing its associated display function key.

Note: When changing calibration values, pressing the up or down arrow keys for more than two seconds will cause the displayed value to increment automatically.

4.2 Calibrating the Temperature Alarm Monitor Probe



Servicing must be performed by qualified service personnel only!

The Enviro-Scan Temperature Monitor has been factory calibrated.

The 8515 Series freezer must be calibrated when the unit is at the low end of its operating temperature (-75°C, -86°C). The probe cannot be properly calibrated at ambient temperatures.

Equipment needed: Accurate low temperature thermometer.

1. Allow the freezer temperature to stabilize at its temperature set point.
2. Fully open the freezer door.
3. Open the bottom two inner doors and place the thermometer near the probe cover.
4. Allow the freezer chamber temperature to stabilize after closing the door.
5. Obtain the prompt for the Access Code by pressing the up arrow and the Battery %Charge keys *simultaneously*. A "1" will appear in the display window. If a "1" does not appear in the window, push the keys again.
6. Enter the four digit Access Code.

7. Press Enter. "CAL" will appear in the display.
8. Press Enter again and the temperature measured by the alarm monitor probe will be displayed.
9. Remove the thermometer from the freezer chamber and compare the displayed reading with the thermometer.
10. If the two temperature readings do not agree, match them by pressing the Up and Down Arrow keys.
11. Press Enter to return to the normal temperature display.

Section 5 - Routine Maintenance

4.3 Calibrating Control Set Point Temperature Probe

1. Obtain the prompt for the Access Code by pressing the up arrow and the Battery %Charge keys *simultaneously*. A "1" will appear in the display window. If a "1" does not appear in the window, push the keys again.
2. Enter the four digit access code.
3. Press Enter. "CAL" will appear in the display.
4. Press the Control Set Point key to display the cabinet temperature measured by the control probe.
5. Compare this reading with the thermometer.
6. If the two temperature readings do not agree, match them by pressing the Up and Down Arrow keys.
7. Press Enter to return to the normal temperature display.

4.4 Changing the Access Code

1. Obtain access code prompt by depressing the up arrow key and the BATTERY %CHARGE key *simultaneously*. A "1" will appear in the display window.

Note: The keys must be pressed firmly and at the same time. If a "1" does not appear in the window, repeat step 1.

2. Enter the current four digit access code.
3. Press ENTER. "CAL" will appear in the display.
4. Depress the (4) key and a "1" will appear in the display prompting the new access code entry.
5. Key in the new four digit code using any combination of the numbers 1, 2, 3 and 4. the monitor will accept the last four digits if more than four are entered. if less than four digits are entered, the display returns to temperature and does not change the access code.
6. Depress ENTER to change to the new code and return to the temperature display.

Note: If the Access Code is changed and the new number combination is misplaced or forgotten, contact the Thermo Forma Service Department, 1-888-213-1790.

5.1 Cleaning the Cabinet Exterior

Clean the freezer exterior with soap and water and a general use laboratory disinfectant. Rinse with water.

5.2 Cleaning the Condenser



De-energize all potential sources of energy to unit. Lockout/tagout de-energized controls per O.S.H.A. Regulation, Section 1910-147 before cleaning the refrigeration system.

The Condenser Hot light illuminates when the temperature in the refrigeration compartment reaches 40°C, which typically indicates a clogged air filter, a clogged condenser, or a fan failure. This compartment temperature increase may also be the result of operating the freezer in high ambient temperatures.

The efficiency of the refrigeration unit is directly related to the temperature of the air entering the air-cooled condenser. Dust in the condenser fins slows the rate of heat dissipation and increases compressor operating temperature (also decreasing compressor life). A dirty condenser will reduce the overall performance of the refrigeration system in terms of recovery time and set point control accuracy and may ultimately cause compressor failure.

The air-cooled condenser (the finned surface located in the center area of the refrigeration compartment) should be cleaned as often as necessary to ensure efficient compressor operation. Thermo Forma recommends a minimum of twice a year.

To clean the condenser, remove the front grille by grasping the assembly at the corners and gently pulling it away from the frame. Clean the compressor housings and condenser fins with a vacuum cleaner or air-hose. Other refrigeration system parts are cleaned by removing the back and side panels. (Refer to Figure 5-1.)

Note: Before replacing the grille, inspect the filter for cleanliness. Clean or replace it if necessary. (Refer to Section 5.3.)

Compressors and fan motors are permanently lubricated and do not require servicing.

After cleaning, remove the lockout/tagout devices and return the unit to service.

5.3 Cleaning the Air Filter (Refer to Figure 5-1)

A foam air filter is located at the front of the freezer base. When the filter appears dirty, it can be easily removed for cleaning. The filter and grille assembly are held in place by snap fasteners on each corner of the grille.

Remove the grille by grasping it at the corners and gently pulling it away from the frame. Remove the filter and wash it with a mild detergent. Dry it by pressing it between two towels.

Should the filter become torn or excessively dirty, a replacement may be ordered from Thermo Forma (Part # 760162).

5.4 Defrosting the Chamber

The type of frost formed in the chamber is generally very soft and may be easily removed with a soft cloth. Do not use any type of abrasive brushes.

A complete defrosting may occasionally be required. To completely defrost the chamber:

1. Remove all product and place it in another freezer.
2. Turn the unit off and pull the plug.
3. Open all of the doors and place towels on the chamber floor.
4. Allow the frost to melt and become loose.
5. Remove the frost with a soft cloth.
6. After defrosting is complete, clean the interior with a non-chloride detergent and wipe the chamber dry with a clean cloth.



Caution! Do not use strong alkaline or caustic agents. Stainless steel is corrosion resistant, not corrosion proof. Do not use solutions of sodium hypochlorite (bleach), as they may also cause pitting and rusting.

5.5 Cleaning the Door Gasket

Routinely (monthly) check the door gasket for any perforations that will cause air leaks. Frost will form around all leakage areas. Frost accumulation on the door gasket may be removed with a soft cloth.

5.6 Cleaning the Vacuum Relief Port (Refer to Figures 5-1 and 5-2)

The vacuum relief port on the Model 8515 Series freezers is located in the lower left front of the chamber interior. Routinely check the vacuum relief port for frost accumulation and clean as necessary, using a soft cloth.



The vacuum relief port contains a small heating element to reduce frost build-up. If the freezer is not disconnected from the electrical supply or turned off at the power switch, the heating element will continue to operate and may cause injury to personnel cleaning the freezer chamber.

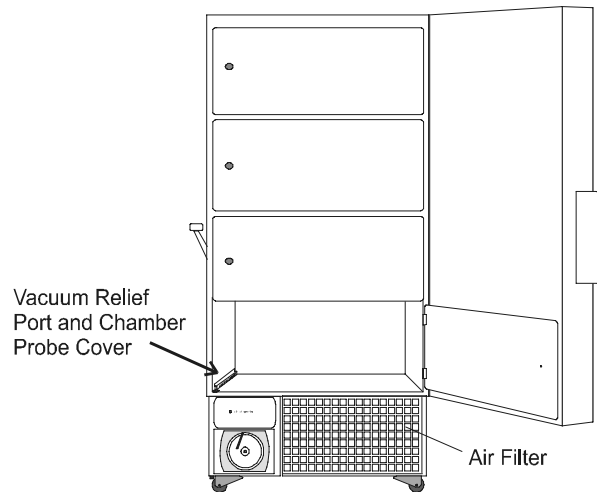


Figure 5-1
Vacuum Relief Port, Temperature Probe and Air Filter Location

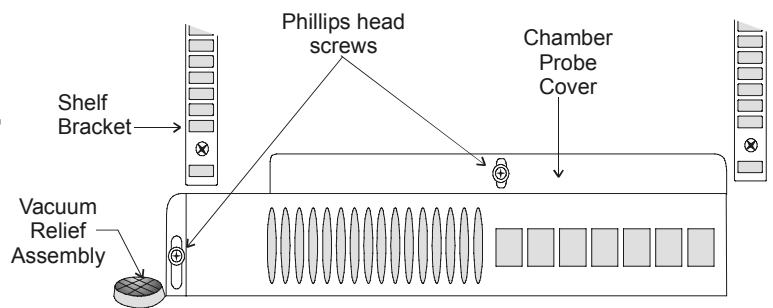


Figure 5-2
Vacuum Relief and Probe Cover Assemblies

5.7 Replacing the Performance Monitor/Alarm Battery



Replacement batteries must be rechargeable and are available from Thermo Forma. Refer to the parts list for stock number and description of the replacement batteries.
Dispose of the used batteries in a safe manner and in accord with good environmental practices.

1. Turn off electrical power to the freezer.
2. Remove the four screws and lock washers securing the front panel.
3. Unplug the battery connection and remove the screws securing the battery to the base.
4. Align the replacement battery pack with the red and black wires in the harness.
5. Plug in the battery (red to positive and black to negative) and replace the front panel.

Section 6 - Service

6.1 Servicing the Refrigeration System



Caution! Servicing must be performed by qualified service personnel only.

In the event of a unit malfunction, check all electrical components including starting relays, thermal protectors, and starting capacitors for the compressors.

Electrical schematics and drawings with parts for the refrigeration system are included in this manual.



Caution! Repair work should be performed only by personnel who have had prior experience with cascade refrigeration systems.

Note: A service manual entitled “ULTRA-LOW REFRIGERATION SYSTEM SERVICE GUIDE” is available from Thermo Forma. Call or write for details.

6.2 Troubleshooting Guide

The chart on the following page is intended as a guide to troubleshooting the system. Servicing of the freezer must only be performed by qualified service personnel.

6.3 8515/8520 Series Cabinet Hardware (Refer to the detail drawings in Section 10)

- a. Door Latch Assembly Detail
- b. Door Hinge Assembly Detail
- c. Vacuum Valve Heater Assembly Detail

Section 7 - Specifications

Symptom	Possible Cause	
No power light on monitor.	Power cord disconnected.	
	Circuit breaker tripped/open.	
	Main power switch OFF.	
	Pin-connector not plugged into the monitor board.	
	Fuse open on temp control board	
Chamber temp deviates from setpoint	Main fuse(s) open.	
	Too much warm product added	
	Door open too long	
	Insufficient voltage	
	Inadequate air circulation	
	Calibration	
	Dirty condenser	
	High Ambient Temperatures	
	Too much frost build-up	Leaking or damaged door gasket
	Freezer not being refrigerated (unit is receiving power)	Compressor thermal overload open
Loss of refrigerant in either system		
Defective compressor(s)		
Defective temp control		
Defective high pressure cut-off		
Low stage compressor locked up		
Main fuse(s) open		
Defective monitor board		
Display problems in general	Defective monitor board	
	Cannot open door after recent door opening	
	Vacuum relief port is clogged with ice.	
	Vacuum relief heater is not functioning	
	See Section 5.6 - Cleaning the Vacuum Relief Port	

17 cu. ft. Upright Freezers

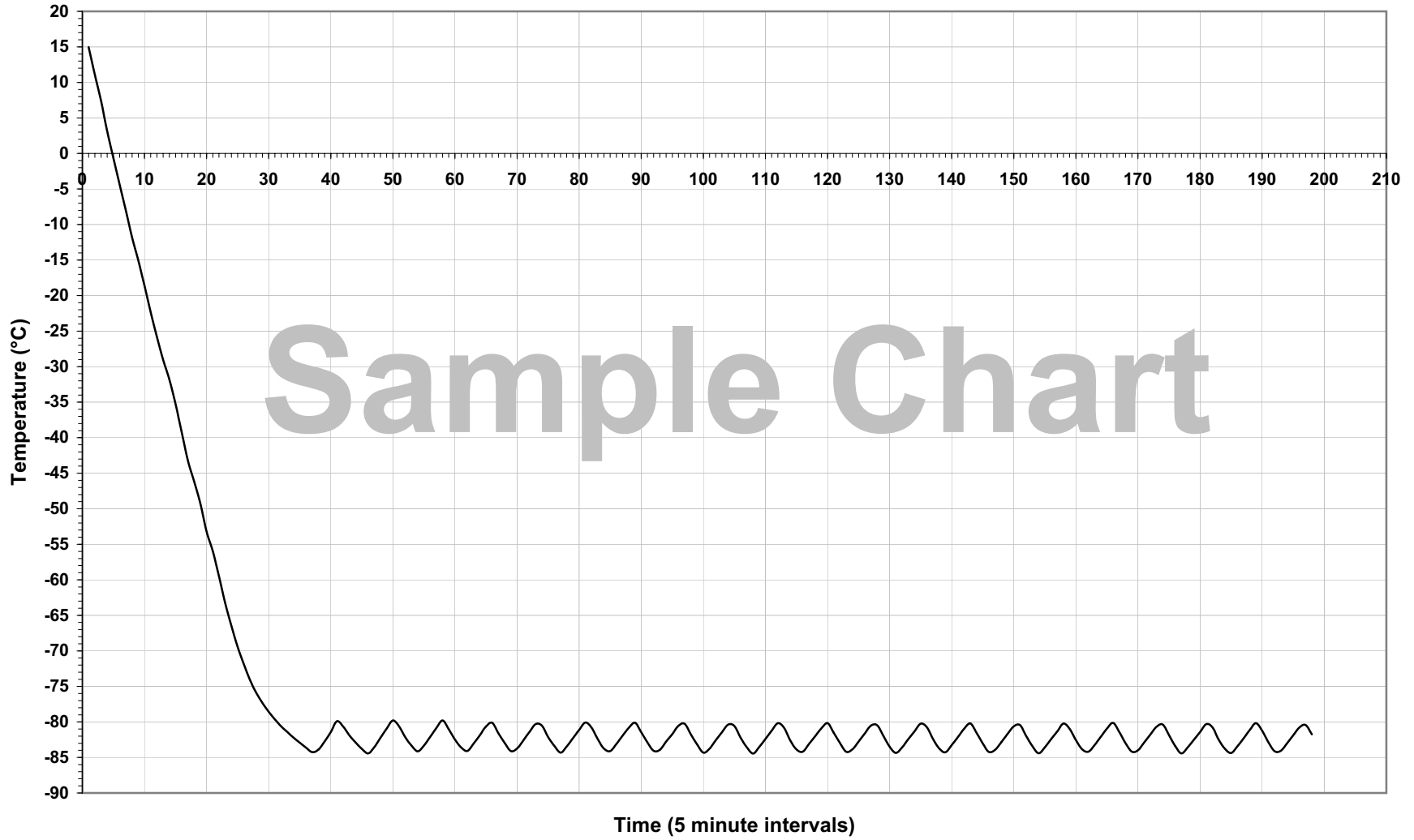
Specification	Model 8515/ 8580
Temperature	-86°C (-123°F)
Exterior Dimensions	33.25" W x 77.75" H x 31" F-B (85cm x 197.5cm x 79cm)
	Add 3" (7.6 cm) to width for handle/hinge
	Add 4.4" (11.2 cm) to F-B for control panel/wall spacer
Interior Dimensions	23.0" W x 51.5" H x 19.25" F-B (58 cm x 131 cm x 49 cm)
Capacity	17.3 cu. ft. (490 liters)
Refrigeration Type	Two 1 HP Compressors (Cascade System)
Insulation	Type: Non-CFC foamed-in-place urethane
	Sides: 5" (12.7 cm)
Electrical	208/230VAC, 1PH, 50/60Hz, 15.0 FLA
	Operating Range: 208VAC to 240VAC
Breaker Requirements (Dedicated Circuit)	15 Amp, 220VAC 20 Amp Time Delay Breaker
Shipping Weight (nominal)	Ocean: 940 lbs. (426 kg) Air/Container: 920 lbs. (417 kg) Motor: 840 lbs. (381 kg)

Continuing research and improvements may result in specification changes at any time.

23.0 cu. ft. Upright Freezer**Section 8 - Spare Parts List**

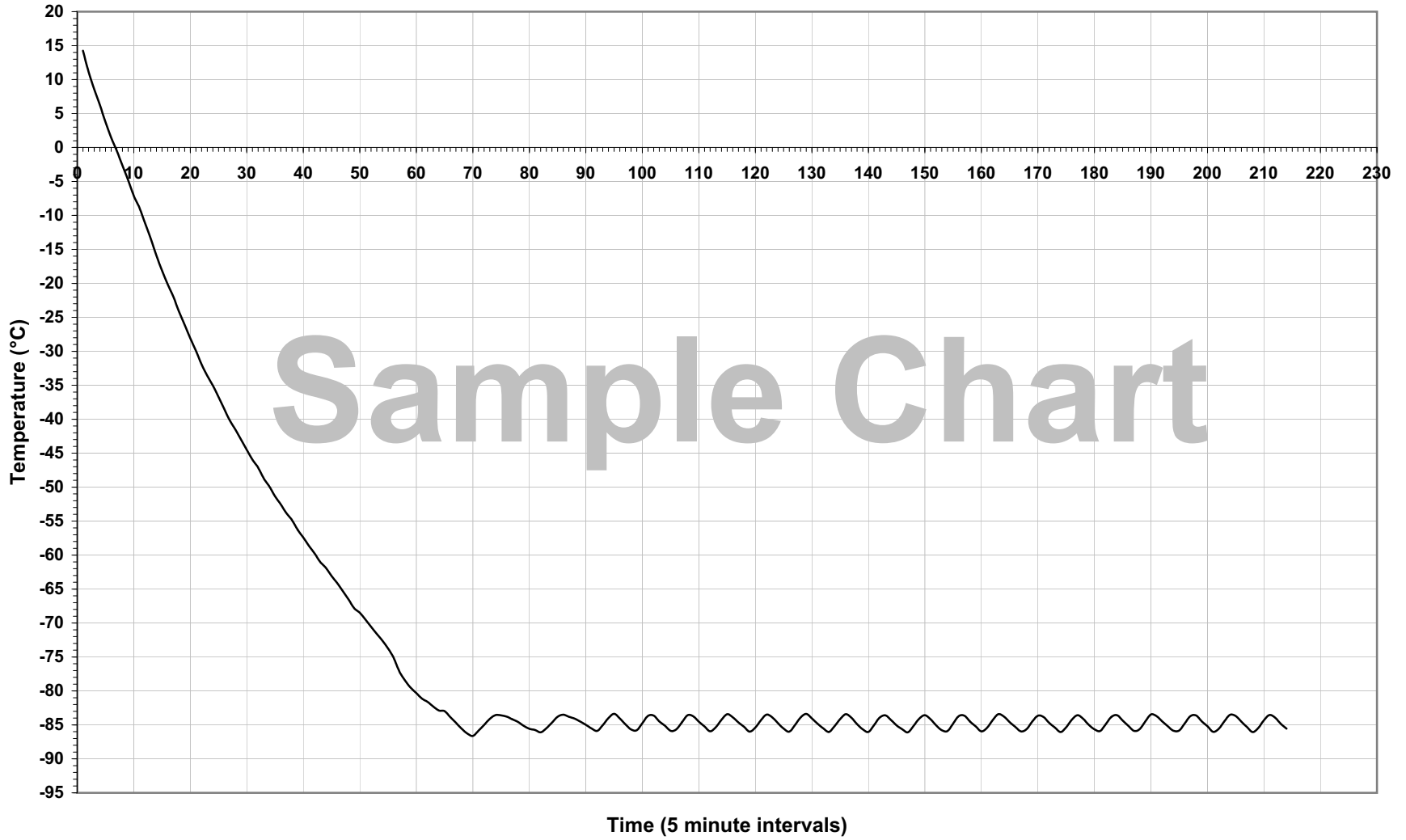
Specification	Model 8520/8583	Stock #	Qty	Description
Temperature	-86° C (-123°F)	190726	1	Temperature Control Board
Exterior Dimensions	33.25" W x 77.75" H x 37" F-B (85 cm x 197.5 cm x 94 cm)	400101	1	Thermostat 40°C
	Add 3" (7.6 cm) to width for handle/hinge	400863	1	Monitor Board (Wired)
	Add 4.4" (11.2 cm) to F-B for control panel/wall spacer	290041	1	Temperature Monitor Probe
Interior Dimensions	23" W x 51.5" H x 25.25" F-B (58.42 cm x 131 cm x 64 cm)	400064	1	Battery 6V, 8 AH (Rechargeable)
Capacity	23 cu. ft. (652 liters)	214006	1	Oil Separator
Refrigeration Type	Two 1 HP Compressors (Cascade System)	209003	1	Dryer 3/8 ODF
		209006	1	Dryer 1/4 ODS
Insulation	Type: Non-CFC foamed-in-place urethane	250111	1	Solenoid Valve "Peak Control"
	Sides: 5" (12.7 cm)	250115	1	Solenoid Valve (220V) "Peak Control"
Electrical	208/230VAC, 1PH, 50/60Hz, 15.0 FLA	207008	1	Pressure Switch, Cutout (high pressure cut-out @ 350 PSIG)
	Operating Range: 208VAC to 240VAC	900111	2	Tubeaxial Fan, 115V (8515, 8520)
Breaker Requirements (Dedicated Circuit)	20 Amp, 220 VAC	760162	1	Air Filter, 21.4" x 13.4"
Shipping Weight (nominal)	Ocean: 970 lbs. (440 kg)	195517	1	(5) 760162 Air Filters
	Air/Container: 880 lbs. (399 kg)	132041	1	Door Heater, 115V, for (optional) Double Door Freezer
	Motor: 880 lbs. (399 kg)	132042	1	Door Heater, 230V, for (optional) Double Door Freezer
		230115	1	0.15A Fuse (Vacuum Relief Heater)
		285614	2	20A Fuses
		195152	1	Heater (Vacuum Relief Port)
		1203007	2	Low Stage Compressor with Zerol 150T, 220V, 1 HP, Semi-hermetic (Models 8515, 8520)
		2203007	2	High Stage Compressor Compressor w/ Ester Oil, 220V, 1 HP, Semi-hermetic (Models 8515, 8520)
		970023	70# cyl	Refrigerant R-134A, High Stage
		970022	70# cyl	Refrigerant R-23, Low Stage
		970009	14.5 oz	Propane
		970010	1	Propane Tank Adapter
		143021	1 gal	Zerol 150T

Thermo Forma - Representative Pulldown and Cycle Curve
for 17 Ft.³ -86°C Power Plus Freezers

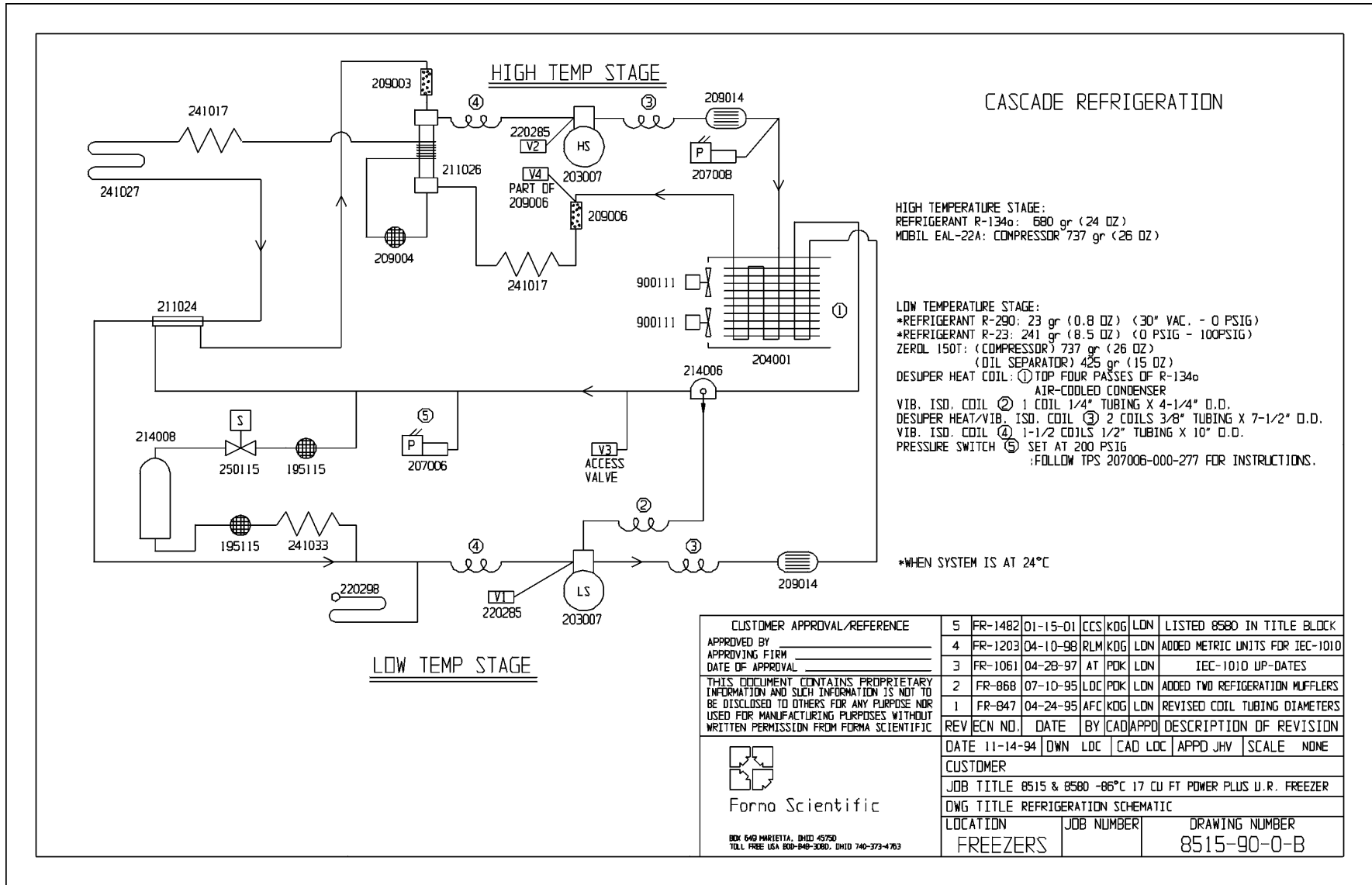


Sample Chart

Thermo Forma - Representative Pulldown and Cycling Curve
for 23 Ft³ -86°C Freezers



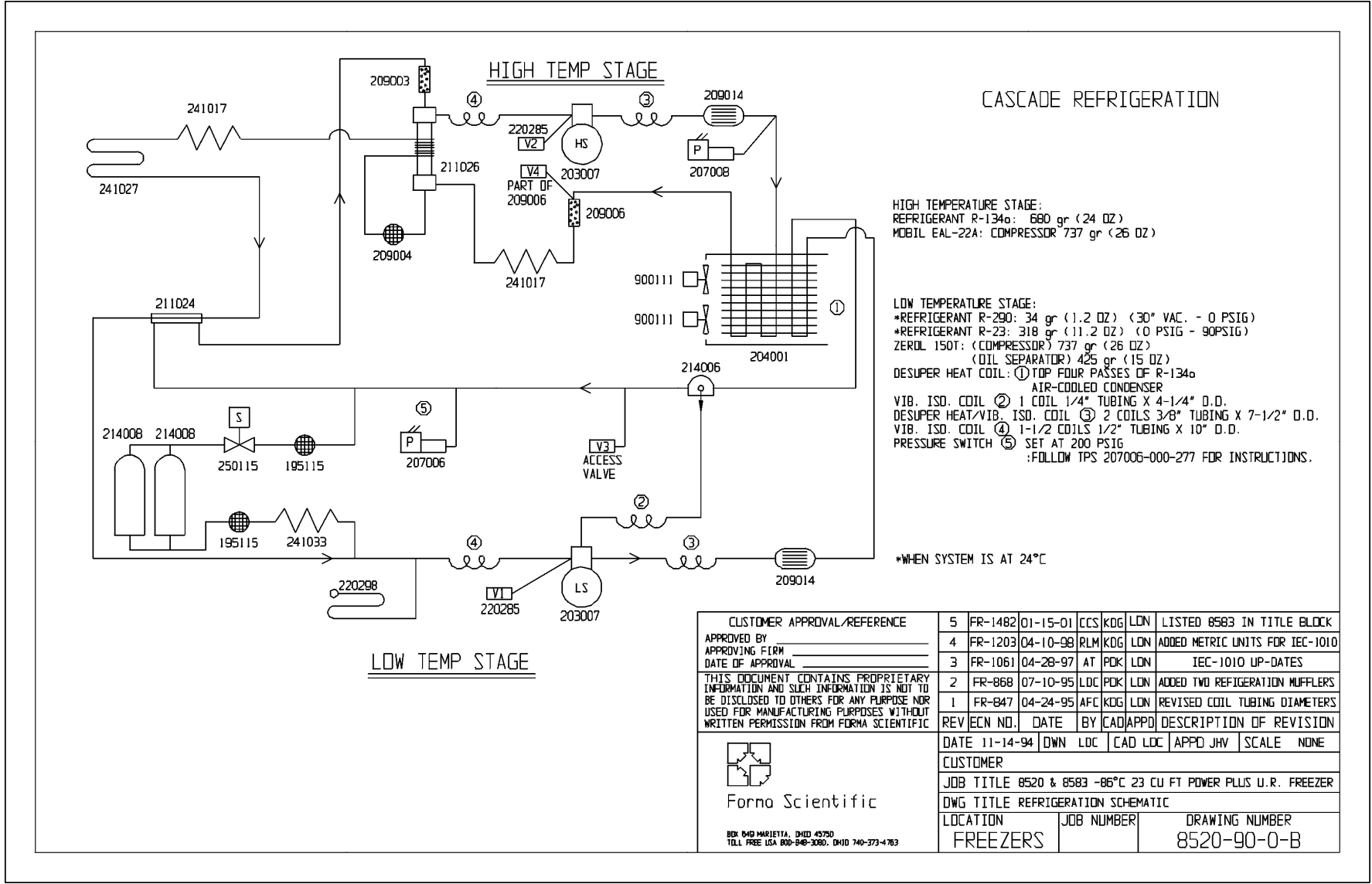
Sample Chart



CUSTOMER APPROVAL/REFERENCE	5	FR-1482	01-15-01	CCS	KDG	LON	LISTED 8580 IN TITLE BLOCK
APPROVED BY	4	FR-1203	04-10-98	RLM	KDG	LON	ADDED METRIC UNITS FOR IEC-1010
APPROVING FIRM	3	FR-1061	04-28-97	AT	POK	LON	IEC-1010 UP-DATES
DATE OF APPROVAL	2	FR-868	07-10-95	LDC	POK	LON	ADDED TWO REFRIGERATION MUFFLERS
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSES WITHOUT WRITTEN PERMISSION FROM FORMA SCIENTIFIC	1	FR-847	04-24-95	AFC	KDG	LON	REVISED COIL TUBING DIAMETERS
REV ECN NO.	DATE	BY	CAD/APPD	DESCRIPTION OF REVISION			
DATE 11-14-94	DWN	LDC	CAD LOC	APPD JHV	SCALE	NDNE	
CUSTOMER							
JOB TITLE 8515 & 8580 -86°C 17 CU FT POWER PLUS U.R. FREEZER							
DWG TITLE REFRIGERATION SCHEMATIC							
LOCATION	JOB NUMBER	DRAWING NUMBER					
FREEZERS		8515-90-0-B					


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REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
5	FR-1482	01-15-01	CCS	KDG	LON	LISTED 8583 IN TITLE BLOCK
4	FR-1203	04-10-98	RLM	KDG	LON	ADDED METRIC UNITS FOR IEC-1010
3	FR-1061	04-28-97	AT	POK	LON	IEC-1010 UP-DATES
2	FR-868	07-10-95	LDC	POK	LON	ADDED TWO REFRIGERATION MUFFLERS
1	FR-847	04-24-95	AFC	KDG	LON	REVISED COIL TUBING DIAMETERS
DATE 11-14-94 DWN LDC CAD LDC APPD JHW SCALE NONE CUSTOMER JOB TITLE 8520 & 8583 -86°C 23 CU FT POWER PLUS U.R. FREEZER DWG TITLE REFRIGERATION SCHEMATIC LOCATION FREEZERS JOB NUMBER DRAWING NUMBER 8520-90-0-B						

CUSTOMER APPROVAL/REFERENCE

APPROVED BY _____
 APPROVING FIRM _____
 DATE OF APPROVAL _____

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Section 10 - Assembly Drawings

10.1 Cabinet Hardware

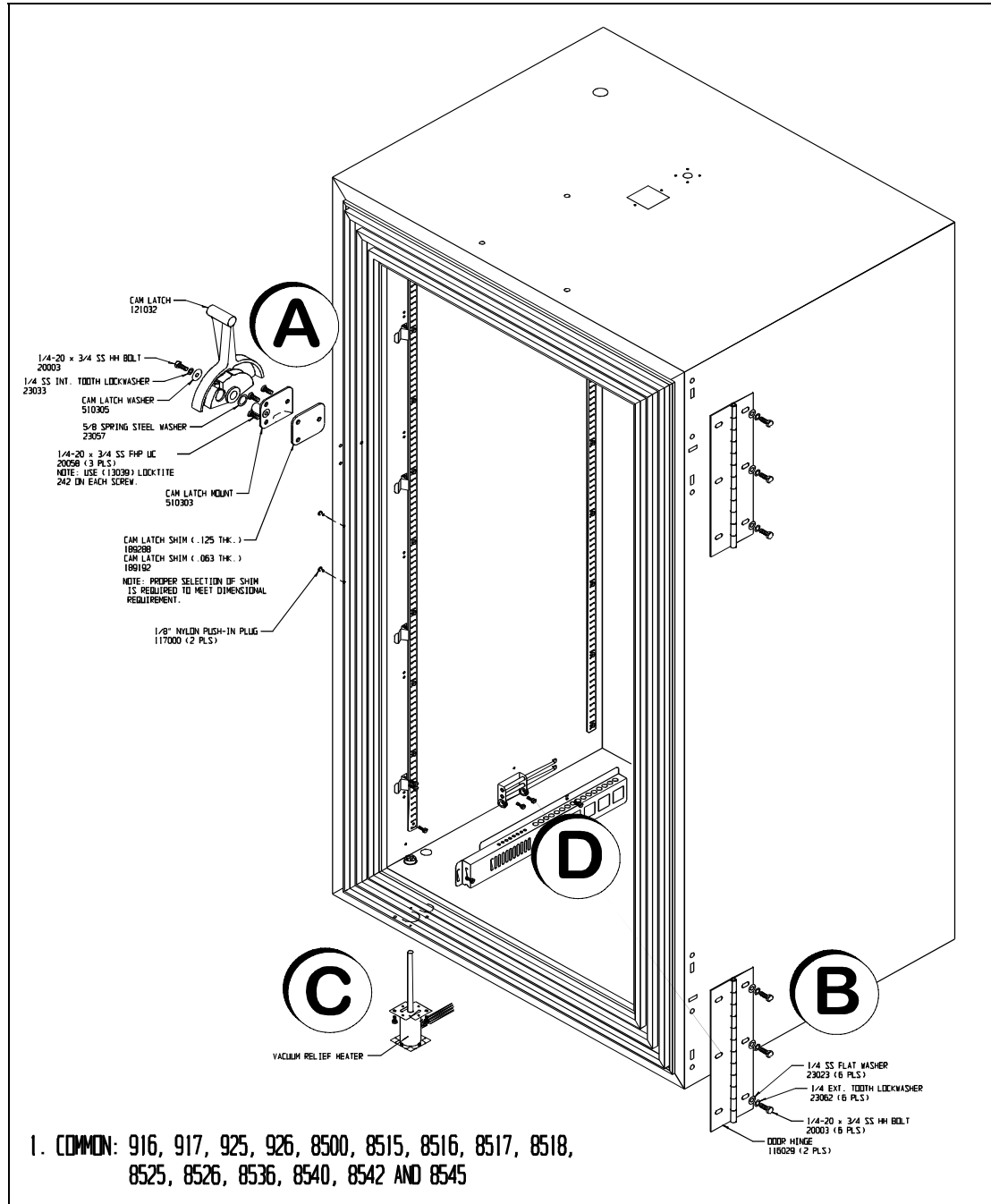
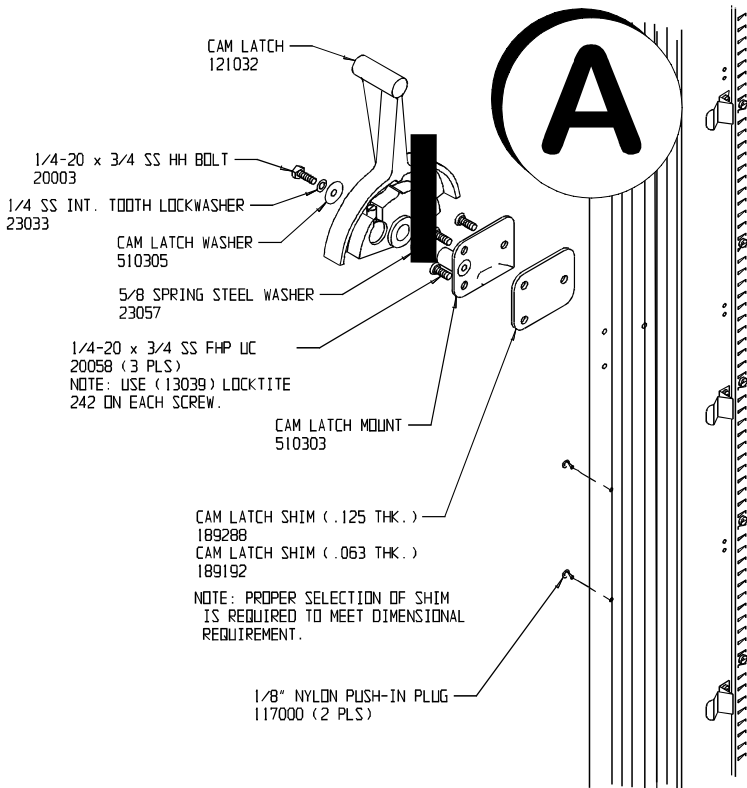
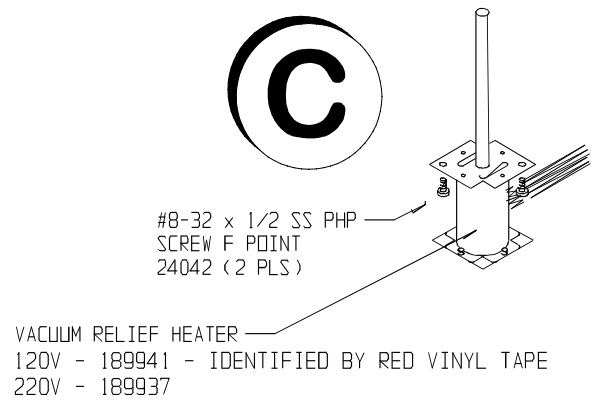


Figure 10-1

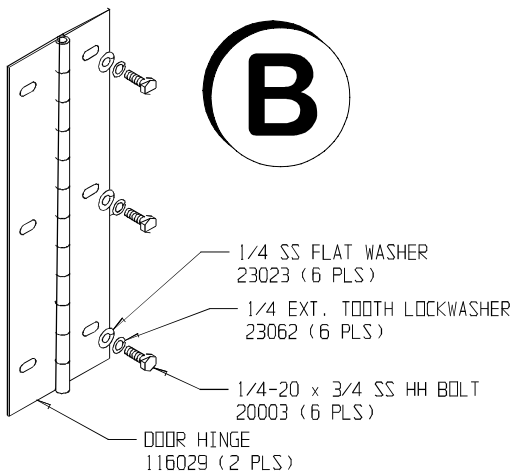
a. Door Handle and Latch



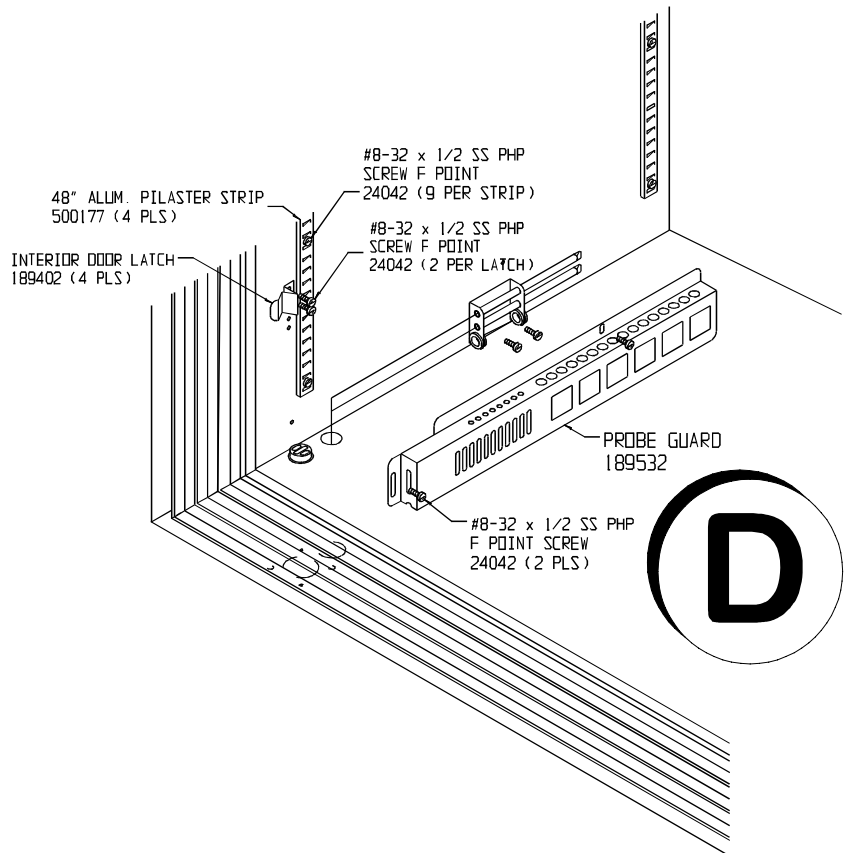
c. Vacuum Relief Heater



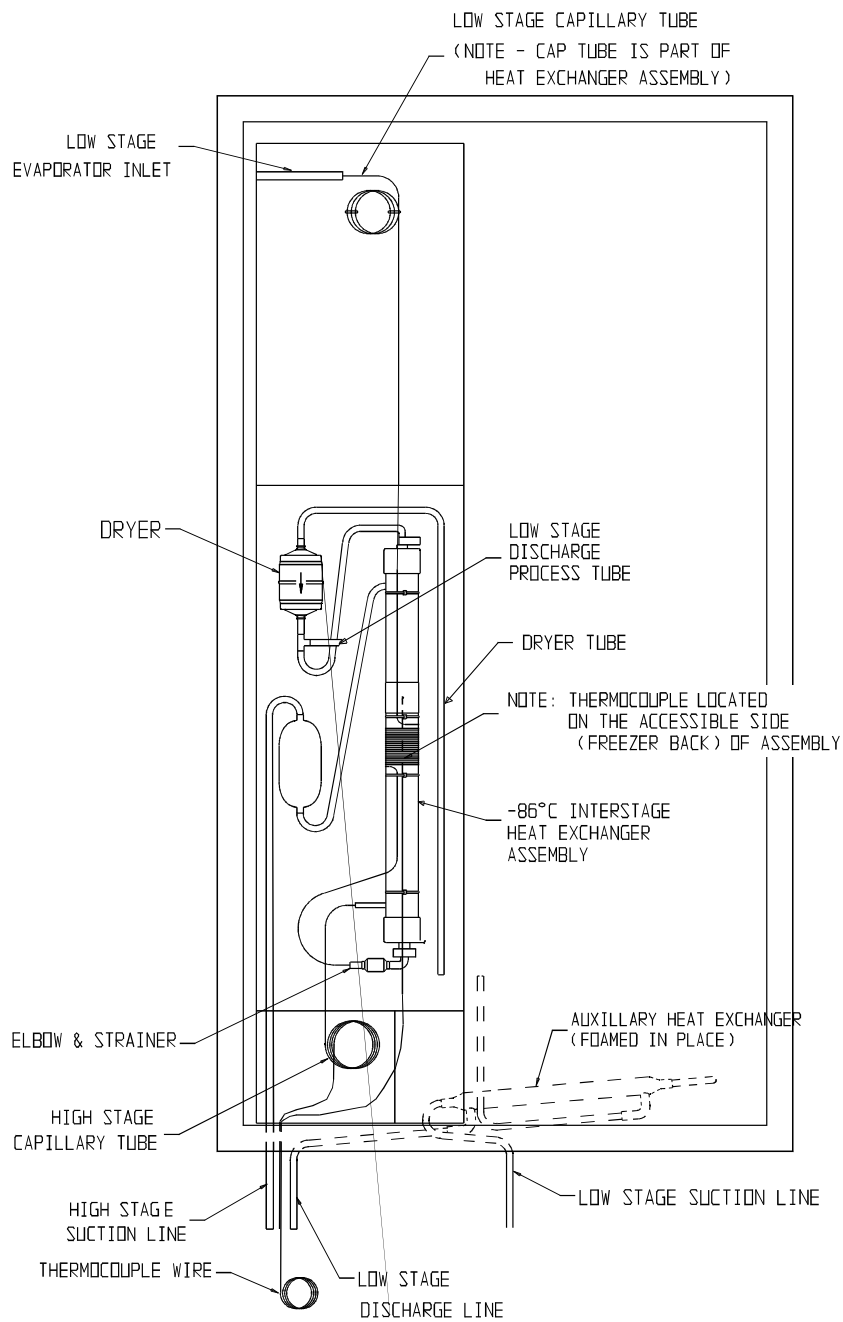
b. Door Hinge



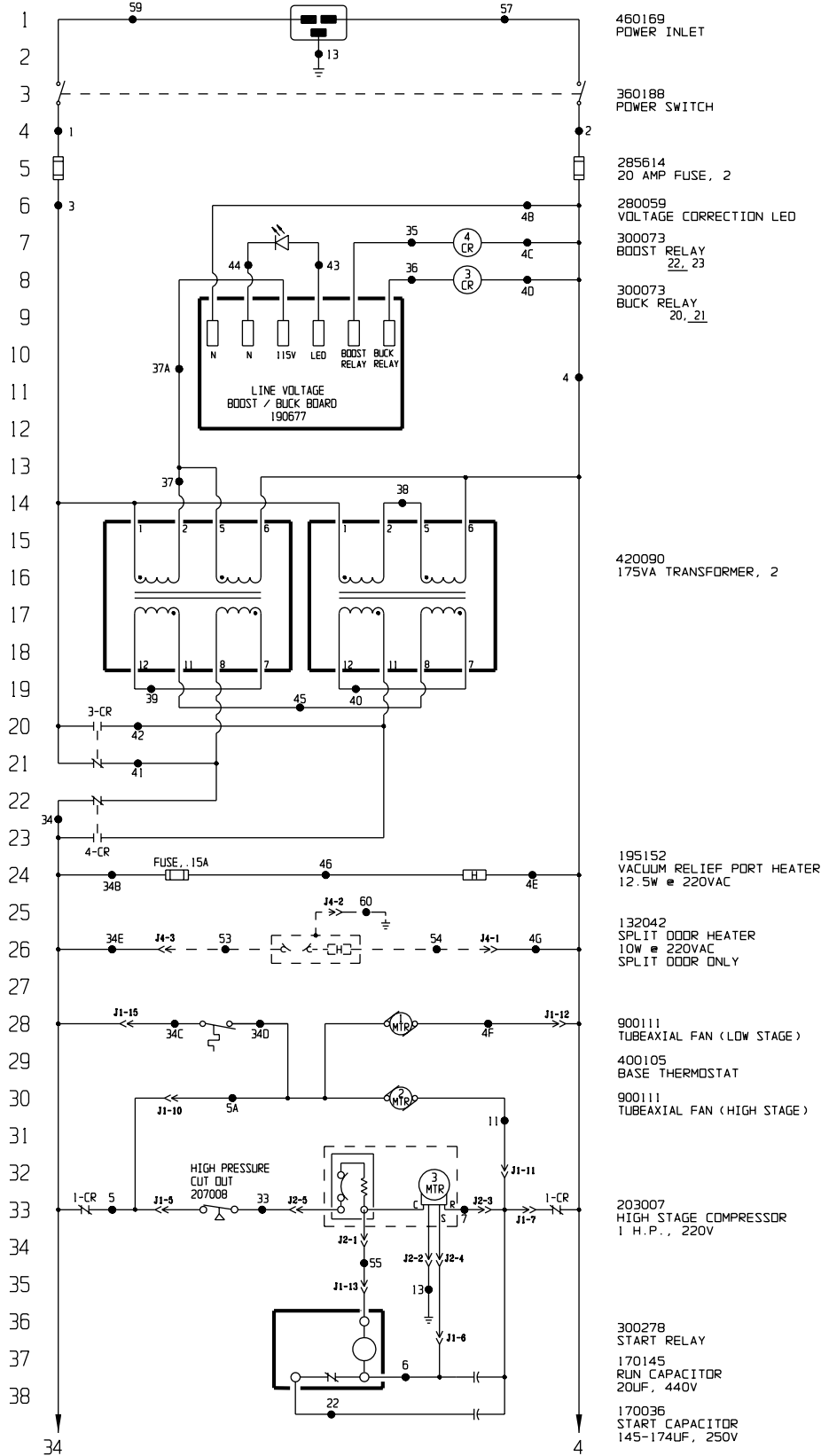
d. Probe Guard



10.2 Heat Exchanger

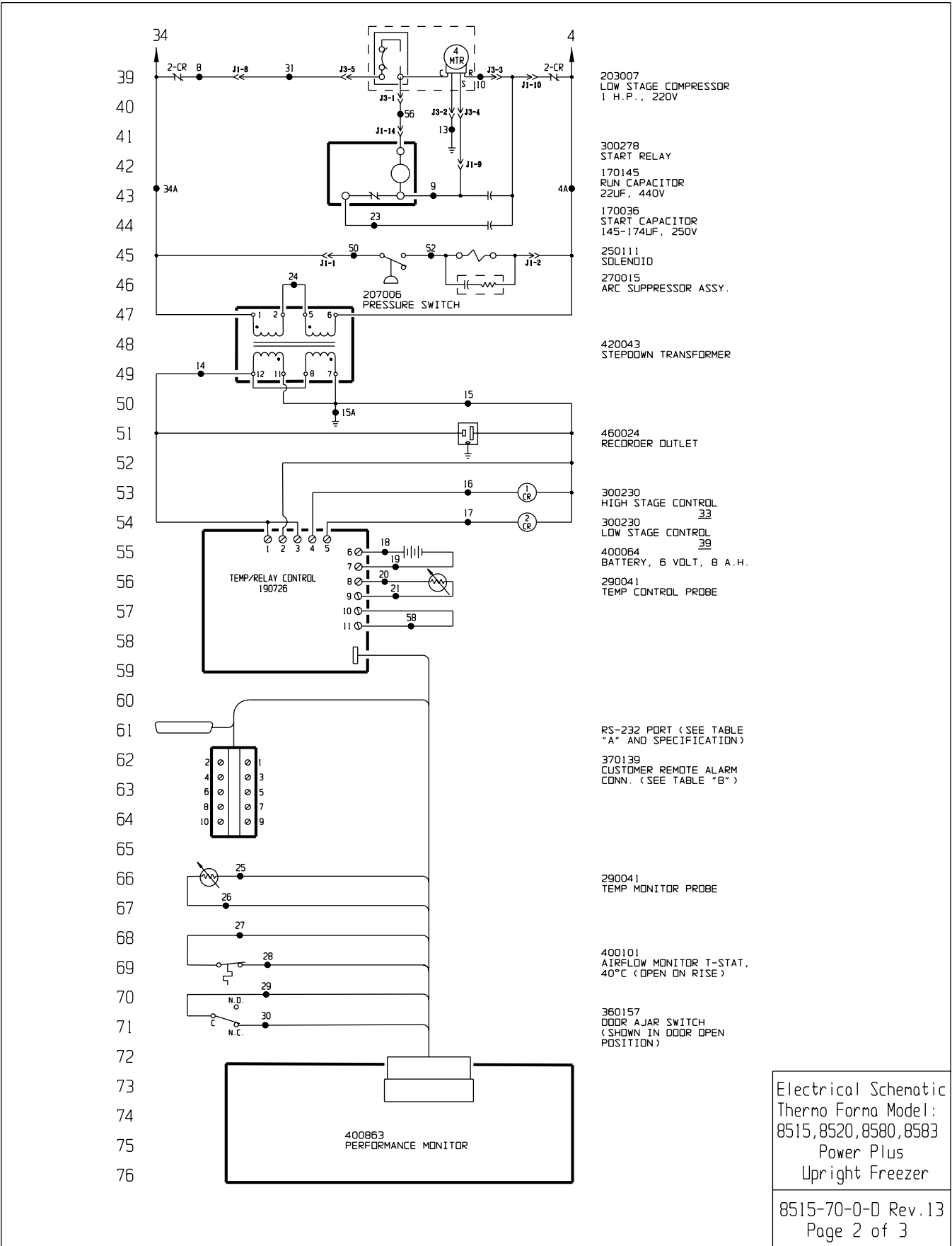


POWER CONNECTION
 230V, 1 ϕ , 2W, 50/60HZ, 15.0 FLA
 (OPERATING RANGE 208-240V)



Electrical Schematic
 Thermo Forma Model:
 8515, 8520, 8580, 8583
 Power Plus
 Upright Freezer

8515-70-0-0 Rev.13
 Page 1 of 3



Electrical Schematic
 Thermo Forma Model:
 8515, 8520, 8580, 8583
 Power Plus
 Upright Freezer
 8515-70-0-D Rev. 13
 Page 2 of 3

WIRE REFERENCE CHART

	WIRE #	GAUGE	COLOR
	1	14	BRN
	2	14	WHT
77	3	14	BRN
	4	14	BLU
78	4A	20	BLU
	4B	20	BLU
	4C	20	BLU
79	4D	20	BLU
	4E	18	BLU
80	4F	18	BLU
	4G	18	WHT
	5	14	BRN
81	5A	18	BRN
	6	14	RED
82	7	14	YEL
	8	14	BLK
83	9	14	PUR
	10	14	ORG
	11	18	YEL
84	13	14	GRN/YEL
	14	20	BLK
85	15	20	WHT
	15A	20	GRN/YEL
86	16	20	YEL
	17	20	ORG
	18	20	RED
87	19	20	BLK
	20	22	RED
88	21	22	WHT
	22	14	GRY
	23	14	BLU
89	24	20	PUR
	25	22	RED
90	26	22	WHT
	27	20	BLK
	28	20	BLK
91	29	20	RED
	30	20	BLK
92	31	14	BLK
	32	---	---
93	33	14	BRN
	34	14	BRN
	34A	20	BRN
94	34B	18	BRN
	34C	18	BLK
	34D	18	BLK
95	34E	18	BLK
	35	20	ORG
96	36	20	YEL
	37	14	PUR
97	37A	20	PUR
	38	14	PUR
	39	14	ORG
98	40	14	YEL
	41	14	RED
99	42	14	BLK
	43	20	RED
100	44	20	BLK
	45	14	GRY
	46	20	BRN
101	50	18	BLK
	52	18	BRN
102	53	18	BLK
	54	18	WHT
	55	14	BRN
103	56	14	BLK
	57	14	WHT
	58	20	BLU
104	59	14	BRN
	60	18	GRN/YEL

TABLE "A"

RS-232 PORT
PIN# 2 TXD
PIN# 3 RXD
PIN# 7 GND

RS-232 SPECIFICATION

BAUD = 1200
 PARITY = N
 BITS = 8
 STOP BITS = 2

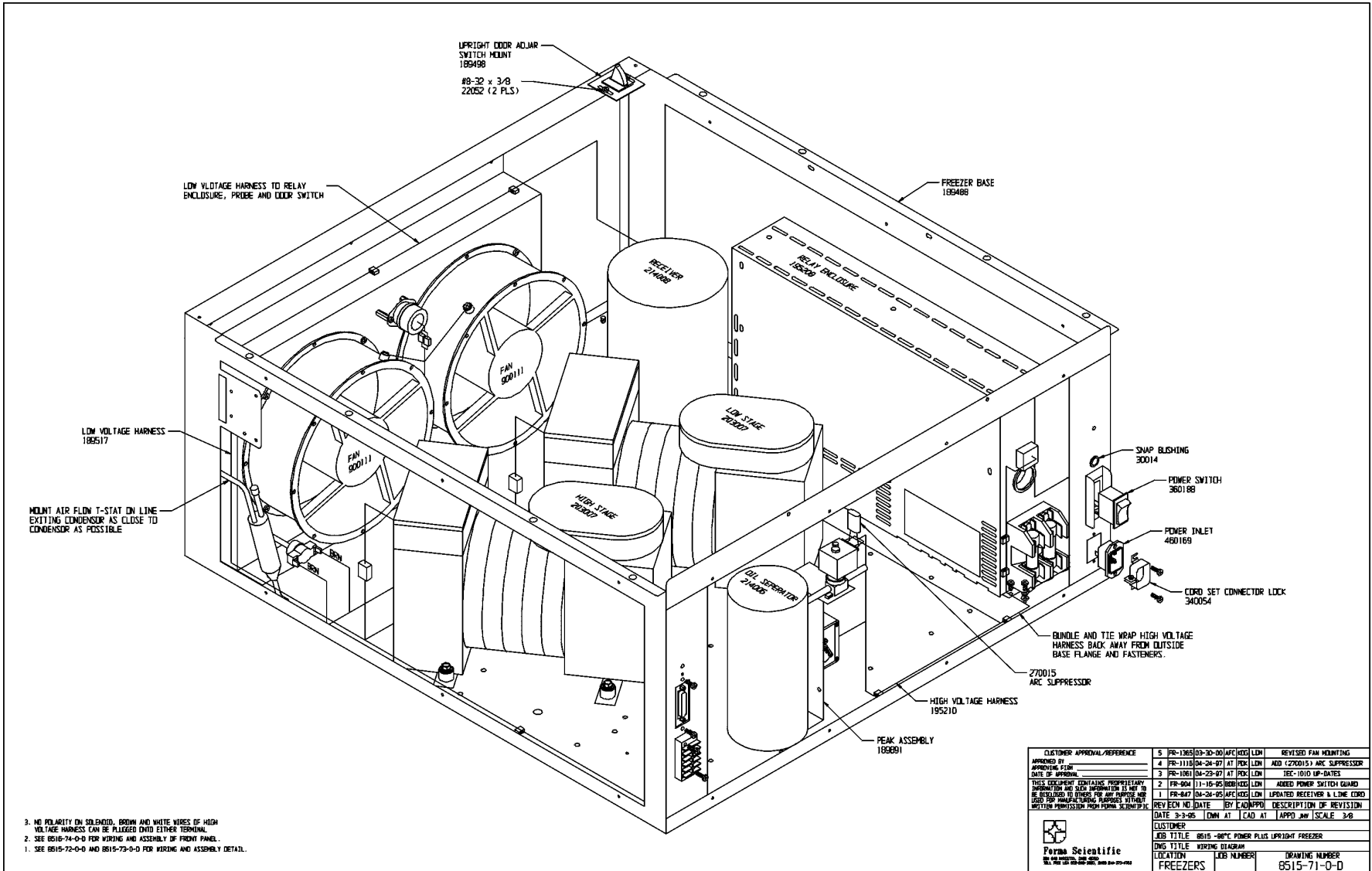
TABLE "B"

CUST. REMOTE ALARM CONNECTIONS	
TERM. #	DESCRIPTION
1	OVERTEMP COM.
2	OVERTEMP N.C.
3	OVERTEMP N.D.
4	MILLIVOLT OUT (POS.)
5	UNDERTEMP N.C.
6	MILLIVOLT OUT (NEG.)
7	UNDERTEMP COM.
8	UNDERTEMP N.D.
9	(NOT USED)
10	(NOT USED)

NOTES: Ⓢ Denotes Terminal Strip Connection 4-CR Last Relay Number N/A Last Terminal Number 60 Last Wire Number	Parts List Reference Number ○ Assembly ◊ Panel ○ Refrigeration □ Wiring	CUSTOMER APPROVAL/REFERENCE APPROVED BY _____ APPROVING FIRM _____ DATE OF APPROVAL _____		13	FR-1619	06-03-02	HCE	KDG	AKS	CORRECT BOOST/BUCK RELAY CONTACTS
		THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSES WITHOUT WRITTEN PERMISSION FROM THERMO FORMA		12	FR-1482	01-15-01	CCS	KDG	LDN	LISTED ALL MODELS IN TITLE BLOCK
				11	FR-1192	01-15-98	RLM	KDG	LDN	CHG. 285613 15A FUSE TO 285614 20A
				10	SI-6703	12-17-97	AT	KDG	LDN	ADD CONNECTORS FOR SPLIT DOOR OPT.
				9	FR-1182	12-03-97	AFC	KDG	LDN	ADDED (2) 285613 15 AMP FUSES
				REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
				DATE	9-21-94	DWN	AT	CAD	AT	APPD JHV SCALE NONE
				CUSTOMER						
				JOB TITLE 8515, 8520, 8580 & 8583 POWER PLUS UPRIGHT FREEZERS						
				DWG TITLE ELECTRICAL SCHEMATIC						
				LOCATION		JOB NUMBER		DRAWING NUMBER		
				FREEZERS				8515-70-0-0		

Electrical Schematic
 Thermo Forma Model:
 8515, 8520, 8580, 8583
 Power Plus
 Upright Freezer
 8515-70-0-0 Rev.13
 Page 3 of 3

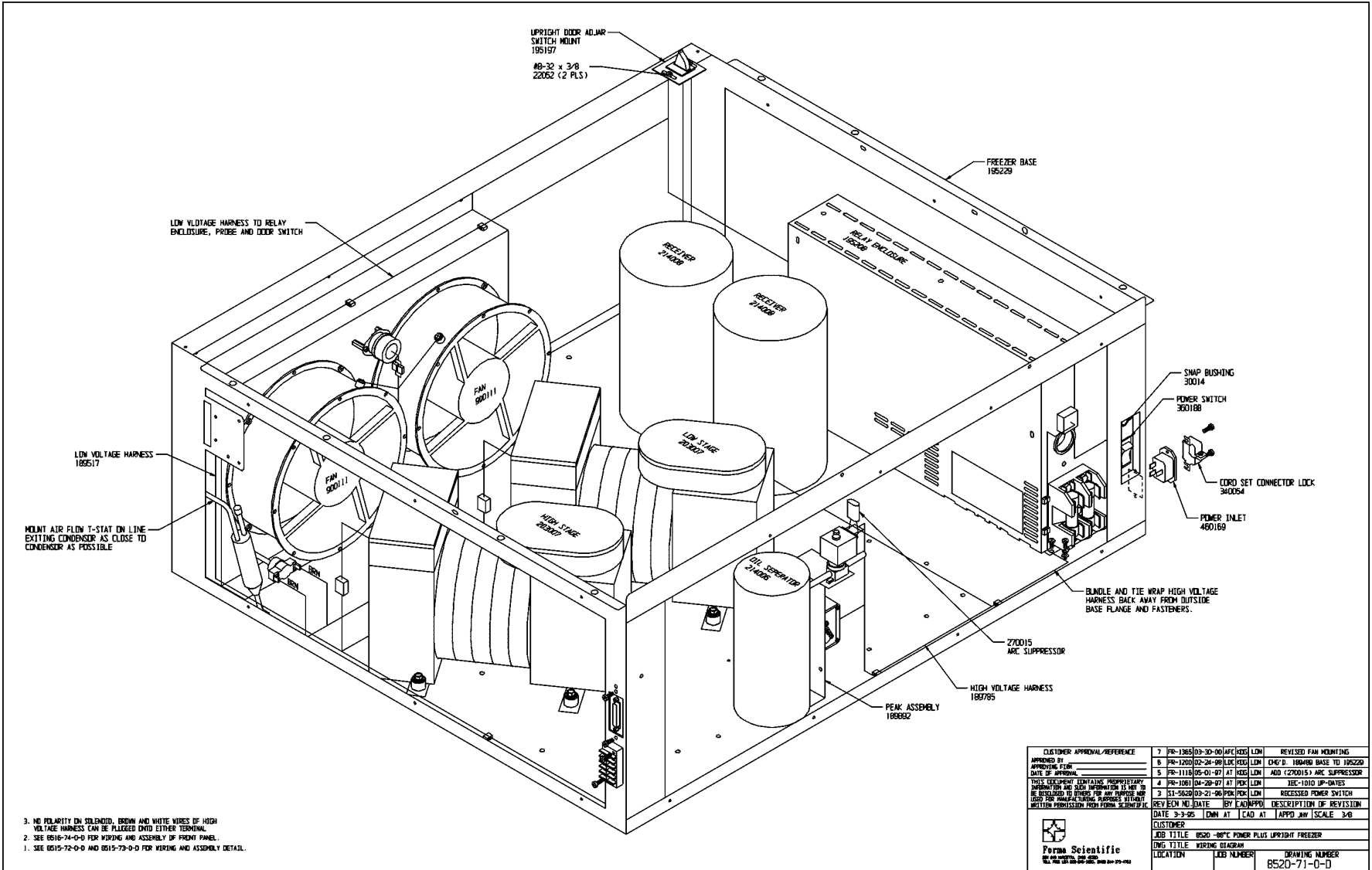




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CUSTOMER APPROVAL/REFERENCE	5	PR-1365	03-30-80	AFC/MSD	LDN	REVISED FAN MOUNTING
APPROVED BY	4	PR-1118	04-24-97	AT	PKR	ADD (270015) ARC SUPPRESSOR
DATE OF APPROVAL	3	PR-1081	04-23-97	AT	PKR	DEC-1010 UP-DATES
THIS EQUIPMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSES WITHOUT THE WRITTEN PERMISSION FROM PERMA SCIENTIFIC.						
	2	FR-804	11-16-95	BBB/HES	LDN	ADDED POWER SWITCH GUARD
	1	FR-847	04-24-95	AFC/MSD	LDN	UPDATED RECEIVER & LOW CORD
REV ECH NO	DATE	BY	CAD/APPD	DESCRIPTION OF REVISION		
DATE	3-3-05	LDN	AT	CAD	AT	APPO
SCALE	3/8					
CUSTOMER						
JOB TITLE	8515 -86°C POWER PLUS UPRIGHT FREEZER					
ENG TITLE	WIRING DIAGRAM					
LOCATION	JES NUMBER	DRAWING NUMBER				
FREEZERS		8515-71-0-0				





THERMO FORMA 900 & 8500 SERIES ULT FREEZER WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period.

During the first year of the warranty period, component parts proven to be defective in materials or workmanship will be repaired or replaced at Thermo Forma's expense, labor included. The 900 Series ULT Freezers include a second year warranty on the compressors, parts only, F.O.B. factory. The 8500 Series ULT Freezers include an additional four year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Thermo Forma Service Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

In addition to the standard warranty, effective March 1, 2000, the foamed-in-place cabinet design carries a unit production lifetime warranty. Please contact your sales representative or Thermo Forma for additional information.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original one year warranty period. The Thermo Forma Service Department must give prior approval for the return of any components or equipment.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo Forma shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Forma Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please call your Thermo Forma Service Office at 1-888-213-1790 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA contact your local distributor for warranty information.



THERMO FORMA 900 & 8500 SERIES ULT FREEZER INTERNATIONAL DEALER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period. Dealers who stock our equipment are allowed an additional four months for delivery and installation, providing the warranty card is completed and returned to the Thermo Forma Service Dept.

During the first year of the warranty period, component parts proven to be defective in materials or workmanship will be repaired or replaced at Thermo Forma's expense, labor excluded. The 900 Series ULT Freezers include a second year warranty on the compressors, parts only, F.O.B. factory. The 8500 Series ULT Freezers include an additional four year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Thermo Forma Service Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

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