Forma Scientific, Inc.
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Models:

8516/8517 and 8523

Non-CFC Ultra-Low Temperature
Upright Storage Freezers

17.3 and 23.0 cubic foot
capacity

Manual No. 7008516 Rev. 6

IMPORTANT!

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.

NOTE:

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

MANUAL NO. 7008516

REV	ECN	DATE	DESCRIPTION
-	SI-5679	4-25-96	Revised component locations to sides of Model 8523. heg
6	SI-317	10-23-95	Added Power Failure indicator to Enviro-Scan
5	FR-881	8/8/95	Clarified operation of the Power Line Voltage key
N/A	FR-867	8/8/95	Revised temperature probe cover hardware
4	4-00784	2/13/95	Add Section 2.4, Moving the Model 8523 through a doorway
3	FR-781	12-2-94	250115 was 250111 (220V models only)
2	FR-765	11-1-94	214008 was 993102
1		9-1-94	Added optional double door freezer, Section 3.9, door heater to parts list.
0		12-1-93	New manual for new product

GENERAL SAFETY NOTES USED IN THIS MANUAL

	This symbol alerts the user to important operating and/or maintenance instructions. It may be used alone or with other safety symbols. Read the accompanying text carefully.
	Potential electrical hazards. Only qualified persons should perform the instructions and procedures associated with this symbol.
	Extreme temperature hazards, hot or cold. Instructions associated with this symbol should only be carried out when using special handing equipment or when wearing special, protective clothing.
	Potential biological hazards. Proper protective equipment and procedures must be used when following instructions associated with this symbol. Reference O.S.H.A. Regulation 1910-1030.
	Potentially hazardous energy. Equipment being maintained or serviced must be turned off and locked off to prevent possible injury. Reference O.S.H.A. Regulation 1910-147.

Remember:

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

Do you need information or assistance on Forma Scientific products?

If you do, contact us 8:00 A.M. to 5:00 P.M. (Eastern Standard Time) at:

1-614-373-4763	**Direct**
1-800-848-3080	**Toll Free, U.S. and Canada**
1-614-373-4189	**FAX**

International customers should contact your local sales group.

Forma's **Inside Sales Support Group** can provide information on pricing, give you quotations, take your order and provide delivery information on major equipment items.

The Forma **Product Service Group** can supply technical information about proper setup, operation or troubleshooting of your equipment and fill your needs for spare or replacement parts or provide you with on-site service.

Whatever 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, you can count on **Life Sciences International North America (LSI/NAS)** for on-the-spot repairs by trained professional field technicians. In addition to checking the reported problem, the technicians also check basic operation, such as:

Control Calibrations
Temperature
CO_2 Levels
Compressors
Electrical Circuits
Recorders
Blowers/Fans
R.H. Levels

The following cities and their surrounding areas are covered by **LSI/NAS** personnel.

Phoenix, AZ	**Boston, MA**	**Cleveland, OH**
Los Angeles, CA	**Detroit, MI**	**Philadelphia, PA**
San Diego, CA	**St. Louis, MO**	**Washington, PA**
San Francisco, CA	**Raleigh/Durham, NC**	**Pittsburgh, PA**
Denver, CO	**Newington, NH**	**Memphis, TN**
Washington, DC	**Newark, NJ**	**Austin, TX**
Atlanta, GA	**New York City, NY**	**Dallas/Ft. Worth, TX**
Des Moines, IA	**Rochester, NY**	**Houston, TX**
Chicago, IL	**Cincinnati, OH**	**Seattle, WA**

Within the continental United States, service coverage is by Life Sciences International North America (LSI/NAS). They offer a Bi-Annual Performance Check which provides a complete checkout of your equipment twice a year. This keeps minor problems from becoming major ones. If you would like to know more about the Bi-Annual Performance Check, contact LSI/NAS, Toll-free, at 1-800-467-4627.

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SECTION 1 - RECEIVING

1.1 Preliminary Inspection

This item 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 Forma Scientific, Inc. ends when the merchandise is loaded onto the carrier's vehicle.

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

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

SECTION 2 - INSTALLATION

2.1 Introduction

The 8500 Series Forma Scientific 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 grill of the freezer and passes through the filter, condenser and compressor housing, exiting out of the rear of the unit.

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 Forma Scientific 8500 Series 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, Forma Scientific has phased out the use of ozone depleting CFC (chlorofluorocarbons) in all of the company's refrigerated products. Forma also uses non-CFC foamed-in-place urethane insulation and all packaging 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. A light on the front of the control panel indicates when incoming voltage is being corrected.

2.2 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

2.3 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. 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 insure 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.

2.4 Moving the Model 8523 through a Doorway

To move the Model 8523 through a 34.5" 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 only. Removing hinge screws will weaken the door, or cause it to fall, resulting in injury to personnel and/or damage the freezer.

2.5 Location

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

2.6 Connecting Power to the Freezer

Forma Scientific, Inc. 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 Section 8.

2.7 Deactivating the Enviro-Scan Monitor for Storage

The Enviro-Scan Monitor has been deactivated (placed in a sleep mode) prior to shipment. The monitor re-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 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 a "1" does not appear in the window, press the keys again.

3. Enter the four digit access code and press Enter. (**The Access Code set at the factory is 1,2,3,4.** To change the Access Code refer to Section 5.4.)

4. "CAL" will appear in the window.

5. Press the Down Arrow key.

The Enviro-Scan monitor is now deactivated (placed in a sleep mode) until electrical power is restored.

2.8 RS-232 Output Interface

Forma 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 printer" formatted to interface with either a computer or a serial printer.

Three wires are used for the RS-232 interface:
TX Data = Pin 2
RX Data = Pin 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.

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 and 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 2-1 identifies the location of the RS-232 output connector.

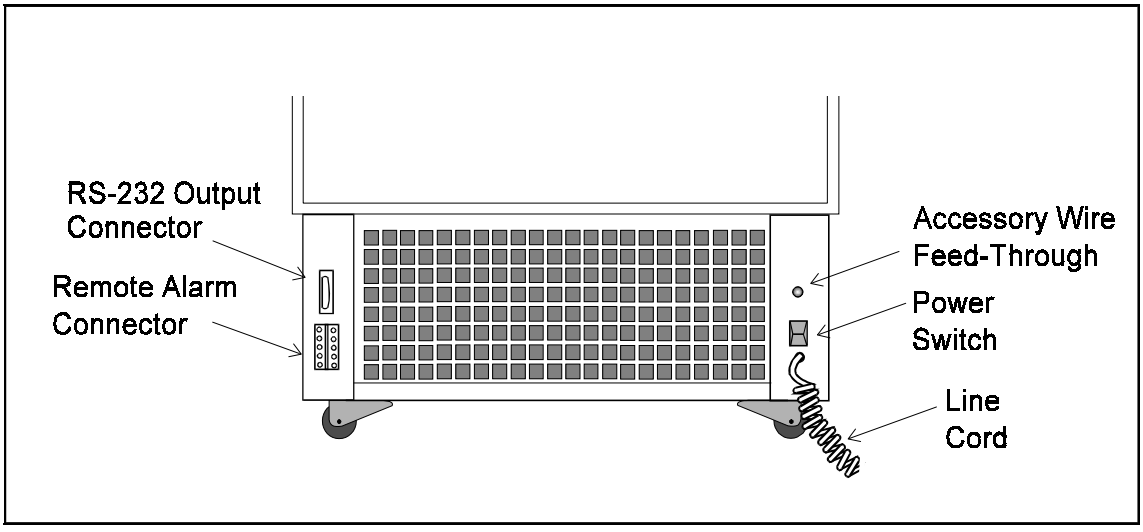


Figure 2-1
Component Locations on the Freezer Rear Panel, Models 8516 and 8517
(Components are mounted on the sides of the Model 8523)

2.9 Remote Alarm Connector

For installations requiring remote temperature monitoring or high/low temperature alarm systems, a remote connector is provided on all Forma Series 8500 Upright Freezers.

Figure 2-1 identifies the location of the remote alarm connector. Figure 2-2 identifies the pin connections. A label on the back of the freezer cabinet also contains this information.

The alarm contacts are rated: .5A at 30 VDC, 15 watts maximum

.6A at 24 VAC, 14 watts maximum

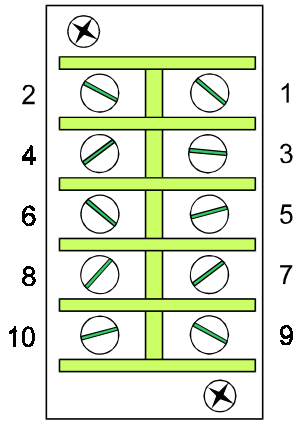
Key	Pin #	Description
	1 2 3 4 5 6 7 8 9 10	Over temperature Common Over temperature N.C. Over temperature N.O. Millivolt Out (Positive +) Under temperature N.C. Millivolt Out (Negative -) Under temperature Common Under temperature N.O. (Not Used) (Not Used)

Figure 2-2
Terminal Pin Descriptions, Remote Alarm Connector

SECTION 3 - ENVIRO-SCAN MONITOR

3.1 The Enviro-Scan Monitor

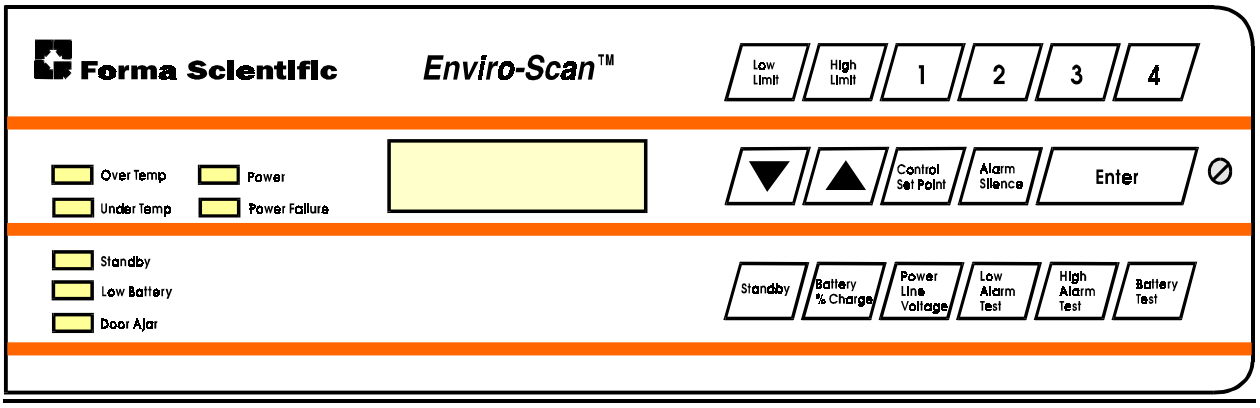


Figure 3-1
Enviro-Scan Monitor

3.2 Enviro-Scan Monitor Description

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 one degree Celsius.

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 5.3 describes the procedures to change the Access Code.)

Functions requiring no access code are:

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

Other features include:

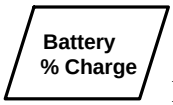
Over Temp light	Under temp light
Standby light	Low Battery light
Door Ajar light	Power light
Normal light	(hidden) Condenser Hot light.

3.3 Main Power Switch

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

Note: OFF = (o) ON = (|).

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

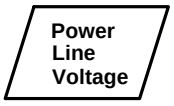


Displays the Enviro-Scan Monitor backup battery's percent of charge. The reading gives some indication of how long the monitor will operate on battery backup. The Backup system is designed to maintain monitor operation for at least 72 hours. A reading of 50%, when on battery power, indicates that the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

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

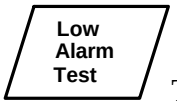
Displays cabinet temperature.

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



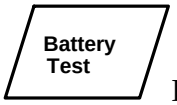
Displays the operating voltage of the freezer when both compressors are running. A zero is displayed when the line voltage drops below 100 volts on a 208/220 volt circuit and 50 volts on a 115 volt circuit.

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 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 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. The test may be aborted at any time by pressing Enter. All other key functions are "locked-out" during this test.



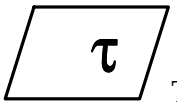
Disconnects the main power from the monitor, making it switch and operate on battery power.

a. Access Keys:

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

3.5 Key Functions Requiring the Access Code (Refer to Figure 3-1)

The Up and Down arrow keys are used for setting the High and Low limits and for calibration. Pressing the Up Arrow key increases the display by increments of one division. If this key is held down for more than two seconds the display will increment automatically.



The Up and Down arrow keys are used for setting the High and Low limits and for calibration. Pressing the Down arrow key decreases 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 the Low Limit Set Point. When the chamber temperature reaches or exceeds the Low Limit Set Point, the audible alarm sounds and the Under Temp indicator lights. The remote alarm contacts on the back of freezer also activate. Refer to Section 4.2 for Low Limit setting instructions.

High Limit key is used to set the High Limit Set Point. When the chamber temperature reaches or exceeds the High Limit Set Point, the audible alarm sounds and the Over Temp indicator lights. The remote alarm contacts on the back of the freezer also activate. Refer to Section 4.2 for High Limit setting instructions.

Pressing 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 on battery backup (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.

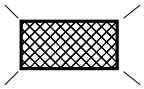
a. Set Point Adjustment Screw located to the right of the Enter key is used to set the operating temperature of the freezer. An adjustment screwdriver is located on the bottom of the compressor section front panel. (See Figure 3-2).

3.6 Audible Alarm and Control Panel Indicators

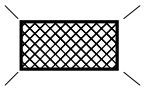
Audible Alarm:

Provides a pulsing tone whenever an alarm condition is present. The Door Ajar Audible Alarm delays 30 seconds to prevent nuisance alarms when the door is opened. Pressing the Alarm Silence key will silence all alarms for 30 minutes.

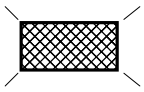
Note: When in Standby, the audible alarm is silent until all alarm conditions are cleared. Audible alarm conditions include Over Temp, Under Temp, Door Ajar and AC Power Failure.



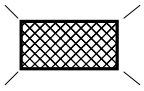
Over Temp (LED): Flashes when an over temperature condition exists.



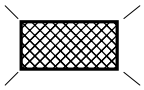
Under Temp (LED): Flashes when an under temperature condition exists.



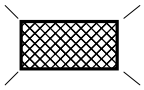
Standby (LED): Lights when in standby mode.



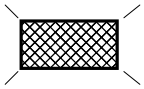
Low Battery (LED): Lights when the battery charge is below 50% and AC power is on. When AC power is off, the Low Battery LED lights when the battery charge is below 15%.



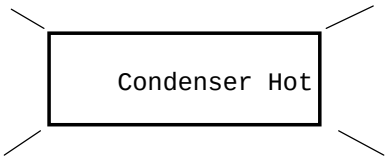
Door Ajar (LED): Flashes when the freezer door is open.



Power (LED): Lights when the AC power is on.



Power Failure (LED): Lights when electrical power is removed from the unit. Press Silence or Standby to silence the audible alarm. Deactivate the Enviro-Scan Monitor if the unit is to be turned off for more than five hours. Refer to Section 2.7.



The words Condenser Hot appears in the alpha-numeric display and the audible alarm sounds for 12 seconds every 15 minutes when the thermostat on the condenser reaches 40° 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.

.

When the Condenser Hot message appears, immediately check the air filter 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 Sections 6.1 and 6.2.

3.7 Set Point Adjustment Screwdriver

A small screwdriver, located on the freezer frame below the compressor section, is used to set the Temperature Set Point. To remove the screwdriver from its holder, pull downward on the black knob. The knob is the handle of the screwdriver. Refer to Figure 3-2.

3.8 Automatic Voltage Compensation System

All Forma 8500 Series 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.

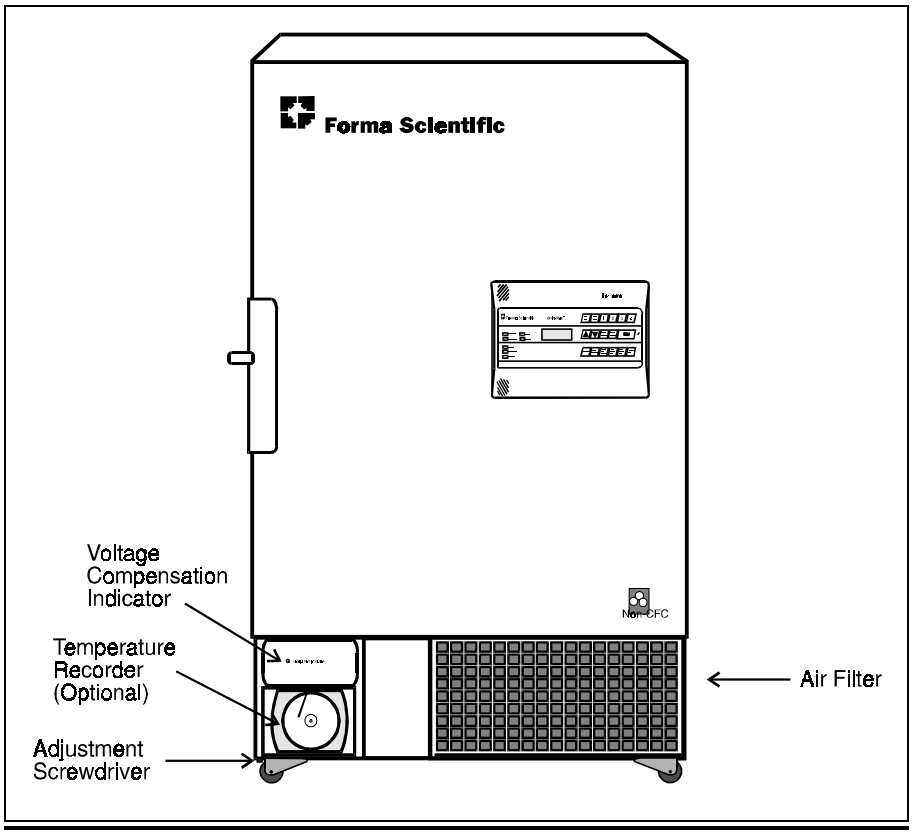


Figure 3-2
8500 Series Freezers

3.9 Double Door Freezer (Factory-Built Option)

Double door models of the 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 with the exception that two door-open alarm switches are installed, one on each door.

Stock# 189757 - 17.3 cu. ft. Models, 120 VAC
Stock# 189759 - 17.3 cu. ft. Models, 220 VAC
Stock# 189761 - 23 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

Ordering information for inventory racks for 23 cu. ft. (652 Liters) Models are listed below.

Order No.	Description	Max Qty per Chamber
189471	Rack includes (12) 3” boxes for top chamber	10
189495	Rack includes (16) 2” boxes for top chamber Dimensions: 5.5” W x 9.7” H x 22.1” F-B (14.0cm x 24.6cm x 56.1cm)	10
820017	Rack includes (12) 3” boxes for bottom chamber	10
820018	Rack includes (20) 2” boxes for bottom chamber Dimensions: 5.5” W x 10.9” H x 22.1” F-B (14.0cm x 27.7cm x 56.1cm)	10

SECTION 4 - START UP

4.1 Setting the Operating Temperature

1. Turn the freezer on. The cabinet temperature will appear in the LCD window.

2. Press the Control Set Point key. A "1" will appear.

3. Enter the Access Code (1,2,3,4). *The "1" will remain in the LCD window*.

4. Press Enter and the word Set and the control set point temperature will be displayed.

5. If an operating temperature other than that 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.)

Forma Scientific recommends setting the cabinet temperature no colder than necessary.

Adjustment of the temperature controller below the normal temperature specification (-86°C) will void the warranty.

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

4.2 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 degrees below the operating temperature. If other temperature limit set points are desired, they are adjusted as follows:

a. To display or change the Low Limit Set Point:

1. Press Low Limit. A "1" will appear in the LCD window.

2. Enter access code (1,2,3,4). *The "1" will remain in the LCD window.*
3. Press Enter. The Low Limit temperature and "Set Low Limit" will be displayed.
4. Change the Low Limit temperature by pressing the Up or Down Arrow keys.
5. Press Enter. The LCD display returns to the cabinet temperature.

b. To display or change the High Limit Set Point:

1. Press High Limit. A "1" will appear in the LCD window.
2. Enter access code (1,2,3,4). *The "1" will remain in the window*.
3. Press Enter. The High Limit temperature and "Set High Limit" will be displayed.
4. Change the High Limit setting by pressing the Up and Down Arrow keys.
5. Press the Enter. The LCD display returns to the cabinet temperature.

4.3 General Recommendations

Avoid leaving the door open for extended time periods. Room air, which is higher in humidity, will replace chamber air and cause frost to develop. It will also put 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.

4.4 Operation of the (Optional) Weksler Temperature Recorder

Before connecting electric power, install a chart on the temperature recorder and remove the protective cap from the pen. Make sure the pen is inking properly by manually rotating the chart.

For additional information, refer to the Weksler Recorder supplement included with this manual.

Temperature probes for the Weksler Recorder and for the Enviro-Scan monitor are located in the left front corner of the freezer chamber. Figures 4-1 and 4-2 illustrate the temperature probes and the probe cover.

The felt-tip pen will require periodic replacement. Usually the ink will appear to fade one to three weeks before replacement becomes necessary. Additional pen tips may be purchased from Forma Scientific, Inc.

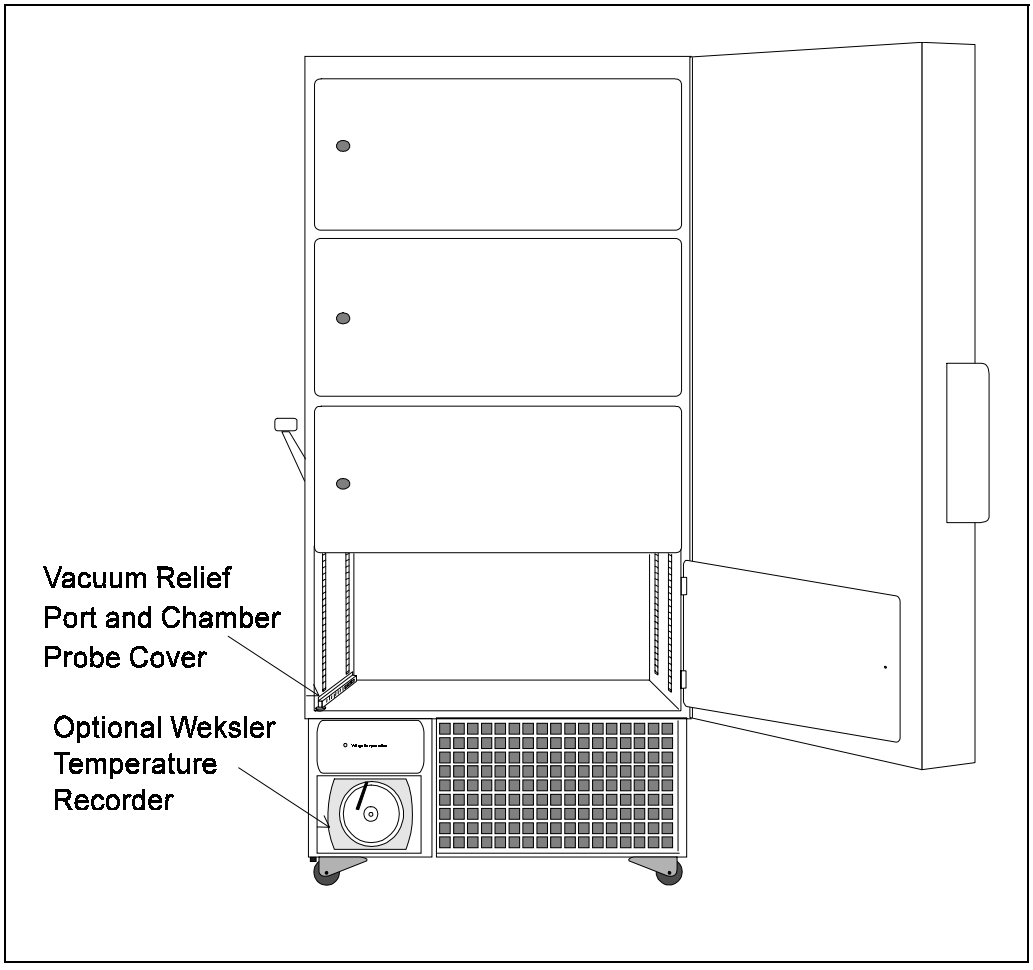


Figure 4-1
Temperature Recorder and Chamber Probe Locations

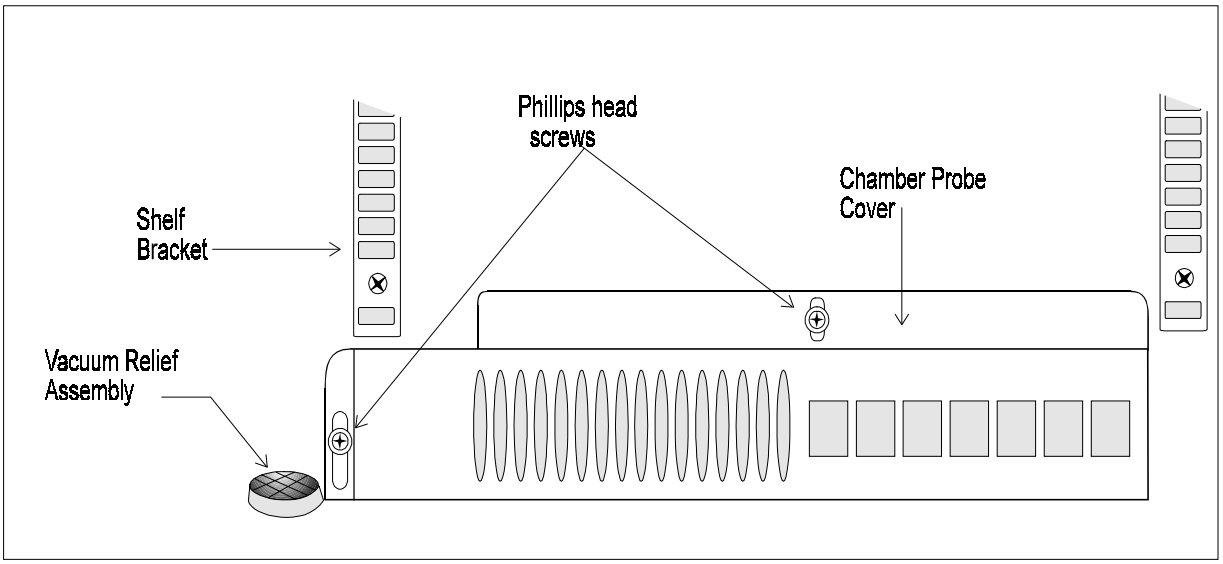


Figure 4-2
Chamber Probe Cover and Vacuum Relief Assembly

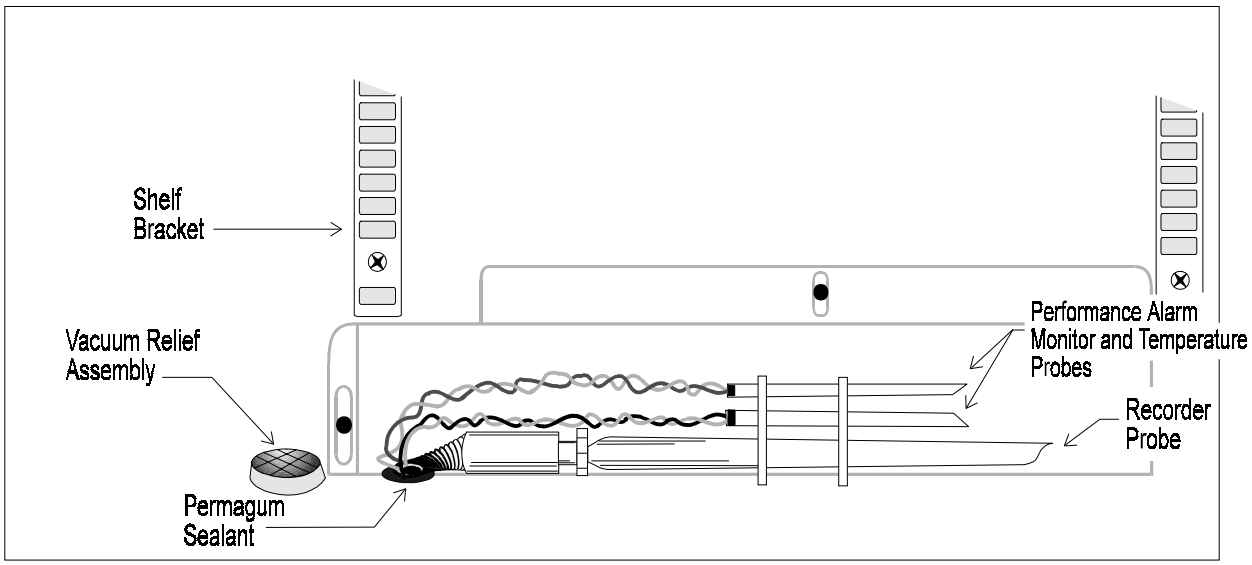


Figure 4-3
Locations of the Performance Alarm Monitor and Temperature Recorder Probes
(Cover removed)

SECTION 5 - CALIBRATION

5.1 Calibration

Calibration of the freezer control system is done from the monitor keypad and requires entry of the four digit Access Code. To obtain the Access Code prompt, *simultaneously* press the Up Arrow key and the Battery %Charge key. The keys must be pressed firmly and at the same time.

When done correctly, a "1" will appear in the display window. After keying in the access code, press Enter. "CAL" will appear in the display. The parameter to be calibrated is selected by pressing the appropriate 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.

5.2 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 8500 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 stablize 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.

5.3 Calibrating the 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.

5.4 Changing the Access Code

1. Obtain the Access Code prompt by pressing the Up Arrow and the Battery %Charge keys *simultaneously*. A "1" will appear in the display window. The keys must be pressed firmly and at the same time. If a "1" does not appear in the window, press the two keys again.

2. Enter the *current* four digit Access Code.

3. Press Enter. "CAL" will appear in the display.

4. Press the (4) key and a "1" will appear in the display prompting entry of the *new* access code.

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. Press Enter to store the new code and return to the temperature display.

SECTION 6 - ROUTINE MAINTENANCE

6.1 Cleaning the Condenser

De-energize all potential sources of energy to this unit and lockout/tagout their controls. (O.S.H.A. Regulation, Section 1910-147.)

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. The 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 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. *Forma Scientific, Inc. recommends a minimum of twice a year*.

To clean the condenser, remove the front grill by grasping the assembly at the corners and gently pulling it away from the frame. Clean the compressor housings, the condenser fins and other refrigeration system parts with a vacuum or air-hose. Other refrigeration system parts are cleaned by removing the back and side panels.

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

Note: Before replacing the grill, inspect the air filter for cleanliness and clean or replace it if necessary. Refer to Section 6.2.

After cleaning, remove the lockout/tagout devices and restore the freezer to service.

6.2 Cleaning the Air Filter (Refer to Figure 6-1)

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

1. Remove the grill by grasping the assembly at the corners and gently pulling it away from the frame. Remove the filter.

2. Clean the filter by washing it with a mild detergent and dry by pressing it between two towels.

3. Should the filter become torn or excessively dirty, a replacement may be ordered from Forma Scientific, Inc., Part # 760162. Refer also to the parts list in Section 9.

6.3 Defrosting the Chamber

Hazardous biological elements may be present.

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 the product and place it in another freezer.

2. Turn off the freezer or pull the plug.

3. Open all of the doors.

4. Place towels on the chamber floor.

5. Allow the frost to melt and become loose from the chamber interior.

6. Remove frost with a soft cloth.

7. After defrosting is complete, wipe the chamber dry with a clean cloth and return the freezer to service.

6.4 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.

6.5 Cleaning the Vacuum Relief Port (Figures 6-1 and 6-2)

The vacuum relief port on Model 900 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.

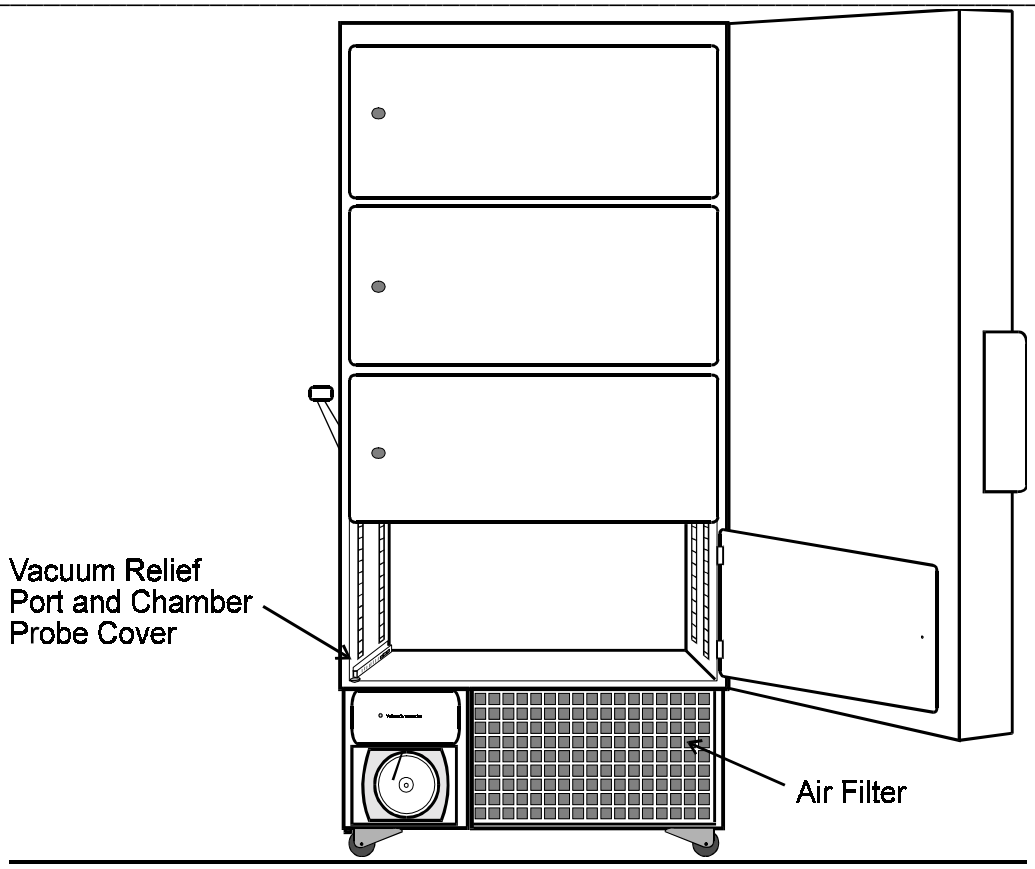


Figure 6-1
Vacuum Relief Port, Temperature Probe and Air Filter Location

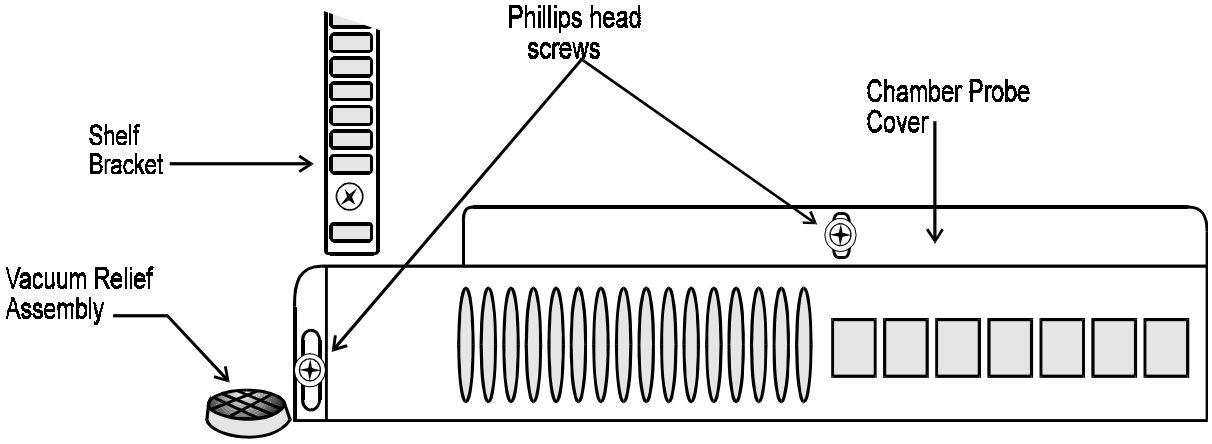


Figure 6-2
Vacuum Relief And Probe Cover Assemblies

SECTION 7 - SERVICE

7.1 Servicing the Refrigeration System

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 on the compressors.

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

Note: A service manual: "Ultra-Low Refrigeration System Service Guide" is available from Forma Scientific, Inc. Call or write for details.

7.2 Troubleshooting Guide

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

Symptom	*Possible Cause*
No Power Light on Monitor	• Power line cord disconnected • Circuit breaker tripped/open • Main power switch off
Chamber Temp Deviates from Set Point	• Too much warm product added • Door open too long • Insufficient voltage • Inadequate air circulation • Calibration. • Dirty condenser • High Ambient Temperature
Too Much Frost Build-Up	• Fan blades loose or bent • Tubing in contact with compressor • Loose fan bracket
Freezer not Being Refrigerated (Unit is receiving Power)	• Compressor thermal overload open • Defective low stage control • Defective temp control • Defective high pressure cut-off • Low stage compressor locked up
Display Problems in General	• Defective monitor board

SECTION 8 - SPECIFICATIONS

Models 8516 and 8517
17.3 cu. ft. Upright Freezers

Specification	Models 8516 and 8517
Temperature	-50° C (-58°F) to -86° C (-123°F)
Exterior Dimensions	33.25" W x 79.0" H x 37.0" F-B (85 cm x 200.7 cm x 94 cm) Add 3" (7.6 cm) to width for handle/hinge Add 7" (17.8 cm) to F-B for control panel/wall spacer
Interior Dimensions	23.0" W x 51.5" H x 25.25" F-B (58 cm x 131 cm x 64 cm)
Capacity	17.3 Cu. Ft. (490 liters)
Refrigeration Type	Two, 1/2 HP Compressors (Cascade System)
Insulation	**Type:** Non-CFC foamed-in-place urethane **Sides:** 5" (12.7 cm) **Door:** 4.5" (11.3 cm)
Electrical	**8516:** 120 VAC, 1PH, 60 Hz, 15.5 FLA **8517:** 208-230 VAC, 1PH , 60 Hz, 12 FLA or 200-240 VAC, 1 PH, 50 Hz, 12 FLA
Breaker Requirements (Dedicated Circuit)	**8516:** 20 Amp, 120 VAC **8517:** 15 Amp, 220 VAC 120V Dedicated Circuit 20 Amp Time Delay Breaker
Automatic Voltage Compensation	**Low:** Cut In: 110V, Cut Out: 115V, Volts Boost: 10 Cut In: 210V, Cut Out: 220V, Volts Boost 18 **High:** Cut In: 125V, Cut Out: 120V Volts Buck: 10 Cut In: 235V, Cut Out: 225V, Volts Buck: 18
Shipping Weight (nominal)	**Ocean:** 1000 lbs. (454 kg) **Air/Container:** 900 lbs. (408 kg) **Motor:** 758 lbs. (344 kg)

Model 8523

23.0 cu. ft. Upright Freezer

Specification	Model 8523
Temperature	-50° C (-58°F) to -86° C (-123°F)
Exterior Dimensions	40.25" W x 79" H x 37" F-B (103.5 cm x 200.7 cm x 94 cm) Add 3" (7.6 cm) to width for handle/hinge Add 7" (17.8 cm) to F-B for control panel/wall spacer
Interior Dimensions	30.6" W x 51.5" H x 25.25" F-B (77 cm x 131 cm x 64 cm)
Capacity	23 Cu. Ft. (652 liters)
Refrigeration Type	Two, 3/4 HP Compressors (Cascade System)
Insulation	**Type:** Non-CFC foamed-in-place urethane **Sides:** 5" (12.7 cm) **Door:** 4.5" (11.3 cm)
Electrical	208-230VAC, 1PH , 60 Hz, 14 FLA or 200-240VAC, 1 PH, 50 Hz, 14 FLA
Breaker Requirements (Dedicated Circuit)	20 Amp, 220 VAC
Automatic Voltage Compensation	**Low:** Cut In: 210V, Cut Out: 220V, Volts Boost 18 **High:** Cut In: 235V, Cut Out: 225V, Volts Buck: 18
Shipping Weight (nominal)	**Ocean:** 1104 lbs. (501 kg) **Air/Container:** 970 lbs. (440 kg) **Motor:** 875 lbs. (397 kg)

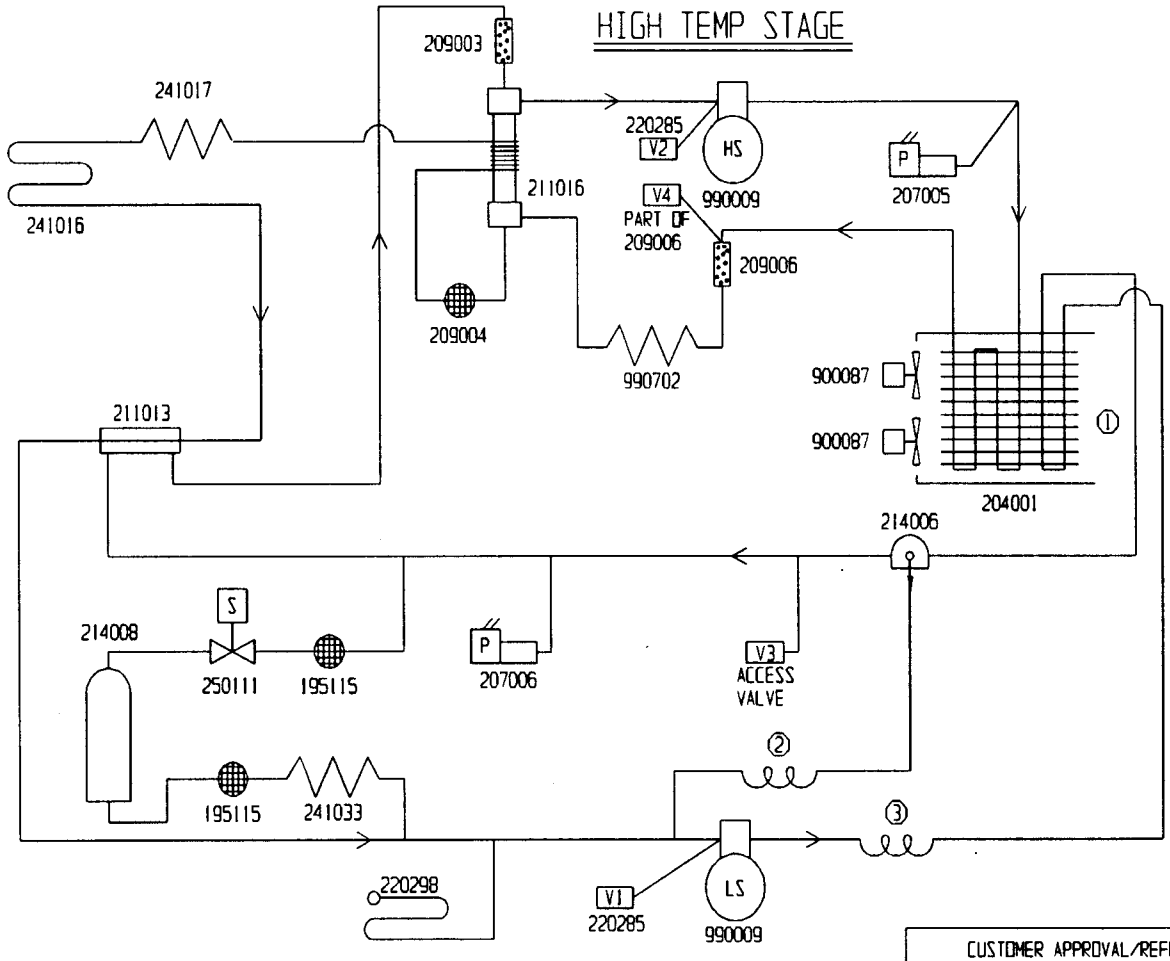
SECTION 9 - PARTS LIST

Models 8516/8517 and 8523

STOCK #	DESCRIPTION
190269	Temperature Control Board
290041	1000 OHM Platinum Probe
400863	Monitor Board (Wired)
400064	Battery 6V, 8AH (Rechargeable)
214003	Oil Separator
209003	Dryer 3/8 ODF
209006	Dryer 1/4 ODS
207006	Pressure Switch, Cutout
900087	Tubeaxial Fan, 115V (8516)
900088	Tubeaxial Fan, 230V (8517 and 8523)
250111	Solenoid Valve (120V models)
250115	Solenoid Valve (220V models)
760162	Air Filter, 21-3/8" x 13-3/8" x 1/2"
132041	Door Heater, 115V, for 13 and 17 cu ft Double Door Freezer
132042	Door Heater, 230V, for 13 and 17 cu ft Double Door Freezer
132043	Door Heater, 230V, for 23 cu ft Double Door Freezer

SECTION 10 - REFRIGERATION SCHEMATICS

CASCADE REFRIGERATION



HIGH TEMPERATURE STAGE:
REFRIGERANT R-134a: 27 OZ
MOBIL EAL-22: COMPRESSOR 40 OZ

LOW TEMPERATURE STAGE:
*REFRIGERANT R-290: 0.9 OZ (30" VAC. - 0 PSIG)
*REFRIGERANT R-23: 8.0 OZ (0 PSIG - 85 PSIG)
ZEROL 150T: (COMPRESSOR) 40 OZ
(OIL SEPARATOR) 15 OZ
DESUPER HEAT COIL: ① TOP FOUR PASSES OF R-134a AIR-COOLED CONDENSER
VIB. ISO. COIL ② 1 COIL 1/4" TUBING X 4" DIA.
DESUPER HEAT/VIB. ISO. COIL ③ 2 COILS 5/16" TUBING X 6-3/4" DIA.

*WHEN SYSTEM IS AT 24°C

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____

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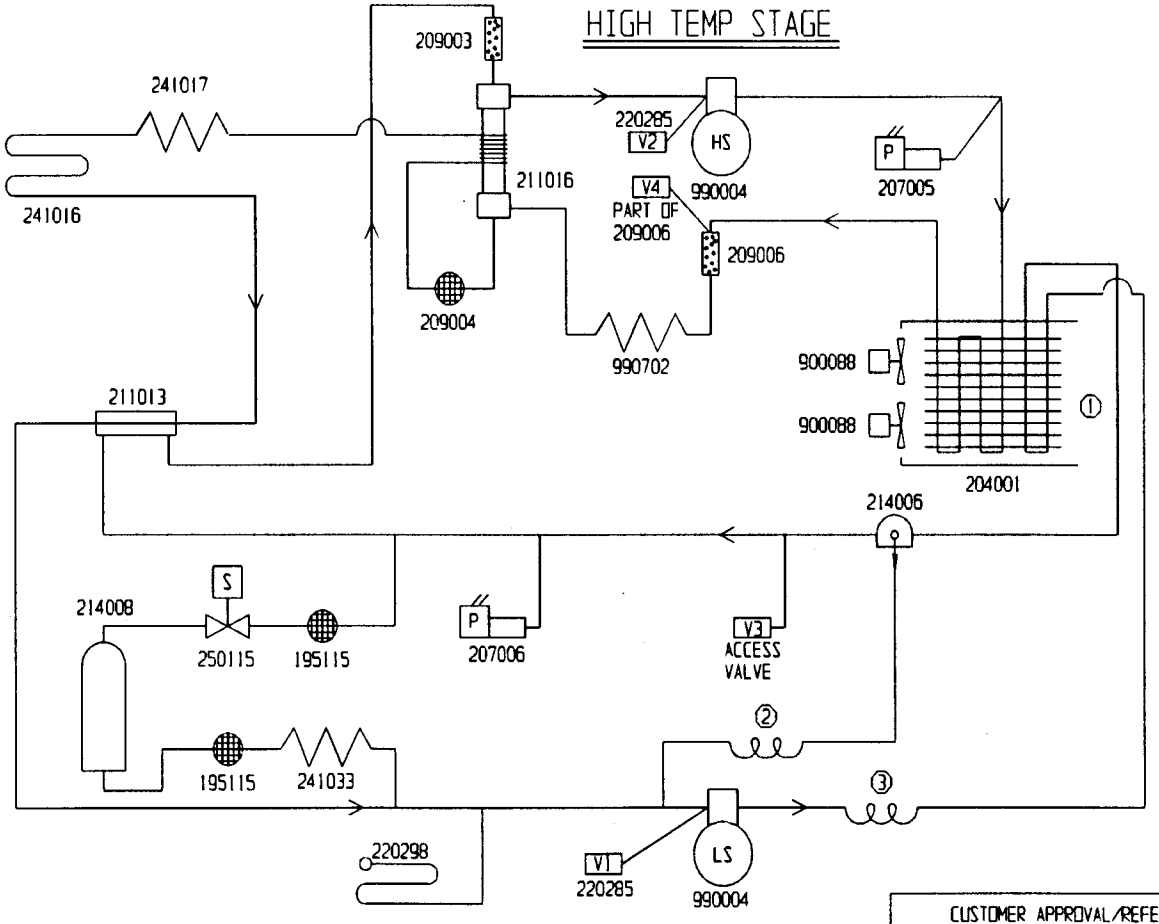
REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
1	FR-765	10-21-94	LDC	KDG		214008 WAS 993102
0	N/A	9-27-93	LC	LC	JV	RELEASED FOR PRODUCTION

DATE 8-23-93	DWN AT	CAD AT	APPD JV	SCALE NONE
CUSTOMER				
JOB TITLE	8516 & 916 -86°C 17 CU FT UPRIGHT FREEZER			
DWG TITLE	REFRIGERATION SCHEMATIC			
LOCATION	JOB NUMBER	DRAWING NUMBER 8516-90-0-B		

Forma Scientific
BOX 649 MARIETTA, OHIO 45750 TELEX 24-5394
TOLL FREE USA 800-848-3080, OHIO 614-373-4763

CASCADE REFRIGERATION



HIGH TEMPERATURE STAGE:
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MOBIL EAL-22: COMPRESSOR 40 OZ

LOW TEMPERATURE STAGE:
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*REFRIGERANT R-23: 8.0 OZ (0 PSIG - 85 PSIG)
ZEROL 150T: (COMPRESSOR) 40 OZ
(OIL SEPARATOR) 15 OZ
DESUPER HEAT COIL: ① TOP FOUR PASSES OF R-134a AIR-COOLED CONDENSER
VIB. ISO. COIL ② 1 COIL 1/4" TUBING X 4" DIA.
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REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
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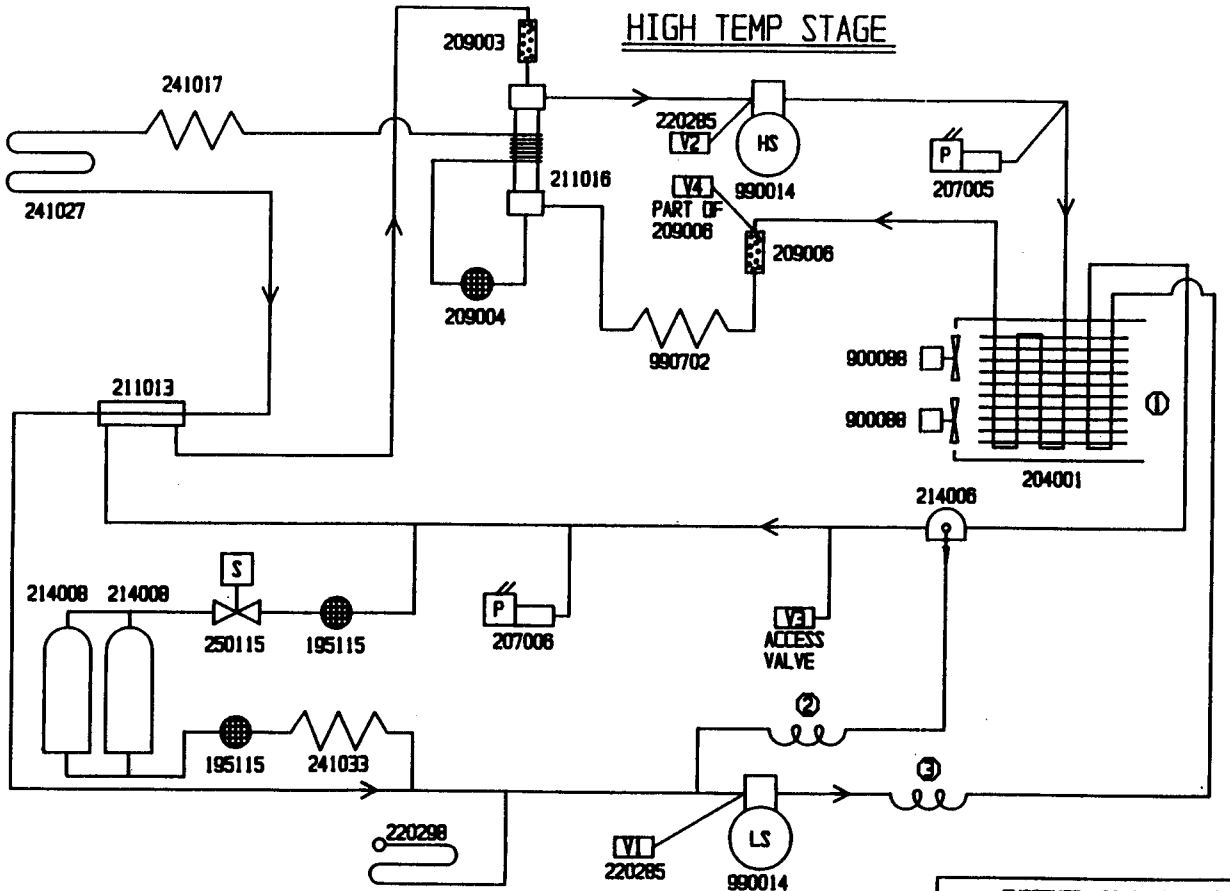
1	FR-765	10-21-94	LDC	KDG	JV	214008 WAS 993102
0	N/A	9-27-93	LC	LC	JV	RELEASED FOR PRODUCTION

Forma Scientific
BOX 649 MARIETTA, OHIO 45750 TELEX 24-5394
TOLL FREE USA 800-848-3080, OHIO 614-373-4763

DATE 8-23-93	DWN AT	CAD AT	APPD JV	SCALE NONE
CUSTOMER			
JOB TITLE	8517 & 917 -86°C 17 CU FT UPRIGHT FREEZER		
DWG TITLE	REFRIGERATION SCHEMATIC		
LOCATION	JOB NUMBER	DRAWING NUMBER	
		8517-90-0-B	



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE:
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MOBIL EAL-22: COMPRESSOR 40 OZ

LOW TEMPERATURE STAGE:
*REFRIGERANT R-290: 1.3 OZ (30" VAC. - 0 PSIG)
*REFRIGERANT R-23: 14.3 OZ (0 PSIG - 100 PSIG)
ZEROL 150T: (COMPRESSOR) 40 OZ
(OIL SEPARATOR) 15 OZ
DESUPER HEAT COIL: ① TOP FOUR PASSES OF R-134a AIR-COOLED CONDENSER
VIB. ISO. COIL ② 1 COIL 1/4" TUBING X 4' DIA.
DESUPER HEAT/VIB. ISO. COIL ③ 2 COILS 5/16" TUBING X 6-3/4" DIA.

*WHEN SYSTEM IS AT 24°C

CUSTOMER APPROVAL/REFERENCE
APPROVED BY
APPROVING FIRM
DATE OF APPROVAL

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REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	FR-781	11-11-94	AT	KDG	JV	250115 WAS 250111
2	FR-765	10-21-94	LDC	KDG	JV	214008 WAS 993102
1	FR-630	12-07-93	LC	KDG	LDN	CHG. STK# 241016 TO 241027
0	N/A	9-27-93	LC	LC	JV	RELEASED FOR PRODUCTION

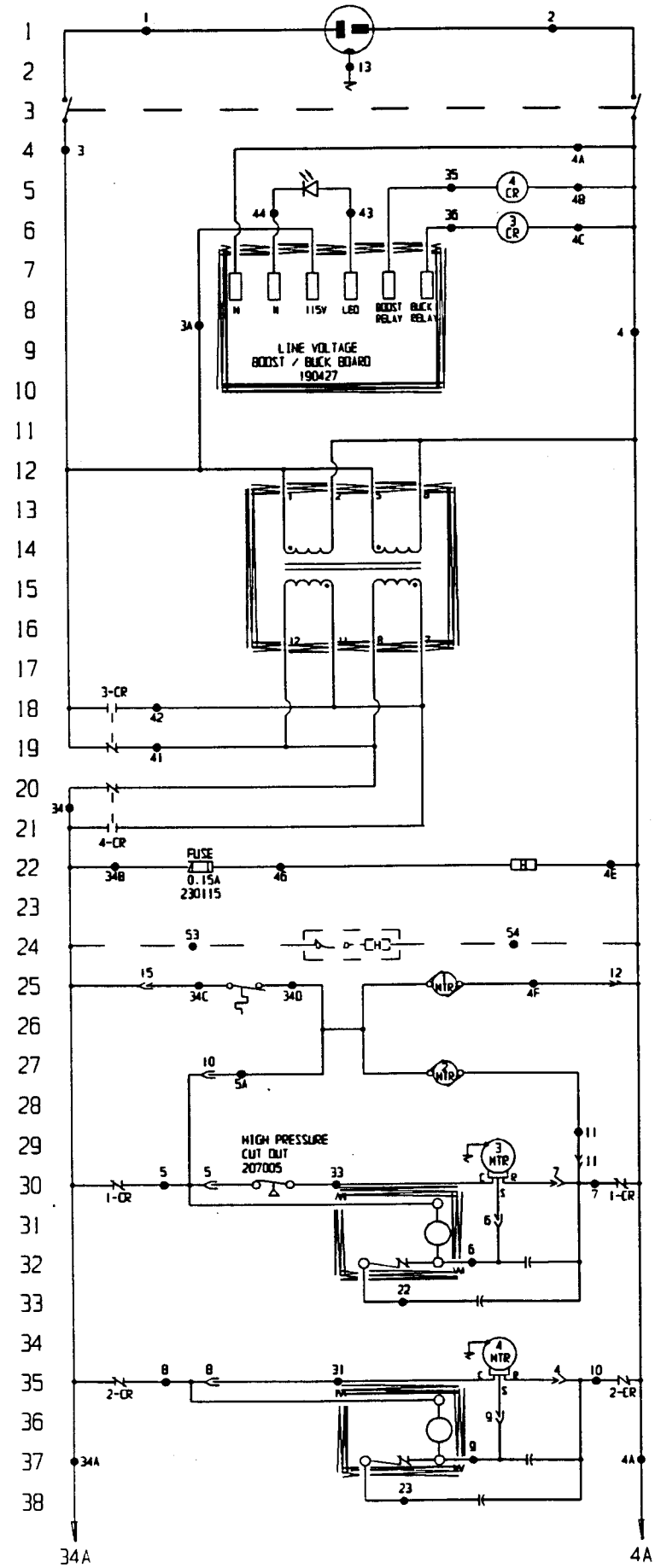
Forma Scientific

[illegible]

DATE 8-23-93	DWN AT	CAD AT	APPD JV	SCALE NONE
CUSTOMER			
JOB TITLE 8523 & 923 -86°C 23 CU FT UPRIGHT FREEZER			
DWG TITLE REFRIGERATION SCHEMATIC			
LOCATION	JOB NUMBER	DRAWING NUMBER 8523-90-0-B	

SECTION 11 - ELECTRICAL SCHEMATICS

POWER CONNECTION
120V, 1Ø, 2W, 60HZ, 15.5 FLA



430094
LINE CORD & PLUG

360188
POWER SWITCH

280059
VOLTAGE CORRECTION LED

300073
BOOST RELAY
20. 21

300073
BUCK RELAY
18. 19

420085
175VA TRANSFORMER

133007
VACUUM RELIEF PORT HEATER
12.5W @ 120VAC
UPRIGHT FREEZERS ONLY

132041
SPLIT DOOR HEATER
10W @ 120VAC
SPLIT DOOR OPTION ONLY

900087
TUBEAXIAL FAN

400105
BASE THERMOSTAT

900087
TUBEAXIAL FAN

990009
HIGH STAGE COMPRESSOR
1/2 H.P., 120V

300099
START RELAY

170108
RUN CAPACITOR
35UF, 370V

170012
START CAPACITOR
270-324UF, 125V

990009
LOW STAGE COMPRESSOR
1/2 H.P., 120V

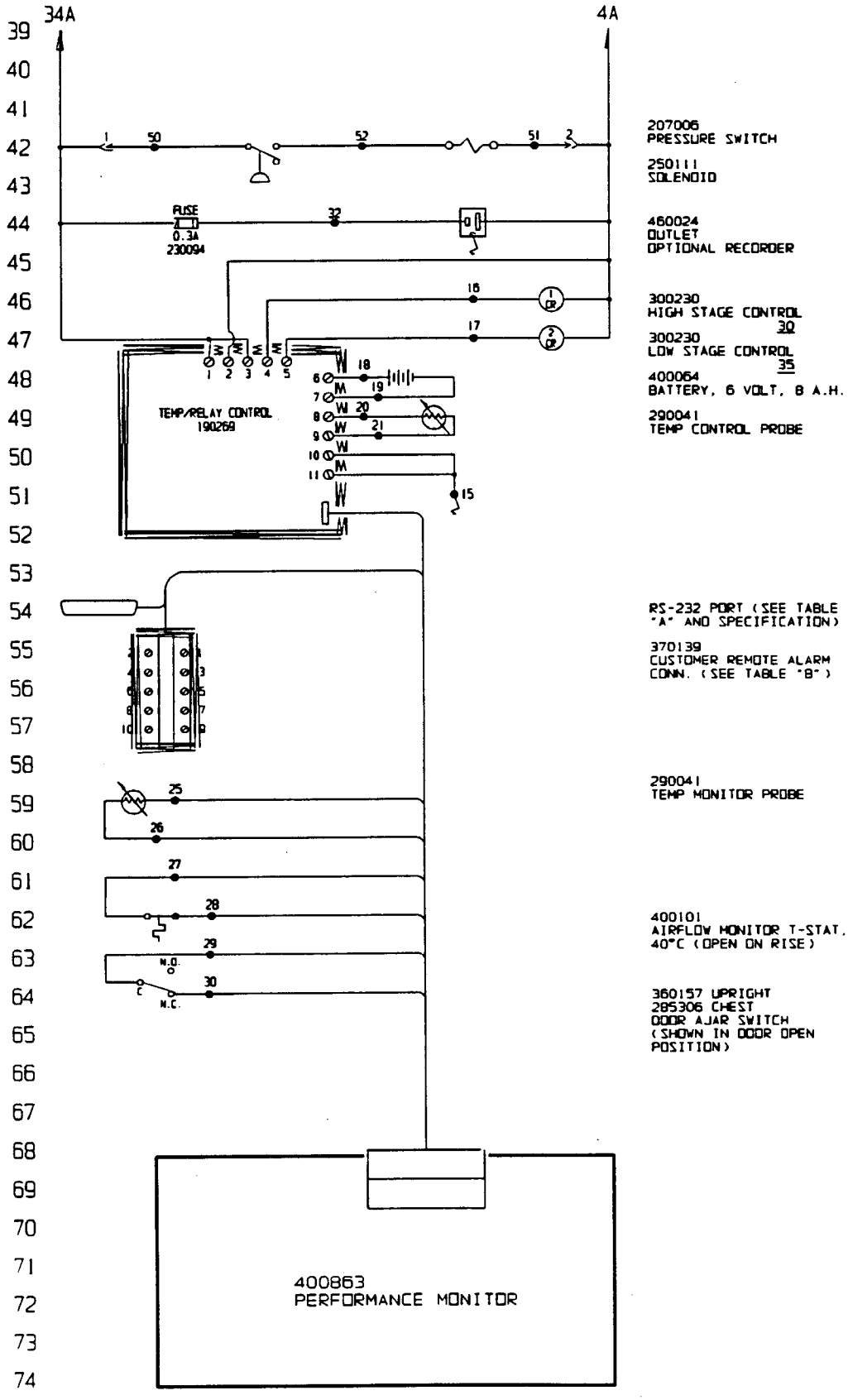
300099
START RELAY

170108
RUN CAPACITOR
35UF, 370V

170012
START CAPACITOR
270-324UF, 125V

Electrical Schematic
Forma Models:
8516, 8526, 8539,
8559

8516-70-0-D Rev. 1
Page 1 of 3



Electrical Schematic
Forma Models:
8516, 8526, 8539,
8559

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
1	14	BLK
2	14	WHT
3	14	BRN
3A	20	BRN
4	14	WHT
4A	20	WHT
4B	20	WHT
4C	20	WHT
4D	20	WHT
4E	18	BLU
4F	18	BLU
5	14	BRN
5A	18	BRN
6	14	RED
7	14	YEL
8	14	BLK
9	14	PUR
10	14	ORG
11	18	YEL
13	14	GRN
15	20	GRN
16	20	YEL
17	20	ORG
18	20	RED
19	20	BLK
20	22	RED
21	22	WHT
22	14	GRY
23	14	BLU
25	22	RED
26	22	WHT
27	20	BLK
28	20	BLK
29	20	RED
30	20	BLK
31	14	BLK
32	20	PUR
33	14	BRN
34	14	BLK
34A	20	BLK
34B	18	BRN
34C	18	BLK
34D	18	BLK
35	20	ORG
36	20	YEL
41	14	RED
42	14	BLK
43	20	RED
44	20	BLK
46	18	BLK
50	18	BLK
51	18	WHT
52	18	BRN
53	14	BRN
54	14	BLU

TABLE "A"

RS-232 PORT	
PIN# 2	$\overline{TXD}$
PIN# 3	$\overline{RXD}$
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.O.
4	MILLIVOLT OUT (POS.)
5	UNDERTEMP N.C.
6	MILLIVOLT OUT (NEG.)
7	UNDERTEMP COM.
8	UNDERTEMP N.O.
9	(NOT USED)
10	(NOT USED)

NOTES:

⊕	Denotes Terminal Strip Connection	Parts List Reference Number	
4-CR	Last Relay Number	○	Assembly
	Last Terminal Number	○	Panel
54	Last Wire Number	○	Refrigeration
		□	Wiring

CUSTOMER APPROVAL/REFERENCE
APPROVED BY
APPROVING FIRM
DATE OF APPROVAL

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REV	ECR NO.	DATE	BY	CAD	APPO	DESCRIPTION OF REVISION
1	SI-4426	7-29-94	AT	AT		ADDED SPLIT DOOR HEATER
0	N/A	9-28-93	AT	AT	JV	RELEASED FOR PRODUCTION

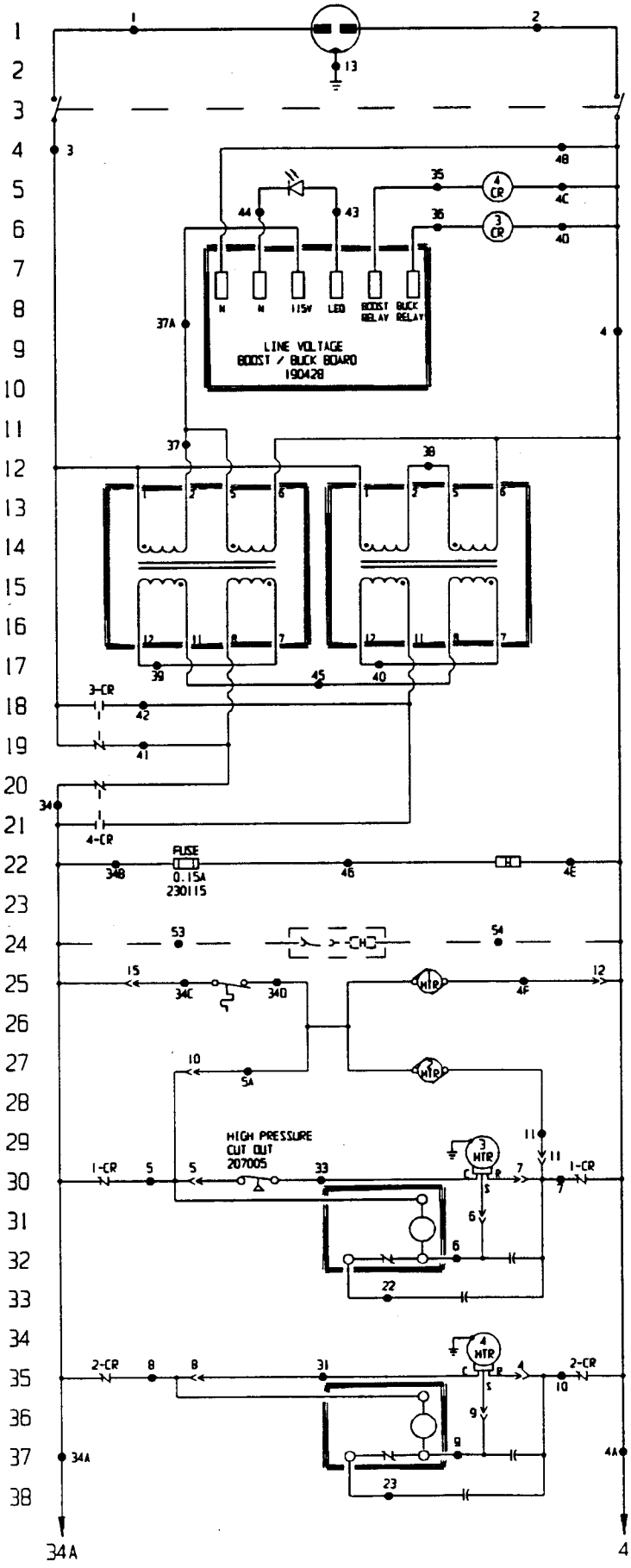
DATE 8-17-93	DWN AT	CAD AT	APPD JV	SCALE NONE	
CUSTOMER					
JOB TITLE	8516, 8526, 8539 & 8559 FREEZERS				
DWG TITLE	ELECTRICAL SCHEMATIC				
LOCATION		JOB NUMBER		DRAWING NUMBER 8516-70-0-D	

Forma Scientific

[illegible]

Electrical Schematic
Forma Models:
8516, 8526, 8539,
8559

POWER CONNECTION
208/230V, 1Ø, 2W, 50/60HZ, 12.0 FLA



430095
LINE CORD & PLUG

360188
POWER SWITCH

280059
VOLTAGE CORRECTION LED

300073
BOOST RELAY
20, 21

300073
BUCK RELAY
18, 19

420066
130VA TRANSFORMER, 2

133008
VACUUM RELIEF PORT HEATER
12.5W @ 220VAC
UPRIGHT FREEZERS ONLY

132042
SPLIT DOOR HEATER
10W @ 240VAC
SPLIT DOOR OPTION ONLY

900088
TUBEAXIAL FAN

400105
BASE THERMOSTAT

900088
TUBEAXIAL FAN

990004
HIGH STAGE COMPRESSOR
1/2 H.P., 220V

300095
START RELAY

170101
RUN CAPACITOR
5UF, 370V

170010
START CAPACITOR
88-108UF, 250V

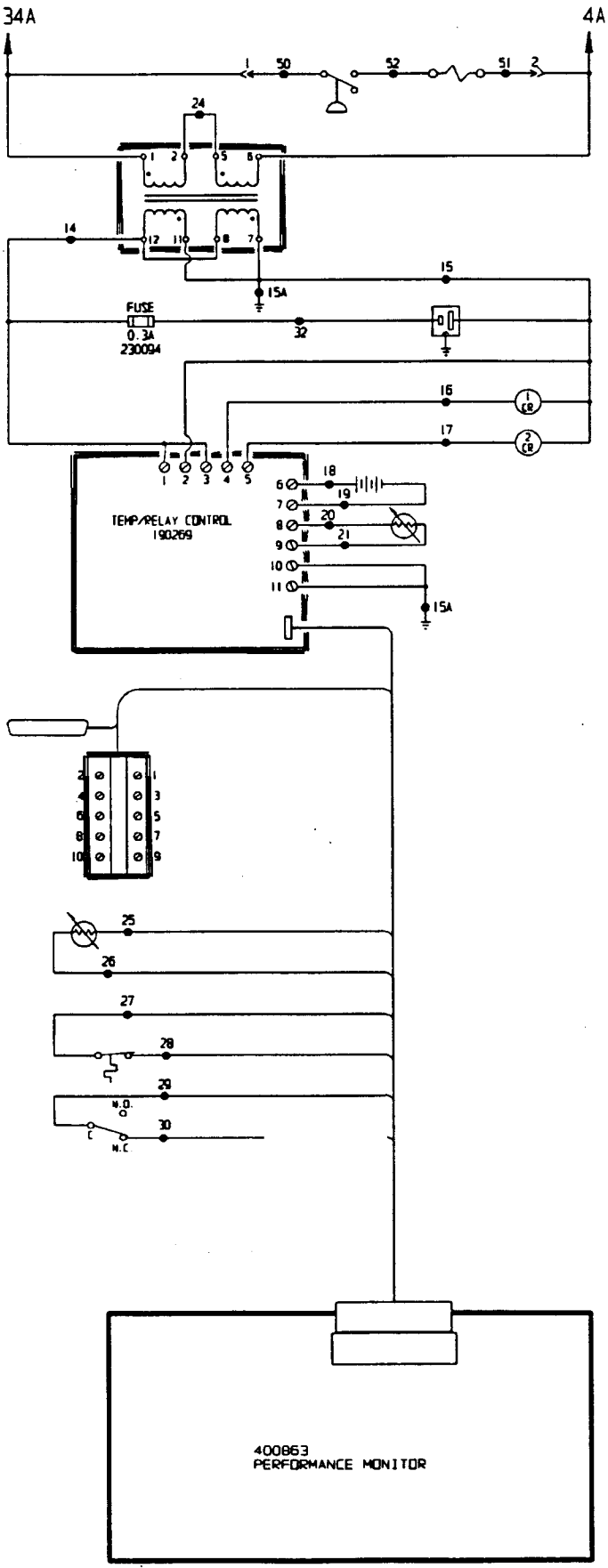
990004
LOW STAGE COMPRESSOR
1/2 H.P., 220V

300095
START RELAY

170101
RUN CAPACITOR
5UF, 370V

170010
START CAPACITOR
88-108UF, 250V

Electrical Schematic
Forma Models:
8517, 8525, 8538
8558, 8560, 8590



Electrical Schematic
Forma Models:
8517, 8525, 8538
8558, 8560, 8590

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
1	14	BRN
2	14	BLU
3	14	BRN
4	14	BLU
4A	20	BLU
4B	20	BLU
4C	20	BLU
4D	20	BLU
4E	18	BLU
4F	18	BLU
5	14	BRN
5A	18	BRN
6	14	RED
7	14	YEL
8	14	BLK
9	14	PUR
10	14	ORG
11	18	YEL
13	14	GRN/YEL
14	20	BLK
15	20	WHT
15A	20	GRN
16	20	YEL
17	20	ORG
18	20	RED
19	20	BLK
20	22	RED
21	22	WHT
22	14	GRY
23	14	BLU
24	20	PUR
25	22	RED
26	22	WHT
27	20	BLK
28	20	BLK
29	20	RED
30	20	BLK
31	14	BLK
32	20	PUR
33	14	BRN
34	14	BRN
34A	20	BRN
34B	18	BRN
34C	18	BLK
34D	18	BLK
35	20	ORG
36	20	YEL
37	14	PUR
37A	20	PUR
38	14	PUR
39	14	ORG
40	14	YEL
41	14	RED
42	14	BLK
43	20	RED
44	20	BLK
45	14	GRY
46	18	BLK
50	18	BLK
51	18	WHT
52	18	BRN
53	14	BRN
54	14	BLU

TABLE "A"

RS-232 PORT	
PIN# 2	$\overline{TXD}$
PIN# 3	$\overline{RXD}$
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.O.
4	MILLIVOLT OUT (POS.)
5	UNDERTEMP N.C.
6	MILLIVOLT OUT (NEG.)
7	UNDERTEMP COM.
8	UNDERTEMP N.O.
9	(NOT USED)
10	(NOT USED)

NOTES:

●	Denotes Terminal Strip Connection	Parts List Reference Number	
4-CR	Last Relay Number	○	Assembly
N/A	Last Terminal Number	⬠	Panel
54	Last Wire Number	○	Refrigeration
		□	Wiring

CUSTOMER APPROVAL/REFERENCE

APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____

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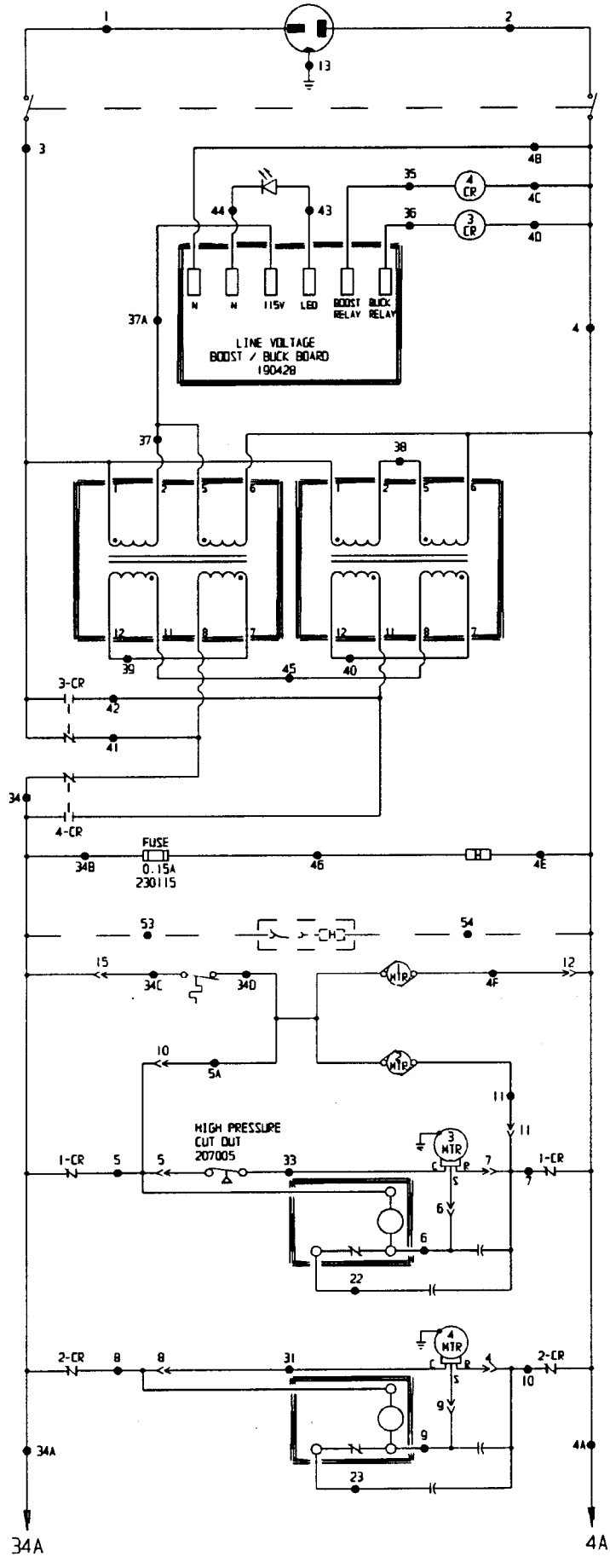
REV	ECR NO.	DATE	BY	CAD	APPO	DESCRIPTION OF REVISION
3	FR-781	11-11-94	AT	KDG		250115 WAS 250111
2	SI-4717	10-05-94	JV	KDG	LDN	CHG. 133008 240VAC TO 220VAC
1	SI-4426	7-29-94	AT	AT	JV	ADDED SPLIT DOOR HEATER
0	N/A	9-28-93	AT	AT	JV	RELEASED FOR PRODUCTION

DATE 8-17-93	DWN AT	CAD AT	APPO JV	SCALE NONE	
CUSTOMER					
JOB TITLE	8517, 8525, 8538, 8558, 8560 & 8590 FREEZERS				
DWG TITLE	ELECTRICAL SCHEMATIC				
LOCATION	JOB NUMBER	DRAWING NUMBER 8517-70-0-D			

Electrical Schematic
Forma Models:
8517, 8525, 8538
8558, 8560, 8590

POWER CONNECTION
208/230V, 1Ø, 2W, 50/60HZ, 14.0 FLA



430122
LINE CORD & PLUG

360188
POWER SWITCH

280059
VOLTAGE CORRECTION LED

300073
BOOST RELAY
20, 21

300073
BUCK RELAY
18, 19

420066
130VA TRANSFORMER, 2

133008
VACUUM RELIEF PORT HEATER
12.5W @ 220VAC

132043
SPLIT DOOR HEATER
13W @ 240VAC
SPLIT DOOR OPTION ONLY

900088
TUBEAXIAL FAN

400105
BASE THERMOSTAT

900088
TUBEAXIAL FAN

990014
HIGH STAGE COMPRESSOR
3/4 H.P., 220V

300124
START RELAY

170101
RUN CAPACITOR
5UF, 370V

170036
START CAPACITOR
145-175UF, 250V

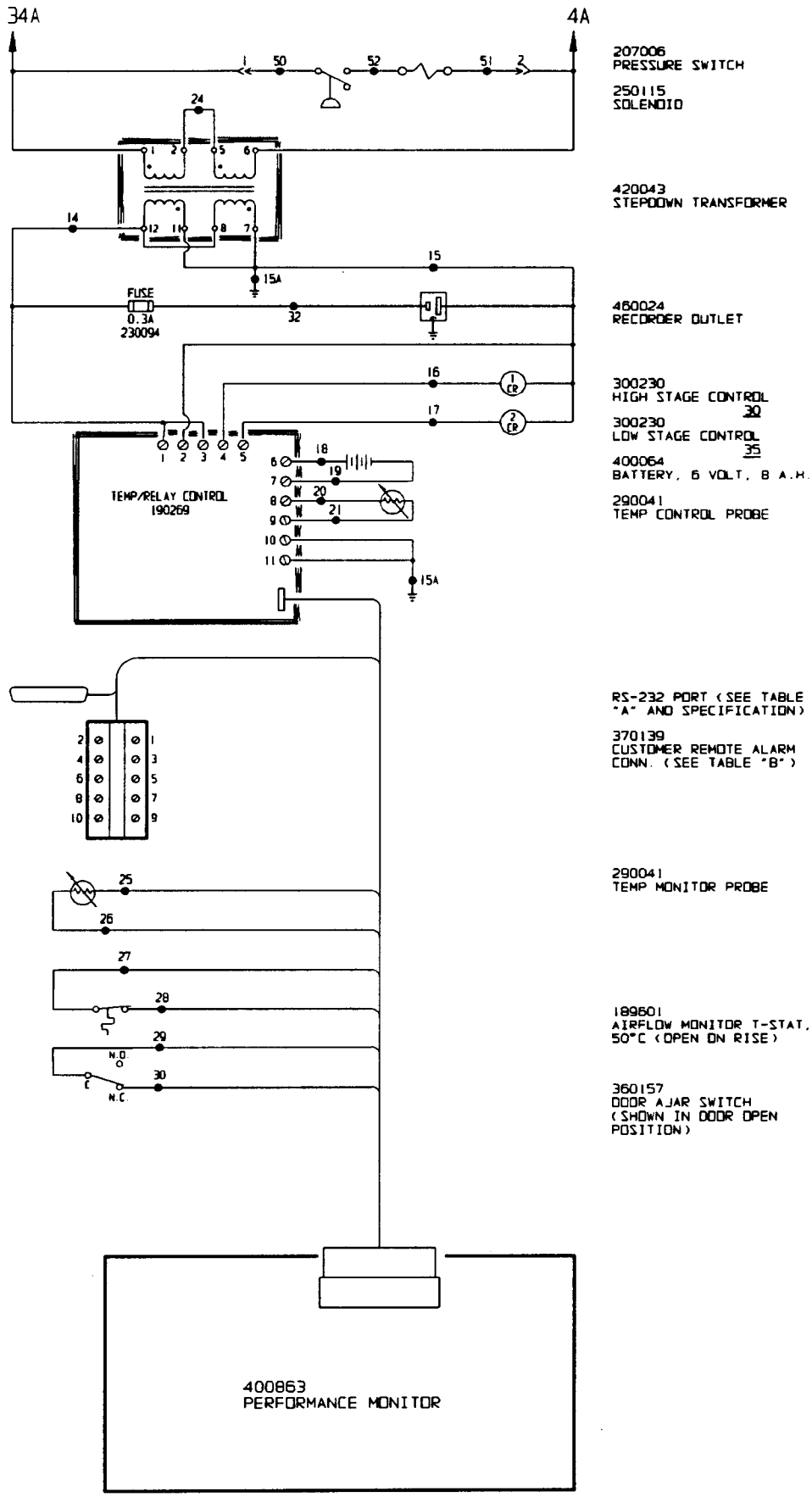
990014
LOW STAGE COMPRESSOR
3/4 H.P., 220V

300124
START RELAY

170101
RUN CAPACITOR
5UF, 370V

170036
START CAPACITOR
145-175UF, 250V

Electrical Schematic
Forma Models:
8523



Electrical Schematic
Forma Models:
8523

8523-70-0-D Rev. 4
Page 2 of 3

WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR
1	14	BRN
2	14	BLU
3	14	BRN
4	14	BLU
4A	20	BLU
4B	20	BLU
4C	20	BLU
4D	20	BLU
4E	18	BLU
4F	18	BLU
5	14	BRN
5A	18	BRN
6	14	RED
7	14	YEL
8	14	BLK
9	14	PUR
10	14	ORG
11	18	YEL
13	14	GRN/YEL
14	20	BLK
15	20	WHT
15A	20	GRN
16	20	YEL
17	20	ORG
18	20	RED
19	20	BLK
20	22	RED
21	22	WHT
22	14	GRY
23	14	BLU
24	20	PUR
25	22	RED
26	22	WHT
27	20	BLK
28	20	BLK
29	20	RED
30	20	BLK
31	14	BLK
32	20	PUR
33	14	BRN
34	14	BRN
34A	20	BRN
34B	18	BRN
34C	18	BLK
34D	18	BLK
35	20	ORG
36	20	YEL
37	14	PUR
37A	20	PUR
38	14	PUR
39	14	ORG
40	14	YEL
41	14	RED
42	14	BLK
43	20	RED
44	20	BLK
45	14	GRY
46	18	BLK
50	18	BLK
51	18	WHT
52	18	BRN
53	14	BRN
54	14	BLU

TABLE "A"

RS-232 PORT	
PIN# 2	$\overline{TXD}$
PIN# 3	$\overline{RXD}$
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.O.
4	MILLIVOLT OUT (POS.)
5	UNDERTEMP N.C.
6	MILLIVOLT OUT (NEG.)
7	UNDERTEMP COM.
8	UNDERTEMP N.O.
9	(NOT USED)
10	(NOT USED)

NOTES:

		Parts List Reference Number
⊛	Denotes Terminal Strip Connection	
4-CR	Lost Relay Number	○ Assembly
N/A	Lost Terminal Number	⬠ Panel
54	Lost Wire Number	○ Refrigeration
		□ Wiring

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____
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REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
4	FR-781	11-11-94	AT	KDG		250115 WAS 250111
3	SI-4717	10-05-94	JV	KDG	LDN	CHG. 133008 240VAC TO 220VAC
2	FR-748	09-09-94	MSB	KDG	LDN	CHG. 10.0 FLA TO 14.0 FLA
1	SI-4426	7-29-94	AT	AT	LDN	ADDDED SPLIT DOOR HEATER
0	N/A	9-29-93	AT	AT	JV	RELEASED FOR PRODUCTION

Forma Scientific

9th AVE MARIETTA, OHIO 45750 TELEX 24-5304
TOLL FREE USA 800-848-3880, OHIO 614-373-4763

DATE 8-17-93	DWN AT	CAD AT	APPD JV	SCALE NONE
CUSTOMER				
JOB TITLE	8523 FREEZER			
DWG TITLE	ELECTRICAL SCHEMATIC			
LOCATION	JOB NUMBER	DRAWING NUMBER 8523-70-0-D		

Electrical Schematic
Forma Models:
8523