VWR® ULT Upright Freezers

INSTRUCTION MANUAL

North American Catalogue Number	European Catalogue Number	Model Number	Size (cu ft)	Size (liters)	Box	Voltage	Temperature
-86°C FREEZERS							
10160-724	--	VWR24086A	13	368	240	120V/60Hz	-86°C
10160-726	--	VWR24086D	13	368	240	208-230V/60Hz	-86°C
--	471-1140	VWR24086V	13	368	240	230/50Hz	-86°C
10160-728	--	VWR32086A	17	490	320	120V/60Hz	-86°C
10160-730	--	VWR32086D	17	490	320	208-230V/60Hz	-86°C
--	471-1141	VWR32086V	17	490	320	230/50Hz	-86°C
10160-732	--	VWR40086A	23	651	400	120V/60Hz	-86°C
10160-734	--	VWR40086D	23	651	400	208-230V/60Hz	-86°C
--	471-1142	VWR40086V	23	651	400	230V/50Hz	-86°C
10160-736	--	VWR60086D	28	793	600	208-230V/60Hz	-86°C
--	471-1143	VWR60086V	28	793	600	230/50Hz	-86°C
-40°C FREEZERS							
10160-748	--	VWR24040A	13	368	240	120V/60Hz	-40°C
10160-750	--	VWR24040D	13	368	240	208-230V/60Hz	-40°C
--	471-1135	VWR24040V	13	368	240	230V/50Hz	-40°C
10160-752	--	VWR32040A	17	490	320	120V/60Hz	-40°C
10160-754	--	VWR32040D	17	490	320	208-220V/60Hz	-40°C
--	471-1136	VWR32040V	17	490	320	230V/50Hz	-40°C

7085602 Version: 8
Issued: October 2017

CE

Important installer and user information:

A redundant temperature sensing device has been included in this ULT freezer. This device is a type "T" thermocouple. For convenient access, the thermocouple (Figure 2-3) terminates in an interconnect jack (Figure 2-5) behind the base front cover. (May be located differently in chests. See Section 2.) It is strongly recommended that this thermocouple be attached to a redundant 24 hour 7 day monitoring system with alarm capabilities. Connecting the sensor to a monitoring and alarm system separate from the freezer provides the utmost in product safety, should the integral system fail.

Legal Address of Manufacturer

United States

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Geldenaaksebaan 464

B-3001 Leuven

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Country of origin: United States

Packing List

Description	Quantity
Key	2
Neoprene Cap	2
1/4-20 x 5-1/2" Bolt	2
Retaining Clip	1
Remote Alarm Connector	1

MANUAL NUMBER 7085602

8	31230	10/23/17	Updated drawing 5602, 5702 bulkhead drawing	bpg
7	41728/41715	10/04/17	Added door operation info/Removed condenser info, update acc chart, added shematics	bpg
6	41370	8/14/17	Updated BUS board information	bpg
5	41348/41159/40543	5/12/17	Corrected intended use temp range, voltage rating, F-gas statement	bpg
4	40797	4/7/16	Updated Low Battery alarm to 8 hours, chart on pg 5-1	ccs
3	40544	12/9/15	BUS information (preventive maintenance and BUS control panel and operation)	ccs

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. ▲

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

Intended Use: The VWR freezers (see cover page for specific models) described in this manual are high performance units for professional use. These products are intended for use as cold storage in research use and as a general purpose laboratory freezer, storing samples or inventory at operating temperatures between -50°C and -86°C, or -10°C and -40°C, depending on model.

It is not considered a medical device ands has therefore not been registered with a medical device regulatory body (e.g. FDA); that is, it has not evaluated for the storage of samples for diagnostic use or for samples to be re-introduced to the body.

This unit is not intended for use in classified hazardous locations, not to be used for the storage of flammable inventory.

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

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

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

Extreme temperature hazards, hot or cold. Use special handling equipment or wear special, protective clothing.

This equipment is marked with the crossed out wheeled bin symbol to indicate that this equipment must not be disposed of with unsorted waste.

Instead it's your responsibility to correctly dispose of your equipment at lifecycle -end by handling it over to an authorized facility for separate collection and recycling. It's also your responsibility to decontaminate the equipment in case of biological, chemical and/or radiological contamination, so as to protect from health hazards the persons involved in the disposal and recycling of the equipment.

For more information about where you can drop off your waste of equipment, please contact your local dealer from whom you originally purchased this equipment.

By doing so, you will help to conserve natural and environmental resources and you will ensure that your equipment is recycled in a manner that protects human health.

- ✔ 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 VWR Products?

The VWR Sales Group 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.

Visit VWR's website at vwr.com for:

- Complete technical service contact information
- Access to VWR's Online Catalogue, and information about accessories and related products.
- Additional product information and special offers.
- Contact us: For information or technical assistance, contact your local VWR representative, or visit vwr.com.

VWR can supply technical information about proper setup, operation or troubleshooting of your equipment. We can fill your needs for replacement parts or provide you with on-site service. We can also provide you with a quotation on our Extended Maintenance Program for your products.

Whatever VWR 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 trained technicians or a qualified service organization for on-the-spot repair. If your service need is covered by the VWR Scientific Products warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Table of Contents

Section 1 Product Specifications

Temperature Range	-50°C (-58°F) to -86°C (-123°F) or -10°C (14°F) to -40°C (-40°F) in an 18°C to 28°C (64.4°F to 82.4°F) ambient		
Capacity	13.0 cu. ft. (368.1 liters)		
	17.3 cu. ft. (489.9 liters)		
	23.0 cu. ft. (651.3 liters)		
	28.0 cu. ft. (792.8 liters)		
Refrigeration	2545 BTUH (Two compressors for -86C units), (One compressor for -40C units)		
Insulation	CFC-free, foamed-in-place urethane: minimum 5.0" (12.7cm) cabinet; 4.5" (11.4 cm) door		
Electrical - nominal voltage ±10%	208-230VAC, 60 Hz, 12 FLA	230VAC, 50 Hz, 12 FLA	120VAC, 60 Hz, 16 FLA
Breaker Requirements	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	15 Amp, Dedicated Circuit, 15 Amp Time Delay Breaker	20 Amp, Dedicated Circuit, 20 Amp Time Delay Breaker

Certifications

Declaration of Conformity is available on request as a separate document. Contact VWR for information.

Safety Specifications

Indoor Use Only
Altitude - Up to 2,000 meters
Temperature - 15°C to 32°C
Humidity - Maximum RH 80% for temperatures up to 31°C, decreasing linearly to 50% RH at 40°C
Mains Supply Fluctuations - Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage
Installation Category II [1]
Pollution Degree 2 [2]
Class of Equipment

Fluorinated Greenhouse Gases

Compliant with REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on fluorinated greenhouse gases. This product contains fluorinated greenhouse gases in a hermetically sealed system. This product contains foam blown with fluorinated greenhouse gas, R-245fa. If a leak in the sealed system is detected, the operator shall repair without undue delay.
For ULT models rated 230V/50Hz, intended for import into the EU, the following sizes are designed for use with the following amounts of fluorinated greenhouse gases:

For -86°C rated units

	1st Stage			2nd Stage		
Size (ft^3)	**Refrigerant**	**Amount (kg)**	**GWP**	**Refrigerant**	**Amount (kg)**	**GWP**
13	R-404a	0.723	3 922	R-508b	0.306	13 396
17	R-404a	0.751	3 922	R-508b	0.388	13 396
23	R-404a	0.751	3 922	R-508b	0.425	13 396
28	R-404a	0.652	3 922	R-508b	0.397	13 396

For -40°C rated units

	1st Stage		
Size (ft^3)	**Refrigerant**	**Amount (kg)**	**GWP**
13	R-404a	0.595	3 922
17	R-404a	0.624	3 922
23	R-404a	0.624	3 922

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.

Section 2 Overview

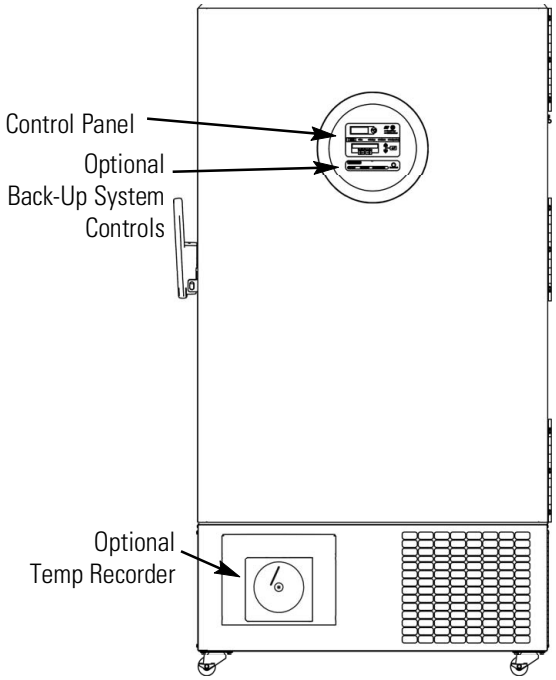


Figure 2-1. Front View

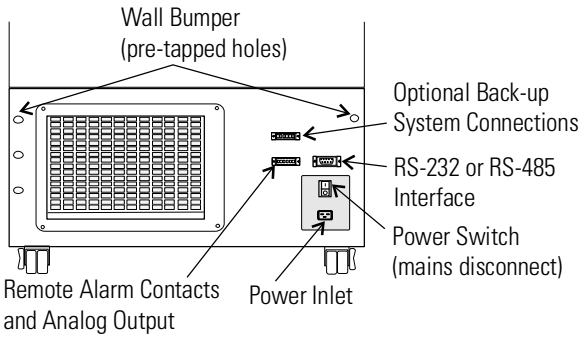


Figure 2-2. Rear View

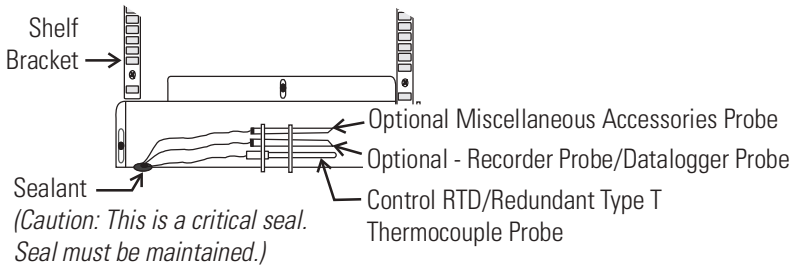


Figure 2-3. Chamber Probes

Figure 2-1

- Control Panel - keypad, displays and indicators
- BUS (Optional Back Up System) panel
- Optional temperature recorder (7 day, one pen)

Figure 2-2

- Remote alarm contacts and selectable analog output connection (0-1V, 4-20mA (default), 0-5V)
- Power inlet for power cord connection.
- Optional BUS connections for probe and solenoid
- RS-232 (default) or RS-485 interface
- Power switch (mains disconnect)

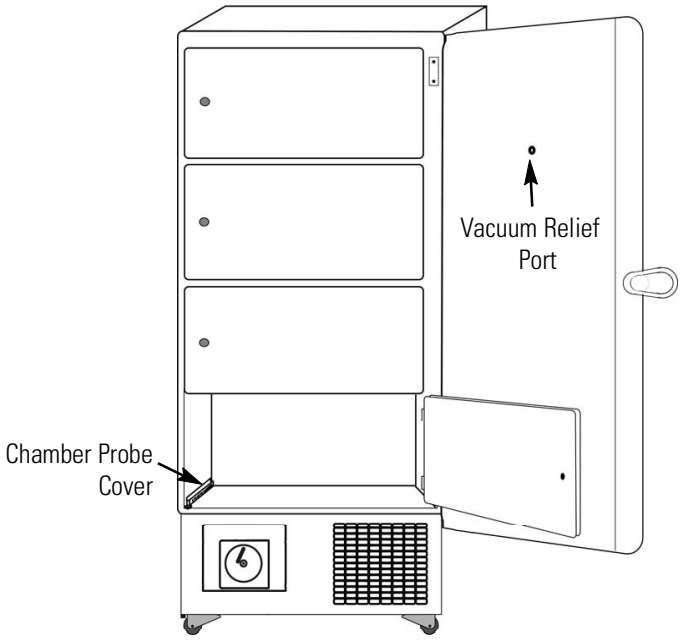


Figure 2-4. Vacuum Relief and Probe Cover Location

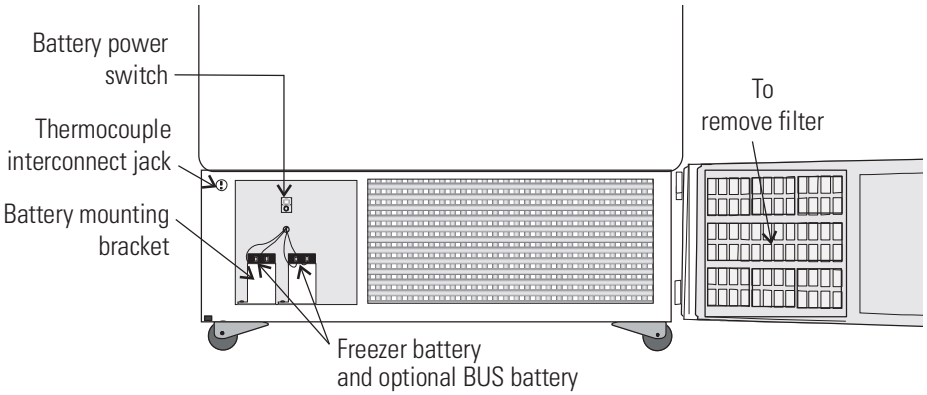


Figure 2-5. Battery(s) Location and Switch

Figure 2-4

- Vacuum relief port - pressure equalization port
- Probe cover houses control, optional recorder, redundant alarm probes.

Figure 2-5

- Battery mounting bracket(s)
- Battery power switch (freezer and BUS)
- Freezer battery
- Optional BUS battery
- Freezer filter location

Control Panel Keys, Displays & Indicators

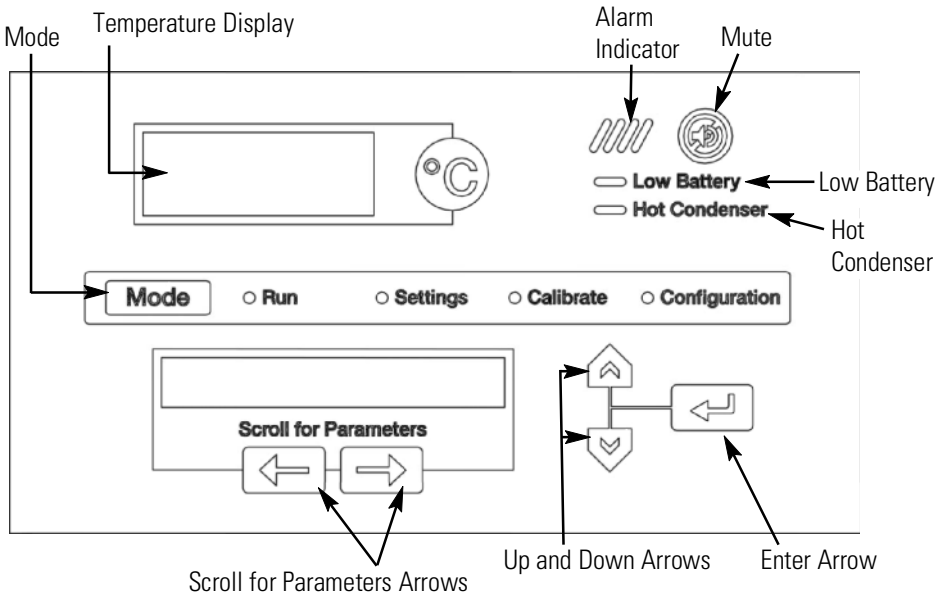


Figure 2-6. Control Panel

- Mode Select Switch - Used to select Run, Settings, Calibrate and System Configuration Modes.

  Mode Select Indicators -

  Run: Run Menu

  Settings: Set Points Menu

  Calibrate: Calibrate Menu

  Configuration: Configuration Menu
- Temperature Display - Displays temperature in degrees Celsius.
- Alarm Indicator - Light pulses on/off during an alarm condition of the cabinet.
- Mute - Silences the audible alarm.
- Low Battery - indicates a low battery condition of the freezer battery.
- Hot Condenser - indicates a hot condenser condition.
- Message Center - displays system status and alarms.
- Scroll for Parameters Arrows - moves the operator through the choices of the selected mode.
- Up and Down Arrows - Increases or decreases values, toggles between choices.
- Enter Arrow - Stores the value into memory.

Keypad Operation

This upright freezer has four basic modes which allow freezer setup: Run, Settings, Calibrate and Configuration.

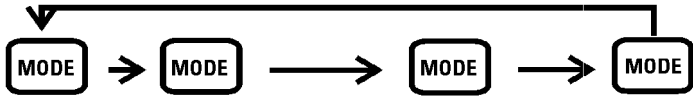
Run is the default mode for the freezer during normal operation.

Settings is used to enter system set points for freezer operation.

Calibrate is used to calibrate various system parameters.

Configuration allows for custom setup of various options.

The chart below shows the selections under each of the modes.



Run	Settings	Calibrate	Configuration
Default Mode System Ok	Control Set Point	Control Probe	High Alarm Test
Line Voltage	High Alarm Set Point	Optional Sample Probe	Low Alarm Test
Compensated Voltage	Low Alarm Set Point		System Battery Test
HSHX Temperature	Optional Back Up System Set Point		BUS Battery Test
			Display Temperature
			Clear High Stage Alarm
			Set Access Code
			RS485 Address
			BUS type CO2 or LN2
			Cold Excursion
			Warm Excursion
			Reset Excursion

Scroll for Parameters Arrows: Steps the operator through the parameters of SETTINGS, CALIBRATE and CONFIGURATION Modes. The right arrow goes to the next parameter, the left arrow returns to the previous parameter.

Up Arrow: Increases or toggles the parameter value that has been selected in the SETTINGS, CALIBRATE, and CONFIGURATION Modes.

Enter: Must press Enter key to save to memory any changed values.

Down Arrow: Decreases or toggles the parameter values that have been selected in the SETTINGS, CALIBRATE and CONFIGURATION Modes.

Mute Key: Press to silence the audible alarm. See Section 4 for alarm ringback times.

Displays

Message Center: Displays the system status (Mode) at all times. Displays SYSTEM OK during normal operation, or alarm messages if the system detects an alarm condition. See the Alarms section.

Install the Freezer

Caution If tipped more than 45°, allow the unit to set upright for 24 hours before start up. ▲

To remove the freezer from the pallet, use the ½" wrench to remove all the bolts securing the shipping bracket to the pallet.

Remove the shipping bracket. Remove the ramp boards from the pallet and place the slotted end over the ramp brackets on the pallet. The support blocks on the ramps will be facing down. Before moving the freezer, make sure the casters are unlocked and moving freely. Align the caster with the ramp boards. Use adequate personnel to roll the freezer off the pallet.

The freezer can be easily pushed to the desired approved location, described below. If necessary, the doors and lower front panel may be opened to move the unit through tight openings. When the freezer is in position, set the front caster brakes.

Caution If the factory installed option water-cooled condenser is present, do not turn the freezer on without water connected and flowing. **Damage to the refrigeration system could occur within 5 minutes if water is not connected and flowing on unit start-up**. Refer to Section 6. ▲

Choose the Location

Locate the freezer on a firm, level surface in an area with an ambient temperature between 18°C and 28°C. Provide ample room to reach the mains disconnect switch (power switch) located on the rear of the freezer.

Caution The freezer must not be moved with the product load inside. ▲

Caution For proper ventilation and airflow, a minimum clearance of 5” at the rear and top, and a clearance of 8” on the side of the freezer is required. Allow adequate space in front of the freezer for door opening. ▲

Door Operation

Upright freezer models are equipped with an advanced assembly specifically designed for ultra-low temperature freezers.

Features include:

- One-hand operation
- A front-accessible lock
- Hasps for a standard padlock to provide additional security. Length of the shackle must be between ¾ inch (1.9 cm) and 1½ inch (3.8 cm).
- Durable construction for reliable operation and safe product storage.

Install the Wall Bumpers

The parts bag, located inside the cabinet, contains the following parts.

Quantity	Description	Purpose
2	1/4-20x5-1/2" Bolt	Wall Bumper
2	Neoprene Cap	Cap Protector

Install the bolts into the pre-tapped holes on the back of the compressor section. Install a neoprene cap on each bolt. Refer to Figure 1-2 for the location of the pre-tapped holes.

Install the Shelves

Install the shelf clips into the shelf pilasters (front and back) at the desired shelf level. Install the shelves in the cabinet onto the clips.

Note On units having the optional 5 inner door option, refer to the instructions accompanying the inner door kit.

RS-232 Communications

This upright freezer has a data communications interface. The factory default setting is RS-232.

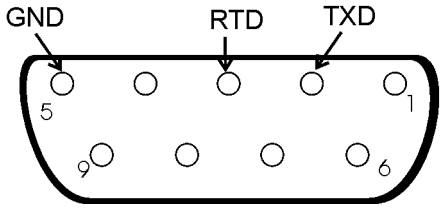


Figure 2-7. Wiring Identification

The wiring identification for the interface is shown in Figure 2-7. One nine pin, sub "D" style connector is located on the back of the freezer. See Figure 1-2 for the location of the connector on the freezer.

RS-232 Communications (continued)

The freezer transmits temperature information every 60 minutes. A standard DB9 serial extension cable can be used to connect the freezer to a serial device. Some serial devices may require a null modem adapter.

Data format:

Baud 1200
Data bits . . . . . 8 (7 bit ASCII with leading zero)
Start bits 1
Stop bits 2
Parity . . . . . none

The data transfer sequence is transmitted in the following format. X refers to numerical temperature data.

(NUL) (-) XXX (SP) C (SP) (Error Message) (SP) (LF) (CR) (EOT) (SP)

In the event of a CNTRLFAIL, Er07, or the control probe is out of range error, the numerical temperature data (XXX) in the transmission would be replaced by T_ERR.

If no alarm condition exists, spaces will be sent. A total of 20 characters will be sent.

SP - Space
LF - Line feed
CR - Carriage return
EOT - End of text (4)
NUL - Null character (00)

If an alarm condition does exist, “Error Message” in the protocol will be replaced by the following:

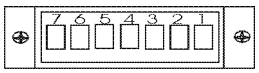
UNDERTEMP (temperature above the low alarm setpoint)
OVERTEMP (temperature below the high alarm setpoint)
PWRFAIL (AC power failure)
CNTRLFAIL (Control probe failure)
Er07 (micro failure)
HSHX FAIL (Heat exchanger failure)
HOT COND (Hot condenser)

Remote Alarm Contacts and Analog Output

This upright freezer has remote alarm contacts and analog output. See Figure 2-2 for the location of the remote alarm contacts. The remote alarm connector is located in the parts bag provided with the manual. It must be installed if connecting the freezer to an alarm system. After installing the wiring from the alarm system to the connector, install the connector to the freezer microboard and secure with the two screws provided.

Remote Alarm Contacts and Analog Output (cont.)

The remote alarm provides a NO (normally open) output, a NC (normally closed) output and COM (common). The contacts will trip on a power outage, high temperature alarm or low temperature alarm. They will also trip on high stage, control probe and microboard failures. Figure 2-8 shows the remote contacts in alarm state.



REMOTE CONTACTS/ANALOG OUTPUT
PIN# 1 Analog Output +
PIN# 2 Analog Output -
PIN# 3 Not Connected
PIN# 4 Not Connected
PIN# 5 Normally Closed
PIN# 6 Common.
PIN# 7 Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

IMPORTANT USER INFORMATION

CAUTION! Stored product should be protected by a redundant 24 hour/day monitoring system with alarm capability. An interconnect jack and thermocouple are installed for centralized monitoring, should on-board system fail.

Figure 2-8. Remote Alarm Contact Pins

The analog output function allows the freezer to output signals representing the temperature of the freezer cabinet. The factory default setting is 4-20 mA. Refer to Figure 2-9 for output specifications.

	4-20 mA	**0-1V**	**0-5V**
Temperature	-100 to +50°C	-100 to +50°C	-100 to +50°C

Figure 2-9. Specifications

Attach the Power Cord

Insert the power cord into the power inlet module. Place the retaining bracket (P/N 195763) over the connector. Tighten retaining screws to secure.

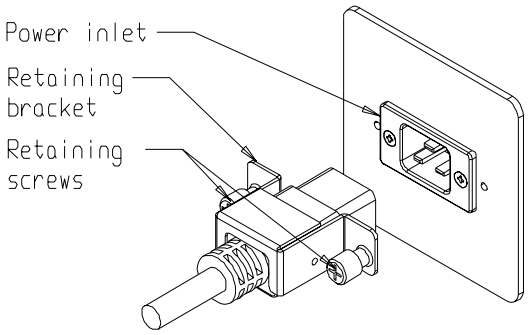


Figure 2-10. Power Cord Connection

Connect Unit to Electrical Power

Caution See the serial tag on the side of the unit for electrical specifications or refer to the electrical schematics in this manual. ▲

Caution If the factory installed option water-cooled condenser is present, do not turn the freezer on without water connected and flowing. **Damage to the refrigeration system could occur within 5 minutes if water is not connected and flowing on unit start-up**. Refer to Section 6. ▲

Connect Unit to Electrical Power (continued)

The freezer should be operated on a dedicated grounded service. Check the voltage rating on the serial tag of the unit and compare it with the outlet voltage. Then, with the power switch turned off, plug the line cord into the wall outlet.

First turn on the freezer power switch. Then open the lower front door by grasping the bottom left corner. Locate the battery switch (Figure 1-5) and turn it to Standby mode (⏻). During initial freezer start-up, the system battery may require charging and the Low Battery message may appear in message center.

Caution Ensure the battery switch is turned to Standby mode (⏻). The rechargeable batteries require 36 hours to charge at initial start-up. A "Low Battery" alarm may occur until the batteries are fully charged. Should a power failure occur during the initial start-up period, the electronics will have limited operation. ▲

Freezer Start-Up

With the freezer properly installed and connected to power, system setpoints can be entered. The following setpoints can be entered in Settings mode: Control temperature, high temperature alarm setpoint, low temperature alarm setpoint, and (optional) BUS setpoint. Default settings are shown in the table below.

Table 2-2. Default Settings

Control Set Point	-80°C
High Temperature Alarm	-70°C
Low Temperature Alarm	-90°C
Optional BUS Set Point	-60°C

Control Set Point	-40°C
High Temperature Alarm	-30°C
Low temperature alarm	-50°C
Optional BUS Set Point	-30C

Caution If the setpoint is changed and the low temperature and high temperature alarms are set 10° from the set point, the alarm setpoints will be adjusted automatically to maintain a distance of at least 10° from setpoint. ▲

Caution If the factory installed option water-cooled condenser is present, do not turn the freezer on without water connected and flowing. **Damage to the refrigeration system could occur within 5 minutes if water is not connected and flowing on unit start-up**. Refer to Section 6. ▲

Set the Operating Temperature

These upright freezers have an operating temperature range of -50°C to -86°C, or -10°C to -40°C, depending on model and ambient temperature. The freezer is shipped from the factory with a temperature set point of -80°C, or -40°C, depending on model. To change the operating temperature setpoint:

1. Press the Mode key until the Settings indicator lights.
2. Press right arrow until "SET PT = -XX" is displayed in message center.
3. Press the up/down arrow key until the desired temperature set point is displayed.
4. Press Enter to save the set point.
5. Press the Mode key until the Run indicator lights for Run mode or press the right/left arrow keys to go to next/previous parameter.

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

For -40°C units: *At -20°C operation, probe may need to be calibrated to ensure cabinet temperatures are within required range. Refer to Calibration section for procedure.*

Set the High Temperature Alarm

The high temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or exceeded the high temperature alarm set point. To set the high temperature alarm set point:

1. Press the Mode key until the Set indicator lights.
2. Press right arrow until "HI ALM = -XX" is displayed in message center.
3. Press the up or down arrow key until the desired high temperature alarm set point is displayed.
4. Press Enter to save the setting.
5. Press the Mode key until the Run indicator lights or press the right or left arrow to go to the next or previous parameter.

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

Caution The high alarm set point must be set at least 5°C from the control set point. At initial start-up, the high temperature alarm is disabled until the cabinet reaches set point, or 12 hours elapse. ▲

Set the Low Temperature Alarm

The low temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or decreased below the low temperature alarm set point. To set the low temperature alarm set point:

1. Press the Mode key until the Settings indicator lights.
2. Press the right arrow until “LO ALM = -XX” is displayed in the message center.
3. Press the up or down arrow key until the desired low temperature alarm set point is displayed.
4. Press Enter to save the setting.
5. Press the Mode key until the Run indicator lights or press the right or left arrow to go to the next or previous parameter.

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

Note The low alarm set point must be set at least 5°C from the control set point.

Access Code

An access code of 000 is required to access the Settings, Calibrate or Configuration modes. If the access code is not set at the default ‘000’, a code must be entered to leave RUN mode. See Section 4 for instructions on modifying the access code.

Run Mode

Run is the default mode for the freezer. The run mode will display the cabinet temperature on the temperature display and ‘SYSTEM OK’ on the message center under normal operating conditions. In addition, this mode allows display of the following information:

LINE VOLTAGE

COMPENSATED VOLTAGE

HSHX TEMPERATURE (heat exchanger temperature), - 86°C models

This information is scrolled individually by pressing the right arrow key. In each case, the message center returns to SYSTEM OK in 10 seconds if no keys are pressed.

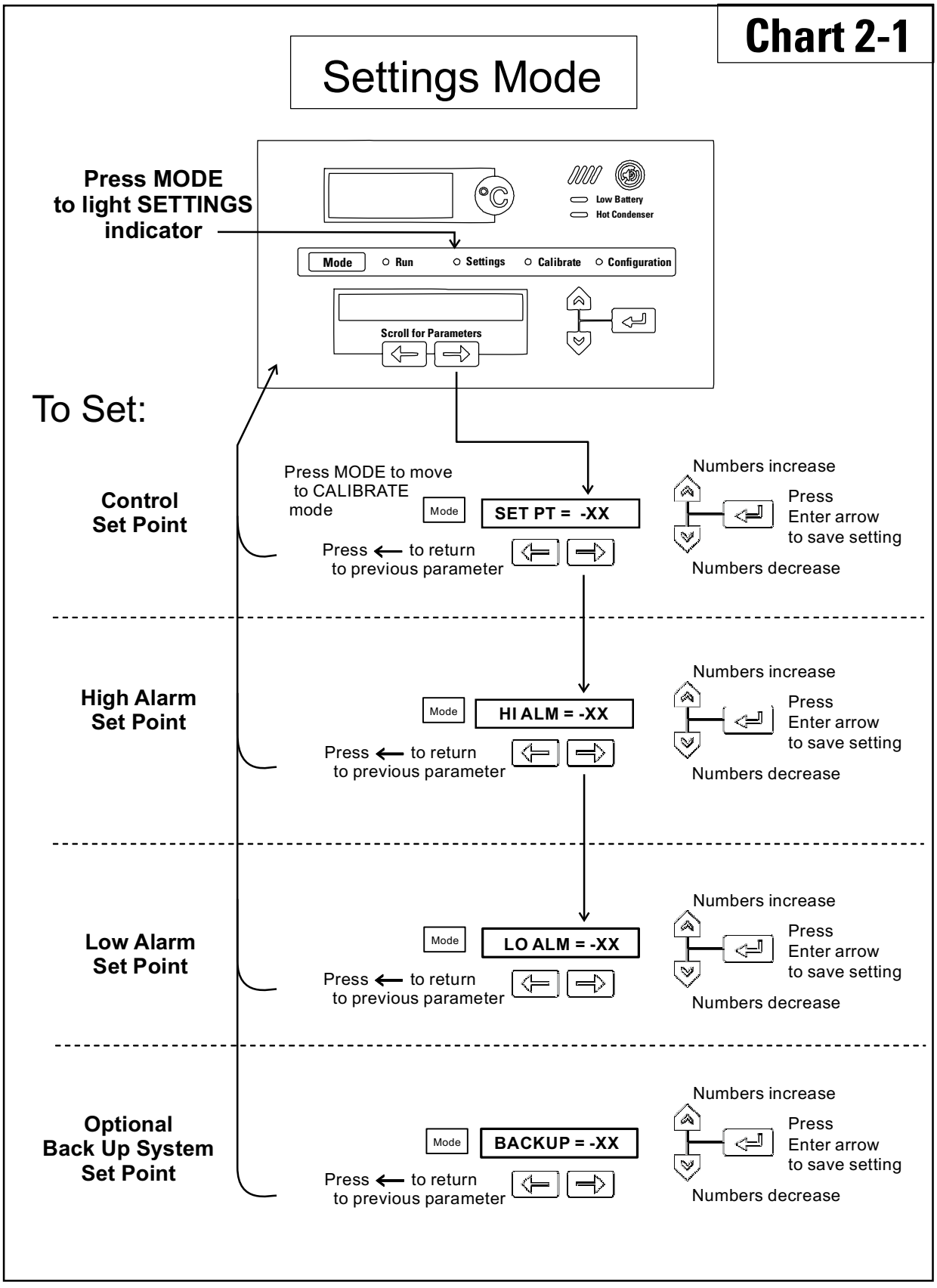


Chart 2-1
Settings Mode
Press MODE
to light SETTINGS
indicator
°C
Low Battery
Hot Condenser
Mode
Run
Settings
Calibrate
Configuration
Scroll for Parameters
To Set:
Control
Set Point
Press MODE to move
to CALIBRATE
mode
Mode
SET PT = -XX
Press ← to return
to previous parameter
Numbers increase
Press
Enter arrow
to save setting
Numbers decrease
High Alarm
Set Point
Mode
HI ALM = -XX
Press ← to return
to previous parameter
Numbers increase
Press
Enter arrow
to save setting
Numbers decrease
Low Alarm
Set Point
Mode
LO ALM = -XX
Press ← to return
to previous parameter
Numbers increase
Press
Enter arrow
to save setting
Numbers decrease
Optional
Back Up System
Set Point
Mode
BACKUP = -XX
Press ← to return
to previous parameter
Numbers increase
Press
Enter arrow
to save setting
Numbers decrease

Section 3 Calibrate

Once the freezer has stabilized, the control or sample probe may need to be calibrated. Calibration frequency is dependent on use, ambient conditions and accuracy required. A good laboratory practice would require at least an annual calibration check. On new installations, all parameters should be checked after the stabilization period.

On -40°C models only: For -20°C operation, calibration may be needed to ensure cabinet air temperatures are within a specified range.

Caution Before making any calibration or adjustments to the unit, it is imperative that all reference instruments be properly calibrated. ▲

Calibrate the Control Probe

Plug a type T thermocouple reader into the receptacle located inside the lower door (Figure 2-5). Compare the control temperature set point to the temperature of the measuring device. See Chart 3-1 at the end of this section for more detail.

1. Press the Mode key until the Calibrate indicator lights.
2. Press right arrow until "CONT T = -XX.X" appears in message center.
3. Press up/down arrow to match the display to calibrated instrument.
4. Press Enter to store calibration.
5. Press the Mode key to return to Run or the right/left arrow to go to next/previous parameter.

On -40°C models only: **Probe Calibration for -20°C Operation**; Note that if the peak variation is within ±5°C of set value, then no calibration is required.

1. Set temperature to -20C.
2. Calibrate probe to -4°C (-2.5 for 13 ft units) per above procedure.
3. Allow unit to stabilize to -20°C per temperature stabilization period below.
4. Check peak variation after unit has achieved steady state operation. Probe may need to be calibrated a second time to achieve the required range.

Calibrate the Optional Sample Probe

For freezers with the optional sample probe, place the calibrated instrument in the center of the sample bottle. The bottle should contain an appropriate medium and the measuring instrument should be centered in the bottle.

1. Press the Mode key until the Calibrate indicator lights.
2. Press the right arrow until "SAMP T = -XX.X" appears in the message center.
3. Press up/down arrow to match display to calibrated instrument.
4. Press Enter to store calibration.
5. Press the Mode key to return to Run or the right/left arrow to go to next/previous parameter.

See Chart 3-1 for calibration process functions.

Temperature Stabilization Periods

Temperature Stabilization Periods

Startup - Allow 12 hours for the temperature in the cabinet to stabilize before proceeding.

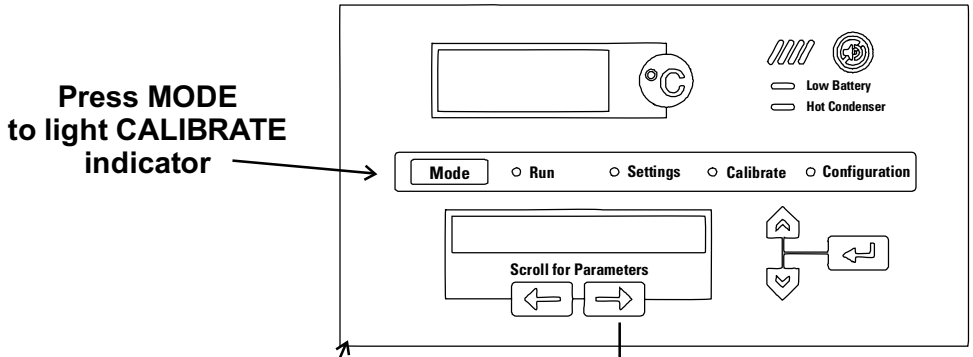
Already Operating - Allow at least 2 hours after the display reaches set point for temperature to stabilize before proceeding.

Caution During calibration, the temperature display is not available. ▲

If no keys are pressed for approximately five minutes while in calibration mode, the system will reset to Run mode.

Chart 3-1

Calibrate Mode



Press MODE to light CALIBRATE indicator

To Calibrate:

Control Probe

Press MODE to move to CONFIGURATION mode

Mode

CONT T = -XX.X

Scroll for parameters

Press ← to return to previous parameter

Numbers increase

Press Enter arrow to save setting

Numbers decrease

Optional Sample Probe

Mode

SAMPT = -XX.X

Scroll for parameters

Press ← to return to previous parameter

Numbers increase

Press Enter arrow to save setting

Numbers decrease

Section 4 Configuration

The Configuration Mode is used for testing and custom setup of the freezer. The configuration functions listed and described below may not be necessary in all applications, but are available if needed. See Chart 3-1 for more detail.

High Alarm Test

The high alarm test is used to verify the high alarm will activate, should the freezer temperature equal or exceed the high alarm set point.

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until HI ALRM TEST is displayed in the message center.
3. Press Enter to initiate the test.

The temperature on the display will begin to increase until the high alarm set point has been reached. The audible alarm will sound and the alarm indicator will flash. Press the Mute key to silence the alarm.

Low Alarm Test

The low alarm test is used to verify the low alarm will activate, should the freezer temperature equal or become less than the low alarm set point.

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until LO ALRM TEST is displayed in the message center.
3. Press Enter to initiate the test.

The temperature on the display will begin to decrease until the low alarm set point has been reached. The audible alarm will sound and the alarm indicator will flash. Press the Mute key to silence the alarm.

System Battery Test

To test the charge of the freezer battery:

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until SYS BAT TEST is displayed in the message center.
3. Press Enter to initiate the test.

TESTING BATT displays during the testing period. Upon completion of the test, the message center displays BATT GOOD or BATT FAIL. When a test is failed, the audible alarm sounds, the alarm indicator and the Low Battery indicator light. Press the Mute key and the alarm indicator goes out. The Low Battery light stays on until a future battery test is performed and passed.

BUS Battery Test

To test the charge of the BUS battery:

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until BUS BAT TEST is displayed in the message center.
3. Press Enter to initiate the test.

TESTING BATT displays during the testing period. Upon completion of the test, the message center displays BBAT GOOD or BBAT FAIL. When a test is failed, the audible alarm sounds, the alarm indicator and the Low Battery indicator lights. Press the Mute key. The audible alarm and alarm indicator go off. The Low Battery light stays on. If this test fails, it is recommended to replace the BUS battery.

Display Temperature

This function, only available on freezers with the optional sample probe, allows the user to select which temperature is displayed in the temperature display window. The options are CONTROL or SAMPLE.

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until DISP CONTROL or DISP SAMPLE is displayed in the message center.
3. Press up/down arrow to toggle between the two display selections.
4. Press Enter to save.

If control probe is selected, the temperature display will be on continuously. If sample probe is selected, the temperature display will be preceded with a letter ‘S’.

Clear High Stage Alarm

Should a high stage alarm occurred, it may become necessary to the clear the alarm condition after the condition has been corrected.

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until CLR HS ALARM is displayed in the message center.
3. Press Enter to clear the alarm.

Set Access Code

To set the Access Code:

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until “SET ACC CODE” is displayed in the message center.
3. Press Enter.
4. The message center will display ACC CODE = 000. Press the up or down arrow key until the desired access code is displayed (000 - 999). Press the left or right arrow key to select digit 1, 2, 3.

Note The left and right arrow keys are used to move from the first through the third digits within the access code. ▲

5. Press Enter to save the setting
6. Press the Mode key until the Run indicator lights. A three digit Access Code can be entered to avoid unauthorized personnel from changing the set points, calibration, or configuration. A setting of 000 will bypass the access code. The factory setting is 000.

RS485 Address

The freezer will need to have a unique identification address for data communications. This address is set through the Configuration mode.

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until RS485ADDR is displayed in the message center.
3. Press Enter. The message center will display 485 ADDR XX.
4. Press up or down arrow to select the appropriate address for the freezer (1 - 24).
5. Press Enter to save.

Back-Up System Type

This function, which is only available on freezers with the optional BUS (back up system), allows the user to select which type of gas is injected into the freezer chamber. The options are CO2 and LN2.

1. Press the Mode key until the Configuration indicator lights.
2. Press the right arrow until BUS TYPE CO2 or BUS TYPE LN2 is displayed in the message center.
3. Press up/down arrow to toggle between the two display selections.
4. Press Enter to save.

Cold Excursion

This function displays the coldest temperature recorded by the control probe.

Warm Excursion

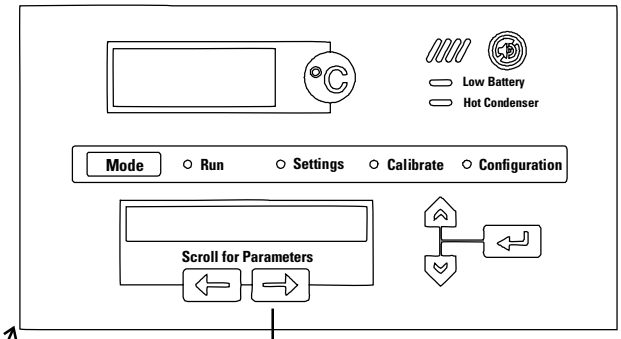
This function displays the warmest temperature recorded by the control probe.

Reset Excursion

This function resets the cold and warm excursions.

Chart 4-1

Configuration Mode



Press MODE to light CONFIGURATION indicator

To Configure:

Press MODE to move to RUN mode

Mode

High Alarm Test

HI ALRM TEST

Scroll for Parameters

Press ← to return to previous parameter

Press Enter to initiate test

Low Alarm Test

Mode

LO ALRM TEST

Scroll for Parameters

Press ← to return to previous parameter

Press Enter to initiate test

System Battery Test

Mode

SYS BAT TEST

Scroll for Parameters

Press ← to return to previous parameter

Press Enter arrow to save setting

Optional **BUS Battery Test**

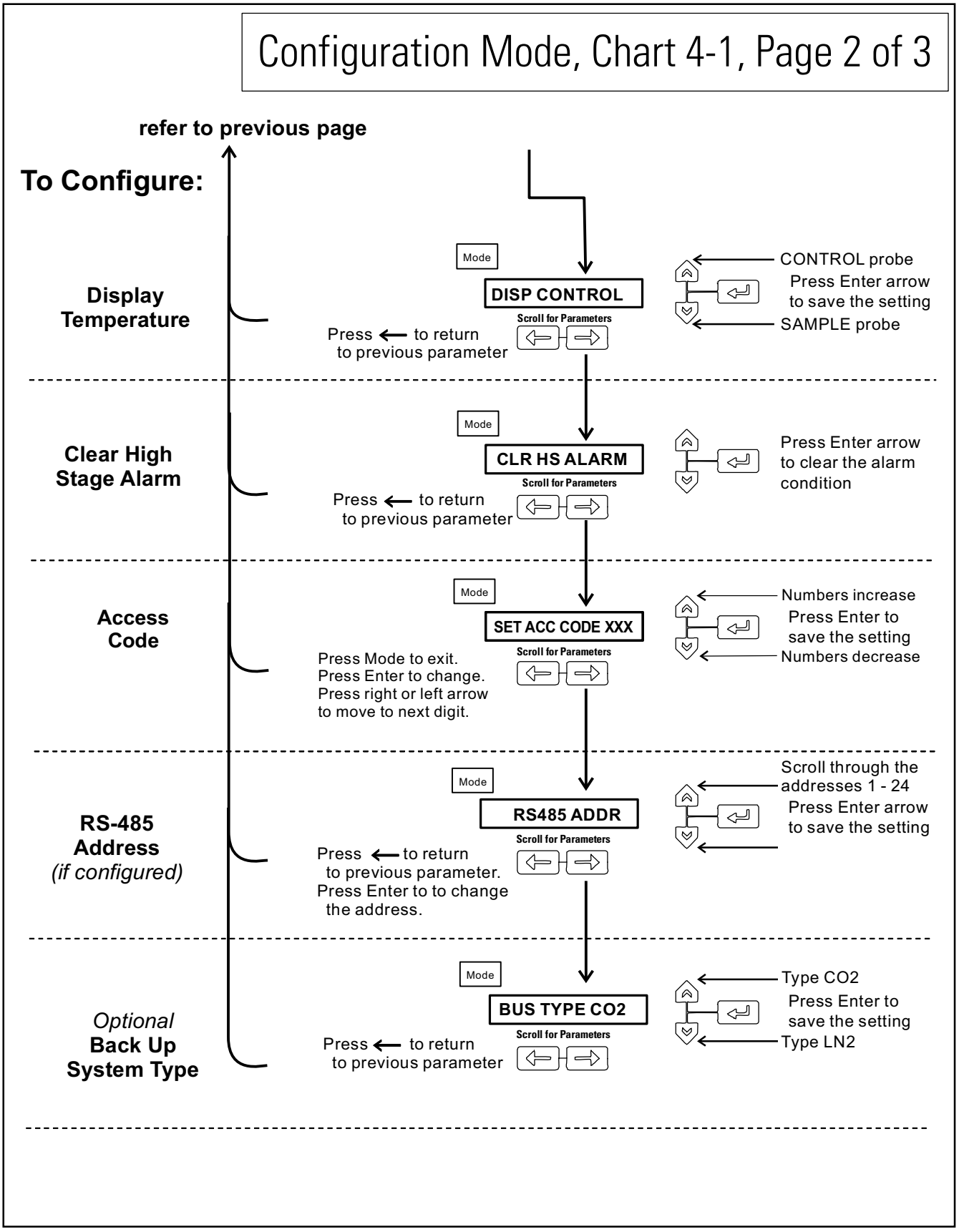
Mode

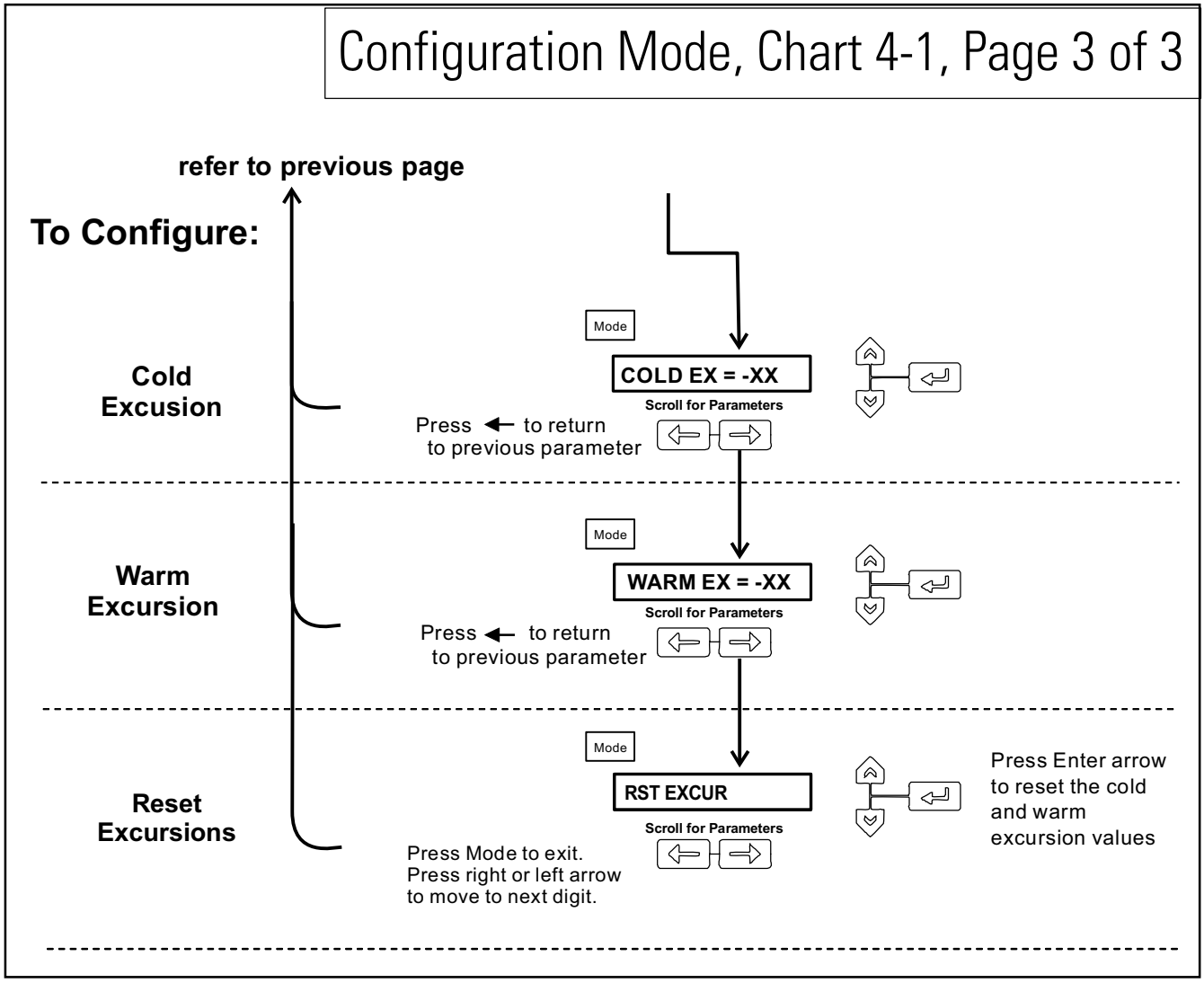
BUS BAT TEST

Scroll for Parameters

Press ← to return to previous parameter

Press Enter to initiate test


Configuration Mode, Chart 4-1, Page 2 of 3
refer to previous page
To Configure:
Display Temperature
Mode
DISP CONTROL
Scroll for Parameters
Press ← to return to previous parameter
CONTROL probe
Press Enter arrow to save the setting
SAMPLE probe
Clear High Stage Alarm
Mode
CLR HS ALARM
Scroll for Parameters
Press ← to return to previous parameter
Press Enter arrow to clear the alarm condition
Access Code
Mode
SET ACC CODE XXX
Scroll for Parameters
Press Mode to exit.
Press Enter to change.
Press right or left arrow to move to next digit.
Numbers increase
Press Enter to save the setting
Numbers decrease
RS-485 Address
(if configured)
Mode
RS485 ADDR
Scroll for Parameters
Press ← to return to previous parameter.
Press Enter to to change the address.
Scroll through the addresses 1 - 24
Press Enter arrow to save the setting
Optional
Back Up System Type
Mode
BUS TYPE CO2
Scroll for Parameters
Press ← to return to previous parameter
Type CO2
Press Enter to save the setting
Type LN2


Configuration Mode, Chart 4-1, Page 3 of 3
refer to previous page
To Configure:
Cold Excusion
Warm Excursion
Reset Excursions
Mode
COLD EX = -XX
Scroll for Parameters
Press ← to return to previous parameter
Mode
WARM EX = -XX
Scroll for Parameters
Press ← to return to previous parameter
Mode
RST EXCUR
Scroll for Parameters
Press Mode to exit.
Press right or left arrow to move to next digit.
Press Enter arrow to reset the cold and warm excursion values

Section 5 Alarms

The upright freezer alarm system is shown in the table below. When an alarm is active, the message appears in the LED message center. Press the Mute key to silence the audible alarm for the ringback period. The visual alarm will continue until the freezer returns to a normal condition. The alarms are momentary alarms only. When an alarm condition occurs and then returns to normal, the freezer automatically clears the alarm condition and the message center.

Description	Message	Delay	Ringback	Relay
No alarm condition exists	SYSTEM OK	----	----	----
Power Failure	POWER FAIL	1 min.	15 min.	Yes
High Temperature Alarm	TEMP IS HIGH	1 min.	15 min.	Yes
Low Temperature Alarm	TEMP IS LOW	1 min.	15 min.	Yes
Door Ajar	DOOR IS OPEN	1 min.	15 min.	No
Low Battery*	LOW BATTERY	1 min.	8 hours	No
Low BUS Battery (optional)	LOW BUS BATT	1 min.	15 min.	No
Control Probe Failure	PROBE 1 FAIL	1 min.	15 min.	Yes
Heat Exchanger Probe Failure	PROBE 2 FAIL	1 min.	15 min.	No
Condenser Probe	PROBE 3 FAIL	1 min.	15 min.	No
Sample Probe Failure (optional)	PROBE 4 FAIL	1 min.	15 min.	No
High Stage System Failure	HS SYST FAIL	1 min.	15 min.	Yes
Condenser Hot Condition (-86°C models only)	HOT CONDENSR	1 min.	none	No
Wrong Power	WRONG POWER	0 min.	none	Yes
Micro Board Failure	MICRO FAIL	0 min.	15 min.	Yes

All alarm delays and ringback times are ±30 seconds.

** The automatic battery test runs immediately on initial start-up, then every 8 hours thereafter.*

High Stage System Failure (-86°C models only)

This condition is created when the high stage compressor and fans run for 30 minutes and are not capable of cooling the interstage heat exchanger to the proper temperature. Under this condition, the high stage compressor and fans will turn off after 30 minutes, and an audible and visual alarm will occur along with the "HS SYST FAIL" message in the LED message center.

Multiple Alarms

When multiple alarm conditions occur, active messages are displayed in the message center one at a time, updating at 5 second intervals. Pressing Mute during multiple alarms causes all active alarms to be muted and to ring back in 15 minutes.

Micro Board Failure Alarm

An internal communications failure has occurred with the micro board. During this alarm, the compressor(s) attempt to run continuously. However, with this type of failure, freezer operation becomes undependable.

Lost Communication Alarm

Communication between the micro board and the display board has been lost. Under this condition, the visual alarm LED flashes along with dashes (----) in the temperature display. In addition, 'LOST COMM' flashes in the message center. Contact Technical Services.

Error Messages

Error	High End Message	Notes
Er00	"INV. MODEL"	**Name:** Improper model selected. **Description:** Indicates that DIP SW3 has not selected a proper model or can't be accessed properly. **Response:** Display shows "Er00" and will not start-up until a proper model is selected. Contact Technical Services.
ErA1	" NO FREQUENCY"	This error condition will prevent peripherals (fans, compressors, etc.) from powering up with the incorrect voltage. **Name:** Voltage/Frequency failure **Description:** Indicates the measured RMS line voltage did not agree with the logic level sensed by the micros provided by the installed high voltage PCB; or the measured RMS voltage is not within a tolerable range (<180VAC < 270 for 230VAC unit / <85 VAC < 160 for 115VAC unit); or the frequency measured over 10 cycles was not within a tolerable range (55 Hz < Freq < 70 Hz for 60 Hz units / 40 Hz < Freq < 55 Hz for 50 Hz units) **Response:** This condition is checked at power on reset and if it is active the unit will NOT power up. The unit will indefinitely display "Er_1" in the display and continue to monitor the frequency and voltage. Furthermore, the audible alarm will sound. Other startup error messages may be displayed prior to this message; however, the system will stop the startup sequence for this condition. ErA1 .. No pulses (zero crossings) detected to determine frequency (50 / 60 Hz) ErC1 .. Frequency detected is below 50 Hz Erd1 .. Frequency detected is above 60 Hz (Possible noise spikes on supply voltage) ErE1 .. Unit is 230V and the voltage detected is below the low limit (180VRMS) ErF1 .. Unit is 230V and the voltage detected is above the high limit (260VRMS) Erg1 .. Unit is 115V and the voltage detected is below the low limit (85VRMS) ErH1 .. Unit is 115V and the voltage detected is above the high limit (160VRMS)
ErC1	"FREQ <50Hz"	
Erd1	"FREQ >60Hz"	
ErE1	"VAC < 180V"	
ErF1	"VAC > 260V"	
Erg1	"VAC < 85V"	
ErH1	"VAC > 160V"	

Error (cont.)	High End Message	Notes
Er02	"CNT PRB FLT"	**Name:** Control (Cabinet) Sensor Failure **Description:** This condition indicates that the control sensor has failed to produce a valid reading for ≥12 consecutive reads (~60 seconds). **Response:** The unit will stage both compressors on (if necessary) and the unit will attempt to head to bottom out. If the sensor recovers, the system will begin to operate normally and respond to the temperature feedback. The remote alarm contacts will become active regardless of the key position for this mode of failure. 'Er02' will be added to the main display queue and the last valid cabinet temperature value will not be displayed
Er03	"HSHX PRB FLT"	**Name:** Heat Exchange Sensor Failure **Description:** This condition indicates that the heat exchange sensor has failed to produce a valid reading for ≥12 consecutive reads (~60 seconds). **Response:** The display will show "Er03" only when the button sequence to read the heat exchange sensor is depressed.
Er05	N/A	**Name:** Display Firmware Integrity Failure **Description:** The display firmware has failed to pass its CRC CCITT checksum integrity test. **Response:** The display performs this check at startup and the display board will fail to startup with out any error indication if it does not pass this at power on.
Er06	N/A	**Name:** Micro Firmware Integrity Failure **Description:** The micro firmware has failed to pass its CRC CCITT checksum integrity test. **Response:** This is checked at power on reset and the "Er06" will be displayed for ~10 seconds at startup if this condition exists.
Er07	"MICRO FAIL"	**Name:** Micro Fail - CS5521 SPI Failure / UISR Failure **Description:** This condition indicates a micro board failure due to either the SPI bus is unable to communicate with the ADC device or a UISR event caused the microcontroller to be in an unstable state. **Response:** The unit will try to recover from this fault three times by a hardware reset of the micro board. In the event that the system couldn't rectify the issue, the following sequence of events will occur: 1. Remote alarm contacts will become active. 2. Buzzer will annunciate audibly and will have a ringback of 15 minutes. 3. "Seven segment" display will show "Er07". 4. The system will have 10 minute staging between the high stage compressor and the low stage compressor activation. 5. The system will go to bottom out temperatures.

Error (cont.)	High End Message	Notes
Er09	N/A	**Name:** Stuck Button **Description:** This condition indicates that the display board has a stuck button. **Response:** The Er09 will show on the display periodically.
Er11	"COND PRB FLT"	**Name:** Condenser Probe Sensor Failure **Description:** This condition indicates that the condenser probe sensor has failed to produce a valid reading for ≥12 consecutive reads (~60 seconds). **Response:** The display shows "Er11".
N/A	"SMPL PRB FLT"	**Name:** Sample Probe Sensor Failure **Description:** This condition indicates that the sample probe sensor has failed to produce a valid reading for ≥12 consecutive reads (~60 seconds). **Response:** The message center shows "SMPL PRB FLT".
dErr	N/A	**This is a general display error in which the value being displayed can not be represented within the characters provided.**
(four dashes) ---- in display	N/A	**Name:** Lost Communication **Description:** Communication between the micro board and the display board has been lost. Under this condition, the visual alarm flashes along with dashes in the temperature display (----). Contact Technical Services.

Section 6 Maintenance

Warning Avoid the excessive use of water around the control area due to the risk of electrical shock. Damage to the controls may also result. ▲

Wipe down the freezer exterior using soap and water and a general use laboratory disinfectant. Rinse thoroughly with clean water and dry with a soft cloth.

Warning If the unit has been in service, turn it off and disconnect the power cord connector before proceeding with any maintenance. ▲

Clean Air Filter

Clean the air filter a minimum of four times per year.*

1. Open the front lower door by grasping the bottom left corner.
2. Locate the grille on the door. See Figure 6-1. Grasp the middle of the grille material and gently pull out to remove.
3. Wash the filter material using water and a mild detergent.
4. Dry by pressing between two towels.
5. Install the filter back into the grille and attach the grille.

** The clean filter alarm occurs every three months as a reminder to clean the air filter. Depending upon environmental conditions, the filter may need to be cleaned or replaced more frequently. If the filter becomes torn or excessively dirty, a replacement can be purchased from VWR. Order part number 760203.*

Clean the Condenser

Clean the condenser a minimum of once a year.*

1. Open the front lower door by grasping the bottom left corner. See Figure 6-1.
2. Using a vacuum cleaner, exercising care to not damage the condenser fins, clean the condenser.

** Depending upon environmental conditions, the condenser may need to be cleaned more frequently.*

Defrost the Chamber

1. Remove all product and place it in another freezer.
2. Turn the unit off and disconnect it from the power source.
3. Turn off the battery switch (O). See Figure 6-1.
4. Open all of the doors and place towels on the chamber floor.
5. Allow the frost to melt and become loose.
6. Remove the frost with a soft cloth.
7. After defrosting is complete, clean the interior with a non-chloride detergent. Rinse thoroughly with clean water and dry with a soft cloth.
8. Plug unit in and turn power switch on.
9. Turn the battery power switch to Standby mode (⏻)
10. Allow the freezer to operate empty overnight before reloading the product.

Clean the Door Gasket

Clean the door gasket a minimum of once a month.*

Using a soft cloth, remove any frost build-up from the gasket and door(s). The Clean Gasket alarm occurs every three months as a reminder to remove frost build-up from the gasket and door(s). Press the Silence key to disable the audible alarm.

**The door gasket may need to be cleaned more frequently if dirt or excessive frost build-up prevents the door from closing properly.*

The exterior door gasket provides an excellent seal that protects product, provides an energy efficient thermal barrier to keep cold air in and room temperature air out, and reduces frost build-up on the inner doors.

Vacuum Relief Port

Because the door gasket seals so well, a vacuum can be created after a door opening. Warm air enters the cabinet, cools and contracts, creating a vacuum that pulls the door in tightly against the seal.

To equalize the pressure inside the cabinet after a door opening requires 1.5-3.0 cu.ft. of ambient air to be drawn into the cabinet. The amount of air required to equalize the pressure varies depending on the cabinet size, cabinet temperature, duration of door opening, inventory volume and the temperature/humidity of the ambient air. This unit is designed with a “vacuum relief port” that allows the pressure to be equalized.

Vacuum Relief Port (cont)

The time required to draw 1.5-3.0 cu.ft. of air into the cabinet depends on two. factors,

a) size and number of paths available for air to enter cabinet, and

b) pressure difference between internal cabinet and ambient room.

Cabinets with the vacuum relief port operating normally, (i.e. vacuum relief port is not iced over) will require a minimum of 30 seconds up to a maximum of 120 seconds for the cabinet to equalize. This is also a good indication that the exterior door is well sealed.

The vacuum relief port requires routine maintenance. It will ice over unless preventive measures are taken. If the vacuum relief port becomes iced over, the freezer will take several hours to equalize pressure.

Caution Do not leave the freezer unattended while the door is unlatched. The vacuum could release at any time, resulting in the door opening and possible product loss. ▲

Vacuum Relief Port Maintenance

Observe the inner side of port periodically for frost and ice build-up. Remove any frost with a soft dry cloth. If the tube should become clogged with ice, it must be cleaned. **Make sure during cleaning that the vacuum relief tube is completely free of ice to prevent rapid ice formation.**

Factors that can affect the vacuum relief port performance include: high ambient temperature, high humidity conditions and frequent door openings. Maintenance should be performed weekly or as needed.

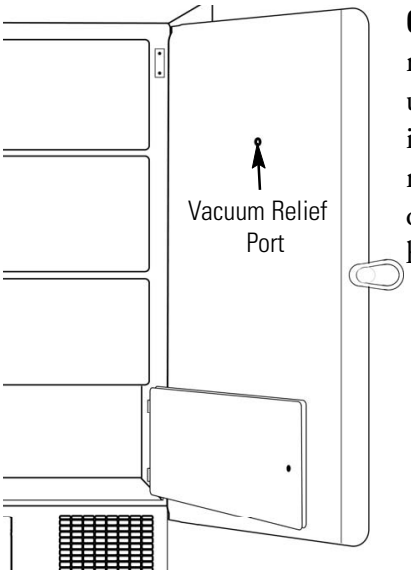


Figure 6-2. Port Location

Caution Failure to maintain the vacuum relief port may result in excessive ice build up inside the tube, clogging the port, and inability to open the door. The vacuum relief port may need to be cleaned more often with frequent door openings and high humidity environments. ▲

Check Battery

1. To gain access to the battery, open the lower door by grasping the bottom left corner. The battery is rectangular in shape, located on the front left corner of the compressor compartment and is secured in place by a mounting bracket.

2. Directly above the battery(s) is the battery power switch. Turn the battery power switch to the off position (O).

3. Cut the tie wrap securing the battery to the mounting bracket. Lift the battery out of the bracket.

4. Disconnect the red and black wires from the battery.

5. Use a voltmeter set to DC volts. Matching the wire colors, connect the meter to the battery.

6. If the voltage reads less than 10.8 volts, replace the battery. If above 10.8, re-install as previously.

7. Turn the battery power switch to Standby mode (⏻).

8. Close lower panel door.

Replace the Battery

1. To gain access to the battery, open the lower door by grasping the bottom left corner. The battery is rectangular in shape, located on the front left corner of the compressor compartment and is secured in place by a mounting bracket.

2. Directly above the battery(s) is the battery power switch. Turn the battery power switch to the off position (O).

3. Disconnect the battery connections.

4. Remove the old battery and install the new battery.

6. Reconnect the battery (red to positive and black to negative).

7. Turn the battery power switch to Standby mode (⏻).

8. Close lower panel door.

Warning 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. Replacement batteries must be rechargeable and are available from VWR. 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 accordance with good environmental practices. ▲

PREVENTIVE MAINTENANCE

Repairs

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

Refer to Manual Section	Action	Monthly	Yearly	Every 2 Years
[redacted]	[redacted]	✔		
[redacted]	[redacted]	✔		
[redacted] [redacted]	[redacted]	[redacted] ✔ [redacted]		
[redacted]	[redacted]		✔ [redacted]	
[redacted]	[redacted]	✔		[redacted]
[redacted]	[redacted]		✔	
[redacted]	[redacted]		✔	
[redacted]	[redacted]		✔	
[redacted]	[redacted]	✔		

[redacted]

[redacted]

[redacted]

[redacted]

Section 7 Factory Installed Options

Options are available as factory or field installed, depending on the territory. Please contact your local VWR representative for details. Refer to the table in Appendix A-5 for the available field-installed options.

Back-Up System (BUS)

Warning Before installation of BUS components, make sure the power to the freezer is disconnected, the battery switch is turned off (O) and the freezer has warmed to ambient temperature. ▲

The built-in BUS (back up system) will keep the freezer chamber temperature below the critical level in the event of a power or equipment failure. If power to the freezer fails, or temperature increases to the back up alarm set point, the BUS injects liquefied gas into the chamber to keep the chamber temperature within the specified range.

The BUS operates on an internal 12-volt, rechargeable battery which is kept charged during normal operation by the integral battery charger.

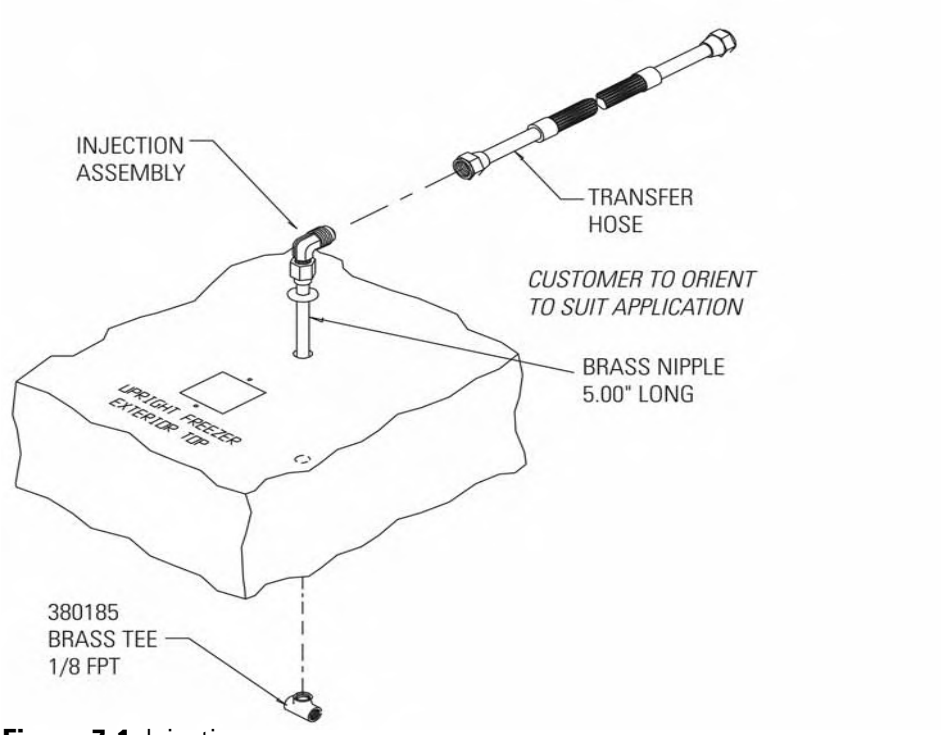


Figure 7-1. Injection

Install Vent Stack, Solenoid & Injection Asm.

1. Install the injection assembly through the 1/2” pre-punched hole, directly behind the 2” vent stack hole in the center of the chamber ceiling.

Note Cover the open end of injection assembly with tape to keep insulation from entering the nipple. ▲

2. Slide 3/8” flatwasher over open end of nipple.
3. Insert the covered end of the injection assembly through the exterior hole.
4. Remove the tape covering from the end of the nipple and install the 1/8” NPT brass tee on the open end of the nipple. Place Permagum sealant between the brass tee and the interior top.
5. Remove the two Phillips head screws securing the metal bracket on the vent stack assembly.
6. Install the vent stack through the opening and secure it to the top of the freezer, using screws.
7. Go to the interior and seal around the end of the vent stack with Permagum.
8. Install the transfer hose connecting one end to the injection assembly, the other end to the solenoid valve. Install the solenoid valve to the supply source. The solenoid mounting bracket is not required and may be discarded.

Caution When selecting a CO_2 supply cylinder, it must be equipped with a siphon tube. ▲

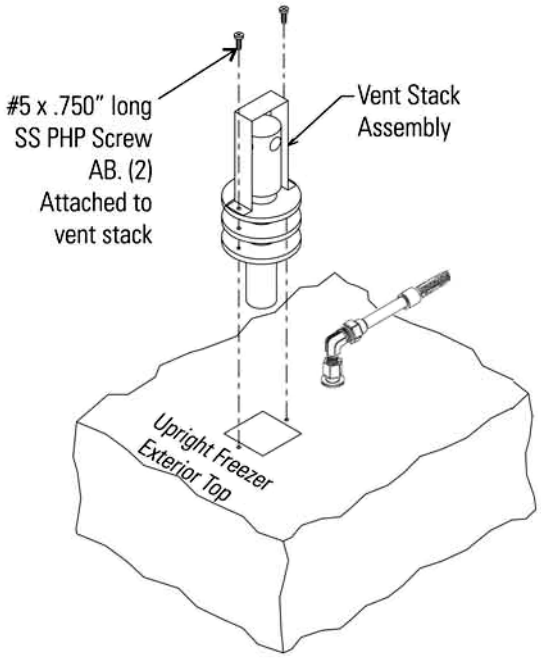


Figure 7-2. Vent Stack

Install the Temperature Probe

1. Locate the 0.500” pre-punched hole in the upper left back corner of the chamber ceiling. Remove the tie wrap securing the coiled probe/solenoid harness. Uncoil the probe lead and run the probe tip (approximately 12”) down through 0.500” porthole (Figure 7-4).

2. As in Figure 7-3, thread the small tie wrap through the openings in the front of the bracket. Secure the probe on the back of the bracket with the tie wrap.

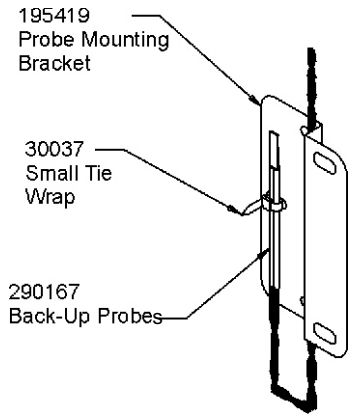


Figure 7-3. Probe

3. Tap #8-32 the two pre-punched holes located on the interior left wall of the freezer. Mount the bracket. Figure 7-4 shows the Back-Up probe mounted on the interior left side wall of the freezer.

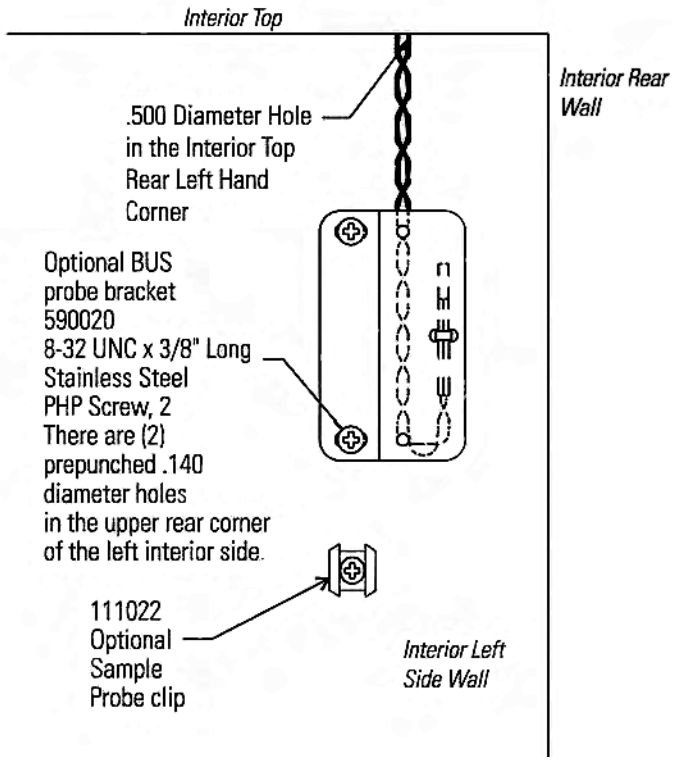


Figure 7-4. Probe Bracket

Connect the Probe/Solenoid Harness

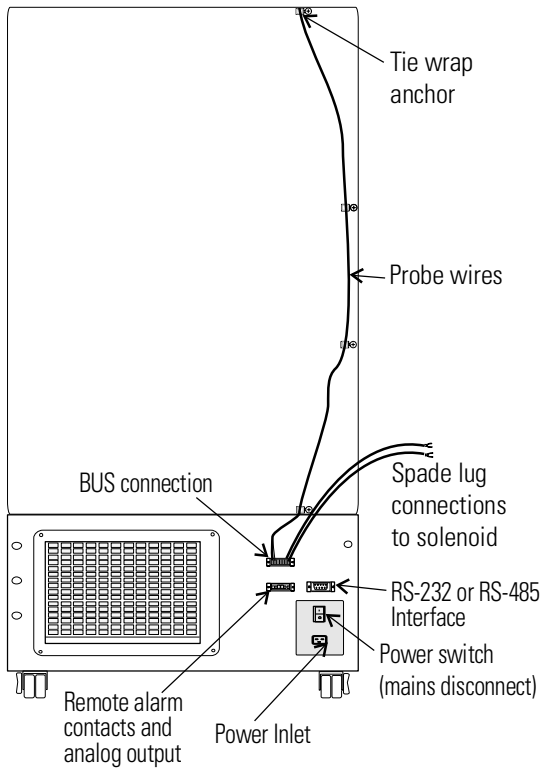


Figure 7-5. Connections

1. Remove the four screws on the freezer back panel and use them to mount the tie wrap anchors as shown in Figure 7-5. Secure the probe wire with tie wraps.

2. Plug the solenoid/probe connector into the BUS connection and secure with a screw on the right and left side. The connector is keyed.

3. Loosen the terminal screws on the solenoid. Slide the spade lug connectors under the screws and tighten to secure.

4. Connect power to the freezer. Turn the freezer On, with battery switch Off (O).

    a. **Arming on Power On**

    The arming function occurs only one time at initial power-on. It may occur in 3 ways; BUS timeout arming, both sensors fail and BUS temperature sensor arming.

    At power-on, the BUS will perform a Hold-off period check. The BUS will not inject the refrigerant for a Hold-off period, calculated as follows:

Connect the Probe/Solenoid Harness (cont.)

Hold-off period:
- 12 hour is between 0 and +70C
- 12 hour is between 0 and (BUS Setpoint - Hysteresis)
- 0 hours is below (BUS Setpoint - Hysteresis)
- 0 hours is temperature Out Of Range or both probes fail.

b. The Low Battery indicator may also illuminate.

5. Turn the battery switch to Standby mode (⏻) to charge both batteries.

BUS Operation and Maintenance

Warning When activated, this unit injects liquid nitrogen or carbon dioxide. Liquid nitrogen can cause serious freezing (frostbite) if it comes in contact with unprotected skin or eyes. Nitrogen and carbon dioxide gas suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to Appendix A for the proper handling of liquid LN_2. ▲

Caution Make sure the pressure relief valve on any LN2 tank is adjusted to 30 PSI max blow-off. ▲

Warning Carbon dioxide gas suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to "Handling Liquid CO_2 in Appendix B. ▲

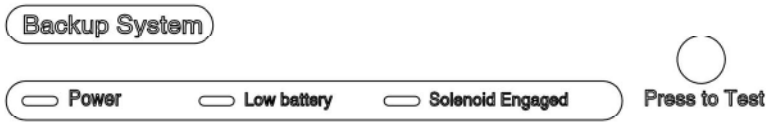


Figure 7-6. Back-Up System (BUS) Control Panel

Power - indicates the unit has AC power.

1. Normal Operation

- Low Battery: Illuminates only after a battery test which occurs every 8 hours. The battery test is a loaded test and during the test, the battery voltage is monitored. When the battery voltage is less than a certain threshold, this light will illuminate and stay illuminated until the next battery test.
- Solenoid Engaged: Illuminates any time the controller is activating the solenoid. Illumination will only occur when the controller senses the solenoid is active and calling for injection.

BUS Operation and Maintenance (cont.)

2. Fault Code

   This same user interface will also permit fault codes to be easily viewed when the user presses and releases the Press to Test button in less than 2 seconds. When this occurs, both the Low Battery LED and Solenoid Engaged LED will blink twice ON/OFF quickly indicating that fault code display mode is active. For the next ~10 seconds, the fault codes will be displayed as shown in the table below. The display shows only the lower number fault code until that fault is resolved.

Low Battery LED	Solenoid Engaged LED	Fault Code Number	Fault Code Definition
OFF	OFF	0	Normal Operation
OFF	Blinks 1 time	1	Primary Probe Failure
OFF	Blinks 2 times	2	Secondary Probe Failure
OFF	Blinks 3 times	3	Solenoid Driver Failure
OFF	Blinks 4 times	4	Low Tank

Table 7-1. BUS Fault Codes

   Each blink will take one second, with half of the second interval being ON (illuminated) and the other half of the second interval being OFF. After the sequence concludes, both the Low Battery LED and the Solenoid Engaged LED will flash four times ON/OFF quickly to indicate a return to normal display.

3. BUS Injection Test

   The user must press and hold the Press-to-Test button for >= 2 seconds before injection occurs. After the Press-to-Test button is pressed for >30 seconds, the solenoid will turn off. This will avoid a button or button signal becoming stuck in an active condition.

   During a Press-to-Test injection, if either RTD #1 or RTD #2 reads a temperature less than 20^{0}C below BUS set point and it is determined to be a valid input, then injection will terminate immediately.

4. BUS Set point “Validation” Feedback

   Whenever the BUS set point or working fluid changes, the BUS acknowledges the set point acceptance by causing the Low Battery LED and Solenoid Engaged LED to blink three times ON/OFF quickly. This does not imply that the BUS error-checked the values, other than that the value received was within the range of the BUS working correctly with prior programming.

Note Solenoid will not engage if door is open. ▲

BUS Operation and Maintenance (cont.)

Caution The back-up system is designed to inject refrigerant (CO_2 or LN_2). In the unlikely event of both probes failing, the back-up system will operate in PWM or Non-PWM mode based on jumper setting (Figure 7-2). ▲

For Hysteresis & Dual probe fault mode settings (Figure 7-2), locate Jumper J17 near to solenoid/ sensor connector (J1), refer to table below for operation details:

Jumper PIN	Status	Hysteresis	Dual Probe Fault Mode
J17 PIN 1 & PIN 2	Short Together/ Jumper Cap Installed	5°C	Non-PWM Mode
J17 PIN 1 & PIN 2	Open/No-Jumper Installed	9°C	PWM Mode

Table 7-2. Probe Fault Modes

PWM mode: If both probes fail, the solenoid will activate peridically, allowing the flow of refrigerant (CO2 or LN2).

Non-PWM mode: If both probes fail, the solenoid remains OFF and no refrigerant will flow

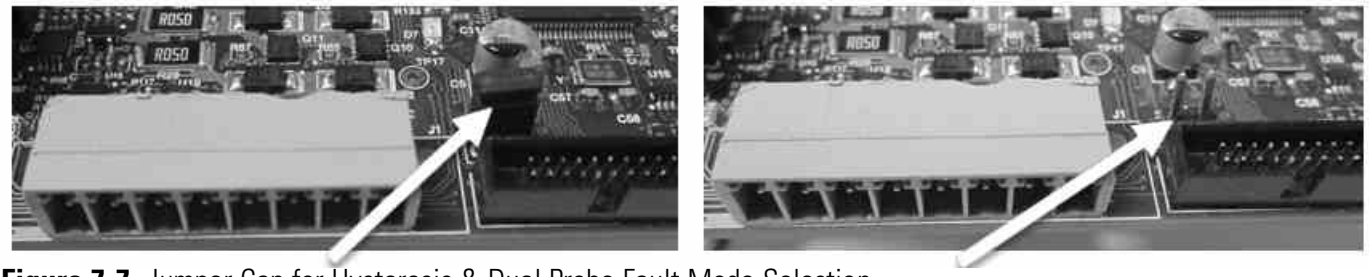


Figure 7-7. Jumper Cap for Hysteresis & Dual Probe Fault Mode Selection

Set Optional BUS Setpoint

The optional back up system is designed to inject CO_2 or LN_2 into the freezer compartment if the temperature rises above back up system set point. To set the BUS set point:

1. Press the Mode key until the Settings indicator lights.
2. Press the right arrow until “BACKUP = -XX” is displayed in the message center.
3. Press the up or down arrow key until the desired BUS set point is displayed.
4. Press Enter to save the setting.
5. Press the Mode key until the Run indicator lights or press the right or left arrow to go to next or previous parameter.

If no control keys are pressed, the freezer automatically returns to RUN mode after 5 minutes.

Set Optional BUS Setpoint (cont.)

Caution The BUS setpoint cannot be set any colder than the high temperature alarm setpoint (see Section 2). If the back-up system is installed with CO_2, then -65°C is the coldest BUS setpoint that can be used (if the cabinet setpoint is -75°C or colder).
Changing the operating temperature setpoint can affect the BUS setpoint. The BUS setpoint will self-adjust to maintain a temperature of at least 10°C above the operating temperature setpoint. ▲

Test BUS Operation

After the freezer has stabilized and both batteries are fully charged, the BUS can be tested to verify proper operation.

1. Disconnect the AC power to the freezer by turning the power switch off.

2. As the freezer warms up, verify the BUS injects at the desired temperature. Displayed temperature may vary by a few degrees from inject temperature due to the differences in probe locations.

3. **Preventive Maintenance** - Monthly maintenance action to check CO_2 or LN_2 back-up system operation, and battery voltage.

   - Check for fault codes on the BUS probe per Table 7-1. Also verify solenoid operation by performing a Press-To-Test.

Clean the Vent Stack

Routinely check the vent stack for frost or ice build-up. The type of frost that forms in the vent stack is generally very soft and may be easily removed with a bristle brush or soft cloth. If ice build-up has occurred, a complete defrost may occasionally be required. See Section 5 for freezer defrost instructions.

Disconnect the Fitting Assembly and Transfer Hose

To disconnect the freezer back-up from the gas supply:

1. Close the supply valve.

2. Depress the test button on the Back-Up System control box to remove the gas from the line.

3. Slowly disconnect the fitting assembly from the supply (in the event that any gas remains in the line).

Chart Recorder

To install the chart paper in the recorder, follow the steps below.

1. Open the glass door of the recorder and press button #3 until the pen begins to move outward.
2. Unscrew the knob at the center of the chart and remove the paper.
3. Install the new chart paper, position the paper to the correct time line and replace the knob.
4. Remove the cap from the felt pen and press button #3.

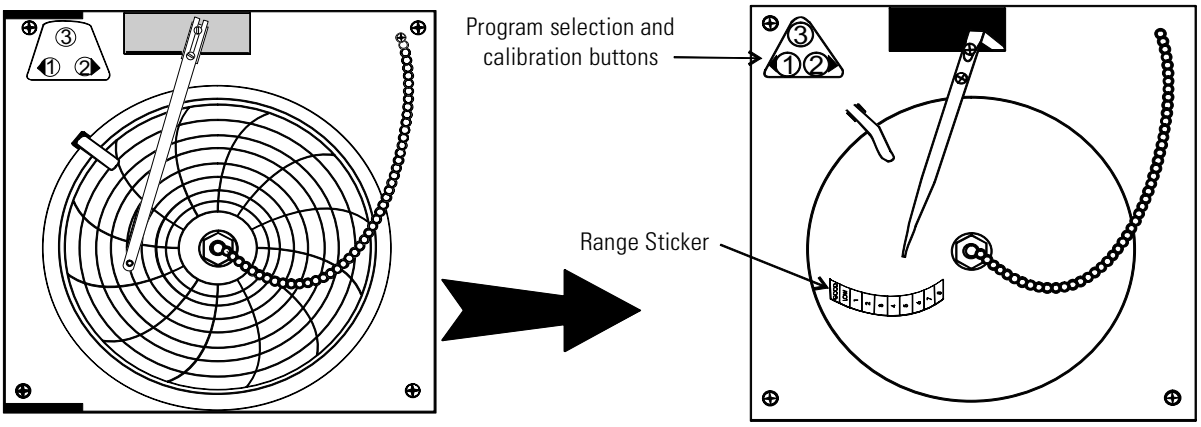


Figure 7-7. Recorder Details

Change the Recorder Temperature Range

The chart recorder contains eight temperature ranges and is factory-programmed for the freezer. A list of the programs with temperature ranges follows.

Range	From	To
1	-40	30°C
2	0	60°C
3	-100	38°C
4	-5	50°C
5	0	100°C
6	-100	200°C
7	-115	50°C
8	-10	70°C

Table 7-3. Recorder Temp Range

1. Press and hold button #3 for one second, then let the pen move off 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 button #3 to bring the pen arm back onto the chart. Recording will begin in the new program.

Calibrate the Recorder

Caution The recorder must be in service for 24 hours before performing the following calibration procedure. ▲

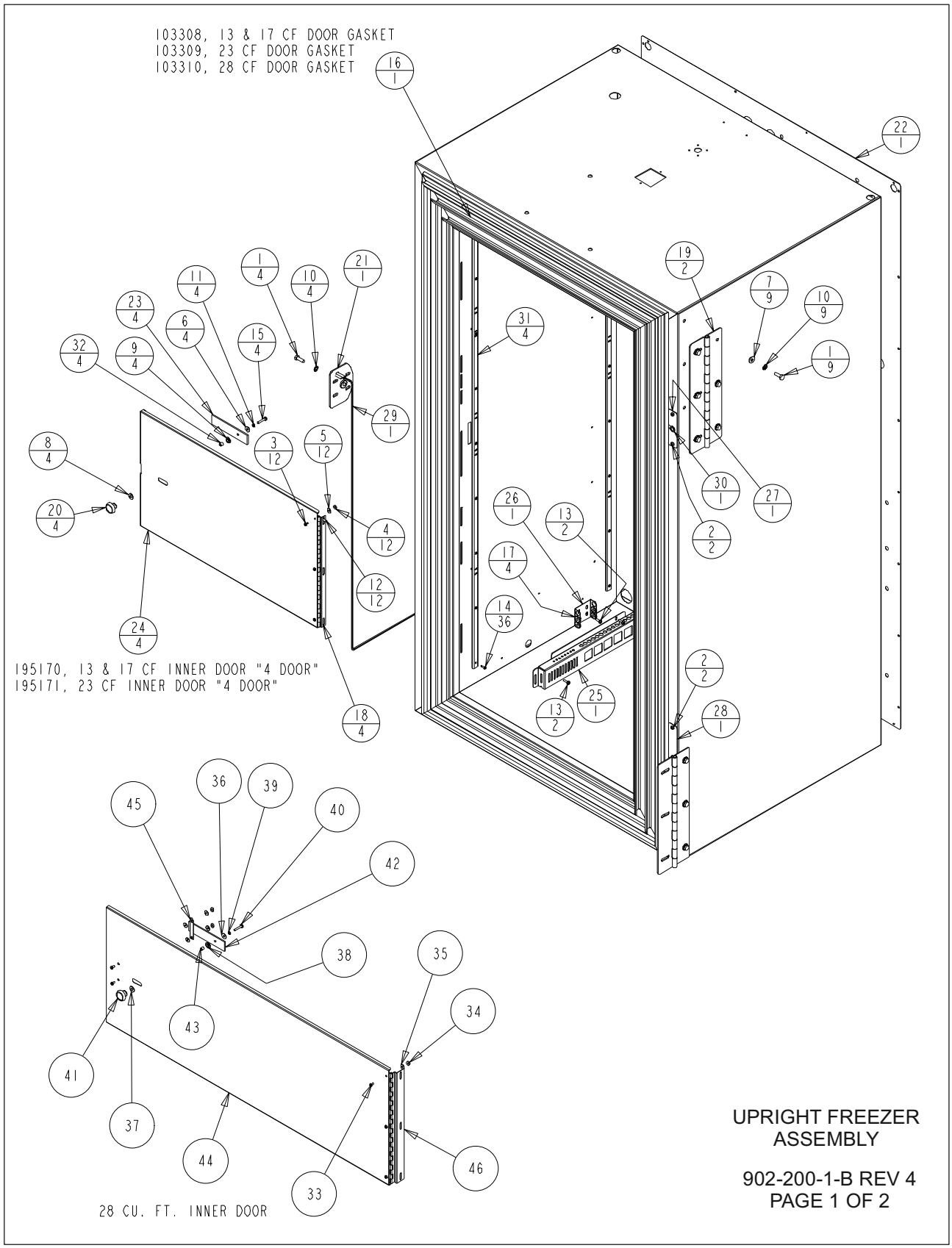
1. Place an accurate thermometer in the chamber next to the recorder probe.

2. Temperature probes for the recorder are located in the left front corner of the freezer chamber (Figure 2-4).

3. After about three minutes, compare the thermometer reading with the chart recorder reading.

4. If an adjustment is necessary, press the #1 button to move the pen to the left or the #2 to move the pen to the right. The button must be held about five seconds before the pen begins to move. Release the button when the pen position matches the thermometer.

Note The felt-tip pen on the recorder requires periodic replacement. Usually the ink will appear to fade before replacement becomes necessary. Additional pen tips are available for purchase. ▲


103308, 13 & 17 CF DOOR GASKET
103309, 23 CF DOOR GASKET
103310, 28 CF DOOR GASKET
195170, 13 & 17 CF INNER DOOR "4 DOOR"
195171, 23 CF INNER DOOR "4 DOOR"
28 CU. FT. INNER DOOR
UPRIGHT FREEZER ASSEMBLY
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BILL OF MATERIALS

ITEM NO.	PART NO.	PART DESCRIPTION
1	20003	1/4-20 X 3/4 SS HH CAP SCREW
2	22053	#8-32 X 1/2 SS PHP SCREW
3	22115	#6-32 X 1/4 SS PHP SCREW
4	23009	#6-32 SS HEX NUT
5	23020	#6 SS FLAT WASHER
6	23021	#8 SS FLAT WASHER
7	23023	1/4 SS FLAT WASHER
8	23043	NYLON FLAT WASHER
9	23044	1/4" NYLON SHOULDER WASHER
10	23062	1/4 SS EXT TOOTH LOCKWASHER
11	23080	#8 SS SPRING LOCKWASHER
12	24032	#8-32 X 3/8 SS PHP SCREW F POINT
13	24042	#8-32 X 1/2 SS PHP SCREW F POINT
14	25018	1/8 X 1/4 SS POP RIVET
15	59008	#8-32 X 7/8 SS PHP SCREW
16	103308	13/17 CU.FT. SINGLE DOOR FRAME GASKET
17	114020	5/8" X 1/2" ID GROMMET
18	116077	FRONT PANEL HINGE
19	116092	EXTERIOR FREEZER DOOR HINGE
20	120400	BLACK PLASTIC KNOB
21	121099	FRZ CAM LATCH STRIKE
22	189921	EXTERIOR BACK 13 & 17
23	195169	LATCH TAB
24	195170	13/17 CU.FT. INNER DOOR
25	195866	PROBE GUARD
26	195867	PROBE MOUNT
27	195830	UR DOOR WIREWAY COVER PLATE
28	195900	MAGNETIC SWITCH
29	30033	RT. ANGLE STRAIN RELIEF
30	500177	PILASTER STRIPS
31	515083	1/4 DIA. X 1/4L SS SPACER
32	22115	#6-32 X 1/4 SS PHP SCREW
33	23009	#6-32 SS HEX NUT
34	23020	#6 SS FLAT WASHER
35	23021	#8 SS FLAT WASHER
36	23043	NYLON FLAT WASHER
37	23044	1/4" NYLON SHOULDER WASHER
38	23080	#8 SS SPRING LOCKWASHER
39	59008	#8-32 X 7/8 SS PHP SCREW
40	120400	BLACK PLASTIC KNOB
41	195169	LATCH TAB
42	515083	1/4 DIA. X 1/4L SS SPACER
43	1950217	28 CU. FT. INNER DOOR
44	1950218	28 CU.FT. INNER DOOR LATCH GUIDE
45	116090	FRONT PANEL HINGE
46	24030	8 X 1/2 ZP PHP SCREW TEKS

UPRIGHT FREEZER
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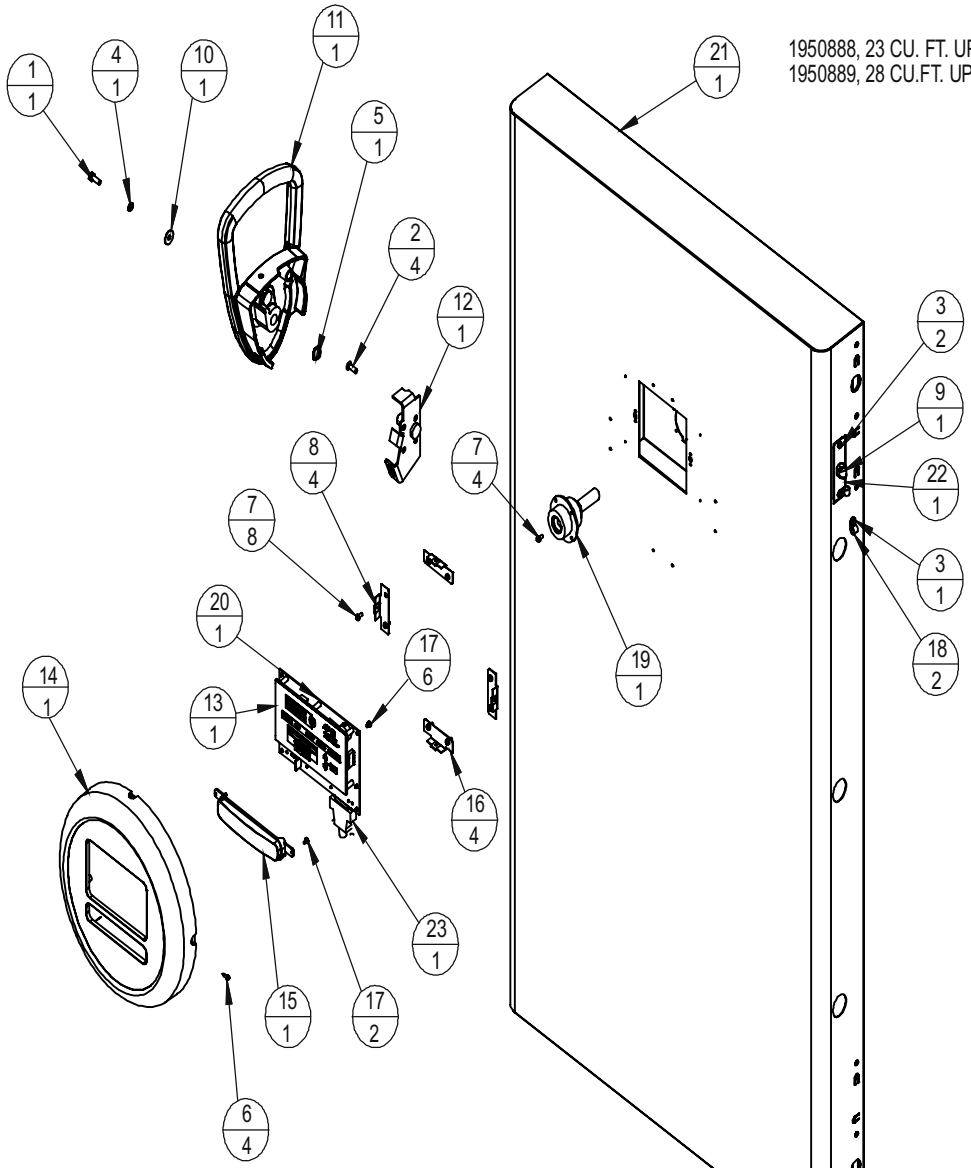

UPRIGHT FREEZER
DOOR ASSEMBLY

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BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	20003	1/4-20 X 3/4 SS HH CAP SCREW
2	20058	#1/4-20 X 3/4 SS FHP UC SCREW
3	22053	#8-32 X 1/2 SS PHP SCREW
4	23033	1/4 SS INTERNAL TOOTH LOCK WASHER
5	23057	5/8 WAVE WASHER
6	24016	#6 X 1/2" SS PHP SCREW AB POI NT
7	24032	#8-32 X 3/8 SS PHP SCREW F POINT
8	25040	#6 U SPEED NUT STL. STL.
9	30033	RIGHT ANGLE STRAIN RELIEF
10	121092	.856" OD FLAT WASHER
11	121104	FINISHED HANDLE VWR PMS 647 "BLU"
12	121102	CAM LATCH MOUNT
13	140474	CONTROL PANEL
14	180387	VWR ROUND PLASTIC CONTROL BEZEL
15	180318	VWR BACK-UP SYSTEM BLANK PANEL
16	1950895	BRACKET MOUNTING
17	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
18	600085	5/16 NYLON CABLE CLAMP
19	1950069	HEATED VACUUM RELIEF PORT
20	191941	FREEZER DISPLAY BOARD
21	1950887	13 &17 CU. FT. UPRIGHT FREEZER DOOR
22	195830	UPRIGHT DOOR WIREWAY COVER PLATE
23	430336	15 FT, RS-232 CABLE 25 POS.

UPRIGHT FREEZER
DOOR ASSEMBLY

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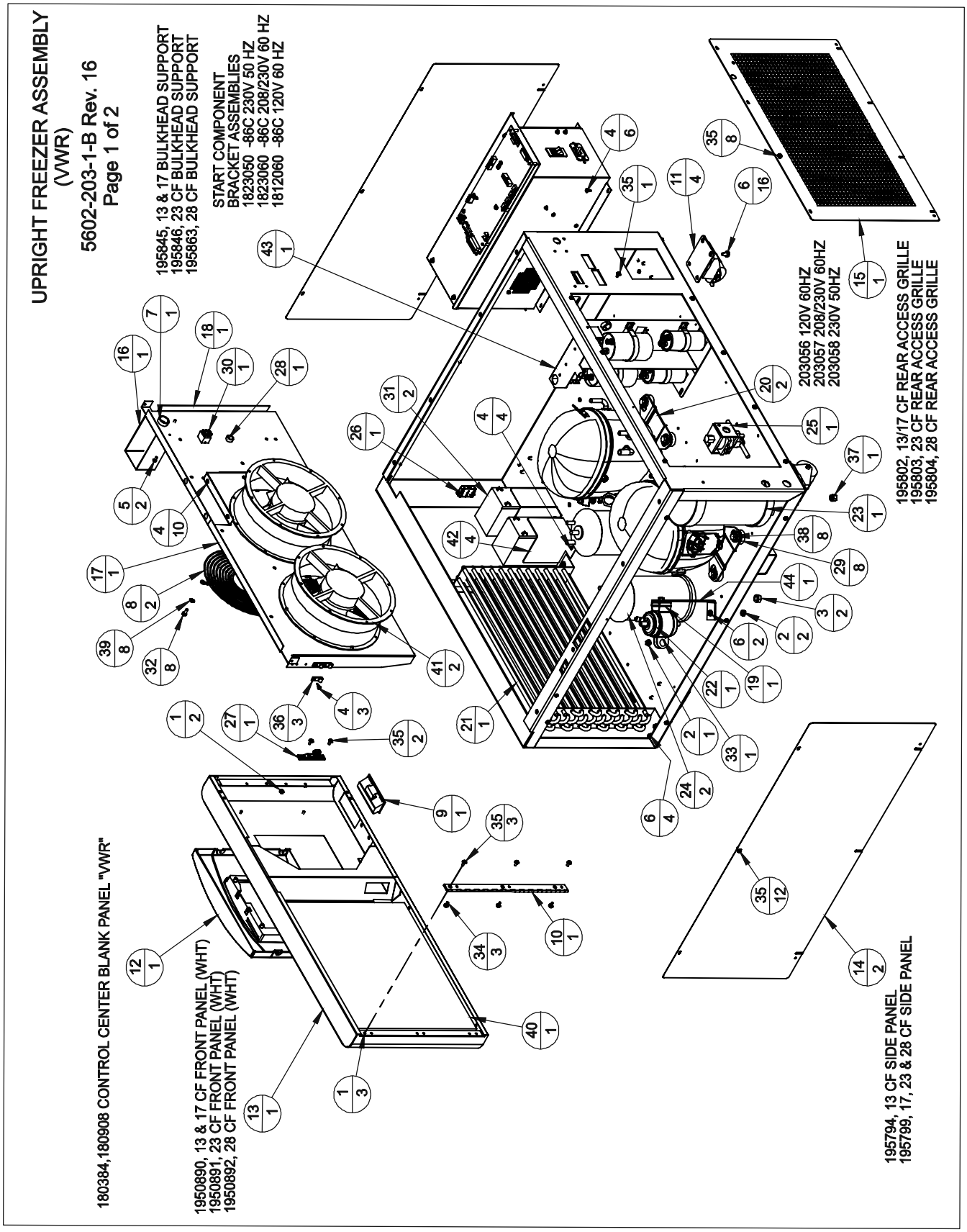
UPRIGHT FREEZER ASSEMBLY
(VWR)
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195845, 13 & 17 BULKHEAD SUPPORT
195846, 23 CF BULKHEAD SUPPORT
195863, 28 CF BULKHEAD SUPPORT
START COMPONENT
BRACKET ASSEMBLIES
1823050 -86C 230V 50 HZ
1823060 -86C 208/230V 60 HZ
1812060 -86C 120V 60 HZ
203056 120V 60HZ
203057 208/230V 60HZ
203058 230V 50HZ
195802, 13/17 CF REAR ACCESS GRILLE
195803, 23 CF REAR ACCESS GRILLE
195804, 28 CF REAR ACCESS GRILLE
180384,180908 CONTROL CENTER BLANK PANEL "VWR"
1950890, 13 & 17 CF FRONT PANEL (WHT)
1950891, 23 CF FRONT PANEL (WHT)
1950892, 28 CF FRONT PANEL (WHT)
195794, 13 CF SIDE PANEL
195799, 17, 23 & 28 CF SIDE PANEL

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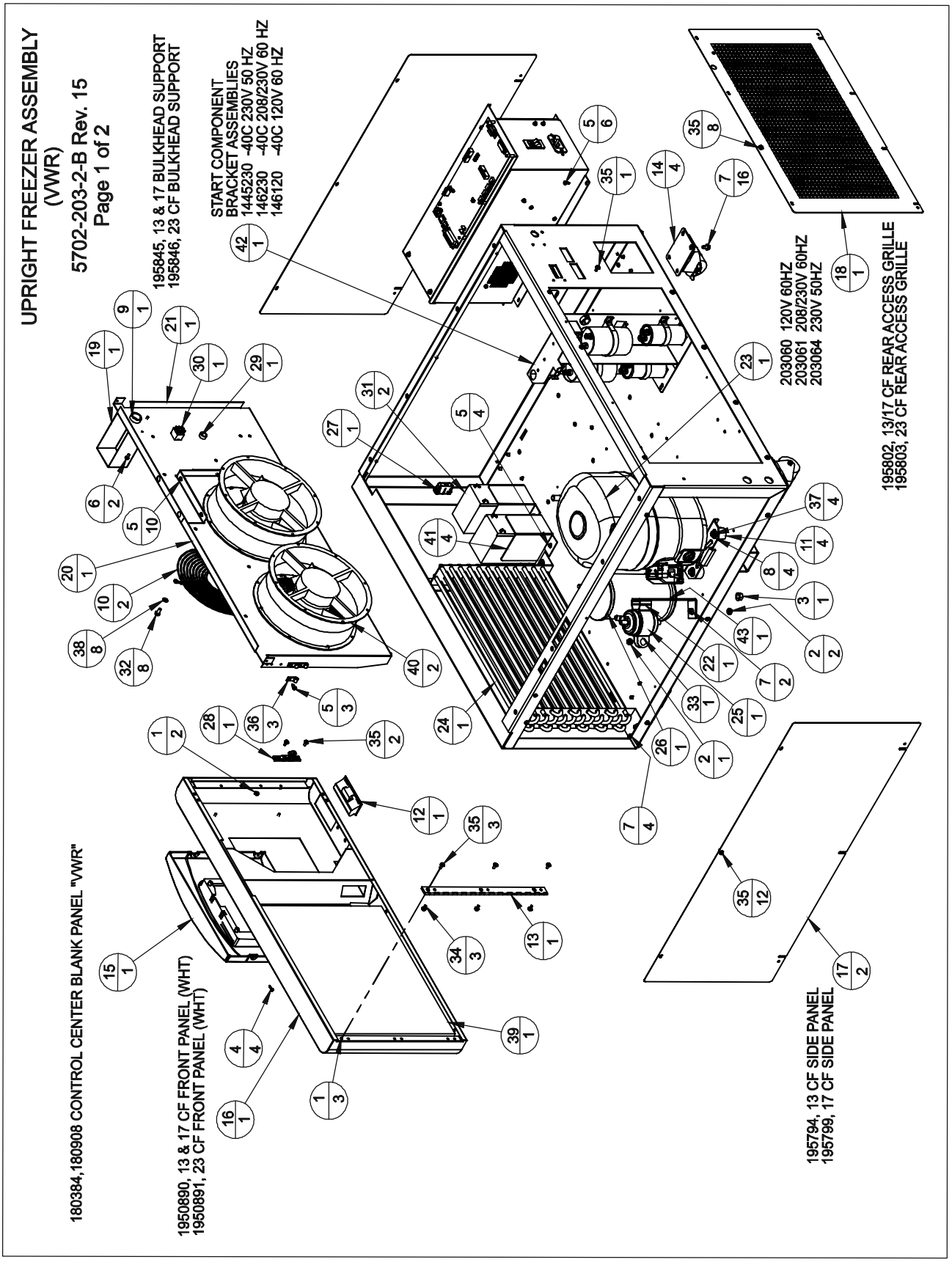
BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	23002	#8-32 ZP LKWASH HEX NUT
2	23011	1/4-20 ZP LKWASH HEX NUT
3	23013	3/8-16 ZP LKWASH HEX NUT
4	24030	#8 X 1/2" TEKS SCREW
5	24032	#8-32 X 3/8 SS PHP SCREW F POINT
6	24038	1/4-20 X 1/2 SELF TAPPING SCREW
7	30016	1" SNAP BUSHING
8	108020	10" WIRE FAN GUARD
9	115032	BLACK ABS PLASTIC PULL
10	116115	FRONT PANEL HINGE
11	120011	DUAL WHEEL CASTER
12	180384	THERMO CONTROL CENTER BLANK PANEL
13	1950890	13&17 CU. FT. UR FRZ BASE FRONT PNL
14	195799	SIDE PANEL 17, 23 AND 28 CU. FT. UPRIGHT
15	195802	13/17 REAR ACCESS GRILLE
16	195829	MULLION /DOOR SWITCH WIRE COVER
17	195844	UR FRZ FAN BULKHEAD
18	195845	13&17 CU.FT. FAN BULKHEAD SUPPORT
19	200126	2" RIGID HANGER
20	203057	UPRIGHT COMPRESSOR 208/230V 60HZ
21	204009	REFRIGERATION CONDENSER
22	209020	LIQUID LINE FILTER DRYER WITH ACCESS PORT
23	214018	10.000" H X 5.000" DIA. EXPANSION TANK
24	214023	OIL SEPARATOR
25	220626	120V - 50/60 HZ SOLENOID VALVE
26	319388	LATCH CATCH, PART OF 319388 ASSEMBLY
27	319388	LATCH KEEPER, PART OF 319388 ASSEMBLY
28	330002	5/8" SNAP BUSHING

BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
29	350096	RUBBER MOUNT FOOT EMBRACO
30	360248	MINI SNAP-IN POWER SWITCH
31	400159	SEALED LEAD ACID BATTERY - 12 VOLT - 7.2 Ah
32	510035	#12-24 X 1/2 SS HH CAP SCREW
33	550043	1/4-20 X 1" L ZP CARRIAGE BOLT
34	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
35	590029	#8-32 X 3/8 SS PHP EXT SEMS SCREW W/PATCH
36	600080	1/4 ALUM CLAMP W/LINER
37	610053	3/8-16 NYLON INSERT LOCK NUT
38	680030	5/16-18 X 1.75 SS HH SHOULDER BOLT
39	730087	#12 SS EXT TOOTH LOCKWASHER
40	760203	AIR FILTER
41	900113	10" TUBEAXIAL FAN, 115V
42	1950074	BATTERY MOUNTING BRACKET
43	120230-01-2	UPRIGHT FREEZER START COMPONENT BRACKET ASSY.
44	1950850	FILTER DRIER MOUNTING BRACKET


UPRIGHT FREEZER ASSEMBLY
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195845, 13 & 17 BULKHEAD SUPPORT
195846, 23 CF BULKHEAD SUPPORT
START COMPONENT
BRACKET ASSEMBLIES
1445230 -40C 230V 50 HZ
146230 -40C 208/230V 60 HZ
146120 -40C 120V 60 HZ
203060 120V 60HZ
203061 208/230V 60HZ
203064 230V 50HZ
195802, 13/17 CF REAR ACCESS GRILLE
195803, 23 CF REAR ACCESS GRILLE
180384,180908 CONTROL CENTER BLANK PANEL "VWR"
1950890, 13 & 17 CF FRONT PANEL (WHT)
1950891, 23 CF FRONT PANEL (WHT)
195794, 13 CF SIDE PANEL
195799, 17 CF SIDE PANEL

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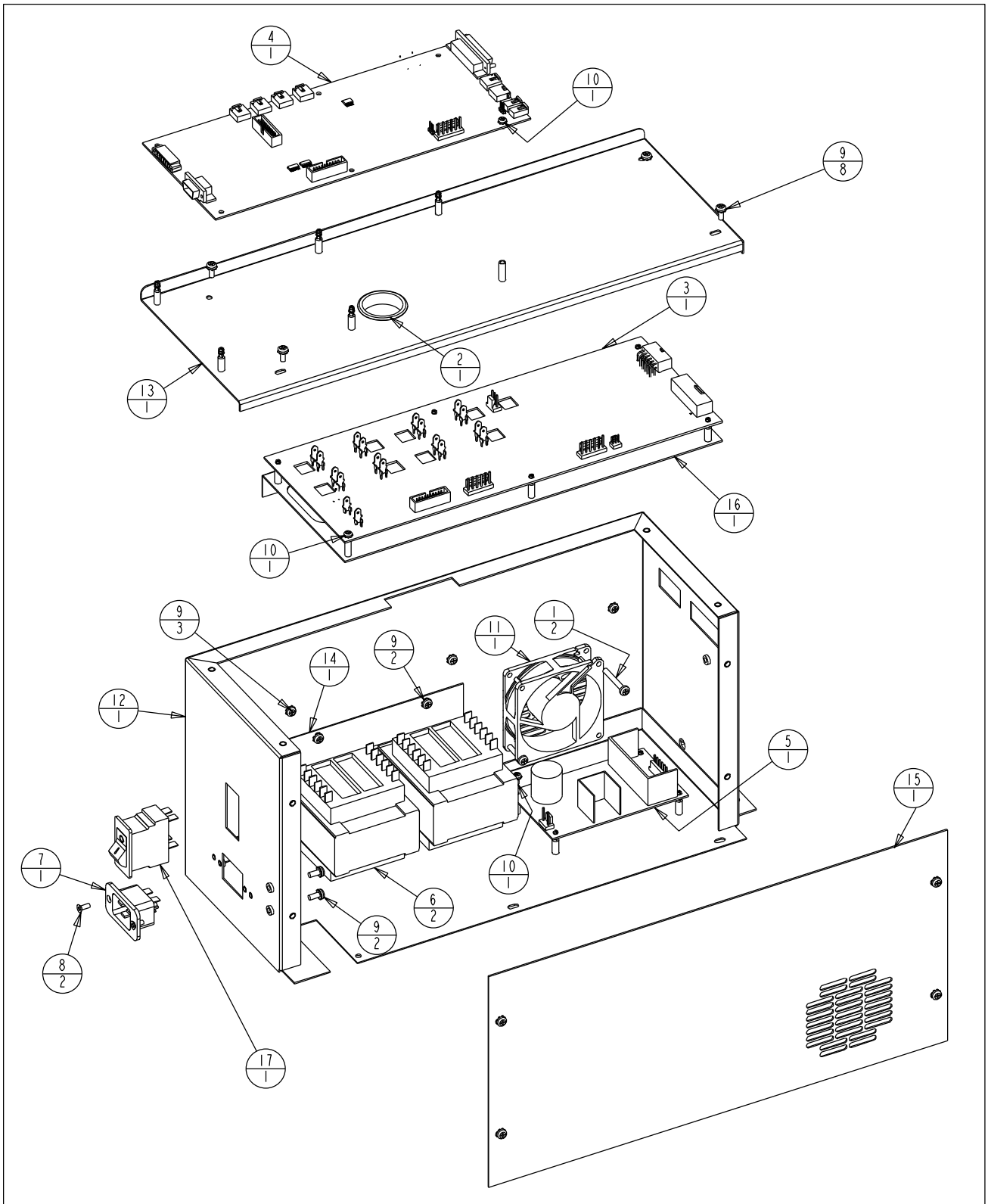
BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	23002	#8-32 ZP LKWASH HEX NUT
2	23011	1/4-20 ZP LKWASH HEX NUT
3	23013	3/8-16 ZP LKWASH HEX NUT
4	24016	#6 X 1/2" SS PHP SCREW AB POINT
5	24030	#8 X 1/2" TEKS SCREW
6	24032	#8-32 X 3/8 SS PHP SCREW F POINT
7	24038	1/4-20 X 1/2 SELF TAPPING SCREW
8	24049	1/4 ZP FLAT WASHER
9	30016	1" SNAP BUSHING
10	108020	10" WIRE FAN GUARD
11	114034	COMPRESSOR MOUNTING SLEEVE
12	115032	BLACK ABS PLASTIC PULL
13	116115	FRONT PANEL HINGE
14	120011	DUAL WHEEL CASTER
15	180384	THERMO CONTROL CENTER BLANK PANEL
16	1950890	13&17 CU. FT. UR FRZ BASE FRONT PNL
17	195799	SIDE PANEL 17, 23 AND 28 CU. FT. UPRIGHT
18	195802	13/17 REAR ACCESS GRILLE
19	195829	MULLION /DOOR SWITCH WIRE COVER
20	195844	UR FRZ FAN BULKHEAD
21	195845	13&17 CU.FT. FAN BULKHEAD SUPPORT
22	200126	2" RIGID HANGER
23	203060	BRISTOL HIGH/LOW STAGE COMPRESSOR
24	204009	REFRIGERATION CONDENSER
25	209020	LIQUID LINE FILTER DRYER WITH ACCESS PORT
26	214023	OIL SEPARATOR
27	319388	LATCH CATCH, PART OF 319388 ASSEMBLY
28	319388	LATCH KEEPER, PART OF 319388 ASSEMBLY

BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
29	330002	5/8" SNAP BUSHING
30	360248	MINI SNAP-IN POWER SWITCH
31	400159	SEALED LEAD ACID BATTERY - 12 VOLT - 7.2 Ah
32	510035	#12-24 X 1/2 SS HH CAP SCREW
33	550043	1/4-20 X 1" L ZP CARRIAGE BOLT
34	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
35	590029	#8-32 X 3/8 SS PHP EXT SEMS SCREW W/PATCH
36	600080	1/4 ALUM CLAMP W/LINER
37	680008	1/4-20 X 1-3/4 SELF TAPPING SCREW
38	730087	#12 SS EXT TOOTH LOCKWASHER
39	760203	AIR FILTER
40	900113	10" TUBEAXIAL FAN, 115V
41	1950074	BATTERY MOUNTING BRACKET
42	120230-01-2	UPRIGHT FREEZER START COMPONENT BRACKET ASSY.
43	1950850	FILTER DRIER MOUNTING BRACKET



230V RELAY ENCLOSURE ASSEMBLY

902-204-1-B Rev. 2
Page 1 of 2

BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	22143	#8-32 x 1-1/4 SS PHP SCREW
2	30077	1-1/2" SNAP BUSHING
3	191923	HIGH VOLTAGE BOARD 230V
4	191989	MICRO BOARD (HIGH END)
5	400165	SWITCHER BOARD
6	420090	175V TRANSFORMER
7	460169	POWER INLET, 16/20A
8	490009	#6-32 X 3/8 SS FHP UC SCREW
9	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
10	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
11	900134	TUBEAXIAL FAN, 30 CFM, 12V
12	195631-16-1	RELAY ENCLOSURE SPOTWELD SUB-ASSEMBLY
13	195631-16-4	RELAY ENCLOSURE COVER/191656 SUPPORT
14	195631-31-3	TRANSFORMER HOLD DOWN
15	195631-31-5	RELAY ENCLOSURE COVER (MAIN)
16	195730-16-1	191658 SUPPORT BRACKET SUB-ASSEMBLY
17	230184	15A DPDT SWITCH/CIRCUIT BKR

1. COMMON TO: 1950124 & 1950128

230V RELAY ENCLOSURE ASSEMBLY

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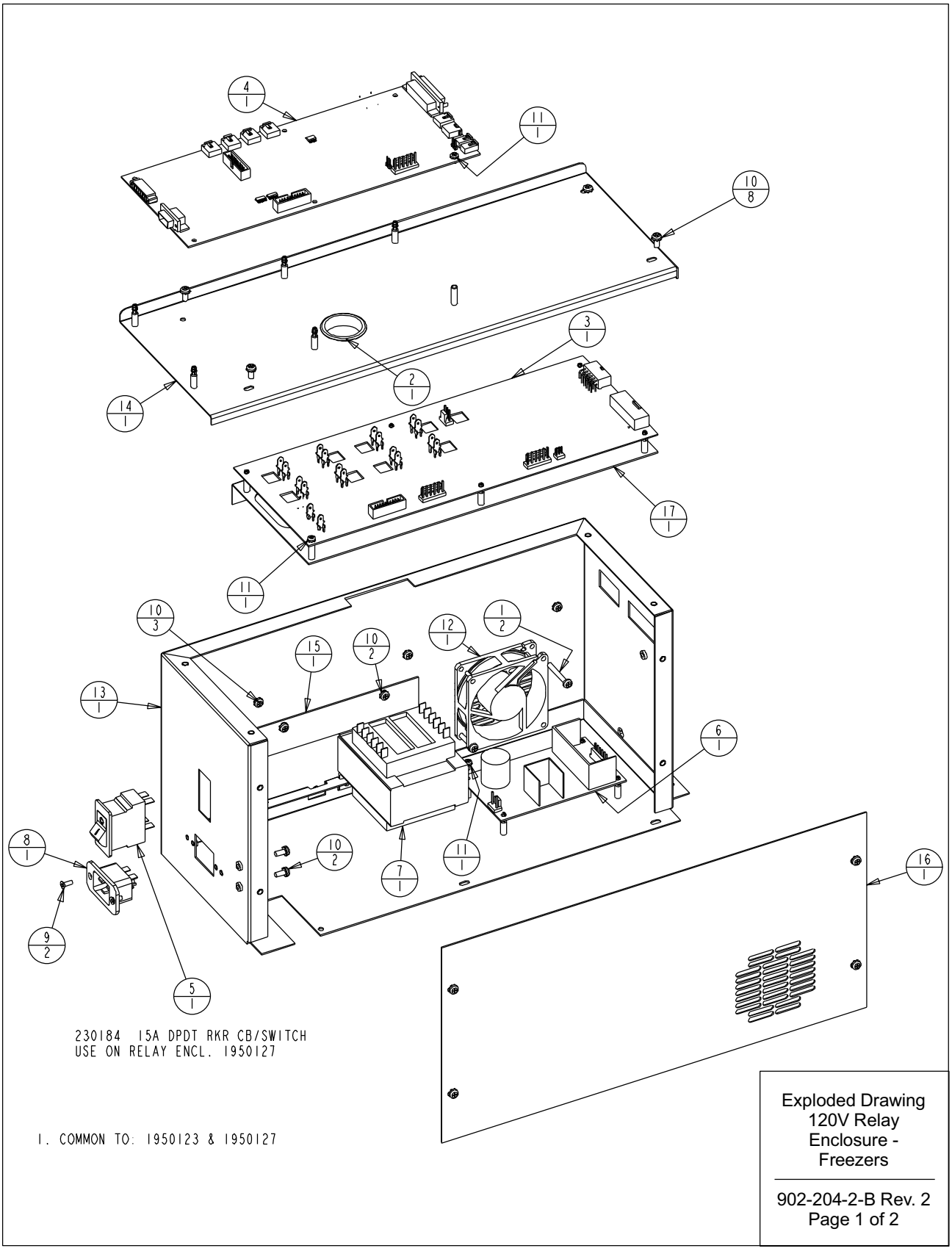
Page 2 of 2



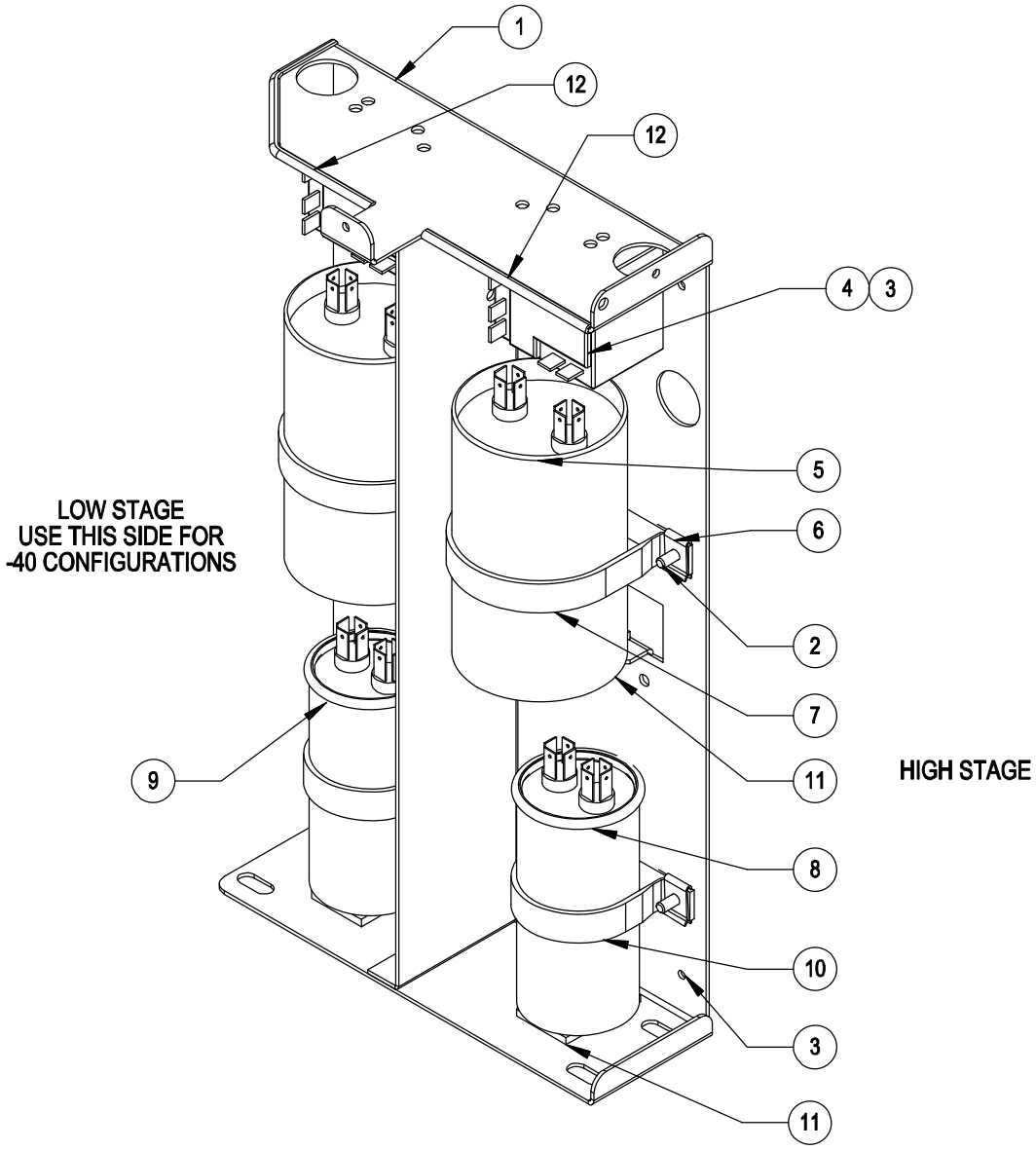
Exploded Drawing
120V Relay
Enclosure -
Freezers

902-204-2-B Rev. 2
Page 1 of 2

BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	22143	#8-32 x 1-1/4 SS PHP SCREW
2	30077	1-1/2" SNAP BUSHING
3	191932	HIGH VOLTAGE BOARD 120V
4	191989	MICRO BOARD (HIGH END)
5	230184	15A DPDT SWITCH/CIRCUIT BKR
6	400165	SWITCHER BOARD
7	420065	175V TRANSFORMER
8	460169	POWER INLET, 16/20A
9	490009	#6-32 X 3/8 SS FHP UC SCREW
10	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
11	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
12	900134	TUBEAXIAL FAN, 30 CFM, 12V
13	195631-16-1	RELAY ENCLOSURE SPOTWELD SUB-ASSEMBLY
14	195631-16-4	RELAY ENCLOSURE COVER/191656 SUPPORT
15	195631-31-3	TRANSFORMER HOLD DOWN
16	195631-31-5	RELAY ENCLOSURE COVER (MAIN)
17	195730-16-1	191658 SUPPORT BRACKET SUB-ASSEMBLY

Exploded Drawing
120V Relay
Enclosure -
Freezers

902-204-2-B Rev. 2
Page 2 of 2



NOTES:
1. SEE PSS 8602-724-012 FOR ASSEMBLY WIRING AND OTHER DETAILS.
2. AFTER ATTACHING NOMEX COVER (250138) WITH SCREWS (590029), STICK ESD LABEL (220555) TO OUTSIDE OF COVER.
3. IDENTIFY EACH ASSEMBLY WITH LABELS ON THE BOTTOM AND BACK THAT INCLUDE THE FOLLOWING:
   FIRST LINE - ASSEMBLY NUMBER AND REVISION
   SECOND LINE - BAR CODE OF ASSEMBLY AND REVISION
   THIRD LINE - UNIQUE SERIAL NUMBER INCLUDING DATE OF MANUFACTURE IN THE FOLLOWING FORMAT AND ORDER: THREE LETTER MANUFACTURING SITE, TWO DIGIT YEAR MANUFACTURED, TWO DIGIT WEEK MANUFACTURED FOLLOWED BY A UNIQUE FOUR DIGIT NUMBER.
   FOURTH LINE - BAR CODE OF UNIQUE SERIAL NUMBER.
   FIFTH LINE - ASSEMBLY DESCRIPTION IN THE FOLLOWING FORMAT: UPRIGHT, TEMPERATURE, VOLTAGE AND FREQUENCY.

Upright Freezer Start Component
Enclosure Assembly

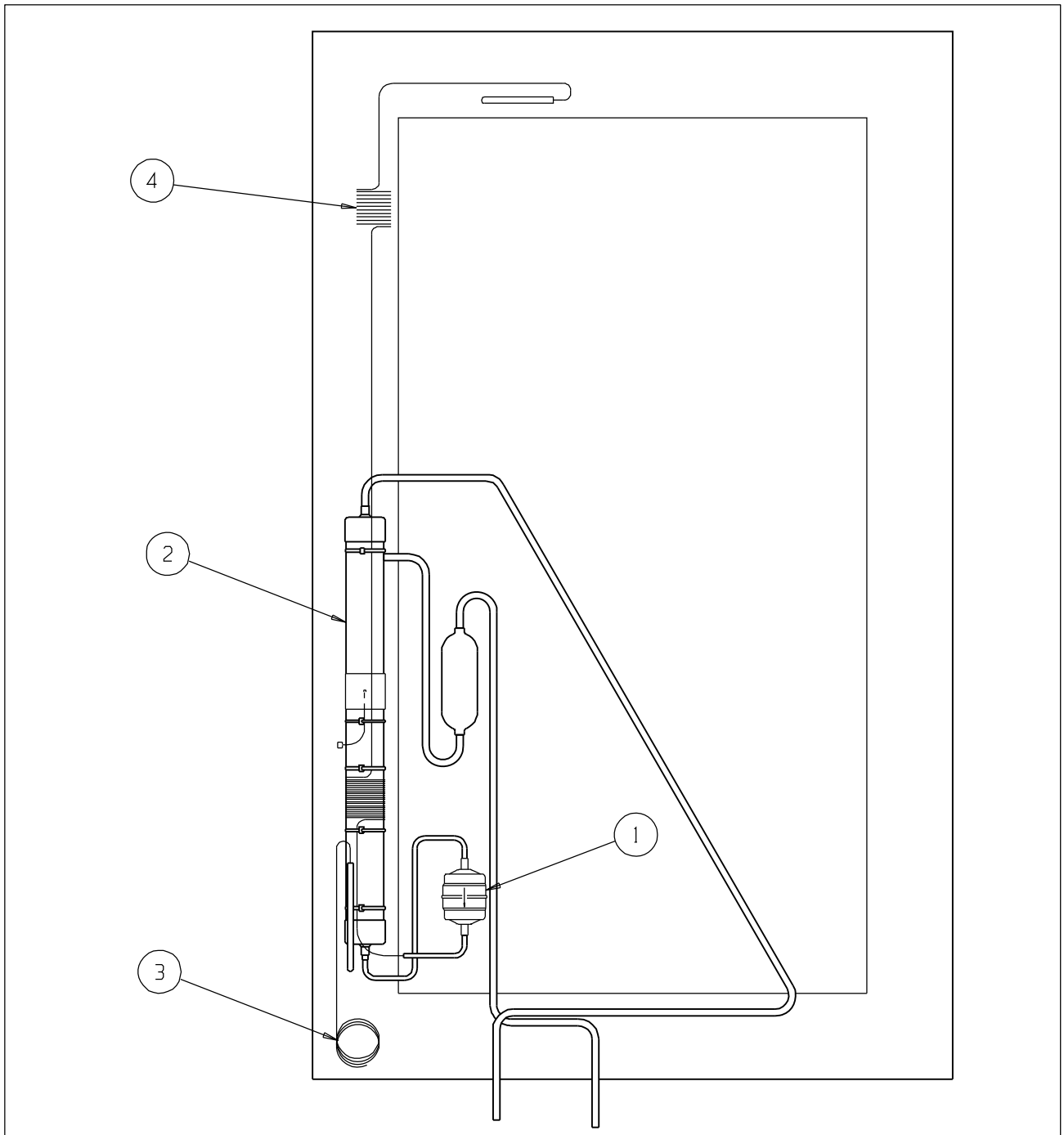
120230-01-2-D Rev 10
Page 1 of 2

	UPRIGHT FREEZER START COMPONENT BRACKET ASSEMBLIES							
	ITEM NO.	DESCRIPTION	1823050 -86C 230V 50 Hz	1823060 -86C 208/230V 60Hz	1812060 -86C 120V 60 Hz	1445230 -40C 230V 50 Hz	146230 -40C 208/230V 60Hz	146120 -40C 120V 60 Hz
	1	COMPONENT BRACKET	120230	120230	120230	120230	120230	120230
	2	#8 X 1/2 PHP TYPE AB	24021 (4)	24021 (4)	24021 (4)	24021 (2)	24021(2)	24021 (2)
	3	8-32 X 3/8 SCREW	590020 (4)	590020 (4)	590020 (4)	590020 (2)	590020 (2)	590020 (2)
	4	START RELAY	312286 (2)	312186 (2)	312086 (2)	312287 (1)	312187 (1)	312087 (1)
	5	START CAPACITOR	623050 (2)	623060 (2)	612060 (2)	170236 (1)	170154 (1)	170154 (1)
	6	#8 SPEED NUT, S.S.	327675 (4)	327675 (4)	327675 (4)	327675 (2)	327675 (2)	327675 (2)
	7A	2.5" VINYL COATED STRAP	N/A	N/A	600106 (4)	N/A	N/A	600106 (2)
	7B	2" VINYL COATED STRAP	600108 (2)	600108 (2)	N/A	600108 (1)	600108 (1)	N/A
	8	RUN CAPACITOR	223050	223060	212060	N/A	N/A	N/A
	9	RUN CAPACITOR	223050	223050	212060	170097 (1)	170226 (1)	170224 (1)
	10	1.75" VINYL COATED STRAP	600107 (2)	600107 (2)	SEE 7A	600107 (1)	600107 (1)	SEE 7A
	11	NEOPRENE TAPE 1/8" X 1" X 2"	28003 (4)	28003 (4)	28003 (4)	28003 (2)	28003 (2)	28003 (2)
	12	EDGE GUARD (CUT TO LENGTH)	114012	114012	114012	114012	114012	114012
NOT SHOWN *	13	ULT MAIN HARNESS (REFERENCE ONLY)	350092	350092	350092	350093	350093	350093
NOT SHOWN	14	ENCLOSURE LOW STAGE HARNESS	350108	350108	350108	350108	350108	350108
NOT SHOWN	15	ENCLOSURE HIGH STAGE HARNESS	350107	350107	350107	N/A	N/A	N/A
NOT SHOWN	16	NOMEX COVER	250138	250138	250138	250138	250138	250138
NOT SHOWN	17	ESD WARNING LABEL	220555 (2)	220555 (2)	220555 (2)	220555 (2)	220555 (2)	220555 (2)
NOT SHOWN, SEE NOTE 3	18	IDENTIFICATION LABEL	823050 (2)	823060 (2)	812060 (2)	423050 (2)	423060 (2)	412060 (2)

* THE ULT MAIN HARNESS IS LISTED FOR INFORMATION ONLY. IT IS NOT PART OF THIS ASSEMBLY.

Upright Freezer Start Component Enclosure Assembly

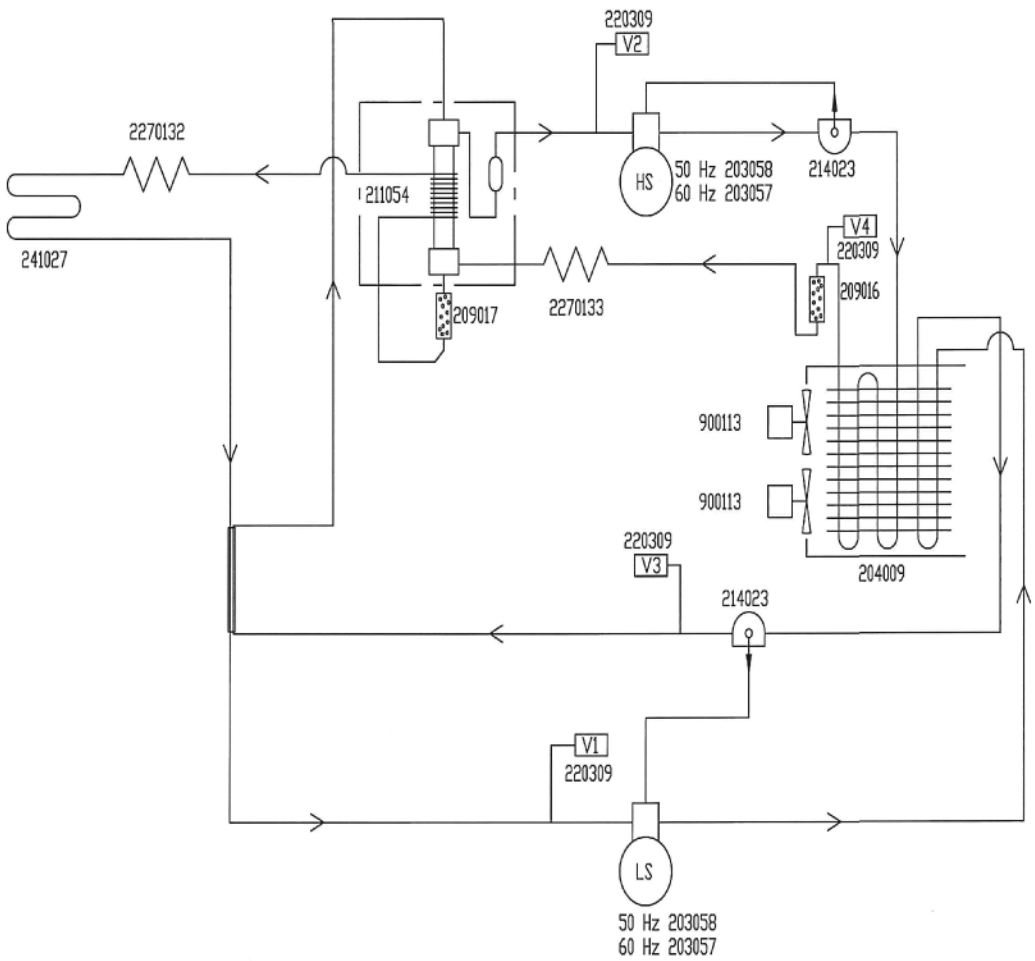
120230-01-2-D Rev 10
Page 2 of 2



BILL OF MATERIALS		
ITEM NO.	PART NO.	PART DESCRIPTION
1	209017	DRYER
2	211050	HEAT EXCHANGER
3	227927	HIGH STAGE CAP. TUBE
4	227928	LOW STAGE CAP. TUBE

Exploded Drawing
Heat Exchanger
Upright Freezer

902-205-1-B Rev. 0
Page 1 of 1



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

13 CUFT 50 Hz UNITS: R-404A 25.5 OZ. (723g) ±1/2 OZ (14g)
13 CUFT 60 Hz UNITS: R-404A 26.5 OZ. (751g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

LOW TEMPERATURE STAGE REFRIGERANT:

13 CUFT 50 Hz UNITS: R-290 0.9 OZ. (25.5g) MAX, ; VAC TO 8 PSIG
R-508B 10.8 OZ (306g) ± 1/4 OZ.(7g) OR
8 PSIG TO 129 PSIG ± 3 PSIG

13 CUFT 60 Hz UNITS: R-290 1.0 OZ. (28.3g) MAX, ; VAC TO 11 PSIG
R-508B 12.7 OZ (360g) ± 1/4 OZ.(7g) OR
11 PSIG TO 158 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
11	41795	12-13-17	KMB	TFI	KMB	ADDED GP & GPD MODELS IN 'COMMON TO' DETAILS
10	40483	10-27-17	KMB	TFI	KMB	8PSIG WAS 8', 11 PSIG WAS 11' & UPDATED 'COMMON TO' DETAILS
9	FR-2861	04-07-16	KB	SAG	DRP	ADDED MODEL CAR 24086D
8	FR-2673	06-04-14	MAM	KDG	DRP	CHG'D. 214006 OIL SEP. TO 214023
7	FR-2586	12-13-13	AJC	SAG	DRP	CHANGED LOW STAGE REFRIGERANT
6	FR-2480	05-14-13	AJC	KDG	DRP	DISCONTINUED MODEL 943
5	FR-2398	01-24-13	AJC	KDG	DRP	DISCONTINUED MODEL 996
4	FR-2409	09-21-12	AJC	KDG	DRP	ADDED NEW MODELS NUMBERS
3	FR-2400	10-23-12	AJC	KDG	DRP	ADD HS SEP. 214006 & CHG. REFRIG.BY 2.5OZ.
2	FR-2400	08-20-12	AJC	KDG	DRP	HS COMP.203055,54 TO 203058,57- REL8
1	FR-2267	12/02/11	JWE	SAG	DRP	COMPRESSOR CHANGE, RELEASE 7
0	FR-2202	05/12/11	SRS	SAG	DRP	RELEASED FOR PRODUCTION/RELEASE 6

1. COMMON TO:
902, 991, EXF24086V, HFU240BV, IU1386V, TSE240V, VWR24086V 13 CU. FT. FREEZERS (50Hz, 230V)
909, 986, CAR24086D, EXF21686D, EXF24086D, HFU240BD, IU1386D, TSE240D, VWR24086D, 909GP, EXF24086GPD
TSE240GPD, 986GP 13 CU. FT. FREEZERS (60Hz, 230V)

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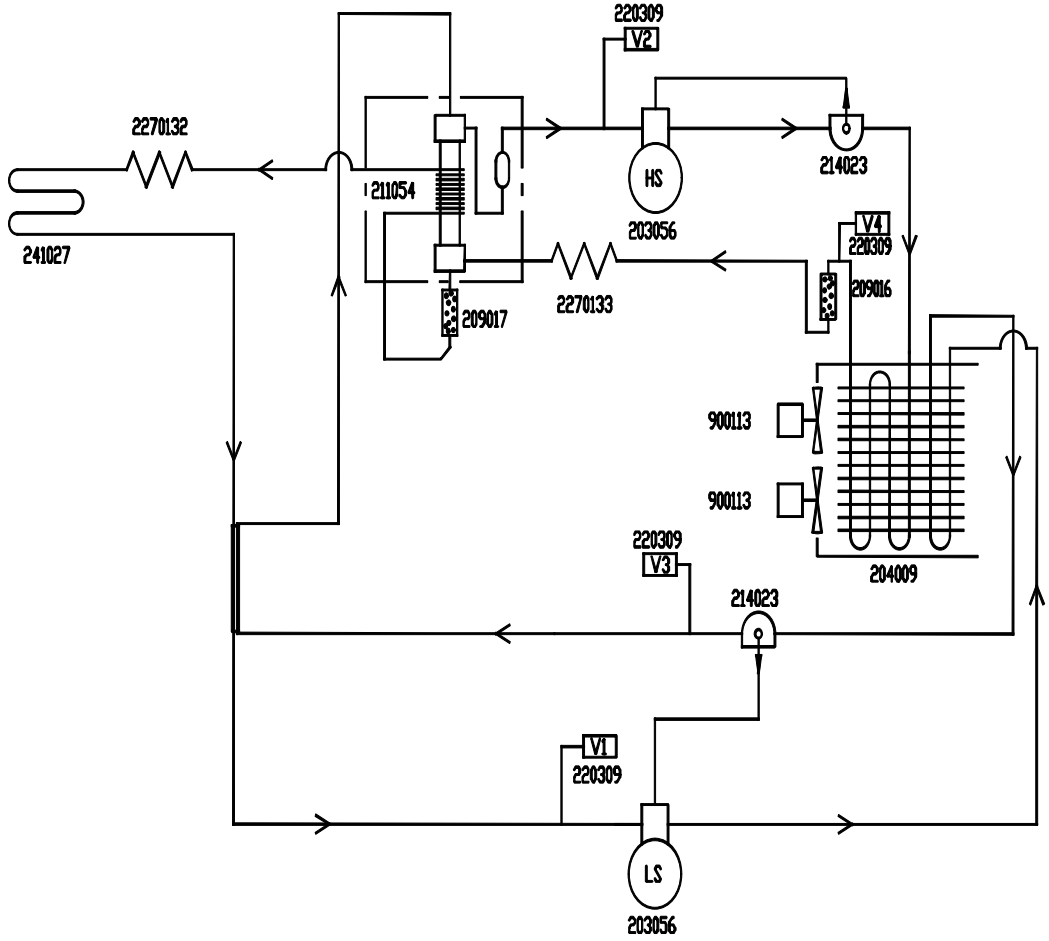
BOX 649, MARIETTA, OHIO 45750

DATE 05-12-11	DWN SAG	CAD SAG	APPD DRP	SCALE NONE
CUSTOMER				
JOB TITLE -86°C 13 CU. FT. UPRIGHT FREEZERS (230 V)				
DWG TITLE REFRIGERATION SCHEMATIC				
LOCATION	JOB NUMBER	DRAWING NUMBER 902-90-0-B		

CASCADE REFRIGERATION



HIGH TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-404A 25.5 OZ. (723g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

LOW TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-290 0.8 OZ. (22.7g) MAX, ; VAC TO 8 PSIG
R-508B 10.0 OZ (283.5g) ± 1/4 OZ.(7g) DR
8" TO 128 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

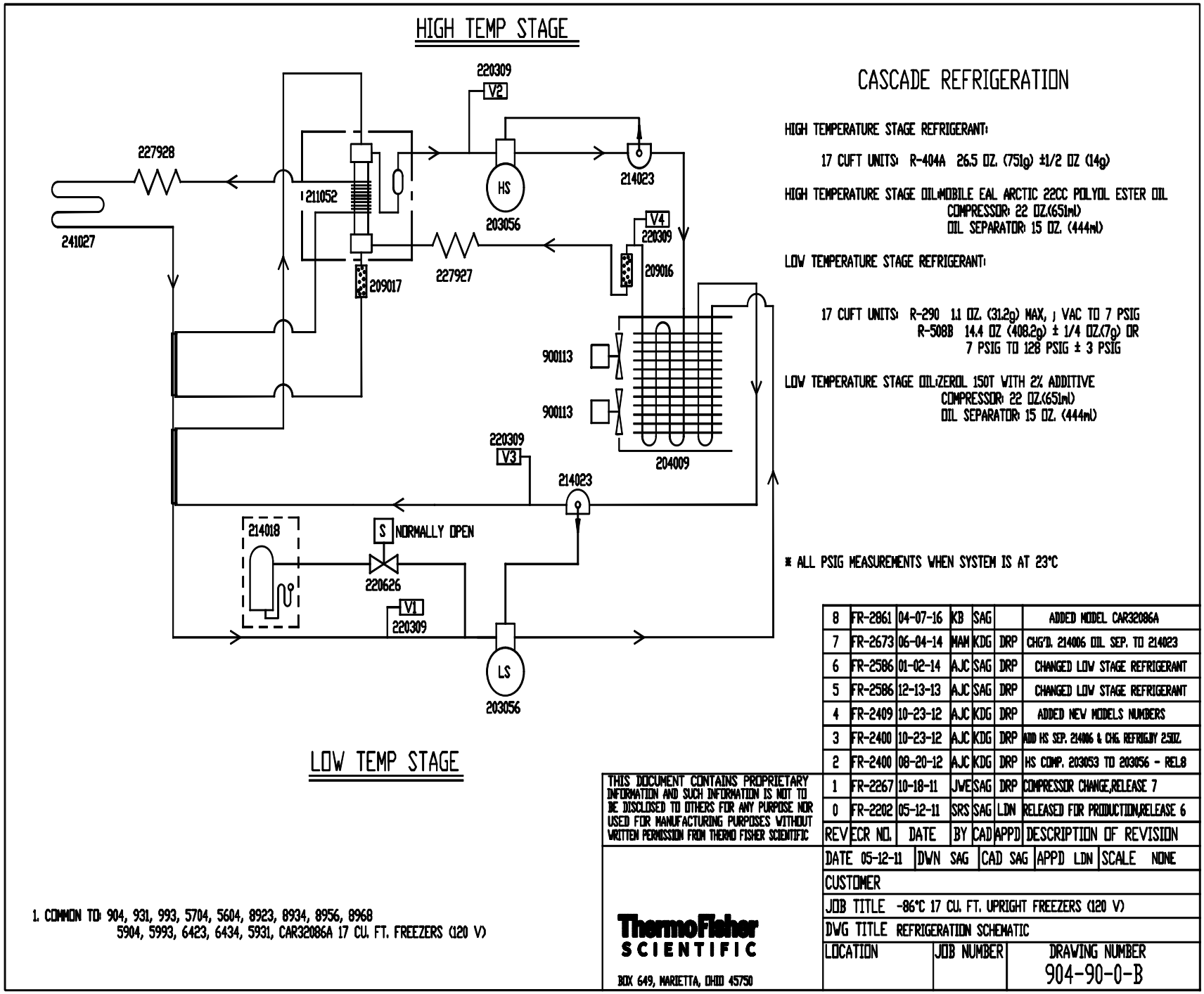
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

1. COMMON TO: 903, 930, 992, 5703, 5603, 8922, 8933, 8955, 8967
5903, 5992, 6422, 6433, 5930, CAR24086A 13 CU. FT. FREEZERS (120 V)

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
7	FR-2861	04-07-16	KB	SAG		ADDED MODEL CAR24086A
6	FR-2673	06-04-14	MAM	KDG	DRP	CHG'D. 214006 OIL SEP. TO 214023
5	FR-2586	12-13-13	AJC	SAG	DRP	CHANGED LOW STAGE REFRIGERANT
4	FR-2409	10-23-12	AJC	KDG	DRP	ADDED NEW MODELS NUMBERS
3	FR-2400	10-23-12	AJC	KDG	DRP	ADD HS SEP. 214006 & CHG. REFRIGNT 250Z.
2	FR-2400	08-20-12	AJC	KDG	DRP	HS COMP.203053 TO 203056 - REL8
1	FR-2267	12/02/11	JWE	SAG	DRP	COMPRESSOR CHANGE, RELEASE 7
0	FR-2202	05-12-11	SRS	SAG	DRP	RELEASED FOR PRODUCTION/RELEASE 6

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

DATE 05-12-11	DWN SAG	CAD SAG	APPD
SCALE NONE			
CUSTOMER			
JOB TITLE -86°C 13 CU. FT. UPRIGHT FREEZERS (120 V)			
DWG TITLE REFRIGERATION SCHEMATIC			
LOCATION	JOB NUMBER	DRAWING NUMBER 903-90-0-B	



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

17 CUFT UNITS: R-404A 26.5 OZ. (751g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

LOW TEMPERATURE STAGE REFRIGERANT:

17 CUFT UNITS: R-290 1.1 OZ. (31.2g) MAX, ; VAC TO 7 PSIG
R-508B 14.4 OZ (408.2g) ± 1/4 OZ.(7g) OR
7 PSIG TO 128 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

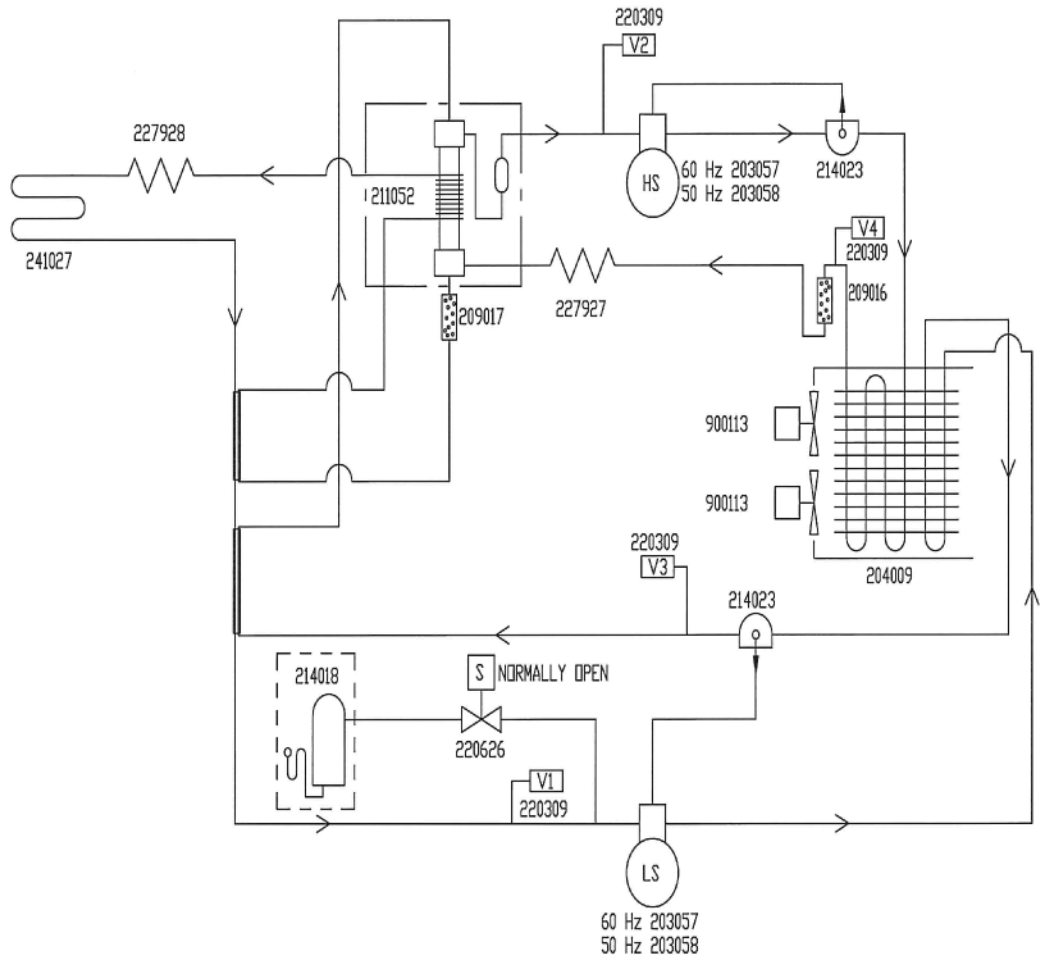
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
8	FR-2861	04-07-16	KB	SAG		ADDED MODEL CAR32086A
7	FR-2673	06-04-14	MAM	KDG	DRP	CHG'D. 214006 OIL SEP. TO 214023
6	FR-2586	01-02-14	AJC	SAG	DRP	CHANGED LOW STAGE REFRIGERANT
5	FR-2586	12-13-13	AJC	SAG	DRP	CHANGED LOW STAGE REFRIGERANT
4	FR-2409	10-23-12	AJC	KDG	DRP	ADDED NEW MODELS NUMBERS
3	FR-2400	10-23-12	AJC	KDG	DRP	ADD HS SEP. 214006 & CHG. REFRIGNT 250Z.
2	FR-2400	08-20-12	AJC	KDG	DRP	HS COMP. 203053 TO 203056 - REL.8
1	FR-2267	10-18-11	JWE	SAG	DRP	COMPRESSOR CHANGE,RELEASE 7
0	FR-2202	05-12-11	SRS	SAG	LDN	RELEASED FOR PRODUCTION,RELEASE 6

DATE 05-12-11	DWN SAG	CAD SAG	APPD LDN	SCALE NONE
CUSTOMER			
JOB TITLE -86°C 17 CU. FT. UPRIGHT FREEZERS (120 V)			
DWG TITLE REFRIGERATION SCHEMATIC			
LOCATION	JOB NUMBER	DRAWING NUMBER 904-90-0-B	

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

1. COMMON TO: 904, 931, 993, 5704, 5604, 8923, 8934, 8956, 8968
5904, 5993, 6423, 6434, 5931, CAR32086A 17 CU. FT. FREEZERS (120 V)



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

17 CUFT UNITS: R-404A 26.5 OZ. (751g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444 ml)

LOW TEMPERATURE STAGE REFRIGERANT:

17 CUFT 50 Hz UNITS: R-290 1.1 OZ. (31.2g) MAX, ; VAC TO 6 PSIG
R-508B 13.7 OZ (388.4g) ± 1/4 OZ.(7g) OR
6 PSIG TO 123 PSIG ± 3 PSIG

17 CUFT 60 Hz UNITS: R-290 1.1 OZ. (31.2g) MAX, ; VAC TO 7 PSIG
R-508B 14.5 OZ (411g) ± 1/4 OZ.(7g) OR
7 PSIG TO 128 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

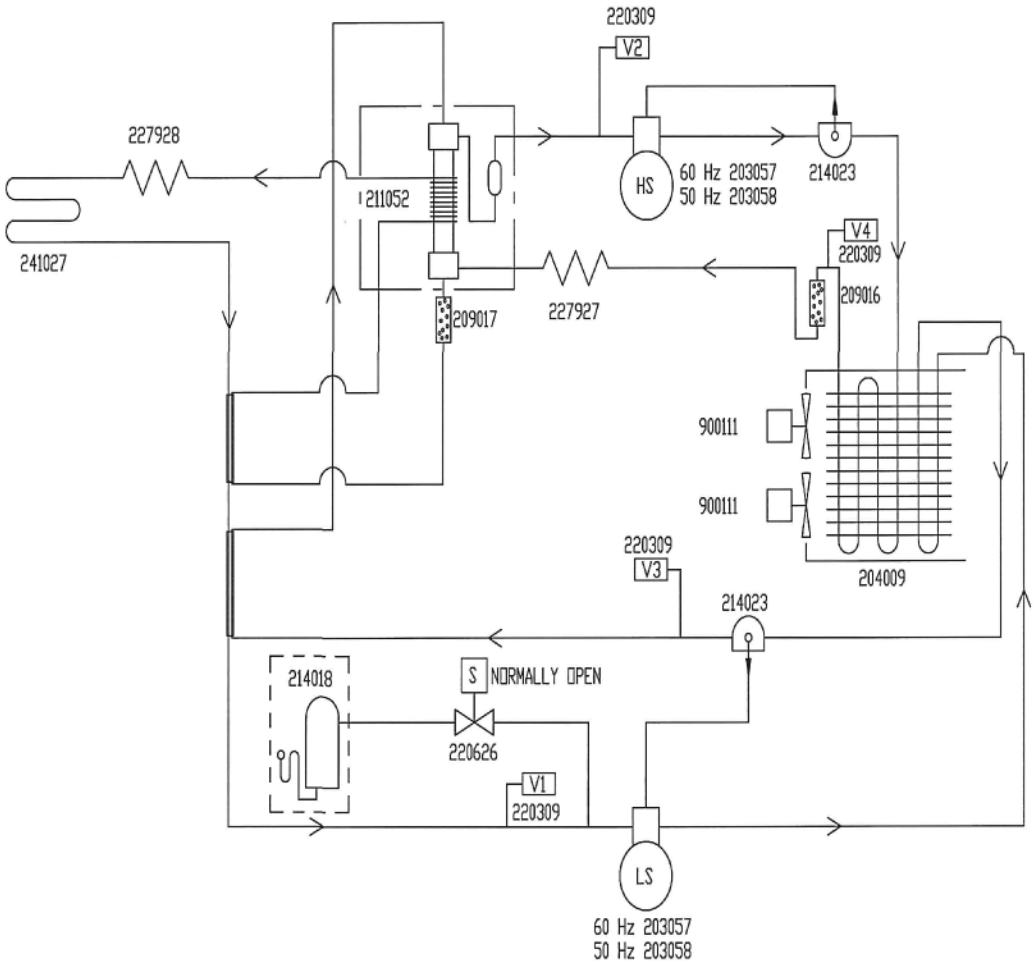
* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
12	41795	12-13-17	KMB	TFI	KMB	ADDED GP & GPD MODELS IN 'COMMON TO' DETAILS
11	40483	10-27-17	KMB	TFI	KMB	UPDATED 'COMMON TO' DETAILS
10	FR-2861	04-07-16	KB	SAG	DRP	ADDED MODEL CAR32086D
9	FR-2673	06-04-14	MAM	KDG	DRP	CHG'D. 214006 OIL SEP. TO 214023
8	FR-2586	12-13-13	AJC	SAG	DRP	CHANGED LOW STAGE REFRIGERANT
7	FR-2480	05-14-13	AJC	KDG	DRP	DISCONTINUED MODEL 945
6	FR-2398	01-24-13	AJC	KDG	DRP	DISCONTINUED MODEL 997
5	FR-2409	10-23-12	AJC	KDG	DRP	ADDED NEW MODEL NUMBERS
4	FR-2400	10-23-12	AJC	KDG	DRP	ADD HS SEP. 214006 & CHG. REFRIG.BY 2.5OZ.
3	FR-2400	08-20-12	AJC	KDG	DRP	HS COMP.203055,54 TO 203058,57- REL.8
2	FR-2267	01-23-12	JWE	SAG	DRP	CHANGED CHARGE, SEPERATED 50 Hz
1	FR-2267	10-18-11	JWE	SAG	DRP	COMPRESSOR CHANGE/RELEASE 7
0	FR-2202	05-12-11	SRS	SAG	LDN	RELEASED FOR PRODUCTION/RELEASE 6

1. COMMON TO: 905, 994, EXF32086V, HFU320BV, IU1786V, TSE320V, VWR32086V 17 CU. FT. FREEZERS (230 V / 50 Hz)
910, 988, CAR32086D, EXF28886D, EXF32086D, HFU320BD, IU1786D, TSE320D
VWR32086D, 910GP, EXF32086GPD, TSE320GPD, 988GP 17 CU. FT.FREEZERS (230 V / 60 Hz)

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

DATE 05-12-11	DWN SAG	CAD SAG	APPD LDN	SCALE NONE
CUSTOMER				
JOB TITLE -86°C 17 CU. FT. UPRIGHT FREEZERS (230 V)				
DWG TITLE REFRIGERATION SCHEMATIC				
LOCATION	JOB NUMBER	DRAWING NUMBER 905-90-0-B		



CASCADE REFRIGERATION

HIGH TEMP. STAGE REFRIGERANT: R-404A, 26.5 OZ. (751g) ±1/2 OZ. (14g)

HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

LOW TEMP. STAGE REFRIGERANT:

23 CUFT 50 Hz UNITS: R-290 1.2 OZ. (34g) MAX. ; VAC TO 6 PSIG
R-508B 15.0 OZ. (425.3g) ± 1/4 OZ. (7g)
OR 6 PSIG TO 126 PSIG ± 3 PSIG

23 CUFT 60 Hz UNITS: R-290 1.2 OZ. (34g) MAX. ; VAC TO 8 PSIG
R-508B 15.6 OZ. (442.3g) ± 1/4 OZ. (7g)
OR 8 PSIG TO 131 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
12	41795	12-13-17	KMB	TFI	KmB	ADDED GP & GPD MODELS IN 'COMMON TO' DETAILS
11	40483	10-27-17	KMB	TFI	KmB	UPDATED 'COMMON TO' DETAILS
10	FR-2861	04-07-16	KB	SAG	DRP	ADDED MODEL CAR40086D
9	FR-2673	06-04-14	MAM	KDG	DRP	CHG'D. 214006 OIL SEP. TO 214023
8	FR-2586	12-13-13	AJC	SAG	DRP	CHANGED LOW STAGE REFRIGERANT
7	FR-2480	05-14-13	AJC	KDG	DRP	DICONTINUED MODEL 946
6	FR-2398	01-24-13	AJC	KDG	DRP	DICONTINUED MODEL 998
5	FR-2409	09-21-12	AJC	KDG	DRP	ADDED NEW MODELS NUMBERS
4	FR-2400	10-23-12	AJC	KDG	DRP	ADD HS SEP. 214006 & CHG. REFRIG.BY 2.5OZ.
3	FR-2400	08-20-12	AJC	KDG	DRP	HS COMP.203055,54 TO 203058,57- REL.8
2	FR-2267	01-24-12	JWE	SAG	DRP	CHANGED CHARGE, SEPERATED 50 Hz
1	FR-2267	10-18-11	JWE	SAG	DRP	COMPRESSOR CHANGE/RELEASE 7
0	FR-2202	05-12-11	SRS	SAG	LDN	RELEASED FOR PRODUCTION/RELEASE 6

1. COMMON TO: 957, 989, CAR40086D, EXF36086D, EXF40086D, HFU400BD, IU2386D, TSE400D
VWR40086D, 957GP, EXF40086GPD, TSE400GPD, 989GP 23 CUFT. FREEZERS (230 V / 60 Hz)
906, 995, EXF40086V, HFU400BV, IU2386V, TSE400V, VWR40086V 23 CUFT. FREEZERS (230 V / 50 Hz)

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

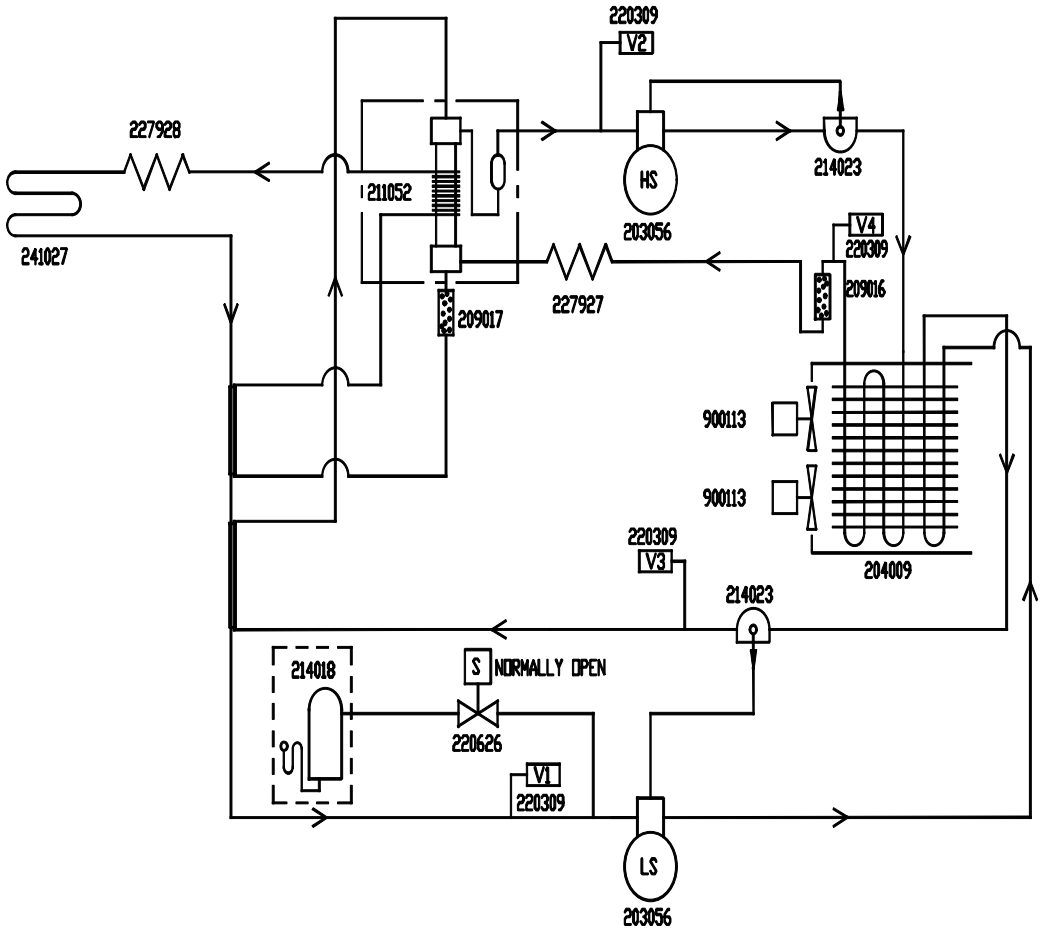
DATE 05-12-11	DWN SAG	CAD SAG	APPD LDN	SCALE NONE
CUSTOMER				
JOB TITLE -86°C 23 CU. FT. UPRIGHT FREEZERS (230 V)				
DWG TITLE REFRIGERATION SCHEMATIC				
LOCATION	JOB NUMBER	DRAWING NUMBER 906-90-0-B		

13	41795	12-13-17	KMB	TF1	[illegible]		ADDED GP & GPD MODELS IN "COMMON TO" DETAILS
12	40483	10-27-17	KMB	TF1	[illegible]		230 OZ WAS 235 OZ, 5 PSIG WAS 2 PSIG & UPDATED "COMMON TO DETAILS"
11	FR-2861	04-07-16	KB	SAG	DRP		ADDED MODEL CAR60086D
10	FR-2673	06-04-14	MAW	KDG	DRP		CHGD. 214006 OIL SEP. TO 214023
9	FR-2586	12-18-13	AJC	SAG	DRP		5 PSIG WAS 2, 113 WAS 114
8	FR-2586	12-12-13	AJC	SAG	DRP		CHG. LOW STG. REFRIG. FOR 28CF. 60 Hz
7	FR-2409	10-23-12	AJC	KDG	DRP		ADDED NEW MODELS NUMBERS
6	FR-2400	10-23-12	AJC	KDG	DRP		ADD HS SEP. 214006 & CHG REFRIGER 25OZ.
5	FR-2400	08-20-12	AJC	KDG	DRP		HAS COMP.203055,54 TO 200656,57- REL8
4	FR-2399	08-20-12	AJC	KDG	DRP		R-290 50HZ. 08 TO 11 & 60HZ. 1 TO 12 OZ.
3	FR-2267	2-02-12	JWE	KDG	DRP		28 50Hz OIL FROM 24 OZ. TO 21 OZ.
2	FR-2267	01-24-12	JWE	SAG	DRP		CHANGED CHARGE
REVISION NO.		DATE	BY	CAD	APPD		DESCRIPTION OF REVISION
DATE 05-13-11		DWN SAG		CAD SAG	APPD DRP		SCALE NONE
CUSTOMER							
JOB TITLE -86°C 28 CU. FT. UPRIGHT FREEZERS (230 V)							
DWG TITLE REFRIGERATION SCHEMATIC							
LOCATION		JOB NUMBER					DRAWING NUMBER
							907-90-0-B

ThermoFisher SCIENTIFIC

3101 649, MARIETTA, OHIO 45750

1. COMMON TO: 907, EXF60086V, HFU600BV, IU2886V, TSE600V, VWR60086V 28 CU. FT. FREEZERS (50 Hz)
908, CAR60086D, EXF60086D, HFU600BD, IU2886D, TSE600D, VWR60086D, 908GP, EXF60086GPD
TSE600GPD 28 CU. FT. FREEZERS (60 Hz)



REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	FR-2202	05-13-11	SRS	SAG	LDN	RELEASED FOR PRODUCTION/RELEASE 6
1	FR-2267	10-18-11	JVE	SAG	DRP	COMPRESSOR CHANGE/RELEASE 7
2	FR-2400	08-20-12	AJC	KDG	DRP	HS COMP. 203053 TO 203056 - REL.8
3	FR-2400	10-23-12	AJC	KDG	DRP	ADD HS SEP. 214006 & CHG. REFRIGJBY 2.5OZ.
4	FR-2409	09-20-12	AJC	KDG	DRP	ADDED NEW MODELS NUMBERS
5	FR-2586	12-12-13	AJC	SAG	DRP	CHG. LOW STAGE REFRIGERANT
6	FR-2673	06-04-14	MAM	KDG	DRP	CHANGE 2140006 OIL SEP. TO 214023
7	FR-2861	04-07-16	KB	SAG		ADDED MODEL CAR40086A

CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

23 CUFT UNITS: R-404A 26.5 OZ. (751g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

LOW TEMPERATURE STAGE REFRIGERANT:

23 CUFT UNITS: R-290 1.1 OZ. (31.2g) MAX, ; VAC TO 7 PSIG
R-508B 14.6 OZ (414g) ± 1/4 OZ.(7g) OR
7 PSIG TO 124 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 22 OZ.(651ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

1. COMMON TO: 932, 956, 990, 5656, 5756, 8928, 8939, 8964, 8973
5956, 5990, 6428, 6439, 5932, CAR40086A 23 CU. FT. FREEZERS (120 V)

MODEL/PART NAME: -86° 23 CU. FT. UP-RIGHT FREEZERS (120 VOLT)

DWG TITLE: REFRIGERATION SCHEMATIC

DWN: SAG	CAD: SAG	APPD: LDN	DATE: 05-13-11	SCALE: NONE

MATERIAL: N/A

PAINT COLOR: N/A

TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=±
.XXX=±

DRAWING NUMBER: 956-90-0

SIZE: B

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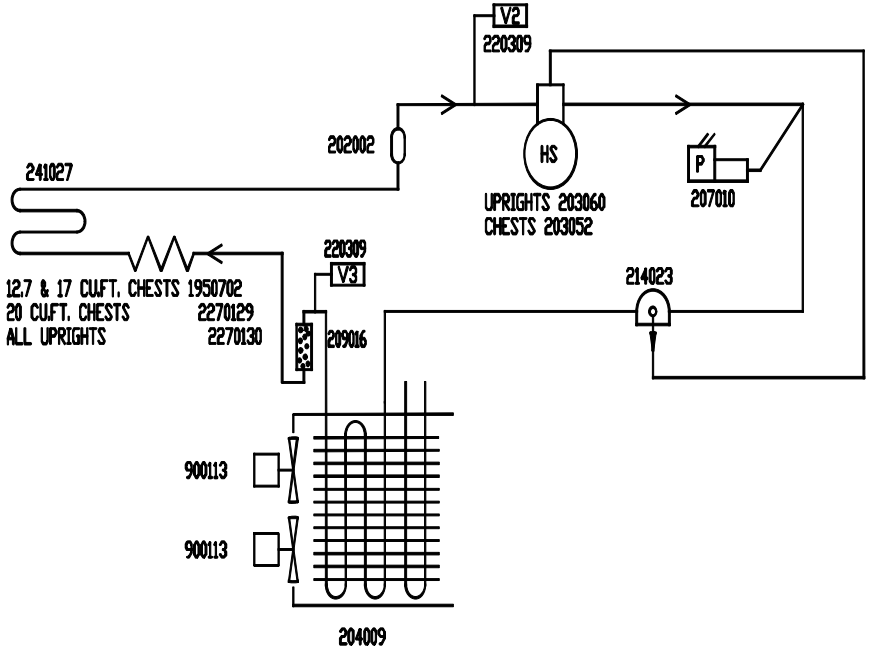
BOX 649, MARIETTA, OHIO 45750

HIGH TEMP STAGE



REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

UPRIGHTS
13.0 CU.FT. UNITS: R-404A 18.5 OZ. (525gr) ±1/2 OZ (14gr)
17.0 CU.FT. UNITS: R-404A 22 OZ. (624gr) ±1/2 OZ (14gr)
23.0 CU.FT. UNITS: R-404A 22 OZ. (624gr) ±1/2 OZ (14gr)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 40 OZ.(1183ml)
CHESTS
12.7 CU.FT. UNITS: R-404A 19 OZ. (538gr) ±1/2 OZ (14gr)
17.0 CU.FT. UNITS: R-404A 21 OZ. (595gr) ±1/2 OZ (14gr)
20.0 CU.FT. UNITS: R-404A 23 OZ. (652gr) ±1/2 OZ (14gr)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR: 40 OZ.(1183ml)
OIL SEPARATOR: 15 OZ.(444ml)

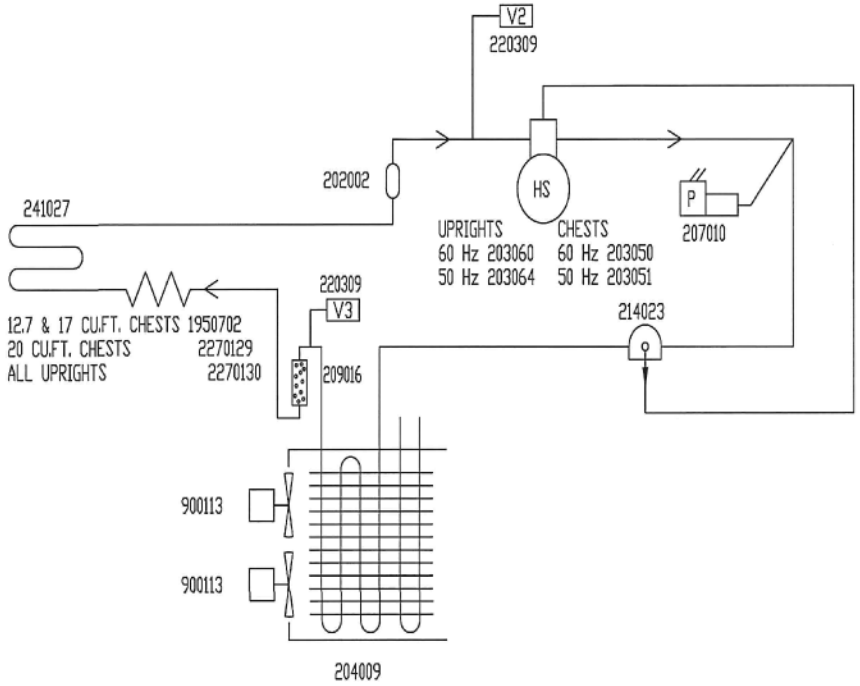
REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
10	FR-2761	01-14-15	AJC	SAG		CHG. 13 UPRIGHT 21 TO 18.5 CHARGE
9	FR-2761	01-07-15	AJC	SAG	DRP	CHANGED UPRIGHT CHARGES
8	FR-2694	07-10-14	AJC	KDG	DRP	SPECIFIED OIL SEP. 15 OZ. OF OIL
7	FR-2673	06-04-14	MAH	KDG	DRP	CHG'D. 214006 OIL SEP. TO 214023
6	FR-2499	07-30-13	AJC	SAG	DRP	U.R. COMP. FROM 203056 TO 203060
5	FR-2400	08-20-12	AJC	KDG	DRP	U.R. COMP.203053 TO 203056-REL.8
4	FR-2267	2/03/12	JWE	KDG	DRP	UPRIGHT OIL FROM 24 OZ. TO 22 OZ.
3	FR-2267	01/16/12	JWE	SAG	DRP	CHEST OIL FROM 24 OZ. TO 40 OZ.
2	FR-2267	11/07/11	JWE	SAG	DRP	COMPRESSOR CHANGE/RELEASE 7
1	FR-2202	08/02/11	AJC	SAG	DRP	ADDED CAP TUBE 2270120
0	FR-2202	05/09/11	SRS	SAG	DRP	RELEASED FOR PRODUCTION/RELEASE 6

1. COMMON TO: 5722, 8800, 8813, 8824, 8838 13.0 CU.FT. UPRIGHT FREEZERS (120 V)
5728, 8804, 8817, 8828, 8842 17.0 CU.FT. UPRIGHT FREEZERS (120 V)
8809, 8821, 8832, 8848 23 CU.FT. UPRIGHT FREEZERS (120 V)
5315, 8728, 8756, 8779 12.7 CU.FT CHEST FREEZER (120V)
5318, 8730, 8757, 8780 17.0 CU.FT CHEST FREEZER (120V)
5321, 8737, 8762, 8785 20.0 CU.FT CHEST FREEZER (120V)

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

DATE 05/09/11	DWN SAG	CAD SAG	APPD DRP	SCALE NONE
CUSTOMER			
JOB TITLE -40°C ULTRA-LOW TEMPERATURE FREEZERS, 120V			
DWG TITLE REFRIGERATION SCHEMATIC			
LOCATION FREEZERS	JOB NUMBER	DRAWING NUMBER 8800-90-0-B	

HIGH TEMP STAGE



REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

50 AND 60 Hz UPRIGHTS
13.0 CU.FT. UNITS: R-404A 21 OZ. (595gr) ±1/2 OZ (14gr)
17.0 CU.FT. UNITS: R-404A 22 OZ. (624gr) ±1/2 OZ (14gr)
23.0 CU.FT. UNITS: R-404A 22 OZ. (624gr) ±1/2 OZ (14gr)

HIGH TEMPERATURE STAGE OIL:MOBIL EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 40 OZ.(1183ml)
OIL SEPARATOR, 15 OZ.(444 ml)

CHESTS
12.7 CU.FT. UNITS: R-404A 19 OZ. (538gr) ±1/2 OZ (14gr)
17.0 CU.FT. UNITS: R-404A 21 OZ. (595gr) ±1/2 OZ (14gr)
20.0 CU.FT. UNITS: R-404A 23 OZ. (652gr) ±1/2 OZ (14gr)

HIGH TEMPERATURE STAGE OIL:MOBIL EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR: 40 OZ.(1183ml)
OIL SEPARATOR: 15 OZ.(444ml)

1. COMMON TO:

7240, DXF24040, HFU40240BD, TSD40240, VWR24040, 7240V, DXF24040V, HFU40240BV, TSD40240V, VWR24040V, 7240GPD, DXF24040GPD, TSD40240GPD 13.0 CU.FT. UPRIGHT FREEZERS (230 V)

7320, DXF32040, HFU40320BD, TSD40320, VWR32040, 7320V, DXF32040V, HFU40320BV, TSD40320V, VWR32040V, 7320GPD, DXF32040GPD, TSD40320GPD 17.0 CU.FT. UPRIGHT FREEZERS (230 V)

7400, DXF40040, HFU40400BD, TSD40400, 7400V, DXF40040V, HFU40400BV, TSD40400V, 7400GPD, DXF40040GPD, TSD40400GPD 23.0 CU.FT. UPRIGHT FREEZERS (230 V)

713CD, HFC1350TD, TSC1350D, ULT1350-10-D, 713CV, HFC1350TV, TSC1350V, ULT1350-10-V, 713CGPD, TSC1350GPD, ULT1350-10-GPD 12.7 CU.FT CHEST FREEZER (230V)

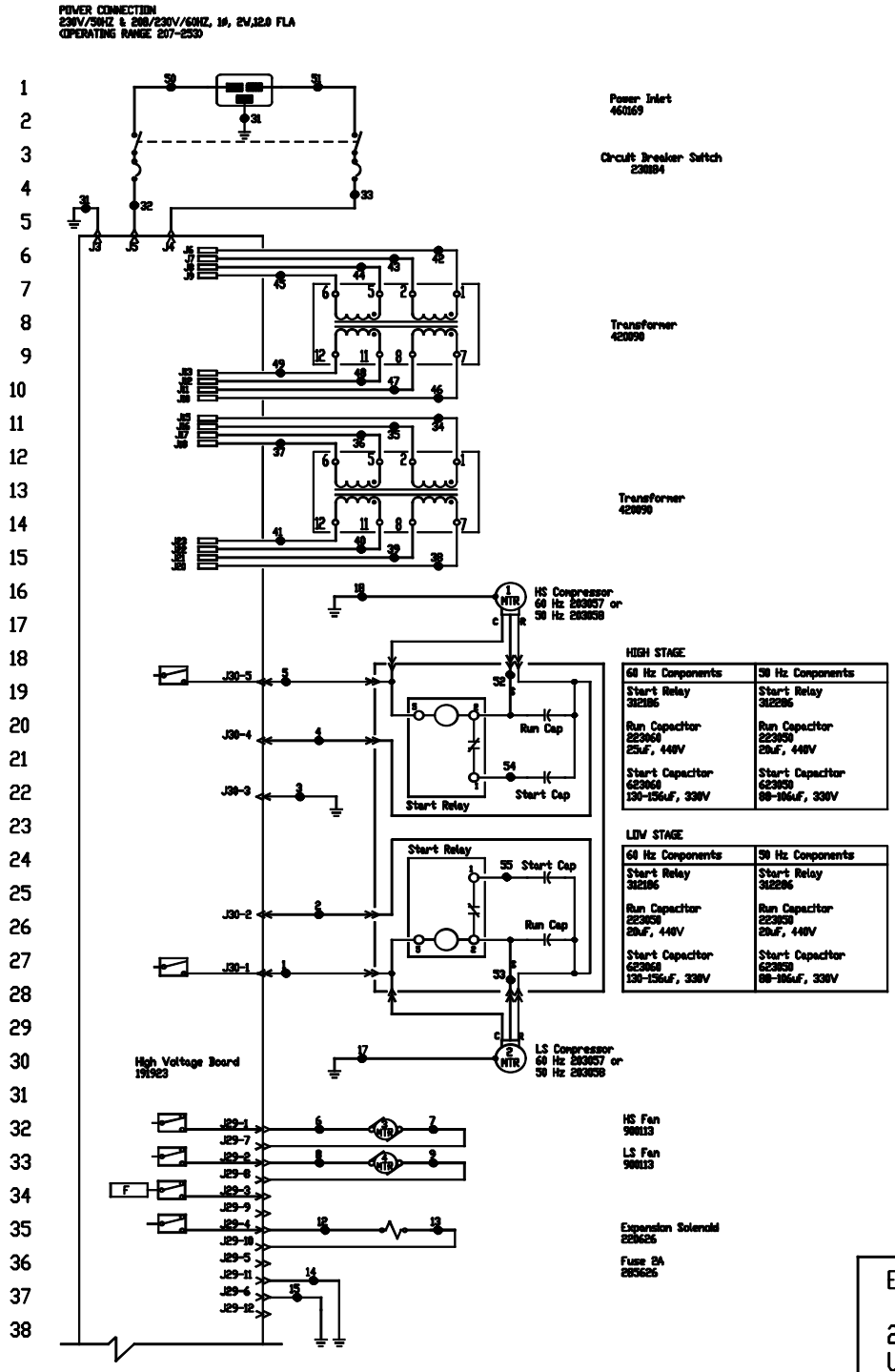
717CD, HFC1750TD, TSC1750D, ULT1750-10-D, 717CV, HFC1750TV, TSC1750V, ULT1750-10-V, 717CGPD, TSC1750GPD, ULT1750-10-GPD 17.0 CU.FT CHEST FREEZER (230V)

720CD, HFC2050TD, TSC2050D, ULT2050-10-D, 720CV, HFC2050TV, TSC2050V, ULT2050-10-V, 720CGPD, TSC2050GPD, ULT2050-10-GPD 20.0 CU.FT CHEST FREEZER (230V)

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
11	41795	12-13-17	KMB	TFI	[illegible]	ADDED GPD MODELS IN "COMMON TO" DETAILS
10	40483	10-27-17	KMB	TFI	[illegible]	ADDED OIL SEPERATOR NOTE AND UPDATED "COMMON TO" DETAILS
9	FR-2761	01-07-15	AJC	SAG	DRP	CHANGED CHARGE,ADDED 5713 & 5726
8	FR-2694	07-10-14	AJC	KDG	DRP	SPECIFIED OIL SEP. 15 OZ. OF OIL
7	FR-2673	06-04-14	MAM	KDG	DRP	CHG'D. 214006 OIL SEP. TO 214023
6	FR-2499	07-30-13	AJC	SAG	DRP	CHANGED U.R. COMPRESSORS & CHARGE
5	FR-2400	08-20-12	AJC	KDG	DRP	UR COMP 203054,55 TO 203057,58-REL.8
4	FR-2267	2/02/12	JWE	KDG	DRP	UPRIGHT OIL FROM 24 OZ. TO 22 OZ.
3	FR-2267	01/16/12	JWE	SAG	DRP	CHEST OIL FROM 24 OZ. TO 40 OZ.
2	FR-2267	11/07/11	JWE	SAG	DRP	COMPRESSOR CHANGE/RELEASE 7
1	FR-2202	08/02/11	AJC	SAG	DRP	ADDED CAP TUBE 2270120
0	FR-2202	05/09/11	SRS	SAG	LDN	RELEASED FOR PRODUCTION/RELEASE 6

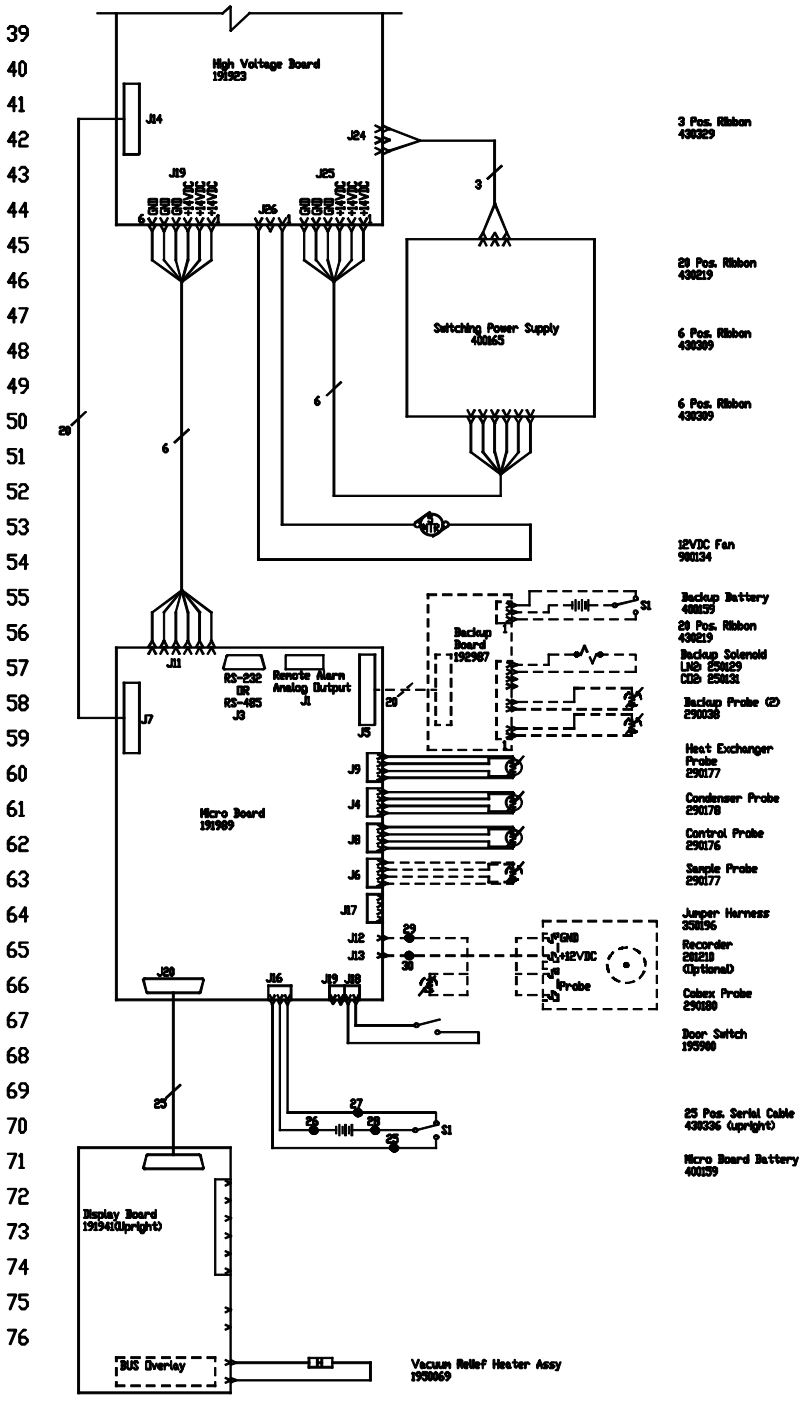
ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

DATE 05/09/11	DWN SAG	CAD SAG	APPD LDN	SCALE NONE
CUSTOMER				
JOB TITLE -40°C ULTRA-LOW TEMPERATURE FREEZERS, 230V				
DWG TITLE REFRIGERATION SCHEMATIC				
LOCATION FREEZERS	JOB NUMBER	DRAWING NUMBER 8801-90-0-B		



Electrical Schematic
Model:
230V, 50 & 60Hz, -86°C
ULT Upright Freezers

5602-70-2-0 REV 3
Page 1 of 3



Electrical Schematic
Model:
230V, 50 & 60Hz, -86°C
ULT Upright Freezers

5602-70-2-0 REV 3
Page 2 of 3

WIRE #	COLOR	GAUGE
1	BLK	14
2	RED	14
3	GRN/YEL	14
4	RED	14
5	BLK	14
6	BLK	18
7	BLK	18
8	BLK	18
9	BLK	18
10	-	-
11	-	-
12	BLK	18
13	BLK	18
14	GRN/YEL	18
15	GRN/YEL	18
16	-	-
17	GRN/YEL	14
18	GRN/YEL	14
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	WHT	18
26	BLK	18
27	BLK	18
28	RED	18

WIRE #	COLOR	GAUGE
29	BLK	22
30	RED	22
31	GRN/YEL	14
32	BLK	14
33	BLU	14
34	BLK	14
35	BLU	14
36	BLK	14
37	BLU	14
38	BLK	14
39	BLU	14
40	BLK	14
41	BLU	14
42	BLK	14
43	BLU	14
44	BLK	14
45	BLU	14
46	BLK	14
47	BLU	14
48	BLK	14
49	BLU	14
50	BLK	14
51	BLU	14
52	YEL/WHT	14
53	YEL	14
54	BLU/WHT	14
55	BLU	14

UPRIGHT MODELS:
13 CU.FT. (230V) - VWR24086D, VWR24086V
17 CU.FT. (230V) - VWR32086D, VWR32086V
23 CU.FT. (230V) - VWR40086D, VWR40086SSD, VWR40086V
28 CU.FT. (230V) - VWR60086D, VWR60086V

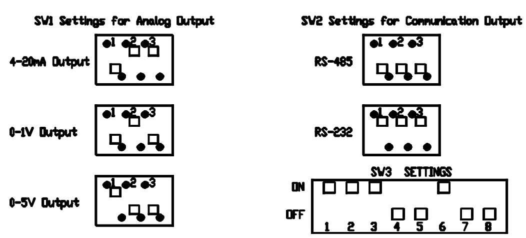
REMOTE CONTACTS/ANALOG OUTPUT	
PIN# 1	Analog Output +
PIN# 2	Analog Output -
PIN# 3	Not Connected
PIN# 4	Not Connected
PIN# 5	Normally Closed
PIN# 6	Common.
PIN# 7	Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

RS-232 SPECIFICATION

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

RS-232 PORT	
PIN# 2	TXD
PIN# 3	RXD
PIN# 5	GND



1. Expansion solenoid on 17, 23 & 28 cuft models only.
2. Door switches shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and acessories shown in dashed lines.

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	41795	12-13-17	KMB	TFI		UPDATED 'UPRIGHT MODELS' DETAILS
2	FR-3006	08-14-17	KB	KDG	KMB	191987 BACKUP BOARD TO 192987
1	FR-2855	03-07-16	KMB	SAG	DRP	312106 VAS 523060, 312206 VAS 523050
0	FR-2753	12-15-14	MW	KDG	DRP	RELEASED FOR PRODUCTION / RELEASE 11

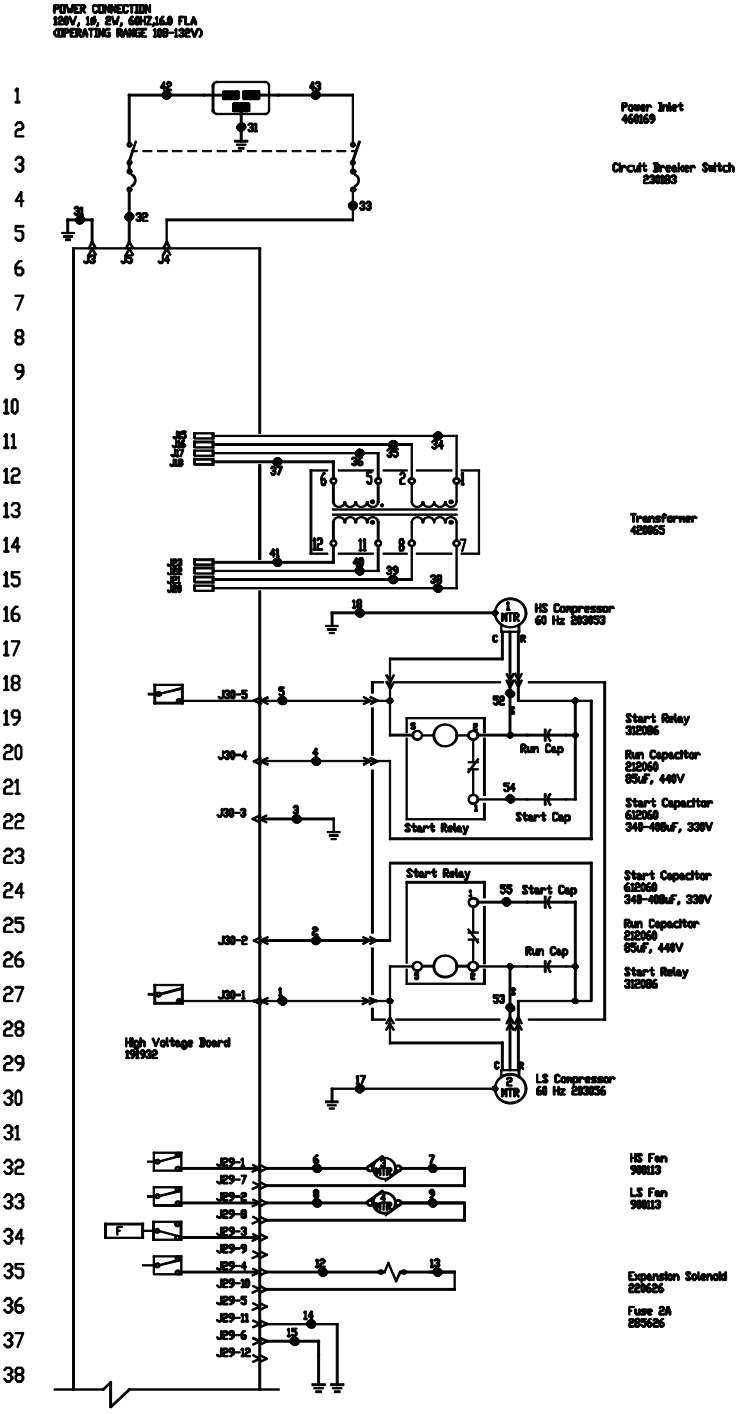
ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

MODEL/PART NAME: ULT -86C UPRIGHT FREEZERS, 230V, 50 & 60Hz
DWG TITLE: UNIT SCHEMATIC
DWN: MW | CAD: KDG | APPD: | DATE: 12-10-14 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 5602-70-1
SIZE D

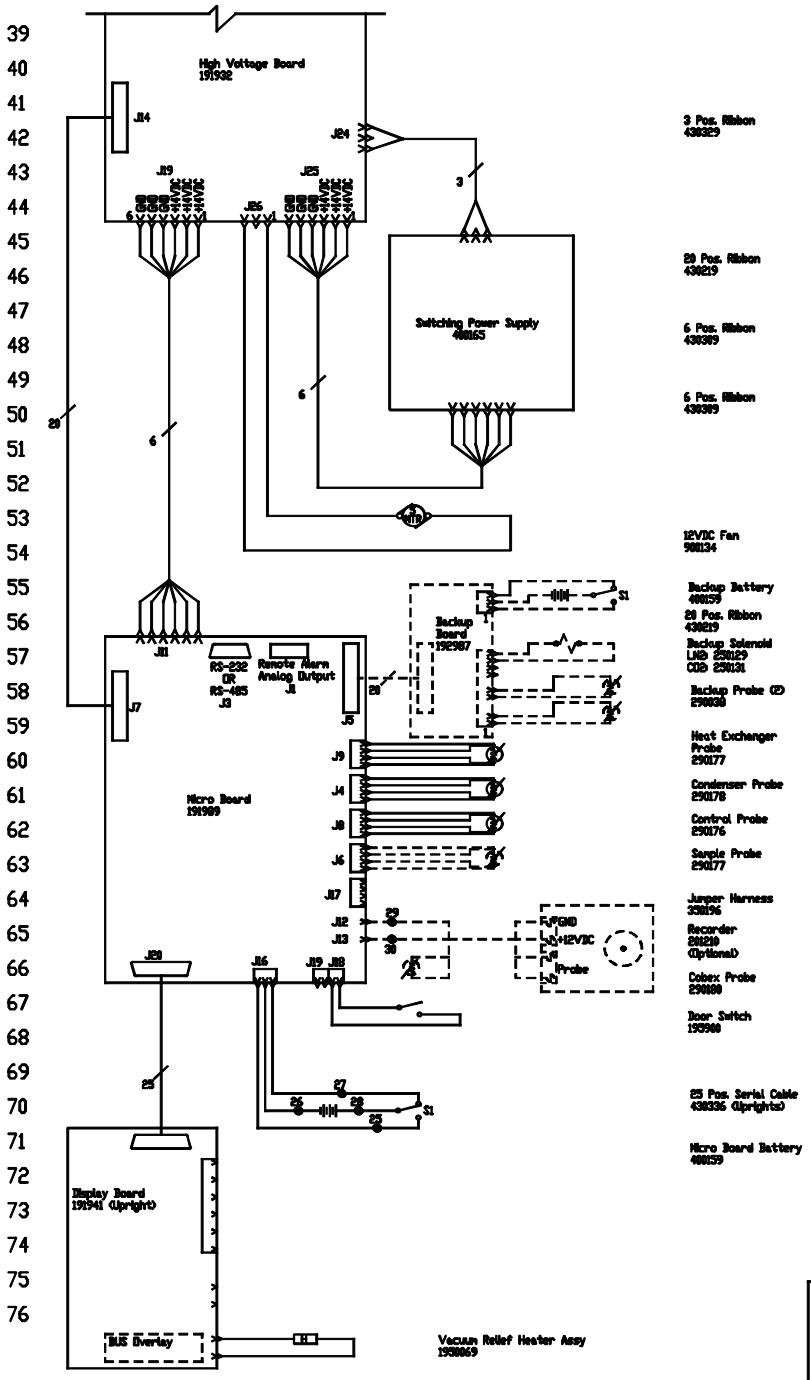
Electrical Schematic
Model:
230V, 50 & 60Hz, -86°C
ULT Upright Freezers

5602-70-1-0 REV 3
Page 3 of 3



Electrical Schematic
Model:
120V, 60Hz, -86°C
ULT Upright Freezers

5603-70-1-0 REV 3
Page 1 of 3



Electrical Schematic
Model:
120V, 60Hz, -86°C
ULT Upright Freezers

5603-70-1-0 REV 3
Page 2 of 3

WIRE #	COLOR	GAUGE	WIRE #	COLOR	GAUGE
1	BLK	14	29	BLK	22
2	RED	14	30	RED	22
3	GRN/YEL	14	31	GRN/YEL	14
4	RED	14	32	BLK	14
5	BLK	14	33	BLU	14
6	BLK	18	34	BLK	14
7	BLK	18	35	BLU	14
8	BLK	18	36	BLK	14
9	BLK	18	37	BLU	14
10	-	-	38	BLK	14
11	-	-	39	BLU	14
12	BLK	18	40	BLK	14
13	BLK	18	41	BLU	14
14	GRN/YEL	18	42	BLK	14
15	GRN/YEL	18	43	BLU	14
16	-	-	44	-	-
17	GRN/YEL	14	45	-	-
18	GRN/YEL	14	46	-	-
19	-	-	47	-	-
20	-	-	48	-	-
21	-	-	49	-	-
22	-	-	50	-	-
23	-	-	51	-	-
24	-	-	52	YEL/WHT	14
25	WHT	18	53	YEL	14
26	BLK	18	54	BLU/WHT	14
27	BLK	18	55	BLU	14
28	RED	18			

UPRIGHT MODELS:
13 CU.FT. (120V) - VWR24086A
17 CU.FT. (120V) - VWR32086A
23 CU.FT. (120V) - VWR40086A

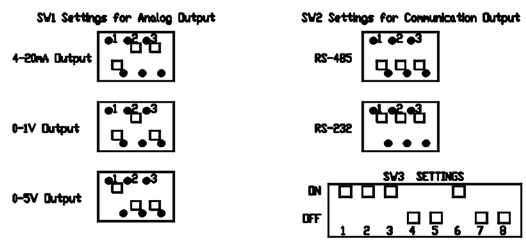
RS-232 SPECIFICATION

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

REMOTE CONTACTS/ANALOG OUTPUT	
PIN# 1	Analog Output +
PIN# 2	Analog Output -
PIN# 3	Not Connected
PIN# 4	Not Connected
PIN# 5	Normally Closed
PIN# 6	Common.
PIN# 7	Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

RS-232 PORT	
PIN# 2	TXD
PIN# 3	RXD
PIN# 5	GND



1. Expansion solenoid on 17 & 23 cuft uprights only.
2. Door switches shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and acessories shown in dashed lines.

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	41795	12-13-17	KMB	TFI		UPDATED 'UPRIGHT MODELS' DETAILS
2	FR-3006	08-14-17	KB	KDG	KMB	191987 BACKUP BOARD TO 192987
1	FR-2846	03-07-16	KB	SAG	DRP	312086 WAS 312060
0	FR-2753	12-15-14	MV	KDG	DRP	RELEASED FOR PRODUCTION / RELEASE 11

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

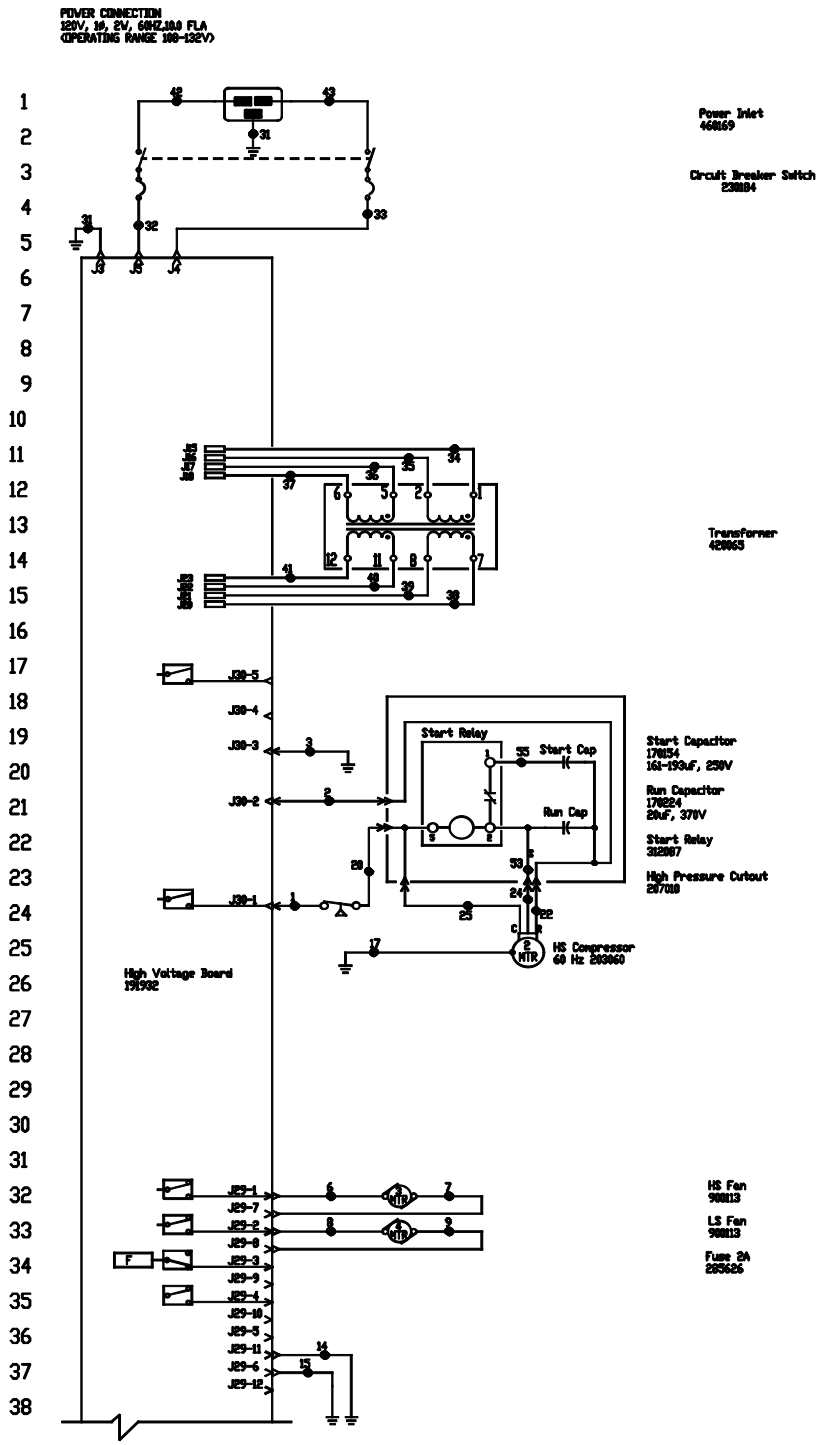
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSES WITHOUT WRITTEN PERMISSION FROM THERMO FISHER SCIENTIFIC

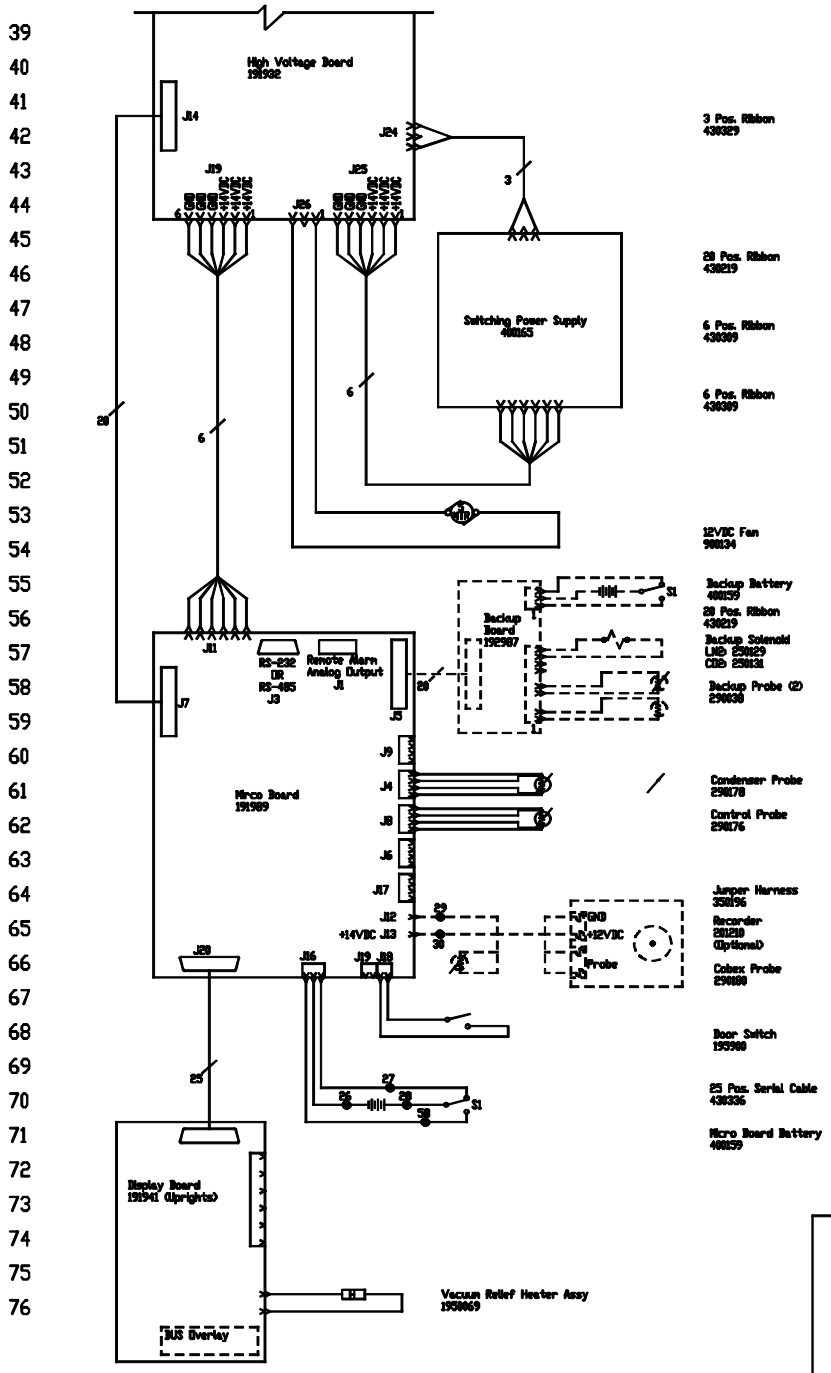
ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

MODEL/PART NAME: ULT -86C UPRIGHT FREEZERS, 120V, 60Hz
DWG TITLE: UNIT SCHEMATIC
DWN: MV | CAD: KDG | APPD: | DATE: 12-10-14 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 5603-70-1
SIZE D

Electrical Schematic
Model:
120V, 60Hz, -86°C
ULT Upright Freezers

5603-70-1-0 REV 3
Page 3 of 3


POWER CONNECTION
120V, 1Ø, 2W, 60HZ,10.0 FLA
(OPERATING RANGE 108-132V)
Power Inlet
468169
Circuit Breaker Switch
238184
Transformer
429865
Start Relay
Start Cap
Start Capacitor
170154
161-193uF, 250V
Run Cap
Run Capacitor
170224
20uF, 370V
Start Relay
352967
High Pressure Cutout
207018
HS Compressor
60 Hz 203060
High Voltage Board
191992
HS Fan
900113
LS Fan
900113
Fuse 2A
285626
Electrical Schematic
Model:
120V, 60Hz, -40°C
ULT Upright Freezers
5722-70-1-0 REV 4
Page 1 of 3



Electrical Schematic
Model:
120V, 60Hz, -40°C
ULT Upright Freezers

5722-70-1-0 REV 4
Page 2 of 3

WIRE #	COLOR	GAUGE
1	BLK	14
2	RED	14
3	GRN/YEL	14
4		
5		
6	BLK	18
7	BLK	18
8	BLK	18
9	BLK	18
10		
11		
12		
13		
14	GRN/YEL	18
15	GRN/YEL	18
16		
17	GRN/YEL	14
18		
19		
20	BLK	14
21		
22		
23		
24	YEL	14
25	BLK	14
26	BLK	18
27	BLK	18
28	RED	18

WIRE #	COLOR	GAUGE
29	BLK	22
30	RED	22
31	GRN/YEL	14
32	BLK	14
33	BLU	14
34	BLK	14
35	BLU	14
36	BLK	14
37	BLU	14
38	BLK	14
39	BLU	14
40	BLK	14
41	BLU	14
42	BLK	14
43	BLU	14
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-
50	-	-
51	-	-
52	-	-
53	YEL	14
54	-	-
55	BLU	14
56	-	-
57	-	-
58	WHT	18

MODELS:

13 CU.FT. (120V) - VWR24040A
17 CU.FT. (120V) - VWR32040A

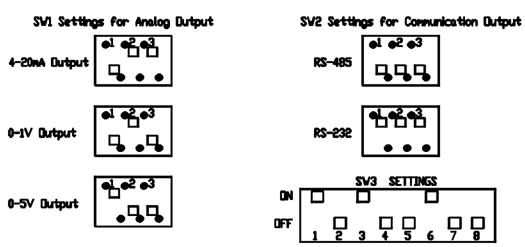
RS-232 SPECIFICATION

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

REMOTE CONTACTS/ANALOG OUTPUT	
PIN# 1	Analog Output +
PIN# 2	Analog Output -
PIN# 3	Not Connected
PIN# 4	Not Connected
PIN# 5	Normally Closed
PIN# 6	Common
PIN# 7	Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

RS-232 PORT	
PIN# 2	TXD
PIN# 3	RXD
PIN# 5	GND



1. Schematic represents single models.
2. Door switches shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and accessories shown in dashed lines.

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
4	41795	12-13-17	KNB	TFI		UPDATED "MODELS" DETAILS
3	FR-3006	08-14-17	KB	KDG	KNB	191987 BACKUP BOARD TO 192987
2	FR-2881	06-15-16	KNB	SAG	DRP	312087 WAS 300431
1	31856	01-27-15	GLS	SAG	DRP	WIRE 82 FROM BLU TO RED, AS BUILT CHG'S
0	FR-2753	12-15-14	NV	KDG	DRP	RELEASED FOR PROD / REL 11

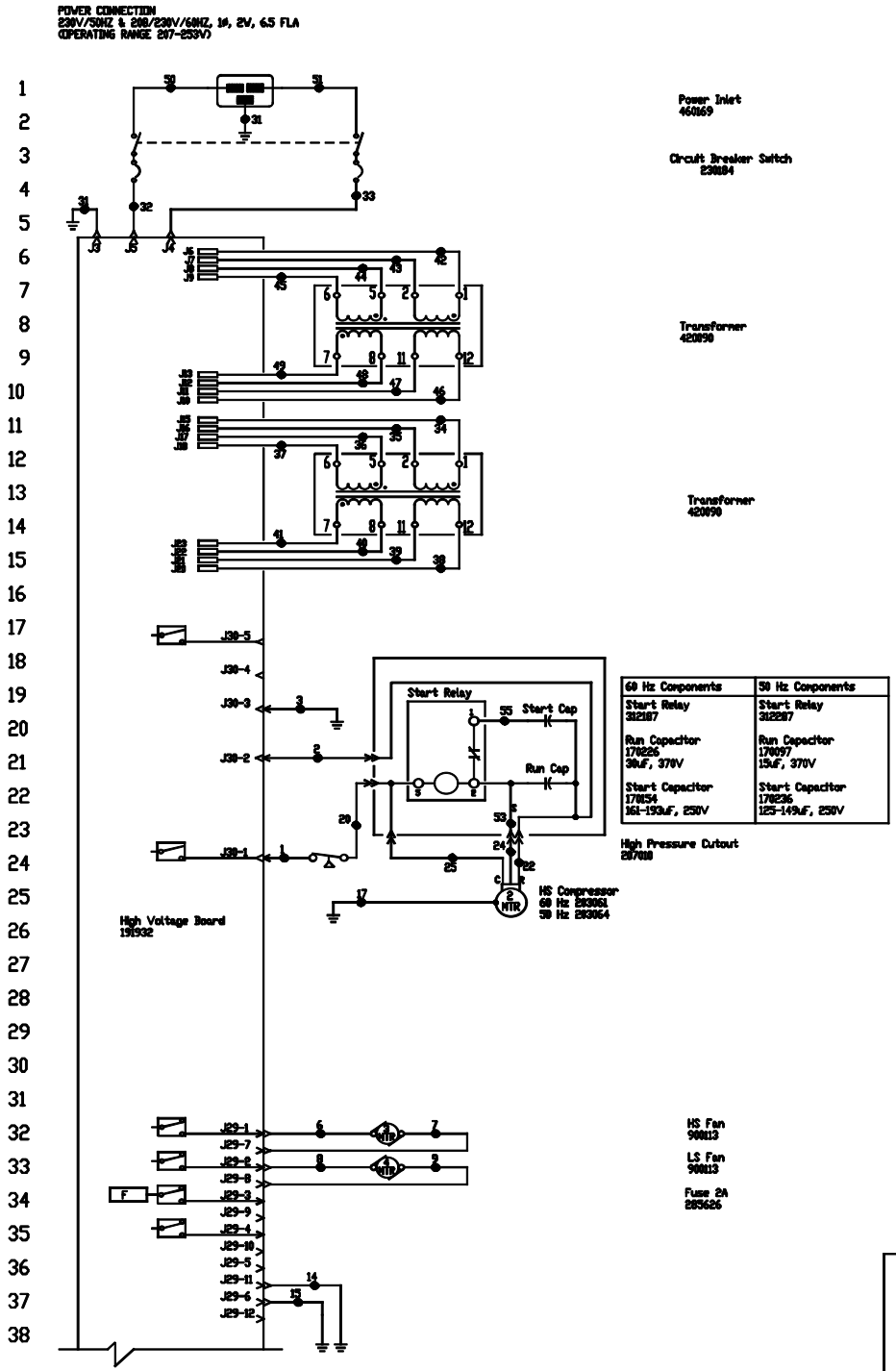
MODEL/PART NAME: HIGH-END, -40° UPRIGHT FREEZERS, 120V, 60Hz
DWG TITLE: UNIT SCHEMATIC
DWN: NV | CAD: KDG | APPD: | DATE: 12-10-14 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 5722-70-1 SIZE D

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

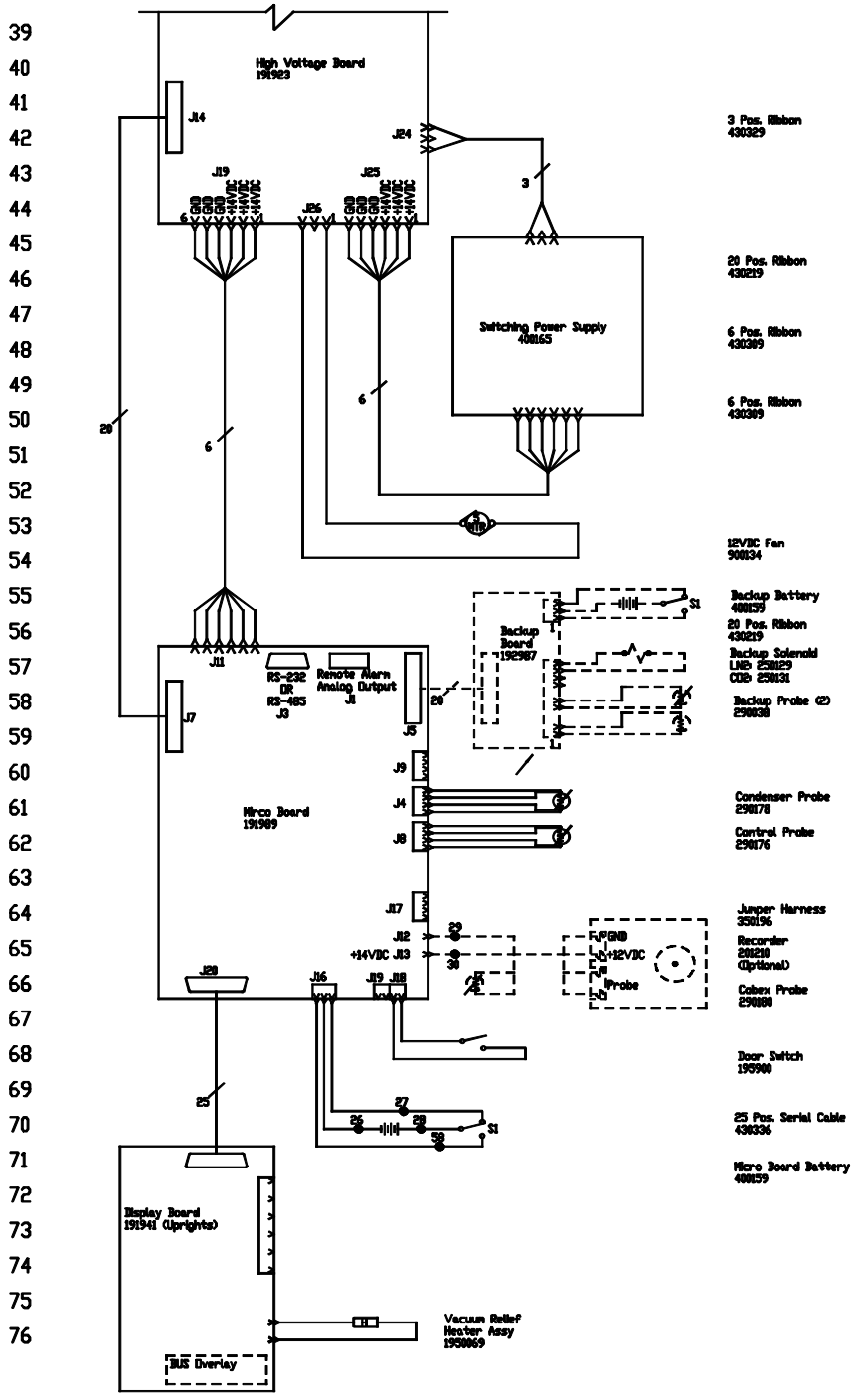
Electrical Schematic
Model:
120V, 60Hz, -40°C
ULT Upright Freezers

5722-70-1-0 REV 4
Page 3 of 3



Electrical Schematic
Model:
230V, 50 & 60Hz, -40°C
ULT Upright Freezers

5727-70-1-0 REV 5
Page 1 of 3



Electrical Schematic
Model:
230V, 50 & 60Hz, -40°C
ULT Upright Freezers

5727-70-1-0 REV 5
Page 2 of 3

WIRE #	COLOR	GAUGE
1	BLK	14
2	RED	14
3	GRN/YEL	14
4		
5		
6	BLK	18
7	BLK	18
8	BLK	18
9	BLK	18
10		
11		
12		
13		
14	GRN/YEL	18
15	GRN/YEL	18
16		
17	GRN/YEL	14
18		
19		
20	BLK	14
21		
22	RED	18
23		
24	YEL	14
25	BLK	14
26	BLK	18
27	BLK	18
28	RED	18

WIRE #	COLOR	GAUGE
29	BLK	22
30	RED	22
31	GRN/YEL	14
32	BLK	14
33	BLU	14
34	BLK	14
35	BLU	14
36	BLK	14
37	BLU	14
38	BLK	14
39	BLU	14
40	BLK	14
41	BLU	14
42	BLK	14
43	BLU	14
44	BLK	14
45	BLU	14
46	BLK	14
47	BLU	14
48	BLK	14
49	BLU	14
50	BLK	14
51	BLU	14
52	-	-
53	YEL	14
54	-	-
55	BLU	14
56	-	-
57	-	-
58	WHT	18

MODELS:

13 CU.FT. (230V) - VWR24040D, VWR24040V
17 CU.FT. (230V) - VWR32040D, VWR32040V

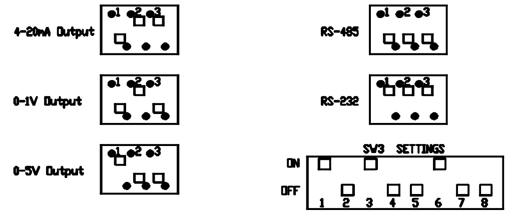
RS-232 SPECIFICATION

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

REMOTE CONTACTS/ANALOG OUTPUT	
PIN# 1	Analog Output +
PIN# 2	Analog Output -
PIN# 3	Not Connected
PIN# 4	Not Connected
PIN# 5	Normally Closed
PIN# 6	Common.
PIN# 7	Normally Open

CONTACT RATING: 1A @ 30V
CONTACTS IN ALARM STATE

RS-232 PORT	
PIN# 2	TXD
PIN# 3	RXD
PIN# 5	GND



1. Schematic represents upright models.
2. Door switch shown in open position.
3. Battery switch shown in the OFF position.
4. Circuit breaker switch shown in OFF position.
5. Options and acessories shown in dashed lines.

ATTENTION
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SENSITIVE DEVICES

ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
5	41795	12-13-17	KMB	TFI		UPDATED "MODELS" DETAILS
4	FR-3006	08-14-17	KB	KDG	KMB	191987 BACKUP BOARD TO 192987
3	FR-2881	06-15-16	KMB	SAG	DRP	312107 WAS 300432, 312287 WAS 300445
2	FR-2843	04-05-16	KB	SAG	DRP	230004 WAS 230078
1	31856	01-27-15	GLS	SAG	DRP	WIRE #2 FROM BLU TO RED,AS BLT CHPS
0	FR-2753	12-15-14	MV	KDG	DRP	RELEASED FOR PROD / REL 11

MODEL/PART NAME: HIGH-END,-40° UPRIGHT FREEZERS, 230V, 50 & 60 Hz
DWG TITLE: UNIT SCHEMATIC
DWN: MV | CAD: KDG | APPD: | DATE: 12-10-14 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 5727-70-1 SIZE D

Electrical Schematic
Model:
230V, 50 & 60Hz, -40°C
ULT Upright Freezers

5727-70-1-0 REV 5
Page 3 of 3

VWR FREEZER WARRANTY - USA

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 two years of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at VWR's expense, labor included. The VWR ULT Freezers include an additional three year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services 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.

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 two year warranty period. VWR 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. VWR shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local VWR 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 the Technical Services Office at 1-800-438-4851 (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.

Rev. 9 12/15

ISO 9001 REGISTERED

VWR FREEZER WARRANTY - INTERNATIONAL (EXCLUDING EUROPE)

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.

During the first two years of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at VWR's expense, labor excluded. The VWR ULT Freezers include an additional three year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services 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.

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 two year warranty period. VWR 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. VWR shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local VWR 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.

Outside the USA, for information or technical assistance, please contact contact your local VWR representative, or visit vwr.com for warranty information.

Rev. 9 12/15

ISO 9001 REGISTERED

VWR FREEZER WARRANTY - INTERNATIONAL (EUROPE ONLY)

VWR warrants that this product will be free from defects in material and workmanship for a period of two (2) years from date of delivery. If a defect is present, VWR will, at its option and cost, repair, replace, or refund the purchase price of this product to the customer, provided it is returned during the warranty period. The VWR ULT Freezers include an additional three year warranty on the compressors, parts only, F.O.B. factory.

Installation and calibration is not covered by this warranty agreement. This warranty does not apply if the product has been damaged by accident, abuse, misuse, or misapplication, or from ordinary wear and tear. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty. If the required maintenance and inspection services are not performed according to the manuals and any local regulations, such warranty turns invalid, except to the extent, the defect of the product is not due to such non performance.

Items being returned must be insured by the customer against possible damage or loss. This warranty shall be limited to the aforementioned remedies. IT IS EXPRESSLY AGREED THAT THIS WARRANTY WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY.

Rev. 9 12/15

ISO 9001 REGISTERED

Appendix A Handling Liquid Nitrogen

Warning Contact of liquid nitrogen or cold gas with the skin or eyes may cause serious freezing (frostbite) injury. ▲

Handle liquid nitrogen carefully.

The extremely low temperature can freeze human flesh very rapidly. When spilled on a surface the liquid tends to cover it completely and intimately, cooling a large area. The gas issuing from the liquid is also extremely cold. Delicate tissue, such as that of the eyes, can be damaged by an exposure to the cold gas which would be too brief to affect the skin of the hands or face.

Never allow any unprotected part of your body to touch objects cooled by liquid nitrogen.

Such objects may stick fast to the skin and tear the flesh when you attempt to free yourself. Use tongs to withdraw objects immersed in the liquid, and handle the object carefully.

Wear protective clothing.

Protect your eyes with a face shield or safety goggles (safety glasses without side shields do not give adequate protection). Always wear gloves when handling anything that is, or may have been, in immediate contact with liquid nitrogen. Insulated gloves are recommended, but heavy leather gloves may also be used. The gloves should fit loosely, so that they can be thrown off quickly if liquid should splash into them. When handling liquid in open containers, it is advisable to wear high-top shoes. Trousers (which should be cuffless if possible) should be worn outside the shoes.

Introduction

The safe handling and use of liquid nitrogen in cryogenic refrigerators and dewar flasks is largely a matter of knowing the potential hazards and using common-sense procedures based on that knowledge. There are two important properties of liquid nitrogen that present potential hazards:

1. It is extremely cold. At atmospheric pressure, liquid nitrogen boils at -320°F (-196°C).
2. Very small amounts of liquid vaporize into large amounts of gas. One liter of liquid nitrogen becomes 24.6 cu. ft. (700l) of gas.

The safety precautions in this booklet must be followed to avoid potential injury or damage which could result from these two characteristics. Do not attempt to handle liquid nitrogen until you read and fully understand the potential hazards, their consequences, and the related safety precautions. Keep this booklet handy for ready reference and review.

Note Argon is an inert gas whose physical properties are very similar to those of nitrogen. The precautions and safe practices for the handling and use of liquid argon are the same as those for liquid nitrogen. ▲

Use only containers designed for low temperature liquids.

Cryogenic containers are specifically designed and made of materials that can withstand the rapid changes and extreme temperature differences encountered in working with liquid nitrogen. Even these special containers should be filled SLOWLY to minimize the internal stresses that occur when any material is cooled. Excessive internal stresses can damage the container.

Do not cover or plug the entrance opening of any liquid nitrogen refrigerator or dewar. Do not use any stopper or other device that would interfere with venting of gas.

These cryogenic liquid containers are generally designed to operate with little or no internal pressure. Inadequate venting can result in excessive gas pressure which could damage or burst the container. Use only the loose-fitting necktube core supplied or one of the approved accessories for closing the necktube. Check the unit periodically to be sure that venting is not restricted by accumulated ice or frost.

Use proper transfer equipment.

Use a phase separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar or refrigerator. The top of the funnel should be partly covered to reduce splashing. Use only small, easily-handled dewars for pouring liquid. For the larger, heavier containers, use a cryogenic liquid withdrawal device to transfer liquid from one container to another. Be sure to follow instructions supplied with the withdrawal device. When liquid cylinders or other large storage containers are used for filling, follow the instructions supplied with those units and their accessories.

Introduction (continued)

Do not overfill containers.

Filling above the bottom of the necktube (or specified maximum level) can result in overflow and spillage of liquid when the necktube core or cover is placed in the opening.

Never use hollow rods or tubes as dipsticks.

When a warm tube is inserted into liquid nitrogen, liquid will spout from the top of the tube due to gasification and rapid expansion of liquid inside the tube.

Warning Nitrogen gas can cause suffocation without warning! ▲

Store and use liquid nitrogen only in a well-ventilated place.

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of nitrogen gas reduce the concentration of oxygen and can result in asphyxiation. Because nitrogen gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

Note The cloudy vapor that appears when liquid nitrogen is exposed to the air is condensed moisture; not the gas itself. The issuing gas is invisible.

Never dispose of liquid nitrogen in confined areas or places where others may enter.

Disposal of liquid nitrogen should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

Handling Liquid Carbon Dioxide

Warning High concentrations of CO_2 gas can cause asphyxiation! OSHA Standards specify that employee exposure to carbon dioxide in any eight-hour shift of a 40-hour work week shall not exceed the eight-hour time weighted average of 5000 PPM (0.5% CO_2). The short term exposure limit for 15 minutes or less is 30,000 PPM (3% CO_2). Carbon dioxide monitors are recommended for confined areas where concentrations of carbon dioxide gas can accumulate. ▲

Store and use liquid CO_2 only in a well-ventilated place.

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of CO_2 gas reduce the concentration of oxygen and can result in asphyxiation. Because CO2 gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

Note The cloudy vapor that appears when liquid CO_2 is exposed to the air is condensed moisture, not the gas itself. The issuing gas is invisible.

Never dispose of liquid CO_2 in confined areas or places where others may enter.

Disposal of liquid CO_2 should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

First Aid

If a person seems to become dizzy or loses consciousness while working with liquid nitrogen or carbon dioxide, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.

If exposed to liquid or cold gas, restore tissue to normal body temperature (98.6° F) as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 108° F. Under no circumstance should the water be over 112° F, nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke nor drink alcohol.

FIELD INSTALLED ACCESSORIES						
NA VWR #	**EU VWR #**	**DESCRIPTION**	**-86°C Upright Freezers**	**-40°C Upright Freezers**	**3 cu ft (85L) Chest Freezers**	**Other Chest Freezers**
10185-060	471-1144	CO2 BUS Kit VWR Collection Upright Freezers Field Installed Option	x	x	x	x
10185-062	471-1145	LN2 BUS Kit VWR Collection Upright Freezers Field Installed Option	x	x	x	x
10185-064	471-1146	Chart Recorder, Pen VWR Collection Upright Freezers *CI, Field Installed Option	x	x		
10185-072	471-1147	Chart Recorder, Pen VWR Collection Chest Freezers *CI, Field Installed Option			x	x
10185-068	471-1148	Chart Recorder, Inkless VWR Collection Upright Freezers *CI, Field Installed Option	x	x		
10185-076	471-1149	Chart Recorder, Inkless VWR Collection Chart Freezers *CI, Field Installed Option			x	x
10185-082	471-1150	S.S. Shelf Kit 13 Cu Ft ULT	x	x		
10185-084	471-1151	S.S. Shelf Kit 17.3 Cu Ft ULT	x	x		
10185-086	471-1152	S.S. Shelf Kit 23 Cu Ft ULT	x			
10185-088	471-1153	S.S. Shelf Kit 28 Cu Ft ULT	x			
89202-604	471-1154	Replacement Back-up Battery	x	x	x	x

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Simon László u. 4.
4034 Debrecen
Tel.: (52) 521-130
Email: info@hu.vwr.com

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Tel.: +91-80-41117125/26 (Bengaluru)
Tel.: +91-2522-647911/922 (Mumbai)
Email: vwr_india@vwr.com

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Northwest Business Park
Ballycoolin
Dublin 15
Tel.: 01 88 22 222
Email sales@ie.vwr.com

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Tel.: 020 4808 400
Email: info@nl.vwr.com

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Albany 0632, Auckland
Tel.: 0800 734 100
Email: sales@globalscience.co.nz

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Haavard Martinsens vei 30
0978 Oslo
Tel.: 02290
Email: info@no.vwr.com

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Tel.: 058 32 38 210
Email: labart@pl.vwr.com

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VWR International –
Material de Laboratório, Lda
Edifício Neopark
Av. Tomás Ribeiro, 43- 3 D
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Tel.: 21 3600 770
Email: info@pt.vwr.com

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Tel: +65 6505 0760
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