Forma -86C ULT Freezer

Model 900 Series

Operating and Maintenance Manual

7020902 Rev. 8

Thermo SCIENTIFIC

Models Covered

Model	Capacity (cubic feet)	Voltage
902	13	230
903	13	120
904	17	120
905	17	230
906	23	230
907	28	230
956	23	120
Double Door Units		
990	23	120
991	13	230
992	13	120
993	17	120
994	17	230
995	23	230

Packing List

Part Number	Description	Quantity
34040	Key Ring	1 (2 for double door units)
122005	Key	2 (4 for double door units)
380520	Neoprene Cap	2
510016	1/4-20 x 5-1/2" Bolt	2
402058	Vacu-Key	1
195763	Retaining Clip	1
370563	Remote Alarm Connector	1

MANUAL NUMBER 7020902

REV	ECR/ECN	DATE	DESCRIPTION	By
8	23939	5/29/07	Added note - adjust LN_2 tank pressure relief valve to 30 PSI maximum blow-off	ccs
--	24100	5/29/07	Clarified battery switch to Standby mode, with symbol	ccs
7	--	4/24/07	Corrected typo in Breaker Requirements of Specifications	ccs
6	23859/FR-1940	1/3/07	Clarified BUS install (probe/solenoid harness) instructions	ccs
5	23700/FR-1919	10/09/06	Updated safety temp specs (from 5° - 40°C to 5° - 43°C)	ccs
--	23390/SI-9595	10/09/06	Updated door switch to 195900 (8602-200-2r4)	ccs
4	23579/FR-1911	8/18/06	Corrected start capacitor part number on electrical schematic	ccs
3	23156	1/23/06	Updated 8656-90 schematic	aks
--	23170	1/23/06	Remote alarm connector is customer installed	aks
--	22930	1/23/06	WEEE directive and new format	aks
2	22895	8/15/05	Removed rotalok valves from compressors	aks
1	22676	5/26/05	Changed control panel alarm indicators	aks
--	22562	4/26/05	Alarms within 5C of set point	aks
--	22518	2/3/05	Changed battery bracket assembly	aks
0	FR-1789	11/24/04	Release 3 vacuum relief port	aks

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. ▲

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Table of Contents

Section 1 Installation and Start-up . . . . . 1 - 1

Freezer Components . . . . . 1 - 1
Control Panel Keys, Displays, Indicators . . . . . 1 - 4
Operation of the Keypad . . . . . 1 - 5
Install Freezer . . . . . 1 - 5
Choose Location . . . . . 1 - 5
Install Wall Bumpers . . . . . 1 - 6
Install Shelves . . . . . 1 - 6
Remote Alarm Contacts . . . . . 1 - 6
Attach Power Cord . . . . . 1 - 7
Connect Unit to Electrical Power . . . . . 1 - 7
Freezer Start-Up . . . . . 1 - 8
Set Operating Temperature . . . . . 1 - 8
Set High Temperature Alarm . . . . . 1 - 9
Set Low Temperature Alarm . . . . . 1 - 9
Run Mode . . . . . 1 - 10

Section 2 Calibrate . . . . . 2 - 1

Calibrate Mode . . . . . 2 - 1
Calibrate Control Probe . . . . . 2 - 1

Section 3 Alarms . . . . . 3 - 1

Alarms . . . . . 3 - 1
Wrong Power Alarm . . . . . 3 - 1
High Stage System Failure . . . . . 3 - 2
Probe Failure Alarm . . . . . 3 - 2
Voltage Compensation Alarm . . . . . 3 - 2

Section 4 Maintenance . . . . . 4 - 1

Clean Cabinet Exterior . . . . . 4 - 1
Clean Air Filter . . . . . 4 - 1
Clean Condenser . . . . . 4 - 1
Clean Water-cooled Condenser . . . . . 4 - 2
Defrost Chamber . . . . . 4 - 2
Clean Door Gasket . . . . . 4 - 3
Vacuum Relief Port . . . . . 4 - 3
Replace Battery(s) . . . . . 4 - 5
Prepare Unit for Storage . . . . . 4 - 6
Preventive Maintenance . . . . . 4 - 7

Section 5 Factory Options . . . . . 5 - 1
BUS (Back Up System) . . . . . 5 - 1
Install Vent Stack, Solenoid and Injection Assembly . . . . . 5 - 1
Install Temperature Probe . . . . . 5 - 4
Connect Probe/Solenoid Harness . . . . . 5 - 5
BUS Control Panel . . . . . 5 - 6
Configure Optional BUS . . . . . 5 - 7
Set Optional BUS Set Point . . . . . 5 - 7
Clean Vent Stack . . . . . 5 - 8
Disconnect Fitting Assembly, Transfer Hose . . . . . 5 - 8
Chart Recorder . . . . . 5 - 8
Install Chart Paper . . . . . 5 - 8
Recorder Calibration . . . . . 5 - 9
Datalogger . . . . . 5 - 10
Water-Cooled Condenser . . . . . 5 - 10
Five Inner Door Option . . . . . 5 - 10

Section 6 Specifications . . . . . 6 - 1

Section 7 Spare Parts . . . . . 7 - 1

Section 8 Refrigeration Schematics . . . . . 8 - 1

Section 9 Electrical Schematics . . . . . 9 - 1

Section 10 Warranty . . . . . 10 - 1

Appendix A Handling Liquid Nitrogen . . . . . A - 1

Appendix B Handling Liquid CO_2 . . . . . B - 1

Appendix C First Aid . . . . . C - 1

Section 1 Installation and Start-up

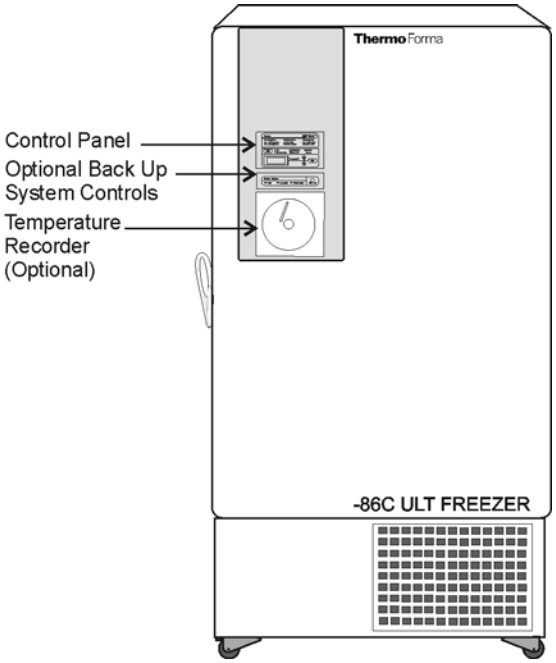


Figure 1-1. Freezer Front View Components

- Control panel - keypad, displays and indicators
- BUS (Optional Back Up System) control panel
- Optional temperature recorder or datalogger

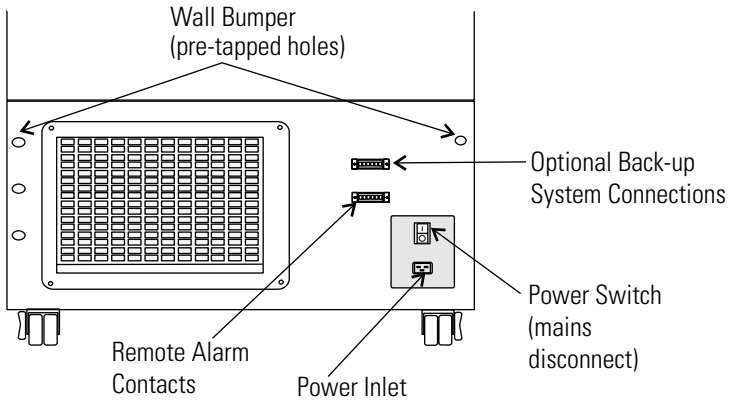


Figure 1-2. Freezer Rear View Components

- Remote alarm contacts
- Power inlet for power cord connection
- Optional BUS connections for probe and solenoid
- Power switch (mains disconnect)

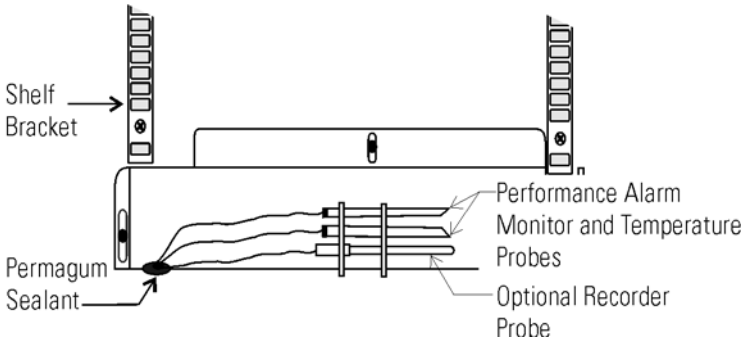


Figure 1-3. Chamber Probe(s)

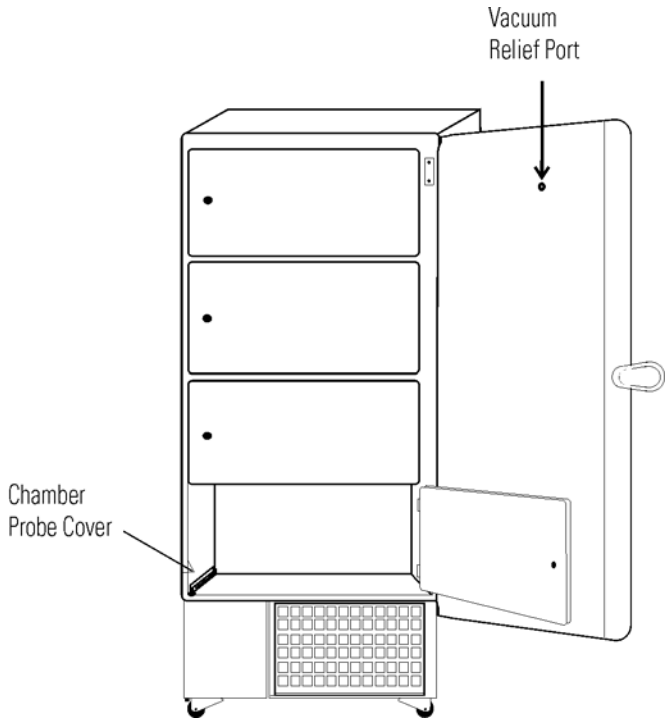


Figure 1-4. Vacuum Relief and Probe Cover Location

- Vacuum relief port - pressure equalization port
- Probe cover - houses control, optional recorder, datalogger, or 1535 alarm probes

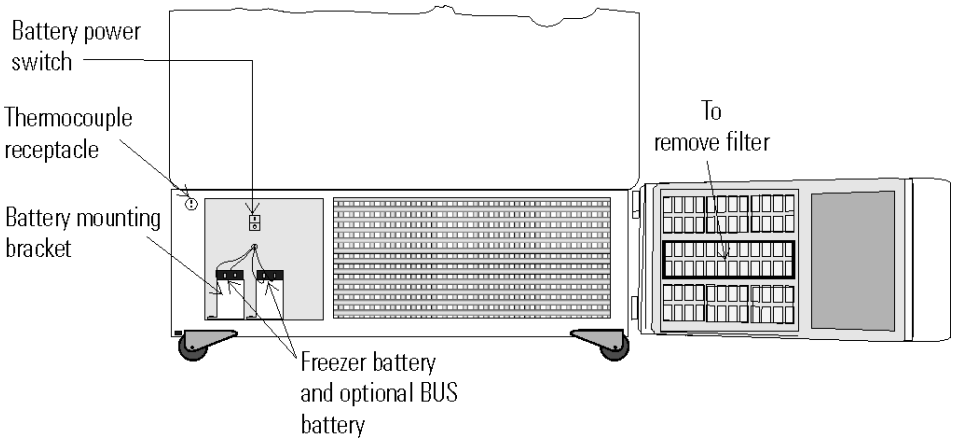


Figure 1-5. Battery(s) location and switch

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

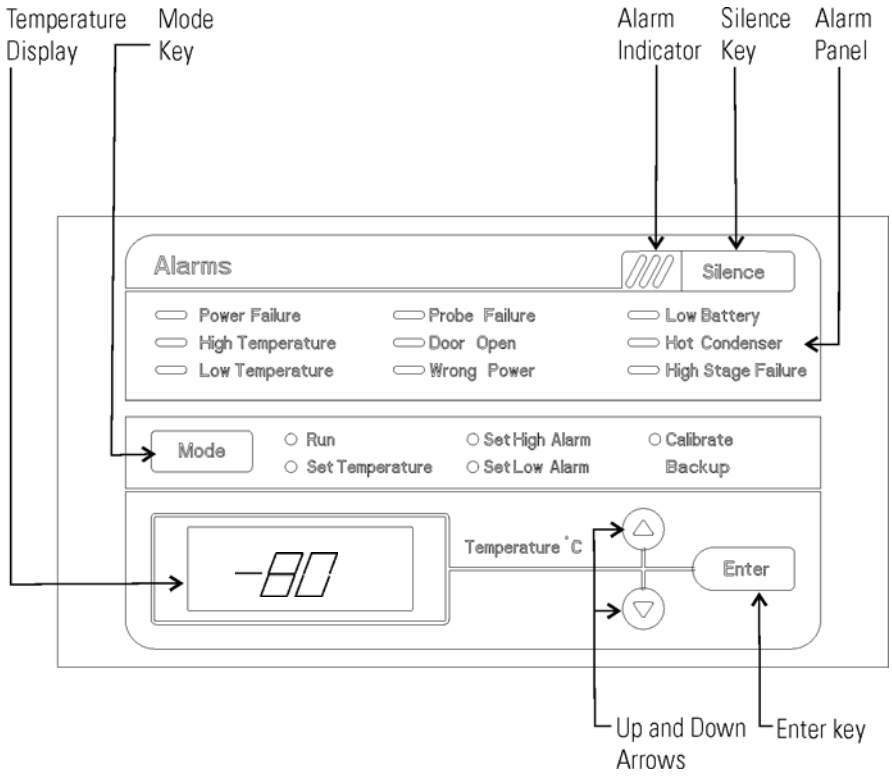


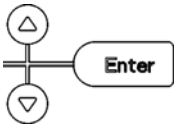
Figure 1-6. Control Panel

Control Panel Keys, Displays, Indicators

- Temperature Display - Displays temperature in degrees Celsius.
- Mode Select Switch - Used to select Run, Set Temperature, Set High Alarm, Set Low Alarm, Calibrate, Backup.
- Alarm Indicator - Light pulses on/off during an alarm condition of the cabinet.
- Silence - Silences the audible alarm. See Section 4 for alarm ringback times.
- Alarm Panel - indicates the current alarm condition.
- Up and Down Arrows - Increases or decreases values, toggles between choices.
- Enter - Stores the value into memory

Operation of the Keypad

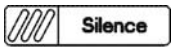
Model 900 Series freezer has five basic modes which allow freezer setup and operation. Press the Mode key to scroll through the mode selections.



Up Arrow: Increases or toggles the parameter value.

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

Down Arrow: Decreases or toggles the parameter value.



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

Install Freezer

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

To remove the freezer from the pallet, use a 7/16" 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.

Choose Location

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.

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

Note 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 the front of the freezer for door opening. ▲

Locate the freezer on a firm, level surface in an area with an ambient temperature between 18°C and 32°C. Provide ample room to reach the mains disconnect switch (power switch) located on the rear of the freezer.

Install Wall Bumpers

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

Quantity	Stock #	Description	Purpose
2	510016	1/4-20 x 5-1/2" Bolt	Wall Bumper
2	380520	Neoprene Cap	Cap Protector

Table 1-1. Parts bag

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 locations of the pre-tapped holes.

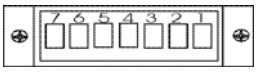
Install Shelves

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. ▲

Remote Alarm Contacts

See Figure 1-2 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. 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. Figure 1-8 shows the remote contacts in alarm state.



REMOTE CONTACTS/ANALOG OUTPUT
PIN# 1 Not Connected
PIN# 2 Not Connected
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 an activated alarm system capable of initiating a timely response 24 hours/day. Alarms provide interconnect for centralized monitoring.

Figure 1-8. Remote Alarm Contacts

Attach 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.

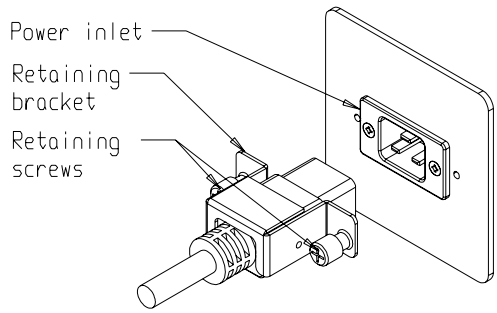


Figure 1-9. Power Cord Connection

Connect Unit to Electrical Power

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

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 indicator may illuminate.

Note 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 set points can be entered. The following set points can be entered in Settings mode: Control temperature, high temperature alarm set point, low temperature alarm set point, and (optional) BUS set point. Default settings are shown in the table below.

Table 1-2. Default Settings

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

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

Set Operating Temperature

Model 900 Series freezers have an operating temperature range of -50°C to -86°C, depending on ambient temperature. The freezer is shipped from the factory with a temperature set point of -80°C. To change the operating temperature set point:

1. Press the Mode key until the Set Temperature indicator lights.
2. Press the up/down arrow key until the desired temperature set point is displayed.
3. Press Enter to save the set point.
4. Press the Mode key until the Run indicator lights for Run mode

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

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

Set 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 High Alarm indicator lights.
2. Press the up or down arrow key until the desired high temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

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

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

Note At initial start-up, the high temperature alarm is disabled until the cabinet reaches set point or 12 hours elapse. ▲

Set Low Temperature Alarm

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

To set the low temperature alarm set point:

1. Press the Mode key until the Set Low Alarm indicator lights.
2. Press the up or down arrow key until the desired low temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

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. ▲

Run Mode

Run mode is the default mode for the freezer. This mode displays the cabinet temperature on the temperature display under normal operating conditions. In addition, the Run mode allows display of the high stage heat exchange temperature.

This information scrolls by pressing the up or down arrow keys. The display returns to the operating temperature in 10 seconds if no keys are pressed.

Section 2 Calibrate

Once the freezer has stabilized, the control 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.

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

Calibrate Control Probe

Plug a type T thermocouple reader into the receptacle located inside the lower door (see Figure 1-5). Compare the control temperature set point to the temperature of the measuring device.

1. Press the Mode key until the Calibrate indicator lights.
2. Press up/down arrow to match the display to calibrated instrument.
3. Press Enter to store calibration.
4. Press the Mode key to return to Run mode.

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.

During calibration, the temperature display will not be available. ▲

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

Section 3 Alarms

The Model 900 Series freezer alarms are displayed on the freezer control panel. When an alarm is active, the indicator next to the alarm description will light and there will be an audible alarm. Press the Silence key to disable 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.

Table 3-1. Alarm Indicators

Description	Delay	Ringback	Relay
Power Failure	1 min.	15 min.	Yes
High Temperature Alarm	1 min.	15 min.	Yes
Low Temperature Alarm	1 min.	15 min.	Yes
Probe Failure see 3.2	1 min.	15 min.	No
Door Open	1 min.	15 min.	No
Wrong Power	0 min.	none	Yes
Low Battery*	1 min.	12 hours	No
Hot Condenser	1 min.	none	No
High Stage Failure	0 min.	15 min.	Yes

All alarm delays and ringback times are ±30 seconds.
** The automatic battery test runs 12 hours after initial start-up, then every 12 hours thereafter.*

Wrong Power

The Wrong Power alarm occurs when incorrect voltage is applied to the freezer. If a 230V freezer is connected to a 120V power source, or a 120V freezer is connected to a 230V power source, the electronics will detect that the "Wrong Power" has been applied. Under this condition, the fans and compressors will not turn on and an audible and visual alarm will occur. This alarm may also occur if the battery switch is turned to Standby mode (⏻) prior to applying power to the freezer. The audible and visual alarms will remain until the freezer is connected to the correct power source. The audible alarm cannot be silenced under this condition.

High Stage System Failure

The "high stage system failure" 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. The audible alarm can be silenced and will ring back every 15 minutes.

Probe Failure Alarm

The microprocessor in Model 900 Series freezers continually scans all probes including the control probe, heat exchanger probe and condenser probe to ensure that they are operating properly. Should an error be detected, the "Probe Failure" alarm will occur as described above. If an error is detected with the control probe, the high and low stage compressors will run continuously. As a result, the cabinet temperature will decrease until it reaches the lowest temperature that the refrigeration system can maintain. If an error is detected with the heat exchanger probe, the freezer will cycle properly at its temperature set point using a 5 minute step start between the high and low stage compressors. If an error is detected with the condenser probe, there is no impact on the performance of the freezer; however, the hot condenser alarm may also occur. Contact the Technical Services department (1-888-213-1790) or your local distributor.

Voltage Compensation Alarm

In addition to the alarms listed above, another condition is detected by the controls that will result in an audible and visual alarm. If the freezer is compensating for high or low line voltage, the system will measure the compensated AC voltage. If the voltage is incorrect, the unit will stop attempting to compensate, and the compressor will run on direct line voltage. Under this condition, there will be a visual and audible alarm that can be silenced with a ringback period of fifteen minutes. This alarm condition is unlikely to occur, and as such, there is no LED alarm indicator for this condition.

Section 4 Maintenance

Clean Cabinet Exterior

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.

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

Clean Air Filter

The air filter should be cleaned four times a year, minimum.

1. Open the front lower door by grasping the bottom left corner.
2. Locate the grille on the door. See Figure 4-1. 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.

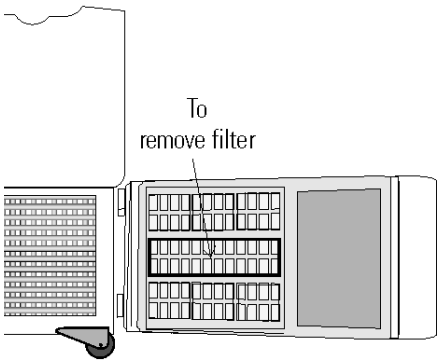


Figure 4-1. Grille with Filter Location

5. Install the filter back into the grille and attach the grille.

Clean Condenser

The condenser should be cleaned once per year, minimum.

1. Open the front lower door by grasping the bottom left corner.
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.

Clean Water-cooled Condenser

The water-cooled condenser can be cleaned-in-place by using the CIP procedure. Cleaning solutions can be used, depending on type of deposits or build-up to be removed.

Note Do not use liquids that are corrosive to stainless steel or the brazing material (copper or nickel). ▲

CIP (Clean-In-Place) Procedure

1. Disconnect the unit from the water supply.
2. Drain the unit.
3. Rinse with fresh water and drain the unit again.
4. Fill with fresh water.
5. Add cleaning agent (solution and concentration dependent on deposits or build-up).
6. Circulate cleaning solution (if feasible).
7. Drain the cleaning solution.
8. Add and circulate a passivating liquid for corrosion inhibition of plate surfaces.
9. Drain this liquid.
10. Rinse with fresh water and drain.
11. Reconnect the water supply and fill the unit.
12. Return to service.

Defrost 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 4-6.
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 Door Gasket

The door gasket should be cleaned monthly, minimum. Using a soft cloth, remove any frost build-up from the gasket and door(s). The door gasket may need to be cleaned more frequently if dirt or excessive frost build-up prevents the door from closing properly.

Vacuum Relief Port

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

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. The unit is designed with a “vacuum relief port” that allows the pressure to be equalized.

Vacuum Relief Port (continued)

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

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

b) the pressure difference between the internal cabinet and the 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 maximim 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.

To open the door if a vacuum lock occurs:

1. Unlatch the handle of the freezer (Figure 4-2).

2. On the HINGED side of freezer (Figure 4-3), slide included pliable tool (P/N 402058), or a non-metallic flat object such as a ruler, tongue depresser or plastic putty knife, carefully between the door gasket and door until only the end of the tool handle is showing (Figure 4-4).

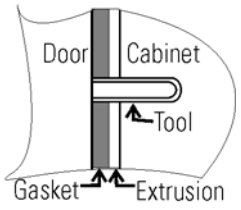


Figure 4-4. Hinge side

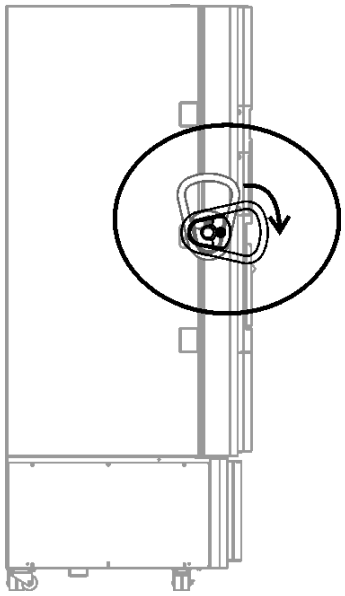


Figure 4-2. Freezer handle

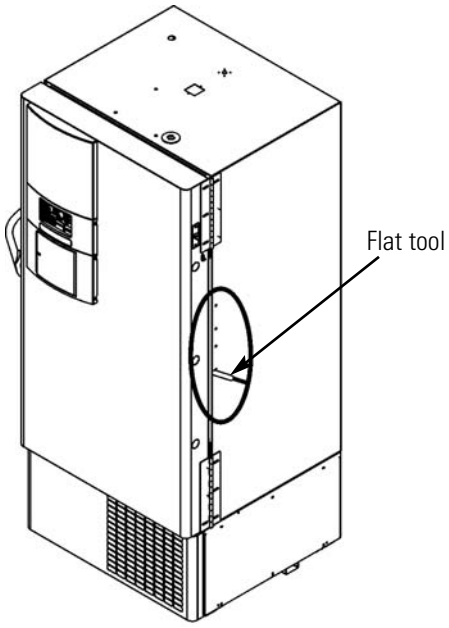


Figure 4-3. Insert tool

Vacuum Relief Port Maintenance

3. The air exchange will be audible and could last a few minutes.

4. As the air pressure equalizes, the door releases.

Warning Do not leave the freezer unattended while the door is unlatched. The vacuum could release, resulting in a door opening and product loss. ▲

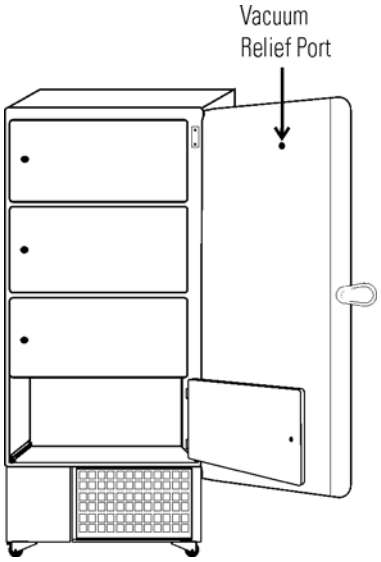


Figure 4-5. Vacuum relief port

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

Warning 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. ▲

Replace Battery(s)

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 Thermo. 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. ▲

Prepare Unit for Storage

Defrost the unit as described in 'Defrost Freezer'. This will prepare the unit for storage. Turn off the battery power switch (O). Turn off the freezer power switch. Disconnect power to the battery(s) and to the freezer.

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

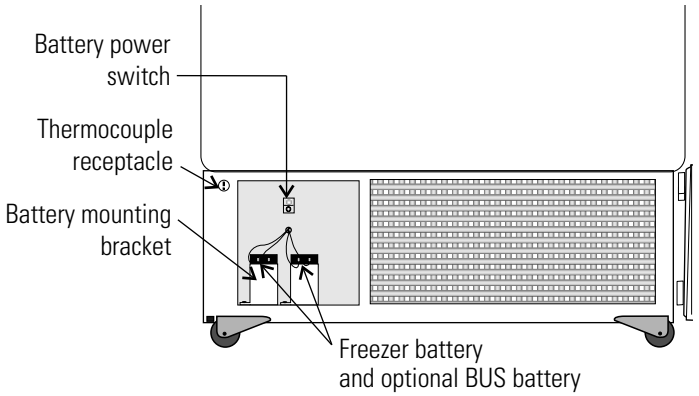


Figure 4-6. Battery Power Switch

PREVENTIVE MAINTENANCE
Freezers

Your equipment has been thoroughly tested and calibrated before shipment. Regular preventive maintenance is important to keep your unit functioning properly. The operator should perform routine cleaning and maintenance on a regular basis. For maximum performance and efficiency, it is recommended that the unit be checked and calibrated periodically by a qualified service technician.

The following is a condensed list of preventive maintenance requirements. See the specified section of the instruction manual for further details.

We have qualified service technicians, using NIST traceable instruments, available in many areas. For more information on Preventive Maintenance or Extended Warranties, please contact the Technical Services Department at 1-888-213-1790. Cleaning and calibration adjustment intervals are dependent upon use, environmental conditions and accuracy required.

Tips:

- Fill an upright by starting at the bottom near the probe and add racks to one shelf at a time. Allow freezer to recover to set point between shelves.
- Fill a chest by starting at the left side near the probe. Filling with room temperature racks will result in a long pull-down time.
- Fill unit with frozen product to help overall performance; frozen water jugs, for example.
- Always make certain the vacuum relief port is free of frost and ice, to allow for timely re-entry into the freezer after a door opening.

Action	Monthly	Yearly	Every 2 Years
Verify ambient temperature, <90°F	✔		
* Adjust door handle for firm latching, as needed	✔		
Check and clean probe cover, gaskets, hinges and lid(s) of ice and snow. See Figure 1-4 for probe location. See “Cleaning the Lid Gasket”.	✔ *More frequent cleaning may be required, depending on use and environmental conditions.*		
Check air filter. Clean or replace as needed. See “Cleaning the Air Filter”.	✔		
Check alarm back-up battery. See “Connecting the unit to Electrical Power” in Section 1 and “Replacing the Battery” in Section 4.	✔		**Replace
Check condenser fan motor for unusual motor noise or vibration.		✔	
* Verify and document calibration, at the minimum, annually. See Section 2 Calibration.			
* Clean condenser compartment and wipe off condenser See “Cleaning the condenser” in Section 4.		✔	

** Qualified service technicians only*
*** Dispose of properly, according to all state and federal regulations.*

To minimize ice build-up inside of freezer:

- Locate the freezer away from drafts or heating/cooling vents
- Keep the number of door openings to a minimum
- Minimize the length of time door is open
- Make sure door latches securely after opening

Section 5 Factory Installed Options

BUS - Back Up System (195875, 195877)

Note 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) maintains 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.

Install Vent Stack, Solenoid and Injection Assembly

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.

Install Vent Stack, Solenoid and Injection (continued)

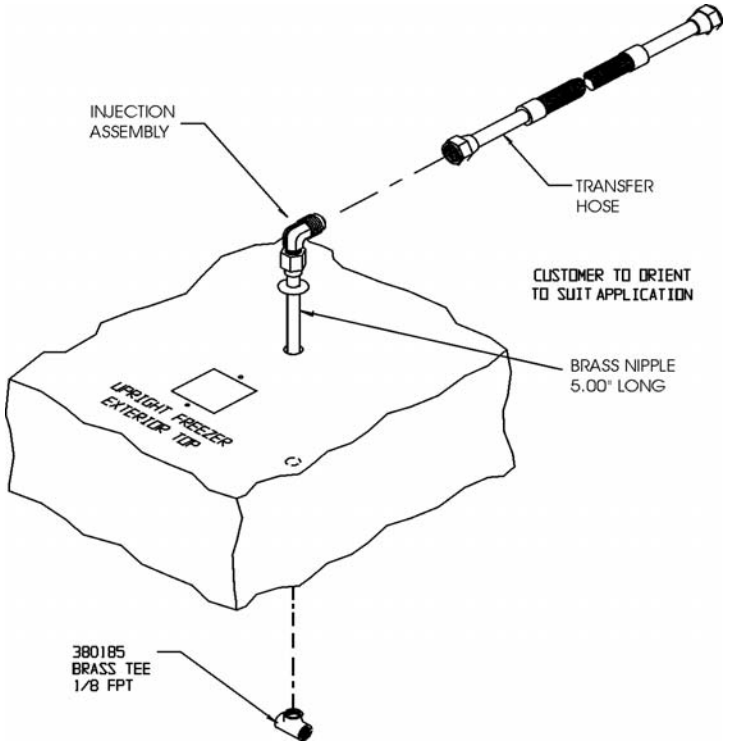


Figure 5-1. Injection Assembly

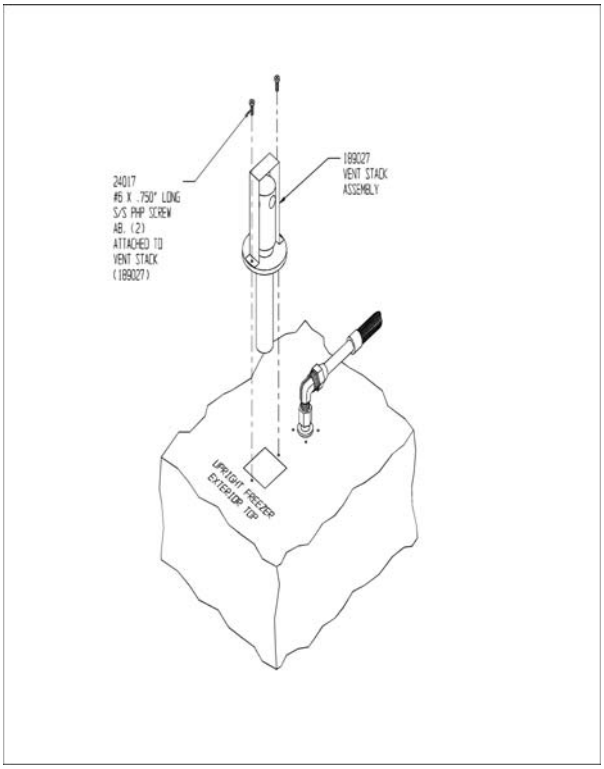


Figure 5-2. Vent Stack Assembly

Install Vent Stack, Solenoid and Injection (continued)

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 to the solenoid valve. Connect the solenoid valve to the supply source. The solenoid mounting bracket may be discarded.

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

Install Temperature Probe

1. Locate the 0.500" pre-punched hole in the upper left hand 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 5-4).

2. As shown in Figure 5-3, 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.

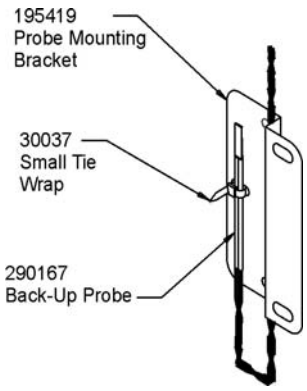


Figure 5-3. Secure probe

3. Tap #8-32 the two pre-punched holes located on the interior left wall of the freezer. Mount the bracket. Figure 5-4 shows the Back-Up probe mounted on the interior left side wall of the freezer.

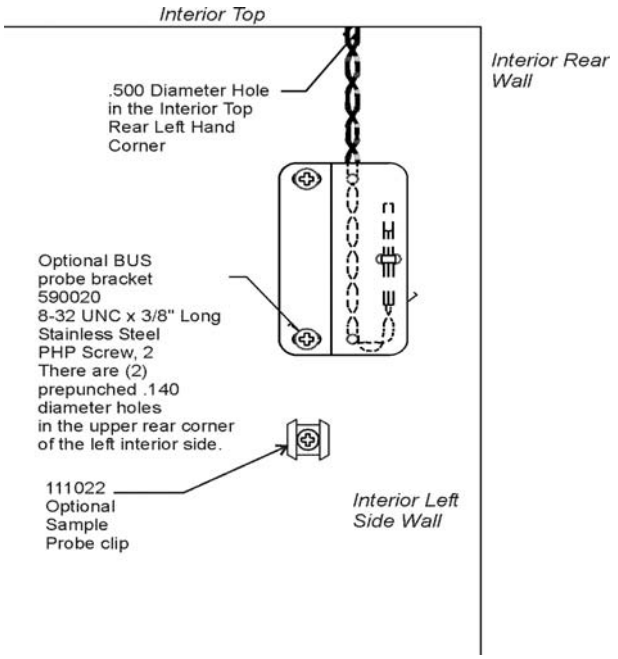


Figure 5-4. Mounted probe clip

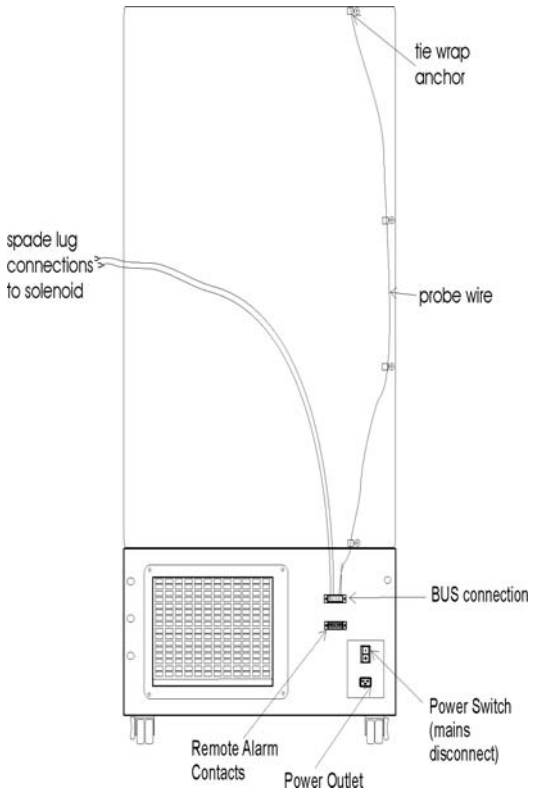


Figure 5-5. Probe wire and solenoid connections

Connect Probe/Solenoid Harness

1. Remove the four screws on the freezer back panel and use them to mount the tie wrap anchors as shown in Figure 5-5. 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. The Solenoid Engaged light on the BUS control panel will illuminate (no injection occurs). This light stays on until the unit is below BUS setpoint.

    b. The Low Battery indicator may also illuminate.

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

BUS Control Panel

The following section describes the configuration and operation of the BUS.

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 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 LN_2 tank is adjusted to 30 PSI maximum 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 of this manual. ▲

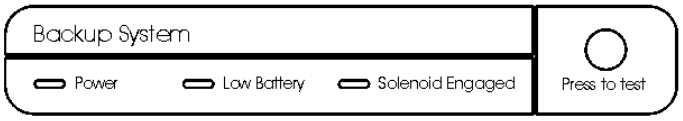


Figure 5-6. BUS Control Panel

Power - indicates the unit has AC power.

Low Battery - battery charge is low. The battery needs replaced or recharged.

Solenoid Engaged - BUS has opened the solenoid so it can inject gas (CO_2 or LN_2).

Press-To-Test - activates the solenoid and injects LN_2 or CO_2 into the freezer chamber as long as the button is depressed. The solenoid engaged indicator should light. If the Low Battery indicator lights during the test, replace the BUS battery.

Note Solenoid will not engage if door is open. ▲

Configure Optional BUS (Back Up System)

The optional BUS can be configured for LN_2 or CO_2 supply.

To select the supply type:

1. Press the Mode key until the Backup indicator lights.
2. Press the up or down arrow key. The display will show OP1 for CO2 selection and OP2 for LN2 selection.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

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

Set Optional BUS Set Point

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 Set Temperature and Backup indicators light.
2. Press the up or down arrow key until the desired BUS set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

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

Warning Changing the operating temperature set point can affect the BUS set point. The BUS set point will self adjust to maintain a temperature of at least 10°C above the operating temperature set point. ▲

Note The BUS set point can not be set any colder than the high temperature alarm set point. (See Section 1 - “Setting the High Temperature Alarm). If the back-up system is installed with CO_2, then -65°C is the coldest BUS set point that can be used (if the cabinet set point is -75°C or colder). ▲

Clean 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 4 for freezer defrost instructions.

Disconnect Fitting Assembly, Transfer Hose

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

1. Close the supply valve.
2. Depress the test button on the BUS 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

The following section describes the set up and operation of the optional chart recorder.

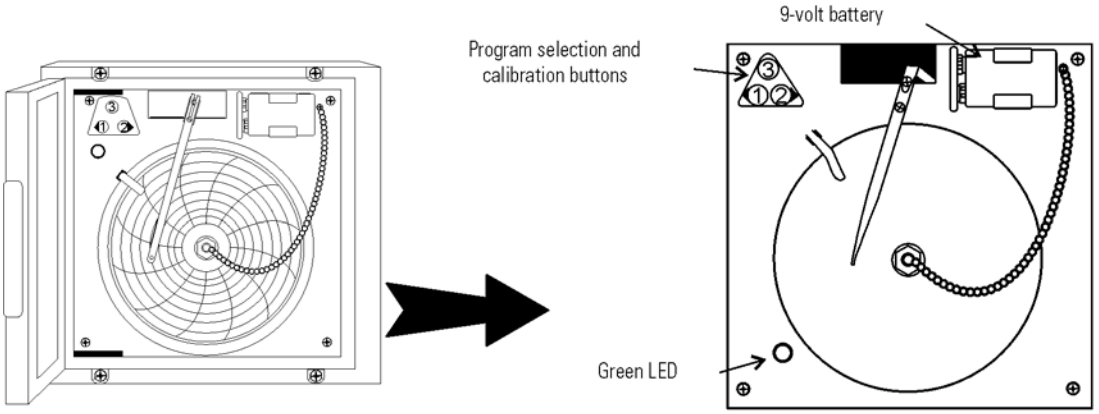
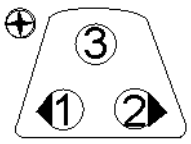


Figure 5-7. Recorder Details

Installing the Chart Paper



1. Open the plastic 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.

Change Recorder Temperature Range

The chart recorder contains eight temperature ranges and is factory-programmed for the freezer. To change the recorder 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.

Program	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

Recorder Calibration

Note 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 1-4).
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 may be purchased from Thermo. ▲

Datalogger

Dataloggers and ELPRO evaluation software provide monitoring and documentation of temperature and alarm conditions. The dataloggers have a memory capacity of 64,000 measured values or data points. Temperature is measured, stored and displayed. Alarm conditions are recorded. Evaluation software permits data to be downloaded to a PC. A variety of statistical information is provided through calculations, analysis, graphs and printed reports. Refer to the ELPRO documentation for operating instructions for the datalogger.

Water-cooled Condenser

The water-cooled condenser is a factory installed option (195145, 195611) and requires a qualified technician at freezer installation. Installation should include proper adjustment of the regulating valve, which controls the discharge pressure. Specifications for this option are displayed in Table 5-1.

Water Source	**Tower**	**City**
Water Pressure	Not to exceed 150 psig	
Water Temperature Range	Not to exceed 29.4C (85F)	
Inlet Connection	0.5" compression	
Outlet Connection	0.5" compression	
Flow Rate Required	3.0 gallons (11.4 liters) per minute	1.0 gallon (3.8 liters) per minute
Drain Required	No (return line is required)	Yes

Table 5-1. Water cooled condenser specifications

Five Inner Door Option

The five inner door option (P/N (189405, 189406, 189407, 195642) is factory installed. The freezer is converted to accommodate four adjustable specimen shelves with the fifth "shelf" as the bottom of the freezer chamber.

Section 6 Specifications

Single Door Units

Model	902	903
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient	
Exterior Dimensions	33.3"W x 77.8" H x 31.0" F-B (84.6cm x 197.6cm x 78.7cm)	
Interior Dimensions	23.0"W x 51.5"H x 19.3" F-B (58.4cm x 130.8cm x 49.0cm)	
Capacity	13.0 cu. ft. (368.1 liters)	
Refrigeration	Two 1 HP (2545 BTUH each)	
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 2.0" (5.0cm) lid; 1.0" (12.5cm) sub-lids	
Electrical	230VAC, 50/60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC
Breaker Requirements	15 Amp, 230VAC, Dedicated Circuit, 15 Amp Time Delay Breaker	20 Amp, 120VAC, Dedicated Circuit, 20 Amp Time Delay Breaker
Shipping Weight	712 lbs. (323.0 kg)	

Model	904	905
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient	
Exterior Dimensions	33.3"W x 77.8" H x 37.0" F-B (84.6cm x 197.6cm x 94.0cm)	
Interior Dimensions	23.0"W x 51.5"H x 25.3" F-B (58.4cm x 130.8cm x 64.3cm)	
Capacity	17.3 cu. ft. (489.9 liters)	
Refrigeration	Two 1 HP (2545 BTUH each)	
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 2.0" (5.0cm) lid; 1.0" (12.5cm) sub-lids	
Electrical	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC	230VAC, 50/60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC
Breaker Requirements	20 Amp, 120VAC, Dedicated Circuit, 20 Amp Time Delay Breaker	15 Amp, 230VAC, Dedicated Circuit, 15 Amp Time Delay Breaker
Shipping Weight	795 lbs. (360.6 kg)	

Model	906	956
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient	
Exterior Dimensions	40.8"W x 77.8" H x 37.0" F-B (103.6cm x 197.6cm x 94.0cm)	
Interior Dimensions	30.6"W x 51.5"H x 27.0" F-B (77.7cm x 130.8cm x 64.3cm)	
Capacity	23.0 cu. ft. (651.3 liters)	
Refrigeration	Two 1 HP (2545 BTUH each)	
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 2.0" (5.0cm) lid; 1.0" (12.5cm) sub-lids	
Electrical	230VAC, 50/60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC
Breaker Requirements	15 Amp, 230VAC, Dedicated Circuit, 15 Amp Time Delay Breaker	20 Amp, 120VAC, Dedicated Circuit, 20 Amp Time Delay Breaker
Shipping Weight	900 lbs. (408.2 kg)	

Model	907
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient
Exterior Dimensions	46.8"W x 77.8" H x 37.0" F-B (118.9cm x 197.6cm x 94.0cm)
Interior Dimensions	36.6"W x 51.5"H x 27.0" F-B (93.0cm x 130.8cm x 68.6cm)
Capacity	28.0 cu. ft. (792,8 liters)
Refrigeration	Two 1 HP (2545 BTUH each)
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 2.0" (5.0cm) lid; 1.0" (12.5cm) sub-lids
Electrical	230VAC, 50/60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC
Breaker Requirements	15 Amp, 230VAC, Dedicated Circuit, 15 Amp Time Delay Breaker
Shipping Weight	980 lbs. (444.5 kg)

Double Door Units

Model	990	995
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient	
Exterior Dimensions	40.8"W x 77.8" H x 37.0" F-B (103.6cm x 197.6cm x 94.0cm)	
Interior Dimensions	30.6"W x 51.5"H x 27.0" F-B (77.7cm x 130.8cm x 64.3cm)	
Capacity	23.0 cu. ft. (651.3 liters)	
Refrigeration	Two 1 HP (2545 BTUH each)	
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 2.0" (5.0cm) lid; 1.0" (12.5cm) sub-lids	
Electrical	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC	230VAC, 50/60 Hz, 12.0 FLA Operating Range: 208VAC-230VAC
Breaker Requirements	20 Amp, 120VAC, Dedicated Circuit, 20 Amp Time Delay Breaker	15 Amp, 230VAC, Dedicated Circuit, 15 Amp Time Delay Breaker
Shipping Weight	900 lbs. (408.2 kg)	

Model	991	992
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient	
Exterior Dimensions	33.3"W x 77.8" H x 31.0" F-B (84.6cm x 197.6cm x 78.7cm)	
Interior Dimensions	23.0"W x 51.5"H x 19.3" F-B (58.4cm x 130.8cm x 49.0cm)	
Capacity	13.0 cu. ft. (368.1 liters)	
Refrigeration	Two 1 HP (2545 BTUH each)	
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 2.0" (5.0cm) lid; 1.0" (12.5cm) sub-lids	
Electrical	230VAC, 50/60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC
Breaker Requirements	15 Amp, 230VAC, Dedicated Circuit, 15 Amp Time Delay Breaker	20 Amp, 120VAC, Dedicated Circuit, 20 Amp Time Delay Breaker
Shipping Weight	712 lbs. (323.0 kg)	

Model	993	994
Temperature Range	-50°C(-58°F) to -86°C(-123°F) in an 18C to 32C * (64.4F to 89.6F) ambient	
Exterior Dimensions	33.3"W x 77.8" H x 37.0" F-B (84.6cm x 197.6cm x 94.0cm)	
Interior Dimensions	23.0"W x 51.5"H x 25.3" F-B (84.6cm x 130.8cm x 64.3cm)	
Capacity	17.3 cu. ft. (489.9 liters)	
Refrigeration	Two 1 HP (2545 BTUH each)	
Insulation	Non CFC, foamed-in-place urethane: 5.0" (12.7cm) cabinet; 2.0" (5.0cm) lid; 1.0" (12.5cm) sub-lids	
Electrical	120VAC, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC	230VAC, 50/60 Hz, 12.0 FLA Operating Range: 208VAC-240VAC
Breaker Requirements	20 Amp, 120VAC, Dedicated Circuit, 20 Amp Time Delay Breaker	15 Amp, 230VAC, Dedicated Circuit, 15 Amp Time Delay Breaker
Shipping Weight	795 lbs. (360.6 kg)	

Certifications
Declaration of Conformity is available from the factory

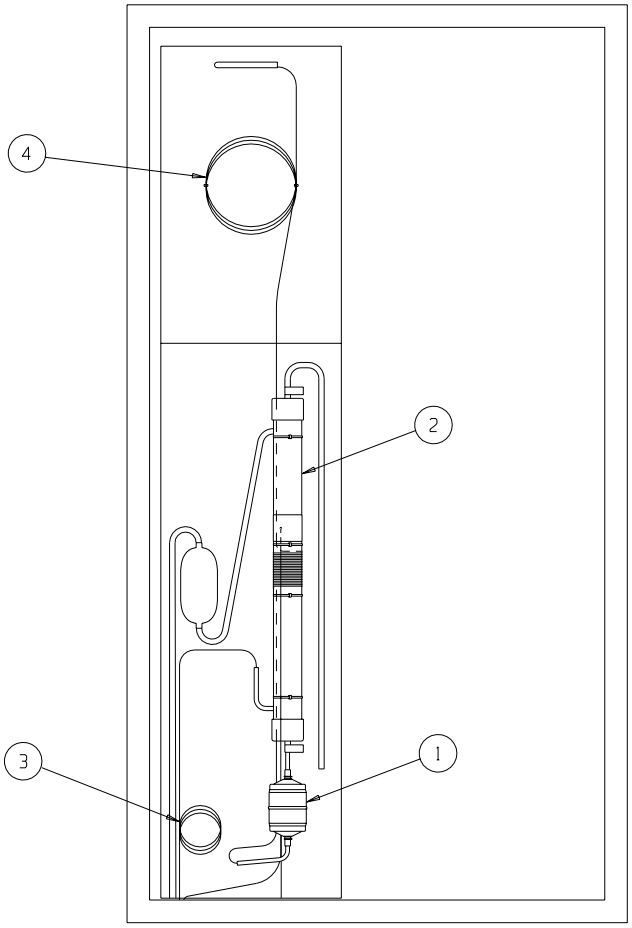
Safety Specifications
Indoor Use Only
Altitude - up to 2,000 meters
Temperature - 5°C to 43°C
Humidity - Maximum RH 80% for temperatures up to 31°C, decreasing linearly to 50% RH at 40°C
Mains Supply Fluctuations - Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage
Installation Category II [1]
Pollution Degree 2 [2]
Class of Equipment I

---

[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.

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	12-04-02	PDK	PDK	AKS	RELEASED FOR PRODUCTION



BILL OF MATERIALS

ITEM NO.	PART NO.	PART DESCRIPTION
1	209016	DRYER
2	211039	HEAT EXCHANGER
3	227927	HIGH STAGE CAP. TUBE
4	227928	LOW STAGE CAP. TUBE

MODEL/PART NAME: 8600 UP-RIGHT FREEZER

DWG TITLE: HEAT EXCHANGER ASSEMBLY

DWN: PDK	CAD: PDK	APPD:	DATE: 12-04-02	SCALE: NTS

MATERIAL: N/A

PAINT COLOR: N/A

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

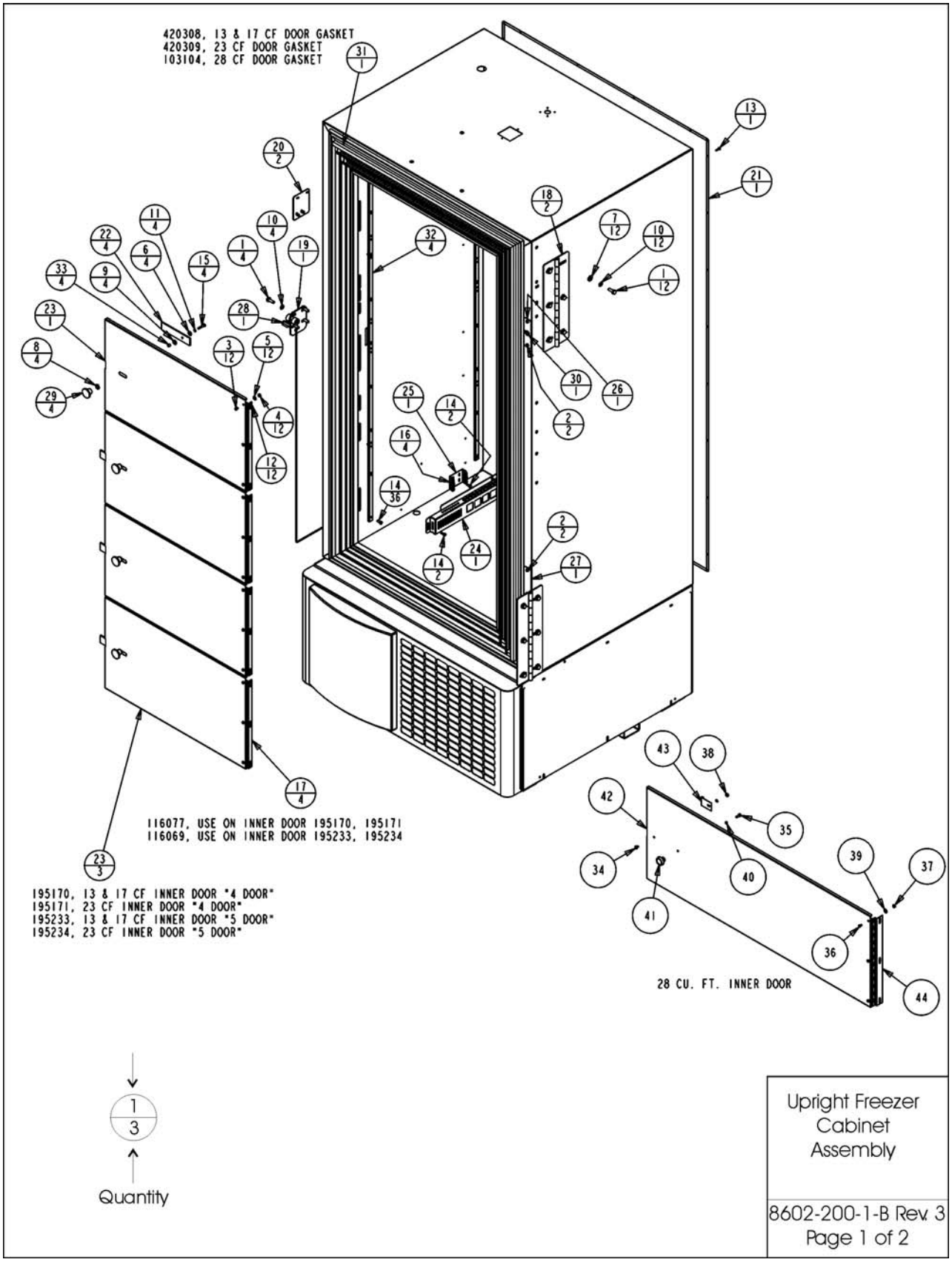
DRAWING NUMBER: 8602-205-1

SIZE: B

Upright Freezer Heat Exchanger Assembly

8602-205-1-B Rev. 0
Page 1 of 1

Thermo Forma
BOX 649, MARIETTA, OHIO 45750


420308, 13 & 17 CF DOOR GASKET
420309, 23 CF DOOR GASKET
103104, 28 CF DOOR GASKET
116077, USE ON INNER DOOR 195170, 195171
116069, USE ON INNER DOOR 195233, 195234
195170, 13 & 17 CF INNER DOOR "4 DOOR"
195171, 23 CF INNER DOOR "4 DOOR"
195233, 13 & 17 CF INNER DOOR "5 DOOR"
195234, 23 CF INNER DOOR "5 DOOR"
28 CU. FT. INNER DOOR
1/3
Quantity
Upright Freezer Cabinet Assembly
8602-200-1-B Rev. 3
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
1	FR-1673	06-05-03	PDK	PDK	LDN	ADDED VACUUM RELIEF PORT
2	FR-1698	09-19-03	JDL	PDK	LDN	ADDED SCREW TO VACUUM RELIEF PORT
3	FR-1789	06-02-05	DHG	DHG	AKS	REMOVED VRP IN TOP OF CABINET, DMHVRP

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	24041	#6-32 X 1/2 SS PHP SCREW F POINT
14	24042	#8-32 X 1/2 SS PHP SCREW F POINT
15	59008	#8-32 X 7/8 SS PHP SCREW
16	114020	5/8" X 1/2" ID GROMMET
17	116077	FRONT PANEL HINGE
18	116092	EXTERIOR FREEZER DOOR HINGE
19	121069	FREEZER CAM LATCH STRIKE
20	180312	CAM LATCH STRIKE COVER
21	189921	EXTERIOR BACK 13 & 17
22	195169	LATCH TAB
23	195170	13/17 CU. FT. INNER DOOR
24	195866	PROBE GUARD
25	195867	PROBE MOUNT
26	195874	CABINET CABLE COVER PLATE
27	195879	CABINET CABLE BLANK COVER PLATE
28	195900	SINGLE DOOR SWITCH ASSY.
29	285658	BLACK PLASTIC KNOB
30	330010	1/2" SPLIT SNAP BUSHING
31	420308	13 & 17 CU. FT. SINGLE DOOR FRAME GASKET
32	500177	PILSATER STRIPS
33	515083	1/4 DIA. X 1/4L SS SPACER
34	22051	#8-32 X 1/4 SS PHP SCREW
35	22053	#8-32 X 1/2 SS PHP SCREW
36	22115	#6-32 X 1/4 SS PHP SCREW
37	23009	#6-32 SS HEX NUT
38	23010	#8-32 SS HEX NUT
39	23020	#6 SS FLAT WASHER
40	23080	#8 SS SPRING LOCKWASHER
41	120400	BLACK PLASTIC KNOB
42	195511	28 CU. FT. INNER DOOR
43	195602	LATCH TAB
44	116090	FRONT PANEL HINGE

MODEL/PART NAME: 8600 UP-RIGHT FREEZER

DWG TITLE: 8602 UP-RIGHT FREEZER ASSEMBLY

DWN: PDK	CAD: PDK	APPD:MAH	DATE: 10-30-02	SCALE: 0.094

MATERIAL: N/A

PAINT: N/A

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

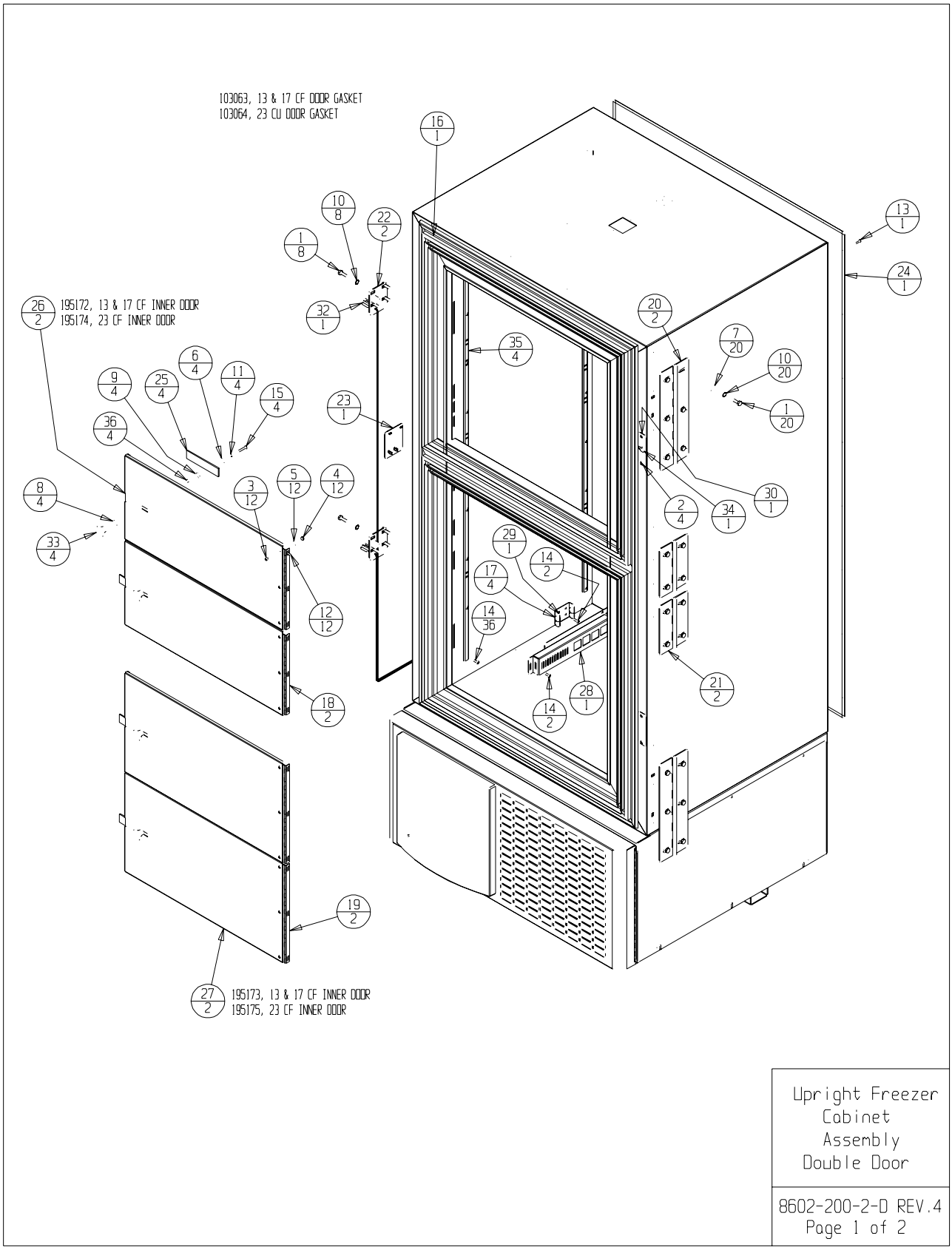
DRAWING NUMBER 8602-200-1

SIZE B

Upright Freezer Cabinet Assembly

8602-200-1-B Rev. 3
Page 2 of 2

Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750


103063, 13 & 17 CF DOOR GASKET
103064, 23 CU DOOR GASKET
195172, 13 & 17 CF INNER DOOR
195174, 23 CF INNER DOOR
195173, 13 & 17 CF INNER DOOR
195175, 23 CF INNER DOOR
Upright Freezer
Cabinet
Assembly
Double Door
8602-200-2-D REV.4
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
2	FR-1698	09-19-03	JDL	PDK	LDN	ADDED SCREW TO VACUUM RELIEF PORT
3	FR-1789	06-02-05	DHG	DHG	LDN	REMOVED VRP IN TOP OF CABINET, OMHVRP
4	SI-9595	05-15-06	DHG	KDG	CCS	CHG. TO COMMON SWITCH ASSY 195900

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	24041	#6-32 X 1/2 SS PHP SCREW F POINT
14	24042	#8-32 X 1/2 SS PHP SCREW F POINT
15	59008	#8-32 X 7/8 SS PHP SCREW
16	103063	DOUBLE DOOR FRAME GASKET
17	114020	5/8" X 1/2" ID GROMMET
18	116069	FRONT PANEL HINGE
19	116077	FRONT PANEL HINGE
20	116092	EXTERIOR FREEZER DOOR HINGE
21	116093	EXTERIOR FREEZER DOOR HINGE
22	121069	FREEZER CAM LATCH STRIKE
23	180312	CAM LATCH STRIKE COVER
24	189921	EXTERIOR BACK 13 & 17
25	195169	LATCH TAB
26	195172	13/17 CU. FT. INNER DOOR, TOP
27	195173	23 CU. FT. INNER DOOR, TOP
28	195866	PROBE GUARD
29	195867	PROBE MOUNT
30	195874	CABINET CABLE COVER PLATE
31	195879	CABINET CABLE BLANK COVER PLATE
32	195900	TOP DOOR SWITCH ASSY.
33	285658	BLACK PLASTIC KNOB
34	330010	1/2" SPLIT SNAP BUSHING
35	500177	PILSATER STRIPS
36	515083	1/4 DIA. X 1/4L SS SPACER

MODEL/PART NAME: 8600 UP-RIGHT FREEZER

DWG TITLE: 8691 UP-RIGHT FREEZER ASSEMBLY

DWN: PDK	CAD: PDK	APPD: MAH	DATE: 10-30-02	SCALE: 0.094

MATERIAL: N/A

PAINT: N/A

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

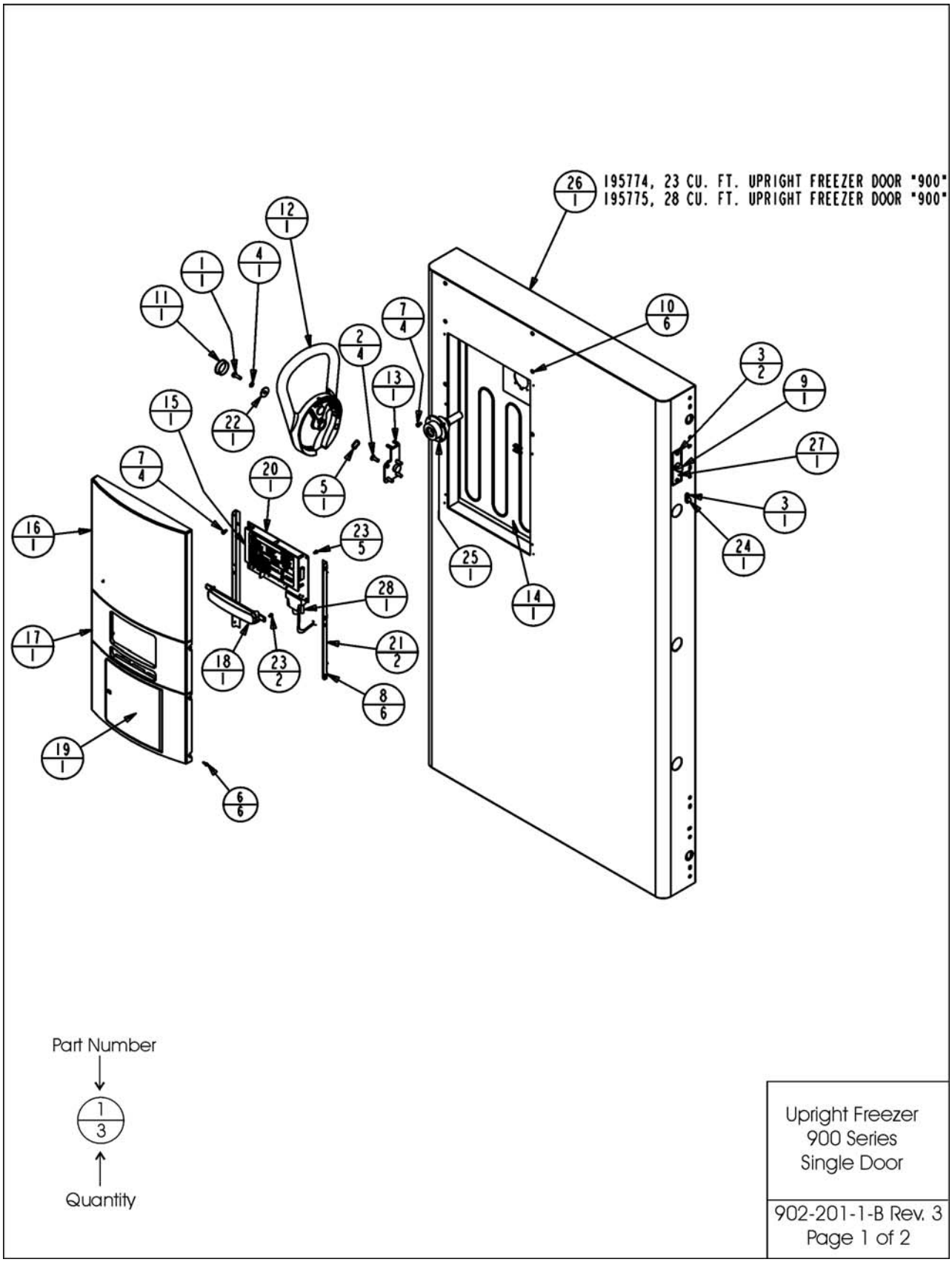
DRAWING NUMBER 8602-200-2

SIZE B

Upright Freezer Cabinet Assembly Double Door

8602-200-2-D REV.4
Page 2 of 2

Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750


26 / 1
195774, 23 CU. FT. UPRIGHT FREEZER DOOR "900"
195775, 28 CU. FT. UPRIGHT FREEZER DOOR "900"
12 / 1
4 / 1
1 / 1
11 / 1
22 / 1
15 / 1
7 / 4
20 / 1
5 / 1
2 / 4
7 / 4
13 / 1
10 / 6
3 / 2
9 / 1
27 / 1
3 / 1
24 / 1
25 / 1
14 / 1
16 / 1
17 / 1
19 / 1
6 / 6
23 / 5
28 / 1
21 / 2
18 / 1
23 / 2
8 / 6
Part Number
1 / 3
Quantity
Upright Freezer
900 Series
Single Door
902-201-1-B Rev. 3
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	10-30-02	PDK	PDK	MAH	RELEASED FOR PRODUCTION
1	FR-1673	06-06-03	DHG	PDK	LDN	REVISED CONTROL PANEL FASTENERS
2	FR-1776	03-08-04	AT	pdk	LDN	CORRECTED CONTROL PANEL STK NUMBER
3	FR-1789	11-18-04	RSB	KDG	AKS	ADDED VACUUM RELIEF PORT

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 POINT
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	111028	TINNERMAN TUBULAR SPEED CLIP
11	117038	1-3/8" DIA. THERMO WHITE HOLE PLUG
12	121068	121068 FINISHED HANDLE/LATCH ASSEMBLY
13	121075	CAM LATCH MOUNT
14	132114	HEATER, 3W, 14VDC
15	140368	CONTROL PANEL ASSEMBLY
16	180301	THERMO CONTROL CENTER BLANK PANEL
17	180305	CONTROL CENTER DISPLAY BEZEL
18	180306	THERMO BACK-UP SYSTEM BLANK PANEL
19	180308	THERMO CONTROL CENTER RECORDER BLANK
20	191803	FREEZER DISPLAY BOARD
21	195837	MOUNTING ANGLE FOR 180305
22	510305	1" OD FLAT WASHER
23	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
24	600085	5/16 NYLON CABLE CLAMP
25	1950069	HEATED VACUUM RELIEF PORT
26	195773	13 &17 CU. FT. UPRIGHT FREEZER DOOR "900"
27	195830	UPRIGHT DOOR WIREWAY COVER PLATE
28	430336	15 FT, RS-232 CABLE 25 POS.

MODEL/PART NAME: ULT UP-RIGHT SERIES FREEZER

DWG TITLE: 900 SINGLE DOOR BOM ASSEMBLY

DWN: PDK	CAD: PDK	APPD: MAH	DATE: 10-30-02	SCALE: 0.094

MATERIAL: N/A

PAINT: N/A

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

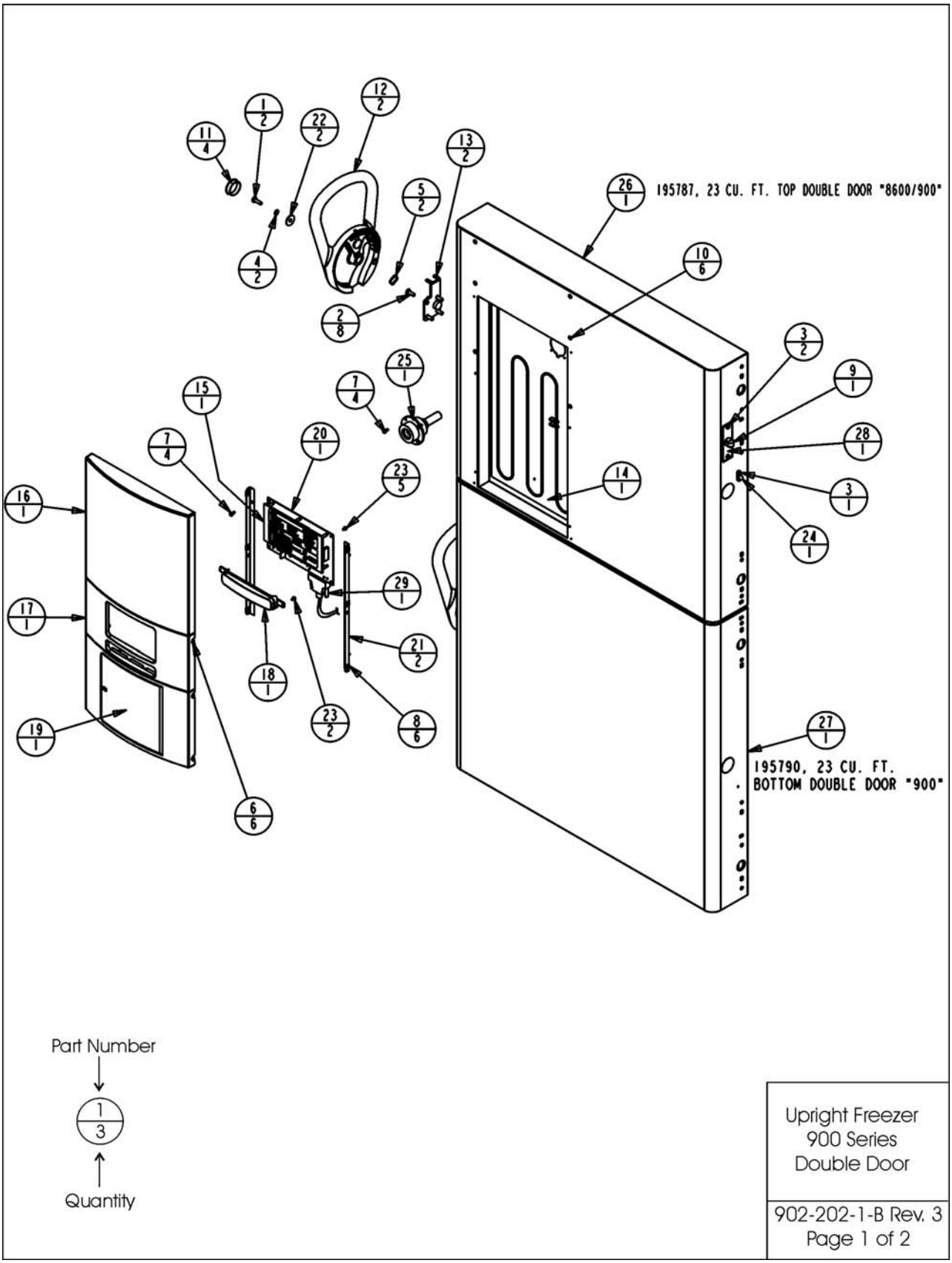
DRAWING NUMBER 902-201-1

SIZE B

Upright Freezer
900 Series
Single Door

902-201-1-B Rev. 3
Page 2 of 2

Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750


195787, 23 CU. FT. TOP DOUBLE DOOR "8600/900"
195790, 23 CU. FT. BOTTOM DOUBLE DOOR "900"
Part Number
1/3
Quantity
Upright Freezer
900 Series
Double Door
902-202-1-B Rev. 3
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	11-05-02	PDK	PDK	MAH	RELEASED FOR PRODUCTION
1	FR-1673	06-06-03	DHG	PDK	LDN	REVISED CONTROL PANEL FASTENERS
2	FR-1776	03-09-04	AT	pdk	LDN	CORRECTED CONTROL PANEL STK NUMBER
3	FR-1789	11-19-04	RSB	KDG	AKS	ADDED VACUUM RELIEF PORT

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 POINT
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	111028	TINNERMAN TUBULAR SPEED CLIP
11	117038	1-3/8" DIA. THERMO WHITE HOLE PLUG
12	121068	121068 FINISHED HANDLE/LATCH ASSEMBLY
13	121075	CAM LATCH MOUNT
14	132114	HEATER, 3W, 14VDC
15	140368	CONTROL PANEL ASSEMBLY
16	180301	THERMO CONTROL CENTER BLANK PANEL
17	180305	CONTROL CENTER DISPLAY BEZEL
18	180306	THERMO BACK-UP SYSTEM BLANK PANEL
19	180308	THERMO CONTROL CENTER RECORDER BLANK
20	191803	FREEZER DISPLAY BOARD
21	195837	MOUNTING ANGLE FOR 180305
22	510305	1" OD FLAT WASHER
23	590027	#6-32 X 1/4 SS PHP EXT SEMS SCREW
24	600085	5/16 NYLON CABLE CLAMP
25	1950069	HEATED VACUUM RELIEF PORT
26	195785	13/17 CF TOP DOUBLE DOOR "8600/900"
27	195789	13/17 CF BOTTOM DOUBLE DOOR "900"
28	195830	UPRIGHT DOOR WIREWAY COVER PLATE
29	430336	15 FT, RS-232 CABLE 25 POS.

MODEL/PART NAME: ULT UP-RIGHT SERIES FREEZER

DWG TITLE: 900 DOUBLE DOOR BOM ASSEMBLY

DWN: PDK	CAD: PDK	APPD: MAH	DATE: 11-05-02	SCALE: 0.094

MATERIAL: N/A

PAINT: N/A

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

DRAWING NUMBER: 902-202-1

SIZE: B

Upright Freezer
900 Series
Double Door

902-202-1-B Rev. 3
Page 2 of 2

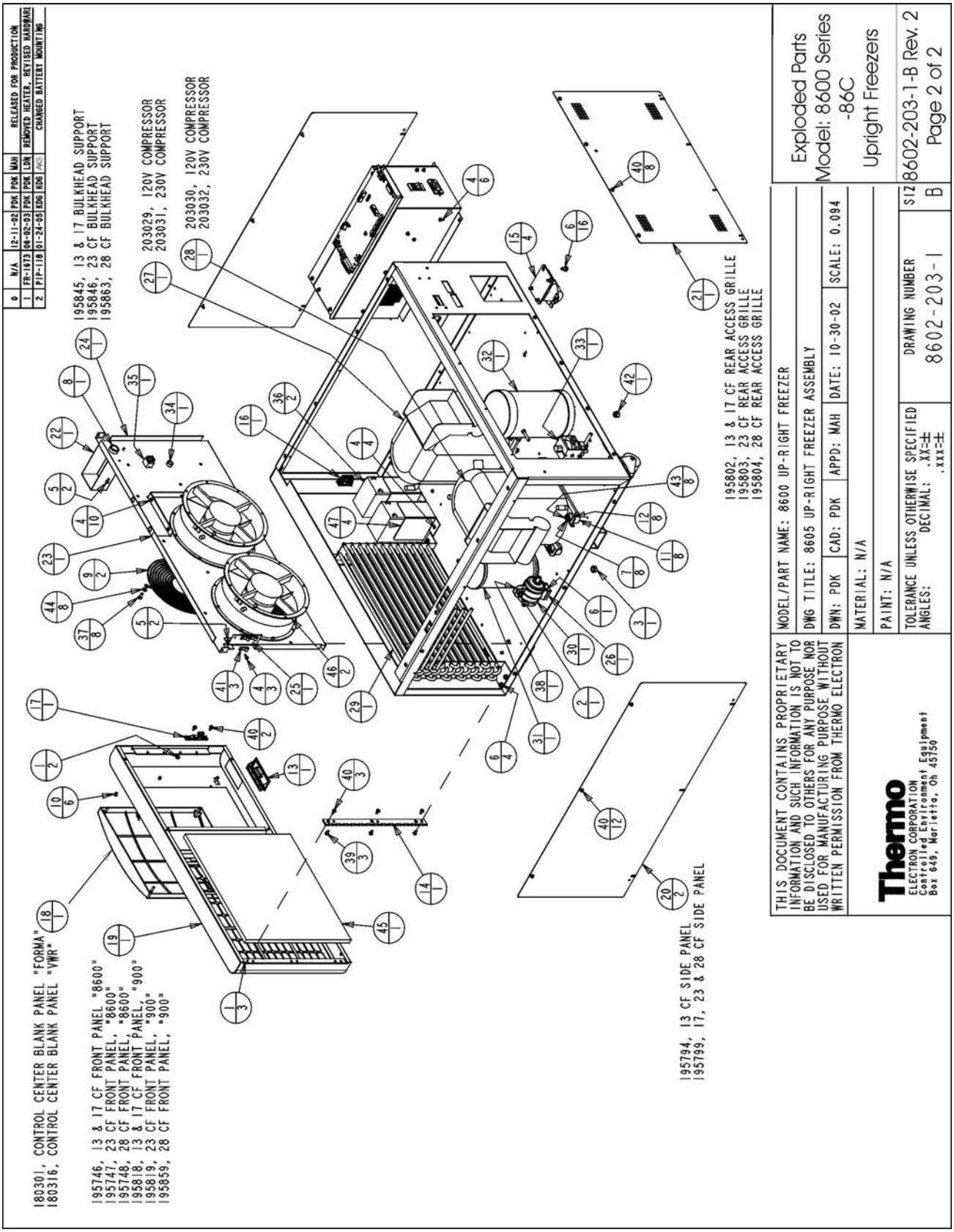
Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750

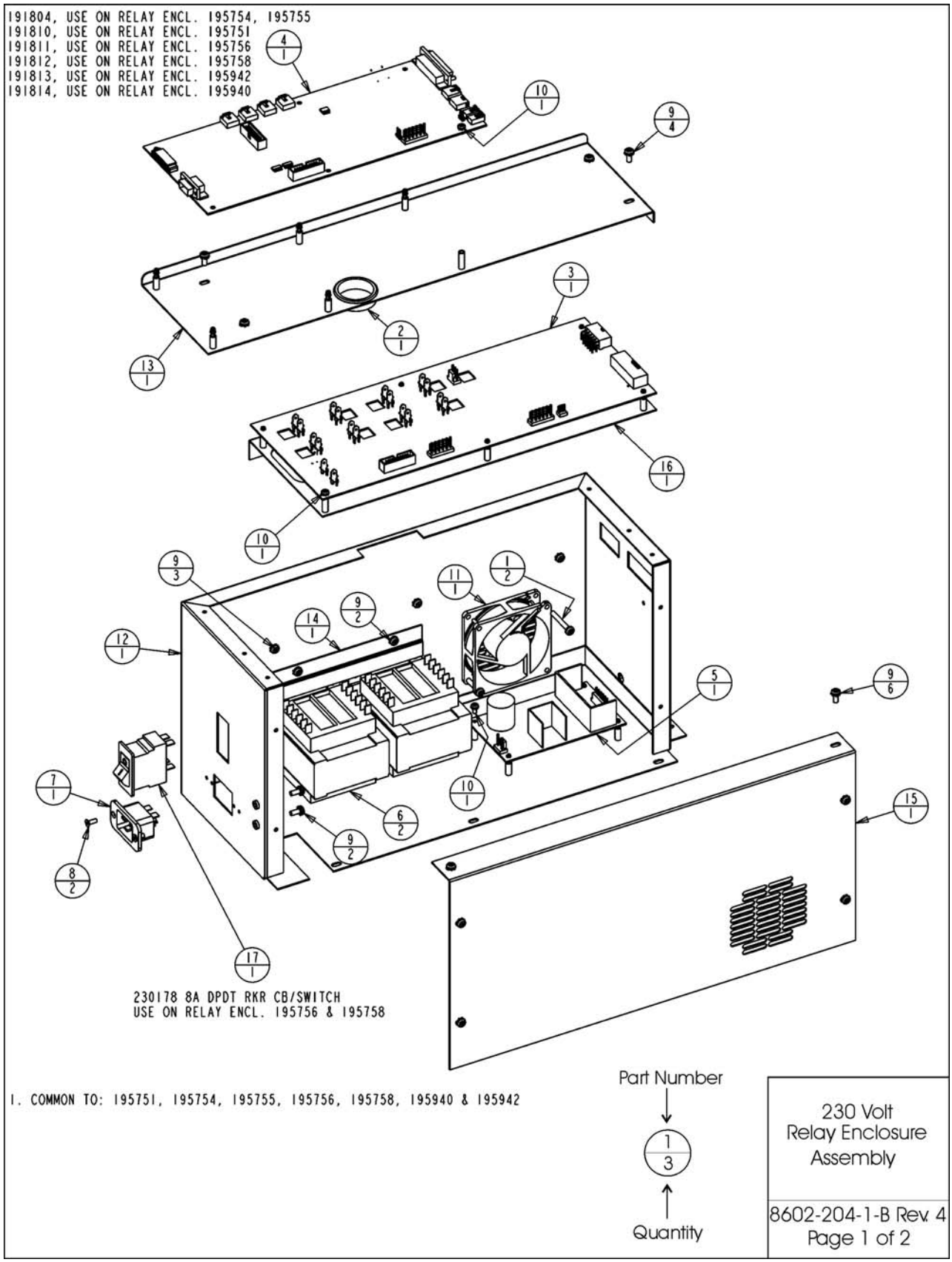
BILL OF MATERIALS

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	24049	1/4 ZP FLAT WASHER
8	30016	1" SNAP BUSHING
9	108020	10" WIRE FAN GUARD
10	111028	TINNERMAN TUBULAR SPEED CLIP
11	114033	COMPRESSOR MOUNTING FOOT
12	114034	COMPRESSOR MOUNTING SLEEVE
13	115032	BLACK ABS PLASTIC PULL
14	116115	FRONT PANEL HINGE
15	120011	DUAL WHEEL CASTER
16	121071	LATCH CATCH, PART OF 121071 ASSEMBLY
17	121071	LATCH KEEPER, PART OF 121071 ASSEMBLY
18	180301	THERMO CONTROL CENTER BLANK PANEL
19	195746	13&17 CU. FT. UR FRZ BASE FRONT PNL,760&8600
20	195799	SIDE PANEL 17, 23 AND 28 CU. FT. UPRIGHT
21	195802	13/17 REAR ACCESS GRILLE
22	195829	MULLION/DOOR SWITCH WIRE COVER
23	195844	UR FRZ FAN BULKHEAD
24	195845	13&17 CU. FT. FAN BULKHEAD SUPPORT
25	195882	REFRIGERATION LINE SUPPORT BRACKET
26	200126	2" RIGID HANGER
27	203031	230V HIGH STAGE COMPRESSOR
28	203032	230V LOW STAGE COMPRESSOR
29	204009	REFRIGERATION CONDENSER
30	209020	LIQUID LINE FILTER DRYER WITH ACCESS PORT
31	214006	OIL SEPARATOR
32	214018	10.000" H X 5.000" DIA. EXPANSION TANK
33	220626	120V - 50/60 HZ SOLENOID VALVE
34	330002	5/8" SNAP BUSHING
35	360248	MINI SNAP-IN POWER SWITCH
36	400159	SEALED LEAD ACID BATTERY - 12 VOLT - 7.2 Ah
37	510035	#12-24 X 1/2 SS HH CAP SCREW
38	550043	1/4-20 X 1"L ZP CARRIAGE BOLT
39	590020	#8-32 X 3/8 SS PHP EXT SEMS SCREW
40	590029	#8-32 X 3/8 SS PHP EXT SEMS SCREW W/PATCH
41	600080	1/4 ALUM CLAMP W/LINER
42	610053	3/8-16 NYLON INSERT LOCK NUT
43	680008	1/4-20 X 1-3/4 SELF TAPPING SCREW
44	730087	#12 SS EXT TOOTH LOCKWASHER
45	760203	AIR FILTER
46	900113	10" TUBEAXIAL FAN, 115V
47	1950074	BATTERY MOUNTING BRACKET

Exploded Parts
Model: 8600 Series
-86C
Upright Freezers

8602-203-1-B Rev. 2
Page 1 of 2


0 N/A 12-11-02 PDK MAH RELEASED FOR PRODUCTION
1 FR-1073 06-02-03 PDK LSM REMOVED HEATER, REVISED HARDWARE
2 PIP-118 01-24-05 KDG JMS CHANGED BATTERY MOUNTING
180301, CONTROL CENTER BLANK PANEL "FORMA"
180316, CONTROL CENTER BLANK PANEL "VWR"
195746, 13 & 17 CF FRONT PANEL "8600"
195747, 23 CF FRONT PANEL, "8600"
195748, 28 CF FRONT PANEL, "8600"
195818, 13 & 17 CF FRONT PANEL, "900"
195819, 23 CF FRONT PANEL, "900"
195859, 28 CF FRONT PANEL, "900"
195794, 13 CF SIDE PANEL
195799, 17, 23 & 28 CF SIDE PANEL
195845, 13 & 17 BULKHEAD SUPPORT
195846, 23 CF BULKHEAD SUPPORT
195863, 28 CF BULKHEAD SUPPORT
203029, 120V COMPRESSOR
203031, 230V COMPRESSOR
203030, 120V COMPRESSOR
203032, 230V COMPRESSOR
195802, 13 & 17 CF REAR ACCESS GRILLE
195803, 23 CF REAR ACCESS GRILLE
195804, 28 CF REAR ACCESS GRILLE
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSE WITHOUT WRITTEN PERMISSION FROM THERMO ELECTRON
MODEL/PART NAME: 8600 UP-RIGHT FREEZER
DWG TITLE: 8605 UP-RIGHT FREEZER ASSEMBLY
DWN: PDK CAD: PDK APPD: MAH DATE: 10-30-02 SCALE: 0.094
MATERIAL: N/A
PAINT: N/A
Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER
8602-203-1
SIZ B
Exploded Parts
Model: 8600 Series
-86C
Upright Freezers
8602-203-1-B Rev. 2
Page 2 of 2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191810, USE ON RELAY ENCL. 195751
191811, USE ON RELAY ENCL. 195756
191812, USE ON RELAY ENCL. 195758
191813, USE ON RELAY ENCL. 195942
191814, USE ON RELAY ENCL. 195940
230178 8A DPDT RKR CB/SWITCH
USE ON RELAY ENCL. 195756 & 195758
1. COMMON TO: 195751, 195754, 195755, 195756, 195758, 195940 & 195942
Part Number
Quantity
230 Volt
Relay Enclosure
Assembly
8602-204-1-B Rev. 4
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	12-02-02	PDK	PDK	MAH	RELEASED FOR PRODUCTION
1	FR-1673	03-06-03	DHG	KDG	LDN	MADE COMMON TO 195940 & 195942
2	FR-1789	07-28-04	ADT	KDG	LDN	CHG. MICRO BOARD FOR VACUUM RELIEF
3	PIP-111	08-02-04	TJ	KDG	LDN	REMOVED 114031 GROMMET EDGING
4	FR-1806	08-23-04	JDL	KDG	AKS	SPECIFIED AMPERAGE OF CB SWITCHES

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	191658	HIGH VOLTAGE BOARD 230V
4	191804	MICRO BOARD (-86 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

MODEL/PART NAME: RELAY ENCLOSURE ASSEMBLY

DWG TITLE: 230 VOLT RELAY ENCLOSURE ASSY (HIGH END)

DWN: DHG	CAD: DHG	APPD: MAH	DATE: 07-26-01	SCALE: 0.250

MATERIAL: -

PAINT: N/A

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

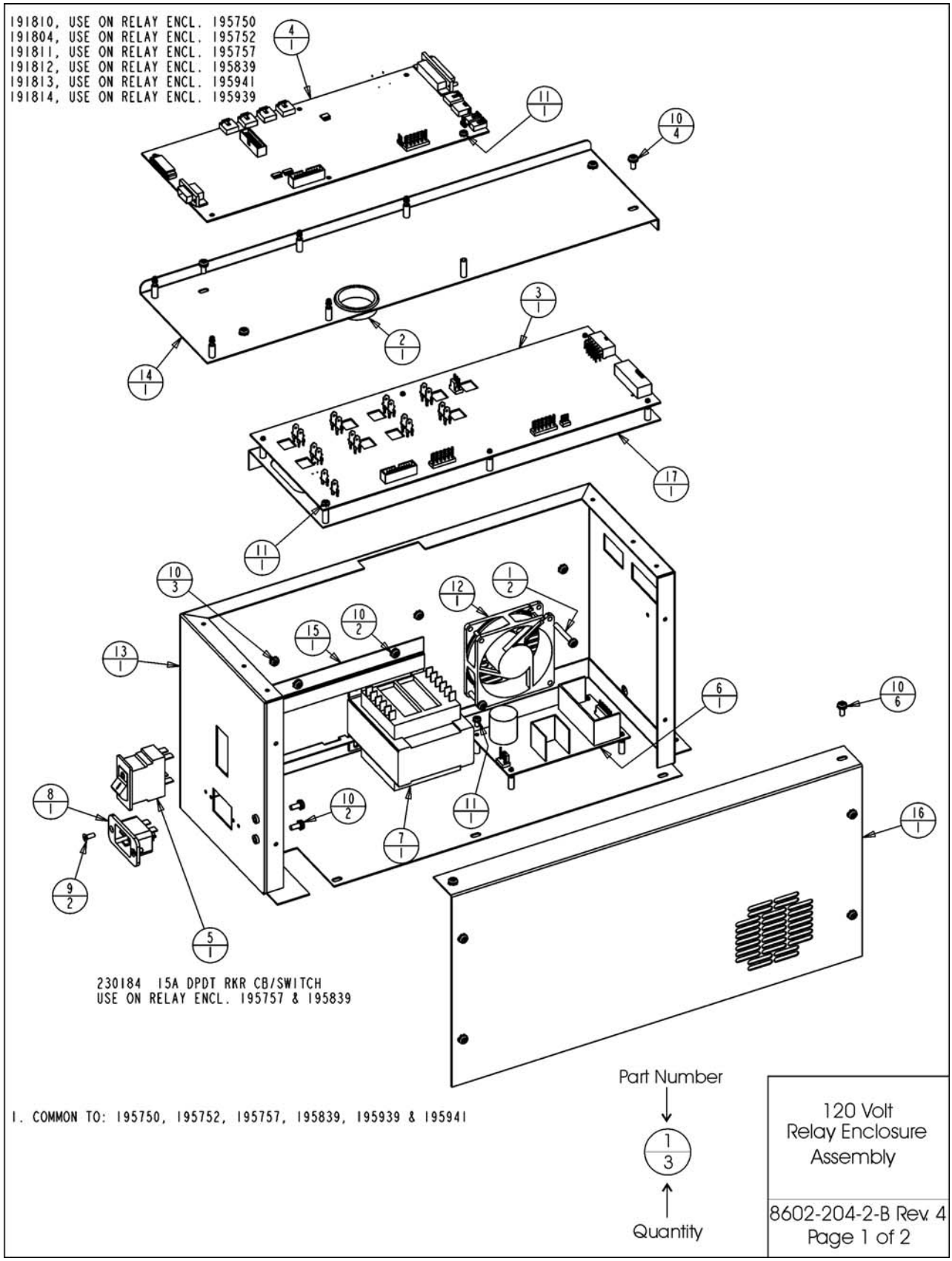
DRAWING NUMBER: 8602-204-1

SIZE: B

230 Volt Relay Enclosure Assembly

8602-204-1-B Rev. 4
Page 2 of 2

Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750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191804, USE ON RELAY ENCL. 195752
191811, USE ON RELAY ENCL. 195757
191812, USE ON RELAY ENCL. 195839
191813, USE ON RELAY ENCL. 195941
191814, USE ON RELAY ENCL. 195939
230184 15A DPDT RKR CB/SWITCH
USE ON RELAY ENCL. 195757 & 195839
1. COMMON TO: 195750, 195752, 195757, 195839, 195939 & 195941
Part Number
Quantity
120 Volt
Relay Enclosure
Assembly
8602-204-2-B Rev. 4
Page 1 of 2

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	12-02-02	PDK	PDK	MAH	RELEASED FOR PRODUCTION
1	FR-1673	03-06-03	DHG	KDG	KDG	MADE COMMON TO 195939 & 195941
2	FR-1789	07-28-04	ADT	KDG	LDN	CHG. MICRO BOARD FOR VACUUM RELIEF
3	PIP-111	08-02-04	TJ	KDG	LDN	REMOVED 114031 GROMMET EDGING
4	FR-1806	08-23-04	JDL	KDG	AKS	SPECIFIED AMPERAGE OF CB SWITCHES

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	191680	HIGH VOLTAGE BOARD 120V
4	191810	MICRO BOARD (-86 LOW END)
5	230183	20A 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

MODEL/PART NAME: RELAY ENCLOSURE ASSEMBLY

DWG TITLE: 120 VOLT RELAY ENCLOSURE ASSY (LOW END)

DWN: DHG	CAD: DHG	APPD: MAH	DATE: 07-26-01	SCALE: 0.250

MATERIAL: -

PAINT: N/A

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

DRAWING NUMBER: 8602-204-2

SIZE: B

120 Volt Relay Enclosure Assembly

8602-204-2-B Rev. 4
Page 2 of 2

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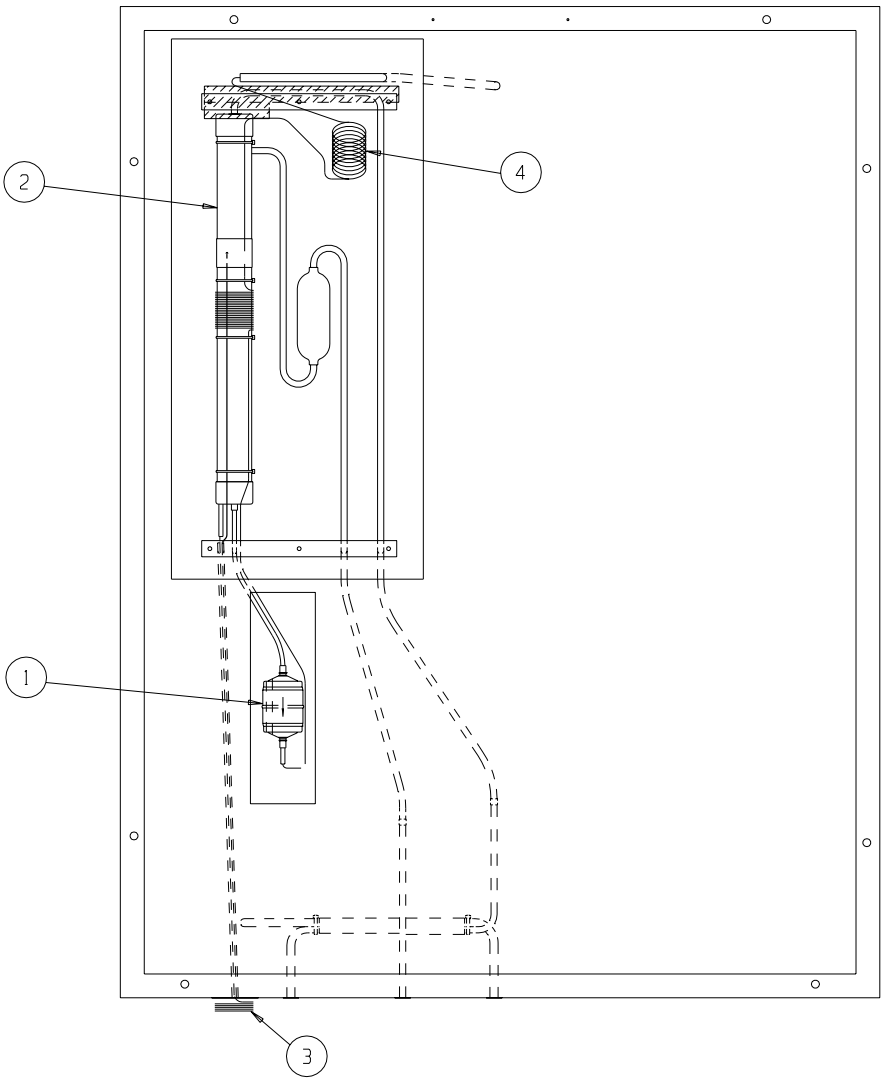
Box 649, Marietta, Oh 45750

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	12-04-02	PDK	PDK	AKS	RELEASED FOR PRODUCTION



BILL OF MATERIALS

ITEM NO.	PART NO.	PART DESCRIPTION
1	209016	DRYER
2	211041	HEAT EXCHANGER
3	227927	HIGH STAGE CAP. TUBE
4	227928	LOW STAGE CAP. TUBE

MODEL/PART NAME: 8600 UP-RIGHT FREEZER

DWG TITLE: 28 CF HEAT EXCHANGER ASSEMBLY

DWN: PDK	CAD: PDK	APPD:	DATE: 12-04-02	SCALE: NTS

MATERIAL: N/A

PAINT COLOR: N/A

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

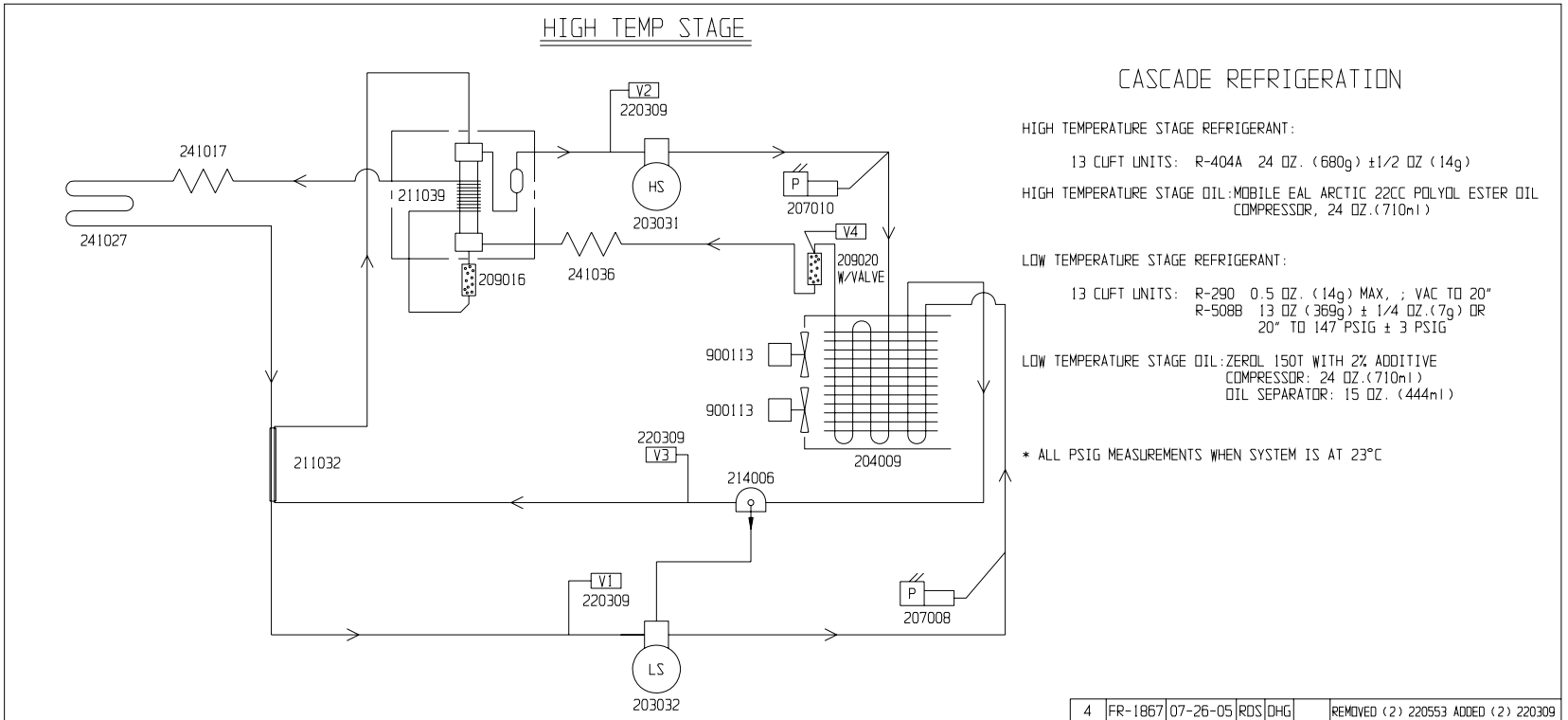
DRAWING NUMBER: 8602-205-2

SIZE: B

28 cu. ft. Upright Freezer Heat Exchanger Assembly

8602-205-2-B Rev. 0
Page 1 of 1

ThermoForma
BOX 649, MARIETTA, OHIO 45750



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 24 OZ.(710ml)

LOW TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-290 0.5 OZ. (14g) MAX, ; VAC TO 20"
R-508B 13 OZ (369g) ± 1/4 OZ.(7g) OR
20" TO 147 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 24 OZ.(710ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

1. COMMON TO: 702, 902, 991, 8602, 8627, 8691, 5702 & 5602 13 CU. FT. FREEZERS (230 V)

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
4	FR-1867	07-26-05	RDS	DHG		REMOVED (2) 220553 ADDED (2) 220309
3	FR-1729	08-27-03	RDS	KDG	MAH	220554 ROTOLOCK VALVE TO 220553
2	N/A	01-07-03	MAH	PDK	MAH	CORRECTED COMPRESSOR STOCK NUMBERS
1	FR-1664	12-17-02	MAH	KDG	MAH	CHANGED 900111 FANS TO 900113
0	N/A	07-22-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION

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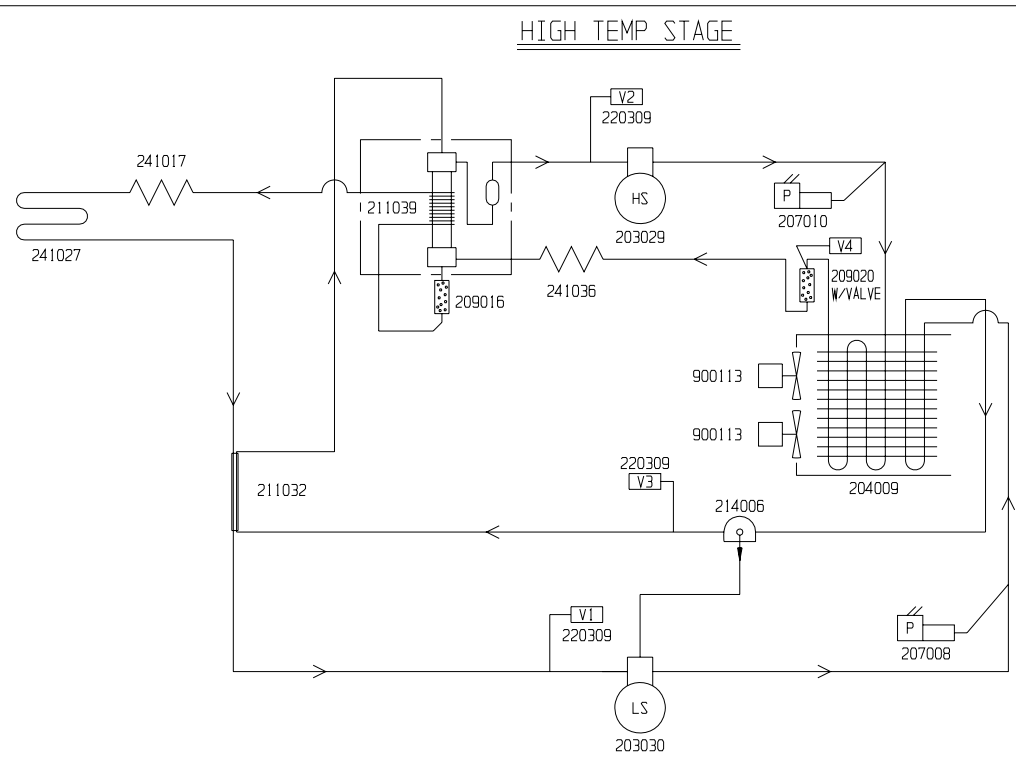
DATE 05-14-02	DWN MAH	CAD KDG	APPD MAH / SCALE NONE
CUSTOMER			
JOB TITLE -86°C 13 CU. FT. UPRIGHT FREEZERS (230 V)			
DWG TITLE REFRIGERATION SCHEMATIC			
LOCATION	JOB NUMBER	DRAWING NUMBER 8602-90-0-B	



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 24 OZ.(710ml)

LOW TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-290 0.5 OZ. (14g) MAX, ; VAC TO 20"
R-508B 13 OZ (369g) ± 1/4 OZ.(7g) OR
20" TO 147 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 24 OZ.(710ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

1. COMMON TO: 703, 903, 992, 8603, 8692, 5703 & 5603 13 CU. FT. FREEZERS (120 V)

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	FR-1867	07-26-05	RDS	DHG		REMOVED (2) 220553 ADDED (2) 220309
2	FR-1729	08-27-03	RDS	KDG	MAH	220554 ROTOLOCK VALVE TO 220553
1	N/A	01-07-03	MAH	PDK	MAH	CORRECTED COMPRESSOR STOCK NUMBERS
0	N/A	07-22-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION

DATE 05-14-02	DWN MAH	CAD KDG	APPD MAH	SCALE NONE
CUSTOMER				
JOB TITLE -86°C 13 CU. FT. UPRIGHT FREEZERS (120 V)				
DWG TITLE REFRIGERATION SCHEMATIC				
LOCATION	JOB NUMBER	DRAWING NUMBER 8603-90-0-B		

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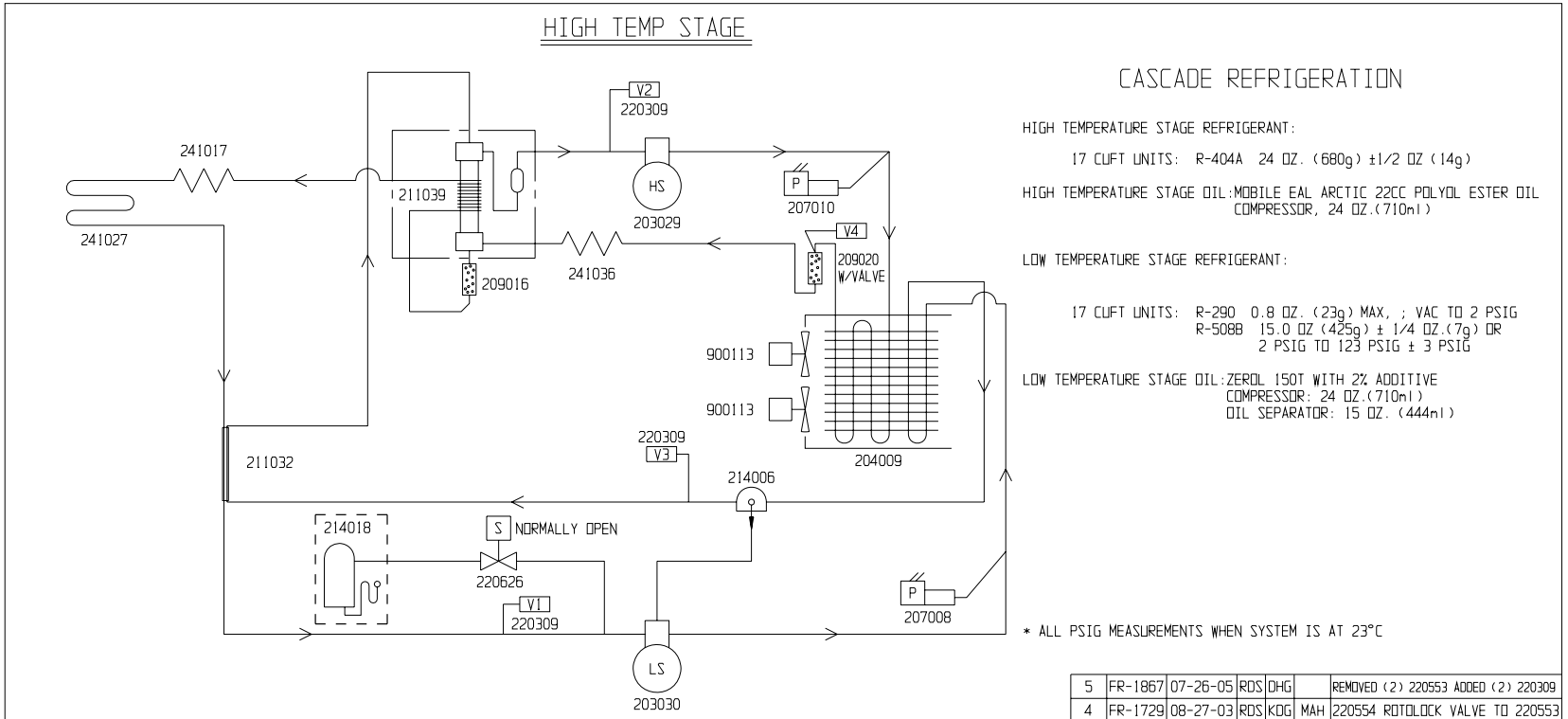
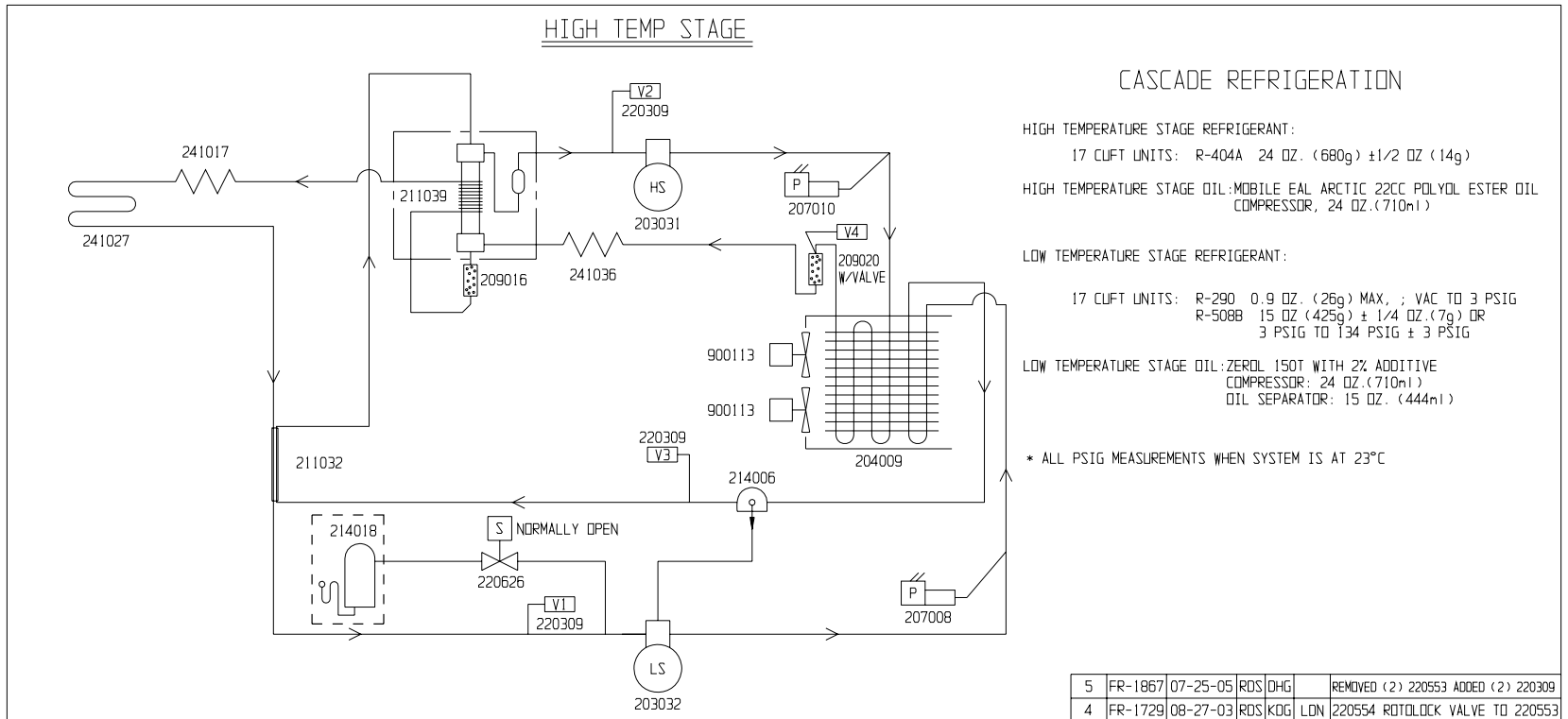


REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
5	FR-1867	07-26-05	RDS	DHG		REMOVED (2) 220553 ADDED (2) 220309
4	FR-1729	08-27-03	RDS	KDG	MAH	220554 ROTOLOCK VALVE TO 220553
3	N/A	01-07-03	MAH	PDK	MAH	CORRECTED COMPRESSOR STOCK NUMBERS
2	FR-1615	11-05-02	MAH	KDG	MAH	CHG'D. L/S CHARGES & REMOVE TANK
1	FR-1615	10-02-02	DHG	KDG	MAH	REMOVE CAP TUBING TO EXP. TANK
0	N/A	07-22-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION

DATE 05-14-02	DWN MAH		CAD KDG	APPD MAH	SCALE NONE
CUSTOMER					
JOB TITLE -86°C 17 CU. FT. UPRIGHT FREEZERS (120 V)					
DWG TITLE REFRIGERATION SCHEMATIC					
LOCATION		JOB NUMBER		DRAWING NUMBER 8604-90-0-B	



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

17 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 24 OZ.(710ml)

LOW TEMPERATURE STAGE REFRIGERANT:

17 CUFT UNITS: R-290 0.9 OZ. (26g) MAX, ; VAC TO 3 PSIG
R-508B 15 OZ (425g) ± 1/4 OZ.(7g) OR
3 PSIG TO 134 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 24 OZ.(710ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

1. COMMON TO: 705, 905, 994, 8605, 8694, 5705 & 5605 17 CU. FT. FREEZERS (230 V)

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
5	FR-1867	07-25-05	RDS	DHG		REMOVED (2) 220553 ADDED (2) 220309
4	FR-1729	08-27-03	RDS	KDG	LDN	220554 ROTOLOCK VALVE TO 220553
3	N/A	01-07-03	MAH	PDK	MAH	CORRECTED COMPRESSOR STOCK NUMBERS
2	FR-1664	12-17-02	MAH	KDG	MAH	CHANGED 900111 FANS TO 900113
1	FR-1615	10-02-02	DHG	KDG	LDN	REMOVE CAP TUBING TO EXP. TANK
0	N/A	07-22-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION

DATE 05-14-02	DWN MAH	CAD KDG	APPD MAH	SCALE NONE
CUSTOMER				
JOB TITLE -86°C 17 CU. FT. UPRIGHT FREEZERS (230 V)				
DWG TITLE REFRIGERATION SCHEMATIC				
LOCATION	JOB NUMBER	DRAWING NUMBER 8605-90-0-B		

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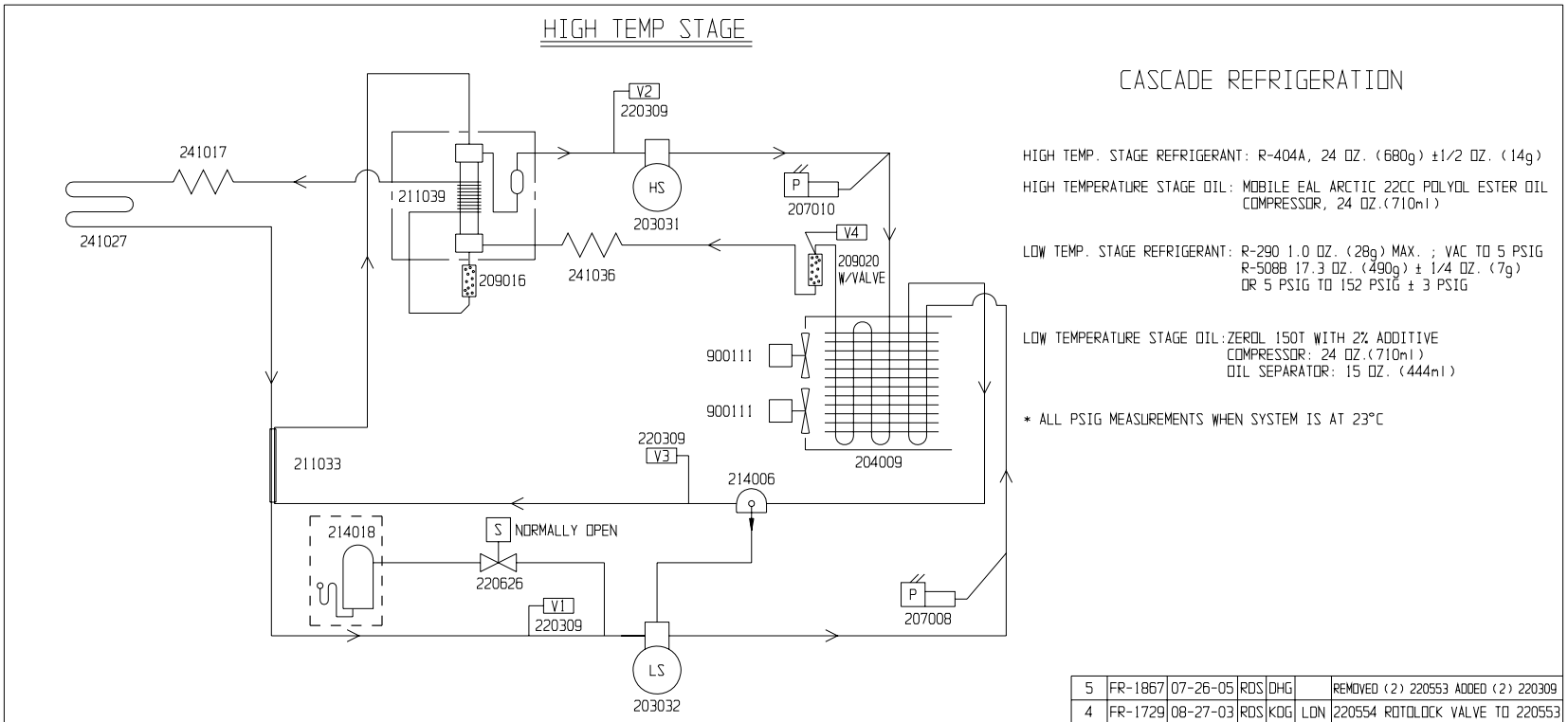
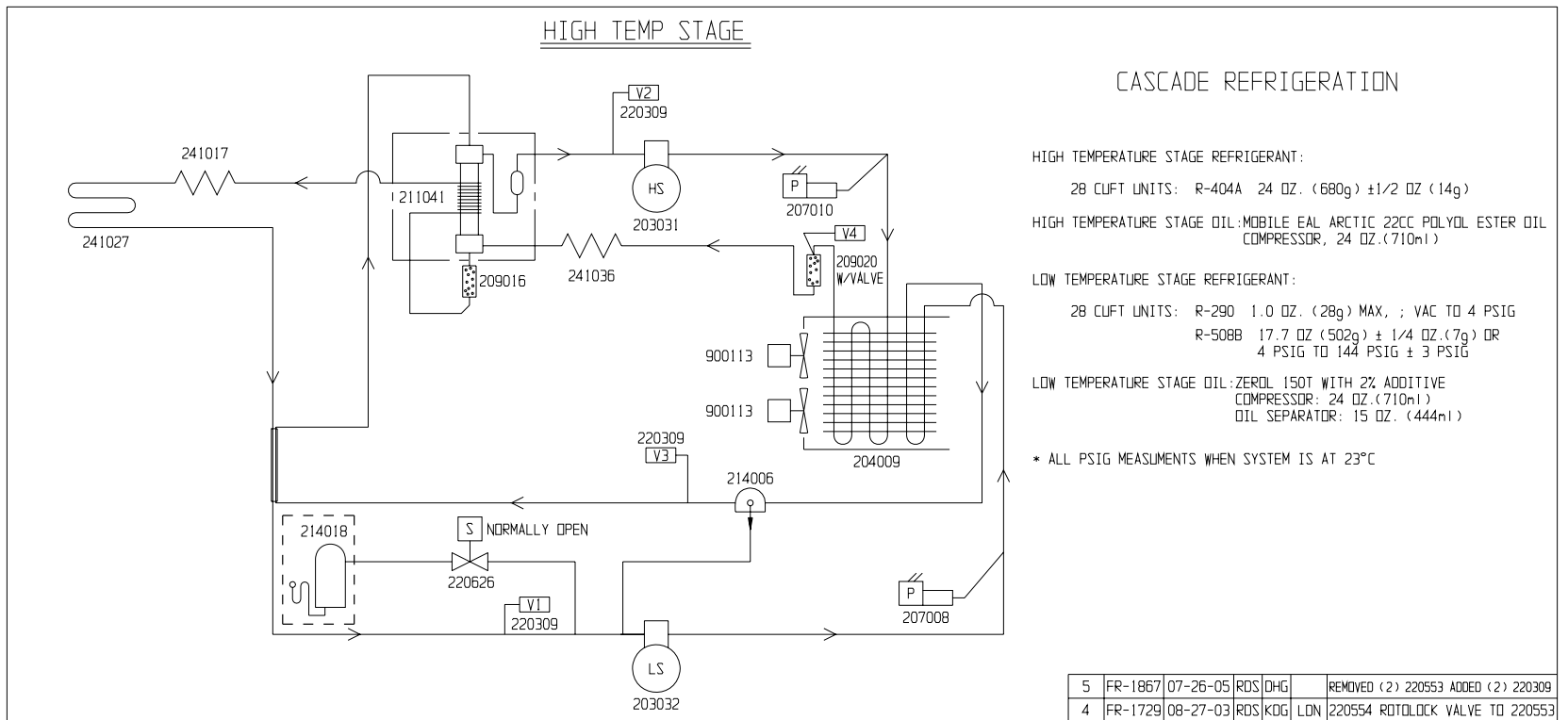
ELECTRON CORPORATION



REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
5	FR-1867	07-26-05	RDS	DHG		REMOVED (2) 220553 ADDED (2) 220309
4	FR-1729	08-27-03	RDS	KDG	LDN	220554 ROTOLOCK VALVE TO 220553
3	N/A	01-07-03	MAH	PDK	MAH	CORRECTED COMPRESSOR STOCK NUMBERS
2	FR-1664	12-17-02	MAH	KDG	MAH	CHANGED 900111 FANS TO 900113
1	FR-1615	10-02-02	DHG	KDG	LDN	REMOVE CAP TUBING TO EXP. TANK
0	N/A	07-22-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION

DATE 05-14-02	DWN MAH	CAD KDG	APPD MAH	SCALE NONE
CUSTOMER				
JOB TITLE -86°C 23 CU. FT. UPRIGHT FREEZERS (230 V)				
DWG TITLE REFRIGERATION SCHEMATIC				
LOCATION	JOB NUMBER	DRAWING NUMBER 8606-90-0-B		

Thermo ELECTRON CORPORATION



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

28 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 24 OZ.(710ml)

LOW TEMPERATURE STAGE REFRIGERANT:

28 CUFT UNITS: R-290 1.0 OZ. (28g) MAX, ; VAC TO 4 PSIG
R-508B 17.7 OZ (502g) ± 1/4 OZ.(7g) OR
4 PSIG TO 144 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 24 OZ.(710ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUMENTS WHEN SYSTEM IS AT 23°C

1. COMMON TO: 8607, 907 28 CU. FT. FREEZERS (230 V)

REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
5	FR-1867	07-26-05	RDS	DHG		REMOVED (2) 220553 ADDED (2) 220309
4	FR-1729	08-27-03	RDS	KDG	LDN	220554 ROTOLOCK VALVE TO 220553
3	N/A	01-07-03	MAH	PDK	MAH	CORRECTED COMPRESSOR STOCK NUMBERS
2	FR-1664	12-17-02	MAH	KDG	MAH	CHANGED 900111 FANS TO 900113
1	FR-1615	10-02-02	DHG	KDG	LDN	REMOVE CAP TUBING TO EXP. TANK
0	N/A	07-22-02	MAH	KDG	MAH	RELEASED FOR PRODUCTION

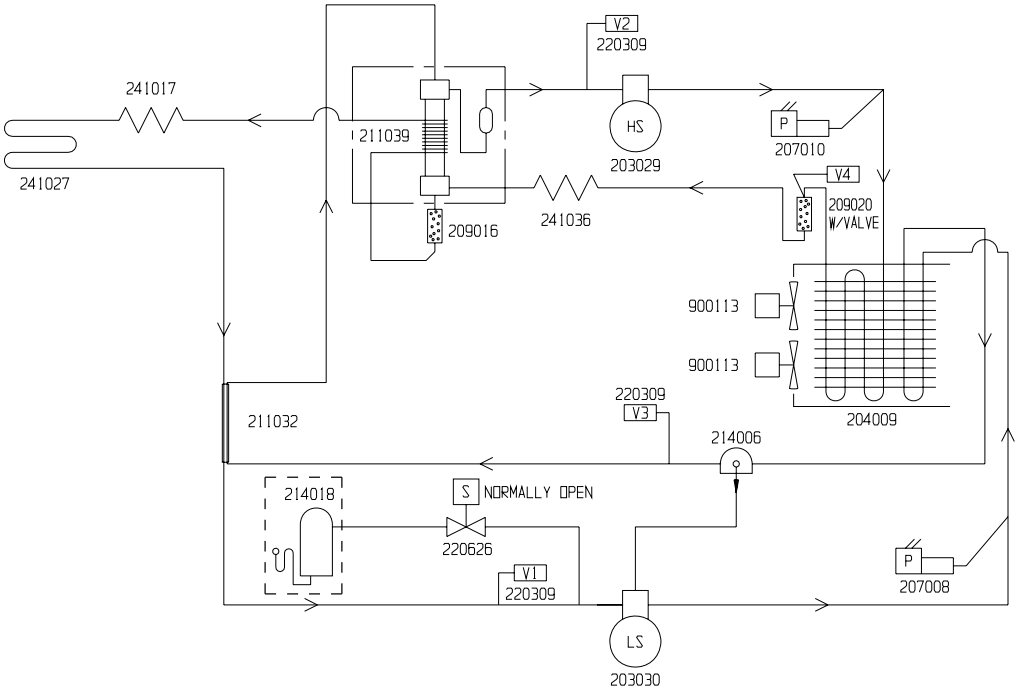
DATE 05-14-02	DWN MAH	CAD KDG	APPD MAH	SCALE NONE	
CUSTOMER					
JOB TITLE -86°C 28 CU. FT. UPRIGHT FREEZERS (230 V)					
DWG TITLE REFRIGERATION SCHEMATIC					
LOCATION	JOB NUMBER	DRAWING NUMBER 8607-90-0-B			

Thermo
ELECTRON CORPORATION

DRAWING NUMBER: 8656-90-0-B

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	FR-1776	03-09-04	AOT	pdk	LON	RELEASED FOR PRODUCTION
1	FR-1867	07-26-05	RDS	DHG	LON	REMOVED (2) 220553 ADDED (2) 220309
2	FR-1893	12-20-05	JAS	KOG		CORRECTLY SHOWED EXP. TANK & VALVE

HIGH TEMP STAGE



LOW TEMP STAGE

CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

23 CUFT UNITS: R-404A 24 OZ. (680g) ±1/2 OZ (14g)

HIGH TEMPERATURE STAGE OIL:MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL
COMPRESSOR, 24 OZ.(710ml)

LOW TEMPERATURE STAGE REFRIGERANT:

23 CUFT UNITS: R-290 0.9 OZ. (14g) MAX, ; VAC TO 4 PSIG
R-508B 15 OZ (369g) ± 1/4 OZ.(7g) OR
4 PSIG TO 133 PSIG ± 3 PSIG

LOW TEMPERATURE STAGE OIL:ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 24 OZ.(710ml)
OIL SEPARATOR: 15 OZ. (444ml)

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

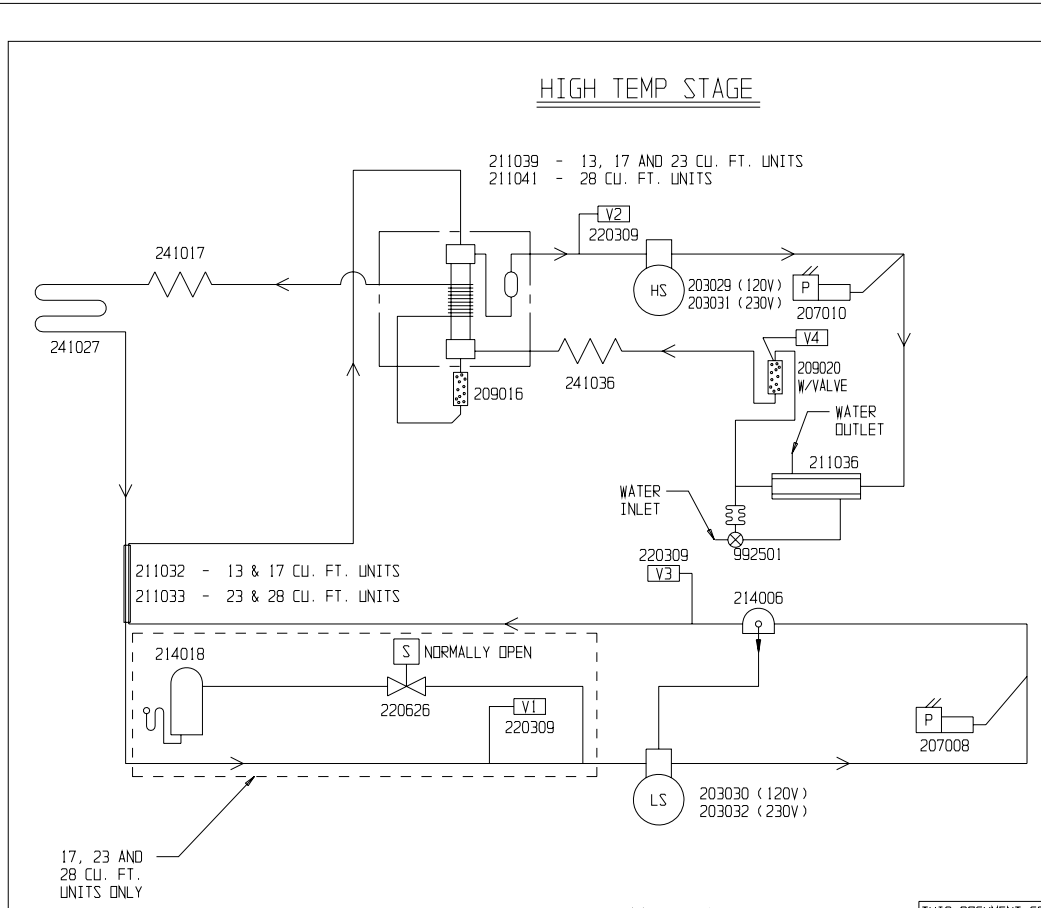
1. COMMON TO: 756, 956, 990, 8656, 8690, 5756 & 5656 23 CU. FT. FREEZERS (120 V)

Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750

MODEL/PART NAME: -86° 23 CU. FT. UP-RIGHT FREEZERS (120 VOLT)					
DWG TITLE: REFRIGERATION SCHEMATIC					
DWN: AOT	CAD: pdk	APPD: MAH	DATE: 03-09-04	SCALE: NONE	
MATERIAL: N/A					
PAINT COLOR: N/A					
TOLERANCE UNLESS OTHERWISE SPECIFIED ANGLES: DECIMAL: .XX=± .XXX=±			DRAWING NUMBER 8656-90-0	SIZE B	

DRAWING NUMBER: 195964-90-1-B

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	N/A	01-23-03	DHG	DHG	MAH	RELEASED FOR PRODUCTION
1	FR-1729	08-27-03	RDS	KDG	LDN	220554 ROTOLOCK VALVE TO 220553
2	FR-1867	07-26-05	RDS	DHG		REMOVED (2) 220553 ADDED (2) 220309



CASCADE REFRIGERATION

HIGH TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-404A 24 OZ. (680gr) ±1/2 OZ (14gr)
17 CUFT UNITS: R-404A 24 OZ. (680gr) ±1/2 OZ (14gr)
23 CUFT UNITS: R-404A 24 OZ. (680gr) ±1/2 OZ (14gr)
28 CUFT UNITS: R-404A 24 OZ. (680gr) ±1/2 OZ (14gr)

HIGH TEMPERATURE STAGE OIL: MOBILE EAL ARCTIC 22CC POLYOL ESTER OIL COMPRESSOR, 24 OZ.(710ml)

LOW TEMPERATURE STAGE REFRIGERANT:

13 CUFT UNITS: R-290 0.5 OZ. (14gr) MAX, ; VAC TO 20"
R-508B 13 OZ (369gr) ± 1/4 OZ.(7gr) OR
20" TO 147 PSIG ± 3 PSIG

17 CUFT UNITS: R-290 0.8 OZ. (23gr) MAX, ; VAC TO 2 PSIG
(120 VOLTS) R-508B 13.4 OZ (380gr) ± 1/4 OZ.(7gr) OR
2 PSIG TO 123 PSIG ± 3 PSIG

17 CUFT UNITS: R-290 0.9 OZ. (26gr) MAX, ; VAC TO 3 PSIG
(230 VOLTS) R-508B 15 OZ (425gr) ± 1/4 OZ.(7gr) OR
3 PSIG TO 134 PSIG ± 3 PSIG

23 CUFT UNITS: R-290 1.0 OZ. (28gr) MAX, ; VAC TO 5 PSIG
R-508B 17.3 OZ (490gr) ± 1/4 OZ.(7gr) OR
5 PSIG TO 152 PSIG ± 3 PSIG

28 CUFT UNITS: R-290 1.0 OZ. (28gr) MAX, ; VAC TO 4 PSIG
R-508B 17.7 OZ (502gr) ± 1/4 OZ.(7gr) OR
4 PSIG TO 144 PSIG ± 3 PSIG

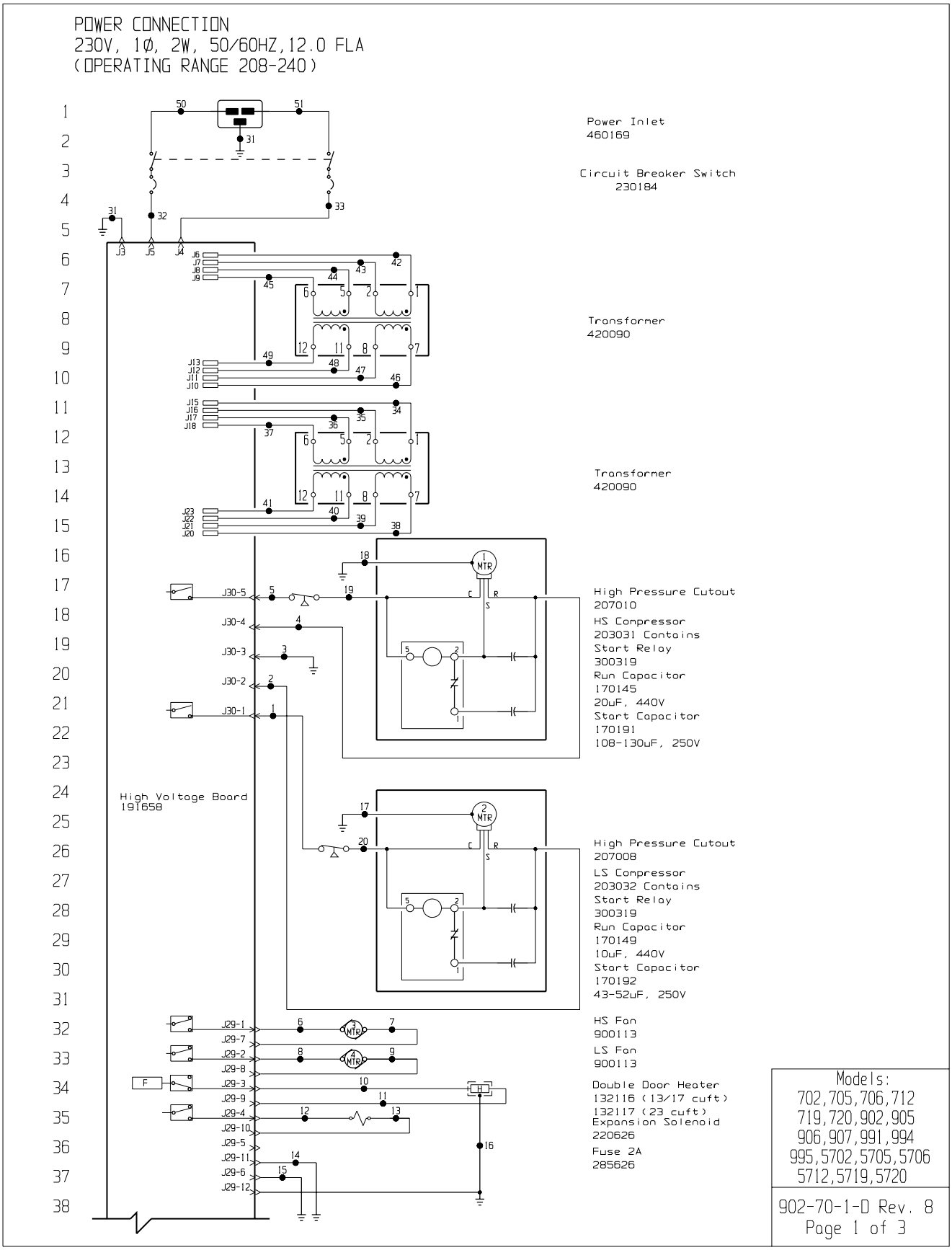
LOW TEMPERATURE STAGE OIL: ZEROL 150T WITH 2% ADDITIVE
COMPRESSOR: 24 OZ.(710ml)
OIL SEPARATOR: 15 OZ. (444ml)

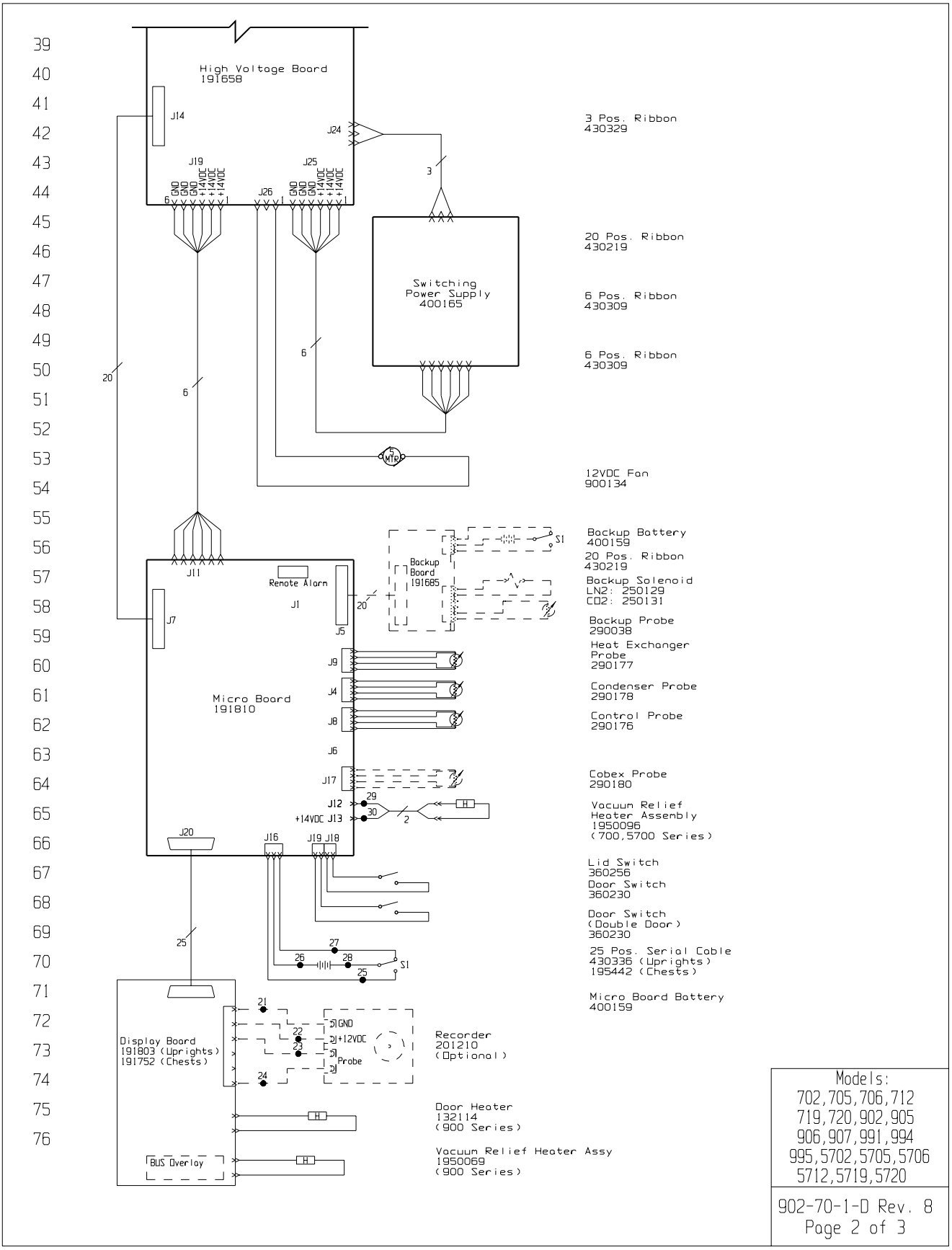
***SET WATER REGULATING VALVE FOR 170 PSIG

* ALL PSIG MEASUREMENTS WHEN SYSTEM IS AT 23°C

Thermo ELECTRON CORPORATION

MODEL/PART NAME: -86°C 13, 17, 23 & 28 CU. FT. UPRIGHT H2O COOLED
DWG TITLE: FREEZER REFRIGERATION SCHEMATIC
DWN: DHG | CAD: DHG | APPD: MAH | DATE: 01-23-03 | SCALE: NONE
MATERIAL: N/A
PAINT COLOR: N/A
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=±, .XXX=±
DRAWING NUMBER: 195964-90-1
SIZE: B


POWER CONNECTION
230V, 1Ø, 2W, 50/60HZ,12.0 FLA
(OPERATING RANGE 208-240)
Power Inlet
460169
Circuit Breaker Switch
230184
Transformer
420090
Transformer
420090
High Pressure Cutout
207010
HS Compressor
203031 Contains
Start Relay
300319
Run Capacitor
170145
20uF, 440V
Start Capacitor
170191
108-130uF, 250V
High Voltage Board
191658
High Pressure Cutout
207008
LS Compressor
203032 Contains
Start Relay
300319
Run Capacitor
170149
10uF, 440V
Start Capacitor
170192
43-52uF, 250V
HS Fan
900113
LS Fan
900113
Double Door Heater
132116 (13/17 cuft)
132117 (23 cuft)
Expansion Solenoid
220626
Fuse 2A
285626
Models:
702,705,706,712
719,720,902,905
906,907,991,994
995,5702,5705,5706
5712,5719,5720
902-70-1-D Rev. 8
Page 1 of 3


High Voltage Board
191658
J14
J24
J19
J25
J26
GND
+14VDC
3 Pos. Ribbon
430329
20 Pos. Ribbon
430219
Switching
Power Supply
400165
6 Pos. Ribbon
430309
6 Pos. Ribbon
430309
12VDC Fan
900134
Backup Battery
400159
20 Pos. Ribbon
430219
Backup Solenoid
LN2: 250129
CO2: 250131
Backup Probe
290038
Heat Exchanger
Probe
290177
Condenser Probe
290178
Control Probe
290176
Cobex Probe
290180
Vacuum Relief
Heater Assembly
1950096
(700,5700 Series)
Lid Switch
360256
Door Switch
360230
Door Switch
(Double Door)
360230
25 Pos. Serial Cable
430336 (Uprights)
195442 (Chests)
Micro Board Battery
400159
Backup
Board
191685
Remote Alarm
J1
J11
J7
J5
J9
J4
J8
J6
J17
J12
J13
J20
J16
J19 J18
Micro Board
191810
Display Board
191803 (Uprights)
191752 (Chests)
BUS Overlay
GND
+12VDC
Probe
Recorder
201210
(Optional)
Door Heater
132114
(900 Series)
Vacuum Relief Heater Assy
1950069
(900 Series)
Models:
702,705,706,712
719,720,902,905
906,907,991,994
995,5702,5705,5706
5712,5719,5720
902-70-1-D Rev. 8
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	BLK	18
11	BLK	18
12	BLK	18
13	BLK	18
14	GRN/YEL	18
15	GRN/YEL	18
16	GRN/YEL	18
17	GRN/YEL	14
18	GRN/YEL	14
19	BLK	14
20	BLK	14
21	BLK	18
22	RED	18
23	BLK	18
24	RED	18

WIRE #	COLOR	GAUGE
25	WHT	18
26	BLK	18
27	BLK	18
28	RED	18
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

Uprights

SIZE	THERMO	THERMO	THERMO	VWR
13	902	991	702	5702
17	905	994	705	5705
23	906	995	706	5706
28	907			

Chests

SIZE	THERMO	VWR
12.7	712	5712
17	719	5719
20	720	5720

REMOTE CONTACTS/ANALOG OUTPUT
PIN# 1 Not Connected
PIN# 2 Not Connected
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

1. Schematic represents single & double door upright models and chest models. All heaters are for uprights only. Expansion solenoid on 17, 23 & 28 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
8	FR-1854	06-13-05	HCE	GLS	AKS	REV. BATTERY CIRCUIT WIRING
7	FR-1789	06-13-05	RTB	KDG	LDN	ADD VACUUM RELIEF HEATER & CHG. DISPLAY BD.
6	FR-1789	08-14-04	ADT	KDG	LDN	CHANGED MICRO BOARD 191687 TO 191810
5	FR-1766	04-26-04	ADT	pdk	LDN	CHANGED DISPLAY BD. 191752 FROM 191716
4	FR-1771	02-18-04	ROS	pdk	LDN	REVISED START CAPACITORS

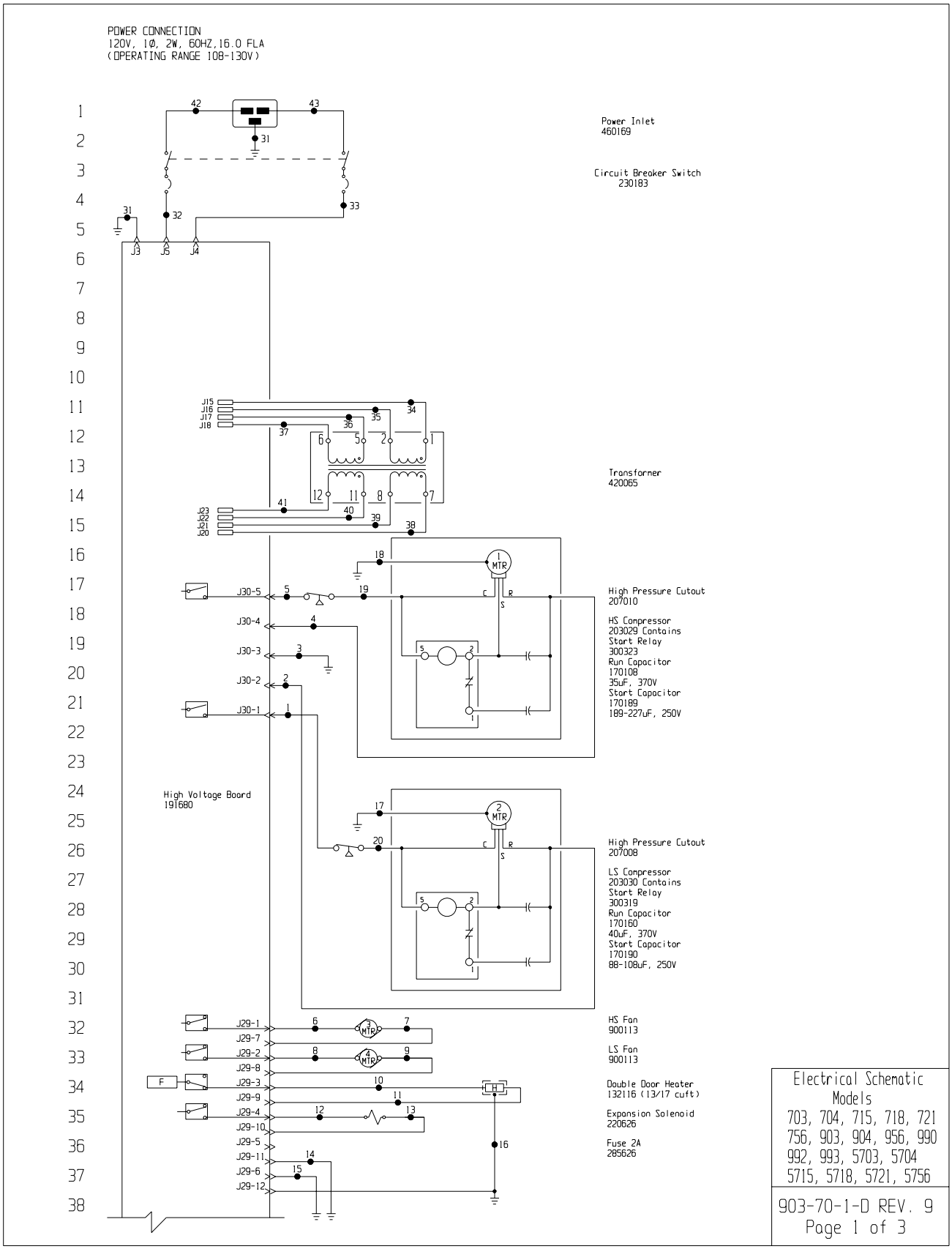
MODEL/PART NAME: LOW-END, 230V, ULT FREEZERS
DWG TITLE: UNIT SCHEMATIC
DWN: ADT | CAD: ADT | APPD: MAH | DATE: 3-22-02 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED ANGLES: DECIMAL: .XX=± .XXX=±
DRAWING NUMBER 902-70-1 | SIZE D

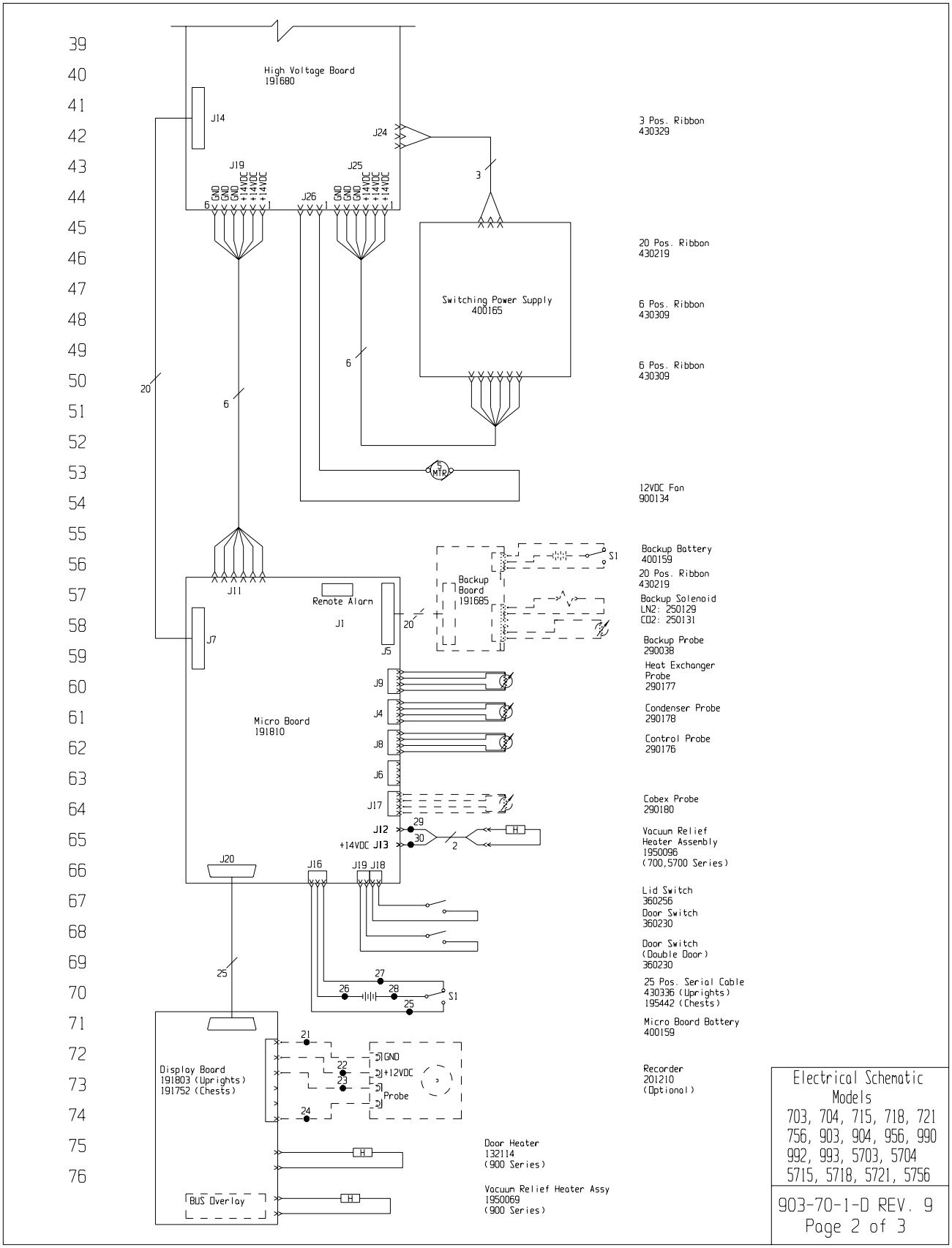
Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

Models:
702,705,706,712
719,720,902,905
906,907,991,994
995,5702,5705,5706
5712,5719,5720

902-70-1-D Rev. 8
Page 3 of 3


POWER CONNECTION
120V, 1Ø, 2W, 60HZ,16.0 FLA
(OPERATING RANGE 108-130V)
Power Inlet
460169
Circuit Breaker Switch
230183
Transformer
420065
High Pressure Cutout
207010
HS Compressor
203029 Contains
Start Relay
300323
Run Capacitor
170108
35uF, 370V
Start Capacitor
170189
189-227uF, 250V
High Voltage Board
191680
High Pressure Cutout
207008
LS Compressor
203030 Contains
Start Relay
300319
Run Capacitor
170160
40uF, 370V
Start Capacitor
170190
88-108uF, 250V
HS Fan
900113
LS Fan
900113
Double Door Heater
132116 (13/17 cuft)
Expansion Solenoid
220626
Fuse 2A
285626
Electrical Schematic
Models
703, 704, 715, 718, 721
756, 903, 904, 956, 990
992, 993, 5703, 5704
5715, 5718, 5721, 5756
903-70-1-D REV. 9
Page 1 of 3


High Voltage Board
191680
J14
J24
J19
J25
GND
GND
GND
+14VDC
+14VDC
+14VDC
J26
3 Pos. Ribbon
430329
20 Pos. Ribbon
430219
Switching Power Supply
400165
6 Pos. Ribbon
430309
6 Pos. Ribbon
430309
MTR
12VDC Fan
900134
J11
Backup
Board
191685
S1
Backup Battery
400159
20 Pos. Ribbon
430219
Backup Solenoid
LN2: 250129
CO2: 250131
Remote Alarm
J1
J5
J7
Backup Probe
290038
Heat Exchanger
Probe
290177
J9
J4
J8
J6
J17
Micro Board
191810
Condenser Probe
290178
Control Probe
290176
Cobex Probe
290180
J12
+14VDC J13
Vacuum Relief
Heater Assembly
1950096
(700,5700 Series)
J20
J16
J19 J18
Lid Switch
360256
Door Switch
360230
Door Switch
(Double Door)
360230
25 Pos. Serial Cable
430336 (Uprights)
195442 (Chests)
S1
Micro Board Battery
400159
Display Board
191803 (Uprights)
191752 (Chests)
GND
+12VDC
Probe
Recorder
201210
(Optional)
Door Heater
132114
(900 Series)
BUS Overlay
Vacuum Relief Heater Assy
1950069
(900 Series)
Electrical Schematic
Models
703, 704, 715, 718, 721
756, 903, 904, 956, 990
992, 993, 5703, 5704
5715, 5718, 5721, 5756
903-70-1-D REV. 9
Page 2 of 3

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

Uprights

SIZE	THERMO	THERMO	THERMO	VWR
13	703	903	992	5703
17	704	904	993	5704
23	756	956	990	5756

Chests

SIZE	THERMO	VWR
12.7	715	5715
17	718	5718
20	721	5721

REMOTE CONTACTS/ANALOG OUTPUT
PIN# 1 Not Connected
PIN# 2 Not Connected
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

1. Schematic represents single & double door upright models and chest models. All heaters are for uprights only. 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
9	FR-1911	07-27-06	SJN	NSE	CCS	CHG'D START CAPACITORS HIGH/LOW COMPRESSORS
8	FR-1854	06-13-05	HCE	GLS	LON	REV. BATTERY CIRCUIT WIRING
7	FR-1789	06-13-05	RTB	KDG	LON	ADD VACUUM RELIEF HEATER & CHG. DISPLAY BD.
6	FR-1789	08-14-04	ADT	KDG	LON	CHANGED MICRO BOARD 191687 TO 191810
5	FR-1766	04-26-04	ADT	pdk	LON	CHANGED DISPLAY BD. 191752 FROM 191716

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750

MODEL/PART NAME: LOW-END, 120V, ULT FREEZERS
DWG TITLE: UNIT SCHEMATIC
DWN: ADT | CAD: ADT | APPD: MAH | DATE: 3-22-02 | SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=±, .XXX=±
DRAWING NUMBER 903-70-1 | SIZE D

Electrical Schematic
Models
703, 704, 715, 718, 721
756, 903, 904, 956, 990
992, 993, 5703, 5704
5715, 5718, 5721, 5756

903-70-1-D REV. 9
Page 3 of 3

THERMO FISHER SCIENTIFIC 900 & 8600 SERIES ULT FREEZER WARRANTY

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

During the first two years of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. The 900 Series ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. The 8600 Series 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.

In addition to the standard warranty, the foamed-in-place cabinet design carries a unit production lifetime warranty (foamed-in-place cabinet, evaporator and foamed-in-place door; parts only). Please contact your sales representative or Thermo for additional information.

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

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

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

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

Rev. 3 2/07

ISO 9001 REGISTERED

THERMO FISHER SCIENTIFIC 900 & 8600 SERIES ULT FREEZER INTERNATIONAL DEALER WARRANTY

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

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 Thermo's expense, labor excluded. The 900 Series ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. The 8600 Series 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.

In addition to the standard warranty, the foamed-in-place cabinet design carries a unit production lifetime warranty (foamed-in-place cabinet, evaporator and foamed-in-place door; parts only). Please contact your sales representative or Thermo for additional information.

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

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

Your local Thermo 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 contact your local distributor or Thermo (1-888-213-1790 in 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. 3 2/07

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 Because 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.

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.

Appendix B Handling Liquid CO_2

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 CO_2 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.

Appendix C 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.

Thermo Fisher Scientific
Controlled Environment Equipment
401 Millcreek Road
Marietta, Ohio 45750
United States

www.thermofisher.com