

+5°C Flammable Materials Storage Laboratory Refrigerators

325099H42

Rev. D

March 2017

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IMPORTANT Failure to follow the instructions in this manual can 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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1 Introduction

This manual provides installation and operation instructions for flammable material storage (FMS) laboratory refrigerators with a preset temperature setpoint of +5°C.

Components and design have been evaluated by Underwriters Laboratories (UL) to meet the requirements of the National Fire Protection Association Standards, Nos. 45, 70, and 99.

FMS refrigerators are designed to be suitable for the storage of materials such as cyclopropane, ethyl ether, ethylene, acetone, alcohol, benzene, lacquer solvent vapors, and naphtha. They are not classified as medical devices.

The control system, standard on all models, includes:

- Key-operated power and alarm switch
- Preset temperature setpoint
- Adjustable temperature range
- Digital temperature display with 0.1°C resolution
- Graphic temperature display
- Audible and visual power failure indicators
- High and low temperature, door ajar, low battery alarms
- Alarm silence, ringback, and automatic reset functions
- SureTemp™ alarm system test
- Logging of highest and lowest recorded temperatures

Other standard features include:

- Keyed door locks
- Remote alarm contacts
- CFC-free refrigerant
- Heavy gauge cold-rolled stainless steel interior
- High density CFC-free foamed in-place urethane insulation
- Hermetically sealed refrigeration compressors

2 Specifications

2.1 Dimensions

Height	78.6 in (200 cm)
Width	28 in (72 cm)
Depth	37.0 in (94 cm)
Weight	425 lbs (193 kg)

2.2 Power Requirements

Voltage	115 V \pm 10% normal rated line
Frequency	60 Hz only
Amperage	4.0 A

2.3 Environmental Operating Conditions

Pollution Degree	2
Installation Category	II
Altitude	2000 m MSL (mean sea level)
Humidity	max 80% - non-condensing
Voltage Tolerance	\pm 10%
Ambient Temperature	15-32°C (59-90°F)
Product Usage	Indoor Use Only

2.4 Refrigerant Type and Charge

R134a	9.5 oz
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2.5 Pressure

High side	400 psig
Low side	88 psig

3 Safety Precautions

In this manual and on labels attached to this product, the words **WARNING** and **CAUTION** mean the following:



WARNING: A potentially hazardous situation which, if not avoided, could result in serious injury or death.



CAUTION: A potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or damage to the equipment.



WARNING: The electrical hazard symbol to the left indicates situations with dangerous voltages and a potential for electric shock.

Be sure to read both Section 2.1 and 2.2 below before use.

3.1 Flammable Storage Safety

Conventional refrigerators are not suitable for storing flammable materials. Such units have components in their electrical and refrigeration systems that can trigger explosions of flammable air and vapor mixtures inside the unit. Flammable Material Storage (FMS) refrigerators have no internal components that could trigger an explosion or fire inside the unit.

FMS refrigerators are designed for use in locations which are not classified as hazardous by the Authority Having Jurisdiction (AHJ). Under normal operating conditions, the buildup or presence of flammable vapors will not occur in the environment outside the unit.



FMS units are NOT designed for use in Class I, Division 1 classified environments, which require explosion-proof models.



WARNING: Keep away from open flames and ignition sources. FMS units are designed for use in laboratory environments with adequate ventilation.



WARNING: This unit uses Zener Diode electrical safety barriers on all temperature sensors. **DO NOT** bypass or alter any of these circuits or wires.



WARNING: The port hole in back of the unit allows the use of redundant temperature monitoring devices. All probes introduced into the cooling chamber **MUST** be suitable for use in Class I, Division 1 environments.



CAUTION: Use safety gloves for all material handling. Operators should be trained in the handling of all potentially hazardous materials.



CAUTION: Always store flammable materials in closed containers. Follow the Standard on Fire Protection for Laboratories Using Chemicals, NFPA 45-2011, Clause 10.5.2.

3.2 General Safety Precautions

Before installing, using or maintaining this product, please be sure to read this manual and product warning labels carefully. Failure to follow these instructions may cause this product to malfunction, which could result in injury or damage. Below are important safety precautions that apply to this product:

Below are important safety precautions that apply to this product:

- Use this product only in the way described in the product literature and in this manual. Before using it, verify that this product is suitable for its intended use. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



- Do not modify system components, especially the controller. Use Thermo Scientific exact replacement equipment or parts. Before use, confirm that the product has not been altered in any way.



- Your unit must be properly grounded in conformity with national and local electrical codes. Never connect the unit to overloaded power sources.



- Disconnect the unit from all power sources before cleaning, troubleshooting, or performing other maintenance on the product or its controls.

4 Unpacking

At delivery, examine the exterior for physical damage while the carrier's representative is present. If exterior damage is present, carefully unpack and inspect the unit and all accessories for damage.

If there is no exterior damage, unpack and inspect the equipment within five days of delivery. If you find any damage, keep the packing materials and immediately report the damage to the carrier. *Do not return goods without written authorization.* When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment.

5 Independent Temperature Monitoring

We recommend the use of a redundant and independent temperature monitoring system so that the refrigerator can be monitored continuously for performance commensurate with the value of product stored.

Each refrigerator has a 1/2 in. port hole located in the upper right corner in the back of the unit. The port hole is designed to allow the use of a redundant temperature monitoring device.



WARNING: All probes introduced into the cooling chamber **MUST** be suitable for use in Class I, Division 1 environments.



CAUTION: When the port hole is not in use, it is important to keep it sealed to avoid excessive condensation due to warm air flowing into the cabinet.



CAUTION: The port hole must be kept sealed at all times. When an auxiliary probe is inserted, be sure to seal open portions of the hole with putty or Permagum.

6 Installation



CAUTION: Improper operation of the equipment could result in dangerous conditions. Follow all instructions and operate within design limits noted on the dataplate.

6.1 Location

Install the unit in a level area free from vibration with a minimum of 6 inches of space on the sides and rear and 12 inches at the top.

Do not position the equipment in direct sunlight or near heating diffusers, radiators, or other sources of heat. The ambient temperature range at the location must be 59 to 90°F (15 to 32°C).

6.2 Leveling

The unit must be level. If the unit is out of level, you may need to shim the corners or casters with thin sheets of metal.

6.3 Wiring

This unit is designed to operate within 10% of the specified nominal voltage.



Before connecting your refrigerator to a power source, be sure to check the dataplate for correct voltage. Standard NEMA plugs are provided with all units. Wiring diagrams are attached to the back of the cabinet.



CAUTION: Connect the equipment to the correct power source. Incorrect voltage can result in severe damage to the equipment.



WARNING: For personal safety and trouble-free operation, this unit must be properly grounded before it is used. Failure to ground the equipment may cause personal injury or damage to the equipment. Always conform to the National Electrical Code and local codes. Do not connect unit to already overloaded power lines.



Note *A dedicated ground wire is provided which may be required by an AHJ to ensure that the Zener Barriers are grounded at all times. The ground wire is taped to the back of the unit. Be sure to check with local electrical authorities to see if it is required.*

Always connect the equipment to a dedicated (separate) circuit. Electrical codes require fuse or circuit breaker protection for branch circuit conductors. Use time delay fuses for #12 AWG circuits.

6.4 Shelves

All the refrigerators come standard with wire shelves. Additional shelves are offered as available options.

Unit Type	Shelf Type	Shelf Count
FMS Laboratory refrigerator	Full shelf	4

Maximum capacity per shelf is 45 kg (100 lbs.).

For safety in shipping, the shelves are packaged and secured inside the cabinet. Insert the shelf support hangers (included with the shelves) into the built-in shelf supports (located on the inside walls of the cabinet interior) at the desired locations. Position the shelves on the flat supports (refer to Figure 1).

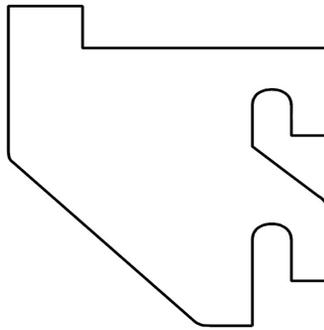


Figure 1. Shelf Support Hanger

6.5 Drip Tray

Note *A clear plastic drip tray is used to collect condensation droplets if any form on the ceiling of the unit to keep condensation away from the payload area. Do not use the drip tray as a shelf.*

For safety in shipping, the tray is packaged and secured inside the cabinet along with shelves. Insert the 4x tall shelf support hangers (included with the shelves) into the built-in shelf supports (located on the walls of the cabinet interior) as shown in steps below.

Step 1: Place the front clips as shown in Figure 2.

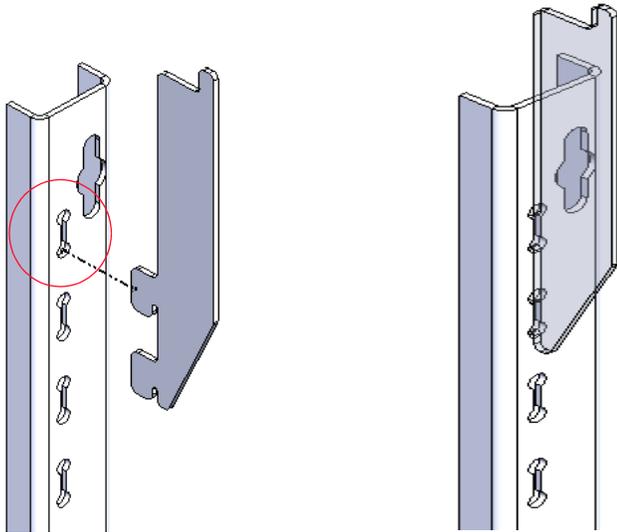


Figure 2. Front 2x shelf support arrangement (Place in top-most slot)

Step 2: Place the rear clips as shown in Figure 3.

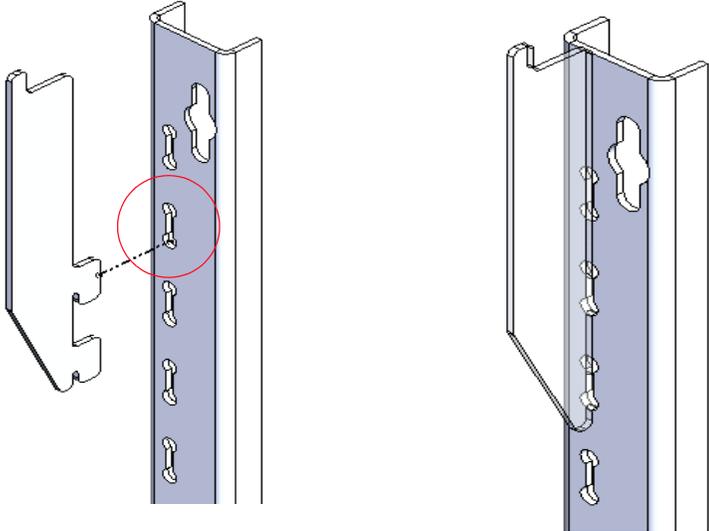


Figure 3. Rear 2x shelf support arrangement (Skip top-most slot and use next two slots)

Place the Drip tray on the shelf support hangers.

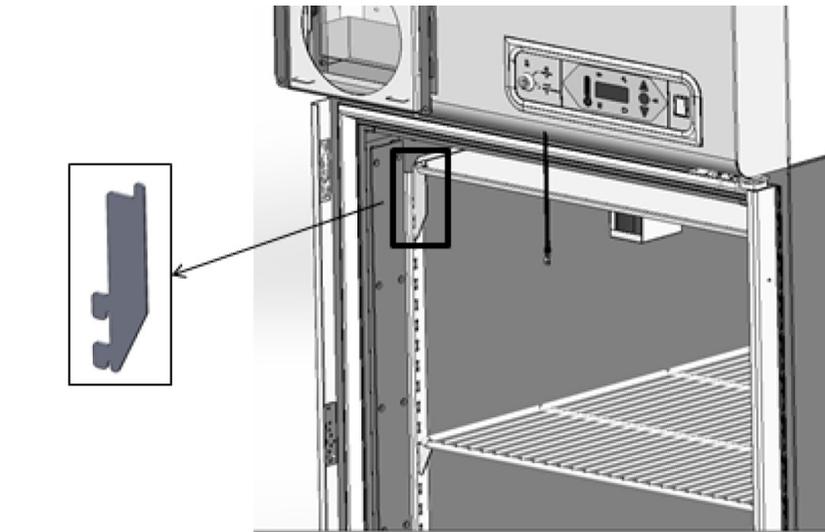


Figure 4. Unit view

Note *When properly installed, the drip tray will be slanted front to back to allow any condensation droplets to funnel to the back wall of the unit.*

6.6 Door Seal

Note *Door seal integrity is critical for refrigerators. A loose fitting gasket allows moist air to be drawn into the cabinet, resulting in quicker frost buildup in the cabinet, longer running time, poor temperature maintenance, and increased operation cost.*

To check the door seal, complete the following steps:

1. Open the door.
2. Insert a strip of paper (a couple of inches wide) between the door gasket and the cabinet flange and close the door.
3. Slowly pull the paper strip from the outside. You should feel some resistance.
4. Repeat this test at 4-inch intervals around the door. If the door does not seal properly, replace the gasket.

6.7 Solid Doors

Solid doors stay open if opened 90 degrees. Solid door spring tension cannot be adjusted.

6.8 Condensate Tray

A removable condensate tray is provided with the refrigerator to collect moisture as the unit operates.

The following pages contain instructions for unpacking, installation, operation and maintenance of the condensate tray.

6.9 Final Checks

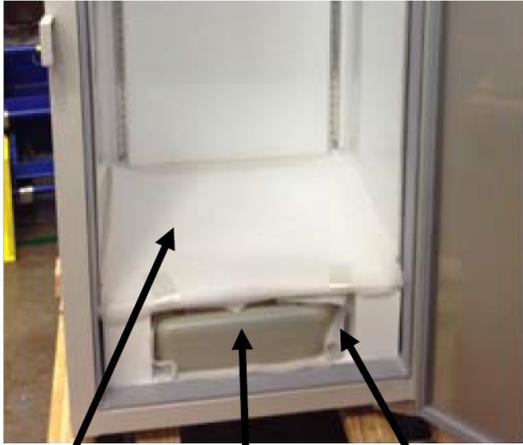
Before start up, complete the following steps:

1. Make sure that the unit is free of all wood or cardboard shipping materials, both inside and outside.
2. Verify that the unit is connected to a dedicated circuit.

+5C Flammable Storage Condensation Management Instructions

Unpacking

1. Remove shelves from on top of condensate tray and install per manual.
2. Remove drain pan and discard foam sheet wrapped around it.



Shelves

Drain Pan

Foam Sheet

Operation

1. During refrigerator use water will collect on walls.
2. Water will drain down to condensate tray which will divert water into the drain pan.
3. Drain pan will collect condensation so it can be removed from the refrigerator.



Condensate Tray

Installation/Setup

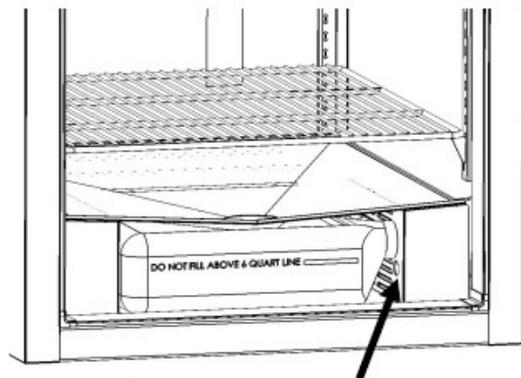
1. Make sure drain plug is removed and stored safely for later use.
2. Ensure top cap is secure.
3. Install drain pan under condensation collection tray so that max fill line is visible.



Fill Line

Drain Plug

Top Cap

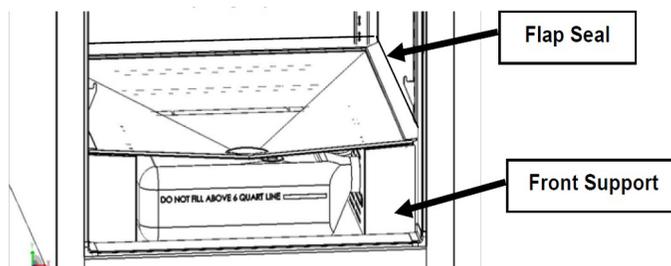


Drain Plug Storage Location

+5C Flammable Storage Condensation Management Instructions

Maintenance

- Drain pan will need to be emptied periodically. 6qt capacity should allow for >20 days of operation before emptying
- Drain pan should not be allowed to fill above fill line
- To empty drain pan
 1. Re-install drain plug
 2. Ensure top cap is secure
 3. Remove drain pan from unit
 4. Empty drain pan in suitable location after removing top cap
 5. Re-install drain pan in unit and remove drain plug
 6. Store drain plug in designated location
 7. Ensure top cap is secure
- Cleaning Inside of Drain Pan
 1. Empty drain pan
 2. Fill partially with a solution of water and mild detergent
 3. Install top cap and drain plug
 4. Shake drain pan with water and detergent solution
 5. Empty water and detergent solution
 6. Rinse drain pan with water
 7. Remove drain plug and store in designated location
 8. Install top cap and install drain pan under condensation collection tray so that max fill line is visible
- Removing condensate tray for cleaning interior of unit
 1. Remove and empty drain pan
 2. Lift condensate tray slightly and pull out horizontally
- Cleaning interior of unit
 1. Wipe down walls, ceiling, floor, and condensate tray with a solution of water and mild detergent
 2. Wipe down condensate tray seal to ensure there is no debris that will prevent a water tight seal against wall of unit
 3. Wipe surfaces dry with a dry soft cloth
- Installation of Condensate Tray
 1. Slide condensate tray back into unit until front support is past breaker and rests on floor
 2. Make sure the seal is seated correctly against wall
 - Seal should not interfere with pilasters
 - Seal should make full contact with the sides and back wall of unit
 - Seal flap tip should be higher than tray surface so that water will drain onto tray instead of collecting on seal or draining to floor. If seal flap tip is not oriented correctly the condensation collection system will not operate as designed. To correct seal flap orientation lift tray slightly then lower back down onto floor



7 Control Panel

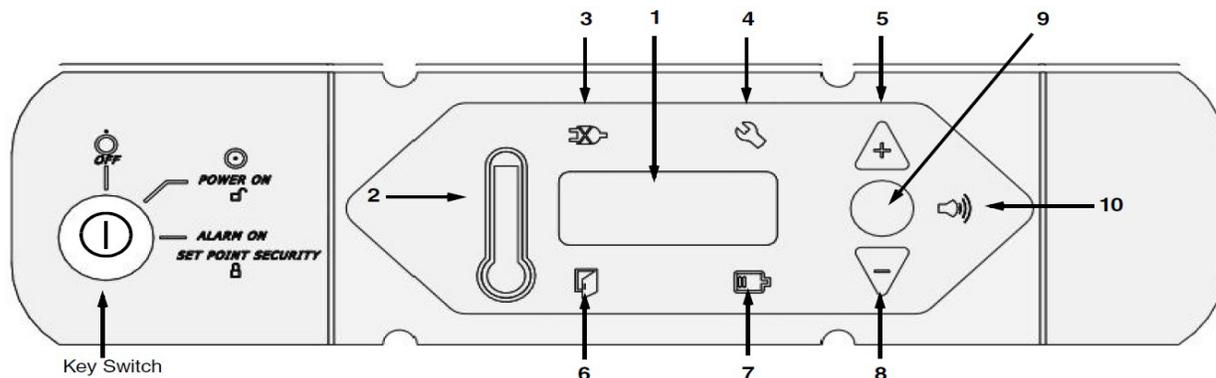


Figure 5. Refrigerator Control Panel

7.1 Control Panel Features

The control panel is located on the top right side of your refrigerator. You can use the three pushbuttons (#5, #8, and #9 in Figure 5) to change the temperature display (#1) or to adjust temperature and alarm setpoints. The thermometer display (#2) provides a quick visual indicator of current cabinet temperature and alarm conditions.

1. Main temperature display — during normal operation, shows cabinet temperature in degrees Celsius, as measured by the sensor probe inserted in the glycol solution bottle inside the cabinet. You can use the buttons to display other values such as setpoints and highest and lowest recorded temperatures. The number in the main display flashes when the value can be modified.
2. Thermometer — shows cabinet temperature and alarm conditions. There are 10 horizontal bars: 9 are displayed during normal operation, the tenth (top) bar indicates a warm alarm condition. The number of bars illuminated indicates approximate cabinet temperature. Depending on alarm settings, 4 or 5 bars illuminated indicate that the cabinet is at setpoint. For example, suppose that the cabinet temperature setpoint is 5°C and that the warm and cold alarm setpoints are 0°C and 10°C. Then the number of bars illuminated indicates cabinet temperature as shown in Table 1.

Table 1. Thermometer displays on control panel (setpoint +5°C).

Bars displayed	Temperature	Bars displayed	Temperature
bulb only	0°C (cold alarm)	6 bars	6°C
1 bar	1°C	7 bars	7°C
2 bars	2°C	8 bars	8°C
3 bars	3°C	9 bars	9°C
4 bars	4°C	10 bars	10°C (warm alarm)
5 bars	5°C (setpoint)		

When cabinet temperature exceeds the warm alarm setpoint, the top bar of the thermometer flashes. When temperature is lower than the cold alarm setpoint, the bulb flashes. When you are in programming mode (described in Table 3) the thermometer shows the setpoint value you are changing.

3. Power failure — illuminated when the main power supply is interrupted. In this case the audible alarm also sounds.
4. Service required — illuminated when the controller is in service programming mode or when simulated warm or cold alarm conditions are failing to occur during an alarm test.
5. Increase — used to increase setpoint values in programming mode and for various display functions.
6. Door ajar — illuminated when the refrigerator door is open, the alarm is activated, and the key switch is turned to the alarm position).
7. Battery low — illuminated when the backup battery is low.
8. Decrease — pushbutton used to decrease setpoint values in programming mode and for various display functions.
9. Scan — pushbutton used to change the main display and for various other functions.
10. Audible alarm — illuminates during warm and cold alarm conditions. For full descriptions of display, programming, and service functions, refer to the following tables.

7.2 Display Function

Table 2. Control Panel Display Functions.

Function	Meaning	Sequence	Display
Normal operation	Default display while refrigerator is running	None (default display)	Temperature display and control panel thermometer icon show cabinet temperature.
Coldest logged temperature	Show coldest cabinet temperature since last startup or reset	Press ▼	Display shows coldest logged temperature while button is pressed.
Warmest logged temperature	Show warmest cabinet temperature since last startup or reset	Press ▲	Display shows warmest logged temperature while button is pressed.
Mute	Silence audible alarm for 6 minutes	Press ● (the Scan button between ▼ and ▲)	Display and thermometer show cabinet temperature, alarm icon continues to flash.
Warmest logged temperature	Return to default display after alarm condition, clears temperature log	Press ▲ and ▼ simultaneously, hold for five seconds	Excursion values are reset; temperature display shows cabinet temperature.
TempTest Alarm test	Tests alarm system by warming probe surface; key switch must be in alarm mode	Press ▲ and ● simultaneously	Display and thermometer icon show simulated cabinet temperature, alarms flash and sound as appropriate. Alarms clear when test is completed.

7.3 Program Functions You can enter programming mode by pressing the Scan button (●) and holding for 5 seconds. Pressing ● repeatedly scrolls through the available setpoint functions: temperature control setpoint, cold alarm and warm alarm.

Table 3. Setpoint Programming Functions.

Function	Programming Sequence
Adjust temperature control setpoint	Enter programming mode by pressing ● and holding for 5 seconds. On release, the current temperature setpoint value flashes in the temperature display; use ▼ and ▲ to adjust it. Press ● to confirm the new value. The display automatically returns to normal operating mode 30 seconds after the last key entry or after scrolling through all available functions.
Adjust cold alarm setpoint	Enter programming mode and press ● repeatedly until the bottom of the thermometer is illuminated. On release, the current cold alarm setpoint value flashes in the temperature display; use ▼ and ▲ to adjust it. Press ● to confirm the new value. The display automatically returns to normal operating mode 30 seconds after the last key entry or after scrolling through all available functions.
Adjust warm alarm setpoint	Enter programming mode and press ● repeatedly until the top of the thermometer is illuminated. The current warm alarm setpoint value then flashes in the temperature display; use ▼ and ▲ to adjust it. Press ● to confirm the new value. The display automatically returns to normal operating mode 30 seconds after the last key entry or after scrolling through all available functions.

7.4 Service Parameters You can access service parameters by entering programming mode with the controller key in the Power On position, then pressing ● for an additional 5 seconds. On release of the button, the display will go blank, then display “SEr” with the service wrench icon illuminated. Then the *firmware checksum* (read-only) will be displayed for about 4 seconds. Pressing ● repeatedly scrolls through the available service functions. While you are in service mode, the wrench icon is illuminated. For any flashing parameter you can use ▼ and ▲ to adjust the value.



Note *Adjusting service parameters may adversely affect operation. Be sure to consult with Technical Support before changing service parameters.*

Table 4. Service parameters.

Parameter	Meaning	Notes
Control probe offset	Value in main display, single bar illuminated in thermometer	Center air temperature calibration. Default value is 0 (maximum + or - 10.0).
Display offset	Value in main display, single bar illuminated in thermometer	Offset between control and display probes. Default value is 0 (maximum + or - 30.0).
Line voltage	Err	Not available for this model.
Control probe temperature	Cnt (2 sec.); Prb (2 sec.); then value	Display only
Network address	nEt (2 sec.); ADr (2 sec.); then value	Can only be modified by RS-485 communications software.

8 Operation

8.1 Temperature Settings



The factory default temperature setting is +5°C for all FMS refrigerators.

CAUTION: The refrigerators described in this manual are designed for optimum performance at +5°C. It is advisable to call Technical Service before changing setpoints.

To change the factory temperature settings, refer to the instructions in Section 7.3.

8.2 Start Up

To start up the refrigerator, complete the following steps:

1. Plug in the power cord.
2. All refrigerators (except undercounter and sliding door models) have a double pole circuit breaker switch located next to the power inlet. Make sure that is in the ON (“1”) position.
3. Insert the silver colored key in the switch on the control panel and turn the power on, turning the key switch to position 1. The compressor and the evaporator fans should start immediately.
4. Rotate the power switch to the ALARM ON position when the temperature drops below the warm alarm setpoint.
5. If desired, lock the cabinet door using the gold colored key. Place duplicate key copies in a safe place.

All controls should now be fully operational, the alarm activated, and all visual indicators active.



CAUTION: Do not operate strong radio emission sources such as walkie-talkies within 3 feet of the refrigerator. EMI and RFI can affect the performance of the control systems.



CAUTION: When loading, avoid placing hot materials next to cold materials.



CAUTION: Always store flammable materials in closed containers. Follow the standard on Fire Protection for Laboratories Using Chemicals, NFPA 45-2011, Clause 10.5.2.

9 Alarm Systems

9.1 Operating the Alarm

The alarm system is designed to provide visual and audible warning signals for both power failure and rise in temperature. The alarm is equipped with a battery backup.

The alarm system is activated only when the key switch is turned all the way to the ALARM ON position. Note that the audible alarm will not sound when the key switch is in the second (ON) position. The audible warning signal sounds when there is a power failure or temperature alarm condition, or when the door is ajar for more than 3 minutes.

The Mute function (pressing the ● button) allows you to turn off the audio warning without turning off the visual indicators.

To turn off and reset flashing visual alarms, press ▼ and ▲ simultaneously.

There is also a ringback function after approximately 6 minutes if any alarm condition remains active.

9.2 Remote Alarm (Optional)

Refrigerator units can have an optional user-installed remote alarm. Operating and testing procedures are the same for both types of alarm.

The maximum distance between a refrigerator and a remote alarm depends on the wire gauge used. Refer to Table 5 below.

Table 5. Wire Gauges and Distance to Remote Alarm.

Wire Gauge	Total Wire Length (feet)	Distance to Alarm 1/2 Wire Length (feet)
20	530	265
18	840	420
16	1330	665
14	2120	1060
12	3370	1685

9.3 Installing a Remote Alarm (Optional)

Remote alarm terminals are located at the rear of the machine compartment. The terminals are: Common (purple), Open on Fail (black, Normally Closed), and Close on Fail (red, Normally Open).

1. Make the following connections:
 - a. Connect the common terminal on the cabinet switch to the Common wire on the alarm.
 - b. Connect the normally closed terminal on the cabinet to the Open on Fail wire on the alarm. This connection gives an alarm when the switch contacts open.
2. Plug the alarm system service cord into an electrical outlet.

9.4 Alarm Test

Your refrigerator is equipped with a SureTemp™ testing system which automatically tests the alarm probe and electronics. This may eliminate the need for other methods of warming or cooling the probe, such as ice baths.

9.4.1 Theory of Operation

During the alarm test, the temperature sensor is artificially heated and cooled by a tiny, built-in thermoelectric heating and cooling unit which simulates both warm and cold conditions. The electronic control module notes the sensor temperature changes and the control panel displays these changes.

While this alarm testing procedure is very accurate and reliable, the temperature of the refrigerated space does not change during the alarm test.

9.4.2 Alarm Test Procedure



Note *This test automatically advances through all steps and stops.*

1. Verify that the key position is in the Alarm On mode, and that the current warm and cold alarm setpoints are within normal ranges (the warm and cold simulations may not work if the setpoints are set to extreme values).
2. To start the alarm test, press Δ and \odot simultaneously. During the test the main display and thermometer bulb will indicate simulated (not actual) cabinet temperature.
3. When simulated temperature exceeds the warm alarm setpoint, the alarm sounds and the alarm icon on the control panel illuminates (#10 in Figure 5).

4. The temperature display begins to drop. After a few seconds, the temperature in the display is back in the operating range.
5. The alarm stops. The temperature on the display drops until the cold alarm sounds.
6. The test is now complete but the alarm continues to sound until the temperature on the display is back in the operating range.

If the simulated alarm conditions do not occur during the first five minutes of the alarm test, the service (wrench) icon illuminates and the test is terminated. You can also terminate the test immediately by turning the key switch to the second (Power On) position. When during the alarm test, the temperature display does not change or the service icon illuminates, check the sensor connections.

After an alarm test has terminated, there is a 10-minute delay before the test can be run again.

10 Chart Recorders (Optional)

Panel-mounted six inch recorders are available as a factory-installed option. Recorder operation begins when the system is powered on.

10.1 Set Up and Operation

To prepare the recorder to function properly, complete the following steps:

1. Open the recorder door to access the recorder.
2. Connect the nine volt DC battery located at the recorder's upper right corner. This battery provides back-up power.
3. Install clean chart paper (refer to Section 10.2 below).
4. Close the recorder door.

Note *The recorder may not respond until the system reaches temperatures within the recorder's range.*

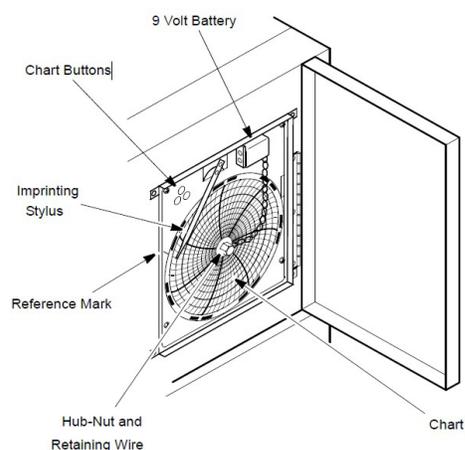


Figure 6. Six Inch Chart Recorder

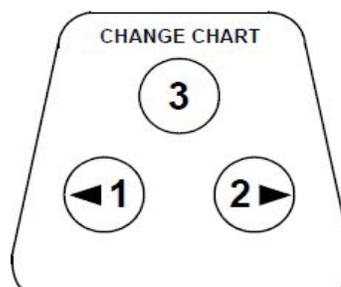


Figure 7. Pressure Sensitive Chart Buttons

10.2 Changing Chart Paper

To change the chart paper, complete the following steps:

1. Locate the pressure sensitive buttons at the front, upper left of the recorder panel.
2. Press and hold the change chart button (#3 on the upper left of the panel) for one second. The pen will move off the scale.
3. Unscrew the center nut, remove the old chart paper, and install new chart paper. Carefully align the day and time with the reference mark on the recorder panel (a small groove on the left side of the panel, shown in Figure 6).
4. Replace the center nut and hand tighten. Press the change chart button again (#3) to resume temperature recording.

10.3 Power Supply

The recorder normally uses AC power when the system is operating. If AC power fails, the LED indicator on the recorder flashes to alert you to a power failure. The recorder continues sensing cabinet temperature and the chart continues turning for approximately 24 hours with back-up power provided by the nine-volt battery.

The LED indicator glows continuously when main power is functioning and the battery is charged.

When the battery is low, the LED flashes to indicate that the battery needs to be changed.

11 Cleaning

11.1 Cleaning the Shelves

To clean the shelves, use a solution of water and a mild detergent. Rinse the shelves and wipe them dry with a soft cloth.

11.2 Cleaning the Condenser



CAUTION: Condensers should be cleaned at least every six months. In heavy traffic areas, condensers load with dirt more quickly. Failure to keep the condenser clean can result in equipment warm-up or erratic temperatures.



WARNING: Be sure to disconnect the unit from main power before cleaning the condenser.



CAUTION: Never clean near condensers with your fingers. Some surfaces are sharp.



CAUTION: When cleaning the compressor deck, be careful to avoid hot surfaces that may cause burns, such as the refrigeration tubing and the compressor.

In all models, the condenser is located in the top machine compartment. To clean the condenser:

1. Disconnect the power.
2. Remove the top front grill.
3. Use a vacuum cleaner with hose and brush attachments to clean the front face of the finned surface.
4. Clean up any loose dust and replace the front grill.
5. Reconnect the power.

12 Troubleshooting

WARNING: Troubleshooting procedures involve working with high voltages which can cause injury or death. Troubleshooting should only be performed by trained personnel.

This section is a guide to troubleshooting equipment problems.

Table 6. Troubleshooting Procedures.

Problem	Possible Cause	Solution
Unit does not operate or power failure indicator is ON.	Unit is not turned ON.	Turn the key switch to the ON position and confirm that the display illuminates.
	Power supply or outlet is not working	Check that the cord is securely plugged-in. All refrigerators (except undercounter and sliding door models) have a double pole circuit breaker located next to the power inlet. Make sure that it is in the ON (“1”) position. Try cycling the switch to OFF (“0”) then ON (“1”). Plug another electrical device into the outlet to confirm that the outlet is receiving power. If the device does not work, check and replace the building fuse or reset the circuit breaker. If the problem persists, call an electrician.
	Power cord unplugged	Plug unit into a grounded 3-prong outlet on a dedicated circuit.
	Building circuit breaker tripped	Reset breaker and plug unit into a grounded 3-prong outlet on a dedicated circuit.
	Power supply voltage incorrect	Verify that the power supply voltage matches the information on the dataplate.
	Key won’t turn to ON position	Confirm that the correct key is being used.
Unit is warming up or temperature fluctuates. (If unit is warming, remove product before troubleshooting)	Cold control	Make sure that the cold control is set correctly. Refer to Section 12.
	Condenser is blocked or dirty.	Make sure that the condenser is clean and that there is sufficient clearance around the unit. Refer to Section 12.
	Power supply problem.	(See previous section)
	Door is open.	Make sure the door is completely closed and sealing properly.
	Warm product loaded into unit.	Allow ample time to recover after loading warm product.
	Impeded air flow to machine compartment.	Make sure that there is sufficient clearance around the unit. Refer to Section 6.1.
	Impeded air flow inside unit.	Make sure that the path to the grill inside the unit is clear and that there is room for air flow around contents.
Warm or cold air from building HVAC.	If air from the building HVAC is blowing directly on the refrigeration system, move the unit to another location.	

Table 6. Troubleshooting Procedures.

Problem	Possible Cause	Solution
Excessive condensation or frost inside unit (some moisture/frost is normal)	Door is open	Door is open Make sure the door is completely closed and sealing properly.
	Excessive humidity in room	Put unit in a controlled environment.
	Frequent or long door openings	Reduce frequency and length of door openings.
	Debris on gasket or sealing surface	Clean and dry gasket.
	External sensor wires routed through gasket seal surface	Route sensor wires through portal on back of unit and insulate portal tunnel.
	Damaged gasket	Replace gasket.
	Unit not level	If the unit is not level, condensate water will not drain properly. Level by placing thin shims under the unit where there is floor contact.
	Part hole open or not insured	Check port hole insulation and replace cap.
Unit seems noisy	Normal operation	The compressor and fans will make some noise while running. Keeping proper spacing to ceiling and walls will help minimize noise.
	Condenser is blocked or dirty.	Make sure that the condenser is clean and that there is sufficient clearance around the unit. Refer to Section 12.
	Loose parts	Check for loose and rattling parts. Tighten any loose screws, especially after performing maintenance tasks.
	Unit not level	Level by placing thin shims under the unit where there is floor contact.
Door will not close completely or pops open	Door blocked by unit contents	Rearrange contents.
	Drawer or shelf out of position.	Adjust door or shelf.
	Unit not level	Level by placing thin shims under the unit where there is floor contact.
Door is difficult to open	Dirty, icy or sticky gaskets	Clean and dry gaskets.
	Vacuum lock	This is normal. Wait a short period after closing door to re-open.
	Key doesn't work	Check key: door key is different from power switch key.

13 Service Parts

The list on the next page shows the most commonly ordered service parts.
Call 800-438-4851 for service and technical support.

Service Parts List

23' +5° FMS Refrigerators

Part No.	Description	Model 2305 "A" 115 V 60 Hz
302268G01	H03 Power Supply Board w/fuses 115 V	1
309327H02	Fuse, SLO BLO, 500 mA, 5 X 20 mm	2
303308H02	Fuse, SLO-BLO 30 A 3 AB 250 V	2
304864G47	Control Board w/E-Prom	1
304863H03	Refrigerator Display Board	1
314720H02	Overlay with 3 buttons, no light switch	1
314807G02	Flush Control Panel, no light switch	1
314722H01	Bezel, Display Blue	1
314722H02	Bezel, Display Gray	1
316088H01	Power Supply to CPU Harness, RoHS	1
309111H01	6 Pin RJ45 Harness - Display	1
309112H02	10 Pin RJ45 Harness - Display	1
325261H01	Temperature Display Sensor, Frz (red) 1/2 barrier is extra	1
325273H01	Temperature Display Sensor, Frz (red) 2/2 barrier is extra	1
325261H02	Temperature Control Sensor, Frz (green) 1/2 barrier is extra	1
325273H02	Temperature Control Sensor, Frz (green) 2/2 barrier is extra	1
325261H03	Temperature Sensor, Recorder or 4-20 mA (gray) 1/2 barrier is extra	1-2
325273H03	Temperature Sensor, Recorder or 4-20 mA (gray) 2/2 barrier is extra	1-2
325262H01	Barrier, Circuit Isolator, 2 Pole	2-4
325261G01 S	Intrinsically Safe Sensor Assy with Barrier, Red	1
325261G02 S	Intrinsically Safe Sensor Assy with Barrier, Green	1
325261G03 S	Intrinsically Safe Sensor Assy with Barrier, Gray	0-2
325479H01	FMS,MOUNTING HOLE Plug	0-2
28109G03 S	Battery 12 V/1.2 Ah	1
316092H01	Key Switch Harness	1
97713H01	Key A126	1

Part No.	Description	Model 2305 "A" 115 V 60 Hz
326211G01 S	Condensing Unit Assembly +5 FMS	1
326513H01	Compressor EM55HHR 115 v	1
82225H01	Condenser	1
05433H02	Fan Motor Condenser 115 V / 14 W	1
322379H01	Fan Blade Condensor	1
312598H01	Pressure Switch	1
325156H01	Filter Drier	1
300367H01	Accumulator	1
314810G03 S	Solid Door - R.H. 23'	1
38497H06	Door Gasket - Solid door	1
49231H02	Power Cartridge door hinge, solid door	1
61429H03	Lock, Comp. Hdwr, solid door	1
301367H01	R.H. Hinge Brkt Bottom Assy - solid door	1
304708H01	Bracket, Hinge - Top - R.H. - solid door	1
314894H01	Assm, Handle Blue Ref/Frz 12-75' - solid door	1
314894H03	Assm, Handle Charcoal Ref/Frz 12-75' - solid door	1
325175H01	Door Switch, Reed	1
325223H01	Magnet, Ultra high pull	1
325222H01	Snap Rivet - Push Mount	3
325191G01	Lock Strike, Solid Door	1
316275H01	Shelf, Full - 23', 45', 50, & 75'	4
60523H01	Shelf Clip Support	16
314191H01	Nameplate, Thermo Scientific	1
322035G11	Front Panel w/Rec, 23/50/75' LED Blue Height Reduction	1
322035G21	Front Panel w/Rec, 23/50/75' LED Gray Height Reduction	1
322675G11	Front Panel w/o Rec, 23/50/75' LED Blue Height Reduction	1
322675G21	Front Panel w/o Rec, 23/50/75' LED Gray Height Reduction	1
322037H01	Upper Side Panel - Painted LED Gray - Height Reduction	2
314725G07 S	Chart Recorder, 6" assy - LED Blue with 50°C offset	1

Part No.	Description	Model 2305 "A" 115 V 60 Hz
314725G08 S	Chart Recorder, 6" assy - LED Gray with 50°C offset	1
325417H01	Fuses for Chart Recorder Harness	2
314779H01	Magnetic Push Latch for recorder	1
90520H11	Chart Paper, 6" Refrig (box of 52)	1
80080G08 S	Bottle for Sensor	1
313398H03	Service Manual	1
325474H01	Wiring Diagram - FMS only	1
89268H16	Refrigeration Diagram - Manual Defrost	1
322332H01	Magnetic White Board - Instructions	1
326217H01	Cond Tray Collection Funnel	1
326266H01	Condensate Tray seal	1
326259H01	Drain Pan, 6 quart	1
328470G01 S	Drip Tray Kit Assembly	1

14 Warranty Statement

Domestic and International Warranty • 24 Months Full Warranty Parts and Labor.

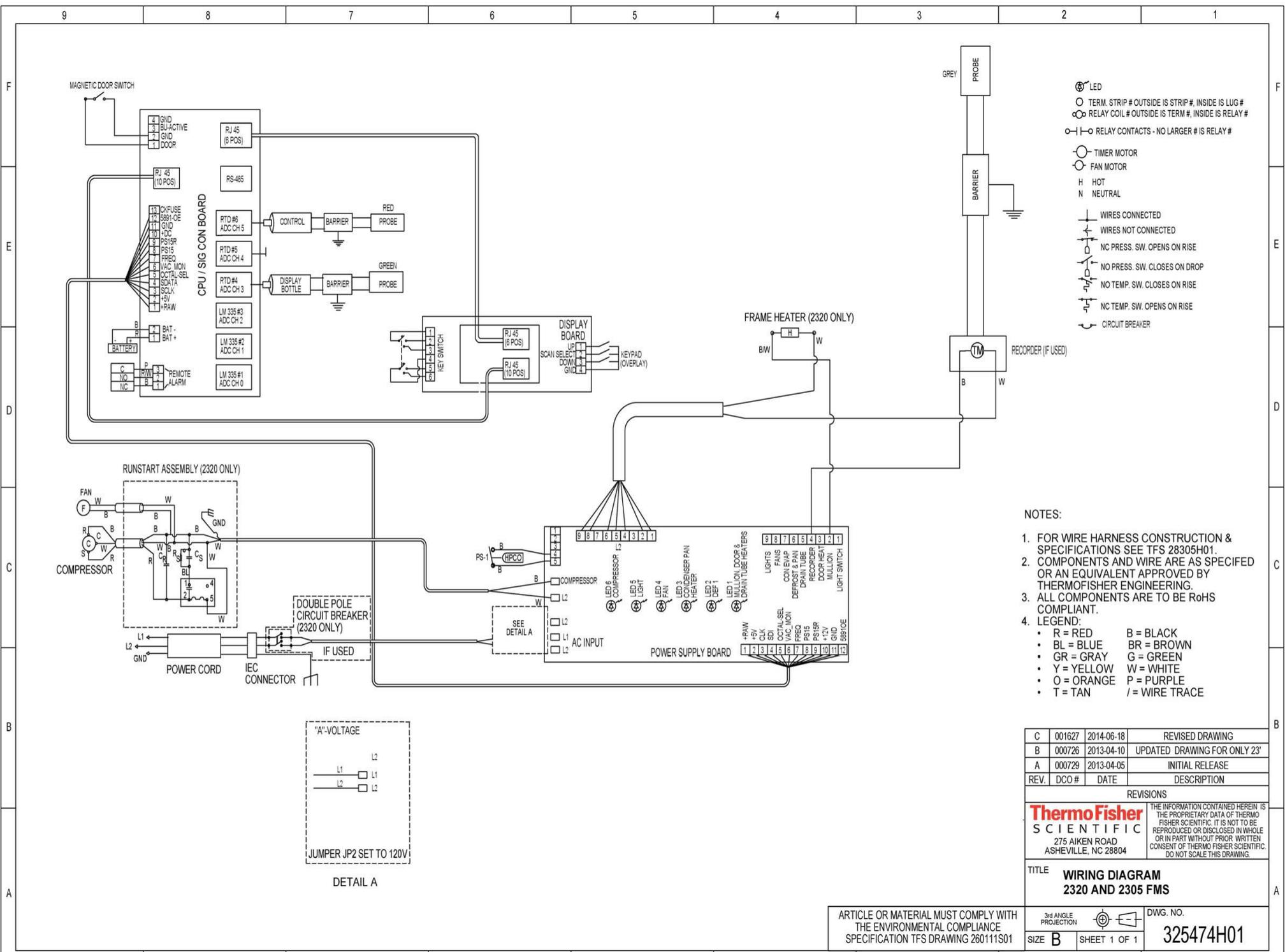
During the first twenty four (24) months from shipment, Thermo Fisher Scientific Inc, through its authorized Dealer or service organizations, will at its option and expense repair or replace any part found to be non-conforming in material or workmanship. Thermo Fisher Scientific Inc reserves the right to use replacement parts, which are used or reconditioned. Replacement or repaired parts will be warranted for only the unexpired portion of the original warranty.

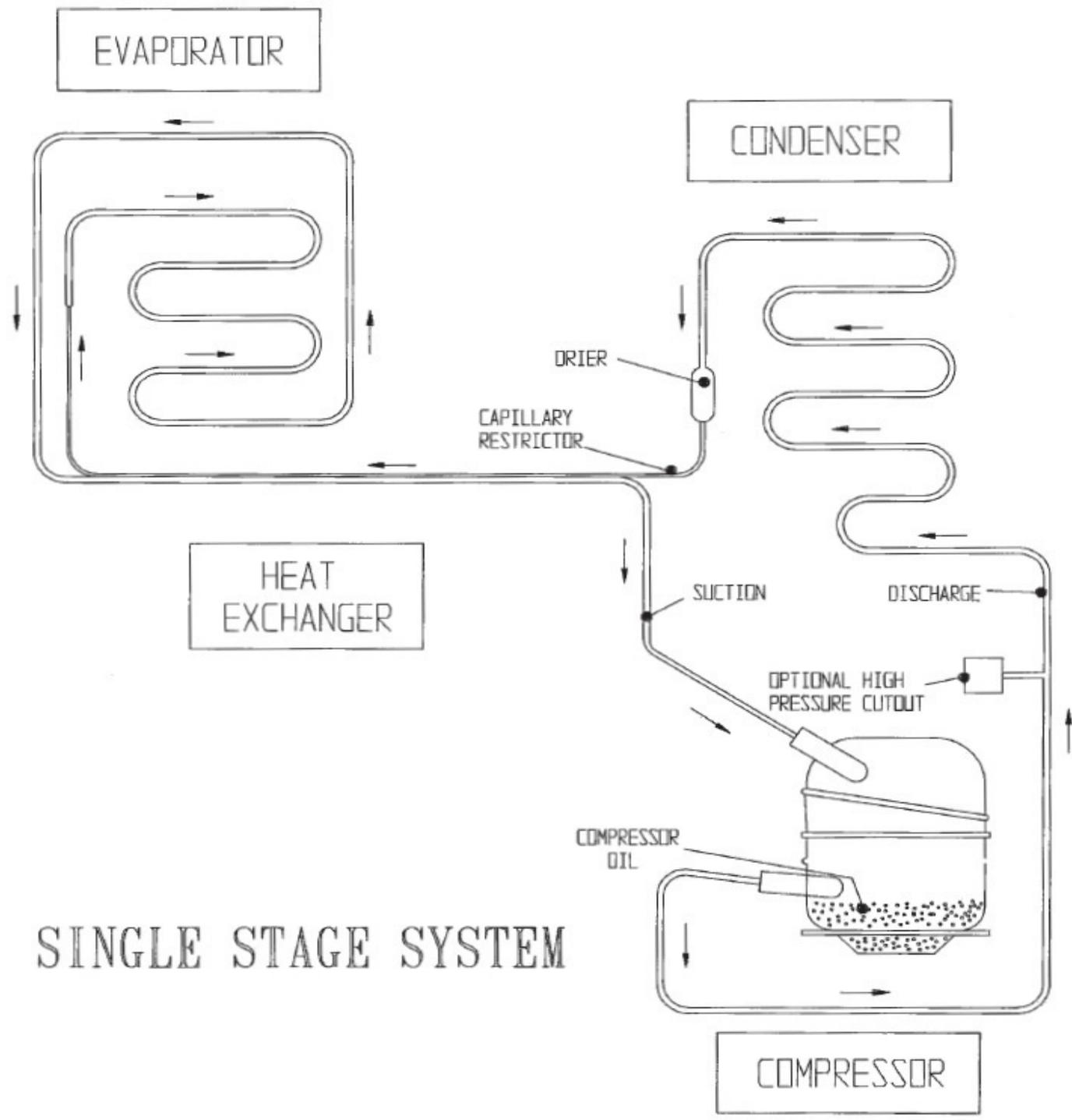
This warranty does not apply to damage caused by (i) accident, misuse, fire, flood or acts of God; (ii) failure to properly install, operate or maintain the products in accordance with the printed instructions provided, (iii) causes external to the products such as, but not limited to, power failure or electrical power surges, (iv) improper storage and handling of the products, (v) use of the products in combination with equipment or software not supplied by Thermo Fisher; or (vi) installation, maintenance, repair, service, relocation or alteration of the products by any person other than Thermo Fisher or its authorized representative. To obtain proper warranty service, you must contact the nearest authorized service center or Dealer. Thermo Fisher Scientific, Inc's own shipping records showing date of shipment shall be conclusive in establishing the warranty period. At Thermo Fisher's option, all non-conforming parts must be returned to Thermo Fisher postage paid and replacement parts are shipped FOB Thermo Fisher's location.

Limitation of Liability

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 FISHER DOES NOT WARRANT THAT THE PRODUCTS ARE ERROR-FREE OR WILL ACCOMPLISH ANY PARTICULAR RESULT.

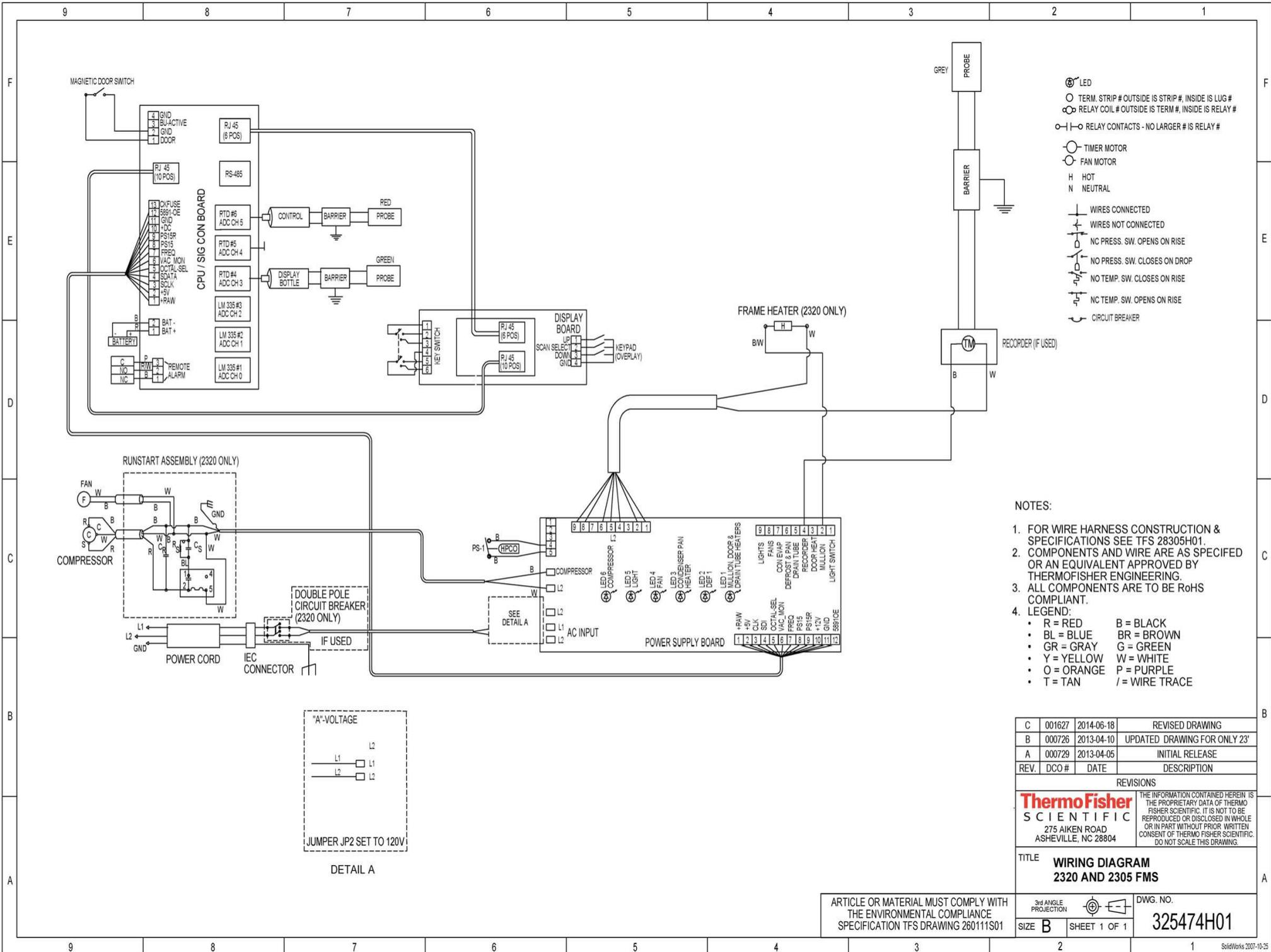
THERMO FISHER SHALL NOT BE LIABLE FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES INCLUDING, WITHOUT LIMITATION, DAMAGES TO LOST PROFITS OR LOSS OF PRODUCTS.





SINGLE STAGE SYSTEM

REFRIGERATION DIAGRAM
A 89268 H16



- ⊗ LED
- TERM. STRIP # OUTSIDE IS STRIP #, INSIDE IS LUG #
- RELAY COIL # OUTSIDE IS TERM #, INSIDE IS RELAY #
- |○ RELAY CONTACTS - NO LARGER # IS RELAY #
- TIMER MOTOR
- FAN MOTOR
- H HOT
- N NEUTRAL
- WIRES CONNECTED
- - - WIRES NOT CONNECTED
- ⏏ NC PRESS. SW. OPENS ON RISE
- ⏏ NO PRESS. SW. CLOSSES ON DROP
- ⏏ NO TEMP. SW. CLOSSES ON RISE
- ⏏ NC TEMP. SW. OPENS ON RISE
- ⏏ CIRCUIT BREAKER

- NOTES:
- FOR WIRE HARNESS CONSTRUCTION & SPECIFICATIONS SEE TFS 28305H01.
 - COMPONENTS AND WIRE ARE AS SPECIFIED OR AN EQUIVALENT APPROVED BY THERMOFISHER ENGINEERING.
 - ALL COMPONENTS ARE TO BE RoHS COMPLIANT.
 - LEGEND:
 - R = RED
 - BL = BLUE
 - GR = GRAY
 - Y = YELLOW
 - O = ORANGE
 - T = TAN
 - B = BLACK
 - BR = BROWN
 - G = GREEN
 - W = WHITE
 - P = PURPLE
 - / = WIRE TRACE

REV.	DCO #	DATE	DESCRIPTION
C	001627	2014-06-18	REVISED DRAWING
B	000726	2013-04-10	UPDATED DRAWING FOR ONLY 23'
A	000729	2013-04-05	INITIAL RELEASE

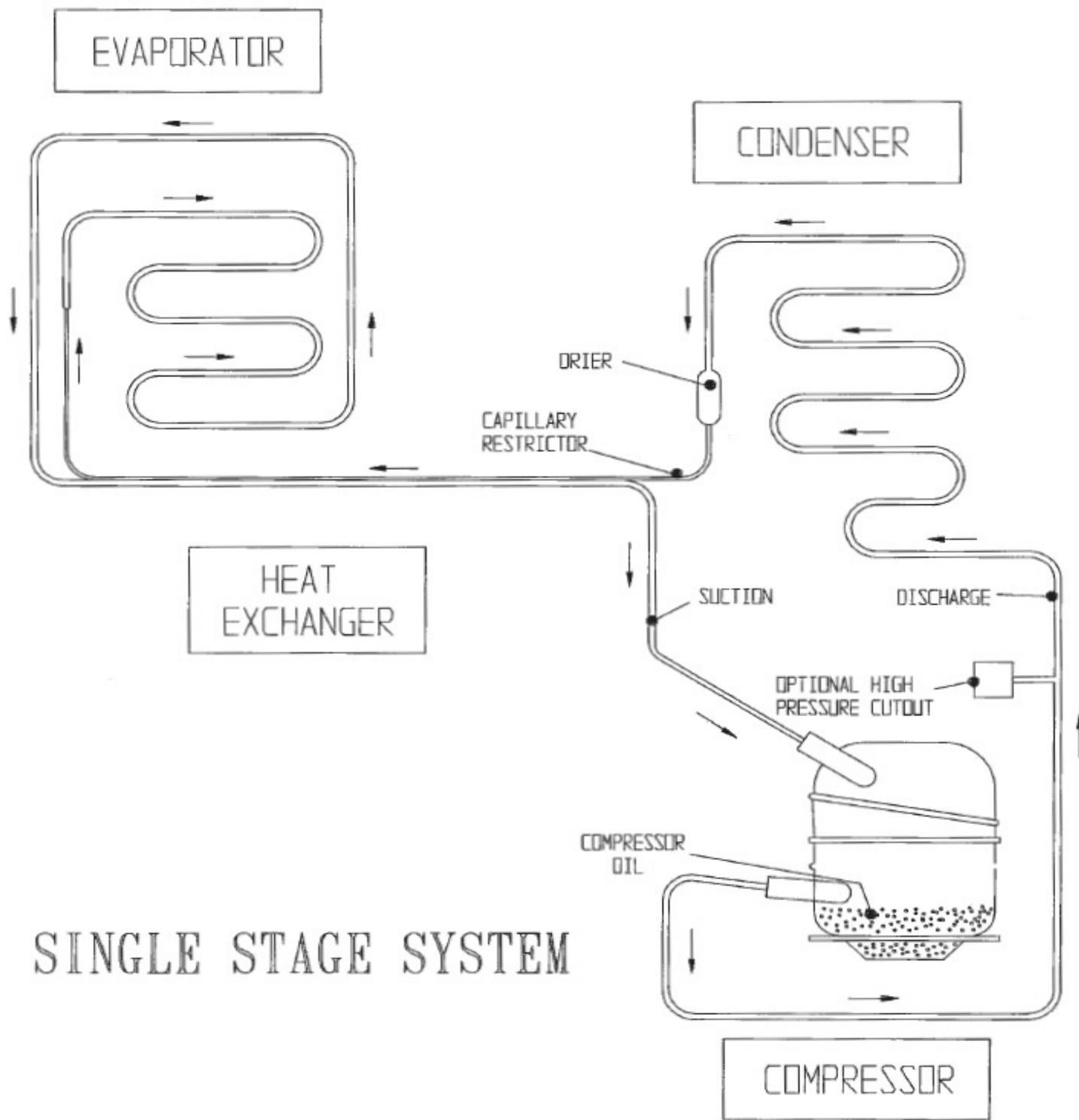
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TITLE		WIRING DIAGRAM 2320 AND 2305 FMS	
3rd ANGLE PROJECTION		DWG. NO.	
SIZE B	SHEET 1 OF 1	325474H01	

ARTICLE OR MATERIAL MUST COMPLY WITH THE ENVIRONMENTAL COMPLIANCE SPECIFICATION TFS DRAWING 260111S01



SINGLE STAGE SYSTEM

REFRIGERATION DIAGRAM
A 89268 H16

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325099H42 Rev. D